ever
e-MOTION SOLUTIONS

Manual for Installation Use and Maintenance

CE

RoHS COMPLIANT

LW3D3032N0A1-00
LW3D3070N0A1-00

TITANIO
VECTOR - STEPPER - DRIVES

error less servo efficient technology else®
by Ever Elettronica

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Release	Build	Name	FA	Action	Date
0.0	00	Sonzogni	HD	First release	17 aprile 2015
0.0	00	Sonzogni	HD	First emission	25 gennaio 2016
0.0	00	Bianchi	CM	Graphical release	22 aprile 2016
0.1	00	Bianchi	CM	Update	23 giugno 2016
0.1	00	Bianchi	CM	Update of the heatsink mounting holes at pag. 6 and protection of the FAULT output at pag. 14.	2 september 2016

Printed in Lodi - Italy - September 2nd 2016

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1 INTRODUCTION

1.1 Guarantee

Ever Elettronica guarantee that their motors and drives supplied to the client (end user, machine builder or distributor), are free of defects caused by materials, shipment operations and packaging and to meet the guarantee in accordance with the client's specifications who has accepted the written terms defined by Ever.

The product guarantee is valid for the duration of one 3 year from the date of construction, which is indicated by the code on the label present on the system.

During the guarantee period of the product, Ever is in no case responsible for damages to the product caused by improper storage or installation, negligent maintenance or unauthorized modifications or repairs to the product.

The responsibility of EVER is limited to the reparation (or replacement at their insight) of any manufactured product, or part of it, which is defect due to defect materials or a manufacturing defect, in accordance with the guarantee conditions of EVER.

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EVER dissuades the use of its products in applications that support vital functions where in the damaging or failure of its products can directly threaten the life or safety of persons, other living beings and things. The user that applies the EVER products to applications that support vital functions is responsible for all risks during the use and the indemnify of EVER from all caused damage.

1.2 In this manual

The symbols used in this manual have the following meaning:

Danger
Warning
Caution

Used for circumstances in which the life or health of the user are exposed to danger or where in serious damage to the materials may occur.

Attention!

Special instructions *for a safe use and an effective installation.*

Information

Used to stress ***important additional information.***

EMC

An essential element to stay within the limits specified by the EMC directives is, in addition to the use of filters, the installation in accordance with the EMC requirements.

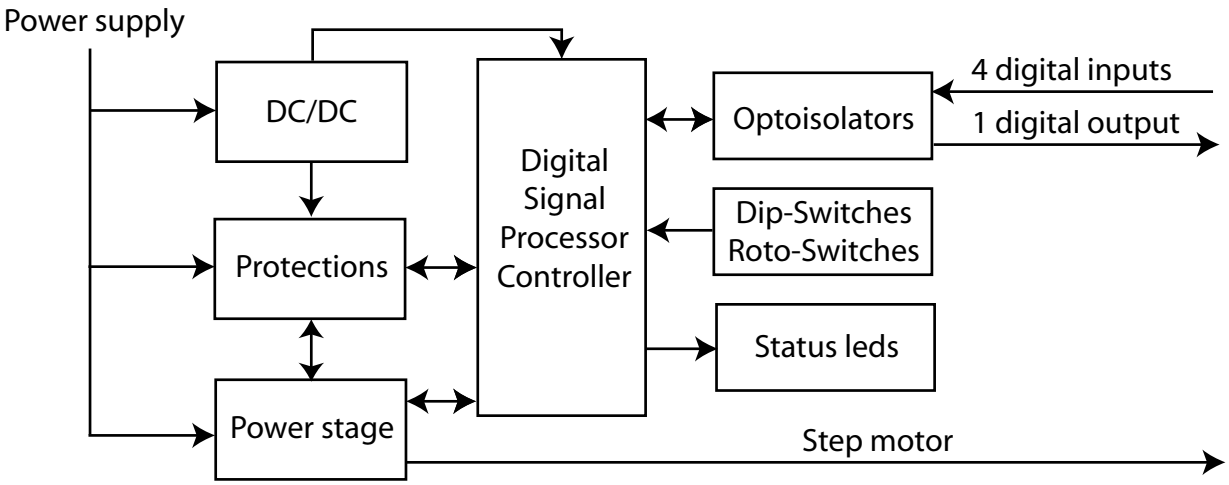
1.3 General drive description

The information in this manual refers to the standard versions of the drives LW3D30xxN0A1-00.
Where there is the general indication, the informations should be considered applicable to all version.

The drives have been designed to drive with stepless technology 2 phase stepper motors, keeping the phase current sinusoidal regardless from the selected step angle resolution, in order to realize fluid movements and precise positioning.

The drives can control the motors with winding current up to 10A peak (7.1Arms) current with a DC power supply voltage from 24 to 80 Vdc.

