FlexiumPro

Parameters manual

(for software release 1.0.0.0)

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flexiumpro

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CNC HighEnd Applications

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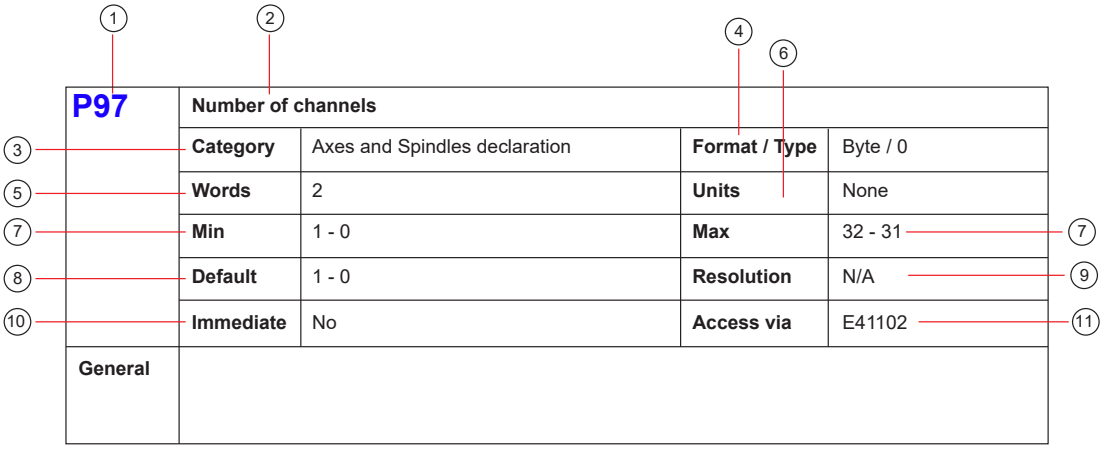
1 Foreword

1.1 Generalities

- This documents describes the machine parameters of FlexiumPro.
- The parameters are mostly set in a transparent manner via the graphic editors of NUM FlexiumPro Tools.
- Knowledge of the different parameters can however be very helpful to better understand the system or fine adjust the values.
- The parameters in this manual are regrouped by their function in the most logical manner for a standard machine.
- Each parameter is defined by the letter " **P** ". They may contain one value or a set of values.
- The term " **Word** " will be used for each component of a parameter.
  This term should be taken as generic and does not reflect the type of this component (e.g. 8 bit, 32 bit, ASCII value etc.). The real type is given in the cell " **Format** ".
- Each word is addressed by the letter " **N** " . *e.g. P25 N18 : word 18 of parameter P25.*

1.2 How to read a P parameter table description



1	**Parameter number**	Parameter identification number
2	**Parameter function**	Function of the particular parameter.
3	**Category**	Category of functions (Axes and Spindles declaration, System configuration, etc.).
4	**Format / Type**	Format and type of each word: Please refer the table in the next page.
5	**Words**	Number of words (N) of this particular format.
6	**Units**	Type of units (increments, µs, rpm, etc.)
7	**Min - Max**	Parameter range values.
8	**Default**	Parameter default values.
9	**Resolution**	Minimal increment related to the unit type (N/A = Not Available).
10	**Immediate**	Can be modified per request (NUM FlexiumPro Tools / HMI) and taken into account immediately.
11	**Access via**	Access possible via E parameter (Parameter name - access type [Read (R), Write (W), Read/Write (R/W]). Access N/A = Not Available. In case of write access the new value will be taken into account immediately but NOT STORED in parameters. Access via ENA is possible for all parameters.

Parameters format

Format	Type	Definition	Range	Bytes
BYTE	0	8 bits Hexadecimal	00 → FF	1
INT	1	16 bits signed Decimal	-32768 → 32767	2
DINT	2	32 bits signed Decimal	-99999999 → 99999999	4
SINT	3	8 bits signed Decimal	-128 → 127	1
UDINT	4	32 bits unsigned Decimal	00 → 99999999	4
UINT	5	16 bits unsigned Decimal	00 → 65535	2
DWORD	6	32 bits Hexadecimal	00000000 → FFFFFFFF	4
WORD	7	16 bits Hexadecimal	0000 → FFFF	2
STRING	8	ASCII String	- - - -	--
LREAL	9	Floating point	-9999999.99999999 → +9999999.99999999	8
LREAL	10	Unsigned Floating point	0.0 → 99999999.0	8

- **Format**: Parameter format as indicated in the field “Format”.
- **Type**: Type of data – Important information for ENA (Extended NCK Access) functions relative to machine parameters.
- **Definition**: For information.
- **Range**: Maximum range of this format – The range for a parameter can be different (smaller)
- **Byte**: Occupation in memory – Also important for ENA function.

Parameters - Main summary table

Click on **Pxxx** to give the detailed information.

Parameter	Description
P0	Displayed axes
P1	Modulo or limited excursion rotary axes
P4	Axes programmable by diameter - Internal measurement - Dimension format for acquisition and display
P5	Channel configuration
P6	Spindle definition and assignement to channels
P7	Miscellaneous functions
P8	Axes with clamps
P9	Axis assignment to a channel
P11	Measurement conversion coefficient for analog axes
P13	Handwheel measurement conversion coefficient
P14	Handwheel declaration
P15	Homing direction
P16	Machine home position
P17	Axis travel limits
P18	Backlash error compensation
P19	High Speed Cutting: feed-forward acceleration time constant - dry friction correction time constant
P20	Dry friction correction amplitude
P22	In-position window
P23	Maximum following error
P24	Synchronised axes correction coefficients
P25	Synchronised axes thresholds
P27	Coupling assignment for duplicated and synchronised axes
P28	Enable slave axis synchronisation
P29	Lubrication pulse distance
P30	Maximum axis traverse rate
P31	JOG speeds and default speed limits
P32	Maximum permissible acceleration
P33	Approach speed
P34	Speed limits
P35	Subroutine call by M function
P37	Maximum number of M function with acknowledge
P40	Number of sensor spindle pulses by revolution
P41	Spindle reference reversal
P42	Spindle origins

P43	Spindle indexing speed and speed limits
P44	Spindle indexing in-position window
P45	Spindle indexing gain
P46	Speed range for spindles @0 ... @7
P47	Speed range for spindles @8 ... @15
P48	Speed range for spindles @16 ... @23
P49	Speed range for spindles @24 ... @31
P50	Sampling period
P51	Minimum block execution time
P52	Radial error tolerated on circles - Path checks in RTCP - Programming precision on circle radius
P53	Acceleration profile
P54	Number of blocks in look-ahead buffer
P55	Speed anticipation coefficient - High Speed Cutting: number of filter terms and order of the filter
P56	Channel specific time constant
P57	Dynamic lag control
P58	Various memory reservations
P59	Memory segments of the symbolic variables
P62	Rigid tapping setting
P63	Servo adjustment for rigid tapping
P64	Carrier or carried axes
P65	Axes with quantified movements
P66	Time constant for axis
P67	Potentiometer min-max range
P68	Rotary axis modulo
P72	Analog axes configuration
P73	Servo-system loop coefficent for analog axes
P74	PLC EtherCAT analog drives absolute sensor resolution bits
P75	PLC EtherCAT analog drives zero shift absolute sensor
P77	Axes with measure stored
P78	Modulo of the absolute sensors and maximum position tolerance
P85	Drives coupling assignment for anti-backlash function
P86	Drives coupling assignment for torque-duplication function
P87	Drives coupling assignment for winding-duplication function
P95	Memory zones allocation (Part program)
P97	Number of channels
P98	Number of origins DAT2
P99	CNC - PLC communication setting
P114	Backup on path, Auto recall after INTERV

P115	Final distance at work rate for recall
P116	EGB function
P117	SSB function
P118	Mean filter: number of filter terms and order of the filter
P120	Machine configuration
P121	Network topology configuration

1.3 Use of the manual

This manual is for use by qualified personnel only.

To reduce the risk due to an improper 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 Use of symbols in the manual

Symbol	Meaning of the symbol
	Important notes on product use.
	You may find this symbol whenever a wrong operation may damage the product.

1.5 Document revisions

Date	Index	Reason for revision	See chapter
01 - 2025	00	Document creation Complies to software revision 1.0.0	-

1.6 How to read the manual

The FlexiumPro Parameters Manual gives information on how to set the parameters to customize the FlexiumPro for a particular Milling and Turning machine-tool.

Chapter	Description
1	**Foreword** This chapter introduces the use of the Parameters manual. - P parameters - Main summary table parameters selection.
2	**General drive configuration with NUM FlexiumPro Tools** This chapter introduces and shows the most usefull customer examples with NUM FlexiumPro Tools: - Open or Create a Project - NCK selection and address. - Settings. - Programming. - Memory. - Miscellaneous. - Handwheel configuration. - Channels configuration. - other....
3	**Axes and Spindles declaration** This chapter introduces the Machine configuration - Number and type of channels, - Number and type of axes, - Number and type of spindles.
4	**Axis initial settings** This chapter introduces the base characteristics of the axes : - Displayed, - Modulo, - Radius or Diameter, - Clamps, - Carrier/carried.
5	**Spindle initial settings** This chapter introduces the base characteristics of the spindles : - Logical address, - Channel assignment, - Indexing, - Speed format, - Sensor, - Switchable.
6	**System configuration** This chapter introduces the configuration parameters : - Timing, - Memory sizes, - Buffers, - Datums, - M codes etc....

7	**Axis characteristics** This chapter introduces the Individual axes characteristics : - Homing, - Travels, - Positionning, - Backlash, - Speeds, etc. - Lubrication pulse distance
8	**Axis dynamics** This chapter introduces the axes dynamic characteristics : - Following errors, - Acceleration, - Acceleration profile.
9	**Performance** This chapter introduces the axes performances: - Speed and acceleration anticipation, - Dry friction compensation, - Time constants (gain), etc.
10	**Spindle characteristics** This chapter introduces the spindle static characteristics : - Sensor counts, - Origin, - Indexing, - Speeds, - Ranges, etc.
11	**Synchronization, Duplication** This chapter introduces the duplicated and synchronised axes characteristics : - Lists, - Coupling, - Coefficients, - Thresholds.
12	**Cycles** This chapter introduces cycles characteristics: - Rigid tapping, - Backup and Retrace.
13	**Analog Axes and Spindles, Handwheels** This chapter introduces the the analog axes characteristics: - Measurement, - Direction, - Gain, - Handwheels declaration.

1.7 NUM Agency

The list of NUM agencies is given click here http://www.num.com

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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:

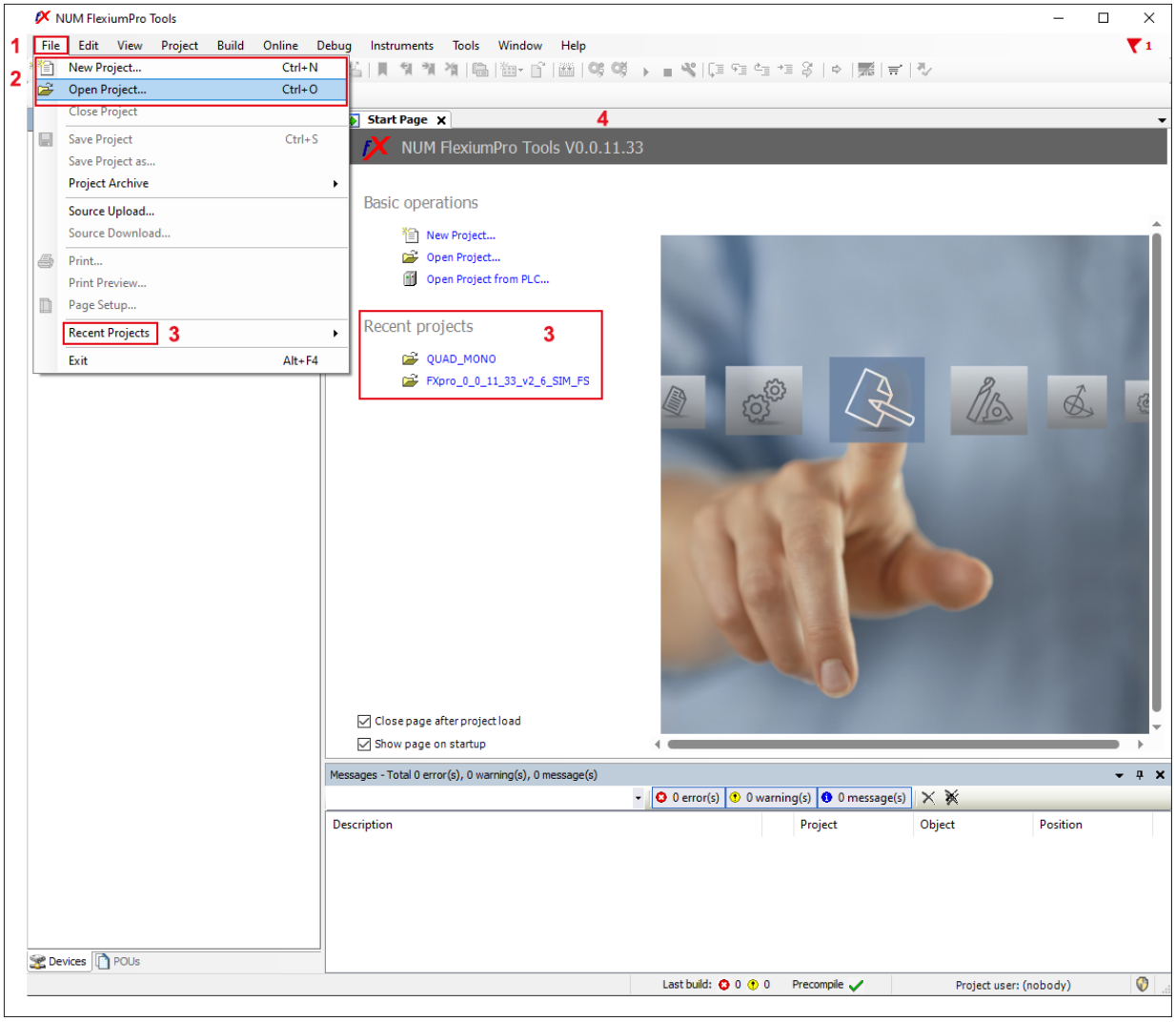


Fig. 1 - Open project

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

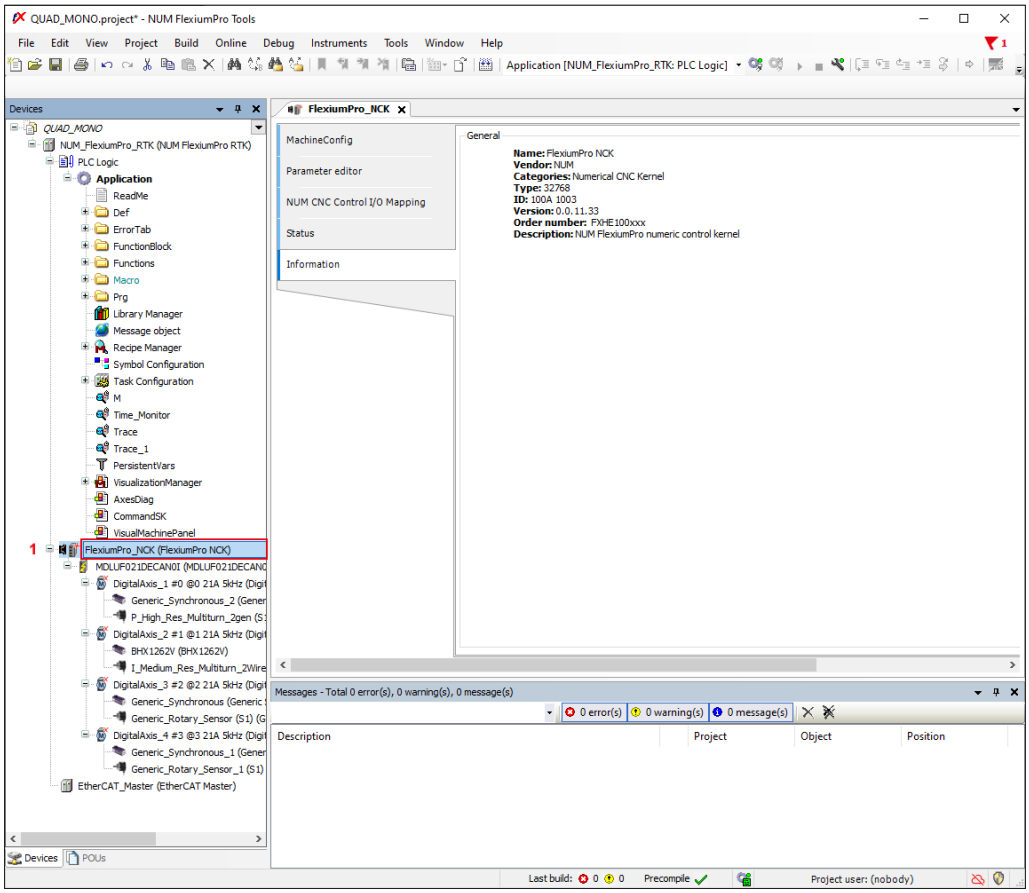


Fig. 2 - Add Device PART#1

1	Select ⟶ "*FlexiumPro_NCK*" and right click to open the "*Device*" tabbed window
2	Select ⟶ "*Add Device*" to open the main drive page selection

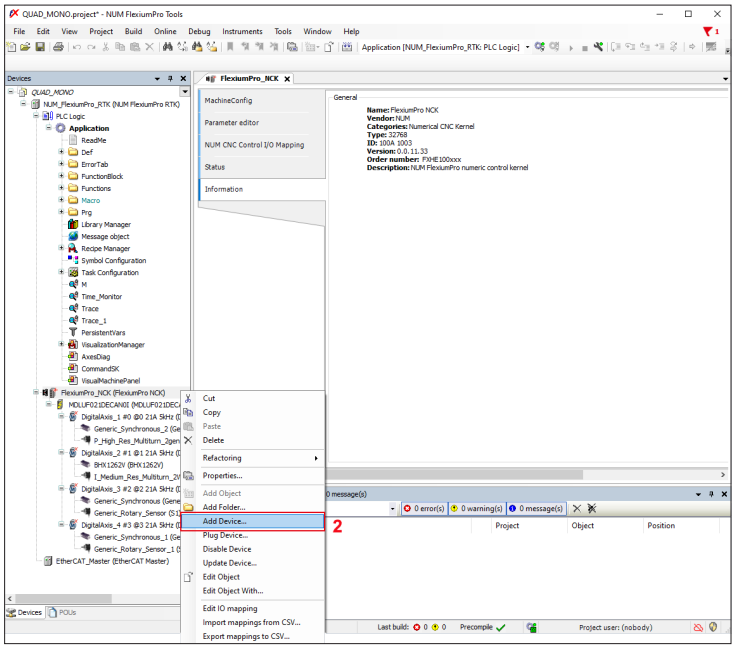


Fig. 3 - Add Device PART#2

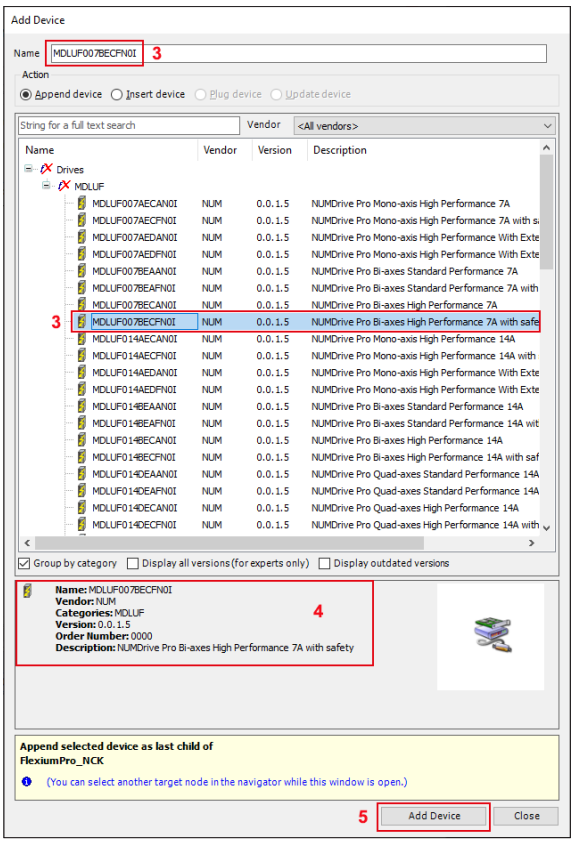


Fig. 4 - Drive selection

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

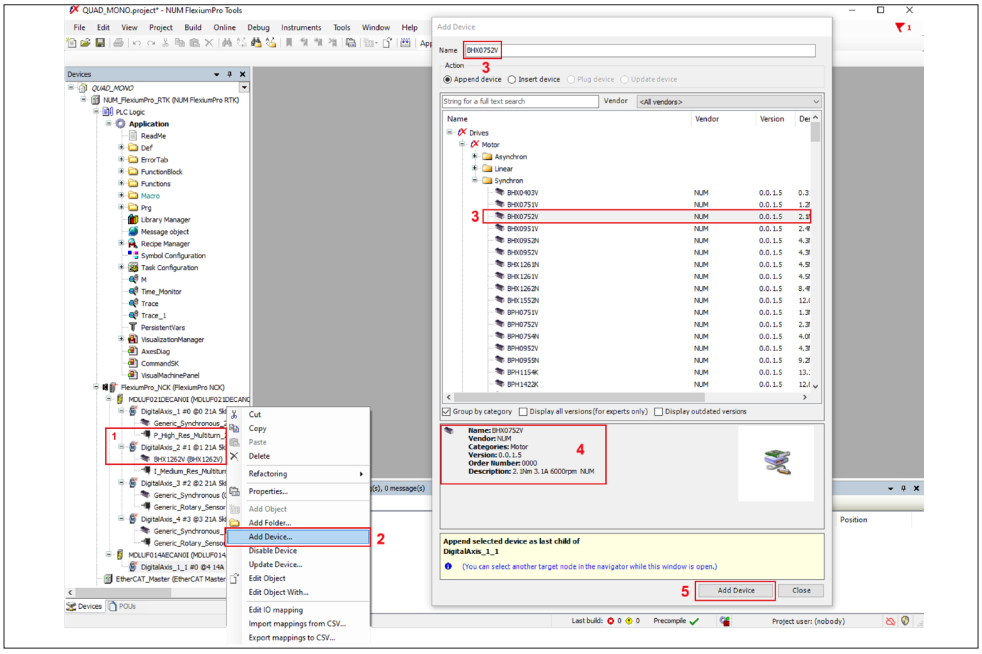


Fig. 5 - New motor selection PART#1

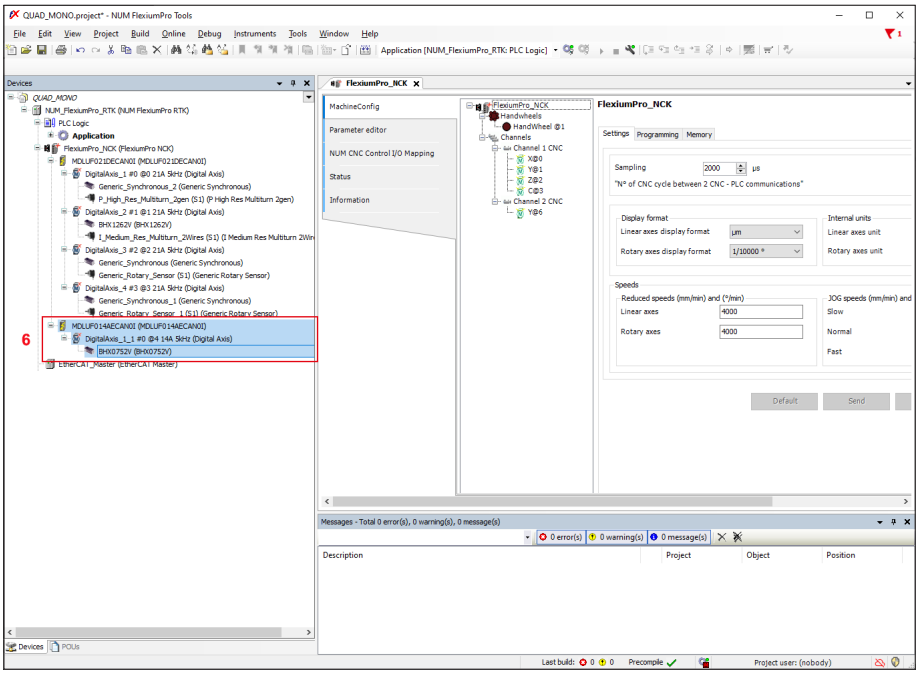
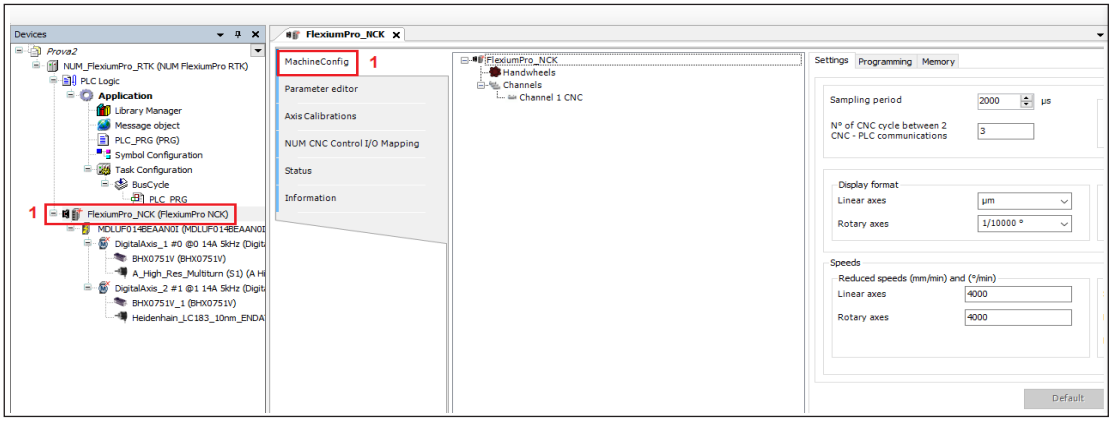


Fig. 6 - New motor selection PART#2

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 Machine configuration

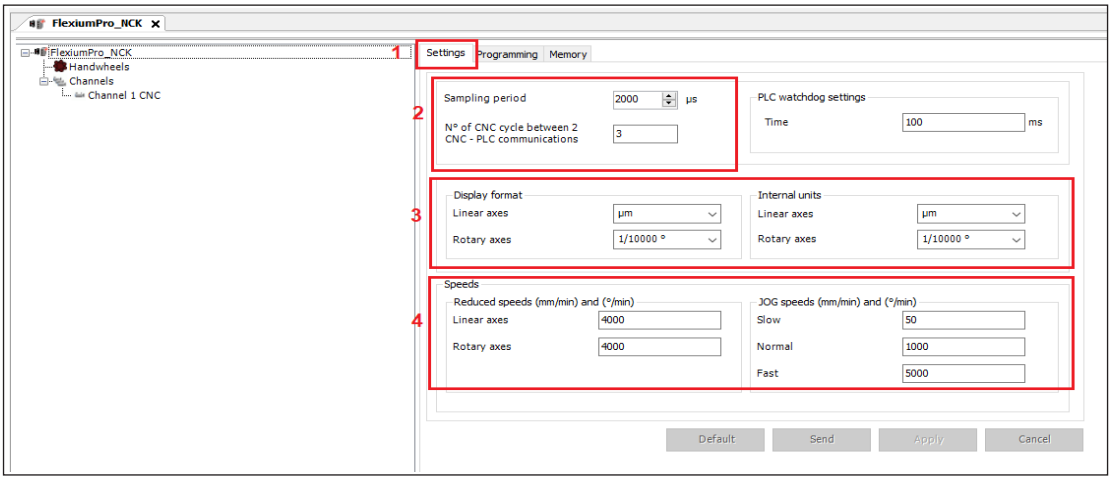


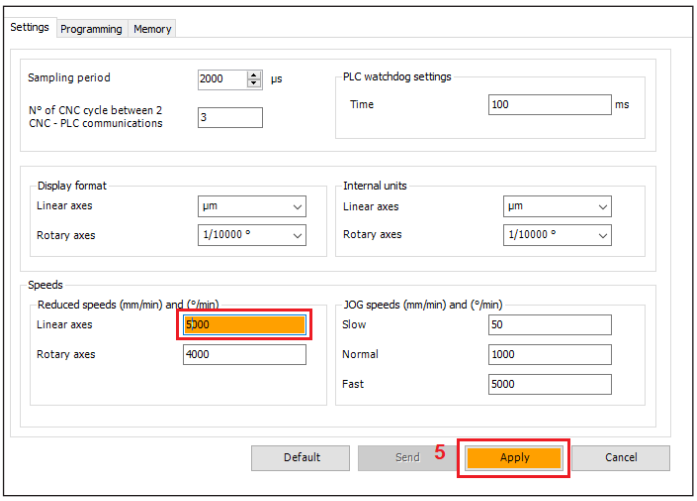
1	Select → *"FlexiumPro_NCK"* and click → *"MachineConfig"* to open the dedicated editor.

2.4.1 Settings

The tab "Settings" gives you access to:

- Sampling period and CNC -PLC exchange data timing.
- Units of measure and display.
- Global speeds characteristics.



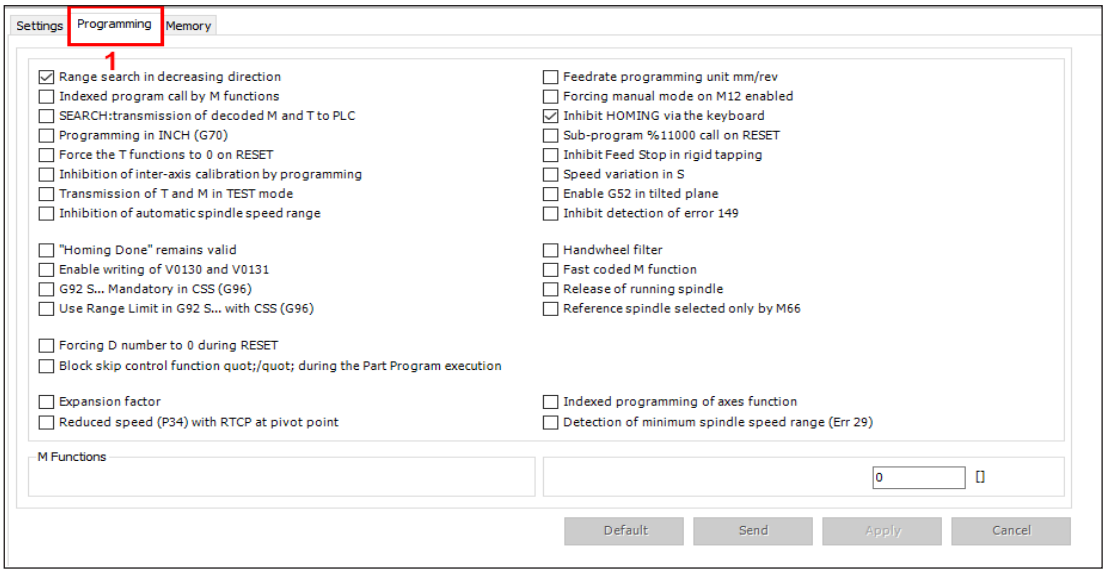


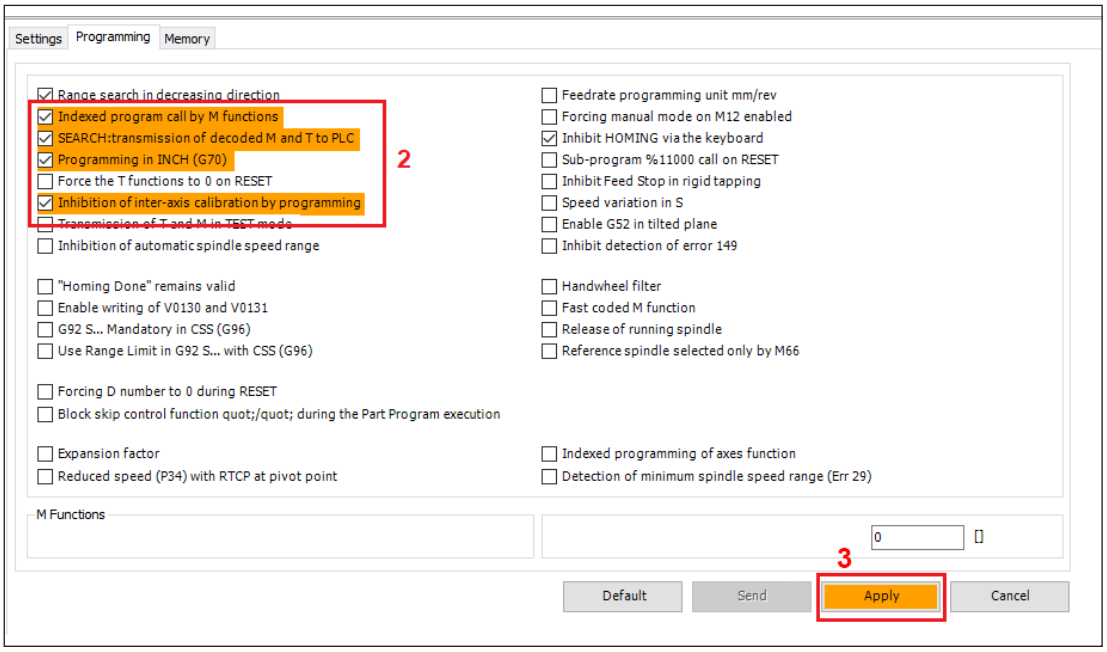
1	Select → *"MachineConfig"* and click → *"Settings"* to open the dedicated editor.
2	Select → *"Sampling"* to select the axis samplig and PLC exchange timinings.
3	Select the tabbed window → *"Internal Units"* to select the Units of measure. Select the tabbed window → *"Display format"* to select the internal units visualization format.
4	Select → *"Speed"* to define the Safety and Jog speeds.
5	Click on → *"Apply"* to enter all the modifications in this page, then a orange icon appears during the modification. After the Apply click on, the color of the modification is green. That means the new data are available but lost if the FlexiumPro Tools is closed without saving the project.

2.4.2 Programming

The tab "Programming" gives access to:

- Comprehensive set of adjustments and parameterization.
- Definition of subroutines invoked by M functions.



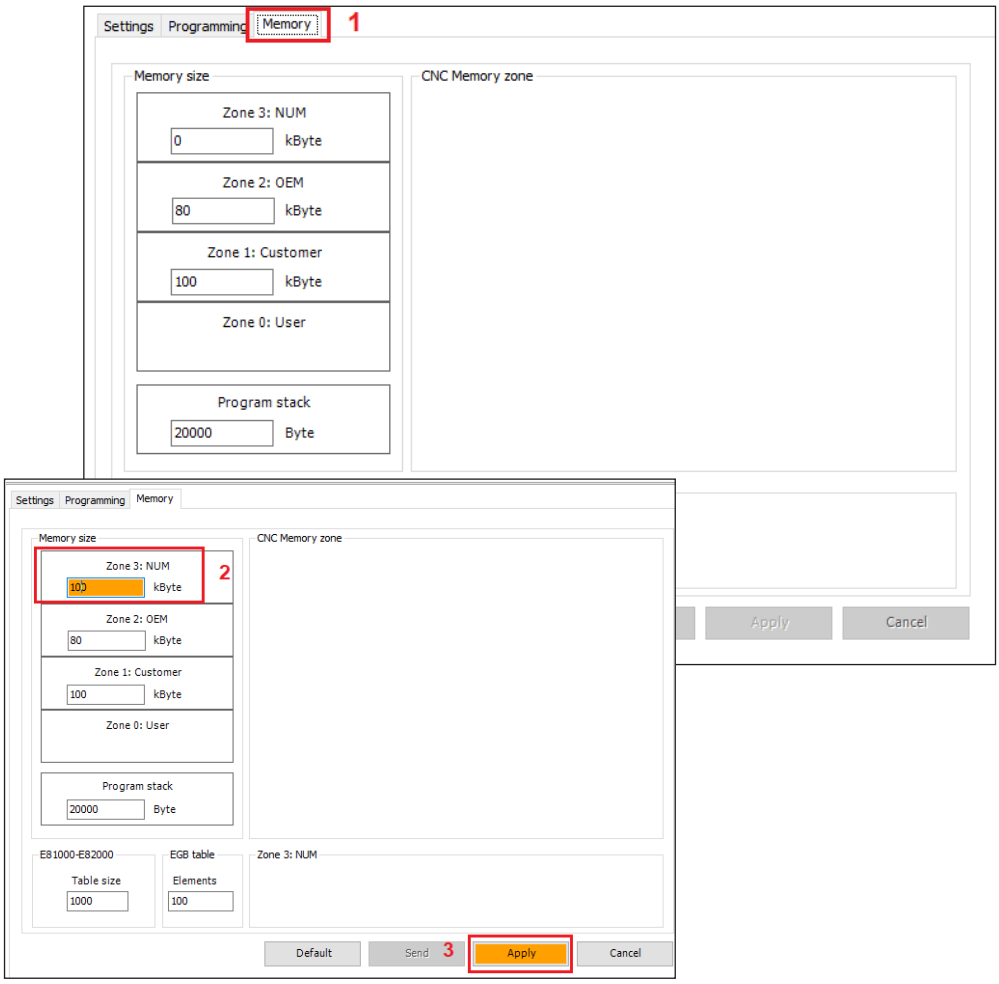


1	Select → *"MachineConfig"* and click oon → *"Programming"* to open the dedicated editor for a comprehensive set of adjustments and parameterization.
2	Click on tick box (✓) to set the functions.
3	Click on → *"Apply"* to enter all the fuction modifications in this page, then a orange icon appears during the modification. After the Apply click on, the color of the modification is green. That means the new data are available but lost if the FlexiumPro Tools is closed without saving the project.

2.4.3 Memory

The tab "Memory" gives access to the parameterization of the different memory zones:

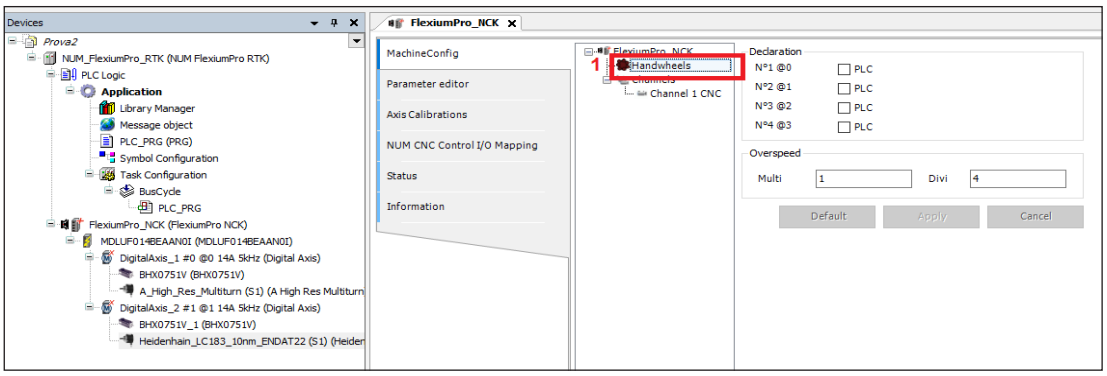
- Zone NUM reserved by NUM for specific part programs or macros.
- Zone OEM reserved by the OEM for machine specific part programs or macros.
- Zone Customer reserved for customer specific macros.
- The size of zone 0 is linked to what has been used for the other zones. It is the area where the part programs are stored and executed from.
- Table size configuration.

