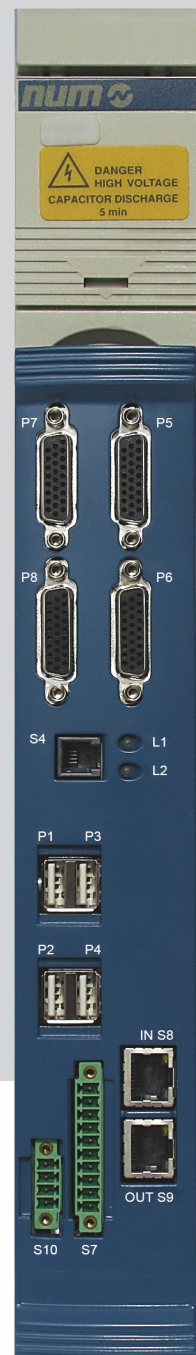
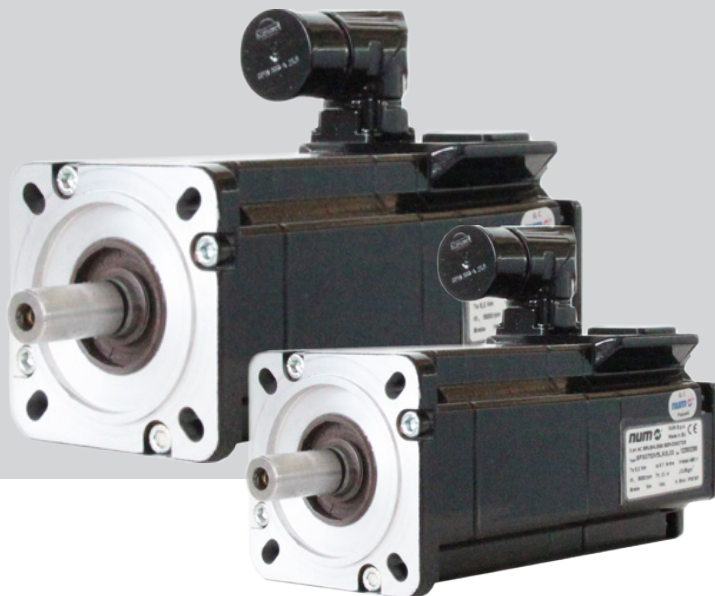


NUM DrivePro

Parameters manual (for software release 1.01.0000)

M00066EN-01

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The programming examples described in this manual are intended for guidance only. They must be specially adapted before they can be used in programs with an industrial application, according to the automated system used and the safety levels required.

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1 Foreword

1.1 Products certification and normatives



The NUM DrivePro conformity to the EMC directive 2014/30/EC can only be assessed if the drive is installed inside a machine or cabinet. The installation instruction inside of this manual must be followed.

For more EMC detailed informations please refer to the M00027 "Cabinet layout and EMC Guide - Installation and Wiring Guide manual".

1.2 Machinery directive

MD 2006/42/EC

The designed products are intended to be incorporated into machinery or assembled with other machinery to constitute products covered by the council directive. Commissioning is forbidden until the products have been integrated in a machine that conforms with the directive 2006/42/EC.

1.3 Use of the manual

This manual is for use by qualified service personnel only. To reduce the risk due to an impropriety use of the product, do not perform any servicing other than that contained in this manual unless you are qualified to do so.

To ensure proper use of these products, please always read this User's manual carefully and retain for future reference. Should the unit require maintenance, please contact a Num authorized service center only.

1.4 NUM DrivePro Software User's information

Before connecting, operating or adjusting these products, please read these following User's software information:

NUM DrivePro Mono-Axis, the associated software release version is 1.01

NUM DrivePro Bi-Axes the associated software release version is 1.01

All alarms extensions indicated and described in manual are referred to the drive software 1.01 version only.



WARNING

Num declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.

1.5 General drives installation warnings instructions

- All the international, state, regional and local standards must be complied during the installation and during the use of this product.
- Only properly qualified personnel having extensive knowledge in servomotor technology should install, commission and/or maintain the product.
- To comply with current safety regulations, all wiring and connections must be made in accordance with the electrical diagrams shown in the MDLUF installation manuals code M00067 manual.
- NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.
- Use only original NUM cables. The original NUM cables have special characteristics (capacitance value...). Not to respect these characteristics can cause serious damage to motors.
- During the servomotor installation, always make sure that the connection cable used is the one established in the MDLUF installation manual code M00067.
The use of an incorrect cable leads to the violation of the international standards.
- The total power length of the motor power cables used in the whole parts of the system, must be <400m at 5kHz PWM and < 200m at 10kHz PWM. (This limits are valid using NUM cables).

1.6 Hazard and safety use instructions - Symbology use in the manual

Symbol	Meaning of the symbol
	The information " i " icone indicates important notes on product use.
	The STOP icone indicates a wrong operation which may damage the product.
	The TRIANGLE icone indicates hazard for human beings and this information is referring to personal damage! Whenever one of these icons appear, please beware, use and apply adequate precautions to avoid hazards or damage situations during the drive installation and commissioning operations! Please beware, consult chapter 1.10 Please beware! Prevent and safety instruction against accidental contact with electrical componenets.

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1.7 Document revisions

M00066EN			
Edition	revision	Reason for revision	See chapter
01.2025	00	Compliance with Software version 1.00 Document creation: NUM DrivePro - Parameters manual.	-
03.2025	01	Compliance with Software release 1.01.0000	-

1.8 How to read the manual



NOTE

This manual is structured and divided into nine main chapters as indicated here-below. We suggest to follow these read instructions in such away to find easily your information.

Chapter	Description
1	This chapter introduces all warnings, hazardous areas and all safety information on product use. Please take into account these instructions before to switch on the drive.
2	This chapter introduces the main drive configuration by means FlexiumPro Tools: how to make a motor / drive association, sensor configuration, parameter selection, parameter display and modification, drive filter selection and modification, Programmable relay configuration, use of oscilloscope and so on....
3	This chapter introduces the general parameter list. We suggest to use this chapter as to find quickly a short information about the parameters. This chapter introduces the full parameters description included adjustment range, default value, motor use, HALT required, Family and typically User's example.
4	This chapter introduces the drive test point TP and the associated measure point (MP), the MP description included adjustment range, relay scale factor, motor use and Modification Level requirement.
5	This chapter introduces typically User's application and parameters optimization.
6	This chapter introduces all drive's diagnostic signalling and software alarms and alarms extension. Moreover, are included the alarms "Possible cause / Possible remedy" by troubleshoot information tables.
7	This chapter introduces all Drive to PLC exchange area warning signalings, status bits, drive addresses and meaning.
8	This chapter introduces the DEMF Drive Embedded Macros configuration and use.

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1.9 NUM Agency

The list of NUM agencies is given on <http://www.num.com>

1.10 View of the hazardous areas around NUM DrivePro units

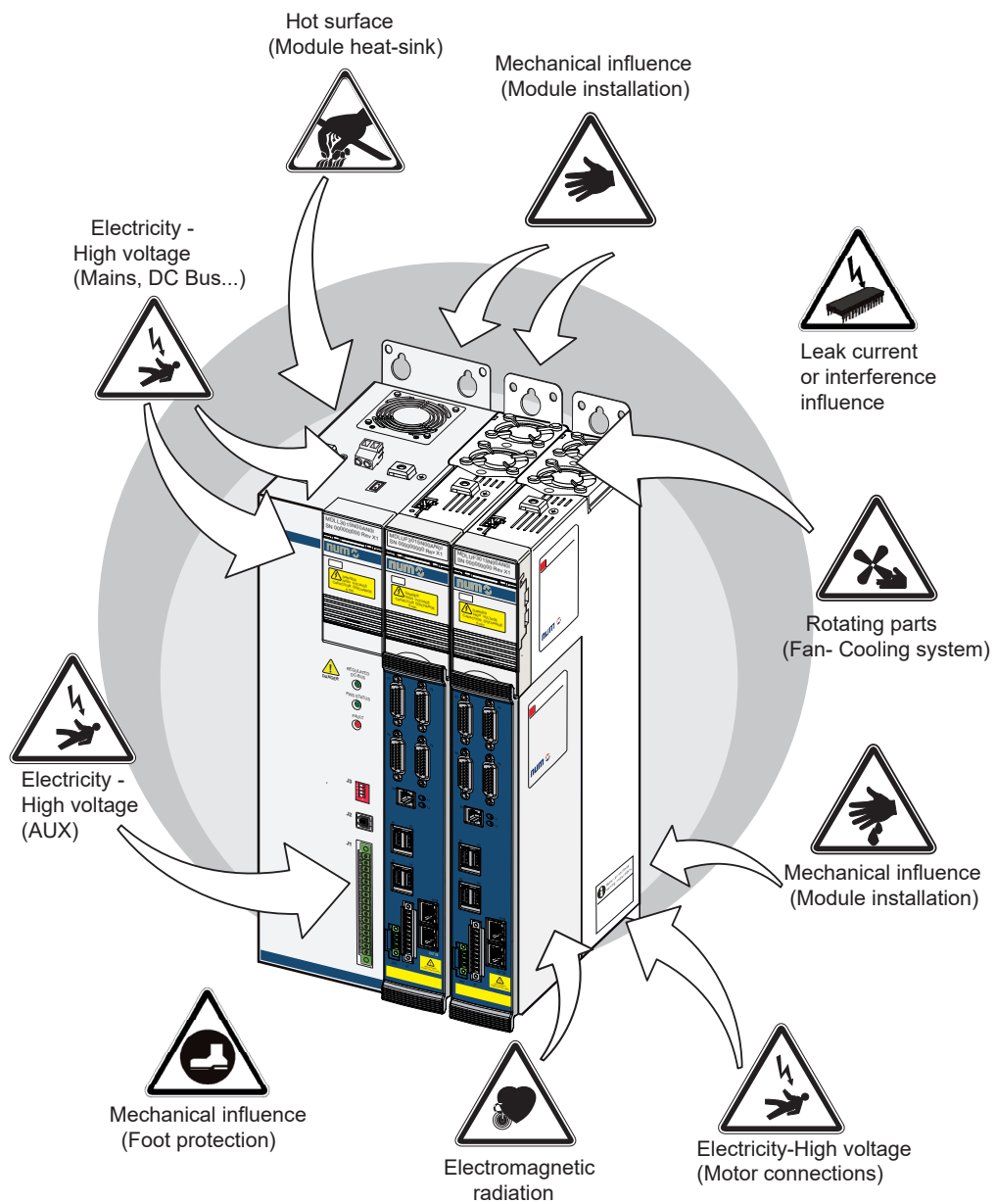


Fig. 1 - Hazardous areas around NUM DrivePro units



WARNING

Num declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.

1.11 How to read the parameters and measure point list

All the parameters indicated and described in this manual are parameters which may be used and optimized during the MDLUF setup. In the chapter 3 of the manual a quickly general parameters list informations is described.

Please refer to chapter 4 of the this manual to give the full parameters description.

(See chapter 1.11.2 How to read a parameter description on next page)

These parameters are typically parameters which have to be adjusted during a standard drive setup and commissioning. To ensure a proper use of the parameters, please always read the here-below legend carefully to reduce the risk due to an improper use of them.

1.11.1 Reading a general parameters list table

1	N°	Parameters description	Unit	3 Motor utilisation		
2	V25	Port Ix1 configuration • Bit 0 = Port Ix1 [0=Enabled] [1=Disabled] • Bit 1 = Homing switch S1 [1=Configured for] • Bit 2 = Homing switch S2 [1=Configured for] • Bit 3 = Electrical range change [1=Configured for] • Bit 4 = Torque enable [1=Configured for] • Bit 5 = Reference enable [1=Configured for] • Bit 6 ÷ 31= Not used	Bit	SM	AM	LM
	V26	Port Ix2 configuration • Bit 0 = Port Ix2 [0=Enabled] [1=Disabled] • Bit 1 = Homing switch S1 [1=Configured for] • Bit 2 = Homing switch S2 [1=Configured for] • Bit 3 = Electrical range change [1=Configured for] • Bit 4 = Torque enable [1=Configured for] • Bit 5 = Reference enable [1=Configured for] • Bit 6 ÷ 31= Not used	Bit	SM	AM	LM
	V50	Torque current limit	Arms	SM	AM	LM
4	V58	Proportional speed loop gain high range	mA/Rpm	•	AM	•
	V100	Deliverable current limit	Reserved parameters			

Fig. 2 - General parameters list table

1	Parameter number, description and unit. ([] = a-dimensional)
2	Parameters in white area are used for all drive User's application.
3	Motor utilisation: - AM = Asynchronous motor - SM = Synchronous motor - LM = Linear motor, - • = Not used in this motor configuration.
4	Parameter in grey area are "Reserved parameter" and they must never be adjusted.

1.11.2 How to read a parameters description - V50 example

V50 Torque current limit

6	General	Unit R	Arms	Motor type	AM, SM, LM	3												
		Unit L																
7		Adjustment range R	0.0 ÷ V1/1.414	HALT required	No	4												
		Adjustment range L																
8		Default R	1.0	Family	4 Speed loop control	5												
		Default L			14 Current loop control													
9		Through the V50 parameter it is possible to reduce the maximum drive current in order to limit the maximum torque delivered by the motor. The value is expressed in Arms.																
10	Description	V50 Torque current limit ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table border="1"> <thead> <tr> <th>Value</th> <th>Unit</th> <th>Description</th> <th>Min</th> <th>Max</th> <th>Default</th> </tr> </thead> <tbody> <tr> <td>9.89</td> <td>Arms</td> <td>Torque current limit</td> <td>0.0</td> <td>9.9</td> <td>9.89</td> </tr> </tbody> </table> Enter the Arms value of the desired torque current into parameter V50. Example of V50 adjustment for NUM DrivePro 014A1Cxxxx (9.89 Arms. max) By entering the value 9.89 in parameter V50 the effective current delivered by the system will be 9.89 Arms max. (with subsequent reduction of motor maximum torque).				Value	Unit	Description	Min	Max	Default	9.89	Arms	Torque current limit	0.0	9.9	9.89	
Value	Unit	Description	Min	Max	Default													
9.89	Arms	Torque current limit	0.0	9.9	9.89													

Fig. 3 - Example of the parameters description

1	Parameter number.
2	Parameter description
3	Parameter / motor type utilisation. Please see "Motor application" description on previous page.
4	Halt required for parameter utilisation. Where YES is required press HALT icon on FlexiumPro Tools.
5	Family = sub-groups of parameters which it belongs to, on Flexium Pro Tools
6	Parameter Unit. Unit R = parameter units in case of rotary motor (AM, SM) Unit L = parameter units in case of linear motor (LM)
7	Minimum and Maximum allowable values. Where ST value is present means that such values are automatically loading by the system. These values may change due to the Drive / Motor association. Adjustment range R = in case of rotary motors (AM, SM) Adjustment range L = in case of linear motors (LM)
8	Default value of the parameter. These values may change due to the Drive / Motor association. Default R = default value in case of rotary motors (AM, SM) Default L = in case of linear motors (LM)
9	General parameter application.
10	FlexiumPro Tools parameter image and parameter description.

1.11.3 How to read the drive measure point (MP) list

All the measure points (MP) indicated and described in this manual are measure points which may be used during the MDLUF installation and setup. Please refer to chapter 4 of this manual to give the full measure point description and application.

These measure points are typically measure points which are used during a standard drive setup and commissioning.

To ensure a proper use, please always read the here-below legend carefully to reduce the risk due to an improper use of them.

1.11.4 How to read a general measure point (MP) list table

1	2	3	4
MP	Description	Physical Unit	Motor utiliz. / Level
001	Mechanical motor speed	rpm	AM, SM / 1
002	Iq current reference	Arms	AM, SM, LM / 1
003	Id current reference	Arms	AM, SM, LM / 2
004	Speed reference	rpm	AM, SM / 1

Fig. 4 - General measure point (MP) list table

1	Measure point (MP) number used for MP selection. (... associated to TP1 ... TP4)
2	MP description
3	MP physical unit
4	Motor utilization: AM = Asynchronous motor. SM = Synchronous motor. LM = Linear motor. /1 = MP level of selection.

1.12 Glossaries - Abbreviations

Abbreviations	Meaning
AM	Asynchronous motor
APxxx	Special application
AUX	Auxiliary power supply
Bi-Axes	Drive for two motors control
BHX, BPX, SHX, SPX, BPH, BPG, BPL, BHL260	NUM axis motor range
BP	Drive Basic Performance version
C	Configurable alarm
CANopen	Digital bus communication type
CNC	NUM CNC
CNC IU	Value expressed in "CNC A-dimensional" for axis position (um, 0.1um, 0.001dgr, etc.)
Control Unit	NUM DrivePro control unit module
DAC	Digital - Analog Converter
EMC	Elettromagnetic Compatibility
EnDat	Type of encoder
EU	European Union
IEC65	Signal level standard
FlexiumPro Tools	Commissioning NUM tool
HOMING	CNC procedure
HP	Drive High Performance version
LED	Light Emitting Diode
LM	Linear motor
M	Motor
MASTER	NUM DrivePro module for TANDEM application
MDLC1010N00	Capacitor module
MDLL3, MDLL2	Power Supply module
Mono-Axis	Drive for one motor control
MP	Measure Point (... associated to TP1 ... TP4)
MSA, MSS	Num Drive Motorspindle range
NC	Not Configurable alarm
NUM DrivePro	Mono-Axis and Bi-Axes digital drives module (Power + Control Units)
NUM HMI	FlexiumPro user interface
NUM-STOX	Safe Torque Off certified SIL 2 module
NUM-SAMX	NUM-Safety certified SIL 3 module
SM	Synchronous motor
PC	Personal computer
PDS	Power Drive System
PTC-NTC	Motor thermal probe (Positive / Negative thermal probe)
Power Unit	NUM DrivePro power supply module
size x	Module width (50mm, 100mm, 200mm, 400mm)
S1	Motor sensor
S2	Additional sensor
S3	vibration detector (accelerometer)
STOP function Category x	See standard EN60204-1
SLAVE	NUM DrivePro module for TANDEM application
TANDEM	Anti-backlash AP03 , Torque duplication AP04 and Winding duplication AP05 applications
TP1, TP2, TP3, TP4	Test point

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2 General drive configuration with FlexiumPro Tools

2.1 Open a Project

Open FlexiumPro Tools and follow the here under instruction:

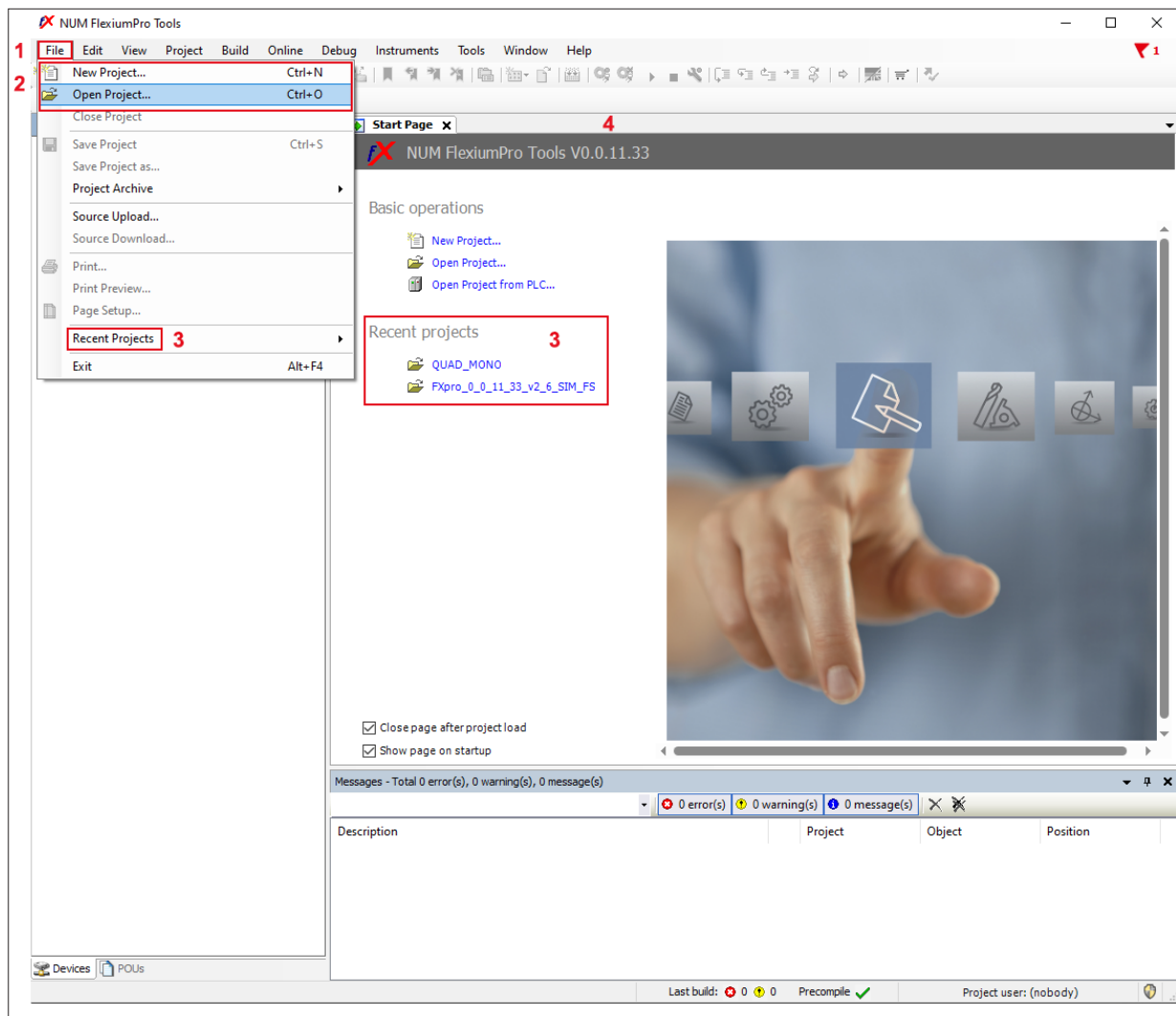


Fig. 5 - Open project

1	Select → "File"
2	Select → "Open Project" in the folder
3	or → Select Recent Project to open a recent one
4	FlexiumPro Tools version

2.2 Drive selection

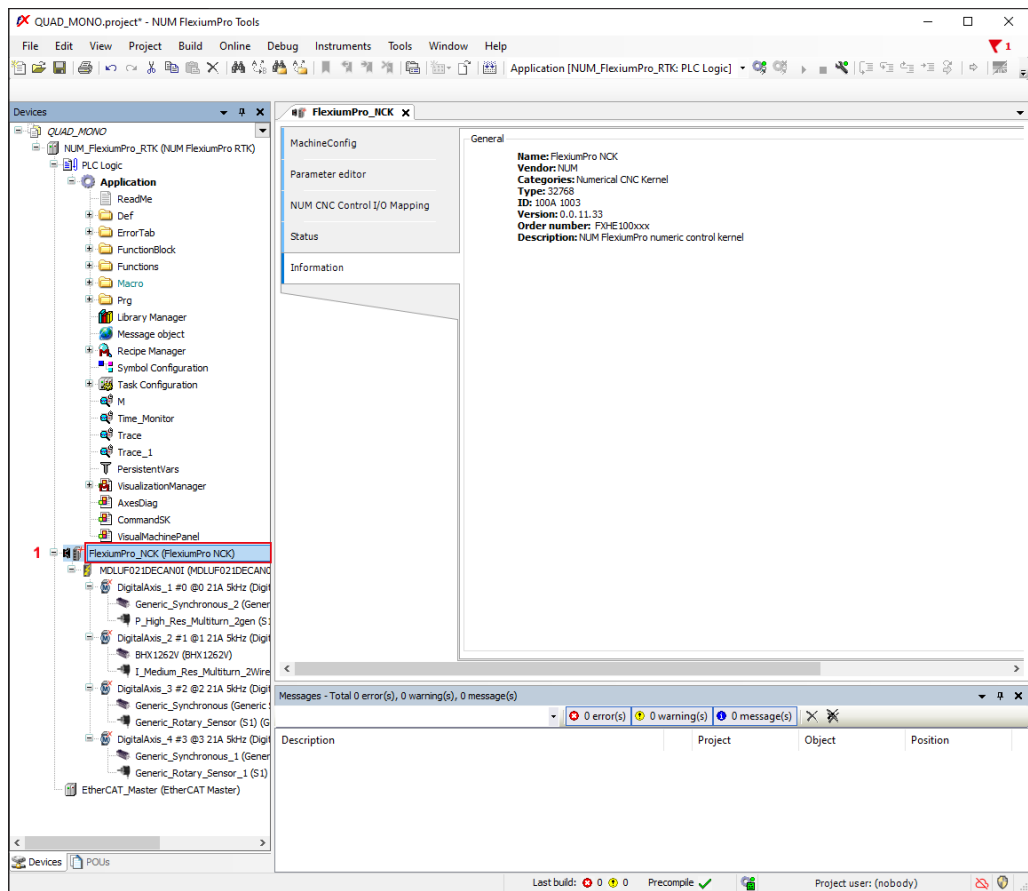


Fig. 6 - Add Device PART#1

1	Select → “FlexiumPro_NCK” and right click to open the “Device” tabbed window
2	Select → “Add Device” to open the main drive page selection

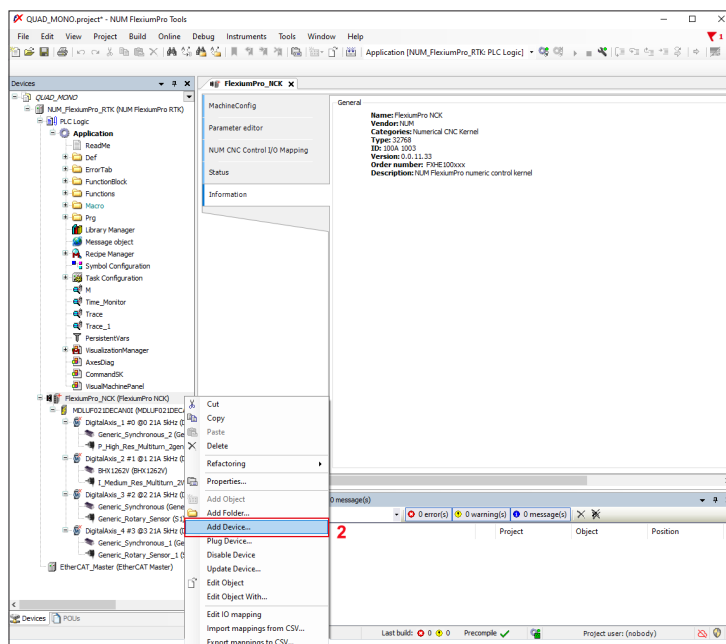


Fig. 7 - Add Device PART#2

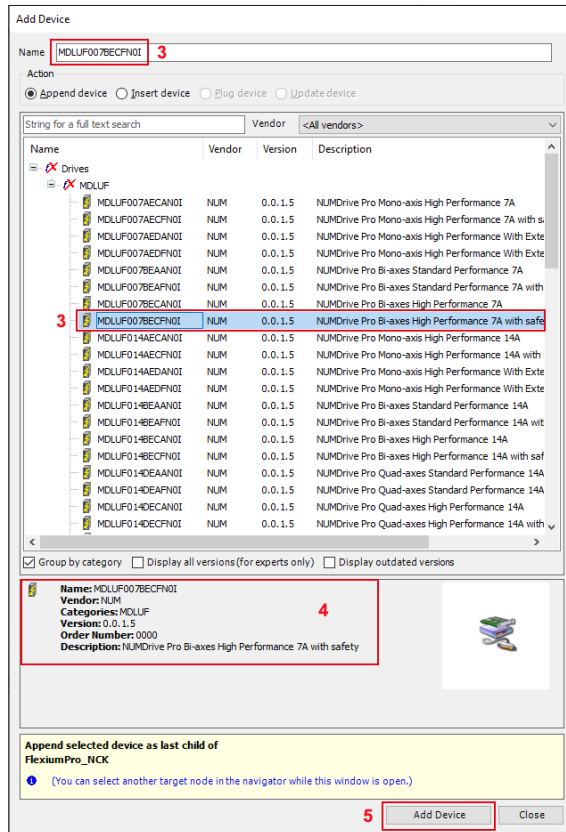


Fig. 8 - Drive selection

3	Click on an "MDLUF Drive" to select the drive then press "Add Device" to open the Power Unit selection page
4	Select the "Power Unit" then press "Add Device" and some main informations about the selection appears.
5	Press "Add Device" to make the selection.

2.3 Motor selection

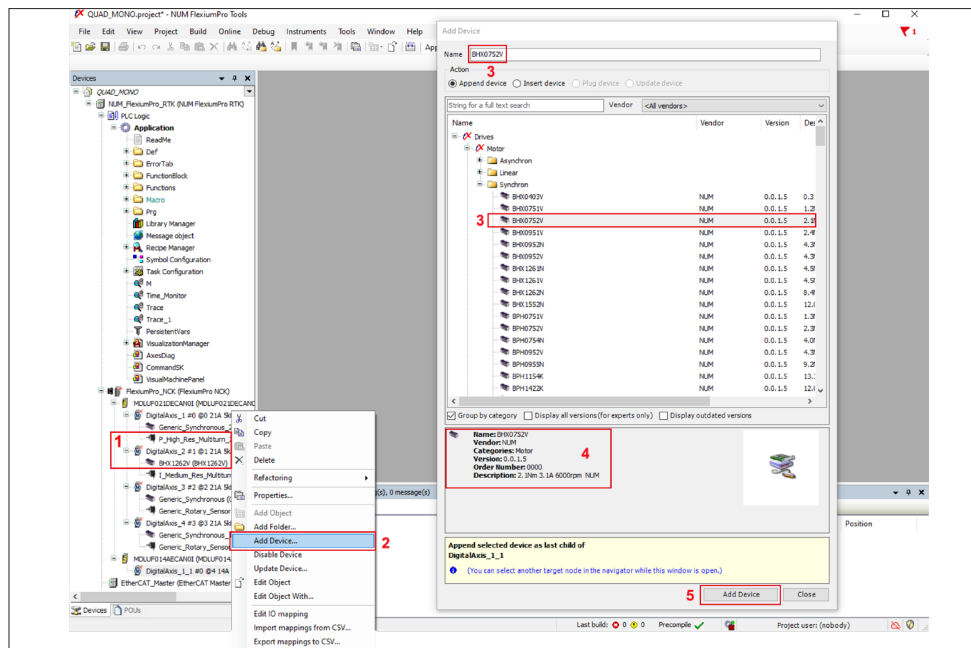


Fig. 9 - New motor selection PART#1

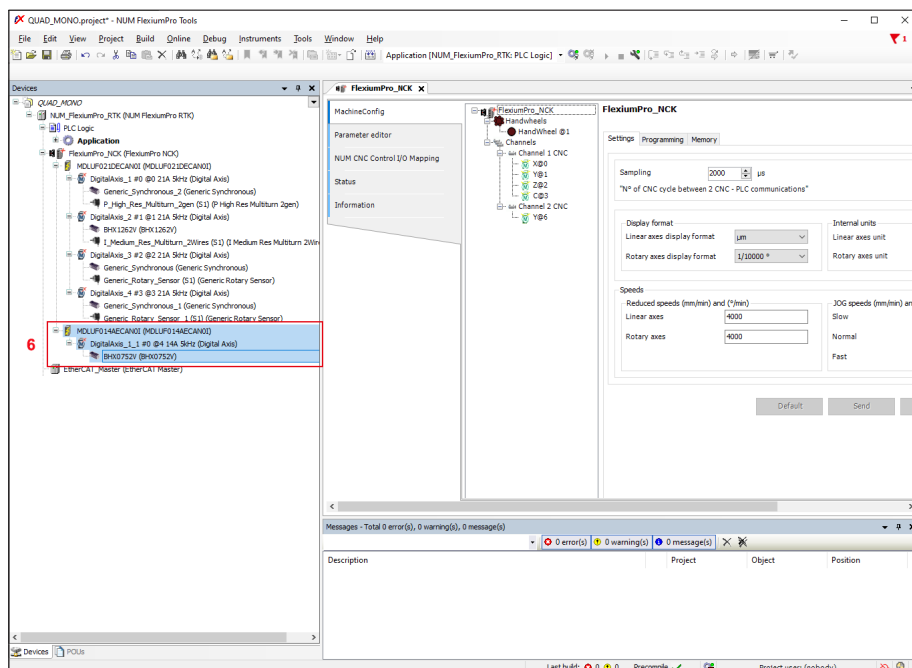


Fig. 10 - New motor selection PART#2

1	Select the drive → then right click to open the “Device” tabbed window
2	Click on → “Add Device” to open the main motors page selection
3	Motor table selection
4	Supplementary drive and motor information
5	Select the motor then press “Add Device”
6	New motor selection setting

2.4 Sensor configuration

The S1 and S2 sensor configuration must always be carried out considering the different sensor typology. Therefore, please give the appropriate S1, S2 and drive / sensor configuration as indicated in the table below and give the NUM sensor selection as indicated here under.

- S1 is the Motor sensors used to close current and speed loop and position loop if S2 not present.
- S2 is the Direct Measure sensor used to close Position Loop only.

S1, S2 configuration	NUM DrivePro		
	Mono-Axis	Bi-Axes (B)	Bi-Axes (C)
S1 sensor	P1, P5	P1, P2, P5, P6	P1, P2, P5, P6
S2 sensor	P6	-	P7, P8

Sensor S1 selection example

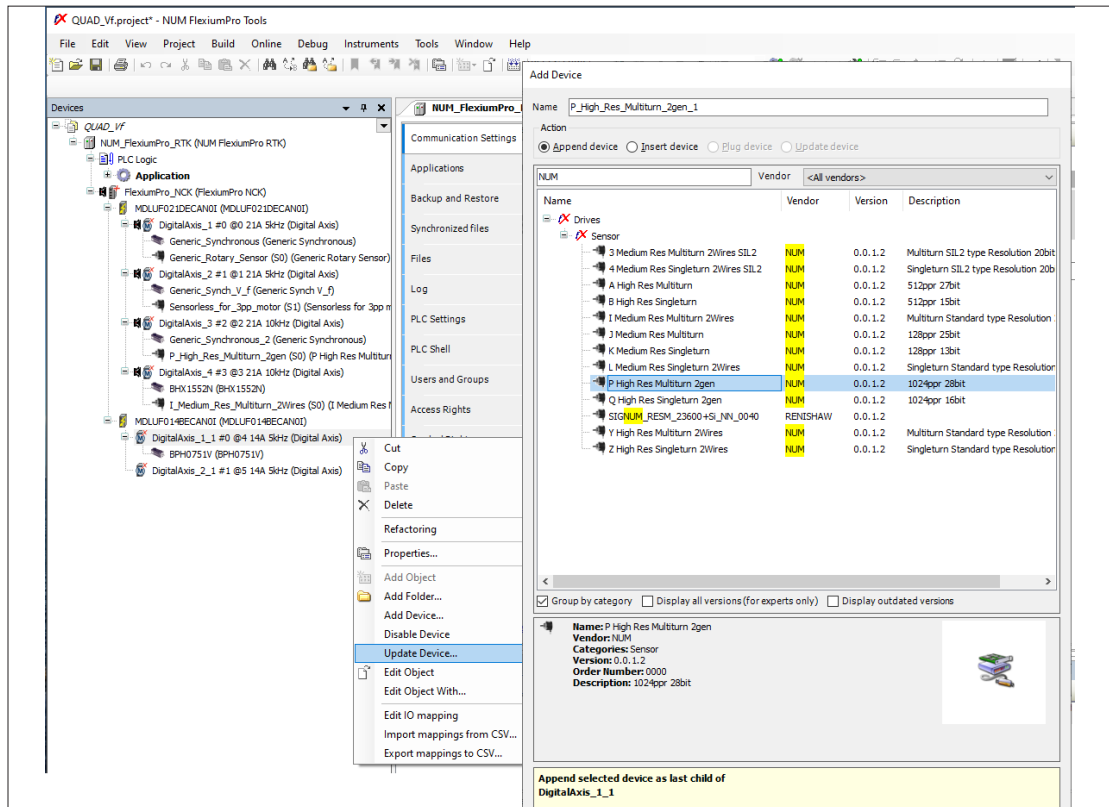


Fig. 11 - NUM sensor selection

1	Select the drive → then right click to open the “Device” tabbed window
2	Click on → “Add Device” to open the main sensor page selection
3	Click on → “Vendor” tabbed window then select → “NUM” to make a NUM sensor selection

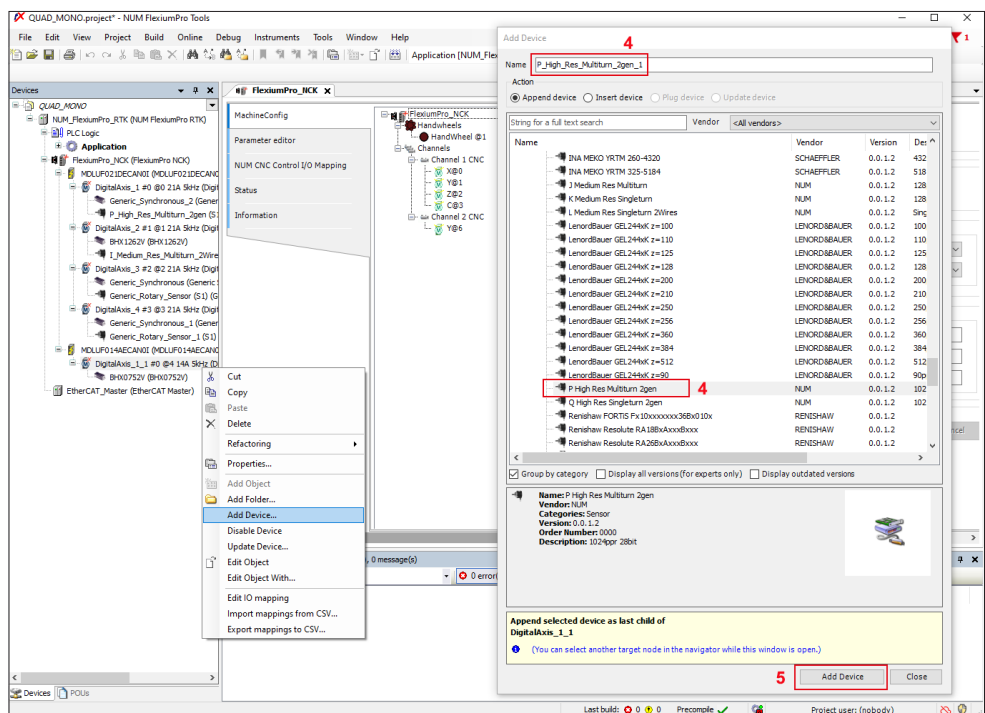


Fig. 12 - Sensor selection PART#1

4	Select the NUM sensor (See also "Information" area for more details about the sensor)
5	Press "Add Device"



NOTE

The same procedure must be used for S2 sensor selection.

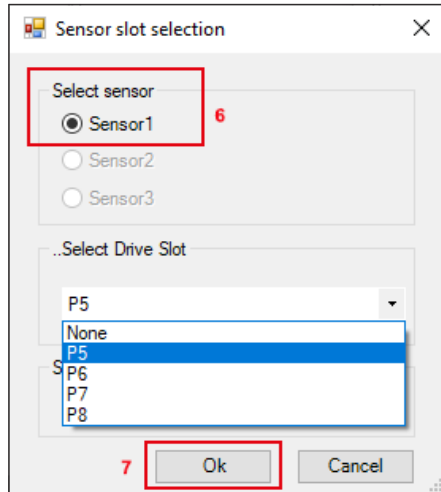


Fig. 13 - Sensor selection PART#2

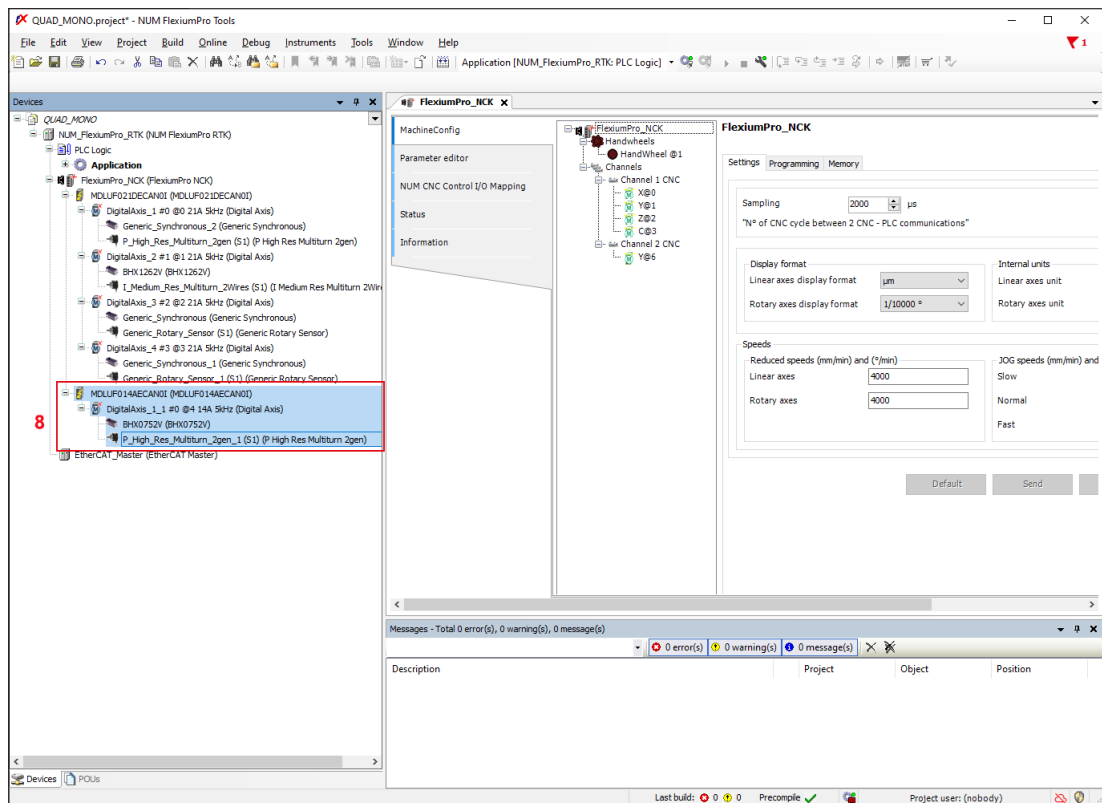


Fig. 14 - Sensor selection PART#3

6	Select the sensor function "S1 or S2"
7	Make → "Selection S1 or S2" setting then press OK
8	Check the new correct sensor selection

2.5 Drive parameters

2.5.1 Display the parameters

In this page is possible to display and modify all drive parameters.

It is strictly suggested to modify only the parameters indicated in the next chapter.

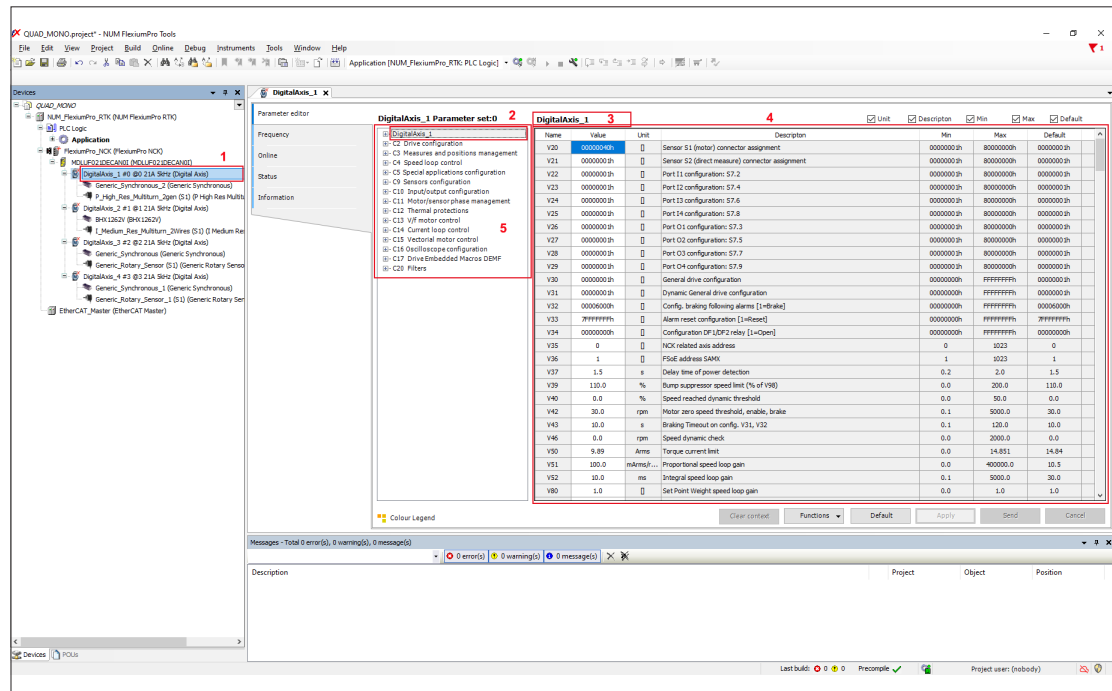


Fig. 15 - Drive parameters PART#I

1	Double click on → “DigitalAxis_1 #0 @0 ...”.
2	Click on → “Parameter editor” tabbed window to open the drive parameters page.
3	Click on → “DigitalAxis_1” to open the main parameter page visualization which shows all parameters present in the drive.
4	Complete drive main parameters page.
5	Parameter family groups.

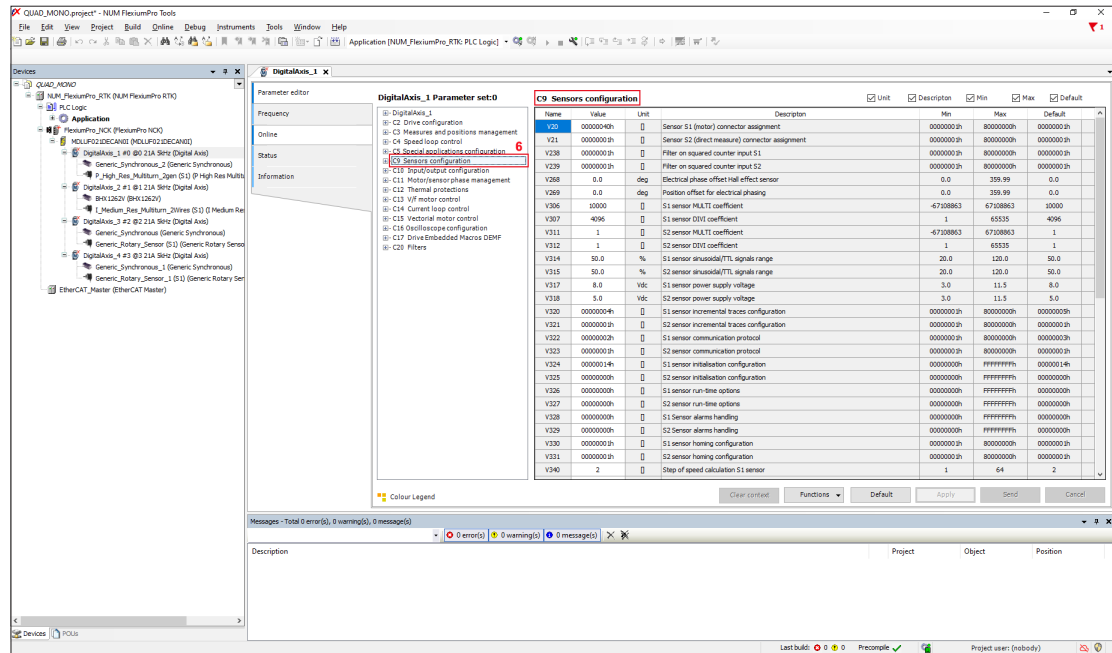


Fig. 16 - Drive parameters PART#2

6	For example click on → “C9 (Sensor configuration)” is possible to display the sensor configuration parameters page only.
...	Click on “Value” to modify the parameter then enter the new value

2.5.2 Parameters modification (i.e. V30 bits configuration)

Parameter selection and modification

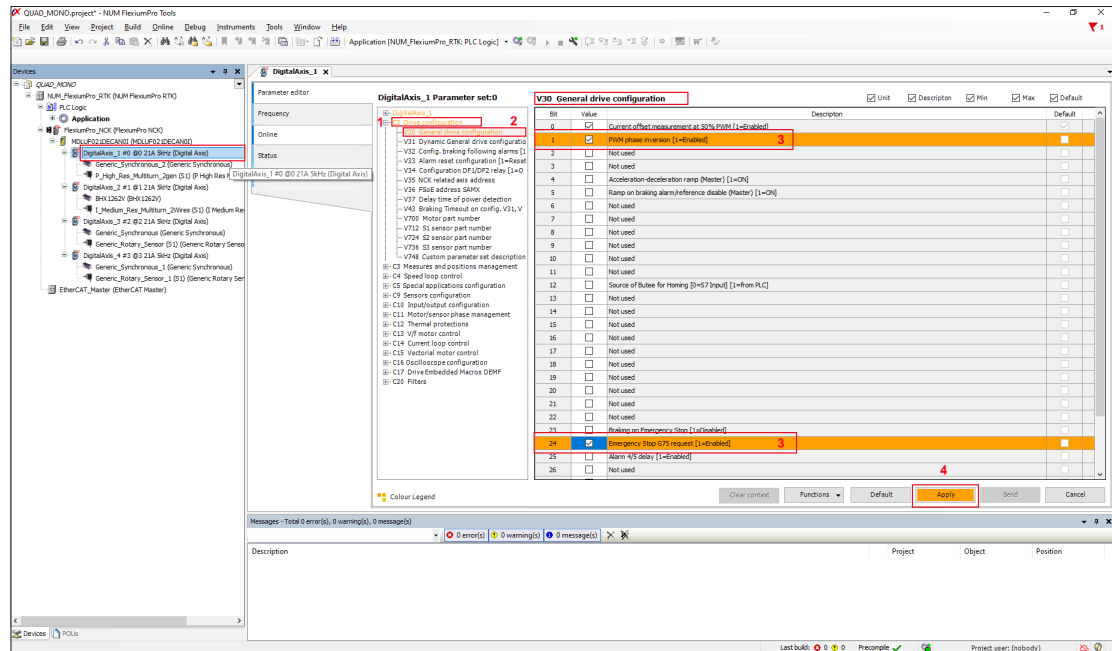


Fig. 17 - Parameter modification

1	Select "Parameter editor", then double click on → "C2 (Drive configuration)" and the drive configuration parameters will appear.
2	Click on → "V30 (General drive configuration)" to open the bits configuration page.
3	Click on "Value" tick box (✓) to set ON the bit as indicated in figure bit3, bit7, bit10 selection and the bits selected are indicated in orange icons as in the figure.
4	Click on "Apply" to set the modification.

Save the modification in the project

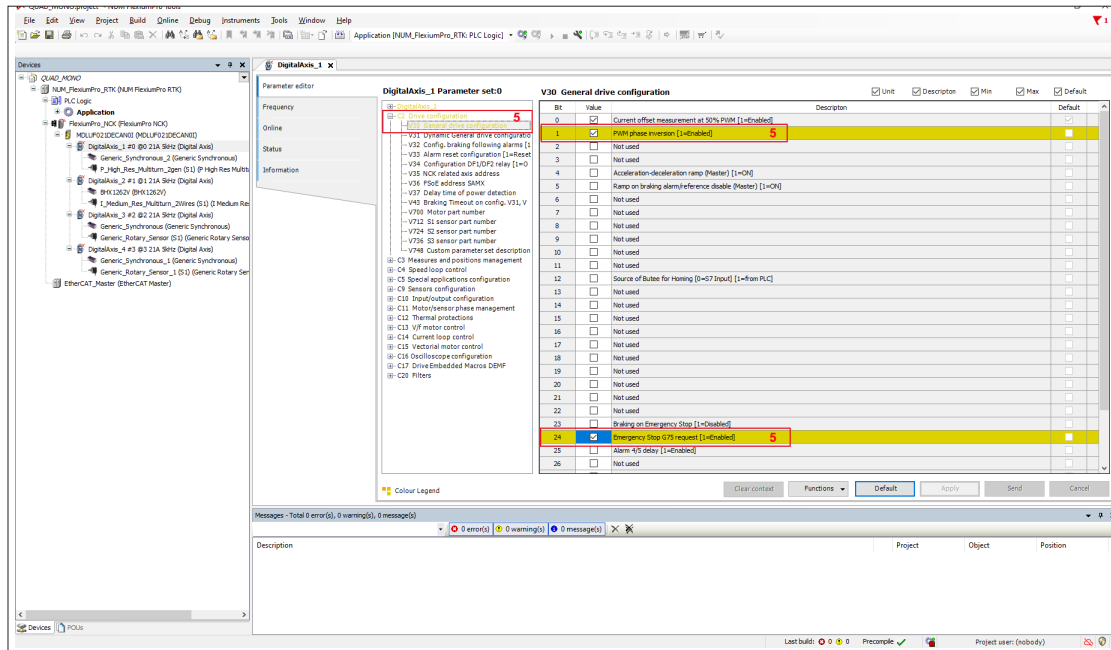


Fig. 18 - Save parameter modification PART#1

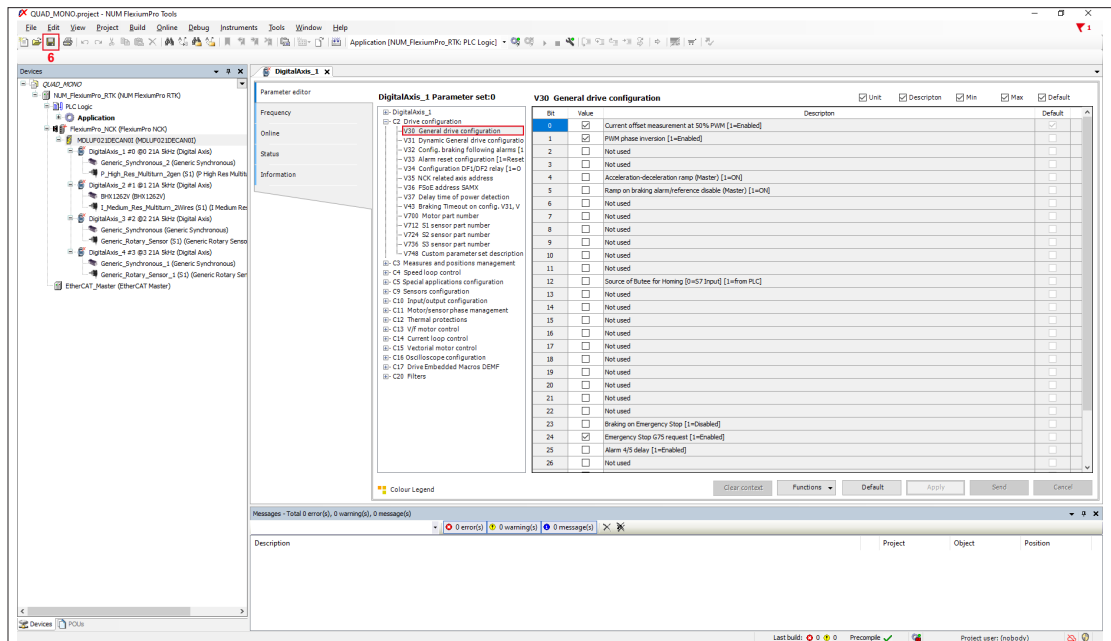


Fig. 19 - Save parameter modification PART#2

5	Now the modified parameters are indicated in green icons as in the figure.
6	Click on → “Save icon” to save the modification and the saved parameters will appear as grey icons as in the figure.

2.5.3 Parameters modification

Example with V301 parameter

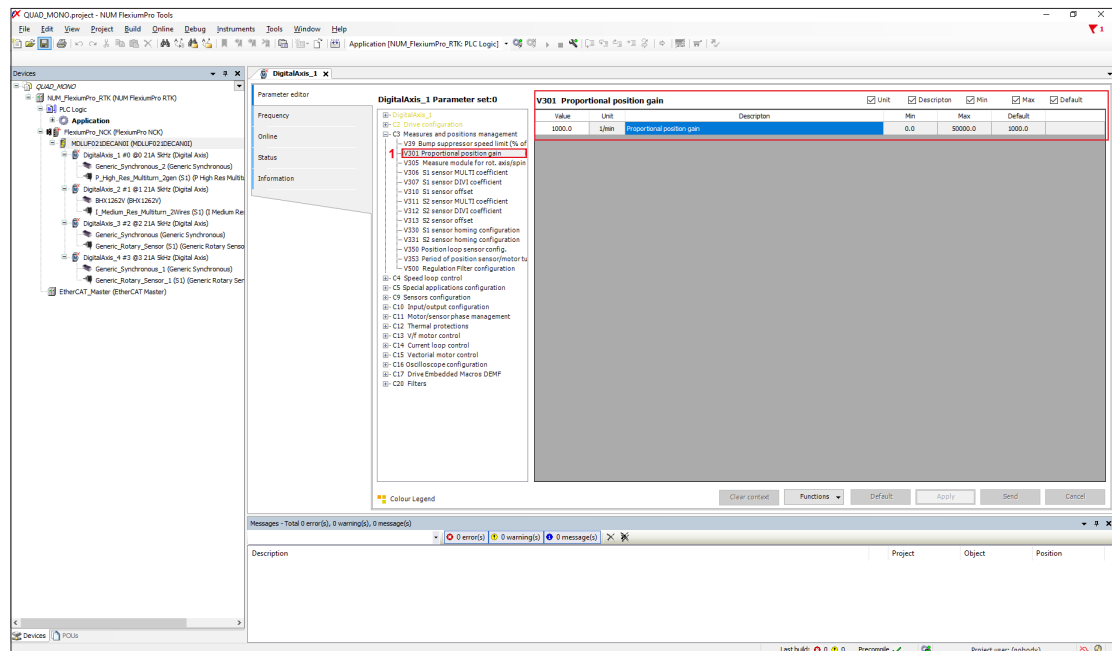


Fig. 20 - V301 parameter modification PART#1

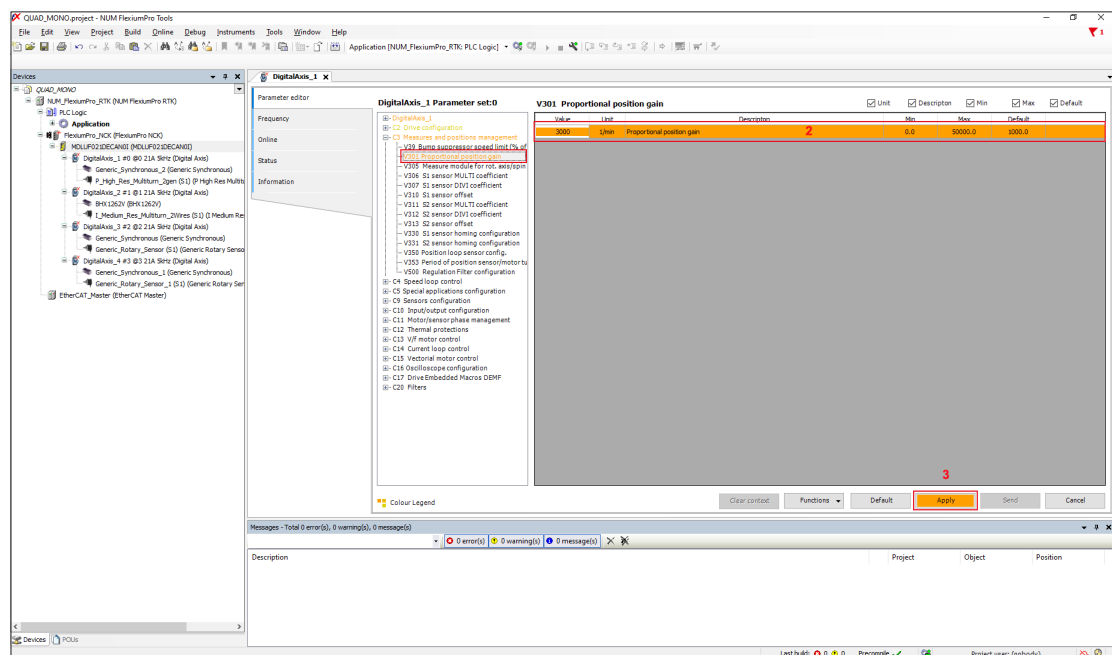


Fig. 21 - V301 parameter modification PART#2

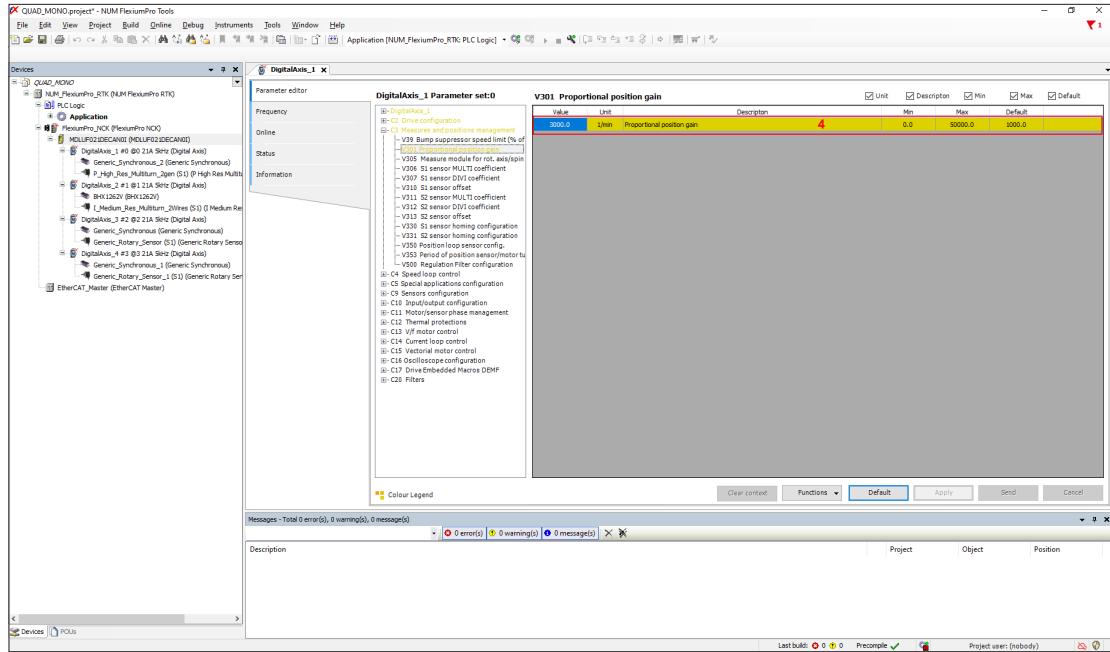


Fig. 22 - V301 parameter modification PART#3

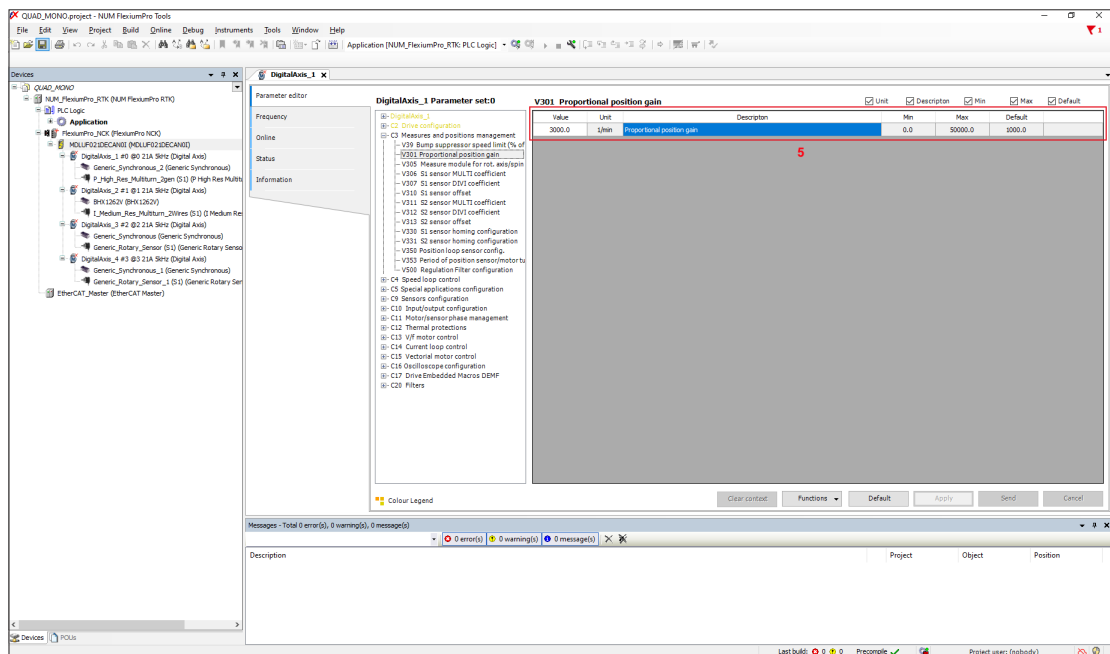


Fig. 23 - V301 parameter modification PART#4

1	Select "Parameter editor", then double click on → "Measures and Positions management" then click on → "V301" to open the parameter.
2	Click on → "Value blue area" to change the parameter value, enter the new value then press ENTER. Now the selected area will be indicated in orange icons as in the figure.
3	Click on "Apply" to set the modification.
4	Now the parameter selected will be indicated in green icons as in the figure.
5	Click on → "Save icon" to save the modification and the saved parameter will appear as grey icons as in the figure.

Example with V25 parameter (Input / Output configuration)

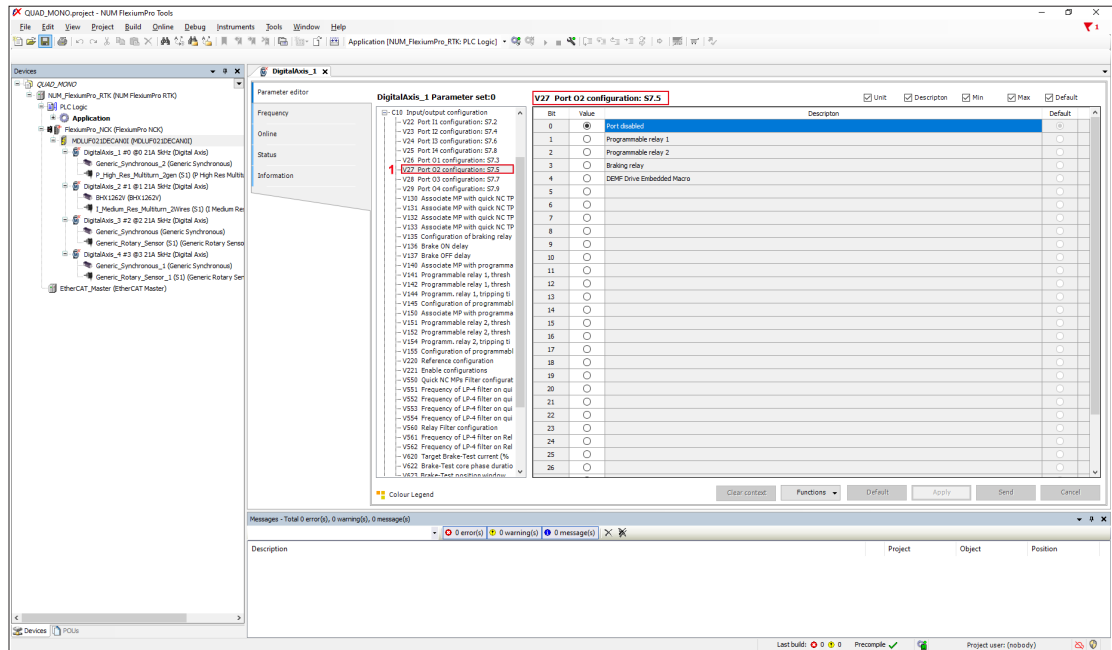


Fig. 24 - V25 parameter modification Output configuration PART#1

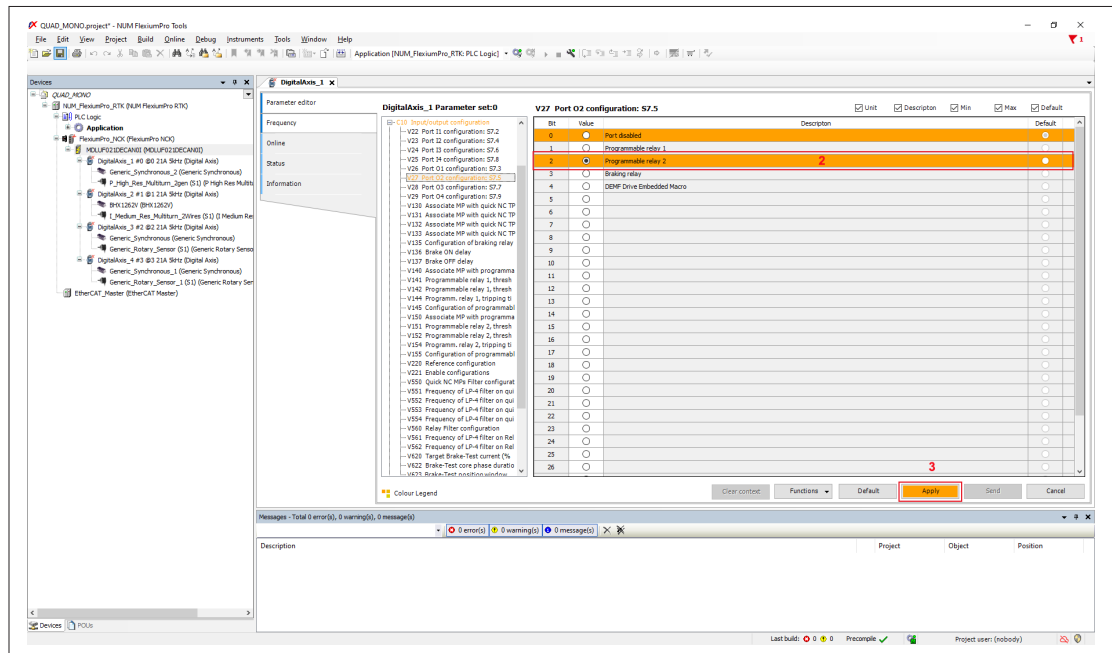


Fig. 25 - V25 parameter modification Output configuration PART#2

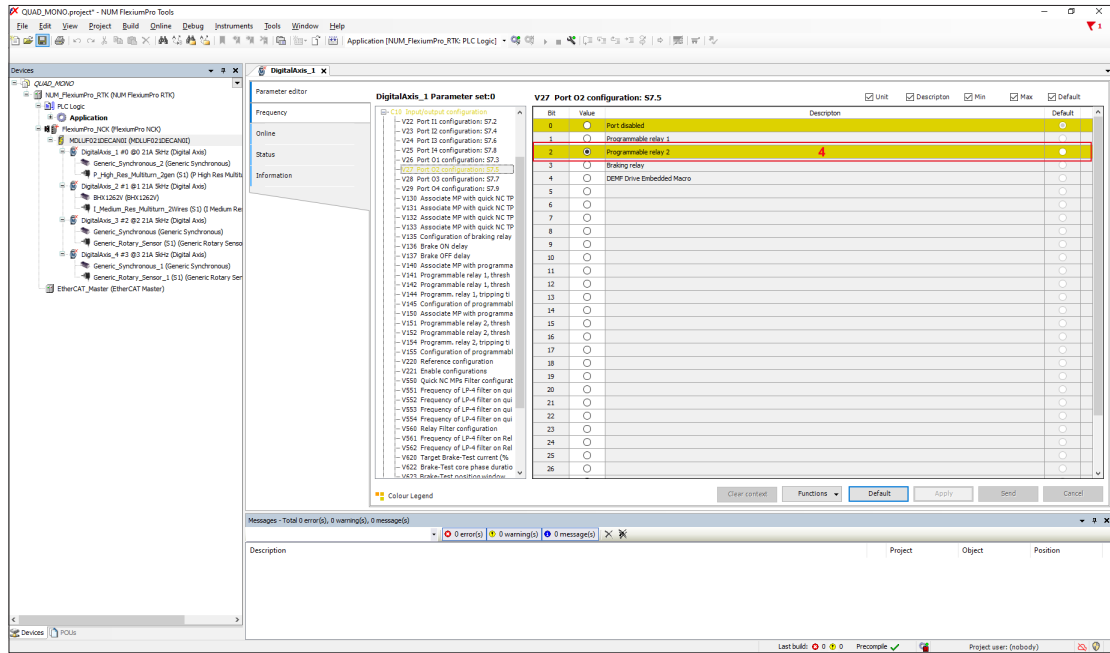


Fig. 26 - V25 parameter modification Output configuration PART#3

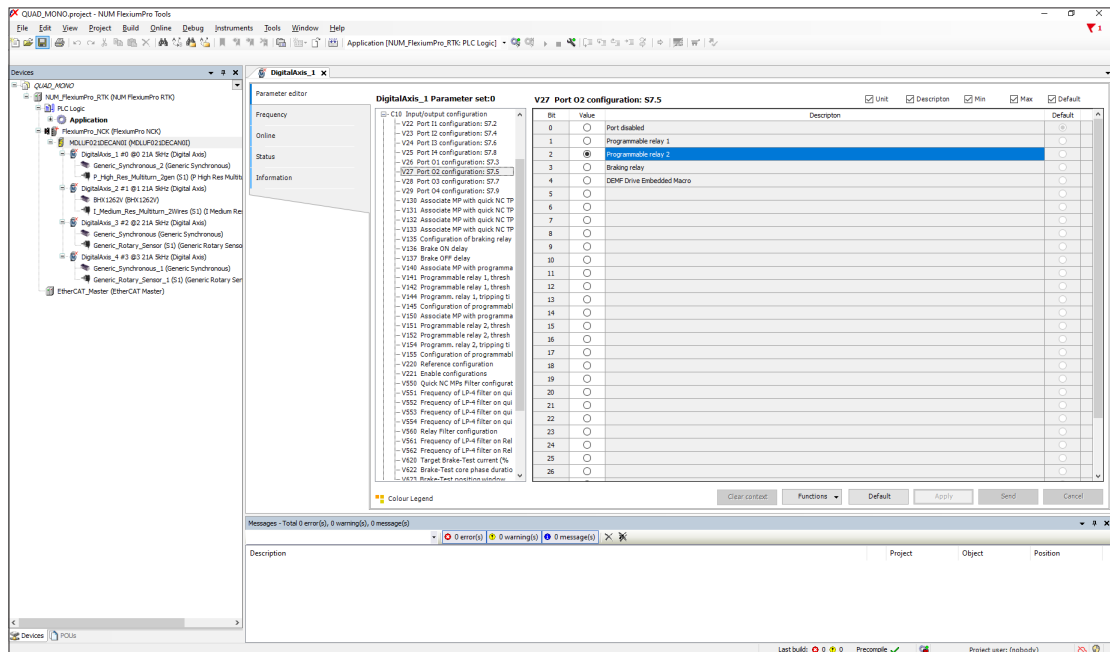


Fig. 27 - V25 parameter modification Output configuration PART#4

1	Select "Parameter editor", then double click on → "C10 (Input/output configuration)" then click on → "V25" to open the parameter.
2	Click on → "Radio button" to change the parameter value. Now the selected area will be indicated in orange icons as in the figure.
3	Click on "Apply" to set the modification.
4	Now the parameter selected will be indicated in green icons as in the figure. .
5	Click on → "Save icon" to save the modification and the saved parameter will appear as grey icons as in the figure.

In this page is possible to display and make the drive measure point (MP) to test point (TP) association. The system provide 4 test points (TP). Please refer to chapter 4 for more detailed information.

Example with MP001 (Mechanical motor speed) associated to TP1

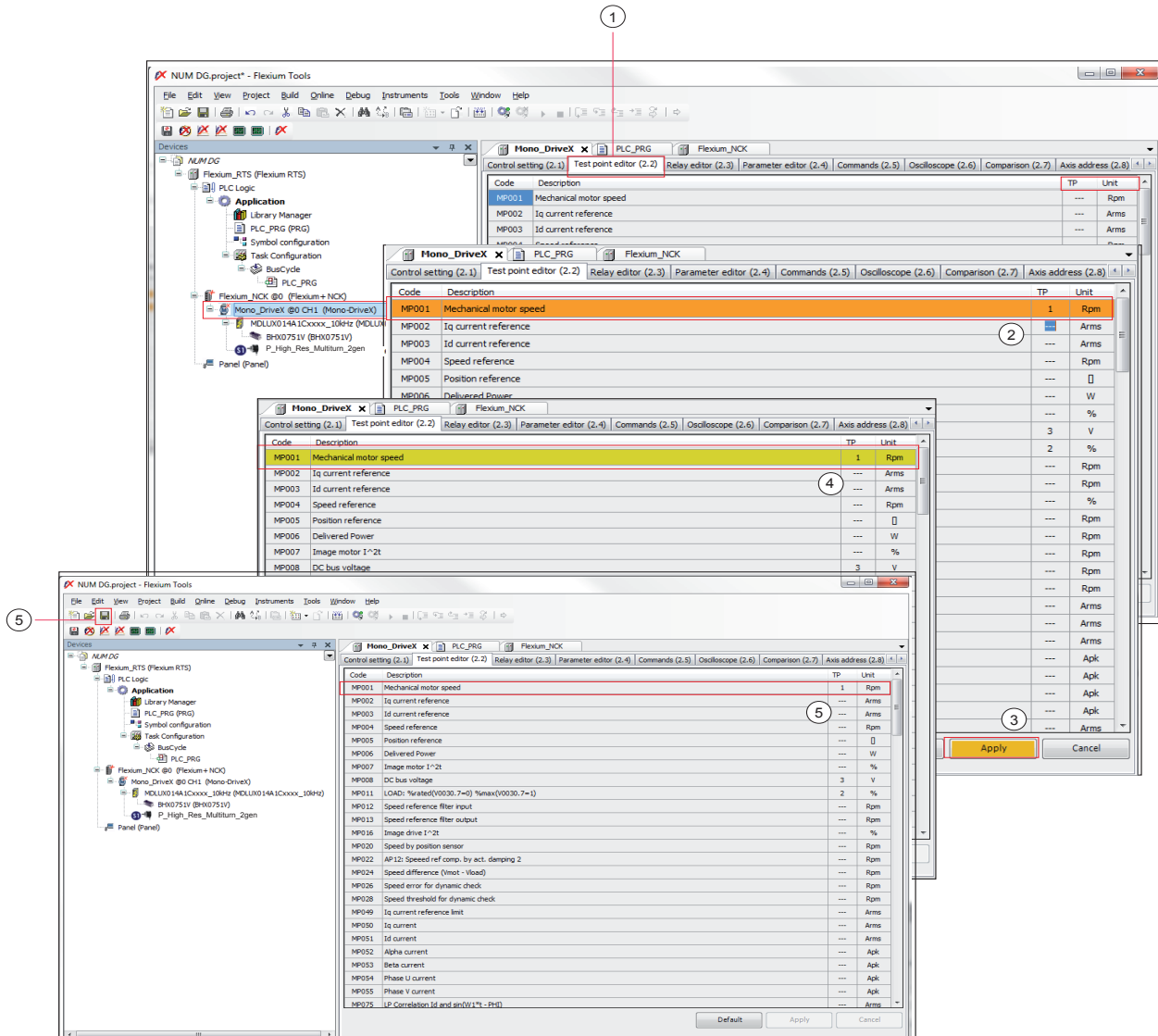


Fig. 28 - Drive test point (TP)

①	Double click on → "Mono_DriveX @0 CH1 (Mono-DriveX)". Click on → "Test point editor" tabbed window to open the drive Measure point / Test point page.
②	Select TP then insert "1" associated to M0001 and press ENTER. Now the selected area will be indicated in orange icons as in the figure.
③	Click on → "Apply" to set the modification.
④	Now the MP001 associated to TP1 will be indicated in green icons as in the figure.
⑤	Click on → "Save icon" to save the modification and the saved parameter will appear as grey icons as in the figure.

2.5.4 Functions setting

In this page is possible to make the setting of the these functions:

- Position loop control “P”
- Filter on speed reference “filter”
- Speed loop controller - Synchronous motor “PI”
- Filter on torque reference “filter +”
- Filter on the speed feedback “filter +”
- MULTI/DIVI “Wizard”.

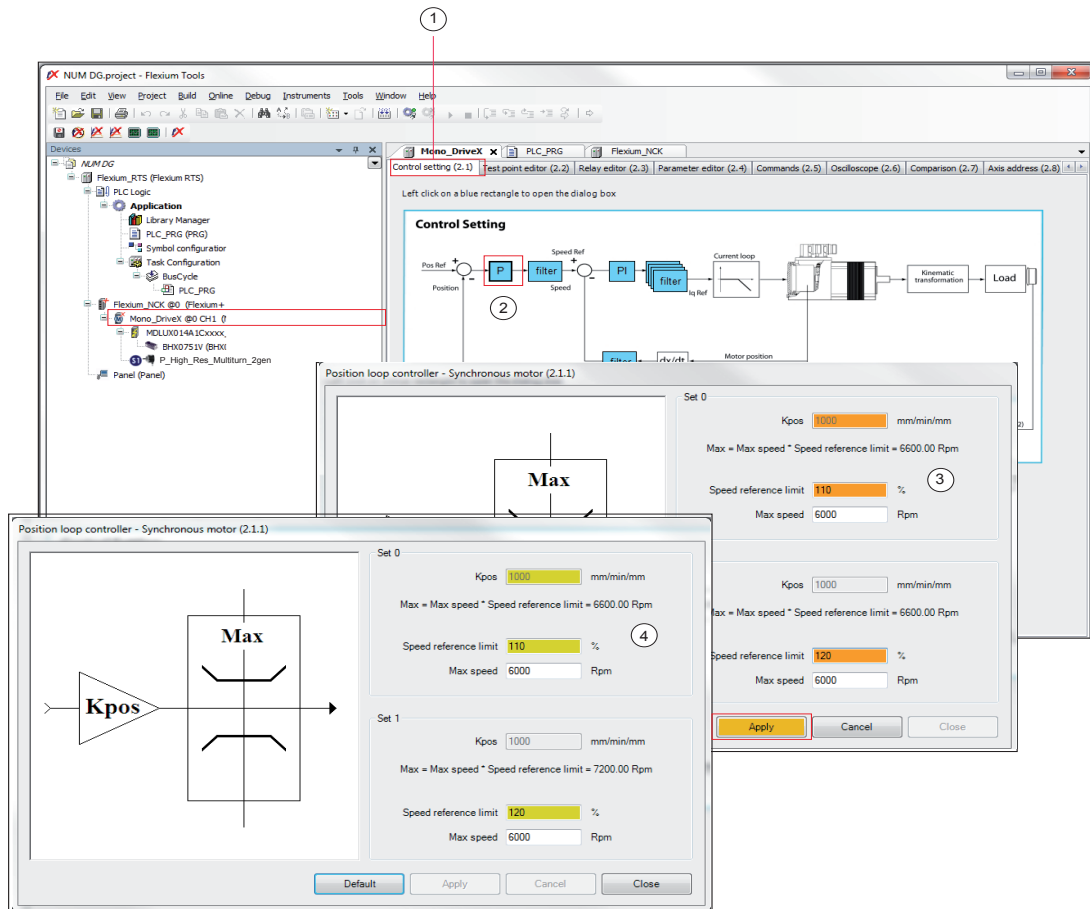


Fig. 29 - Position loop controller “P”

①	Double click on → “Mono_DriveX @0 CH1 (Mono-DriveX)”. Click on → “Control setting” tabbed window to open the main page.
②	Click on → “P” to open the Position loop control page.
③	Click on → tabbed window and insert the new values. Now the selected area will be indicated in orange icons as in the figure. Click on → “Apply” to set the modification. Now the selected area will be indicated in green icons as in the figure.
④	Click on → “Close” to close the window. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

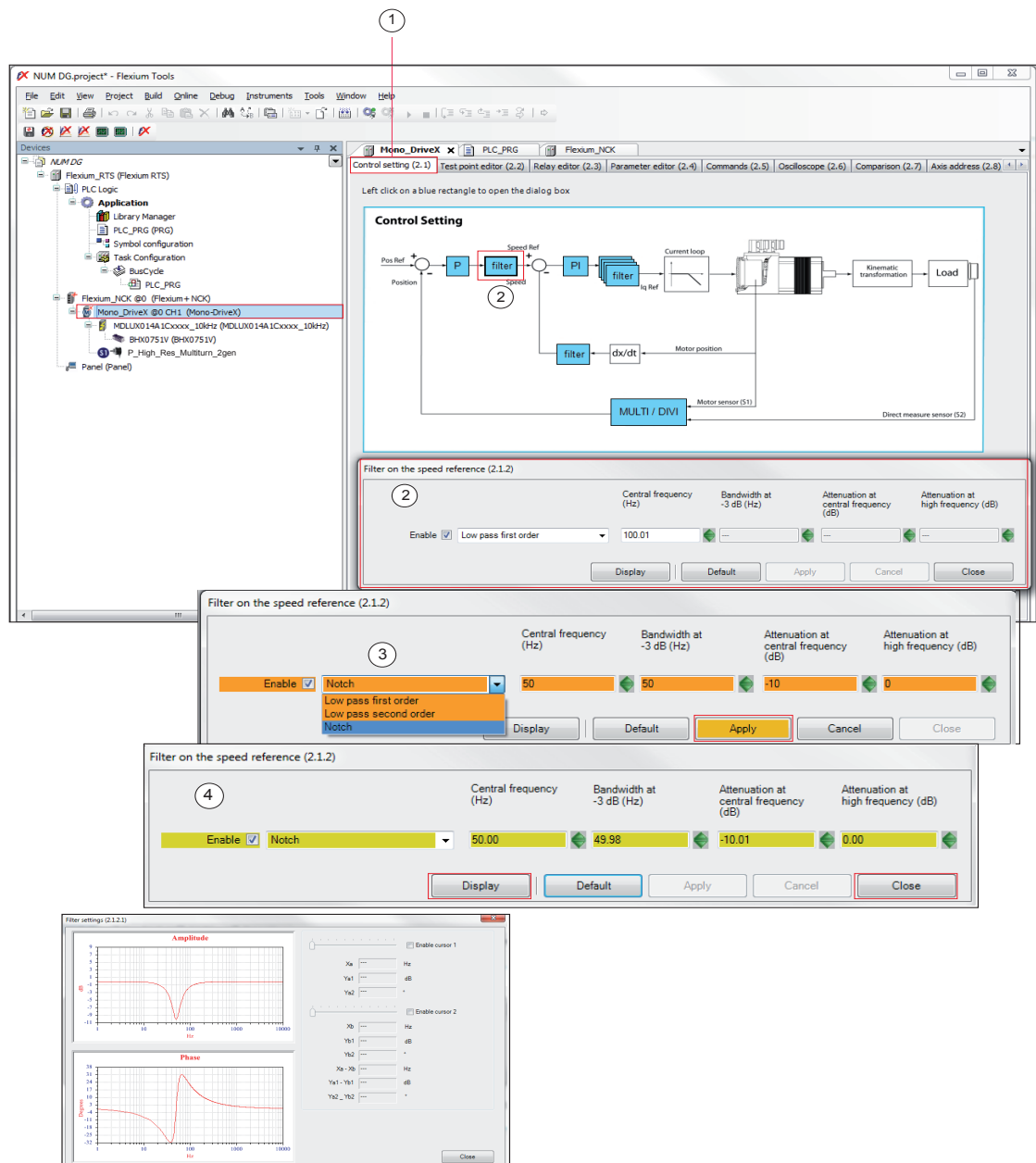


Fig. 30 - Filter setting

①	Double click on → “Mono_DriveX @0 CH1 (Mono-DriveX)”. Click on → “Control setting” tabbed window to open the main page.
②	Click on → “filter” to open the Filter on speed reference page.
③	Click on → tabbed window, select the type of filter, then insert the new values. Now the selected area will be indicated in orange icons as in the figure.
④	Click on → “Apply” to set the modification. Now the selected area will be indicated in green icons as in the figure.
⑤	Click on → “Display” to visualize the filter into graphic form. Click on → “Close” to close the window. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

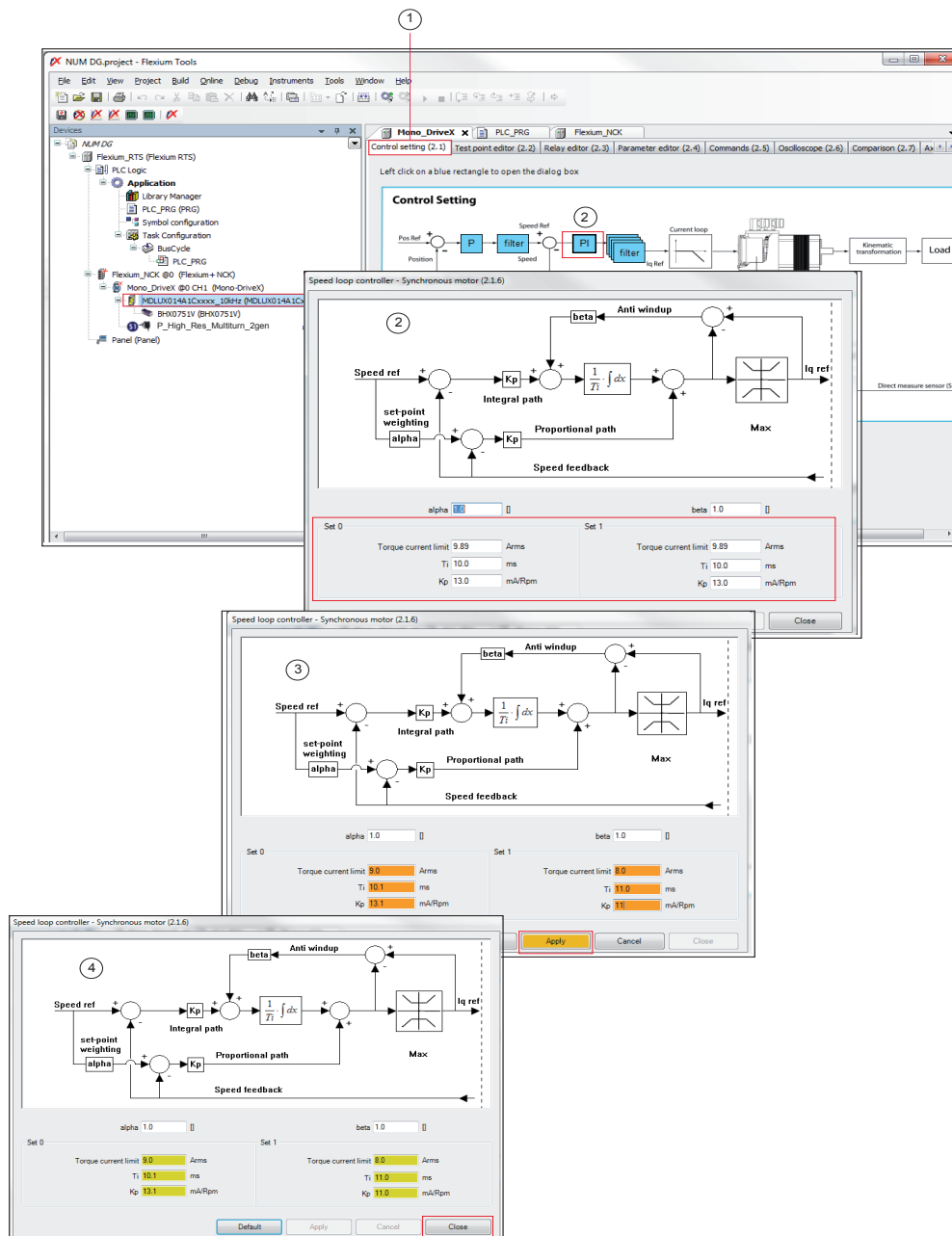


Fig. 31 - Position loop controller "PI"

①	Double click on → "Mono_DriveX @0 CH1 (Mono-DriveX)". Click on → "Control setting" tabbed window to open the main page.
②	Click on → "Speed loop controller" to open the main page.
③	Click on → the window, then insert the new values. Now the selected area will be indicated in orange icons as in the figure. Click on → "Apply" to set the modification. Now the selected area will be indicated in green icons as in the figure.
④	Click on → "Close" to close the window. Click on → "Save icon" to save the modification and the saved values will appear as grey icons.



①	Double click on → “Mono_DriveX @0 CH1 (Mono-DriveX)”. Click on → “Control setting” tabbed window to open the main page.
②	Click on → “filter +” to open the Filter on torque reference page.
③	Click on → tabbed window, select the type of filter (Low pass first order, Low pass second order, Notch), then insert the new values. Now the selected area will be indicated in orange icons as in the figure.
	Click on → “Apply” to set the modification. Now the selected area will be indicated in green icons as in the figure.
④	Click on → “Display” to visualize the filter selected by tabbed window into graphic form. Click on → “Close” to close the window. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

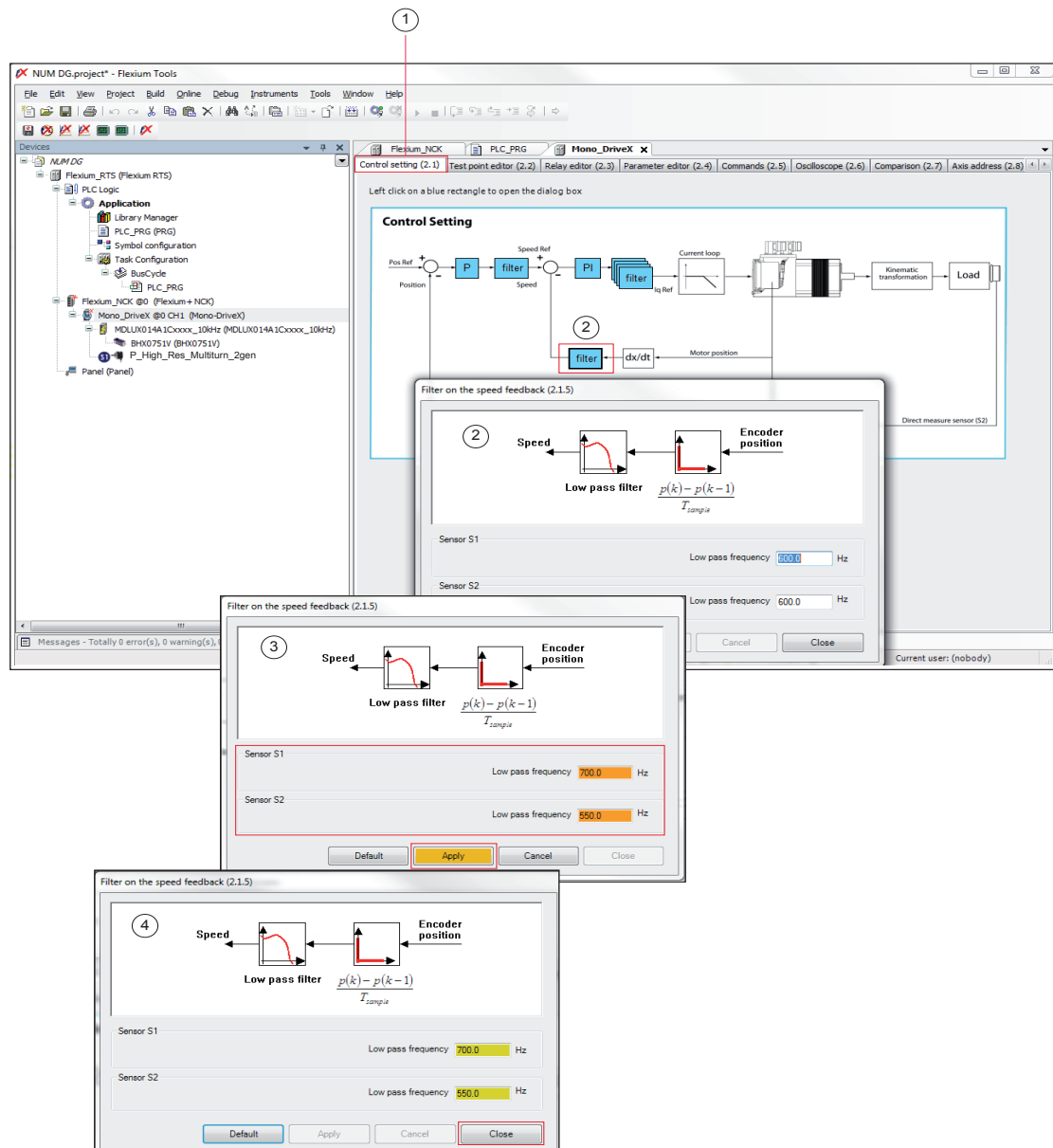


Fig. 33 - Filter on speed feedback

①	Double click on → "Mono_DriveX @0 CH1 (Mono-DriveX)". Click on → "Control setting" tabbed window to open the main page.
②	Click on → "filter" to open the Filter on speed feedback page.
③	Click on → tabbed window, then insert the new values. Now the selected area will be indicated in orange icons as in the figure. Click on → "Apply" to set the modification. Now the selected area will be indicated in green icons as in the figure.
④	Click on → "Close" to close the window. Click on → "Save icon" to save the modification and the saved values will appear as grey icons.

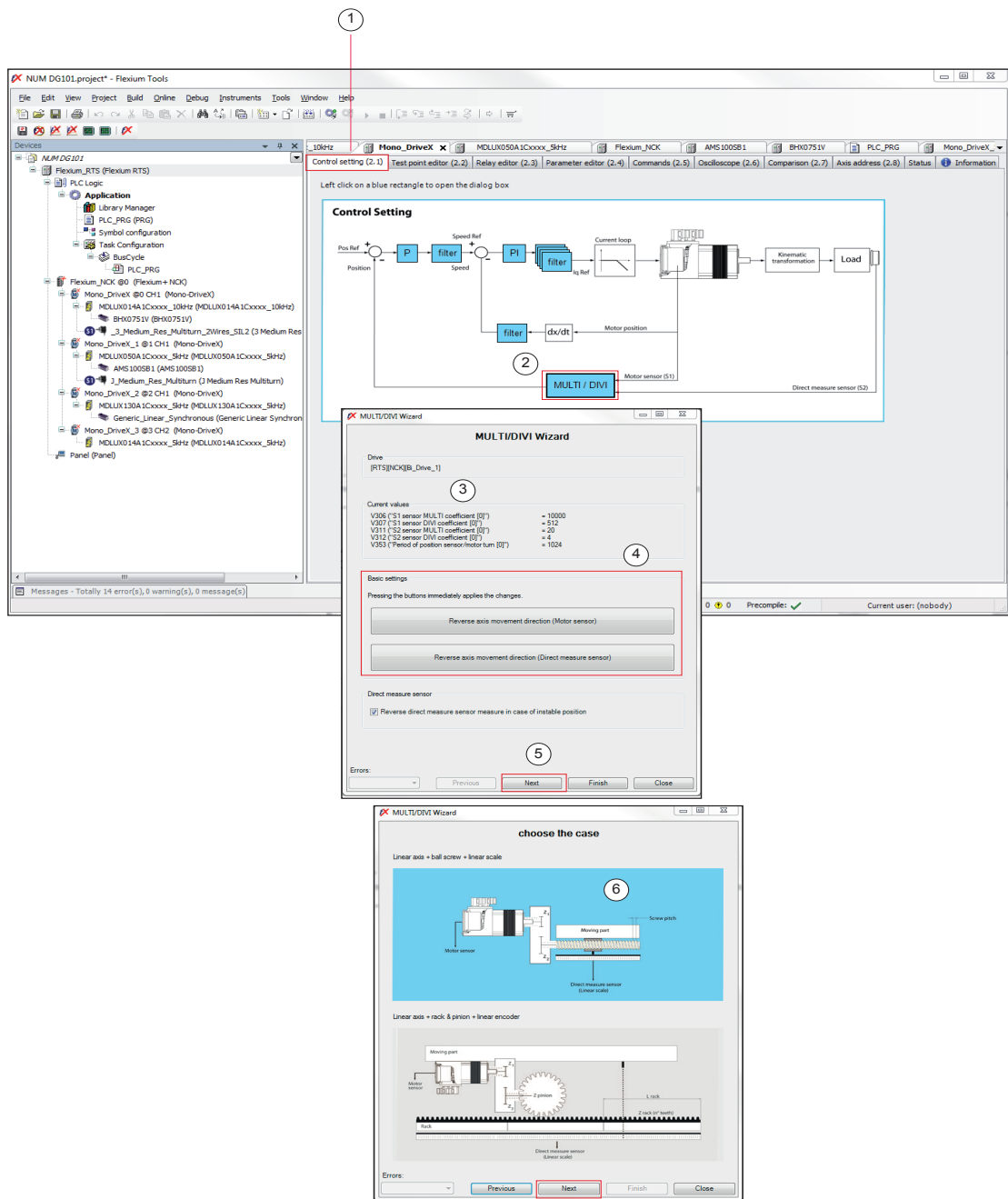


Fig. 34 - MULTI/DIVI application page

①	Click on → "Control setting" tabbed window to open the main page.
②	Click on → "MULTI/DIVI" to open the MULTI/DIVI page.
③	Current values of MULTI/DIVI and relative parameters.
④	Click on → "Reverse misure ..." in the Basic setting area to change the movement axis direction.
⑤	Click on → "Next" to open the MULTI/DIVI Wizard window.
⑥	Click on your application case → "xxxx" to open your MULTI/DIVI application page (the application appears as blue area) then press "Next" to open the Gear box area.

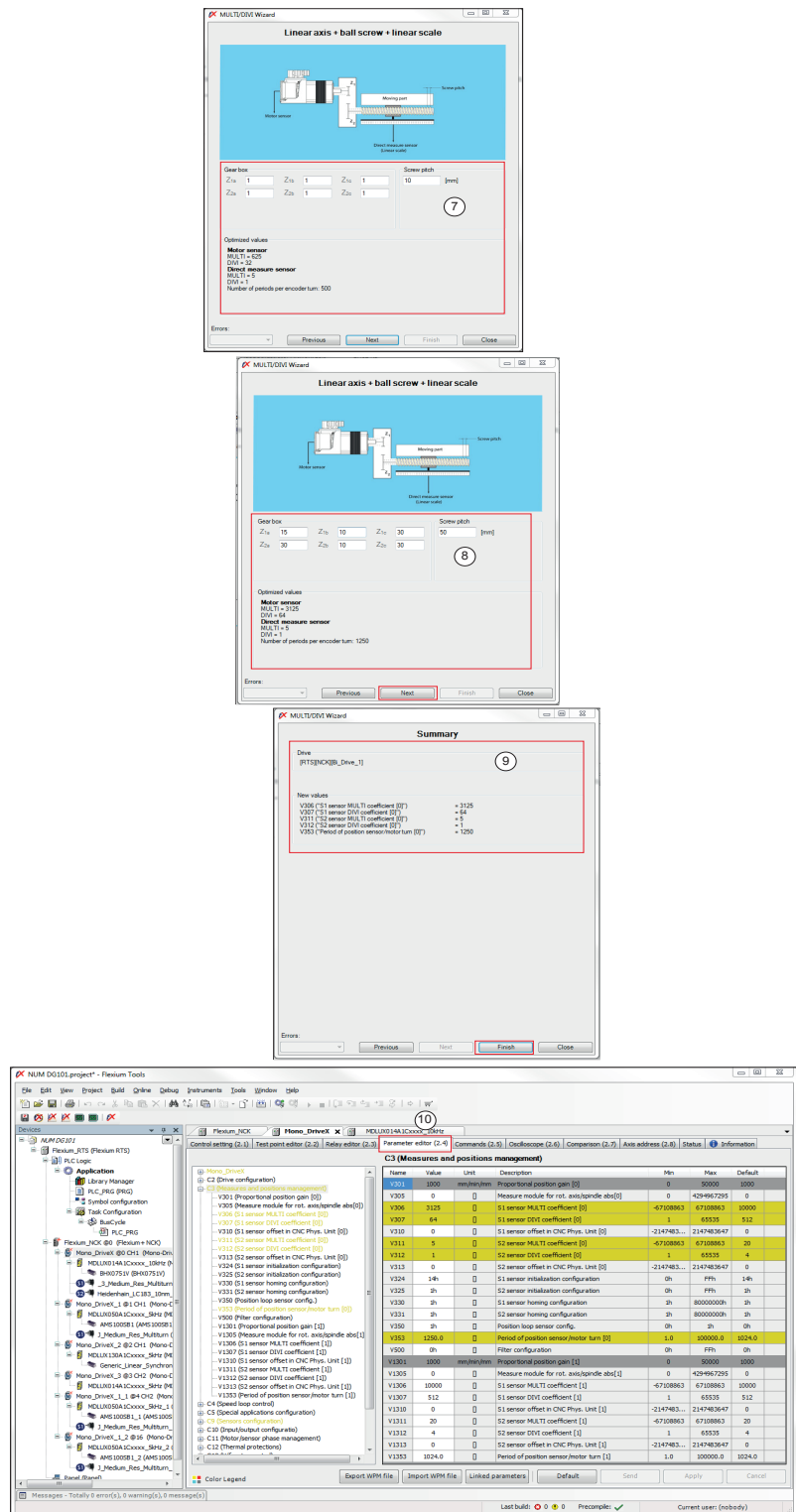


Fig. 35 - MULTI/DIVI new parameters values

7	The "Gear box" page shows the MULTI/DIVI current values.
8	Insert your application MULTI/DIVI values and automatically the "Optimized values" will appear, then click on → "Next".
9	This page shows all the MULTI/DIVI new parameters values. Click on → "Finish" to ultimate the procedure.
10	Click on → "Parameters editor" to display the new current parameter values. (The modified parameters appear as green area)

Measure point MP selection / modification (i.e. Mechanical motor speed MP001)

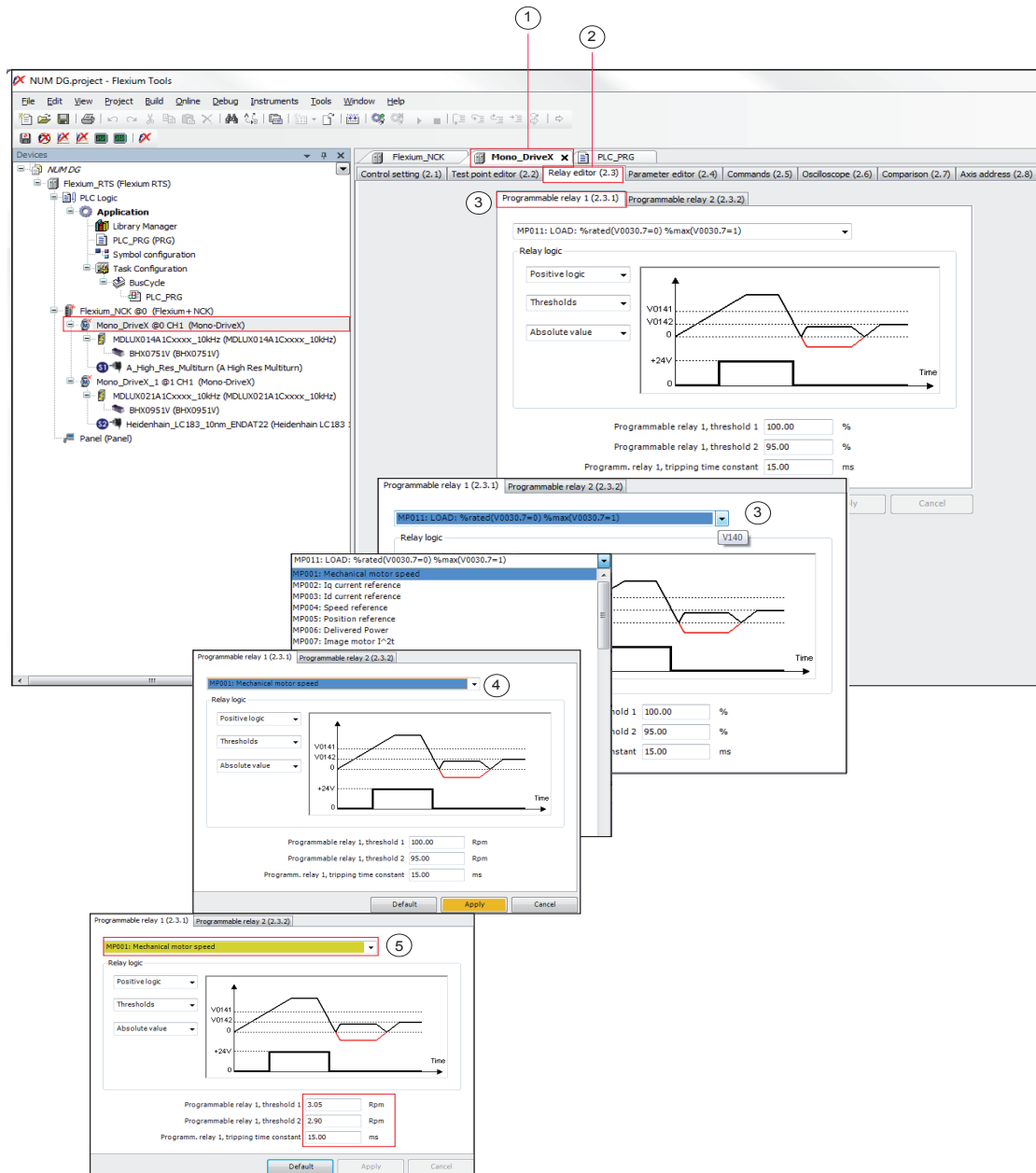


Fig. 36 - Programmable relay 1

①	Double click on → "Mono_DriveX @0 CH1 (Mono-DriveX)". Click on → "Control setting" tabbed window to open the main page.
②	Click on → "Relay editor" to open the Programmable relay 1 or 2 main page, then click on → "Programmable relay 1".
③	Click on → tabbed window which show all the available measure points MP and make MP001 selection (even the related V140 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
④	Click on → "Apply" to set the modification. Now the selected area will be indicated in green icons as in the figure.
⑤	Now the selected area will be indicated in green icons as in the figure and all the new MP001 value and scale will appear. Click on → "Save icon" to save the modification and the saved values will appear as grey icons.

Relay logic selection: i.e. Positive logic

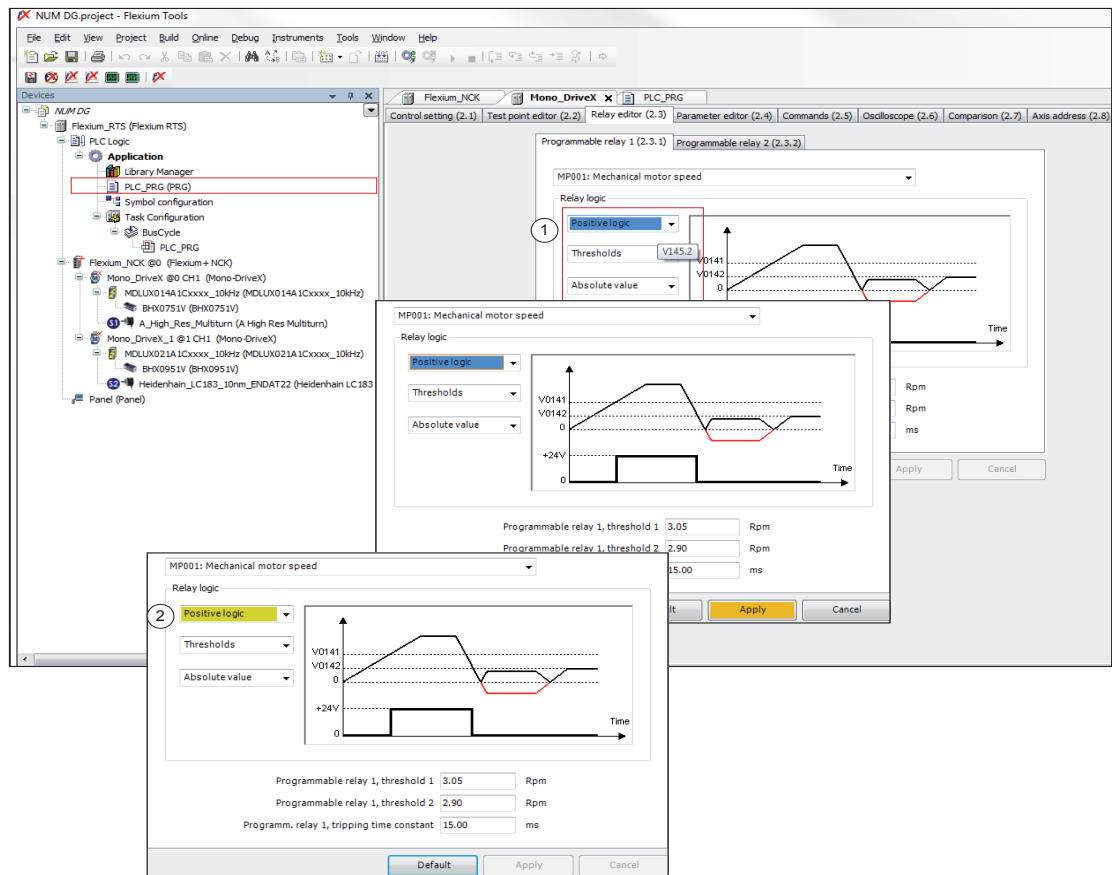


Fig. 37 - Modification and save value of positive logic relay

①	Click on → tabbed window "Positive logic" (even the related V145.2 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → "Apply" to set the modification. Now the selected area will be indicated in green icons as in the figure.
③	Click on → "Save icon" to save the modification and the saved values will appear as grey icons.