The diagram shows the functional blocks composing the drives:



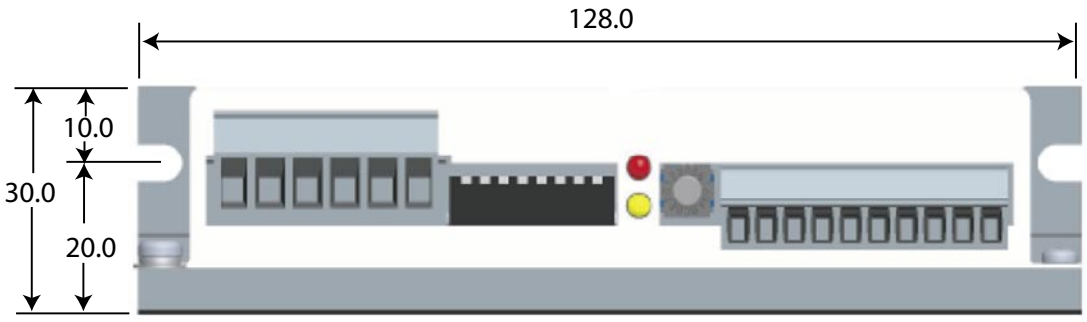
As shown in the block diagram, the functions of the drives are controlled by 4 digital opto-isolated inputs.

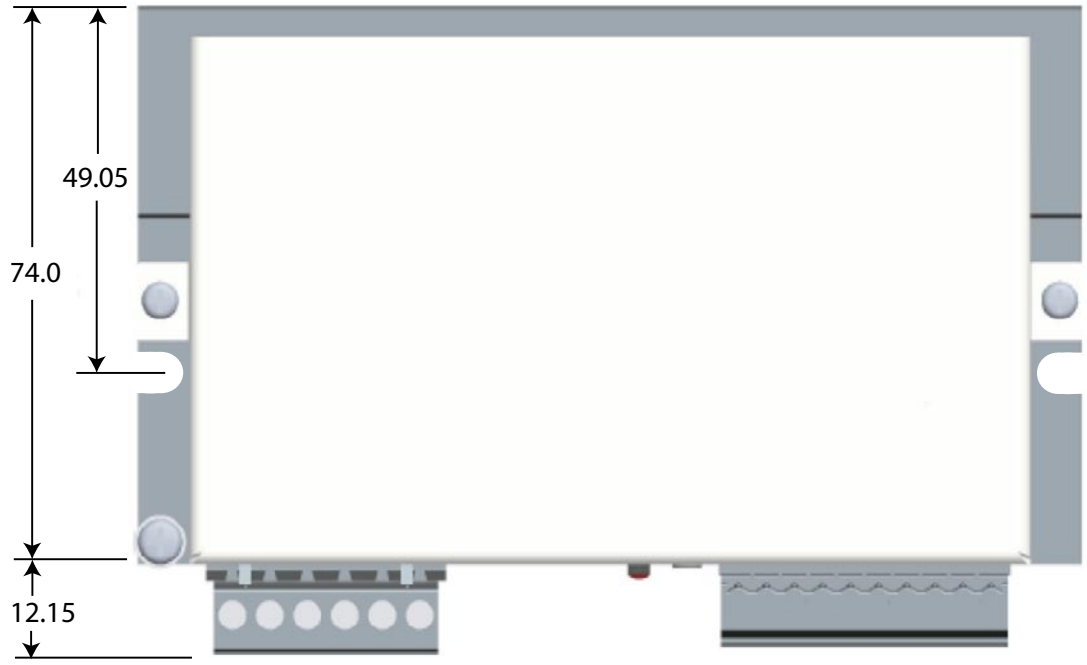
A digital output communicates to the external world the protection intervention (FAULT).

2 FUNCTIONAL CHARACTERISTICS

2.1 Mechanical and Environmental

	LW3D30xxN0A1	UNIT	NOTES
Dimensions	128 x 74 x 30 (L x D x H)	mm	Excluding the footprint of the mating connectors. (For details check the following mechanical design).
Weight	290	gr	Excluding the mating connectors.
IP protection class	IP20	-	
Pollution Degree	2	-	
Operating temperature	5°C ÷ 40°C	°C	
Storage temperature	-25°C ÷ 55°C	°C	
Umidity	5% ÷ 85%	%	Without condensing.





2.2 Electrical

2.2.1 Power supply

For the functioning of the drives a DC power supply is needed.
For the technical specifications, limitations and connections regarding the power supply, refer to the chapters ***3.2 Planning the power supply*** and ***3.3 Choosing the stepper motor***.

		LW3D3032			LW3D3070			UNIT	NOTES
		MIN	TYP	MAX	MIN	TYP	MAX		
DC Power supply	Nominal Voltage	24		80	24		80	Vcc	Nominal range
	Input Limit Voltage	21		88	21		88	Vcc	Including the ripple and the network fluctuations.
	Minimum current	0.23			0.23			Arms	@ motor current zero V+=minimum allowed, without load to the shaft.
	Maximum current			2.4			7.1	Arms	@ maximum motor current V+=maximum allowed, full step, maximum load to the shaft. **(1)**
	Power			300			880	VA	@ maximum motor current V+=maximum allowed, full step, maximum load to the shaft. **(1)**
Motor	Current	0.21		3.2	1.7		7.1	Arms	Settable by Dip-switches.
		0.3		4.5	2.4		10.0	Apk	
	PWM Frequency	Ultrasonic 40KHz (one event every 25µsec)						KHz	
	Step angle	Full step, ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/5, 1/10, 1/25, 1/50, 1/125, 1/250							Settable by Roto-switch R1.
	Rotation speed			3000			3000	RPM	**(2)**
Driver status	2 LEDs	Green LED Red/Yellow LED							

(1) The maximum current and power consuption depend from the motor, the load applied to the shaft and the motion parameters set.

