SERVICE MANUAL

AXOR INDUSTRIES®

ENGLISH

CE

MAGNUM 400®

Stand alone 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: "7: Applications". Insert Index. Corrections.
ver.1 rel.03/'07	Update chapter: "5: Diagnostic". New chapter reserved to Positioner and Homing procedure. Update chapter "7: Applications": Reset Fault Function, Emergency Function, Stop Functions. Corrections.
ver.2 rel.09/'07	Manual reorganisation: first base version.
ver.2 rel.02/'08	Regen resistance dimensions insertion. Min/max dc bus voltege values insertion. Brake circuit set point insertion. Corrections.
ver.2 rel.12/'08	Corrections. Figure pag.31 corrected. Figure and note pag.39 corrected. Note pag.40 corrected. RS485 connection inserted.
ver.2 rel.01/'10	Note about regen resistance inserted.

THIS MANUAL CONTAINS A DESCRIPTION OF MAGNUM400™ AND A GUIDELINES FOR THE DRIVE'S INSTALLATION; FOR MORE DETAILS SEE ENCLOSURES ON THE CD PROVIDED WITH THE DRIVE.

USING THE DRIVE INCORRECTLY CAN INJURE PEOPLE OR DAMAGE THINGS. FULLY RESPECT THE TECHNICAL DATA AND INDICATIONS ON CONNECTION CONDITIONS.

Summary

1) Description

2) Installation

3) Diagnostic

Enclosures to the manual

On the CD provided with the drive there are the following enclosures (in pdf):

- Operative Modes Manual
- Additional Features Manual
- Speeder One Interface
- Positioner Manual
- Display and Keypad Manual
- Alarms Manual
- ModBus Manual
- CanOpen Reference Manual
- Cables Manual
- Oscilloscope Manual
- Procedures Manual (*available only on request*)

Chapter 1
Description

1.1 Description

The **Magnum400™** is a digital drive capable of piloting both rotary AC brushless motors and linear motors, up to **30Nm**. It can be supplied by a 3-phase voltage equal to **400** or **480Vac**.

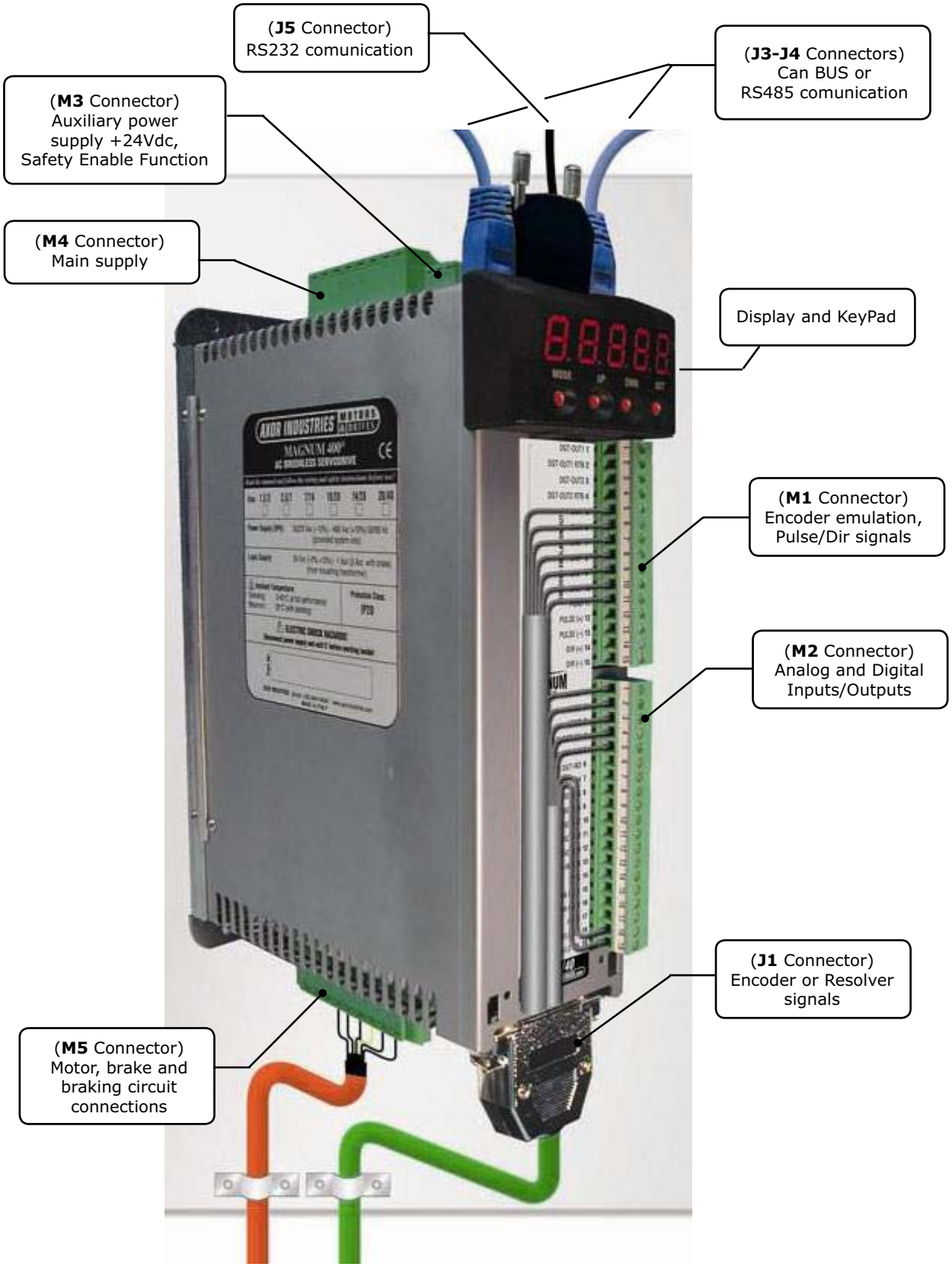
OPERATIVE MODES		
SPEED CONTROL	It is **speed piloting** utilising a digital reference or an analogue reference (differential or common mode).	standard
TORQUE CONTROL	It is **torque piloting** utilising a digital reference or an analogue reference. This function allows you to control the current from the drive.	standard
POSITION CONTROL	The positioner can be managed via hardware (by using the digital inputs) or via RS232 (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 signal* of the encoder.	standard
ELECTRICAL AXIS (GEARING)	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).	standard
PULSE/DIRECTION	It is possible to connect the drive to a **stepper-motor controller**, piloting it with the +/-Pulse and +/-Dir signals (Pulse/Dir Mode).	standard
MULTIDROP RS232	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 interface*.	*optional*
RS485 INTERFACE	It is possible to communicate with two or more drives by using the **RS485 interface**.	*optional*
CANBUS	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**	*optional*
Notes: • The current controller is vectorial with sampling time of 62,5μs. The velocity and position loop both work with sampling time of 250μs. • The current commutation is sinusoidal.		
FEEDBACK		
ENCODER	incremental encoder signals plus hall signals	standard
RESOLVER	2 pole	*optional*

DIGITAL INPUTS/OUTPUTS		
9 DIGITAL INPUTS	They are programmable for: the limit switch, the holding brake, the homing and positioning procedures, the emergency stop, the reset alarm, etc.	standard
2 programmable DIGITAL OUTPUTS	They can be used to send messages from pre-programmed functions of the drive.	standard
EMULATED ENCODER OUTPUTS	There are 6 pins dedicated to **emulated encoder** with different programmed ratios (1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128) between output pulse/rev and encoder/ resolver ones.	standard
ANALOG INPUTS/OUTPUTS		
1 ANALOG COMMON MODE INPUT (TPRC)	It is used for controlling the current from the drive.	standard
1 ANALOG DIFFERENTIAL or COMMON MODE INPUTS (+/-Vref)	It is used for piloting the drive with an analogue speed reference from an external controller.	standard
2 programmable ANALOG OUTPUTS	They allow you to visualise by the oscilloscope some of the drive's measurement values (for example: the velocity, the Iq current, etc.).	standard
GENERAL FEATURES		
KEYPAD	**Four buttons** (**UP**-**DW**-**MODE**-**SET**) allow the manual insertion of data without using a PC.	standard
DISPLAY	A **display with 5 characters** visualises: the inserted values, the drive's status, the alarms.	standard
SPEEDER ONE **SOFTWARE INTERFACE**	It allows you to set and manage all drive's parameters by using a PC connected to the drive. The communication between the drive and PC is done by a RS232 cable using the ModBUS protocol. The software works on the following operating systems: Windows 98, Windows 2000, Windows XP.	standard

HOLDING BRAKE	The drive has circuitry that allows the control of the **electromechanical brake integrated** in the motor, which can be used *with motor not running, for blocking the motor's axis*. The drive supplies the brake with **+24Vdc**. It can be **externally** managed by the user or **automatically** by the drive.	*optional*
EMI FILTER	The drive is equipped with an integrated **EMI anti-disturbance filter** at the 3-phase power supply input and with another EMI anti-disturbance filter at the auxiliary +24V power supply input.	standard
REGEN CIRCUIT		standard
EXPANSION CARDS	There is a slot for expansion card to implement additional features.	*optional*
SAFETY		
SAFETY	The converter is protected from short circuitry, the Max/Min Voltage, the drive I^2t , the Motor I^2t , 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 compromising the system's functioning.	standard
SAFETY ENABLE FUNCTION	It is a personnel safety function which avoids the accidental startup of the motor in the absence of 24Vdc on indicated pin.	*optional AVAILABLE SOON*
BLACK-OUT DYNAMIC BRAKE FUNCTION	It stops the motor when there is a black-out.	*optional AVAILABLE SOON*
EQUIPMENT		
a drive serie Magnum400™		standard
terminals: M1, M2, M3, M4, M5		
Service Manual		
a CD-ROM with ***Speeder One*** software interface and all enclosures to service manual		
Motor inductance, 3x1.2mH, for cables over 20/25 meters in length		*optional*
an external braking resistor (500W or 1000W)		
CBLS cable for motor feedback signal, encoder/resolver (meter multiple)		
CBLS power cable for motors series *SuperSAX*;		
motors series *SuperSAX*		

All *optional* features have to be requested by using the proper ordering code (see "1.5 Product plate and Ordering code").

1.2 General view Magnum400



1.3 Technical Data

Nominal Data							
Nominal Voltage	Vac	**Three phase**: 3x480Vac +10% max, 3x400Vac -10%, 50/60Hz (Single phase permetted for setup only)					
Min/Max dc bus voltage	Vdc	**400Vac**			**480Vac**		
		400Vdc min ÷ 800Vdc max			500Vdc min ÷ 870Vdc max		
Auxiliary power supply (for back up)	Vdc	+24Vdc (0%, +15%) - 1Adc (3Adc with brake)					
Size		1,5/3	3,5/7	7/14	10/20	14/28	20/40
Nominal Current	Arms	1,5	3,5	7	10	14	20
Peak current for 5 sec.	Arms	3	7	14	20	28	40
Dissipation at nominal current	W	30	42	56	88	165	195
Dissipation with output stage disabled	W	20					
PWM output frequency	kHz	8					

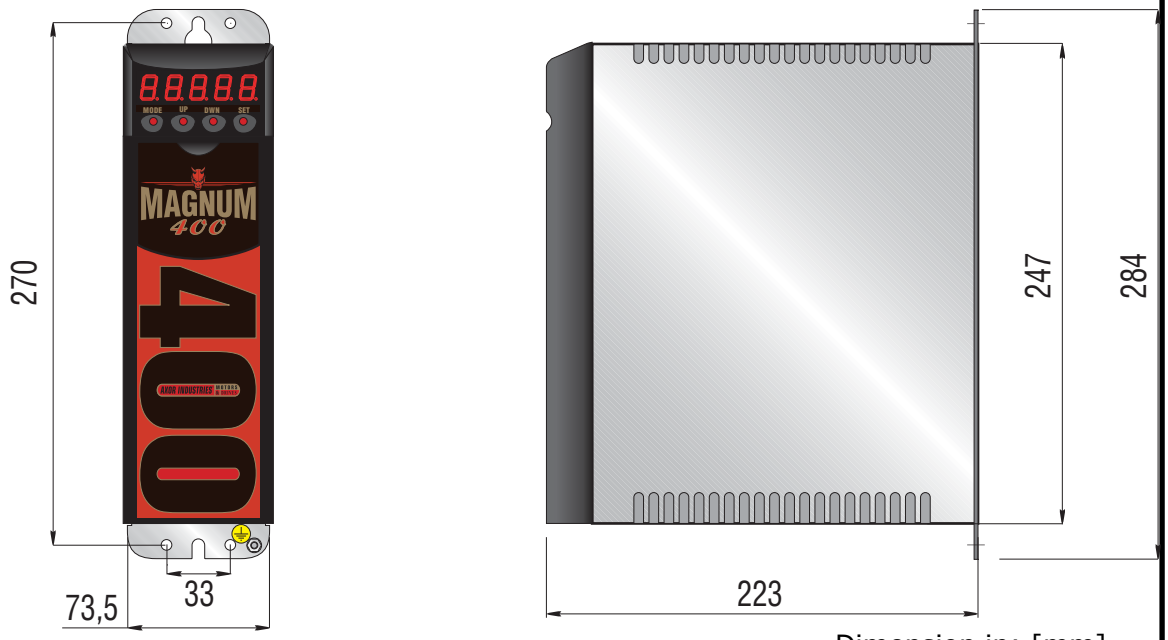
Control signals	
Optoisolated digital inputs	+24Vdc - 7mA (PLC compatible)
Optoisolated digital outputs	+24Vdc - 50mA (PLC compatible)
Analog programmable outputs	±10V (±5%)
A common mode analog input (TPRC)	±10V max, 10kOhm input resistance
A differential or common analog input (+/-Vref)	±10V max, 40kOhm input resistance
Pulse/Dir digital inputs	+5V, optoisolated, max. frequency 250kHz
Emulated encoder outputs	V_{OH}=2.5V min - I_{OH}=-20mA V_{OL}=0.5V max - I_{OL}=20mA

Braking Resistance		
Internal Resistance	200W - 66Ohm size: 1.5/3, 3.5/7, 7/14	
	200W - 33Ohm size: 10/20, 14/28, 20/40.	
External Resistance	500W - 66Ohm size: 1.5/3, 3.5/7, 7/14.	
	500W - 33Ohm size: 10/20, 14/28, 20/40.	
	1000W - 33Ohm +33Ohm 500W size: 1.5/3, 3.5/7, 7/14.	
	1000W - 66Ohm // 66Ohm 500W size: 10/20, 14/28, 20/40.	
Set point values	**400Vac**	**480Vac**
	695Vdc min ÷ 735Vdc max	815Vdc min ÷ 845Vdc max

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

External Protections (fuses or similar)			
Size	1,5/3 and 3,5/7	7/14 and 10/20	14/28 and 20/40
Power supply (F_2)	6A T(Time Lag)	10A T	20A T
Auxiliary power supply (F_3)	6A T		
External braking resistor (F_4)	4A F(Fast)	6A F	6A F

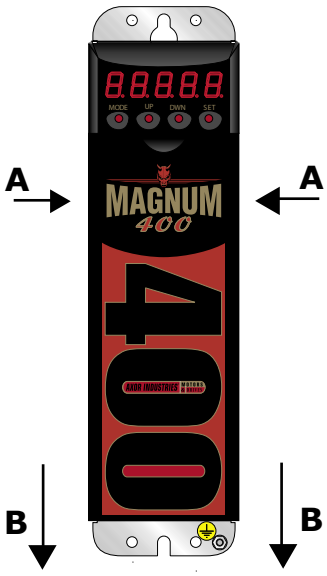
1.4 Mechanical Dimension



Dimension in: [mm]

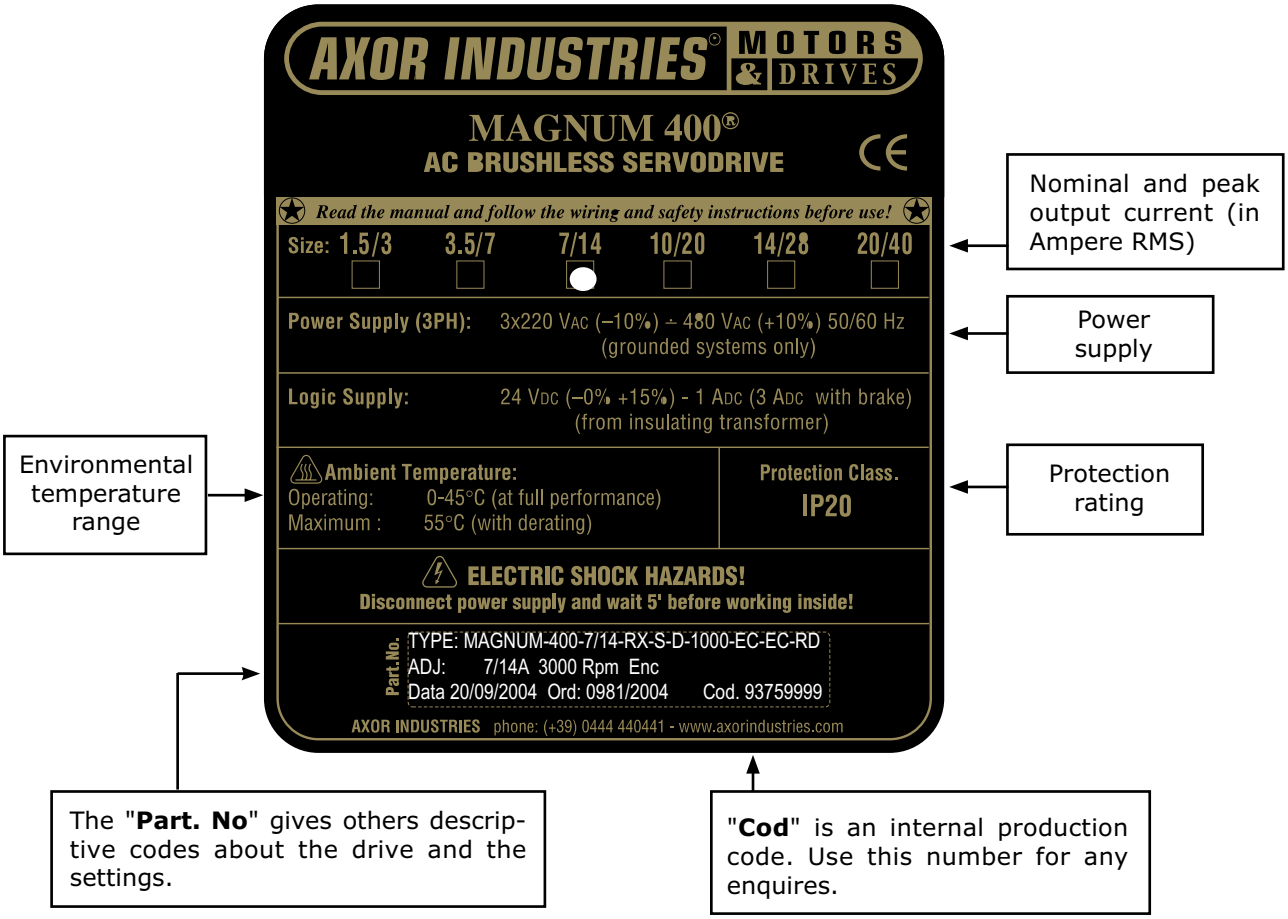
Mechanical specifications							
External dimensions	mm	284 x 223 x 73,5					
Size		1,5/3	3,5/7	7/14	10/20	14/28	20/40
Weight	Kg	4,2			4,6		

NOTE:
The **M1** and **M2** connectors are located under the plastic cover.
To open it, push the cover on the borders (see A), move it down and remove it (see B).



1.5 Product plate and Ordering Code

On the side of each **Magnum400™** there is a ***product plate*** like the following:



To order a digital drive serie **Magnum400**™ refer to this ***ordering code***:

M400 - 20/40 - RXX - S - RO - 0 0 0 0 0 X - 00 - Sxxx

Drive Model

Size: 1.5/3, 3.5/7, 7/14, 14/28, 20/40

Dumping size:
RXX = Internal standard resistor
R5 = 500W external resisor (opt)
66Ω (for 1.5/3 to 7/14)
33Ω (for 10/20 to 20/40)
R10 = 1000W external resistor (opt)
33Ω + 33Ω da 500W (for 1.5/3 to 7/14)
66Ω // 66Ω da 500W (for 10/20 to 20/40)

Protection:
S = Standard
T = Tropicalized

Feedback:
RO = Resolver
EC = Commutation encoder
ER = Encoder or Resolver (both)

CBMD: CanBus + Multidrop Interface
1= Present (opt)
0= Not Present (std)

Additional features:
0 0 0 0 0 X

Not in use

HBD: Holding Brake Drive
1= Present (opt)
0= Not Present (std)

SEF: Safety Enable Function
1= Present (opt)
0= Not Present (std)

RXDB: Black Out Dynamic Brake
1= Present (opt)
0= Not Present (std)

R485: RS485 Interface
1= Present (opt)
0= Not Present (std)

Expansion cards:
00 = Not present (std)

Specific number presence (opt):
S xxx
001÷999=specific number

Chapter 2
Installation

2.1 General Advices

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.
In details:

- for the drive having a power supply equal to 380VAC: power it by using a single phase (or three phase) supply equal to 220VAC;
- for the drive having a power supply equal to 220VAC: power it 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.

Security standard

• This manual is exclusively addressed to technical personnel with the following requirements:

- Technician with knowledge on movimentation of elements sensitive to electrostatic discharges (for the transport).

- Technician with appropriate technical training and with vast knowledge on electrotechnics/drive technical field (for the installation and operation of servodrives).

Using the drive incorrectly can injure people or damage 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 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 all objects.

• 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 **Magnum400™** 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.

2.1 General Advices

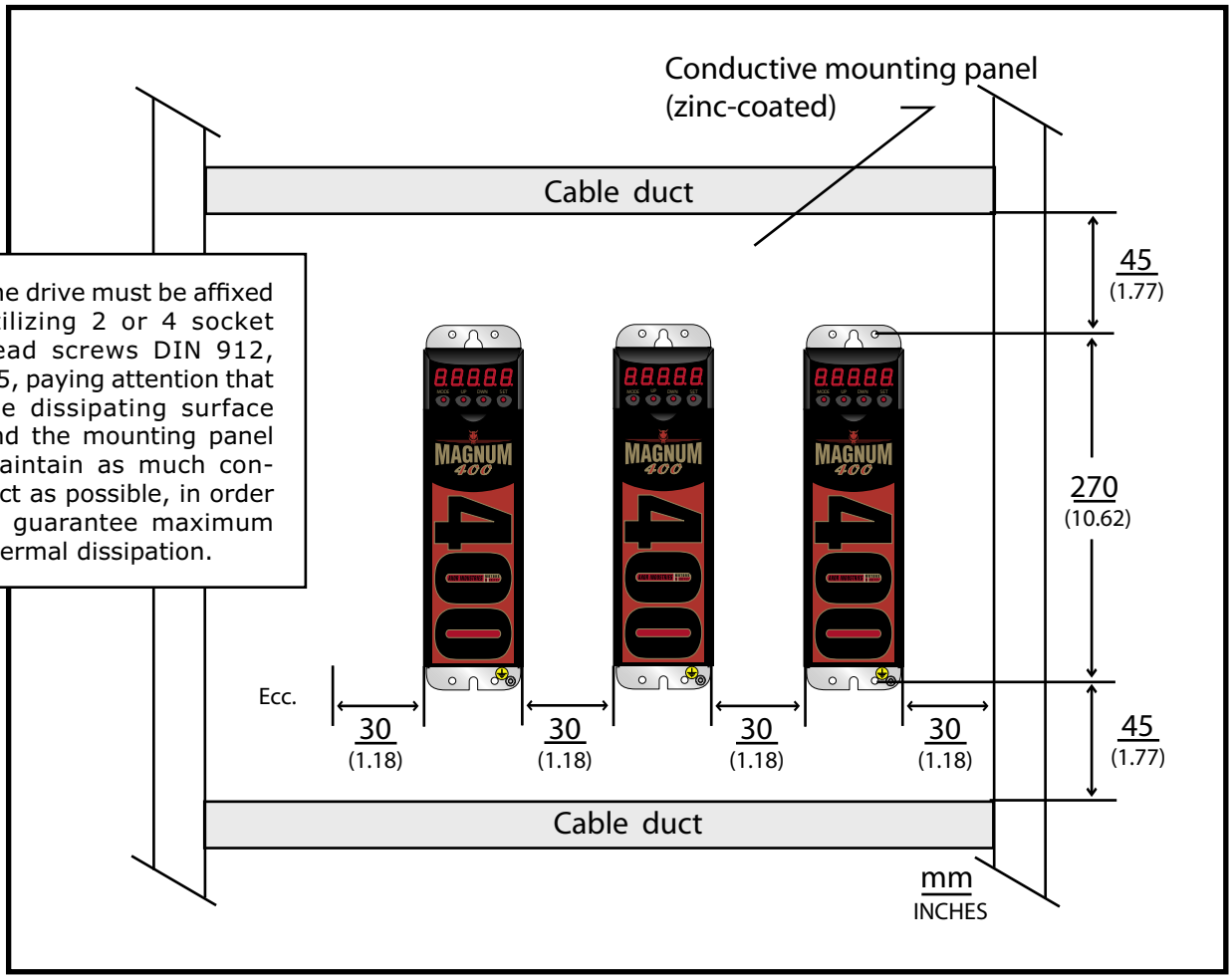
• Protect the converter from excessive mechanical vibrations in the electrical box.