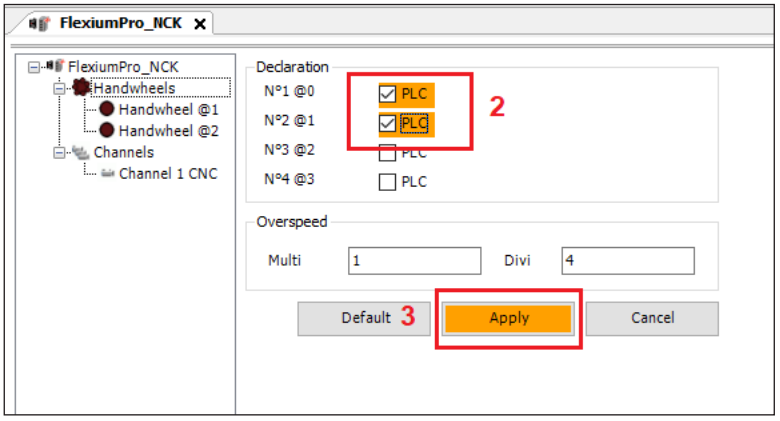


1	Select → *"MachineConfig"* and click → *"Memory"* to open the dedicated page for the parameterization of the different memory zones.
2	Click on → *"Zone"* area then insert the new value, then a orange icon appears during the modification.
3	Click on → *"Apply"* to enter the modification. After the Apply click on, the color of the modification is green. That means the new data are available but lost if the FlexiumPro Tools is closed without saving the project.

2.4.4 Handwheels

Clicking on "Handwheels" gives access to defining the handwheels used whether CAN connected. A handwheel can be only CAN.
Additionally this tab gives the possibility to define the overspeed coefficient used with G12 function (see FlexiumPro Programming manual M00073).



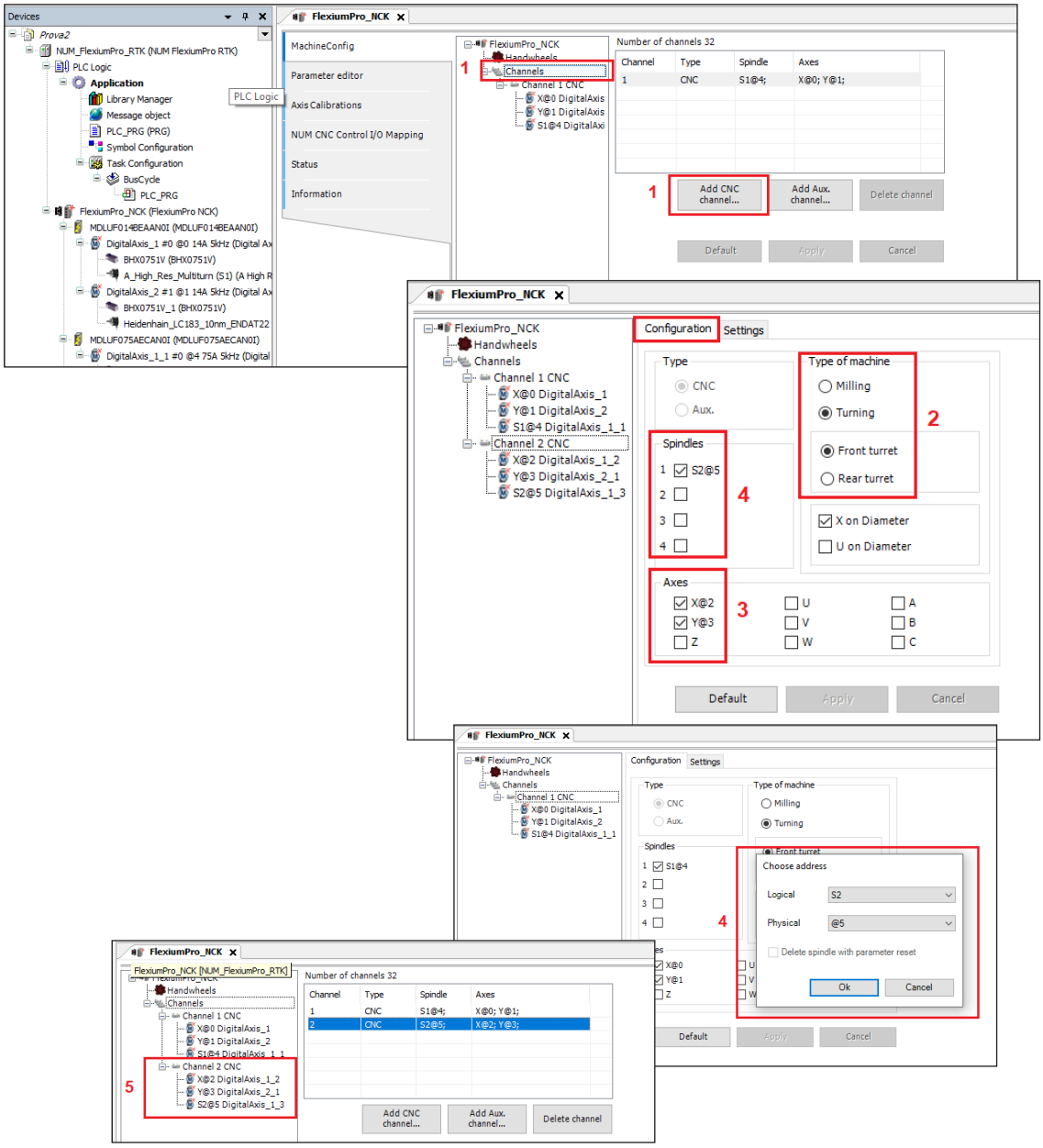


1	Select → *"Handwheels"* to open the dedicated page for the handwheels configuration.
2	Click on → tick box (✓) to set the handwheels configuration, then a orange icon appears during the modification.
3	Click on → *"Apply"* to enter the modification. After the Apply click on, the color of the modification is green. That means the new data are available but lost if the FlexiumPro Tools is closed without saving the project.

2.5 Channels

2.5.1 Channels Configuration

Click on "Channels Configuration" and add as many CNC or Auxiliary channel as required in your configuration.

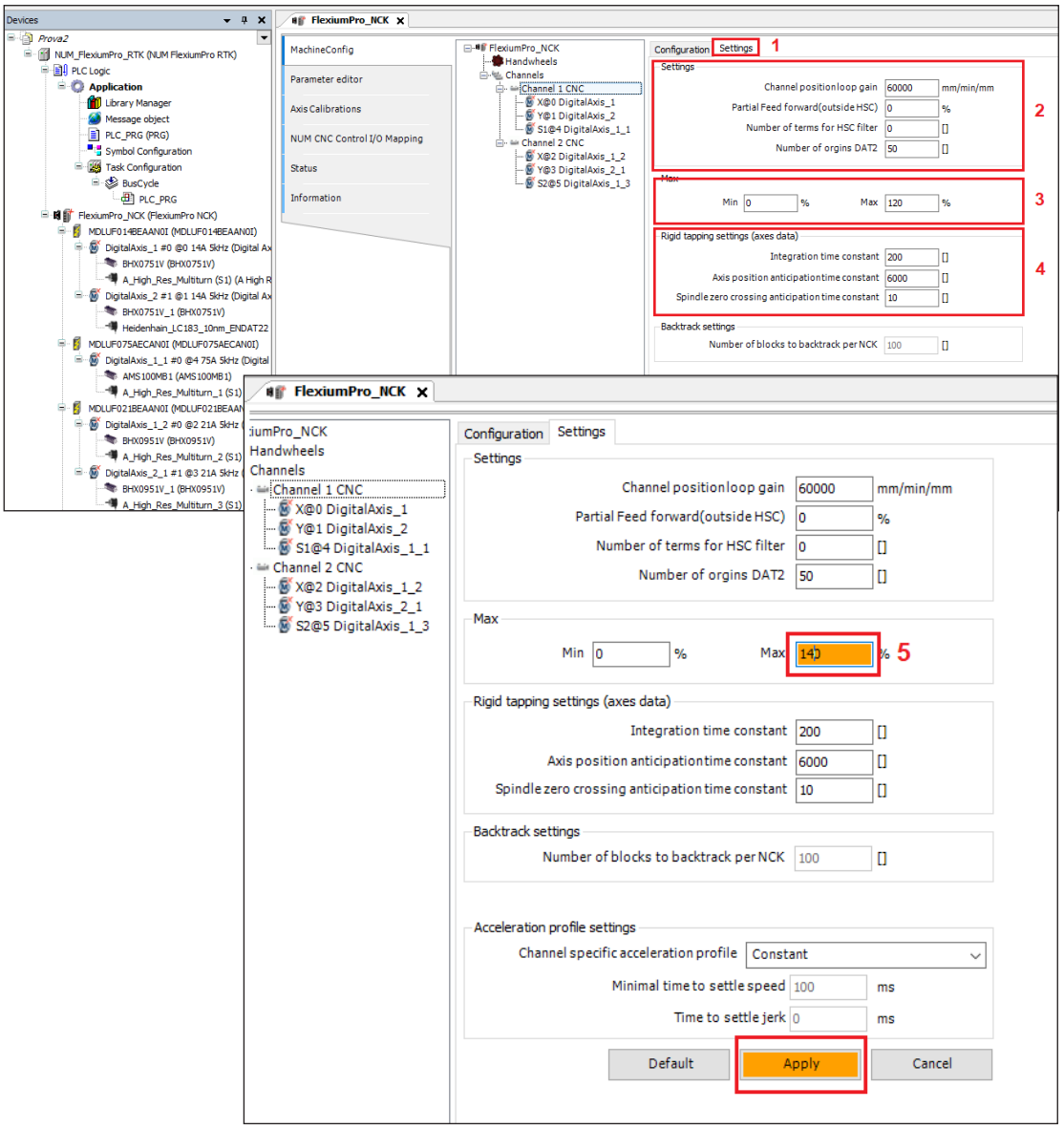


1	Click on → *"Channels"* to open the dedicated channels page configuration. Click on → *"Add CNC Channel or Aux Channel"* to create a new channel and add as many CNC or Auxiliary channel as required in your configuration.
2	Click on → tick box (✓) to set the *"Type of machine"* (Milling or Turning).
3	Click on → tick box (✓) to set the *"Axes"* addresses selection. Note. Up to 9 axes each one linked to a particular drive or address.
4	Click on → tick box (✓) to set the *"Spindles"* addresses selection (up to four spindles). Select with the tabbled window the *"Logic"* and *"Physical address"* then click on → *"Apply"* to enter the modification.
5	New Channel 2 CNC page.

2.5.2 Channels Settings

The tab "Settings" gives access for each channel individually to:

- Channel specific dynamic (Time constant → gain and High Speed Cutting parameters).
- Feed override range.
- Rigid tapping settings .

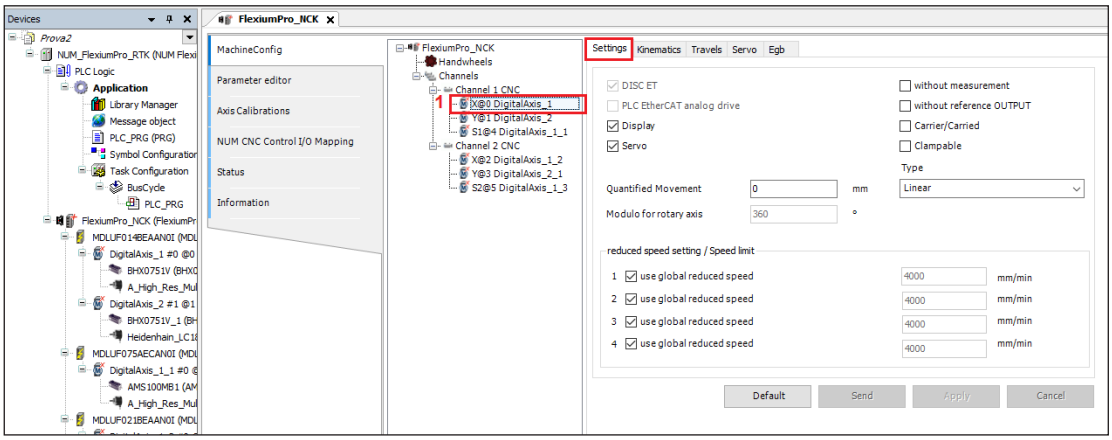


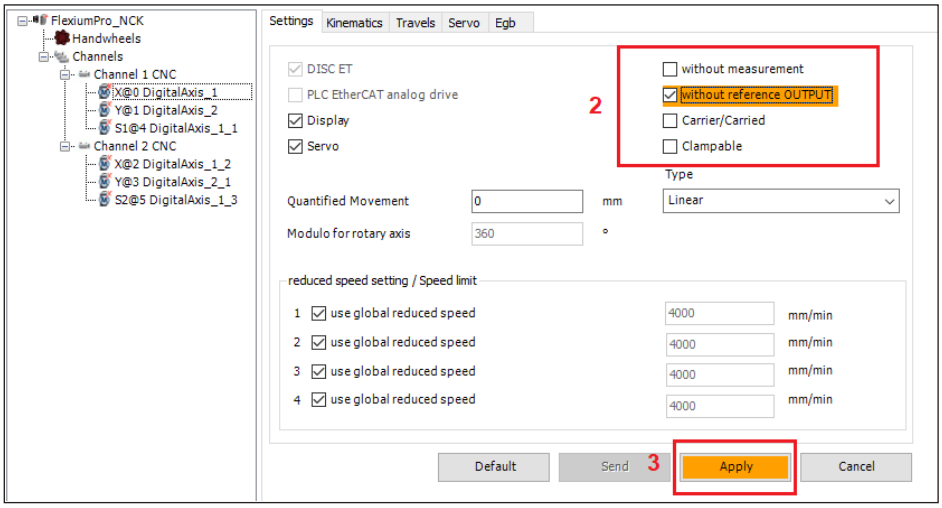
1	Click on → *"Settings"* to open the dedicated channels page settings.
2	Enter the new value for the *Channel specific dynamic,* then click on → *"Apply"* to enter the modification
3	Enter the new value for the *Feed override* range, then click on → *"Apply"* to enter the modification.
4	Enter the new value for the *Rigid tapping* settings, then click on → ok and after *"Apply"* to enter the modification.
5	Example of Feed override range modification.

2.5.3 Axis channels

2.5.3.1 "Settings"

Select each axis individually and enter its structural characteristics.

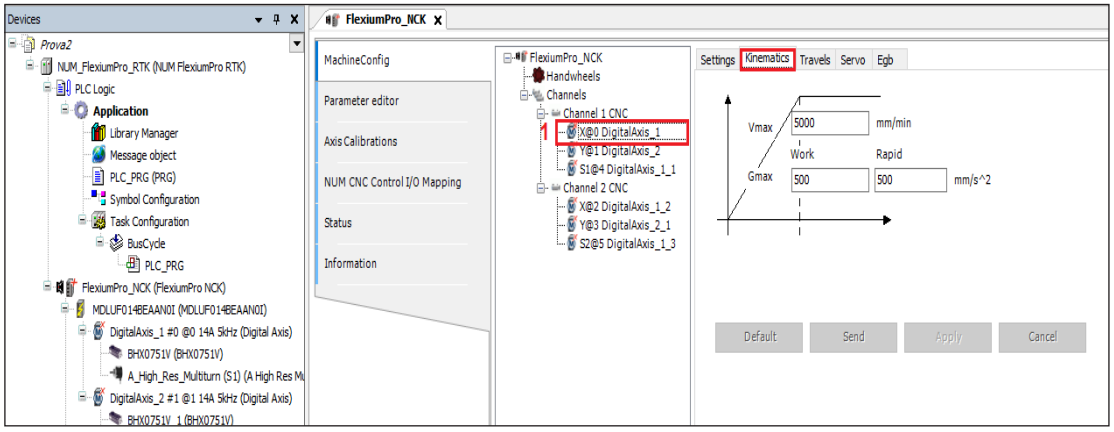


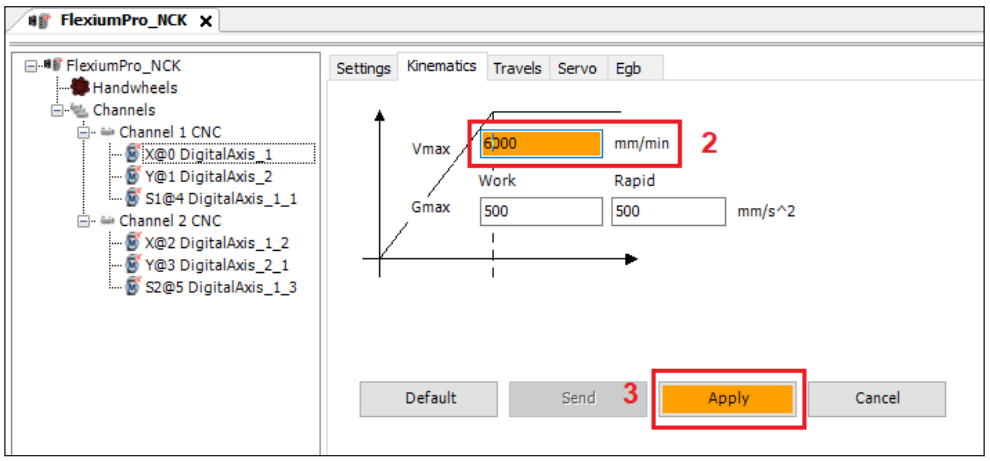


1	Click on → *"X@0Mono_Axis"* to open the dedicated axis page settings.
2	Click on → tick box (✓) to set the *Axis configuration*, then a orange icon appears during the modification.
3	Click on → *"Apply"* to enter the modification. After the Apply click on, the color of the modification is green. That means the new data are available but lost if the FlexiumPro Tools is closed without saving the project.

2.5.3.2 "Kinematics"

The tab "Kinematics" gives access to the speed and acceleration characteristics of each particular axis.



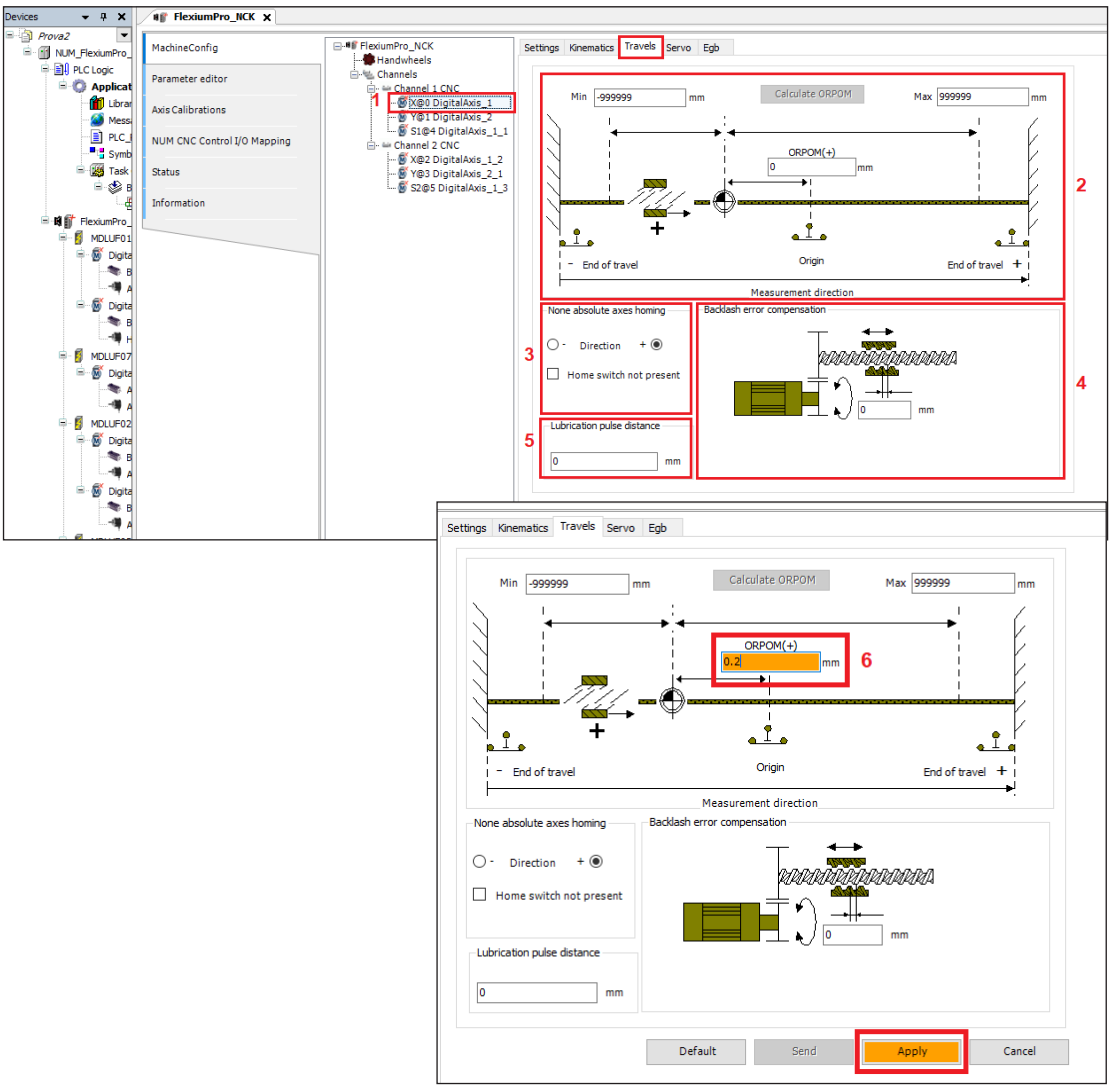


1	Click on → *"X@0Mono_Axis"* then click on *"Kinematics"* to open the dedicated configuration page.
2	Enter the new modification, then a orange icon appear during the modification..
3	Click on → *"Apply"* to enter the modification. After the modification the icon returns grey.

2.5.3.3 "Travels"

The tab "Travels" gives access to:

- Software travel limits.
- Homing characteristics for non-absolute measured axes.
- Backlash value.

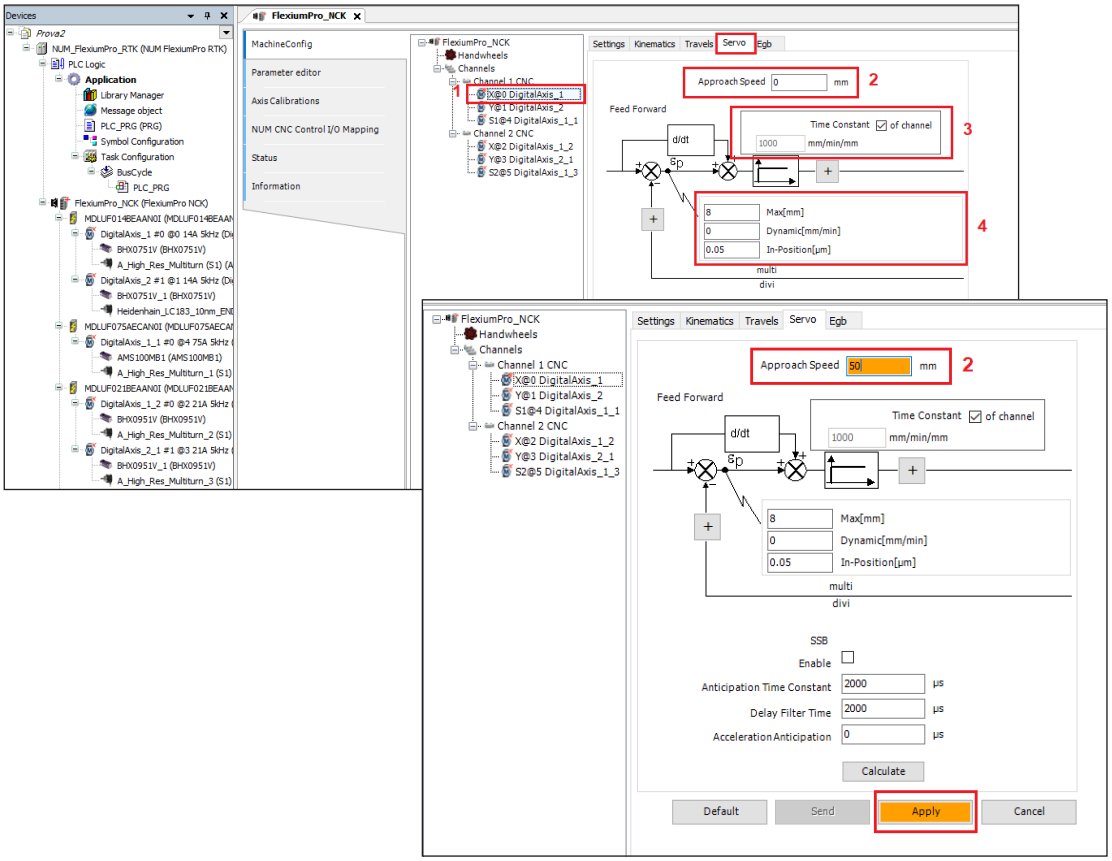


1	Click on → *"X@0Mono_Axis"* then click on on → *"Travels"* to open the dedicated configuration page.
2	Enter the new value modification on *"Measurement direction"* , then a orange icon appear during the modification. Click on on → *"Apply"* to enter the modification.
3	Click on → *"Direction"* radio button to select *"- / + direction"*, then a orange icon appears during the modification. Click on → *"Apply"* to enter the modification. Click on → tick box (✓) *"Home switch not present"* to set the homing switch, then a orange icon appears during the modification. Click on → *"Apply"* to enter the modification.
4	Enter the new value modification on *"Backlash error compensation"*, then a orange icon appears during the modification. Click on → *"Apply"* to enter the modification.
5	Enter the new value modification on "Lubrication pulse distance", then a orange icon appears during the modification. Click on --> "Apply" to enter the modification
6	Modification example

2.5.3.4 "Servo-systems"

The tab "Servo System" gives access to:

- Approach speed (see P33).
- Axis specific time constant if required.
- Axis dynamic characteristics.

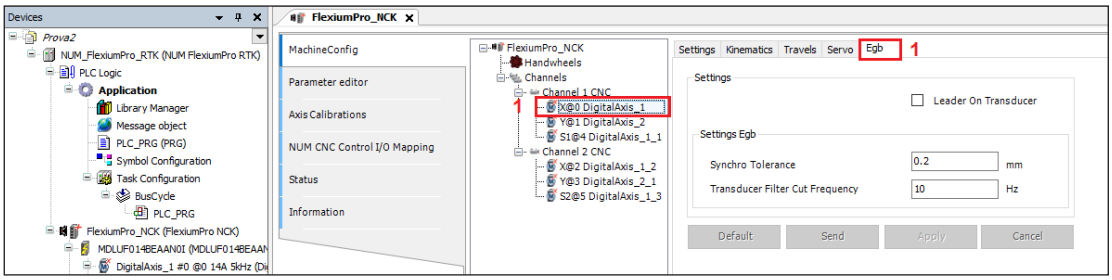


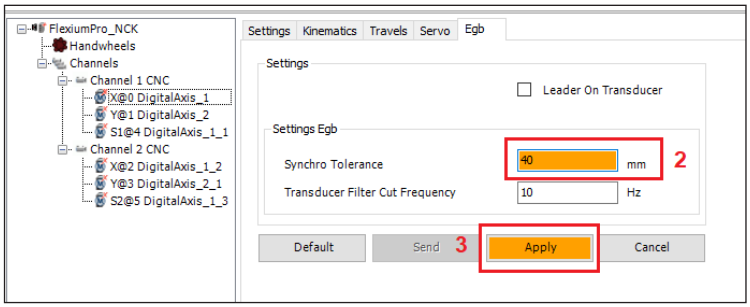
1	Click on → *"X@0Mono_Axis"* then click on → *"Servo-systems"* to open the dedicated configuration page.
2	Enter the new value modification on *"Approach speed"*, then a orange icon appears during the modification. Click on → *"Apply"* to enter the modification.
3	Click on → tick box (✓) *"Time constant"*, then a orange icon appears during the modification. Click on *"Apply"* to enter the modification.
4	Enter the new value modification on *"Feed Forward"* , then a orange icon appears during the modification. Click on → *"Apply"* to enter the modification.

2.5.3.5 Egb

The tab Egb gives access to:

- Parameters for the EGB (Electronic Gear Box) function activation.





1	Click on → *"X@0DigitalAxis"* then click on → *Egb* to open the dedicated configuration page.
2	Enter the new value modification on *Synchro Tolerance* and fields, then a orange icon appear during the modification.
3	Click on → *"Apply"* to enter the modification.

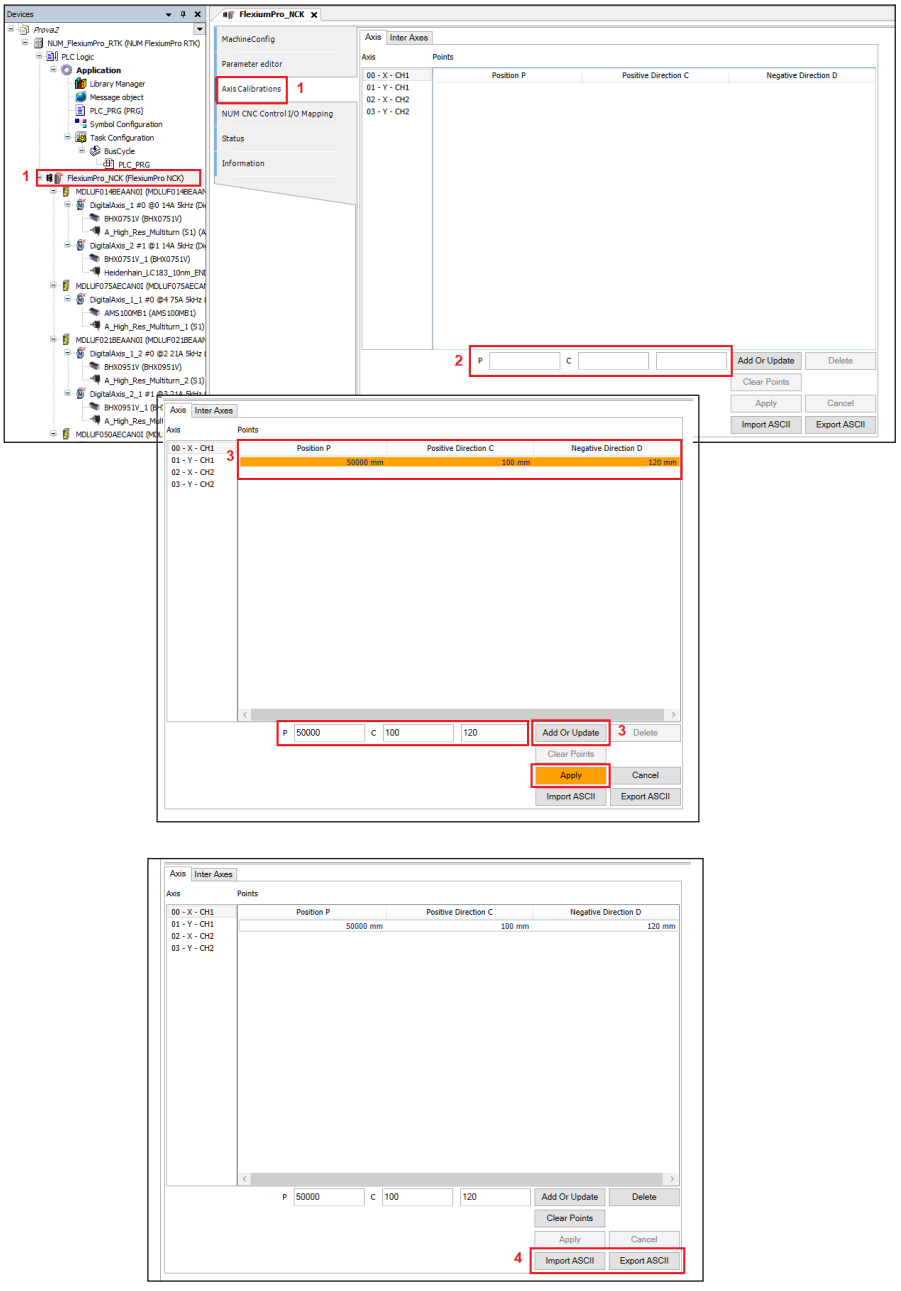
2.6 Other tabs of NCK device

2.6.1 Axis calibration

2.6.1.1 Axes

Axes calibration: correction of positioning errors on the travel of each axis individually.
The possibilities are:

- Import directly a calibration table (ASCII format).
- Enter the points individually; the correction can be different according to the direction.

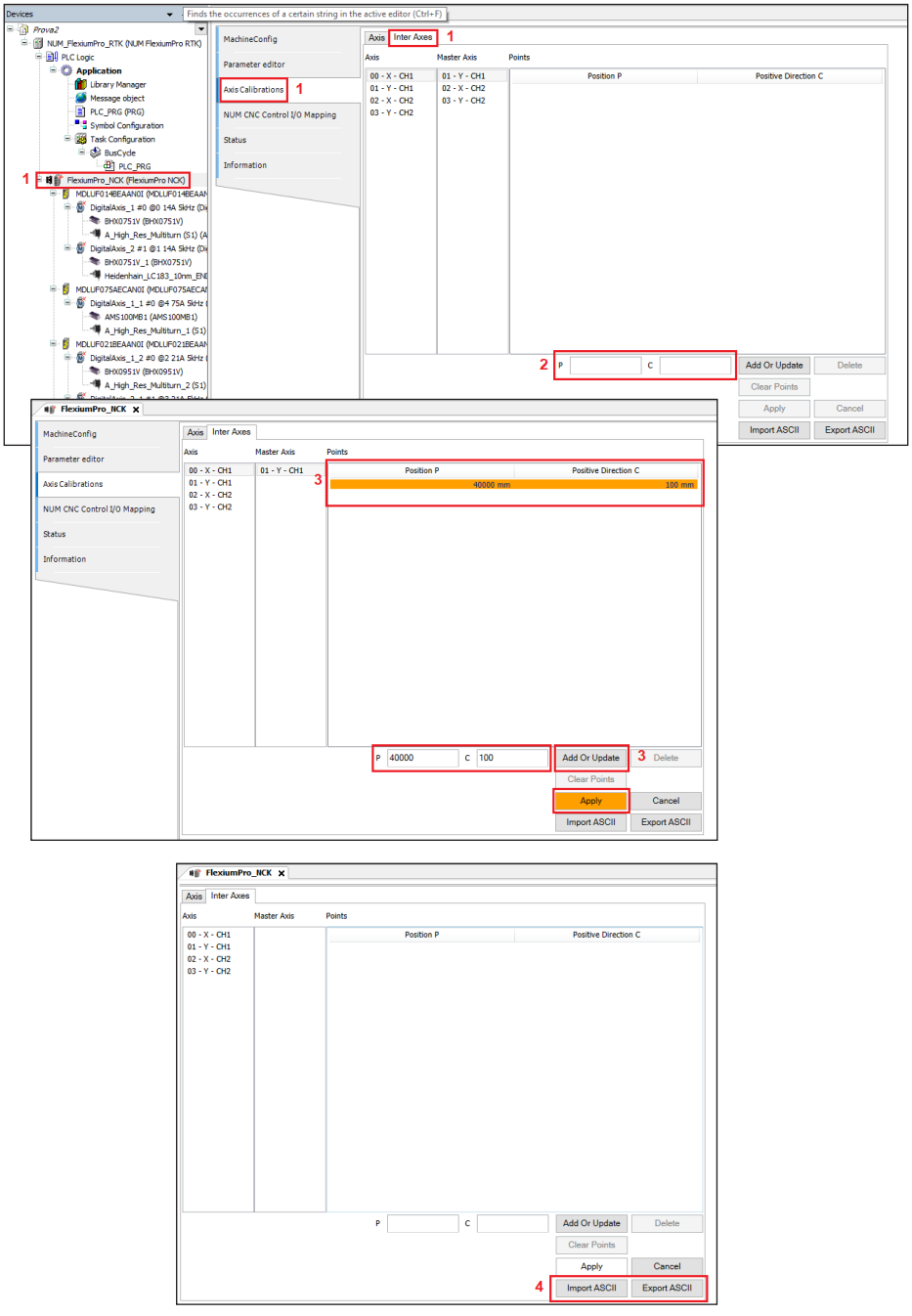


1	Click on → *"FlexiumPro_NCK"* then click on → *"Axis Calibration"* to open the dedicated axis page settings.
2	Enter individually the axis modification values on: - *"P"* Position travel, - *"C"* Positive direction correction, - *"D"* Negative direction correction.
3	Click on → *"Add Or Update"* to enter the modification and the new values will appears in the table .
4	Click on → *"Import ASCII"* to import directly a calibration table (ASCII format) .

2.6.1.2 InterAxes

Inter axes calibration gives the compensation of positioning error of an axis according to the position of another axis (Master Axis).
The possibilities are:

- Import directly a InterAxes calibration table.
- Enter the points individually.

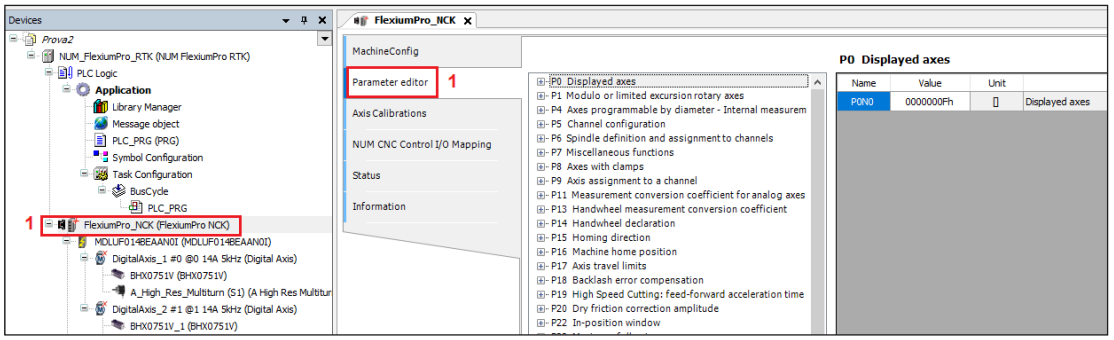


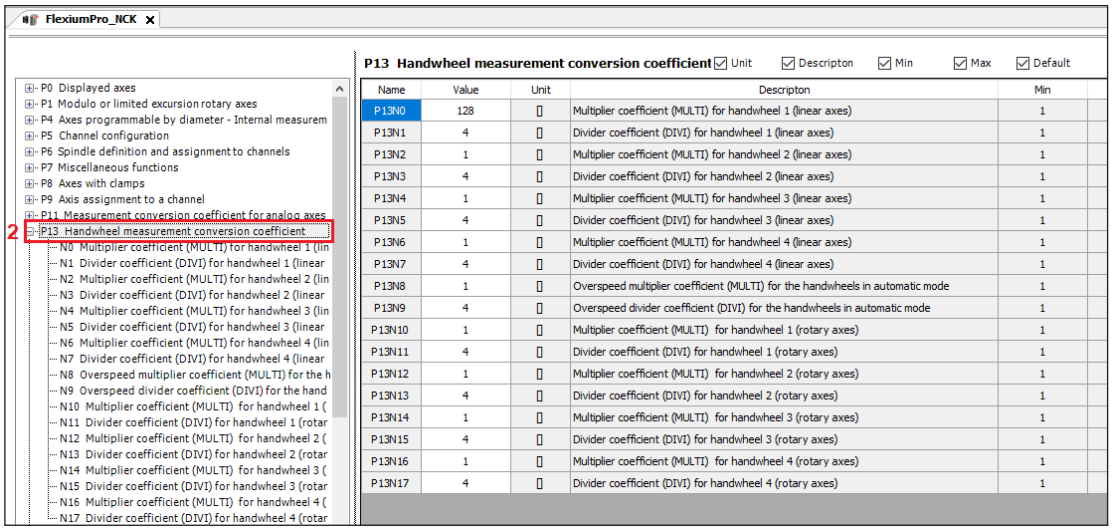
1	Click on → *"FlexiumPro_NCK"*, then click on → *"Axis Calibration"* and click on → *"Inter Axes"* to open the dedicated axis page settings.
2	Enter individually the axis modification values on: - *"P"* Master axis position, - *"C"* Correction on the slave axis.
3	Click on → *"Add Or Update"* to enter the modification and the new values will appear in the table.
4	Click on → *"Import ASCII"* to import directly an inter-axes calibration table.