(2) Theoretical rotation limit managed by the drive, depending on the following physical parameters: power supply voltage, phase current, dynamic motor characteristics, load to the shaft.
Outside this limit, the drive is not able to guarantee a correct sequences control.

Protections and warinings:

PROTECTION	TRIGGER	EFFECT	RESTORE
Over Current Fast electronic protection on the motor outputs against short circuits between the motor phases and between the phases and ground.	Short circuit or excessive current absorption.	- opening of the drive power stages; - LEDs signalling; - opening the FAULT output.	It's necessary to remove the power supply to the drive to eliminate the cause of the protection.

PROTECTION	TRIGGER	EFFECT	RESTORE
Open Phase Detects an open circuit on the motor phases.	Motor connection not right.	- opening of the drive power stages; - LEDs signalling; - opening the FAULT output.	It's necessary to remove the power supply to the drive to eliminate the cause of the protection.

PROTECTION	TRIGGER	EFFECT	RESTORE
Over Temperature Detects an over temperature of the heatsink.	Temperature of heatsink >75°C.	- opening of the drive power stages; - LEDs signalling; - opening the FAULT output.	It's necessary to remove the power supply to the drive to eliminate the cause of the protection.

PROTECTION	TRIGGER	EFFECT	RESTORE
Over/Under Voltage Detects a power supply voltage outside the functioning range.	Low power supply voltage, too high, extra voltages due to BEMF generated by the motor dragged by the load. **(1)**	- opening of the drive power stages; - LEDs signalling; - opening the FAULT output.	It's necessary to remove the power supply to the drive to eliminate the cause of the protection.

WARNING	TRIGGER	EFFECT	RESTORE
Stall detection Detects a stall of the motor.	Load on the motor too high.	- LEDs signalling; - opening the FAULT output.	It's necessary to make a toggle on ENABLE input or removing the power supply to the drive to eliminate the cause of the protection.

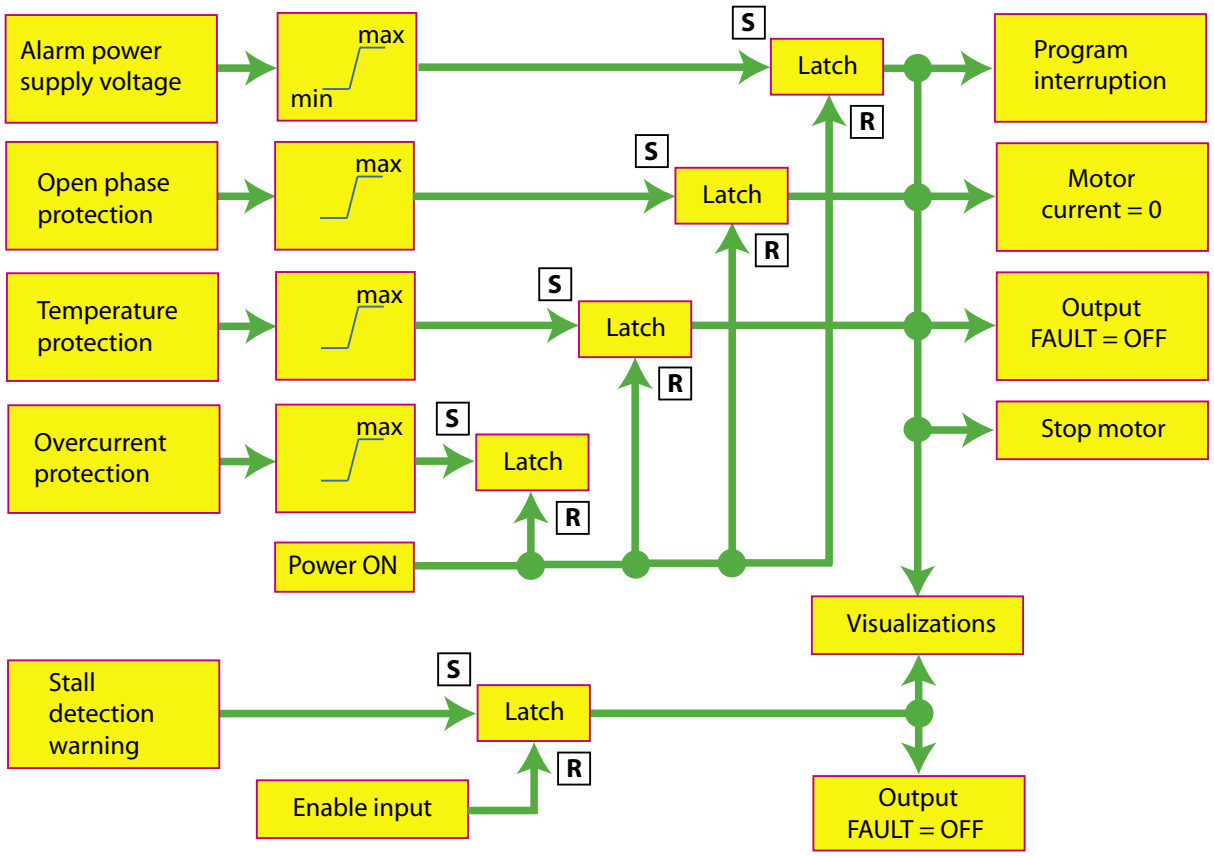
(1) Note : the voltage value is measured on base of the power supply for the motor. Eventual voltage out of range Range of 24V$_{DC}$ for digital output can't be detected.