Relay logic selection: i.e. Bands

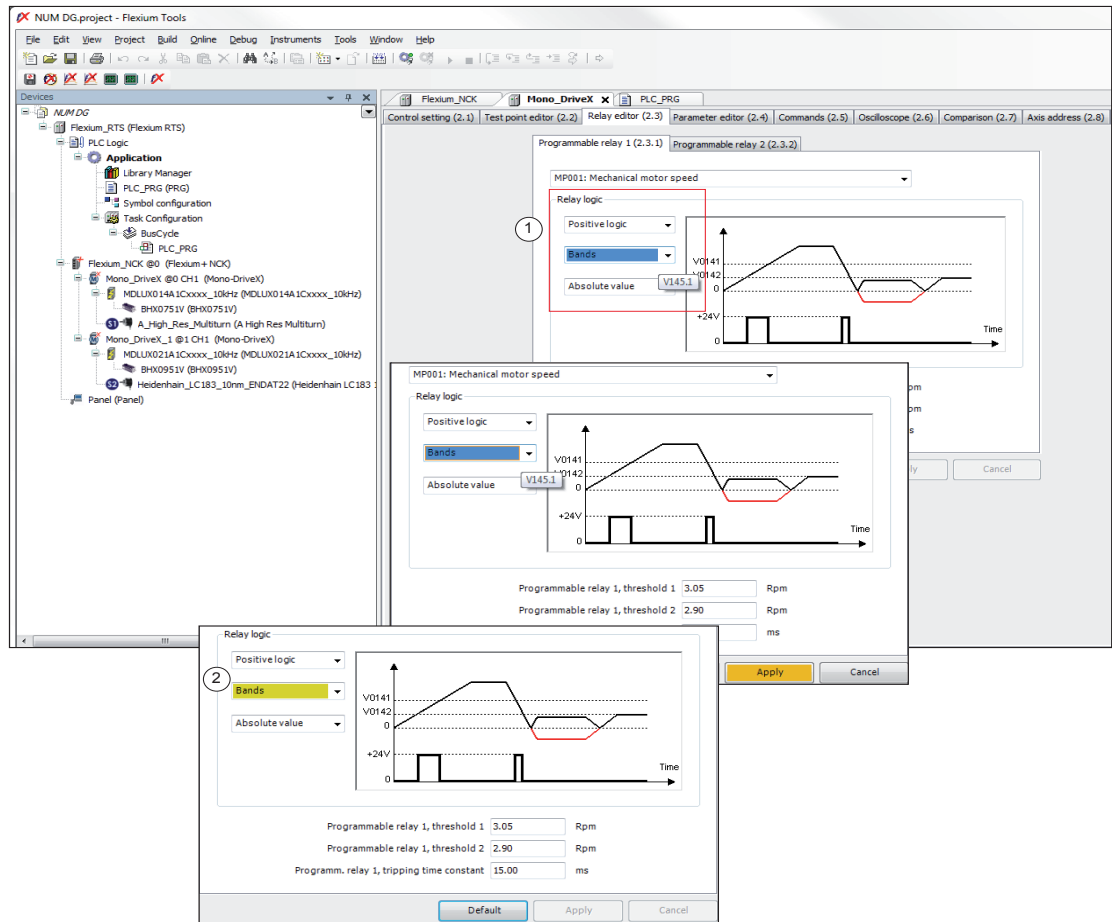


Fig. 38 - Modification and save value of the bands relay

①	Click on → tabbed window “Bands” (even the related V145.1 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → “Apply” to set the modification. Now the selected area will be indicated in green icons as in the figure.
③	Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

Relay logic selection: i.e. Absolute value

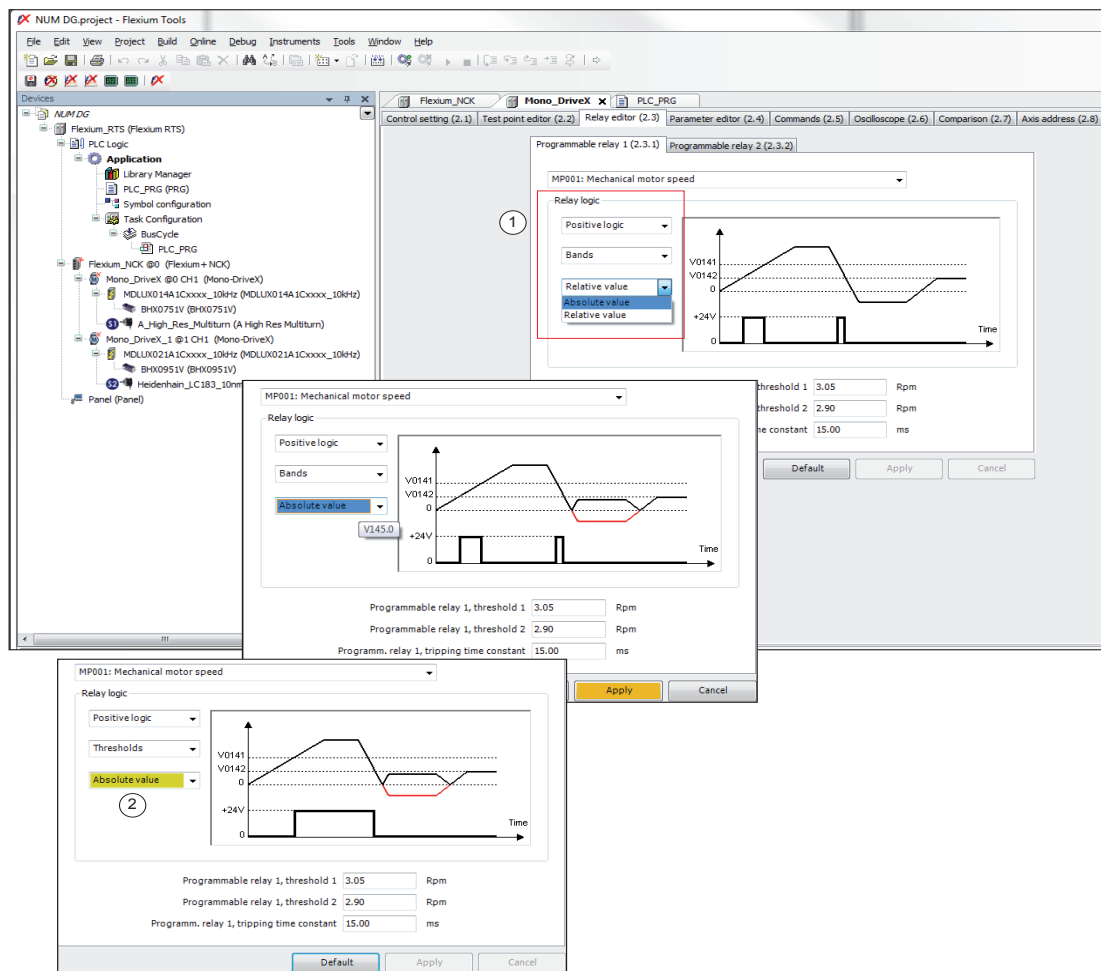


Fig. 39 - Modification and save absolute value of the logic relay

①	Click on → tabbed window “Absolute” (even the related V145.0 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → “Apply” to set the modification. Now the selected area will be indicated in green icons as in the figure.
③	Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

Thresholds selection: Programmable relay 1, threshold 1

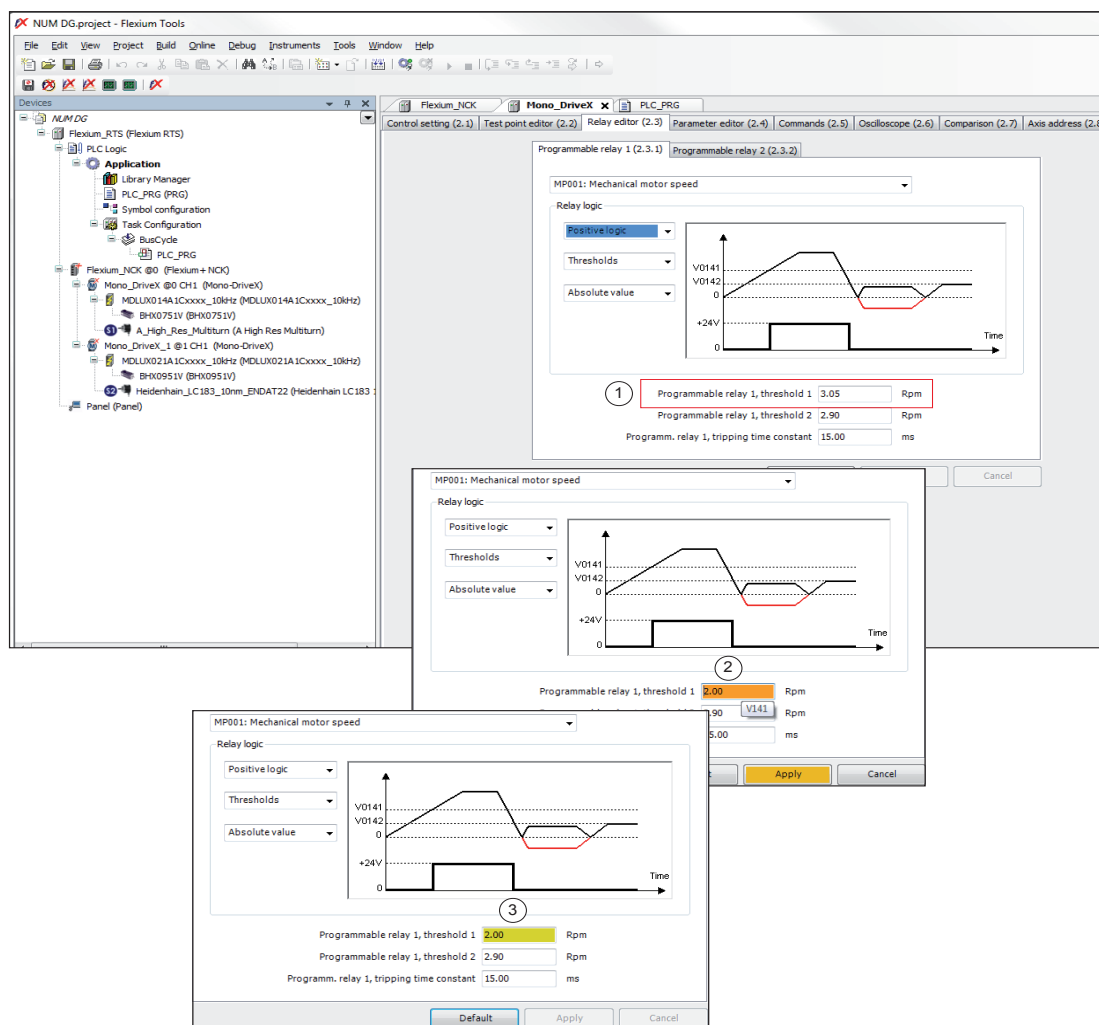


Fig. 40 - Inserting new values of programmable relay 1, threshold 1

①	Click on → tabbed window “Programmable relay 1, threshold 1” insert the new value then press ENTER. (even the related V141 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → “Apply” to set the modification.
③	Now the selected area will be indicated in green icons as in the figure. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

Thresholds selection: Programmable relay 1, threshold 2

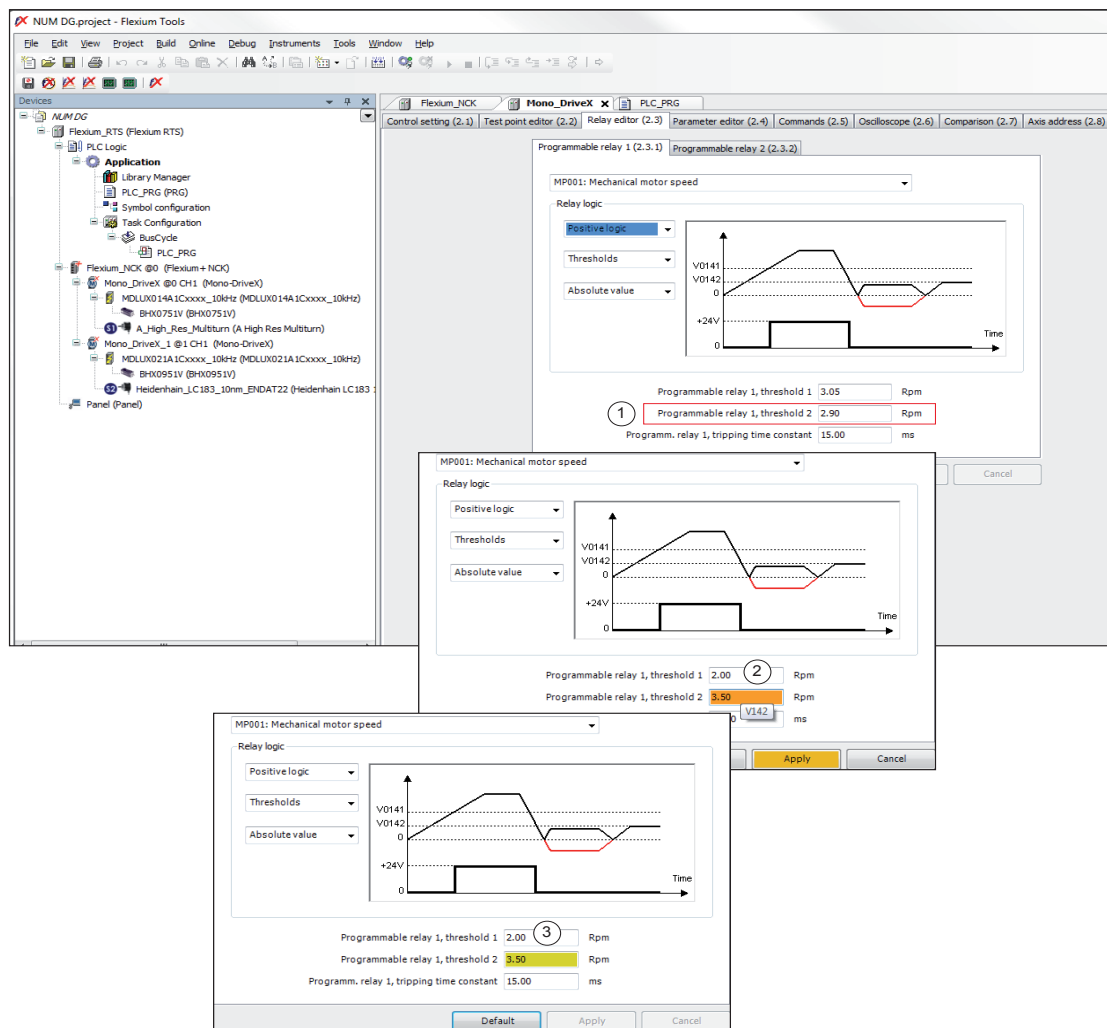


Fig. 41 - Inserting new values of programmable relay 1, threshold 2

①	Click on → tabbed window “Programmable relay 1, threshold 2” insert the new value then press ENTER. (even the related V142 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → “Apply” to set the modification.
③	Now the selected area will be indicated in green icons as in the figure. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

Tripping time constant selection: Programmable relay 1, tripping time constant

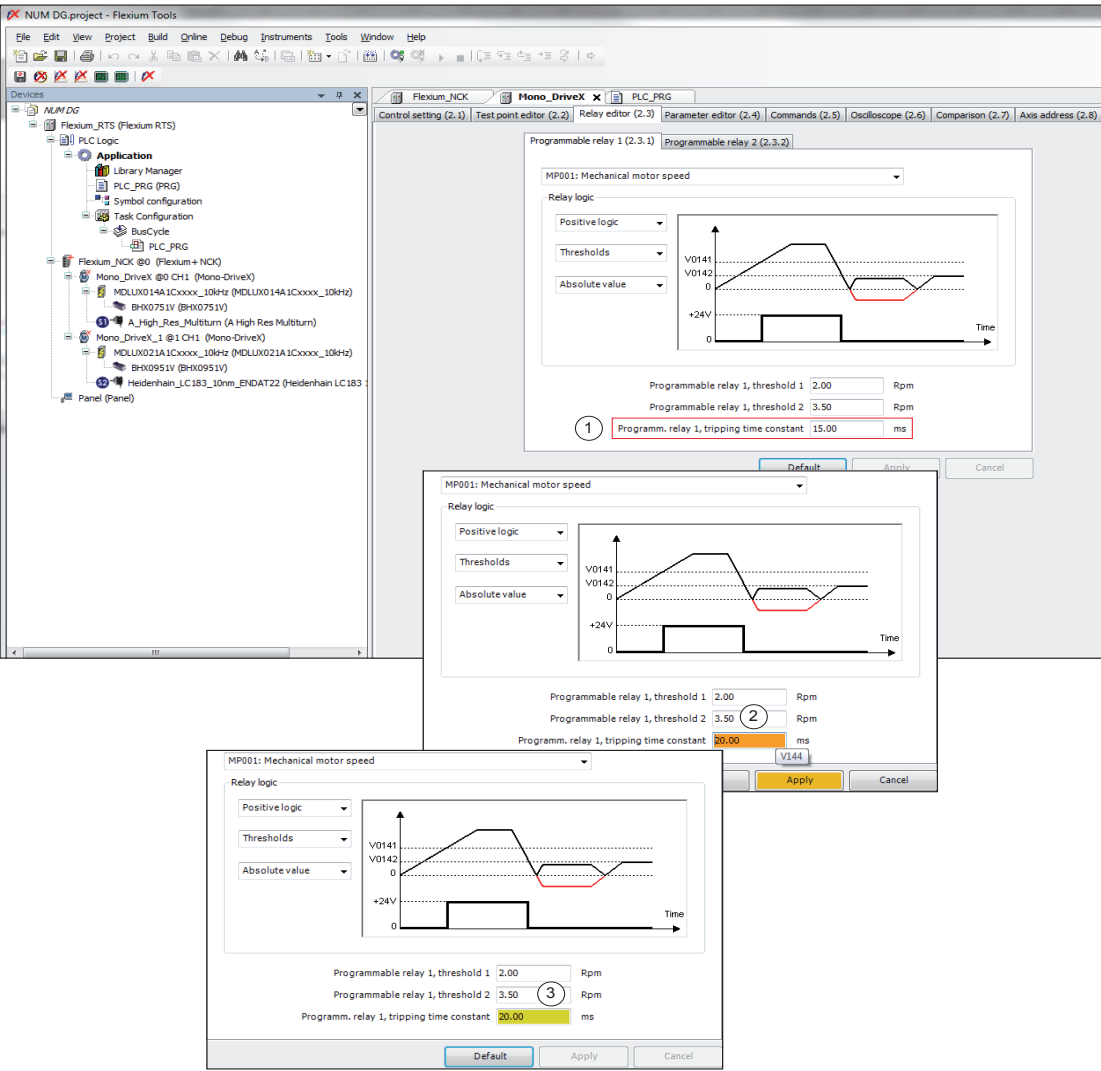


Fig. 42 - Inserting new values of tripping time constant

①	Click on → tabbed window “Programm relay 1, tripping time constant” insert the new value then press Enter. (even the related V144 parameter number will appear). Now the selected area will be indicated in orange icons as in the figure.
②	Click on → “Apply” to set the modification.
③	Now the selected area will be indicated in green icons as in the figure. Click on → “Save icon” to save the modification and the saved values will appear as grey icons.

2.5.5 Oscilloscope general example

Oscilloscope configuration

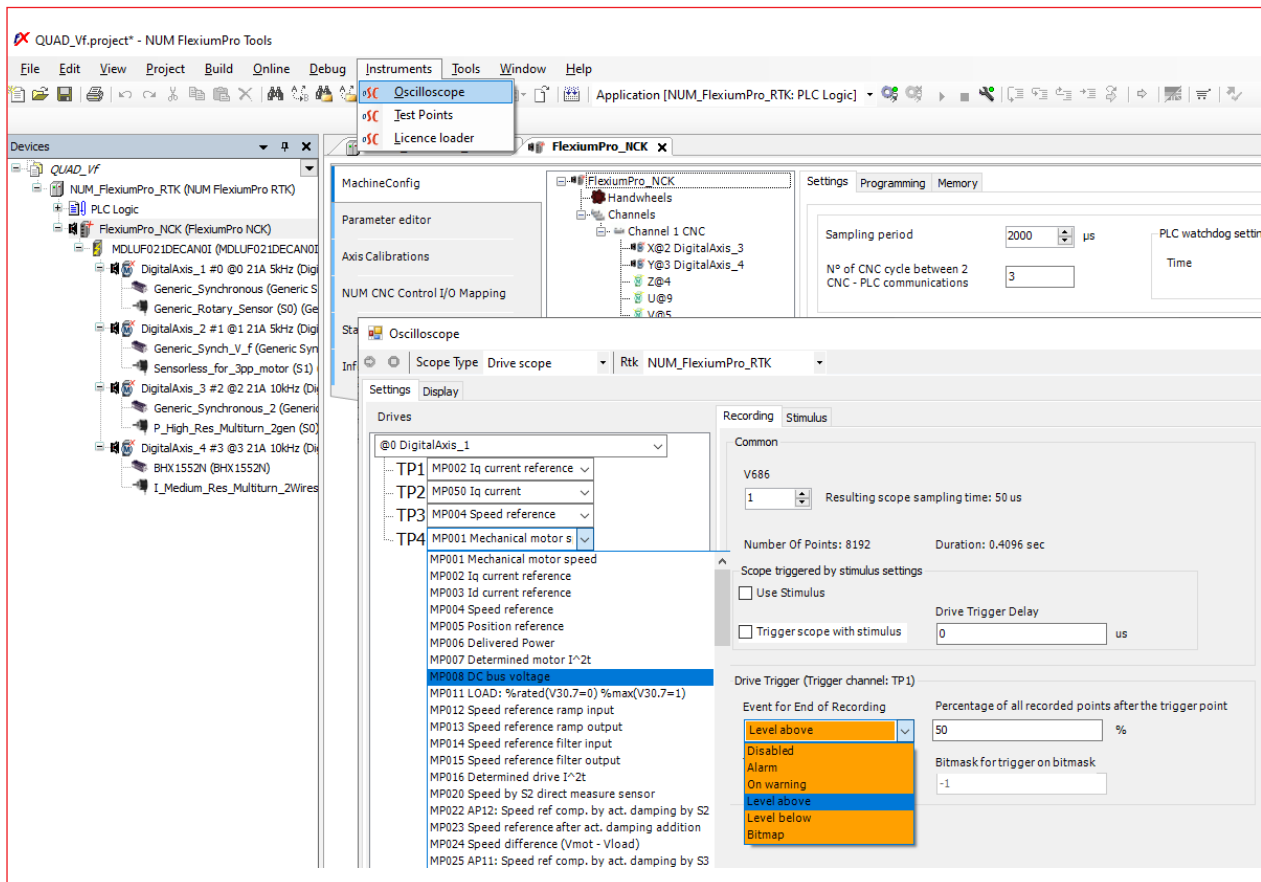


Fig. 44 - Oscilloscope configuration

①	Double click on → “Instruments” --> “Oscilloscope” function.
②	Chose “Drive” to be checked, and 4 measure points (TP1..4) the process data configuration.
③	Click on → “Measure point trace 1 / 2” tabbed window, then select the measure points to be processed.
④	Click on → “Event for End of Recording” tabbed window and make the event of end recording selection. Now enter the “Threshold” and “Percentage of all recorded points after the trigger point”.
⑤	Click on → “Send” to send the process data setting in the drive.
⑥	Click on → “Read settings from the drive” to reproduce a previously saved setting.
⑦	Click on → “Save settings” or “Load settings” to Save or Load a setting.



NOTE

It possible to configure the oscilloscope star after each Halt / Run transition by means V680 bit 0 = 1.

Record the oscilloscope data

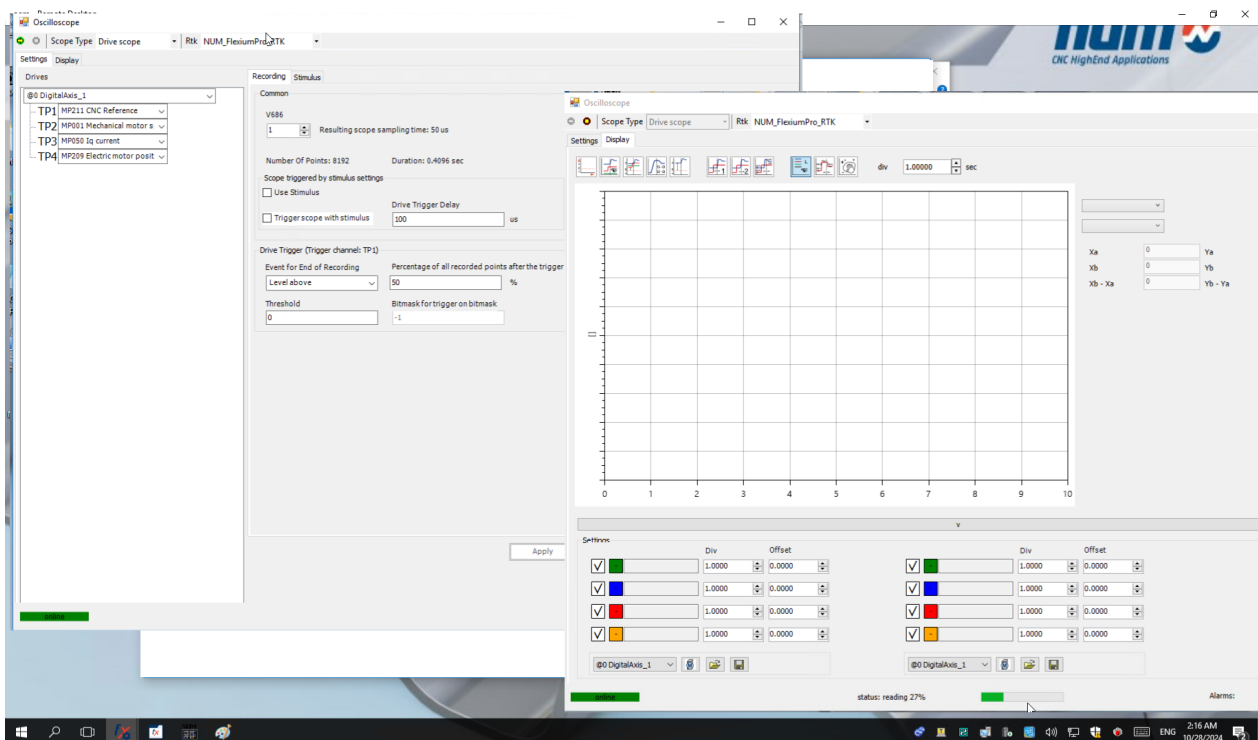


Fig. 45 - Recording oscilloscope data process

8	Click on → “Record ” to start the settings recording data.
9	Waiting the process recording data.

Load / Save and setting the trace

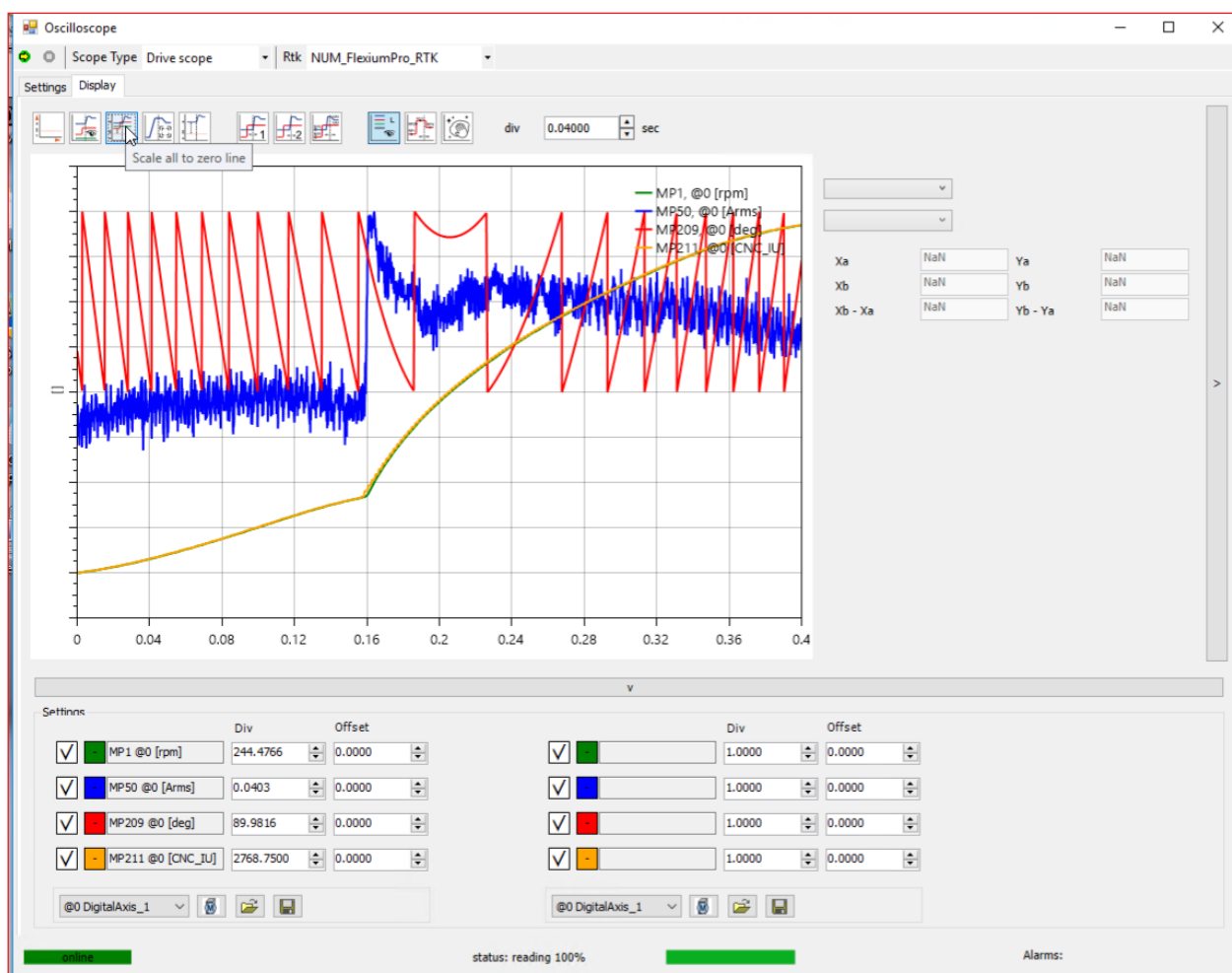


Fig. 46 - Load and Save the trace from different areas

10	Click on → “Display” to open the visualization page.
11	Click on → “CH1, CH2”, “CH3, CH4” → “From drive”, “From file”, “Save trace” commands to load / save the setting event visualization from different areas. (i.e. directly from your drive or from your folder as for a previous saved setting)
12	Click on → tick box (✓) “X” box on the Setting area and to make the trace visualization selection.
13	Click on → “Common” area → “Show info” to give more information, “Cancel trace” to delete a trace. Click on → tick box (✓) “Show legend” to display the measure point associated to the trace. Click on → tick box (✓) “Show data point” to display the trace sampling data points.

Setting the Zoom and Cursor

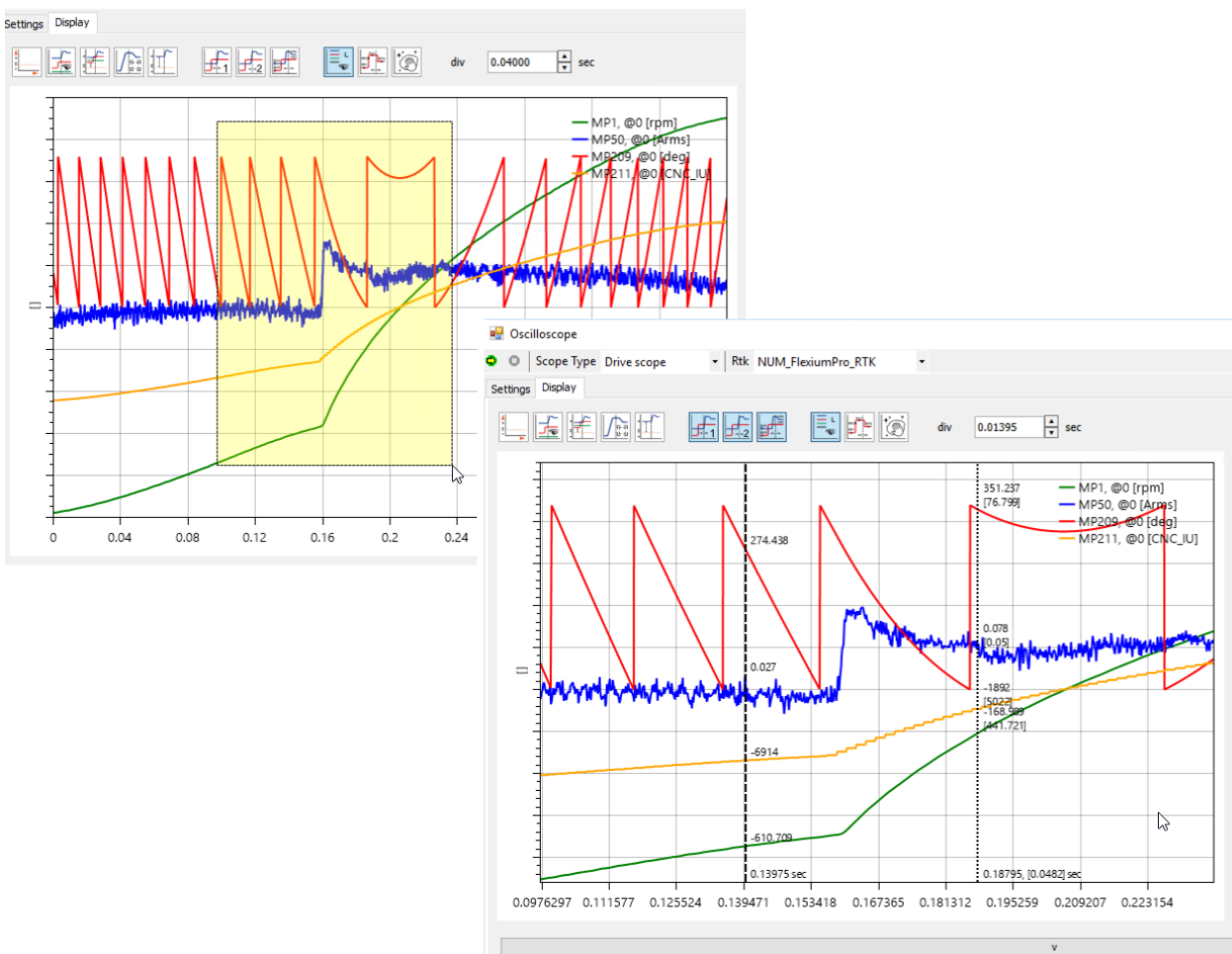


Fig. 47 - Cursor setting

14	"Zoom in" area: Select → with the mouse the zoom area desired.
15	"Zoom in" area selected. Click on → "Zoom out" to enable the zoom out selection.
16	Click on → "Cursor" area → "Cursor 1 or 2 on line" to enable the cursors over the oscilloscope page.

Page deliberately empty

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3 NUM DrivePro Mono Axis, Bi-Axes and Quad-Axes parameters

3.1 Parameters list

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V20		Sensor S1 (motor) connector assignment	□	AM	SM	LM
	0	Not assigned				
	1	Assigned to P1				
	2	Assigned to P2				
	3	Assigned to P3				
	4	Assigned to P4				
	5	Assigned to P5 (max 300 kHz)				
	6	Assigned to P6 (max 300 kHz)				
	7	Assigned to P7 (max 100 kHz)				
	8	Assigned to P8 (max 70 kHz)				
V21		Sensor S2 (direct measure) connector assignment	□	AM	SM	LM
	0	Not assigned				
	1	Assigned to P1				
	2	Assigned to P2				
	3	Assigned to P3				
	4	Assigned to P4				
	5	Assigned to P5 (max 300 kHz)				
	6	Assigned to P6 (max 300 kHz)				
	7	Assigned to P7 (max 100 kHz)				
	8	Assigned to P8 (max 70 kHz)				
V22		Port I1 configuration: S7.2	□	AM	SM	LM
	0	Port disabled				
	1	Homing switch				
	2	Torque enable				
	3	Reference enable				
	4	PWM enable				
V23		Port I2 configuration: S7.4	□	AM	SM	LM
	0	Port disabled				
	1	Homing switch				
	2	Torque enable				
	3	Reference enable				
	4	PWM enable				
V24		Port I3 configuration: S7.6	□	AM	SM	LM
	0	Port disabled				
	1	Homing switch				
	2	Torque enable				
	3	Reference enable				
	4	PWM enable				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V25		Port I4 configuration: S7.8	[]	AM	SM	LM
	0	Port disabled				
	1	Homing switch				
	2	Torque enable				
	3	Reference enable				
	4	PWM enable				
V26		Port O1 configuration: S7.3	[]	AM	SM	LM
	0	Port disabled				
	1	Programmable relay 1				
	2	Programmable relay 2				
	3	Braking relay				
	4	DEMF Drive Embedded Macro				
V27		Port O2 configuration: S7.5	[]	AM	SM	LM
	0	Port disabled				
	1	Programmable relay 1				
	2	Programmable relay 2				
	3	Braking relay				
	4	DEMF Drive Embedded Macro				
V28		Port O3 configuration: S7.7	[]	AM	SM	LM
	0	Port disabled				
	1	Programmable relay 1				
	2	Programmable relay 2				
	3	Braking relay				
	4	DEMF Drive Embedded Macro				
V29		Port O4 configuration: S7.9	[]	AM	SM	LM
	0	Port disabled				
	1	Programmable relay 1				
	2	Programmable relay 2				
	3	Braking relay				
	4	DEMF Drive Embedded Macro				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V30		General drive configuration	□	AM	SM	LM
	0	Current offset measurement at 50% PWM [1=Enabled]				
	1	PWM phase inversion [1=Enabled]				
	2	Not used				
	3	Not used				
	4	Acceleration-deceleration ramp (Master) [1=ON]				
	5	Ramp on alarm/reference disable (Master) [1=ON]				
	6	Not used				
	7	Not used				
	8	Not used				
	9	Not used				
	10	Not used				
	11	Not used				
	12	Not used				
	13	Not used				
	14	Not used				
	15	Not used				
	16	Not used				
	17	Not used				
	18	Not used				
	19	Not used				
	20	Not used	□	AM	SM	LM
	21	Not used				
	22	Not used				
	23	Not used				
	24	Alarm 37 Ext 0 exclusion [1=Excluded]				
	25	Not used				
	26	Not used				
	27	Not used				
	28	Not used				
	29	Alarm LOG file recording [1=Active]				
	30	Drive parking [1=Enabled]				
	31	Not used				

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NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V31		Dynamic general drive configuration				
	0	Wait for motor to stop to enable [1=Wait]	□	AM	SM	LM
	1	Braking when torque disabled [1=Brake]				
	2	Not used				
	3	Not used				
	4	MP11 (LOAD) = 100% with load [0=Rated] [1=Max]				
	5	Source of Butee for Homing [0=S7 Input] [1=from PLC]				
	6	Not used				
	7	Not used				
	8	Braking on Emergency Stop [1=Disabled]				
	9	Emergency Stop G75 request [1=Enabled]				
	10	Not used				
	11	Not used				
	12	Alarm 4/5 delay [1=Enabled]				
	13	Alarm 60 Ext 268 [1=Enabled]				
	14	Alarm 3 exclusion [1=Excluded]				
V32		Config. braking following alarms [1=Brake]	□	AM	SM	LM
	0	Alarm 3: Motor overtemperature				
	1	Alarm 4: Drive overtemperature				
	2	Alarm 8: Local link				
	3	Alarm 9: S1 sensor				
	4	Alarm 11: Overspeed				
	5	Alarm 13: NC synchronization				
	6	Alarm 18: Self-calibration				
	7	Alarm 37: Following error				
	8	Alarm 38: S2 sensor				
	9	Alarm 49: I ^Δ 2t				
	10	Alarm 51: Congruence position S1-S2				
	11	Alarm 52: Anti-backlash function				
	12	Alarm 57: Power Supply class 0				
	13	Alarm 61: Safety Module class 1				
	14	Alarm 62: Safety Module class 2				
	15	Alarm 70: Torque duplication function				
	16	Alarm 71: Winding duplication function				
V33		Alarm reset configuration [1=Reset]	□	AM	SM	LM
	0	Alarm 3: Motor overtemperature				
	1	Alarm 4: Drive overtemperature				
	2	Alarm 5: Braking resistor or PWS overtemperature				
	3	Alarm 6: Short-circuit to earth				
	4	Alarm 7: Auxiliary power supply				
	5	Alarm 8: Local link				
	6	Alarm 9: S1 sensor				
	7	Alarm 10: Timeout				
	8	Alarm 11: Overspeed				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
	9	Alarm 12: Drive overcurrent				
	10	Alarm 14: Wrong SD card handling				
	11	Alarm 16: Incompatible parameters				
	12	Alarm 18: Self-calibration				
	13	Alarm 37: Following error				
	14	Alarm 38: S2 sensor				
	15	Alarm 49: I ² t				
	16	Alarm 51: Congruence position S1-S2				
	17	Alarm 52: Anti-backlash function				
	18	Alarm 54: Brake failure				
	19	Alarm 56: V/f regulation				
	20	Alarm 57: Power Supply class 0				
	21	Alarm 58: Power Supply class 1				
	22	Alarm 59: Link Power Supply				
	23	Alarm 60: Safety Module class 0				
	24	Alarm 61: Safety Module class 1				
	25	Alarm 62: Safety Module class 2				
	26	Alarm 63: Safety Module class 3				
	27	Alarm 64: Safety Module class 4				
	28	Alarm 70: Torque duplication function				
	29	Alarm 71: Winding duplication function				
	30	Alarm 80: DEMF Drive Embedded Macro function				
V34		Configuration DF1/DF2 relay [1=Open]	□	AM	SM	LM
	0	Alarm 2: BUS overvoltage				
	1	Alarm 3: Motor overtemperature				
	2	Alarm 4: Drive overtemperature				
	3	Alarm 5: Braking resistor or PWS overtemperature				
	4	Alarm 6: Short-circuit to earth				
	5	Alarm 7: Auxiliary power supply				
	6	Alarm 8: Local link				
	7	Alarm 9: S1 sensor				
	8	Alarm 10: Timeout				
	9	Alarm 11: Overspeed				
	10	Alarm 12: Drive overcurrent				
	11	Alarm 13: NC synchronization				
	12	Alarm 15: Data memory checksum error				
	13	Alarm 16: Incompatible parameters				
	14	Alarm 18: Self-calibration				
	15	Alarm 37: Following error				
	16	Alarm 38: S2 sensor				
	17	Alarm 49: I ² t				
	18	Alarm 51: Congruence position S1-S2				
	19	Alarm 52: Anti-backlash function				
	20	Alarm 70: Torque duplication function				
	21	Alarm 71: Winding duplication function				
V35		NCK related axis address	□	AM	SM	LM
V36		FSoE address SAMX	□	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V37		Delay time of power detection	s	AM	SM	LM
V39		Bump suppressor speed limit (% of V98)	%	AM	SM	LM
V40		Speed reached dynamic threshold	%	AM	SM	LM
V42		Motor zero speed threshold, enable, brake	rpm	AM	SM	LM
V43		Braking Timeout on config. V30, V32	s	AM	SM	LM
V46		Speed dynamic check	rpm	AM	SM	LM
V50		Torque current limit	Arms	AM	SM	LM
V51		Proportional speed loop gain	(R) mArms/rpm	AM	SM	LM
			(L) Arms/(m/min)			
V52		Integral speed loop gain	ms	AM	SM	LM
V80		Set Point Weight speed loop gain	ms	AM	SM	LM
V91		Acceleration/deceleration ramp	(R) rpm/s	AM	SM	LM
			(L) mm/s ²			
V97		Speed reference Limit (% V98)	%	AM	SM	LM
V98		Maximum motor speed	%	AM	SM	LM
V99		Overspeed alarm threshold	(R) rpm	AM	SM	LM
			(L) m/min			
V100		Deliverable current limit	Arms	AM	SM	LM
V101		Voltage limits Vd and Vq	Vrms	AM	SM	LM
V102		Proportional Iq current loop gain	Vrms/Arms	AM	SM	LM
V103		Integral Iq current loop gain	ms	AM	SM	LM
V104		Motor EMF phase compensation	(R) mVrms/rpm	-	SM	LM
			(L) Vrms/(m/s)			
V105		Compensation of motor Lq inductance	mH	AM	SM	LM
V106		Compensation of motor Ld inductance	mH	AM	SM	LM
V107		Lowpass Filter electrical speed	Hz	AM	SM	LM
V108		Motor rated current [I ² t]	Arms	AM	SM	LM
V109		Vertical load compensation current	Arms	AM	SM	LM
V119		Phase lead	Arms	AM	SM	LM
V121		Iq gain reduction at V123 current	Arms	AM	SM	LM
V123		Maximal motor current	Arms	AM	SM	LM
V125		Current percentage V108 for EPSM	%	-	SM	LM
V126		Current percentage V108 for EPS	%	-	SM	LM
V128		Locked rotor current I ² t (% V108)	%	-	SM	LM
V130		Associate MP with quick NC TP1	□	AM	SM	LM
V131		Associate MP with quick NC TP2	□	AM	SM	LM
V132		Associate MP with quick NC TP3	□	AM	SM	LM
V133		Associate MP with quick NC TP4	□	AM	SM	LM
V135		Configuration of braking relay	□	AM	SM	LM
	0	Brake management [1=Active]				
	1	Brake: check presence of current V109 [1=On] [0=Off]				
	2	Alarm 54 ext 0 (24V missing) exclusion [1=Excluded]				
	3	Alarm 54 ext 1/2 (feedback incoherent) exclusion [1=Excluded]				
	4	Alarm 54 ext 20,21,22,23 treated as Warnings [0=Alarm] [1=Warning]				
	5	Not used				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
	6	SAFE Brake required [1=Required]				
	7	External only (S10) brake management [1=External]				
V136		Brake ON delay	ms	AM	SM	LM
V137		Brake OFF delay	ms	AM	SM	LM
V140		Associate MP with programmable relay 1	ms	AM	SM	LM
V141		Programmable relay 1, threshold 1	□	AM	SM	LM
V142		Programmable relay 1, threshold 2	□	AM	SM	LM
V144		Programm. relay 1, tripping time constant	ms	AM	SM	LM
V145		Configuration of programmable relay 1	□	AM	SM	LM
	0	Absolute value for prog. relay [1=Absol.]				
	1	Prog. relay mode [1=Band] [0=Thresholds]				
	2	Logic of prog. relay [1=Positive] [0=Negative]				
V150		Associate MP with programmable relay 2	□	AM	SM	LM
V151		Programmable relay 2, threshold 1	□	AM	SM	LM
V152		Programmable relay 2, threshold 2	□	AM	SM	LM
V154		Programm. relay 2, tripping time constant	ms	AM	SM	LM
V155		Configuration of programmable relay 2	□	AM	SM	LM
	0	Absolute value for prog. relay [1=Absol.]				
	1	Prog. relay mode [1=Band] [0=Thresholds]				
	2	Logic of prog. relay [1=Positive] [0=Negative]				
V160		Special applications selection	□	AM	SM	LM
	0	AP01: Absolute position with motor sensor				
	1	AP02: Rotary axis with mech. ratio not 2 ^x				
	2	AP03: Anti-backlash				
	3	AP04: Torque duplication				
	4	AP05: Winding duplication				
	5	AP06: Coherence S1/S2				
	6	AP07: DEMF Drive Embedded Macro				
	7	AP08: Inter-drive DEMF data exchange				
	8	Not used				
	9	Not used				
	10	AP11: Active damping by Accelerometer S3				
	11	AP12: Active damping by S2				
V162		AP02: Mechanical ratio: load turns	□	AM	SM	-
V163		AP02: Mechanical ratio: sensor turns	□	AM	SM	-
V164		AP02: configuration	□	AM	SM	-
	0	AP02 sensor [0=S1] [1=S2]				
	1	AP02 for long linear axes [1=ON] [0=OFF] AP02 for long linear axes [1=ON] [0=OFF]				
V168		AP03: Anti-backlash link connection type	□	AM	SM	-
	0	Internal link via memory-A				
	1	Internal link via memory-B				
	2	Internal link via memory-C				
	3	External link via P7 connector				
	4	External link via P8 connector				
V169		AP03: Anti-backlash role	□	AM	SM	-
	0	Role [0=Slave] [1=Master]				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V170		AP03: Anti-backlash configuration	□	AM	SM	-
	0	Inward/outward slave [1=Outward]				
	1	Manchester encoding [1=ON] [0=OFF]				
V171		AP03 Master: Preload Tandem current	Arms	AM	SM	-
V172		AP03 Master: Proportional torq. equaliz. gain	rpm/Arms	AM	SM	-
V173		AP03 Master: Integral torq. equaliz. gain	ms	AM	SM	-
V175		AP03 Master: Max compens. torque equalizer	rpm	AM	SM	-
V176		AP03 Mst: T.out alarm 52 Ext 41 (Saturated torque equalizer)	ms	AM	SM	-
V177		AP03 Master: Preload ramp speed	Arms/s	AM	SM	-
V179		AP04: Torque duplication link connection type	□	-	SM	LM
	0	Internal link via memory-A				
	1	Internal link via memory-B				
	2	Internal link via memory-C				
	3	External link via P7 connector				
	4	External link via P8 connector				
V180		AP04: Torque duplication total drives number	□	-	SM	LM
V181		AP04: Torque duplication address	□	-	SM	LM
V182		AP04: Torque duplication configuration	□	-	SM	LM
	0	Inward/outward slave [1=Outward]				
	1	Manchester encoding [1=ON] [0=OFF]				
V184		AP05: Winding duplication link connection type	□	-	SM	LM
	0	Internal link via memory-A				
	1	Internal link via memory-B				
	2	Internal link via memory-C				
	3	External link via P7 connector				
	4	External link via P8 connector				
V185		AP05: Winding duplication total drives number	□	-	SM	LM
V186		AP05: Winding duplication address	□	-	SM	LM
V187		AP05: Winding duplication configuration	□	-	SM	LM
	0	Manchester encoding [1=ON] [0=OFF]				
V190		AP06: Max displacement measure S1-S2	CNC IU	AM	SM	LM
V191		AP06: Max duration measure displacement S1-S2	ms	AM	SM	LM
V199		AP08: Inter-drive exch. link connection type	□	AM	SM	LM
	0	Internal link via memory-A				
	1	Internal link via memory-B				
	2	Internal link via memory-C				
	3	External link via P7 connector				
	4	External link via P8 connector				
V200		AP08: Inter-drive exchange role	□	AM	SM	LM
	0	Role [0=Slave] [1=Master]				
V201		AP08: Inter-drive exchange configuration	□	AM	SM	LM
	0	Manchester encoding [1=ON] [0=OFF]				
V202		AP08: Associate MP with Inter-drive exchange	□	AM	SM	LM
V217		AP12: Active damping by S2 K1	□	AM	SM	LM
V218		AP12: Active damping by S2 filter	Hz	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V220		Reference configuration	[]	AM	SM	LM
	0	Not used				
	1	Not used				
	2	Interpolator active [1=Active]				
	3	Interpolator Type [0=1 order] [1=2 order]				
	4	Reversal of speed reference [1=Rev]				
V221		Enable configurations	[]	AM	SM	LM
	0	Torque enable [0=Digital bus] [1=Input port]				
	1	Reference enable [0=Digital bus] [1=Input port]				
	2	Torque AND digital bus enable				
	3	Reference AND digital bus enable				
	4	PWM enabling by digital input [1=Input port]				
V238		Filter on squared counter input S1	[]	AM	SM	LM
	0	Filtering time = 50 ns				
	1	Filtering time = 100 ns				
	2	Filtering time = 150 ns				
	3	Filtering time = 200 ns				
	4	Filtering time = 250 ns				
	5	Filtering time = 300 ns				
	6	Filtering time = 350 ns				
	7	Filtering time = 400 ns				
V239		Filter on squared counter input S2	[]	AM	SM	LM
	0	Filtering time = 50 ns				
	1	Filtering time = 100 ns				
	2	Filtering time = 150 ns				
	3	Filtering time = 200 ns				
	4	Filtering time = 250 ns				
	5	Filtering time = 300 ns				
	6	Filtering time = 350 ns				
	7	Filtering time = 400 ns				
V240		I²t motor: first time constant	s	AM	SM	LM
V241		I²t motor: second time constant	s	AM	SM	LM
V245		I²t motor: threshold change of time constant	Hz	AM	SM	LM
V246		I²t motor: frequency threshold hysteresis (V245)	Hz	AM	SM	LM
V248		I²t drive: first time constant	s	AM	SM	LM
V249		I²t drive: second time constant	s	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V250		Motor XML information	[]	AM	SM	LM
	0	XML revision				
	1	XML revision				
	2	XML revision				
	3	XML revision				
	4	XML variant				
	5	XML variant				
	6	XML variant				
	7	XML variant				
	8	XML variant				
	9	XML origin [0=Factory] [1=Self-made]				
	10	Not used				
	11	Not used				
	12	Not used				
	13	Not used				
	14	Not used				
	15	Motor initialisation configuration [0=Done] [1=Not done]				
V255		Motor type	ascii	AM	SM	LM
V256		Motor power connection type	ascii	AM	SM	LM
V257		Motor poles pairs number	[]	AM	SM	LM
V259		Linear motor pole pitch [180 deg el.]	(L) mm	-	-	LM
V263		System sampling time	us	AM	SM	LM
V268		Electrical phase offset Hall effect sensor	deg	-	SM	LM
V269		Position offset for electrical phasing	deg	-	SM	LM
V270		Motor thermal sensor PTC-NTC value	Ohm	-	SM	LM
V271		Current loop sampling time	us	AM	SM	LM
V272		Motor thermal sensor configuration	[]	AM	SM	LM
	0	Thermal sensor type [0=PTC] [1=NTC]				
	1	unused				
	2	Thermal sensor control NTC open [1=Act.]				
V273		Electrical phase offset management	[]	AM	SM	LM
	0	Phase offset exchange after EPS/Hall+Homing [1=No]				
	1	unused				
	2	APEM automatic phase offset exchange on mark [1=ON]				
	3	Alarm 18 Ext 3 exclusion [1=Excluded]				
	4	Forced EPS with absolute sensors [1=ON]				
	5	Alarm 18 Ext 2 exclusion [1=Excluded]				
	6	EPS for highly anisotropic motors [1=ON]				
	7	Force phase offset exchange after EPSM+POM/APEM [1=ON]				
	8	EPS for Iron-less motors [1=ON]				
V274		Motor thermal sensor wiring	[]	AM	SM	LM
	0	Thermal sensor wired on S1 (motor) sensor				
	1	Thermal sensor wired on S2 (additional) sensor				
	2	Thermal sensor wired on S3 (accelerometer) sensor				
V301		Proportional position gain	(R) 1/min	AM	SM	LM
			(L) (mm/min)/mm			

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V305		Measure modulo for rotary axis / spindle absolute	CNC IU	AM	SM	LM
V306		S1 sensor MULTI coefficient	□	AM	SM	LM
V307		S1 sensor DIVI coefficient	□	AM	SM	LM
V310		S1 sensor offset	CNC IU	AM	SM	LM
V311		S2 sensor MULTI coefficient	□	AM	SM	LM
V312		S2 sensor DIVI coefficient	□	AM	SM	LM
V313		S2 sensor offset	CNC IU	AM	SM	LM
V314		S1 sensor sinusoidal/TTL signals range	%	AM	SM	LM
V315		S2 sensor sinusoidal/TTL signals range	%	AM	SM	LM
V317		S1 sensor power supply voltage	Vdc	AM	SM	LM
V318		S2 sensor power supply voltage	Vdc	AM	SM	LM
V320		S1 sensor incremental traces configuration	□	AM	SM	LM
V321		S2 sensor incremental traces configuration	□	AM	SM	LM
V322		S1 sensor communication protocol	□	AM	SM	LM
	0	Not configured				
	1	Hiperface				
	2	Hiperface DSL				
	3	Not used				
	4	Not used				
	5	Not used				
	6	EnDat 2.1				
	7	EnDat 2.2				
	8	Not used				
	9	Not used				
	10	Not used				
	11	Magnescape				
	12	Not used				
	13	Not used				
	14	Tamagawa				
	15	Not used				
	16	Not used				
	17	Resolute Renishaw				
	18	Not used				
	19	Not used				
	20	Fagor BiSS				
	21	Not used				
	22	Not used				
	23	Not used				
	24	Not used				
	25	Not used				
	26	Not used				
	27	Not used				
	28	Not used				
	29	Not used				
	30	Not used				
	31	Not used				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V323		S2 sensor communication protocol	□	AM	SM	LM
	0	Not configured				
	1	Hiperface				
	2	Hiperface DSL				
	3	Not used				
	4	Not used				
	5	Not used				
	6	EnDat 2.1				
	7	EnDat 2.2				
	8	Not used				
	9	Not used				
	10	Not used				
	11	Magnescape				
	12	Not used				
	13	Not used				
	14	Not used				
	15	Not used				
	16	Not used				
	17	Resolute Renishaw				
	18	Not used				
	19	Not used				
	20	Fagor BiSS				
	21	Not used				
	22	Not used				
	23	Not used				
	24	Not used				
	25	Not used				
	26	Not used				
	27	Not used				
	28	Not used				
	29	Not used				
	30	Not used				
	31	Hall				
V324		S1 sensor initialization configuration	□	AM	SM	LM
	0	Sensor [0=Rotative] [1=Linear]				
	1	Not used				
	2	Abs. measure translation for rotary sensor [1=ON]				
	3	Fast-Ser Abs position half-travel displacement[1=ON]				
	4	Memory handling [1=ON]				
	5	External back-up battery [1=ON]				
	6	Homing switch used [1=Yes]				
	7	Homing switch logic [1=Inverted]				
	8	Homing switch mode [0=level] [1=edge]				
	9	Homing switch active edge [0=positive] [1=negative]				
	10	Fine alignment of digital and analog pos. [1=ON]				
	11	Sensor cyclical direction [0=Clockwise]				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V325		S2 sensor initialization configuration	□	AM	SM	LM
	0	Sensor [0=Rotative] [1=Linear]				
	1	Reversal measure for position loop [1=Rev]				
	2	Abs. measure translation for rotary sensor [1=ON]				
	3	Fast-Ser Abs position half-travel displacement[1=ON]				
	4	Memory handling [1=ON]				
	5	External back-up battery [1=ON]				
	6	Homing switch used [1=Yes]				
	7	Homing switch logic [1=Inverted]				
	8	Homing switch mode [0=level] [1=edge]				
	9	Homing switch active edge [0=positive] [1=negative]				
	10	Fine alignment of digital and analog pos. [1=ON]				
	11	Not used				
V326		S1 sensor run-time options	□	AM	SM	LM
	0	Compensation of sinusoidal signals [1=ON]				
	1	Speed filter [0=V342] [1=V340]				
V327		S2 sensor run-time options	□	AM	SM	LM
	0	Compensation of sinusoidal signals [1=ON]				
	1	Speed filter [0=V343] [1=V341]				
V328		S1 Sensor alarms handling	□	AM	SM	LM
	0	Alarms 9 Ext 248/260 exclusion [1=Excluded]				
	1	Alarm 9 Ext 60 to 9 Ext 67 Endat22 Safety bit alarm [1=Excluded]				
	2	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]				
	3	Alarms 9 Ext 230/248/254/260/261 exclusion [1=Excluded]				
	4	UGA misalignment handling [0=Alarm] [1=Warning]				
V329		S2 Sensor alarms handling	□	AM	SM	LM
	0	Alarms 38 Ext 248/260 exclusion [1=Excluded]				
	1	Alarm 38 Ext 60 to 38 Ext 67 Endat22 Safety bit alarm [1=Excluded]				
	2	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]				
	3	Alarms 38 Ext 230/248/254/260/261 exclusion [1=Excluded]				
	4	UGA misalignment handling [0=Alarm] [1=Warning]				
V330		S1 sensor homing configuration	□	AM	SM	LM
	0	CNC absolute measure				
	1	Soft top mark homing for absolute sensor				
	2	Single top mark homing				
	3	Coded reference homing				
	4	BUTEE homing				
V331		S2 sensor homing configuration	□	AM	SM	LM
	0	CNC absolute measure				
	1	Not used				
	2	Single top mark homing				
	3	Coded reference homing				
	4	BUTEE homing				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V340		Step of speed calculation S1 sensor	□	AM	SM	LM
V341		Step of speed calculation S2 sensor	□	AM	SM	LM
V342		Speed filter by S1 sensor	Hz	AM	SM	LM
V343		Speed filter by S2 sensor	Hz	AM	SM	LM
V344		S1 sensor code ID	□	AM	SM	LM
V345		S2 sensor code ID	□	AM	SM	LM
V350		Position loop sensor configuration	□	AM	SM	LM
	0	Position loop sensor configuration [0=S1] [1=S2]				
V353		Period of position sensor/motor turn	□	AM	SM	-
V360		Period by turn S1 sensor	□	AM	SM	-
V361		Absolute resolution by turn S1 sensor	□	AM	SM	-
V365		Number of absolute S1 sensor turns	□	AM	SM	-
V368		Intervals between S1 coded references	□	AM	SM	LM
V369		Multiplier of S1 coded references	□	AM	SM	LM
V370		Period by turn S2 sensor	□	AM	SM	-
V371		Absolute resolution by turn S2 sensor	□	AM	SM	-
V375		Number of absolute S2 sensor turns	□	AM	SM	-
V378		Intervals between S2 coded references	□	AM	SM	LM
V379		Multiplier of S2 coded references	□	AM	SM	LM
V380		Period of linear S1 sensor	nm	AM	SM	LM
V381		Absolute resolution of linear S1 sensor	nm	AM	SM	LM
V389		S1 sensor serial position datum bit size	bit	AM	SM	LM
V390		Period of linear S2 sensor	nm	AM	SM	LM
V391		Absolute resolution of linear S2 sensor	nm	AM	SM	LM
V399		S2 sensor serial position datum bit size	bit	AM	SM	LM
V400		Rs at 120 deg. C	mOhm	AM	-	-
V401		Rr at 150 deg. C	mOhm	AM	-	-
V402		sigmaLs	uH	AM	-	-
V403		Lr	mH	AM	-	-
V408		Additional extern inductance	mH	AM	SM	LM
V409		ST flux-weakening voltage	Vrms	AM	SM	LM
V410		Proportional gain flux loop	Arms/mWbrms	AM	-	-
V411		Integral gain flux loop	ms	AM	-	-
V412		Magnetization inductance (Lm) saturation level	%	AM	-	-
V414		Observer engagement speed	rpm	AM	-	-
V415		Observer engagement hysteresis	rpm	AM	-	-
V425		Min_flux as a %age of V427	%	AM	-	-
V426		Flux weakening integral gain	mWbrms/(Vrms*s)	AM	-	-
V427		Magnetization current	Arms	AM	-	-
V428		Magnetization current limit	Arms	AM	-	-
V434		Proportional Id current loop gain	Vrms/Arms	AM	SM	LM
V435		Integral Id current loop gain	ms	AM	SM	LM
V480		Correction factor for MP6	%	AM	SM	LM
V481		Control mode selection	□	AM	SM	LM
	0	Vectorial d-q regulation				
	1	V/f regulation				

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V482		Current loop d-q Decoupling and Compensations	□	AM	SM	LM
	0	Current compens. calc. [0=Measure] [1=Reference]				
	1	Asynchronous back-EMF compensation [0=NO] [1=Active]				
V488		Resistance tt at 20 deg. C	mOhm			
V489		Motor Lq inductance	mH			
V491		Id_Max (defluxing parameter)	Arms			
V492		Id current without defluxing	Arms			
V496		Defluxing starting speed	rpm	AM	SM	LM
V498		K Iq reduction	Arms/(Vrms*s)	AM	SM	LM
V499		K flux-weakening Id	Arms/(Vrms*s)	-	SM	LM
V500		Regulation Filter configuration	□	AM	SM	LM
	0	1. Filter torque current ref. [1=Active]				
	1	2. Filter torque current ref. [1=Active]				
	2	3. Filter torque current ref. [1=Active]				
	3	4. Filter torque current ref. [1=Active]				
	4	1. Filter for speed ref. [1=Active]				
V501		Type (FILTER 1 torque current ref.)	□	AM	SM	LM
	0	First order low pass				
	1	Second order low pass (Butterworth)				
	2	Notch				
V502		Frequency (FILTER 1 torque current ref.)	Hz	AM	SM	LM
V503		Attenuation (FILTER 1 torque current ref.)	dB	AM	SM	LM
V504		Width (FILTER 1 torque current ref.)	Hz	AM	SM	LM
V505		HF attenuation (FILTER 1 torque current ref.)	dB	AM	SM	LM
V511		Type (FILTER 2 torque current ref.)	□	AM	SM	LM
	0	First order low pass				
	1	Second order low pass (Butterworth)				
	2	Notch				
V512		Frequency (FILTER 2 torque current ref.)	Hz	AM	SM	LM
V513		Attenuation (FILTER 2 torque current ref.)	dB	AM	SM	LM
V514		Width (FILTER 2 torque current ref.)	Hz	AM	SM	LM
V515		HF attenuation (FILTER 2 torque current ref.)	dB	AM	SM	LM
V521		Type (FILTER 3 torque current ref.)	□	AM	SM	LM
	0	First order low pass				
	1	Second order low pass (Butterworth)				
	2	Notch				
V522		Frequency (FILTER 3 torque current ref.)	Hz	AM	SM	LM
V523		Attenuation (FILTER 3 torque current ref.)	dB	AM	SM	LM
V524		Width (FILTER 3 torque current ref.)	Hz	AM	SM	LM
V525		HF attenuation (FILTER 3 torque current ref.)	dB	AM	SM	LM
V531		Type (FILTER 4 torque current ref.)	□	AM	SM	LM
	0	First order low pass				
	1	Second order low pass (Butterworth)				
	2	Notch				
V532		Frequency (FILTER 4 torque current ref.)	Hz	AM	SM	LM
V533		Attenuation (FILTER 4 torque current ref.)	dB	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V534		Width (FILTER 4 torque current ref.)	Hz	AM	SM	LM
V535		HF attenuation (FILTER 4 torque current ref.)	dB	AM	SM	LM
V541		Type (FILTER speed ref.)	[]	AM	SM	LM
	0	First order low pass				
	1	Second order low pass (Butterworth)				
	2	Notch				
V542		Frequency (FILTER speed ref.)	Hz	AM	SM	LM
V543		Attenuation (FILTER speed ref.)	dB	AM	SM	LM
V544		Width (FILTER speed ref.)	Hz	AM	SM	LM
V545		HF attenuation (FILTER speed ref.)	dB	AM	SM	LM
V550		Quick NC MPs Filter configuration	[]	AM	SM	LM
	0	LP-4 Filter on quick NC TP1 [1=Active]				
	1	LP-4 Filter on quick NC TP2 [1=Active]				
	2	LP-4 Filter on quick NC TP3 [1=Active]				
	3	LP-4 Filter on quick NC TP4 [1=Active]				
V551		Frequency of LP-4 filter on quick NC TP1	Hz	AM	SM	LM
V552		Frequency of LP-4 filter on quick NC TP2	Hz	AM	SM	LM
V553		Frequency of LP-4 filter on quick NC TP3	Hz	AM	SM	LM
V554		Frequency of LP-4 filter on quick NC TP4	Hz	AM	SM	LM
V560		Relay Filter configuration	Hz	AM	SM	LM
	0	LP-4 Filter on TP of Relay1 [1=Active]				
	1	LP-4 Filter on TP of Relay2 [1=Active]				
V561		Frequency of LP-4 filter on Relay1	Hz	AM	SM	LM
V562		Frequency of LP-4 filter on Relay2	Hz	AM	SM	LM
V570		Oscilloscope Filter configuration	Hz	AM	SM	LM
	0	LP-4 Filter on oscilloscope trace 1 [1=Active]				
	1	LP-4 Filter on oscilloscope trace 2 [1=Active]				
	2	LP-4 Filter on oscilloscope trace 3 [1=Active]				
	3	LP-4 Filter on oscilloscope trace 4 [1=Active]				
V571		Frequency of LP-4 filter on oscilloscope trace 1	Hz	AM	SM	LM
V572		Frequency of LP-4 filter on oscilloscope trace 2	Hz	AM	SM	LM
V573		Frequency of LP-4 filter on oscilloscope trace 3	Hz	AM	SM	LM
V574		Frequency of LP-4 filter on oscilloscope trace 4	Hz	AM	SM	LM
V600		V/f: Maximal motor current (% of V108)	%	AM	SM	-
V601		V/f: Rated frequency	Hz	AM	SM	-
V602		V/f: Rated voltage	Vrms	AM	SM	-
V603		V/f: V0	Vrms	AM	SM	-
V604		V/f: Stator resistance at 20 deg. C	mOhm	AM	SM	-
V605		V/f: Intermittent overload (% of V108)	%	AM	SM	-
V606		V/f: Freq. start of overload reduction	Hz	AM	SM	-
V607		V/f: Q-Q stabilizing inductance	mH	-	SM	-
V608		V/f: D-Q stabilizing inductance	mH	-	SM	-
V620		Target Brake-Test current (% V108)	%	AM	SM	LM
V622		Brake-Test core phase duration	ms	AM	SM	LM
V623		Brake-Test position window	CNC IU	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V630		Sensor S3 (accelerometer) connector assignment	□	AM	SM	LM
	0	Not assigned				
	1	Not available as S3				
	2	Not available as S3				
	3	Not available as S3				
	4	Not available as S3				
	5	Assigned to P5 (max 300 kHz)				
	6	Assigned to P6 (max 300 kHz)				
	7	Assigned to P7 (max 100 kHz)				
	8	Assigned to P8 (max 70 kHz)				
V631		S3 sensor power supply voltage	V	AM	SM	LM
V632		S3 sensor initialization configuration	□	AM	SM	LM
	0	1Vpp connection [0=Cos] [1=Sin]				
	1	signal reversal (+/-) [1=ON]				
	2	D.C. offset removal [1=ON]				
V633		Accelerometer full scale range	m/s ²	AM	SM	LM
V634		Accelerometer displacement per motor revolution	mm/rev	AM	SM	-
V640		AP11: Active damping by S3 Accelerometer K1	□	AM	SM	LM
V680		Oscilloscope general control	□	AM	SM	LM
	0	Individual start command [1=Enabled]				
	1	Auto-start after initialization [1=Enabled]				
	2	Stimulus synchronized start [1=Enabled]				
V681		Oscilloscope trigger control	□	AM	SM	LM
	0	Trigger disabled				
	1	Trigger on alarm				
	2	Trigger on warning				
	3	Trigger when greater than threshold				
	4	Trigger when smaller than threshold				
	5	Trigger when equal to bitmap				
V682		MP associated to oscilloscope trace 1 (trigger)	□	AM	SM	LM
V683		MP associated to oscilloscope trace 2	□	AM	SM	LM
V684		MP associated to oscilloscope trace 3	□	AM	SM	LM
V685		MP associated to oscilloscope trace 4	□	AM	SM	LM
V686		Oscilloscope sampling time to V263 ratio	□	AM	SM	LM
V687		Percentage of samples to be recorded post trigger	%	AM	SM	LM
V688		Threshold level for trigger (trace 1)	□	AM	SM	LM
V689		Threshold bitmask for trigger on bitmap	□	AM	SM	LM
V700		Motor part number	ascii	AM	SM	LM
V712		S1 sensor part number	ascii	AM	SM	LM
V724		S2 sensor part number	ascii	AM	SM	LM
V736		S3 sensor part number	ascii	AM	SM	LM
V748		Custom parameter set description	ascii	AM	SM	LM
V900		AP07: instruction #0	ascii	AM	SM	LM
V901		AP07: instruction #1	ascii	AM	SM	LM
V902		AP07: instruction #2	ascii	AM	SM	LM
V903		AP07: instruction #3	ascii	AM	SM	LM
V904		AP07: instruction #4	ascii	AM	SM	LM

NUM DrivePro general parameters list						
n	bit	Description	Unit	Motor utilization		
V905		AP07: instruction #5	ascii	AM	SM	LM
V906		AP07: instruction #6	ascii	AM	SM	LM
V907		AP07: instruction #7	ascii	AM	SM	LM
V908		AP07: instruction #8	ascii	AM	SM	LM
V909		AP07: instruction #9	ascii	AM	SM	LM
V910		AP07: instruction #10	ascii	AM	SM	LM
V911		AP07: instruction #11	ascii	AM	SM	LM
V912		AP07: instruction #12	ascii	AM	SM	LM
V913		AP07: instruction #13	ascii	AM	SM	LM
V914		AP07: instruction #14	ascii	AM	SM	LM
V915		AP07: instruction #15	ascii	AM	SM	LM
V920		AP07: floating-point operator #32	□	AM	SM	LM
V921		AP07: floating-point operator #33	□	AM	SM	LM
V922		AP07: floating-point operator #34	□	AM	SM	LM
V923		AP07: floating-point operator #35	□	AM	SM	LM
V924		AP07: floating-point operator #36	□	AM	SM	LM
V925		AP07: floating-point operator #37	□	AM	SM	LM
V926		AP07: floating-point operator #38	□	AM	SM	LM
V927		AP07: floating-point operator #39	□	AM	SM	LM
V928		AP07: floating-point operator #40	□	AM	SM	LM
V929		AP07: floating-point operator #41	□	AM	SM	LM
V930		AP07: floating-point operator #42	□	AM	SM	LM
V931		AP07: floating-point operator #43	□	AM	SM	LM
V932		AP07: floating-point operator #44	□	AM	SM	LM
V933		AP07: floating-point operator #45	□	AM	SM	LM
V934		AP07: floating-point operator #46	□	AM	SM	LM
V935		AP07: floating-point operator #47	□	AM	SM	LM
V940		AP07: integer operator #48	□	AM	SM	LM
V941		AP07: integer operator #49	□	AM	SM	LM
V942		AP07: integer operator #50	□	AM	SM	LM
V943		AP07: integer operator #51	□	AM	SM	LM
V944		AP07: integer operator #52	□	AM	SM	LM
V945		AP07: integer operator #53	□	AM	SM	LM
V946		AP07: integer operator #54	□	AM	SM	LM
V947		AP07: integer operator #55	□	AM	SM	LM
V948		AP07: integer operator #56	□	AM	SM	LM
V949		AP07: integer operator #57	□	AM	SM	LM
V950		AP07: integer operator #58	□	AM	SM	LM
V951		AP07: integer operator #59	□	AM	SM	LM
V952		AP07: integer operator #60	□	AM	SM	LM
V953		AP07: integer operator #61	□	AM	SM	LM
V954		AP07: integer operator #62	□	AM	SM	LM
V955		AP07: integer operator #63	□	AM	SM	LM

3.2 Parameters association groups editor with FlexiumPro Tools

This function allows to display all the drive parameters associated to a function parameters sub-groups (or Families) as indicated in the picture below as “Cx”.

For instance click on “C2 (Drive configuration)” sub-group (Family) just the configuration parameters will appear in the FlexiumPro Tools page as indicated in the picture.

DigitalAxis_3 Parameter set:0

DigitalAxis_3

- Frequency
- Address
- Online
- Status
- Information

C2 Drive configuration

Name	Value	Unit	Description
V30	00000000	1h	General drive configuration
V31	00000000	1h	Dynamic General drive configuration
V32	00006000	h	Config. braking following alarms [1=Brake]
V33	7FFFFFFF	h	Alarm reset configuration [1=Reset]
V34	00000000	h	Configuration DF1/DF2 relay [1=Open]
V35	0	h	NCK related axis address
V36	1	h	FSoE address SAMX
V37	1.5	s	Delay time of power detection
V43	10.0	s	Braking Timeout on config. V31, V32
V700	"BPH142_sepa..."	ascii	Motor part number
V712	"P High Res M..."	ascii	S1 sensor part number
V724	"S2:"	ascii	S2 sensor part number
V736	"S3:"	ascii	S3 sensor part number
V748	"Pset:"	ascii	Custom parameter set description

Fig. 48 - Parameters association groups function

3.3 Parameter Description NUM DrivePro



NOTE

The “Adjustment range” and “Default” values indicated in this chapter are relative to a standard NUM DrivePro association and may changed due to a different NUM DrivePro drive / motor association.

By rotary motors, NUM refers to synchronous motors (SM) and rotary asynchronous motors (AM). By linear motors NUM means linear synchronous motors (LM)	
Unit R	Unit of measurement for rotary motors
Unit L	Unit of measurement for linear motors
Adjustment range R	Range of values accepted for Rotary
Adjustment range L	Range of accepted values for Linear
Default R	Value that the drive assigns to the parameter in the absence of user input for R
Default L	Value that the drive assigns to the parameter in the absence of user input for L

V20

Sensor S1 (motor) connector assignment

General	Unit R		Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R				1 ÷ 2.147.483.648	HALT required	Yes
	Adjustment range L						
	Default R				1	Family	9 Sensors configuration
	Default L						

V20 Sensor S1 (motor) connector assignment

☒ Unit

☒ Description

☒ Min

☒ Max

☒ Default

Bit	Value	Description	Default
0	☒	Not assigned	☒
1	☐	Assigned to P1	☐
2	☐	Assigned to P2	☐
3	☐	Assigned to P3	☐
4	☐	Assigned to P4	☐
5	☐	Assigned to P5 (max 300 kHz)	☐
6	☐	Assigned to P6 (max 300 kHz)	☐
7	☐	Assigned to P7 (max 100 kHz)	☐
8	☐	Assigned to P8 (max 70 kHz)	☐
9	☐		☐
-			

This parameter allows you to configure the connector (P1 .- P8) to which the motor sensor S1 is connected.

Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals and connector description.

Description	Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5
	NOTE With regard to parameter V20 sensor S1 (motor), it is possible to configure bit 0 only if the motor control is of the V/f... type (see parameter V481) and the sensor S1 is declared to be of the sensorless type (see parameter V320). While in all other cases it is not possible to configure bit 0 of the V20.

V21**Sensor S2 (direct measure) connector assignment**

General	Unit R	☐	Motor type	AM, SM, LM																																											
	Unit L																																														
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																																											
	Adjustment range L																																														
	Default R	1	Family	9 Sensors configuration																																											
	Default L																																														
This parameter allows you to configure the connector (P1 .- P8) to which the S2 additional sensor is connected. Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals and connector description.																																															
Description	V21 Sensor S2 (direct measure) connector assignment																																														
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Not assigned</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Assigned to P1</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Assigned to P2</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Assigned to P3</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Assigned to P4</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Assigned to P5 (max 300 kHz)</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Assigned to P6 (max 300 kHz)</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Assigned to P7 (max 100 kHz)</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>Assigned to P8 (max 70 kHz)</td><td>☐</td></tr><tr><td>9</td><td>☐</td><td></td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Not assigned	☒	1	☐	Assigned to P1	☐	2	☐	Assigned to P2	☐	3	☐	Assigned to P3	☐	4	☐	Assigned to P4	☐	5	☐	Assigned to P5 (max 300 kHz)	☐	6	☐	Assigned to P6 (max 300 kHz)	☐	7	☐	Assigned to P7 (max 100 kHz)	☐	8	☐	Assigned to P8 (max 70 kHz)	☐	9	☐	
Bit	Value	Description	Default																																												
0	☒	Not assigned	☒																																												
1	☐	Assigned to P1	☐																																												
2	☐	Assigned to P2	☐																																												
3	☐	Assigned to P3	☐																																												
4	☐	Assigned to P4	☐																																												
5	☐	Assigned to P5 (max 300 kHz)	☐																																												
6	☐	Assigned to P6 (max 300 kHz)	☐																																												
7	☐	Assigned to P7 (max 100 kHz)	☐																																												
8	☐	Assigned to P8 (max 70 kHz)	☐																																												
9	☐		☐																																												

V22**Port I1 configuration: S7.2**

General	Unit R	☐	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to input 1 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals and connector description.																																
Description	V22 Port I1 configuration: S7.2 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Homing switch</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Torque enable</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Reference enable</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>PWM enable</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Homing switch	☐	2	☐	Torque enable	☐	3	☐	Reference enable	☐	4	☐	PWM enable	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Homing switch	☐																													
2	☐	Torque enable	☐																													
3	☐	Reference enable	☐																													
4	☐	PWM enable	☐																													
5	☐		☐																													

V23**Port I2 configuration: S7.4**

General	Unit R	□	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to input 2 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description	V23 Port I2 configuration: S7.4 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Homing switch</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Torque enable</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Reference enable</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>PWM enable</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Homing switch	☐	2	☐	Torque enable	☐	3	☐	Reference enable	☐	4	☐	PWM enable	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Homing switch	☐																													
2	☐	Torque enable	☐																													
3	☐	Reference enable	☐																													
4	☐	PWM enable	☐																													
5	☐		☐																													

V24**Port I3 configuration: S7.6**

General	Unit R	□	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to input 3 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description	V24 Port I3 configuration: S7.6 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Homing switch</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Torque enable</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Reference enable</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>PWM enable</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Homing switch	☐	2	☐	Torque enable	☐	3	☐	Reference enable	☐	4	☐	PWM enable	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Homing switch	☐																													
2	☐	Torque enable	☐																													
3	☐	Reference enable	☐																													
4	☐	PWM enable	☐																													
5	☐		☐																													

V25 Port I4 configuration: S7.8

General	Unit R	□	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to input 4 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description	V25 Port I4 configuration: S7.8 ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Homing switch</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Torque enable</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Reference enable</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>PWM enable</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Homing switch	☐	2	☐	Torque enable	☐	3	☐	Reference enable	☐	4	☐	PWM enable	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Homing switch	☐																													
2	☐	Torque enable	☐																													
3	☐	Reference enable	☐																													
4	☐	PWM enable	☐																													
5	☐		☐																													

V26 Port O1 configuration: S7.3

General	Unit R	□	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to output 1 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description																																
V26 Port O1 configuration: S7.3 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Programmable relay 1</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Programmable relay 2</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Braking relay</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>DEMF Drive Embedded Macro</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5					Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Programmable relay 1	☐	2	☐	Programmable relay 2	☐	3	☐	Braking relay	☐	4	☐	DEMF Drive Embedded Macro	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Programmable relay 1	☐																													
2	☐	Programmable relay 2	☐																													
3	☐	Braking relay	☐																													
4	☐	DEMF Drive Embedded Macro	☐																													
5	☐		☐																													

V27**Port O2 configuration: S7.5**

General	Unit R	□	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to output 2 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description	V27 Port O2 configuration: S7.5 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Programmable relay 1</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Programmable relay 2</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Braking relay</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>DEMF Drive Embedded Macro</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></tbody></table>				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Programmable relay 1	☐	2	☐	Programmable relay 2	☐	3	☐	Braking relay	☐	4	☐	DEMF Drive Embedded Macro	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Programmable relay 1	☐																													
2	☐	Programmable relay 2	☐																													
3	☐	Braking relay	☐																													
4	☐	DEMF Drive Embedded Macro	☐																													
5	☐		☐																													
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5																																

V28**Port O3 configuration: S7.7**

General	Unit R		Motor type	AM, SM, LM																																																																																
	Unit L																																																																																			
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																																																																																
	Adjustment range L																																																																																			
	Default R	1	Family	10 Input/output configuration																																																																																
	Default L																																																																																			
This parameter allows you to specify the functionality that the drive assigns to output3 of the S7 digital input/output connector Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																																																																				
Description	<table><tr><th colspan="5">V28 Port O3 configuration: S7.7</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Bit</th><th>Value</th><th colspan="7">Description</th><th>Default</th></tr><tr><td>0</td><td>☒</td><td colspan="7">Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td colspan="7">Programmable relay 1</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td colspan="7">Programmable relay 2</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td colspan="7">Braking relay</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td colspan="7">DEMF Drive Embedded Macro</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td colspan="7"></td><td>☐</td></tr></table>				V28 Port O3 configuration: S7.7					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Bit	Value	Description							Default	0	☒	Port disabled							☒	1	☐	Programmable relay 1							☐	2	☐	Programmable relay 2							☐	3	☐	Braking relay							☐	4	☐	DEMF Drive Embedded Macro							☐	5	☐								☐
V28 Port O3 configuration: S7.7					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																																																																											
Bit	Value	Description							Default																																																																											
0	☒	Port disabled							☒																																																																											
1	☐	Programmable relay 1							☐																																																																											
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5	☐								☐																																																																											
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5																																																																																				

V29**Port O4 configuration: S7.9**

General	Unit R	[]	Motor type	AM, SM, LM																												
	Unit L																															
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																												
	Adjustment range L																															
	Default R	1	Family	10 Input/output configuration																												
	Default L																															
This parameter allows you to specify the functionality that the drive assigns to output 4 of the S7 digital input/output connector. Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																
Description	V29 Port O4 configuration: S7.9 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Port disabled</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Programmable relay 1</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Programmable relay 2</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Braking relay</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>DEMF Drive Embedded Macro</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td></td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Port disabled	☒	1	☐	Programmable relay 1	☐	2	☐	Programmable relay 2	☐	3	☐	Braking relay	☐	4	☐	DEMF Drive Embedded Macro	☐	5	☐		☐
Bit	Value	Description	Default																													
0	☒	Port disabled	☒																													
1	☐	Programmable relay 1	☐																													
2	☐	Programmable relay 2	☐																													
3	☐	Braking relay	☐																													
4	☐	DEMF Drive Embedded Macro	☐																													
5	☐		☐																													

1

2

3

4

5

6

7

8

V30

General drive configuration

General	Unit R	1	Motor type	AM, SM, LM																																																																																																																																																																																																																																																																																																																		
	Unit L	1																																																																																																																																																																																																																																																																																																																				
	Adjustment range R	0 ÷ 4.294.967.295	HALT required	Yes																																																																																																																																																																																																																																																																																																																		
	Adjustment range L																																																																																																																																																																																																																																																																																																																					
	Default R	1	Family	2 Drive configuration																																																																																																																																																																																																																																																																																																																		
	Default L																																																																																																																																																																																																																																																																																																																					
The V30 parameter allows to sets up the main general drive configuration by means of bit configurable functions. The parameters reported on the table below are bit parameters used for the general configuration of the drive.																																																																																																																																																																																																																																																																																																																						
Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																																																																																																																																																																																																																																																																																																						
Description	<table><tr><th colspan="4">V30 General drive configuration</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th><td colspan="5"></td></tr><tr><td>0</td><td>☒</td><td>Current offset measurement at 50% PWM [1=Enabled]</td><td>☒</td><td colspan="5"></td></tr><tr><td>1</td><td>☐</td><td>PWM phase inversion [1=Enabled]</td><td>☐</td><td colspan="5"></td></tr><tr><td>2</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>3</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>4</td><td>☐</td><td>Acceleration-deceleration ramp (Master) [1=ON]</td><td>☐</td><td colspan="5"></td></tr><tr><td>5</td><td>☐</td><td>Ramp on braking alarm/reference disable (Master) [1=ON]</td><td>☐</td><td colspan="5"></td></tr><tr><td>6</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>7</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>8</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>9</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>10</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>11</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>12</td><td>☐</td><td>Source of Butee for Homing [0=S7 Input] [1=from PLC]</td><td>☐</td><td colspan="5"></td></tr><tr><td>13</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>14</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>15</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>16</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>17</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>18</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>19</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>20</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>21</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>22</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>23</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>24</td><td>☐</td><td>Alarm 37 Ext 0 exclusion [1=Excluded]</td><td>☐</td><td colspan="5"></td></tr><tr><td>25</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>26</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>27</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>28</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr><tr><td>29</td><td>☐</td><td>Alarm LOG file recording [1=Active]</td><td>☐</td><td colspan="5"></td></tr><tr><td>30</td><td>☐</td><td>Drive parking [1=Enabled]</td><td>☐</td><td colspan="5"></td></tr><tr><td>31</td><td>☐</td><td>Not used</td><td>☐</td><td colspan="5"></td></tr></table>				V30 General drive configuration				☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Bit	Value	Description	Default						0	☒	Current offset measurement at 50% PWM [1=Enabled]	☒						1	☐	PWM phase inversion [1=Enabled]	☐						2	☐	Not used	☐						3	☐	Not used	☐						4	☐	Acceleration-deceleration ramp (Master) [1=ON]	☐						5	☐	Ramp on braking alarm/reference disable (Master) [1=ON]	☐						6	☐	Not used	☐						7	☐	Not used	☐						8	☐	Not used	☐						9	☐	Not used	☐						10	☐	Not used	☐						11	☐	Not used	☐						12	☐	Source of Butee for Homing [0=S7 Input] [1=from PLC]	☐						13	☐	Not used	☐						14	☐	Not used	☐						15	☐	Not used	☐						16	☐	Not used	☐						17	☐	Not used	☐						18	☐	Not used	☐						19	☐	Not used	☐						20	☐	Not used	☐						21	☐	Not used	☐						22	☐	Not used	☐						23	☐	Not used	☐						24	☐	Alarm 37 Ext 0 exclusion [1=Excluded]	☐						25	☐	Not used	☐						26	☐	Not used	☐						27	☐	Not used	☐						28	☐	Not used	☐						29	☐	Alarm LOG file recording [1=Active]	☐						30	☐	Drive parking [1=Enabled]	☐						31	☐	Not used	☐					
V30 General drive configuration				☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																																																																																																																																																																																																																																																																																																														
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V31**Dynamic General drive configuration**

General	Unit R	[]	Motor type	AM, SM, LM																																																																																																																																				
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V31 collects all drive general configurable functions that can be enabled/disabled at run-time, without the need to put the drive in HALT..																																																																																																																																								
Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals description.																																																																																																																																								
Description	V31 Dynamic General drive configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☒</td><td>Wait for motor to stop to enable [1=Wait]</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Braking when torque disabled [1=Brake]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>MP11 (LOAD) = 100% with load [0=Rated] [1=Max]</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Source of Butee for Homing [0=S7 Input] [1=from PLC]</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>Braking on Emergency Stop [1=Disabled]</td><td>☐</td></tr><tr><td>9</td><td>☐</td><td>Emergency Stop G75 request [1=Enabled]</td><td>☐</td></tr><tr><td>10</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>11</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>12</td><td>☐</td><td>Alarm 4/5 delay [1=Enabled]</td><td>☐</td></tr><tr><td>13</td><td>☐</td><td>Alarm 60 Ext 268 [1=Enabled]</td><td>☐</td></tr><tr><td>14</td><td>☐</td><td>Alarm 3 exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>15</td><td>☐</td><td></td><td>☐</td></tr><tr><td>16</td><td>☐</td><td></td><td>☐</td></tr><tr><td>17</td><td>☐</td><td></td><td>☐</td></tr><tr><td>18</td><td>☐</td><td></td><td>☐</td></tr><tr><td>19</td><td>☐</td><td></td><td>☐</td></tr><tr><td>20</td><td>☐</td><td></td><td>☐</td></tr><tr><td>21</td><td>☐</td><td></td><td>☐</td></tr><tr><td>22</td><td>☐</td><td></td><td>☐</td></tr><tr><td>23</td><td>☐</td><td></td><td>☐</td></tr><tr><td>24</td><td>☐</td><td></td><td>☐</td></tr><tr><td>25</td><td>☐</td><td></td><td>☐</td></tr><tr><td>26</td><td>☐</td><td></td><td>☐</td></tr><tr><td>27</td><td>☐</td><td></td><td>☐</td></tr><tr><td>28</td><td>☐</td><td></td><td>☐</td></tr><tr><td>29</td><td>☐</td><td></td><td>☐</td></tr><tr><td>30</td><td>☐</td><td></td><td>☐</td></tr><tr><td>31</td><td>☐</td><td></td><td>☐</td></tr></table>				Bit	Value	Description	Default	0	☒	Wait for motor to stop to enable [1=Wait]	☒	1	☐	Braking when torque disabled [1=Brake]	☐	2	☐	Not used	☐	3	☐	Not used	☐	4	☐	MP11 (LOAD) = 100% with load [0=Rated] [1=Max]	☐	5	☐	Source of Butee for Homing [0=S7 Input] [1=from PLC]	☐	6	☐	Not used	☐	7	☐	Not used	☐	8	☐	Braking on Emergency Stop [1=Disabled]	☐	9	☐	Emergency Stop G75 request [1=Enabled]	☐	10	☐	Not used	☐	11	☐	Not used	☐	12	☐	Alarm 4/5 delay [1=Enabled]	☐	13	☐	Alarm 60 Ext 268 [1=Enabled]	☐	14	☐	Alarm 3 exclusion [1=Excluded]	☐	15	☐		☐	16	☐		☐	17	☐		☐	18	☐		☐	19	☐		☐	20	☐		☐	21	☐		☐	22	☐		☐	23	☐		☐	24	☐		☐	25	☐		☐	26	☐		☐	27	☐		☐	28	☐		☐	29	☐		☐	30	☐		☐	31	☐		☐
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V32

Config. braking following alarms [1=Brake]

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The V32 parameter can configure the motor stop in case of alarm. The motor may stop by inertia (coasting) bit = 0 or by braking bit = 1. The motor stop configuration is only possible with configurable alarms (type C). In the table below are reported the C alarms (configurable). For not configurable alarms qualified as NC the motor stops by inertia.																																																																																																																																																																																																																																																																																																																						
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Click on → tick box (✓) to change the bit value = 1. Please also refer to chapter 2.5

Use of the bit

V32	Bit	Configuration braking following alarms	Bit = 1 Motor stop by braking
	0	Alarm 3: Motor overtemperature	Motor stops with brake by setting to zero the speed reference with ramp if V30.5=1 . Setting V30.5=0 the motor stops with the maximum current (less value between V123 and V50).
	1	Alarm 4: Drive overtemperature	
	2	Alarm 8: Local link	
	3	Alarm 9*: S1 sensor	
	4	Alarm 11*: Overspeed	
	5	Alarm 13: NC synchronization	
	6	Alarm 18*: Self-calibration	
	7	Alarm 37*: Following error	
	8	Alarm 38: S2 sensor	
	9	Alarm 49: I ^Δ 2t	
	10	Alarm 51: Congruence position S1-S2	
	11	Alarm 52: Anti-backlash function	
	12	Alarm 57: Power Supply class 0	
	13	Alarm 61: Safety Module class 1	
	14	Alarm 62: Safety Module class 2	
	15	Alarm 70: Torque duplication function	
	16	Alarm 71: Winding duplication function	In case of SLAVE of Winding Duplication (AP05) then Motor stops by braking through short-circuiting the motor phases if Synchronous or Linear motors.
	*	Motor stops by braking through short-circuiting the motor phases if Synchronous or Linear motors. Motor stops by inertia if Asynchronous motors.	

**NOTE**

The slave drives in torque duplication configuration will always stop the motor by braking through short-circuiting the motor phases.

For a correct use of the configuration bits see next page and see “General NUM DrivePro alarms / securities configuration” on chapter 6.3.1 The bits 29 and 30 must always be set = 1.

V33

Alarm reset configuration [1=Reset]

General	Unit R	☐	Motor type	AM, SM, LM																																																																																																																																																																																																																																																																																																																		
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The V33 parameter allows to sets up the drive alarm reset configuration by means of bit configurable functions. The parameters reported on the table below are bit parameters used for the general configuration of the drive. Every single alarm to be reset must be previously configured by means of parameter V33 with bit set to 1. An alarm reset within the drive is carried out by CNC unit. The duration of reset pulse must be >500ms and the reset must be carried out in absence of torque enable request.																																																																																																																																																																																																																																																																																																																						
Description	<table><tr><th colspan="4">V33 Alarm reset configuration [1=Reset]</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th><th></th><th></th><th></th><th></th><th></th></tr><tr><td>0</td><td>☒</td><td>Alarm 3: Motor overtemperature</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>☒</td><td>Alarm 4: Drive overtemperature</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>☒</td><td>Alarm 5: Braking resistor or PWS overtemperature</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>3</td><td>☒</td><td>Alarm 6: Short-circuit to earth</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>☒</td><td>Alarm 7: Auxiliary power supply</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td>☒</td><td>Alarm 8: Local link</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>6</td><td>☒</td><td>Alarm 9: S1 sensor</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>7</td><td>☒</td><td>Alarm 10: Timespeed</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>8</td><td>☒</td><td>Alarm 11: Overspeed</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>9</td><td>☒</td><td>Alarm 12: Drive overcurrent</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>10</td><td>☒</td><td>Alarm 14: Wrong SD card handling</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>11</td><td>☒</td><td>Alarm 16: Incompatible parameters</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>12</td><td>☒</td><td>Alarm 18: Self-calibration</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>13</td><td>☒</td><td>Alarm 37: Following error</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>14</td><td>☒</td><td>Alarm 38: S2 sensor</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>15</td><td>☒</td><td>Alarm 49: I^2t</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>16</td><td>☒</td><td>Alarm 51: Congruence position S1-S2</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>17</td><td>☒</td><td>Alarm 52: Anti-backlash function</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>18</td><td>☒</td><td>Alarm 54: Brake failure</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>19</td><td>☒</td><td>Alarm 56: V/f regulation</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>20</td><td>☒</td><td>Alarm 57: Power Supply class 0</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>21</td><td>☒</td><td>Alarm 58: Power Supply class 1</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>22</td><td>☒</td><td>Alarm 59: Link Power Supply</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>23</td><td>☒</td><td>Alarm 60: Safety Module class 0</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>24</td><td>☒</td><td>Alarm 61: Safety Module class 1</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>25</td><td>☒</td><td>Alarm 62: Safety Module class 2</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>26</td><td>☒</td><td>Alarm 63: Safety Module class 3</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>27</td><td>☒</td><td>Alarm 64: Safety Module class 4</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>28</td><td>☒</td><td>Alarm 70: Torque duplication function</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>29</td><td>☒</td><td>Alarm 71: Winding duplication function</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>30</td><td>☒</td><td>Alarm 80: DEMF Drive Embedded Macro function</td><td>☒</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>31</td><td>☐</td><td></td><td>☐</td><td></td><td></td><td></td><td></td><td></td></tr></table> Click on → tick box (✓) to change the bit value = 1. Please also refer to chapter 2.5				V33 Alarm reset configuration [1=Reset]				☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Bit	Value	Description	Default						0	☒	Alarm 3: Motor overtemperature	☒						1	☒	Alarm 4: Drive overtemperature	☒						2	☒	Alarm 5: Braking resistor or PWS overtemperature	☒						3	☒	Alarm 6: Short-circuit to earth	☒						4	☒	Alarm 7: Auxiliary power supply	☒						5	☒	Alarm 8: Local link	☒						6	☒	Alarm 9: S1 sensor	☒						7	☒	Alarm 10: Timespeed	☒						8	☒	Alarm 11: Overspeed	☒						9	☒	Alarm 12: Drive overcurrent	☒						10	☒	Alarm 14: Wrong SD card handling	☒						11	☒	Alarm 16: Incompatible parameters	☒						12	☒	Alarm 18: Self-calibration	☒						13	☒	Alarm 37: Following error	☒						14	☒	Alarm 38: S2 sensor	☒						15	☒	Alarm 49: I^2t	☒						16	☒	Alarm 51: Congruence position S1-S2	☒						17	☒	Alarm 52: Anti-backlash function	☒						18	☒	Alarm 54: Brake failure	☒						19	☒	Alarm 56: V/f regulation	☒						20	☒	Alarm 57: Power Supply class 0	☒						21	☒	Alarm 58: Power Supply class 1	☒						22	☒	Alarm 59: Link Power Supply	☒						23	☒	Alarm 60: Safety Module class 0	☒						24	☒	Alarm 61: Safety Module class 1	☒						25	☒	Alarm 62: Safety Module class 2	☒						26	☒	Alarm 63: Safety Module class 3	☒						27	☒	Alarm 64: Safety Module class 4	☒						28	☒	Alarm 70: Torque duplication function	☒						29	☒	Alarm 71: Winding duplication function	☒						30	☒	Alarm 80: DEMF Drive Embedded Macro function	☒						31	☐		☐					
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Use of the bits	The alarms are divided in two categories according to the reset procedure used: - NC = To reset the alarm, it is mandatory to turn OFF power and auxiliary supply. (Not Configurable) - C = The alarm reset mode may be configured by means of CNC (Configurable).																																																																																																																																																																																																																																																																																																																					



NOTE

To reset an alarm, the torque enable command must be absent. For the alarms reset configuration, please refer to the chapter 6.3.1 "General NUM DrivePro alarms / securities configuration".

V34**Configuration DF1/DF2 relay [1=Open]**

General	Unit R	□	Motor type	AM, SM, LM																																																																																																																																				
	Unit L																																																																																																																																							
	Adjustment range R	0 ÷ 2.097.151	HALT required	No																																																																																																																																				
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	Default R	0	Family	2 Drive configuration																																																																																																																																				
	Default L																																																																																																																																							
The V34 parameter allows to configure the mains contactor opening through the contact DF1 / DF2 of the MDLL3 power supply when any of the alarms listed in the table below occurs. Set V34 parameter to 1 configure the opening of DF1 / DF2 contact in case of alarm.																																																																																																																																								
Description	V34 Configuration DF1/DF2 relay [1=Open] ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td>Alarm 2: BUS overvoltage</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Alarm 3: Motor overtemperature</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Alarm 4: Drive overtemperature</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Alarm 5: Braking resistor or PWS overtemperature</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Alarm 6: Short-circuit to earth</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Alarm 7: Auxiliary power supply</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Alarm 8: Local link</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Alarm 9: S1 sensor</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>Alarm 10: Timeout</td><td>☐</td></tr><tr><td>9</td><td>☐</td><td>Alarm 11: Overspeed</td><td>☐</td></tr><tr><td>10</td><td>☐</td><td>Alarm 12: Drive overcurrent</td><td>☐</td></tr><tr><td>11</td><td>☐</td><td>Alarm 13: NC synchronization</td><td>☐</td></tr><tr><td>12</td><td>☐</td><td>Alarm 15: Data memory checksum error</td><td>☐</td></tr><tr><td>13</td><td>☐</td><td>Alarm 16: Incompatible parameters</td><td>☐</td></tr><tr><td>14</td><td>☐</td><td>Alarm 18: Self-calibration</td><td>☐</td></tr><tr><td>15</td><td>☐</td><td>Alarm 37: Following error</td><td>☐</td></tr><tr><td>16</td><td>☐</td><td>Alarm 38: S2 sensor</td><td>☐</td></tr><tr><td>17</td><td>☐</td><td>Alarm 49: I⁺2t</td><td>☐</td></tr><tr><td>18</td><td>☐</td><td>Alarm 51: Congruence position S1-S2</td><td>☐</td></tr><tr><td>19</td><td>☐</td><td>Alarm 52: Anti-backlash function</td><td>☐</td></tr><tr><td>20</td><td>☐</td><td>Alarm 70: Torque duplication function</td><td>☐</td></tr><tr><td>21</td><td>☐</td><td>Alarm 71: Winding duplication function</td><td>☐</td></tr><tr><td>22</td><td>☐</td><td></td><td>☐</td></tr><tr><td>23</td><td>☐</td><td></td><td>☐</td></tr><tr><td>24</td><td>☐</td><td></td><td>☐</td></tr><tr><td>25</td><td>☐</td><td></td><td>☐</td></tr><tr><td>26</td><td>☐</td><td></td><td>☐</td></tr><tr><td>27</td><td>☐</td><td></td><td>☐</td></tr><tr><td>28</td><td>☐</td><td></td><td>☐</td></tr><tr><td>29</td><td>☐</td><td></td><td>☐</td></tr><tr><td>30</td><td>☐</td><td></td><td>☐</td></tr><tr><td>31</td><td>☐</td><td></td><td>☐</td></tr></table>				Bit	Value	Description	Default	0	☐	Alarm 2: BUS overvoltage	☐	1	☐	Alarm 3: Motor overtemperature	☐	2	☐	Alarm 4: Drive overtemperature	☐	3	☐	Alarm 5: Braking resistor or PWS overtemperature	☐	4	☐	Alarm 6: Short-circuit to earth	☐	5	☐	Alarm 7: Auxiliary power supply	☐	6	☐	Alarm 8: Local link	☐	7	☐	Alarm 9: S1 sensor	☐	8	☐	Alarm 10: Timeout	☐	9	☐	Alarm 11: Overspeed	☐	10	☐	Alarm 12: Drive overcurrent	☐	11	☐	Alarm 13: NC synchronization	☐	12	☐	Alarm 15: Data memory checksum error	☐	13	☐	Alarm 16: Incompatible parameters	☐	14	☐	Alarm 18: Self-calibration	☐	15	☐	Alarm 37: Following error	☐	16	☐	Alarm 38: S2 sensor	☐	17	☐	Alarm 49: I ⁺ 2t	☐	18	☐	Alarm 51: Congruence position S1-S2	☐	19	☐	Alarm 52: Anti-backlash function	☐	20	☐	Alarm 70: Torque duplication function	☐	21	☐	Alarm 71: Winding duplication function	☐	22	☐		☐	23	☐		☐	24	☐		☐	25	☐		☐	26	☐		☐	27	☐		☐	28	☐		☐	29	☐		☐	30	☐		☐	31	☐		☐
Bit	Value	Description	Default																																																																																																																																					
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Click on → tick box (✓) to change the bit value = 1. Please also refer to chapter 2.5

**NOTE**

For a correct use of the configuration bits see “General NUM DrivePro alarms / securities configuration” on chapter [6.3.1](#)

V35 NCK related axis address

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0 ÷ 1023	HALT required	Yes		
	Adjustment range L					
	Default R	0	Family	2 Drive configuration		
	Default L					
The V35 parameter contains the physical address of the axis assigned to it by the NC.						
Description	V35 NCK related axis address ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0	□	NCK related axis address	0	1023	0

V36 FSoE address SAMX

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0 ÷ 1023	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	2 Drive configuration		
	Default L					
The V36 parameter allows to make the NUM-SAMX address. The V36 value must be matched with NUM-SAMX parameter S0021.						
Description	V36 FSoE address SAMX ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	FSoE address SAMX	1	1023	1
Such address create the link with the Safe PLC master of the FSoE protocol. If the NUM-SAMX is installed on a Bi-axes drive each axis must have own FSoE address. Please refer to NUM-SAMX Safety module Instruction manual M00036 for more detailed information.						

V37 Delay time of power detection

General	Unit R	s	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.2 ÷ 2.0	HALT required	No		
	Adjustment range L					
	Default R	1.5	Family	2 Drive configuration		
	Default L					
	The V37 parameter sets the delay time power detection.					
Description	V37 Delay time of power detection ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1.5	s	Delay time of power detection	0.2	2.0	1.5
This delay time is a time interval between the instant of DC Bus power enabling and the drive status information DCBUS ON available on feedback PLC status word FlexiumPro_NCK.RCNC. Axis[n].DigitalAxis.DCBusPresent After having switched on the DC Bus power, the drive wait for V37 time elapsed before enabling any torque and motor movement.						

V39

Bump suppressor speed limit (% of V98)

General	Unit R	%	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0.0 ÷ 200.0	HALT required	No	
	Adjustment range L				
	Default R	110.0	Family	3	Measures and positions management
	Default L				
The V39 parameter limits the speed reference when torque enabled.					

Description	V39 Bump suppressor speed limit (% of V98)					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	110.0	%	Bump suppressor speed limit (% of V98)	0.0	200.0	110.0				
	There are cases, where after motor torque removing, external mechanical forces move the axis from the position you leaved it with the last movement, for example inserting a brake with hirth toothing or a mechanical index creating in such way a lag error. Normally when you will give again torque to the motor you will hear like a “bump” sound in the axis due to the immediate following error recovering with maximum acceleration and speed.									
	To smooth this situation the “Bump suppressor” function could be used.									
	V39 is a percentage of the maximal motor speed.									
	The “Bump suppressor” functionality will be active ONLY for NCK “position control” (FlexiuPro_NCK.RCNC.Axis[n].DigitalAxis.ControlMode = ENUMCONTRLMODE.DeltaPos) and V39 < 100 (default value 110).									
	In case of “speed control” (spindles)(FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.ControlMode = ENUMCONTRLMODE.Speed) the “Bump suppressor” functionality is OFF !!!									
	Bump suppressor functionality is ON:									
	- Only if “position control” is active - Whenever the torque is disabled - At torque enabling, until the speed reference output from position regulator is below the “Bump suppressor” speed limit for at least 50 ms									
Bump suppressor functionality is OFF:										
- Whenever “speed control” is active - After torque enabling AND after the speed reference output from position regulator is below the “Bump suppressor” speed limit for at least 50 ms.										
Whenever “Bump suppressor” function is ON, then the speed reference from position regulator is limited to V39 percentage of maximal motor speed.										
FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.BumpSuppressor = TRUE whenever “Bump suppressor” functionality is active.										
That allows PLC to be aware of the speed limitation induced by “Bump suppressor” functionality.										
When V30.0 = 1, the FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.ReferenceEnabled = TRUE only after “Bump suppressor” function has gone OFF after torque enabling.										

4C Oscilloscope (9.0)

Settings

Graphic

15

14

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0.05

0.1

0.15

0.2

0.25

0.3

0.35

0.4

0.45

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4

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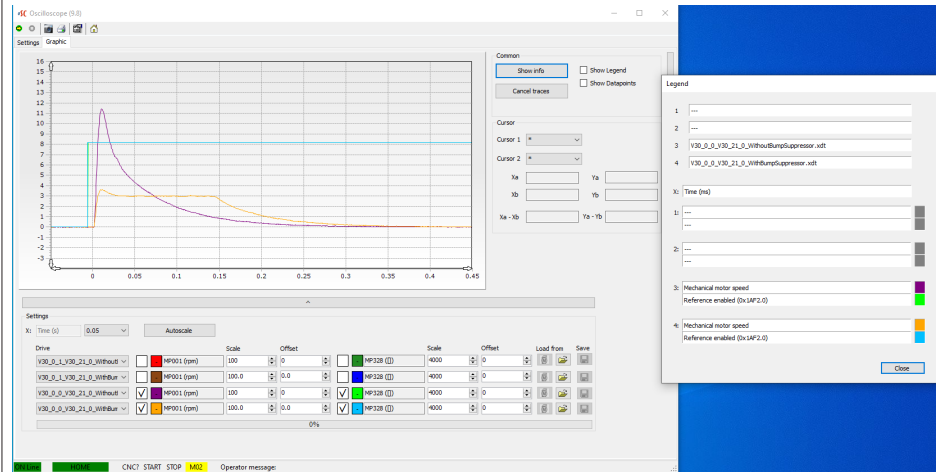
6

7

8

Description

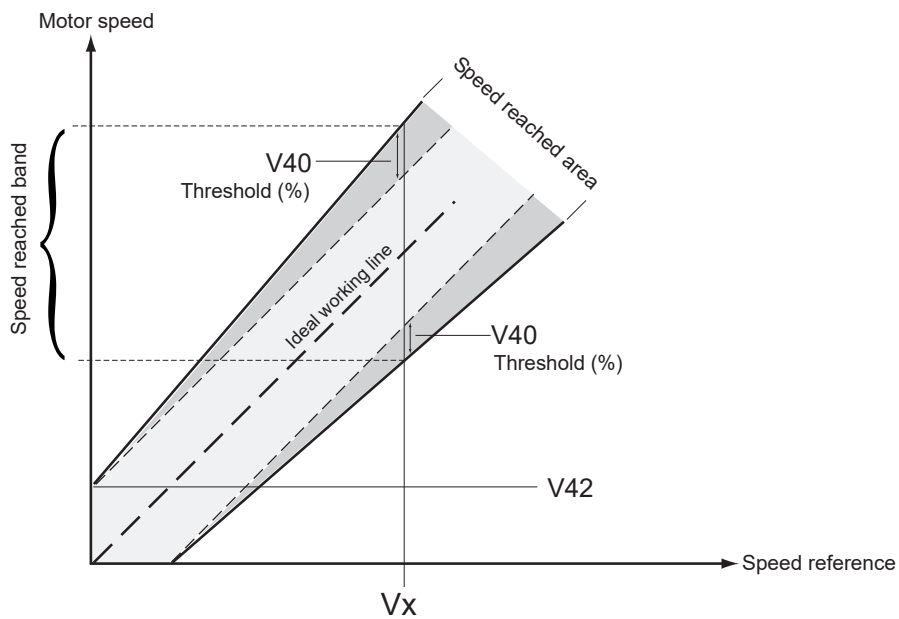
When $V30.0 = 0$, the FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.ReferenceEnabled = TRUE always immediately after , with or without Bump suppressor activated.



NOTE

Oscilloscope trigger on $MP325 > 32767$
 FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.
 TorqueEnable and FlexiumPro_NCK.WCNC.Axis[n].
 DigitalAxis.ReferenceEnable simultaneously TRUE

V40**Speed reached dynamic threshold**

General	Unit R	%	Motor type	AM, SM, LM																						
	Unit L																									
	Adjustment range R	0.0 ÷ 50.0	HALT required	No																						
	Adjustment range L																									
	Default R	0.0	Family	4 Speed loop control																						
	Default L																									
The V40 parameter is used to set the speed reached threshold. The parameter value is expressed in % of the reference speed as indicated in figure. This parameter may be used for checking the real speed through two thresholds which generate a band upon the speed. When the motor speed goes into the such band the PLC bit FlexiumPro_NCK.RCNC.Axis[n]. DigitalAxis.SpeedReached bit is set to "TRUE". Whenever the motor speed goes out of such band the PLC bit FlexiumPro_NCK.RCNC.Axis[n]. DigitalAxis.SpeedReached bit is set to "FALSE".																										
Description	<table><tr><th colspan="5">V40 Speed reached dynamic threshold</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>%</td><td>Speed reached dynamic threshold</td><td>0.0</td><td>50.0</td><td>0.0</td></tr></table>				V40 Speed reached dynamic threshold					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	0.0	%	Speed reached dynamic threshold	0.0	50.0	0.0
	V40 Speed reached dynamic threshold					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																
Value	Unit	Description	Min	Max	Default																					
0.0	%	Speed reached dynamic threshold	0.0	50.0	0.0																					
 $\text{Speed reached band} = 2 * \left(V42 + \left(\frac{V40}{100} \right) * Vx \right)$																										

V42**Motor zero speed threshold, enable, brake**

General	Unit R	rpm	Motor type	AM, SM, LM		
	Unit L	mm/min				
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No		
	Adjustment range L	1.0 ÷ 3000.0				
	Default R	30.0	Family	4 Speed loop control		
	Default L	300.0				
The V42 parameter is used to set the linear motor zero speed threshold.						
Description	V42 Motor zero speed threshold, enable, brake ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	30.0	rpm	Motor zero speed threshold, enable, brake	0.1	5000.0	30.0
This parameter may be used in according with V31 bit 0 configuration in order to control the motor torque enable / disable. (see V31.0 use) whenever the motor zero speed threshold is reached. Moreover, when the speed is lower than V42 value the PLC bit FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.MotorMoving bit is set to “FALSE”.						

