Nidec

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Commissioning manual

Powerdrive MD2

LEROY-SOMER™

Manual corresponding to software versions higher than or equal to 5.80

SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES
(In accordance with the low voltage directive 2014/35/EU)

⚠ • **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 2014/30/EC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2014/35/EU. 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.

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.

⚠ **• Do not connect/disconnect the interface when the drive is powered up.**

After a loading phase following powering-up of the drive, the parameter-setting interface displays the following screen:
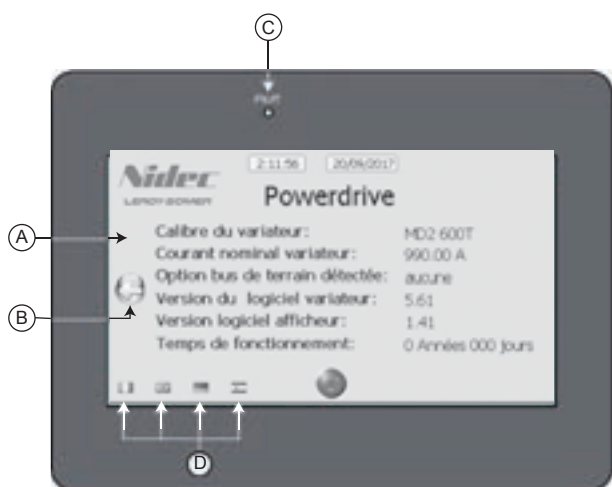
Repère	Fonction
A	4.3" touch screen
B	Touch-sensitive button for access to the main menu
C	"PWR" LED, indicates the state of the interface power supply
D	Touch-sensitive buttons for language selection (can take a few minutes to load)

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.
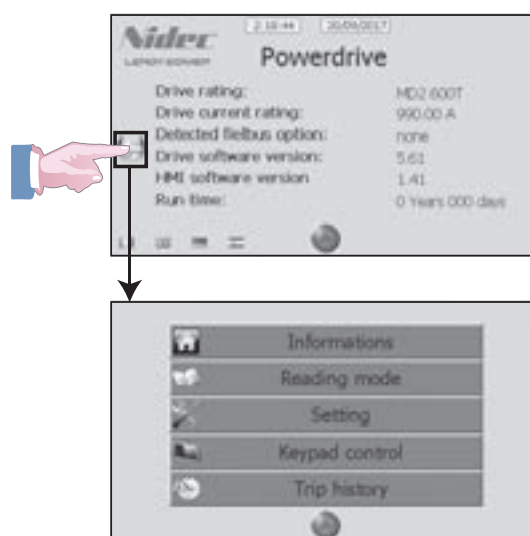
2.2.1 - «Informations» page

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.
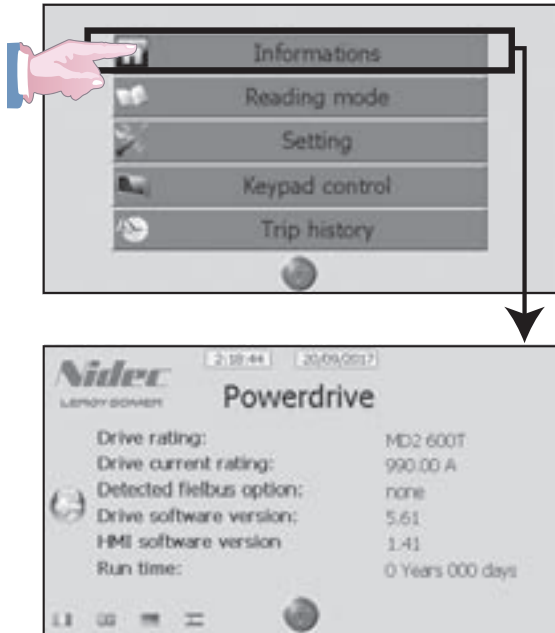
2.2.2 - «Reading mode» page

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.

Previous page   Next page
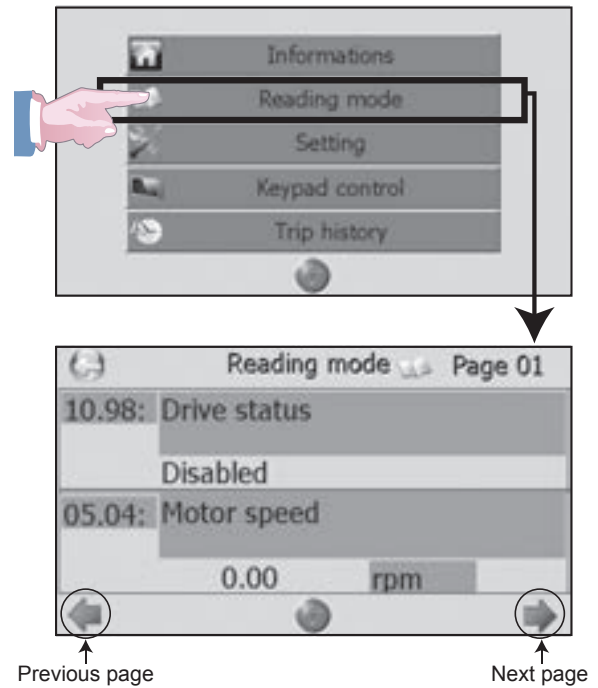
List of parameters displayed in Reading mode

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	DI1 to DI5 Digital input states	**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).
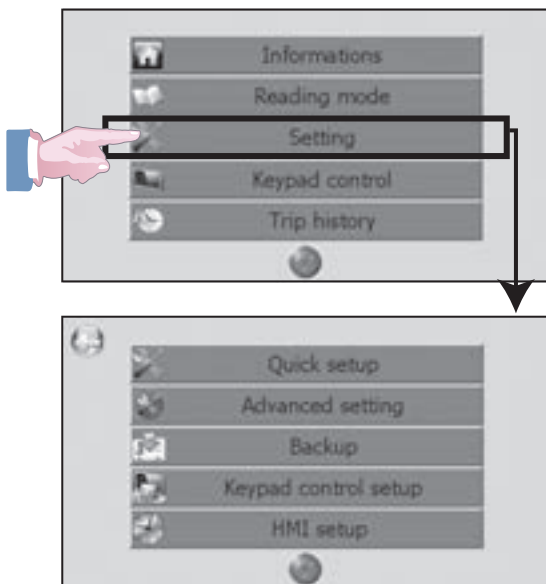
2.2.3.1 - Quick setup
«Quick setup» contains the most commonly used parameters.
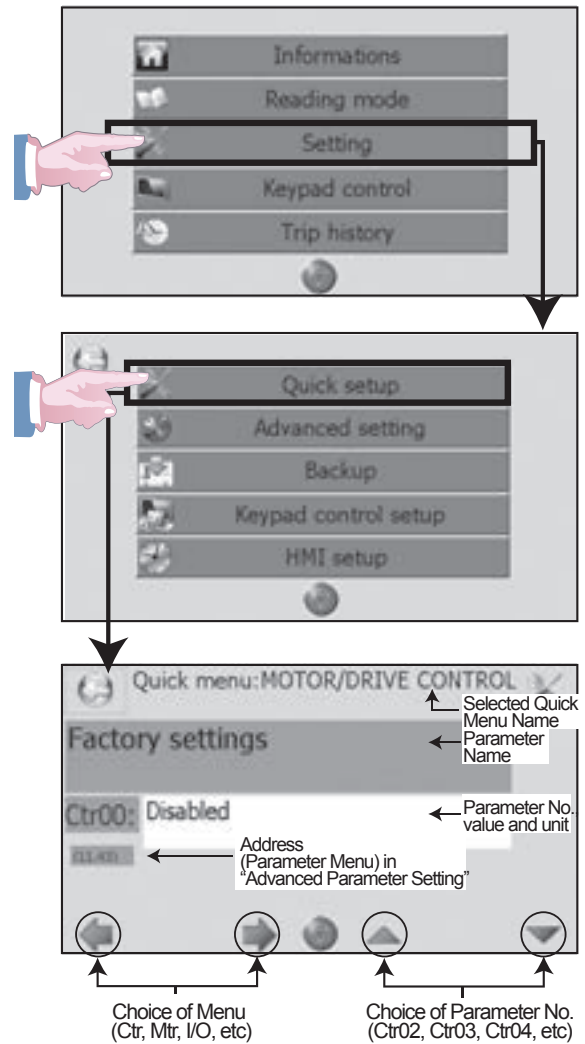
For a more detailed explanation of the menus and parameters offered in «**Quick setup**», refer to section 4.

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.

Cancel the entry if you make a mistake

Menu Number and Name

Parameter Name

Menu No. Parameter, value and unit

Choice of Menu (01 to 21)

Choice of Parameter No.

- 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)**
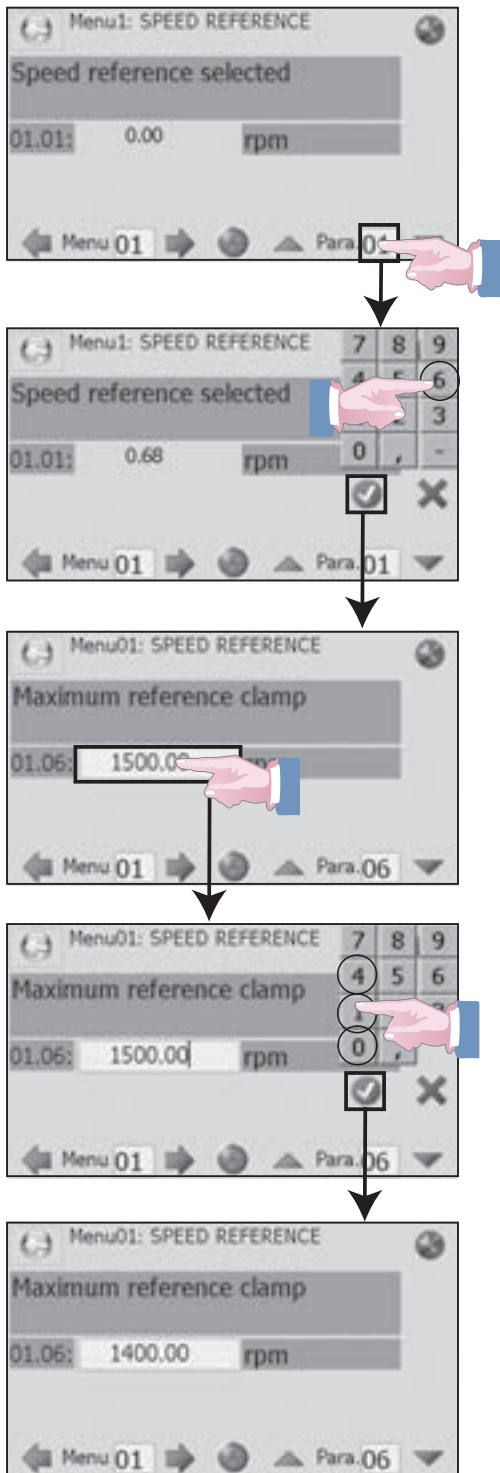
2.2.3.3 - Backup

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

Cancel the entry if you make a mistake

Loading progress bars

Choice of direction of data loading

Choice of file to be saved (maximum 3 saves)
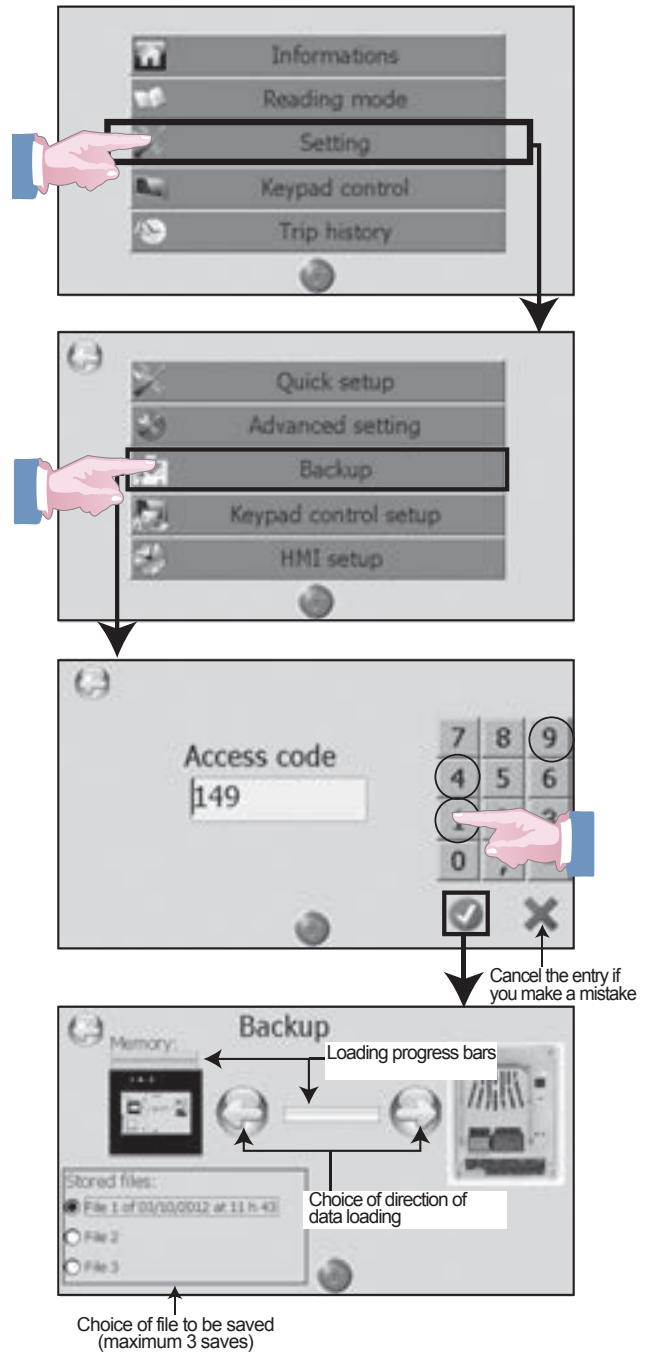
- Example of Backup operation from drive to interface:

The settings are stored in the interface...

Uploading end

... and correspond to file no. 1 with date and time

NOTE

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

- Example of Backup operation from interface to drive:

Select the file to be transferred to the drive

Are you sure to want to download the drive parameter File 1 of 03/10/2012 at 13 h 44?

yes ✓   no ✓

Downloading end

Parameter set no. 1 has been copied to the 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.
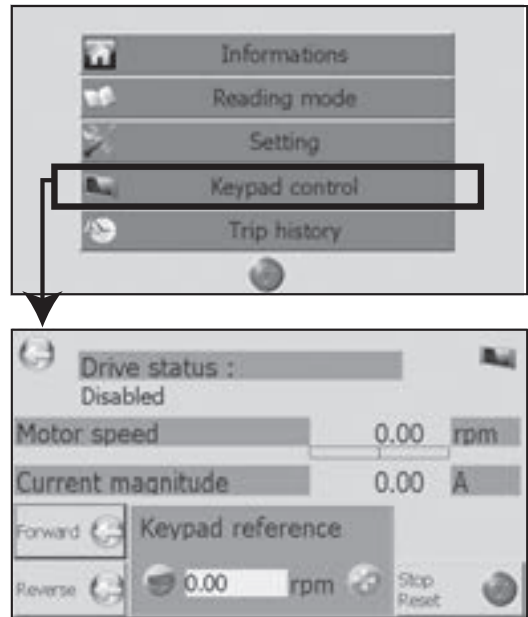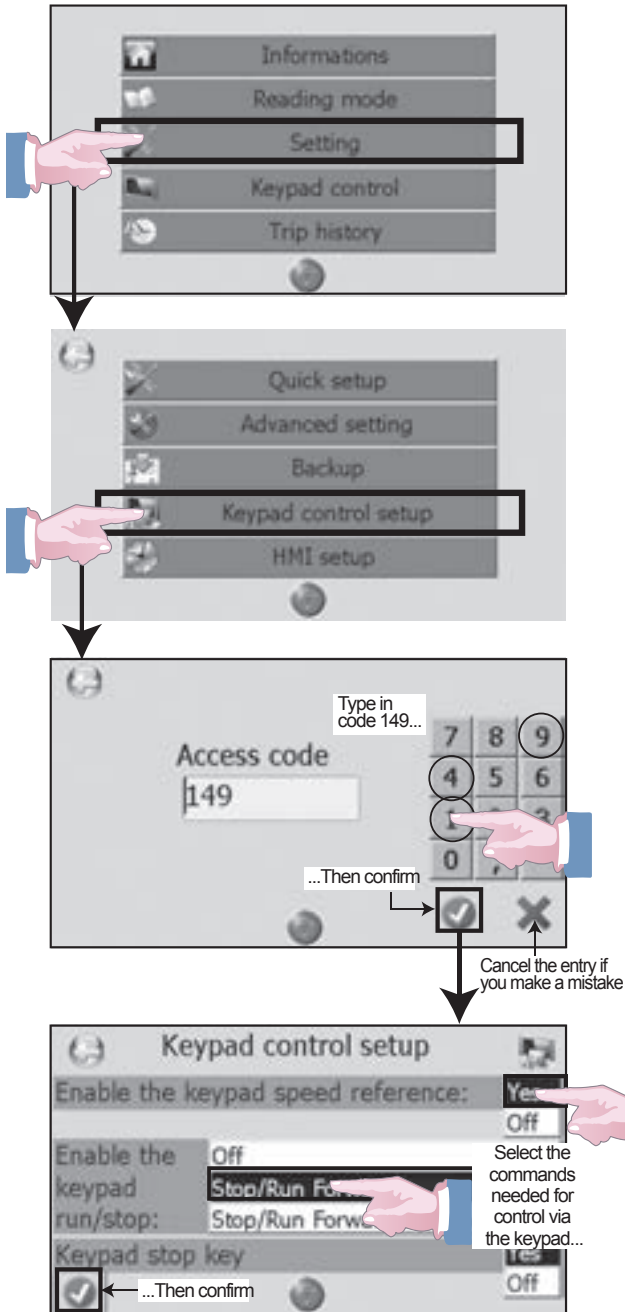
CAUTION:
Selections made in the «Keypad control setup» page have interactions with the Quick or advanced Setting parameters:
Setting the keypad reference to «Yes» forces Spd.03 (1.14) «Reference selector» to «Keypad».
Enabling Run/Stop commands via the keypad forces 06.43 (Ctr.05) to «LCD keypad». The 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.

- Setting the date or time

Cancel the entry if
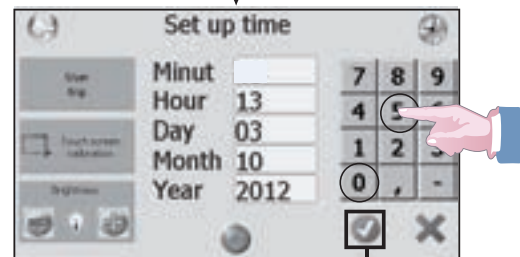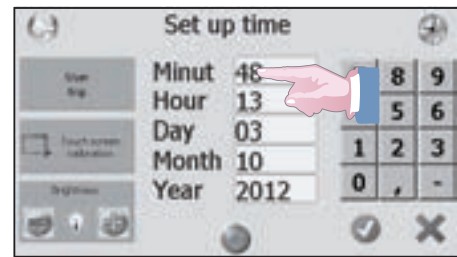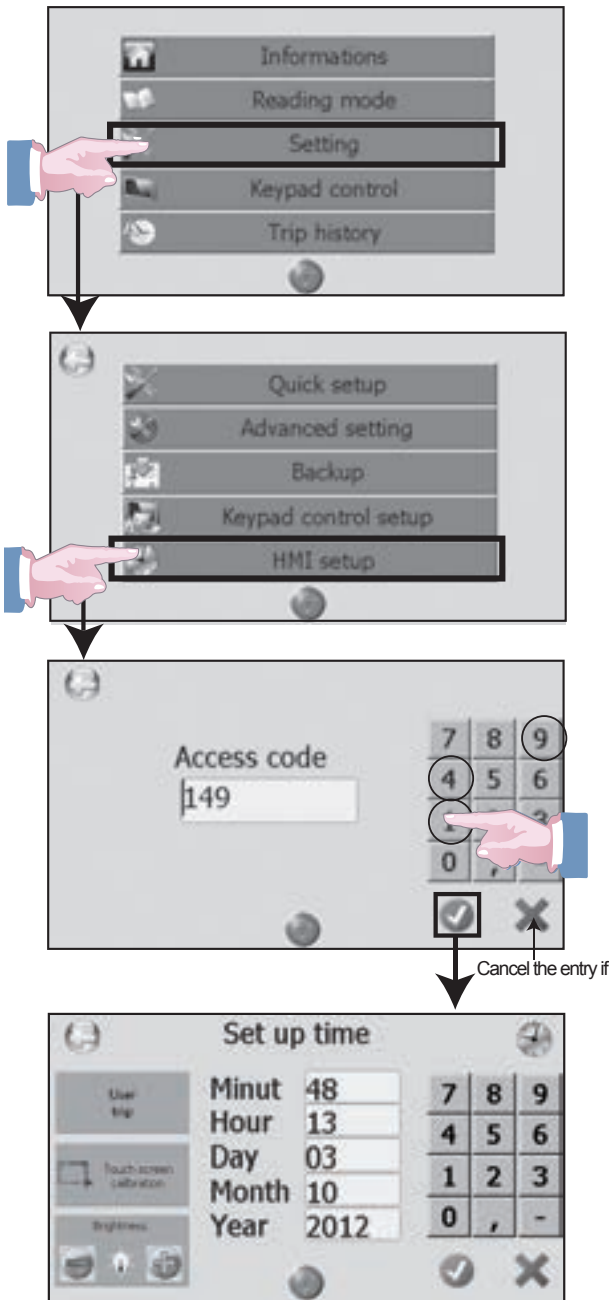
• **Modifying the user trip labels**
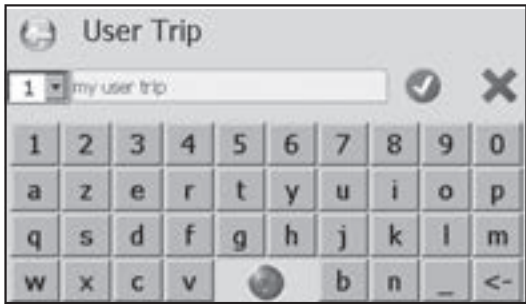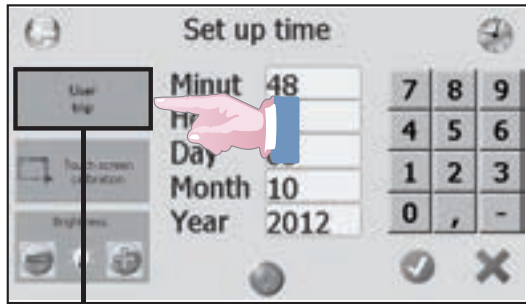
1 Select the trip number to be modified, then **2** use the keypad to type the text, then **3** confirm.

Once the trip has been activated, the text will be added to the standard label, as indicated below.
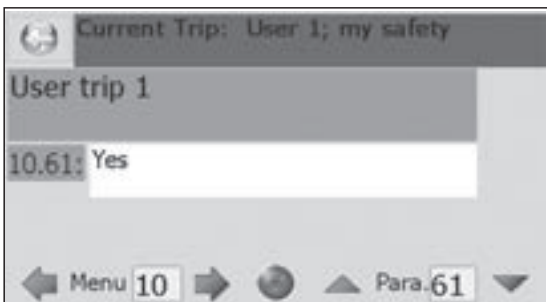
• **Setting the screen calibration**

A stylus is used for this calibration in order to set the touch screen parameters correctly.
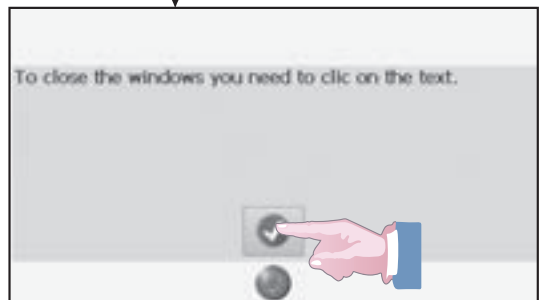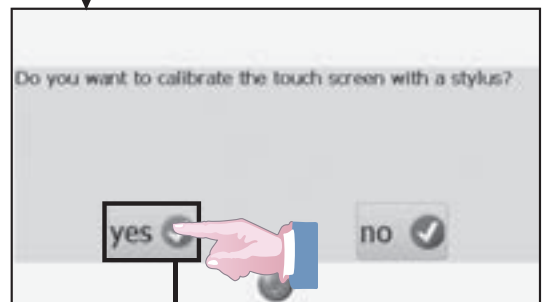
The stylus should then be positioned at several points suggested by crosses positioned on the screen. At the end of calibration, click on the text at the top of the screen to return to the «Date/Time» page.

• **Setting the screen brightness**
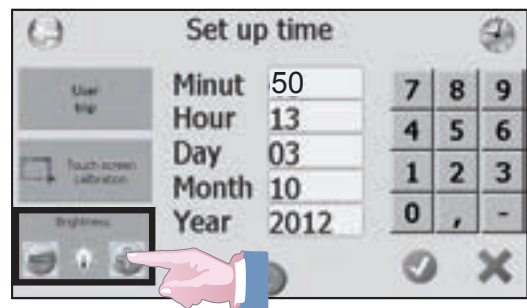
Click on the plus sign to increase the brightness or the minus sign to reduce it.

2.2.4 - Keypad control

«Keypad control « is used to control the drive interface using the parameter-setting interface.
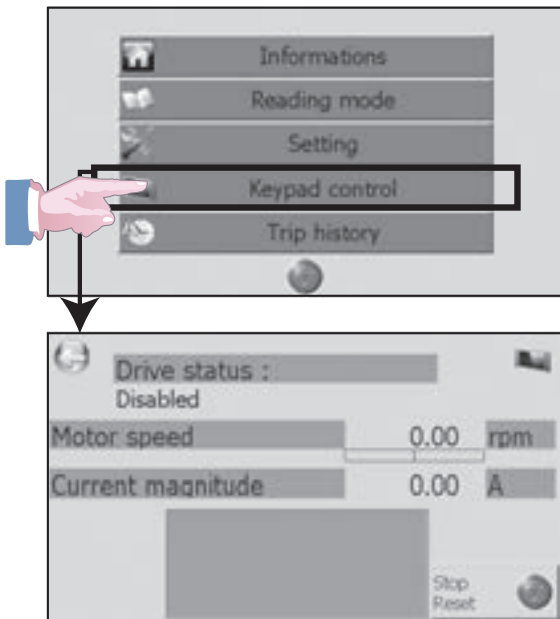
By default, the screen gives Informations about the drive status, the calculated motor speed and the current magnitude. The Stop/Reset command is also active.

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.
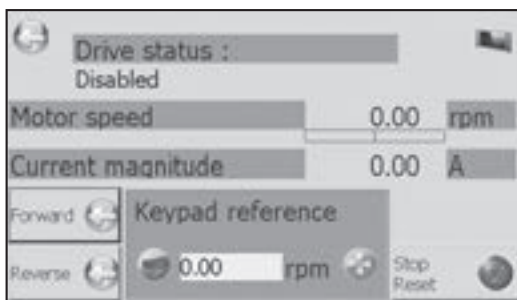
2.2.5 - «Trip history» page

«Trip history» displays the last 10 drive trips with the precise date and time of the event.
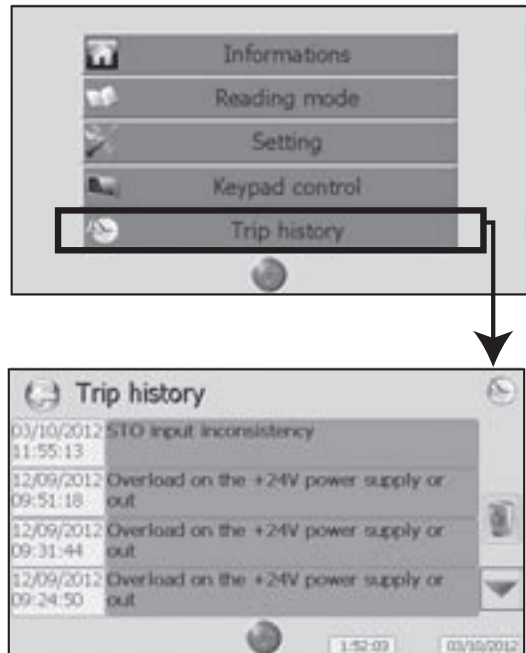
When the drive trips, it is displayed in a red banner, at the top of the interface screen. When the drive trips an alarm, it is displayed in a orange banner.
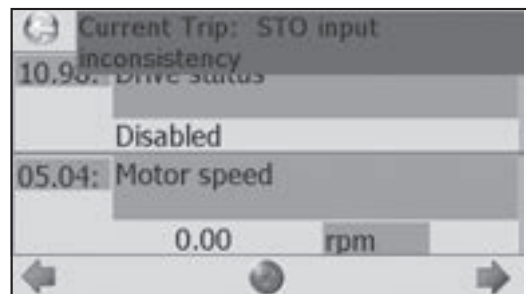
To clear a trip: resolve the problem, then press the Stop/Reset button.
If necessary, see section "TRIPS - DIAGNOSTICS".

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.

Bad serial link with the drive.
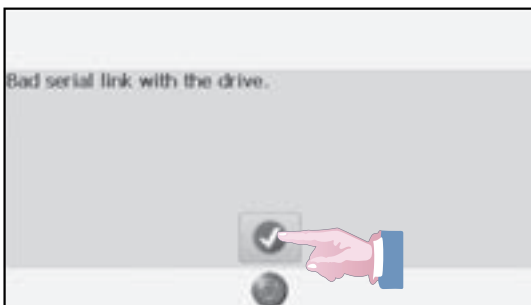
3 - PARAMETER-SETTING SOFTWARE

With MDX-SOFT, setting parameters and supervising the **POWERDRIVE MD2** 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://acim.nidec.com/motors/leroy-somer/downloads/software-and-drawings

To connect the PC to the POWERDRIVE MD2CS, use an «MDX-USB Isolator» isolated USB kit. The other drive types have an isolated USB port as standard.

⚠ **• In conformity with standard EN 60950, the drive USB link must provide an isolation of 4 kV (MDX-USB isolator option is needed for POWERDRIVE MD2CS).**

NOTE

If the control board is only supplied by the USB (drive powered down), the optional board settings are not visible, and are therefore neither saved nor restored.

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	11.30	Motor technology selection	None Induction motor: Voltage vector ctrl Induction motor: Oriented flux ctrl NC PM: Oriented flux ctrl. (LSRPM) NC PMASR: Oriented flux ctrl. (LSHRM)	None
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	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 Forced motor stop before restart	Disabled
Ctr.10	06.03	Mains loss mode	No detection Full stop Delayed stop	No detection

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 select	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: incomplete motor data Encoder offset measure/rotor parking Encoder offset measure/signal injection Stationary: incomplete motor data Reserved	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**	75% x **11.32**
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	Motor thermal protection management	Disabled Control board terminal MDX Encoder terminal Control board & MDX encoder terminals	Disabled
Mtr.07	05.50	Motor ventilation	Not cooled Self cooled Forced cooling	Self cooled
If Ctr.02 = PM: Oriented flux ctrl. (LSRPM) or PMASR: Oriented flux ctrl. (LSHRM):				
Mtr.08	05.24	d-axis inductance / leakage ind	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 Soft. 1 / Back EMF orientation Soft. 2 / Back EMF orientation Soft. 3 / Adaptative model Soft. 4 / Stator flux orientation Soft. 5 Resolver Resolver + signal loss detection	Soft. 2 / Back EMF orientation
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°

Parameter	Address	Name	Adjustment range	Factory setting
If Ctr.02 = PMASR: Oriented flux ctrl. (LSHRM):				
Mtr.14	05.76	Design Base Current (DBC)	± 2.22 x **11.32** (A)	0.01 A
Mtr.15	05.72	q-axis inductance @ no load	0.000 to 9000.000 mH	0.000 mH
Mtr.16	05.78	q-axis inductance @ DBC	0.000 to 9000.000 mH	0.000 mH
Mtr.17	05.87	Phase offset @ DBC	0 to 90°	58°
Mtr.18	05.86	Partial load phase Offset	0 to 90°	48°

• 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 = PM: Oriented flux ctrl. (LSRPM) or PMASR: Oriented flux ctrl. (LSHRM):				
Spd.09	03.10	Speed loop proportional gain Kp1	0 to 32000	500
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 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 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	None Motor speed Current magnitude Output power Active current	Current magnitude
I/O.05	07.20	AO1 analog output 1 scale	0.000 to 60.000	1.000

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 Preset reference selection using digital inputs
I/O.08	08.23	DI3 input destination		Bit 0 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

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
4.2.1 - Symbols and abbreviations

Key:

▣ : Indicates a parameter used when the drive is configured in Voltage Vector Control or V/F mode.

▣ : Indicates a parameter used when the drive is configured in Oriented Flux control mode with or without speed feedback.

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

• **Low saliency PM mode** (e.g for LSRPM motor, from Dyneo® range of Leroy-Somer):
Dedicated for ISPM (surface mounted permanent magnet motor) or IPM (Interior permanent magnet motor) where torque is mainly produced by the magnet field.

• **PM Assisted Synchro Reluctance PMASR mode** (e.g for LSHRM motor, from Dyneo⁺ range of Leroy-Somer):
Dedicated for hybrid motor technology with high saliency ratio where the torque is mainly produced by the reluctant effect.

4.2.2 - Accuracy and resolution

- Analog input resolution (AI1): 11 bits + sign.
- Analog input resolution (AI2): 12 bits + sign.
- Analog input resolution (AI3): 11 bits + sign.
- Speed loop sampling time: 2 ms.
- PID (Menu 14) sampling time: 6 ms.
- Preset speed reference resolution: 0.01 rpm.
- Static speed accuracy with encoder (1,024 pulses/rev): ±0.01% of Max speed.
- Current loop bandwidth: up to 100 Hz according to the settings.
- Analog input and output sampling time period is 2 ms.

4.2.3 - 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 4.2.7).
"Centrifugal application" is not restrictive and also covers the common applications such as pumps, fans, compressors, mixers, extruders, crushers.

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 4.2.8).

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 : Motor technology selection
This parameter can only be modified when the drive is stopped. **Each time the parameter Ctr.02 is edited, some parameters related to the motor technology are automatically preset**. Sets the motor technology and the type of control method (for detailed list of all preset parameters, see the advanced parameter **11.30**).

None (#):
No selection.

Induction motor: Voltage vector ctrl ▣ :
Dedicated for induction motors controlled in Voltage control mode (see **Ctr.13**).

Induction motor: Oriented flux ctrl ▣ :
Dedicated for induction motors controlled in Oriented flux control mode with or without speed feedback (see **Mtr.10**).

NC
Not used in Quick setup menu.

PM: Oriented flux ctrl. (LSRPM) ▣ :
Dedicated for PM motors with a low saliency ratio (< 2) controlled in Oriented flux control mode with or without speed feedback (see **Mtr.10**).

NC
Not used in Quick setup menu.

PMASR: Oriented flux ctrl. (LSHRM) ▣ :
Dedicated for PMASR motors or IPM motors with high saliency ratio (>2), controlled in oriented flux control mode with or without speed feedback (see **Mtr.10**).

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

Note: For frequencies higher than 6 kHz, please consult Nidec Leroy-Somer.

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.

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 section 5.5.

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 for Advanced Setup.

Not active:
Not used.

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

NOTE

Open STO1 and STO2 terminals before modifying **Ctr.05**.

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

Open STO1 and STO2 terminals before modifying **Ctr.06**.

Run no latch:
Command for FWD/Stop and REV/Stop via non latching contacts. In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.
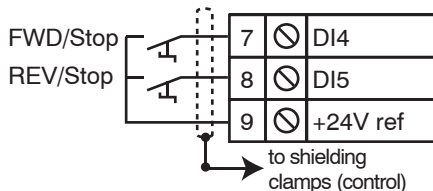
On power-up or after a trip reset, if a Run command is already selected, the motor starts as soon as the speed reference appears.

Run latched:
Command for Run and Stop via latching 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).

In its factory setting:
- Terminal DI4 preset to FWD.
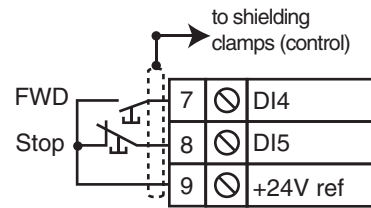
To change from FWD to REV or vice versa, go via a Stop command.

Run Fwd/Rev:
Command for Run/Stop via non latching 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).
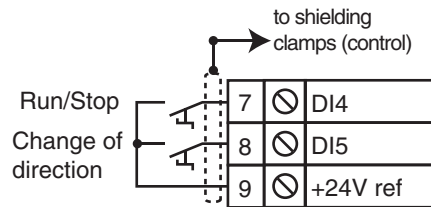
Controlled run (no latch) (#):
Command for FWD/Stop and REV/Stop via non latching contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.
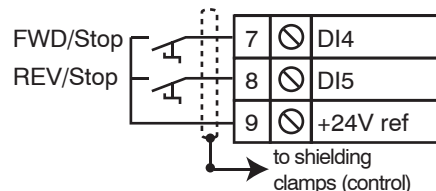
On power-up or after a trip reset, if a run command is already selected, the motor does not start. The Run input (DI4 or DI5) must be cycled for the command to take effect.

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).

CAUTION
If a LSHRM motor has no speed feedback sensor and if the application needs both directions of rotation, Ctr.07 must be set to Yes.

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.
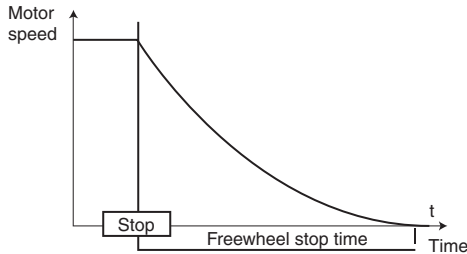
Ramp (#):

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».
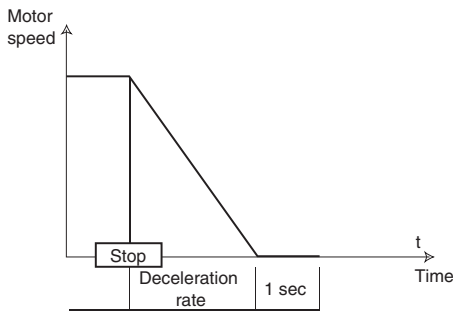
Ramp + DC ( ):

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».
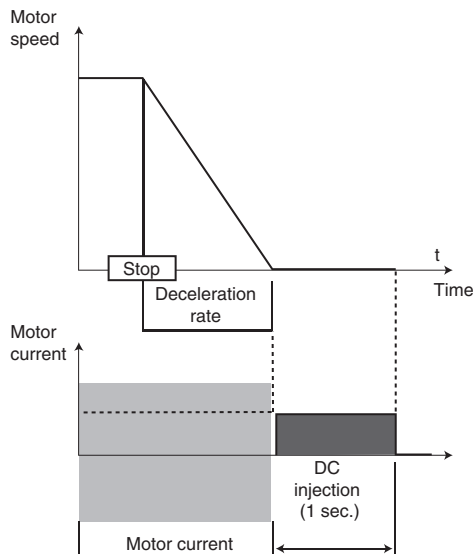
Zero speed DC ( ):

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».
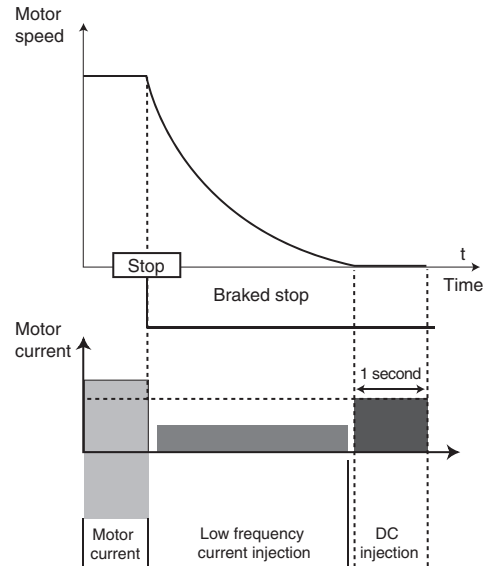
Timed DC ( ):

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».
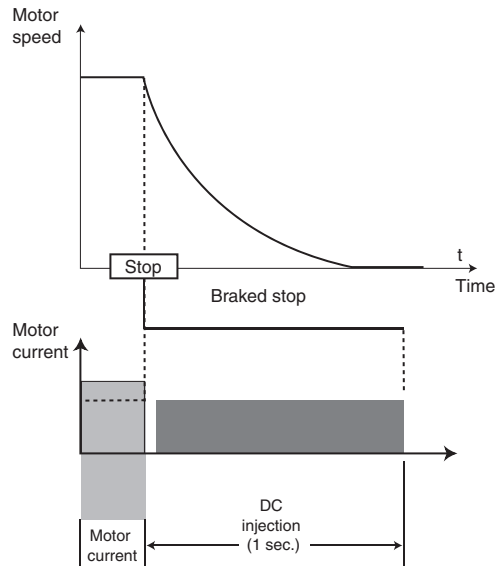
NOTE

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 (#):
The drive does not execute a "Catch a spinning motor" of a coasting motor.

