



SERVICE MANUAL

ENGLISH



MACK INDY

Stand Alone Brushless Servo Drive

AXOR INDUSTRIES®
MOTORS
& DRIVES

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**THIS MANUAL CONTAINS A DESCRIPTION OF MACK® INDY
AND A GUIDELINES FOR THE DRIVE'S INSTALLATION.**

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

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Chapter 1

Description

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1.1 General Description

The **MACK® INDY** is a digital drive capable of piloting both rotary AC brushless motors and linear motors, up to **500W**. It can be supplied by a single phase voltage equal to **1x230Vac** ($\pm 15\%$). With the appropriate hardware setting, it support the following **OPERATIVE MODE**:

OPERATIVE MODES	
ANALOG SPEED	Speed piloting utilising an analogue reference.
DIGITAL SPEED	Speed piloting utilising a digital reference.
ANALOG TORQUE	Torque piloting utilising an analogue reference.
DIGITAL TORQUE	Torque piloting utilising a digital reference.
POSITION MODE	<p>Piloting the motor with configured profile with speed and position. The positioner can be managed via hardware (using the digital inputs appropriately configured) or via USB (using the SpeederOne.2 interface).</p> <p>It supports 32 programmable position profiles, a single task or a sequence of tasks are permitted.</p> <p>The Homing Procedure is implemented. It uses the signal coming from the homing sensor and eventually the zero signal of the encoder.</p>
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.
PULSE/DIR MODE	It is possible to connect the drive to a motor piloting it with the CLOCK and DIR signals: the DIR signal defines the clockwise/counter clockwise rotation, while the CLOCK signal defines the speed rotation.
CANOPEN	<p>It can be configured and controlled using CanBus. It supports the following Can Open protocols:</p> <ul style="list-style-type: none">• Part of the DS301-V4.02• Part of the DSP402-V2.0
CW/CCW	It is possible to connect the drive to a motor piloting it with the CLOCK and DIR signals: if pulses arrive at the CLOCK input, the motor rotates clockwise (CW); while if pulses arrive at the DIR input, the motor rotates counter clockwise (CCW).
ETHERCAT	The drive can be configured and controlled using EtherCAT .
SQUARE WAVE PERIOD	The motor is piloted with a "square wave" signal. This is useful for adjustments of the speed loop.
ANALOG TO POSITION	The motor moves between two programmable positions corresponding the min and max voltages at the dedicated pins.
DIGITAL POSITION	The motor moves between two digital positions.
RS485 MODBUS-RTU	It allows to communicate and control the drive by using the RS485 interface.

1.1 General Description

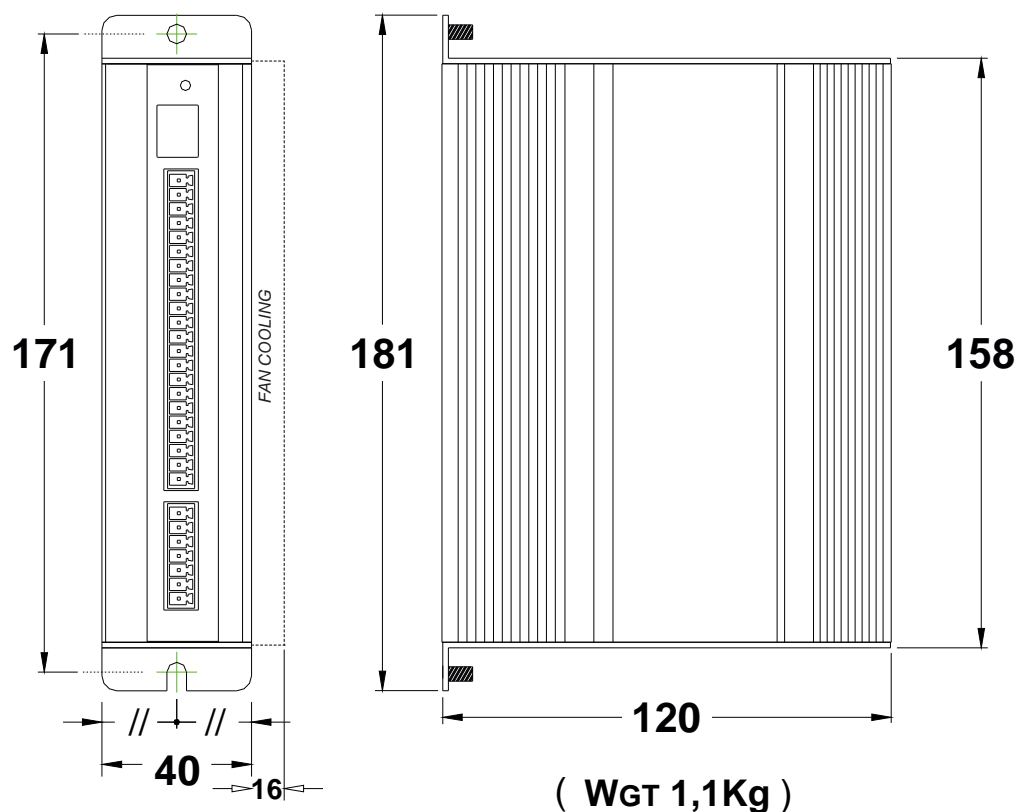
FEEDBACK	
SERIAL ENCODER	Serial angular encoder.
ABSOLUTE ENCODER	Absolute multi-turn encoder.
COMMUTATION ENCODER	Commutation encoder + hall.
ANALOG INPUT	
1 ANALOG COMMON MODE INPUT (Tp.RC)	It is used for controlling the current from the drive.
1 ANALOG DIFFERENTIAL or COMMON MODE INPUT (+/-REF)	It can be used for piloting the drive with an analogue speed reference from an external controller.
DIGITAL INPUTS/OUTPUTS	
2 DIGITAL INPUTS (IN1 & IN6) OPTO-ISOLATED NOT PROGRAMMABLE	The digital inputs are programmed as following: IN1: ENABLE IN6: RESET FAULT
4 DIGITAL INPUTS (IN2÷IN5) OPTO-ISOLATED PROGRAMMABLE	The digital inputs are programmable with the options present in chapter <i>"5.9 Digital I/O window" on page 106.</i>
1 DIGITAL INPUTS (OUT3) OPTO-ISOLATED NOT PROGRAMMABLE	The digital output are programmed as following: OUT3: HOLDING BREAK
2 DIGITAL OUTPUT (OUT1 ÷ OUT2) OPTO-ISOLATED PROGRAMMABLE	The digital outputs are programmable with the options present in chapter <i>"5.9 Digital I/O window" on page 106.</i>
STANDARD AND ADDITIONAL FEATURES	
EMI FILTER	There are avviable two EMI anti-disturbace filter integrated for power supply and auxiliary power supply.
SPEEDERONE.2 SOFTWARE INTERFACE	The Axor <i>Speeder One</i> interface allows user to set and manage all drive's parameters, just using an USB single access cable.
EMULATED ENCODER OUTPUTS	There are 6 pins dedicated to an emulated encoder with different programmed ratios (1:1, 1:2, 1:4, 1:8, 1:16, 1:32, 1:64, 1:128).
SAFETY	
SAFETY	The system is protected from the short circuitry, the Max/Min Voltage, the drive I ² t , the Motor I ² t , etc.
SAFE TORQUE OFF FUNCTION	It is a safety function which avoids the accidental startup of the motor in the absence of +24Vdc on indicated pins (See enclosure "STO Manual" to find more information provided on request).

1.2 Technical Data

Mack® Indy Technical Data						
Power Supply (grounded system only)	Vac	Single phase: 1x230Vac ± 10% , 50/60Hz				
Auxiliary power supply (for back up)	Vac	Single phase: 1x230Vac ± 10% , 50/60Hz				
Size		MKYD 230				
		1,5/3	2,5/5	3,5/7	5/10	8/16
Nominal Current	Arms	1,5	2,5	3,5	5	8
Peak current for 5 sec.	Arms	3	5	7	10	16
PWM output frequency	kHz	8				
External Fuse Protection						
Backup	F1	1A T				
Power Supply	F2	6A T				
Dumping Resistor	F3	4A F				
Ambient condition during operation	Temperature	From +5°C to +40°C (without condensation)[Class 3K3 according to EN 60721-3-3]. From +40°C to +55°C the drive must be derated 2.5%/°C in reference to nominal and peak current.				
	Humidity	From 5% to 85% (without condensation) [Class 3K3 according to EN 60721-3-3].				
	Vibration	Class 3M1 according to EN 60721-3-3.				
Ambient condition during transport	Temperature	From -25°C to +70°C [Class 2K3 according to EN 60721-3-2].				
	Humidity	Relative humidity max 95% (without condensation) [Class 2K3 according to EN 60721-3-2].				
	Vibration	Class 2M1 according to EN 60721-3-2.				
Ambient condition during storage	Temperature	From -5°C to +55°C [Class 1K3 according to EN 60721-3-1].				
	Humidity	Relative humidity from 5% to 85% (without condensation) [Class 1K3 according to EN 60721-3-1].				
	Vibration	Class 1M1 according to EN 60721-3-1.				
Control signals						
Optoisolated digital inputs			+24Vdc - 7mA (PLC compatible)			
Optoisolated digital outputs 1-2			+24Vdc - 15mA (PLC compatible)			
Optoisolated digital output 3			+24Vdc - 120mA (PLC compatible)			
Pulse/Dir digital inputs Low			+5V, optoisolated, max. frequency 500kHz			
Pulse/Dir digital inputs High			+24V, optoisolated, max. frequency 500kHz			
Braking Resistance						
External Resistance		39Ω - 100W				

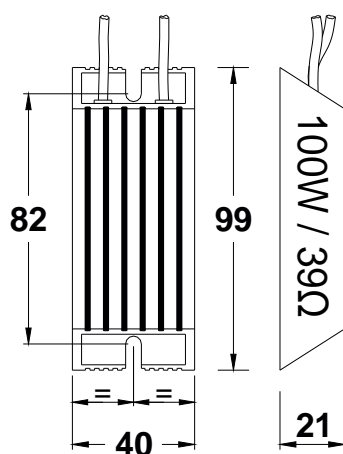
1.3 Mechanical Dimension

CASE A



R01

DUMPING RESISTOR

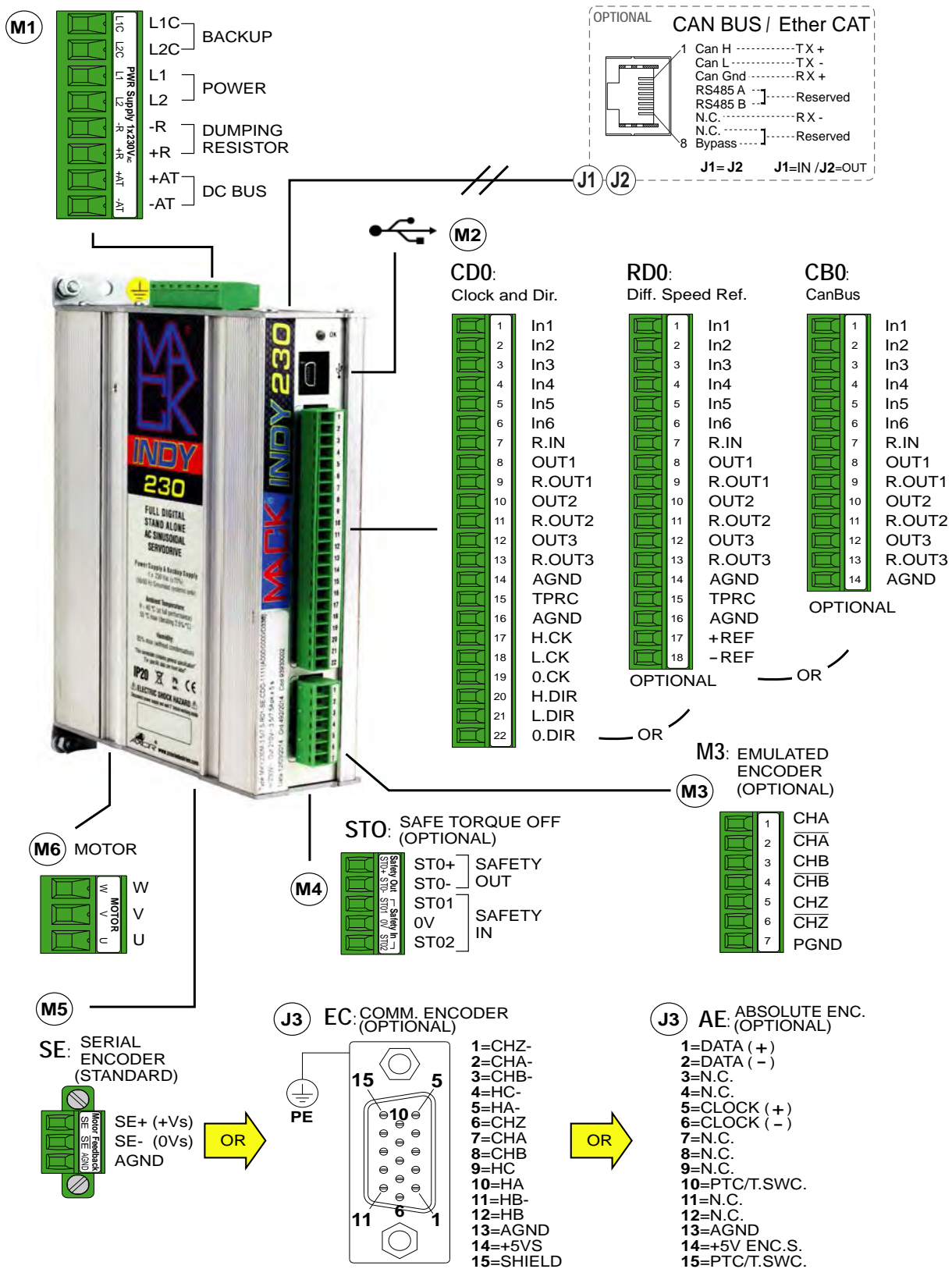


(WGT 0,16Kg)

Mechanical specifications

Drive assembly		Panel mount
External dimensions	mm	181 x 120 x 40(56 with fan)
Weight	Kg	1,1
Weight with fan cooling	Kg	1,3

1.4 Connectors Description



1.4 Connectors Description

M1	POWER	DESCRIPTION
L1C	L1C	Backup Supply 230Vac
L2C	L2C	Backup Supply 230Vac
L1	L1	Power Supply 230Vac
L2	L2	Power Supply 230Vac
- R	- R	External dumping resistor
+R	+R	External dumping resistor
+AT	+AT	+ DC BUS
-AT	-AT	- DC BUS

M2	CONTROL	DESCRIPTION
FOR: CD0(Clock and Dir.) / RD0(Diff. Speed Ref) / CB0(Can BUS)		
1	In1	Digital input 1
2	In2	Digital input 2
3	In3	Digital input 3
4	In4	Digital input 4
5	In5	Digital input 5
6	In6	Digital input 6
7	R.IN	Return for all digital input
8	OUT1	Digital output 1
9	R.OUT1	Return for digital output 1
10	OUT2	Digital output 2
11	R.OUT2	Return for digital output 2
12	OUT3	Digital output 3
13	R.OUT3	Return for digital output 3
14	AGND	AGND
FOR: RD0(Diff. Speed Ref)		
15	TPRC	Analog Toque Input ($\pm 10V$)
16	AGND	AGND
17	+REF	Analog Input Positive Reference (+10V)
18	-REF	Analog Input Negative Reference (-10V)
FOR: CD0(Clock and Dir.)		
15	TPRC	Analog Toque Input ($\pm 10V$ - 12bit)
16	AGND	AGND
17	H.CK	Clock Input (+24V)
18	L.CK	Clock Input (+5V)
19	O.CK	0 Clock
20	H.DIR	Dir Input (+24V)
21	L.DIR	Dir Input (+5V)
22	O.DIR	0 Clock

1.4 Connectors Description

M3	EMULATED ENCODER	DESCRIPTION
1	CHA	Channel A
2	CHA-	Channel A-
3	CHB	Channel B
4	CHB-	Channel B-
5	CHZ	Channel Z
6	CHZ-	Channel Z-
7	PGND	GND

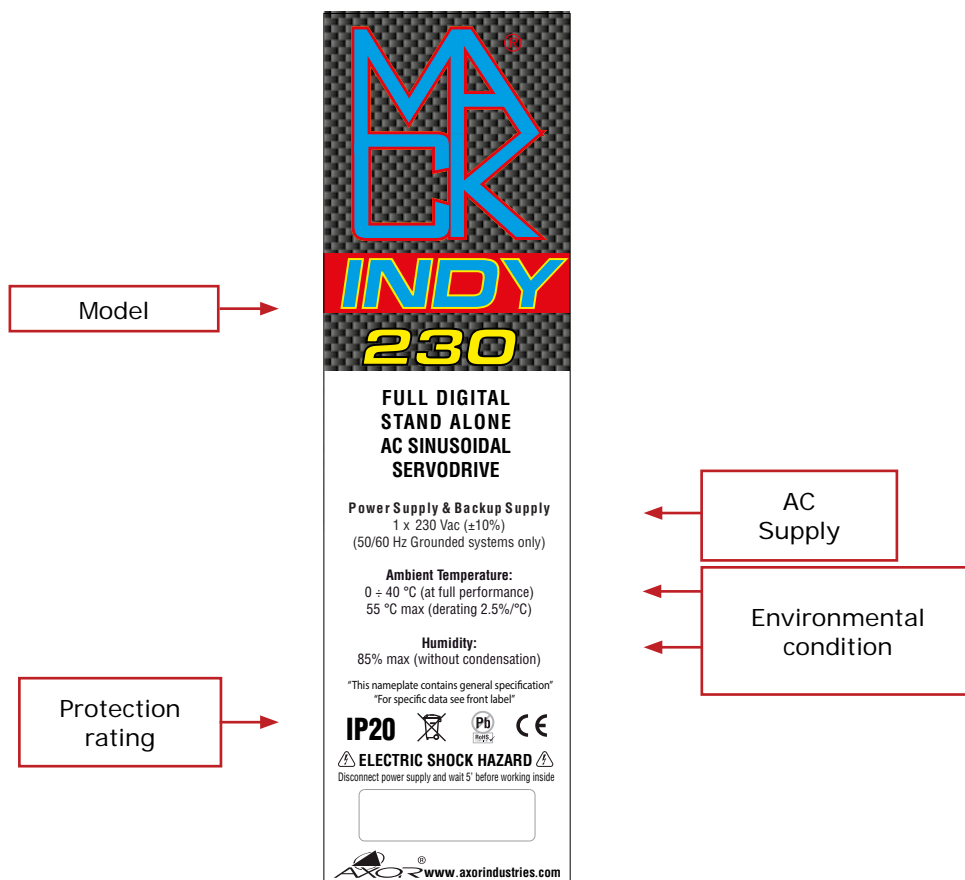
M4	STO (SAFE TORQUE OFF)	DESCRIPTION
1	STO+	Output closed if there aren't malfunctions
2	STO -	
3	STO1	Channel 1 Safety Input
4	0V	Common For STO1 and STO2
5	STO2	Channel 2 Safety Input

M5	SERIAL ENCODER	DESCRIPTION
SE+	SE +	Serial Encoder +
SE -	SE -	Serial Encoder -
AGND	AGND	AGND

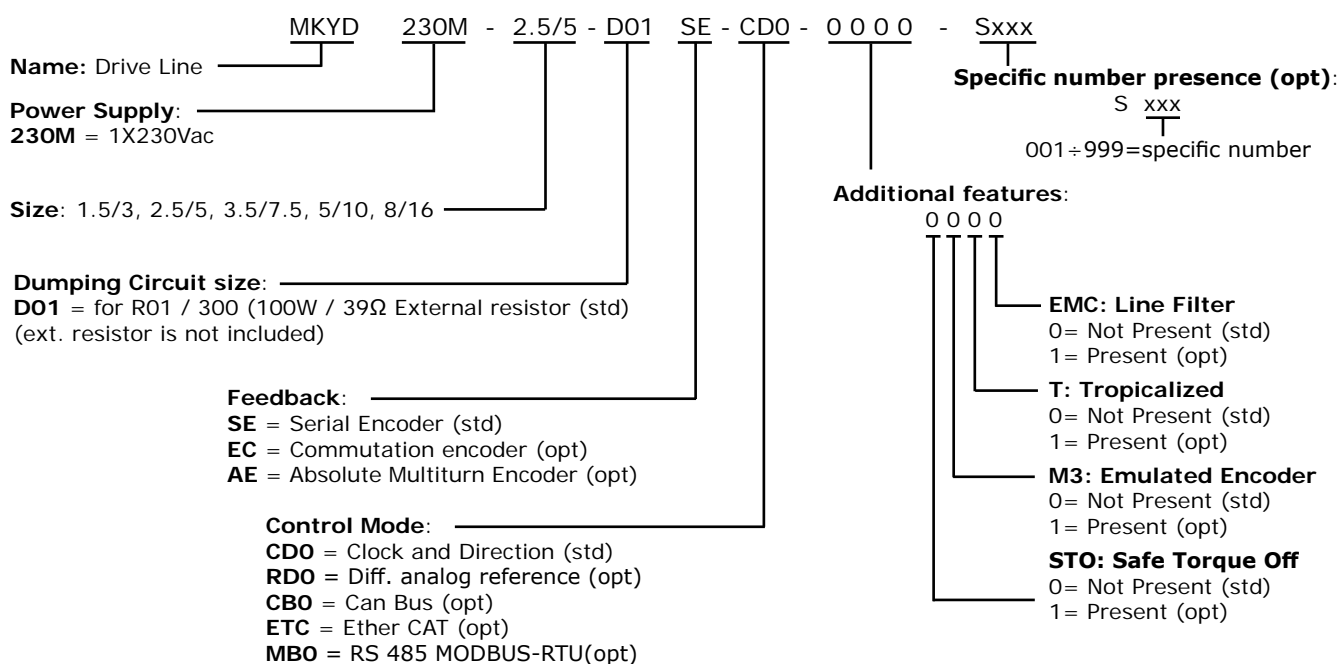
M6	MOTOR	DESCRIPTION
U	U	Motor Phase U
V	V	Motor Phase V
W	W	Motor Phase W

1.5 Product plate and Ordering Code

On the side of each drive there is a **product plate** like the follow:



Ordering code:



1.5 Product plate and Ordering Code

ABBINAMENTO DRIVE-MOTORE/MOTOR-DRIVE COUPLING

In fase di assemblaggio della macchina si raccomanda di eseguire il corretto abbinamento drive-motore. A tal proposito confrontare l'etichetta presente nel drive (vedi FIG.1) con il certificato di collaudo abbinato allo stesso drive. Nel certificato di collaudo sono presenti il codice e la descrizione del file di taratura caricato nel drive, nonché il motore da abbinare al drive (vedi FIG.2) / *During the machine assembly phase remember to correctly execute the proper drive/motor coupling. With this in mind, compare the drive label (see FIG.1) with the test certificate supplied with the drive. You will find on the test certificate the code and description of the adjustment file, along with the proper motor coupling for the drive (see FIG.2).*






	HW: MKYD230M3.5/7-R01SE CD0 0101 SW: B023 / X000 / D039
0444/440441	Data: 27/01/2016 Ord: 78/2016 Cod: 93930258

FIG.1 (Etichetta presente nel drive / Drive label)

Codice del file di taratura caricato nel drive / **Code of the adjustment file for which drive has been setup**

		Certificato di collaudo / Test certificate MACK® INDY	
Cliente / Client : Totale pezzi / Tot. pieces : 2 di / of : 2 Codice prod. / Order code : 93930258 HW: MKYD230M3.5/7-R01SE CD0 0101		N. Ordine / Order N.: Data / Date : Matricola / ID Number : SW: B023 / X000 / D039	
N. Lotto modulo / N. Block modular board: 1/15 N. Lotto com-reg / N. Block com-reg: 3/15		N. Lotto ethercat / N. Block ethercat:	
File di taratura / Adjustment file: MKYD230M_3.5_7_MKM85_M_30_23_0_MKES1 Versione firmware / Firmware version: firmware_MKYD_B_023.mot Versione CPLD / CPLD version: cpld_MKYD_0_2_ems.jed Versione Boot / Boot version: boot_MKYD_--.ldr Versione software / Software version: -		Taratura / Settings: I rms / Rated I : 3,3 Arms I peak / Peak I : 7 Arms Speed limit: 3000 Rpm Note:	
Etichetta prodotto / Product label <div></div>			
Caratteristiche motore / Motor features: Tipo / Type : Encoder : 2048 Imp/rev P. Motor : 8 P. Resolver : Phasing angle : 330 deg Brake : no		Tipo / Type : Encoder : 2048 Imp/rev P. Motor : 8 P. Resolver : Phasing angle : 330 deg Brake : no	
N. ID strumenti / Instrument IDs: Tester : Lem :		N. ID attrezzature di prod. / N. ID prod equipment : Banco : Oscilloscopio :	
COLLAUDO / TEST Questo documento certifica che l'apparecchiatura soddisfa i requisiti specificati nel contratto di acquisto, in quanto tutte le prove previste nelle procedure di collaudo sono state superate con esito positivo. <i>This document certifies that the device meets the requirements that are displayed on the purchase contract, because all of the programmed tests on the test procedures were positive.</i>			
 UNIVERSITÀ CASA N. 9723		 Nec N. 9723	
		Operatore C.Q. / Quality test op : Firma / Signature :	

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FIG.2 (Certificato di collaudo / Test Certificate)

Nota/Note: Si raccomanda al cliente di archiviare il certificato di collaudo del drive e del motore / *It is recommended that the client retains the test certificate of both drive and motor.*

Chapter 2

Installation

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2.1 General Advices

Transport

During the transport of the device respect the following indications:

- The transport must be made by qualified personnel.
- The temperature range must be between -25°C and +70°C [class 2K3 according to EN 60721-3-2].
- The Max humidity must be 85% (without condensation) [class 2K3 according to EN 60721-3-2].
- The system 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 device condition at its arrival to survey eventual damages.
- Avoid shocks (the drive has class 2M1 is according to EN 60721-3-2).

Storage

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

- Temperature from -5°C to +45°C [class 1K3 according to EN 60721-3-1];
- Max relative humidity: 95% (without condensation) [class 1K3 according to EN 60721-3-1];
- Max time with the drive powered off (without supply connections): **1 YEAR**.

After this time, before enable the system, 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 (single phase) for 30 minutes using a single 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.

- Avoid shocks (the drive has class 1M1 is according to EN 60721-3-1).

Maintenance

We recommend an **accurate maintenance plane**, according to using norms (for example CEI EN 60439-1).

In particular, we recommend the following:

- *If the casing is dirty*, clean it with isopropanol or similar;
- *If the drive is dirty*: the cleaning is reserved to the producer;
- ***Monthly clean drives from external dirt and dust deposits; pay particular attention on fans and grids cleaning.***



If the fans and grid are dirty, clean them by using a dry brush or an adequate air compressed jet.

ADOPT ALL NECESSARY MEASURE TO AVOID DUST DEPOSITS INSIDE THE DRIVE AND ON FANS.

- ***Monthly control the correct functioning of the drives fans (if present);.***
- ***Monthly control the functioning of the extracted air filter and cooling air filter of the electrical cabinet, in particular control the functioning and cleaning of fans and filters.***

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.

2.1 General Advices

- 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 drive surface can become hot. Protect the user from accidental contact and keep the indicated distances from all objects.

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



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

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

- Protect the drive 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 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 drive is equipped with an integrated **EMI anti-disturbance filter** at the 1-phase power supply input and with another EMI anti-disturbance filter at the backup supply input.

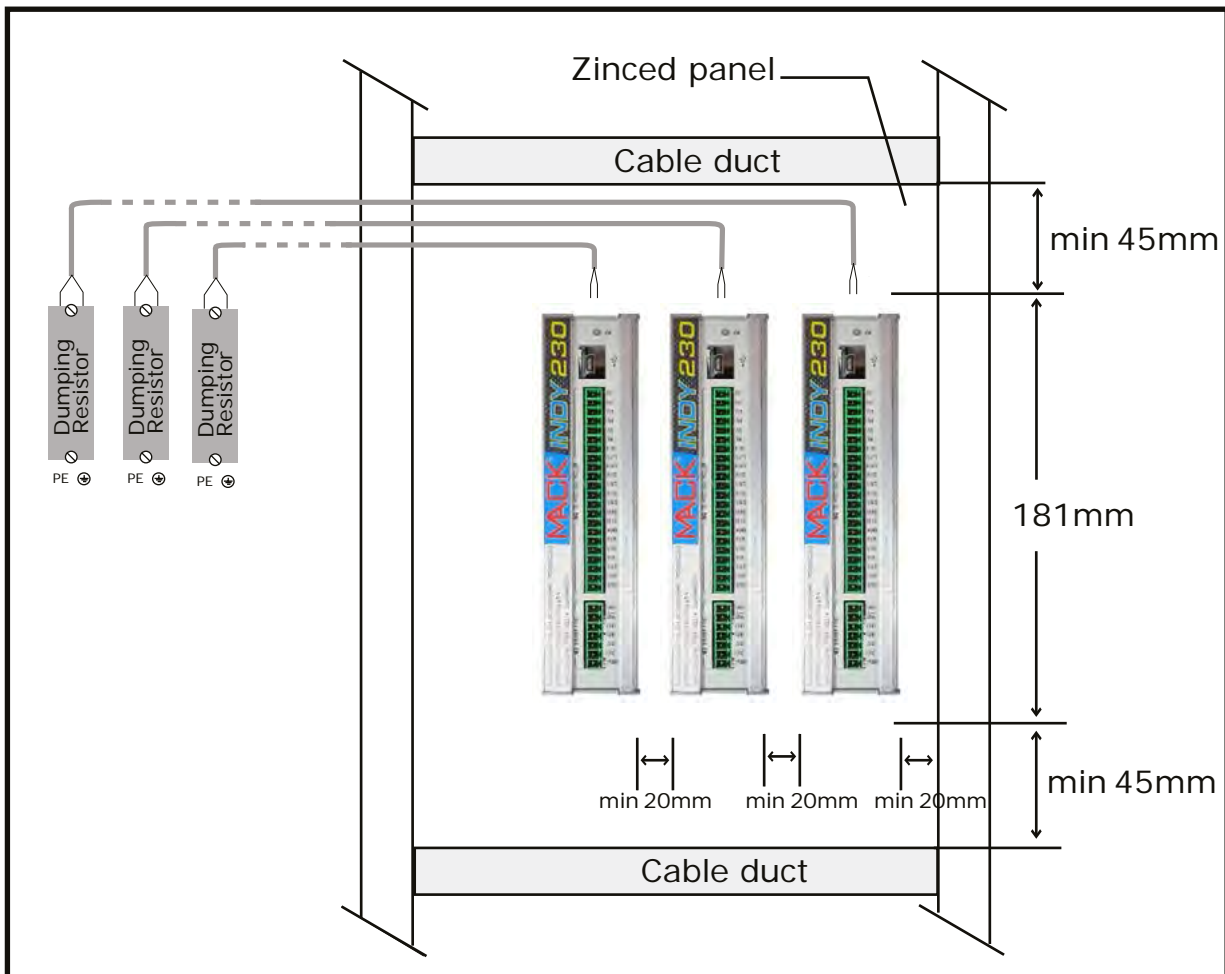
Being implicit to filter operation the deviation towards earth or mass of the undesired frequencies, ensure that these devices can produce leakage currents towards earth, which are measurable in milliampere.