V43**Braking Timeout on config. V31, V32**

General	Unit R	s	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.1 ÷ 120.0	HALT required	No		
	Adjustment range L					
	Default R	10.0	Family	2	Drive configuration Speed loop control	
	Default L			4		
	The V43 parameter is used to set the braking timeout value					
Description	V43 Braking Timeout on config. V31, V32 Value Unit Description Min Max Default 10.0 s Braking Timeout on config. V31, V32 0.1 120.0 10.0 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	When the time set in the V43 parameter will be elapsed the drive will be disabled and the motor stops by inertia (coasting).					
	The watchdog time starts when a braking condition is activated. The braking time depending on the V50, V123, and V91 setting.					

V46 Speed dynamic check

General	Unit R	rpm	Motor type	AM, SM, LM		
	Unit L	mm/min				
	Adjustment range R	0.0 ÷ 2000.0	HALT required	No		
	Adjustment range L	0.0 ÷ 20000.0				
	Default R	0.0	Family	4 Speed loop control		
	Default L					
The V46 parameter is used to generate an alarm able to stop the motor if the motor direction movement is not coherent with reference signal. This alarm is A37.1 Speed dynamic check threshold exceeded.						
Description	V46 Speed dynamic check ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	rpm	Speed dynamic check	0.0	2000.0	0.0
	When the drive torque is enabled, the following check is performed:					
	1. Drive managed in "speed control" mode (FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis. ControlMode = ENUMCONTRLMODE.Speed) If the motor speed exceeds 12.5% Speed reference + V46. The alarm 37 Ext 1 is activated.					
	Causes of the above condition could be:					
	- Wrong value of V220.4 - Sensors phase offset wrong - Requested acceleration to high - Motor locked for mechanical reason.					
	2. Drive managed in "position control" mode (FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis. ControlMode = ENUMCONTRLMODE.DeltaPos) If the motor speed exceeds 12.5% Speed reference + V46 if the sign of the delta position is different from the sign of the position movement required the alarm 37 Ext 1 is activated.					
	Causes of the above condition could be:					
	- Wrong value of V220.4 - Sensors phase offset wrong - Requested acceleration to high - Wrong value of V325.1, related to the S2 sensor when is closing the position loop - Motor locked for mechanical reason. - The motor brake is released, if V46 is too small respect to the oscillation created by the energy present into the motor before brake releasing due to V109 <> 0 or from the vertical load. You can trace MP001 into the drive oscilloscope activating the trigger on alarm condition and looking at the maximum value reached. V46 must be higher than that maximum value.					

Actual speed

V46

V46

Speed reference

V50 Torque current limit

General	Unit R	Arms	Motor type	AM, SM, LM											
	Unit L														
	Adjustment range R	0.0 ÷ drive size current/1.414	HALT required	No											
	Adjustment range L														
	Default R	1.0	Family	4 Speed loop control 14 Current loop control											
	Default L														
	Through the V50 parameter it is possible to reduce the maximum drive current in order to limit the maximum torque delivered by the motor.														
The value is expressed in Arms.															
Description	V50 Torque current limit ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default														
	<table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>9.89</td><td>Arms</td><td>Torque current limit</td><td>0.0</td><td>9.9</td><td>9.89</td></tr></table>	Value	Unit	Description	Min	Max	Default	9.89	Arms	Torque current limit	0.0	9.9	9.89		
Value	Unit	Description	Min	Max	Default										
9.89	Arms	Torque current limit	0.0	9.9	9.89										
Enter the Arms value of the desired torque current into parameter V50. Example of V50 adjustment for NUM DrivePro 014A1Cxxxx (9.89 Arms. max) By entering the value 9.89 in parameter V50 the effective current delivered by the system will be 9.89 Arms max. (with subsequent reduction of motor maximum torque).															



NOTE

By selecting the drive size association, the maximum value foreseen for that power unit will automatically be setup on V50 parameter.

V51 Proportional speed loop gain

General	Unit R	mArms/rpm	Motor type	AM, SM, LM			
	Unit L	Arms/(m/min)					
	Adjustment range R	0.0 ÷ 400000.0	HALT required	No			
	Adjustment range L	0.0 ÷ 40000.0					
	Default R	15.0	Family	4 Speed loop control			
	Default L	1.5					
The V51 parameter is used to improve the dynamic response of the system.							
Description	V51 Proportional speed loop gain		☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default	
	15.0	mArms/r...	Proportional speed loop gain	0.0	400000.0	15.0	
The value of the speed cycle's proportional gain will have to be increased by adjusting parameter V51 in general by the same percentage as the load inertia in relation to the motor. For a correct use of the parameter see chapter 5.1.1 - Speed loop parameters optimisation procedure.							

V52 Integral speed loop gain

General	Unit R	ms	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No												
	Adjustment range L															
	Default R	30.0	Family	4 Speed loop control												
	Default L															
The V52 parameter is used to improve the dynamic response of the system.																
Description	V52 Integral speed loop gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>30.0</td><td>ms</td><td>Integral speed loop gain</td><td>0.1</td><td>5000.0</td><td>30.0</td></tr></table>				Value	Unit	Description	Min	Max	Default	30.0	ms	Integral speed loop gain	0.1	5000.0	30.0
Value	Unit	Description	Min	Max	Default											
30.0	ms	Integral speed loop gain	0.1	5000.0	30.0											
For a correct use of the parameter see chapter 5.1.1 - Speed loop parameters optimisation procedure.																

V80 Set Point Weight speed loop gain

General	Unit R	ms	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	0.0 ÷ 1.0	HALT required	No												
	Adjustment range L															
	Default R	1.0	Family	4 Speed loop control												
	Default L															
The V80 parameter is used to adjust the Set Point Weight speed loop gain.																
Description	V80 Set Point Weight speed loop gain ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>1.0</td><td>□</td><td>Set Point Weight speed loop gain</td><td>0.0</td><td>1.0</td><td>1.0</td></tr></tbody></table>				Value	Unit	Description	Min	Max	Default	1.0	□	Set Point Weight speed loop gain	0.0	1.0	1.0
	Value	Unit	Description	Min	Max	Default										
1.0	□	Set Point Weight speed loop gain	0.0	1.0	1.0											
We suggesty to set V80 =1 (standard value).																

**ATTENTION!**

Using value <1 may reduce the speed loop performance, but may reduce also the motor acceleration and the motor vibration.

V91

Acceleration/deceleration ramp

General	Unit R	rpm/s	Motor type	AM, SM, LM		
	Unit L	mm/s ²				
	Adjustment range R	4.0 ÷ 1000000.0	HALT required	No		
	Adjustment range L	5.0 ÷ 100000.0				
	Default R	5000.0	Family	4 Speed loop control 13 V/f motor control		
	Default L	1000.0				
The V91 parameter is used to adjust the acceleration / deceleration ramp for Asynchronous and Synchronous motors. The V91 ramp parameter is expressed in rpm/s.						
Set the bit V30.4 or bit V30.5 = 1 to enable the ramp.						
The use of the acceleration / deceleration ramp is described on chapter 5.14						
Description	V91 Acceleration/deceleration ramp ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	5000.0	rpm/s	Acceleration/deceleration ramp	4.0	1000000.0	5000.0
Utilisation example setting V91 = 1000.						
rpm						

V97

Speed reference Limit (% V98)

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 200.0	HALT required	No		
	Adjustment range L					
	Default R	110.0	Family	4	Speed loop control	
	Default L					
During the control speed, delta position modes, the V97 parameter is the maximum value of the speed reference which can be reached.						
The value of V97 parameter refer to a percentage (%) of V98 parameter.						
Description	V97 Speed reference Limit (% V98) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	110.0	%	Speed reference Limit (% V98)	0.0	200.0	110.0
Example						
V98 = 3000 rpm						
V97 = 110 %						

V98 Maximum motor speed

General	Unit R	%	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 120000.0	HALT required	No													
	Adjustment range L	0.0 ÷ 1000.0															
	Default R	1500.0	Family	4 13	Speed loop control V/f motor control												
	Default L	10.0															
Description	V98 Maximum motor speed ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>1500.0</td><td>rpm</td><td>Maximum motor speed</td><td>0.0</td><td>120000.0</td><td>1500.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	1500.0	rpm	Maximum motor speed	0.0	120000.0	1500.0
	Value	Unit	Description	Min	Max	Default											
1500.0	rpm	Maximum motor speed	0.0	120000.0	1500.0												
Valid for all motors types: rotary & linear motors. Command mode: Speed control (spindle) Digital reference : V98 parameter defines the rotation speed of the motor with the maximum reference defined through CNC parameters P46...P49 N1, N3.... Command mode: Position control (axis) Digital reference : V98 parameter is used as basic value for calculation of V97 parameter. (See also V97 parameter)																	
Application example	Spindle motors: The parameter value is strictly connected to the value set for P46/P47/P48/P49 parameters of CNC. (Max speed of range M4x for spindle @n in rpm) Example. Max spindle speed 2000 rpm Reduction ratio 1:2 V98 parameter value = 4000. Axis motors: The parameter value is strictly connected to the value set for P30 parameter of CNC. (Maximum traverse rate for axis @n in mm/min) Example. Axis speed 20000 mm/min Screw pitch 10 mm with motor directly connected on screw V98 parameter value = 2000.																

**NOTE**

Please refer to Flexium+ Parameters manual M00041 for more detailed information over P30, P46, P47, P48, P49.

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V99

Overspeed alarm threshold

General	Unit R	rpm	Motor type	AM, SM, LM																							
	Unit L	m/min																									
	Adjustment range R	0.0 ÷ 150000.0	HALT required	No																							
	Adjustment range L	0.0 ÷ 1200.0																									
	Default R	2000.0	Family	4	Speed loop control V/f motor control																						
	Default L	12.0		13																							
	The motor overspeed control is one of the possible functions associated with the speed loop; in fact, the triggering of alarm 11 Ext 0 (motor overspeed) can be controlled through the adjustment of V99 parameter.																										
By means of this parameter, it is possible for example to stop the motor in the event of an anomaly (motor coast or incorrect programming of parameters associated with the speed loop).																											
Description	<table><tr><td colspan="5">V99 Overspeed alarm threshold</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>2000.0</td><td>rpm</td><td>Overspeed alarm threshold</td><td>0.0</td><td>150000.0</td><td>2000.0</td></tr></table> Setup V99 parameter with the desiderated overspeed value in rpm. If the speed setup in V99 parameter is exceeded, the alarm 11 Ext 0 will be activated. Always check that V99 parameter is compatible with the value setup in V98 parameter. Overspeed values - Axis motor overspeed: normally, the overspeed threshold value is calibrated at the rated motor speed +20%. - Spindle motors overspeed : normally, the overspeed threshold value is calibrated at the rated motor speed +20%. In case of overspeed alarm activation, the motor will stop by inertia or through short-circuiting phases and the alarm 11 Ext 0 will be displayed. (See V32 use of the bit configuration)					V99 Overspeed alarm threshold					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	2000.0	rpm	Overspeed alarm threshold	0.0	150000.0	2000.0
V99 Overspeed alarm threshold					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																		
Value	Unit	Description	Min	Max	Default																						
2000.0	rpm	Overspeed alarm threshold	0.0	150000.0	2000.0																						
Application example	Application example with motor BPH0953V. - Motor operating speed 4000 rpm + 20% = 4800 (value to be entered into V99) - Select V99 parameter, then enter 4800.																										

V100

Deliverable current limit

General	Unit R	Arms	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R	0.0 ÷ drive size current/1.414	HALT required	No			
	Adjustment range L						
	Default R	1.0	Family	14	Current loop control		
	Default L						
	The V100 parameter is used to defines the maximum total current that the drive can supply to the motor						
Description	V100 Deliverable current limit		☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default	
	9.89	Arms	Deliverable current limit	0.0	9.9	9.89	

V101 Voltage limits Vd and Vq

General	Unit R	Vrms	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 1000.0	HALT required	No		
	Adjustment range L					
	Default R	480.0	Family	13	V/f motor control Current loop control	
	Default L			14		
The V101 parameter is used to adjust to set the nominal voltage of the motor winding.						
Description	V101 Voltage limits Vd and Vq					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	480.0	Vrms	Voltage limits Vd and Vq	0.0	1000.0	480.0

V102 Proportional Iq current loop gain

General	Unit R	Vrms/Arms	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 5000.0	HALT required	No		
	Adjustment range L					
	Default R	10.0	Family	14	Current loop control	
	Default L					
	The V102 parameter is used to defines the proportional gain of the motor torque current regulation loop					
Description	V102 Proportional Iq current loop gain ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	10.0	Vrms/Arms	Proportional Iq current loop gain	0.0	5000.0	10.0

V103 Integral Iq current loop gain

General	Unit R	ms	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No		
	Adjustment range L					
	Default R	10.0	Family	14	Current loop control	
	Default L					
	The V103 parameter is used to defines the integral gain of the motor torque current regulation loop					
Description	V103 Integral Iq current loop gain ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	10.0	ms	Integral Iq current loop gain	0.1	5000.0	10.0

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V104 Motor EMF phase compensation

General	Unit R	mVrms/rpm	Motor type	SM, LM														
	Unit L	Vrms/(m/s)																
	Adjustment range R	0.0 ÷ 100000.0	HALT required	No														
	Adjustment range L	0.0 ÷ 5000.0																
	Default R	0.0	Family	14	Current loop control													
	Default L																	
	The V104 parameter is used to defines the voltage developed by the back-electromotrice force of the motor. Used by the motor torque current regulation loop																	
Description	V104 Motor EMF phase compensation ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>mVrms/r...</td><td>Motor EMF phase compensation</td><td>0.0</td><td>100000.0</td><td>0.0</td></tr></table>						Value	Unit	Description	Min	Max	Default	0.0	mVrms/r...	Motor EMF phase compensation	0.0	100000.0	0.0
Value	Unit	Description	Min	Max	Default													
0.0	mVrms/r...	Motor EMF phase compensation	0.0	100000.0	0.0													

V105 Compensation of motor Lq inductance

General	Unit R	mH	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 2000.0	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	14	Current loop control												
	Default L																
The V105 parameter is used to defines the inductance value involved in the motor torque current regulation loop																	
Description	V105 Compensation of motor Lq inductance ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>mH</td><td>Compensation of motor Lq inductance</td><td>0.0</td><td>2000.0</td><td>0.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0.0	mH	Compensation of motor Lq inductance	0.0	2000.0	0.0
Value	Unit	Description	Min	Max	Default												
0.0	mH	Compensation of motor Lq inductance	0.0	2000.0	0.0												

V106 Compensation of motor Ld inductance

General	Unit R	mH	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 2000.0	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	14	Current loop control												
	Default L																
	The V106 parameter is used to defines the inductance value involved in the motor flux current regulation loop																
Description	V106 Compensation of motor Ld inductance ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>0.0</td><td>mH</td><td>Compensation of motor Ld inductance</td><td>0.0</td><td>2000.0</td><td>0.0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	0.0	mH	Compensation of motor Ld inductance	0.0	2000.0	0.0
Value	Unit	Description	Min	Max	Default												
0.0	mH	Compensation of motor Ld inductance	0.0	2000.0	0.0												

V107 Lowpass Filter electrical speed

General	Unit R	Hz	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.1 ÷ 1000.0	HALT required	No													
	Adjustment range L																
	Default R	750.0	Family	14 20	Current loop control Filters												
	Default L																
	The V107 parameter is used to low pass filter applied to the calculation of the rotation speed of the magnetic flux field of the motor.																
Description	V107 Lowpass Filter electrical speed ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>750.0</td><td>Hz</td><td>Lowpass Filter electrical speed</td><td>0.1</td><td>1000.0</td><td>750.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	750.0	Hz	Lowpass Filter electrical speed	0.1	1000.0	750.0
	Value	Unit	Description	Min	Max	Default											
750.0	Hz	Lowpass Filter electrical speed	0.1	1000.0	750.0												

V108 Motor rated current [I²t]

General	Unit R	Arms	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.1 ÷ 0.9*drive size current/1.414	HALT required	No		
	Adjustment range L					
	Default R	0.707	Family	12	Thermal protections V/f motor control	
	Default L			13		
The value of V108 parameters determines three adjustment thresholds of the current limit. (See operating diagram here under)						
Description	V108 Motor rated current [I^2t] ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.707	Arms	Motor rated current [I^2t]	0.1	8.91	0.707
Motor thermal image management Thresholds definition: Threshold Warning 49 Ext 0 "OFF" = $V108^2$ Threshold Warning 49 Ext 0 "ON" = $1.05 * (V108^2)$ Threshold Alarm 49 Ext 0 = $1.167 * (V108^2)$ (1) The Warning presence could be read from PLC by means of FlexiumPro_NCK.RCNC. Axis[n].DigitalAxis.Warnings and the specific warning Ext can be read in the HMI Diagnostics. (2) If $V50 < V123 (V124)$ then $t > V240 (V241)$.						



WARNING

The use of these parameters is strictly reserved to NUM Technical Service. The motor rated current I_{nom} [Arms] is automatically selected on V108 parameters during the motor / drive association.

V109 Vertical load compensation current

General	Unit R	Arms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	-V108 ÷ V108	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	5	Special applications configuration												
	Default L																
	The V109 parameter is used to defines the torque current necessary to support a vertical load. Used in motors with brakes that manage vertical axes.																
Description	V109 Vertical load compensation current ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>Arms</td><td>Vertical load compensation current</td><td>-0.707</td><td>0.707</td><td>0.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0.0	Arms	Vertical load compensation current	-0.707	0.707	0.0
	Value	Unit	Description	Min	Max	Default											
0.0	Arms	Vertical load compensation current	-0.707	0.707	0.0												

**NOTE**

Select the right compensation value to prevent an unexpected axis movement during the system enable phase.

V119 Phase lead

General	Unit R	Arms	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R	0.0 ÷ 3.0	HALT required	No														
	Adjustment range L																	
	Default R	1.5	Family	14	Current loop control													
	Default L																	
	The V119 parameter is used to defines the compensation of the delay in applying the U-V and W voltages to the motor.																	
Description	V119 Phase lead ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>1.5</td><td>°</td><td>Phase lead</td><td>0.0</td><td>3.0</td><td>1.5</td></tr></table>						Value	Unit	Description	Min	Max	Default	1.5	°	Phase lead	0.0	3.0	1.5
	Value	Unit	Description	Min	Max	Default												
1.5	°	Phase lead	0.0	3.0	1.5													

V121 Iq gain reduction at V123 current

General	Unit R	Arms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.4 ÷ 1.0	HALT required	No													
	Adjustment range L																
	Default R	1.0	Family	5	Special applications configuration Current loop control												
	Default L			14													
	The V121 parameter is used to defines the reduction factor of the proportional gain of the motor torque current regulation loop, as a function of the requested torque current.																
Description	V121 Iq gain reduction at V123 current ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>1.0</td><td>□</td><td>Iq gain reduction at V123 current</td><td>0.4</td><td>1.0</td><td>1.0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	1.0	□	Iq gain reduction at V123 current	0.4	1.0	1.0
Value	Unit	Description	Min	Max	Default												
1.0	□	Iq gain reduction at V123 current	0.4	1.0	1.0												

V123 Maximal motor current

General	Unit R	Arms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	V108*1.12 ÷ V108*8.0	HALT required	No													
	Adjustment range L																
	Default R	1.0	Family	5	Special applications configuration Current loop control												
	Default L			14													
The V123 parameter sets the maximal motor current.																	
Description	V123 Maximal motor current ☒ Unit☒ Descripton☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>1.0</td><td>Arms</td><td>Maximal motor current</td><td>0.791</td><td>5.656</td><td>1.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	1.0	Arms	Maximal motor current	0.791	5.656	1.0
Value	Unit	Description	Min	Max	Default												
1.0	Arms	Maximal motor current	0.791	5.656	1.0												

V125 Current percentage V108 for EPSM

General	Unit R	%	Motor type	SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 100.0	HALT required	No													
	Adjustment range L																
	Default R	50.0	Family	11	Motor/sensor phase management												
	Default L																
	The V125 parameter sets the current percentage (%) to use for EPSM. The parameter value is expressed in % and the default value 50%.																
Description	V125 Current percentage V108 for EPSM ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>50.0</td><td>%</td><td>Current percentage V108 for EPSM</td><td>0.0</td><td>100.0</td><td>50.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	50.0	%	Current percentage V108 for EPSM	0.0	100.0	50.0
	Value	Unit	Description	Min	Max	Default											
50.0	%	Current percentage V108 for EPSM	0.0	100.0	50.0												
Increase the parameter value only if using special motors or when there are strong frictions preventing to reach the correct position during EPSM operation. (Electrical Position Synchronisation with movement).																	

V126 Current percentage V108 for EPS

General	Unit R	%	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R	0.0 ÷ 127.0*V100/V108	HALT required	No														
	Adjustment range L																	
	Default R	50.0	Family	11	Motor/sensor phase management													
	Default L																	
	The V126 parameter sets the current percentage (%) to use for EPS. The parameter value is expressed in % and the default value 50%.																	
Description	V126 Current percentage V108 for EPS ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>50.0</td><td>%</td><td>Current percentage V108 for EPS</td><td>0.0</td><td>179.632</td><td>50.0</td></tr></tbody></table>						Value	Unit	Description	Min	Max	Default	50.0	%	Current percentage V108 for EPS	0.0	179.632	50.0
	Value	Unit	Description	Min	Max	Default												
50.0	%	Current percentage V108 for EPS	0.0	179.632	50.0													

V128 Locked rotor current I[∧]2t (% V108)

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	50.0 ÷ 100.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	12 Thermal protections		
	Default L					
The V128 define the maximum current value which could be maintained by the motor when the speed is lower than value set in the V245. It represents the “stall rated” motor current.						
Description	V128 Locked rotor current I^2t (% V108) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	%	Locked rotor current I^2t (% V108)	50.0	100.0	100.0

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V130 Associate MP with quick NC TP1

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	1 ÷ 9999	HALT required	No												
	Adjustment range L															
	Default R	1	Family	10 Input/output configuration												
	Default L															
V130 parameter allows to associate and display the internal measure point MP of the drive with test point TP1 in digital form. The measure points MP value are described in the chapter 4																
Description	V130 Associate MP with quick NC TP1 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>1</td><td>□</td><td>Associate MP with quick NC TP1</td><td>1</td><td>9999</td><td>1</td></tr></table> By means V130 it is possible to select the measure point which has to be associated to the TP1. Example V130 = 050 → TP1 with Iq current measure point association. (Default)				Value	Unit	Description	Min	Max	Default	1	□	Associate MP with quick NC TP1	1	9999	1
Value	Unit	Description	Min	Max	Default											
1	□	Associate MP with quick NC TP1	1	9999	1											



NOTE

It is possible to apply a low pass filter to the values of the MP measure point associated with TP1 via parameter V550 and V551.



NOTE

This parameter is automatically adjusted whenever we required to set up the drive test point and measure point association box via FlexiumPro Tools as indicated on chapter 2.6

V131 Associate MP with quick NC TP2

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	1 ÷ 9999	HALT required	No												
	Adjustment range L															
	Default R	50	Family	10 Input/output configuration												
	Default L															
V131 parameter allows to associate and display the internal measure point MP of the drive with test point TP2 in digital form. The measure points MP value are described in the chapter 4.																
Description	V131 Associate MP with quick NC TP2 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>50</td><td>□</td><td>Associate MP with quick NC TP2</td><td>1</td><td>9999</td><td>50</td></tr></table> By means V131 it is possible to select the measure point which has to be associated to the TP2. Example V131 = 11 → TP2 with LOAD signal measure point association. (Default).				Value	Unit	Description	Min	Max	Default	50	□	Associate MP with quick NC TP2	1	9999	50
Value	Unit	Description	Min	Max	Default											
50	□	Associate MP with quick NC TP2	1	9999	50											

**NOTE**

It is possible to apply a low pass filter to the values of the MP measure point associated with TP2 via parameter V550 and V552.

**NOTE**

This parameter is automatically adjusted whenever we required to set up the drive test point and measure point association box via FlexiumPro Tools as indicated on chapter 2.6

V132 Associate MP with quick NC TP3

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	1 ÷ 9999	HALT required	No												
	Adjustment range L															
	Default R	8	Family	10 Input/output configuration												
	Default L															
	V132 parameter allows to associate and display the internal measure point MP of the drive with test point TP3 in digital form. The measure points MP value are described in the chapter 4															
Description	V132 Associate MP with quick NC TP3 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>8</td><td>□</td><td>Associate MP with quick NC TP3</td><td>1</td><td>9999</td><td>8</td></tr></tbody></table>				Value	Unit	Description	Min	Max	Default	8	□	Associate MP with quick NC TP3	1	9999	8
	Value	Unit	Description	Min	Max	Default										
8	□	Associate MP with quick NC TP3	1	9999	8											
By means V132 it is possible to select the measure point which has to be associated to the TP3. Example V132 = 8 → TP3 with BUS Voltage measure point association. (Default)																



NOTE

It is possible to apply a low pass filter to the values of the MP measure point associated with TP3 via parameter V550 and V553



NOTE

This parameter is automatically adjusted whenever we required to set up the drive test point and measure point association box via FlexiumPro Tools as indicated on chapter 4.

V133 Associate MP with quick NC TP4

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	1 ÷ 9999	HALT required	No												
	Adjustment range L															
	Default R	260	Family	10 Input/output configuration												
	Default L															
	V133 parameter allows to associate and display the internal measure point MP of the drive with test point TP4 in digital form. The measure points MP value are described in the chapter 4															
Description	V133 Associate MP with quick NC TP4 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>260</td><td>□</td><td>Associate MP with quick NC TP4</td><td>1</td><td>9999</td><td>260</td></tr></tbody></table>				Value	Unit	Description	Min	Max	Default	260	□	Associate MP with quick NC TP4	1	9999	260
	Value	Unit	Description	Min	Max	Default										
260	□	Associate MP with quick NC TP4	1	9999	260											
By means V133 it is possible to select the measure point which has to be associated to the TP4. Example V133 = 260 → TP4 with motor PTC-NTC measure point association. (Default)																

**NOTE**

It is possible to apply a low pass filter to the values of the MP measure point associated with TP4 via parameter V550 and V554

**NOTE**

This parameter is automatically adjusted whenever we required to set up the drive test point and measure point association box via FlexiumPro Tools as indicated on chapter 4.

V135 Configuration of braking relay

General	Unit R	□	Motor type	AM, SM, LM
	Unit L			
	Adjustment range R	0 ÷ 255	HALT required	Yes
	Adjustment range L			
	Default R	0	Family	10 Input/output configuration
	Default L			
The V135 parameter allows to configure the braking relay using bits configuration.				

Description	V135 Configuration of braking relay ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Brake management [1=Active]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Brake: check presence of current V109 [1=On] [0=Off]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Alarm 54 ext 0 (24V missing) exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Alarm 54 ext 1/2 (feedback incoherent) exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Alarms 54 ext 20,21,22,23 treated as Warnings [0=Alarm] [1=Warning]</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>SAFE Brake required [1=Required]</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>External only (S10) brake management [1=External]</td><td>☐</td></tr></tbody></table>	Bit	Value	Description	Default	0	☐	Brake management [1=Active]	☐	1	☐	Brake: check presence of current V109 [1=On] [0=Off]	☐	2	☐	Alarm 54 ext 0 (24V missing) exclusion [1=Excluded]	☐	3	☐	Alarm 54 ext 1/2 (feedback incoherent) exclusion [1=Excluded]	☐	4	☐	Alarms 54 ext 20,21,22,23 treated as Warnings [0=Alarm] [1=Warning]	☐	5	☐	Not used	☐	6	☐	SAFE Brake required [1=Required]	☐	7	☐	External only (S10) brake management [1=External]	☐
	Bit	Value	Description	Default																																	
	0	☐	Brake management [1=Active]	☐																																	
	1	☐	Brake: check presence of current V109 [1=On] [0=Off]	☐																																	
	2	☐	Alarm 54 ext 0 (24V missing) exclusion [1=Excluded]	☐																																	
	3	☐	Alarm 54 ext 1/2 (feedback incoherent) exclusion [1=Excluded]	☐																																	
	4	☐	Alarms 54 ext 20,21,22,23 treated as Warnings [0=Alarm] [1=Warning]	☐																																	
	5	☐	Not used	☐																																	
	6	☐	SAFE Brake required [1=Required]	☐																																	
	7	☐	External only (S10) brake management [1=External]	☐																																	
	Click on → tick box (✓) to change the bit status value = 1.																																				
	Bit 0 Brake management [1 = active] This bit set to 1 allows to make the brake management.																																				
Bit 1 Brake: check the presence of current V109 [1 = On] This bit set to 1 check the presence of vertical load compensation current V109 before to Relayase the brake.																																					
Bit 2 Alarm 54 exclusion [1 = Excluded] This bit set to 1 excluded the alarm 54 (Brake failure). Please also refer to chapter 7 for more detailed information.																																					
The status of the signal BrakeRelay could be associated to a drive output on S7 connector by means of one among parameters V26, V27, V28 and V29 setting.																																					
Please refer to chapter 5.3 for more detailed information.																																					
Furthermore, in case of power equipped with SAFE-BRAKE it is mandatory to set Bit 6																																					
Bit 7 has to be set if the Brake is completely controlled externally, and NOT by the drive. Note that Bit 0 and Bit 7 are mutually exclusive: only one of them could be set at the same time.																																					

V136 Brake ON delay

General	Unit R	ms	Motor type	AM, SM, LM																														
	Unit L																																	
	Adjustment range R	25 ÷ 1500	HALT required	No																														
	Adjustment range L																																	
	Default R	25	Family	10 Input/output configuration																														
	Default L																																	
The V136 brake ON delay time allows to manage the motor brake Relayased time.																																		
Description	<table><tr><td colspan="5">V136 Brake ON delay</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td colspan="3">Description</td><td>Min</td><td>Max</td><td colspan="3">Default</td></tr><tr><td>25</td><td>ms</td><td colspan="3">Brake ON delay</td><td>25</td><td>1500</td><td colspan="3">25</td></tr></table> Please refer the diagram in chapter 5.3.				V136 Brake ON delay					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description			Min	Max	Default			25	ms	Brake ON delay			25	1500	25		
V136 Brake ON delay					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																									
Value	Unit	Description			Min	Max	Default																											
25	ms	Brake ON delay			25	1500	25																											

V137 Brake OFF delay

General	Unit R	ms	Motor type	AM, SM, LM
	Unit L			
	Adjustment range R	25 ÷ 1500	HALT required	No
	Adjustment range L			
	Default R	25	Family	10 Input/output configuration
	Default L			
	The V137 brake OFF delay time allows to manage the motor brake insertion time.			

Description	V137 Brake OFF delay					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	25	ms	Brake OFF delay	25	1500	25				

Please refer the diagram in chapter 5.3.

V140 Associate MP with programmable relay 1

General	Unit R	ms	Motor type	AM, SM, LM																				
	Unit L																							
	Adjustment range R	1 ÷ 9999	HALT required	No																				
	Adjustment range L																							
	Default R	11	Family	10 Input/output configuration																				
	Default L																							
The V140 parameter is used for associating a measure point MP to the programmable relay 1. The measure point MP and programmable relay associations is shown on chapter 4. It is possible to apply a low pass filter to the values of the MP measure point associated with relay1 via parameter V560 and V561																								
Description	<table><tr><td colspan="3">V140 Associate MP with programmable relay 1</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>11</td><td>□</td><td>Associate MP with programmable relay 1</td><td>1</td><td>9999</td><td>11</td></tr></table> The default value is V140 = 11 (LOAD) Please also refer to chapter 2 for more detailed informations.				V140 Associate MP with programmable relay 1			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	11	□	Associate MP with programmable relay 1	1	9999	11
V140 Associate MP with programmable relay 1			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																	
Value	Unit	Description	Min	Max	Default																			
11	□	Associate MP with programmable relay 1	1	9999	11																			
Example	We want to associate to the relay 1 the measure point code 001 (mechanical motor speed selection) - Select V140 = 1																							



NOTE

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V141 Programmable relay 1, threshold 1

General

Unit R

Unit L

Adjustment range R

Adjustment range L

Default R

Default L

□

- 2147483648 ÷ 2147483647
-3.4e+38 ÷ 3.4e+38

100.0

Motor type

HALT required

Family

AM, SM, LM

No

10 Input/output configuration

The V141 parameter defines the threshold values to be used with V140 parameter. Please always observe this rule: V141 value must be > V142 value.

Description

V141 Programmable relay 1, threshold 1

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
100.0	□	Programmable relay 1, threshold 1	0.0	3.402823E+38	100.0

Once the measure point to be associated to programmable relay No.1 has been selected and the application mode has been configured using the V145 parameter, it is necessary to setup the values of both thresholds as well as the intervention time constant.

The thresholds 1/2 Internal Unit is automatically adapted to the selected quantity. If, for example, an item representing a speed has been selected, the threshold will be configured in Rpm. Please also refer to chapter 2 for more detailed informations.

- If the selected measure point is a “speed” or a “speed reference”:
Enter the thresholds in rpm.
- If the selected measure point is an “iq”, “id current” or an “iq” or “id current reference”:
Enter the thresholds in Arms.
- If the selected measure point MP007 “Image I²t” (see chapter 4) :
Enter the thresholds in %.
- If the selected measure point is a “vq”, “vd”, “bus voltage” :
Enter the thresholds in Volts.

**NOTE**

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V142 Programmable relay 1, threshold 2

General	Unit R	□	Motor type	AM, SM, LM																																
	Unit L																																			
	Adjustment range R	- 2147483648 ÷ 2147483647	HALT required	No																																
	Adjustment range L																																			
	Default R	95.0	Family	10 Input/output configuration																																
	Default L																																			
The V142 parameter defines the threshold values to be used with V140 parameter. Please always observe this rule: V141 value must be > V142 value.																																				
Description	<table><tr><td colspan="5">V142 Programmable relay 1, threshold 2</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>95.0</td><td>□</td><td>Programmable relay 1, threshold 2</td><td>0.0</td><td>3.402823E+38</td><td>95.0</td><td></td><td></td><td></td><td></td><td></td></tr></table>				V142 Programmable relay 1, threshold 2					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default						95.0	□	Programmable relay 1, threshold 2	0.0	3.402823E+38	95.0					
	V142 Programmable relay 1, threshold 2					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																										
Value	Unit	Description	Min	Max	Default																															
95.0	□	Programmable relay 1, threshold 2	0.0	3.402823E+38	95.0																															
Once the measure point to be associated to programmable relay No.1 has been selected and the application mode has been configured using the V145 parameter, it is necessary to setup the values of both thresholds as well as the intervention time constant. The thresholds 1/2 Internal Unit is automatically adapted to the selected quantity. If, for example, an item representing a speed has been selected, the threshold will be configured in Rpm. Please also refer to chapter 2 for more detailed informations. - If the selected measure point is a “speed” or a “speed reference”: Enter the thresholds in rpm. - If the selected measure point is an “iq”, “id current” or an “iq” or “id current reference”: Enter the thresholds in Arms. - If the selected measure point MP007 “Image I^2t” (see chapter 4) Enter the thresholds in %. - If the selected measure point is a “vq”, “vd”, “bus voltage” : Enter the thresholds in Volts.																																				



NOTE

Further information concerning the relay scale factor values and measure point unit measurement are shown on the chapter 4.



NOTE

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V144 Programm. relay 1, tripping time constant

General	Unit R	ms	Motor type	AM, SM, LM
	Unit L			
	Adjustment range R	5 ÷ 1500	HALT required	No
	Adjustment range L			
	Default R	15	Family	10 Input/output configuration
	Default L			
The V144 programmable relay time constant manages the relay ON / OFF switching and viceversa.				

Description	V144 Programm. relay 1, tripping time constant ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	15	ms	Programm. relay 1, tripping time constant	5	1500	15

When the value of the quantity controlled has reach for a time longer than value set in the V144 parameter the relay will switch ON or OFF.

The relay thresholds are selected by the V141, V142 parameters.
The programmable relay time constant is expressed in ms.

Please also refer to chapter [5.2](#) for more detailed informations.

**NOTE**

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

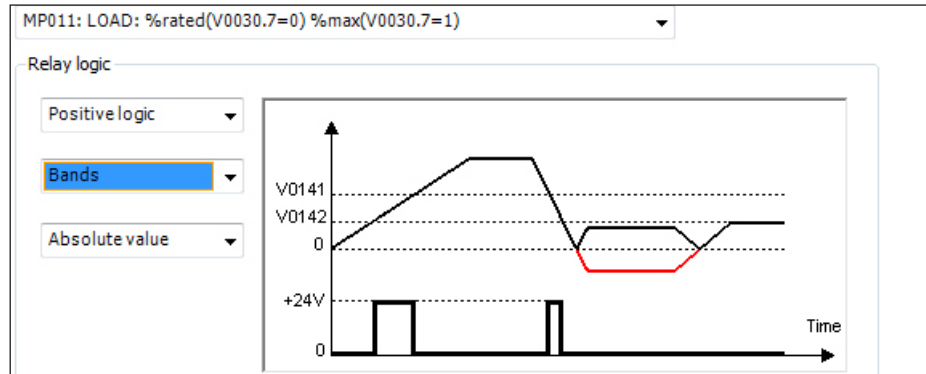
V145 Configuration of programmable relay 1

General	Unit R	□	Motor type	AM, SM, LM																					
	Unit L																								
	Adjustment range R	0 ÷ 7	HALT required	Yes																					
	Adjustment range L																								
	Default R	5	Family	10 Input/output configuration																					
	Default L																								
The V145 parameter sets the programmable relay 1 for different application by means of bits configurations. The bits use and descriptions are shown here under. By means of the programmable relays it is possible to control control quantities using two thresholds (see V141, V142), logic intervention and a time constant. During the relay configuration please also take into consideration the V26 ...V29 parameters configuration. The programmable relay 1 output is available on FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.Prog01 as PLC variable and as physical NUM DrivePro output on S7 connector making the I/O configuration by means of one among parameters V26, V27, V28 and V29. Please also refer to NUM DrivePro Installation manual M00067 S7 connector for physical drive output. Click on → tick box (✓) to change the bit status value = 1. Please also refer to chapter 2 for more detailed informations.																									
Description	V145 Configuration of programmable relay 1 ☒Unit ☒Description ☒Min ☒Max ☒Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Absolute value for prog. relay [1=Absol.]</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Prog. relay mode [1=Band] [0=Thresholds]</td><td>☐</td></tr><tr><td>2</td><td>☒</td><td>Logic of prog. relay [1=Positive] [0=Negative]</td><td>☒</td></tr></tbody></table> Bit 0 Absolute value for programmable relay This bit set to 1 allows to define the logic operation in absolute mode of the relay 1, considering either the absolute (Bit0 = 1) or not absolute (Bit0 = 0) control value of the selected quantity on the relay in this example MP011. - Bit 0 = 0 Relative value for programmable relay MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Positive logic Thresholds Relative value <tr><td>Description</td><td colspan="4"> - Bit 0 = 1 Absolute value for programmable relay MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Positive logic Thresholds Absolute value </td></tr>				Bit	Value	Description	Default	0	☒	Absolute value for prog. relay [1=Absol.]	☒	1	☐	Prog. relay mode [1=Band] [0=Thresholds]	☐	2	☒	Logic of prog. relay [1=Positive] [0=Negative]	☒	Description	- Bit 0 = 1 Absolute value for programmable relay MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Positive logic Thresholds Absolute value			
Bit	Value	Description	Default																						
0	☒	Absolute value for prog. relay [1=Absol.]	☒																						
1	☐	Prog. relay mode [1=Band] [0=Thresholds]	☐																						
2	☒	Logic of prog. relay [1=Positive] [0=Negative]	☒																						
Description	- Bit 0 = 1 Absolute value for programmable relay MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Positive logic Thresholds Absolute value																								

Bit 1 Programmable mode

- Bit 0 = 0 Band

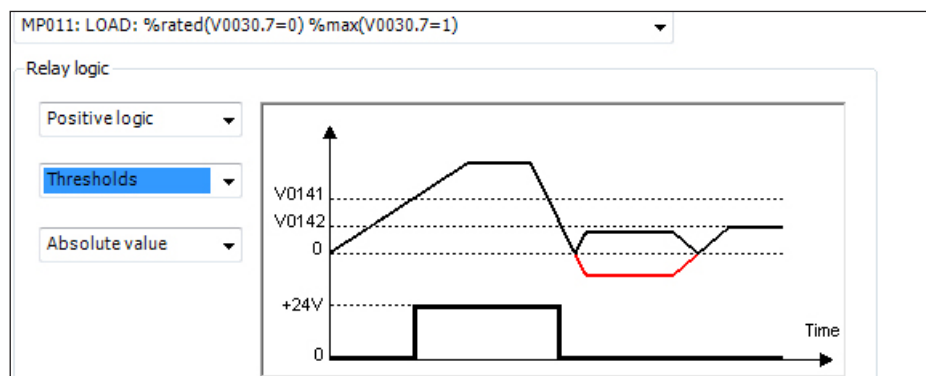
In this mode the programmable relay switches OFF when the quantity MP011 value is outside the band created by the two thresholds (V141, V142). The relay switching will occur only if the condition is present for a time longer than value set in the V144 parameter.



- Bit 0 = 1 Thresholds

The working range of the selected quantity MP011 is monitored.

The programmable relay switches ON / OFF as the quantity crosses the band created by the two thresholds. The relay switches ON as the quantity exceeds the value of threshold 1 and OFF as it falls below the value of threshold 2. The relay switching will occur only if the condition is present for a time longer than value set in the V144 parameter.



1

2

3

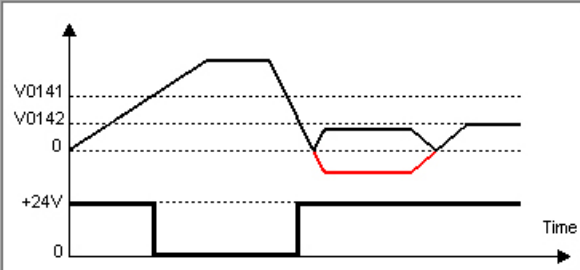
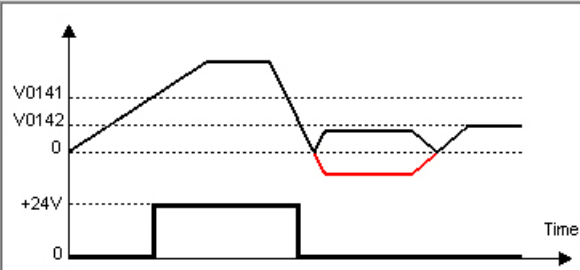
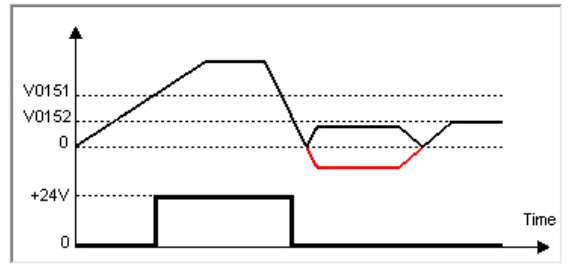
4

5

6

7

8

Description	Bit 2 Logic of programmable relay - Bit 2 = 0 Negative The negative logic sets the output status condition of the programmable relay 1 threshold mode with negative or positive logic control. In this mode the programmable relay switches OFF when the quantity MP011 value is outside the band created by the two thresholds (V141, V142). The relay switching will occur only if the condition is present for a time longer than value set in the V144 parameter. MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Negative logic Thresholds Absolute value  - Bit 2 = 1 Positive The working range of the selected quantity MP011 is monitored. The programmable relay switches ON / OFF as the quantity crosses the band created by the two thresholds. The relay switches ON as the quantity exceeds the value of threshold 1 and OFF as it falls below the value of threshold 2. The relay switching will occur only if the condition is present for a time longer than value set in the V144 parameter. MP011: LOAD: %rated(V0030.7=0) %max(V0030.7=1) Relay logic Positive logic Thresholds Absolute value 
Example	MP016: Image drive I²t Relay logic Positive logic Thresholds Absolute value 

V150 Associate MP with programmable relay 2

General	Unit R	□	Motor type	AM, SM, LM																								
	Unit L																											
	Adjustment range R	1 ÷ 9999	HALT required	No																								
	Adjustment range L																											
	Default R	16	Family	10 Input/output configuration																								
	Default L																											
	The V150 parameter is used for associating a measure point MP to the programmable relay 2. The measure point MP and programmable relay associations is shown on chapter 4.																											
	It is possible to apply a low pass filter to the values of the MP measure point associated with relay 2 via parameter V560 and V562																											
Description	<table><tr><td colspan="3">V150 Associate MP with programmable relay 2</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td><td colspan="2"></td></tr><tr><td>16</td><td>□</td><td>Associate MP with programmable relay 2</td><td>1</td><td>9999</td><td>16</td><td colspan="2"></td></tr></table>				V150 Associate MP with programmable relay 2			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default			16	□	Associate MP with programmable relay 2	1	9999	16		
V150 Associate MP with programmable relay 2			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																					
Value	Unit	Description	Min	Max	Default																							
16	□	Associate MP with programmable relay 2	1	9999	16																							
	The default value is V150 = 16 (Image drive I^2t)																											
Example	We want to associate to the relay 2 the measure point code 002 (Iq current reference) - Select V150 = 2																											

**NOTE**

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V151 Programmable relay 2, threshold 1

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	- 2147483648 ÷ 2147483647	HALT required	No												
	Adjustment range L															
	Default R	105.0	Family	10 Input/output configuration												
	Default L															
The V151 parameter defines the threshold values to be used with V155 parameter. Please always observe this rule: V151 value must be > V152 value.																
Description	V151 Programmable relay 2, threshold 1 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>105.0</td><td>□</td><td>Programmable relay 2, threshold 1</td><td>0.0</td><td>3.402823E+38</td><td>105.0</td></tr></table>				Value	Unit	Description	Min	Max	Default	105.0	□	Programmable relay 2, threshold 1	0.0	3.402823E+38	105.0
	Value	Unit	Description	Min	Max	Default										
105.0	□	Programmable relay 2, threshold 1	0.0	3.402823E+38	105.0											
Once the measure point to be associated to programmable relay No.1 has been selected and the application mode has been configured using the V155 parameter, it is necessary to setup the values of both thresholds as well as the intervention time constant. The thresholds 1/2 Internal Unit is automatically adapted to the selected quantity. If, for example, an item representing a speed has been selected, the threshold will be configured in Rpm. Please also refer to chapter 2 for more detailed informations. - If the selected measure point is a “speed” or a “speed reference”: Enter the thresholds in rpm. - If the selected measure point is an “iq”, “id current” or an “iq” or “id current reference”: Enter the thresholds in Arms. - If the selected measure point MP007 “Image I^2t” (see chapter 4): Enter the thresholds in %. - If the selected measure point is a “vq”, “vd”, “bus voltage” : Enter the thresholds in Volts.																



NOTE

Further information concerning the relay scale factor values and measure point unit measurement are shown on the chapter 4.



NOTE

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V152 Programmable relay 2, threshold 2

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	- 2147483648 ÷ 2147483647	HALT required	No												
	Adjustment range L															
	Default R	100.0	Family	10 Input/output configuration												
	Default L															
The V152 parameter defines the threshold values to be used with V155 parameter. Please always observe this rule: V151 value must be > V152 value.																
Description	V152 Programmable relay 2, threshold 2 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>100.0</td><td>□</td><td>Programmable relay 2, threshold 2</td><td>0.0</td><td>3.402823E+38</td><td>100.0</td></tr></table>				Value	Unit	Description	Min	Max	Default	100.0	□	Programmable relay 2, threshold 2	0.0	3.402823E+38	100.0
	Value	Unit	Description	Min	Max	Default										
100.0	□	Programmable relay 2, threshold 2	0.0	3.402823E+38	100.0											
Once the measure point to be associated to programmable relay No.1 has been selected and the application mode has been configured using the V155 parameter, it is necessary to setup the values of both thresholds as well as the intervention time constant. The thresholds 1/2 Internal Unit is automatically adapted to the selected quantity. If, for example, an item representing a speed has been selected, the threshold will be configured in Rpm. Please also refer to chapter 2 for more detailed informations. - If the selected measure point is a “speed” or a “speed reference”: Enter the thresholds in rpm. - If the selected measure point is an “iq”, “id current” or an “iq” or “id current reference”: Enter the thresholds in Arms. - If the selected measure point MP007 “Image I^2t” (see chapter 4): Enter the thresholds in %. - If the selected measure point is a “vq”, “vd”, “bus voltage”: Enter the thresholds in Volts.																

**NOTE**

Further information concerning the relay scale factor values and measure point unit measurement are shown on the chapter 4.

**NOTE**

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V154 Programm. relay 2, tripping time constant

General	Unit R	ms	Motor type	AM, SM, LM
	Unit L			
	Adjustment range R	5 ÷ 1500	HALT required	No
	Adjustment range L			
	Default R	15	Family	10 Input/output configuration
	Default L			
The V154 programmable relay time constant manages the relay ON / OFF switching and viceversa.				

Description	V154 Programm. relay 2, tripping time constant					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	15	ms	Programm. relay 2, tripping time constant	5	1500	15				

When the value of the quantity controlled has reach for a time longer than value set in the V154 parameter the relay will switch ON or OFF.

The relay thresholds are selected by the V151, V152 parameters.
The programmable relay time constant is expressed in ms.

See relay utilisation on chapter [5.2](#).

Speed [rpm]

V151

V152

0

Relay ON = output +24V

Relay OFF = output 0V

V154

V154

t



NOTE

This parameter is automatically adjusted whenever we required to set up the Relay editor box via FlexiumPro Tools as indicated on chapter 2.7.7.

V155 Configuration of programmable relay 2

General	Unit R	□	Motor type	AM, SM, LM
	Unit L			
	Adjustment range R	0 ÷ 7	HALT required	Yes
	Adjustment range L			
	Default R	5	Family	10 Input/output configuration
	Default L			
The V155 parameter sets the programmable relay 2 for different application by means of bit configurations (see table below). The bits use and descriptions are shown here under.				
Description	V155 Configuration of programmable relay 2 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default			
	Bit	Value	Description	Default
	0	☒	Absolute value for prog. relay [1=Absol.]	☒
	1	☐	Prog. relay mode [1=Band] [0=Thresholds]	☐
	2	☒	Logic of prog. relay [1=Positive] [0=Negative]	☒
	By means of the programmable relays it is possible to control control quantities using two thresholds (see V151, V152), logic intervention and a time constant (V154).			
	The programmable relay 2 output is available on FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis. Prog02 as PLC variable and as physical NUM DrivePro output on S7 connector making the I/O configuration by means of one among parameters V26, V27, V28 and V29. Please also refer to NUM DrivePro Installation manual M00067 S7 connector for physical drive output..			
	Click on → tick box (✓) to change the bit status value = 1. Please also refer to chapter 2 for more detailed informations.			
	Please refer to V145 for the bits use example.			

V160 Special applications selection

General

Unit R

Unit L

Adjustment range R

Adjustment range L

Default R

Default L

0 ÷ 4.095

0

Motor type

HALT required

Family

AM, SM, LM

Yes

5 Special applications configuration

The V160 bits parameter allows to make the Special application selection.

Description

V160 Special applications selection

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Bit	Value	Description	Default
0	☐	AP01: Absolute position with motor sensor	☐
1	☐	AP02: Rotary axis with mech. ratio not 2 ⁿ x	☐
2	☐	AP03: Anti-backlash	☐
3	☐	AP04: Torque duplication	☐
4	☐	AP05: Winding duplication	☐
5	☐	AP06: Coherence S1/S2	☐
6	☐	AP07: DEMF Drive Embedded Macro	☐
7	☐	AP08: Inter-drive DEMF data exchange	☐
8	☐	Not used	☐
9	☐	Not used	☐
10	☐	AP11: Active damping by Accelerometer S3	☐
11	☐	AP12: Active damping by S2	☐

Please refer to chapter 5 for more detailed information upon the “Special application”.
Click on → tick box (✓) to change the bit status value = 1.



ATTENTION!

To use the AP01 - AP02 special application please refer to the description provided on chapter 5.

On NUM DrivePro Standard Performances version only the AP02 function is available.

V162 AP02: Mechanical ratio: load turns

General	Unit R	□	Motor type	AM, SM
	Unit L			
	Adjustment range R	0 ÷ 32767	HALT required	Yes
	Adjustment range L			
	Default R	0	Family	5 Special applications configuration
	Default L			
	The V162 parameter refers to the AP02 special application and must be used together with V163 parameter. Enter into V163 the load turns value of the application.			

Description

V162 AP02: Mechanical ratio: load turns

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
0	□	AP02: Mechanical ratio: load turns	0	32767	0

The AP02 application manages the absolute position management (without to perform the HOMING procedure at each machine power on) of rotary axes with a mechanical ratio between the position sensor (S1 or S2) and axis (load) which is not 2ⁿ.

The AP02 special application is activated by setting:

- V160 bit 1 = 1

Please also refer to chapter 5.11 “AP02 application” .

V163 AP02: Mechanical ratio: sensor turns

General	Unit R	□	Motor type	AM, SM	
	Unit L				
	Adjustment range R	1 ÷ 32767	HALT required	Yes	
	Adjustment range L				
	Default R	1	Family	5 Special applications configuration	
	Default L				
	The V163 parameter refers to the AP02 special application and must be used together with V162 parameter. Enter into V163 the sensor turns value of the application.				

Description	V163 AP02: Mechanical ratio: sensor turns ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	AP02: Mechanical ratio: sensor turns	1	32767	1

The AP02 application manages the absolute position management (without to perform the HOMING procedure at each machine power on) of rotary axes with a mechanical ratio between the position sensor (S1 or S2) and axis (load) which is not 2^n.

The AP02 special application is activated by setting:

- V160 bit 1 = 1

Please also refer to chapter 5.11 “AP02 application” .

V164 AP02: configuration

General	Unit R	☐	Motor type	AM, SM
	Unit L			
	Adjustment range R	0 ÷ 3	HALT required	Yes
	Adjustment range L			
	Default R	0	Family	5 Special applications configuration
	Default L			
The V164 parameter allows to make the AP02 configuration as indicated in the figure.				

Description	V164 AP02: configuration					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Bit	Value	Description				Default			
	0	☐	AP02 sensor [0=S1] [1=S2]				☐			
	1	☐	AP02 for long linear axes [1=ON] [0=OFF]				☐			
	Please refer to chapter 5.11 for more detailed information upon the “Special application”. Click on → tick box (✓) to change the bit status value = 1.									
	Bit 0 AP02 sensor [0=S1] [1=S2] Selecting the bit to 1 the AP02 application is configured on S2 sensor. Selecting the bit to 0 the AP02 application will be configured on S1 sensor.									
	Bit 1 AP02 for long linear axes [1=ON] [0=OFF] Selecting the bit to 1 the AP02 application for long linear axes is enabled. Selecting the bit to 0 the AP02 application for long linear axes is disabled.									

V168 AP03: Anti-backlash link connection type

General	Unit R	☐	Motor type	AM, SM																								
	Unit L																											
	Adjustment range R	0 ÷ 31	HALT required	Yes																								
	Adjustment range L																											
	Default R	1	Family	5 Special applications configuration																								
	Default L																											
The V168 parameter defines the type of communication link used by all the axes involved in the anti-backlash function.																												
Description	V168 AP03: Anti-backlash link connection type ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Internal link via memory-A</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Internal link via memory-B</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Internal link via memory-C</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>External link via P7 connector</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>External link via P8 connector</td><td>☐</td></tr></tbody></table> Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				Bit	Value	Description	Default	0	☒	Internal link via memory-A	☒	1	☐	Internal link via memory-B	☐	2	☐	Internal link via memory-C	☐	3	☐	External link via P7 connector	☐	4	☐	External link via P8 connector	☐
Bit	Value	Description	Default																									
0	☒	Internal link via memory-A	☒																									
1	☐	Internal link via memory-B	☐																									
2	☐	Internal link via memory-C	☐																									
3	☐	External link via P7 connector	☐																									
4	☐	External link via P8 connector	☐																									

V169 AP03: Anti-backlash role

General	Unit R	☐	Motor type	AM, SM								
	Unit L											
	Adjustment range R	0 ÷ 1	HALT required	Yes								
	Adjustment range L											
	Default R	0	Family	5 Special applications configuration								
	Default L											
The V169 parameter allows to make the Anti-Backlash to the module Slave or Master configuration.												
Description	V169 AP03: Anti-backlash role ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Role [0=Slave] [1=Master]</td><td>☐</td></tr></tbody></table> Click on → tick box (✓) to change the bit status value = 1.				Bit	Value	Description	Default	0	☐	Role [0=Slave] [1=Master]	☐
Bit	Value	Description	Default									
0	☐	Role [0=Slave] [1=Master]	☐									

1

2

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V170

AP03: Anti-backlash configuration

General	Unit R	□	Motor type	AM, SM
	Unit L			
	Adjustment range R	0 ÷ 3	HALT required	Yes
	Adjustment range L			
	Default R	0	Family	5 Special applications configuration
	Default L			
The V170 parameter allows to make the Anti-Backlash configuration as indicated in the figure . To set up the Anti-backlash function adjust the tandem pre-load current values. (See parameter V171)				

Description	V170 AP03: Anti-backlash configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description	Default	
	0	☐	Inward/outward slave [1=Outward]	☐	
	1	☐	Manchester encoding [1=ON] [0=OFF]	☐	
	Click on → tick box (✓) to change the bit status value = 1.				
	Bit 0 Inward/outward slave [1=Outward] This bit it allows the selection of the direction of movement of the slave (see +/- boxes in the figure).				
Bit 1 Manchester encoding [1=ON] [0=OFF] This bit allows the use of Manchester encoding for the data communicationj between master and slave. this is useful in case master and slave drives are NOT placed in the same cabinet. This bit has no meaning in case of AP03 on a Bi-Axes module. The wiring connection is not present.					
Drive Master Drive Slave					

V172

AP03 Master: Proportional torq. equaliz. gain

General	Unit R	rpm/Arms	Motor type	AM, SM
	Unit L			
	Adjustment range R	0.0 ÷ 500.0	HALT required	No
	Adjustment range L			
	Default R	1.0	Family	5 Special applications configuration
	Default L			
The V172 parameter allows to set up the proportional torque equalizer gain value. The proportional gain value is expressed in rpm/Arms.				

Description	V172 AP03 Master: Proportional torq. equaliz. gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1.0	rpm/Arms	AP03 Master: Proportional torq. equaliz. gain	0.0	500.0	1.0

The suggested default value is 1.00 rpm/Arms.

Drive Master

The diagram illustrates a dual-drive system with a Drive Master and a Drive Slave. Both drives have a speed reference input and a speed measure feedback input. The Drive Master's speed reference is compared with its speed measure at a summing junction. The resulting error signal is processed by a speed regulator (represented by a block with a graph) to produce the master current reference (Iq_ref master). This reference is then compared with the master's speed measure at another summing junction. The output of this second summing junction is fed into a torque equalizer block (V172/V166/V173), which also receives a gain parameter (V172). The output of the torque equalizer is fed back into the master's speed reference summing junction. The Drive Slave's speed reference is the master's speed measure. Its speed measure feedback is compared with its speed reference at a summing junction. The resulting error signal is processed by a speed regulator to produce the slave current reference (Iq_ref slave). This reference is then compared with the slave's speed measure at another summing junction. The output of this second summing junction is fed into a torque equalizer block (V172/V166/V173), which also receives a gain parameter (V172). The output of the torque equalizer is fed back into the slave's speed reference summing junction. Various other parameters are shown, including V175 (V165), V176, V177, V171, and V170 bit 1, which are used to configure the system.

Drive Slave

V173 AP03 Master: Integral torque equalizer gain

General	Unit R	ms	Motor type	AM, SM	
	Unit L				
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No	
	Adjustment range L				
	Default R	150.0	Family	5 Special applications configuration	
	Default L				
The V173 parameter allows to set up the Anti-backlash integral torque equalizer gain value. The integral gain value is expressed in ms.					

Description	V173 AP03 Master: Integral torq. equaliz. gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	150.0	ms	AP03 Master: Integral torq. equaliz. gain	0.1	5000.0	150.0

The suggested default value is 150ms.

Drive Master

Drive Slave

V175

AP03 Master: Max compensation torque equalizer

General	Unit R	rpm	Motor type	AM, SM	
	Unit L				
	Adjustment range R	0.0 ÷ 400.0	HALT required	No	
	Adjustment range L				
	Default R	50.0	Family	5	Special applications configuration
	Default L				

The V175 parameter allows to set up the maximum torque compensation value of the speed reference. The parameter is expressed in rpm. The default value is 50 rpm.

V175 AP03 Master: Max compens. torque equalizer						☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
Value	Unit	Description	Min	Max	Default					
50.0	rpm	AP03 Master: Max compens. torque equalizer	0.0	400.0	50.0					

The applied value is subjective and depends on the mechanical and system characteristics.

Drive Master

Speed reference

Speed measure

V175 (V165)

V172 (V166)
V173

V176

V177

V171

V170 bit 1

V170 bit 1

Speed regulator

Speed regulator

Iq_{reg master}

Iq_{ref master}

Iq_{reg slave}

Iq_{ref slave}

Drive Slave



WARNING

Setting a too much low value in V175 parameter may produce alarm 52 Ext 41. (See parameter V176).

AP03 Master: Preload ramp speed

General	Unit R	Arms/s	Motor type	AM, SM	
	Unit L				
	Adjustment range R	0.1 ÷ 10000.0	HALT required	No	
	Adjustment range L				
	Default R	10.0	Family	5	Special applications configuration
	Default L				
The V177 parameter allows to set up the preload ramp speed.The parameter is expressed in Arms/s. The default value is 10 Arms/s.					

Description	V177 AP03 Master: Preload ramp speed ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	10.0	Arms/s	AP03 Master: Preload ramp speed	0.1	10000.0	10.0

This parameter is used to prevent mechanical problems during the Anti-backlash start function.

Drive Master

The diagram illustrates the control system for a Drive Master and Drive Slave. The Drive Master section includes a Speed reference input, a Speed measure feedback loop, a Speed regulator, and a current feedback loop. The Drive Slave section includes a Speed reference input, a Speed measure feedback loop, a Speed regulator, and a current feedback loop. The diagram shows the interconnection of these components, including the use of parameters V175, V176, V177, V171, and V170 bit 1.



WARNING

Using AP03 Anti-Backlash application the NUM DrivePro modules must always be of same size.

V179 AP04: Torque duplication link connection type

General	Unit R	□	Motor type	SM, LM
	Unit L			
	Adjustment range R	0 ÷ 31	HALT required	Yes
	Adjustment range L			
	Default R	1	Family	5 Special applications configuration
	Default L			
The V179 parameter defines the type of communication link used by all the axes involved in the torque-duplication function.				
Description	V179 AP04: Torque duplication link connection type ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default			
	Bit	Value	Description	Default
	0	☒	Internal link via memory-A	☒
	1	☐	Internal link via memory-B	☐
	2	☐	Internal link via memory-C	☐
	3	☐	External link via P7 connector	☐
	4	☐	External link via P8 connector	☐

V180 AP04: Torque duplication total drives number

General	Unit R		Motor type	SM, LM	
	Unit L				
	Adjustment range R	2 ÷ 4	HALT required	Yes	
	Adjustment range L				
	Default R	2	Family	5 Special applications configuration	
	Default L				
The V180 parameter defines the number of drives used in the Torque duplication application.					
Description	V180 AP04: Torque duplication total drives nbr Unit Description Min Max Default 2 AP04: Torque duplication total drives nbr 2 4 2				
	The maximum drive number available is 4. Drive Master Speed reference + Speed measure Speed regulator Iq_{ref master} + Filter Filter Filter Filter to Master current loop controller Drive Slave +/- V182 bit 1 Iq_{ref slave} Filter Filter Filter Filter to Slave current loop controller				

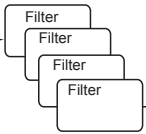
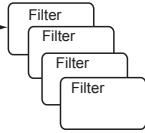


WARNING

Using AP04 Torque duplication application the NUM DrivePro modules must always be of same size.

V181

AP04: Torque duplication address

General	Unit R	[]	Motor type	SM, LM													
	Unit L																
	Adjustment range R	0 ÷ 3	HALT required	Yes													
	Adjustment range L																
	Default R	1	Family	5 Special applications configuration													
	Default L																
The V181 parameter defines the drives Slave address used in the torque duplication application.																	
Description	V181 AP04: Torque duplication address ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>1</td><td>[]</td><td>AP04: Torque duplication address</td><td>0</td><td>3</td><td>1</td></tr></table>					Value	Unit	Description	Min	Max	Default	1	[]	AP04: Torque duplication address	0	3	1
	Value	Unit	Description	Min	Max	Default											
1	[]	AP04: Torque duplication address	0	3	1												
This parameter contains the logical address of the drives in the torque duplication application. - The Master drive of torque duplication has always address 0. - The Slave drives have addresses ranging from 1 to 3.																	
Example	Suppose you have torque duplication with 1 Master and 2 Slaves. So you will have the following values in V181: - Master drive V181 = 0 - First slave drive V181 = 1 - Second slave drive V181 = 2 The default value is 1, meaning that, by default the drive is the first Slave of torque duplication. Drive Master Speed reference →  →  → Iq_ref master Speed measure →  Iq_ref master →  → to Master current loop controller Drive Slave Iq_ref master →  → Iq_ref slave Iq_ref slave →  → to Slave current loop controller																



WARNING

Using AP04 Torque duplication application the NUM DrivePro modules must always be of same size.

V182**AP04: Torque duplication configuration**

General	Unit R	☐	Motor type	SM, LM																																			
	Unit L																																						
	Adjustment range R	0 ÷ 3	HALT required	Yes																																			
	Adjustment range L																																						
	Default R	0	Family	5 Special applications configuration																																			
	Default L																																						
The V181 parameter defines the Torque duplication configuration by means of bits. The default value is 0.																																							
Description																																							
	<table><tr><td colspan="4">V182 AP04: Torque duplication configuration</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Bit</td><td>Value</td><td>Description</td><td>Default</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>0</td><td>☐</td><td>Inward/outward slave [1=Outward]</td><td>☐</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>☐</td><td>Manchester encoding [1=ON] [0=OFF]</td><td>☐</td><td></td><td></td><td></td><td></td><td></td></tr></table>				V182 AP04: Torque duplication configuration				☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Bit	Value	Description	Default						0	☐	Inward/outward slave [1=Outward]	☐						1	☐	Manchester encoding [1=ON] [0=OFF]	☐				
V182 AP04: Torque duplication configuration				☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																															
Bit	Value	Description	Default																																				
0	☐	Inward/outward slave [1=Outward]	☐																																				
1	☐	Manchester encoding [1=ON] [0=OFF]	☐																																				
Click on → tick box (✓) to change the bit status value = 1. Bit 0 Inward/outward slave [1=Outward] This bit it allows the selection of the direction of movement of the slave (see +/- boxes in the figure). Bit 1 Manchester encoding [1=ON] [0=OFF] This bit allows the use of Manchester encoding for the data communicationj between Master and Slave. this is useful in case Master and Slave drives are NOT placed in the same cabinet.																																							

**WARNING**

Using AP04 Torque duplication application the NUM DrivePro modules must always be of same size.

V184**AP05: Winding duplication link connection type**

General	Unit R	☐	Motor type	SM, LM
	Unit L			
	Adjustment range R	1 ÷ 31	HALT required	Yes
	Adjustment range L			
	Default R	1	Family	5 Special applications configuration
	Default L			
The V184 parameter defines the type of communication link used by all the axes involved in the winding-duplication function.				

Description	V184 AP05: Winding duplication link connection type					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Bit	Value	Description			Default				
	0	☒	Internal link via memory-A			☒				
	1	☐	Internal link via memory-B			☐				
	2	☐	Internal link via memory-C			☐				
	3	☐	External link via P7 connector			☐				
	4	☐	External link via P8 connector			☐				

Click on → “Radio button” to change the parameter value. Please also refer to chapter [2.5](#)

V185 AP05: Winding duplication total drives number

General	Unit R	□	Motor type	SM, LM												
	Unit L															
	Adjustment range R	2 ÷ 4	HALT required	Yes												
	Adjustment range L															
	Default R	2	Family	5 Special applications configuration												
	Default L															
Description	V185 AP05: Winding duplication total drives no. ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>2</td><td>□</td><td>AP05: Winding duplication total drives no.</td><td>2</td><td>4</td><td>2</td></tr></tbody></table>				Value	Unit	Description	Min	Max	Default	2	□	AP05: Winding duplication total drives no.	2	4	2
	Value	Unit	Description	Min	Max	Default										
2	□	AP05: Winding duplication total drives no.	2	4	2											
The V185 parameter defines the number of drives used in the Winding duplication application. The maximum drive number available is 4.																
Example	In case of winding duplication involving 1 Master and 2 Slaves, then write 3 (=2 + 1) in V185 parameter.															



WARNING

Using AP05 Winding duplication the NUM DrivePro modules must always be of same size.

V186 AP05: Winding duplication address

General	Unit R	□	Motor type	SM, LM													
	Unit L																
	Adjustment range R	0 ÷ 3	HALT required	Yes													
	Adjustment range L																
	Default R	1	Family	5 Special applications configuration													
	Default L																
	The V185 parameter defines the drives Slave address used in the Winding duplication application.																
Description	V186 AP05: Winding duplication address ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>1</td><td>□</td><td>AP05: Winding duplication address</td><td>0</td><td>3</td><td>1</td></tr></table>					Value	Unit	Description	Min	Max	Default	1	□	AP05: Winding duplication address	0	3	1
	Value	Unit	Description	Min	Max	Default											
	1	□	AP05: Winding duplication address	0	3	1											
This parameter contains the logical address of the drives in the winding duplication application. - The Master drive of Winding duplication has always address 0. - The Slave drives have addresses ranging from 1 to 3.																	
Example	Suppose you have torque duplication with 1 Master and 2 Slaves. So you will have the following values in V186: - Master drive V186 = 0 - First Slave drive V186 = 1 - Second Slave drive V186 = 2 The default value is 1, meaning that, by default the drive is the first Slave of Winding duplication.																



WARNING

Using AP05 Winding duplication the NUM DrivePro modules must always be of same size.

V187 **AP05: Winding duplication configuration**

General	Unit R	☐	Motor type	SM, LM									
	Unit L												
	Adjustment range R	0 ÷ 1	HALT required	Yes									
	Adjustment range L												
	Default R	0	Family	5	Special applications configuration								
	Default L												
Description	V187 AP05: Winding duplication configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td>Manchester encoding [1=ON] [0=OFF]</td><td>☐</td></tr></table>					Bit	Value	Description	Default	0	☐	Manchester encoding [1=ON] [0=OFF]	☐
	Bit	Value	Description	Default									
0	☐	Manchester encoding [1=ON] [0=OFF]	☐										
The V187 parameter defines the Winding duplication configuration by means of bits. The default value is 0. Click on → tick box (✓) to change the bit status value = 1. Bit 0 Manchester encoding [1=ON] [0=OFF] This bit allows the use of Manchester encoding for the data communicationj between Master and Slave. this is useful in case Master and Slave drives are NOT placed in the same cabinet.													

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V190

AP06: Max displacement measure S1-S2

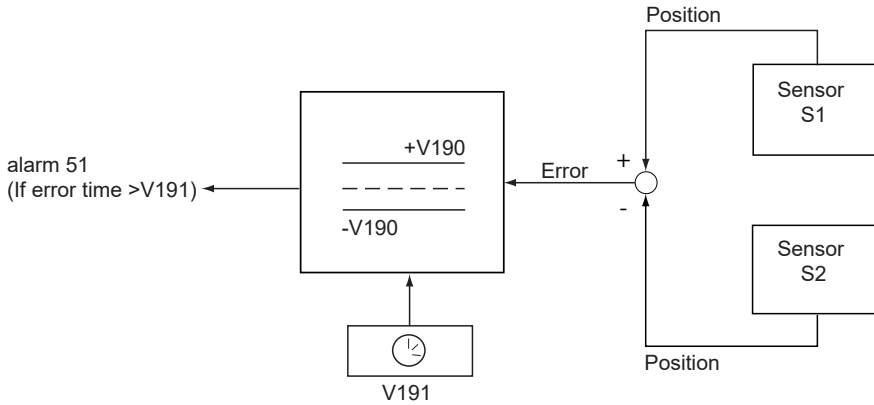
General	Unit R	CNC IU	Motor type	SM, AM, LM
	Unit L			
	Adjustment range R	1 ÷ 2000000000	HALT required	No
	Adjustment range L			
	Default R	100	Family	5 Special applications configuration
	Default L			
Description	V190 AP06: Max displacement meas. S1-S2 Value Unit Description Min Max Default 100 CNC_IU AP06: Max displacement meas. S1-S2 1 2000000000 100			
	The V190 parameter allows to control the maximum displacement between the measure coming from S1 and S2 sensor. This measure is available on the MP216 and MP217 measure points; the displacement value is available on the MP190 measure point. The default value is 100. (CNC Internal Unit) In case the displacement value between the two measures is greater than the value introduced on the V190 parameter, and this condition remains present for a time longer than the value set into V191 (ms), the drive will display alarm 51. (Congruence position S1-S2 sensors). alarm 51 (If error time >V191) +V190 ----- -V190 V191 Position Sensor S1 Position Sensor S2 Error + -			



WARNING

To use AP06 function it is necessary that MP216 and MP217 measure point have the same incremental value.

V191**AP06: Max duration measure displacement S1-S2**

General	Unit R	ms	Motor type	SM, AM, LM													
	Unit L																
	Adjustment range R	0 ÷ 1000	HALT required	No													
	Adjustment range L																
	Default R	10	Family	5	Special applications configuration												
	Default L																
Description	V191 AP06: Max duration measure displac. S1-S2 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>10</td><td>ms</td><td>AP06: Max duration measure displac. S1-S2</td><td>0</td><td>1000</td><td>10</td></tr></table>					Value	Unit	Description	Min	Max	Default	10	ms	AP06: Max duration measure displac. S1-S2	0	1000	10
	Value	Unit	Description	Min	Max	Default											
10	ms	AP06: Max duration measure displac. S1-S2	0	1000	10												
The V191 parameter allows to set up the maximum time duration of the measure displacement violation between the measure coming from S1 and S2 sensor (V190). In the case of this duration time is longer than the value (ms) set on the V191 parameter the drive will display alarm 51. (Congruence position S1-S2 sensors). The default value is 10ms. 																	

**WARNING**

To use AP06 function it is necessary that MP216 and MP217 measure point have the same incremental value.

V199 AP08: Inter-drive exch. link connection type

General	Unit R	□	Motor type	SM, AM, LM																								
	Unit L																											
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																								
	Adjustment range L																											
	Default R	1	Family	5 Special applications configuration 17 Drive Embedded Macros DEMF																								
	Default L																											
The V199 parameter defines the type of communication link used by all the axes involved in the AP08 inter-drive exchange function																												
Description	V199 AP08: Inter-drive exch. link connection type ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Internal link via memory-A</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Internal link via memory-B</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Internal link via memory-C</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>External link via P7 connector</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>External link via P8 connector</td><td>☐</td></tr></tbody></table>				Bit	Value	Description	Default	0	☒	Internal link via memory-A	☒	1	☐	Internal link via memory-B	☐	2	☐	Internal link via memory-C	☐	3	☐	External link via P7 connector	☐	4	☐	External link via P8 connector	☐
Bit	Value	Description	Default																									
0	☒	Internal link via memory-A	☒																									
1	☐	Internal link via memory-B	☐																									
2	☐	Internal link via memory-C	☐																									
3	☐	External link via P7 connector	☐																									
4	☐	External link via P8 connector	☐																									
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5																												

V200 AP08: Inter-drive exchange role

General	Unit R	□	Motor type	SM, AM, LM								
	Unit L											
	Adjustment range R	0 ÷ 1	HALT required	Yes								
	Adjustment range L											
	Default R	0	Family	5 Special applications configuration 17 Drive Embedded Macros DEMF								
	Default L											
Description	V200 AP08: Inter-drive exchange role ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Role [0=Slave] [1=Master]</td><td>☐</td></tr></tbody></table>				Bit	Value	Description	Default	0	☐	Role [0=Slave] [1=Master]	☐
	Bit	Value	Description	Default								
0	☐	Role [0=Slave] [1=Master]	☐									
The V200 parameter allows select the Inter-drive DEMF data exchange on Slave or Master. Please also refer to chapter 8.												

V201**AP08: Inter-drive exchange configuration**

General	Unit R	☐	Motor type	SM, AM, LM								
	Unit L											
	Adjustment range R	0 ÷ 1	HALT required	Yes								
	Adjustment range L											
	Default R	0	Family	5 Special applications configuration 17 Drive Embedded Macros DEMF								
	Default L											
Description	V201 AP08: Inter-drive exchange configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Manchester encoding [1=ON] [0=OFF]</td><td>☐</td></tr></tbody></table>				Bit	Value	Description	Default	0	☐	Manchester encoding [1=ON] [0=OFF]	☐
	Bit	Value	Description	Default								
0	☐	Manchester encoding [1=ON] [0=OFF]	☐									
The V201 parameter allows select the Inter-drive DEMF data exchange over upon a drive connector. Please also refer to chapter 8. This bit allows the use of Manchester encoding for the data communicationj between Master and Slave. This is useful in case Master and Slave drives are NOT placed in the same cabinet.												

V202**AP08: Associate MP with Inter-drive exchange**

General	Unit R	□	Motor type	SM, AM, LM												
	Unit L															
	Adjustment range R	1 ÷ 9999	HALT required	Yes												
	Adjustment range L															
	Default R	1	Family	5 Special applications configuration 17 Drive Embedded Macros DEMF												
	Default L															
Description	V202 AP08: Associate MP with Inter-drive exch. ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>1</td><td>□</td><td>AP08: Associate MP with Inter-drive exch.</td><td>1</td><td>9999</td><td>1</td></tr></tbody></table>				Value	Unit	Description	Min	Max	Default	1	□	AP08: Associate MP with Inter-drive exch.	1	9999	1
	Value	Unit	Description	Min	Max	Default										
1	□	AP08: Associate MP with Inter-drive exch.	1	9999	1											
The V202 parameter allows select the Inter-drive DEMF data exchange upon a drive measure point.																

V220 Reference configuration

General	Unit R	□	Motor type	SM, AM, LM																							
	Unit L																										
	Adjustment range R	0 ÷ 31	HALT required	Yes																							
	Adjustment range L																										
	Default R	4h	Family	10 Input/output configuration 20 Filters																							
	Default L																										
Description																											
	V220 Reference configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>2</td><td>☒</td><td>Interpolator active [1=Active]</td><td>☒</td></tr><tr><td>3</td><td>☐</td><td>Interpolator Type [0=1 order] [1=2 order]</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Reversal of speed reference [1=Rev]</td><td>☐</td></tr></tbody></table>				Bit	Value	Description	Default	0	☐	Not used	☐	1	☐	Not used	☐	2	☒	Interpolator active [1=Active]	☒	3	☐	Interpolator Type [0=1 order] [1=2 order]	☐	4	☐	Reversal of speed reference [1=Rev]
Bit	Value	Description	Default																								
0	☐	Not used	☐																								
1	☐	Not used	☐																								
2	☒	Interpolator active [1=Active]	☒																								
3	☐	Interpolator Type [0=1 order] [1=2 order]	☐																								
4	☐	Reversal of speed reference [1=Rev]	☐																								

The V220 parameter allows to set up Reference configuration.

Click on → tick box (✓) to change the bit status value = 1.

- **Bit 2 Interpolator active**
Always leave the interpolator activate.
- **Bit 3 Interpolator Type**
Always use the interpolator of 1° order.
- **Bit 4 Reversal of speed reference**
It is used when with an additional position sensor, the position loop is in a positive reaction (following error on the first movement).

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V221 Enable configurations

General	Unit R	[]	Motor type	SM, AM, LM																									
	Unit L																												
	Adjustment range R	0 ÷ 31	HALT required	Yes																									
	Adjustment range L																												
	Default R	0	Family	10	Input/output configu																								
	Default L																												
Description	V221 Enable configurations ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Torque enable [0=Digital bus] [1=Input port]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Reference enable [0=Digital bus] [1=Input port]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Torque AND digital bus enable</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Reference AND digital bus enable</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>PWM enabling by digital input [1=Input port]</td><td>☐</td></tr></tbody></table>					Bit	Value	Description	Default	0	☐	Torque enable [0=Digital bus] [1=Input port]	☐	1	☐	Reference enable [0=Digital bus] [1=Input port]	☐	2	☐	Torque AND digital bus enable	☐	3	☐	Reference AND digital bus enable	☐	4	☐	PWM enabling by digital input [1=Input port]	☐
	Bit	Value	Description	Default																									
0	☐	Torque enable [0=Digital bus] [1=Input port]	☐																										
1	☐	Reference enable [0=Digital bus] [1=Input port]	☐																										
2	☐	Torque AND digital bus enable	☐																										
3	☐	Reference AND digital bus enable	☐																										
4	☐	PWM enabling by digital input [1=Input port]	☐																										
The V221 parameter allows to set up the Enable configurations. Click on → tick box (✓) to change the bit status value = 1.																													

N° Bit	Bit function	Bit value = 0	Bit value = 1	Default value
0	Torque enable [0=Digital bus] [1=Input port]	From Digital Bus (PLC program)	From Ixn input (see V22 ... V25)	0
1	Reference enable [0=Digital bus] [1=Input port]			0
2	Torque AND digital bus enable	Not active	See note below (1)	0
3	Reference AND digital bus enable			0
4	PWM enabling by digital input [1=Input port] (2)	From drive internal enable	From Ixn input (see V22 ... V25)	0

- (1) It is possible to configure the drive in such a way as to obtain the torque or the reference speed enable only if both FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis. TorqueEnable command and Ixn (see pins 2, 4, 6, 8 of S7 connector) input commands are simultaneously present.

Example

To obtain the torque enable only when both FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis. TorqueEnable + Ixn commands are simultaneously present, set V221 bit 0 = 1 and bit 2 = 1

- (2) This input could be used in conjunction with external VPM device to stop fast the PWM in case of VPM intervention due to synchronous motor overvoltage.

V238 Filter on squared counter input S1

General	Unit R	□	Motor type	SM, AM, LM																																
	Unit L																																			
	Adjustment range R	1 ÷ 2.147.483.648	HALT required	Yes																																
	Adjustment range L																																			
	Default R	1	Family	..9 20	Sensors configuration Filters																															
	Default L																																			
Description	V238 Filter on squared counter input S1 ☒ Unit☒ Description☒ Min☒ Max☒ Default																																			
	<table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Filtering time = 50 ns</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Filtering time = 100 ns</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Filtering time = 150 ns</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Filtering time = 200 ns</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Filtering time = 250 ns</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Filtering time = 300 ns</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Filtering time = 350 ns</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Filtering time = 400 ns</td><td>☐</td></tr></tbody></table>	Bit	Value	Description	Default	0	☒	Filtering time = 50 ns	☒	1	☐	Filtering time = 100 ns	☐	2	☐	Filtering time = 150 ns	☐	3	☐	Filtering time = 200 ns	☐	4	☐	Filtering time = 250 ns	☐	5	☐	Filtering time = 300 ns	☐	6	☐	Filtering time = 350 ns	☐	7	☐	Filtering time = 400 ns
Bit	Value	Description	Default																																	
0	☒	Filtering time = 50 ns	☒																																	
1	☐	Filtering time = 100 ns	☐																																	
2	☐	Filtering time = 150 ns	☐																																	
3	☐	Filtering time = 200 ns	☐																																	
4	☐	Filtering time = 250 ns	☐																																	
5	☐	Filtering time = 300 ns	☐																																	
6	☐	Filtering time = 350 ns	☐																																	
7	☐	Filtering time = 400 ns	☐																																	

Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5

V239 Filter on squared counter input S2

General	Unit R		Motor type	SM, AM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes	
	Adjustment range L				
	Default R	1h	Family	..9 20	Sensors configuration Filters
	Default L				
Description	V239 Filter on squared counter input S2 ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description	Default	
	0	☒	Filtering time = 50 ns	☒	
	1	☐	Filtering time = 100 ns	☐	
	2	☐	Filtering time = 150 ns	☐	
	3	☐	Filtering time = 200 ns	☐	
	4	☐	Filtering time = 250 ns	☐	
	5	☐	Filtering time = 300 ns	☐	
	6	☐	Filtering time = 350 ns	☐	
	7	☐	Filtering time = 400 ns	☐	

Click on → “Radio button” to change the parameter value. Please also refer to chapter [2.5](#)

V240 I²t motor: first time constant

General	Unit R	s	Motor type	SM, AM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 5.0	HALT required	No		
	Adjustment range L					
	Default R	1.0	Family	12	Thermal protections	
	Default L					
Description	V240 I²t motor: first time constant ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1.0	s	I ² t motor: first time constant	1.0	5.0	1.0
	The V240 parameter allows to set up the I ² t motor first time constant. Whenever the electrical speed in Hz is < (V245 - V246) the drive select the first time constant V240.					
Please refer the diagram on next page for more detailed information.						

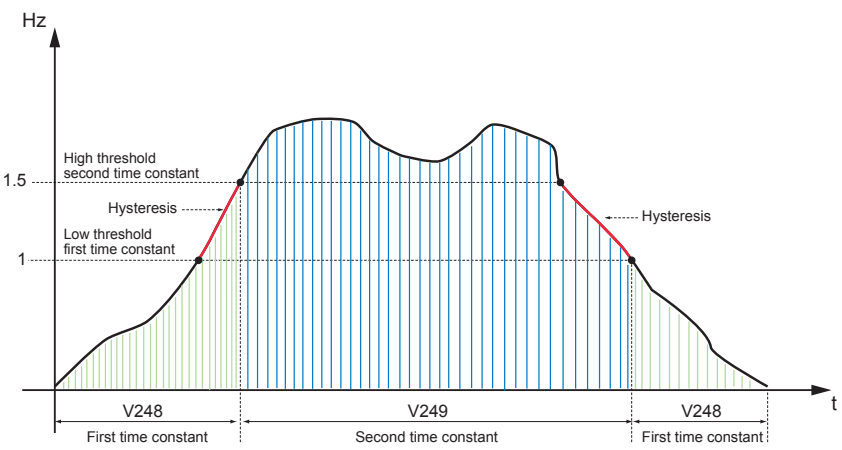
V241 I²t motor: second time constant

General	Unit R	s	Motor type	SM, AM, LM	
	Unit L				
	Adjustment range R	1.0 ÷ 1000.0	HALT required	No	
	Adjustment range L				
	Default R	5.0	Family	12	Thermal protections
	Default L				
Description	V241 I²t motor: second time constant ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	5.0	s	I ² t motor: second time constant	1.0	1000.0
	The V241 parameter allows to set up the I ² t motor second time constant. Whenever the electrical speed in Hz is > (V245 + V246) the drive select the second time constant V241.				
Please refer the diagram on next page for more detailed information.					

V248 I²t drive: first time constant

General	Unit R	s	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 5.0	HALT required	No		
	Adjustment range L					
	Default R	1.0	Family	12	Thermal protections	
	Default L					
Description	V248 I²t drive: first time constant ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	2.0	s	I ² t drive: first time constant	1.0	5.0	2.0
The V248 parameter allows to set up the I²t drive first time constant. Whenever the electrical speed in Hz is < 1Hz the drive selects the first time constant V248. Please refer the diagram on next page for more detailed information.						

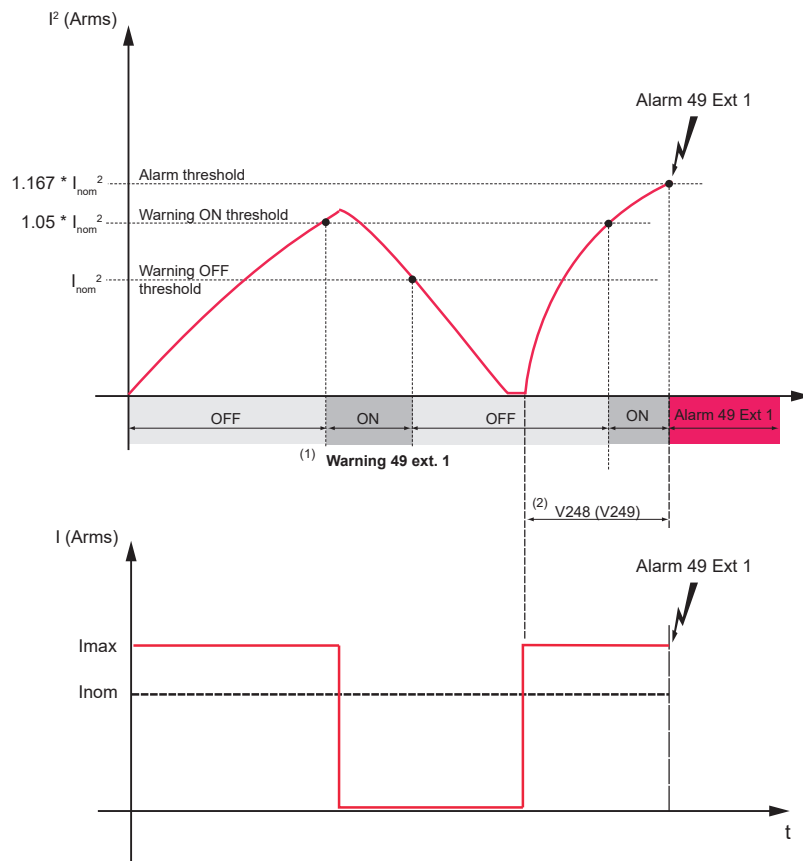
V249 I²t drive: second time constant

General	Unit R	s	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1.0 ÷ 1000.0	HALT required	No	
	Adjustment range L				
	Default R	5.0	Family	12	Thermal protections
	Default L				
Description	V249 I²t drive: second time constant ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	240.0	s	I ² t drive: second time constant	1.0	1000.0
The V249 parameter allows to set up the I²t drive second time constant. Whenever the electrical speed in Hz is > 1.5 Hz the drive selects the second time constant V249. Please refer the diagram on next page for more detailed information.					
I²t drive diagram 					

I²t drive current diagram**Drive thermal image management**

Thresholds definition:

- Threshold Warning 49 Ext 1 "OFF" = $I_{nom_drive}^2$
- Threshold Warning 49 Ext 1 "ON" = $1.05 * I_{nom_drive}^2$
- Threshold Alarm 49 Ext 1 = $1.167 * I_{nom_drive}^2$



(1) The Warning presence could be read from PLC by means of FlexiumPro_NCK.RCNC.Axis[n]. DigitalAxis.Warnings and the specific Ext can be read via HMI diagnostics.

(2) If $V50 < I_{max}$ then $t > V248$ (V249).

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V250 Motor XML information

General	Unit R	[]	Motor type	AM, SM, LM																																																																				
	Unit L																																																																							
	Adjustment range R	0h ÷ FFFFh	HALT required	Yes																																																																				
	Adjustment range L																																																																							
	Default R	8000h	Family	13 15	V/f motor control Vectorial motor control																																																																			
	Default L																																																																							
Description	V250 Motor XML information																																																																							
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>XML revision</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>XML revision</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>XML revision</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>XML revision</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>XML variant</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>XML variant</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>XML variant</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>XML variant</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>XML variant</td><td>☐</td></tr><tr><td>9</td><td>☐</td><td>XML origin [0=Factory] [1=Self-made]</td><td>☐</td></tr><tr><td>10</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>11</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>12</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>13</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>14</td><td>☐</td><td>Not used</td><td>☐</td></tr><tr><td>15</td><td>☒</td><td>Motor initialisation configuration [0=Done] [1=Not done]</td><td>☒</td></tr></tbody></table>					Bit	Value	Description	Default	0	☐	XML revision	☐	1	☐	XML revision	☐	2	☐	XML revision	☐	3	☐	XML revision	☐	4	☐	XML variant	☐	5	☐	XML variant	☐	6	☐	XML variant	☐	7	☐	XML variant	☐	8	☐	XML variant	☐	9	☐	XML origin [0=Factory] [1=Self-made]	☐	10	☐	Not used	☐	11	☐	Not used	☐	12	☐	Not used	☐	13	☐	Not used	☐	14	☐	Not used	☐	15	☒	Motor initialisation configuration [0=Done] [1=Not done]
Bit	Value	Description	Default																																																																					
0	☐	XML revision	☐																																																																					
1	☐	XML revision	☐																																																																					
2	☐	XML revision	☐																																																																					
3	☐	XML revision	☐																																																																					
4	☐	XML variant	☐																																																																					
5	☐	XML variant	☐																																																																					
6	☐	XML variant	☐																																																																					
7	☐	XML variant	☐																																																																					
8	☐	XML variant	☐																																																																					
9	☐	XML origin [0=Factory] [1=Self-made]	☐																																																																					
10	☐	Not used	☐																																																																					
11	☐	Not used	☐																																																																					
12	☐	Not used	☐																																																																					
13	☐	Not used	☐																																																																					
14	☐	Not used	☐																																																																					
15	☒	Motor initialisation configuration [0=Done] [1=Not done]	☒																																																																					

V255 Motor type

General	Unit R	ascii	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R	0 ÷ 2	HALT required	Yes														
	Adjustment range L																	
	Default R	0	Family	13	V/f motor control Vectorial motor control													
	Default L	2		15														
Description																		
	V255 Motor type ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><td>Name</td><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>V255</td><td>'0'</td><td>ascii</td><td>Motor type</td><td>'0'</td><td>'2'</td><td>'0'</td></tr></table> This parameter identifies the type of motor: 0 = rotary synchronous motor (SM) 1 = rotary asynchronous motor (AM) 2 = linear synchronous motor (LM)					Name	Value	Unit	Description	Min	Max	Default	V255	'0'	ascii	Motor type	'0'	'2'
Name	Value	Unit	Description	Min	Max	Default												
V255	'0'	ascii	Motor type	'0'	'2'	'0'												

V257 Motor poles pairs number

General	Unit R	ascii	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 32767	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	13 15	V/f motor control Vectorial motor control	
	Default L					
Description	V257 Motor pole pairs number ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	Motor pole pairs number	1	32767	1
The V257 parameter allows to define the motor poles pairs number.						

V259 Linear motor pole pitch [180 deg el.]

General	Unit R		Motor type	LM		
	Unit L	mm				
	Adjustment range R		HALT required	Yes		
	Adjustment range L	0.0 ÷ 32760.0				
	Default R		Family	15	Vectorial motor control	
	Default L	100.0				
Description	V259 Linear motor pole pitch [180 deg el.] ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	□	Linear motor pole pitch [180 deg el.]	0.0	32760.0	100.0
It defines the linear dimension of the pole pitch of magnetic linear track (180 electrical degrees).						

V263 System sampling time

General	Unit R	us	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	25 ÷ 50	HALT required	Yes	
	Adjustment range L				
	Default R	50	Family	14	Current loop control
	Default L				
Description	V263 System sampling time ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	50	us	System sampling time	25	50

V268 Electrical phase offset Hall effect sensor

General	Unit R	deg	Motor type	SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 359.99	HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	9 11	Sensors configuration Motor/sensor phase management	
	Default L					
Description	V268 Electrical phase offset Hall effect sensor ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	deg	Electrical phase offset Hall effect sensor	0.0	359.99	0.0
	The V268 parameter allows to set up the the electrical phase offset between the Hall sensor and the 0 motor electrical phase. (U motor phase)					

V269 Position offset for electrical phasing

General	Unit R	deg	Motor type	SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 359.99	HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	9 11	Sensors configuration Motor/sensor phase management	
	Default L					
Description	V269 Position offset for electrical phasing ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	deg	Position offset for electrical phasing	0.0	359.99	0.0
The V269 parameter allows to modify the electrical phasing. For NUM motors the V269 parameter value must be 0. This parameter is also used for motors having EPS function.						

**WARNING**

With EPS in use if the parameter value is 0 (zero), and if HOMING is required from the system, on the drive will appear alarm 18 Ext 4. For a correct use of EPS please refer to chapter 5.

V270**Motor thermal sensor PTC-NTC value**

General	Unit R	Ohm	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 50000.0	HALT required	No		
	Adjustment range L					
	Default R	1000.0	Family	12	Thermal protections	
	Default L					
Description	V270 Motor thermal sensor PTC-NTC value ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1000.0	Ohm	Motor thermal sensor PTC-NTC value	0.0	50000.0	1000.0
	The V270 parameter sets the motor thermal sensor alarm threshold of alarm 3 Ext 0: Motor overtemperature alarm as indicated below. Please also refer to alarm 3 description.					
	The V270 parameter value is expressed in Ohms.					
	- For NUM motors BPH, BPG, BPL and BPX055 with PTC the thermal sensor default value is 1000. (See use example as indicated in figure below). - For NUM motors SPX, BPX, SHX, BHX the thermal sensor default value is 1340. - For non NUM motors check the PTC or NTC thermal sensor technical data sheet and insert the correct Ohms values on the V270 parameter.					

PTC thermal sensor

NTC thermal sensor

**NOTE**

For the thermal probe configuration please refer to parameter V272.

V271 **Current loop sampling time**

General	Unit R	us	Motor type	AM, SM, LM								
	Unit L											
	Adjustment range R	50 ÷ 100	HALT required	No								
	Adjustment range L											
	Default R	100	Family	14	Current loop control							
	Default L											
Description												
	V271 Current loop sampling time ☒ Unit☒ Descripton☒ Min☒ Max☒ Default											
	<table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>100</td><td>us</td><td>Current loop sampling time</td><td>50</td><td>100</td><td>100</td></tr></table>	Value	Unit	Description	Min	Max	Default	100	us	Current loop sampling time	50	100
Value	Unit	Description	Min	Max	Default							
100	us	Current loop sampling time	50	100	100							
It allows to set the PWM switching frequency: - V271 = 50 then PWM frequency = 10 kHz - V271 = 100 then PWM frequency = 5 kHz												

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Description	Bit 2 Motor thermal sensor control NTC open [1 active] The bit 2 tests the presence of the NTC thermal sensor connection. With bit 2 = 1 the NTC control is active. Whenever the presence is not OK the alarm 3 Ext 1 will appear. Please refer to chapter 7 for more detailed information.
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V273 Electrical phase offset management

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 1FFh	HALT required	Yes	
	Adjustment range L				
	Default R	0h	Family	12	Thermal protections
	Default L				
Description	V273 Electrical phase offset management ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Bit	Value	Description	Default	
	0	☐	Phase offset exchange after EPS/Hall+Homing [1=No]	☐	
	1	☐	unused	☐	
	2	☐	APEM automatic phase offset exchange on mark [1=ON]	☐	
	3	☐	Alarm 18 Ext 3 exclusion [1=Excluded]	☐	
	4	☐	Forced EPS with absolute sensors [1=ON]	☐	
	5	☐	Alarm 18 Ext 2 exclusion [1=Excluded]	☐	
	6	☐	EPS for highly anisotropic motors [1=ON]	☐	
	7	☐	Force phase offset exchange after EPSM+POM/APEM [1=ON]	☐	
8	☐	EPS for Iron-less motors [1=ON]	☐		
The V273 parameter sets the electrical phase offset as indicated below. Click on → tick box (✓) to change the bit value = 1.					

V274 Motor thermal sensor wiring

General	Unit R	□	Motor type	AM, SM, LM																	
	Unit L																				
	Adjustment range R	0h ÷ 7h	HALT required	No																	
	Adjustment range L																				
	Default R	1h	Family	12	Thermal protections																
	Default L																				
Description	V274 Motor thermal sensor wiring ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Thermal sensor wired on S1 (motor) sensor</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Thermal sensor wired on S2 (direct measure) sensor</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Thermal sensor wired on S3 (accelerometer) sensor</td><td>☐</td></tr></tbody></table>					Bit	Value	Description	Default	0	☒	Thermal sensor wired on S1 (motor) sensor	☒	1	☐	Thermal sensor wired on S2 (direct measure) sensor	☐	2	☐	Thermal sensor wired on S3 (accelerometer) sensor	☐
	Bit	Value	Description	Default																	
0	☒	Thermal sensor wired on S1 (motor) sensor	☒																		
1	☐	Thermal sensor wired on S2 (direct measure) sensor	☐																		
2	☐	Thermal sensor wired on S3 (accelerometer) sensor	☐																		
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5																					

V301 Proportional position gain

General	Unit R	1/min	Motor type	AM, SM, LM	
	Unit L	(mm/min)/mm			
	Adjustment range R	0.0 ÷ 50000.0	HALT required	No	
	Adjustment range L				
	Default R	1000.0	Family	3	Measures and positions management
	Default L				
Description	V301 Proportional position gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	1000.0	1/min	Proportional position gain	0.0	50000.0
The V301 parameter allows to adjust the position loop gain.					
This parameter is linked to P56 (P66) CNC parameter of the axis moved by the motor of this drive.					



WARNING

If additional sensor S2 for position loop closure are used to obtain a correct gain it is necessary to properly set the V353 parameter.

To optimize the adjustment of proportional position gain, first it is necessary to optimize the speed loop gain.

V305 Measure modulo for rotary axis / spindle absolute

General	Unit R	CNC IU	Motor type	AM, SM	
	Unit L				
	Adjustment range R	0 ÷ 360000000	HALT required	Yes	
	Adjustment range L				
	Default R	0	Family	3	Measures and positions management
	Default L				
Description	V305 Measure module for rot. axis/spindle abs ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	0	CNC_IU	Measure module for rot. axis/spindle abs	0	360000000
The V305 parameter allows to adjust rotary axis module whenever the position loop is closed by absolute measure system. (i.e. 360° rotary table, i.e. spindle or tool changing) Enter as V305 parameter rotary axis value in CNC Internal Unit for one revolution, this value must match the CNC rotary axes setup. This parameter is also used in AP02 application (please refer to AP02 on chapter 5.11).					
Example with rotary axis	P4 - N4 CNC parameter value, rotary axis resolution = 1/10000° Enter V305 = 3600000 =10000 * 360				
Example with spindle	Enter as V305 parameter the resolution value for one revolution, this value is the same used by the CNC. (P40 CNC parameter value) i.e. if the resolution is 16384 enter V305 = 16384. For more detailed information upon CNC Parameters please refer to Flexium+ Parameters manual M00041.				

V306 S1 sensor MULTI coefficient

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	-67108863 ÷ 67108863	HALT required	Yes	
	Adjustment range L				
	Default R	1	Family	3	Measures and positions management Sensors configuration
	Default L			9	

Description	V306 S1 sensor MULTI coefficient ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	S1 sensor MULTI coefficient	-67108863	67108863	1
	The MULTI / DIVI parameters are measurement conversion coefficients.					
	The MULTI (V306) / DIVI (V307) parameters convert the feedback provided by the position sensor into the CNC Internal Unit.					
	The V306 and V307 parameters are needed when the S1 sensor is used to close the position loop as well as in the AP01 special application during the initialization of absolute position provided by S1 sensor.					
	- Enter as V306 parameter an axis displacement in CNC Internal Unit. - Enter as V307 parameter the number of feedback counts needed to carry out the displacement indicated in V306 parameter.					
	The measure in CNC Internal Unit. (Measure point MP216) is:					
	S1 sensor measurement * V306 V307					

The maximum value for V306 is 67108863 and for V307 is 65535.					
If the values to be used are higher, it is advisable to simplify the ratio by eliminating the factors common to numerator and denominator. By selecting the negative sign (-) on V306 parameter (ex. -10000) the measurement direction is inverted.					
The inversion of measurement direction must be used if the measurement decreases when the axis moves in the positive direction.					

The maximum value for V306 is 67108863 and for V307 is 65535.

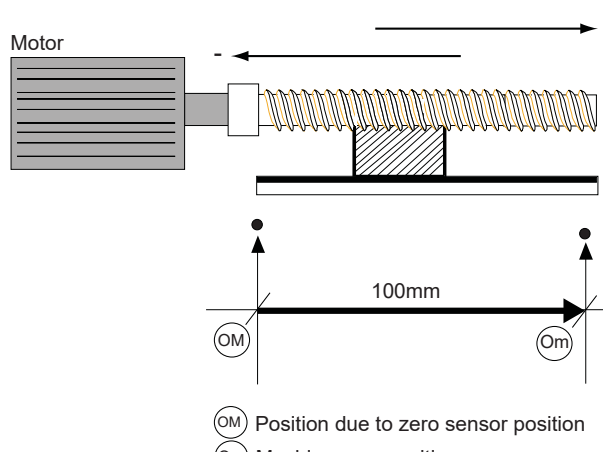
If the values to be used are higher, it is advisable to simplify the ratio by eliminating the factors common to numerator and denominator. By selecting the negative sign (-) on V306 parameter (ex. -10000) the measurement direction is inverted.

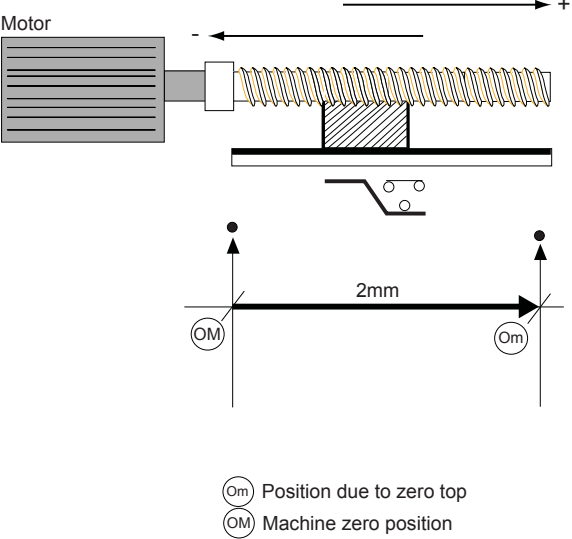
The inversion of measurement direction must be used if the measurement decreases when the axis moves in the positive direction.

V307 S1 sensor DIVI coefficient

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 65535	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	3	Measures and positions management Sensors configuration	
	Default L			9		
Description	V307 S1 sensor DIVI coefficient ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	S1 sensor DIVI coefficient	1	65535	1
	To use the V307 parameter see the description provided for the V306 parameter.					

V310 S1 sensor offset

General	Unit R	CNC IU	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R	-140737488355328 ... +140737488355328	HALT required	Yes			
	Adjustment range L						
	Default R	0	Family	3	Measures and positions management		
	Default L						
Description	V310 S1 sensor offset ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default						
	Value	Unit	Description	Min	Max	Default	
	0	CNC_IU	S1 sensor offset	-92233720368...	92233720368...	0	
	The V310 parameter is active when the S1sensor is used to close the positioning loop as well as in the AP01 and AP02 special application, during the initialization of absolute position performed by S1 motor sensor.						
	The value of the V310 parameter is added to the position value in CNC Internal Unit.						
	- S1 sensor managed as incremental for the CNC (V330.0 = 0): During the HOMING execution (machine origin detection) the V310 parameter is added to the position value in CNC Internal Unit. - S1 sensor managed as absolute for the CNC (V330.0 = 1) : The value of V310 is added to the position value in CNC Internal Unit during the initialization of the absolute position automatically performed at drive power on and after every RUN command or by means the alarms reset.						
	 NOTE AP01 and AP02 special application. During the initialization of absolute position by S1 sensor the V310 parameter is used as described in the second case.						
	Application example	V310 Application example S1 sensor type P (High resolution Multiturn encoder) If the machine zero does not correspond to zero encoder it is necessary to enter in V310 parameter the measure read on CNC when the axis is on the desired machine zero position. The measurement sign must be the opposite of measurement read on CNC in machine zero position.					
		  Position due to zero sensor position  Machine zero position					
	 NOTE If the CNC Internal Unit is expressed in μm enter the value +100000 in the V310 parameter. The offset value must always be entered using the CNC Internal Unit. i.e: if the CNC Internal Unit is the μm, then the offset value must be expressed in μm.						

Application example	V310 Application example S1 sensor type Q (High resolution Singleturn encoder) If the machine zero does not correspond to zero encoder it is necessary to enter in V310 parameter the measure read on CNC when the axis is on the desired machine zero position. The measurement sign must be the opposite of measurement read on CNC in machine zero position..   Position due to zero top  Machine zero position NOTE If the CNC Internal Unit is expressed in μm enter the value +2000 in the V310 parameter. The offset value must always be entered using the CNC Internal Unit. I.e if the CNC Internal Unit is the μm, then the offset value must be expressed in μm.
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V311 S2 sensor MULTI coefficient

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	-67108863 ÷ 67108863	HALT required	Yes	
	Adjustment range L				
	Default R	1	Family	3	Measures and positions management Sensors configuration
	Default L			9	

Description	V311 S2 sensor MULTI coefficient ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	S2 sensor MULTI coefficient	-67108863	67108863	1
	The MULTI / DIVI parameters are measurement conversion coefficients.					
	The MULTI (V311) / DIVI (V312) parameters convert the feedback provided by the position sensor into the CNC Internal Unit.					
	The V311 and V312 parameters are needed when the S2 sensor is used to close the position loop as well as in the AP01 special application during the initialization of absolute position provided by S2 sensor.					
	- Enter as V311 parameter an axis displacement in CNC Internal Unit.. - Enter as V312 parameter the number of feedback counts needed to carry out the displacement indicated in V311 parameter.					
	The measure in CNC Internal Unit. (Measure point MP217) is:					
	S2 sensor measurement * V311 V312					
	The maximum value for V311 is 67108863 and for V312 is 65535.					

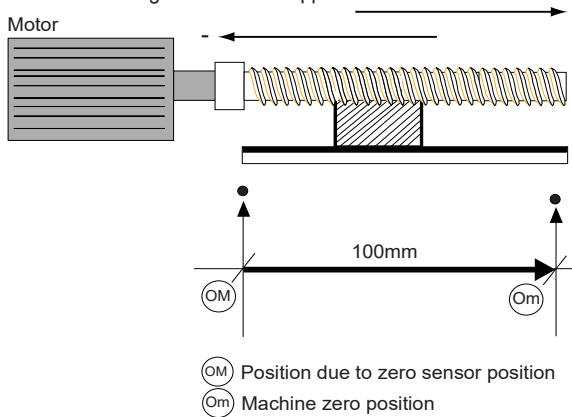
If the values to be used are higher, it is advisable to simplify the ratio by eliminating the factors common to numerator and denominator. By selecting the negative sign (-) on V311 parameter (ex. -10000) the measurement direction is inverted.

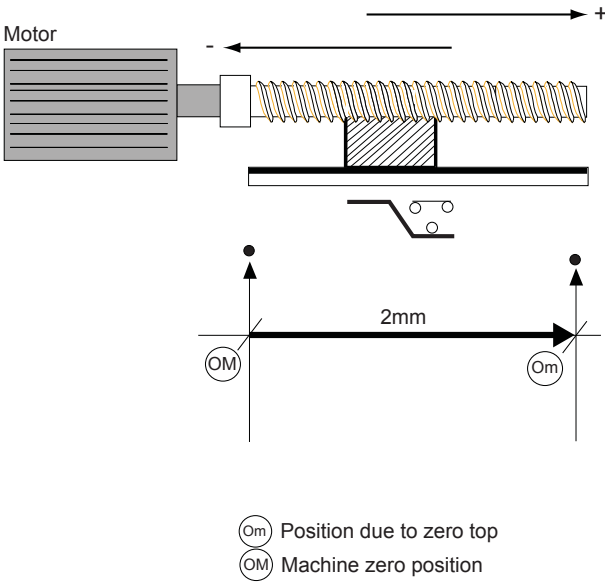
The inversion of measurement direction must be used if the measurement decreases when the axis moves in the positive direction.

V312 S2 sensor DIVI coefficient

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 65535	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	3	Measures and positions management Sensors configuration	
	Default L			9		
Description	V312 S2 sensor DIVI coefficient ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	S2 sensor DIVI coefficient	1	65535	1
	To use the V312 parameter see the description provided for the V311 parameter.					

V313 S2 sensor offset

General	Unit R	CNC IU	Motor type	AM, SM, LM																																		
	Unit L																																					
	Adjustment range R	-140737488355328 ... +140737488355328	HALT required	Yes																																		
	Adjustment range L																																					
	Default R	0	Family	3	Measures and positions management																																	
	Default L																																					
Description	<table><tr><th colspan="6">V313 S2 sensor offset</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th><td></td><td></td><td></td><td></td><td></td></tr><tr><td>0</td><td>CNC_IU</td><td>S2 sensor offset</td><td>-92233720368...</td><td>92233720368...</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr></table>					V313 S2 sensor offset						☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default						0	CNC_IU	S2 sensor offset	-92233720368...	92233720368...	0					
	V313 S2 sensor offset						☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																											
Value	Unit	Description	Min	Max	Default																																	
0	CNC_IU	S2 sensor offset	-92233720368...	92233720368...	0																																	
If the machine zero does not correspond to the cam zero it is necessary to enter in V313 parameter the measure read on CNC when the axis is on the desired machine zero position. The measurement sign must be the opposite of measurement read on CNC in machine zero position. The V313 parameter is active when the S2 sensor is used to close the positioning loop as well as during the initialization of absolute position performed by S2 sensor. The value of V313 parameter is added to the position value in CNC Internal Unit. - S2 sensor managed as incremental for the CNC (V331.0 = 0) : During the HOMING execution (machine origin detection) the V313 parameter is added to the position value in CNC Internal Unit. - S2 sensor managed as absolute for the CNC (V331.0 = 1) : The value of V313 is added to the position value in CNC Internal Unit during the initialization of the absolute position automatically performed at drive power on and after every RUN command or by means the alarms reset.																																						
 NOTE AP01 and AP02 special application. During the initialization of absolute position by S2 sensor the V313 parameter is used as described in the second case.																																						
Application example	V313 Application example S2 sensor type P (High resolution Multiturn encoder) If the machine zero does not correspond to zero encoder it is necessary to enter in V313 parameter the measure read on CNC when the axis is on the desired machine zero position. The measurement sign must be the opposite of measurement read on CNC in machine zero position. 																																					
 NOTE If the CNC Internal Unit is expressed in μm enter the value +100000 in the V313 parameter. The offset value must always be entered using the CNC Internal Unit. i.e: if the CNC measurement is the μm, then the offset value must be expressed in μm.																																						

Application example	V313 Application example S2 sensor type Q (High resolution Singleturn encoder) If the machine zero does not correspond to zero encoder it is necessary to enter in V313 parameter the measure read on CNC when the axis is on the desired machine zero position. The measurement sign must be the opposite of measurement read on CNC in machine zero position.  Motor 2mm OM Position due to zero top Om Machine zero position NOTE If the CNC Internal Unit is expressed in μm enter the value +2000 in the V313 parameter. The offset value must always be entered using the CNC Internal Unit. I.e.: if the CNC measurement is the μm, then the offset value must be expressed in μm.
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V314 S1 sensor sinusoidal/TTL signals range

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	20.0 ÷ 120.0	HALT required	No		
	Adjustment range L					
	Default R	50.0	Family	9	Sensors configuration	
	Default L					
Description	V314 S1 sensor sinusoidal/TTL signals range ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	50.0	%	S1 sensor sinusoidal/TTL signals range	20.0	120.0	50.0
The V314 parameter is used to select the sinusoidal signals range for a correct use of S1 sensor. The parameter allows to select the alarm 9 Ext 254 threshold which controls the sinusoidal signal absence: whenever the amplitude of sinusoidal or TTL signal are below the V314 threshold, then alarm A9 ext 254 is issued.						

