SERVICE MANUAL

AXOR INDUSTRIES®

ENGLISH

CE

MICRO B NET®

DIGITAL

A.C. brushless servodrive

Twenty years of great motordrives

Release	Notes
ver.1 rel.12/'05	New paging. Insert: Positioning and Homing Procedures Corrections.
ver.1 rel.09/'06	New paging. Update chapters: "General Advices", "Installation", "Interfaces", "Diagnostic", "Appendix". Insert chapter: "Applications". Insert Index. Corrections.
ver.1 rel.01/'07	Update chapter: "5: Diagnostic". A new chapter reserved to Positioner and Homing procedure was created. Update chapter "6: Speeder One". Update chapter "7: Applications": Reset Fault Function, Emergency Function. Corrections.
ver.1 rel.04/'07	Update chapter: "4: Interface". Corrections.

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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

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Chapter 1
General Advices

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1.1 Norms

European directives and norms

The servodrives are *"components"* that are intended to be incorporated into electrical plant and machines for industrial use.
When the servodrive in used into machines or plant, the electrical plant/machine must respect the following directives: **EC Machinery Directive** (**98/37/EC**), **EC Directive on EMC** (**89/336/CE**), **Low Voltage Directive** (**73/23/EEC**).

To fulfil the **EC Machinery Directive** (**98/37/EC**) the following standards have to be applied:
- **EN 60204-1** (Safety and electrical equipment of machines)
- **EN 292** (Safety of machines)

To fulfil the **Low Voltage Directive** (**73/23/EEC**) the following standards have to be applied:
- **EN 60204-1** (Safety and electrical equipment of machines)
- **EN 50178** (Equipment of high voltage plant with electronic devices)
- **EN 60439-1** (Low-voltage switch gear and control gear assemblies)

To fulfil the **EC Directive on EMC** (**89/336/EEC**) the following standards have to be applied:
- **EN 61000-6-1** or **EN 61000-6-2** (Noise immunity within the domestic range/industrial range)
- **EN 61000-6-3** or **EN 61000-6-4** (Noise emission within the domestic range/industrial range)

The manufacturer of the machine/plant is responsible for ensuring that they meet the limits required by the EMC regulations.

The machine/plant manufacturer must examine whether with its machine/plant still further or other standards or EEC guidelines are to be used.

1.2 EC Conformity

EC Conformity

The **EC** mark that is applied to the drives references to the **Low Voltage Directive** (**73/23/EEC**).

AXOR DECLARES under its responsibility that the **McbNET Digital**™, together with its accessories and options, installed as illustrated in this manual, is in accordance with the following safety standard:

Machine Directive (**89/392, 91/368, 93/44, 93/68**)
Electromagnetic Compatibility Directive (**89/336, 92/31, 93/68**)

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 61000-4-2**, **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 manufacturer: Axor s.n.c. Viale Stazione 5, 36054 Montebello Vi.no (VI)

The Direction

In reference to noise immunity and noise emission the converters fulfil the requirement to the category *second environment* (industrial environment).

The drives has been tested by an authorized testing laboratory to check their adherence to the limit values requested by the directives regarding magnetic compatibility.
The reference standard used for electromagnetic compatibility is summarized in the CEI 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.

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Description

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2.1 Principal characteristics

The **McbNET Digital**™ is a digital drive capable of piloting both rotary AC brushless motors and linear motors. It must be installed on a machine or electrical system as integrated "component".

***Control*:**
It is **speed piloting** utilising a digital reference or an analogue reference (differential or common mode).

It is **torque piloting** utilising a digital reference or an analogue reference from an analogue input (TPRC). This function allows you to limit the current from the drive.

It furnishes the **positioning function**. The positioner can be managed via hardware (by using the digital inputs) or via software (by using the Axor's *Speeder One* interface or another ModBus Master). 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.

It is possible to connect the drive to a **stepper-motor controller**, piloting it with the +/-Pulse and +/-Dir signals (**Pulse/Dir Mode**).

It is possible to pilot the drive with the quadrature signals of an emulated encoder from a Master drive or with the quadrature signals of an incremental encoder from a Master motor (**Electrical Axis** or **Gearing**).

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*.

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**

The current controller is vectorial with sampling time Tc of 50μs.
The velocity and position loop both work with Tc of 200μs.

The current commutation is sinusoidal.

***Feedback*:**
There are two types of feedback:
- **Encoder** (incremental encoder signals plus hall signals);
- **Resolver**.

***I/O Digital*:**
There are **11 digital inputs** and 6 of them are programmable for the limit switch, the homing and positioning procedures, the emergency stop, the reset alarm, etc.

There are **2 digital programmable outputs** to send messages from pre-programmed functions of the drive.

There are 6 **encoder emulated outputs** with different programmed ratios (1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128) between output pulse/rev and encoder ones.

***I/O Analogue*:**
There is a **differential or common mode analogue input** for piloting the drive from an external controller.

There is another **common mode analogue input** (TPRC) to control the current from the drive.

There are **2 analogue outputs** which allow you to visualise by the oscilloscope some of the drive's measurement values (for example: the velocity, the Iq current, etc.)

***Software Interface*:**
The **McbNET Digital**™ is supplied with the ***Speeder One*** software interface which allows you to set and manage all drive's parameters.
The software works on the following operating systems: Windows 98, Windows 2000, Windows XP.
The communication between the drive and PC is done by a RS232 cable using the ModBUS protocol.

It is possible to update the control firmware by using a download program and the RS232 cable.

***Kaypad*:**
Four buttons (**UP**-**DW**-**MODE**-**SET**) allow the manual insertion of data without using a PC.

***Display*:**
A **display with 3 characters** visualises: the inserted values, the drive's status, the alarms.

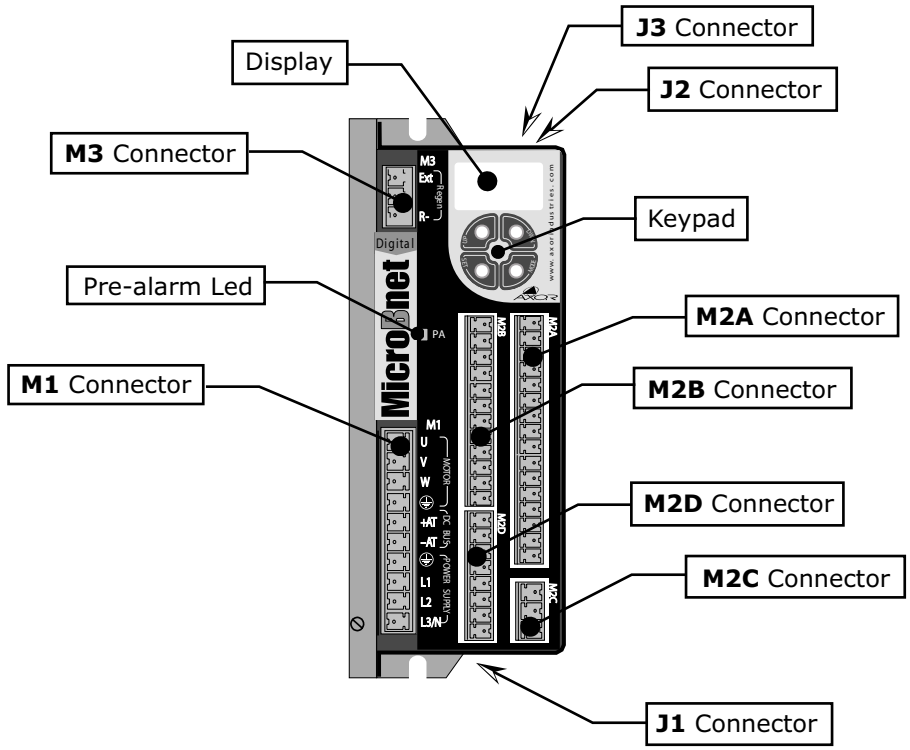
***Memory supports*:**
The internal memory supports are: an **EEPROM** for the "basic parameters" of the drive and a **FLASH** for the "motion parameters" of the positioner.

***Security*:**
The converter is protected from the short circuitry, the Max./Min. Voltage, the I^2T drive, the I^2T Motor, etc.
When there is an alarm the "Relè OK" contact opens and the motor is stopped, or a message is visualised on the display without compromise the functioning of the system.

All the digital inputs and outputs are isolated by opto-isolators.

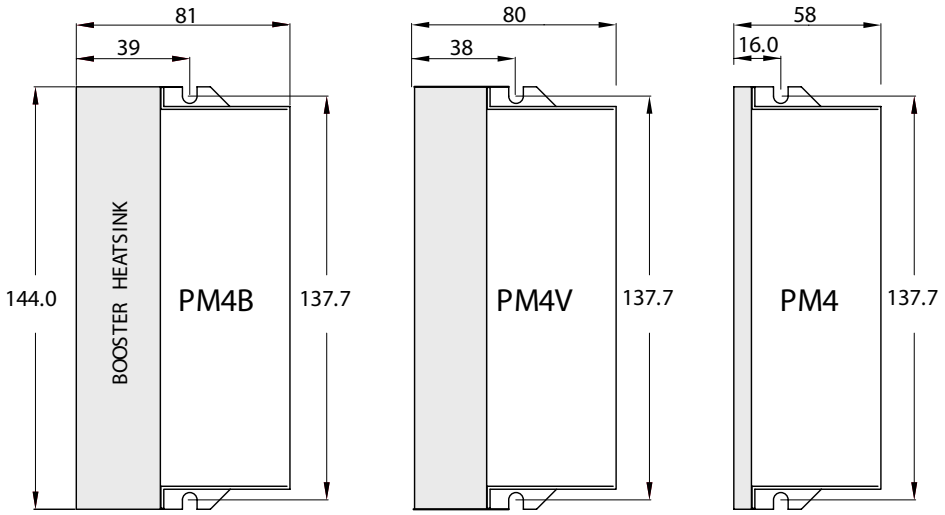
***EMI Filter*:**
The **McbNET Digital**™ is equipped with an integrated **EMI anti-disturbance filter** at the power supply input.

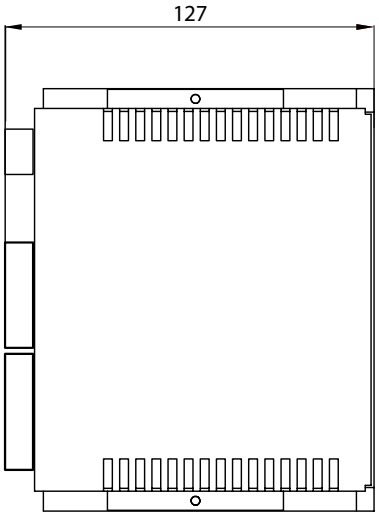
2.2 General view



Type	Description
M1	Power connector.
M3	External braking resistor connector.
M2A	Control signal connector (Digital Inputs/Outputs).
M2B	Control signal connector (Analogue Inputs/Outputs and Pulse/Dir Inputs).
M2C	Relè OK contact.
M2D	Emulation encoder outputs.
J1	Motor signal connector.
J2	RS232 interface (RJ11 connector).
J3	CanBus interface (RJ45 connector).

2.3 Mechanical dimensions





[case PM4]
McbNET Digital standard

[case PM4V]
McbNET Digital fan cooled

[case PM4B]
McbNET Digital with booster

[mm]

2.4 Equipment

The converter series **McbNET Digital™** is composed as follows:

- J1 Connector (25 pole sub-D female);
- M1 terminal (10 pole, pass 5.08);
- M2A terminal (16 pole, pass 3.81);
- M2B terminal (10 pole, pass 3.81);
- M2C terminal (3 pole, pass 3.81);
- M2D terminal (8 pole, pass 3.81);
- M3 terminal (3 pole, pass 5.08);
- an external braking resistor (100W-39 ohm) for all sizes;
- Service Manual;
- CD-ROM with ***Speeder One*** software.

ACCESSORIES: (Optional)

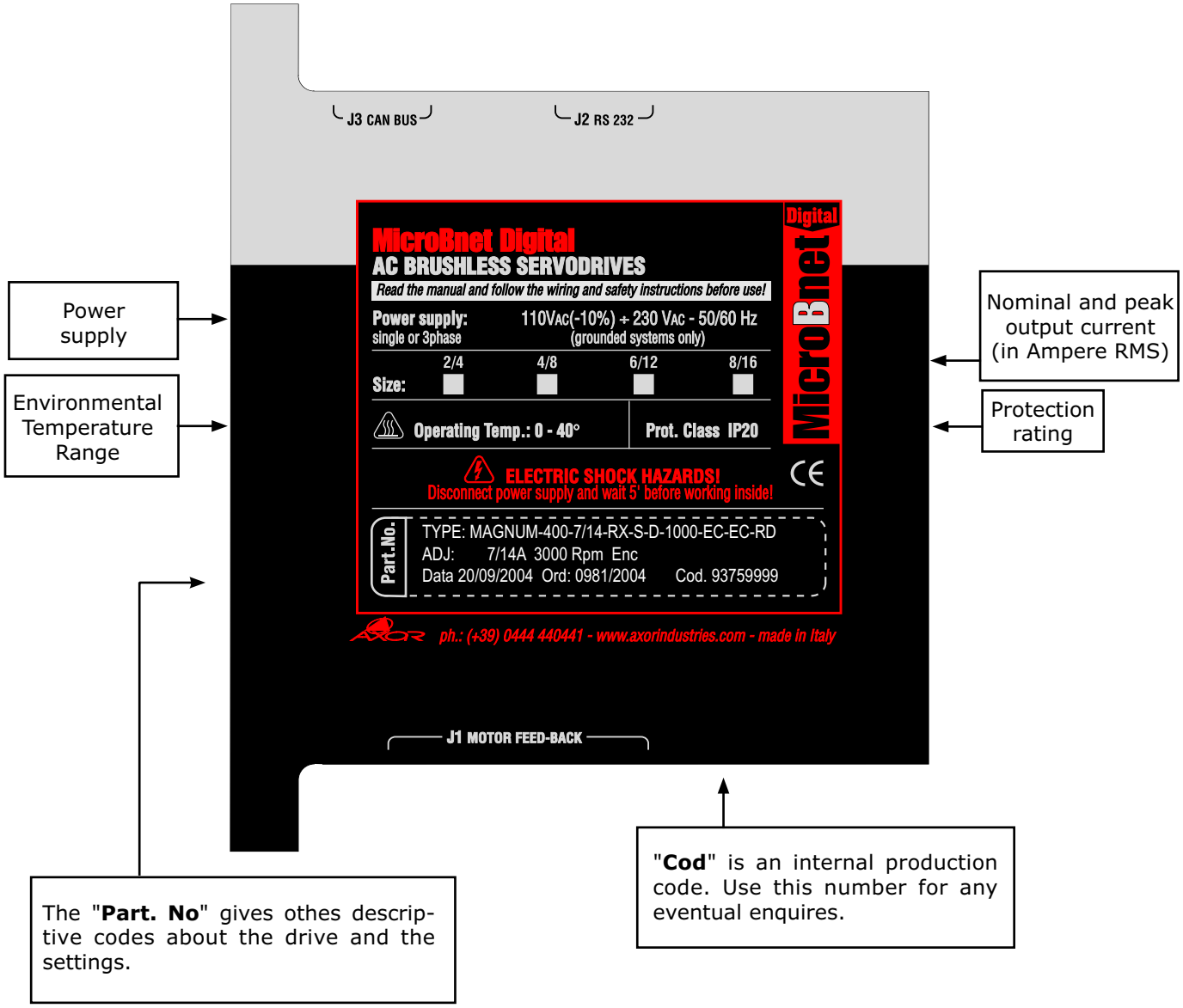
- Motor inductance (3x1.2mH) for cables over 20/25 meters in length;
- an external braking resistor (200W-22 ohm);
- CBLS cable series for motor series *SuperSAX*;
- CBLS cable series for power signal (meter multiple);
- RS232 communication cable for software interface.

MOTORS:

- Servomotors series *SuperSAX* up to 7.5Nm.

2.5 Product plate

On the side of each **McbNET Digital™** there is a **product plate** like the following:



2.6 Technical Data

Rated Data					
Nominal Voltage	Vac	**3-Phase**: 3x230Vac, 3x110Vac, 50/60Hz **Single phase**: 1x230Vac, 1x110Vac, 50/60Hz			
Internal DC BUS (+AT, -AT)	Vdc	85 Vdc min - 400 Vdc max			
Size		2/4	4/8	6/12	8/16
Nominal current	Arms	2	4	6	8
Peak current for 2 sec.	Arms	4	8	12	16
Dissipation at nominal current	W	28	42	58	76
Dissipation with output stage disabled	W	12			
PWM output frequency	kHz	10			
I LEAKAGE EMI Filter	mA	≤0,5 @ 230Vac			

Environmental conditions	
Ambient temperature in operation	0°C...+40°C
Storage temperature	-20°C...+55°C
Humidity	10%...85% without condensation
Altitude	Up to 1500m without restrictions. From 1500m to 2500m the output current must be derated 2%/100m.
Enclosure protection	IP20
Pollution level	LEVEL 2 Norm EN60204/EN50178

Control signals	
9 opto-isolated digital inputs	+24Vdc - 7mA (PLC compatible)
2 opto-isolated digital outputs	+24Vdc - 50mA (PLC compatible)
2 analog programmable outputs	±10V (±5%)
1 common mode analog input (TPRC)	±10V max, 10kOhm input resistance
1 differential or common mode analog input	±10V max, 200kOhm input resistance
Pulse/Dir digital inputs	+5V, optoisolated, max frequency 200kHz
Auxiliary supply input (+14Vdc)	+14V (±5%), 50mA max.

External braking resistor		
Continuous power of the braking module	W	200W max a 45°C
Brake circuit set point DC	Vdc	370-375
Max Brake circuit set point DC	Vdc	385
Value of the resistor	Ohm	≥22 per 200W

2.6 Technical data

Motor encoder inputs	
Encoder supply	+5V @ 220mA (±5%)
Differential encoder inputs line receiver RS485	AM26LS33
Differential hall signal inputs line receiver RS485	AM26LS33
Encoder max frequency	250kHz

Mechanical properties					
Drive mounting		Panel			
Size		2/4	4/8	6/12	8/16
Radiator's case		PM4	PM4	PM4B	PM4V
External dimensions [mm]	H	137,7	137,7	137,7	137,7
	L	58	58	80	81
	S	127	127	127	127
Weight	Kg	0,6	0,6	0,7	1

Conductor cross-sections	
Main supply cable	1,5mm²/15AWG
Motor power cable	1,5mm²/15AWG (shielded)
Motor signal cable	Encoder: 16 x 1 x (0,25-0,35) mm²/22-24AWG (shielded) Resolver: 8 x 2 x (0,25-0,35) mm²/24-22AWG (shielded)
External braking resistor cable	1,5mm²/15AWG
Emulation encoder cable	8 x 1 x (0,25-0,35) mm²/24-22AWG (shielded)
Control signal cable	0,5mm²/20AWG
NOTE: - Use motor cables with a capacity ≤ 150pF. - Use "Encoder o resolver" signal cable with a capacity ≤ 120pF.	

External protections (fuses or similar)				
Size	2/4	4/8	6/12	8/16
F_2: Supply Line fuses (Time-Lag)	3A / 250V	5A / 250V	8A / 250V	10A / 250V
F_3: External braking resistor fuses	4A F (Fast)		4A F	4A F

Chapter 3
Installation

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3.1 Wiring

The Axor's digital servodrives are capable of piloting both rotary AC brushless motors and linear motors; they can be controlled in torque, velocity and positioning.
The nominal motor voltage must be superior or at least equal to the middling circuit furnished by the servodrive.

The following indications should help the user to install and wire the **McbNET Digital**™.

Security standard

• **<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.

• Switch off the converter and wait at least 5 minutes before opening it. Remove the fuses or switch off the main switch before removing the drive. When opening, place the converter on a surface that does not belong to the electrical panel.

• The residual charges in the capacitors can remain at a dangerous level for up to 5 minutes after disconnection from the mains. Measure the voltage at the intermediate circuit (+AT/-AT) and wait until it is below 15V.

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

• The **McbNET Digital**™ is equipped with electronic protections that deactivate it in case of irregularities. The motor, as a result, is not controlled and can stop or go into neutral (for a time determined by the type of system).

• During installation, avoid letting any residue with metallic components fall inside the drive.

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

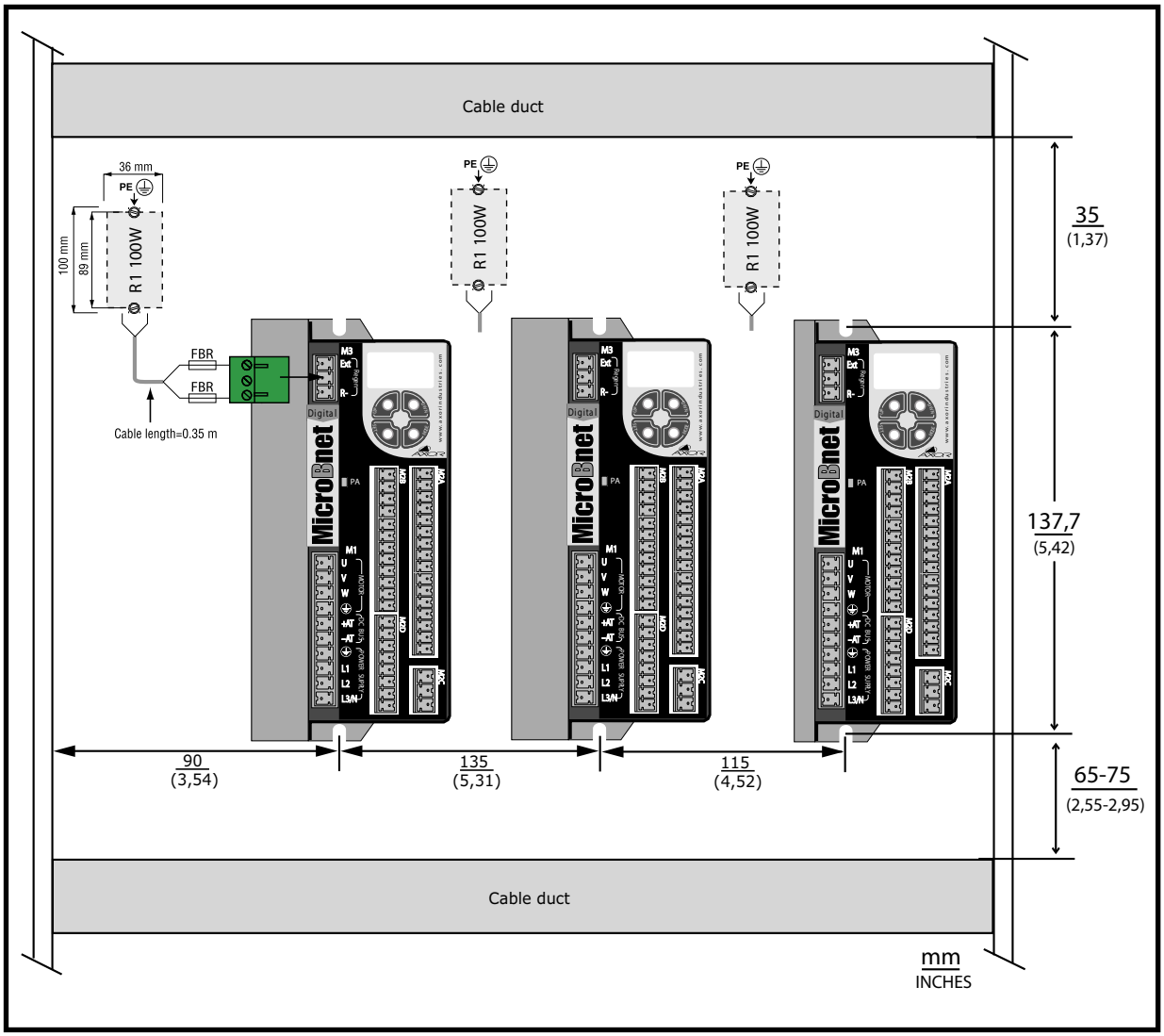
• Check that the main supply and the nominal current are coherent with the rating of the drive. Be sure that the nominal voltage between the connectors L1-L2-L3 is not more than 10% of the admitted values. A too high voltage causes the breakdown of the load circuitry and of the drive.

• The **McbNET Digital**™ is equipped with an integrated **EMI anti-disturbance filter** at the power supply input.
Being implicit to filter operation the deviation towards earth or mass of the undesired frequencies, ensure that these device can produce escape currents towards earth, which are measurable in milliAmpers. Please remember that "leakage currents" must be considered when settings differential devices in order to avoid useless interventions.
For safety reasons connect the prepared terminal to earth before powering the drive. Incorrect connections makes filter operation unreliable.

Positioning

The **McbNET Digital**™ is made to be fixed vertically to the **bottom of the electrical box** in order to guarantee reliable cooling.
The minimum volume of the electrical box for proper thermal dissipation of one amplifier is **0,10**m³.
The minimum volume of the electrical box for proper thermal dissipation of a 4 axis system (or 4 amplifiers) is **0,4**m³.

Maintain uniform distances between drives as per diagram:



Note: Arrange the power components (converters, main's filters, resistors, terminals, ...) in bins of the electrical panel which are not those reserved to the command or control systems (PLC, PC, CNC, regulators, ...). This improves the level of immunity to interference of the system.

Environmental conditions

For good converter operation, guarantee a **working temperature** at nominal current **between 0 and +40°C** (without derating).
From 1500 to 2500m of altitude the converter must be derated in the output current of 2% every 100m.

Guarantee a **humidity** level ranging from 10% to 85% without condensation.

The drives are designed to be utilized in an electrical box protected against the infiltration of polluting agents such as water, oil, conductive dust and others. So at least "IP20" protection is required.
We forecast the "Level 2" pollution, in accordance with the EN60204 and EN50178 norms.

The electrical box must have suitably **filtered air vents**.
Leave the necessary space both above and below the converters.

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

Cable choice

Select cables in accordance with the EN 60204 norm.

The following table illustrates the technical characteristics of all cables:

Cables	Technical characteristics
for the Main Supply	Use cables having the following section: 1.5mm^2/15AWG.
	Always insert a power relay or a thermal magnet on every phase of the products power supply.
for the Auxiliary Supply	Use cables having the following section: 1.5mm^2/15AWG.
	Connect the 0V of the auxiliary supply to the ground bar.
for the Motor's Power	Use cables having the following section: 1.5mm^2.
	It must be shielded. Connect the shield stocking as soon as possible (20...50cm) from the drive, utilising u clamp to the zinced panel of the electrical box. On the motor side of the cable, the shield must be internally connected to the connector's ring.
	It must have a capacity of ≤150pF/m.
	In the configuration without filter, the wire can reach a maximum length of 20/25m. If the length exceeds 20/25m, insert an Axor **3x1.2mH** filter.
for the Control signals and I/O signals from PLC/CNC	Use cables having the following sections: 0.5mm^2/20AWG.
	To reduce the capacitive and inductive coupling, these cables must be run keeping a distance of more than 30cm from the power cables (10 cm if they are shielded).
	If it is absolutely necessary to cross the control cables with the I/O's, do so at 90°, in order to reduce the effect of the magnetic fields.
	The **conductors for the analogic signals** (torque or speed reference, programmable outputs, resolver, hall sensor, real encoder and emulation encoder, etc.) must be braided and shielded. Connect the shield to ground, utilising u clamps to the zinced panel of the electrical box, near the drive. The continuity of the shield must be guaranteed along all the cable.

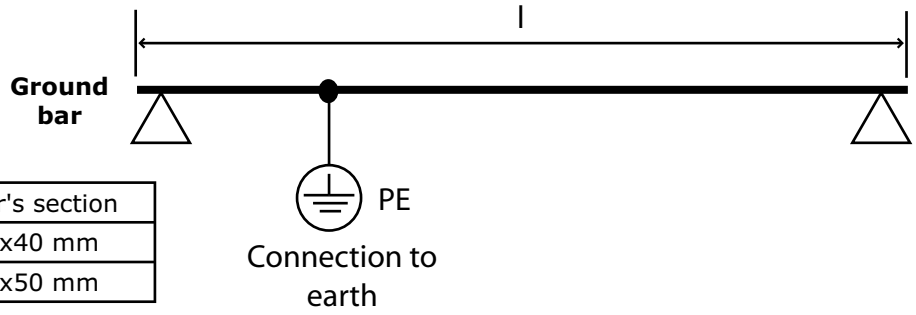
for the Encoder signals	Use cables having the following sections: 0.25-0.35mm²/24-22AWG.
	It must have 8 twisted pairs. Motor side three pairs (the signal's ones) must be shielded and connected together and with the external shield; while drive side they must be connected together and with pin 8 of the J1 connector (not with the external shield).
	It must be externally shielded. Motor side the external shield must be connected to ground through the connector's ring; drive side the shield must be connected to ground utilising pressed cable on the zinced panel of the electrical box.
	It must have a capacity less than 120pF/m.
for the Resolver signals	Use cables having the following sections: 0.25-0.35mm²/24-22AWG.
	It must be made by using four twisted and shielded pairs and also be externally shielded. Motor side the three internal shields must be connected together and with the external shield through the connector's ring. Drive side the internal shields must be connected together and to pin 13 of the J1 connector; while the external shield must be connected to ground utilising u clamps to the zinced panel of the electrical box, and to pin 8.
	It must have a capacity less than 120pF/m.
for the RS232 communication	The section of the conductors must be 0.22mm²/24AWG or 0.34mm²/22AWG.
	The length of the cable must be equal or less than 2m.
	It must be connected when the main supply and the auxiliary supply are both powered off.
	It must have a capacity less than 160pF/m.
for the CanBus communication	Cable capacitance: max 60 nF/km.
	Characteristic impedance: 100...120Ω.
	Lead resistance (loop): 159,8 Ω/km
	The length depends by the transmission speed: • 1000kbit/s ⇨20m max; • 500kbit/s ⇨70m max; • 250kbit/s ⇨115m max.

Note:
• Avoid crossing, overlapping and twisted cables together. If it is absolutelly necessary to cross them, do so at 90°.

• On request Axor provides motor signal cables series *encoder or resolver* for motors series *Super-SAX*.

Connection to ground and earth

Make sure that the servodrive and the motor are connected to earth in accordance with the current norms.
This connection must be done by using a copper bar, mounted on insulating supports, as illustrated below:



l	Bar's section
0,5 ...1 m	5x40 mm
1 ... 2 m	5x50 mm

then follow these indications:

1. Connect the **zero volt** (**AGND**) **of the converter** and the **internal zero volt of the CNC** to the ground bar.

2. Connect the **earth terminals of the PLC/CNC frames** to the ground bar.

3. Connect the **earth power terminal of the drives** to the ground bar.

4. Connect the **0V of the auxiliary supply** to the ground bar.

5. Connect the **CHASSIS** of all drives to the ground bar.

6. Connect the **ground bar** to the zinced panel by using a screw, then connect that screw to **earth**.

7. Connect to earth to **motor's carcass**.

Symbol	Description
	It suggests a conductive connection as roomy as possible to the chassis, or the radiator, or the mounting panel of the electrical box.
	It refers to the earth connection.
	It refers to the connection of the shield to the connector's metal ring.

Installation procedure

• Power off all the supplies of the electrical box.

• Verify the drive-motor coupling, comparing the rated voltage and the rated current of the system. The stall current (I_o) of the motor should be equal to/or greater than the nominal output current of the drive.

• Verify the **positioning** of the drive into the electrical box, the pollution level and the **ventilation** (see pages 22 and 23).

• Verify the **connection to earth** of the electrical box where the drive is installed (see page 25).

• Verify the **cables' characteristics** and connections (see page 23).

• Execute the wiring following this order, avoiding that wiring's pieces, cables, wires, screws, conductive objects, etc. enter into the drive through its slits:

1- First connect **earth**.

2- Connect the **cables for the motor's power** (U, V, W) and the **filter 3x1.2mH**, if the cable is length more than 20/25m.

3- Connect the **earth of the motor's power** (PE).

4- Connect the **external shield** of the motor's cable: it must be shielded utilising u clamp to the zinced panel of the electrical box.

5- Connect the **external braking resistor** by using a cable as short as possible. If the cable is length more than 20/30 cm, the cable must be plaited and shielded, besides the shield must be connected to ground to both ends utilising u clamps to the zinced panel of the electrical box.

6- Connect the cables for the **control signals** (digital inputs and outputs, encoder emulation outputs, Pulse/Direction signals, analogue inputs and outputs, Relè OK contact), except the Enable command (DGT-IN1 digital input).
Then connect the **shield** of these cables utilising u clamps to the zinced panel of the electrical box, near the drive.

7- Connect to the drive the **J1** connector (feedback motor signals).

8- Connect the **main power supply cable** (L1-L2-L3) and the **earth cable** (PE).

9- Connect the **auxiliary supply cable** (+24V).

10- Connect the **cable for the Enable command** (DGT-IN1).

11- Connect the PC to the drive utilising the **RS232** cable.

