SERVICE MANUAL

AXOR INDUSTRIES®

ENGLISH

CE

FAST-BACK®

Powered Brushless Motor

Twenty years of great motordrives

Release	Note
ver.1 rev.03/06	First edition.
ver.1 rev.06/06	Corrections.
ver.1 rev.07/06	New cover. New paging.
ver.1 rev.09/06	Corrections. New paragraph. Insert mechanical curves. Insert Index.
ver.1 rev.01/07	Insert Fast Back 100 technical data.
ver.1 rev.02/07	Insert chapter "5:Application" about: Reset Fault Function, Emergency Function, Positioner and Homing procedures, Motor Brake Management, Stop Functions. Corrections.
ver.1 rev.03/07	Corrections.
ver.1 rev.04/07	Insert note about power supply transformer.

Print in Italy 06/04/2007

AXOR INDUSTRIES
Via Stazione N°5
36054 Montebello Vi.no (VI)
Italy
Tel. +39 0444 440441
Fax. +39 0444 440418
E-mail: info@axorindustries.com
Internet: http://www.axorindustries.com

Index

6) Appendix

Chapter 1
General Advices

1.1 Norms

The **Fast Back**™ is in accordance with the following safety standards:

- Machines Directive
- Electromagnetic compatibility Directive

and the following technical norms have been applied:

CEI EN 60204-1 Machine safety - Machine electric equipment.
CEI EN 60439-1 Combined protective and manoeuvring apparatus for low voltages (BT panels) - Part 1: Standard apparatus subject to (AS) type testing and non-standard apparatus subject to (ANS) type testing.

CEI EN 61800-3 Variable speed electric drives Part 3: Product norm regarding electromagnetic compatibility and scientific testing methods.

Recalls: **CEI EN 61000-4 CEI EN 60146-1-1.**

CEI 28-6 Co-ordination of the insulation for apparatus in low voltage systems.
CEI 64-8 Electric systems using a nominal voltage of not above 1000V in alternate current and 1500V in direct current.

The **Fast Back**™ series converters have been tested by a laboratory to check their adherence to the limit values requested by the directive regarding magnetic compatibility.
The reference standard used for electromagnetic compatibility is summarized in the CIE EN 61800 Norm (all parts).
If the installation of the drive is carried out differently than described in this manual, the user must carry out new measures to satisfy the requisites of law.

Chapter 2
Description

2.1 Product description

The **Fast Back**™ is an all in one fully digital DRIVE plus BRUSHLESS MOTOR.

There are two available sizes:
- ✓ **Fast Back 75**: having a continuos stall torque from 1.1 Nm to 3.8Nm;
- ✓ **Fast Back 100**: having a continuos stall torque from 3.2 Nm to 7.5Nm.

Control:
It can be configured and controlled using CanBus. It supports the following **Can Open protocols**:
- part of the **DS301-V4.02**
- part of the **DSP402-V2.0**

It can work in **Multidrop**, where the first drive, connected via RS232 to the Master PC, is piloted with *ModBus communication*, while the other drives are piloted with the duplication of commands using the *CanBus communication*.

In **speed control** it utilises a digital reference from an external controller.

In **torque control** it utilises a digital torque reference. This function allows you to control the current from the drive.

It can be controlled as **POSITIONERS**. An **ABSOLUTE POSITIONER** was implemented, which implies transactions to *absolute quotas* reference to the reference point. It supports 32 programmable position profiles; a single task or a sequence of tasks are permitted.
The **Homing Procedure** is implemented. It uses the signal coming from the homing sensor and eventually the zero of the encoder.
The positioner and homing procedures can be managed ***via software*** (by using the Axor's *Speeder One* interface or another ModBus Master).

Digital In/Out:
There are **2 digital inputs** and 1 is programmable.

There is **1 digital programmable output** to send messages from pre-programmed functions of the drive.

Analog Out:
There is **one programmable analog output**, that permits visualisation by oscilloscope of some of the drive's measurement values.

Software Interface:
The **Fast Back**™ is supplied with the Axor ***Speeder One*** software interface that allows you to set and manage all of the drive's parameters.
The software works on the following operating systems: Windows 98, Windows 2000, Windows XP.

The communication between the driver and PC is done through the utilisation of a RS232 cable using ModBUS protocol.

Security:
The **Fast Back**™ is equipped with a series of protections which safeguard the servo system.

Led:
A **led** allows you to see the drive's status.

EMI Filter:
The **Fast Back**™ converter is equipped with an **integrated EMI anti-disturbance filter** at the 3-phase 230V power supply input.

2.2 General view

TYPE	DESCRIPTION
X1	Power supply and Back Up connector, 6 pole
X2	CanBus (or RS485 optional) connector, 4 pole
X3	CanBus (or RS485 optional) connector, 4 pole
X4	IN/OUT digital signals connector, 5 pole
X5	RS232 interface and analog output, 5 pole

2.3 Technical data - General

Power Supply		
Power supply	Vac	230Vac ±10% 3-phase, 50/60Hz 230Vac ±10% single phase, 50/60Hz (IT DOES NOT ALLOW THE RATED PERFORMANCE, contact Axor's technical department for details)
Logic supply (for back-up only)	Vdc	24Vdc (±10%) - 200mA
Logic supply (back-up + brake)	Vdc	24Vdc (±5%) - 500mA for Fast Back 75 24Vdc (±5%) - 800mA for il Fast Back 100

Environmental Conditions	
Storage temperature	-20...+55°C
Humidity	From 10% to 80% max. without condensation
Altitude	Up to 1000m without restrictions. From 1000 to 2500m power derating 1.5%/100m
Pollution Level	Level 2 (norm EN60204/EN50178)
Enclosure protection	IP54 (optional IP65 and IP65S)

Notes:
• The electrical box must have suitably **filtered air vents**.
An area of at least 15cm around the **Fast Back**™ is required.

• Periodically check drive case and fans for excess dust or dirt, that could interfere with the correct dissipation of the drive.

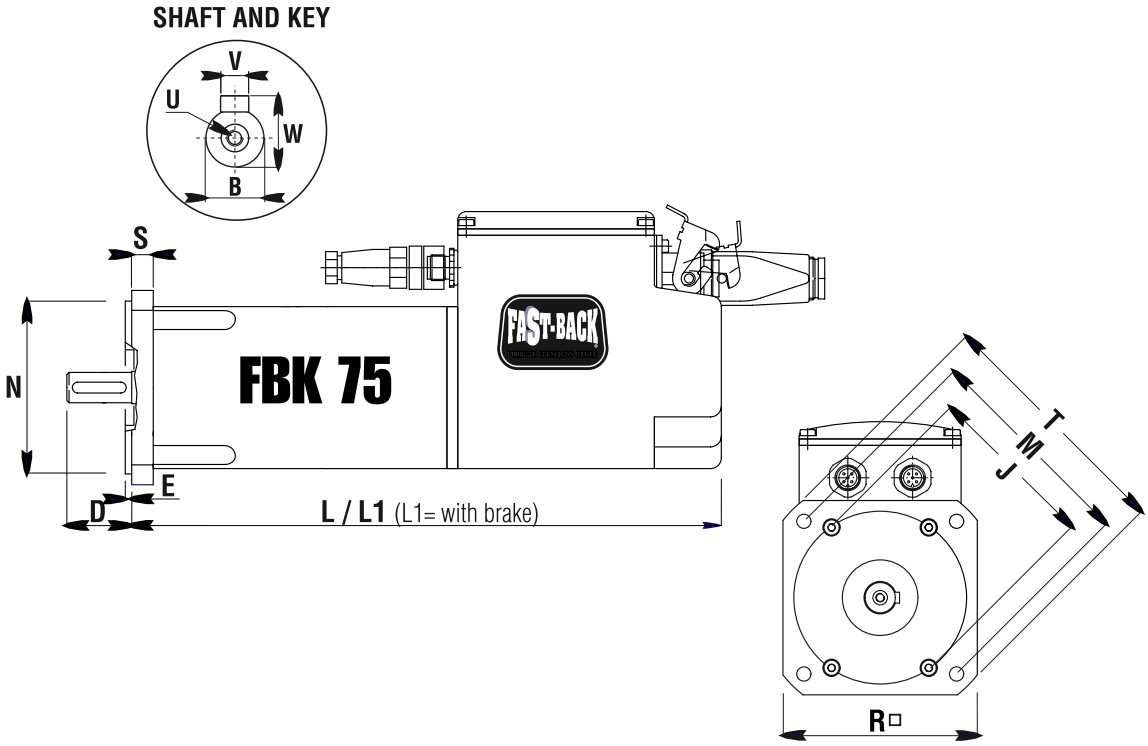
Inputs/Outputs	
Programmable analog output	±10V - 10mA
Digital output	24Vdc - 50mA
Digital input	24Vdc - 7mA

Cables sections	
Power supply cables	1.5mm^2/15AWG
Signals cables	0.5mm^2/20AWG

2.4 Technical data - Fast Back 75

FAST BACK - serie 75					
Performance Data					
SIZE		XS	S	M	L
Stall Torque, Mo	Nm	1.1	1.6	2.7	3.8
Peak Stall Torque, Mpk	Nm	3.3	4.8	8.1	10
Rated speed, Nn	Rpm	3000	3000	3000	3000
Rated torque at Nn, Mn	Nm	0.95	1.45	2.35	3.3
Mechanical Data					
Weight	Kg	2.85	3.3	4.2	5.0
Weight with brake	Kg	3.45	3.9	4.8	5.6
Rotor inertia	$(Kgm^2)10^{-4}$	0.4	0.6	1	1.4
Brake inertia	$(Kgm^2)10^{-4}$	0.122			
External fuses					
Size		XS/S		M/L	
AC Supply L1-L2-L3 (F_2)		6AT		10AT	
Auxiliary Supply +24VDC		6AT			

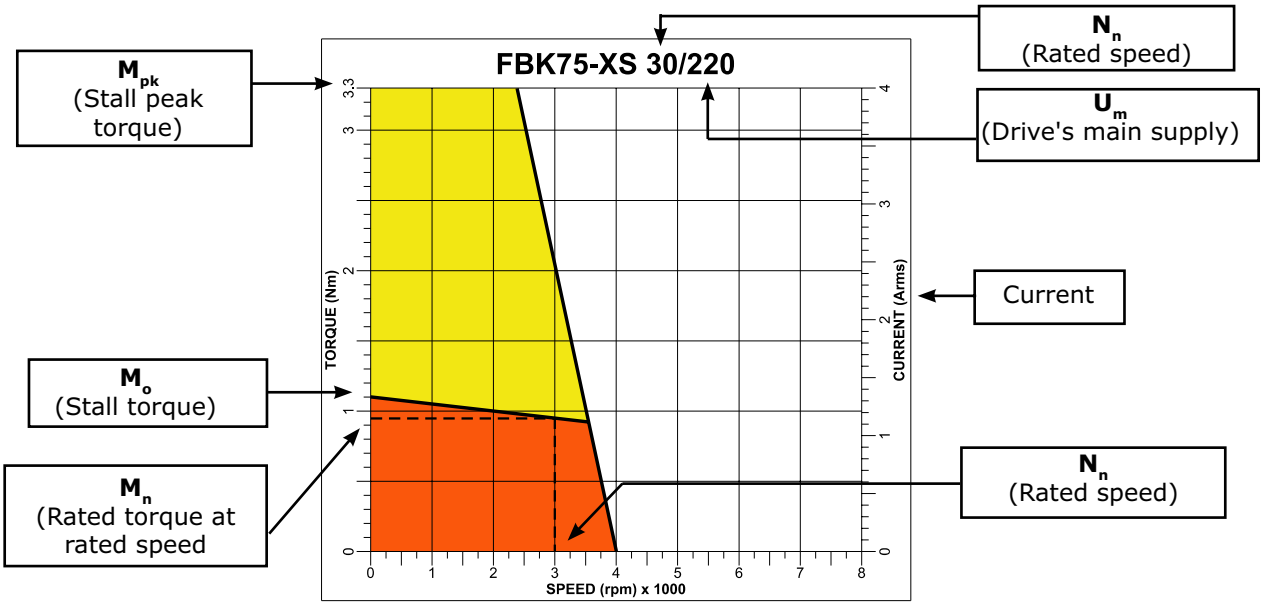
2.5 Mechanical dimensions - Fast Back 75

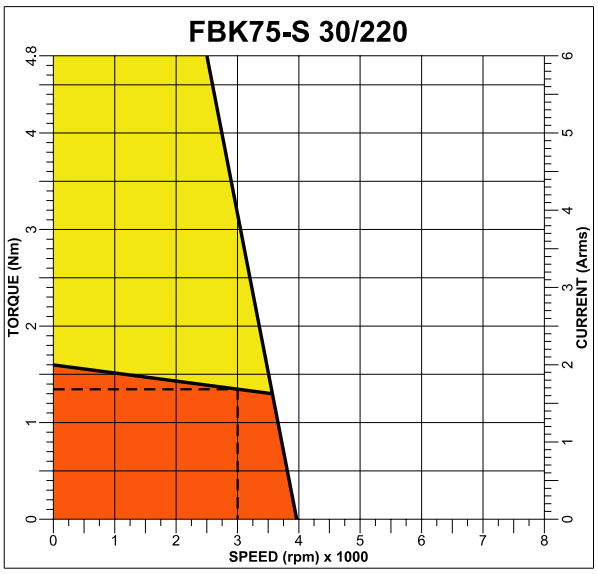


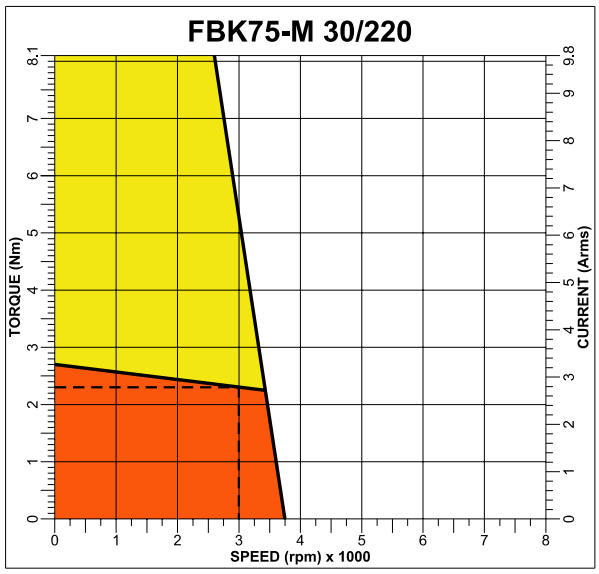
Mechanical Dimensions - Fast Back 75									
	L	L1	B	D	V	W	U	F	F'
Type - Mo (Nm)	mm	mm	mm	mm	mm	mm	mm	mm	mm
FBK 75_XS - 1.1	230	280	11	23	4x18	12.5	M4x10	5.5	M5x8
FBK 75_S - 1.6	245	295							
FBK 75_M - 2.7	275	325							
FBK 75_L - 3.8	305	355	14	30	5x25	16			

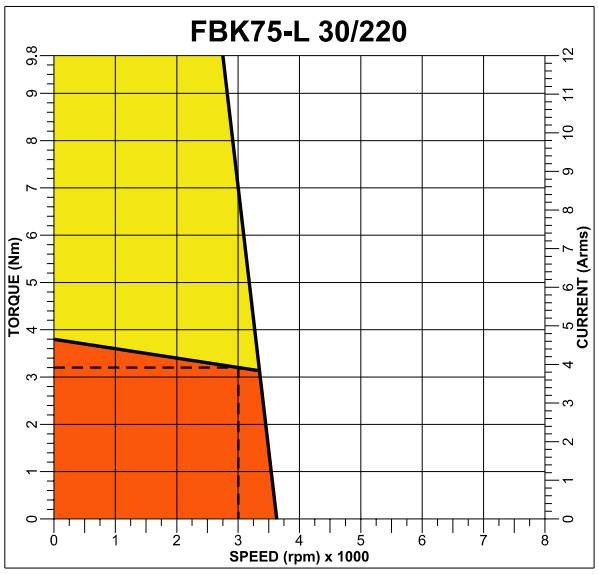
2.6 Mechanical Curves - Fast Back 75

The **Fast Back**™ serie **75** has the following **mechanical curves**:





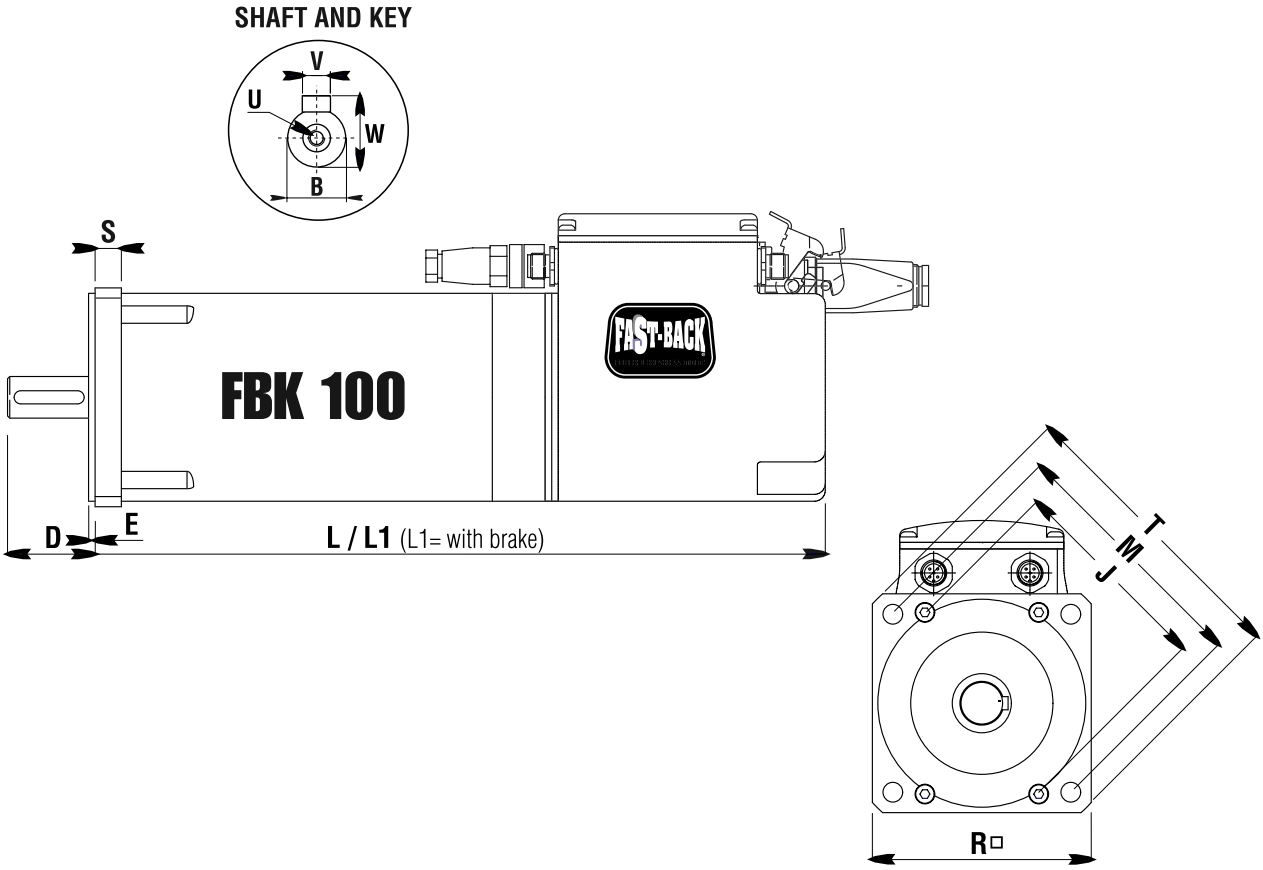




2.7 Technical data - Fast Back 100

FAST BACK - serie 100				
Performance Data				
SIZE		S	M	L
Stall Torque, Mo	Nm	3.2	5.2	7.5
Peak Stall Torque, Mpk	Nm	10.3	10.5	15
Rated speed, Nn	Rpm	3000	3000	2200
Rated torque at Nn, Mn	Nm	2.8	4.5	6.4
Mechanical Data				
Weight	Kg	5.8	7	8.2
Weight with brake	Kg	6.5	7.7	8.9
Rotor inertia	$(Kgm^2)10^{-4}$	1.8	2.8	3.8
Brake inertia	$(Kgm^2)10^{-4}$	0.37		
External fuses				
Size		S/M/L		
AC Supply L1-L2-L3 (F_2)		10AT		
Auxiliary Supply +24VDC		6AT		

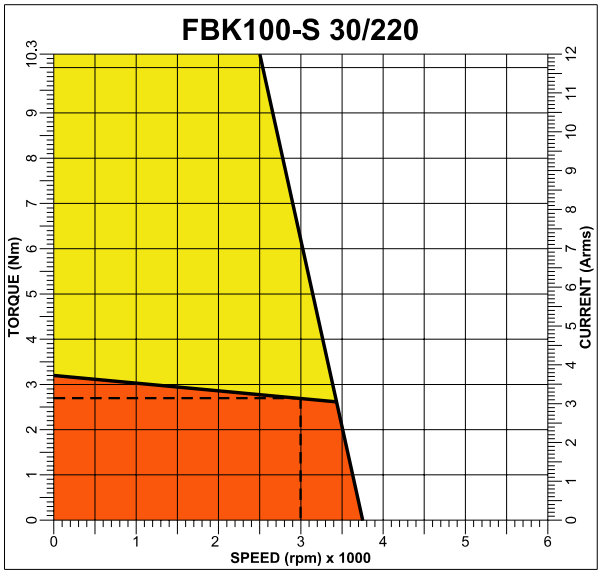
2.8 Mechanical dimensions - Fast Back 100

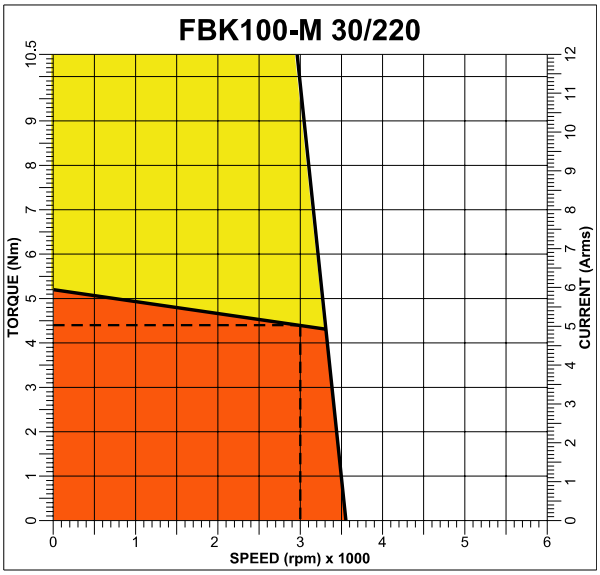


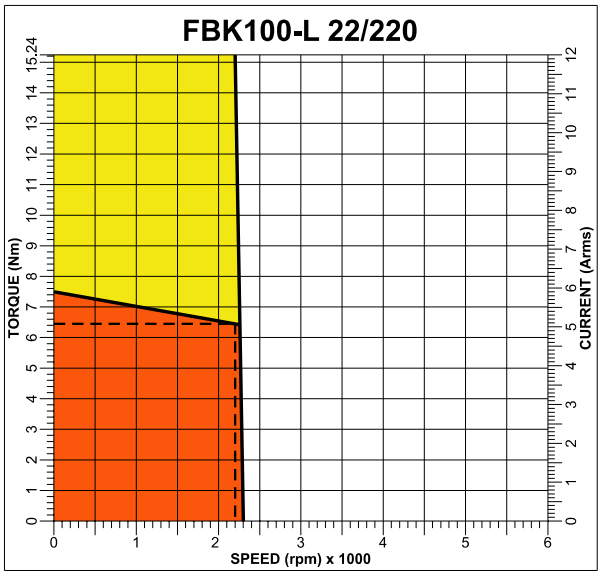
Mechanical Dimensions - Fast Back 100							
	L	L1	B	U	V	W	F
Type - Mo (Nm)	mm	mm	mm	mm	mm	mm	mm
FBK 100_S - 3.2	303	359	19	M6x16	6x32	21.5	9
FBK 100_M - 5.2	338	394					
FBK 100_L - 7.5	373	429					

2.9 Mechanical Curves - Fast Back 100

The **Fast Back**™ serie **100** has the following **mechanical curves**:







Chapter 3
Installation

3.1 Important notes

The **Fast Back**™ must be installed on a machine or electrical system as integrated components.

The following indications should help the user to install and wire the **Fast Back**™:

• **<u>This manual is exclusively addressed to technical personnel with the following requirements:</u>**
- Technician with knowledge on movimentation of elements sensitive to electrostatic discharges (for the transport).
- Technician with an appropriate technical training and with vast knowledge on electrotechnics/drive technical field (for the installation and for operate the servodrive).
Using the drive incorrectly can injure people or manage things. Fully respect the technical data and indications on connection conditions.

• As well as the points described in this manual, current regulations regarding safety and accident prevention must be followed in order to prevent accidents and residual risks.
The installer must be familiar with and observe the following norms and directives:
- IEC 364 and CENELEC HD 384 or DIN VDE 0100;
- IEC-Report 664 or DIN VDE 0110;
- national accident prevention dispositions or BGV A2.

• The user must analyse possible machine risks and take the necessary measures to avoid injuries to people and damage to things because of unpredictable movements.

• The converters contains elements which are sensitive to electrostatic discharges. These elements can be damaged by careless manipulation.
Discharge static electricity from your body before touching the converter.
Avoid contact with material that insulates well (synthetic fibres, films of plastic material and so forth).

• During operation, the converter surface can become hot. Protect the user from accidental contact and keep the indicated distances from every object.

• Never loosen electrical connections while the servoamplifiers are being powered.
The appropriate terminals of the drive must always be connected to earth as instructed in this manual.
After having disconnected the converters from the supply current, always wait at least 5 minutes before touching the powered components (e.g. contacts) or loosening connections.

• The command and power connections can still hold current even when the motor has stopped.