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 drive is made to be fixed vertically to the **bottom of a closed electrical box** in order to guarantee reliable cooling, respecting the following distances:



Notes:

- ✓ 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.
- ✓ Fix the drives on a conductive zinc-plated panel.
- ✓ We recommend putting the drives at least 20mm each other.
- ✓ Possibly connect the resistance externally to the zinc-plated panel utilising two screws.
If the above solution is not practicable, connect the resistance inside the zinc-plated panel, but as far as possible above the drives and isolated from the zinc-plated panel.
In both cases, 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.

2.3 Environmental conditions

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

Environmental conditions		
Ambient condition during operation	Temperature	From +5°C to +40°C (without condensation). From +40°C to +55°C the drive must be derated 2.5%/°C in reference to nominal and peak current. Class 3K3 according to EN 60721-3-3.
	Humidity	From 5% to 85% (without condensation). Class 3K3 according to EN 60721-3-3.
	Vibration	Class 3M1 according to EN 60721-3-3.
Ambient condition during transport	Temperature	From -25°C to +70°C . Class 2K3 according to EN 60721-3-2.
	Humidity	Relative humidity Max 95% (without condensation). Class 2K3 according to EN 60721-3-2.
	Vibration	Class 2M1 according to EN 60721-3-2.
Ambient condition during storage	Temperature	From -5°C to +45°C . Class 1K3 according to EN 60721-3-1.
	Humidity	Relative humidity from 5% to 95% (without condensation). Class 1K3 according to EN 60721-3-1.
	Vibration	Class 1M1 according to EN 60721-3-1.
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 (according to norm EN60664-1) 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. <u>Do not permit the dust accumulation inside the drive, on grids and fans [see Notes].</u>	

Notes:

- The electrical box must have suitably **filtered air vents**.

Leave the necessary space both above and below the drives.



You must pay particular attention to the sizing of the (eventual) cooling system, remembering that the electrical box size and power internal dissipation of the drive(s) and braking resistors (if positioned inside of the electrical box).

Monthly control the functioning of the extracted air filter and cooling air filter of the electrical cabinet, in particular control the functioning and cleaning of fans and filters.

- Monthly** check the internal cleaning of the electrical panel and define an **accurate cleaning plane**, according to using norms (for example CEI EN 60439-1).
- Monthly** 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 recommended technical characteristics of all cables:

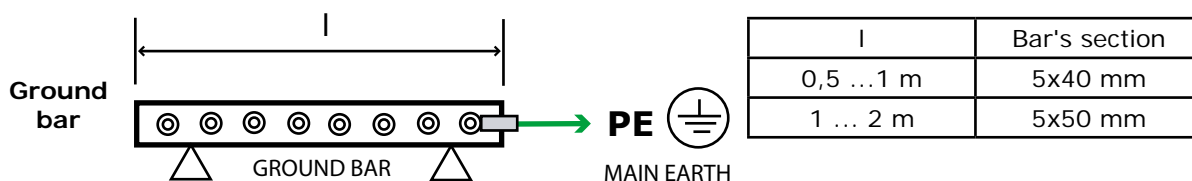
Cables (as norm EN60204)		
Type	Section	Notes
Main Supply	1.5mm ² 15AWG	Always insert a fuse or a power protective switch on every phase of the products power supply.
Backup Supply	1.5mm ² 15AWG	The cable must be as short as possible.
Motor's power	1.5mm ² 15AWG	It must be shielded. It must have a capacity 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.
Control signals and I/O signals from PLC/CNC	0.5mm ² 20AWG	<i>see cap. 2.6 Note about cable shielding on page 27.</i>
For the Encoder signals (commutation encoder)	0.25-0.35mm ² / 22-24AWG	It must be shielded. It must have a capacity of ≤120pF/m.
For the Encoder signals (serial encoder DSL)	0.25-0.35mm ² / 22-24AWG	Capacitance 800 ÷ 1000Hz : ≤90pF/m Characteristic Impedance at 10MHz : 110 ± 10 Ω
External resistor	1.5mm ² 15AWG	If the cable length is longer than 20/30cm, it must be twisted and shielded. The shield must be connected to ground on both ends, utilising U-clamps to the zinc panel of the electrical box.
SpeederOne.2 interface	-	Mini USB B 5P to USB A type male. The cable length must be 3m Max.
CanBus communication	0.25mm ² / 0.34mm ²	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. On request Axor provides the RJ45 cable (for connecting drives together) and the terminal resistor.
EtherCAT communication	26-27AWG	CAT. 5E (Min) - 6A (suggested) / SFTP

Note:

- Use only copper conductors for cabling.
- Avoid crossing, overlapping and twisting cables together. If it is absolutely necessary to cross them, do so at 90°.

2.5 Connection to ground and earth

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



then follow these indications:

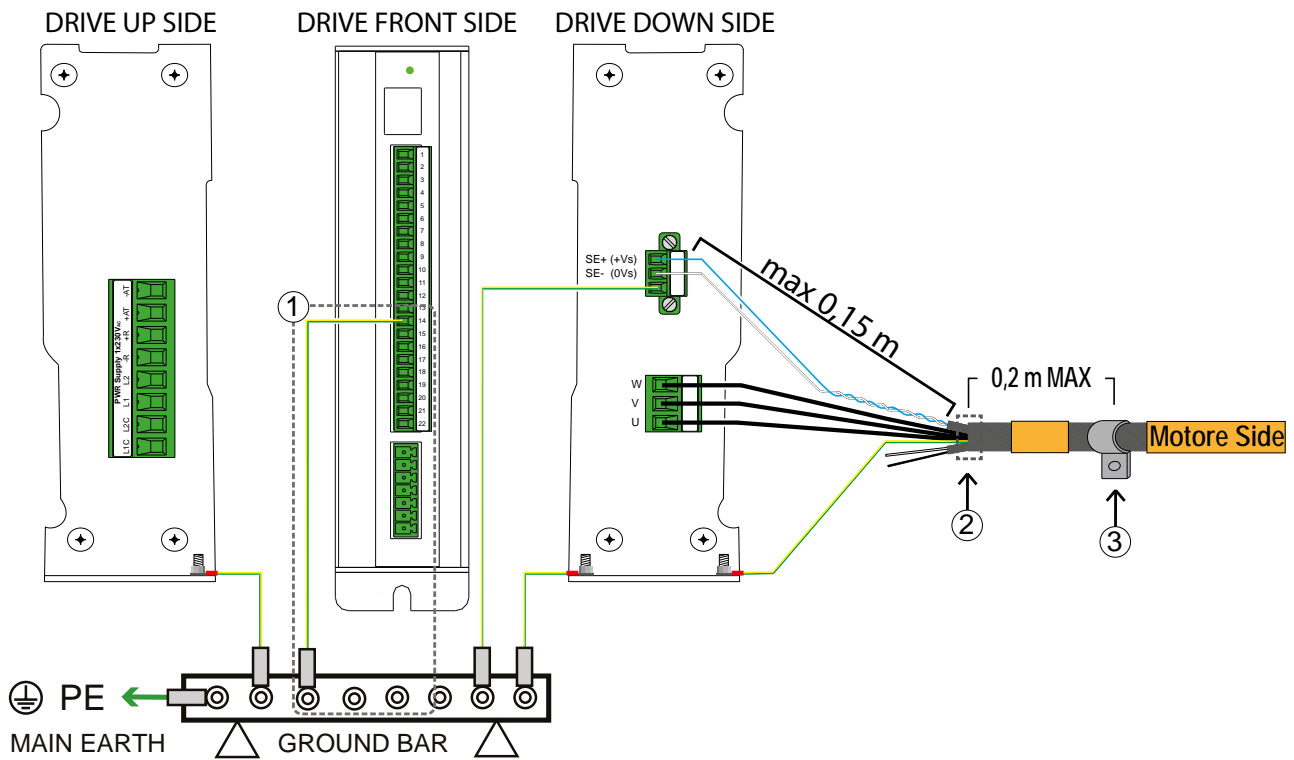
1. **All yellow/green cables** used for ground connections must have **a section greater or equal** then the power one (according to norm CEI 64-8).
2. Connect to the ground bar:
 - ✓ The **earth power terminal of the drive**;
 - ✓ The **CHASSIS** of the drive (using the predisposed screws);
 - ✓ The **AGND** (pin AGND of **SE Serial Encoder** connector, or **pin14** of **M2** connector) ;
 - ✓ The **internal zero voltage of the CNC**;
 - ✓ The **earth terminals of the PLC/CNC frames**;
3. Connect the **ground bar** to the **main earth** (following prescriptions of **CEI 64-8 norm**).
4. Connect the shield of the control signal to ground by using an U-clamp (*see cap. 2.6 Note about cable shielding on page 27.*).
5. Connect the PE terminal of the motor power cable to the chassis by using the predisposed screw.

The table below illustrates the symbols used in the following pages:

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 connection to the ground bar.
	It refers to the connection of the shield to the connector's metal ring.

2.5 Connection to ground and earth

The scheme below show the connection of ground and earth:



NOTE:

- ① Connected when the feedback is Commutation Encoder.
- ② Internal and external shield are wrapped together.
- ③ Uclamp (connect it to the cabinet's metal back plane PE ⊕).

2.6 Note about cable shielding

Control signal cables

The conductor of the analogical signal must be twisted and shielded, and the shield must be connected to ground ⇒ remove the outside sheath and affix the shield to the zinc panel by using an U-clamp.

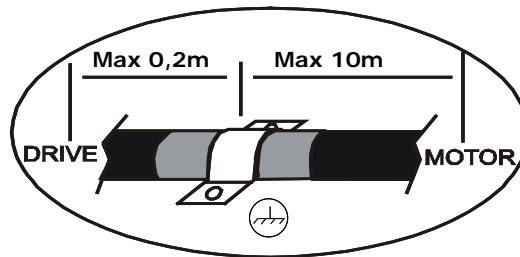
To reduce the capacitive and inductive coupling, these cables must be run keeping a distance of more than 30cm from the power cables (10 cm if they are shielded).

If it is absolutely necessary to cross the control cables with the power's, do so at 90°, in order to reduce the effect of the magnetic fields.

Motor cable

The shield of the motor cable (hybrid cable or power and signal cables) has to be connected as follows:

- *Drive side* ⇒ remove the outside sheath and fix shield to the zinc panel, by using a U-clamp:



2.7 Basic installation procedure



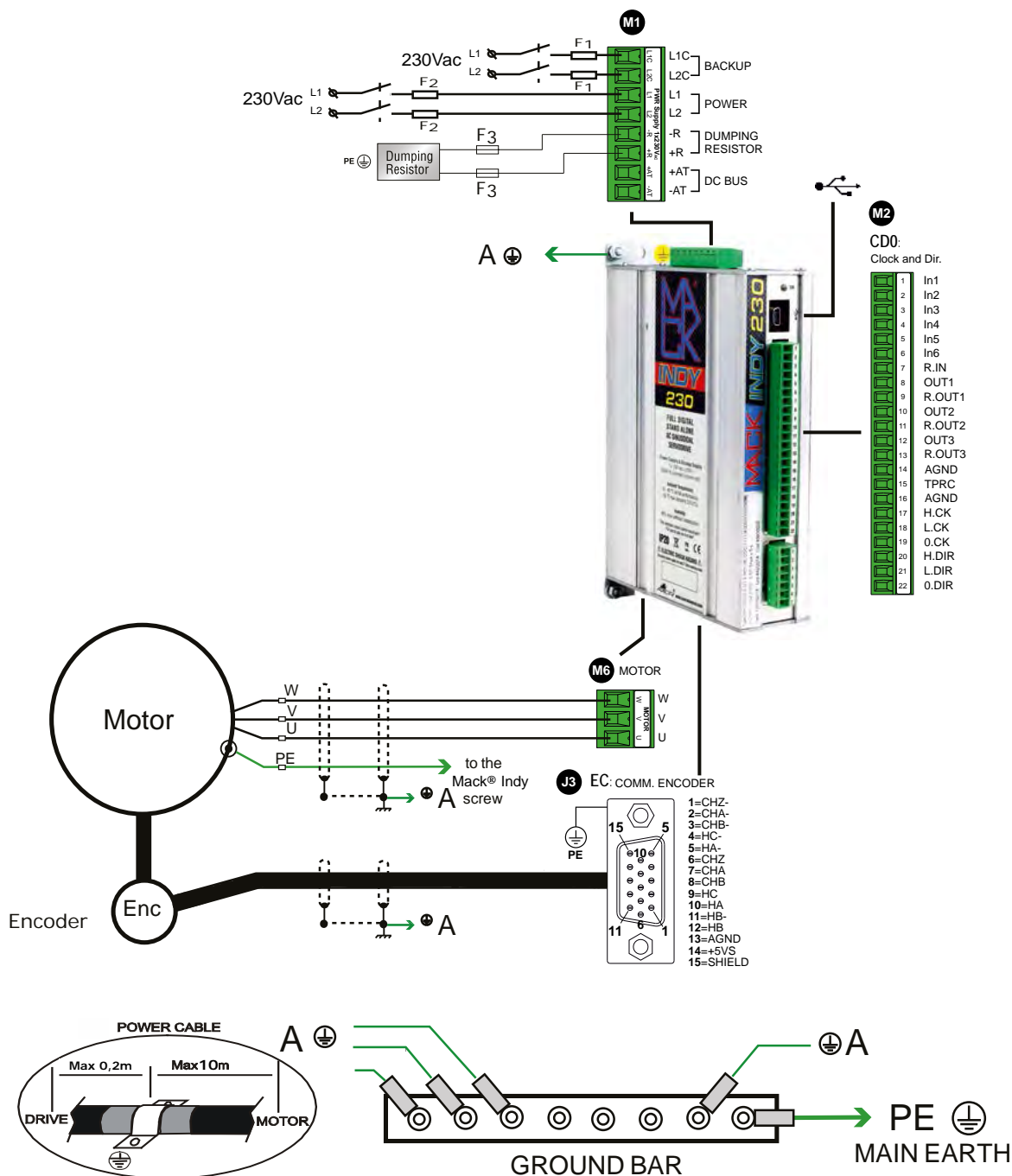
This procedure must be done only by qualified personnel which are familiar with drives.

- a) **Power off** all the supplies of the electrical box.
- b) Verify:
- ✓ The **drive-motor coupling** \Rightarrow 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 cap. 2.5 Connection to ground and earth on page 25.*).
- 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 **the ground bar to earth**.
 - 2- Connect the **cables for the motor's power** (U, V, W) and the Axor **3x1.2mH filter**, if the cable length is greater than 10m.
 - 3- Connect the **earth of the motor's power** (PE) to the drive's chassis by using the predisposed screw.
 - 4- Connect the **external shield** of the motor's cable: it must be shielded utilising an U-clamp to the zinc panel of the electrical box (*see cap. 2.6 Note about cable shielding on page 27.*).
 - 5- If an **external braking resistor** is used, connect it between pins **+R** and **-R** of the drive's **M1** connector with a cable as short as possible (max 30cm). If the length of the cable is greater than 20cm, then the cable must be twisted and shielded, besides the shield must be connected to ground on both ends utilising U-clamps to the zinc panel of the electrical box.
 - 6- Connect the motor's feedback cable.
 - 7- Connect the **earth cable** (PE) and the **main power supply cable** (L1-L2) in the drive.
 - 8- Connect the **Back UP supply cable**.
 - 9- Connect the PC utilising an **USB** cable. The cable length must be 3m Max.
 - 10- Supply the drive with the **Back UP supply** and then the **main supply**.
 - 11- Open the *SpeederOne.2* interface to setup the drive.
 - 12- Execute the tests on the drive and the motor.

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

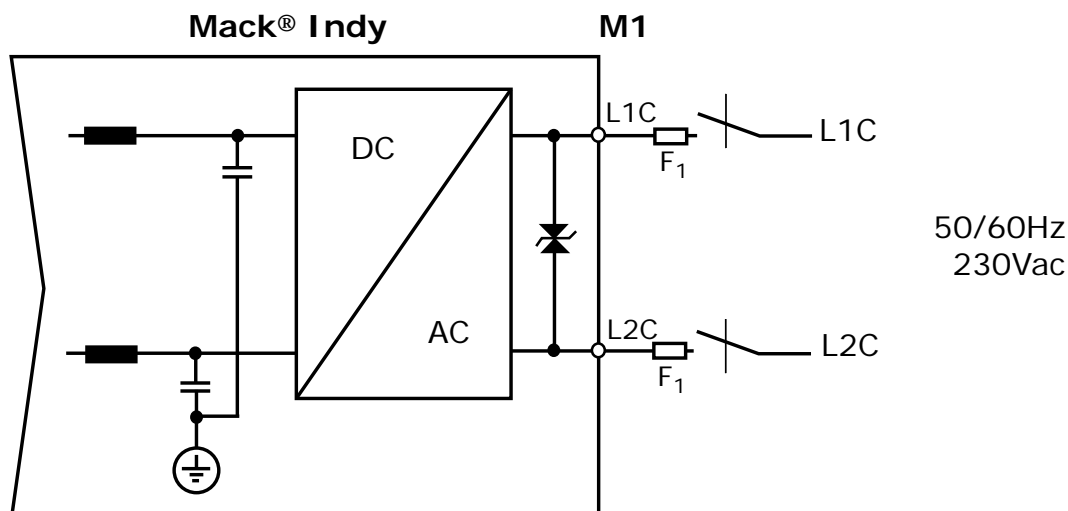
2.8 Example of base connection

Example of BASE connection:



2.9 Power and Backup Supply connections

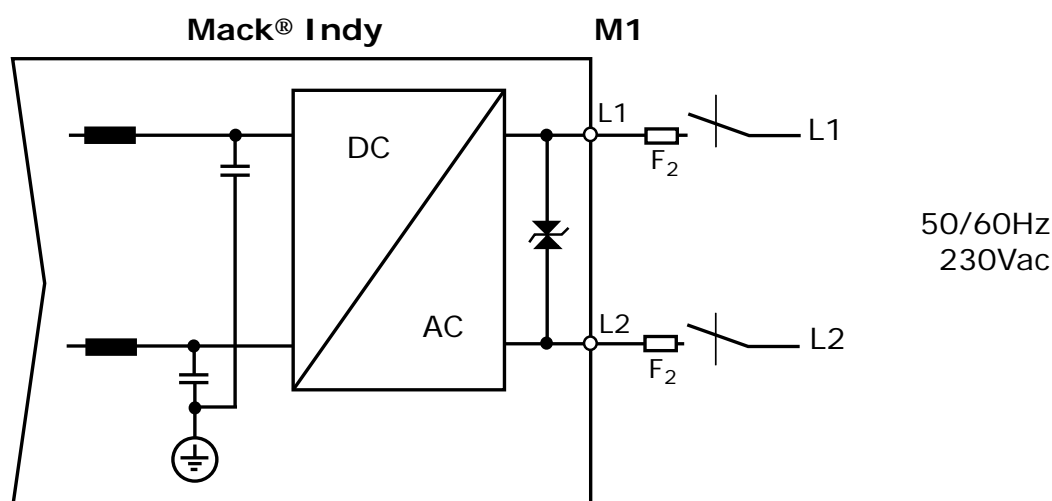
BACKUP SUPPLY



Note:

- Accepted voltage: **230Vac** ($\pm 10\%$);
- We suggest to insert the **F₁** fuse;

POWER SUPPLY

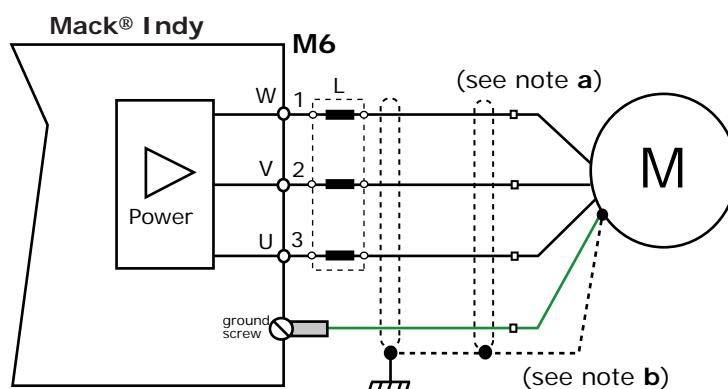


Note:

- We suggest to insert the **F₂** fuse;
- **Always insert a power relay or a thermal magnet on every phase of the products power supply.**

2.10 Motor power connection

MOTOR POWER

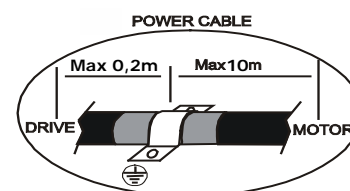


FUNCTION	(MM²)	WIRE COLOR	MARK
U MOTOR	0.35	BLACK	1
V MOTOR	0.35	BLACK	2
W MOTOR	0.35	BLACK	3

Note:

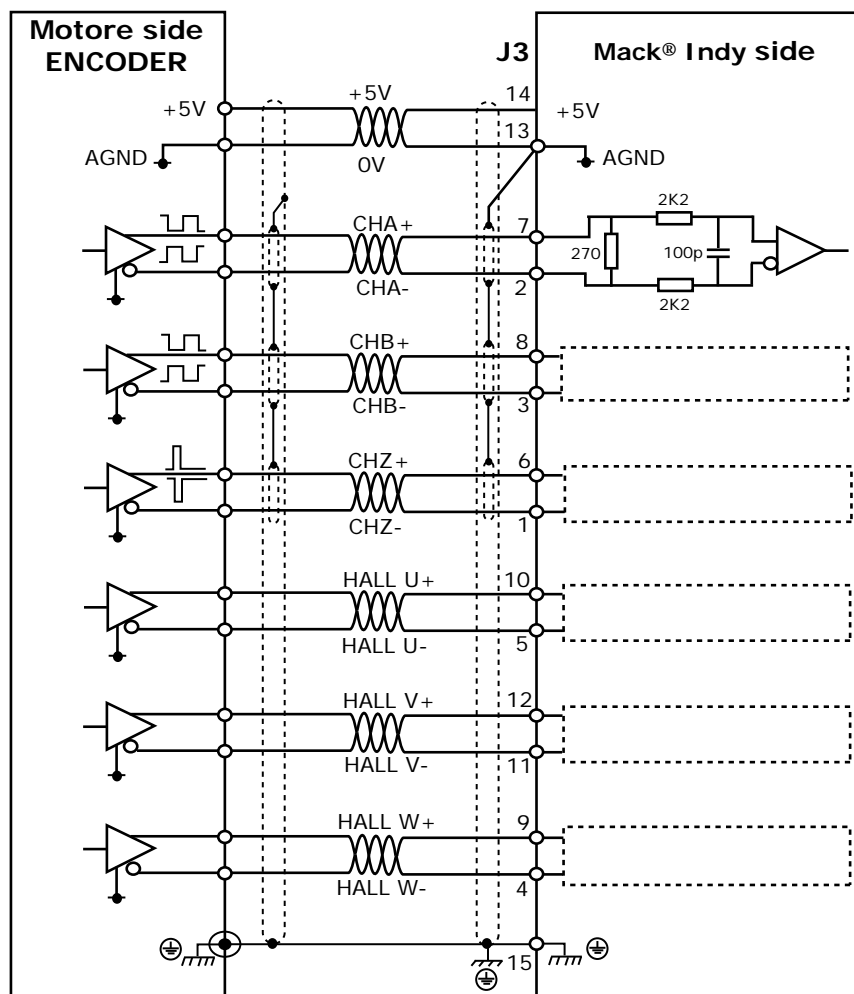
a- Use 3x1.2mH - 20Arms filter series for connections with cables longer than 10 meters.

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 (0,2 m). Motor side: the shield is connected to connector's metal ring, so it is connected to ground through motor's carcass.

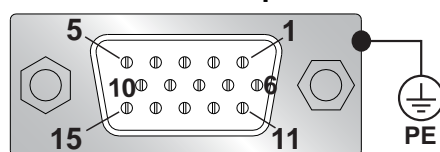


2.11 Feedback signals connections

COMMUTATION ENCODER FEEDBACK connection

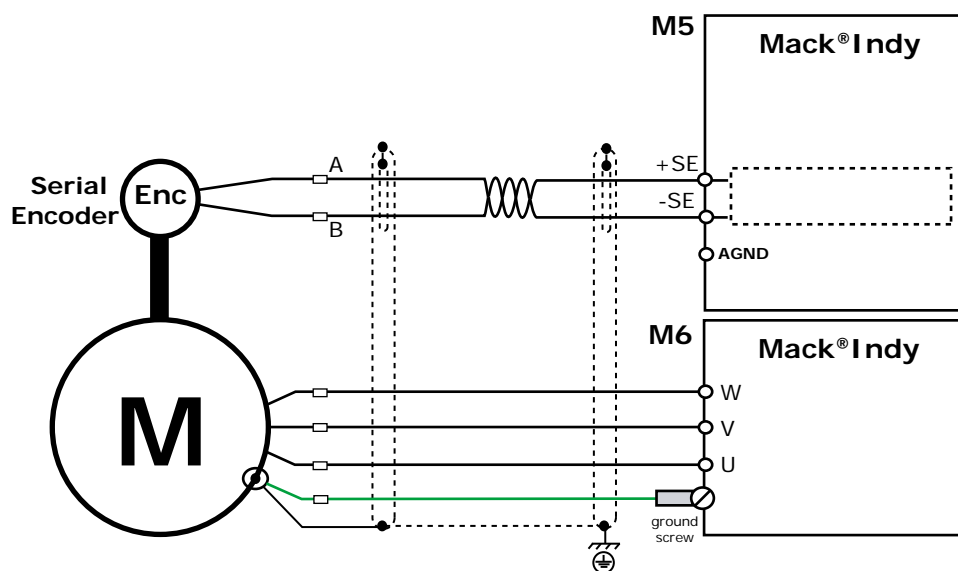


**J3 connector
Sub-HD 15 pole**



2.11 Feedback signals connections

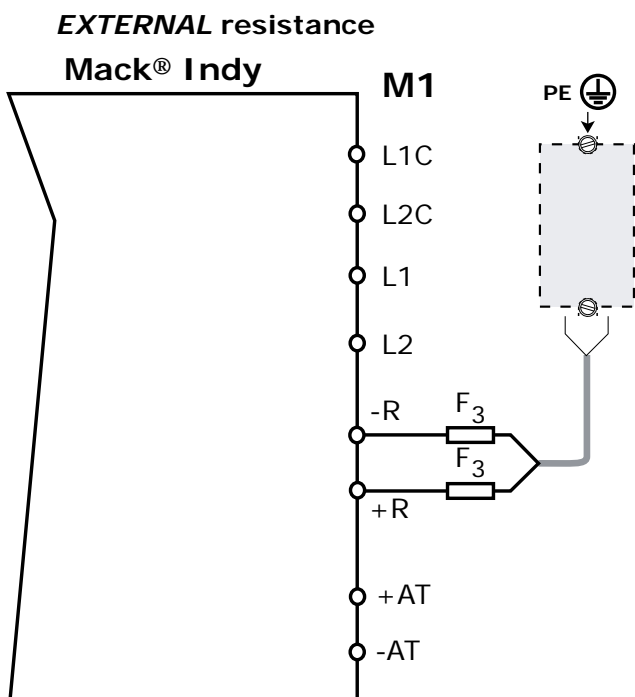
SERIAL ENCODER FEEDBACK connection



FUNCTION	(MM ²)	WIRE COLOR
+SE	0.25	BLU
-SE	0.25	WHITE

2.12 Regen resistance connections

EXTERNAL REGEN RESISTANCE connection



It is possible to use one external resistance: **39Ω - 100W**;
The cable must be as short as possible (max 30cm).
The resistances must be connected to the zinc-plated panel utilising two screws.
If the cable length is greater than 30cm, it must be twisted and shielded. The shield must be connected to ground on both ends, utilising U-clamps to the zinc-plated panel of the electrical box.