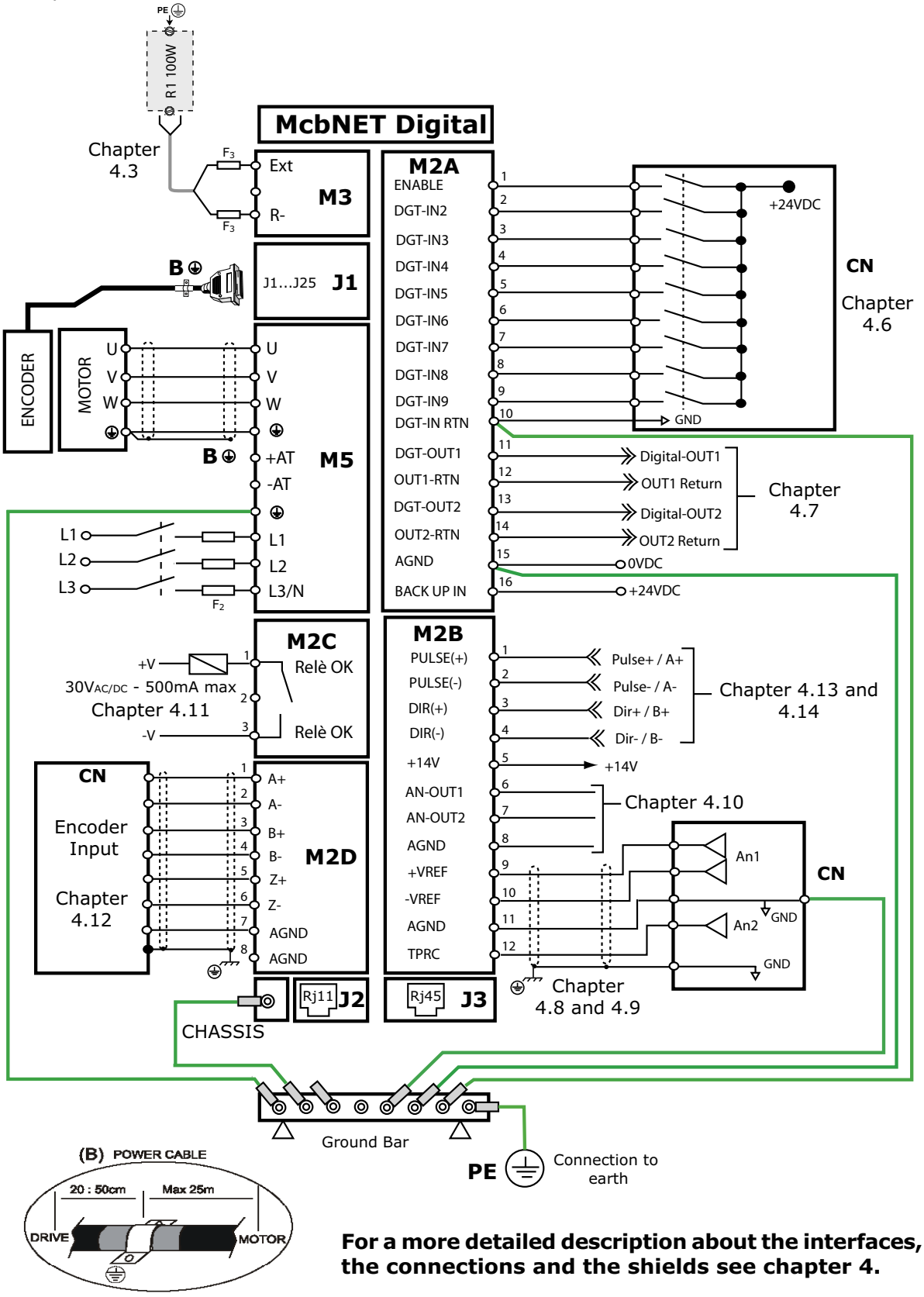
12- Power on the **main power supply**.

13- Execute the tests on the motor.

In the following page there is an *example of connection*.

3.2 Example of connection

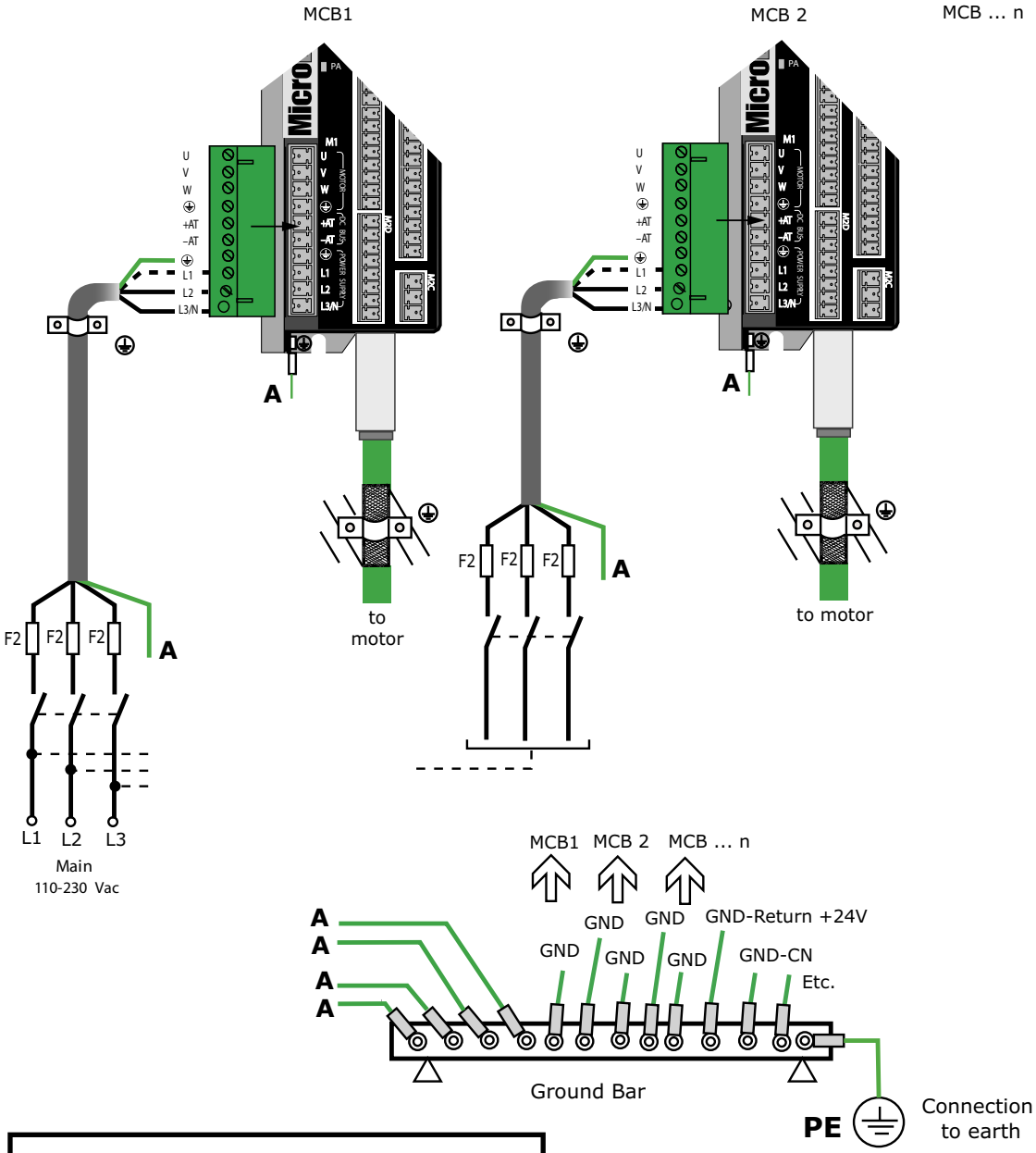
Example of connection:



For a more detailed description about the interfaces, the connections and the shields see chapter 4.

3.3 Ex. of connection for multi-axis system

Example of connection:



There is only one **electrical box ground bar**, where the various grounding wires for the motor and the **McbNET Digital**™ are combined.
The bar is earth connected in PE.

Chapter 4
Interface

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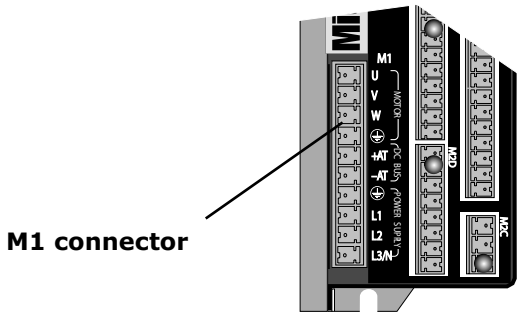
4.1 Main supply connection

The **M1 connector** contains:
- the brushless motor's power signals;
- the AC supply direct from the mains.



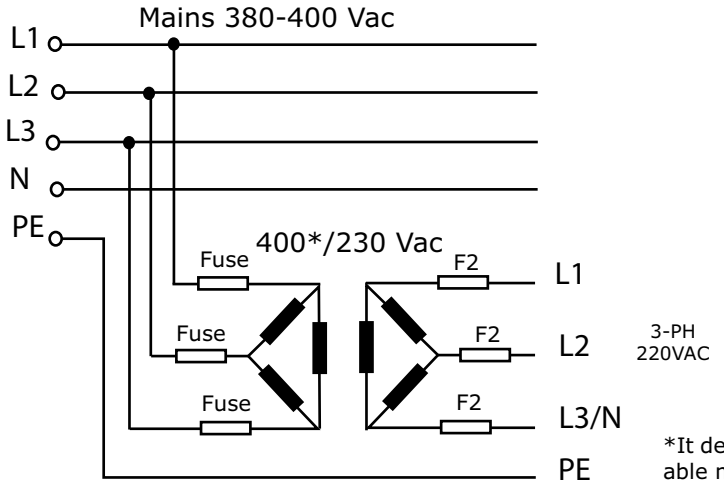
PIN	DESCRIPTION	
U	OUT	Motor's U phase
V	OUT	Motor's V phase
W	OUT	Motor's W phase
EARTH	OUT	Motor's ground
+AT	OUT	Internal BUS positive supply
-AT	OUT	Internal BUS negative supply
EARTH	INPUT	Drive's earth connection
L1	INPUT	Mains power supply
L2	INPUT	Mains power supply
L3/N	INPUT	Mains power supply
SCREW	INPUT	Chassis

4.1 Main supply connection

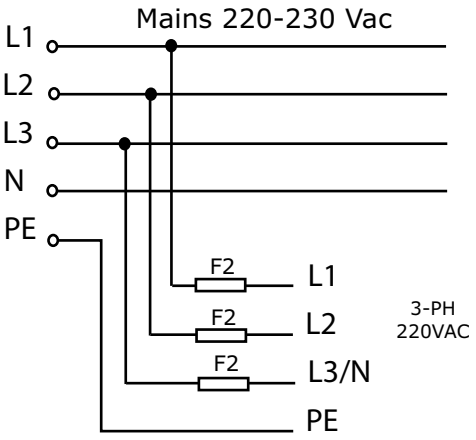
The **McbNET Digital**™ can have two different power supplies: **3-phase** or **single phase** between the range **110Vac** and **230Vac**.
The product is optoisolated and this guarantee the galvanic isolation between the mains and the control signals.

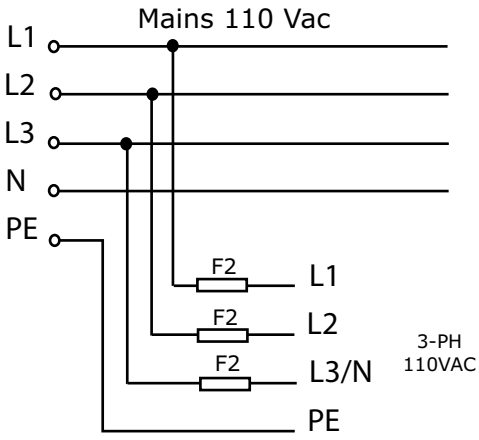
The figura below displays some supply possibilities for the **McbNET Digital**™.

3-Phase McbNET Digital



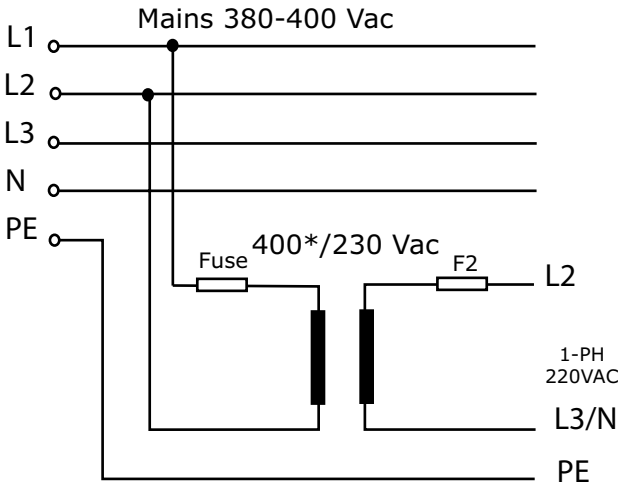
*It depends by the available main supply.

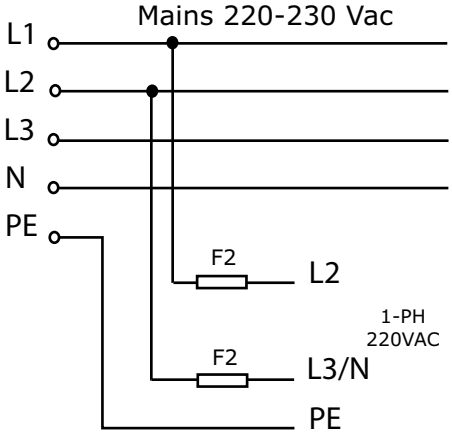




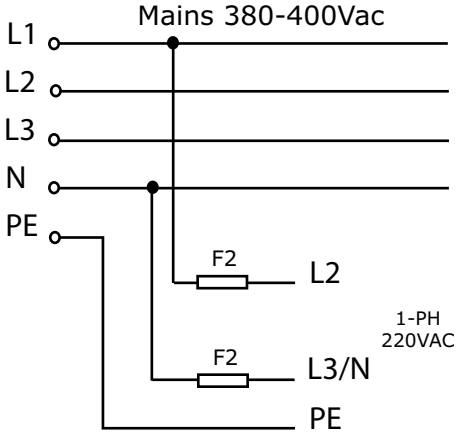
Always insert a power relay or a thermal magnet on every phase of the products power supply (L1, L2 and L3/N) reference to the norm EN CEI 60204-1.

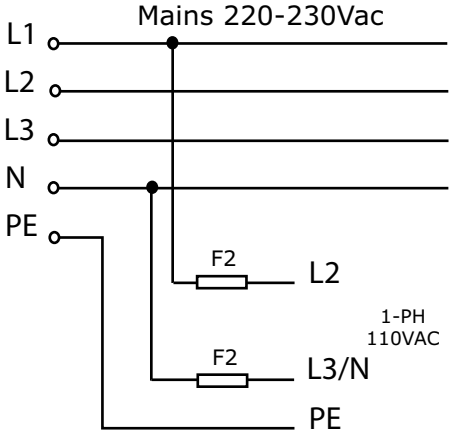
Single Phase McbNET Digital





*It depends by the available main supply.





IMPORTANT NOTE: Always insert a power relay or a thermal magnet on every phase of the products power supply (L1, L2 and L3/N) reference to the norm EN CEI 60204-1.

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

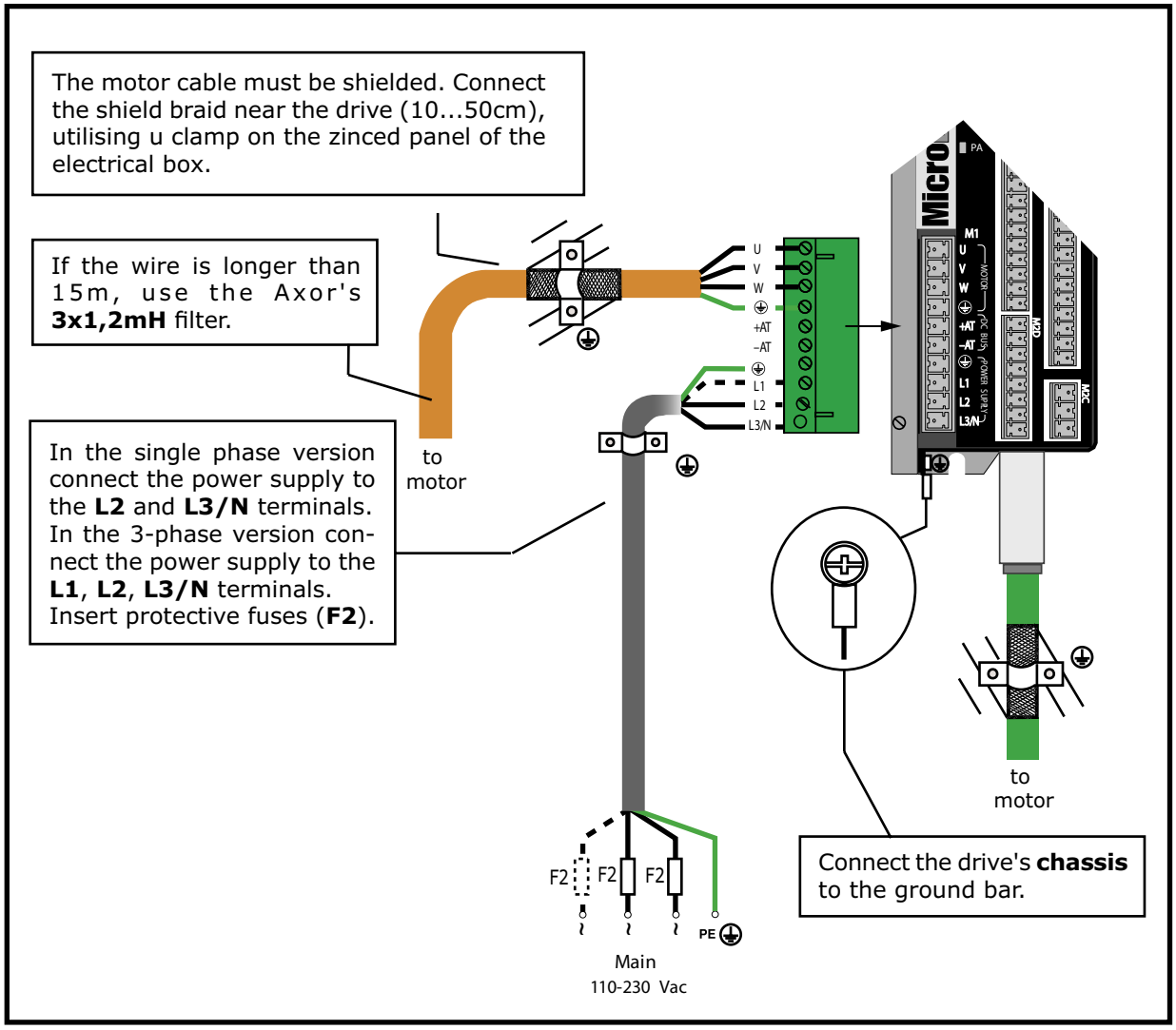
Pn = n x Cn / 9,55

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]



Notes:

• Instead of the 3-phase or single phase power supply, it is possible to use a continuos voltage, utilising the **+AT** and **-AT** pins on the **M1** connector.

• You must not connected the DC buses of more than one drive in parallel, due to the drive's braking circuitry.
This note must be respected, otherwise the drive may not function properly and be damaged.

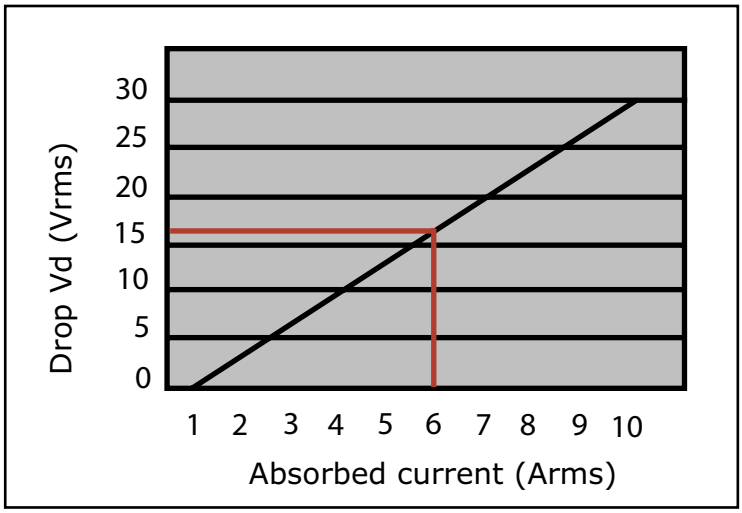
4.2 Available output voltage

The **McbNET Digital™** (**single phase** power supply version) has an output voltage given by the following formula:

Vout= 0,9*(Vac-Vd)

where
Vout = drive's output voltage.
Vac = power supply between **L2** and **L3/N**.
Vd = voltage fall caused by the single phase supply.

Vd is proportional to the current absorbed by the motor, as can be seen in the following figure:



Example: If the current absorbed by the motor is 6A, the voltage drop is about 17V (see the figure above); so in this case the maximum voltage outpust is 191,7V, infact:

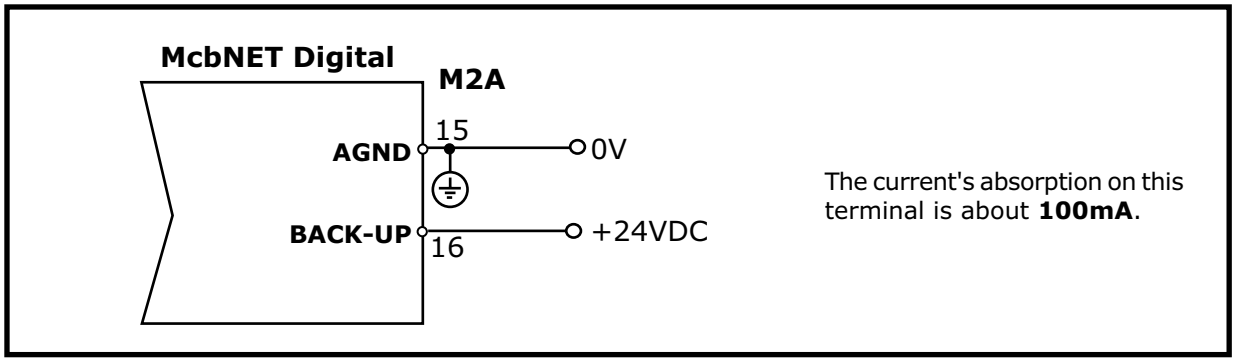
Vout = 0,9*(230-17) = 191,7V

4.3 Back UP input

The terminal **16** on the **M2A** connector is utilised as an **external power supply input**:

Terminal 15 ... Groung return, **AGND**
Terminal 16 ... Back UP input (**+24VDC, +25%** / **-30%**)

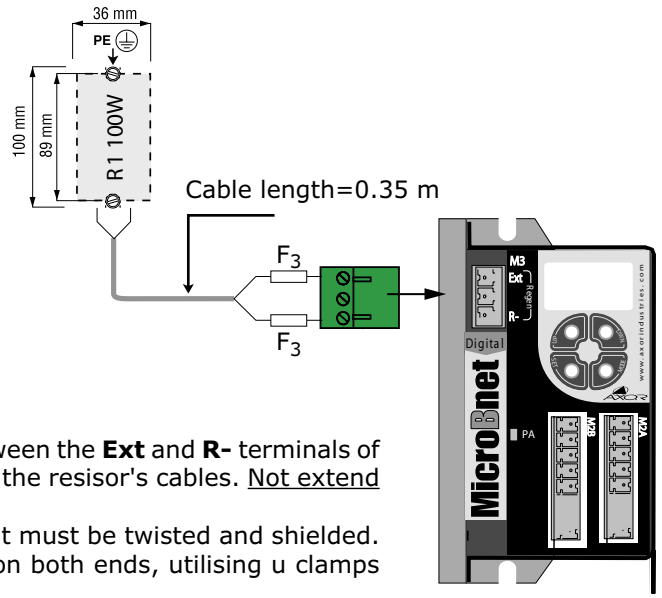
This supply is utilised to power the logic board and the encoder when the drive is shut off. In this condition the display visualises the symbol "---", while the "Relè OK" contact remains open.



Note: Connect the 0V reference to the ground bar of the system.

4.4 Braking resistance

The **McbNET Digital™** is standard supplied with an external braking resisor of **100W-39 ohm** (**R1**).



The external resisor should be inserted between the **Ext** and **R-** terminals of the **M3** connector, near the drive, utilising the resisor's cables. Not extend this connection using othes cables.
If the cable is length more then 20/30cm, it must be twisted and shielded. The shield must be connected to ground, on both ends, utilising u clamps to the zinced panel of the electrical box.

If during the deceleration phase the led "**PA**" turns on, (**Pre-alarm Recovery**), probably it is necessary to change the R1 resistor with a higher resistor of **200W - 22 Ohm** (**R2**).

If the power accumulated by the motor during deceleration exceeds the set load power, the converter activates the **alarm 8**, "**I2t Brake**". This causes the opening of the "Relè OK" contact and the drive's stop. In this case disable the drive, then:

- be sure that the external resistance has the correct Ohm value and that it is connected as described in the manual;
- check the AC power supply input;
- check that the working cycles are not excessive;
- verified if the motor, going at half speed, shows the same problem;

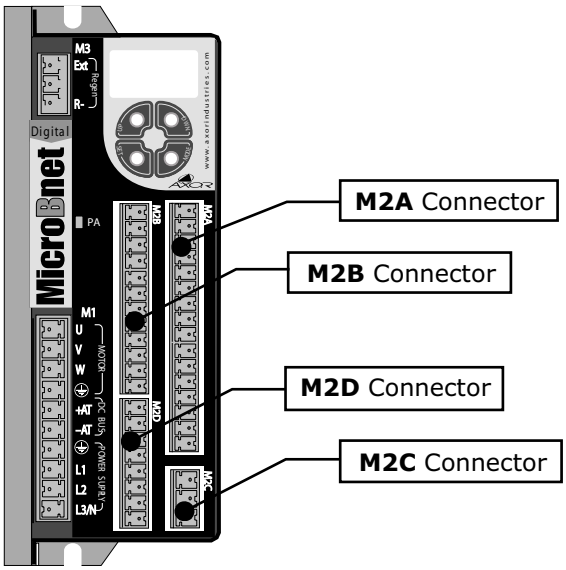
reset the alarm, then enable the drive.

Before changing the R1 resistor, we suggest to contact Axor.

4.5 Control interfaces

The **McbNET Digital**™ has **four control terminals**: **M2A, M2B, M2C** and **M2D**, which enable the programmable digital inputs and outputs, the Pulse/Direction Mode, the Electrical Axis, the Analogue inputs and outputs, the emulated encoder, etc.

The following is a desciption of all functions which are enbled utilising these terminals.



16 pole connector (M2A)			
PIN	**NAME**	**DESCRIPTION**	**CHA**
1	DGT-IN1	Digital input (ENABLE)	4.6
2	DGT-IN2	Programmable digital input	
3	DGT-IN3	Programmable digital input	
4	DGT-IN4	Programmable digital input	
5	DGT-IN5	Programmable digital input	
6	DGT-IN6	Digital input	
7	DGT-IN7	Digital input	
8	DGT-IN8	Digital input	
9	DGT-IN9	Digital input	
10	IN-RTN	Ground of the digital input	
11	DGT-OUT1	Programmable digital output, OUT1	4.7
12	OUT1-RTN	OUT1 ground return	
13	DGT-OUT2	Programmable digital output, OUT2	
14	OUT2-RTN	OUT2 ground return	
15	AGND	Back-UP ground return	4.3
16	BACK-UP IN	+24Vdc input	

12 pole connector (M2B)			
PIN	**NAME**	**DESCRIPTION**	**CHA**
1	PULSE(+)	Interface for stepper-motor controller: digital frequency input, or positive encoder signal from a Master drive (CHA+).	4.13 and 4.14
2	PULSE(-)	Interface for stepper-motor controller: digital frequency input, or negaive encoder signal from a Master drive (CHA-).	
3	DIR(+)	Interface for stepper-motor controller: digital direction input, or positive encoder signal from a Master drive (CHB+).	
4	DIR(-)	Interface for stepper-motor controller: digital direction input, or negative encoder signal from a Master drive (CHB-).	
5	+14V	Auxiliary power supply (+14V, max. 50mA)	
6	AN-OUT1	Programmable analog output	4.10
7	AN-OUT2	Programmable analog output	
8	AGND	Ground return	
9	+VREF	Differential analog input (positive velocity reference).	4.8
10	-VREF	Differential analog input (negative velocity reference).	
11	AGND	Ground return	
12	TPRC	Analog input	4.9

3 pole connector (M2C)			
PIN	**NAME**	**DESCRIPTION**	**CHA**
1	RELE' OK	Relè OK contact	4.11
2	N.C.	Not used	
3	RELE' OK	Relè OK contact	

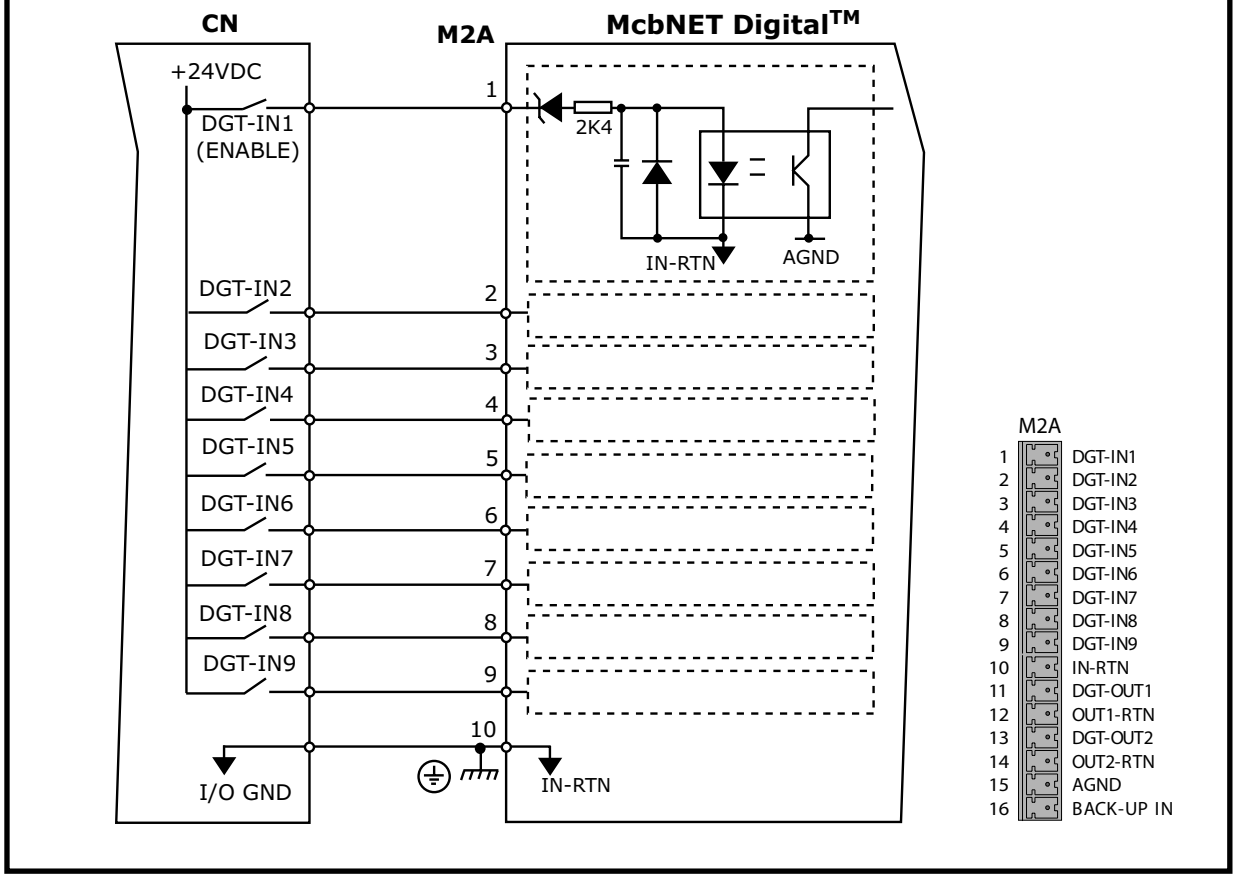
8 pole connector (M2D)			
PIN	**NAME**	**DESCRIPTION**	**CHA**
1	A+	Incremental encoder emulation output CHA+ (for CN)	4.12
2	A-	Incremental encoder emulation output CHA- (for CN)	
3	B+	Incremental encoder emulation output CHB+ (for CN)	
4	B-	Incremental encoder emulation output CHB- (for CN)	
5	Z+	Incremental encoder emulation output CHZ+ (for CN)	
6	Z-	Incremental encoder emulation output CHZ- (for CN)	
7	AGND	Ground return for the encoder emulation outputs	
8	AGND	Ground return	

4.6 Digital inputs

The **McbNET Digital**™ has **9 digital inputs** (on the **M2A** connector), isolated by opto-isolators.

The input circuit is pre-disposed for +**24VDC-7mA** (PLC compatible). The **enable range** is between **+14V Min** and **+30V Max**.

Connection diagram:



The **1** terminal (**ENABLE**) is used only as the drive's enable. If 1 is HIGH (+24VDC) the drive is enabled (without alarms); if 1 is LOW (0V), the motor is free and without torque.

The **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9** terminals can be used to activate pre-programmed functions of the drive (for example: switch limit, homing and positioning procedure, emergency stop, etc.).
For a detailed description about these functions see Chapters 7 and 8.