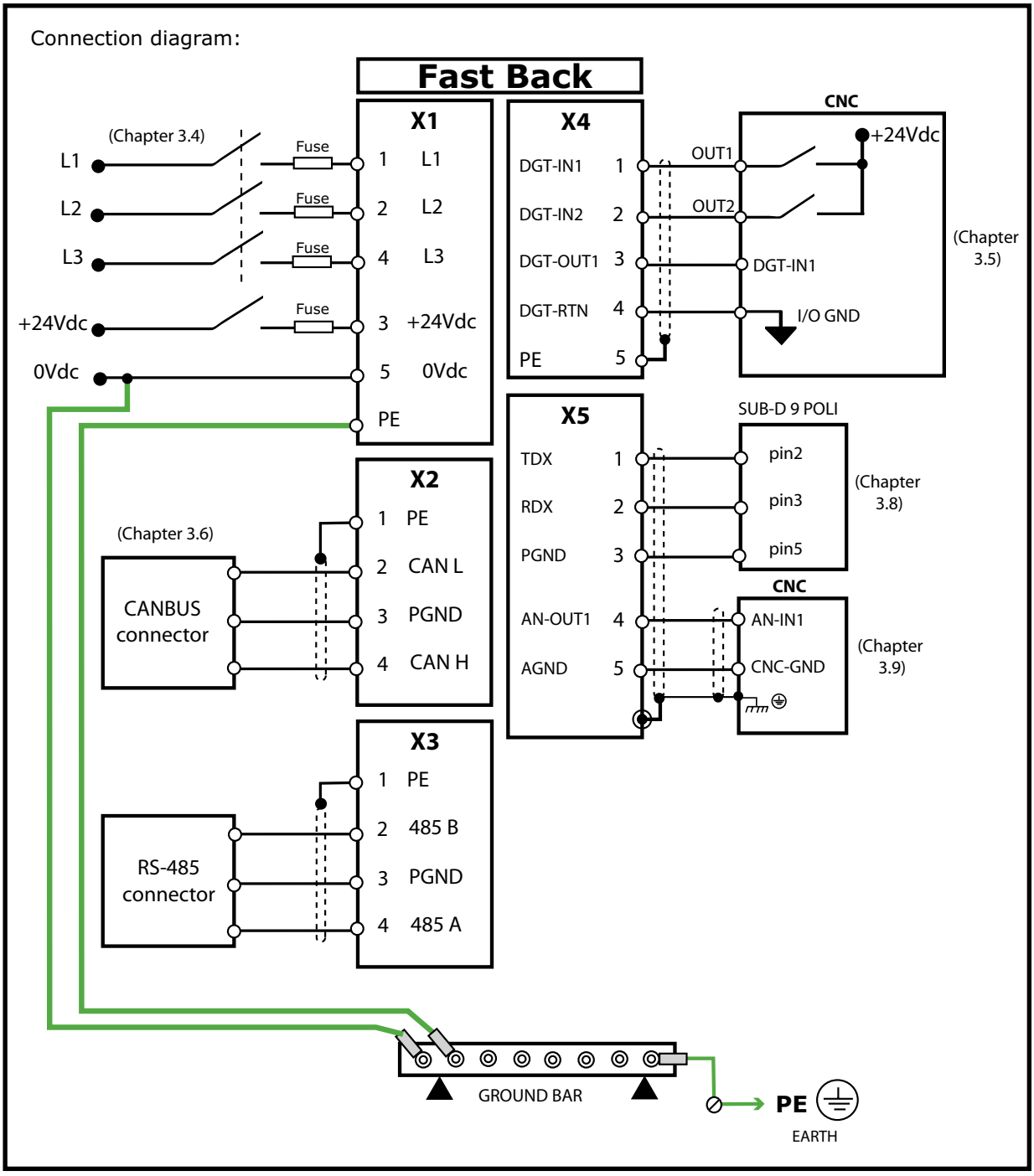
• The **Fast Back**™ is equipped with electronic protections that deactivate it in case of irregularities.

• Protect the converter from excessive mechanical vibrations in the electric box.

• <u>Always section all of the products' power phases, utilising a power relay or a thermal magnet. In the case of three phase interrupt L1, L2 and L3.</u>

• Make sure that the **Fast Back**™ is earth-connected in accordance with the current norms. See the connection diagram on the next page.

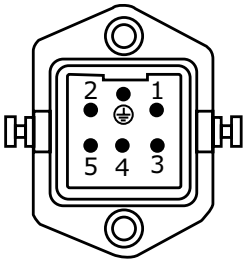
3.2 Ex. of connection for single axis system



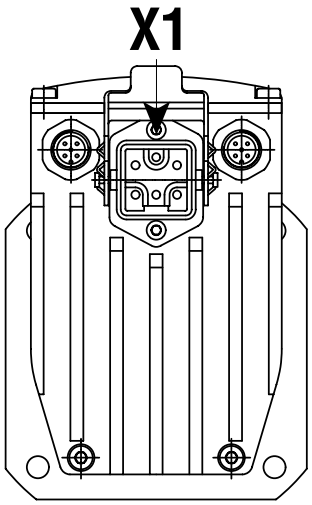
In the following chapters there is a detailed description about interfaces in the Fast Back™, and many connection examples.

3.3 Power Supply connection

The **X1 connector** contains:
- the **alternate supply** coming from the mains;
- the **+24VDC external power supply**.

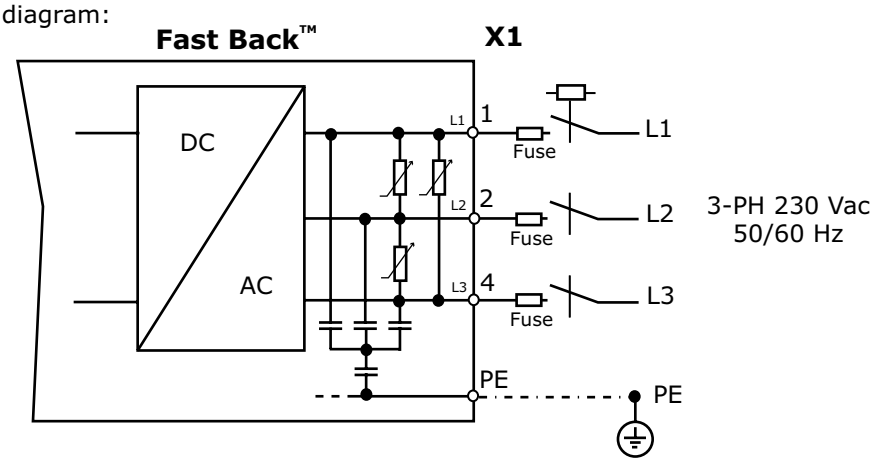


Male connector, X1
(Front view)



Connector, X1 - Power supply	
PIN	**DESCRIPTION**
1	Power supply, L1
2	Power supply , L2
3	Back-up supply, +24V
4	Power supply, L3
5	Back-up ground reference, 0V
6, PE	Connectiot to Earth

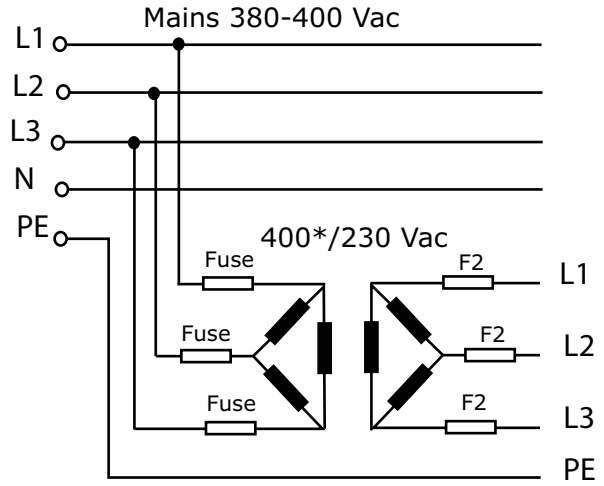
Connection diagram:

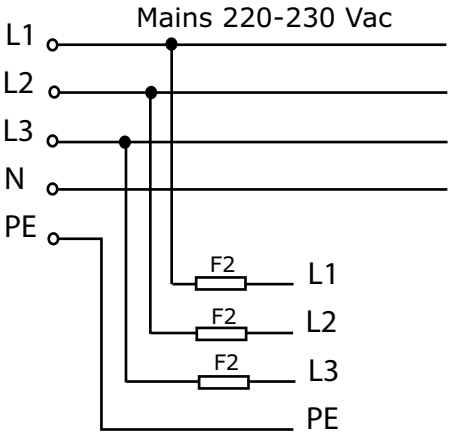


3.3 Power Supply connection

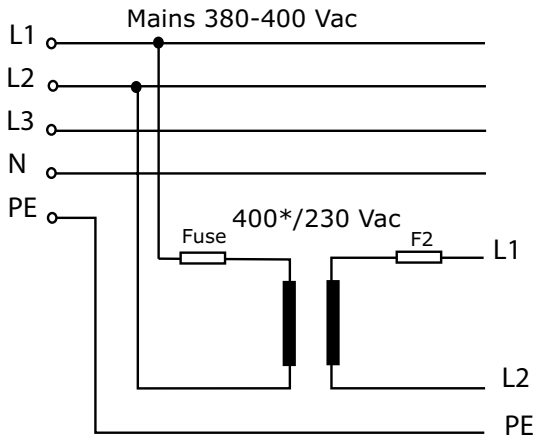
The **Fast Back**™ has the following power supply: **three phase 230Vac ±10%**.
The single phase power supply, 230Vac ±10%, DOES NOT ALLOW THE RATED PERFORMANCE, contact Axor's technical department for details.
The product is opto-isolated and this guarantees the galvanic isolation between the mains and control signals.

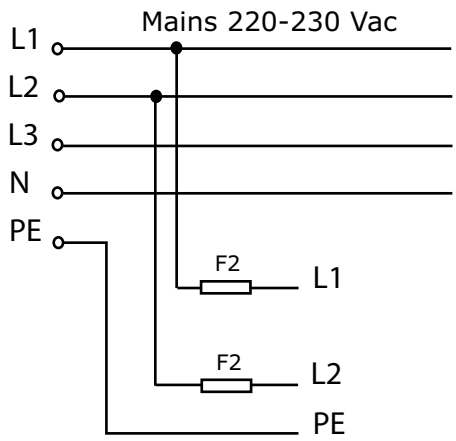
The figures below displays some example of connection:





* It depends by the available main supply.



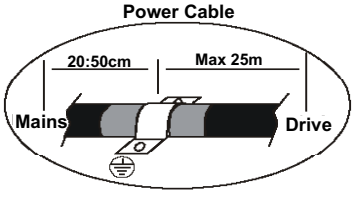


Notes:

- Insert protective fuses (F_2).

- **<u>Always section all of the products' power phases, utilising a power relay or a thermal magnet. In the case of three phase the power relay or thermal magnet is applied to L1, L2 and L3.</u>**

- Power cable must be shielded and the shield must be connected on both sides.
Drive side the shield is connected to ground by connector; main supply side the shield must be connected on the zinced panel of the electrical box by clamp, after taking out a piece of the external sheat (see figure near here).



3.3 Power Supply connection

Note: The **nominal power of each motor** is calculated in this way:

Pn = n x Cn / 9,55

Pn=nominal motor power [VA]
n= motor speed [rpm]
Cn= motor rated torque [Nm]

The **nominal power of the transformer** is calculated by adding the various wattege of each motor:

Pt = Pn+Pn+Pn+...

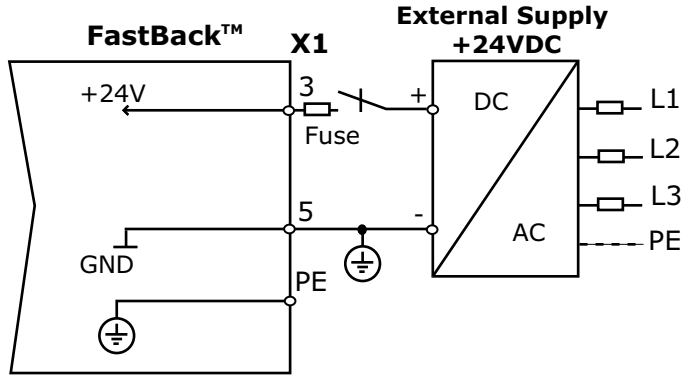
Pt= nominal power of the transformer [VA]
Pn= nominal power of each motor [VA]

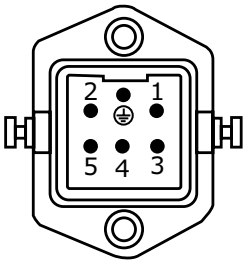
Pin **3** on the **X1** connector is utilised for an **external power supply input**.

Pin 3 .... External power supply **+24VDC** (**±10%**) input, **BACK-UP**
Pin 5 .... Ground reference return Back-up, **0VDC**

This external power supply is utilised **to power the logic board** when the drive is turned off.

Connection diagram:





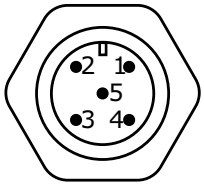
Male connector, X1
(Front view)

The **technical characteristics** of the Back Up input are the follows**:**

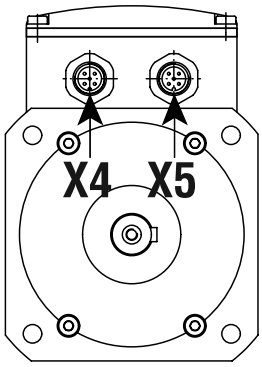
- The current's absorption on this terminal is **200mA** without brake and **1000mA** with brake.
- Input protected against polarity inversion.

3.4 IN/OUT Digital connection

The **X4 connector** of the **Fast Back**™ manages two digital inputs and one digital output.



M12 male connector, X4
(Front view)

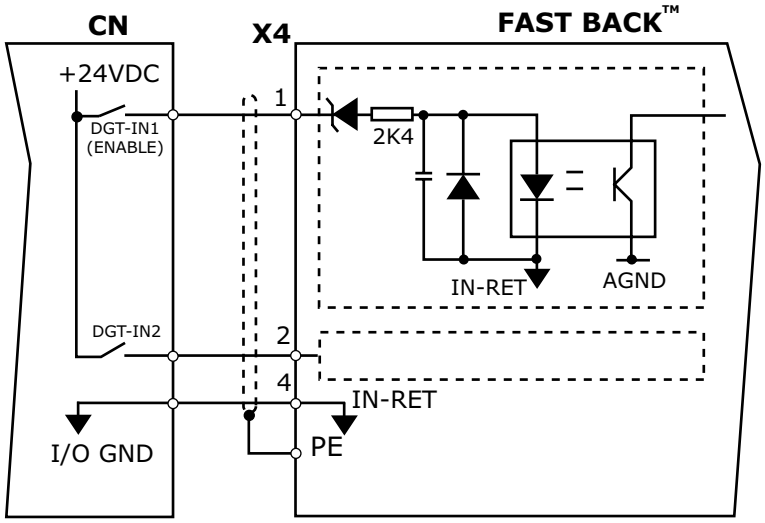


M12 connector, X4 - Digital inputs and output	
PIN	**DESCRIPTION**
1	Digital input, DGT-IN1
2	Programmable digital input, DGT-IN2
3	Digital output, DGT-OUT1
4	Digital inputs/output ground return
5	Earth/Shield, PE

The **Fast Back**™ has **2 digital inputs** (**DGT-IN1** and **DGT-IN2**), which are opto-isolated.
The input circuit is pre-disposed for **+24VDC-7mA** (PLC compatible). The range of enable is between **+14VDC Min.** and **+30VDC Max**.

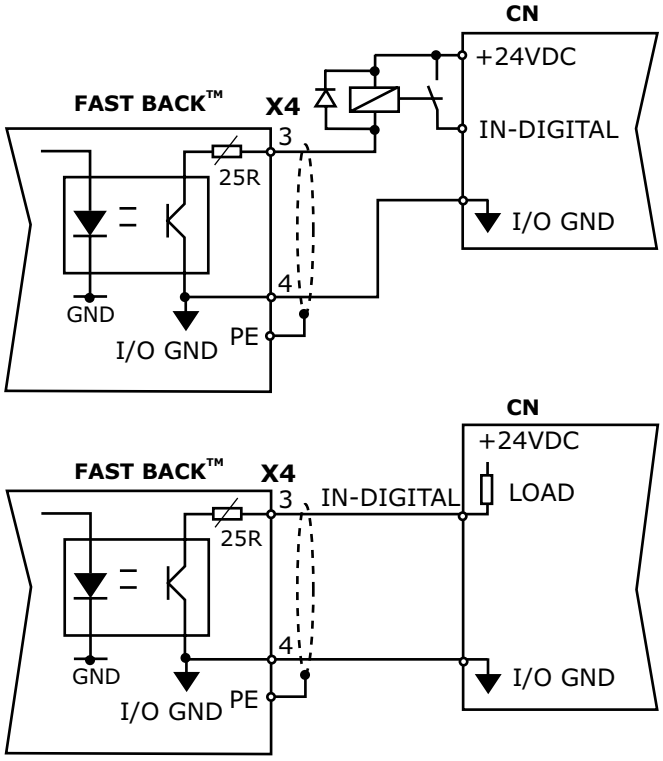
Pin **X4-1 (ENABLE)** is used only as the drive's enable.
Pin **X4-2** (**Programmable digital input**) can be used to activate pre-programmed functions of the drive.

Connection to the Numerical Control:



The **Fast Back**™ has **one opto-isolated digital output** (**DGT-OUT1, +24Vdc-50mA, PLC compatible**).
It is possible to utilise the digital output **to send messages from pre-programmed functions** of the drive.

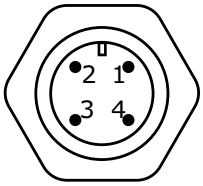
In the figure below examples of some of the possible connections utilising this output are illustrated:



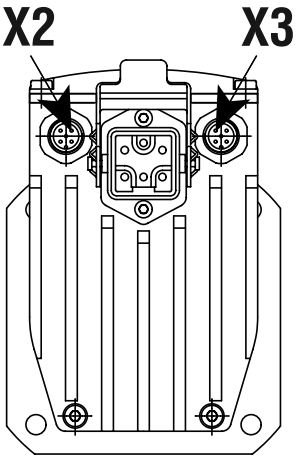
To set or enable the digital inputs **by software** or to visualise the **hardware status** of the digital output select "**Digital I/O**" in the main window of *Speeder One*.

3.5 Can Bus Interface

The **X2** and **X3 connectors** of the **Fast Back**™ manage the **IN/OUT signals for Can Bus communication**.



M12 male connector, X2 and X3
(Front view)



M12 connectors, X2 and X3 - CanBus	
PIN	**DESCRIPTION**
1	Earth/Shield, PE
2	LO CanBus chanel, CAN L
3	Ground return (0V CAN)
4	HI CanBus chanel, CAN H

On the **X2**/**X3** connectors an **interface for CANBus communication** is available (defined velocity 500kbit/sec, max. 1Mbit/sec).
The integrated software is based upon **CAN open DS301** communication protocol and on the **DSP402 profile**.
The CANOpen interface is isolated by opto-isolators and there is a dc-dc power converter that powers all of the circuitry of this interface. For this reason it is not necessary to connect any external supply.
See the "**Axor- CanOpen Reference Manual**".

Can Bus SETTINGS:

To do a CanOpen Network you have to:

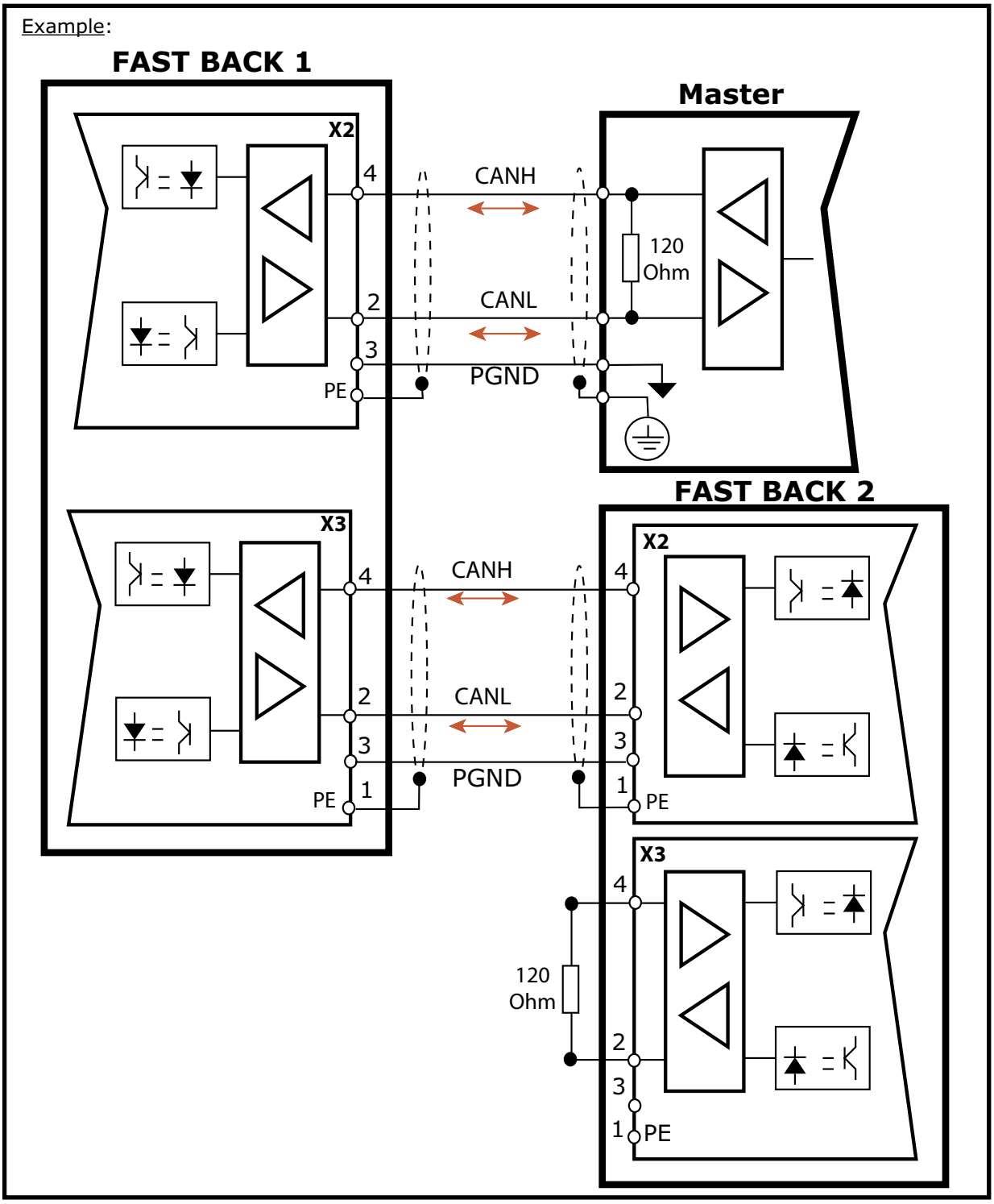
- set the **baud rate** parameter (in the "**General Settings**" window of the Speeder One interface), in order to define the communication speed and the performance of the system. All drives must have the same baudrate.

- set the **DEVICE-ID** (the "**Device-ID**" parameter in the "**General Settings**" window) to each drive. All drives must have a different DEVICE-ID.

Can Bus CONNECTIONS

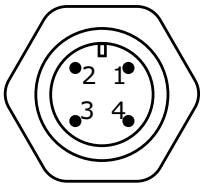
1. Connect the first **Fast Back™** to the MASTER using the CanBus cable (from the **X2** or **X3** connectors of the drive to the Master).
2. Connect each **Fast Back™** to the preceding and the following drive using the CanBus cables (**X2** and **X3** connectors).
3. Connect a **resistor** (120 Ohm) between pins **2** and **4** of the **X2** (or **X3**) connector of the the last **Fast Back™**.

Example:



3.6 RS485 Interface

The **X2** and **X3 connectors** of the **Fast Back**™ manage also the **RS485 interface** (AVAILABLE SOON).

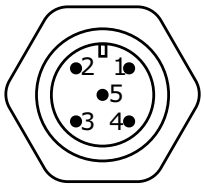


M12 male connector, X2 and X3
(Front view)

M12 connectors, X2 e X3 - RS485 Interface	
PIN	**DESCRIPTION**
1	Earth/Shield, PE
2	Chanel B 485
3	Ground return (0V 485)
4	Chanel A 485

3.7 RS232 Interface

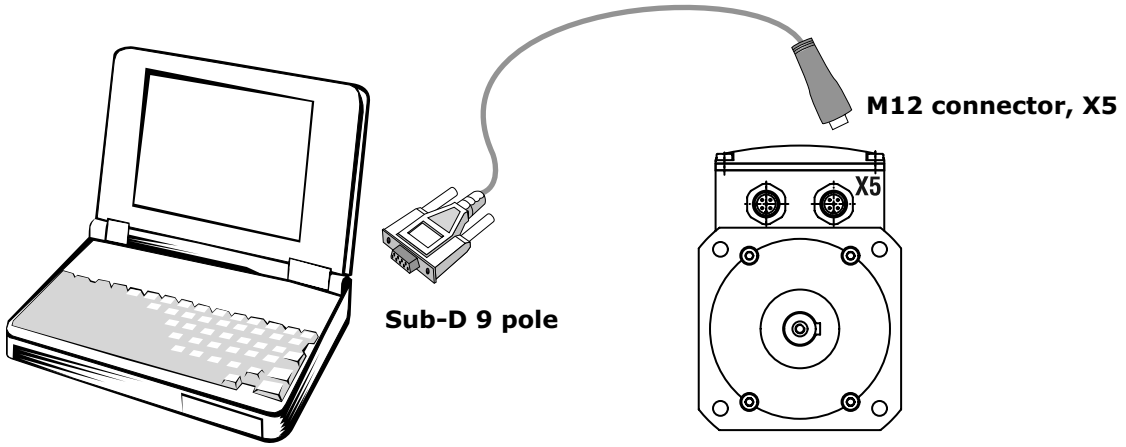
The **X5 connector** of the **Fast Back**™ manages:
- the **RS232 interface**;
- **one analog output**.



M12 male connector, X5
(Front view)

M12 connector, X5 - RS232 Interface	
PIN	**DESCRIPTION**
1	Chanel TXD RS232 interface
2	Chanel RXD RS232 interface
3	PGND
4	Analog output, AN-OUT1
5	AGND

The RS232 interface allows you to connect the **Fast Back**™ to the *Speeder One* software interface and to insert all parameters of the drive (regulation, positioning, etc.) using the PC. This allows for communication via RS232 by ***Mod BUS*** protocol.