When the protection interrupt the power supply of the motor, no maintenance torque (Holding Torque) is supplied and the load can drag the motor shaft. **The user must provide devices which will ensure the safaty of the load.**

In deafault condition all Dip-Switches=OFF.

A detailed description of the protections and the related visualizations is given in paragraph ***3.7 Analyses of malfunctions***.

FUNCTIONAL DIAGRAM OF THE PROTECTIONS AND WARNINGS



NOTES

2.2.2 Digital Inputs

The drives are equipped with 4 digital inputs for the control of the functions:

• Boost current	**BOOST**
• Enabling of the power stage	**EN**
• Step (or CLK_UP)	**STEP**
• Direction (or CLK_DWN)	**DIR**

All digital inputs are available on CN2 connector of the drive and they can be used at voltages **2-24Vdc**.
For information regarding the connection to the digital inputs, refer to paragraph ***3.5.1 Connection to the drive***.

The functionality of the inputs depends on the settings of DIP 6 and 7.

- **BOOST: i**ncrease the phase current of 20%.
BOOST input closed, the drive increases the phase current of 20% from phase current setting.
BOOST input open, the phase current is the nominal phase current setting.
The BOOST current function is useful during the acceleration and deceleration time and while the load on the motor is variable.

With rated current setted near to the maximum, the percentage increase during the boost will not be 20% but will be limited to reaching the maximum value. The phase current in the motor, can NOT exceed the max current value of the drive.
Choose the motor type depending on BOOST current function.

- **EN (ENABLE):** enable or disable the current in the motor in function of **DIP6** status.

***DIP 6 OFF --> Disable Mode* - input closed = disable the motor current.**
***DIP 6 ON --> Enable Mode* - input open = enable the motor current.**

For other information about the functioning mode of the input EN – ENABLE, refer to paragraph ***3.5.2.5 Functioning mode of the EN input***.

When the current in the motor windings is zero, no maintenance torque is supplied (Holding Torque) and the load can drag the motor shaft.

In applications where in a maintenance torque is necessary at stand still of the motor, keep the winding current at motor stand still or provide a braking system.

- STEP – Step or CLK_UP: the motor executes a step for each switch of this input.
The function depends on the **DIP7**.

***DIP 7 OFF* --> STEP input = STEP, DIR input = Direction.**

The motor executes a movement in steps equal to the number of pulses applied to the STEP input. To change the motion direction, it's necessary to change the DIR input status..

***DIP 7 ON* --> STEP input = CLK_UP, DIR input = CLK_DWN.**

The motor executes a movement in a direction when the step pulses are applied to the STEP (CLK_UP) input and in the opposite direction when they are applied to the DIR (CLK_DWN) input.

For more information about the functioning of the STEP input, refer to paragraph ***3.5.2.6 STEP/DIR or CLK_UP/CLK_DWN Mode***.

Steps per Rotation Table:

The rotation measured in degrees of the motor shaft, for every single step pulse depends on the settings of the Roto-switch R1 (refer to paragraph 3.5.2.2 Step angle). The following table shows the number of necessary step pulses to let the motor shaft execute a full rotation (360°) and the rotation in degrees executed by the motor shaft at every step pulse (the table refers to 50 poles motors, 1.8° per full step.).

STEP TYPE	STEPS PER ROTATION	STEP DEGREE
Passo pieno	200	1.8°
1/2 passo	400	0.9°
1/4 passo	800	0.45°
1/8 passo	1600	0.225°
1/16 passo	3200	0.1125°
1/32 passo	6400	0.05625°
1/64 passo	12800	0.028125°
1/128 passo	25600	0.0140625°
1/256 passo	51200	0.00703125°
1/5 passo	1000	0.36°
1/10 passo	2000	0.18°
1/25 passo	5000	0.072°
1/50 passo	10000	0.036°
1/125 passo	25000	0.0144°
1/250 passo	50000	0.0072°

*Paragraph **3.5.2.2 Step angle** shows a formula to calculate the step frequency (Hz) necessary to obtain the desired rotation velocity (RPM) depending on the set step angle.*