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

• The **Magnum400™** is equipped with an integrated **EMI anti-disturbance filter** at the 3-phase power supply input and with another EMI anti-disturbance filter at the auxiliary +24V power supply input.
Being implicit to filter operation the deviation towards earth or mass of the undesired frequencies, ensure that these devices can produce leakage 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 make filter operation unreliable.

2.2 Positioning

The **Magnum400™** is made to be fixed vertically to the **bottom of the electrical box** in order to guarantee reliable cooling, respecting the following distances:



Note: Arrange the power components (converters, main's filters, resistors, terminals, ...) in bins of the electrical panel different from those reserved to the command or control systems (PLC, PC, CNC, regulators, ...). This improves the level of immunity to interference of the system.

2.3 Environmental conditions

During the storage and the installation respect the followings environmental conditions:

Condizioni ambientali	
Storage temperature	-20°C...+55°C
Working environmental temperature	From 0°C to +45° C (no derating). From +45°C to +55°C the drive must be derated 2.5%/°C in reference to nominal and peak current.
Humidity	From 10% to 85%
Altitude	Up to 1000m without restriction. From 1000 to 2500m of altitude the converter must be derated in the output current of 1.5% every 100m.
Enclosure protection	IP20
Pollution level	LEVEL 2 (Norm EN60204/EN50178) 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.

Notes:

• 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.

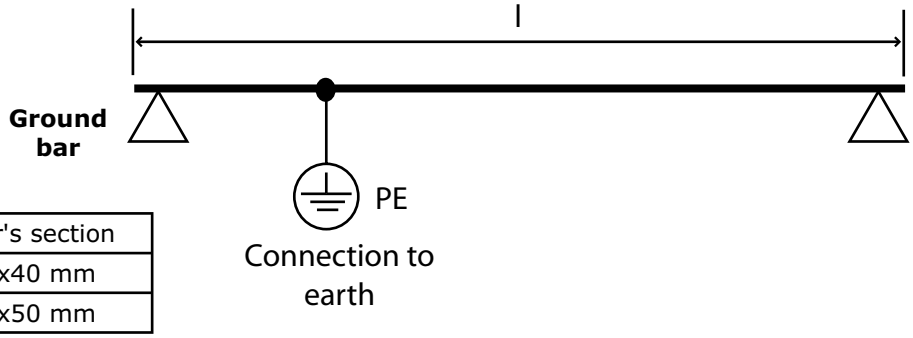
2.4 Cables

The following table illustrates the technical characteristics of all cables:

Cables (as norm EN60204)		
Type	**Section**	**Notes**
for the Main Supply	**1.5**mm²/15AWG drive size: 1.5/3, 3.5/7, 7/14	**Always insert a power relay or a thermal magnet on every phase of the products power supply.**
	2.5mm²/14AWG drive size: 10/20, 14/28, 20/40	
for the Auxiliary Supply	**1.5**mm²/15AWG	Connect the 0V of the auxiliary supply to the ground bar.
for the Motor's Brake	**0.75**mm²	It must shielded.
for the Motor's Power	**1.5**mm²/15AWG drivesize: 1.5/3, 3.5/7, 7/14	It must be shielded. It must have a capacity of ≤150pF/m. In the configuration without filter, the cable can reach a maximum length of 20/25m. If the length exceeds 20/25m, insert an Axor **3x1.2mH** filter.
	2.5mm²/14AWG drive size: 10/20, 14/28, 20/40	
for the Control signals and I/O signals from PLC/CNC	**0.5**mm²/20AWG	See "2.6 Note about cable shielding"
for the Encoder signals	**0.25**-**0.35**mm²/ 22-24AWG	It must be shielded. It must have a capacity less than 120pF/m.
for the Resolver signals	**0.25**-**0.35**mm²/ 22-24AWG	
for external resistor	**1.5**mm²/15AWG	The cable must be as short as possible. If the cable length is greater than 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.
for the RS232 communication	**0.22**mm²/24AWG or **0.34**mm²/22AWG	The length of the cable must be equal to or less than 2.5m. 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	**0.25**mm²/**0.34**mm²	Cable capacitance: max 60 nF/km. Impedance characteristics : 100...120Ω. Lead resistance (loop): 159,8 Ω/km. The length depends upon the transmission speed: • 1000kbit/s ⇨20m max; • 500kbit/s ⇨70m max; • 250kbit/s ⇨115m max.
Note: • Avoid crossing, overlapping and twisting cables together. If it is absolutely necessary to cross them, do so at 90°. • On request Axor provides motor signal cables series *encoder or resolver* for motors series *Super-SAX*.		

2.5 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 to the ground bar:
   - ✓ the **earth power terminal of the drives**;
   - ✓ the **CHASSIS** of all drives;
   - ✓ the **DGT-IN RTN** pin of the digital inputs for each drive;
   - ✓ the **0V of the auxiliary supply**;
   - ✓ the **internal zero voltage of the CNC**;
   - ✓ the **earth terminals of the PLC/CNC frames**;
2. Connect the **ground bar** to the zinced panel of the drive by using a screw, then connect that screw to **earth**.
3. Connect earth to the **motor's carcass**.

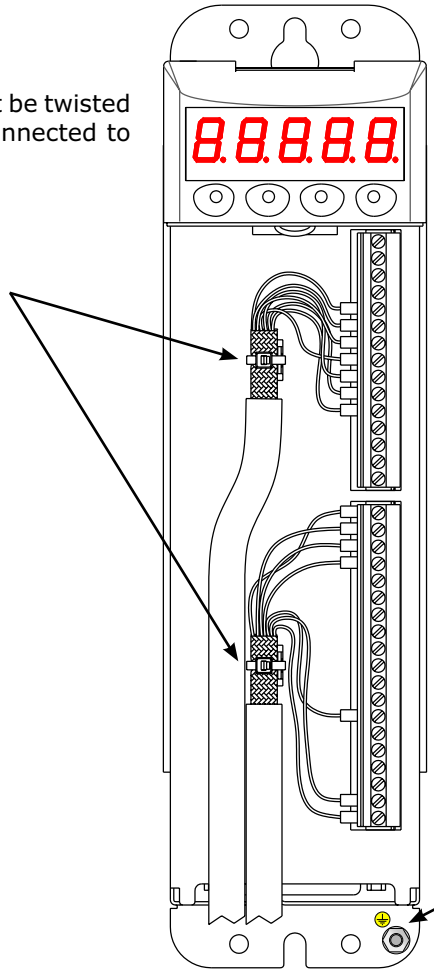
Symbol	Description
	It suggests a conductive connection as much as possible to the chassis, or the heat-sink, or the mounting panel of the electrical box.
	It refers to the earth connection.
	It refers to the connection of the shield to the drive's carcass as illustrated on page 23.
	It refers to the connection of the shield to the connector's metal ring.

2.6 Note about cable shielding

Control signal cables

The conductor of the analogic signal must be twisted and shielded, and the shield must be connected to ground as illustrated below:

Remove the outside sheath and affix the shield to the dedicated retainer rings, by using plastic clamps.



Chassis: Connect the screw to the ground bar.

Note:

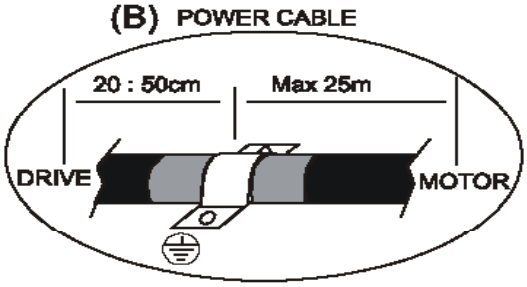
• To reduce the capacitive and inductive coupling, these cables must be run keeping a distance of more than 30cm from the power cables (10 cm if they are shielded).

• 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.

Motor cables

The shield of the motor cable (power and signal cables) are connected as follows:

• *drive side* (20:50cm) ⇨ remove the outside sheath and fix shield to the zinced pannel, by using a u-clamp (Axor's cables have incorporated u-clamp):



• *motor side* ⇨ the shield is internally connected to the metal ring of the motor connector, thus to earth through the motor's carcass.

2.7 Base installation procedure

This procedure must be done only by qualified personel which are familiar with drives. If you need more information contact Axor.

a) **Power off** all the supplies of the electrical box.

b) Verify:
- ✓ the **drive-motor coupling** ⇨ the stall current (I_o) of the motor should be equal to/or greater than the nominal output current of the drive;
- ✓ the **positioning** of the drive into the electrical box;
- ✓ the **pollution level** and the **ventilation**;
- ✓ the **connection to earth** of the electrical box where the drive is installed (see "2.5 Connection to ground and earth").

c) Execute the wiring following this order, avoiding that wiring's pieces, cables, wires, screws, conductive objects, etc. do not 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 length is greater than 20/25m.

3- Connect the **earth of the motor's power** (PE) and, if necessary, connect the cables of the **electromechanical brake**.

4- Connect the **external shield** of the motor's cable: it must be shielded utilising a u-clamp to the zinced panel of the electrical box (see "2.6 Note about cable shielding").

5- If the **internal braking resistor** is used, insert a bridge between pins INT and -AT.
If an **external braking resistor** is used, connect it between pins EXT and -AT by using a cable as short as possible. If the cable length is greater than 20/30 cm, the cable must be twisted and shielded, besides the shield must be connected to ground on both ends utilising u-clamps to the zinced panel of the electrical box.

6- Connect the motor's feedback cable to the drive's **J1** connector

7- Connect the **main power supply cable** (L1-L2-L3) and the **earth cable** (PE).
Always insert a power relay or a thermal magnet on every phase of the products power supply.

8- Connect the **auxiliary supply cable** (+24V).
Use an external power supply, that must be stabilized and galvanically isolated from the main supply.

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

10- Supply the drive with the **auxiliary supply** and then **main supply** following the *procedure* illustrated at the end of the chapter.

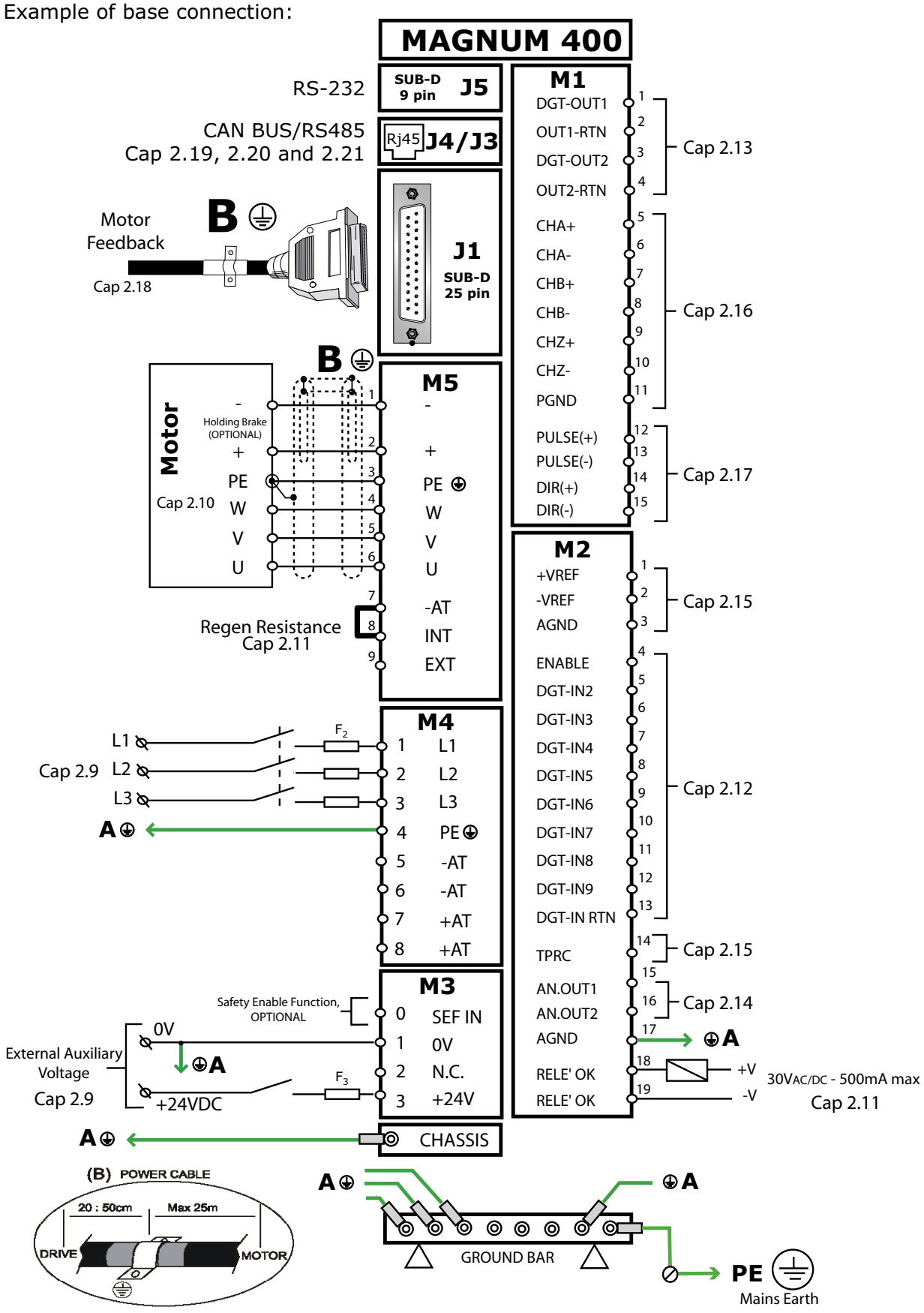
11- Open the *Speeder One* interface.

12- Execute the tests on the drive and the motor.

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

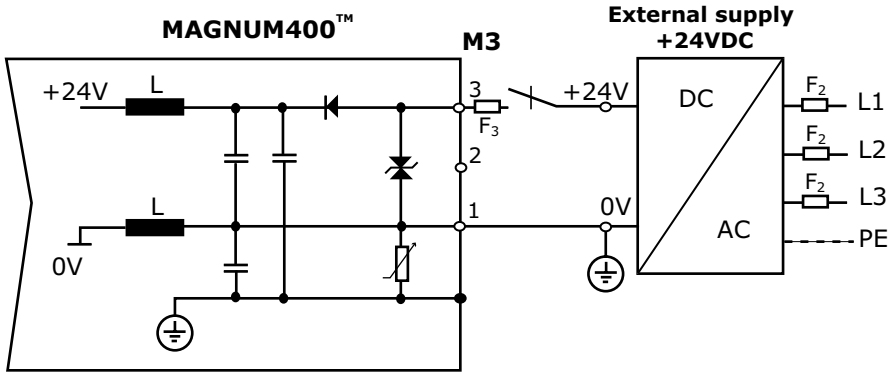
2.8 Example of base connection

Example of base connection:



2.9 Supply connections

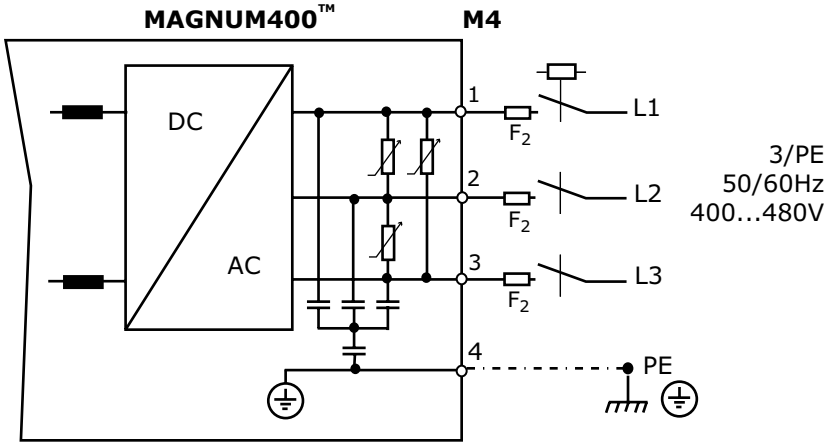
AUXILIARY SUPPLY +24Vdc



Note:

- Accepted voltage: **+24VDC** (0%/+15%);
- current required for the external supply: **3A** (motor with brake);
- current required for the external supply: **1A** (motor without brake);
- we suggest to insert the **F_3** (6A T) fuse;
- we suggest to connect the 0V of the external supply to the ground bar .

POWER SUPPLY



Note:

• Always insert a power relay or a thermal magnet on every phase of the products power supply.

• If a power supply between 400V and 480V is utilized and ground protection is not present, or there is an asymmetrical grounding system, an **isolation transformer** is required.
The **nominal power of the transformer** is calculated by adding the various wattage of each motor:

Pt = Pn+Pn+Pn+...

Pt= nominal power of the transformer (VA)
Pn= nominal power of each motor (VA), which can be calculated in this way:

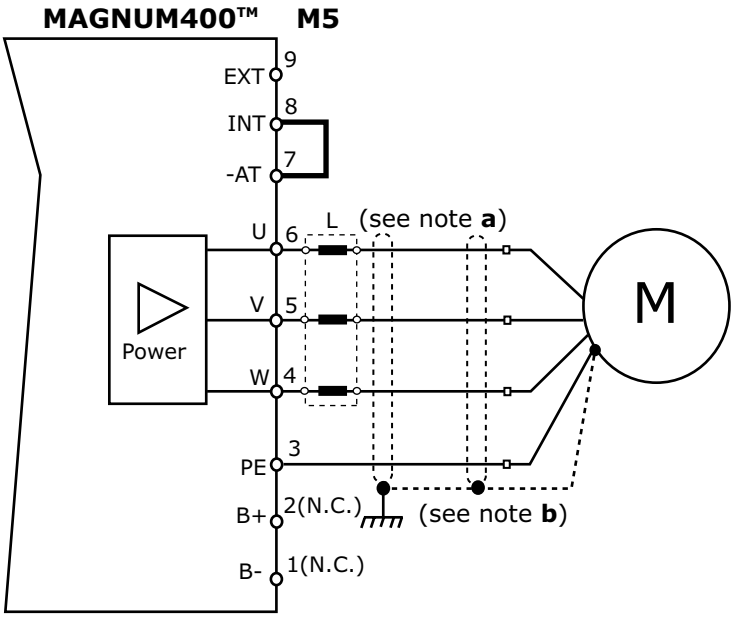
Pn = n x Cn / 9,55

Pn=nominal motor power (W)
n= motor speed (rpm)
Cn= motor nominal torque (Nm)

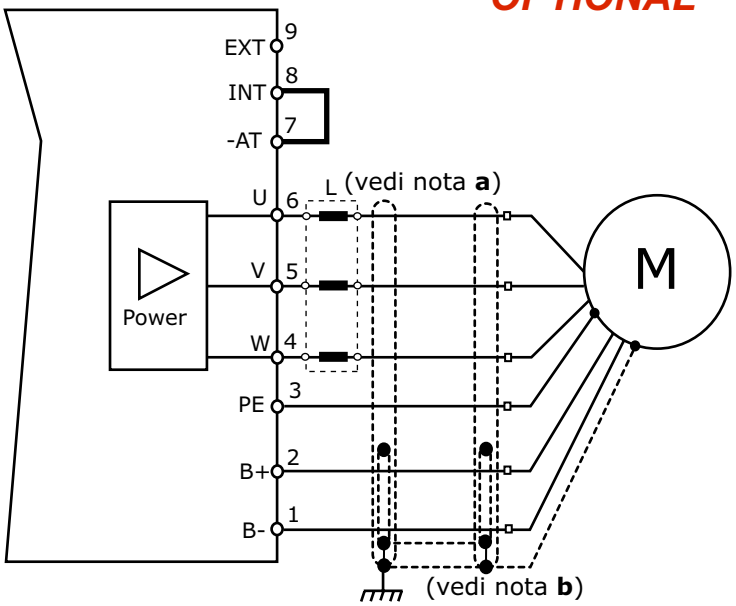
2.10 Motor power connection

MOTOR POWER + MOTOR HOLDING BRAKE

WITHOUT brake



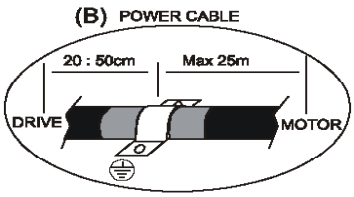
WITH brake ***OPTIONAL***



Technical characteristics of brake outputs:
- ✓ Output Voltage: **+24VDC** [0%, +15%].
- ✓ Maximum available current: **3A**.

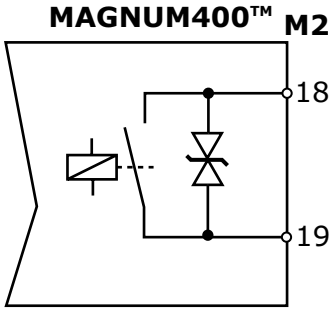
Note:
a- Use **3x1.2mH - 20Arms** filter series for connections with cables longer than 20/25 meters.

b- The **earth connection** of the power cable's shield must be made on the zinc-coated panel (using a u-clamp) near the drive (20-50cm). Motor side: the shield is connected to connector's metal ring, so it is connected to ground through motor's carcass.



2.11 Relè OK and regen resistance connections

RELE' OK connection

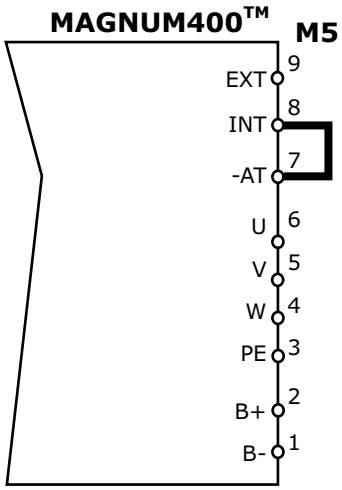


It is normally open when the drive is not supplied; it is normally closed when the drive is supplied and it has not active alarms.

30VAC/DC - 500mA max

REGEN RESISTANCE connection

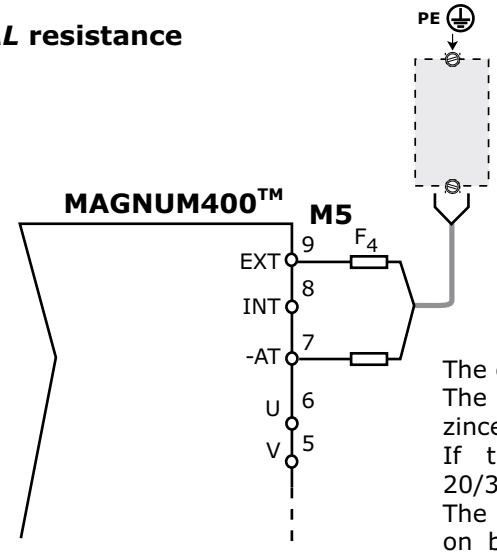
INTERNAL resistance



Attention: The <u>internal</u> braking circuit is enabled <u>only</u> if a bridge is present between pins 7 (-AT) and 8 (INT) on the M5 connector.

