AXOR
★ INDUSTRIES ★
drives & motors
SINCE
1988
ITALY

SERVICE MANUAL

ENGLISH

Speeder-one

Software Interface

Enclosures to Service Manual of:
- MCB Net Digital
- Magnum400
- Mini Magnum
- Mack Drive+Power

Ver.1 rev. 09/'08

Summary

Release	Notes
ver.1 rev.06/'07	First edition.
ver.1 rev.02/'08	Corrections.
ver.1 rev.09/'08	Addresses, for ModBus management, inserted.

**THIS MANUAL IS EXCLUSIVELY ADDRESSED TO TECHNICAL PERSONNEL WITH AN APPROPRIATE TECHNICAL KNOWLEDGE ON SERVODRIVE.
BEFORE USING THIS MANUAL READ DRIVE'S SERVICE MANUAL.**

1 Speeder one Interface

The Axor software **Speeder One** interface allows you to setup, modify and save all the parameters of the system, by connecting a PC to the drive.

The interface communicates with the drive via *serial RS232* and *ModBus communication protocol*.

PC minimum preconditions:
    Operative system: *Windows 98*, *Windows 2000*, *Windows XT;*
    Graphic sheet: Windows compatible, coloured;
    Drive: Hard disk having at least 5 MB free;
            Drive for CD-ROM
    Work memory: at least 8 MB;
    Interface: free serial interface

Installation procedure:
    1- connect the RS232 cable to the PC serial interface and to the drive connector (do this with the drive not supplied).
    2- insert the CD, click on the installation file "**Setup.EXE**" that you find on the CD directory, then follow the instructions.
    3- at the end of the installation, to start the interface click on the "**Axormb.exe**" file that you find on the directory: "C:\ Program\Axor" (or in the directory selected during installation).

**Attention: The parameter variation, via interface, should be done only by technical qualified personnel.**

Note: The main parameters set by *Speeder One* interface can be changed <u>by keypad</u> or <u>via ModBus</u>. On the following pages, near the name of parameters there is the corresponding address, that you can use for the keypad or for the ModBus managements.
For more information see enclosures "***Display and Keypad* Manual**" and "***ModBus* Manual**" available on the CD provided with the drive.

1 Speeder one Interface

The program is started by clicking on "**Axormb.exe**".
The main window "**Axor Servo Drive**" and the "**Select Driver**" window open simultaneously. On the **Select Driver** window insert the drive's address (all drives have **1** as default value), then click OK.
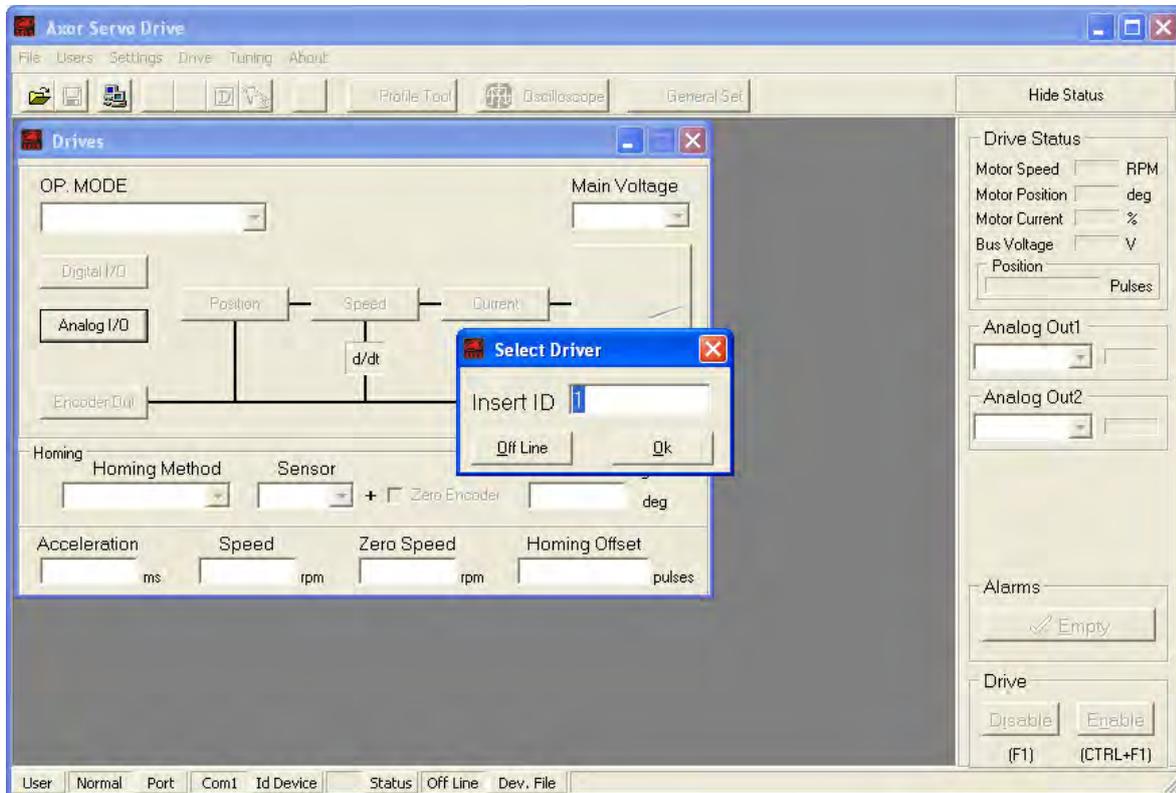

If the PC is not connected to the drive or the drive is not supplied, clicking on "**OFF line**" and then clicking on icon "**Open**", a window containing a serie of pre-set files will open. Openig one of these files you can visualise a series of standard parameters:
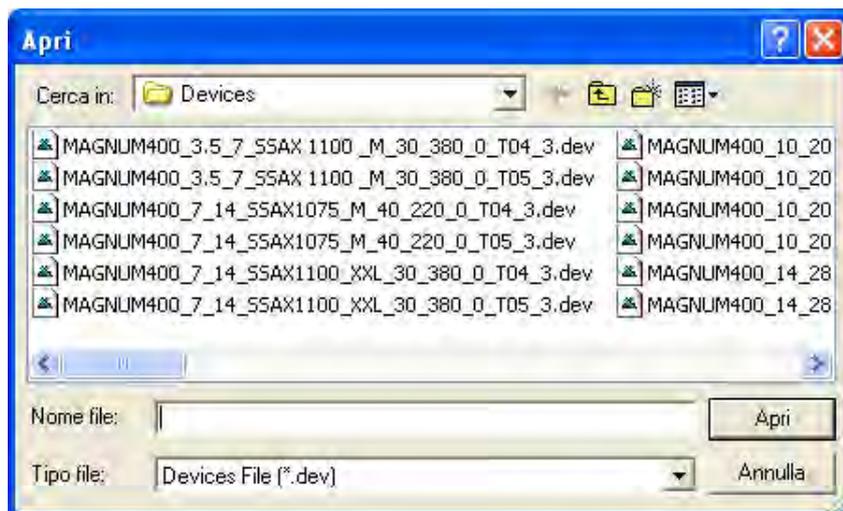
The main window of the **Speeder One** software is displayed below:
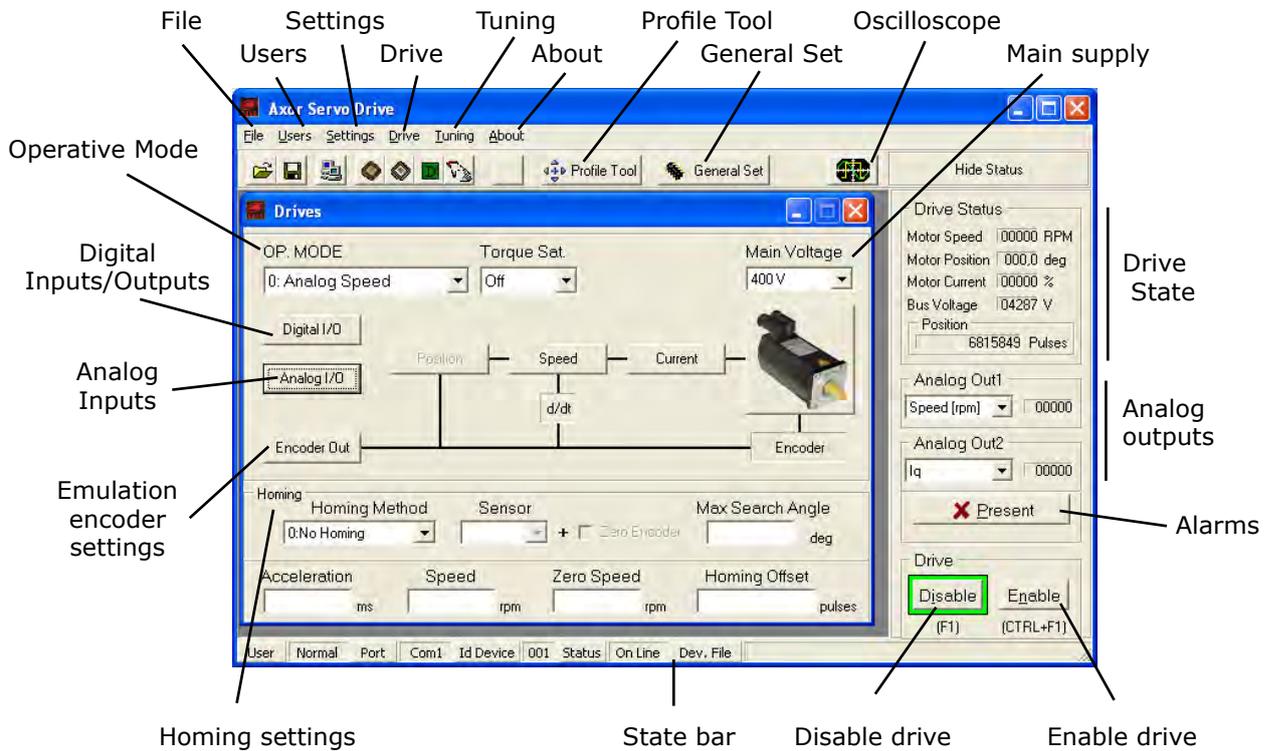
File
By clicking on "**File**" it is possible to *open*, *save* or *save as* a file "*.dev", or to *compare* two configurations or to *exit* the program.

Users
Axor reserved information.

Settings
By clicking on "**Settings**" the "**General Settings**" and "**Com Port**" menu are displayed.

Com Port
By clicking on "C**om Port**", it is possible to modify the serial communication data between the PC and driver.
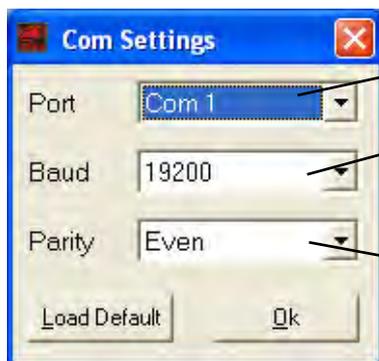
Set the serial port of PC.