Notes:

- The temperature of the zinc-plated 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 resistor is mounted externally, protect it.
- Respect the distances and shielding illustrated in Fig.1.
- We suggest to insert the F_3 fuse;

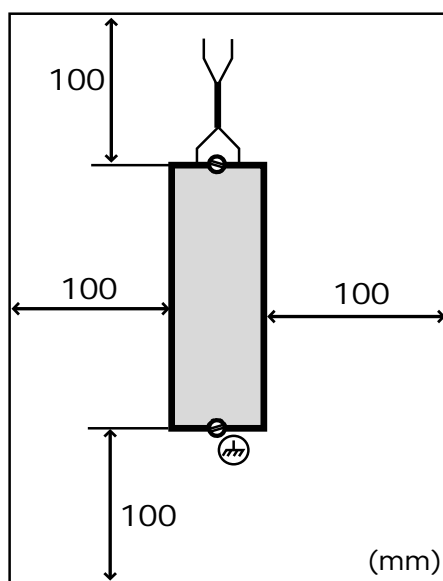
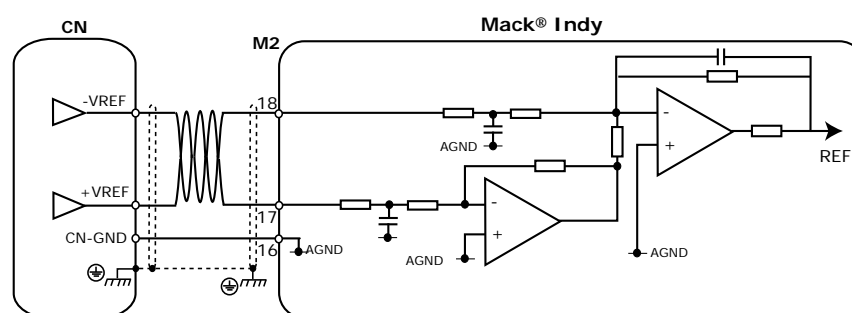


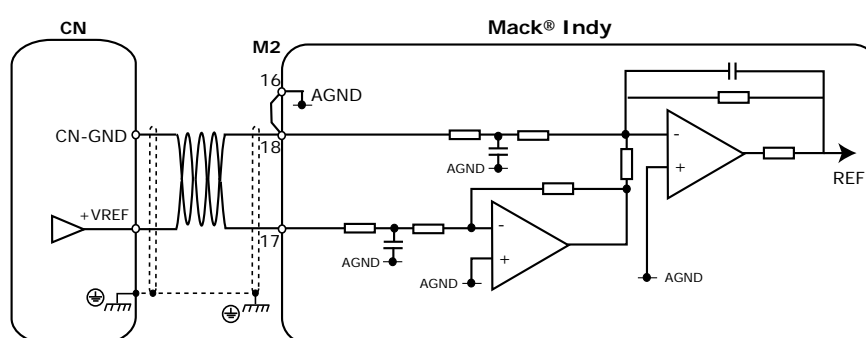
Fig.1

2.13 Analog inputs connection

ANALOG DIFFERENTIAL OR COMMON MODE INPUTS (+/-REF) DIFFERENTIAL MODE



COMMON MODE



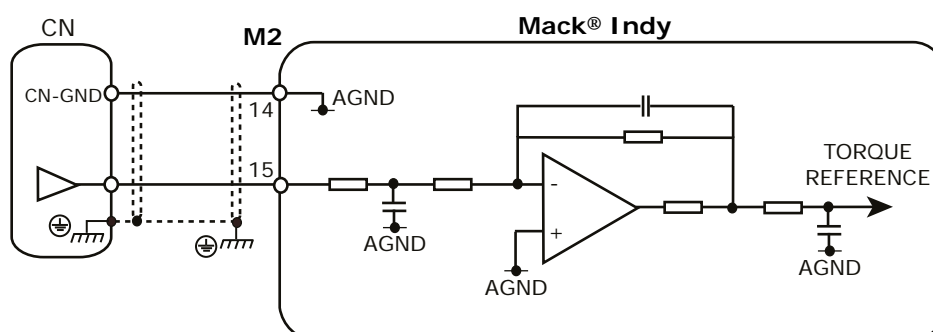
The **technical characteristics** of these inputs are as follows:

- ✓ Voltage: 10V Max Diff.
- ✓ Input impedance: 50k ohm.

To change the sense of rotation, apply the positive voltage reference to **M2-18**, or change the **Rotary Direction** parameter in the **Speed** window (from **Positive** to **Negative**).

Note: We suggest connecting the shield on both sides.

ANALOG COMMON MODE INPUT (Tp.RC) used as torque analog reference



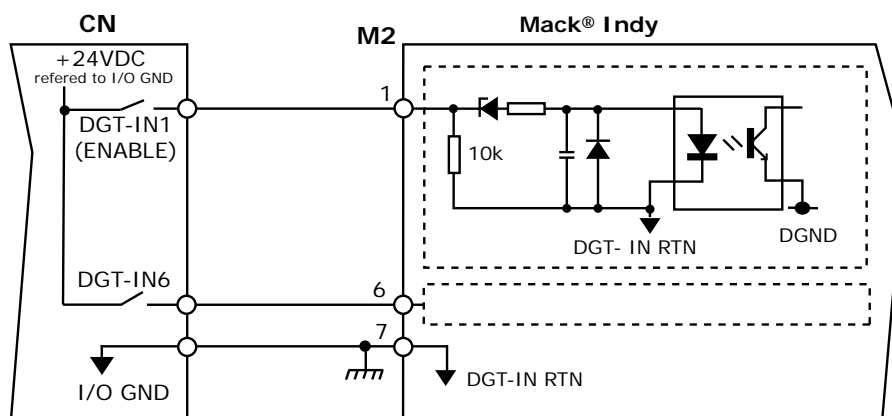
The **technical characteristics** of Tp.RC input are as follows:

- ✓ Voltage: $\pm 10V$ Max.

Note: We suggest connecting the shield on both sides.

2.14 Digital inputs connection

DIGITAL INPUTS connection

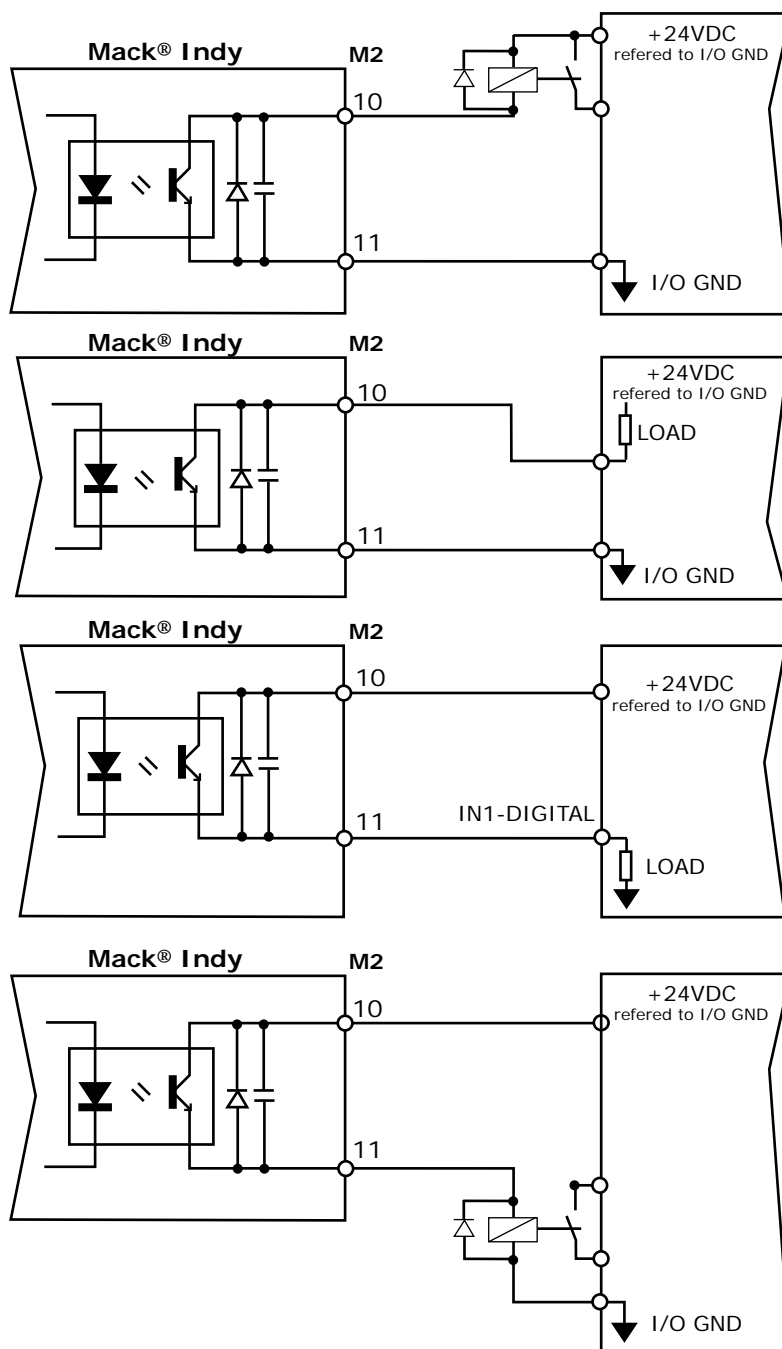


Note:

- The enable signal should be **+24VDC-7mA** (PLC compatible). The enable range is between **+14V Min** and **+30V Max**; they are disabled with a voltage less than **+5VDC max**.
- The **M2-1** terminal (**DGT-IN1 (ENABLE)**) is used only as the drive's enable. If **M2-1** is **HIGH (+24VDC)** the Mack® Indy is enabled (without active alarms and if start up sequence, see cap. 2.22 Power up on page 47); if **M2-1** is **LOW (0V)**, the motor is without torque.
ATTENTION: THE MACK® INDY'S ENABLE/DISABLE, BY USING THE ENABLE INPUT, IS NOT CONSIDERED A SECURITY FUNCTION.
- The **M2-6** input is used for reset the "resettable" alarms.

2.15 Digital outputs connections

DIGITAL OUTPUT Connection (example)



Max. load for each output:
-DIG.OUT 1 - 2 = 15[mA]
-DIG.OUT 3 = 120[mA]

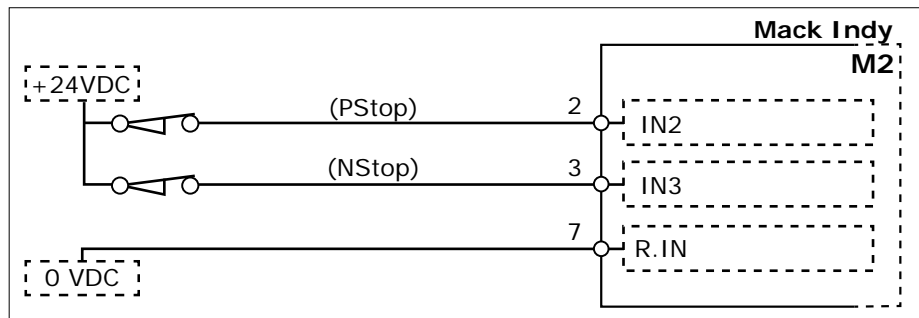
Always use a relay with a diode in parallel.

Note:

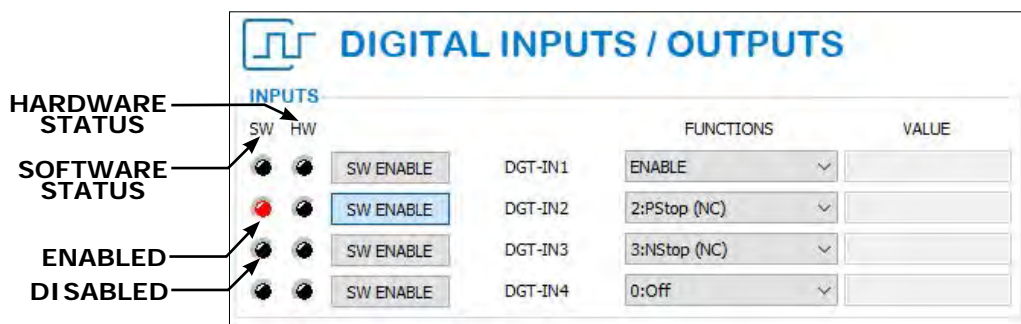
- The DIG.OUT 3 is setted with the fixed function "18:Out Brake", is used to control the motor's brake using a relay.

2.16 Limit Switch connections

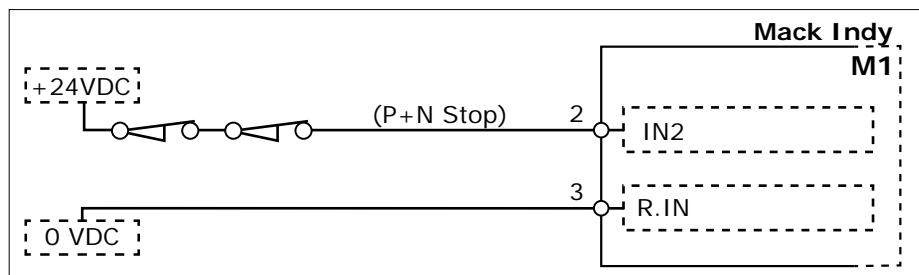
LIMIT SWITCH connection with PStop & NStop



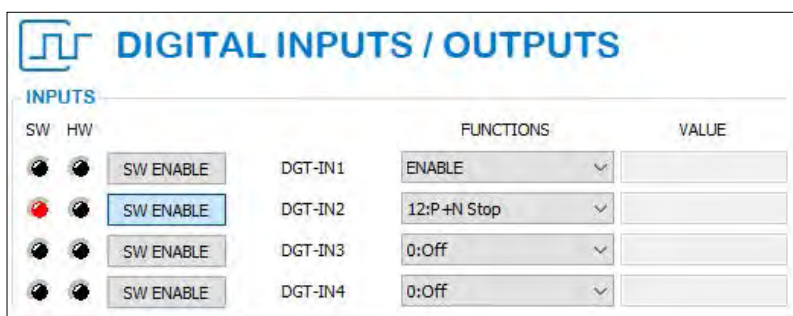
LIMIT SWITCH configuration with PStop & NStop



LIMIT SWITCH connection with P+N Stop



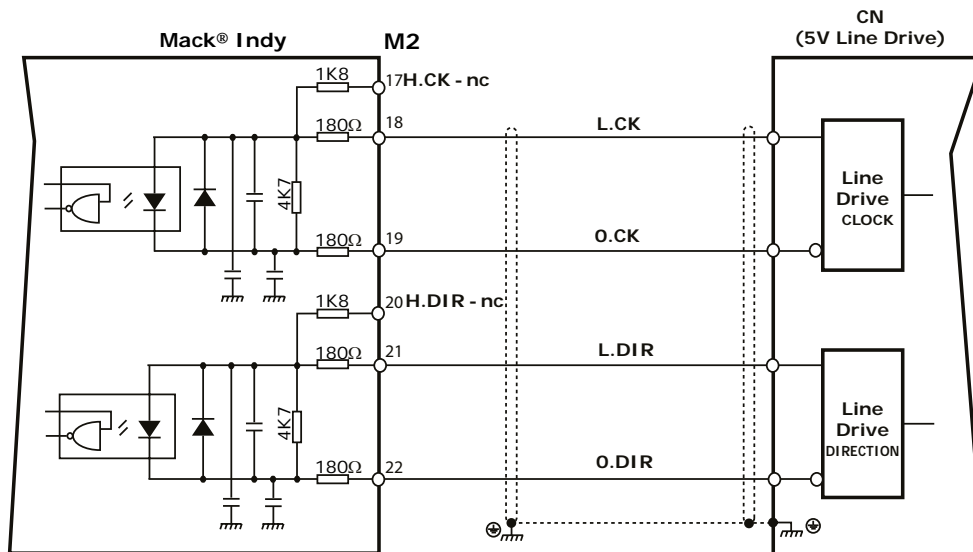
LIMIT SWITCH configuration with P+N Stop



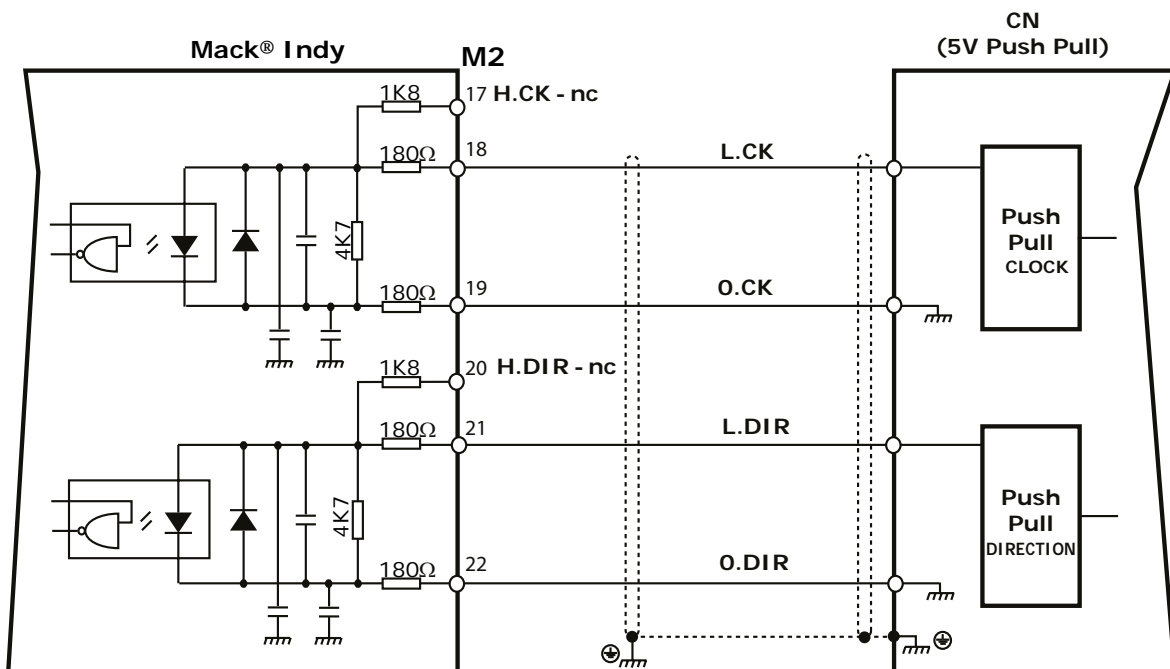
2.17 Clock/Dir inputs connections

CLOCK/DIRECTION MODE connection

5V Line Drive control

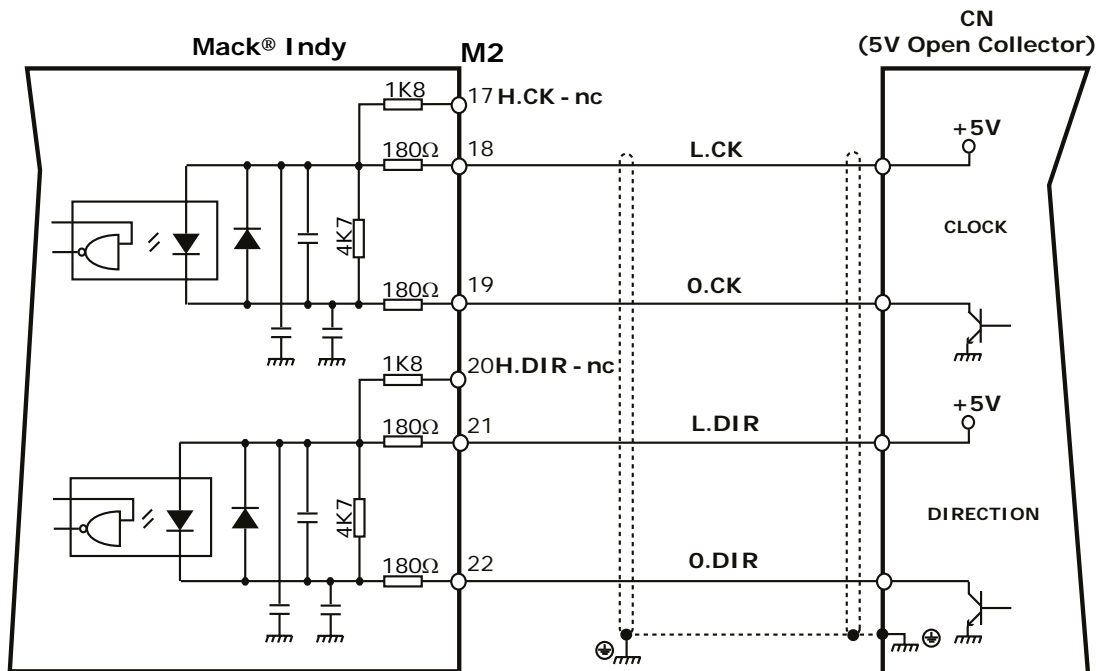


5V Push Pull control

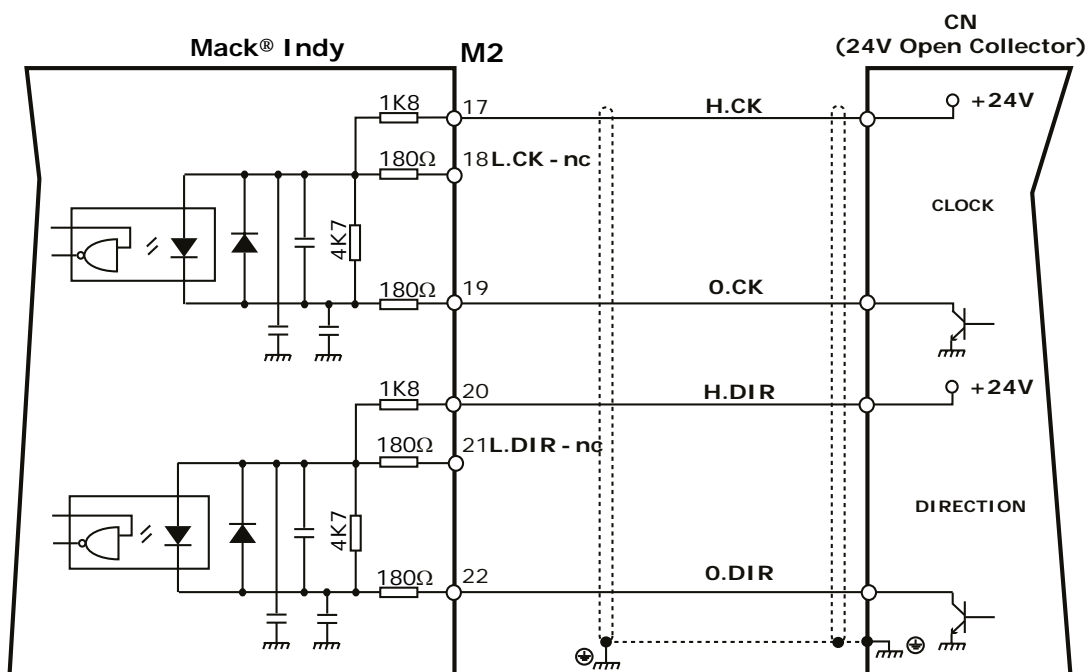


2.17 Clock/Dir inputs connections

5V Open Collector control

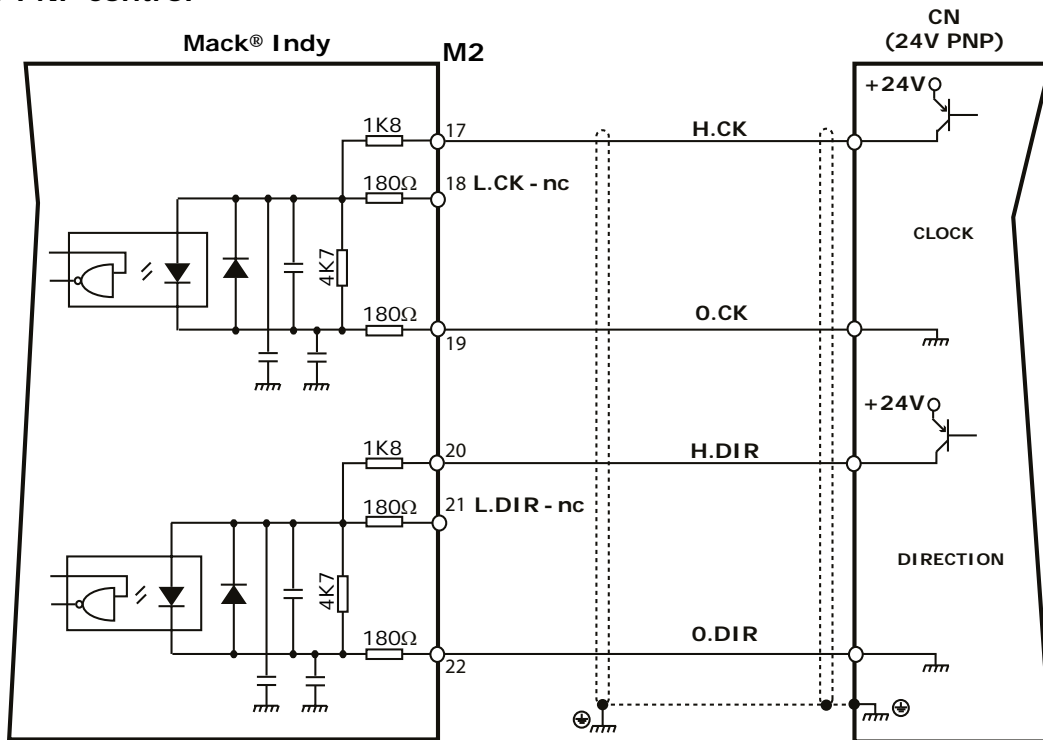


24V Open Collector control

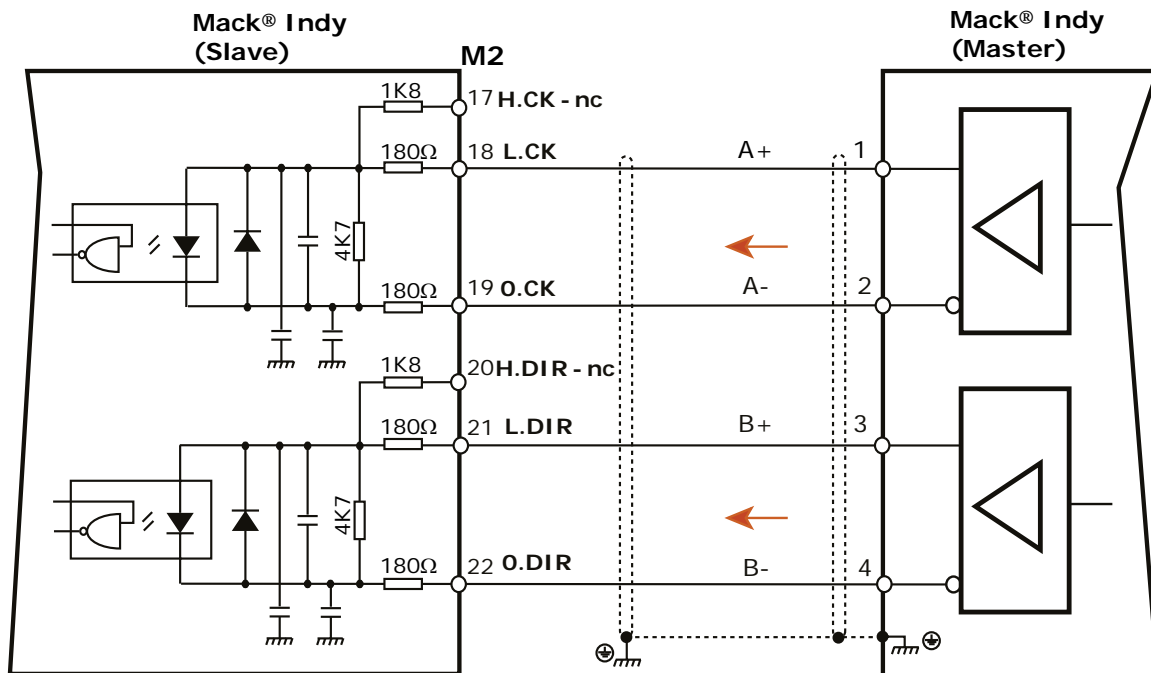


2.17 Clock/Dir inputs connections

24V PNP control

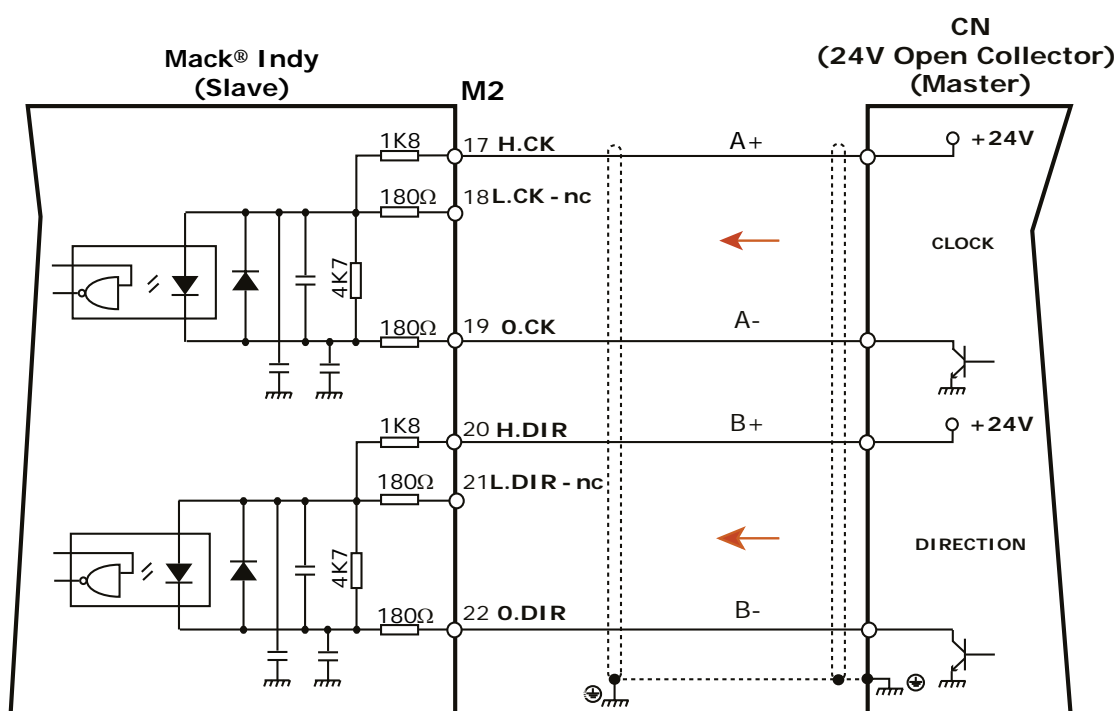


GEARING MODE connection (5V signal)



2.17 Clock/Dir inputs connections

GEARING MODE connection (24V signal)

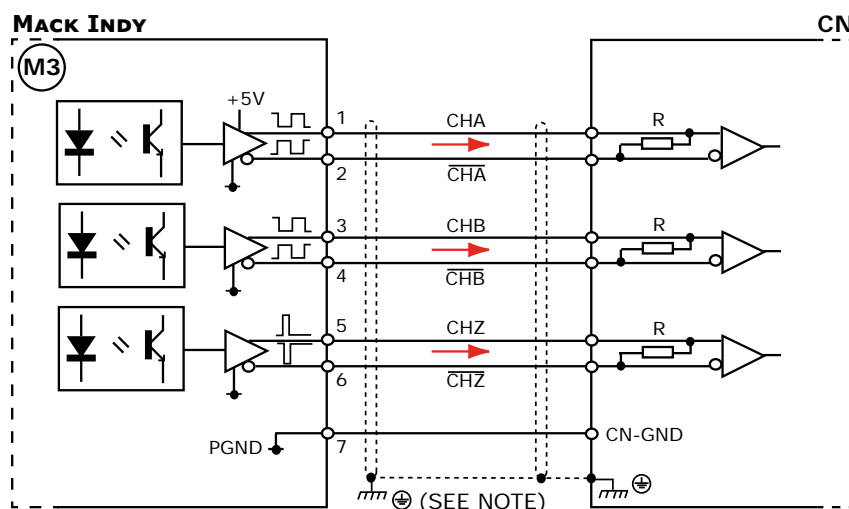


Note: In all cases we suggest connecting the shield on both sides.