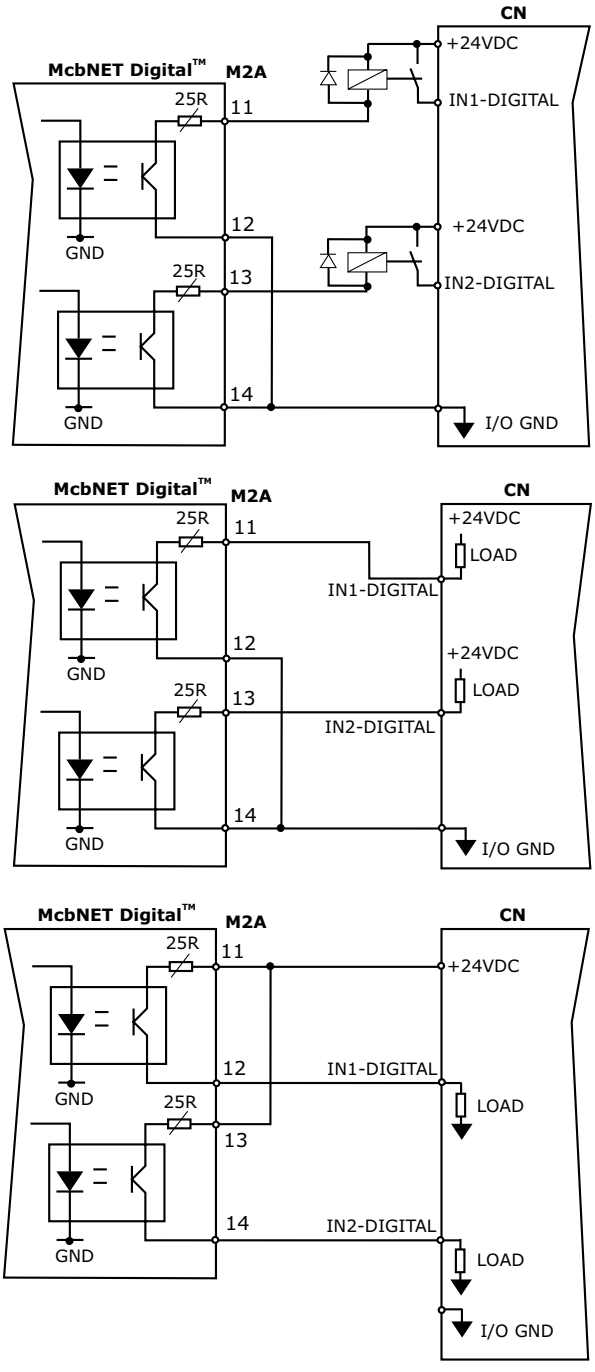
Note: we suggest to connect pin **M2A-10** (DGT-IN RTN) to the ground bar of the system.

4.7 Digital outputs

The **McbNET Digital**™ has **two digital outputs** (on the **M2A** connector), which are isolated by opto-isolators.

It is possible to utilize these outputs to send messages from the pre-programmed memorized function of the drive. For a detailed description about these functions see Chapters 7 and 8.

In the figure below some possible connections with these outputs are shown.



Max. load for each output: 50[mA].

Always use a relay with a diode in parallel.

M2A

1	DGT-IN1
2	DGT-IN2
3	DGT-IN3
4	DGT-IN4
5	DGT-IN5
6	DGT-IN6
7	DGT-IN7
8	DGT-IN8
9	DGT-IN9
10	IN-RTN
11	DGT-OUT1
12	OUT1-RTN
13	DGT-OUT2
14	OUT2-RTN
15	AGND
16	BACK-UP IN

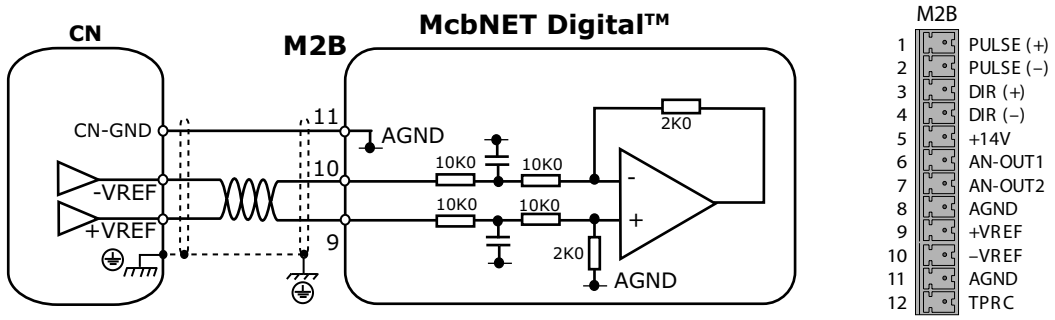
4.8 Differential and common mode analog input

The **McbNET Digital**™ has a **differential or common mode analog input** (furnished by the pins **9**, **10**, **11** on the **M2B** connector) for controlling the drive with an analog speed reference.

The axis card used in the Numerical Control or PLC can have two different types of analog reference outputs:

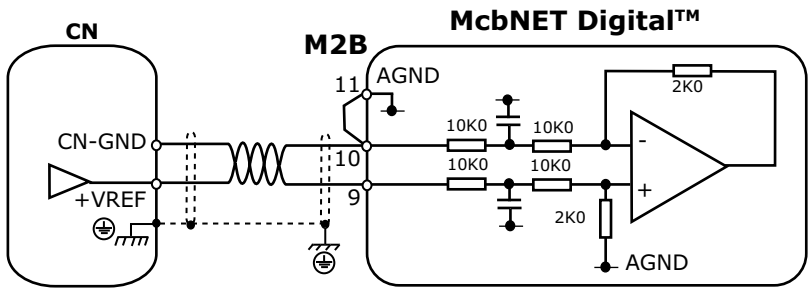
- **differential analog output**, in this case connect **+VREF** and **-VREF** to the **9** and **10** terminals:

DIFFERENTIAL MODE



- **common mode reference analog output**, in this case connect the control's analogue output either to the **9** terminal or to the **10** terminal, depending upon the required rotational direction. Then connect the **11** (AGND) to the reference input terminal that is NOT used.

COMMON MODE



The **technical characteristics** of these inputs are the following:

- Accepted voltage: **±10V** Max.
- Input impedance: **10kOhm**.

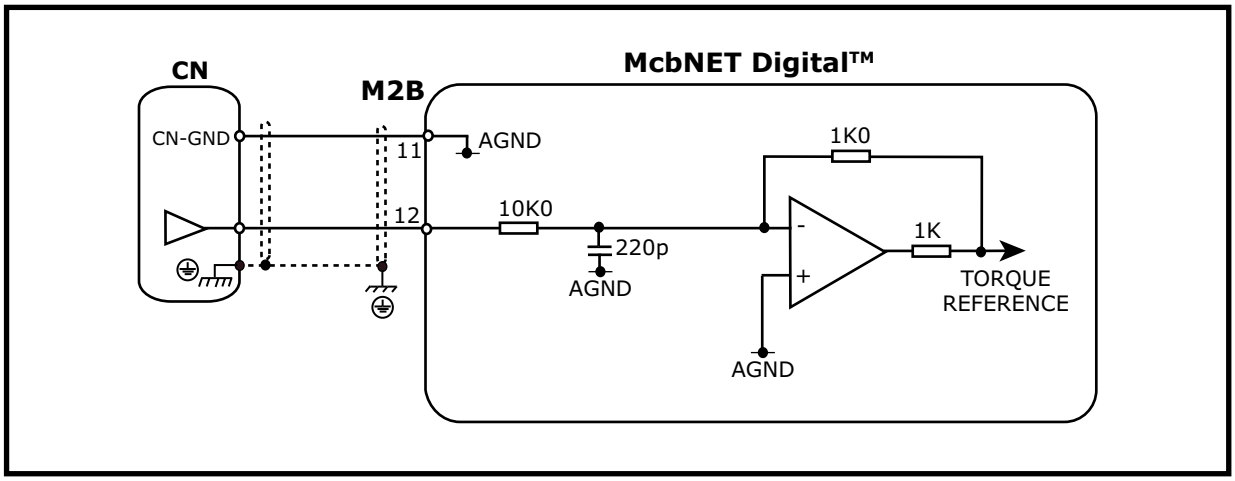
Note: We suggest to connect shield on both sides: drive side connect the shield to ground by using u clamp on the zinced panel of the electrical box.

4.9 TPRC analog input

The **McbNET Digital™** has an **analog input** (**TPRC**, pin **12** on the **M2B** connector) which can be used:

- to **control the current** delivered by the drive (by using a variable voltage between the range **0** and **+10V**) with speed control;

- to **control the system in torque** by using an external torque reference (by using a variable voltage between the range **±10V**).



Note: We suggest to connect shield on both sides: drive side connect the shield to ground by using u clamp on the zinced panel of the electrical box.

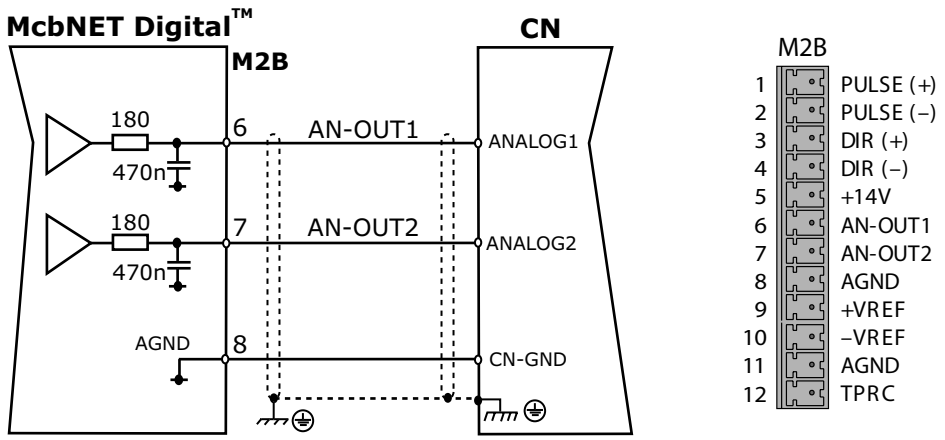
For a more detailed description about this analog input see the Chapter: "7.1 Torque limitation".

4.10 Analog outputs

The **McbNET Digital**™ provides **two analog outputs** (on the **6** and **7** terminals of the **M2B** connector), which permit visualisation by oscilloscope of some of the drive's measurement values.

The **AN-OUT1** and **AN-OUT2** outputs furnish **+/-10Volt** as the low scale setting refers to.

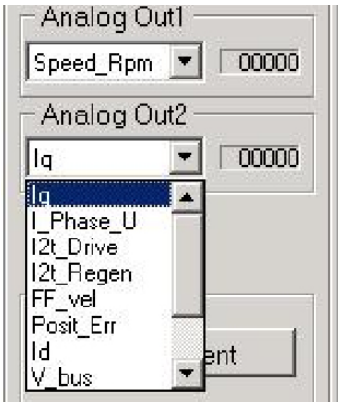
Example (Common mode connection):



Note: We suggest to connect shield on both sides: drive side connect the shield to ground by using u clamp on the zinced panel of the electrical box.

Utilizing the *Speeder One* you may set the **AN_OUT1** and **AN_OUT2** outputs; the different options are as follows:

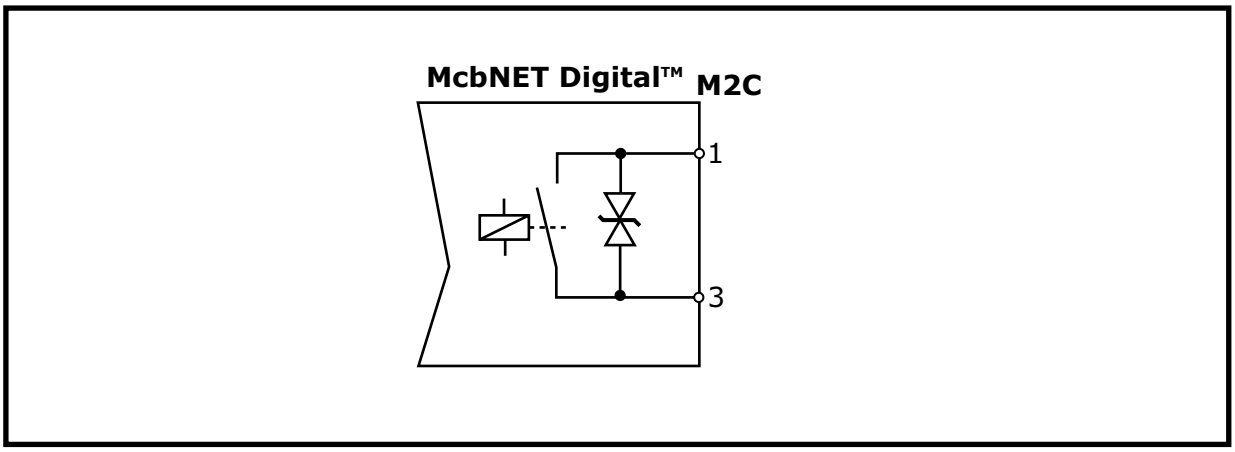
- drive's speed in RPM (**Speed_RPM**);
- Iu current (**I_Phase_U**);
- I^2t drive (**I2t_Drive**);
- I^2t Regen (**I2t Regen**), this option is not available with **McbNet Digital**™;
- feed forward speed (**FF_vel**);
- position error (**Posit_Err**);
- direct current (**Id**);
- bus voltage (**V_bus**), this option is not available with **McbNet Digital**™;
- motor angle(**Angle**), this option is not available with **McbNet Digital**™;
- quadrature current (**Iq**);
- +/-10V voltage reference (**+10Volt** and **-10Volt**).



4.11 Relè OK

On the **1** and **3** terminals on the **M2C** connector the "**Relè OK**" contact is available.

This contact is normally closed during drive functioning. It opens when an alarm intervenes on the drive, signaling the alarm on the display.



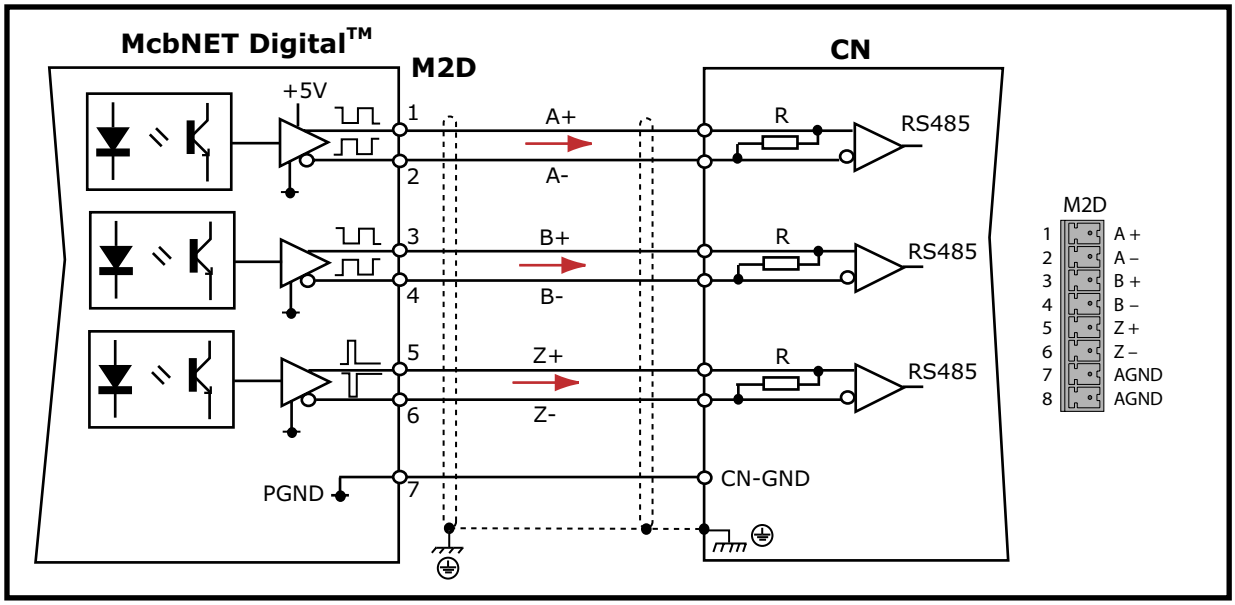
The **electrical characteristics** of the contact are the following:

- Resistive load: 500mA max
- Switching voltage: 30VAC/DC.
- UL (E 43149) - CSA (LR 26550) Approvals

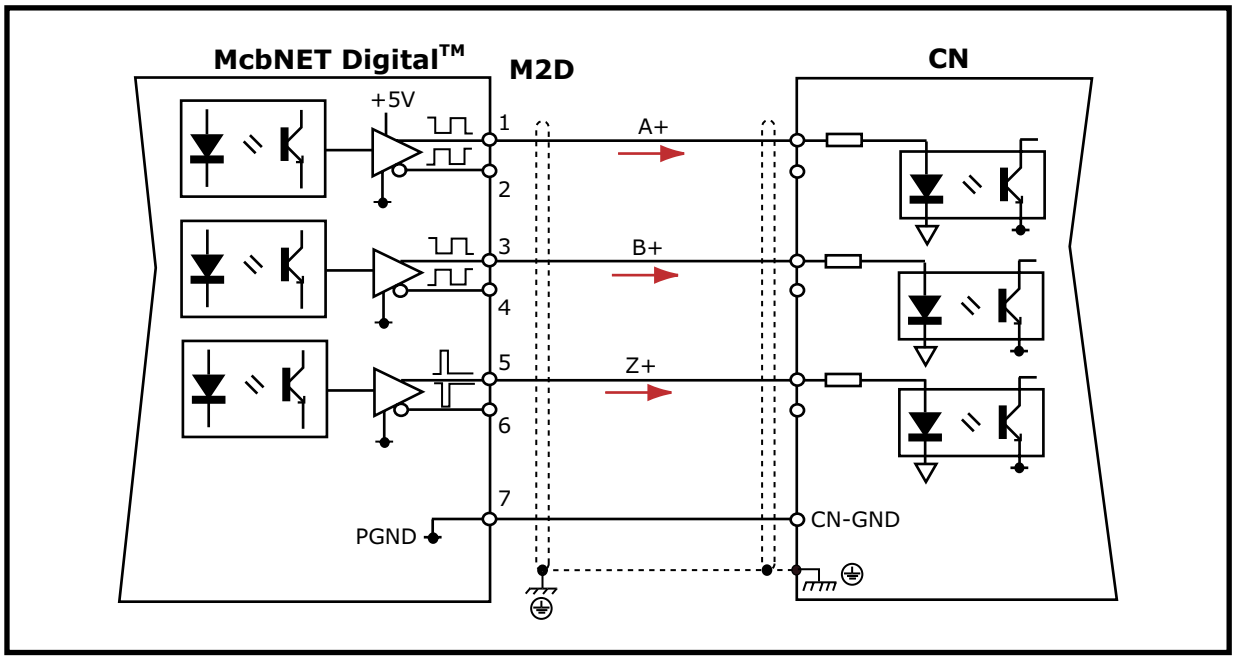
4.12 Encoder emulation

On **M2D** connector there are the **encoder emulation outputs** which permit to connect the drive to a CN or PLC.

The connections shown below are to be carried out when the Numeric Control or the axis card used have input gates for reading from **LINE-RECEIVER type encoders**:



When the Numeric Control uses **COMMON MODE** or **OPTO-ISOLATED** type inputs, execute the following type of connections:

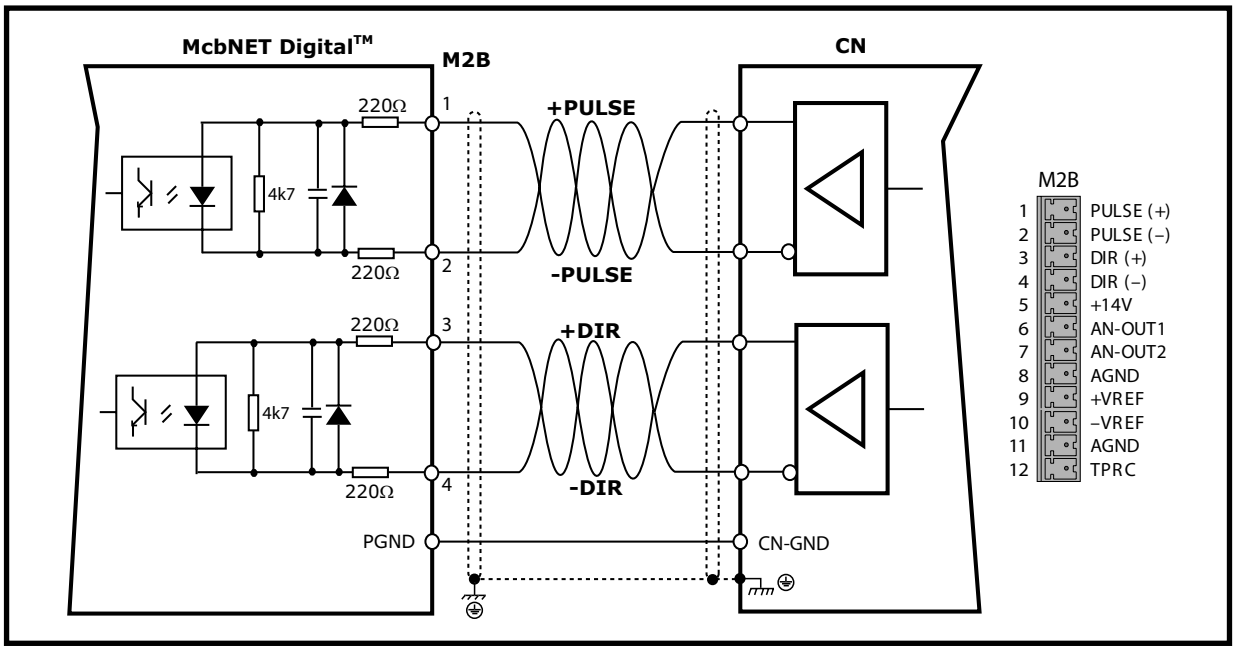


Note: We suggest to connect shield on both sides: drive side connect the shield to ground by using u clamp on the zinced panel of the electrical box.

The emulation output pulses are emitted under the form of two signals, **A** and **B**, which are electrically staggered by 90° and a zero signal, **Z**.

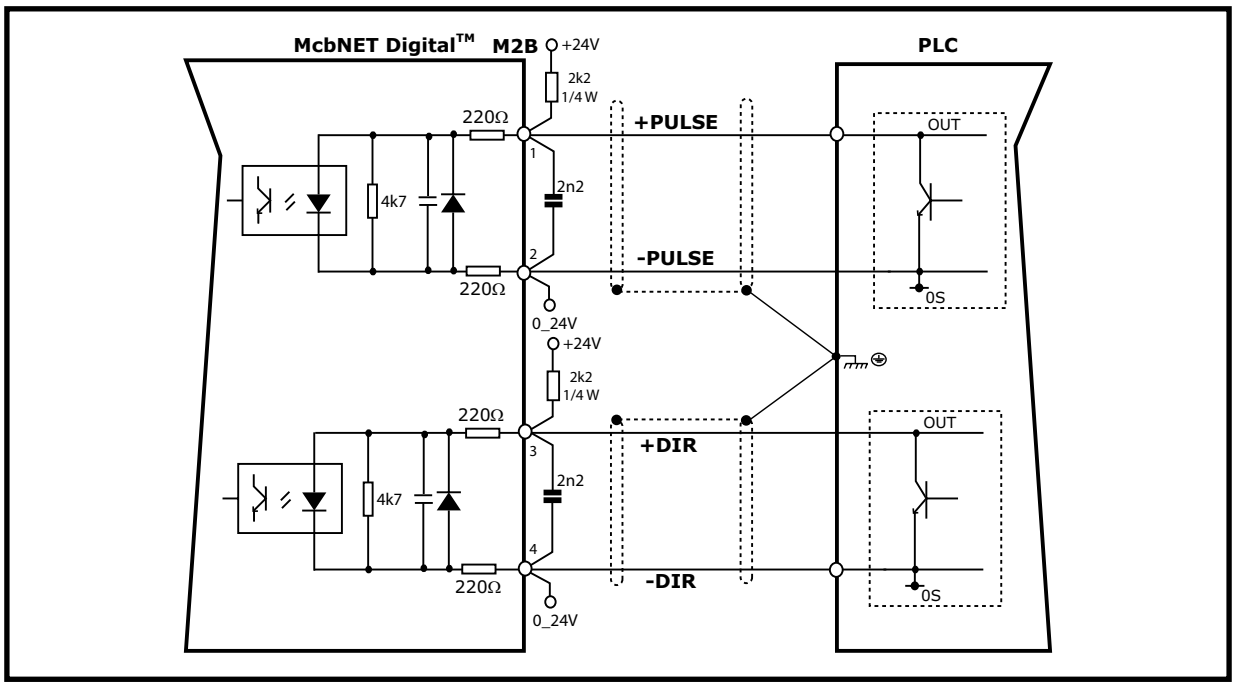
4.13 Pulse Direction Mode

The **McbNET Digital**™ has the pins **1**, **2**, **3**, **4**, on the **M2B** connector, which can be used to connect the drive to a **stepper-motor controller** (Pulse/Dir Mode).
The accepted logic levels are **0-5V**, while the max frequency is **200kHz**.



Note: We suggest to connect shield on both sides: drive side connect the shield to ground by using u clamp on the zinced panel of the electrical box.

If the CN supplies a logical signal equal to **0/+24V** open collector NPN, follow this connection:



Note: We suggest to shield separately the two couple of conductors and to connect together the shields and to the ground of the PLC.

4.14 Electrical Axis (Gearing)

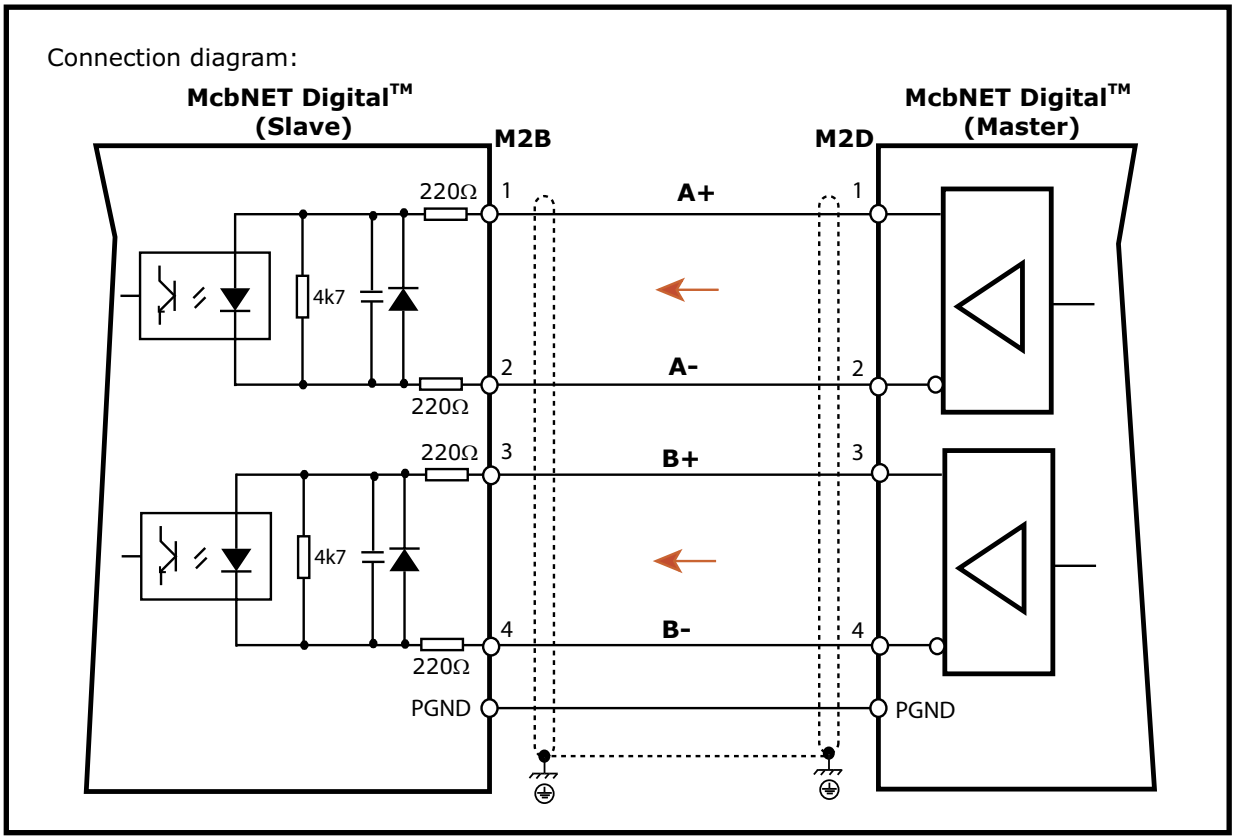
It is possible to connect together two **McbNET Digital**™ (the first drive will be set as **Master**, the second as **Slave**) and controll the Slave:

- by the i**ncreasing channels of the encoder** from the Master motor, or:

- by the **emulation encoder outputs** from the Master drive.

In the Slave it is necessary to use the pins 1, 2, 3, 4 on the M2B connector.

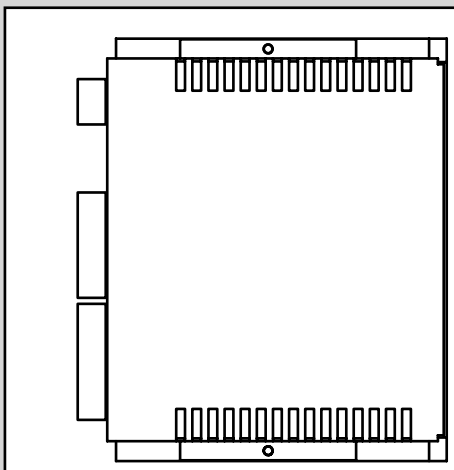
Connection diagram:



Note: We suggest to connect shield on both sides by using u clamps on the zinced panel of the electrical box.

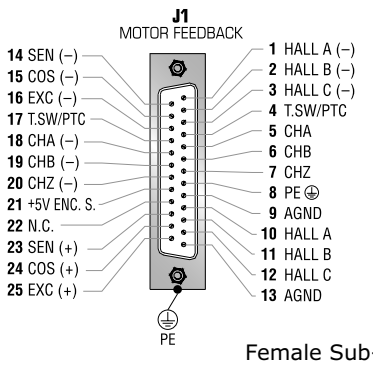
Note: If you want to connect more than two drives together contact Axor.

4.15 Motor signals



In the "**J1, Sub-D 25 Poles**" connector arrives all the signals coming from the brushless motor.
The cable utilized must absolutely be shielded and the section of each wire must be of 0.25 or 0.35 mm².

On request power and feedback cables for brushless motors series *SuperSAX* are available (cables series CBLS).



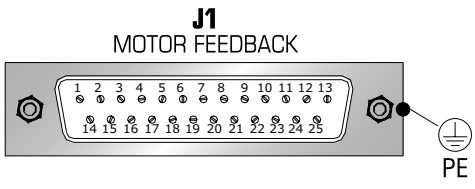
Female Sub-D 25 pole, solder view

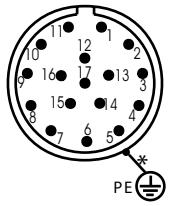
The drive can be furnished with **Encoder feedback** (incremental encoder and hall cells), or with a board for the **resolver** input.

4.16 Encoder feedback

If the **encoder feedback** is used, the wiring to the **J1** connector are the follows:

Sub-D 25 pole, J1	Function	Description	17 pole connector (Encoder)	Color Axor's cable
1	Hall U-	Negative hall signal.	12	White Yellow
2	Hall V-	Negative hall signal.	13	White Black
3	Hall W-	Negative hall signal.	16	Brown Yellow
4	T.SW/PTC	Motor thermal protection.	17	Blue
5	CHA+	Encoder channel A+.	5	Yellow
6	CHB+	Encoder channel B+.	7	Red
7	CHZ+	Encoder channel Z+.	9	Black
8	PE	Cable's external shield. Remove part of the outer insulation and connect it to the cabinet metal back plane and to the pin 8.	Connector metal ring	-
10	Hall U+	Positive hall signal.	11	Green Black
11	Hall V+	Positive hall signal.	14	Green Red
12	Hall W+	Positive hall signal.	15	Brown Grey
13	0V	Encoder power supply, +0V.	4	Brown Blue
13	AGND	Cable's internal shields.	Connector metal ring	-
17	T.SW/PTC	Motor thermal protection.	2	Grey
18	CHA-	Encoder channel A-.	6	Green
19	CHB-	Encoder channel B-.	8	Orange
20	CHZ-	Encoder channel Z-.	10	Brown
21	+5V	Encoder power supply, +5V. Max load 220mA. Protected from the short circuits, not protected from negative or alternate voltages.	3	Brown Red
9-14-15-16-22-23-24-25	-	Not connected.	-	-
Note: Use only a 16 pole globally shielded cable. It must have a capacity less than 120pF/m.				



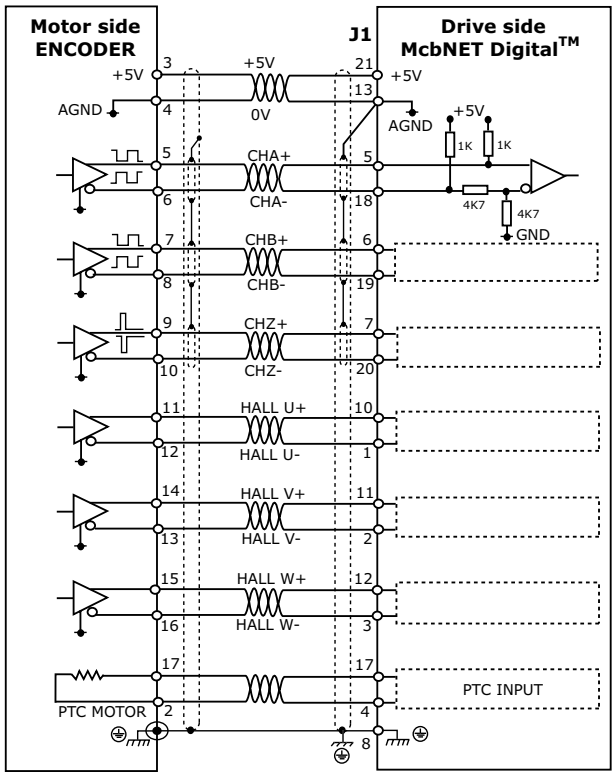


17 pole connector (Encoder)

Motor signal connector (differential mode input)

The figure illustrates the connections between an **Encoder with RS485 differential outputs** and the **McbNET Digital™**:

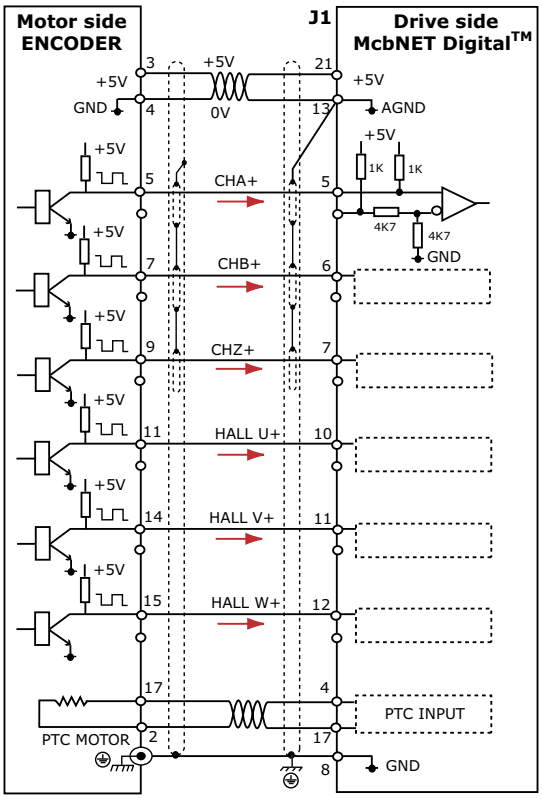
With this configuration improved transmission signal immunity is guarantee as opposed to common mode type signals.