V315 S2 sensor sinusoidal/TTL signals range

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	20.0 ÷ 120.0	HALT required	No		
	Adjustment range L					
	Default R	50.0	Family	9	Sensors configuration	
	Default L					
Description	V315 S2 sensor sinusoidal/TTL signals range ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	50.0	%	S2 sensor sinusoidal/TTL signals range	20.0	120.0	50.0
The V315 parameter is used to select the sinusoidal signals range for a correct use of S2 sensor. The parameter allows to select the alarm 38 Ext 254 threshold which controls the sinusoidal signal absence: whenever the amplitude of sinusoidal or TTL signal are below the V315 threshold, then alarm A38 ext 254 is issued.						

V317 S1 sensor power supply voltage (P5..P8)

General	Unit R	Vdc	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	3.0 ÷ 11.5	HALT required	Yes		
	Adjustment range L					
	Default R	5.0	Family	9	Sensors configuration	
	Default L					
Description	V317 S1 sensor power supply voltage (P5..P8) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	5.0	Vdc	S1 sensor power supply voltage (P5..P8)	3.0	11.5	5.0
The parameter V317 sets the S1 sensor power supply voltage. The value of V317 is expressed in Volt. For a correct use of the sensor before connecting it always take into consideration the sensor data sheet and select the appropriate power supply voltage.						

V318 S2 sensor power supply voltage (P5..P8)

General	Unit R	Vdc	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	3.0 ÷ 11.5	HALT required	Yes		
	Adjustment range L					
	Default R	5.0	Family	9	Sensors configuration	
	Default L					
Description	V318 S2 sensor power supply voltage (P5..P8) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	5.0	Vdc	S2 sensor power supply voltage (P5..P8)	3.0	11.5	5.0
	The parameter V318 sets the S2 sensor power supply voltage. The value of V318 is expressed in Volt.					
	For a correct use of the sensor before connecting it always take into consideration the sensor data sheet and select the appropriate power supply voltage.					

V320 S1 sensor incremental traces configuration

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes		
	Adjustment range L					
	Default R	1h	Family	9	Sensors configuration	
	Default L					
Description	V320 S1 sensor incremental traces configuration					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Bit	Value	Description			Default
	0	☒	Not configured			☒
	1	☐	Sensorless			☐
	2	☐	Sinus / Cosinus			☐
	3	☐	Fast Serial			☐
	4	☐	TTL			☐
	The parameter V320 allows to set the S1 incremental traces configuration. Click on → “Radio button” to change the parameter value.					

V321**S2 sensor incremental traces configuration**

General	Unit R		Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes						
	Adjustment range L									
	Default R	1h	Family	9	Sensors configuration					
	Default L									
Description	V321 S2 sensor incremental traces configuration					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Bit	Value	Description					Default		
	0	☒	Not configured					☒		
	1	☐	Sensorless					☐		
	2	☐	Sinus / Cosinus					☐		
	3	☐	Fast Serial					☐		
	4	☐	TTL					☐		
	The parameter V321 allows to set the S2 incremental traces configuration. Click on → “Radio button” to change the parameter value.									

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V322

S1 sensor communication protocol

General	Unit R	□	Motor type	AM, SM, LM																																																																																																																																					
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V323**S2 sensor communication protocol**

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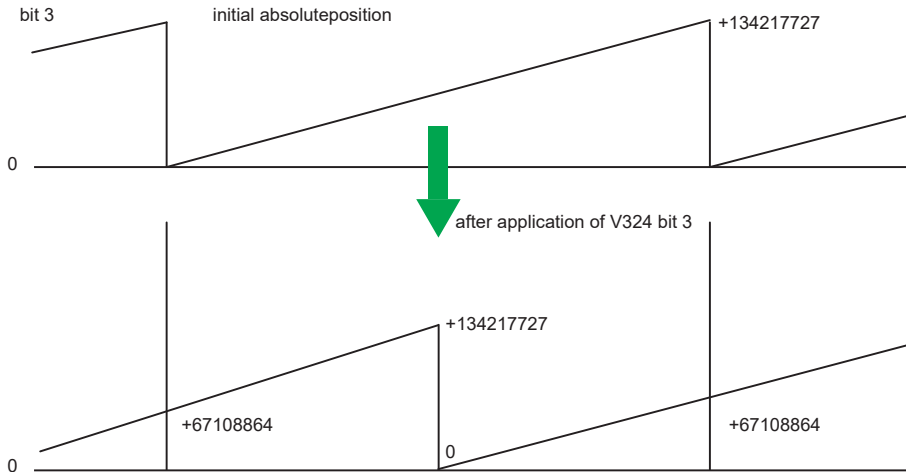
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V324

S1 sensor initialization configuration

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11	☐	Sensor cyclical direction [0=Clockwise]	☐																																																					
The parameter V324 allows to set the S1 sensor initialization configuration. Click on → tick box (✓) to change the bit value = 1. Bit 2: Abs. measure translation for rotary sensor [1=ON]</bit> • can only be used on rotary encoders (bit 0 of the same parameter = 0) • if bit 2 = 1, then the absolute position read by the encoder at initialization is decreased by an amount equal to half of its maximum value. • the effect is to center the absolute position of the encoder around zero. example: - multi-turn rotary encoder with 4096 turns and a resolution on the single turn of 32768 increments per turn; - in this case the absolute position read by the encoder at initialization is always positive and included in the range 0 ... +134'217'727 - the effect of bit 2 is to subtract half of the maximum value (=67'108'864) from the initial position, bringing the initial position of the encoder into the range -67'108'864 ... +67'108'863																																																								

	Bit 3: Fast-Serial Abs position half-travel displacement[1=ON]</bit> It can only be used on rotary encoders (bit 0 of the same parameter = 0) if bit 3 = 1, then the absolute position read by the encoder at initialization is translated, in a positive direction, by an amount equal to half of its maximum value. example: multi-turn rotary encoder with 4096 turns and a resolution on the single turn of 32768 increments per turn; in this case the absolute position read by the encoder at initialization is always positive and included in the range 0 ... +134'217'727.  The diagram consists of two graphs. The top graph, labeled 'initial absolute position', shows a sawtooth wave on a coordinate system where the horizontal axis represents position and the vertical axis represents the absolute position value. The wave starts at 0, rises linearly to a peak labeled '+134217727', and then drops back to 0. The bottom graph, labeled 'after application of V324 bit 3', shows a similar sawtooth wave. However, the entire wave has been shifted to the right by a constant value of +67108864. The new zero point is now at the midpoint of the previous range. The peak remains at +134217727. A green arrow points from the top graph to the bottom graph, indicating the transformation. - This function is useful when it is desired to move the "0" position outside the range of displacement of the axis, so that at every machine switch-on the position measure of the axis is the same of the last position before switch off. *** Bit 2 and Bit 3 can both be set at the same time. Bit 11: Sensor cyclical direction [0=clockwise] This bit must be set = 0 (CW) or = 1 (CCW) in accordance to comply the following information: turning the motor shaft clockwise (seen from out shaft) the axis position increases. (CCW = Counter Clockwise / CW = Clockwise).
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V325 S2 sensor initialization configuration

General	Unit R	[]	Motor type	AM, SM, LM																																																				
	Unit L																																																							
	Adjustment range R	0h ÷ FFFh	HALT required	Yes																																																				
	Adjustment range L																																																							
	Default R	0h	Family	9	Sensors configuration																																																			
	Default L																																																							
Description	V325 S2 sensor initialisation configuration																																																							
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Sensor [0=Rotative] [1=Linear]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Reversal measure for position loop [1=Rev]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Abs. measure translation for rotary sensor [1=ON]</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Fast-Serial Abs position half-travel displacement[1=ON]</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Memory handling [1=ON]</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>External back-up battery [1=ON]</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Homing switch used [1=Yes]</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Homing switch logic [1=Inverted]</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>Homing switch mode [0=level] [1=edge]</td><td>☐</td></tr><tr><td>9</td><td>☐</td><td>Homing switch active edge [0=positive] [1=negative]</td><td>☐</td></tr><tr><td>10</td><td>☐</td><td>Fine alignment of digital and analog pos. [1=ON]</td><td>☐</td></tr><tr><td>11</td><td>☐</td><td>Not used</td><td>☐</td></tr></tbody></table>					Bit	Value	Description	Default	0	☐	Sensor [0=Rotative] [1=Linear]	☐	1	☐	Reversal measure for position loop [1=Rev]	☐	2	☐	Abs. measure translation for rotary sensor [1=ON]	☐	3	☐	Fast-Serial Abs position half-travel displacement[1=ON]	☐	4	☐	Memory handling [1=ON]	☐	5	☐	External back-up battery [1=ON]	☐	6	☐	Homing switch used [1=Yes]	☐	7	☐	Homing switch logic [1=Inverted]	☐	8	☐	Homing switch mode [0=level] [1=edge]	☐	9	☐	Homing switch active edge [0=positive] [1=negative]	☐	10	☐	Fine alignment of digital and analog pos. [1=ON]	☐	11	☐	Not used
Bit	Value	Description	Default																																																					
0	☐	Sensor [0=Rotative] [1=Linear]	☐																																																					
1	☐	Reversal measure for position loop [1=Rev]	☐																																																					
2	☐	Abs. measure translation for rotary sensor [1=ON]	☐																																																					
3	☐	Fast-Serial Abs position half-travel displacement[1=ON]	☐																																																					
4	☐	Memory handling [1=ON]	☐																																																					
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6	☐	Homing switch used [1=Yes]	☐																																																					
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9	☐	Homing switch active edge [0=positive] [1=negative]	☐																																																					
10	☐	Fine alignment of digital and analog pos. [1=ON]	☐																																																					
11	☐	Not used	☐																																																					

The parameter V325 allows to set the S2 sensor initialization configuration.
Click on → tick box (✓) to change the bit value = 1.

V326 S1 sensor run-time options

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 3h	HALT required	No	
	Adjustment range L				
	Default R	0h	Family	9	Sensors configuration
	Default L				
Description	V326 S1 sensor run-time options ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Bit	Value	Description	Default	
	0	☐	Compensation of sinusoidal signals [1=ON]	☐	
	1	☐	Speed filter [0=V342] [1=V340]	☐	
The parameter V326 allows to set the S1 sensor run-time options. Click on → tick box (✓) to change the bit value = 1.					
Bit 0 Compensation of sinusoidal signals [1=ON]					
The sinusoidal signal compensation sets a compensation on the sine and cosine signals. These compensations are due to a offset or different amplitude presence.					
Bit 1 Speed filter [0=V342] [1=V340]					
By selecting the bit to 0 or to 1 is possible to select the speed filter on V342 or V340. On the NUM DrivePro Standard Performances version the “Speed filter” is available with V342 only.					

V327 S2 sensor run-time options

General	Unit R	□	Motor type	AM, SM, LM								
	Unit L											
	Adjustment range R	0h ÷ 3h	HALT required	No								
	Adjustment range L											
	Default R	0h	Family	9	Sensors configuration							
	Default L											
Description	V327 S2 sensor run-time options ☒ Unit☒ Description☒ Min☒ Max☒ Default											
	<table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td>Compensation of sinusoidal signals [1=ON]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Speed filter [0=V343] [1=V341]</td><td>☐</td></tr></table>	Bit	Value	Description	Default	0	☐	Compensation of sinusoidal signals [1=ON]	☐	1	☐	Speed filter [0=V343] [1=V341]
Bit	Value	Description	Default									
0	☐	Compensation of sinusoidal signals [1=ON]	☐									
1	☐	Speed filter [0=V343] [1=V341]	☐									
The parameter V327 allows to set the S2 sensor run-time options. Click on → tick box (✓) to change the bit value = 1.												
Bit 0 Compensation of sinusoidal signals [1=ON] The sinusoidal signal compensation sets a compensation on the sine and cosine signals. These compensations are due to a offset or different amplitude presence. Bit 1 Speed filter [0=V343] [1=V341] By selecting the bit to 0 or to 1 is possible to select the speed filter on V343 or V341. On the NUM DrivePro Standard Performances version the “speed filter” is available with V343 only.												

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General	Unit R	□	Motor type	AM, SM, LM																														
	Unit L																																	
	Adjustment range R	0h ÷ 3Fh	HALT required	No																														
	Adjustment range L																																	
	Default R	0h	Family	9	Sensors configuration																													
	Default L																																	
Description	V328 S1 Sensor alarms handling ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td>Alarms 9 Ext 248/260 exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Alarm 9 Ext 60 to 9 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Alarms 9 Ext 230/248/254/260/261 exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>UGA misalignment handling [0=Alarm] [1=Warning]</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Alarm 9 Ext 231 exclusion [1=Excluded]</td><td>☐</td></tr></table>						Bit	Value	Description	Default	0	☐	Alarms 9 Ext 248/260 exclusion [1=Excluded]	☐	1	☐	Alarm 9 Ext 60 to 9 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]	☐	2	☐	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]	☐	3	☐	Alarms 9 Ext 230/248/254/260/261 exclusion [1=Excluded]	☐	4	☐	UGA misalignment handling [0=Alarm] [1=Warning]	☐	5	☐	Alarm 9 Ext 231 exclusion [1=Excluded]	☐
	Bit	Value	Description	Default																														
0	☐	Alarms 9 Ext 248/260 exclusion [1=Excluded]	☐																															
1	☐	Alarm 9 Ext 60 to 9 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]	☐																															
2	☐	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]	☐																															
3	☐	Alarms 9 Ext 230/248/254/260/261 exclusion [1=Excluded]	☐																															
4	☐	UGA misalignment handling [0=Alarm] [1=Warning]	☐																															
5	☐	Alarm 9 Ext 231 exclusion [1=Excluded]	☐																															
The parameter V328 allows to set the S1 sensor alarms handling. Click on → tick box (✓) to change the bit value = 1.																																		
Bit 0 Alarms 9 Ext 248/260 exclusion [1=Excluded] This bit sets 1 excluded the following alarms detection: - alarm 9 Ext 248 Sensor signals sine or cosine saturated - alarm 9 Ext 260 Sensor TTL signals saturated. Bit 1 = Alarms 9 Ext 60 to 9 Ext 67 Endat2.2 Safety bit [1=Excluded] This bit sets 1 excluded the following alarms detection: - Alarm 9 Ext 60: EnDat 2.2 2nd Safety bit: absolute position error - Alarm 9 Ext 61: EnDat 2.2 2nd Safety bit: lighting - Alarm 9 Ext 62: EnDat 2.2 2nd Safety bit: signal amplitude - Alarm 9 Ext 63: EnDat 2.2 2nd Safety bit: position error - Alarm 9 Ext 64: EnDat 2.2 2nd Safety bit: supply voltage too high - Alarm 9 Ext 65: EnDat 2.2 2nd Safety bit: supply voltage too low - Alarm 9 Ext 66: EnDat 2.2 2nd Safety bit: current too high - Alarm 9 Ext 67: EnDat 2.2 2nd Safety bit: battery failure Bit 2 EnDat 2.2. sensor CRC error [0=Alarm 9 Ext 259] [1=Warning] This bit gives the possibility to define how to manage the CRC error detected during the EnDat 2.2 communication. This bit sets 0: in case of CRC error the alarm 9 Ext 259 will appear. This bit sets 1: in case of CRC error the warning 9 Ext 1 will be set. Bit 3 Alarms 9 Ext 230/248/254/260/261 exclusion [1=Excluded] This bit sets 1 excluded the following alarms detection: - Alarm 9 Ext 230: Sensor: repeated pulse counter UGA misalignments - Alarm 9 Ext 248: Sensor signals sine or cosine saturated - Alarm 9 Ext 254: Sensor not connected or sine or cosine signal too low - Alarm 9 Ext 260: Sensor TTL signals saturated - Alarm 9 Ext 261: Sensor not connected or TTL signals too low Please refer to chapter 7 for more detailed informations.																																		

	Bit 4 UGA misalignment handling [0=Alarm 9 Ext 230] [1=Warning] This bit sets 0: in case of Sensor repeated pulse counter UGA misalignments the alarm 9 Ext 230 will appear. This bit sets 1: in case of sensor repeated pulse counter UGA misalignments a warning 9 Ext 0 will be set. Please refer to chapter 6 for more detailed informations. Bit 5 Alarm 9 Ext 231 exclusion [1=Excluded] This bit sets 1 excluded the following alarm detection: - alarm 9 Ext 231 Sensor: excess of movement detected while waiting for UGA alignment. Please refer to chapter 6 for more detailed informations.
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V329

S2 Sensor alarms handling

General	Unit R	□	Motor type	AM, SM, LM																														
	Unit L																																	
	Adjustment range R	0h ÷ 3Fh	HALT required	No																														
	Adjustment range L																																	
	Default R	0h	Family	9	Sensors configuration																													
	Default L																																	
Description	V329 S2 Sensor alarms handling ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td>Alarms 38 Ext 248/260 exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td>Alarm 38 Ext 60 to 38 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Alarms 38 Ext 230/248/254/260/261 exclusion [1=Excluded]</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>UGA misalignment handling [0=Alarm] [1=Warning]</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Alarm 38 Ext 231 exclusion [1=Excluded]</td><td>☐</td></tr></table>						Bit	Value	Description	Default	0	☐	Alarms 38 Ext 248/260 exclusion [1=Excluded]	☐	1	☐	Alarm 38 Ext 60 to 38 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]	☐	2	☐	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]	☐	3	☐	Alarms 38 Ext 230/248/254/260/261 exclusion [1=Excluded]	☐	4	☐	UGA misalignment handling [0=Alarm] [1=Warning]	☐	5	☐	Alarm 38 Ext 231 exclusion [1=Excluded]	☐
	Bit	Value	Description	Default																														
0	☐	Alarms 38 Ext 248/260 exclusion [1=Excluded]	☐																															
1	☐	Alarm 38 Ext 60 to 38 Ext 67 Endat2.2 Safety bit alarm [1=Excluded]	☐																															
2	☐	EnDat 2.2. sensor CRC error [0=Alarm] [1=Warning]	☐																															
3	☐	Alarms 38 Ext 230/248/254/260/261 exclusion [1=Excluded]	☐																															
4	☐	UGA misalignment handling [0=Alarm] [1=Warning]	☐																															
5	☐	Alarm 38 Ext 231 exclusion [1=Excluded]	☐																															
The parameter V329 allows to set the S2 sensor alarms handling. Click on → tick box (✓) to change the bit value = 1.																																		
Bit 0 Alarms 38 Ext 248/260 exclusion [1=Excluded] This bit sets 1 excluded the following alarms detection: - alarm 38 Ext 248 Sensor signals sine or cosine saturated - alarm 38 Ext 260 Sensor TTL signals saturated. Bit 1 = Alarms 38 Ext 60 to 38 Ext 67 Endat2.2 Safety bit [1=Excluded] This bit sets 1 excluded the following alarms detection: - Alarm 38 Ext 60: EnDat 2.2 2nd Safety bit: absolute position error - Alarm 38 Ext 61: EnDat 2.2 2nd Safety bit: lighting - Alarm 38 Ext 62: EnDat 2.2 2nd Safety bit: signal amplitude - Alarm 38 Ext 63: EnDat 2.2 2nd Safety bit: position error - Alarm 38 Ext 64: EnDat 2.2 2nd Safety bit: supply voltage too high - Alarm 38 Ext 65: EnDat 2.2 2nd Safety bit: supply voltage too low - Alarm 38 Ext 66: EnDat 2.2 2nd Safety bit: current too high - Alarm 38 Ext 67: EnDat 2.2 2nd Safety bit: battery failure Bit 2 EnDat 2.2. sensor CRC error [0=Alarm 38 Ext 259] [1=Warning] This bit gives the possibility to define how to manage the CRC error detected during the EnDat 2.2 communication. This bit sets 0: in case of CRC error the alarm 38 Ext 259 will appear. This bit sets 1: in case of CRC error a warning bit into the drive warning 38 Ext 1 will be set. Bit 3 Alarms 38 Ext 230/248/254/260/261 exclusion [1=Excluded] This bit sets 1 excluded the following alarms detection: - Alarm 38 Ext 230: Sensor: repeated pulse counter UGA misalignments - Alarm 38 Ext 248: Sensor signals sine or cosine saturated - Alarm 38 Ext 254: Sensor not connected or sine or cosine signal too low - Alarm 38 Ext 260: Sensor TTL signals saturated - Alarm 38 Ext 261: Sensor not connected or TTL signals too low Please refer to chapter 6 for more detailed informations.																																		

	Bit 4 UGA misalignment handling [0=Alarm 38 Ext 230] [1=Warning] This bit sets 0 : in case of Sensor repeated pulse counter UGA misalignments the alarm 38 Ext 230 will appear. This bit sets 1 : in case of sensor repeated pulse counter UGA misalignments a warning 38 Ext 0 will be set. Please refer to chapter 6 for more detailed informations. Bit 5 Alarm 38 Ext 231 exclusion [1=Excluded] This bit sets 1 excluded the following alarm detection: - alarm 38 Ext 231 Sensor: excess of movement detected while waiting for UGA alignment. Please refer to chapter 6 for more detailed informations.
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V330 S1 sensor homing configuration

General	Unit R	□	Motor type	AM, SM, LM																									
	Unit L																												
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes																									
	Adjustment range L																												
	Default R	1h	Family	3	Measures and positions management Sensors configuration.																								
	Default L			9																									
Description	V330 S1 sensor homing configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr><tr><td>0</td><td>☒</td><td>CNC absolute measure</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Soft top mark homing for absolute sensor</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Single top mark homing</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Coded reference homing</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>BUTEE homing</td><td>☐</td></tr></table> The parameter V330 allows to set the S1 sensor homing configuration. Click on → “Radio button” to set the configurazion.					Bit	Value	Description	Default	0	☒	CNC absolute measure	☒	1	☐	Soft top mark homing for absolute sensor	☐	2	☐	Single top mark homing	☐	3	☐	Coded reference homing	☐	4	☐	BUTEE homing	☐
Bit	Value	Description	Default																										
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1	☐	Soft top mark homing for absolute sensor	☐																										
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3	☐	Coded reference homing	☐																										
4	☐	BUTEE homing	☐																										
Bit 0 CNC absolute measure Selecting the bit to 1 the CNC acquires the sensor measure as absolute and HOMING procedure is not required. Selecting the bit to 0 the CNC treats the sensor measure as incremental and therefore the HOMING procedure is required. Bit 1 Soft top mark homing for absolute sensor This bit is used in case of incremental encoder, without any TOP mark. In this case, the encoder HOMING position is referred to the 180° position within a single turn of the encoder. Bit 2 Single top mark homing This bit is used in case of encoder with a TOP mark. In case of multiple TOP marks, the user may select one of them by exploiting the HOMING SWITCH digital input. Bit 3 Coded reference homing This bit is used in case of encoder with distance-coded reference marks. Bit 4: BUTEE homing homing is carried out on the edge/level of the HOMING switch signal, as configured in parameters V31, V22...V25 and V324																													

V331 S2 sensor homing configuration

General	Unit R	□	Motor type	AM, SM, LM																										
	Unit L																													
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes																										
	Adjustment range L																													
	Default R	1h	Family	3	Measures and positions management Sensors configuration.																									
	Default L			9																										
Description	V331 S2 sensor homing configuration ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default																													
	Bit	Value	Description	Default																										
<table><tr><td>0</td><td>☒</td><td>CNC absolute measure</td><td colspan="2">☒</td></tr><tr><td>1</td><td>☐</td><td>Not used</td><td colspan="2">☐</td></tr><tr><td>2</td><td>☐</td><td>Single top mark homing</td><td colspan="2">☐</td></tr><tr><td>3</td><td>☐</td><td>Coded reference homing</td><td colspan="2">☐</td></tr><tr><td>4</td><td>☐</td><td>BUTEE homing</td><td colspan="2">☐</td></tr></table>						0	☒	CNC absolute measure	☒		1	☐	Not used	☐		2	☐	Single top mark homing	☐		3	☐	Coded reference homing	☐		4	☐	BUTEE homing	☐	
0	☒	CNC absolute measure	☒																											
1	☐	Not used	☐																											
2	☐	Single top mark homing	☐																											
3	☐	Coded reference homing	☐																											
4	☐	BUTEE homing	☐																											
The parameter V331 allows to set the S2 sensor homing configuration. Click on → “Radio button” to change the parameter value.																														
Bit 0 CNC absolute measure Selecting the bit to 1 the CNC acquires the sensor measure as absolute and HOMING procedure is not required. Selecting the bit to 0 the CNC treats the sensor measure as incremental and therefore the HOMING procedure is required. Bit 2 Single top mark homing This bit is used in case of encoder with a TOP mark. In case of multiple TOP marks, the user may select one of them by exploiting the HOMING SWITCH digital input. Bit 3 Coded reference homing This bit is used in case of encoder with distance-coded reference marks. Bit 4: BUTEE homing homing is carried out on the edge/level of the HOMING switch signal, as configured in parameters V31, V22...V25 and V325																														

V340**Step of speed calculation S1 sensor**

General

Unit R	□	Motor type	AM, SM, LM	
Unit L				
Adjustment range R	1 ÷ 64	HALT required	No	
Adjustment range L				
Default R	8	Family	9	Sensors configuration. Filters
Default L			20	

Description

V340 Step of speed calculation S1 sensor

☒ Unit☒ Description☒ Min☒ Max☒ Default

Value	Unit	Description	Min	Max	Default
8	□	Step of speed calculation S1 sensor	1	64	8

The parameter V340 allows to set the step of speed calculation S1 sensor.

Using the V340 parameter it is possible to change the value of calculation step on the speed loop. The speed calculation step parameter is used in case of high motor noise due to disturbances on speed signal. V340 has to be enabled by means V326 bit 1 = 1.

The standard value of V340 parameter is 4.

Recommended values of V340 depending on sensor type as indicated in the table.

S1 sensor (close the speed loop)	Recommended V340 value
A, B, P, Q encoder,	4
2-Wires sensor (DSL)	4
J , K encoder	8
Toothed wheel	16
Optical linear scale	4

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NOTE

Higher values (max 64) reduce the disturbances on speed signal, but provide a worse dynamic response of the system (reduction of speed loop bandwidth).

ATTENTION!

After the modification of V340 parameter it is necessary to repeat the speed loop adjustment operations (V51,V52).

V341 Step of speed calculation S2 sensor

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	1 ÷ 64	HALT required	No													
	Adjustment range L																
	Default R	8	Family	9 20	Sensors configuration. Filters												
	Default L																
Description	V341 Step of speed calculation S2 sensor ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>8</td><td>□</td><td>Step of speed calculation S2 sensor</td><td>1</td><td>64</td><td>8</td></tr></table>					Value	Unit	Description	Min	Max	Default	8	□	Step of speed calculation S2 sensor	1	64	8
	Value	Unit	Description	Min	Max	Default											
	8	□	Step of speed calculation S2 sensor	1	64	8											
	The parameter V341 allows to set the step of speed calculation S2 sensor.																
	Using the V341 parameter it is possible to change the value of calculation step on the speed loop. The speed calculation step parameter is used in case of high motor noise due to disturbances on speed signal. V341 has to be enabled by means V327 bit 1 = 1.																
	The standard value of V341 parameter is 4.																
	Recommended values of V341 depending on sensor type as indicated in the table.																
	<table><tr><th>S2 sensor (close the speed loop)</th><th>Recommended V341 value</th></tr><tr><td>A, B, P, Q encoder,</td><td>4</td></tr><tr><td>2-Wires sensor (DSL)</td><td>4</td></tr><tr><td>J , K encoder</td><td>8</td></tr><tr><td>Toothed wheel</td><td>16</td></tr><tr><td>Optical linear scale</td><td>4</td></tr></table>					S2 sensor (close the speed loop)	Recommended V341 value	A, B, P, Q encoder,	4	2-Wires sensor (DSL)	4	J , K encoder	8	Toothed wheel	16	Optical linear scale	4
	S2 sensor (close the speed loop)	Recommended V341 value															
	A, B, P, Q encoder,	4															
2-Wires sensor (DSL)	4																
J , K encoder	8																
Toothed wheel	16																
Optical linear scale	4																
 NOTE Higher values (max 64) reduce the disturbances on speed signal, but provide a worse dynamic response of the system (reduction of speed loop bandwidth).																	

V342 Speed filter by S1 sensor

General	Unit R	Hz	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	50.0 ÷ 6000.0	HALT required	No													
	Adjustment range L																
	Default R	600.0	Family	9 20	Sensors configuration. Filters												
	Default L																
Description	V342 Speed filter by S1 sensor ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>600.0</td><td>Hz</td><td>Speed filter by S1 sensor</td><td>50.0</td><td>6000.0</td><td>600.0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	600.0	Hz	Speed filter by S1 sensor	50.0	6000.0	600.0
	Value	Unit	Description	Min	Max	Default											
	600.0	Hz	Speed filter by S1 sensor	50.0	6000.0	600.0											
	The V342 parameter allows to set up the speed filter by S1 sensor and has to be enabled by means V326 bit 1 = 0.																
	Recommended values of V342 depending on sensor type. (See table below)																
	<table><thead><tr><th>S1 / S2 sensor</th><th>Recommended V342 / 343 value [Hz]</th></tr></thead><tbody><tr><td>A, B, P, Q encoder,</td><td>600</td></tr><tr><td>2-Wires sensor (DSL)</td><td>600</td></tr><tr><td>J , K encoder</td><td>250</td></tr><tr><td>Toothed wheel</td><td>150</td></tr><tr><td>Optical linear scale</td><td>600</td></tr></tbody></table>					S1 / S2 sensor	Recommended V342 / 343 value [Hz]	A, B, P, Q encoder,	600	2-Wires sensor (DSL)	600	J , K encoder	250	Toothed wheel	150	Optical linear scale	600
	S1 / S2 sensor	Recommended V342 / 343 value [Hz]															
	A, B, P, Q encoder,	600															
	2-Wires sensor (DSL)	600															
	J , K encoder	250															
Toothed wheel	150																
Optical linear scale	600																
S1 sensor Motor Ⓜ ↻ Bit 1=1 V340 V326 Bit 1=0 V342 S1 speed Bit 1=1 V341 V327 Bit 1=0 V343 S2 speed																	

V343 Speed filter by S2 sensor

General	Unit R	Hz	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R	50.0 ÷ 6000.0	HALT required	No														
	Adjustment range L																	
	Default R	600.0	Family	9 20	Sensors configuration. Filters													
	Default L																	
Description	V343 Speed filter by S2 sensor ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>600.0</td><td>Hz</td><td>Speed filter by S2 sensor</td><td>50.0</td><td>6000.0</td><td>600.0</td></tr></table>						Value	Unit	Description	Min	Max	Default	600.0	Hz	Speed filter by S2 sensor	50.0	6000.0	600.0
	Value	Unit	Description	Min	Max	Default												
	600.0	Hz	Speed filter by S2 sensor	50.0	6000.0	600.0												
The V343 parameter allows to set up the speed filter by S3 sensor and has to be enabled by means V327 bit 1 = 0. Please also refer to V342 for S1 sensor for more detailed informations. Recommended values of V342 depending on sensor type. (See table above for S1 sensor)																		

V344 S1 sensor code ID

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0 ÷ 4294967295	HALT required	No		
	Adjustment range L					
	Default R	0	Family	9	Sensors configuration.	
	Default L					
Description	V344 S1 sensor code ID ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0	□	S1 sensor code ID	0	4294967295	0
- If V322.0 = 1 (Sensor without serial communication) V344 has no meaning. - If V322.1 = 1 or V 322.2 = 1 (Hiperface protocol) V344 value must match with the ID value store into the sensor (Visible on MP318). - If V322.6 = 1 or V322.7 = 1 (EnDat protocol) V344 is the number of mismatching admitted between sensor configuration parameter into the drive and sensor data, so V344 = 0 means no mismatching admitted. - If V322.11 = 1 (Magnetoscale) V344 = 0 not test with data stored into the sensor, V344 = 1 all the data stored into the sensor must match the drive sensor parameters. - If V322.14 = 1 (Tamagawa protocol) V344 has no meaning. - If V322.17 = 1 (Resolute Renishaw) V344 has no meaning. - If V322.20 = 1 (Fagor BiSS) V344 has no meaning The identification word ID is automatically loaded during the sensor configuration by FlexiumPro Tools as indicated in the chapter 2 “Sensor configuration”. If an incompatibility error occurs the alarm 9 Ext 253 will appear. (Sensor different from the configured one). Please refer to chapter 6 for more detailed information.						

V345 S2 sensor code ID

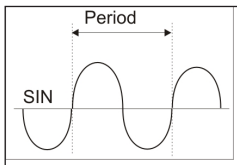
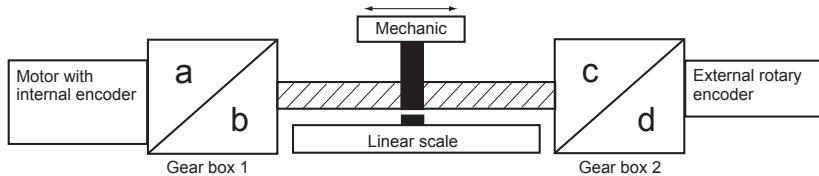
General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0 ÷ 4294967295	HALT required	No													
	Adjustment range L																
	Default R	0	Family	9	Sensors configuration.												
	Default L																
Description	V345 S2 sensor code ID ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0</td><td>□</td><td>S2 sensor code ID</td><td>0</td><td>4294967295</td><td>0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0	□	S2 sensor code ID	0	4294967295	0
	Value	Unit	Description	Min	Max	Default											
0	□	S2 sensor code ID	0	4294967295	0												
<																	

V350 Position loop sensor configuration

General	Unit R	□	Motor type	AM, SM, LM										
	Unit L													
	Adjustment range R	0h ÷ 1h	HALT required	Yes										
	Adjustment range L													
	Default R	0h	Family	3	Measures and positions management									
	Default L					9	Sensors configuration.							
Description	V350 Position loop sensor config. ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☐</td><td>Position loop sensor configuration [0=S1] [1=S2]</td><td>☐</td></tr></tbody></table>						Bit	Value	Description	Default	0	☐	Position loop sensor configuration [0=S1] [1=S2]	☐
	Bit	Value	Description	Default										
0	☐	Position loop sensor configuration [0=S1] [1=S2]	☐											
The V350 parameter allows to set the position loop sensor configuration on S1 or S2 selection. Click on → tick box (✓) to change the bit value = 1. Bit 0 Position loop sensor configuration [0=S1] [1=S2] Selecting the bit to 0 the position loop configuration is set on S1. Selecting the bit to 1 the position loop configuration is set on S2. If an incompatibility error occurs (Bit 0 = 1 and S2 not present) the alarm 16 Ext 350 will appear. Please refer to chapter 7 for more detailed information.														

V353 Period of position sensor/motor turn

General	Unit R	□	Motor type	AM, SM	
	Unit L				
	Adjustment range R	0.1 ÷ 100000.0	HALT required	Yes	
	Adjustment range L				
	Default R	1.0	Family	3	Measures and positions management Sensors configuration.
	Default L			9	

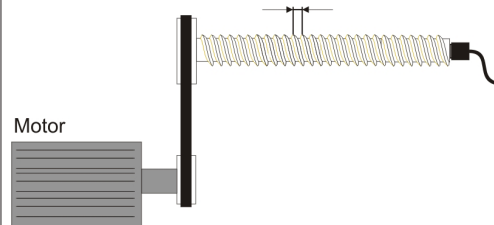
Description	V353 Period of position sensor/motor turn ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1.0	□	Period of position sensor/motor turn	0.0	3.402823E+38	1.0
	Enter in V353 parameter the number of direct measurement sensor periods per motor revolution.					
	The adjustment of V353 parameter is essential when two different sensors are used to close the speed and position loops. The V353 parameter is not used when the same sensor closes the speed and position loops.					
						
	Generally you can calculate with the following formulas. If no EXE (additional interpolation electronic) is used, the corresponding value in the formula becomes "1".					
	By use of rotary axis you can calculate with a screw pitch of 360. The calculated values for V353 must be rounded to two digits after the comma. The following drawing should clarify both cases (direct linear scale or direct rotary encoder).					
	In case of the external rotary encoder, the possibility of an additional gear ratio is considered. If there don not exist an additional gear ratio, the corresponding values in the formula (gear ratio parameter "c" and "d") become "1".					
	- Direct linear scale $V353 = \text{imechanic}(b) / \text{imotor}(a) * \text{screw pitch [mm]} / \text{grating optical scale [μm]} * \text{EXE} * 1000$ - Direct ratio encoder $V353 = (\text{imechanic} (b) * \text{iencoder} (d)* \text{encoder periods} * \text{EXE}) / (\text{imotor}(a) * \text{imechanic} (c))$					
						

Application example

V353 Application example with 1Vpp sinusoidal encoder

Enter the number of sinusoids generated by the encoder in one motor revolution.

- 1Vpp encoder, 1024 sinusoids/rev.
- Reduction ratio between motor and encoder = 2
(for each motor revolution the encoder will generate 512 sinusoids)
- V353 = 512.00 (it is possible insert two decimal number after the comma)



WARNING

The number of periods per motor revolution is not the number of counting pulses used to set-up the MULTI/DIVI measurement parameter.

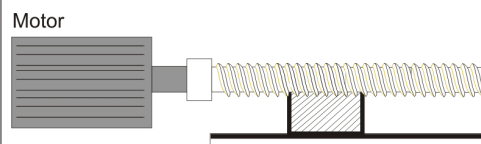
A wrong parameter setting causes wrong gains of the position loop. V353 is a double precision floating point value. It must be input with as many digits after comma as possible..

V353 Application example with 1Vpp sinusoidal optical scale

Enter the number of sinusoids generated by the optical scale in one motor revolution.

- 1Vpp sinusoidal scale (one sinusoid every 16μ)
- Screw pitch = 10mm (10.000μ) with motor directly connected on screw

$$V353 = \frac{10000}{16} = 625 \text{ (Number of scale sinusoids for each motor revolution)}$$



WARNING

The number of periods per motor revolution is not the number of counting pulses used to set-up the MULTI/DIVI measurement parameter.

A wrong parameter setting causes wrong gains of the position loop.

V360 Period by turn S1 sensor

General

Unit R	□	Motor type	AM, SM	
Unit L				
Adjustment range R	1 ÷ 360000	HALT required	Yes	
Adjustment range L				
Default R	1024	Family	9	Sensors configuration.
Default L				

Description

V360 Period by turn S1 sensor

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
1024	□	Period by turn S1 sensor	1	360000	1024

The parameter V360 sets the numbers of periods for S1 sensor revolution.

This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

NOTE

If the sensor is not shown in the table on chapter 2 before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V361 Absolute resolution by turn S1 sensor

General

Unit R

Unit L

Adjustment range R

Adjustment range L

Default R

Default L

1 ÷ 4294967296

4096

Motor type

HALT required

Family

AM, SM

Yes

9

Sensors configuration.

Description

V361 Absolute resolution by turn S1 sensor

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
4096		Absolute resolution by turn S1 sensor	-92233720368...	92233720368...	4096

The V361 parameter sets the absolute resolution for S1 sensor revolution. This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

Using an incremental sensor type without digital communication observe this rule:
 $V361 = V360 * 4$.

NOTE

If the sensor is not shown in the table on chapter 2 before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V365 Number of absolute S1 sensor turns

General

Unit R	□	Motor type	AM, SM	
Unit L				
Adjustment range R	1 ÷ 65536	HALT required	Yes	
Adjustment range L				
Default R	1	Family	9	Sensors configuration.
Default L				

Description

V365 Number of absolute S1 sensor turns

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
1	□	Number of absolute S1 sensor turns	1	65536	1

The V365 parameter sets the number of absolute resolutions for S1 sensor.
If the sensor has not the absolute digital communication insert 1.

This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

i

NOTE

If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V368 Intervals between S1 coded references

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 65536	HALT required	Yes		
	Adjustment range L					
	Default R	1000	Family	9	Sensors configuration.	
	Default L					
Description	V368 Intervals between S1 coded references ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1000	□	Intervals between S1 coded references	1	65536	1000
	The V368 parameter is used when we want to obtain the absolute position from an optical scale with coded references.					
	Check the number of intervals generated by the optical scale between three reference marks. (Usually declared by the optical scale manufacturer).					
	In V368 parameter it is necessary to enter the number of periods generated by the optical scale between three reference marks. The default value is 1000.					
Enter the number of periods in V368 parameter.						
Application example	Application example with optical scale using coded references. Optical scale with coded references Codification every 20mm Period 20μ. $V368 = \frac{20 \times 1000}{20} = 1000$					

1

2

3

4

5

6

7

8

V369 Multiplier of S1 coded references

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	1 ÷ 32	HALT required	Yes													
	Adjustment range L																
	Default R	1	Family	9	Sensors configuration.												
	Default L																
Description	V369 Multiplier of S1 coded references ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>1</td><td>□</td><td>Multiplier of S1 coded references</td><td>1</td><td>32</td><td>1</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	1	□	Multiplier of S1 coded references	1	32	1
	Value	Unit	Description	Min	Max	Default											
1	□	Multiplier of S1 coded references	1	32	1												
The V369 parameter is used in case of distance coded reference mark encoders where the number of periods between any pair of consecutive traversed marks is always a multiple of an integer number greater than 1.																	
Example	A distance coded reference mark encoder with a nominal number of periods between reference marks = 1000 (V368), can have the following sequence of distances between consecutive traversed mark pairs: 501 - 499 - 502 - 498 - 503 - 497 - etc.. In this case all the distances listed in the sequence have a unique common factor = 1, so in V369 you have to write 1. As another example: A distance coded reference mark encoder with a nominal number of periods between reference marks = 3600 (V368), can have the following sequence of distances between consecutive traversed mark pairs: 1795 - 1805 - 1790 - 1810 - 1785 - 1815 - etc.. In this case all the distances listed in the sequence have a unique common factor = 5, so in V369 we have to write 5.																

V370 Period by turn S2 sensor

General

Unit R	□	Motor type	AM, SM	
Unit L				
Adjustment range R	1 ÷ 360000	HALT required	Yes	
Adjustment range L				
Default R	1024	Family	9	Sensors configuration.
Default L				

Description

V370 Period by turn S2 sensor

☒ Unit☒ Description☒ Min☒ Max☒ Default

Value	Unit	Description	Min	Max	Default
1024	□	Period by turn S2 sensor	1	360000	1024

The parameter V370 sets the numbers of periods for S2 sensor revolution.
This parameter has to be adjusted in present of new sensor only, otherwise see note here below.



NOTE

If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V371 Absolute resolution by turn S2 sensor

General	Unit R	□	Motor type	AM, SM								
	Unit L											
	Adjustment range R	1 ÷ 4294967296	HALT required	Yes								
	Adjustment range L											
	Default R	4096	Family	9	Sensors configuration.							
	Default L											
Description	V371 Absolute resolution by turn S2 sensor ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default											
	<table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>4096</td><td>□</td><td>Absolute resolution by turn S2 sensor</td><td>-92233720368...</td><td>92233720368...</td><td>4096</td></tr></table>	Value	Unit	Description	Min	Max	Default	4096	□	Absolute resolution by turn S2 sensor	-92233720368...	92233720368...
Value	Unit	Description	Min	Max	Default							
4096	□	Absolute resolution by turn S2 sensor	-92233720368...	92233720368...	4096							
The V371 parameter sets the absolute resolution for S2 sensor revolution. This parameter has to be adjusted in present of new sensor only, otherwise see note here below. Using an incremental sensor type without digital communication observe this rule: $V371 = V370 * 4$.												
 NOTE If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.												

V375 Number of absolute S2 sensor turns

General	Unit R	□	Motor type	AM, SM		
	Unit L					
	Adjustment range R	1 ÷ 65536	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	9	Sensors configuration.	
	Default L					
Description	V375 Number of absolute S2 sensor turns ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	Number of absolute S2 sensor turns	1	65536	1
The V375 parameter sets the number of absolute resolutions for S2 sensor. If the sensor has not the absolute digital communication insert 1. This parameter has to be adjusted in present of new sensor only, otherwise see note here below.						
 NOTE If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.						

V378 Intervals between S2 coded references

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 65536	HALT required	Yes		
	Adjustment range L					
	Default R	1000	Family	9	Sensors configuration.	
	Default L					
Description	V378 Intervals between S2 coded references ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1000	□	Intervals between S2 coded references	1	65536	1000
	The V378 parameter is used when we want to obtain the absolute position from an optical scale with coded references. Check the number of intervals generated by the optical scale between three reference marks. (Usually declared by the optical scale manufacturer). In V378 parameter it is necessary to enter the number of periods generated by the optical scale between three reference marks. The default value is 1000. Enter the number of periods in V378 parameter.					
Application example	Application example with optical scale using coded references.					
	- Optical scale with coded references - Codification every 20mm - Period 20μ. $V378 = \frac{20 \times 1000}{20} = 1000$					

V379 Multiplier of S2 coded references

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 32	HALT required	Yes		
	Adjustment range L					
	Default R	1	Family	9	Sensors configuration.	
	Default L					
Description	V379 Multiplier of S2 coded references					
	☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	
	Value	Unit	Description	Min	Max	Default
	1	□	Multiplier of S2 coded references	1	32	1
The V379 parameter is used in case of distance coded reference mark encoders where the number of periods between any pair of consecutive traversed marks is always a multiple of an integer number greater than 1.						
Application example	A distance coded reference mark encoder with a nominal number of periods between reference marks = 1000 (V378), can have the following sequence of distances between consecutive traversed mark pairs: 501 - 499 - 502 - 498 - 503 - 497 - etc.. In this case all the distances listed in the sequence have a unique common factor = 1, so in V379 you have to write 1.					
	As another example: A distance coded reference mark encoder with a nominal number of periods between reference marks = 3600 (V378), can have the following sequence of distances between consecutive traversed mark pairs: 1795 - 1805 - 1790 - 1810 - 1785 - 1815 - etc.. In this case all the distances listed in the sequence have a unique common factor = 5, so in V379 we have to write 5.					

V380 Period of linear S1 sensor

General

Unit R	nm	Motor type	AM, SM, LM	
Unit L				
Adjustment range R	1 ÷ 20000000000	HALT required	Yes	
Adjustment range L				
Default R	20000	Family	9	Sensors configuration.
Default L				

Description

V380 Period of linear S1 sensor ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
Value	Unit	Description	Min	Max	Default
20000	nm	Period of linear S1 sensor	1	20000000000	20000

The V380 parameter sets the dimension of the linear S1 sensor period.
 The parameter value is expressed in micron (µm).
 This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

NOTE

If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V381**Absolute resolution of linear S1 sensor**

General	Unit R	nm	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 1000000	HALT required	Yes		
	Adjustment range L					
	Default R	100	Family	9	Sensors configuration.	
	Default L					
Description	V381 Absolute resolution of linear S1 sensor ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100	nm	Absolute resolution of linear S1 sensor	1	1000000	100
The V381 parameter sets the absolute resolution of linear S1 sensor. The parameter value is expressed in nm (nanometer). This parameter has to be adjusted in present of new sensor only, otherwise see note here below.						
 NOTE If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.						

V389**S1 sensor serial position datum bit size**

General	Unit R	bit	Motor type	AM, SM, LM																							
	Unit L																										
	Adjustment range R	0 ÷ 48	HALT required	Yes																							
	Adjustment range L																										
	Default R	0	Family	9	Sensors configuration.																						
	Default L																										
Description	<table><tr><th colspan="5">V389 S1 sensor serial position datum bit size</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0</td><td>bit</td><td>S1 sensor serial position datum bit size</td><td>0</td><td>48</td><td>0</td></tr></table>					V389 S1 sensor serial position datum bit size					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	0	bit	S1 sensor serial position datum bit size	0	48	0
	V389 S1 sensor serial position datum bit size					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																	
	Value	Unit	Description	Min	Max	Default																					
	0	bit	S1 sensor serial position datum bit size	0	48	0																					
	The V389 parameter sets the serial position datum bit size for S1 sensor. This parameter has to be adjusted only for encoders with digital serial communication as for instance sensor type: - Stegmann Hiperface - EnDat - Hiperface DSL - Tamagawa - Magnescale - Resolute Renishaw. This parameter is not used in case of analog sin/cos encoder and Hall sensors. It contains the number of bit of the digital position information transmitted serially by the encoder to the drive. The V389 parameter is not mandatory for many kind of encoders. But it is mandatory in case of linear scales for which the position datum size (in bit) is not readable from the encoder itself.																										
Examples	V389 is mandatory for: - Resolute Renishaw linear scale - Magnescale linear scale - Tamagawa linear scale (if any exists) V389 is not mandatory for: - Stegmann Hiperface, rotary or linear encoders - EnDat, rotary or linear encoders - Hiperface DSL, rotary or linear encoders - Tamagawa, rotary only encoders - Magnescale, rotary only encoders - Resolute Renishaw, rotary only encoders. Sometimes it happens that the serially transmitted digital position datum size (in bit), even if not mandatory, has to be specified anyway, because the real position datum size could be different from what the drive is able to estimate from other encoder parameters.																										
Examples	In case of rotary encoders, the drive is able to estimate the digital position datum size (in bit) from V361 and V365, in fact the following formula applies: LOG2 (V361 * V365) = digital position datum size (in bit) ...but sometimes the encoder serial communication protocol uses a larger position datum bit size. In such a case, V389 has to be set to the size specified in the encoder serial communication protocol. In case the information is not mandatory and not needed, the parameter value has to be set to zero. A wrong or incongruent value of V389 with respect to what is read from encoder causes alarm 9 with proper Ext, specifying the incongruency.																										

V390 Period of linear S2 sensor

General

Unit R	nm	Motor type	AM, SM, LM	
Unit L				
Adjustment range R	1 ÷ 20000000000	HALT required	Yes	
Adjustment range L				
Default R	20000	Family	9	Sensors configuration.
Default L				

Description

V390 Period of linear S2 sensor					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
Value	Unit	Description	Min	Max	Default				
20000	nm	Period of linear S2 sensor	1	20000000000	20000				

The V390 parameter sets the dimension of the linear S2 sensor period.
The parameter value is expressed in micron (µm).

This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

NOTE

If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V391 Absolute resolution of linear S2 sensor

General

Unit R

Unit L

Adjustment range R

Adjustment range L

Default R

Default L

nm

1 ÷ 1000000

100

Motor type

HALT required

Family

AM, SM, LM

Yes

9

Sensors configuration.

Description

V391 Absolute resolution of linear S2 sensor

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Value	Unit	Description	Min	Max	Default
100	nm	Absolute resolution of linear S2 sensor	1	1000000	100

The V391 parameter sets the absolute resolution of linear S2 sensor.

The parameter value is expressed in nm (nanometer). This parameter has to be adjusted in present of new sensor only, otherwise see note here below.

NOTE

If the sensor is not shown in the table on chapter 2, before connecting it, always take into consideration the sensor data sheet and select the appropriate values and adjusting appropriate parameters as indicated on chapter 5.

V399**S2 sensor serial position datum bit size**

General	Unit R	bit	Motor type	AM, SM, LM																							
	Unit L																										
	Adjustment range R	0 ÷ 48	HALT required	Yes																							
	Adjustment range L																										
	Default R	0	Family	9	Sensors configuration.																						
	Default L																										
Description	<table><tr><th colspan="5">V399 S2 sensor serial position datum bit size</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0</td><td>bit</td><td>S2 sensor serial position datum bit size</td><td>0</td><td>48</td><td>0</td></tr></table>					V399 S2 sensor serial position datum bit size					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	0	bit	S2 sensor serial position datum bit size	0	48	0
	V399 S2 sensor serial position datum bit size					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																	
	Value	Unit	Description	Min	Max	Default																					
	0	bit	S2 sensor serial position datum bit size	0	48	0																					
The V399 parameter sets the serial position datum bit size for the S2 sensor. This parameter has to be adjusted only for encoders with digital serial communication as for instance sensor type: - Stegmann Hiperface - EnDat - Hiperface DSL - Tamagawa - Magnescale - Resolute Renishaw. This parameter is not used in case of analog sin/cos encoder and Hall sensors. It contains the number of bit of the digital position information transmitted serially by the encoder to the drive. The V399 parameter is not mandatory for many kind of encoders. But it is mandatory in case of linear scales for which the position datum size (in bit) is not readable from the encoder itself.																											
Examples	V399 is mandatory for: - Resolute Renishaw linear scale - Magnescale linear scale - Tamagawa linear scale (if any exists) V399 is not mandatory for: - Stegmann Hiperface, rotary or linear encoders - EnDat, rotary or linear encoders - Hiperface DSL, rotary or linear encoders - Tamagawa, rotary only encoders - Magnescale, rotary only encoders - Resolute Renishaw, rotary only encoders. Sometimes it happens that the serially transmitted digital position datum size (in bit), even if not mandatory, has to be specified anyway, because the real position datum size could be different from what the drive is able to estimate from other encoder parameters.																										
	In case of rotary encoders, the drive is able to estimate the digital position datum size (in bit) from V371 and V375, in fact the following formula applies: LOG2 (V371 * V375) = digital position datum size (in bit) ...but sometimes the encoder serial communication protocol uses a larger position datum bit size. In such a case, V399 has to be set to the size specified in the encoder serial communication protocol. In case the information is not mandatory and not needed, the parameter value has to be set to zero. A wrong or incongruent value of V399 with respect to what is read from encoder causes alarm 38 with proper Ext, specifying the incongruency.																										

V400 Rs at 120 deg. C

General	Unit R	mOhm	Motor type	AM		
	Unit L					
	Adjustment range R	0.0 ÷ 100000.0	HALT required	No		
	Adjustment range L					
	Default R	125.0	Family	15	Vectorial motor control	
	Default L					
The V400 parameter defines the stator resistance @ 120°C						
Description	V400 Rs at 120 deg.C ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	125.0	mOhm	Rs at 120 deg.C	0.0	100000.0	125.0

V401 Rr at 150 deg. C

General	Unit R	mOhm	Motor type	AM	
	Unit L				
	Adjustment range R	0.0 ÷ 100000.0	HALT required	No	
	Adjustment range L				
	Default R	75.0	Family	15	Vectorial motor control
	Default L				
The V401 parameter defines the rotor resistance @ 150°C					
Description	V401 Rr at 150 deg.C ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	75.0	mOhm	Rr at 150 deg.C	0.0	100000.0

V402 sigmaLs

General	Unit R	uH	Motor type	AM	
	Unit L				
	Adjustment range R	0.0 ÷ 2000000.0	HALT required	No	
	Adjustment range L				
	Default R	1500.0	Family	15	Vectorial motor control
	Default L				
	The V402 parameter defines the total leakage inductance (stator + rotor) of the motor alone.				
Description	V402 signals ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Value	Unit	Description	Min	Max
	1500.0	uH	signals	0.0	2000000.0

V403 Lr

General	Unit R	mH	Motor type	AM													
	Unit L																
	Adjustment range R	0.0 ÷ 10000.0	HALT required	No													
	Adjustment range L																
	Default R	125.0	Family	15	Vectorial motor control												
	Default L																
The V403 parameter defines the unsaturated magnetizing inductance of the motor																	
Description	V403 Lr ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>125.0</td><td>mH</td><td>Lr</td><td>0.0</td><td>10000.0</td><td>125.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	125.0	mH	Lr	0.0	10000.0	125.0
	Value	Unit	Description	Min	Max	Default											
125.0	mH	Lr	0.0	10000.0	125.0												

V408 Additional extern inductance

General	Unit R	mH	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 100.0	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	15	Vectorial motor control												
	Default L																
The V408 parameter defines any additional external inductance between motor and drive																	
Description	V408 Additional extern inductance ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>mH</td><td>Additional extern inductance</td><td>0.0</td><td>100.0</td><td>0.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0.0	mH	Additional extern inductance	0.0	100.0	0.0
	Value	Unit	Description	Min	Max	Default											
0.0	mH	Additional extern inductance	0.0	100.0	0.0												

V409 ST flux-weakening voltage

General	Unit R	Vrms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 700.0	HALT required	No													
	Adjustment range L																
	Default R	350.0	Family	15	Vectorial motor control												
	Default L																
The V409 parameter defines the maximum stator voltage at which flux-weakening starts.																	
Description	V409 ST flux-weakening voltage ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>350.0</td><td>Vrms</td><td>ST flux-weakening voltage</td><td>0.0</td><td>700.0</td><td>350.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	350.0	Vrms	ST flux-weakening voltage	0.0	700.0	350.0
	Value	Unit	Description	Min	Max	Default											
350.0	Vrms	ST flux-weakening voltage	0.0	700.0	350.0												

V410 Proportional gain flux loop

General	Unit R	Arms/mWbrms	Motor type	AM				
	Unit L							
	Adjustment range R	0.0 ÷ 20.0	HALT required	No				
	Adjustment range L							
	Default R	0.5	Family	15	Vectorial motor control			
	Default L							
The V410 parameter defines the proportional gain of the motor magnetic flux regulation loop								
Description	V410 Proportional gain flux loop			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.5	Arms/m...	Proportional gain flux loop	0.0	20.0	0.5		

V411 Integral gain flux loop

General	Unit R	ms	Motor type	AM		
	Unit L					
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	15	Vectorial motor control	
	Default L					
The V411 parameter defines the integral gain of the motor magnetic flux regulation loop.						
Description	V411 Integral gain flux loop ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	ms	Integral gain flux loop	0.1	5000.0	100.0

V412 Magnetization inductance (Lm) saturation level

General	Unit R	%	Motor type	AM		
	Unit L					
	Adjustment range R	2.0 ÷ 100.0	HALT required	No		
	Adjustment range L					
	Default R	70.0	Family	15	Vectorial motor control	
	Default L					
	The V412 parameter defines the magnetizing inductance in saturated regime, with respect to V403					
Description	V412 Magnetization inductance (Lm) saturation level ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	70.0	%	Magnetization inductance (Lm) saturation level	2.0	100.0	70.0

V414 Observer engagement speed

General	Unit R	rpm	Motor type	AM													
	Unit L																
	Adjustment range R	0.0 ÷ 200000.0	HALT required	No													
	Adjustment range L																
	Default R	500.0	Family	15	Vectorial motor control												
	Default L																
The V414 parameter defines the observer engagement/disengagement speed: (with hysteresis) at speeds higher than V414 the flux observer is activated at speeds lower than V(414 - V415) the flux observer is deactivated																	
Description	V414 Observer engagement speed ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>500.0</td><td>rpm</td><td>Observer engagement speed</td><td>0.0</td><td>200000.0</td><td>500.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	500.0	rpm	Observer engagement speed	0.0	200000.0	500.0
Value	Unit	Description	Min	Max	Default												
500.0	rpm	Observer engagement speed	0.0	200000.0	500.0												

V415 Observer engagement hysteresis

General	Unit R	rpm	Motor type	AM		
	Unit L					
	Adjustment range R	0.0 ÷ 2000.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	15	Vectorial motor control	
	Default L					
The V415 parameter defines the amplitude of the speed hysteresis for the activation / deactivation of the motor magnetic flux observer.						
Description	V415 Observer engagement hysteresis					
	☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	
	Value	Unit	Description	Min	Max	Default
	100.0	rpm	Observer engagement hysteresis	0.0	2000.0	100.0

V425 Min_flux as a %age of V427

General	Unit R	%	Motor type	AM								
	Unit L											
	Adjustment range R	1.0 ÷ 20.0	HALT required	No								
	Adjustment range L											
	Default R	5.0	Family	15	Vectorial motor control							
	Default L											
The V425 parameter defines the minimum flux guaranteed by the flux-weakening function.												
Description	V425 Min_flux as a %age of V427 ☒ Unit☒ Description☒ Min☒ Max☒ Default											
	<table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>5.0</td><td>%</td><td>Min_flux as a %age of V427</td><td>1.0</td><td>20.0</td><td>5.0</td></tr></table>	Value	Unit	Description	Min	Max	Default	5.0	%	Min_flux as a %age of V427	1.0	20.0
Value	Unit	Description	Min	Max	Default							
5.0	%	Min_flux as a %age of V427	1.0	20.0	5.0							

V426 Flux weakening integral gain

General	Unit R	mWbrms/(Vrms*s)	Motor type	AM		
	Unit L					
	Adjustment range R	0.0 ÷ 10000.0	HALT required	No		
	Adjustment range L					
	Default R	50.0	Family	15	Vectorial motor control	
	Default L					
The V426 parameter defines the integral gain of the flux weakening regulator.						
Description	V426 Flux weakening integral gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	50.0	mWbrm...	Flux weakening integral gain	0.0	10000.0	50.0

V427 Magnetization current

General	Unit R	Arms	Motor type	AM		
	Unit L					
	Adjustment range R	0.0 ÷ drive size current/2.0	HALT required	No		
	Adjustment range L					
	Default R	0.5	Family	15	Vectorial motor control	
	Default L					
The V427 parameter defines the magnetization current: in the region of constant flux.						
Description	V427 Magnetization current ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.5	Arms	Magnetization current	0.0	7.0	0.5

V428 Magnetization current limit

General	Unit R	Arms	Motor type	AM		
	Unit L					
	Adjustment range R	0.0 ÷ drive size current/1.414	HALT required	No		
	Adjustment range L					
	Default R	0.707	Family	15	Vectorial motor control	
	Default L					
	The V428 parameter defines the maximum value for the magnetizing current, guaranteed during flux variations. ??					
Description	V428 Magnetization current limit ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.707	Arms	Magnetization current limit	0.0	9.9	0.707

V434 Proportional Id current loop gain

General	Unit R	Vrms/Arms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 5000.0	HALT required	No													
	Adjustment range L																
	Default R	10.0	Family	14	Current loop control												
	Default L																
The V434 parameter defines the proportional gain of the motor flux current regulation loop.																	
Description	V434 Proportional Id current loop gain ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>10.0</td><td>Vrms/Arms</td><td>Proportional Id current loop gain</td><td>0.0</td><td>5000.0</td><td>10.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	10.0	Vrms/Arms	Proportional Id current loop gain	0.0	5000.0	10.0
	Value	Unit	Description	Min	Max	Default											
10.0	Vrms/Arms	Proportional Id current loop gain	0.0	5000.0	10.0												

V435 Integral Id current loop gain

General	Unit R	ms	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.1 ÷ 5000.0	HALT required	No													
	Adjustment range L																
	Default R	10.0	Family	14	Current loop control												
	Default L																
The V435 parameter defines the integral gain of the motor flux current regulation loop.																	
Description	V435 Integral Id current loop gain ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>10.0</td><td>ms</td><td>Integral Id current loop gain</td><td>0.1</td><td>5000.0</td><td>10.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	10.0	ms	Integral Id current loop gain	0.1	5000.0	10.0
	Value	Unit	Description	Min	Max	Default											
10.0	ms	Integral Id current loop gain	0.1	5000.0	10.0												

V480 Correction factor for MP6

General	Unit R	%	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 100.0	HALT required	No													
	Adjustment range L																
	Default R	75.0	Family	13 15	V/f motor control Vectorial motor control												
	Default L	90.0															
	The V480 parameter correction factor, in percentage, of MP006: power delivered to the crankshaft.																
Description	V480 Correction factor for MP6 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>75.0</td><td>%</td><td>Correction factor for MP6</td><td>0.0</td><td>100.0</td><td>75.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	75.0	%	Correction factor for MP6	0.0	100.0	75.0
Value	Unit	Description	Min	Max	Default												
75.0	%	Correction factor for MP6	0.0	100.0	75.0												

V481 Control mode selection

General	Unit R		Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes	
	Adjustment range L				
	Default R	1h	Family	13 15	V/f motor control Vectorial motor control
	Default L				
The V481 parameter defines the control mode of the motor: - vectorial control - V/f control					

Description	V481 Control mode selection ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default											
	<table><tr><td>Bit</td><td>Value</td><td>Description</td><td>Default</td></tr><tr><td>0</td><td> </td><td>Vectorial d-q regulation</td><td> ☒ </td></tr><tr><td>1</td><td> </td><td>V/f regulation</td><td> ☐ </td></tr></table>	Bit	Value	Description	Default	0		Vectorial d-q regulation	☒	1		V/f regulation
Bit	Value	Description	Default									
0		Vectorial d-q regulation	☒									
1		V/f regulation	☐									

Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5

V482 Current loop d-q Decoupling and Compensations

General	Unit R	☐	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 3h	HALT required	No	
	Adjustment range L				
	Default R	0h	Family	13 15	V/f motor control Vectorial motor control
	Default L				
The V482 parameter allows the setting of special behaviour of the D-Q current loop controllers.					

Description	V482 Current loop d-q Decoupling and Compensations					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Bit	Value	Description						Default	
	0	☐	Current compens. calc. [0=Measure] [1=Reference]						☐	
	1	☐	Asynchronous back-EMF compensation [0=NO] [1=Active]						☐	

Bit 0 Current compensation calculation [0=Measure] [1=Reference]
Bit 0 = 0 : the compensation voltage of motor inductances Lq (V105) and Ld (V106) is calculated based on the measured current.
Bit 0 = 1 : the compensation voltage of motor inductances Lq (V105) and Ld (V106) is calculated based on the reference current.

Bit 1: activation of the counter-EMF compensation of the asynchronous motor.

V492 Id current without defluxing

General	Unit R	Arms	Motor type	SM, LM													
	Unit L																
	Adjustment range R	V491 ÷ V108	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	15	Vectorial motor control												
	Default L																
The V492 parameter flux current, also applied outside the flux-weakening regime.																	
Description	V492 Id current without defluxing ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>Arms</td><td>Id current without defluxing</td><td>0.0</td><td>0.707</td><td>0.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0.0	Arms	Id current without defluxing	0.0	0.707	0.0
	Value	Unit	Description	Min	Max	Default											
0.0	Arms	Id current without defluxing	0.0	0.707	0.0												

V496 Defluxing starting speed

General	Unit R	rpm	Motor type	AM, SM, LM													
	Unit L	m/min															
	Adjustment range R	0.0 ÷ 120000.0	HALT required	No													
	Adjustment range L	0.0 ÷ 1000.0															
	Default R	120000.0	Family	15	Vectorial motor control												
	Default L	1000.0															
The V496 parameter defines the motor speed above which flux-weakening can be applied. the flux-weakening will be activated only above this speed and only if the voltage requested by the motor exceeds V309.																	
Description	V496 Defluxing starting speed ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>120000.0</td><td>rpm</td><td>Defluxing starting speed</td><td>0.0</td><td>120000.0</td><td>120000.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	120000.0	rpm	Defluxing starting speed	0.0	120000.0	120000.0
Value	Unit	Description	Min	Max	Default												
120000.0	rpm	Defluxing starting speed	0.0	120000.0	120000.0												

V498 K Iq reduction

General	Unit R	Arms/(Vrms*s)	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 500.0	HALT required	No													
	Adjustment range L																
	Default R	5.0	Family	15	Vectorial motor control												
	Default L																
The V498 parameter defines the gain of the torque current reduction regulation loop in flux-weakening mode.																	
Description	V498 K Iq reduction ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>5.0</td><td>Arms/(V...</td><td>K Iq reduction</td><td>0.0</td><td>500.0</td><td>5.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	5.0	Arms/(V...	K Iq reduction	0.0	500.0	5.0
Value	Unit	Description	Min	Max	Default												
5.0	Arms/(V...	K Iq reduction	0.0	500.0	5.0												

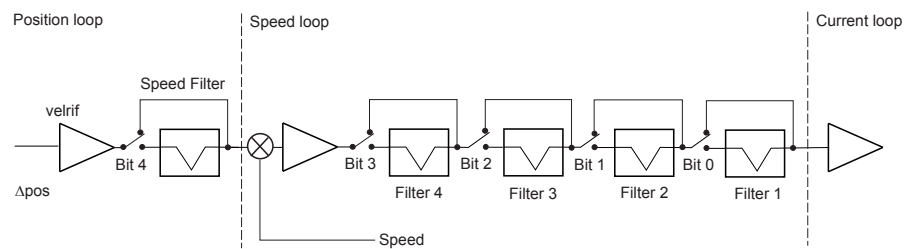
Application

The drive is provided with 4 filters on torque current and speed reference which may be adjusted by means of parameters listed before.

The filters are used in some particular cases, i.e. when the motor is directly connected on screw, and therefore, even with motor in torque from stationary, high noisiness situations (resonance) may occur.

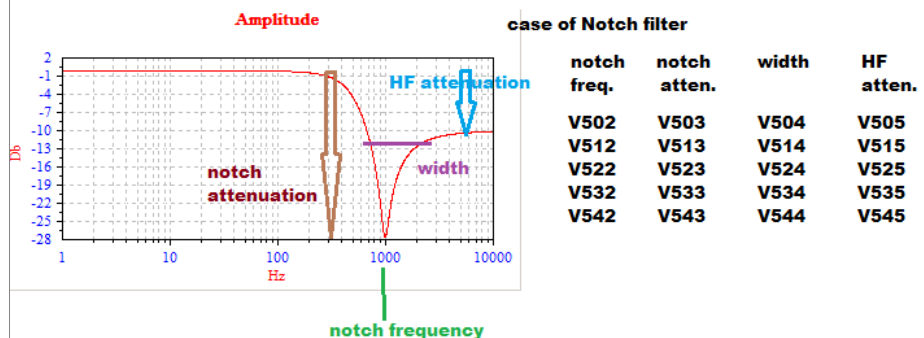
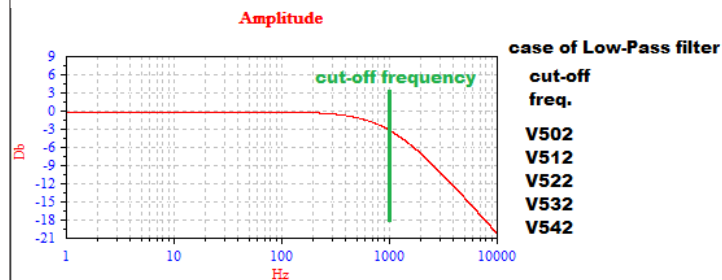
Generally, if we analyze, in this case, the wave form of the torque current, we will see a cyclic oscillation which approximately indicate the resonance frequency. As regards the frequency analysis, by means FlexiumPro Tools it is possible to characterize all the mentioned filters.

Functional diagram



NOTE

The filters can be used as lowpass filters of first or second order or as notch filter, depending on V501 - V511 - V521 - V531 - V541



V501 Type (FILTER 1 torque current ref.)

General

Unit R

Unit L

Adjustment range R

Adjustment range L

Default R

Default L

1h ÷ 80000000h

1h

Motor type

HALT required

Family

AM, SM, LM

No

20

Filters

The V501 parameter

Description

V501 Type (FILTER 1 torque current ref.)

☒ Unit
☒ Description
☒ Min
☒ Max
☒ Default

Bit	Value	Description	Default
0	☒	First order low pass	☒
1	☐	Second order low pass (Butterworth)	☐
2	☐	Notch	☐

Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5

V502 Frequency (FILTER 1 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM																					
	Unit L																								
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No																					
	Adjustment range L																								
	Default R	2000.0	Family	20	Filters																				
	Default L																								
	The V502 parameter definisce la frequenza caratteristica del filtro: (descriz. valida per V502, V012, V522, V532, V542) - in caso di filtro passa-basso del 1' o 2' ordine é la frequenza di taglio del filtro - nel caso di filtri notch e' la frequenza centrale del notch																								
Description	<table><tr><td colspan="3">V502 Frequency (FILTER 1 torque current ref.)</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>2000.0</td><td>Hz</td><td>Frequency (FILTER 1 torque current ref.)</td><td>1.0</td><td>6000.0</td><td>2000.0</td></tr></table>					V502 Frequency (FILTER 1 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	2000.0	Hz	Frequency (FILTER 1 torque current ref.)	1.0	6000.0	2000.0
V502 Frequency (FILTER 1 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																		
Value	Unit	Description	Min	Max	Default																				
2000.0	Hz	Frequency (FILTER 1 torque current ref.)	1.0	6000.0	2000.0																				

V503 Attenuation (FILTER 1 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	3.0 ÷ 40.0	HALT required	No		
	Adjustment range L					
	Default R	6.0	Family	20	Filters	
	Default L					
The V503 parameter used only in the case of notch filter: Defines the attenuation at the center frequency of the notch						
Description	V503 Attenuation (FILTER 1 torque current ref.)					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	6.0	dB	Attenuation (FILTER 1 torque current ref.)	3.0	40.0	6.0

V504 Width (FILTER 1 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM																					
	Unit L																								
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No																					
	Adjustment range L																								
	Default R	2000.0	Family	20	Filters																				
	Default L																								
	The V504 parameter used only in the case of notch filter. Defines the stop-band width of the notch.																								
Description	<table><tr><td colspan="3">V504 Width (FILTER 1 torque current ref.)</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>2000.0</td><td>Hz</td><td>Width (FILTER 1 torque current ref.)</td><td>1.0</td><td>6000.0</td><td>2000.0</td></tr></table>					V504 Width (FILTER 1 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description	Min	Max	Default	2000.0	Hz	Width (FILTER 1 torque current ref.)	1.0	6000.0	2000.0
V504 Width (FILTER 1 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																		
Value	Unit	Description	Min	Max	Default																				
2000.0	Hz	Width (FILTER 1 torque current ref.)	1.0	6000.0	2000.0																				

V505 HF attenuation (FILTER 1 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	0.0 ÷ 10.0	HALT required	No													
	Adjustment range L																
	Default R	0.0	Family	20	Filters												
	Default L																
	The V505 parameter Used in the case of the notch filter. Defines the constant attenuation above the notch frequency.																
Description	V505 HF attenuation (FILTER 1 torque current ref.) ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>0.0</td><td>dB</td><td>HF attenuation (FILTER 1 torque current ref.)</td><td>0.0</td><td>10.0</td><td>0.0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	0.0	dB	HF attenuation (FILTER 1 torque current ref.)	0.0	10.0	0.0
Value	Unit	Description	Min	Max	Default												
0.0	dB	HF attenuation (FILTER 1 torque current ref.)	0.0	10.0	0.0												

1

2

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V511 Type (FILTER 2 torque current ref.)

General	Unit R		Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	No	
	Adjustment range L				
	Default R	1h	Family	20	Filters
	Default L				
	The V511 parameter				
Description	V511 Type (FILTER 2 torque current ref.) Bit Value Description Default 0 First order low pass 1 Second order low pass (Butterworth) 2 Notch				
	Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5				

V512 Frequency (FILTER 2 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	2000.0	Family	20	Filters	
	Default L					
	The V512 parameter					
Description	V512 Frequency (FILTER 2 torque current ref.) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	2000.0	Hz	Frequency (FILTER 2 torque current ref.)	1.0	6000.0	2000.0

V513 Attenuation (FILTER 2 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	3.0 ÷ 40.0	HALT required	No		
	Adjustment range L					
	Default R	6.0	Family	20	Filters	
	Default L					
The V513 parameter used only in the case of notch filter: Defines the attenuation at the center frequency of the notch.						
Description	V513 Attenuation (FILTER 2 torque current ref.) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	6.0	dB	Attenuation (FILTER 2 torque current ref.)	3.0	40.0	6.0

V514 Width (FILTER 2 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	2000.0	Family	20	Filters	
	Default L					
	The V514 parameter used only in the case of notch filter: defines the stop-bandwidth of the notch.					
Description	V514 Width (FILTER 2 torque current ref.) ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	2000.0	Hz	Width (FILTER 2 torque current ref.)	1.0	6000.0	2000.0

V515 HF attenuation (FILTER 2 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	0.0 ÷ 10.0	HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	20	Filters			
	Default L							
	The V515 parameter Used in the case of the notch filter. Defines the constant attenuation above the notch frequency.							
Description	V515 HF attenuation (FILTER 2 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	dB	HF attenuation (FILTER 2 torque current ref.)	0.0	10.0	0.0		

V521 Type (FILTER 3 torque current ref.)

General	Unit R		Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	No	
	Adjustment range L				
	Default R	1h	Family	20	Filters
	Default L				
The V521 parameter					
Description	V521 Type (FILTER 3 torque current ref.)				
	☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description	Default	
	0	☒	First order low pass	☒	
	1	☐	Second order low pass (Butterworth)	☐	
	2	☐	Notch	☐	
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5					

V522 Frequency (FILTER 3 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	2000.0	Family	20	Filters	
	Default L					
	The V522 parameter					
Description	V522 Frequency (FILTER 3 torque current ref.) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	2000.0	Hz	Frequency (FILTER 3 torque current ref.)	1.0	6000.0	2000.0

V523 Attenuation (FILTER 3 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	3.0 ÷ 40.0	HALT required	No				
	Adjustment range L							
	Default R	6.0	Family	20	Filters			
	Default L							
The V523 parameter used only in the case of notch filter: Defines the attenuation at the center frequency of the notch.								
Description	V523 Attenuation (FILTER 3 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	6.0	dB	Attenuation (FILTER 3 torque current ref.)	3.0	40.0	6.0		

V524 Width (FILTER 3 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	2000.0	Family	20	Filters	
	Default L					
The V524 parameter used only in the case of notch filter: defines the stop-bandwidth of the notch.						
Description	V524 Width (FILTER 3 torque current ref.) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	2000.0	Hz	Width (FILTER 3 torque current ref.)	1.0	6000.0	2000.0

V525 HF attenuation (FILTER 3 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM																																		
	Unit L																																					
	Adjustment range R	0.0 ÷ 10.0	HALT required	No																																		
	Adjustment range L																																					
	Default R	0.0	Family	20	Filters																																	
	Default L																																					
	The V525 parameter Used in the case of the notch filter. Defines the constant attenuation above the notch frequency.																																					
Description	<table><tr><td colspan="6">V525 HF attenuation (FILTER 3 torque current ref.)</td><td>☒ Unit</td><td>☒ Descripton</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td colspan="4">Description</td><td>Min</td><td>Max</td><td colspan="3">Default</td></tr><tr><td>0.0</td><td>dB</td><td colspan="4">HF attenuation (FILTER 3 torque current ref.)</td><td>0.0</td><td>10.0</td><td colspan="3">0.0</td></tr></table>					V525 HF attenuation (FILTER 3 torque current ref.)						☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default	Value	Unit	Description				Min	Max	Default			0.0	dB	HF attenuation (FILTER 3 torque current ref.)				0.0	10.0	0.0		
V525 HF attenuation (FILTER 3 torque current ref.)						☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default																												
Value	Unit	Description				Min	Max	Default																														
0.0	dB	HF attenuation (FILTER 3 torque current ref.)				0.0	10.0	0.0																														

V531 Type (FILTER 4 torque current ref.)

General	Unit R		Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	No	
	Adjustment range L				
	Default R	1h	Family	20	Filters
	Default L				
The V531 parameter					
Description	V531 Type (FILTER 4 torque current ref.) ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description	Default	
	0		First order low pass	☒	
	1		Second order low pass (Butterworth)	☐	
	2		Notch	☐	
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5					

V532 Frequency (FILTER 4 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No				
	Adjustment range L							
	Default R	2000.0	Family	20	Filters			
	Default L							
The V532 parameter								
Description	V532 Frequency (FILTER 4 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	2000.0	Hz	Frequency (FILTER 4 torque current ref.)	1.0	6000.0	2000.0		

V533 Attenuation (FILTER 4 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM																															
	Unit L																																		
	Adjustment range R	3.0 ÷ 40.0	HALT required	No																															
	Adjustment range L																																		
	Default R	6.0	Family	20	Filters																														
	Default L																																		
The V533 parameter used only in the case of notch filter: Defines the attenuation at the center frequency of the notch.																																			
Description	<table><tr><td colspan="5">V533 Attenuation (FILTER 4 torque current ref.)</td><td>☒ Unit</td><td>☒ Description</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td colspan="3">Description</td><td>Min</td><td>Max</td><td colspan="3">Default</td></tr><tr><td>6.0</td><td>dB</td><td colspan="3">Attenuation (FILTER 4 torque current ref.)</td><td>3.0</td><td>40.0</td><td colspan="3">6.0</td></tr></table>					V533 Attenuation (FILTER 4 torque current ref.)					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Value	Unit	Description			Min	Max	Default			6.0	dB	Attenuation (FILTER 4 torque current ref.)			3.0	40.0	6.0		
V533 Attenuation (FILTER 4 torque current ref.)					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																										
Value	Unit	Description			Min	Max	Default																												
6.0	dB	Attenuation (FILTER 4 torque current ref.)			3.0	40.0	6.0																												

V534 Width (FILTER 4 torque current ref.)

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	2000.0	Family	20	Filters	
	Default L					
The V534 parameter used only in the case of notch filter: defines the stop-bandwidth of the notch.						
Description	V534 Width (FILTER 4 torque current ref.)					
	☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	
	Value	Unit	Description	Min	Max	Default
	2000.0	Hz	Width (FILTER 4 torque current ref.)	1.0	6000.0	2000.0

V535 HF attenuation (FILTER 4 torque current ref.)

General	Unit R	dB	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	0.0 ÷ 10.0	HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	20	Filters			
	Default L							
The V535 parameter Used in the case of the notch filter. Defines the constant attenuation above the notch frequency.								
Description	V535 HF attenuation (FILTER 4 torque current ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	dB	HF attenuation (FILTER 4 torque current ref.)	0.0	10.0	0.0		

V541 Type (FILTER speed ref.)

General	Unit R		Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1h ÷ 80000000h	HALT required	No	
	Adjustment range L				
	Default R	1h	Family	20	Filters
	Default L				
The V541 parameter					
Description	V541 Type (FILTER speed ref.) ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description		Default
	0	☒	First order low pass		☒
	1	☐	Second order low pass (Butterworth)		☐
	2	☐	Notch		☐
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5					

V542 Frequency (FILTER speed ref.)

General	Unit R	Hz	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No				
	Adjustment range L							
	Default R	2000.0	Family	20	Filters			
	Default L							
The V542 parameter								
Description	V542 Frequency (FILTER speed ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	2000.0	Hz	Frequency (FILTER speed ref.)	1.0	6000.0	2000.0		

V543 Attenuation (FILTER speed ref.)

General	Unit R	dB	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	3.0 ÷ 40.0	HALT required	No				
	Adjustment range L							
	Default R	6.0	Family	20	Filters			
	Default L							
	The V543 parameter used only in the case of notch filter: Defines the attenuation at the center frequency of the notch.							
Description	V543 Attenuation (FILTER speed ref.)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	6.0	dB	Attenuation (FILTER speed ref.)	3.0	40.0	6.0		

V544 Width (FILTER speed ref.)

General	Unit R	Hz	Motor type	AM, SM, LM																															
	Unit L																																		
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No																															
	Adjustment range L																																		
	Default R	2000.0	Family	20	Filters																														
	Default L																																		
	The V544 parameter used only in the case of notch filter: defines the stop-bandwidth of the notch.																																		
Description	<table><tr><td colspan="5">V544 Width (FILTER speed ref.)</td><td>☒ Unit</td><td>☒ Descripton</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td colspan="3">Descripton</td><td>Min</td><td>Max</td><td colspan="3">Default</td></tr><tr><td>2000.0</td><td>Hz</td><td colspan="3">Width (FILTER speed ref.)</td><td>1.0</td><td>6000.0</td><td colspan="3">2000.0</td></tr></table>					V544 Width (FILTER speed ref.)					☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default	Value	Unit	Descripton			Min	Max	Default			2000.0	Hz	Width (FILTER speed ref.)			1.0	6000.0	2000.0		
V544 Width (FILTER speed ref.)					☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default																										
Value	Unit	Descripton			Min	Max	Default																												
2000.0	Hz	Width (FILTER speed ref.)			1.0	6000.0	2000.0																												

V545 HF attenuation (FILTER speed ref.)

General	Unit R	dB	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	0.0 ÷ 10.0	HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	20	Filters	
	Default L					
	The V545 parameter Used in the case of the notch filter. Defines the constant attenuation above the notch frequency.					
Description	V545 HF attenuation (FILTER speed ref.)					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	dB	HF attenuation (FILTER speed ref.)	0.0	10.0	0.0

V550 Quick NC MPs Filter configuration

General	Unit R	□	Motor type	AM, SM, LM																																																							
	Unit L																																																										
	Adjustment range R																																																										
	Adjustment range L																																																										
	Default R	0h	Family	5	Special applications configuration																																																						
	Default L			10	Input/output configuration																																																						
				20	Filters																																																						
The V550 parameter																																																											
Description	Click on → "Radio button" to change the parameter value. Please also refer to chapter 2.5																																																										
	<table><tr><th colspan="5">V550 Quick NC MPs Filter configuration</th><th>☒ Unit</th><th>☒ Description</th><th>☒ Min</th><th>☒ Max</th><th>☒ Default</th></tr><tr><th>Bit</th><th>Value</th><th colspan="6">Description</th><th>Default</th></tr><tr><td>0</td><td>☐</td><td colspan="6">LP-4 Filter on quick NC TP1 [1=Active]</td><td>☐</td></tr><tr><td>1</td><td>☐</td><td colspan="6">LP-4 Filter on quick NC TP2 [1=Active]</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td colspan="6">LP-4 Filter on quick NC TP3 [1=Active]</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td colspan="6">LP-4 Filter on quick NC TP4 [1=Active]</td><td>☐</td></tr></table>					V550 Quick NC MPs Filter configuration					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default	Bit	Value	Description						Default	0	☐	LP-4 Filter on quick NC TP1 [1=Active]						☐	1	☐	LP-4 Filter on quick NC TP2 [1=Active]						☐	2	☐	LP-4 Filter on quick NC TP3 [1=Active]						☐	3	☐	LP-4 Filter on quick NC TP4 [1=Active]					
V550 Quick NC MPs Filter configuration					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default																																																		
Bit	Value	Description						Default																																																			
0	☐	LP-4 Filter on quick NC TP1 [1=Active]						☐																																																			
1	☐	LP-4 Filter on quick NC TP2 [1=Active]						☐																																																			
2	☐	LP-4 Filter on quick NC TP3 [1=Active]						☐																																																			
3	☐	LP-4 Filter on quick NC TP4 [1=Active]						☐																																																			
This parameter allows you to filter with low pass (4th order) the quick measure points selected with parameters V130-131 - 132 - 133. Such Quick measure points are sent cyclically, every P50 cycle, to the NC.																																																											

V551 Frequency of LP-4 filter on quick NC TP1

General	Unit R	Hz	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No						
	Adjustment range L									
	Default R	100.0	Family	10 20	Input/output configuration Filters					
	Default L									
The V551 parameter defines the cut-off frequency of the fourth order low pass filter applied to TP1										
Description	V551 Frequency of LP-4 filter on quick NC TP1					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	100.0	Hz	Frequency of LP-4 filter on quick NC TP1	1.0	6000.0	100.0				

V552 Frequency of LP-4 filter on quick NC TP2

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	10 20	Input/output configuration Filters	
	Default L					
The V552 parameter defines the cut-off frequency of the fourth order low pass filter applied to TP2						
Description	V552 Frequency of LP-4 filter on quick NC TP2 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	Hz	Frequency of LP-4 filter on quick NC TP2	1.0	6000.0	100.0

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V553 Frequency of LP-4 filter on quick NC TP3

General	Unit R	Hz	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No						
	Adjustment range L									
	Default R	100.0	Family	10 20	Input/output configuration Filters					
	Default L									
The V553 parameter defines the cut-off frequency of the fourth order low pass filter applied to TP3										
Description	V553 Frequency of LP-4 filter on quick NC TP3					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	100.0	Hz	Frequency of LP-4 filter on quick NC TP3	1.0	6000.0	100.0				

V554 Frequency of LP-4 filter on quick NC TP4

General	Unit R	Hz	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No	
	Adjustment range L				
	Default R	100.0	Family	10 20	Input/output configuration Filters
	Default L				
	The V554 parameter defines the cut-off frequency of the fourth order low pass filter applied to TP4				
Description	V554 Frequency of LP-4 filter on quick NC TP4 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	100.0	Hz	Frequency of LP-4 filter on quick NC TP4	1.0	6000.0
				Default	100.0

V560 Relay Filter configuration

General	Unit R	Hz	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 3h	HALT required	No	
	Adjustment range L				
	Default R	0h	Family	..5	Special applications configuration
	Default L			10	Input/output configuration
				20	Filters
The V560 parameter					
Description	V560 Relay Filter configuration ☒ Unit☒ Description☒ Min☒ Max☒ Default				
	Bit	Value	Description		Default
	0	☐	LP-4 Filter on TP of Relay1 [1=Active]		☐
	1	☐	LP-4 Filter on TP of Relay2 [1=Active]		☐
This parameter allows you to filter with low pass (4th order) the measure points associated with the relay functionality selected with parameters V140-150					

V561 Frequency of LP-4 filter on Relay1

General	Unit R	Hz	Motor type	AM, SM, LM																																		
	Unit L																																					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No																																		
	Adjustment range L																																					
	Default R	100.0	Family	10	Input/output																																	
	Default L			20	configuration Filters																																	
	The V561 parameter defines the cut-off frequency of the fourth order low pass filter applied to MP associated with relay1																																					
Description	<table><tr><td colspan="6">V561 Frequency of LP-4 filter on Relay1</td><td>☒ Unit</td><td>☒ Descripton</td><td>☒ Min</td><td>☒ Max</td><td>☒ Default</td></tr><tr><td>Value</td><td>Unit</td><td colspan="4">Descripton</td><td>Min</td><td>Max</td><td colspan="3">Default</td></tr><tr><td>100.0</td><td>Hz</td><td colspan="4">Frequency of LP-4 filter on Relay1</td><td>1.0</td><td>6000.0</td><td colspan="3">100.0</td></tr></table>					V561 Frequency of LP-4 filter on Relay1						☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default	Value	Unit	Descripton				Min	Max	Default			100.0	Hz	Frequency of LP-4 filter on Relay1				1.0	6000.0	100.0		
V561 Frequency of LP-4 filter on Relay1						☒ Unit	☒ Descripton	☒ Min	☒ Max	☒ Default																												
Value	Unit	Descripton				Min	Max	Default																														
100.0	Hz	Frequency of LP-4 filter on Relay1				1.0	6000.0	100.0																														

V562 Frequency of LP-4 filter on Relay2

General	Unit R	Hz	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No				
	Adjustment range L							
	Default R	100.0	Family	10	Input/output			
	Default L			20	configuration Filters			
The V562 parameter defines the cut-off frequency of the fourth order low pass filter applied to MP associated with relay2								
Description	V562 Frequency of LP-4 filter on Relay2			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	100.0	Hz	Frequency of LP-4 filter on Relay2	1.0	6000.0	100.0		

V570 Oscilloscope Filter configuration

General	Unit R	Hz	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ FFFFFFFFh	HALT required	No	
	Adjustment range L				
	Default R	0h	Family	16	Oscilloscope configuration
	Default L			20	configuration Filters
	The V570 parameter				
Description	V570 Oscilloscope Filter configuration ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Bit	Value	Description	Default	
	0	☐	LP-4 Filter on oscilloscope trace 1 [1=Active]	☐	
	1	☐	LP-4 Filter on oscilloscope trace 2 [1=Active]	☐	
	2	☐	LP-4 Filter on oscilloscope trace 3 [1=Active]	☐	
	3	☐	LP-4 Filter on oscilloscope trace 4 [1=Active]	☐	
	This parameter allows you to filter with low pass (4th order) the measure points associated with the oscilloscope functionality selected with parameters V682-683 -684 - 685 Such filter are anti-aliasing filters.				

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V571 Frequency of LP-4 filter on oscilloscope trace 1

General	Unit R	Hz	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No						
	Adjustment range L									
	Default R	100.0	Family	16	Oscilloscope configuration					
	Default L			20	configuration Filters					
The V571 parameter defines the cut-off frequency of the fourth order low pass filter applied to trace 1 of the oscilloscope.										
Description	V571 Frequency of LP-4 filter on oscilloscope trace 1					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	100.0	Hz	Frequency of LP-4 filter on oscilloscope trace 1	1.0	6000.0	100.0				

V572 Frequency of LP-4 filter on oscilloscope trace 2

General	Unit R	Hz	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No													
	Adjustment range L																
	Default R	100.0	Family	16	Oscilloscope configuration												
	Default L			20	configuration Filters												
	The V572 parameter defines the cut-off frequency of the fourth order low pass filter applied to trace 2 of the oscilloscope.																
Description	V572 Frequency of LP-4 filter on oscilloscope trace 2 ☒ Unit☒ Descripton☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>100.0</td><td>Hz</td><td>Frequency of LP-4 filter on oscilloscope trace 2</td><td>1.0</td><td>6000.0</td><td>100.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	100.0	Hz	Frequency of LP-4 filter on oscilloscope trace 2	1.0	6000.0	100.0
Value	Unit	Description	Min	Max	Default												
100.0	Hz	Frequency of LP-4 filter on oscilloscope trace 2	1.0	6000.0	100.0												

V573 Frequency of LP-4 filter on oscilloscope trace 3

General	Unit R	Hz	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	16	Oscilloscope configuration	
	Default L			20	configuration Filters	
The V573 parameter defines the cut-off frequency of the fourth order low pass filter applied to trace 3 of the oscilloscope.						
Description	V573 Frequency of LP-4 filter on oscilloscope trace 3 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	Hz	Frequency of LP-4 filter on oscilloscope trace 3	1.0	6000.0	100.0

V574 Frequency of LP-4 filter on oscilloscope trace 4

General	Unit R	Hz	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1.0 ÷ 6000.0	HALT required	No						
	Adjustment range L									
	Default R	100.0	Family	16	Oscilloscope configuration					
	Default L			20	configuration Filters					
	The V574 parameter defines the cut-off frequency of the fourth order low pass filter applied to trace 4 of the oscilloscope.									
Description	V574 Frequency of LP-4 filter on oscilloscope trace 4					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	100.0	Hz	Frequency of LP-4 filter on oscilloscope trace 4	1.0	6000.0	100.0				

V600 V/f: Maximal motor current (% of V108)

General	Unit R	%	Motor type	AM, SM		
	Unit L					
	Adjustment range R	0.0 ÷ drive size current * 100 / (1.41 * V108)	HALT required	No		
	Adjustment range L					
	Default R	110.0	Family	13	V/f motor control	
	Default L					
	The V600 parameter					
Description	V600 V/f: Maximal motor current (% of V108) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	110.0	%	V/f: Maximal motor current (% of V108)	0.0	1400.422	110.0
	The V600 parameter sets the V/f maximal current.					
Please refer to the chapter 5.15 for more detailed informations.						

V601 V/f: Rated frequency

General	Unit R	Hz	Motor type	AM, SM						
	Unit L									
	Adjustment range R	1.0 ÷ 2000.0	HALT required	No						
	Adjustment range L									
	Default R	1500.0	Family	13	V/f motor control					
	Default L									
Description	V601 V/f: Rated frequency					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	1500.0	Hz	V/f: Rated frequency	1.0	2000.0	1500.0				
	The V601 parameter sets the V/f rated frequency.									
Please refer to the chapter 5.15 for more detailed informations.										

V602 V/f: Rated voltage

General	Unit R	Vrms	Motor type	AM, SM	
	Unit L				
	Adjustment range R	100.0 ÷ 500.0	HALT required	No	
	Adjustment range L				
	Default R	350.0	Family	13	V/f motor control
	Default L				
Description	V602 V/f: Rated voltage				
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	350.0	Vrms	V/f: Rated voltage	100.0	500.0
					Default
					350.0
The V602 parameter sets the V/f rated voltage.					
Please refer to the chapter 5.15 for more detailed informations.					

V603 V/f: V0

General	Unit R	Vrms	Motor type	AM, SM		
	Unit L					
	Adjustment range R	0.0 ÷ 50.0	HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	13	V/f motor control	
	Default L					
Description	V603 V/f: V0 ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	Vrms	V/f: V0	0.0	50.0	0.0
	The V603 parameter sets the V/f V0.					
Please refer to the chapter 5.15 for more detailed informations.						

V604 V/f: Stator resistance at 20 deg. C

General	Unit R	mOhm	Motor type	AM, SM		
	Unit L					
	Adjustment range R	0.0 ÷ 100000.0	HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	13	V/f motor control	
	Default L					
Description	V604 V/f: Stator resistance at 20 deg.C					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	mOhm	V/f: Stator resistance at 20 deg.C	0.0	100000.0	0.0
The V604 parameter sets the V/f Stator resistance @ 20 degrees C. Please refer to the chapter 5.15 for more detailed informations.						

V605 V/f: Intermittent overload (% of V108)

General	Unit R	%	Motor type	AM, SM		
	Unit L					
	Adjustment range R	0.0 ÷ 0.91*V600	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	13	V/f motor control	
	Default L					
Description	V605 V/f: Intermittent overload (% of V108) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	%	V/f: Intermittent overload (% of V108)	0.0	100.1	100.0
	The V605 parameter sets the V/f Intermittent overload (% of V108).					
Please refer to the chapter 5.15 for more detailed informations.						

V606 V/f: Freq. start of overload reduction

General	Unit R	Hz	Motor type	AM, SM	
	Unit L				
	Adjustment range R	1.0 ÷ 2000.0	HALT required	No	
	Adjustment range L				
	Default R	1500.0	Family	13	V/f motor control
	Default L				
Description	V606 V/f: Freq. start of overload reduction ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	1500.0	Hz	V/f: Freq. start of overload reduction	1.0	2000.0
The V606 parameter sets the V/f frequency start of overload reduction. Please refer to the chapter 5.15 for more detailed informations.					

V607 V/f: Q-Q stabilizing inductance

General	Unit R	mH	Motor type	SM						
	Unit L									
	Adjustment range R	0.0 ÷ 1000.0	HALT required	No						
	Adjustment range L									
	Default R	0.0	Family	13	V/f motor control					
	Default L									
Description	V607 V/f: Q-Q stabilising inductance					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	0.0	mH	V/f: Q-Q stabilising inductance	0.0	1000.0	0.0				
	The V607 value should be equal to the motor phase inductance. The value could be modified to improve the stability of the V/F control in case of synchronous motors.									

V608 V/f: D-Q stabilizing inductance

General	Unit R	mH	Motor type	SM	
	Unit L				
	Adjustment range R	0.0 ÷ 1000.0	HALT required	No	
	Adjustment range L				
	Default R	0.0	Family	13	V/f motor control
	Default L				
Description	V608 V/f: D-Q stabilising inductance				
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Value	Unit	Description	Min	Max
	0.0	mH	V/f: D-Q stabilising inductance	0.0	1000.0
The V608 value should be equal to the motor phase inductance. The value could be modified to improve the stability of the V/F control in case of synchronous motors.					

V620 Target Brake-Test current (% V108)

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	10.0 ÷ 120.0	HALT required	No		
	Adjustment range L					
	Default R	100.0	Family	10	Input/output configuration	
	Default L					
Description	V620 Target Brake-Test current (% V108) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	100.0	%	Target Brake-Test current (% V108)	10.0	120.0	100.0
The V620 parameter is used to define the current limit that must be reached during the Brake-Test otherwise Err 9: the brake test target current has NOT been reached, will be given by the Brake-Test function. Refer to chapter 5.17 for more detailed explanation.						

V622 Brake-Test core phase duration

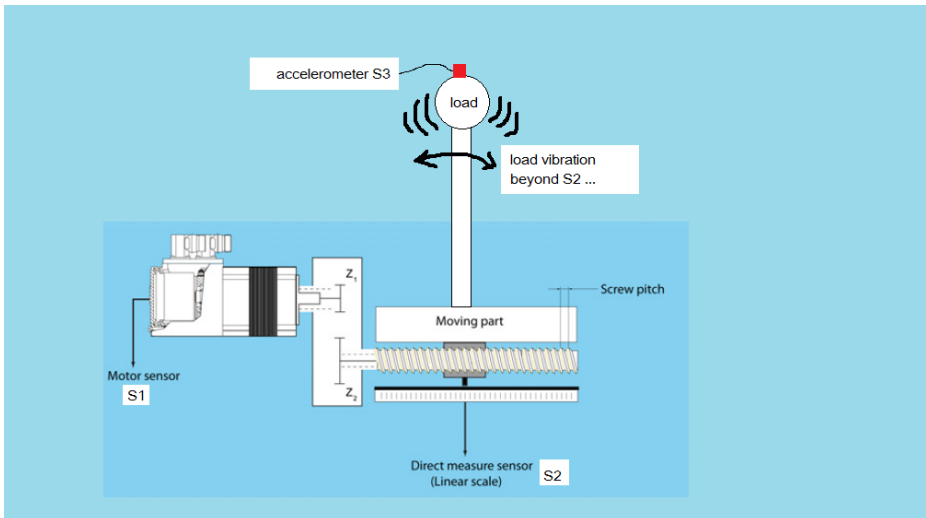
General	Unit R	ms	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	50 ÷ 1000	HALT required	No		
	Adjustment range L					
	Default R	500	Family	10	Input/output configuration	
	Default L					
Description	V622 Brake-Test core phase duration					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	500	ms	Brake-Test core phase duration	50	1000	500
The V622 parameter is used to define the time duration of the Brake-Test, After reaching the Brake-Test current, the drive will maintain the current into the motor for the specified duration, during which the motor shaft must not shift. Refer to chapter 5.17 for more detailed explanation.						

V623 Brake-Test position window

General	Unit R	CNC IU	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 2000	HALT required	No		
	Adjustment range L					
	Default R	10	Family	10	Input/output configuration	
	Default L					
Description	V623 Brake-Test position window ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	10	CNC_IU	Brake-Test position window	1	2000	10
The V623 parameter is used to define the maximum motor shaft shift during the Brake-Test, Refer to chapter 5.17 for more detailed explanation.						

V630

Sensor S3 (accelerometer) connector assignment

General	Unit R	□	Motor type	AM, SM, LM																																								
	Unit L																																											
	Adjustment range R	1h ÷ 80000000h	HALT required	Yes																																								
	Adjustment range L																																											
	Default R	1	Family	5	Special applications configuration																																							
	Default L			9	Sensors configuration																																							
Description																																												
	V630 Sensor S3 (accelerometer) connector assignment ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Bit</th><th>Value</th><th>Description</th><th>Default</th></tr></thead><tbody><tr><td>0</td><td>☒</td><td>Not assigned</td><td>☒</td></tr><tr><td>1</td><td>☐</td><td>Not available as S3</td><td>☐</td></tr><tr><td>2</td><td>☐</td><td>Not available as S3</td><td>☐</td></tr><tr><td>3</td><td>☐</td><td>Not available as S3</td><td>☐</td></tr><tr><td>4</td><td>☐</td><td>Not available as S3</td><td>☐</td></tr><tr><td>5</td><td>☐</td><td>Assigned to P5 (max 300 kHz)</td><td>☐</td></tr><tr><td>6</td><td>☐</td><td>Assigned to P6 (max 300 kHz)</td><td>☐</td></tr><tr><td>7</td><td>☐</td><td>Assigned to P7 (max 100 kHz)</td><td>☐</td></tr><tr><td>8</td><td>☐</td><td>Assigned to P8 (max 70 kHz)</td><td>☐</td></tr></tbody></table>					Bit	Value	Description	Default	0	☒	Not assigned	☒	1	☐	Not available as S3	☐	2	☐	Not available as S3	☐	3	☐	Not available as S3	☐	4	☐	Not available as S3	☐	5	☐	Assigned to P5 (max 300 kHz)	☐	6	☐	Assigned to P6 (max 300 kHz)	☐	7	☐	Assigned to P7 (max 100 kHz)	☐	8	☐	Assigned to P8 (max 70 kHz)
Bit	Value	Description	Default																																									
0	☒	Not assigned	☒																																									
1	☐	Not available as S3	☐																																									
2	☐	Not available as S3	☐																																									
3	☐	Not available as S3	☐																																									
4	☐	Not available as S3	☐																																									
5	☐	Assigned to P5 (max 300 kHz)	☐																																									
6	☐	Assigned to P6 (max 300 kHz)	☐																																									
7	☐	Assigned to P7 (max 100 kHz)	☐																																									
8	☐	Assigned to P8 (max 70 kHz)	☐																																									
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5 This parameter allows you to configure the connector (P5 - P8) to which the S3 accelerometer sensor (vibration detector) is connected. Accelerometer sensor (vibration detector) is used to damp mechanical vibrations by mean of special application AP11. Please refer to NUM DrivePro Installation manual M00067 for detailed informations of the signals and connector description.  Typical application where accelerometer (vibration detector) is used, via AP11 See chapter 5.18																																												

V631 S3 sensor power supply voltage (P5..P8)

General	Unit R	V	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	3.0 ÷ 11.5	HALT required	Yes		
	Adjustment range L					
	Default R	5.0	Family	5	Special applications configuration	
	Default L			9	Sensors configuration	
	The V631 parameter defines the supply voltage of the accelerometer sensor (vibration detector).					
Description	V631 S3 sensor power supply voltage (P5..P8) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	5.0	V	S3 sensor power supply voltage (P5..P8)	3.0	11.5	5.0

V632 S3 sensor initialization configuration

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 7h	HALT required	Yes	
	Adjustment range L				
	Default R	0h	Family	5	Special applications configuration
	Default L			9	Sensors configuration
The V632 parameter allows the configuration of the accelerometer (vibration detector) signal pre-processing					
Description	V632 S3 sensor initialization configuration				
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Bit	Value	Description		Default
	0	☐	1Vpp connection [0=Cos] [1=Sin]		☐
	1	☐	signal reversal (+/-) [1=ON]		☐
	2	☐	D.C. offset removal [1=ON]		☐
bit 0: indicates whether the accelerometer signal is wired to the Cosine (=0) or Sine (=1) input of the P5..P8 connector to which the accelerometer (vibration detector) is connected. bit 1:allows to reverse the signum of the accelerometer signal bit 2: allows to remove the constant offset (d.c. offset) from the accelerometer signal see chapter 5.18					

V633 Accelerometer full scale range

General	Unit R	m/s^2	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0.1 ÷ 1000.0	HALT required	Yes	
	Adjustment range L				
	Default R	20.0	Family	5	Special applications configuration
	Default L				
	The V633 parameter defines the full scale acceleration value of the accelerometer sensor (vibration detector).				
Description	V633 Accelerometer full scale range				
	☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max
	20.0	m/s^2	Accelerometer full scale range	0.1	1000.0

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V634 Accelerometer displacement per motor revolution

General	Unit R	mm/rev	Motor type	AM, SM		
	Unit L					
	Adjustment range R	0.001 ÷ 1000.0	HALT required	No		
	Adjustment range L					
	Default R	1.0	Family	5	Special applications configuration	
	Default L					
	The V634 parameter allows you to relate the acceleration measurement of the accelerometer sensor to the motor.					
Description	V634 Accelerometer displacement per motor revolution ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1.0	mm/rev	Accelerometer displacement per motor revolution	0.001	1000.0	1.0
Indicates by how many millimeters the anchoring point of the acceleration sensor is translated for each complete revolution of the engine.						

V640 AP11: Active damping by S3 Accelerometer K1

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	0.0 ÷ 6.0	HALT required	No												
	Adjustment range L															
	Default R	0.0	Family	5	Special applications configuration											
	Default L															
	The V640 parameter damping factor of mechanical oscillations implemented by the AP11 function, based on the accelerometer signals see chapter 5.18															
Description	V640 AP11: Active damping by S3 Accelerometer K1															
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>0.0</td><td>□</td><td>AP11: Active damping by S3 Accelerometer K1</td><td>0.0</td><td>6.0</td><td>0.0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	0.0	□	AP11: Active damping by S3 Accelerometer K1	0.0	6.0
Value	Unit	Description	Min	Max	Default											
0.0	□	AP11: Active damping by S3 Accelerometer K1	0.0	6.0	0.0											

V680**Oscilloscope general control**

General	Unit R	[]	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	0h ÷ 7h	HALT required	No	
	Adjustment range L				
	Default R	1	Family	16	Oscilloscope configuration
	Default L				
	The V680 parameter sets the oscilloscope control configuration.				
Description	V680 Oscilloscope general control ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default				
	Bit	Value	Description	Default	
	0	☒	Individual start command [1=Enabled]	☒	
	1	☐	Auto-start after initialization [1=Enabled]	☐	
	2	☐	Stimulus synchronised start [1=Enabled]	☐	
Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5 Click on → tick box (✓) to change the bit value = 1. - Bit 0 The oscilloscope function is activated by the user, clicking on the “start” button of the Drive Oscilloscope page of FlexiumPro Tools. See 2.5.5 - Bit 1: Set to 1 this bit to enable the automatic start of the drive’s oscilloscope after each Halt / Run transition. (the meaning of this bit is to give the possibility to trace an event that occurs rarely). - Bit 2 The oscilloscope function is activated in synchronous mode with the activation of the stimulus function.					

V681 Oscilloscope trigger control

General	Unit R	[]	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1h ÷ 80000000h	HALT required	No						
	Adjustment range L									
	Default R	1	Family	16	Oscilloscope configuration					
	Default L									
The V681 parameter defines the event that trigger the recording of oscilloscope samples										
Description	V681 Oscilloscope trigger control					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Bit	Value	Description					Default		
	0	☒	Trigger disabled					☒		
	1	☐	Trigger on alarm					☐		
	2	☐	Trigger on warning					☐		
	3	☐	Trigger when greater than threshold					☐		
	4	☐	Trigger when smaller than threshold					☐		
	5	☐	Trigger when equal to bitmap					☐		
	Click on → “Radio button” to change the parameter value. Please also refer to chapter 2.5									
	bit 0: trigger disabled : the oscilloscope samples recording is started as soon as the “start oscilloscope” command is given.									
	bit 1: trigger on alarm : the oscilloscope samples recording is started as soon as the first alarm occurrence is detected									
	bit 2: trigger on warning : the oscilloscope samples recording is started as soon as the first warning occurrence is detected									
bit 3: trigger when greater than threshold : the oscilloscope samples recording is started as soon as the actual value of first trace MP (V682) crosses the threshold value (V688) with positive slope (increasing)										
bit 4: trigger when smaller than threshold : the oscilloscope samples recording is started as soon as the actual value of first trace MP (V682) crosses the threshold value (V688) with negative slope (decreasing)										
bit 5: trigger when equal to bitmap : such trigger mode is used with trace 1 MP that are bitmap values (ex.: MP325) the oscilloscope samples recording is started as soon as the actual value of first trace MP (V682) AND-masked with bitmask V689, is equal to the threshold value (V688)										

V682 MP associated to oscilloscope trace 1 (trigger)

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	1 ÷ 9999	HALT required	No				
	Adjustment range L							
	Default R	2	Family	16	Oscilloscope configuration			
	Default L							
	The V682 parameter defines the first measure point recorded by the oscilloscope.							
Description	V682 MP associated to oscilloscope trace 1 (trigger)			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	2	□	MP associated to oscilloscope trace 1 (trigger)	1	9999	2		
It is also used as a signal from which to detect the trigger event for the oscilloscope.								

V683 MP associated to oscilloscope trace 2

General	Unit R	□	Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1 ÷ 9999	HALT required	No						
	Adjustment range L									
	Default R	50	Family	16	Oscilloscope configuration					
	Default L									
The V683 parameter defines the second measure point recorded by the oscilloscope.										
Description	V683 MP associated to oscilloscope trace 2					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	50	□	MP associated to oscilloscope trace 2	1	9999	50				

V684 MP associated to oscilloscope trace 3

General	Unit R		Motor type	AM, SM, LM						
	Unit L									
	Adjustment range R	1 ÷ 9999	HALT required	No						
	Adjustment range L									
	Default R	4	Family	16	Oscilloscope configuration					
	Default L									
The V684 parameter defines the third measure point recorded by the oscilloscope.										
Description	V684 MP associated to oscilloscope trace 3					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	4		MP associated to oscilloscope trace 3	1	9999	4				

V685 MP associated to oscilloscope trace 4

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	1 ÷ 9999	HALT required	No		
	Adjustment range L					
	Default R	1	Family	16	Oscilloscope configuration	
	Default L					
The V685 parameter defines the fourth measure point recorded by the oscilloscope.						
Description	V685 MP associated to oscilloscope trace 4 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	1	□	MP associated to oscilloscope trace 4	1	9999	1

V686**Oscilloscope sampling time to V263 ratio**

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R	1 ÷ 1000	HALT required	No	
	Adjustment range L				
	Default R	1	Family	16	Oscilloscope configuration
	Default L				
The V686 parameter defines the sampling time period of the oscilloscope					
Description	V686 Oscilloscope sampling time to V263 ratio Value Unit Description 1 □ Oscilloscope sampling time to V263 ratio Min 1 Max 1000 Default 1				
	This time period is indicated as the number of system cycles where the duration of the single system cycle is given by parameter V263 example: if you want to set a sampling period equal to one millisecond (sampling period = 1ms) and the parameter V263 is equal to 50 microseconds. then you will need to set V686 as follows: V686 = 20 because 20 * 50us = 1ms				

V687**Percentage of samples to be recorded post trigger**

General	Unit R	%	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	10 ÷ 90	HALT required	No		
	Adjustment range L					
	Default R	50	Family	16	Oscilloscope configuration	
	Default L					
	The V687 parameter allows you to define how much of the oscilloscope trace (in percentage) will be recorded after the trigger event.					
Description	V687 Percentage of samples to be recorded post trigger ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	50	%	Percentage of samples to be recorded post trigger	10	90	50
Used only when using the trigger. i.e. only if bit 0 of parameter V681 is null (=0)						
Note: the oscilloscope always stores 8192 samples for each of the 4 traces.						