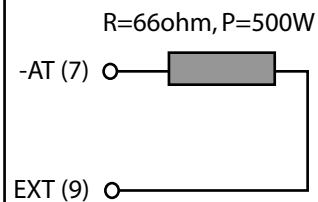
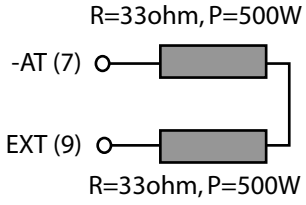
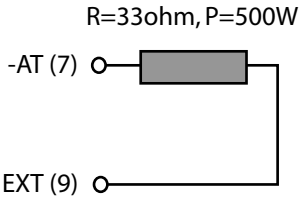
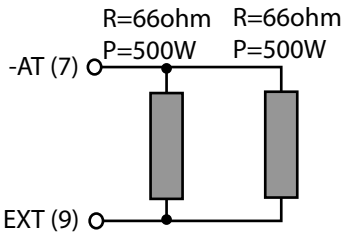
EXTERNAL resistance

OPTIONAL

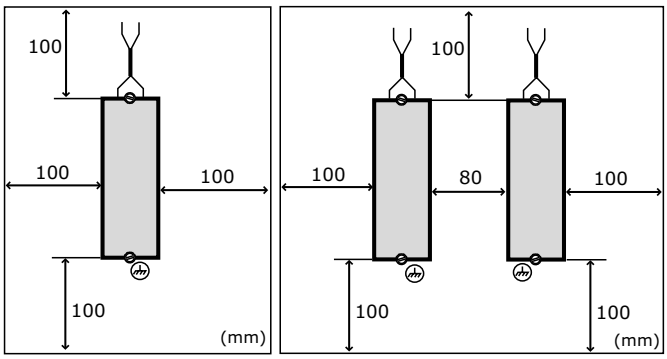


The cable must be as short as possible.
The resistances must be connected to the zinced pannel utilising two screws.
If the cable length is greater than 20/30cm, it must be twisted and shielded.
The shield must be connected to ground on both ends, utilising u-clamps to the zinced panel of the electrical box.

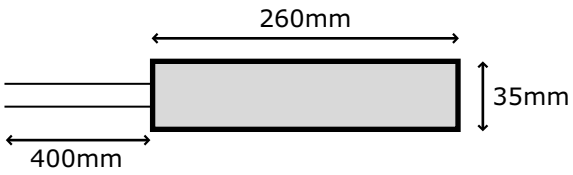
2.11 Relè OK and regen resistance connections

<table>
<tr><th colspan="5">EXTERNAL BRAKING CIRCUIT</th></tr>
<tr><th>Drive Size [A]</th><th>R5 Resistor P_{tot}=500W</th><th>Connection</th><th>R10 Resistor P_{tot}=1000W</th><th>Connection</th></tr>
<tr><td>1,5/3
3,5/7
7/14</td><td>1 resistor 66 ohm 500W</td><td> 
</td><td>2 series resistors 33 ohm 500W</td><td> 
</td></tr>
<tr><td>10/20
14/28
20/40</td><td>1 resistor 33 ohm 500W</td><td> 
</td><td>2 parallel resistors 66 ohm 500W</td><td> 
</td></tr>
</table>

Notes:
- The temperature of the zinced panel of the electrical box can be higher than 200°C.
- Do not mount the resistor on surfaces which can be damaged by heat.
- If the resistors are mounted externally, protect them.
- Respect the following distances and shieldings:



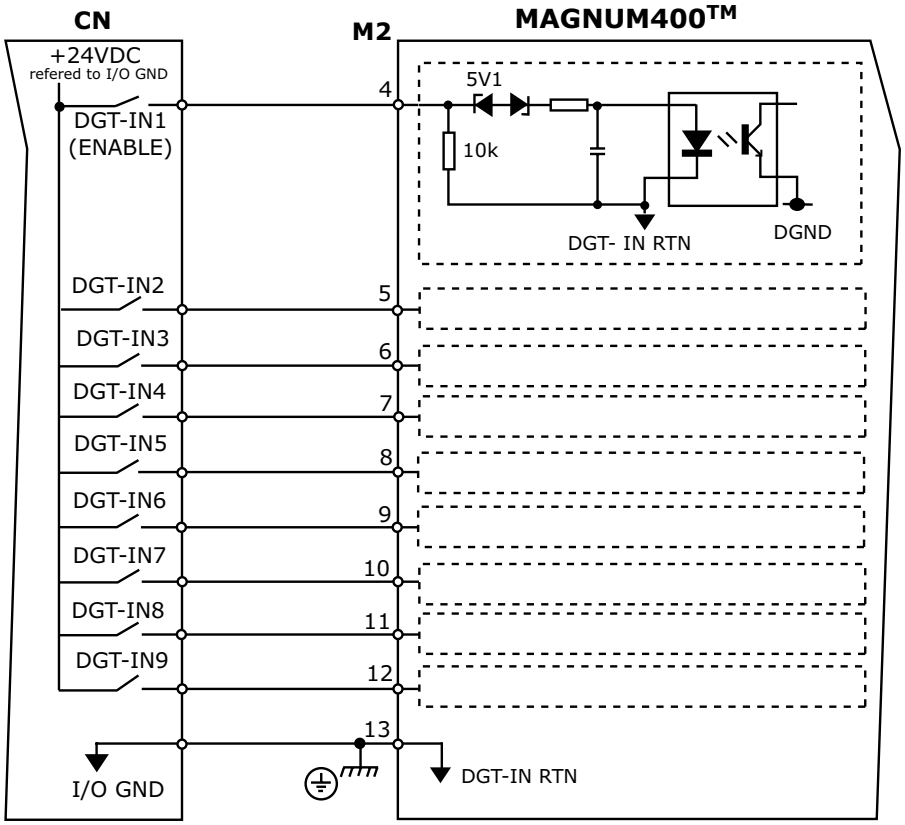
- Axor external resistances have the following dimensions:



Note: In accordance with the used resistance, internal or external, we recommend to correctly set the *Regen Resistance* parameter in the "General Setting" window in the *Speeder One* interface: ***internal*** (if the internal resistance is used), ***external*** (if an external resistance is used).

2.12 Digital inputs connection

DIGITAL INPUTS connection



Notes:

• The enable signal should be +**24VDC-7mA** (PLC compatible). The enable range is between **+14V Min** and **+30V Max**.

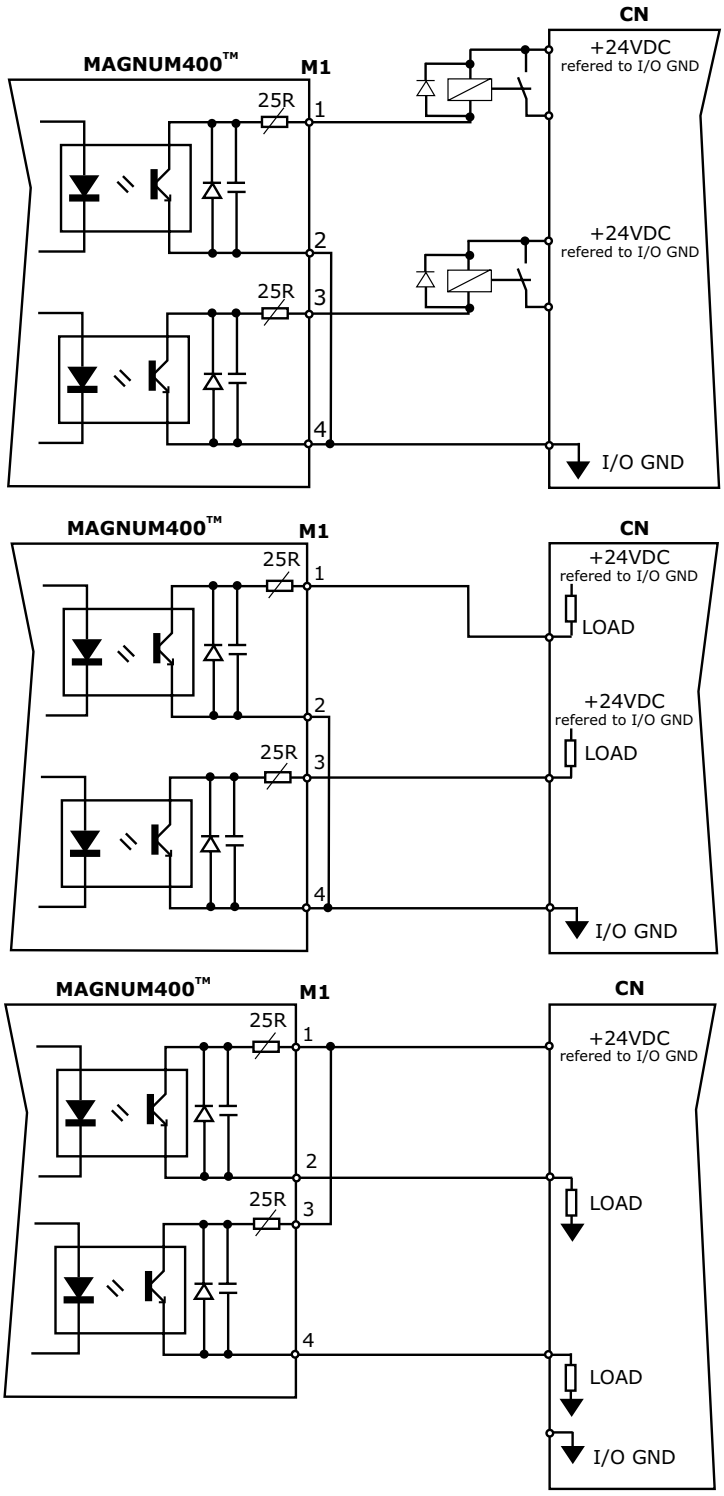
• The **M2-4** terminal (**DGT-IN1 (ENABLE)**) is used only as the drive's enable. If M2-4 is HIGH (+24VDC) the drive is enabled (without active alarms and if start up sequence, illustrated on paragraph 2.21, is respected); if M2-4 is LOW (0V), the motor is without torque.
ATTENTION: THE DRIVE'S ENABLE/DISABLE, BY USING THE ENABLE INPUT, IS NOT CONSIDERED A SECURITY FUNCTION.

• The other inputs can be used to activate pre-programmed functions of the drive (for example: limit switch , electromechanical brake, homing and positioning procedures, emergency stop, etc.).
For a detailed description of the pre-programmed functions see enclosure "*Speeder One* Interface", "Additional Features Manual" and "Positioner Manual" on the CD provided with the drive.

• Connect pin **M2-13** (**DGT-IN RTN**) to the ground bar of the system.

2.13 Digital outputs connections

DIGITAL OUTPUT Connection (example)



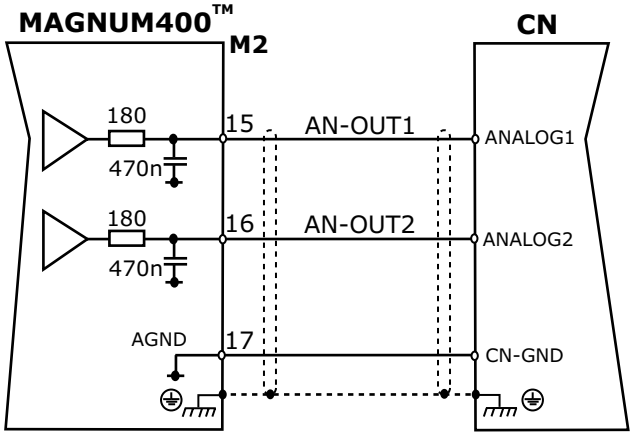
Max. load for each output: 50[mA].

Always use a relay with a diode in parallel.

This digital output can be used to send messages from the pre-programmed function of the drive. For a detailed description of the pre-programmed functions see enclosure "*Speeder One* Interface" on the CD provided with the drive.

2.14 Analog outputs connections

ANALOG OUTPUTS Connections



They permit visualisation by oscilloscope of some of the drive's measurement values.

The two outputs furnish **+/-10Volt** as the low scale setting refers to.

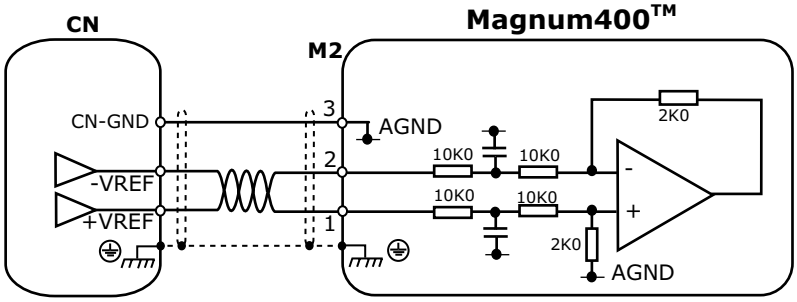
They can be set by the *Speeder One* interface.

Note: We suggest to connect the shield on both sides: drive side follow the indications illustrated on paragraph 2.6.

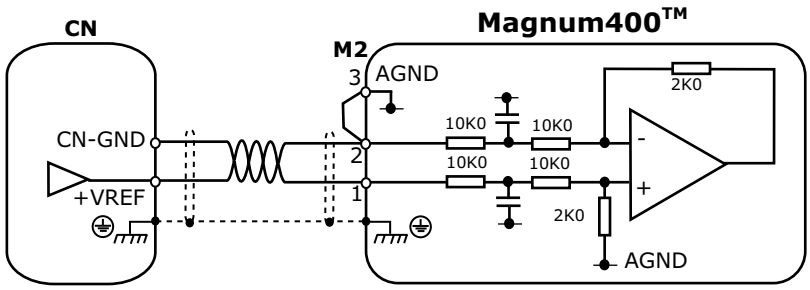
2.15 Analog inputs connections

ANALOG DIFFERENTIAL OR COMMON MODE INPUT (+/-Vref and TPRC) connection

DIFFERNTIAL MODE (+/-Vref)



COMMON MODE (+/-Vref)



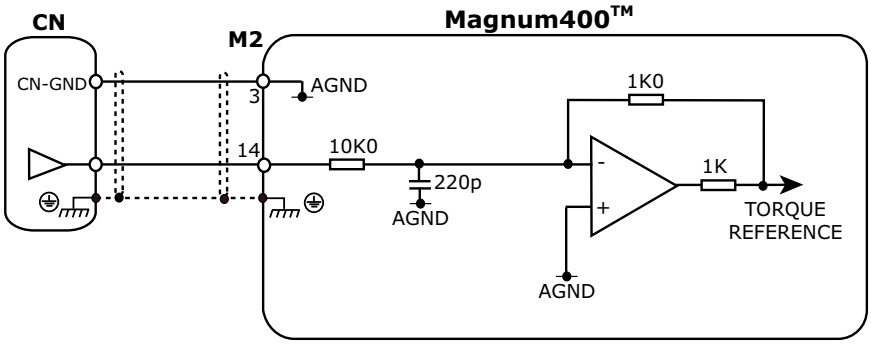
The **technical characteristics** of +/-Vref inputs are as follows:

- ✓ Voltage: **±10V** Max.
- ✓ Input impedance: **40k ohm**.

To change the sense of rotation, apply the positive voltage reference to **M2-1**, or change the **Rotary Direction** parameter in the **Speed** window (from **Positive** to **Negative**).

Note: We suggest connecting the shield on both sides: drive side, follow the indications illustrated on paragraph 2.6.

COMMON MODE (TPRC)



The **technical characteristics** of TPRC input are as follows:

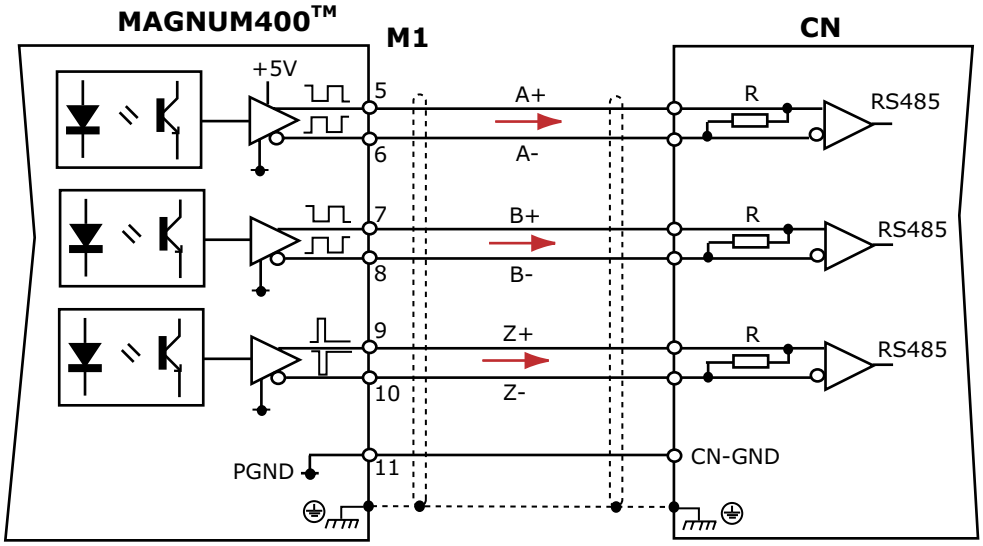
- ✓ Voltage: **±10V** Max.
- ✓ Input impedance: **10k ohm**.

Note: We suggest connecting the shield on both sides: drive side, follow the indications illustrated on paragraph 2.6.

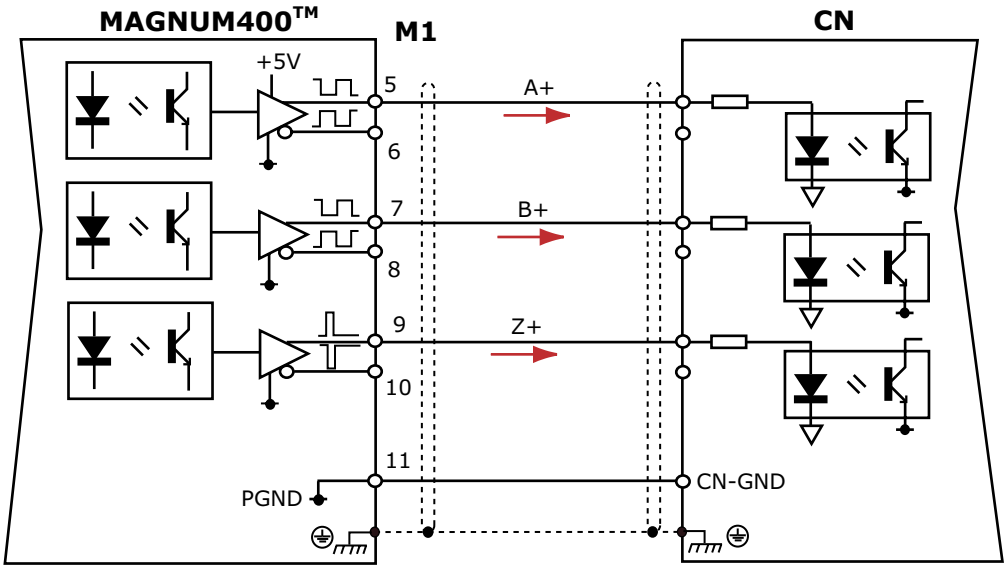
2.16 Emulated encoder outputs connection

EMULATED ENCODER OUTPUTS connection

LINE RECEIVER CN inputs



COMMON MODE CN inputs

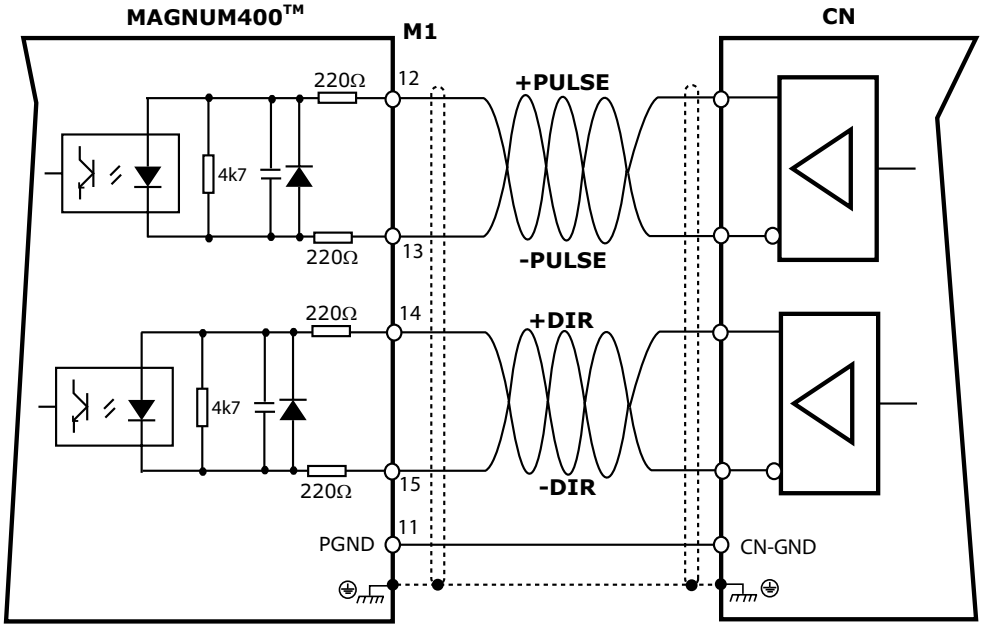


Note: We suggest connecting the shield on both sides: drive side, follow the indications illustrated on paragraph 2.6.

2.17 Pulse/Dir inputs connections

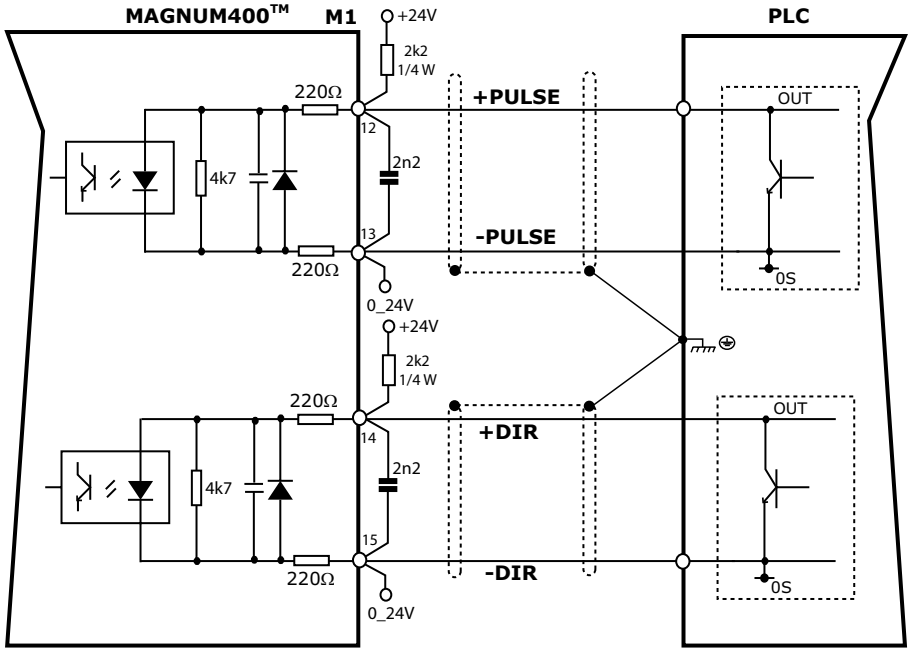
PULSE/DIRECTION MODE connection

Logical signal 0/+5V



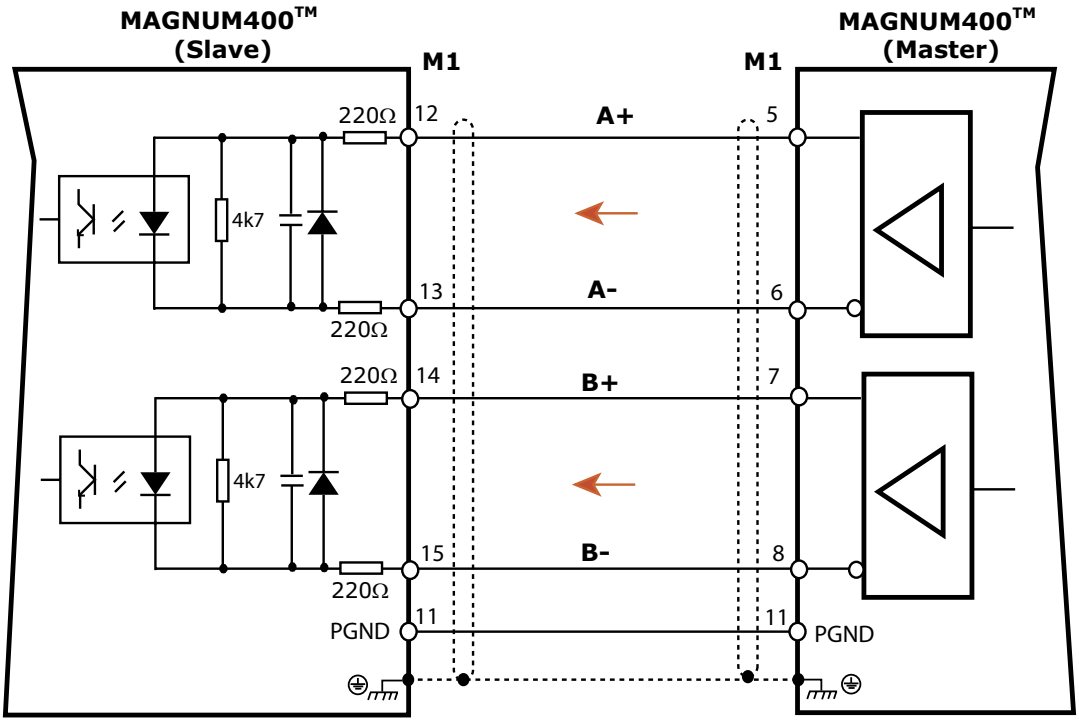
Note: We suggest connecting the shield on both sides: drive side, follow the indications illustrated on paragraph 2.6.