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.

Forced Motor stop before restart:
This mode can be used to stop a coasting motor before starting it again.
- Induction motor: A DC current is injected in the motor. The level and the duration of the DC current injection are respectively set to 100% of motor rated current during 1 seconde.
- Synchronous motor: To decelerate the motor, the drive adds losses in the stator by controlling the motor current amplitude. The level and the duration of the motor current are respectively set to 100% of motor rated current during 1 seconde.

NOTE
Catch a coasting motor is not compatible with the S ramp associated with brake control (**Apl.01** ≠ Disabled).

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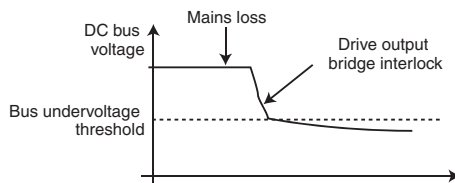
CAUTION:
The "Full stop" and "Delayed stop" cases can only work correctly if the energy stored in the application is more than the energy to be provided during the mains loss.
Eligible applications: ventilation, centrifuging, etc.

Full stop:
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».
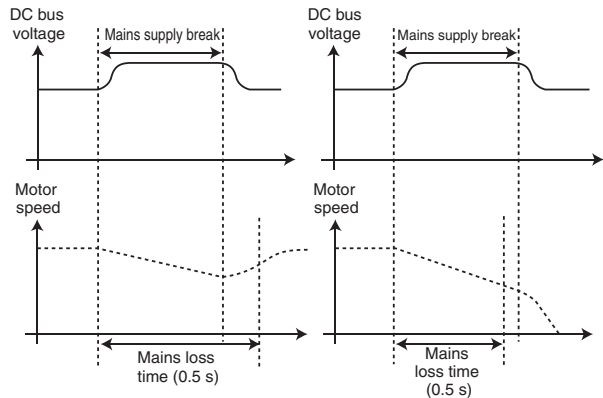
| Ctr.11 | : Auto reset type

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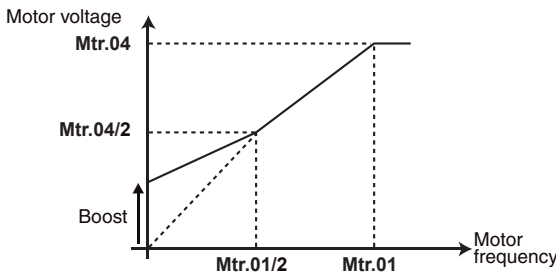
Rs measured after each factory setting:
After a return to factory settings, the stator resistance and voltage offset are measured the first time the drive is enabled (drive output active).

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

⚠ **• A voltage is briefly applied to the motor. For safety reasons, live parts must NOT be accessible once the drive is powered up.**

Square U/F law with boost:
Square voltage/frequency law with fixed boost.
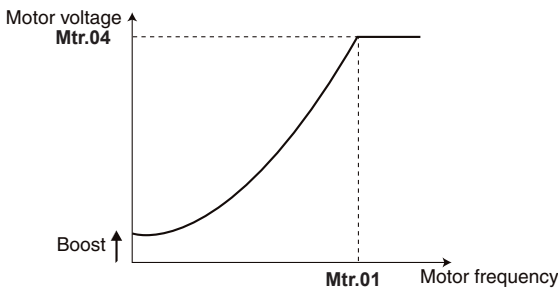
Ctr.14 : Autotune

⚠ **• During the autotune phase, brake control is disabled.**
• If Ctr.14 is set to "Rotating: incomplete motor data", "Encoder offset measure / rotor parking" or "Encoder offset measure / signal injection", the motor rotates at low speed or at 2/3 of its rated speed. Make sure that this operation does not present any safety risks, and that the motor is stopped before initiating the autotune procedure.
• After modifying the motor parameters, repeat autotuning.

• If **Ctr.02** = "Induction motor: Voltage vector ctrl"

None (#):
No autotune performed.

Stationary: motor data completed:
The stator resistance and the voltage offset are measured and stored.

Rotating: incomplete motor data:
Not relevant.

Encoder offset measure/rotor parking:
Not relevant.

Encoder offset measure/signal injection:
Not relevant.

Stationary: incomplete motor data:
Not relevant.

Reserved:
Not relevant.

• If **Ctr.02** = "Induction motor: Oriented flux ctrl"

None (#):
No autotune performed.

Stationary: motor data completed:
The stator resistance and the voltage offset are measured and stored.

Rotating: incomplete motor data:
The stator resistance and the voltage offset are measured and stored. The d-axis inductance / leakage ind **Mtr.08** and total inductance «Ls» are also measured and stored. The power factor **Mtr.05** is automatically updated.

Encoder offset measure/rotor parking :
This mode is only active if **Mtr.10** is set «Resolver». In this mode, the motor runs at very low speed so that the resolver offset can be measured. This offset is automatically stored in **Mtr.13**.

Encoder offset measure/signal injection:
Not relevant.

Stationary: incomplete motor data:
Not relevant.

Reserved:
Not relevant.

• If **Ctr.02** = "PM: Oriented flux ctrl. (LSRPM)"

None (#):
No autotune performed.

Stationary: motor data completed:
The stator resistance and the voltage offset 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.

Rotating: incomplete motor data:
The stator resistance and the voltage offset are measured and stored. The d-axis inductance / Leakage ind **Mtr.08** and Motor volt per 1000 rpm (Ke) **Mtr.09** are measured and stored.

Encoder offset measure/rotor parking:
This mode is only active if **Mtr.10** is set to «U, V, W only», «Incremental UVW», «Hall effect sensor» or «Resolver». In this mode, the motor runs at very low speed so that the encoder offset can be measured. This offset is automatically stored in **Mtr.13**.

Encoder offset measure/signal injection:
Not relevant.

Stationary: incomplete motor data:
Reserved.

Reserved:
Not relevant.

• If **Ctr.02** = "PMASR: Oriented flux ctrl. (LSHRM) "

None (#):
No autotune performed.

Stationary: motor data completed:
The stator resistance and the voltage offset are measured and stored. The stator inductance is measured but not stored. The current loop is automatically set.

Rotating: incomplete motor data:
Not relevant.

Encoder offset measure/rotor parking:
Not relevant.

Encoder offset measure/signal injection:
This mode is only active if **Mtr.10** is set to «U, V, W only», «Incremental UVW», «Hall effect sensor» or «Resolver».A current signal with high frequency and low amplitude is injected into the motor stator. The encoder offset is determined by measuring the motor stator inductance in multiple directions.
This offset is automatically stored in **Mtr.13**.

Stationary: incomplete motor data:
Reserved.

Reserved:
Not relevant.

Procedures to carry out the autotune:

• Stationary: motor data completed:
- 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 **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. **Ctr.14** reverts to «None».
- Disable the drive and remove the run command.
The motor is then ready to operate normally.

• Rotating: incomplete motor data:
- Ensure that the known motor parameters have been configured and that the motor is stopped.
- 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.
- Enable the drive.
- Give a run command. The motor is driven, then performs a freewheel stop when autotuning is complete.
- Wait until the procedure ends. **Ctr.14** reverts to «None».
- Disable the drive and remove the run command.
The motor is then ready to operate normally.

⚠ **• In this mode, the motor runs at 2/3 of its rated speed or at 1000 rpm maximum.**

• Encoder offset measure/rotor parking:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command. The motor runs at very low speed until the encoder offset can be measured.

• Encoder offset measure/signal injection:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command. The motor shaft moves slightly during the measuring phase.

NOTE
- If a stop command is given before the end of the autotune phase, an autotune trip is generated.
- An auto-tune test cannot be initiated if the drive is tripped or the drive inverter is active.
- After modifying motor parameters, repeat autotuning.
- If **Ctr.14** = "Encoder offset measure/rotor parking" or "Encoder offset measure/signal injection": the autotune is required only in oriented flux control mode.

4.2.4 - 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.
CAUTION:
Do not set a different value than the one plated on the motor.

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 induction 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 : **Motor thermal protection management**

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

Control board terminal:
Fault management of a motor temperature sensor connected to DI1/CTP input of the main control board.

MDX Encoder terminal:
Fault management of a motor temperature sensor connected to T1/T2 of the MDX-ENCODER or MDX-RESOLVER option.

Control board & MDX encoder terminals:
Fault management of 2 motor temperature sensors respectively connected to DI1/CTP input of the main control board and T1/T2 of the MDX-ENCODER or MDX-RESOLVER option.

CAUTION:
If Mtr.06 is set to «Control board terminal» or «Control board & MDX encoder terminals», then digital input DI1 must not be used (do not assign I/O.06).

NOTE
Mtr.06 can be preset by **Ctr.02** depending of motor technology selection.

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.

NOTE
This parameter combined with other motor parameters is used to estimate the machine thermal use percentage.

Mtr.08 : **d-axis inductance / leakage ind**

- Induction motor: Value of the overall leakage inductance applied to the typical machine stator. The value of **Mtr.08** is stored automatically during an autotune when running in Oriented flux control mode (see **Ctr.14**).

- Synchronous motor: Value of the cyclical stator inductance. The value of **Mtr.08** is used for PM or PMASR motors. Its value should be entered preferably from the nameplate data, or else using the autotune procedure (see **Ctr.14**).

Mtr.09 : **Motor volt per 1000 rpm (Ke)** ■
The value of **Mtr.09** is used for synchronous motors.
Its value should be entered preferably from the nameplate data or else using the rotating autotune procedure.

NOTE
If motor speed is over 15000 rpm, the value of **Mtr.09** represents the Motor volt per 10000 rpm.

Mtr.10 : **Encoder type**
The drive must be equipped:
- With an MDX-ENCODER option for managing encoders or Hall effect sensors.
- With an MDX-RESOLVER option for managing resolvers.
CAUTION:
Mtr.10 is not active when Ctr.02 = Induction motor: Voltage vector ctrl.

NOTE
Mtr.10 can be preset by **Ctr.02** depending of motor technology selection.

• If **Ctr.02** = "Induction motor : Oriented flux Ctrl"

Incremental:
Speed feedback via quadrature incremental encoder with A,A\,B,B\ signals. Related parameter: **Mtr.11**.

Reserved:
Not applicable.

U,V,W only:
Not applicable.

Incremental U,V,W:
Same as «Incremental».The U, V, W signals are not used.

Hall effect sensor:
Not applicable.

Soft. 1 / Back EMF orientation:
"Sensorless" mode recommended for applications where low starting torque is required (pump, fan, etc).

Soft. 2 / Back EMF orientation (#):
This "Sensorless" mode is automatically preselected after memorizing "Induction motor : Oriented flux Control" in **Ctr.02**. It is recommended for applications where high starting torque is required (grinder, press, extruding machine, etc).

Soft. 3 to 5:
Not applicable.

Resolver:
Speed feedback via resolver with no monitoring of the signals level.

Resolver + signal loss detection:
Resolver with monitoring of the signals feedback level.

• If **Ctr.02** = "PM: Oriented flux Ctrl (LSRPM)" or "PMASR: Oriented flux ctrl (LSHRM)"

Incremental:
Not applicable

Reserved:
Not applicable.

U,V,W only:
This selection allows use in downgraded operation of an encoder with commutation signals whose A and B channels are not operational.

Incremental U,V,W:
Dedicated to permanent magnet machines fitted with an incremental encoder with A,A\,B,B\ signals and U,U\ V,V\ W,W\ commutation channels.

Hall effect sensor:
Dedicated to permanent magnet machines fitted with 3 Hall effect sensors phase-shifted by 120° electrical.

Soft. 1 / Back EMF orientation:
"Sensorless" mode available for the "Advanced" menu.

Soft. 2 / Back EMF orientation (# if Ctr.02 = PM: Oriented flux ctrl. (LSRPM)):
This sensorless mode is automatically preselected after memorizing « PM: Oriented flux Ctrl. (LSRPM) » in **Ctr.02**. It is not suitable for **Ctr.02** = "PMASR: Oriented flux ctrl. (LSHRM)".

NOTE
Fill in parameters **Mtr.01** to **Mtr.04**, **Mtr.08** and **Mtr.09** using the motor nameplate data. Then perform an autotune **Ctr.14** = "Stationary: motor data completed".

Soft. 3 / Adaptive model (# if Ctr.02 = PMASR: Oriented flux Ctrl. (LSHRM)):
This sensorless mode is automatically preselected after memorizing "PMASR: Oriented flux Ctrl. (LSHRM)" in **Ctr.02**. It is not suitable for **Ctr.02** = "PM: Oriented flux Ctrl. (LSRPM)".

NOTE
Fill in parameters **Mtr.01** to **Mtr.04**, **Mtr.08** , **Mtr.09**, **Mtr.14**, **Mtr.15**, **Mtr.16**, **Mtr.17** and **Mtr.18** using motor data available, then perform an autotune **Ctr.14** = «Stationary: motor data completed».

Soft. 4 / Stator flux orientation:
This mode is recommended for applications where the ratio between the load inertia and the motor inertia is more than 80 and **Ctr.02** = "PM: Oriented flux Ctrl. (LSRPM)".

Soft. 5:
Not applicable.

Resolver:
Speed feedback via resolver with no monitoring of the signals level.

Resolver + signal loss detection:
Resolver with monitoring of the signals feedback level.

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.**

Mtr.14 : **Design Base Current (DBC)**
Current that defines the point where the saturated inductance value **Mtr.16** and Phase Offset **Mtr.17** are characterized.
NOTE
This parameter is suitable when **Ctr.02** = PMASR: Oriented flux ctrl. (LSHRM).

Mtr.15 : **q-axis inductance @ no load**
Defines the inductance value in the q axis when the motor current is equal to 10% of the design base current **Mtr.14**.
NOTE
This parameter is suitable when **Ctr.02** = PMASR: Oriented flux ctrl. (LSHRM).

Mtr.16 : **q-axis inductance @ DBC**
Defines the theoretical inductance value in the q axis when the motor current is equal to the Design Base Current **Mtr.14** and the phase offset equals to **Mtr.17**.
NOTE
This parameter is suitable when **Ctr.02** = PMASR: Oriented flux ctrl. (LSHRM).

Mtr.17 : **Phase offset @ DBC**
Defines the theoretical offset angle between the direction of the motor current and the direction of the no-load motor voltage which produces the maximum torque when the motor current is equal to the design base current (DBC) **Mtr.14**.
NOTE
This parameter is suitable when **Ctr.02** = PMASR: Oriented flux ctrl. (LSHRM).

Mtr.18 : **Partial load phase offset**

Defines the theoretical offset angle between the direction of the motor current and the direction of the no-load motor voltage which produces the maximum torque when the motor current is equal to half design base current (DBC) (**Mtr.14**/2) . This value is indicated on the motor nameplate.

NOTE

This parameter is suitable when **Ctr.02** = PMASR: Oriented flux ctrl. (LSHRM).

4.2.5 - Speeds and ramps

Spd.01 : **Maximum reference clamp**

Maximum speed in both directions of rotation.

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

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 PR1 if digital input DI2 is open or PR2 if DI2 is closed (set **Spd.04** for PR1 or **Spd.05** for PR2).

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.

$$\textbf{Spd.06} = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$
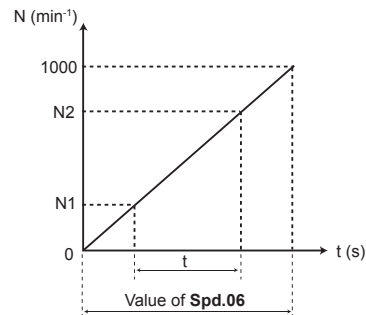
Spd.07 : **Deceleration rate 1**
Sets the time for deceleration from 1000 rpm to 0.

$$\textbf{Spd.07} = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$
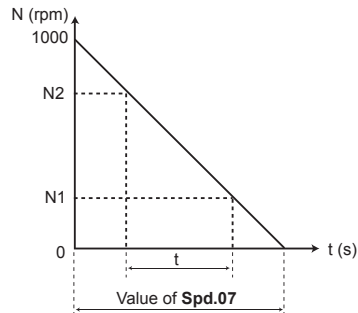
Spd.08 : **Deceleration ramp mode select**

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 (■)**
Used to set the amount by which the speed reference is exceeded following an acceleration or following a load impact. The setting of **Spd.09** depends on the load inertia. The factory value is suitable for low inertia. For applications with high applied inertia (fan, centrifuge, grinders, etc), the value of **Spd.09** needs to be increased.
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.

4.2.6 - 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 Mode**
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 «Control board terminal» or «Control board & MDX encoder terminals», 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.

4.2.7 - 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:

$$\Longrightarrow \mathbf{Apl.03} = \frac{1000}{\mathbf{Spd.01}} = 0.67$$

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 PR1: 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 detects 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 detects 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 (for buffer variable details, please refer to section 5.15).

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 (for buffer variable details, please refer to section 5.15).

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 PR1: Preset reference or PR2: Preset reference.

Apl.15 : **PID proportional gain**
With a PID error of 100%, the proportional part of the PID output equals 100% when **Apl.15** = 32.000.

`Apl.16` : **PID integral gain**
With a PID error of 100% and a gain **Apl.16** = 1.000 the integral part of the PID varies by 100% in 1 s.

`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` and `Apl.20` : **Not used**

4.2.8 - 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 Voltage control 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 - Default drive control connections and functions

- Most common applications include pumps, fans, compressors, mixers, crushers, extruders, …
- This section applies to 6 pulse rectifier drives Powerdrive MD2 (MD2MS, MD2CS or MD2S) with or without sensor and without brake.
- The quick start considers commissioning the drive using the following default terminal configuration with easy run sequence adaptation.
- The STO-1 and STO-2 inputs must be closed before giving a run command.

PX1

	1	+10V ref
0-10 V speed reference	2	AI1+
	3	AI1-
4-20 mA speed reference	4	AI2+
	5	AI2-
	6	0V
	7	AI3
4-20 mA current image	8	AO1
Motor PTC*	9	DI1/PTC
	10	0V

PX2

	1	+24V ref
Zero speed	2	DO1
Safe Torque Off/ Drive enable input 1	3	STO-1
Reference selection	4	DI2
Reference selection	5	DI3
Safe Torque Off/ Drive enable input 2	6	STO-2
Run FWD/Stop	7	DI4
Run REV/Stop	8	DI5
	9	+24V ref

PX3

Drive status relay (N/O)**	1	COM-RL1
	2	RL1
Maximum speed alarm relay (N/O)	3	COM-RL2
	4	RL2

(*) If the motor thermal sensor needs to be connected to DI1/CTP, set **Mtr.06** (**05.70**) = Control board terminal (1).
(**) If the 2 STO inputs are not closed at the same time, the relay RL1 opens.

• **Modification of the Run/Stop control logic**
- For «3 wire» control (Jog Run/Stop)

Run FWD	7	DI4
Stop	8	DI5
	9	+24V ref
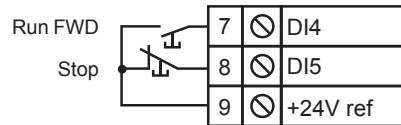
List of parameters to adjust :
Ctr.06 (06.04) = Run Latched (1),
I/O.10 (08.25) = Stop **06.39** (DI5 terminal).

- For Run/Stop control with change of direction :

Run/Stop	7	DI4
Change of direction	8	DI5
	9	+24V ref
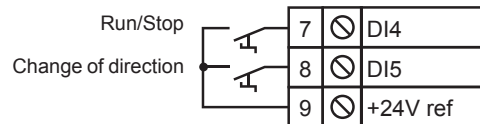
List of parameters to adjust :
Ctr.06 (06.04) = Run Fwd/Rev (2),
I/O.09 (08.24) = Run/Stop **06.34** (DI4 terminal),
I/O.10 (08.25) = Fwd/Reverse **06.33** (DI5 terminal).

For MDX-ENCODER or MDX-RESOLVER connection, please refer to the Installation guide ref.5340.

• **Selection of the reference via digital inputs:**

DI2 (01.45)	DI3 (01.41)	Selection
0	0	Voltage speed reference (0-10 V) on analog input AI1+, AI1-
0	1	Current speed reference (4-20 mA) on analog input AI2+, AI2-
1	0	Preset reference 2 **Spd.05 (01.22)** to be set
1	1	

4.4 - Quick start procedure in Voltage vector or Oriented flux control mode

This quick start is suitable to control an induction motor (e.g LSES) in voltage vector control or a permanent magnet motor (e.g LSRPM) in oriented flux control without speed feedback ("sensorless" mode) from drive default settings.

Oriented flux control has the following limitations:
- Starting torque (0 to 10% of rated speed) = 75% of rated torque,
- Maximum load/motor inertia ratio = 80. If the ratio between the load inertia and the motor inertia is more than 80, set **Mtr.10** = "Soft. 4 / Stator flux orientation",
- Minimum application rated speed = $1/10^e$ of rated speed.

Drive auto test sequence

Drive off, check that:

- STO-1 and STO-2 terminals are connected to +24V terminal
- Run command is connected but not enabled
- U,V,W motor terminals are respectively connected to U, V and W terminals of the drive. Motor will run clockwise looking at DE when run forward is enabled. If not appropriate use parameter **Ctr.12** to reverse direction rather than crossing cables

Switch the drive power supply ON:

- The test is automatically performed during power up (5 sec sequence)
- At the end of the test:
    - ✓ If the test passed, the HMI displays "Ready" and the drive is ready to use
    - ✓ if a "Diagnostic" trip appears, read the result of the power module test in **17.06**

Set the HMI clock according to procedure detailed in section 2.2.3.5

Open STO-1 and STO-2 to disable the drive during drive setting

---

↓

Application selection

In "Setting" mode, select "Quick Setup" mode

Set **Ctr.01 (11.43)** = "Centrifugal application" (1) (suitable for constant torque application also).
At the end of the sequence, parameter value is automatically set back to "Disabled"

Induction ← ◇ Motor technology ? → Synchronous (Permanent magnet)

Induction motor

Set **Ctr.02 (11.30)** Control mode = "Induction motor: voltage vector ctrl" (1) ▣

Check **Ctr.03 (05.18)** Switching frequency = value shown on motor nameplate "minFsw" (see NOTE 2)

Set **Ctr.14 (05.12)** Autotune = "Stationary: motor data completed" (1)

↓

(A)

LSRPM Permanent Magnet motor

Set **Ctr.02 (11.30)** Control mode = "PM: Oriented flux ctrl. (LSRPM)" (4) ▣

Check **Ctr.03 (05.18)** Switching frequency = value shown on motor nameplate "minFsw" (see NOTE 2)

Set **Ctr.14 (05.12)** Autotune = "Stationary: motor data completed" (1)

↓

(B)

Caution
Parameters must be entered as shown on nameplate (including decimals).

(A)

(B)

Set induction motor parameters from nameplate

- **Mtr.01 (05.06)** Motor rated Frequency (Hz)
- **Mtr.02 (05.07)** Motor rated current (Amps)
- **Mtr.03 (05.08)** Motor rated speed (rpm)
- **Mtr.04 (05.09)** Motor rated voltage (V)
- **Mtr.05 (05.10)** Rated power factor
- **Mtr.06 (05.70)** Motor thermal protection management
  (if PTC is connected to DI1/CTP terminals, set
  Mtr.06 = Control board terminal (1))

Mtr.04 (05.09) Mtr.01 (05.06) Mtr.05 (05.10)

Mtr.03 (05.08) Mtr.02 (05.07)

Set PM motor parameters from nameplate

- **Mtr.01 (05.06)** Motor rated Frequency (Hz)
- **Mtr.02 (05.07)** Motor rated current (Amps)
- **Mtr.03 (05.08)** Motor rated speed (rpm)
- **Mtr.04 (05.09)** Motor rated voltage (V)
- **Mtr.06 (05.70)** Motor thermal protection management
  (if PTC is connected to DI1/CTP terminals, set
  Mtr.06 = Control board terminal (1))
- **Mtr.08 (05.24)** d-axis inductance (mH)
- **Mtr.09 (05.33)** Motor volt per 1000 rpm, Ke (V)

Mtr.04 (05.09) Mtr.01 (05.06) Mtr.02 (05.07)

Mtr.03 (05.08) Mtr.08 (05.24) Mtr.09 (05.33)

Main operating parameters

- **Spd.01 (01.06)** Maximum reference clamp (rpm)
- **Spd.06 (02.11)** Acceleration rate (s/1000rpm)
- **Spd.07 (02.21)** Deceleration rate (s/1000rpm)

⚠ **Before setting the maximum speed, check that the motor and the driven machine can withstand it.**

Wish to trip on minimum speed threshold ?

Yes →

No →

Minimum Speed trip settings

- **Apl.08 (12.84)** Minimum Speed Threshold (rpm)
- **Apl.09 (12.87)** User trip 1. Enable User trip 1 which will be displayed on HMI
- **Apl.10 (12.88)** Masking time (s). Masking used to delay detection of minimum speed to avoid detection on starting

(C)

C

Run Autotune sequence

- Close STO-1 and STO-2 to enable the drive. HMI displays "Ready"
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed

Application is ready to be operated

Parameter settings are automatically memorized in drive control board. However it is possible to make a copy in the HMI using procedure described in section 2.2.3.3

NOTE 1

- This quick start procedure will provide optimum level of performance for most of the applications. However it may happen, in some few configurations with PM motors, that settings require to be optimized (for example in the case of high load/motor inertia ratio) some instabilities may be experienced with default settings). For those cases, parameters **Spd.09** & **Spd.10** may be used to tune the system.
- To help supervising the behavior of the motor during tuning, the **MDX-SOFT** PC tool can be used with a laptop connected to the USB port available on the drive front door. Use the "Charts" feature of **MDX-SOFT** to supervise the speed reference (**03.01**), the motor speed (**05.04**) and the motor current (**04.01**).

NOTE 2

In the event the minimum switching frequency is not available (hidden nameplate), set:
- 8 kHz for LSRPM132 and 160 with a rated speed ≥ 2400 rpm,
- according to the table below for other LSRPM motors.

Rated Speed	Minimum Switching Frequency
≤ 1800 rpm	3 KHz
1800 rpm < Rated speed ≤ 3600 rpm	4 KHz
3600 rpm < Rated speed ≤ 4500 rpm	5 KHz
4500 rpm < Rated speed ≤ 5500 rpm	6 KHz

For induction motor, keep the factory setting.

4.5 - Quick start procedure in oriented flux control with speed feedback (induction or LSRPM motor)

This quick start is suitable to control an induction motor (e.g LSES) or a permanent magnet motor (e.g LSRPM) with a speed feedback from drive default settings. For simplicity only an incremental quadrature encoder will be considered here.

Drive auto test sequence

Drive off, check that:

- STO-1 and STO-2 terminals are connected to +24V terminal
- Run command is connected but not enabled
- U,V,W motor terminals are respectively connected to U, V and W terminals of the drive. Motor will run   clockwise looking at DE when run forward is enabled. If not appropriate use parameter **Ctr.12** to reverse direction rather than crossing cables

Switch the drive power supply ON:

- The test is automatically performed during power up (5 sec sequence)
- At the end of the test:
    - ✓ If the test passed, the HMI displays "Ready" and the drive is ready to use
    - ✓ if a "Diagnostic" trip appears, read the result of the power module test in **17.06**

Set the HMI clock according to procedure detailed in section 2.2.3.5

Open STO-1 and STO-2 to disable the drive during drive setting

---

Application selection

In "Setting" mode, select "Quick Setup" mode

Set **Ctr.01 (11.43)** = "Centrifugal application" (1) (suitable for constant torque application also).
At the end of the sequence, parameter value is automatically set back to "Disabled"

Motor technology ?

Induction

Synchronous (Permanent magnet)

Induction motor

Set **Ctr.02 (11.30)** Control mode = "Induction motor: oriented flux ctrl" (2) ▣⟩

Check **Ctr.03 (05.18)** Switching frequency = value shown on motor nameplate "minFsw" (see NOTE 2)

Set **Ctr.14 (05.12)** Autotune = "Stationary: motor data completed" (1)

A

LSRPM Permanent Magnet motor

Set **Ctr.02 (11.30)** Control mode = "PM: Oriented flux ctrl. (LSRPM)" (4) ▣⟩

Check **Ctr.03 (05.18)** Switching frequency = value shown on motor nameplate "minFsw" (see NOTE 2)

Set **Ctr.14 (05.12)** Autotune = "Stationary: motor data completed" (1)

B

Caution
Parameters must be entered as shown on nameplate (including decimals).

Ⓐ

Ⓑ

Set induction motor parameters from nameplate

- **Mtr.01 (05.06)** Motor rated Frequency (Hz)
- **Mtr.02 (05.07)** Motor rated current (Amps)
- **Mtr.03 (05.08)** Motor rated speed (rpm)
- **Mtr.04 (05.09)** Motor rated voltage (V)
- **Mtr.05 (05.10)** Rated power factor
- **Mtr.06 (05.70)** Motor thermal protection management
        (if PTC is connected to DI1/CTP terminals, set
        Mtr.06 = Control board terminal (1))

Mtr.04 (05.09)   Mtr.01 (05.06)   Mtr.05 (05.10)

Mtr.03 (05.08)   Mtr.02 (05.07)

Set PM motor parameters from nameplate

- **Mtr.01 (05.06)** Motor rated Frequency (Hz)
- **Mtr.02 (05.07)** Motor rated current (Amps)
- **Mtr.03 (05.08)** Motor rated speed (rpm)
- **Mtr.04 (05.09)** Motor rated voltage (V)
- **Mtr.06 (05.70)** Motor thermal protection management
        (if PTC is connected to DI1/CTP terminals, set
        Mtr.06 = Control board terminal (1))
- **Mtr.08 (05.24)** d-axis inductance (mH)
- **Mtr.09 (05.33)** Motor volt per 1000 rpm, Ke (V)

Mtr.04 (05.09)   Mtr.01 (05.06)   Mtr.02 (05.07)

Mtr.03 (05.08)   Mtr.08 (05.24)   Mtr.09 (05.33)

Set encoder parameters

- **Mtr.10 (03.38)** Encoder type = "Incremental" (0)
- **Mtr.11 (03.34)** Encoder lines per revolution
        (default = 1024 lpr)
- **Mtr.12 (03.36)** Encoder supply voltage (5V (0) or 15V (1))

Set encoder parameters

- **Mtr.10 (03.38)** Encoder type = "Incremental U,V,W" (3)
- **Mtr.11 (03.34)** Encoder lines per revolution
        (default = 1024 lpr)
- **Mtr.12 (03.36)** Encoder supply voltage (5V (0) or 15V (1))

Main operating parameters

- **Spd.01 (01.06)** Maximum reference clamp (rpm)
- **Spd.06 (02.11)** Acceleration rate (s/1000rpm)
- **Spd.07 (02.21)** Deceleration rate (s/1000rpm)

⚠ **Before setting the maximum speed, check that the motor and the driven machine can withstand it.**

Ⓒ

C

Wish to trip on minimum speed threshold ?

Yes → **Minimum Speed trip settings**

- **Apl.08 (12.84)** Minimum Speed Threshold (rpm)
- **Apl.09 (12.87)** User trip 1. Enable User trip 1 which will be displayed on HMI
- **Apl.10 (12.88)** Masking time (s). Masking used to delay detection of minimum speed to avoid detection on starting

No

Motor technology ?

Induction

Run Autotune sequence

- Close STO-1 and STO-2 to enable the drive. HMI displays "Ready"
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed

Synchronous (Permanent magnet)

Run Autotune sequence

- Close STO-1 and STO-2 to enable the drive. HMI displays "Ready"
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed
- Set **Ctr.14 (05.12)** Autotune = "Encoder offset measure / Rotor parking" to select the second required autotune.
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed

Application is ready to be operated

Parameter settings are automatically memorized in drive control board. However it is possible to make a copy in the HMI using procedure described in section 2.2.3.3

Set **Spd.09 (03.10)** Speed loop proportional gain and **Spd.10 (03.11)** Speed loop integral gain to adjust the stability of the motor speed with MDX-SOFT

NOTE 1

To help supervising the behavior of the motor during tuning, the **MDX-SOFT** PC tool can be used with a laptop connected to the USB port available on the drive front door (MD2). Use the "Charts" feature of **MDX-SOFT** to supervise the speed reference (**03.01**), the motor speed (**05.04**) and the motor current (**04.01**).

NOTE 2

In the event the minimum switching frequency is not available (hidden nameplate), set the switching frequency according to the table below for LSRPM motors or set 8 kHz for LSRPM132 and 160 with a rated speed ≥ 2400 rpm. For induction motor, keep the factory setting.

Rated Speed	Minimum Switching Frequency
≤ 1800 rpm	3 KHz
1800 rpm < Rated speed ≤ 3600 rpm	4 KHz
3600 rpm < Rated speed ≤ 4500 rpm	5 KHz
4500 rpm < Rated speed ≤ 5500 rpm	6 KHz

4.6 - Quick start procedure of a LSHRM motor

This quick start is suitable to control a LSHRM permanent magnet motor from drive default settings. Only a resolver will be considered here as an optional speed feedback as it is the standard for Dyneo⁺ motors.

Drive auto test sequence

Drive off, check that:

- STO-1 and STO-2 terminals are connected to +24V terminal
- Run command is connected but not enabled
- U,V,W motor terminals are respectively connected to U, V and W terminals of the drive. Motor will run clockwise looking at DE when run forward is enabled. If not appropriate use parameter **Ctr.12 (05.59)** to reverse direction rather than crossing cables

Switch the drive power supply ON:

- The test is automatically performed during power up (5 sec sequence)
- At the end of the test:
  - ✓ If the test passed, the HMI displays "Ready" and the drive is ready to use
  - ✓ if a "Diagnostic" trip appears, read the result of the power module test in **17.06**

Set the HMI clock according to procedure detailed in section 2.2.3.5
Open STO-1 and STO-2 to disable the drive during drive setting

---

Application selection

In "Setting" mode, select "Quick Setup" mode

Set **Ctr.01 (11.43)** Factory settings = "Centrifugal application" (1) (suitable for constant torque application also)
At the end of the sequence, parameter value is automatically set back to "Disabled"

LSHRM Permanent Magnet motor technology

Set **Ctr.02 (11.30)** Control mode = "PMASR: Oriented flux ctrl. (LSHRM)" (6)

Ⓐ

A

Set motor parameters from motor design or nameplate

- **Mtr.01 (05.06)** Motor rated Frequency (Hz)
- **Mtr.02 (05.07)** Motor rated current (Amps)
- **Mtr.03(05.08)** Motor rated speed (rpm)
- **Mtr.04 (05.09)** Motor rated voltage (V)
- **Mtr.07 (05.50)** Motor ventilation. Set Not cooled (0) or Self cooled (1) or Forced cooled (2)
- **Mtr.08 (05.24)** d-axis inductance (mH)

- **Mtr.09 (05.33)** Motor volt per 1000 rpm, Ke (V)
- **Mtr.14 (05.76)** Design Base current, DBC (A)
- **Mtr.15 (05.72)** q-axis inductance @ no load (mH)
- **Mtr.16 (05.78)** q-axis inductance @ DBC (mH)
- **Mtr.17 (05.87)** Phase offset @ DBC (°)
- **Mtr.18 (05.86)** Partial load phase offset (°)

CAUTION
- **Parameters must be entered as shown on nameplate (including decimals). Motor rated current must NOT be set to a higher value than the plated one.**
- **Motor PTC sensor must be connected to DI1/CTP and 0V teminals of the drive (managed by default).**

Run Autotune sequence

- **Ctr.14 (05.12)** Autotune = "Stationary: motor data completed" (1)
- Close STO-1 and STO-2 to enable the drive. HMI displays "Ready"
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed

B

B

Set main operating parameters

- **Spd.01 (01.06)** Maximum reference clamp (rpm)
- **Spd.06 (02.11)** Acceleration rate (s/1000 rpm)
- **Spd.07 (02.21)** Deceleration rate (s/1000 rpm)

⚠️ **Before setting the maximum speed, check that the motor and the driven machine can withstand it.**

CAUTION : If there is no speed feedback sensor and if the application needs both directions of rotation, Ctr.07 (01.10) must be set to Yes (1).

NOTE : **02.08** Standard ramp voltage (V) is to be set to 750 Vdc if mains supply voltage is higher than 440 Vac.
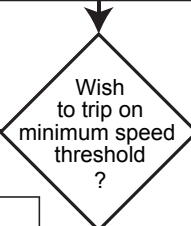
Wish to trip on minimum speed threshold ?