2.7 Parameter editor

2.7.1 Parameter selection (i.e. P13N0)

The parameter editor gives the possibility to enter parameters values directly without the help of the graphic editors. It can be used to adjust out of standard configuration.
Please note that the parameter editor adjust one parameter at a time; there is no interaction between all of them (Gain and Time constant for example).
It is the responsability of the programmer to make sure the parameters are coherent.

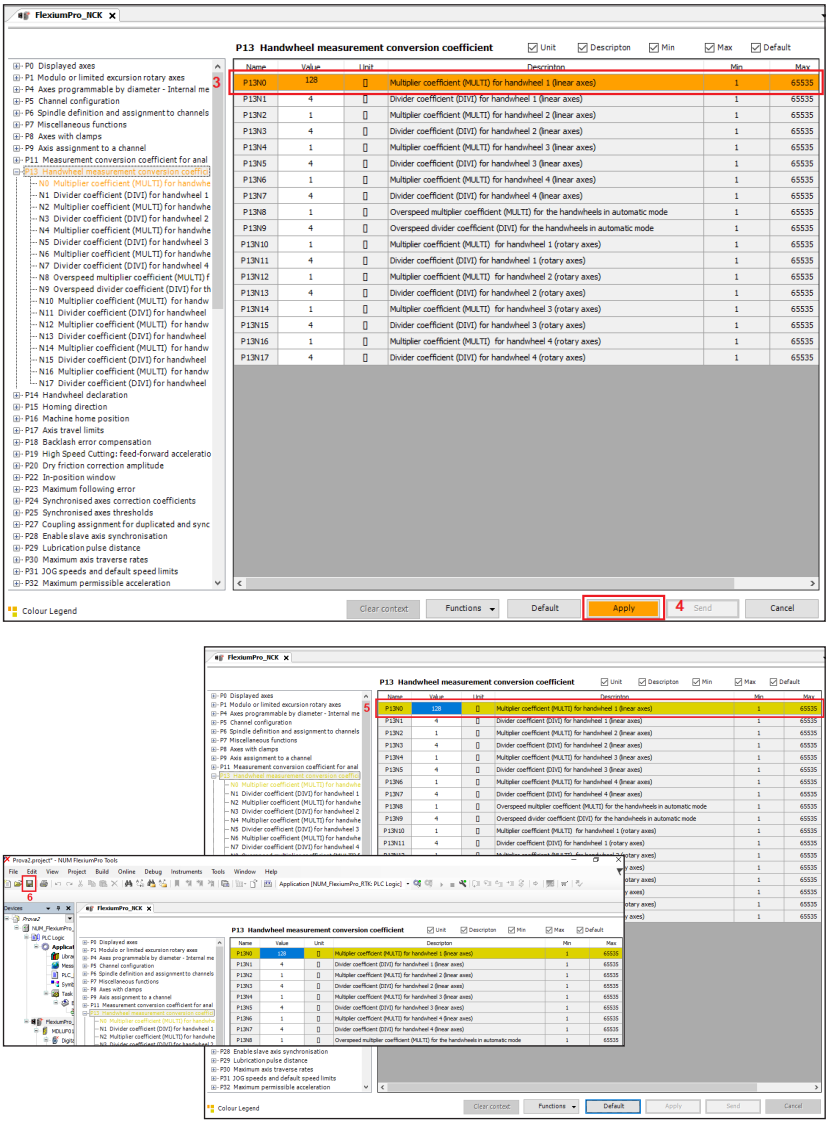




1	Click on → *"Parameter editor"* and the parameters list will appear in the right side.
2	Click on → *"P13 (Handwheel measurement conversion coefficient)"* on the left side of the page and the parameter will appear as blue selection in the right side of the page.

- It is possible to edit parameters *"OnLine"* or *"OffLine"*.
- When *"OnLine"* only the parameters that can be changed immediately are accessible.
- Pressing *"Apply"* will send the parameters to the NCK; it is not possible to edit an other parameters as long as the changes on the current one have not been applied or cancelled.
- Color codes show the parameters that were changed and not applied or changed and applied.
- When saving the project all parameters are displayed on a white background again.

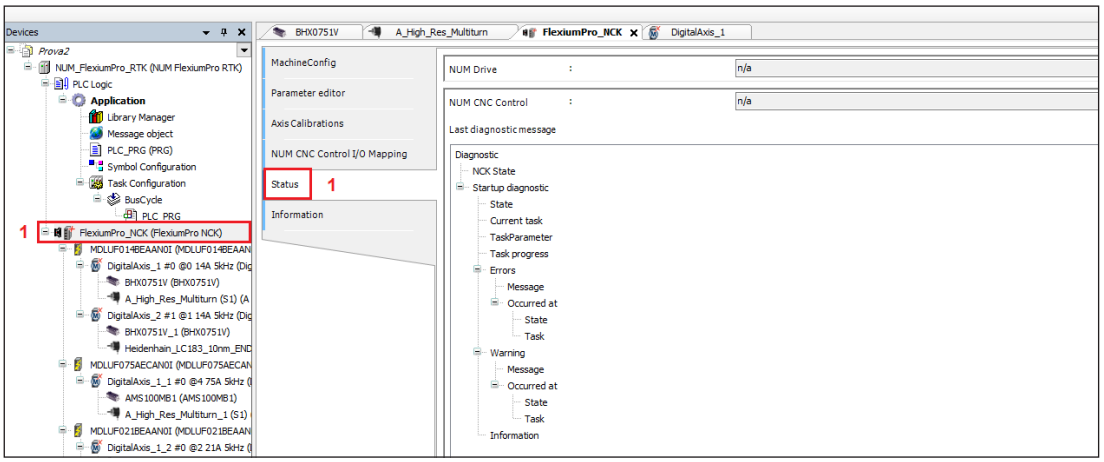
2.7.2 Parameter modification (i.e. P13N0)

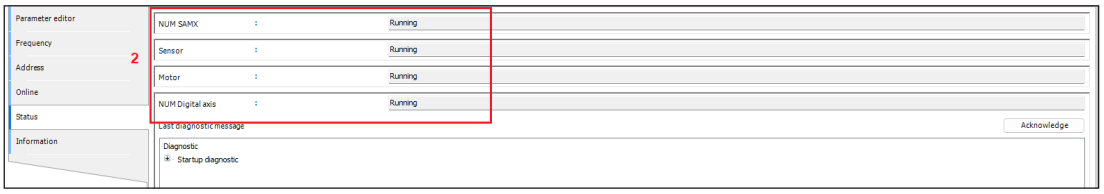


3	Now if you want to modify the *"Word N0"* click on → *"N0"* . Click on → *"Value"* box enter the new value then press *"Enter"* and the parameter will be indicated in orange icons as in the figure.
4	Now → click on *"Apply"* to set the modification.
5	Now the modified parameter is indicated in green icons as in the figure.
6	Click on → *"Save"* icon to save the modification in the project and the saved parameter will appears as grey icons.

When the CNC is in OnLine some parameters will not be accessible. It means they cannot be modified on fly in the CNC.
If they can be modified, then the modification will be carried out at the time you press "Apply".

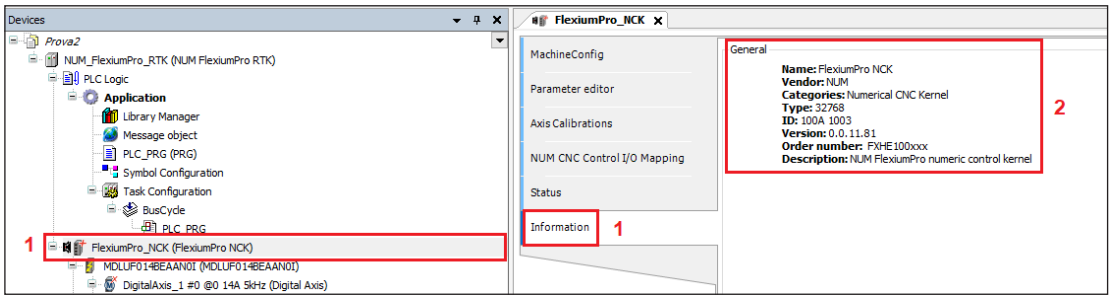
2.8 Status





1	Click on → *"Status"* to open the status page.
2	Status informations

2.9 Information



1	Click on → *"Information"* to open the information page.
2	General system information

Page deliberately empty

Summary

3 Axes and Spindles declaration 49
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3.2 Network topology configuration ► P121 50
3.3 Machine configuration ► P120 51
3.3.1 Different "Drives Interfaces" configurations 53
3.4 Number of channels ► P97 54
3.5 Channel configuration ► P5 55
3.6 Axis assignement to a channel ► P9 56

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3 Axes and Spindles declaration

3.1 Prerequisite

In a FlexiumPro system all axes and spindles are associated with a unique number.

Later in this document this number will be called "physical address" and identified by means of the simbol @.

- The physical address ranges from 0 to 31. It is defined in the parameter P121. In that parameter, the proper physical address can be associated to the digital drives present on the DISC ET network by means of the node and sub-node identification.
- The physical address selection is absolutely free considering that two devices (axes or spindles) cannot have the same number.
- It is important to have defined the physical address of each device before setting the other machine parameters as this value is often used as an index.

A FlexiumPro NCK can handle a maximum of 32 devices (a device being an axis or a spindle).

The axes are assigned to channels; there is a maximum of 32 channels, each one including up to a maximum of 9 axes named with the symbolic names X, Y, Z, U, V, W, A, B, C.

To enhance the possibilities, this assignation to channels can be modified via specific parameters (E parameters) while the machine is running.

In a first step it is necessary to declare all the devices used on the system and their structure.

Axes declaration relies on the following parameters and in the following order:

P121	Network topology configuration
P120	Machine configuration
P97	Number of channels
P5	Channel configuration
P9	Axis assignment to a channel

P121	Network topology configuration			
	Category	Axes and spindles declaration	**Format / Type**	INT / 1
	Words	64	**Units**	None
	Min	-1	**Max**	255 - 3
	Default	-1	**Resolution**	1
	Immediate	No	**Access via**	N/A

General

This parameter is used to define the network topology configuration of the motor drives linked to the FlexiumPro NCK by means of the DISC ET network.

That means to define the physical address for each drive present on the newtwork

Description

The FlexiumPro NCK can control up to 32 axes / spindles. Each motor drive (axis or spindle) is identified on the bus by means of the network node and the network sub-node.

Each NUM DrivePro device is a node of the DISC ET network. The NUM DrivePro device nearer to the FlexiumPro NCK is identified like the node 0. The node 1 is the following NUM DrivePro along the bus and so on….

Due to the fact that the NUM DrivePro can manage one, two or four motor drives, the different drives are identified by means of the sub-node. The sub-node 0 identifies the first motor drive (connector M1), the sub-node 1 identifies the second motor drive (connector M2), the sub-node 2 the third motor drive (connector M3) and the sub-node 3 the fourth motor drive (connector M4).

Word N0	**Drive @0 network node** Max: 255
Word N1	**Drive @0 network sub-node** Max: 3
Word N2/N3 **to** **Word 62/63**	Identical to Word N0/N1 for the other drives physical address @1 to @31

Example

Machine with:

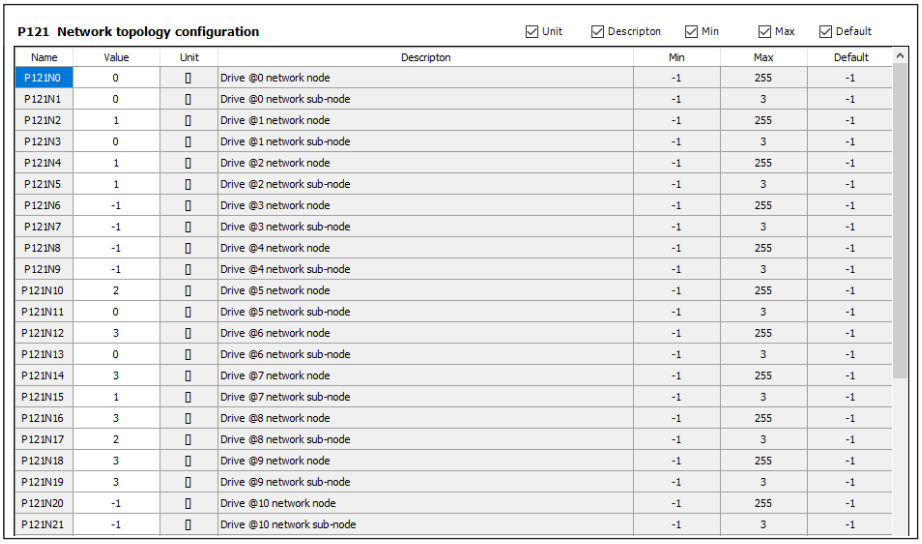
2 NumDrivePro Mono-axis, 1 NumDrivePro Bi-axes, 1 NumDrivePro Quad-axes.

The first NumDrivePro on the network (node 0) is a Mono-axis with physical address @0.

The second NumDrivePro on the network (node 1) is the Bi-axes with physical addresses @1 and @2.

The third NumDrivePro on the network (node 2) is a Mono-axis with physical address @5.

The fourth NumDrivePro on the network (node 3) is the Quad-axes with physical addresses @6, @7, @8 and @9.



P121 Network topology configuration ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P121N0	0	[]	Drive @0 network node	-1	255	-1
P121N1	0	[]	Drive @0 network sub-node	-1	3	-1
P121N2	1	[]	Drive @1 network node	-1	255	-1
P121N3	0	[]	Drive @1 network sub-node	-1	3	-1
P121N4	1	[]	Drive @2 network node	-1	255	-1
P121N5	1	[]	Drive @2 network sub-node	-1	3	-1
P121N6	-1	[]	Drive @3 network node	-1	255	-1
P121N7	-1	[]	Drive @3 network sub-node	-1	3	-1
P121N8	-1	[]	Drive @4 network node	-1	255	-1
P121N9	-1	[]	Drive @4 network sub-node	-1	3	-1
P121N10	2	[]	Drive @5 network node	-1	255	-1
P121N11	0	[]	Drive @5 network sub-node	-1	3	-1
P121N12	3	[]	Drive @6 network node	-1	255	-1
P121N13	0	[]	Drive @6 network sub-node	-1	3	-1
P121N14	3	[]	Drive @7 network node	-1	255	-1
P121N15	1	[]	Drive @7 network sub-node	-1	3	-1
P121N16	3	[]	Drive @8 network node	-1	255	-1
P121N17	2	[]	Drive @8 network sub-node	-1	3	-1
P121N18	3	[]	Drive @9 network node	-1	255	-1
P121N19	3	[]	Drive @9 network sub-node	-1	3	-1
P121N20	-1	[]	Drive @10 network node	-1	255	-1
P121N21	-1	[]	Drive @10 network sub-node	-1	3	-1

3.3 Machine configuration ► P120

P120	Machine configuration			
	Category	Axes and spindles declaration	**Format / Type**	DWORD / 6
	Words	13	**Units**	None
	Min	0	**Max**	FFFFFFFF
	Default	0	**Resolution**	N/A
	Immediate	Yes : N2, N5	**Access via**	E910xx, E931xx. See description.

General

This parameter is used to define the machine configuration in regard to axes and spindles.

FlexiumPro handles the following configurations:

- *Standard axes*:
  Axes that can be programmed and interpolated, servo controlled and connected to a digital drive.
- *Open loop axis*:
  Device without feedback – can control an actuator.
- *Virtual axis*:
  Not connected to a physical device. Can be programmed and interpolated – Generally used with dynamic operators.
- *Standard spindle*:
  Spindle with a proper measuring device connected to a digital drive. Can be used for threading or rigid tapping.
- *Non measured spindle* :
  Spindle without measuring device (asynchronous sensor-less). Cannot be used for threading or rigid tapping.
- *PLC only spindle*:
  Non measured and not connected to a digital drive.
  The spindle speed is available in the PLC and can optionally be output on an analog PLC output. Cannot be used for threading or rigid tapping.

A spindle switchable with an axis should be declared twice (with the same address) as a spindle and as an axis.

Slave axes in Anti-backlash, Torque duplication or Winding duplication are not declared in P120. However the address of the drive on which they are connected is reserved and cannot be used.

If the total number of axes and spindles is higher than that permitted by system customization, the message "TOO MANY AXES OR SPINDLES" is displayed at initialization.

After acknowledgement, the "PRSOV" indicator is displayed in the CNC screen status window and AUTO, SINGLE, DRYRUN, and MDI modes are inhibited.

Description

This parameter contains 13 words of 32 bits each. In each word the rank of the bit corresponds to the physical address of the said drive:

Structure of a word

@ 31	@ 30	@ 29	@ 28	@ 27	@ 26	@ 25	@ 24	@ 23	@ 22	@ 21	@ 20	@ 19	@ 18	@ 17	@ 16	@ 15	@ 14	@ 13	@ 12	@ 11	@ 10	@ 9	@ 8	@ 7	@ 6	@ 5	@ 4	@ 3	@ 2	@ 1	@ 0

Word N0	**Axes**
Word N1	**Spindles**
Word N2	**Servo-controlled and interpolated axes**
Word N3	**DISC ET digital drives**
Word N4	**Axes without measure INPUT**
Word N5	**Spindles without measure INPUT**
Word N6	**Axes without set value OUTPUT**

	Word N7	**Spindles without set value OUTPUT**
	Word N8	**Auxiliary axes**
	Word N9	**Not used**
	Word N10	**PLC EtherCAT analog drives**
	Word N11	**EGB leader on transducer** When EGB option "Leader on transducer" (P120N11=1) on the leader axis, the NCK should use the position of the leader axis as a reference for the slaves.
	Word N12	**SSB function activation**
Example	Machine with : • Three standard digital axes (@ 0,1,2) • One digital spindle (@20) • One non measured analog spindle (@21)	

P120 Machine configuration ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P120N0	00000007h	[]	Axes	00000000h	FFFFFFFFh	00000000h
P120N1	00300000h	[]	Spindles	00000000h	FFFFFFFFh	00000000h
P120N2	00000007h	[]	Servo-controlled and interpolated axes	00000000h	FFFFFFFFh	00000000h
P120N3	00100007h	[]	DISC ET digital drives	00000000h	FFFFFFFFh	00000000h
P120N4	00000000h	[]	Axes without measure INPUT	00000000h	FFFFFFFFh	00000000h
P120N5	00200000h	[]	Spindles without measure INPUT	00000000h	FFFFFFFFh	00000000h
P120N6	00000000h	[]	Axes without set value OUTPUT	00000000h	FFFFFFFFh	00000000h
P120N7	00000000h	[]	Spindles without set value OUTPUT	00000000h	FFFFFFFFh	00000000h
P120N8	00000000h	[]	Auxiliary axes	00000000h	FFFFFFFFh	00000000h
P120N9	00000000h	[]	Not used	00000000h	FFFFFFFFh	00000000h
P120N10	00000000h	[]	PLC EtherCAT analog drives	00000000h	FFFFFFFFh	00000000h
P120N11	00000000h	[]	EGB leader on transducer	00000000h	FFFFFFFFh	00000000h
P120N12	00000000h	[]	SSB function activation	00000000h	FFFFFFFFh	00000000h

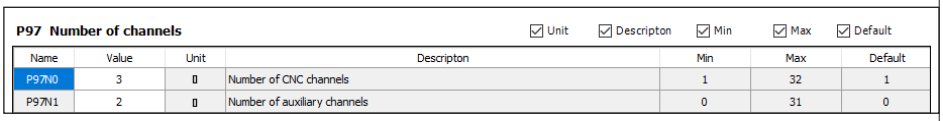
3.3.1 Different "Drives Interfaces" configurations

Type		List Axes	List Spindles	Axes servo	Digital Drives	Axes without IN	Spindle without IN	Axes without OUT	Spindle without OUT
		N0	N1	N2	N3	N4	N5	N6	N7
Digital axis	Full axis	**1**		**1**	**1**				
	Measuring device	**1**			**1**				
Digital slaves [1]	Synchronized	**1**			**1**				
	Anti-backlash[1]	**1**			**1**				
	Torque duplication[1]	**1**			**1**				
	Winding duplication[1]	**1**			**1**				
Virtual axes	Programmable	**1**		**1**		**1**		**1**	
	Dyn OP controlled	**1**				**1**		**1**	
Digital spindle	Full spindle		**1**		**1**				
	Non measured		**1**		**1**		**1**		
	PLC only		**1**		**1**		**1**		**1**
Analog spindle	Non measured		**1**				**1**		
	PLC only		**1**				**1**		**1**

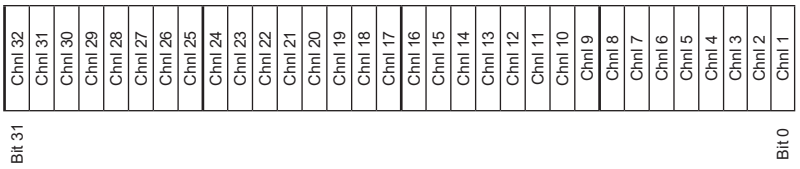
(1) Anti -backlash - Torque duplication and winding duplication are also available for spindles. In this case declare the configuration in Word N1 instead of Word N0.

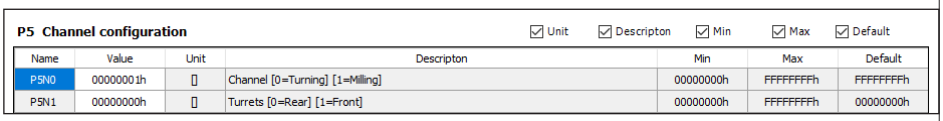
3.4 Number of channels ► P97

<table>
<tr><td>P97</td><td colspan="4">Number of channels</td></tr>
<tr><td></td><td>Category</td><td>Axes and spindles declaration</td><td>Format / Type</td><td>SINT / 3</td></tr>
<tr><td></td><td>Words</td><td>2</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>1 - 0</td><td>Max</td><td>32 - 31</td></tr>
<tr><td></td><td>Default</td><td>1 - 0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>E41102 (Read) :
See description</td></tr>
<tr><td>General</td><td colspan="4">The system can control a maximum of 32 channels. There are two types of channels:
• CNC channels
• Auxiliary channels: Auxiliary channels are generally used for machine functions like tool or pallet changer. They can run independently of the CNC channels under control of a particular part program (%9998.ii).
They cannot execute machining cycles.

Maximum number of channels
<table>
<tr><td>Product</td><td>CNC channels</td><td>Auxiliary channels</td></tr>
<tr><td>FlexiumPro 6</td><td>1</td><td>0</td></tr>
<tr><td>FlexiumPro 8</td><td>2</td><td>1*</td></tr>
<tr><td>FlexiumPro 68</td><td>32</td><td>31</td></tr>
</table>
(*) for FlexiumPro 8 the number of channels (CNC + Auxiliary) cannot exceed 2.</td></tr>
<tr><td>Description</td><td colspan="4">This parameter contains 2 words of 8 bits each.</td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Number of CNC channels
Min: 1, Max: 32, Default: 1
This value can be read in the external parameter E41102.</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Number of of Auxiliary channels
Min: 0, Max: 31, Default: 0
The channels are assigned in numerical order, starting with the first CNC compulsory channel (channel 1) and then the Auxiliary channels after the last CNC channel.</td></tr>
<tr><td>Example</td><td colspan="4">Machine with 3 CNC channels and two additional auxiliary channels

</td></tr>
</table>

3.5 Channel configuration ► P5

<table>
<tr><td>P5</td><td colspan="4">Channel configuration</td></tr>
<tr><td></td><td>Category</td><td>Axes and spindles declaration</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td></td><td>Words</td><td>2</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>FFFFFFFF</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>E11016 (R/W) see description</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define the machine configuration:
• Lathe and milling machine channels
• Front and rear turrets.</td></tr>
<tr><td>Description</td><td colspan="4">Each bit of each word is associated with a channel as described here below:
 

Word N0
Channel [0=Turning][1=Milling]
A bit set (=1) means a milling channel when reset (=0) means a turning channel.
• A milling channel will be initialized in G17, a turning channel in G20.
• A milling channel will include the milling canned cycles a turning channel the turning cycles in particular all roughing cycles.
Word N1
Turrets [0=Rear][1=Front]
A front turret is defined by the channel associated bit set (1).
• A rear turret by the channel associated bit reset (0)
N.B.: It is possible to overwrite this status by program parameter E11016:
• E11016 = 1 for a front turret
• E11016 = 0 for a rear turret.
The selection front or rear turret has an effect on the radius correction (G41 /G42 inverted). This configuration is for lathe configurations only.</td></tr>
<tr><td>Example</td><td colspan="4"> 
</td></tr>
</table>

3.6 Axis assignement to a channel ► P9

P9	Axis assignement to a channel			
	Category	Axes and spindles declaration	**Format / Type**	Word / 7
	Words	32	**Units**	None
	Min	FF - FF	**Max**	8 - 20h
	Default	FF for each word	**Resolution**	N/A
	Immediate	No	**Access via**	E7x005 (R/W) : See description

General

This parameter is used to associate the physical address of each axis to its symbolic name and channel.

Description

The system can control up to 32 axes. These axes can be assigned to 32 channels with a maximum of nine axes in a channel.

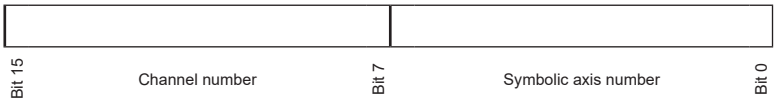
Each word is linked to a physical axis address. The first byte specifies the axis symbolic name and the second the channel of belonging.

Word N0 to Word N31

Symbolic name and channel assignment for axis @0 to @31

Channel number	
Channel 1:	1
Channel 2:	2
Channel 3:	3
Channel 4:	4
Channel 5:	5
Channel 6:	6
...	
Channel 30:	1E
Channel 31:	1F
Channel 32:	20h
No Channel:	FF

Symbolic name	
Axis X:	0
Axis Y:	1
Axis Z:	2
Axis U:	3
Axis V:	4
Axis W:	5
Axis A:	6
Axis B:	7
Axis C:	8
No name:	FF



Remarks

- The association to a channel can be modified by the external parameters E7x005 (please refer to Programming Manual M00073). A reset reconfigures the axes as in P9.
- It is obviously not possible to have the same assignment for two different physical addresses except in case of synchronized axes where it is allowed.
- The value FFFF means that the specified physical address has no symbolic name and does not belong to any channel.
- The value FFxx (xx = 0 to 8) indicates that the specified axis address has a symbolic name but does not belong to any channel.

Example

Channel 1 : 3 axes X@0, Y@1 and Z@2

Channel 2 : 2 axes X@3 and Y@4

Channel 3 : 3 axes X@5, Y@6 and C@7

Channel 4 : 3 axes X@8, Y@9 and Z@10

P9 Axis assignment to a channel

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P9N0	0100h	[]	Symbolic name and channel assignment for axis @0	FFh,FFh	20h,08h	FFFFh
P9N1	0101h	[]	Symbolic name and channel assignment for axis @1	FFh,FFh	20h,08h	FFFFh
P9N2	0102h	[]	Symbolic name and channel assignment for axis @2	FFh,FFh	20h,08h	FFFFh
P9N3	0200h	[]	Symbolic name and channel assignment for axis @3	FFh,FFh	20h,08h	FFFFh
P9N4	0201h	[]	Symbolic name and channel assignment for axis @4	FFh,FFh	20h,08h	FFFFh
P9N5	0300h	[]	Symbolic name and channel assignment for axis @5	FFh,FFh	20h,08h	FFFFh
P9N6	0301h	[]	Symbolic name and channel assignment for axis @6	FFh,FFh	20h,08h	FFFFh
P9N7	0308h	[]	Symbolic name and channel assignment for axis @7	FFh,FFh	20h,08h	FFFFh
P9N8	0400h	[]	Symbolic name and channel assignment for axis @8	FFh,FFh	20h,08h	FFFFh
P9N9	0401h	[]	Symbolic name and channel assignment for axis @9	FFh,FFh	20h,08h	FFFFh
P9N10	0402h	[]	Symbolic name and channel assignment for axis @10	FFh,FFh	20h,08h	FFFFh
P9N11	FFFFh	[]	Symbolic name and channel assignment for axis @11	FFh,FFh	20h,08h	FFFFh
P9N12	FFFFh	[]	Symbolic name and channel assignment for axis @12	FFh,FFh	20h,08h	FFFFh
P9N13	FFFFh	[]	Symbolic name and channel assignment for axis @13	FFh,FFh	20h,08h	FFFFh
P9N14	FFFFh	[]	Symbolic name and channel assignment for axis @14	FFh,FFh	20h,08h	FFFFh
P9N15	FFFFh	[]	Symbolic name and channel assignment for axis @15	FFh,FFh	20h,08h	FFFFh
P9N16	FFFFh	[]	Symbolic name and channel assignment for axis @16	FFh,FFh	20h,08h	FFFFh
P9N17	FFFFh	[]	Symbolic name and channel assignment for axis @17	FFh,FFh	20h,08h	FFFFh
P9N18	FFFFh	[]	Symbolic name and channel assignment for axis @18	FFh,FFh	20h,08h	FFFFh
P9N19	FFFFh	[]	Symbolic name and channel assignment for axis @19	FFh,FFh	20h,08h	FFFFh
P9N20	FFFFh	[]	Symbolic name and channel assignment for axis @20	FFh,FFh	20h,08h	FFFFh
P9N21	FFFFh	[]	Symbolic name and channel assignment for axis @21	FFh,FFh	20h,08h	FFFFh

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Summary

4 Axis initial settings 61

4.1 Displayed axes ► P0 62

4.2 Modulo or limited excursion rotary axes ► P1 63

4.4 Axes with clamps ► P8 66

4.5 Carrier or carried axes ► P64 67

4.6 Axes with quantified movements ► P65 68

4.7 Rotary axis modulo ► P68 69

4.8 Axes with measure stored ► P77 70

4.9 Modulo of the absolute sensors and maximum position tolerance ► P78 71

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4 Axis initial settings

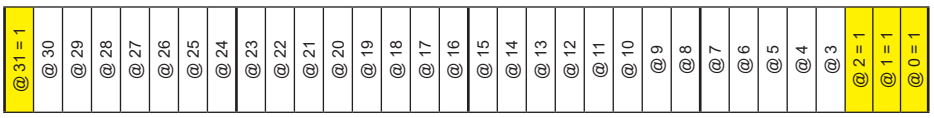
This part will define the base characteristics of all axes controlled by the CNC, such characteristics are generally defined by the machine construction and do not require further adjustments.

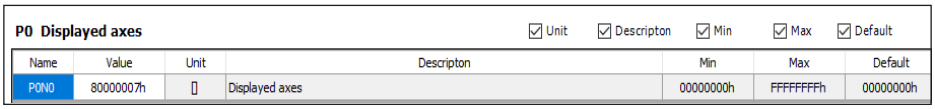
Performances and tuning will be addressed in the chapters 8 "Axis dynamics" and in the chapter 9 "Performances".

Such characteristics can be defined in the following order:

P0	Displayed axes
P1	Modulo or limited excursion rotary axes
P4	Axes programmable by diameter - Internal measurement - Dimension format for acquisition and display
P8	Axes with clamps
P64	Carrier or carried axes
P65	Axes with quantified movements
P68	Rotary axis modulo
P77	Axes with measure stored
P78	Modulo of the absolute sensors and maximum position tollerance

4.1 Displayed axes ► P0

<table>
<tr><td>P0</td><td colspan="4">Displayed axes</td></tr>
<tr><td></td><td>Category</td><td>Axis initial settings</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td></td><td>Words</td><td>1</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>FFFFFFFF</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define which axes will be displayed in the HMI pages.
The Production page of the HMI displays the axes position value independently for each channel.</td></tr>
<tr><td>Description</td><td colspan="4">To be displayed an axis should be assigned to a channel (see P9) and declared in the list of axes (see P120 N0).
This parameter is based on the axes physical address.
Word N0 | Displayed axes</td></tr>
<tr><td>Example</td><td colspan="4">Axes with physical address 0, 1, 2, 31 displayed
 


</td></tr>
</table>

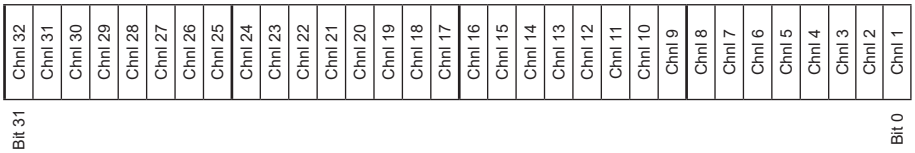
4.2 Modulo or limited excursion rotary axes ► P1

P1	Modulo or limited excursion rotary axes			
	Category	Axis initial settings	**Format / Type**	DWORD / 6
	Words	3	**Units**	None
	Min	0	**Max**	FFFFFFFF
	Default	0	**Resolution**	N/A
	Immediate	No	**Access via**	E932xx (R/W): See description
General	This parameter is used to declare the rotary axes either as modulo 360 degrees or with limited excursion. It is based on the axes physical address.			
Description	**Word N0**	**Modulo rotary axes** Such axes can execute an unlimited number of revolutions. The direction of rotation is defined according to program parameter E11010: - If E11010 = 1 (default) the direction is defined by the sign of the value, the value gives the angular position: e.g: C-90: go to position 90° by rotating in negative direction. - If E11010 = 0 then the position is reached via the shortest path. Reprogramming the current position has different effects according to the status: • In G0: No move at all: the movement is considered already executed. • In G1: - If E11009 = 1 (default) execution of a complete turn in the direction as defined above. - If E11009 = 0 the axis does not move as in G0. Example: Axes with physical address 7, 8 are rotary ➔ P1 N0 = 00000180h @ 31 @ 30 @ 29 @ 28 @ 27 @ 26 @ 25 @ 24 @ 23 @ 22 @ 21 @ 20 @ 19 @ 18 @ 17 @ 16 @ 15 @ 14 @ 13 @ 12 @ 11 @ 10 @ 9 @ 8 = 1 @ 7 = 1 @ 6 @ 5 @ 4 @ 3 @ 2 @ 1 @ 0 N.B. : The rotary status of the axes can be read and written by part program parameter E932xx .		
	Word N1	**Limited excursion rotary axes** A rotary axis with limited excursion is controlled like a linear axis. It has over-travels, it can be defined over a fraction of revolution or several revolutions. The value programmed is in degrees regardless of the system units (inches or metric) and the scaling factor does not affect the position to reach. It is not recommended to declare axes both modulo and with limited excursion; in such case, the axis will be considered modulo.		
	Word N2	**Enumerated positions for modulo rotary axes** This field is axis bitmap wich specified the axes wit enumerating programming The program and display positoin axes dipendiding by P65 Axes with quantiied movements. Easier and more intuitive programming for special kind of axes, typically the tool carrier chain. In enumerated programming the only values that uses this special unit are: displayed position, distance to go and programmed position. All the others remain in degrees as usual (following error, offset etc).		
Example	Machine with one modulo axis (C - @8) and two limited excursion rotary axes (A - @6 and B - @7)			

P1 Modulo or limited excursion rotary axes ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P1N0	00000100h	[]	Modulo rotary axes	00000000h	FFFFFFFFh	00000000h
P1N1	000000C0h	[]	Limited excursion rotary axes	00000000h	FFFFFFFFh	00000000h
P1N2	00000000h	[]	Enumerated positions for modulo rotary axes	00000000h	FFFFFFFFh	00000000h

4.3 Axes programmable by diameter - Internal measurement - Dimension format for acquisition and display ► P4

<table>
<tr><td>P4</td><td colspan="4">Axes programmable by diameter - Internal measurement - Dimension format for acquisition and display
<table>
<tr><td>Category</td><td>Axis initial settings</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td>Words</td><td>5</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>Word dependent</td><td>Max</td><td>Word dependent</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>N/A</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>E11005 partially (R/W): see description</td></tr>
</table></td></tr>
<tr><td>General</td><td colspan="4">This parameter has different functions relative to the axes dimensions:
• Declare the X and/or U axes of each channel as programmed by the radius or the diameter for lathes machines.
• Define the internal system measurement unit and the format used for acquisition and display of the dimensions.
• Specify that, in incremental JOG and handwheel mode, the control of the X and/or U axes of each channel is referenced to the radius or diameter (including N/M auto).
• Specify the divider for the rotary axes.</td></tr>
<tr><td>Description</td><td colspan="4">Word structure for N0, N1 and N3
Each bit of these two words represent the channel on which the function applies:
 

<table>
<tr><td>Word N0</td><td>X axis displayed and programmed by diameter for turning
If the bit is set to 1, the X axis for the specified channel will be displayed at the diameter and programmed at the diameter in G20 state (turning).
This feature is linked to the X axis, regardless of its physical address.
Min: 0, Max: FFFF, Default: 0</td></tr>
<tr><td>Word N1</td><td>U axis displayed and programmed by diameter for turning
If the bit is set to 1, the U axis for the specified channel will be displayed at the diameter and programmed at the diameter in G20 state (turning).
This feature is linked to the U axis, regardless of its physical address.
Min: 0, Max: FFFF, Default: 0</td></tr>
</table>

If diameter programming is activated by P4, it is possible to temporarily suspend this function through parameter E11005.
Example
E11005 = 0: Programming by diameter inhibited.
E11005 = 1: Programming by diameter enabled in G20 on the X and U axes (if declared in P4).
A reset forces E11005 to 1.</td></tr>
</table>

Description

Word N2

Internal measurement unit for linear axes / Dimension format for display

Defines the internal system measurement unit (always metric) and the dimension unit used for linear axis dimension acquisition and display.

The system uses the internal unit defined and works internally in floating point with a 1nm resolution.