Logical signal 0/+24V open collector NPN



Note: We suggest to shield separatelly the couples of cable and to connect the shields together and to the PLC ground.

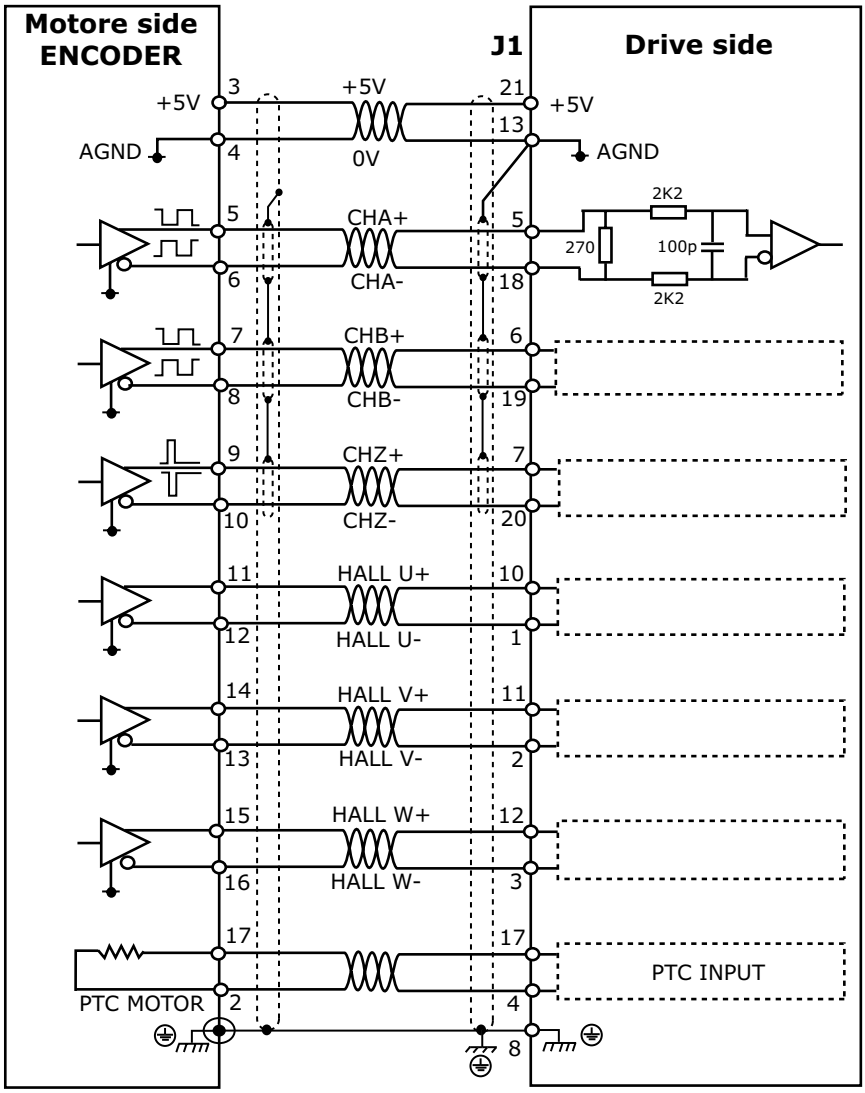
ELECTRICAL AXIS (GEARING) Connection



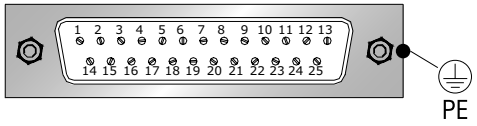
Note: We suggest connecting the shield on both sides: drive side, follow the indications illustrated on paragraph 2.6.

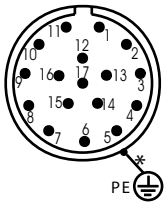
2.18 Feedback signals connections

ENCODER FEEDBACK connection



J1 connector
Sub-D 25 pole

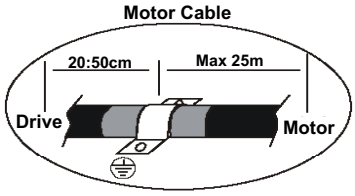




17 pole connector
(Encoder)

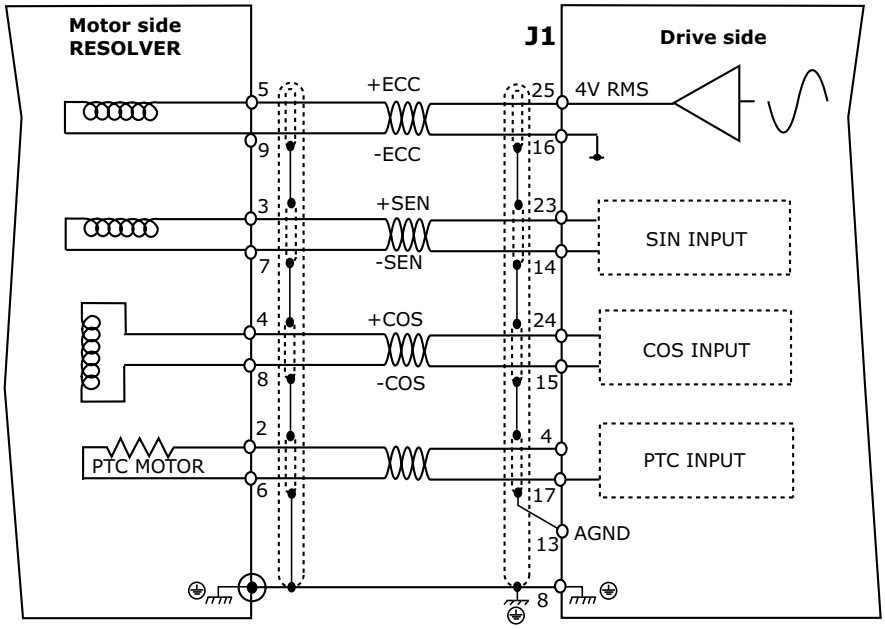
If the motor has not the thermal protection (PTC MOTOR) you should bridge pins 4 and 17 on the "J1, Sub-D 25 pole" connector of the drive.

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

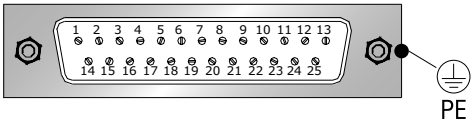


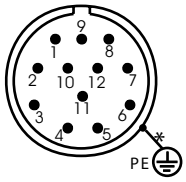
RESOLVER FEEDBACK connection

OPTIONAL



J1 connector
Sub-D 25 pole

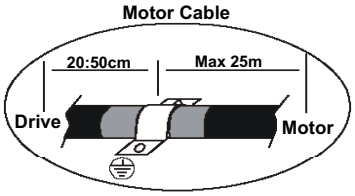




12 pole connector
(Resolver)

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

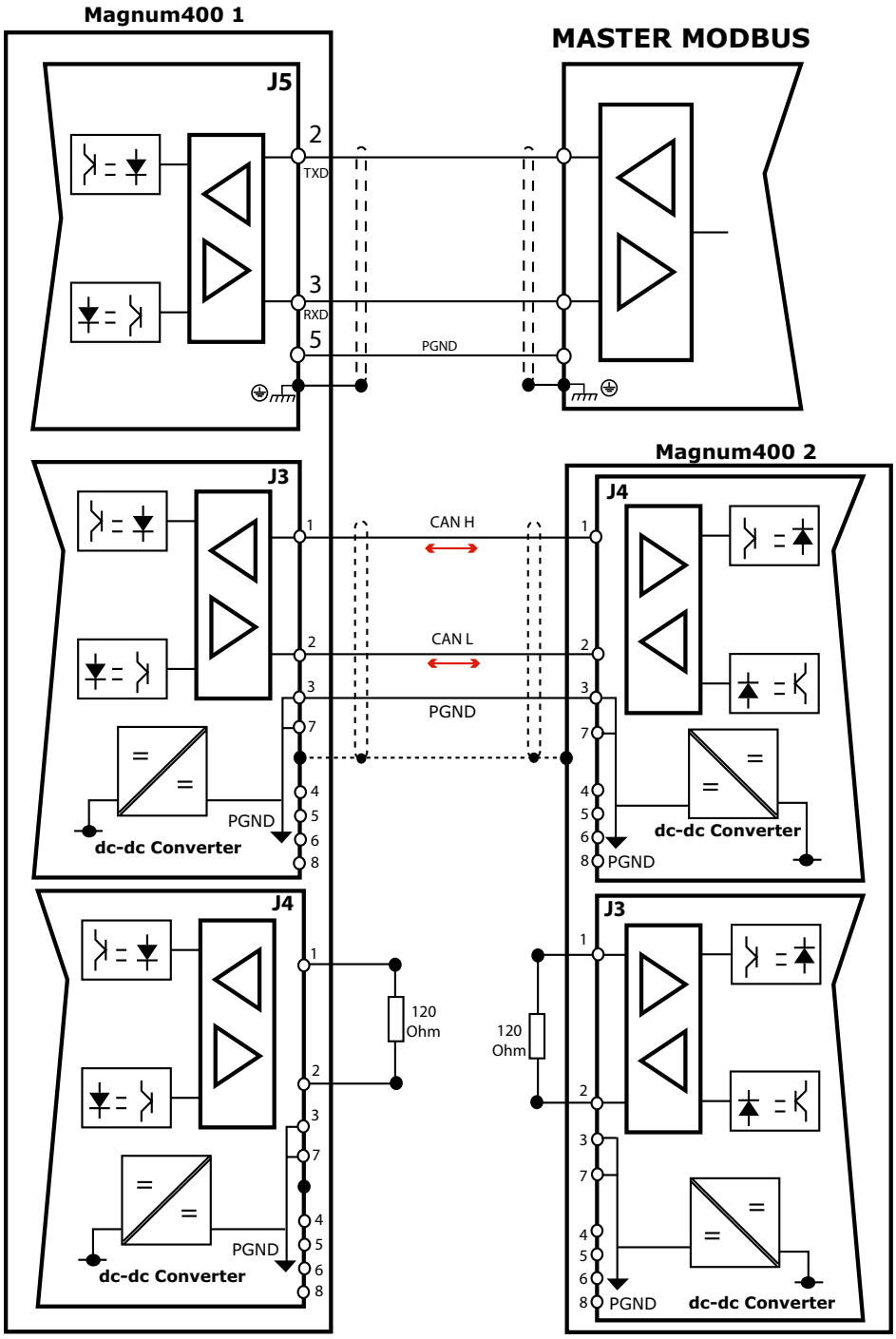
Note: The **ground connection** of the external shield must be made on the zinc-coated panel (using a u-clamp) near the drive (20-50cm).
Motor side: the shield is connected to connector's metal ring.



2.19 Multidrop connection

MULTIDROP connection

OPTIONAL



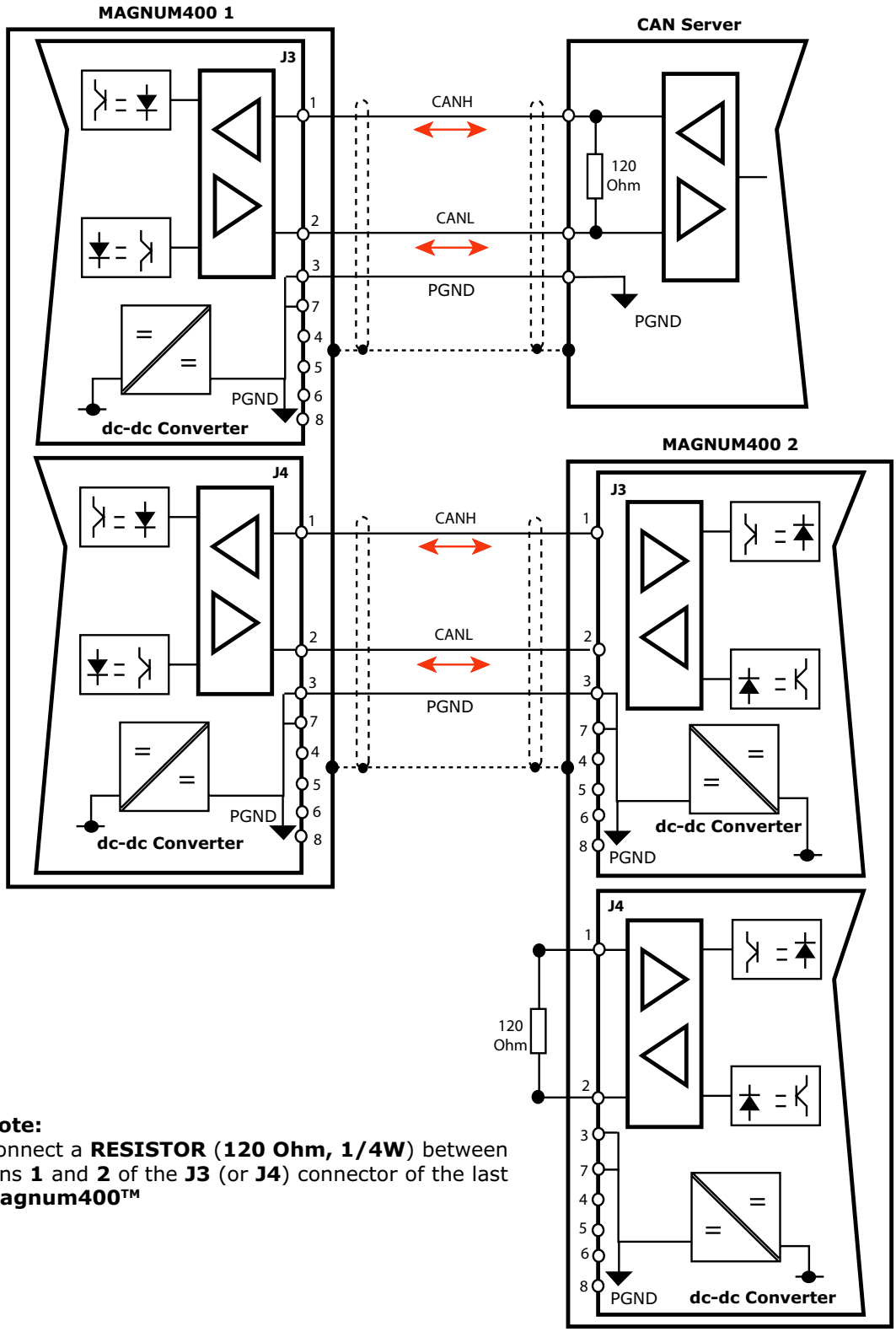
Notes:

• Connect the first **Magnum400™** to the **Master** using the RS232 cable (**J5** connector); connect each additional drive with to the drive preceeding it using the Can Bus cables and the **J3** and **J4** connectors; connect a **RESISTOR** (**120 Ohm, 1/4W**) between pins **1** and **2** of the **J3** (or **J4**) connector of the first **Magnum400™** and another resistor between pins **1** and **2** of the **J3** (or **J4**) connector of the last drive.

• Axor drives use **MODBUS communication protocol** specified in the **Modicon** instructions (see http://www.modicon.com/techpubs/).
For more information see enclosure "***Modbus* Manual**" on the CD provided with the drive.

CANBUS connection

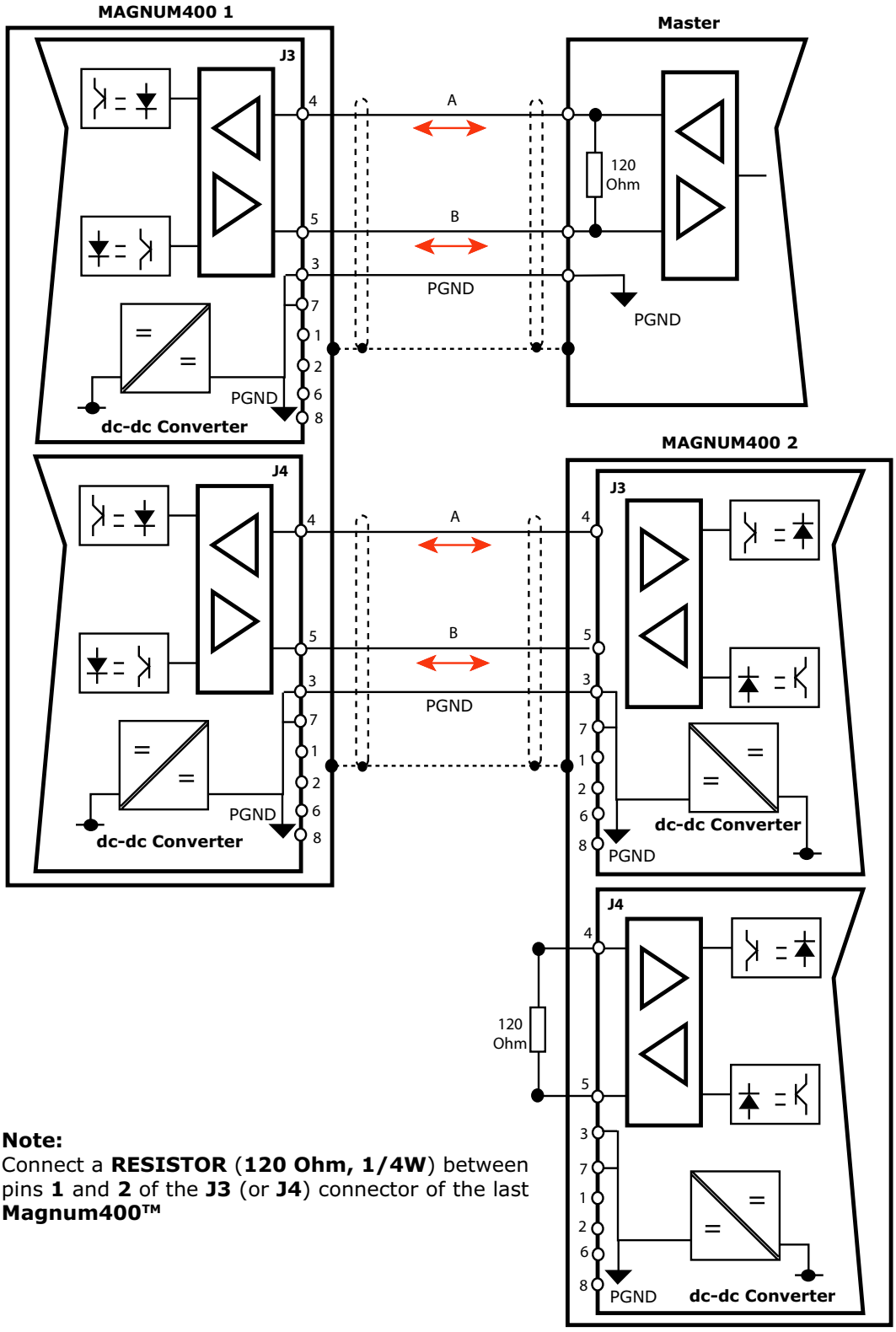
OPTIONAL



Note:
Connect a **RESISTOR** (**120 Ohm, 1/4W**) between pins **1** and **2** of the **J3** (or **J4**) connector of the last **Magnum400™**

RS485 connection

OPTIONAL



Note:
Connect a **RESISTOR** (**120 Ohm, 1/4W**) between pins **1** and **2** of the **J3** (or **J4**) connector of the last **Magnum400™**

2.22 Magnum400™ power up

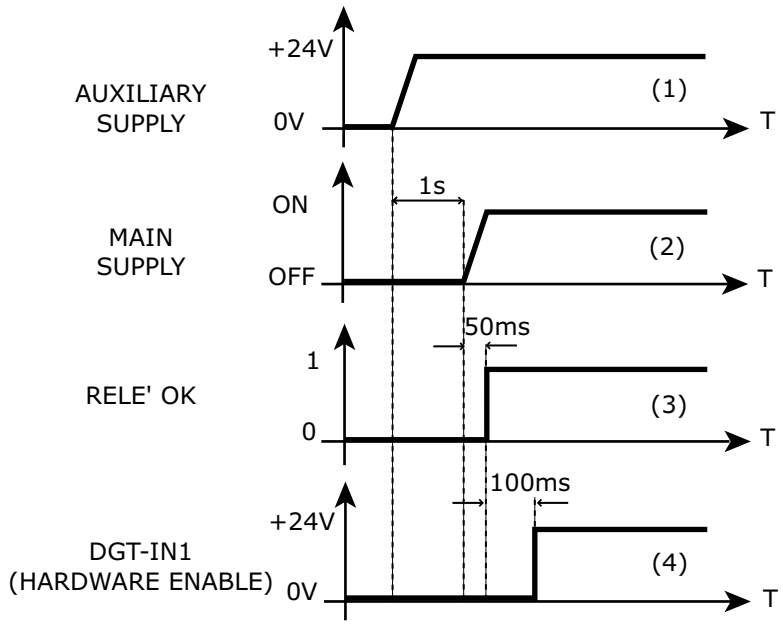
The power up of the **Magnum400™** must be done following this sequence, in order to save the drive and the electrical box:

1) Power the drive utilising the auxiliary supply, **+24VDC**.

2) After **1sec.** power the main supply.

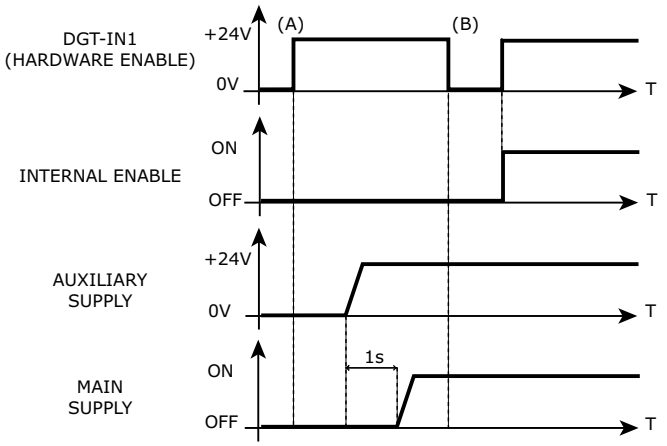
3) the "Relè Ok " contact closes(*).