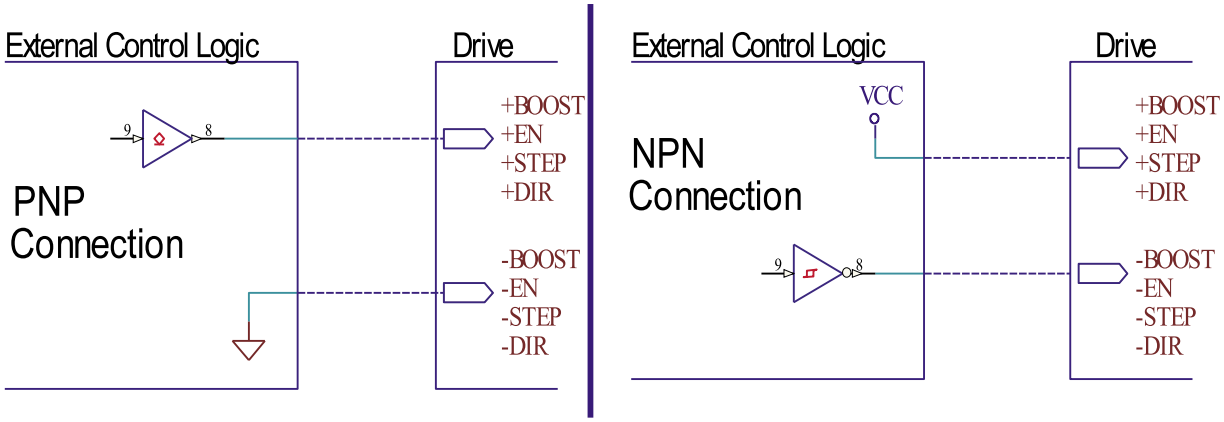
- DIR – Direction or CLK_DWN: rotation direction of the motor. The function depends on **DIP7** status. *See note about DIP7 related to the STEP input.*

For more information about the functioning of the DIR input, refer to paragraph ***3.5.2.6 STEP/DIR or CLK_UP/CLK_DWN Mode.***

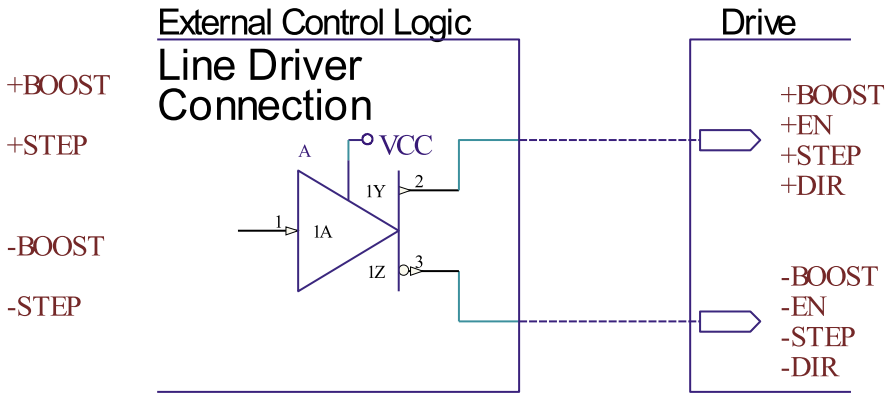
The clockwise or anti-clockwise rotation direction of the motor depends, besides on the DIR input status, also on the connection of the motor windings. To avoid wrong movements and possible damages, the rotation direction must be checked before fixating the motor to the load.

The following figures supply some examples of possible connections to the digital inputs:

Voltage: 3.3 – 24 Vdc



Voltage: 2 – 24 Vdc



N.B. It's recommended to use 2Vdc digital inputs only in Line-Driver configuration to have more noise immunity..

For a proper use, the Digital inputs must be wired using shielded cables. The connection of the screen has to be valued for every application; depending on the layout of the machine. Generally, it's more utile to connect the screen from both sides to the ground. It's important that the cables of the digital inputs are not exposed to disturbing sources. Therefore it's important to follow the instructions of paragraph ***3.5.1.4 Guideline for wiring.***

Electrical specification of digital inputs:

TYPE	CHARACTERISTICS	MIN	MAX	UNIT
Standard (EN, BOOST)	Supply voltage	2	24	Vdc
	Input frequency	-	10	KHz
	Threshold switching voltage	1.61	-	Vdc
	Current at 2Vdc	-	3.13	mA
	Current at 3.3Vdc	-	5.84	mA
	Current at 5Vdc	-	6.28	mA
	Current at 24Vdc	-	8.75	mA
High-speed (STEP, DIR)	Supply voltage	2	24	Vdc
	Input frequency	-	1	Mhz
	Threshold switching voltage	1.61	-	Vdc
	Current at 2Vdc	-	2.53	mA
	Current at 3.3Vdc	-	5.84	mA
	Current at 5Vdc	-	6.28	mA
	Current at 24Vdc	-	8.75	mA