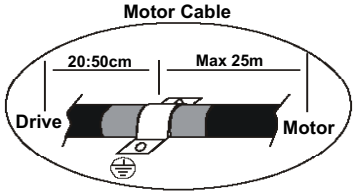
Motor signal connector (common mode input)

The figure illustrates the connections between an **Encoder with Open Collector type outputs** and the **McbNET Digital™**:

If the motor has not the thermal protection (PTC MOTOR) you shuld bridge the 4 and 17 pins on the "J1, Sub-D 25 pole" connector of the drive.



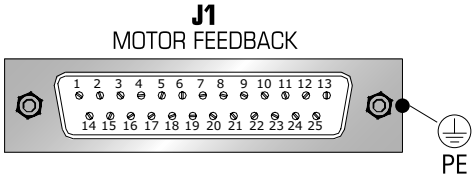
Note: The **ground connection** of the external shield must be made on the zinc-coated panel (using a cable tie) near the drive (20-50cm).
Motor size the shield is connected to connector's metal ring.

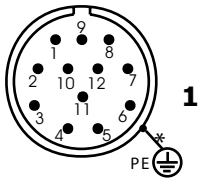


4.17 Resolver feedback

If the **resolver feedback** is used, the wiring to the **J1** connector are the follows:

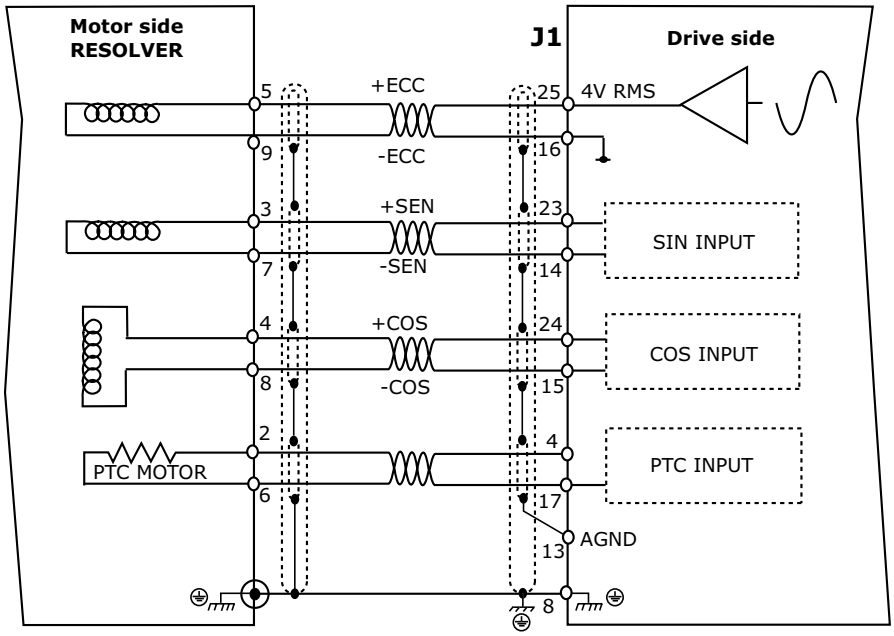
Sub-D 25 pole	Function	Description	12 pole connector (Resolver)	Color Axor's cable
1-2-3-5-6-7-9-10-11-12-18-19-20-21-22	-	Not connected.	1-10-11-12	
4	T.SW/PTC	Motor thermal protection.	2	Green
8	PE	External shield.	-	
13	AGND	Global internal schield.	Connector metal ring	Connected with the White cable (Exc(-))
14	Sen -	Negative resolver signal.	7	White
15	Cos -	Negative resolver signal.	8	White
16	Exc -	Negative resolver signal.	9	White
17	T.SW/PTC	Motor thermal protection.	6	White
23	Sen +	Positive resolver signal.	3	Yellow
24	Cos +	Positive resolver signal.	4	Blue
25	Exc +	Positive resolver signal.	5	Red
Note: It must be made by using four couples of conductors. Each couple must have the conductors twisted and shielded. It must be externally shielded. It must have a capacity less than 120pF/m.				





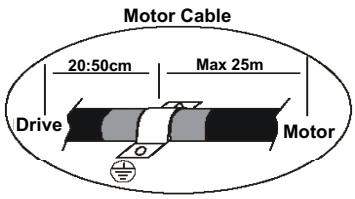
12 pole connector (Resolver)

The following figure illustrates the connections between the **resolver board** and the **McbNET Digital**™:



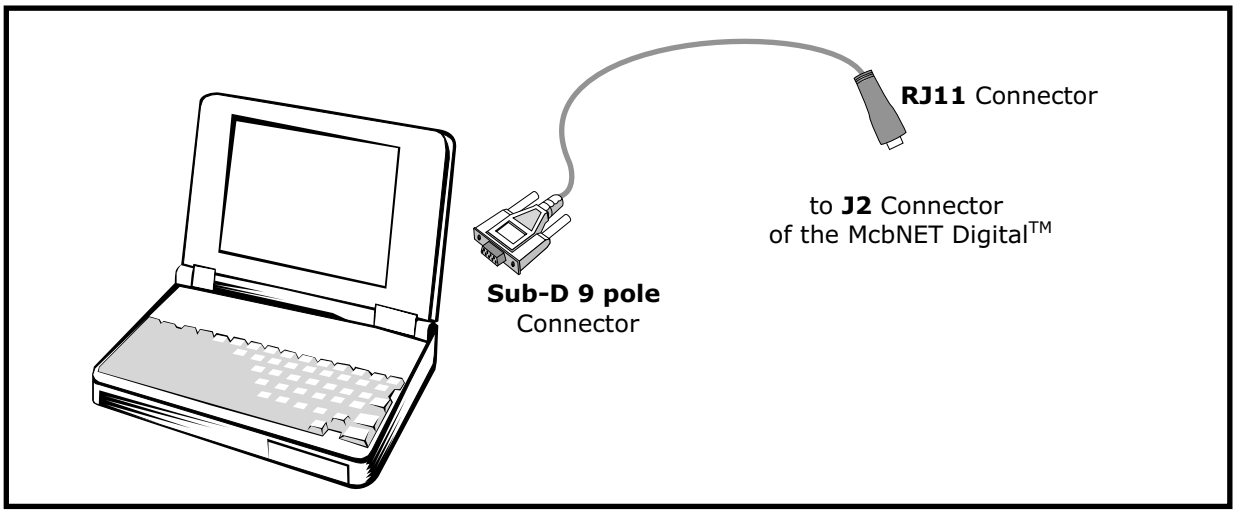
If the motor has not the thermal protection (PTC MOTOR) you shuld bridge the 4 and 17 pins on the "J1, Sub-D 25 pole" connector of the drive.

Note: The **ground connection** of the external shield must be made on the zinc-coated panel (using a cable tie) near the drive (20-50cm).
Motor size the shield is connected to connector's metal ring.



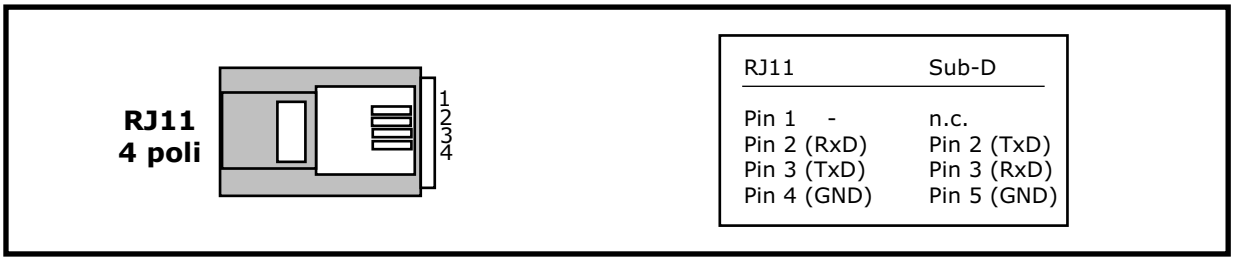
4.18 RS232 Interface

The *Speeder one* interface comunicates with the **McbNET Digital**™ by using the **RS232** serial cable and the ***ModBUS*** communication protocol.



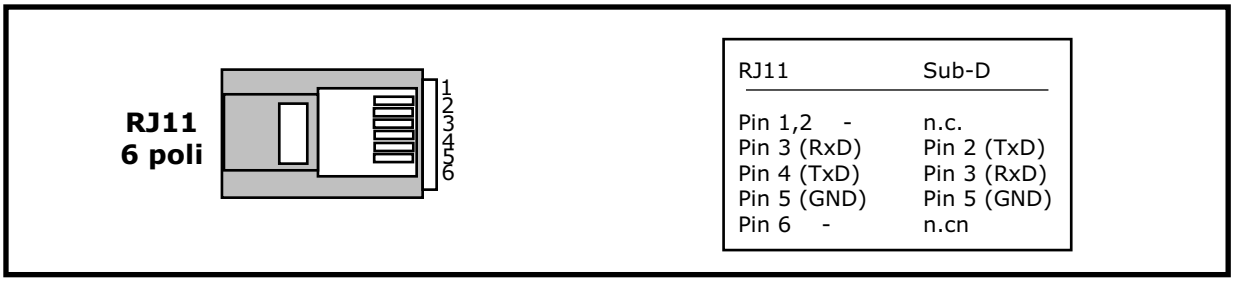
On request the RS232 cable can be supplied by Axor; otherwise it is possible to make the cable following this procedure:

1) take a normal telephone cable type **RJ11** (4 pole or 6 pole);
2) cut off one end and solder to a feminine **connettore Sub-D 9 pole**;
3) if a **RJ11 4 pole** connector is utilised execute the following connections:



RJ11	Sub-D
Pin 1 -	n.c.
Pin 2 (RxD)	Pin 2 (TxD)
Pin 3 (TxD)	Pin 3 (RxD)
Pin 4 (GND)	Pin 5 (GND)

if a **RJ11 6 pole** connector is utilised execute the following connections:



RJ11	Sub-D
Pin 1,2 -	n.c.
Pin 3 (RxD)	Pin 2 (TxD)
Pin 4 (TxD)	Pin 3 (RxD)
Pin 5 (GND)	Pin 5 (GND)
Pin 6 -	n.cn

Note:

- The maximum length of the prepared cable must not be superior to 2 meters.
- The cable is a "pin to pin" one and must be connected with the supply voltage disconnected.
- The RS232 interface is galvanicly isolated.

4.19 MultiDrop

It is possible to connect 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**.

The Axor drives use the **MODBUS communication protocol** specified in the **Modicon** instructions (see http://www.modicon.com/techpubs/ and the chapter 8.1: "ModBus Protocol").

MultiDrop SETTINGS:

In the "**General Settings**" window of each drive 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.

To make these settings operative save them onto the EEPROM and then disable and enable the drive.

MultiDrop CONNECTIONS:

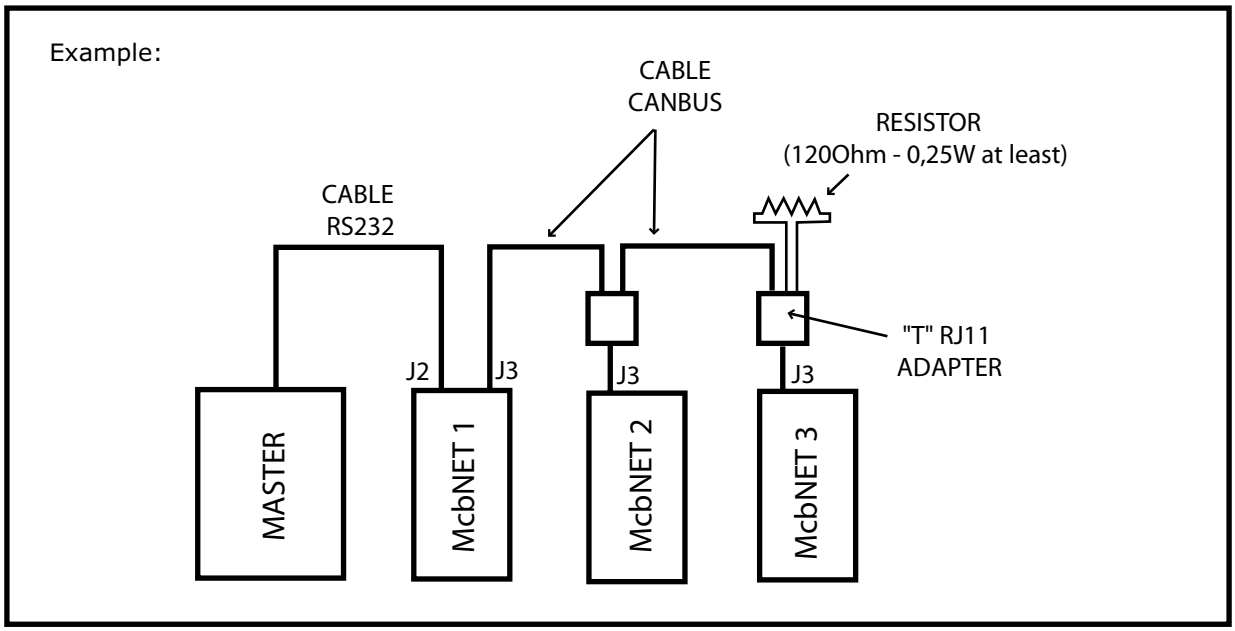
1. Connect the first **McbNET Digital**™ to the master PC by using the RS232 cable (**J2** connector) and to the following drive by using the CANBus cable;

2. connect each drive with the following by using "T" RJ11 adaptors as illustrated in the figure below;

3. connect a **RESISTOR** (**120 Ohm, 0.25W**) between the pins of the last drive as illustrated in the figure below;

Note: On request RS232 and CanBus cables are available by Axor.

Example:



4.20 Can Open

On connectors **J2**/**J3** the **CAN BUS communication interface** is available (defined velocity 500KBaud, max 1Mbit/sec).

The integrated software is based upon the **CAN open DS301** communication protocol and on profile **DSP402** (See the "**Axor - CANOpen reference manual**").
The interface is isolated by opto-isolators and a dc-dc power converter is present which powers all of the circuitry of this interface. It is therefore not necessary to connect any external power supply.

CanBus SETTINGS:

In order to create a CANBus network the user must:

- set the **baud rate** parameter (in the "**General Settings**" window in the Speeder One interface), to define the comunication speed and so the performance of the system.

- set the **NODE-ID** for each drive.

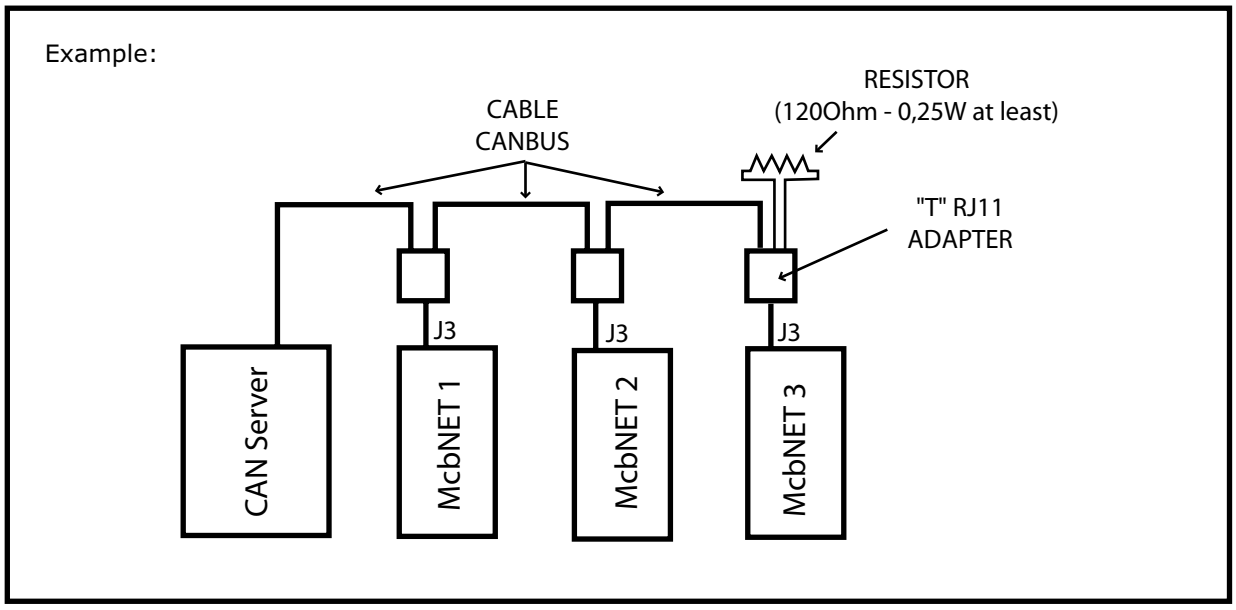
All drives connected to the network must have the same baud rate, and the two or more drives cannot have the same NODE-ID.

CanBus CONNECTIONS:

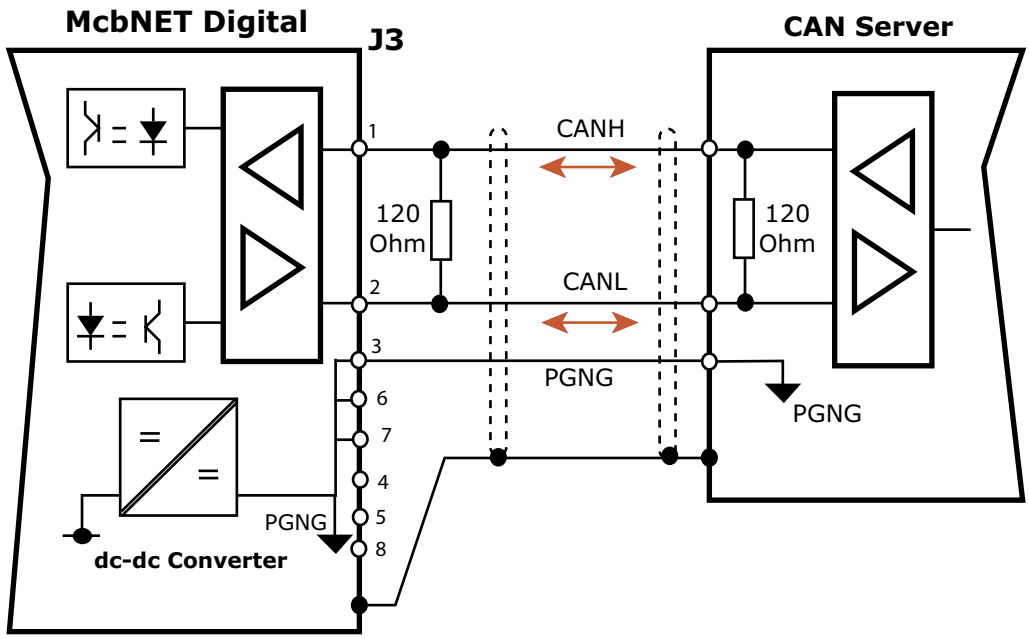
1. Connect the first **McbNET Digital™** to the MASTER by using a CanBus cable (from the **J3** connector to the Master).

2. Connect each **McbNET Digital™** to the following by using "T" RJ11 adaptors as illustrated in the figure below;

3. Connect a **RESISTOR** (120 Ohm, 0.25W) between the pins of the last drive of the network as illustrated in the figure below.



Connection diagram:

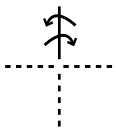


Chapter 5
Diagnostic

5.1 Display 58
5.2 Key pad 59
5.3 Key pad menu 60
5.4 Key pad functions 66
5.5 Error messages and protections 67

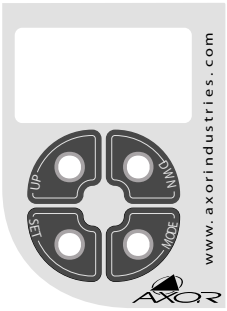
5.1 Display

A **display LED** visualises: the drive's status, the inserted values, the alarms.

Symbol	Description
F	The digital input ENABLE is enabled, while the digital input set with the "Ref on" function is disabled.
E	The digital input ENABLE is disabled, while the digital input set with the "Ref on" function is enabled.
[ ]	The digital input ENABLE and the digital input set with the "Ref on" function are both enabled; or only the digital input ENABLE is enabled and there is not any input set with the "Ref on" function. The motor does not move.
 (segment appears rotating in a clockwise or counter-clockwise direction)	The rotor is turning in a clockwise or counter-clockwise direction.
0ı	This appears when the negative limit switch (NSTOP) is interrupted.
0 ı	This appears when the positive limit switch (PSTOP) is interrupted.
- - -	This appears when the converter is correctly powered on, the digital input ENABLE is disabled and there are no alarms.
24 UP	This appears when there is the +24VDC auxiliary supply, but not the main supply.

5.2 Key pad

The **4 keys** (**UP**, **DWN**, **SET**, **MODE**) present on the **McbNET Digital**™ allow the insertion and variation of the main parameters even without having a PC connected.



UP.....Press once to scroll through the menu upwards.
DW....Press once to scroll through the menu downwards.
SET...Press once to enter the menu or to memorize settings.
MODE...Press once to return to the previous menu.

Example: Suppose we want to change the number of resolver pole.

1) From the tables of the next pages reach the menu of the desired parameter: **F3** → **d2** (address "**8**").

2) Press once **SET**: **F1** will be visualised.

3) Press twice **UP** in order to visualise **F3**.

4) Press once **SET** in order to enter into the **F3** menu: **d1** will be visualised.

5) Press once **UP** in order to visualise **d2**.

6) Pressing once **SET** the value preceading memorised in the "Nr of resolver pole" parameter will be visualised. By using **UP** and **DWN** increment or decrement the value of the parameter.

7) Press once **SET** to confirm the new value.

8) Press once **MODE** to return to the preceading menu.

5.3 Key pad menu

Menu F1		Address	Min	Max
b1	Drive Version	0	-32768	32767
b2	Firmware Version	1	-32768	32767
Menu F2	**COMMUNICATION**			
c1	Drive Address (1)	2	0	127
c2	Baud Rate RS232	3	0	32767
c3	Baud Rate Can	4	50	1000
c4	Reserved by Can	5	-32768	32767
c5	Reserved by Can	6	-32768	32767
Menu F3	**MOTOR**			
d1	Nr. of motor pole	7	0	12
d2	Nr. of resolver pole	8	2	12
d3	Encoder pulses/turn	9	256	8192
d4	I^2t motor	10	0	999
d5	Phase angle (2)	11	0	3600
d6	Feedback type (3)	12	0	20
Menu F4	**CURRENT LOOP**			
E1	Nominal current (4)	13	1	50
E2	Peak current (5)	14	1	100
E3	Kp current Iq	15	0	999
E4	Ti current Iq (18)	16	0	999
E5	Analog In 1 Filter (18)	17	0	1000
E6	Kp current Id	18	0	999
E7	Ti current Id (18)	19	0	999
E8	Parity	20	-32768	32767
E9	I^2t Drive	21	0	999
E10	Analog In 2 Filter (18)	22	0	1000
Menu F5	**SPEED LOOP**			
h1	Kp speed	23	0	4000
h2	Ki speed	24	0	4000
h3	Kd speed	25	0	4000
h4	Feedback filter (18)	26	0	999
h5	Reference filter (18)	27	0	999
h6	Dead Band An In 1	28	0	10000
h7	Offset Analog In 1 (8)	29	-32768	32767
h8	Offset Analog In 2 (8)	30	-32768	32767
h9	Maximum speed	31	128	8000
h10	Speed limit +	32	128	8000
h11	Speed limit -	33	128	8000
h12	Acceleration ramp (6)	34	0	5000
h13	Deceleration ramp (6)	35	0	5000
h14	Emergency ramp (6)	36	0	5000
h15	Square wave period (6)	37	0	32767

MENU F6	**SPACE LOOP**			
P1	Dynamic gain	38	0	999
P2	Static gain	39	0	999
P3	Reserved positioner	40	0	999
P4	Position feedforward	41	0	150
P5	Max. position error (9)	42	1000	32767
P6	Position state	43	-32768	32767
P7	Position control	44	-32768	32767
MENU F7	**ELECTRICAL AXIS**			
L1	Pulse/rev Master	45	128	
L2	Numerator gear	46	-32768	32767
L3	Denominator gear	47	1	32767
MENU F8	**PULSE/DIRECTION**			
A1	Pulse per turn	48	100	800
A2	Pulse/Direction filter (18)	49	0	999
A3	Dead Band An In 2 (7)	50	0	10000
MENU F9	**MONITOR**			
o1	Alarm HI	51	-32768	32767
o2	Alarm LO	52	-32768	32767
o3	Bus voltage	53	0	1000
o4	Motor temperature	54	-32768	32767
o5	Drive temperature	55	-32768	32767
o6	Iu Offset	56	-32768	32767
o7	Iv Offset	57	-32768	32767
o8	Current feedback	58	-32768	32767
o9	Speed feedback	59	-32768	32767
o10	Position feedback	60	-32768	32767
o11	Monitor 1	61	-32768	32767
o12	Monitor 2	62	-32768	32767
o13	State 1	63	-32768	32767
o14	State 2	64	-32768	32767
o15	State digital I/O	65	-32768	32767
MENU F10	**SETTINGS**			
U1	Monitor settings 1	66	0	50
U2	Monitor settings 2	67	0	50
U3	Encoder Out settings (10)	68	1	8
U4	Commands (11)	69	-32768	32767
U5	Configurations 1	70	-32768	32767
U6	Operative Mode (12)	71	0	20
U7	HW digital I/O	72	-32768	32767
U8	I/O dig SW set (13)	73	-32768	32767
U9	I/O dig SW clr (14)	74	-32768	32767

MENU F11	MIX			
H1	Tar. V_Bus 1	75	-32768	32767
H2	Tar. V_Bus 2	76	-32768	32767
H3	Tar. drive temperature	77	-32768	32767
H4	Tar. motor temperature	78	-32768	32767
H5	Current digital reference	79	-4096	4095
H6	Speed digital reference (15)	80	-32768	32767
H7	Position digital reference	81	-32768	32767
H8	Password	82	-32768	32767
H9	Historical alarms 1	83	-32768	32767
H10	Historical alarms 2	84	-32768	32767
H11	Boot Version	85	-32768	32767
H12	Main Voltage	86	0	480
H13	DGT-IN3 settings (16)	87	0	32767
H14	DGT-IN4 settings (16)	88	0	32767
MENU F12	**POSITION**			
I1	Reserved positioner	89	-32768	32767
I2	Homing speed	90	1	1000
I3	Homing type (17)	91	0	100
I4	Homing_offset_HI	92	-32768	32767
I5	Homing_offset_LO	93	-32768	32767
I6	ModBus_Command	94	-32768	32767
I7	ModBus_Data_HI	95	-32768	32767
I8	ModBus_Data_LO	96	-32768	32767
I9	ModBus_Answer_HI	97	-32768	32767
I10	ModBus_Answer_LO	98	-32768	32767
I11	Flash Alarm Code	99	-32768	32767
I12	Abs position 2	100	-32768	32767
I13	Abs position 1	101	-32768	32767
I14	Abs position 0	102	-32768	32767
I15	Regen resistor	103	-32768	32767
I16	DGT-IN2 settings (16)	104	-32768	32767
I17	DGT-IN5 settings (16)	105	-32768	32767
I18	Homing Acc	106	10	5000
I19	Homing zero speed	107	1	50
I20	Max search angle	108	0	359
MENU F13				
C1	Reserved by Can	109	-32768	32767
C2	Reserved by Can	110	-32768	32767
C3	Reserved by Can	111	-32768	32767
C4	Reserved by Can	112	-32768	32767
C5	Reserved by Can	113	-32768	32767
C6	Reserved by Can	114	-32768	32767
C7	Reserved by Can	115	-32768	32767

C8	Reserved by Can	116	-32768	32767
C9	Reserved by Can	117	-32768	32767
C10	Reserved by Can	118	-32768	32767
C11	Reserved by Can	119	-32768	32767
C12	Reserved by Can	120	-32768	32767
C13	Reserved by Can	121	-32768	32767
C14	Reserved by Can	122	-32768	32767
C14	P_Codice_Alrm_FLASH	123	-32768	32767
MENU F14				
]1	PULSE In settings (16)	124	-32768	32767
]2	DGT-OUT1 settings (16)	125	-32768	32767
]3	DGT-OUT2 settings (16)	126	-32768	32767
]4	Dir_In_settings (16)	127	-32768	32767
]5	DGT-IN2_value	128	-32768	32767
]6	DGT-IN3_value	129	-32768	32767
]7	DGT-IN4_value	130	-32768	32767
]8	DGT-IN5_value	131	-32768	32767
]9	Pulse-In_value	132	-32768	32767
]10	Dir-In_value	133	-32768	32767
]11	Vis_Position_hi	134	-32768	32767
]12	Vis_Position_lo	135	-32768	32767
]13	DGT-OUT1_value	136	-32768	32767
]14	DGT-OUT2_value	137	-32768	32767
]15	Vis Analog In 1	138	-32768	32767
]16	Vis Analog In 2	139	-32768	32767
MENU F15				
n1	Deflux_1	140	-32768	32767
n2	Deflux_2	141	-32768	32767
n3	Deflux_3	142	-32768	32767
n4	Kp speed 2	143	0	4000
n5	Ki speed 2	144	0	4000
n6	Kd speed 2	145	0	4000
n7	Feedback filter 2	146	0	999
n8	PID-filter 2	147	0	999
n9	Switch speed	148	64	8000
n21	Aux_Monitor 1	160	-32768	32767
n22	Aux_Monitor 1	161	-32768	32767

(1) To activate the parameter about the Baud Rate RS232, you must turn the drive off and then on.

(2) The phase angle is expressed in *electrical degrees*.

(3) Insert 0 to set the *Encoder feedback* (incremental encoder + hall cells), insert 1 to set the *Resolver feedback*.

(4) Insert the value in *percentage* of the rated current furnished by the drive referred to the peak current; example: setting 15%, having a drive size 8/16A, the rated current will be equal to 2,4A.

(5) Insert the value in *percentage* of the peak current furnished by the drive; example: setting 75%, having a drive size 8/16A, the peak current will be equal to 12A.

(6) Value expressed *in ms*.

(7) Value expressed *in mV*.

(8) The value has to be normalized reference to +/-10V.
Example: Suppose we want to set the offset of the analog input 1 equal to 16mV ⇨ insert on the address F5 → H7 this value:

$$\frac{16m \times 2^{15}}{10} = 53$$

(9) Insert the desired value *in pulses*.

(10) Insert: - 1 to divide the encoder pulse per turn by 1;
- 2 to divide the encoder pulse per turn by 2;
- 3 to divide the encoder pulse per turn by 4;
- 4 to divide the encoder pulse per turn by 8;
- 5 to divide the encoder pulse per turn by 16;
- 6 to divide the encoder pulse per turn by 32;
- 7 to divide the encoder pulse per turn by 64;
- 8 to divide the encoder pulse per turn by 128.

(11) Insert: - 1 to read EEPROM's parameters
- 2 to memorise parameters into EEPROM
- 4 to read default parameters
- 8 to execute the speed offset
- 16 to do the autophasing
- 32 to write motion parameters into Flash
- 64 to read motion parameters from Flash
- 256 to execute the torque offset

(12) Insert the number of the desired *operative mode*:
- 0 to set Analog Speed
- 1 to set Digital Speed
- 2 to set Analog Torque
- 3 to set Digital Torque
- 4 to set Position Mode
- 5 to set Gearing
- 6 to set Pulse/Dir Mode
- 7 to set Can Open
- 10 to set Square Wave

(13) Insert: - 1 to set the digital input DGT-IN1
- 2 to set the digital input DGT-IN2
- 4 to set the digital input DGT-IN3
- 8 to set the digital input DGT-IN4
- 16 to set the digital input DGT-IN5
- 32 to set the digital input DGT-IN6
- 64 to set the digital input DGT-IN7
- 128 to set the digital input DGT-IN8
- 256 to set the digital input DGT-IN9

(14) Insert: - 1 to reset the digital input DGT-IN1
- 2 to reset the digital input DGT-IN2
- 4 to reset the digital input DGT-IN3
- 8 to reset the digital input DGT-IN4
- 16 to reset the digital input DGT-IN5
- 32 to reset the digital input DGT-IN6
- 64 to reset the digital input DGT-IN7
- 128 to reset the digital input DGT-IN8
- 256 to reset the digital input DGT-IN9

(15) The value has to be normalised reference to the max set speed.
Example: Suppose we want to insert a digital speed reference equal to 1500rpm, having as max speed 3000rpm ⇨ insert on the address F11 → H6 this value:

$$\frac{1500 \times 2^{15}}{3000} = 16384$$

(16) Insert the number of the desired function.

(17) Insert the number of the desired *homing type*:
- 0 for setting No homing
- 1 for setting Homing method 1 (direct)
- 2 for setting Homing method 2 (inverse)
- 3 for setting Homing method 3
- 4 for setting Homing method 4
- 5 for setting Homing immediate

(18) Value expressed *in ms* and *mulplied by 10*.
Example: Suppose we want to set a value equal to 1,2ms ⇨ insert into the predisposed address the value 12 (in fact 1,2x10=12).