4) After **100ms** it is possible to enable the drive utilising the "Enable" key or the DGT-IN1 digital input.

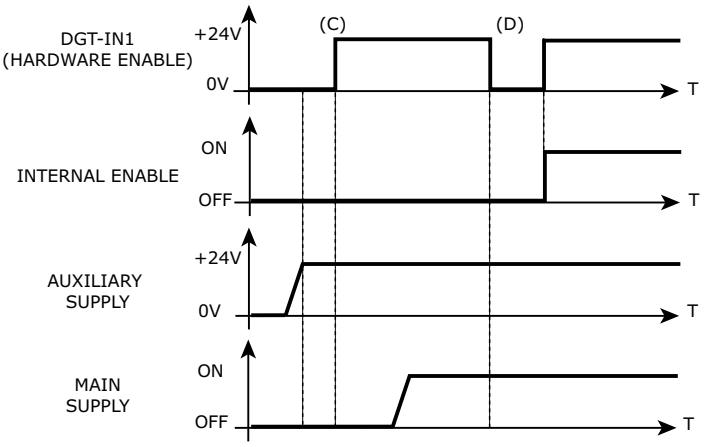


(*) It is possible to close the contact after auxiliary supply insertion, setting the "Closed when ready" function in the "General Settings" window of the *Speeder One* interface.

Attention: If the DGT-IN1 (ENABLE) digital input is enabled by the CN before powering the drive (A), after powering the drive utilising the auxiliary supply and the main supply, it is necessary disable and enable the DGT-IN1 input (B), in order to enable the INTERNAL ENABLE. If the DGT-IN1 is not disabled , then re-enabled, the INTERNAL ENABLE remains disabled and the user cannot execute any movement.



Attention: If the digital input DGT-IN1 (ENABLE) is enabled by the CN after powering the drive utilising the auxiliary supply, but before powering the drive utilising the main supply (C), it is necessary to disable and then re-enable DGT-IN1 input (D), in order to enable the INTERNAL ENABLE also. If the DGT-IN1 is not disabled then re-enabled, the INTERNAL ENABLE remains disabled and the user cannot execute any movement.



6) If alarm should appear, resolve them before going forward (see chapter 3).

7) Set the operative mode "**1: Digital Speed**", set a speed reference equal to 100rpm, enable the drive with the **Enable** button.
If shaft turns correctly, at teh set speed, without alarms, it is possible to connect the load and cable the machineè possibile procedere con il collegamento del carico e con il cablaggio della macchina; at teh contrary, if alarms should be compare or if the behavior should not be as set, we suggest to control te connections and the settings (eventually contact Axor).

8) Connecting the load to the motor, it shoul be necessary to connect gains of speed loop, following this procedure:

a- Set the "**10: Square wave**" operating mode.

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

c- Connect the probe of the oscilloscope on pins **AN.OUT1** (speed signal) and **AGND** (zero signal).

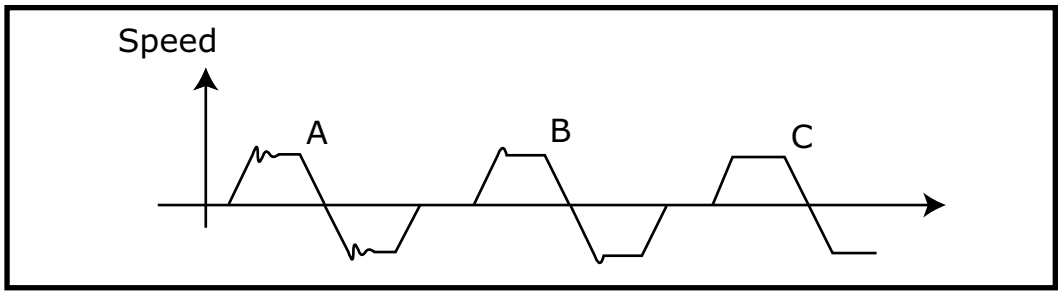
d- Enable the drive.

e- 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.

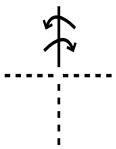


9) At this point it is possible to set other parameters in reference to the desired operative mode (see enclosures "***Operative modes* Manual**", "***Additional Features* Manual**", "***Speeder One* Interface**" available on the CD provided with the drive).

Chapter 3
Diagnostic

3.1 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; 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.
ALxx	There is alarm xx.

3.2 Alarms

The table below illustrates all the message errors:

ALARM		SOLUTION
AL1	**EEPROM alarm** Error while memorising parameter to the drive's EEPROM or reading parameters from drive's Eeprom.	Disable the drive, try to memorise the parameter, then re-enable.
AL2	**Overcurrent alarm** Short circuit between U, V, W or towards earth.	Disconnect the power, verify the wiring, then power up again.
AL3	**Drive Temperature alarm** Heat sink temperature too high, >75°C.	Disable the drive, verify: • the forced ventilation functioning, • the ambient temperature, wait until the radiator has cooled off, reset the alarm then enable the drive.
AL4	**Hall alarm** This alarm comes on if one or more of the hall cell's wires are disconnected.	Disable the drive, verify the cell's wire connection, reset the alarm, then enable the drive.
AL5	**Encoder alarm** This alarm comes on if one or more of the encoder channels are interrupted.	Disable the drive, control the connections, reset the alarm, then enable the drive. If the alarm persists contact Axor.
AL6	**I^2t Drive alarm** The internal I^2t function has reached the maximum permitted. The cause could be one of the following: • the working cycle could be too heavy; • a possible mechanical block; • motor phase inversion; • the electronic brake is not unblocked; • the amplifier's dynamic costants: "KP", "KI" and "KD", could create useless current oscillation.	*It is only a message.* This does not cause the disabling of the drive's functioning, but it is possible to close the Relè OK contact during this alarm. The current is limited to the rated one, set in "Current" window.
AL7	**Motor Temperature alarm** Heat sink temperature too high. This causes the opening of the Ok Relè contact and disables the drive.	Disable the drive: • control the heat sink temperature; • decrease the dynamic constant if the motor is vibrating. This situation causes current oscillation and consequently the overheating of the motor. Wait until the motor has cooled off, reset the alarm, then enable the drive.
AL8	**Regenerative Resistance alarm** The value I^2t energy recovery has reached the maximum allowed. This causes the opening of the Ok Relè contact and disables the drive.	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.
AL9	**Min/Max Voltage alarm** Minimum or maximum converter voltage. See min/max voltage values at "1.3 Technical Data". This causes the opening of the Ok Relè contact and disables the drive.	Disable the drive, wait until the DC power supply voltage reaches the correct threshold, check the AC power supply input, then enable the drive.
AL10	**Pre-Alarm Recovery alarm** 80% of the I^2t energy recovery value has been reached. This does not cause the disabling of the drive.	Check the AC power supply input and the working cycles. This is *only a message*, it anticipates the intervention of the "Maximum recovery" alarm.

AL12	**Resolver alarm** Missing one or more resolver signals. This causes the opening of the Ok Relè contact and disables the drive.	Disable the drive, control the resolver's contact, reset the alarm, then enable the drive.
AL14	**Following Error** The error between the position reference and the position feedback exceeds the "Max Position Error" parameter, because 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 Ok Relè contact and disables the drive.	Disable the drive, check the Max Position Error parameter, check the dynamic gains, reset the alarm, then enable the drive.
AL15	**Limit Switch** The two fixed limited positions have both been disabled or interrupted. This causes the opening of the Ok Relè contact and disables the drive.	Disable the drive, check the limit contacts and external connections, then enable the drive.
AL17	**Overcurrent regen resistance circuit** Possible short-circuit in the regen resistance circuit. This causes the opening of the Relè OK contact and the disabling of the functioning.	Power off the drive, control the short-circuit, then power on the drive.
AL18	**Mechanical Brake** Overcurrent at the internal brake command or wrong connections. This causes the opening of the Ok Relè contact and disables the drive.	Disconnect the power: • control the external connections; • control the current absorption of the motor brake; • verify the settings of the "Holding Brake" parameter on the "Motor" window; then power up again.
24 UP	**In-rush Bus** *This is not an alarm.* Indication of the drive's in-rush phase or the lack of the main power supply.	
AL20	**Auxiliary Voltage** Presence of the main supply (L1, L2, L3), but the auxiliary +24Vdc voltage is missing. This causes the opening of the Ok Relè contact and disables the drive's functionability.	Disable the drive, connect the Auxiliary Voltage, and then re-enable..
AL23	**Flash Alarm** Errors in reading/writing parameters on the Flash memory, or Flash memory is empty. This causes the opening of the Ok Relè contact and disables the drive's functionability.	Disable the drive, save new values, then re-enable. If the problem persists contact Axor.
AL24	**Can Bus Alarm** Error during communication with CanOpen protocol. This causes the opening of the Ok Relè contact and disables the drive's functionability.	Disable the drive, check the cabling and re-enable. If the problem persists contact Axor.
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.

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Conformity

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 is used into machines or plant, the electrical plant/machine must respect the following directives: **EC Machinery Directive** (**2006/42/EC**), **EC Directive on EMC** (**2004/108/EC**), **Low Voltage Directive** (**2006/95/EEC**).

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

EC Conformity

The **EC** mark that is applied to the drives references to the **Low Voltage Directive** (**2006/95/EC**) and **EC Directive on EMC** (**2004/108/EC**).

The standard EN 61800-5-1 is applied to ensure conformance with the Low Voltage Directive.
The standard EN 61800-3 is applied to ensure conformance with the EMC Directive.
In reference to noise immunity and noise emission the converters fulfil the requirement to the category *second environment* (industrial environment).
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.

Since AXOR INDUSTRIES MOTORS SERVO DRIVES *1988*

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Operative Modes Manual

ver.1 rev.12/'08

Enclosures to Service Manuals of:

- **McbNET Digital™**
- **Magnum400™**
- **MiniMagnum400™**
- **FastBack™**

Summary

Release	Notes
ver.1 rev.06/'07	Preliminary first edition.
ver.1 rev.11/'07	Extension to FastBack.
ver.1 rev.12/'08	Figure pag.12 corrected. Figure pag.16 corrected.

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

1 Operative Modes

Axor digital drives support the followings operative modes:

CONTROL	DESCRIPTION	PAGE
DIGITAL SPEED CONTROL	It is **speed piloting** utilising a digital reference.	pag. 4
ANALOG SPEED CONTROL	It is **speed piloting** utilising an analogue reference (differential or common mode). FastBack does not manage it.	pag. 5 and 8
DIGITAL TORQUE CONTROL	It is **torque piloting** utilising a digital reference.	pag. 10
ANALOG TORQUE CONTROL	It is **torque piloting** utilising an analogue reference. FastBack does not manage it.	pag. 11
POSITION CONTROL	The positioner can be managed via hardware (by using the digital inputs) or via RS232 (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 signal* of the encoder.	see enclosure "Positioner Manual"
ELECTRICAL AXIS (GEARING)	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). FastBack does not manage it.	pag. 12
PULSE/DIRECTION	It is possible to connect the drive to a **stepper-motor controller**, piloting it with the +/-Pulse and +/-Dir signals (Pulse/Dir Mode). FastBack does not manage it.	pag. 16
MULTIDROP RS232	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 interface*.	pag. 19
RS485 INTERFACE	It is possible to communicate with two or more drives by using the **RS485 interface**.	*AVAILABLE SOON*
CANBUS	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**	pag. 21

Note for FastBack: FastBack has not the keypad, so any reference to keypad use in the following pages is to be ignored.

2 Digital Speed

Axor digital drives can control a motor by using a ***speed digital reference***.

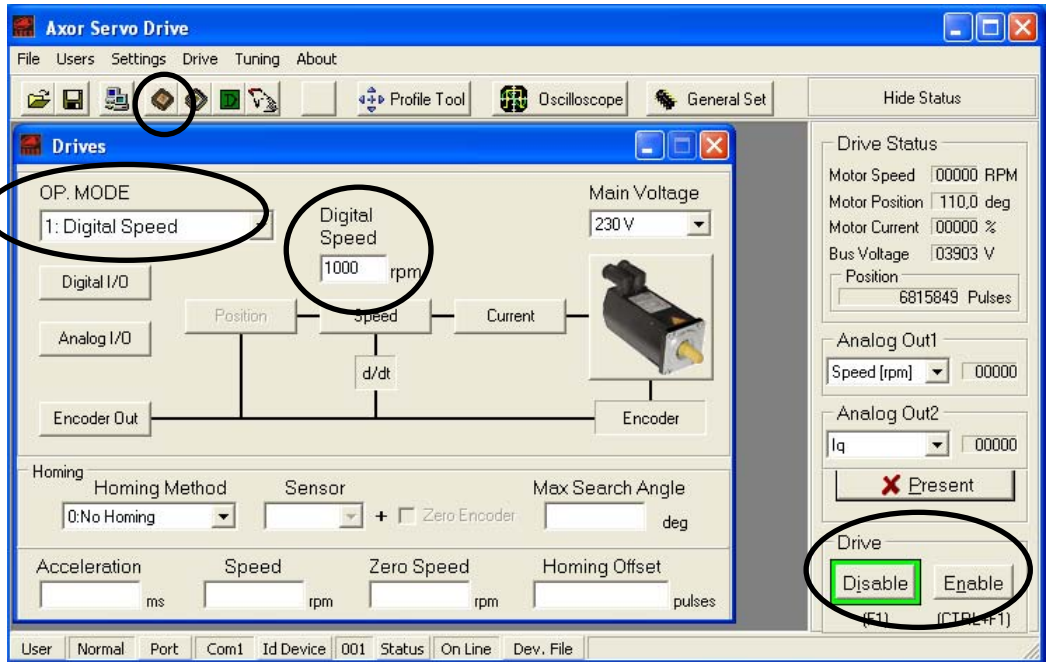
The procedure is the following:

1- Perform the *basic installation procedure* and *the motor tests* illustrated in the Drive's Service Manual;

2- Enable digital speed control via ***Speeder One interface*** or ***via keypad***:

- ***via Speeder One interface:***

  a- set the operative mode ***1:Digital Speed***;
  b- insert the desired speed reference [in rpm];
  c- save settings by clicking on icon "**Save data to Eeprom**";
  d- enable/disable the drive by using the **Enable**/**Disable** buttons.



- ***via keypad:***

Parameter	Menu (Indirizzo)	Inserted value
Set operative mode "1: Digital Speed"	F10 ⇨ U6 (71)	1
Set digital speed reference "Digital Speed"	F11 ⇨ H6 (80)	(*)
Save settings on Eeprom	F10 ⇨ U4 (69)	2
Enable DGT-IN1 (ENABLE)	F10 ⇨ U8 (73)	1
Disable DGT-IN1 (ENABLE)	F10 ⇨ U9 (74)	1

(*) Insert the desired speed reference normalized reference "Speed Limit" parameter set in the "Speed" window.

$$\frac{\text{SpeedReference} \times 2^{15}}{\text{SpeedLimit}}$$

Example: Suppose we want to insert a speed reference equal to 1500rpm, having as max speed 3000rpm ⇨ at address F11 → H6 insert this value 16384, in fact $(1500 \times 2^{15})/3000 = 16384$.

3- If the turning is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* by using an adeguate procedure (see enclosure " Procedure Manual" available on request contacting Axor).

3 Analog Speed

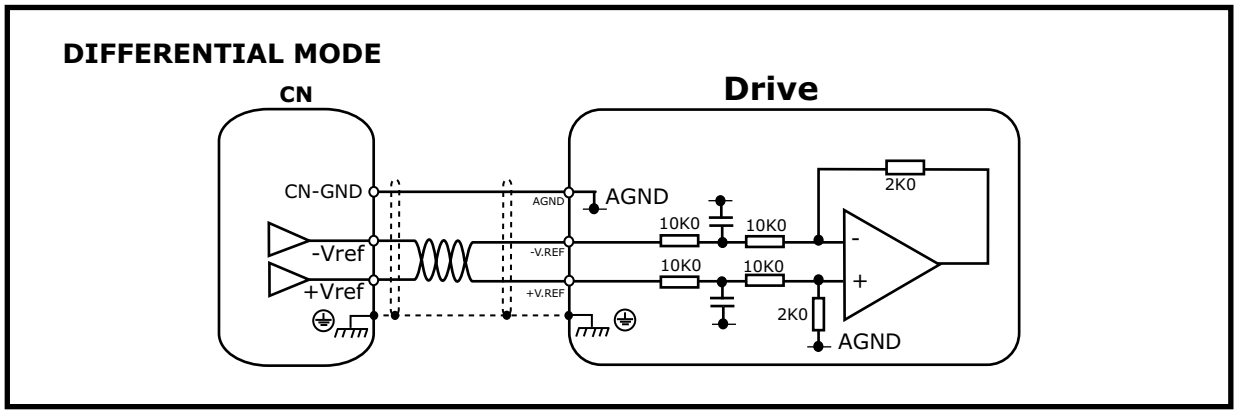
Axor digital drives can control a motor by using a **differential or common mode analog speed reference from the CN or PLC**.

The procedure is the following:

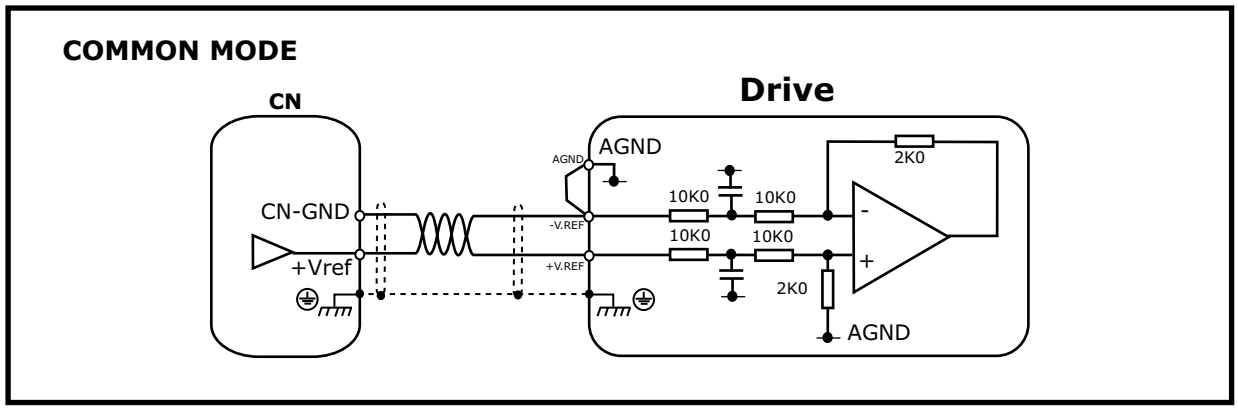
1- Perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual;

2- Use pins **+Vref**, **-Vref** and **AGND** to *apply the desired 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 the positive speed reference to **+VREF** and the negative speed reference to **-VREF**.



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



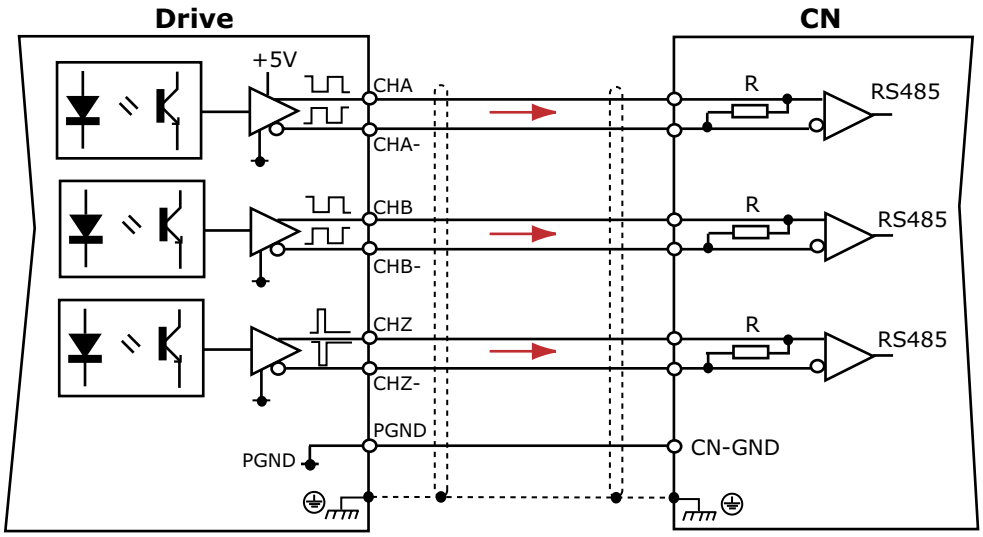
Notes:

✓ To change the sense of rotation apply the positive voltage reference to **-Vref**, or change the **Rotary Direction** parameter in the **Speed** window (from **Positive** to **Negative**).

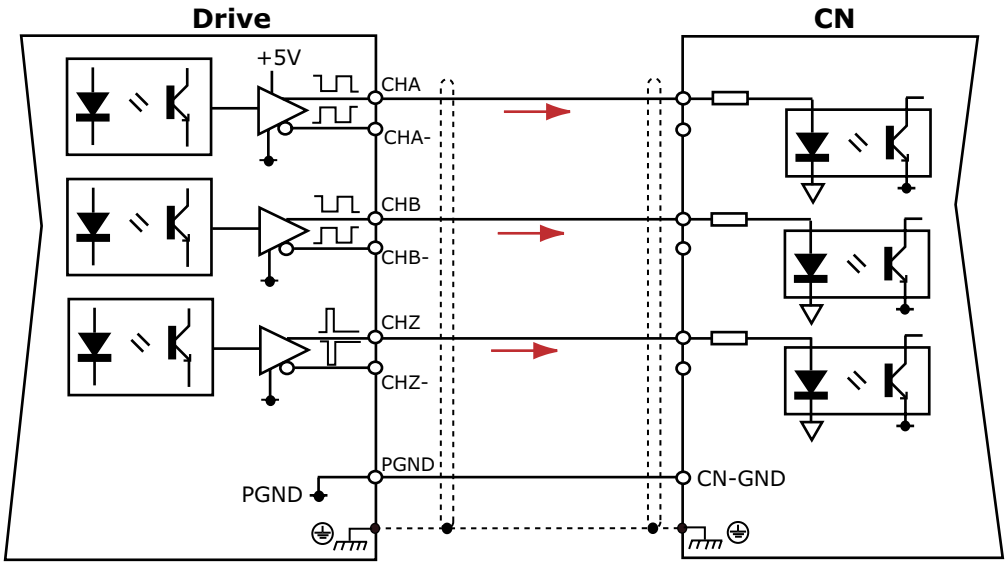
✓ We suggest to connect the shield on both sides (drive side follow the indications illustrated on service manual of the drive).

3- Connect the emulated encoder outputs of the drive to the CN ⇨

- if the CN has ***LINE RECEIVER*** inputs, follow these connections:



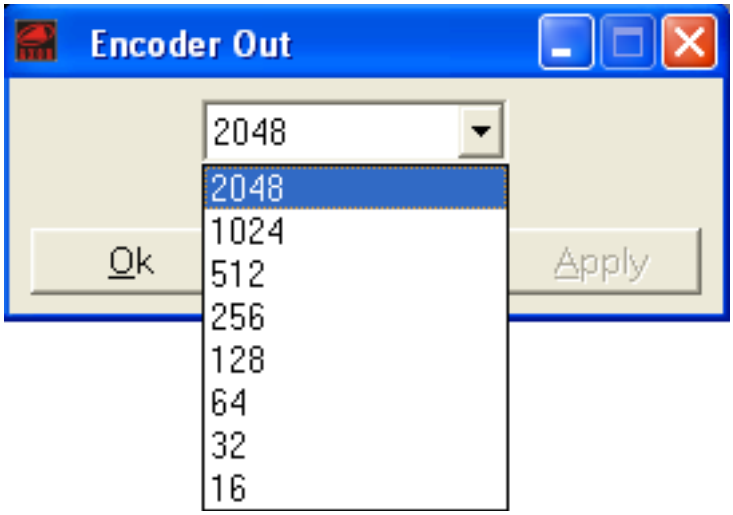
- if the CN has ***COMMON MODE*** inputs, follow these connections:



Note: We suggest connecting the shield on both sides (drive side follow the indications illustrated on service manual of the drive).