By clicking on "**Baud**", you can set the velocity communication baud rate between PC and driver.
[By keypad: F2 ⇨ c2]
[ModBus address: 3]

By clicking on "**Parity**", you can display the parity bit settings.
[By keypad: F4 ⇨ E8]
[ModBus address: 20]
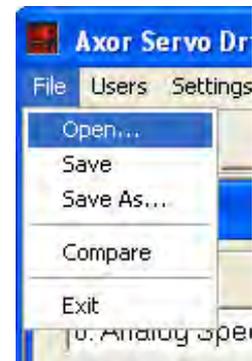
General Settings

By clicking on "**General Settings**", it is possible to visualize some of the drive's properties, and to impose some generic functions:
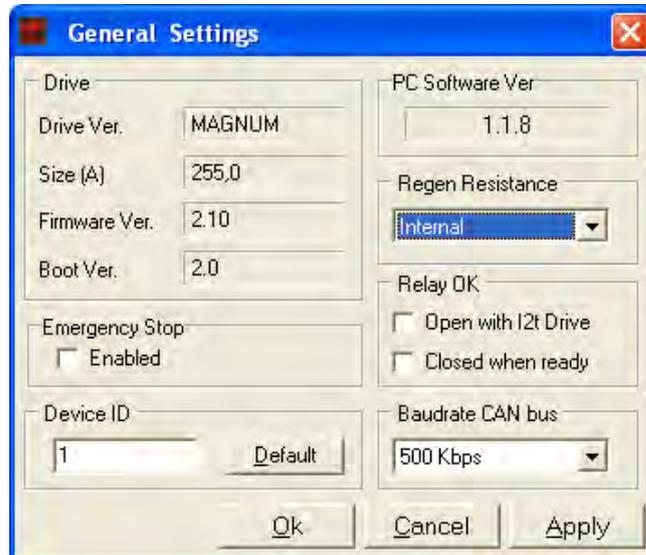
Drive

It visualizes the main properties of the drive, such as:
- Drive Ver.   Type of digital connected servodrive;
- Size   Nominal size in Amperage;
- Firmware Ver.   Firmware version;
- Boot Ver.   Boot Software version.

PC Software Ver.

It visualizes the software version of *Speeder One*.

Regen resistance [By keypad: F12 ⇨ I15]

It visualizes the type of regen resistance: Internal or External (more information on the Service Manual of the drive).

Relay OK

It enables two functions:
- "**Open with I2t Drive**": It enables or not the opening of the "Relè OK" contact during the alarm 6: "I²t Drive";
- "**Closed when ready**": When the auxiliary power supply (+24V) is turned on, this option enables the closing of the "Relè Ok" before the main supply is turned on.

Baudrate CAN bus [By keypad: F2 ⇨ c3] [ModBus address: 4]

This option allows you to set the "baudrate" of the drive during the Can Bus communications. The selectable values are those specified by the CAN DS301 ver. 4.0.2 instructions, therefore: 50, 100, 125, 250, 500, 800, 1000 Kbps.

Device ID [By keypad: F2 ⇨ c1] [ModBus address: 2]

This option allows you to set or to change the address of the drive. All drives have as default value **1**. If you change the address of the drive you have to save it onto the EEPROM and then disable and enable the drive.

Emergency Stop

It enables/disables the **Emergency Stop** *function*, which allows you to stop the motor, by using a settable emergency ramp, in presence of a disable or an alarm (more information on enclosure "Additional Features Manual").

Drive

"**Select Drive**" opens the "**Select Driver**" window, "**Compare with File**" opens a window which allows you to compare two configuration files, while "**Enable**" and "**Disable**" manage the state of the drive.
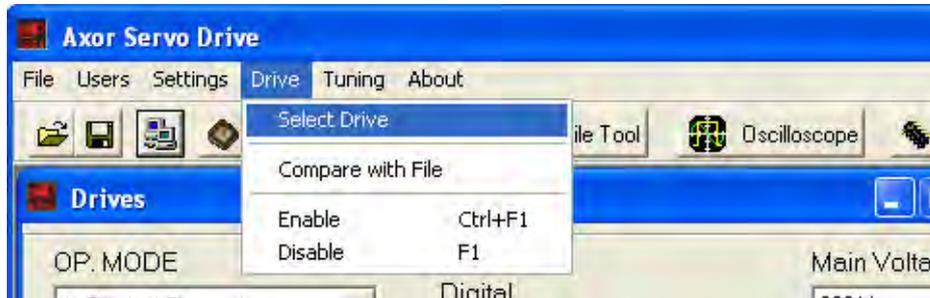
Tuning

This menu is utilized for the phasing of the motor ("**Motor Phasing**"), the settings of the offset of the velocity analog input reference ("**Speed offset**") or the torque offset settings ("**Torque Offset**").

Motor Phasing

When you select this option the program asks if it should execute motor phasing, if confirmed the motor automatically enables and executes. The phase angle is visualized in the "**Motor**" window.

Speed Offset

This option is to be paired with the operation mode "**0:Analog Speed**" and it calculates the voltage on the analog +/-VREF inputs taken as zero speed reference (0 rpm).
The value of the calculated offset can be read in the "**Analog I/O**" window and it is expressed in mV.

Torque Offset

This option calculates the voltage on the analog +/-VREF inputs taken as zero torque reference.
The value of the calculated offset can be read in the "**Analog I/O**" window and it is expressed in mV.

About

This option shows the program version and additional information, for example: "Axor Servo Drive Software 1.1.8".

2 Main menu

The program functions may be chosen both from the main menu, as well as from the icons shown below:
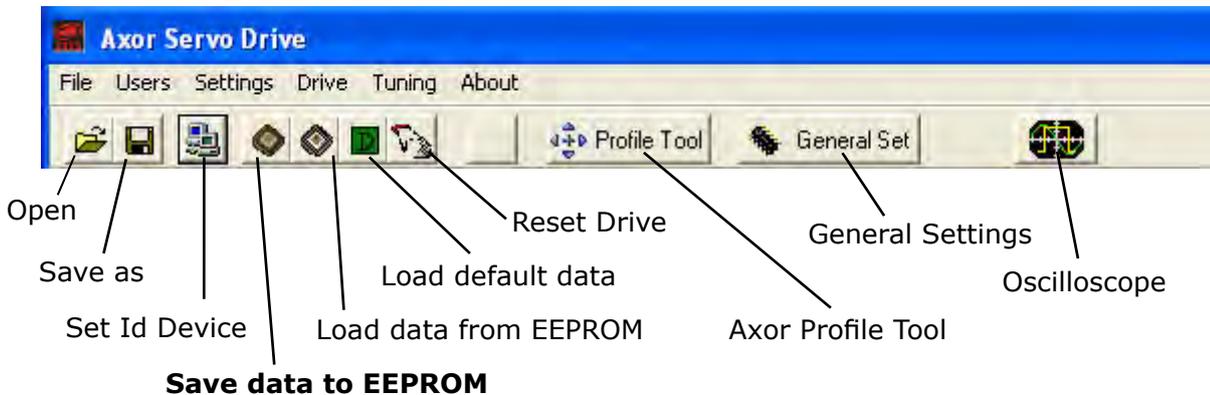

Open
It opens a file "*filename*.dev".

Save as
It saves with name on EEPROM a file with the configuration visualized on the interface at the moment of the memorisation.

Set Id Device [By keypad: F2 ⇨ c1] [ModBus address: 2]
It opens the "**Select Driver**" window, which allows you to select the drive's address with which you wish to communicate; this permits "**single drop communication**" (with a *single* driver) or "**multi drop communication**" (with *multiple* drivers).
All drives have as default value 1. It is possible to change the drive's address in the "**General Settings**" window.

Save data to EEPROM [By keypad: F10 ⇨ U4] [ModBus address: 69]
It saves the configuration created on EEPROM of the drive and therefore it makes it operative. The program asks for confirmation.
Note: Every time you desire to make modifications and render them operative at the re-start of the drive, the information must be saved on the EEPROM by clicking this icon.

Load data from EEPROM [By keypad: F10 ⇨ U4] [ModBus address: 69]
It loads all the values which are present on EEPROM to the drive.
The program asks for confirmation.

Load default data [By keypad: F10 ⇨ U4] [ModBus address: 69]
It uploads a list of standard parameters.
Note: These parameters could be different from those actually required by the motor utilized.
The program requests confirmation.

Reset Drive
It re-sets the basic functions of the drive.

Axor Profile Tool
It opens the "**Axor Profile Tool**" window, with which you can setup all the parameters about the positioner.

General Settings
It opens the "**General Setting**" window.

Oscilloscope
It opens the "**Oscilloscope**" window.

3 Operative Mode

The "**OP. MODE**" menu allows you to select the operation mode of the drive. With every selection all associated information are automatically pre-disposed.
The Axor digital drives offer the following operation modes:
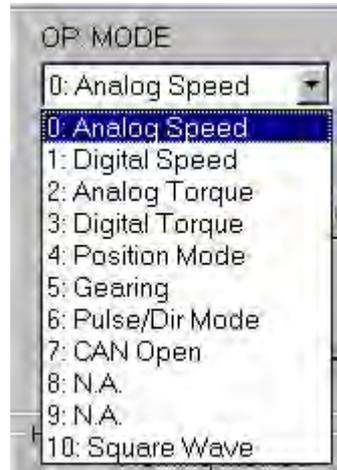
0: Analog Speed
The motor is controlled in velocity mode through an analog differential or common mode input from an external controller.

1: Digital Speed
The motor is controlled in velocity mode through a digital reference.

2: Analog Torque
The motor is controlled in torque mode through an analog reference.

3: Digital Torque
The motor is controlled in torque mode through a digital reference.

4: Position Mode
The motor is controlled in position.

5: Gearing
The position of the motor is controlled through the quadrature signals from an incremental encoder of a Master motor, or through the emulated encoder signals from a Master drive.

6: Pulse/Dir Mode
The position of the motor is controlled through the digital piloting inputs: +/- Pulse and +/-Dir.

7: Can Open
This mode allows you to configure and control the drive using CanBus.

10: Square Wave
The motor is piloted with a "square wave" signal.
This is useful for adjustments of the speed loop.

Note: To set the desired operative mode <u>by the keypad</u>, use the following address: F10 ⇨ U6.

Note: To set the desired operative mode <u>by ModBus</u> use the following address: 71.

Note: You can found more information about operative modes on enclosures "Operative Modes Manual" and "Positioner Manual" available on the CD provided with the drive.