Yes →

No →

Minimum Speed trip settings

- **Apl.08 (12.84)** Minimum Speed Threshold (rpm)
- **Apl.09 (12.87)** User trip 1. Enable User trip 1 which will be displayed on HMI
- **Apl.10 (12.88)** Masking time (s). Masking used to delay detection of minimum speed to avoid detection on starting

Is a resolver fitted to the motor?
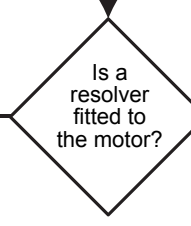
Yes →

No →

Set resolver feedback (MDX-RESOLVER option is needed)

- **Mtr.10 (03.38)** Encoder type = Resolver (10)

For standard resolver mounted on LSHRM motors, you need to set parameters as follows:
- **03.56** Resolver filter = 1 (default setting)
- **03.57** Resolver polarity = 2 poles (0) (default setting)
- **03.58** Resolver transformation ratio = 2:1 (1)
- **03.59** Resolver resolution = 16 bits (3)

Run Autotune sequence (second)

- **Ctr.14 (05.12)** Autotune = "Encoder offset measure / signal injection (4)
- Give a run command to start Autotune sequence. HMI displays "Autotune" during the sequence and reverts to "Ready" once completed
- Open Run command when sequence is completed

Application is ready to be operated

Parameter settings are automatically memorized in drive control board. However it is possible to make a copy in the HMI using procedure described in section 2.2.3.3

NOTE
- This quick start procedure will provide optimum level of performance for most of the applications. However it may happen, in some few configurations with PM motors, that settings require to be optimized (for example in the case of high load/motor inertia ratio) some instabilities may be experienced with default settings). For those cases, **Spd.09 (03.10)** Proportional gain, **Spd.10 (03.11)** Integral gain and **05.31** Defluxing loop gain may be used to tune the system.
- To help supervising the behavior of the motor during tuning, the **MDX-SOFT** PC tool can be used with a laptop connected to the USB port available on the drive front door (MD2). Use the "Charts" feature of **MDX-SOFT** to supervise the speed reference (**03.01**), the motor speed (**05.04**) and the motor current (**04.01**).
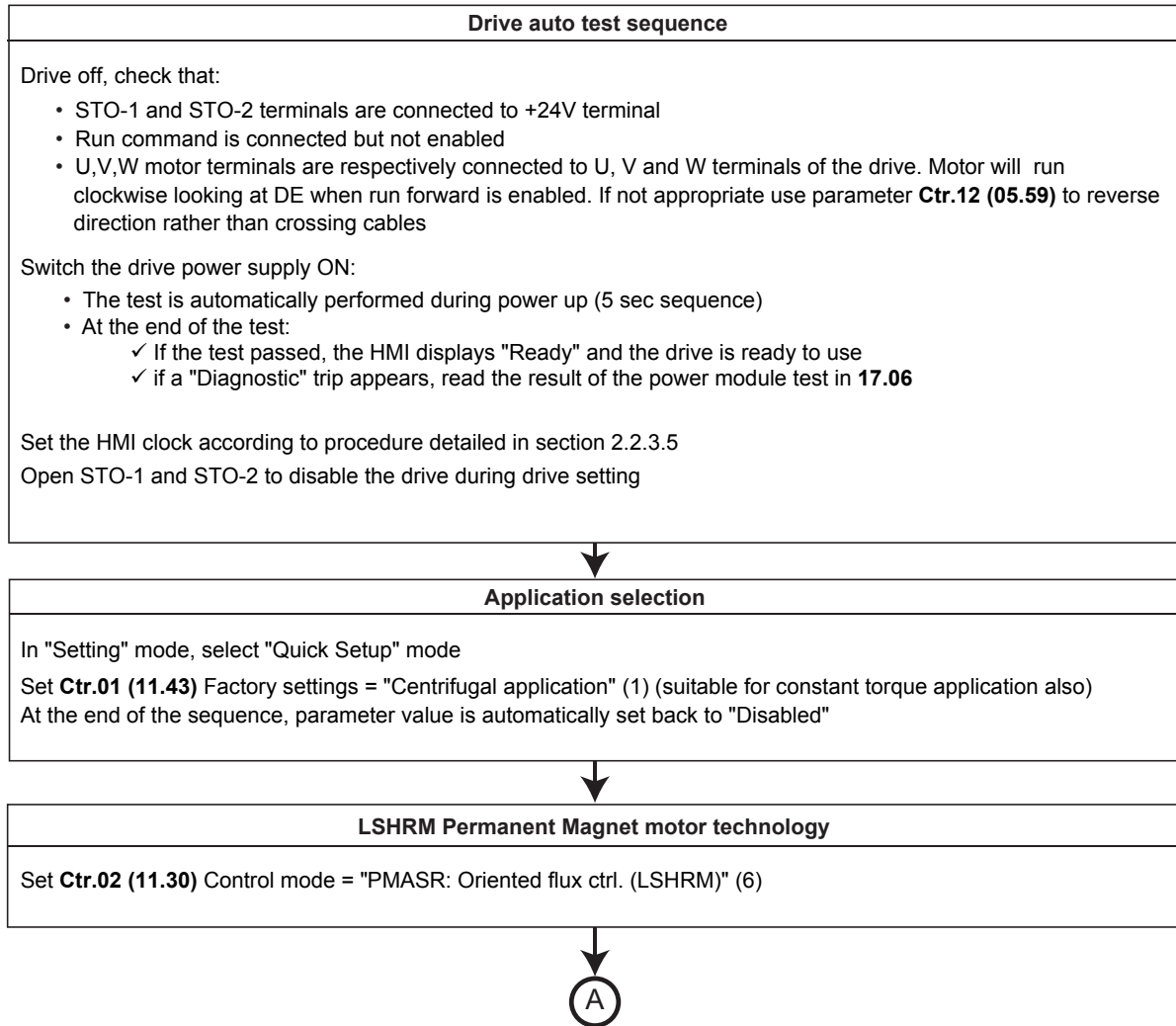
4.7 - Brake control sequence

● **Ctr.02** = Induction motor: voltage vector ctrl.
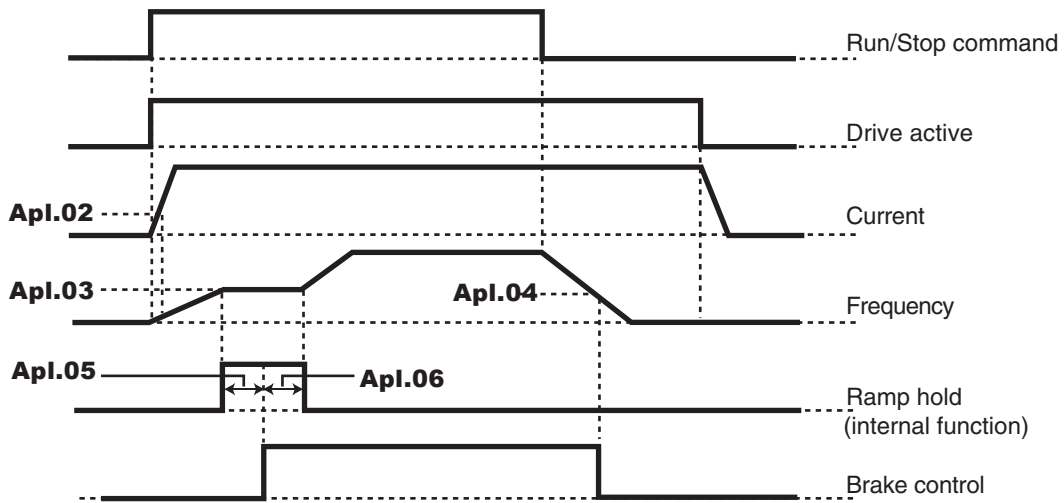
● **Ctr.02** = Induction motor: oriented flux ctrl.
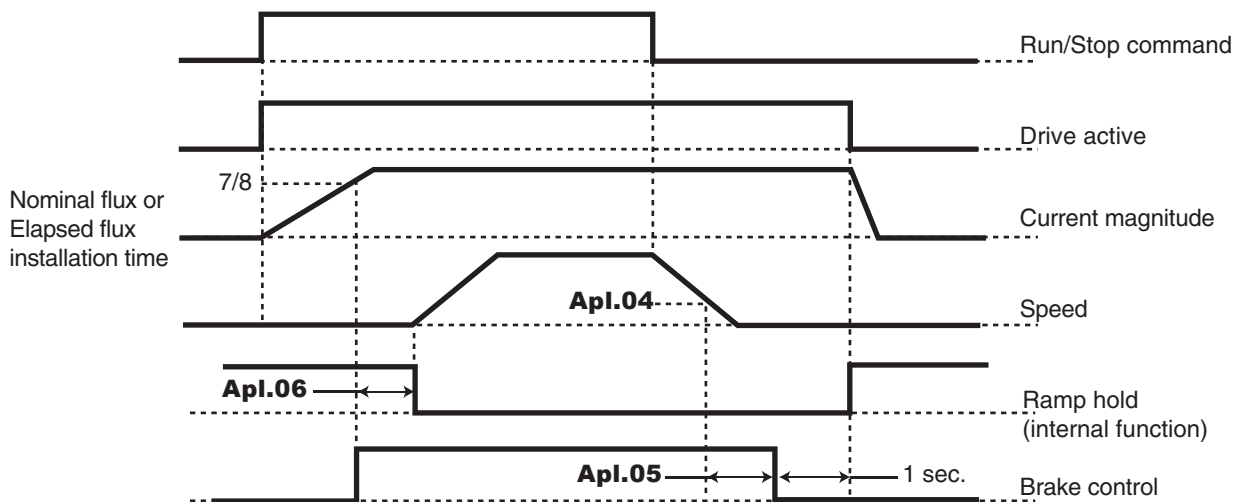
5 - ADVANCED PARAMETER-SETTING MODE

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 trickly observed (manuals supplied with the drive).**

5.1.1 - Menu organisation

Commissioning manual Powerdrive MD2
4617 en - 2020.07 / h
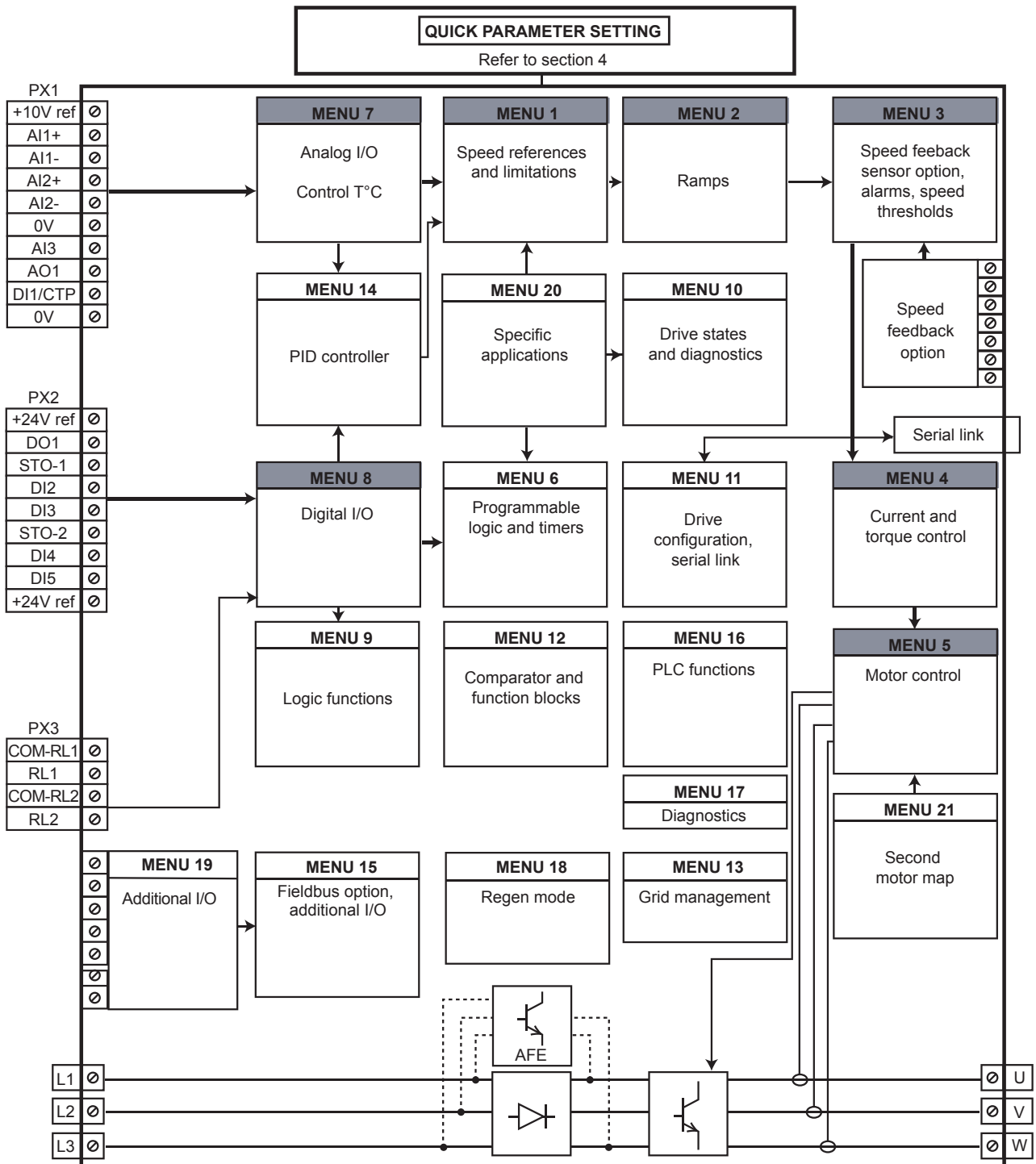
5.1.2 - Explanations of symbols used

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)
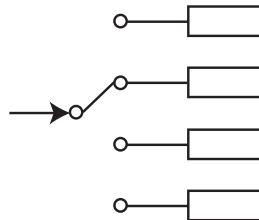
01.01   : Parameters which appear in a diamond are parameters with Read Only access and are write-protected.
They are used to provide information concerning operation of the drive and can be designated as an
assignment source for connection to:
- Digital outputs for bit parameters
- Analog outputs for non-bit parameters
- Inputs of internal functions (comparators, logical or arithmetic operations, etc)
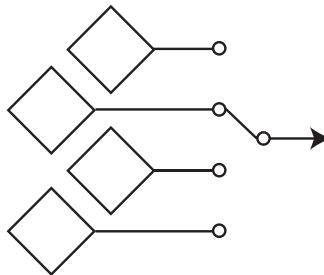
01.36   : Parameters which appear in a hexagon are parameters which can only be assigned to:
- Digital inputs for bit parameters
- Analog inputs for non-bit parameters
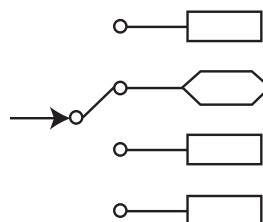
- Destinations of internal functions (comparators, logical or arithmetical operations, etc.)

◧   : Indicates a parameter used when the drive is configured in Voltage Vector Control or V/F mode.

◨   : Indicates a parameter used when the drive is configured in Oriented Flux Control modes with or without speed feedback.

5.2 - Menu 1: Speed references and limitations

5.2.1 - Menu 1 diagrams

• **Selection of reference (speed)**
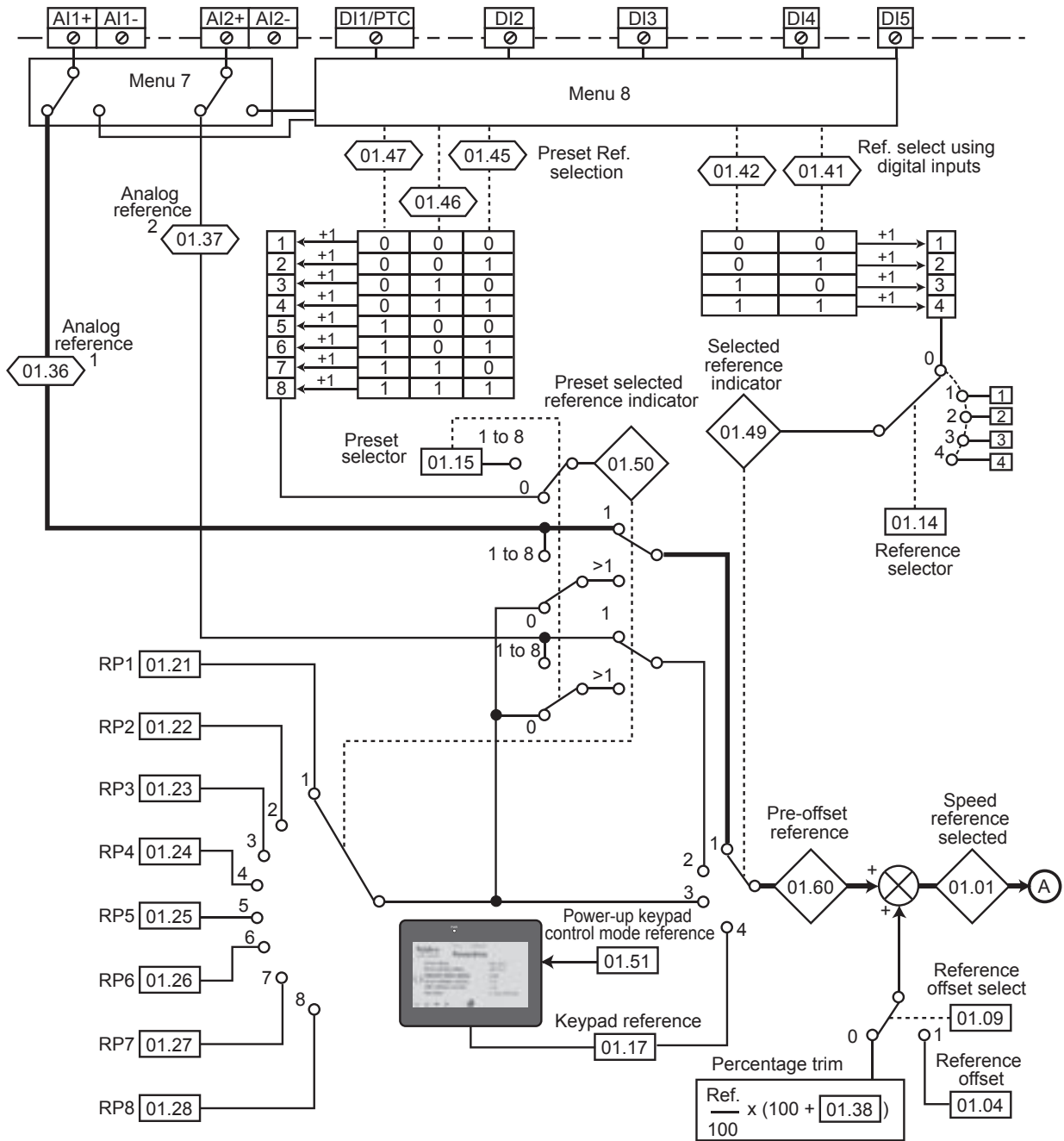
• Limiting and filters
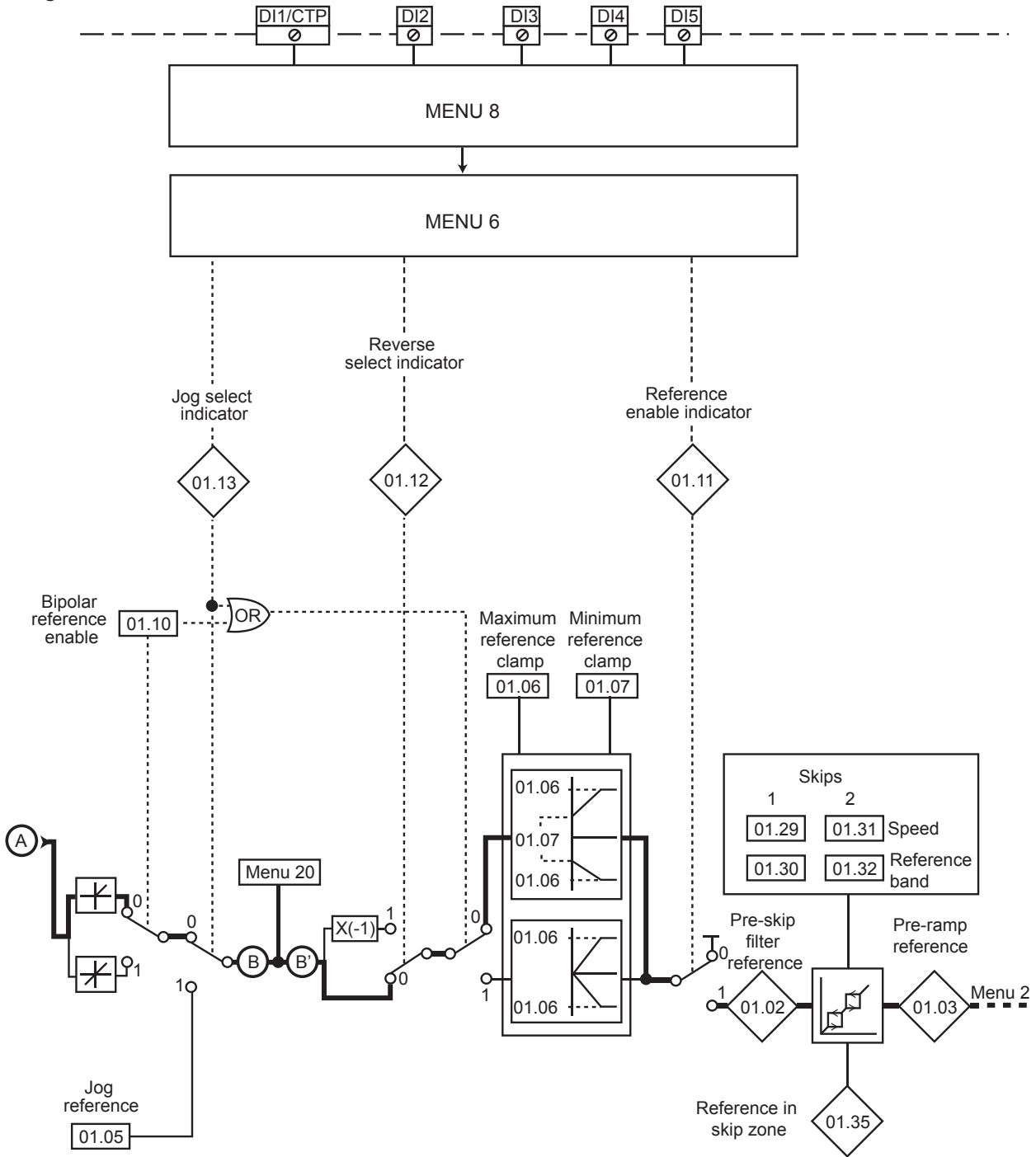
5.2.2 - Explanation of parameters in menu 1

01.01 **: Speed reference selected**

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

01.02 **: Pre-skip filter reference**

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**

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**
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** (1). It can be used to correct the selected main reference to obtain an accurate setting.

01.05 **: Jog reference**
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**
Range: 0.00 to 60000.00 rpm
Factory setting: 1500.00 rpm
Format: 32 bits
Maximum speed in both directions of rotation.

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

01.07 **: Minimum reference clamp**
Range: 0.00 to **01.06** rpm
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**
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**
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).

CAUTION:
If a LSHRM motor has no speed feedback sensor and if the application needs both directions of rotation, 01.10 must be set to Yes (1).

01.11 **: Run command**

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

01.12 **: Reverse select indicator**

Range: Run forward (0) or Run reverse (1)
Format: 8 bits

Run forward (0):
forward.

Run reverse (1):
reverse.

01.13 **: Jog select indicator**

Range: Disabled (0) or Enabled (1)
Format: 8 bits

Disabled (0):
Jog operation disabled.

Enabled (1):
Jog operation enabled.

01.14 **: Reference selector**
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
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
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
Range: ± **01.06** rpm
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
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
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
Range: Disabled (0) or Enabled (1)
Format: 8 bits
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
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)**
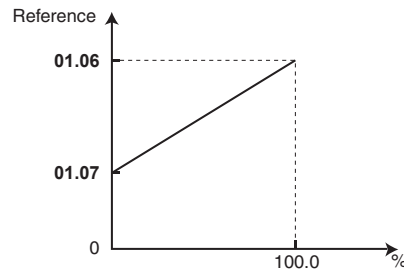
• **Bipolar mode (01.10 = 1)**
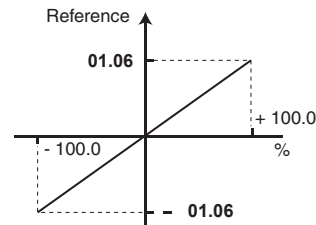
01.38 : Percentage trim
Range: ± 100.0%
Factory setting: 0.0%
Format: 16 bits
An offset proportional to the selected reference can be added to this reference.
The multiplication coefficient is determined by the analog input assigned to **01.38**.

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

01.39 and 01.40 : Not used

◇ **01.41** : **Reference select via digital input (bit 0)**

◇ **01.42** : **Reference select via digital input (bit 1)**
Range: Ana 1/Preset (0) or Ana 2/Keypad (1) (**01.41**)
       Ana 1/Ana 2 (0) or Preset/Keypad (1) (**01.42**)
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**
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 (PR1)
	0	0	1	2	Preset reference 2 (PR2)
	0	1	0	3	Preset reference (PR3)
	0	1	1	4	Preset reference 4 (PR4)
	1	0	0	5	Preset reference 5 (PR5)
	1	0	1	6	Preset reference 6 (PR6)
	1	1	0	7	Preset reference 7 (PR7)
	1	1	1	8	Preset reference 8 (PR8)

01.48 : **Not used**

◇ **01.49** : **Reference selected indicator**

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**

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**
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**

Range: ± **01.06**
Format: 32 bits
Indicates the value of the selected speed reference before offset.

01.61 to **01.78** : **Not used**

5.3 - Menu 2: Ramps

5.3.1 - Menu 2 diagrams

• Acceleration ramps

Menu 9

Binary sum
output

09.32

Acceleration
rate selector

02.10

Preset selected
reference indicator

Menu 1

01.50

Acceleration rate 1 | 02.11
Acceleration rate 2 | 02.12
Acceleration rate 3 | 02.13
Acceleration rate 4 | 02.14
Acceleration rate 5 | 02.15
Acceleration rate 6 | 02.16
Acceleration rate 7 | 02.17
Acceleration rate 8 | 02.18

Jog acceleration
rate

02.19

Jog select
indicator

01.13 ·········▸ Ⓐ

Single ramp

Run FWD

Run REV

Double ramps

02.53

02.54

02.53

Pre-ramp
reference

Menu 1

01.03 ▸ Ⓑ

Special ramp
validation | 02.52 | = 0 or 2

Special ramp
validation | 02.52 | = 1 or 3

S ramp
acceleration limit

02.07

0

1

02.06

S ramp
enabled

Ⓒ

• Deceleration ramps

Menu 9

Binary sum
output

09.32

Deceleration
rate selector

02.20

Preset selected
reference indicator

Menu 1

01.50

Deceleration rate 1 02.21
Deceleration rate 2 02.22
Deceleration rate 3 02.23
Deceleration rate 4 02.24
Deceleration rate 5 02.25
Deceleration rate 6 02.26
Deceleration rate 7 02.27
Deceleration rate 8 02.28

Jog deceleration
rate

02.29

A

B

Single ramp	Double ramps
Run FWD	02.53
Run REV	02.55
	02.53
Special ramp validation 02.52 = 0 or 1	Special ramp validation 02.52 = 2 or 3

Menu 4
Current
loop

Ramp bypass
(■)

02.02

Post ramp
reference

02.01 Menu 3

Ramp hold

02.03

Ramp hold
condition

02.51

V min

02.04	Deceleration ramp mode select
02.08	Standard ramp voltage
02.50	Speed reference locked at motor speed
02.54	High speed acceleration ramp
02.55	High speed deceleration ramp
02.56	Accel/Decel speed reference

C

5.3.2 - Explanation of parameters in menu 2

02.01 ◇ **: Post ramp reference**

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 (▣)**
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**
Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits

No (0):
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**
Range: Fixed ramp (0), Automatic ramp (1),
 Automatic ramp + (2),Fixed ramp + (3)
Factory setting: Automatic ramp (1)
Format: 8 bits

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:
Set 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**
Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits

No (0):
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**
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**
Range: 0 to 1300 V
Factory setting: T rating = 710 V, TH rating = 1100 V
Format: 16 bits

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**
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**
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*.

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

Value of **02.11** to **02.18**

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

 * NOTE

The reference speed can be changed from 1000 to 100 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

 02.19 : **Jog acceleration rate**
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*.

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

Value of **02.19**

 * NOTE

The reference speed can be changed from 1000 to 100 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

 02.20 : **Deceleration rate selector**
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**
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.

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

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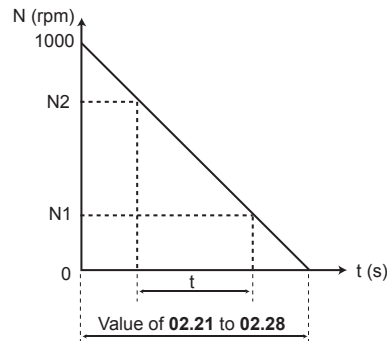
02.21: Deceleration rate 1 (main ramp in factory settings)
02.22 to **02.28**: Deceleration rate 2 to Deceleration rate 8

 * NOTE

The reference speed can be changed from 1000 to 100 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.
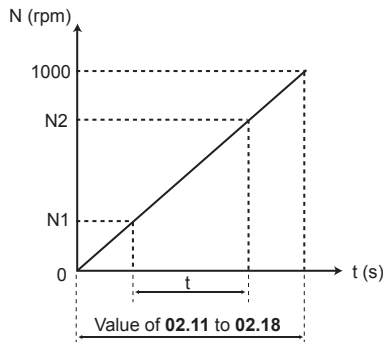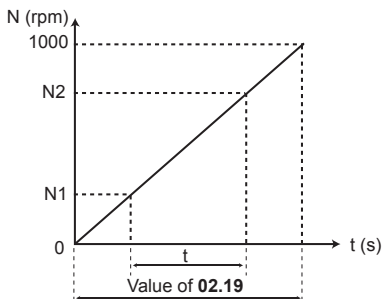
02.29 : **Jog deceleration rate**
Range: 0.1 to 3200.0 s *
Factory setting: 0.2 s
Format: 16 bits
Sets the time for deceleration from 1000 rpm * to 0.

$$02.29 = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}} \quad *$$
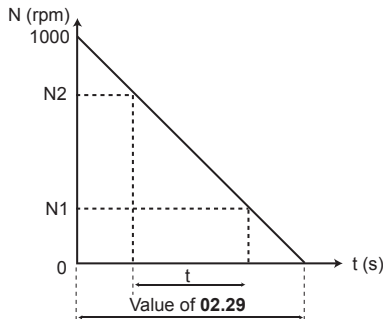
* NOTE
The reference speed can be changed from 1000 to 100 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

02.30 to **02.49** : **Not used**

02.50 : **Speed reference locked at motor speed**
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.
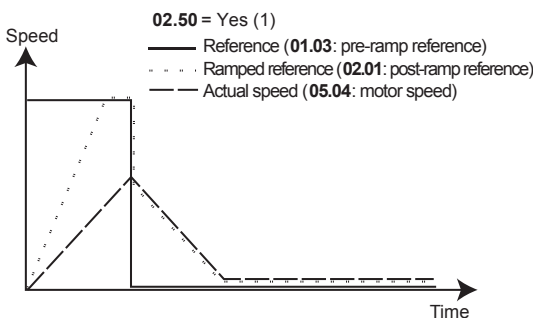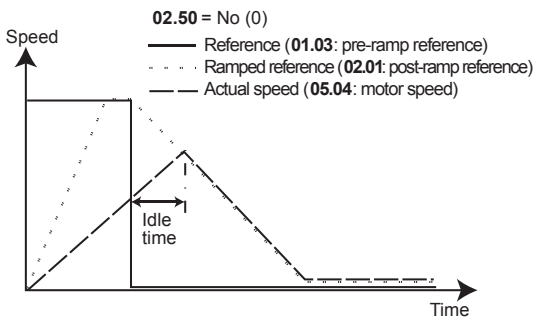
02.51 : **Ramp hold condition**
Range: Always (0) or Speed > **01.07** (1)
Factory setting: Always (0)
Format: 8 bits

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**
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.**
Range: ± **01.06**
Factory setting: 400.00 rpm
Format: 32 bits
See explanation in **02.52**.

02.54 : **High speed acceleration ramp**
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 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

02.55 : **High speed deceleration ramp**
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 rpm using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

02.56 **: Accel/Decel speed reference**
Range: 1000 min^{-1} (0) or 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
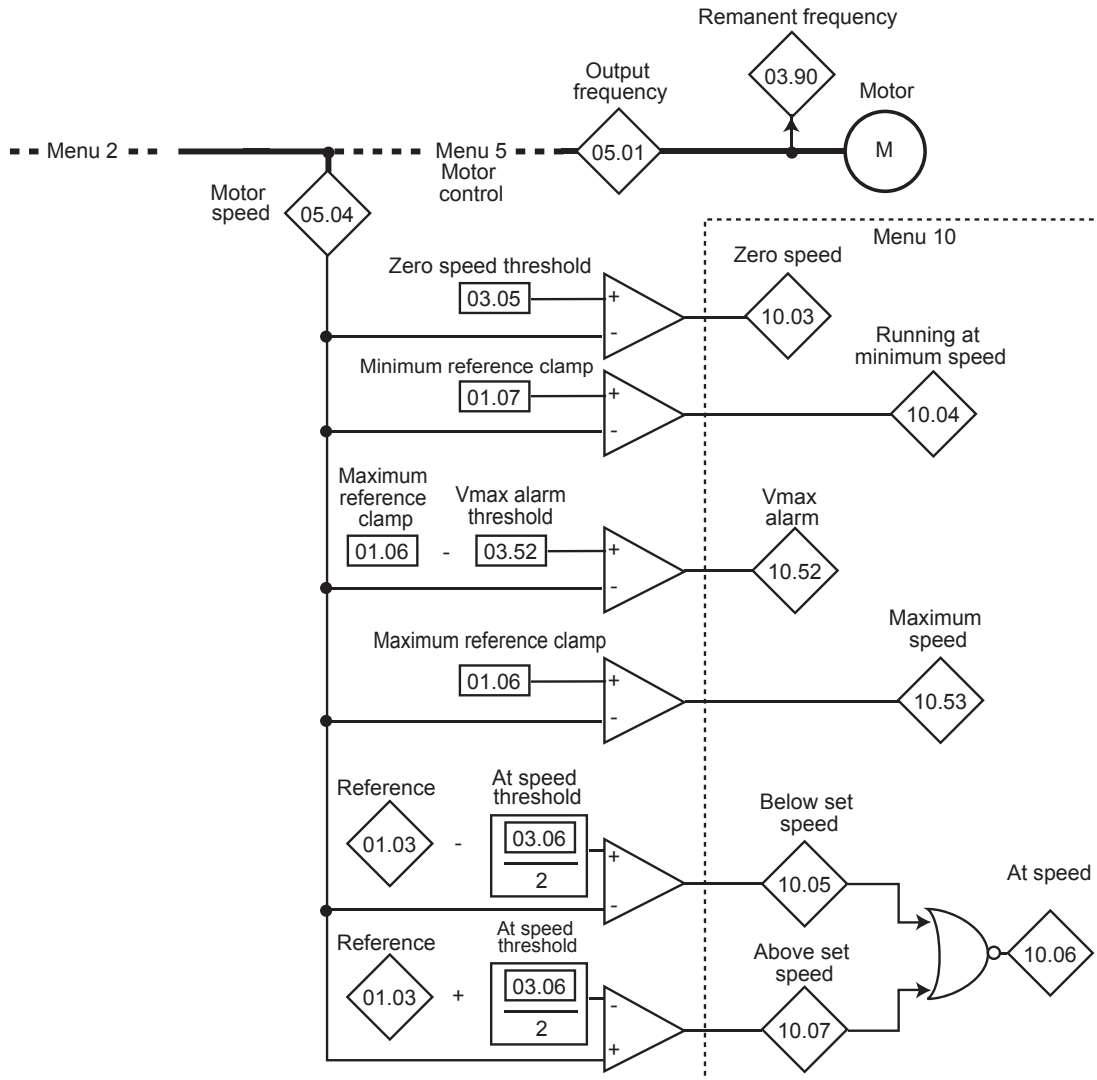
Frequency input
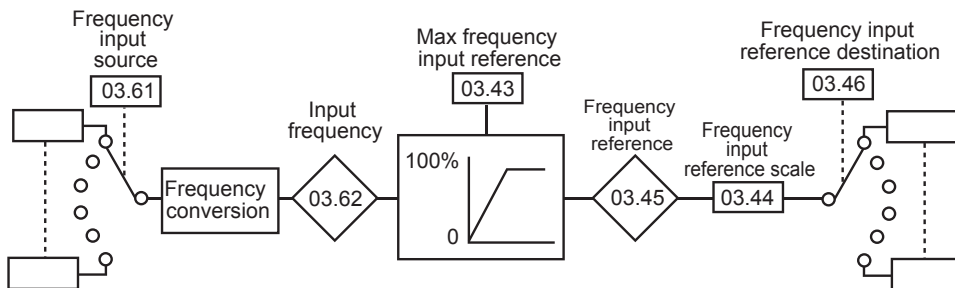
• With encoder and resolver option
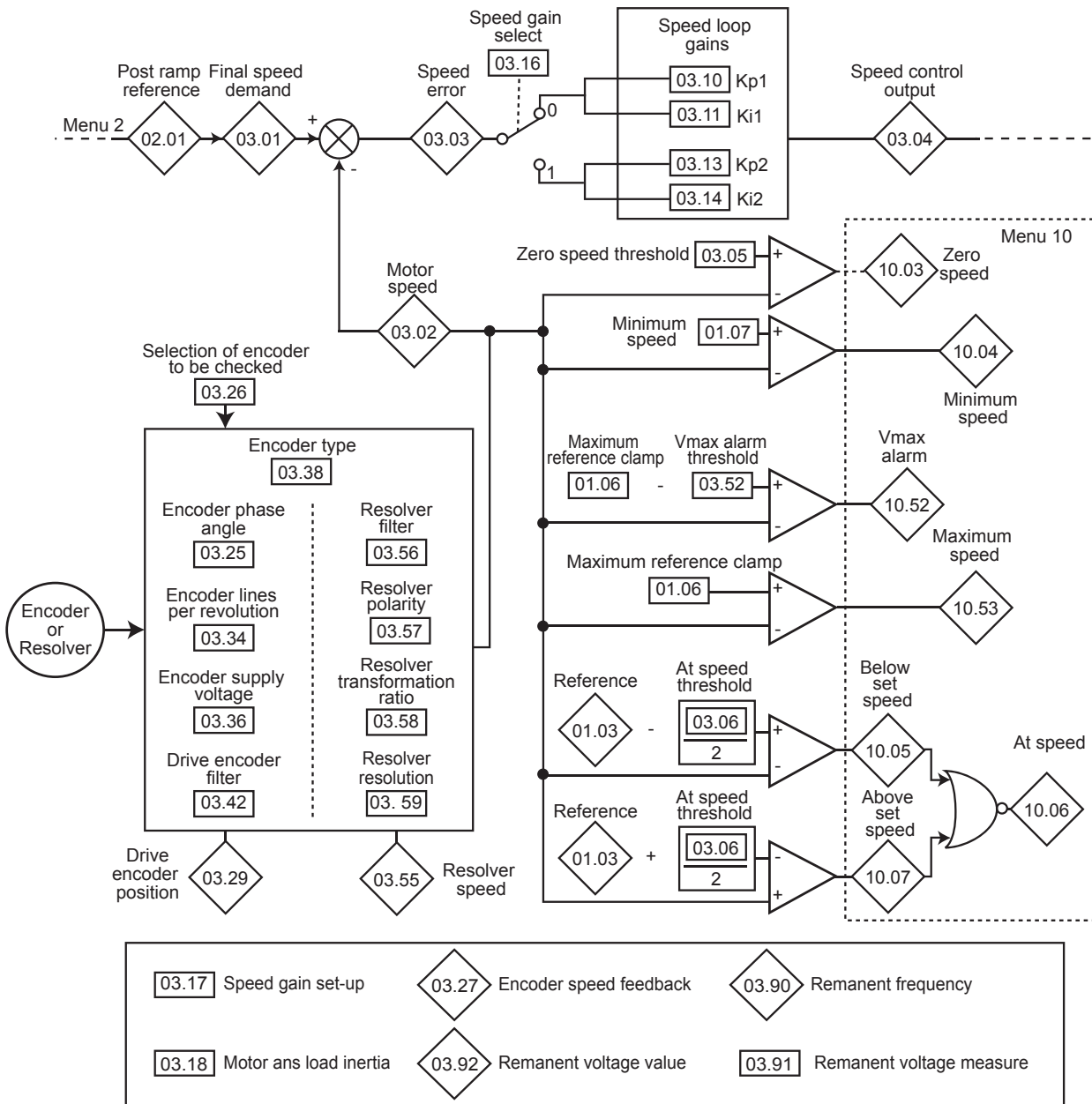
Frequency input
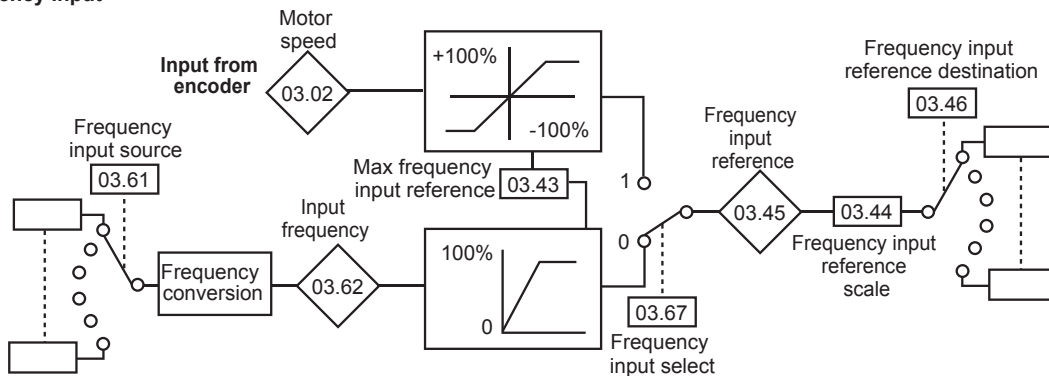
5.4.2 - Explanation of parameters in menu 3

03.01 : **Final speed reference (■)**

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**

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

03.03 : **Speed error (■)**

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

03.04 : **Speed controller output (■)**

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**
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 Voltage control 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**
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 (■)**
Range: 0 to 32000
Factory setting: 200
Format: 16 bits
Used to set the amount by which the speed reference is exceeded following an acceleration or following a load impact. The setting of **03.10** depends on the load inertia. The factory value is suitable for low inertia. For applications with high applied inertia (fan, centrifuge, grinders, etc), the value of **03.10** needs to be increased.
Increase the proportional gain until vibrations occur in the motor, then reduce the value by 20 to 30%, checking that the motor stability is acceptable in the event of sudden variations in speed, both at no load and on load.