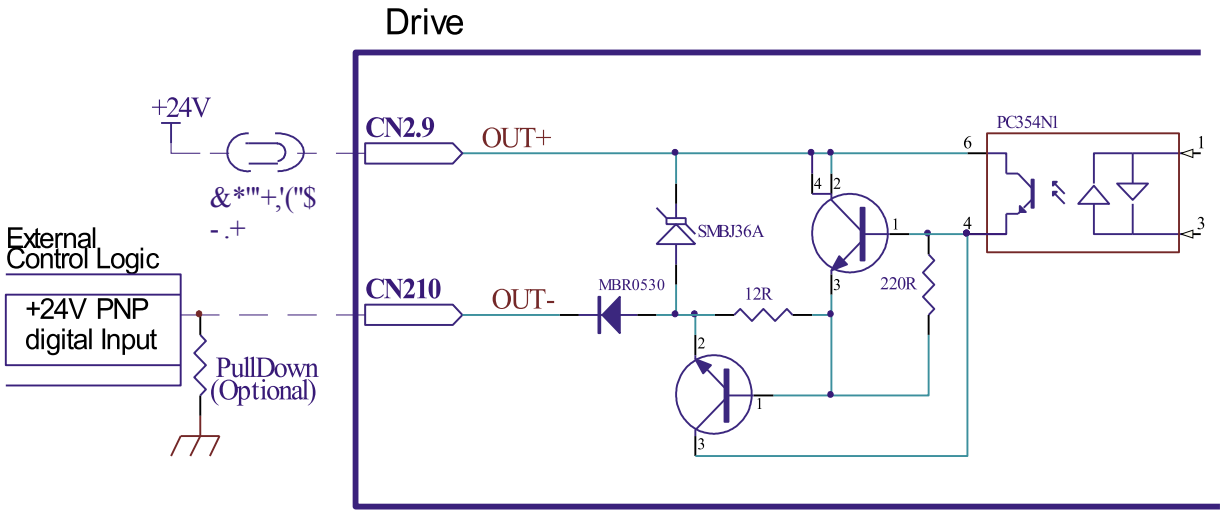
2.2.3 *Digital FAULT Output*

Through this digital output you can check the operational status of the drives.

	FAULT OUTPUT	MEANING OUTPUT	VISUALIZATION
1	Not engaged (Transistor open)	Not ready – FAULT One or more active protections.	Green LED OFF and FAULT visualization following paragraph ***3.5.3 Operational statuses and their signals.***
2	Output engaged (Transistor closed)	System ready and operational.	Green LED ON or blinking.

The FAULT output is dimensioned to function at VOUTmax=24Vdc, IOUTmax=100mA and it's protected from inversion of the polarity.

Schematic of the digital FAULT output for example of the connections:



Electrical specifications:

TYPE	CHARACTERISTICS	MIN	TYP	MAX	UNIT
PNP Transistor Output	Power supply voltage output	19	24	30	V
	Output current **(1)**	-	-	100	mA

(1) Depends from the load.

Attention : <u>the FAULT output is not protected in current.</u>
Provide an external current limitation device (I_{OUTmax} = 100mA).
The protective device may be placed on the output power conductor +24V_{DC} (CN2.10).

2.3 Standards

The EVER drives have been designed and produced observing the following Directives and Standards:

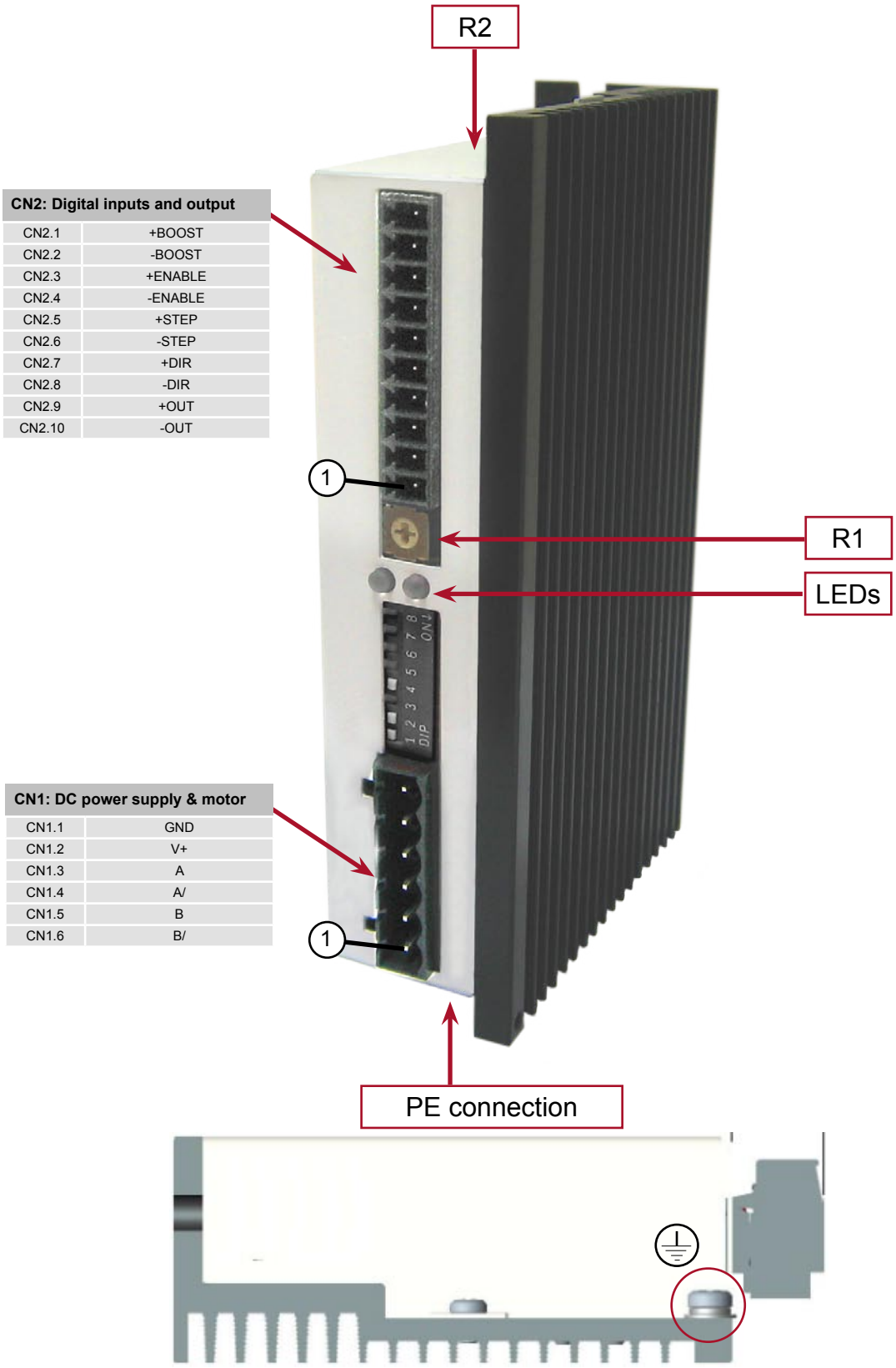
Directives:	2014/35/EU	Low Voltage
	2014/30/EU	Electromagnetic compatibility
Standards:	EN 61800-3	Variable speed drives – Electromagnetic compatibility and specific testing methods
	EN 61800-5-1	Variable speed drives – Safety requirements