4 Drive Status

Drive Status (Status bar on the right of the main window)
- **Motor Speed** displays the velocity of the motor in RPM **[ModBus address: 59]**;
- **Motor Position** displays the rotor position in mechanical degrees;
- **Motor Current** displays the motor current (in percentages) with respect to twice the rated current of the drive. 50%= rated current, 100%= 2*rated current ;
- **Bus Voltage** displays the bus voltage **[ModBus address: 53]**;
- **Position** displays the rotor position in pulses (only in the following operative modes: "4: Position Mode", "5: Gearing", "6: Pulse/Dir Mode");
- **Analog Out1** and **Analog Out2**: by clicking on those it is possible to select which internal parameter will be put into the analog outputs. Default settings are: "motor speed" on Analog Out1 and "motor current" on Analog Out2 **[ModBus address: 66 for Analog Out1, ModBus address: 67 for Analog Out2]**.
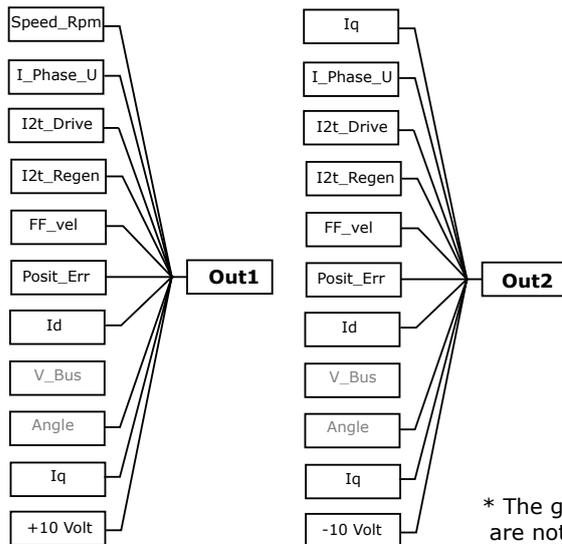
* The grey options are not yet active.
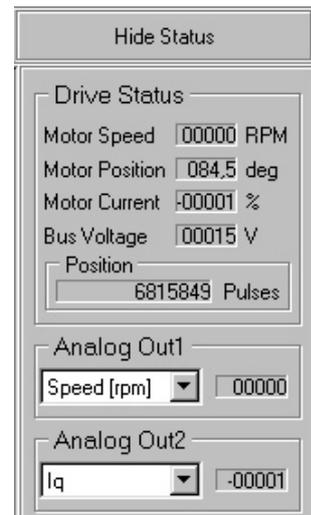
Alarms

Selecting this window allows you to visualize the history of the drive's alarms and the status of them.

A red dot ● and the red symbol ✓ near the alarm name indicate that the alarm is currently on, while a red checkmark signifies that the alarm has been resolved.

It is possible to reset the *history* of alarms by disabling and enabling the drive or clicking on "**Reset Historic Alarms**".

You can found more information about alarms on enclosure "Alarms Manual" available on the CD provided with the drive.


Enable, Disable

By clicking on this button you can enable or disable the drive's torque. ATTENTION: DRIVE'S ENABLE/DISABLE IS NOT COSIDERED A SAFETY FUNCTION.
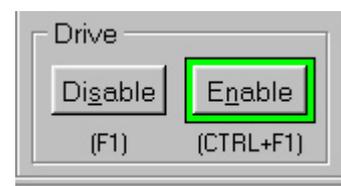
5 Speed Window

This window allows modification of the dynamic costants of the drive's **speed loop**.
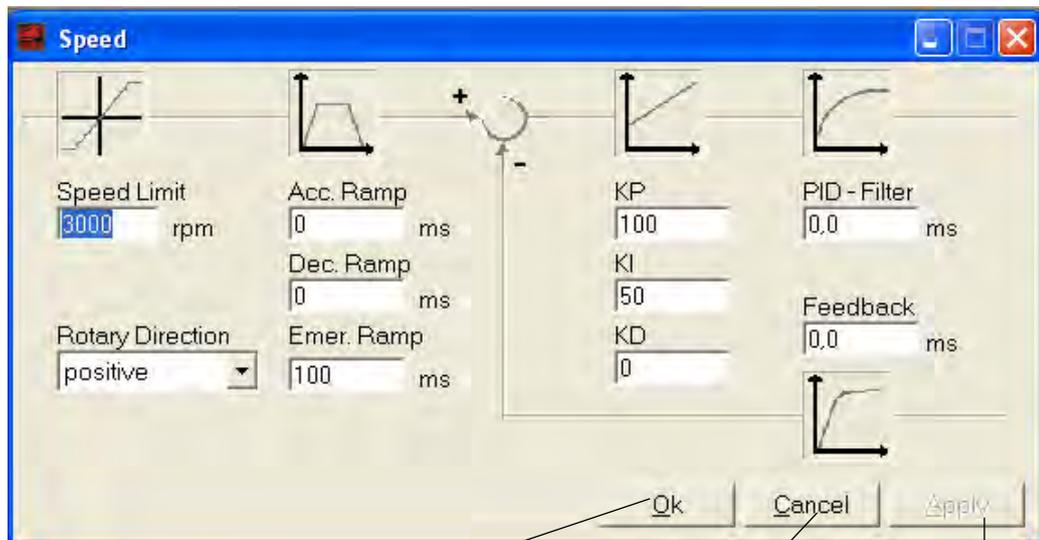
OK confirms the set value and closes the window.

Cancel closes the window without change any parameter.

Apply confirms the set value, but it does not close the window.

Speed limit [By keypad: F5 ⇨ h9] [ModBus address: 31]
Generally in this box there is the rated speed of the motor coupled with the drive, but it is possible to insert greater value up to 8000rpm max.

Rotary Direction
It allows you to set the rotor's sense of rotation: Positive (CW) or Negative (CCW).

Acc. Ramp [By keypad: F5 ⇨ h12]
[ModBus address: 34]
It is possible to insert the value of the acceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).

Dec. Ramp [By keypad: F5 ⇨ h13]
[ModBus address: 35]
It is possible to insert the value of the deceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).
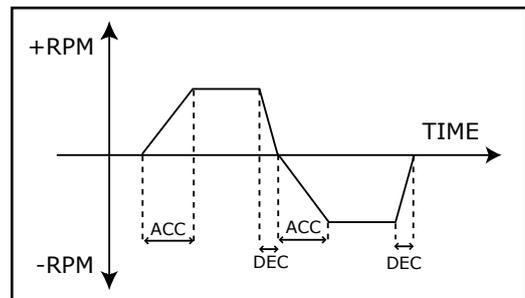
Emer.Ramp [By keypad: F5 ⇨ h14] [ModBus address: 36]
It is possible to insert the value of the deceleration ramp "in ms" during the emergency stop.

PID-Filter [By keypad: F5 ⇨ h5] [ModBus address: 27]
It is a filter on the output of the speed regulator.

Feedback [By keypad: F5 ⇨ h4] [ModBus address: 26]
It is a filter on the feedback speed.

Note: Setting the PID-Filter and Feedback parameters make the system less noisy, therefore non appropriate tuning may cause a less dynamic or instable system.

KP **[By keypad: F5 ⇨ h1] [ModBus address: 23]**
It is the proportional gain of the speed loop.
This setting optimises the dynamic behaviour of the motor. The range is between zero and 4000.

KI **[By keypad: F5 ⇨ h2] [ModBus address: 24]**
It is the integral gain of the speed loop.
This setting optimises the dynamic behaviour of the motor. The range is between zero and 4000.

The **procedure for the speed loop tuning** is described on enclosure "Procedure Manual" available on request. **That procedure can be executed only by technical qualified personnel. For any question contact Axor.**

6 Current Window

This window allows you to modify the dynamic costants of the drive's **current loop**.
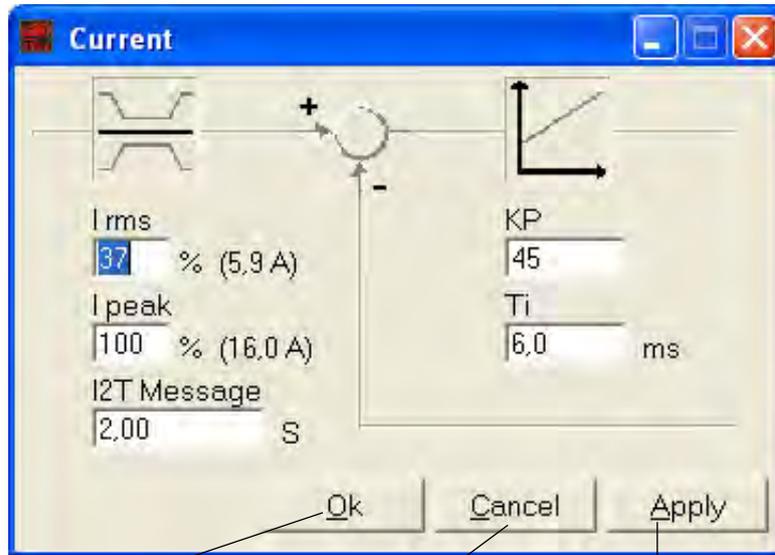
OK confirms the set value and closes the window.

Cancel closes the window without change any parameter.

Apply confirms the set value, but it does not close the window.

I rms [By keypad: F4 ⇨ E1] [ModBus address: 13]
In this box it is possible to insert the percentage value of the rated current furnished by the drive. The numerical range is between 1 and 50 and it is referred to the peak current value.
Example: suppose we have a drive size 8/16, if we insert into this box the value 15%, we'll have a setting of rated current equal to 2,4A (in fact 16X15/100=2,4), so the drive will provide a rated current equal to 2,4A to the motor.

I peak [By keypad: F4 ⇨ E2] [ModBus address: 14]
In this section it is possible to insert the percentage value of the peak current furnished by the drive. The numerical range is between 1 and 100
Example: suppose we have a drive size 8/16, if we insert into this box the value 75%, we'll have a setting of peak current equal to 12A (in fact 16X75/100=12), so the drive will provide a peak current equal to 12A to the motor.

The value of nominal and peak current is RMS.

I2T Message [By keypad: F4 ⇨ E9] [ModBus address: 21]
Time of the peak current.
Typically with an adjustment of Ipeak = 100%, the time will be 5 seconds (for the Magnum400 and the MiniMagnum), 2 seconds (for the McbNET Digital).
Not to change this parameter before consulting Axor.

KP [By keypad: F4 ⇨ E3] [ModBus address: 15]
It is the proportional gain of the current loop. This adjustment allows for optimizing the dynamic behaviour of the motor's current loop. The numerical range of this parameter varies from 0 up to 999.

TI [By keypad: F4 ⇨ E4] [ModBus address: 16]
It is the integral time in "ms" of the current loop.
The numerical range of this parameter varies from 0 up to 999ms.

The **procedure for the current loop tuning** is described on enclosure "Procedure Manual" available on request. **That procedure can be executed only by technical qualified personnel. For any question contact Axor.**

7 Encoder Out window

With this parameter you can set the number of pulses per turn on encoder emulation outputs available to the numerical controller or PLC.

Using an encoder with **N** pulse/rev, it is possible to set **N**, **N/2**, **N/4**, **N/8**, **N/16**, **N/32**, **N/64**, **N/128** pulse/rev.