V688 Threshold level for trigger (trace 1)

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R																
	Adjustment range L	0.0	HALT required	No													
	Default R		Family	16	Oscilloscope configuration												
	Default L																
The V688 parameter defines the threshold level for the trigger, always applied to the first trace (MP1 from V682)																	
Description	V688 Threshold level for trigger (trace 1) ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>□</td><td>Threshold level for trigger (trace 1)</td><td>0.0</td><td>3.402823E+38</td><td>0.0</td></tr></table>					Value	Unit	Description	Min	Max	Default	0.0	□	Threshold level for trigger (trace 1)	0.0	3.402823E+38	0.0
Value	Unit	Description	Min	Max	Default												
0.0	□	Threshold level for trigger (trace 1)	0.0	3.402823E+38	0.0												

V689 Threshold bitmask for trigger on bitmap

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R		HALT required	No													
	Adjustment range L																
	Default R	-1	Family	16	Oscilloscope configuration												
	Default L																
	The V689 parameter allows you to define the binary mask applied to the “bitmap” type measurement points used as triggers.																
Description	V689 Threshold bitmask for trigger on bitmap ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>-1</td><td>□</td><td>Threshold bitmask for trigger on bitmap</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>-1</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	-1	□	Threshold bitmask for trigger on bitmap	-9223372036854775808	9223372036854775807	-1
	Value	Unit	Description	Min	Max	Default											
-1	□	Threshold bitmask for trigger on bitmap	-9223372036854775808	9223372036854775807	-1												
Is used only in the case of trigger on bitmap, i.e. only when bit 5 of parameter V681 is set to 1) example of use: if you want to trigger the oscilloscope on the rising edge of bit 7 of the MP325 measure point, you need to set the parameters as follows: V681 = 32 (trigger on bitmap) V682 = 325 (trigger on MP325) V688 = 128 (mask for seventh bit = 2^7) v689 = 128 (trigger when the selected bit goes from 0 to 1) if you want to trigger the oscilloscope on the falling edge of bit 7 of the MP325 measure point, you need to set the parameters as follows: V681 = 32 (trigger on bitmap) V682 = 325 (trigger on MP325) V688 = 128 (mask for seventh bit = 2^7) V689 = 0 (trigger when selected bit changes from 1 to 0)																	

V736 S3 sensor part number

General	Unit R	ascii	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R	HALT required	No					
	Adjustment range L							
	Default R	S3:	Family	..2	Drive configuration			
	Default L							
Description	V736 S3 sensor part number			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Name	Value	Unit	Description	Min	Max	Default	
	V736	"S3:"	ascii	S3 sensor part number			"S3:"	
	The V736 parameter contains the label description of the S3 sensor part number.							

V748 Custom parameter set description

General	Unit R	ascii	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R	HALT required	No				
	Adjustment range L						
	Default R	Pset:	Family	..2	Drive configuration		
	Default L						
Description	V748 Custom parameter set description ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default						
	Name	Value	Unit	Description	Min	Max	Default
	V748	"Pset:"	ascii	Custom parameter set description			"Pset:"
	The V748 parameter contains the label description of the parameter set file.						

V900 AP07: instruction #0

General	Unit R	ascii	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R	HALT required	Yes				
	Adjustment range L						
	Default R	NOP	Family	..5	Special applications configuration		
	Default L			17	Drive Embedded Macros DEMF		
Description	V900 AP07: instruction #0 ☒ Unit☒ Description☒ Min☒ Max☒ Default						
	Name	Value	Unit	Description	Min	Max	Default
	V900	"NOP"	ascii	AP07: instruction #0			"NOP"
The V900 parameter allow to select the AP07 instruction #0. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.							

V901 AP07: instruction #1

General	Unit R	ascii	Motor type	AM, SM, LM																	
	Unit L																				
	Adjustment range R		HALT required	Yes																	
	Adjustment range L																				
	Default R	NOP	Family	..5	Special applications configuration																
	Default L			17	Drive Embedded Macros DEMF																
Description	V901 AP07: instruction #1 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V901</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #1</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>					Name	Value	Unit	Description	Min	Max	Default	V901	"NOP"	ascii	AP07: instruction #1			"NOP"		
	Name			Value	Unit	Description	Min	Max	Default												
V901	"NOP"	ascii	AP07: instruction #1			"NOP"															
The V901 parameter allow to select the AP07 instruction #1. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																					

V902 AP07: instruction #2

General	Unit R	ascii	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R		HALT required	Yes														
	Adjustment range L																	
	Default R	NOP	Family	..5	Special applications configuration													
	Default L			17	Drive Embedded Macros DEMF													
Description	V902 AP07: instruction #2 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default																	
	<table><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>V902</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #2</td><td></td><td></td><td>"NOP"</td></tr></table>					Name	Value	Unit	Description	Min	Max	Default	V902	"NOP"	ascii	AP07: instruction #2		
Name	Value	Unit	Description	Min	Max	Default												
V902	"NOP"	ascii	AP07: instruction #2			"NOP"												
The V902 parameter allow to select the AP07 instruction #2. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																		

V903 AP07: instruction #3

General	Unit R	ascii	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R		HALT required	Yes			
	Adjustment range L						
	Default R	NOP	Family	..5	Special applications configuration		
	Default L			17	Drive Embedded Macros DEMF		
Description	V903 AP07: instruction #3 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default						
	Name	Value	Unit	Description	Min	Max	Default
	V903	"NOP"	ascii	AP07: instruction #3			"NOP"
The V903 parameter allow to select the AP07 instruction #3. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.							

V904 AP07: instruction #4

General	Unit R	ascii	Motor type	AM, SM, LM															
	Unit L																		
	Adjustment range R	HALT required	Yes																
	Adjustment range L																		
	Default R	NOP	Family	..5	Special applications configuration														
	Default L			17	Drive Embedded Macros DEMF														
Description	V904 AP07: instruction #4 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V904</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #4</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>					Name	Value	Unit	Description	Min	Max	Default	V904	"NOP"	ascii	AP07: instruction #4			"NOP"
	Name	Value	Unit	Description	Min	Max	Default												
V904	"NOP"	ascii	AP07: instruction #4			"NOP"													
The V904 parameter allow to select the AP07 instruction #4. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																			

V905 AP07: instruction #5

General	Unit R	ascii	Motor type	AM, SM, LM										
	Unit L													
	Adjustment range R	HALT required	Yes											
	Adjustment range L													
	Default R	NOP	Family	..5	Special applications configuration									
	Default L			17	Drive Embedded Macros DEMF									
Description	V905 AP07: instruction #5 ☒ Unit☒ Description☒ Min☒ Max☒ Default													
	<table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V905</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #5</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>	Name	Value	Unit	Description	Min	Max	Default	V905	"NOP"	ascii	AP07: instruction #5		
Name	Value	Unit	Description	Min	Max	Default								
V905	"NOP"	ascii	AP07: instruction #5			"NOP"								
The V905 parameter allow to select the AP07 instruction #5. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.														

V906 AP07: instruction #6

General	Unit R	ascii	Motor type	AM, SM, LM										
	Unit L													
	Adjustment range R		HALT required	Yes										
	Adjustment range L													
	Default R	NOP	Family	..5	Special applications configuration									
	Default L			17	Drive Embedded Macros DEMF									
Description	V906 AP07: instruction #6 ☒ Unit☒ Description☒ Min☒ Max☒ Default													
	<table><tr><td>Name</td><td>Value</td><td>Unit</td><td>Description</td><td>Min</td><td>Max</td><td>Default</td></tr><tr><td>V906</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #6</td><td></td><td></td><td>"NOP"</td></tr></table>	Name	Value	Unit	Description	Min	Max	Default	V906	"NOP"	ascii	AP07: instruction #6		
Name	Value	Unit	Description	Min	Max	Default								
V906	"NOP"	ascii	AP07: instruction #6			"NOP"								
The V906 parameter allow to select the AP07 instruction #6. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.														

V907 AP07: instruction #7

General	Unit R	ascii	Motor type	AM, SM, LM															
	Unit L																		
	Adjustment range R	HALT required	Yes																
	Adjustment range L																		
	Default R	NOP	Family	..5	Special applications configuration														
	Default L			17	Drive Embedded Macros DEMF														
Description	V907 AP07: instruction #7 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default <table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V907</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #7</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>					Name	Value	Unit	Description	Min	Max	Default	V907	"NOP"	ascii	AP07: instruction #7			"NOP"
	Name	Value	Unit	Description	Min	Max	Default												
V907	"NOP"	ascii	AP07: instruction #7			"NOP"													
The V907 parameter allow to select the AP07 instruction #7. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																			

V908 AP07: instruction #8

General	Unit R	ascii	Motor type	AM, SM, LM														
	Unit L																	
	Adjustment range R		HALT required	Yes														
	Adjustment range L																	
	Default R	NOP	Family	..5	Special applications configuration													
	Default L			17	Drive Embedded Macros DEMF													
Description	V908 AP07: instruction #8 ☒ Unit ☒ Descripton ☒ Min ☒ Max ☒ Default																	
	<table><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>V908</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #8</td><td></td><td></td><td>"NOP"</td></tr></table>					Name	Value	Unit	Description	Min	Max	Default	V908	"NOP"	ascii	AP07: instruction #8		
Name	Value	Unit	Description	Min	Max	Default												
V908	"NOP"	ascii	AP07: instruction #8			"NOP"												

The V908 parameter allow to select the AP07 instruction #8.
Please refer chapter 8 for more detailed information on AP07 DEMF instructions.

V909 AP07: instruction #9

General	Unit R	ascii	Motor type	AM, SM, LM										
	Unit L													
	Adjustment range R		HALT required	Yes										
	Adjustment range L													
	Default R	NOP	Family	..5	Special applications configuration									
	Default L			17	Drive Embedded Macros DEMF									
Description	V909 AP07: instruction #9 ☒ Unit☒ Description☒ Min☒ Max☒ Default													
	<table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V909</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #9</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>	Name	Value	Unit	Description	Min	Max	Default	V909	"NOP"	ascii	AP07: instruction #9		
Name	Value	Unit	Description	Min	Max	Default								
V909	"NOP"	ascii	AP07: instruction #9			"NOP"								
The V909 parameter allow to select the AP07 instruction #9. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.														

V910 AP07: instruction #10

General	Unit R	ascii	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R		HALT required	Yes	
	Adjustment range L				
	Default R	NOP	Family	..5	Special applications configuration
	Default L			17	Drive Embedded Macros DEMF

Description	V910 AP07: instruction #10 ☒ Unit☒ Description☒ Min☒ Max☒ Default						
	Name	Value	Unit	Description	Min	Max	Default
	V910	"NOP"	ascii	AP07: instruction #10			"NOP"

The V910 parameter allow to select the AP07 instruction #10.
Please refer chapter 8 for more detailed information on AP07 DEMF instructions.

V911 AP07: instruction #11

General	Unit R	ascii	Motor type	AM, SM, LM																
	Unit L																			
	Adjustment range R		HALT required	Yes																
	Adjustment range L																			
	Default R	NOP	Family	..5	Special applications configuration															
	Default L			17	Drive Embedded Macros DEMF															
Description	V911 AP07: instruction #11 ☒ Unit☒ Description☒ Min☒ Max☒ Default																			
	<table><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>V911</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #11</td><td></td><td></td><td>"NOP"</td></tr></table>						Name	Value	Unit	Description	Min	Max	Default	V911	"NOP"	ascii	AP07: instruction #11			"NOP"
	Name	Value	Unit	Description	Min	Max	Default													
V911	"NOP"	ascii	AP07: instruction #11			"NOP"														
The V911 parameter allow to select the AP07 instruction #11. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																				

V912 AP07: instruction #12

General	Unit R	ascii	Motor type	AM, SM, LM															
	Unit L																		
	Adjustment range R		HALT required	Yes															
	Adjustment range L																		
	Default R	NOP	Family	..5	Special applications configuration														
	Default L			17	Drive Embedded Macros DEMF														
Description	V912 AP07: instruction #12 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V912</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #12</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>					Name	Value	Unit	Description	Min	Max	Default	V912	"NOP"	ascii	AP07: instruction #12			"NOP"
	Name	Value	Unit	Description	Min	Max	Default												
V912	"NOP"	ascii	AP07: instruction #12			"NOP"													
The V912 parameter allow to select the AP07 instruction #12. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																			

V913 AP07: instruction #13

General	Unit R	ascii	Motor type	AM, SM, LM			
	Unit L						
	Adjustment range R		HALT required	Yes			
	Adjustment range L						
	Default R	NOP	Family	..5	Special applications configuration		
	Default L			17	Drive Embedded Macros DEMF		
Description	V913 AP07: instruction #13 ☒ Unit☒ Description☒ Min☒ Max☒ Default						
	Name	Value	Unit	Description	Min	Max	Default
	V913	"NOP"	ascii	AP07: instruction #13			"NOP"
The V913 parameter allow to select the AP07 instruction #13. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.							

V914 AP07: instruction #14

General	Unit R	ascii	Motor type	AM, SM, LM										
	Unit L													
	Adjustment range R		HALT required	Yes										
	Adjustment range L													
	Default R	NOP	Family	..5	Special applications configuration									
	Default L			17	Drive Embedded Macros DEMF									
Description	V914 AP07: instruction #14 ☒ Unit☒ Description☒ Min☒ Max☒ Default													
	<table><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>V914</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #14</td><td></td><td></td><td>"NOP"</td></tr></table>	Name	Value	Unit	Description	Min	Max	Default	V914	"NOP"	ascii	AP07: instruction #14		
Name	Value	Unit	Description	Min	Max	Default								
V914	"NOP"	ascii	AP07: instruction #14			"NOP"								
The V914 parameter allow to select the AP07 instruction #14. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.														

V915 AP07: instruction #15

General	Unit R	ascii	Motor type	AM, SM, LM															
	Unit L																		
	Adjustment range R		HALT required	Yes															
	Adjustment range L																		
	Default R	NOP	Family	..5	Special applications configuration														
	Default L			17	Drive Embedded Macros DEMF														
Description	V915 AP07: instruction #15 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Name</th><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>V915</td><td>"NOP"</td><td>ascii</td><td>AP07: instruction #15</td><td></td><td></td><td>"NOP"</td></tr></tbody></table>					Name	Value	Unit	Description	Min	Max	Default	V915	"NOP"	ascii	AP07: instruction #15			"NOP"
	Name	Value	Unit	Description	Min	Max	Default												
V915	"NOP"	ascii	AP07: instruction #15			"NOP"													
The V915 parameter allow to select the AP07 instruction #15. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																			

V920 AP07: floating-point operator #32

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V920 AP07: floating-point operator #32 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator #32	0.0	3.402823E+38	0.0
The V920 parameter allow to select the AP07 floating-point operator #32. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V921 AP07: floating-point operator #33

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V921 AP07: floating-point operator #33			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	□	AP07: floating-point operator #33	0.0	3.402823E+38	0.0		
The V921 parameter allow to select the AP07 floating-point operator #33. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.								

V922 AP07: floating-point operator #34

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V922 AP07: floating-point operator #34 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator #34	0.0	3.402823E+38	0.0
The V922 parameter allow to select the AP07 floating-point operator #34. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V923 AP07: floating-point operator #35

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V923 AP07: floating-point operator #35					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator #35	0.0	3.402823E+38	0.0
The V923 parameter allow to select the AP07 floating-point operator #35. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V924 AP07: floating-point operator #36

General	Unit R	□	Motor type	AM, SM, LM								
	Unit L											
	Adjustment range R	HALT required	No									
	Adjustment range L											
	Default R	0.0	Family	..5	Special applications configuration							
	Default L			17	Drive Embedded Macros DEMF							
Description	V924 AP07: floating-point operator #36 ☒ Unit☒ Description☒ Min☒ Max☒ Default											
	<table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>0.0</td><td>□</td><td>AP07: floating-point operator #36</td><td>0.0</td><td>3.402823E+38</td><td>0.0</td></tr></tbody></table>	Value	Unit	Description	Min	Max	Default	0.0	□	AP07: floating-point operator #36	0.0	3.402823E+38
Value	Unit	Description	Min	Max	Default							
0.0	□	AP07: floating-point operator #36	0.0	3.402823E+38	0.0							
The V924 parameter allow to select the AP07 floating-point operator #36. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.												

V925 AP07: floating-point operator #37

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R	HALT required	No													
	Adjustment range L															
	Default R	0.0	Family	..5	Special applications configuration											
	Default L			17	Drive Embedded Macros DEMF											
Description	V925 AP07: floating-point operator #37 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default															
	<table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>0.0</td><td>□</td><td>AP07: floating-point operator #37</td><td>0.0</td><td>3.402823E+38</td><td>0.0</td></tr></table> The V925 parameter allow to select the AP07 floating-point operator #37. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.					Value	Unit	Description	Min	Max	Default	0.0	□	AP07: floating-point operator #37	0.0	3.402823E+38
Value	Unit	Description	Min	Max	Default											
0.0	□	AP07: floating-point operator #37	0.0	3.402823E+38	0.0											

V926 AP07: floating-point operator #38

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V926 AP07: floating-point operator #38 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator #38	0.0	3.402823E+38	0.0
The V926 parameter allow to select the AP07 floating-point operator #38. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V927 AP07: floating-point operator #39

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V927 AP07: floating-point operator #39 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator #39	0.0	3.402823E+38	0.0
The V927 parameter allow to select the AP07 floating-point operator #39. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V928 **AP07: floating-point operator #40**

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V928 AP07: floating-point operator #40 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	□	AP07: floating-point operator: #40	0.0	3.402823E+38	0.0
The V928 parameter allow to select the AP07 floating-point operator #40. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V929 **AP07: floating-point operator #41**

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R		HALT required	No												
	Adjustment range L															
	Default R	0.0	Family	..5	Special applications configuration											
	Default L			17	Drive Embedded Macros DEMF											
Description	V929 AP07: floating-point operator #41 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default															
	<table border="1"> <thead> <tr> <th>Value</th> <th>Unit</th> <th>Description</th> <th>Min</th> <th>Max</th> <th>Default</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>□</td> <td>AP07: floating-point operator #41</td> <td>0.0</td> <td>3.402823E+38</td> <td>0.0</td> </tr> </tbody> </table> The V929 parameter allow to select the AP07 floating-point operator #41. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.					Value	Unit	Description	Min	Max	Default	0.0	□	AP07: floating-point operator #41	0.0	3.402823E+38
Value	Unit	Description	Min	Max	Default											
0.0	□	AP07: floating-point operator #41	0.0	3.402823E+38	0.0											

V930 AP07: floating-point operator #42

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V930 AP07: floating-point operator #42			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	□	AP07: floating-point operator #42	0.0	3.402823E+38	0.0		
The V930 parameter allow to select the AP07 floating-point operator #42. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.								

V931 AP07: floating-point operator #43

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V931 AP07: floating-point operator #43			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	□	AP07: floating-point operator #43	0.0	3.402823E+38	0.0		
The V931 parameter allow to select the AP07 floating-point operator #43. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.								

V932 AP07: floating-point operator #44

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V932 AP07: floating-point operator #44			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	□	AP07: floating-point operator #44	0.0	3.402823E+38	0.0		
	The V932 parameter allow to select the AP07 floating-point operator #44. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.							

V933 AP07: floating-point operator #45

General	Unit R	□	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0.0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V933 AP07: floating-point operator #45			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	0.0	□	AP07: floating-point operator #45	0.0	3.402823E+38	0.0		
The V933 parameter allow to select the AP07 floating-point operator #45. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.								

V934 AP07: floating-point operator #46

General	Unit R	[]	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0.0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V934 AP07: floating-point operator #46 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	0.0	[]	AP07: floating-point operator #46	0.0	3.402823E+38	0.0
The V934 parameter allow to select the AP07 floating-point operator #46. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V935 AP07: floating-point operator #47

General	Unit R	[]	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R		HALT required	No	
	Adjustment range L				
	Default R	0.0	Family	..5	Special applications configuration
	Default L			17	Drive Embedded Macros DEMF

Description	V935 AP07: floating-point operator #47					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	0.0	[]	AP07: floating-point operator #47	0.0	3.402823E+38	0.0				

The V935 parameter allow to select the AP07 floating-point operator #47.
Please refer chapter 8 for more detailed information on AP07 DEMF instructions.

V940 AP07: integer operator #48

General	Unit R	[]	Motor type	AM, SM, LM				
	Unit L							
	Adjustment range R		HALT required	No				
	Adjustment range L							
	Default R	0	Family	..5	Special applications configuration			
	Default L			17	Drive Embedded Macros DEMF			
Description	V940 AP07: integer operator #48			☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default		
	8	[]	AP07: integer operator #48	-9223372036854775808	9223372036854775807	0		
The V940 parameter allow to select the AP07 integer operator #48. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.								

V941 AP07: integer operator #49

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	HALT required	No			
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V941 AP07: integer operator #49 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	□	□	AP07: integer operator #49	-9223372036854775808	9223372036854775807	0
The V941 parameter allow to select the AP07 integer operator #49. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V942 AP07: integer operator #50

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V942 AP07: integer operator #50 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	8	□	AP07: integer operator #50	-9223372036854775808	9223372036854775807	0
The V942 parameter allow to select the AP07 integer operator #50. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V943 AP07: integer operator #51

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V943 AP07: integer operator #51					
	☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	□	□	AP07: integer operator #51	-9223372036854775808	9223372036854775807	0
The V943 parameter allow to select the AP07 integer operator #51. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V944 AP07: integer operator #52

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R		HALT required	No	
	Adjustment range L				
	Default R	0	Family	..5	Special applications configuration
	Default L			17	Drive Embedded Macros DEMF

Description	V944 AP07: integer operator #52					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	8	□	AP07: integer operator #52	-9223372036854775808	9223372036854775807	0				

The V944 parameter allow to select the AP07 integer operator #52.

Please refer chapter 8 for more detailed information on AP07 DEMF instructions.

V945 AP07: integer operator #53

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V945 AP07: integer operator #53 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	8	□	AP07: integer operator #53	-9223372036854775808	9223372036854775807	0
The V945 parameter allow to select the AP07 integer operator #53.						
Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V946 AP07: integer operator #54

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R		HALT required	No													
	Adjustment range L																
	Default R	0	Family	..5	Special applications configuration												
	Default L			17	Drive Embedded Macros DEMF												
Description	V946 AP07: integer operator #54 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td> 54 </td><td>□</td><td>AP07: integer operator #54</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>0</td></tr></table>					Value	Unit	Description	Min	Max	Default	54	□	AP07: integer operator #54	-9223372036854775808	9223372036854775807	0
	Value	Unit	Description	Min	Max	Default											
54	□	AP07: integer operator #54	-9223372036854775808	9223372036854775807	0												
The V946 parameter allow to select the AP07 integer operator #54. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																	

V947 AP07: integer operator #55

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R	HALT required	No			
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V947 AP07: integer operator #55 ☒ Unit☒ Description☒ Min☒ Max☒ Default					
	Value	Unit	Description	Min	Max	Default
	8	□	AP07: integer operator #55	-9223372036854775808	9223372036854775807	0
The V947 parameter allow to select the AP07 integer operator #55. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V948 AP07: integer operator #56

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V948 AP07: integer operator #56 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
		□	AP07: integer operator #56	-9223372036854775808	9223372036854775807	0
The V948 parameter allow to select the AP07 integer operator #56. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V949 AP07: integer operator #57

General	Unit R	□	Motor type	AM, SM, LM												
	Unit L															
	Adjustment range R		HALT required	No												
	Adjustment range L															
	Default R	0	Family	..5	Special applications configuration											
	Default L			17	Drive Embedded Macros DEMF											
Description																
V949 AP07: integer operator #57 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>□</td><td>□</td><td>AP07: integer operator #57</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>0</td></tr></tbody></table>					Value	Unit	Description	Min	Max	Default	□	□	AP07: integer operator #57	-9223372036854775808	9223372036854775807	0
Value	Unit	Description	Min	Max	Default											
□	□	AP07: integer operator #57	-9223372036854775808	9223372036854775807	0											
The V949 parameter allow to select the AP07 integer operator #57. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																

V950 AP07: integer operator #58

General	Unit R	□	Motor type	AM, SM, LM		
	Unit L					
	Adjustment range R		HALT required	No		
	Adjustment range L					
	Default R	0	Family	..5	Special applications configuration	
	Default L			17	Drive Embedded Macros DEMF	
Description	V950 AP07: integer operator #58 ☒ Unit ☒ Description ☒ Min ☒ Max ☒ Default					
	Value	Unit	Description	Min	Max	Default
	□	□	AP07: integer operator #58	-9223372036854775808	9223372036854775807	0
The V950 parameter allow to select the AP07 integer operator #58.						
Please refer chapter 8 for more detailed information on AP07 DEMF instructions.						

V951 AP07: integer operator #59

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R		HALT required	No	
	Adjustment range L				
	Default R	0	Family	..5	Special applications configuration
	Default L			17	Drive Embedded Macros DEMF

Description	V951 AP07: integer operator #59					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
	8	□	AP07: integer operator #59	-9223372036854775808	9223372036854775807	0				

The V951 parameter allow to select the AP07 integer operator #59.

Please refer chapter 8 for more detailed information on AP07 DEMF instructions.

V952 AP07: integer operator #60

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R	HALT required	No														
	Adjustment range L																
	Default R	0	Family	..5	Special applications configuration												
	Default L			17	Drive Embedded Macros DEMF												
Description	V952 AP07: integer operator #60 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>8</td><td>□</td><td>AP07: integer operator #60</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>0</td></tr></table>					Value	Unit	Description	Min	Max	Default	8	□	AP07: integer operator #60	-9223372036854775808	9223372036854775807	0
	Value	Unit	Description	Min	Max	Default											
8	□	AP07: integer operator #60	-9223372036854775808	9223372036854775807	0												
The V952 parameter allow to select the AP07 integer operator #60. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.																	

V953 AP07: integer operator #61

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R		HALT required	No													
	Adjustment range L																
	Default R	0	Family	..5	Special applications configuration												
	Default L			17	Drive Embedded Macros DEMF												
Description	V953 AP07: integer operator #61 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr><tr><td>□</td><td>□</td><td>AP07: integer operator #61</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>0</td></tr></table> The V953 parameter allow to select the AP07 integer operator #61. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.					Value	Unit	Description	Min	Max	Default	□	□	AP07: integer operator #61	-9223372036854775808	9223372036854775807	0
Value	Unit	Description	Min	Max	Default												
□	□	AP07: integer operator #61	-9223372036854775808	9223372036854775807	0												

V954 AP07: integer operator #62

General	Unit R	□	Motor type	AM, SM, LM	
	Unit L				
	Adjustment range R		HALT required	No	
	Adjustment range L				
	Default R	0	Family	..5	Special applications configuration
	Default L			17	Drive Embedded Macros DEMF

Description	V954 AP07: integer operator #62					☒ Unit	☒ Description	☒ Min	☒ Max	☒ Default
	Value	Unit	Description	Min	Max	Default				
		□	AP07: integer operator #62	-9223372036854775808	9223372036854775807	0				

The V954 parameter allow to select the AP07 integer operator #62.

Please refer chapter [8](#) for more detailed information on AP07 DEMF instructions.

V955 AP07: integer operator #63

General	Unit R	□	Motor type	AM, SM, LM													
	Unit L																
	Adjustment range R		HALT required	No													
	Adjustment range L																
	Default R	0	Family	..5	Special applications configuration												
	Default L			17	Drive Embedded Macros DEMF												
Description	V955 AP07: integer operator #63 ☒ Unit☒ Description☒ Min☒ Max☒ Default <table><thead><tr><th>Value</th><th>Unit</th><th>Description</th><th>Min</th><th>Max</th><th>Default</th></tr></thead><tbody><tr><td>8</td><td>□</td><td>AP07: integer operator #63</td><td>-9223372036854775808</td><td>9223372036854775807</td><td>0</td></tr></tbody></table> The V955 parameter allow to select the AP07 integer operator #63. Please refer chapter 8 for more detailed information on AP07 DEMF instructions.					Value	Unit	Description	Min	Max	Default	8	□	AP07: integer operator #63	-9223372036854775808	9223372036854775807	0
Value	Unit	Description	Min	Max	Default												
8	□	AP07: integer operator #63	-9223372036854775808	9223372036854775807	0												

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4 NUM DrivePro Measure points

4.1 Measure points general list (MP)

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
1	Mechanical motor speed	float	rpm mm/min	AM, SM, LM
2	Iq current reference	float	Arms	AM, SM, LM
3	Id current reference	float	Arms	AM, SM, LM
4	Speed reference	float	rpm mm/min	AM, SM, LM
5	Position reference	int	°	AM, SM, LM
6	Delivered Power	float	Wrms	AM, SM, LM
7	Image motor I ² t	float	%	AM, SM, LM
8	DC bus voltage	float	Vdc	AM, SM, LM
11	LOAD: %rated(V30.7=0)%max (V30.7=1) (see also V30.7 on chapter "4")	float	%	AM, SM, LM
12	Speed reference ramp input	float	rpm mm/min	AM, SM, LM
13	Speed reference ramp output	float	rpm mm/min	AM, SM, LM
14	Speed reference filter input	float	rpm mm/min	AM, SM, LM
15	Speed reference filter output	float	rpm mm/min	AM, SM, LM
16	Image drive I ² t	float	%	AM, SM, LM
20	Speed by S2 direct measure sensor	float	rpm mm/min	AM, SM, LM
22	AP12: Speed ref comp. by act. damping by S2	float	rpm mm/min	AM, SM, LM
23	Speed reference after act. damping addition	float	rpm mm/min	AM, SM, LM
24	Speed difference (V _{mot} - V _{load})	float	rpm mm/min	AM, SM, LM
25	AP11: Speed ref comp. by act. damping by S3	float	rpm mm/min	AM, SM, LM
48	Id current reference limit	float	Arms	AM, SM, LM
49	Iq current reference limit	float	Arms	AM, SM, LM
50	Iq current	float	Arms	AM, SM, LM
51	Id current	float	Arms	AM, SM, LM
52	Alpha current	float	Apeak	AM, SM, LM
53	Beta current	float	Apeak	AM, SM, LM
54	Phase U current	float	Apeak	AM, SM, LM
55	Phase V current	float	Apeak	AM, SM, LM
56	Phase W current	float	Apeak	AM, SM, LM
57	Phase U current offset	double	Apeak	AM, SM, LM
58	Phase V current offset	double	Apeak	AM, SM, LM

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
61	Rotor equations alpha flux	double	mWbpk	AM
62	Rotor equations beta flux	double	mWbpk	AM
63	Observer alpha flux	double	mWbpk	AM
64	Observer beta flux	double	mWbpk	AM
65	Magnetic Flux	float	mWbrms	AM
66	Flux reference	float	mWbpk	AM
73	Rotor equations flux magnitude	float	mWbpk	AM
74	Bellini's observer flux magnitude	float	mWbrms	AM
75	ETST: LP Correlation Id and sinusoidal ref	float	Apeak	AM, SM, LM
76	ETST: LP Correlation Va_obs and sinusoidal ref	float	Vpk	AM, SM, LM
79	Magnetization inductance (Lm)	float	mH	AM
100	Vqreg	float	Vrms	AM, SM, LM
101	Vdreg	float	Vrms	AM, SM, LM
102	Vq	float	Vrms	AM, SM, LM
103	Vd	float	Vrms	AM, SM, LM
104	Ref Va	float	Vpk	AM, SM, LM
105	Ref Vb	float	Vpk	AM, SM, LM
106	Inst Va	float	Vpk	AM, SM, LM
107	Inst Vb	float	Vpk	AM, SM, LM
108	Va observer	float	Vpk	AM, SM, LM
109	Vb observer	float	Vpk	AM, SM, LM
110	Time inverter phase U	int	ns	AM, SM, LM
111	Time inverter phase V	int	ns	AM, SM, LM
112	Time inverter phase W	int	ns	AM, SM, LM
113	Integral Vq component of current reg.	double	Vrms	AM, SM, LM
116	Flux weakening Vq-voltage error	float	Vrms	AM, SM, LM
117	Flux weakening Vd-voltage error	float	Vrms	AM, SM, LM
118	Flux weakening Iq-current integral	float	Vrms	AM, SM, LM
119	Flux weakening Id-current integral	float	Arms	AM, SM, LM
150	AP3: Mst: Torque equaliz. output	float	rpm mm/min	AM, SM
151	AP3: Mst: Torque equaliz. ramped preload	float	rpm mm/min	AM, SM
152	AP3 Mst: Torque equaliz. input feedback	float	Arms	AM, SM
180	Total motor current	float	Arms	AM, SM, LM
181	V/f: Freq. of current limiter output	float	Hz	AM, SM

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
182	V/f: Overload current limit	float	Arms	AM, SM
190	AP6: displacement measure S1-S2	int	CNC IU	AM, SM, LM
200	Position loop feedback	int	[]	AM, SM, LM
202	S1 sensor cosine	float	%	AM, SM, LM
203	S1 sensor sine	float	%	AM, SM, LM
204	S2 sensor cosine	float	%	AM, SM, LM
205	S2 sensor sine	float	%	AM, SM, LM
206	S1 sensor position	int	[]	AM, SM, LM
207	S2 sensor position	int	[]	AM, SM, LM
208	Position in the motor rev.	float	deg	AM, SM, LM
209	Electric motor position	float	deg	AM, SM, LM
210	Electric motor speed	float	Hz	AM, SM, LM
211	CNC reference	int	CNC IU	AM, SM, LM
212	Drive reference	int	[]	AM, SM, LM
213	Drive reference interpolated	int	[]	AM, SM, LM
215	Position [Measure]	long long	CNC IU	AM, SM, LM
216	S1 position [Measure]	long long	CNC IU	AM, SM, LM
217	S2 position [Measure]	long long	CNC IU	AM, SM, LM
218	(Sensor motor) phase offset	float	deg	SM, LM
220	Position error	int	[]	AM, SM, LM
221	Phased electric position	float	deg	AM, SM, LM
223	S1 sensor turn counter	int	[]	AM, SM
224	AP2 sensor overflow counter	short int	[]	AM, SM
225	S2 sensor turn counter	int	[]	AM, SM
226	Compensated S1 sensor cosine	float	%	AM, SM, LM
227	Compensated S1 sensor sine	float	%	AM, SM, LM
228	Offset of S1 sensor cosine	float	%	AM, SM, LM
229	Offset of S1 sensor sine	float	%	AM, SM, LM
230	Amplitude of S1 sensor cosine	float	%	AM, SM, LM
231	Amplitude of S1 sensor sine	float	%	AM, SM, LM
232	Compensated S2 sensor cosine	float	%	AM, SM, LM
233	Compensated S2 sensor sine	float	%	AM, SM, LM
234	Offset of S2 sensor cosine	float	%	AM, SM, LM
235	Offset of S2 sensor sine	float	%	AM, SM, LM

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
236	Amplitude of S2 sensor cosine	float	%	AM, SM, LM
237	Amplitude of S2 sensor sine	float	%	AM, SM, LM
238	SQRT(sin^2+cos^2) S1 sensor	float	%	AM, SM, LM
239	SQRT(sin^2+cos^2) S2 sensor	float	%	AM, SM, LM
240 ⁽¹⁾	Top Mark S1 sensor	unsigned char	[]	AM, SM, LM
241 ⁽¹⁾	Top Mark S2 sensor	unsigned char	[]	AM, SM, LM
242 ⁽¹⁾	(Top Mark AND Sinus AND Cosinus) S1 sensor	unsigned char	[]	AM, SM, LM
243 ⁽¹⁾	(Top Mark AND Sinus AND Cosinus) S2 sensor	unsigned char	[]	AM, SM, LM
252	Iq reference at Filter input	float	Arms	AM, SM, LM
253	Iq reference at Filter output	float	Arms	AM, SM, LM
254	Integral Iq comp. from speed reg.	double	Arms	AM, SM, LM
260	Motor PTC-NTC temperature resistance	float	Ohm	AM, SM, LM
261	(Sensor motor) phase offset [HOMING]	float	deg	SM, LM
262	Final pulse dimension for EPS	short int	[]	AM, SM, LM
264	Hall sensor electric position	float	deg	SM, LM
265	Hall sensor electric phase offset (EPSM)	float	deg	SM, LM
290	S3 Sensor cosine	float	%	AM, SM, LM
291	S3 Sensor sine	float	%	AM, SM, LM
292	S3 Sensor Acceleration	float	mm/s^2	AM, SM, LM
310	Power Supply info bitmap	unsigned	[]	AM, SM, LM
	Bit 0: UNDERVOLTAGE			
	Bit 1: OVERVOLTAGE			
	Bit 2: OVERTEMPERATURE			
	Bit 3: OVERLOAD			
	Bit 4: PZ_OPEN			
	Bit 6: CLAMP_FAULT			
	Bit 9: FUSE_FAIL			
	Bit 10: MAINS_OK			
	Bit 11: SCR_FAULT			
	Bit 12: BRAKE_OPEN			
	Bit 13: ALARM_CLASS_0			
	Bit 14: ALARM_CLASS_1			
	Bit 15: DSPRESET_NOTUSEDAL			

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
311	Drive Zynq processor Temperature and Voltage bitmap	unsigned	[]	AM, SM, LM
	Bit 0: TEMPERATURE			
	Bit 1: VCCINT			
	Bit 2: VCCAUX			
	Bit 3: VCCBRAM			
	Bit 4: VCCPINT			
	Bit 5: VCCPAUX			
	Bit 6: VCCPDRO			
312	Drive Zynq processor Temperature	float	deg.C	AM, SM, LM
315 ⁽¹⁾	Logical HOMING switch to NC	unsigned char	[]	AM, SM, LM
316 ⁽¹⁾	HOMING OK pulse	unsigned char	[]	AM, SM, LM
317 ⁽¹⁾	APEM OK pulse	unsigned char	[]	SM, LM
318	S1 sensor diagnostic	long long	[]	AM, SM, LM
319	S2 sensor diagnostic	long long	[]	AM, SM, LM
320	Axis state switch command Possible values for MP320 are the followings:	unsigned char	[]	AM, SM, LM
	SSWF_IDLE = 0			
	SSWF_ACK = 1			
	SSWF_SUCC = 2			
	SSWF_UNSUCC = 3			
321	Axis F.S.M. status Possible values for MP321 are the followings:	unsigned char	[]	AM, SM, LM
	XST_START = 0			
	XST_INIT = 1			
	XST_RdyToPwrOn = 2			
	XST_RdyToOPER = 3			
	XST_OPERATIONAL = 4			
	XST_FaultReactActive = 5			
	XST_FAULT = 6			
	XST_HALT = 7			
322	NC synchronization status Possible values for MP322 are the followings:	unsigned char	[]	AM, SM, LM
	CNSYN_AFTER_PWRUP = 0			
	CNSYN_ETH_DETECTED = 1			
	CNSYN_CNCYC_DETECTED = 2			
	CNSYN_SYNCHROcalc = 3			
	CNSYN_waitREGIM_1 = 4			

MP	Description		Numerical representation	Physical Unit [PU]	Motor utiliz.
	CNSYN_findBESTslot	= 5			
	CNSYN_calcBESTslot	= 6			
	CNSYN_waitREGIM_2	= 7			
	CNSYN_SYNCHRO_OK	= 8			
	CNSYN_LOST_SYNCHRO	= 9			
323 ⁽¹⁾	NC communication cyclic msg received		unsigned char	[]	AM, SM, LM
324	NC scheduler slot counter		int	[]	AM, SM, LM
325	Behavioural flags: ISR regulation		unsigned	[]	AM, SM, LM
	Bit 0:	REGL_PWM_ON PWM is activated (running)			
	Bit 1:	REGL_AB_PI_I Enable current regulator			
	Bit 2:	REGL_AB_PI_F Enable flux regulator			
	Bit 3:	REGL_FLX_UP_VLOOP 1=flux has reached steady-state for V-loop enabling			
	Bit 4:	REGL_AB_PI_V Enable speed regulator			
	Bit 5:	REGL_AB_PI_AB Enable anti backlash regulator			
	Bit 6:	REGL_AB_UP_PLOOP 1=anti backlash has reached steady-state for P-loop enabling			
	Bit 7:	REGL_AB_PI_P Enable position regulator			
	Bit 8:	REGL_ABIL_RIC Releasing brake request			
	Bit 9:	REGL_FRENA Enable brake request			
	Bit 10:	REGL_FRENA_AL Braking request on alarm			
	Bit 11:	REGL_EMG_BRK Emergency braking request			
	Bit 15:	REGL_REF_EN to inform CNC that the axis can follow reference (brake released, ecc...)			
326	Behavioural flags: ISR logicals		unsigned	[]	AM, SM, LM
	Bit 0:	ISRLOG_IADC_OFFSETS_OK 1 = ADC current offset calculation has reached its steady state after power-up			
	Bit 1:	ISRLOG_EMG_SPEED Emergency: speed limited to 0 by Ref dis, alarm, torque dis....			
	Bit 2:	ISRLOG_OSS_INS 1=Bellini's flux observer activated			
	Bit 3:	ISRLOG_FLUX_UP_OBSS 1=flux has reached steady-state for observers switching			
	Bit 4:	ISRLOG_F_ERR_OFF 1=flux loop error OFF: flux loop reg has reached its steady state !			
	Bit 5:	ISRLOG_AB_ERR_OFF_FLAGS 1=anti backlash error OFF: anti backlash reg has reached its steady state !			
	Bit 6:	ISRLOG_NO_FRENA_TQ do not brake if EPSM or torque control or slave of tandem !!!			
	Bit 7:	ISRLOG_HOMING_ON homing running			

MP	Description		Numerical representation	Physical Unit [PU]	Motor utiliz.
	Bit 8:	ISRLOG_HOMING_DONE_OK	homing done OK (it stays 1 for a single task_CN)		
	Bit 9:	ISRLOG_FIRSTHOME_DONE	FIRST homing executed after RUN: now check on acceleration coherence can start...		
	Bit 10:	ISRLOG_OSCILLO_RUN	oscillo running (wether one shot or triggered...)		
	Bit 11:	ISRLOG_STIMULUS_RUN	stimulus running		
	Bit 12:	ISRLOG_PWMRESYNC_REQ	PWM re-synchronization request		
	Bit 13:	ISRLOG_1stORDER_INTERP	first order fine-interpolator active on NCK reference		
	Bit 14:	ISRLOG_2ndORDER_INTERP	second order fine-interpolator active on NCK reference		
	Bit 15:	ISRLOG_SAMX_RQ_TQ_DISAB	SAMX requires Torque Disabling		
	Bit 16:	ISRLOG_SAMX_RQ_SAFEHOME	SAMX requires Safe Homing position		
	Bit 17:	ISRLOG_SAMX_RQ_RAZALARM	SAMX requires reset alarms		
	Bit 24:	ISRLOG_DEMF	DEMF digital output		
	Bit 25:	ISRLOG_DRV_RUN	Drive in RUN: initialization ended		
	Bit 26:	ISRLOG_TQ_ENA	Torque Enabled		
	Bit 27:	ISRLOG_QMP1_FLOAT	Quick MP #1 is floating double precision		
	Bit 28:	ISRLOG_QMP2_FLOAT	Quick MP #2 is floating double precision		
	Bit 29:	ISRLOG_QMP3_FLOAT	Quick MP #3 is floating double precision		
	Bit 30:	ISRLOG_QMP4_FLOAT	Quick MP #4 is floating double precision		
	Bit 31:	ISRLOG_TOGGILING_BIT	toggling bit to indicate "i'm still alive..."		
327	Behavioural flags: BKG logicals		unsigned	[]	AM, SM, LM
	Bit 0:	BKGLOG_PWM_AVAIL	to inform CNC that the PWM is available (not disabled by SAMF...)		
	Bit 1:	BKGLOG_ES	Safety (SAMF or NUM-STOF) enable management		
	Bit 2:	BKGLOG_EPS_TOBE_DONE	EPS procedure has to be executed (smooth phasing)		
	Bit 3:	BKGLOG_PWRON_DELAYED	Power BUS filtered at V37 sec.		
	Bit 4:	BKGLOG_MOTMOV	Motor moving: 1=move 0=stop		
	Bit 5:	BKGLOG_WAIT_BRK	Wait for insertion brake motor		
	Bit 6:	BKGLOG_ETST_ABIL	ETST (EPSM or BLK_ROT or NO_LOAD test) torque enabling request (Afasa)		
	Bit 7:	BKGLOG_MIS_OK	Misure ready 0=not ready 1=ready		
	Bit 8:	BKGLOG_UGA_ALIGN	1 = true : UGA aligned for all useful encoders		
	Bit 9:	BKGLOG_SPEED_OK	Speed reached flag (1= ok) (valid if and only if ramps are active)		
	Bit 10:	BKGLOG_REF_EN_BY_BRK	REF_EN by BRAKE fsm		
	Bit 11:	BKGLOG_APEM_REQ	APEM request: triggered by EPS or EPSM		
	Bit 12:	BKGLOG_APEM_ON	APEM running		
	Bit 13:	BKGLOG_APEM_DONE_OK	APEM done OK (it stays 1 for 10ms at least)		

MP	Description		Numerical representation	Physical Unit [PU]	Motor utiliz.
	Bit 14:	BKGLOG_FIRSTAPEM_DONE	FIRST APEM executed after RUN: now check on acceleration coherence can start...		
	Bit 15:	BKGLOG_SWITCH_OFFS	switch phase offset pending... executed as soon as next POM / APEM...		
	Bit 16:	BKGLOG_CHECK_ACCEL	check on acceleration coherence after EPSM / POM / APEM		
	Bit 17:	BKGLOG_BUMP_SUPPRESS	"Bump suppression" function active		
	Bit 18:	BKGLOG_FIRST_LLNK	true if first local link is used and active		
	Bit 19:	BKGLOG_SECOND_LLNK	true if second local link is used and active		
	Bit 20:	BKGLOG_BT_RUNNING	Brake-Test (BT) : in progress		
	Bit 21:	BKGLOG_BT_DISAB_RIC	Brake-Test (BT) : disable Brake request by BT		
	Bit 22:	BKGLOG_BT_APPLY_IQLIM	Brake-Test (BT) : apply Iq limitation by BT		
	Bit 23:	BKGLOG_SAMX_COMM_WORK	SAMX cyclic communication working		
	Bit 24:	BKGLOG_SAMX_QUICKSTOP	SAMX quickstop command		
328	Behavioral flags: BKG I/Os		unsigned	[]	AM, SM, LM
	Bit 0:	BKGIOS_TELERUTTORE	image of Teleruttore flag		
	Bit 1:	BKGIOS_PROGO1			
	Bit 2:	BKGIOS_PROGO2			
	Bit 3:	BKGIOS_BRAKE_CMD			
	Bit 4:	BKGIOS_BRAKE_FDBK			
	Bit 5:	BKGIOS_BRAKE_24V			
	Bit 7:	BKGIOS_BUTEE	status BUTEE for Homing (digital input state, possibly inverted)		
	Bit 8:	BKGIOS_EXT_TQ	External Enable torque request (digital input)		
	Bit 9:	BKGIOS_EXT_REFEN	External Enable reference request (digital input)		
	Bit 10:	BKGIOS_EXT_PWM_ENA	PWM is externally enabled by digital input		
	Bit 14:	BKGIOS_STOX_PRESENCE			
	Bit 15:	BKGIOS_SAMX_PRESENCE			
	Bit 16:	BKGIOS_SAMX_EMGY_STOP			
	Bit 17:	BKGIOS_SAMX_EM_ST_G75			
	Bit 20:	BKGIOS_LLNK_P7	indicates that P7 local link is used (as declared !!!)		
	Bit 21:	BKGIOS_LLNK_P8	indicates that P8 local link is used (as declared !!!)		
	Bit 22:	BKGIOS_TANDEM_SLAVE	true if and only if the axis is a slave of ANY tandem function !!!		
	Bit 23:	BKGIO_CTRL_OVERTAKEN	NCK control OVERTAKEN by RS232 console		
	Bit 24:	BKGIOS_APEM_SELECTED	APEM selected by parameters		
	Bit 25:	BKGIOS_VF_CONTROL	TRUE if VF control is active, false if vectorial control is active		
	Bit 26:	BKGIOS_S1_SLESS	S1 sensorless: NO motor encoder (1 = sensorless)		

MP	Description			Numerical representation	Physical Unit [PU]	Motor utiliz.
	Bit 27:	BKGIOS_BUTEE_CN	status BUTEE of homing, info for CNC: ... = 0 in case of Butee declared as NOT used			
	Bit 28:	BKGIOS_MAINS_OK	Mains OK flag (1= power ok)			
	Bit 29:	BKGIOS_SENS_ASS	Type of sensor 0=trasd. increm. 1=assol.			
	Bit 30:	BKGIOS_PLOOP_S2	Position loop: 0=S1 1=S2			
	Bit 31:	BKGIOS_PARK	1 = axis in PARK...			
329	NC command bitmap			unsigned	[]	AM, SM, LM
330	PWM re-synchronization status			unsigned char	[]	AM, SM, LM
331 ⁽¹⁾	Port I1 input status (S7.2)			unsigned char	[]	AM, SM, LM
332 ⁽¹⁾	Port I2 input status (S7.4)			unsigned char	[]	AM, SM, LM
333 ⁽¹⁾	Port I3 input status (S7.6)			unsigned char	[]	AM, SM, LM
334 ⁽¹⁾	Port I4 input status (S7.8)			unsigned char	[]	AM, SM, LM
335 ⁽¹⁾	Port O1 output status (S7.3)			unsigned char	[]	AM, SM, LM
336 ⁽¹⁾	Port O2 output status (S7.5)			unsigned char	[]	AM, SM, LM
337 ⁽¹⁾	Port O3 output status (S7.7)			unsigned char	[]	AM, SM, LM
338 ⁽¹⁾	Port O4 output status (S7.9)			unsigned char	[]	AM, SM, LM
350	AP7: additive contribution to speed ref.			float	rpm mm/min	AM, SM, LM
351	AP7: additive contribution to Iq ref.			float	Arms	AM, SM, LM
352 ⁽¹⁾	AP7: digital Output			unsigned char	[]	AM, SM, LM
353	AP7: execution computational cost			int	[]	AM, SM, LM
355	AP8: Received bitmap (cmd/sts) from mate			unsigned short	[]	AM, SM, LM
356	AP8: Received data as unsigned integer			unsigned short	[]	AM, SM, LM
357	AP8: Received data as floating point			float	[]	AM, SM, LM
360	AP7: floating-point variable #0			double	[]	AM, SM, LM
361	AP7: floating-point variable #1			double	[]	AM, SM, LM
362	AP7: floating-point variable #2			double	[]	AM, SM, LM
363	AP7: floating-point variable #3			double	[]	AM, SM, LM
364	AP7: floating-point variable #4			double	[]	AM, SM, LM
365	AP7: floating-point variable #5			double	[]	AM, SM, LM
366	AP7: floating-point variable #6			double	[]	AM, SM, LM
367	AP7: floating-point variable #7			double	[]	AM, SM, LM
368	AP7: floating-point variable #8			double	[]	AM, SM, LM
369	AP7: floating-point variable #9			double	[]	AM, SM, LM
370	AP7: floating-point variable #10			double	[]	AM, SM, LM

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
371	AP7: floating-point variabile #11	double	[]	AM, SM, LM
372	AP7: floating-point variabile #12	double	[]	AM, SM, LM
373	AP7: floating-point variabile #13	double	[]	AM, SM, LM
374	AP7: floating-point variabile #14	double	[]	AM, SM, LM
375	AP7: floating-point variabile #15	double	[]	AM, SM, LM
380	AP7: integer variabile #16	long long	[]	AM, SM, LM
381	AP7: integer variabile #17	long long	[]	AM, SM, LM
382	AP7: integer variabile #18	long long	[]	AM, SM, LM
383	AP7: integer variabile #19	long long	[]	AM, SM, LM
384	AP7: integer variabile #20	long long	[]	AM, SM, LM
385	AP7: integer variabile #21	long long	[]	AM, SM, LM
386	AP7: integer variabile #22	long long	[]	AM, SM, LM
387	AP7: integer variabile #23	long long	[]	AM, SM, LM
388	AP7: integer variabile #24	long long	[]	AM, SM, LM
389	AP7: integer variabile #25	long long	[]	AM, SM, LM
390	AP7: integer variabile #26	long long	[]	AM, SM, LM
391	AP7: integer variabile #27	long long	[]	AM, SM, LM
392	AP7: integer variabile #28	long long	[]	AM, SM, LM
393	AP7: integer variabile #29	long long	[]	AM, SM, LM
394	AP7: integer variabile #30	long long	[]	AM, SM, LM
395	AP7: integer variabile #31	long long	[]	AM, SM, LM
400	SAMX: status Possible values for MP400 are the followings:	unsigned char	[]	AM, SM, LM
	SAMFsts_RESET = 0			
	SAMFsts_CHECK_DRIVE_COM = 1			
	SAMFsts_CHECK_DRIVE_RUN = 2			
	SAMFsts_MODE_MANAGER = 3			
	SAMFsts_AUTOMATIC_MODE = 4			
	SAMFsts_SAFE_STOPPING_PROCESS = 5			
	SAMFsts_SAFE_OPERATIONAL_STOP = 6			
	SAMFsts_SAFE_LIMITED_SPEED = 7			
	SAMFsts_SAFE_STOP = 8			
	SAMFsts_SAM_FAILURE = 9			
	SAMFsts_RUNTIME_TEST = 10			
	SAMFsts_SAFE BRAKING = 11			
	SAMFsts_SAFE_COND_DISOB_BRK_MON = 12			
	SAMFsts_STOP_POS_STORE = 13			
	SAMFsts_WAIT_ETHERCAT_COM = 14			
401	SAMX: Trace 1 datum	int	[]	AM, SM, LM
402	SAMX: Trace 2 datum	int	[]	AM, SM, LM
403	SAMX: input	unsigned	[]	AM, SM, LM
404	SAMX: output	unsigned	[]	AM, SM, LM
405	SAMX: diagnostic	unsigned	[]	AM, SM, LM

MP	Description	Numerical representation	Physical Unit [PU]	Motor utiliz.
406	SAMX: safe pos turn from drive	int	[]	AM, SM, LM
407	SAMX-STOX: hi/lo feedback signals	unsigned char	[]	AM, SM, LM
408 ⁽¹⁾	SAMX: emergency req.	unsigned char	[]	AM, SM, LM
⁽¹⁾ MP with boolean value 0 = false = OFF 1 = true = ON				

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4.2 **Legenda**

CNC IU	Value expressed in "CNC Internal Unit" for axis position (um, 0.1um, 0.001dgr, etc.) or spindle speed (32768 = V98)
[]	Drive Internal Unit values
Float	Single precision floating-point number -3.402823466e+38 ... +3.402823466e+38
Double	double precision floating point number -1.7976931348623158e+308 ... +1.7976931348623158e+308

unsigned char = unsigned byte (8bit)

0 .. 256

short = short signed integer (16bit)

-32768 ... +32767

unsigned short = short unsigned integer (16bit)

0 ... 65536

int = signed integer (32bit)

-2147483648 ... +2147483648

unsigned = unsigned integer (32bit)

0 ... 4294967295

long long = long signed integer (64bit)

-9223372036854775808 ... +9223372036854775807

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5 Application - User example

5.1 Speed loop parameters optimization V51 / V52

The procedure described below refers to the adjustment of axis motors with Flexium Tools.

For spindle motors the parameters related to speed loop are normally modified only when there is a need to improve particular performances (positioning precision, overshoot on speed, excessive mechanical noise).

Before starting the speed loop parameter optimization, ensure that the following preliminary operations have been carried out:

- Motor / drive association correctly carried out.
- Correct configuration of bit parameters concerning the specific application.

5.1.1 Speed loop parameters optimization procedure

- Use Flexium Tools to select the CNC digital oscilloscope
- Select motor speed on TP1 (MP code 001) and torque current on TP2 (MP code 050)
- Operate the motor with small reference steps (~10% of maximum speed) and check the response of the speed and current signals.

The [FIG. 39](#), [FIG. 40](#), [FIG. 41](#), [FIG. 42](#) of the following pages are referred to the use of Flexium Tools digital oscilloscope.

5.1.2 Speed loop parameters optimization procedure A example

Description

If the inertia of the load (axis) seen from the motor is greater than that of the motor itself and the drive line is sufficiently rigid, the quantities should run a trace as shown in Fig. 39, characterized by large overshoot and long re-entry time.

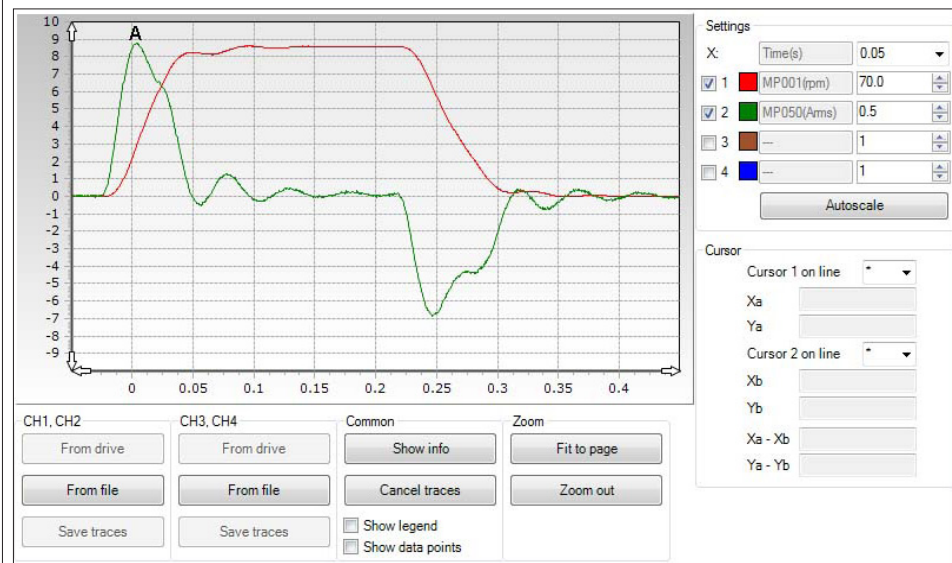


Fig. 39 - Flexium Tools digital oscilloscope.

A = Overshoot Red = Speed Green = Torque current

To improve the dynamic response of the system (see Fig. 39) the value of the speed cycle's proportional gain will have to be increased by adjusting the V51 parameter in general by the same percentage of the load inertia in relation to the motor.

Enter the value of V51 parameter so as to obtain a response similar to that of Fig. 40. Pay particular attention to the motor noise and avoid setting the V51 parameter with excessively high values with could cause performance instability.

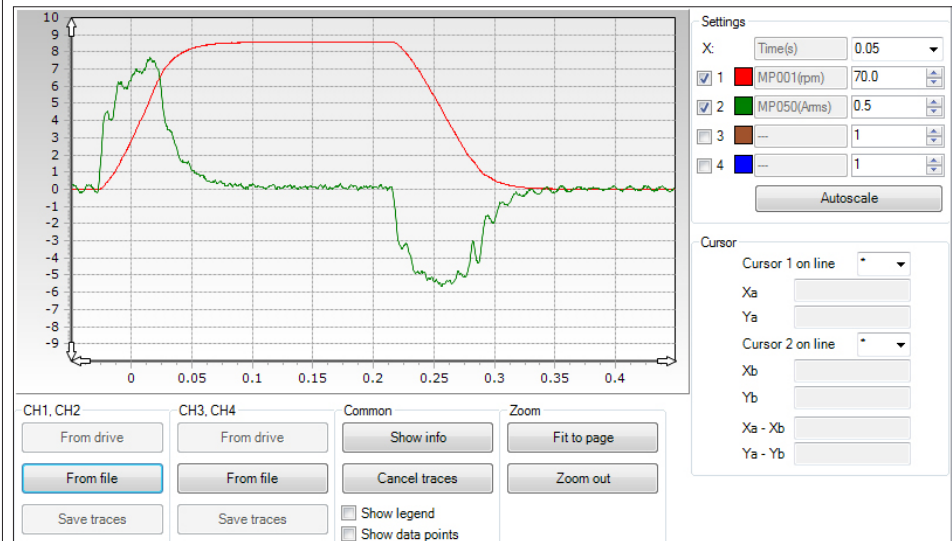


Fig. 40 - Flexium Tools digital oscilloscope - Adjusting V51 parameter.

5.1.3 Speed loop parameters optimization procedure B example

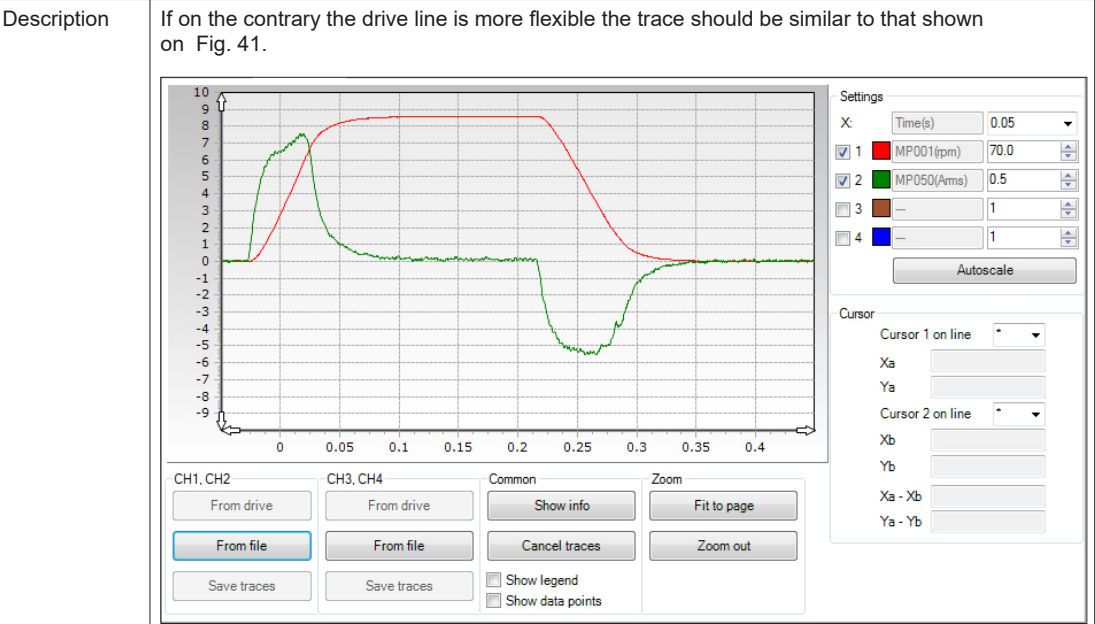


Fig. 41 - Flexium Tools digital oscilloscope - Drive line is more flexible.

B = Speed C = Torque current

To improve this response (Fig. 41) the value of the speed cycle integral gain must be reduced by adjusting the V52 parameter in order to obtain a response similar to that in Fig. 42.

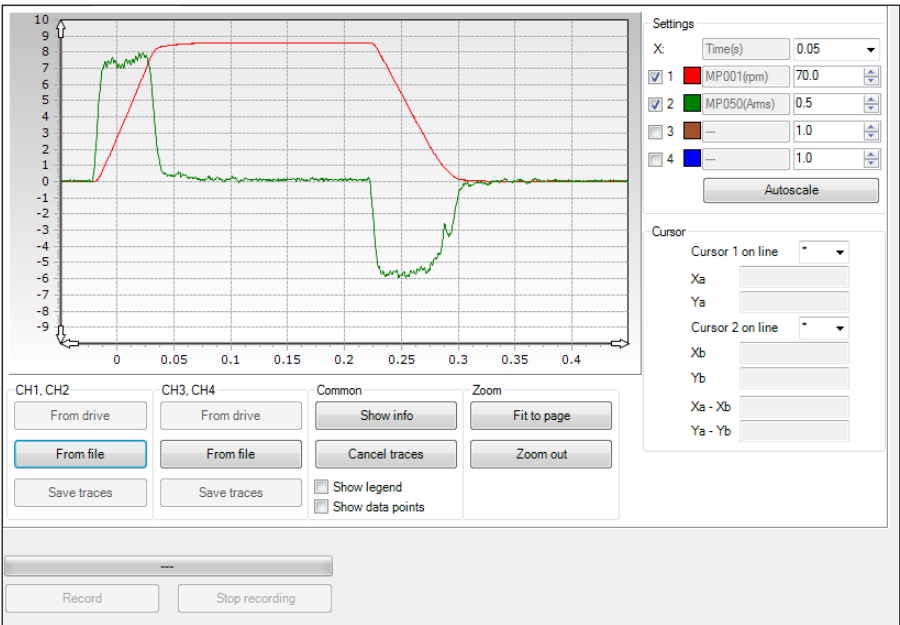
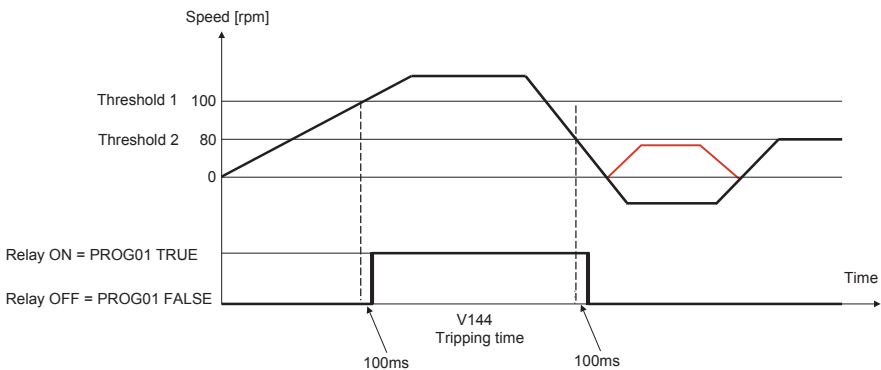


Fig. 42 - Flexium Tools digital oscilloscope - Adjusting V52 parameters.

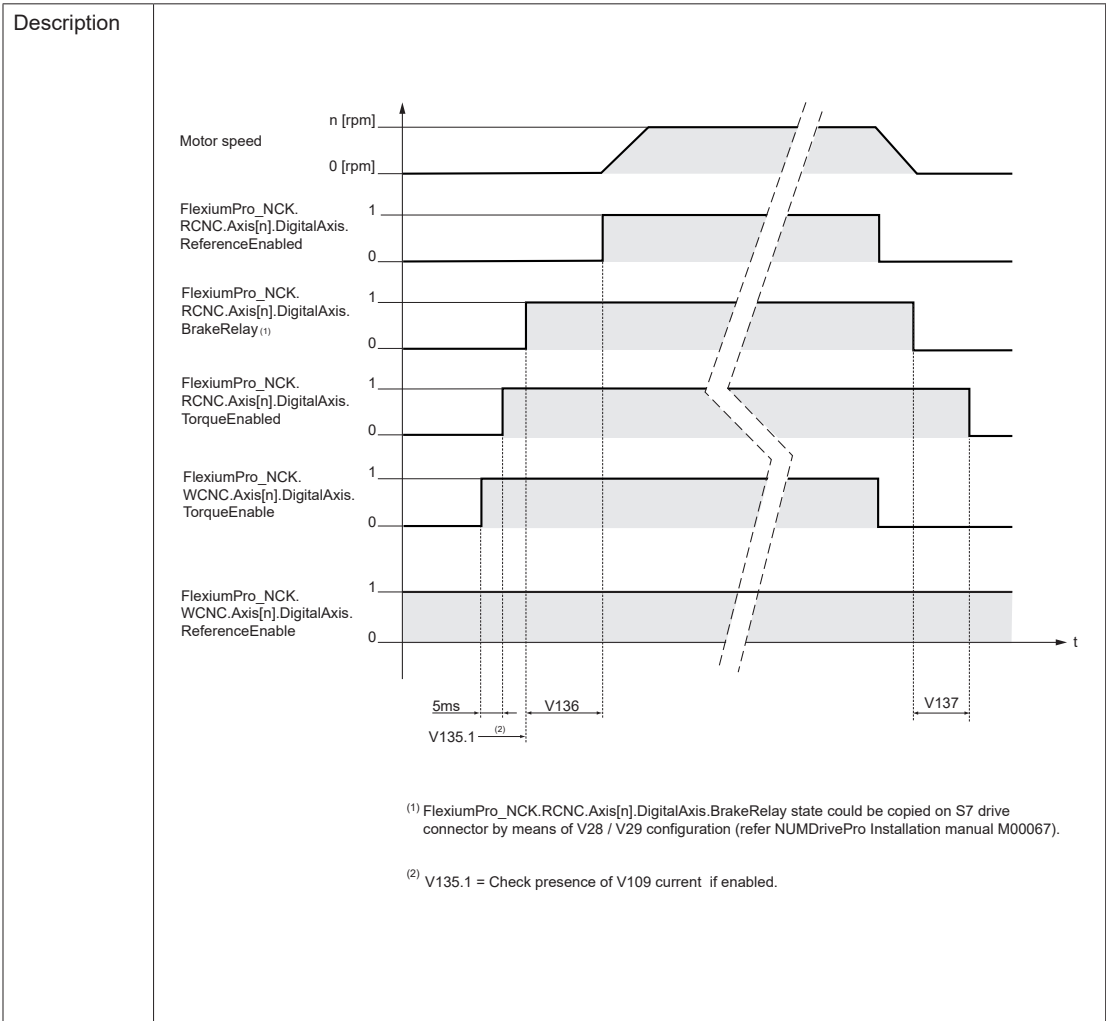
5.2 Programmable relays 1 or 2 application examples

5.2.1 Control of an axis in motion (using relay 1 - Output on “.FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.Prog01”)

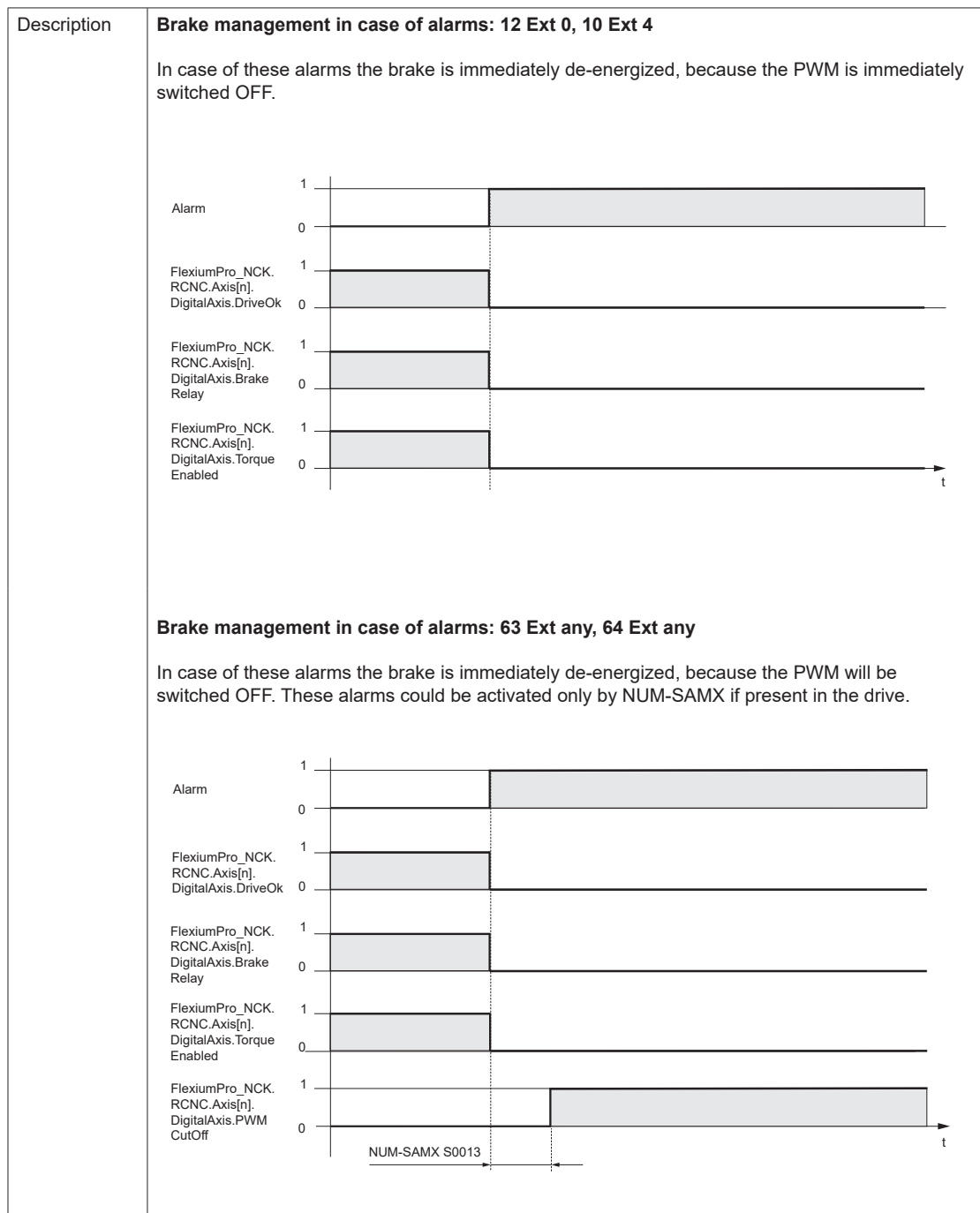
Description	We give to manage the programmable relay 1 in threshold mode with 0.100s delay in such a way that its signals to CNC or PLC: - relay ON condition (axis in motion) when the speed value is >100 rpm - relay OFF condition (axis stationary) when the speed is < 80 rpm. Adjusting procedure Select the quantity to be associated to programmable relay by means V140 =1 (Mechanical motor speed) - Select V145 parameter (Configuration of programmable relay 1) as follows: - Configure Bit 0 = 0 (Absolute value for progr. relay 1) - Configure Bit 1 = 1 (Prog. relay 1 mode in threshold mode) - Configure Bit 2 = 1 (Logic of prog. relay 1 is Positive) - Select V141 parameter (Threshold 1) and enter 100 (speed value in rpm) - Select V142 parameter (Threshold 2) and enter 80 (speed value in rpm) - Select V144 parameter (Delay tripping time) and enter 100 (trip to 100ms) - By programming the relay as indicated above we will obtain the following motor speed control as in figure.  The status of the signal PROG01 could be associated to a drive output on S7 connector by means of one among V26...V29 parameter setting.
-------------	---

5.3 Motor brake management

5.3.1 Brake relay management in standard case (no drive alarm)



5.3.2 Brake relay management in case of drive alarms



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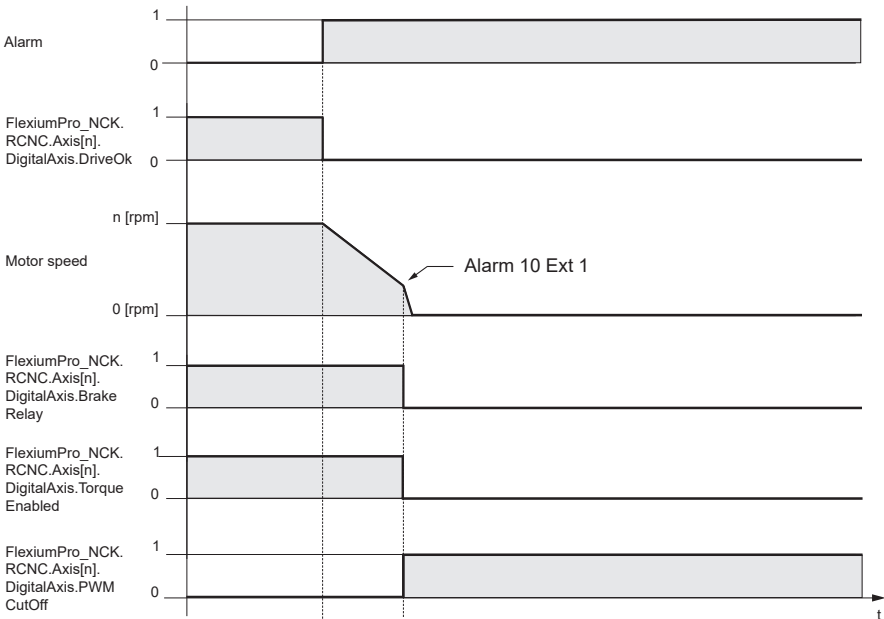
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Description

Brake management in case of alarm: 10 Ext 1

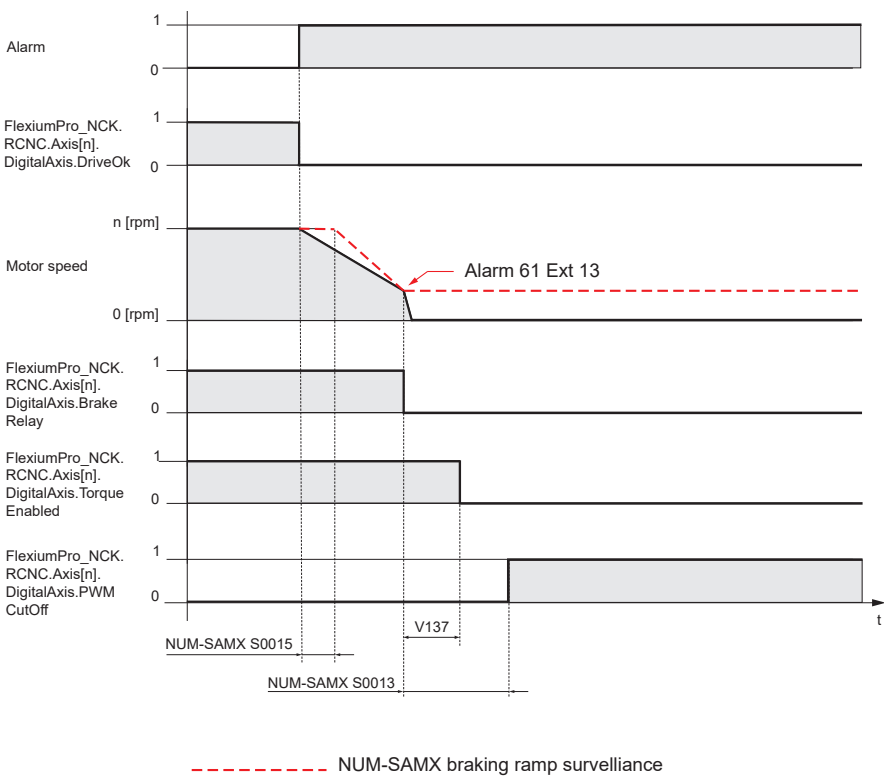
For all the alarms, depending on V32 setting, the axis will first be stopped with torque enabled, when alarm 10 Ext 1 happens the holding brake is immediately de-energized, the torque is immediately disabled and the PWM is immediately switched OFF.

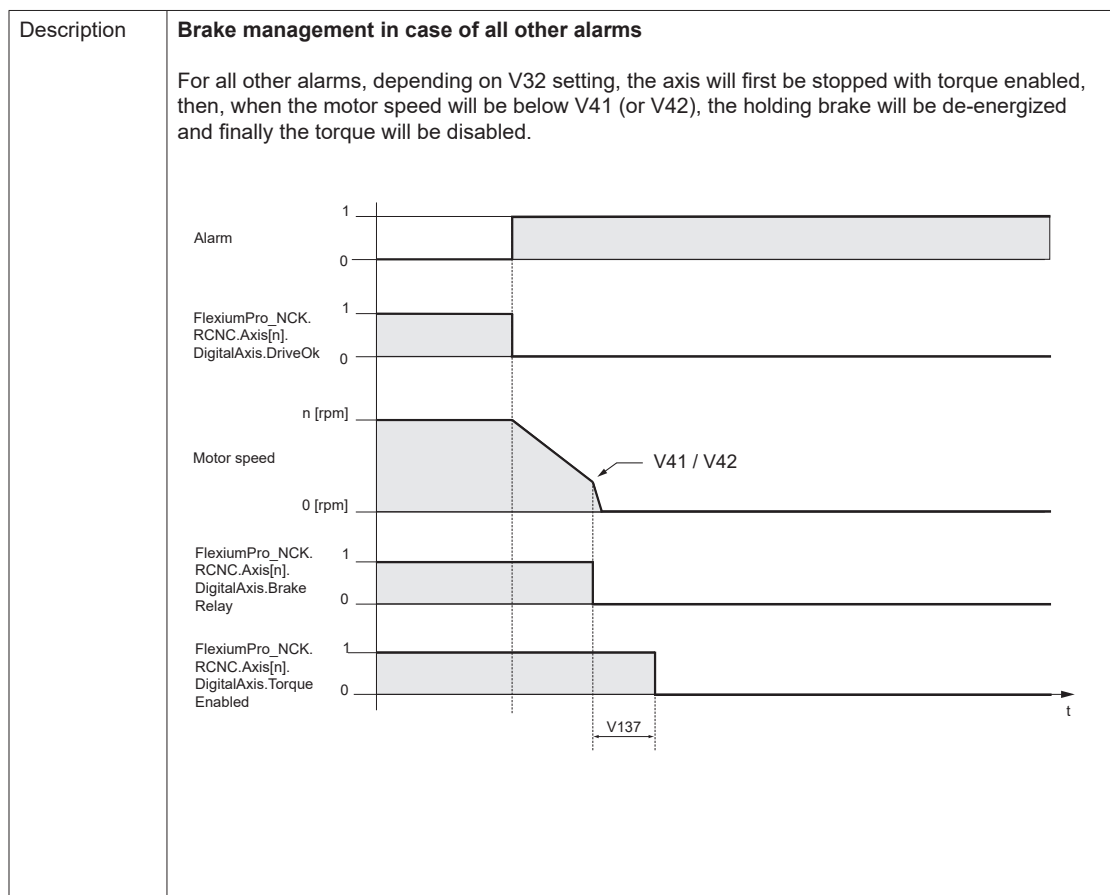


Brake management in case of alarms: 61 Ext 13, 61 Ext 113

These alarms could be activated only by NUM-SAMX if present in the drive, they could happens following alarms 61 Ext any or 62 Ext any.

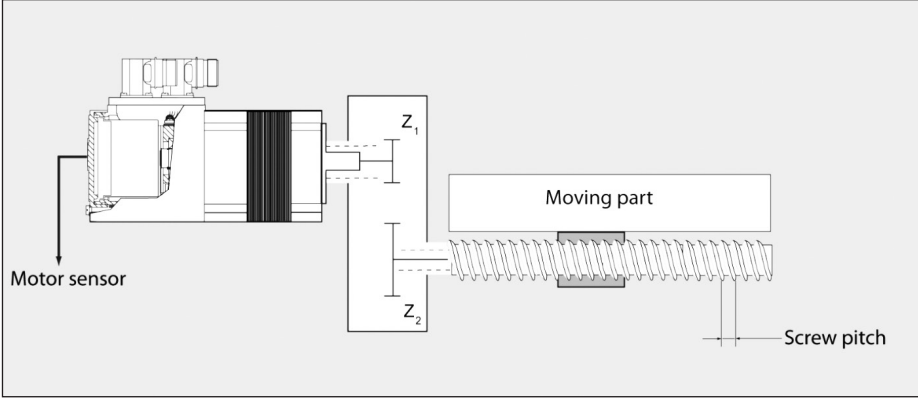
In case of these alarms the axis will first be stopped with torque enabled, when alarm 61 Ext 13 or 61 Ext 113 happens the holding brake is immediately de-energized, the torque will be disabled and the PWM will be switched OFF.





5.4 MULTI /DIVI parameters utilization V306, V307

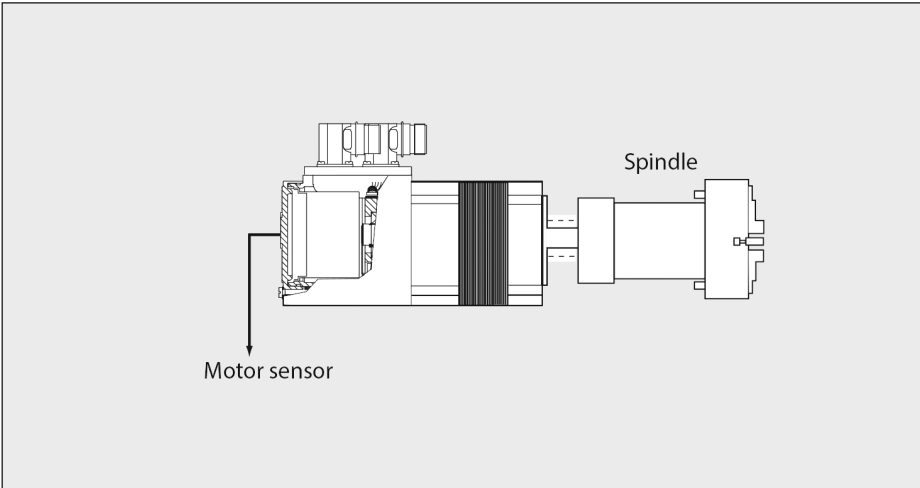
5.4.1 MULTI/DIVI with S1 sensor type P, Q for linear axis

Description	Adjusting procedure - CNC internal resolution unit (μ). - Screw pitch: 10mm. - Axis / motor ratio: motor fitted directly on the screw. - Motor sensor (P or Q type) 1024 periods per rev. therefore the counting pulse number for one motor sensor revolution = $1024 * 4 = 4096$. - Where: 1024 = Number of periods per motor rev. 4 = Internal multiplier coefficient. See figure here-under. Taking into consideration that one motor revolution is equal to a linear shift of 10mm (10.000μ), to convert the sensor feedback to the CNC internal measurement it is necessary to set-up the following MULTI/DIVI parameters: - V306 (MULTI MEASURE) = $10000 * Z1 / Z2$ (Shift in CNC internal measurement unit for one motor revolution) - V307 (DIVI MEASURE) = 4096 (Counts occurred during the movement selected into V306 parameter)  Only for type P motor encoder. Check that during the complete axis path the value detected on test point MP223 (type S1 encoder revolution counter) does not reset from 4095 to 0 or vice-versa. Otherwise it is necessary to remove the motor and change the mechanical position in order to avoid the problem described below. If the above condition is not met, move the axis to the middle of the path and carry out the writing procedure of the absolute position. 
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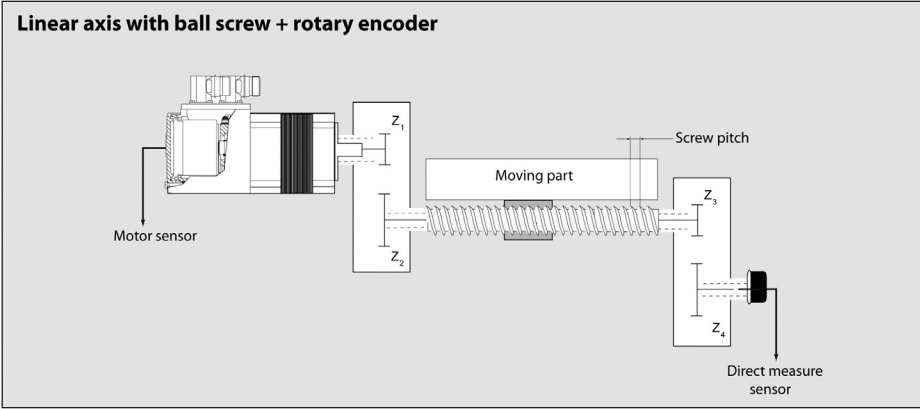


The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

5.4.2 MULTI/DIVI with S1 sensor type Q for spindle motor reduction ratio 1:1

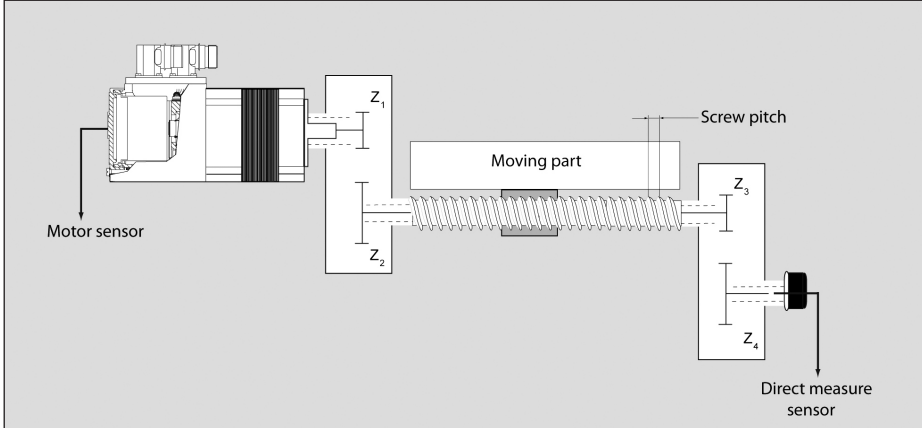
Description	Adjusting procedure - Type Q motor sensor with 1024 periods for motor rev, therefore the counting pulse number for one spindle revolution = $1024 * 4 = 4096$. Where: 1024 = Number of periods per motor rev. 4 = Internal multiplier coefficient. See figure here-under. To convert the sensor feedback to the CNC internal measurement it is necessary to set-up the following MULTI/DIVI parameters: - V306 (MULTI MEASURE) = Insert the value of CNC P40 parameter (spindle meas.conversion) - V307 (DIVI MEASURE) = 4096 (Counting pulses for one spindle rev.)  Once the MULTI/ DIVI parameters have been setup check that the maximum spindle speed is compatible with the desired resolution. 
-------------	---

5.4.3 MULTI/DIVI with type Q motor sensor for spindle motor with C axis application

Description	Adjusting procedure Application example of MULTI/DIVI parameters with S1 sensor type Q for spindle motor reduction ratio 1:1 with C axis application - Type Q motor sensor with 1024 periods for motor rev, therefore the counting pulse number for one spindle revolution = $1024 * 4 = 4096$ - Resolution = $1/10000^\circ$ (P4 N4 = _4 - CNC parameter). By dividing numerator and denominator by 128 we have: - V306 (MULTI MEASURE) = $3.600.000 = 28125$ - V307 (DIVI MEASURE) = $4096 = 32$ STOP Once the MULTI/ DIVI parameters have been setup, check that the maximum axis motor speed is compatible with the desired resolution. Linear axis with ball screw + rotary encoder 
-------------	--

5.5 Direct measure sensor applications

5.5.1 Rotary encoder for linear axis and rotary motor

Description	Adjusting procedure
	 - CNC internal measure unit micron (μm). (P4 N2 = _3 - CNC parameter) - Screw pitch : 5mm (5000μm) - 1Vpp singleturn sinusoidal encoder with 1024 periods/rev therefore the number of counts for each encoder revolution = $1024 * 4 = 4096$ Where: 1024 = Number of periods for one encoder rev. 4 = Internal multiplier coefficient.

Rotary sensor with 1VppSine/Cosine traces with 1 top mark on S2 for position loop closure

Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[5000 * Z3 / Z4]
V312	S2 sensor DIVI coefficient	[4096]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[64]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[4]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2 * Z3 / Z4]
V370	Period by turn S2 sensor	[1024]
V371	Absolute resolution by turn S2 sensor	[4096] = V370 * 4
V375	Number of absolute S2 sensor turns	[1]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder multitrans EnDat 2.1 or EnDat 2.2 with 1Vpp Sine/Cosine traces on S2 for position loop closure

Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[5000]
V312	S2 sensor DIVI coefficient	[4096]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[64]
V325	S2 sensor initialization configuration	[4]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2]
V370	Period by turn S2 sensor	[1024]
V371	Absolute resolution by turn S2 sensor	[16384] See sensor datasheet.
V375	Number of absolute S2 sensor turns	[4096]
V724	S2 sensor part number	[string containing the part number of the sensor]



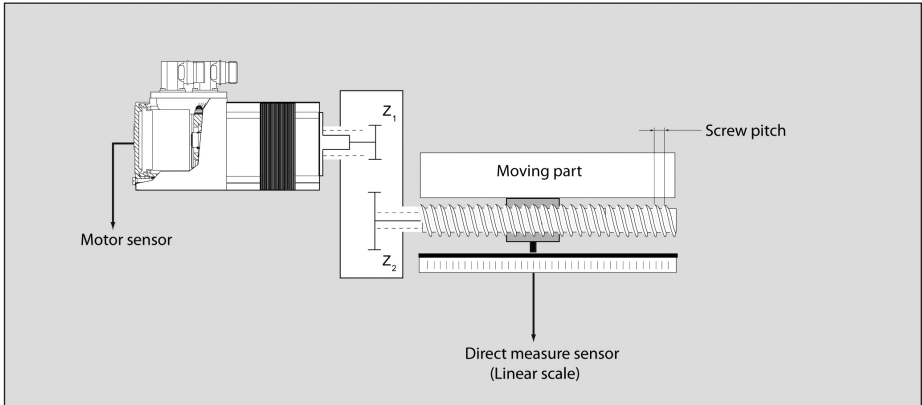
The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder multiturns EnDat 2.2 without Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[5000]
V312	S2 sensor DIVI coefficient	[4096]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[8]
V323	S2 sensor communication protocol	[128]
V325	S2 sensor initialization configuration	[4]
V327	S2 sensor run-time options	[0]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2]
V370	Period by turn S2 sensor	[1024] Any value power of 2 with the limit: V371/V370 < 65536
V371	Absolute resolution by turn S2 sensor	[4194304] See sensor datasheet.
V375	Number of absolute S2 sensor turns	[4096]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

5.5.2 Linear scale for linear axis and rotary motor

Description	Adjusting procedure
	 - CNC internal measure unit micron (μm) - 1Vpp sinusoidal scale with one sinusoid every $20\mu\text{m}$ therefore the number of counts for each sinusoid = 4

Linear scale with 1Vpp Sine/Cosine traces with 1 top mark on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[20]
V312	S2 sensor DIVI coefficient	[4]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[65]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[4]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[$250 * Z1 / Z2$]
V390	Period of linear S2 sensor	[20]
V724	S2 sensor part number	[string containing the part number of the sensor]

Linear scale with 1Vpp Sine/Cosine traces coded reference marks on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[20]
V312	S2 sensor DIVI coefficient	[4]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[1]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[8]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[250]
V378	Intervals between S2 coded references	[1000]
V379	Multiplier of S2 coded references	[1]
V390	Period of linear S2 sensor	[20]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Linear scale EnDat 2.1 or EnDat 2.2 with 1Vpp Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[20]
V312	S2 sensor DIVI coefficient	[4]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[64]
V325	S2 sensor initialization configuration	[1]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[250]
V390	Period of linear S2 sensor	[20]
V391	Absolute resolution of linear S2 sensor	[10] See sensor datasheet.
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

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Linear scale EnDat 2.2 without Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[20]
V312	S2 sensor DIVI coefficient	[4]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[8]
V323	S2 sensor communication protocol	[128]
V325	S2 sensor initialization configuration	[1]
V327	S2 sensor run-time options	[0]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[250]
V390	Period of linear S2 sensor	[20]
V391	Absolute resolution of linear S2 sensor	[10] See sensor datasheet.
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

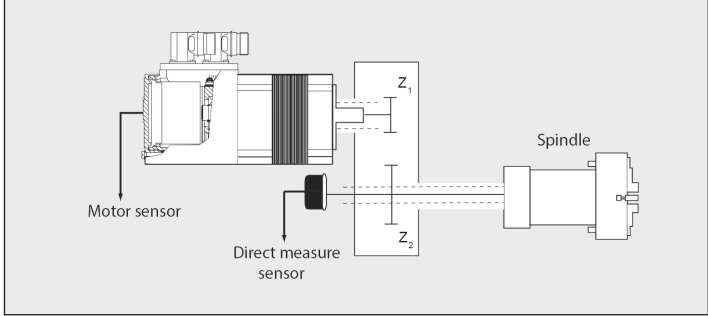
Linear scale Magnescale without Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[20]
V312	S2 sensor DIVI coefficient	[4]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[8]
V323	S2 sensor communication protocol	[128]
V325	S2 sensor initialization configuration	[1]
V327	S2 sensor run-time options	[0]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[250]
V390	Period of linear S2 sensor	[20]
V391	Absolute resolution of linear S2 sensor	[10] See sensor datasheet .
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

5.5.3

Rotary encoder for spindle motor with C axis

Description	Adjusting procedure  - Sensor directly mounted on spindle - 1Vpp encoder with 2048 pulses per spindle rev. therefore the number of counts per spindle rev. = $2048 * 4 = 8192$ - C axis resolution $1/10000^\circ$ (3.600.000 information per rev.) Where: 2048 = No. periods per spindle rev. 4 = Internal multiplier coefficient.
-------------	---

Rotary encoder with 1Vpp Sine/Cosine traces with 1 top mark on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[P40 NC value]
V312	S2 sensor DIVI coefficient	[8192]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[64]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[4]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[$V370 * Z1 / Z2$]
V370	Period by turn S2 sensor	[2048]
V371	Absolute resolution by turn S2 sensor	[8192] = $V370 * 4$
V375	Number of absolute S2 sensor turns	[1]
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder with 1Vpp Sine/Cosine traces coded reference marks on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[P40 NC value]
V312	S2 sensor DIVI coefficient	[8192]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[0]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[8]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2]
V370	Period by turn S2 sensor	[2048]
V371	Absolute resolution by turn S2 sensor	[8192] = V370 *4
V375	Number of absolute S2 sensor turns	[1]
V378	Intervals between S2 coded references	[1024]
V379	Multiplier of S2 coded references	[1]
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder with 1Vpp Sine/Cosine traces coded reference marks on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[P40 NC value]
V312	S2 sensor DIVI coefficient	[8192]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[1]
V325	S2 sensor initialization configuration	[0]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[8]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[$V370 * Z1 / Z2$]
V370	Period by turn S2 sensor	[2048]
V371	Absolute resolution by turn S2 sensor	[8192] = $V370 * 4$
V375	Number of absolute S2 sensor turns	[1]
V378	Intervals between S2 coded references	[1024]
V379	Multiplier of S2 coded references	[1]
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder singleturn EnDat 2.1 or EnDat 2.2 with 1Vpp Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[P40 NC value]
V312	S2 sensor DIVI coefficient	[8192]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[4]
V323	S2 sensor communication protocol	[64]
V325	S2 sensor initialization configuration	[4]
V327	S2 sensor run-time options	[1]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2]
V370	Period by turn S2 sensor	[2048]
V371	Absolute resolution by turn S2 sensor	[4096]
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



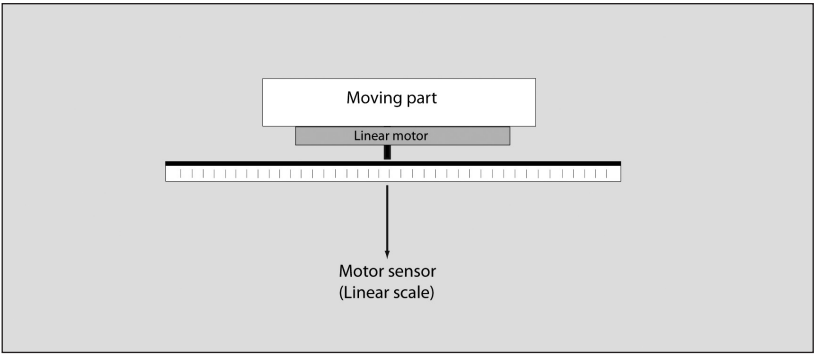
The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder singleturn EnDat 2.2 without Sine/Cosine traces on S2 for position loop closure		
Basic parameters used		Parameter value
V311	S2 sensor MULTI coefficient	[P40 NC value]
V312	S2 sensor DIVI coefficient	[8192]
V315	S2 sensor sinusoidal/TTL signals range	[50%]
V318	S2 sensor power supply voltage	[5] See sensor data sheet.
V321	S2 sensor incremental traces configuration	[8]
V323	S2 sensor communication protocol	[128]
V325	S2 sensor initialization configuration	[0]
V327	S2 sensor run-time options	[0]
V329	S2 Sensor alarms handling	[0]
V331	S2 sensor homing configuration	[1]
V341	Step of speed calculation S2 sensor	[2]
V343	Speed filter by S2 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[1]
V353	Period of position sensor/motor turn	[V370 * Z1 / Z2]
V370	Period by turn S2 sensor	[1024] Any value power of 2 with the limit: V371/V370 < 65536
V371	Absolute resolution by turn S2 sensor	[33554432] See sensor data sheet.
V375	Number of absolute S2 sensor turns	[1]
V378	Intervals between S2 coded references	[1000]
V379	Multiplier of S2 coded references	[1]
V390	Period of linear S2 sensor	[20]
V391	Absolute resolution of linear S2 sensor	[10]
V399	S2 sensor serial position datum bit size	[0]
V724	S2 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

5.5.4 Linear sinusoidal encoder for linear motor

Description	Adjusting procedure  - CNC internal measure unit micron (μm) - 1Vpp sinusoidal scale with one sinusoid every 16μm therefore the number of counts for each sinusoid = 4
-------------	---

Linear scale with 1Vpp Sine/Cosine traces with 1 top mark on S1 for current, speed and position loop closure

Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[20]
V307	S1 sensor DIVI coefficient	[4]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[1]
V324	S1 sensor initialization configuration	[65]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[4]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V380	Period of linear S1 sensor	[20]
V712	S1 sensor part number	[string containing the part number of the sensor]

Linear scale with 1Vpp Sine/Cosine traces coded reference marks on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[20]
V307	S1 sensor DIVI coefficient	[4]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[1]
V324	S1 sensor initialization configuration	[1]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[8]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V368	Intervals between S1 coded references	[1000]
V369	Multiplier of S1 coded references	[1]
V380	Period of linear S1 sensor	[20]
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Linear scale EnDat 2.1 or EnDat 2.2 with 1Vpp Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[20]
V307	S1 sensor DIVI coefficient	[4]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[64]
V324	S1 sensor initialization configuration	[1]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[1]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10] See sensor datasheet.
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Linear scale EnDat 2.2 without Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameters value
V306	S1 sensor MULTI coefficient	[20]
V307	S1 sensor DIVI coefficient	[4]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[8]
V322	S1 sensor communication protocol	[128]
V324	S1 sensor initialization configuration	[1]
V326	S1 sensor run-time options	[0]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[1]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10] See sensor datasheet.
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Linear scale Magnescale without Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[20]
V307	S1 sensor DIVI coefficient	[4]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[8]
V322	S1 sensor communication protocol	[128]
V324	S1 sensor initialization configuration	[1]
V326	S1 sensor run-time options	[0]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[1]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10] See sensor datasheet.
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

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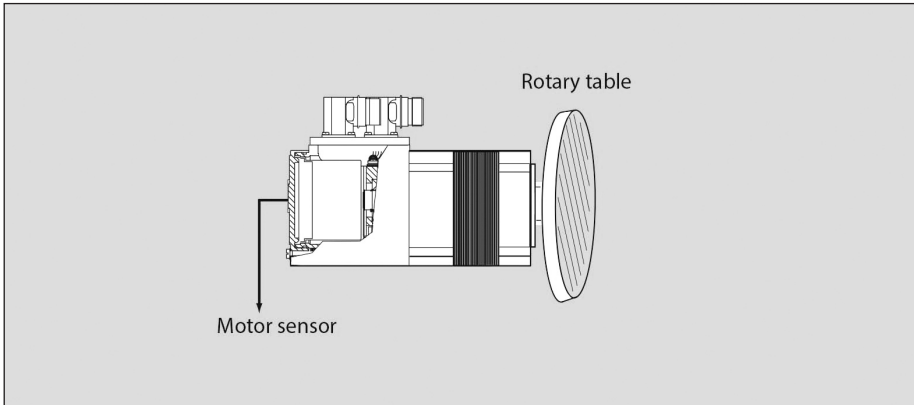
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5.5.5

Rotary sinusoidal encoder for direct torque motor

Description	Adjusting procedure  Rotary table Motor sensor - CNC internal measure unit 1/10000° - 1Vpp encoder with 32768 sinusoids per revolution therefore the number of counts for each table rotation = $32768 * 4 = 131072$ Where: 32768 = number of counts for each encoder revolution 4 = Internal multiplier coefficient.
-------------	--

Rotary encoder with 1Vpp Sine/Cosine traces with 1 top mark on S1 for current, speed and position loop closure

Basic parameters used		Parameters value
V306	S1 sensor MULTI coefficient	[28125]
V307	S1 sensor DIVI coefficient	[64]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[1]
V324	S1 sensor initialization configuration	[64]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[4]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V345	S2 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V360	Period by turn S1 sensor	[2048]
V361	Absolute resolution by turn S1 sensor	[8192] = V360 *4
V365	Number of absolute S1 sensor turns	[1]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10] See sensor datasheet.
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/ DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder with 1Vpp Sine/Cosine traces coded reference marks on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[28125]
V307	S1 sensor DIVI coefficient	[64]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[1]
V324	S1 sensor initialization configuration	[0]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[8]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V360	Period by turn S1 sensor	[2048]
V361	Absolute resolution by turn S1 sensor	[8192] = V360 *4
V365	Number of absolute S1 sensor turns	[1]
V368	Intervals between S1 coded references	[1024]
V369	Multiplier of S1 coded references	[1]
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

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Rotary encoder singleturn EnDat 2.1 or EnDat 2.2 with 1Vpp Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[28125]
V307	S1 sensor DIVI coefficient	[64]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[4]
V322	S1 sensor communication protocol	[1]
V324	S1 sensor initialization configuration	[0]
V326	S1 sensor run-time options	[1]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[8]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V360	Period by turn S1 sensor	[2048]
V361	Absolute resolution by turn S1 sensor	[8192] = V360 *4
V365	Number of absolute S1 sensor turns	[1]
V368	Intervals between S1 coded references	[1024]
V369	Multiplier of S1 coded references	[1]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10]
V389	S1 sensor serial position datum bit size	[0]
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder singleturn EnDat 2.2 without Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[28125]
V307	S1 sensor DIVI coefficient	[64]
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[8]
V322	S1 sensor communication protocol	[128]
V324	S1 sensor initialization configuration	[4]
V326	S1 sensor run-time options	[0]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[1]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V353	Period of position sensor/motor turn	[2048] = V360
V360	Period by turn S1 sensor	"[2048] Any value power of 2 with the limit: V361/V360 < 65536"
V361	Absolute resolution by turn S1 sensor	"[33554432] See sensor data sheet "Number bit per turn"
V365	Number of absolute S1 sensor turns	[1]
V368	Intervals between S1 coded references	[1000]
V369	Multiplier of S1 coded references	[1]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10]
V389	S1 sensor serial position datum bit size	[0]
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

Rotary encoder singleturn Resolute Renishaw (Biss) without Sine/Cosine traces on S1 for current, speed and position loop closure		
Basic parameters used		Parameter value
V306	S1 sensor MULTI coefficient	[3600000]
V307	S1 sensor DIVI coefficient	[V360] * 4
V314	S1 sensor sinusoidal/TTL signals range	[50%]
V317	S1 sensor power supply voltage	[5] See sensor data sheet.
V320	S1 sensor incremental traces configuration	[8]
V322	S1 sensor communication protocol	[131072]
V324	S1 sensor initialization configuration	[0]
V326	S1 sensor run-time options	[0]
V328	S1 Sensor alarms handling	[0]
V330	S1 sensor homing configuration	[1]
V340	Step of speed calculation S1 sensor	[2]
V342	Speed filter by S1 sensor	[600]
V344	S1 sensor code ID	[0]
V350	Position loop sensor configuration	[0]
V353	Period of position sensor/motor turn	[2048] = V360
V360	Period by turn S1 sensor	[16384] Any value power of 2 with the limit: V361/V360 < 65536"
V361	Absolute resolution by turn S1 sensor	[2^30] See sensor data sheet "Number bit per turn"
V365	Number of absolute S1 sensor turns	[1]
V368	Intervals between S1 coded references	[1000]
V369	Multiplier of S1 coded references	[1]
V380	Period of linear S1 sensor	[20]
V381	Absolute resolution of linear S1 sensor	[10]
V389	S1 sensor serial position datum bit size	[32] See sensor data sheet.
V712	S1 sensor part number	[string containing the part number of the sensor]



The resolutions obtained by counting are used exclusively for MULTI/DIVI calculation purposes, therefore the values do not indicate the system resolution.

5.6 Maximum spindle speed admitted

Check that the maximum spindle speed is compatible with the desired resolution as indicated here below:

$$\text{Max speed} < \frac{32767 * 60 * 10^6}{\text{TASK CNC} * \text{Spindle resolution}} = \text{rpm}$$

- Max speed = P46 CNC parameter (rpm)
- TASK CNC = P50 CNC parameter (μs)
- Spindle resolution = P40 CNC parameter.

If the max speed is not admitted reduce the spindle resolution.

Example

- P50 TASK CNC = 2000
- Spindle resolution = 16384

$$\text{Max speed} < \frac{32767 * 60 * 10^6}{2000 * 16384} = 59998 \text{ rpm}$$



For CNC parameters see Flexium+ Parameters manual M00021.

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5.7 Maximum axis following error admitted

5.7.1 Linear axis or rotary axis not modulo

Check that the following error at the maximum speed expected for the axis is never greater then the value obtained by the following formula:

$$\text{Max CNC following error} = \frac{\text{MULTI}}{\text{DIVI}} * 129024 * \left[\frac{60'000'000}{60'000'000 + [4 * V301 * \text{CNC TASK}]} \right]$$

- MULTI - DIVI = See table below.
- TASK CNC = P50 CNC parameter (µs)
- Max CNC Following Error = P23 CNC parameter, expressed in Internal CNC Unit (see P4 CNC parameter)

ex.: microns or tenth of microns



In case of P23 CNC parameter, once expressed in CNC Internal Unit, exceeds the limit given by the formula above, then Warning 37:ext. 0 Overflow error computing following error internal units is issued by the drive see paragraph 6.6.1 Warning description.

	MULTI	DIVI
S1	V306	V307
S2	V311	V312



For CNC parameters see Flexium+ Parameters manual M00021.

5.7.2 Modulo rotary axis



The maximum following error is 180°.
If the value exceed to 180° the axis will reverse immediately the motion direction.

5.8 EPSM procedure with Flexium Tools

5.8.1 EPSM type 0 - Phase offset memorization in the sensor

Utilization

The EPSM type 0 is used for sensors with communication protocol of absolute position type Hiperface Stegmann or EnDat whenever we want to manage the internal sensor memory.

- Setup V322 parameter bit 1 = 1. (Hiperface sensor selection)

V322 (S1 sensor communication protocol)			
Bit	Value	Description	Default
0	☐	Not configured	☒
1	☒	Hiperface	☐
2	☐	Hiperface DSL	☐
3	☐	Not used	☐
4	☐	Not used	☐
5	☐	Not used	☐
6	☐	EnDat 2.1	☐
7	☐	EnDat 2.2	☐

- Setup V324 parameter bit 4 = 1. (Memory handling ON)

V324 (S1 sensor initialization configuration)			
Bit	Value	Description	Default
0	☒	Sensor [0=Rotative] [1=Linear]	☒
1	☐	Not used	☐
2	☐	Abs. measure translation for rotary sensor [1=...	☐
3	☐	Fast-Ser Abs position half-travel displacement[1...	☐
4	☒	Memory handling [1=ON]	☐

Start the EPSM procedure:

- Check the drive in HALT condition, Torque disabled and Reference disabled, then press “EPSM” button than press “SI” (YES) or “NO” for all advance steps as indicated in the figure.

5.8.2

EPSM type 1 - Phase offset memorization in V269 parameter

Utilization

The EPSM type 1 is used for sensors with communication protocol of absolute position where it is not possible to manage the internal sensor memory (or the not manage is selected by V324).

- Setup V322 parameter bit 7 = 1. (EnDat 2.2 sensor selection)

V322 (S1 sensor communication protocol)			
Bit	Value	Description	Default
0	☐	Not configured	☒
1	☐	Hiperface	☐
2	☐	Hiperface DSL	☐
3	☐	Not used	☐
4	☐	Not used	☐
5	☐	Not used	☐
6	☐	EnDat 2.1	☐
7	☒	EnDat 2.2	☐

- Setup V324 parameter bit 4 = 0. (Memory handling OFF)

V324 (S1 sensor initialization configuration)			
Bit	Value	Description	Default
0	☒	Sensor [0=Rotative] [1=Linear]	☒
1	☐	Not used	☐
2	☐	Abs. measure translation for rotary sensor [1=...	☐
3	☐	Fast-Ser Abs position half-travel displacement[1...	☐
4	☐	Memory handling [1=ON]	☐

Start the EPSM procedure:

- Check the drive in HALT condition, Torque disabled and Reference disabled, then press “EPSM” button than press “SI” (YES) or “NO” for all advance steps as indicated in the figure.

Control setting (2.1) | Test point editor (2.2) | Relay editor (2.3) | Parameter editor (2.4) | **Commands (2.5)** | Oscilloscope (2.6) | Comparison (2.7) | Axis a

Buttons: Set HALT, Enable torque, Enable reference, Save parameters

Compliance Table:

Name	Project	Drive
Boot SW	6.00	6.03
Type	MDLUX014B_C	MDLUX014B_C
Max current	14 Apk	14 Apk
Sw	1.0.0000	1.0.0000
Address	0	0

Buttons: Set sensor position to 0, **EPSM** (1), Apply, Cancel

Dialog 1: EPSM Command-DANGER!!!!
The EPSM procedure needs that particular axis motor to be mechanically decoupled from the machine.
Warning :
The torque commands of the drive, its master and slaves will be invalidated.
The position control of the axis (and its slaves or its master) will be disabled.
Continue? (2) **SI** No

Dialog 2: EPSM Command-DANGER!!!!
The position control of the axis (and its slaves or its master) will be disabled.
In case of an axis with brakes:
If the brake is managed by the drive, its control is automatic.
If the brake is managed by the PLC, release it via the PLC.
Continue? (3) **SI** No

Dialog 3: EPSM
EPSM Command-Running ...

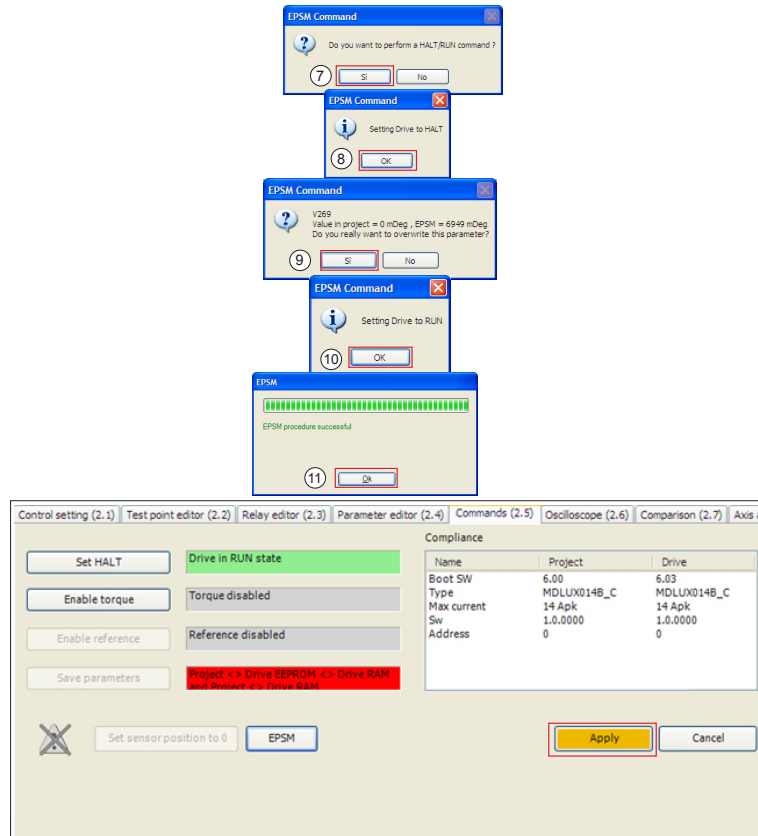
Dialog 4: EPSM Command-EPSM...
The value of NP218 is : 356484.38 mDeg.
Launch a second EPSM.
(4) **SI** No

Dialog 5: EPSM
EPSM Command-Running ...