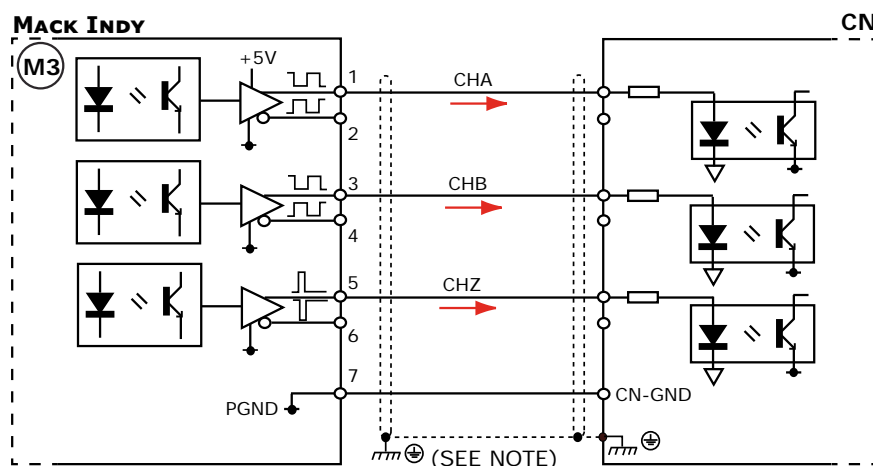
2.18 Emulated encoder connection

EMULATED ENCODER connection

LINE RECEIVER CN inputs

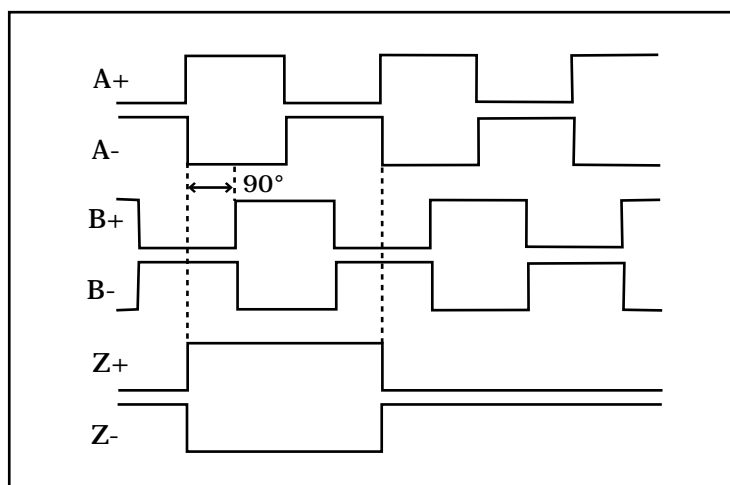


COMMON MODE CN inputs



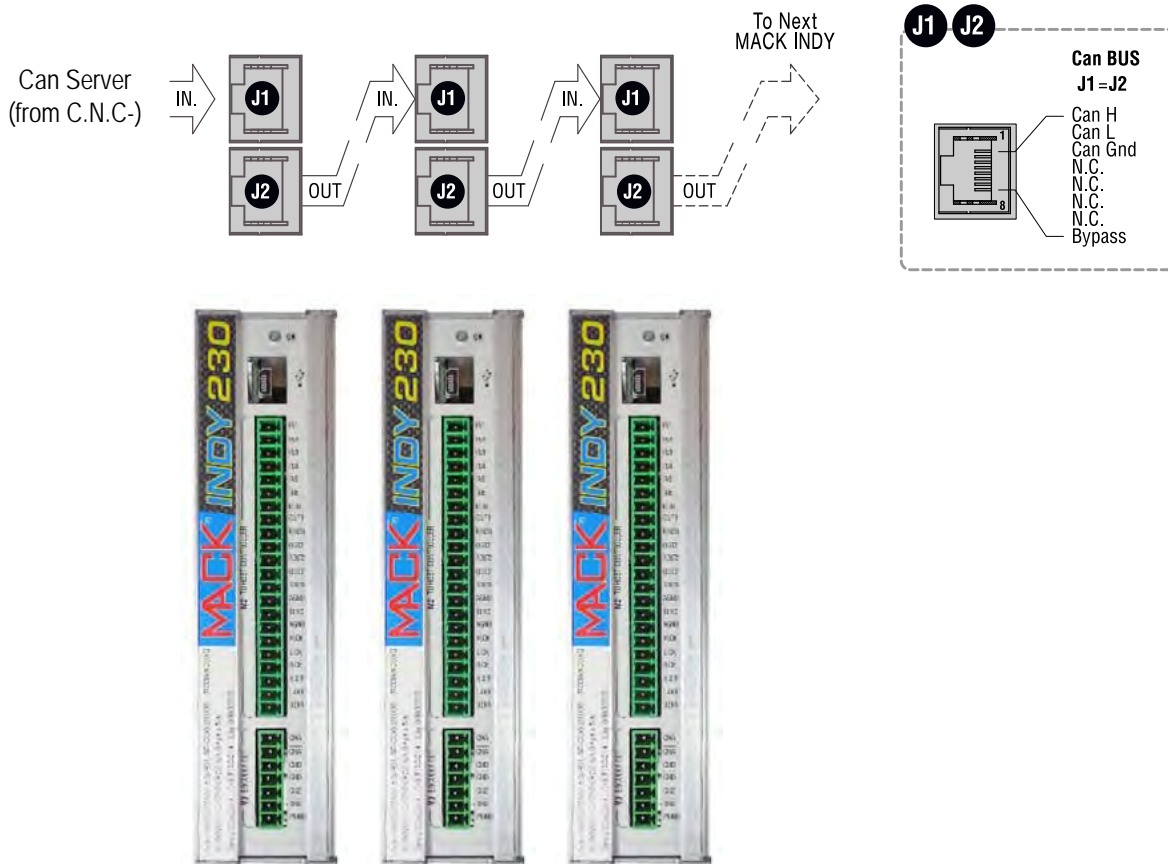
Note: We suggest connecting the shield on both sides.

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



2.19 CanBus connections

CANBUS connection

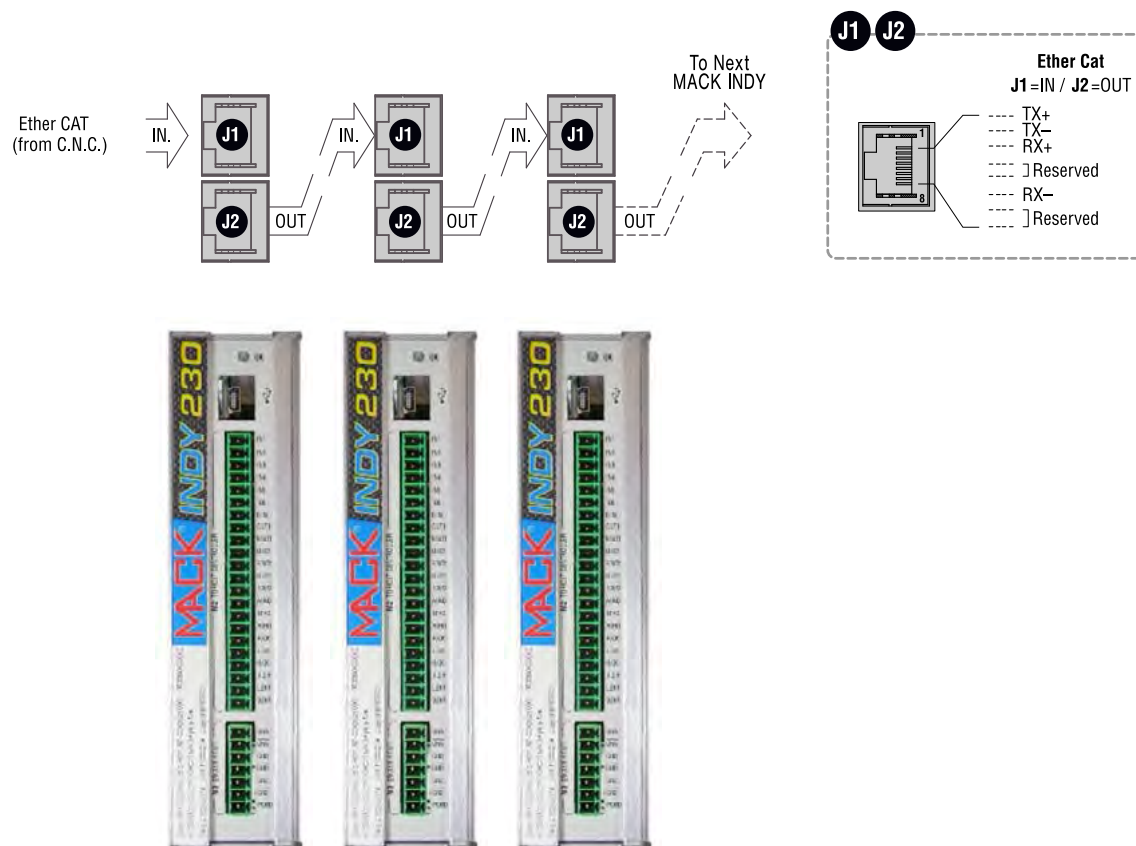


Notes:

- Connect a **RESISTOR (120 Ohm, 1/4W)** between pins **1** and **2** of the **J2** connector of the last drive.
- On request Axor provides the RJ45 cable and the terminal resistor.
- Respect the input and output of the RJ45 connectors:
J1 = Input;
J2 = Output;
- For the settings *see cap. 4.12 CanBus - Settings on page 79.*

2.20 EtherCAT connections

EtherCAT connections



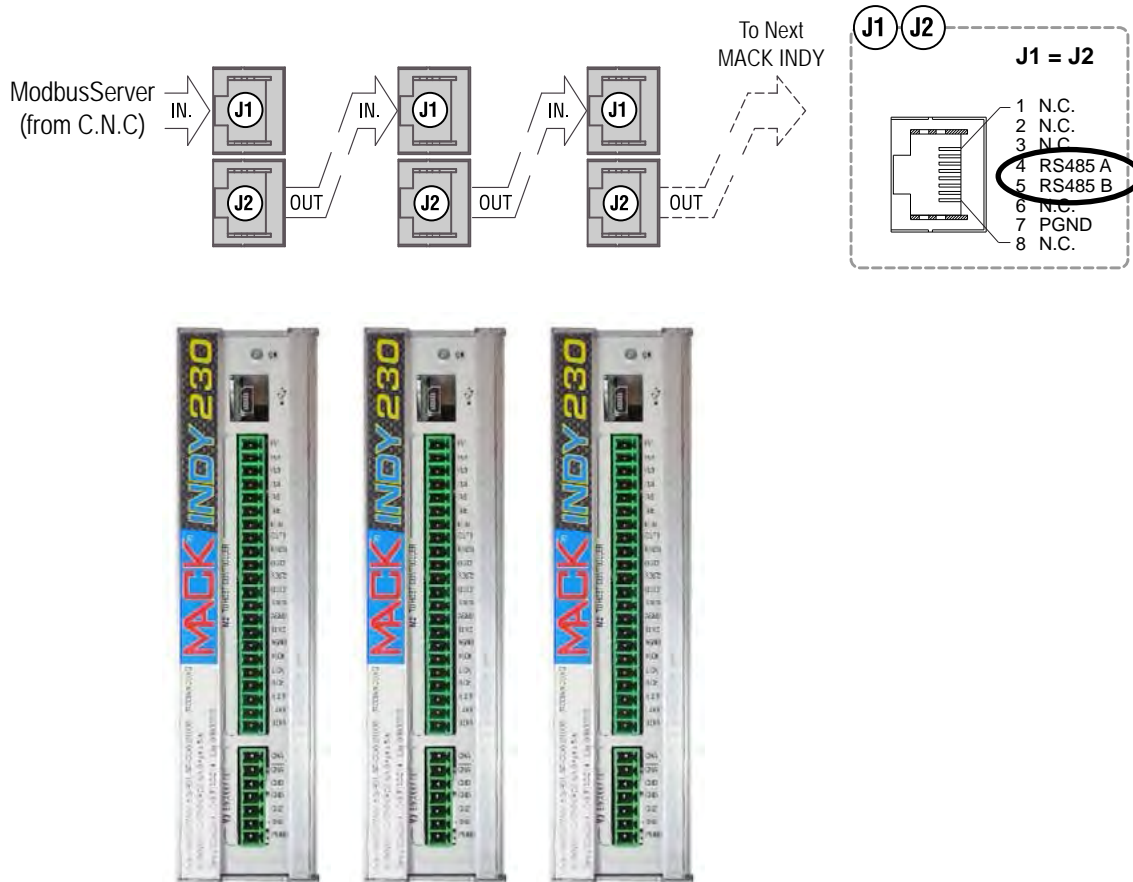
Notes:

- Respect the input and output of the RJ45 connectors:
J1 = Input;
J2 = Output;
- For the settings *see cap. 4.14 EtherCAT - Settings on page 89.*

2.21 RS485 Connection

RS485 Connection

In order to connect the ModBus RS485 interface, use pins 4 (for RS485 A) and pins 5 (for RS485 B), of J1 and J2 connector:

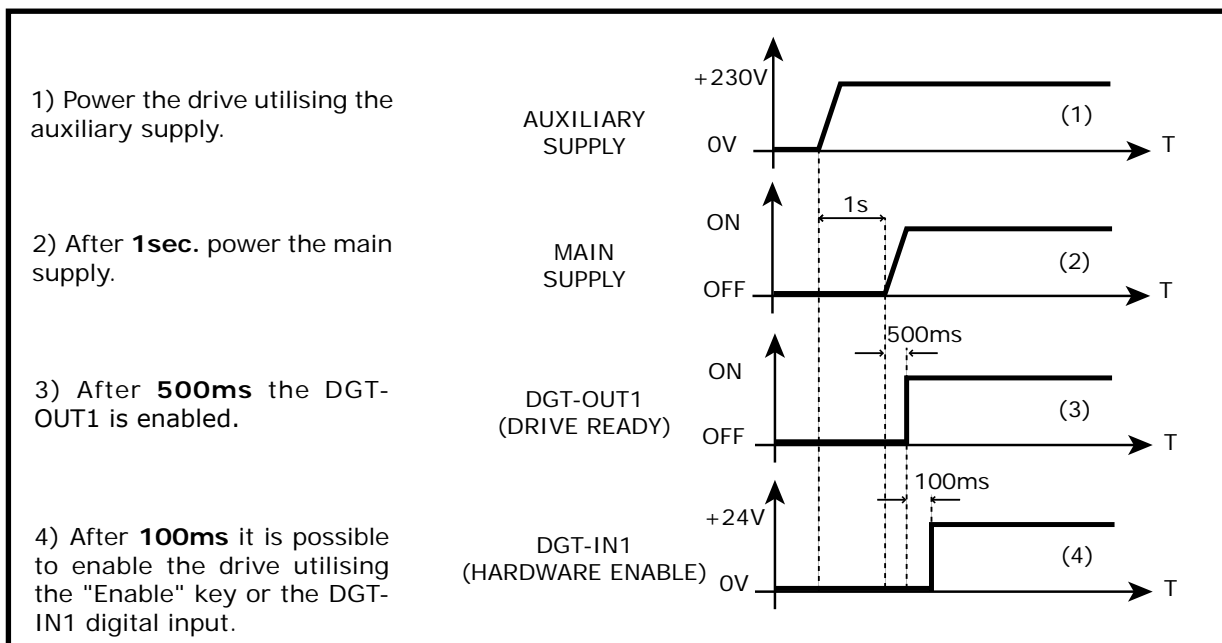


Notes:

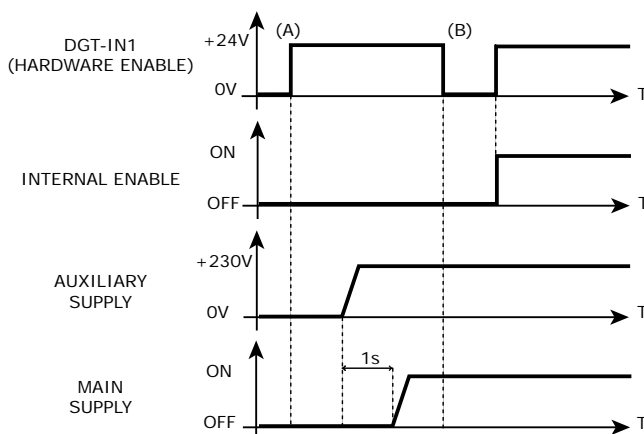
- Is recommended to connect a **RESISTOR (120 Ohm, 1/4W)** between pins **4** and **5** on each end of the line of the same value of the twisted cable used as the line in order to avoid signal reflections.
- Respect the input and output of the RJ45 connectors:
J1 = Input;
J2 = Output;
- See "**Positioner&Modbus Mack Manual**" for a more detailed description about the ModBus RS485 protocol implemented on the drive.

2.22 Power up

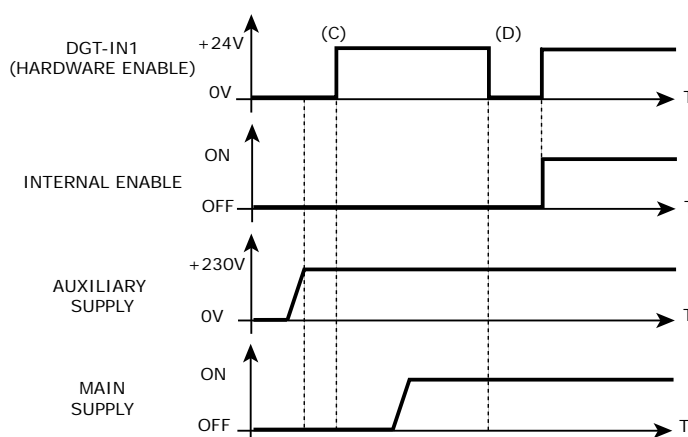
The power up of the drive must be done following this diagram, in order to save the drive and the electrical box:



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 to 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.

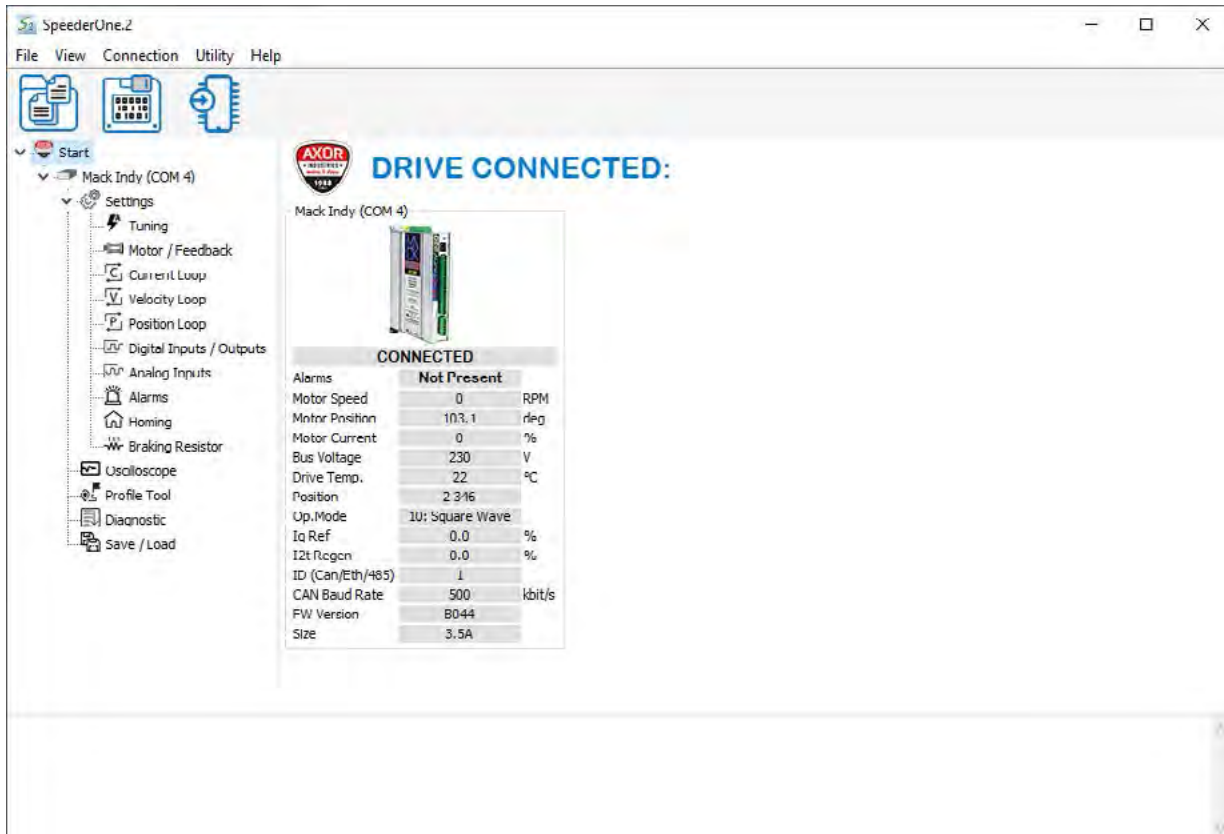


2.23 Motor Test



This procedure is a guide line for the first power up of the drive-motor system. **It must only be executed by technically qualified personnel.**

- 1) Follow the basic procedure previously described. **ATTENTION: do not apply load to the motor.**
- 2) Install *SpeederOne.2* interface.
- 3) Power up the drive: apply the auxiliary supply and then the main supply (follow the procedure previously described).
- 4) Open the *SpeederOne.2* interface.



5) If the drive is **"Not configured"**, it is necessary to open a pre-set configuration file, following this procedure:







- In the main window select the **"File"** menu and then **"Open Setting File"**;
- In the directory: ...\\SpeederOne.2\\DriveSettings\\ select a file reference to the coupling drive-motor, then click on **"Open"**;
- Save load parameters by using **"Save Data To EEPROM"** icon.

If the drive is *configured for a specified motor*, it is sufficient to check these parameters:

- ✓ Number of motor poles (*Motor* window)
- ✓ Feedback type (*Motor* window)
- ✓ Irms current (*Current* window)
- ✓ Ipk current (*Current* window)
- ✓ Speed Limit (*Speed* window)

2.24 Status Led

In the drive there is a **LED** (red or green, fixed or blinking) that visualises the system's status:

COLOR	STATE	CAUSE
No color	-	The drive is off.
  (Green - Red)	Alternating and Blinking	There is only the auxiliary supply.
 (Green)	Blinking	The drive is ready.
 (Green)	Fixed	II drive is enabled and there is no alarm.
 (Red)	Fixed	There is an alarm.
 (Red)	Blinking	There is I2t alarm (alarm 6).

Chapter 3

Diagnostic

3.1 Alarms.....	52
3.2 Problem solving	54

3.1 Alarms

The table below illustrates all the message errors supported by the drive:

ALARM	
1	EEPROM Error while memorising parameter to the drive's EEPROM or while reading parameters from Eeprom.
2	Overcurrent Short circuit between U, V, W or towards earth.
3	Drive Temperature Heat sink temperature too high (>70°C).
4	Hall This alarm comes on if one or more of the hall cell's wires are disconnected.
5	Encoder This alarm comes on if one or more of the encoder channels are interrupted.
6	I2t Drive The internal I2t function (refer to the rated current) has reached the maximum permitted.
7	Motor Temperature Motor heat sink temperature too high.
8	Regenerative Resistance The value I2t energy recovery has reached the maximum permitted.
9	Min Voltage Power supply under the minimum limit voltage.
10	Pre-Alarm Recovery 80% of the I2t energy recovery has been reached.
11	USB Mack-Link Malfunctions in the drive's communication.
12	<i>Reserved</i>
13	Overvoltage Power supply is over the maximum limit voltage.
14	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.
15	Limit Switch The two fixed limit switches have both been disabled or interrupted.
16	<i>Reserved</i>
17	Regenerative OC Possible short-circuit in the regen resistance circuit.
18	<i>Reserved</i>
19	<i>Reserved</i>
20	<i>Reserved</i>
21	<i>Reserved</i>
22	STO Malfunction in the Safe Torque Off safety function or wrong sequence.
23	<i>Reserved</i>

3.1 Alarms

24	Can Bus Error during communication with CANopen protocol.
25	<i>Reserved</i>
26	Homing Error Position error too high during the homing procedure. The motor stops, but it is not disabled.
27	<i>Reserved</i>
28	EtherCAT Failure or breakage EtherCAT board.
29	<i>Reserved</i>
30	<i>Reserved</i>
31	Unsupported Operation The 'operating mode' / 'CANopen OP mode' selected is not supported.
32	Speed Following Error The motor rotates at a higher speed then the reference.

The table below illustrates the type of reset of the alarms:

ALARM	RESET*
1	NO
2	NO
3	AUTO
4	YES
5	YES
6	AUTO
7	NO
8	NO

ALARM	RESET*
9	AUTO
10	AUTO
11	YES
13	AUTO
14	YES
15	AUTO
17	NO
22	NO

ALARM	RESET*
24	YES
26	YES
28	YES
31	AUTO
32	YES

- * - **YES** = is resettable with a digital input IN.6 setted with function "14:Alarm Reset", or with the software interface;
- **AUTO** = auto-reset when out of the problem condition;
- **NO** = is not resettable with the reset input, need to be restarted removing and applying the backup supply;

3.2 Problem solving

SOLUTION FOR ALARM 1 (EEPROM):

- With the software interface try to save the parameters to the drive's EEPROM, then power off and on the drive, if the Alarm 1 appears then contact for assistance;



SOLUTION FOR ALARM 2 (Overcurrent):

- Power off the drive;
- Verify if the motor wire connection is correct (*see cap. 2.10 Motor power connection on page 31*).
- If the connection are correct, check if there are any type of faulty wiring that can cause any type of short circuit;
- If there aren't any faulty cable, disconnect only the motor phases (U/V/W), leave the feedback connected, power up the drive and set it with the OP Mode: Digital speed (*see cap. 4.3 Digital Speed on page 63*) and with Speed 100 RPM, enable the drive. If the Alarm 2 appears then contact for assistance, if not that means the drive don't have the problem, continue on the next point.
- If there are an extension cable between the motor and the drive then:
 - If you have a replacement, try to replace it with an equal cable.
 - If you don't have a replacement, disconnect the cable form the motor and the drive, with a multimeter or multitester, check if there any short circuit between two wire of the cable. Check if there are wire's isolation damaged that can create any type of short circuit, because all the wire must be isolate form each-others, if there are any damaged or short circuit then replace the cable. Connect the cable between the drive and the motor, and try to enable the drive. If the Alarm 2 appears then continue on the next point.
- If you have a replacement motor, then replace it with an equal motor (a working one) and try to enable the drive, if the Alarm 2 appears then contact for assistance, if it not appears then that means the replaced motor have a problem.

SOLUTION FOR ALARM 3 (Drive Temperature):

- Verify the ambient temperature around the drive.
- Verify the heat dissipating power of the heat-sink where is mounted the drive.
- Verify if there are enough airflow in the cabinet that remove the hot air.
- Wait until the radiator has cooled off, the alarm will auto-reset when the temperature drop under 70°C, then enable the drive.

SOLUTION FOR ALARM 4 (Hall):

- Verify the cell's wire connection and feedback setting (*see cap. 2.11 Feedback signals connections on page 32*), reset the alarm, then enable the drive.

SOLUTION FOR ALARM 5 (Encoder):

- Verify the wire connection and feedback setting (*see cap. 2.11 Feedback signals connections on page 32*), reset the alarm, then enable the drive.

SOLUTION FOR ALARM 6 (12t Drive):

- Disable the drive.
- The cause could be one of the following:
 - The working cycle could be too heavy;
 - A possible mechanical block / degradation or the some mechanical parts need of lubrication;

3.2 Problem solving

- A motor phase inversion;
- Incorrect motor phase angle;
- The amplifier's dynamic constants: "KP", "KI" and "KD", could create useless current oscillation.
- Try running the motor with digital reference in OP Mode 10: Square Wave Period, be aware of the mechanical movement;

SOLUTION FOR ALARM 7 (Motor Temperature):

- Verify the motor case 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, then enable the drive.

SOLUTION FOR ALARM 8 (Regenerative Resistance):

- Verify the resistor connection.
- Verify 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 system.

SOLUTION FOR ALARM 9 (Min Voltage):

- Disable the drive.
- Verify the power supply connection on the drive (*see cap. 2.9 Power and Backup Supply connections on page 30*).
- Verify the voltage level on the power input (*see cap. 1.2 Technical Data on page 10*).
- Verify the output voltage stability of the power supply, even during the working cycles.

SOLUTION FOR ALARM 10 (Pre-Alarm Recovery):

- This alarm will auto-reset when the I2t energy recovery drop under 80%.

SOLUTION FOR ALARM 11 (USB Mack-Link):

- Verify if the ground and earth connection are performed as showed in basic installation procedure (*see cap. 2.7 Basic installation procedure on page 28*).
- Replace the USB cable if is damaged or is not shielded (*see cap. 2.4 Cables on page 24*).