Example: Utilizing a motor transducer with 2048 PPR, the setable values are: 2048, 1024, 512, 256, 128, 64, 32 and 16.
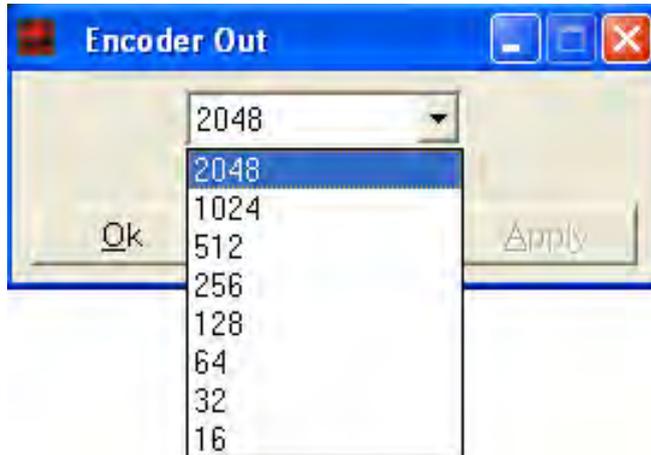
The figure below illustrates the typical encoder emulation output pulses when the motor turns clockwise: the emulation output pulses are emitted under the form of two signals, **A** and **B**, which are electrically staggered by 90° and a zero signal, **Z**.
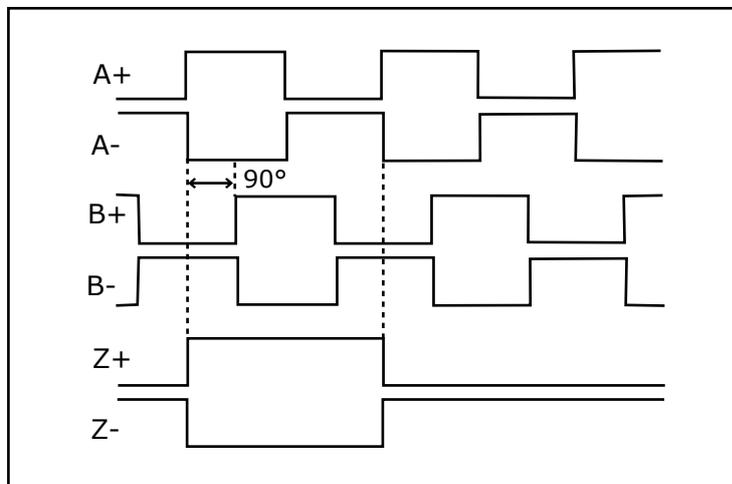
Note: If the **2 pole resolver feedback** is used, the max resolution of the emulated encoder will be **1024 pulses per turn**, so the setable values are: 1024, 512, 256, 128, 64, 32, 16 and 8.

Note: To set by keypad the Encoder Out parameter, use the following address: F10 ⇨ U3.

Note: To set by ModBus the Encoder Out parameter, use the following address: 68.

Note: You can found more information about emulated encoder on enclosure "Operative Modes Manual" available on the CD provided with the drive.

Clicking this icon it is possible to modify items relating to the **motor**'s characteristics.
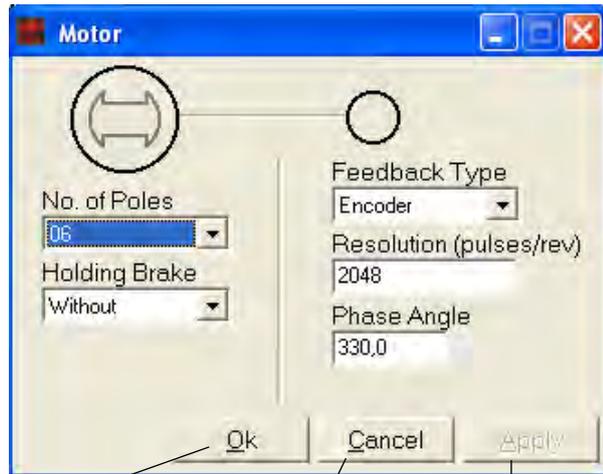
OK confirms the set value and closes the window.

Cancel closes the window without change any parameter.

Apply confirms the set value, but it does not close the window.

No. of Poles [By keypad: F3 ⇨ d1] [ModBus address: 7]
Number of motor poles. It is possible to set 0, 2, 4, 6, 8, 10, and 12 poles.
The value pre-set as a default is 6 poles. The value 0 is to be used when utilizing linear motors.

Feedback Type [By keypad: F3 ⇨ d6] [ModBus address: 12]
It permits to select the type of motor feedback: Encoder or Resolver.

Resolution (pulses/rev) [By keypad: F3 ⇨ d3] [ModBus address: 9]
Insert in this section the value of encoder pulses/rev.

No. of Poles [By keypad: F3 ⇨ d2] [ModBus address: 8]
It visualises the number of resolver poles. Currently only 2 poles resolver feedback is supported.
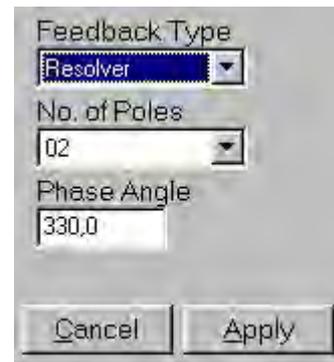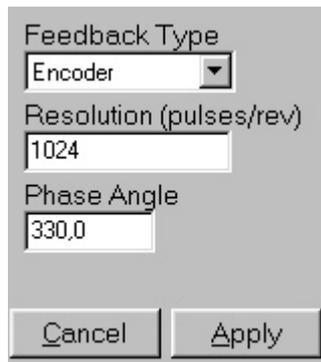
Phase angle [By keypad: F3 ⇨ d5] [ModBus address: 11]
In this section the phasing angle of the motor, previously calculated with the "**Tuning** ⇨ "**Motor Phasing**" procedures, is visualized. The phasing angle, for Axor motors serie SuperSAX encoder feedback, is 330° ±5°, while for resolver feedback it is 0° ±5°.

Holding Brake
When the "**Without**" option is selected the electromechanical brake integrated on the motor is not manage, while when the "**With**" option is selected the electromechanical brake can be manage *externally* by the user or *internally* by the control (You can find more information about holding brake on enclosure "Additional Features Manual" available on the CD provided with the drive).
ATTENTION: **McbNET Digital™** does not manage this function.

9 Analog I/O window

This window allows you to control and condition the analogic signal of the differential or common mode reference from the external controller or the analogic signal of the torque reference (TPRC input).
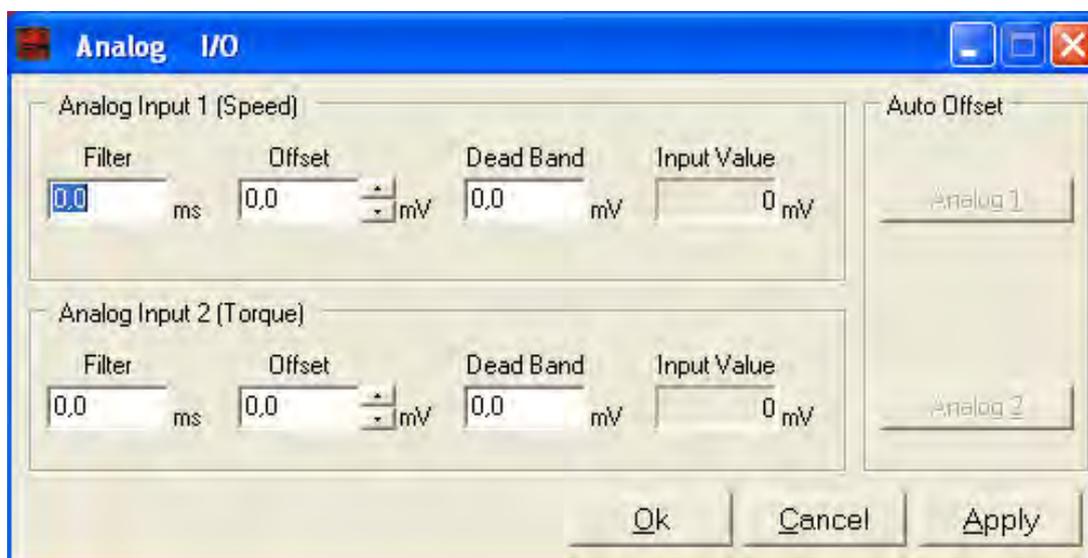
Filter [By keypad: F4 ⇨ E5 for the Analog Input 1, F4 ⇨ E10 for the Analog Input 2]
[ModBus address: 17 for the Analog Input 1, ModBus address: 22 for the Analog Input 2]
Filter in "ms" on the analog input signal.

Offset (Speed) **[By keypad: F5 ⇨ E7] [ModBus address: 29]**
Voltage in "mV" on the +/-VREF analog inputs taken as zero speed reference (0 rpm). This value is calculated using the "**Tuning ⇨ Speed Offset**" procedure or by clicking on the "**Speed**" button of the "**Analog I/O**" window, otherwise it is possible to increase or decrease this value using the up/down arrows near the "**Offset**" window.

Offset (Torque) **[By keypad: F5 ⇨ E8] [ModBus address: 30]**
Voltage in "mV" on the TPRC analog input taken as zero torque reference. This value is calculated using the "**Tuning ⇨ Torque Offset**" procedure or by clicking on the "**Torque**" button of the "**Analog I/O**" window, otherwise it is possible to increase or decrease this value using the up/down arrows near the "**Offset**" window.

Dead Band (Speed) **[By keypad: F5 ⇨ h6] [ModBus address: 28]**
If the voltage on the +/-VREF analog inputs is within the range [-Dead Band, +Dead Band], the analog speed reference is zero (0 rpm).

Dead Band (Torque) **[By keypad: F8 ⇨ A3] [ModBus address: 50]**
If the voltage on the TPRC analog input is within the range [-Dead Band, +Dead Band], the analog torque reference is zero.

Input Value
[By keypad: F14 ⇨]15 for the Analog Input 1, F14 ⇨]16 for the Analog Input 2]
[ModBus address: 138 for the Analog Input 1, ModBus address: 139 for the Analog Input 2]
It visualises in "mV" the voltage measured on the analog inputs This value depends by the Offset, the Filter and the Dead Band settings.

Auto Offset
The two buttons *automatically* execute: the settings of the offset of the velocity analog input reference ("**Analog1**") and the torque offset settings ("**Analog2**").