5.4 Key pad functions

Some functions managing by the key pad are illustrated below:

Drive enable

Menu F10 → U8 → set 1 → SET

Drive disable

Menu F10 → U9 → set 1 → SET

Setting of the digital inputs

Menu F10 → U8 → set 1 (DGT-IN1) → SET
→ set 2 (DGT-IN2)
→ set 4 (DGT-IN3)
→ set 8 (DGT-IN4)
→ set 16 (DGT-IN5)
→ set 32 (DGT-IN6)
→ set 64 (DGT-IN7)
→ set 128 (DGT-IN8)
→ set 256 (DGT-IN9)

Example: if you want to set the digital input DGT-IN5, insert the value 16; if you want to set contemporary the digital inputs DGT-IN6 and DGT-IN9, insert the value 32+256=288.

Resetting of the digital inputs

Menu F10 → U9 → set 1 (DGT-IN1) → SET
→ set 2 (DGT-IN2)
→ set 4 (DGT-IN3)
→ set 8 (DGT-IN4)
→ set 16 (DGT-IN5)
→ set 32 (DGT-IN6)
→ set 64 (DGT-IN7)
→ set 128 (DGT-IN8)
→ set 256 (DGT-IN9)

Example: if you want to reset the digital input DGT-IN4, insert the value 8; if you want to set contemporary the digital inputs DGT-IN1 and DGT-IN6, insert the value 1+32=33.

Memorisation of the parameters on EEPROM

Menu F10 → U4 → insert the value 2 → SET

5.5 Error messages and protections

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 opening of the internal "Relè OK" contact and the block of the drive, others visualise only a message without change the system's functioning.
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);
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.

5.5 Error messages and protections

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 opening of the Relè Ok contact and the disabling of the functioning. Disable the drive, try to memorise the parameter, then rienable. If the alarm persists contact Axor.	Resets itself
AL2	**Overcurrent**	Short circuit between U, V, W or toward earth. This causes the opening of the Relè Ok contact and 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 opening of the Relè Ok contact and 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 opening of the Relè Ok contact and the disabling of the functioning. Disable the drive, verify the cell's wire, reset the alarm, then enable the drive. If the alarm persists contact Axor.	Can be reset
AL5	**Encoder**	This alarm goes on if one or more of the encoder channels are interrupted. This causes the opening of the Relè Ok contact and the disabling of the functioning. Disable the drive, control the connections, reset the alarm, then enable the drive. If the alarm persists 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 opening of the Relè Ok contact and 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 opening of the Relè Ok contact and 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 opening of the Relè Ok contact and 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
AL12	**Resolver**	Missing of resolver's power supply/signal. This causes the opening of the Relè Ok contact and the disabling of the functioning. Disconnect the power, control the resolver's contact, then power again.	Cannot be reset
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 opening of the Relè Ok contact and 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 two fixed extra-run positions are both interrupted. This causes the opening of the Relè Ok contact and 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. Disable the drive, save new values, then rienable. 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"

Chapter 6
Speeder One

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6.1 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 communicates with the drive via *serial RS232* (J2 connector). For a more detailed description of the RS232 interface and the realisation of the communication cable see chapters "3.1: Wiring" and "4.18: 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

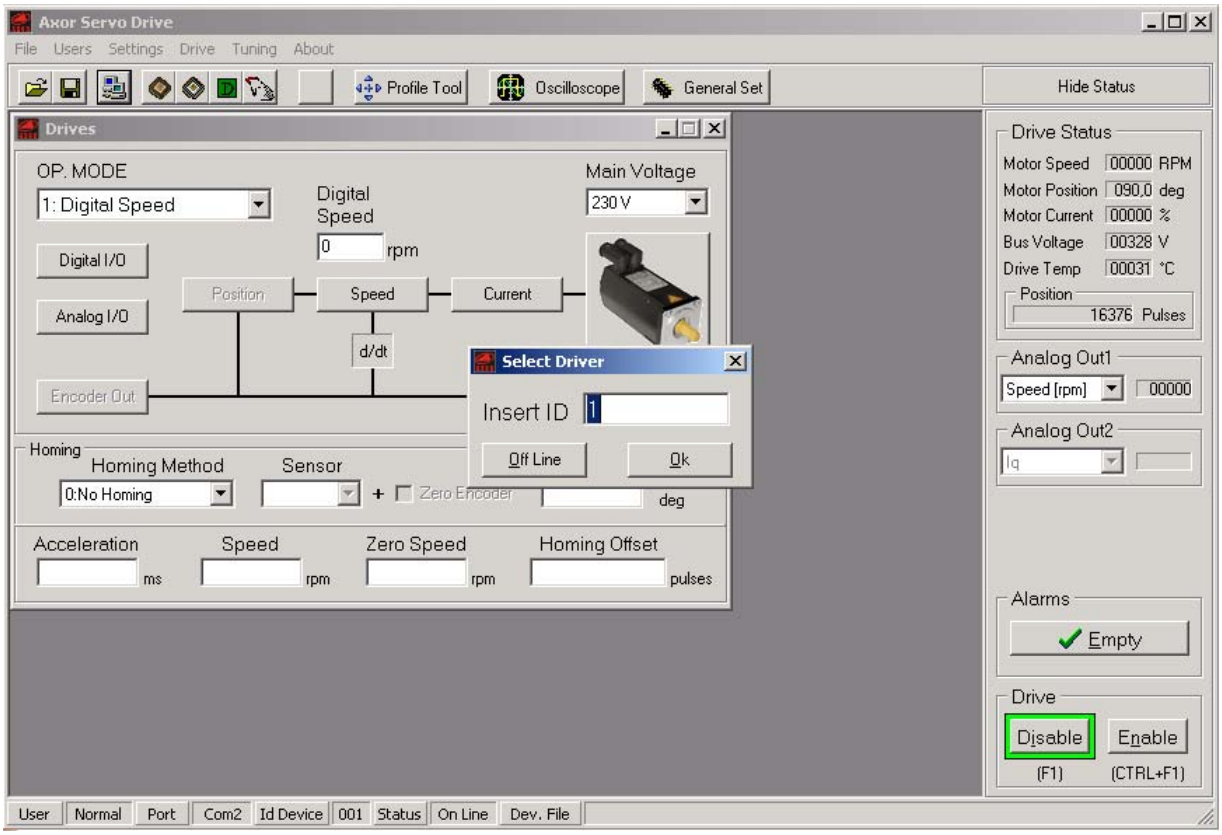
Installation procedure:

1- connect the RS232 cable to the PC serial interface and to the J2 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 or keypad, should be done only by technically qualified personnel.

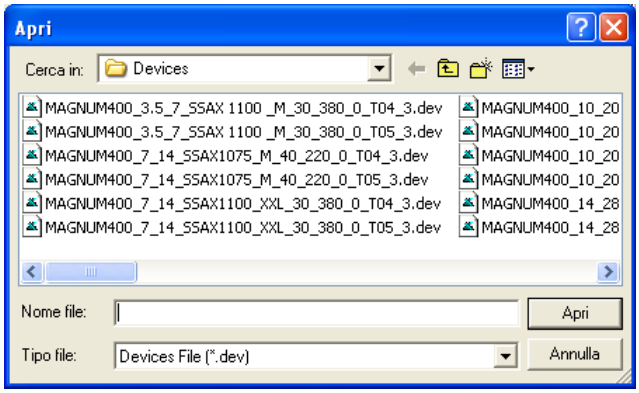
Note: All parameter settings by Speeder One interface can be changed and are visible by keypad. On the following pages, near the name of parameters there is the corresponding address, that you can use during keypad management.
We suggest that you re-read the chapter 5: "Diagnostic".

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



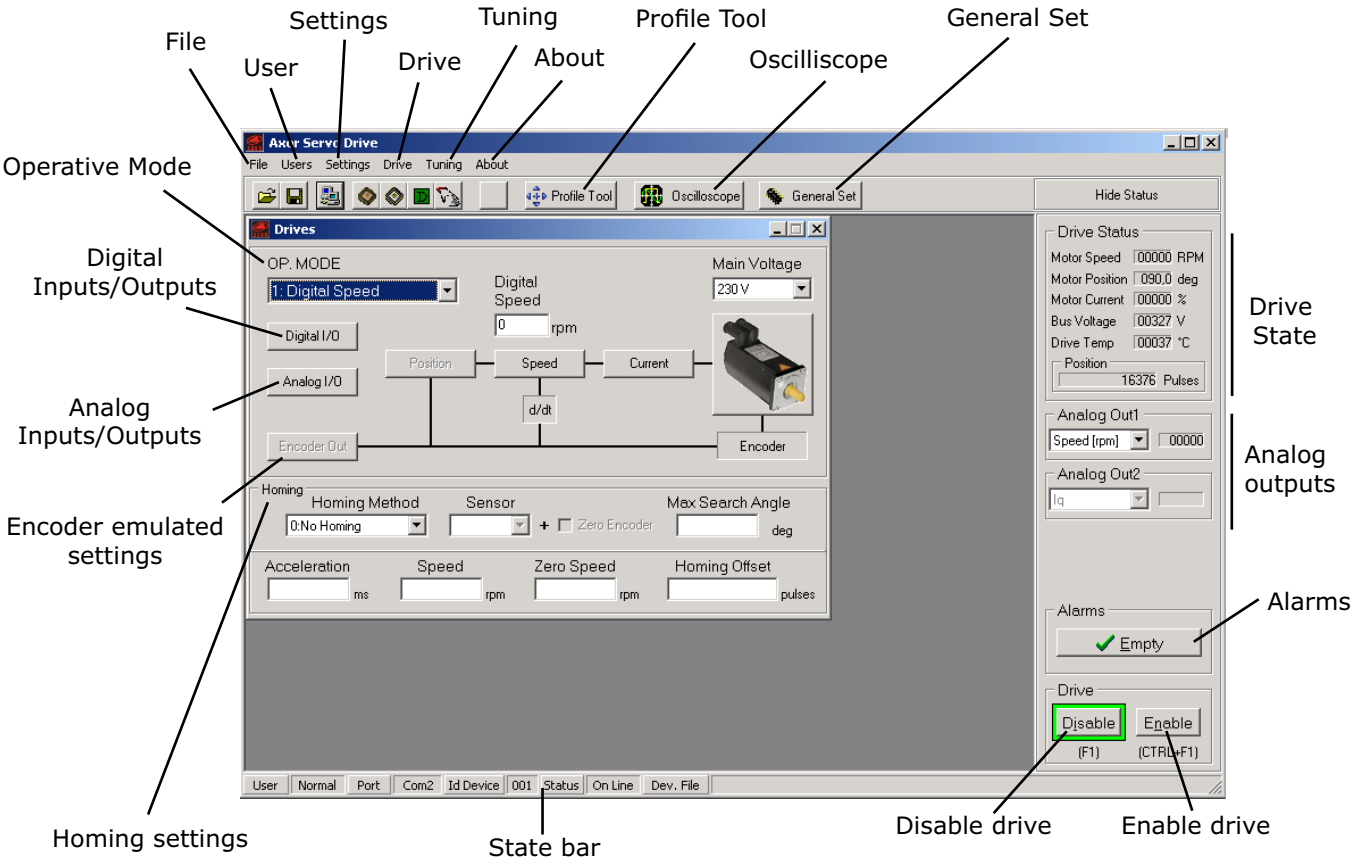
The window "**Select drive**" allows you to select the drive's address with which you wish to communicate; this permits "**single drop communication**" (with a single driver) or "**multi drop communication**" (with multiple drivers).
All drives have as default value **1**. It is possible to change the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



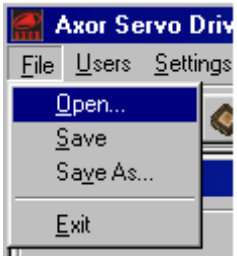
6.2 Main menu

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

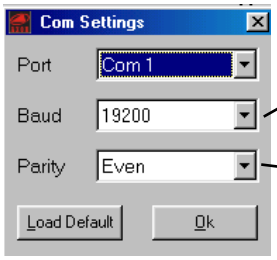
Axor reserved information.

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.

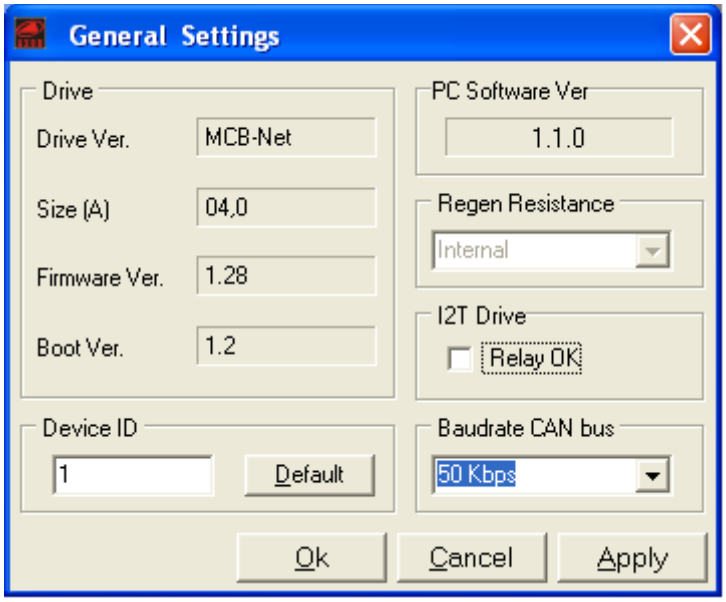


By clicking on "**Baud**", you can set the velocity communication baud rate between PC and driver.
[by keypad: F2 ⇨ c2]

By clicking on "**Parity**", you can display the parity bit settings.
[by keypad: F4 ⇨ E8]

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 [by keypad: F12 ⇨ I15]

It visualizes the type of regen resistance: External.

Relay OK

It enables two functions:

- "**open with I2t Drive**": It enables or not the opening of the "Relè OK" contact during the alarm 6: "I^2T Drive" ;
- "**closed when ready**": **This function is <u>not</u> available for the McbNET Digital™**.

Baudrate CAN bus [by keypad: F2 ⇨ c3]

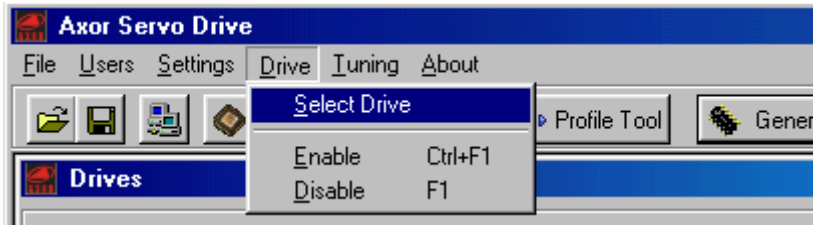
This option allows you to set the "baudrate" of the drive during the Can Bus communications. The selectable values are those specified by the CAN DS301 ver. 4.0.2 instructions, therefore: 50, 100, 125, 250, 500, 800, 1000 Kbps.

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.

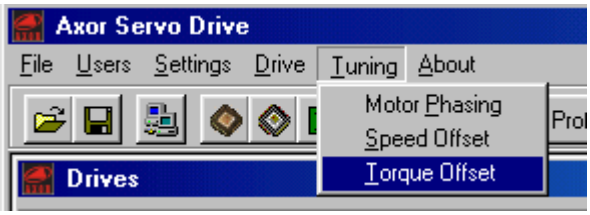
Drive

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**"), the offset of the speed analog input reference ("**Speed offset**") or the torque offset settings ("**Torque Offset**").



Motor Phasing

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

Speed Offset

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

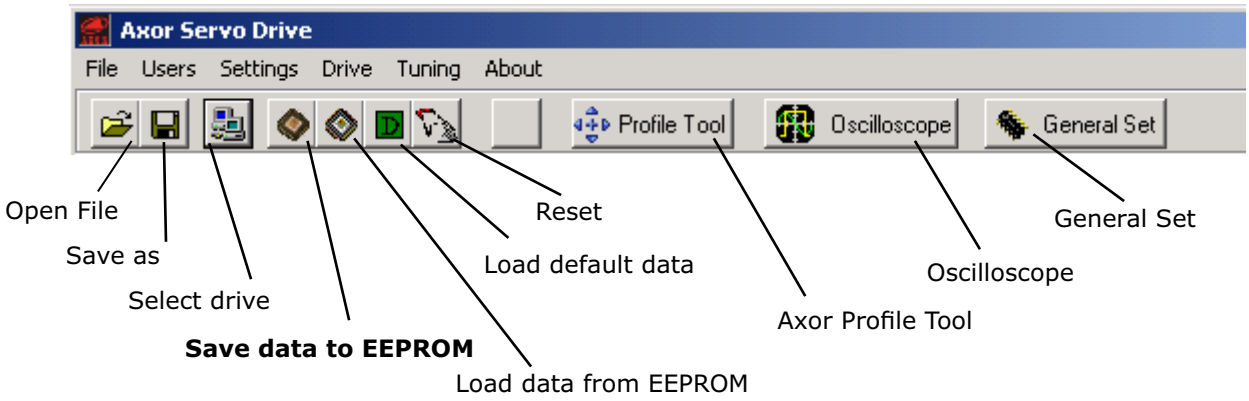
Torque Offset

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

About

This option shows the program version and additional information, for example: "Axor Servo Drive Software 1.0.2".

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 [by keypad: F10 ⇨ U4]
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 [by keypad: F10 ⇨ U4]
It loads all the values which are present on EEPROM to the drive.
The program asks for confirmation.

Load default data [by keypad: F10 ⇨ U4]
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.

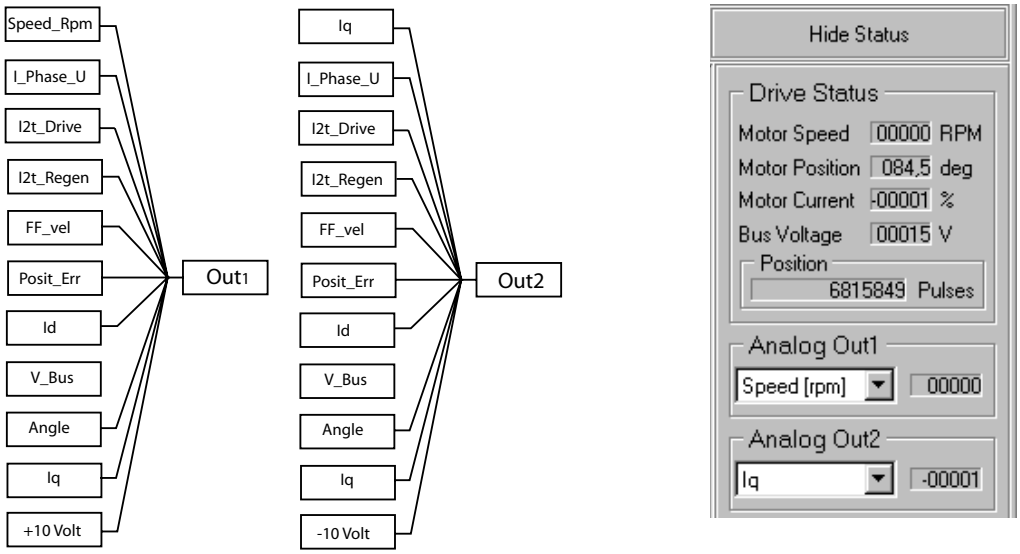
Axor Profile Tool
It opens the "**Axor Profile Tool**" window, with which you can setup all the parameters about the positioner.

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

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

6.3 Drive Status

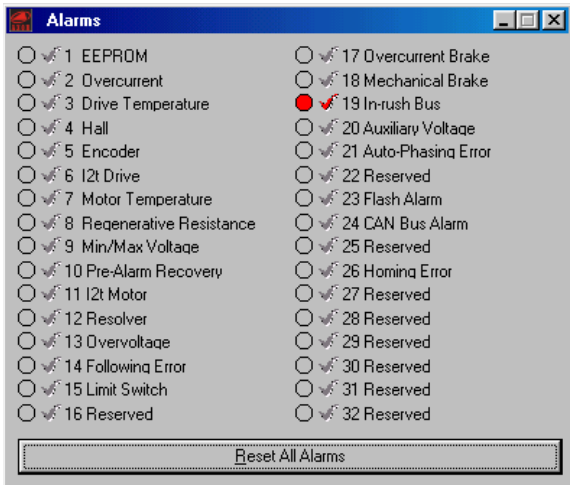
Drive Status (Status bar on the right of the main window)
- **Motor Speed** displays the velocity of the motor in RPM;
- **Motor Position** displays the rotor position in mechanical degrees;
- **Motor Current** displays the motor current (in percentages) with respect to twice the rated current of the drive. 50%= rated current, 100%= 2*rated current;
- **Bus Voltage** displays the bus voltage;
- **Position** displays the rotor position in pulses (only in the following operative modes: "4: Position Mode", "5: Gearing", "6: Pulse/Dir Mode");
- **Analog Out1** and **Analog Out2**: by clicking on those it is possible to select which internal parameter will be put into the analog outputs. Default settings are: "motor speed" on Analog Out1 and "motor current" on Analog Out2.



Alarms

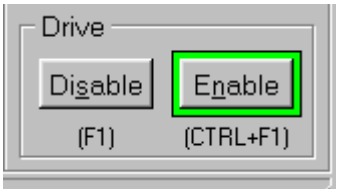
Selecting this window allows you to visualize the history of the drive's alarms and the status of them.

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**".
For a more detailed description of all alarm see chapter: "5.5 Message errors and protections".



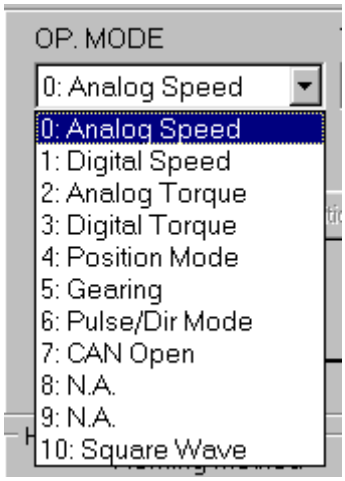
Enable, Disable

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



6.4 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 Axor's drives offer the following operation modes:



0: Analog Speed
The motor is controlled in velocity mode through an analog differential or common mode input from an external controller.

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

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

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

4: Position Mode
The motor is controlled in position mode.

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

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

7: Can Open
This mode allows you to configure and control the drive using CanBus. It supports the following **Can Open** protocols:

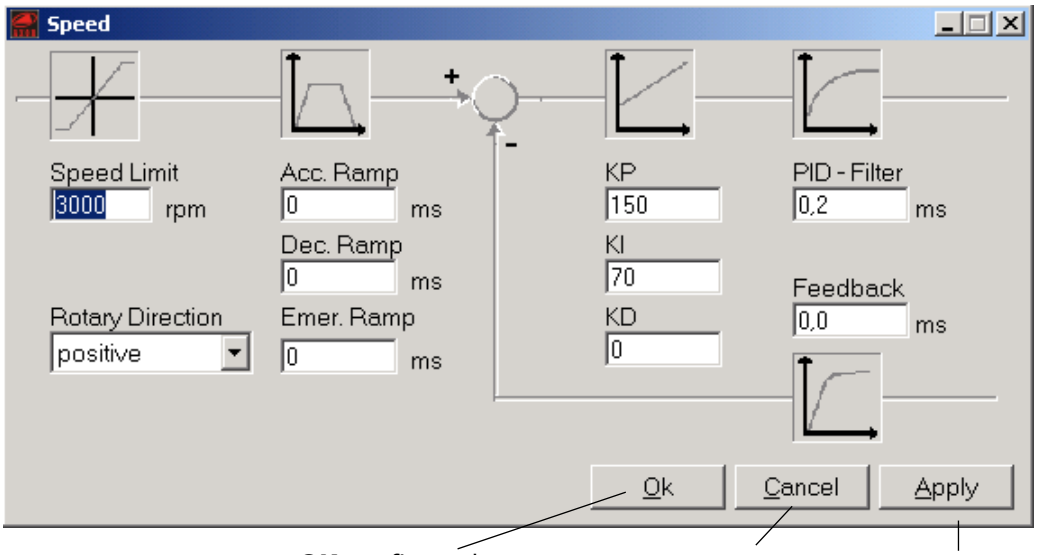
- part of the **DS301-V4.02**
- part of the **DSP402-V2.0**

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

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

6.5 Speed Window

This window allows modification of the dynamic costants of the drive's **speed loop**.



OK confirms the set value and closes the window.

Cancel closes the window without change any parameter.

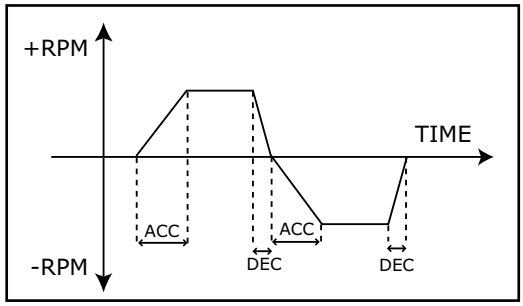
Apply confirms the set value, but it does not close the window.

Speed limit [by keypad: F5 ⇨ h9]
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 [by keypad: F5 ⇨ h12]
It is possible to insert the value of the acceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).

Dec. Ramp [by keypad: F5 ⇨ h13]
It is possible to insert the value of the deceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).



Emer.Ramp [by keypad: F5 ⇨ h14]
It is possible to insert the value of the deceleration ramp "in ms" during the emergency stop.

PID-Filter [by keypad: F5 ⇨ h5]
It is a filter on the speed reference. Suggested values: between 0 and 0,5ms.

Feedback [by keypad: F5 ⇨ h4]
It is a filter on the feedback speed.

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

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

KI [by keypad: F5 ⇨ h2]
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.

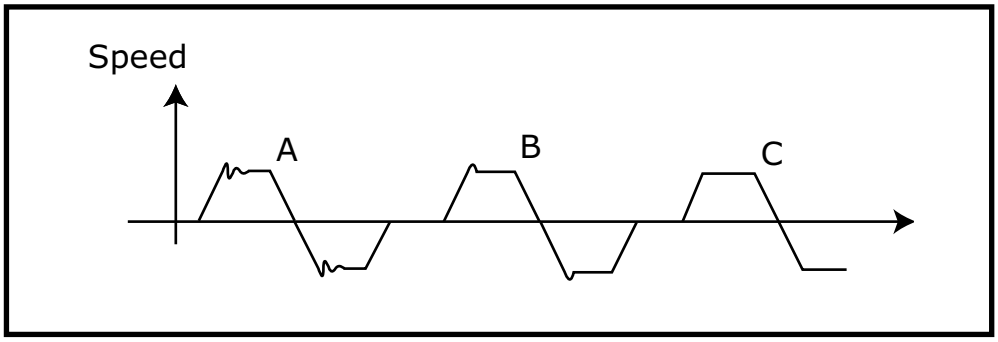
3- Connect the probe of the oscilloscope on pins **M2-15** (speed signal) and **M2-17** (zero signal).

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:

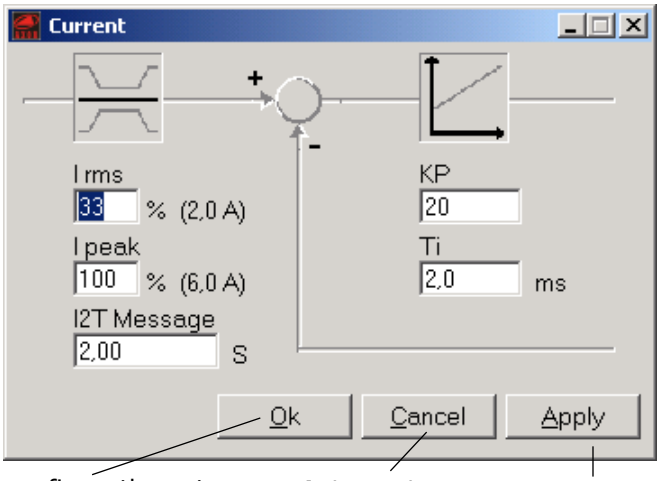
A) Proportional and integral gains too low. Increase the numerical values of KP and KI.

B) and C) Good proportional and integral gains.



6.6 Current Window

This window allows you to modify the dynamic costants of the drive's **current loop**.



OK confirms the set value and closes the window.

Cancel closes the window without change any parameter.

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

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

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

The value of nominal and peak current is RMS.

I2T Message [By keypad: F4 ⇨ E9]
Time of the peak current.
Typically with an adjustment of Ipeak = 100%, the time will be 5 seconds.
We suggest not to change this parameter before consulting Axor.

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

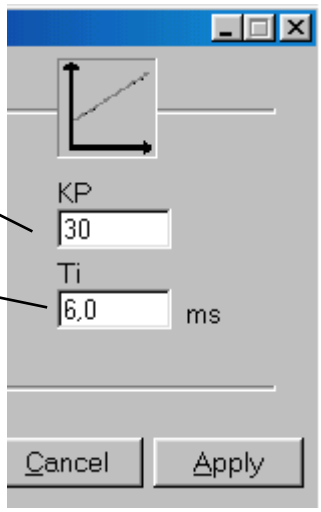
TI [By keypad: F4 ⇨ E4]
It is the integral time in "ms" of the current loop.
The numerical range of this parameter varies from 0 up to 999ms.

Tuning Current Loop

KP and Ti can be calculated by using these formulas:

KP = 0,286*(Fo*Lff*In)/Vin

Ti = Lff/Rff (ms)



Where:

Fo = current loop bandwidth [Hz] (tipically 1kHz-1,2kHz max.)
Rff = resistance phase-to-phase of the motor [Ohm]
Lff = inductance phase-to-phase of the motor [mH]
In = rated current of the drive [A]
Vin = main power supply of the drive [V rms].

Example:

Lff=1,5mH
Rff=0,9 Ohm
MAGNUM400™ size 7/14A
Vin=230Vac

Ti = 1,5/0,9 = 1,66 [ms]

KP = 0,286*(1000*1,5*7)/230 = 13

Insert in the KP e Ti fields of the "Current" window the values KP =13 e Ti = 1,6 [ms].

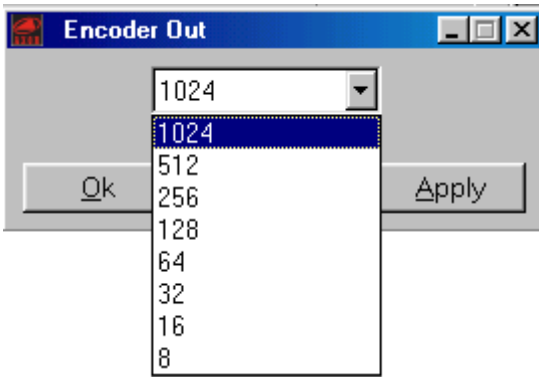
Note: for the tuning current loop we suggest to contact Axor's technical department.

6.7 Encoder Out window

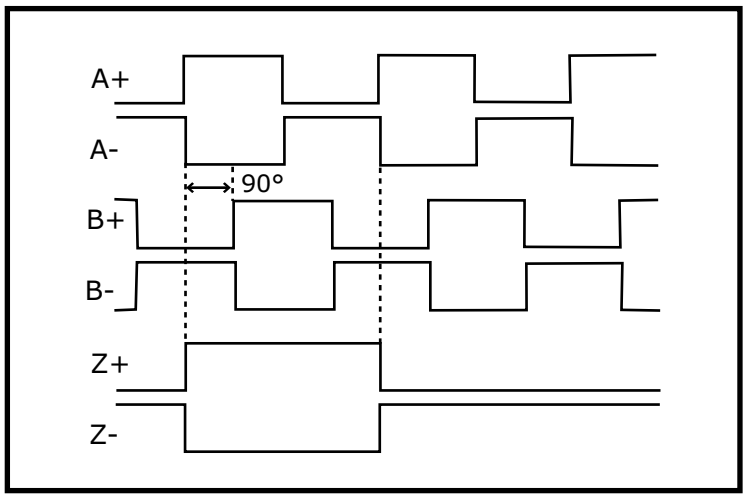
With this parameter you can set the number of pulses per turn on encoder emulation outputs available to the numerical controller or PLC.

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

Example: Utilizing a motor transducer with 1024 PPR, the setable values are: 1024, 512, 256, 128, 64, 32, 16 and 8.



The figure below illustrates the typical encoder emulation output pulses when the motor turns clockwise: the emulation output pulses are emitted under the form of two signals, **A** and **B**, which are electrically staggered by 90° and a zero signal, **Z**.

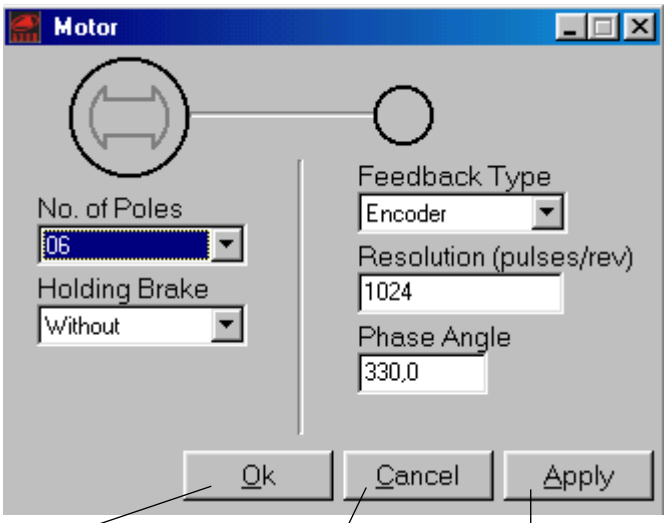


Note: If the **2 pole resolver feedback** is used, the max resolution of the emulated encoder will be **1024 pulses per turn**, so the setable values are: 1024, 512, 256, 128, 64, 32, 16 and 8.

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

6.8 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.