4- Set the desired pulses per turn on emulated encoder outputs by ***Speeder One interface*** or ***by keypad:***

- ***by Speeder One interface***: open the "**Encoder Out**" window and select the desired pulses per turn:



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.

- ***by keypad***: insert the pulses per turn desired on emulated encoder outputs on address **F10** ⇨ **U3**.

5- Execute the *settings of the offset of the velocity analog input reference* ***via Speeder One interface*** or ***via keypad***:

- ***via Speeder One interface***: open the "**Analog I/O**" window and click on the **Analog 1** icon.

- ***via keypad***: insert value **8** at address **F10** ⇨ **U4**.

6- Enable analog speed control via ***Speeder One interface*** or ***via keypad***:

- ***via Speeder One interface:***
  a- set the operative mode ***0:Analog Speed*** and keep the **Torque Sat.** box to **OFF**;
  b- save settings by clicking on icon "**Save data to Eeprom**";
  c- enable/disable the drive by using the **Enable**/**Disable** buttons.

- ***via keypad:***

Parameter	Menu (Indirizzo)	Inserted value
Set operative mode "0: Analog Speed"	F10 ⇨ U6 (71)	0
Save settings on Eeprom	F10 ⇨ U4 (69)	2
Enable DGT-IN1 (ENABLE)	F10 ⇨ U8 (73)	1
Disable DGT-IN1 (ENABLE)	F10 ⇨ U9 (74)	1

7- If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* by using an adequate procedure (see enclosure " Procedure Manual" available on request contacting Axor).

4 Analog speed control and Torque Limitation

Axor digital drives have another **common mode analog input**, **TPRC**, which can be used to **control the current delivered by the drive during the analog speed control**.

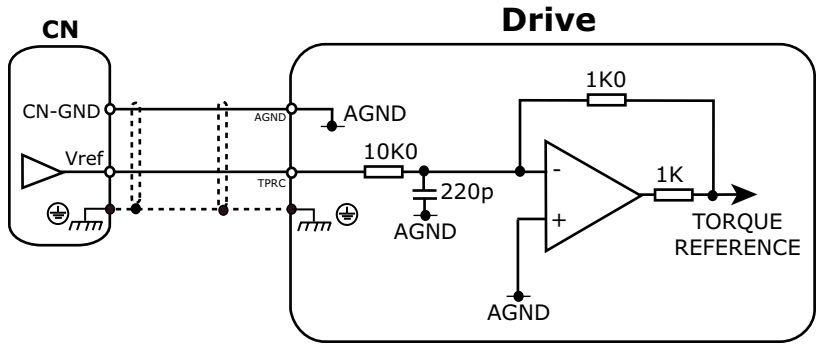
The procedure is the following:

1- Perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual;

2- Use pins **+Vref**, **-Vref** and **AGND** to *apply the desired speed reference (differential or common mode)*.

3- Use pin **TPRC** to *control the current delivered* from zero up to peak value, applying a voltage between 0V and +10V. The ground return is **AGND**.

TPRC connection:



The formula for determining the voltage value to be applied in TPRC in order to obtain the necessary current is as follows:

$$V_{TPRC} = \frac{10 * I\ desired}{I\ peaK}$$

Example: Suppose we have a drive size: 7/14A, and we want to limit the converter's current to 5A. The voltage value to be applied in TPRC is 3,6V:

$$\frac{10 * 5}{14} = 3{,}6V$$

4- *Connect the emulated encoder outputs* of the drive to the CN (see point 3 in the previous paragraph).

5- Set the desired pulses per turn on the emulated encoder outputs via Speeder One interface or via keypad (see point 4 in the previous paragraph).

6- Execute the setting *of the offset of the velocity analog input reference* via Speeder One interface or via keypad (see point 5 in the previous paragraph).

7- Execute the *setting of the torque offset* ***via Speeder One interface*** or ***via keypad***:

- ***via Speeder One interface***: open the "**Analog I/O**" window and click on icon **Analog 2**.
- ***via keypad***: insert value **256** on address **F10** ⇨ **U4**.

8- Enable the control via ***Speeder One interface*** or ***via keypad:***

- ***via Speeder One interface***:

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

b- save settings by clicking on icon "**Save data to Eeprom**";

c- enable/disable the drive by using the **Enable**/**Disable** buttons.

- ***via keypad:***

Parameter	Menu (Indirizzo)	Inserted value
Set operative mode "0: Analog Speed"	F10 ⇨ U6 (71)	0
Torque Sat. Enable	Only by use of Speeder One Interface	
Save settings on Eeprom	F10 ⇨ U4 (69)	2
Enable DGT-IN1 (ENABLE)	F10 ⇨ U8 (73)	1
Disable DGT-IN1 (ENABLE)	F10 ⇨ U9 (74)	1

9- If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* by using an adequate procedure (see enclosure " Procedure Manual" available on request contacting Axor).

5 Digital Torque

Axor digital drives can control a motor by using a **digital torque reference**.

The procedure is the following:

1- perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual;

2- enable the control via ***Speeder One interface*** or ***via keypad:***

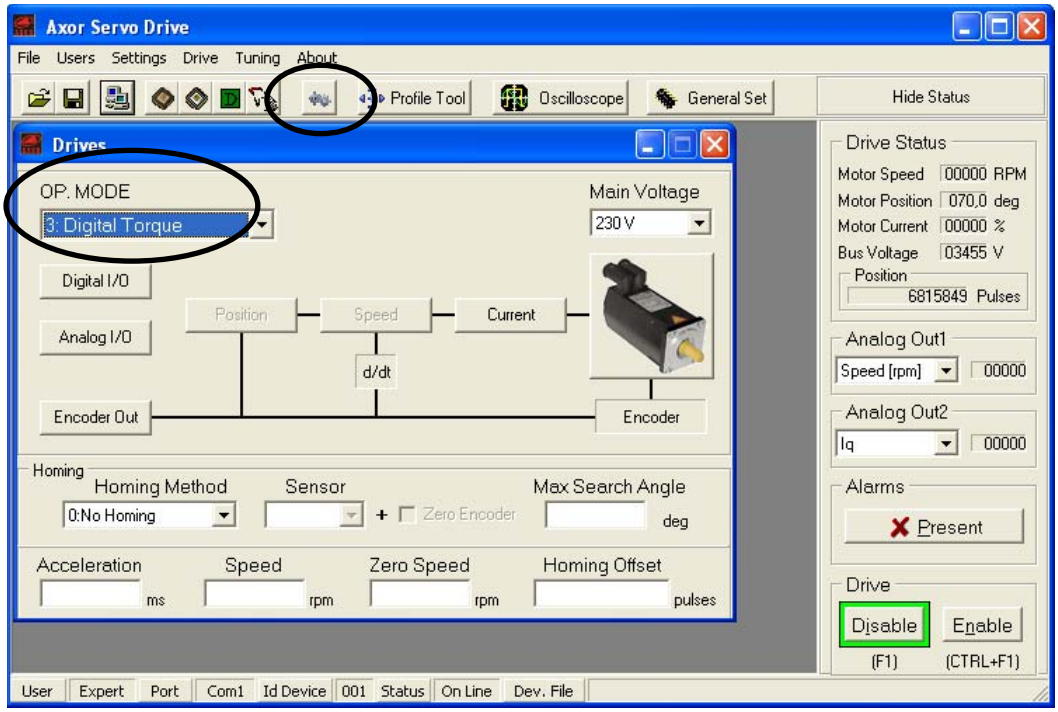
- ***via Speeder One interface***:

  a- set the operative mode **3:Digital Torque**;

  b- insert the desired torque reference (*) in parameter 79 of the Diagnostic window (to enable Diagnostic window follow this procedure: open menu Users ⇨ click on Change ⇨ insert password "cfg" ⇨ click OK ⇨ in the main window a new icon appears that allows you to open Diagnostic window);

  c- save all settings by clicking on icon "**Save data to Eeprom**";

  d- enable/disable the drive by using the **Enable**/**Disable** buttons.



- ***via keypad:***

Parameter	Menu (Indirizzo)	Inserted value
Set Operative mode "1: Digital Torque"	F10 ⇨ U6 (71)	3
Set torque reference	F11 ⇨ H5 (79)	(*)
Save settings on Eeprom	F10 ⇨ U4 (69)	2
Enable DGT-IN1 (ENABLE)	F10 ⇨ U8 (73)	1
Disable DGT-IN1 (ENABLE)	F10 ⇨ U9 (73)	1

(*) Insert the calculate torque reference using this formula:

$$\frac{I_{desired} \times 8192}{I_{peak}}$$

Example: Suppose we want to set a digital torque reference equal to 5A, having a drive size of 10/20 (10A=rated current, 20A=peak current) ⇨ at address F11 → H5 insert the value 2048, in fact (5x8192)/20=2048.

6 Analog Torque

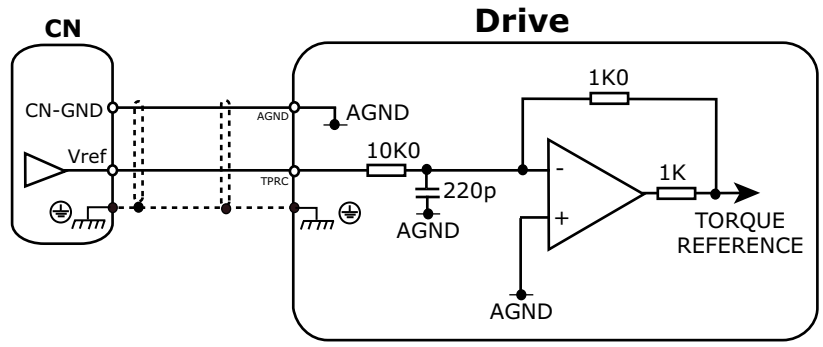
Axor digital drives can control a motor by using an **analog torque reference**.

The procedure is the following:

1- Perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual;

2- use pins **TPRC** and **AGND** to apply the desired torque reference (using a common mode signal equal to **+/-10V**):

Connection scheme:



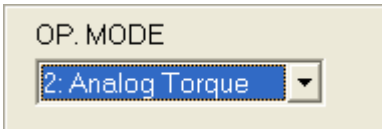
The formula for determining the voltage value to be applied in TPRC in order to obtain the necessary current is as follows:

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

3- enable the control via ***Speeder One interface*** or ***via keypad:***

- ***via Speeder One interface***:

a- Set operative mode "**2:Analogue Torque**":



b- save settings by clicking on icon "**Save data to Eeprom**";

c- enable/disable the drive by using the **Enable**/**Disable** buttons.

- ***via keypad:***

Parameter	Menu (Indirizzo)	Inserted value
Set operative mode "2: Analog Torque"	F10 ⇨ U6 (71)	2
Save settings on Eeprom	F10 ⇨ U4 (69)	2
Enable DGT-IN1 (ENABLE)	F10 ⇨ U8 (73)	1
Disable DGT-IN1 (ENABLE)	F10 ⇨ U9 (74)	1

7 Electrical Axis (Gearing)

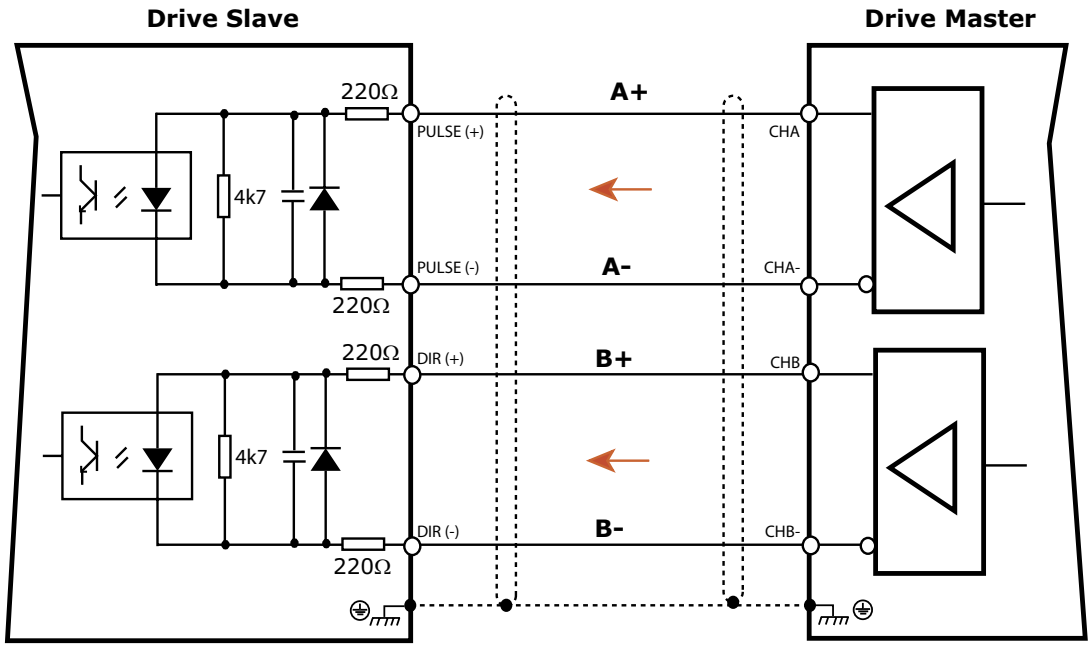
The operative mode **Gearing** allows you to connect together two drives: the first drive will be set as **Master**, the second as **Slave**. The Slave will be controlled by the **emulation encoder outputs** from the Master drive.

The procedure is the following:

1- Perform the *basic installation procedure* and the motor tests illustrated in the Service Manual of the drive.

2- Execute hardware connections between the Master and the Slave drive:

Connection scheme:



Note: We suggest connecting the shield on both sides (drive side follow the indications illustrated on service manual of the drive).

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

3- Set the Master and the Slave drives by using the *Speeder One* interface:

Setting Master drive

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

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

Setting Slave drive

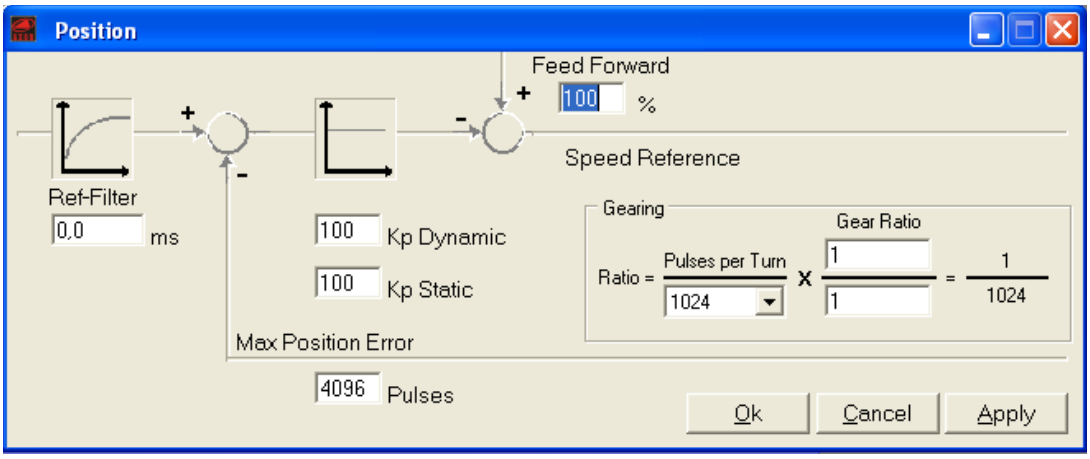
a- Select the "**5:Gearing**" operating mode.

b- Select the ratio between the pulses from the 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.
Example: Inserting the value **-1** at numerator and **2** at denominator in the "**Gear Ratio**", SLAVE motor will rotate at half that of the MASTER's speed.

4- In **Position** window set:
- ✓ **FeedForward**: set to 100;
- ✓ **Kp Dynamic** e **Kp Static**;
- ✓ **Max Position Error**: set to 4096.



5- 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**).

6- Save all settings by clicking on icon "**Save data to Eeprom**".

7- For enabling the Electrical Axis follow this procedure:

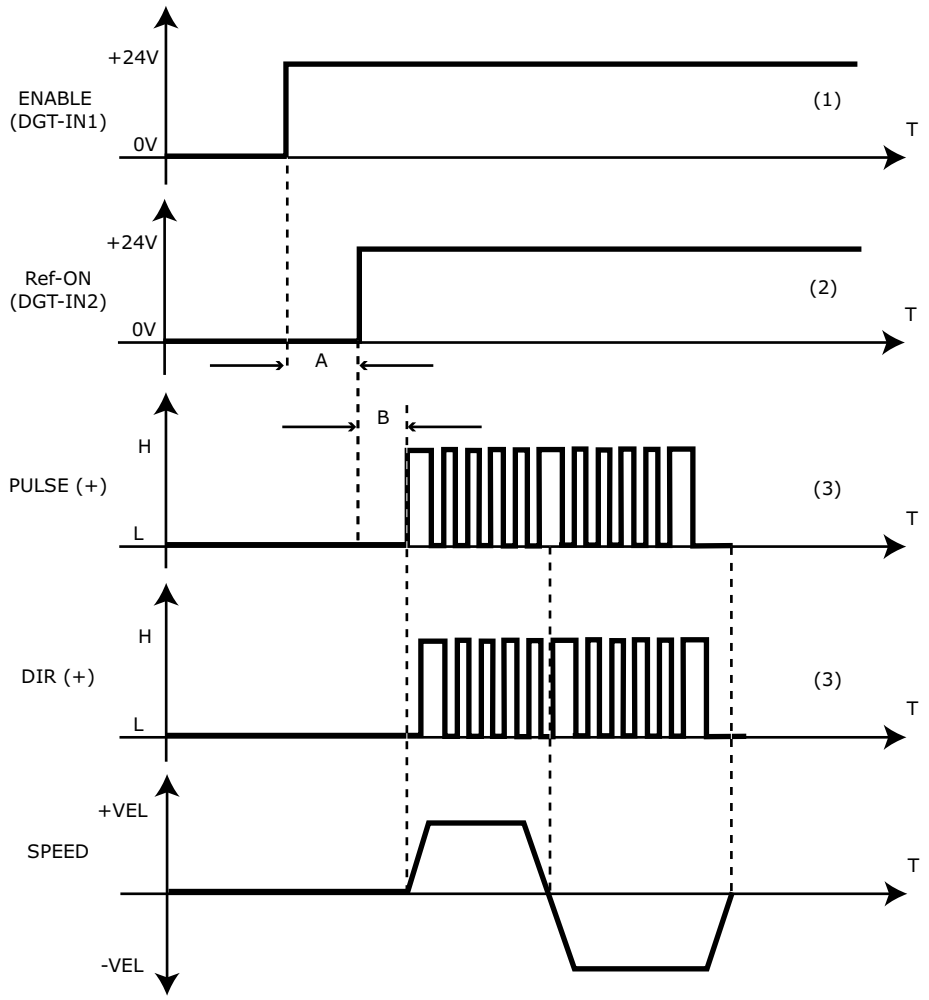
a- Enable the Master giving +24V to the DGT-IN1 (ENABLE) input. The motor will start move following the operating mode set for the Master.

b- 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)

c- Bring the input **DGT-IN2**, set with "**Ref-On**" function, high to enable the motor movement in the GEARING function. See (2)

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

Electrical Axis sequence:



Note: If required by the application, at anytime it is possible to execute a ***homing procedure***. This operation must take place inside the **A** zone; therefore, after the enable-input, but before the DGT-IN2 signal's.
See enclosure "Positioner Manual" to find a detailed description about Homing procedures.

7 Electrical Axis (Gearing)

It is possible to control the Slave by using the **increasing channels of an external encoder** or **the emulated encoder signals from a CN**, in this case:

1- Use the **Pulse(+/-)** and **Dir(+/-)** pins to connect 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- Bring the input **DGT-IN2**, set with "**Ref-On**" function, high to enable the motor movement in the GEARING function.

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

ATTENTION: If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* or of *the position loop* by using an adequate procedure (see enclosure " Procedure Manual" available on request contacting Axor).

8 Pulse/Dir Mode

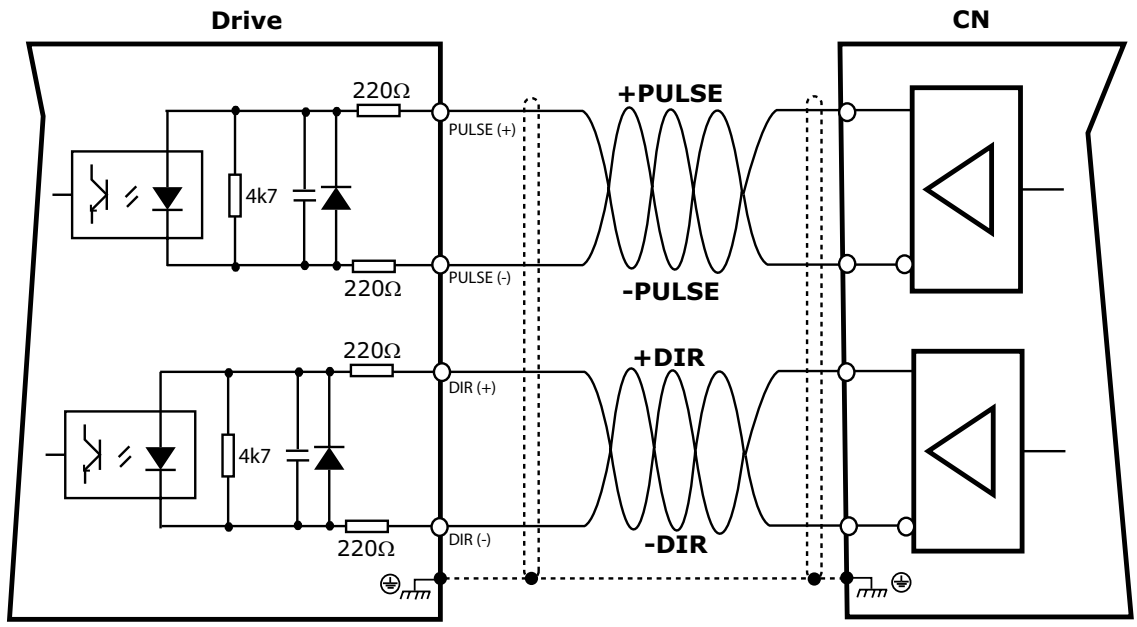
The **Pulse/Dir Mode** allows you to connect the drive to a **stepper-motor controller**.

The procedure is the following:

1- Perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual.

2- Execute hardware connections between drive and CN:

Connection scheme:

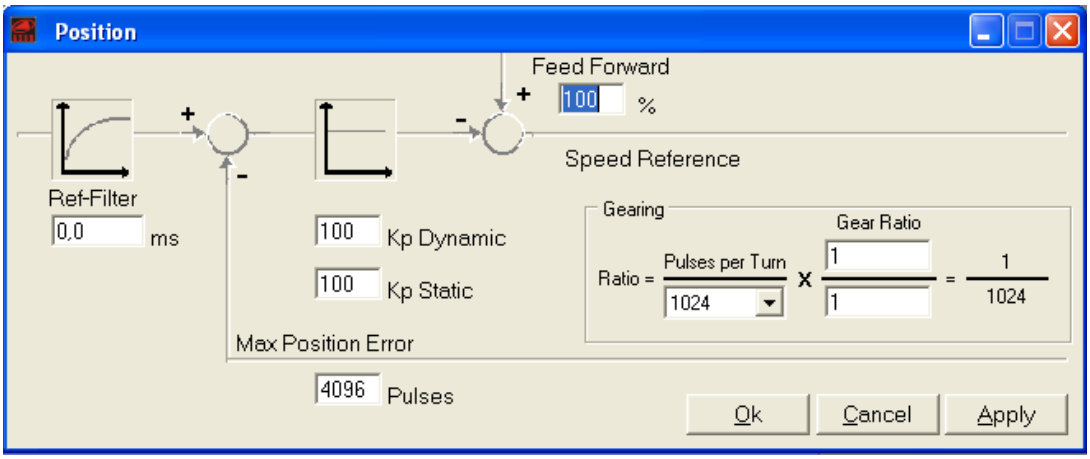


Note:

• We suggest connecting the shield on both sides (drive side follow the indications illustrated on service manual of the drive).