SOLUTION FOR ALARM 13 (Overvoltage):

- Verify the power supply connection on the drive (*see cap. 2.9 Power and Backup Supply connections on page 30*).
- Verify the voltage level on the power input (*see cap. 1.2 Technical Data on page 10*).
- When the input voltage level on power supply and connection are correct then the alarm will auto-reset.
- Verify that the working cycles are not excessive, if the problem appears during the running operation and there is not present any braking resistor maybe is necessary to install one (*see cap. 2.12 Regen resistance connections on page 34*).

SOLUTION FOR ALARM 14 (Following Error):

- Verify if the connection are correct.
- Verify if there are any mechanical block.
- With the software interface check:
 - The Max Position Error parameter and the dynamic gains under Position Loop;

SOLUTION FOR ALARM 15 (Limit Switch):

- Disable the drive.
- Verify the limit switch and the connections between them and the drive
- Verify the setting with the software interface.
- Then enable the drive.

3.2 Problem solving

SOLUTION FOR ALARM 17 (Regenerative OC):

- Verify the resistor connection.
- Verify that the working cycles are not excessive.
- Verify if the motor going at half speed shows the same problem.

SOLUTION FOR ALARM 22 (STO):

- Verify if the STO wire connection.
- Verify the presence of the STO signals (STO.IN 1 / 2) applied on M4 connector.
- Verify the correct sequence of application of the STO signals and the Enable signal.

SOLUTION FOR ALARM 24 (CanBus):

- Verify cable connection.
- Verify all the drive in the node have the same baud rates and different ID.
- Reset the alarm and re-enable.

SOLUTION FOR ALARM 26 (Homing Error):

- Homing position non respected based on function.
- Zero Finding limit exceeded.

SOLUTION FOR ALARM 28 (EtherCAT):

- Verify cable connection.

SOLUTION FOR ALARM 31 (Unsupported Operation):

- the 'operating mode' / 'CANopen OP mode' selected is not supported.

SOLUTION FOR ALARM 32 (Speed Following Error):

- Disable the drive.
- Verify the phasing angle with the software interface.
- Verify if the motor wire connection is correct (*see cap. 2.10 Motor power connection on page 31*).
- Verify the encoder connection and setting (*see cap. 2.11 Feedback signals connections on page 32*).
- Verify if there are any mechanical block.
- With the software interface check:
 - The Max Position Error parameter and the dynamic gains under Position Loop;
 - The dynamic gains under Velocity Loop;

3.2 Problem solving

OTHER PROBLEMS:

DRIVE DOESN'T STARTUP:

- Verify the voltage level on the backup input (*see cap. 1.2 Technical Data on page 10*).
- Verify the backup supply connection on the drive (*see cap. 2.9 Power and Backup Supply connections on page 30*), backup supply is required to startup the drive.

DRIVE DOESN'T COMMUNICATE:

- Verify the USB cable is correctly connected.
- Try to replace the USB cable.
- Be sure the driver is installed.

Chapter 4

Operative Modes

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4.1 Operative Modes

The drive supports the following operative modes:

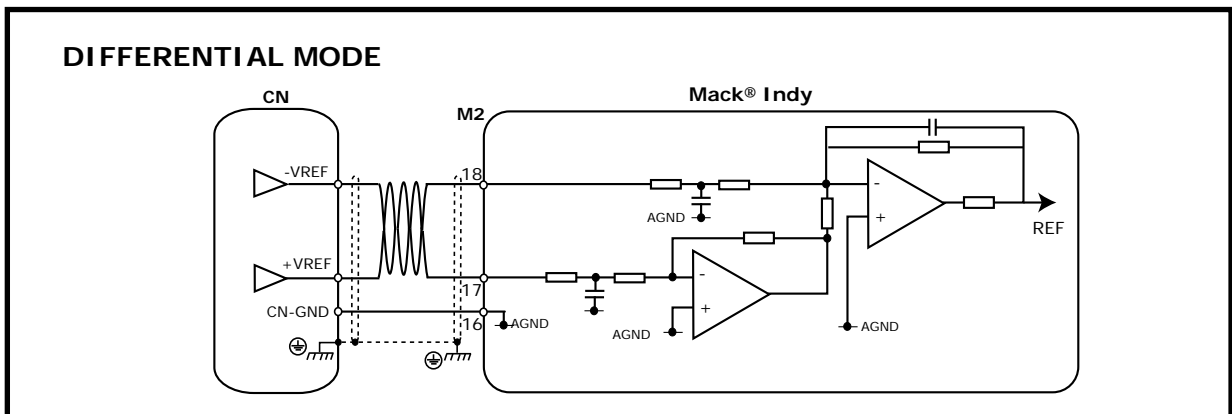
CONTROL	DESCRIPTION
ANALOG SPEED	It is speed piloting utilising an analogue reference.
DIGITAL SPEED	It is speed piloting utilising a digital reference.
ANALOG TORQUE	It is torque piloting utilising an analogue reference.
DIGITAL TORQUE	It is torque piloting utilising a digital reference.
POSITION MODE	<p>The positioner can be managed via hardware (by using the digital inputs appropriately configured) or via USB (by using the SpeederOne.2 interface). It supports 32 programmable position profiles, a single task or a sequence of tasks are permitted.</p> <p>The Homing Procedure is implemented. It uses the signal coming from the homing sensor and eventually the zero signal of the encoder.</p>
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).
PULSE/DIR MODE	It is possible to connect the drive to a stepper-motor controller , piloting it with the H.CK/L.CK/O.CK and H.DIR/L.DIR/O.DIR signals.
CANOPEN	<p>It can be configured and controlled using CanBus. It supports the following Can Open protocols:</p> <ul style="list-style-type: none">• Part of the DS301-V4.02• Part of the DSP402-V2.0
CW/CCW	It is possible to connect the drive to a motor piloting it with the CLOCK (H.CK/L.CK/O.CK) and DIR(H.DIR/L.DIR/O.DIR) signals: if pulses arrive at the CLOCK input, the motor rotates clockwise (CW); while if pulses arrive at the DIR input, the motor rotates counter clockwise (CCW).
ETHERCAT	The drive can be configured and controlled using EtherCAT .
SQUARE WAVE PERIOD	The motor is piloted with a "square wave" signal. This is useful for adjustments of the speed loop.
ANALOG to POSITION	The motor moves between two programmable positions corresponding the Min. and Max. voltages at the dedicated pins.
DIGITAL POSITION	The motor moves between two digital positions.

4.2 Analog Speed

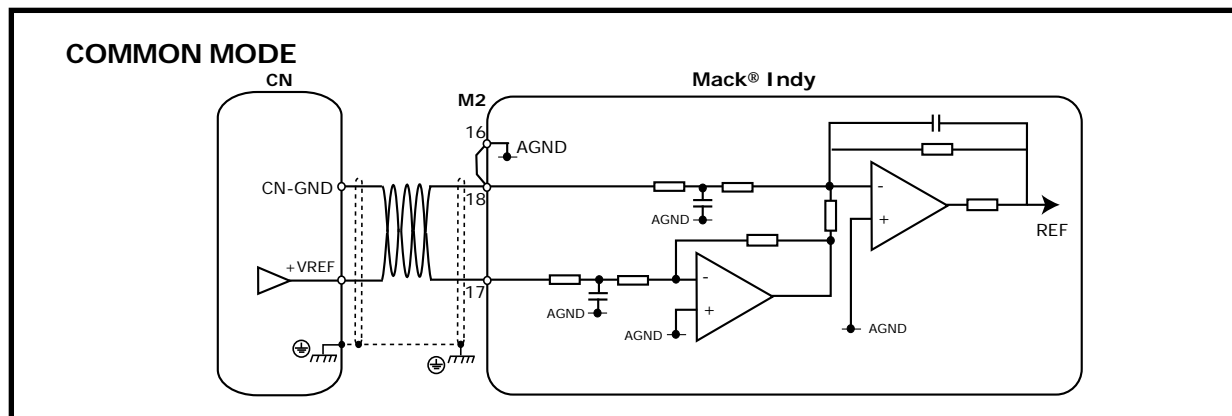
The drive can control a motor by using a **differential or common mode analog speed reference ($\pm V_{dc}$) from the CN or PLC.**

The procedure is the following:

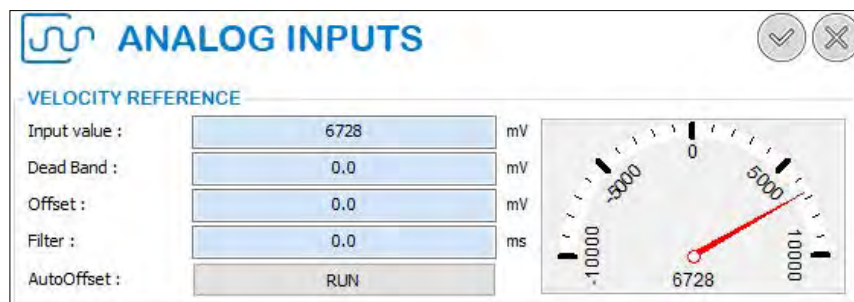
- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Use pins **+REF**, **-REF** and **AGND** to *apply the desired speed reference* \Rightarrow the axis card used in the Numerical Control or PLC can have two different types of analog reference outputs:
 - **Differential analog output**, in this case connect the positive speed reference to **+REF** and the negative speed reference to **-REF**.



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



- 3- Execute the *settings of the offset of the velocity analog input reference via SpeederOne.2 interface*:
 - Open the "**Analog Inputs**" window run **AutoOffset**.



4.2 Analog Speed

4- Enable analog speed control via software interface:

a- Set the operative mode **0:Analog Speed**;



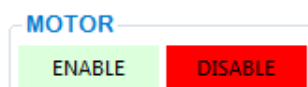
b- It is possible to limit the torque by setting the % of I_{max} by the value Torque Sat. (the value 0,0% disable this function)(*).



c- Save data to Eeprom;



d- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.



e- When the desired speed reference arrive at the **+REF** or **-REF** the motor will move.

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

Example: Suppose we want to set a digital torque reference equal to 4A, having a drive size of 5/10 (5A=rated current, 10A=peak current) ⇒ insert in the window Torque Sat. the value 40, in fact (4x100)/10=40.

The value 0,0% disable the function.

ATTENTION: If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the velocity loop* by using an adequate procedure.

Note:

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

4.3 Digital Speed

The drive can control a motor by using a **digital speed reference**.

The procedure is the following:

- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Enable digital speed control via software interface:
 - a- Set the operative mode **1:Digital Speed**;



- b- Insert the desired speed reference [in rpm];



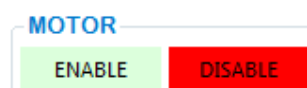
- c- It is possible to limit the torque by setting the % of I_{max} by the value Torque Sat. (the value 0,0% disable this function)(*).



- d- **Save data to Eeprom**;



- e- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.



- 3- If the turning is irregular or noisy, it should be necessary to *adjust the gains of the speed loop* by using an adequate procedure.

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

Example: Suppose we want to set a digital torque reference equal to 4A, having a drive size of 5/10 (5A=rated current, 10A=peak current) □ insert in the window Torque Sat. the value 40, in fact (4x100)/10=40.

The value 0,0% disable the function.

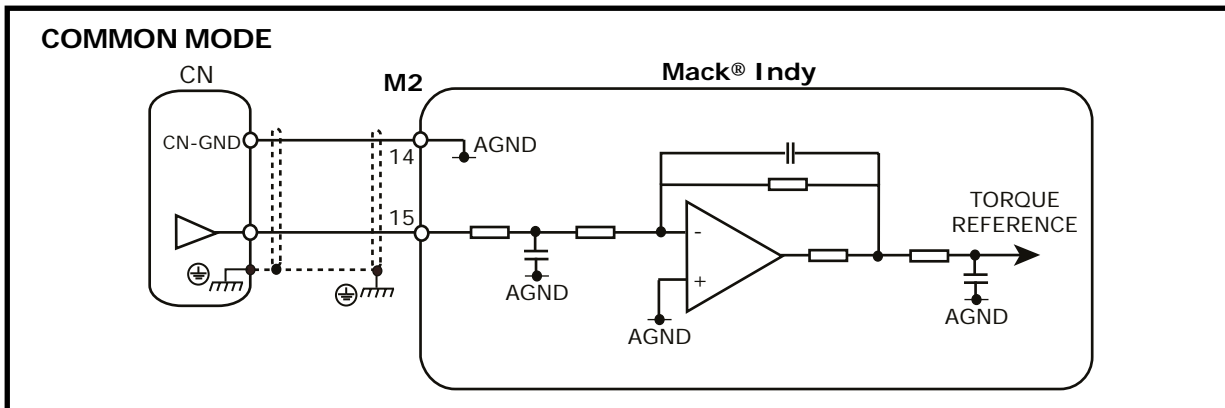
4.4 Analog Torque

The drive can control a motor by using an **analog torque reference**.

The procedure is the following:

- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Use pins **TPRC** and **AGND** to *apply the desired torque reference* ⇒ the axis card used in the Numerical Control or PLC can have common mode types of analog reference outputs:

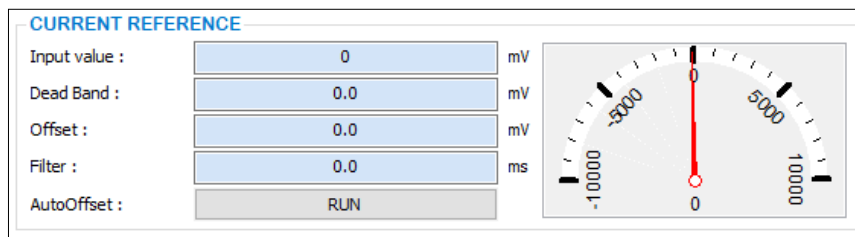
- **Common mode reference analog output:**



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

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

- 3- Execute the *settings of the offset of the velocity analog input reference* via software interface:
 - Open the "**Analog Inputs**" window run **AutoOffset**.



- 4- Enable analog torque control via software interface:
 - a- Set the operative mode **2:Analog Torque**;



b- It is possible to limit the max torque by setting the % of I_{max} by the value Torque Sat. (the value 0,0% disable this function)(*).

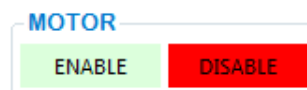


4.4 Analog Torque

c- Save data to Eeprom;



d- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.



ATTENTION: If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the velocity loop* by using an adequate procedure.

4.5 Digital Torque

The drive can control a motor by using a **digital torque reference**.

The procedure is the following:

1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);

2- Enable analog speed control via software interface:

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



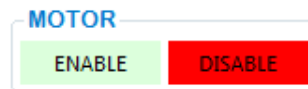
b- Insert the desired torque reference(*) in the window Torque Sat.;



c- **Save data to Eeprom**;



d- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.



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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) ⇒ insert in the window Torque Sat. the value 25, in fact $(5 \times 100) / 20 = 25$.

The value 0,0% disable the function.

4.6 Position Mode

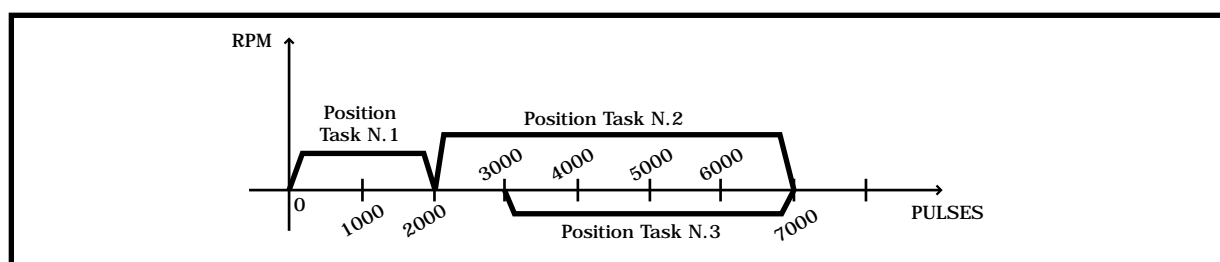
The drive can be controlled as **POSITIONER** by using the operative mode: "**4:Position Mode**".

It is possible to set up to **8 trapezoidal positioner profiles** on *Mack Indy* with the software interface in the **Profile Tool** window or by another *master ModBus* by using the *RS485* interface.

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

The implemented **ABSOLUTE POSITIONER** executes transactions to *absolute quota* reference to the reference point.

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



Notes:

- It is necessary to execute a correct *homing procedure* before starting an absolute positioner.

To select the **8 trapezoidal positioner profiles**, hardware input can be used with the following setup:

Profile N°	INPUTS		
	TPRC	H.DIR	H.CK
1	0	0	0
2	0	0	0
3	0	0	1
4	0	0	1
5	0	1	0
6	0	1	0
7	0	1	1
8	0	1	1

Note:

- Connect **O.CK** , **O.DIR** to the **GND**, while **L.DIR**, **L.CK** are not to be connected.;

See "**Positioner Manual Mack**" for a more detailed description about the positioner implemented on the drives (contact the provider).

4.7 Gearing (Electrical Axis)

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

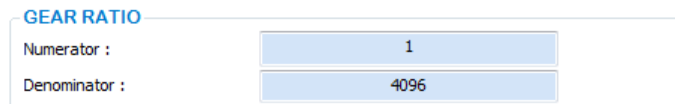
- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Use the **M2-17/M2-20** or **M2-18/M2-21** pins to connect relatively encoder signals +CHA / +CHB (see cap. 1.4 Connectors Description on page 12).
- 3- Set the operative mode "**5:Gearing**" in the OP. MODE menu.



- 4- It is possible to limit the torque by setting the % of I_{max} by the value Torque Sat.(the value 0,0% disable this function)(*).



- 5- Open the "**Position Loop**" window 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.

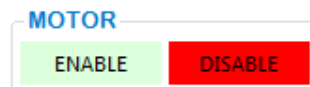


Example: For 4096 pulses/revolution set as in figure(1/4096)

- 6- **Save Data to Eeprom.**



- 7- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input. The motor will remain blocked in torque with the position loop inserted and waiting to move.



- 8- When the pulse's arrive at the 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 position loop* by using an adequate procedure.

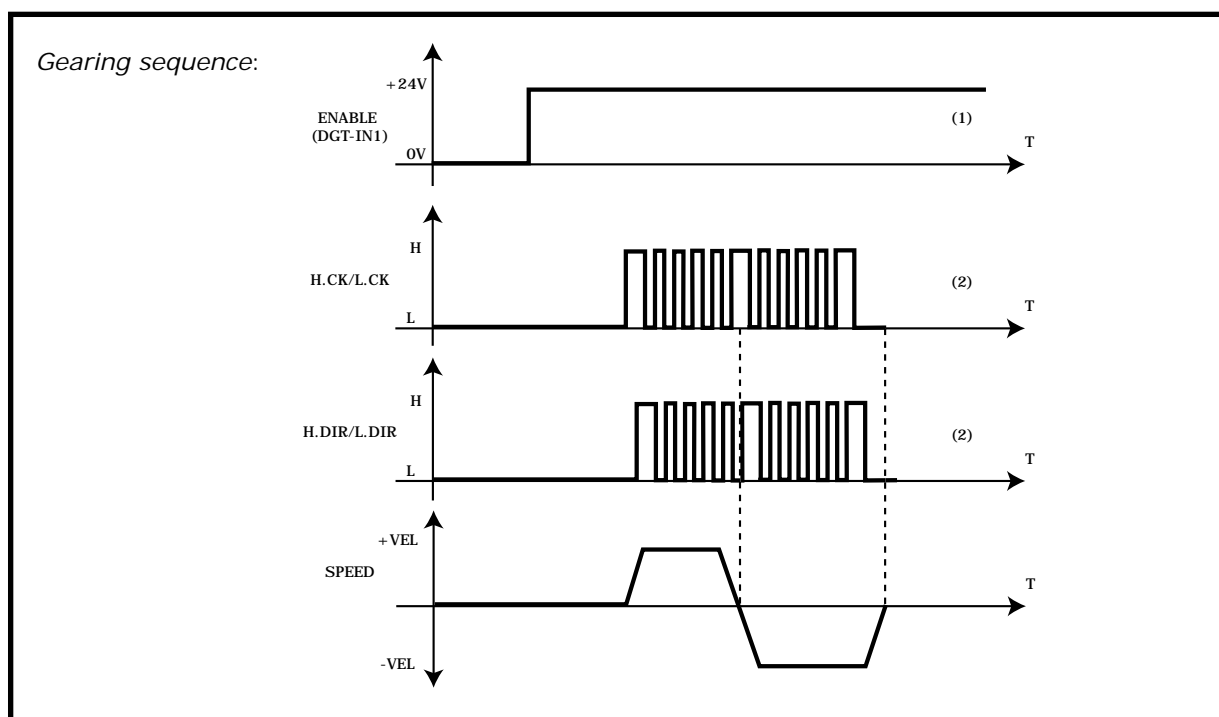
(*) Insert the calculate torque reference using this formula:

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) ⇒ insert in the window Torque Sat. the value 25, in fact (5x100)/20=25.

The value 0,0% disable the function.

4.7 Gearing (Electrical Axis)



Note: If required by the application, at anytime it is possible to execute a **homing procedure**.

Timing on inputs:

The following table show the timing to respect on the input **H.CK**, **L.CK**, **H.DIR**, **L.DIR**.

Signal	Positive command	Negative command
CK	<p>Phase A</p>	
DIR	<p>Phase B</p> <p>Phase B advanced by 90 deg from phase A</p>	<p>Phase B delayed by 90 deg from phase A</p>

CK / DIR signal	Max. allowable input frequency	Minimum required time width [μs]
		t
Line driver	500 KHz	2
Open collector	200 KHz	5

4.8 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* (see cap. 2.7 Basic installation procedure on page 28);

2- Enable pulse/dir control via software interface:

a- Set the operative mode **6: Pulse/Dir Mode**;



b- Insert the desired torque reference(*) in the window Torque Sat.;



c- Open the "**Position Loop**" window insert into the numerator and denominator of the **Gear Ratio**, the ratio that allows you to obtain the desired speed in regards to the encoder.



Example: For 4096 pulses/revolution set as in figure(1/4096)

d- **Save data to Eeprom, turn off and on the drive;**



3- Execute hardware connections between drive and CN (see cap. 2.17 Clock/Dir inputs connections on page 39).

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) \Rightarrow insert in the window Torque Sat. the value 25, in fact $(5 \times 100) / 20 = 25$.

The value 0,0% disable the function.

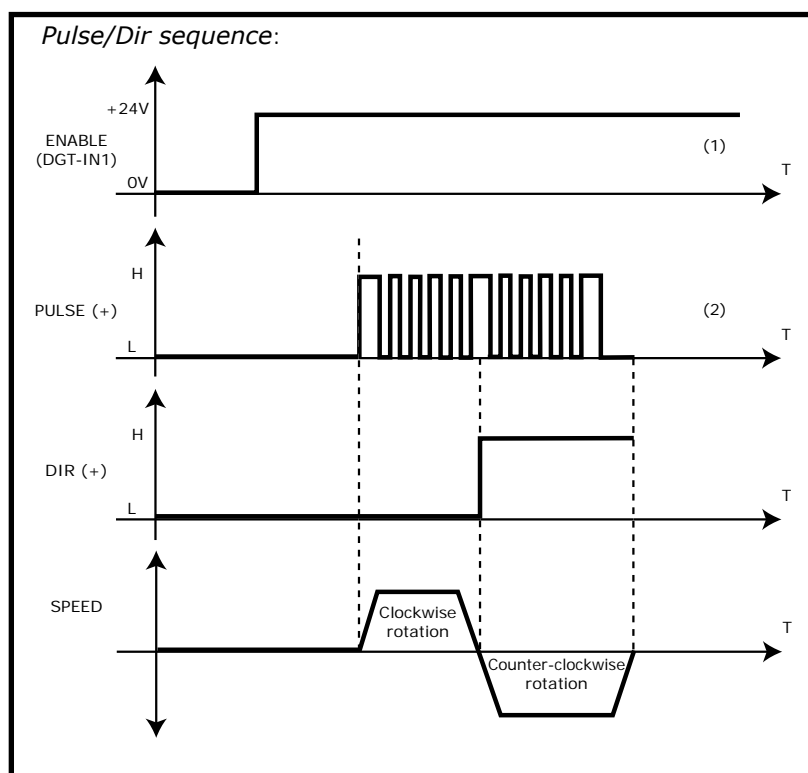
4.8 Pulse/Dir Mode

5- 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- When the pulses arrive at the input the motor will move. See (2)

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



Note: If required by the application, at anytime it is possible to execute a **homing procedure**.

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.

Timing on inputs:

The following table show the timing to respect on the input **H.CK**, **L.CK**, **H.DIR**, **L.DIR**.

Signal	Positive command	Negative command			
CK					
DIR					
CK / DIR signal		Max. allowable input frequency	Minimum required time width [μs]		
			t1	t2	t3
Line driver		500 KHz	1	1	1
Open collector		200 KHz	2.5	2.5	2.5

4.9 CW/CCW

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* (see cap. 2.7 Basic installation procedure on page 28);

2- Enable pulse/dir control via software interface:

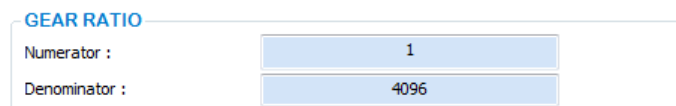
a- Set the operative mode **8: CW/CCW**;



b- Insert the desired torque reference(*) in the window Torque Sat.;



c- Open the "**Position Loop**" window insert into the numerator and denominator of the **Gear Ratio**, the ratio that allows you to obtain the desired speed in regards to the encoder.



Example: For 4096 pulses/revolution set as in figure(1/4096)

d- **Save data to Eeprom, turn off and on the drive;**



3- Execute hardware connections between drive and CN (see cap. 2.17 Clock/Dir inputs connections on page 39).

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) \Rightarrow insert in the window Torque Sat. the value 25, in fact $(5 \times 100) / 20 = 25$.

The value 0,0% disable the function.

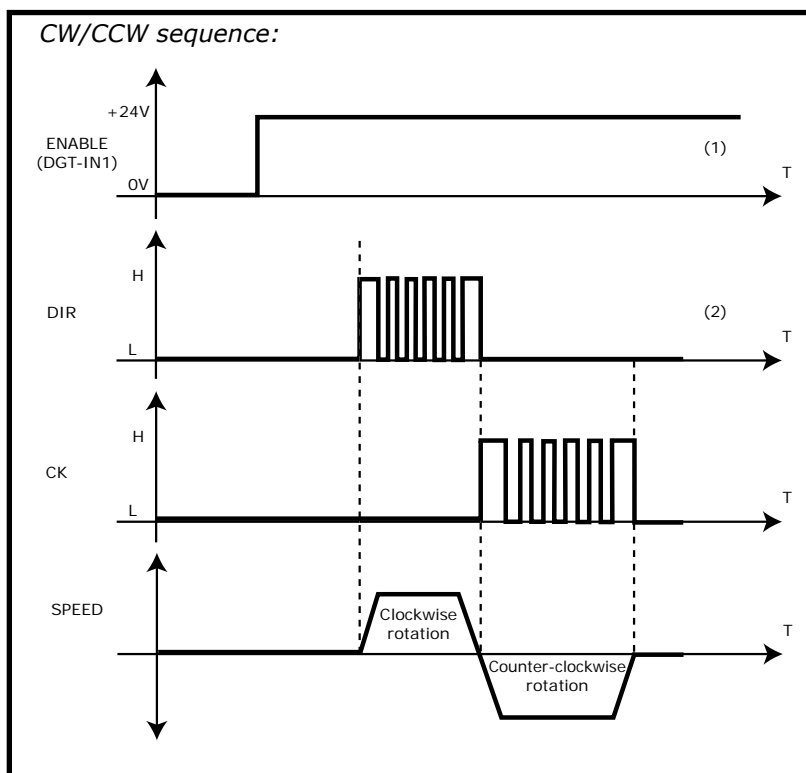
4.9 CW/CCW

5- 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- When the pulses arrive at the input the motor will move. See (2)

With the signal on the input **H.DIR/L.DIR/O.DIR** the motor turns clockwise (**CW**); with the signal on **H.CK/L.CK**, the motor turns counter-clockwise (**CCW**).

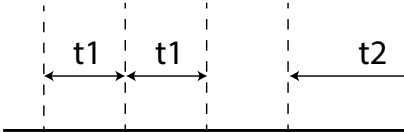
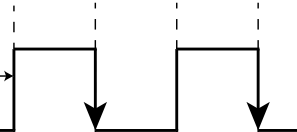
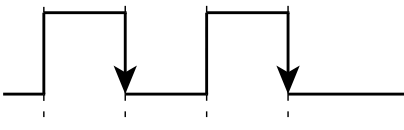
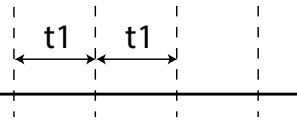


Note: If required by the application, at anytime it is possible to execute a **homing procedure**.

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.

Timing on inputs:

The following table show the timing to respect on the input **H.CK**, **L.CK**, **H.DIR**, **L.DIR**.

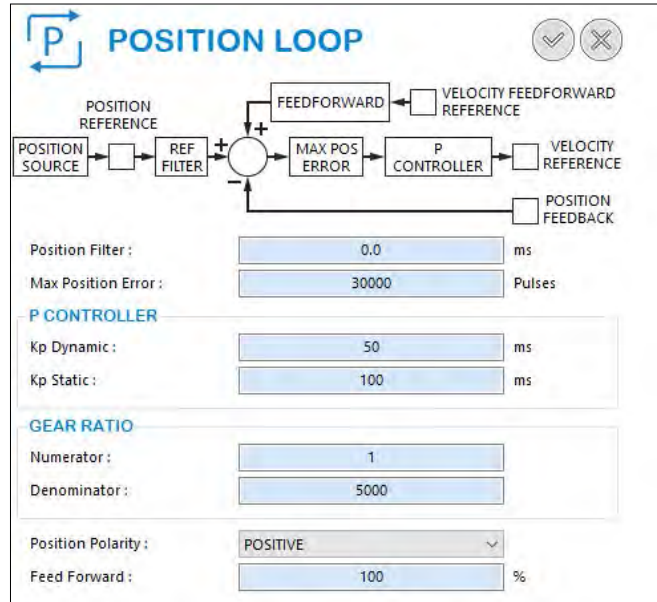
Signal	Positive command	Negative command	
CK			
DIR			
CK / DIR signal	Max. allowable input frequency	Minimum required time width [μs]	
		t1	t2
Line driver	500 KHz	1	1
Open collector	200 KHz	2.5	2.5

4.10 Homing - Settings

1- Operative mode settings:

Set the desired operative mode.