The value entered in each word basically defines the number of decimal digits:

Value	Dimension format for display	Internal measurement unit
1	1 decimal digits	0.1 mm
2	2 decimal digits	0.01 mm
3	3 decimal digits	0.001 mm (1 µm)
4	4 decimal digits	0.0001 mm (0.1 µm)
5	5 decimal digits	10 (10 nm)
6	6 decimal digits	1 (1 nm)
7	7 decimal digits	
8	8 decimal digits	

The default values are:

Dimension format for display = 3,

Internal measurement unit = 3

The min values are 1 for both.

For the Dimension format for display it is possible to have up to 8 digits (10^{-9} m) whereas the max value for Internal measurement unit is 6 (1 nm).

Word N3

X and U axes controlled by diameter in incremental JOG and Handwheel

The structure is identical to N0 and N1 (a bit for each channel) except that the characteristic applies for both X and U axes simultaneously.

N.B.: If the jogs are set at the radius while the display is set at the diameter, then for the smallest increment, only every second demand will be taken into account.

Min: 0, Max: FFFF, Default: 0

Word N4

Internal measurement unit for rotary axes / Dimension format for display

The same like Word N2 but in degrees for rotary axes

Example

N0 : X axis in channel 1 programmed by diameter

N1 : U axis in channel 2 programmed by diameter

N2 : Linear axes resolution 0.1 µm – Display 1µm

N3 : In Jog and Handwheel X and U (channel 1 and 2) by the diameter

N4 : Rotary axes resolution 1/10000° – Display 1/10000°

P4 N2 = 34h

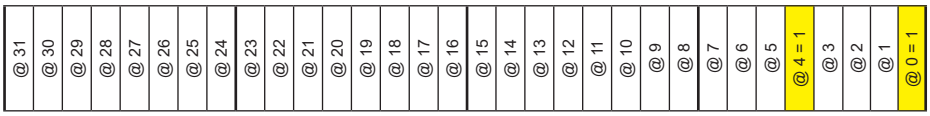
• Dimension format for display (display of values) 0.001mm (1µm)

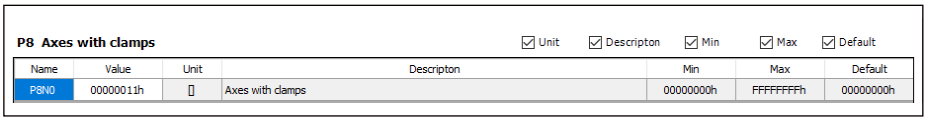
• Internal measurement unit 0.0001mm (0.1µm)

P4 Axes programmable by diameter - Internal measurement - Dimension f(☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P4N0	00000001h	[]	X axis displayed and programmed by diameter for turning	00000000h	FFFFFFFFh	00000000h
P4N1	00000002h	[]	U axis displayed and programmed by diameter for turning	00000000h	FFFFFFFFh	00000000h
P4N2	00030004h	[]	Internal measurement unit for linear axes / Dimension format for display	0001h,0001h	0008h,0006h	00030003h
P4N3	00000003h	[]	X and U axes controlled by diameter in incremental JOG and Handwheel	00000000h	FFFFFFFFh	00000000h
P4N4	00040004h	[]	Internal measurement unit for rotary axes / Dimension format for display	0001h,0001h	0008h,0006h	00040004h

4.4 Axes with clamps ► P8

<table>
<tr><td>P8</td><td colspan="4">Axes with clamps</td></tr>
<tr><td></td><td>Category</td><td>Axis initial settings</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td></td><td>Words</td><td>1</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>FFFFFFFF</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>E913xx (R/W)</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to declare the machine axes equipped with mechanical clamps.
When an axis is declared with clamps:
• Status M10 will be initialized by default (can be overwritten by program)
• If M10 is active : at each bloc transition were the moving status of this axis changes, the system will generate an halt long enough for the PLC to clear the flag … FlexiumPro_NCK.WCNC.Channel[i].AckMFunction. When all appropriate actions are taken, the PLC will raise this flag again and motion will resume.
• If M11 is active the motions is continuous, the axes are supposed unclamped all the time.</td></tr>
<tr><td>Description</td><td colspan="4"></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Axes with clamps
Each bit of this word corresponds to the physical address of an axis.</td></tr>
<tr><td>Example</td><td colspan="4">Axis of address 0 and 4 declared with clamps P8 N0 = 11h
 


</td></tr>
</table>

4.5 Carrier or carried axes ► P64

P64	Carrier or carried axes			
	Category	Axis initial settings	**Format / Type**	DWORD / 6
	Words	1	**Units**	None
	Min	0	**Max**	FFFFFFFF
	Default	0	**Resolution**	N/A
	Immediate	No	**Access via**	E7x006 (RW)

General

This parameter is used to declare couples of carrier/carried linear axis pairs by associating a primary axis with a secondary axis (X/U, Y/V or Z/W).

The program parameter E7x006 can be used to modify such coupling (x = physical address of the carrier axis)

Example of usage of E 7x006 parameter

- E70006 = 0 The X and U axes are independent.
- E72006 = 1 Carrier/carried Z and W axis pair.

Description

Word N0	**Carrier or carried axes**. To declare a couple of axes as carrier/carried, the bit associated with the physical address of at least one of the two should be set to 1. If the bits of the axis pair are set, then the axis is declared as carrier or carried axis according to its declaration in P9 as primary (X, Y, Z) or secondary (U, V, W).

Example

Assuming @X = 0, @Y=1, @Z=2, @U=3, @V=4, @W= 5 @A=6, @B=7 and @C=8:

@ 31	@ 30	@ 29	@ 28	@ 27	@ 26	@ 25	@ 24	@ 23	@ 22	@ 21	@ 20	@ 19	@ 18	@ 17	@ 16	@ 15	@ 14	@ 13	@ 12	@ 11	@ 10	@ 9	@ 8	@ 7 = 1	@ 6	@ 5	@ 4	@ 3 = 1	@ 2	@ 1 = 1	@ 0 = 1
																								1				1		1	1

P64 Carrier or carried axes ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P64N0	0000008Bh	[]	Carrier or carried axes	00000000h	FFFFFFFFh	00000000h

The couple X/U and Y/V are declared Carrier/Carried (even though V is not declared) Bit 7 (@B) is ignored.

4.6 Axes with quantified movements ► P65

<table>
<tr><td>P65</td><td colspan="4">Axes with quantified movements</td></tr>
<tr><td></td><td>Category</td><td>Axis initial settings</td><td>Format / Type</td><td>LREAL / 10</td></tr>
<tr><td></td><td>Words</td><td>32</td><td>Units</td><td>mm or °</td></tr>
<tr><td></td><td>Min</td><td>0.0</td><td>Max</td><td>360.0</td></tr>
<tr><td></td><td>Default</td><td>0.0</td><td>Resolution</td><td>10^{-8}</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define the axis minimal positioning increment (step). It applies only to the axes declared as modulo in P1 and equipped with mechanical clamps.
For instance, this parameter applies to the movements of a turntable controlled by 1/2 degree and measured to one ten-thousandths of a degree (HIRTH coupling).</td></tr>
<tr><td>Description</td><td colspan="4">Each of the 32 words of this parameter applies to a particular physical address.</td></tr>
<tr><td></td><td>Word N0
to
Word N31</td><td colspan="3">Step increment for axis @0 to @31
The values are expressed in decimal degrees. A value of 0 means that the positioning increment has no minimal step.
When a minimal positioning increment is defined for an axis
• If a programmed value (in Auto, MDI etc.) is not a multiple of this increment then an error will be generated.
• In Jog (unlimited or incremental) when an axis is stopped at a position which is not a multiple of the positioning increment, the motion will be continued till the next multiple except in incremental jog where the system will not request clamping
• FlexiumPro_NCK.RCNC.Axis[i].Moving remains Set to 1. However additional move in manual or programmed remains authorized.</td></tr>
<tr><td>Example</td><td colspan="4">Machine with a B table at @7. The positioning is every 2.5 degrees:</td></tr>
</table>

P65 Axes with quantified movements ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P65N0	0.0	mm	Step increment for axis @0	0.0	360.0	0.0
P65N1	0.0	mm	Step increment for axis @1	0.0	360.0	0.0
P65N2	0.0	mm	Step increment for axis @2	0.0	360.0	0.0
P65N3	0.0	°	Step increment for axis @3	0.0	360.0	0.0
P65N4	0.0	°	Step increment for axis @4	0.0	360.0	0.0
P65N5	0.0	mm	Step increment for axis @5	0.0	360.0	0.0
P65N6	0.0	mm	Step increment for axis @6	0.0	360.0	0.0
P65N7	2.5	°	Step increment for axis @7	0.0	360.0	0.0
P65N8	0.0	mm	Step increment for axis @8	0.0	360.0	0.0
P65N9	0.0	mm	Step increment for axis @9	0.0	360.0	0.0
P65N10	0.0	mm	Step increment for axis @10	0.0	360.0	0.0

4.7 Rotary axis modulo ► P68

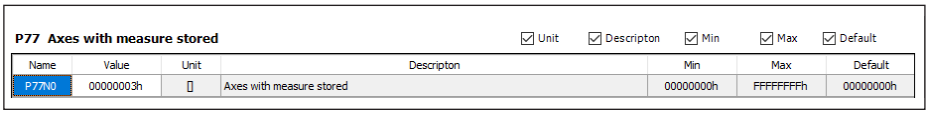
P68	Rotary axis modulo			
	Category	Axis initial settings	**Format / Type**	LREAL / 10
	Words	32	**Units**	°
	Min	1.0	**Max**	100000.0
	Default	360.0	**Resolution**	10^{-2}
	Immediate	No	**Access via**	E93232-93263 (R)
General	The modulo of the programmed and displayed position axis will not be done at 360 degrees as usual but at the value specified. Valid only with P1 N0 Modulo rotary axes active.			
Description	The words refer to the physical address of each axis.			
	Word N0 to Word N31	**Modulo for rotary axis @0 to @31**		
Example	Axes @ 6 = modulo 40°			

P68 Rotary axis modulo ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

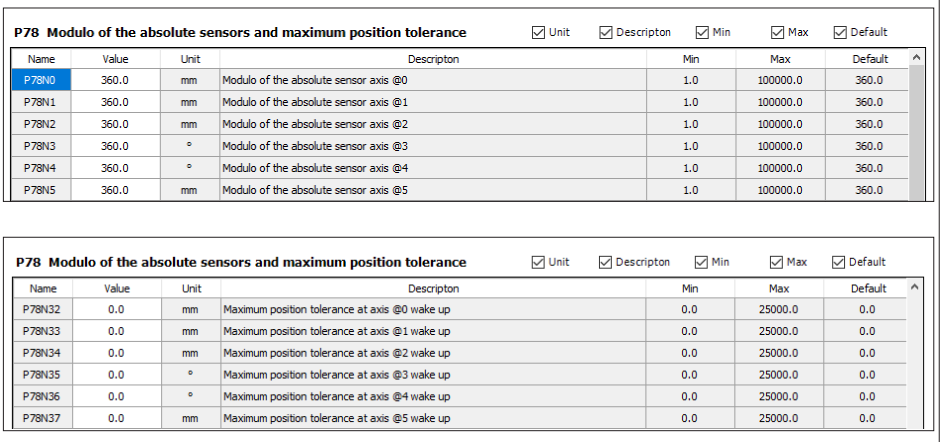
Name	Value	Unit	Descripton	Min	Max	Default
P68N0	360.0	°	Modulo for rotary axis @0	1.0	100000.0	360.0
P68N1	360.0	°	Modulo for rotary axis @1	1.0	100000.0	360.0
P68N2	360.0	°	Modulo for rotary axis @2	1.0	100000.0	360.0
P68N3	360.0	°	Modulo for rotary axis @3	1.0	100000.0	360.0
P68N4	360.0	°	Modulo for rotary axis @4	1.0	100000.0	360.0
P68N5	360.0	°	Modulo for rotary axis @5	1.0	100000.0	360.0
P68N6	40.0	°	Modulo for rotary axis @6	1.0	100000.0	360.0
P68N7	360.0	°	Modulo for rotary axis @7	1.0	100000.0	360.0

The typical application could be a tool magazine with 40 pockets.

4.8 Axes with measure stored ► P77

<table>
<tr><td rowspan="6">P77</td><td colspan="4">Axes with measure stored</td></tr>
<tr><td>Category</td><td>Axis initial settings</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td>Words</td><td>1</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>0</td><td>Max</td><td>FFFFFFFF</td></tr>
<tr><td>Default</td><td>0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to enable the store measure function for specific axes.
Save the measure needed the multi turn absolute sensor emulation by single turn absolute sensor</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4"></td></tr>
<tr><td>Word N0</td><td colspan="3">Axes with measure stored
Value in hexadecimal code to enable measure store of the axes.</td></tr>
<tr><td>Example</td><td colspan="4">N0 = 3h means store function active for @0 and @1 axes.
 
</td></tr>
</table>

4.9 Modulo of the absolute sensors and maximum position tolerance ► P78

P78	Modulo of the absolute sensors and maximum position tolerance			
	Category	Axis initial settings	**Format / Type**	LREAL / 9
	Words	64	**Units**	mm or °
	Min	1.0 - 0.0	**Max**	100000.0 - 25000.0
	Default	360.0 - 0.0	**Resolution**	10^{-2}
	Immediate	No	**Access via**	N/A
General	This parameter is used to set modulo values of the absolute sensor for the stored function (P77) and the maximum tolerance at wake up position error at switch on.			
Description				
	Word N0 to Word N31	**Modulo of the absolute sensor axis @0 to @31** Min: 1.0, Max: 100000.0, Default: 360.0		
	Word N32 to Word N63	**Maximum position tolerance at axis @0 to @31 wake up** Min: 0.0, Max: 25000.0, Default: 0.0		
Example				

P78 Modulo of the absolute sensors and maximum position tolerance ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P78N0	360.0	mm	Modulo of the absolute sensor axis @0	1.0	100000.0	360.0
P78N1	360.0	mm	Modulo of the absolute sensor axis @1	1.0	100000.0	360.0
P78N2	360.0	mm	Modulo of the absolute sensor axis @2	1.0	100000.0	360.0
P78N3	360.0	°	Modulo of the absolute sensor axis @3	1.0	100000.0	360.0
P78N4	360.0	°	Modulo of the absolute sensor axis @4	1.0	100000.0	360.0
P78N5	360.0	mm	Modulo of the absolute sensor axis @5	1.0	100000.0	360.0

P78 Modulo of the absolute sensors and maximum position tolerance ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P78N32	0.0	mm	Maximum position tolerance at axis @0 wake up	0.0	25000.0	0.0
P78N33	0.0	mm	Maximum position tolerance at axis @1 wake up	0.0	25000.0	0.0
P78N34	0.0	mm	Maximum position tolerance at axis @2 wake up	0.0	25000.0	0.0
P78N35	0.0	°	Maximum position tolerance at axis @3 wake up	0.0	25000.0	0.0
P78N36	0.0	°	Maximum position tolerance at axis @4 wake up	0.0	25000.0	0.0
P78N37	0.0	mm	Maximum position tolerance at axis @5 wake up	0.0	25000.0	0.0

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Summary

5 Spindle initial settings 75

5.1 Spindle definition and assignement to channels ► P6 76

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5 Spindle initial settings

FlexiumPro is able to control up to 32 spindles with a maximum of 4 simultaneously controlled spindles per channel. To deal more easily with all spindles they are given a "*Logical address*" (1 to 32).

This logical address is used for programming. For parameters definition the spindles are considered according to their "*Physical addresses*" as defined in the prerequisite above

During the declaration, the spindles are assigned to a channel but can be freely exchanges between them via part programming in two steps

- The channel who "owns" the spindle will release it via M61:<Logical address>
- The channel who needs the spindle will take control via M62:<Logical address> .

Spindle declaration relies on the following parameters:

P6	Spindle definition and assignement to channels

5.1 Spindle definition and assignement to channels ► P6

P6	Spindle definition and assignement to channels			
	Category	Spindle initial settings	**Format / Type**	DWORD / 6
	Words	56	**Units**	None
	Min	Word dependent	**Max**	Word dependent
	Default	Word dependent	**Resolution**	N/A
	Immediate	No	**Access via**	N/A

General

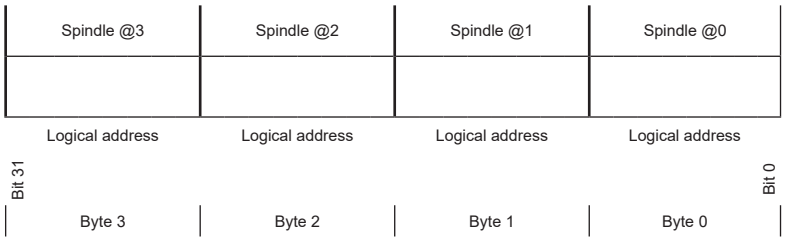
General

P6 presents three different functions

- N0 to N7 : Assignation to a logical address
- N8 to N39 : Spindle characteristics
- N40 to N55 : Assignation to a channel.

Description

Word N0 — **Logical addresses associated to spindles @3...@0**



Please note that the values are ordered from @3 to @0

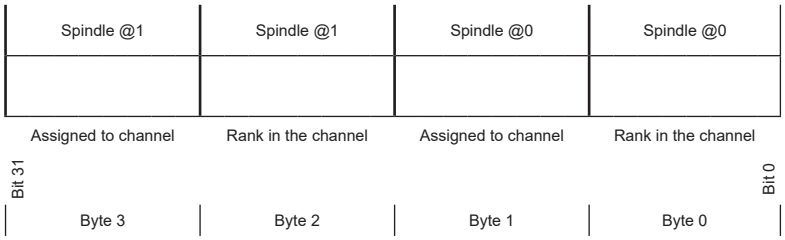
Minimal value per byte:1

Maximal value per byte: FF

Default values: per byte: FF

Word N1 to Word N7 — Identical to Word N0 for the other spindles physical addresses:

- N1 : to spindles @7 .... @4
- N2 : to spindles @11 .... @8
- N3 : to spindles @15 .... @12
- N4 : to spindles @19 .... @16
- N5 : to spindles @23 .... @20
- N6 : to spindles @27 .... @24
- N7 : to spindles @31 .... @28.

Description	**Word N8** **to** **Word N39**	**Spindle @0 to @31 definition** Spindle characteristics for addresses @0 respectively to @31. Format: • Bit 0: Reserved • Bit 1: Reserved • Bit 2: Indexed type [0=Turning][1=Milling] : A turning spindle is indexed by M19 {C…}, a milling spindle by M19 {EC…} • Bit 3: Indexed by the CNC (M19 recognized) • Bit 4: Speed programming format [0=S5.0][1=S3.2] • Bit 5: Indexing [0=No deceleration (quick)][1=Controlled deceleration (P32)] • Bit 6: Speed programming format = S6.0 (max. 655350 rpm) • Bit 7 to 9: Reserved. • Bit 10: Sensor coupled on the motor shaft [0 = Not coupled] [1 = Coupled]. This is useful in case of several spindle ranges. When the sensor is coupled on the shaft, then the gear reduction is taken into account to measure the speed. Generally the sensor is connected on the spindle itself. • Bit 11: Spindle angular position (E904xx) increases in M03 • Bit 12 to 31: Not used
	Word N40	**Spindle@1...@0 assignement to a channel**  • Byte 0 - Spindle @0 rank in the channel (00 = Main, 1 = Aux1, 2 = Aux2, 3 = Aux3, FF = None). The main spindle is addressed directly with M3/4/5, 19, 40,… Auxiliary spindles needs to be declared main first (M62:… or programmed with advanced syntax . • Byte 1 - Spindel @0 assigned to channel (1 to 32, FF not assigned) Other values not authorized. • Byte 2 and Byte 3 same structure for Spindle @1.
	Word N41 **to** **Word N55**	Word N41: Same structure for spindle @3 and spindle @2 Word N42: Same structure for spindle @5 and spindle @4 Word N43: Same structure for spindle @7 and spindle @6 Word N44: Same structure for spindle @9 and spindle @8 Word N45: Same structure for spindle @11 and spindle @10 Word N46: Same structure for spindle @13 and spindle @12 Word N47: Same structure for spindle @15 and spindle @14 Word N48: Same structure for spindle @17 and spindle @16 Word N49: Same structure for spindle @19 and spindle @18 Word N50: Same structure for spindle @21 and spindle @20 Word N51: Same structure for spindle @23 and spindle @22 Word N52: Same structure for spindle @25 and spindle @24 Word N53: Same structure for spindle @27 and spindle @26 Word N54: Same structure for spindle @29 and spindle @28 Word N55: Same structure for spindle @31 and spindle @30

Example

Example

A machine with two spindles:

- First spindle: @24 we define it as the first logical spindle
- Second spindle: @25 we define it as the second logical spindle.

N6 Logical addresses associated to spindles @27 ... @24

Byte	Value	Unit	Descripton	Min	Max	Default
0	01h	[]	Logical address associated to spindle @24	01h	FFh	FFh
1	02h	[]	Logical address associated to spindle @25	01h	FFh	FFh
2	FFh	[]	Logical address associated to spindle @26	01h	FFh	FFh
3	FFh	[]	Logical address associated to spindle @27	01h	FFh	FFh

Example

- Spindle @24 (logical 1): Milling, can be indexed at constant gain, standard format
- Spindle @25 (logical 2: Milling, speed format 6.0

P6 Spindle definition and assignment to channels

Name	Value	Unit	Descripton	Min	Max	Default
P6N25	0000002Ch	[]	Spindle @17 definition	00000000h	FFFFFFFFh	0000002Ch
P6N26	0000002Ch	[]	Spindle @18 definition	00000000h	FFFFFFFFh	0000002Ch
P6N27	0000002Ch	[]	Spindle @19 definition	00000000h	FFFFFFFFh	0000002Ch
P6N28	0000002Ch	[]	Spindle @20 definition	00000000h	FFFFFFFFh	0000002Ch
P6N29	0000002Ch	[]	Spindle @21 definition	00000000h	FFFFFFFFh	0000002Ch
P6N30	0000002Ch	[]	Spindle @22 definition	00000000h	FFFFFFFFh	0000002Ch
P6N31	0000002Ch	[]	Spindle @23 definition	00000000h	FFFFFFFFh	0000002Ch
P6N32	0000002Ch	[]	Spindle @24 definition	00000000h	FFFFFFFFh	0000002Ch
P6N33	00000044h	[]	Spindle @25 definition	00000000h	FFFFFFFFh	0000002Ch
P6N34	0000002Ch	[]	Spindle @26 definition	00000000h	FFFFFFFFh	0000002Ch

Example

- Spindle @24 (logical 1): Main spindle in channel 2
- Spindle @25 (logical 2: First auxiliary spindle in channel 2

N52 Spindle@25...@24 assignement to a channel

Byte	Value	Unit	Descripton	Min	Max	Default
0	00h		Spindle @24 rank in the channel	00h	FFh	FFh
1	02h		Spindle @24 assigned to channel	01h	FFh	FFh
2	01h		Spindle @25 rank in the channel	00h	FFh	FFh
3	02h		Spindle @25 assigned to channel	01h	FFh	FFh

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Summary

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6.11 Potentiometer min-max range ► P67 98

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6.13 Number of origins DAT2 ► P98 101

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6 System configuration

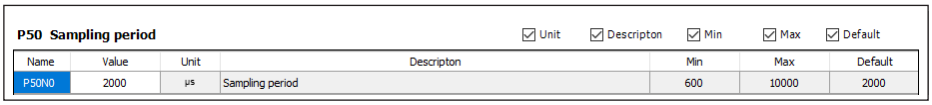
This category of parameters describes NCK characteristics.

Even though they are not all necessary at this stage, it is recommended to define them before entering axes characteristics and performances as the first ones (P50, P99 and P7) may have influence on the rest of the commissioning.

This category contains the following parameters:

P50	Sampling period
P99	CNC - PLC communication setting
P7	Miscellaneous functions
P35	Subroutine call by M function
P37	Maximum number of M function with acknowledge
P51	Minimum block execution time
P52	Radial error tolerated on circles - Path checks in RTCP - Programming precision on circle radius
P54	Number of blocks in look-ahead buffer
P58	Various memory reservations
P59	Memory segments of the symbolic variables
P67	Potentiometer min-max range
P95	Memory zones allocation (Part program)
P98	Number of origins DAT2

6.1 Sampling period ► P50

P50	Sampling period			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	1	**Units**	µs
	Min	600	**Max**	10000
	Default	2000	**Resolution**	200
	Immediate	No	**Access via**	E41005 (R)
General	This parameter defines the CNC sampling period.			
Description				
	Word N0	**Sampling period** Defines the CNC sampling period (T) in µs. The value must be a multiple of 200 µs. The minimum sampling period accepted by the system is 600 µs and the maximum is 10000 µs. If the value entered is outside these limits, the system forces the limit values. It is possible to read the value of P50 via program parameter E41005.		
Example				

6.2 CNC - PLC communication setting ► P99

P99	CNC - PLC communication setting			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	3	**Units**	None, ms, ms
	Min	Word dependent	**Max**	Word dependent
	Default	Word dependent	**Resolution**	1
	Immediate	No	**Access via**	N/A

General

This parameter has the following functions:

- To define the communication period between NC and PLC.
- To define the timeout used to monitor CNC ⇔ PLC communication.
- To delay the apparition of a CNC ⇔ communication error.

Description

Word N0 — **Number of CNC cycles between 2 CNC-PLC communications**

Communication period between the NC and PLC in numbers of NC sampling periods (P50). This value should be short enough to make sure a new update has been performed between to PLC main tasks. A too small value brings no advantage.

Example: PLC Scan =10 ms (standard), NC Scan = 2ms (standard)

- Good value for P99 N0 = 3 (⇔ 6ms) or 4 (⇔ 8 ms).
- A value of 5 (10 ms) is not recommended as the PLC and NC real time clocks are not synchronized.
- Min: 1, Max: 6, Default 3, Units: none

Word N1 — **Maximum time for the detection of the machine error 249.**

Defines the timeout in number of NC sampling periods (P50) used to monitor the communications between PLC and CNC. If this value is exceeded without NC ⇔PLC communication, then error 249 will be issued.

Min: 16, Max: 65535, Default: 64, Units: ms

Word N2 — **Delay time before issue of machine error 249.**

Possibilities to delay the issue of alarm 249 in order to trigger an emergency retract.

- Value = 0 : Error 249 issued immediately
- Value >0: In case of communication error, an emergency retract is generated automatically (No PLC action required) and after <value> ms the error will be issued triggering a machine power down.

This feature is especially important when it is necessary to disengage tool and part in case of a dangerous situation (e.g. Grinder, Gear Hobber etc…)

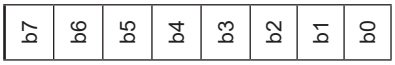
Min: 0, Max: 65535, Default: 0, Units: ms

Example

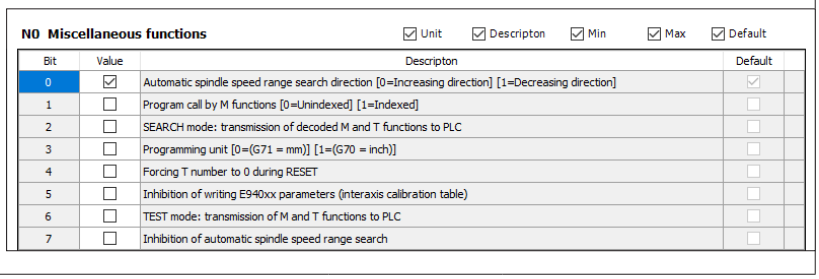
P99 CNC - PLC communication setting — ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P99N0	3	D	Number of CNC cycles between 2 CNC - PLC communications	1	6	3
P99N1	64	ms	Maximum time for the detection of machine error 249	16	65535	64
P99N2	0	ms	Delay time before issue of machine error 249	0	65535	0

6.3 Miscellaneous functions ► P7

<table>
<tr><td>P7</td><td colspan="4">Miscellaneous functions</td></tr>
<tr><td></td><td>Category</td><td>System configuration</td><td>Format / Type</td><td>BYTE / 0</td></tr>
<tr><td></td><td>Words</td><td>6</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>FF</td></tr>
<tr><td></td><td>Default</td><td>Word dependent</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter regroups different validations and selection for system configuration.</td></tr>
<tr><td>Description</td><td colspan="4">The structure of the words is a byte
 

word N_</td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Miscellaneous functions
• b0: Automatic spindle speed range search direction [0=Increasing direction] [1=Decreasing direction]
(0 → M40 to M45, 1 M45 → M40)
• b1: Program call by M functions [0=Unindexed][1=Indexed]
(0 → without channel index [%xxx], 1→ with channel index [%xxx.i]
• b2 : SEARCH mode: transmission of decoded M and T functions to PLC
(0 → No transmission, 1 → functions transmitted)
• b3 : Programming unit [0=(G71 = mm)][1=(G70 = inch)]
(0 → Metric : G71, 1→ Inches : G70)
• b4 : Forcing T number to 0 during RESET (Flexium_NCK.RCNC.Channel[x].ToolNumber=0)
(0 → No, 1 → Yes)
• b5 : Inhibition of writing E940xx parameters (interaxis calibration table) by part program (1)
(0 → Writing authorized, 1 → writing inhibited)
• b6: TEST mode transmission of M and T functions to PLC (2)
(0 → No transmission, 1 → functions transmitted)
• b7: Inhibition of automatic spindle speed range search (3)
(0 → Enabled, 1 → Disabled).

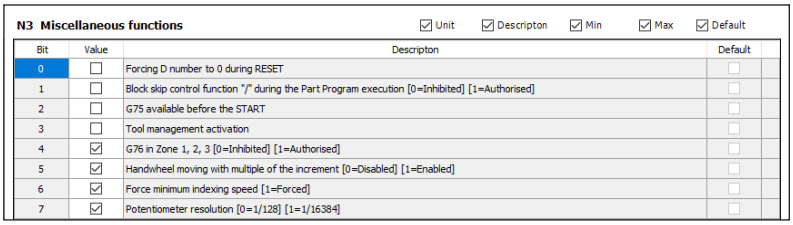
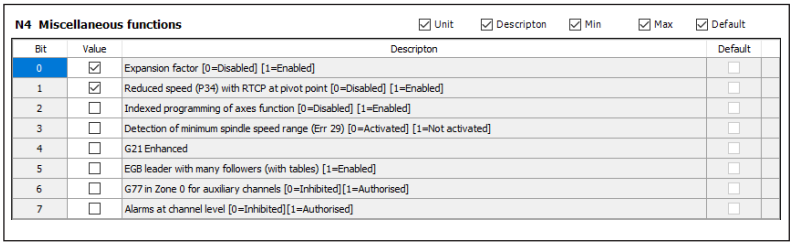
(1) Such parameters can be used for interaxes calibration. In this case, a modification could have undesired results : therefore the possibility of preventing any change.
(2) Transmit such functions can be necessary if they request a specific action from the PLC (calling sub routine, setting parameters etc…). However this transmission will increase the time required for testing the program.
(3) Automatic spindle gear change dipending by spindle speed programmed.
Default: 1
Example
 
</td></tr>
</table>

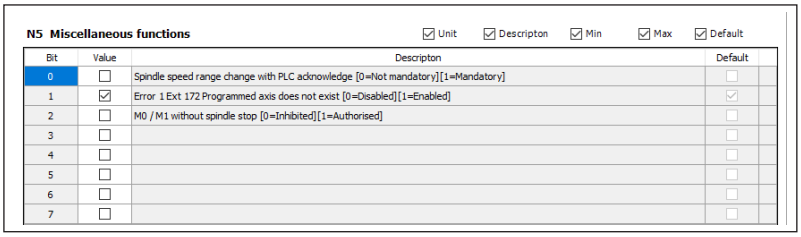
Description	**Word N1**	**Miscellaneous functions** • b0 : Feed rate initialisation in [0=(G94 = mm/min)][1=(G95 = mm/rev)] • b1 : M12 activates manual intervention (0 → No M12 like any other M code, 1 → Yes M12 specific: refer to M00073) • b2 : Inhibition of HOMING via keyboard (0 → Authorized, 1 → Inhibited) • b3 : %11000 subroutine call on RESET (0 → No, 1 → Yes) • b4 : FEED STOP inhibited during rigid tapping (0 → Authorized, 1 → Inhibited) • b5 : Radius calculation on the trajectory (E32014) [0=Disabled][1=Enabled] • b6 : G52 (Prog/OM) in inclined plane [0=Inhibited][1=Authorised] (1 → The radius value is stored in the E32014 • b7 : Detection of tool interface (Err 149) [0=Activated][1=Not activated]. Default: 4 Example **N1 Miscellaneous functions** ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Bit	Value	Descripton	Default
0	☐	Feed rate initialisation in [0=(G94 = mm/min)] [1=(G95 = mm/rev)]	☐
1	☐	M12 activates manual intervention	☐
2	☑	Inhibition of HOMING via keyboard	☑
3	☐	%11000 subroutine call on RESET	☐
4	☐	FEED STOP inhibited during rigid tapping	☐
5	☐	Radius calculation on the trajectory (E32014) [0=Disabled] [1=Enabled]	☐
6	☐	G52 (Prog/OM) in inclined plane [0=Inhibited] [1=Authorised]	☐
7	☐	Detection of tool interference (Err 149) [0=Activated] [1=Not activated]	☐

	Word N2	**Miscellaneous functions** • b0 : Status "Homing completed" when switching from "Limited excursion" to "Modulo" [0=Lost][1=Maintained] • b1 : Writing the drive parameters V130, V131 via E352xx [0=Inhibited] [0=Authorised] • b2 : G92 S...(speed limitation) when G96 programmed [0=Not mandatory] [1=Mandatory] • b3 : Maximum programmable spindle speed of the current range in G92 with CSS [0=Max speed][1=Limited speed] (0 → Max speed, 1 → Limit speed defined in P46 – P49) (1) • b4 : PLC hanwheel filter [0=Disabled][1= Enabled] • b5 : Fast coded M functions [0=Disabled][1=Enabled] (2) • b6 : Spindles release by M61 [0=With stop][1=Without stop] (0 → Stop required, 1 → Stop NOT required) • b7 : Reference spindle [0=Main spindle][1=Selected by M66] (3) (1) Is only significant if b2 is set. (2) When enabled two consecutive M codes will be transferred to the PLC without a code 0 between them (except if the two codes are identical). (3) It is always possible to select the reference spindle by M66, when this bit is cleared such selection will be automatic at each new master spindle selection. Default: 0 Example **N2 Miscellaneous functions** ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Bit	Value	Descripton	Default
0	☐	Status "Homing completed" when switching from "Limited excursion" to "Modulo" [0=Lost] [1=Maintained]	☐
1	☐	Writing the drive parameters V130, V131 via E352xx [0=Inhibited] [1=Authorised]	☐
2	☐	G92 S...(speed limitation) when G96 programmed [0=Not mandatory] [1=Mandatory]	☐
3	☐	Maximum programmable speed of the current range in G92 with CSS [0=Max speed] [1=Limited speed]	☐
4	☐	PLC handwheel filter [0=Disabled] [1=Enabled]	☐
5	☐	Fast coded M functions [0=Disabled] [1=Enabled]	☐
6	☐	Spindles release [0=With stop] [1=Without stop]	☐
7	☐	Reference spindle [0= Main spindle] [1=Selected by M66]	☐

Description	**Word N3**	**Miscellaneous functions** • b0 : Forcing D number to 0 during RESET [1 = Reset D] • b1 : Block skip control function "/" during the Part Program execution [0=Inhibited] [1=Authorised] • b2 : G75 available before the START • b3 : Tool management activation • b4 : G76 in Zone 1, 2, 3 [0=Inhibited][1=Authorised] • b5 : Handwheel moving with multiple of the increment [0=Disabled][1=Enabled] Reminder that if the handwhell turning speed causes an over speed of the axes (exced P30 or acceleration exced P32) the CNC reduces the speed and the end point could be not a multiple of the increment selected. The b5 enables the end positoin as multiple of increment by an automatic CNC computation. In the version 4.2.00.00 the function is automatically activated, the b5 is not working. • b6 : Force minimum indexing speed [1=Forced] • b7 : Potentiometer resolution [0=1/128][1=1/16384] Default: 0 Example 
	Word N4	**Miscellaneous functions** • b0 : Expansion factor [0=Disabled][1=Enabled] • b1 : Reduced speed (P34) with RTCP at pivot poin [0=Disabled][1=Enabled] • b2 : Indexed programming of axes function [0=Disabled][1=Enabled] New programming sintax: X1=100 (X100) • b3 : Detection of minimum spindle speed range (Err 29) [0=Activated][1=Not activated] • b4 : G21 Enhanced • b5 : EGB leader with many followers (with tables) [1=Enabled] • b6 : G77 in Zone 0 for auxiliary channels [0=Inhibited][1=Authorised] • b7 : Alarms at channel level [0=Inhibited][1=Authorised] With b7=1 the channel alarm doesn't stop the othere channels (only for independent groups). Default: 0 Example 

Description	**Word N5**	**Miscellaneous functions** • b0: Spindle speed range change with PLC acknowledge [0=Not mandatory][1=Mandatory] The CNC will activate the new speed range only at .WCNC.Channel[x]. AckMFunction = True. • b1: Error 1 Ext 172 Programmed axis does not exist [0=Disabled][1=Enabled]. • b2: M0 / M1 without spindle stop [0=Inhibited] [1=Authorised]. Default: 2 Example 

N5 Miscellaneous functions ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Bit	Value	Descripton	Default
0	☐	Spindle speed range change with PLC acknowledge [0=Not mandatory][1=Mandatory]	☐
1	☑	Error 1 Ext 172 Programmed axis does not exist [0=Disabled][1=Enabled]	☑
2	☐	M0 / M1 without spindle stop [0=Inhibited][1=Authorised]	☐
3	☐		☐
4	☐		☐
5	☐		☐
6	☐		☐
7	☐		☐

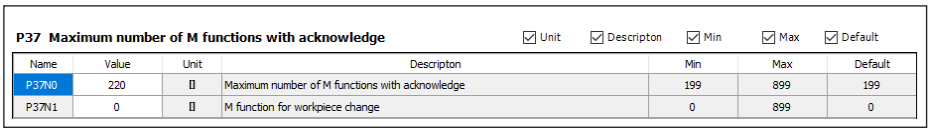
6.4 Subroutine call by M fuction ► P35

<table>
<tr><td>P35</td><td colspan="4">Subroutine call by M function</td></tr>
<tr><td></td><td>Category</td><td>System configuration</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td></td><td>Words</td><td>64</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0 - 1</td><td>Max</td><td>899 - 29999</td></tr>
<tr><td></td><td>Default</td><td>0 - 1</td><td>Resolution</td><td>1</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to declare up to 32 M functions that will activate the execution of a subroutine and the subroutine in question.</td></tr>
<tr><td>Description</td><td colspan="4"></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">M function number
Min: 0, Max: 899, Default: 0</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Subroutine number
Min: 1, Max: 29999, Default: 1</td></tr>
<tr><td></td><td>Word N2/3
to
Word N62/63</td><td colspan="3">Identical to Word N0/N1 for channels 2 to 32.</td></tr>
<tr><td></td><td colspan="4">Each even word will contain the number of an M code and the following even word the number of subroutine executed.
As M0 cannot trigger a subroutine, each unused word should be set to 0.
It is not necessary to sort the M function in ascending order.
Only codes up to 899 can request execution of a subroutine.
The subroutine number is limited to 29999.</td></tr>
<tr><td>Example</td><td colspan="4">
P35 Subroutine call by M function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P35N0</td><td>6</td><td></td><td>M function number</td><td>0</td><td>899</td><td>0</td></tr>
<tr><td>P35N1</td><td>9106</td><td></td><td>Subroutine number</td><td>1</td><td>29999</td><td>1</td></tr>
<tr><td>P35N2</td><td>75</td><td></td><td>M function number</td><td>0</td><td>899</td><td>0</td></tr>
<tr><td>P35N3</td><td>9175</td><td></td><td>Subroutine number</td><td>1</td><td>29999</td><td>1</td></tr>
<tr><td>P35N4</td><td>0</td><td></td><td>M function number</td><td>0</td><td>899</td><td>0</td></tr>
<tr><td>P35N5</td><td>1</td><td></td><td>Subroutine number</td><td>1</td><td>29999</td><td>1</td></tr>
</table>

M6 will trigger %9106, M75 %9175

P.S. For PLC axes according to P7 N0 b1, the call to a subroutine will be with or without channel index. The channel index will not be defined in P35.
</td></tr>
</table>

6.5 Maximum number of M function with acknowledge ► P37

P37	Maximum number of M function with acknowledge			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	2	**Units**	None
	Min	199 - 0	**Max**	899
	Default	199 - 0	**Resolution**	1
	Immediate	No	**Access via**	N/A
General	This parameter is used to define the higher M function with acknowledge number. M codes above this value will be without acknowledge also named "On the fly" function.			
Description				
	Word N0	**Maximum number of M functions with acknowledge.** Min: 199, Default: 199		
	Word N1	**M function for workpiece change.** Min: 0, Default: 0		
Example				

P37 Maximum number of M functions with acknowledge ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P37N0	220	[]	Maximum number of M functions with acknowledge	199	899	199
P37N1	0	[]	M function for workpiece change	0	899	0

- M functions up to M220 will be sent with acknowledge request.
- M functions from M221 and above will be sent on the fly.