10 Digital I/O window

This window allows you to modify **via software** the status of the programmable digital inputs and to control the hardware status of the digital inputs and outputs.
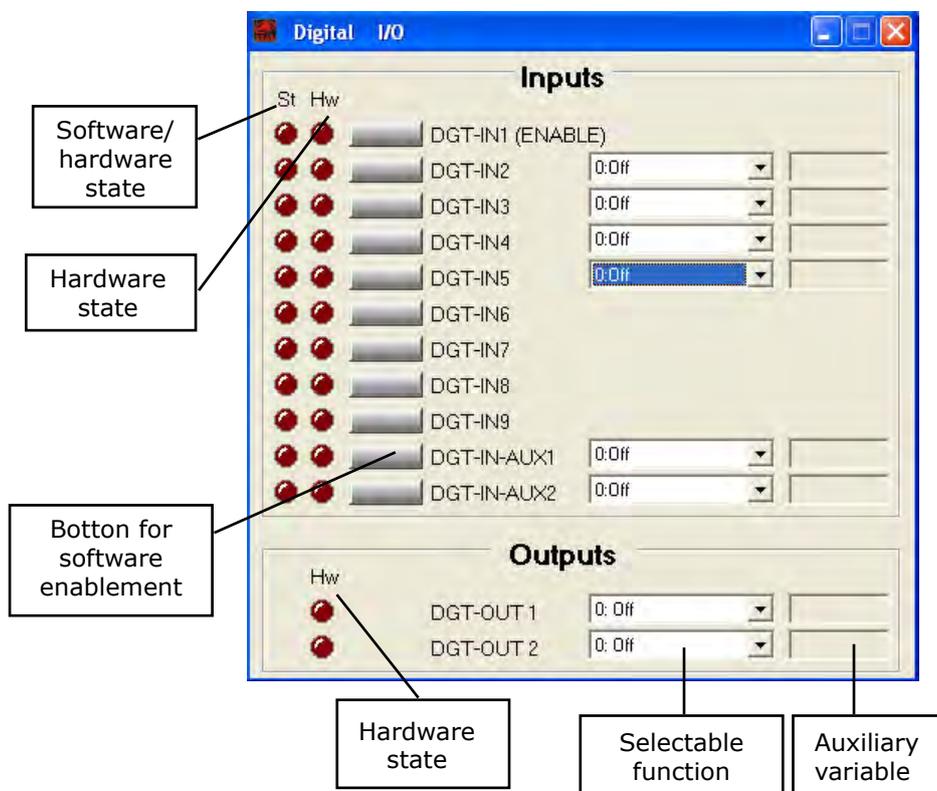
The "**St**" led visualises the **status** (**software or hardware**) of the digital inputs. Clicking on the button near the name of the digital input, the "St" led becomes red and a high logic signal is present on the input.

The "**Hw**" led visualises the **hardware status** of the digital input, if it is red a voltage is present on the input.
he DGT-IN1,...DGT-IN9 inputs are enabled by giving +24V, while the DGT-INAUX1 and DGT-IN-AUX2 inputs are enabled by giving +5V.
Attention: it is not possible to enable the DGT-INAUX1 and DGT-IN-AUX2 giving +24V.

If the Hw led is red, the St led is red too.

The "**Hw**" led, about digital outputs, visualises the **hardware status** of the digital outputs, if it is red the output is closed.

Near the name of each digital input/output there are two fields:

- There is a menu that allows you to select a **function**;
- There is a field where you can insert the **auxiliary variable** if necessary. (Not all functions need an auxiliary variable).

10 Digital I/O window

The **DGT-IN2**…**DGT-IN5** and **DGT-IN-AUX1**…**DGT-IN-AUX2** inputs can be set to enable the following functions:

FUNCTION	DESCRIPTION	OP MODE
Off	With this settings there is not a particular function assigned to the input.	all
Ref-On	It enables the motor rotation.	Analog Speed Digital Speed Gearing Pulse/Dir Mode
PStop	Positive limit switch. A low logical signal on this input disables the "CW" rotation of the motor.	
NStop	Negative limit switch. A low logical signal on this input disables the "CCW" rotation of the motor.	Analog Speed Digital Speed
P+N Stop	Positive and negative limit switch. A low logical signal on this input disables the CW or CCW rotation of the motor.	
Brake	It enables the external manage braking by the user.	all
Homing Sensor	Homing sensor.	Position Mode Gearing Pulse/Dir Mode
Start Jog	It enables a movement having the following parameters: • acceleration time that is equal to the homing acceleration time; • speed (in rpm) equal to the value set in the auxiliary variable; • target equal to the positive extreme (PSTOP software) of the axis if the speed is positive, or equal to the negative extreme (NSTOP software) of the axis if the speed is negative; • deceleration time that is equal to the homing acceleration time.	
Start_Task_n°	It enables the task set by the auxiliary variable. There is not possibility of blending with this function.	
Start Task I/O	It enables the task set by the digital inputs DGT-IN5…DGT-IN9. There is not possibility of blending with this function.	Position Mode
Start Sequence	It enables a sequence of tasks. The first task is set by the digital inputs DGT-IN5…DGT-IN9, while the next tasks are set by using the "Next Profile" parameter associated to each task. At the end of each task the following automatically starts.	
Start Next	It enables a sequence of tasks. The first task is set by the digital inputs DGT-IN5…DGT-IN9, while the next tasks are set by using the "Next Profile" parameter associated to each task. At the end of each task the motor stops, the user has to click the task button (clicking twice: disabling and enabling) in order to start the next task of the sequence.	
Emergency	Lowering the logic input along with this function, stops the motor rotation utilising the Emer. Ramp set in the Speed window.	Analog Speed Digital Speed Position Mode
Start Homing	It is used to start/stop the homing procedure.	Position Mode Gearing Pulse/Dir Mode
Reset Fault	It allows the reset the "resettable" alarms.	all

Very Important Notes:

• **The function just illustrated are selectable on all the digital inputs, otherwise the functions: Ref-On, PStop, NStop, Brake, P+N Stop, Homing Sensor, Start Task I/O, Start Sequence, Star Next, Emergency, Start Homing, Reset Alarm can be set on one input at a time.**

• **If the OP MODE "6:Pulse/Dir Mode" is set, the digital inputs DGT-IN-AUX1 and DGT-IN-AUX2 cannot be utilised as programmable digital inputs.**

• **Before changing the function on a programmable input make sure that the function is disabled.**
For example:
  The "Start Homing" function is not active with a <u>low</u> signal on the dedicated input.The "Pstop" function is not active with a <u>high</u> signal on the dedicated input.

• **Remember to save to the EEPROM all settings made on the programmable digital input in order to make them permanent.**

• To set or reset <u>by keypad</u> the digital inputs, see enclosure "Display and Keypad Manual" available on the CD provided with the drive.

The **DGT-IN5**…**DGT-IN9** are used to select via software one of the **32 pre-set positioning profiles** for the functions: *Start Task I/O*, *Start Sequence*, *Start Next*.

If the **DGT-IN5** digital input is set with the "**Off**" function, it is possible to make the direct addressing of **all the 32 available tasks** by using the tables below:

Profile N°	Digital Inputs						Profile N°	Digital Inputs				
	9	**8**	**7**	**6**	**5**			**9**	**8**	**7**	**6**	**5**
1	0	0	0	0	0		17	1	0	0	0	0
2	0	0	0	0	1		18	1	0	0	0	1
3	0	0	0	1	0		19	1	0	0	1	0
4	0	0	0	1	1		20	1	0	0	1	1
5	0	0	1	0	0		21	1	0	1	0	0
6	0	0	1	0	1		22	1	0	1	0	1
7	0	0	1	1	0		23	1	0	1	1	0
8	0	0	1	1	1		24	1	0	1	1	1
9	0	1	0	0	0		25	1	1	0	0	0
10	0	1	0	0	1		26	1	1	0	0	1
11	0	1	0	1	0		27	1	1	0	1	0
12	0	1	0	1	1		28	1	1	0	1	1
13	0	1	1	0	0		29	1	1	1	0	0
14	0	1	1	0	1		30	1	1	1	0	1
15	0	1	1	1	0		31	1	1	1	1	0
16	0	1	1	1	1		32	1	1	1	1	1

<u>Example</u>: If the **DGT-IN5** digital input is set with the "**Off**" function and you want to select the **n° 10 profile**: apply a high logic signal to the **DGT-IN8** and **DGT-IN5** inputs and disable the **DGT-IN6**, **DGT-IN7** and **DGT-IN9** inputs.

If the **DGT-IN5** digital input is set with any functions other than "**Off**", it is possible to make the direct addressing of only **16 profiles**, from 1 to 16, using the tables below:

Profile N°	Digital Inputs				
	9	**8**	**7**	**6**	**5**
1	0	0	0	0	X
2	0	0	0	1	X
3	0	0	1	0	X
4	0	0	1	1	X
5	0	1	0	0	X
6	0	1	0	1	X
7	0	1	1	0	X
8	0	1	1	1	X
9	1	0	0	0	X
10	1	0	0	1	X
11	1	0	1	0	X
12	1	0	1	1	X
13	1	1	0	0	X
14	1	1		0	X
15	1	1	1	0	X
16	1	1	1	1	X

<u>Example</u>: If the **DGT-IN5** digital input is set with any functions other than "**Off**" and you want to select the **n° 10 profile**: apply a high logic signal to the **DGT-IN9** and **DGT-IN6** inputs and disable the **DGT-IN7** and **DGT-IN8** inputs.

10 Digital I/O window

In the following table there are the setting functions for the two digital outputs:

FUNCTION	DESCRIPTION	OP MODE
Off	Selecting this function the output will always be open.	all
|Speed|>x	If the absolute value of the actual speed is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual speed is less than the value inserted in the auxiliary variable the output will be opened.	all
|Speed|<x	If the absolute value of the actual speed is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual speed is greater than the value inserted in the auxiliary variable the output will be opened.	all
Homing OK	The output will be closed after a complete and successful homing procedure. At the start of every new homing procedure the output will be opened.	Position mode Gearing Pulse/Dir Mode
I2t	The output will be closed if the I^2t condition is reached. When this condition comes down the output will be opened.	all
|Irms%|>x	If the absolute value of the actual current is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is less than the value inserted in the auxiliary variable the output will be opened.	all
|Irms%|<x	If the absolute value of the actual current is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is greater than the value inserted in the auxiliary variable the output will be opened.	all
Target OK	This function closes the output when a positioning task successfully terminates; at the start of a new profile the output is opened.	Position mode
Error	With this function the output is closed if one or more alarms are present. When all alarm are cleared the output will be opened.	all
Ready	When the control circuitry is powered up (with a minimum delay), the output will be closed.	all
P.A. Max	When 80% of the maximum recovery is reached, the output is closed and it will be re-opened if the value becomes less than 80% of the maximum recovery value. ATTENTION: **McbNET Digital™** does <u>not</u> manage this function.	all
|Err Pos|>x	If the absolute value of the actual Position Error is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is less than the value inserted in the auxiliary variable the output will be opened. The actual position error can be monitored in main window of Speeder One interface by selecting Posit_Err option in Analog Out1 or Analog Out2 menu.	Position mode Gearing Pulse/Dir Mode
|Err Pos|<x	If the absolute value of the actual Position Error is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is greater than the value inserted in the auxiliary variable the output will be opened. The actual position error can be monitored in main window of Speeder One interface by selecting Posit_Err option in Analog Out1 or Analog Out2 menu.	Position mode Gearing Pulse/Dir Mode
Next Target	This function is to be utilized exclusively with either the *Start Sequence* function or the *Start Next* function on a programmable input. At the start of the first profile the output is opened and it will change status (toggled) at the start of every new profile.	Position mode

Note: to set or reset <u>by keypad</u> the digital outputs, see enclosure "Dispaly and Keypad Manual" available on the CD provided with the drive.

11 Position window

This window allows you to set the static and dynamic parameters about "**4:Position Mode**", "**5:Gearing**", "**6:Pulse/Dir Mode**".
With every selection all associated parameters are pre-disposed automatically.