• If the CN supplies a logical signal equal to **0/+24V open collector NPN**, follow connections illustrated on drive's service manual.

3- 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 **Pulses per Turn** and **Gear Ratio** parameters:

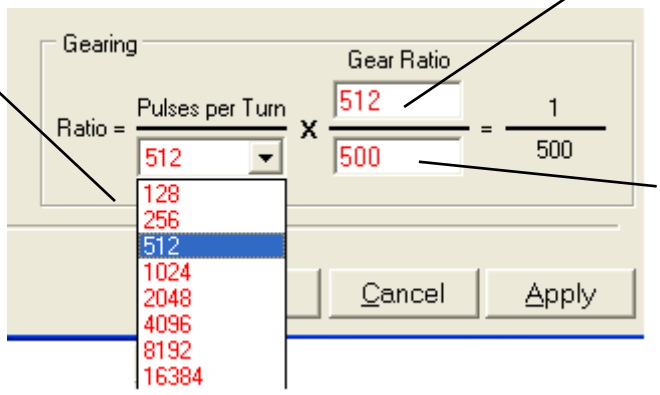


Pulses per turn
This is the number of pulses that must be given to the **PULSE** input in order to have a motor's mechanical turn.
Insert in this field one of the given values (256…16384).
Example: Putting the value at 2048, the motor will complete a mechanical turn with 2048 pulses present on the PULSE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

4- 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**).

5- Save all settings by clicking on icon "**Save data to Eeprom**".

6- For enabling the Pulse/Dir Mode follow this procedure:

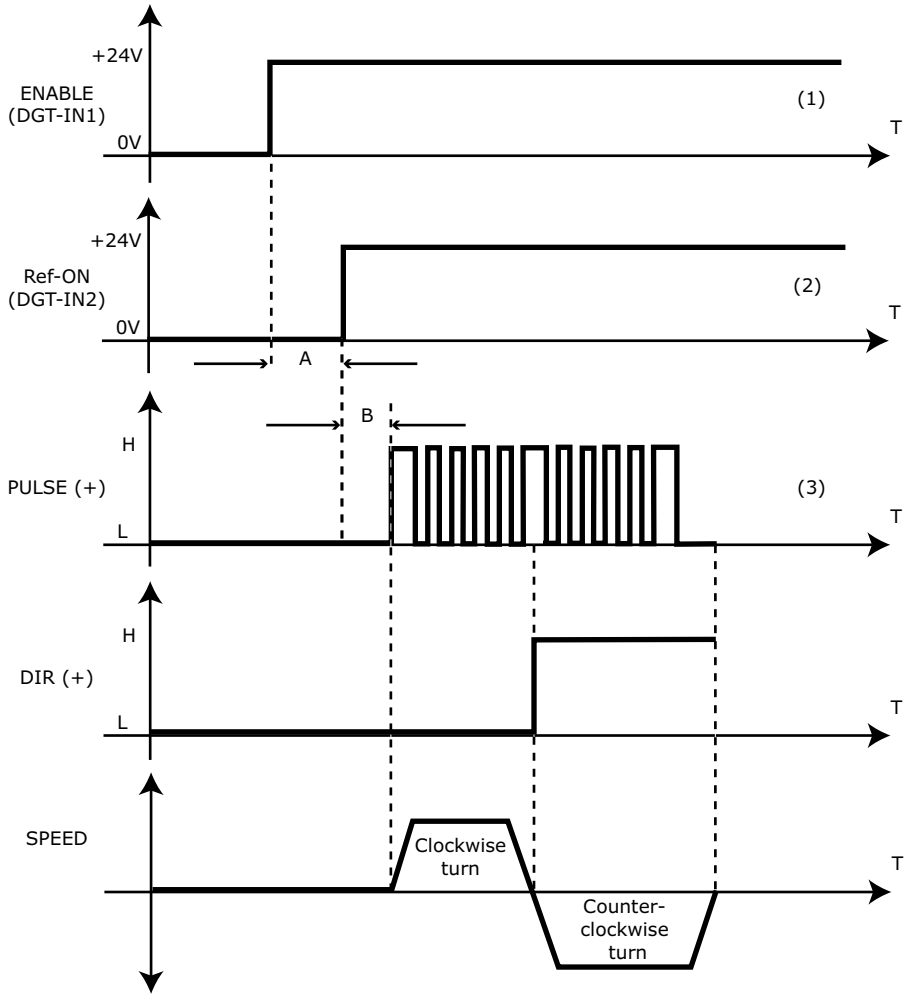
a- Enable the drive giving +24V to the ENABLE input (DGT-IN1). The motor will remain locked in torque with the position loop inserted and waiting to move. See (1)

b- Bring the input DGT-IN2, set with "Ref-On" function, high to enable the motor movement in the Pulse/DIR function. See (2)

c- 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**).

Pulse/Dir sequence:



Note: If required by the application, at anytime it is possible to execute a ***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.
See enclosure "Positioner Manual" to find a detailed description about Homing procedures.

ATTENTION: If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* or of *the position loop* by using an adeguate procedure (see enclosure "Procedure Manual" available on request contacting Axor).

9 Multidrop

It is possible to connect more than one Axor drive simultaneously with the "**Multi Drop connection**". This connection must take place between a 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 interface***.

The procedure is the following:

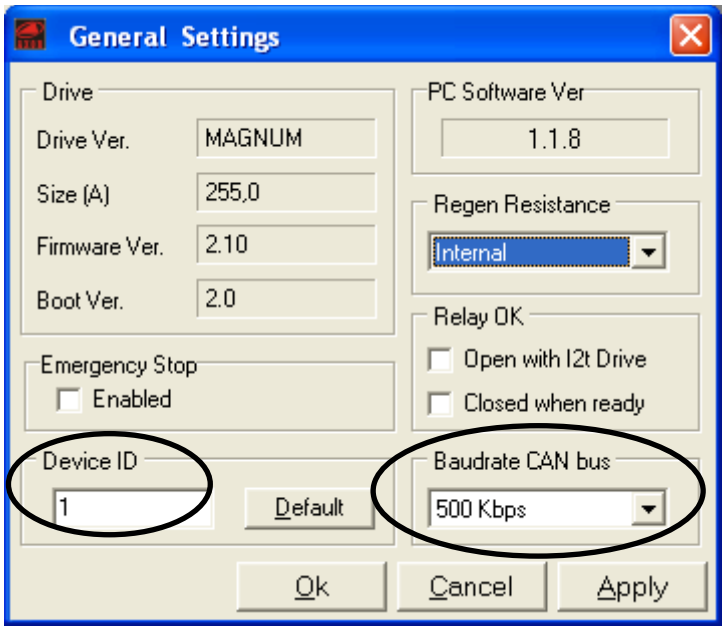
1- For each drive perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual.

2- Connect to one drive at a time, by using the RS232 interface, then in the "**General Settings**" window of each drive set:

✓ **500 kbps** into the **Baudrate CAN bus** parameter;

✓ 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 identification of **1**, 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.



3- Connect the first drive to the **Master PC** using the RS232 cable.

4- Connect each drive with the preceding and the following using the Can Bus cables.

5- Connect a **RESISTOR** (**120 ohm, 1/4W**) between pins **CAN H** and **CAN L** of the first drive and another resistor between pins **CAN H** and **CAN L** of the last drive.

6- At this point for communicating with each drive it is necessary to insert the **Device Id** parameter, set at point 2, in the **Select Driver** window ⇨ for each drive set the desired operative mode.

Example of **Multidrop** connection with **Magnum400™**:

You can find more information in the enclosure "*ModBus Manual*" available on CD provided with the drive.

10 CanBus

Axor digital drives can be controlled in **CanBus**.

The procedure is the following:

1- for each drive perform the *basic installation procedure* and the *motor tests* illustrated in the Drive's Service Manual;

2- In the "**General Settings**" window of each drive set:

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

✓ set the **DEVICE-ID** for each drive.

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

3-For each drive set the operative mode "**7: Can Open**".

4- Connect the first drive to the CAN MASTER by using a CanBus cable.

5- Connect each drive to the preceding and the following by using a CanBus cable.

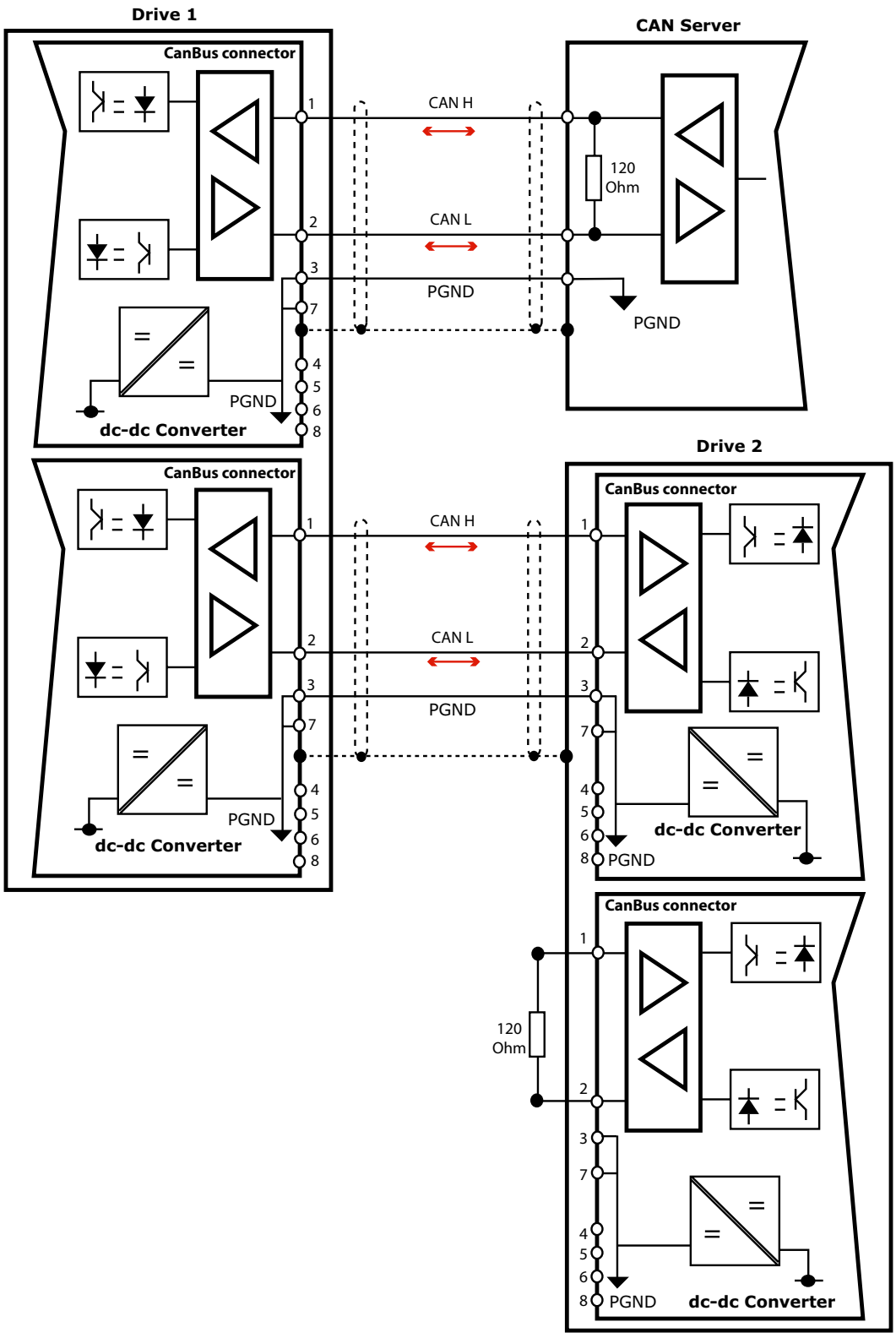
6- Connect a **RESISTOR** (120 ohm, 1/4W) between pins **CAN H** and **CAN L** of the last drive of the network.

Notes:

• The integrated software is based upon the **CAN open DS301** communication protocol and on profile **DSP402**.

• 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 to the drive.

Example:



You can find more information on enclosure "*CanOpen Reference Manual*" available on CD provided with the drive.

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MOTORS SERVO DRIVES

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Additional Features Manual

ver.1 rev.12/'08

Enclosures to Service Manuals of:

- **McbNET Digital™**
- **Magnum400™**
- **MiniMagnum400™**
- **FastBack™**

Summary

Release	Notes
ver.1 rev.06/'07	Preliminary first edition.
ver.1 rev.12/'08	Corrections.

Print in Italy 12/2008

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

1 Programmable digital inputs

The following table illustrates all functions settable on **programmable digital inputs** and operative modes which manage them:

FUNCTION	DESCRIPTION	OP MODE
Off	With this settings there is not a particular function assigned to the input.	all
Ref-On	It enables the motor rotation.	Analog Speed Digital Speed Gearing Pulse/Dir Mode
PStop	See chapter "3 Limit Switch".	Analog Speed Digital Speed
NStop		
P+N Stop		
Brake	See chapter "6 Motor Brake Management".	all
Homing Sensor	Homing sensor.	Position Mode Gearing Pulse/Dir Mode (See "Positioner Manual)
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.	Position Mode (See "Positioner Manual)
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 disable and enable the input set with the "Start Next" function in order to start the next task of the sequence.	
Emergency	See chapter "5 Emergency Function".	Analog Speed Digital Speed Position Mode
Start Homing	It is used to start/stop the homing procedure.	Position Mode Gearing Pulse/Dir Mode (See "Positioner Manual)
Reset Fault	See chapter "4 Reset Fault Function".	all

2 Programmable digital outputs

The following table illustrates all functions settable on **programmable digital outputs** and operative modes which manage them:

FUNCTION	DESCRIPTION	OP MODE
Off	Selecting this function the output will always be open.	all
|Speed|>x	If the absolute value of the actual speed is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual speed is less than the value inserted in the auxiliary variable the output will be opened.	all
|Speed|<x	If the absolute value of the actual speed is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual speed is greater than the value inserted in the auxiliary variable the output will be opened.	all
Homing OK	The output will be closed after a complete and successful homing procedure.	Position mode Gearing Pulse/Dir Mode (see "Positioner Manual")
I2t	The output is closed if there is alarm 6 (I^2t Drive Alarm). When this condition comes down the output opens.	all
|Irms%|>x	If the absolute value of the actual current is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is less than the value inserted in the auxiliary variable the output will be opened.	all
|Irms%|<x	If the absolute value of the actual current is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is greater than the value inserted in the auxiliary variable the output will be opened.	all
Target OK	This function closes the output when a positioning task successfully terminates; at the start of a new profile the output is opened.	Position mode (see "Positioner Manual")
Error	With this function the output is closed if one or more alarms are present. When all alarm are cleared the output will be opened.	all
Ready	When the control circuitry is powered up (with a minimum delay), the output will be closed.	all
P.A. Max	When 80% of the maximum recovery is reached, the output is closed and it will be re-opened if the value becomes less than 80% of the maximum recovery value. ATTENTION:This function is not active for **McbNET Digital™**.	all
|Err Pos|>x	If the absolute value of the actual Position Error is greater than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is less than the value inserted in the auxiliary variable the output will be opened. The actual position error can be monitored in main window of Speeder One interface by selecting Posit_Err option in Analog Out1 or Analog Out2 menu.	Position mode Gearing Pulse/Dir Mode (see "Positioner Manual")
|Err Pos|<x	If the absolute value of the actual Position Error is less than the value inserted in the auxiliary variable, the output will be closed. On the contrary, if the absolute value of the actual current is greater than the value inserted in the auxiliary variable the output will be opened. The actual position error can be monitored in main window of Speeder One interface by selecting Posit_Err option in Analog Out1 or Analog Out2 menu.	
Next Target	At the start of the first profile the output is opened and it will change status (toggled) at the start of every new profile.	Position mode (see "Positioner Manual")

3 Limit Switch

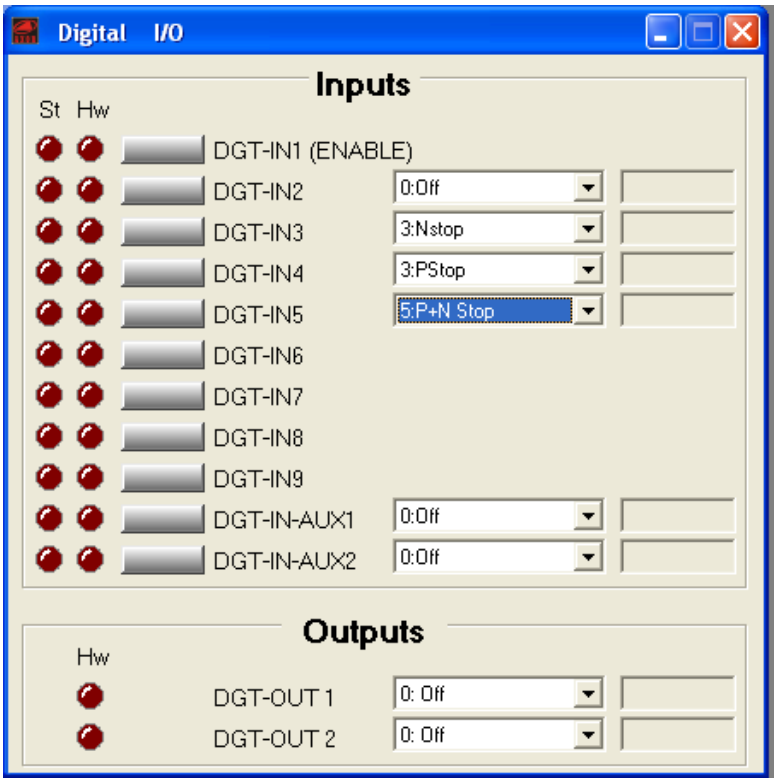
In the "**Digital I/O**" window it is possible to manage ***limit switches***, setting the "**NSTOP**", "**PSTOP**" and "**P+N STOP**" functions:

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

The procedure is the following:

1- connect the limit switches to the pins dedicated to the digital inputs, DGT-IN2...DGT-IN5 (see the service manual of the drive);

2- set the function/s NSTOP, PSTOP and P+NSTOP in the Digital I/O window, referring to the connections at point 1:

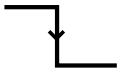
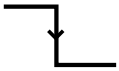
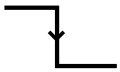
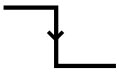
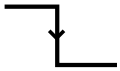
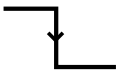
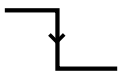
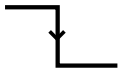


3- select the desired operative mode: "0: Analog Speed", "1: Digital Speed" (the others operative modes do not manage the limit switches).

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.

NOTE FOR FastBack™: FastBack™ DOES NOT MANAGE LIMIT SWITCHES.

4 Reset Fault Function

The "**Reset Fault**" function, that can be set on one of the programmable digital inputs 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 of the available programmable digital inputs and applying a high logic signal to this input (see note below);

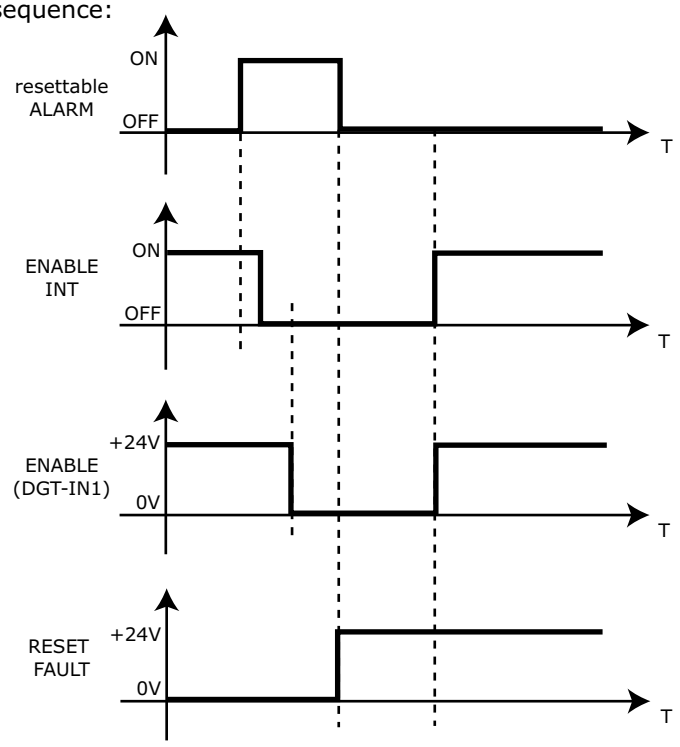
4) enable the drive (using the "**Enable**" icon and/or **DGT-IN1** input).

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" (visualized on "Digital I/O" window) to show red.

Reset Fault function sequence:



5 Emergency Function

Axor drives have an **EMERGENCY *function***, which can be set on one of the programmable digital inputs in the **Digital I/O** window ⇨ a falling edge on the input set with this function causes the motor to stop by using the "**Emer.Ramp**" parameter set in the "**Speed**" window.

The procedure is the following:

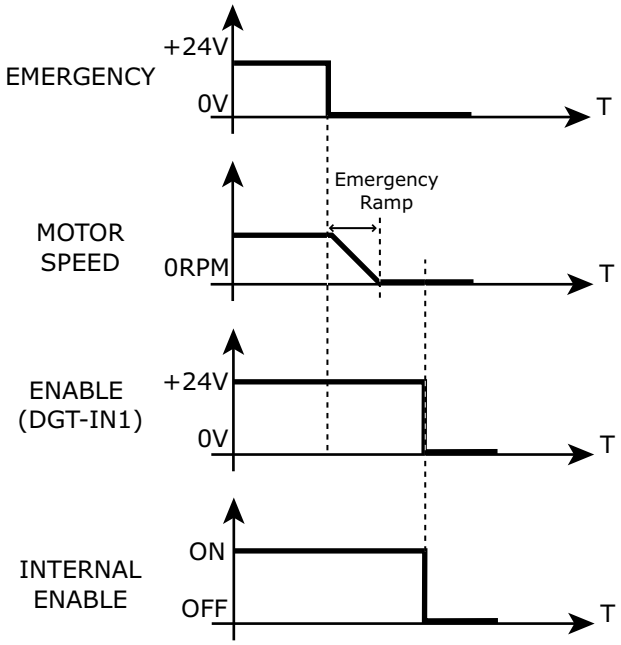
1- set the Emergency function on one digital input in the Digital I/O window;

2- select the desired operative mode between "0: Analog Speed", "1: Digital Speed" or "4:Position Mode" (the others operative modes do not manage the limit switches);

3- enable/disable the drive by using **Enable**/**Disable** buttons.

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

Emergency function sequence:



6 Motor brake management

Some Axor digital servodrives (**MAGNUM**400™, **MiniMagnum**™ and **FastBack™**) have a circuitry which allows the control of the **electromechanical brake integrated** in the motor. It is a ***Stationary Brake***, so it can be used with motor not running, for blocking the motor's axis.

It cannot be used for dynamic braking.