6.6 Minimum block execution time ► P51

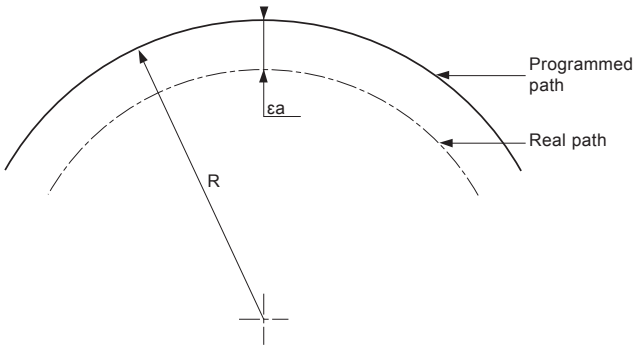
<table>
<tr><td rowspan="6">P51</td><td colspan="4">Minimum block execution time</td></tr>
<tr><td>Category</td><td>System configuration</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td>Words</td><td>1</td><td>Units</td><td>ms</td></tr>
<tr><td>Min</td><td>0</td><td>Max</td><td>65535</td></tr>
<tr><td>Default</td><td>0</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>E32000 (R/W)</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define the minimum time to execute a block.
By defining a minimum time we can be sure that the following block to be executed can be prepared in full.
When set to 0, Flexium adapts dynamically this value to achieve the best performances. Therefore except particular situation, this parameter should be left to its default value.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4"></td></tr>
<tr><td>Word N0</td><td colspan="3">Minimum time for executing a block by interpolation
Smallest number of "ms" requested to execute a block in interpolation.</td></tr>
<tr><td>Example</td><td colspan="4">Example: Standard value
P51 Minimum block execution time ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P51N0</td><td>0</td><td>ms</td><td>Minimum time for executing a block by interpolator</td><td>0</td><td>65535</td><td>0</td></tr>
</table></td></tr>
</table>

6.7 Radial error tolerated on circles - Path checks in RTCP - Programming precision on circle radius ► P52

P52	Radial error tolerated on circles - Path checks in RTCP - Programming precision on circle radius			
	Category	System configuration	**Format / Type**	LREAL / 10
	Words	3	**Units**	mm or °
	Min	Word dependent	**Max**	Word dependent
	Default	Word dependent	**Resolution**	10^{-6} - 10^{-7}
	Immediate	No	**Access via**	E32002 , E32012 (R/W) See description
General	This parameter is used to define several types of precision during machining.			
Description				

Word N0 — **Radial error tolerated on circles**

Defines the maximum servo error allowed for circles by limiting the feed rate.



εa (servo-loop error) is the error in mm between a programmed path and the real path.

εa is approximated by the following equation:

$$\varepsilon a = \frac{Vmax^2 * T^2}{2R}$$

- εa = Servo-loop error (in m),
- Vmax = Max speed (in m/s),
- T = Time constant (in µs),
- R = Radius (in m).

This equation can be reformulated to give the maximum tolerated speed:

$$Vmax = \frac{\sqrt{2R * \varepsilon a}}{T}$$

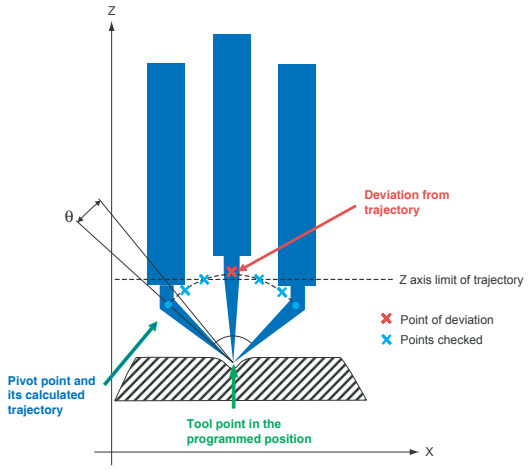
- Application: maximum tolerated speed for εa = 50 µm T= 60 ms and R = 50 mm.

$$Vmax = \frac{\sqrt{2 * 50 * 10^{-3} * 50 * 10^{-6}}}{60 * 10^{-3}} = \frac{\sqrt{5 * 10^{-6}}}{60 * 10^{-3}} = 0.037 \frac{m}{s} = 2.236 \frac{m}{min}$$

In case of High Speed Cutting (HSC) this parameter must be set to a low value, especially for finishing (a few units).

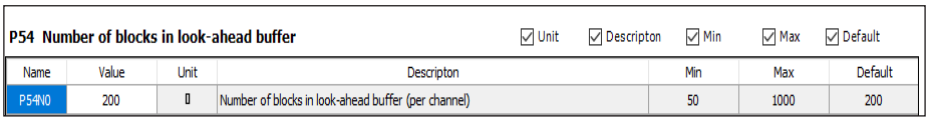
Please note that it is not only applied to circles but also to curves programmed by small segments (TABCYLS). The setting is adjusted via the external parameter E32002.

Min: 0.0, Max: 65.0, Default 0.05, Resolution: 10^{-6}

Description	**Word N1**	**Path checks in RTCP** To verify that the trajectory just calculated does not exceed the travel limits, the numerical control will test the conditions to be met over a number of check points. These points are specified so that they are uniformly distributed along the trajectory with angular distance between two of them less or equal to the angular distance defined in P52N1. For each point thus specified, checks are carried out for the axes of the pivot point. The checks are valid for the following types of interpolated trajectories: - Linear interpolation, - Circular interpolation, - Segmented polynomial interpolation (Smoothed polynomial interpolation is not covered). Parameter P52N1 is set in degrees. The system allows values from 5° to 45°. Outside this range, the checks are not carried out. The value of parameter P52N1 is a compromise between the precision required in checking the trajectories and the additional computation time required.  θ: The angle θ is calculated by the CNC so that the check points are uniformly distributed along the circular trajectory and the angular distance between two consecutive points is less than that given by P52N1. Min: 5.0, Max: 45.0, Default: 5.0, Resolution: 10^{-6}
	Word N2	**Programming precision on circle radius**. This word defines the maximum tolerated difference between the Ending radius and the Starting radius on a circle. Error 107 is generated if this value is exceeded. External parameter E32012 is the image of this parameter. Min: 0.02, Max: 0.255, Default 0.02, Resolution: 10^{-7}
Example		**P52 Radial error tolerated on circles - Path checks in RTCP - Programming** ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P52N0	0.05	mm	Radial error tolerated on circles	0.0	65.0	0.05
P52N1	5.0	°	Path checks in RTCP	5.0	45.0	5.0
P52N2	0.02	mm	Programming precision on circle radius	0.02	0.255	0.02

6.8 Number of blocks in look-ahead buffer ► P54

P54	Number of blocks in look-ahead buffer			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	1	**Units**	None
	Min	50	**Max**	1000
	Default	200	**Resolution**	1
	Immediate	No	**Access via**	N/A
General	Defines the number of NC blocks in the look-ahead buffer. The look ahead permits to anticipate the change of speeds and direction. If this value is too low especially for small blocks, there is a risk of limited speed capacities to prevent shocks at changes of direction. A too high value will result in additional computing without practical interest; therefore it is recommended that this size is dynamically adjusted.			
Description				
	Word N0	**Number of blocks in look-ahead buffer (per channel)** Size of the buffers for blocks ready to be executed (prepared). This is a global value that will be dynamically distributed over all channels for optimal performances. A value of 0 means this size will be dynamically adjusted. Therefore it is suggested not to change the default value. The minimum number of blocks per channel is 50 and the maximum is 1000. If the value of P54 is outside these limits, the system forces the limit value.			
Example				

6.9 Various memory reservations ► P58

<table>
<tr><td rowspan="6">P58</td><td colspan="4">Various memory reservations</td></tr>
<tr><td>Category</td><td>System configuration</td><td>Format / Type</td><td>UDINT / 4</td></tr>
<tr><td>Words</td><td>3</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>Word dependent</td><td>Max</td><td>Word dependent</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define the number of E81xxx/E82xxx parameters as well as the size of part program stack.</td></tr>
<tr><td>Description</td><td colspan="4"></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Number of E81000/E82000 parameters
This word defines the number of parameters E81xxx / E82xxx. They can be used either to define an Interaxis calibration table but more and more used as generic as the calibration is also available through NUM FlexiumPro Tools.
Min: 0, Max:1000, Default: 1000
Decreasing the default value may help to gain some room in the NCK NVRAM which is not really an issue. For this reason it is strongly suggested to keep the value at the default.
Entering a value higher than 1000 has no effect.</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Program stack size for channel
This word is used to define the size of the program stack size of each channel.
All channels will get the same amount. This stack is used to save symbolic variables as well as data for some dynamic operators.
Min: 10000, Max: 8388608, Default: 20000
The value entered corresponds to the size in words (2 bytes) per channel. The minimum stack size must be above 10 kBytes.
This stack is taken on the part program memory, therefore especially in case of multi channels machine it may be interesting not to reserve the maximum amount.
N.B.: The extended programming manual describes the relation between number of variables and memory allocation.</td></tr>
<tr><td></td><td>Word N2</td><td colspan="3">EGB table elements
The N2 can reserved a predefined memory for EGB table.
Min: 10, Max: 10000, Default: 100</td></tr>
<tr><td>Example</td><td colspan="4">P58 Various memory reservations ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P58N0</td><td>1000</td><td></td><td>Number of E81000/E82000 parameters</td><td>0</td><td>1000</td><td>1000</td></tr>
<tr><td>P58N1</td><td>20000</td><td></td><td>Program stack size for channel</td><td>10000</td><td>8388608</td><td>20000</td></tr>
<tr><td>P58N2</td><td>100</td><td></td><td>EGB table elements</td><td>10</td><td>10000</td><td>100</td></tr>
</table></td></tr>
</table>

6.10 Memory segments of the symbolic variables ► P59

P59	Memory segments of the symbolic variables			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	32	**Units**	KByte
	Min	0	**Max**	1000
	Default	0	**Resolution**	1
	Immediate	No	**Access via**	N/A

General

This parameter is used to define up to 32 segments of memory for saving symbolic variables.

The values of the variables are kept even after a Reset

The main use of these segments is related to dynamic operators in C program that need to save variables over a complete work power on session of the machine.

The total size of the segments can not exceed 1024 kBytes.

Description

Word N0 to Word N31	**Quantity of memory reserved for the segment 1 to 32**

Example

P59 Memory segments of the symbolic variables ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P59N0	0	kByte	Quantity of memory reserved for the segment 1	0	1000	0
P59N1	0	kByte	Quantity of memory reserved for the segment 2	0	1000	0
P59N2	0	kByte	Quantity of memory reserved for the segment 3	0	1000	0
P59N3	0	kByte	Quantity of memory reserved for the segment 4	0	1000	0
P59N4	0	kByte	Quantity of memory reserved for the segment 5	0	1000	0
P59N5	0	kByte	Quantity of memory reserved for the segment 6	0	1000	0
P59N6	0	kByte	Quantity of memory reserved for the segment 7	0	1000	0
P59N7	0	kByte	Quantity of memory reserved for the segment 8	0	1000	0

6.11 Potentiometer min-max range ► P67

P67	Potentiometer min-max range			
	Category	System configuration	**Format / Type**	UINT / 5
	Words	128	**Units**	%
	Min	Word dependent	**Max**	Word dependent
	Default	Word dependent	**Resolution**	1
	Immediate	No	**Access via**	E79005 – E79008 (R/W)
General	This parameter defines the range of values for the different overrides. The values are specified as percentages in 16-bit words.			
Description	The feed override values are defined par channel whereas the speed override values are defined per spindle. All the values must be positive or zero. • The highest possible value is 255% • The lowest possible value is 0% • 100% must be within the min-max range. • The max values must always be higher than the min values • If these conditions are not satisfied, at power on, the default values will be set: - 0-120% for feed rate potentiometers - 50-100% for spindle speed potentiometers.			
	Word N0	**Min feed percentage for channel 1** Min: 0, Max: 100, Default: 0		
	Word N1	**Max feed percentage for channel 1** Min: 100, Max: 255, Default: 120		
	Word N2/3 **to** **Word N62/63**	Identical to Word N0/N1 for channels 2 to 32.		
	Word N64	**Min percentage for spindle @0** Min: 0, Max: 100, Default: 50		
	Word N65	**Max percentage for spindle @0** Min: 100, Max: 255, Default: 100		
	Word N66 **to** **Word N126**	Even words: Identical to Word N64 for spindles @1 to @31		
	Word N67 **to** **Word N127**	Odd words: Identical to Word N65 for spindles @1 to @31		

Example

P67 Potentiometer min-max range

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P67N0	0	%	Min feed percentage for channel 1	0	100	0
P67N1	120	%	Max feed percentage for channel 1	100	255	120
P67N2	0	%	Min feed percentage for channel 2	0	100	0
P67N3	120	%	Max feed percentage for channel 2	100	255	120
P67N4	0	%	Min feed percentage for channel 3	0	100	0
P67N5	120	%	Max feed percentage for channel 3	100	255	120

P67 Potentiometer min-max range

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P67N64	50	%	Min percentage for spindle @0	0	100	50
P67N65	100	%	Max percentage for spindle @0	100	255	100
P67N66	50	%	Min percentage for spindle @1	0	100	50
P67N67	100	%	Max percentage for spindle @1	100	255	100
P67N68	50	%	Min percentage for spindle @2	0	100	50
P67N69	100	%	Max percentage for spindle @2	100	255	100
P67N70	50	%	Min percentage for spindle @3	0	100	50
P67N71	100	%	Max percentage for spindle @3	100	255	100

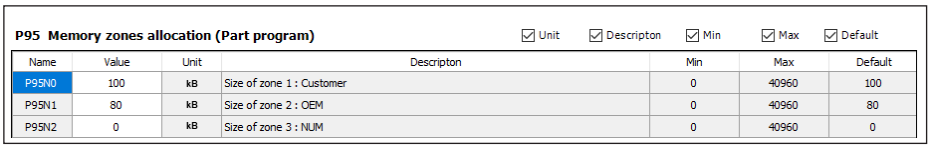
6.12 Memory zones allocation (Part program) ► P95

<table>
<tr><td>P95</td><td colspan="4">Memory zones allocation (Part program)</td></tr>
<tr><td></td><td>Category</td><td>System configuration</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td></td><td>Words</td><td>3</td><td>Units</td><td>Kbytes</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>40960</td></tr>
<tr><td></td><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td></td><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to allocate memory areas for part programs.</td></tr>
<tr><td>Description</td><td colspan="4">The part program memory is divided into four areas:
• Free access area 0
• Zone 1: Customer
• Zone 2: OEM
• Zone 3: NUM

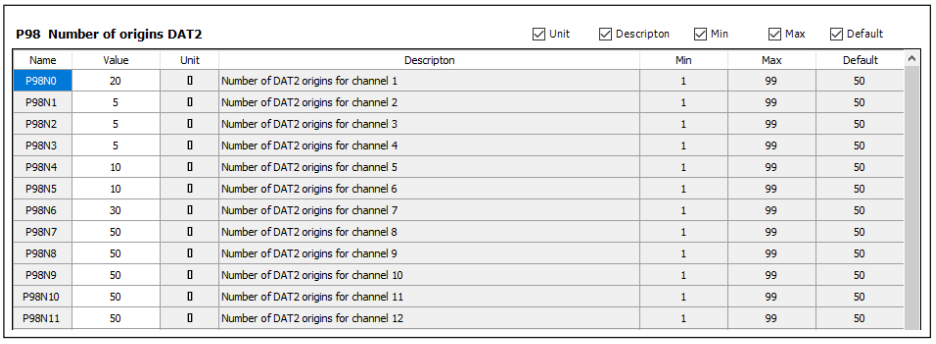
The different zones (except zone 0) are intended to store specific or proprietary programs.
Programs in these zones can be protected so as not to be editable or visible (the NUM Zone is always protected).
There is a hierarchy between the different zones. A program is searched for in zone 0 at first, then zone 1, 2 and finally 3. This way it is always possible to overwrite an existing program by another with the same number existing in a lower zone.
N.B: This feature is very useful to add or change some functionality but could lead to a malfunction if improperly used. Refer to the programming manuals to know which program number you can use.
The sizes (in Kbytes) of the zones 1 to 3 are described with this parameter. Zone 0 gets the remaining memory.

Word N0 — Size of zone 1: Customer
Default: 100

Word N1 — Size of zone 2: OEM
Default: 80

Word N2 — Size of zone 3: NUM
Default: 0</td></tr>
<tr><td>Example</td><td colspan="4"> 
</td></tr>
</table>

6.13 Number of origins DAT2 ► P98

P98	Number of origins DAT2			
	Category	System configuration	**Format / TYPE**	UINT / 5
	Words	32	**Units**	None
	Min	1	**Max**	99
	Default	50	**Resolution**	1
	Immediate	No	**Access via**	N/A
General	FlexiumPro offers the possibility of up to 99 program offsets (DAT2). In order to limit the complexity of the system, it is possible to define for each channel the number of program offsets that will be used.			
Description	Each word represents a channel.			
	Word N0 **to** **Word N31**	**Number of DAT2 origins for channel 1 to 32**		
Example				

P98 Number of origins DAT2 ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P98N0	20	0	Number of DAT2 origins for channel 1	1	99	50
P98N1	5	0	Number of DAT2 origins for channel 2	1	99	50
P98N2	5	0	Number of DAT2 origins for channel 3	1	99	50
P98N3	5	0	Number of DAT2 origins for channel 4	1	99	50
P98N4	10	0	Number of DAT2 origins for channel 5	1	99	50
P98N5	10	0	Number of DAT2 origins for channel 6	1	99	50
P98N6	30	0	Number of DAT2 origins for channel 7	1	99	50
P98N7	50	0	Number of DAT2 origins for channel 8	1	99	50
P98N8	50	0	Number of DAT2 origins for channel 9	1	99	50
P98N9	50	0	Number of DAT2 origins for channel 10	1	99	50
P98N10	50	0	Number of DAT2 origins for channel 11	1	99	50
P98N11	50	0	Number of DAT2 origins for channel 12	1	99	50

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Summary

7 Axis characteristics 105

7.1 Homing direction ► P15 106

7.2 Machine home position ► P16 107

7.3 Axis travel limits ► P17 108

7.4 Backlash error compensation ► P18 109

7.5 In-position window ► P22 110

7.6 Lubrication pulse distance ► P29 111

7.7 Maximum axis traverse rates ► P30 112

7.8 JOG speeds and default speed limits ► P31 113

7.9 Speed limits ► P34 114

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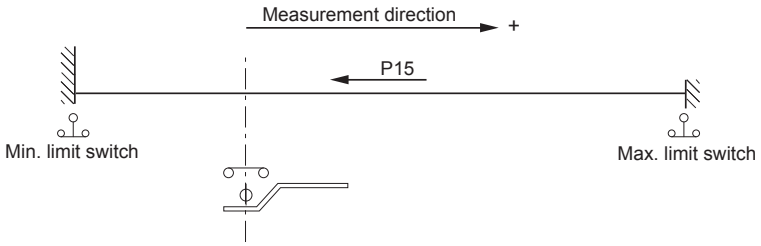
7 Axis characteristics

This category of parameters describes the static characteristics of the axes. They should be filled before adjusting the dynamics.

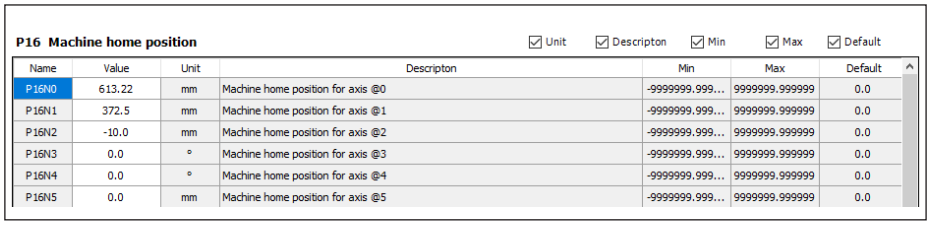
This category contains the following parameters:

P15	Homing direction
P16	Machine home position
P17	Axes travel limits
P18	Backlash error compensation
P22	In-position window
P29	Lubrication pulse distance
P30	Maximum axes traverse
P31	JOG speeds and default speed limits
P34	Speed limits

7.1 Homing direction ► P15

<table>
<tr><td>P15</td><td colspan="4">Homing direction</td></tr>
<tr><td></td><td>Category</td><td>Axis characteristics</td><td>Format / Type</td><td>DWORD / 6</td></tr>
<tr><td></td><td>Words</td><td>2</td><td>Units</td><td>None</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>FFFFFFFF</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>N/A</td></tr>
<tr><td></td><td>Immediate</td><td>Yes</td><td>Access via</td><td>N0 : E933xx (R)
N1 : E934xx (R)</td></tr>
<tr><td>General</td><td colspan="4">This parameter is useful for axes not equipped with absolute measurement systems. It has two functions:
• Define the direction from which the datum switch is approached in homing.
• Declare if a home switch is required or not. If the home switch is required, the system will make this switch is not open at start of the homing procedure (Error 32). Home switch is not required if there is only one marker (top zero) over the full travel or in case of measure system with coded reference mark.</td></tr>
<tr><td>Description</td><td colspan="4"></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Datum switch approach direction in HOMING [0=Positve][1=Negative]
The bit position gives the physical axis address.
Bit Set means homing is in the negative direction on the particular axis.
The homing direction can be checked in E933xx.
 
</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Ignore the datum switch in HOME mode
The bit position gives the physical axis address.
Bit Set means the datum switch is not tested on the corresponding axis.
In HOME mode, homing is complete when on the first marker pulse is encountered.
The status of the switch can be checked in E934xx.</td></tr>
<tr><td>Example</td><td colspan="4">• Axes @2 and @3 homed in the negative direction
• Axis @0 do not require a datum switch.
P15 Homing direction ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P15N0</td><td>0000000Ch</td><td>[]</td><td>Datum switch approach direction in HOMING [0=Positive] [1=Negative]</td><td>00000000h</td><td>FFFFFFFFh</td><td>00000000h</td></tr>
<tr><td>P15N1</td><td>00000001h</td><td>[]</td><td>Ignore the datum switch in HOME mode</td><td>00000000h</td><td>FFFFFFFFh</td><td>00000000h</td></tr>
</table></td></tr>
</table>

7.2 Machine home position ► P16

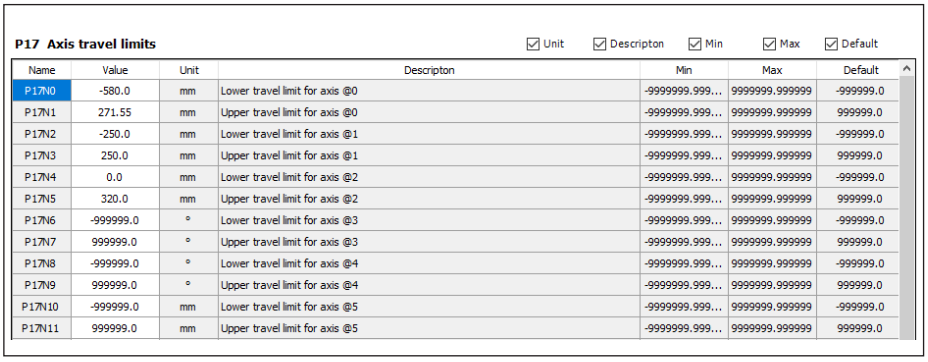
P16	Machine home position			
	Category	Axis characteristics	**Format / Type**	LREAL / 9
	Words	32	**Units**	mm or °
	Min	-9999999.999999	**Max**	9999999.999999
	Default	0.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	E951xx
General	This parameter is used to set the measure origin of an axis.			
Description	The word number gives the physical address of the axis.			
	Word N0 **to** **Word N31**	**Machine home position for axis @0 to @31** The values are expressed in mm for linear axes or degrees for rotary axes. The word contains the position of the datum switch on the corresponding axis in machine dimensions.		
Example				

P16 Machine home position

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P16N0	613.22	mm	Machine home position for axis @0	-9999999.999...	9999999.999999	0.0
P16N1	372.5	mm	Machine home position for axis @1	-9999999.999...	9999999.999999	0.0
P16N2	-10.0	mm	Machine home position for axis @2	-9999999.999...	9999999.999999	0.0
P16N3	0.0	°	Machine home position for axis @3	-9999999.999...	9999999.999999	0.0
P16N4	0.0	°	Machine home position for axis @4	-9999999.999...	9999999.999999	0.0
P16N5	0.0	mm	Machine home position for axis @5	-9999999.999...	9999999.999999	0.0

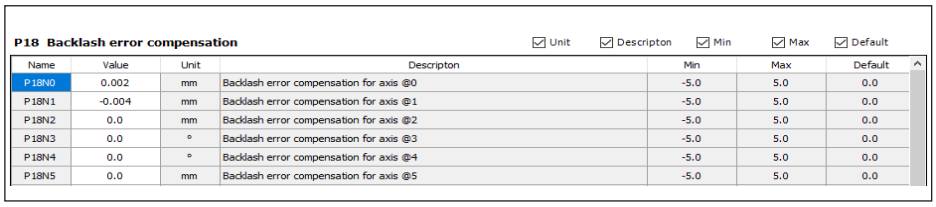
7.3 Axis travel limits ► P17

P17	Axis travel limits			
	Category	Axis characteristics	**Format / Type**	LREAL / 9
	Words	64	**Units**	mm or °
	Min	-9999999.999999	**Max**	9999999.999999
	Default	+/- 999999.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	E7x002 – E7x003 (R)
General	This parameter is used to define the static axes travel limits.			
Description	The values are related to the physical address of the axes.			
	Word N0	**Lower travel limit for axis @0**		
	Word N1	**Upper travel limit for axis @0**		
	Word N2/N3 to Word N62/N63	Identical to N0/N1 for the other axes @1 to @31		
Example				

P17 Axis travel limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P17N0	-580.0	mm	Lower travel limit for axis @0	-9999999.999...	9999999.999999	-999999.0
P17N1	271.55	mm	Upper travel limit for axis @0	-9999999.999...	9999999.999999	999999.0
P17N2	-250.0	mm	Lower travel limit for axis @1	-9999999.999...	9999999.999999	-999999.0
P17N3	250.0	mm	Upper travel limit for axis @1	-9999999.999...	9999999.999999	999999.0
P17N4	0.0	mm	Lower travel limit for axis @2	-9999999.999...	9999999.999999	-999999.0
P17N5	320.0	mm	Upper travel limit for axis @2	-9999999.999...	9999999.999999	999999.0
P17N6	-999999.0	°	Lower travel limit for axis @3	-9999999.999...	9999999.999999	-999999.0
P17N7	999999.0	°	Upper travel limit for axis @3	-9999999.999...	9999999.999999	999999.0
P17N8	-999999.0	°	Lower travel limit for axis @4	-9999999.999...	9999999.999999	-999999.0
P17N9	999999.0	°	Upper travel limit for axis @4	-9999999.999...	9999999.999999	999999.0
P17N10	-999999.0	mm	Lower travel limit for axis @5	-9999999.999...	9999999.999999	-999999.0
P17N11	999999.0	mm	Upper travel limit for axis @5	-9999999.999...	9999999.999999	999999.0

7.4 Backlash error compensation ► P18

P18	Backlash error compensation			
	Category	Axis characteristics	**Format / Type**	LREAL / 9
	Words	32	**Units**	mm or °
	Min	-5.0	**Max**	5.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	N/A
General	Used to correct positioning errors due to backlash.			
Description	The word number gives the physical axis address			
	Word N0 to Word N31	**Backlash error compensation for axis @0 to @31** The values are expressed in the mm for linear axes or degrees for rotary axes. The absolute value contained in a word gives the maximum backlash on the corresponding axis. The sign determines the direction of backlash correction. - Value > 0: Positive correction applied when the axis moves in the positive direction. - Value < 0: Negative correction applied when the axis moves in the positive direction. In principle the sign should be opposite to the homing direction .		
Example				

P18 Backlash error compensation

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P18N0	0.002	mm	Backlash error compensation for axis @0	-5.0	5.0	0.0
P18N1	-0.004	mm	Backlash error compensation for axis @1	-5.0	5.0	0.0
P18N2	0.0	mm	Backlash error compensation for axis @2	-5.0	5.0	0.0
P18N3	0.0	°	Backlash error compensation for axis @3	-5.0	5.0	0.0
P18N4	0.0	°	Backlash error compensation for axis @4	-5.0	5.0	0.0
P18N5	0.0	mm	Backlash error compensation for axis @5	-5.0	5.0	0.0

7.5 In-position window ► P22

<table>
<tr><td rowspan="6">P22</td><td colspan="4">In-position window</td></tr>
<tr><td>Category</td><td>Axis characteristics</td><td>Format / Type</td><td>LREAL / 10</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>mm or °</td></tr>
<tr><td>Min</td><td>0.0</td><td>Max</td><td>65.0</td></tr>
<tr><td>Default</td><td>0.05</td><td>Resolution</td><td>10^{-6}</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">Used to define the following error threshold below which the CNC considers the movement to be finished or the axis stopped.
If an axis exceed this limit when it should be stopped (e.g. Clampable axis) the status NPOS will be shown on the HMI and further movement will be impossible until the axis position returns within the limits.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">The word number gives the physical axis address.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">In-position window for axis @0 to @31
The axis is considered in position when the following error is within + /- the value of the parameter.</td></tr>
<tr><td>Example</td><td colspan="4">
P22 In-position window ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P22N0</td><td>0.05</td><td>mm</td><td>In-position window for axis @0</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
<tr><td>P22N1</td><td>0.05</td><td>mm</td><td>In-position window for axis @1</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
<tr><td>P22N2</td><td>0.05</td><td>mm</td><td>In-position window for axis @2</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
<tr><td>P22N3</td><td>0.05</td><td>°</td><td>In-position window for axis @3</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
<tr><td>P22N4</td><td>0.05</td><td>°</td><td>In-position window for axis @4</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
<tr><td>P22N5</td><td>0.05</td><td>mm</td><td>In-position window for axis @5</td><td>0.0</td><td>65.0</td><td>0.05</td></tr>
</table>
</td></tr>
</table>

7.6 Lubrication pulse distance ► P29

P29	Lubrication pulse distance			
	Category	Axis characteristics	**Format / Type**	LREAL / 10
	Words	32	**Units**	mm or °
	Min	0.0	**Max**	9999999.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	No	**Access via**	N/A
General	Used to define the distance at which the lubrication pulse for the axis guideways is to be output. When the cumulative displacement of an axis will be greater than the value in the parameter P29 the NCK will set the relative bit FlexiumPro_NCK.RCNC.Axis[i].LubricationPulse for **two** PLC cycles and the cumulate distance will be cleared.			
Description	The word number gives the physical axis address.			
	Word N0 to Word N31	**Lubrication pulse distance for axis @0 to @31**		
Example	Axes @ 0 = 1000mm			

P29 Lubrication pulse distance ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P29N0	1000.0	mm	Lubrication pulse distance for axis @0	0.0	9999999.0	0.0
P29N1	0.0	mm	Lubrication pulse distance for axis @1	0.0	9999999.0	0.0
P29N2	0.0	mm	Lubrication pulse distance for axis @2	0.0	9999999.0	0.0
P29N3	0.0	°	Lubrication pulse distance for axis @3	0.0	9999999.0	0.0
P29N4	0.0	°	Lubrication pulse distance for axis @4	0.0	9999999.0	0.0
P29N5	0.0	mm	Lubrication pulse distance for axis @5	0.0	9999999.0	0.0

7.7 Maximum axis traverse rates ► P30

<table>
<tr><td rowspan="6">P30</td><td colspan="4">Maximum axis traverse rates</td></tr>
<tr><td>Category</td><td>Axis characteristics</td><td>Format / Type</td><td>LREAL / 10</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>mm/min or °/min</td></tr>
<tr><td>Min</td><td>0.001</td><td>Max</td><td>99999999.0</td></tr>
<tr><td>Default</td><td>5000.0</td><td>Resolution</td><td>10^{-6}</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>E970xx (R)</td></tr>
<tr><td>General</td><td colspan="4">Used to define the maximum axis traverse rates.</td></tr>
<tr><td>Description</td><td colspan="4">The word number gives the physical axis address.
Word N0
to
Word N31
Maximum traverse rate for axis @0 to @31
Maximum traverse rate for axis @0. This value should be such as not to exceed the maximum rpm of the motor.</td></tr>
<tr><td>Example</td><td colspan="4">• X axis driven by a 6000 rpm motor on a 10 mm pitch ball screw.
• P50 = 2ms – Units mm
• Max speed is 60000 mm/min.
• Distance per scan = 2000 increments /2ms well below the limit of 65000.</td></tr>
</table>

P30 Maximum axis traverse rates ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P30N0	60000.0	mm/min	Maximum traverse rate for axis @0	0.001	99999999.0	5000.0
P30N1	5000.0	mm/min	Maximum traverse rate for axis @1	0.001	99999999.0	5000.0
P30N2	5000.0	mm/min	Maximum traverse rate for axis @2	0.001	99999999.0	5000.0
P30N3	5000.0	°/min	Maximum traverse rate for axis @3	0.001	99999999.0	5000.0
P30N4	5000.0	°/min	Maximum traverse rate for axis @4	0.001	99999999.0	5000.0
P30N5	5000.0	mm/min	Maximum traverse rate for axis @5	0.001	99999999.0	5000.0

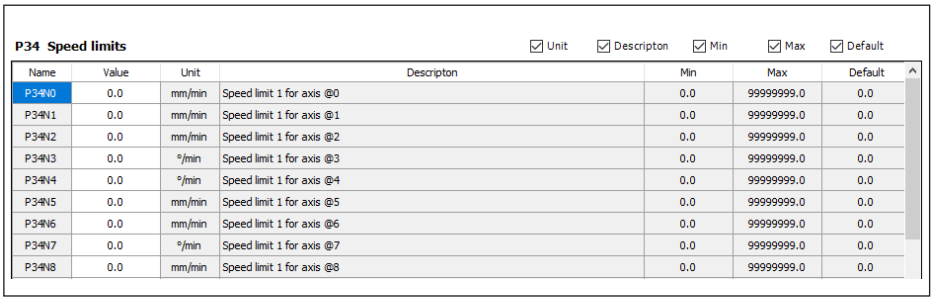
7.8 JOG speeds and default speed limits ► P31

P31	JOG speeds and default speed limits			
	Category	Axis characteristics	**Format / Type**	LREAL / 10
	Words	5	**Units**	mm /min or °/min
	Min	0.1	**Max**	99999999.0
	Default	Word dependent	**Resolution**	10^{-6}
	Immediate	No	**Access via**	N/A
General	Used to defined three different speed in manual mode (speeds selected by the PLC). As well as the limit of speed for the linear and the rotary axis in speed limitation condition (information from the PLC). The data are active for all channels.			
Description				
	Word N0	**Slow JOG speed** Default: 50.0		
	Word N1	**Normal JOG speed** Default: 1000.0		
	Word N2	**Fast JOG speed** Default: 5000.0		
	Word N3	**Default speed limit for all linear axes** Default: 4000.0		
	Word N4	**Default speed limit for all rotary axes** Default: 4000.0		
Example				

P31 JOG speeds and default speed limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P31N0	50.0	mm/min ...	Slow JOG speed	0.1	99999999.0	50.0
P31N1	1000.0	mm/min ...	Normal JOG speed	0.1	99999999.0	1000.0
P31N2	5000.0	mm/min ...	Fast JOG speed	0.1	99999999.0	5000.0
P31N3	4000.0	mm/min	Default speed limit for all linear axes	0.1	99999999.0	4000.0
P31N4	4000.0	°/min	Default speed limit for all rotary axes	0.1	99999999.0	4000.0

7.9 Speed limits ► P34

P34	Speed limits			
	Category	Axis characteristics	**Format / Type**	LREAL / 10
	Words	128	**Units**	mm /min or °/min
	Min	0.0	**Max**	99999999.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	No	**Access via**	E973xx
General	This parameter is used to define up to four speed limits per axis. If the value for an axis is zero then the limit will be the one defined in P31. The choice of a particular limit will be done by the PLC variable *FlexiumPro_NCK.WCNC.Axis[i]. ReducedSpeed*			
Description				
	Word N0 to Word N31	**Speed limit 1 for axis @0 to @31**		
	Word N32 to Word N63	**Speed limit 2 for axis @0 to @31**		
	Word N64 to Word N95	**Speed limit 3 for axis @0 to @31**		
	Word N96 to Word N127	**Speed limit 4 for axis @0 to @31**		
Example				

P34 Speed limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P34N0	0.0	mm/min	Speed limit 1 for axis @0	0.0	99999999.0	0.0
P34N1	0.0	mm/min	Speed limit 1 for axis @1	0.0	99999999.0	0.0
P34N2	0.0	mm/min	Speed limit 1 for axis @2	0.0	99999999.0	0.0
P34N3	0.0	°/min	Speed limit 1 for axis @3	0.0	99999999.0	0.0
P34N4	0.0	°/min	Speed limit 1 for axis @4	0.0	99999999.0	0.0
P34N5	0.0	mm/min	Speed limit 1 for axis @5	0.0	99999999.0	0.0
P34N6	0.0	mm/min	Speed limit 1 for axis @6	0.0	99999999.0	0.0
P34N7	0.0	°/min	Speed limit 1 for axis @7	0.0	99999999.0	0.0
P34N8	0.0	mm/min	Speed limit 1 for axis @8	0.0	99999999.0	0.0

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Summary

8 Axis dynamics 119

8.1 Maximum following error ► P23 120

8.2 Maximum permissible acceleration ► P32 121

8.3 Acceleration profile ► P53 122

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8 Axis dynamics

This set of parameters is used to define the dynamic characteristics of the axes. It should be set before adjusting the axes.