Dialog 6: EPSM Command-EPSM...
The value of NP218 is : 11315.92 mDeg.
Do you want to restart the EPSM ?
(5) **SI** No

Dialog 7: EPSM Command
Do you really want to overwrite all parameters?
(6) **SI** No

Start the
EPSM
procedure:



- Press "Apply" button to save the EPMS dates in the V269 parameter.

5.8.3 Phase offset exchange after EPS/Hall+HOMING

This function enables the user to avoid the electrical offset exchange that is usually executed after the first HOMING procedure.

Such an exchange requires a previous tuning of parameter **V0269**, otherwise, the **alarm A18 ext.4** will be issued as soon as a HOMING procedure is requested.

In case the Hall sensor box is very reliable, or in case the **V0269** tuning procedure can't give the exact electrical motor phase, then it is possible to inhibit the above described exchange of the electrical offset by properly setting bit 0 of parameter **V0273**, and it will be possible to use the machine continuously with the electrical phase given by the Hall sensor box or by EPS function.

V0273.0 = Phase offset exchange after EPS/Hall+POM

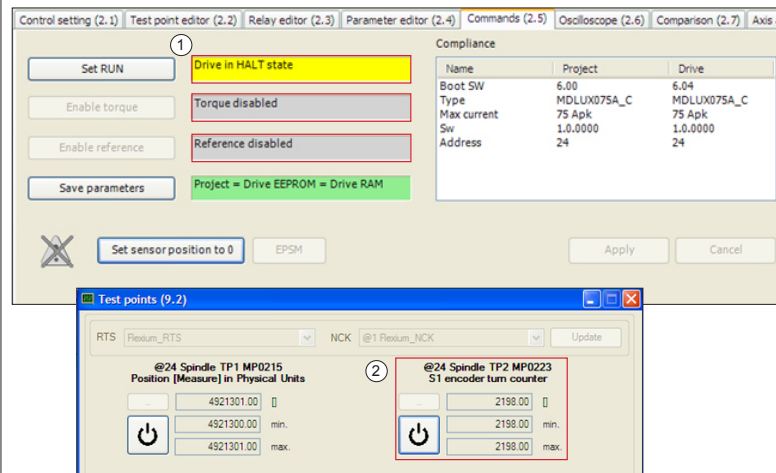
- **V273.0 = 0** EPS or Hall sensor electrical phase **will be substituted** with **V0269**; in this case, **whenever a POM is requested after EPS, if parameter V0269=0**, then the alarm A18, extension 4 is issued by the drive
- **V273.0 = 1** EPS or Hall sensor electrical phase will NOT be substituted; in this case parameter **V0269** is useless and the alarm A18 ext.4 will be never issued; so doing, **the electrical phase offset given by the hall sensor box will be used throughout all the operative use** of the machine.

5.9 Set axis 0 position into the sensor by means of Flexium Tools

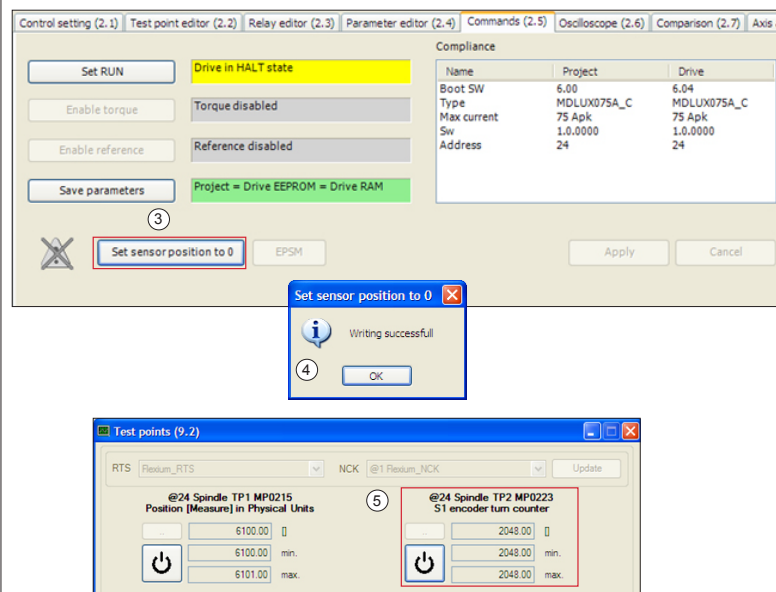
Utilization

Set position to 0 for Stegmann Hiperface and Tamagawa Multiturns sensor procedure with drive in Halt.

- Check the drive in Halt with Torque and Reference disabled (1).
- Check TPx selected on MP223 and check and keep in mind the value (2).



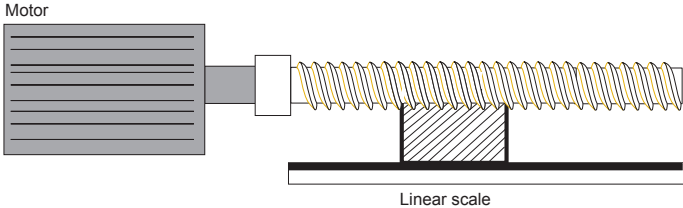
- Press "Set sensor position to 0" to start the procedure (3), then at the finish of the writing procedure the message "Writing successful" appears (4).
- Check now the new TPx MP223 value (5), such value must be around 2048.



5.10 AP01 : Special application

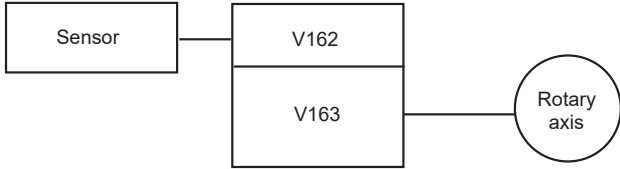
Utilization	The AP01 special application allows to obtain the absolute position from type A, P, J, L or 3 (S1) motor encoder during the initialization of CNC-drive system, and can subsequently initialize the measure of the S2 direct measure system used for the position loop closure. During the initialization procedure with AP01 application activated, the drive supplies the CNC of the absolute measure take from the absolute sensor. Being therefore declared absolute measure the CNC won't require the homing (POM) on the axis in use. Subsequently, when the CNC will require a HOMING, the drive will carry it out on the sensor that is used for closing the position loop. This application must only be used after having individually optimized the MULTI/DIVI and OFFSET parameters of both S1 and S2 sensors.
Adjustment	Adjustment procedure using absolute S1 sensor and incremental S2 sensor - Start by optimizing the MULTI/DIVI (V306/V307) and OFFSET (V310) parameters of S1 sensor, without selecting any additional S2 sensor. - Check that during the complete axis stroke the value shown on MP223 (counter of S1 encoder revolutions) is not reset during transition from 4095 to 0 or viceversa. Otherwise it is necessary to remove the motor, change the mechanical position in order to avoid the above described situation. In case of Stegmann encoder see the chapter "6.12" "Writing procedure of the absolute position = 0 for STEGMANN SinCos encoder Hyperface". - Setup the S2 sensor parameters (V311, V312, V313 S2 sensor MULTI / DIVI) and select the position loop closure with S2 sensor by means bit 0 = 1 of V350 parameter. - Correctly setup V353 parameter. (Numbers of periods per motor revolution) - Perform the axis start up by closing the position loop with the S2 additional sensor, and optimize V313 (sensor S2 offset).  using additional sensor during the startup operation it could be necessary to enter in the V220 parameter the speed reference reverse function bit 4 = 1. - Enable the AP01 application operation by means of V160 parameter, bit 0 = 1. Using AP01 application during the system initialization in the absolute measurement calculation the value of V310 parameter will be used (S1 sensor offset in CNC Internal Unit). Subsequently, during the HOMING execution the value of the parameter V313 (S2 sensor offset in CNC Internal Unit) will be used. Generally the position loop is closed with S2, V313 parameter.

5.10.1 Example with sensor P type and 1Vpp linear scale additional S2 sensor

Example	Example of parameters adjusting  - Type P motor sensor with motor directly connected on screw and screw pitch 10mm (10000μm) - Linear scale additional sensor with coded reference every 20mm (20μm every period) equal to 1000 periods between two coded reference. - CNC resolution in μm. Startup with S1 sensor - V350 (Position loop sensor config.) = 0 - V306 (S1 sensor MULTI coefficient) = 10000 - V307 (S1 sensor DIVI coefficient) = 4096 - V310 (S1 sensor offset) = Enter the value needed to bring the zero distance in the desired mechanical position. Check that during the complete axis stroke, the value shown on MP223 (counter of S1 encoder revolutions) is not reset at the transition from 4095 to 0 or viceversa. Otherwise it is necessary to remove the motor, change the mechanical position in order to avoid the above described situation. In case of Stegmann encoder see the chapter “5.9” “Writing procedure of the absolute position = 0 for STEGMANN SinCos encoder Hiperface”. - Check the correct axis operation with the motor sensor only. Startup with S2 sensor - V350 (Position loop sensor config.) = 1 - V353 (Period of position sensor/motor turn [0]) = 500 (N. of periods meas. direct sensor per rev.) - V378 (Intervals between S2 coded references) = 1000 (N. of periods between 2 coded ref.). - V311 (S2 sensor MULTI coefficient) = 20 - V312 (S2 sensor DIVI coefficient) = 4 - V313 (S2 sensor offset) = Enter the value needed to bring the zero distance in the desired mechanical position. - Check the correct axis operation with direct measurement S2 sensor - Enable the AP01 special application by setting bit 0 =1 in V160 parameter.
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5.11 AP02 : Special application adjustment procedure

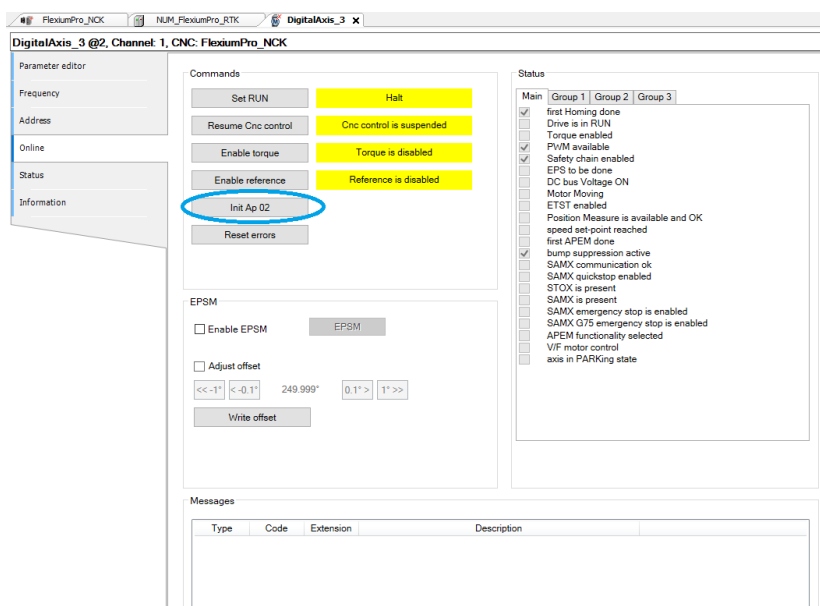
5.11.1 Rotary axis application

Utilization	The AP02 application allows the absolute position management (without the need of performing the HOMING procedure at each machine power on) of: - Rotary axis with a mechanical ratio between position sensor and axis (load) different 2n using a rotary multiturn sensor with Hyperface or EnDat protocol. - Linear axis using a rotary multiturn sensor with Hyperface or EnDat protocol where the axis travel exceeds the number of turn that could be counted by the multiturn counter.
Procedure	Rotary axis application The AP02 version managed in the MDLUF drive admits every ratio between sensor turns (motor) and rotary axis turns with the only following limitation: - $1 \leq V162 \leq 32767$ - $1 \leq V163 \leq 32767$ - $\frac{V163}{V162} \leq (V365 - 1)$ if the sensor involved is connected on S1 - $V164 = 0$ or - $\frac{V163}{V162} \leq (V375 - 1)$ if the sensor involved is connected on S2. - $V164 = 1$ If the criteria are not met during the initialization of the absolute measurement, some overflow conditions may occur on measurement in CNC Internal Unit. In this case the drive will display alarm 16 (Incompatible parameters) with proper extension.  <pre> graph LR Sensor[Sensor] --- V162_V163[V162 V163] V162_V163 --- RotaryAxis((Rotary axis)) </pre>

Procedure

Startup procedure for rotary axis

- Put the drive in HALT
- Select AP02 application by setting the V160 bit1 = 1 to enable the application.
- Select V164 bit 0= 0/1 (AP02 application on sensor S1/S2)
- Enter in the V163 parameter the value of the mechanical ratio of the sensor.
- Enter in the V162 parameter the value of the mechanical ratio of the load.
- Enter V305 (P4/N4 or P40 CNC) value axes module. (V1305 for set[1])
- Save the parameters.
- Put the drive in RUN.
- A16.2 Alarm should be displayed.
- In order to remove Alarm A16.2, command "INIT_AP02" must be executed:
 - Put the drive in HALT;
 - Executed command "INIT_AP02";



- Put the drive in RUN.
- No more Alarm A16.2 should be present.
- check that MP224 test point is 0;
- It is advisable to take note of MP223 test point value for S1 or MP225 for S2 sensor (counter of encoder turns).



NOTE

- The MP223 (S1) / MP225 (S2) measure point indicates the number of position sensor revolutions counted from AP02 enabling. Such value will be set to 0 when the V365 * V163 (S1), V375 * V163 (S2) value is reached. This means that the mechanical alignment has been reached.
- MP224 = AP02 encoder overflow counter. MP224 test point indicates the number of absolute measurement overflows: one overflow is generated every V365 parameter for S1 or V375 for S2.
- When the axis is mechanically re-aligned, the MP224 test point value is reset.
- List of Alarm 16 extensions due to AP02 application:
 - Ext 2, Ext 3, Ext 5, Ext 6, Ext 7, Ext 160, Ext 162, Ext 305. Please see chapter **6 Alarm 16**.

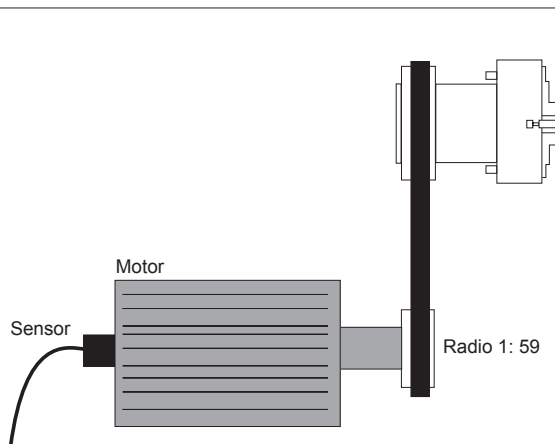
5.11.2 Linear axis application

Procedure	Startup procedure for linear axis Preliminary condition: - V160 bit 1 = 0 - V324 (V325) bit 2 = 0 (Configure the bit on the parameter related to the sensor used to close the position loop V350 bit 0) - V310 (V313) = 0 - P16 N (axis address) = 0 Setup all the others drive parameter in a way that you are able to move the axis by means of the CNC command, in the requested direction, with right path movement (the multi/divi must be set correctly) Now by means of an example we can describe how to proceed on the AP02 setup. - Motor equipped with "P" encoder, linked to a gear box with ratio 4:15, out of the gear box a pinion with a primitive circumference = 10560micron (1 pinion turn = 10.56mm) - P4N2 = 33, axis travel = 30mt - To cover the complete axis path the motor must do: $30000/10.56*15/4 = 10653.4$ turns. - You should have already: $V306 / V307 = 10560*4 / 4096*15 = 42240 / 61440 = 11 / 16$ $V360 = 1024$ $V365 = 4096$ To cover the complete axis path we will have $10653.4 / 4096 = 2.6009$ multiturn overflows, so we will use the first bigger integer number +1 = 4. - Put the drive in HALT. - Write le following parameter: $V305 = 0$ $V164 \text{ bit } 0 = 0$ $V164 \text{ bit } 1 = 1$ $V160 \text{ bit } 1 = 0$ $V350 \text{ bit } 0 = 0$ (position from S1) - Store the parameter. - Put the drive in RUN. - Show MP223 - Move the axis into the direction where MP223 decreases. The range of MP223 value during this phase will be between 0 and 4095 (= [V365]-1) and restart from 4096 every time there will be an overflow into the multiturn counter. Reach the farther position, after the over-travel switches, if possible, this must be a position never reachable on standard working condition. The main thing is that it must not be possible to wakeup the drive with axis in a farther position. - Put the drive in HALT. - Set V160 bit 1 = 1(activate AP02) $V162 = 1$ $V163 = 4096 \times 4 = 16384$ - Store the parameter. - Put the drive in RUN. - In order to remove Alarm A16.2, comand "INIT_AP02" must be executed: - Executed command "INIT_AP02" - Put the drive in RUN. - No more Alarm A16.2 should be present. - Now AP02 has been initialized, and such an extreme position will represent the MP224 = 0 range of position. - Now you can move the axis and adjust P16. - From now MP223 will only increase till reaching the theoretically value 16384 [V163] as MP224 will range from 0 to 3 (= 4 -1)
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5.11.3 Linear axis application with gantry axe

Procedure	Startup procedure for linear axis with gantry axe The procedure described in the previous page for a linear axis must be applied two times one for each axis in gantry. The particular case that could happen is that MP223 could decrease, in the second axis, moving it in the opposite direction of the first axis, this is a pity, but in any case the important rule also for the second axis is that you must reach the farther position in the direction where its MP223 decreases, also if this means that the position is at the end of the axis on the opposite side of the first axis.
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5.11.4 Example with 1:59 mechanical ratio and 1/10000° resolution (S1 sensor P type)



Adjust correctly the parameters.

- V160 bit 1 = 1
- V164 bit 0 = 0
- V305 = 3600000 (P4/N4-CNC)
- V306 = 3600000 => 28125
- V307 = 1024 * 4 * 59 = 241664 => 1888
- V350 = 0
- V162 = 1
- V163 = 59
- V365 = 4096



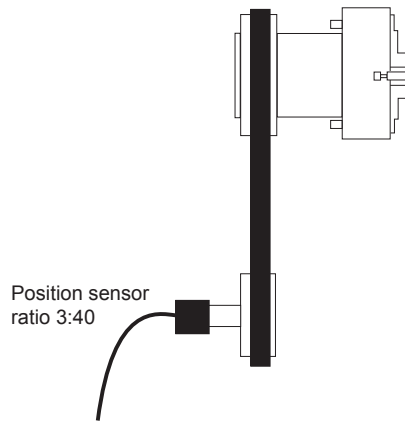
- The mechanical re-alignment of the system will take place at the 59° absolute measurement overflow of motor sensor, i.e. after V163 * V365 motor revolutions therefore:

- MP223 test point will reset after 59 * 4096 motor revolutions
- MP224 test point will reset after 59 overflow occurrences of absolute measurement provided by sensor (the range of MP224 is from 0 to 58).

Example of checking the compatibility of an application with the defined parameter configuration:

$$\frac{V163}{V162} \leq (V365 - 1) - 1 = \frac{59}{1} \leq (4096 - 1)$$

5.11.5 Example with 3:40 mechanical ratio and 1/10000° resolution (S2 sensor ROQ425 5DSK ENDAT type)



Adjust correctly the parameters.

- V160 bit 1 = 1
- V164 bit 0 = 1
- V305 = 3600000 (P4/N4-CNC)
- V311 = 3600000 * 3 = 10800000 => 16875
- V312 = 2048 * 4 * 40 = 327680 => 512
- V350 = 1
- V162 = 3
- V163 = 40
- V375 = 4096



The mechanical re-alignment of the system will take place at the 59° absolute measurement overflow of motor sensor, i.e. after V163 * V375 motor revolutions and therefore:

- MP225 test point will reset after 40 * 4096 motor revolutions
- MP224 test point will reset after 40 overflow occurrences of absolute measurement provided by sensor (the range of MP224 is from 0 to 39).

Example of checking the compatibility of an application with the defined parameter configuration:

$$\frac{V163}{V162} \leq (V375 - 1) - 1 = \frac{40}{3} \leq (4096 - 1)$$

5.12 TANDEM application

In the TANDEM application we have one drive, that is referenced as the “Master” drive, that is committed directly by the NCK, and one or more “Slave” drives, that receive their own command references directly by the master drive.

MDLUX comes up with a wider range of TANDEM applications:

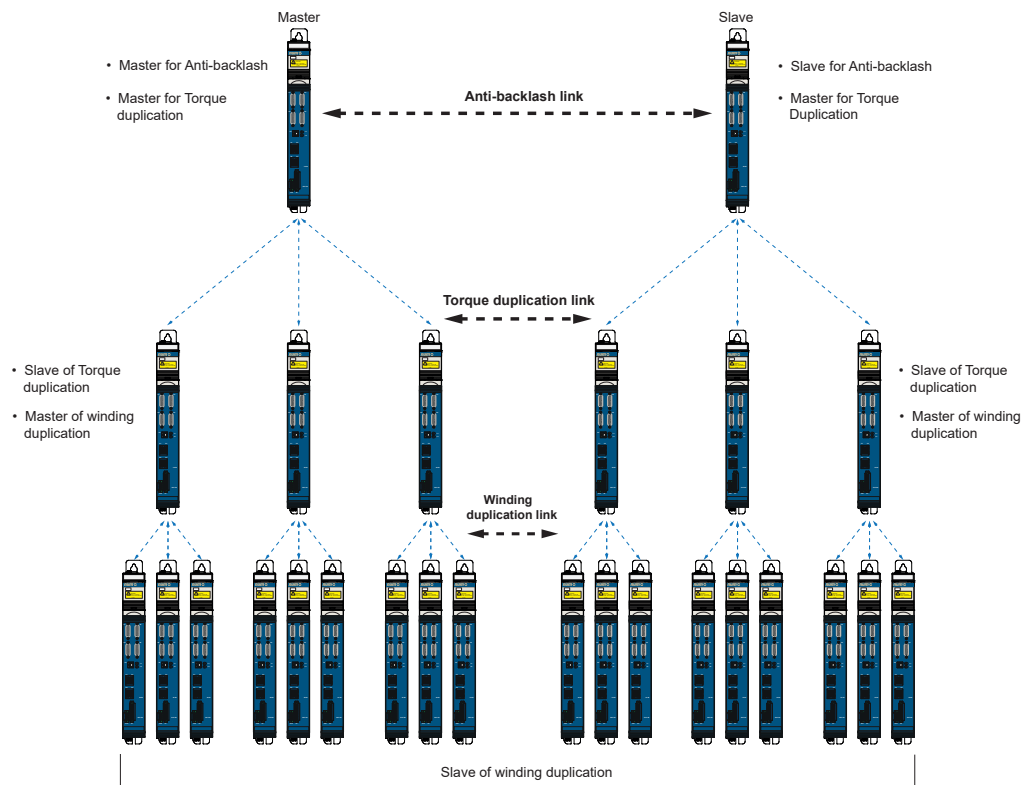
- Anti-backlash application (AP03)
- Torque duplication application (AP04)
- Winding duplication application (AP05)
- Mechatronic applications using “DEMF drive embeded macro” functionality. (See chapter “8”)

Furthermore, with MDLUF it will be possible to create very powerful hierarchic structures of TANDEM applications.

As an exemple, with MDLUF it is possible to create a TANDEM application involving 26 drives, organized in the following hierarchic structure:

- An antibacklash pair of drives (master/slave)
- Where both, master and slave, are master of a group of 4 drives involved in torque duplication.
- Then, each torque-duplication slave drive is, by its own, master of a group of 4 drives involved in winding duplication application.

The picture below shows the full hierarchic structure:



A subset of this application could be done using High Performance Bi-Axes module. In this case TANDEM application involves only the two drives (motors) of the Bi-Axes module, NO communication cable is required and NO hierarchic structure is possible.

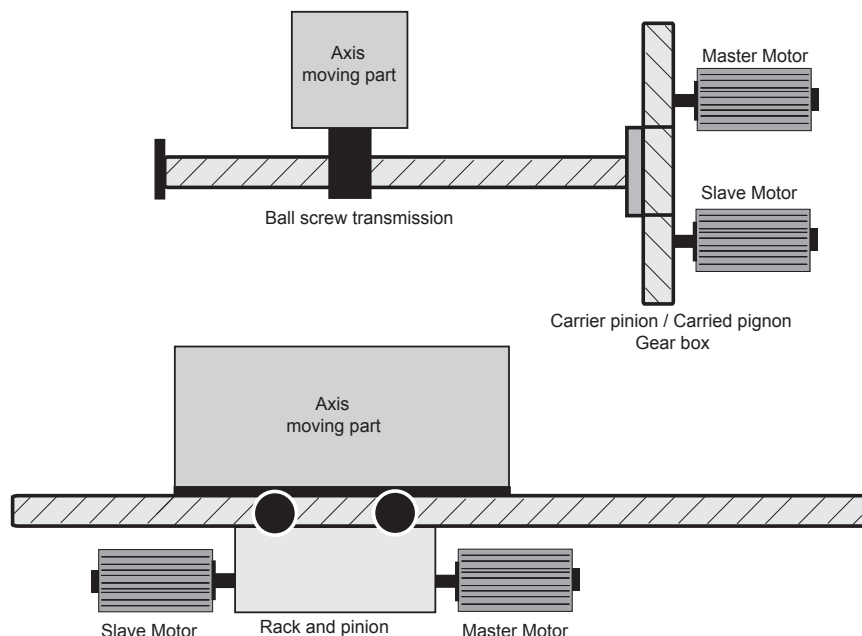
5.12.1 AP03: Anti-backlash function

The main application of tandem control is to replace the mechanical stress gearbox used on a pinion/rack transmission.

The tandem system generates twice the torque of a single motor and eliminates the mechanical backlash at reverse direction.

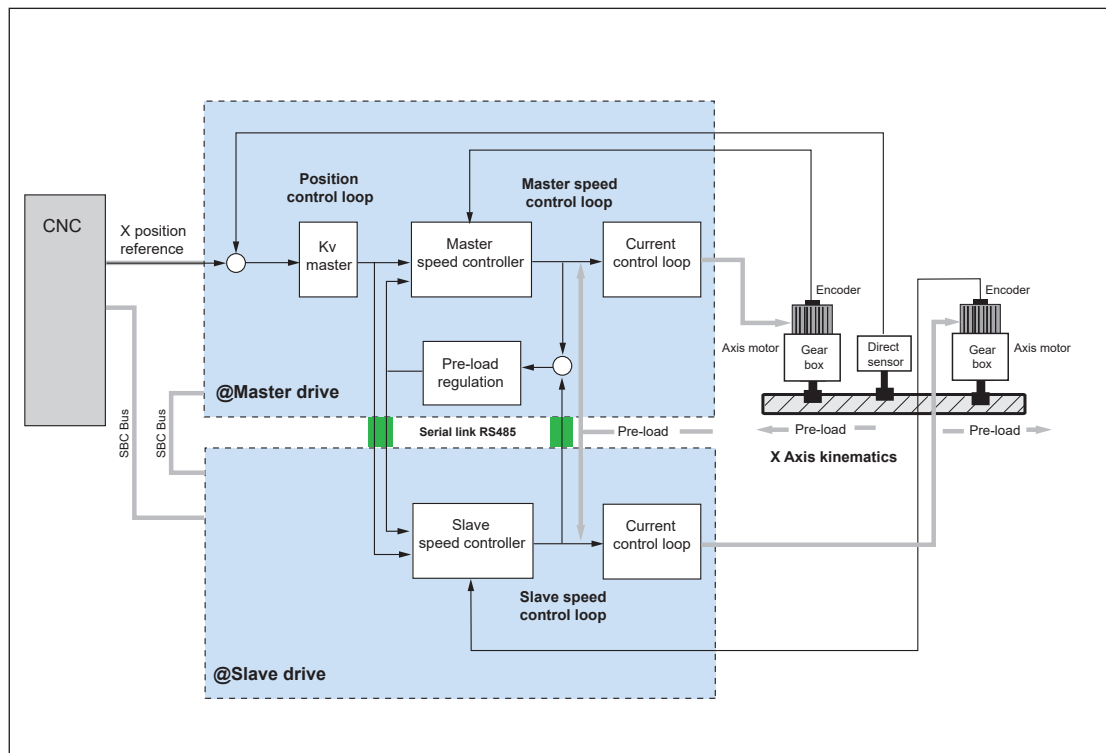
- Anti-backlash is a TANDEM application that involves two drives: one Master and one Slave. The two drives could be two MDLUF Mono-Axis module of the same size (High performance with external link option is required) or the two drives of one MDLUF Bi-Axes module in High Performance configuration. A mix of one MDLUF Mono-Axis module with one drive of one MDLUF Bi-Axes module is not admitted.
- Two motors, coupled together in Master Slave design, can generate the torque required in acceleration or deceleration for driving one axis (Tandem Control).
- The Master tries to keep the difference of torque, between Master and Slave, as constant as possible during the movement of the axis (so keeping the rack-pinion gear precharging constant), while allowing the axis to follow the NCK position reference without any backlash. If there is any difference in acceleration between master and slave motor, a damping compensation function can suppress vibrations occurring in the transmission mechanism (Pre-load regulator PI).
- Moreover to reduce the influence of backlash between the Master and Slave axis, the Master and Slave motors apply two opposite torque's components in axial direction (Pre-load function).
- Its aim is to implement an electronic gear precharging on a rack-pinion coupling in such way to remove any backlash effect.
- The "Electronic gearbox precharge" is, obviously, programmable via drive parameter.
- In such application, the NCK sends its position reference to the Master, and this latter sends a proper speed reference to its Slave partner.

Mechanical application example with two motors TANDEM



Anti-backlash function could be used if the mechanical reduction gear have reversibility capability greater than 80%.

The control structure of the master-slave coupling for anti-backlash is shown in the figure below:



Setting procedure example

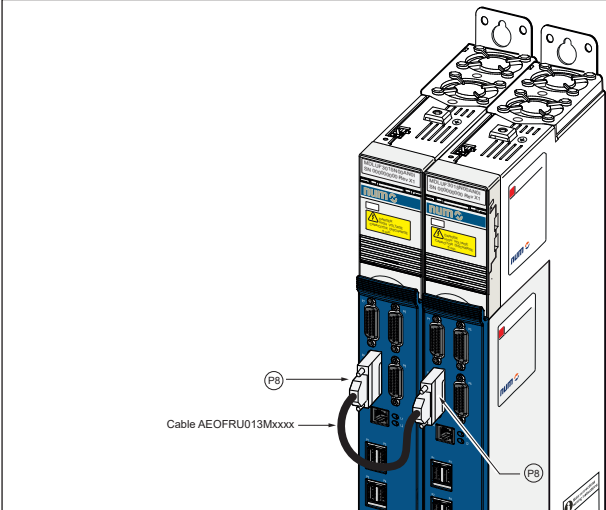
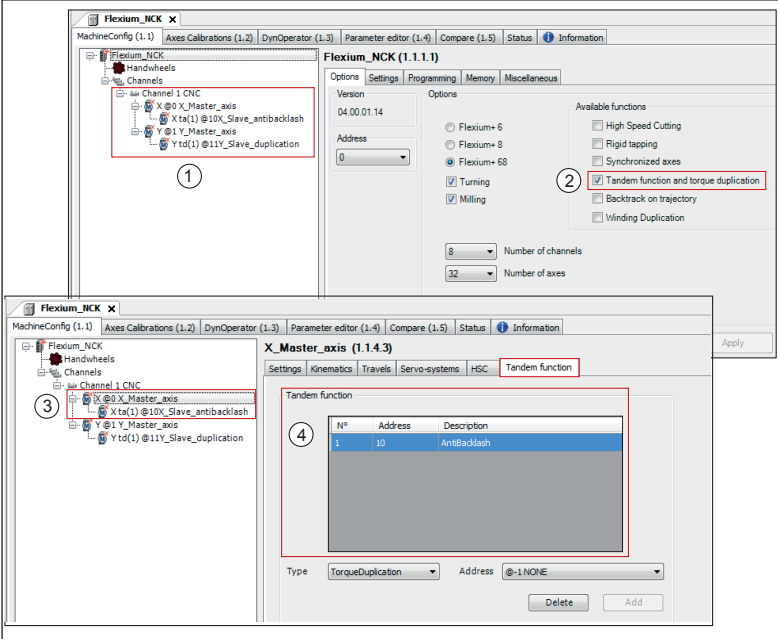
NUM DrivePro Basic parameters used Master axis		Parameter value
V168	Internal link via memory-A	[1]
V169	AP03: Anti-backlash role	[1]
V170	AP03: Anti-backlash configuration	[0]
V171	AP03 Master: Preload Tandem current	See procedure on next page.
V177	AP03: Master: Preload ramp speed	See procedure on next page.
V172	P03 Mst: Proportional torq. equaliz. gain	See procedure on next page.
V173	AP03 Mst: Integral torque equalizer gain	See procedure on next page.
V175	AP03 Mst: Max compens. torque equalizer	See procedure on next page.
V176	AP03 Mst: T.out A52.41 (saturated trq eq.)	[100]

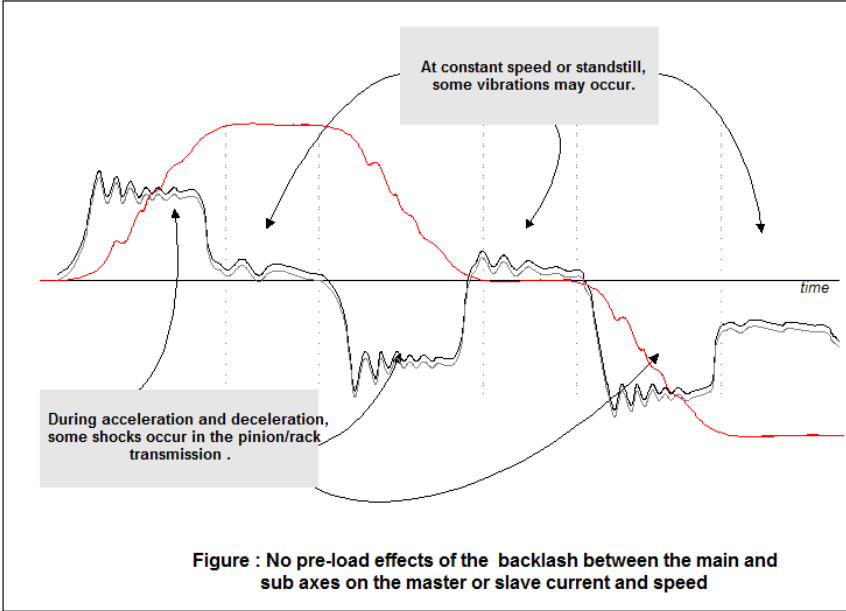
NUM DrivePro Basic parameters used Slave axis		Parameter value
V168	Internal link via memory-A	[1]
V169	AP03: Anti-backlash role	[0]
V170	AP03: Anti-backlash configuration	[0]
V171	AP03 Master: Preload Tandem current	Not used.
V177	AP03: Master: Preload ramp speed	Not used.
V172	P03 Mst: Proportional torq. equaliz. gain	Not used.
V173	AP03 Mst: Integral torque equalizer gain	Not used.
V175	AP03 Mst: Max compens. torque equalizer	Not used.
V176	AP03 Mst: T.out A52.41 (saturated trq eq.)	Not used.

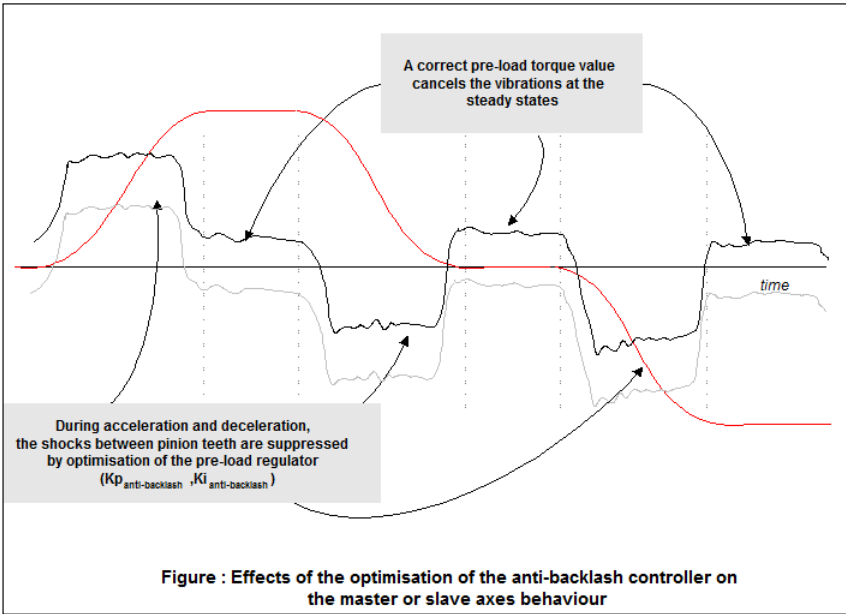
CNC Basic parameters used		Parameter value
P85	Declaration of torque master /slave drives application	See procedure on next page.
P120	Declaration of master drives with torque synchronization	See procedure on next page.

Measure point used	
MP1	Mechanical motor speed from motor sensor. This test-point provides the user with the mechanical speed, in rpm, for a rotary motor, in mm/min, for a linear motor, as computed by the motor sensor.
MP2	Torque current reference Iq_rif. This test-point provides the user with torque current, in Arms, delivered by the drive.
MP20	Mechanical motor speed from position sensor. This test-point provides the user with the mechanical speed, in rpm, for a rotary motor, in mm/min, for a linear motor, as computed by the position sensor.
MP50	Torque current Iq. This test-point provides the user with torque current, in Arms, delivered by the drive.

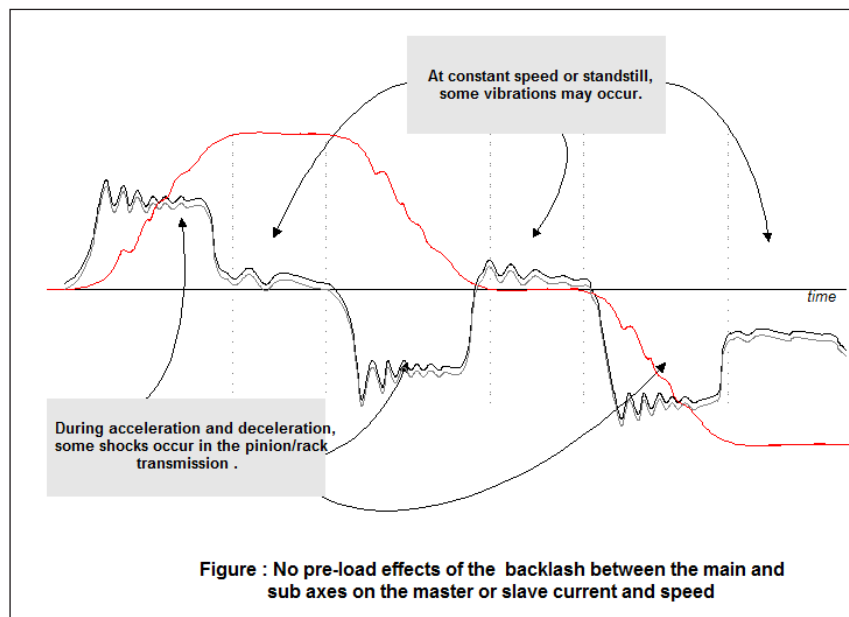
Application procedure example

Objectives	- Increase the torque by driving two motors working in tandem. - Produce mechanical tension between two motors through gears by an active pre-load. - Eliminate the vibrations on reverse motion.
Sequence	Description
Drive connections	- Connect the TANDEM (X3 connector) between Master and Slave drives, if two Mono-Axis modules are used. In case one Bi-Axes module is used, no wiring is required to link the two drives. Please refer to NUM DrivePro Installation manual M00067 for more detailed information. 
Enable Tandem function on master and slave drives. P85, P120 V160, V168, V169, V170, V171, V172, V173, V175, V176, V177 In caso di link esterno via cavo, come mostratoin figura V168 va impostato come segue: + V168 = 8 (se si usa connettore P7) + V168 = 16 (se si usa connettore P8)	- Declare the Channel and drives before start the Tandem function ① - Click on → <i>Flexium_NCK</i> + “Options” then select on “Available functions” area “Tandem function and torque duplication” ②  Flexium Tools configure automatically NC parameters and drives parameters. Contact NUM for more detailed information.

Sequence	Description
NC Reset	- It's necessary to reset the CNC after the axes configuration.
Configuration of the both drives parameters	- Before to set up the parameters of Tandem functions, it's necessary to : - Set up the position measurements parameters of both drives. - Adjust the maximal speed parameters.
Check the <i>sign</i> of the speed and torque references on <i>slave</i> drive.	- Erase eventually the parameters of the pre-load regulator on Master drive. - Inhibit torque on the slave drive. - Apply a positive step in open position loop on the Master drive only (no Tandem control). - Inhibit torque on the Slave drive. - Observe the direction of the axis. - Inhibit torque on the slave drive. - Apply the same test on the Slave drive (first disable the torque on the Master drive) and compare the movement direction with the one obtained at previous test. - Set the sign value by modifying: - V170 bit 1 = 0 if Master and Slave are in same direction. - V170 bit 1 = 1 if Master and Slave are in opposite direction.
Set the pre-load torque: V171, V177	- With Flexium Tools test perform a test in speed loop with step reference: - Select Test points : Torque current and motor speed on the Master and Slave drives. - Now Flexium Tools shows both Master and Slave curves. - Note the friction current on Master and Slave drives. - Adjust the pre-load torque (V170) with a value higher than the highest friction current (about 2 times). - Check if the value of pre-load current is lower than 30% I nominal current of the motor. Otherwise, the motor is not adapted to mechanical axis. - Eventually, modify the time ramp for pre-load current (V177). The pre-load torque reduces an influence of backlash between the Master and Slave axes and improves the stiffness of the mechanical coupling. With a correct pre-load torque value, the low frequency oscillations are eliminated at standstill.  Figure : No pre-load effects of the backlash between the main and sub axes on the master or slave current and speed
Set the pre-load PI regulator: V172, V173	- Adjust the integral time constant V173 Anti-backlash at about 100ms - Apply a back and forth movement in speed loop test. - Adjust the V172 Anti-backlash gain little by little to reduce the oscillations during the transients.

Sequence	Description
Set the pre-load PI regulator	 A correct pre-load torque value cancels the vibrations at the steady states During acceleration and deceleration, the shocks between pinion teeth are suppressed by optimisation of the pre-load regulator ($K_{p_anti-backlash}$, $K_{i_anti-backlash}$) Figure : Effects of the optimisation of the anti-backlash controller on the master or slave axes behaviour
Set the position loop V301	- Close the position loop - Optimise the position gain V301 - Check the speed load response without vibration and overshoot. - Adjust eventually the pre-load regulator.

Set the pre-load torque: V171, V177	- With Flexium Tools test perform a test in speed loop with step reference: - Select Test points : Torque current and motor speed on the Master and Slave drives. - Now Flexium Tools shows both Master and Slave curves. - Note the friction current on Master and Slave drives. - Adjust the pre-load torque (V170) with a value higher than the highest friction current (about 2 times). - Check if the value of pre-load current is lower than 30% I nominal current of the motor. Otherwise, the motor is not adapted to mechanical axis. - Eventually, modify the time ramp for pre-load current (V177). The pre-load torque reduces an influence of backlash between the Master and Slave axes and improves the stiffness of the mechanical coupling. With a correct pre-load torque value, the low frequency oscillations are eliminated at standstill.
Set the pre-load PI regulator: V172, V173	- Adjust the integral time constant V173 Anti-backlash at about 100ms - Apply a back and forth movement in speed loop test. - Adjust the V172 Anti-backlash gain little by little to reduce the oscillations during the transients.



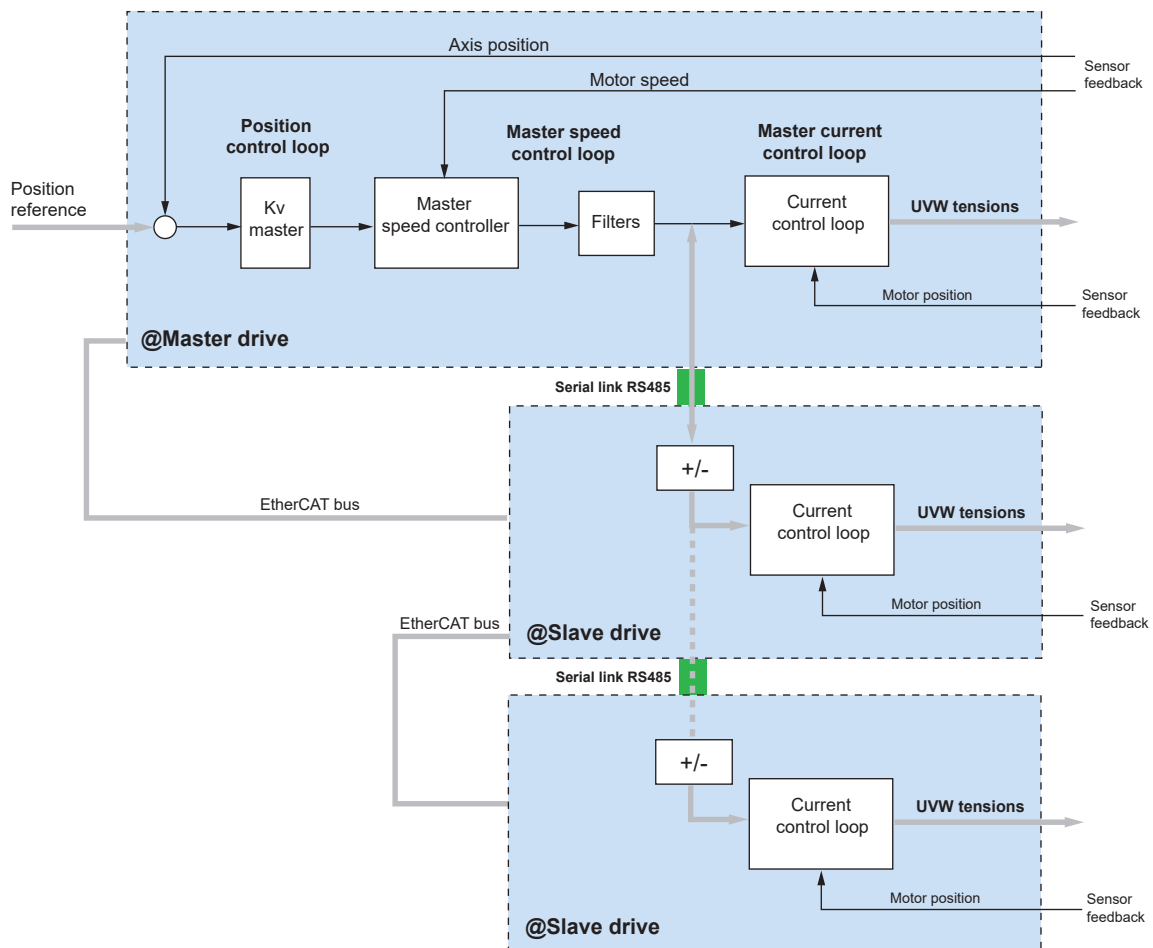
5.12.2 AP04: Torque duplication

The torque duplication is used to increase torque in some application by means of two or more motors pushing the axis chariot in parallel.

With the torque duplication function two or more drives can be used: one Master and different Slaves. The communication between Master and Slaves drives is carried out through RS485 full-duplex local link which uses a synchronous serial port.

- Torque duplication is a TANDEM application where up to 4 drives are involved: one Master and up to 3 Slaves.
- Its aim is to increase the delivered axis torque/force by making two or more (up to 4) motors acting in parallel on the same axis chariot.
- In this application each involved drive controls its own motor.

Torque duplication between Mater and Slave and multiple Slave drives



Application procedure

No procedure required.

5.13 AP05: Winding duplication

Winding duplication is a TANDEM application where up to 4 drives are involved: one Master and up to 3 Slaves. Its aim is to increase the delivered drive current to a single motor by making two or more (up to 4) stator windings acting in parallel on the same motor rotor.

In such application, each involved drive controls its own stator winding. All stator winding current contribute, synchronously, to the creation of proper torque on the single rotor of the motor.

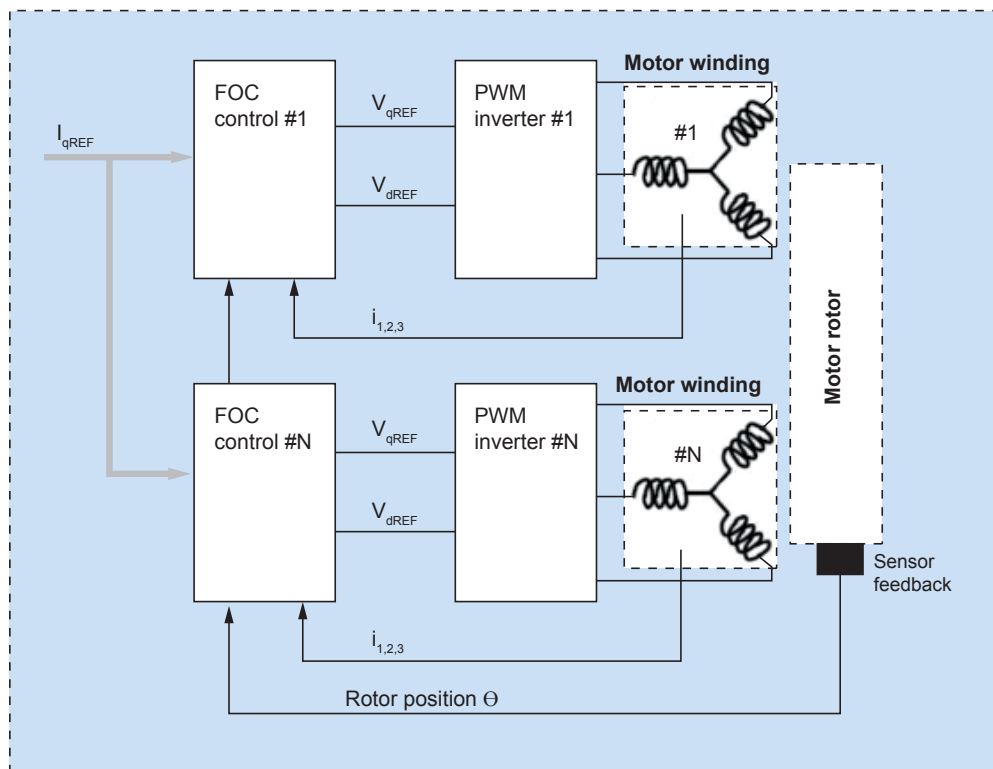
Only the Master drive is fed-back with encoder position sensor; while all Slaves are “*sensorless*” drives. In such application, the NCK sends its position reference to the master, and this latter propagate the three-phase voltage reference to all its slave partners.

Application example

By mean of such application, it is possible to control an axis, of a special machine, that required 1000 Arms (thousand Ampere r.m.s) as maximal torque current for instance.

The motor was built with 1 rotor and 4 separated stator windings, each one carrying up to 250 Arms. Using a drive size of 280 Arms for instance, by using this function we were able to “parallelize” the 4 motor windings implementing a “virtual” drive of 1000 Arms of maximal torque current.

Please contact NUM for more detailed information.



5.14 Use of the speed ramp

5.14.1 Drive acceleration / deceleration ramps

Description	This function gives the possibility to manage a ramp inside the drive. The target of this function is to provide the opportunity to manage the speed of a spindle via PLC with a ramp. This feature could be selected by: - V30 parameter: General drive configuration. - Bit 4 = 1: Acceleration / deceleration ramp (Master) [1=ON] - Bit 5 = 1: Ramp on alarm / reference disable (Master) [1=ON] The two options works independently because refer to different drive working conditions, so you can select one or both options without any problem. "Master" means that into a "Tandem function" application, only the selection done on the master drive will be taken in account. If you set the bit into the slave drive you will receive the alarm A16.30 by the slave drive. Both options are managed in presence of sensorless declaration too. The ramp managing is completed by the PLC interface bit <i>FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.SpeedReached</i> that defines the reference speed reached. This bit is set to 1 when the absolute value of the difference between motor speed value (or estimated motor speed in case of sensorless application) and reference speed value in input before the ramp function is less then motor zero speed (V42) plus the product of absolute speed reference times V40. By this way if the CNC spindle ramp has declared = 0 (P32 N48, N50, N52, N54 =0) the bit <i>FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.SpeedReached</i> could be used as reached speed. We recommend to set the option V30 bit 5 = 1 if the drive is equipped with the NUM-SAMX module. By this way you can easy define the same ramp that must be controlled by the NUM-SAMX module.
-------------	---

5.14.2 Acceleration / deceleration ramp

5.14.2.1 Acceleration / deceleration ramp enable - V30 bit 4 = 1

Description	The acceleration / deceleration ramp is taken in account in all drive working condition with reference enabled and drive not in alarm condition. The ramp works taking the today speed reference in input to the drive and generating a speed reference with ramp in output that is applied to the speed loop control. For example, in case of spindle managing, if you define the ramp on both sides CNC parameter P32 (N48..N55) and V91... into the drive, the result will be that the speed will increase with the lowest ramp. Obviously this is not the right use of this new drive function because you will have only confusion, but if you will put P32 (N48 or ...N55) equal zero you will use the drive ramp value. This drive function has been thought to have a ramp for the spindle managed by PLC with <i>.WCNC.Spindle[n].PlcSpeedControl</i> and <i>.WCNC.Spindle[n].Speed</i>. This function is applied to all the motor types: synchronous, asynchronous, linear. The parameters used into the ramp definition are: - V91: Acceleration/deceleration ramp, in mm/s² for linear motors, in Rpm/s for rotating motors, synchronous or asynchronous. If the requested ramp is too high the acceleration will be limited by the max motor current applied: (V50) * ((128 - <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.CurrentReduction</i>) / 128) or V123. The selection done with V30 bit 4 = 1 could be temporary removed by the managing of the PLC interface bit <i>.FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.RampDisabled</i> This means to substitute the ramp with a step. Setting this bit the ramp is suppressed: the speed reference is sent immediately to the speed loop regulator input without ramp.
-------------	--

5.14.2.2 Acceleration / deceleration ramp disable - V30 bit 4 = 0

Description	The speed reference in input to the drive is applied to the speed loop control in all drive working condition with: <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.TorqueEnable = TRUE</i> and <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.ReferenceEnable = TRUE</i> and drive not in alarm condition. No control is applied to the variation of the speed (motor acceleration) except, if the requested variation is too high, the acceleration will be limited by the max motor current applied: $(V50) * ((128 - \text{FlexiumPro_NCK.WCNC.Axis}[n].\text{DigitalAxis.CurrentReduction}) / 128)$ or V123.
-------------	---

5.14.3 Ramp on “Alarm” or “Reference disable”

5.14.3.1 Ramp on “Alarm” or “Reference disable” - V30 bit 5 = 1

Description	This option is taken in account when the drive falls in braking condition as defined by (V32 and V30.1) or V30.2 or when the reference request <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.ReferenceEnable</i> goes FALSE or it is switched to FALSE automatically by the CNC when a critical alarm has detected by the CNC. The parameters involved into the ramp definition are the same of V30.14. This selection is not affected by the drive reference mode requested: speed or position. This selection is not affected by the status of the PLC interface bit <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.RampDisabled</i> This selection is applied to all the motor types: synchronous, asynchronous, linear. If the requested ramp is too high the deceleration will be limited by the max motor current applied: $(V50) * ((128 - \text{FlexiumPro_NCK.WCNC.Axis}[n].\text{DigitalAxis.CurrentReduction}) / 128)$ or V123.
-------------	---

5.14.3.2 Ramp on “Alarm” or “Reference disable” - V30 bit 5 = 0

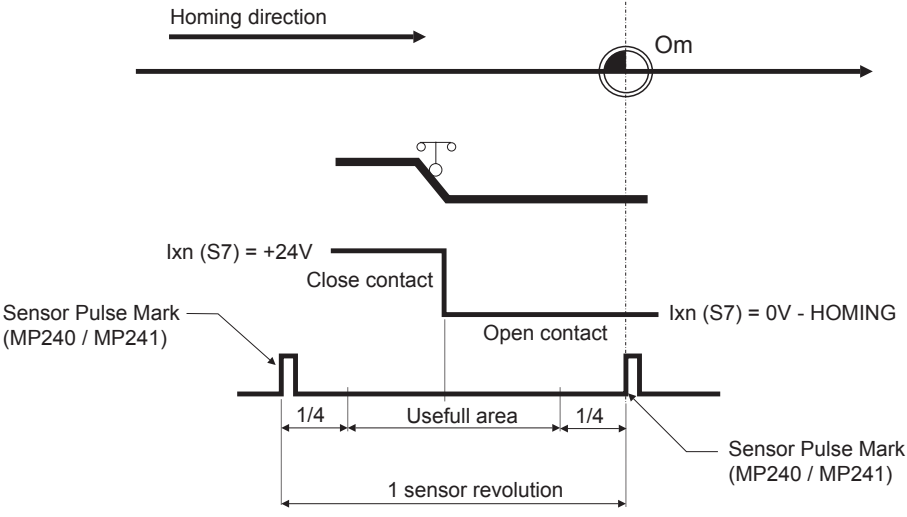
Description	This option is taken in account when the drive falls in braking condition as defined by (V32 and V31.1) or when the reference request. <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.ReferenceEnable</i> goes FALSE or it is switched to FALSE automatically by the CNC when a critical alarm has detected by the CNC. In case <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.ReferenceEnable</i> goes FALSE without drive alarm condition (for example putting <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.ReferenceEnable = FALSE</i> by PLC program) with <i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.TorqueEnable = TRUE</i>, the drive will brake the motor with the maximum current limited only by: $(V50) * ((128 - \text{FlexiumPro_NCK.WCNC.Axis}[n].\text{DigitalAxis.CurrentReduction}) / 128)$ or V123. In case of drive alarm, the braking method applied will depend from the drive alarm type as described on V32 if the braking request on V32 will be set, otherwise the motor will brake by inertia.
-------------	---

5.15 Asynchronous motor management in V/f mode (Inverter mode)

Description	V/f feature gives the possibility to easy setup and management of asynchronous motor. For this motor management type only one configuration is allowed, so electrical gear and parameter set exchange are not allowed. Other constrains are: - No vertical load compensation allowed: V109 = 0 - All the special applications AP are not allowed except AP02. - Acceleration and deceleration ramps must be enabled: V30.4 = 1, V30.5 = 1 - Current and speed loop must be closed with sensorless type sensor: V320.1 = 1
Utilization	V/f Parameters To define the characteristic of this new motor management, the following parameters must be set: - V481 = 2 Asynchronous motor controlled in V/f mode (= 1 Asynchronous motor controlled in vectorial mode) - V600 = "V/f: Maximal motor current (% of V108)". - V601 = "V/f: Rated frequency", together with V602 and V603 they define the V/f rule. - V602 = "V/f: Rated voltage" (Phase to phase voltage) - V603 = "V/f: V0" (Phase to phase voltage at 0 frequency) V Limit could be bigger or smaller then V602 and it is the smaller value between: V101 and DCBus value (MP8) divided SQRT(2). V604 = "V/f: Stator resistance @ 20 degrees C" (Stator resistance terminal to terminal divided by 2) V605 = "V/f: Intermittent overload (% of V108)", its value must be less of V600. If the acceleration (or deceleration) ramp is too high so the motor current became higher then V605, the drive reduces the output frequency till the motor current became lower of V605. V606 = "V/f: Freq. start of overload reduction". This is the frequency limit over that the motor cannot work in overload (V605). V/f Measure Points MP180 = "V/f: Total motor current"[Arms]. It is the current flowing into the motor in each phase. MP181 = "V/f: Current limiter output" [Hz]. This MP has normally value 0, but if the motor current became bigger then V605, this MP shows the correction value added to the requested frequency to obtain an output frequency that limits the motor current to a value smaller then V605. MP182 = "V/f: Overload current limit". This MP shows the disposable Overload current at the instant frequency.

5.16 Setting HOMING procedure

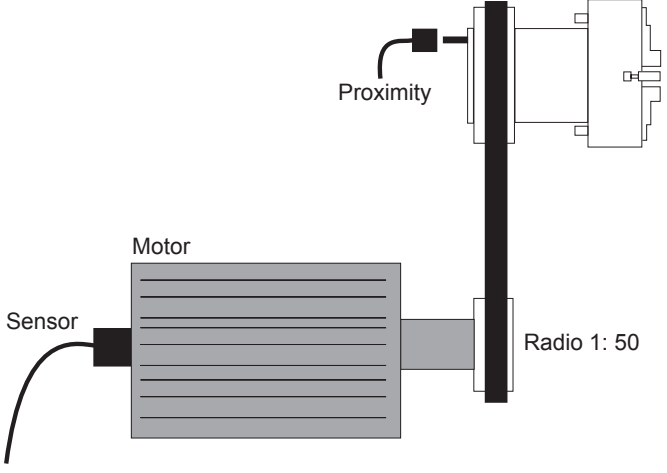
5.16.1 Setting axes HOMING

Description	The axis travel exceeds the sensor measurement travel. Homing is carried out on opening of the origin switch. It is used to identify the sensor revolution on which the zero pulse.
Utilization	The electrical contact opening signal must be clean without bounce. The switch must be set so that the contact opens between one-quarter and three-quarters of the distance separating two zero pulses. This is to avoid coincidence between switch operation and the zero pulse, which could cause a random shift by a distance equal to that separating two zero pulses. The switch size should be such that the contact opens before detection of the sensor zero pulse and remains open until the axis stops after detection of the open contact on the switch input. 



When the impulse of Pulse Mark is ON (MP240/241) check that the compensated Sine and Cosine signals (see MP226/227 - MP232/233) must be both positive.
If this requirement is satisfied you must see a pulse on MP242/243.
Please refer the example on next pages.

5.16.2 Setting spindle HOMING

Description	The spindle travel exceeds the sensor measurement travel. Homing is carried out on opening of the origin switch. It is used to identify the sensor revolution on which the zero pulse.
Utilization	The electrical contact opening signal must be clean without bounce. The switch must be set so that the contact opens between one-quarter and three-quarters of the distance separating two zero pulses. This is to avoid coincidence between switch operation and the zero pulse, which could cause a random shift by a distance equal to that separating two zero pulses. The switch size should be such that the contact opens before detection of the sensor zero pulse and remains open until the axis stops after detection of the open contact on the switch input.  The diagram illustrates the spindle homing setup. A motor is connected to a sensor. A proximity switch is mounted on the spindle. The sensor is connected to the motor. The proximity switch is connected to the sensor. The radio is set to 1:50.



When the impulse of Pulse Mark is ON (MP240/241) check that the compensated Sine and Cosine signals (see MP226/227 - MP232/233) must be both positive. If this requirement is satisfied you must see a pulse on MP242/243.

5.16.3 Check the Sensor Pulse Mark

Description	To verify the right connection of Sine/Cosine and Top Mark you can use the drive oscilloscope. Configure the drive trigger as below. The example refers to S2 sensor. You can configure the MP related to S1 sensor if S1 sensor i used to close the position loop. Run the motor turning at a speed convenient to record the trace in a clear manner. For example if the sensor used to close the position loop is the motor sensor connected on S1 and the sensor has 1024 periods per turn, to obtain the following trace you must run the motor at +5 rpm
Utilization	Settings Graphic Drives X @0 CH1 Asse_X TP1 MP232 Compensated TP2 MP233 Compensated Recording Stimulus X @0 CH1 Asse_X Common Number of points 1000 [2 + 2048] - Record time = 10000.0 ms Sample time 10.0 [0.1 ms + 6553.5 ms] Step 0.1 ms Delay on recording 0.0 [0.0 ms + 6553.5 ms] Step 0.1 ms Trigger (independent) Event of end recording Test point value > threshold Measurement Point Trigger MP241: Top Mark S2 sensor Threshold 1000.0 Number of points recorded after the event 500 [0 + 999] Send Read settings from drive Save settings Load settings Settings Graphic 10 -8 -6 -4 -2 2 4 6 8 -0.04 -0.03 -0.02 -0.01 0 0.01 0.02 0.03 0.04 0.05 Common Show info Show Legend Cancel traces Show Datapoints Cursor Cursor1 Cursor2 Xa Ya Xb Yb Xa - Xb Ya - Yb Settings X0 Time (s) 0.01 Autoscale Drive V @4 CH1 V_axis ☒ MP243 4000 ☒ MP232 2000 V @4 CH1 V_axis ☐ MP243 4000 ☒ MP233 2000 V @4 CH1 V_axis ☒ MP241 4000 ☐ MP243 4000 X @0 CH1 X_axis ☒ 1 ☒ 1 Load from Save 0% STOP START CNC1 STOP M02 The example refers to S2 sensor. You can configure the MP related to S1 sensor if S1 sensor i used to close the position loop. Run the motor turning at a speed convenient to record the trace in a clear manner. For example if the sensor used to close the position loop is the motor sensor connected on S1 and the sensor has 1024 periods per turn, to obtain the following trace you must run the motor at +5 rpm.

5.17 Brake test management

The brake test function can be used to check if the motor brake could hold or not the axis in a fixed position.

5.17.1 Main points to take into account

- 1) In the drive software the following new parameters have added:

V620	Target Brake-Test current (% V108)
V622	Brake-Test core phase duration [ms] (Time duration of the brake-test core phase, the time during which the drive applies the delta position sent by the CNC and imposed by the user into the PLC function)
V623	Brake-Test position window [CNC Internal Unit – for example microns] (It is the position window in CNC Internal Unit to be compared against, to understand if the motor moves or not during the brake-test. It has to be intended as absolute value, +/- from the starting position.

- 2) The CNC, before to launch the brake test request to the drive, checks if the axes of the channel to which belong the axis under test are in a known position. These compared positions must be written into E90064...E90095 (depending from the axis address) and the value are in CNC Internal Unit, like E900xx. We would be sure that the axis is in a mechanical safe position in case of brake test fault.

Obviously, if before calling the brake test, you put E90064 = E90000 and so on, you can make the test in every position you are in that moment.

- 3) To run the test the drive requires that Torque and Reference enabled must be TRUE otherwise error 3



In case of test not passed the drive will not remove the torque to guarantee the axis position control.
No drive alarm or CNC alarm will be issued.

- 4) To run the test the drive requires that the axis is stopped (zero speed, the drive looks at .RCNC.Axis[x].DigitalAxis.MotorMoving = FALSE bit) otherwise error 4
- 5) To make possible such test it's obvious that the brake must be managed by the drive (V135.0 = 1) otherwise error 5
- 6) In case of axes involved in TANDEM coupling:
- Antibacklash AP03
 - Torque duplication AP04
 - Winding duplication AP05

The PLC function call must be parametrised referring only to the master drive address of the TANDEM.

The CNC, on its own, will send "brake test" command ONLY to the master drive of the TANDEM function: it is a drive job to exchange "brake-ON" and "brake-OFF" command from master drive to slave drive/s. (We assume that all the motors involved in TANDEM coupling are equipped with brake).

In case of TANDEM coupling, because only the master has under control the axis position, in case of test fail it is not possible to identify if the fail raises from one motor or from all.

- 7) In case of GANTRY axes:
the PLC function call must be parametrised referring only to the master drive address of the GANTRY. It is a job of CNC to “duplicate”, contemporaneously, the brake-test on the axes involved in the GANTRY coupling, sending them the same reference.

From the drive point of view, no special treatment is foreseen for GANTRY coupling, because each single drive manages its own axis independently from the other.

In case of test fail different errors number will be sent back to the PLC function to identify if the fail has detected on master or slave axis.

- 8) The PLC variable Flexium.RCNC.Axis[x].DigitalAxis.BrakeTestRunning has been added to show the drive condition.

5.17.2 Application example

5.17.2.1 Drive parametrization:

The default value could be used

V620 = 100 [%]

V622 = 100 [ms]

V623 = 10 [CNC increments]

Motor SHX0751V5F2L00 with V108 = 1.7 [A]

5.17.2.2 PLC Program

The BrakeTest_Ch1 POU of the example is called in a cyclic task priority 5 interval 20ms, the Bus-Cycle has interval 2ms, CNC P50N0 = 2ms, CNC P99N0 = 3

PROGRAM BrakeTest_Ch1

VAR

```
DirPos: LREAL:= 2000; // Delta position to be applied to perform the brake test, if equal 0
                        // the test in such direction will be not executed.
                        // It is not mandatory to write value on both variables, for example
                        // for vertical axis a movement in the direction to move up
                        // the axis is useless, because only adding a torque to the torque
                        // created by the weight of the axis you can have a useful test
                        // of the brake.
DirNeg: LREAL:= -1000; // It is not relevant if a delta position positive is applied to the input
                        // function IrNegAmp or viceversa.
                        // The test will be executed applying the written value. If we assign
                        // to the two input variable IrNegAmp and IrPosAmp the same value
                        // the test will be done twice on the same direction
                        //
BrTest: W_Motor_Brake_Test;
```

END_VAR

// E33000_ is the drive address

// M161 is the M function used to activate the test in such example

IF MF161Ch1 **THEN**

BrTest(CNCAdr:=ADR(Flexium_NCK), byDriveAdd:= E33000_, IrNegAmp:= DirNeg, IrPosAmp:= DirPos);

BrTest.enable:= TRUE;

END_IF

```

IF BrTest.uiReqResult = 0 AND BrTest.uiRespResult = 0 THEN
    BrTest.enable:= FALSE; // Brake test end
IF BrTest.uiRespCode = 0 THEN // If uiRespCode = 0 test OK
    IF BrTest.uiRespStatus = 0 THEN // Otherwise error analysis
        MF161Ch1:= FALSE;
    ELSIF MF161Ch1 THEN

        CASE BrTest.uiRespStatus OF
            1:
                MSG311:= TRUE; // Brake test: Err 1 Channel axes in wrong position for test.
            3:
                MSG313:= TRUE; // Brake test: Err 3 Drive is NOT torque enabled NEITHER reference enabled.
            4:
                MSG314:= TRUE; // Brake test: Err 4 Drive is MOVING (NOT zero speed).
            5:
                MSG315:= TRUE; // Brake test: Err 5 Drive does NOT manage the brake (V135).
            6:
                MSG316:= TRUE; // Brake test: Err 6 Drive software does NOT support the test.
            7:
                MSG317:= TRUE; // Brake test: Err 7 A Drive ALARM occurred during the test or DC bus
                               // missing or Torque disabled.
            8:
                MSG318:= TRUE; // Brake test: Err 8 A Drive ALARM occurred during the test or PWM disabled
                               // by SAFETY functions.
            9:
                MSG319:= TRUE; // Brake test: Err 9 The brake test target current has NOT been reached.
            10:
                MSG320:= TRUE; // Brake test: Err 10 Movement detected immediately after torque limitation.
            11:
                MSG321:= TRUE; // Brake test: Err 11 Movement detected immediately after CNC displacement
                               // command.
            12:
                MSG322:= TRUE; // Brake test: Err 12 Movement detected while waiting for CNC command
                               // brake-test removal.
            13:
                MSG323:= TRUE; // Brake test: Err 13 Delta Position value in PLC function call is NULL.
            14:
                MSG324:= TRUE; // Brake test: Err 14 Time out.
            103:
                MSG353:= TRUE; // Brake test: Err 103 Slave gantry axis is NOT torque enabled NEITHER
                               // reference enabled.
            104:
                MSG354:= TRUE; // Brake test: Err 104 Slave gantry axis is MOVING (NOT zero speed).
            105:
                MSG355:= TRUE; // Brake test: Err 105 Slave gantry axis does NOT manage the brake (V135).
            106:
                MSG356:= TRUE; // Brake test: Err 106 Slave gantry axis software does NOT support the test.
            107:
                MSG357:= TRUE; // Brake test: Err 107 Slave gantry axis ALARM occurred during the test or DC
                               // bus missing or Torque disabled.
            108:

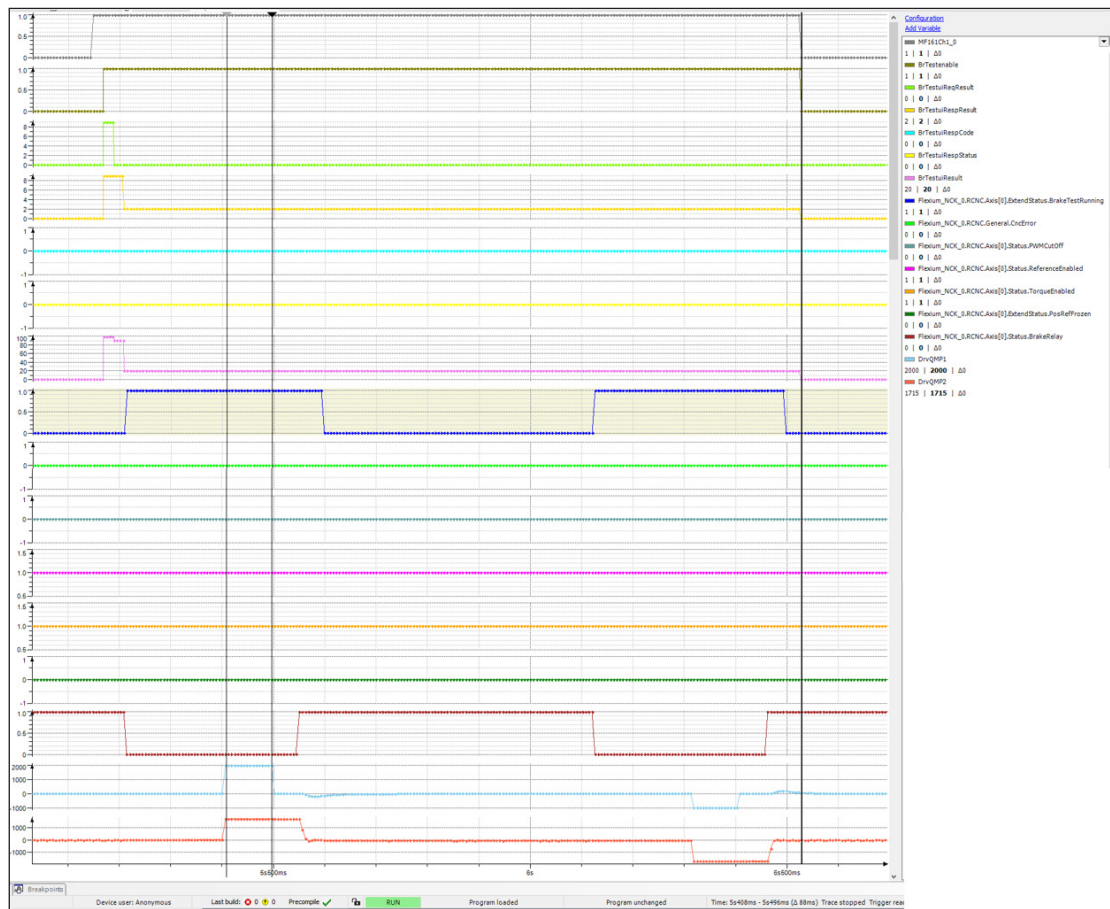
```

```

MSG358:= TRUE; // Brake test: Err 108 Slave gantry axis ALARM occurred during the test or
// PWM disabled by SAFETY functions.
109:
MSG359:= TRUE; // Brake test: Err 109 The brake test target current has NOT been reached on
// slave gantry axis.
110:
MSG360:= TRUE; // Brake test: Err 110 Movement detected immediately after torque limita-
tion // on slave gantry axis.
111:
MSG361:= TRUE; // Brake test: Err 111 Movement detected immediately after CNC
// displacement command on slave gantry axis.
112:
MSG362:= TRUE; // Brake test: Err 112 Movement detected while waiting for CNC command
// brake-test removal on slave gantry axis.
170:
MSG370:= TRUE; // Brake test: Err 170 Drive unknown address
END_CASE
END_IF
ELSIF MF161Ch1 THEN
CASE BrTest.uiRespCode OF
1:
MSG301:= TRUE; // Brake test: Answer message incomplete
2:
MSG302:= TRUE; // Brake test: No option in licence file
END_CASE
END_IF
MF161Ch1:= FALSE;
END_IF
IF ClrMsg THEN
MSG301:= MSG302:= FALSE;
MSG311:= MSG313:= MSG314:= MSG315:= MSG316:= MSG317:= MSG318:= MSG319:= FALSE;
MSG320:= MSG321:= MSG322:= MSG323:= MSG324:= FALSE;
MSG353:= MSG354:= MSG355:= MSG356:= MSG357:= MSG358:= MSG359:= MSG360:= MSG361:= MSG362:=
FALSE;
MSG370:= FALSE;
END_IF
// The following instruction are not relevant for the test. They have been defined only to make easier the link
//to the PLC oscilloscope traces.
BrTestONCh1:= Flexium_NCK.RCNC.Axis[E33000_].DigitalAxis.BrakeTestRunning;
BrTestuiReqResultCh1:= BrTest.uiReqResult;
BrTestuiRespResultCh1:= BrTest.uiRespResult;
BrTestuiRespCodeCh1:= BrTest.uiRespCode;
BrTestuiRespStatusCh1:= BrTest.uiRespStatus;
BrTestuiResultCh1:= BrTest.uiResult;
BrTestenableCh1:= BrTest.enable;

```

5.17.2.3 BrakeTest OK

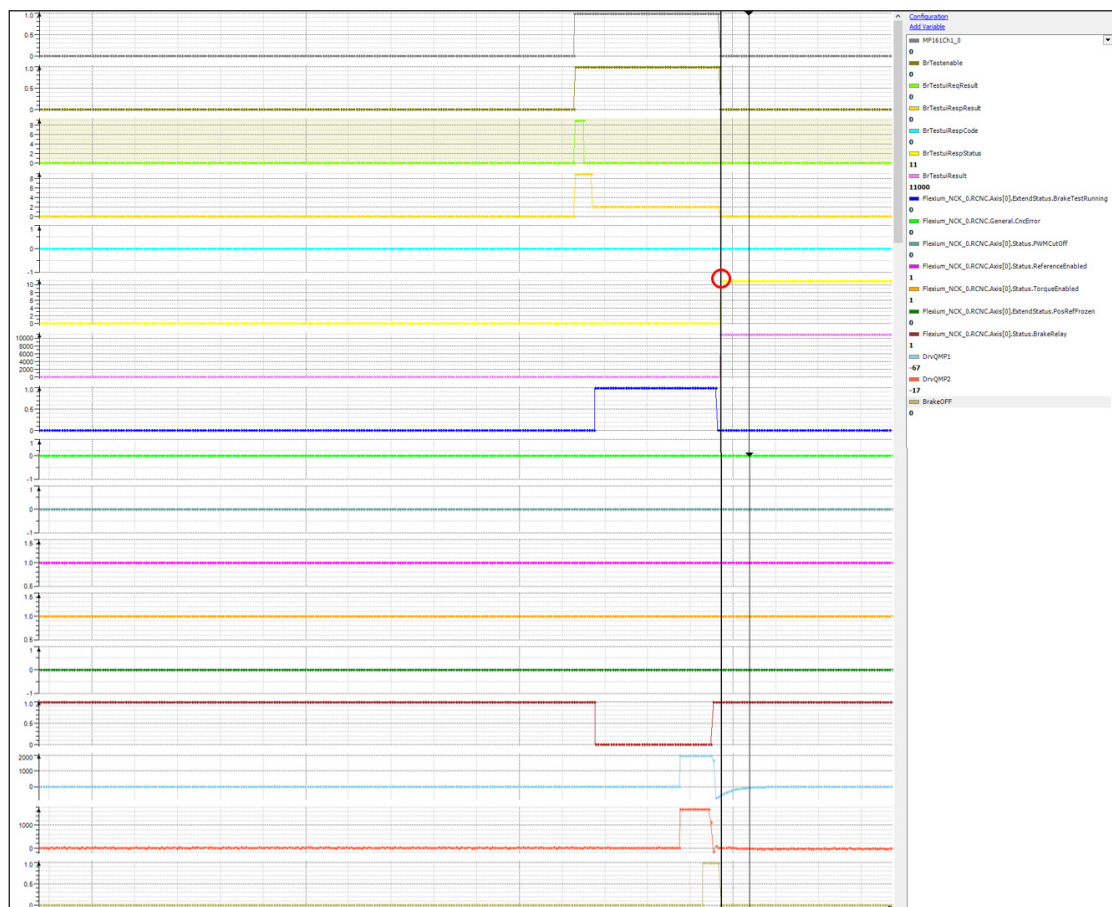


Applied delta position = +2000 and -1000 as for DrvQMP1 trace from drive MP211 (Reference in CNC Internal Unit) and brake test duration V622 = 100 ms.

DrvQMP2 trace from drive MP2 (Iq current reference) and is represented in mA.

Interval delay between the two tests into the opposite directions about 500 ms. See ...[DigitalAxis.BrakeRelay](#)

5.17.2.4 BrakeTest KO



To create the error the motor brake has been energized during the test, with V135.2 = 1 to avoid alarm 54.

The test detects error 11, see  BrTestuiRespStatus trace.

5.18 Low frequency mechanical vibrations damping

Due to unavoidable elasticity of the mechanic of a machine, it is possible that axes movements excitate mechanical resonances, causing low frequency vibrations of the machine, and, ultimately, yielding poor quality of the machining.

NUM DrivePro provides two advanced special applications to damp low frequency mechanical vibration:

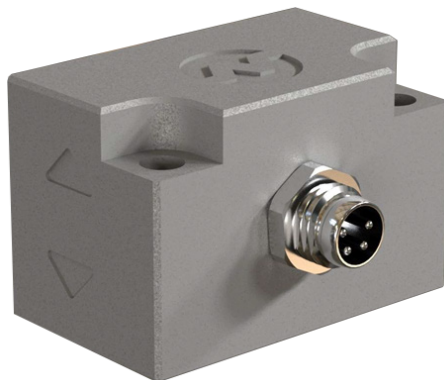
- AP11 active damping by Accelerometer S3;
- AP12 active damping by Direct measure sensor S2.

Both algorithms are “active”: they are based on real measurement of vibrations, and actively re-inject proper feedback to axis control loop.

It is not possible to activate both special applications at the same time.

NUM vibration detector VDX1002A00AC000 can be used as accelerometer sensor S3.

Technical Data	VDX1002A00AC000
Acceleration range	±2g
Direction of measurement	mono-axis, normal to mounting plane
Max measurable frequency	2 kHz
Output signal type	analogue (differential) 1 Vpp
Max output	60% of 1 Vpp at 2g
Power supply input	8÷15V
Working temperature range	0-85 °C
Storage temperature range	0÷100°C
Case material	Aluminium
Weight	~55g
Mounting	2 screws M4x30 ISO4762 (DIN912)
Protection degree	IP67 (with plugged female connector)



VDX1002A00AC000



AEOCON016
Accelerometer cable connector (optional)

AP11 active damping by Accelerometer S3

It detects vibrations by mean of Accelerometer sensor S3.

this application is enabled via parameter V160 bit 10, and needs proper configuration of following parameters:

- V630: Sensor S3 (accelerometer) connector assignment
- V631: S3 sensor power supply voltage (P5..P8)
- V632: S3 sensor initialization configuration
- V633: Accelerometer full scale range
- V634: Accelerometer displacement per motor revolution (only for rotary motors)

The tuning of the application, to remove low frequency mechanical vibration, is done via parameter

- V640: AP11: Active damping by S3 Accelerometer K1

AP11 will be effective if the following conditions will be satisfied:

- vibration frequency in the range from 1 Hz to 20 Hz;

the mechanical resonance must be located beyond the ultimate position measuring point;

- the closed position loop must be stable even without AP11.

Before activating AP11, the parameter V632 (initial configuration) has to be set in order to have:

- D.C. removal active;
- the sign reversal bit properly configured in order to have positive acceleration whenever the axis speed is positive.

Also parameters V633 (accelerometer full range scale) and V634 (accelerometer displacement per motor revolution), in case of rotary motors, have to set properly.

In order to see the acceleration measured by S3 accelerometer sensor, and to check correct configuration of the accelerometer, then the following measure points are useful:

- MP290 : S3 Sensor cosine;
- MP291 : S3 Sensor sine;
- MP292 : S3 Sensor Acceleration.

Once all involved parameter have been properly set, V160 can be used to activate AP11 active damping application, then it is sufficient to increase gradually parameter V640 (AP11: Active damping by S3 Accelerometer K1) until the vibrations are sufficiently reduced.

1

2

3

4

5

6

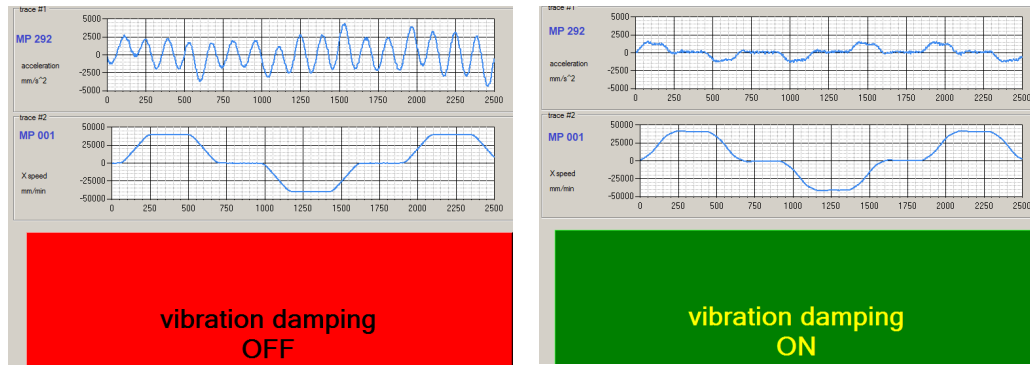
7

8

Other useful measure points are:

- MP23 : Speed reference after act. damping addition;
- MP25 : AP11: Speed ref comp. by act. damping by S3.

Here follows an example of an X axis moving back and forth, showing vibrations detected by accelerometer, then, after AP11 proper setting and activation, the X axis vibrations are completely removed:



AP12 : active damping by Direct measure sensor S2

Such application can be used if and only if we have two position sensors available for the axis:

- motor sensor S1
- direct measure sensor S2 used to close position loop.

AP12 will be effective if the following conditions will be satisfied:

- vibration frequency in the range from 1 Hz to 20 Hz;
- the mechanical resonance is located between motor sensor S1 and direct measure sensor S2.

This application is enabled via parameter V160 bit 11

Before activating AP12, it is necessary to guarantee that both speed, computed by motor sensor S1 (MP1) and direct measure position sensor S2 (MP20) be identical !!!:

- same direction (signum);
- same magnitude (value).

In order to guarantee that, we need to properly set/clear the following parameters:

- V220 bit 4 : Reversal of speed reference [1=Rev];
- V325 bit 1 : Reversal measure for position loop [1=Rev];
- in case of rotary motor, also the parameter V353 : Period of position sensor/motor turn.

BE CAREFUL: erroneous setting of above cited parameters can cause motor “run-away” as soon as AP12 is enabled !!!

AP12 exploits the difference between speed coming from motor sensor (S1) and speed coming from direct measure sensor (S2), slowing/accelerating the motor in order to obtain an as much constant as possible load speed.

The tuning of the application, to remove low frequency mechanical vibration, is done via parameter

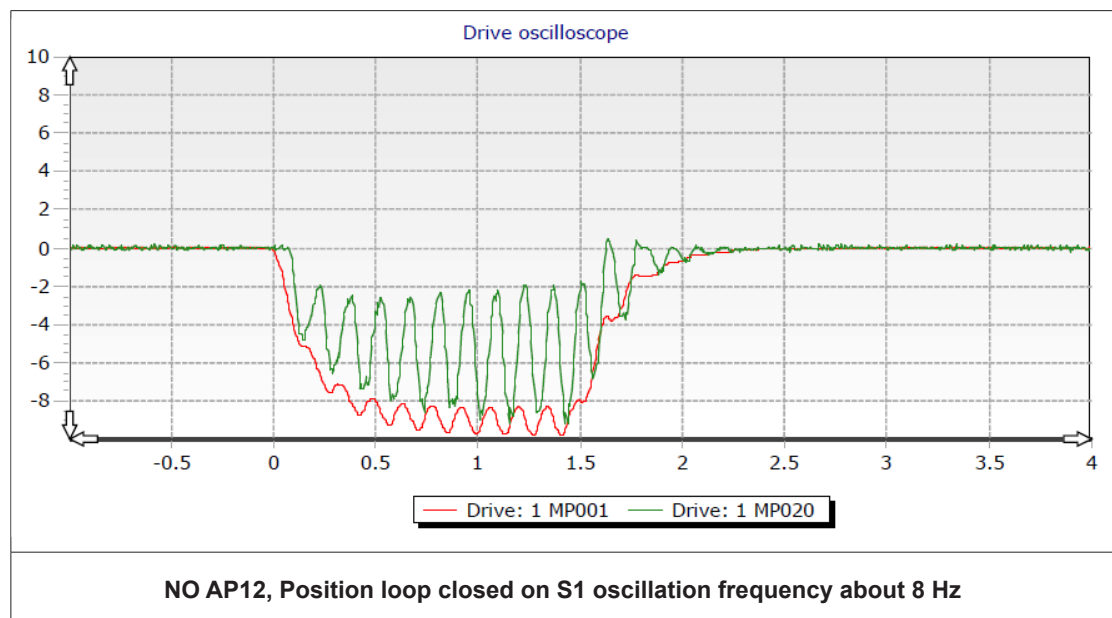
- V217 : AP12: Active damping by S2 K1;
- V218 : AP12: Active damping by S2 filter.

Useful measure points are the followings:

- MP22 : AP12: Speed ref comp. by act. damping by S2;
- MP23 : Speed reference after act. damping addition;
- MP24 : Speed difference ($V_{mot} - V_{load}$).

In order to tune the application, to remove mechanical vibrations due to resonances, the user has to operate as follows:

- after having properly parametrized direct measure sensor (S2) and parameters V220.4 , V325.1, V353, and after having closed position loop on moto sensor (S1), then we display both speeds motor (MP1) and load (MP20) speeds , and try to estimate the frequency of oscillation.

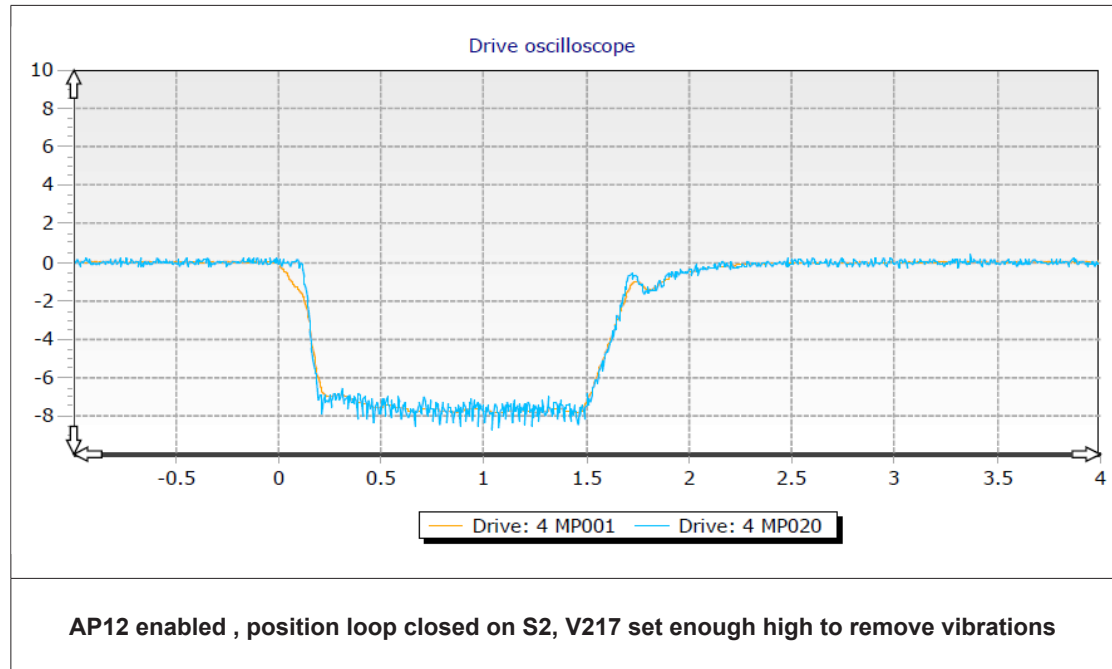


NO AP12, Position loop closed on S1
oscillation frequency about 8 Hz

- then we close position loop on S2, and we activate AP12 setting it at its minimal value:
 - V218 AP12: Active damping by S2 filter [Hz] = 8 Hz (..from previous estimation...)
 - V217 AP12: Active damping by S2 K1 = 0.1(...minimal value...)
...obviously, with such minimal activation we don't expect big effects...
- move the axis back and forth, and, if all is OK...:
 - no alarms,
 - no motor run-away
 - the axis moves showing vibrations of position...

Then we can start increase active damping coefficient V217 gradually...

- increase gradually V217 up to reach a sufficient reduction (or elimination) of the vibrations movement:



AP12 enabled , position loop closed on S2, V217 set enough high to remove vibrations

- eventually we can try to increase V301, to improve axis control performances, as far as we have no vibrations.

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6 Diagnostic signalling and software alarms

6.1 Meaning of LED signalling in NUMDrivePRO (MDLUF)

6.1.1 introduction

MDLUF is equipped with 2 LEDs : a green one and a red one.

Both LEDS are devoted to EtherCAT status signalling ONLY !

NO led is devoted to any axis state, due to the following reasons:

a single MDLUF drive may contain up to four (4) axes, ...for which a single led is NOT enough...

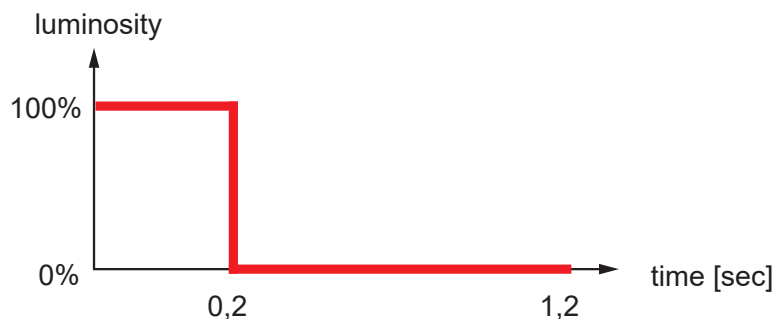
info about axis state can be collected via EtherCAT communication

so it is much more important to get info about EtherCAT communication status and the reasons of its possible malfunctions.

Obviously the GREEN led must indicates also the presence of power supply... in addition to EtherCAT status... so it is used also to indicate the initial "power-up" state of the whole drive.

RED led is used during the initial drive "power-up" phase and also to indicate an EtherCAT communication ERROR condition.

From now on, the behaviour of the led will be indicated by a graph showing luminosity vs. time, for example. for a particular case of RED led:



in this examples it is shown a RED led blinking periodically, with period = 1,2 sec:

RED led is ON for 0,2 sec

then it is OFF for 1 sec

the cycles repeat itself every 1,2 sec.

6.1.2 MDLUF start-up sequence

Here is described the sequence of states that MDLUF pass through after switch-ON:

NUM DrivePro status	description	GREEN led	RED led
BOOT	NUM DrivePro is switched ON and the BOOT loading is in execution	OFF	OFF
BOOT ERR	...in case of BOOT ERROR, then, NUM DrivePro remains "stuck" here forever...	OFF	OFF
INIT core#0	BOOT ended successfully, core#0 is started: - POWER module EEprom is read - ECAT EEprom is configured accordingly - FPGA μ P is started	ON	ON
INIT core#0 ERR	The drive tries anyway to continue...	OFF	ON
INIT core#1	INIT core#0 is successful, then core#1 is started	ON	OFF
INIT core#1 ERR	NUM DrivePro remains stuck" here forever...	OFF	ON
WAIT for ECAT communication	INIT core#1 ended successfully, then NUM DrivePro is waiting for DISC ET communication with RTK to be started...	SMOOTHLY varying pattern	OFF
ECAT INIT	DISC ET communication started	OFF	OFF
ECAT PRE-OP	DISC ET PRE-operational state	BLINKing	OFF
ECAT SAFE-OP	DISC ET SAFE-operational state, Acyclic communication works (FoE)	SINGLE flash	OFF
ECAT OPERATIONAL	DISC ET OPERATIONAL state, Cyclic communication is working	FLICKERing	OFF
ECAT OPERATIONAL + ANY AXIS IN FAULT	EtherCAT OPERATIONAL state, Cyclic communication is working BUT there is at least one axis that is in FAULT state the FAULT is indicate by proper ALARM + EXTension.	FLICKERing	ON
ECAT SYNChro ERR	case of DISC ET DC synchronization error	...see ECAT state...	SINGLE flash
ECAT watchdog ERR	case of DISC ET watchdog expiration errpr	...see ECAT state...	DOUBLE flash
ECAT other ERR	case of any other DISC ET error condition	...see ECAT state...	BLINKing

...it follows the description of led behaviour in case of SINGLE and DOUBLE flashes, FLICKering and SMOOTHLY varying pattern...

6.1.3 Graphs of LED behaviour

behaviour	graph luminosity vs. time
SMOOTHLY varying pattern (periodical period = 0,5 sec)	
SINGLE flash (periodical period = 1,2 sec)	
DOUBLE flash (periodical period = 1,6 sec)	
BLINKing (periodical period = 0,4 sec)	
FLICKering (NOT periodic, very fast...)	

6.2 Alarm signalling

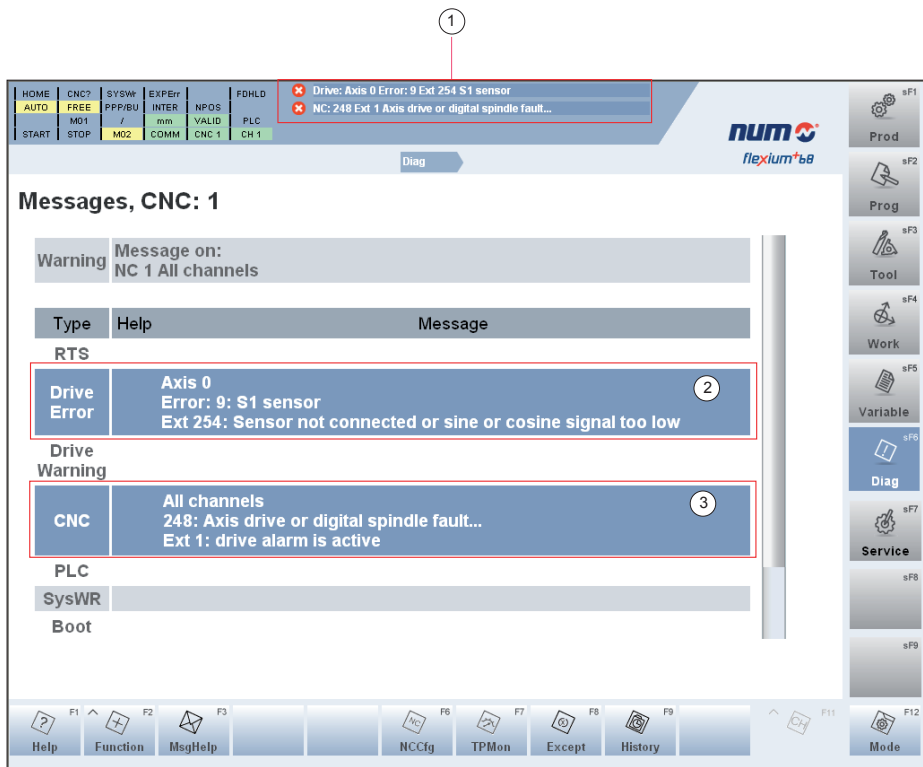
By means of Flexium+ HMI page is possible to control in real time the drive status and the all drive devices information.

If a fault occurs which causes an alarm to operate, the drive's red fault Led illuminates, and the alarm is displayed on Flexium+ HMI page (1). Moreover for any alarms additional information relating to the alarm extension is available (2) and some warning informations).

(Please refer to "Drive alarms extension" and "Drive warnings" on chapter 6.6, chapter 6.7)

For example, if we consider an alarm generated by "S1 Sensor Alarm (A9)", by programming and enabling the above-mentioned parameters in an appropriate way, it is possible to stop the motor by inertia or with braking, with or without tripping of the line remote switch, just as it is possible, if previously programmed, to reset the alarm memorized.

6.2.1 Alarm signalling by Flexium+ HMI



- Alarm signalling by Flexium+ HMI

①	General drive alarm display
②	Drive alarm with detailed alarm extension message "Ext 254: "Sensor not connected or sine or cosine signal too low"
③	CNC alarm with detailed alarm extension message "Ext 1: "drive alarm is active"



For more detailed information upon the CNC alarms and alarms extensions please consult the Flexium+ Programming manual M00040.

6.3 Alarms configuration

A series of parameters configured according to specific needs make it possible to manage the drive at all times, even in the event of an alarm.

For example, if we consider an alarm 3 generated by “Motor overtemperature” by programming and enabling the above-mentioned parameters in an appropriate way, it is possible to stop the motor by inertia or with braking, with or without opening of the mains contactor, just as it is possible, if previously programmed to reset the alarm memorized from CNC unit .

The drive alarms configuration are setted by means **V32**, **V33**, **V34** parameter and are divided in two different categories:

Parameters		Alarm configuration
V32	NC =	Motor stop not configurable (motor stop by inertia only)
	C =	Motor stop configurable by inertia or by braking.
V33	NC =	To reset the alarm, it is mandatory to turn OFF power and auxiliary supply (Not configurable)
	C =	The alarm reset mode may be configured by means of CNC (Configurable).
V34	NC =	Opening of contact DF1 / DF2 (1) for mains contactor command is not possible.
	C =	Opening of contact DF1 / DF2 for mains contactor command is configurable.
(1) See MDLL2 and MDLL3 power supply		



See the general drive / alarms configuration table in the next page.
The alarm 53 “Self-test Hardware alarm” is not configurable alarm, therefore is mandatory turn OFF the system.

6.3.1

General NUM DrivePro alarms / securities configuration

Alarms description		Alarms / securities configuration		
Alarm Number	Description	V32 (Braking config.)	V33 (Reset config.)	V34 (Relay config.)
2	BUS overvoltage	NC	NC	C
3	Motor overtemperature	C	C	C
4	Drive overtemperature	C	C	C
5	Braking Resistor or PWS overtemperature	NC	C	C
6	Short-circuit to earth	NC	C	C
7	Drive internal voltage	NC	C	C
8	Local link	C	C	C
9	S1 Sensor	C	C	C
10	Timeout	NC	C	C
11	Overspeed	C	C	C
12	Drive overcurrent	NC	C	C
13	NC synchronization	C	NC :always resettable	C
14	Wrong SD card handling	NC	C	NC
15	Data handling error, SD card corrupted	NC	NC	C
16	Incompatible parameters	NC	C	C
18	Self-calibration	C	C	C
37	Following error	C	C	C
38	S2 Sensor	C	C	C
49	I ² t	C	C	C
51	Congruence position S1-S2 sensors	C	C	C
52	Anti-backlash function	C	C	C
53	Self-test Hardware	NC	NC	NC
54	Brake failure	NC	C	NC
56	V/f regulation	NC	C	NC
57	Power Supply class 0	C	C	NC
58	Power Supply class 1	NC	C	NC
59	Link Power Supply	NC	C	NC
60	Safety Module class 0	NC	C	NC
61	Safety Module class 1	C	C	NC
62	Safety Module class 2	C	C	NC
63	Safety Module class 3	NC	C	NC
64	Safety Module class 4	NC	C	NC
70	Torque duplication function	C	C	C
71	Winding duplication function	C	C	C
80	DEMF Drive Embedded Macro function	NC	C	NC

6.4 Alarms reset procedure

Alarms reset procedure	
From CNC unit (C alarms)	- Check the type of alarm signalled by consulting the alarm tables. - Disable the drive torque. - Eliminate the cause if possible (see chapter 6.6). - Reset the alarm by means the CNC (See CNC unit instruction manual). If the cause of the alarm has been removed, the red fault led will go out, otherwise the previous alarm fault will reappear.
Hardware reset of the not configurable alarm (NC alarms)	Switch off the mains 3 phases and auxiliary power supply. Eliminate the cause if possible (see chapter 6.6). Switch on the mains 3 phases and auxiliary power supply.

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6.5 Alarms and alarms extensions signalling

Alarm 2 BUS overvoltage

DC BUS voltage higher than the allowed value (No resettable: the system has to be switched OFF).	
Possible cause	Possible remedy
Wrong operation of internal or external braking resistor. Mains voltage too high Peak of power braking not enough.	Check connection and functioning of the internal/ external braking resistor. Check the mains voltage. Check the dimensioning time.
Alarm 2 extension	
0	Overvoltage from PWS signal
1	Overvoltage BUS voltage image

Alarm 3 Motor overtemperature

The motor temperature is higher than the maximum allowed (No measures lost). This alarm could be excluded by setting the parameter bit V30.27	
Possible cause	Possible remedy
The motor has worked in overchase status for too long and the thermal switch has operated. The thermal switch wiring is not connected present or is incorrect.	Check the working thermal cycle of the motor. Check the connector thermal switch wiring and the continuity of the thermal switch connections cable.
Alarm 3 extension	
0	Motor overtemperature. The allowable max value is putted into the V270 parameter that contain the value, in Ohm, of the resistance of the thermal probe after that the alarm will go out. Check the technical data sheets of the thermal probe for to find the relation between ohmic resistance and motor temperature. This extension is applicable to both PTC and NTC thermal probes. The resistance of the thermal probe PTC is bigger then V270 value. The resistance of the thermal probe NTC is lower then V270 value.
1	NTC thermal probe not wired. This alarm is issued when an NTC thermal probe is used and it is not wired or it is wrong wired. The resistance of the thermal probe NTC is bigger than 100kOhm. This alarm is issued only if the parameter bit V272.2 is set.

Alarm 4 Drive overtemperature

The temperature of the heat-sink power module is higher than the maximum allowed (about 90°C). (No measures lost). This alarm could be delayed with respect to the related Warning signal of 5s by setting the parameter bit V30.25.	
Possible cause	Possible remedy
The internal temperature of the electric box or the environment temperature is too high (> 45°C). Incorrect system dimensioning. The force ventilation fan does not turn.	Address to the machine manufacturer to check the correct thermal exchange. Check the dimensioning of the drives and electrical cabinet system. Inform NUM Technical Assistance.
Alarm 4 extension	
0	Heat sink thermal sensor overtemperature
1	Drive Zynq processor temperature overtemperature exceeded

Alarm 5 Braking Resistor or PWS overtemperature

The temperature of the braking resistor or of the heat sink's power supply module is higher than the maximum allowed. This alarm signal is issued by Power Supply MDLLx. The PWS alarms linked are: A900, A903. (No measures lost) This alarm could be delayed with respect to the related Warning signal of 5s by setting the parameter bit V30.25.	
Possible cause	Possible remedy
The working cycle is characterized with very close accelerations/decelerations and the external braking resistor has reached a too high temperature. See PWS alarms A900, A903 on manual M00067.	Use a less heavy working cycle by increasing the time between the accelerations or by increasing the braking resistor power. Check the correct thermal heat exchange inside the enclosure the electrical cabinet.
Alarm 5 extension	
-	This alarm doesn't have extensions.

Alarm 6 Short-circuit to earth

Short circuit to the ground of the power section. This alarm signal is issued by Power Supply MDLLx. The PWS alarms linked are: A905, A906. This alarm can be excluded setting the bit parameter V30.10.	
Possible cause	Possible remedy
DC BUS ground leakage. Drive Power Supply. See PWS alarms A905, A906 on manual M00067.	Check the motor cable/ cables and drive ground leakage. Change Drive Power Supply (MDLLx) that could be damaged.
Alarm 6 extension	
-	This alarm doesn't have extensions.

Alarm 7 Drive internal voltage

The auxiliary voltage is not available.

Due to the fact that the auxiliary voltage could be not available, **this alarm is not memorized in the drive alarms buffer in Flash memory.**

The memorization in that condition could be not correct and it cans damage the complete alarms buffer.

Possible cause	Possible remedy
One or more of the drive internal voltage inside the drive is not available	Inform NUM Technical Assistance.
Alarm 7 extension	
0	+15V drive internal voltage missing. This alarm is issued whenever +15V internal voltage is missing. Such internal voltage is used to power the AD conversion circuitry of sensors and BUS voltage; furthermore it is used to supply power to the sensor itself.
1	-15V drive internal voltage missing. This alarm is issued whenever -15V internal voltage is missing. Such internal voltage is used to power the AD conversion circuitry of sensors and BUS voltage; furthermore it is used to supply power to the sensor itself.
5	Unable to give power supply to S1 sensor on P5 connector
6	Unable to give power supply to S1 sensor on P6 connector
7	Unable to give power supply to S1 sensor on P7 connector
8	Unable to give power supply to S1 sensor on P8 connector
15	Unable to give power supply to S2 sensor on P5 connector
16	Unable to give power supply to S2 sensor on P6 connector
17	Unable to give power supply to S2 sensor on P7 connector
18	Unable to give power supply to S2 sensor on P8 connector
25	Unable to give power supply to S3 sensor on P5 connector
26	Unable to give power supply to S3 sensor on P6 connector
27	Unable to give power supply to S3 sensor on P7 connector
28	Unable to give power supply to S3 sensor on P8 connector
30	Drive Zynq processor voltage VCCINT out of range
31	Drive Zynq processor voltage VCCAUX out of range
32	Drive Zynq processor voltage VCCBRAM out of range
33	Drive Zynq processor voltage VCCPINT out of range
34	Drive Zynq processor voltage VCCPAUX out of range
35	Drive Zynq processor voltage VCCPDRO out of range

Alarm 8 Local link

This alarm is due to fault on the serial link between MDLUF drives.	
Possible cause	Possible remedy
-	-
Alarm 8 extension	
9	NO synchronization with CNC.
10	P7 communication CRC error in message received from master
11	P7 communication CRC error in message received from slave 1
12	P7 communication CRC error in message received from slave 2
13	P7 communication CRC error in message received from slave 3
20	P7 communication PACKET lost in message received from master
21	P7 communication PACKET lost in message received from slave 1
22	P7 communication PACKET lost in message received from slave 2
23	P7 communication PACKET lost in message received from slave 3
30	P8 communication CRC error in message received from master
31	P8 communication CRC error in message received from slave 1
32	P8 communication CRC error in message received from slave 2
33	P8 communication CRC error in message received from slave 3
40	P8 communication PACKET lost in message received from master
41	P8 communication PACKET lost in message received from slave 1
42	P8 communication PACKET lost in message received from slave 2
43	P8 communication PACKET lost in message received from slave 3

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Alarm 9 S1 Sensor

This alarm is related to the S1 sensor.	
Possible cause	Possible remedy
Wrong connection of one or more sensors, sensor damage or fault sensor.	Check the sensor connections on the connector.
Alarm 9 extension	
1	Stegmann: analogue signal outside specification
2	Stegmann: wrong internal angle offset
3	Stegmann: data field partition destroyed
4	Stegmann: analogue limit not available
5	Stegmann: internal I2C not working
6	Stegmann: internal checksum error
7	Stegmann: sensor reset by program monitoring
8	Stegmann: counter overflow
9	Stegmann: parity error
10	Stegmann: wrong checksum of transmitted data
11	Stegmann: command unknown
12	Stegmann: number of transmitted data wrong
13	Stegmann: transmitted command not allowed
14	Stegmann: data can't be written to selected data field
15	Stegmann: wrong access code
16	Stegmann: size of data fields can't be changed
17	Stegmann: specified word address is outside data field
18	Stegmann: access to non-existent data field
28	Stegmann: monitoring the magnitude of analogue signals
29	Stegmann: critical sensor current (contamination, transmitter breakdown)
30	Stegmann: critical sensor temperature
31	Stegmann: speed too high, position acquisition impossible
32	Stegmann: position of single-turn not allowed
33	Stegmann: position error multi-turn, 1
34	Stegmann: position error multi-turn, 2
35	Stegmann: position error multi-turn, 3
40	Stegmann: error building absolute position (linear system)
50	Endat: absolute position error
51	Endat: lighting
52	Endat: signal amplitude
53	Endat: position error
54	Endat: supply voltage too high
55	Endat: supply voltage too low
56	Endat: current too high
57	Endat: battery failure
60	Endat 22 2nd Safety bit: absolute position error
61	Endat 22 2nd Safety bit: lighting
62	Endat 22 2nd Safety bit: signal amplitude
63	Endat 22 2nd Safety bit: position error
64	Endat 22 2nd Safety bit: supply voltage too high
65	Endat 22 2nd Safety bit: supply voltage too low
66	Endat 22 2nd Safety bit: current too high
67	Endat 22 2nd Safety bit: battery failure

100	Hiperface DSL: NO link established
101	Hiperface DSL: bad link quality
102	Hiperface DSL: persistent error on incremental position
103	Hiperface DSL: persistent error on absolute position
104	Hiperface DSL: persistent error on initialization
105	Hiperface DSL: persistent error on monitoring
106	Hiperface DSL: persistent error on resource access
107	Hiperface DSL: unable to remove all files from sensor memory
108	Hiperface DSL: communication error reading temperature
109	Hiperface DSL: communication link lost
110	Hiperface DSL incremental position: protocol reset
111	Hiperface DSL incremental position: acceleration overflow
112	Hiperface DSL incremental position: test in progress
114	Hiperface DSL incremental position: tracking filter error
115	Hiperface DSL incremental position: vector length error
116	Hiperface DSL incremental position: counter error
117	Hiperface DSL incremental position: synchronisation error
120	Hiperface DSL monitoring: critical temperature
121	Hiperface DSL monitoring: critical led current
122	Hiperface DSL monitoring: critical supply voltage
123	Hiperface DSL monitoring: critical speed
124	Hiperface DSL monitoring: critical acceleration
125	Hiperface DSL monitoring: counter overflow
126	Hiperface DSL monitoring: internal error
130	Hiperface DSL short msg error: timeout waiting for start tx
131	Hiperface DSL short msg error: timeout waiting for acknowledge
140	Hiperface DSL long msg error: timeout waiting for start tx
141	Hiperface DSL long msg error: timeout waiting for acknowledge
142	Hiperface DSL resource address not implemented in the sensor
143	Hiperface DSL wrong length indicated for resource access
144	Hiperface DSL wrong length indicated for direct resource access
145	Hiperface DSL offset address too high
146	Hiperface DSL invalid offset address
147	Hiperface DSL invalid long msg qualifier
148	Hiperface DSL missing offset value
149	Hiperface DSL write access not possible
150	Hiperface DSL read access not possible
151	Hiperface DSL write access denied
152	Hiperface DSL read access denied
153	Hiperface DSL write access for direct resource access denied
154	Hiperface DSL resource database entry corrupt
155	Hiperface DSL timeout during resource access
156	Hiperface DSL internal processing error during resource access
157	Hiperface DSL file name not found
158	Hiperface DSL invalid address for file access
159	Hiperface DSL file not erasable
160	Hiperface DSL file storage space full
161	Hiperface DSL file allocation table corrupt
162	Hiperface DSL no file loaded for action
163	Hiperface DSL file with same name exists

200	HOMING with coded references: The distance measured between two references is higher than the value present in the V368 parameter.
201	HOMING with coded references: The first zero reference position was detected in a wrong position (not multiple of 4).
202	HOMING with coded references: The second zero reference position was detected in a wrong position (not multiple of 4).
203	HOMING with coded references: The distance between two references is not divisible by multiplier (V369).
210	Sensor NOT compatible with Enhanced performance MDLUF drive (V322)
230	Sensor: repeated pulse counter UGA misalignments. It is possible to exclude the alarm setting V328.4 = 1
231	Sensor: excess of movement detected while waiting for UGA alignment. The axis has done an uncontrolled movement during the analogue & sensor position components alignment phase. It is possible to exclude the alarm setting V328.5 = 1
234	APEM on BUTEE NOT possible (see V330.4)
235	Homing on BUTEE requires butee used on EDGE (see V324.6 V324.8 V330.4)
236	EPSM with phase offset switching NOT allowed if NOT EPS active (see V273.7)
237	Homing switch required but related digital input NOT configured (see V324.6, V22...V25)
238	Wrong setup sensor MODE_SINCOS RS485 It is issued by a wrong set up of MODE_SINCOS RS485 sensor
239	Wrong setup sensor Baud Rate RS485 It is issued by a wrong set up Baud Rate RS485 sensor.
240	Wrong data field format Stegmann sensor: no data field defined It is issued by a wrong data field format Stegmann sensor: No data fields defined ! No data field necessary to manage an Hiperface NUM sensor.
241	Wrong init. timeout sensor position. No digital communication with the sensor It is issued by a wrong initialization timeout sensor position. No digital communication with the sensor Possible special cause: Wrong power supply connection. Possible remedy: Check sensor connections on the connector. Verify the amplitude of sine and cosine signals using MP202 and MP203, if they are both simultaneously around zero could be a power supply problem. MP238 must be around 100% if power supply is good.
242	Wrong data field format for NUM Stegmann sensor It is issued by a wrong data field format for NUM Stegmann sensor.
246	UGA alarms exclusion V328 bits 4,5 not allowed if fine alignment of digital and analog pos. active.
247	Fine alignment of digital and analog pos. not allowed for this sensor.
248	Sensor signals sine or cosine saturated. It is possible to exclude the alarm setting V328.0 = 1 or V328.3 = 1.
250	Phase offset not present in the sensor
251	Checksum error in the sensor EEPROM memory datafield#0
252	Checksum error in the sensor EEPROM memory datafield#1
253	Sensor different from the configured one. This alarm extension is issued when a Stegmann sensor has the sensor code ID declared in the V344 parameter not coherent. See the MP318 to know the value into the sensor.
254	Sensor no connected or sine or cosine signal too low. Check the sensor wiring and if it will be ok, set the right value in the V314 parameter. It is possible to exclude the alarm setting V328.3 = 1
255	Fault in the sensor communication. The drive cannot communicate with the sensor through the digital interface during the initialization phase. It is possible that the sensor is badly connected or the wiring is wrong. Possible special cause: Wrong power supply connection. Possible remedy: Check sensor connections on the connector. Verify the amplitude of sine and cosine signals using MP202 and MP203, if they are both simultaneously around zero could be a power supply problem. MP238 must be around 100% if power supply is good.