NOTE
The speed loop sampling period is 2 ms.

03.11 : **Speed loop integral gain Ki1 (■)**
Range: 0 to 32000
Factory setting: 100
Format: 16 bits
Used to set the speed loop damping. Increase the integral gain to limit the speed recovery time following an acceleration or following a torque impact.

NOTE
The settings **03.10** and **03.11** are only active when **11.31** operating mode is set to 2 (Induction motor: oriented flux control) and 3 (Synchronous motor: Oriented flux Control).
Use the Scope function in the MDX-Soft software to display the effect of the **03.10** and **03.11** gain settings.

03.12 : **Speed loop differential gain Kd1 (■)**
Reserved.

03.13 : **Speed loop proportional gain Kp2 (■)**
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 (■)**
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 ( )**
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 ( )**
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 proportional gain is only applied to the speed feedback signal. This checking method is recommended for process applications where the response time is not a critical setting.
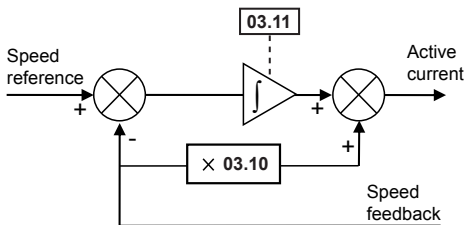
Automatic (1):
Reserved.

Manual mode 2 (2):
The proportional gain is applied to the reference signal and to the speed feedback signal.
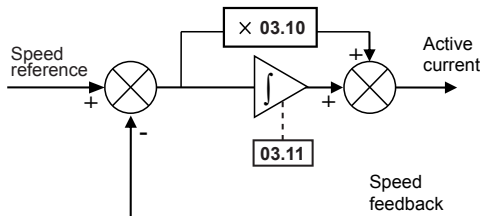
03.18 : **Motor and load inertia ( )**
Range: 0.000 to 32.000 kg.m^2
Factory setting: 0.000 Kg.m^2
Format: 16 bits
Corresponds to the total inertia applied to the motor (motor inertia + load inertia).

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 ( )**
Range: 0.0 to 359.9 °
Factory setting: 0.0 °
Format: 16 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 : **Selection of encoder to be checked**
Range: None (0), Incremental (1),U,V,W only (2),
        Incremental, U,V,W (3), Hall effect sensor (4),
        Resolver (5)
Factory setting: None (0)
Format: 8 bits

This parameter is used to check an encoder's operation without the feedback information being used in the check.

None (0):
No test.

Incremental (1):
Tests a quadrature incremental encoder with complemented signals A, B. Set encoder voltage in **03.36**.

U,V,W only (2):
Tests the U,V,W signals of an incremental encoder with commutation channels. Set encoder voltage in **03.36**.

Incremental U,V,W (3):
Tests the A,B signals of an incremental encoder with commutation channels. Set encoder voltage in **03.36**.

Hall effect sensor (4):
Tests the 3 Hall effect sensors phase-shifted by 120° electrical integrated in some motors.

Resolver (5):
Tests a resolver. Set resolver characteristics in **03.56** to **03.59**. The speed of the encoder selected in **03.26** is displayed in **03.27**.

NOTE

The encoder actually used in oriented flux control mode is defined by the parameter **03.38**.

03.27 : **Encoder (defined by 03.26) speed feedback**

Range: ± **01.06**
Format: 32 bits
This parameter indicates the speed fed back by the encoder configured by **03.26**. During commissioning, this parameter is used to ensure that the speed feedback system (from the encoder to the MDX-Encoder option) is working. After configuring Voltage vector control operation, check that **03.27** is consistent with the actual speed.

03.28 : **Not used**

03.29 : **Drive encoder position (▣)**

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**
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**
Range: 5V (0) or 15V (1)
Factory setting: 5V (0)
Format: 8 bits

5V (0):
This parameter is used to set the encoder supply voltage to 5V.

15V (1):
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.

03.37 : **Not used**

03.38 : **Encoder type**
Range: Incremental (0), Reserved (1), U,V,W only (2),
Incremental U,V,W (3), Hall effect sensor (4),
Soft. 1 / Back EMF orientation (5),
Soft. 2 / Back EMF orientation (6),
Soft. 3 / Adaptive model (7),
Soft. 4 / Stator flux orientation (8),
Soft. 5 (9), Resolver (10),
Resolver + signal loss detection (11)
Factory setting: Soft. 2 / Back EMF orientation (6).
Format: 8 bits
The drive must be equipped:
- With an MDX-ENCODER option for managing encoders (**03.38** = 0 to 3) or Hall effect sensors (**03.38** = 4).
- With an MDX-RESOLVER option for managing resolvers (**03.38** =10 or 11).
CAUTION:
03.38 is only active for Flux Control strategies: when User drive mode 11.31 = 2 or 3, or Motor technology selection 11.30 = 2, 4 or 6).

NOTE
03.38 can be preset by **11.30** depending of motor technology selection.

• If **11.30** = Induction motor : Oriented flux Ctrl (2)

Incremental (0):
Speed feedback via quadrature incremental encoder with A,A\,B,B\ signals. Related parameters: **03.34, 03.36** and **03.42**.

Reserved (1):
Not applicable.

U,V,W only (2):
Not applicable.

Incremental U,V,W (3):
Not applicable.

Hall effect sensor (4):
Not applicable.

Soft. 1 / Back EMF orientation (5):
«Sensorless» mode in which the position is reconstituted by the software. Recommended for applications where low starting torque is required (pump, fan, etc).

Soft. 2 / Back EMF orientation (6):
«Sensorless» mode in which the position is reconstituted by the software. Recommended for applications where high starting torque is required (grinder, press, extruding machine, etc).

Soft. 3 to 5 (7, 8, 9):
Not applicable.

Resolver (10):
Speed feedback via resolver with no monitoring of the signals level. Set resolver characteristics in **03.56** to **03.59**.

Resolver + signal loss detection (11):
Resolver with monitoring of the signals feedback level.

NOTE
When **03.38** is set to one of the «software encoder» modes, enter the menu 5 parameters (**05.06** to **05.10**) using the motor nameplate data.

• If **11.30** = PM: Oriented flux Ctrl. (LSRPM) (4) or PMASR: Oriented flux Ctrl. (LSHRM) (6)

Incremental (0):
Not applicable.

Reserved (1):
Not applicable.

U,V,W only (2):
This selection allows use in downgraded operation of an encoder with commutation signals whose A and B channels are not operational.

Incremental U,V,W (3):
Dedicated to permanent magnet machines fitted with an incremental encoder with A,A\,B,B\ signals and U,U\ V,V\ W,W\ commutation channels.

Hall effect sensor (4):
Dedicated to permanent magnet machines fitted with 3 Hall effect sensors phase-shifted by 120° electrical.

Soft. 1 / Back EMF orientation (5):
«Sensorless» mode in which the rotor position is determined by reconstituting the motor Electro-Motive Force vector. This mode is not suitable for PM motors with high saliency ratio (PMASR) or synchronous reluctance motors. During the starting phase the motor is parked in accordance with the description in the «Current vector» mode in parameter **05.36**. The parking phase is especially helpful for starting large fans or crushers.

Soft. 2 / Back EMF orientation (6):
«Sensorless» mode in which the rotor position is determined by reconstituting the motor Electro-Motive Force vector. This mode is not suitable for PM motors with high saliency ratio (PMASR) or synchronous reluctance motors and applications where the ratio between the load inertia and the motor inertia is more than 80. **This mode is automatically selected after setting 11.30 = PM: Oriented flux Ctrl. (LSRPM)» (4)**.

Soft. 3 / Adaptive model (7):
«Sensorless» mode suitable for PMASR motor in which the rotor position is determined from an adaptive model of the machine in which the voltage and current values linked to a rotational reference frame are compared with the actual measurements. See parameter **05.36** for starting phase. **This mode is automatically selected after setting 11.30 = PMASR: Oriented flux Ctrl. (LSHRM) (6)**.

Soft. 4 / Stator flux orientation (8):
«Sensorless» mode in which the rotor position is determined by reconstituting the machine flux in a fixed reference frame.
This mode is recommended for applications using PM motors (**11.30** = PM: Oriented flux Ctrl. (LSRPM)» (4)) with low saliency ratio where the ratio between the load and the motor inertia exceeds 80.
See parameter **05.36** for starting phase.

Soft. 5 (9):
Not applicable.

Resolver (10):
Speed feedback via resolver with no monitoring of the signals level.

Resolver + signal loss detection (11):
Resolver with monitoring of the signals feedback level

NOTE

An autotune «Stationary: motor data completed» (**05.12** = 1) must be performed if **11.30** is set to 4 or 6 and **03.38** is set to one of the "Sensorless" mode (Soft 1 to 5).

The following parameters should be set according to the data given on the motor nameplate:
- **05.24, 05.33, 05.51** for low saliency PM motor (**5.37** = 0).
- **05.24, 05.33, 05.72, 05.76, 05.78, 05.86, 05.87** for PMASR motor (**05.37** = 1).

03.39 to **03.41** : Not used

03.42 : Drive encoder filter (▣)
Range: 0 to 7
Factory setting: 3
Format: 16 bits
This parameter is used to insert a filter in the encoder speed feedback, such that:
time constant = $2^{03.42}$ 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.

NOTE

03.42 can be preset by **11.30** depending of motor technology selection.

03.43 : Max frequency input reference
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
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

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
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**
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 Voltage control mode
- (**03.02**) > Max spd (**01.06** or **21.01**) - **03.52** in oriented flux control mode (with speed feedback).

03.53 and **03.54** : **Not used**

03.55 : **Resolver speed**

Range: ± (2 x **01.06**)
Format: 32 bits
Indicates the speed from the resolver.

03.56 : **Resolver filter**
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 = $2^{03.56}$ ms.

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

03.58 : **Resolver transformation ratio**
Range: 1:1 (0), 2:1 (1), 3:1 (2), 4:1 (3)
Factory setting: 1:1 (0)
Format: 8 bits
This value should be entered from the resolver manufacturer data.

Transformation ratio 03.58	Excitation voltage (Vrms)
1 : 1 (0)	1.3
2 : 1 (1)	2.6
3 : 1 (2)	3.8
4 : 1 (3)	5.2

03.59 : **Resolver resolution**
Range: 10 bits (0), 12 bits (1), 14 bits (2),16 bits (3)
Factory setting: 14 bits (2)
Format: 8 bits
The resolver resolution depends on the maximum resolver speed (see table hereafter).
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 resolver speed (rpm)	Maximum value of 03.34
10 bits (0)	150000 / Pp	256
12 bits (1)	60000 / Pp	1024
14 bits (2)	30000 / Pp	4096
16 bits (3)	7500 / Pp	16384

Pp : number of resolver pole pairs.

03.60 : **Not used**

03.61 : **Frequency input source**
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**

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 (■)**
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**

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**
Range: None (0), Digital (1),
       Digital and analog with motor speed update (2),
       Digital and analog w/o motor speed update (3)
Factory setting: Digital and analog with motor speed update (2)
Format: 8 bits

None (0):
The measurement of the motor remanent voltage is disabled. No possibility to catch a spinning motor.

Digital (1):
This setting should be used when the product has only a digital information feedback.

Digital and analog with motor speed update (2):
The remanent frequency measurement combines analog and digital information. When the run command is not active, the motor speeds **03.02** and **05.04** are updated according to the remanent frequency **03.90**.

Digital and analog w/o motor speed update (3):
Same as previous but motor speed **03.02** and **05.04** are not updated when the run command is disabled.

◇ **03.92** ◇ **: Remanent voltage value**

Range: 0 to 999V
Format: 16 bits
Rms value of the remanent voltage present at the motor terminals when the drive is disabled.

5.5 - Menu 4: Current loop - Torque control

5.5.1 - Menu 4 diagrams

• Voltage control

• **Oriented flux control**

Time between starting and permanent torque 04.51

Symmetric current limit 04.07

Motor current limit 04.05

Generator current limit 04.06

Active current limiting

Overriding current limit 04.18

Speed control output 03.04

Torque regulation mode selector 04.11

Menu 3

User current maximum scaling 04.24

Torque reference 04.08

Torque offset selection 04.10

Torque offset 04.09

Maximum reference clamp 01.06

Torque demand 04.03

Motor torque per amp conversion

Active current demand 04.04

Current demand filter 04.12

Filter

Current control
04.13 Proportional gain
04.14 Integral gain

Standard ramp voltage 02.08

DC bus voltage 05.05

DC bus voltage monitoring

Reactive current reference

Reactive current 04.17

Percentage load 04.20

User current maximum scaling 04.24

Active current 04.02

Reactive I
Total I
Active I

Current magnitude 04.01

Overload accumulator 04.19

04.15 Motor thermal time constant

04.55 Current limitation mode

04.60 Electromagnetic torque

5.5.2 - Explanation of parameters in menu 4

◇ **04.01** : **Current magnitude**

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**

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**

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**

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**
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**
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**
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: Voltage control (1) and **05.14** is set to Linear U/F law with boost (2) or Square U/F law with boost (5), the only current limit is then defined by **04.07**.
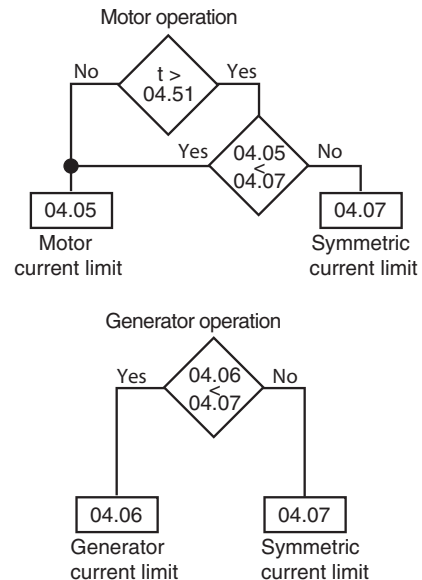
04.08 : **Torque reference**
Range: ± **04.24** (% motor active In)
Factory setting: 0.0% In
Format: 16 bits
Main torque reference when the drive is configured for torque control.
Give a positive reference for the torque to be applied clockwise and conversely, a negative reference for the torque to be applied counter-clockwise.
The maximum value of **04.08** is fixed by **04.24**.

04.09 : **Torque offset**
Range: ± 150.0%
Factory setting: 0.0%
Format: 16 bits

04.10 : **Torque offset selection**
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**
Range: Speed regulation (0), Direct torque (1),
        Controlled torque (2), Reserved (3) (4)
Factory setting: Speed regulation (0)
Format: 8 bits

■▶ :

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

Direct torque (1):
Torque control as described in the Menu diagram 5.5.1.

Controlled torque (2):
Torque control as described in the Menu diagram 5.5.1.

■▶ :

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 (1)).
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**.

Reserved (3) (4)

⚠ • **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 (■▶)**
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.

NOTE
04.12 can be preset by **11.30** depending of motor technology selection.

04.13 : **Current loop proportional gain**
Range: 1 to 999
Factory setting: 50
Format: 16 bits
The proportional gain is the most critical parameter in controlling the performance of the current controllers. Increasing **04.13** increases the bandwidth of the current control loop. A too high bandwidth induces a whistling in the motor and increases the risk of overcurrent. A bandwidth that is too low leads to poor performance, especially in sensorless control of PM or PMASR motors

- For Induction motor, the factory setting is adapted to the most standard situations.

- For PM or PMASR motors, the value of **04.13** will automatically be set after performing a stationary autotune (see **05.12**).

NOTE
Simple method to define **04.13**:
04.13 = 1.5 x **05.24** x **05.07**

04.14 : **Current loop integral gain**
Range: 0 to 250
Factory setting: 40
Format: 16 bits
The current loop stability and the overshoot in step response of current set point are impacted by the value of **04.14**. The factory setting covers most common situations.

04.15 : **Motor thermal time constant**
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**

Range: ± 2.22 x **11.32** (A)
Format: 32 bits
Magnetising current reading.

◇ **04.18** : **Overriding current limit**

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**

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**

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** ▷ **: Drive Ixt level**

Range: 0 to 110.0%
Format: 16 bits
Indicates the drive average load level as a percentage of its rated current **11.3** (see relevant drive installation manual). The alarm **10.19** is activated when **04.21** exceeds 100%.

04.22 to **04.23** **: Not used**

04.24 **: User current maximum scaling**
Range: 0 to 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**
Range: 0 to 32000 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**
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.

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.

NOTE

04.55 can be preset by **11.30** depending of motor technology selection.

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

◇ **04.60** ▷ **: Electromagnetic torque**

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

5.6.2 - Explanation of parameters in menu 5

Key:

• **Low saliency PM mode** (e.g for LSRPM motor, from Dyneo® range of Leroy-Somer):
Dedicated for ISPM (surface mounted permanent magnet motor) or IPM (Interior permanent magnet motor) where torque is mainly produced by the magnet field.

• **PM Assisted Synchro Reluctance PMASR mode** (e.g for LSHRM motor, from Dyneo+ range of Leroy-Somer):
Dedicated for hybrid motor technology with high saliency ratio where the torque is mainly produced by the reluctant effect.

05.01 : **Output frequency**

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

05.02 : **Output voltage**

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

05.03 : **Output power**

Range: $\pm$ **11.33** x **11.32** x 2.22 x $\dfrac{\sqrt{3}}{1000}$ kW

Format: 32 bits (1)
05.03 is the calculated motor active power.

05.03 = **04.01** x **05.02** x (**05.10** x $\dfrac{\sqrt{3}}{1000}$ 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**).

(1): Two digits after the decimal point.

05.04 : **Motor speed**

Range: ± 2 x **01.06** rpm
Format: 32 bits (1)
The motor speed is calculated from the output frequency **05.01** according to the formula:

05.04 (min⁻¹) = $\dfrac{60 \text{ x } \mathbf{05.01}}{\text{number of pairs of motor poles}}$

(1): Two digits after the decimal point.

05.05 : **DC bus voltage**

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

05.06 : **Motor rated frequency**
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**
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**.
CAUTION:
Do not set a different value than the one plated on the motor.

05.08 : **Motor rated speed**
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.

NOTE

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

05.09 : **Motor rated voltage**
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:
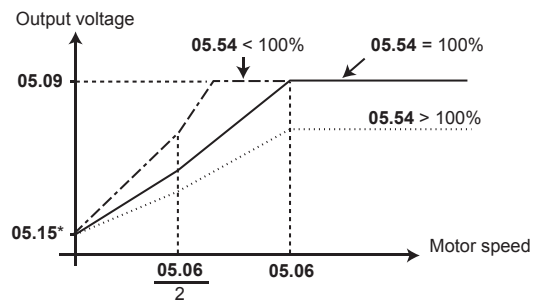
* If **05.14** = Linear U/F law with boost (2) or Square U/F law with boost (5), the boost value is set via **05.15**.

05.10 : **Rated power factor**
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**
Range: Automatic (0), 2 Poles (1), 4 Poles (2), 6 Poles (3),
8 Poles (4), 10 Poles (5), 12 Poles (6), 14 Poles (7),
6 Poles (8)
Factory setting: Automatic (0)
Format: 8 bits
When this parameter is at Automatic (0), 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 hereafter:

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 (0).

05.12 : **Autotune**
Range: None (0), Stationary: motor data completed (1),
Rotating: incomplete motor data (2),
Encoder offset measure/rotor parking (3),
Encoder offset measure/signal injection (4),
Stationary: incomplete motor data (5),
Reserved (6)
Factory setting: None (0)
Format: 8 bits

⚠ • **During the autotune phase, brake control is disabled.**
• **If 05.12 is set to 2, 3 or 4, the motor rotates at low speed or at 2/3 of its rated speed. 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.**

• If **11.31** = Synchronous motor: Voltage control (0) or Induction motor: Voltage control (1)

None (0):
No autotune performed.

Stationary: motor data completed (1):
The stator resistance and the voltage offset are stored in **05.17** and **05.23** respectively. The gain **04.13** is automatically updated.

Rotating: incomplete motor data (2):
No action.

Encoder offset measure/rotor parking (3) :
No action.

Encoder offset measure/signal injection (4) :
No action.

Stationary: incomplete motor data (5):
No action.

• If **11.31** = Induction motor: Oriented flux control (2)

None (0):
No autotune performed.

Stationary: motor data completed (1):
The stator resistance and the voltage offset are stored in **05.17** and **05.23** respectively. The gain **04.13** is automatically updated.

Rotating: incomplete motor data (2):
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.

Encoder offset measure/rotor parking (3):
This mode is only active if **03.38** is set to «Resolver». In this mode, the motor runs at very low speed so that the resolver offset can be measured. This offset is automatically stored in **03.25**.

Encoder offset measure/signal injection (4):
No action.

Stationary: incomplete motor data (5):
No action.

• If **11.31** = Synchronous motor: Oriented flux control (3)

None (0):
No autotune performed.

Stationary: motor data completed (1):
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.

Rotating: incomplete motor data (2):
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.

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

Encoder offset measure/signal injection (4) :
This mode (typically for LSHRM motors) is only active if **03.38** is set to «U, V, W only», «Incremental UVW», «Hall effect sensor» or «Resolver». It can only be used on permanent magnet machines with high saliency ratio [Lq > 120% of Ld] . A current signal with high frequency and low amplitude is injected into the motor stator. The encoder offset is determined by measuring the motor stator inductance in multiple directions and it is automatically stored in 03.25.

Stationary: incomplete motor data (5):
Reserved.

Procedures to carry out the autotune:

Stationary: motor data completed (1):

- 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. **05.12** reverts to «None».
- Disable the drive and remove the run command.

The motor is then ready to operate normally.

Rotating: incomplete motor data (2):

> ⚠ **In this mode, the motor runs at 2/3 of its rated speed or at 1000 rpm maximum.**

Ensure that the known motor parameters have been configured and that the motor is stopped.

- 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
- Enable the drive.
- Give a run command. The motor is driven, then performs a freewheel stop when autotuning is complete.
- Wait until the procedure ends. **05.12** reverts to «None».
- Disable the drive and remove the run command.

The motor is then ready to operate normally.

Encoder offset measure/rotor parking (3):

- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command. The motor runs at very low speed until the encoder offset can be measured.

Encoder offset measure/signal injection (4):

- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command. The motor shaft moves slightly during the measuring phase.

NOTE

- If a stop command is given before the end of the auto-tune phase, an «Autotune» trip is generated.
- An auto-tune test cannot be initiated if the drive is tripped or the drive inverter is active.
- After modifying motor parameters, repeat auto-tuning.
- When **05.12** = 3 or 4: the auto-tune is required only in oriented flux control mode.

05.13 **: Flux optimization select**

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 (■)**

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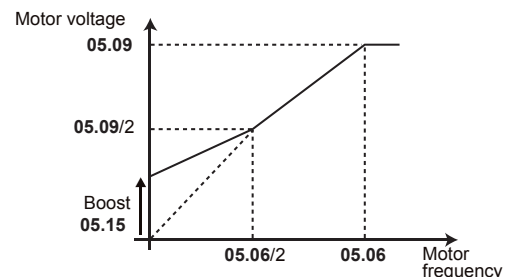
Rs measured after each factory setting (3):
After a return to factory settings, the stator resistance **05.17** and voltage offset **05.23** are measured the first time the drive is enabled (drive output active).

Rs measured after each power up (4):
The stator resistance **05.17** and voltage offset **05.23** are measured the first time the run command is active following each power-up.

⚠ **• A voltage is briefly applied to the motor. For safety reasons, live parts must NOT be accessible once the drive is powered up.**

Square U/F law with boost (5):
Square law characteristic.
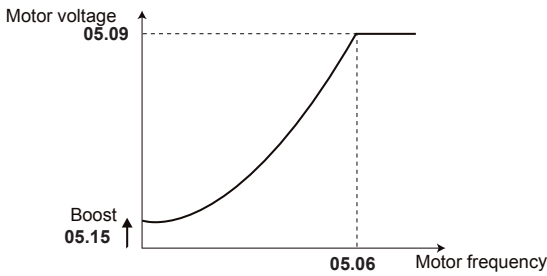
05.15 : **Low frequency voltage boost**
Range: 0.0 to 25.0% of motor Un (**05.09**)
Factory setting: 1.0% motor Un
Format: 16 bits
If **11.31** is set to «Induction motor in Voltage control mode» (1) and **05.14** to «Linear U/F law with boost (2)» or «Square U/F law with boost (5)» parameter **05.15** 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**).
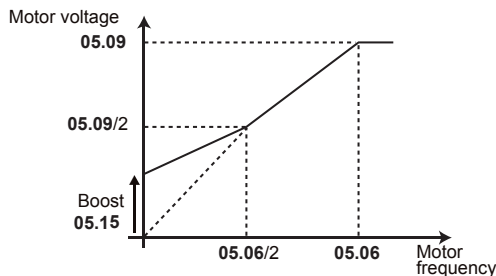
05.16 : **Not used**

05.17 : **Stator resistance**
Range: 0.000 to 90000.000 mΩ
Factory setting: 0.000 mΩ
Format: 32 bits
During autotuning (**05.12** = Stationary: motor data completed (1) or Rotating: incomplete motor data (2)), the value of the stator resistance is stored automatically in **05.17** (see parameter **05.14**).
If the stator resistance cannot be measured (motor not connected, value higher than the maximum rating) a «Stator resistance» trip occurs.

05.18 : **Switching frequency**
Range: 2 kHz (0) to 18 kHz (19)
Factory setting: 3 kHz (2) for the **POWERDRIVE MD2**

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.
- For LSHRM motor, the switching frequency must be higher than motor rated frequency (Hz) x 15 (3 kHz is the minimum allowed setting).

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 : **Modulation pattern**
Range: SPWM (0), DPWM1 (1), Auto (2), DPWM (3)
Factory setting: Auto (2)
Format: 8 bits

SPWM (0):
Space vector PWM (Pulse Width Modulation).

DPWM1 (1):
Discontinuous PWM optimized to minimize the drive losses when motor power factor exceeds 0.9.

Auto (2):
The controller selects the most adapted pattern according to the operating point.

DPWM (3):
Discontinuous PWM optimized to minimize the drive losses when motor power factor lower than 0.9.

Reserved (4)

CAUTION:
Enabling DPWM or DPWM1 can lead to additional losses in the motor. These two modes are not active when 11.31 = 0 or 3 and 05.37 = 0 and 05.95 = 0. Instead SPWM is used.

05.20 : **Quasi square output**
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**
Range: With Hv3 (0), Without Hv3 (1), Randomize (2)
Factory setting: With Hv3 (0)
Format: 8 bits

With 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).

Without 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 : **Voltage synchronization**
Range: No (0), 03.26 (1), Reserved (2)
Factory setting: No (0)
Format: 8 bits
This parameter is dedicated for synchronization of the output voltages of two or more inverters set in U/F law (**05.14** = 2) with a shared position coming from an absolute encoder. On starting command, the voltage is ramped according to half the value of parameter **05.53**.

No (0):
Normal Voltage control operation.

03.26 (1):
The position given by the encoder selected by **03.26** is used to generate a synchronized output voltage.
When **05.22** ≠ 0, if the inverter operates in current limitation, the output voltage will decrease down to a minimum value settable by **05.15** "Low frequency voltage boost".

Reserved (2)

05.23 : **Voltage offset**
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 : **d-axis inductance / leakage ind**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 32 bits
- Induction 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 rotating in oriented flux control mode (see **05.12**).

- Synchronous motor: Value of the typical machine cyclical stator inductance. The value of **05.24** is used for PM or

PMASR motors. Its value should be entered from the nameplate data, or else using the autotune procedure (see **05.12**).

05.25 : **Stator inductance (Ls)**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 32 bits
- Induction 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 rotating (**05.12** = Rotating: incomplete motor data (2)).
- Synchronous motor: The value of **05.25** is stored automatically during an autotune when rotating (**05.12** = Rotating: incomplete motor data (2)).

05.26 : **Dynamic control enable**
Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits

No (0):
No feed-forward terms are used.

Yes (1):
In oriented flux control (**11.30** = 2, 4 or 6), a feed-forward term based on the estimated level of flux in the motor and the motor speed is used to improve the performance of the current controllers.

NOTE
05.26 can be preset by **11.30** depending of motor technology selection.

05.27 to **05.30** : **Not used**

05.31 : **Defluxing loop gain**
Range: 0 to 32000
Factory setting: 1000
Format: 16 bits
This parameter controls the gain of the drive output voltage limiting loop. It only acts when the motor is operating above its rated speed in the c onstant voltage zone (defluxing zone).

NOTE
05.31 can be preset by **11.30** depending of motor technology selection.
05.31 is only active for «Induction motor: oriented flux control mode» (**11.31** = 2), «Synchronous motor: oriented flux control» (**11.31** = 3), «Grid inverter in current mode» (**11.31** = 3 and **18.28** = 1).

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

05.33 : **Motor volt per 1000 rpm (Ke) (▣)**
Range: 0 to 32000 V
Factory setting: 98 V
Format: 16 bits
The value of **05.33** is used for synchronous motors. Its value should be entered preferably from the nameplate data or else using the autotune procedure.

NOTE
If **05.04** (motor speed) is over 15000 rpm, the value of **05.33** represents the Motor volt per 10000 rpm.

05.34 and **05.35** : **Not used**

05.36 : **Low speed sensorless mode for PM motors**
Range: Signal injection (0), Current vector (1), None (2)
Factory setting: Current vector (1)
Format: 8 bits
CAUTION:
05.36 is only active if 03.38 = «Soft. 1 / Back EMF orientation», «Soft. 3 / adaptive model», «Soft. 4 / flux oriented» or «Soft. 5».

NOTE

05.36 can be preset by **11.30** depending of motor technology selection.

Signal injection (0):
At low speed, a current signal with high frequency and low amplitude is injected into the motor stator. The information collected is used to detect the rotor flux axis down to zero speed. This method can only be used on machines with high saliency ratio [Lq > 120% of Ld].

Current vector (1):
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 drive applies a current rotating vector whose acceleration ramp depends on parameter **02.11**. When the machine speed reaches the value set in **05.64**, control switches to the mode defined by **03.38**.
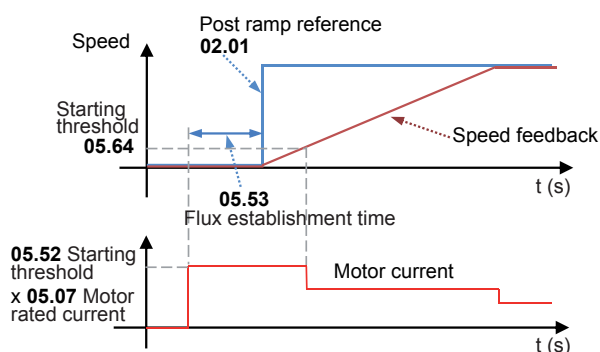
None (2)

05.37 : **Synchronous motor technology**
Range: Low saliency PM (LSRPM) (0),
        PM assisted Synchro Reluctance (LSHRM) (1),
        Synchronous reluctance (2), Wound rotor (3)
Factory setting: Low saliency PM (LSRPM) (0)
Format: 8 bits

NOTE

05.37 can be preset by **11.30** depending of motor technology selection.

Low saliency PM (LSRPM) (0):
Dedicated for PM motors where torque is mainly produced by the magnet field. Only the Ld and Lq values entered in **05.24** and **05.51** are taken into account for the motor control.

PM assisted Synchro Reluctance (LSHRM) (1):
Dedicated for PM motors with high saliency ratio where the torque is mainly produced by the reluctant effect. See parameters **05.72** to **05.88**.

Synchronous reluctance (2):
Reserved.

Wound rotor (3):
Reserved.

05.38 to **05.49** : **Not used**

05.50 : **Motor ventilation**
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.

NOTE

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)**
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 saliency.

05.52 : **Starting current (synchronous motor)**
Range: ± 300% of **05.07**
Factory setting: 20%
Format: 16 bits
With a synchronous motor (**11.30** = PM: oriented flux Ctrl (LSRPM) (4)), this parameter is used to improve starting for permanent magnet motors controlled without a position sensor.
With an asynchronous motor (**11.30** = Induction motor: oriented flux Ctrl (2)), this parameter is used to boost the magnetising current on machine starting for quicker flux installation.

NOTE

05.52 can be preset by **11.30** depending of motor technology selection.

05.53 : **Flux establishment time**
Range: 0.00 to 320.00 s
Factory setting: 0.25 s
Format: 16 bits
With a synchronous motor (**11.30** = PM: oriented flux Ctrl (LSRPM) (4)) 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**
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.
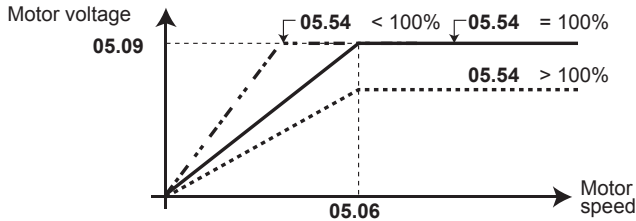
05.55 : **Motor overcurrent threshold**
Range: 0 to 999%
Factory setting : 150%
Format: 16 bits

Synchronous motors:
This threshold (% of **05.07**) defines the detection level for the «Motor overcurrent» trip. In case of overcurrent, if the threshold exceeds 1.5 x **11.32**, the drive will more likely display an "overcurrent at drive output" trip than a "Motor overcurrent" trip.
Active only if **11.31** is set to 0 or 3 (Synchronous motors).

Induction motors:
No effect.

CAUTION:
Do not increase this parameter value without notification of motor manufacturer.

NOTE

05.55 can be preset by **11.30** depending of motor technology selection.

05.56 : **Fast motor current monitoring**
Range: No (0) or Yes (1)
Factory setting : Yes (1)
Format: 8 bits

No (0):
A comparison between the motor current and the threshold defined by **05.55** is made one time per switching frequency. If the motor current exceeds the threshold, a "Motor overcurrent" trip is generated.

Yes (1):
A fast monitoring of the motor current (multiple times per switching period) is performed by the drive. Then, a comparison between this fast motor current measurement and the threshold defined by **05.55** is made. If the motor current exceeds the threshold, a "Motor overcurrent" trip is generated.

NOTE

05.56 can be preset by **11.30** depending of motor technology selection.

05.57 : **Actual switching frequency**

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**
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**
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**
Range: 2 kHz (0) to 18 kHz (19)
Factory setting: 3 kHz (2) for the POWERDRIVE MD2

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 Nidec Leroy-Somer.
Used to set the switching frequency when the motor frequency/speed is below the threshold defined in **05.61**.

05.61 : **Switching frequency threshold**
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 n the speed in rpm.

05.62 : **Torque/speed optimisation for synchronous motor**

Range: Standard (0), Fixed (1), Optimized mode 1 (2),
        Optimized mode 2 (3), Reserved (4)
Factory setting: Standard (0)
Format: 8 bits

NOTE

05.62 can be preset by **11.30** depending of motor technology selection.
This parameter is only active when **11.30** is set to 4 or 6 (oriented flux control for synchronous motor).

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):
- If Synchronous motor technology **11.30** = PM: oriented flux Ctrl. (LSRPM) (4) (low saliency PM) is selected, 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**.
- If Synchronous motor technology **11.30** = PMASR: oriented flux Ctrl. (LSHRM) (6) (PM assisted synchro reluctance) is selected, the drive manages the d axis current according to the values of **05.86** and **05.87**.

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**, **05.72** and **05.78**).

Reserved (4)

When the drive output voltage reaches its limit (defluxing range), the pole axis current is imposed by automatic defluxing.

05.63 : **Optimal magnetizing current**

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 = 3.

When **05.62** equals to 1 or 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)**

Range: 0% to 100% of **05.08**
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**).

NOTE

05.64 can be preset by **11.30** depending of motor technology selection.

05.65 : **Variable flux on mains voltage dip**

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**.
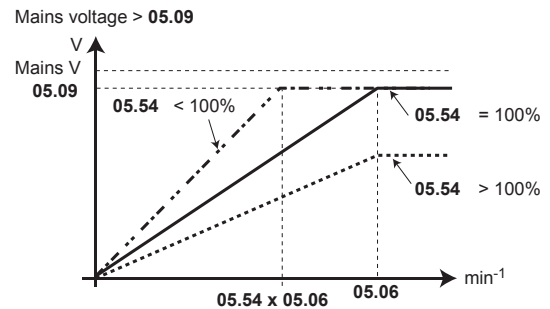
Mains voltage > **05.09**

Mains voltage < **05.09** and **05.65** = 0
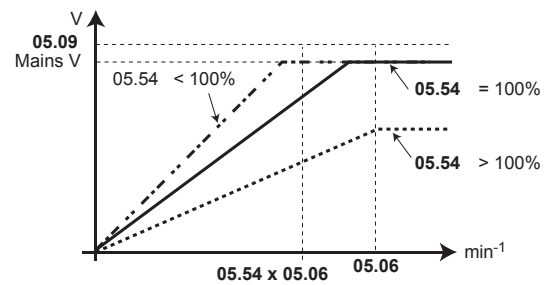
Mains voltage < **05.09** and **05.65** = 1
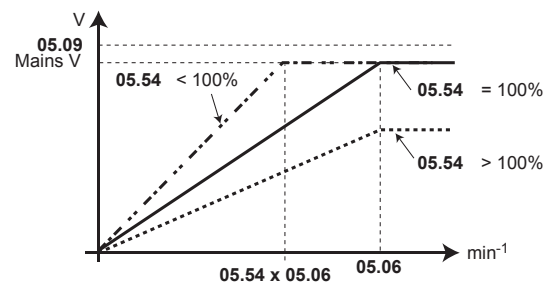
05.66 to **05.69** : **Not used**

05.70 : **Motor thermal protection management**

Range: Disabled (0), Control board terminal (1),
        MDX Encoder terminal (2),
        Control board & MDX encoder terminals (3)
Factory setting: Disabled (0)
Format: 8 bits

NOTE

05.70 can be preset by **11.30** depending of motor technology selection.

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

Control board terminal (1):
Fault management of a motor temperature sensor connected to DI1/CTP input of the main control board.

MDX Encoder terminal (2):
Fault management of a motor temperature sensor connected to T1/T2 of the MDX-ENCODER or MDX-RESOLVER option.

Control board & MDX encoder terminals (3):
Fault management of 2 motor temperature sensors respectively connected to DI1/CTP input of the main control board and T1/T2 of the MDX-ENCODER or MDX-RESOLVER option.

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

NOTE
See Menu 8 diagram (section 5.9.1) for more details.

05.71 : **Low Speed Sensorless Mode Current Limit**
Range: 0.0 to 300.0%
Factory setting: 20.0%
Format: 16 bits

NOTE
05.71 can be preset by **11.30** depending of motor technology selection.
Defines the drive current limits when signal injection is active (**05.36** = 0).

05.72 : **q-axis inductance @ no load**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 16 bits
Defines the inductance value in the q axis when the motor current (**04.01**) is equal to 10% of the design base current DBC (**05.76**).

05.73 and **05.74** : **Not used**

05.75 : **Iq Test Current For Inductance Measurement**
Reserved.