This category contains the following parameters:

P23	Maximum following error
P32	Maximum permissible acceleration
P53	Acceleration profile

8.1 Maximum following error ► P23

<table>
<tr><td rowspan="6">P23</td><td colspan="4">Maximum following error</td></tr>
<tr><td>Category</td><td>Axis dynamics</td><td>Format / Type</td><td>LREAL / 10</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>mm or °</td></tr>
<tr><td>Min</td><td>0.0</td><td>Max</td><td>10000.0</td></tr>
<tr><td>Default</td><td>8.0</td><td>Resolution</td><td>10^{-6}</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">Defines the maximum following error (Lag value) permissible for each axis individually.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">Each word corresponds to the physical address of an axis.
The value is function of the maximum speed and the gain of the axis.
E.g. max speed =8 m/min gain = 2 → Lag at max speed = 8/2 = 4.
With a safety factor of 10%, the value for P23 will be set to 4.4.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Maximum following error for axis @0 to @31
The values are expressed in mm or degrees.
If the value is exceeded, the CNC triggers a machine error 40 to 71 according to the axis in fault.</td></tr>
<tr><td>Example</td><td colspan="4">Default values.
P23 Maximum following error ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P23N0</td><td>8.0</td><td>mm</td><td>Maximum following error for axis @0</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
<tr><td>P23N1</td><td>8.0</td><td>mm</td><td>Maximum following error for axis @1</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
<tr><td>P23N2</td><td>8.0</td><td>mm</td><td>Maximum following error for axis @2</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
<tr><td>P23N3</td><td>8.0</td><td>°</td><td>Maximum following error for axis @3</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
<tr><td>P23N4</td><td>8.0</td><td>°</td><td>Maximum following error for axis @4</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
<tr><td>P23N5</td><td>8.0</td><td>mm</td><td>Maximum following error for axis @5</td><td>0.0</td><td>10000.0</td><td>8.0</td></tr>
</table></td></tr>
</table>

8.2 Maximum permissible acceleration ► P32

P32	**Maximum permissible acceleration**			
	Category	Axis dynamics	**Format / Type**	LREAL / 10
	Words	96	**Units**	mm/s² or °/s²
	Min	0.001	**Max**	240000.0 - 99999999.0
	Default	500.0 - 20000.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	E971xx / E972xx / E907xx (RW)
General	Used to define the maximum permissible accelerations (in work rate and rapid) for each of the axes or each of the spindles.			
Description	The first 32 pairs of word correspond to the physical address of an axis. The following words are related to the spindles. The values are expressed in mm/s² or °/s² .			
	Word N0	**Maximum permissible acceleration at work feed-rate for axis @0** Max: 240000.0, Default: 500.0		
	Word N1	**Maximum permissible acceleration in rapid for axis @0 (DRYRUN, FAST JOG and G0 modes)** Max: 240000.0, Default: 500.0		
	Word N2/N3 **to** **Word N62/N63**	Identical to Word N0/N1 for the other axes.		
	Word N64 **to** **Word N95**	**Maximum permissible acceleration for spindle @0 to @31** The value is function of the speed format: - S5 : Value in °/s² - S6 : Value in 10°/s² - S3.2: Value in .01°/s² Max: 99999999.0, Default: 20000.0		
Example	Default values.			

P32 Maximum permissible acceleration ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P32N0	500.0	mm/s^2	Maximum permissible acceleration at work feed-rate for axis @0	0.001	240000.0	500.0
P32N1	500.0	mm/s^2	Maximum permissible acceleration in rapid for axis @0 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0
P32N2	500.0	mm/s^2	Maximum permissible acceleration at work feed-rate for axis @1	0.001	240000.0	500.0
P32N3	500.0	mm/s^2	Maximum permissible acceleration in rapid for axis @1 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0
P32N4	500.0	mm/s^2	Maximum permissible acceleration at work feed-rate for axis @2	0.001	240000.0	500.0
P32N5	500.0	mm/s^2	Maximum permissible acceleration in rapid for axis @2 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0
P32N6	500.0	°/s^2	Maximum permissible acceleration at work feed-rate for axis @3	0.001	240000.0	500.0
P32N7	500.0	°/s^2	Maximum permissible acceleration in rapid for axis @3 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0
P32N8	500.0	°/s^2	Maximum permissible acceleration at work feed-rate for axis @4	0.001	240000.0	500.0
P32N9	500.0	°/s^2	Maximum permissible acceleration in rapid for axis @4 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0
P32N10	500.0	mm/s^2	Maximum permissible acceleration at work feed-rate for axis @5	0.001	240000.0	500.0
P32N11	500.0	mm/s^2	Maximum permissible acceleration in rapid for axis @5 (DRYRUN, FAST JOG and G0 m…	0.001	240000.0	500.0

P32 Maximum permissible acceleration ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P32N64	20000.0	°/s^2	Maximum permissible acceleration for spindle @0	0.001	99999999.0	20000.0
P32N65	20000.0	°/s^2	Maximum permissible acceleration for spindle @1	0.001	99999999.0	20000.0
P32N66	20000.0	°/s^2	Maximum permissible acceleration for spindle @2	0.001	99999999.0	20000.0
P32N67	20000.0	°/s^2	Maximum permissible acceleration for spindle @3	0.001	99999999.0	20000.0
P32N68	20000.0	°/s^2	Maximum permissible acceleration for spindle @4	0.001	99999999.0	20000.0
P32N69	20000.0	°/s^2	Maximum permissible acceleration for spindle @5	0.001	99999999.0	20000.0

8.3 Acceleration profile ► P53

P53	Acceleration profile			
	Category	Axis dynamics	**Format / Type**	UINT / 5
	Words	96	**Units**	Word dependent
	Min	0	**Max**	Word dependent
	Default	Word dependent	**Resolution**	1
	Immediate	No	**Access via**	E11013, E32006, E32008 (R/W) : see description

General

This parameter defines the type of acceleration profile and sets the corresponding parameters.

FlexiumPro basically handles 4 different types of acceleration.

- Constant acceleration: speed buildup is minimal but the Jerk (derivative of acceleration is very high (theoretically infinite).
- Triangular (Saw-tooth) acceleration: jerk is square but depends of the trajectory – maximum acceleration is available for a very short time therefore speed buildup is long.
- Trapezoidal acceleration: Jerk is still square but its shape is constant. Max acceleration is reached over a longer time giving a shorter speed buildup.
- Parabolic acceleration (trapezoidal jerk). Jerk variation is smoother and its maximum can be slightly higher giving a smoother speed build-up with almost the same performance than trapezoidal acceleration.

Description

Word N0 to N2 applied for channel 1.

Word N0	**Acceleration profile for channel 1 [0=Constant][1=Triangular][2=Trapezoidal or Parabolic]** - This parameter can also be accessed (R/W) via E11013 - [0 = step][1 = triangular][-1 = trapezoidal or parabolic] Max: 2, Default: 0, Units: None
Word N1	**Minimum time to settle speed (N0=1) or time to settle maximum acceleration(N0=2) for channel 1** - This parameter can also be accessed (R/W) via E32006 - Min 0, Max 65535 Default 100, Units ms, Resolution 1ms. Max: 65535, Default: 100, Units: ms
Word N2	**Time to settle jerk (only if N0=2) for channel 1.** Generally set to N1/2 to get a trapezoidal jerk curve. - This parameter can also be accessed (R/W) via E32008 - Min 0, Max 32767, Default 0, Units ms, Resolution 1ms. Max: 32767, Default: 0, Units: ms
Note	The Word N3-N5, N6- N8, N9-N11, N12-N14, N15-N17, N18-N20, N21-N23 and so on identical to Word N0- N2 respectively but relative to the other channels.

Recommendations

The trapezoidal acceleration profile is defined by parameter P53 N2 (assuming N0 = 1 and N1 <> 0.

This jerk profile allows faster speed buildups and stopping, especially for high speeds of movement (e.g. positioning blocks).

It allows a speed buildup profile with gradual acceleration and deceleration especially well-suited to high speed cutting (HSC) by:

- Decreasing mechanical jerks and stresses on the machine
- Decreasing profile errors and synchronization errors.

P53 N2 (or E32008) is adjustable between 0 and (P53 N1) / 2:

- If P53 N2 = 0, the jerk profile is constant by segments, which produces a trapezoidal acceleration.
- If P53 N2 = (P53 N1) / 2, the jerk profile is a saw-tooth, which produces a parabolic acceleration by segments.

It is recommended to set:

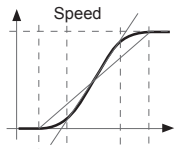
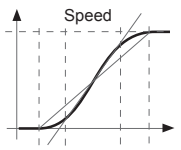
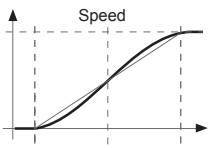
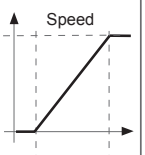
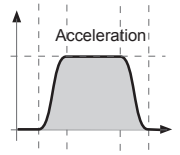
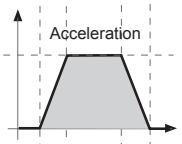
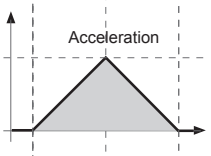
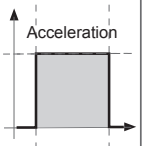
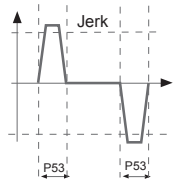
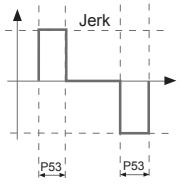
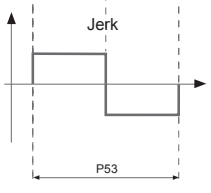
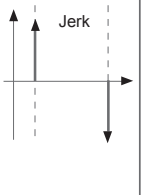
- Parameter P53 N1 to two or three times the position loop time constant (P56), and
- Parameter P53 N2 between (P53 N1) / 3 and (P53 N1) / 2.

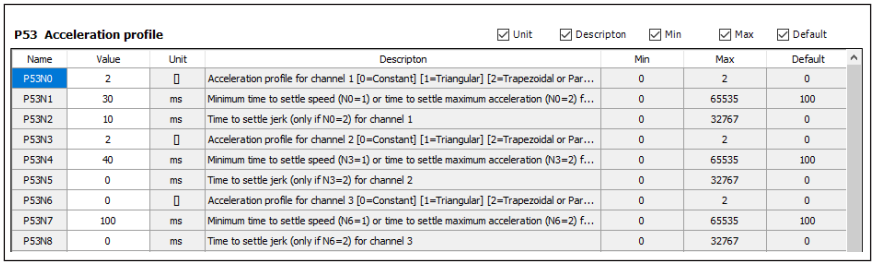
Smoothing the acceleration buildup profile (increasing P53 N1 and N2) increases the speed buildup time.

To reduce the machining time, it is often preferable to increase the maximum acceleration (P32) within the limit of the machine performance rather than increasing the jerk.

Trapezoidal acceleration cannot be used with sequenced thread cutting.

In G38, E11013 is forced to 0. It is necessary to reset E11013 to -1 after thread cutting. In G33, trapezoidal acceleration is cancelled during the cycle, but is resumed automatically at the end.

Word N0	**2**	**2**	**1**	**0**
Word N1	**Z ms**	**Y ms**	**X ms**	**-**
Word N2	**Z/3 ms**	**0**	**-**	**-**
Speed curve				
Acceleration curve				
Jerk Curve				
Role of P53	P53 sets the acceleration buildup time		P53 sets the minimum speed buildup time	P53 is not significant
Acceleration	The maximum acceleration P32 is reached for a long time, giving a short speed buildup time.		The maximum acceleration P32 is reached only for a very short time	The speed buildup time is at minimum level
Calculation of $J_{MAX\ AXE}$	$J_{MAX\ AXIS} = \frac{P32_{AXIS}}{P53 - E32008}$	$J_{MAX\ AXIS} = \frac{P32_{AXIS}}{P53}$	$J_{MAX\ AXIS\ maximum} = \frac{2 \times P32_{AXIS}}{P53}$	–
Type of Jerk	The shape and level of the trapezoidal jerk can be set	The square jerk has a constant level which can be set	The jerk is square but the jerk level varies according to the geometric profile and the speed variations required	The jerk level is very high (theoretically infinite)
Type of machine	HSC	HSC	HSC	Conventional

Example	• Channel 1: Parabolic acceleration – acceleration buildup 30 ms, jerk buildup 10 ms • Channel 2: Trapezoidal acceleration – Acceleration buildup 40 ms • Channel 3: Constant acceleration. 

P53 Acceleration profile

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P53N0	2	[]	Acceleration profile for channel 1 [0=Constant] [1=Triangular] [2=Trapezoidal or Par...	0	2	0
P53N1	30	ms	Minimum time to settle speed (N0=1) or time to settle maximum acceleration (N0=2) f...	0	65535	100
P53N2	10	ms	Time to settle jerk (only if N0=2) for channel 1	0	32767	0
P53N3	2	[]	Acceleration profile for channel 2 [0=Constant] [1=Triangular] [2=Trapezoidal or Par...	0	2	0
P53N4	40	ms	Minimum time to settle speed (N3=1) or time to settle maximum acceleration (N3=2) f...	0	65535	100
P53N5	0	ms	Time to settle jerk (only if N3=2) for channel 2	0	32767	0
P53N6	0	[]	Acceleration profile for channel 3 [0=Constant] [1=Triangular] [2=Trapezoidal or Par...	0	2	0
P53N7	100	ms	Minimum time to settle speed (N6=1) or time to settle maximum acceleration (N6=2) f...	0	65535	100
P53N8	0	ms	Time to settle jerk (only if N6=2) for channel 3	0	32767	0

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Summary

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9.3 Approach speed ► P33 132

9.4 Speed anticipation coefficient – High Speed Cutting: number of filter terms and order of the filter ► P55 133

9.5 Mean filter: number of filter terms and order of the filter ► P118 135

9.6 Channel specific time constant ► P56 136

9.7 Dynamic lag control ► P57 137

9.8 Time constant for axis ► P66 139

9.9 Smart Servo Balance (SSB) function ► P117 140

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9 Performances

This set of parameters is used to adjust the performances of the axes.

This category contains the following parameters:

P19	High Speed Cutting: feed-forward acceleration time constant - dry friction correction time constant
P20	Dry friction correction amplitude
P33	Approach speed
P55	Speed anticipation coefficient - High Speed Cutting: number of filter terms and order of the filter
P118	Mean filter: number of filter terms and order of the filter
P56	Channel specific time constant
P57	Dynamic lag control
P66	Time constant for axis
P117	**SSB function**

9.1 High Speed Cutting: feed-forward acceleration time constant – dry friction correction time constant ► P19

<table>
<tr><td>P19</td><td colspan="4">High Speed Cutting: feed-forward acceleration time constant – dry friction correction time constant
<table>
<tr><td>Category</td><td>Performances</td><td>Format / Type</td><td>UDINT / 4</td></tr>
<tr><td>Words</td><td>64</td><td>Units</td><td>µs</td></tr>
<tr><td>Min</td><td>0</td><td>Max</td><td>Word dependent</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>E981xx, E983xx</td></tr>
</table></td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to set:
- The acceleration anticipation for each axis,
- The dry friction correction time constant for each axis.</td></tr>
<tr><td>Description</td><td colspan="4"></td></tr>
<tr><td></td><td>Word N0
to
Word N31</td><td colspan="3">Feed-forward acceleration time constant for axis @0 to @31
Each word corresponds to the physical address of an axis. The acceleration anticipation is expressed in µs. The order of magnitude is 400 µs.
The speed anticipation corrector "Kv" is set to 100 percent and cannot be modified.
Max: 65535, Default: 4000
These words can also be accessed (RW) via external parameter E981xx.</td></tr>
<tr><td></td><td>Word N32
to
Word N63</td><td colspan="3">Dry friction correction time constant for axis @0 to @31
Each word corresponds to the physical address of an axis. The dry friction correction time constant is expressed in micro-seconds. The order of magnitude is 50000 µs.
Max: 655350, Default: 50000
These words can also be accessed via external parameter E983xx.</td></tr>
<tr><td>Example</td><td colspan="4">Default values.
P19 High Speed Cutting: feed-forward acceleration time constant - dry fricti ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P19N0</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @0</td><td>0</td><td>65535</td><td>4000</td></tr>
<tr><td>P19N1</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @1</td><td>0</td><td>65535</td><td>4000</td></tr>
<tr><td>P19N2</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @2</td><td>0</td><td>65535</td><td>4000</td></tr>
<tr><td>P19N3</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @3</td><td>0</td><td>65535</td><td>4000</td></tr>
<tr><td>P19N4</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @4</td><td>0</td><td>65535</td><td>4000</td></tr>
<tr><td>P19N5</td><td>4000</td><td>µs</td><td>Feed-forward acceleration time constant for axis @5</td><td>0</td><td>65535</td><td>4000</td></tr>
</table>
P19 High Speed Cutting: feed-forward acceleration time constant - dry fricti ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P19N32</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @0</td><td>0</td><td>655350</td><td>50000</td></tr>
<tr><td>P19N33</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @1</td><td>0</td><td>655350</td><td>50000</td></tr>
<tr><td>P19N34</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @2</td><td>0</td><td>655350</td><td>50000</td></tr>
<tr><td>P19N35</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @3</td><td>0</td><td>655350</td><td>50000</td></tr>
<tr><td>P19N36</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @4</td><td>0</td><td>655350</td><td>50000</td></tr>
<tr><td>P19N37</td><td>50000</td><td>µs</td><td>Dry friction correction time constant for axis @5</td><td>0</td><td>655350</td><td>50000</td></tr>
</table></td></tr>
</table>

9.2 Dry friction correction amplitude ► P20

P20	Dry friction correction amplitude			
	Category	Performances	**Format / Type**	LREAL / 10
	Words	32	**Units**	mm or °
	Min	0.0	**Max**	65.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	E982xx
General	This parameter is used to set the amplitude of the pulse generated at each quadrant change in circular interpolation. It is linked to P19.			
Description	The words refer to the physical address of each axis.			
	Word N0 to Word N31	**Dry friction correction amplitude for axis @0 to @31** The order of magnitude is 10 µm. These words can also be accessed (RW) via external parameter E982xx.		
Example	Default values.			

P20 Dry friction correction amplitude ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P20N0	0.0	mm	Dry friction correction amplitude for axis @0	0.0	65.0	0.0
P20N1	0.0	mm	Dry friction correction amplitude for axis @1	0.0	65.0	0.0
P20N2	0.0	mm	Dry friction correction amplitude for axis @2	0.0	65.0	0.0
P20N3	0.0	°	Dry friction correction amplitude for axis @3	0.0	65.0	0.0
P20N4	0.0	°	Dry friction correction amplitude for axis @4	0.0	65.0	0.0
P20N5	0.0	mm	Dry friction correction amplitude for axis @5	0.0	65.0	0.0
P20N6	0.0	mm	Dry friction correction amplitude for axis @6	0.0	65.0	0.0
P20N7	0.0	°	Dry friction correction amplitude for axis @7	0.0	65.0	0.0
P20N8	0.0	mm	Dry friction correction amplitude for axis @8	0.0	65.0	0.0

9.3 Approach speed ► P33

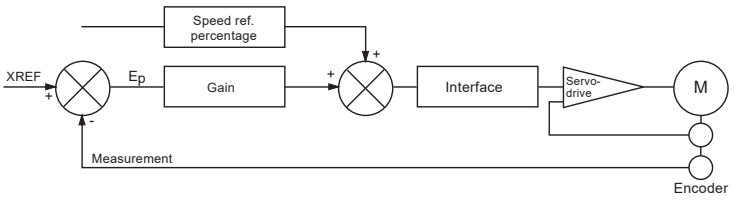
<table>
<tr><td rowspan="6">P33</td><td colspan="4">Approach speed</td></tr>
<tr><td>Category</td><td>Performances</td><td>Format / Type</td><td>LREAL / 10</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>mm /min , ° /min</td></tr>
<tr><td>Min</td><td>0.0</td><td>Max</td><td>99999999.0</td></tr>
<tr><td>Default</td><td>0.0</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>E973xx</td></tr>
<tr><td>General</td><td colspan="4">Specifies the maximum speed variation when passing from one block to another.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">The words refer to the physical address of each axis.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Approach speed for axis @0 to @31
Each word corresponds to the physical address of an axis. The value is expressed in mm/min or in deg/min. The default value is 0.0.
The approach speed is defined by the equation:
P33 = $\gamma * \tau$

where:
- γ is the maximum permissible acceleration in mm/s^2 or deg/s^2 (P32).
- τ is the servo-loop time constant in ms (P56).
If high speed machining is active the value of P33 should be about 9 times smaller.

Warning:
For virtual axis the value 0.0 doesn't enable the automatic computation.</td></tr>
<tr><td>Example</td><td colspan="4">Where γ = 1000 mm/s^2 and τ = 60 ms, we have: P33 = 60 mm/s = 3600 mm/min

P33 Approach speed ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P33N0</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @0</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N1</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @1</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N2</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @2</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N3</td><td>0.0</td><td>°/min</td><td>Approach speed for axis @3</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N4</td><td>0.0</td><td>°/min</td><td>Approach speed for axis @4</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N5</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @5</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N6</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @6</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N7</td><td>0.0</td><td>°/min</td><td>Approach speed for axis @7</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
<tr><td>P33N8</td><td>0.0</td><td>mm/min</td><td>Approach speed for axis @8</td><td>0.0</td><td>99999999.0</td><td>0.0</td></tr>
</table></td></tr>
</table>

9.4 Speed anticipation coefficient – High Speed Cutting: number of filter terms and order of the filter ► P55

<table>
<tr><td rowspan="6">P55</td><td colspan="4">Speed anticipation coefficient – High Speed Cutting: number of filter terms and order of the filter</td></tr>
<tr><td>Category</td><td>Performances</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td>Words</td><td>96</td><td>Units</td><td>%, None</td></tr>
<tr><td>Min</td><td>Word dependent</td><td>Max</td><td>Word dependent</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>E32005, E32062, E11012</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used for High Speed Cutting (HSC). It has three functions:
Define the percentage of the speed reference re-injected in the position servo-loop so that it operates with a small following error, for words N0 to N31,
The number of terms used to calculate the filtered reference for very high speed machining, for each channel.
The definition of the filter order for each channel.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">Each word represents a channel.</td></tr>
<tr><td colspan="4">Word N0
to
Word N31
Speed anticipation percentage for channel 1 to 32
Speed reference correction expressed as a percentage between 0 and 100.
If a value higher than 100 is set in P55, the system will clamp the correction to 100%
If HSC is active the value is internally forced at 100% but the parameter should be set at 0 (to prevent overshoots).
A value of zero has no effect on the system.
Min: 0, Max: 100, Default: 0, Units: %
 
</td></tr>
<tr><td></td><td colspan="4">Word N32
to
Word N63
Number of filter terms for channel 1 to 32
Used when HSC is active.
For high speed machining, a filter smooth the position reference.
This filter averages several consecutive reference values.
Words N32 to N63 define the number of terms of this filter:
A standard value for these words is 5
To enable HSC and Anti Pitch correction these words should have a non-zero value.
These words can be accessed (RW) via parameter E32005.
This parameter can be read and written and retains the last value programmed after a reset.
It can be written if:
- The high-speed machining option is present; otherwise error 4 is declared.
- Anticipation is disabled (E11012 = 0), otherwise error 95 is returned.
Min: 0, Max: 100, Default: 0, Units: None</td></tr>
</table>

	Word N64 to Word N95	**Order of the filter for channel 1 to 32** Min: 1, Max: 3, Default: 1, Units: None
Example	• Channel 1 : speed anticipation 100%, Filter with 5 terms an second order. • Channel 2 : No HSC but speed anticipation 80%.	

P55 Speed anticipation coefficient - High Speed Cutting: number of filter tern ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P55N0	100	%	Speed anticipation percentage for channel 1	0	100	0
P55N1	80	%	Speed anticipation percentage for channel 2	0	100	0
P55N2	0	%	Speed anticipation percentage for channel 3	0	100	0
P55N3	0	%	Speed anticipation percentage for channel 4	0	100	0
P55N4	0	%	Speed anticipation percentage for channel 5	0	100	0

P55 Speed anticipation coefficient - High Speed Cutting: number of filter tern ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P55N32	5	[]	Number of filter terms for channel 1	0	100	0
P55N33	0	[]	Number of filter terms for channel 2	0	100	0
P55N34	0	[]	Number of filter terms for channel 3	0	100	0
P55N35	0	[]	Number of filter terms for channel 4	0	100	0
P55N36	0	[]	Number of filter terms for channel 5	0	100	0

P55 Speed anticipation coefficient - High Speed Cutting: number of filter term ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P55N64	2		Order of the filter for channel 1	1	3	1
P55N65	1		Order of the filter for channel 2	1	3	1
P55N66	1		Order of the filter for channel 3	1	3	1
P55N67	1		Order of the filter for channel 4	1	3	1
P55N68	1		Order of the filter for channel 5	1	3	1

9.5 Mean filter: number of filter terms and order of the filter ► P118

P118	Mean filter: number of filter terms and order of the filter			
	Category	Performances	**Format / Type**	UINT / 5
	Words	64	**Units**	None
	Min	0 - 1	**Max**	100 - 3
	Default	0 - 1	**Resolution**	1
	Immediate	No	**Access via**	E32011, E32063, E11021

General

The parameter P118 is used to define the characteristics of a mean filter available for the following correctors: simple proportional, partial speed feedforward and SSB (Smart Servo Balance also named Tau).

There is only one mean filter for each channel used either by HSC (see parameter P55) or by one (exclusive) of the three correctors mentioned above.

As for HSC, when the mean filter is used by one of the other correctors, it applies to all axes belonging to the channel.

Description

Each word represents a channel.

Word N0 to Word N31	**Number of filter terms for channel 1 to 32** Min: 0, Max: 100, Default: 0

Remarks

Important: for a given channel if both Number of filter terms in P55 and P118 are not null, the priority is given to HSC (P55) for backward compatibility.

Word N32 to Word N63	**Order of the filter for channel 1 to 32** Min: 1, Max: 3, Default: 1

Example

Mean filter: number of terms 7 and order 3

P118 Mean filter: number of filter terms and order of the filter ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P118N0	0	[]	Number of filter terms for channel 1	0	100	0
P118N1	7	[]	Number of filter terms for channel 2	0	100	0
P118N2	0	[]	Number of filter terms for channel 3	0	100	0
P118N3	0	[]	Number of filter terms for channel 4	0	100	0
P118N4	0	[]	Number of filter terms for channel 5	0	100	0

P118 Mean filter: number of filter terms and order of the filter ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P118N32	1	[]	Order of the filter for channel 1	1	3	1
P118N33	3	[]	Order of the filter for channel 2	1	3	1
P118N34	1	[]	Order of the filter for channel 3	1	3	1
P118N35	1	[]	Order of the filter for channel 4	1	3	1
P118N36	1	[]	Order of the filter for channel 5	1	3	1

9.6 Channel specific time constant ► P56

<table>
<tr><td rowspan="6">P56</td><td colspan="4">Channel specific time constant</td></tr>
<tr><td>Category</td><td>Performances</td><td>Format / Type</td><td>UDINT / 4</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>µs</td></tr>
<tr><td>Min</td><td>2000</td><td>Max</td><td>2500000</td></tr>
<tr><td>Default</td><td>60000</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>E41006</td></tr>
<tr><td>General</td><td colspan="4">Defines the position servo-loop time constant.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">Each word corresponds to a channel.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Time constant for channel 1 to 32
- The time constant is defined by the following equation: T = 60000 / Gain (in µs)
- The value is in µs with a basic value of 60000 µm <-> gain of 1.
- This parameter is used for dynamic movement control and speed control at the end of a block.
The value applies for all axes of the channel except for axes where a specific time constant will be defined by P66. If P66 of a particular axis is non zero its value will supersede P56 for this axis channel.</td></tr>
<tr><td>Example</td><td colspan="4">Channel 1: gain of 2 other channels gain of 1
P56 Channel specific time constant ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P56N0</td><td>60000</td><td>µs</td><td>Time constant for channel 1</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N1</td><td>60000</td><td>µs</td><td>Time constant for channel 2</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N2</td><td>60000</td><td>µs</td><td>Time constant for channel 3</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N3</td><td>60000</td><td>µs</td><td>Time constant for channel 4</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N4</td><td>60000</td><td>µs</td><td>Time constant for channel 5</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N5</td><td>60000</td><td>µs</td><td>Time constant for channel 6</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N6</td><td>60000</td><td>µs</td><td>Time constant for channel 7</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N7</td><td>60000</td><td>µs</td><td>Time constant for channel 8</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N8</td><td>60000</td><td>µs</td><td>Time constant for channel 9</td><td>2000</td><td>2500000</td><td>60000</td></tr>
<tr><td>P56N9</td><td>60000</td><td>µs</td><td>Time constant for channel 10</td><td>2000</td><td>2500000</td><td>60000</td></tr>
</table></td></tr>
</table>

9.7 Dynamic lag control ► P57

P57	Dynamic lag control			
	Category	Performances	**Format / Type**	LREAL / 10
	Words	32	**Units**	mm/min, °/min
	Min	0.0	**Max**	99999999.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	N/A

General

This parameter is used to compare the real speed of the axis (deduced from the lag value) versus the theoretical speed. If a deviation is found, the system will generated error 40 to 71 according to the axis considered.

Description

Each word is associated with the axis physical address.

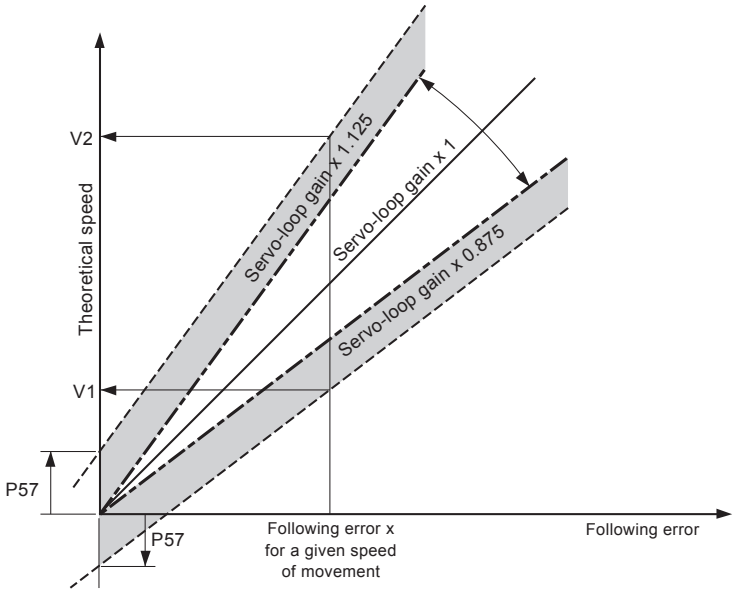
Word N0 to Word N31

Dynamic lag control for axis @0 to @31

For a correct use of the settings of this parameter, the position servo-loop time constants must be accurately specified in parameter P56.

A value of zero in a word disables dynamic control on the corresponding axis.

The system surrounds the theoretical Lag vs Speed curve by two lines whose slope is +/- 12.5 %. If the real following error is out of this surrounding an error will be triggered.



To be efficient the value of P57 must be small enough not to trigger an error in normal conditions.

If errors are triggered too often, verify the settings of P56 and/or P66 matches accurately the gain setting if the machine.

Dynamic movement control can be modified by the ENA function.

A reset (CNC reset) resets the CNC to the state specified by P57.

Example	Control active on axes 0, 1 and 2.

P57 Dynamic lag control

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P57N0	1.0	mm/min	Dynamic lag control for axis @0	0.0	99999999.0	0.0
P57N1	1.0	mm/min	Dynamic lag control for axis @1	0.0	99999999.0	0.0
P57N2	1.0	mm/min	Dynamic lag control for axis @2	0.0	99999999.0	0.0
P57N3	0.0	°/min	Dynamic lag control for axis @3	0.0	99999999.0	0.0
P57N4	0.0	°/min	Dynamic lag control for axis @4	0.0	99999999.0	0.0
P57N5	0.0	mm/min	Dynamic lag control for axis @5	0.0	99999999.0	0.0
P57N6	0.0	mm/min	Dynamic lag control for axis @6	0.0	99999999.0	0.0
P57N7	0.0	°/min	Dynamic lag control for axis @7	0.0	99999999.0	0.0
P57N8	0.0	mm/min	Dynamic lag control for axis @8	0.0	99999999.0	0.0

9.8 Time constant for axis ► P66

P66	Time constant for axis			
	Category	Performances	**Format / Type**	UDINT / 4
	Words	32	**Units**	µs
	Min	0	**Max**	2500000
	Default	0	**Resolution**	1
	Immediate	Yes	**Access via**	N/A
General	Defines the position servo-loop time constant for each axis. If this value is no-zero it will supersede the value given by P56 for this particular axis .			
Description	Each word corresponds to the physical address of an axis.			
	Word N0 to Word N31	**Time constant for axis @0 to @31.** - The time constant is defined by the following equation: T = 60000 / Gain (in µs) - The value is in µs with a basic value of 60000 µm <-> gain of 1 - This parameter is used for dynamic movement control and speed control at the end of a block.		
Example	Axis 2: Gain of 1, other axes will get the gain defined in the channel.			

P66 Time constant for axis ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P66N0	0	µs	Time constant for axis @0	0	2500000	0
P66N1	0	µs	Time constant for axis @1	0	2500000	0
P66N2	60000	µs	Time constant for axis @2	0	2500000	0
P66N3	0	µs	Time constant for axis @3	0	2500000	0
P66N4	0	µs	Time constant for axis @4	0	2500000	0
P66N5	0	µs	Time constant for axis @5	0	2500000	0
P66N6	0	µs	Time constant for axis @6	0	2500000	0
P66N7	0	µs	Time constant for axis @7	0	2500000	0
P66N8	0	µs	Time constant for axis @8	0	2500000	0
P66N9	0	µs	Time constant for axis @9	0	2500000	0
P66N10	0	µs	Time constant for axis @10	0	2500000	0
P66N11	0	µs	Time constant for axis @11	0	2500000	0
P66N12	0	µs	Time constant for axis @12	0	2500000	0
P66N13	0	µs	Time constant for axis @13	0	2500000	0
P66N14	0	µs	Time constant for axis @14	0	2500000	0
P66N15	0	µs	Time constant for axis @15	0	2500000	0
P66N16	0	µs	Time constant for axis @16	0	2500000	0

P117	SSB function			
	Category	Performances	**Format / Type**	UINT / 5
	Words	96	**Units**	µs
	Min	2000 - 0	**Max**	2500000 - 65535
	Default	2000 - 0	**Resolution**	1
	Immediate	No	**Access via**	E98600 to E98631 (N0-31) E98632 to E98663 (N32-63) E92300 to E92331 (N64-95)
General	This parameter is used to set the SSB function, activation dependent on the parameter P120N12			
Description				
	Word N0 to Word N31	**Anticipation time constant for axis @0 to @31** Min: 2000, Max: 2500000, Default: 2000		
	Word N32 to Word N63	**Delay time constant for axis @0 to @31** Min: 2000, Max: 2500000, Default: 2000		
	Word N64 to Word N95	**Acceleration anticipation time constant for axis @0 to @31** Min: 0, Max: 65535, Default: 0		
Example				

P117 SSB function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P117N0	2000	µs	Anticipation time constant for axis @0	2000	2500000	2000
P117N1	2000	µs	Anticipation time constant for axis @1	2000	2500000	2000
P117N2	2000	µs	Anticipation time constant for axis @2	2000	2500000	2000
P117N3	2000	µs	Anticipation time constant for axis @3	2000	2500000	2000
P117N4	2000	µs	Anticipation time constant for axis @4	2000	2500000	2000
P117N5	2000	µs	Anticipation time constant for axis @5	2000	2500000	2000

P117 SSB function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P117N32	2000	µs	Delay time constant for axis @0	2000	2500000	2000
P117N33	2000	µs	Delay time constant for axis @1	2000	2500000	2000
P117N34	2000	µs	Delay time constant for axis @2	2000	2500000	2000
P117N35	2000	µs	Delay time constant for axis @3	2000	2500000	2000
P117N36	2000	µs	Delay time constant for axis @4	2000	2500000	2000
P117N37	2000	µs	Delay time constant for axis @5	2000	2500000	2000

P117 SSB function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P117N64	0	µs	Acceleration anticipation time constant for axis @0	0	65535	0
P117N65	0	µs	Acceleration anticipation time constant for axis @1	0	65535	0
P117N66	0	µs	Acceleration anticipation time constant for axis @2	0	65535	0
P117N67	0	µs	Acceleration anticipation time constant for axis @3	0	65535	0
P117N68	0	µs	Acceleration anticipation time constant for axis @4	0	65535	0
P117N69	0	µs	Acceleration anticipation time constant for axis @5	0	65535	0

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Summary

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10 Spindle characteristics

This series of parameters groups the spindle characteristics. The different words always relate to the spindle Physical Address.

This category contains the following parameters:

P40	Number of sensor spindle pulses by revolution
P41	Spindle reference reversal
P42	Spindle origins
P43	Spindle indexing speed and speed limits
P44	Spindle indexing in-position window
P45	Spindle indexing gain
P46	Speed range and max speed for spindles @0 ... @7
P47	Speed range and max speed for spindles @8 ... @15
P48	Speed range and max speed for spindles @16 ... @23
P49	Speed range and max speed for spindles @24 ... @31

10.1 Number of sensor spindle pulses by revolution ► P40

P40	Number of sensor spindle pulses by revolution			
	Category	Spindle characteristics	**Format / Type**	UDINT / 4
	Words	32	**Units**	None
	Min	0	**Max**	8388608 (2^{23})
	Default	8000	**Resolution**	1
	Immediate	Yes	**Access via**	E90432, .., E90463

General

This parameter is used to define the number of measurement counts given by the spindle sensor, taking into account a multiplier of 4 for compatibility with TTL encoders.

The internal units for spindle measurement depend on the entered values.

The system automatically determines the spindle modulo (number of measurement units per revolution). The spindle modulo is the power of two just above or equal to the number of increments per encoder revolution.

The spindle modulo cannot be less than 4096.

In case of spindle and C axis switching this parameter defines the required spindle resolution (as the real precision comes form the C axis measurement unit).

Description

The words refer to the physical address of each spindle.

Word N0 to Word N31	**Number of sensor pulses for spindle @0 to @31.**

Example

- Spindle @ 0 : J sensor (128 periods per revolutions if V306 / V307 = 1/1)
- Spindle @1 : TTL encoder 2500 counts/rev

Internal measurement

- Spindle @ 0 360/4096° Minimal value
- Spindle@ 1 360/16384° 16384 is the power of two immediately higher than 10000.