SUB-D 9 pole		M12
Pin 2 (RxD)	-->	Pin 1 (TxD)
Pin 3 (TxD)	-->	Pin 2 (RxD)
Pin 5 (GND)	-->	Pin 3 (GND)

Note: The cable must be shielded and both sides of the shield must be connected to ground. On the side of the M12 connector connect the shield to the pin 5, on the side of the Sub-D connector connect the shield to the chassis of the connector.

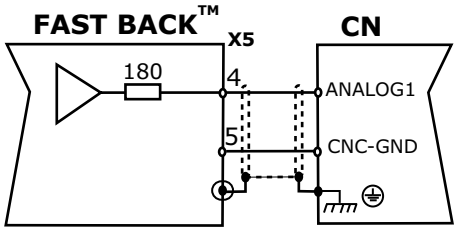
3.8 Analog Output

The **Fast Back**™ provides one **analog output** (on pin **X5-4**), which permits visualisation by oscilloscope of some of the drive's measurement values.

Pin X5-4....Monitor output, **AN-OUT1**
Pin X5-5....Mass reference of the monitor, **AGND**

Pins **X5-4** (AN-OUT1) and **X5-5** (**AGND**) furnish **±10Volt** as the low scale setting refers to.

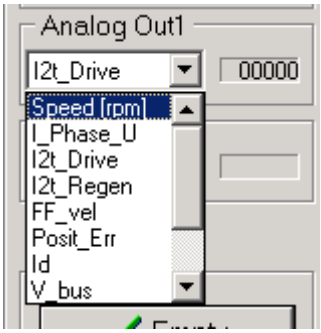
Connection to the Numerical Control:



Note: The shield is to be connected to ground through connector's ring.

Utilizing the *Speeder One* you may set the **AN_OUT1** output, the different options are as follows:

- drive's speed in RPM (**Speed_RPM**);
- Iu current (**I_Phase_U**);
- I²t drive (**I²t_Drive**);
- I²t Regen (**I²t Regen**);
- feed forward speed (**FF_vel**);
- position error (**Posit_Err**);
- direct current (**Id**);
- bus voltage (**V_bus**);
- motor angle(**Angle**);
- quadrature current (**Iq**);
- +10V voltage reference(**+10Volt**).



3.9 Multidrop

It is possible to comunicate more than one Axor drive simultaneously with the "**Multi Drop connection**". This connection must take place between PC ("**MASTER**") and the first drive in **RS232** using the **MODBUS communication protocol**, while between the first drive and the other drives the communication will be copied utilizing **CAN BUS**.
In this way it is possible to set simultaneously the parameters of more drives.

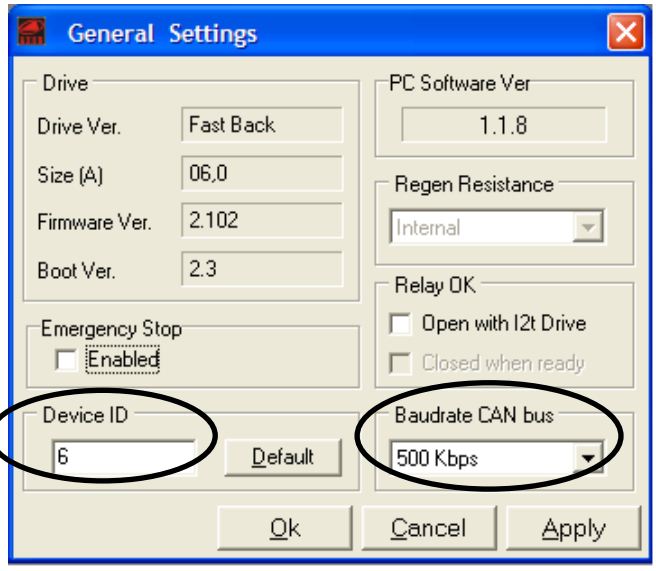
The Axor drives use the **MODBUS** communication protocol specified in the **Modicon** instructions (see http://www.modicon.com/techpubs/).
See the chapter "5.1: ModBus Protocol".

Multidrop SETTINGS

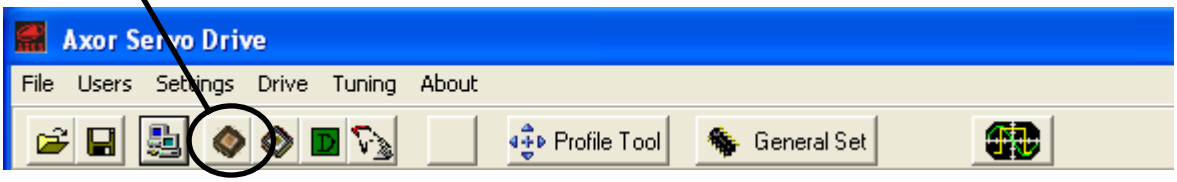
In the "**General Settings**" window of each converter set:

1. **500 kbps** into the **Baudrate CAN bus** parameter;

2. the **Device ID** parameter**.** Each converter must have its **Device ID** parameter; it is convenient to set for the first drive connected to the PC in RS232 the **1** identification, while for the other drives it is convenient to set identifications in an incremental order.



3. After these settings **save all to EEPROM** (using the "**Save Data to EEPROM**" icon), then **turn on and off** the **Fast Back™**.



Multidrop CONNECTIONS

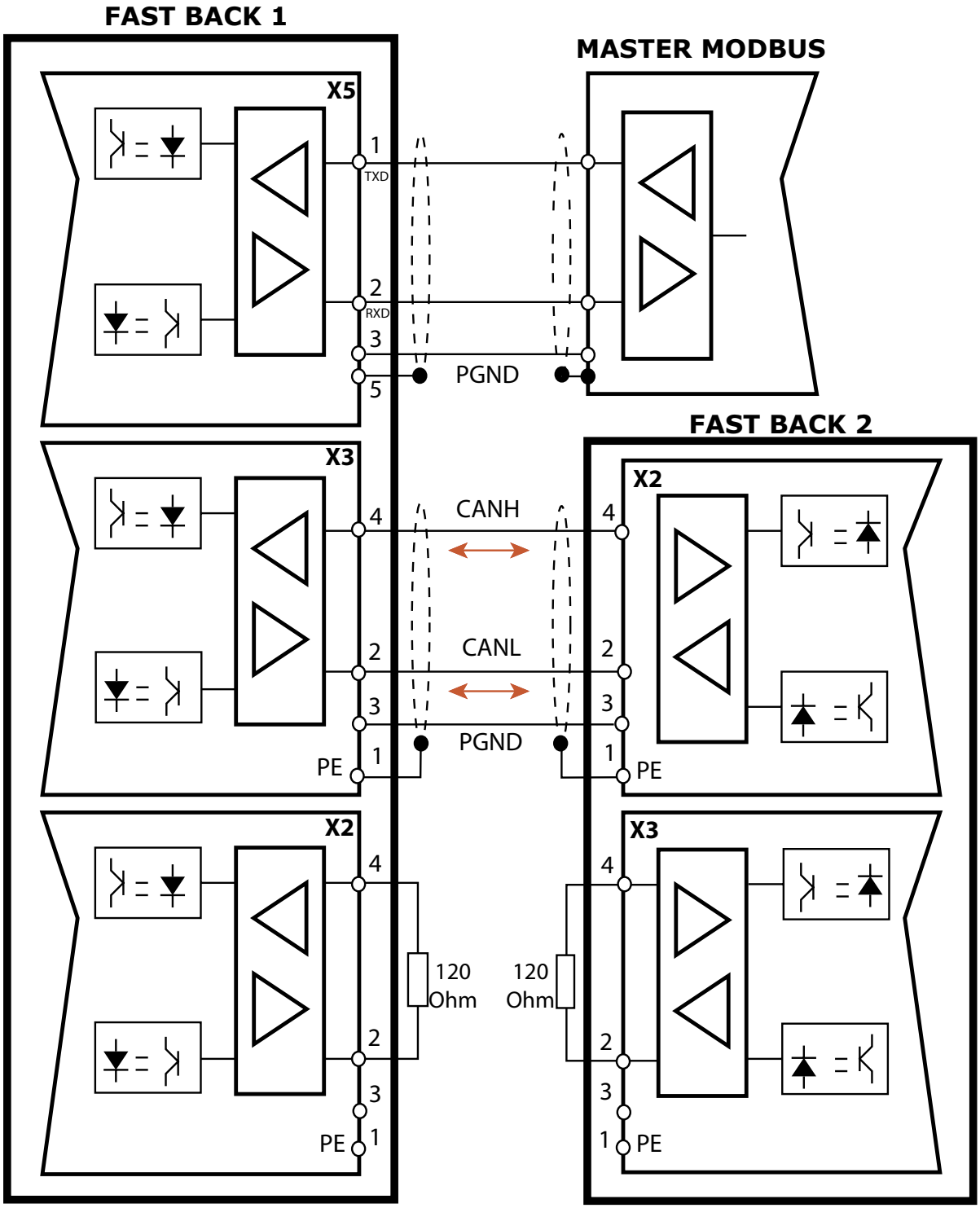
1. connect the first **Fast Back**™ to the "**Master**" PC using the RS232 cable (**X5** connector);

2. connect each **Fast Back**™ with the preceding and the following using the **X2** and **X3** connectors;

3. connect a **RESISTOR** (**120 Ohm**) between the **2** and **4** pins of the **X2** (or **X3**) connector of the first **Fast Back**™ and another resistor between the **2** and **4** pins of the **X3** (or **X2**) connector of the last **Fast Back**™.

*(See connection diagram on the next page)

Example:


FAST BACK 1
MASTER MODBUS
X5
1
TXD
2
RXD
3
5
PGND
FAST BACK 2
X3
X2
4
CANH
2
CANL
3
PGND
PE
1
X2
X3
120
Ohm
120
Ohm

3.10 Led

In the **Fast Back**™ there is a **LED** (red or green, fixed or blinking) that visualises the systems' status:

COLOR	STATE	CAUSE
No color	-	The Fast Back is turn off.
(Green)	Blinking	There is only the +24Vdc auxiliary supply.
(Green)	Fixed	The Fast Back is ready.
		The rotor is not running or it is running and there are not active alarms.
(Red)	Fixed	There is an alarm.

During the start up of the system the led changes in this manner:

1) at the beginning it is switched off;
2) it becomes red because of the pre-loading phase;
3) it becomes green (fixed).

Chapter 4
Speeder One

4.1 Speeder One Interface

All Axor's servodrives are supplied with the software ***Speeder One*** which permits you to setup, modify and save all the parameters of the system, by connecting a PC to the drive (via RS232).

The interface communicate with the drive via *serial RS232*. For a more detailed description about the RS232 interface and the realisation of the communication cable see chapters "3.7 RS232 Interface".

PC minimum preconditions:

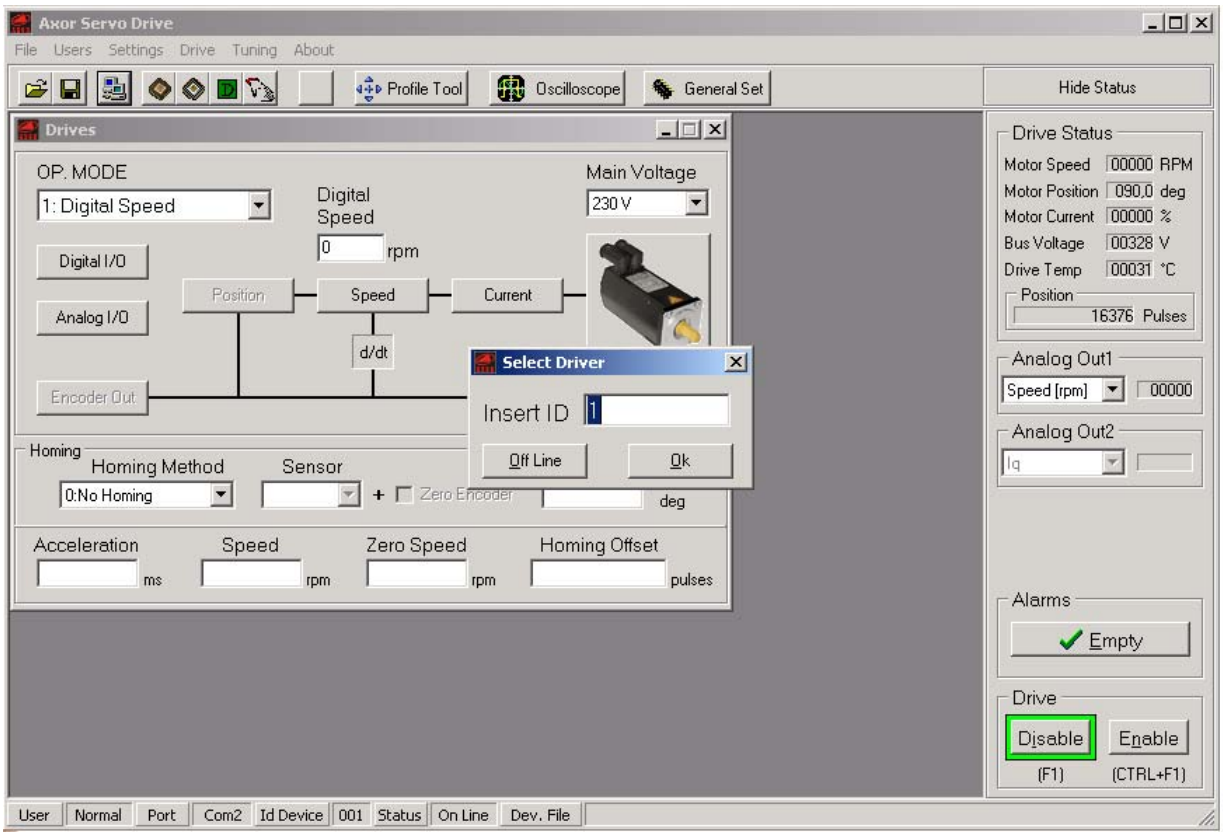
Operative system: *Windows 98*, *Windows 2000*, *Windows XT;*
Graphic sheet: Windows compatible, coloured;
Drive: Hard disk having at least 5 MB free;
Drive for CD-ROM
Work memory: at least 8 MB;
Interface: free serial interface

Installation procedure:

1- connect the RS232 cable to the PC serial interface and to the J5 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".

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

The program is started by clicking on **"Axormb.exe"**.
The main window "**Axor Servo Drive**" and the "**Select Drive**" window open simultaneously.

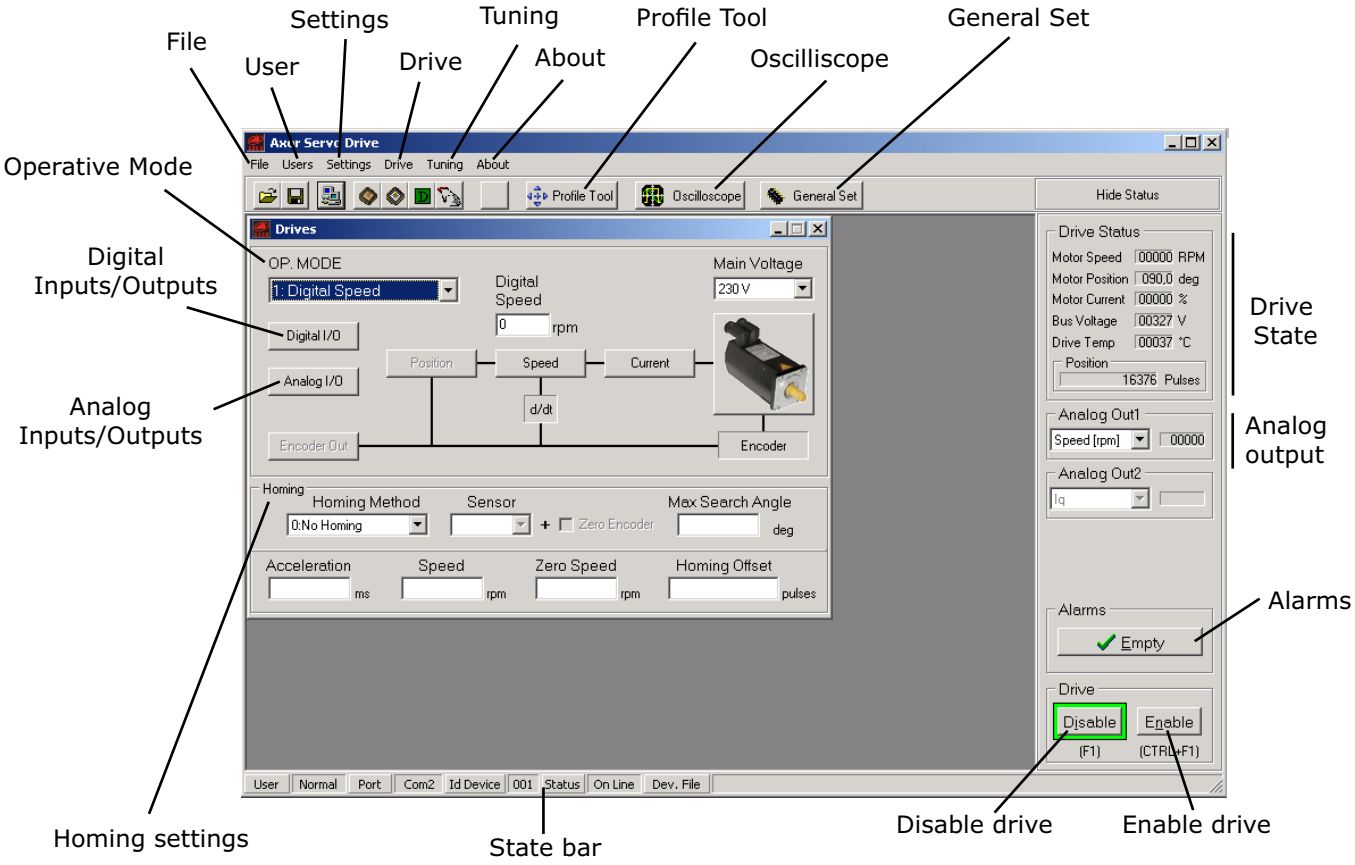


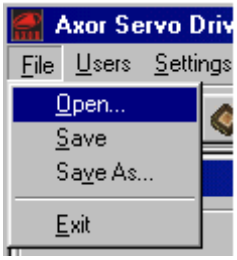
The window "**Select drive**" allows you to select the drive's address with which you wish to communicate; this permits "**single drop communication**" (with a single driver) or "**multi drop communication**" (with multiple drivers).
All drives have as default value **1**. It is possible to change the drive's address in the "**General Settings**" window.

If the communication between the PC and driver is "**OFF line**", it is possible to open a configuration file utilizing the "*.dev" extension; it will visualise standard parameters:

4.2 Main menu

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 exit the program.

User

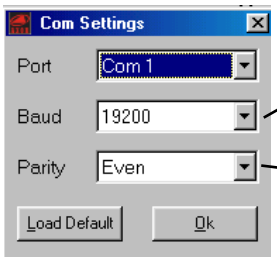
Axor reserved information.

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.

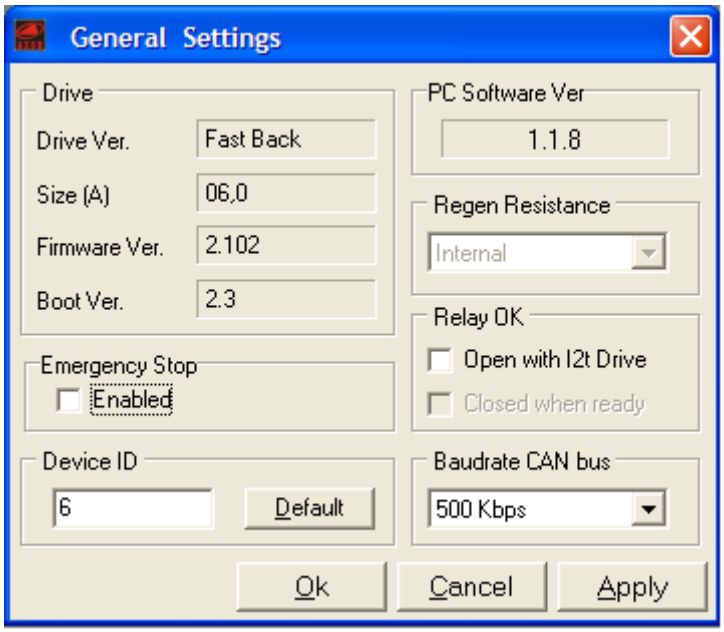


By clicking on "**Baud**", you can set the velocity communication baud rate between PC and driver.

By clicking on "**Parity**", you can display the parity bit settings.

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 servodrive connected;
- 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

It visualises the type of regen resistance: Internal or External. In the **Fast Back™** this function is not active.

Relay OK

Not active with the **Fast Back**™.

Baudrate CAN bus

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

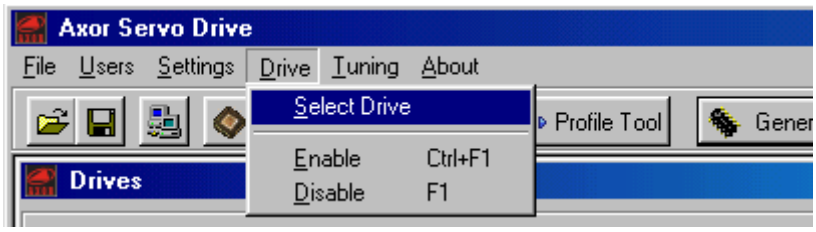
This option allows you to set or to change the address of the drive. All drives have as default value **1**. If you change the address of the drive you have to save it onto the EEPROM and then disable and enable the drive.

Emergency Stop

It allows to enable/disable the ***Emergency Stop*** *function* (see chapter 5:Application").

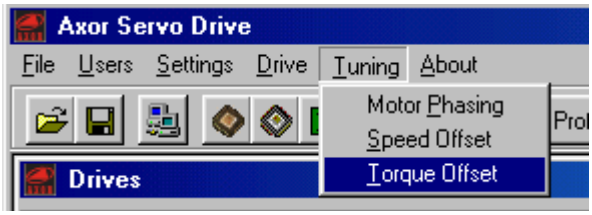
Drive

By clicking on "**Select Drive**" it is possible to select the address of the drive with which you want to communicate, while "**Enable**" and "**Disable**" manage the state of the drive.



Tuning

This menu is utilized for the phasing of the motor ("**Motor Phasing**")**.**

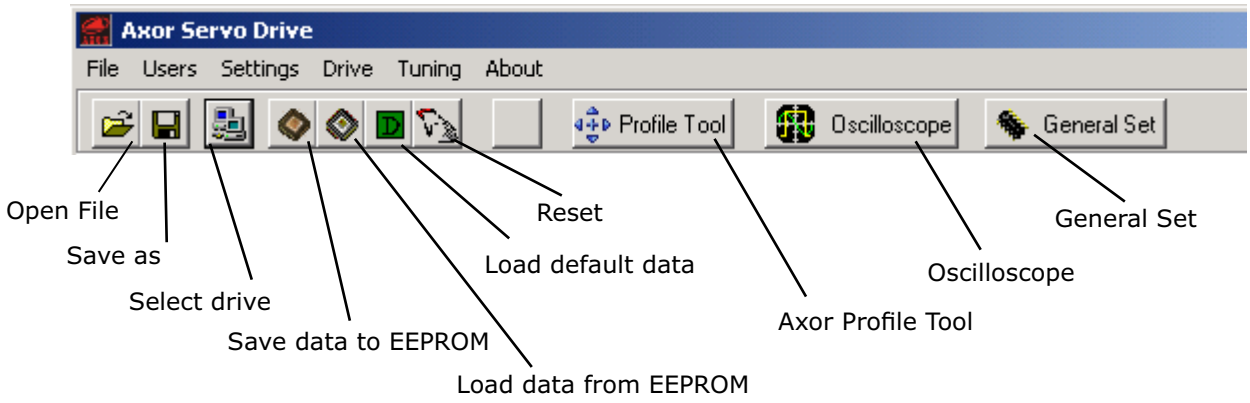


About

This option shows the program version and additional information, for example: "Axor Servo Drive Software 1.1.4".

4.2 Main menu

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



Open file
It opens a file "nomefile.dev".

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

Select drive
It opens the "**Select Driver**" window.

Save data to EEPROM
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.

Load data from EEPROM
It loads all the values which are present on EEPROM to the drive.
The program asks for confirmation.

Load default data
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
It re-sets the basic functions of the drive.

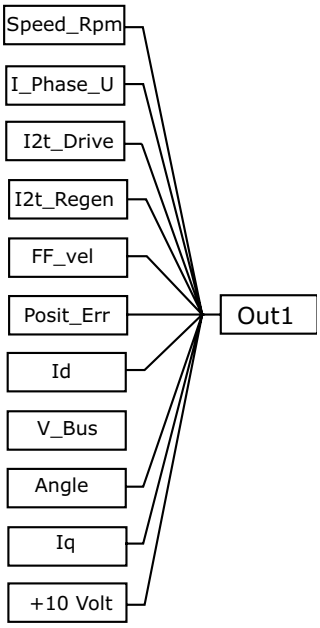
Axor Profile Tool
It opens the "**Axor Profile Tool**" window, with which you can setup all the parameters about the positioner.

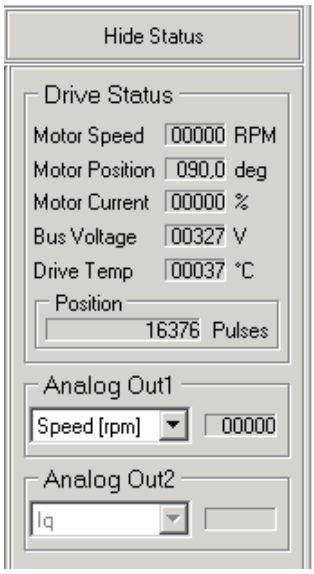
Oscilloscope
It opens the "**Oscilloscope**" window.