"4:Position Mode"

If the "**4:Position Mode**" operative mode is set, the "**Position**" window is the following:

Feed Forward
This improves the system's dynamics.
Suggested value: 100%.
[By keypad: F6 ⇨ P4]
[ModBus address: 41]

Kp Dynamic
This is the position loop gain.
Suggested values:
1÷999.
[By keypad: F6 ⇨ P1]
[ModBus address: 38]

Kp Static
Set as Kp Dynamic.
[By keypad: F6 ⇨ P2]
[ModBus address: 39]
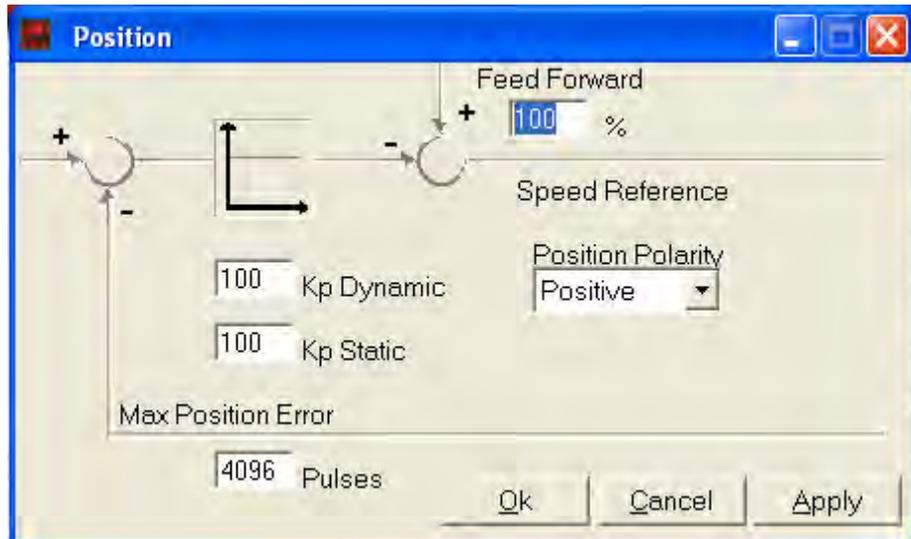
Position Polarity
Positive or Negative. This parameter enables a complete inversion of axis control.
Selecting the "**Negative**" choice you have effects on homing and positioning procedures like as follow:
 1) The rotation wise of supported homing procedures is inverted referred to the procedures in the chapter relative to homing procedures.
 2) The "Homing Offset" value set is multiplied by -1.
 3) All target positions ("Final Position") are multiplied by -1.

Max Position Error [By keypad: F6 ⇨ P5] [ModBus address: 42]
This is the position error after which the drive goes into alarm 14 ("Following Error").
To calculate the value to insert in this field, use the following formula:

$$\text{Max\_Position\_Error} = \frac{K°}{360°} * 65536$$

where K° is the value in mechanical degrees of the maximum accepted error.
The maximum selectable position error is 180° (32767 pulses).

Example: If the maximum mechanical accepted error is 45° (1/8 mechanical turn), then the value to insert in the Max Position Error box is 8192, in fact:

$$\text{Max\_Position\_Error} = \frac{45°}{360°} * 65536 = 8192$$

We suggest to insert the value 8192.

Note: You can find more information about Positioner on enclosure "Positioner Manual" available on the CD provided with the drive.

"5:Gearing"

If the "**5:Gearing**" operative mode is set, the "**Position**" window is the following:
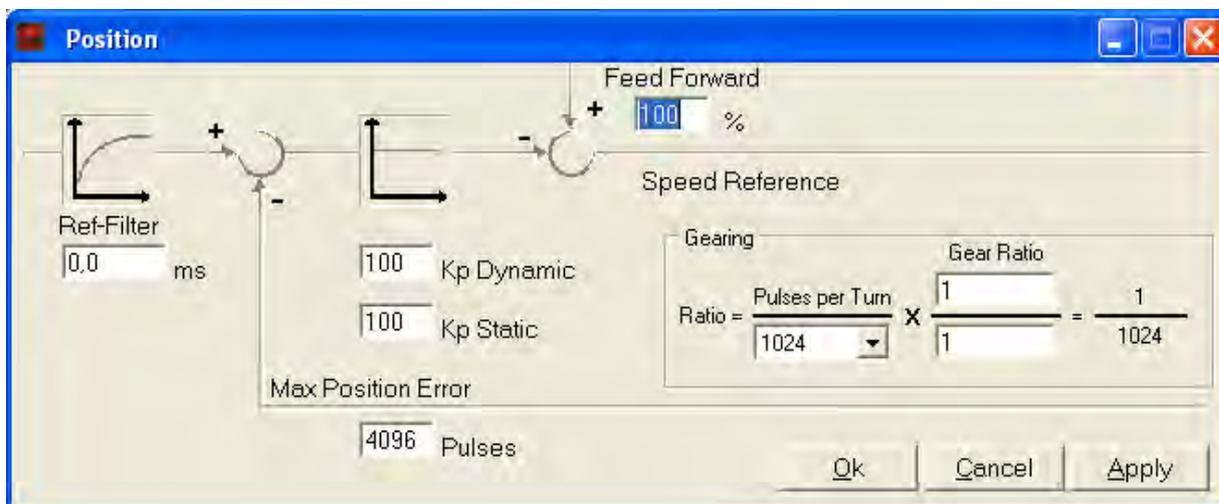
The **Feedforward**, **Kp Dynamic**, **Kp Static** and **Max.Position Error** parameters have the same functions illustrated in the preceeding page, but may have to be re-set, while adding the new parameters for gearing:

Pulses per turn [By keypad: F7 ⇨ L1] [ModBus address: 45]
Insert into this field the number of pulses per turn of the encoder of the Master motor or the number of pulses per turn of the emulated encoder from the Master drive.

Gear Ratio [By keypad: F7 ⇨ L2 for the numerator, and F7 ⇨ L3 for the denominator]
[ModBus address: 46 for the numerator, and 47 for the denominator]
Insert into the numerator and denominator, the ratio that allows you to obtain the desired Slave speed in regards to the Master.
Note: the values which you can insert are between the **1/64**<|**Ratio**|<**64** range.

**Ref-Filter [By keypad: F8 ⇨ A2] [ModBus address: 49]**
It is a filter on the position reference. It can be used, at low speed, to limit axis' vibration or to make the system less noisy.

You can find more information about gearing on enclosure "Operative Modes Manual" available on the CD provided with the drive.

"6:Pulse/Dir Mode"

If the "**6:Pulse/Dir Mode**" operative mode is set, the "**Position**" window is the following:
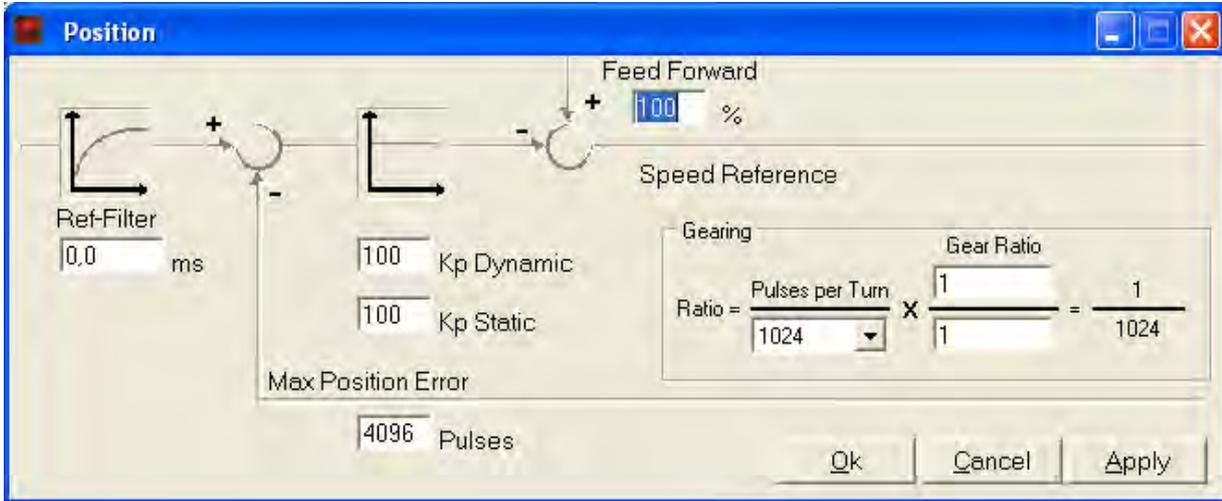
The **Feedforward**, **Kp Dynamic**, **Kp Static**, **Max Position Error** and **Ref-Filter** parameters have the same functions illustrated in the preceding page, but the **Pulses per Turn** and **Gear Ratio** windows are significantly different.

Pulses per turn [By keypad: F8 ⇨ A1] [ModBus address: 48]
This is the number of pulses that must be given to the PULSE input in order to have a motor's mechanical turn.
Insert in this field one of the given values (256…16384).
Example: Putting the value at 2048, the motor will complete a mechanical turn with 2048 pulses present on the PULSE input.

Gear Ratio [By keypad: F7 ⇨ L2 for the numerator, and F7 ⇨ L3 for the denominator]
[ModBus address: 46 for the numerator, and 47 for the denominator]
If the number of the desired pulses is not present on the Pulses per Turn menu, adjust it by using the **Gear Ratio** factor in the **1/64<|ratio|<64 range**. Therefore:

1) Select in the Pulses per Turn menu the value that is closest to the desired value;
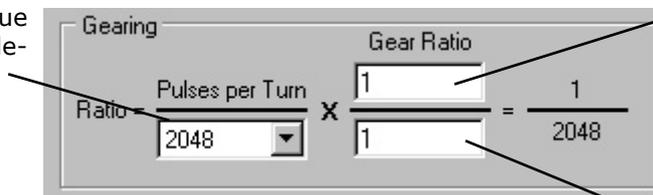
2) put in the Gear Ratio's numerator the value set on the Pulses per Turn menu;


3) put in the Gear Ratio's denominator the desired value.

It is suggested to use values around 1, especially in systems that requires high precision.

You can find more information about Pulse/Direction mode on enclosure "Operative Modes Manual" available on the CD provided with the drive.

12 Homing window

In the main window of the interface there is an area where you can set the parameters of the **Homing procedure**:

The homing procedure uses the **signal of the homing sensor** and, eventually, the **zero signal of the encoder**.
Before start a positioning it is necessary execute a successful homing procedure.

Homing Method [By keypad: F12 ⇨ I3] [ModBus address: 91]
It defines the method of homing. The supported options are:

- **No homing**: disables the homing procedure.
For safety reasons it is <u>not</u> possible to use this option in the "**4:Position Mode**" operational mode. If this method is set it will <u>not</u> be possible to make the positioning procedure.

- **Homing method 1** (**direct**): the drive makes the motor turn in a **counter-clockwise** direction to search for the homing sensor.

- **Homing method 2** (**reverse**): the drive makes the motor turn in a **clockwise** direction to search for the homing sensor.

- **Immediate**: the current position becomes the home position without moving the motor to search the homing sensor.

Sensor
It selects the type of sensor used for the homing procedure. The available options are **NOpen** (**normally open**) or **NClosed** (**normally closed**).

Zero Encoder
Marking the "**Zero Encoder**" box the home position is set on the **first zero pulse** of the motor feedback after the interception of the homing sensor. This allows you to execute the homing procedure with better precision.