The user has the following possibilities:

a- **Not manage the brake by drive.**

b- MANUAL brake management:

- **The current necessary to unblock the brake is given by the drive's electronics, but it is controlled by a logic external to the drive.**

- **The user has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the blocking time of the brake during alarms or when the motor is turning.

c- AUTOMATIC brake management:

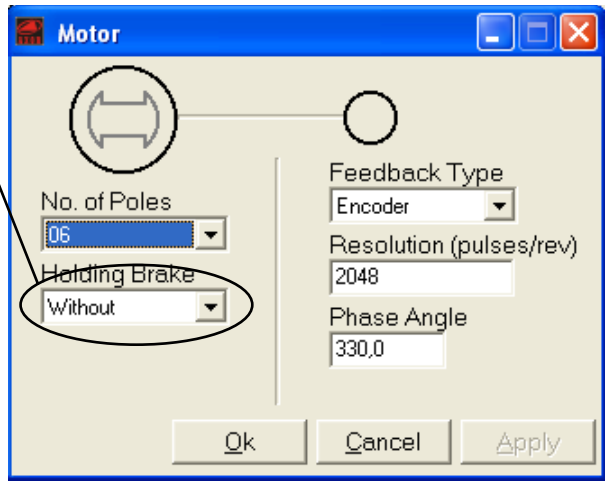
- **The current necessary to unblock the brake is given by the drive's electronics and it is controlled by a logic internal to the drive.**

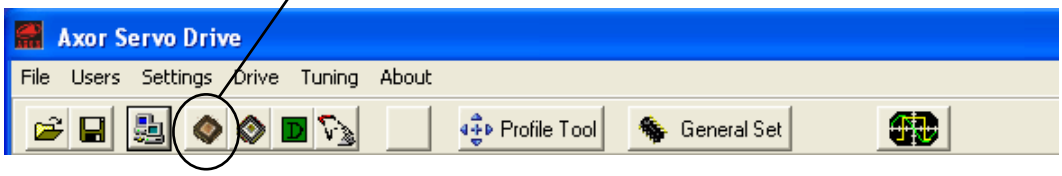
- **The drive has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the opening time of the brake during alarms or when the motor is turning.

a- NOT managing the brake by drive

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

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



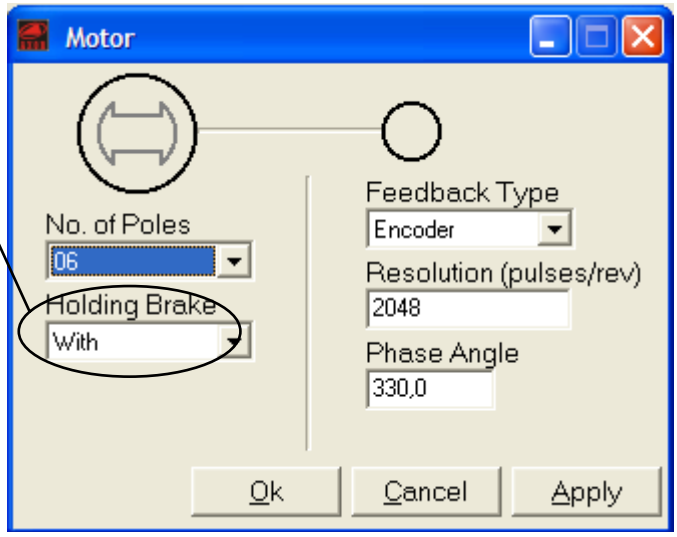


During alarms the functioning of the system is interrupted, the motor remains free and will eventually stop due to the friction and inertia of the axis; at this point there are two possibilities:

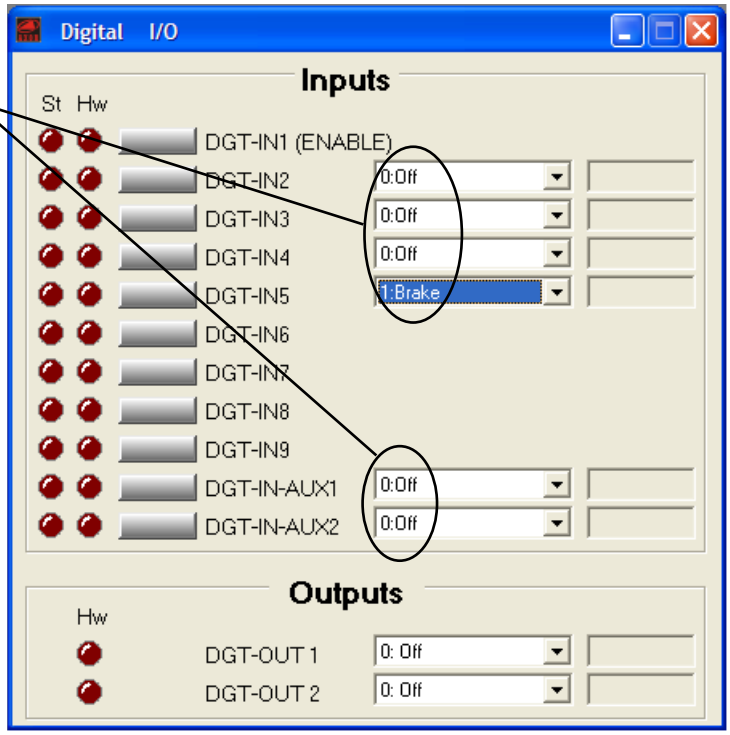
- **if the motor has no brake, the axis remains free;**
- **if the motor has an electromechanical brake, the user can manage the axis block, for example using an external relè.**

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

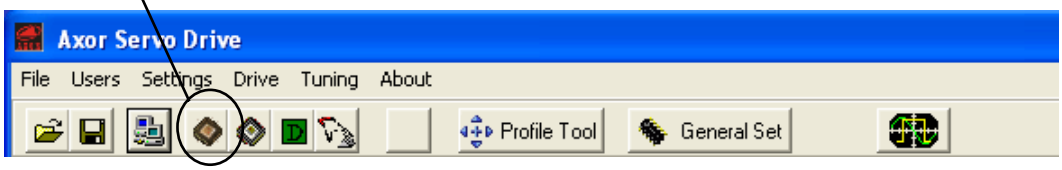
1) Select ***With*** in the **Holding Brake** box of the "**Motor**" window.



2) Select ***Brake*** in a digital programmable input (DGT-IN2...DGT-IN5 or DGT-IN-AUX1...DGT-IN-AUX1).



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



Follow this ***insertion procedure***:

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

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

3) After **100ms** it is possible to disable the drive applying **0V** on the **DGT-IN1(ENABLE)** input.
At this point the motor will remain mechanically blocked.

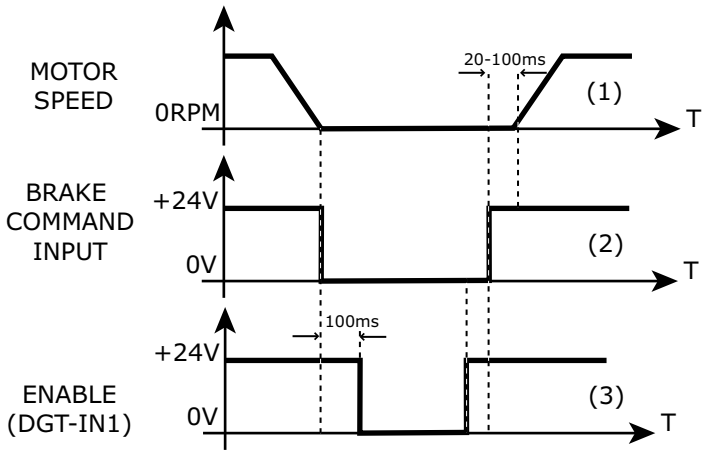
Follow this ***dis-insertion procedure***:

1) Apply **+24V** to the **DGT-IN1** (**ENABLE**) input.

2) Apply **+24V** to the digital input set with the **"Brake"** function.

3) After **20÷100ms** (reference to brake), it will be possible to setup the desired speed reference.

***Insertion* and *dis-insertion procedure* of the motor brake:**



Attention: it is possible to drive the **DGT-IN1** and **Brake** digital inputs:
- ✓ **via software**: in the **Digital I/O** window, by using the dedicated buttons;
- ✓ **via hardware**: applying the appropriate voltage (0V/+24V) on pin corresponding to the digital input set with Brake function. It is necessary to connect the pin **DGT-IN RTN** to CN, too.

Note: You can found more information about the *behaviour of the system in presence of alarms* on paragraph "7 Stop Functions".

c- AUTOMATIC brake management:

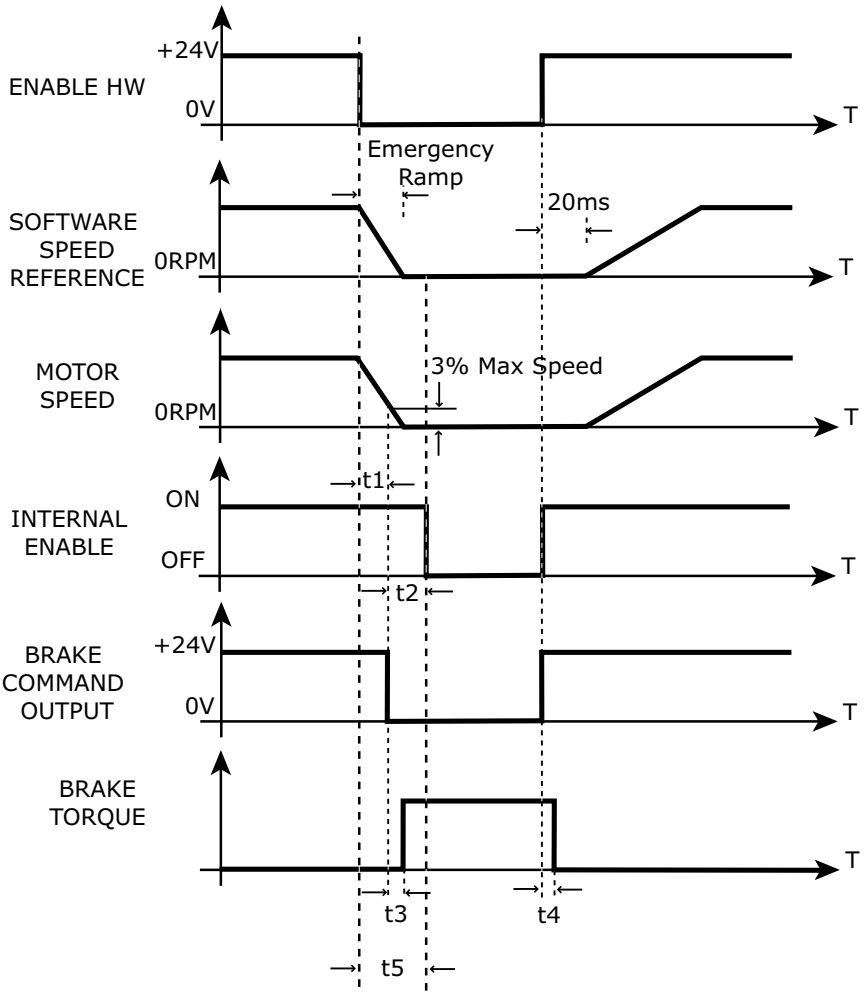
It works with these operative modes: "0: Analog Speed", "1: Digital Speed", "4: Position Mode", "7: Can Open", "10: Square Wave".

Execute these ***settings***:

1) Select ***With*** on the **Holding Brake** box of the "**Motor**" window.
2) **Do not** select the "**Brake**" function in a programmable digital input.

The ***behaviour of the system*** is the following:

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



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

Note: You can found more information about the behaviour of the system in presence of alarms on paragraph "7 Stop Functions".

7 Stop Functions

In the following pages we illustrate the behaviour of the system in reference to these settings:

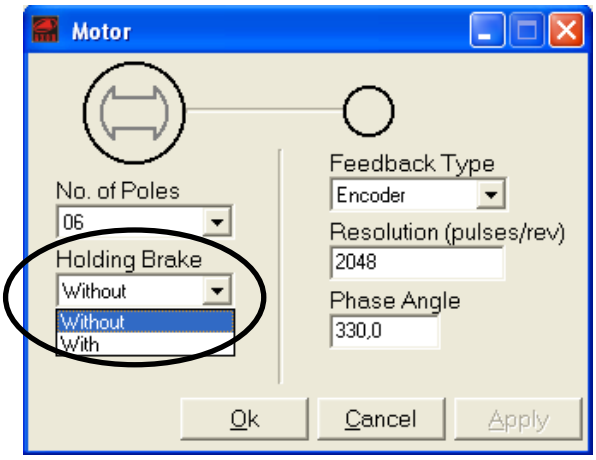
- automatic or manual management of the *stationary brake*;
- *emergency stop*.

We remember that:

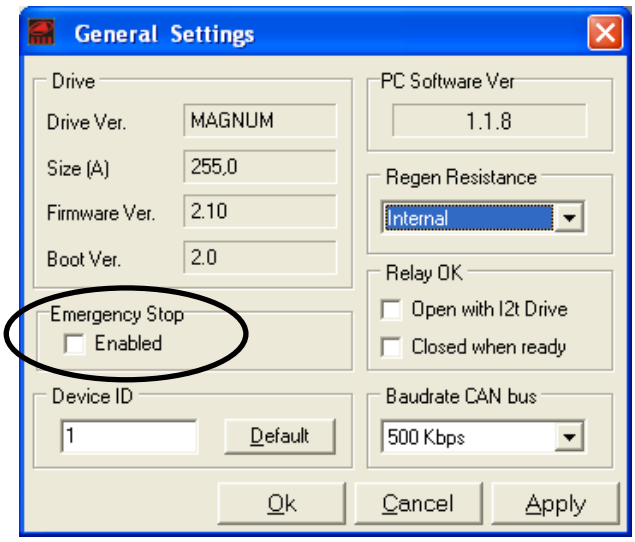
• For the ***manual management*** of the brake it is necessary to set the "**With**" option in the "**Holding Brake**" box in the "**Motor**" window, then it is necessary to select the "**Brake**" function on one of the programmable digital inputs.

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

• For the ***no management*** of the brake it is necessary to set the "**Without**" option in the "**Holding Brake**" box in the "**Motor**" window.



• For the ***emergency stop function*** it is necessary to set the dedicated flag in the "**General Set**" window, and to set the "**Emer. Ramp**" parameter [in ms] in the "**Speed**" window. **ATTENTION: In the "7: CAN open" operative mode the "Emer. Ramp" parameter is set via CanBus.**



The ***dangerous alarms***, which cause the immediately insertion of the brake, are the followings:
- AI2: Over Current;
- AI4: Hall;
- AI5: Encoder;
- AI9: Max/Min Voltage;
- AI12: Resolver;
- AI14: Following Error;
- AI17: Over Current Brake.

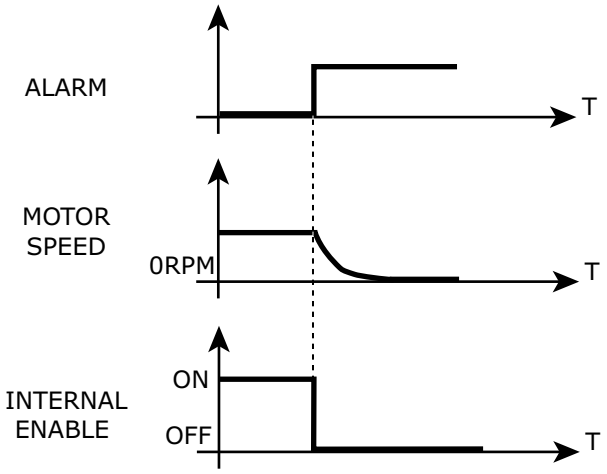
All others alarms stop the system by using the emergency ramp before the brake's insertion.

This table illustrates all possible cases:

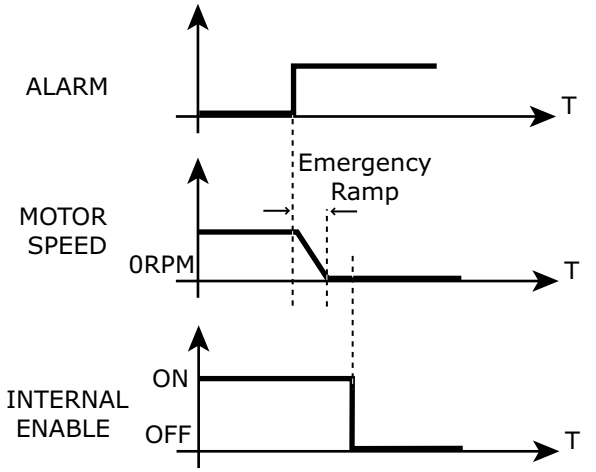
CASES	BRAKE MANAGEMENT	EMERGENCY STOP FUNCTION	BEHAVIOUR	
			DISABLING OR NOT DANGEROUS ALARM	DANGEROUS ALARM
1°	No brake management	Disable	The internal enable immediately disables, the motor remains free and will eventually stop due to the friction and inertia of the axis.	
2°	No brake management	Enable	The motor stops following an emergency ramp equal to the "**Emer. Ramp**" parameter set in the "Speed" window.	The internal enable immediately disables, the motor remains free and will eventually stop due to the friction and inertia of the axis.
3°	Automatic brake management	Enable or Disable	The motor stops following an emergency ramp equal to the "**Emer. Ramp**" parameter; when 3% of the max speed is reached the brake output is disabled, then after the motor stops, the internal enable disables.	The brake is immediately activated.
4°	Manual brake management	Disable	The internal enable disables, the motor remains free and will eventually stop due to the friction and inertia of the axis; after the motor stops it is possible to block the axis enabling the brake command. In particular conditions (for example: having a vertical axis), it is possible to immediately enable the brake without waiting the axis' stop ⇨ the motor will stop due to the friction. ATTENTION: THE TIME FOR BRAKE ENABLE IS DECIDED BY THE USER.	
5°	Manual brake management	Enable	The motor stops following the emergency ramp; after the motor stops it is possible to block the axis enabling the brake command.	The motor remains free and will eventually stop due to the friction and inertia of the axis; after the motor stops it is possible to block the axis enabling the brake command. In particular conditions (for example: having a vertical axis), it is possible to immediately enable the brake without waiting the axis' stop ⇨ the motor will stop due to the friction. ATTENTION: THE TIME FOR BRAKE ENABLE IS DECIDED BY THE USER.

NOTA: McbNET Digital™ DOES NOT MANAGE BRAKE, SO IN PRESENCE OF A DISABLE OR AN ALARM IT FOLLOWS CASE 1° OR CASE 2° DEPENDENT ON EMERGENCY STOP FUNCTION SETTINGS.

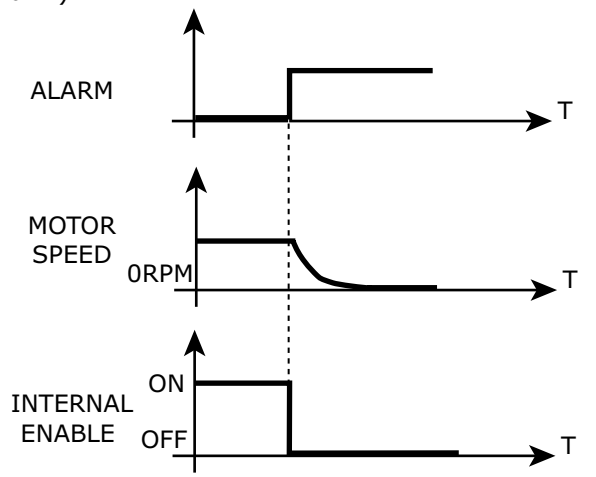
Case 1° (disable or alarm):



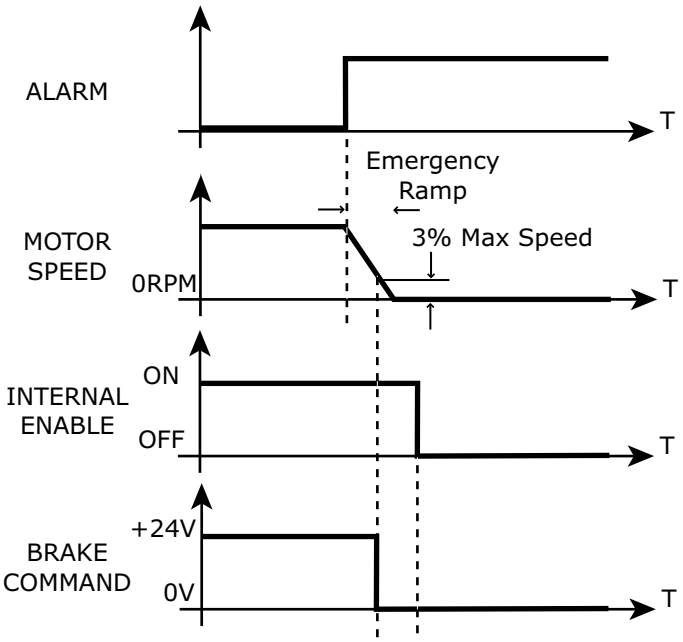
Case 2° (disable or not dangerous alarm):



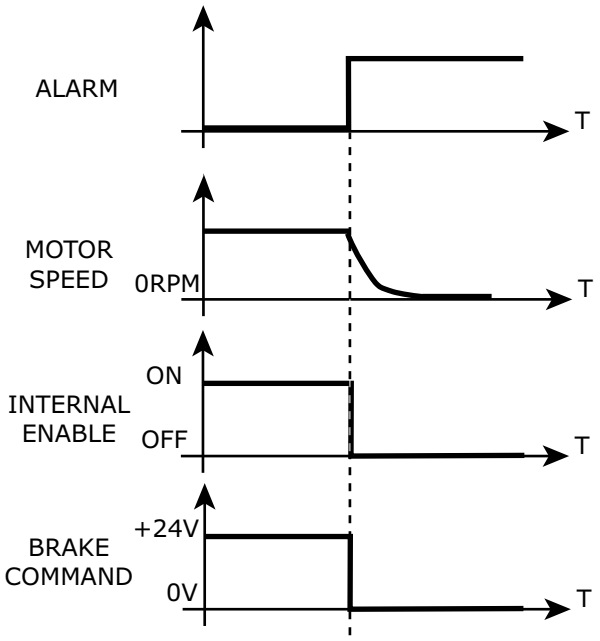
Case 2° (dangerous alarm):



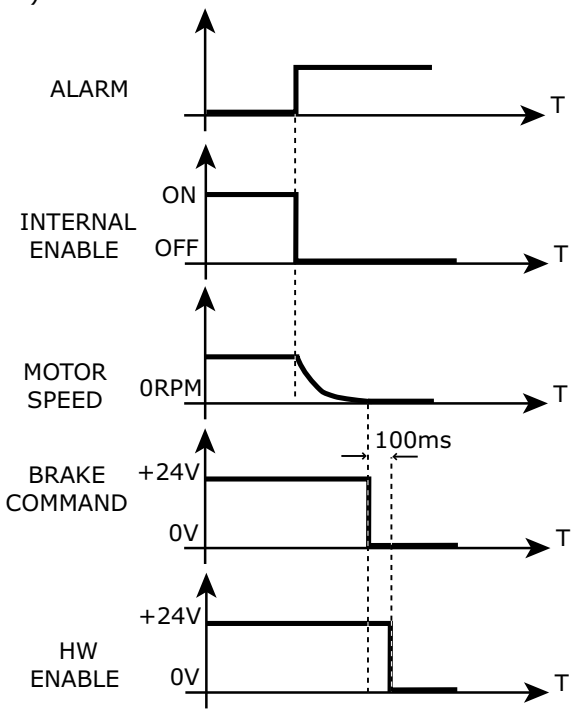
Case 3° (disable or not dangerous alarm):



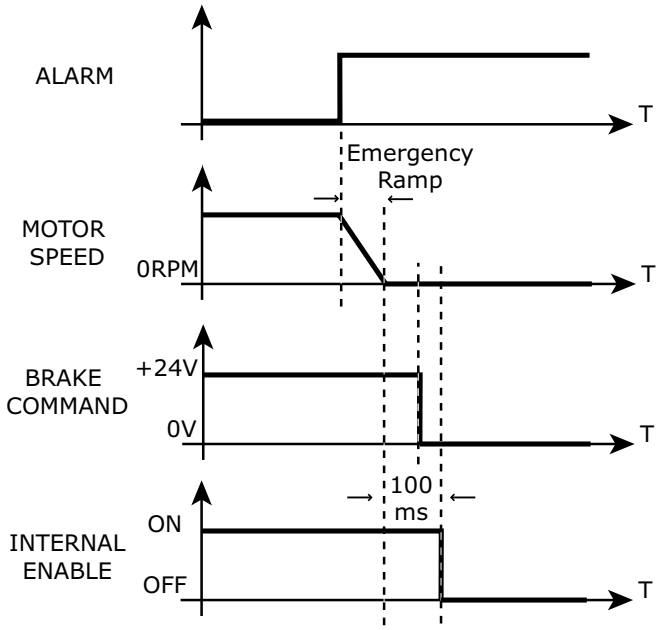
Case 3° (dangerous alarm):



Case 4° (disable or alarm):



Case 5° (disable or not dangerous alarm):



Since AXOR™ INDUSTRIES MOTORS SERVO DRIVES 1988

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