2- Settings on "POSITION LOOP" window:



Position Filter

Not used during homing.

Max Position Error

This is the position error after which the drive goes into alarm 14 ("Following Error").

To calculate the value to insert in this field, use the following formula:

$$\text{Max_Position_Error} = \frac{K^\circ}{360^\circ} * 65536$$

where K° is the value in mechanical degrees of the maximum accepted error.

The maximum selectable position error is 180° (32767 pulses).

Example: If the maximum mechanical accepted error is 45° ($1/8$ mechanical turn), then the value to insert in the Max Position Error box is 8192, in fact $45^\circ \times 65536 / 360^\circ = 8192$.

Kp Dynamic

This is the position loop gain.

Kp Static

Not used.

Numerator

Not used during homing.

Denominator

Not used during homing.

Position Polarity

Positive or Negative. This parameter enables a complete inversion of axis control.

Feed Forward

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

4.10 Homing - Settings

3- Homing parameters settings:



Homing Method

It defines the method of homing (a video will explain how the selected homing work).

Torque Limit

It allows to limit the max torque in %, during the homing procedure.

Acceleration

This is the acceleration and deceleration time for the homing procedure. It is defined in milliseconds and allows values in ranges between 10 and 5000 ms. This time references the maximum motor speed set by using the "Speed Limit" parameter in the "Speed Loop" window, so the **actual acceleration** time can be found utilizing the following formula:

$$T_{acc_homing} [ms] = \frac{Speed_homing [rpm] * T_{acc_sett}[ms]}{Speed_motor[rpm]}$$

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

For example if you have a motor with the following parameters:

- "Speed Limit" (on the "Speed Loop" window) = 3000 rpm;
- "Acceleration" (on the "Homing" window) = 500 ms;
- "Speed" (on the "Homing" window) = 1000 rpm.

The acceleration time set in the homing window is the time that the motor should employ to accelerate from 0 rpm to the maximum speed (in this case 3000rpm).

The real acceleration time from 0 rpm to 1000 rpm is 167ms, in fact:

$$T_{acc_homing} [ms] = \frac{1000 \text{ rpm} * 500 \text{ ms}}{3000 \text{ rpm}} = 167 \text{ ms}$$

4.10 Homing - Settings

Speed

This parameter sets the speed reference used during the homing process and it is given in "rpm".

Zero Speed

This defines the motor's speed during the realignment with the homing sensor and/or during the search for the encoder's zero pulse from the motor feedback after the home sensor is reached.

Homing Offset

This defines the difference between the zero position for the application and the machine's home position (which is found during homing process). It is measured in pulses and the allowed values are in ranges: $\pm(2^{32}-1)$. This value is assigned to the home position found at the end of a successful homing process. The Homing Offset value is obtained by the execution of the following calculation:

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

Example: suppose we have an application where the distance between the home position and the zero position of the axis is equal to the distance that the axis can go with a rotation of 4 turns plus an addition 90° mechanical turn.

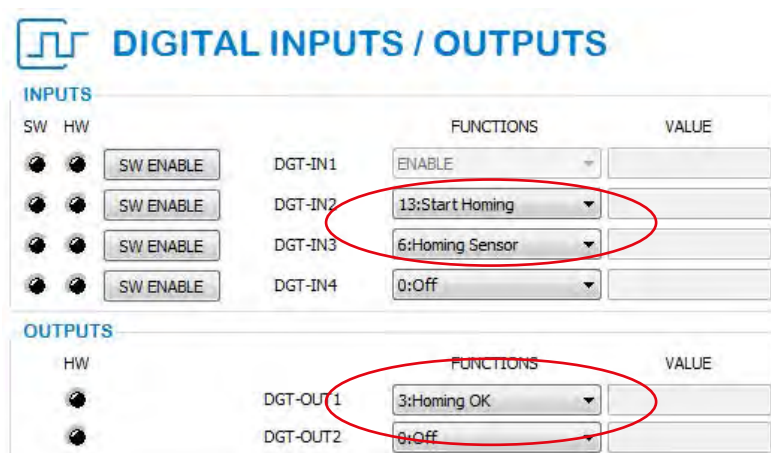
The first thing to do is to find the number of turns to insert into the formula. In this example: $n^{\circ} \text{ turns} = 4 + 90^{\circ}/360^{\circ} = 4.25$ to refer to the fraction of turn above 360°. Now it is possible to calculate utilizing the following operation: $4.25 * 65536 = \mathbf{278528}$. This bold number is the value that must be inserted in the "Homing Offset" window.

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

5- Digital inputs/outputs settings:

A homing procedure needs following settings:

- a digital programmable input with function "Start Homing";
- a digital programmable input with function "Homing Sensor";
- an output with function "Homing OK".



Homing sensor connection:

Connect homing sensor to the digital input pin set with the "Homing Sensor" function.

4.11 Homing - Example

Example: Homing sequence

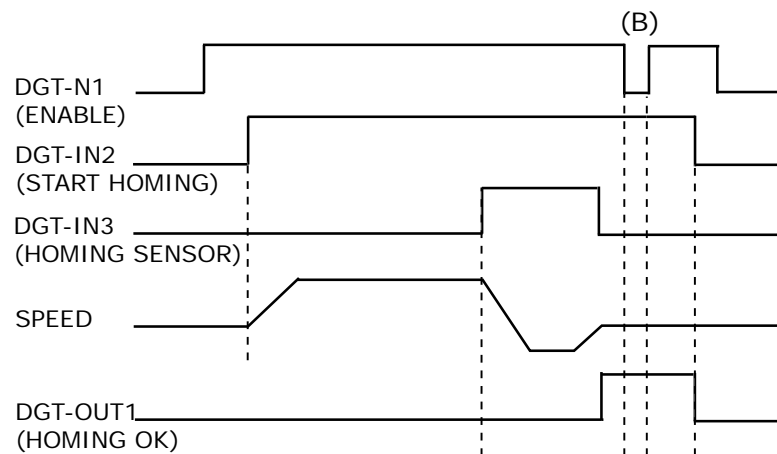
Suppose to do the homing method: "**3 : Clockwise home switch (NO) and index pules**". The procedure is the following:

- 1- Select the desired operative mode.
- 2- In the "Homing" window of the interface set the desired homing method and its parameters.
Save all to the Eeprom.
- 3- Open the "**Digital Input/Outputs**" window and set:
 - A digital programmable input with the "**Start Homing**" function (for example: **DGT-IN2**);
 - A digital programmable input with the "**Homing Sensor**" function (for example: **DGT-IN3**);
 - A digital output with the "**Homing OK**" function (for example: **DGT-OUT1**);Save all to the Eeprom.

- 4- Execute the homing procedure:

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

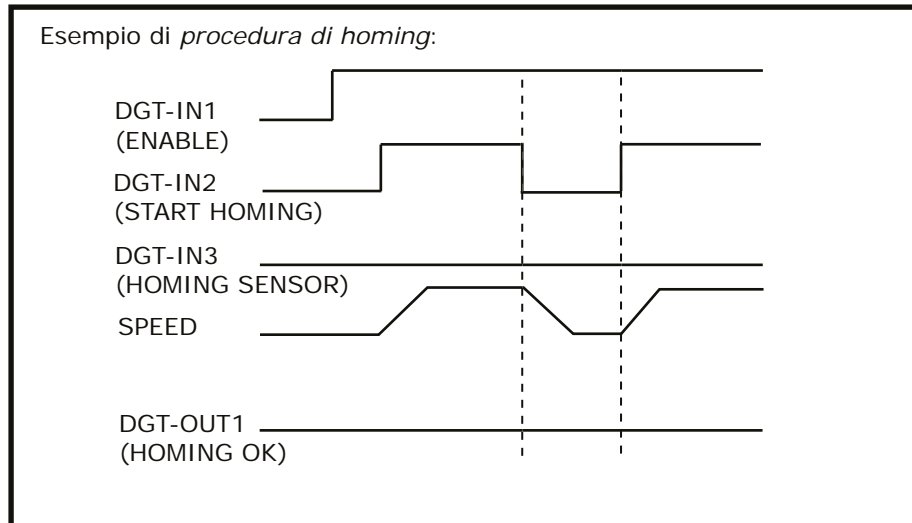
Example: homing procedure



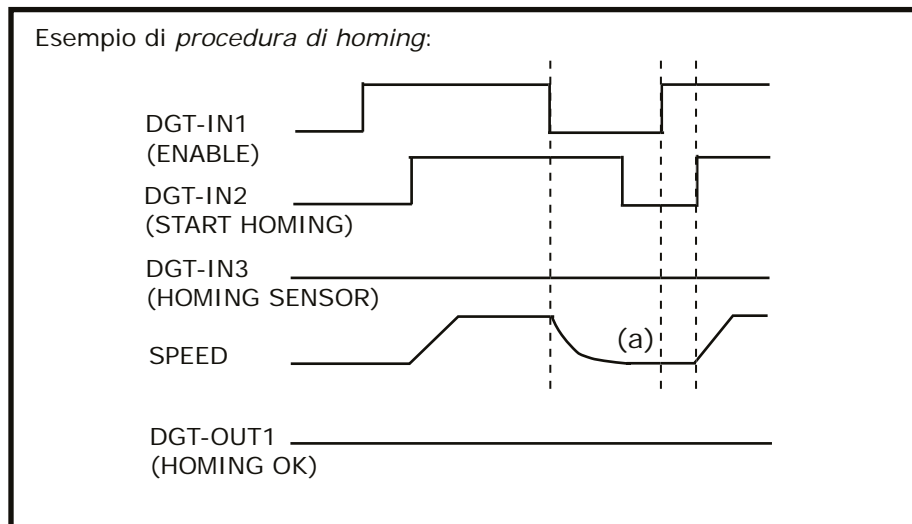
4.11 Homing - Example

Warnings:

1) Disabling the **DGT-IN2 (Start Homing)** digital input, before that the home position reached indication is generated, makes the homing process to abort. No home position is saved and the motor decelerates using the "**Acceleration**" parameter.



2) Disabling the **DGT-IN1 (ENABLE)** digital input, before the ending of the homing procedure, causes the interruption of homing process. In this case no homing position is saved and the motor is left free (deceleration is depending of inertia and friction). A new homing process can be start disabling the **DGT-IN2 (Start Homing)** input and then enabling the **DGT-IN1** and **DGT-IN2** digital inputs ((a) in figure).

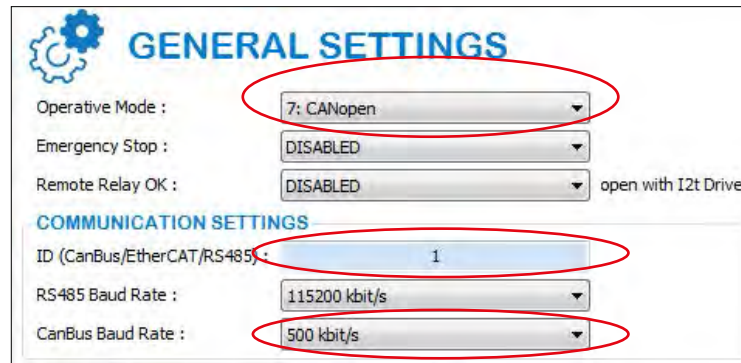


4.12 CanBus - Settings

The drive can be controlled in CanBus interface.

The procedure is the following:

- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- In the "**Settings**" window set:



- a- Set the operative mode "**7: Can Open**".
 - b- The baud rate parameter to define the communication speed and so the performance of the system. All drives connected to the network must have the same baud rate.
 - c- For each drive on the same network set a different "**CanBus ID**".
 - d- Save always in Eeprom to save the settings.
- 3- Connect the first drive to the CAN MASTER by using a CanBus cable.
 - 4- Connect each drive to the preceding and the following by using a CanBus cable.
 - 5- Connect a **RESISTOR** (120 ohm, 1/4W) between pins **CAN H** and **CAN L** of the last drive of the network.

See "**CanOpen/Ethercat Reference Manual**" for a more detailed description about the CanOpen protocol implemented on the drives (contact Axor).

4.13 Can Bus - Command Sequences

The integrated software is based upon the **CAN open DS301-V4.02** communication protocol and on profile **DSP402-V2.0**.

Objects used in all operative modes

The following objects can be used independently to the selected operative mode (*Position Mode, Velocity Mode, Homing Mode or Interpolated Mode*) and they allow to check and command the axis:

Index	Name	Access	Description
6040.0 _H	Controlword	R/W	It enables the axis and, in some modes, it gives the start motion command.
6041.0 _H	Statusword	RO	It reads the axis status.
6060.0 _H	Mode of operation	R/W	It sets one of the CanOPEN (DSP402) operative modes: <ul style="list-style-type: none">• <i>profile velocity mode</i>: 3• <i>profile position mode</i>: 1• <i>homing mode</i>: 6• <i>interpolated mode</i>: 7
6061.0 _H	Mode of op. display	RO	It reads the active operative mode.
6064.0 _H	Position actual value	RO	It provides the actual axis position, in Um.
606C.0 _H	Velocity actual value	RO	It provides the actual axis velocity, in Um/s.
6092.1 _H	Feed	R/W	It converts the Can unit of measurement into increments by using the following formula: $\text{Position}_{\text{um}} = \text{Position}_{\text{inc}} * \text{Feed} / (65536 * \text{Motor shaft})$
6092.2 _H	Motor shaft	R/W	

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Object 6040_H: Controlword

This object has 16 bits, each of these has a particular meaning; some bits have a different function in accordance to the selected operative mode.

In the following table there are the bits descriptions for all drive operative modes.

Profile Position Mode (OP number: 1)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 MANUFACT SPECIFIC	BIT 12 MANUFACT SPECIFIC	BIT 11 MANUFACT SPECIFIC	BIT 10 RESERVED	BIT 9 RESERVED	BIT 8 HALT
BIT 7 FAULT RESET	BIT 6 ABSOLUTE RELATIVE	BIT 5 CHANGE SET IMMEDIATELY	BIT 4 NEW SET POINT	BIT 3 ENABLE OPERATION	BIT 2 QUICK STOP	BIT 1 ENABLE VOL- TAGE	BIT 0 SWITCH ON

Profile Velocity Mode (OP number: 3)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 MANUFACT SPECIFIC	BIT 12 MANUFACT SPECIFIC	BIT 11 MANUFACT SPECIFIC	BIT 10 RESERVED	BIT 9 RESERVED	BIT 8 HALT
BIT 7 FAULT RESET	BIT 6 RESERVED	BIT 5 RESERVED	BIT 4 RESERVED	BIT 3 ENABLE OPERATION	BIT 2 QUICK STOP	BIT 1 ENABLE VOL- TAGE	BIT 0 SWITCH ON

Homing Mode (OP number: 6)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 MANUFACT SPECIFIC	BIT 12 MANUFACT SPECIFIC	BIT 11 MANUFACT SPECIFIC	BIT 10 RESERVED	BIT 9 RESERVED	BIT 8 HALT
BIT 7 FAULT RESET	BIT 6 RESERVED	BIT 5 RESERVED	BIT 4 START OPERATION	BIT 3 ENABLE OPERATION	BIT 2 QUICK STOP	BIT 1 ENABLE VOL- TAGE	BIT 0 SWITCH ON

Interpolated Mode (OP number: 7)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 MANUFACT SPECIFIC	BIT 12 MANUFACT SPECIFIC	BIT 11 MANUFACT SPECIFIC	BIT 10 RESERVED	BIT 9 RESERVED	BIT 8 HALT
BIT 7 FAULT RESET	BIT 6 RESERVED	BIT 5 RESERVED	BIT 4 ENABLE IP MODE	BIT 3 ENABLE OPERATION	BIT 2 QUICK STOP	BIT 1 ENABLE VOL- TAGE	BIT 0 SWITCH ON

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Object 6041_H: Statusword

This object has 16 bits, each of these has a particular meaning; some bits have a different function in accordance to the selected operative mode.

In the following table there are the bits descriptions for all drive operative modes.

Profile Position Mode (OP number: 1)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 FOLLOWING ERROR	BIT 12 SET POINT ACK	BIT 11 INTERNAL LIM ACTIVE	BIT 10 TARGET REACHED	BIT 9 REMOTE	BIT 8 MANUFACT SPECIFIC
BIT 7 WARNING	BIT 6 SWITCH ON DISABLED	BIT 5 QUICK STOP	BIT 4 VOLTAGE ENABLED	BIT 3 FAULT	BIT 2 OPERATION ENABLED	BIT 1 SWITCH ON	BIT 0 READY TO SWITCH ON

Profile Velocity Mode (OP number: 3)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 MAX SLIP ERROR	BIT 12 SPEED	BIT 11 INTERNAL LIM ACTIVE	BIT 10 TARGET REACHED	BIT 9 REMOTE	BIT 8 MANUFACT SPECIFIC
BIT 7 WARNING	BIT 6 SWITCH ON DISABLED	BIT 5 QUICK STOP	BIT 4 VOLTAGE ENABLED	BIT 3 FAULT	BIT 2 OPERATION ENABLED	BIT 1 SWITCH ON	BIT 0 READY TO SWITCH ON

Homing Mode (OP number: 6)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 HOMING ERROR	BIT 12 HOMING ATTAINED	BIT 11 INTERNAL LIM ACTIVE	BIT 10 TARGET REACHED	BIT 9 REMOTE	BIT 8 MANUFACT SPECIFIC
BIT 7 WARNING	BIT 6 SWITCH ON DISABLED	BIT 5 QUICK STOP	BIT 4 VOLTAGE ENABLED	BIT 3 FAULT	BIT 2 OPERATION ENABLED	BIT 1 SWITCH ON	BIT 0 READY TO SWITCH ON

Interpolated Mode (OP number: 7)							
BIT 15 MANUFACT SPECIFIC	BIT 14 MANUFACT SPECIFIC	BIT 13 RESERVED	BIT 12 IP MODE ACTIVE	BIT 11 INTERNAL LIM ACTIVE	BIT 10 TARGET REACHED	BIT 9 REMOTE	BIT 8 MANUFACT SPECIFIC
BIT 7 WARNING	BIT 6 SWITCH ON DISABLED	BIT 5 QUICK STOP	BIT 4 VOLTAGE ENABLED	BIT 3 FAULT	BIT 2 OPERATION ENABLED	BIT 1 SWITCH ON	BIT 0 READY TO SWITCH ON

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Profile Velocity (mode of operation=3)

In this operative mode the axis is control by using a *speed reference*, that can be changed at any moment. SDO and PDO messages can be used indifferently.

In the following table there are the specific objects which can be used in this operative mode:

Usable objects:

Index	Name	Access	Description
607E.0 _H	Polarity	R/W	It inverts the movement direction setting to 1 the bit 6 of the object.
60FF0 _H	Target velocity	R/W	It sets a value for the <i>speed reference</i> .
6083.0 _H	Profile acceleration	R/W	It sets the <i>acceleration</i> used to reach the set speed reference, in Um/s ² .
6084.0 _H	Profile deceleration	R/W	It sets the <i>deceleration</i> used by the axis during normal functioning, Um/s ² .
6085.0 _H	Quick stop deceleration	R/W	It sets the <i>deceleration</i> used by the axis in case of malfunctions, Um/s ² .

Command sequence

In the following table there is the axis enable and movement sequence in the *profile velocity mode*.

CW means *controlword* and **SW** means *statusword* and we suppose that the Can node is into the operational state (NMT state= 5).

Command	Issue
---	Start state, machine start up: node into <i>operational</i> mode, axis without torque: CW=0000 _H and SW=0250 _H .
obj(6060 _H) = 3	I set the <i>Profile velocity</i> Can operative mode.
CW=0006 _H	First step of the enable sequence: SW=0231 _H .
CW=0007 _H	Second step of the enable sequence: SW=0233 _H .
CW=000F _H	Third step of the enable sequence: SW=0237 _H . At this point the motor is steady with torque.
obj(6083 _H) = <i>acc</i>	I set the acceleration value.
obj(6084 _H) = <i>dec</i>	I set the deceleration value.
obj(60FF _H) = <i>value</i>	The axis moves with an acceleration equal to <i>acc</i> and reach the <i>value</i> speed.
obj(60FF _H) = 0	The axis stops with a deceleration equal to <i>dec</i> and it remains steady with torque.

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Profile Position (mode of operation=1)

In this mode the axis has to reach an absolute position; the speed profile, the acceleration and the deceleration have to be set. The axis movement starts after the start command expedition; at this point the axis makes the positioning and when the positioning is finished it informs the control that the set position is reached or it dispatches a following error if the positioning has not been completed. During the positioning the control cannot modify the parameters of the previously set profile; it can only stop the movement by using the *Halt* command.

Usable objects:

Index	Name	Access	Description
6067.0 _H	Position window	R/W	It sets the <i>space range</i> for the set quote, in Um.
6068.0 _H	Pos. window time	R/W	It sets the <i>time</i> , in ms, after which the attainment of the quote is indicated .
607A.0 _H	Target position	R/W	It sets the <i>absolute position</i> that has to be reached.
607D.1 _H	Min position limit	R/W	It sets the <i>min value</i> that the set quote can reach.
607D.2 _H	Max position limit	R/W	It sets the <i>max value</i> that the set quote can reach.
607E.0 _H	Polarity	R/W	It inverts the movement direction by setting to 1 the bit 7 of the object.
607F.0 _H	Max profile velocity	R/W	It sets the max value for the profile speed.
6081.0 _H	Profile velocity	R/W	It sets the profile <i>speed</i> used to reach the set quote.
6083.0 _H	Profile acceleration	R/W	It sets the <i>acceleration</i> used to reach the set reference speed.
6084.0 _H	Profile deceleration	R/W	It sets the <i>deceleration</i> used by the axis to stop in normal conditions.
6085.0 _H	Quick stop deceleration	R/W	It sets the <i>deceleration</i> used by the axis during malfunctions.

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Command sequence

In the following table there is the axis enable and movement sequence in the *profile position mode*.

CW means *controlword* and **SW** means *statusword* and we suppose that the Can node is into the operational state (NMT state= 5).

Command	Issue
---	Start state, machine start up: node into <i>operational mode</i> , exit without torque: CW=0000 _H and SW=0250 _H .
obj(6060 _H) = 1	I set the <i>Profile position</i> Can operative mode.
CW=0006 _H	First step of the enable sequence: SW=0231 _H .
CW=0007 _H	Second step of the enable sequence: SW=0233 _H .
CW=000F _H	Third step of the enable sequence: SW=0237 _H . At this point the motor is steady with torque.
obj(607A _H) = <i>pos_rif</i>	I set the <i>absolute quote</i> that has to be reached.
obj(6083 _H) = <i>acc</i>	I set the <i>acceleration</i> value.
obj(6084 _H) = <i>dec</i>	I set the <i>deceleration</i> value.
obj(6081 _H) = <i>vel_profile</i>	I set the profile <i>velocity</i> .
CW=001F _H	Start command: the axis starts to move toward the set quote.
---	SW = 1237 _H ...positioning...
---	SW = 0637 _H ...positioning ended: the quote is reached.

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Homing mode (mode of operation = 6)

This mode allows for zeroing the axis; the homing mode is one of the following:

Mode	Description
3	Clockwise + NA sensor + zero encoder
4	Counter clockwise + NC sensor + zero encoder
5	Counter clockwise + NA sensor + zero encoder
6	Clockwise + NC sensor + zero encoder
7	Clockwise + NA sensor
8	Counter clockwise + NC sensor
9	Counter clockwise + NA sensor
10	Clockwise + NC sensor
33	Clockwise + zero encoder
34	Counter clockwise + zero encoder
35	Immediate homing

Usable objects:

Index	Name	Access	Description
607C.0 _H	Home offset(*)	R/W	It sets the <i>preset quote</i> desired after homing.
6098.0 _H	Home method	R/W	It sets the desired <i>homing mode</i> . See the previous table.
6099.1 _H	Speed during search for switch	R/W	It sets the <i>speed</i> used during the homing for switch search.
6099.2 _H	Speed during search for zero	R/W	It sets the <i>speed</i> used during the homing for zero search.
609A.0 _H	Profile deceleration	R/W	It sets the <i>acceleration</i> and <i>deceleration</i> used to reach the set homing speed.

(*) This value does not modify the homing procedure, it just sets the start up quote (preset) visualized after homing; the real position does not change.

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED BY REQUEST.

4.13 Can Bus - Command Sequences

Command sequence

In the following table there is the axis enable and movement sequence in the *homing mode*.

CW means *controlword* and **SW** means *statusword* and we suppose that the Can node is into the operational state (NMT state= 5).

Command	Issue
---	Start state, machine start up: node into <i>operational mode</i> , exit without torque: CW=0000 _H and SW=0250 _H
obj(6060 _H) = 6	I set the <i>Homing mode</i> Can operative mode.
CW=0006 _H	First step of the enable sequence: SW=0231 _H .
CW=0007 _H	Second step of the enable sequence: SW=0233 _H .
CW=000F _H	Third step of the enable sequence: SW=0237 _H . At this point the motor is steady with torque.
obj(609A _H) = acc	I set the <i>acceleration</i> value.
obj(6099.1 _H) = vel1	It sets the <i>speed</i> used during the homing for switch search.
obj(6099.2 _H) = vel2	It sets the <i>speed</i> used during the homing for zero search.
obj(6098 _H) = home	I set the <i>homing mode</i> (see the previous table)
CW=001F _H	Start up command: the axis starts moving for zero search.
---	SW = 0237H ...homing...
---	SW = 1237H ...homing ended correctly SW = 2237H ...error during homing procedure

NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED ON REQUEST.

4.13 Can Bus - Command Sequences

Interpolated mode (mode of operation = 7)

In this mode, the master sends to the drive, at a predetermined interval of time, a quota delta that the axis must reach. The drive divides this interval into four subintervals and calculates the share of feed to meet the reference setted from the can master (delta quota). To start the movement, the master has to send a start command via the controlword.

Usable objects:

Indice	Nome	Accesso	Descrizione
60C0.0 _H	Interpolation submode select	R/W	Set the type of interpolation: the only value accepted is 0, linear interpolation.
60C1.1 _H	Interpolation Data	R/W	Quota sent from the can master
60C2.1 _H	Ip Time Unit	R/W	Set the value n of the period using the following formula $n \cdot 10^{\text{Ip_Time_Index}}$ second.
60C2.2 _H	Ip Time Index	R/W	The only accepted value is -3, milliseconds.
60C3.1 _H	Synchronize on Group	R/W	The only accepted value is 0, generic sync.
60C3.2 _H	Ip_Sync every n Event	R/W	Set the number of sync that must arrive before receiving the quota.

Command sequence

In the following table is showed the sequence of enable and movement of the axis in interpolation mode. For convenience is indicated with CW the controlword e SW the statusword and is assumed that the node Can is in the the operational state (state NMT = 5).

Comando	Esito
---	Initial state, machine powerup: node in operational mode, axis is not in torque: CW=0000 _H e SW=0250 _H .
obj(6060 _H) = 7	Set the operative mode of Can in <i>Interpolated Mode</i> .
obj(60C2.1 _H) = p	Set the period of interpolazione.
CW=0006 _H	First step of the enable sequence: SW=0231 _H .
CW=0007 _H	Second step of the enable sequence: SW=0233 _H .
CW=000F _H	Third step of the enable sequence: SW=0237 _H . Now the motor in stop in torque.
CW=001F _H	Start command: the axis start to move.
obj(60C1.1 _H) = Q _i	The can master sent the quote of position every interval of p time.

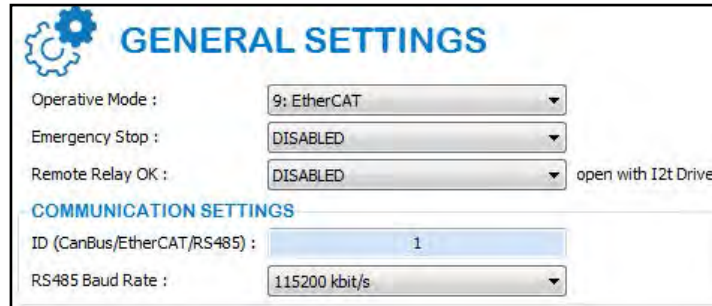
NOTE: FOR MORE DETAIL ABOUT CANOPEN PROTOCOL IMPLEMENTED BY AXOR SEE "CANOPEN/ETHERCAT REFERENCE MANUAL" PROVIDED ON REQUEST.

4.14 EtherCAT - Settings

The drive can be controlled in **EtherCAT** interface.

The procedure is the following:

- 1- For each drive perform the basic installation procedure;
- 2- In the "**Settings**" window set:



The screenshot shows a software window titled "GENERAL SETTINGS" with a gear icon. It contains several configuration options:

- Operative Mode :** A dropdown menu set to "9: EtherCAT".
- Emergency Stop :** A dropdown menu set to "DISABLED".
- Remote Relay OK :** A dropdown menu set to "DISABLED", with a note "open with I2t Drive" to its right.
- COMMUNICATION SETTINGS** (Section Header):
- ID (CanBus/EtherCAT/RS485) :** A text input field containing the value "1".
- RS485 Baud Rate :** A dropdown menu set to "115200 kbit/s".

- a- Set the operative mode "**9: EtherCAT**".
 - b- For each drive on the same network set a different ID.
 - c- Save always in Eeprom to save the settings.
- 3- Connect the first drive to the MASTER by using a RJ45 cable (J1 connector).
 - 4- Connect each drive to the preceding and the following by using a RJ45 cable (J2 connector).

EtherCAT - Setting node ID

EtherCAT protocol supports up to 65536 nodes in a communication network.

Each drive has its own ID, which may only exist once in the system.

The value 0 or values > 32767 are not allowed and cannot be set.

After changing of the node ID, save on eeprom, then power off and on the drive.

A value equal to 32767 means that the master EtherCAT allocates automatically the node ID.