Max Search Angle [By keypad: F12 ⇨ I20] [ModBus address: 108]
It is the maximum mechanical angle (0-359 degrees) that can be made during the search for the zero encoder signal after the correct interception of the homing sensor. Above this angle the motor stops, no homing position is saved and alarm 26 (the "Homing Error" alarm) is displayed (this alarm is cleared after the disabling of the digital input set with the "Reset Fault" function).
This parameter (when used correctly) allows the homing process to be repeated with excellent results and avoid errors due to sensor signal elasticity or mechanical tolerance.

Speed [By keypad: F12 ⇨ I2] [ModBus address: 90]
This parameter sets the speed reference used during the homing process and it is given in "rpm". The admitted values are in ranges between 10 and 1000 rpm.

12 Homing window

Acceleration **[By keypad: F12 ⇨ I18] [ModBus address: 106]**
This is the acceleration and deceleration time for the homing procedure. It is defined in milliseconds and allows values in ranges between 10 and 5000 ms. This time references the maximum motor speed set by using the "Speed Limit" parameter in the "Speed" window, so the **actual acceleration** time can be found utilizing the following formula:

$$\text{T\_acc\_homing [ms]} = \frac{\text{Speed\_homing [rpm]} * \text{T\_acc\_sett[ms]}}{\text{Speed\_motor[rpm]}}$$

Where: **T_acc_homing** = real acceleration time during the homing search process;
Speed_homing = speed set for the homing process ("Speed" parameter);
Speed_motor = motor speed limit set on the interface ("Speed Limit" parameter);
T_acc_set = value inserted in the "Acceleration" parameter.

For <u>example</u> if you have a motor with the following parameters:
- "Speed Limit" (on the "Speed" window) = 3000 rpm;
- "Acceleration" (on the "Homing" window) =500 ms;
- "Speed" (on the "Homing" window) = 1000 rpm.

The acceleration time set in the homing window is the time that the motor should employ to accelerate from 0 rpm to the maximum speed (in this case 3000rpm).
The real acceleration time from 0 rpm to 1000 rpm is 167ms, in fact:

$$\text{T\_acc\_homing [ms]} = \frac{100 \text{ rpm}}{3000 \text{ rpm}} * 500 \text{ ms} = 167 \text{ ms}$$

Zero Speed **[By keypad: F12 ⇨ I19] [ModBus address: 107]**
This defines the motor's speed during the realignment with the homing sensor and/or during the search for the encoder's zero pulse from the motor feedback after the home sensor is reached.
It is defined in "rpm" and allows values in ranges between 1 and 50 rpms. We suggested utilising low values for this parameter in order to obtain good precision.

Homing Offset **[By keypad: F12 ⇨ I4 and I5] [ModBus address: 92 and 93]**
This defines the difference between the zero position for the application and the machine's home position (which is found during homing process). It is measured in pulses and the allowed values are in ranges: $+/-(2^{32}-1)$. This value is assigned to the home position found at the end of a successful homing process. The Homing Offset value is obtained by the execution of the following calculation:

$$\text{Homing Offset} = \text{n° turns (also not integer)} * 65536$$

<u>Example:</u> suppose we have an application where the distance between the home position and the zero position of the axis is equal to the distance that the axis can go with a rotation of 4 turns plus an addition 90° mechanical turn.
The first thing to do is to find the number of turns to insert into the formula. In this example: n° turns = 4 + 90°/360° = 4.25 to refer to the fraction of turn above 360°. Now it is possible to calculate utilizing the following operation: <u>4,25</u> *65536 = **278528.** This bold number is the value that must be inserted in the "Homing Offset" window.

After the setting of the desired homing parameters save the changes using the "Save To EEPROM" function on the software interface, doing this the drive's setup will become permenent.

You can find more information about homing procedures on enclosure "Positioners Manual" available on the CD provided with the drive.

13 Axor Profile Tool window

This window allows you to setup all the parameters about the 32 positioner trapezoidal profiles.
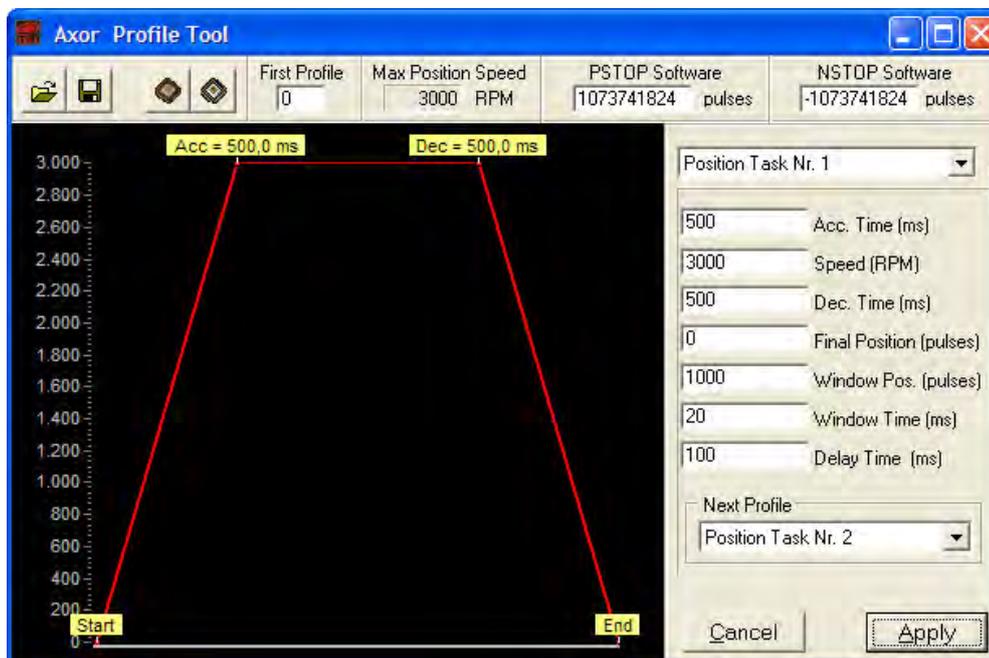
Final position

It defines the absolute position reference for the selected position profile.

The admitted values are in the range $+/-(2^{31}-1)$. Setting the value 0 means "return to zero position" (the position found during homing <u>only if the Homing Offset was set to zero</u>).

To define the value (approximated at the nearest integer value) that should be inserted, the following formula will be used:

> Final position = n° turns (also not integer) * 65536

Example: We want to start from the position 0 after a successful homing procedure, with a Homing Offset value equal to zero. Suppose that the set task makes a rotation of the motor's shaft of 20 turns and 60° mechanical. First thing is to normalise 60° on 360° and add the obtained value to the number of integer turn: n° of turns = 20 + 60°/360° = 20 + 0,16 = 20,16 after this you must multiply by 65536 the obtained number like as follow: 20,16 * 65536 = 1321642,6 and insert in the Final Position parameter the integer part of the number found, in this case 1321642.

Acc Time

It sets the acceleration time value for the trapezoidal profile ramp. This parameter admits values in the range: 10...5000 ms. The time value is refered to the max motor speed, "Speed Limit" parameter set in the "Speed" window, so the real acceleration time related to the profile speed can be found using the following expression:

$$T\_acc \ [ms] = \frac{Speed \ [rpm] \ * \ T\_acc\_set \ [ms]}{Speed\_motor \ [rpm]}$$

where: **T_acc** = real acceleration time for the profile ramp;
Speed = speed set for the profile ("Speed" parameter);
Speed_motor = motor speed limit set on interface ("Speed Limit" parameter in the "Speed" window);
T_acc_set = value inserted in the "Acc. Time" parameter.

Dec Time

It sets the deceleration time value of the trapezoidal profile ramp. This parameter admits values in the range: 10...5000 ms. The time value is refered to the max motor speed, "Speed Limit" parameter set in the "Speed" window, so the real acceleration time related to the profile speed can be found using the following expression:

$$T\_dec \ [ms] = \frac{Speed \ [rpm] \ * \ T\_dec\_set \ [ms]}{Speed\_motor \ [rpm]}$$

where: **T_dec** = real deceleration time for the profile ramp;
  Speed = speed set for the profile ("Speed" parameter);
  Speed_motor = motor speed limit set on interface ("Speed Limit" parameter);
  T_dec_set = value inserted in the "Dec. Time" parameter;

Speed

It sets the speed reference of the trapezoidal profile. This parameter is limited by "Max Position Speed".

Max Position Speed

It sets the maximum speed allowed for all motion position profiles. It is defined in "rpm" and rappresents the minimum value between 6000 rpm and the motor speed limit ("Speed Limit" parameter on the "Speed" window).

Next Profile

It is the number of the following profile to execute after the quote reached of last task. This parameter is defined for concatenated profiles mode.

Window Pos.

It is the window of position quotes admitted around the sensor position to declare "position reached". It is defined in feedback pulses and can be calculated with the following formula:

$$Window \ Pos = n° \ turns \ (also \ not \ integer) \ * \ 65536$$

Window Time

It is the time limit used when the motor is within the position window to set "target reached" indication. It is declared in "ms" and admits values in the range: 0...65536.

Window Delay

It is the waiting time after the quote reached and after the "Window Time", to declare "position reached".

Note: The **Window Pos**, **Window Time**, and **Window Delay** parameters are utilised to guarantee a good positioning; in fact there are some situations (very high inertia, joint elasticity or belt, etc), where after a positioning there is an oscillation. Setting correctly these parameters it is possible to be sure that these oscillation is contained in a range (Window Pos) for a time over the time set in "Window Time" parameter.

PSTOP Software
If the Final Position parameter is greater then the PTSOP Software, the task stops when the PSTOP target is reached.

NSTOP Software
If the Final Position parameter is greater then the NTSOP Software, the task stops when the NSTOP target is reached.

First profile
Not used.

Note: Each profile is identified and saved with a number from 1 to 32 (for example "Position Task Nr. 1"), selectable in the dedicated menu on the "Axor Profile Tool" window.

The "**Axor Profile Tool**" window has 4 icons which helps you during the parameter configuration:

Open Profile File

Save Profile File

Load Data from Flash
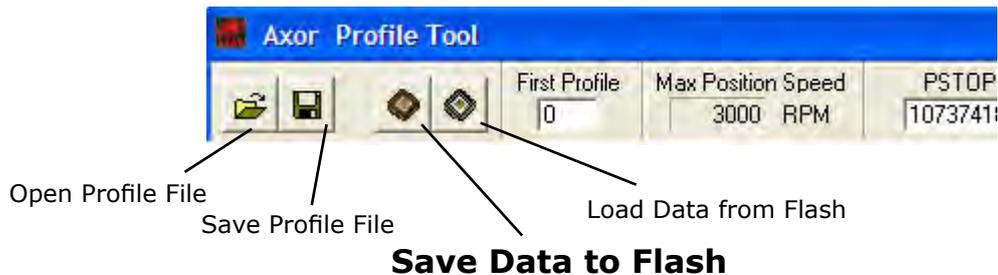
Save Data to Flash

Load Data from Flash
It permits the visualisation of the data saved into Flash. This values can be different from the precedent visualised value, if a saving process has not been performed yet.