The compliance with the Electromagnetic Compatibility directives of the EVER product can only be verified if the entire machine, where from the drive is a component, has been designed and realized in compliance with the requirements for Electromagnetic Compatibility.

The installation of the drive has to be executed in accordance with the guidelines outline in chapter ***3 DRIVE INSTALLATION .***

3 DRIVE INSTALLATION

In this section are given some guidelines for the safe installation of the drives and the stepper motor.



CN2: Digital inputs and output	
CN2.1	+BOOST
CN2.2	-BOOST
CN2.3	+ENABLE
CN2.4	-ENABLE
CN2.5	+STEP
CN2.6	-STEP
CN2.7	+DIR
CN2.8	-DIR
CN2.9	+OUT
CN2.10	-OUT

CN1: DC power supply & motor	
CN1.1	GND
CN1.2	V+
CN1.3	A
CN1.4	A/
CN1.5	B
CN1.6	B/

3.1 Safe installation and use of the unit

Only qualified staff is allowed to install the drives, after having read and understood the information in this manual. The installation instructions have to be followed and approved. Eventual doubts need to be clarified with the supplier of the equipment before using.

EVER will not take any responsibility for indirect damage due to negligence, wrong installation, modifications to the product without approval or wrong connections of the equipment to the wiring.

SECURITY
In particular, the user must:

- remove the power supply before realizing or removing a connection;
- ot work on the drive without that has been realized a ground connection for the drive and the motor. The Protective Earth connection (PE) has to comply with the local requirements in force;
- not establish connections to the internal circuit of the drive;
- wait until the green LED light is switched off before manipulating or executing maintenance to the drive;
- not use the digital ENABLE input as safety stop. Always remove the power supply voltage from the drive to establish a safe switching off;
- pay attention to the heat loss of some parts of the drive: using the drive in extreme applications, some surfaces reach high temperatures. Before disconnecting the device, wait until it has cooled down;
- in case of missing voltage the motor is not able to keep the load: it's thus forbidden to use the motor if the condition of missing holding torque of the motor can create a dangerous situation, unless the user provides special devices to block the load.

The negative pole of the power supply is NOT connected to the ground through an internal connection to the drive. If this default connection doesn't suit the requirements of the application, the user needs to refer to support@everelettronica.it for the necessary technical information.

ELECTROMAGNETIC COMPATIBILITY

Take all precautions and requirements which are necessary for the compliance with the electromagnetic compatibility (drive is in Category C3 following standard EN 61800-3).

Some disturbances generated by other insufficiently filtered and/or shielded equipment, can cause malfunctions in the drive which can result into uncontrolled movements.