P40 Number of sensor spindle pulses by revolution ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P40N0	512	[]	Number of sensor pulses for spindle @0	0	8388608	8000
P40N1	10000	[]	Number of sensor pulses for spindle @1	0	8388608	8000
P40N2	8000	[]	Number of sensor pulses for spindle @2	0	8388608	8000
P40N3	8000	[]	Number of sensor pulses for spindle @3	0	8388608	8000
P40N4	8000	[]	Number of sensor pulses for spindle @4	0	8388608	8000
P40N5	8000	[]	Number of sensor pulses for spindle @5	0	8388608	8000
P40N6	8000	[]	Number of sensor pulses for spindle @6	0	8388608	8000

10.2 Spindle reference reversal ► P41

P41	Spindle reference reversal			
	Category	Spindle characteristics	**Format / Type**	BYTE / 0
	Words	32	**Units**	None
	Min	0	**Max**	FF
	Default	0	**Resolution**	N/A
	Immediate	Yes	**Access via**	N/A

General

This parameter is used to define the spindle direction according to the range selected to take into account the possibility of reversing the direction in some range.

Description

Each word corresponds to a spindle address 0 to 31.

Only bit 0 to 5 of each word are significant. The bits of each word are addressable by spindle ranges M40 to M45.

b7	b6	b5	b4	b3	b2	b1	b0

word N_

The bit is set to 1 to indicate that the spindle reference is reversed in that particular range.

Word N0 to Word N31	**Reference reversal for spindle @0 to @31**

Example

Spindle @0 : Direction reversed in range M44 : Value of N0 = 10h

N0 Reference reversal for spindle @0

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Bit	Value	Descripton	Default
0	☐	Speed range M40	☐
1	☐	Speed range M41	☐
2	☐	Speed range M42	☐
3	☐	Speed range M43	☐
4	☑	Speed range M44	☐
5	☐	Speed range M45	☐
6	☐	Not used	☐
7	☐	Not used	☐

10.3 Spindle origins ► P42

P42	Spindle origins			
	Category	Spindle characteristics	**Format / Type**	UDINT / 4
	Words	32	**Units**	Internal spindle Units
	Min	0	**Max**	999999999
	Default	0	**Resolution**	1
	Immediate	Yes	**Access via**	N/A
General	This parameter defines the spindle origin in **Internal spindle Units** (see P40).			
Description	The words relate to the spindle physical address.			
	Word N0 to Word N31	**Origin position for spindle @0 to @31.** Value of the spindle position effective on the zero sensor encountered during the first revolution.		
Example	Spindle @ 0 has 4096 internal counts – value 2048 sets the origin at 180°			

P42 Spindle origins

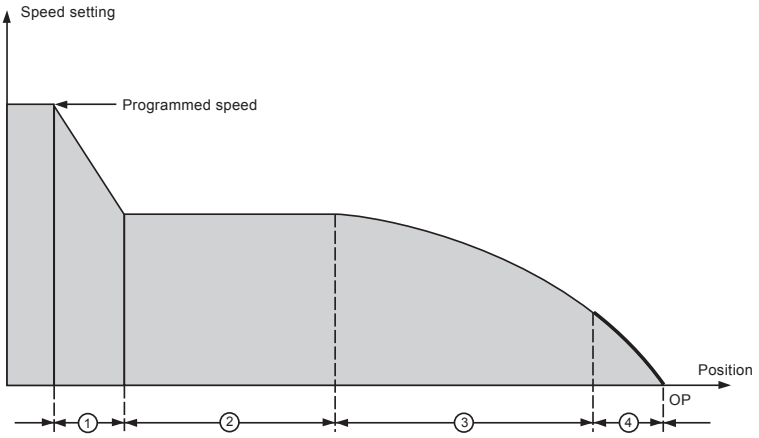
☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P42N0	2048	IU	Origin position for spindle @0	0	99999999	0
P42N1	0	IU	Origin position for spindle @1	0	99999999	0
P42N2	0	IU	Origin position for spindle @2	0	99999999	0
P42N3	0	IU	Origin position for spindle @3	0	99999999	0
P42N4	0	IU	Origin position for spindle @4	0	99999999	0
P42N5	0	IU	Origin position for spindle @5	0	99999999	0

10.4 Spindle indexing speed and speed limits ► P43

<table>
<tr><td rowspan="6">P43</td><td colspan="4">Spindle indexing speed and speed limits</td></tr>
<tr><td>Category</td><td>Spindle characteristics</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td>Words</td><td>192</td><td>Units</td><td>Rpm (see description)</td></tr>
<tr><td>Min</td><td>1</td><td>Max</td><td>65535</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>E90600 to E90631</td></tr>
<tr><td>General</td><td colspan="4">This parameter defines two types of spindle limit speeds:
- Limit speed for indexing.
- Speed limitation.
N0-N31 Speed for indexing
N32-N63 Speed limit1
N64-N95 Speed limit2
N96-N127 Speed limit3
N128-N159 Speed limit4
N160-N191 Jog speed</td></tr>
<tr><td>Description</td><td colspan="4">The words are related to the spindle physical address. The speed unit depends about the spindle speed programming format.
<table><tr><th>Format</th><th>Unit</th><th>Max speed</th></tr><tr><td>S3.2</td><td>Rpm/100</td><td>655.35</td></tr><tr><td>S5.0</td><td>Rpm</td><td>65535</td></tr><tr><td>S6.0</td><td>Rpm*10</td><td>655350</td></tr></table></td></tr>
</table>

Description	**Word N0** **to** **Word N31**	**Indexing speed for spindle @0 to @31** Default: 200 This chart illustrates the indexing most commonly used : at controlled deceleration.



Indexing at constant deceleration :

(1) The speed reference decreases along the deceleration slope (parameter P32) up to the limit speed.

(2) The speed reference remains equal to the limit speed:
- Until arriving in the deceleration region (if the *AckMFunction = 1*), and
- As long as the PLC flag *AckMFunction = 0*.

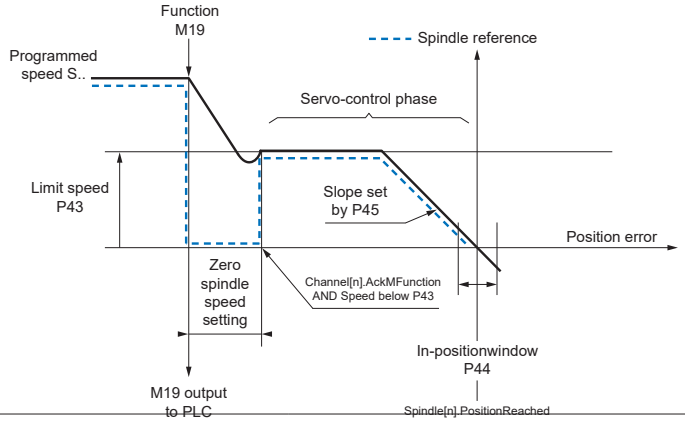
(3) The speed reference decreases to the indexing point along a deceleration slope with constant "gamma". This limit speed should be low enough so that the spindle can stop in less than 1/2 turn.

(4) The servo-control gain is constant up to the indexing point.
NB: For a good management of M19 it is necessary to manage the PLC flag *EndExtMovement* and keep it clear until the spindle is in position.

Phases (3) and (4) are normally carried out within one spindle revolution.

For light spindles it is possible to use an other algorithm slightly quicker but that could result in some shocks as the initial phase is conducted without controlled deceleration.

This algorithm is maintained mostly for compatibilty and is alsmost not used anymore on machines. See picture below.



Description	**Word N32 to Word N63**	**Speed limit 1 for spindle @0 to @31** It is possible to limit the spindle speed under certain conditions. This is triggered by the PLC variable *Flexium_NCK.WCNC.Axis[0..31]. SpeedLimit*. They are up to four possible limits. Word N32 and following to N63 define the speed limit 1. Default: 1
	Word N64 to Word N95	**Speed limit 2 for spindle @0 to @31** Identical to words N32 to N63 but for the speed limit 2
	Word N96 to Word N127	**Speed limit 3 for spindle @0 to @31** Identical to words N32 to N63 but for the speed limit 3
	Word N128 to Word N159	**Speed limit 4 for spindle @0 to @31** Identical to words N32 to N63 but for the speed limit 4
	Word N160 to Word N191	**JOG speed for spindle @0 to @31** Default: 50
Example	Indexing speed for spindle	

P43 Spindle indexing speed and speed limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P43N0	200	Rpm	Indexing speed for spindle @0	1	65535	200
P43N1	200	Rpm	Indexing speed for spindle @1	1	65535	200
P43N2	200	Rpm	Indexing speed for spindle @2	1	65535	200
P43N3	200	Rpm	Indexing speed for spindle @3	1	65535	200
P43N4	200	Rpm	Indexing speed for spindle @4	1	65535	200
P43N5	200	Rpm	Indexing speed for spindle @5	1	65535	200

Speed limit for spindle

P43 Spindle indexing speed and speed limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P43N32	1	Rpm	Speed limit 1 for spindle @0	1	65535	1
P43N33	1	Rpm	Speed limit 1 for spindle @1	1	65535	1
P43N34	1	Rpm	Speed limit 1 for spindle @2	1	65535	1
P43N35	1	Rpm	Speed limit 1 for spindle @3	1	65535	1
P43N36	1	Rpm	Speed limit 1 for spindle @4	1	65535	1
P43N37	1	Rpm	Speed limit 1 for spindle @5	1	65535	1

JOG speed for spindle

P43 Spindle indexing speed and speed limits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P43N160	50	Rpm	JOG speed for spindle @0	1	65535	50
P43N161	50	Rpm	JOG speed for spindle @1	1	65535	50
P43N162	50	Rpm	JOG speed for spindle @2	1	65535	50
P43N163	50	Rpm	JOG speed for spindle @3	1	65535	50
P43N164	50	Rpm	JOG speed for spindle @4	1	65535	50
P43N165	50	Rpm	JOG speed for spindle @5	1	65535	50

10.5 Spindle indexing in-position window ► P44

P44	**Spindle indexing in-position window**			
	Category	Spindle characteristics	**Format / Type**	UINT / 5
	Words	32	**Units**	360° = 65535
	Min	1	**Max**	16384
	Default	183	**Resolution**	1
	Immediate	Yes	**Access via**	E90632 to E90663
General	Defines the spindle servo-loop accuracy for spindles.			
Description	The values are expressed in 1/65535 of a turn. They related to the spindle physical address.			
	Word N0 to Word N31	**In-position window in indexing for spindle @0 to @31.**		
Example	With default values			

P44 Spindle indexing in-position window ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P44N0	183	IU	In-position window in indexing for spindle @0	1	16384	183
P44N1	183	IU	In-position window in indexing for spindle @1	1	16384	183
P44N2	183	IU	In-position window in indexing for spindle @2	1	16384	183
P44N3	183	IU	In-position window in indexing for spindle @3	1	16384	183
P44N4	183	IU	In-position window in indexing for spindle @4	1	16384	183
P44N5	183	IU	In-position window in indexing for spindle @5	1	16384	183

10.6 Spindle indexing gain ► P45

P45	Spindle indexing gain			
	Category	Spindle characteristics	**Format / Type**	UINT / 5
	Words	32	**Units**	1/min
	Min	1	**Max**	65535
	Default	1000	**Resolution**	1
	Immediate	Yes	**Access via**	E90664 to E90695
General	Define the spindle indexing gain (value x 1000).			
Description	The words are related to the spindle physical address.			
	Word N0 to Word N31	**Indexing gain for spindle @0 to @31** Please refer to the P43N0 drawing in the previuos pages.		
Example	With default values			

P45 Spindle indexing gain ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P45N0	1000	1/min	Indexing gain for spindle @0	1	65535	1000
P45N1	1000	1/min	Indexing gain for spindle @1	1	65535	1000
P45N2	1000	1/min	Indexing gain for spindle @2	1	65535	1000
P45N3	1000	1/min	Indexing gain for spindle @3	1	65535	1000
P45N4	1000	1/min	Indexing gain for spindle @4	1	65535	1000
P45N5	1000	1/min	Indexing gain for spindle @5	1	65535	1000

10.7 Speed range for spindles @0 ... @7 ► P46

<table>
<tr><td>P46</td><td colspan="4">Speed range for spindles @0 ... @7</td></tr>
<tr><td></td><td>Category</td><td>Spindle characteristics</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td></td><td>Words</td><td>144</td><td>Units</td><td>Rpm (see description)</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>65535</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>1</td></tr>
<tr><td></td><td>Immediate</td><td>Yes</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to define the limits of each programmed range as well as the maximum speed in each range.
It is used to calculate the range to select according to the speed (the search direction is defined in parameter P7). It is also used to verify that range and speed are compatible is expressly programmed.
The max of the range is used to compute the reference sent to the drive whereas the limit will clamp the value.</td></tr>
<tr><td>Description</td><td colspan="4">The speed unit depends about the speed programming format:
<table><tr><th>Format</th><th>Unit</th><th>Max speed</th></tr><tr><td>S3.2</td><td>Rpm/100</td><td>655.35</td></tr><tr><td>S5.0</td><td>Rpm</td><td>65535</td></tr><tr><td>S6.0</td><td>Rpm*10</td><td>655350</td></tr></table></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Min speed of range M40 for spindle @0.</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Max speed of range M40 for spindle @0.
This is the theoretical spindle speed when the motor is running at its maximum rpm.</td></tr>
<tr><td></td><td>Word N12</td><td colspan="3">Limit speed of range M40 for spindle @0.
If zero the limit speed is the max speed of the range.</td></tr>
<tr><td></td><td>Word xxx</td><td colspan="3">N2, N3, N13 : Identical for spindle @0 in M41
N4, N5, N14 : Identical for spindle @0 in M42
N6, N7, N15 : Identical for spindle @0 in M43
N8, N9, N16 : Identical for spindle @0 in M44
N10, N11, N17 : Identical for spindle @0 in M45

N18, N19, N30 : Identical for spindle @1 in M40
N20, N21, N31 : Identical for spindle @1 in M41
N22, N23, N32 : Identical for spindle @1 in M42
N24, N25, N33 : Identical for spindle @1 in M43
N26, N27, N34 : Identical for spindle @1 in M44
N28, N29, N35 : Identical for spindle @1 in M45</td></tr>
</table>

Description	**Word xxx**	**N36, N37, N48** : Identical for spindle @2 in M40 **N38, N39, N49** : Identical for spindle @2 in M41 **N40, N41, N50** : Identical for spindle @2 in M42 **N42, N43, N51** : Identical for spindle @2 in M43 **N44, N45, N52** : Identical for spindle @2 in M44 **N46, N47, N53** : Identical for spindle @2 in M45 **N54, N55, N66** : Identical for spindle @3 in M40 **N56, N57, N67** : Identical for spindle @3 in M41 **N58, N59, N68** : Identical for spindle @3 in M42 **N60, N61, N69** : Identical for spindle @3 in M43 **N62, N63, N70** : Identical for spindle @3 in M44 **N64, N65, N71** : Identical for spindle @3 in M45 **N72, N73, N84** : Identical for spindle @4 in M40 **N74, N75, N85** : Identical for spindle @4 in M41 **N76, N77, N86** : Identical for spindle @4 in M42 **N78, N79, N87** : Identical for spindle @4 in M43 **N80, N81, N88** : Identical for spindle @4 in M44 **N82, N83, N89** : Identical for spindle @4 in M45 **N90, N91, N102** : Identical for spindle @5 in M40 **N92, N93, N103** : Identical for spindle @5 in M41 **N94, N95, N104** : Identical for spindle @5 in M42 **N96, N97, N105** : Identical for spindle @5 in M43 **N98, N99, N106** : Identical for spindle @5 in M44 **N100, N101, N107** : Identical for spindle @5 in M45 **N108, N109, N120** : Identical for spindle @6 in M40 **N110, N111, N121** : Identical for spindle @6 in M41 **N112, N113, N122** : Identical for spindle @6 in M42 **N114, N115, N123** : Identical for spindle @6 in M43 **N116, N117, N124** : Identical for spindle @6 in M44 **N118, N118, N125** : Identical for spindle @6 in M45 **N126, N127, N138** : Identical for spindle @7 in M40 **N128, N129, N139** : Identical for spindle @7 in M41 **N130, N131, N140** : Identical for spindle @7 in M42 **N132, N133, N141** : Identical for spindle @7 in M43 **N134, N135, N142** : Identical for spindle @7 in M44 **N136, N137, N143** : Identical for spindle @7 in M45

Example

- Spindle @ 0
- Range M40 : 5 to 500 – Limit 500
- Range M41 : 100 to 6000 – Limit 4000

P46 Speed range for spindles @0 ... @7

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P46N0	5	Rpm	Min speed of range M40 for spindle @0	0	65535	0
P46N1	500	Rpm	Max speed of range M40 for spindle @0	0	65535	6000
P46N2	100	Rpm	Min speed of range M41 for spindle @0	0	65535	0
P46N3	6000	Rpm	Max speed of range M41 for spindle @0	0	65535	0
P46N4	0	Rpm	Min speed of range M42 for spindle @0	0	65535	0
P46N5	0	Rpm	Max speed of range M42 for spindle @0	0	65535	0
P46N6	0	Rpm	Min speed of range M43 for spindle @0	0	65535	0
P46N7	0	Rpm	Max speed of range M43 for spindle @0	0	65535	0
P46N8	0	Rpm	Min speed of range M44 for spindle @0	0	65535	0
P46N9	0	Rpm	Max speed of range M44 for spindle @0	0	65535	0
P46N10	0	Rpm	Min speed of range M45 for spindle @0	0	65535	0
P46N11	0	Rpm	Max speed of range M45 for spindle @0	0	65535	0
P46N12	500	Rpm	Limit speed of range M40 for spindle @0	0	65535	0
P46N13	4000	Rpm	Limit speed of range M41 for spindle @0	0	65535	0
P46N14	0	Rpm	Limit speed of range M42 for spindle @0	0	65535	0
P46N15	0	Rpm	Limit speed of range M43 for spindle @0	0	65535	0
P46N16	0	Rpm	Limit speed of range M44 for spindle @0	0	65535	0
P46N17	0	Rpm	Limit speed of range M45 for spindle @0	0	65535	0

10.8 Speed range for spindles @8 ... @15 ► P47

P47	Speed range for spindles @8 ... @15			
	Category	Spindle characteristics	**Format / Type**	UINT / 5
	Words	144	**Units**	Rpm (see description)
	Min	0	**Max**	65535
	Default	0	**Resolution**	1
	Immediate	Yes	**Access via**	N/A

General

This parameter is identical to P46 except that it concerns spindles @8 to @15.

This parameter is used to define the limits of each programmed range as well as the maximum speed in each range.

It is used to calculate the range to select according to the speed (the search direction is defined in parameter P7). It is also used to verify that range and speed are compatible is expressly programmed.

The max of the range is used to compute the reference sent to the drive whereas the limit will clamp the value.

Description

The speed unit depends about the speed programming format:

Format	Unit	Max speed
S3.2	Rpm/100	655.35
S5.0	Rpm	65535
S6.0	Rpm*10	655350

Word N0	**Min speed of range M40 for spindle @8**
Word N1	**Max speed of range M40 for spindle @8** This is the theoretical spindle speed when the motor is running at its maximum rpm.
Word N12	**Limit speed of range M40 for spindle @8** If Zero the limit speed is the max speed of the range.
Word xxx	**N2, N3, N13** : Identical for spindle @8 in M41 **N4, N5, N14** : Identical for spindle @8 in M42 **N6, N7, N15** : Identical for spindle @8 in M43 **N8, N9, N16** : Identical for spindle @8 in M44 **N10, N11, N17** : Identical for spindle @8 in M45 **N18, N19, N30** : Identical for spindle @9 in M40 **N20, N21, N31** : Identical for spindle @9 in M41 **N22, N23, N32** : Identical for spindle @9 in M42 **N24, N25, N33** : Identical for spindle @9 in M43 **N26, N27, N34** : Identical for spindle @9 in M44 **N28, N29, N35** : Identical for spindle @9 in M45

Description	**Word xxx**	**N36, N37, N48** : Identical for spindle @10 in M40 **N38, N39, N49** : Identical for spindle @10 in M41 **N40, N41, N50** : Identical for spindle @10 in M42 **N42, N43, N51** : Identical for spindle @10 in M43 **N44, N45, N52** : Identical for spindle @10 in M44 **N46, N47, N53** : Identical for spindle @10 in M45 **N54, N55, N66** : Identical for spindle @11 in M40 **N56, N57, N67** : Identical for spindle @11 in M41 **N58, N59, N68** : Identical for spindle @11 in M42 **N60, N61, N69** : Identical for spindle @11 in M43 **N62, N63, N70** : Identical for spindle @11 in M44 **N64, N65, N71** : Identical for spindle @11 in M45 **N72, N73, N84** : Identical for spindle @12 in M40 **N74, N75, N85** : Identical for spindle @12 in M41 **N76, N77, N86** : Identical for spindle @12 in M42 **N78, N79, N87** : Identical for spindle @12 in M43 **N80, N81, N88** : Identical for spindle @12 in M44 **N82, N83, N89** : Identical for spindle @12 in M45 **N90, N91, N102** : Identical for spindle @13 in M40 **N92, N93, N103** : Identical for spindle @13 in M41 **N94, N95, N104** : Identical for spindle @13 in M42 **N96, N97, N105** : Identical for spindle @13 in M43 **N98, N99, N106** : Identical for spindle @13 in M44 **N100, N101, N107** : Identical for spindle @13 in M45 **N108, N109, N120** : Identical for spindle @14 in M40 **N110, N111, N121** : Identical for spindle @14 in M41 **N112, N113, N122** : Identical for spindle @14 in M42 **N114, N115, N123** : Identical for spindle @14 in M43 **N116, N117, N124** : Identical for spindle @14 in M44 **N118, N118, N125** : Identical for spindle @14 in M45 **N126, N127, N138** : Identical for spindle @15 in M40 **N128, N129, N139** : Identical for spindle @15 in M41 **N130, N131, N140** : Identical for spindle @15 in M42 **N132, N133, N141** : Identical for spindle @15 in M43 **N134, N135, N142** : Identical for spindle @15 in M44 **N136, N137, N143** : Identical for spindle @15 in M45

10.9 Speed range for spindles @16 ... @23 ► P48

<table>
<tr><td>P48</td><td colspan="4">Speed range for spindles @16 ... @23</td></tr>
<tr><td></td><td>Category</td><td>Spindle characteristics</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td></td><td>Words</td><td>144</td><td>Units</td><td>Rpm (see description)</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>65535</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>1</td></tr>
<tr><td></td><td>Immediate</td><td>Yes</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is identical to P46 except that it concerns spindles @16 to @23
This parameter is used to define the limits of each programmed range as well as the maximum speed in each range.
It is used to calculate the range to select according to the speed (the search direction is defined in parameter P7). It is also used to verify that range and speed are compatible is expressly programmed.
The max of the range is used to compute the reference sent to the drive whereas the limit will clamp the value.</td></tr>
<tr><td>Description</td><td colspan="4">The speed unit depends about the speed programming format:
<table><tr><th>Format</th><th>Unit</th><th>Max speed</th></tr><tr><td>S3.2</td><td>Rpm/100</td><td>655.35</td></tr><tr><td>S5.0</td><td>Rpm</td><td>65535</td></tr><tr><td>S6.0</td><td>Rpm*10</td><td>655350</td></tr></table></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Min speed of range M40 for spindle @16</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Max speed of range M40 for spindle @16
This is the theoretical spindle speed when the motor is running at its maximum rpm.</td></tr>
<tr><td></td><td>Word N12</td><td colspan="3">Limit speed of range M40 for spindle @16
If Zero the limit speed is the max speed of the range.</td></tr>
<tr><td></td><td>Word xxx</td><td colspan="3">N2, N3, N13 : Identical for spindle @16 in M41
N4, N5, N14 : Identical for spindle @16 in M42
N6, N7, N15 : Identical for spindle @16 in M43
N8, N9, N16 : Identical for spindle @16 in M44
N10, N11, N17 : Identical for spindle @16 in M45

N18, N19, N30 : Identical for spindle @17 in M40
N20, N21, N31 : Identical for spindle @17 in M41
N22, N23, N32 : Identical for spindle @17 in M42
N24, N25, N33 : Identical for spindle @17 in M43
N26, N27, N34 : Identical for spindle @17 in M44
N28, N29, N35 : Identical for spindle @17 in M45</td></tr>
</table>

Description	**Word xxx**	**N36, N37, N48** : Identical for spindle @18 in M40 **N38, N39, N49** : Identical for spindle @18 in M41 **N40, N41, N50** : Identical for spindle @18 in M42 **N42, N43, N51** : Identical for spindle @18 in M43 **N44, N45, N52** : Identical for spindle @18 in M44 **N46, N47, N53** : Identical for spindle @18 in M45 **N54, N55, N66** : Identical for spindle @19 in M40 **N56, N57, N67** : Identical for spindle @19 in M41 **N58, N59, N68** : Identical for spindle @19 in M42 **N60, N61, N69** : Identical for spindle @19 in M43 **N62, N63, N70** : Identical for spindle @19 in M44 **N64, N65, N71** : Identical for spindle @19 in M45 **N72, N73, N84** : Identical for spindle @20 in M40 **N74, N75, N85** : Identical for spindle @20 in M41 **N76, N77, N86** : Identical for spindle @20 in M42 **N78, N79, N87** : Identical for spindle @20 in M43 **N80, N81, N88** : Identical for spindle @20 in M44 **N82, N83, N89** : Identical for spindle @20 in M45 **N90, N91, N102** : Identical for spindle @21 in M40 **N92, N93, N103** : Identical for spindle @21 in M41 **N94, N95, N104** : Identical for spindle @21 in M42 **N96, N97, N105** : Identical for spindle @21 in M43 **N98, N99, N106** : Identical for spindle @21 in M44 **N100, N101, N107** : Identical for spindle @21 in M45 **N108, N109, N120** : Identical for spindle @22 in M40 **N110, N111, N121** : Identical for spindle @22 in M41 **N112, N113, N122** : Identical for spindle @22 in M42 **N114, N115, N123** : Identical for spindle @22 in M43 **N116, N117, N124** : Identical for spindle @22 in M44 **N118, N118, N125** : Identical for spindle @22 in M45 **N126, N127, N138** : Identical for spindle @23 in M40 **N128, N129, N139** : Identical for spindle @23 in M41 **N130, N131, N140** : Identical for spindle @23 in M42 **N132, N133, N141** : Identical for spindle @23 in M43 **N134, N135, N142** : Identical for spindle @23 in M44 **N136, N137, N143** : Identical for spindle @23 in M45

10.10 Speed range for spindles @24 ... @31 ► P49

<table>
<tr><td>P49</td><td colspan="4">Speed range for spindles @24 ... @31</td></tr>
<tr><td></td><td>Category</td><td>Spindle characteristics</td><td>Format / Type</td><td>UINT / 5</td></tr>
<tr><td></td><td>Words</td><td>144</td><td>Units</td><td>Rpm (see description)</td></tr>
<tr><td></td><td>Min</td><td>0</td><td>Max</td><td>65535</td></tr>
<tr><td></td><td>Default</td><td>0</td><td>Resolution</td><td>1</td></tr>
<tr><td></td><td>Immediate</td><td>Yes</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is identical to P46 except that it concerns spindles @24 to @31.
This parameter is used to define the limits of each programmed range as well as the maximum speed in each range.
It is used to calculate the range to select according to the speed (the search direction is defined in parameter P7). It is also used to verify that range and speed are compatible is expressly programmed.
The max of the range is used to compute the reference sent to the drive whereas the limit will clamp the value.</td></tr>
<tr><td>Description</td><td colspan="4">The speed unit depends about the speed programming format:
<table><tr><th>Format</th><th>Unit</th><th>Max speed</th></tr><tr><td>S3.2</td><td>Rpm/100</td><td>655.35</td></tr><tr><td>S5.0</td><td>Rpm</td><td>65535</td></tr><tr><td>S6.0</td><td>Rpm*10</td><td>655350</td></tr></table></td></tr>
<tr><td></td><td>Word N0</td><td colspan="3">Min speed of range M40 for spindle @24</td></tr>
<tr><td></td><td>Word N1</td><td colspan="3">Max speed of range M40 for spindle @24
This is the theoretical spindle speed when the motor is running at its maximum rpm.</td></tr>
<tr><td></td><td>Word N12</td><td colspan="3">Limit speed of range M40 for spindle @24
If Zero the limit speed is the max speed of the range.</td></tr>
<tr><td></td><td>Word xxx</td><td colspan="3">N2, N3, N13 : Identical for spindle @24 in M41
N4, N5, N14 : Identical for spindle @24 in M42
N6, N7, N15 : Identical for spindle @24 in M43
N8, N9, N16 : Identical for spindle @24 in M44
N10, N11, N17 : Identical for spindle @24 in M45

N18, N19, N30 : Identical for spindle @25 in M40
N20, N21, N31 : Identical for spindle @25 in M41
N22, N23, N32 : Identical for spindle @25 in M42
N24, N25, N33 : Identical for spindle @25 in M43
N26, N27, N34 : Identical for spindle @25 in M44
N28, N29, N35 : Identical for spindle @25 in M45</td></tr>
</table>

Description	**Word xxx**	**N36, N37, N48** : Identical for spindle @26 in M40 **N38, N39, N49** : Identical for spindle @26 in M41 **N40, N41, N50** : Identical for spindle @26 in M42 **N42, N43, N51** : Identical for spindle @26 in M43 **N44, N45, N52** : Identical for spindle @26 in M44 **N46, N47, N53** : Identical for spindle @26 in M45 **N54, N55, N66** : Identical for spindle @27 in M40 **N56, N57, N67** : Identical for spindle @27 in M41 **N58, N59, N68** : Identical for spindle @27 in M42 **N60, N61, N69** : Identical for spindle @27 in M43 **N62, N63, N70** : Identical for spindle @27 in M44 **N64, N65, N71** : Identical for spindle @27 in M45 **N72, N73, N84** : Identical for spindle @28 in M40 **N74, N75, N85** : Identical for spindle @28 in M41 **N76, N77, N86** : Identical for spindle @28 in M42 **N78, N79, N87** : Identical for spindle @28 in M43 **N80, N81, N88** : Identical for spindle @28 in M44 **N82, N83, N89** : Identical for spindle @28 in M45 **N90, N91, N102** : Identical for spindle @29 in M40 **N92, N93, N103** : Identical for spindle @29 in M41 **N94, N95, N104** : Identical for spindle @29 in M42 **N96, N97, N105** : Identical for spindle @29 in M43 **N98, N99, N106** : Identical for spindle @29 in M44 **N100, N101, N107** : Identical for spindle @29 in M45 **N108, N109, N120** : Identical for spindle @30 in M40 **N110, N111, N121** : Identical for spindle @30 in M41 **N112, N113, N122** : Identical for spindle @30 in M42 **N114, N115, N123** : Identical for spindle @30 in M43 **N116, N117, N124** : Identical for spindle @30 in M44 **N118, N118, N125** : Identical for spindle @30 in M45 **N126, N127, N138** : Identical for spindle @31 in M40 **N128, N129, N139** : Identical for spindle @31 in M41 **N130, N131, N140** : Identical for spindle @31 in M42 **N132, N133, N141** : Identical for spindle @31 in M43 **N134, N135, N142** : Identical for spindle @31 in M44 **N136, N137, N143** : Identical for spindle @31 in M45

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11 Synchronisation, Duplication

FlexiumPro offers several possibilities for axes duplication and synchronisation.

This list of parameter describes the possibilities offered by machine parameters.

The difference compared to the synchronisation made by external parameters is that the couplings cannot be modified during operation. Therefore, the preferred use is for gantry axes.

The list also describes the functionalities of Anti-backlash, Torque-duplication and Winding-duplication and contains the following parameters:

P24	Synchronised axes correction coefficients
P25	Synchronised axes thresholds
P27	Coupling assignment for duplicated and synchronised axes
P28	Enable slave axis synchronisation
P85	Drives coupling assignment for anti-backlash function
P86	Drives coupling assignment for torque-duplication function
P87	Drives coupling assignment for winding-duplication function

11.1 Synchronised axes correction coefficients ► P24

P24	Synchronised axes correction coefficients			
	Category	Synchronisation	**Format / Type**	UINT / 5
	Words	32	**Units**	1/1000
	Min	0	**Max**	999
	Default	250	**Resolution**	1
	Immediate	Yes	**Access via**	N/A
General	Defines the coefficient of correction for each axis slave axis in a gantry structure.			
Description	Each word corresponds to the physical address of an axis. The word number corresponds to the physical address of the driven axis of a pair.			
	Word N0 to Word N31	**Correction coefficient for axis @0 to @31.** It is a fraction of the error re-injected into the driven axis servo-loop to achieve synchronisation.		
Example	With default values			

P24 Synchronised axes correction coefficients ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P24N0	250	[]	Correction coefficient for axis @0	0	999	250
P24N1	250	[]	Correction coefficient for axis @1	0	999	250
P24N2	250	[]	Correction coefficient for axis @2	0	999	250
P24N3	250	[]	Correction coefficient for axis @3	0	999	250
P24N4	250	[]	Correction coefficient for axis @4	0	999	250
P24N5	250	[]	Correction coefficient for axis @5	0	999	250
P24N6	250	[]	Correction coefficient for axis @6	0	999	250
P24N7	250	[]	Correction coefficient for axis @7	0	999	250

11.2 Synchronised axes thresholds ► P25

P25	Synchronised axes thresholds			
	Category	Synchronisation	**Format / Type**	LREAL / 10
	Words	33	**Units**	mm or °
	Min	0.0	**Max**	65.0
	Default	0.16 - 0.6	**Resolution**	10^{-6}
	Immediate	Yes	**Access via**	N/A

General

Defines the maximum Synchronisation error.

The Synchronisation uses two thresholds:

- Threshold 1: If passed, an error is triggered but this error can be canceled.
- Threshold 2: Error triggered if passed, this error cannot be cancelled.
  It require a new homing of the machine.

Description

Each word corresponds to the physical address of an axis.

The word number corresponds to the physical address of the driven axis of a pair.

Word N0 to Word N31	**Threshold 1 for axis @0 to @31 - Maximum permissible error** Defines the value threshold 1 for driven axis @0, which is the maximum permissible error after synchronisation. Above this threshold, the system generates an error but allows the driven axis to be resynchronised on its driver axis. Default: 0.16 mm.
Word N32	**Threshold error for all axes - Maximum synchronisation error** Defines the value for threshold 2 valid for all axes. If this threshold is passed the axes alignment requires to be checked before re-enabling synchronisation. Default: 0.6 mm

Example

P25 Synchronised axes thresholds ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

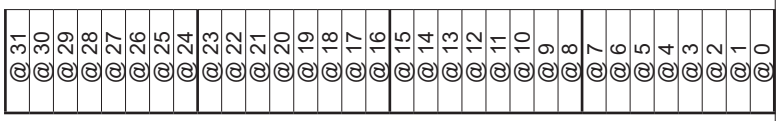
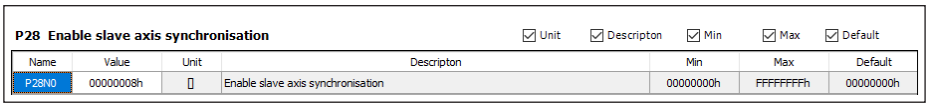
Name	Value	Unit	Descripton	Min	Max	Default
P25N0	0.16	mm	Threshold 1 for axis @0 - Maximum permissible error	0.0	65.0	0.16
P25N1	0.16	mm	Threshold 1 for axis @1 - Maximum permissible error	0.0	65.0	0.16
P25N2	0.16	mm	Threshold 1 for axis @2 - Maximum permissible error	0.0	65.0	0.16
P25N3	0.16	°	Threshold 1 for axis @3 - Maximum permissible error	0.0	65.0	0.16
P25N4	0.16	°	Threshold 1 for axis @4 - Maximum permissible error	0.0	65.0	0.16
P25N5	0.16	mm	Threshold 1 for axis @5 - Maximum permissible error	0.0	65.0	0.16
P25N6	0.16	mm	Threshold 1 for axis @6 - Maximum permissible error	0.0	65.0	0.16
P25N7	0.16	°	Threshold 1 for axis @7 - Maximum permissible error	0.0	65.0	0.16
P25N8	0.16	mm	Threshold 1 for axis @8 - Maximum permissible error	0.0	65.0	0.16

P25N32	0.6	mm or °	Threshold error for all axes - Maximum synchronisation error	0.0	65.0	0.6

11.3 Coupling assignment for duplicated and synchronised axes ► P27

<table>
<tr><td rowspan="6">P27</td><td colspan="4">Coupling assignment for duplicated and synchronised axes</td></tr>
<tr><td>Category</td><td>Synchronisation, Duplication</td><td>Format /Type</td><td>SINT / 3</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>-1</td><td>Max</td><td>31</td></tr>
<tr><td>Default</td><td>-1</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>E941xx</td></tr>
<tr><td>General</td><td colspan="4">Used to assign a slave axis to a master axis.
Concerns the different types of coupling:
• Simple coupling (drive axis reference copied to driven axis).
• Coupling with symmetry (reverse of the drive axis reference copied to the driven axis).
• Coupling with synchronisation (the error of synchronisation is minimized).</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">Each word corresponds to the physical address of the slave axis.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Axis master address for slave @0 to @31.
Contain the physical address of the master axis of axis @0 in a master slave configuration. The value -1 specifies the absence of a master axis.
Parameters E94100 to E94131 are used to assign a driven axis to a drive axis by programming.</td></tr>
<tr><td>Example</td><td colspan="4">Axis @3 is slave of axis @0 who is master.
P27 Coupling assignment for duplicated and synchronised axes ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P27N0</td><td>-1</td><td></td><td>Axis master address for slave @0</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N1</td><td>-1</td><td></td><td>Axis master address for slave @1</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N2</td><td>-1</td><td></td><td>Axis master address for slave @2</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N3</td><td>0</td><td></td><td>Axis master address for slave @3</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N4</td><td>-1</td><td></td><td>Axis master address for slave @4</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N5</td><td>-1</td><td></td><td>Axis master address for slave @5</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N6</td><td>-1</td><td></td><td>Axis master address for slave @6</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P27N7</td><td>-1</td><td></td><td>Axis master address for slave @7</td><td>-1</td><td>31</td><td>-1</td></tr>
</table></td></tr>
</table>

11.4 Enable slave axis synchronisation ► P28

P28	Enable slave axis synchronisation			
	Category	Synchronisation	**Format / Type**	DWORD / 6
	Words	1	**Units**	None
	Min	0	**Max**	FFFFFFFF
	Default	0	**Resolution**	N/A
	Immediate	No	**Access via**	E962xx (R/W) : see description
General	Enables synchronisation of a driven axis with a drive axis.			
Description				
	Word N0	**Enable slave axis synchronisation** The bit position gives the physical address of the driven axis of a pair.  By convention, it is also the coupling number. If the bit is SET, the driven axis is synchronised with its master axis declared in P27.		
Example	To synchronize axis 3 to its master axis 0 (see example of P27) bit 3 should be set. 			