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

4.3 Drive Status

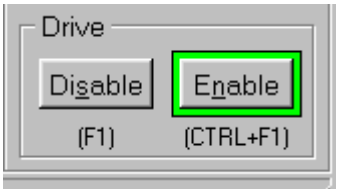
Drive Status (Status bar on the right of the main window)
- **Motor Speed** displays the velocity of the motor in RPM;
- **Motor Position** displays the rotor position in mechanical degrees;
- **Motor Current** displays the motor current (in percentages) with respect to twice the rated current of the drive. 50%= rated current, 100%= 2*rated current;
- **Bus Voltage** displays the bus voltage;
- **Drive Temp**: it visualised drive's temperature in degrees;
- **Position** displays the rotor position in pulses (<u>only</u> in the following operative mode: "4: Position Mode");
- **Analog Out1**: by clicking on this it is possible to select which internal parameter will be put into the analog output. Default settings on Analog Out1 is "motor speed".





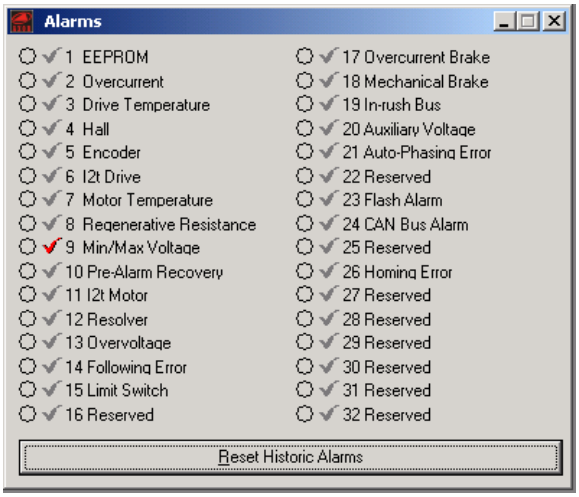
Enable, Disable

By clicking on this button you can enable or disable the drive's torque.



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 the alarms by disabling and enabling the drive or clicking on "**Reset All Alarms**".



4.3 Drive Status

Eventual functioning errors of the drive are visualized on the display on the front of the drive.

The drive is equipped with a series of **protections** which safeguard both the drive and the motor in case of malfunctions.
Some alarms cause the block of the drive so the user has to disable or power off the system, while others reset themselves or can be reset via interface without power off the system.
There are three kinds of protection: **reversible**, **resettable** and **irreversible**.

Reversible protection intervention
It compares in presence of alarms which "reset itself" when the cause that has determined intervention is no longer present.
This causes the block of the drive. To restore the correct functioning it is necessary to:
1) disable the drive (using the "Disable" icon or the DGT-IN1 input);
2) eliminate the cause that has determined intervention;
3) enable the drive (using the "Enable" icon or the DGT-IN1 input).

Resettable protection intervention
It compares in presence of alarms which "can be reset" using the "Reset Fault" function.
This causes the block of the drive. To restore the correct functioning it is necessary to:
1) disable the drive (using the "Disable" icon or the DGT-IN1 input);
2) reset the alarm using the "Reset Fault" function;
3) enable the drive (using the "Enable" icon or the DGT-IN1 input).

Irreversible protection intervention
It compares in presence of alarms which "cannot be reset".
This causes the disabling of the drive. To restore the correct functioning it is necessary to:
1) Disconnect the power (main power supply plus Back Up supply);
2) eliminate the cause of the block;
3) power again.
N.B. Before powering again wait a short while until the drive is securely switched off.

The table below illustrates all the message errors:

	ERROR MESSAGES		
	Designation	**Explanation**	**Reset**
AL1	**EEPROM**	Error during the parameter memorising on the drive's eeprom. This causes the disabling of the functioning. This alarm resets itself memorising parameters on eeprom; if the alarm persists contact Axor.	Resets itself
AL2	**Overcurrent**	Short circuit between U, V, W or toward earth. This causes the disabling of the functioning. Disconnect the power, verify the wiring, then power again.	Cannot be reset
AL3	**Drive Temperature**	Heat sink temperature too high, >75°C. This causes the disabling of the functioning. Disable the drive, verify the forced ventilation functioning, verify the ambient temperature, wait that the radiator has cool off, reset the alarm then enable the drive.	Can be reset
AL4	**Hall**	This alarm goes on if one or more of the hall cell's wire is interrupted. This causes the disabling of the functioning. Contact Axor.	Can be reset
AL5	**Encoder**	This alarm goes on if one or more of the encoder channels are interrupted. This causes the disabling of the functioning. Contact Axor.	Can be reset
AL6	**I^2t Drive**	The internal I^2t function has reached the maximum permitted, because of: - the working cycle could be too heavy; - a possible mechanical block; - a motor phases inversion; - the electronic brake not unblocked; - the amplifier dynamic costants: "KP", "KI" and "KD", could create useless current oscillation. This does not cause the disabling of the functioning.	Resets itself
AL7	**Motor Temperature**	Heat sink temperature too high. This causes the disabling of the functioning. Disable the drive: - control the heat sink temperature; - decrease the dynamic constant if the motor is vibrating. This situation causes the current oscillation and consequently the overheating of the motor. Wait the motor has cool off, reset the alarm, then enable the drive.	Can be reset

AL8	**Regenerative Resistance**	The value I^2t energy recovery has reached the maximum permitted. This causes the disabling of the functioning. Disable the drive: - check the AC power supply input; - check that the working cycles are not excessive; - verify if the motor, going at half speed, shows the same problem. Reset the alarm, then enable the drive.	Can be reset
AL9	**Min/Max Voltage**	Minimum or maximum converter voltage. This causes the disabling of the functioning. Disable the drive, wait the DC power supply voltage reaches the correct threshold, check the AC power supply input, then enable the drive.	Resets itself
AL10	**Pre-Alarm Recovery**	It has been reached the 80% of the I^2t energy recovery value. This does not cause the disabling of the functioning. Check the AC power supply input and the working cycles. This is a visual alarm, it anticipates the eventual intervention of the "Maximum recovery" alarm.	Resets itself
AL14	**Following Error**	The error between the position reference and the position feedback exceeds the "Max Position Error" parameter, because of the "Max Position Error" parameter is too small, or the dynamic gains of the velocity-positioning loop are wrong. This causes the disabling of the functioning. Disable the drive, check the Max Position Error parameter, check the dynamic gains, reset the alarm, then enable the drive.	Can be reset
AL15	**Limit Switch**	The fixed extra-run position is interrupted. This causes the disabling of the functioning. Disable the drive, check the end-run contact and external connections, then enable the drive.	Resets itself
AL23	**Flash Alarm**	Errors in reading/writing parameters on Flash, or Flash is empty. This causes the opening of the Relè Ok contact and the disabling of the functioning. Disconnect the drive, save new values, then power again. If the problem persists contact Axor.	Resets itself
AL24	**Can Bus Alarm**	Error during communication on CANBus. This causes the opening of the Relè Ok contact and the disabling of the functioning. Disable the drive, check the cabling and re-enable. If the problem persists contact Axor.	Can be reset by CAN
AL26	**Homing Error**	Position error too high during the homing procedure. The motor stops, but it is not disabled. Check the homing setup, then reset the alarm using the "Start Homing" function.	Can be reset by "Start Homing"

4.4 Operative Mode

The "**OP. MODE**" menu allows you to select the operation mode of the drive. With every selection all associated information is pre-disposed automatically.
The **Fast Back™** offers the following operation modes:

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

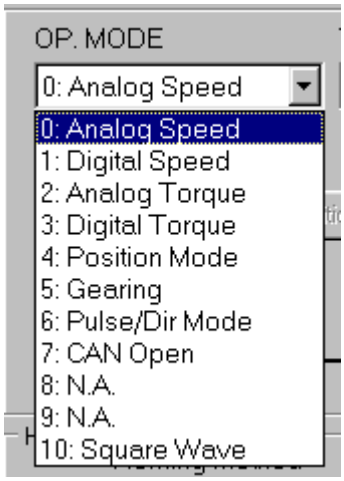
Digital Torque
The motor is controlled in torque mode through a digital reference.

Position Mode
The motor is controlled in position mode.

Can Open
This mode allows you to configure and control the drive using CanBus. It supports the following **Can Open** protocols:
• part of the **DS301-V4.02**
• part of the **DSP402-V2.0**

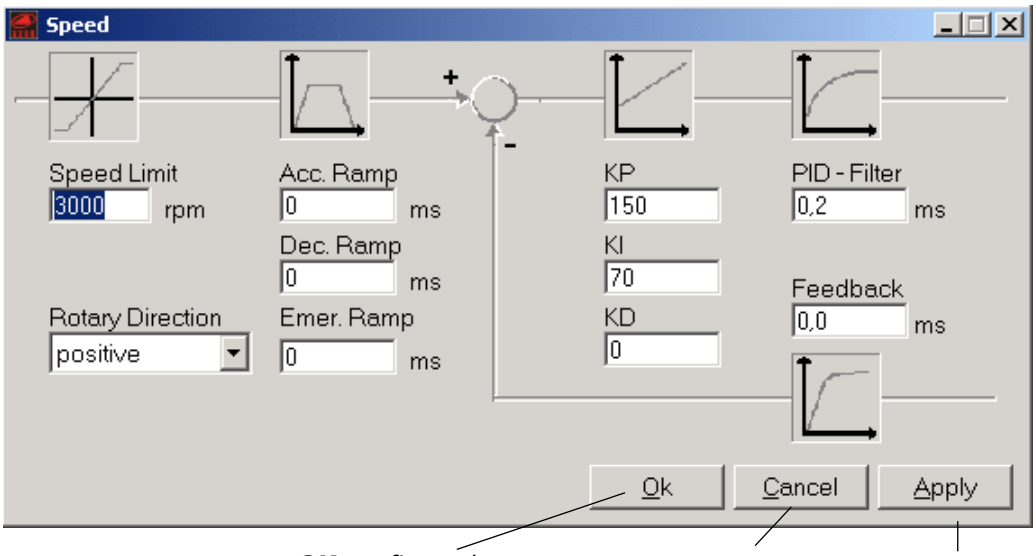
Square Wave
The motor is piloted with a "square wave" signal. This is useful for dynamic adjustments of the motor.

The others operative modes visualized on the menu are **not** active for the **Fast Back™**.



4.5 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.

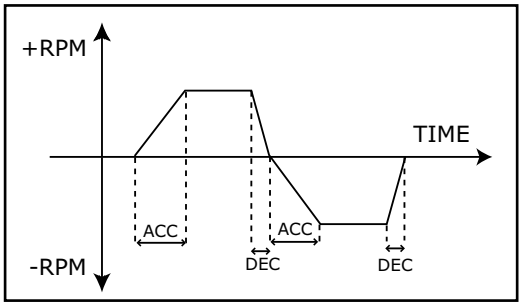
Apply confirms the set value, but it does not close the window.

Speed limit
It is the maximum speed limit. Actual limit is 8000rpm.

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

Acc. Ramp
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
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
It is possible to insert the value of the deceleration ramp "in ms" during the emergency stop.

PID-Filter
It is a filter on the speed reference.

Feedback
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
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
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.

Tuning Speed loop

To optimize KP and KI utilize the following procedure:

1- set the "**10: Square wave**" operating mode.

2- Set the "Speed_RPM" parameter on the "Analog OUT1" menu.

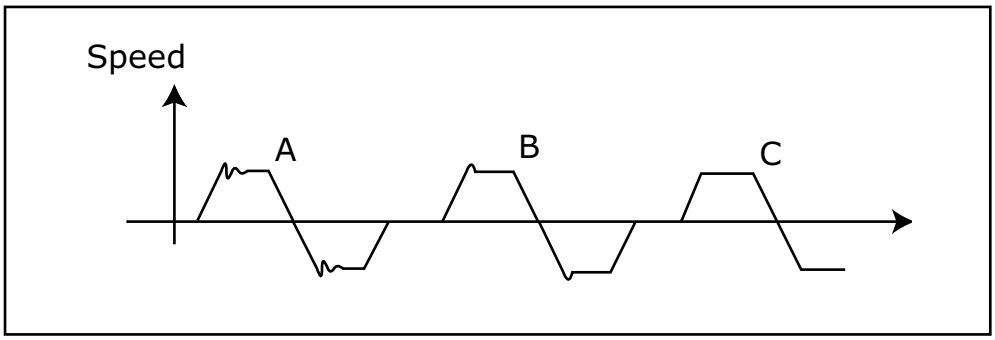
3- Connect the probe of the oscilloscope on pins **X5-4** (speed signal) and **X5-6** (zero signal).

4- Adjust the KP and KI gains in a way that you obtain a stable step response in both directions.
Increasing KP decreases the system's response time; however, the system gets closer to becoming unstable; therefore, during adjustment increase the KP to the oscillation limit and then reduce until secure oscillation stoppage.
Increasing KI the steady state diminishes, however increasing the overshoot, therefore after adjusting KP increase KI keeping the overshoot within authorized limits (±10%).

The figure below illustrates some typical oscilloscope tracks:

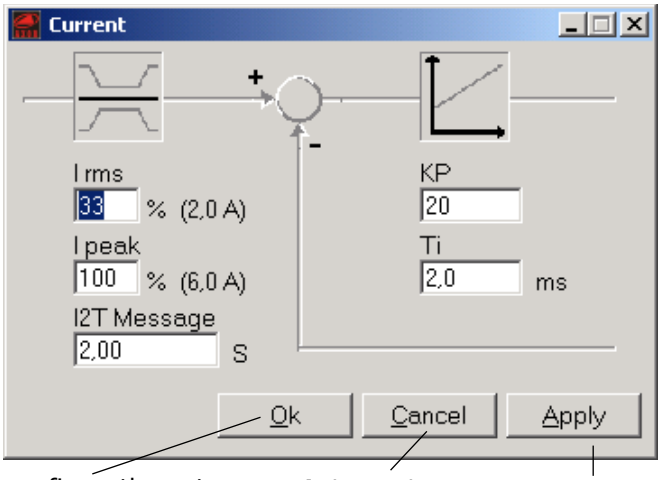
A) Proportional and integral gains too low. Increase the numerical values of KP and KI.

B) and C) Good proportional and integral gains.



4.6 Current Window

This window allows you to modify the dynamic costants of the drive's **current loop**.
In the Fast Back™ it is <u>not</u> possible to change any parameter of this window.



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
In this section it is possible to insert the percentage value of the nominal current furnished by the drive. The numerical range is between 1 and 50 and it is referred to the peak current value.

I peak
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.

The value of nominal and peak current is RMS.

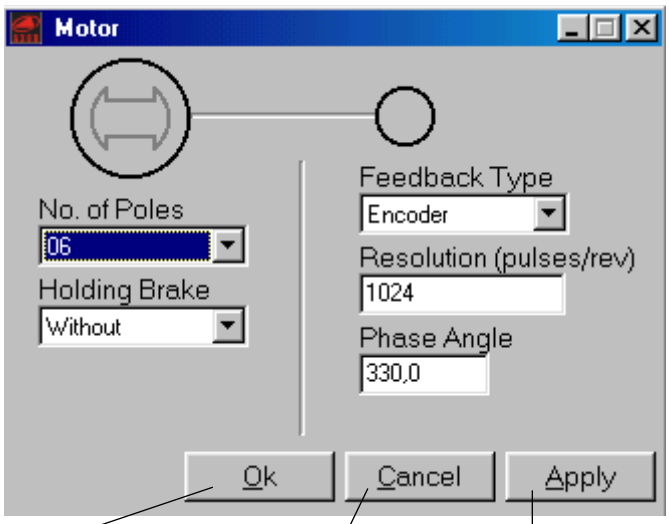
I2T Message
Time of the peak current. The drive automatically calculates the thermal image I2T.

KP
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
It is the integral time in "ms" of the current loop.
The numerical range of this parameter varies from 0 up to 99,9ms.

4.7 Motor window

Clicking this icon it is possible to modify items relating to the **motor**'s characteristics.



OK confirms the set value and closes the window.

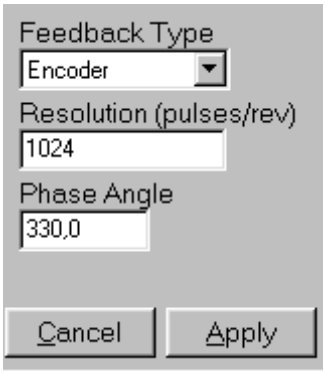
Cancel closes the window without change any parameter.

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

No. of Poles
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
It permits to select the type of motor feedback: Encoder or Resolver. The **Fast Back™** has only the Encoder feedback.

Resolution (pulses/rev)
In this section there are the value of encoder pulses/rev.

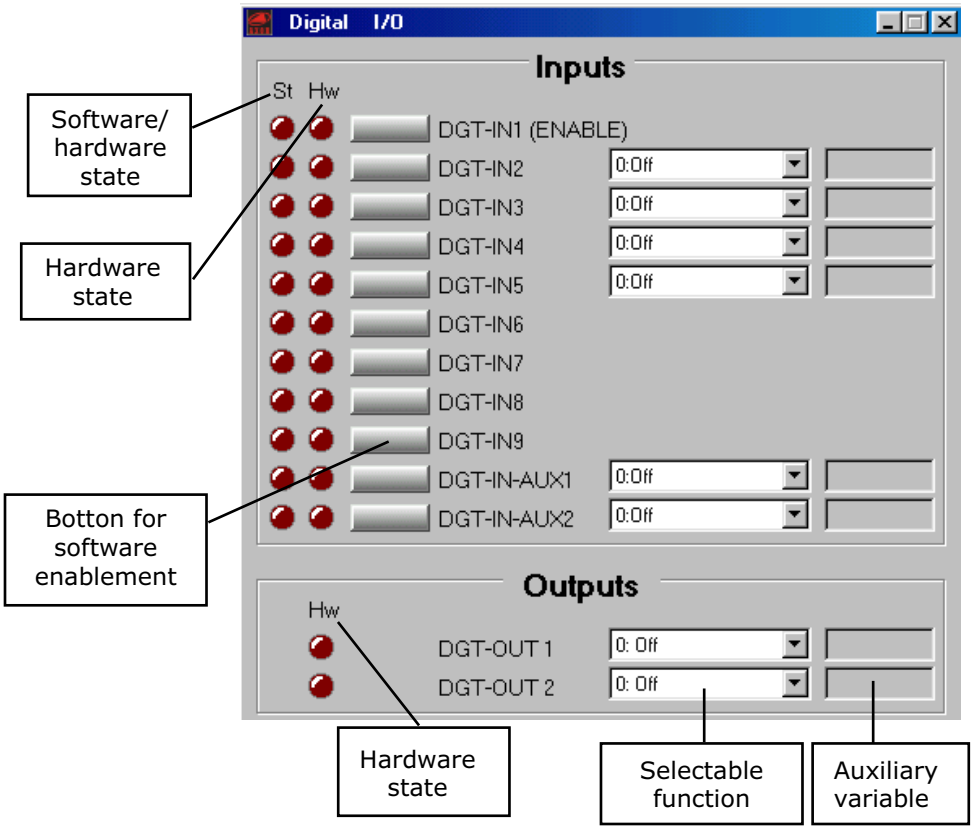


Phase angle
In this section the phasing angle of the motor is visualized.

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 (for more information see chapter "5.6 Motor Brake Management").

4.8 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.



Inputs

The "**St**" led visualises the status of the digital inputs, if it is red 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 high logic signal is present on the input.
Note: If the Hw led is red, the St led is red too.

It is possible to **apply a high logic signal** to the input in two modes:

- **utilising the Speeder One interface**: clicking on the button near the name of the digital input which will then show red on the "St" led.

- **hardware**: by applying the corresponding voltage (+24V) on the connector pins. This will cause leds "St" and "Hw" to show red.

Attention: In the Fast Back there are only two digital inputs (one programmable) and one digital output, which can be menaged or via software (by the Speeder One interface or another Modbus), or via hardware. The others digital programmable inputs and the digital output, which you find in the Digital I/O window, are menaged only via Modbus.

4.8 Digital I/O window

Near the name of each digital input 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).

FUNCTION	DESCRIPTION
Off	With this settings there is not a particular function assigned to the input.
Ref-On	It enables the motor rotation.
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.
Brake	This function is **not** available for the **Fast Back™**.
P+N Stop	Positive and negative limit switch. A low logical signal on this input disables the rotation of the motor (CCW and CW).
Homing Sensor	Homing sensor.
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.
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.
Start Homing	It is used to start/stop the homing procedure.
Reset Fault	It allows the reset the "resettable" alarms.

Outputs

The "**Hw**" led visualises the hardware status of the digital output, if it is red a high logic signal is present on the output.

In the following table there are the setting functions for the digital output:

FUNCTION	DESCRIPTION
Off	Selecting this function the output will always be open.
|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.
|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.
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.
I2t	The output will be closed if the I^2t condition is reached. When this condition comes down the output will be opened.
|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.
|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.
Target OK	This function closes the output when a positioning task successfully terminates; at the start of a new profile the output is opened.
Error	With this function the output is closed if one or more alarms are present. When all alarms are cleared the output will be opened.
Ready	When the control circuitry is powered up (with a minimum delay), the output will be closed.
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.
|Error 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.
|Error 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.
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.

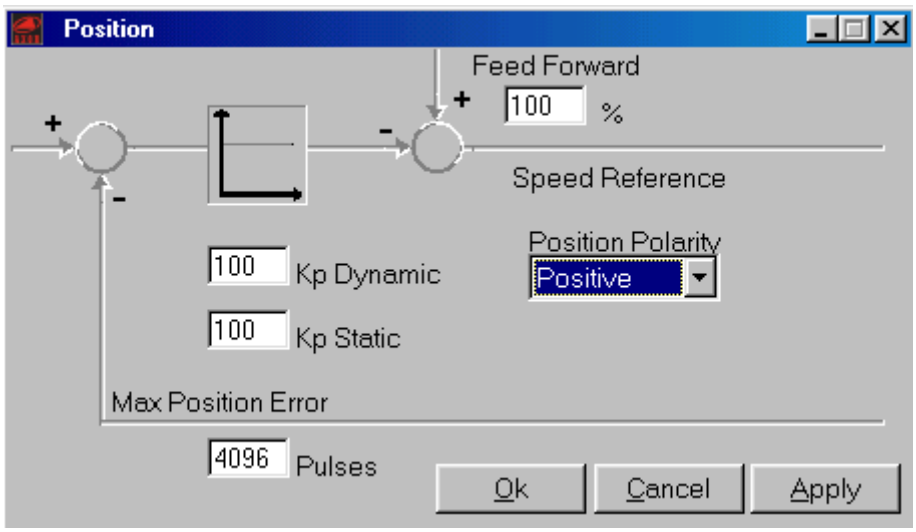
4.9 Position window

This window allows you to set the static and dynamic parameters about "**4:Position Mode**".

Feed Forward
This improves the system's dynamics.
Suggested value: 100%.

Kp Dynamic
This is the position loop gain.
Admited values: 1÷999.

Kp Static
Insert the same value inserted in the **Kp Dynamic** parameter.



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 is multiplied by -1.
3) All target positions ("Final Position") are multiplied by -1.

Max Position Error
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).

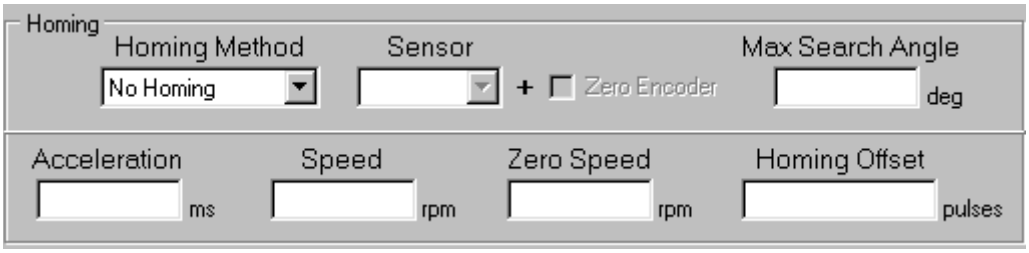
Example: If the maximum mechanical accepted error is 45° (1/8 mechanical turn), then the value to insert in the Max Position Error box is 8192, in fact:

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

We suggest to insert the value: 8192.

4.10 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
It defines the method of homing. The supported options are:

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

Acceleration

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:

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

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 example 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:

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

Zero Speed

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

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:

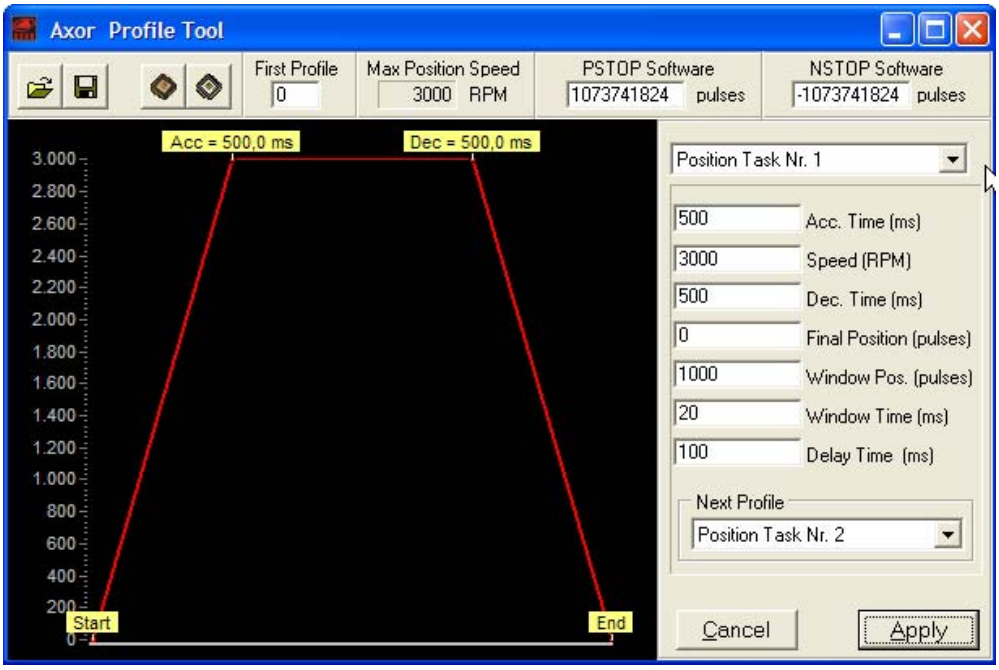
$$Homing\ Offset = n°\ turns\ (also\ not\ integer) * 65536$$

Example: 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: 4,25 *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.