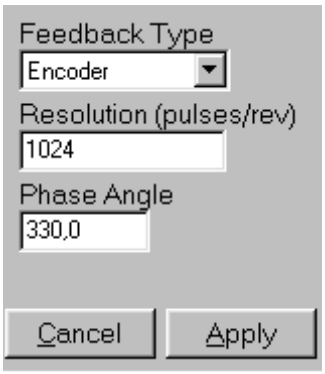
Cancel closes the window without change any parameter.

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

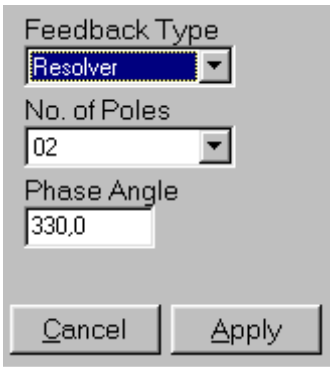
No. of Poles [By keypad: F3 ⇨ d1]
Number of motor poles. It is possible to set 0, 2, 4, 6, 8, 10, and 12 poles.
The value pre-set as a default is 6 poles. The value 0 is to be used when utilizing linear motors.

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

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



No. of Poles
[By keypad: F3 ⇨ d2]
It visualises the number of resolver poles.
Currently only 2 poles resolver feedback is supported.

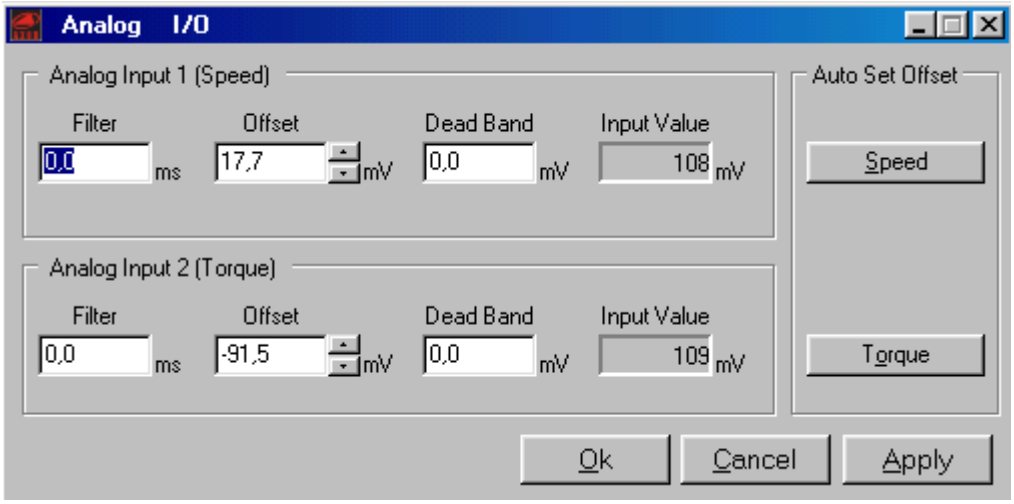


Phase angle [By keypad: F3 ⇨ d5]
In this section the phasing angle of the motor, previously calculated with the "**Tuning** ⇨ "**Motor Phasing**" procedures, is visualized.

Holding Brake
This option is **not** available for the **McbNET Digital™**.

6.9 Analaog I/O window

This window allows you to control and condition the analogic signal of the differential or common mode reference from the external controller or of the torque reference (TPRC input).



Filter [By keypad: F4 ⇨ E5 for the Analog Input 1, F4 ⇨ E10 for the Analog Input 2]
Filter in "ms" on the analog input signal.

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

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

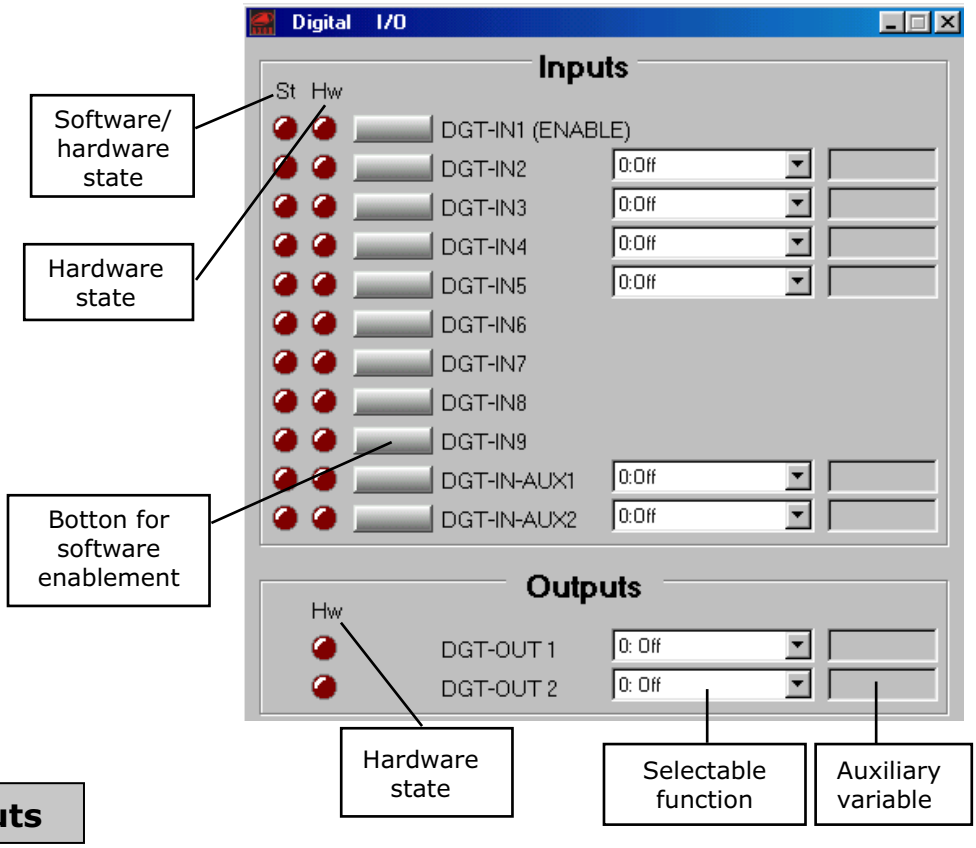
Dead Band (Speed) **[By keypad: F5 ⇨ h6]**
If the voltage on the +/-VREF analog inputs is within the range [-Dead Band, +Dead Band], the analog speed reference is zero (0 rpm).

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

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

6.10 Digital I/O window

This window allows you to modify **via software** the status of the programmable digital inputs and to control the hardware status of the digital inputs and outputs.



Inputs

The **McbNET Digital**™ has **11 digital inputs**: **DGT-IN1**,...**DGT-IN9** (on the **M2A** connector), **DGT-IN-AUX1** and **DGT-IN-AUX2** (on the **M2B** connector); 6 of these are programmable.

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 on the M2A (or M2B) connector pins. This will cause leds "St" and "Hw" to show red.

The DGT-IN1,...DGT-IN9 inputs are enabled by giving +24V, while the DGT-INAUX1 and DGT-IN-AUX2 inputs are enabled by giving +5V.

Attention: it is not possible to enable the DGT-INAUX1 and DGT-IN-AUX2 giving +24V.

6.10 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).

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

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 **McbNET Digital™**.
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.

Very Important Notes:

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

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

• Before changing the function on a programmable input make sure that the function is disabled.

For example:
The "Start Homing" function is not active with a low signal on the dedicated input.
The "Pstop" function is not active with an high signal on the dedicated input.

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

• To set or reset by keypad the digital inputs, use the following addresses:
- **F12 ⇨ I16 for DGT-IN2**
- **F11 ⇨ H13 for DGT-IN3**
- **F11 ⇨ H14 for DGT-IN4**
- **F12 ⇨ I17 for DGT-IN5**
- **F14 ⇨]1 for DGT-IN-AUX1**
- **F14 ⇨]4 for DGT-IN-AUX2**

• To set by keypad the auxiliary variables of the digital inputs, use the following addresses:
- **F14 ⇨]5 for DGT-IN2**
- **F14 ⇨]6 for DGT-IN3**
- **F14 ⇨]7 for DGT-IN4**
- **F14 ⇨]8 for DGT-IN5**
- **F14 ⇨]9 for DGT-IN-AUX1**
- **F14 ⇨]10 for DGT-IN-AUX2**

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

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

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

Profile N°	Digital Inputs				
	9	8	7	6	5
17	1	0	0	0	0
18	1	0	0	0	1
19	1	0	0	1	0
20	1	0	0	1	1
21	1	0	1	0	0
22	1	0	1	0	1
23	1	0	1	1	0
24	1	0	1	1	1
25	1	1	0	0	0
26	1	1	0	0	1
27	1	1	0	1	0
28	1	1	0	1	1
29	1	1	1	0	0
30	1	1	1	0	1
31	1	1	1	1	0
32	1	1	1	1	1

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

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

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

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

Outputs

The **McbNET Digital**™ has **2 programmable digital outputs**: **DGT-OUT1** and **DGT-OUT2**.
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 2 digital outputs:

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.

Notes:
- **To set or reset by keypad the digital outputs, use the following addresses:**
  - **F14 ⇨]2 for DGT-OUT1**
  - **F14 ⇨]3 for DGT-OUT2**
- **To set by keypad the auxiliary variables of the digital outputs, use theese addresses:**
  - **F14 ⇨]13 for DGT-OUT1**
  - **F14 ⇨]14 for DGT-OUT2**

6.11 Position window

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

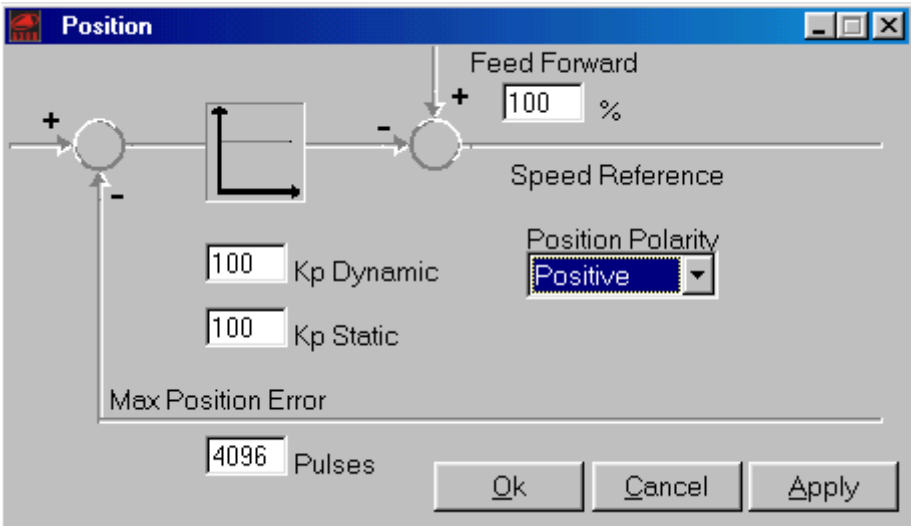
"4:Position Mode"

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

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

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

Kp Static
Not active.
[By keypad: F6 ⇨ P2]



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 [By keypad: F6 ⇨ P5]
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).

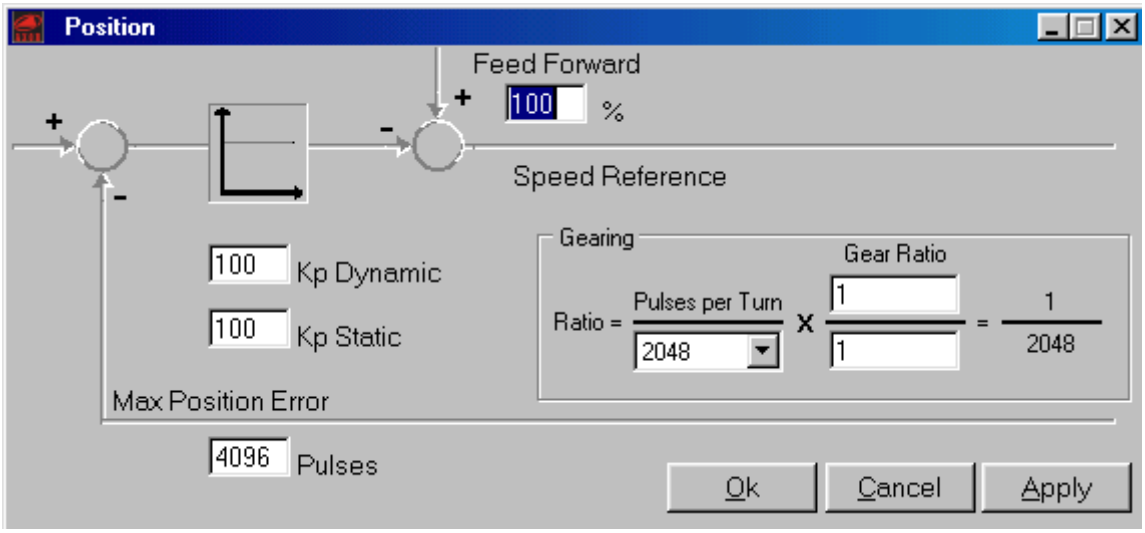
Example: If the maximum mechanical accepted error is 45° (1/8 mechanical turn), then the value to insert in the Max Position Error box is 8192, in fact:

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

We suggest to insert the value: 8192.

"5:Gearing"

If the "**5:Gearing**" operative mode is set, the "**Position**" window is the following:



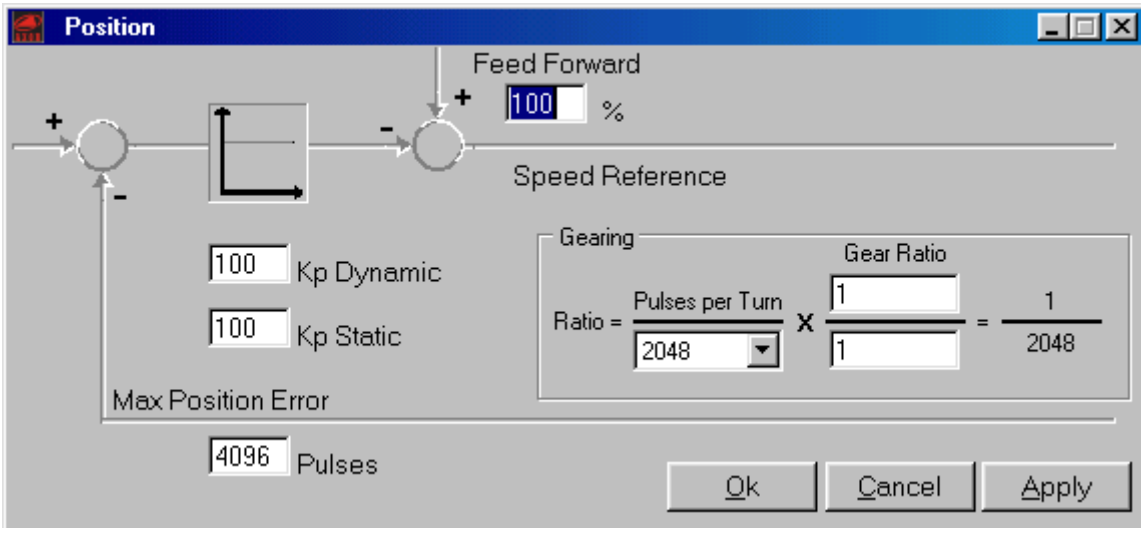
The **Feedforward**, **Kp Dynamic**, **Kp Static** and **Max.Position Error** parameters have the same functions illustrated in the preceeding page, but may have to be re-set, while adding the new parameters for gearing:

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

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

"6:Pulse/Dir Mode"

If the "**6:Pulse/Dir Mode**" operative mode is set, the "**Position**" window is the following:

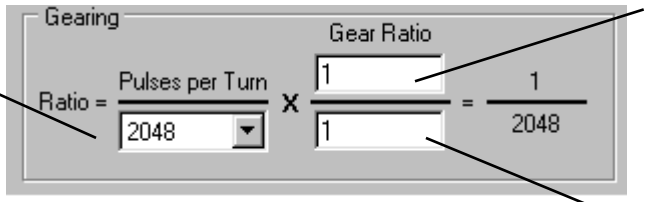


The **Feedforward**, **Kp Dynamic**, **Kp Static** and **Max Position Error** parameters have the same functions illustrated in the preceding page, but the **Pulses per Turn** and **Gear Ratio** windows are significantly different.

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

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

1) Select in the Pulses per Turn menu the value that is closest to the desired value;



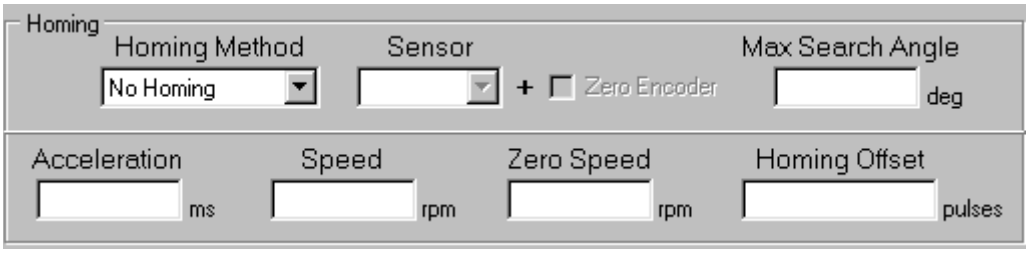
2) put in the Gear Ratio's numerator the value set on the Pulses per Turn menu;

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

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

6.12 Homing window

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



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

Homing Method [By keypad: F12 ⇨ I3]
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 [By keypad: F12 ⇨ I20]
It is the maximum mechanical angle (0-359 degrees) that can be made during the search for the zero encoder signal after the correct interception of the homing sensor. Above this angle the motor stops, no homing position is saved and alarm 26 (the "Homing Error" alarm) is displayed (this alarm is cleared after the disabling of the digital input set with the "Reset Fault" function).
This parameter (when used correctly) allows the homing process to be repeated with excellent results and avoid errors due to sensor signal elasticity or mechanical tolerance.

Speed [By keypad: F12 ⇨ I2]
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 [By keypad: F12 ⇨ I18]

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 [By keypad: F12 ⇨ I19]

This defines the motor's speed during the realignment with the homing sensor and/or during the search for the encoder's zero pulse from the motor feedback after the home sensor is reached.
It is defined in "rpm" and allows values in ranges between 1 and 50 rpms. We suggested utilising low values for this parameter in order to obtain good precision.

Homing Offset [By keypad: F12 ⇨ I4 and I5]

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:

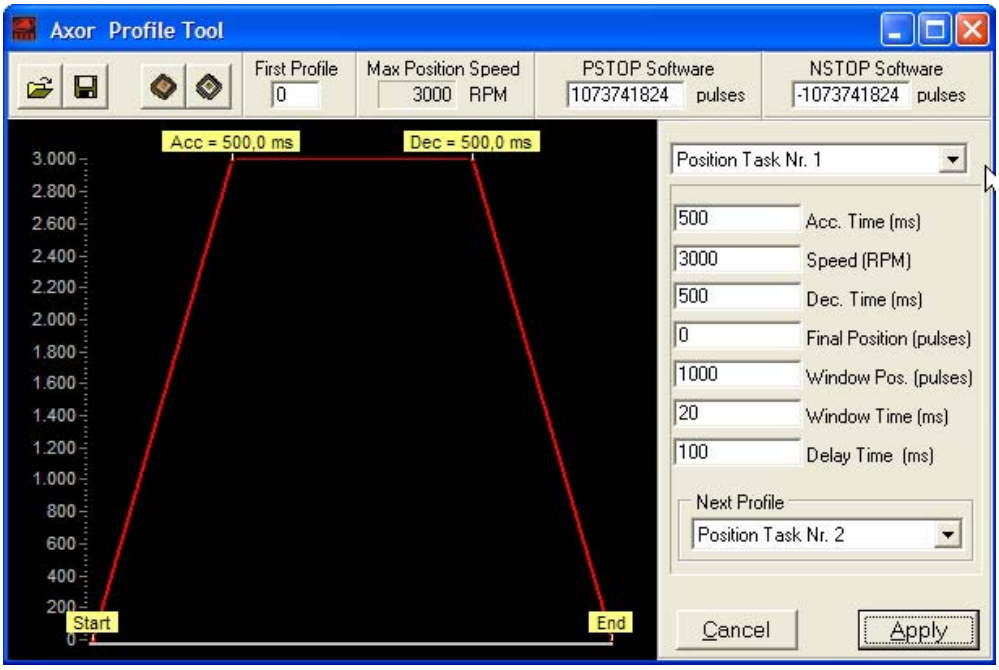
Homing Offset = n° turns (also not integer) * 65536

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.

6.13 Axor Profile Tool window

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



Final position

It defines the absolute position reference for the selected position profile.
The admitted values are in the range +/-(2^{31}-1). Setting the value 0 means "return to zero position" (the position found during homing 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.

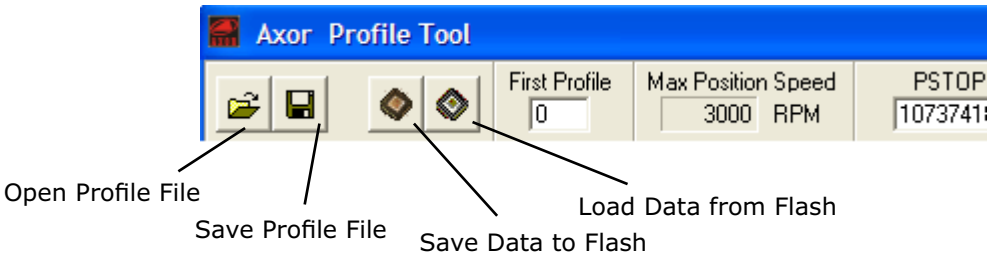
PSTOP Software
If the Final Position parameter is greater then the PTSOP Software, the task stops when the PSTOP target is reached.

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.

6.14 Standard configuration files

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

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

1) Open the "**Speeder One**" software.

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

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

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

5) Disable and enable the drive: it is now able to work with the selected motor.

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

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

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

- **"Current" window**: gains are set to work with a specific motor and its nominal current. I^2t value ("I2t Message" parameter) is set to 2s.

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

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

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

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

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

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

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

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

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

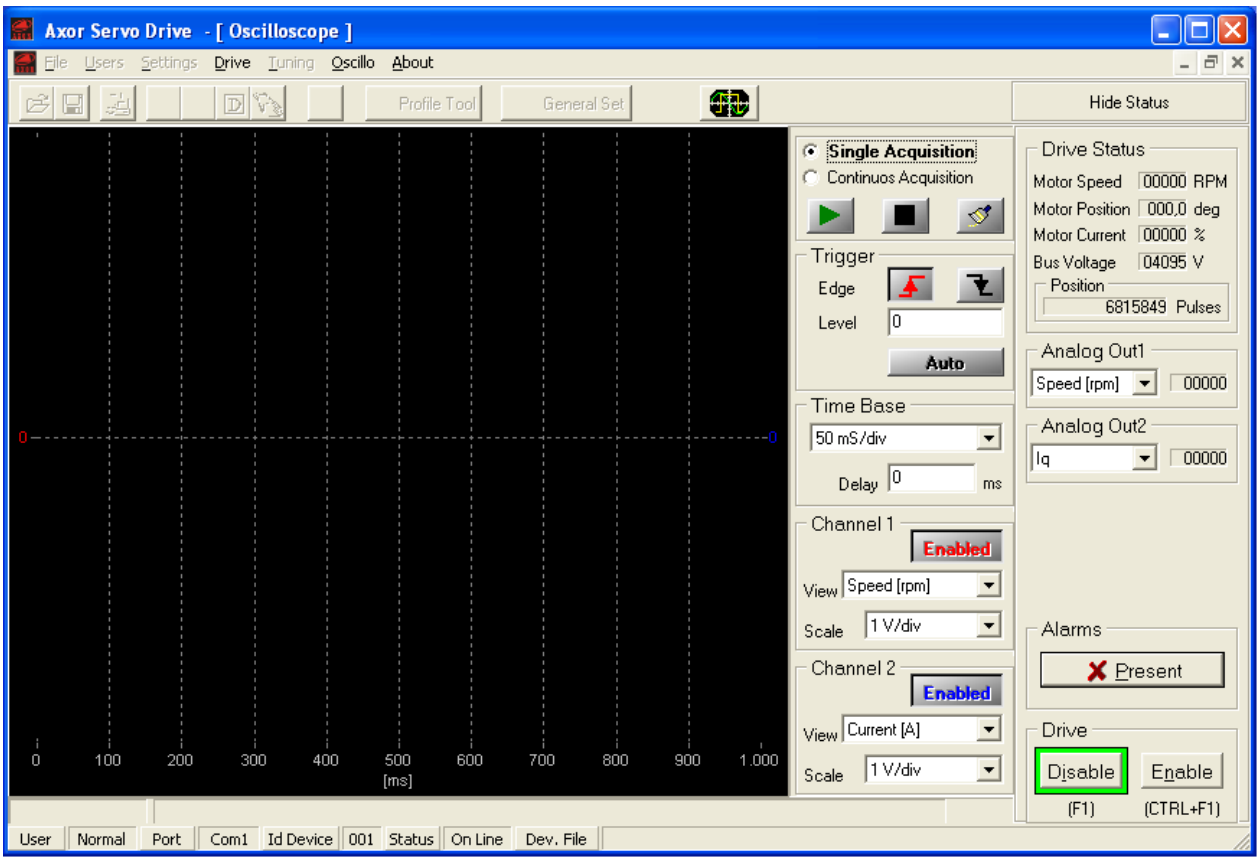
Notes:

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

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

6.15 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.

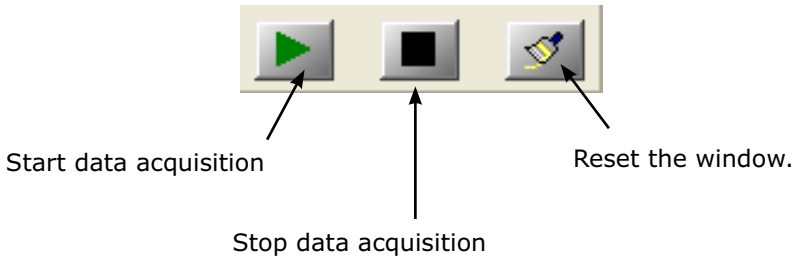
Time Base
It allows to set the time base of the window.

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 7
Applications

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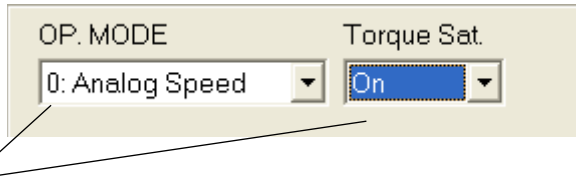
7.1 Torque Limit

The drive has an analogue input (**TPRC**, pin **B12** on the **M2B** connector) that can be used as **limitation of the delivered torque**.
This input can be set for **two types of configurations**:

Configuration 1:

Control in speed with a differential or common mode analogue reference and limitation of the delivered torque.
The procedure is the following:

1) Select "**0:Analog Speed**" on the OP.MODE window and select "**On**" on the "**Torque Sat.**" window:



2) Using the **B9** and **B10** terminals (**+/- VREF**) control the motor speed with a differential or common analogue reference (see chapter "4.8: Differential analog input" for the connections).

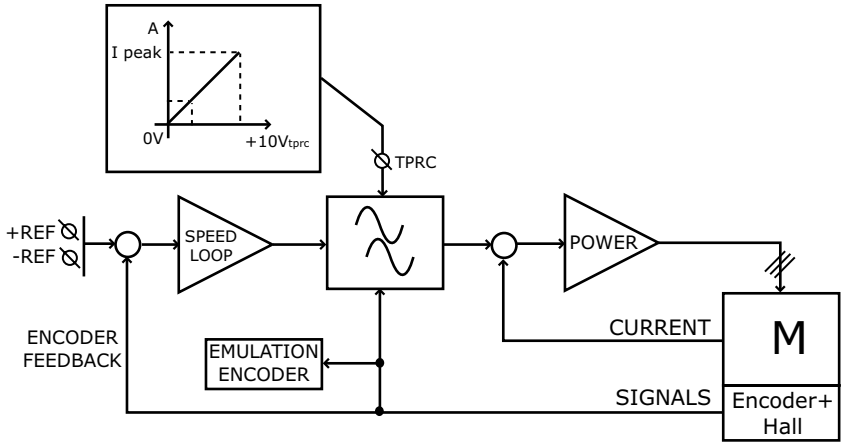
3) Using the **B12** terminal (**TPRC**) limit the converter's current from zero to the peak value applaing a voltage between **+0V** and **+10V** (see chapter "4.9: TPRC analog input" for the connections). The ground return is the **B11** terminal (**AGND**).
The formula for determining the voltage value to be applied in TPRC in order to obtain the necessary current is as follows:

$$V_{TPRC} = \frac{10 * I\ Limit}{I\ pK}$$

Example: Suppose we have a drive size: 6/12A, and we want to limit the converter's corrent to 5A. The voltage value to be applied in TPRC is 4,16V; in fact:

$$\frac{10 * 5}{12} = 4{,}16V$$

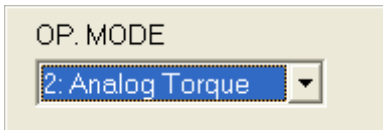
Functioning scheme:



Configuration 2:

Control in torque with common mode input and without limitating the maximum turns.
The procedure is the following:

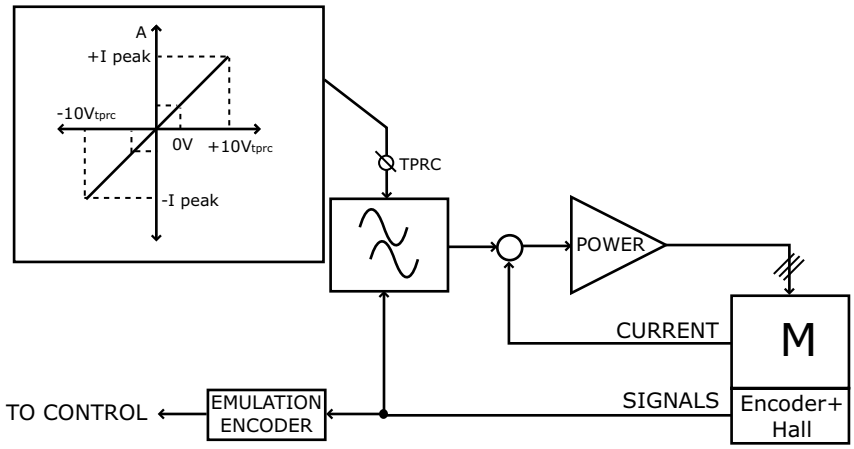
1) Select "**2:Analog Torque**" on the OP.MODE window:



2) Using the **B12** terminal (**TPRC**) control the drive's current with a **+/-10V** analogue signal in common mode (see chapter "4.9: TPRC analog input" for the connections). The ground return is the **B11** terminal (**AGND**). The maximum value cannot exceed the limit of +/-10V max, to which the peak current of the drive corresponds.
The formula for determining the voltage value to be applied in TPRC in order to obtain the necessary current is as follows:

$$V_{TPRC} = \frac{10 * (+/-)I\ Limit}{I\ pk}$$

Functioning scheme:



7.2 Electrical Axis (Gearing)

It is possible to connect together two drives, the first drive will be set as **Master**, the second as **Slave**. The Slave will be controlled by the **emulation encoder outputs** from a Master drive.

For enabling the Elecrical Axis function it is necessary:

a) to execute the hardware connections between the Master and the Slave drive (see Chapter "4.14: Electrical Axis (Gearing)");

b) to set the Master drive and the Slave drive by using the *Speeder One* interface.

Setting Master drive

1- Select one of the possible operating modes (You may select any of the available operating modes, with the exception of "5: Gearing");

2- select the number of pulses in the "**Encoder Out**" window, which must be sent to the Slave drive.

Setting Slave drive

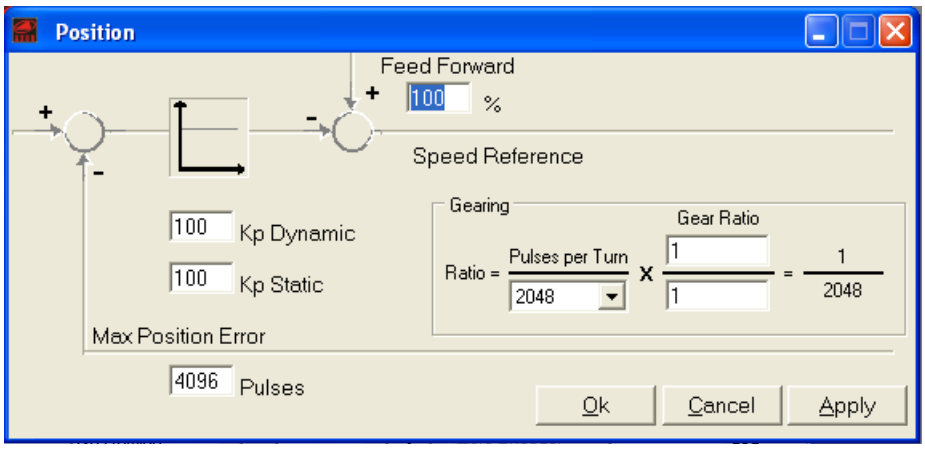
1- Select the "**5:Gearing**" operating mode;

2- select the ratio between the pulses coming from an external encoder, or from a Master drive, and the desired pulses/rev on the Slave drive, setting the "**Pulses per Turn**" and "**Gear Ratio**" parameters in the "**Position**" window:

Pulses per turn
Insert into this field the number of pulses per turn of the emulated encoder from the Master drive.

Gear Ratio
Insert into the numerator and denominator, the ratio that allows you to obtain the desired Slave speed in regards to the Master.
Note: the values which you can insert are between the **1/64<|Ratio|<64** range.