256	Absolute position half-travel displacement is not allowed for EnDat linear sensor
257	Error on absolute position communication during initialization.
258	Fast serial sensor missing data. The drive does not communicate correctly with the sensor through the digital interface. It is possible that the sensor is badly connected or the wiring is wrong.
259	Fast serial sensor CRC error. The drive does not communicate correctly with the sensor through the digital interface. It is possible that the sensor or the wiring electromagnetic shield is badly connected. It is possible to exclude the alarm setting V328.2 = 1
260	Sensor TTL signals saturated. It is possible to exclude the alarm setting V328.0 = 1 or V328.3 = 1.
261	Sensor not connected or TTL signals too low. Check the sensor wiring and if it will be ok, set the right value in the V314 parameter. It is possible to exclude the alarm setting V328.3 = 1
262	Sensor type linear or rotary mismatch (V324.0). Check sensor type connection. It is possible that the sensor is not correctly declared.
263	Sensor type reference mark mismatch (V330.3). Check sensor type connection. It is possible that the sensor is not correctly declared.
264	Sensor type backup battery mismatch (V324.5) Check sensor type connection. It is possible that the sensor is not correctly declared.
265	Wrong serial protocol position datum bit size (V389) It is possible that the sensor features are not correctly declared. See the MP318 to know the value into the sensor.
266	Sensor absolute homing type mismatch (V330.0).
267	Sensor single top homing type mismatch (V330.2).
268	Parameter mismatch: wrong number periods between coded references (V368).
269	Battery replace requires drive switch off and Homing (see manual) This alarm is not resettable and the only way to cancel it is to switch OFF the drive. This alarm reminds the user that the sensor has lost completely the measures due to previous battery alarms. After the switch back ON, the user has to re-execute the Homing procedure and if AP02 was active before the battery alarm, he has to re-initialise the AP02 function.
270	EnDat 2.2 command set is not supported by the sensor
271	EnDat 2.2 additional info 1 position 2 is not supported by the sensor
272	EnDat 2.2 Homing with coded reference : communication error while waiting for reference mark
273	EnDat 2.2 Homing with coded reference : communication error while reading absolute position
274	EnDat 2.2 APEM with coded reference : communication error while waiting for reference mark
275	EnDat 2.2 APEM with coded reference : communication error while reading absolute position
276	EnDat 2.2 Homing with coded reference : Homing + APEM not allowed (V273.2)
277	EnDat2.2 wrong initialization recovery time value: encoder re-init is requested
281	Parameter mismatch: wrong number of periods per revolution (V360). See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V360 parameter. If the MP value is equal to 0, the parameter V344 has to be incremented by 1 till the alarm disappears.
282	Parameter mismatch: wrong absolute resolution per revolution (V361). See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V361 parameter. If the MP value is equal to 0, the parameter V344 has to be incremented by 1 till the alarm disappears.
283	Parameter mismatch: wrong internal number of revolutions (V365). This alarm is issued when V365 =1 that means Single Turn sensor, but into the sensor has been read as number of revolution 0 or >1. Sometimes in case of Single Turn sensor, the sensor builder wrote into the sensor the number of revolution = 0 instead of 1. See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V365 parameter, performing that you will change the sensor definition from Single Turn to Multi Turns, as it is internally defined. If the MP value is equal to 0, the parameter V344 has to be incremented by 1 till the alarm disappears
284	Parameter mismatch: wrong number of revolutions (V365). See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V365 parameter. If the MP value is equal to 0, you must put V365 =1, performing that you will change the sensor definition from Multi Turns to Single Turn, as it is internally defined and the parameter V344 has to be incremented by 1 till the alarm disappears.
291	Parameter mismatch: wrong single period length (V380). See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V380 parameter. If the MP value is equal to 0, the parameter V344 has to be incremented by 1 till the alarm disappears.

292	Parameter mismatch: wrong absolute resolution (V381). See the MP318 to know the value into the sensor and, if it is not equal to 0, copy this value into V381 parameter. If the MP value is equal to 0, the parameter V344 has to be incremented by 1 till the alarm disappears.
300	Overflow error in computation of position measure
301	Overflow error in computation of position homing
302	Absolute position from sensor out of allowed range (max 48 bit)
303	Overflow error in computation of maximal AP02 turn counter (V163 * V365). This means (V163 * V365) > (2 ³¹ -1). If V163 and V365 are rights, it means that AP02 cannot be used.
304	Overflow error in computation of absolute AP02 correction. This alarm has issued in case of AP02 applied to long linear axes and the computed offset in drive internal units is > (2 ⁴⁸ -1). If V163 and V365 are rights, it means that AP02 cannot be used.
305	Overflow error in computation of physical AP02 correction This alarm has issued in case of AP02 applied to long linear axes and the computed offset in CNC Internal Unit is > (2 ⁴⁷ -1) or < (-2 ⁴⁷ +1). If V163 and V365 are rights, it means that AP02 cannot be used.
306	Overflow error in computation of AP02 correction ratio (V162 * V365 mod V163). This alarm has issued if (V162 * V365 mod V163) > 32767. If V162 , V163 and V365 are rights, it means that AP02 cannot be used.
900	Basic BiSS: unknown error during initialization
901	Basic BiSS: no answer from sensor during initialization
902	Basic BiSS: position error during initialization
903	Basic BiSS: CRC error during initialization
1000	Tamagawa: unknown error
1001	Tamagawa: overspeed
1002	Tamagawa: wrong full absolute status
1003	Tamagawa: counting error
1004	Tamagawa: counter overflow
1006	Tamagawa: multi-turn position error
1007	Tamagawa: battery error during power off, measure lost, replace battery, (see manual) This alarm is issued if during the drive switching OFF, the battery voltage falls below 2.5V +/- 0.2. That could happen if the battery is exhausted or if it has been disconnected while the drive switching OFF. The sensor has lost completely the measures. This alarm is not resettable and the only way to cancel it is to replace the battery with the drive ON (see chapter 6.7) and then, switch OFF the drive. After the switch back ON, the user has to re-execute the Homing procedure and if AP02 was active before the battery alarm, he has to re-initialise the AP02 function.
1008	Tamagawa: battery low or disconnected, measure lost, replace battery, (see manual) This alarm is issued if during the drive delivering power supply to the sensor, the battery voltage falls below 3.1V +/- 0.1. That could happen also after a reset of the alarm A9.1009. The sensor has lost completely the measures. This alarm is not resettable and the only way to cancel it is to replace the battery with the drive ON (see chapter 6.7) and then, switch OFF the drive. After the switch back ON, the user has to re-execute the Homing procedure and if AP02 was active before the battery alarm, he has to re-initialise the AP02 function.
1009	Tamagawa: battery error during power off, still low or disconnected, measure lost, replace battery (see manual). This alarm is issued if during the drive switching OFF, the battery voltage falls below 2.5V +/- 0.2 and the battery level is still low. That could happen if the battery is exhausted or if it has been disconnected while the drive switching OFF and the battery is still now exhausted or disconnected. The sensor has lost completely the measures. This alarm is not resettable and the only way to cancel it is to replace the battery with the drive ON (see chapter 6.7) and then, switch OFF the drive. After the switch back ON, the user has to re-execute the Homing procedure and if AP02 was active before the battery alarm, he has to re-initialise the AP02 function.
1100	MagneScale: unknown error
1101	MagneScale: device failure
1102	MagneScale: hardware error
1103	MagneScale: system error
1109	MagneScale: homing error, homing needs sensor re-initialization

Alarm 10 Timeout

Time out expired. Inform NUM Technical Assistance.	
Possible cause	Possible remedy
-	-
Alarm 10 extension	
1	Timeout on braking (configuration V31 / V32) The speed motor has not been gone down speed V41 , V42 within the time V43
2	Timeout saturation of I-loop regulators (check power connections)
3	Timeout accessing SDcard
4	PWM timing error: missing PWM refresh. (No measures lost)
5	Timeout waiting for availability of param switching handler
6	Timeout waiting for acknowledge from param switching handler
7	Timeout waiting termination of from param switching handler
8	Timeout waiting for cmd cancel of param switching handler
20	Timeout waiting for availability of I2C Power EEPROM
21	Timeout waiting for availability of I2C SAMX EEPROM
25	Timeout waiting for availability of I2C pwr supply P5
26	Timeout waiting for availability of I2C pwr supply P6
27	Timeout waiting for availability of I2C pwr supply P7
28	Timeout waiting for availability of I2C pwr supply P8

Alarm 11 Overspeed

The motor exceeded the maximum speed permitted for the motor or the motor didn't stay at 0 speed during the initialization phase of the drive.	
Possible cause	Possible remedy
-	-
Alarm 11 extension	
0	Motor overspeed Possible special cause: The motor speed has exceeded the max.speed threshold foreseen with parameter V96, V99, V1096, V1099. Wrong set up of the speed loop parameters. It has been requested to enable the drive while the motor is moving at speed above its flux-weakening starting speed (V417, V457, V496, V497 reserved parameters). Possible remedy: Check the present in the parameters managing the maximum speed V96, V99, V1096, V1099. Check the values present in the parameter managing the speed loop control. Check enabling condition: wait for motor speed has reached a value below its flux-weakening starting speed (V417, V457, V496, V497) before enabling it.
1	Motor running during the initialization phase. The motor didn't stay at 0 speed during the initialization phase of the drive: a drive re-initialization was tried while the motor was moving; wait for motor stop before retry a drive reset/re-initialization.
2	Torque enabling request with motor running speed > flux-weakening starting speed. (No measures lost) The drive was requested to enable while the motor was running at speed higher than the flux-weakening starting speed (V417 , V457 , V496 , V497). Other possibilities: for synchronous motor V42 > V497 , for linear motor V41 > V496 , for asynchronous motor V42 > V417 (low range) or V457 (high range).

Alarm 12 Drive overcurrent

The current exceeded the maximum value allowable for the drive	
Possible cause	Possible remedy
Error on the power connection motor side. Error in the sensor wiring connection used for feedback in the current loop management. Error in the sensor used for feedback in the current loop management Error in motor / drive association; used a wrong ST. (Technical specification). EPS function started with a wrong set up of the parameters. (V180, V181, V182, V183).	Check motor power wiring U, V, W. Check the wiring of the sensor used as feedback in the current loop management. Load the right ST. Make a new and right set up of the EPS function.
Alarm 12 extension	
0	Motor phase overcurrent. (No measures lost)
1	Phase U current offset out of range.
2	Phase V current offset out of range.
3	Current offset at 50% PWM: V30.0 = 0 not allowed. This alarm is issued only if V30.21 = 1
4	Current offset at 50% PWM: V42 too high. This alarm is not issued with torque reference enabled. This alarm is issued only if V30.21 = 1 (No measures lost)
5	Current offset at 50% PWM: V/f not allowed. This alarm is issued only if V30.21 = 1

Alarm 13 NC synchronization

Possible cause	Possible remedy
-	-
Alarm 13 extension	
0	Synchronization with NC has been LOST !

Alarm 14 Wrong SD card handling

Alarm due to SW checksum incompatibility in Flash memory (managed by Boot program). This alarm is issued during the initialization phase of the drive. Inform the NUM technical assistance.	
Possible cause	Possible remedy
-	-
Alarm 14 extension	
3	AP02: unable to get access to SD memory card (cause semaphore)
4	AP02: unable to delete file
5	AP02: unable to write file
10	Alarm LOG: unable to open file
11	Alarm LOG: unable to write file

Alarm 15 Data handling error, SD card corrupted

The checksum of the Data Memory of the drive is wrong. (No resettable: the system has to be switched OFF) This alarm is issued during the initialization phase of the drive. Inform the NUM technical assistance.	
Possible cause	Possible remedy
-	-
Alarm 15 extension	
-	...

Alarm 16 Incompatible parameters

Alarm for parameter incompatibility.	
Possible cause	Possible remedy
Motor / drive association incompatibility. Parameters not available. (i.e. parameter memory formatted)	Load the correct parameters configuration for the motor / drive association and verify the parameter value. Load the correct ST.
Alarm 16 extension	
2	AP02: unable to initialize : NOT enough valid files Error in the mechanical ratio checksum (it is correlated to the AP02 special application). This alarm is issued if the Checksum of AP02 information stored in Flash memory is wrong. The first time the function is enabled on a new drive this alarm is issued.
3	AP02: sensor for AP02 NOT correctly configured Power DC Bus not allowed in Setup Mode (AP02 special application)
4	Product Code mismatch: additional HW boards equipment. This alarm is issued if the Drive HW boards equipment is not compatible with the SW Relayase version. The SW is not supported by the Drive HW.
5	AP02 needs re-initialization after ZERO absolute position or after PARKING
6	MULTI-TURN value too low for AP02 application (V365/V375 must be ≥ 64)
7	AP02: impossible initialization of AP02 due to previous alarms presence
8	Motor sensor S1 is NOT correctly configured
9	Sensor S2 used to close position loop (V350) but NOT correctly configured
10	S1 sensor configured but NOT assigned to any connector
11	S2 sensor configured but NOT assigned to any connector
12	Wrong connector association to S1 sensor type
13	Wrong connector association to S2 sensor type
14	Wrong connector association to S3 sensor type
15	Standard Performance drive: special application NOT allowed (V160)
16	Standard Performance drive: accelerometer NOT allowed (V630)
17	Standard Performance drive: P-loop on S2 NOT allowed (V350)
18	Standard Performance drive: Current loop sampling time NOT allowed (V271)
20	Wrong S1 sensor connector assignment configuration
21	Wrong S2 sensor connector assignment configuration
22	Wrong configuration of digital input I1
23	Wrong configuration of digital input I2
24	Wrong configuration of digital input I3
25	Wrong configuration of digital input I4
26	Wrong configuration of digital output O1
27	Wrong configuration of digital output O2

28	Wrong configuration of digital output O3
29	Wrong configuration of digital output O4
100	De-rating in case of PWM @ 25us: V100 greater than 70% of maximal module current
160	Incompatibility between special application and others drive parameters E.g. AP01: two sensors have to be configured otherwise the alarm issues. Sensor S1 MUST have absolute position info otherwise the alarm issues. AP02: this alarm can issue for many reasons: 1) The motor is a linear motor 2) The sensor selected for AP02 is not present 3) The sensor selected for AP02 is not an absolute sensor. 4) The sensor selected for AP02 is coded reference AP06: two sensors have to be configured. AP12: this alarm can issue for many reasons: 1) It is not possible activates AP12 if all loops are closed by the same sensor 2) The axis is Slave in anti-backlash function V169.0=0 . If the axis is Slave V169.0=0 but anti-backlash function is not active V160.3=0 the alarm doesn't issue.
162	AP02 requires the setting of V162 != 0 if V163 > 1
168	AP03: invalid link connection type
179	AP04: invalid link connection type
184	AP05: invalid link connection type
201	AP08: invalid link connection type
221	At least one enable via digital input required, but related input not configured (V221 , V22...V25)
238	Filter on squared counter input S1 sensor wrong setting
239	Filter on squared counter input S2 sensor wrong setting
250	Wrong motor initialization configuration
251	Parameter compatibility doesn't match with the drive SW revision
255	Standard Performance drive: Motor type NOT supported
256	Motor power connection type unknown
257	Standard Performance drive: Motor poles pairs number NOT allowed
263	System sampling time (V263) not allowed or different from mate axis (bi-axes model)
271	Current loop sampling time not allowed
272	Motor thermal sensor configuration not allowed (only MDLUF Bi-Axes Standard Performance drive V252=L). This alarm is issued if the thermal sensor is wiring on S2 (see parameter V272.1)
273	EPS not available: no force it. (see parameter V273.4)
274	Motor thermal sensor wiring not allowed
305	AP02 requires the setting of V305 "Measure modulo for rot. axis/spindle abs". V305 has not to be equal to 0
307	S1 sensor overflow error on multi-divi
310	S1 sensor overflow error on multi-divi + offset
312	S2 sensor overflow error on multi-divi
313	S2 sensor overflow error on multi-divi + offset
320	Wrong S1 sensor incremental traces configuration This alarm can issue for many reasons: 1) More than one bit or a unused bit selected. 2) S1 has ALWAYS to be configured 3) Sensorless sensors declared on Linear and Synchronous motors
321	Wrong S2 sensor incremental traces configuration. This alarm can issue when more than one bit or an unused bit has been selected.
322	Wrong S1 sensor communication protocol This alarm can issue for many reasons: 1) More than one bit or an unused bit selected. 2) NOT allowed Fast serial on S1 without absolute trace EnDat 2.2 or Hiperface DSL or TAMAGAWA

323	Wrong S2 sensor communication protocol. This alarm can issue for many reasons: 1) More than one bit or an unused bit selected. 2) NOT allowed Fast serial on S2 without absolute trace EnDat 2.2 or Hiperface DSL or TAMAGAWA
324	Wrong S1 sensor initialization configuration. This alarm can issue for many reasons: 1) NOT allowed V324.1 (S1) on current-loop sensor. 2) NOT allowed Linear sensors S1 as Current-loop sensor for Rotative motors 3) NOT allowed Rotative sensors S1 as Current-loop sensor for Linear motors
325	Wrong S2 sensor initialization configuration.
326	Wrong S1 sensor run-time options. This alarm can issue for many reasons: 1) NOT allowed "Emmentahler" filter on Bi-axes Standard-Performances drive. 2) NOT allowed sinusoidal signal compensation (CSS) on Sensorless sensors
327	Wrong S2 sensor run-time options
330	Wrong S1 sensor homing configuration. This alarm can issue when more than one bit or an unused bit has been selected.
331	Wrong S2 sensor homing configuration. This alarm can issue when more than one bit or an unused bit has been selected.
350	P-loop not allowed with Hall sensor
360	Wrong period by turn or wrong absolute resolution by turn S1 sensor
370	Wrong period by turn or wrong absolute resolution by turn S2 sensor
389	S1 sensor serial position datum bit size V389 wrong or not allowed
399	S2 sensor serial position datum bit size V399 wrong or not allowed
481	Wrong control mode selection
630	Wrong S3 sensor connector assignment configuration
ext. #parameter: #parameter identifies the missing parameter number in flash table	

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Alarm 18 Self-calibration related

Alarm related to the self-calibration phases of the EPS and EPSM functions.	
Possible cause	Possible remedy
-	-
Alarm 18 extension	
1	ETST enabling error
2	EPS self-calibration error. Error during EPS self-phasing phase: The EPS procedure was not able to find the electrical phase of the motor. E.g. the electric current used during EPS function is too low. It is necessary to tune well the V126 parameter.
3	Incoherency between the acceleration sign and torque current sign This alarm condition is monitored from the start of the EPS / EPSM procedure till 1 second after the HOMING end, this motoring is performed for security motivation. E.g. acceleration versus not coherent with current versus owing to phase offset error. If this alarm is issued, it is necessary a new tuning of the EPS / EPSM procedure. To enable this new tuning it is necessary to disable the monitoring, setting V273.3 = 1.
4	EPS error: homing requested with V269 parameter = 0 It was requested a HOMING after an EPS procedure V273.0 = 0 with the parameter V269 = 0 It is necessary input the correct value in the V269 parameter as described in chapter 5
5	Timeout on EPSM command: conditions for EPSM not satisfied This alarm has issued about 6 seconds after the start of the EPSM command, in case one or more conditions needed for to enable the EPSM command are not satisfied. The conditions to satisfy for enable the EPSM are: Drive in Run DC BUS energized: voltage present. Drive with torque and speed disabled . Safety relays enabled. (STOX inputs enabled or SAMX Cut Off = FALSE) .RCNC.Axis[x].DigitalAxis.MotorMoving = FALSE if V30.0 = 1 Motor speed lower then V417 or V457 depending of the active range for asynchronous motor or V496 for synchronous rotary motor or V497 for linear motor. The drive deasy chain ready (It means DF1/DF2 contact closed on MDLL power supply)
6	Timeout on EPSM state machine: background program not running (No measures lost)
7	Timeout on EPSM offset writing in the sensor
8	Timeout on EPS command: conditions for EPS not satisfied. Conditions for EPS not satisfied. The conditions that lead to this kind of alarm are: EPS procedure has been started with the ADC Drive not yet stable (drive initialization phase not correctly completed) DC BUS energized: voltage present info disappears during the procedure (due to drive or Power Supply fault). The U, V, W currents don't reach the values defined in the parameter V126 (due to Drive fuse fault or IGBT U,V,W phase fault, drive – motor cable interrupted, motor not connected, coil-winding U,V,W phase open).
9	EPS for Iron-less motors AND brake is NOT allowed.
10	EPS for Iron-less motors AND highly anisotropic motors is NOT allowed.

Alarm 37 Following error

The motor exceeded the allowable maximum following error.	
Possible cause	Possible remedy
No good tuning of the control speed loop. No good tuning of the position speed loop. No good working of the sensor used for the feedback of the control speed loop. No good working of the sensor used for the feedback of the control position loop.	Check the right tuning of the system or inform NUM Technical Service.
Alarm 37 extension	
0	CNC parameter P23 threshold exceeded. (No measures lost) This alarm can be excluded by setting the parameter bit V30.5
1	Speed dynamic check threshold exceeded. See values parameters V46
2	Return from CNC control suspend procedure. This alarm is always issued (for safety reasons) when WPM leaves again the drive control to the CNC.
3	Overflow error in computation of position reference

Alarm 38 S2 Sensor

This alarm is related to the S2 sensor.	
Possible cause	Possible remedy
Wrong connection of one or more sensor connections or sensor fault.	Check sensor connections on the connector.
Alarm 38 extension	
1	Stegmann: analogue signal outside specification
2	Stegmann: wrong internal angle offset
3	Stegmann: data field partition destroyed
4	Stegmann: analogue limit not available
5	Stegmann: internal I2C not working
6	Stegmann: internal checksum error
7	Stegmann: sensor reset by program monitoring
8	Stegmann: counter overflow
9	Stegmann: parity error
10	Stegmann: wrong checksum of transmitted data
11	Stegmann: command unknown
12	Stegmann: number of transmitted data wrong
13	Stegmann: transmitted command not allowed
14	Stegmann: data can't be written to selected data field
15	Stegmann: wrong access code
16	Stegmann: size of data fields can't be changed
17	Stegmann: specified word address is outside data field
18	Stegmann: access to non-existent data field
28	Stegmann: monitoring the magnitude of analogue signals
29	Stegmann: critical sensor current (contamination, transmitter breakdown)
30	Stegmann: critical sensor temperature
31	Stegmann: speed too high, position acquisition impossible
32	Stegmann: position of single-turn not allowed

33	Stegmann: position error multi-turn, 1
34	Stegmann: position error multi-turn, 2
35	Stegmann: position error multi-turn, 3
40	Stegmann: error building absolute position (linear system)
50	Endat: absolute position error
51	Endat: lighting
52	Endat: signal amplitude
53	Endat: position error
54	Endat: supply voltage too high
55	Endat: supply voltage too low
56	Endat: current too high
57	Endat: battery failure
60	Endat 22 2nd Safety bit: absolute position error
61	Endat 22 2nd Safety bit: lighting
62	Endat 22 2nd Safety bit: signal amplitude
63	Endat 22 2nd Safety bit: position error
64	Endat 22 2nd Safety bit: supply voltage too high
65	Endat 22 2nd Safety bit: supply voltage too low
66	Endat 22 2nd Safety bit: current too high
67	Endat 22 2nd Safety bit: battery failure
100	Hiperface DSL: NO link established
101	Hiperface DSL: bad link quality
102	Hiperface DSL: persistent error on incremental position
103	Hiperface DSL: persistent error on absolute position
104	Hiperface DSL: persistent error on initialization
105	Hiperface DSL: persistent error on monitoring
106	Hiperface DSL: persistent error on resource access
107	Hiperface DSL: unable to remove all files from sensor memory
108	Hiperface DSL: communication error reading temperature
109	Hiperface DSL: communication link lost
110	Hiperface DSL incremental position: protocol reset
111	Hiperface DSL incremental position: acceleration overflow
112	Hiperface DSL incremental position: test in progress
114	Hiperface DSL incremental position: tracking filter error
115	Hiperface DSL incremental position: vector length error
116	Hiperface DSL incremental position: counter error
117	Hiperface DSL incremental position: synchronisation error
120	Hiperface DSL monitoring: critical temperature
121	Hiperface DSL monitoring: critical led current
122	Hiperface DSL monitoring: critical supply voltage
123	Hiperface DSL monitoring: critical speed
124	Hiperface DSL monitoring: critical acceleration
125	Hiperface DSL monitoring: counter overflow
126	Hiperface DSL monitoring: internal error
130	Hiperface DSL short msg error: timeout waiting for start tx
131	Hiperface DSL short msg error: timeout waiting for acknowledge
140	Hiperface DSL long msg error: timeout waiting for start tx
141	Hiperface DSL long msg error: timeout waiting for acknowledge
142	Hiperface DSL resource address not implemented in the sensor
143	Hiperface DSL wrong length indicated for resource access

144	Hiperface DSL wrong length indicated for direct resource access
145	Hiperface DSL offset address too high
146	Hiperface DSL invalid offset address
147	Hiperface DSL invalid long msg qualifier
148	Hiperface DSL missing offset value
149	Hiperface DSL write access not possible
150	Hiperface DSL read access not possible
151	Hiperface DSL write access denied
152	Hiperface DSL read access denied
153	Hiperface DSL write access for direct resource access denied
154	Hiperface DSL resource database entry corrupt
155	Hiperface DSL timeout during resource access
156	Hiperface DSL internal processing error during resource access
157	Hiperface DSL file name not found
158	Hiperface DSL invalid address for file access
159	Hiperface DSL file not erasable
160	Hiperface DSL file storage space full
161	Hiperface DSL file allocation table corrupt
162	Hiperface DSL no file loaded for action
163	Hiperface DSL file with same name exists
200	The distance between two references is higher than the value in the V378 parameter.
201	The first zero reference position was detected in wrong position (not multiple of 4).
202	The second zero reference position was detected in wrong position (not multiple of 4).
203	The distance between two references is not divisible by multiplier (V379).
210	Sensor NOT compatible with 'Enhanced performance' MDLUF drive (V323)
230	Sensor: repeated pulse counter UGA misalignments It is possible to exclude the alarm setting V329.4 = 1
231	Sensor: excess of movement detected while waiting for UGA alignment.
235	Homing on BUTEE requires butee used on EDGE (see V325.6 V325.8 V331.4)
237	Homing switch required but related digital input NOT configured (see V325.6, V22...V25)
238	Wrong setup sensor MODE_SINCOS RS485
239	Wrong setup sensor Baud Rate RS485
240	Wrong data field format Stegmann sensor: no data field defined. NO data field necessary to manage an Hiperface NUM sensor.
241	Wrong initializationTimeout sensor position. No digital communication with the sensor Possible special cause: Wrong power supply connection. Possible remedy: Check sensor connections on the connector. Verify the amplitude of sine and cosine signals using MP204 and MP205, if they are both simultaneously around zero could be a power supply problem. MP239 must be around 100% if power supply is good.
242	Wrong data field format for NUM Stegmann sensor.
246	UGA alarms exclusion V329 bits 4,5 not allowed if fine alignment of digital and analog pos. active.
247	Fine alignment of digital and analog pos. not allowed for this sensor.
248	Sensor signals sine or cosine saturated. It is possible to exclude the alarm setting V329.0 = 1 or V329.3 = 1.
250	Phase offset not present in the sensor
251	Checksum error in the sensor EEPROM memory
253	Sensor different from the configured one. This alarm extension is issued when a Stegmann sensor has the sensor code ID declared in the V345 parameter not coherent. See the MP 319 to know the value into the sensor.
254	Sensor not connected or sine or cosine signal too low. Check the sensor wiring and if it will be ok, set the right value in the V315 parameter. It is possible to exclude the alarm setting V329.3 = 1

255	Fault in the sensor communication. The drive cannot communicate with the sensor through the digital interface. It is possible that the sensor is badly connected or the wiring is wrong. Possible special cause: Wrong power supply connection. Possible remedy: Check sensor connections on the connector. Verify the amplitude of sine and cosine signals using MP204 and MP205, if they are both simultaneously around zero could be a power supply problem. MP239 must be around 100% if power supply is good.
256	Absolute position half-travel displacement is not allowed for EnDat linear sensor
257	Error on absolute position communication during initialization.
258	Fast serial sensor missing data. The drive does not communicate correctly with the sensor through the digital interface. It is possible that the sensor is badly connected or the wiring is wrong.
259	Fast serial sensor CRC error. The drive does not communicate correctly with the sensor through the digital interface. It is possible that the sensor or the wiring electromagnetic shield is badly connected. It is possible to exclude the alarm setting V329.2 = 1
260	Sensor TTL signals saturated. It is possible to exclude the alarm setting V329.0 = 1 or V329.3 = 1 .
261	Sensor no connected or TTL signals too low. Check the sensor wiring and if it will be ok, set the right value in the V315 parameter. It is possible to exclude the alarm setting V329.3 = 1
262	Sensor type linear or rotary mismatch (V325.0). Check sensor type connection. It is possible that the sensor is not correctly declared.
263	Sensor type reference mark mismatch (V331.3) Check sensor type connection. It is possible that the sensor is not correctly declared.
264	Sensor type backup battery mismatch (V325.5) Check sensor type connection. It is possible that the sensor is not correctly declared.
265	Wrong serial protocol position datum bit size (V399) It is possible that the sensor features are not correctly declared. See the MP319 to know the value into the sensor.
266	Sensor absolute homing type mismatch (V331.0).
267	Sensor single top homing type mismatch (V331.2).
268	Parameter mismatch: wrong number periods between coded references (V378).
269	Battery replace requires drive switch off and Homing (see manual) This alarm is not resettable and the only way to cancel it is to switch OFF the drive. This alarm reminds the user that the sensor has lost completely the measures due to previous battery alarms. After the switch back ON, the user has to re-execute the Homing procedure and if AP02 was active before the battery alarm, he has to re-initialise the AP02 function.
270	EnDat 2.2 command set is not supported by the sensor
271	EnDat 2.2 additional info 1 position 2 is not supported by the sensor
272	EnDat 2.2 Homing with coded ref. : communication err. while waiting for ref. mark
273	EnDat 2.2 Homing with coded ref. : communication err. while reading absolute pos.
274	EnDat 2.2 Apem with coded ref. : communication error while waiting for ref. mark
275	EnDat 2.2 Apem with coded ref. : communication error while reading absolute pos.
276	EnDat 2.2 Homing with coded ref. : Homing + Apem not allowed (V273.2)
277	EnDat2.2 wrong initialization recovery time value: encoder re-init is requested
281	Parameter mismatch: wrong number of periods per revolution (V370). See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V370 parameter. If the MP value is equal to 0, the parameter V345 has to be incremented by 1 till the alarm disappears.
282	Parameter mismatch: wrong absolute resolution per revolution (V371). See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V371 parameter. If the MP value is equal to 0, the parameter V345 has to be incremented by 1 till the alarm disappears.
283	Parameter mismatch: wrong internal number of revolutions (V375). This alarm is issued when V375=1 that means Single Turn sensor, but into the sensor has been read as number of revolution 0 or >1. Sometimes in case of Single Turn sensor, the sensor builder wrote into the sensor the number of revolution = 0 instead of 1. See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V375 parameter, performing that you will change the sensor definition from Single Turn to Multi Turns, as it is internally defined. If the MP value is equal to 0, the parameter V345 has to be incremented by 1 till the alarm disappears.

284	Parameter mismatch: wrong number of revolutions (V375). See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V375 parameter. If the MP value is equal to 0, you must put V375=1 , performing that you will change the sensor definition from Multi Turns to Single Turn, as it is internally defined and the parameter V345 has to be incremented by 1 till the alarm disappears.
291	Parameter mismatch: wrong single period length (V390). See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V390 parameter. If the MP value is equal to 0, the parameter V345 has to be incremented by 1 till the alarm disappears.
292	Parameter mismatch: wrong absolute resolution (V391). See the MP319 to know the value into the sensor and, if it is not equal to 0, copy this value into V391 parameter. If the MP value is equal to 0, the parameter V345 has to be incremented by 1 till the alarm disappears.
300	Overflow error in computation of position measure
301	Overflow error in computation of position homing
302	Absolute position from sensor out of allowed range (max 48 bit)
303	Overflow error in computation of maximal AP02 turn counter (V163 * V375). This means $(V163 * V375) > (2^{31}-1)$. If V163 and V375 are rights, it means that AP02 cannot be used.
304	Overflow error in computation of absolute AP02 correction. This alarm has issued in case of AP02 applied to long linear axes and the computed offset in drive internal units is $> (2^{48}-1)$. If V163 and V375 are rights, it means that AP02 cannot be used.
305	Overflow error in computation of physical AP02 correction. This alarm has issued in case of AP02 applied to long linear axes and the computed offset in CNC Internal Unit is $> (2^{47}-1)$ or $< (-2^{47}+1)$. If V163 and V375 are rights, it means that AP02 cannot be used.
306	Overflow error in computation of AP02 correction ratio (V162 * V375 mod V163). This alarm has issued if $(V162 * V375 \text{ mod } V163) > 32767$. If V162, V163 and V375 are rights, it means that AP02 cannot be used.
900	Basic BiSS: unknown error during initialization
901	Basic BiSS: no answer from sensor during initialization
902	Basic BiSS: position error during initialization
903	Basic BiSS: CRC error during initialization
1100	MagneScale: unknown error
1101	MagneScale: device failure
1102	MagneScale: hardware error
1103	MagneScale: system error
1109	MagneScale: homing error: homing needs sensor reinitialization

Alarm 49 I²t

This alarm is issued whenever the I ² t condition has been reached.	
Possible cause	Possible remedy
The working cycle of the machine-tool involves a phase where the drive current delivered to the motor is too high for a too long time. Some damage/defect has caused friction to increase, so requiring more current to be delivered to the motor in order to follow CNC acceleration commands. Some parameters on CNC require very high accelerations which can't be respected by the drive and motor which the machine-tool is equipped with.	Check the working cycle of the machine-tool. Check the machine-tool mechanics for any cause of increased friction. Check CNC accelerations parameter and, possibly, relax them to reduce required working speed.
Alarm 49 extension	
0	Motor I ² tThreshold exceeded. (No measures lost)
1	Drive I ² t Threshold exceeded. (No measures lost)

Alarm 51 Congruence position S1-S2 sensors

This alarm is related to the AP06 special application. The difference between the measures, in CNC Internal Unit, coming from the S1 and S2 sensors exceeds the value stored in V190 parameter and this condition stays active for a time longer than the value stored in V191 parameter.	
Possible cause	Possible remedy
Broken of the kinematical chain motor / load. Broken of one or both sensors. Wrong set up of the AP06 special application.	Check the kinematical chain motor / load. Check the connections of the sensors, their mechanical fit, check the fullfill sensors are good or not. Make a new tuning of the AP06 special application. (V190 , V191 parameters)
Alarm 51 extension	
-	This alarm doesn't have extensions.

Alarm 52 Anti-backlash function

This alarm is related to the tandem function: AP03 special application.
This alarm summarizes all the fault conditions emerging from mechanical problems and/or electronic problems in the Master and Slave drives.

Possible cause	Possible remedy
-	-
Alarm 52 extension	
0	AP03 impossible: two other local link functions already active !
7	AP03 NOT allowed 20KHz PWM (see V263).
9	Ramps NOT allowed on slave (V30. 4 / 5).
10	P7 local link connector used by another application: ax 1
11	P7 local link connector used by another application: ax 2
12	P7 local link connector used by another application: ax 3
13	P7 local link connector used by another application: ax 4
14	P8 local link connector used by another application: ax 1
15	P8 local link connector used by another application: ax 2
16	P8 local link connector used by another application: ax 3
17	P8 local link connector used by another application: ax 4
18	local link memory a used by another application: ax 1
19	local link memory a used by another application: ax 2
20	local link memory a used by another application: ax 3
21	local link memory a used by another application: ax 4
22	local link memory b used by another application: ax 1
23	local link memory b used by another application: ax 2
24	local link memory b used by another application: ax 3
25	local link memory b used by another application: ax 4
26	local link memory c used by another application: ax 1
27	local link memory c used by another application: ax 2
28	local link memory c used by another application: ax 3
29	local link memory c used by another application: ax 4
30	Torque equalizer saturation timeout. (No measures lost) The timeout value is stored in the V176 parameter. The alarm has been created with the scope to detect electrical and/or mechanical problems of the anti-backlash system: this means that the two motors, mechanically coupled to realize the anti-backlash function, don't supply the same torque to move the machine. Check the kinematical chain, the sensors fitting, the mechanical joints, etc. This alarm is issued only by the master drive. The "balancer saturated" condition has been detected for a period longer than V176
40	Balancer timeout: master not enabled due to unknown reasons. (No measures lost) E.g.: master enables current, flux and speed loops, then it waits 500 msec the slave communication of current, flux and speed loops enabled. If the answer is o.k., the master activates torque balancer and position loop: axis is completely operative. If the answer is not o.k. owing to e.g. 1) Slave SAMX board is not in status 6 and the slave hasn't completed the own loops enable phase 2) Slave Safety Light is open and then the slave hasn't completed the own loops enable phase, the alarm issues.
41	Balancer timeout: slave not enabled due to unknown reasons. (No measures lost)

50	The master is in Halt state while the slave is torque enabled. (No measures lost) The Slave drive will go immediately in alarm status if the system is torque enabled and the Master has been put in Halt status using external tools (WPM or FXTools). To go out from this alarm condition, it is imperative to put in the same state all the drives involved in the anti-backlash function, master and all the slaves: 1) Put in alarm status the master drive and all the slave drives 2) Send an Alarm Reset command, at same time, to the master and to all the slaves This alarm is issued only by the slave drive.
51	The slave is in Halt state while the master is torque enabled. (No measures lost) The master drive goes immediately in the alarm status if the system is torque enabled and the slave drive has been put in Halt status using external tools (WPM or FXTools). To go out from this alarm condition, it is imperative to put in the same status all the drives involved in the anti-backlash function, master and all the slaves: 1) Put in alarm status the master drive and all the slave drives 2) Send an Alarm Reset command, at same time, to the master and to all the slaves This alarm is issued only by the master drive.
60	Master is in fault state.
61	The slave drive is in fault status.
70	Partner not enabled due to unknown reasons. (No measures lost).

Alarm 53 Self-test Hardware

Alarm due to bad hardware functionality. (No resettable: the system has to be switched OFF) This alarm is issued during the initialization phase of the drive. * Inform NUM Technical Assistance. (* solo per alcuni estensioni attendere info Nando)	
Possible cause	Possible remedy
-	-
Alarm 53 extension	
5	Safe Brake: cpu0 FW memory corrupted.
6	Safe Brake: cpu0 ALU corrupted.
7	Safe Brake: cpu0 Stack Pointer corrupted.
8	Wrong EtherCAT HW initialization.
9	Unable to mount SDcard: files handling is not possible
10	microBlaze NOT started: EtherCAT communication not possible
11	Unable to adapt EtherCAT SII EEPROM: EtherCAT communication not possible
12	File not found on SDcard
13	microBlaze watchdog expired: EtherCAT communication not possible
14	Wrong Power data initialization: NO current scaling available
15	PWR EEPROM I2C: not detected
16	PWR EEPROM I2C: invalid type
17	PWR EEPROM I2C: checksum error
18	PWR EEPROM I2C: missing I _{max} data
19	PWR EEPROM I2C: missing I _{nom} data
20	P7-P8 sensor board not detected
21	Kernel board not coherent with SW type

22	Power board not coherent with drive type. If the Drive is Mono-axis and the Power board is for Bi-axes the alarm is issued. If the Drive is Bi-axes and the Power board is for Mono-axis the alarm is issued.
23	SW release NOT compatible with kernel HW revision
28	A WATCHDOG expiration occurred during machining on 1st CPU core.
29	A WATCHDOG expiration occurred during machining on 2nd CPU core.
32	Dual use application not allowed.
34	A CPU RESET occurred during machining.
35	Unable to create file on SDcard
36	Error reading from file on SDcard
37	Error writing to file on SDcard
38	An EXCEPTION occurred during machining on 1st CPU core
39	An EXCEPTION occurred during machining on 2nd CPU core
41	Conflict on digital output O1: used by other entity: ax 1
42	Conflict on digital output O2: used by other entity: ax 1
43	Conflict on digital output O3: used by other entity: ax 1
44	Conflict on digital output O4: used by other entity: ax 1
45	Conflict on digital output O1: used by other entity: ax 2
46	Conflict on digital output O2: used by other entity: ax 2
47	Conflict on digital output O3: used by other entity: ax 2
48	Conflict on digital output O4: used by other entity: ax 2
49	Conflict on digital output O1: used by other entity: ax 3
50	Conflict on digital output O2: used by other entity: ax 3
51	Conflict on digital output O3: used by other entity: ax 3
52	Conflict on digital output O4: used by other entity: ax 3
53	Conflict on digital output O1: used by other entity: ax 4
54	Conflict on digital output O2: used by other entity: ax 4
55	Conflict on digital output O3: used by other entity: ax 4
56	Conflict on digital output O4: used by other entity: ax 4
61	Conflict on connector associated to S1: used as sensor S1 by ax 1
62	Conflict on connector associated to S1: used as sensor S1 by ax 2
63	Conflict on connector associated to S1: used as sensor S1 by ax 3
64	Conflict on connector associated to S1: used as sensor S1 by ax 4
65	Conflict on connector associated to S2: used as sensor S1 by ax 1
66	Conflict on connector associated to S2: used as sensor S1 by ax 2
67	Conflict on connector associated to S2: used as sensor S1 by ax 3
68	Conflict on connector associated to S2: used as sensor S1 by ax 4
71	Conflict on connector associated to S1: used as sensor S2 by ax 1
72	Conflict on connector associated to S1: used as sensor S2 by ax 2
73	Conflict on connector associated to S1: used as sensor S2 by ax 3
74	Conflict on connector associated to S1: used as sensor S2 by ax 4
75	Conflict on connector associated to S2: used as sensor S2 by ax 1

76	Conflict on connector associated to S2: used as sensor S2 by ax 2
77	Conflict on connector associated to S2: used as sensor S2 by ax 3
78	Conflict on connector associated to S2: used as sensor S2 by ax 4
81	Conflict on connector associated to S1: used as local link by ax 1
82	Conflict on connector associated to S1: used as local link by ax 2
83	Conflict on connector associated to S1: used as local link by ax 3
84	Conflict on connector associated to S1: used as local link by ax 4
85	Conflict on connector associated to S2: used as local link by ax 1
86	Conflict on connector associated to S2: used as local link by ax 2
87	Conflict on connector associated to S2: used as local link by ax 3
88	Conflict on connector associated to S2: used as local link by ax 4
91	Conflict on connector associated to S1: used as accelerometer by ax 1
92	Conflict on connector associated to S1: used as accelerometer by ax 2
93	Conflict on connector associated to S1: used as accelerometer by ax 3
94	Conflict on connector associated to S1: used as accelerometer by ax 4
95	Conflict on connector associated to S2: used as accelerometer by ax 1
96	Conflict on connector associated to S2: used as accelerometer by ax 2
97	Conflict on connector associated to S2: used as accelerometer by ax 3
98	Conflict on connector associated to S2: used as accelerometer by ax 4
100	Conflict on connector associated to S3: used as sensor S1 by ax 1
101	Conflict on connector associated to S3: used as sensor S2 by ax 1
102	Conflict on connector associated to S3: used as sensor S1 by ax 2
103	Conflict on connector associated to S3: used as sensor S2 by ax 2
104	Conflict on connector associated to S3: used as sensor S1 by ax 3
105	Conflict on connector associated to S3: used as sensor S2 by ax 3
106	Conflict on connector associated to S3: used as sensor S1 by ax 4
107	Conflict on connector associated to S3: used as sensor S2 by ax 4
110	Conflict on connector associated to S3: used as local link by ax 1
111	Conflict on connector associated to S3: used as local link by ax 2
112	Conflict on connector associated to S3: used as local link by ax 3
113	Conflict on connector associated to S3: used as local link by ax 4
115	Conflict on connector associated to S3: used as accelerometer by ax 1
116	Conflict on connector associated to S3: used as accelerometer by ax 2
117	Conflict on connector associated to S3: used as accelerometer by ax 3
118	Conflict on connector associated to S3: used as accelerometer by ax 4
262	Wrong NC period (P50): it must be a multiple of 4 times sampling time (V263)
263	Drive switch-off is mandatory after system sampling time (V263) modification.
264	conflict on V263 of ax 1 entity and ax 2 entity
265	conflict on V263 of ax 1 entity and ax 3 entity
266	conflict on V263 of ax 1 entity and ax 4 entity

Alarm 54 Brake failure

This alarm is related to the Brake internal functionalities.	
Possible cause	Possible remedy
-	-
Alarm 54 extension	
0	24V for brake S10.3 - S10.4 not connected or open fuse. (No measures lost)
1	Brake not connected. (No measures lost)
2	Brake overcurrent or S10.2 / S10.1 not connected. This alarm is issued if there is a overcurrent or a short circuit or the connector S10 is not correctly connected: S10.2 is the pin related to the axis 1, S10.1 is the pin related to the axis 2. (No measures lost)
3	Check presence of current (V135.1): $V109 = 0$ value not acceptable. (No measures lost). This alarm is issued if the bit V135.1 has been set with the value of the vertical load compensation current V109 is equal to 0.
5	Check presence of current (V135.1): motor current no coherent with V109 . (No measures lost). This alarm is issued if the bit V135.1 has been set and $ V109 - I_q \geq V109/4 $ where I_q is the current delivered to the motor. Could be linked to the HW problem to the brake circuit.
6	Wrong config. V135.0/7: External AND Internal management NOT possible
10	Safe-Brake Cross Channel comm: CRC error on PL Cpu1
11	Safe-Brake Cross Channel comm: CRC error on PL Cpu2
12	Safe-Brake Cross Channel comm: CRC error on PS
13	Safe-Brake Cross Channel comm: NOT alive by PL Cpu1
14	Safe-Brake Cross Channel comm: NOT alive by PL Cpu2
15	Safe-Brake Cross Channel comm: NOT alive by PS
20	Safe-Brake feedback dyn.test: failure by PL Cpu1
21	Safe-Brake feedback dyn.test: failure by PL Cpu2
22	Safe-Brake feedback dyn.test: failure by PS hi-lo
23	Safe-Brake feedback dyn.test: failure by PS lo-hi

Alarm 56 V/f regulation

This alarm is related to the V/f regulation motor control.	
Possible cause	Possible remedy
-	-
Alarm 56 extension	
0	Configuration: motor type not allowed (V255).
4	Configuration: no vertical payloads allowed (V109). (No measures lost)
5	Configuration: special applications not allowed (V160.0 , V160.5 , V160.11).
6	Configuration: special application AP03/4/5 not allowed (V160.2 , V160.3 , V160.4)
7	Configuration: acceleration deceleration ramps mandatory (V30. 4 / 5)
8	Configuration: sensor type for current loop not allowed.
9	Configuration: EPS for ironless motor not allowed
11	Math err: wrong [V/Hz] slope (check V601 , V602 , V603). (No measures lost)
12	Math err: wrong gain of current limiter (check V91 , V600 , V605). (No measures lost)

Alarm 57 Power Supply class 0

This alarm is related to the Power Supply.	
This alarm is issued when the PWS goes in alarm. Normally this alarm is not linked to a PWS failure but to a not correct running of the system.	
Possible cause	Possible remedy
-	-
Alarm 57 extension	
0	PWS overtemperature. (No measures lost)
1	Overload (I^2t). (No measures lost)
2	Unbalanced mains. (No measures lost)
3	Check PWS fault LED for number of flashes
9	Undervoltage while axis in Operational state

Alarm 58 Power Supply class 1

This alarm is related to the Power Supply.	
This alarm is issued when the PWS goes in alarm. Normally this alarm is linked to a PWS failure.	
Possible cause	Possible remedy
-	-
Alarm 58 extension	
0	Desaturation of the clamp IGBT. (No measures lost)
1	DC BUS precharge error. (No measures lost)
2	Braking resistor. (No measures lost)
5	Check PWS fault LED for number of flashes
6	PWS DSP reset.

Alarm 59 Link Power Supply

This alarm is related to the serial communication Link from Power Supply to the drive.	
This alarm is issued when the link is not correct.	
Possible cause	Possible remedy
-	-
Alarm 59 extension	
0	No communication. (No measures lost)
1	Communication error: wrong parity. (No measures lost)
2	Communication error: wrong stop bit. (No measures lost)
3	Communication error: wrong sequence. (No measures lost)
4	Communication error: wrong checksum. (No measures lost)

Alarm 60 Safety Module class 0

This alarm is related to the Safety board (NUM-SAMX or NUM-STOX). This alarm summarizes all the fault conditions monitored by Safety board.	
Possible cause	Possible remedy
-	-
Alarm 60 extension	
255	NUM-SAMX communication - Togglebit FrameRF does not toggle.
256	NUM-SAMX communication - Wrong communication checksum.
259	NUM-SAMX requested by control board but not detected.
260	NUM-SAMX detected but not requested by control board.
261	NUM-SAMX doesn't communicate with the control board. NUM-SAMX communication with the Control board of the drive is in failure. A waiting answer time-out has been overcome.
262	FSoE address NUM-SAMX doesn't match with the parameter V36
263	NUM-SAMX alarm code not defined.
265	NUM-STOX requested by control board but not detected.
266	NUM-STOX detected but not requested by control board.
267	NUM-STOX feedback signals - inputs not coherent
268	NUM-STOX feedback signals - inputs NOT changing for 36h
269	NUM-STOX FEEDBACK SIGNALS - INPUTS UNSTABLE
300	PWM disabled while axis in Operational state.
301	NUM-SAMX communication - locked: missing msgId increment
302	NUM-SAMX communication - failure: SAMX receives wrong CRC
324	NUM-SAMX Safe Homing - timeout writing Safe Homing position
325	NUM-SAMX Safe Homing - abort writing Safe Homing position
326	NUM-SAMX Safe Homing - unable to write Safe Homing position

Alarm 61 Safety Module class 1

These alarms are related to the Safety board NUM-SAMX. Please refer to NUM-SAMX Safety manual M00069.	
Possible cause	Possible remedy
-	-
Alarm 61 extension	
-	Please refer to NUM-SAMX Safety manual M00069.

Alarm 62 Safety Module class 2

These alarms are related to the Safety board NUM-SAMX. Please refer to NUM-SAMX Safety manual M00069.	
Possible cause	Possible remedy
-	-
Alarm 62 extension	
-	Please refer to NUM-SAMX Safety manual M00069.

Alarm 63 Safety Module class 3

These alarms are related to the Safety board NUM-SAMX. Please refer to NUM-SAMX Safety manual M00069.	
Possible cause	Possible remedy
-	-
Alarm 63 extension	
-	Please refer to NUM-SAMX Safety manual M00069.

Alarm 64 Safety Module class 4

These alarms are related to the Safety board NUM-SAMX. Please refer to NUM-SAMX Safety manual M00069.	
Possible cause	Possible remedy
-	-
Alarm 64 extension	
-	Please refer to NUM-SAMX Safety manual M00069.

Alarm 70 Torque duplication function

This alarm is related to the torque duplication function: AP04 special applications	
This alarm summarizes all the fault conditions emerging from mechanical problems and/or electronic problems in the master and slave drives.	
Possible cause	Possible remedy
-	-
Alarm 70 extension	
0	AP04 impossible: two other local link functions already active !
3	AP04 NOT allowed for asynchronous motors
4	AP03 NOT allowed on a drive that is slave of AP04
7	AP04 NOT allowed 20KHz PWM (see V263)
8	Address greater than nbr of drives for AP04 function
9	Ramps NOT allowed on slave (V30. 4 / 5)

10	P7 local link connector used by another application: ax 1
11	P7 local link connector used by another application: ax 2
12	P7 local link connector used by another application: ax 3
13	P7 local link connector used by another application: ax 4
14	P8 local link connector used by another application: ax 1
15	P8 local link connector used by another application: ax 2
16	P8 local link connector used by another application: ax 3
17	P8 local link connector used by another application: ax 4
18	local link memory A used by another application: ax 1
19	local link memory A used by another application: ax 2
20	local link memory A used by another application: ax 3
21	local link memory A used by another application: ax 4
22	local link memory B used by another application: ax 1
23	local link memory B used by another application: ax 2
24	local link memory B used by another application: ax 3
25	local link memory B used by another application: ax 4
26	local link memory C used by another application: ax 1
27	local link memory C used by another application: ax 2
28	local link memory C used by another application: ax 3
29	local link memory C used by another application: ax 4
40	Timeout: master not enabled due to unknown reasons
41	Timeout: slave #1 not enabled due to unknown reasons
42	Timeout: slave #2 not enabled due to unknown reasons
43	Timeout: slave #3 not enabled due to unknown reasons
50	Master halted when torque enable on slave
51	Slave #1 halted when torque enable by master
52	Slave #2 halted when torque enable by master
53	Slave #3 halted when torque enable by master
60	Master drive is in fault status
61	Slave #1 drive is in fault status
62	Slave #2 drive is in fault status
63	Slave #3 drive is in fault status
70	Master is not enabled due to unknown reasons
71	Slave #1 drive is not enabled due to unknown reasons
72	Slave #2 drive is not enabled due to unknown reasons
73	Slave #3 drive is not enabled due to unknown reasons

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Alarm 71 Winding duplication function

This alarm is related to the winding duplication function: AP05 special applications.

This alarm summarizes all the fault conditions emerging from mechanical problems and/or electronic problems in the master and slave drives.

Possible cause	Possible remedy
-	-
Alarm 71 extension	
0	AP05 impossible: two other local link functions already active !
1	AP05 NOT compatible with current offset measurement at 50% PWM (V30.0)
2	AP05 NOT compatible with PWM phase inversion (V30.1)
3	AP05 NOT allowed for asynchronous motors
4	AP03 NOT allowed on a drive that is slave of AP05
5	AP04 NOT allowed on a drive that is slave of AP05
7	AP05 NOT allowed 20KHz PWM (see V263)
8	Address greater than nbr of drives for AP05 function
9	Ramps NOT allowed on slave (V30.4 / 5)
10	P7 local link connector used by another application: ax 1
11	P7 local link connector used by another application: ax 2
12	P7 local link connector used by another application: ax 3
13	P7 local link connector used by another application: ax 4
14	P8 local link connector used by another application: ax 1
15	P8 local link connector used by another application: ax 2
16	P8 local link connector used by another application: ax 3
17	P8 local link connector used by another application: ax 4
18	local link memory A used by another application: ax 1
19	local link memory A used by another application: ax 2
20	local link memory A used by another application: ax 3
21	local link memory A used by another application: ax 4
22	local link memory B used by another application: ax 1
23	local link memory B used by another application: ax 2
24	local link memory B used by another application: ax 3
25	local link memory B used by another application: ax 4
26	local link memory C used by another application: ax 1
27	local link memory C used by another application: ax 2
28	local link memory C used by another application: ax 3
29	local link memory C used by another application: ax 4
40	Timeout: master not enabled due to unknown reasons
41	Timeout: slave #1 not enabled due to unknown reasons
42	Timeout: slave #2 not enabled due to unknown reasons
43	Timeout: slave #3 not enabled due to unknown reasons
50	Master halted when torque enable on slave

51	Slave #1 halted when torque enable by master
52	Slave #2 halted when torque enable by master
53	Slave #3 halted when torque enable by master
60	Master drive is in fault status
61	Slave #1 drive is in fault status
62	Slave #2 drive is in fault status
63	Slave #3 drive is in fault status
70	Master is not enabled due to unknown reasons
71	Slave #1 drive is not enabled due to unknown reasons
72	Slave #2 drive is not enabled due to unknown reasons
73	Slave #3 drive is not enabled due to unknown reasons

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Alarm 80 DEMF Drive Embedded Macro function

This alarm is related to the DEMF Drive Embedded Macro function: AP07 special applications.

This alarm summarizes all the fault conditions that can arise using this function.

Possible cause		Possible remedy
-		-
Alarm 80 extension		
2	DEMF function not allowed on slave drives	
3	Not enough computation time to exec DEMF function	
5	AP08 NOT allowed 20KHz PWM (see V263)	
6	AP08 requires AP07 enabling	
7	AP08 impossible: two other local link functions already active !	
8	AP08 exchanged measure point not found (V202)	
10	Error in instruction #0 : wrong instruction mnemonic	
11	Error in instruction #0 : unknown token found	
12	Error in instruction #0 : 1st result variable nbr out of range (0..31)	
13	Error in instruction #0 : 2nd result variable nbr out of range (0..31)	
14	Error in instruction #0 : bit index out of range (0..63)	
15	Error in instruction #0 : parameter of type string are not allowed	
16	Error in instruction #0 : measure point not found	
17	Error in instruction #0 : parameter not found	
18	Error in instruction #0 : instruction with 2 results must use different variables	
19	Error in instruction #0 : relative offset of jump instruction is out of range	
20	Error in instruction #0 : operand nbr out of range (0..63)	
21	Error in instruction #0 : constant can not be used as operand	
22	Error in instruction #0 : unknown token: operand expected	
23	Error in instruction #0 : unknown token: variable expected	
24	Error in instruction #0 : unknown token: = expected	
25	Error in instruction #0 : unknown token: jump OFFSET expected	
26	Error in instruction #0 : invalid type conversion character (T,C,R)	
27	Error in instruction #0 : invalid character found	
28	Error in instruction #0 : unknown token: PAR nbr expected	
29	Error in instruction #0 : unknown token: MP nbr expected	
30	Error in instruction #0 : unknown token: BIT nbr expected	
110	Error in instruction #1 : wrong instruction mnemonic	
111	Error in instruction #1 : unknown token found	
112	Error in instruction #1 : 1st result variable nbr out of range (0..31)	
113	Error in instruction #1 : 2nd result variable nbr out of range (0..31)	
114	Error in instruction #1 : bit index out of range (0..63)	
115	Error in instruction #1 : parameter of type string are not allowed	
116	Error in instruction #1 : measure point not found	
117	Error in instruction #1 : parameter not found	

118	Error in instruction #1 : instruction with 2 results must use different variables
119	Error in instruction #1 : relative offset of jump instruction is out of range
120	Error in instruction #1 : operand nbr out of range (0..63)
121	Error in instruction #1 : constant can not be used as operand
122	Error in instruction #1 : unknown token: operand expected
123	Error in instruction #1 : unknown token: variable expected
124	Error in instruction #1 : unknown token: = expected
125	Error in instruction #1 : unknown token: jump OFFSET expected
126	Error in instruction #1 : invalid type conversion character (T,C,R)
127	Error in instruction #1 : invalid character found
128	Error in instruction #1 : unknown token: PAR nbr expected
129	Error in instruction #1 : unknown token: MP nbr expected
130	Error in instruction #1 : unknown token: BIT nbr expected
210	Error in instruction #2 : wrong instruction mnemonic
211	Error in instruction #2 : unknown token found
212	Error in instruction #2 : 1st result variable nbr out of range (0..31)
213	Error in instruction #2 : 2nd result variable nbr out of range (0..31)
214	Error in instruction #2 : bit index out of range (0..63)
215	Error in instruction #2 : parameter of type string are not allowed
216	Error in instruction #2 : measure point not found
217	Error in instruction #2 : parameter not found
218	Error in instruction #2 : instruction with 2 results must use different variables
219	Error in instruction #2 : relative offset of jump instruction is out of range
220	Error in instruction #2 : operand nbr out of range (0..63)
221	Error in instruction #2 : constant can not be used as operand
222	Error in instruction #2 : unknown token: operand expected
223	Error in instruction #2 : unknown token: variable expected
224	Error in instruction #2 : unknown token: = expected
225	Error in instruction #2 : unknown token: jump OFFSET expected
226	Error in instruction #2 : invalid type conversion character (T,C,R)
227	Error in instruction #2 : invalid character found
228	Error in instruction #2 : unknown token: PAR nbr expected
229	Error in instruction #2 : unknown token: MP nbr expected
230	Error in instruction #2 : unknown token: BIT nbr expected
310	Error in instruction #3 : wrong instruction mnemonic
311	Error in instruction #3 : unknown token found
312	Error in instruction #3 : 1st result variable nbr out of range (0..31)
313	ERROR IN INSTRUCTION #3 : 2ND RESULT VARIABLE NBR OUT OF RANGE (0..31)
314	Error in instruction #3 : bit index out of range (0..63)
315	Error in instruction #3 : parameter of type string are not allowed
316	Error in instruction #3 : measure point not found

317	Error in instruction #3 : parameter not found
318	Error in instruction #3 : instruction with 2 results must use different variables
319	Error in instruction #3 : relative offset of jump instruction is out of range
320	Error in instruction #3 : operand nbr out of range (0..63)
321	Error in instruction #3 : constant can not be used as operand
322	Error in instruction #3 : unknown token: operand expected
323	Error in instruction #3 : unknown token: variable expected
324	Error in instruction #3 : unknown token: = expected
325	Error in instruction #3 : unknown token: jump OFFSET expected
326	Error in instruction #3 : invalid type conversion character (T,C,R)
327	Error in instruction #3 : invalid character found
328	Error in instruction #3 : unknown token: PAR nbr expected
329	Error in instruction #3 : unknown token: MP nbr expected
330	Error in instruction #3 : unknown token: BIT nbr expected
410	Error in instruction #4 : wrong instruction mnemonic
411	Error in instruction #4 : unknown token found
412	Error in instruction #4 : 1st result variable nbr out of range (0..31)
413	Error in instruction #4 : 2nd result variable nbr out of range (0..31)
414	Error in instruction #4 : bit index out of range (0..63)
415	Error in instruction #4 : parameter of type string are not allowed
416	Error in instruction #4 : measure point not found
417	Error in instruction #4 : parameter not found
418	Error in instruction #4 : instruction with 2 results must use different variables
419	Error in instruction #4 : relative offset of jump instruction is out of range
420	Error in instruction #4 : operand nbr out of range (0..63)
421	Error in instruction #4 : constant can not be used as operand
422	Error in instruction #4 : unknown token: operand expected
423	Error in instruction #4 : unknown token: variable expected
424	Error in instruction #4 : unknown token: = expected
425	Error in instruction #4 : unknown token: jump OFFSET expected
426	Error in instruction #4 : invalid type conversion character (T,C,R)
427	Error in instruction #4 : invalid character found
428	Error in instruction #4 : unknown token: PAR nbr expected
429	Error in instruction #4 : unknown token: MP nbr expected
430	Error in instruction #4 : unknown token: BIT nbr expected
510	Error in instruction #5 : wrong instruction mnemonic
511	Error in instruction #5 : unknown token found
512	Error in instruction #5 : 1st result variable nbr out of range (0..31)
513	Error in instruction #5 : 2nd result variable nbr out of range (0..31)
514	Error in instruction #5 : bit index out of range (0..63)
515	Error in instruction #5 : parameter of type string are not allowed
516	Error in instruction #5 : measure point not found

517	Error in instruction #5 : parameter not found
518	Error in instruction #5 : instruction with 2 results must use different variables
519	Error in instruction #5 : relative offset of jump instruction is out of range
520	Error in instruction #5 : operand nbr out of range (0..63)
521	Error in instruction #5 : constant can not be used as operand
522	Error in instruction #5 : unknown token: operand expected
523	Error in instruction #5 : unknown token: variable expected
524	Error in instruction #5 : unknown token: = expected
525	Error in instruction #5 : unknown token: jump OFFSET expected
526	Error in instruction #5 : invalid type conversion character (T,C,R)
527	Error in instruction #5 : invalid character found
528	Error in instruction #5 : unknown token: PAR nbr expected
529	Error in instruction #5 : unknown token: MP nbr expected
530	Error in instruction #5 : unknown token: BIT nbr expected
610	Error in instruction #6 : wrong instruction mnemonic
611	Error in instruction #6 : unknown token found
612	Error in instruction #6 : 1st result variable nbr out of range (0..31)
613	Error in instruction #6 : 2nd result variable nbr out of range (0..31)
614	Error in instruction #6 : bit index out of range (0..63)
615	Error in instruction #6 : parameter of type string are not allowed
616	Error in instruction #6 : measure point not found
617	Error in instruction #6 : parameter not found
618	Error in instruction #6 : instruction with 2 results must use different variables
619	Error in instruction #6 : relative offset of jump instruction is out of range
620	Error in instruction #6 : operand nbr out of range (0..63)
621	Error in instruction #6 : constant can not be used as operand
622	Error in instruction #6 : unknown token: operand expected
623	Error in instruction #6 : unknown token: variable expected
624	Error in instruction #6 : unknown token: = expected
625	Error in instruction #6 : unknown token: jump OFFSET expected
626	Error in instruction #6 : invalid type conversion character (T,C,R)
627	Error in instruction #6 : invalid character found
628	Error in instruction #6 : unknown token: PAR nbr expected
629	Error in instruction #6 : unknown token: MP nbr expected
630	Error in instruction #6 : unknown token: BIT nbr expected
710	Error in instruction #7 : wrong instruction mnemonic
711	Error in instruction #7 : unknown token found
712	Error in instruction #7 : 1st result variable nbr out of range (0..31)
713	Error in instruction #7 : 2nd result variable nbr out of range (0..31)
714	Error in instruction #7 : bit index out of range (0..63)
715	Error in instruction #7 : parameter of type string are not allowed
716	Error in instruction #7 : measure point not found

717	Error in instruction #7 : parameter not found
718	Error in instruction #7 : instruction with 2 results must use different variables
719	Error in instruction #7 : relative offset of jump instruction is out of range
720	Error in instruction #7 : operand nbr out of range (0..63)
721	Error in instruction #7 : constant can not be used as operand
722	Error in instruction #7 : unknown token: operand expected
723	Error in instruction #7 : unknown token: variable expected
724	Error in instruction #7 : unknown token: = expected
725	Error in instruction #7 : unknown token: jump OFFSET expected
726	Error in instruction #7 : invalid type conversion character
727	Error in instruction #7 : invalid character found
728	Error in instruction #7 : unknown token: PAR nbr expected
729	Error in instruction #7 : unknown token: MP nbr expected
730	Error in instruction #7 : unknown token: BIT nbr expected
810	Error in instruction #8 : wrong instruction mnemonic
811	Error in instruction #8 : unknown token found
812	Error in instruction #8 : 1st result variable nbr out of range (0..31)
813	Error in instruction #8 : 2nd result variable nbr out of range (0..31)
814	Error in instruction #8 : bit index out of range (0..63)
815	Error in instruction #8 : parameter of type string are not allowed
816	Error in instruction #8 : measure point not found
817	Error in instruction #8 : parameter not found
818	Error in instruction #8 : instruction with 2 results must use different variables
819	Error in instruction #8 : relative offset of jump instruction is out of range
820	Error in instruction #8 : operand nbr out of range (0..63)
821	Error in instruction #8 : constant can not be used as operand
822	Error in instruction #8 : unknown token: operand expected
823	Error in instruction #8 : unknown token: variable expected
824	Error in instruction #8 : unknown token: = expected
825	Error in instruction #8 : unknown token: jump OFFSET expected
826	Error in instruction #8 : invalid type conversion character (T,C,R)
827	Error in instruction #8 : invalid character found
828	Error in instruction #8 : unknown token: PAR nbr expected
829	Error in instruction #8 : unknown token: MP nbr expected
830	Error in instruction #8 : unknown token: BIT nbr expected
910	Error in instruction #9 : wrong instruction mnemonic
911	Error in instruction #9 : unknown token found
912	Error in instruction #9 : 1st result variable nbr out of range (0..31)
913	Error in instruction #9 : 2nd result variable nbr out of range (0..31)
914	Error in instruction #9 : bit index out of range (0..63)
915	Error in instruction #9 : parameter of type string are not allowed
916	Error in instruction #9 : measure point not found

917	Error in instruction #9 : parameter not found
918	Error in instruction #9 : instruction with 2 results must use different variables
919	Error in instruction #9 : relative offset of jump instruction is out of range
920	Error in instruction #9 : operand nbr out of range (0..63)
921	Error in instruction #9 : constant can not be used as operand
922	Error in instruction #9 : unknown token: operand expected
923	Error in instruction #9 : unknown token: variable expected
924	Error in instruction #9 : unknown token: = expected
925	Error in instruction #9 : unknown token: jump OFFSET expected
926	Error in instruction #9 : invalid type conversion character (T,C,R)
927	Error in instruction #9 : invalid character found
928	Error in instruction #9 : unknown token: PAR nbr expected
929	Error in instruction #9 : unknown token: MP nbr expected
930	Error in instruction #9 : unknown token: BIT nbr expected
1010	Error in instruction #10 : wrong instruction mnemonic
1011	Error in instruction #10 : unknown token found
1012	Error in instruction #10 : 1st result variable nbr out of range (0..31)
1013	Error in instruction #10 : 2nd result variable nbr out of range (0..31)
1014	Error in instruction #10 : bit index out of range (0..63)
1015	Error in instruction #10 : parameter of type string are not allowed
1016	Error in instruction #10 : measure point not found
1017	Error in instruction #10 : parameter not found
1018	Error in instruction #10 : instruction with 2 results must use different variables
1019	Error in instruction #10 : relative offset of jump instruction is out of range
1020	Error in instruction #10 : operand nbr out of range (0..63)
1021	Error in instruction #10 : constant can not be used as operand
1022	Error in instruction #10 : unknown token: operand expected
1023	Error in instruction #10 : unknown token: variable expected
1024	Error in instruction #10 : unknown token: = expected
1025	Error in instruction #10 : unknown token: jump OFFSET expected
1026	Error in instruction #10 : invalid type conversion character (T,C,R)
1027	Error in instruction #10 : invalid character found
1028	Error in instruction #10 : unknown token: PAR nbr expected
1029	Error in instruction #10 : unknown token: MP nbr expected
1030	Error in instruction #10 : unknown token: BIT nbr expected
1110	Error in instruction #11 : wrong instruction mnemonic
1111	Error in instruction #11 : unknown token found
1112	Error in instruction #11 : 1st result variable nbr out of range (0..31)
1113	Error in instruction #11 : 2nd result variable nbr out of range (0..31)
1114	Error in instruction #11 : bit index out of range (0..63)
1115	Error in instruction #11 : parameter of type string are not allowed
1116	Error in instruction #11 : measure point not found

1117	Error in instruction #11 : parameter not found
1118	Error in instruction #11 : instruction with 2 results must use different variables
1119	Error in instruction #11 : relative offset of jump instruction is out of range
1120	Error in instruction #11 : operand nbr out of range (0..63)
1121	Error in instruction #11 : constant can not be used as operand
1122	Error in instruction #11 : unknown token: operand expected
1123	Error in instruction #11 : unknown token: variable expected
1124	Error in instruction #11 : unknown token: = expected
1125	Error in instruction #11 : unknown token: jump OFFSET expected
1126	Error in instruction #11 : invalid type conversion character (T,C,R)
1127	Error in instruction #11 : invalid character found
1128	Error in instruction #11 : unknown token: PAR nbr expected
1129	Error in instruction #11 : unknown token: MP nbr expected
1130	Error in instruction #11 : unknown token: BIT nbr expected
1210	Error in instruction #12 : wrong instruction mnemonic
1211	Error in instruction #12 : unknown token found
1212	Error in instruction #12 : 1st result variable nbr out of range (0..31)
1213	Error in instruction #12 : 2nd result variable nbr out of range (0..31)
1214	Error in instruction #12 : bit index out of range (0..63)
1215	Error in instruction #12 : parameter of type string are not allowed
1216	Error in instruction #12 : measure point not found
1217	Error in instruction #12 : parameter not found
1218	Error in instruction #12 : instruction with 2 results must use different variables
1219	Error in instruction #12 : relative offset of jump instruction is out of range
1220	Error in instruction #12 : operand nbr out of range (0..63)
1221	Error in instruction #12 : constant can not be used as operand
1222	Error in instruction #12 : unknown token: operand expected
1223	Error in instruction #12 : unknown token: variable expected
1224	Error in instruction #12 : unknown token: = expected
1225	Error in instruction #12 : unknown token: jump OFFSET expected
1226	Error in instruction #12 : invalid type conversion character (T,C,R)
1227	Error in instruction #12 : invalid character found
1228	Error in instruction #12 : unknown token: PAR nbr expected
1229	Error in instruction #12 : unknown token: MP nbr expected
1230	Error in instruction #12 : unknown token: BIT nbr expected
1310	Error in instruction #13 : wrong instruction mnemonic
1311	Error in instruction #13 : unknown token found
1312	Error in instruction #13 : 1st result variable nbr out of range (0..31)
1313	Error in instruction #13 : 2nd result variable nbr out of range (0..31)
1314	Error in instruction #13 : bit index out of range (0..63)
1315	Error in instruction #13 : parameter of type string are not allowed

1316	Error in instruction #13 : measure point not found
1317	Error in instruction #13 : parameter not found
1318	Error in instruction #13 : instruction with 2 results must use different variables
1319	Error in instruction #13 : relative offset of jump instruction is out of range
1320	Error in instruction #13 : operand nbr out of range (0..63)
1321	Error in instruction #13 : constant can not be used as operand
1322	Error in instruction #13 : unknown token: operand expected
1323	Error in instruction #13 : unknown token: variable expected
1324	Error in instruction #13 : unknown token: = expected
1325	Error in instruction #13 : unknown token: jump OFFSET expected
1326	Error in instruction #13 : invalid type conversion character (T,C,R)
1327	Error in instruction #13 : invalid character found
1328	Error in instruction #13 : unknown token: PAR nbr expected
1329	Error in instruction #13 : unknown token: MP nbr expected
1330	Error in instruction #13 : unknown token: BIT nbr expected
1410	Error in instruction #14 : wrong instruction mnemonic
1411	Error in instruction #14 : unknown token found
1412	Error in instruction #14 : 1st result variable nbr out of range (0..31)
1413	Error in instruction #14 : 2nd result variable nbr out of range (0..31)
1414	Error in instruction #14 : bit index out of range (0..63)
1415	Error in instruction #14 : parameter of type string are not allowed
1416	Error in instruction #14 : measure point not found
1417	Error in instruction #14 : parameter not found
1418	Error in instruction #14 : instruction with 2 results must use different variables
1419	Error in instruction #14 : relative offset of jump instruction is out of range
1420	Error in instruction #14 : operand nbr out of range (0..63)
1421	Error in instruction #14 : constant can not be used as operand
1422	Error in instruction #14 : unknown token: operand expected
1423	Error in instruction #14 : unknown token: variable expected
1424	Error in instruction #14 : unknown token: = expected
1425	Error in instruction #14 : unknown token: jump OFFSET expected
1426	Error in instruction #14 : invalid type conversion character (T,C,R)
1427	Error in instruction #14 : invalid character found
1428	Error in instruction #14 : unknown token: PAR nbr expected
1429	Error in instruction #14 : unknown token: MP nbr expected
1430	Error in instruction #14 : unknown token: BIT nbr expected
1510	Error in instruction #15 : wrong instruction mnemonic
1511	Error in instruction #15 : unknown token found
1512	Error in instruction #15 : 1st result variable nbr out of range (0..31)
1513	Error in instruction #15 : 2nd result variable nbr out of range (0..31)
1514	Error in instruction #15 : bit index out of range (0..63)
1515	Error in instruction #15 : parameter of type string are not allowed

1516	Error in instruction #15 : measure point not found
1517	Error in instruction #15 : parameter not found
1518	Error in instruction #15 : instruction with 2 results must use different variables
1519	Error in instruction #15 : relative offset of jump instruction is out of range
1520	Error in instruction #15 : operand nbr out of range (0..63)
1521	Error in instruction #15 : constant can not be used as operand
1522	Error in instruction #15 : unknown token: operand expected
1523	Error in instruction #15 : unknown token: variable expected
1524	Error in instruction #15 : unknown token: = expected
1525	Error in instruction #15 : unknown token: jump OFFSET expected
1526	Error in instruction #15 : invalid type conversion character (T,C,R)
1527	Error in instruction #15 : invalid character found
1528	Error in instruction #15 : unknown token: PAR nbr expected
1529	Error in instruction #15 : unknown token: MP nbr expected
1530	Error in instruction #15 : unknown token: BIT nbr expected
1910	AP08 P7 local link connector used by another application: ax 1
1911	AP08 P7 local link connector used by another application: ax 2
1912	AP08 P7 local link connector used by another application: ax 3
1913	AP08 P7 local link connector used by another application: ax 4
1914	AP08 P8 local link connector used by another application: ax 1
1915	AP08 P8 local link connector used by another application: ax 2
1916	AP08 P8 local link connector used by another application: ax 3
1917	AP08 P8 local link connector used by another application: ax 4
1918	AP08 local link memory A used by another application: ax 1
1919	AP08 local link memory A used by another application: ax 2
1920	AP08 local link memory A used by another application: ax 3
1921	AP08 local link memory A used by another application: ax 4
1922	AP08 local link memory B used by another application: ax 1
1923	AP08 local link memory B used by another application: ax 2
1924	AP08 local link memory B used by another application: ax 3
1925	AP08 local link memory B used by another application: ax 4
1926	AP08 local link memory C used by another application: ax 1
1927	AP08 local link memory C used by another application: ax 2
1928	AP08 local link memory C used by another application: ax 3
1929	AP08 local link memory C used by another application: ax 4

6.6 Drive Warning signalings to CNC

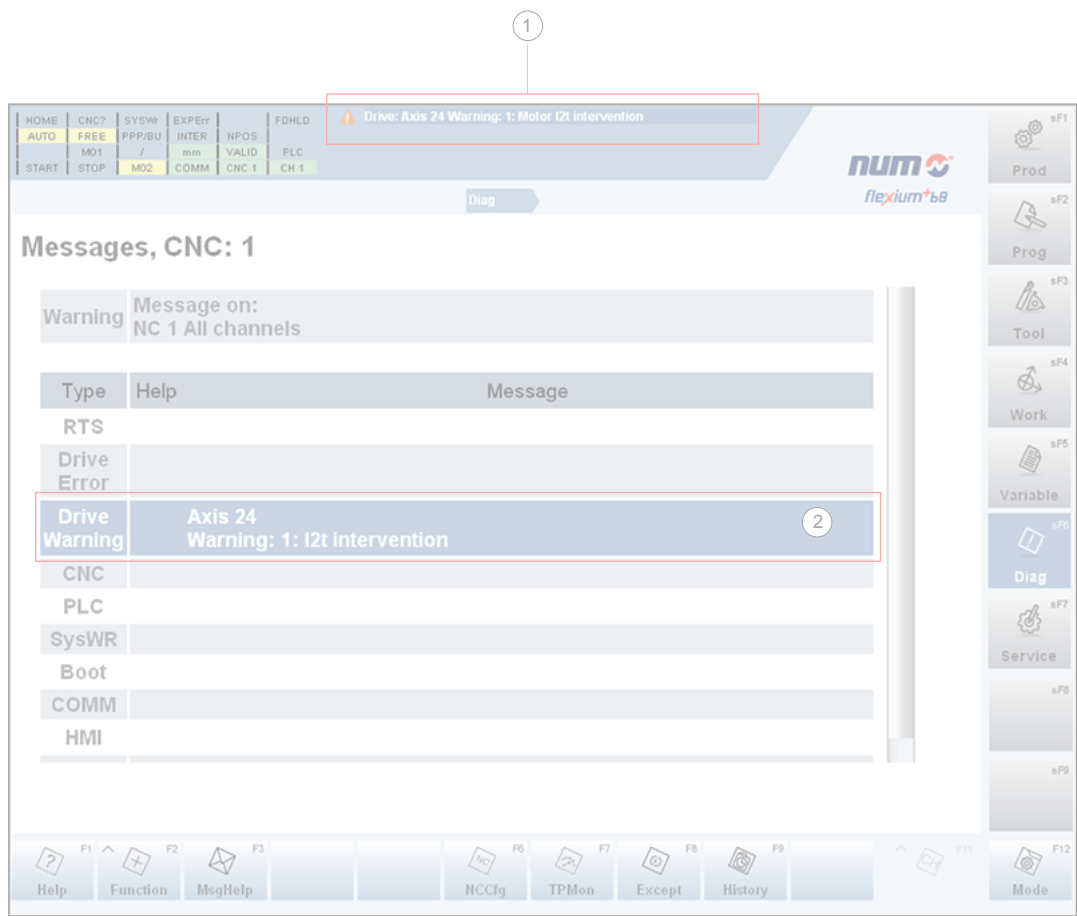


Fig. 43 - Drive Warning signalings to CNC

①	Warning advise occurred
②	Warning message description

6.6.1 Warning description

Warning 3 Overtemperature

Description	
Possible cause	Possible remedy
Warning 3 extension	
1	Motor NTC warning overtemperature (110% of A03) exceeded

Warning 4 Drive overtemperature

Description	
Possible cause	Possible remedy
Warning 4 extension	
0	Drive warning overtemperature exceeded
1	DRIVE ZYNQ PROCESSOR TEMPERATURE OVERTEMPERATURE EXCEEDED

Warning 5 Braking resistor or PWS overtemperature

Description	
Possible cause	Possible remedy
Warning 5 extension	
0	Braking resistor or PWS overtemperature

Warning 9 S1 Sensor

Description	
Possible cause	Possible remedy
Warning 9 extension	
0	Error of repeated congruity UGA with analog quadrant
1	Wrong CRC of the fast serial communication
2	Battery low warning: change battery as soon as possible !
3	"bad signal" warning: sensor scale should be cleaned

Warning 10 Timeout

Description	
Possible cause	Possible remedy
Warning 10 extension	
9	Synchronization with NC not yet started

Warning 14 Wrong SD card handling

Description	
Possible cause	Possible remedy
Warning 14 extension	
3	AP02: unable to get access to SD memory card (cause semaphore)
4	AP02: unable to delete file
5	AP02: unable to write file
10	Alarm LOG: file too big to be managed: remove it !
11	Alarm LOG: unable to check file size: ...LOG allowed

Warning 16 Wrong SD card handling

Description	
Possible cause	Possible remedy
Warning 16 extension	
130	NOT existing MP associated to quick NC TP1
131	NOT existing MP associated to quick NC TP2
132	NOT existing MP associated to quick NC TP3
133	NOT existing MP associated to quick NC TP4
140	NOT existing MP associated to Relay1
141	MP belonging to wrong motor type associated to Relay1
142	MP associated to Relay1 can NOT be filtered
150	NOT existing MP associated to Relay2
151	MP belonging to wrong motor type associated to Relay2
152	MP associated to Relay2 can NOT be filtered
670	MP assoc. to quick NC TP1 belonging to wrong motor type
671	MP assoc. to quick NC TP2 belonging to wrong motor type
672	MP assoc. to quick NC TP3 belonging to wrong motor type
673	MP assoc. to quick NC TP4 belonging to wrong motor type
674	MP assoc. to quick NC TP1 can NOT be filtered
675	MP assoc. to quick NC TP2 can NOT be filtered
676	MP assoc. to quick NC TP3 can NOT be filtered
677	MP assoc. to quick NC TP4 can NOT be filtered
682	NOT existing MP associated to oscilloscope trace 1
683	NOT existing MP associated to oscilloscope trace 2
684	NOT existing MP associated to oscilloscope trace 3
685	NOT existing MP associated to oscilloscope trace 4
686	MP assoc. to oscillo trace 1 belonging to wrong motor type
687	MP assoc. to oscillo trace 2 belonging to wrong motor type
688	MP assoc. to oscillo trace 3 belonging to wrong motor type
689	MP assoc. to oscillo trace 4 belonging to wrong motor type
690	MP assoc. to oscillo trace 1 can NOT be filtered
691	MP assoc. to oscillo trace 2 can NOT be filtered
692	MP assoc. to oscillo trace 3 can NOT be filtered
693	MP assoc. to oscillo trace 4 can NOT be filtered

Warning 18 Wrong SD card handling

Description	
Possible cause	Possible remedy
Warning 18 extension	
0	EPSM will cause phase offset switching after POM/APEM

Warning 37 Self-calibration related

Description	
Possible cause	Possible remedy
Excessive value for P23 CNC parameter see paragraph 5.7.1	Reduce P23 CNC parameter value
Warning 37 extension	
0	Overflow error computing following error internal units

Warning 38 S2 sensor

Description	
Possible cause	Possible remedy
Warning 38 extension	
0	Error of repeated congruity UGA with analog quadrant
1	Wrong CRC of the fast serial communication
2	Battery low warning: change battery as soon as possible !
3	"bad signal" warning: sensor scale should be cleaned

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Warning 49 I²t

Description	
Possible cause	Possible remedy
Warning 49 extension	
0	Motor I ² t warning threshold exceeded
1	Drive I ² t warning threshold exceeded
10	Mathematical limit exceeded for motor second time constant Mathematical limit exceeded for motor second time constant
11	Mathematical limit exceeded for drive second time constant

Warning 53 Self test HW

Description	
Possible cause	Possible remedy
Warning 53 extension	
11	Conflict on digital input ix1: used by other entity: ax 1
12	Conflict on digital input ix2: used by other entity: ax 1
13	Conflict on digital input ix3: used by other entity: ax 1
14	Conflict on digital input ix4: used by other entity: ax 1
21	Conflict on digital input ix1: used by other entity: ax 2
22	Conflict on digital input ix2: used by other entity: ax 2
23	Conflict on digital input ix3: used by other entity: ax 2
24	Conflict on digital input ix4: used by other entity: ax 2
31	Conflict on digital input ix1: used by other entity: ax 3
32	Conflict on digital input ix2: used by other entity: ax 3
33	Conflict on digital input ix3: used by other entity: ax 3
34	Conflict on digital input ix4: used by other entity: ax 3
41	Conflict on digital input ix1: used by other entity: ax 4
42	Conflict on digital input ix2: used by other entity: ax 4
43	Conflict on digital input ix3: used by other entity: ax 4
44	Conflict on digital input ix4: used by other entity: ax 4

Warning 54 Brake failure

Description	
Possible cause	Possible remedy
Warning 54 extension	
20	Safe-Brake feedback dyn.test: failure by PL Cpu1
21	Safe-Brake feedback dyn.test: failure by PL Cpu2
22	Safe-Brake feedback dyn.test: failure by PS hi-lo
23	Safe-Brake feedback dyn.test: failure by PS lo-hi

Warning 56 V/f related

Description	
Possible cause	Possible remedy
Warning 56 extension	
11	Math err: wrong [V/Hz] slope (check V601, V602, V603)
12	Math err: wrong gain of current limiter (check V91, V600, V605)

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Warning 60 Safety modules

Description	
Possible cause	Possible remedy
Warning 60 extension	
268	No feedback signals of the NUM-STOX inputs changing for 35h
303	NUM-SAMX timeout writing drive Kernel S/N
304	NUM-SAMX abort writing drive Kernel S/N
305	NUM-SAMX unable to write drive Kernel S/N
306	NUM-SAMX timeout writing drive SW version
307	NUM-SAMX abort writing drive SW version
308	NUM-SAMX unable to write drive SW version
309	NUM-SAMX timeout reading SAMX SW version
310	NUM-SAMX abort reading SAMX SW version
311	NUM-SAMX unable to read SAMX SW version
312	NUM-SAMX timeout reading SAMX Board version
313	NUM-SAMX abort reading SAMX Board version
314	NUM-SAMX unable to read SAMX Board version
315	NUM-SAMX timeout reading SAMX FSoE address
316	NUM-SAMX abort reading SAMX FSoE address
317	NUM-SAMX unable to read SAMX FSoE address
318	NUM-SAMX timeout reading SAMX Parameter checksum
319	NUM-SAMX abort reading SAMX Parameter checksum
320	NUM-SAMX unable to read SAMX Parameter checksum
321	NUM-SAMX timeout resetting SAMX alarms
322	NUM-SAMX abort rx resetting SAMX alarms
323	NUM-SAMX unable to reset SAMX alarms
324	NUM-SAMX TIMEOUT WRITING PWR 1 HW VERSION
325	NUM-SAMX ABORT WRITING PWR 1 HW VERSION
326	NUM-SAMX UNABLE TO WRITE PWR 1 HW VERSION
327	NUM-SAMX TIMEOUT WRITING PWR 2 HW VERSION
328	NUM-SAMX ABORT WRITING PWR 2 HW VERSION
329	NUM-SAMX UNABLE TO WRITE PWR 2 HW VERSION
330	NUM-SAMX mismatch reading SAMX SW version
331	NUM-SAMX mismatch reading SAMX Board version
332	NUM-SAMX mismatch reading SAMX FSoE address
333	NUM-SAMX mismatch reading SAMX param. checksum

6.7 BHX040 motor: Tamagawa battery alarm and warning handling

There exist 4 battery alarms and 1 warning in case of Tamagawa:

- A9 .269
- 1007
- 1008
- 1009
- Warning 9 extension 2 or Warning 38 extension 2

That because the combination of battery status and external sensor power supply by drive active or not active.

All such alarms and warnings are detected only at sensor initialization phase:

- At drive switch on
- At drive Halt ---> Run transition.

CNC alarm display	Alarm extension	
S1 Sensor A9	269	This alarm is there only to remind the user that sensor absolute measure was lost previously due to some battery alarm. The user has to remember to re-execute proper HOMING on such axis and also to re-initialize AP02, ...if AP02 was active before battery alarm. This alarm is not resettable. The only way to cancel this alarm is to switch OFF the drive. After drive is switched back ON, then the alarm will be no more present, but the user has to remember to re-execute HOMING on such axis. If AP02 was active, then AP02 must be re-initialized.
	1007	Battery voltage fallen below 2.5V +/- 0.2V. When the drive was switched OFF: no external power supplied to the sensor. That could happen if the battery is exhausting while drive was switched OFF or if the battery has been disconnected while the drive was switched OFF. The measure is lost (because sensor power supply and the battery were OFF) This alarm is not resettable. The only way to cancel this alarm is to replace the battery with drive ON. (See procedure below) After having followed proper procedure, and after having switched drive ON again then the alarm will be no more present, but the user has to remember to re-execute HOMING on such axis. If AP02 was active, then AP02 must be re-initialized.
	1008	Battery voltage fallen below 3.1V +/- 0.1V and drive is delivering power supply to Tamagawa sensor. That could happen after a reset of alarm 1009. The measure is lost. (...due to previous alarm 1009) After having followed proper procedure, and after having switched drive ON again then the alarm will be no more present, but the user has to remember to re-execute HOMING on such axis. If AP02 was active, then AP02 must be re-initialized.
	1009	Battery voltage fallen below 2.5V +/- 0.2V. When the drive was switched OFF: no external power supplied to the sensor, and the battery level is low, still now. That could happen if the battery is exhausting while drive was switched OFF or if the battery has been disconnected while the drive was switched OFF and the battery is still disconnected. The measure is lost (because sensor power supply and battery were OFF...). After having followed proper procedure, and after having switched drive ON again then the alarm will be no more present, but the user has to remember to re-execute HOMING on such axis. If AP02 was active, then AP02 must be re-initialized.

CNC alarm display	Procedure in case of Alarm 1007, 1008, 1009
S1 Sensor A9	If, after drive switch ON, you get alarm 1007 or 1008 or 1009 then you have to operate as follows: Keep the drive switched ON. Remove the battery ...but do not put a new one !!! Reset the alarm, repeatedly, until you get alarm 1008. Insert a new battery ..now !!! while the drive is still ON... Reset the alarm ...then you should get alarm 269. Switch the drive OFF. Switch back the drive ON ..and any alarm should have disappeared. Now you have to re-execute HOMING of the axis and, if AP02 was active, you have to re-initialize AP02 !!!
	If it is not successful, or you do not reach the end of the procedure in which the error 269 is displayed, try: - Disable bit 5 of parameter V0324. - Reset the drive. - Re-enable bit 5 of parameter V0324. - Reset the drive again. - At this point we should find ourselves with alarm 269 and from here continue until the end of the normal procedure.

Warning 9 ext 2 or 38 ext 2 Battery low warning

CNC warning 9 ext 2 or 38 ext 2 display	This warning is issued in case of low battery level detection. When the drive undergoes an HALT/RUN transition or after any alarm reset. It means that you should replace encoder battery as soon as possible !!! The sensor absolute measure is not yet lost... so you can continue the machining but as soon as the machining phase is finished you should replace battery !!! Do not switch off the drive !!! Otherwise sensor absolute measure will be lost !!! The only way to remove the warning is to replace battery with drive ON, then to re-execute an HALT/RUN transition of the drive or switch drive OFF and ON again. Remember The battery replacement has to be done keeping drive switched ON !!! See detailed procedure below.
---	---

CNC warning 9 ext 2 or 38 ext 2 display	Procedure in case of Warning 9 ext 2 or 38 ext 2 (battery low warning) • In case you have only warning 9 ext 2 or 38 ext 2 (battery low warning) issued on HMI screen, it means that you should replace encoder battery as soon as possible! The encoder absolute measure is not yet lost... so you can continue machining but as soon as the machining phase is finished you should replace battery !!! • Do not switch off the drive !!! otherwise sensor absolute measure will be lost !!! • How to replace battery: - Stop machining. - Keep the drive switched ON !!! - Replace Tamagawa sensor battery while drive is still ON. - Then, in order to remove the warning you could: put the drive in HALT and then in RUN again or switch the drive OFF and ON again.
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Please refer to NUM OEM Information NO1077A for more detailed information concerning the battery replacement procedure!

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7 NUM DrivePro / PLC exchange area

7.1 FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.

<i>FlexiumPro_NCK.WCNC.Axis[n].DigitalAxis.</i>		
<i>TorqueEnable</i>	Torque request	0: Torque enable not requested
		1: Torque enable requested
<i>ReferenceEnable</i>	Reference request	0: Reference enable not requested
		1: Reference enable requested
<i>RampDisabled</i>	Ramp Disabled	0: Ramp on speed reference enabled by V30.4
		1: Ramp on speed reference enabled by V30.4 is suppressed
<i>CurrentReduction</i>	Current reduction	Rule: $I_{red} = I_{nom} (128 - \text{value}) / 128$ $I_{nom} = V50$
<i>SpindleElectricalConfiguration</i>	Spindle electrical gear switching in execution	0: spindle electrical gear switching disabled
		1: spindle electrical gear switching in execution

7.2 FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.

<i>FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.</i>			
Meaning	Bit value	Causes	Status
BrakeRelay	OFF		It is possible to drive a 24V digital Output on S7 connector depending on configuration of parameters V26 ... V29
	ON		
BrakeTestRunning	0: NO BrakeTest is running		
	1: BrakeTest is in execution		
BumpSuppressor	0: Bump Suppressor is OFF		
	1: Bump Suppressor is active		
ConsWPMActive	0: OFF	WPM not connected or not in console mode.	User is able to move the motor using WPM.
	ON	WPM connected or in console mode	Drive is able to move motor
ControlMode	In reality it is NOT a single bit but a 4 bit integer (0..15)	0 = Delta position control mode	
		1 = Speed control mode	
DCBusPresent	Bus voltage not present	Power Supply not connected. to the mains Line switch opened	Drive disabled"
	Bus voltage present	Line switch closed	
DEMxDigitalOutput	0: Output low	digital output controlled by DEMF function (see chapter 8)	It is possible to drive a 24V digital Output on S7 connector depending on configuration of parameters V26 ... V29
	Output high		
DigitalAxisI2T	In reality it is NOT a single bit but an 8 bit integer (0..255)	Represents the drive I2T value in percentage: ex.: value 87 means I2Tdrive = 87%	
		Also available on measure-point MP016	
DriveInRunState	Drive stopped	Halt Request = 1 Alarm	Drive is able to receive commands for parameter handling. Drive is not able to move motor.
	Drive start	Halt Request = 0	Drive is able to move motor
DriveOk	0: Drive error	Alarm condition.	No motor current Drive not able to move motor Drive not able to follow ref., HALT status
	No error	No alarm.	Drive able to move motor Drive able to follow ref.
EmergencyQuickStop	0: Emergency Quick stop From SAMX not active		
	1: Emergency Quick stop From SAMX active		
EmergencyStopStatus		0 = Emergency Stop Status From SAMX not active	
		1 = Emergency Stop Status From SAMX active	

FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.			
EPS_EPSMActiv	Self-calibration completed	Phasing Request =0	Drive normal status
	Self-calibration in progress	Phasing Request =1	Procedure used to phase synchronous motor sensor is in progress.
EtherCATOK	0: EtherCAT communication down	Link cable not connected or wrong cabled CNC fault Link fault.	Drive not synchronised with CNC sampling EtherCAT status KO. Not able to follow ref. Not able to receive commands or to send status
	1: EtherCAT communication OK		Drive synchronised with CNC sampling. Drive able to follow ref. correctly. EtherCAT status OK.
MainsOn	0: No mains present on Drives Power Supply (MDLLxxx)		
	1: Mains present on Drives Power Supply		
MechPower	In reality it is NOT a single bit but a floating-point integer on 32 bits	Represents the estimated power at the crankshaft in Watts [W] positive if supplied to the load; negative if absorbed by the load.	
MotorI2T	In reality it is NOT a single bit but a 8-bit integer (0..255)	Represents the I2T value of the motor in percentage: ex.: value 87 means I2Tmotor = 87% Also available on measure-point MP007	
MotorLoad	In reality it is NOT a single bit but a 16 bit integer (0..65536) effective range = 0 .. 800	Represents the torque current level, in percentage, compared to the available torque current: - maximum torque if V31.4 = 1 - nominal torque if V31.4 = 0 e.g.: 87 means 87% of torque current on the available. Also available on the measure-point MP011	
MotorMoving	Motor stopped	Motor stopped or slowly moving, speed is less than +/- V41 or V42	
	Motor running	Motor speed is higher than +/- V41 or V42	

FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.			
ParameterSet	In reality it is NOT a single bit but an 8 bit integer (0..255) Effective range 0..99	Indicates the number of parameter sets currently in use in the drive. e.g.: 0 means that the parameter set currently in use in drive 2 is set#0 13 means that the parameter set currently in use in drive 2 is set#13 Set 99 is RESERVED for the drive: indicates DEFAULT parameterization	
Parking	0: axis active		
	1: axis in PARKING: all alarms & warnings are inhibited !!!		
Prog01	Output low		It is possible to drive a 24V digital Output on S7 connector depending on configuration of parameters V26 ... V29
	Output high		
Prog02	Output low		It is possible to drive a 24V digital Output on S7 connector depending on configuration of parameters V26 ... V29
	Output high		
PWMCutOff	0: OK		
	With Stop Function enabled V30 bit 9 = 1 PWM cutted by Stop Function intervention"	Stop Function intervention: S8 pin 1 without 24Vdc S8 pin 2 without 0Vdc S8 pin 3-4 contact opened S8 pin 5-6 contact opened	No motor current Drive not able to move motor Drive not able to follow ref."
	With NUM-SAMX PWM cutted by NUM-SAMX	NUM-SAMX before start	No motor current Drive not able to move motor Drive not able to follow ref."
	With NUM-SAMX PWM cutted by NUM-SAMX"	NUM-SAMX intervention	No motor current Drive not able to move motor Drive not able to follow ref. HALT status"
ReferenceEnabled	Reference (speed) not enabled	Reference request = 0 CNC fault"	Drive not able to turn the motor"
	Reference (speed) enabled	Reference request = 1 No CNC fault"	Drive is able to turn the motor if torque enabled.
SpeedReached (1)	Speed not reached		The absolute value of (ref. speed - motor speed) >V40. See V40 use.
	Speed reached		The absolute value of (ref. speed - motor speed) <=V40. See V40 use.
TorqueEnabled	Drive not enabled	Torque request = 0 DC-BUS OFF Security relais opened Halt Status Alarm"	No motor current Drive not able to move motor
	Drive enabled	Torque request = 1 DC-BUS ON Security relais closed Run Status No Alarm"	Motor current, if motor connected. Drive is able to move motor Drive is able to follow ref, if ref. enable will be given.

<i>FlexiumPro_NCK.RCNC.Axis[n].DigitalAxis.</i>			
Warning	0: no warning present		
	1: at least one warning present		
Note. (1) This signal is enabled only if V30.4 = 1.			
For the meaning of the LED signals refer to chapter 6			

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LPA	Load a drive parameter into a variable.....	455
FSDO, ISDO	Store variable content to DEMF programmable digital output.....	456
STS	Store variable content to additive contribution to speed reference	457
STT	Store variable content to additive contribution to torque reference	457
FADD, IADD	Add two operands and store the result into a variable	458
FSUB, ISUB	Subtract two operands and store the result into a variable	459
FMUL, IMUL	Multiply two operands and store the result into a variable	460
FDIV, IDIV	Divide two operands and store quotient into a variable.....	461
FMOD, IMOD	Divide two operands and store remainder into a variable	462
SQRT	Calculation square root of an operand and store the result into a variable	463
ATN	Calculation arctangent of two operand and store the result (degrees) into a variable	464
TRG	Calculation sin and cos of an operand (degrees) and store the result into two variables	465
FMAC, IMAC	Multiply two operands and accumulate the result into a third variable	466
LOG	Calculation base-10 logarithm of an operand and store the result into a variable	467
POW	Elevates first operand to power second operand and store the result into a variable.....	468
TANH	Calculation hyperbolic tangent of an operand and store the result into a variable.....	469
TRGH	Calculation hyperbolic sin and cos of an operand and store the result into two variables	470
FABS, IABS	Calculation absolute value of an operand and store the result into a variable	471
FSGN, ISGN	Calculation signum of an operand and store the result into a variable.....	472
FMAX, IMAX	Calculation max value between two operands and store the result into a variable.....	473
FMIN, IMIN	Calculation min value between two operands and store the result into a variable	474
FSAT, ISAT	Calculation saturated value of an operand with respect to another one and store the result into a variable	475

ASH	Arithmetic shift first operand, based on second operand, and store the result into a variable	476
LSH	Logical shift first operand, based on second operand, and store the result into a variable	477
EXT	Extends, with signum, a portion of an operand to its full size (64bit) and store result into a variable	478
FRNG, IRNG	“ranging” of a variable to fit it into the range defined by two operands.....	479
AND	Calculation logical AND of two operand and store the result into a variable	480
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XOR	Calculation logical XOR of two operand and store the result into a variable.....	482
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FJEQ, IJEQ	Compare two operands and jump relative if first is exactly equal to the second one.....	487
FJNE, IJNE	Compare two operands and jump relative if first is not equal to the second one	488
JBS	Jump relative if a bit of an operand is set.....	489
JBC	Jump relative if a bit of an operand is cleared	490
DMP	Differentiate successive samples of a measure point and store result into a variable	491
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8 AP7: DEMF Drive Embedded Macros

8.1 DEMF utilisation

DEMF special application AP7 for NUM DrivePro drives allows the user to create micro-code that is executed by the drive with the same scheduling of motion control tasks.

The user micro code allows to implement small motion control functions as well as creations of new “ad hoc” test-points for monitoring purposes as well as management of programmable I/Os, etc.

This embedded macros functionality allows a wide range of micro-applications, limited only by some obvious constraints about memory space and computation time consumed, and, obviously, by the capabilities of the programmer.

Also, DEMF allows to test new ideas for new control algorithms, that, if proven successful, could be implemented definitely in drive FW.

8.2 AP8: DEMF Inter-Drive communication (i.e. Mechatronic application)

This application allows to exploit the possibilities of Drive Embedded Macro function (DEMF) to allow the creation of new Mechatronic applications, able, for example, to damp axis vibrations by mean of proper torque perturbation on another axis.

DEMF function could be used to compute the proper torque perturbation on the second axis based on the information exchanged between the two axis involved.

In such a kind of function there is not a real Master and a real Slave; rather there is a pair of drives that exchange each-other its proper information, and such info is used in one of the drives, or both drives, by a proper regulation algorithm (DEMF function).

The special function regulator is created via DEMF macros, inside one or both drives.

Results of its computation could be an additive torque correction, as well as a speed additive correction, on one drive or both.

Please contact NUM for more detailed information.

8.3 Functionality description

Drive Embedded Macros for NUM DrivePro (DEM-F) is a new functionality that allows the user to create and run micro-code inside the NUM DrivePro drive, in order to implement small motion control functions as well as new “ad hoc” test-points for monitoring purposes as well as management of programmable I/Os, etc.

Such micro-code will be executed, by the drive, every 50us, in order to make it possible to adjust speed and torque reference as a function of the micro-code itself.

That should cope with the full range of motion control.

The micro-code will be composed by a set of elementary operating instructions, arithmetical as well as logical and of program flow conditioning, like, for example:

- load the content of a measure point and store it in a variable
 - (...note that all I/Os are accessible via MPs...)
- load the content of a parameter a and store it in a variable
- etc...
- add two variables and store the result in a third one,
- subtract two variables and store the result in a third one,
- multiply two variables and store the result in a third one,
- etc ...
- set a programmable digital output depending on the content of a variable
- add the content of a variable to the speed reference
- add the content of a variable to the torque current reference
- ...
- jump to a certain instruction unconditionally
- jump to a certain instruction based on the result of a comparisons between variables
- ...

Furthermore, in order to extend the range of applicability, the following features will be added:

- possibility to use constants as instructions' operands
- constants will be implemented as drive parameters, that could be changed run-time
- all variables will be available also as measure points, in order to make micro-code debug easier, as well as to allow the creation of new useful monitoring measure points.

Due to execution time and memory space constraints, the following limitations to the micro-code capabilities will apply:

- the functionality will not be available for:
 - standard performance drives
 - slave of any tandem function
- the maximum number of executable instruction in a single cycle will be limited to 16
- all instructions are implemented as drive parameters
- instruction parameters can NOT be changed run-time: drive must be put in Halt !
- the maximum number of usable variables will be limited to 32 (= 16 integer and 16 floating-point)
- the maximum number of usable constants will be limited to 32 (= 16 integer and 16 floating-point)
- all variables are 64bit wide, whether integer or floating-point values

- all constants are 64bit wide, whether integer or floating-point values
- all internal computations are made 64bit wide; it is left to the user to guarantee that no computation overflow occurs.
- only one digital output is available to the Drive Embedded Macro functionality
- the “jump” instruction can go only forward: no backward jump is admitted !

The additive contributions, to speed and torque current references, will be calculated as soon as the DEM-F functionality has been enabled.

Anyway, the micro-code will be executed cyclically as soon as the DEM-F function is enabled.

All DEM-F variables will be reset at each Halt/Run transition !

The drive executes always all the 16 instructions !

So, if a micro code is shorter than 16 instructions, then the remaining instructions must be NOP instructions. The additive contributions, to speed and torque current references, will be calculated as soon as the DEMF functionality has been enabled.

Anyway, the micro-code will be executed cyclically as soon as the DEMF function is enabled.

All DEMF variables will be reset at each Halt/Run transition!



WARNING

The drive executes always all the 16 instructions!

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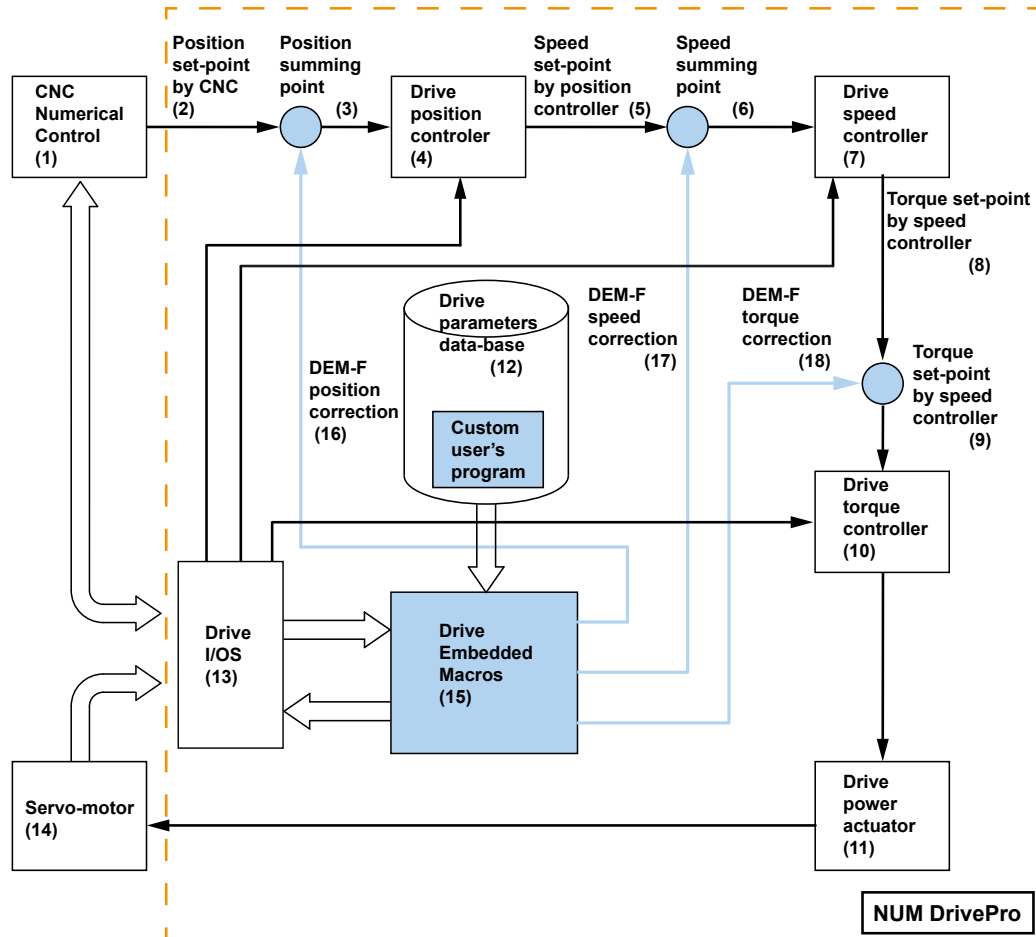
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So, if a micro code is shorter than 16 instructions, then the remaining instructions must be NOP instructions.

A schematic of the action of “additive” contribution to torque and speed reference is given below:



- The additive contributions, to speed and torque current references



WARNING

The position summing point is redundant ! So it will NOT be implemented.