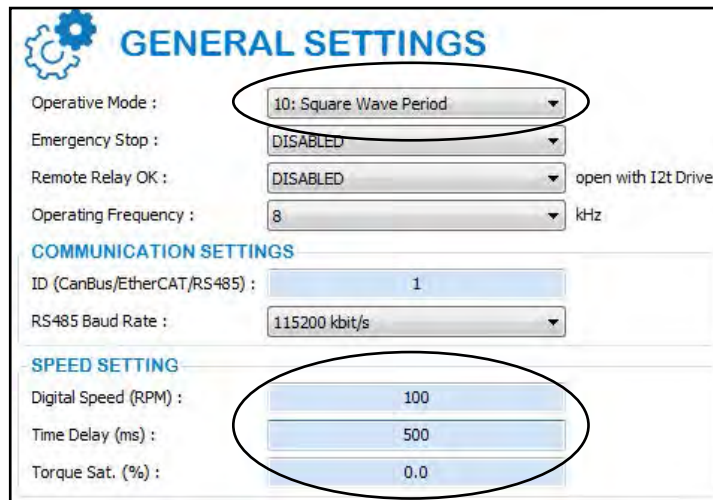
See "**CanOpen/Ethercat Reference Manual**" for a more detailed description about the CanOpen protocol implemented on the drives (contact Axor).

4.15 Square Wave Period

The drive can control a motor by using a **speed digital reference in square wave**.

The procedure is the following:

- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Enable digital speed control via software interface:



- a- Set the operative mode **10:Square Wave Period**;
- b- Insert the desired speed reference in Digital Speed;
- c - Insert the desired reversal motor period in Time Delay;
- d - Is possible to set the ramp of acceleration and deceleration in the Velocity Loop window;
- e- It is possible to limit the torque by setting the % of I_{max} by the value Torque Sat. (the value 0,0% disable this function)(*).
- f- **Save data to Eeprom**;
- g- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.

3- If the rotation is irregular or noisy, it should be necessary to adjust the gains of the Velocity loop or position loop by using an adequate procedure.

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) ⇒ insert in the window Torque Sat. the value 25, in fact $(5 \times 100) / 20 = 25$.

The value 0,0% disable the function.

4.16 Analog to Position Control

The drive can control a motor between two programmable positions corresponding the Min. and Max. voltages at the dedicated pins.

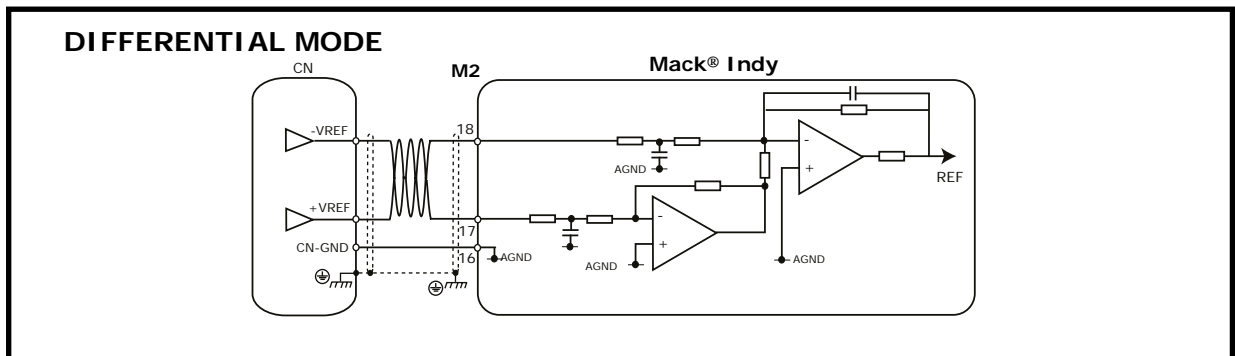
The procedure is the following:

1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);

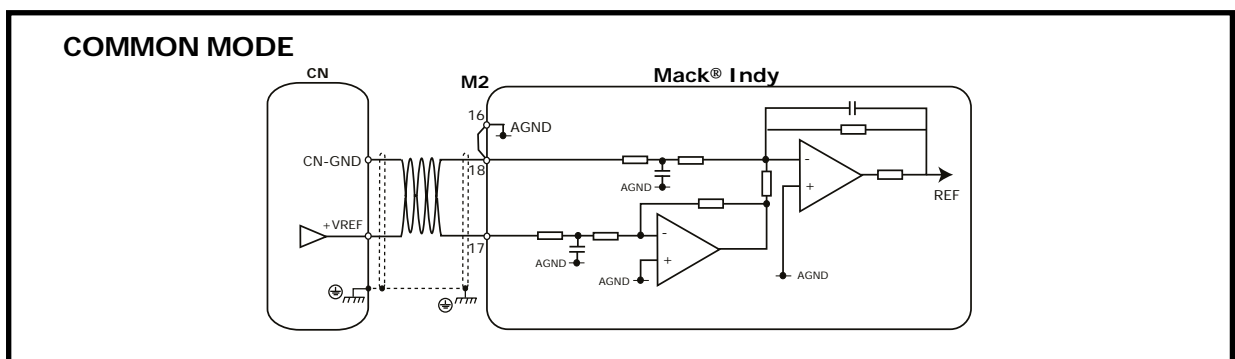
2- Use pins **+REF**, **-REF** and **AGND** to apply the desired speed reference.

The control can have two different types of analog reference outputs:

- **Differential analog output**, in this case connect the positive speed reference to **+REF** and the negative speed reference to **-REF**.

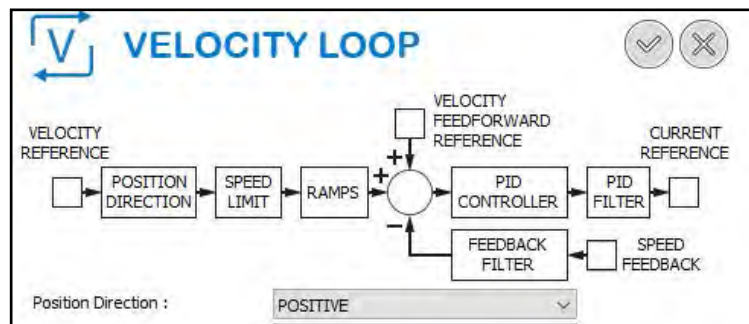


- **Common mode reference analog output**, in this case connect the control's analogue output either to the **+REF** terminal or to the **-REF** terminal, depending upon the required rotational direction. Then connect the **AGND** to the reference input terminal that is NOT used.



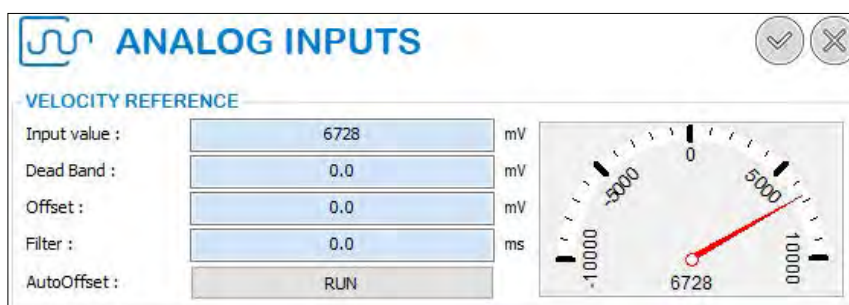
Note:

To change the sense of rotation apply the positive voltage reference to **-REF**, or change the **Position Direction** parameter in the **Velocity Loop** window (from **Positive** to **Negative**).

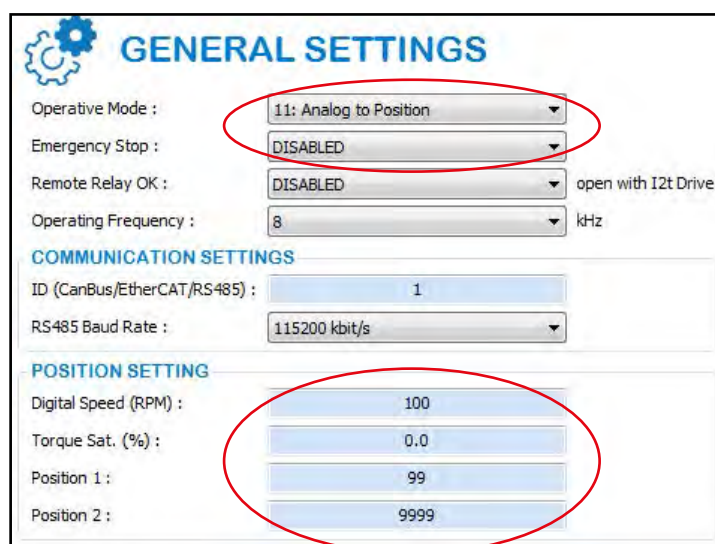


4.16 Analog to Position Control

3- Execute the settings of the offset of the velocity analog input reference **via software interface**: open the "**Analog Inputs**" window and run the AutoOffset.



4- Enable analog speed control via **Speeder One interface**:



- a- set the operative mode **11: Analog to Position** and keep the **Torque Sat.** box to **0,0**;
- b- in **Digital Speed** box set the desired speed during movements;
- c- in **Position 1** and **Position 2** set the desired position corresponding to the +10V and -10V at the dedicated inputs;
- d- save settings to Eeprom.;
- e- enable/disable the drive by using the **Enable/Disable** buttons.

ATTENTION: If the rotation is irregular or noisy, it should be necessary to *adjust the gains of the Velocity loop or position loop*.

4.17 Digital position

The drive can control a motor between two digital programmable positions.

The procedure is the following:

- 1- Perform the *basic installation procedure* (see cap. 2.7 Basic installation procedure on page 28);
- 2- Enable digital speed control via software interface:

GENERAL SETTINGS

Operative Mode : 12: Digital Position

Emergency Stop : DISABLED

Remote Relay OK : DISABLED open with I2t Drive

Operating Frequency : 8 kHz

COMMUNICATION SETTINGS

ID (CanBus/EtherCAT/RS485) : 1

RS485 Baud Rate : 115200 kbit/s

SPEED POSITION SETTING

Digital Speed (RPM) : 100

Time Delay (ms) : 500

Torque Sat. (%) : 0.0

Position 1 : 0

Position 2 : 5000

- a- Set the operative mode **12: Digital position**;
- b- Insert the desired speed reference in **Digital Speed**;
- c- Insert the desired pause period which the motor wait after reaching the position in **Time Delay**;
- d- In **Position 1** and **Position 2** set the desired position;
- e - Is possible to set the ramp of acceleration and deceleration in the Velocity Loop window;
- e- It is possible to limit the torque by setting the % of I_{max} by the value Torque Sat. (the value 0,0% disable this function)(*).
- f- **Save data to Eeprom**;
- g- Enable/disable the drive by using the **Enable/Disable** buttons or giving +24V to the **D.IN1 (ENABLE)** input.

3- If the rotation is irregular or noisy, it should be necessary to adjust the gains of the Velocity loop or position loop by using an adequate procedure.

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

$$\frac{I_{\text{desired}} \times 100}{I_{\text{peak}}}$$

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) ⇒ insert in the window Torque Sat. the value 25, in fact (5x100)/20=25.

The value 0,0% disable the function.

Chapter 5

SpeederOne.2 Interface

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5.1 Interface

The software **SpeederOne.2** interface allows you to setup, modify and save all parameters, by connecting a PC to the system.



PC minimum preconditions:

- Operative system: *Windows 7* and higher;
- Drive: Hard disk having at least 50 MB free;
- Interface: free USB port, rs485 to usb adapter..

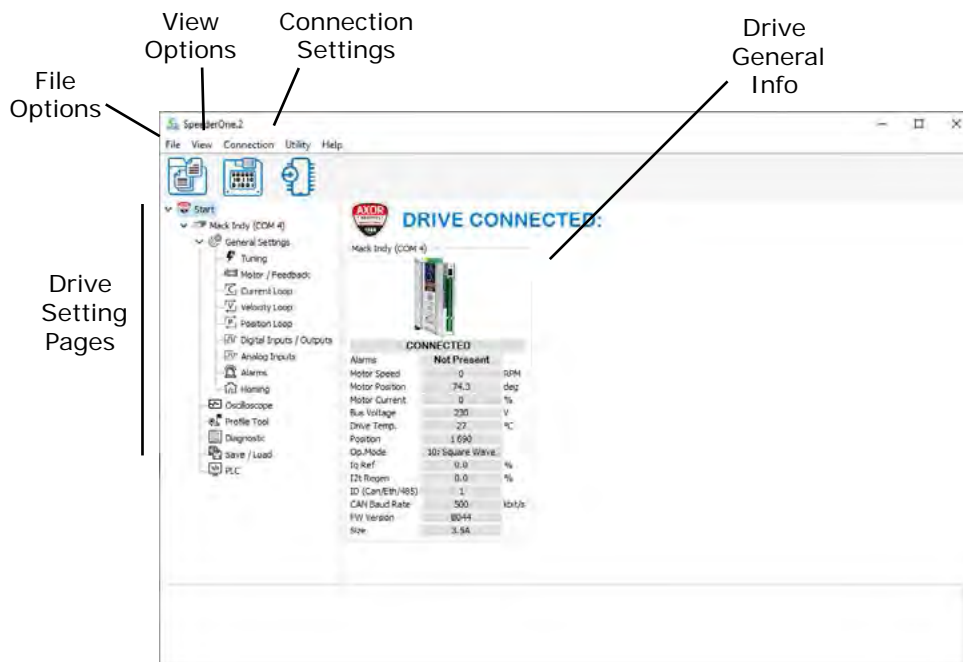
Installation procedure:

- 1- Run the installation file "**SpeederOne.2_Setup_X.XX.XXXXXXXX.exe**".
- 2- At the end of the installation, to start the interface click on the link "**SpeederOne.2**" on your desktop (if created) or on the "**SpeederOne.2.exe**" file that you find on the directory: "C:\ Program\SpeederOne.2" (or in the directory selected during installation).



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

After the program is started with the drive powered and connected to the pc, the following window will appear:



5.1 Interface

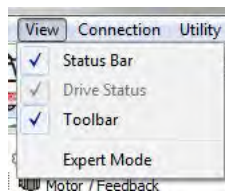
File

By clicking on it is possible to save and load drive's configuration file, create a virtual drive.



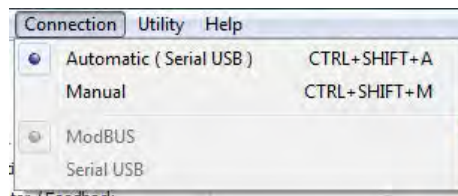
View

By clicking on it is possible to show/hide "Status Bar", "Drive Status", "Toolbar" and enable the "Expert Mode" to permit the user to write in the "Diagnostic" page.



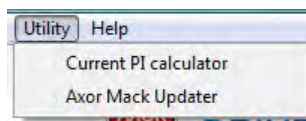
Connection

By clicking on "**Connection**" it is possible to select **Automatic** to connect all the drive connected to the PC (only for serial USB connections), **Manual** to connect to a single drive and select between ModBus / Serial USB for the type of Manual Mode.



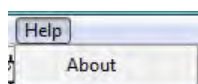
Utility

By clicking on "**Utility**" it is possible to found some useful tools.



About

This option shows the program version and additional information.



5.2 System Overview

SYSTEM OVERVIEW:

In "System Overview" it is possible to visualizes some drive's properties:

SYSTEM OVERVIEW	
DRIVE	
Name :	Mack Indy (COM 4)
Drive Version :	Mack Indy
Size :	3.5A
Firmware Version :	B044
Firmware Date :	2019.09.25 12:00
Hardware Version :	11.001.1
CONFIGURATION	
Motor Type :	BRUSHLESS
Feedback Type :	SERIAL ENCODER
Operative Mode :	10: Square Wave Period
COMMUNICATION	
ID (Can/Eth/485) :	1
CAN Baud Rate :	500 kbit/s

DRIVE / CONFIGURATION / COMMUNICATION

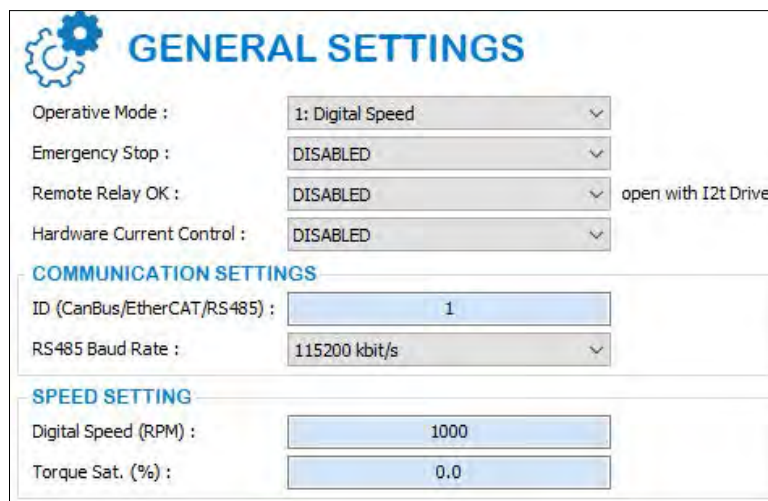
It visualizes the current setting of the drive:

- **Drive Version:** Drive Line
- **Size:** Nominal size in Ampere
- **Firmware Version:** Drive's current firmware
- **Firmware Date:** Drive's current firmware release date
- **Hardware Version:** Drive's motherboard version
- **Motor Type:** Current motor type selected
- **Feedback Type:** Current Feedback type selected
- **Operative Mode:** Current operative mode
- **ID(CAN/ETH/485):** CanBus / EtherCat / ModBus ID
- **Can Baud Rate:** CanBus Baud rate

5.3 General Settings

GENERAL SETTINGS:

In "General Settings" it is possible to change the operative mode and the relative settings:



The screenshot displays the 'GENERAL SETTINGS' window. It features a gear icon and the title 'GENERAL SETTINGS'. The settings are organized into sections: 'Operative Mode' with a dropdown set to '1: Digital Speed'; 'Emergency Stop' set to 'DISABLED'; 'Remote Relay OK' set to 'DISABLED' with a note 'open with I2t Drive'; and 'Hardware Current Control' set to 'DISABLED'. Below these is the 'COMMUNICATION SETTINGS' section with 'ID (CanBus/EtherCAT/RS485)' set to '1' and 'RS485 Baud Rate' set to '115200 kbit/s'. The 'SPEED SETTING' section includes 'Digital Speed (RPM)' set to '1000' and 'Torque Sat. (%)' set to '0.0'.

Remote Relay OK

It enables or disables the **Open with I2t Drive** function, which opens the programmed output during the alarm 6: "I2t Drive".

Hardware Current Control

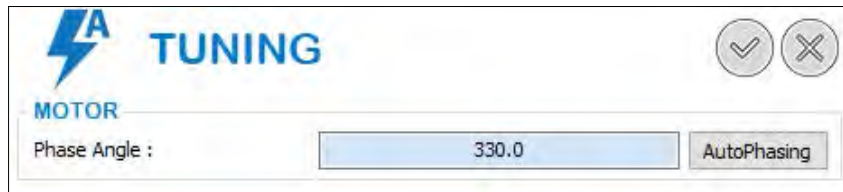
It enables or disables the Max limit output current of the drive using an Analog Input.

The "Operative Mode" menu allows you to select the operation mode of the drive. With every selection all associated information are automatically pre-disposed:

- **ID(CanBus/EtherCAT/RS485):** CanBus / EtherCat / ModBus ID
- **RS485 Baud Rate:** RS485 Baud rate
- **Can Baud Rate:** CanBus Baud rate
- **Digital Speed:** Digital speed reference
- **Torque Sat.:** Torque limit in % (0% means torque limit disabled)
- **Time Delay:** Square wave reverse time
- **Position 1:** Position 1.
- **Position 2:** Position 2.

5.4 Tuning

In "**Tuning**" it is possible to change the phase angle or run the AutoPhasing function.



- **Phase Angle**

It visualizes the phasing angle of the motor.

- **AutoPhasing**

When you select this option the program asks if it should execute motor phasing, if confirmed the motor automatically enables and executes.

5.5 Motor / Feedback

MOTOR / FEEDBACK:

In "**Motor/Feedback**" it is possible to change motor and feedback setting:

MOTOR / FEEDBACK

MOTOR SETTINGS

Motor Type : BRUSHLESS

N Of Poles : 08

FEEDBACK SETTINGS

Feedback Type : SERIAL ENCODER

Resolution (pulses/rev) : 2048

Step : 0

Motor Voltage : 0.0

Rpm.mot : 0

EMULATED ENCODER

Encoder Out : 2048 pulse/rev

Motor Settings:

- **Motor Type:** Select the type of motor.
- **N° Of Poles:** If the motor type is brushless then select the number of motor's pole.

Feedback Settings:

- **Feedback Type:** Set the type of the motor feedback.
- **Revolution (pulses/rev):** It contain the value of encoder pulses/rev.

Step, V. mot, RPM Mot change their function according to the configuration motor/encoder.

EMULATED ENCODER:

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

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

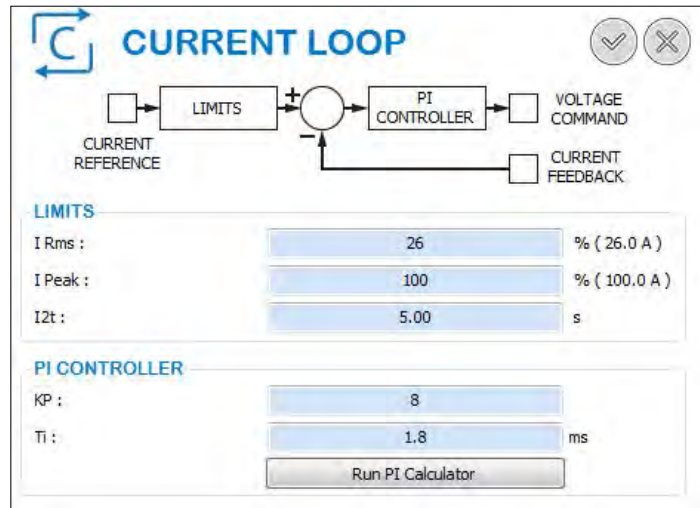
After the changes, save to the Eeprom and restart the drive.

Example: Utilizing a motor transducer with 2048 PPR, the settable values are: 2048, 1024, 512, 256, 128, 64, 32 and 16.

5.6 Current Loop

CURRENT LOOP:

In "Current Loop" it is possible to modify the dynamic constants of the drive's current loop:



I rms: In this box it is possible to insert the percentage value of the rated current furnished by the drive. The numerical range is between 1 and 50 and it is referred to the peak current value.

Example: suppose we have a drive size 8/16, if we insert into this box the value 15%, we'll have a setting of rated current equal to 2,4A (in fact $16 \times 15 / 100 = 2,4$), so the drive will provide a rated current equal to 2,4A to the motor.

I peak: In this section it is possible to insert the percentage value of the peak current furnished by the drive. The numerical range is between 1 and 100

Example: suppose we have a drive size 8/16, if we insert into this box the value 75%, we'll have a setting of peak current equal to 12A (in fact $16 \times 75 / 100 = 12$), so the drive will provide a peak current equal to 12A to the motor.

The value of nominal and peak current is RMS.

I2T: Time of the peak current.

Typically with an adjustment of $I_{peak} = 100\%$, the time will be 5 seconds.

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

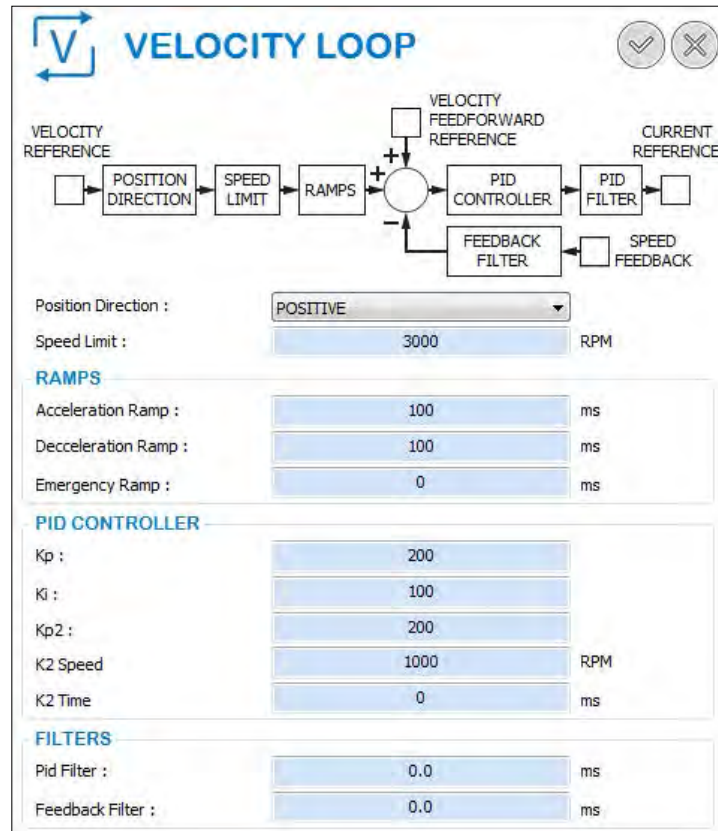
Ti: It is the integral time in "ms" of the current loop.

The numerical range of this parameter varies from 0 up to 999ms.

5.7 Velocity Loop

VELOCITY LOOP:

In "Velocity Loop" is possible to modify the dynamic constants of the drive's velocity loop:



- **Position Direction:** It allows you to set the rotor's sense of rotation: Positive (CW) or Negative (CCW).
- **Speed Limit:** In this box there is the max speed of the motor coupled with the drive.
- **Acceleration Ramp:** It is possible to insert the value of the acceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).
- **Deceleration Ramp:** It is possible to insert the value of the deceleration ramp "in ms". The range is between zero and 5000 ms (0-5sec).
- **Emergency Ramp:** It is possible to insert the value of the deceleration ramp "in ms" during the emergency stop.
- **Kp:** It is the proportional gain of the speed loop. This setting optimizes the dynamic behavior of the motor.
- **Ki:** It is the integral gain of the speed loop. This setting optimizes the dynamic behavior of the motor.

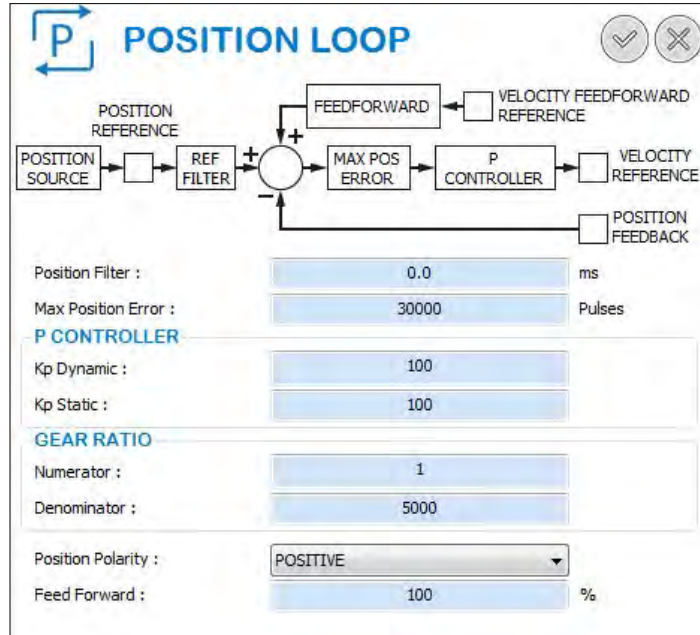
5.7 Velocity Loop

- **Kp2:** If enabled (K2 Time different from 0), it is the proportional gain of the speed loop when the speed is less than K2 Speed for K2 Time.
- **K2 Speed:** Max Speed reference for switch from Kp to Kp2 after K2 Time.
- **K2 Time:** When the motor speed drops under K2 Speed and the K2 Time has passed, the drive switches from Kp to Kp2 (the value 0 disables the function).
- **Pid Filter:** It is a filter on the output of the speed regulator.
- **Feedback Filter:** It is a filter on the feedback speed.

5.8 Position Loop

POSITION LOOP:

In "Position Loop" is possible modify the dynamic constants of the drive's position loop:



- **Position Filter**

It is a filter on the position reference. It can be used, at low speed, to limit axis' vibration or to make the system less noisy.

- **Max Position Error**

This is the position error after which the drive goes into alarm 14 ("Following Error").

- **Kp Dynamic**

This is the position loop gain. Suggested values: $1 \div 999$.

- **Kp Static**

Set as Kp Dynamic.

- **Numerator**

This is the number of complete rotation of the axis with the number of pulse(denominator) received.

- **Denominator**

Number of pulses necessary to do the rotation setted in the numerator.

- **Position Polarity**

Positive or Negative. This parameter enables a complete inversion of axis control.

- **Feed Forward**

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

5.9 Digital I/O window

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

DIGITAL INPUTS / OUTPUTS

INPUTS

SW	HW			FUNCTIONS	VALUE
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN1	ENABLE	
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN2	0:Off	
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN3	0:Off	
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN4	0:Off	
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN5	0:Off	
<input type="checkbox"/>	<input type="checkbox"/>	SW ENABLE	DGT-IN6	14:Alarm Reset	

OUTPUTS

HW		FUNCTIONS	VALUE
<input type="checkbox"/>	DGT-OUT1	0:Off	
<input type="checkbox"/>	DGT-OUT2	0:Off	
<input type="checkbox"/>	DGT-OUT3	18:Out Brake	

The "**St**" led visualises the **status (software)** of the digital inputs. Clicking on the button near the name of the digital input, the "St" led becomes red and a high logic signal is present on the input.

The "**Hw**" led visualises the **hardware status** of the digital input, if it is red a voltage is present on the input.

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

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

- There is a menu that allows you to select a **function**;
- There is a field where you can insert the **auxiliary variable** if necessary.

Digital inputs not programmable:

INPUT	FUNCTION	DESCRIPTION
IN1	Enable	It enables the motor rotation.
IN6	Reset Fault	It allows the reset the "resettable" alarms.