Save Data to Flash
It permits to save the parameter into Flash. In this mode the parameter will be loaded automatically at the next power-up.

Save Profile File
It permits to save on a file the parameters set in the "Axor Profile Tool" window.

Open Profile File
It permits the loading of the parameters saved on a file.

Note: The functions **Save Profile File** and **Open Profile File** are very useful if you want to configure more than a drive with the same setup.
In this case you can configure all parameters on a drive, save in flash and save the setup on a file.
For other drives it is not necessary to configure one by one the parameter of the single task but you can use the file saved before and load the parameter saved on the file. After this save the parameter into flash.

You can find more information about positioner on enclosure "Positioner Manual" available on the CD provided with the drive.

14 Oscilloscope window

With drives **Magnum400™**, **McbNET Digital™**, **Fast Back™** and **MiniMagnum™** it is possible to use the digital oscilloscope implemented into the Axor *Speeder One* interface.
The oscilloscope functions as a normal two channel digital oscilloscope and it allows visualizing: *motor speed*, *phase current*, *position error*, etc.

To open the **Oscilloscope** window (see *Fig.1*) click on the **oscilloscope icon** in the main window of the *Speeder One* interface:
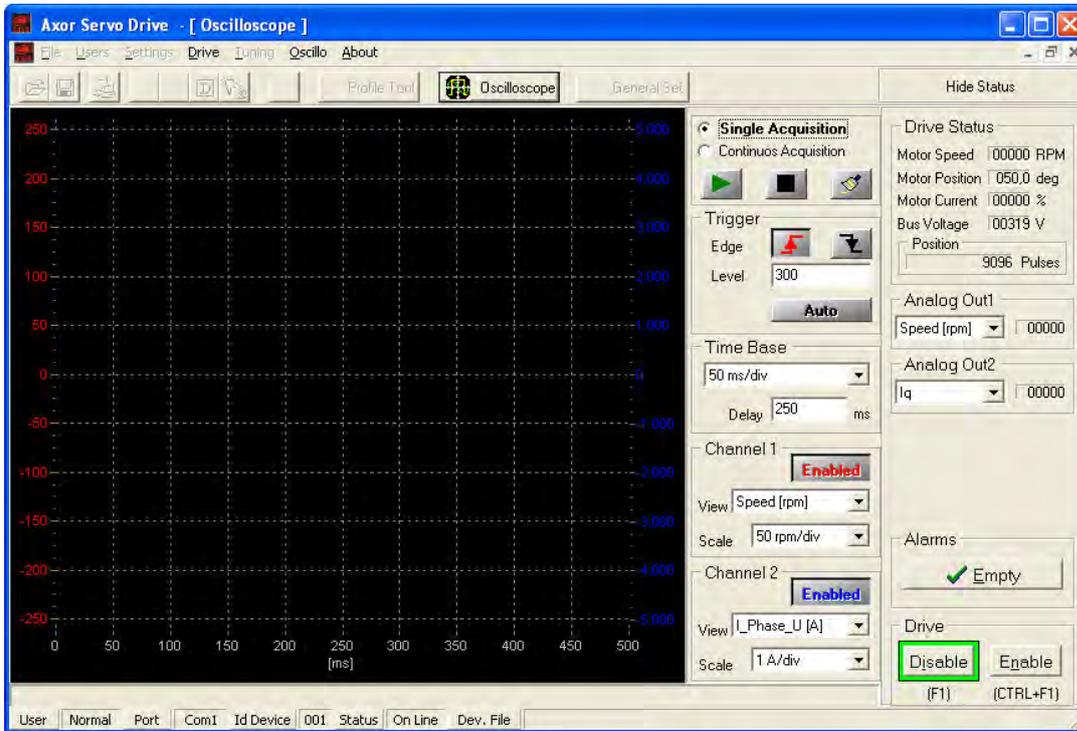

Fig. 1: Oscilloscope window

START/STOP/RESET DATA ACQUISITION:

It starts data acquisition in both modes *Single* or *Continuous Acquisition.*

It resets the window eliminating the visualized traces.

It stops data acquisition in Continuous Acquisition mode, or in Single Acquisition mode if there is not a trigger event.

DATA ACQUISITION:

Fig. 2: Data acquisition settings

Single Acquisition
Selecting the *Single Acquisition* option, the oscilloscope's behaviour is dependant upon enablement/disablement of a trigger event:
    CASE 1: If the trigger event is enabled on rising edge or falling one of signal in Channel 1, the oscilloscope waits for the first trigger event. At trigger arrival the trace is visualized and data acquisition is stopped. To capture a new trigger event it is necessary to start a new acquisition by clicking on the icon ▶.
    CASE 2: If trigger event is disabled, the oscilloscope acquires new data, it visualizes it, then it stops. To upgrade the trace it is necessary to start a new acquisition by clicking on the icon ▶.

Continuous Acquisition
Selecting the *Continuous Acquisition* option, the oscilloscope's behaviour depends upon enablement/disablement of trigger event:
    CASE 1: If trigger event is enabled on the rising or falling edge of a signal in Channel 1, oscilloscope waits until the first trigger event. At trigger's arrival the trace is visualized and it is updated at each trigger event.
    CASE 2: If trigger is disabled, oscilloscope continually acquires new data and updates traces.

TRIGGER EVENT:
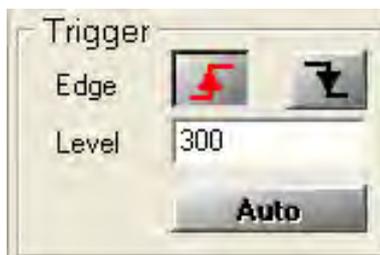
Fig. 3: Trigger event setting

Enabling trigger event it is possible to acquire and visualize the traces only at the occurrence of a definite signal in Channel 1; that signal is characterized by a ring edge or a falling one and by a level (or amplitude). To enabled a trigger event it is necessary:
    1° to set the rising or falling edge (**Edge** icons);
    2° to set the desired level (**Level** parameter).

Clicking the **Auto** button it is possible to disabled the trigger event ⇒ the oscilloscope will continue to acquire new data and update the traces.
You should use the **Auto** trigger function:
    • during first acquisition, in order the know the scale of input signals;
    • in presence of low repetitive rate signals;
    • in presence of dc signals.

TIME BASE:

Fig. 4: Time base setting

Time Base
This allows you to change the scale of the horizontal axis, the time base. The min. resolution is 1ms/div, while the max is 1s/div.

Delay
If the trigger event is enabled the value set in **Delay** fixes the point, in the horizontal axis, where the trigger event will be visualized; on the contrary, if the trigger event is disabled the value set in Delay is ignored.
The default value set for the Delay parameter is in the middle window.

SIGNAL SETTING:
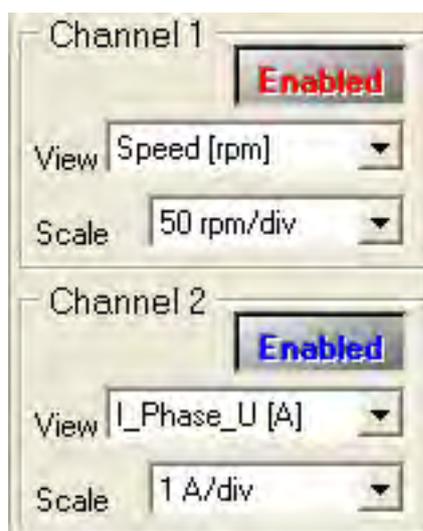
Fig. 5: Input signal setting

Channel 1 (View) and Channel 2 (View)
This allows you to select the signal to visualize. The different options are as follows:
   • the motor speed: **Speed [rpm]**
   • the phase U current: **I_Phase_U [A]**
   • the position error: **Posit_Err [Pulses]** (not yet enabled)
   • the quadrature current: **Iq[A]**
The Channel 1 is enabled if the reference button **Enabled** is red, while Channel 2 is enabled if the reference button **Enabled** is blue.
To disable a channel click on the Enabled button ⇒ **Disabled** appears.

Channel 1 (Scale) and Channel 2 (Scale)
The unit of vertical scale is automatically set by choosing an input signal:
   • **rpm/div** for speed
   • **mA/div** or **A/div** for current
   • **Pulses/div** for position error
However, it is possible to change the scale selecting from values in the **Scale** menu.
For Channel 1 the scale will be visualized in red on the left, while for Channel 2 the scale will be visualized in blue on the right.

15 Standard configuration files

Using the Axor's *Speeder One* software you can select some *standard configuration files* to allow the drive to be setup for *SuperSAX* series brushless servomotors.

To select a "standard" configuration file with the software:

1) Open the ***Speeder One*** interface.

2) In the main window select the "**Open**" icon (otherwise select "**File**" and then "**Open**").

3) Select a file in the directory: ...\Axor\Data\Devices\, and then press "**Open**".

4) Save the values loaded using the "**Save Data To EEPROM**" button.

5) Disable and enable the drive.

A standard configuration file loads the following **settings**:

• **OP.MODE**: the operative mode "0: Analog Speed" is selected.

• **"Motor" window**: sets for 6 motor pole, with or without brake, encoder (2048 ppr) or resolver (2 pole) feedback.

• **"Current" window**: gains and currents (rated and peak) are set to work with a <u>specific motor</u>, while I^2t value ("I2t Message" parameter) is set reference to the drive.

• **"Speed" window**: gains are set for a motor without load (free).
The Acc and Dec ramp are set at 0ms; while the Emergency ramp is set at 100ms.
The Speed Limit is set equal to the max speed supported by the motor.
Others parameters are set at 0.

• **"Encoder Out" window**: The pulses per turn of the simulated encoder are set equal to those of the motor's encoder.

• **"Digital Speed" window** (operative modes: "Digital Speed", "Square Wave"): the speed reference is set to 0 RPM.

• **"Square Wave Period"** operative mode: the semi-period of the square wave is set to 500 ms.

• **Homing** settings: the "No homing" method is set while all others homing parameters are set at 0.

• **"Position" window** (operative modes: "Position Mode", "Gearing" and "Pulse/Dir Mode"): all gains are set at **100**, while the max position error is set at **8192**.
In the "Pulses per Turn" parameter the number of pulses/rev of the encoder is set, while the Gear Ratio is set equal to 1/1.

• **"Digital I/O" window**: all inputs and outputs are set with "0:Off" function.

• **"Analog I/O" window**: the filter times, the offsets and the deadband are set to 0.

The files are made in this conditions:
- Drive standard.
- Drive not installed in an electrical cabinet.
- Motor with no load (free to run).
- Encoder feedback 2048 pulse/rev.

Notes:

• **The loading of a file and the parameter variation should be done only by qualified technical personnel.**

• The standard configuration files are not protected against accidental changing, so after loading a new file it is necessary to control all the parameter, in particular:
- Main voltage (*Main Voltage* menu in the main window)
- Number of motor pole (*Motor* window)
- Feedback (*Motor* window)
- Irms (*Current* window)
- Ipk (*Current* window)
- Rated speed (*Speed* window)

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