05.76 : **Design Base Current (DBC)**
Range: ± 2.22 x **11.32** (A)
Factory setting: 0.01 A
Format: 32 bits
Current that defines the point where the saturated inductance value **05.78** and Phase Offset **05.87** are characterized.

05.77 : **Phase Offset at Iq Test Current**
Reserved.

05.78 : **q-axis inductance @ DBC**
Range: 0.000 to 9000.000 mH
Factory setting : 0.000 mH
Format: 32 bits
Defines the theoretical inductance value in the q axis when the motor current (**04.01**) is equal to the Design Base Current (**05.76**) and the phase offset equals to **05.87**.

05.79 : **Not used**

05.80 : **Inductances correction factor**
Range: ± 50 %
Factory setting: 0 %
Format: 8 bits
Allows adjusting in percentage the theoretical value of inductances **05.72** and **05.78**. The factory setting is suitable for most situations.

05.81 : **Estimated q-axis inductance**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 32 bits
Estimated value of Lq including the effects of Id and Iq.

05.82 to **05.85** : **Not used**

05.86 : **Partial load phase offset**
Range: 0 to 90°
Factory setting: 48°
Format: 8 bits
Defines the theoretical offset angle between the direction of the motor current and the direction of the no-load motor voltage which produces the maximum torque when the motor current is equal to half DBC (**05.76**/2) . This value is indicated on the motor nameplate.

05.87 : **Phase offset @ DBC**
Range: 0 to 90°
Factory setting: 58°
Format: 8 bits
Defines the theoretical offset angle between the direction of the motor current and the direction of the no-load motor voltage which produces the maximum torque when the motor current is equal to design base current DBC (**05.76**).
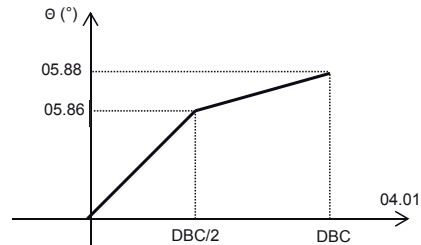
05.88 : **Torque angle tuning**
Range: ± 10.0°
Factory setting: -1.0°
Format: 8 bits
Allows to finely tune the theoretical optimum torque angle **05.87**. The final torque angle is equal to **05.87** + **05.88**.

05.89 : **Not used**

05.90 : **Inverted saturation characteristic**
Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits
Used to declare that the motor has an inverted saturation characteristic.

NOTE
05.90 can be preset by **11.30** depending of motor technology selection.

05.91 : **Not used**

05.92 : **Frequency stabilisation gain for PM motor in open loop**

Range: 0 to 1000
Factory setting: 0
Format: 16 bits
This parameter is used to control a PM motor in voltage control (**11.31** = 0). Function disabled if set to 0.

05.93 : **Voltage stabilisation gain for PM motor in open loop**

Range: 0 to 1000
Factory setting: 0
Format: 16 bits
This parameter is used to control a PM motor in voltage control (**11.31** = 0). Function disabled if set to 0.

05.94 : **Not used**

05.95 : **Filter between drive and motor**
Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits
Used to declare the presence of an LC filter between drive and motor.

05.96 : **Filter inductance**
Range: 0 to 9999.9 µH
Factory setting: 0 µH
Format: 32 bits
This parameter is used to enter the value of the LC filter inductance when **05.95** = "Yes" . It is used:
- To control a PM motor in voltage control (**11.31** = 0) supplied via a sine filter. The parameter is then filled in with the value of the filter inductance.
- To define the voltage value actually applied at the terminals of a motor/generator supplied via a filter. The parameter value should then integrate the total inductance between drive and motor.

05.97 : **Filter capacity**
Range: 0 to 9999.9 µf
Factory setting: 0 µf
Format: 32 bits
This parameter is used to enter the value of the LC filter capacity when **05.95** = "Yes ".

05.98 : **Filter damping resistor**
Range : 0 to 90,000.000 mΩ
Factory setting : 0 mΩ
Format : 32 bits
This parameter is used to enter the value of the LC filter damping resistor when **05.95** = "Yes ".

05.99 : **Final voltage applied to the load**

Range : 0 to 999 V
Format : 16 bits
Indicates the estimated voltage at the motor terminals taking account of the voltage drops modelled by parameters **05.96** to **05.98**.

5.7 - Menu 6: Programmable logic and counters
5.7.1 - Menu 6 diagrams
• **Management of logic commands**
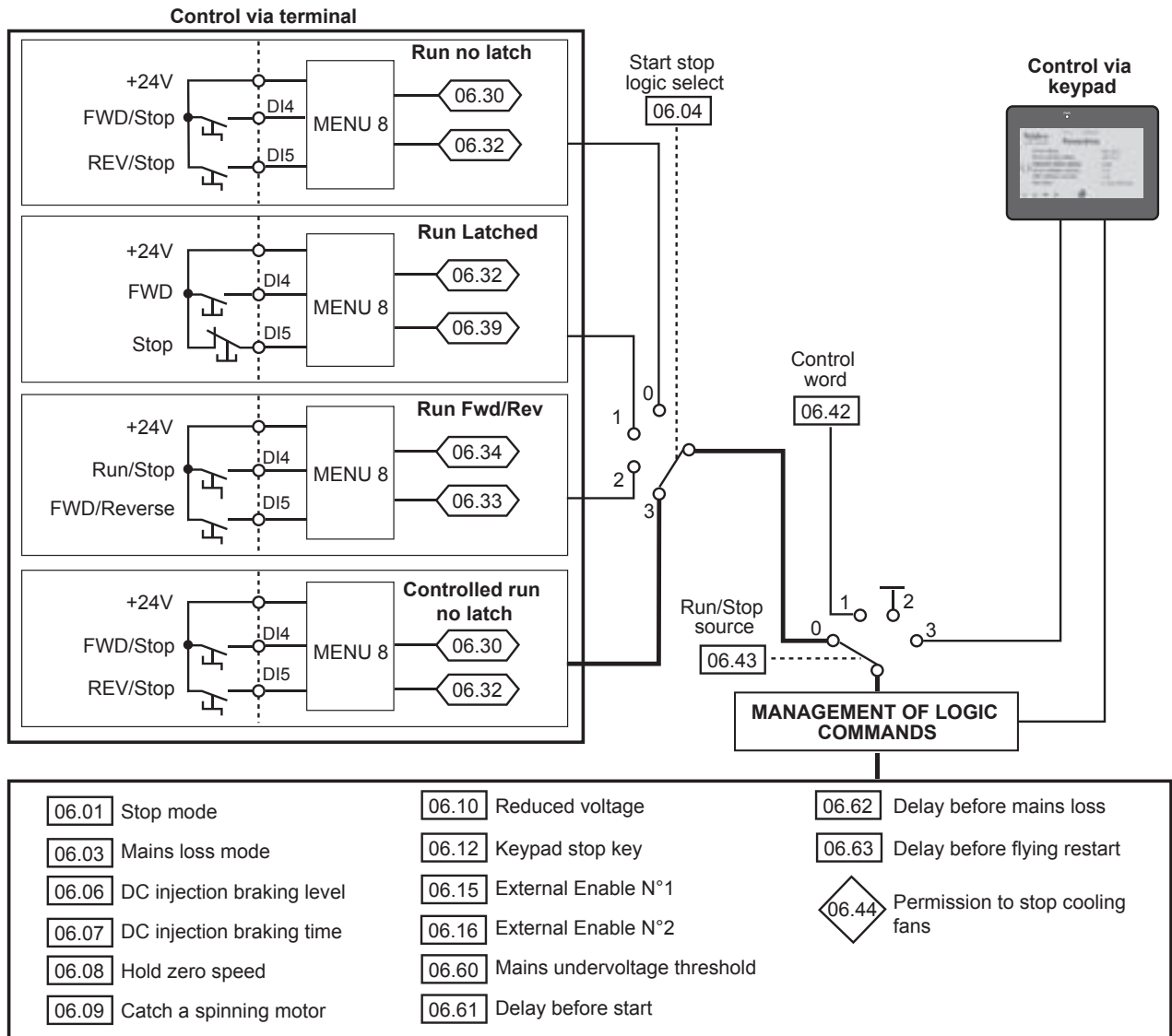
• **Timer, energy meter**
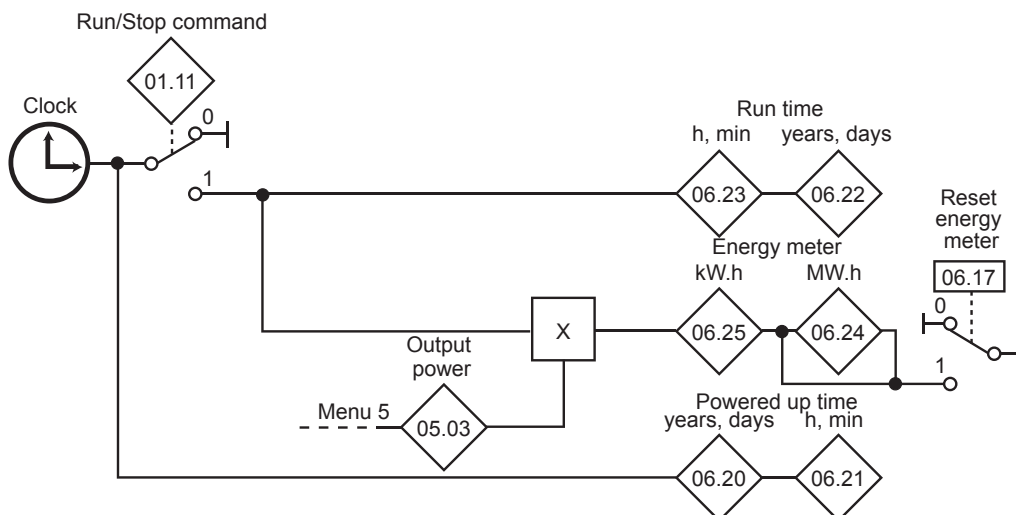
5.7.2 - Explanation of parameters in menu 6

06.01 : **Stop mode**
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.
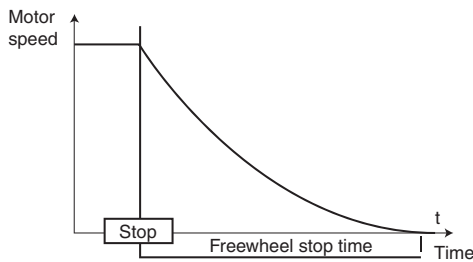
Ramp (1):
Stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter **02.04**.
One second after the stop, the drive is «ready».
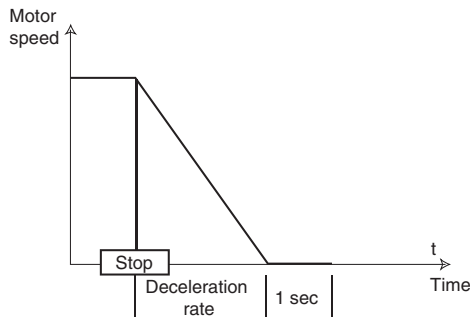
Ramp + DC (2) (▣):
Stop on deceleration ramp with DC injection for an imposed period of time.
The drive decelerates the motor according to the deceleration mode chosen in parameter **02.04**.
When zero frequency is reached, the drive injects DC with a magnitude which can be set in parameter **06.06** for a time defined by parameter **06.07**.
The drive is «ready».
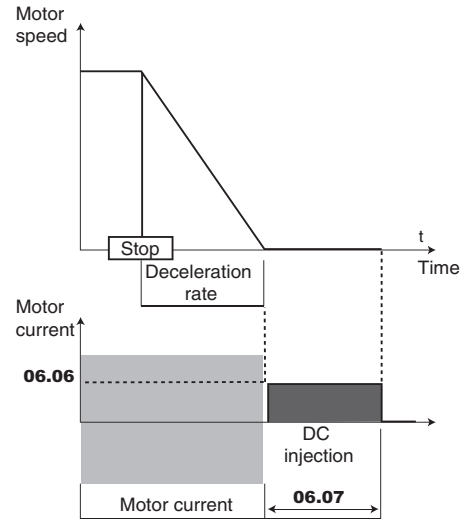
Zero speed DC (3) (▣):
Stop by braking using low frequency current injection, then DC injection at zero speed.
The drive decelerates the motor by imposing a low frequency current until it reaches almost zero speed, which the drive detects automatically.
The drive then injects DC with a magnitude which 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».
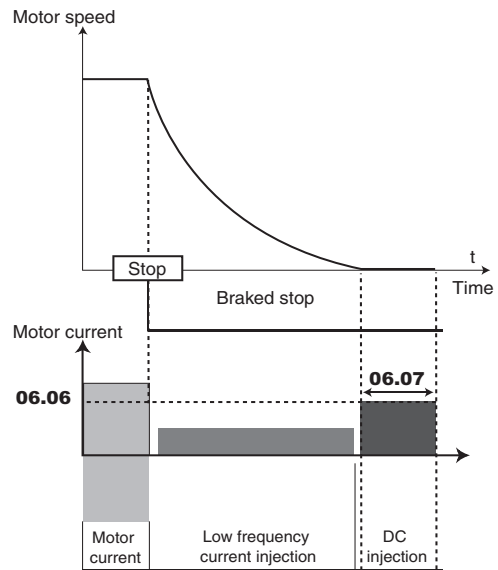
Timed DC (4) (▣):

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».
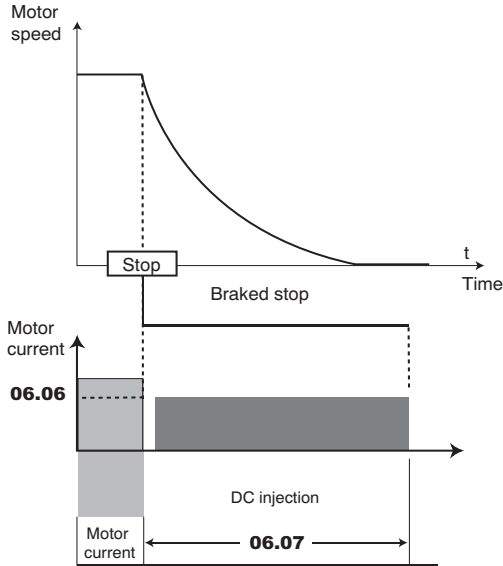
NOTE

In oriented flux control 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**

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.
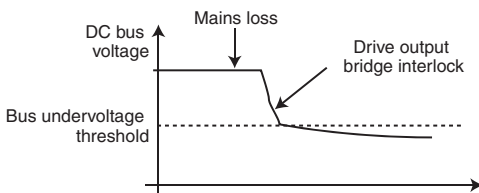
CAUTION:

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».
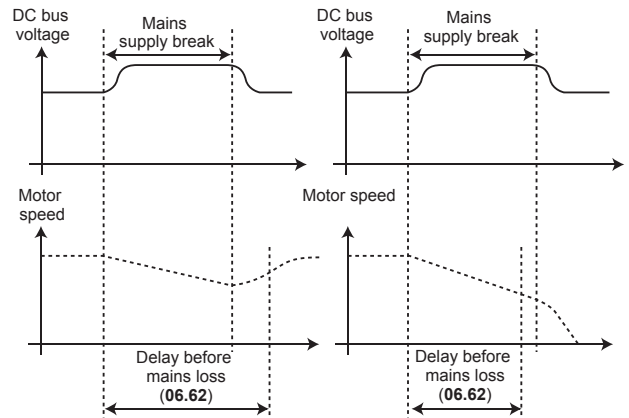
NOTE

See also parameter **18.70**.

06.04 : **Start stop logic select**

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

Open STO-1 and STO-2 terminals before modifying **06.04**.

Run no latch (0):

Command for FWD/Stop and REV/Stop via non-latching contacts. In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.
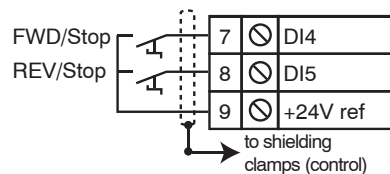
On power-up or after a trip reset, if a Run command is already selected, the motor starts as soon as the speed reference appears.

Run latched (1):
Command for Run and Stop via latching 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.
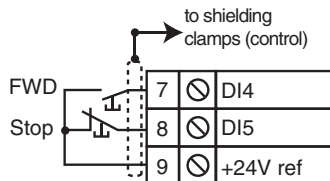
To change from FWD to REV or vice versa, go via a stop command.

Run Fwd/Rev (2):
Command for Run/Stop via non-latching 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)
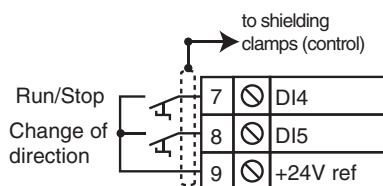
Controlled run (no latch) (3):
Command for FWD/Stop and REV/Stop via non-latching contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.
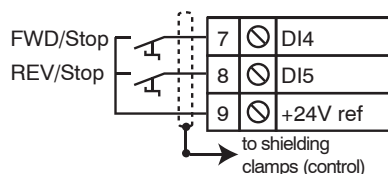
On power-up or after a trip reset, if a run command is already selected, the motor does not start. The Run input (DI4 or DI5) must be cycled for the command to take effect.

06.05 : **Not used**

06.06 : **Injection braking level**
Range: 0.0 to 300.0% (% of **05.07**)
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**
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**
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**
Range: Disabled (0), Enabled (1),
       Forced Motor stop before restart (2)
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):
The drive does not execute a «catch a spinning motor» procedure of a coasting motor.

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 initiate the output frequency to the measured value and reaccelerate the motor up to the reference frequency. See **03.91**.
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 **06.63**.

Forced Motor stop before restart (2):
This mode can be used to stop a coasting motor before starting it again.

- For induction motors (**11.31** = 1 or 2): a DC current is injected in the motor. The level and the duration of the DC current injection are respectively set by **06.06** and **06.07**.

- For synchronous motors (**11.31** = 0 or 3): to decelerate the motor, the drive adds losses in the stator by controlling the motor current amplitude. The level and the duration of the motor current are respectively set by **06.06** and **06.07**.

NOTE
Catch a coasting motor is not compatible with the S ramp (**02.06**) associated with brake control (**12.41** ≠ Disabled).

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

Disabled (0):
The DC bus undervoltage detection thresholds are those defined for the rated voltage.

Enabled (1):
Lowers the DC bus undervoltage detection threshold to that of the drive with the next lowest rated voltage. This enables a 400 V (T) rating to be supplied with 230 V or a 690 V (TH) with 400 V, as necessary.

CAUTION:
The value of 06.10 is taken into account only after the drive is powered back up.

If **06.10** = «Enabled», the mains undervoltage threshold **06.60** must be set accordingly.

06.11 : **Not used**

06.12 : **Keypad stop key**
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.
The RESET function is not affected by this parameter when the keypad is being used.

06.13 and **06.14** : **Not used**

06.15 : **External Enable N°1**
06.16 : **External Enable N°2**
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** and **06.16**.
CAUTION:
Disabling via the drive terminals STO-1 and STO-2 overrides 06.15.
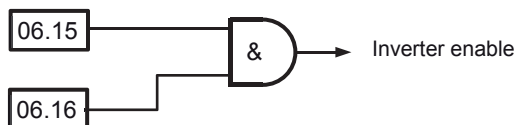
06.17 : **Reset energy meter**
Range: Disabled (0) or Enabled (1)
Factory setting: Disabled (0)
Format: 8 bits
When this parameter is set to Enabled (1), the meters **06.24** and **06.25** are reset to 0, then **06.17** reverts to Disabled (0).

06.18 and **06.19** : **Not used**

06.20 : **Powered-up time: years, days**

Range: 0.000 to 9.364 years, days
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**

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**

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**

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**

Range: 0.0 to 999.9 MW.h
Format: 16 bits
This meter counts the energy part in MW.h which circulates from the DC to the AC side of an inverter. For an inverter located to the motor side, the value represents the energy consumed by the motor. For an inverter located to the grid side, the value represents the energy returned to the grid.
This meter can be reset to 0 by changing parameter **06.17** to "Enabled" (1).

06.25 : **Energy meter: kW.h**

Range: 0.0 to 99.99 kW.h
Format: 16 bits
Same as **06.24** for the energy part in kW.h.

◇ **06.26** ◇ : **Regenerated energy meter: MW.h**

Range: 0.0 to 999.9 MW.h
Format: 16 bits
This meter counts the energy part in MW.h which circulates from the AC to the DC side of an inverter. For an inverter located to the motor side, the value represents the energy returned to the DC bus (For POWERDRIVE MD2R, this energy is returned to the Grid; for other Powerdrive architecture, this energy is dissipated in the braking resistor). For an inverter located to the grid side, the value represents the energy absorbed to the Grid.
This meter can be reset to 0 by changing parameter **06.17** to "Enabled" (1).

◇ **06.27** ◇ : **Regenerated energy meter: kW.h**

Range: 0.0 to 99.99 kW.h
Format: 16 bits
Same as **06.26** for the energy part in kW.h.

06.28 and **06.29** : **Not used**

◇ **06.30** ◇ to ◇ **06.34** ◇ and ◇ **06.39** ◇ : **Sequencing bits**

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 **06.41** : **Not used**

06.42 : **Control word**
Range: 0 to 32767
Factory setting: 0
Format: 16 bits
The control word is used to control the drive via a serial link or fieldbus:

Control word bits 06.42	Decimal conversion	Functions	Equivalent parameter
0	1	External Enable	**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	

Control word bits 06.42	Decimal conversion	Functions	Equivalent parameter
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**, **06.39**.

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**
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).

NOTE
Open STO1 and STO2 terminals before modifying **06.43**.

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

◇ **06.44** ◇ : **Permission to stop cooling fans**

Range: No (0) or Yes (1)

No (0):
10.02 «Drive active» is on «Yes (1)» or one of the inverter module temperatures (**07.51** to **07.53**) is higher than 65°C.

Yes (1):
All the inverter module temperatures are lower than 65°C and **10.02** «Drive active» is on «No (0)».

06.45 to **06.59** : **Not used**

06.60 : **Mains undervoltage threshold**
Range: 100 to 600 V
Factory setting: T rating = 300 V, TH rating = 520 V
Format: 16 bits
Used to define the detection level for mains undervoltage.

06.61 : **Delay before start**
Range: 0.00 to 327.00 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**
Range: 0.00 to 327.00 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**
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 catch a spinning motor (flying restart) procedure (see **06.09**). A setting of 2 seconds is generally sufficient.
If the catch a spinning motor procedure 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
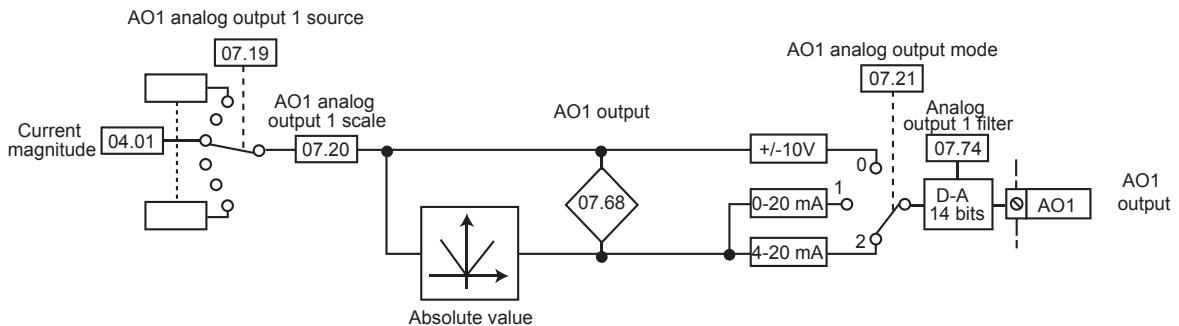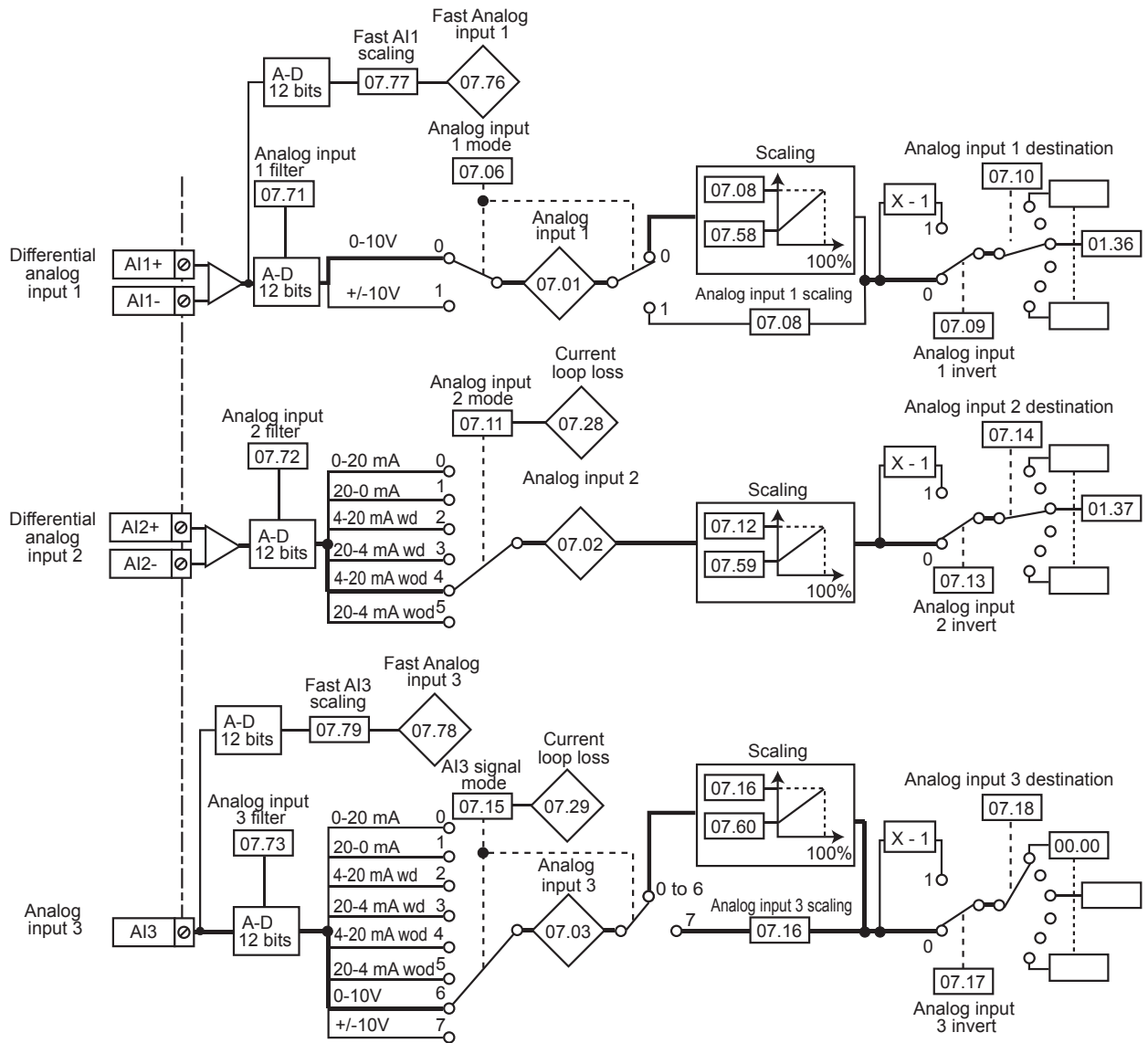
5.8.2 - Explanation of parameters in menu 7

NOTE

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

07.01 : **Analog input 1**

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**

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**

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**
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**

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**
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**
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**
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**
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 mode**
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**
Range: 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**
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**
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**
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**
Range: 0.000 to 60.000
Factory setting: 1.000
Format: 16 bits
Used to scale the analog output.
If **07.75** = «Automatic calibration» (0): When **07.20** = 1.000, 100% of the analog output corresponds to the maximum value of the Range of the parameter which has been assigned to it.
If **07.75** = «Manual calibration» (1): **07.20** x 1000 expresses the calibration of the 10 V (20 mA). For example **07.20** = 2.500 = A source value of 2500 gives 10 V (20 mA) on the analog output.

07.21 : **AO1 analog output 1 mode**
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**
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 **07.48** : Not used

07.49 : **Selection of the displayed temperature**
Range: Case (0) or Silicon chips (1)
Factory setting: Case (0)
Format: 8 bits

Case (0):
The temperature displayed in **07.50, 07.51, 07.52, 07.53** is the temperature measured on casings of IGBT power modules.

Silicon chips (1):
The temperature displayed in **07.50, 07.51, 07.52, 07.53** is the estimated temperature of the semiconductors.

07.50 : **Not used**

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

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

07.55 : **Control board temperature**
Range: - 40 to + 125°C
Format: 16 bits
If **07.55** exceeds 70°C, the drive over temperature alarm (**10.18**) is activated.

07.56 and **07.57** : **Not used**

07.58 : **Minimum value of AI1**
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 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**
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 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**
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 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**

Range: ± 100.00%
Format: 16 bits
Used to read the value of the AO1 output.

07.69 and 07.70 : **Not used**

07.71 , 07.72 and 07.73 : **Analog input filters 1, 2 and 3**
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**
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 : **Scale management for analog output**
Range: Automatic calibration (0) or Manual calibration (1)
Factory setting: Automatic calibration (0)
Format: 8 bits
Defines the type of calibration of all the analog outputs including I/O boards like MDX-I/O M2M or MDX-I/O Lite (see **07.20** too).

07.76 : **Fast analog input 1**

Range: ± 3200.0
Format: 16 bits
The measure is based on a 12-bit analog/digital converter sampled at the actual switching frequency **05.57**.

07.77 : **Fast analog input 1 scaling factor**
Range: ± 320.0 Units/V
Factory setting: 0,0 Units/V
Format: 16 bits
This scaling factor converts the raw value read on the analog input in V into a value corresponding to the measured variable in "units" (in the case of a current sensor "units" stands for Amperes). This scaling factor is related to the characteristics of the sensor used.

07.78 : **Fast analog input 3**

Range: • ± 3200.0 in voltage mode (**07.15** = 6 or 7),
• 0 to 3200.0 in current mode (**07.15** = 0 to 5)
Format: 16 bits
The measure is based on a 12-bit analog/digital converter sampled at the actual switching frequency **05.57**.

07.79 : **Fast analog input 3 scaling factor**
Range: ± 320.0 Units/V
Factory setting: 0,0 Units/V
Format: 16 bits
This scaling factor converts the raw value read on the analog input (in V or mA depending on **07.15**) into a value corresponding to the measured variable in "units" (in the case of a current sensor "units" stands for Amperes). This scaling factor is related to the characteristics of the sensor used.

07.80 : **DC bus voltage**

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

07.81 : **Supply voltage**

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**
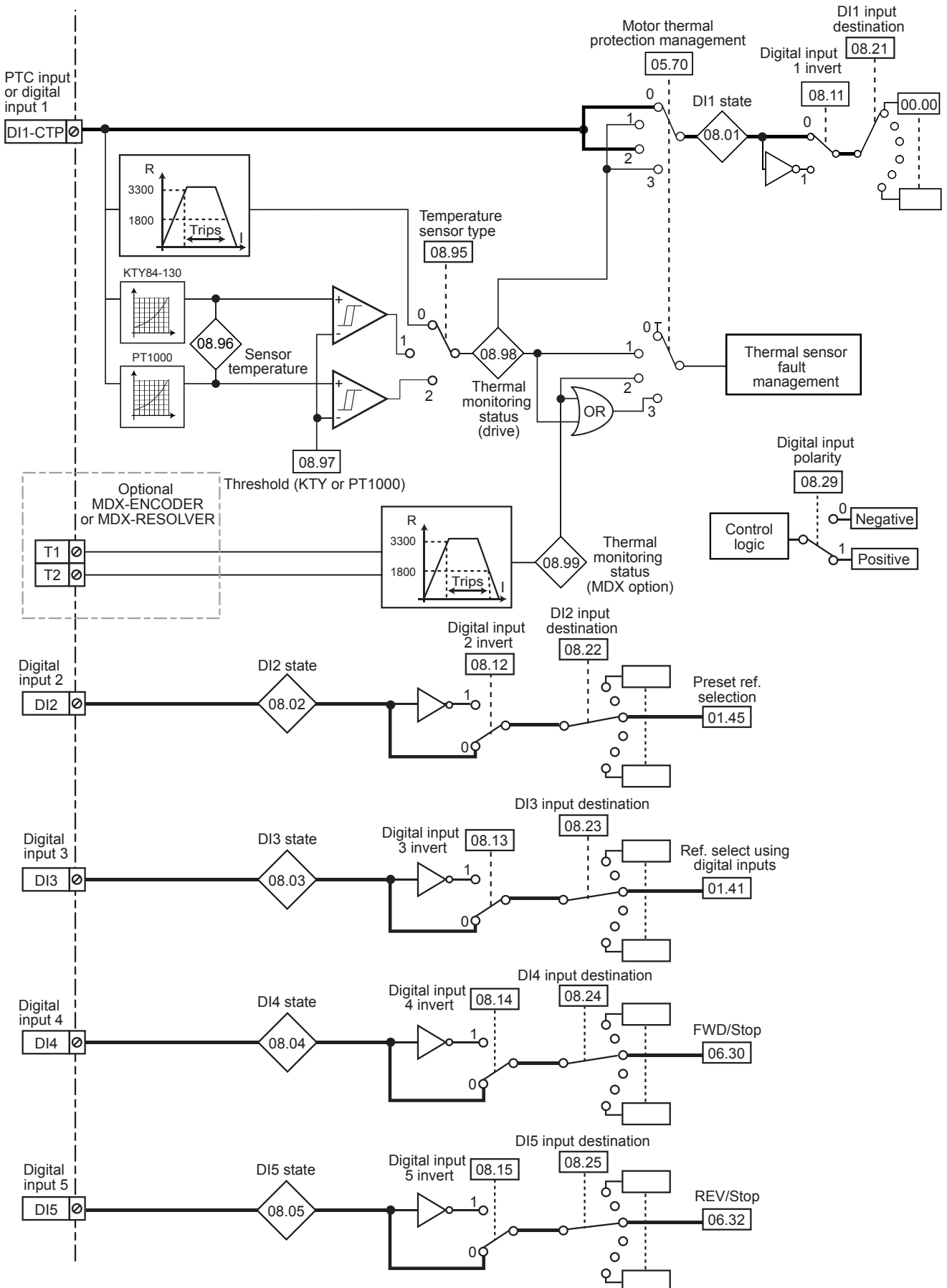
• **Assignment of digital outputs and relay outputs**
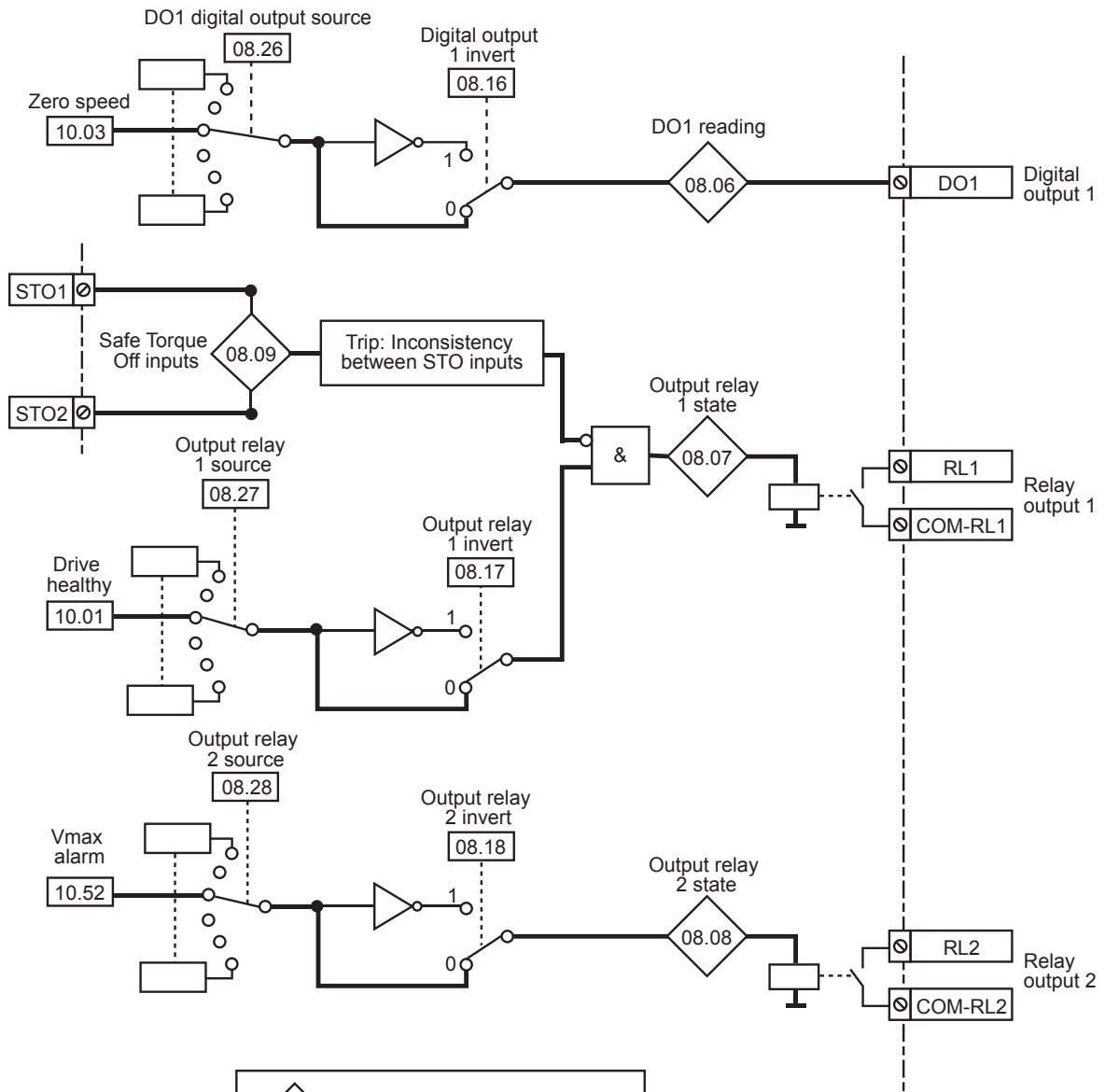
5.9.2 - Explanation of parameters in menu 8

NOTE

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

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

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

08.06 : DO1 reading

Range: Disabled (0) or Enabled (1)
Format: 8 bits

08.07 : Output relay 1 state

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

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

Range: STO2 - STO1: 00 (0), STO2 - STO1: 01 (1),
STO2 - STO1: 10 (2), STO2 - STO1: 11 (3)
Format: 8 bits
This parameter indicates the state of the «Safe Torque Off» inputs (at the terminal block), from STO1, STO2 terminals.

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

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

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

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

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

Disabled (0):
Not inverted.

Enabled (1):
Inverted.

08.19 : Not used

08.20 : Digital I/O read word

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	08.06	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**
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 Control board terminal (1) or Control board & MDX encoder terminals (3), then digital input DI1 must not be used (do not assign 08.21).

08.22 : **DI2 input destination**
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**
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**
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**
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**
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**
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**
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**
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**
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 **08.94** : **Not used**

08.95 : **Temperature sensor type**
Range: PTC (0), KTY84-130 (1), PT1000 (2)
Factory setting: PTC (0)
Format: 8 bits
Selects the type of sensor used for motor thermal protection connected to DI1/CTP and 0V terminals.

PTC (0):
PTC sensor.

KTY84-130 (1):
KTY84-130 sensor.

PT1000 (2):
PT1000 sensor.

◇ **08.96** ◇ **: Sensor temperature**

Range: 0 to 200°C
Format: 16 bits
The temperature displayed in **08.96** is valid only if a KTY84-130 or a PT1000 is connected between DI1-CTP terminal and 0V and if **05.70** is equal to 1 or 3. The displayed temperature is 0°C when **05.70** is set to 0 or 2.