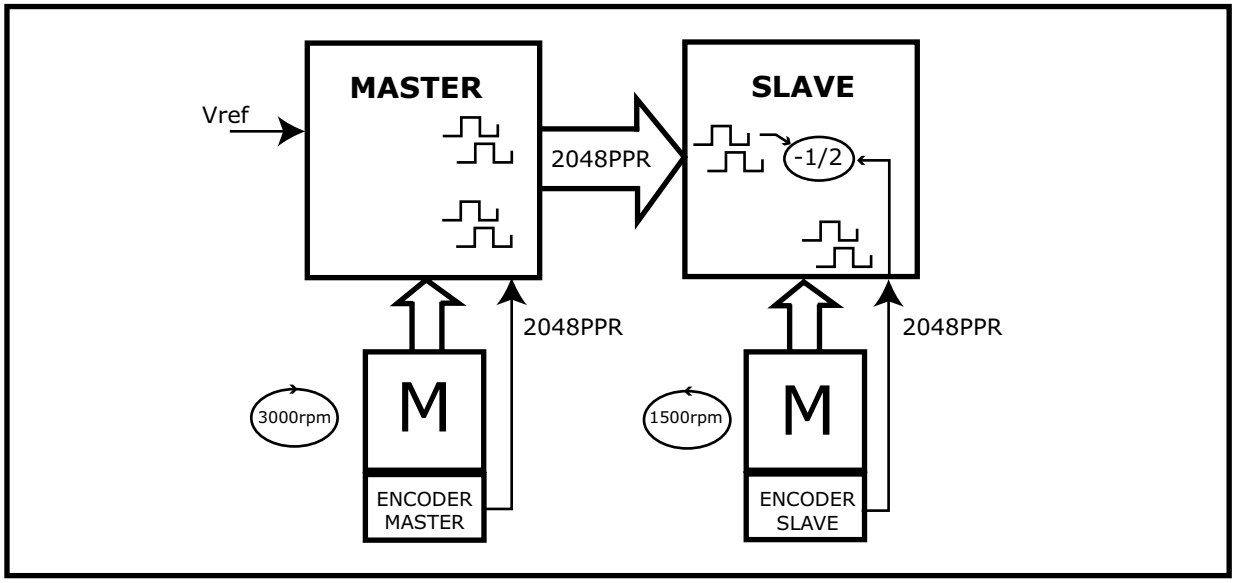
In the same window set the parameters: **FeedForward**, **Kp Dynamic** and **Max Position Error**.



3- Open the "**Digital I/O**" window and select the "**Ref-On**" function on the **DGT-IN2** input.
Attention: Only the DGT-IN2 input can be set with the Ref-On function.

Example:

- Application with two drives and two motors with 2048ppr encoders;
- SLAVE motor's rotation speed = -½ of the MASTER one;
- The MASTER drive is controlled by an analog speed reference.



Setting MASTER drive:

1- Set "**0:Analog Speed**" in the OP MODE window;

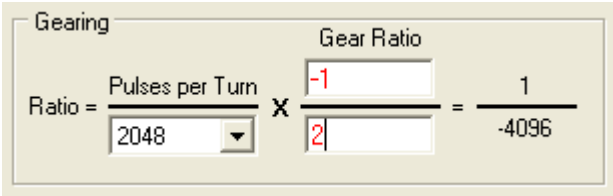
2- Verify the output setting of the MASTER drive by checking in the "**Encoder Out**" window.

Setting SLAVE drive:

1- Set "**5:Gearing**" in the OP MODE window;

2- input the value 2048 in the "**Pulses per Turn**" window;

3- Insert the value **-1** at numerator and **2** at denominator in the "**Gear Ratio**". In this way the SLAVE motor will rotate at half that of the MASTER speed.



4- Open the "**Digital I/O**" window and select the "**Ref-On**" function on the **DGT-IN2** digital input.

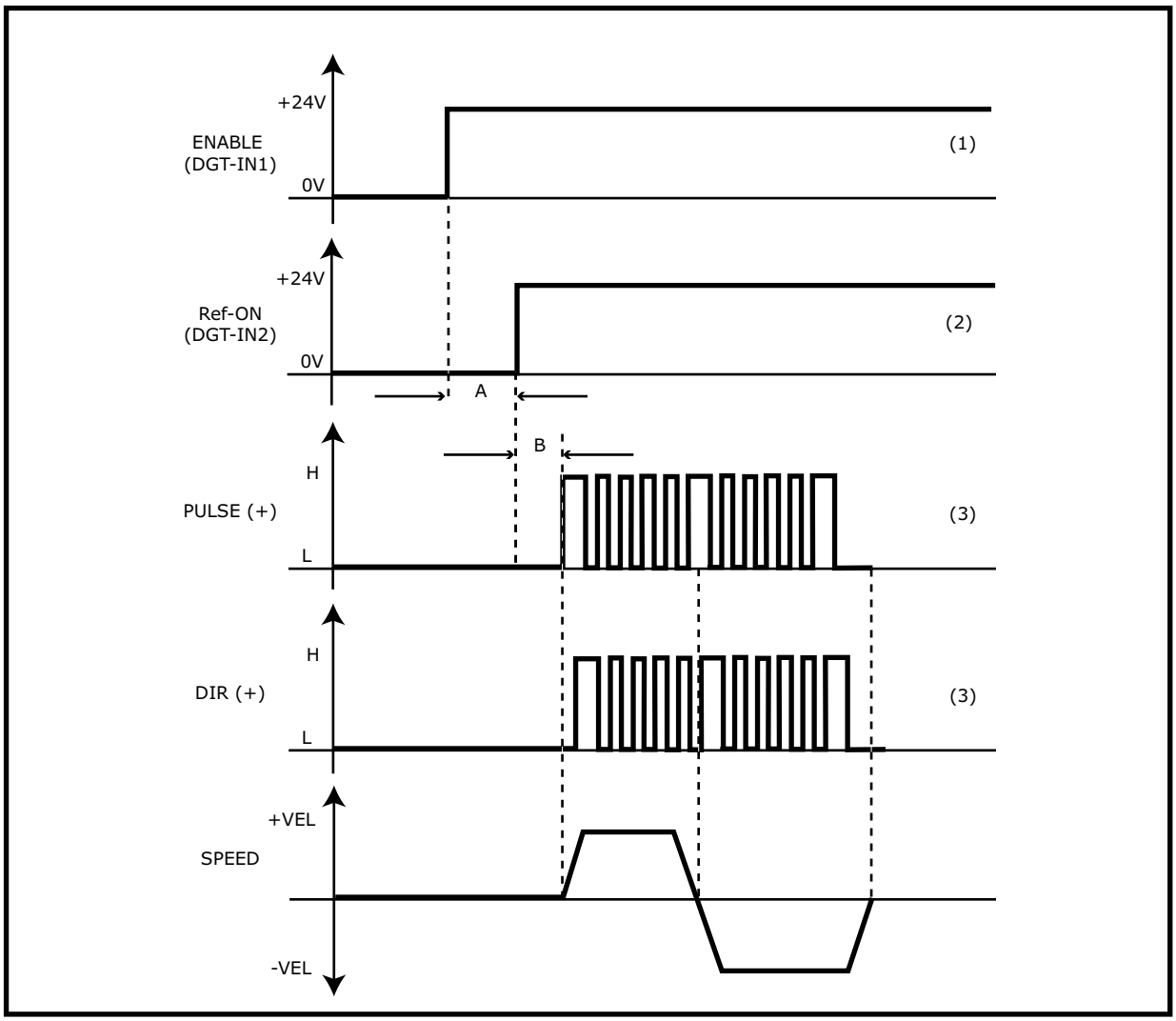
For enabling the Electrical Axis follow this procedure:

1- Enable the Master giving +24V to the ENABLE input. The motor will start move following the operating mode set for the Master.

2- Enable the Slave giving +24V to the ENABLE input. The motor will remain blocked in torque with the position loop inserted and waiting to move. See (1)

3- Set on the **DGT-IN2** input the "**Ref-On**" function, then bring the input high to enable the motor movement in the GEARING function. See (2)

4- With the pulses's arrive at the **Pulse(+/-)** and **Dir(+/-)** inputs the motor will move. See (3)



Note: If required by the application it is possible at anytime to zero the axis by using the "homing procedure". This operation must take place inside the **A** zone (see above), so after the enable-inputs arrival, but before the DGT-IN2 signals arrival.

7.2 Electrical Axis (Gearing)

It is possible to control the Slave by using the **increasing channels of an external encoder**, in this case:

1- Use the **Pulse(+/-)** and **Dir(+/-)** pins to connect the encoder signals (+/-CHA and +/-CHB).

2- Set the operative mode "**5:Gearing**" in the OP. MODE menu.

3- Insert into the **Pulse per Turn** field the number of pulses per turn of the external encoder.

4- Insert into the numerator and denominator of the **Gear Ratio**, the ratio that allows you to obtain the desired Slave speed in regards to the encoder.

5- In the **Digital I/O** window set the "**Ref-On**" function on the **DGT-IN2** digital input.

6- Enable the drive giving +24V to the **DGT-IN1** (**ENABLE**) input. The motor will remain blocked in torque with the position loop inserted and waiting to move.

7- Set on the **DGT-IN2** input the "**Ref-On**" function, then bring the input high to enable the motor movement in the GEARING function.

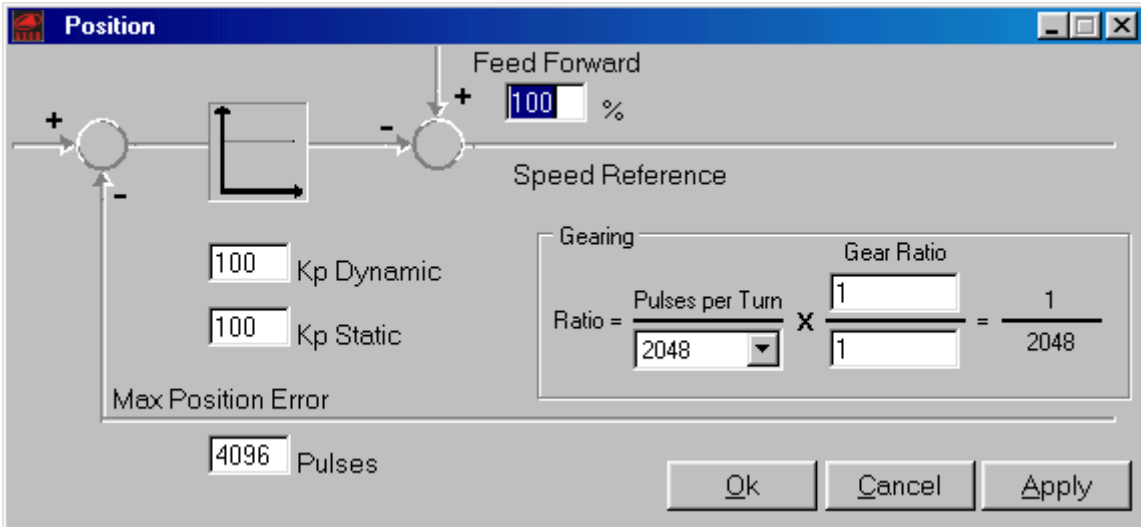
8- With the pulses's arrive at the **Pulse(+/-)** and **Dir(+/-)** inputs the motor will move.

7.3 Pulse/Dir Mode

The **Pulse/Dir Mode** allows you to connect the drive to a **stepper-motor controller**.

For enabling the Pulse/Dir Mode it is necessary:

1- execute the hardware connections between the drive and the CN (see Chapter "4.13: Pulse/Direction Mode" for the connections);
2- set the drive by using the *Speeder One* interface:
- set the operative mode "**6:Pulse/Dir Mode**" in the OP. MODE window;
- open the "**Position**" window and set the parameters **Pulses per Turn** and **Gear Ratio**:

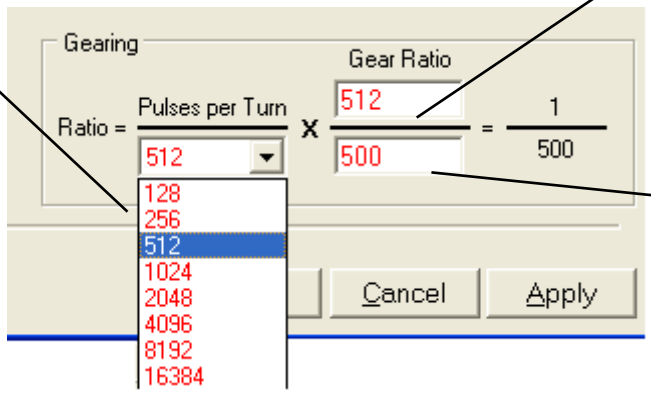


Pulses per turn
This is the number of pulses that must be given to the **PULSE** input in order to have a motor's mechanical turn.
Insert in this field one of the given values (256…16384).
Example: Putting the value at 2048, the motor will complete a mechanical turn with 2048 pulses present on the PULSE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

Gear Ratio
If the number of the desired pulses is not present on the Pulses per Turn menu adjust it by using the Gear Ratio factor in the **1/64<|ratio|<64** range. Therefore:

1) Select in the Pulses per Turn menu the value that is closest to the desired value;

2) put in the Gear Ratio's numerator the value set on the Pulses per Turn menu;



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

3- Open the "**Digital I/O**" window and select the "**Ref-On**" function on the **DGT-IN2** digital input (**Attention: It is necessary to use the DGT-IN2 digital input to set the Ref-On function**).

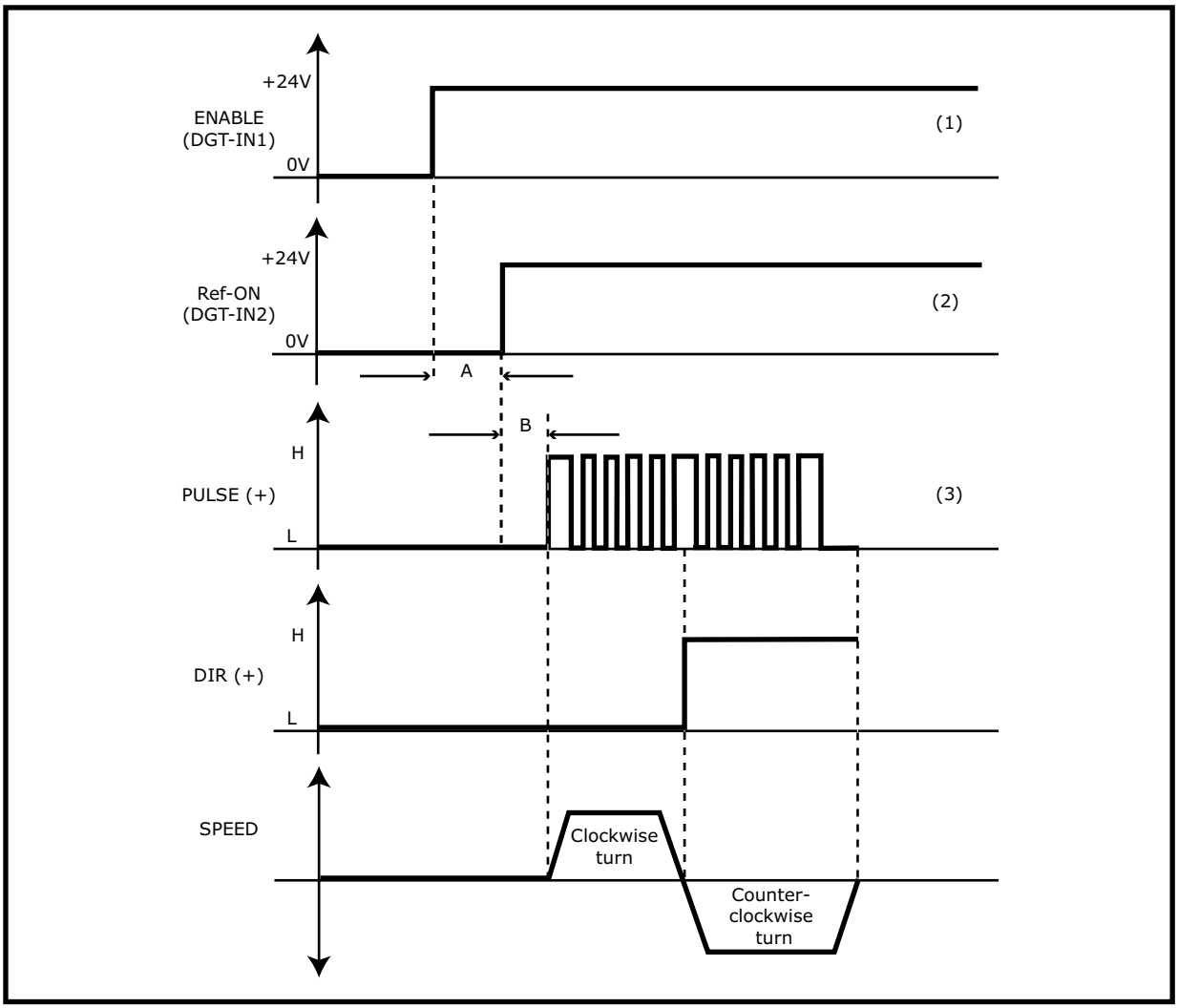
For enabling the Pulse/Dir Mode follow this procedure:

1- Enable the drive giving +24V to the ENABLE input (DGT-IN1). The motor will remain locked in torque with the position loop inserted and waiting to move. See (1)

2- Set on the DGT-IN2 input the "Ref-On" function, then bring the input high to enable the motor movement in the Pulse/DIR function. See (2)

3- When the pulses arrive at the input PULSE (+/-) the motor will move. See (3)

The **DIR** logic signal determines the motor's direction: with the signal **DIR = L** the motor turns clockwise (**CW**); with the signal **DIR = H**, the motor turns counter-clockwise (**CCW**).



Note: If required by the application, at anytime it is possible to zero the axis by using the homing procedure. This operation must take place inside the **A** zone, so after the enable-input's arrival, but before the DGT-IN2 signal's arrival.

7.4 Limit Switch

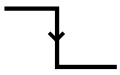
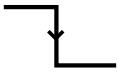
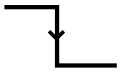
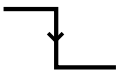
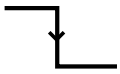
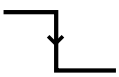
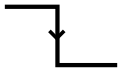
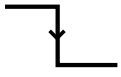
In the "**Digital I/O**" window it is possible to enable the limit switches, setting the "**NSTOP**", "**PSTOP**" and "**P+N STOP**" functions.
These functions are usable in the following operative modes: "0:Analog Speed", "1:Digital Speed", "2: Analog Torque", "3:Digital Torque".

Function	Description
PSTOP	If in the input set with this function a low logical signal is reached, the motor rotating in a clockwise direction, decelerates by using the "Emer.Ramp" parameter set in the "Speed" window.
NSTOP	If in the input set with this function a low logical signal is reached, the motor rotating in a counter-clockwise direction, decelerates by using the "Emer.Ramp" parameter set in the "Speed" window.
P+N STOP	If in the input set with this function a low logical signal is reached, the motor rotating in a clockwise or counter-clockwise direction, decelerates by using the "Emer.Ramp" parameter set in the "Speed" window.

Note:
• The DGT-IN1 digital input is always the primary input verses the limit swiches inputs (PSTOP, NSTOP and P+N STOP).

• If a low logical signal is reached on *both* inputs set with the PSTOP and NSTOP functions, the alarm 15 (Limit Switch) appears, which causes the opening of the Relè Ok contact and the disabling of the functioning. Disable the drive, check the end-run contact and external connections, then enable the drive.

The following table illustrates which limit switch operates reference to the "speed reference" (POSITIVE or NEGATIVE) and the "Rotary Direction" parameter (Positive or Negative) set on the "Speed" window:

ROTOR TURNING (driving shaft view)	SPEED REFERENCE	ROTARY DIRECTION Parameter	PSTOP	NSTOP	P + N STOP
CW (clockwise)	POSITIVE	Positive		- (*)	
	NEGATIVE	Negative		- (*)	
CCW (counter-clockwise)	POSITIVE	Negative	- (*)		
	NEGATIVE	Positive	- (*)		

(*) a lowering signal on input set with this function does not change the rotor movement.

7.5 Reset Fault Function

The "**Reset Fault**" function, that can be set on one digital programmable input in the **Digital I/O** window, allows you to reset all *resettable alarms*.

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);

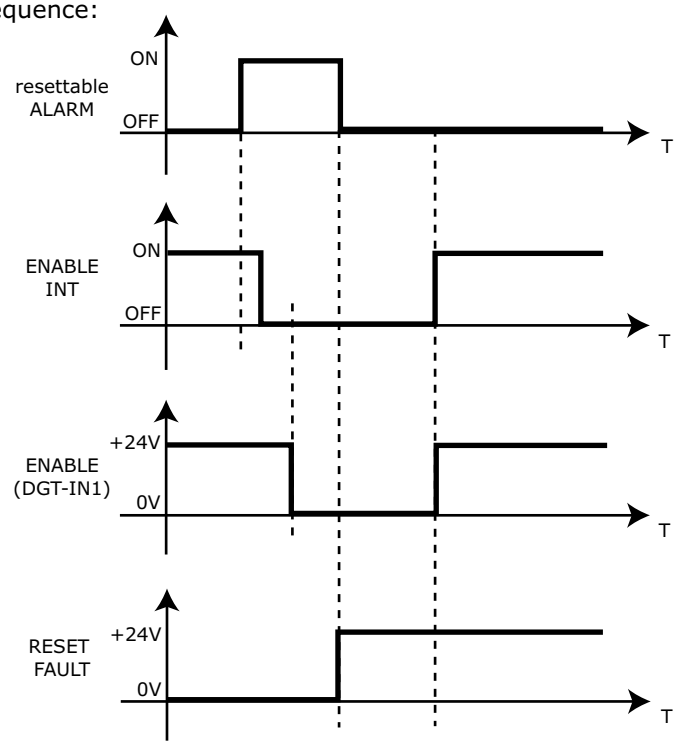
4) enable the drive (using the "**Enable**" icon and/or **DGT-IN1** input).

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:



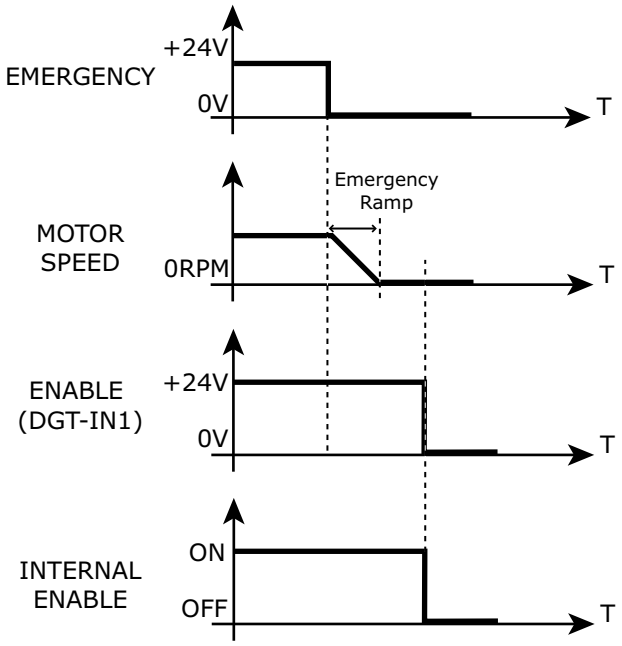
7.6 Emergency Function

The Axor drives have the **EMERGENCY *function***, which can be set 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 .

The *emergency function* is not managed by the operative modes: "2: Analog Torque", "3: Digital Torque", "5: Gearing" and "6: Pulse/Dir Mode".

Emergency function sequence:



Chapter 8
Positioner

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8.2 Homing procedure 119
8.3 Positioning procedure 125

8.1 Positioner

The Axor drives can be controlled as **POSITIONERS**. An **ABSOLUTE POSITIONER** is implemented, which executes transactions to *absolute quotas* reference to the reference point.

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

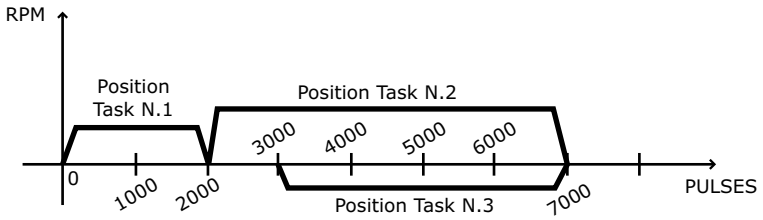
	POSITION TASK	**FINAL POSITION (**pulses**)**
1°	Position Task N.1	2000 pulses
2°	Position Task N.2	7000 pulses
3°	Position Task N.3	3000 pulses

a- During the first profile there will be a transaction from 0 pulse 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 for the profile. The homing procedure uses the signal of the homing sensor and, eventually, the zero signal of the encoder.

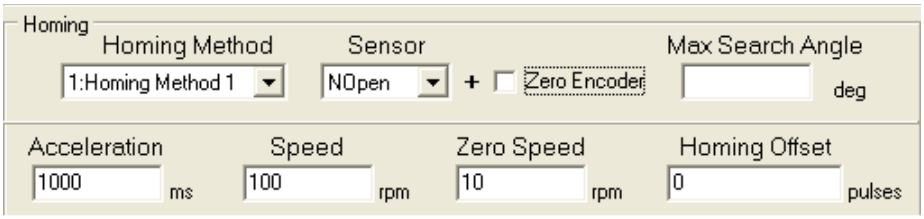
The positioner and homing procedure can be managed:
- **via hardware**: by using predisposed digital inputs;
- **via RS232 interface**: by using the Speeder One interface or another master ModBus.

The following chapters illustrate, by using examples, homing and positioner procedures. Before going on, we suggest to read again these chapters:
- 4.6 Digital Inputs (for the connections);
- 6.10 Digital I/O Window (for positioner and homing procedures settings);
- 6.11 Position Window (for position loop settings);
- 6.12 Homing Window (for homing settings);
- 6.13 Axor Profile Tool Window (for tasks settings).

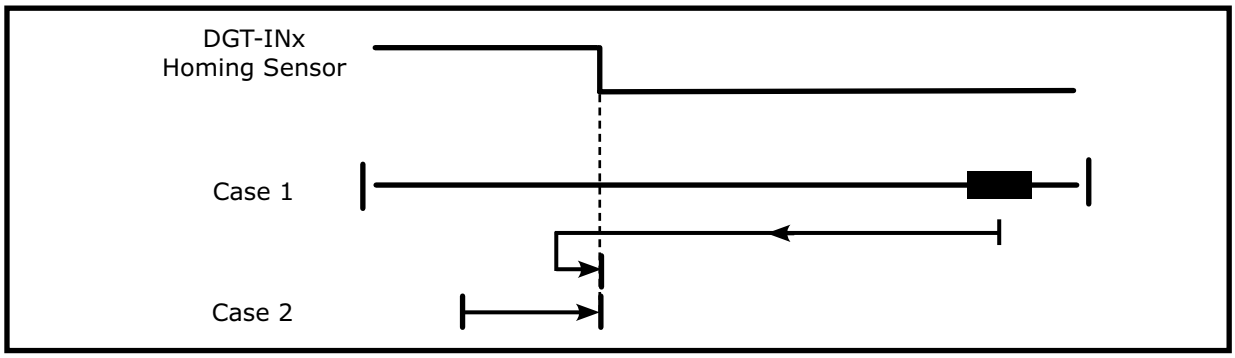
8.2 Homing procedure

The Axor digital drives supports the following **homing procedures**:

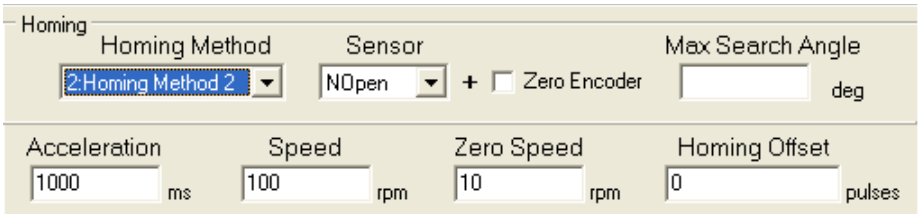
a- **Direct homing procedure with normally opened home sensor**



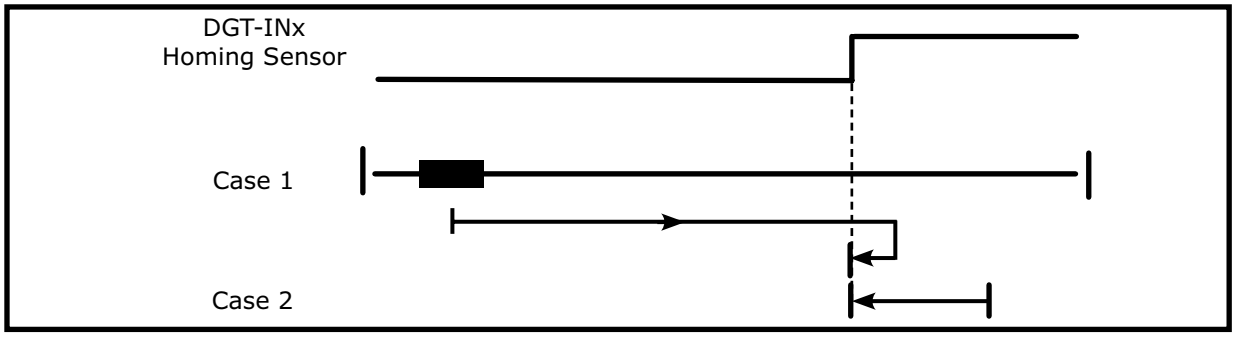
Case 1: If the homing sensor is low at the start homing the drive pilots the motor in counter-clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the 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.



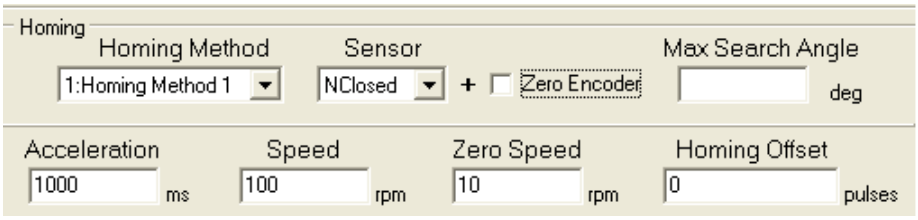
b- **Reverse homing procedure with normally opened home sensor**



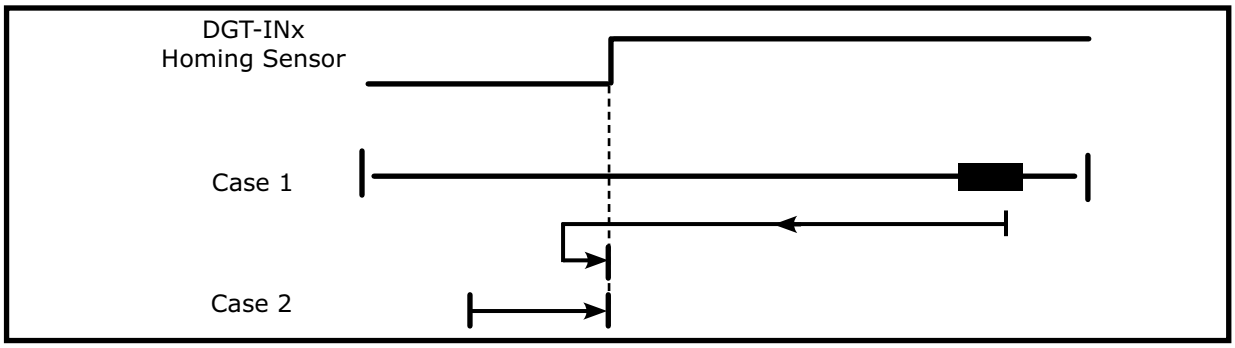
Case 1: If the homing sensor is low at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor 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.



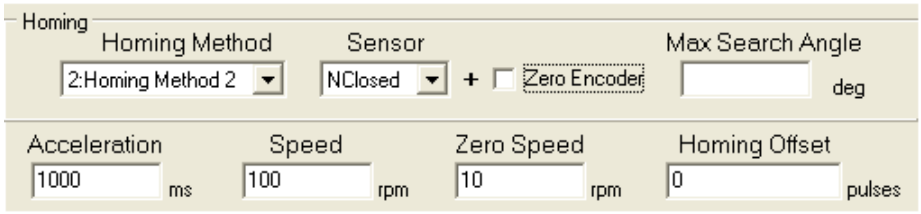
c- **Direct homing procedure with normally closed home sensor**



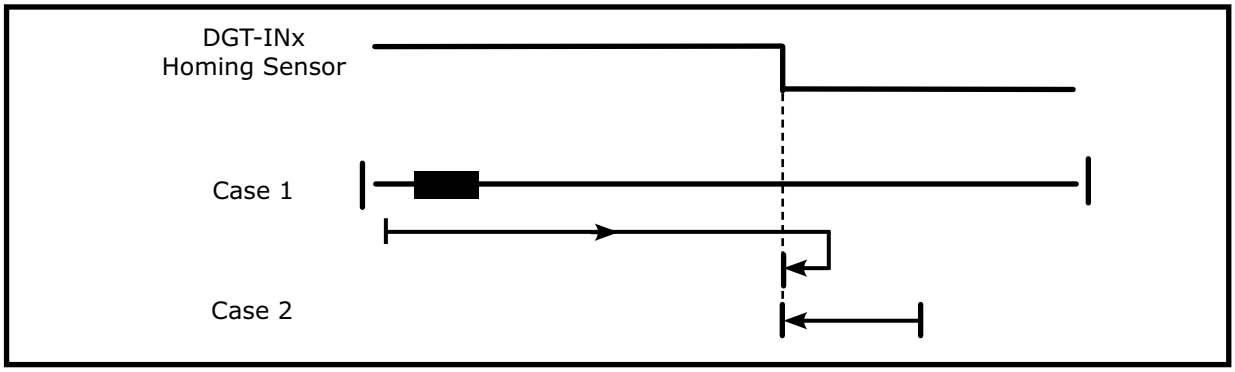
Case1: If the homing sensor is high at the start homing the drive pilots the motor in counter-clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already low at the homing start the 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.