P28 Enable slave axis synchronisation — Unit, Descripton, Min, Max, Default

Name	Value	Unit	Descripton	Min	Max	Default
P28N0	00000008h	[]	Enable slave axis synchronisation	00000000h	FFFFFFFFh	00000000h

11.5 Drives coupling assignment for anti-backlash function ► P85

P85	Drives coupling assignment for anti-backlash function			
	Category	Duplication	**Format / Type**	SINT / 3
	Words	32	**Units**	None
	Min	-1	**Max**	31
	Default	-1	**Resolution**	1
	Immediate	Yes	**Access via**	N/A

General	Specifies the master and slave axes to be associated by coupling. This parameter defined the coupling authorized for Anti-Backlash (torque synchronisation with a preload current value).	
Description	• Each word corresponds to the physical address of the slave axis. • The value of the word is the physical address of the master axis. • A setting of -1 indicates the absence of coupling. • Further adjustments (if required) for this function are made at the drive level.	
	Word N0 to Word N31	**Drive master address for slave @0 to @31.** Physical address of the master axis for anti-backlash function. A value of -1 means no coupling.
Example	Axes 1 and 3 slaved in anti-backlash to axes 0 and 2 respectively.	

P85 Drives coupling assignment for anti-backlash function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P85N0	-1	[]	Drive master address for slave @0	-1	31	-1
P85N1	0	[]	Drive master address for slave @1	-1	31	-1
P85N2	-1	[]	Drive master address for slave @2	-1	31	-1
P85N3	2	[]	Drive master address for slave @3	-1	31	-1
P85N4	-1	[]	Drive master address for slave @4	-1	31	-1
P85N5	-1	[]	Drive master address for slave @5	-1	31	-1
P85N6	-1	[]	Drive master address for slave @6	-1	31	-1
P85N7	-1	[]	Drive master address for slave @7	-1	31	-1

11.6 Drives coupling assignment for torque-duplication function ► P86

<table>
<tr><td rowspan="6">P86</td><td colspan="4">Drives coupling assignment for torque-duplication function</td></tr>
<tr><td>Category</td><td>Duplication</td><td>Format / Type</td><td>SINT / 3</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>-1</td><td>Max</td><td>31</td></tr>
<tr><td>Default</td><td>-1</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">Specifies the master and slave axes to be associated by coupling.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">• Each word corresponds to the physical address of the slave axis.
• The value of the word is the physical address of the master axis.
• A setting of -1 indicates the absence of coupling.
• Further adjustments (if required) for this function are made at the drive level.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Drive master address for slave @0 to @31.
Physical address of the master axis for anti-backlash function.
A value of -1 means no coupling.</td></tr>
<tr><td>Example</td><td colspan="4">Axis 4 slaved in torque duplication to axis 3.
P86 Drives coupling assignment for torque-duplication function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P86N0</td><td>-1</td><td></td><td>Drive master address for slave @0</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N1</td><td>-1</td><td></td><td>Drive master address for slave @1</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N2</td><td>-1</td><td></td><td>Drive master address for slave @2</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N3</td><td>-1</td><td></td><td>Drive master address for slave @3</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N4</td><td>3</td><td></td><td>Drive master address for slave @4</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N5</td><td>-1</td><td></td><td>Drive master address for slave @5</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N6</td><td>-1</td><td></td><td>Drive master address for slave @6</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P86N7</td><td>-1</td><td></td><td>Drive master address for slave @7</td><td>-1</td><td>31</td><td>-1</td></tr>
</table></td></tr>
</table>

11.7 Drives coupling assignment for winding-duplication function ► P87

<table>
<tr><td rowspan="6">P87</td><td colspan="4">Drives coupling assignment for winding-duplication function</td></tr>
<tr><td>Category</td><td>Duplication</td><td>Format / Type</td><td>SINT / 3</td></tr>
<tr><td>Words</td><td>32</td><td>Units</td><td>None</td></tr>
<tr><td>Min</td><td>-1</td><td>Max</td><td>31</td></tr>
<tr><td>Default</td><td>-1</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>No</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">Specifies the master and slave axes to be associated by coupling.
This parameter defined the coupling authorized for Winding Duplication.</td></tr>
<tr><td rowspan="2">Description</td><td colspan="4">• Each word corresponds to the physical address of the slave axis.
• The value of the word is the physical address of the master axis.
• A setting of -1 indicates the absence of coupling.
• Further adjustments (if required) for this function are made at the drive level.</td></tr>
<tr><td>Word N0
to
Word N31</td><td colspan="3">Drive master address for slave @0 to @31.
Physical address of the master axis for Winding Duplication function.
A value of -1 means no coupling.</td></tr>
<tr><td>Example</td><td colspan="4">Drives 1 and 2 slaved in winding duplication to drive 0.
P87 Drives coupling assignment for winding-duplication function ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default
<table>
<tr><th>Name</th><th>Value</th><th>Unit</th><th>Descripton</th><th>Min</th><th>Max</th><th>Default</th></tr>
<tr><td>P87N0</td><td>-1</td><td></td><td>Drive master address for slave @0</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N1</td><td>0</td><td></td><td>Drive master address for slave @1</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N2</td><td>0</td><td></td><td>Drive master address for slave @2</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N3</td><td>-1</td><td></td><td>Drive master address for slave @3</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N4</td><td>-1</td><td></td><td>Drive master address for slave @4</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N5</td><td>-1</td><td></td><td>Drive master address for slave @5</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N6</td><td>-1</td><td></td><td>Drive master address for slave @6</td><td>-1</td><td>31</td><td>-1</td></tr>
<tr><td>P87N7</td><td>-1</td><td></td><td>Drive master address for slave @7</td><td>-1</td><td>31</td><td>-1</td></tr>
</table></td></tr>
</table>

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Summary

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12.3 Backup on path, Auto recall after INTERV ► P114 184
12.4 Final distance at work rate for recall ► P115 185
12.5 EGB (Electronic Gear Box) function ► P116 186

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12 Cycles

This series of parameters is related to cycles. It contains:

Rigid tapping

Backup and retrace

Auto recall after intervention.

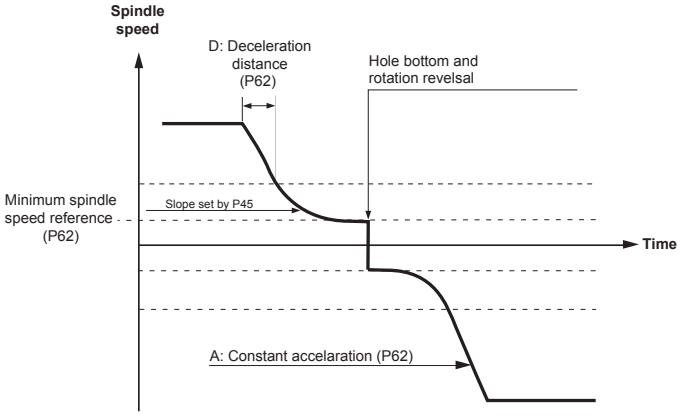
Electronic gear box (EGB)

The list of parameters covered is:

P62	Rigid tapping setting
P63	Servo adjustments for rigid tapping
P114	Backup on path, Auto recall after INTERV
P115	Final distance at work rate for recall
P116	EGB function

12.1 Rigid tapping setting ► P62

P62	Rigid tapping setting			
	Category	Cycles	**Format / Type**	INT / 1
	Words	64	**Units**	Word dependent
	Min	1	**Max**	32767 - 10000
	Default	10 - 100	**Resolution**	1
	Immediate	No	**Access via**	N/A
General	This parameter is used to define the spindle acceleration and minimum spindle speed reference at the bottom of the hole.			
Description				
	Word N0	**Deceleration before bottom of the hole for spindle @0** Used to calculate the position where the deceleration should start, the value is given in rpm/s. This value is generally equal or slightly higher than the spindle deceleration parameter (P32). A too high value (higher than the system capacity) might result in an overshoot at the bottom whereas a too low will increase the cycle time. Max: 32767, Default: 10, Units: rev/s^2.		

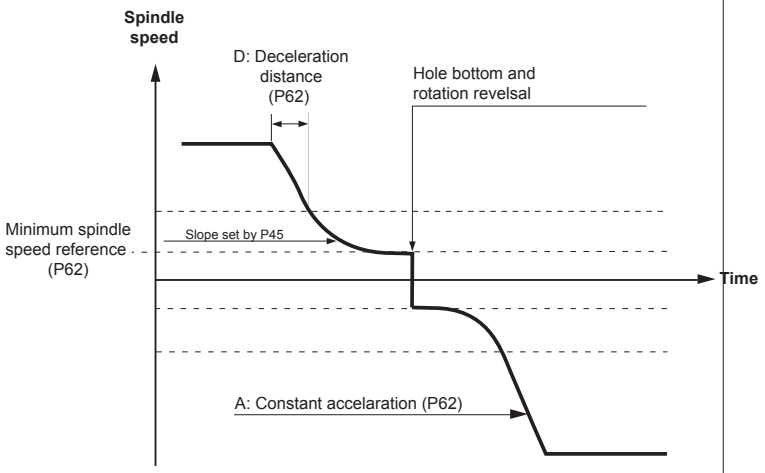
	Word N1	**Speed at reversal for spindle @0 (in 1/10000 of the max speed of the range).** This value given in 1/10000 of the max speed of the range is used to prevent any stopping of the spindle that will result in a halt as the feed is synchronised to the spindle speed. A too low value might generate this stopping whereas a too high could lead to an abrupt inversion. Max: 10000, Default: 100, Units: None. **Cycle** At the beginning of infeed, the cycle axis is synchronised on the spindle zero pulse. This synchronisation is repeated for each cycle. The start of movement is anticipated with respect to the spindle zero pulse in order to obtain a gradual acceleration (parameter P63, spindle crossing anticipation time constant). When approaching the bottom of the tapped hole, the spindle slows down according to the preset deceleration value (parameter P62, spindle deceleration). In the hole bottom, a minimum spindle speed is applied to effectively reach the hole bottom (parameter P62, minimum speed reference in the hole bottom). The spindle then reverses and accelerates up to the programmed speed. The infeed and outfeed speeds may be different. At the end of outfeed, the spindle reverses and the axis/spindle coupling is cancelled. It is possible to inhibit the feed-stop during the tapping. In this case it will be memorized and taken into account at the end of the current hole (see P7 N2 B4). 
	Word N2/N3 to Word N62/N63	Identical to Word N0/N1 for spindles @1 to @ 31 respectively.
Example	With default values	

P62 Rigid tapping setting ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P62N0	10	rev/s²	Deceleration before bottom of the hole for spindle @0	1	32767	10
P62N1	100	[]	Speed at reversal for spindle @0 (in 1/10000 of the max speed of the range)	1	10000	100
P62N2	10	rev/s²	Deceleration before bottom of the hole for spindle @1	1	32767	10
P62N3	100	[]	Speed at reversal for spindle @1 (in 1/10000 of the max speed of the range)	1	10000	100
P62N4	10	rev/s²	Deceleration before bottom of the hole for spindle @2	1	32767	10
P62N5	100	[]	Speed at reversal for spindle @2 (in 1/10000 of the max speed of the range)	1	10000	100
P62N6	10	rev/s²	Deceleration before bottom of the hole for spindle @3	1	32767	10
P62N7	100	[]	Speed at reversal for spindle @3 (in 1/10000 of the max speed of the range)	1	10000	100
P62N8	10	rev/s²	Deceleration before bottom of the hole for spindle @4	1	32767	10

12.2 Servo adjustment for rigid tapping ► P63

<table>
<tr><td rowspan="6">P63</td><td colspan="4">Servo adjustment for rigid tapping</td></tr>
<tr><td>Category</td><td>Cycles</td><td>Format / Type</td><td>INT / 1</td></tr>
<tr><td>Words</td><td>96</td><td>Units</td><td>Word dependent</td></tr>
<tr><td>Min</td><td>Word dependent</td><td>Max</td><td>Word dependent</td></tr>
<tr><td>Default</td><td>Word dependent</td><td>Resolution</td><td>1</td></tr>
<tr><td>Immediate</td><td>Yes</td><td>Access via</td><td>N/A</td></tr>
<tr><td>General</td><td colspan="4">This parameter is used to adjust the servo response in each channel to optimize the rigid tapping by setting three parameters in order cancel the following error on the tool axis during the cycle and anticipate the spindle zero for starting the descent.
• Integral time constant
• Anticipation time constant
• Spindle zero anticipation time constant.</td></tr>
<tr><td rowspan="3">Description</td><td colspan="4"></td></tr>
<tr><td>Word N0</td><td colspan="3">Tool axis integration time constant for channel 1
Defines the integral time constant for the cycle axis for channel 1 to fine tunes the cancelation of the cycle axis following error with respect to the spindle speed.
The time constant is expressed in number of samples and the value entered is 1000 / number of samples.
Min: 1, Max: 500, Default: 200, Units: None</td></tr>
<tr><td>Word N1</td><td colspan="3">Tool axis position anticipation time constant for channel 1
Defines the cycle axis position anticipation time constant for channel 1.
It is used for the rough cancelation of the following error on the cycle axis.
The time constant T is expressed in number of samples and the value entered is:
1000 * T
Min: 1, Max: 32767, Default: 6000, Units: None
The value to enter is P56 / P50 * 1000.</td></tr>
</table>

Description	**Word N2**	**Spindle zero crossing anticipation time constant (CNC sampling period) for channel 1.** It is used to define the start of the axis with respect to the spindle zero crossing in order to gradually accelerate and be fully synchronised at this zero position. The value is expressed as a number of samples. The faster the accelerations allowed on the cycle axis, the lower the value programmed in this constant. The value to enter is 16 * P30 / P32 / P50. **Tuning**: (If required - generally the default values provide a good result) • Set word 0 to 0, • Start with the calculated values in words 1 and 2 • Search for the optimum value of word 0 in by gradually increasing the setting without exceeding 1000 until instability appears. Enter the maximum value obtained divided by 2. The result should be less than 500. • Check that the following error is small on reversal. If not, decrease the value of word 0 of P62. See P62 for cycle explanations.  Min: 1, Max: 32767, Default: 10, Units: CNC sampling period
	Word N3/N5 to Word N93/95	Identical to Word N0/N2 for the other channels.
Example	With standard values	

P63 Servo adjustment for rigid tapping ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P63N0	200	0	Tool axis integration time constant for channel 1	0	500	200
P63N1	6000	0	Tool axis position anticipation time constant for channel 1	1	32767	6000
P63N2	10	0	Spindle zero crossing anticipation time constant (CNC sampling period) for channel 1	1	32767	10
P63N3	200	0	Tool axis integration time constant for channel 2	0	500	200
P63N4	6000	0	Tool axis position anticipation time constant for channel 2	1	32767	6000
P63N5	10	0	Spindle zero crossing anticipation time constant (CNC sampling period) for channel 2	1	32767	10
P63N6	200	0	Tool axis integration time constant for channel 3	0	500	200
P63N7	6000	0	Tool axis position anticipation time constant for channel 3	1	32767	6000
P63N8	10	0	Spindle zero crossing anticipation time constant (CNC sampling period) for channel 3	1	32767	10
P63N9	200	0	Tool axis integration time constant for channel 4	0	500	200
P63N10	6000	0	Tool axis position anticipation time constant for channel 4	1	32767	6000
P63N11	10	0	Spindle zero crossing anticipation time constant (CNC sampling period) for channel 4	1	32767	10

12.3 Backup on path, Auto recall after INTERV ► P114

P114	Backup on path, Auto recall after INTERV			
	Category	Cycles	**Format / Type**	UINT / 5
	Words	34	**Units**	None
	Min	0	**Max**	8000 - 10
	Default	Word dependent	**Resolution**	1
	Immediate	No	**Access via**	N/A

General

Defines the number of stored blocks that can be backed up in the path, the number of points that can be stored during axis retraction in INTERV mode and the distance after which approach to the recall point is carried out at the work rate.

This function is only available in channel 1.
INTERV mode is activated by a PLC command. It is the possibility of manual control of axes after a Feed Stop.

Description

Word N0	**Number of blocks memorised for backup on path after a Feed Stop for all the channels** Defines the number of blocks stored during backup along the path after a feed stop. Backup and return are carried out at the speed programmed in the blocks stored (see FlexiumPro HMI Operator Manual M00076). Max: 8000, Default: 100.
Word N1	**Number of points stored during axis retraction in INTERV mode** Defines the number of points to be stored during axis retraction in INTERV mode. This to allow axis recall on the same path (see FlexiumPro HMI Operator Manual M00076). Max: 10, Default: 10 Auto recall can be combined with backup and return in the path.
Word N2 **to** **Word N33**	**Number of blocks memorised for backup on path after a Feed Stop for channel 1 to 32.** Max: 8000, Default: 0

Example

P114 Backup on path, Auto recall after INTERV ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P114N0	100	[]	Number of blocks memorised for backup on path after a Feed Stop for all the channels	0	8000	100
P114N1	10	[]	Number of points stored during axis retraction in INTERV mode	0	10	10
P114N2	0	[]	Number of blocks memorised for backup on path after a Feed Stop for channel 1	0	8000	0
P114N3	0	[]	Number of blocks memorised for backup on path after a Feed Stop for channel 2	0	8000	0

12.4 Final distance at work rate for recall ► P115

P115	Final distance at work rate for recall			
	Category	Cycles	**Format / Type**	LREAL / 10
	Words	1	**Units**	mm or °
	Min	0.0	**Max**	65.0
	Default	0.0	**Resolution**	10^{-6}
	Immediate	No	**Access via**	N/A

General

While in INTERV mode, the system stores a certain number of points (see P114) in order to retrieve the initial position.

The Auto-recall feature will be executed under the operator surveillance at the jog feed rate up to a certain clearance distance where the feed rate will be the programmed feedrate.

The parameter defines such clearance.

INTERV mode is activated by a PLC command. It is the possibility of manual control of axes after a Feed Stop.

Description

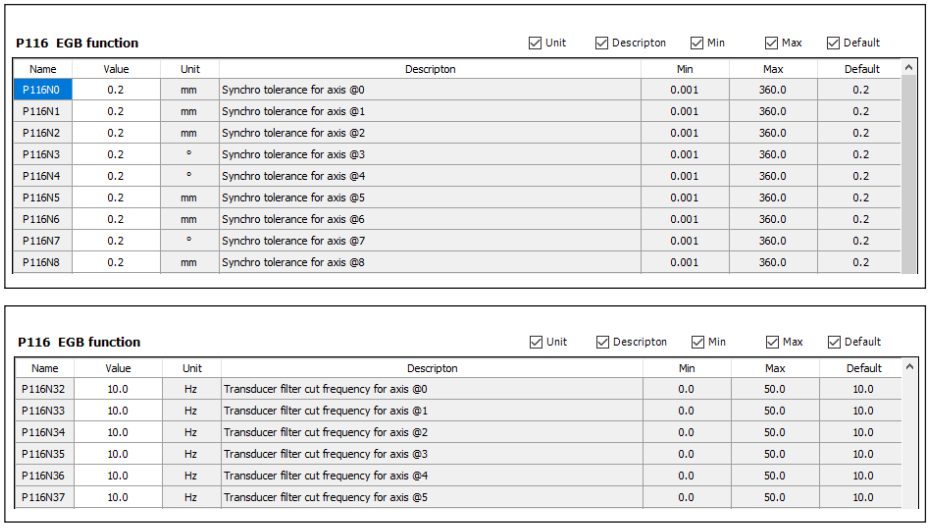
Word N0	**Final distance at work rate for recall.**

Example

P115 Final distance at work rate for recall ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P115N0	0.0	mm or °	Final distance at work rate for recall	0.0	65.0	0.0

12.5 EGB (Electronic Gear Box) function ► P116

P116	EGB function			
	Category	Cycles	**Format / Type**	LREAL / 10
	Words	64	**Units**	mm or °, Hz
	Min	0.001 - 0.0	**Max**	360.0 - 50.0
	Default	0.2 - 10.0	**Resolution**	10^{-3} - 10^{-2}
	Immediate	Yes	**Access via**	**E7x206** (P116 N0 to N31)
General	The parameter P116 N0-N31 contains the synchro tolerance. If the synchro error exceeds this parameter the machine goes in emergency. The parameter P116 N32-N63 contains the cut frequency for the transducer filter. If is set to 0.0 the filter is disabled.			
Description				
	Word N0 to Word N31	**Synchro tolerance for axis @0 to @31** Min: 0.001, Max: 360.0, Default: 0.2, Resolution: 10^{-3}		
	Word N32 to Word N63	**Transducer filter cut frequency for axis @0 to @31** Min: 0.0, Max: 50.0, Default: 10.0, Resolution: 10^{-2}		
Example				

P116 EGB function

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P116N0	0.2	mm	Synchro tolerance for axis @0	0.001	360.0	0.2
P116N1	0.2	mm	Synchro tolerance for axis @1	0.001	360.0	0.2
P116N2	0.2	mm	Synchro tolerance for axis @2	0.001	360.0	0.2
P116N3	0.2	°	Synchro tolerance for axis @3	0.001	360.0	0.2
P116N4	0.2	°	Synchro tolerance for axis @4	0.001	360.0	0.2
P116N5	0.2	mm	Synchro tolerance for axis @5	0.001	360.0	0.2
P116N6	0.2	mm	Synchro tolerance for axis @6	0.001	360.0	0.2
P116N7	0.2	°	Synchro tolerance for axis @7	0.001	360.0	0.2
P116N8	0.2	mm	Synchro tolerance for axis @8	0.001	360.0	0.2

P116 EGB function

☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P116N32	10.0	Hz	Transducer filter cut frequency for axis @0	0.0	50.0	10.0
P116N33	10.0	Hz	Transducer filter cut frequency for axis @1	0.0	50.0	10.0
P116N34	10.0	Hz	Transducer filter cut frequency for axis @2	0.0	50.0	10.0
P116N35	10.0	Hz	Transducer filter cut frequency for axis @3	0.0	50.0	10.0
P116N36	10.0	Hz	Transducer filter cut frequency for axis @4	0.0	50.0	10.0
P116N37	10.0	Hz	Transducer filter cut frequency for axis @5	0.0	50.0	10.0

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Summary

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13.2.2 Handwheel measurement conversion coefficien ► P13 199

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13 Analog Axes and Spindles, Handwheels

13.1 Analog Axes and Spindles

The following parameters are required for analog axes.

The list of parameters covered is:

P11	Measurement conversion coefficient for analog axes
P72	Analog axes configuration
P73	Servo-system loop coefficent for analog axes
P74	PLC EtherCAT analog drives absolute sensor resolution bits
P75	PLC EtherCAT analog drives zero shift absolute sensor

13.1.1 Measurement conversion coefficient for analog axes ► P11

P11	Measurement conversion coefficient for analog axe			
	Category	Analog axes and Spindles	**Format / Type**	UINT / 5
	Words	64	**Units**	None
	Min	1	**Max**	65535
	Default	1	**Resolution**	1
	Immediate	Yes	**Access via**	N/A
General	Adapts the measurement supplied by the position encoder to the internal CNC measurement. Each pair of words corresponds to the values assigned to an axis. The first word of the pair indicates the multiplier coefficient (MULTI) and the second the divider coefficient (DIVI).			
Description				
	Word N0	**Multiplier coefficients (MULTI) for axis @0.**		
	Word N1	**Divider coefficient (DIVI) for axis @0.**		
	Word N2/N3 to Word N62/N63	Identical to Word N0/N1 for axes @1 to @31.		
Example	With default values			

P11 Measurement conversion coefficient for analog axes ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P11N0	1	[]	Multiplier coefficient (MULTI) for axis @0	1	65535	1
P11N1	1	[]	Divider coefficient (DIVI) for axis @0	1	65535	1
P11N2	1	[]	Multiplier coefficient (MULTI) for axis @1	1	65535	1
P11N3	1	[]	Divider coefficient (DIVI) for axis @1	1	65535	1
P11N4	1	[]	Multiplier coefficient (MULTI) for axis @2	1	65535	1
P11N5	1	[]	Divider coefficient (DIVI) for axis @2	1	65535	1
P11N6	1	[]	Multiplier coefficient (MULTI) for axis @3	1	65535	1
P11N7	1	[]	Divider coefficient (DIVI) for axis @3	1	65535	1

13.1.2 Analog axes configuration ► P72

P72	Analog axes configuration			
	Category	Analog axes and Spindles	**Format / Type**	DWORD / 6
	Words	3	**Units**	None
	Min	0	**Max**	FFFFFFFF
	Default	0	**Resolution**	N/A
	Immediate	No	**Access via**	N/A

General

Used to reverse the direction of the axis speed reference sent to the axis servo-drive.

N.B. : For digital axes the speed reference reversal is defined by the sign of parameters V306 (V1306).

Description

The bit position gives the physical axis address.

@31	@30	@29	@28	@27	@26	@25	@24	@23	@22	@21	@20	@19	@18	@17	@16	@15	@14	@13	@12	@11	@10	@9	@8	@7	@6	@5	@4	@3	@2	@1	@0

Word N0	**Axis reference reversal [1=Reverse]** If the bit is SET, a positive speed reference applied to the servo-drive results in a negative movement of the axis.
Word N1	**PLC EtherCAT analog drives measurement direction [1=Reverse]** If the bit is SET indicate the axes with inversed measure direction.
Word N2	**PLC EtherCAT analog drives with absolute measure sensor** If the bit is SET indicate the axes with absolute measure sensor.

Example

Axes @ 5 and @6 are analog and run in inverted direction

P72 Analog axes configuration ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P72N0	00000060h	[]	Axis reference reversal [1=Reverse]	00000000h	FFFFFFFFh	00000000h
P72N1	00000000h	[]	PLC EtherCAT analog drives measurement direction [1 = Reverse]	00000000h	FFFFFFFFh	00000000h
P72N2	00000000h	[]	PLC EtherCAT analog drives with absolute measure sensor	00000000h	FFFFFFFFh	00000000h

13.1.3 Servo-system loop coefficent for analog axes ► P73

P73	Servo-system loop coefficent for analog axes			
	Category	Analog axes and Spindles	**Format / Type**	UDINT / 4
	Words	32	**Units**	None
	Min	0	**Max**	99999999
	Default	5898	**Resolution**	1
	Immediate	Yes	**Access via**	E980xx

General

Defines the coefficient used by the CNC to calculate the reference supplied to the servo-drive according to the following error.

Before parameter P73 can be set, it is first necessary to set parameter P56 or P66.

Description

The words refer to the physical address of each axis.

Word N0 to Word N31

Servo-system loop coefficient for axis @0 to @31

Proportional action coefficient applied to the following error of axis @ 0 to obtain the speed reference.

Calculation:

The CNC function generates a theoretical speed reference voltage of 10V maximum.

This voltage is provided by a DAC on an axis encoder card.
Generally, the servo-drives are set so that the axis speed is obtained for a servo-drive input voltage of 9V.

The 15-bit DAC of the axis encoder card provides an output voltage of 10V for 32768 DAC points. The output is therefore 9V for 29491 DAC points.

According to the expected gain this maximal speed will be achieved for a following error of :

ε (in mm) = Max speed (in m/min) / Gain.

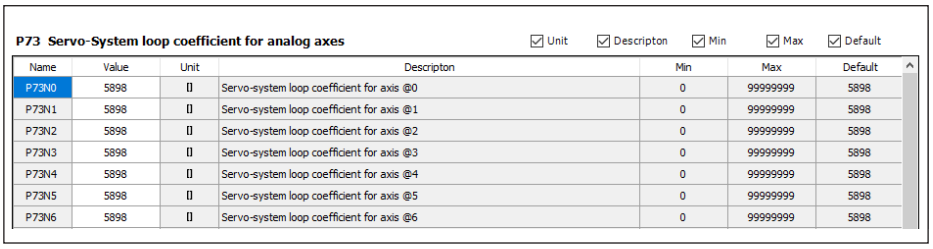
The value of P73 is then given by: P73 = 29491 / $\varepsilon_{\text{max speed}}$.

Example

- Considering an axis running up to 12 m/min with a gain of 1.5 and a resolution of 1µm.
- The following error at max speed will be 12/1.5 = 8 mm = 8000 internal counts.
- The 12 m/min are achieved with a reference of 9V (drive tuning) = 29491 DAC points
- P73 = 29491/8 = 3686

Example

With default values.

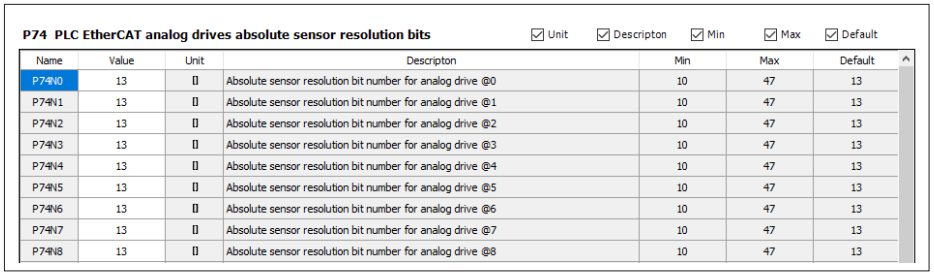


P73 Servo-System loop coefficient for analog axes

Unit Descripton Min Max Default

Name	Value	Unit	Descripton	Min	Max	Default
P73N0	5898	[]	Servo-system loop coefficient for axis @0	0	99999999	5898
P73N1	5898	[]	Servo-system loop coefficient for axis @1	0	99999999	5898
P73N2	5898	[]	Servo-system loop coefficient for axis @2	0	99999999	5898
P73N3	5898	[]	Servo-system loop coefficient for axis @3	0	99999999	5898
P73N4	5898	[]	Servo-system loop coefficient for axis @4	0	99999999	5898
P73N5	5898	[]	Servo-system loop coefficient for axis @5	0	99999999	5898
P73N6	5898	[]	Servo-system loop coefficient for axis @6	0	99999999	5898

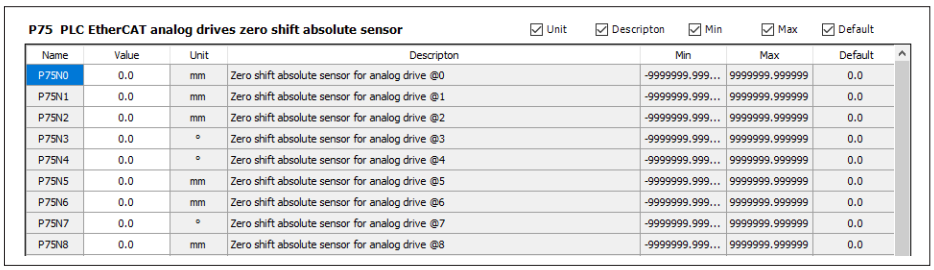
13.1.4 PLC EtherCAT analog drives absolute sensor resolution bits ► P74

P74	PLC EtherCAT analog drives absolute sensor resolution bit			
	Category	Analog axes and Spindles	**Format / Type**	SINT / 3
	Words	32	**Units**	None
	Min	10	**Max**	47
	Default	13	**Resolution**	1
	Immediate	No	**Access via**	N/A
General	Used to define the bit resolution of the absolute sensor, information needed by NCK to calculate the mesure			
Description				
	Word N0 to Word N31	**Absolute sensor resolution bit number for analog drive @0 to @31.**		
Example				

P74 PLC EtherCAT analog drives absolute sensor resolution bits ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P74N0	13	[]	Absolute sensor resolution bit number for analog drive @0	10	47	13
P74N1	13	[]	Absolute sensor resolution bit number for analog drive @1	10	47	13
P74N2	13	[]	Absolute sensor resolution bit number for analog drive @2	10	47	13
P74N3	13	[]	Absolute sensor resolution bit number for analog drive @3	10	47	13
P74N4	13	[]	Absolute sensor resolution bit number for analog drive @4	10	47	13
P74N5	13	[]	Absolute sensor resolution bit number for analog drive @5	10	47	13
P74N6	13	[]	Absolute sensor resolution bit number for analog drive @6	10	47	13
P74N7	13	[]	Absolute sensor resolution bit number for analog drive @7	10	47	13
P74N8	13	[]	Absolute sensor resolution bit number for analog drive @8	10	47	13

13.1.5 PLC EtherCAT analog drives zero shift absolute sensor ► P75

P75	EtherCAT analog drives zero shift absolute sensor			
	Category	Analog axes and Spindles	**Format / Type**	LREAL / 9
	Words	32	**Units**	mm or °
	Min	-9999999.999999	**Max**	9999999.999999
	Default	0.0	**Resolution**	10^{-6}
	Immediate	No	**Access via**	N/A
General	This parameter is used to set the measure origin of an axis. The word number gives the physical address of the axis.			
Description				
	Word N0 to Word N31	**Zero shift absolute sensor for analog drive @0 to @31**		
Example				

P75 PLC EtherCAT analog drives zero shift absolute sensor ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P75N0	0.0	mm	Zero shift absolute sensor for analog drive @0	-9999999.999...	9999999.999999	0.0
P75N1	0.0	mm	Zero shift absolute sensor for analog drive @1	-9999999.999...	9999999.999999	0.0
P75N2	0.0	mm	Zero shift absolute sensor for analog drive @2	-9999999.999...	9999999.999999	0.0
P75N3	0.0	°	Zero shift absolute sensor for analog drive @3	-9999999.999...	9999999.999999	0.0
P75N4	0.0	°	Zero shift absolute sensor for analog drive @4	-9999999.999...	9999999.999999	0.0
P75N5	0.0	mm	Zero shift absolute sensor for analog drive @5	-9999999.999...	9999999.999999	0.0
P75N6	0.0	mm	Zero shift absolute sensor for analog drive @6	-9999999.999...	9999999.999999	0.0
P75N7	0.0	°	Zero shift absolute sensor for analog drive @7	-9999999.999...	9999999.999999	0.0
P75N8	0.0	mm	Zero shift absolute sensor for analog drive @8	-9999999.999...	9999999.999999	0.0

13.2 Handwheels

FlexiumPro can handle up to 4 handwheels interfaced by CAN.

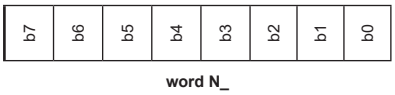
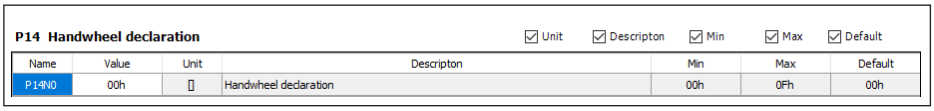
The CAN handwheels provide an averaging filter that can be activated by P7 N2 b4.

Handwheels are identified by a number (0 to 3) that has no interaction with the axes addresses.

This category contains two parameters:

P14	Handwheel declaration
P13	Handwheel measurement conversion coefficient

13.2.1 Handwheel declaration ► P14

P14	Handwheel declaration			
	Category	Handwheels	**Format / Type**	BYTE / 0
	Words	2	**Units**	None
	Min	0	**Max**	F
	Default	0	**Resolution**	N/A
	Immediate	No	**Access via**	N/A
General	Declare the presence of handwheel.			
Description				
	Word N0	**Handwheel declaration** The bit position defines the presence of handwheel. Only bit 0 to 3 are significant.  word N_		
Example	With default values. 			

P14 Handwheel declaration — Unit, Descripton, Min, Max, Default

Name	Value	Unit	Descripton	Min	Max	Default
P14N0	00h	[]	Handwheel declaration	00h	0Fh	00h

13.2.2 Handwheel measurement conversion coefficien ► P13

P13	Handwheel measurement conversion coefficient			
	Category	Handwheels	**Format / Type**	UINT / 5
	Words	18	**Units**	None
	Min	1	**Max**	65535
	Default	1 - 4	**Resolution**	1
	Immediate	Yes (not N8 and N9)	**Access via**	N/A

General

Adapts the measurement supplied by the handwheel sensor.

Each pair of words corresponds to the values assigned to an handwheel.

The first word of the pair indicates the multiplier coefficient (MULTI) and the second the divider coefficient (DIVI).

The handwheel coefficients in Automatic Mode are related to the overspeed function (G12 Feed Increase by handwheel).

Description

Word N0	**Multiplier coefficient (MULTI) for handwheel 1 (linear axes)**
Word N1	**Divider coefficient (DIVI) for handwheel 1 (linear axes)**
Word N2/N3 to Word N6/N7	Identical to Word N0/N1 for the other handwheels (for linear axes)
Word N8	**Overspeed multiplier coefficient (MULTI) for the handwheels in automatic mode**
Word N9	**Overspeed divider coefficient (DIVI) for the handwheels in automatic mode**
Word N10	**Multiplier coefficients for handwheel 1 (rotary axis)**
Word N11	**Divider coefficient for handwheel 1 (rotary axis)**
Word N12/N13 to Word N16/N17	Identical to Word N10/N11 for the other handwheel (for rotary axes)

Example

Standard values.

P13 Handwheel measurement conversion coefficient ☑ Unit ☑ Descripton ☑ Min ☑ Max ☑ Default

Name	Value	Unit	Descripton	Min	Max	Default
P13N0	1	[]	Multiplier coefficient (MULTI) for handwheel 1 (linear axes)	1	65535	1
P13N1	4	[]	Divider coefficient (DIVI) for handwheel 1 (linear axes)	1	65535	4
P13N2	1	[]	Multiplier coefficient (MULTI) for handwheel 2 (linear axes)	1	65535	1
P13N3	4	[]	Divider coefficient (DIVI) for handwheel 2 (linear axes)	1	65535	4
P13N4	1	[]	Multiplier coefficient (MULTI) for handwheel 3 (linear axes)	1	65535	1
P13N5	4	[]	Divider coefficient (DIVI) for handwheel 3 (linear axes)	1	65535	4
P13N6	1	[]	Multiplier coefficient (MULTI) for handwheel 4 (linear axes)	1	65535	1
P13N7	4	[]	Divider coefficient (DIVI) for handwheel 4 (linear axes)	1	65535	4
P13N8	1	[]	Overspeed multiplier coefficient (MULTI) for the handwheels in automatic mode	1	65535	1
P13N9	4	[]	Overspeed divider coefficient (DIVI) for the handwheels in automatic mode	1	65535	4
P13N10	1	[]	Multiplier coefficient (MULTI) for handwheel 1 (rotary axes)	1	65535	1
P13N11	4	[]	Divider coefficient (DIVI) for handwheel 1 (rotary axes)	1	65535	4
P13N12	1	[]	Multiplier coefficient (MULTI) for handwheel 2 (rotary axes)	1	65535	1
P13N13	4	[]	Divider coefficient (DIVI) for handwheel 2 (rotary axes)	1	65535	4
P13N14	1	[]	Multiplier coefficient (MULTI) for handwheel 3 (rotary axes)	1	65535	1
P13N15	4	[]	Divider coefficient (DIVI) for handwheel 3 (rotary axes)	1	65535	4
P13N16	1	[]	Multiplier coefficient (MULTI) for handwheel 4 (rotary axes)	1	65535	1
P13N17	4	[]	Divider coefficient (DIVI) for handwheel 4 (rotary axes)	1	65535	4

To avoid shock on the axes due too big handwhell step movement, the CNC reduces the increment from the handwheel when the speed and/ or the acceleration, in the sample, is bigger than the values set in P30 (Max Axes speed) and P32 (Max Axes acceleration) .

For example with an Axes with P30 = 2500 mm/min and P50 = 2ms, the maximum speed in 1 sample is:
P30 -> 2500/60000 * 2 = 0,0833333 mm

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