4.11 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 only if the Homing Offset was set to zero).
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 referred 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:

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

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 on 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 deceleration time** related to the profile speed can be found using the following expression:

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

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 on the "Speed window);
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 admitted position quotes 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.

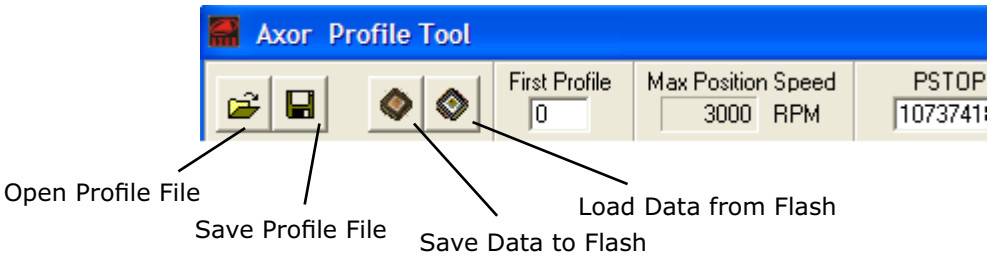
PSTOP Software
If the Final Position parameter is greater then the PTSOP Software, the task stops when the PSTOP target is reached.

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:



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.

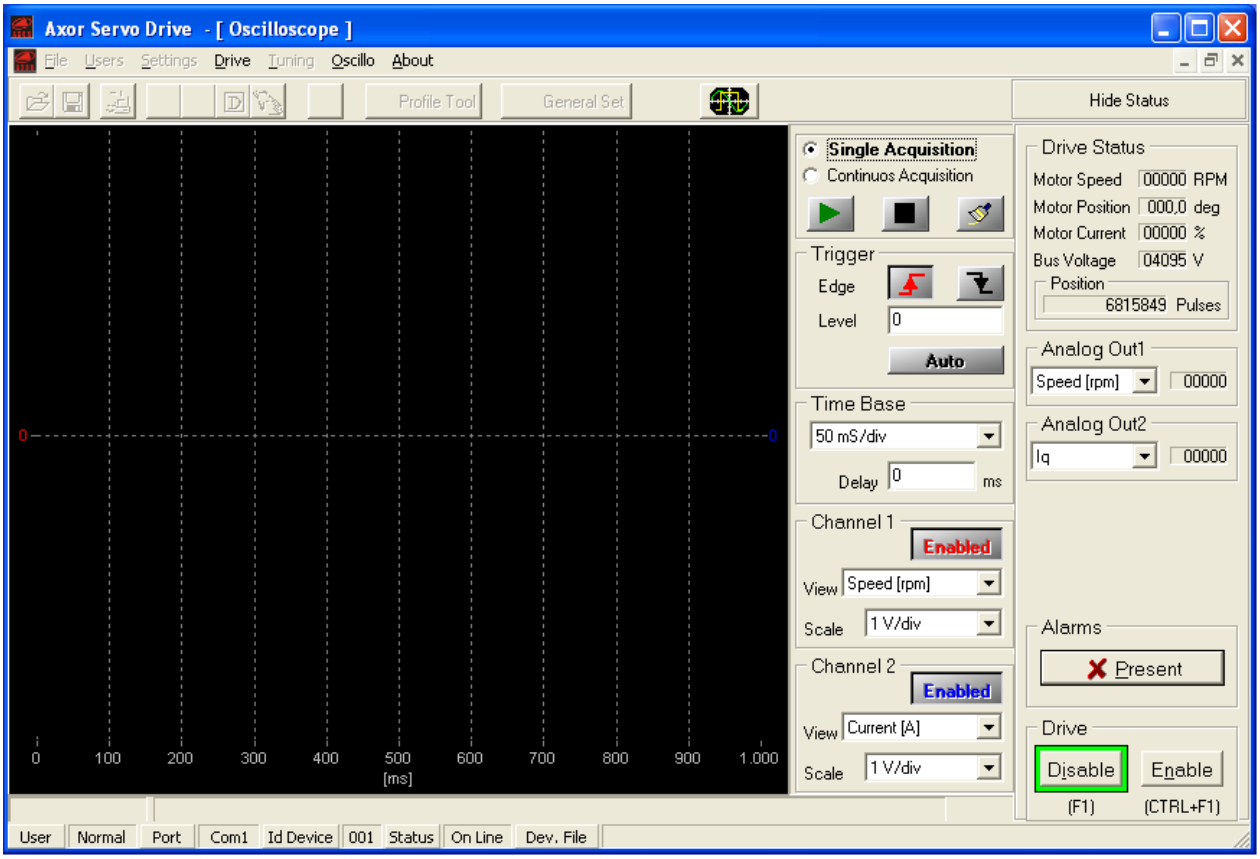
Save Profile File
It permits to save on a file the parameters set in the "Axor Profile Tool" window.

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.

4.12 Oscilloscope

The "**Oscilloscope**" window menages a two channel oscilloscope:



Single Acquisition
It allows to set a single acquisition of data, when the first trigger event is reached.

Continuous Acquisition
It allows to set a continuous acquisition of data, for each trigger event.

Trigger (Edge)
It allows to set the trigger on the rising edge or the falling one.

Trigger (Level)
It allows to set the trigger level.

Auto
It set automatically the trigger level. Use this function for the first acquisition, in order to know the level of the visualized signals.

Time Base
It allows to set the time base of the window.

Delay
It allows to apply a delay on the *visualisation* of the acquired data on the trigger event.

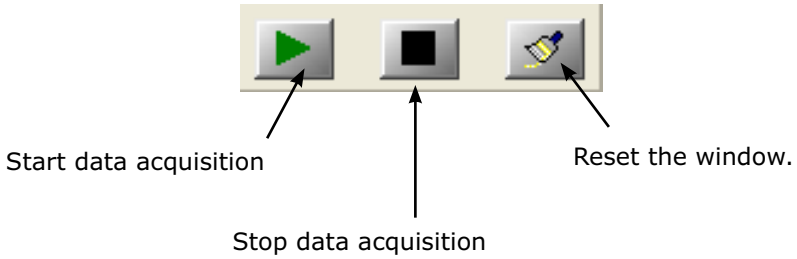
Channel 1 (o 2) (View)
It allows to select the signal to visualise with the oscilloscope. There are two options:

1- rotor speed: Speed [rpm]
2- phase current: I_Phase_U [A]
3- position error: Posit_Err [Pulses]

To disable a channel click the corresponding **Enabled** buttom.

Channel 1 (o 2) (Scale)
It allows to set the vertical scale of the window, in volt or millivolt for division. For the channel 1 the scale will be visualized red on the left, while for the channel 2 the scale will be visualized blue on the right.

For enabling/disabling data acquisition use the following icons:



Chapter 5
Applications

5.1 Reset Fault Function

In the **Fast Back™** it is possible to reset all *resettable alarms* by using the "**Reset Fault**" function, that can be set on one digital programmable input in the **Digital I/O** window.

The *resettable alarms* are the following:

- Al3: Drive's temperature;
- Al4: Hall;
- Al5: Encoder;
- Al7: Motor's temperature;
- Al8: Regenerative Resistance;
- Al14: Following Error.

When a resettable alarm occurs the motor is blocked; to restore the correct functioning it is necessary to:

1) disable the drive (using the "**Disable**" icon and/or **DGT-IN1** input);

2) eliminate the cause that has determined intervention;

3) reset the alarm by setting the "**Reset Fault**" function in one available programmable digital input and applying a high logic signal to this input (see note below);

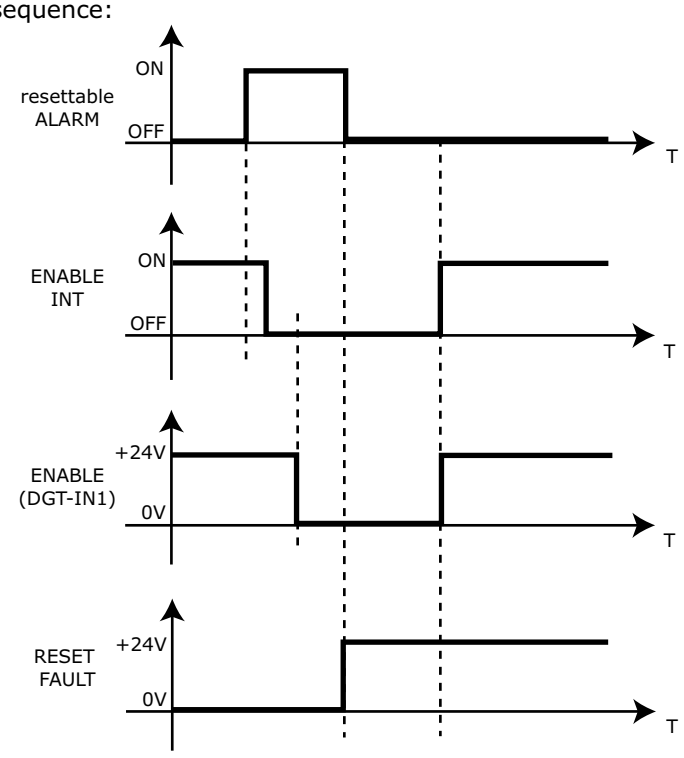
4) enable the drive (using the "**Enable**" icon and/or **DGT-IN1** input).

Note: It is possible to **apply a high logic signal** to the input in two modes:

- **utilising the Speeder One interface**: clicking on the button near the name of the digital input which will then show red on the "St" led.

- **hardware**: by applying the corresponding voltage on the connector pins. This will cause leds "St" and "Hw" to show red.

Reset Fault function sequence:

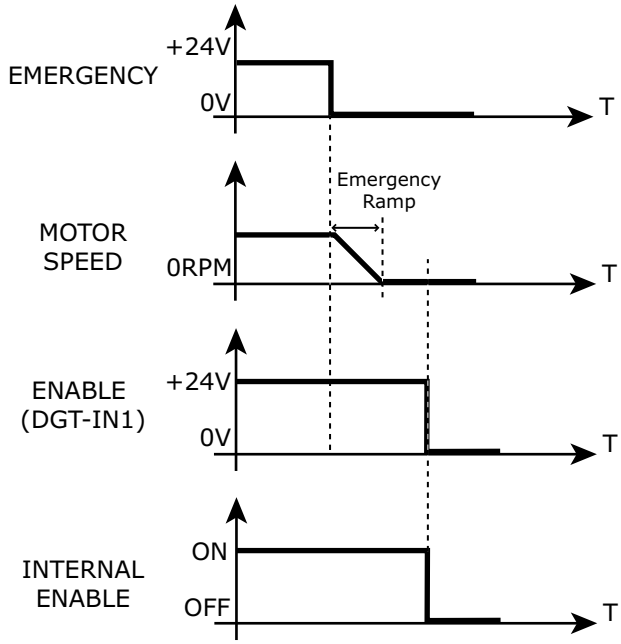


5.2 Emergency Function

The **Fats Back™** has the **EMERGENCY *function***, settable on one digital programmable input in the **Digital I/O** window ⇨ a falling edge on the input set with this function cause the stop of the motor by using the "**Emer.Ramp**" parameter set in the "**Speed**" window.

Attention: After the stop the motor remains in torque until a hardware disable .

Emergency function sequence:



5.3 Positioner

The **Fast Back™** can be controlled as **POSITIONER**. An **ABSOLUTE POSITIONER** was implemented, which implies transactions to *absolute quotas* reference to the reference point.

Example: Suppose we want to blend the following profiles, having the origin (0 pulses) as reference point:

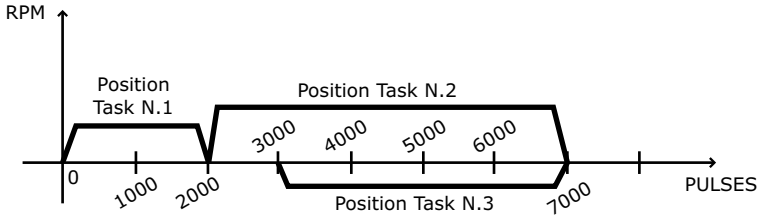
	POSITION TASK	**FINAL POSITION (**pulses**)**
1°	Position Task N.1	2000 pulses
2°	Position Task N.2	7000 pulses
3°	Position Task N.3	3000 pulses

a- During the first profile there will be a transaction from 0 pulses to 2000 pulses.

b- During the second profile there will be a transaction from 2000 pulses to 7000 pulses, so there will be a turning equivalent to 5000 pulses.

c- During the third profile there will be a transaction from 7000 pulses to 3000 pulses; to execute this movement the sense of rotation will change.

Example: Absolute Positioner



It is possible to set up to **32 trapezoidal positioner profiles**, by the *Speeder One* interface in the ***Axor Profile Tool*** window.

It is possible to execute a single profile or a sequence of blending profiles.

Before starting an *absolute positioning*, it is necessary to execute a correct **homing procedure**, which is the research of the reference position. The homing procedure uses the signal of the homing sensor and, eventually, the zero signal of the encoder.

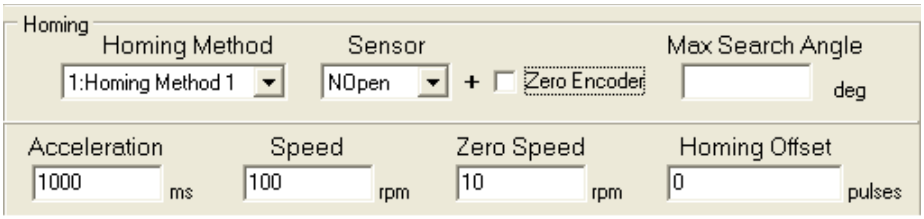
In the **Fast Back™** the positioner and homing procedures can be managed **via RS232**, by using the *Speeder One* interface or another master *ModBus*.

The following chapters illustrate examples of homing and positioner procedures.

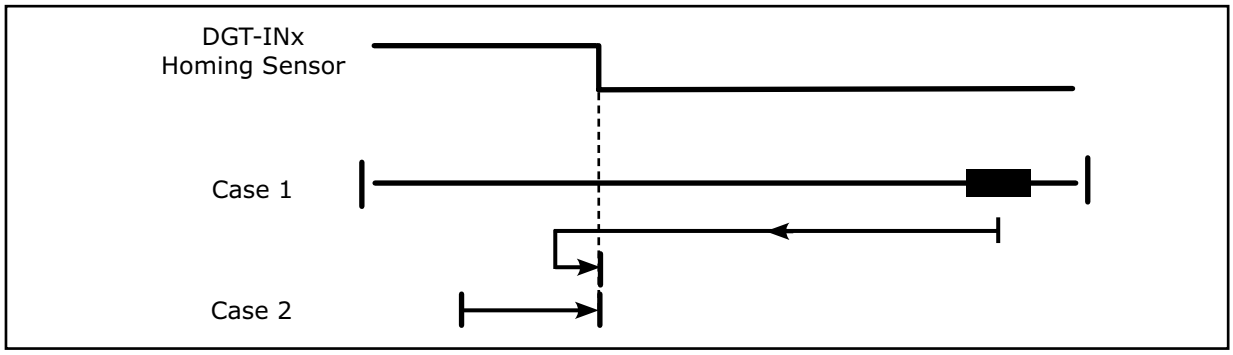
5.4 Homing procedure

The **Fast Back™** supports the following **homing procedures**:

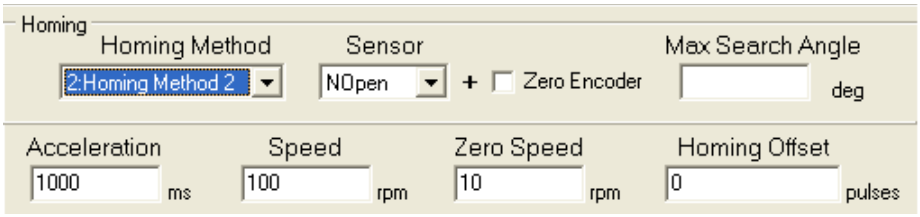
a- **Direct homing procedure with normally opened home sensor**



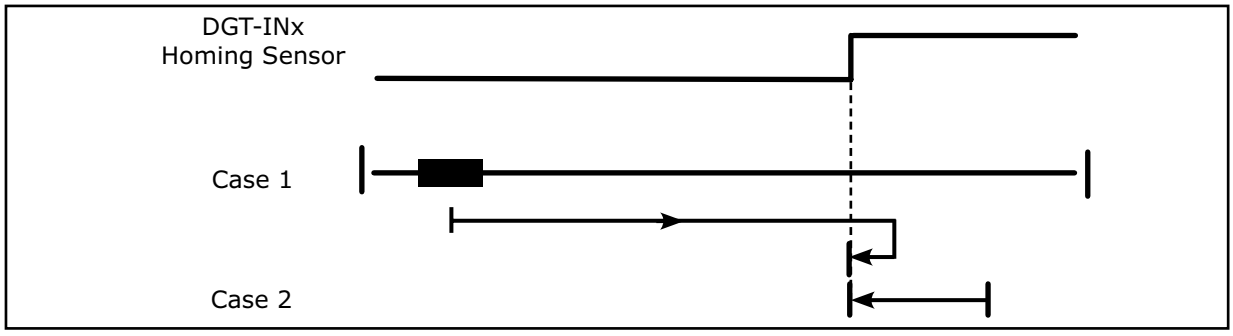
Case 1: If the homing sensor is low at the start homing the drive pilots the motor in counter-clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor simply turns clockwise with a speed like the "Zero speed" parameter.
The home position will be set when the falling edge of the home sensor is received.



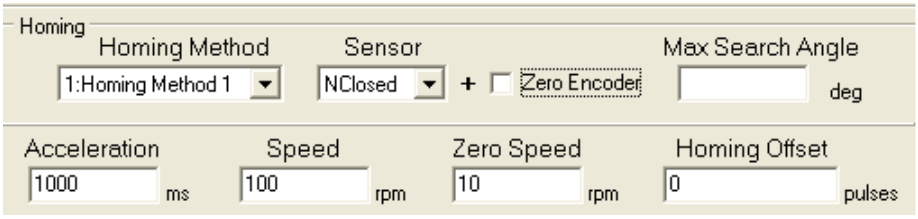
b- **Reverse homing procedure with normally opened home sensor**



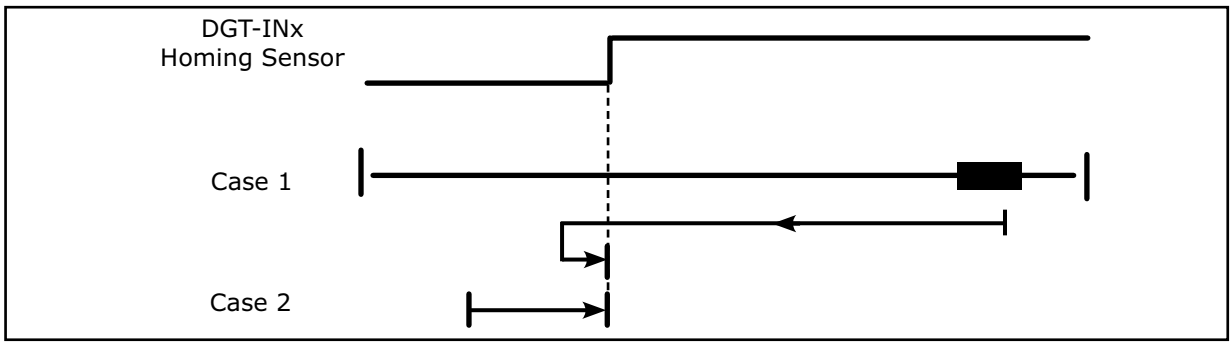
Case 1: If the homing sensor is low at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor simply turns counter- clockwise with a speed like the "Zero speed" parameter.
The home position will be set when the falling edge of home sensor is received.



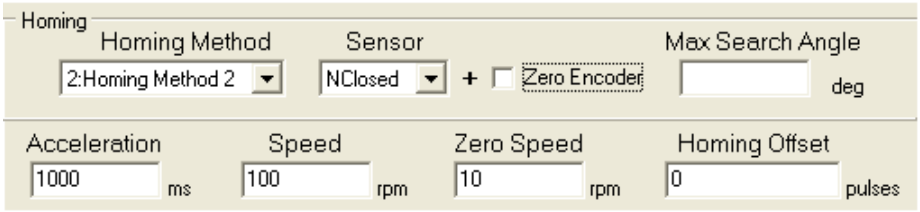
c- **Direct homing procedure with normally closed home sensor**



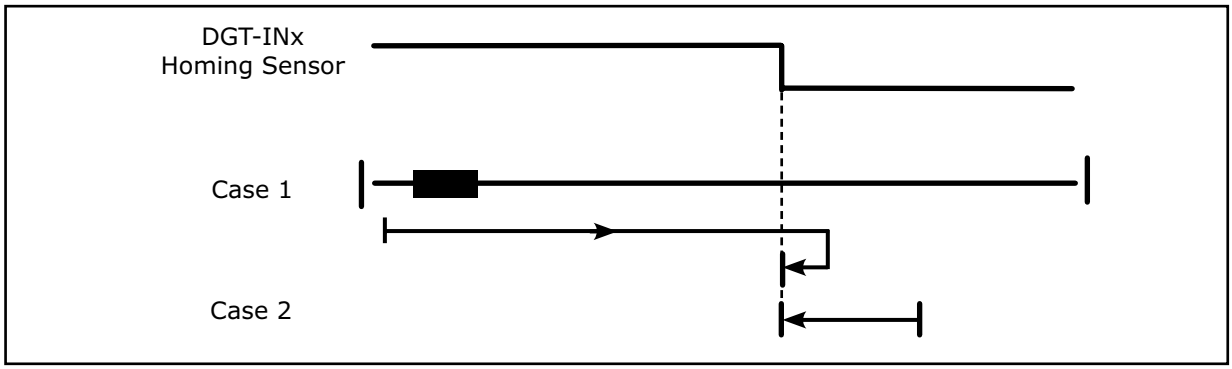
Case1: If the homing sensor is high at the start homing the drive pilots the motor in counter-clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already low at the homing start the motor simply turns clockwise with a speed like the "Zero speed" parameter.
The home position will be set when the rising edge of home sensor is received.



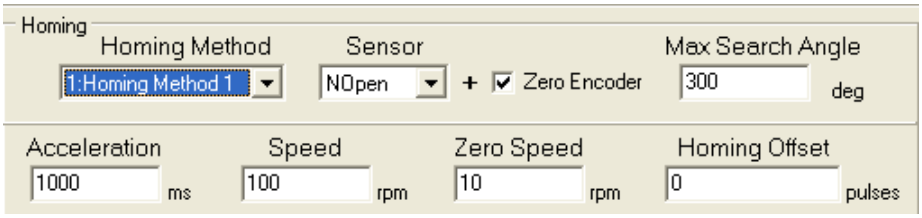
d- **Reverse homing procedure with normally closed home sensor**



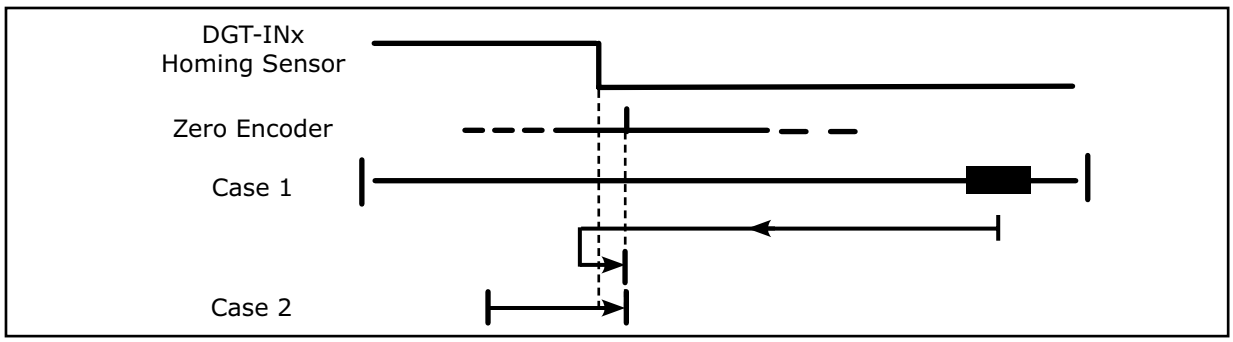
Case1: If the homing sensor is high at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output was already low at the homing start the motor axis simply turns counter-clockwise with a speed like the "Zero speed" parameter.
The home position will be set when the rising edge of home sensor is received.