08.97 **: Threshold (KTY or PT1000)**
Range: 0 to 200°C
Factory setting: 150°C
Format: 16 bits
Defines temperature threshold for the motor thermal protection trip (when KTY or PT1000 sensor connected).
See block diagram as shown in section 5.9.1.

◇ **08.98** ◇ **: Thermal monitoring status (Drive terminal)**

Range: Not triggered (0) or Triggered (1)
Format: 8 bits

Not triggered (0):
Temperature of the probe connected on DI1/CTP does not exceed the limit.

Triggered (1):
The temperature of the probe connected on DI1/CTP exceeds the limit or the probe is opened.

◇ **08.99** ◇ **: Thermal monitoring status (MDX-option)**

Range: Not triggered (0) or Triggered (1)
Format: 8 bits
Indicates the state of the MDX-ENCODER or MDX-RESOLVER PTC sensor if **05.70** = 2.

Not triggered (0):
Temperature of the probe connected on the MDX-option does not exceed the limit.

Triggered (1):
The temperature of the probe connected on the MDX-option exceeds the limit or the probe is opened.

5.10 - Menu 9: Logic functions

5.10.1 - Menu 9 diagrams

• **Logic functions**
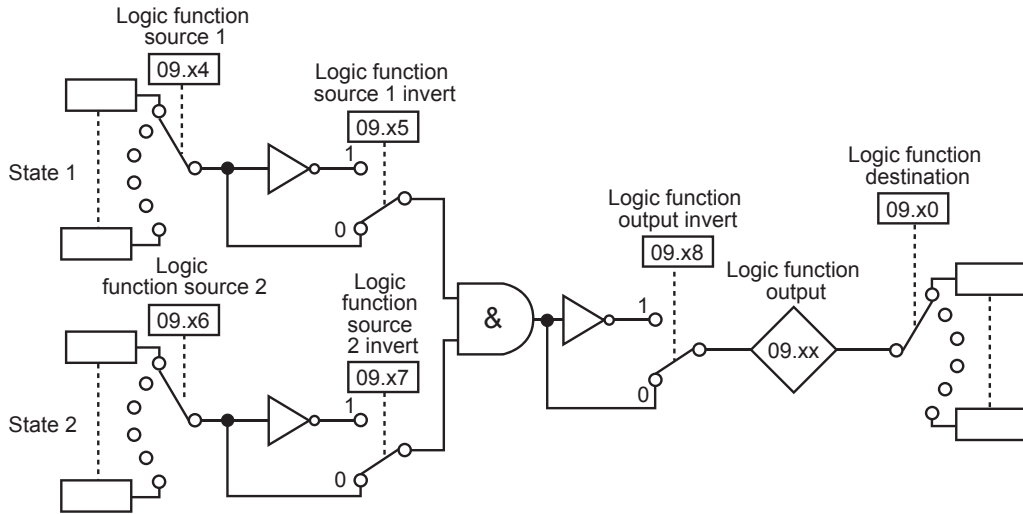
	Source 1	Source 2	Source 1 invert	Source 2 invert	Output invert	Output	Source destination
Function 1	**09.04**	**09.06**	**09.05**	**09.07**	**09.08**	**09.01**	**09.10**
Function 2	**09.14**	**09.16**	**09.15**	**09.17**	**09.18**	**09.02**	**09.20**
Function 3	**09.64**	**09.66**	**09.65**	**09.67**	**09.68**	**09.61**	**09.60**
Function 4	**09.74**	**09.76**	**09.75**	**09.77**	**09.78**	**09.71**	**09.70**
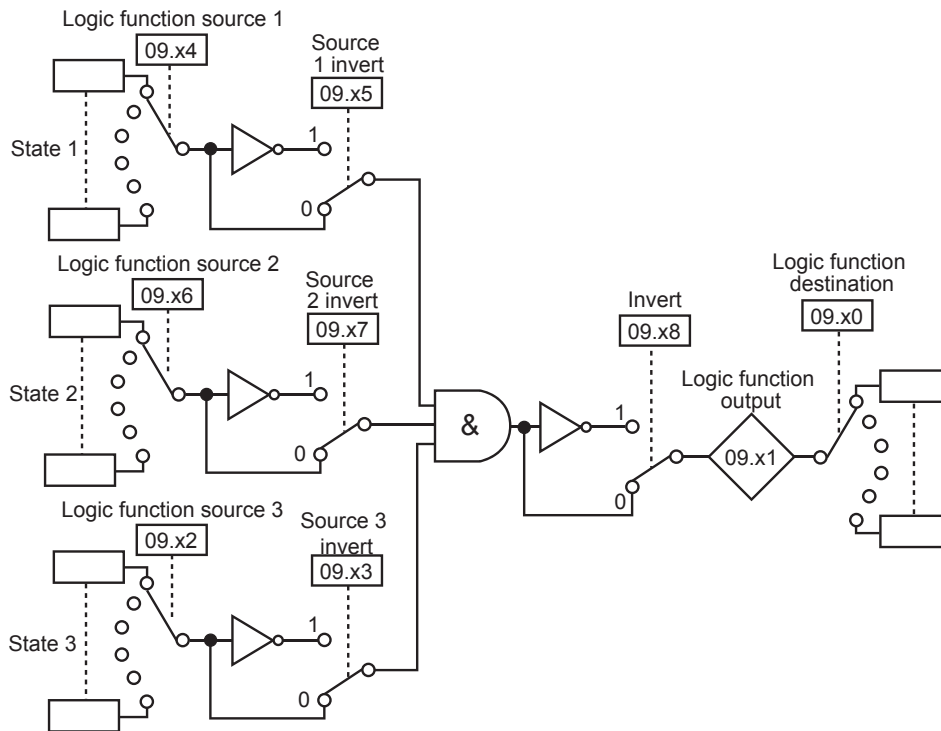
	Source 1	Source 2	Source 3	Source 1 invert	Source 2 invert	Source 3 invert	Output invert	Output	Destination
Function 5	**09.84**	**09.86**	**09.82**	**09.85**	**09.87**	**09.83**	**09.88**	**09.81**	**09.80**
Function 6	**09.94**	**09.96**	**09.92**	**09.95**	**09.97**	**09.93**	**09.98**	**09.91**	**09.90**

• Motorised potentiometer function

Motorised potentiometer mode
09.21

Motorised potentiometer destination
09.25

Motorised potentiometer up
09.26

+100 %
0
t

+100 %
0
−100

Motorised potentiometer reference
09.03

Motorised potentiometer scale factor
09.24

Motorised potentiometer down
09.27

09.22 Motorised potentiometer bipolar select

09.23 Motorised potentiometer rate

09.28
Motorised potentiometer reset

• Binary sum functions

Bit 0
09.29

Bit 1
09.30

Bit 2
09.31

Binary sum output offset
09.34

Binary sum destination
09.33

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

Binary sum output
09.32

Binary sum 2 zero source
09.52

Binary sum 2 ones source
09.53

Binary sum 2 twos source
09.54

Binary sum 2 output offset
09.55

Binary sum 2 destination
09.57

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

Binary sum 2 output
09.56

5.10.2 - Explanation of parameters in menu 9

09.01 : **Logic function 1 output**

09.02 : **Logic function 2 output**

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**

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

09.04 : **Logic function 1 source 1**
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**
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**
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**
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**
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**
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**
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**
Range: Disabled (0) or Enabled (1)
Factory setting: Disabled (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**
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**
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**
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**
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**
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**
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**
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**
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 Range +**01.06**.
- If **01.06** = 1500 rpm, so that the maximum value of the motorised potentiometer reference corresponds to 1000 rpm:

$$==> \mathbf{09.24} = \frac{1000}{\mathbf{Spd.01}} = 0.67$$

09.25 : **Motorised potentiometer destination**
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**: PR1: Preset reference)

09.26 : **Motorised potentiometer up**
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**
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**
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**
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

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

09.33 : Binary sum destination
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
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
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
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

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

09.57 : Binary sum 2 destination
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
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

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
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
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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**
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**
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**
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

• Operating states

10.01	Drive healthy	10.20	Last trip
10.02	Drive active	10.21	Trip -2
10.03	Zero speed	10.22	Trip -3
10.04	Running at minimum speed	10.23	Trip -4
10.05	Below set speed	10.24	Trip -5
10.06	At speed	10.25	Trip -6
10.07	Above set speed	10.26	Trip -7
10.08	Nominal load reached	10.27	Trip -8
10.09	Drive output at current limit	10.28	Trip -9
10.10	Regenerating operation	10.29	Trip -10
10.11	Braking IGBT active	10.40	Status word **10.01** to **10.15**
10.13	Direction commanded	10.52	Maximum speed alarm
10.14	Direction running	10.53	Maximum speed
10.15	Mains loss	10.76	Preload contactor closed
10.16	DC bus undervoltage	10.97	Alarm status
10.17	Motor overload alarm	10.98	Drive status
10.18	Drive over temperature alarm	10.99	Current trip
10.19	Drive general warning		

• 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

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

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

10.03 : Zero speed

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

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

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

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

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

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

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

10.10 : Regenerating operation

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

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

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**

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**

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**

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**

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**

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**

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 or the drive Ixt level **04.21** exceeds 100%.

10.19 : **Drive general warning**

Range: No (0) or Yes (1)
Format: 8 bits
Drive general warning = Yes (1) if Braking resistor alarm **10.12** or Motor overload alarm **10.17** or Drive overtemperature alarm **10.18** = Yes (1).

10.20 to **10.29** : **Last 10 trips stored**

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.
See the list of trips in section 7.

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

10.30 : **Full power braking time**
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. This is why a thermal overload protection device must be added to protect the braking resistor.

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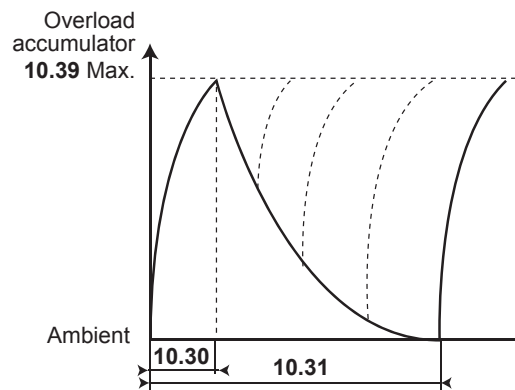
CAUTION:
If this parameter is left at 0, the braking resistor will not be protected.

10.32 : **Not used**

10.33 : **Drive reset**

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**

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**

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**

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**

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.)

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».

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, AI3 loss, Drive overload Ixt, COM loss, EEPROM fail., Fieldbus loss, User 1 to 10, Internal ventilation.

10.38 : **Serial link user trip**

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**

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).

10.40 : **Status word 10.01 to 10.15**

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**

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 Voltage control mode or speed (**03.02**) > V_{max} (**01.06** or **21.01**) - **03.52** in oriented flux control 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 Voltage control, or (**03.02**) > V_{max} (**01.06** or **21.01**) - **03.52** - 10 rpm.

10.53 : **Maximum speed**

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**

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**

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**

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**

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**

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**

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**

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**

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**

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**
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**

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.

10.78 and **10.79** : **Not used**

10.80 : **Auto reset type**
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**.

NOTE
For Powerdrive MD2R drives, the regen rectifier automatic reset is only operational if parameter 18.04 is set to «Synchro x3». The number of resets is set at 3.

10.81 : **Special trip n°1**
Range: 0 to 102
Factory setting: 0
Format: 8 bits
Enter the number of the trips which should or should not be reset automatically depending on the setting of **10.80**.
See the list of trips in section 7.

10.82 : **Special trip n°2**
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**.
See the list of trips in section 7.

10.83 : **Special trip n°3**
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**.
See the list of trips in section 7.

10.84 : **Special trip n°4**
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**.
See the list of trips in section 7.

10.85 and **10.96** : **Not used**

10.97 : **Alarm status**

Range: 0 to 22
Format: 8 bits
The alarms are for information only: the drive continues to operate but may switch to fault mode if no corrective action is taken.
See section 7.3.

10.98 : **Drive status**

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 section 7.2.

10.99 : **Current trip**

Range: 0 to 102
Format: 8 bits
Contains the code for the current trip. Value 0 indicates that the drive has not tripped. The other values indicate the trip number. See section 7.4.

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	11.34	: Drive Ixt function trip threshold

• 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
		11.26	Min comms transmit delay
11.24	Serial mode	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

Range: **00.00** to **21.51**
Factory setting: See table below.
Format: 16 bits

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

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

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
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

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 / LS Net 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
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**

Range: ± 9.99
Format: 16 bits
Indicates the drive software version.

| **11.30** | **: Motor technology selection**
Range: None (0), Induction motor: Voltage vector ctrl (1),
Induction motor: Oriented flux ctrl (2), NC (3),
PM: Oriented flux ctrl. (LSRPM) (4), NC (5),
PMASR: Oriented flux ctrl. (LSHRM) (6)
Factory setting: None (0)
Format: 8 bits
Each time the parameter **11.30** is changed, some parameters related to the motor technology are automatically overwritten according to the table below.

Related Parameters	Pr 11.30 values					
	0	**3 & 5**	**1**	**2**	**4**	**6**
03.38	-	6	6	6	6	7
03.42	-	3	3	3	3	5
04.12	-	2	2	2	2	0
04.55	-	0	1	0	0	1
05.26	-	0	0	0	0	1
05.31	-	1000	1000	1000	1000	5000
05.36	-	1	1	1	1	0
05.37	-	0	0	0	0	1
05.52	-	20%	20%	20%	20%	0%
05.55	-	160%	160%	160%	160%	150%
05.56	-	1	0	0	1	1
05.62	-	0	0	0	0	2
05.64	-	10%	10%	10%	10%	10%
05.70	-	0	0	0	0	1
05.71	-	20%	20%	20%	20%	70%
05.90	-	0	0	0	0	1
11.31	-	1	1	2	3	3

None (0):
No selection.

Induction motor: voltage vector ctrl (1):
Dedicated for induction motors controlled in Voltage control mode (see **05.14**).

Induction motor: Oriented flux ctrl (2):
Dedicated for induction motors controlled in Oriented flux control mode with or without speed feedback (see **03.38**).

NC (3)

PM: Oriented flux ctrl. (LSRPM) (4):
Dedicated for PM motors with a low saliency ratio (< 2) controlled in Oriented flux control mode with or without speed feedback (see **03.38**).

NC (5)

PMASR: Oriented flux ctrl. (LSHRM) (6):
Dedicated for PMASR motors or IPM motors with high saliency ratio (>2), controlled in oriented flux control mode with or without speed feedback (see **03.38**).

| **11.31** | **: User drive mode**
Range: Synchronous motor: Voltage control (0),
Induction motor: Voltage control (1),
Induction motor: Oriented flux control (2),
Synchronous motor: Oriented flux control (3),
Grid inverter for REGEN drive (4),
Grid inverter in current mode (5), Islanded Inverter (6),
DC/DC converter (7)
Factory setting: Induction motor: Voltage control (1)
Format: 8 bits
The operating mode can only be selected when the drive is stopped.
CAUTION:
• **If the mode is changed with a fieldbus option, reset the option (15.32 = ON).**
• **If 11.30 ≠ 0, do not edit 11.31 value (automatic preset sequence).**

Synchronous motor: Voltage control (0):
Reserved.

Induction motor: Voltage control (1):
Induction motor controlled in Voltage control mode (without speed feedback). See also **05.14**.

Induction motor: Oriented flux control (2):
Induction motor controlled in oriented flux control mode with speed feedback or with the sensorless function. See also **03.38**.

Synchronous motor: Oriented flux control (3):
Synchronous or Permanent magnet motor controlled in oriented flux control mode with speed feedback or with the sensorless function. See also **03.38**.

Grid inverter for REGEN drive (4):
The inverter is used as an active rectifier connected to the Grid via a 3 phase reactor. The line current magnitude is controlled by DC bus regulation.

Grid inverter in current mode (5):
The inverter is used as an active rectifier connected to the Grid via a 3 phase reactor. The line current magnitude can be controlled by external reference (**18.28** = 0) or by DC bus regulation (**18.28** = 1).

Islanded inverter (6):
The inverter is used to create an islanded AC Grid (refer to menu 18).

DC/DC converter (7):
See application note related to DC/DC converter (please contact Leroy-Somer).

11.32 ◇ : **Drive current rating**

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**

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 : **Drive Ixt function trip threshold**
Range: 30% to 110%
Factory setting: 100%
Format: 8 bits
Parameter **11.34** is used to protect the drive thermally for specific uses not protected by measuring the temperature of its modules alone (high switching frequency, etc).
- When the drive output thermal current exceeds **11.34** x **11.32,** parameter **10.19** (drive general warning) is set to «Yes».
- When the drive output thermal current exceeds ~105% x **11.34** x **11.32,** the drive displays a «Ixt drive overload trip.

11.35 to **11.42** : **Not used**

11.43 : **Factory settings**
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 section4.2.7).
"Centrifuge application" is not restrictive and also covers the common applications such as pumps, fans, compressors, mixers, extruders, crushers.

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 4.2.8).

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**
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)

11.46 to **11.51** : **Not used**

11.52 ◇ : **Drive Serial Number LS Read**

Reserved.

11.53 ◇ : **Drive Serial Number MS Read**

Reserved.

11.54 to **11.59** : **Not used**

11.60 ◇ : **Drive identification code**

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 : **Level 1 menu protection password**
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**
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**
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**
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**
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),
    Inverter <-> rectifier (9)
Factory setting: None (0)
Format: 8 bits
This parameter defines the type of internal serial link communication to select according to the drive communication.

None (0):
No communication.

Inverter of Regen (1):
Dedicated to the motor side inverter of a "Regen drive" or a "Low harmonic drive".

Rectifier of Regen (2):
Dedicated to the grid side inverter of a "Regen drive" or a "Low harmonic drive".

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.

Inverter <-> rectifier (9):
Reserved.

11.67 : **Encoder module presence**

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**

Range: No (0), MDX-I/O (1), MDX-I/O LITE (2)
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 M2M module, connected to the drive.

MDX-I/O LITE (2):
Presence of an optional MDX-I/O Lite module, connected to the drive.

5.13 - Menu 12: Comparator and function blocks

5.13.1 - Menu 12 diagrams

• **Comparators**
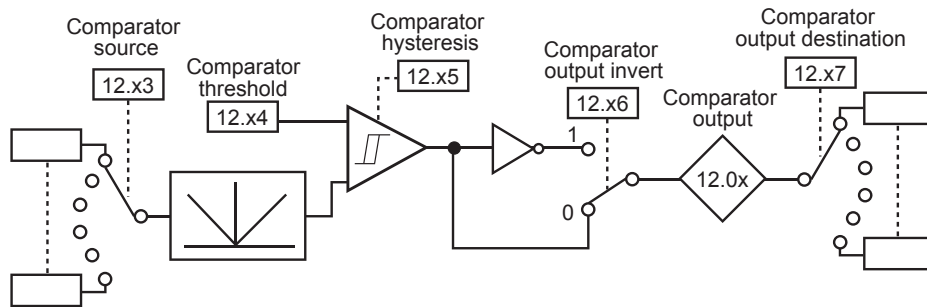
Comparator	Source	Threshold	Hysteresis	Invert	Output state	Destination
Comparator 1	**12.03**	**12.04**	**12.05**	**12.06**	**12.01**	**12.07**
Comparator 2	**12.23**	**12.24**	**12.25**	**12.26**	**12.02**	**12.27**
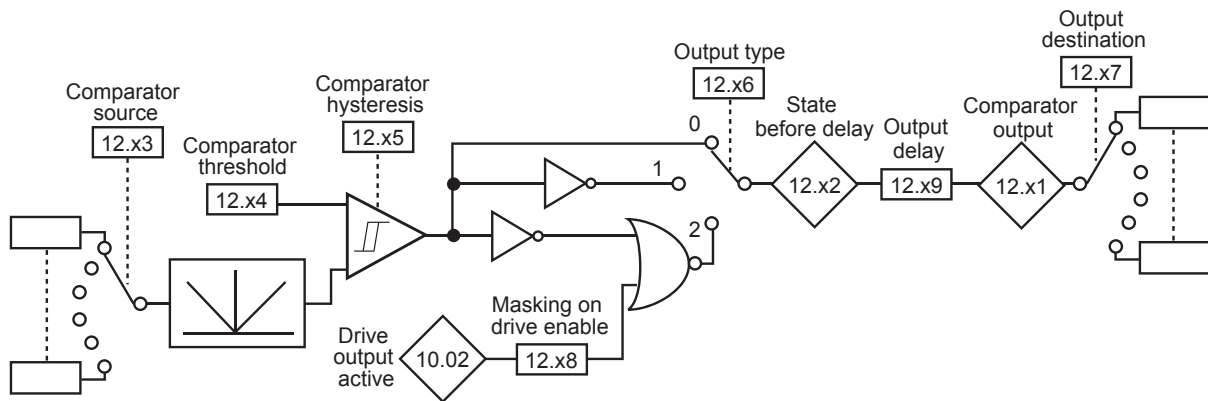
Comparator	Source	Threshold	Hysteresis	Masking	Type	State before delay	Time delay	State	Destination
Comparator 3	**12.63**	**12.64**	**12.65**	**12.68**	**12.66**	**12.62**	**12.69**	**12.61**	**12.67**
Comparator 4	**12.73**	**12.74**	**12.75**	**12.78**	**12.76**	**12.72**	**12.79**	**12.71**	**12.77**
Comparator 5	**12.83**	**12.84**	**12.85**	**12.88**	**12.86**	**12.82**	**12.89**	**12.81**	**12.87**

• Processing of internal variables

Function block
variable 1 source
12.x8

Function block
variable 1 scale
12.x3

Function
block select
12.x0

Function block
applied factor
12.x5

Function block
output destination
12.x1

Function
block output
12.x2

0 : V1
1 : V2
2 : V1 + V2
3 : V1 - V2
4 : (V1 x V2) / 100
5 : (V1 / V2) x 100
6 : filter/V1
7 : ramp/V1
8 : |V1|
9 : V112.x5

Function block
variable 2 scale
12.x4

12.x9
Function block
variable 2 source
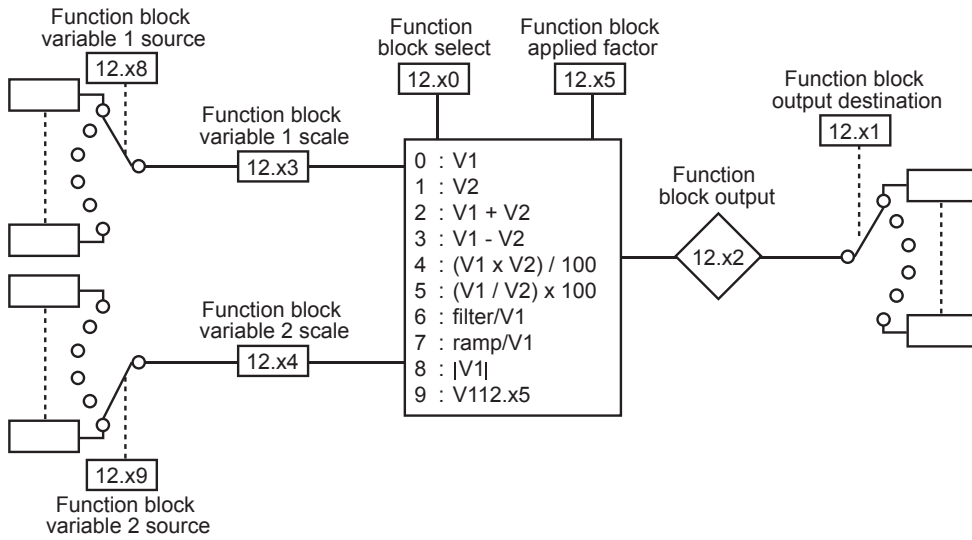
Block	Variable 1 source	Variable 1 scaling	Variable 2 source	Variable 2 scaling	Function selection	Applied factor	Output destination	Output
Block 1	12.08	12.13	12.09	12.14	12.10	12.15	12.11	12.12
Block 2	12.28	12.33	12.29	12.34	12.30	12.35	12.31	12.32

• Brake control in Voltage control mode
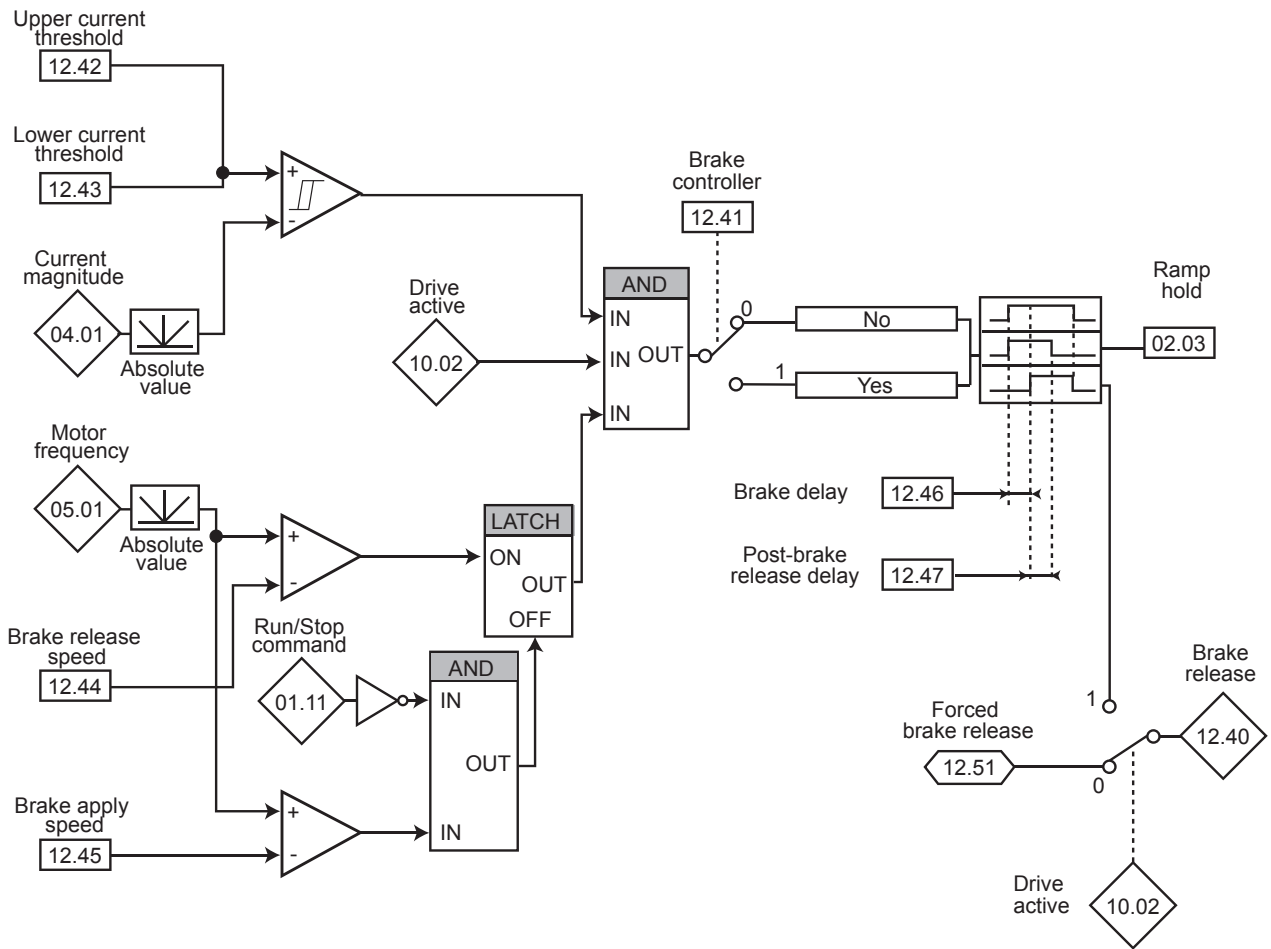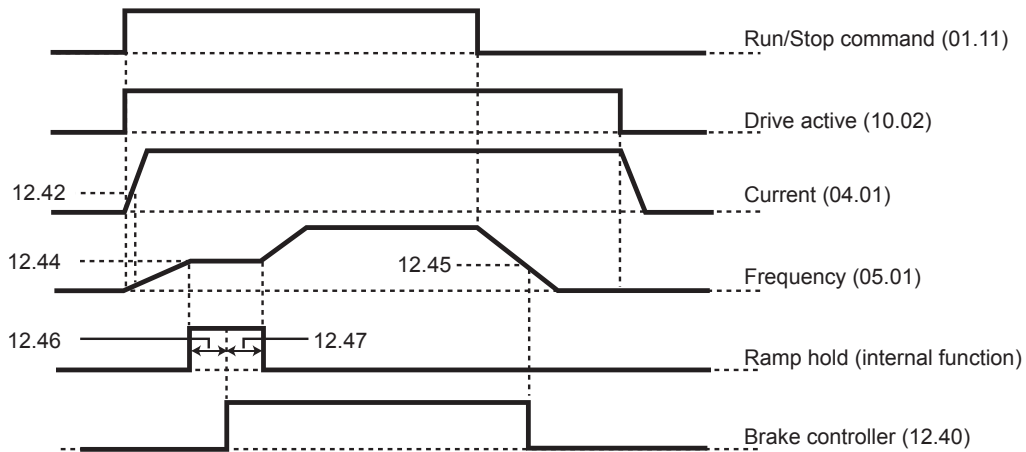
• Brake control in flux vector mode
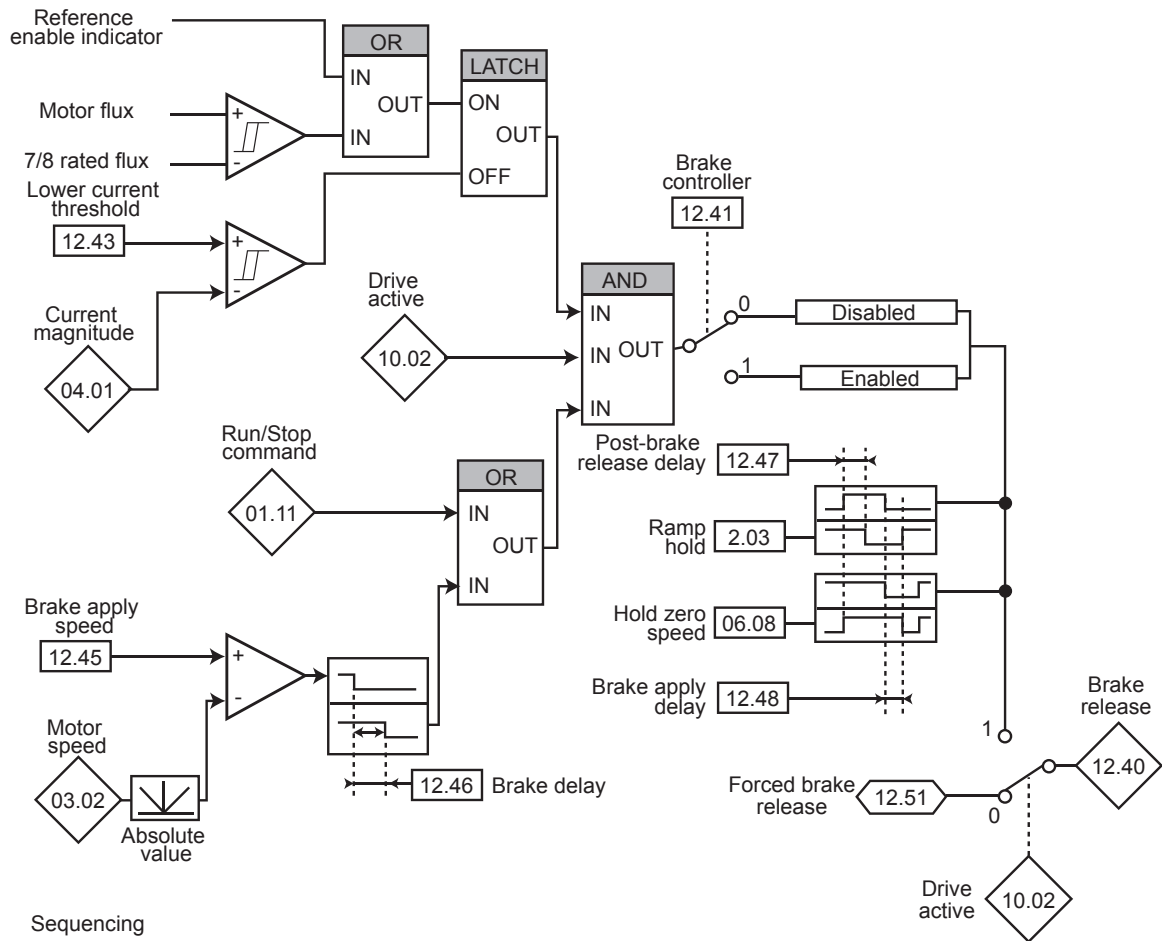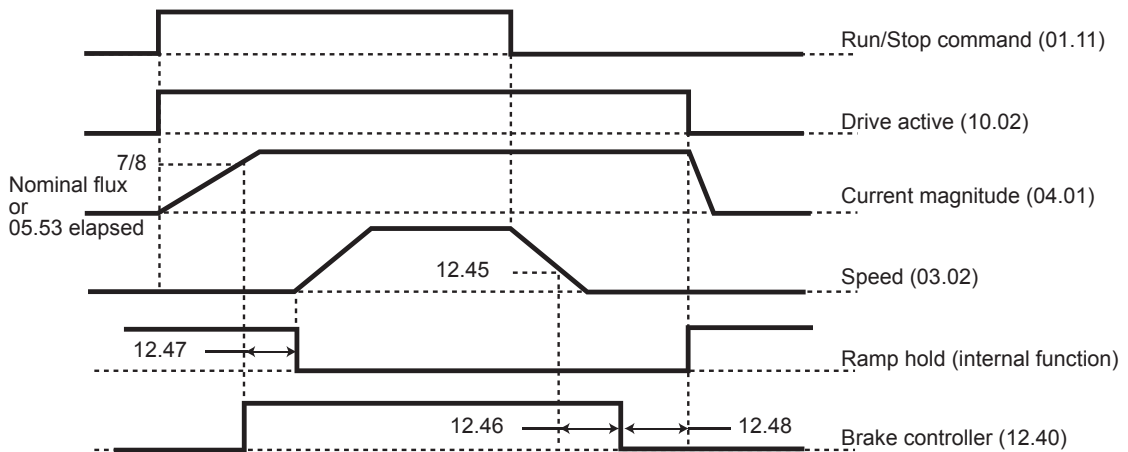
5.13.2 - Explanation of parameters in menu 12

12.01 : **Comparator 1 output**

12.02 : **Comparator 2 output**

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**
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**
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**
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**
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**
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**
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**
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**
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	$= V1(1 - e^{\frac{-t}{12.15}})$	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**)	$= V1^{12.15}$	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**
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**

Range: ± 100.00%
Format: 16 bits
Indicates the value of the function output as a percentage of the Range of the destination parameter.

12.13 **: Function 1 variable 1 scale**
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 Range of the source parameter.

12.14 **: Function 1 variable 2 scale**
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 Range of the source parameter.

12.15 **: Function 1 applied factor**
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

Function	Associated parameter value
$\sqrt{V1}$	12.00
$\sqrt[3]{V1}$	13.00

12.16 to **12.22** **: Not used**

12.23 **: Comparator 2 source**
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**
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**
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**
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**
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**
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**
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**
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	$= V1(1 - e^{\frac{-t}{12.35}})$	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$^{12.35}$	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**
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**

Range: ± 100.00%
Format: 16 bits
Indicates the value of the function output as a percentage of the Range of the destination parameter.

12.33 : **Function 2 variable 1 scale**
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 Range of the source parameter.

12.34 : **Function 2 variable 2 scale**
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 Range of the source parameter.

12.35 : **Function 2 applied factor**
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
√V1	12.00
^{3}√V1	13.00

12.36 to **12.39** : **Not used**

12.40 **: Brake release**

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**
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 «catch a spinning motor» function (**06.09** = enabled (1)) is not compatible with the brake control function (see **06.09**).
By convention, in hoisting, configure ascent in rotation with a positive speed, and descent with a negative speed.

12.42 **: Upper current threshold (■)**
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**
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**
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**
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**
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**
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 (■)**
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**
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**

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 ⬦ **: Comparator 3 state before delay**

Range: Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the comparator state before the time delay.

12.63 **: Comparator 3 source**
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**
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.

12.65 **: Comparator 3 hysteresis**
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.
* The unit is defined by the one used for the source parameter of the relevant comparator.

12.66 **: Comparator 3 level type**
Range: Over level (0), Under level (1), Masked under level (2)
Factory setting: Over level (0)
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.

12.67 **: Comparator 3 output destination**
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.

12.68 **: Comparator 3 masking**
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**
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**

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 ⬦ **: Comparator 4 state before delay**

Range: Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the comparator state before the time delay.

12.73 **: Comparator 4 source**
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)
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**
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.
* The unit is defined by the one used for the source parameter of the relevant comparator.

12.76 : **Comparator 4 output invert**
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**
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**
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**
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**

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 : **Comparator 5 state before delay**

Range: Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the comparator state before the time delay.

12.83 : **Comparator 5 source**
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**
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.
* The unit is defined by the one used for the source parameter of the relevant comparator.

12.85 : **Comparator 5 hysteresis**
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.
* The unit is defined by the one used for the source parameter of the relevant comparator.

12.86 **: Comparator 5 output invert**
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**
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.

12.88 **: Comparator 5 masking**
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**
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: Grid management

5.14.1 - Menu 13 presentation

Parameters of menu 13 are only used when User drive mode **11.31** = Grid inverter for REGEN drive (4) and when voltage dip management **18.70** = Enabled (1). The parameters of this menu are dedicated to the management of grid disturbances by the active rectifier. Its behavior can be configured to withstand voltage dips and provide reactive current. Alarms and trips can be configured to stop the active rectifier if the grid voltage is out of the defined LVRT/HVRT patterns.

5.14.2 - Explanation of parameters in menu 13

13.01 : **Grid rated voltage**
Range: 0 to 1000 V
Factory setting: 400 V
Format: 16 bits
Rated value of the RMS phase-to-phase grid voltage.

13.02 : **Grid rated frequency**
Range: 0.0 to 1000.0 Hz
Factory setting: 50.0Hz
Format: 16 bits
Rated value of the grid frequency.

13.03 : **Selection of grid voltage measurement for display**
Range: Average RMS value (0), Maximal RMS value (1), Minimal RMS value (2), Positive sequence value (3)
Factory setting: Average RMS value (0)
Format: 8 bits
Selection of the grid voltage measurement displayed in parameter **13.04**.

Average RMS value (0):
The value displayed in parameter **13.04** is the average value of the three RMS phase-to-phase grid voltages. This value is updated twice in each electrical period of the grid.

Maximal RMS value (1):
The value displayed in parameter **13.04** is the maximal value of the three RMS phase-to-phase grid voltages. This value is updated twice in each electrical period of the grid.

Minimal RMS value (2):
The value displayed in parameter **13.04** is the minimal value of the three RMS phase-to-phase grid voltages. This value is updated twice in each electrical period of the grid.