5.9 Digital I/O window

The **D.IN2...D.IN5** inputs can be set to enable the following functions:

FUNCTION	INPUT DESCRIPTION
0:Off	No function.
1:Ref-On	Enable motor rotation.
2:PStop (NC)	Positive limit switch normally closed. A low logical signal on this input disables the "CW" rotation of the motor.
3:NStop (NC)	Negative limit switch normally closed. A low logical signal on this input disables the "CCW" rotation of the motor.
4:Brake	Manual command for the digital output setted as "Out Brake"
5:Start Jog 7:Start Jog	It enables a movement having the following parameters: <ul style="list-style-type: none"> • 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.
6:Homing Sensor	Homing sensor.
8:Start Task Num	Start the task set by the auxiliary variable. There is no possibility of blending with this function.
9:Start Task I/O	Start the task set by the digital inputs. There is not possibility of blending with this function.
10:Start Sequence	Start a sequence of tasks. The first task is set by the digital inputs, 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.
11:Start Next	Start a sequence of tasks. The first task is set by the digital inputs, while the next tasks are set by using the "Next Profile" parameter associated to each task. At the end of each task the motor stops, the user has to click the task button (clicking twice: disabling and enabling) in order to start the next task of the sequence.
12:P+N Stop	Positive and negative limit switch. A low logical signal on this input disables the CW or CCW rotation of the motor.
13:Start Homing	Start the homing procedure.
14:Alarm Reset	Reset the "resettable" alarms.
15:Speed Inv.	Inversion of the motor rotation.

Very Important Notes:

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

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

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

5.9 Digital I/O window

Digital outputs not programmable:

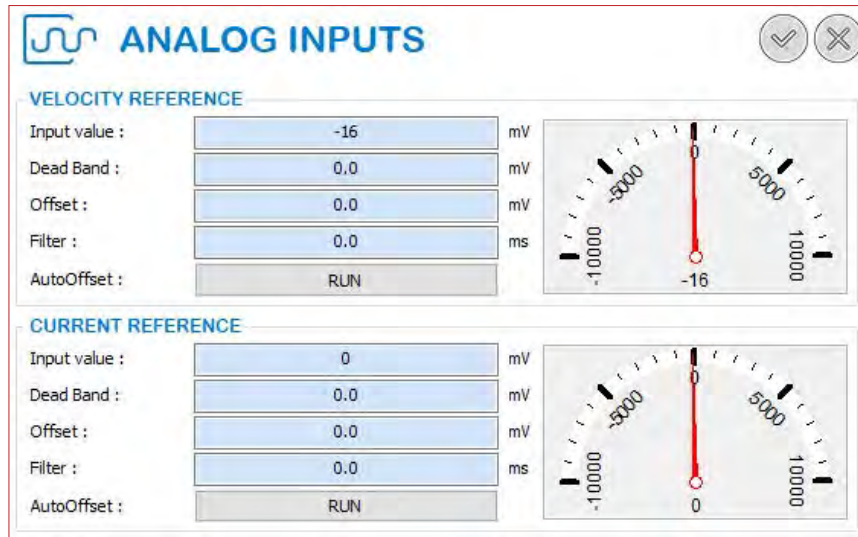
OUTPUT	FUNCTION	DESCRIPTION
OUT3	Brake	Digital output that allows to control an electromechanical brake motor via an external relay.

In the following table there are the setting functions for the two digital programmable outputs (**DGT-OUT1** and **DGT-OUT2**):

FUNCTION	OUTPUT DESCRIPTION
0:Off	Selecting this function the output will always be open.
1: 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.
2: 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.
3:Homing OK	The output will be closed after a complete and successful homing procedure. At the start of every new homing procedure the output will be opened.
4:I2t	The output will be closed if the I ² t condition is reached. When this condition comes down the output will be opened.
5: I_{rms}% >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.
6: I_{rms}% <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.
7:Target OK	The output will be closed after a successful position task. At the start of every new task the output will be opened.
8: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.
9:Ready	When the control circuitry is powered up (with a minimum delay), the output will be closed.
11:limitSw	The drive reached the software PSTOP/NSTOP setted in the profile position.
12: 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.
13: 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.
14:Next target	This function is to be utilized exclusively with either the Start Sequence function or the Start Next function on a programmable input. At the start of the first profile the output is opened and it will change status (toggled) at the start of every new profile.
28:ZeroToggle	Every time the motor passes form the the zero encoder, the output is toggled.
31:Blink	The output is switched about every 500ms.

5.10 Analog I/O window

This window allows you to control and condition the analog signal of the differential or common mode reference from the external controller.



- **Input Value**

It visualises in "mV" the voltage measured on the analog inputs. This value depends on the Offset, the Filter and the Dead Band settings.

- **Dead Band**

If the voltage on the analog inputs is within the range $[-\text{Dead Band}, +\text{Dead Band}]$, the analog reference is zero.

- **Offset**

Voltage in "mV" on the analog inputs taken as zero reference.

- **Filter**

Filter in "ms" on the analog input signal.

- **Auto Offset**

This button *automatically* executes the settings of the offset.

5.11 Alarms window

This window show if there is any fault state of the drive.



For detail about the alarms (see cap. 3.1 Alarms on page 52).

5.12 Homing window

This window allows you set the parameters of the **Homing procedure**:



The homing procedure uses the **signal of the homing sensor** and, eventually, the **zero signal of the encoder**.

Homing Method

It defines the type of homing.

Torque Limit

It allows limit the torque %, during the homing procedure

Acceleration

This is the acceleration and deceleration time for the homing procedure.

It is defined in milliseconds and allows values in ranges between 10 and 5000 ms. This time references the maximum motor speed set by using the "Speed Limit" parameter in the "Velocity Loop" setting.

Speed

This parameter sets the speed reference used during the homing process and it is given in "rpm". The admitted values are in ranges between 10 and 1000 rpm.

Zero Speed

This defines the motor's speed during the realignment with the homing sensor and/or during the search for the encoder's zero pulse from the motor feedback after the home sensor is reached.

It allows values in ranges between 1 and 50 RPM. We suggested utilising low values for this parameter in order to obtain good precision.

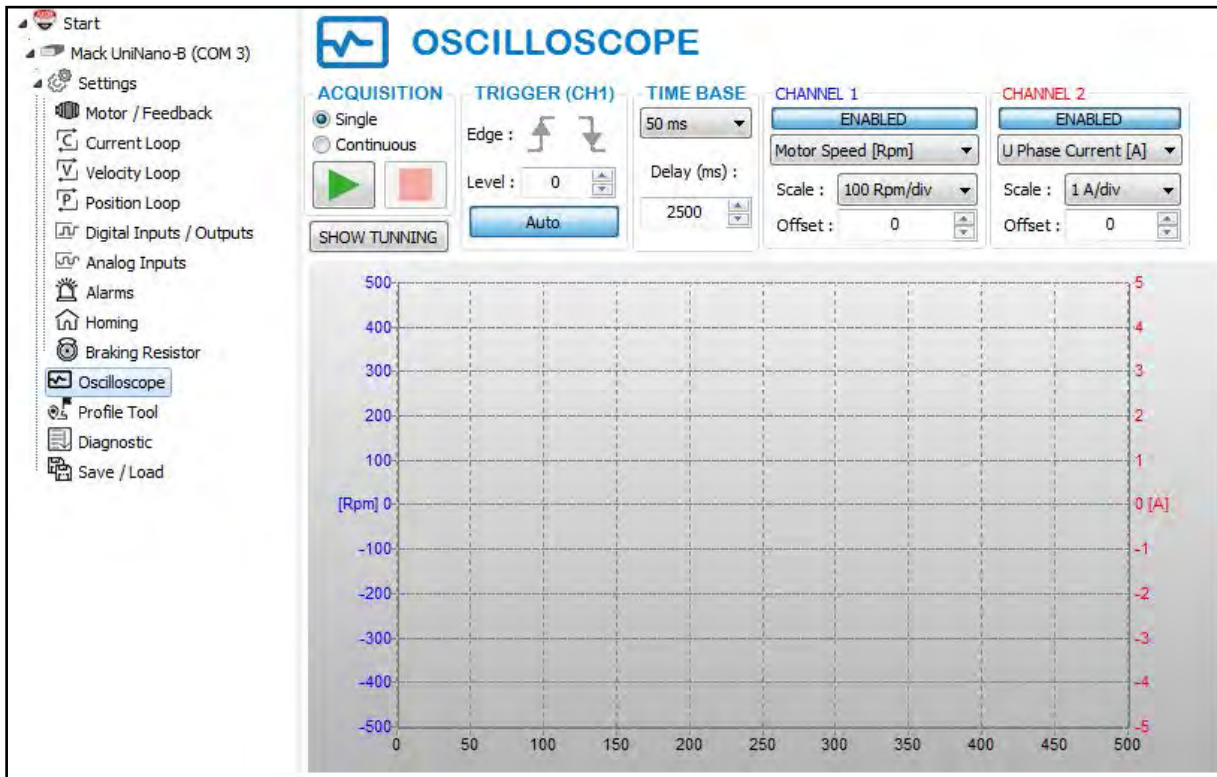
Home Offset

This defines the difference between the zero position for the application and the machine's home position (which is found during homing process). It is measured in pulses and the allowed values are in ranges: $\pm(2^{32}-1)$. This value is assigned to the home position found at the end of a successful homing process.

5.13 Oscilloscope

Clicking on "**Oscilloscope**" it is possible to open the digital oscilloscope.

The oscilloscope functions as a normal two channel digital oscilloscope and it allows visualizing: *motor speed, phase current, position error*, etc.



5.13 Oscilloscope

DATA ACQUISITION:



Single Acquisition

Selecting the *Single Acquisition* option, the oscilloscope's behaviour is dependant upon enablement/disablement of a trigger event:

CASE 1: If the trigger event is enabled on rising edge or falling one of signal in Channel 1, the oscilloscope waits for the first trigger event. At trigger arrival the trace is visualized and data acquisition is stopped. To capture a new trigger event it is necessary to start a new acquisition by clicking on the icon ►.

CASE 2: If trigger event is disabled, the oscilloscope acquires new data, it visualizes it, then it stops. To upgrade the trace it is necessary to start a new acquisition by clicking on the icon ►.

Continuous Acquisition

Selecting the *Continuous Acquisition* option, the oscilloscope's behaviour depends upon enablement/disablement of trigger event:

CASE 1: If trigger event is enabled on the rising or falling edge of a signal in Channel 1, oscilloscope waits until the first trigger event. At trigger's arrival the trace is visualized and it is updated at each trigger event.

CASE 2: If trigger is disabled, oscilloscope continually acquires new data and updates traces.

START/STOP DATA ACQUISITION:

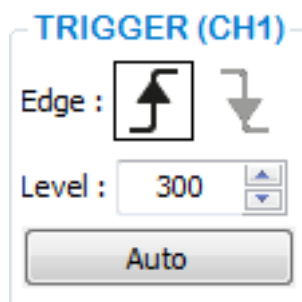


It starts data acquisition in both modes *Single* or *Continuous Acquisition*.

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

5.13 Oscilloscope

TRIGGER EVENT:



Enabling trigger event it is possible to acquire and visualize the traces only at the occurrence of a definite signal in Channel 1; that signal is characterized by a rising edge or a falling one and by a level (or amplitude). To enable a trigger event it is necessary:

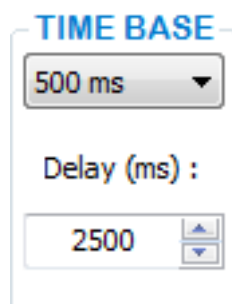
- 1st to set the rising or falling edge (**Edge** icons);
- 2d to set the desired level (**Level** parameter).

Clicking the **Auto** button it is possible to disable the trigger event \Rightarrow the oscilloscope will continue to acquire new data and update the traces.

You should use the **Auto** trigger function:

- During first acquisition, in order to know the scale of input signals;
- In presence of low repetitive signal rates;
- In presence of dc signals.

TIME BASE:



Time Base

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

Delay

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

The default value set for the Delay parameter is in the middle window.

5.13 Oscilloscope

SIGNAL SETTING:



Channel 1 (View) and Channel 2 (View)

This allows you to select the signal to visualize. The different options are as follows:

- The motor speed: **Speed [rpm]**
- The phase U current: **I_Phase_U [A]**
- The position error: **Posit_Err [Pulses]** (not yet enabled)
- The quadrature current: **Iq[A]**

Channel 1 (Scale) and Channel 2 (Scale)

The unit of vertical scale is automatically set by choosing an input signal:

- **Rpm/div** for speed
- **mA/div** or **A/div** for current
- **Pulses/div** for position error

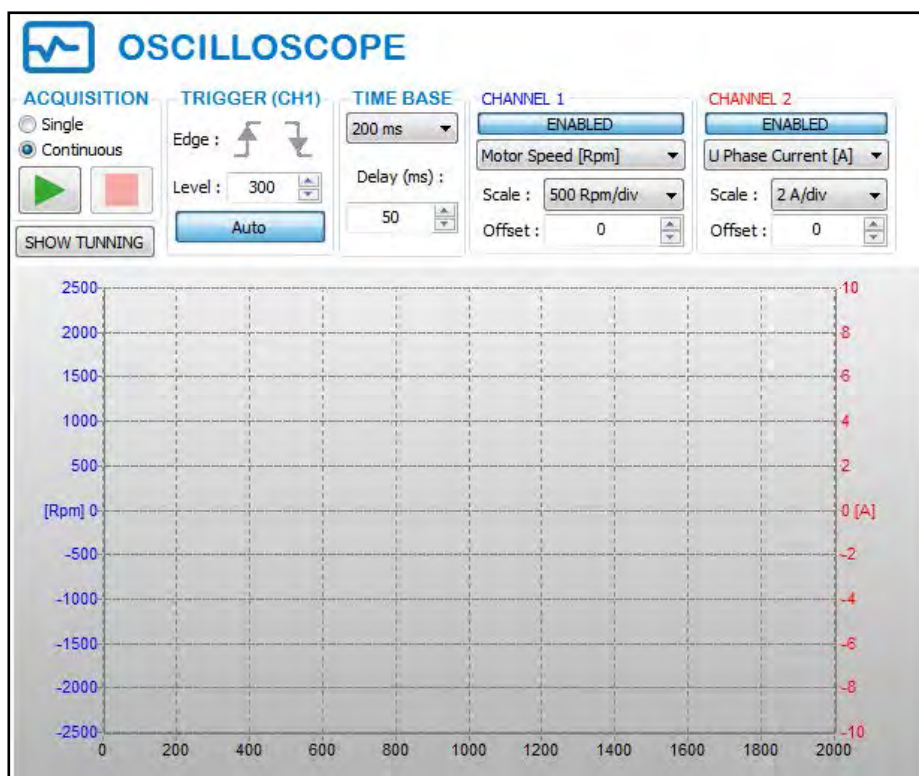
However, it is possible to change the scale selecting from values in the **Scale** menu.

5.13 Oscilloscope

EXAMPLE: Suppose we want to visualize by digital oscilloscope *motor speed* and *phase current*.

The procedure is described below:

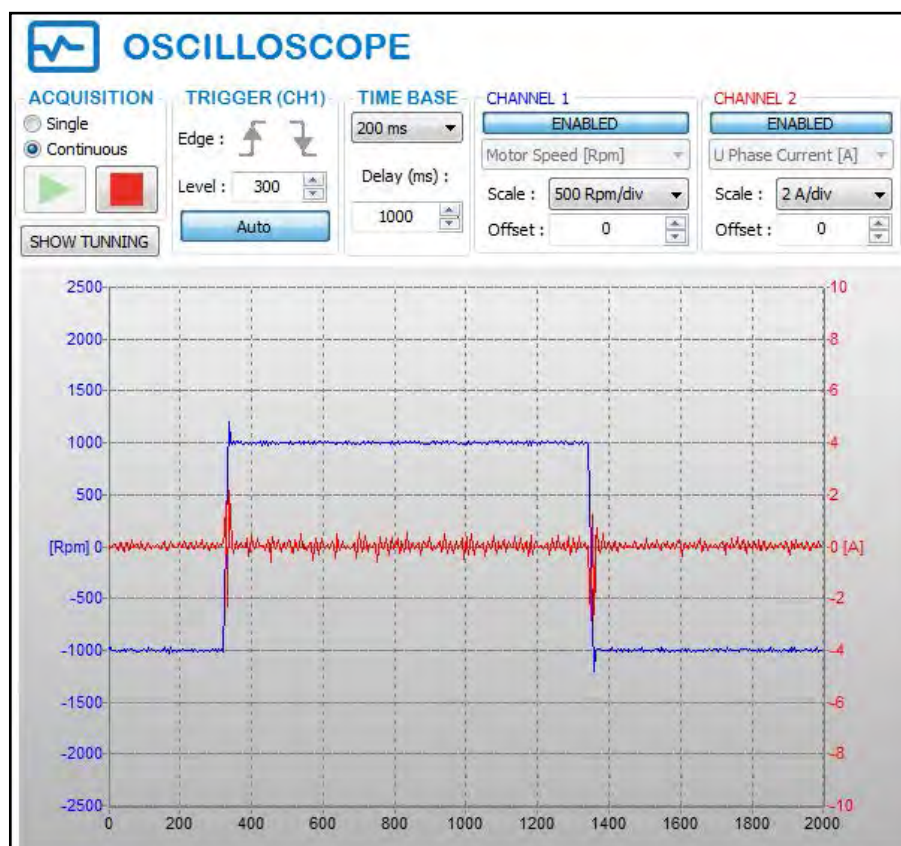
- 1- Follow the *base installation procedure* illustrated in the previous chapter.
- 2- Open the *Speeder One* interface and connect to the drive.
- 3- Select, for example, the operative mode "**Square Wave**", then set a *speed reference* equal to 1000rpm and a *square wave period* equal to 2000ms.
- 4- Open the **Oscilloscope** window by clicking on oscilloscope icon.
- 5- In the Oscilloscope window set the *initial parameters*:
 - a) Select **Continuous Acquisition**.
 - b) Trigger \Rightarrow click on **Auto** button.
 - c) Time base \Rightarrow set to 200ms/div.
 - d) Channel 1: View \Rightarrow select Speed[rpm].
Scale \Rightarrow select 500rpm/div.
 - e) Channel 2: View \Rightarrow select U Phase Current[A].
Scale \Rightarrow select 2A/div.



5.13 Oscilloscope

6- Enable the drive by clicking the **Enable** icon.

7- Start data acquisition by clicking the icon ►. Wait a few seconds in order to acquire traces:



8- Parameters corrections:

a) If necessary, *adjust the vertical scale* of speed and current:

- If the trace overflows the window ⇒ increase the scale.
- If the trace is too pressed ⇒ decrease the scale.

In the above visualized trace, it is not necessary to change the speed scale nor the current scale.

b) Set the *Trigger* on the rising edge (or falling edge) of the signal in Channel 1, choosing a trigger level based upon the signal to be visualized. Setting a level that is too high will result in no data acquisition.

Having the above visualized traces, it is convenient to set the trigger on the rising edge and with a level equal to 500 (in the range between -1000 and +1000); in fact setting a level too high (>1000 or <-1000) should result in no valid trigger event.

c) If necessary, *adjust the horizontal scale, Time Base* parameter:

- To visualize more periods of input signals ⇒ increase Time Base parameter.
- To visualize less periods of input signals ⇒ decrease Time Base parameter.

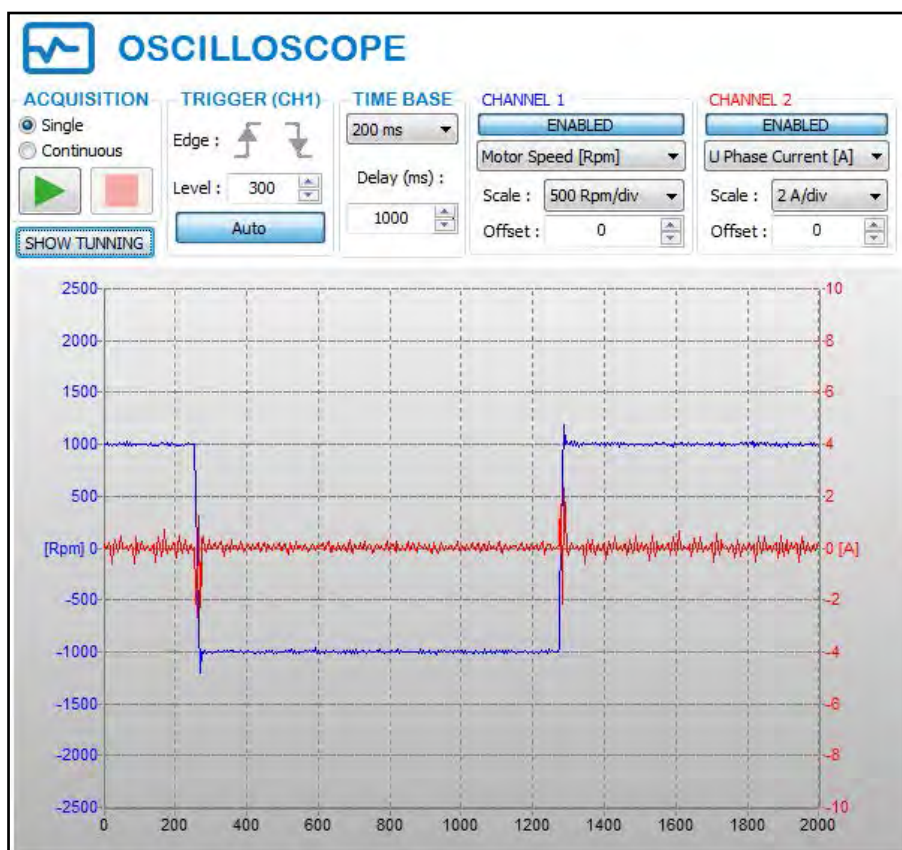
In the above visualized trace, it is not necessary to change the time base.

5.13 Oscilloscope

d) To avoid the continuous trace refresh and to visualize the signal on the first valid trigger event:

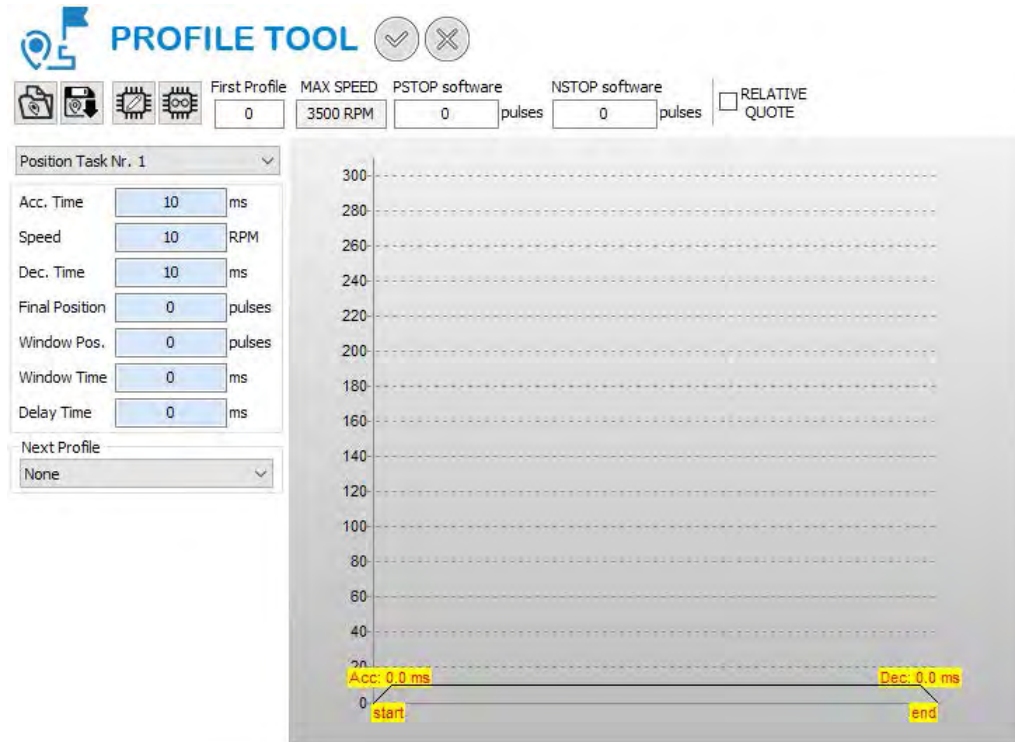
1. Click on icon ■.
2. Select **Single Acquisition**.
3. Click on icon ►.
4. At each new desired acquisition click on icon ►.

Doing the adjustments described above, we acquired the traces illustrated in the following:



5.14 Profile Tool

In "**Profile Tool**" window it is possible to manage the positioner integrated in the drive:



Final position

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

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

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

$$\text{Final position} = n^{\circ} \text{ turns (also not integer)} * 65536$$

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

5.14 Profile Tool

Acc Time

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

$$T_{acc} [ms] = \frac{Speed [rpm] * T_{acc_set} [ms]}{Speed_motor [rpm]}$$

where: **T_{acc}** = real acceleration time for the profile ramp;
Speed = speed set for the profile ("Speed" parameter);
Speed_{motor} = motor speed limit set on interface ("Speed Limit" parameter in the "Speed Loop" window);
T_{acc_set} = value inserted in the "Acc. Time" parameter.

Dec Time

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

$$T_{dec} [ms] = \frac{Speed [rpm] * T_{dec_set} [ms]}{Speed_motor [rpm]}$$

where: **T_{dec}** = real deceleration time for the profile ramp;
Speed = speed set for the profile ("Speed" parameter);
Speed_{motor} = motor speed limit set on interface ("Speed Limit" parameter);
T_{dec_set} = value inserted in the "Dec. Time" parameter;

Speed

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

Max Position Speed

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

Net Profile

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

Window Pos.

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

$$Window Pos = n^{\circ} \text{ turns (also not integer)} * 65536$$

Window Time

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

Delay Time

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

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

5.14 Profile Tool

PSTOP Software

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

NSTOP Software

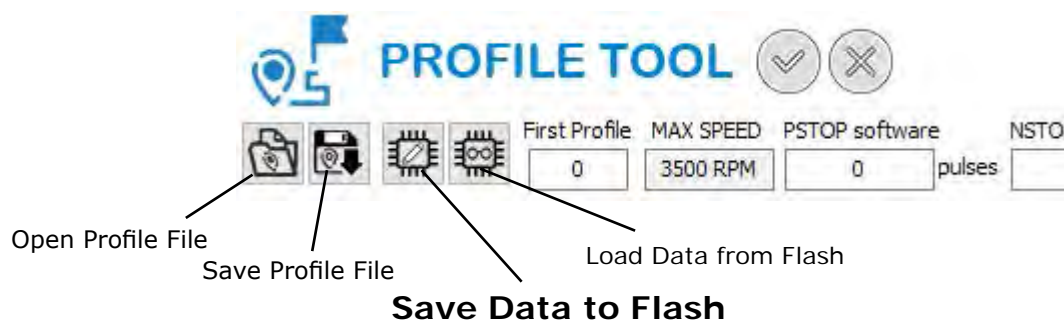
If the Final Position parameter is greater than the NSTOP Software, the task stops when the NSTOP target is reached.

First profile

Set the initial profile, if 0 the drive start the task 1.

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

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



Load Data from Flash

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

Save Data to Flash

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

Save Profile File

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

Open Profile File


It permits the loading of the parameters saved on a file.

Note: The functions **Save Profile File** and **Open Profile File** are very useful if you want to configure more than a drive with the same setup.

In this case you can configure all parameters on a drive, save in flash and save the setup on a file. For other drives it is not necessary to configure one by one the parameter of the single task but you can use the file saved before and load the parameter saved on the file. After this save the parameter into flash.

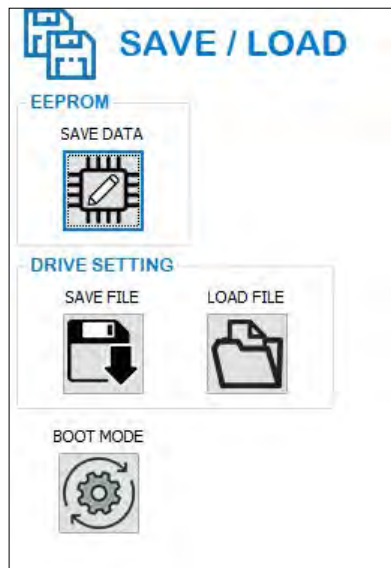
5.15 Diagnostic

This window allows you set all the parameters (advance mode):

 DIAGNOSTIC						
Description	Address	Min.	Max.	Read (decimal)	Read (hex)	Write
Drive Address	2	1	32767	1	0x0001	
Baud rate Rs485	3	0	32767	1152	0x0480	
Baud rate Can	4	50	1000	500	0x01F4	
CAN_CW	5	-32768	32767	0	0x0000	
CAN_SW	6	-32768	32767	5200	0x1450	
Nr. of motor poles	7	-3	56	8	0x0008	
Nr. of resol. poles	8	2	12	2	0x0002	
Encoder pulses/turn	9	1	8192	2500	0x09C4	
I2T motor	10	0	999	0	0x0000	
Phase angle	11	0	3600	384	0x0180	
Feedback type	12	0	20	4	0x0004	
I rated	13	1	50	26	0x001A	
I max	14	1	150	100	0x0064	
Kp current Iq	15	0	999	8	0x0008	
Ti current Iq	16	0	999	18	0x0012	
Analog In 1 Filter	17	0	1000	0	0x0000	
Kp current Id	18	0	999	0	0x0000	
Ti current Id	19	0	999	0	0x0000	
Fair_Fiera	20	-32768	32767	0	0x0000	
I2T drive	21	0	999	500	0x01F4	
Analog In 2 Filter	22	0	1000	0	0x0000	
Kp speed	23	0	2000	200	0x00C8	
Ki speed	24	0	2000	100	0x0064	
Kd speed	25	0	32000	200	0x00C8	
Feedback filter	26	0	999	0	0x0000	
Reference filter	27	0	999	0	0x0000	

5.16 Save/Load

This window allows you to:



SAVE DATA

Save the drive configuration in the Eeprom permanently.

SAVE FILE

It allows you to save the drive configuration in a file on your PC.

LOAD FILE

It allows you to load the drive configuration from a file on your PC.

BOOT MODE

Put the drive in BOOT MODE.

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.



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