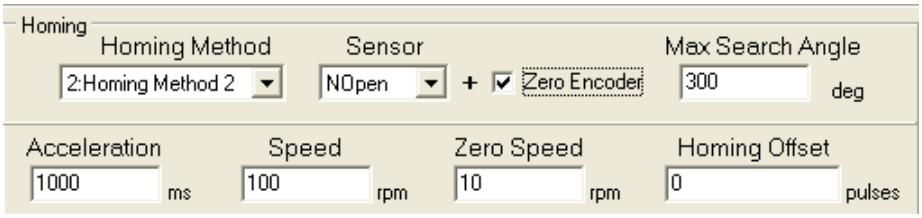
e- **Direct homing procedure with normally opened home sensor and zero index pulses**



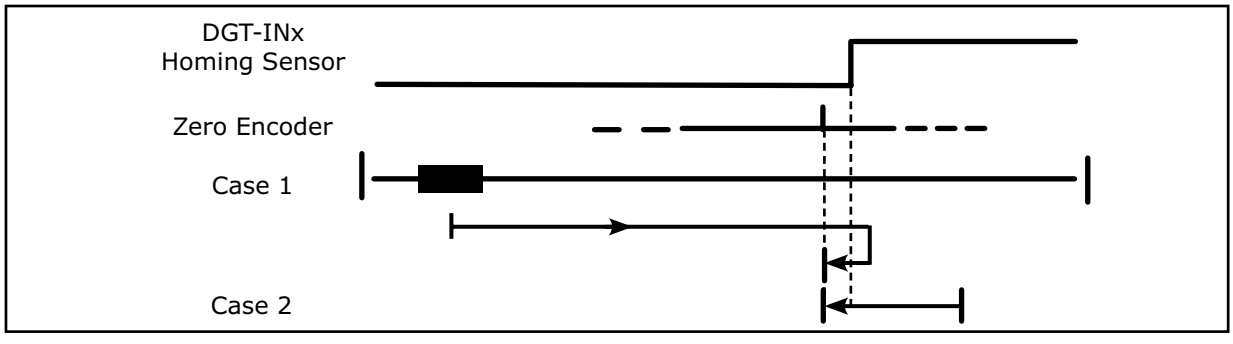
Case1: If the homing sensor is low at the start homing the drive pilots the motor axis in counter-clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor simply tursn clockwise with a speed like the "Zero speed" parameter.
The home position will be set on the first zero pulse after the falling edge of the home sensor.



f- **Reverse homing procedure with normally opened sensor and zero index pulses**

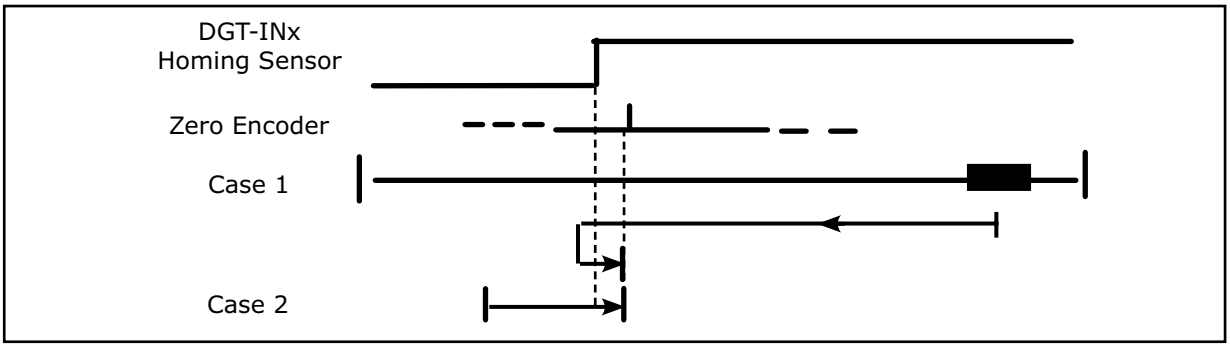


Case1: If the homing sensor is low at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor simply turns counter- clockwise with a speed like the "Zero speed" parameter.
The home position will be set on the first zero pulse after that the falling edge of the home sensor.



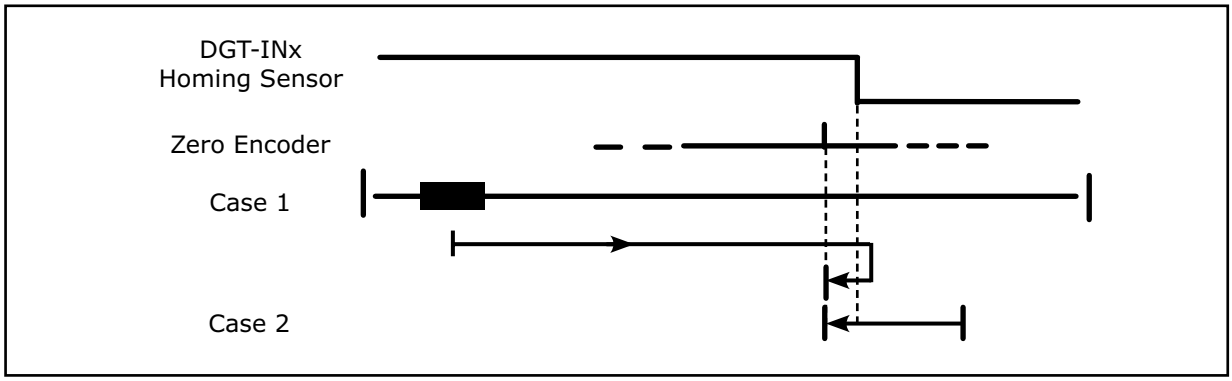
g- Direct homing procedure with normally closed home sensor and zero index pulses

Case1: If the homing sensor is high at the start homing the drive pilots the motor in counter-clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already low at the homing start the motor simply turns clockwise with a speed like the "Zero speed" parameter.
The home position will be set on the first zero pulse after that the rising edge of home sensor is received.



h- Reverse homing procedure with normally closed home sensor and zero index pulses

Case1: If the homing sensor is high at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already low at the homing start the motor simply turns counter-clockwise with a speed like the "Zero speed" parameter.
The home position will be set on the first zero pulse after that the rising edge of home sensor is received.



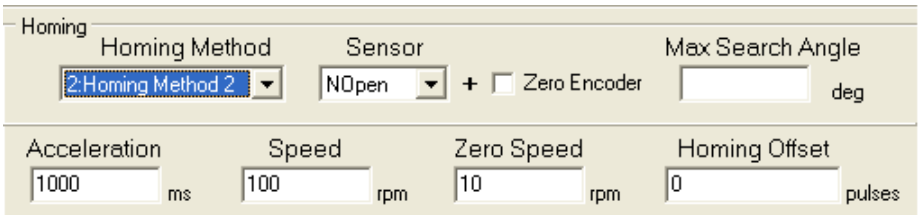
i- Homing immediate

Enabling the digital input (active high) with this homing method the motor doesn't move and the current position is set as the home position.

Homing utilizing sequence

Suppose to do the homing procedure: "b- **Reverse homing procedure with normally opened home sensor**". The procedure is the following:

1- Select the operative mode "**4:Position Mode**" and enable the "**Hardware Control**" box.
2- In the main window of the interface set the desired homing metod and its parameters, then save all by using the "**Save to EEPROM**" icon. For example:

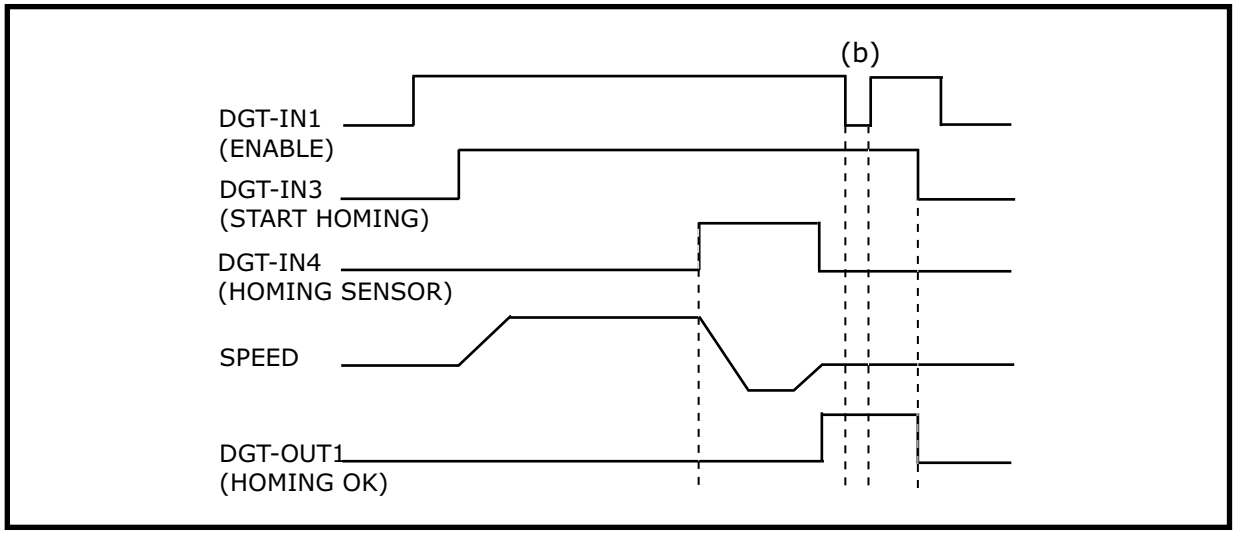


3- Open the "**Digital I/O**" window and set:
- a digital programmable input with the **Start Homing** function (for example: **DGT-IN3**);
- a digital programmable input with the **Homing Sensor** function (for example: **DGT-IN2**);
- a digital output with the **Homing OK** function (for example: **DGT-OUT1**);

Save all using the "**Save to EEPROM**" icon.

4- Execute the procedure:

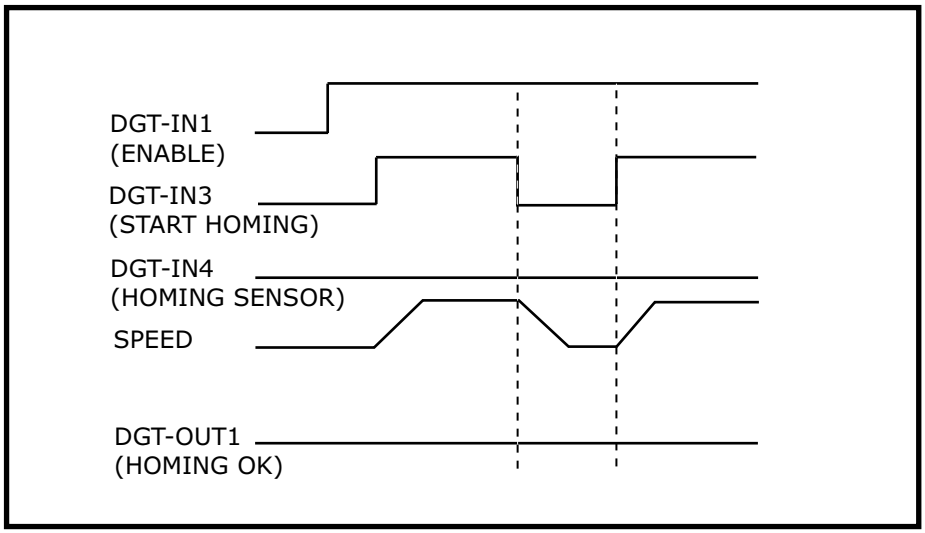
a- Enable the **DGT-IN1** (**Enable**) digital input ⇨ the motor will be on torque.
b- Enable the **DGT-IN3** (**Start Homing**) digital input ⇨ the motor moves to search the home position using the homing parameters saved on the interface. Every time this input is disabled the homing position is resetted.
c- When the home sensor output, connected to the **DGT-IN2** (**Homing Sensor**) digital input, is sensed active (in this example we considered a normally opened sensor), the motor decelerates and inverts its motion.
d- The home position is set when the falling edge of home sensor is received. When this happens the drive enables the **DGT-OUT1** (**Homing OK**) digital output. This value is kept high as soon as the **DGT-IN3** (**Start Homing**) digital input is kept high, independently of the **DGT-IN1** digital input (see (b) in the figure).



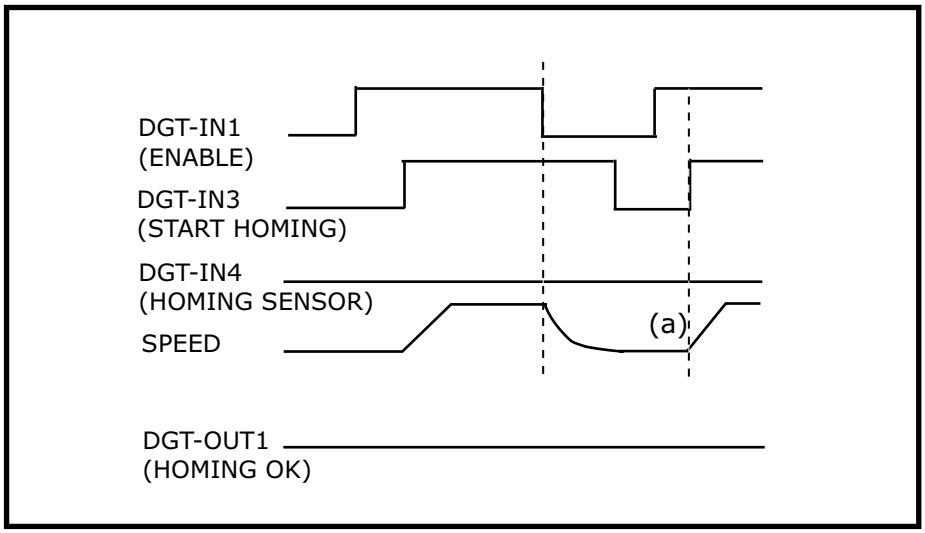
Attention: If the procedure is not successful, it is not possible to execute a positioning profile.

Warnings

1) Disabling the **DIG-IN3** (**Start Homing**) digital input, before that the home position reached indication is generated, makes the homing process to abort. No home position is saved and the motor decelerates using the "**Acceleration**" parameter.



2) Disabling the **DGT-IN1** (**ENABLE**) digital input, before the ending of the homing procedure, causes the interruption of homing process. In this case no homing position is saved and the motor is left free (deceleration is depending of inertia and friction). A new homing process can be start disabling the **DGT-IN3** input and then enabling the **DGT-IN1** and **DGT-IN3** digital inputs ((a) in figure).



5.5 Positioning procedure

The following table illustrates the "**Positioning Procedures**" available by the **Fast Back™**, while in the following pages there are examples:

FUNCTION	DESCRIPTION
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 I/O	It enables the task set by the digital inputs: DGT-IN5...DGT-IN9. There is not possibility of blending with this function.
Start_Task_n°	It enables the task set by the auxiliary variable. There is not possibility of blending with this function.
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 twice the task button (disabling and enabling) in order to start the next task of the sequence.

Example: Start Task I/O positioning procedure

Suppose we want to do the **Start Task I/O** positioning procedure, which executes the task selected by the **DGT-IN5...DGT-IN9** digital inputs.

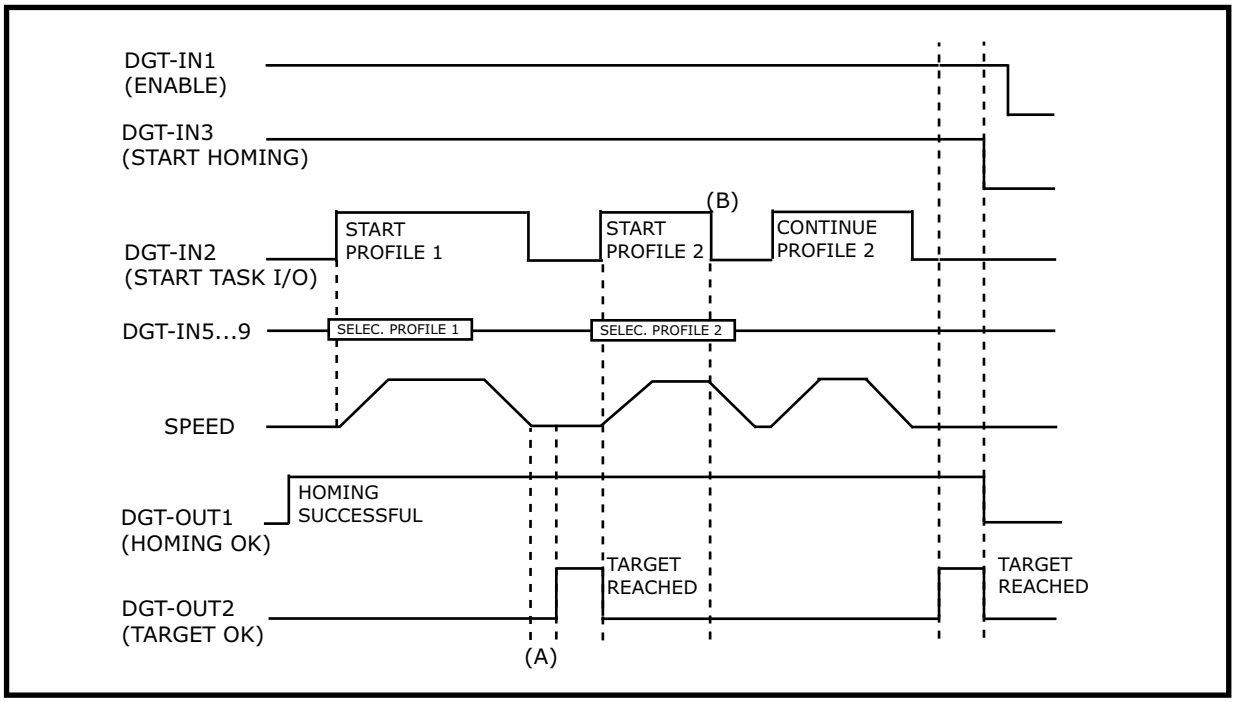
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

2. In the "**Axor Profile Tool**" window set all of the parameters reference the desired positioner profile, then save to FLASH utilizing the "**Save Data to FLASH**" icon.
Each task is saved with a number (from 1 to 32). Refer to that number to select the desired task using the digital inputs.

3. Open the "**Digital I/O**" window and set:
- a programmable input with the **Start Task I/O** function (for example **DGT-IN2**);
- the **DGT-IN5...DGT-IN9** inputs in order to select the desired positioner profile. 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, while 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.
- an output with the **Target OK** function (for example **DGT-OUT2**).

Save all utilizing the "**Save to EEPROM**" icon.

4. Enabling the **DGT-IN2** (**Start Task I/O**) input the selected task will start and the motor will move following the defined motion profile parameters.



Note:

• If during a profile task the **DGT-IN2** (**Start Task I/O**) digital input is disabled (see (B)), the motor decelerates using the "**Dec.Time**" parameter associated to the selected profile and stops. If the **DGT-IN2** (**Start Task I/O**) is re-enabled, it will be possible to conclude the interruped task.

• At the end of a successful position task the drive will enable the **DGT-OUT2** (**Target OK**) digital output to indicate the position quote has been reached. This indication is generated when the absolute quote of the motor is within the "**Window Pos.**" parameter for a period (A) longer than the "**Window Time**" value.
The **DGT-OUT2** (**Target OK**) output will be high until the next profile starts or the **DGT-IN3** (**Start Homing**) input is high.

• After the conclusion of the position profile there are two different possibilities:

Disable the drive:
Disabling the **DGT-IN1** (**Enable**) digital input will release the motor (quote can be lost). Remember this in order to maintain safe working conditions for the system!
The axis position is kept as long as the drive is powered, so it is possible to re-enable the drive and make other positions without completing a new homing procedure.

Start another motion profile:
To start another position task keeping the home position already defined, use the **DGT-IN5... DGT-IN9** digital inputs to select the new profile task. Then disabling and re-enabling the **DGT-IN2** digital input (**Start Task I/O**) the new position task will start.

During this time the **DGT-IN3** (**Start Homing**) input must remain active.

Example: Start_Task_n° positioning procedure

Suppose we want to do the **Start_Task_n°** positioning procedure, which executes the task selected by the **auxiliary variable** associated to the **Start_Task_n°** function.

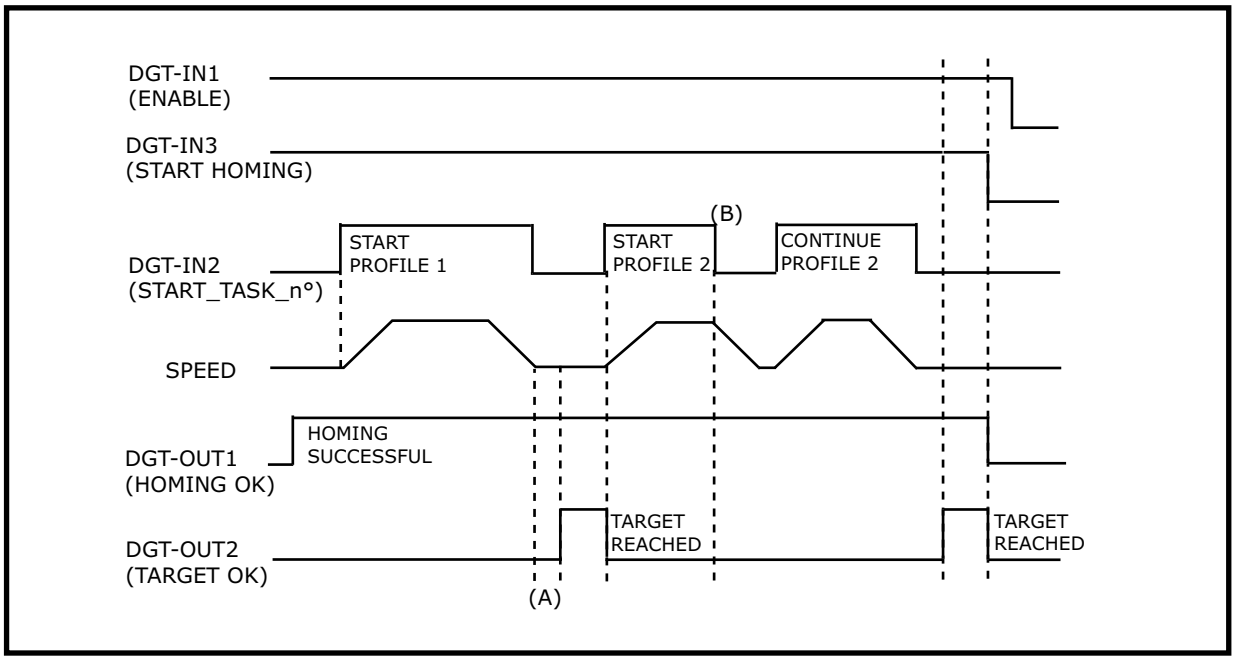
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

2. In the "**Axor Profile Tool**" window set all of the parameters reference the desired positioner profile, then save to FLASH utilizing the "**Save Data to FLASH**" icon.
Each task is saved with a number (from 1 to 32). Refer to that number to select the desired task using the auxiliary variable.

3. Open the "**Digital I/O**" window and set:
- a programmable input with the **Start_Task_n°** function (for example **DGT-IN2**), inserting in the auxiliary variable the number of the desired task;
- an output with the **Target OK** function (for example **DGT-OUT2**).

Save all utilizing the "**Save to EEPROM**" icon.

4. Enabling the **DGT-IN2** (**Start_Task_n°**) input the selected task will start and the motor will move following the defined motion profile parameters.



Note:

• If during a profile task the **DGT-IN2** (**Start_Task_n°**) digital input is disabled (see (B)), the motor decelerates using the "**Dec.Time**" parameter associated to the selected profile and stops. If the **DGT-IN2** (**Start_Task_n°**) is re-enabled, it will be possible to conclude the interruped task.

• At the end of a successful position task the drive will enable the **DGT-OUT2** (**Target OK**) digital output to indicate the position quote has been reached. This indication is generated when the absolute quote of the motor is within the "**Window Pos.**" parameter for a period (A) longer than the "**Window Time**" value.
The **DGT-OUT2** (**Target OK**) output will be high until the next profile starts or the **DGT-IN3** (**Start Homing**) input is high.

• After the conclusion of the position profile there are two different possibilities:

Disable the drive:
Disabling the **DGT-IN1** (**Enable**) digital input will release the motor (quote can be lost). Remember this in order to maintain safe working conditions for the system!
The axis position is kept as long as the drive is powered, so it is possible to re-enable the drive and make other positions without completing a new homing procedure.

Start another motion profile:
To start another position task keeping the home position already defined:
1- change the auxiliary variable of the digital input set with the **Start_Task_n°** function, save all, then disable and enable the digital input. Or:
2- set another digital input with the **Start_Task_n°** function, save all, then enable the digital input to start the new sequence.

During this time the **DGT-IN3** (**Start Homing**) input must remain active.

Example: Start Next positioning procedure

Suppose we want to do the **Start Next** positioning procedure.

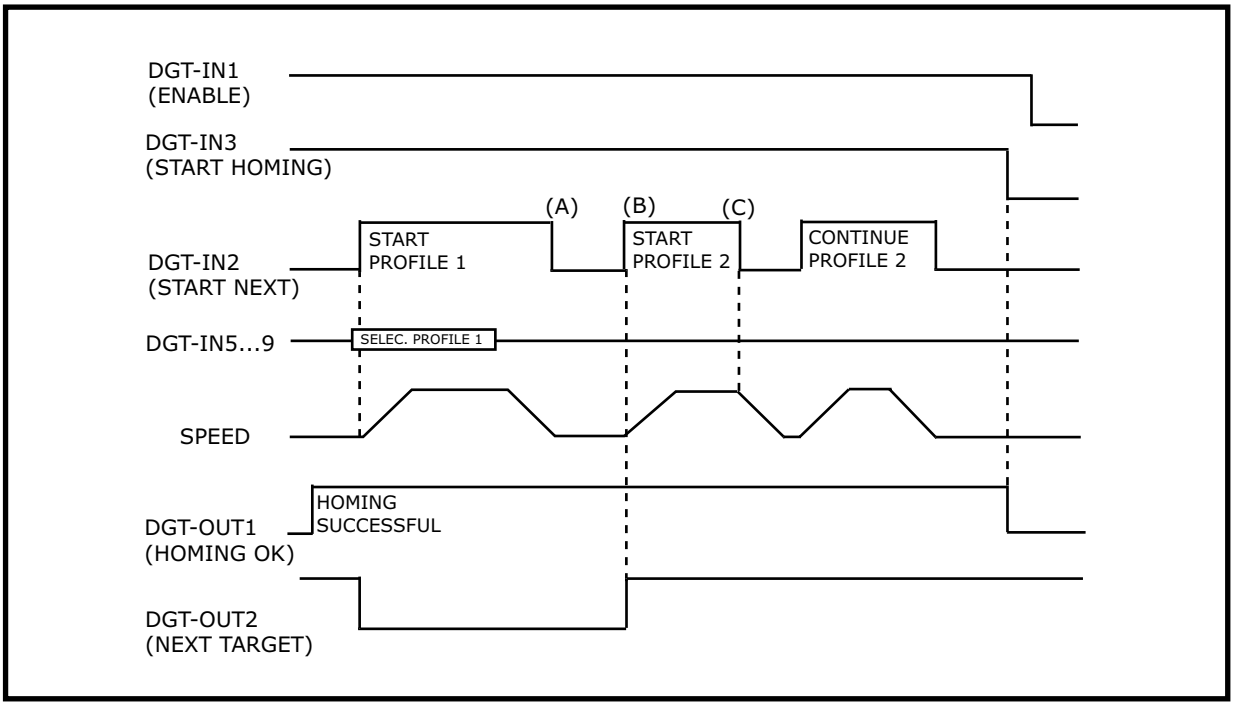
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

2. In the "**Axor Profile Tool**" window set all of the parameters of the positioner profiles of the sequence, then save to FLASH utilizing the "**Save Data to FLASH**" icon.
Each task is saved with a number (from 1 to 32). Refer to that number to select the first task of the sequence using the digital inputs.