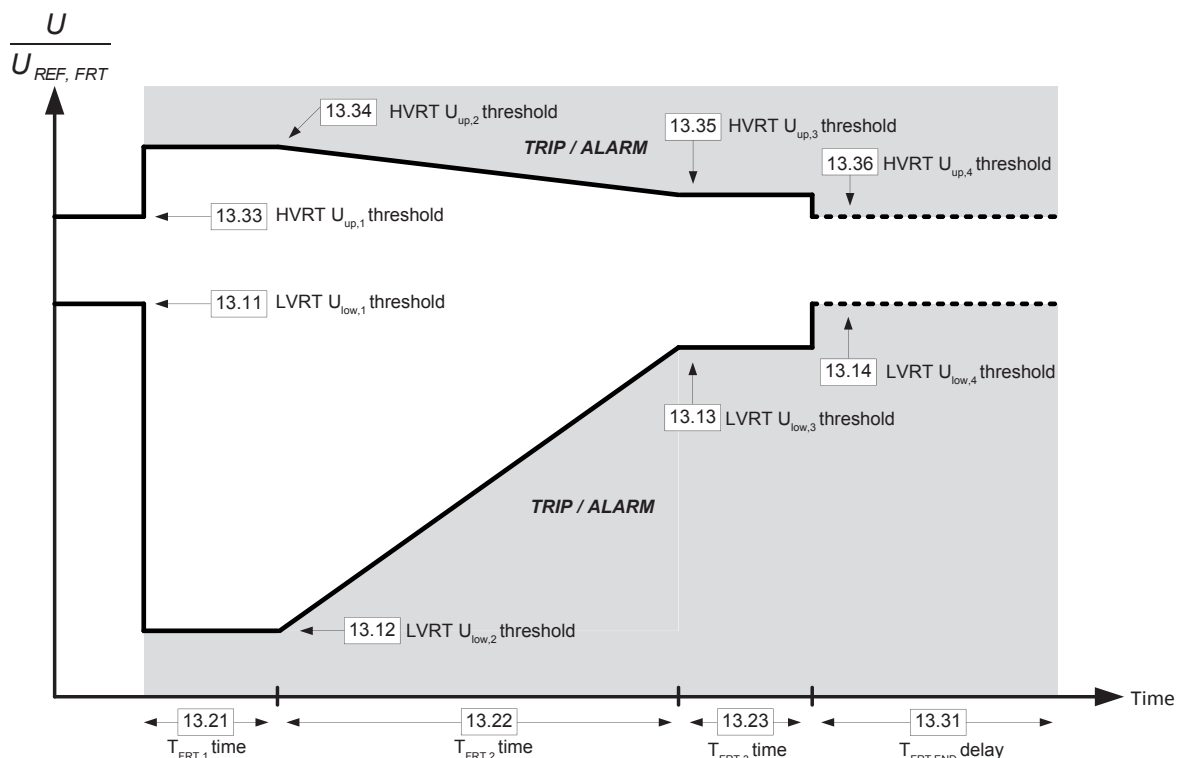**Positive sequence value (3):**
The value displayed in parameter **13.04** is the positive sequence value of the grid voltage. This value is filtered at 33 milliseconds.

13.04 : **Grid voltage**

Range: ± 32767 V
Format: 16 bits
RMS phase-to-phase grid voltage (calculated acccording to the method selected via parameter **13.03**).

13.05 and **13.06** : **Not used**

5.14.2.1 - FRT management

13.07 : "Fault Ride Through" (FRT) management mode

Range: Disabled (0), Enabled. Average RMS value (1),
Enabled. Maximal RMS value (2),
Enabled. Minimal RMS value (3),
Enabled. Positive sequence (4)
Factory setting: Enabled. Minimal RMS value (3)
Format: 8 bits
Selection of the "Fault Ride Through" management mode.

Disabled (0):
The FRT management is disabled.

Enabled. Average RMS value (1):
The FRT management is enabled and relies on the average value of the three RMS phase-to-phase grid voltages.

Enabled. Maximal RMS value (2):
The FRT management is enabled and relies on the maximal value of the three RMS phase-to-phase grid voltages.

Enabled. Minimal RMS value (3):
The FRT management is enabled and relies on the minimal value of the three RMS phase-to-phase grid voltages.

Enabled. Positive sequence (4):
The FRT management is enabled and relies on the positive sequence value of the grid voltage.

13.08 : FRT grid voltage

Range: ± 32767 V
Format: 16 bits
Grid voltage used for FRT management (selected via parameter **13.07**).

13.09 : FRT reference voltage selection

Range: Specified by parameter 13.01 (0) or
Average grid voltage over 60 seconds (1)
Factory setting: Specified by parameter 13.01 (0)
Format: 8 bits
Selection of the reference voltage used for FRT management.

Specified by parameter 13.01 (0):
The grid voltage reference used for the design of the FRT pattern is the rated grid voltage specified in parameter **13.01**.

Average grid voltage over 60 seconds (1):
The grid voltage reference used for the design of the FRT pattern is the voltage measurement specified in parameter **13.07** and averaged over 60 seconds.

13.10 : FRT reference voltage

Range: ± 32767 V
Format: 16 bits
Reference voltage used for FRT management (selected via parameter **13.09**).

13.11 to **13.14** : First to fourth voltage threshold of the LVRT pattern

Range: 0% to 100.0%
Factory setting: 90.0% (**13.11**)
Factory setting: 15.0% (**13.12**)
Factory setting: 85.0% (**13.13**)
Factory setting: 90.0% (**13.14**)
Format: 16 bits
Voltage thresholds of the LVRT pattern. Expressed as a percentage value of the FRT reference voltage (parameter **13.10**).

13.15 to **13.20** : Not used

13.21 to **13.23** : First to third duration of the FRT pattern

Range: 0 to 65535 ms
Factory setting: 200 ms (**13.21**)
Factory setting: 1600 ms (**13.22**)
Factory setting: 200 ms (**13.23**)
Format: 16 bits
Durations of the FRT pattern.

13.24 to **13.30** : Not used

13.31 : FRT exit delay
Range: 0 to 655.35 s
Factory setting: 0.50 s
Format: 16 bits
FRT exit delay.
Grid voltage has to remain above the level given by parameter **13.14** during that period to exit LVRT mode and for parameter **13.72** to change from 1 to 0.
Grid voltage has to remain under the level given by parameter **13.36** during that period to exit HVRT mode and for parameter **13.72** to change from 2 to 0.

13.32 : HVRT activation
Range: HVRT disabled (0) or HVRT enabled (1)
Factory setting: HVRT disabled (0)
Format: 8 bits
Activation/Deactivation of HVRT management.

HVRT disabled (0):
HVRT management is disabled.

HVRT enabled (1):
HVRT management is enabled.

13.33 to **13.36** : First to fourth voltage threshold of the HVRT pattern

Range: 0% to 200.0%
Factory setting: 110.0% (**13.33**)
Factory setting: 120.0% (**13.34**)
Factory setting: 115.0% (**13.35**)
Factory setting: 110.0% (**13.36**)
Format: 16 bits
Voltage thresholds of the HVRT pattern. Expressed as a percentage value of the FRT reference voltage (parameter **13.10**).

13.37 to **13.50** : Not used

5.14.2.2 - Grid support during FRT
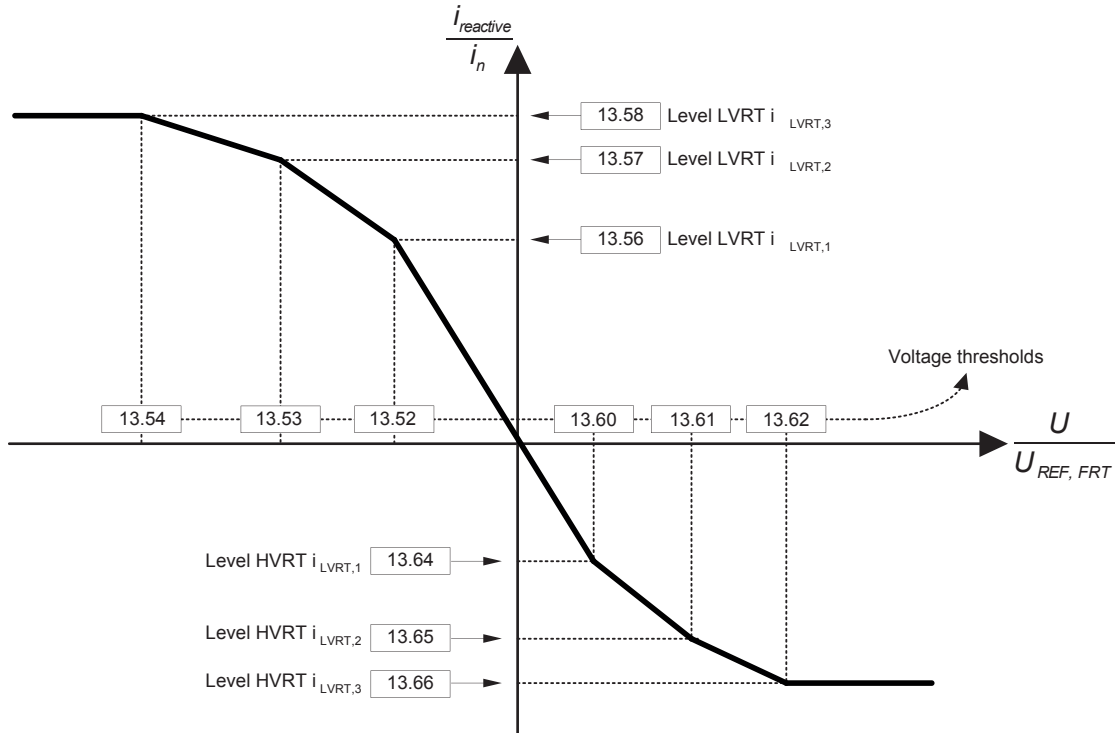
| 13.51 | : **FRT reactive current reference selection**

Range: Zero (0) or Average reactive current over 60 seconds (1)
Factory setting: Zero (0)
Format: 8 bits
Selection of the reactive current base level to which is added, in FRT mode, the reactive current pattern defined by parameters **13.52** to **13.66**.

Zero (0):

Null value. The level of reactive current injected/absorbed to the grid is only specified by parameters **13.52** to **13.66**.

Average reactive current over 60 seconds (1):
The base value, to which is added the current level specified by parameters **13.52** to **13.66**, corresponds to the level of reactive current injected to the grid averaged over the last 60 seconds before the activation of the FRT mode.

| 13.52 | to | 13.54 | : **First to third voltage threshold of the LVRT grid support pattern**

Range: 0% to 200.0%
Factory setting: 75.0% (**13.52**)
Factory setting: 50.0% (**13.53**)
Factory setting: 25.0% (**13.54**)
Format: 16 bits
Voltage thresholds of the LVRT grid voltage support pattern. Expressed as a percentage value of the FRT reference voltage (parameter **13.10**).

| 13.55 | : **Not used**

| 13.56 | to | 13.58 | : **First to third reactive current level of the LVRT grid support pattern**

Range: ± 200.0%
Factory setting: 50.0% (**13.56**)
Factory setting: 100.0% (**13.57**)
Factory setting: 100.0% (**13.58**)
Format: 16 bits
Reactive current levels of the LVRT grid voltage support pattern. Expressed as a percentage value of the rated current (parameter **18.26**).

| 13.59 | : **Not used**

| 13.60 | to | 13.62 | : **First to third voltage threshold of the HVRT grid support pattern**

Range: 0 to 200.0%
Factory setting: 110.0% (**13.60**)
Factory setting: 115.0% (**13.61**)
Factory setting: 120.0% (**13.62**)
Format: 16 bits
Voltage thresholds of the HVRT grid voltage support pattern. Expressed as a percentage value of the FRT reference voltage (parameter **13.10**).

| 13.63 | : **Not used**

| 13.64 | to | 13.66 | : **First to third reactive current level of the HVRT grid support pattern**

Range: ± 200.0%
Factory setting: - 20.0% (**13.64**)
Factory setting: - 30.0% (**13.65**)
Factory setting: - 40.0% (**13.66**)
Format: 16 bits
Reactive current levels of the HVRT grid voltage support pattern. Expressed as a percentage value of the rated current (parameter **18.26**).

13.67 : **Not used**

13.68 : **Reactive current setpoint ramp in FRT mode**
Range: 0 to 65536 ms
Factory setting: 20 ms
Format: 16 bits
Adjustment of the time to change, in FRT mode, from a reactive current setpoint equal to 0% to a reactive current setpoint equal to 100%.

13.69 : **Active current limit in FRT mode**
Range: 0 to 150.0%
Factory setting: 100.0%
Format: 16 bits
Limitation, in percentage of the rated current (parameter **18.26**), of the active current injected to the grid.

13.70 and 13.71 : **Not used**

13.72 : **FRT status indicator**

Range: No grid disturbance (0), LVRT : Low grid voltage (1),
HVRT : High grid voltage (2)
Format: 8 bits
This parameter provides information on the grid voltage state.

LVRT : Low grid voltage (1):
LVRT mode ("Low Voltage Ride Through") : Low grid voltage.

HVRT : High grid voltage (2):
HVRT mode ("High Voltage Ride Through") : High grid voltage.

13.73 : **FRT protection mode**
Range: No additional protection (0), Alarm (1), Trip (2)
Factory setting: No additional protection (0)
Format: 8 bits
This parameter provides the choice of protection mode in case of grid voltage disturbance.

No additional protection (0):
No alarm or trip is triggered if the grid voltage is out of the FRT pattern.
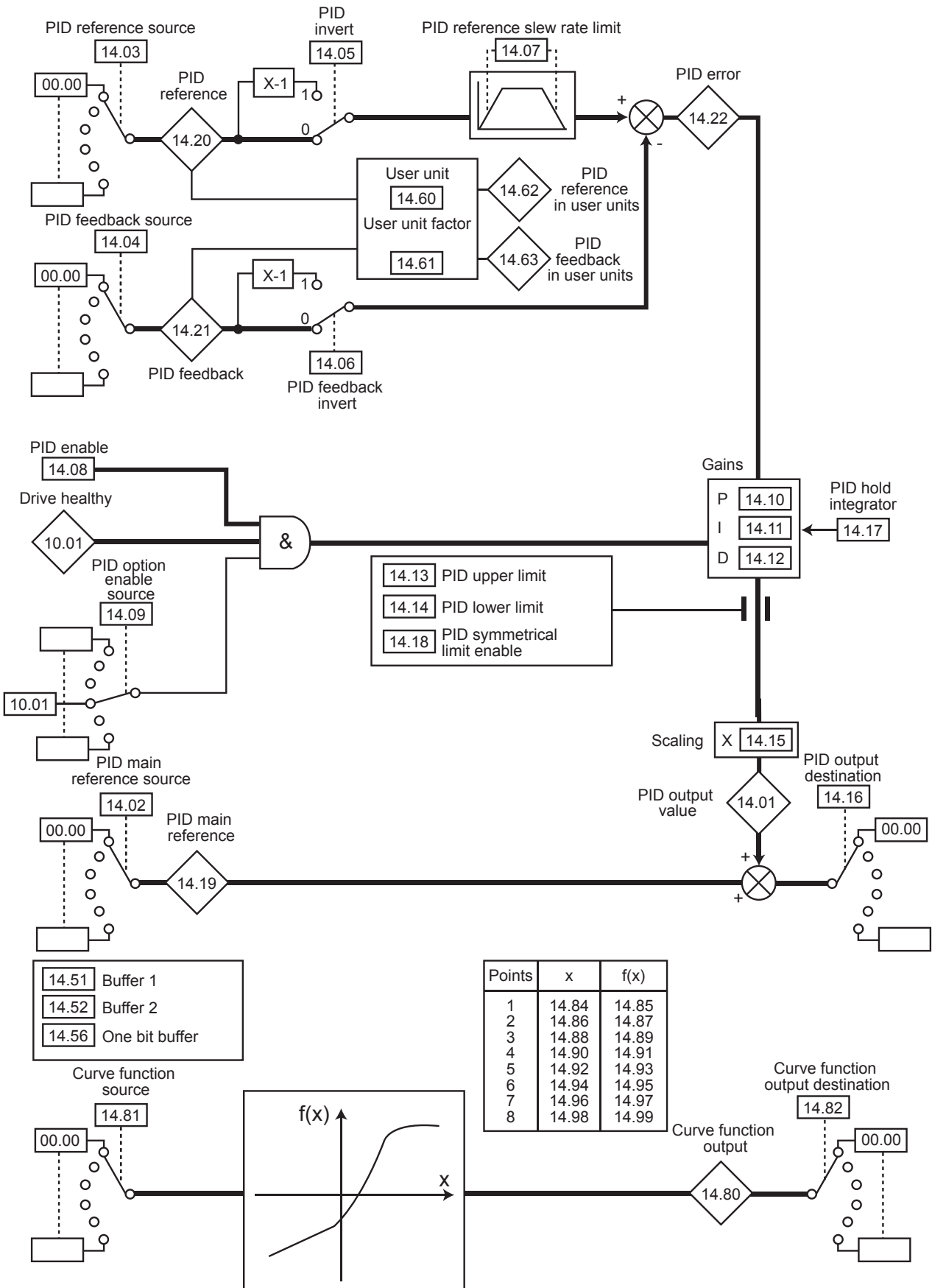
Alarm (1):
An alarm is triggered if the grid voltage is out of the FRT pattern.

Trip (2):
A trip is triggered if the grid voltage is out of the FRT pattern.

5.15 - Menu 14: PID controller

5.15.1 - Menu 14 diagram

5.15.2 - Explanation of parameters in menu 14

Sampling period for PID menu: 6 ms

◇ **14.01** **: PID output value**

Range: ± 100.0%
Format: 16 bits
This parameter indicates the level of the PID controller output after scaling.

14.02 **: PID main reference source**
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 Range of ± 100.0% or 0 to 100.0% if they are unipolar.

14.03 **: PID reference source**
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 Range of ± 100.0% or 0 to 100.0% if they are unipolar.

14.04 **: PID feedback source**
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 Range of ± 100.0% or 0 to 100.0% if they are unipolar.

14.05 and **14.06** **: PID invert/PID feedback invert**
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**
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**
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**
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**
Range: 0.000 to 32.000
Factory setting: 1.000
Format: 16 bits
This is the proportional gain applied to the PID error.
With an error of 100%, the proportional part of the PID output (**14.01**) equals 100% when **14.10** = 32.000 and **14.15** = 1.00.

14.11 **: PID integral gain**
Range: 0.000 to 32.000
Factory setting: 0.500
Format: 16 bits
This is the integral gain applied to the PID error.
With an error of 100% and a gain **14.11** of 1.000 the integral part of the PID varies by 100% in 1 s.

14.12 **: PID derivative gain**
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**
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**
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**
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 Range of the parameter to which it is addressed.

14.16 : **PID output destination**
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**
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**
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**

Range: ± 100.0%
Format: 16 bits
This parameter indicates the value of the main reference.

14.20 : **PID reference**

Range: ± 100.0%
Format: 16 bits
This parameter indicates the value of the PID reference.

14.21 : **PID feedback**

Range: ± 100.0%
Format: 16 bits
This parameter indicates the value of the PID feedback.

14.22 : **PID error**

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**
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**
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**
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**
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**
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**

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**

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**

Range: ± 20000.00
Format: 32 bits
This parameter indicates the value of the function output.

14.81 : **Curve function source**
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**
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** : **Abscissas of points**
14.90 , **14.92** , **14.94** **1 to 8 of the curve function**
14.96 , **14.98**

Range: ± 20000.00
Factory setting: 0.00
Format: 32 bits

14.85 , **14.87** , **14.89** : **Ordinates of points**
14.91 , **14.93** , **14.95** **1 to 8 of the curve function**
14.97 , **14.99**

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.

CAUTION:
If the curve does not pass through the (0;0) point, you need to enter all the settings.

5.16 - Menu 15: Fieldbus options

(Please consult the manuals for the corresponding options)

5.17 - Menu 16: PLC functions

5.17.1 - Menu 16 diagrams

• **Timer relays**
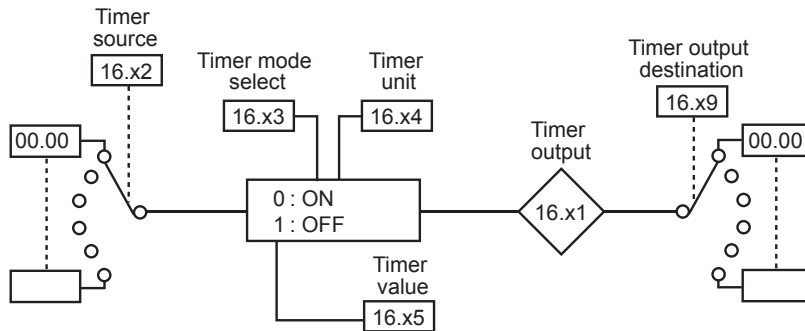
Timer	Source	Timer type	Time delay	Unit of time	Output state	Destination
Timer 1	16.02	16.03	16.05	16.04	16.01	16.09
Timer 2	16.12	16.13	16.15	16.14	16.11	16.19
Timer 3	16.22	16.23	16.25	16.24	16.21	16.29
Timer 4	16.32	16.33	16.35	16.34	16.31	16.39

• **Latching relays 1 and 2**
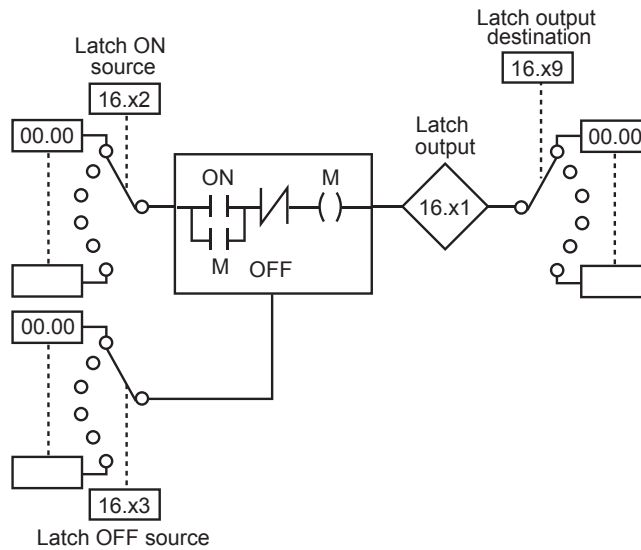
Latching	ON source	OFF source	Output	Output destination
LR 1	16.42	16.43	16.41	16.49
LR 2	16.52	16.53	16.51	16.59

• Latching relays 3 and 4
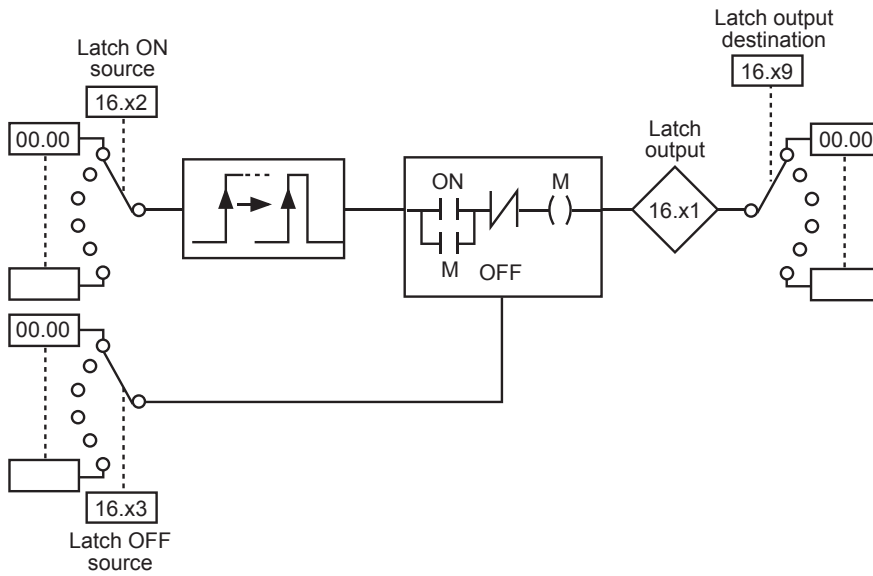
Latching	ON source	OFF source	Output	Output destination
LR 3	16.62	16.63	16.61	16.69
LR 4	16.72	16.73	16.71	16.79

• Scan timer
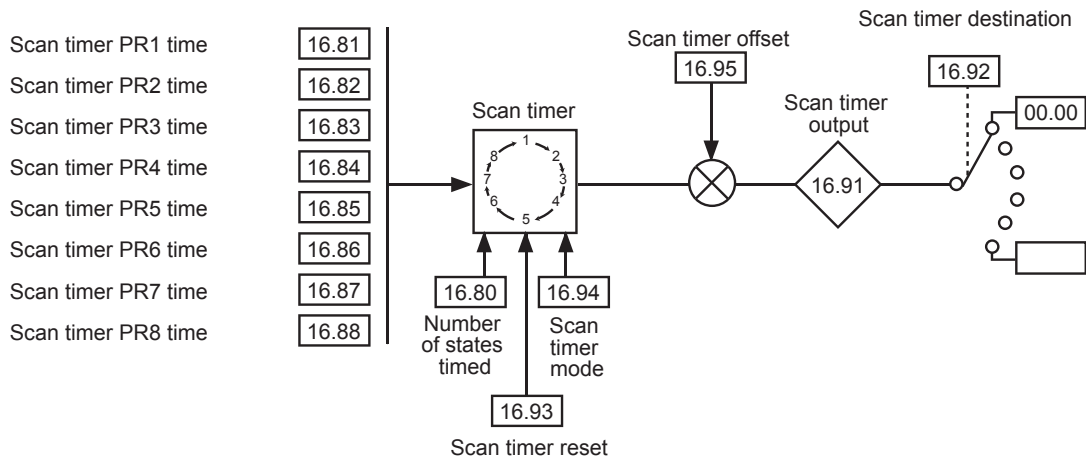
5.17.2 - Explanation of parameters in menu 16

16.01 : **Timer 1 output**

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**
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**
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**
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**
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**
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**

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**
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**
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**
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**
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**
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

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
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 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
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
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
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
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

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
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
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
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
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
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**

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**
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**
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**
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**

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**
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**
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**
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.

16.60 : **Not used**

16.61 : **Latch 3 output**

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**
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**
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**
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**

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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

Range: -127 to +135
Format: 16 bits
Indicates the scan timer state.

16.92 **: Scan timer destination**
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**
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**

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**

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
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. 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
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».
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.

17.03 : Power module autotest
Range: No (0) or Yes (1)
Factory setting: Yes (1)
Format: 8 bits

⚠ **• 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

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**

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 **17.03** is set to "Yes", the Power-on test is launched each time the drive is powered up. The test result is given in **17.06** and **17.08**
The table below indicates step by step the procedure to follow to fix the issue according to the error messages **17.06** and **17.08**.
After each modification a new diagnostic sequence must be performed.

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	A fault is issued by one of the IGBT drivers: - Short circuit between U and V phases or motor insulation problem, - No signal exchange between the IGBT driver boards and the control board, - Faulty IGBT module or IGBT driver Boards - Ensure U, V and W drive power terminals are not shorted and megger the motor.
	00001 00003 00004 00005 00008 00009	No current is flowing in the motor phases : - Motor leads not connected properly, - No IGBT command signal is arriving to the IGBT driver boards. - Check motor lead connections or open circuit on motor.
	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	DC bus voltage not increasing: - One Grid phases missing - Disturbed power grid - DC BUS preloading circuit faulty - One or both fuses for measuring the DC bus voltage blown - Check the Mains input voltages directly on the rectifier terminals
	00011	Fast increase of the DC bus voltage: - DC BUS voltage measurement incorrect - Disturbed power grid - Faulty rectifier module - Megger the motor - Change the rectifier module if none of the other actions has fix the issue
	00007	DC BUS discharge time too long - Motor insulation issue - DC bus voltage measurement incorrect - Megger the motor
	00019	Incorrect rectifier temperature reading. - Faulty rectifier module - Faulty thermal probe - Change the rectifier module if none of the other actions has fix the issue
Error motor (6)	00012	Short-circuit between 2 drive output phases. - Megger the motor - Check that U, V, W drive power terminals are not shorted
	00016	Short-circuit between one drive output phase and earth. Megger the motor.
Error U and V phase (7) **Error V and W phase (8)** **Error U and W phase (9)**	00010 00002	One measure of the motor currents is not correct: - Current sensor faulty, - Cabling issue between the IGBT driver boards and the control board.
	00013	Master/Interface board malfunction
	00023	Incorrect reading of the temperature on module U (**17.06** = 2); V (**17.06** = 3); W (**17.06** = 4)

17.06	17.08	Comment/Description of the problem
Error STO not connected (10)	00018	The STO inputs are not active. Check that terminals STO-1 and STO-2 are connected correctly and restart the test.
None (15)	None	The test cannot been performed : - One Mains phase missing - Problem reading the mains voltage on the rectifier bridge - No power supply on rectifier board - Check the Mains input voltage is present at rectifier terminals

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

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

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

Range: 0 to 37 (see **10.98**)
Format: 8 bits
This is the drive status before the trip.

17.12 : Status at fault

Range: 0 to 37 (see **10.98**)
Format: 8 bits
This is the drive status at the time of the trip.
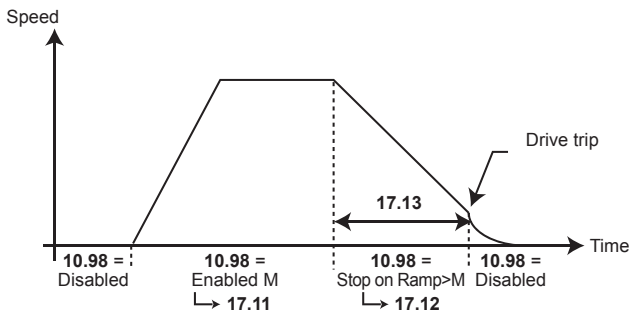
17.13 : Time between states

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 : Not used

17.15 : Second fault code for last trip

17.16 : Third fault code for last trip

17.17 : Fourth fault code for last trip

Range: 0 to 999
Format: 16 bits
In case of multiple faults recorded simultaneously, the current trip is displayed in **10.99**.
17.15, **17.16** and **17.17** indicate the code of the second, third and fourth faults.

17.18 and **17.19** : Counter duration fault - 1

Range: 0.000 to 9.364 (y, d) (**17.18**)
Range: 00.00 to 23.59 (h, m) (**17.19**)
Format: 16 bits

17.20 and **17.21** : Counter duration fault - 2

Range: 0.000 to 9.364 (y, d) (**17.20**)
Range: 00.00 to 23.59 (h, m) (**17.21**)
Format: 16 bits

17.22 and **17.23** : Counter duration fault - 3

Range: 0.000 to 9.364 (y, d) (**17.22**)
Range: 00.00 to 23.59 (h, m) (**17.23**)
Format: 16 bits
These counters indicate the operating time since the drive was first commissioned until the occurrence of trip -1, -2 and -3

17.24 and **17.25** : Counter duration fault - 4

Range: 0.000 to 9.364 (y, d) (**17.24**)
Range: 00.00 to 23.59 (h, m) (**17.25**)
Format: 16 bits

17.26 and **17.27** : Counter duration fault - 5

Range: 0.000 to 9.364 (y, d) (**17.26**)
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 -4 and 5.

NOTE
Trip -5 corresponds to the trip displayed in **10.24**.

17.28 : Not used

17.29 : Reset of measured maximum
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

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

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

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

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

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
Range: 32 ms (0), 64 ms (1), 128 ms (2), 256 ms (3),
512 ms (4), 1 s (5), 2 s (6)
Factory setting: 512 ms (4)
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

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

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

Range: ± 60000 rpm
Format: 32 bits
Average speed filtered by **17.36** at the time of the last trip.

17.40 : Average motor current

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

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**

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**

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**

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**

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**

Range: 0 to 999 V
Format: 16 bits

17.48: Supply voltage at T_0 (trip)
17.49: Supply voltage at T_0 - 4 ms
17.50: Supply voltage at T_0 - 8 ms
17.51: Supply voltage at T_0 - 12 ms
17.52: Supply voltage at T_0 - 16 ms
17.53: Supply voltage at T_0 - 20 ms
17.54: Supply voltage at T_0 - 24 ms

17.55 : **Not used**

17.56 to **17.62** : **7 last values of the motor speed at trip**

Range: ± 60000 rpm
Format: 32 bits

17.56: Motor speed at T_0 (trip)
17.57: Motor speed at T_0 - 4 ms
17.58: Motor speed at T_0 - 8 ms
17.59: Motor speed at T_0 - 12 ms
17.60: Motor speed at T_0 - 16 ms
17.61: Motor speed at T_0 - 20 ms
17.62: Motor speed at T_0 - 24 ms

17.63 : **Not used**

17.64 : **DC bus and motor current sampling**
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 T_0 (trip)**

Adjustment rang: 0 to 1300 V
Format: 16 bits
Fd = Switching frequency

17.65: DC bus value at T_0
17.66: DC bus value at T_0 - 1 x (**17.64** / F_d)
17.67: DC bus value at T_0 - 2 x (**17.64** / F_d)
17.68: DC bus value at T_0 - 3 x (**17.64** / F_d)
17.69: DC bus value at T_0 - 4 x (**17.64** / F_d)
17.70: DC bus value at T_0 - 5 x (**17.64** / F_d)
17.71: DC bus value at T_0 - 6 x (**17.64** / F_d)
17.72: DC bus value at T_0 - 7 x (**17.64** / F_d)
17.73: DC bus value at T_0 - 8 x (**17.64** / F_d)
17.74: DC bus value at T_0 - 9 x (**17.64** / F_d)
17.75: DC bus value at T_0 - 10 x (**17.64** / F_d)
17.76: DC bus value at T_0 - 11 x (**17.64** / F_d)
17.77: DC bus value at T_0 - 12 x (**17.64** / F_d)
17.78: DC bus value at T_0 - 13 x (**17.64** / F_d)
17.79: DC bus value at T_0 - 14 x (**17.64** / F_d)
17.80: DC bus value at T_0 - 15 x (**17.64** / F_d)
17.81: DC bus value at T_0 - 16 x (**17.64** / F_d)

17.82 : **Not used**

17.83 to **17.99** : **17 last values of the motor current at trip**

Range:0.00 to 2.2 x **11.32**
Format : 32 bits
Fd = Switching frequency

17.83: Motor current value at T_0 (trip)
17.84: Motor current value at T_0 - 1 x (**17.64** / F_d)
17.85: Motor current value at T_0 - 2 x (**17.64** / F_d)
17.86: Motor current value at T_0 - 3 x (**17.64** / F_d)
17.87: Motor current value at T_0 - 4 x (**17.64** / F_d)
17.88: Motor current value at T_0 - 5 x (**17.64** / F_d)
17.89: Motor current value at T_0 - 6 x (**17.64** / F_d)
17.90: Motor current value at T_0 - 7 x (**17.64** / F_d)
17.91: Motor current value at T_0 - 8 x (**17.64** / F_d)
17.92: Motor current value at T_0 - 9 x (**17.64** / F_d)
17.93: Motor current value at T_0 - 10 x (**17.64** / F_d)
17.94: Motor current value at T_0 - 11 x (**17.64** / F_d)
17.95: Motor current value at T_0 - 12 x (**17.64** / F_d)
17.96: Motor current value at T_0 - 13 x (**17.64** / F_d)
17.97: Motor current value at T_0 - 14 x (**17.64** / F_d)
17.98: Motor current value at T_0 - 15 x (**17.64** / F_d)
17.99: Motor current value at T_0 - 16 x (**17.64** / F_d)

5.19 - Menu 18: Regen mode

5.19.1 - Menu 18 diagram
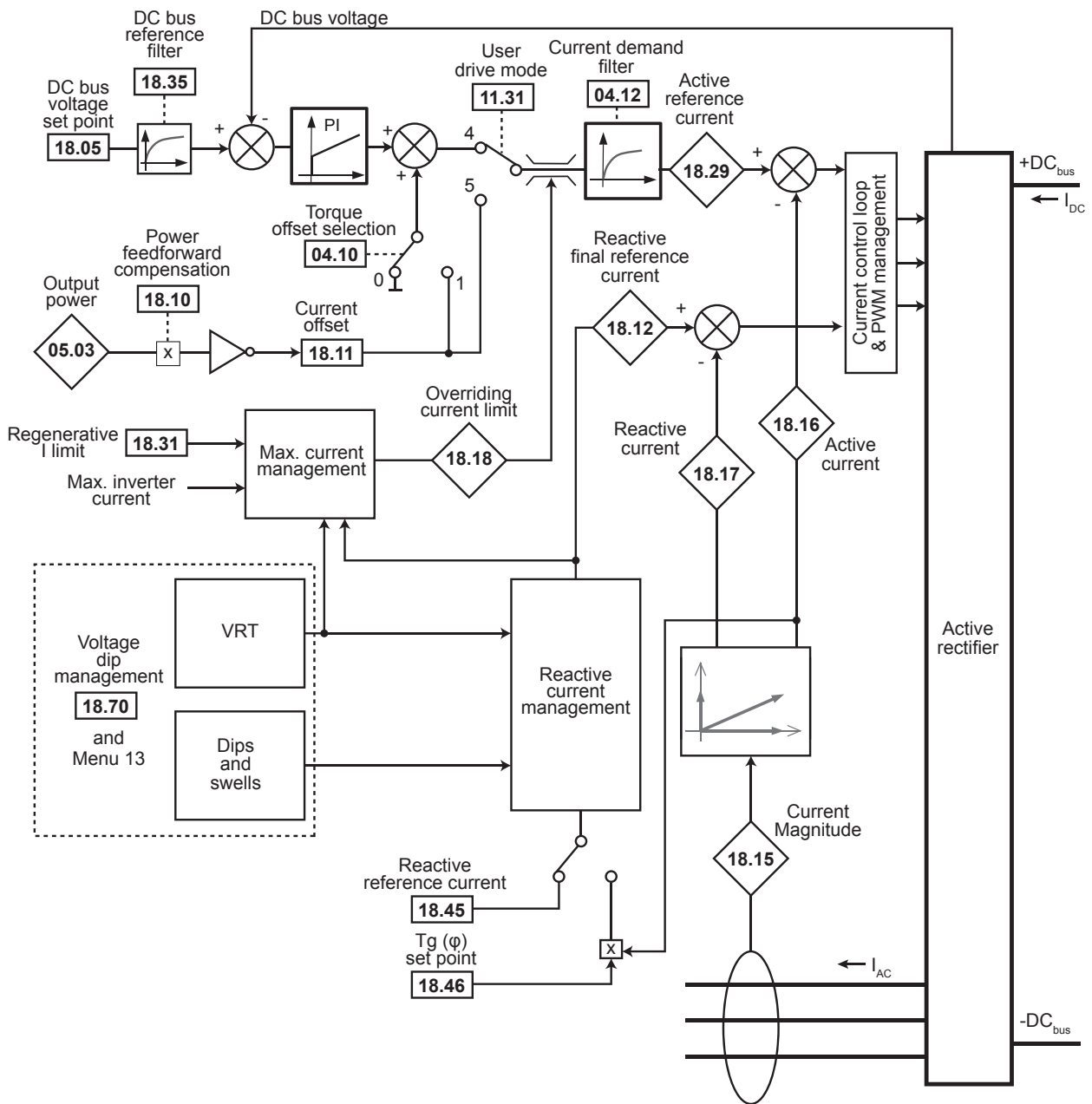
5.19.2 - Explanation of parameters in menu 18

A « Low harmonic drive » or a « Regen drive » is a drive combining two identical inverters: a motor/load inverter and a Grid inverter. The « Regen drive » is set via a unique interface (HMI or keypad). The menu 18 is dedicated to the settings related for the Grid inverter.

To configure an inverter as an active rectifier, some parameters are set to the values shown in the table below (factory-set, do not change these parameters).

Pr	Parameter names	Set to
02.04	Deceleration ramp mode select	Fixed ramp (0)
08.24	DI4 input destination	00.00 (Not used)
08.25	DI5 input destination	00.00 (Not used)
09.04	Logic function 1 source 1	Drive healthy (**10.01**)
09.06	Logic function 1 source 2	Start order for the Grid inverter (**18.40**)
09.10	Logic function 1 output destination	Run forward (**06.30**)
11.31	User drive mode	Grid Inverter for Regen drive (4)
11.66	Communication type between drives	Rectifier of Regen (2)
17.03	Power module autotest	No (0)

18.01 : **Reactive power**

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**

Range: ± 3200.00 kW
Format: 32 bits

18.02 represents the inverter power in generator convention. IE: positive power indicates power flowing from the DC bus to the mains or the generator and negative power indicates power flowing from the mains or the generator to the DC bus.
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**

Range: 0 to 1300 V
Format: 16 bits
Indicates the DC bus voltage measurement in Regen mode only.