8.4 Operating instruction behavior

In order to fully exploit the floating-point capabilities of NUM DrivePro, the DEM-F instruction set is composed of 2 types of instructions :

- instructions that operates on purely integer operands, yielding an integer result
- instructions that operates on purely floating-point operands, yielding a floating-point result

Sometimes, the same instruction is duplicated in order to operates on both types of operands (integer and floating-point), for example, the « multiply » instruction is duplicated into :

- IMUL : integer multiplication, operating on integers
- FMUL : floating.-point multiplication, operating on floating-points

That because sometimes we'll be interested in operate on 64bit integer, without loosing any bit (for example instructions involving counters or bitmaps...) and sometimes we're interested in operating on floating-point variables only, exploiting a range of values larger than 2^{64} , even loosing less significant bits (for example applying a low-pass filter on torque currents...)

To improve DEM-F flexibility, any instruction can operate on any type of operand, previous proper conversion from one type to another :

- integer instruction can operate on floating-point operands, previous conversion of these latter to integer format (for example via « truncation » or « rounding »...)
- floating point instruction can operate on integer operands, previous conversion of these latter to floating point format, even loosing least significant bit resolution.

Three (3) types of conversion from floating-point format to integer will be possible :

- **truncation (T):**
 - obtains the integer 64bit closest but not bigger than the floating-point original value
 - example :
 - 3,421 will be truncated to integer 3
 - 7,998 will be truncated to integer 7
 - - 3,421 will be truncated to integer -4
 - -7,998 will be truncated to integer -8
- **rounding (R):**
 - obtains the integer 64bit closest to the floating-point original value
 - example :
 - 3,421 will be rounded to integer 3
 - 7,998 will be rounded to integer 8
 - - 3,421 will be rounded to integer -3
 - -7,998 will be rounded to integer -8
- **ceiling (C):**
 - obtains the greatest integer 64bit closest but not smaller than the floating-point original value
 - example :
 - 3,421 will be truncated to integer 4
 - 7,998 will be truncated to integer 8
 - - 3,421 will be truncated to integer -3
 - -7,998 will be truncated to integer -7

In order to specify the type of conversion of an operand from floating-point to integer, before its use by the instruction, a proper letter (T, R or C) will be appended to the operand identifier, as showed later.

When not specified by the user, the default type of conversion from floating-point to integer applied will be « rounding » (R).

As said previously, all internal computations are made 64bit wide;

it is left to the user to guarantee that no computation overflow occurs !!!

- **neither during computation**
- **neither during conversion from integer to floating-point and viceversa**

8.5 Operating instruction summary

Mnemonic	Description
NOP	No operation
LMP	Load a measure-point into a variable
LPA	Load a drive parameter into a variable
FSDO, ISDO	Store variable content to DEMF programmable digital output
STS	Store variable content to additive contribution to speed reference
STT	Store variable content to additive contribution to torque reference
FADD, IADD	Add two operands and store the result into a variable
FSUB, ISUB	Subtract two operands and store the result into a variable
FMUL, IMUL	Multiply two operands and store the result into a variable
FDIV, IDIV	Divide two operands and store quotient into a variable
FMOD, IMOD	Divide two operands and store remainder into a variable
SQRT	Calculation square root of an operand and store the result into a variable
ATN	Calculation arctangent of two operand and store the result (degrees) into a variable
TRG	Calculation sin and cos of an operand (degrees) and store the result into two variables
FMAC, IMAC	Multiply two operands and accumulate the result into a third variable
LOG	Calculation base-10 logarithm of an operand and store the result into a variable
POW	Elevates first operand to power second operand and store the result into a variable
TANH	Calculation hyperbolic tangent of an operand and store the result into a variable
TRGH	Calculation hyperbolic sin and cos of an operand and store the result into two variables
FABS, IABS	Calculation absolute value of an operand and store the result into a variable
FSGN, ISGN	Calculation signum of an operand and store the result into a variable
FMAX, IMAX	Calculation maximum value between two operands and store the result into a variable
FMIN, IMIN	Calculation minimum value between two operands and store the result into a variable
FSAT, ISAT	Calculation saturated value of an operand with respect to another one and store the result into a variable
ASH	Arithmetic shift first operand, based on second operand, and store the result into a variable
LSH	Logical shift first operand, based on second operand, and store the result into a variable
EXT	Extends, with signum, a portion of an operand to its full size (64bit) and store result into a variable
FRNG, IRNG	"ranging" of a variable to fit it into the range defined by two operands
AND	Calculation logical AND of two operand and store the result into a variable
OR	Calculation logical OR of two operand and store the result into a variable
XOR	Calculation logical XOR of two operand and store the result into a variable
NOT	Calculation logical negation of an operand and store the result into a variable
JMP	Unconditional jump, relative
FJLT, IJLT	Compare two operands and jump relative if first is less than the second one
FJLE, IJLE	Compare two operands and jump relative if first is less than or equal to the second one

Mnemonic	Description
FJEQ, IJEQ	Compare two operands and jump relative if first is exactly equal to the second one
FJNE, IJNE	Compare two operands and jump relative if first is not equal to the second one
JBS	Jump relative if a bit of an operand is set
JBC	Jump relative if a bit of an operand is cleared
DMP	Differentiate successive samples of a measure point and store result into a variable
XMP	X or successive samples of an integer measure point and store result into a variable
PMP	Detects positive edged toggled an integer measure point and store it into a variable
NMP	Detects negative edged toggled an integer measure point and store it into a variable

8.6 Instruction syntax

Every instruction will be implemented as a NUM DrivePro drive parameter of type **"string"** of up to 80 **uppercase** characters !

depending on the instruction, the syntax is one of the followings:

- mnemonic
 - ex. NO-operation:
 - "NOP"
- mnemonic + space + "#" + integer
 - ex. JUMP to next third instruction
 - "JMP #3"
- mnemonic + space + "#" + integer + space + "=" + space + "V" + integer + optional "T" or "R" or "C"
 - ex. LOAD MP290 into variable 23, applying truncation
 - "LMP #290 = V23T"
- mnemonic + space + "#" + integer + space + list of operands, with optional "T" or "R" or "C", separated by spaces
 - ex. JUMP to next seventh instruction if integer operand 1 is less than truncated integer operand 18
 - "JLT #7 O1 O18T"
- mnemonic + space + list of operands, with optional "T" or "R" or "C", separated by spaces + space + "=" + space + destination variable + optional "T" or "R" or "C"
 - ex. floating Multiply and ACcumulate
 - "FMAC O2 O4 O22C = V30R"

Concerning destination variables, the following rules apply:

- destination variables are indicated by letter "V", followed by their index number
- destination variable from index 0 to 15 (V0 ... V15) are floating point variables
- destination variable from index 16 to 31 (V16 ... V31) are floating point variables

Operands may indicate variables as well as constants (parameters).

Concerning operands, the following rules apply:

- operands are indicated by letter "O", followed by their index number
- conversion from floating point to integer letter may follow index number ("R", "T", or "C")
- operands from index 0 to 15 (O0 ... O15)
 - are related to variables from 0 to 15 (V0 ... V15)
 - are floating point operands
- operands from index 16 to 31 (O16 ... O31)
 - are related to variables from 16 to 31 (V16 ... V31)
 - are integer operands
- operands from index 32 to 47 (O32 ... O47)
 - are related to constants (parameters) from 0 to 15
 - are floating point operands
- operands from index 48 to 63 (O48 ... O63)
 - are related to constants (parameters) from 16 to 31
 - are integer operands

Only uppercase characters are allowed !!!

8.7 Instruction list

NOP No operation

Description	This instruction executes nothing at all: it is a “no-operation” instruction.
Constraints	None
Example	NOP

LMP Load a measure-point into a variable

Description	This instruction loads a measure-point into a destination variable. In case the destination variable is of a different type with respect to measure point, then proper conversion is applied. - case of MP type integer and destination variable integer • MP value is copied into destination variable, without any conversion - case of MP type integer and destination variable floating-point • MP value is casted to floating-point (64bit) and put into destination variable - case of MP type floating-point and destination variable integer • MP is converted to integer, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - case of MP type floating-point and destination variable floating-point • MP is copied into destination variable, without any conversion
Constraints	The number of the chosen MP to be loaded must be an existing one. In case of MP number out of range, then a proper alarm will be issued during initialization. Destination variable can be of any type, floating-point as well as integer, number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	LMP #6 = V12 load content of measure point number 6 (delivered power, floating point), and store it into variable nbr 12 (floating point) LMP #334 = V26 load content of measure point number 334 (Port Ix4 input status S7.1, integer), and store it into variable nbr 26 (integer) LMP #6 = V22T load content of measure point number 6 (delivered power, floating point), and store it into variable nbr 22 (integer) after having truncated its value to lower integer LMP #6 = V22 load content of measure point number 6 (delivered power, floating point), and store it into variable nbr 22 (integer) after having rounded (default if not specified) its value to closest integer

LPA Load a drive parameter into a variable

Description	This instruction loads a drive parameter into a destination variable. In case the destination variable is of a different type with respect to measure point, then proper conversion is applied. - case of PAR type integer and destination variable integer • PAR value is copied into destination variable, without any conversion - case of PAR type integer and destination variable floating-point • PAR value is casted to floating-point (64bit) and put into destination variable - case of PAR type floating-point and destination variable integer • PAR is converted to integer, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - case of PAR type floating-point and destination variable floating-point • PAR is copied into destination variable, without any conversion
Constraints	The number of the chosen parameter to be loaded must be an existing one. In case of PAR nbr out of range, then a proper alarm will be issued during initialization. PAR of type "array of characters" are NOT allowed: then a proper alarm will be issued during initialization. Destination variable can be of any type, floating-point as well as integer, number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	LPA #50 = V12 load content of parameter number 50 (Torque current limit, floating), and store into variable nbr 12 (floating) LPA #50 = V26C load content of parameter number 50 (Torque current limit, floating), and store into variable nbr 65 (integer) by applying ceiling conversion to highest integer LPA #50 = V26 load content of parameter number 50 (Torque current limit, floating), and store into variable nbr 12 (floating) after having rounded (default if not specified) its value to closest integer

Description	This instruction set properly DEMF programmable digital output based on the content of an operand. The programmable output involved is the DEMF one declared in proper programmable I/Os drive parameters. The operand could be a variable as well as a constant. Two form of such instruction exists: - integer instruction ISDO: - it accepts 2 arguments: - first integer operand - it contains the value to be checked , in order to set properly digital output - second integer operand - it contains bit index of first operand to be checked against - content of second operand is masked with value 0x3F inn order to get always valid bit index range (0..63) - it sets DEMF output = 1 if first operand bit value, selected by second operand, is = 1 - it clears DEMF output = 0 if checked bit, selected by second operand , of first operand is = 0 - The position of the interested bit, is given by the least 6 significant bit value of second operand 2 (that is second operand is masked with the hexadecimal value 0x3F). - floating point instruction FSDO: - it accepts 1 argument: - floating-point operand - it sets DEMF output = 1 if operand is greater than zero (> 0.0) - it clears DEMF output = 0 if operand is less than or equal to zero (<= 0.0) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - ISDO will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FSDO will convert integer operands to floating point before applying comparison against null value.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. In case of integer instruction ISDO, bit number must be within the range 0..63. In case of bit nbr out of range, then a proper alarm will be issued during initialization.
Example	ISDO 024 030 take operand nbr 24 (integer variable) and set DEMF digital output accordingly to bit whose index is selected bit 4 via content of operand nbr 30 (integer variable) FSDO 060 take operand nbr 30 (integer constant), convert it to floating-point and set DEMF digital output accordingly converted operand value greater than zero or not. FSDO 02 take operand nbr 2 (floating point) and set DEMF digital output accordingly operand value greater than zero or not.

STS Store variable content to additive contribution to speed reference

Description	This instruction stores an operand content to additive contribution to speed reference (see element 17 in figure above). As far as the additive contribution to speed reference is a floating-point entity, then STS instruction is a floating-point instruction: any operand will be converted to floating-point before storing it to additive contribution to speed reference.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization.
Example	STS O12 take operand nbr 12 (floating point, variable) and store it result into the “additive contribution” to speed reference STS O60 take operand nbr 60 (integer constant), convert it to floating point and store it result into the “additive contribution” to speed reference

STT Store variable content to additive contribution to torque reference

Description	This instruction stores an operand content to additive contribution to torque reference (see element 18 in figure above). As far as the additive contribution to torque reference is a floating-point entity, then STT instruction is a floating-point instruction: any operand will be converted to floating-point before storing it to additive contribution to torque reference.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization.
Example	STT O12 take operand nbr 12 (floating point, variable) and store it result into the “additive contribution” to torque reference STT O60 take operand nbr 60 (integer constant), convert it to floating point and store it result into the “additive contribution” to torque reference

FADD, IADD Add two operands and store the result into a variable

Description	This instruction adds two operands and store the result into a variable. Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: • integer instruction IADD: - it adds 2 integer values, and returns an integer result • floating point instruction FADD: - it adds 2 floating point values, and returns a floating point result No check on addition overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of overflow of integer instruction (IADD), then the result is modularized to $\pm 2^{63}$. Addition is executed as follows: • result = first operand + second operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • IADD will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified • FADD will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • IADD integer result will be converted to floating-point before storing it to destination floating-point variable • FADD floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IADD O22 O43T = V17 integer addition of operand 22 (integer variable) to operand 43 (floating point constant) and store it into variable nbr 17 (integer variable) FADD O22 O43 = V17C floating point addition of operand 22 (integer variable), converted to floating point, added to operand 43 (floating point constant), then apply ceiling conversion to highest integer to result and store it into variable nbr 17 (integer variable) FADD O2 O3 = V1 floating point addition of operand 2 (floating point variable) to operand 3 (floating point variable) and store it into variable nbr 1 (floating point variable)

FSUB, ISUB **Subtract two operands and store the result into a variable**

Description	This instruction subtracts two operands and store the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction ISUB: - it subtracts 2 integer values, and returns an integer result - floating point instruction FSUB: - it subtracts 2 floating point values, and returns a floating point result No check on subtraction overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of overflow of integer instruction (ISUB), then the result is modularized to $\pm 2^{63}$. Subtraction is executed as follows: result = first operand – second operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - ISUB will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FSUB will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - ISUB integer result will be converted to floating-point before storing it to destination floating-point variable - FSUB floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	ISUB O22 O43T = V17 integer subtraction of operand 43 (floating point constant) from operand 22 (integer variable) and store it into variable nbr 17 (integer variable) FSUB O22 O43 = V17C floating point subtraction of operand 43 (floating point constant) from operand 22 (integer variable), converted to floating point, then apply ceiling conversion to highest integer to result and store it into variable nbr 17 (integer variable) FSUB O2 O3 = V1 floating point subtraction of operand 3 (floating point variable) from operand 2 (floating point variable) and store it into variable nbr 1 (floating point variable)

Description	This instruction multiplies two operands and store the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IMUL: - it multiplies 2 integer values, and returns an integer result - floating point instruction FMUL: - it multiplies 2 floating point values, and returns a floating point result No check on multiplication overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of overflow of integer instruction (IMUL), then the result is modularized to $\pm 2^{63}$. Multiplication is executed as follows: result = first operand * second operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IMUL will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FMUL will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IMUL integer result will be converted to floating-point before storing it to destination floating-point variable - FMUL floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IMUL O22 O43T = V17 integer multiplication of operand 22 (integer variable) by operand 43 (floating point constant) and store it into variable nbr 17 (integer variable) FMUL O22 O43 = V17C floating point multiplication of operand 22 (integer variable), converted to floating point, by operand 43 (floating point constant) then apply ceiling conversion to highest integer to result and store it into variable nbr 17 (integer variable) FMUL O2 O3 = V1 floating point multiplication of operand 2 (floating point variable) by operand 3 (floating point variable) and store it into variable nbr 1 (floating point variable)

FDIV, IDIV
Divide two operands and store quotient into a variable

Description	This instruction divides two operands and store the quotient o the division into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IDIV: - it divides 2 integer values, and returns an integer result - floating point instruction FDIV: - it divides 2 floating point values, and returns a floating point result No check on division errors is performed: it is up to the user to guarantee that such errors never occurs ! In case divisor (second operand) equal to zero, then the result will be unpredictable ! Division is executed as follows: result = first operand / second operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IDIV will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FDIV will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IDIV integer result will be converted to floating-point before storing it to destination floating-point variable - FDIV floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization. Divisor must be different than zero, otherwise the instruction execution gives unpredictable results.
Example	IDIV O22 O3 = V1 it performs integer division of operand 22 (integer variable) by operand 3 (floating point variable) rounded by default, and store the integer resulting quotient into variable 1 after having converted it to floating point FDIV O22 O3 = V1 it performs integer division of operand 22 (integer variable), converted to floating point, by operand 3 (floating point variable) and store the floating point resulting quotient into variable 1 (floating point) FDIV O22 O3C = V17T it performs integer division of operand 22 (integer variable) , converted to floating point, by operand 3 (floating point variable), converted by ceiling to greater integer by ceiling function, truncate the floating point resulting quotient and store it into variable 17 (integer)

FMOD, IMOD Divide two operands and store remainder into a variable

Description	This instruction divides two operands and store the positive remainder (modulo) of the division into a variable. Remainder is always positive ! Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IMOD: - it computes remainder of division of 2 integer values, and returns an integer result - floating point instruction FMOD: - it computes remainder of division of 2 floating point values, and returns a floating point result No check on division errors is performed: it is up to the user to guarantee that such errors never occurs! In case divisor (second operand) less or equal to zero, then the result will be unpredictable! Calculus of remainder of division is executed as follows: result = remainder of first operand divided by second (positive) operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IMOD will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FMOD will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IMOD integer result will be converted to floating-point before storing it to destination floating-point variable - FMOD floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization. Divisor must be greater than zero, otherwise the instruction execution gives unpredictable results.
Example	IMOD O22 O3 = V1 it computes remainder of integer division of operand 22 (integer variable) by operand 3 (floating point variable) rounded by default, and store the integer remainder into variable 1 after having converted it to floating point FMOD O22 O3 = V1 it computes remainder of integer division of operand 22 (integer variable), converted to floating point, by operand 3 (floating point variable) and store the floating point remainder into variable 1 (floating point) FMOD O22 O3C = V17T it computes remainder of integer division of operand 22 (integer variable), converted to floating point, by operand 3 (floating point variable), converted by ceiling to greater integer by ceiling function, truncate the floating point resulting remainder and store it into variable 17 (integer)

SQRT Calculation square root of an operand and store the result into a variable

Description	This instruction computes the square root of the absolute value of an operand, and store the result into a variable. Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Square root is executed as follows: result = square root of (absolute of (operand)) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - SQRT will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - SQRT floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	SQRT O3 = V17T it computes the square root of absolute value of operand 3 (floating point variable), truncate the result to smallest integer, and store it into variable nbr 17 (integer) SQRT O3 = V1 it computes the square root of the absolute value of operand 3 (floating point variable), and stores it into variable nbr 1 (floating point)

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ATN Calculation arctangent of two operand and store the result (degrees) into a variable

Description	This instruction calculates the arctangent of the two operands (the cosinus part and the sinus part) and store the result into a variable. The arctangent result is a floating point value as “degrees”, spanning the range from 0.0 to 360.0 degrees, and is always positive. Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Arctangent is executed as follows: result = arctangent of (first operand / second operand) so: - first operand acts like a sinus - second operand acts like a cosinus note that the division is NOT executed, but such functions performs like the usual “atan2” of the “C” language, so that it works even if the second operand (cosinus part) is null (zero) ! In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - ATN will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - ATN floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	ATN O22 O3 = V12 it computes the arctangent of the ratio of operator 22 (integer variable), converted to floating point, and operator 3 (floating point variable), and store it into variable nbr 12 (floating point variable) ATN O22 O43 = V23T it computes the arctangent of the ratio of operator 22 (integer variable), converted to floating point, and operator 3 (floating point constant), truncates the floating point result to smaller integer, and store it into variable nbr 23 (integer variable)

TRG Calculation sin and cos of an operand (degrees) and store the result into two variables

Description	This instruction calculates the trigonometric functions sinus and cosinus of an operand, in degrees, and store the results into two variables. Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. sinus and cosinus calculation is executed as follows: first resulting variable = sinus of (operand modularized 0,0 ... 360.0) second resulting variable = cosinus of (operand modularized 0,0 ... 360.0) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - TRG will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - TRG floating-point results will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization. The two result (sinus and cosinus) must be stored in different variables, otherwise a proper alarm is issued during initialization.
Example	TRG O3 = V4 V2 it computes sinus and cosinus of operand 3 (floating point variable), in degrees, and store them into variable nbr 4 and 12 respectively (floating point variables)

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Description	This instruction calc the “multiply & accumulate” function: it multiplies two operands, then add the intermediate result to a third operand, and store the final result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IMAC: - it multiplies & accumulate 3 integer values, and returns an integer result - floating point instruction FMAC: - it multiplies & accumulate 3 floating point values, and returns a floating point result No check on multiplication & accumulation overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of overflow of integer instruction (IMAC), then the result is modularized to $\pm 2^{63}$. Multiply & Accumulate operation is executed as follows: result = (first operand * second operand) + third operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IMAC will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FMAC will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IMAC integer result will be converted to floating-point before storing it to destination floating-point variable - FMAC floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IMAC O3T O63 O22 = V22 performs integer multiply of operand 3 (floating point variable), truncated to smallest integer, by operand 63 (integer constant, add operand 22 (integer variable) to result of integer multiplication and store the final integer result to variable 22 (integer). FMAC O1 O63 O22 = V22T performs floating point multiply of operand 1 (floating point variable) by operand 63 (integer constant) converted to floating point, add operand 22 (integer variable), converted to floating point, to result of floating point multiplication, truncate the final result to smallest integer and store it into variable 22 (integer).

LOG Calculation base-10 logarithm of an operand and store the result into a variable

Description	This instruction computes the base-10 logarithm of the value of a positive operand, and store the result into a variable Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Square root is executed as follows: result = base-10 logarithm of (operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - LOG will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - LOG floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable. No check on logarithm errors is performed: it is up to the user to guarantee that such errors never occurs ! In case of operand less than or equal to zero, then the result will be unpredictable !
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	LOG O3 = V17T it computes the base-10 logarithm of absolute value of operand 3 (floating point variable), truncate the result to smallest integer, and store it into variable nbr 17 (integer) LOG O3 = V1 it computes the base-10 logarithm of the absolute value of operand 3 (floating point variable), and stores it into variable nbr 1 (floating point)

POW Elevates first operand to power second operand and store the result into a variable

Description	This instruction raises the absolute value of a first positive operand to the power of a second operand value and store the result into a variable Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Raise to power is executed as follows: result = (absolute of (first operand)) raise to power (second operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - POW will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - POW floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable. No check on raise to power errors is performed: it is up to the user to guarantee that such errors never occurs ! In case of first operand less then or equal to zero and a negative second operand, then the result will be unpredictable !
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	POW O3 O52 = V1 it computes the raising of absolute value of operand 3 (floating point variable), to power of operand 52 (integer constant), converted to floating point, and store it into variable nbr 1 (floating point) POW O19 O22 = V17T it computes the raising of absolute value of operand 19 (integer variable), converted to floating point, to power of operand 22 (integer constant), converted to floating point, truncate the floating point result to smaller integer and store it into variable nbr 17 (integer)

TANH Calculation hyperbolic tangent of an operand and store the result into a variable

Description	This instruction computes the hyperbolic tangent of an operand, and store the result into a variable Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Hyperbolic tangent is executed as follows: result = hyperbolic tangent of (operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - TANH will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - TANH floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	TANH O3 = V17T it computes the hyperbolic tangent of operand 3 (floating point variable), truncate the result to smallest integer, and store it into variable nbr 17 (integer) TANH O3 = V1 it computes the hyperbolic tangent of operand 3 (floating point variable), and stores it into variable nbr 1 (floating point)

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TRGH Calculation hyperbolic sin and cos of an operand and store the result into two variables

Description	This instruction calculates the hyperbolic sinus and hyperbolic cosinus of an operand, and store the results into two variables. Such instruction is a floating point instruction: it accepts floating point argument and returns a floating point result. Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. hyperbolic sinus and hyperbolic cosinus calculation is executed as follows: • first resulting variable = hyperbolic sinus of operand • second resulting variable = hyperbolic cosinus of operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • TRGH will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • TRGH floating-point results will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization. The two result (hyp. sinus and hyp. cosinus) must be stored in different variables, otherwise a proper alarm is issued during initialization.
Example	TRGH O3 = V4 V2 it computes hyperbolic sinus and hyperbolic cosinus of operand 3 (floating point variable) and store them into variable nbr 4 and 12 respectively (floating point variables) TRGH O3 = V4 V19T it computes hyperbolic sinus and hyperbolic cosinus of operand 3 (floating point variable) and store them into variable nbr 4 (floating point) and nbr 19 respectively (integer), after having truncated this latter to the smaller integer.

FABS, IABS

Calculation absolute value of an operand and store the result into a variable

Description	This instruction calculates the absolute value of an operand and stores the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IABS: - it computes absolute value of an integer operand, and returns an integer result - floating point instruction FABS: - it computes absolute value of floating point operand, and returns a floating point result Calculus of absolute value is executed as follows: result = operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IABS will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FABS will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IABS integer result will be converted to floating-point before storing it to destination floating-point variable - FABS floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IABS O3T = V22 it computes integer absolute value of operand 3 (floating point variable), converted to integer by truncation, and store the result into variable nbr 22 (integer) FABS O3 = V2 it computes floating point absolute value of operand 3 (floating point variable) and store the result into variable nbr 2 (floating point)

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Description	This instruction calculates the signum of an operand, and stores the result into a variable. The signum is intended as follows: • signum = 1 if operand is greater than zero • signum = 0 if operand is zero • signum = -1 if operand is less than zero Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: • integer instruction ISGN: - it computes signum of an integer operand, and returns an integer result • floating point instruction FSGN: - it computes signum of floating point operand, and returns a floating point result Calculus of signum value is executed as follows: • result = signum of (operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • ISGN will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified • FSGN will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • ISGN integer result will be converted to floating-point before storing it to destination floating-point variable • FSGN floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	ISGN O3C = V22 it returns signum of operand 3 (floating point variable), converted to integer by ceiling function, and store the result into variable nbr 22 (integer) FSGN O3 = V2 it returns signum of operand 3 (floating point variable), and store the result into variable nbr 2 (floating point)

FMAX, IMAX **Calculation max value between two operands and store the result into a variable**

Description	This instruction finds the maximum value between two operands and store the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IMAX: - it computes maximum value between 2 integer values, and returns an integer result - floating point instruction FMAX: - it computes maximum value between 2 floating point values, and returns a floating point result Calculus of maximum value is executed as follows: result = maximum of (first operand , second operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IMAX will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FMAX will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IMAX integer result will be converted to floating-point before storing it to destination floating-point variable - FMAX floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IMAX O22 O43 = V18 it finds the integer maximum between operand 22 (integer variable) and operand 43 (floating point constant), converted to integer by rounding (default action), and store the result into variable nbr 22 (integer) FMAX O22 O43 = V1 it finds the floating point maximum between operand 22 (integer variable), converted to floating point, and operand 43 (floating point constant), and store the result into variable nbr 1 (floating point)

Description	This instruction finds the minimum value between two operands and store the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction IMIN: - it computes minimum value between 2 integer values, and returns an integer result - floating point instruction FMIN: - it computes minimum value between 2 floating point values, and returns a floating point result Calculus of minimum value is executed as follows: result = minimum of (first operand , second operand) In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IMIN will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FMIN will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - IMIN integer result will be converted to floating-point before storing it to destination floating-point variable - FMIN floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IMIN O22 O43 = V18 it finds the integer minimum between operand 22 (integer variable) and operand 43 (floating point constant), converted to integer by rounding (default action), and store the result into variable nbr 22 (integer) FMIN O22 O43 = V1 it finds the floating point minimum between operand 22 (integer variable), converted to floating point, and operand 43 (floating point constant), and store the result into variable nbr 1 (floating point)

FSAT, ISAT into a variable

Calculation saturated value of an operand with respect to another one and store the result

Description	This instruction computes the saturated value of first operand with respect to the absolute value of a second one, and store the result into a variable. Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. Two form of such instruction exists: - integer instruction ISAT: - it computes saturation of a integer value against a second integer values, and returns an integer result - floating point instruction FSAT: - it computes saturation of a floating point value against a second floating point value, and returns a floating point result Calculus of saturation value is executed as follows: if first operand < (- absolute value of second operand) then result = (- absolute value of second operand) else if first operand > (+ absolute value of second operand) then result = (+ absolute value of second operand) else result = first operand In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - ISAT will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FSAT will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - ISAT integer result will be converted to floating-point before storing it to destination floating-point variable - FSAT floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	ISAT O3 O52 = V22 it saturates value of operand 3 (floating point variable), converted to integer by rounding (default action), to absolute value of operand 52 (integer constant) and store result into variable nbr 22 (integer) FSAT O13 O22 = V12 it saturates value of operand 13 (floating point variable) to absolute value of operand 22 (integer variable), converted to floating point, and store result into variable nbr 22 (integer)

ASH Arithmetic shift first operand, based on second operand, and store the result into a variable

Description	This instruction shifts arithmetically (...signum is preserved !) an integer 64bit operand by a number of positions given in a second integer operand, and store the result into an integer 64bit variable. If the content of second operand is positive, then left shift is applied to first operand. If the content of second operand is negative, then right shift is applied to first operand. Right shift is intended as arithmetic shift: the signum is preserved ! Left shift overflow can cause unpredictable results ! Right shift overflow leaves only the signum as a result ! Such instruction is an integer instruction. Calculus of arithmetic shift is executed as follows: • result = arithmetic shift (first operand) by second operand Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. No check on left shift overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • ASH will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • ASH integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	ASH O19 O52 = V22 it shifts arithmetically (sign preserving...) the content of operand 19 (integer variable) by content of operand 52 (integer constant), and store the result into variable nbr 22 (integer) ASH O22 O3T = V22 it shifts arithmetically (sign preserving...) the content of operand 22 (integer variable) by content of operand 3 (floating point variable), converted to integer by truncation, and store the result into variable nbr 22 (integer)

LSH Logical shift first operand, based on second operand, and store the result into a variable

Description	This instruction shifts logically (...signum is lost !) an integer 64bit operand by a number of positions given in a second operand, and stores the result into an integer 64bit variable. If the content of second operand is positive, then left shift is applied onto first operand. If the content of second operand is negative, then right shift is applied onto first operand. Right shift is intended as logical shift: the signum is lost ! and the result is filled with "0s" at its left ! Left shift overflow can cause unpredictable results ! Right shift overflow leaves only zero as result ! Such instruction is an integer instruction. Calculus of logical shift is executed as follows: result = logical shift (first operand) by second operand Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. No check on left shift overflow is performed: it is up to the user to guarantee that such overflow never occurs ! In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - LSH will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - LSH integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	LSH O19 O52 = V22 it shifts logically (sign lost...) the content of operand 19 (integer variable) by content of operand 52 (integer constant), and store the result into variable nbr 22 (integer) LSH O22 O3T = V22 it shifts logically (sign lost...) the content of operand 22 (integer variable) by content of operand 3 (floating point variable), converted to integer by truncation, and store the result into variable nbr 22 (integer)

EXT **Extends, with signum, a portion of an operand to its full size (64bit) and store result into a variable**

Description	This instruction extends, with signum, a portion of an integer operand to 64bit size, and store the result into an integer variable. The number of retained bit of the original value (the valid size) is contained in an operand. More specifically, the number of retained bit is given by content of second operand: from 1 to 64 bit. Meaningless values of second operand will not be checked against, and could give unpredictable results. It is equivalent to the execution of two consecutive shift instructions: • first execute a logical shift to the left (LSH), in order to eliminate useless bit • then executes an arithmetical right shift (ASH) to restore the original size, extended, with signum, to 64bit. Such instruction is an integer instruction. Calculus of extension is executed as follows: • result = - arithmetic shift right [• logical shift left (first operand) by (64 – second operand) -] by (64 – second operand) Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • EXT will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • EXT integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization. The number of retained bit of the original value (the valid size) is contained in the second operand: that should be any value in the range 1 to 64. Meaningless values of second operand will not be checked against, and could give unpredictable results.
Example	EXT O23 O42C = V23 it extends contents of operand 23 (integer variable) to 64 bit size , retaining only the nbr of bit contained into operand 42 (floating point constant), converted to integer by ceiling function, and store result into variable nbr 23 (integer)

FRNG, IRNG**“ranging” of a variable to fit it into the range defined by two operands**

Description	This instruction performs the “ranging” of an operand in order to fit it into the range defined by two other operands (min and max of the range); the result is stored into a variable. The range is defined as follows: • second operand defines the minimal value of the range (included) • third operand defines the maximal value of the range (excluded) • the range is open on the right: the maximal value is excluded: Two form of such instruction exists: • integer instruction IRNG: - it ranges an integer operand to fit 2 integer limit values, and returns an integer result • floating point instruction FRNG: - it ranges a floating point operand to fit 2 floating point limit values, and returns a floating point result Obviously, content of third operand (maximum of the range) must be greater than content of second operand (minimum of the range), but NO check is executed to detect anomalous values it is up to the user to guarantee that such anomaly never occurs ! Calculus of ranging is executed as follows: • if first operand < second operand - then result = first operand + (third operand – second operand) • else if first operand >= third operand - then result = first operand - (third operand – second operand) • else - result = first operand Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • IRNG will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified • FRNG will convert integer operands to floating point. In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • IRNG integer result will be converted to floating-point before storing it to destination floating-point variable • FRNG floating-point result will be converted to integer by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, before storing it to destination variable.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	IRNG O23 O52 O53 = V23 it fits content of operand 23 (integer variable) to the range defined by operand 52 (minimum, integer constant) and O53 (maximum excluded, integer constant) and store the result into variable nbr 23 (integer)

AND Calculation logical AND of two operand and store the result into a variable

Description	This instruction computes the logical AND (bit by bit) of two integer 64bit operands, and store the integer result into a variable. Such instruction is an integer instruction. Calculus of logical-and is executed as follows: • result = first operand AND second operand Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • AND will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • AND integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	AND O18 O52 = O22 calc the logical AND (bit by bit) of operand 18 (integer variable) and operand 52 (integer constant) and store it into variable nbr 22 (integer)

OR Calculation logical OR of two operand and store the result into a variable

Description	This instruction computes the logical OR (bit by bit) of two integer 64bit operands, and store the integer result into a variable. Such instruction is an integer instruction. Calculus of logical-or is executed as follows: result = first operand OR second operand Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - OR will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - OR integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	OR O18 O52 = O22 calc the logical OR (bit by bit) of operand 18 (integer variable) and operand 52 (integer constant) and store it into variable nbr 22 (integer)

XOR Calculation logical XOR of two operand and store the result into a variable

Description	This instruction computes the logical exclusive-or XOR (bit by bit) of two integer 64bit operands, and store the integer result into a variable. Such instruction is an integer instruction. Calculus of logical-xor is executed as follows: • result = first operand XOR second operand Operands could be constants as well as variables: • operands from 0 to 31 = variable from 0 to 31 • operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • XOR will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: • XOR integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	XOR O18 O52 = O22 calc the logical exclusive-or XOR (bit by bit) of operand 18 (integer variable) and operand 52 (integer constant) and store it into variable nbr 22 (integer)

NOT Calculation logical negation of an operand and store the result into a variable

Description	This instruction computes the logical negation NOT (bit by bit) of an integer 64bit operands, and store the integer result into a variable. Such instruction is an integer instruction. Calculus of logical-not is executed as follows: - result = NOT operand Operands could be constants as well as variables: - operands from 0 to 31 = variable from 0 to 31 - operands from 32 to 63 = parameter constants from 0 to 31 It is possible to use the same variable as an operand as well as a result, in the same instruction. In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - NOT will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified In case of destination variable type different from the type of instruction result, the usual conversion rules apply: - NOT integer result will be converted to floating-point before storing it to destination floating-point variable
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	NOT O18 = V22 calc the logical negation NOT (bit by bit) of operand 18 (integer variable) and store it into variable nbr 22 (integer)

JMP Unconditional jump, relativ

Description	This instruction effects an unconditional relative jump to an instruction that follows. The operand of this instruction is the offset of the instruction to execute with respect to the actual (JMP) instruction. The Jump can be only a forward jump (in order to avoid unwanted endless loops...).
Constraints	Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	JMP #3 it jumps unconditionally to the instruction that is 3 places offset from here ! <pre>.... instruction N-1: instruction N: JMP #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4: </pre>

FJLT, IJLT
Compare two operands and jump relative if first is less than the second one

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if first operand is less than second operand. Otherwise the next instruction is executed. The Jump can be only a forward jump (in order to avoid unwanted endless loops...). Two form of such instruction exists: - integer instruction IJLT: - it compares two integer values, and possibly executes the relative jump - floating point instruction FJLT: - it compares two floating point values, and possibly executes the relative jump conditional relative jump is executed as follows: if first operand < second operand then JUMP to instruction @ #offset from here else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IJLT will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FJLT will convert integer operands to floating point.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	FJLT #3 O3 O42 jump conditionally to the instruction that is 3 places offset from here, based on the floating-point comparison between operand 3 (floating point variable) and operand 42 (floating-point constant): - if operand 3 is less than operand 42 then jump, else continue with next instruction. IJLT #2 O23 O42T jump conditionally to the instruction that is 2 places offset from here, based on the integer comparison between operand 23 (integer variable) and operand 42 (floating-point constant), converted to integer by truncation: - if operand 23 is less than operand 42 truncated then jump, else continue with next instruction. <pre> instruction N-1: instruction N: IJLT,FJLT #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4: </pre> 

FJLE, IJLE**Compare two operands and jump relative if first is less than or equal to the second one**

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if first operand is less than or equal to second operand. Otherwise the next instruction is executed. The Jump can be only a forward jump (in order to avoid unwanted endless loops...). Two form of such instruction exists: - integer instruction IJLE: - it compares two integer values, and possibly executes the relative jump - floating point instruction FJLE: - it compares two floating point values, and possibly executes the relative jump conditional relative jump is executed as follows: if first operand <= second operand then JUMP to instruction @ #offset from here else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IJLE will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FJLE will convert integer operands to floating point.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	FJLE #3 O3 O42 jump conditionally to the instruction that is 3 places offset from here, based on the floating-point comparison between operand 3 (floating point variable) and operand 42 (floating-point constant): - if operand 3 is less than or equal to operand 42 then jump, else continue with next instruction. IJLE #2 O23 O42T jump conditionally to the instruction that is 2 places offset from here, based on the integer comparison between operand 23 (integer variable) and operand 42 (floating-point constant), converted to integer by truncation: - if operand 23 is less than or equal to operand 42 truncated then jump, else continue with next instruction. instruction N-1: instruction N: IJLE,FJLE #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4:

FJEQ, IJEQ
Compare two operands and jump relative if first is exactly equal to the second one

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if first operand is exactly equal to second operand. Otherwise the next instruction is executed. The Jump can be only a forward jump (in order to avoid unwanted endless loops...). Two form of such instruction exists: - integer instruction IJEQ: - it compares two integer values, and possibly executes the relative jump - floating point instruction FJEQ: - it compares two floating point values, and possibly executes the relative jump conditional relative jump is executed as follows: if first operand == second operand then JUMP to instruction @ #offset from here else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IJEQ will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FJEQ will convert integer operands to floating point.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	FJEQ #3 O3 O42 jump conditionally to the instruction that is 3 places offset from here, based on the floating-point comparison between operand 3 (floating point variable) and operand 42 (floating-point constant): - if operand 3 is equal to operand 42 then jump, else continue with next instruction. IJEQ #2 O23 O42T jump conditionally to the instruction that is 2 places offset from here, based on the integer comparison between operand 23 (integer variable) and operand 42 (floating-point constant), converted to integer by truncation: - if operand 23 is equal to operand 42 truncated then jump, else continue with next instruction. instruction N-1: instruction N: IJEQ,FJEQ #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4: 

FJNE, IJNE**Compare two operands and jump relative if first is not equal to the second one**

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if first operand is different from second operand. Otherwise the next instruction is executed. The Jump can be only a forward jump (in order to avoid unwanted endless loops...). Two form of such instruction exists: - integer instruction IJNE: - it compares two integer values, and possibly executes the relative jump - floating point instruction FJNE: - it compares two floating point values, and possibly executes the relative jump conditional relative jump is executed as follows: if first operand <> second operand then JUMP to instruction @ #offset from here else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: - IJNE will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified - FJNE will convert integer operands to floating point.
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	FJNE #3 O3 O42 jump conditionally to the instruction that is 3 places offset from here, based on the floating-point comparison between operand 3 (floating point variable) and operand 42 (floating-point constant): - if operand 3 is different from operand 42 then jump, else continue with next instruction. IJNE #2 O23 O42T jump conditionally to the instruction that is 2 places offset from here, based on the integer comparison between operand 23 (integer variable) and operand 42 (floating-point constant), converted to integer by truncation: - if operand 23 is different from operand 42 truncated then jump, else continue with next instruction. instruction N-1: instruction N: IJNE,FJNE #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4: </

JBS Jump relative if a bit of an operand is set

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if the bit of first integer 64bit operand which has a position defined by the content of second operand, is set to 1. Otherwise the next instruction is executed. The position of the interested bit, is given by the least 6 significant bit value of second operand 2 (that is second operand is masked with the hexadecimal value 0x3F). The Jump can be only a forward jump (in order to avoid unwanted endless loops...). This is an integer instruction. conditional relative jump is executed as follows: • if first operand has bit nbr (second operand & 0x3F) set to 1 - then JUMP to instruction @ #offset from here - else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • JBS will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !
Example	JBS #7 O23 O52 that means: jump conditionally to the instruction that is 7 places offset from here, based on the value of bit, defined by operand 52 (integer constant, masked with 0x3F,), belonging to operand 23 (integer variable) • bit position "bitpos" is given by: (operand 52 & 0x3F) • if operand 23, bit position "bitpos", is set to one then jump, else continue with next instruction. <pre> instruction N-1: instruction N: JBS #3 instruction N+1: instruction N+2: instruction N+3: instruction N+4: </pre> 

JBC Jump relative if a bit of an operand is cleared

Description	This instruction effects a conditional relative jump to an instruction that follows the actual one by an offset, if and only if the bit of first integer 64bit operand which has a position defined by the content of second operand, is cleared to 0. Otherwise the next instruction is executed. The position of the interested bit, is given by the least 6 significant bit value of second operand 2 (that is second operand is masked with the hexadecimal value 0x3F). The Jump can be only a forward jump (in order to avoid unwanted endless loops...). This is an integer instruction. conditional relative jump is executed as follows: • if first operand has bit nbr (second operand & 0x3F) cleared to 0 - then JUMP to instruction @ #offset from here - else continue... In case of operand type different from the accepted instruction operand, the usual conversion rules apply: • JBC will convert floating-point operand to integer one, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified																		
Constraints	Operand can be a variable as well as a constant. Operand can be any type, integer as well as floating point. So, operand numbers can range from 0 to 63. In case of operand number out of range, then a proper alarm will be issued during initialization. Offset can range from 2 to any positive integer. In case of offset less than 2, then a proper alarm will be issued during initialization. In case of jump to an instruction that is outside the limit of 16 instructions list, then DEM-X macro execution is immediately terminated ! No other instruction will be executed !																		
Example	JBC #7 O23 O52 that means: jump conditionally to the instruction that is 7 places offset from here, based on the value of bit, defined by operand 52 (integer constant, masked with 0x3F,), belonging to operand 23 (integer variable) • bit position "bitpos" is given by: (operand 52 & 0x3F) • if operand 23, bit position "bitpos", is cleared to zero then jump, else continue with next instruction. <table><tr><td>instruction</td><td>N-1:</td><td>....</td></tr><tr><td>instruction</td><td>N:</td><td>JBC #3</td></tr><tr><td>instruction</td><td>N+1:</td><td>....</td></tr><tr><td>instruction</td><td>N+2:</td><td>....</td></tr><tr><td>instruction</td><td>N+3:</td><td>....</td></tr><tr><td>instruction</td><td>N+4:</td><td>....</td></tr></table> 	instruction	N-1:		instruction	N:	JBC #3	instruction	N+1:		instruction	N+2:		instruction	N+3:		instruction	N+4:	
instruction	N-1:																		
instruction	N:	JBC #3																	
instruction	N+1:																		
instruction	N+2:																		
instruction	N+3:																		
instruction	N+4:																		

DMP Differentiate successive samples of a measure point and store result into a variable

Description	This instruction differentiates a measure-point variable: it loads a measure-point, calculate the difference of its value with respect to a first operand variable, and store the result into a second variable; then it updates the value of first operand variable, used as memory, with the actual MP value. Note that first operand must be a variable ! The first operand variable is used as memory containing value of previous sample of measure-point In case the operand (memory) variable or the destination variable are of a different type with respect to measure point, then proper conversion is applied. - case of MP type integer and variables (whether operand or destination) integer - MP value is copied into operand variable, without any conversion - result of MP differentiation is copied into destination variable, without any conversion - case of MP type integer and variables (whether operand or destination) floating-point - MP value is casted to floating-point (64bit) and put into operand variable - result of MP differentiation is casted to floating-point (64bit) and put into operand variable - case of MP type floating-point and variables (whether operand or destination) integer - MP is converted to integer, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, and put into operand variable - result of MP differentiation is converted to integer, by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, and put into destination variable - case of MP type floating-point variables (whether operand or destination) floating-point - MP is copied into operand variable, without any conversion - result of MP differentiation is copied into destination variable, without any conversion Differentiation of MP executes as follows: result = MP value – first operand value first operand (memory) = MP value
Constraints	The number of the chosen MP to be loaded must be an existing one. In case of MP number out of range, then a proper alarm will be issued during initialization. Operand number ranges from 0 to 31 (it must be a variable). In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	DMP #208 O12 = V1 differentiate measure point number 208 (mechanical motor position, floating point), using memory variable 12 (floating point variable, and store it into variable nbr 1 (floating point) DMP #320 O22 = V26 load content of measure point number 334 (Axis state switch command, integer), and store it using memory variable 22 (integer), and store the result into variable nbr 26 (integer)

XMP X or successive samples of an integer measure point and store result into a variable

Description	This instructions extracts toggled bit from a measure point: it loads a MP, calculates the XOR of its 64bit integer value with respect to the content of a first operand variable, and store the result into a second variable; then it updates the content of the first operand variable, used as memory, with the actual MP value. Note that first operand must be a variable ! The first operand variable is used as memory containing value of previous sample of measure-point It is an inherent integer instruction: • MP value and memory operand are converted to integer 64bit value - by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, • result of XMP is an integer 64bit value. - in case of floating-point destination variable, then the result is converted to floating point before copying it to destination variable. XMP instruction executes as follows: • result = MP value XOR first operand value • first operand (memory) = MP value
Constraints	The number of the chosen MP to be loaded must be an existing one. In case of MP number out of range, then a proper alarm will be issued during initialization. Operand number ranges from 0 to 31 (it must be a variable). In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	XMP #333 O16 = V17 load content of MP 333 (Port Ix3 input status (S7.3), integer), XOR it with content of memory operand 16 (integer variable), and store result into variable nbr 17 (integer); then copy MP value into operand 16 (memory).

PMP **Detects positive edged toggled an integer measure point and store it into a variable**

Description	This instruction extracts positive edge toggled bit from a measure point MP: it loads a MP, calculates the XOR of its 64bit integer value with respect to the content of a first operand variable, and calculates bitwise AND of the result with the loaded MP, and store the result into a second variable; then it updates the content of the first operand variable, used as memory, with the actual MP value. Note that first operand must be a variable ! The first operand variable is used as memory containing value of previous sample of measure-point It is an inherent integer instruction: • MP value and memory operand are converted to integer 64bit value - by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, • result of PMP is an integer 64bit value. - in case of floating-point destination variable, then the result is converted to floating point before copying it to destination variable. PMP instruction executes as follows: • result = (MP value XOR first operand value) AND MP value • first operand (memory) = MP value
Constraints	The number of the chosen MP to be loaded must be an existing one. In case of MP number out of range, then a proper alarm will be issued during initialization. Operand number ranges from 0 to 31 (it must be a variable). In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	XMP #333 O16 = V17 load content of MP 333 (Port Ix3 input status (S7.3), integer), XOR it with content of memory operand 16 (integer variable), makes the AND of the result and the original MP value, and store result into variable nbr 17 (integer); then copy MP value into operand 16 (memory).

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NMP **Detects negative edged toggled an integer measure point and store it into a variable**

Description	This instruction extracts negative edge toggled bit from a measure point MP: it loads a MP, calculates the XOR of its 64bit integer value with respect to the content of a first operand variable, and calculates bitwise AND of the result with the bitwise complement (negation) of loaded MP, and store the result into a second variable; then it updates the content of the first operand variable, used as memory, with the actual MP value. Note that first operand must be a variable ! The first operand variable is used as memory containing value of previous sample of measure-point It is an inherent integer instruction: • MP value and memory operand are converted to integer 64bit value - by applying conversion specified by user (T, R or C) or applying default rounding (R) if not specified, • result of PMP is an integer 64bit value. - in case of floating-point destination variable, then the result is converted to floating point before copying it to destination variable. NMP instruction executes as follows: • result = (MP value XOR first operand value) AND (NOT MP value) • first operand (memory) = MP value
Constraints	The number of the chosen MP to be loaded must be an existing one. In case of MP number out of range, then a proper alarm will be issued during initialization. Operand number ranges from 0 to 31 (it must be a variable). In case of operand number out of range, then a proper alarm will be issued during initialization. Variable number ranges from 0 to 31. In case of variable number out of range, then a proper alarm will be issued during initialization.
Example	XMP #333 O16 = V17 load content of MP 333 (Port Ix3 input status (S7.3), integer), XOR it with content of memory operand 16 (integer variable), makes the AND of the result and the complement (negation) of original MP value, and store result into variable nbr 17 (integer); then copy MP value into operand 16 (memory).

8.8 Micro-code examples

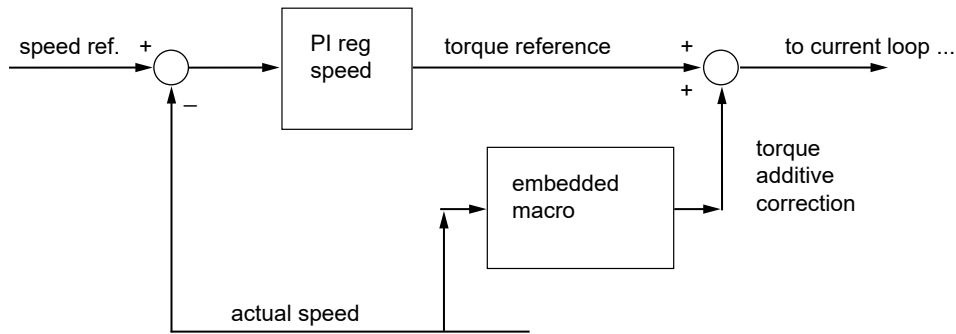
Here follow some examples of drive embedded macros.

They are **intended only for teaching purposes**: no optimization of code, neither optimization in the use of variables has been taken into account.

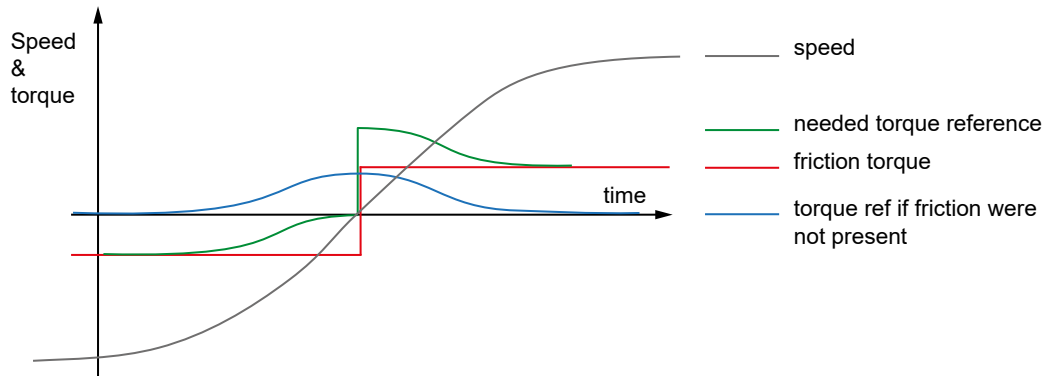
Furthermore, some functions are completely useless: they are listed here only as examples on how to create typical control block such as PIs, filters and so on.

8.8.1 A simple anti-pitch function

It is possible to implement an anti-pitch function based on the signum of actual speed



here follows the torque vs. time representation of a typical antipitch application:



As explained by the figure above, the “red” curve is the desired corrective action by the embedded macro; such a curve can be implemented by mean of a simple signum function on speed:

$$correction = \begin{cases} K^+ & \text{if } (speed > hysteresys) \\ K^- & \text{if } (speed < -hysteresys) \\ unchanged & \text{else} \end{cases}$$

where

- K is the friction current , expressed in Arms.
- speed is the actual speed, expressed in rpm
- hysteresis is a speed threshold used in order not to make the system oscillate

supposing that

- the friction current, for positive speed is 2 Arms, then $K+ = 2.0$
- the friction current, for negative speed is -1 Arms, then $K- = -1.0$
- speed hysteresis = 10rpm

Furthermore, we want to activate “anti-pitch” function whenever bit 20 of NCK command bitmap (MP #329):

- if bit #20 of MP329 is = 1
 - then activate antipitch function
- else
 - jump to exit, clearing any additive torque contribution.

Here is the distribution of operands: constant and variables:

Distribution of operands: constant and variables

# op	variable n°	type	meaning
0	variable #00	floating-point	actual speed
1	variable #01	floating-point	value of additive friction torque
2	variable #02	floating-point	not used
...	...		
15	variable #15	floating-point	not used
16	variable #16	integer	image of NCK command bitmap MP #329
17	variable #17	integer	not used
...			not used
31	variable #31	integer	not used

# op	constant nbr	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	2.0	positive friction current (Arms)
34	constant #02	floating-point	-1.0	negative friction current (Arms)
35	constant #03	floating-point	10.0	positive speed threshold (rpm)
36	constant #04	floating-point	-10.0	negative speed threshold (rpm)
37	constant #05	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	it's a good rule of thumb to keep constant #16 = 0 (...useful for integer comparisons & sign reversal...)
49	constant #17	integer	1	it's a good rule of thumb to keep constant #17 = 1 (...useful to increase counters...)
50	constant#18	integer	20	bit of NCK command bitmap to be checked against.
51	constant#19	integer	0	not used
...				
63	constant #31	integer	0	not used

Finally, the code for the embedded macro could be the following:

# Instr	mnemonic	description
0	LMP #329 = V16	load MP #329 (NC command bitmap) into variable #16 (integer)
1	JBC #13 O16 O50	jump to instruction#14 (#1 + offset#13) in case of bit indexed by O50 is cleared.
2	LMP #1 = V0	load measure point #1 (motor speed) into variable #00 (floating-point)
3	FJLT #3 O35 O0	jump to instruction #6 (#3 + offset#3) if positive threshold (O35) is less than or equal to actual speed (O0)
4	FJLT #4 O0 O36,	jump to instruction #8 (#4 + offset#4) if actual speed (variable #00) is less than or equal to negative threshold (O36)
5	JMP #12	jump unconditionally to last instruction (+12 from here)
6	FADD O33 O32 = V1	copy positive friction constant O33 to variable #01 (...using trick to ADD zero (O32)...)
7	JMP #10	jump unconditionally to last instruction (+10 from here)
8	FADD O34 O32 = V1	copy negative friction constant to variable #01 (...using trick to ADD zero (O32)...)
9	JMP #8	jump unconditionally to last instruction (+8 from here)
8	NOP	
9	NOP	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	FSUB O1 O1 = V1	clear variable #01 (...using trick V1 = V1 – V1 ...)
15	STT V1	store variable #01 to additive torque current reference

Note that, after initialization, the variable #1 is set to 0.0, but, as soon as the speed overcome any threshold, positive or negative, then in variable #1 will be put the proper friction current, that is kept unchanged until actual speed overcome the opposite threshold.

note that both variables:

- variable #00 = actual speed
- variable #01 = friction current

are available as drive measure point !

8.8.2 Filtered torque measure point

Suppose that our customer needs a test-point indicating the actual motor torque available at the motor shaft.

Such “new” measure point will be read by NCK via the “quick measure point” functionality, with a sampling time of 6ms.

We could create such a “new” measure point by applying a proper anti-aliasing low pass filter on the actual torque current, and scaling the result by mean of the motor torque constant “KT”.

We don't want to apply any additive correction to any reference !

So we'll follow the strategy below:

- read torque current measure point (MP50 [Arms])
- filter it by two cascaded low pass filters with -3dB cut-off freq = 66 Hz = $1 / (2,5 * 6ms)$;
 - so the single filter time constant is $1 / (2 \pi 66Hz) = 2,4 \text{ ms}$
- scale the output as Nm by knowing the motor KT , stored in a DEMF parameter constant.
- store the result in a variable, so having it available as a drive test-point.

supposing that

- motor Kt = 2,7 Nm/Arms

concerning low pass filters, then we'll implement the well known digital filter implementation:

- $\text{filterOutput}(k+1) = (\text{filterOutput}(k)*A) + \text{filterInput}(k+1)*B$

where:

- $A = \exp(-0,05ms / 2,4ms) = 0.979382$
- $B = 1.0 - A = 0.020618$

note that such filter can implemented also as:

- $\text{filterOutput}(k+1) = \text{filterOutput}(k) + [\text{filterInput}(k+1) - \text{filterOutput}(k)] * B$

...that uses only one constant: B !...

here is the distribution of operands: constant and variables:

Distribution of operands: constant and variables

#op	variable n°	type	meaning
0	variable #00	floating-point	actual torque current
1	variable #01	floating-point	first filter memory
2	variable #02	floating-point	first filter output = second filter input
3	variable #03	floating-point	second filter memory
4	variable #04	floating-point	second filter output
5	variable #05	floating-point	scaled output in milli Nm
6	variable #06	floating-point	not used
...	...		
15	variable #15	floating-point	not used
...			
16	variable #16	integer	not used
...			
31	variable #31	integer	not used

# op	constant nbr	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	2.7	torque constant K_T of the motor [Nm/Arms]
34	constant #02	floating-point	0.979382	A coefficient of low pass filter
35	constant #03	floating-point	0.020618	B coefficient of low pass filter
37	constant #05	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	it's a good rule of thumb to keep constant #16 = 0 (...useful for integer comparisons & sign reversal...)
49	constant #17	integer	1	it's a good rule of thumb to keep constant #17 = 1 (...useful to increase counters...)
51	constant#18	integer	0	not used
...				
63	constant #31	integer	0	not used

1

2

3

4

5

6

7

8

Finally, the code for the embedded macro could be the following:

# instr	mnemonic	description
0	LMP #50 = V0	load measure point #50 (torque current) into variable #00
1	FSUB O0 O1 = V2	calc $V2 = O0 - O1$
2	FMAC O2 O35 O1 = V1	calc new first filter output $V1 = (O2 * O35) + O1$
3	FSUB O1 O3 = V4	calc $V4 = O1 - O3$
4	FMAC O4 O35 O3 = V3	calc new second filter output $V3 = (O4 * O35) + O3$
5	FMUL O3 O33 = V5	$V5$ = second filter output scaled as Nm (by O33)
6	JMP #15	Jump unconditionally to outside of macro: terminate execution ! ...to avoid useless waste of time executing NOPs...
7	NOP	
8	NOP	
9	NOP	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	NOP	

...as can be seen from the example above, to implement a first order low-pass filter, then we need only two instructions: a FSUB + a FMAC !

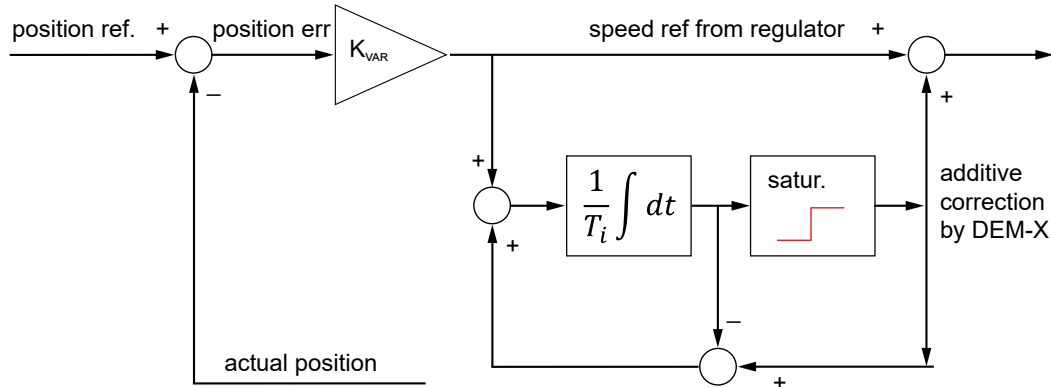
...that shows the power of MAC instruction !

Our new measure point “filtered torque” is now available as variable #05 !

Integrator block added to position regulator

All what we need is to add a proper integral of the position error to the speed reference already computed by the position gain.

After simple reasoning, we can convince ourselves that it is sufficient that we integrate properly the speed reference and use such an integral as the additive correction of the embedded macro.



Suppose that we want to implement an integral position gain with time constant equal to 50 ms; furthermore the saturation of integral part is taken into account.

Then we do the following:

- input to the embedded macro is the speed reference computed by the proportional position regulator (MP#4)
- the following discrete equations will be applied:
 - integral output $[k+1] = \text{integral output}[k] +$
 $+ K_i * [\text{speed ref} + (\text{saturated output}[k] - \text{integral output}[k])]$
 - saturated output = SAT (integral output, maximal speed)
 - corrective action = saturation output
- the maximal speed (1000rpm) is stored in a constants:
- the integral gain factor ($K_i = 50\mu\text{s} / T_i$) is stored in constant multiplied by the same scaling factor
 - $K_i = 50 / 50000 = 0,001$



**That this is only an example!
Don't use it in real application!**

Because the addition of an integrator into position regulator can make the motion **control unstable** !

Distribution of operands: constant and variables

#op	variable n°	type	meaning
0	variable #00	floating-point	actual speed ref from position regulator (MP #4)
1	variable #01	floating-point	integrator input
2	variable #02	floating-point	output of integrator = input to saturator block
3	variable #03	floating-point	output of saturator block = additive correction to speed ref
4	variable #04	floating-point	not used
...	...		
15	variable #15	floating-point	not used
16	variable #16	integer	not used
...			
31	variable #31	integer	not used

#op	constant n°	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	0.001	integrator gain
34	constant #02	floating-point	1000	maximal saturator output [rpm]
35	constant #03	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	it's a good rule of thumb to keep constant #16 = 0 (...useful for integer comparisons & sign reversal...)
49	constant #17	integer	1	it's a good rule of thumb to keep constant #17 = 1 (...useful to increase counters...)
51	constant #18	integer	0	not used
...				
63	constant #31	integer	0	not used

# instr	mnemonic	description
0	LMP #4 = V0	load measure point #4 (speed ref) into variable #00
1	FSUB O3 O2 = V1	calc saturator output – integral output
2	FADD O1 O0 = V1	calc integrator input : var#01 = var#01 + speed ref
3	FMAC O1 O33 O2 = V2	calc new integral output V2 = (O1*O33) + O2
4	FSAT O2 O34 =V3	calc saturator output = sat(integral out, max speed)
5	JMP offs#10	jump unconditionally to last instruction (10 places from here !)...only not to waste time executing useless NOPs...
6	NOP	
7	NOP	
8	NOP	
9	NOP	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	STS O3	store var#03 as additive macro contribution to speed reference

8.8.3 AP12 (with motor encoder only)

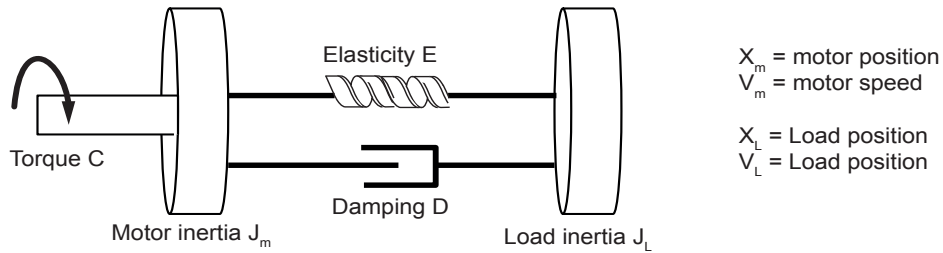
What we want to show here is a very simple AP12 simulation, starting from the motor encoder only. AP12 is an “active damping” function, available on high performance drives equipped with two encoders: motor and load ones.

Such function simulates an acceleration feedback that damps mechanical resonances.

All AP12 function theoretical aspects and details can be found in related documentation SVS SP 047.

AP12 needs the load speed measured starting from the load encoder, but here we estimate load speed starting from motor speed and motor torque current, by mean of a very simple observer:

The simplified mechanical model is the following:



Formulas relating torque, speed and positions are the followings:

$$X_m = \frac{C (1 + J_L/J_m)}{(J_m + J_L) s^2} * \frac{s^2 + s 2 \xi_a \omega_a + \omega_a^2}{s^2 + s 2 \xi_r \omega_r + \omega_r^2}$$

$$X_L = \frac{C}{(J_m + J_L) s^2} * \frac{s 2 \xi_r \omega_r + \omega_r^2}{s^2 + s 2 \xi_r \omega_r + \omega_r^2}$$

Where:

s = Laplace operator

ω_a = anti-resonance = $\sqrt{E/J_L}$

ω_r = resonance = $\omega_a * \sqrt{1 + J_L/J_m}$

ξ_a = hole damping = $(D/2E) * \sqrt{E/J_L}$

ξ_r = peak damping = $\xi_a * \sqrt{1 + J_L/J_m}$

- Simulation of the mechanical model AP12

V_L and V_m are, obviously, computed by derivation of related positions X_L and X_m

By assuming that the model above is valid, it is possible to estimate load speed starting from motor speed only.

Then it is possible to use AP12 on the estimated load speed in order to avoid load resonances during machining.

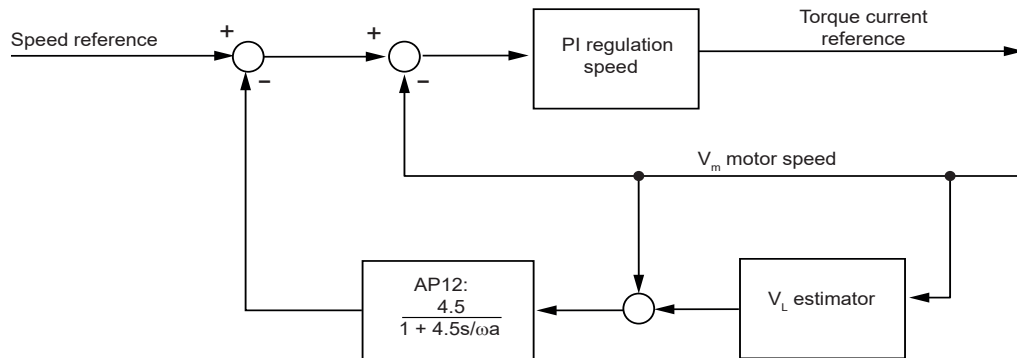
In fact, the following equations derive from the model above:

$$V_L = V_m * \frac{s 2 \xi_a \omega_a + \omega_a^2}{s^2 + s 2 \xi_a \omega_a + \omega_a^2}$$

All equation parameters (anti-resonance frequency and its related damping) may be estimated by performing a frequential analysis of the V_m/C transfer function.

Then, after having estimated load speed (VL) it is possible to apply AP12 to the PI speed regulator, so obtaining an improved speed regulator with respect to mechanical resonances avoidance:

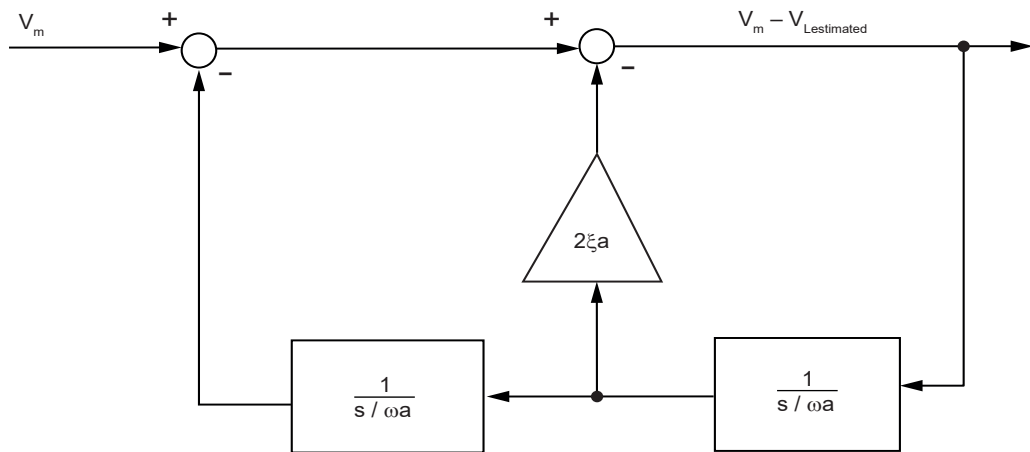
Here it is the theoretical schematic:



- Theoretical schematic AP12

The input to AP12 low-pass filter $V_m - V_{L_{estimated}}$ can be derived as follows:

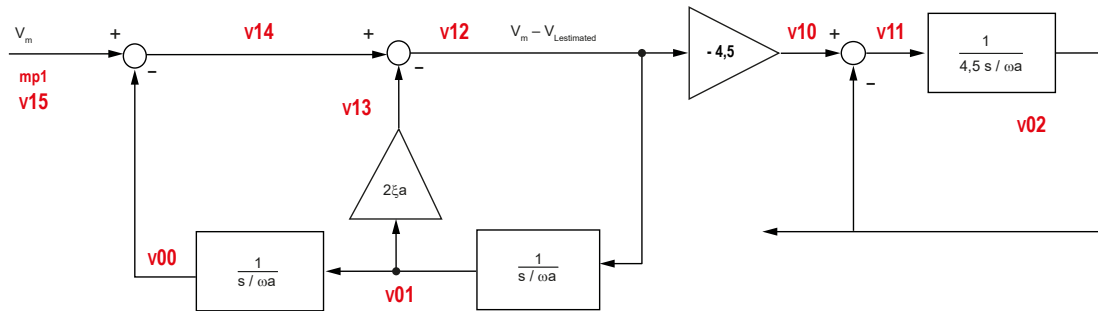
$$V_m - V_{L_{estimated}} = V_m * \frac{s^2}{s^2 + 2 \xi_a \omega_a s + \omega_a^2}$$



- Theoretical schematic AP12

The AP12 low-pass filter can be implemented as explained in previous chapter.

After proper re-arrangement, we obtain the final theoretical schematic shown in next page.



- Theoretical schematic AP12

We decide to set data of the regulator as follows (see explanations below...):

- general data
 - motor speed [rpm]
 - cycle @ 50us to create additive correction to speed reference
- Mechanical anti-resonance
 - $\zeta_a = 0.1$
 - $\omega_a = 125.6 \text{ rad/sec}$ (corresponding to 20 Hz)

Here it is the memory map:

#op	variable n°	type	meaning
0	variable #00	floating-point	...see picture above
...			
15	variable #15		
...			
16	variable #16	integer	not used
...			
31	variable #31	integer	not used

#op	constant n°	type	value	meaning
32	constant #00	floating-point	0.0	
33	constant #01	floating-point	0.2	
34	constant #02	floating-point	-4.5	
35	constant #03	floating-point	0.00628	
36	constant #04	floating-point	0.00139555	
37	constant #05	floating-point	0.0	
...	...			
47	constant #15	floating-point	0.0	
...				
48	constant #16	integer	0	
49	constant #17	integer	1	
51	constant #18	integer	0	not used
...				
63	constant #31	integer	0	not used



NOTE

The signum chngement to AP12 factor “4.5”!
That’s due to the fact that the AP12 contribution has to be subtracted to speed reference.

Here is the code:

# instr	mnemonic	description
0	LMP #1 = V15	load measure point #1 (speed) into variable #15
1	FMUL O1 O33 = V13	calc $V13 = V1 * 2 * \text{damping coeff}$
2	FSUB O15 O0 = V14	calc $V14 = V15 - V0$
3	FSUB O14 O13 = V12	calc $V12 = V14 - V13$
4	FMAC O1 O35 O0 = V0	calc new $V0 = V0 + (V1 * \text{Kintegrator})$
5	FMAC O12 O35 O1 = V1	calc new $V1 = V1 + (V12 * \text{Kintegrator})$
6	FMUL O12 O34 = V10	calc $V10 = V12 * \text{Kap12}$
7	FSUB O10 O2 = V11	calc $V11 = V10 - V2$
8	FMAC O11 O36 O2 = V2	calc new $V2 = V2 + (V11 * \text{Kintegr.ap12})$
9	FSUB O15 O12 = V7	calc $V7 = V15 - V12$ variable #07 is TP ONLY ! showing estimated load speed !!!
10	JMP #5	jump unconditionally to last instruction (5 places from here !) ...only not to waste time executing useless NOPs...
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	STS O2	store V2 as additive macro contribution to speed reference



NOTE

The addition of var#07 as a measure point, estimating V_L (load speed) !!!

8.8.4 Compensation of Harmonic Drive position errors (Forest-Line problem)

At Forest Line client, we detected a problem with Harmonic drives that caused machine vibrations amplified by a mechanical resonance.

The problem with harmonic drives was that, even running the motor at constant speed, the output speed of harmonic drive shaft was affected by a periodic oscillation, around the average speed, with period equal to one half of rotating motor period.

In order to avoid the excitement of nasty mechanical resonance, we'll try to implement a compensation of such speed disturbance as follows:

- we'll add to the speed reference a sinusoidal additive correction with frequency equal to the double of the mechanical motor angular position frequency:

$$\text{correction} = A \times \sin(2 \times (\text{motor angular position} + \text{offset}))$$

The amplitude "A" of the correction will be a percentage of the speed reference from position regulator. So doing, at speed = zero the additive contribution will be zero: no position offset will be introduced !

So we do the following:

- input to the dynamic operator is the motor mechanical angular position (MP #208)
 - a floating-point MP, whose range is = 0.0 ... 360.0 degrees
- the additive perturbation amplitude to the speed perturbation is stored in a constant, as a percentage of the speed ref (MP#04):
 - speed perturbation amplitude scale = 0.0 .. 1.0 that means 0% ... 100%
- the sinusoidal angular offset is stored in a constants:
 - angular offset (0.0 ... 360.0 degrees)
- keep in mind that the sinus / cosinus output scale is = -1.0 ... 0.0 ... +1.0

Memory map

#op	variable n°	type	meaning
0	variable #00	floating-point	actual angular motor position from MP #208
1	variable #01	floating-point	actual speed reference from MP#04
2	variable #02	floating-point	actual angle + offset
3	variable #03	floating-point	sinus
4	variable #04	floating-point	cosinus
5	variable #05	floating-point	amplitude of perturbation
6	variable #06	floating-point	additive correction to speed ref
7	variable #07	floating-point	not used
...	...		
15	variable #15	floating-point	not used
16	variable #16	integer	not used
...	...		
31	variable #31	integer	not used



NOTE

In order to allow constant motor speed as high as 10.000 rpm, then we scale down the sinus value by a factor 2⁵.

#op	constant n°	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	30.0	offset [degrees]
34	constant #02	floating-point	0.02	amplitude percentage
35	constant #03	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	it's a good rule of thumb to keep constant #16 = 0 (...useful for integer comparisons & sign reversal...)
49	constant #17	integer	1	it's a good rule of thumb to keep constant #17 = 1 (...useful to increase counters...)
51	constant #18	integer	0	not used
...				
63	constant #31	integer	0	not used

then, here follows the code:

#instr	mnemonic	description
0	LMP #208 = V0	load measure point #208 (angular position) into variable #00
1	LMP #4 = V1	load measure point #4 (speed ref) into variable #01
2	FADD O0 O33 = V2	calc angle = V2 = V0 + offset
3	TRG O2 = V3 V4	calc sinus (=V3) and cosinus (=V4) from angle V2 (...note that it is not necessary to modularize between 0...360, because MP208 is already modularized...)
4	FMUL O1 O34 = V5	calc amplitude V5 = A = V1 * percentage
5	FMUL O3 O5 = V6	calc additive correction V6 = (V5 * sinus)
6	JMP offs#9	jump unconditionally to last instruction (9 places from here !) ...only not to waste time executing useless NOPs...
7	NOP	
8	NOP	
9	NOP	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	STS O6	store V6 as additive macro contribution to speed reference



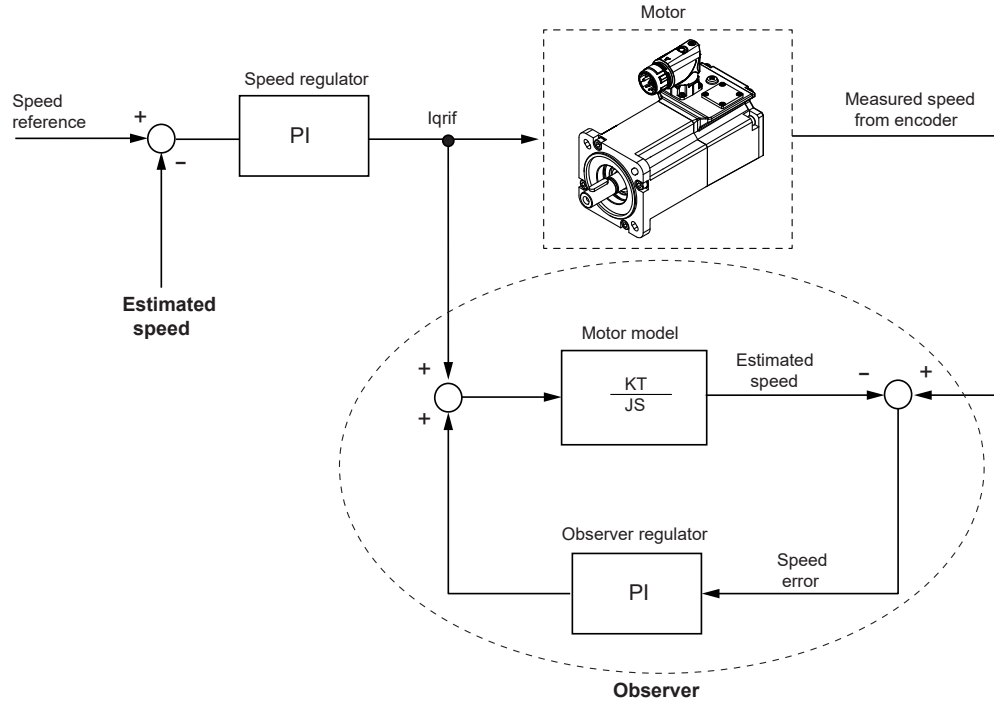
NOTE

Obviously this is only an example!

..maybe a low pass filtering on speed reference could be needed !

8.8.5 Speed observer

Here follows the schematic of a simple speed observer, that should allow an increase of speed-loop bandwidth, by taking the estimated speed as feedback, instead of the measured (and filtered) one:



- Schematic Speed observer

It is very easy to convince one selves that in order to use the observed speed as feedback, instead of the measured one, it is sufficient to add the observer error to the speed reference.

So this application is perfect for our “additive contribution to speed ref” of our Drive Embedded Macro function !

We suppose to have the following drive-motor association:

- we suppose to have a NUM DrivePro014 (14 Apk), so the maximal deliverable current is 9.89 Arms
- we have a rotary motor BPH0752V with torque constant (K_T) = 0,65 Nm/Arms and an inertia (J) of 0,00012 Kgm2

The Laplace's transfer function of the observer is:

$$\text{Speed error} = \text{measured speed} \left(\frac{s^2 \frac{J\tau}{K_T K_p}}{s^2 \frac{J\tau}{K_T K_p} + s\tau + 1} \right) - I_{qr} \text{ ref} \left(\frac{s \frac{\tau}{K_p}}{s^2 \frac{J\tau}{K_T K_p} + s\tau + 1} \right)$$

where the observer poles are:

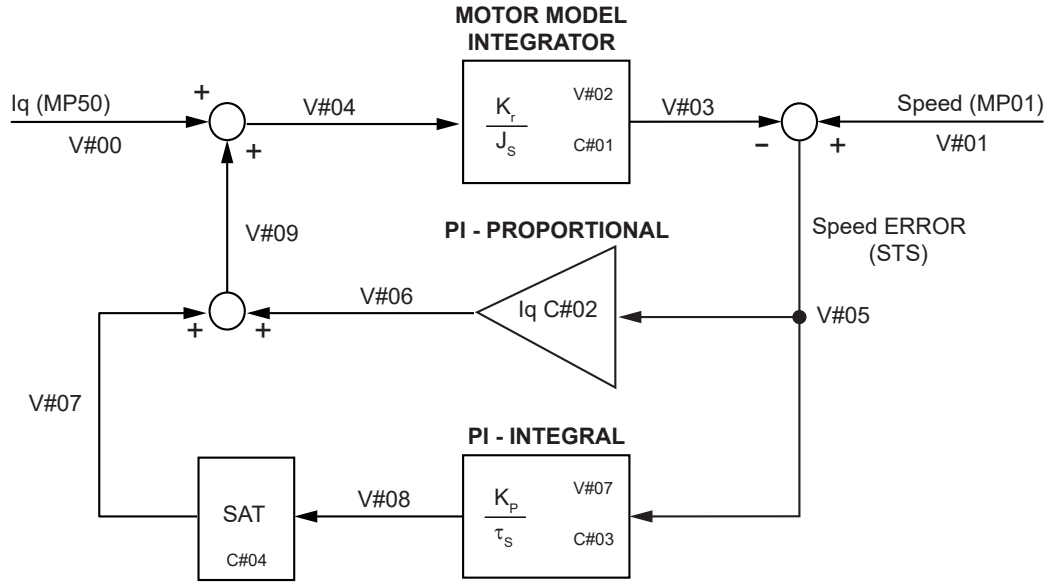
$$\text{poles} = \frac{K_p K_T}{2J} \left(-1 \mp \sqrt{1 - \frac{4J}{K_p K_T \tau}} \right)$$

In order to simplify observer tuning we decide to set the PI parameters in order to have two coincident real poles at frequency = 400 Hz, so obtaining:

- K_p = proportional gain = $4 \pi \text{ freq} / (K_T / J)$ = 0.93 Arms / (rad/s)
- τ = integral time constant = $1 / (\pi \text{ freq})$ = 0.8 ms

Due to the fact that actual speed and torque reference, available to DEMF, have not the same timing, then **better result can be obtained by using the measured torque current**, that is available to DEMF at the **same timing!**

This is the final schematic of the observer:



With reference to the picture above, and from DMF cycle time = 50 μ s, we define all constants as follows:

- constant #01 (floating point operand #33) = integration multiplier constant

$$(K_r/J * 0,00005s)(60/2\pi) \cong 2.6 \text{ [rpm/Arms]}$$

- constants #02 (floating point operand #34) = observer PI proportional gain:

$$(4\pi f/(K_r/J))(2\pi/60) \cong 0.1 \text{ [Arms/rpm]}$$

- constants #03 (floating point operand #35) = observer PI integral gain

$$((4\pi^2 f^2)/(K_r/J) 0.00005s)(2\pi/60) \cong 0.0063 \text{ [Arms/rpm]}$$

- constant #04 (floating point operand #36) = max PI integral output saturation:

$$9.89 \text{ [Arms]}$$

Here it is the memory map:

#op	variable n°	type	meaning
0	variable #00	floating-point	...see picture above
...			
15	variable #15		
16	variable #16	integer	not used
...	...		
31	variable #31	integer	not used

#op	constant n°	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	2.6	integrator multiplier
34	constant #02	floating-point	0.1	observer PI proportional gain
35	constant #03	floating-point	0.0063	observer PI integral gain
36	constant #04	floating-point	9.89	max PI output saturation
37	constant #05	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	not used
...				
63	constant #31	integer	0	not used

And here is the micro code:

#instr	mnemonic	description
0	LMP #50 = V0	load measure point #50 (torque current) into variable#00
1	LMP #1 = V1	load measure point #1 (speed) into variable #01
2	FADD O6 O7 = V9	var#09 = (var#06 + var#07)
3	FADD O0 O9 = V4	model input var#04 = var#00 + var#09
4	FMAC O4 O33, O3 = V3	update motor model integral = estimated speed var#03 = var#03 + (const#01 * var#04)
5	FSUB O1 O3 = V5	calc speed error (to be added later to speed reference) speed error : var#05 = var#01 – var#03
6	FMUL O5 O34 = V6	calc proportional component of speed observer var#06 = var#05 * const#02
7	FMAC O5 O35 O7 = V8	update observer PI integral before saturation: var#08 = (var#05 * const#03) + var#07
8	FSAT O8 O36 = V7	saturate observer PI integral output : observer integral : var#07 = sat(var#08, const#04)
9	JMP #6	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	STS O5	add speed error (var#05) to speed reference

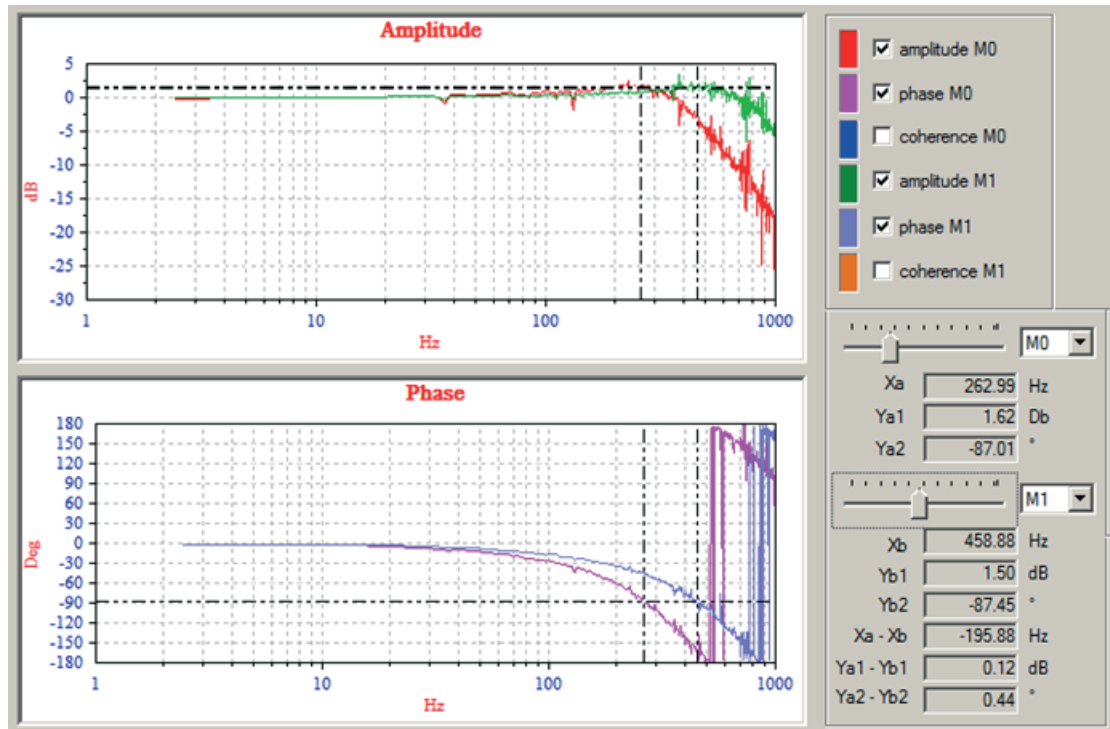


Remember to use NO filter on speed... to get the maximum performances from the observer !!!...

Note also the **anti-windup trick to use saturator output as “old memory” of PI integral component...**

Here is shown the improvement:

- the gain has been increased by 72% (from 32 mA/Rpm to 55 mA/Rpm)
- the 90 degree speed loop bandwidth has been increased by more than 200 Hz about !!!



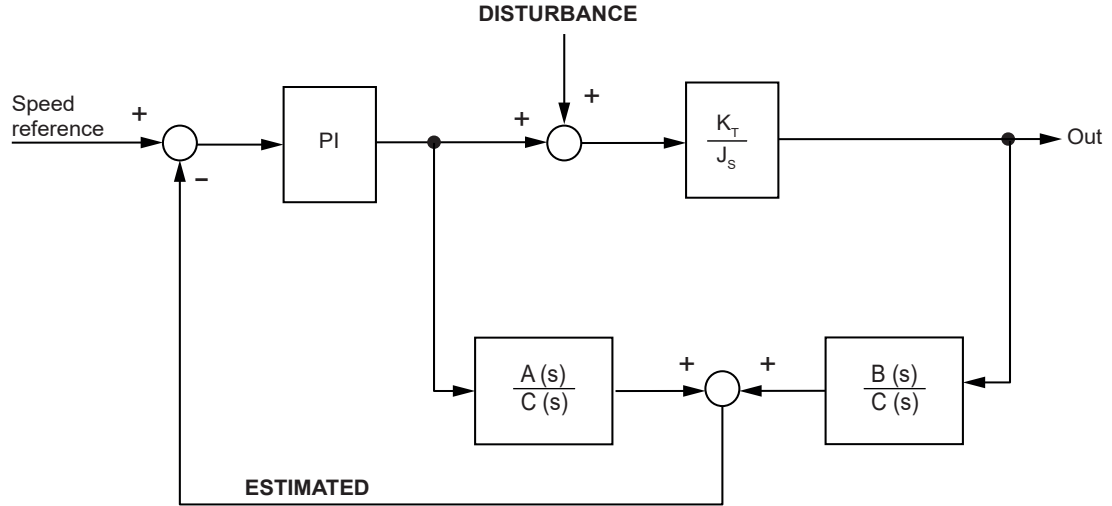
- Improvement of the gain and speed loop bandwidth

8.8.5.1 Mathematical digression

The increase of speed-loop bandwidth seen before is a little bit misleading...

Here follows the math behind observers and which are the real bandwidths of the speed feedback regulation system equipped with an observer.

Here is the Laplace's domain model of our speed-loop equipped with observer:



Where:

$$PI(s) = K_p \frac{(1+s\tau)}{s}$$

$$A(s) = \frac{s^2 K_T}{\omega_0^2 J_s}$$

$$B(s) = 1 + \frac{2\xi s}{\omega_0}$$

$$C(s) = 1 + \frac{2\xi s}{\omega_0} + \frac{s^2}{\omega_0^2}$$

With our choice, and as long as our “model” data K_T and J are coincident to real motor data, then we have:

$$\xi = 1$$

$$A(s) + \frac{K_T}{J_s} B(s) = \frac{K_T}{J_s} C(s)$$

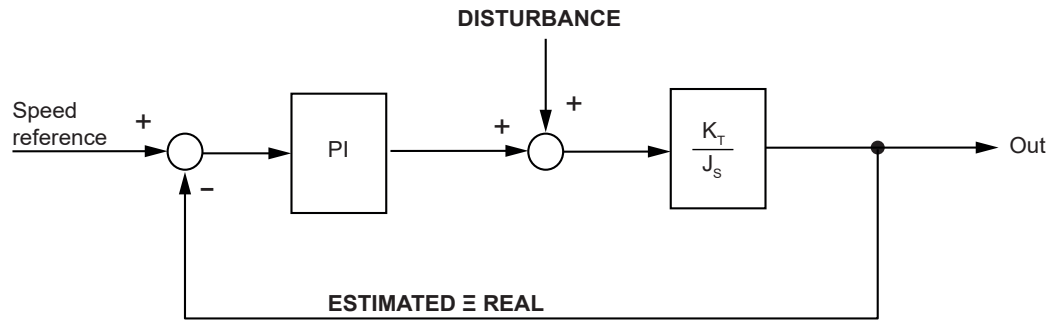
So, the transfer function from reference to output is:

$$\frac{out}{ref} = \frac{C(s)PI(s)\frac{K_T}{J_s}}{C(s) + A(s)PI(s) + B(s)PI(s)\frac{K_T}{J_s}} = \frac{PI(s)\frac{K_T}{J_s}}{1 + PI(s)\frac{K_T}{J_s}}$$

and the transfer function from torque disturbance to output is:

$$\frac{out}{disturbance} = \frac{(C(s) + A(s)PI(s))\frac{K_T}{J_s}}{C(s) + A(s)PI(s) + B(s)PI(s)\frac{K_T}{J_s}} = \frac{\frac{K_T}{J_s}}{1 + PI(s)\frac{K_T}{J_s}} + \frac{A(s)}{C(s)} \cdot \frac{PI(s)\frac{K_T}{J_s}}{1 + PI(s)\frac{K_T}{J_s}}$$

note that the transfer function “output vs reference” is the same that we would obtain for the case of ideal loop sketched below:



While the “output vs disturbance” transfer function differs from the ideal case by the additive term:

$$\frac{A(s)PI(s)\frac{K_T}{J_s}}{C(s)\left(1 + PI(s)\frac{K_T}{J_s}\right)} \cong \frac{A(s)}{C(s)} = \frac{s \frac{\tau_{obs}}{K_{p\ obs}}}{1 + \frac{2\xi s}{\omega_0} + \frac{s^2}{\omega_0^2}}$$

where, it is immediately recognizable that, **the disturbance is attenuated by the “observer” filter: the disturbance tail is eliminated as fast as the observer poles !!!**

So, at the end, **the disturbance rejection bandwidth is the same of the observer one !**

Let’s examine the “static stiffness”, defined as the steady state position error per torque disturbance [rad/Nm] is:

$$\begin{aligned} \lim_{s \rightarrow 0} \left(\frac{\text{position}}{\text{disturbance}} \right) &= \lim_{s \rightarrow 0} \left(\frac{\left(\frac{\text{speed}}{s} \right)}{\text{disturbance}} \right) = \lim_{s \rightarrow 0} \left(\frac{1}{s} \right) \left(\frac{\frac{K_T}{J_s}}{1 + PI(s)\frac{K_T}{J_s}} + \frac{A(s)}{C(s)} \cdot \frac{PI(s)\frac{K_T}{J_s}}{1 + PI(s)\frac{K_T}{J_s}} \right) \\ &= \frac{\tau}{K_p} + \frac{K_T}{J\omega_0^2} \end{aligned}$$

..that, again, is the sum of the ideal case stiffness and the “observer” stiffness.

8.8.5.2 Static stiffness improvement

It is possible to improve disturbance rejection by using the output of the observer integrator as a disturbance estimator, subtracting it to the torque reference.

That can be done with **just few more instruction and a STT instruction!**

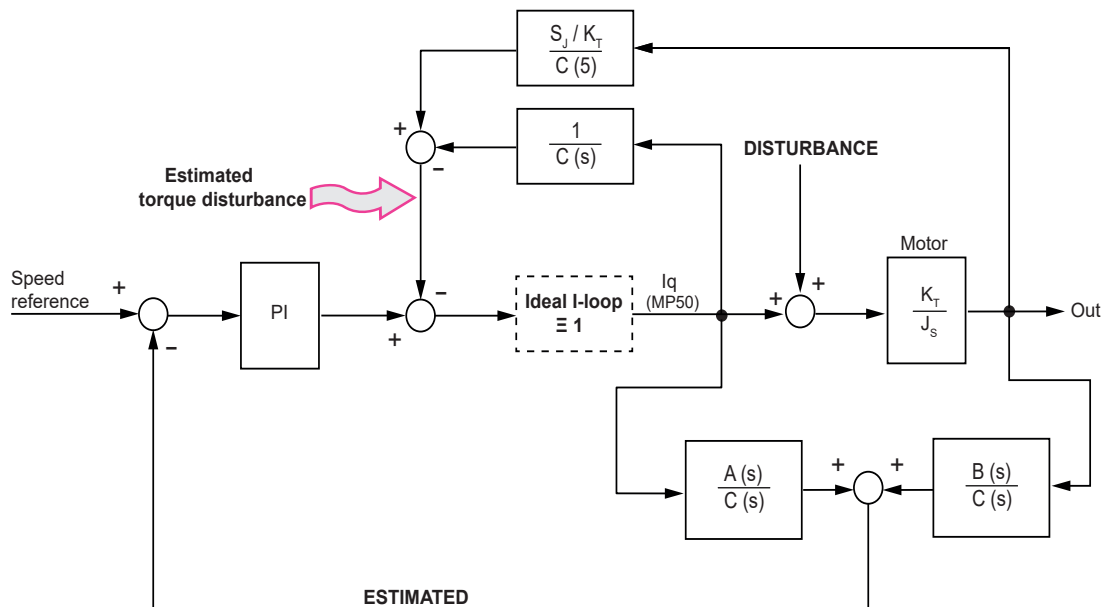
The output of observer integrator is a direct function of the speed error:

$$\text{Integrator out} = \text{Speed error} \left(\frac{K_{p\text{ obs}}}{s\tau_{\text{obs}}} \right) = \text{measured speed} \left(\frac{s \frac{J}{K_T}}{C(s)} - I_q \left(\frac{1}{C(s)} \right) \right)$$

where, with the same choice of previous paragraphs:

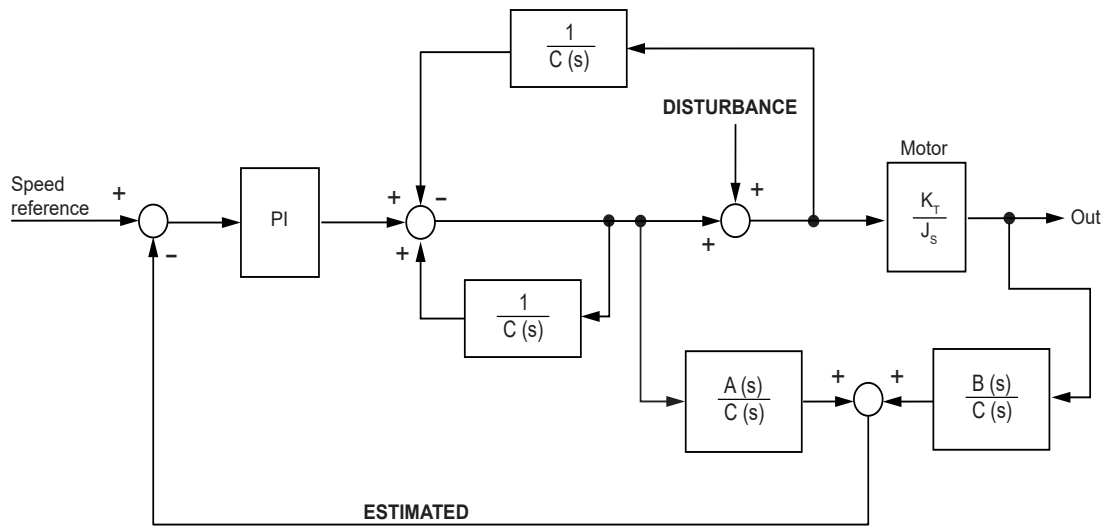
- K_p = observer proportional gain
- τ = observer integral time constant
- $C(s) = 1 + 2\xi s / \omega_0 + s^2 / (\omega_0^2)$
- $K_p = 2\omega_0 (J/K_T)$
- $\tau = (2\xi / \omega_0) \times \text{xxxxxxxxxxxx}$
- $\xi = 1$

By reinjection of **observer integrator output as a negative torque reference feed forward**, the resulting model schematic is the following:



Note that we can do this because, as input to the observer, we used the measured torque current instead of the reference torque current; so, now, we can re-injection the integral observer output to the torque current reference.

By considering torque current-loop as ideal (=1), we can re-arrange the schematic as follows:



Concerning the “output vs reference” transfer function, as soon as the disturbance is removed, it is very easy to see that the “ $1/C(s)$ ” blocks cancel out each other, resulting in an unchanged transfer function with respect to the one determined in the previous paragraph: it is the same of the ideal speed loop !

Concerning the “output vs disturbance” transfer function, here it is the result:

$$\frac{out}{disturbance} = \frac{(C(s) + A(s)PI(s) - 1) \frac{K_T}{J_s}}{C(s) + A(s)PI(s) + B(s)PI(s) \frac{K_T}{J_s}} = \frac{C(s) - 1}{C(s)} \frac{\frac{K_T}{J_s}}{1 + PI(s) \frac{K_T}{J_s}} + \frac{A(s)}{C(s)} \cdot \frac{PI(s) \frac{K_T}{J_s}}{1 + PI(s) \frac{K_T}{J_s}}$$

Note that the first term has no effect on steady state: it contributes with a null position error to steady torque disturbance !

So the static stiffness, defined as the steady state position error per torque disturbance [rad/Nm] is:

$$\begin{aligned} \lim_{s \rightarrow 0} \left(\frac{position}{disturbance} \right) &= \lim_{s \rightarrow 0} \left(\frac{\left(\frac{speed}{s} \right)}{disturbance} \right) \\ &= \lim_{s \rightarrow 0} \left(\frac{1}{s} \right) \left(\left(\frac{C(s) - 1}{C(s)} \right) \cdot \left(\frac{\frac{K_T}{J_s}}{1 + PI(s) \frac{K_T}{J_s}} \right) + \frac{A(s)}{C(s)} \cdot \left(\frac{PI(s) \frac{K_T}{J_s}}{1 + PI(s) \frac{K_T}{J_s}} \right) \right) = \frac{K_T}{J\omega_0^2} \end{aligned}$$



BE CAREFUL

This is the **only** “observer stiffness” !!!

It is **independent by the speed loop PI tuning** !!! and, also, it is **inversely proportional to the square of the observer bandwidth** !!!

Here below it is shown how to modify the program in order to obtain such a static stiffness improvement: where all additions and modifications to previous macro are **highlighted in green**.

#op	type	value	meaning
0	variable #00		torque current from MP#50
1	variable #01		actual speed from MP#01
2	variable #02		not used
3	variable #03		estimated speed : motor model output
4	variable #04		motor-model input
5	variable #05		speed error
6	variable #06		proportional observer PI component
7	variable #07		integral observer PI component
8	variable #08		integral observer PI component before saturation
9	variable #09		total observer output
10	variable #10		negative estimated torque disturbance = sign reversed
11	variable #11		not used
...	...		
15	variable #15		not used

Micro codes

#instr	mnemonic	description
0	LMP #50 = V0	load measure point #50 (torque current) into variable#00
1	LMP #1 = V1	load measure point #1 (speed) into variable #01
2	FADD O6 O7 = V9	var#09 = (var#06 + var#07)
3	FADD O0 O9 = V4	model input var#04 = var#00 + var#09
4	FMAC O4 O33, O3 = V3	update motor model integral = estimated speed : var#03 = var#03 + (const#01 * var#04)
5	FSUB O1 O3 = V5	calc speed error (to be added later to speed reference) speed error : var#05 = var#01 – var#03
6	FMUL O5 O34 = V6	calc proportional component of speed observer var#06 = var#05 * const#02
7	FMAC O5 O35 O7 = V8	update observer PI integral before saturation: var#08 = (var#05 * const#03) + var#07
8	FSAT O8 O36 = V7	saturate observer PI integral output : observer integral : var#07 = sat(var#08, const#04)
9	FSUB O32 O7 = V10	calc negative torque disturbance estimation: var#10 = (const#00 – var#07)
10	JMP #4	unconditional jump to STT instruction (+4 places from here !)
11	NOP	
12	NOP	
13	NOP	
14	STT O10	add negative torque disturbance estimation
15	STS O5	add speed error (var#05) to speed reference

Finally, here we check the stiffness theory described above:

- using a 1422N motor + MDLUF3014 + P encoder (1024 sinus/revolution)
 - $K_T = 1.15 \text{ Nm / Arms}$
 - $J = 1.59 \text{ gm}^2$

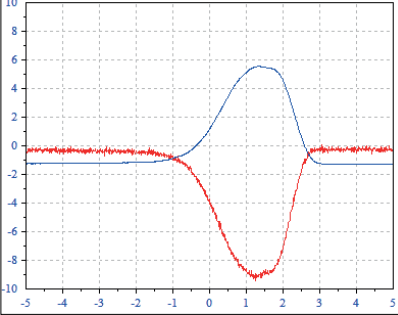
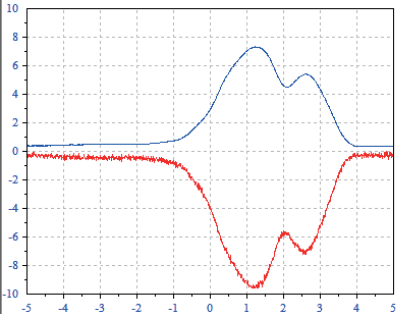
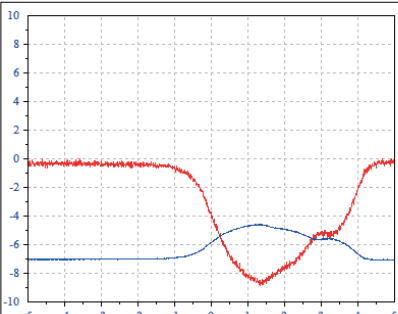
we performed stiffness test by measuring the torque current (MP50) vs the I.U. feedback position (MP200),

where, MP200 has a scaling related to the encoder sinus: 1 encoder sinus = 65536 I.U.

note that stiffness is computed as torque needed to obtain 1 radian of angular displacement, as follows:

$$stiffness \left[\frac{Nm}{rad} \right] = \frac{torque \ variation}{angular \ displacement} = \frac{\Delta MP50 \cdot K_T}{\left(\frac{\Delta MP200}{65536} \right) \cdot \left(\frac{2\pi}{1024} \right)}$$

Here are the results:

RED → MP50 = Torque current BLUE → MP200 = Feedback position	Test conditions and results
	Test with standard ST - speed proportional gain = 180 mArms/rpm - speed integral gain = 10 ms - expected stiffness = 200 Nm/rad - measured current variation = 4.5 Arms - measured position displacement = 270.000 IU - computed stiffness = 205 Nm/rad ok ! theory confirmed !
	Test with observer only - speed proportional gain = 220 mArms/rpm - speed integral gain = 5 ms - observer bandwidth = 200 Hz - expected stiffness = 400 Nm/rad - measured current variation = 4.6 Arms - measured position displacement = 140.000 IU - computed stiffness = 404 Nm/rad ok ! theory confirmed !
	Test with observer + stiffness boost - speed proportional gain = 220 mArms/rpm - speed integral gain = 5 ms - observer bandwidth = 200 Hz - expected stiffness = 2500 Nm/rad - measured current variation = 4.2 Arms - measured position displacement = 20.000 IU - computed stiffness = 2580 Nm/rad best ! theory more than confirmed !

8.9 “resistance to temperature” translator for KTY84

What we want to show here is a very simple “resistance to temperature” translator for the motor temperature sensor KTY84_130.

Such translator, starting from the Ohmic resistance value of motor temperature sensor, available in measure point MP #260, will produce a new test point, in a proper DEMF variable, in Celsius degrees [°C].

The first thing to do is to start from the KTY84 data-sheet information, shown below.

Then, by mean of an Excel worksheet, we derived the following translation formula:

$$T[{}^{\circ}C] = -188.0{}^{\circ}C + 110.0{}^{\circ}C \times \sqrt{\frac{R[\Omega]}{128.0\ \Omega} - 1.0}$$

such formula, used with real numbers, guarantees a temperature error less than +/- 1,0°C.

all such operators (square root, add, subtract, and division) are available to DEMF !

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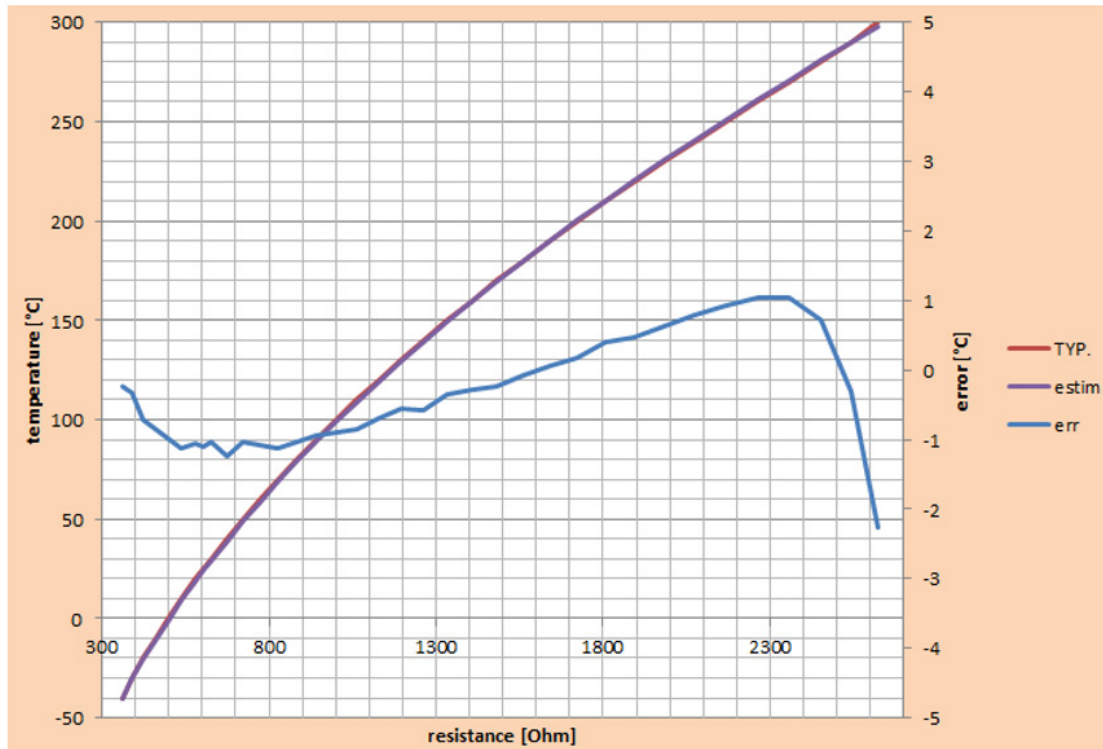
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Table 1 Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY84/130

I_{cont} = 2 mA.

AMBIENT TEMPERATURE		TEMP. CO-EFF.	KTY84/130			
(°C)	(°F)	(%/K)	RESISTANCE (Ω)			TEMP. ERROR (K)
			MIN.	TYP.	MAX.	
-40	-40	0.84	340	359	379	±6.48
-30	-22	0.83	370	391	411	±6.36
-20	-4	0.82	403	424	446	±6.26
-10	14	0.80	437	460	483	±6.16
0	32	0.79	474	498	522	±6.07
10	50	0.77	514	538	563	±5.98
20	68	0.75	555	581	607	±5.89
25	77	0.74	577	603	629	±5.84
30	86	0.73	599	626	652	±5.79
40	104	0.71	645	672	700	±5.69
50	122	0.70	694	722	750	±5.59
60	140	0.68	744	773	801	±5.47
70	158	0.66	797	826	855	±5.34
80	176	0.64	852	882	912	±5.21
90	194	0.63	910	940	970	±5.06
100	212	0.61	970	1000	1030	±4.9
110	230	0.60	1029	1062	1096	±5.31
120	248	0.58	1089	1127	1164	±5.73
130	266	0.57	1152	1194	1235	±6.17
140	284	0.55	1216	1262	1309	±6.63
150	302	0.54	1282	1334	1385	±7.1
160	320	0.53	1350	1407	1463	±7.59
170	338	0.52	1420	1482	1544	±8.1
180	356	0.51	1492	1560	1628	±8.62
190	374	0.49	1566	1640	1714	±9.15
200	392	0.48	1641	1722	1803	±9.71
210	410	0.47	1719	1807	1894	±10.28
220	428	0.46	1798	1893	1988	±10.87
230	446	0.45	1879	1982	2085	±11.47
240	464	0.44	1962	2073	2184	±12.09
250	482	0.44	2046	2166	2286	±12.73
260	500	0.42	2132	2261	2390	±13.44
270	518	0.41	2219	2357	2496	±14.44
280	536	0.38	2304	2452	2600	±15.94
290	554	0.34	2384	2542	2700	±18.26
300	572	0.29	2456	2624	2791	±22.12

below is shown the temperature vs resistance curve and also the estimation errors of the original and DemF implemented formula:



where:

- TYP is the temperature vs resistance curve derived from TYPical column of data sheet
- estim is the temperature vs resistance curve derived from the original formula
- err is the temperature error curve of the original formula

Memory map

#op	variable n°	type	meaning
0	variable #00	floating-point	actual thermal resistance value from MP #260
1	variable #01	floating-point	estimated temperature [°C]
2	variable #04	floating-point	not used
...	...		
15	variable #15	floating-point	not used
16	variable #16	integer	not used
...	...		
31	variable #31	integer	not used

#op	constant n°	type	value	meaning
32	constant #00	floating-point	0.0	it's a good rule of thumb to keep constant #00 = 0.0 (...useful for floating-point comparisons & and sign reversal...)
33	constant #01	floating-point	-188.0	temperature offset T0
34	constant #02	floating-point	110.0	temperature scaling T1
35	constant #03	floating-point	0.0078125	resistance offset R0
36	constant #04	floating-point	1.0	unity
37	constant #05	floating-point	0.0	not used
...	...			
47	constant #15	floating-point	0.0	not used
48	constant #16	integer	0	it's a good rule of thumb to keep constant #16 = 0 (...useful for integer comparisons & sign reversal...)
49	constant #17	integer	1	it's a good rule of thumb to keep constant #17 = 1 (...useful to increase counters...)
51	constant #18	integer	0	not used
...				
63	constant #31	integer	0	not used

and here is the micro code:

#instr	mnemonic	description
0	LMP #260 = V0	load measure point #260 (PTC NTC resistance) into variable#00
1	FMUL O0 O35 = V1	calc temporary V1 = V0 * (1/R1)
2	FSUB O1 O36 = V1	calc temporary V1 = V1 - 1
3	SQRT O1 = V1	calc temporary V1= SQRT(V1)
4	FMUL O1 O34 = V1	calc temporary V1= V1 * T1
5	FADD O1 O33 = V1	temperature [°C]: V1 = V1 + T0
6	NOP	
7	NOP	
8	NOP	
9	NOP	
10	NOP	
11	NOP	
12	NOP	
13	NOP	
14	NOP	
15	NOP	



NOTE

that we prefer to MULTIply by $1/128.0 = 0.0078125$ instead of computing a DIVision because DIVision is much more CPU-time consuming !!!

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