3. Open the "**Digital I/O**" window and set:
- a programmable input with the **Start Next** function (for example **DGT-IN2**);
- the **DGT-IN5...DGT-IN9** inputs in order to select the first profile of the sequence.
- an output with the **Target OK** function (for example **DGT-OUT2**).

Save all utilizing the "**Save to EEPROM**" icon.

4. Enabling the **DGT-IN2** (**Start Next**) input the first task of the sequence, selected by the digital inputs, will start and the motor will move following the defined motion profile parameters.
At the end of each task the motor stops, then disabling (see (A)) and enabling (see(B)) the **DGT-IN2** (**Start Next**) input the task set in the "**Next Profile**" parameter will start. If in the "**Next Profile**" parameter there is "**None**", the sequence will start from the first task.



Note:

• If during a task the **DGT-IN2** (**Start Next**) digital input is disabled (see (C)), the motor decelerates using the "**Dec.Time**" parameter associated to the current task and stops. If the **DGT-IN2** (**Start Next**) is re-enabled, it will be possible to finish the interrupted task.

• When the first task of the sequence starts, the output set with the "**Next Target**" is opened, then at the end of each position task the "Next Target" digital output changes its status.

• After the conclusion of the sequence there are two different possibilities:

Disable the drive:
Disabling the **DGT-IN1** (**Enable**) digital input will release the motor (quote can be lost). Remember this in order to maintain safe working conditions for the system!
The axis position is maintained as long as the drive is powered, so it is possible to re-enable the drive and make other positions without completing a new homing procedure.

Start another motion profile:
To start another position task keeping the home position that is already defined, use the **DGT-IN5... DGT-IN9** digital inputs to select the new first task of the sequence. Then disabling and re-enabling the **DGT-IN2** digital input (**Start Next**) the new sequence will start.

During this time the **DGT-IN3** (**Start Homing**) input must remain active.

Example: Start Sequence positioning procedure

Suppose we want to do the **Start Sequence** positioning procedure.

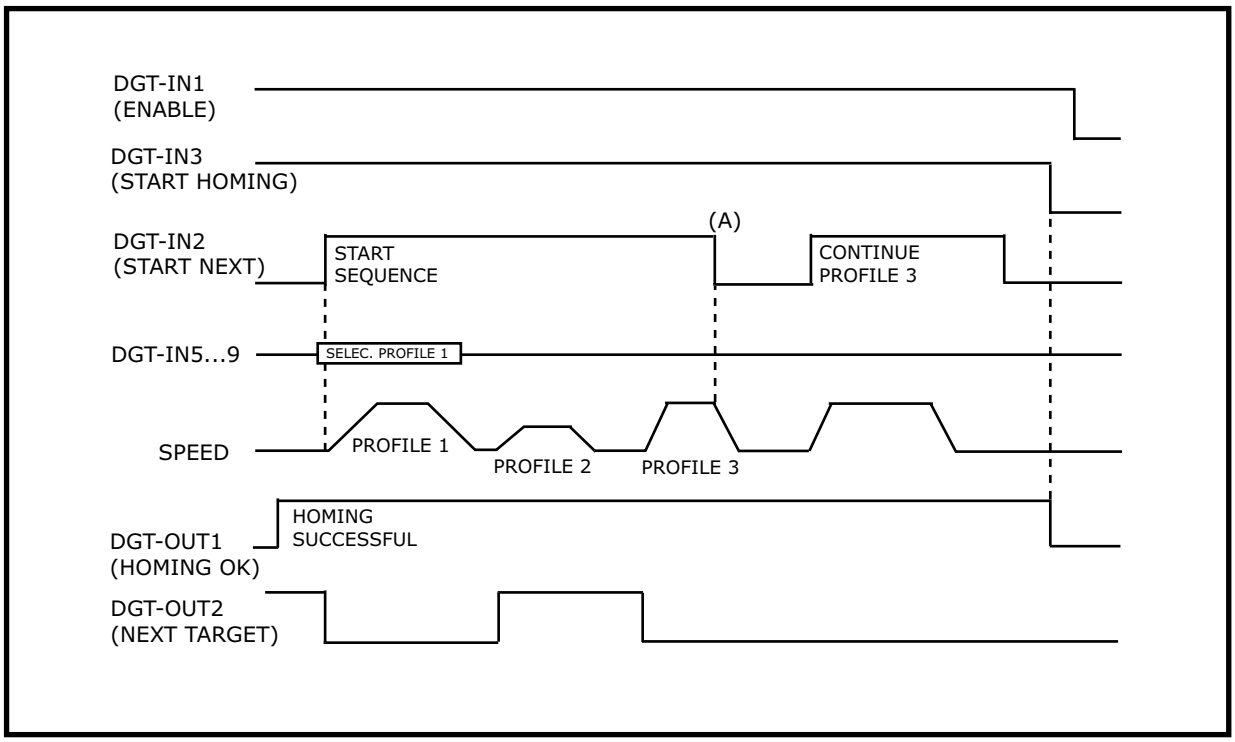
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

2. In the "**Axor Profile Tool**" window set all of the parameters of the positioner profiles of the sequence, then save to FLASH utilizing the "**Save Data to FLASH**" icon.
Attention: set the "**Next Profile**" parameter in order to execute correctly the desired sequence.
Each task is saved with a number (from 1 to 32). Refer to that number to select the desired task using the digital inputs.

3. Open the "**Digital I/O**" window and set:
- a programmable input with the **Start Sequence** function (for example **DGT-IN2**);
- the **DGT-IN5...DGT-IN9** inputs in order to select the first profile of the sequence.
- an output with the **Target OK** function (for example **DGT-OUT2**).

Save all utilizing the "**Save to EEPROM**" icon.

4. Enabling the **DGT-IN2** (**Start Sequence**) input the first task of the sequence, selected by the digital inputs, will start and the motor will move following the defined motion profile parameters.
If at the end of a task the **DGT-IN2** input is kept active and in the "**Next Profile**" variable there is a label other than "**None**", the task set in the "**Next Profile**" starts automatically. This sequence continues until a label "**None**" is found in the "**Next Profile**" variable. In this case the sequence is ended and must be re-programmed by the user.



Note:

• If during a task the **DGT-IN2** (**Start Sequence**) digital input is disabled (see (A)), the motor decelerates using the "**Dec.Time**" parameter associated to the selected profile and stops. If the **DGT-IN2** (**Start Sequence**) is re-enabled, it will be possible to finish the interrupted task.

• When the first task of the sequence starts the output set with the "**Next Target**" is opened, then at the end of each position task the "Next Target" digital output changes its status.

• After the conclusion of the sequence there are two different possibilities:

Disable the drive:
Disabling the **DGT-IN1** (**Enable**) digital input will let the motor free (quote can be lost). Remember this in order to maintain safe working conditions for the system!
The axis position is kept as long as the drive is powered, so it is possible to re-enable the drive and make other positions without completing a new homing procedure.

Start another sequence:
To start another sequence keeping the home position that is already defined, use the **DGT-IN5... DGT-IN9** digital inputs to select the new first motion profile task of the sequence. Then disabling and re-enabling the **DGT-IN2** digital input (**Start Sequence**) the new sequence will start.

During this time the **DGT-IN3** (**Start Homing**) input must remain active.

Example: Start_JOG positioning procedure

Suppose we want to do the **Start_JOG** positioning procedure.

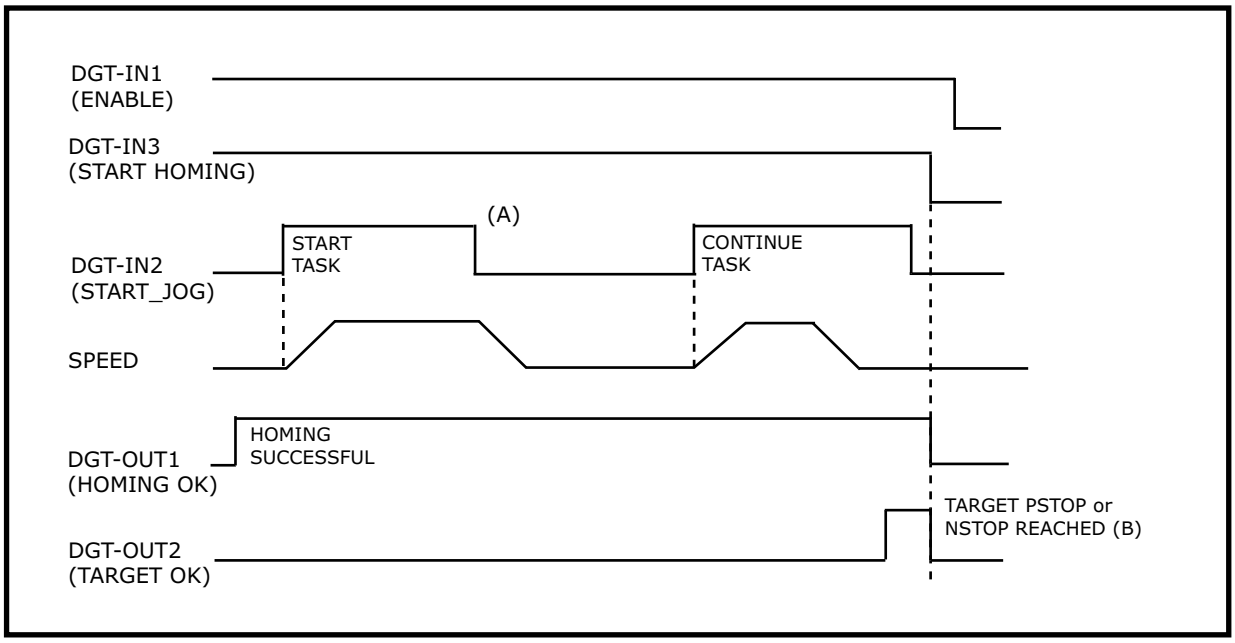
1. Execute a homing procedure. In this case a homing procedure is not necessary.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

2. In the "**Axor Profile Tool**" window set the parameters "**PSTOP Software**", "**NSTOP Software**", "**Window Pos**.", "**Window Time**", then save to FLASH utilizing the "**Save Data to FLASH**" icon.

3. Open the "**Digital I/O**" window and set:
- a programmable input with the **Start_Jog** function (for example **DGT-IN2**);
- an output with the **Target OK** function (for example **DGT-OUT2**).

Save all utilizing the "**Save to EEPROM**" icon.

4. By clicking the **DGT-IN2** (**Start_JOG**) digital input, it enables a moviment 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.



Note:

If during a profile task the **DGT-IN2** (**Start_JOG**) digital input is disabled (see (A)), the motor decelerates using the "**Acceleration**" parameter associated to the homing procedure and stops. If the **DGT-IN2** (**Start_JOG**) is re-enabled, it is possible to finish the interrupted task.
At the end of a successful position task the drive will enable the **DGT-OUT2** (**Target OK**) digital output to indicate the position quote has been reached (see (B)).

5.6 Motor brake management

The **Fast Back™** has a circuitry which allows the control of the **electromechanical brake integrated** in the motor. It is a ***Stationary Brake***, so it can be used:

- with motor not running, for blocking the motor's axis;
- for "occasionally" emergency stops.

It cannot be used for dynamic braking, except on emergency.

The user has the following possibilities:

a- **Not manage the brake.**

b- Manual brake management:

- **The current necessary to unblock the brake is given by the drive's electronics, but it is controlled by a logic external to the drive.**
- **The user has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the blocking time of the brake during alarms or when the motor is turning.

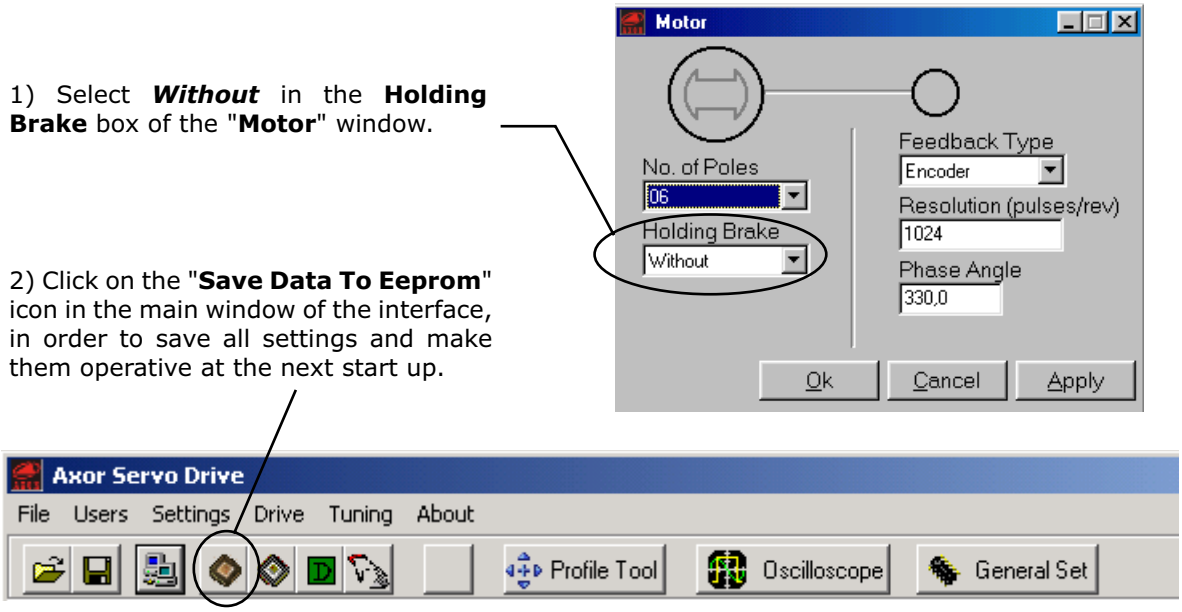
c- Automatic brake management:

- **The current necessary to unblock the brake is given by the drive's electronics and it is controlled by a logic internal to the drive.**
- **The drive has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the opening time of the brake during alarms or when the motor is turning.

a- Not managing the brake

1) Select ***Without*** in the **Holding Brake** box of the "**Motor**" window.

2) Click on the "**Save Data To Eeprom**" icon in the main window of the interface, in order to save all settings and make them operative at the next start up.

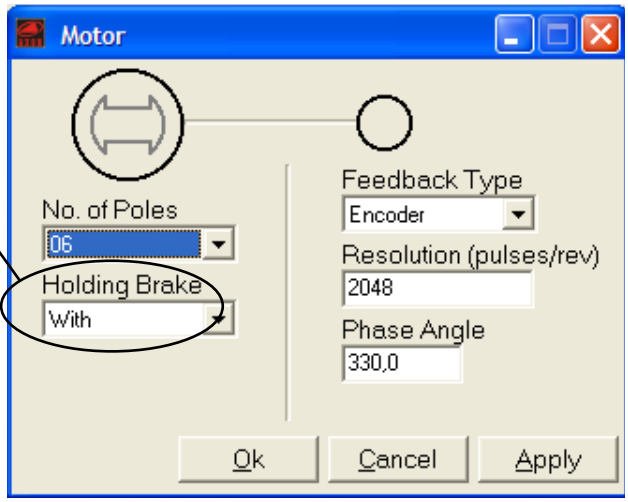


During alarms the functioning of the system is interrupted, the motor remains free and will eventually stop due to the friction and inertia of the axis; at this point there are two possibilities:

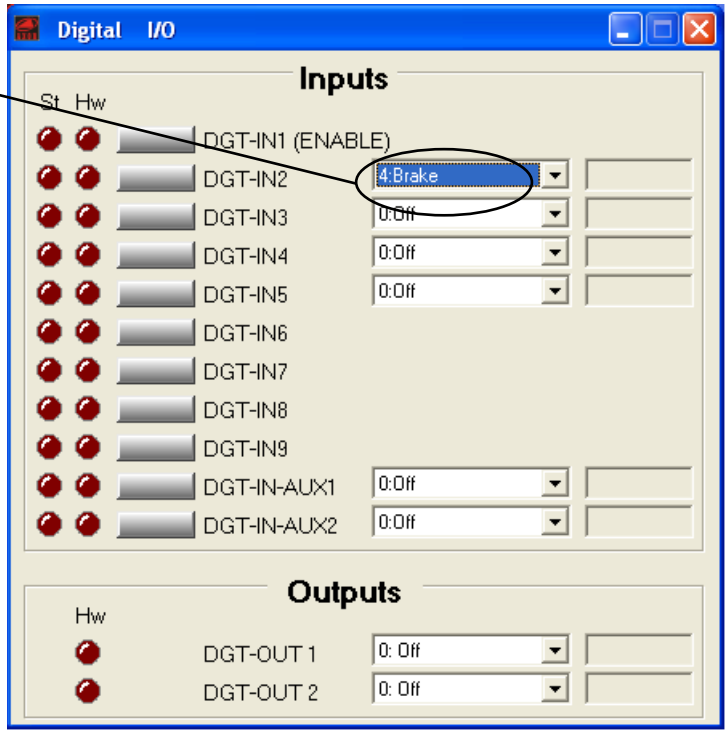
- **if the motor has not the brake, the axis remains not blocked;**
- **if the motor has the electromechanical brake, the user can manage the axis block, for example using an external relè.**

b- Manual brake management: the brake can be **manually** controlled via **software,** or via **hardware**.

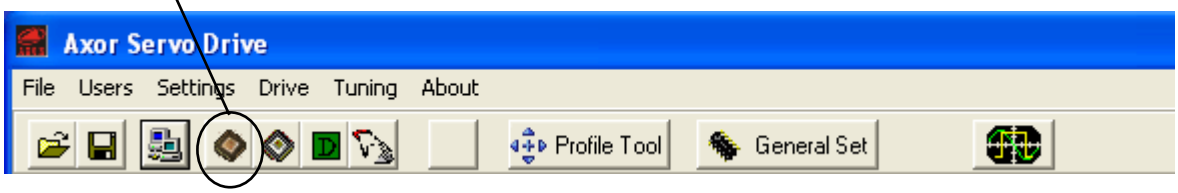
1) Select ***With*** in the **Holding Brake** box of the "**Motor**" window.



2) Select ***Brake*** in digital programmable input DGT-IN2.



3) Click on the "**Save Data To Eeprom**" icon in the main window of the interface, in order to save all settings and make them operative at the next startup.

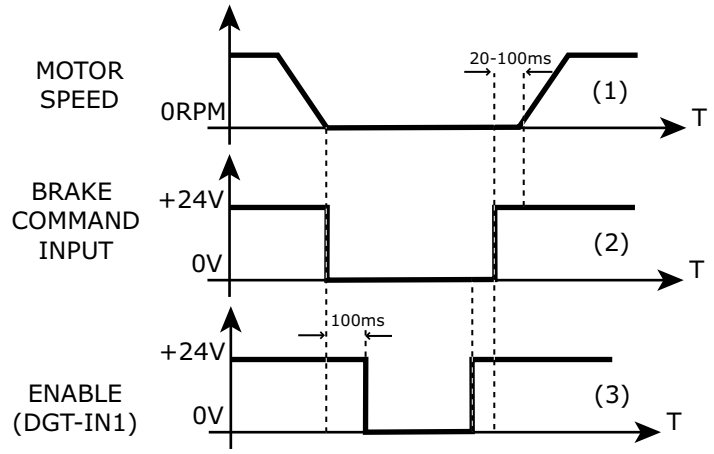


Insertion and dis-insertion diagram:

1) Stop the motor by applying a zero speed reference.

2) Then block the motor brake by applying **0V** on the digital input set with the **"Brake"** function.

3) After **100ms** it is possible to disable the drive applying **0V** on the **DGT-IN1** (ENABLE) input.



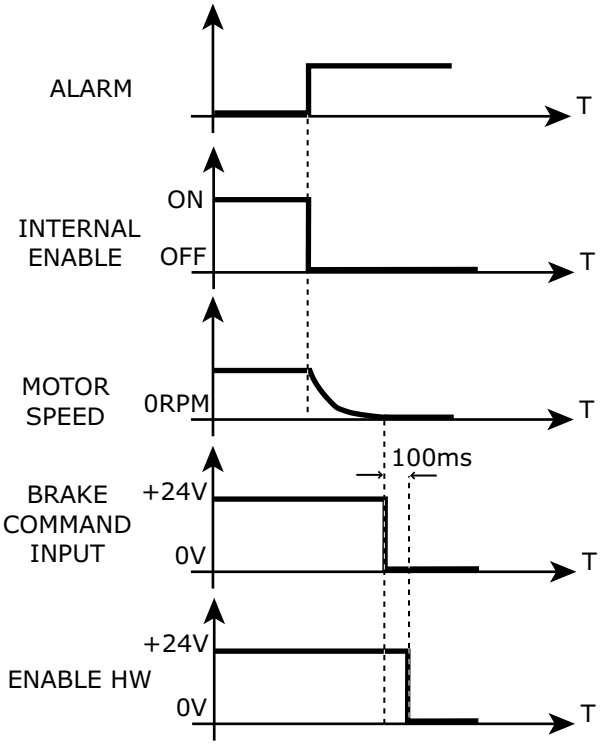
At this point the motor will remain mechanically blocked.

To UNBLOCK the electromechanical brake, it is necessary to apply **+24V** to the **DGT-IN1** (**ENABLE**) input, then **+24V** to the digital input set with the **"Brake"** function and then after **20ms**, it will be possible to setup the desired speed reference.

Attention: it is possible to drive the **DGT-IN1** and **Brake** digital inputs:
- ✓ **via software**: in the Digital I/O window, by using the dedicated buttons;
- ✓ **via hardware**: applying the appropriate voltage on the pins of the X4 connector. It is necessary to connect the pin X4-4 (**DGT-IN RTN**) to the CN, too.

Stop of the system and insertion of the brake with the manual brake management during an alarm:

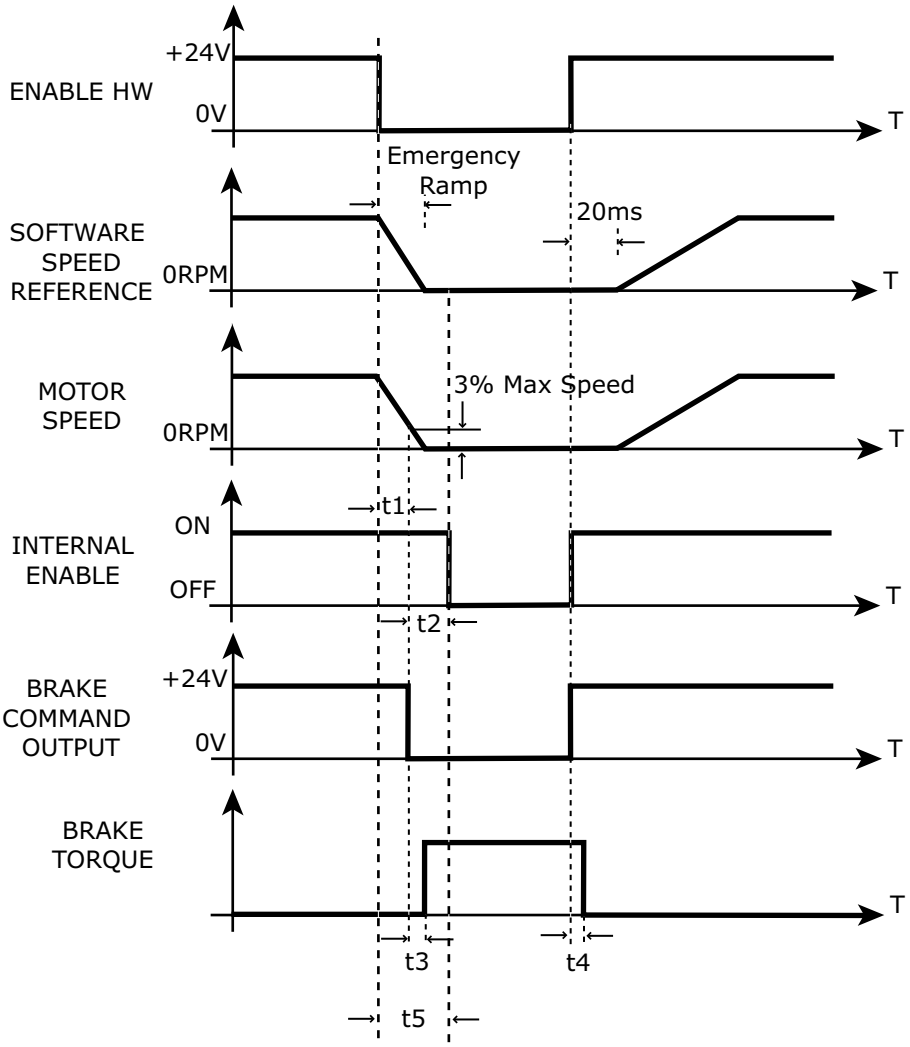
During an alarm the internal control of the **Fast Back**™ stops the system functioning disabling the INTERNAL ENABLE, so the motor remains free and it continues to move by inertia and frictions. At this point the user can activate the brake by applying **0V** on the digital input set with the "**Brake**" function and then it is possible to disable the drive by applying **0V** to the **DGT-IN1** (ENABLE HW) input:



c- Automatic brake management:

- It works with these operative modes: "1: Digital Speed", "4: Position Mode", "7: Can Open", "10: Square Wave".
- Select ***With*** on the **Holding Brake** box of the "**Motor**" window.
- **Do not** select the "**Brake**" function in a programmable digital input.

Insertion and dis-insertion diagram:



t1 = max. deceleration time (1.5x Emergency Ramp).
t2 = internal software delay after the brake block (100ms)
t3, t4 = opening and closing times of the brake (they depend from the brake).
t5 = **into this time the functioning of the system is controlled only by the drive, all external commands are ignored.**

After the hardware disabling the speed reference becomes zero by using the emergency ramp. When 3% of the max. speed is reached, or after a time equal to 1,5xEmer.Ramp, the brake output is disabled (so the brake is blocked).
During the dis-insertion phase of the brake, the internal speed reference can be supplied after about 20ms from the disabling of the brake output.

Important note about the "automatic brake management":

The internal control of the **Fast Back**™, during some alarms, stops the system by using the emergency ramp before activating the brake (as illustrated in the insertion and dis-insertion diagram of the preceading page), while for more dangerous alarms the brake is immediately activated (so when the alarm is active, 0V is applied to the INTERNAL ENABLE and to the BRAKE COMMAND OUTPUT).