18.04 : **Regen restart mode**
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**

Range : 0 to 1300 V
Factory setting : T rating = 660 V, TH rating = 1070 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**

18.07 : **Voltage loop integral gain**
Range: 0 to 32000 (**18.06**)
          0 to 120 (**18.07**)
Factory setting: 500 (**18.06**)
              20 (**18.07**)
Format: 16 bits
Set proportional and integral gain values.

18.08 : **Mains voltage**

Range: 0 to 999 V
Format: 16 bits
This is the rms voltage at the Regen drive input.

18.09 : **Mains frequency**

Range: ± 400.0 Hz
Format: 16 bits
Indicates the mains frequency.

18.10 : **Power feed forward compensation**
Range: 0.00 to 100.00%
Factory setting: 0.00%
Format: 16 bits
In MD2R configuration, with a communication link between the motor/generator inverter and the grid inverter, the current reference offset **18.11** is automatically defined as the product of the power **05.03** by -**18.10**.
If Torque offset selection **04.10** is set to Yes (1), the value **18.11** is added to the current demand issued from the DC bus voltage regulator allowing an active current compensation to reduce the transient voltages of the DC bus in the event of load power impacts.

18.11 : **Current offset**
Range: ± 300.0% (% of **18.26**)
Factory setting: 0.0%
Format: 16 bits
If **11.31** is set to Grid inverter in current mode (5) and **18.28** is set to No (0), the value represents the active current reference of the Grid inverter. 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.

If **11.31** is set to Grid inverter for REGEN drive (4) or **18.28** is set to Yes (1) and **04.10** is set to Yes (1), this parameter is added to the current demand issued from the DC bus voltage regulator allowing an active current compensation to reduce the transient voltages of the DC bus in the event of load power impacts.

18.12 : **Reactive final reference current**

Range: ± 300.0%
Format: 16 bits
Reading of the reactive reference current after application of compensations.

18.13 : **Current loop proportional gain**
Range: 0 to 250
Factory setting: 30
The frequency bandwidth of the grid inverter current loop is related to the value of the grid inverter reactor in combination with the **18.13** setting. The factory setting is adapted to a 5% "Regen" reactor. Increasing **18.13** increases the frequency bandwidth.

18.14 : **Current loop integral gain**
Range: 0 to 250
Factory setting: 40
Format: 16 bits
Defines the current loop controller integral gain. The overshoot in response to a step change of current reference is impacted by the value of **04.14**. The factory setting covers most situations.

18.15 : **Current magnitude**

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 Range of **18.15** is limited by the max. drive current (drive I_{max} = 2.22 x **11.32**).

18.16 : **Active current**

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**

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**

Range: 0 to 300%
Format: 16 bits
Indication of the rms current limit value of the grid inverter. This value depends on **18.19** and limits internal to the drive.

18.19 : **Symmetric current limit**
Range: 0.0 to 300.0%
Factory setting: 150.0%
Format: 16 bits
Used to set the maximum permanent current limit permitted when both directions: absorbing and returning power.
See also **18.26** and **18.30**.

18.20 : **Input inductance value**
Reserved.

18.21 : **Regen healthy**

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**

Range: 0 to 32767
Format: 16 bits
Binary state of parameters **10.01** to **10.15** of the Grid inverter. A copy of parameter **10.40** of the Grid inverter.

18.23 : **Regen drive status**

Range: 0 to 37
Format: 8 bits
A copy of parameter **10.98** of the Grid inverter.

18.24 ◇ **: Regen current trip**

Range: 0 to 102
Format: 8 bits
Contains the code for the Grid inverter 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 **: High stability modulation**

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

Disabled (0):
A standard pulse width modulation is applied to the active rectifier.

Enabled (1):
Pulse width modulation optimised to minimise the active rectifier losses.

18.26 **: Regen rated current**

Range: 0.00 to 2.2 x **11.32**
Factory setting: According to the drive rating
Format: 32 bits
Grid drive rated current value. **18.26** can be set up to the value I_L (maximum line current) which is given in the electrical characteristics section of the MD2R installation manual.

18.27 **: Regen switching frequency**

Range: 2 kHz (0) to 18 kHz (19)
Factory setting: 5 kHz (6) for the Powerdrive MD2
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

Refer to the installation guide of Regen drive. For frequencies higher than 6 kHz, please consult Nidec Leroy-Somer.

CAUTION:
Do not change the active rectifier switching frequency when a standard sine filter is used.

18.28 **: DC bus regulation**

Range: No (0) or Yes (1)
Factory setting: No (0)
Format: 16 bits

No (0):
The active rectifier does not regulate the DC bus. It operates as described by **11.31**.

Yes (1):
In this mode, the active rectifier sets the voltage at the DC bus terminals to the reference specified in **18.05**.
This selection is dedicated to applications where the inverter is used as an active rectifier whether the inverter is connected to the grid via reactors or connected to a PM or an induction generator *.
- When **Pr 11.31** is set on 2, 3 or 6, the set point of the motor active power is internally managed in order to regulate the DC bus according to **Pr 18.05**.
- If **Pr 11.31** is set on 0, 1 or 7, the set point of the motor active power is fixed by the speed reference or by the torque reference.

* The induction generator is driven by a prime mover at a speed exceeding 20% of the nominal speed. After a start command, the POWERDRIVE measures the remanent flux of the induction generator (See **06.09** and **03.91**) and executes a «catch a spinning motor» procedure of the generator.

Pr 11.31 (User Drive mode)	Pr 18.28 (DC bus regulation)	
	No (0)	Yes (1)
Synchronous motor: Voltage control (0)	Reserved	
Induction motor: Voltage control (1)	Induction motor in Voltage control	
Induction motor: Oriented flux control (2)	Induction motor in Flux control	Induction motor in Flux control with a DC bus regulation defining the motor current magnitude
Synchronous motor: Oriented flux control (3)	Synchronous or PM motor in Flux control	Synchronous or PM motor in Flux control with DC bus regulation defining the motor current magnitude
Grid inverter for REGEN drive (4)	Active rectifier with DC-Bus regulation dedicated for "Low harmonics" or "Regen" drives	
Grid inverter in current mode (5)	Active rectifier with line current magnitude sets by reference	Active Infeed converter with DC-Bus regulation defining the line current magnitude value
Islanded Inverter (6)	Voltage controlled inverter	
DC/DC (7)	-	-

◇ **18.29** : **Active reference current**

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**.
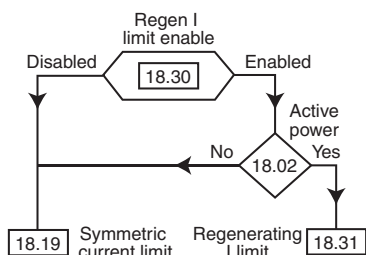**CAUTION:**
This tandem operation requires the rectifiers to be connected in a specific manner. Please consult your usual interlocutor.

18.30 : **Regenerating I limit enable**
Adjustment rang: Disabled (0) or Enabled (1)
Factory setting: Disabled (0)
Format: 8 bits
When the parameter **11.31** = 4, 5 or 6, this parameter defines whether or not the regenerating current limit is used .

18.31 : **Regenerating I limit**
Range: ● If **11.31** = 4: 0.0 to 300.0% of **18.26**
    ● If **11.31** = 5 or 6: 0.0 to 300.0% of **05.07**
Factory setting: 150.0%
Format: 16 bits
If **18.30** = Enabled (1), this parameter is used to limit the power flowing from the DC bus to the mains (**11.31**= 4) or the generator (**11.31** = 5 or 6).
See also **18.26** and **18.30**.

18.32 : **Rectifier trip validation**
Range: Disabled (0) or Enabled (1)
Factory setting: Enabled (1)
Format: 8 bits

Disabled (0):
The rectifier trip information has no effect on the inverter.

Enabled (1):
If **11.66** = «Regen inverter**»** an active rectifier trip generates a Regen inverter «Rectifier» trip.

◇ **18.33** : **Active rectifier type**

Range: No (0), Low Harmonic (1), Regen (2)
Format: 16 bits
Reserved.

18.34 : **Not used**

18.35 : **DC bus reference filter**
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 Grid inverter**

Range: No (0) or Yes (1)
Format: 8 bits
Information coming from the motor/load inverter that authorizes the grid inverter to operate. To use when the start order of the Grid inverter is controlled automatically by the motor inverter.
18.40 = Yes (1) if **01.11** "Run command" on motor/load inverter is at Run (1) or **10.02** "Drive active" status on motor/load inverter is at Yes (1).

◇ **18.41** : **Inverter healthy**

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**
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**
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**
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**
Range: ± 100.0% (% of **18.26**)
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**
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.

18.63 : **Filtering capacitance (low voltage side)**
Range: 0.0 to 10000.0 mF
Factory setting: 1.0 mF
Format: 32 bits
Reserved.

18.64 : **Total DC bus capacitance**
Range: 0.0 to 10000.0 mF
Factory setting: 10.0 mF
Format: 32 bits
Reserved.

18.65 to **18.69** : **Not used**

18.70 : **Voltage dip management**
Range: Disabled (0) or Enabled (1)
Factory setting: Disabled (0)
Format: 8 bits

Disabled (0):
For drives with active rectifier, mains voltage dips are managed in accordance with the description in the table below. This mode is recommended when the active rectifier is used to reduce the level of harmonics drawn from the mains.

State of 06.03 at inverter end	State of 06.03 at active rectifier end	Comments
Disabled (0)	Disabled (0)	See **06.03** when at Disabled (0)
	Stop (1) or Delayed stop (2)	
Stop (1) or Delayed stop (2)	Disabled (0)	See **06.03** when at Stop (1) and Delayed stop (2)
	Stop (1) or Delayed stop (2)	

Enabled (1):
When mains voltage dips occur, the active rectifier limits the current to a value defined by **18.71**. If the dip lasts longer than **18.73**, the active rectifier locks. If the power supply line opens, the drive displays a «MAINS-LOSS» trip. This mode should be selected when the drive converts energy from a generator to inject it onto the mains supply.

18.71 to **18.74** : **Not used**

18.75 : **PTI/PTO mode selector**
Range: Classic (0), PTI (1), PTO (2)
Factory setting: Classic (0)
Format: 8 bits
Energy management mode selector, as follows.

Classic (0):
Classic working mode.

PTI (1):

"Power Take In" (PTI). In this mode, parameters **18.79**, **18.80** and **18.81** are used to ajust the limit of power consumed by the motor inverter. Enabling this mode does not affect the active rectifier operation.

PTO (2):

"Power Take Out" (PTO). In this mode, parameters **18.79, 18.80** and **18.81** are used to ajust the limit of power produced by the motor inverter. Enabling this mode does not affect the active rectifier operation.

18.76 : PTI, PTO or island PTO status

Range: Classic (0), PTI (1), PTO Island (2), PTO (3)
Format: 8 bits
Working status of the inverter (or rectifier). This status depends on parameters **18.75** and **18.28**.

18.77 : Power setpoint in PTO mode

Range: ± 1000.0%
Factory setting: 0.0%
Format: 16 bits
Motor power set point in PTO mode. Expressed as a percentage of rated power, $\sqrt{3}$ x **05.09** x **05.07**.

18.78 : Active power production limit in PTO mode

Range: ± 1000.0%
Factory setting: 0.0%
Format: 16 bits
Active power production limit in PTO mode as a percentage of rated power, $\sqrt{3}$ x **05.09** x **05.07**.

18.79 : Active power consumption limit in PTI mode

Range: ± 1000.0%
Factory setting: 0.0%
Format: 16 bits
Active power consumption limit in PTI mode as a percentage of rated power $\sqrt{3}$ x **05.09** x **05.07**.

18.80 : Enable power limitation mode

Range: Disabled (0) or Enabled (1)
Factory setting: Disabled (0)
Format: 8 bits
Enabling of a priority limit of power consumption in PTI mode.

18.81 : Active power priority limit when 18.80 is set to 1

Range: ±1000.0%
Factory setting: 0.0%
Format: 16 bits
Priority limit of active power consumption in PTI mode as a percentage of rated power, $\sqrt{3}$ x **05.09** x **05.07**.

18.82 : Master/slave status

Range: Slave (0) or Master (1)
Factory setting: Slave (0)
Format: 8 bits
Master/slave status of the rectifier in island PTO mode.

18.83 : Synchronization loop proportional gain

Range: 0 to 10000
Factory setting: 100
Format: 16 bits
Proportional gain of the control loop used to synchronize the slave AIC with the master AIC.

18.84 : Synchronisation loop integral gain

Range: 0 to 10000
Factory setting: 100
Format: 16 bits
Integral gain of the control loop used to synchronize the slave AIC with the master AIC.

18.85 : Balancing loop integral gain

Range: 0 to 10000
Factory setting: 100
Format: 16 bits
Integral gain of the control loop used to balance the voltage of the slave AIC with the one of the master AIC.

18.86 : Short-circuit current set point

Range: 0.0% to 1000.0%
Factory setting: 200.0%
Format: 16 bits
Short-circuit current set point as a % of **18.26**.

18.87 : Short-circuit protection loop proportional gain

Range: 0 to 10000
Factory setting: 100
Format: 16 bits
Short-circuit protection loop proportional gain.

18.88 : Short-circuit protection loop integral gain

Range: 0 to 10000
Factory setting: 100
Format: 16 bits
Short-circuit protection loop integral gain.

18.89 : Short-circuit controller output slew-rate

Range: 1.00 to 100.00
Factory setting: 1.00
Format: 16 bits
Short-circuit controller output slew-rate. Duration for which the short-circuit controller output changes from -**13.01** to zero.

18.90 : Current magnitude filter coefficient

Range: 0.1 to 1000.0
Factory setting: 10.0
Format: 16 bits
Current magnitude filter coefficient used in the management of short-circuits occurring on the islanded grid.

18.91 : Active power average value

Range: 0.0 to 1000.0%
Factory setting: 0.0%
Format: 16 bits
Defines the average value of the active power produced by the slave AIC and master AIC.

18.92 : Reactive power average value

Range: 0.0 to 1000.0%
Factory setting: 0.0%
Format: 16 bits
Defines the average value of the reactive power produced by the slave AIC and master AIC.

18.93 : Island grid rated power (kW)

Range: 0 to 10000 kW
Factory setting: 0
Format: 16 bits
Defines the Rated power of the AIC.

18.94 : **Active power**
Range: 0.0 to 1000.0%
Factory setting: 0.0 %
Format: 16 bits
Defines the active power injected in the islanded grid by the AIC. Expressed as a percentage of **Pr 18.93**.

18.95 : **Reactive power**
Range: 0.0 to 1000.0%
Factory setting: 0.0 %
Format: 16 bits
Defines the reactive power injected in the islanded grid by the AIC. Expressed as a percentage of **Pr 18.93**.

18.96 : **Available active power**
Range: 0.0 to 1000.0%
Factory setting: 0.0 %
Format: 16 bits
Available active power as a % of percentage of **Pr 18.93**.

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
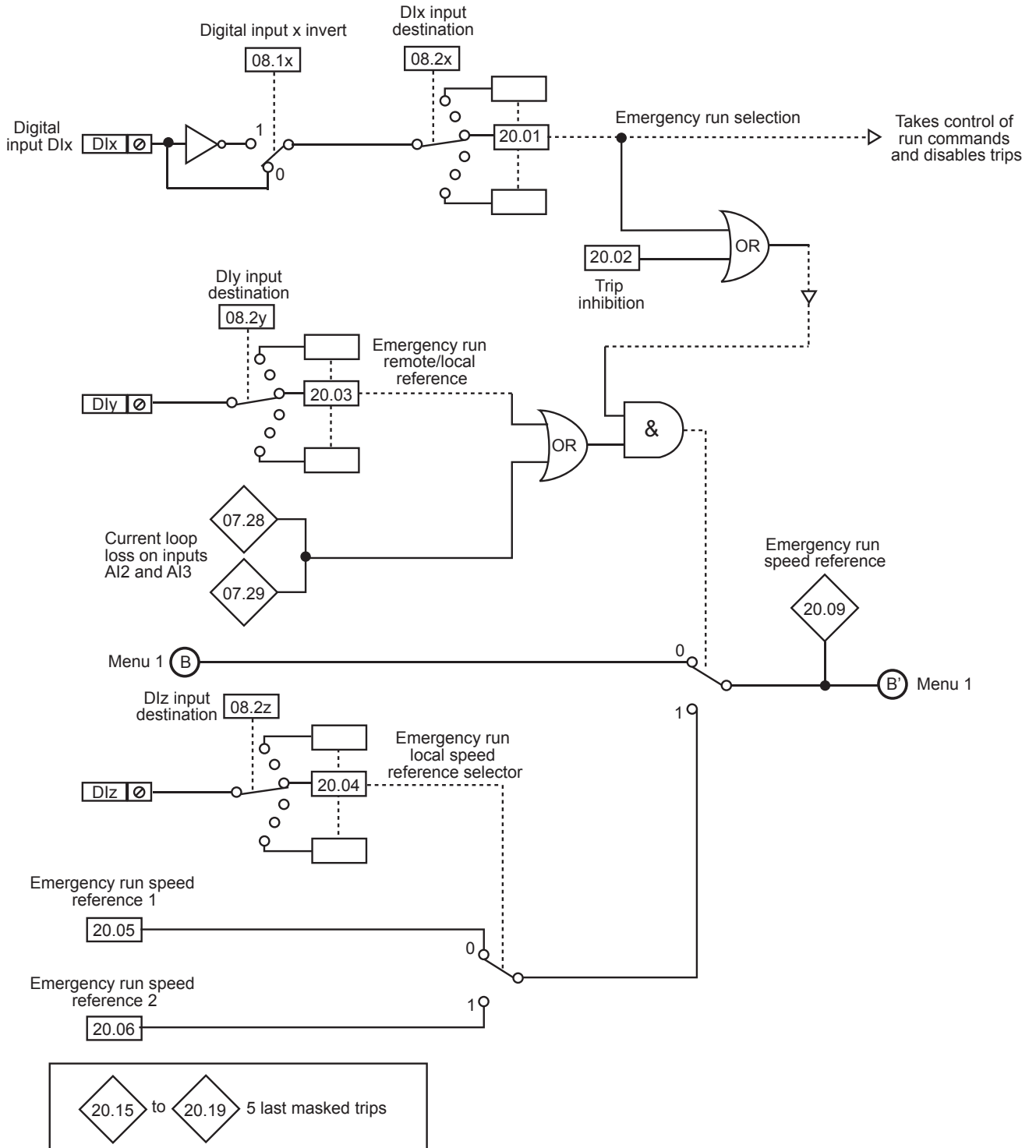
• Backspin and Kick start

20.30	Backspin management		20.43	Kick start main speed ref
20.40	Kick start enable		20.44	Reference running time
20.41	Kick start speed ref 1		20.45	Acceleration/deceleration ramp
20.42	Kick start speed ref 2			

5.21.2 - Explanation of parameters in menu 20

20.01 : **Emergency run selection**

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**).
- Catch a spinning motor 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**
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**
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**
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**
Range: ± **01.06**
Factory setting: 0.00 rpm
Format: 32 bits
Emergency run speed reference.

20.06 : **Emergency run speed reference 2**
Range: ± **01.06**
Factory setting: 0.00 rpm
Format: 32 bits
Emergency run speed reference.

20.07 and **20.08** : **Not used**

20.09 : **Emergency run speed reference**

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**

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 IMBLANCED	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

No.	Name	Reason for trip
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
37	Encoder signal loss	One of the encoder feedback data items is missing
40	Encoder board	The control board fails to communicate with the encoder board
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 ld	The DO1 output load current is > 200 mA
68	Motor overcurrent	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting.
70	AI4 loss on MDX-IO	Loss of the current reference on analog input AI4 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
78	LVRT	The grid voltage has dropped below the LVRT pattern (see menu 13)
79	HVRT	The grid voltage has exceeded the HVRT pattern (see menu 13)

No.	Name	Reason for trip
101	MAINS LOSS	Loss of AC supply
102	Rectifier	MD2R: Regen rectifier trip, signalled by the serial link to the Regen inverter (see **11.66**).

20.20 to **20.29** : Not used

20.30 : Backspin management
Range: Disabled (0) or Enabled (1)
Factory setting: Disabled (0)
Format: 8 bits
When this function is enabled, the drive harnesses the potential energy that may be stored in some very specific load types (eg: Progressive Cavity Pumps), to extend the possible operating time without the mains. Depending on the system status when the mains supply disappears, the drive can therefore operate for a few minutes rather than a few seconds with just the load's kinetic energy.
If the mains supply returns before the time set in **06.62** (adjustable up to 320 seconds, or more than 5 minutes), the drive reaccelerates the motor up to the reference speed. Otherwise, a mains loss trip is generated.

20.31 : Backspin speed
Reserved.

20.32 : Not used

20.33 : Backspin torque
Reserved.

20.34 : Backspin threshold
Reserved.

20.35 to **20.39** : Not used

20.40 : **Kick start enable**
Range: Disabled (0) or Enabled **(**1)
Factory setting: 0
Format: 8 bits
The purpose of the Kick start function is to unblock a clogged pump by oscillating the drive speed reference.
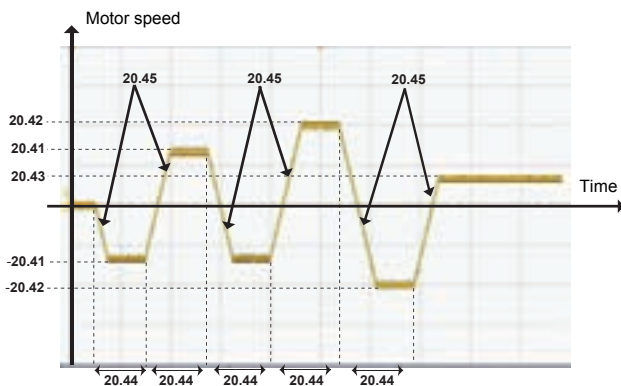Function reserved for specific applications.
CAUTION:
This operation can damage the motor.

Disabled (0):
Function disabled.

Enabled (1):
On the next run command, the intensive pump unblocking sequence will be initiated.

20.41 : **Kick start speed ref 1**
Range: ± 01.06
Factory setting: 0
Format: 32 bits

20.42 : **Kick start speed ref 2**
Range: ± **01.06**
Factory setting: 0
Format: 32 bits

20.43 : **Kick start main speed ref**
Range: ± **01.06**
Factory setting: 0
Format: 32 bits
Final reference used in Kick start.

20.44 : **Reference running time**
Range: 0.1 to 60.0 s
Factory setting: 3.0 s
Format: 16 bits
Used to set the time between each reference.

20.45 : **Acceleration/deceleration ramp**
Range: 0.1 to 3200.0 s
Factory setting: 3.0 s
Format: 16 bits
Used to set the ramps for each reference.

5.22 - Menu 21: Second motor map

Refer to parameter **11.45** for the motor selection.

21.01 : Motor 2 maximum speed
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.**

This parameter defines the maximum speed in both directions of rotation.
This parameter is equivalent to 01.06 in motor 1.

21.02 : Motor 2 minimum speed
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
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):
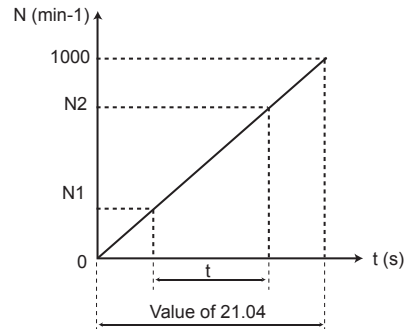The speed reference comes from the preset references (RP1 to RP8).

Keypad (4):
The speed reference comes from the parameter-setting interface (see section2.2.4).
This parameter is equivalent to 01.14 in motor 1.

21.04 : Motor 2 acceleration rate 1
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 *****.

$$21.04 = \frac{t(s) \times 1000 \text{ min}^{-1}}{(N2 - N1) \text{ min}^{-1}}$$

This parameter is equivalent to 02.11 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.

21.05 : Motor 2 deceleration rate 1
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.

$$21.05 = \frac{t(s) \times 1000 \text{ min}^{-1}}{(N2 - N1) \text{ min}^{-1}}$$

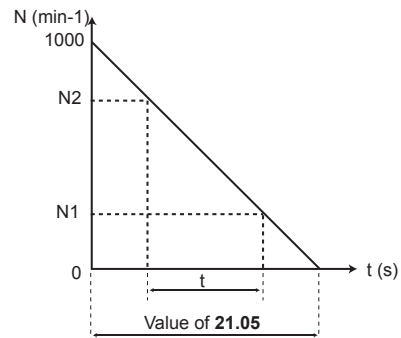**This parameter is equivalent to 02.21 in motor 1.**

* 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 rated frequency
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 rated current**
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 rated speed**
Range: 0.00 to 60000.00 rpm
Factory setting: 1500.00 rpm
Format: 32 bits
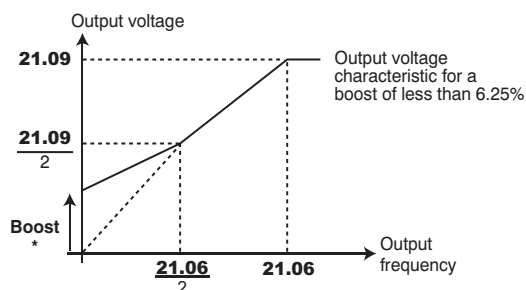This is the on-load speed of the motor indicated on the nameplate.
This parameter is equivalent to 05.08 in motor 1.

21.09 : **Motor 2 rated voltage**
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/F law with boost (2) or Square V/F law with boost (5), the boost value is set via **05.15**.
This parameter is equivalent to 05.09 in motor 1.

21.10 : **Motor 2 power factor**
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**
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 calculation (0):
Format: 8 bits
When this parameter is at Automatic (0), 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)

Number of poles	21.11
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**
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**
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 d-axis inductance / Leakage ind**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 32 bits
- Induction motor: Value of the overall leakage inductance applied to the typical machine stator. The value of **21.14** is stored automatically during an autotune when running in flux vector mode (**05.12** = Rotating: incomplete motor data (2)).

- Synchronous motor: Value of the typical machine cyclical stator inductance. The value of **21.14** is used for PM or PMASR motors with sensorless control mode (**03.38** = 5 to 9). Its value should be entered from the nameplate data, or else using the autotune procedure (see **05.12**).
This parameter is equivalent to 05.24 in motor 1.

21.15 : **Motor 2 map enable**

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).

21.16 to **21.23** : **Not used**

21.24 **: Motor 2 stator inductance L$_s$ (◨)**
Range: 0.000 to 9000.000 mH
Factory setting: 0.000 mH
Format: 32 bits
- Induction motor: sum of the magnetising inductance and the leakage inductance at the motor rated flux.
The value of **05.24** is stored automatically during an autotune when running (**05.12**: Rotating: incomplete motor data (2)).
- Synchronous motor: 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) (◨)**
Range: 0 to 10000 V
Factory setting: 98 V
Format: 16 bits
The value of **21.30** is used in synchronous motor sensorless control mode (**03.38** = 5 to 9). Its value should be entered preferably from the nameplate data or else using the autotune procedure.
This parameter is equivalent to 05.33 in motor 1.

21.31 to **21.50** **: Not used**

21.51 **: Q axis inductance motor 2**
         (synchronous motor) (◨)
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 synchronous motors with saliency.
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.

Connector for
MODBUS RTU

P1 P2 Px1 Px2 Px3
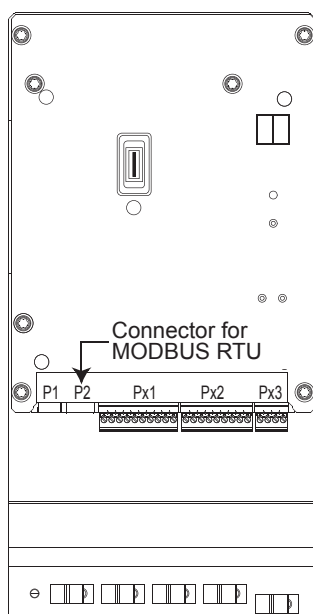
Terminals	Description
1	0V
2	Rx\, Tx\
3	Rx, Tx
4	24V

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.
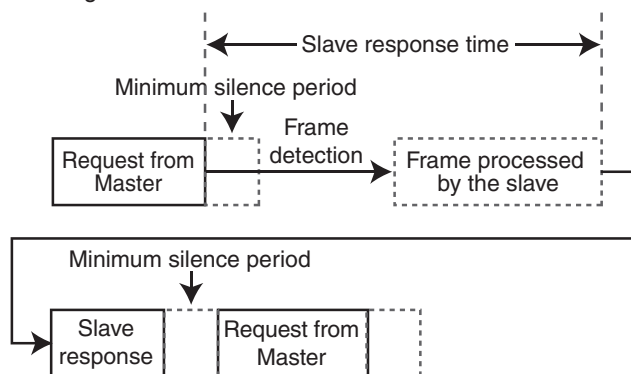
6.4.3 - Parameter mapping

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 + 16-bit parameters** for 16-bit parameters. For 32-bit parameter addressing, add 0x4000 to the address, giving 16384, and read or write 2 words. As Modbus only uses 16-bit registers, 8-bit parameters should be addressed in the same way as 16-bit.

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

Drive parameter	Register address (protocol level)
	(X x 100) + Y -1
X.Y in 32-bit	16384 + (X x 100) + Y - 1
Examples	
01.01 (32-bit)	**16484**
01.09 (8-bit but treated as 16-bit	**108**
07.03 (16-bit)	**X.Y in 16-bit**

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:

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

6.4.5 - Function codes

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

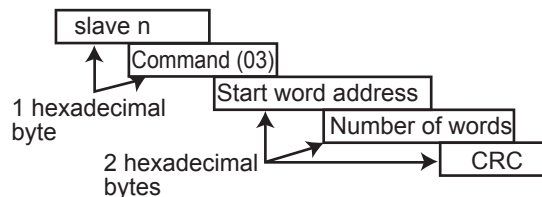| Function code		Description
Decimal	**Hexadecimal**	
3	0x03	Read multiple 16-bit registers or words
6	0x06	Write single 16-bit register or word
16	0x10	Write multiple 16-bit registers or words
23	0x17	Read and write multiple 16-bit registers or words

• 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**
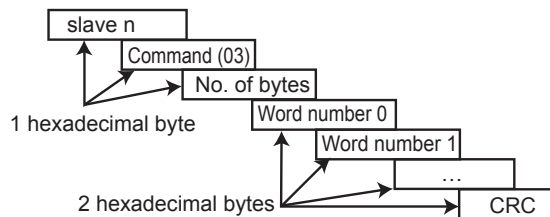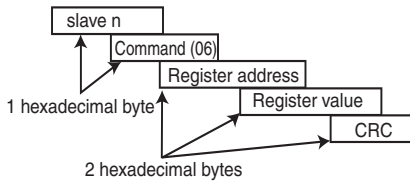> 12 parameters maximum can be written.

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.
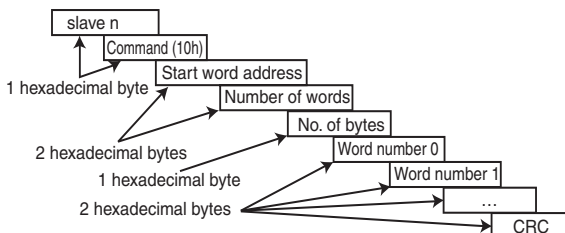
Frame returned by the slave:

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.
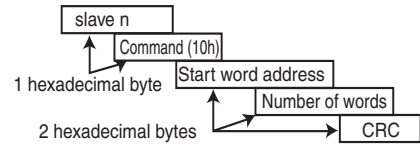
> **NOTE**
> 99 parameters maximum can be read and 10 parameters maximum can be written.

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 - Drive status

The parameter **10.98** defines the drive operating status.

When the drive is not in the trip or alarm state, the two digits on the control board provide information about the drive status when stopped or running.

The LEDs display alternately a 2-letter code and a number that can be used to find out the drive status using the table below (this number corresponds to the value of parameter **10.98**).

IH : "Inhibit"
OP : "Operating"
St : "Stop"
Lt : "Limit"
rd : "Ready"
CH : "Check"
tr : "Trip" (see section 7.4)
Fr : Fire (emergency operation)
re : "Regen"

LED Code	Value	Name	Meaning
IH	0	DISABLED	Disabled
	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.**
OP	1	ENABLED M	Enabled / motor (on load)
	2	ENABLED G	Enabled / generator (driving load)
	27	Fly. RESTART	Catch a spinning motor restart
	28	Start. DELAY	Delay before starting
	29	Delay before flying restart	Delay before Catch a spinning motor
	31	MAINS < Min.V	Mains voltage < Minimum voltage

LED Code	Value	Name	Meaning
St	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
	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
	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
Lt	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
rd	32	READY	Drive healthy

LED Code	Value	Name	Meaning
CH	33	AUTOTUNE	Autotune
	35	BOARDS TEST	Test of boards (control/interface)
	36	POWER TEST	Test of the power
re	34	REGEN MODE	Rectifier mode (Regen drives)
Fr	37	EMERGENCY OP.	Emergency operation enabled

7.3 - 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**).

10.97	HMI message	Reason for alarm
1	User alarm 1	See **10.54**
2	User alarm 2	See **10.55**
3	User alarm 3	See **10.56**
4	User alarm 4	See **10.57**
5	Braking resistor alarm	See **10.12**
6	Motor overload alarm	See **10.17**
7	Drive over temperature alarm	See **10.18**
8	Micro-controller overload	Consult Nidec Leroy-Somer
10	Emergency run: hidden trip	In emergency operation, trips re-lated to the software are disabled and this alarm is generated.
11	Autotune: measured inductance	After an autotune (**05.12** = 1 or 2) the alarm is triggered if the dif-ference between the measured value of the inductance Ld and the value set in 05.24 exceeds 20%.
12	Autotune: measured EMF	After an autotune (**05.12** = 2) the alarm is triggered if the diffe-rence between the measured EMF and the value set in 05.33 exceeds +/-20%.
13	Autotune: no offset on this encoder	After an autotune (**05.12** = 3) the alarm is triggered if no top zero is detected

10.97	HMI message	Reason for alarm
15	LVRT	The grid is out of the defined LVRT/HVRT pattern
16	HVRT	
21	Stack overload	The main program stack over flow has occurred
22	Rise time of supply voltage	Rise time of the electronic card supply voltage is too long

7.4 - 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 hereafter.

> ⚠ **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.	HMI message	Reason for trip	Solution
1	DC bus UnderVoltage	DC bus voltage is below 330V for "T" ratings or 480V for "TH" ratings	- Check the input fuses - Check the quality of the power supply (voltage dips)
2	DC bus overvoltage	DC bus voltage exceeds 815V for "T" ratings or 1200V for "TH" ratings	- Check that the mains voltage is within the permitted tolerance - Check the quality of the power supply (commutation notches or voltage spikes may not exceed 780Vpeak for T version and 950Vpeak for M version) - Check the motor insulation
3	Overcurrent	Instantaneous output current exceeds 2.22 times the VSD rated current for normal duty use. **This trip cannot be reset for a period of 10 seconds**.	- Perform a power module test (**17.03**) by switching off and on the drive (the drive should be fully de-energize before switching back on) - Check the motor insulation (megger the motor) - Check the motor cables (connections and insulation) - Check the belt tension in the case of a belt drive - Check the quality of the mains supply
4	Brak. IGBT	Braking IGBT transistor overcurrent (POWERDRIVE MD2 only). **This trip cannot be reset for a period of 10 seconds**.	- Check the braking resistor wiring and insulation level. - Make sure that the resistor ohmic value is compatible with the MD TF option used.
5	I imbalance	The sum of the 3 motor currents exceeds 15% of the VSD rated current for normal duty use.	- Perform a power module test (**17.03**) by switching off and on the drive (the drive should be fully de-energize before switching back on) - Check the motor insulation (megger the motor) - Check the cable insulation
6	Out phase lost	One of the 3 motor currents is less than 10% of the other two	- Check the motor cables - Check that a motor phase is not open
7	Overspeed	The speed is higher than (1.3 x **01.06**) or (**01.06** + 1000 rpm)	- Check the drive settings - Disable the catch a spinning motor function (Set **06.09** to «Disabled»)
8	Ixt drive overload	The integration of VSD overloads exceeds the allowed value	- Check the application - Check the ambient temperature
9	IGBT U	Internal protection of phase U IGBTs	- Megger the motor - Check the cable insulation - Perform a power module test (**17.03**) by switching off and on the drive (the drive should be fully de-energize before switching back on)
10	Rectifier Overheating	Rectifier heatsink temperature exceeds the maximum allowed	- Clean the cabinet dust filters - Check the VSD rectifier blower is working properly - Check that the cabinet air inlet temperature is not outside the limits - Perform a power module test (**17.03**) by switching off and on the VSD. (NB : the VSD should be fully de-energize before switching back on)
11	Encoder rotation	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	Tune UVW reversed	The encoder U, V, W signals are reversed (only if encoder option is present)	- Check the conformity of the encoder wiring
14	Tune U encoder missing	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 encoder missing		
16	Tune W encoder missing		

No.	HMI message	Reason for trip	Solution
18	Autotune trip	A stop command has been given during the autotune phase.	Repeat the autotune procedure (see **05.12**)
19	Ixt braking resistor overload	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	IGBT U Overheating	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 - Check that the motor shaft is not stalled - Perform a power module test (**17.03**) by switching off and on the drive (the drive should be fully de-energize before switching back on)
24	Motor PTC sensor	The motor temperature sensor indicates a temperature that exceeds the maximum allowed	- 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 - Set **17.01** = Yes (1) to perform a control and interface board test.
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	
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	Control failure of synchronous motor in oriented flux control mode	- Check the menu 5 parameters are compatible with the values on the motor nameplate - If reverse direction is needed, check that bipolar reference is enabled (01.10 set to Yes (1))
40	Encoder board	The control board fails to communicate with the encoder board	Change the encoder board
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, 10.37**
46	User 6	User trip 6 triggered by the serial link **10.38** = 46	See **10.38, 10.37**

No.	HMI message	Reason for trip	Solution
47	User 7	User trip 7 triggered by the serial link **10.38** = 47	See **10.38**, **10.37**
48	User 8	User trip 8 triggered by the serial link **10.38** = 48	See **10.38**, **10.37**
49	User 9	User trip 9 triggered by the serial link **10.38** = 49	See **10.38**, **10.37**
50	User 10	User trip 10 triggered by the serial link **10.38** = 50	See **10.38**, **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 - Set **17.01** = Yes (1) to perform a control and interface board test.
52	DO3 MDX-IO over ld	The DO3 output load current (MDX-IO option) is >200 mA	
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	- Megger the motor - Check the cable insulation - Perform a power module test (**17.03**) by switching off and on the drive (the drive should be fully de-energize before switching back on)
57	IGBT W	Internal protection of phase W IGBTs	
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
59	Th IGBT W	Overheating of phase W IGBTs	- If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency have been complied with - Refer to drive installation manual, section of derating at low frequency - Check that the switching frequency **05.18** is compatible with the motor current level - Check that the motor shaft is not stalled
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 - Set **17.01** = Yes (1) to perform a control and interface board test.
66	DO1 over ld	The DO1 output load current is >200 mA	- Check that DO1 is not short-circuited - Set **17.01** = Yes (1) to perform a control and interface board test.
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 - Set **17.01** = Yes (1) to perform a control and interface board test.

No.	HMI message	Reason for trip	Solution
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	
78	LVRT	The grid voltage has dropped below the LVRT pattern (see menu 13)	- Change the LVRT pattern parameters - Check the quality of the power supply
79	HVRT	The grid voltage has exceeded the HVRT pattern (see menu 13)	- Change the HVRT pattern parameters - Check the quality of the power supply
101	MAINS LOSS	Loss of AC supply	• Check the input fuses • Check the quality of the power supply (voltage dips)
102	Rectifier	MD2R: Regen rectifier trip, signalled by the serial link to the Regen inverter (see **11.66**).	MD2R: Check the Regen inverter. See **18.24**.

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.

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