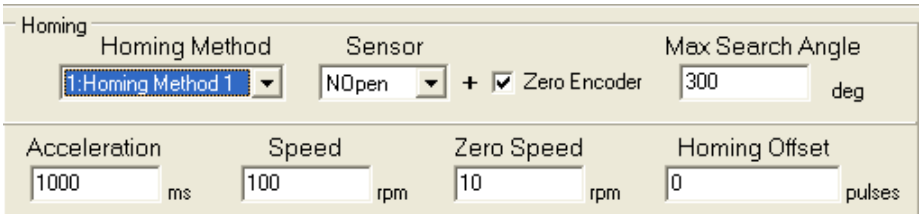
d- **Reverse homing procedure with normally closed home sensor**



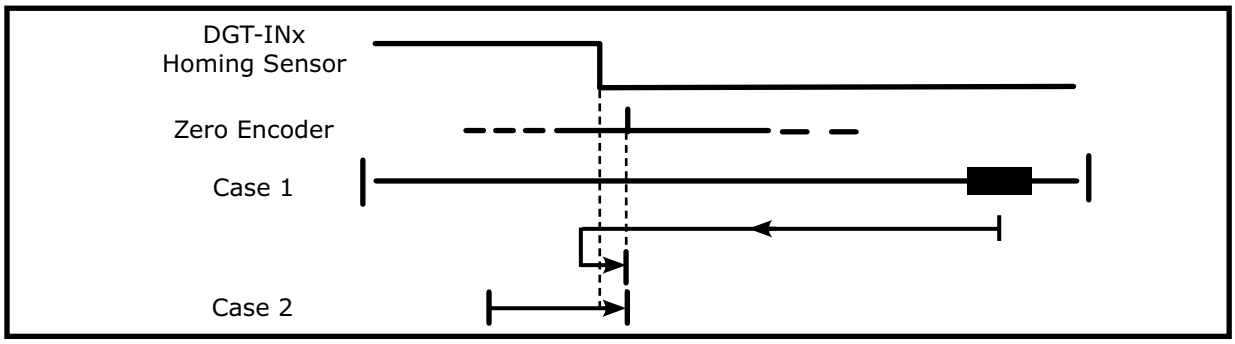
Case1: If the homing sensor is high at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes low, the motor decelerates and inverts its motion.
Case2: If the homing sensor output was already low at the homing start the motor axis 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.



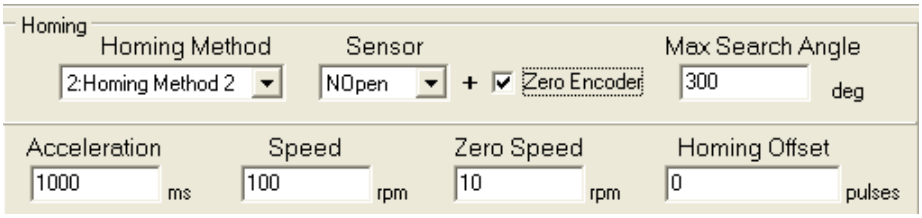
e- **Direct homing procedure with normally opened home sensor and zero index pulses**



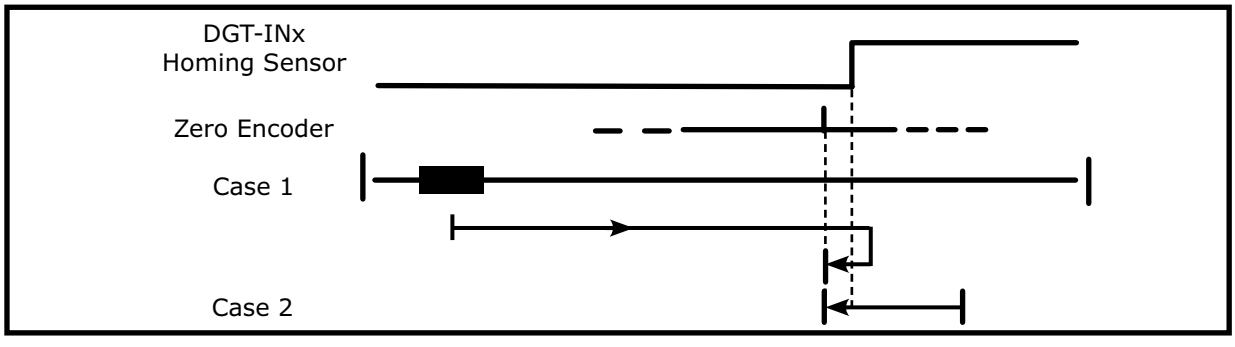
Case1: If the homing sensor is low at the start homing the drive pilots the motor axis in counter-clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start 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**

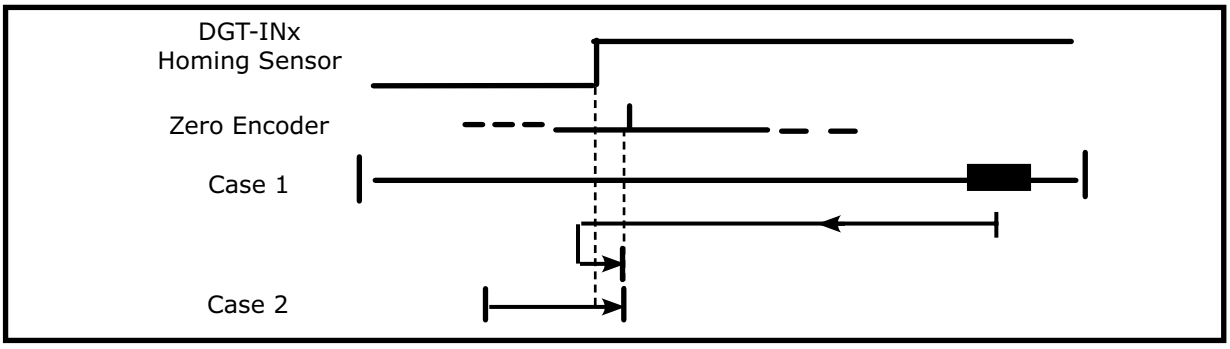


Case1: If the homing sensor is low at the start homing the drive pilots the motor in clockwise direction searching for the home sensor. When the sensor output becomes high, the motor decelerates and inverts its motion.
Case2: If the homing sensor output is already high at the homing start the motor simply 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.



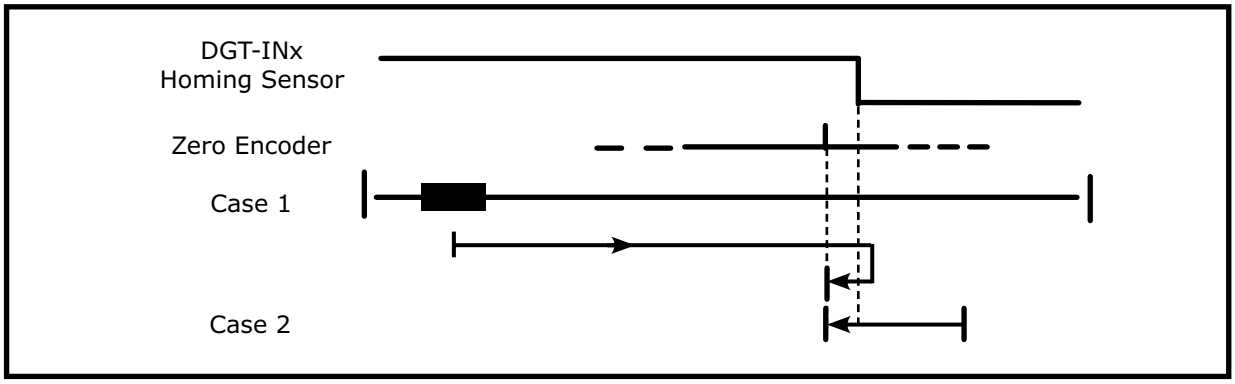
g- Direct homing procedure with normally closed home sensor and zero index pulses

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.



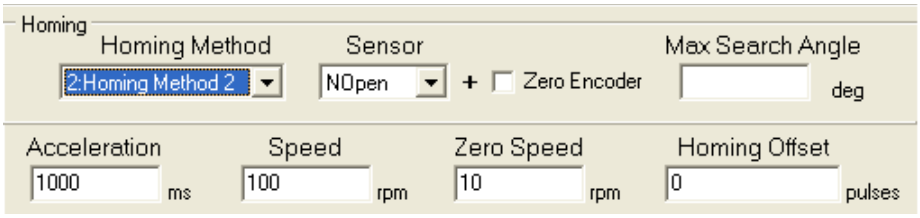
i- Homing immediate

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:

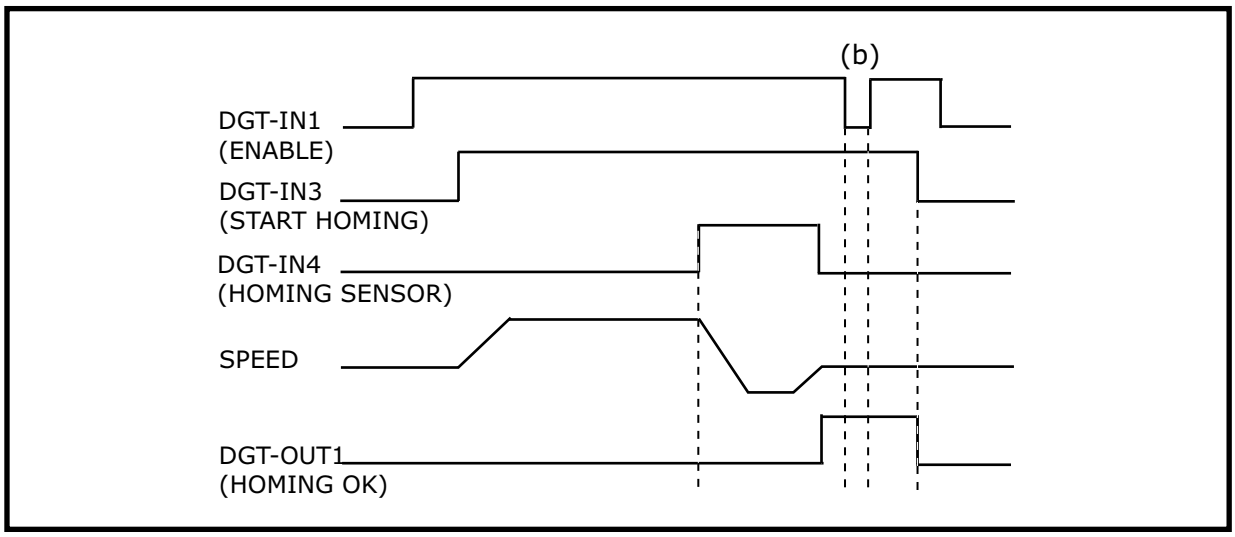
1- Select the operative mode "**4:Position Mode**" and enable the "**Hardware Control**" box.
2- In the main window of the interface set the desired homing metod and its parameters. For example:



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

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.

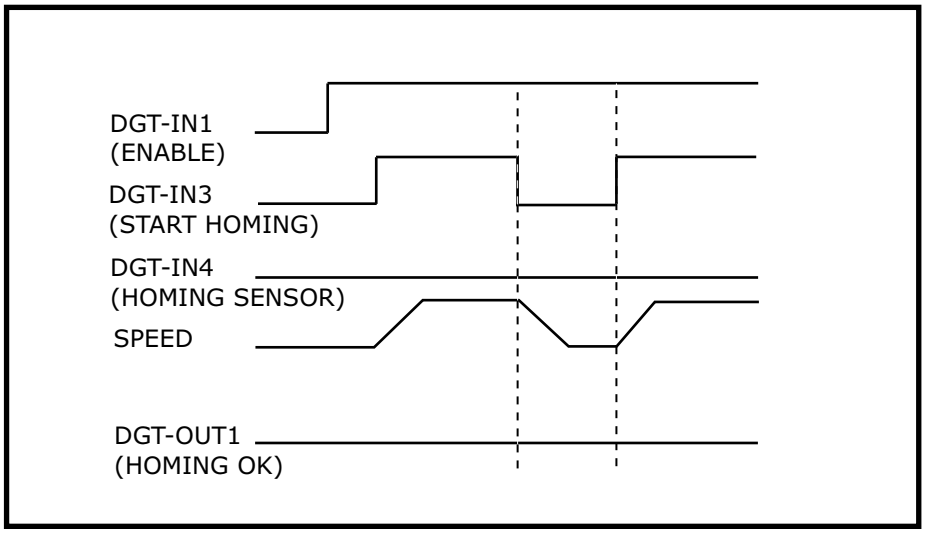


Sequence description:

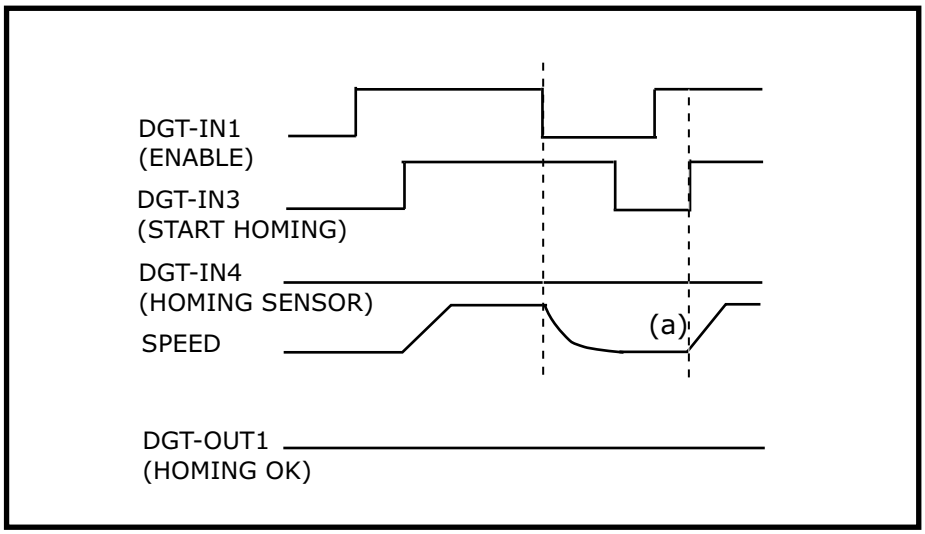
1- Enable the **DGT-IN1** (**Enable**) digital input ⇨ the motor will be on torque.
2- Enable the **DGT-IN3** (**Start Homing**) digital input ⇨ the motor moves to search the home position using the homing parameters saved on the interface. Every time this input is disabled the homing position is resetted.
3- 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.
4- 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).

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).



8.3 Positioning procedure

The Axor digital drive can be controlled as positioners by selecting the "**4: Position Mode**" operative mode. It is possible to set up to **32 trapezoidal positioner profiles**.

The following table illustrates the "**Positioning Procedures**" available by the Axor drive, 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.

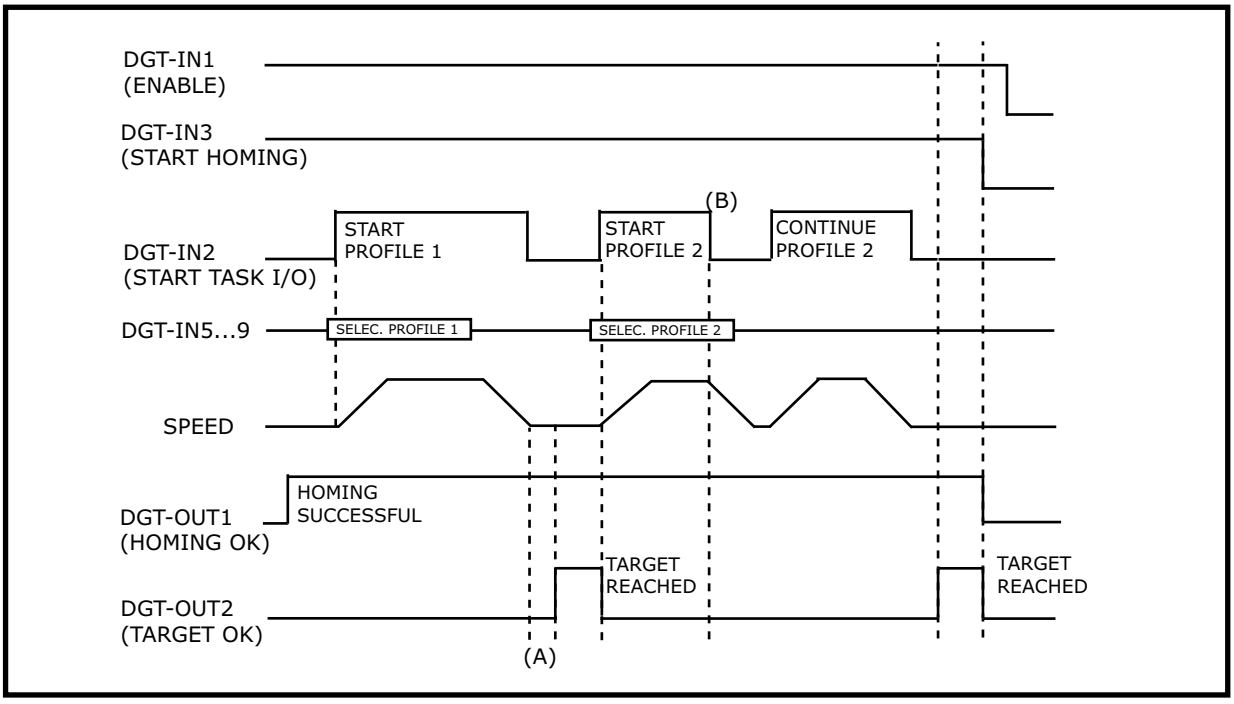
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

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.

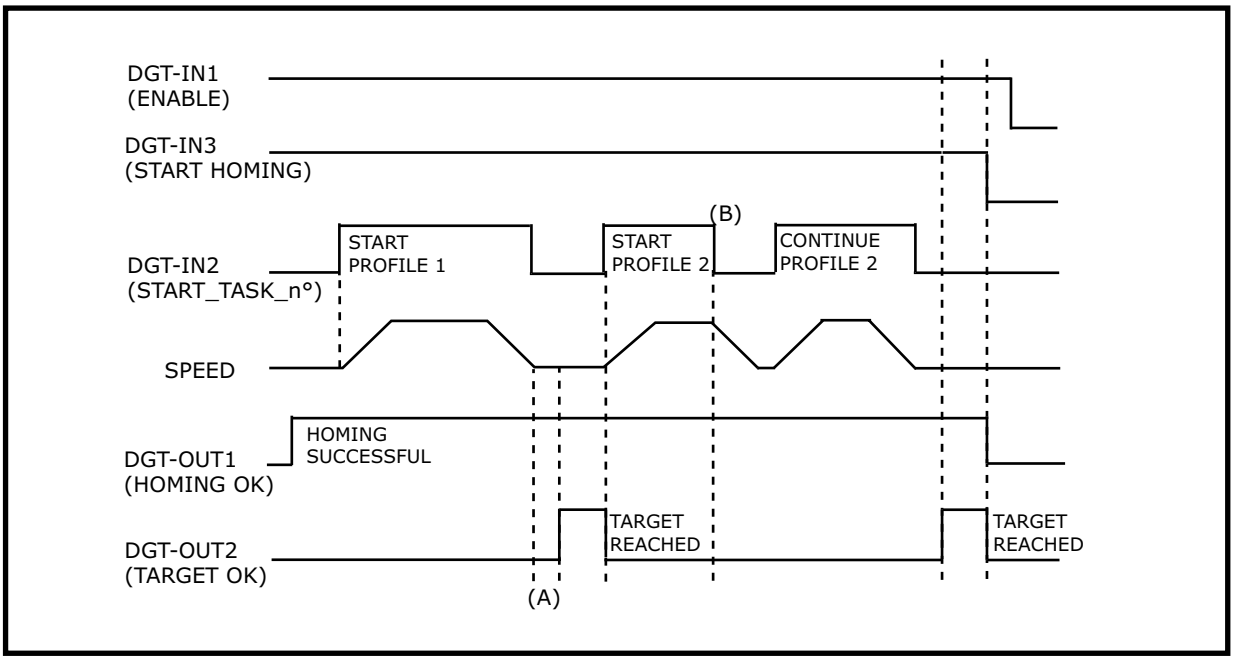
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

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.

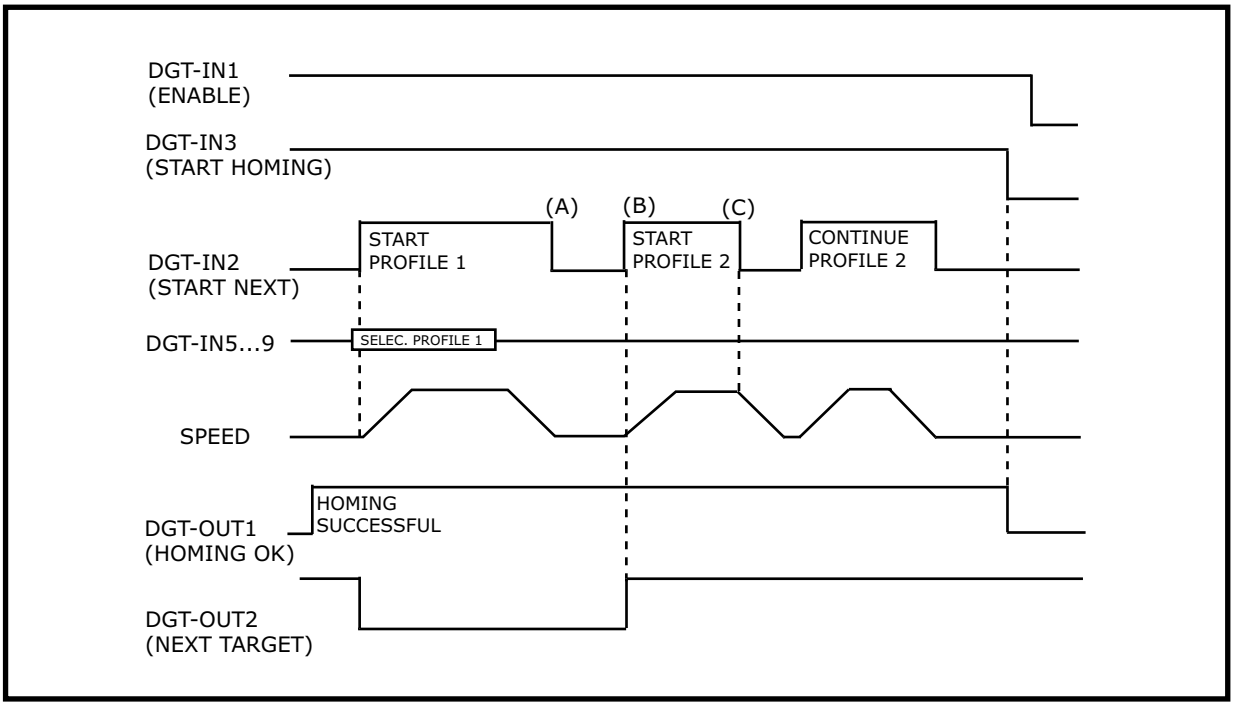
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

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.

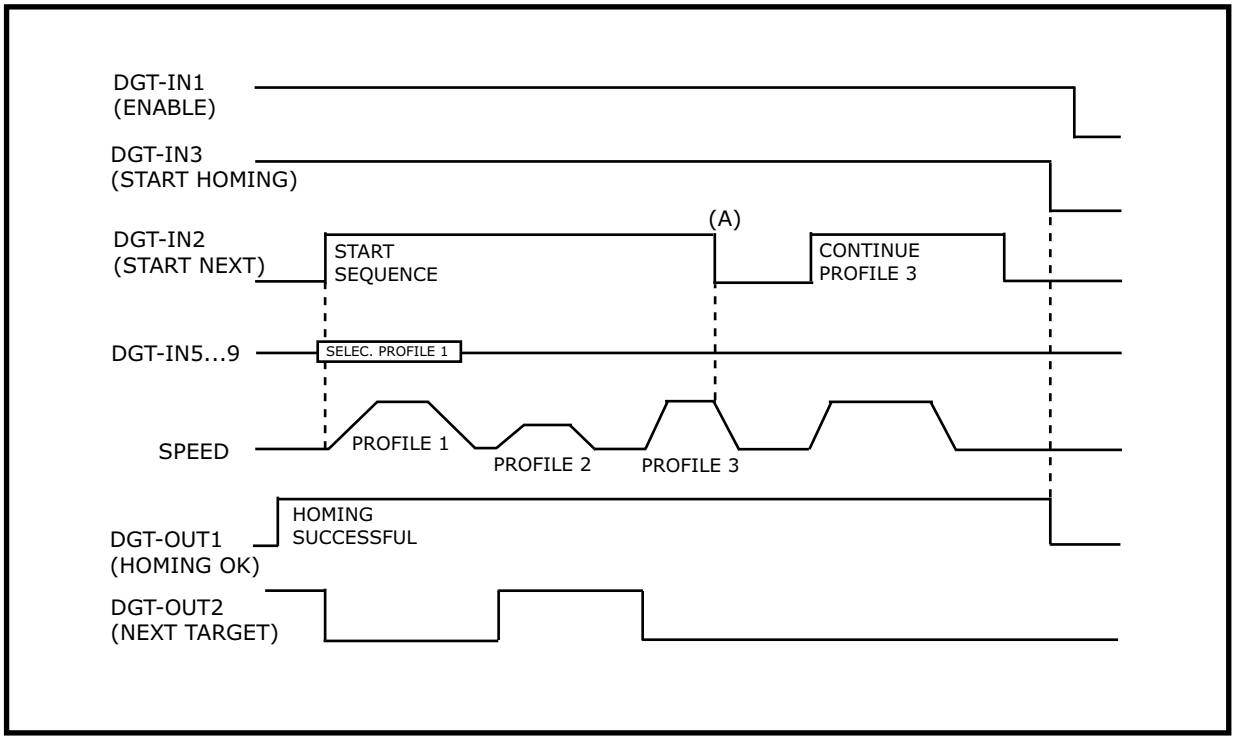
1. Execute a successful homing procedure. If no homing procedure is successful completed, no positioning profile can be made.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

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.

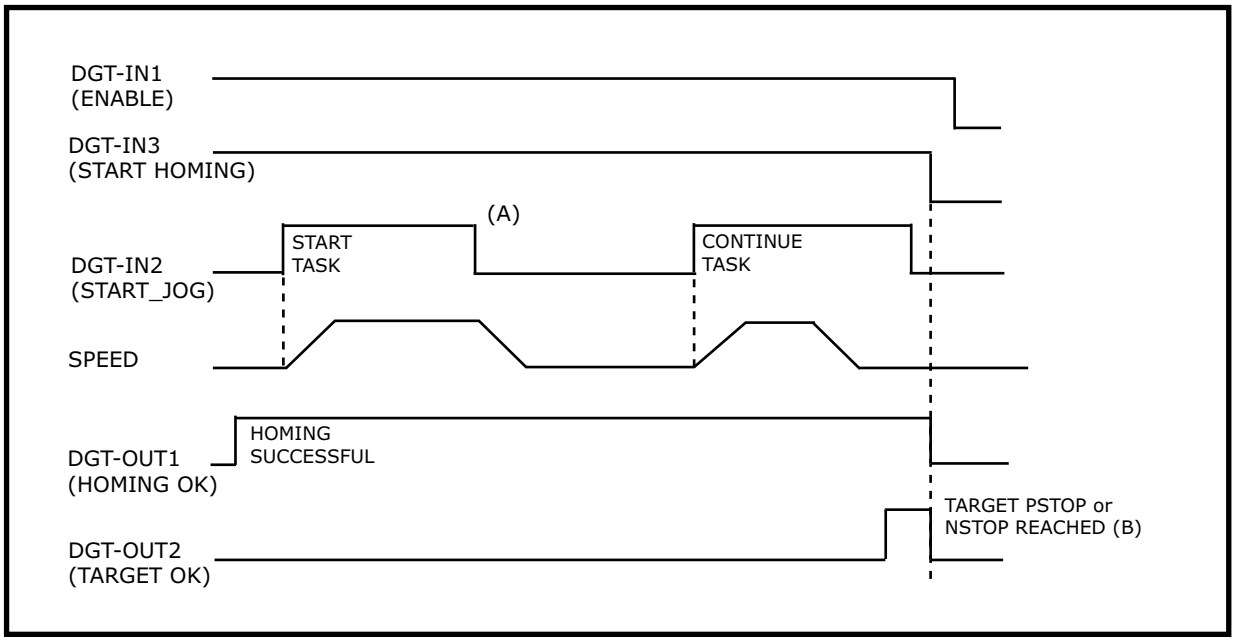
1. Execute a homing procedure. In this case a homing procedure is not necessary.
At the end of the homing procedure keep active the **DGT-IN1** (**ENABLE**) and **DGT-IN3** (**Start Homing**) digital inputs.

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)).

Chapter 9
Appendix

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9.1 ModBus Protocol

It is possible to connect the Axor drives to a PC (or a Master server) in **RS-232** 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 a register (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 address 0 (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 interrogations 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	Parity bit	Stop bit

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 registers.

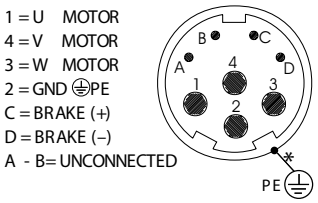
Character name	Example (hex)
Identification	14
Command	10
Start address Hi	00
Start address Lo	01
Number of registers Hi	00
Number of registers Lo	02
CRC	--
CRC	--

9.2 Motor power connection

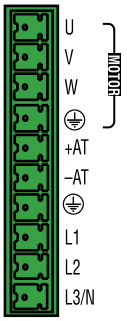
For the motor power connection use a globally shielded 3P+T cable. It must have a capacity less than 100pF/m. If the length exceeds 15/20m, insert an Axor 3x1.2mH filter.

Motor power connector 8 pole	Function	Axor's cable colour/mark	Axor's power connector
1	Motor lead U	Black 1/U	U
4	Motor lead V	Black 3 /V	V
3	Motor lead W	Black 2/W	W
2	GND, PE	Yellow/Green	PE
C	Brake (+)	Black 6/BR+	+
D	Brake (-)	Black 5/BR-	-
A	Not connected	/-	/
B	Not connected	/-	/
Connector's metal ring	Brake internal shield	-	Touching zinced paneled electrical box
Connector's metal ring	Brake external shield	-	Touching zinced paneled electrical box

Motor power connector 8 pole

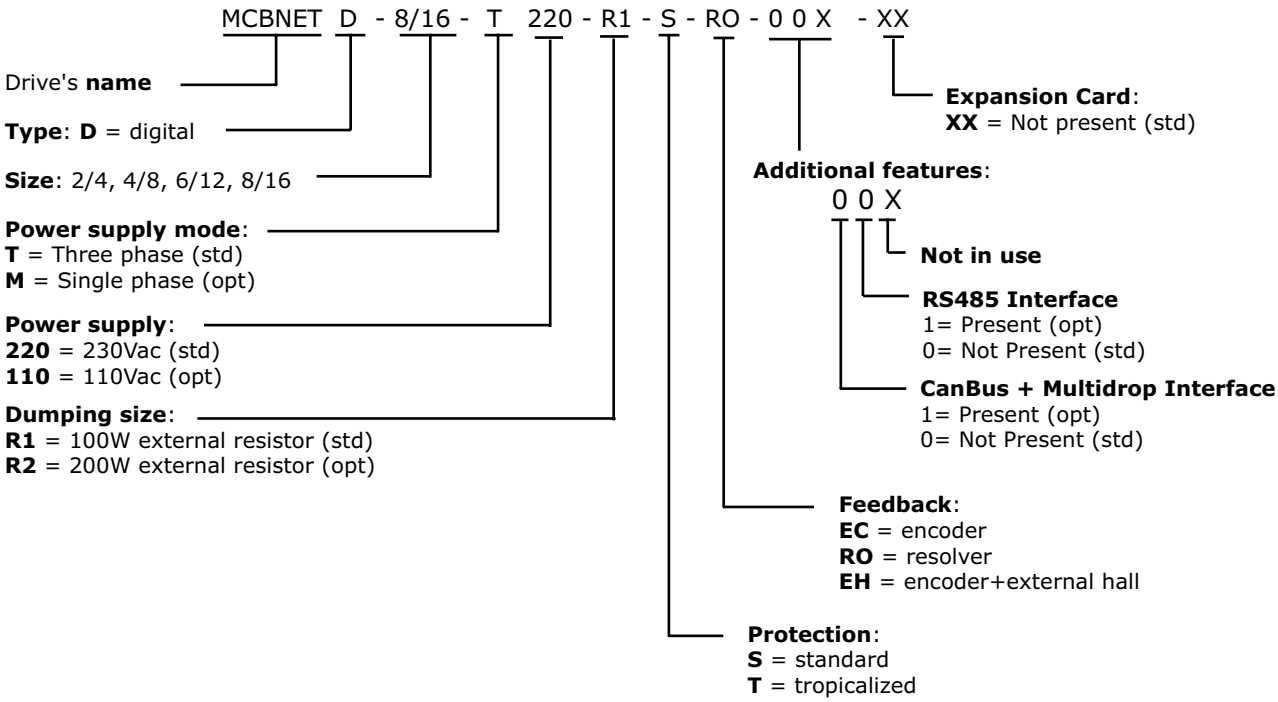


McbNET Digital™ power connector



9.3 Ordering code

To order a digital drive serie **McbNET Digital**™ refer to this ordering code:



9.4 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);
- max. time with the drive powered off (without supply connections):
  - ✓ drive having a power supply ≥ 220VAC ⇨ **1 year**
  - ✓ drive having a power supply ≤ 145VAC (200VDC) ⇨ **2 years**

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 (three phase or single phase) for 30 minutes. So, in this case power the **McbNET Digital**™ by using a single phase (or three phase) 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.

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AXOR INDUSTRIES®

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

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

www.axorindustries.com

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