The more dangerous alarms, which cause the immediately insertion of the brake, are the following:

- Al2: Over Current;
- Al4: Hall;
- Al5: Encoder;
- Al9: Max/Min Voltage;
- Al14: Following Error;
- Al17: Over Current Brake.

All others alarms stop the system by using the emergency ramp before the brake's insertion.

5.7 Stop Functions

In the following pages we illustrate the behaviour of the **Fast Back™** reference of the these settings:

- automatic or manual management of the *stationary brake*;
- *emergency stop*.

We remember that:

• For the manual management of the brake it is necessary to set the "**With**" option on the "**Holding Brake**" box in the "**Motor**" window, then it is necessary to select the "**Brake**" function on one digital programmable input.

• For the automatic management of the brake it is only necessary to set the "**With**" option on the "**Holding Brake**" box in the "**Motor**" window (Attention: Not select the "**Brake**" function on one digital programmable input).

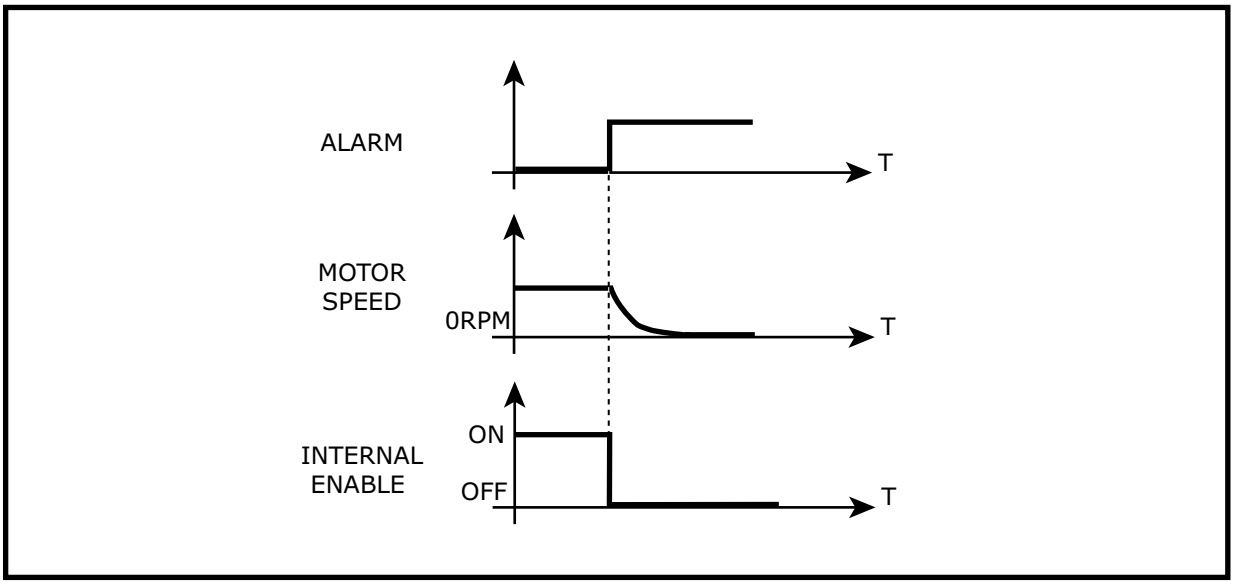
• For the emergency stop it is necessary to set the dedicated flag in the "**General Set**" window.

The **Fast Back™** has the following ***stop functions***:

1) If there are these settings:

- **there is not the manual or automatic management of the brake,**
- **the emergency function is not set,**

⇨ **if there is a disable (DGT-IN1 input or DISABLE button) or if there is an alarm, the motor remains free and will eventually stop due to the friction and inertia of the axis.**



2) If there are these settings:

- **there is <u>not</u> the manual or automatic management of the brake,**
- **the <u>emergency function</u> is set,**

⇨ **we can distinguished these cases:**

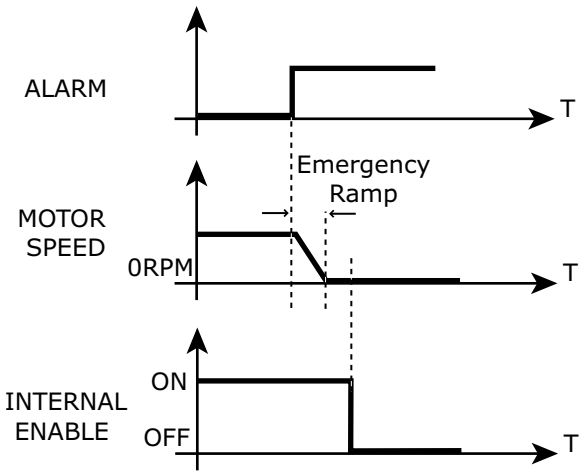
a- if there is a *disable* (DGT-IN1 input or DISABLE button) or if there is a *no danger alarm*, the motor stops following an emergency ramp equal to the "Emer. Ramp" parameter set in the "Speed" window;

b- if there is a *danger alarm*, the internal enable immediately disables, the motor remains free and will eventually stop due to the friction and inertia of the axis.

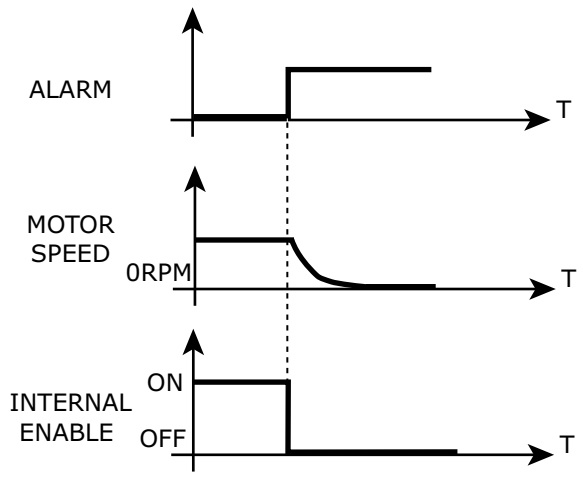
The *dangerous alarms*, which cause the immediately insertion of the brake, are the followings:
- AI2: Over Current;
- AI4: Hall;
- AI5: Encoder;
- AI9: Max/Min Voltage;
- AI14: Following Error;
- AI17: Over Current Brake.

All others alarms stop the system by using the emergency ramp before the brake's insertion.

<u>Case a</u>



<u>Case b</u>



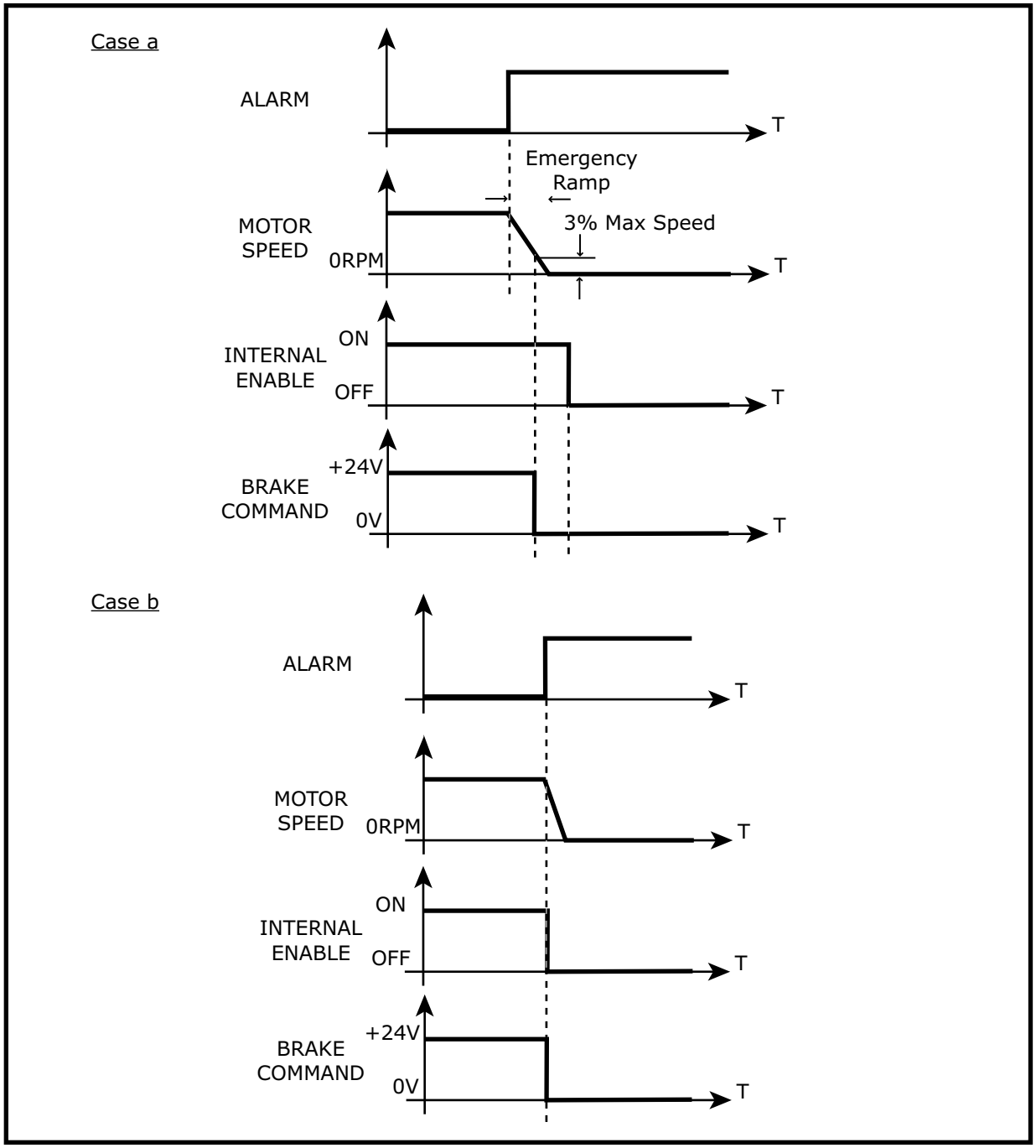
3) If there are the following settings:

- **there is the automatic management of the brake,**
- **there is not the emergency stop,**

⇨ **we can distinguished these cases:**

a- if there is a *no danger alarm* the motor stops following an emergency ramp equal to the "Emer. Ramp" parameter; when 3% of the max. speed is reached the brake output is disabled, then after the stop the internal enable disables;

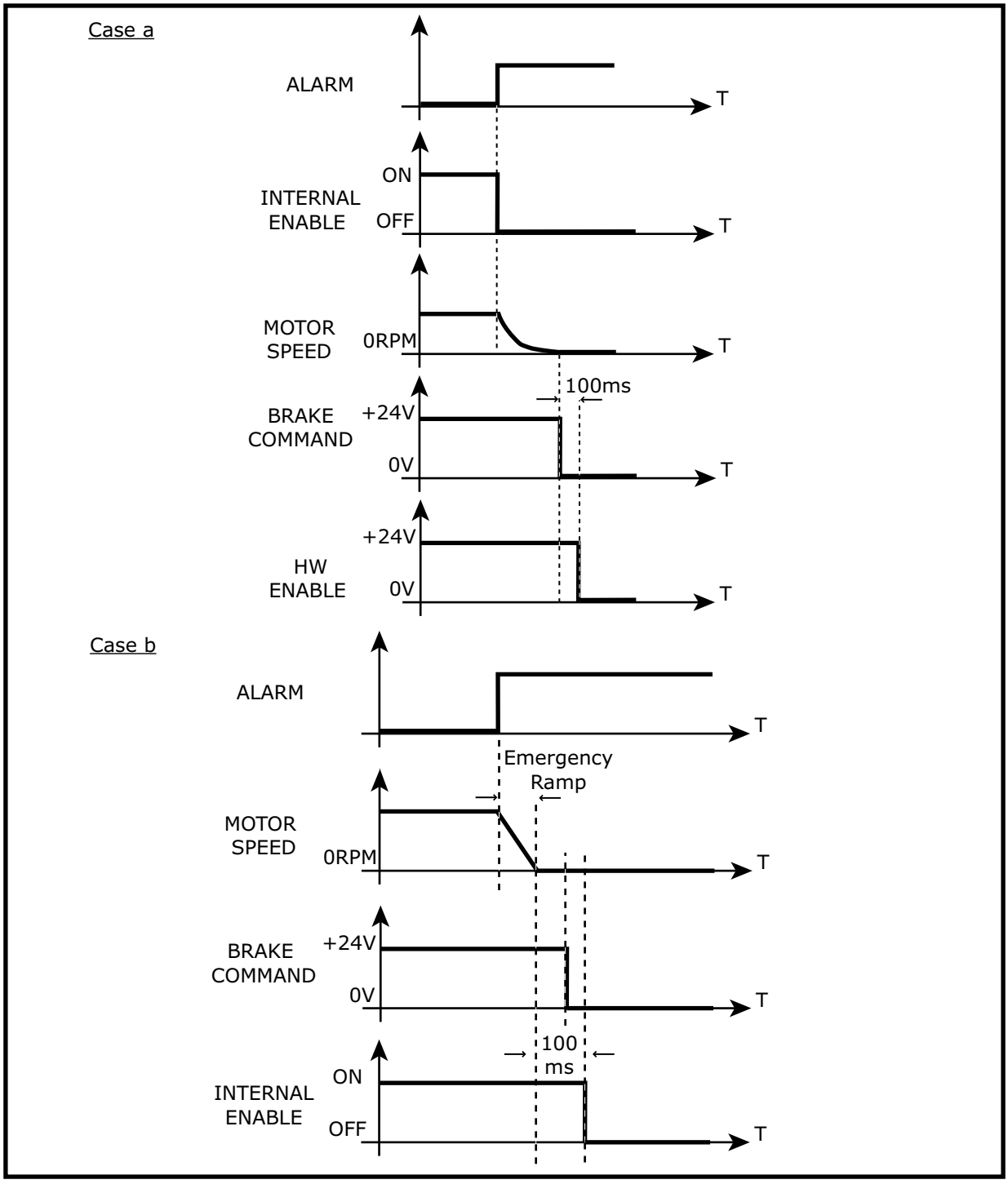
b- if there is a *danger alarm* the brake is immediately activated.



4) If there is the <u>manual management of the brake</u> ⇨ we can distinguished these cases:

a- if the emergency stop is <u>not</u> set, if there is an alarm the internal enable disables, the motor remains free and will eventually stop due to the friction and inertia of the axis; after the stop it is possible to block the axis enabling the brake command and disabling the hardware enable;

b- if the <u>emergency stops</u> is set, if there is a no danger alarm or if there is a disable, the more stop following the emergency ramp; after the stop it is possible to block the axis enabling the brake command and disabling the hardware enable.



5) If the drive has not the electromechanical brake, but one digital input is set with the Brake function, it is an anomalous condition because the Brake function should not be set in any input. However, it is possible to distinguish these cases:

a- if the *emergency function* is not set and there is an alarm or a disable, the internal enable disables, the motor remains free and will eventually stop due to the friction and inertia of the axis;

b- if the *emergency function* is set and there is a not grave alarm or a disable, the motor stops following the emergency ramp set on the "Emer. Ramp" parameter. If there is a grave alarm, the drive disables and the motor is free.

Chapter 6
Appendix

6.1 ModBus Protocol

It is possible to connect the Axor drives to a PC (or a Master server) in **RS232** using the ***MODBUS communication protocol*** specified in the **Modicon** instructions (see http://www.modicon.com/techpubs/).
In particular, the instructions supported by the drive are the following:

- Read more registers (command: 0x03)
- Write one register (command: 0x06)
- Write more registers (command: 0x10)

We remind that registers have 16 bits and each register is characterised by its address; in particular the first register has the 0 address (each register has 16 bits).
The registers addressed from 0 to 254 are used for the drive's control parameters, the register having the 255 address contains the CRC of the control parameters, while the registers addressed from 256 to 831 are reserved for the integrated positioner. If you try to read a register having an address above 831, the "drive's timeout" exception is generated.

The interogations must be sent to the drive using the following parameters:

- RTU modality (Remote Terminal Unit)
- Baud rate = 19200
- 1 start bit
- 8 data bit
- 1 parity bit (EVEN)
- 1 stop bit

MESSAGGE STRUCTURE

Using the **RTU** mode a message has the following **structure**:

START	IDENTIFICATION	COMMAND	DATA	CRC	END
T1-T2-T3-T4	8bit	8bit	N*8bit	16bit	T1-T2-T3-T4

1. **Start**: period of silence 4 character length (T1-T2-T3-T4).
2. **Identification**: it has 8 bits and can change between 1 and 127. It represents the drive with which you want to communicate.
3. **Command**: it has 8 bits and contains the "to do" function .
4. **Data**: it can have a variable length and contains the necessary information to do the set command.
5. **CRC** (Cyclical Redundancy Check): it has 16 bits and is utilised to verify the correction of the message.
6. **End**: period of silence 4 character length.

It is necessary that the bytes of the message are sent compact and continuative (not separate from one another) for this could generate an CRC alarm in reception.

CHARACTER STRUCTURE

When a message is sent, each character of the message is sent from left to right:

less significant bit (LSB)……more significant bit (MSB)

In particular, in RTU mode, the sequence of bits of every character is the following:

Start Bit	1 LSB	2	3	4	5	6	7	8 MSB	Bit di parità	Bit di stop

0x03 COMMAND: READ REGISTER

The **0x03 command** allows you to read the registers of the drive.

Example:

Question: the MASTER asks the SLAVE, having the 0x14 identification, to read the registers having the following addresses: 0x0005, 0x0006, 0x0007.

Character Name	Example (hex)
Identification	14
Command	03
Start address Hi	00
Start address Lo	05
Number of register Hi	00
Number of register Lo	03
CRC	--
CRC	--

Answer: the SLAVE, having the 0x14 identification, sends the values of the registers having the following addresses: 0x0005, 0x0006, 0x0007.

Character Name	Example (hex)
Identification	14
Command	03
Number of byte	06
Data Hi (register 0x0005)	12
Data Lo (register 0x0005)	A2
Data Hi (register 0x0006)	02
Data Lo (register 0x0006)	1F
Data Hi (register 0x0007)	0A
Data Lo (register 0x0007)	10
CRC	--
CRC	--

The 0x0005 register has the 0x12A2 value, the 0x0006 register has the 0x021F value, the 0x0007 register has the 0x0A10 value.

0x06 COMMAND: WRITE A REGISTER

The **0x06 command** allows you to write a value on a register of the drive.

Example:

Question: the MASTER asks the SLAVE, having the 0x14 identification, to write the 0x0003 value into the 0x0002 register.

Character name	Example (hex)
Identification	14
Command	06
Start address Hi	00
Start address Lo	02
Number of register Hi	00
Number of register Lo	03
CRC	--
CRC	--

Answer: the answer is an echo of the question after that the register is written.

Character name	Example (hex)
Identification	14
Command	06
Start address Hi	00
Start address Lo	02
Number of register Hi	00
Number of register Lo	03
CRC	--
CRC	--

0x10 COMMAND: WRITE N REGISTERS

The **0x10 command** allows you to write "n" consecutive registers, using only one question. The number of registers that can be written using this command are 16.

Example:

Question: the MASTER asks the SLAVE, having the 0x14 identification, to write into two registers the 0x000A and 0x0102 values, starting from the 0x0001 address.

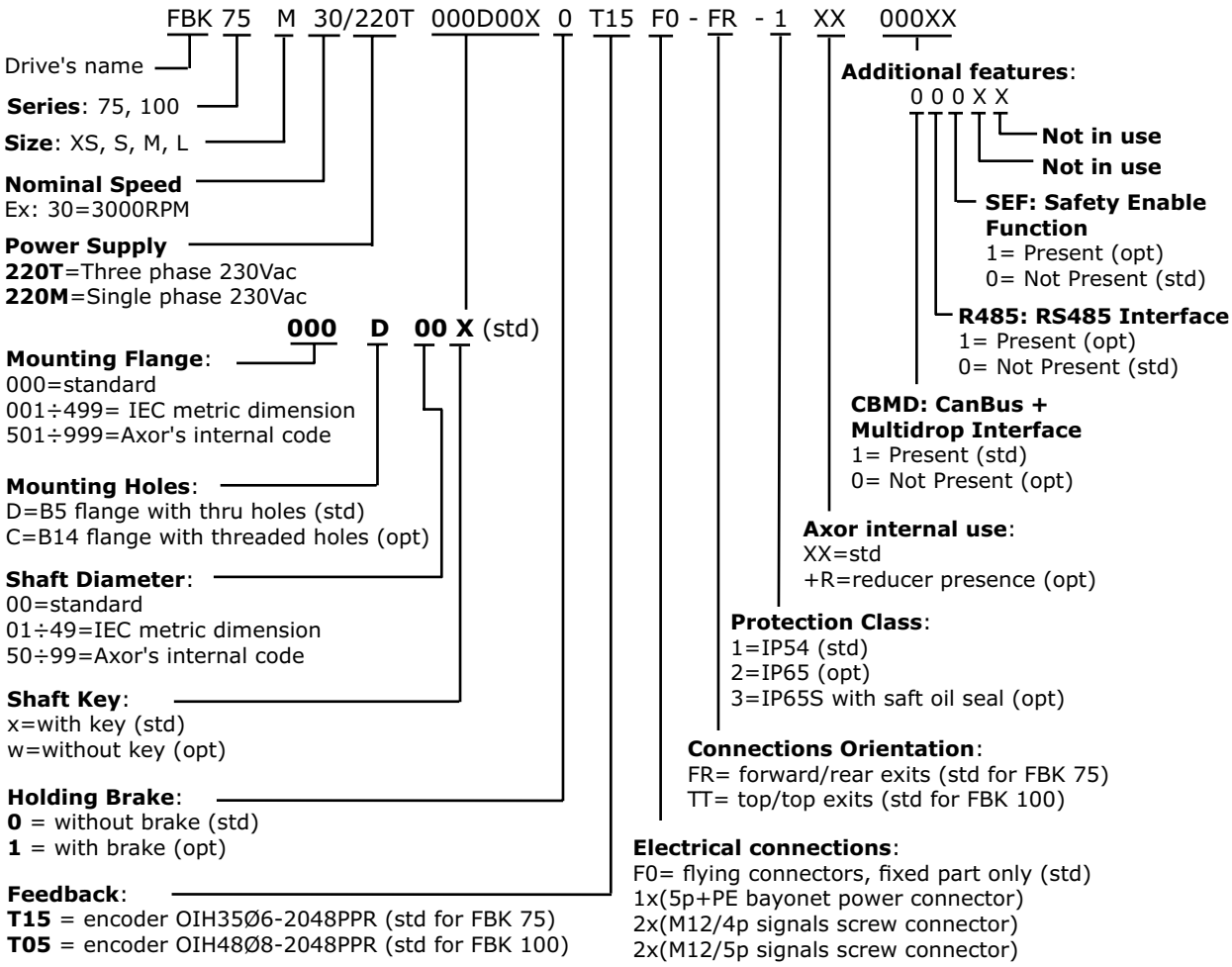
Character name	Example (hex)
Identification	14
Command	10
Start address Hi	00
Start address Lo	01
Number of registers Hi	00
Number of registers Lo	02
Number of byte	04
Value Hi	00
Value Lo	0A
Value Hi	01
Value Lo	02
CRC	--
CRC	--

Answer: the answer is an echo of the identification, the command, the start address and the number of the written register.

Character name	Example (hex)
Identification	14
Command	10
Start address Hi	00
Start address Lo	01
Number of registers Hi	00
Number of registers Lo	02
CRC	--
CRC	--

6.2 Ordering code

To order a digital drive serie **Fast Back**™ refer to this ordering code:



Special Flanges & Shafts (optional)	B_{j6}	D	V_{h9}	W	U	N_{j6}	M	F	J	F'	E	S	R □	T
100D14X (FBK 75 all sizes)	14	30	5X25	16	M4x10	80	100	6.6	-	-	3	10	90	115
130D14X (FBK 75 all sizes)	14	30	5X25	16	M4x10	110	130	9	-	-	3.5	10	115	150
100C19X (FBK 100 all sizes)	19	40	6X32	21.5	M6x16	80	-	-	100	M6X10	3	12	95	120
115D24X (FBK 100 all sizes)	24	50	8X40	27	M8x19	95	115	9	-	-	3	12	100	135

6.3 Transport, Storage, Maintenance, Disposal

Transport

During the transport of the drive respect the following indications:

- the transport must be made by qualified personnel;
- avoid shocks;
- the temperature range must be between -25°C and +55°C;
- the max. humidity must be 95% (without condensation);
- The converters contains elements which are sensitive to electrostatic discharges. These elements can be damaged by careless manipulation.
  Discharge static electricity from your body before touching the converter.
  Avoid contact with material that insulates well (synthetic fibres, films of plastic material and so forth).
- we suggest to check the motor condition at its arrival to survey eventual damages.

Storage

The unused drives must be storage in an environment having the following characteristics:

- temperature from -25°C to +55°C;
- max. relative humidity 95% (without condensation).

Drives having a power supply ≥ 220VAC have a max. time with the drive powered off (without supply connections) equal to **1 YEAR**.
After this time, before enable the drive, it is necessary activate the capacitors following this procedure: remove all electrical connections, then supply the input terminals of the supply with the main voltage for 30 minutes.
In details, for drives having a power supply equal to 220VAC: power it by using a supply equal to 110÷130VAC.

In order to avoid this procedure, we suggest to power on the drive with its rated voltage for 30 minutes, before the max. time is reached.

Maintenance

The drives does not need maintenance.
Otherwise:

- if the casing is dirty: clean it with isopropanol or similar;
- if the drive is dirty: the cleaning is reserved to the producer;
- if the fans are dirty: clean them by using a dry brush.

Disposal

The disposal should be carried out by a certified company.

Index

O

P

R

S

T

Since AXOR™ INDUSTRIES MOTORS SERVO DRIVES *1988*

AXOR INDUSTRIES®

viale **Stazione, 5**
36054 Montebello Vic.
Vicenza - Italy

phone **(+39) 0444 440441**
fax **(+39) 0444 440418**
info@axorindustries.com

www.axorindustries.com

CERTIFIED UNI EN ISO 9001 CERTIFIED N.9135 CERTIFIED

CSQ CERTIFICAZIONE DEI SISTEMI DI QUALITA' DELLE AZIENDE
UNI EN ISO 9001 CERTIFIED
N° 9135