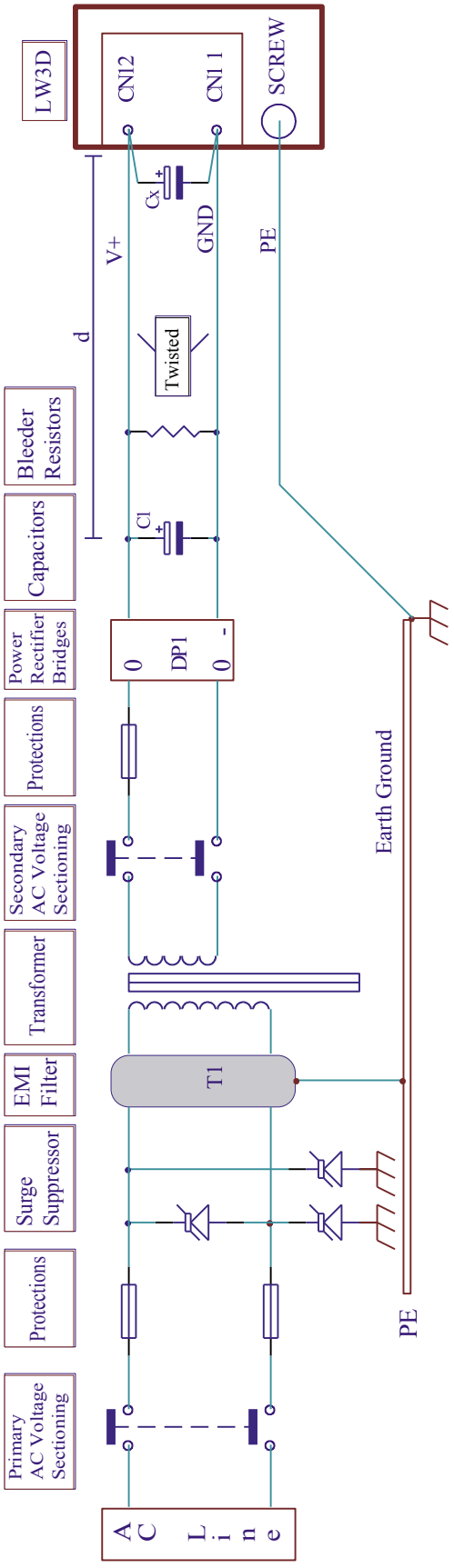
When making the connections, take into account the requirement of paragraph ***3.5.1.4 Guideline for wiring.***

When the emissions generated by the working drive are not adequately filtered, the correct functioning of other devices can be disturbed.

NOTES

3.2 Planning the power supply

Circuit and power supply connection schemes.



Main characteristics of the drive power supply:

AC network switch: is a recommended safety device.

Primary protections: use fuses on the AC bus or an equivalent safety switch.

Surge suppressors: on the primary circuit, they protect the drive against Surges coming from the primary network power supply.

EMC filter: is generally necessary to satisfy the EMC compatibility requirements related to the emissions. An EMC filter is recommended in case of sensible circuits powered by an AC line. If a commercial line filter is chosen, one needs to take into account the total RMS current of the powered system.

The AC line filter needs to be installed following the builder's directives. Generally, the filter needs to be inserted between the principal AC line and the transformer, if the last one is positioned near the drive or to the electrical cabinet, between the transformer and the rectifier bridge in the other cases, keeping the bridge near the drive, and keeping the connection between the filter and the transformer as short as possible.

Transformer: The primary circuit of the transformer must be dimensioned in function of the characteristics of the AC power supply line. The voltage peaks on the secondary circuit if the transformer are equal to 1.41*secondary RMS voltage. The DC power supply voltage must not exceed the Vdc power supply voltage of the drive.

DON'T use an Auto-transformer to interface with the electric network. Only a transformer guarantees the galvanic isolation necessary for electrical safety.

The power of the transformer depends on the power required by the motor: to define the motion characteristics under control (dimensioning of the power supply and the motor), it's possible to contact our support department by the e-mail address: support@everelettronica.it. Alternatively the following procedure can be used to define approximately the power supply characteristics:

1. power to the motor shaft for every axle in watts:
   Wn = π*Nn[RPM]*Tn[Nm]/30
2. power to the total load in watts:
   WS = sum of the Wn of the axles moving simultaneously;
3. power of the transformer in watts:
   TW = 2 * WS (efficiency = 0.5)
4. power of the transformer in VA:
   TVA=TW / 0,7 (single phase) o TVA= TW / 0,8 (three phases);
5. take into account a voltage drop of about 8% for the transformer during the application of the load (the secondary voltage must not exceed a voltage value of 108% of the nominal value when the load is zero).

A simple and fast alternative method to calculate the power in VA of the transformer is:

$$TVA(VA) = \sqrt{2} * Vdc_{BUS} * Imax_{PHASE(RMS)}$$

Secondary protections: must be placed before the rectifier bridge and must be calibrated depending on the set phase current. Instead of the secondary protections can be used an automatic safety switch.

Rectifier bridge: a rectifier of 15A is recommended for the maximum absorption of a single axle.

Capacitor: the sizing of the capacitor should take into consideration the functional parameter of the installation, the type of AC line (mono o three-phase), the load on the shaft and the cycle of the movement.
The working voltage of the capacitor must be evaluated considering the DC voltage peaks (VdcBUS) keeping an adequate safety margin.

An additional capacitor must be provided in the nearance of the drive when the cable length of the DC power supply exceeds the length of 1 m.

When using a power supply of the switching type, insert a capacity between the drive and the power supply able to handle the pulse current which the drive sends to the power supply in special functioning conditions and which are required for the motion handling. The purpose of this capacity is to keep the voltage applied to the drive within acceptable values.

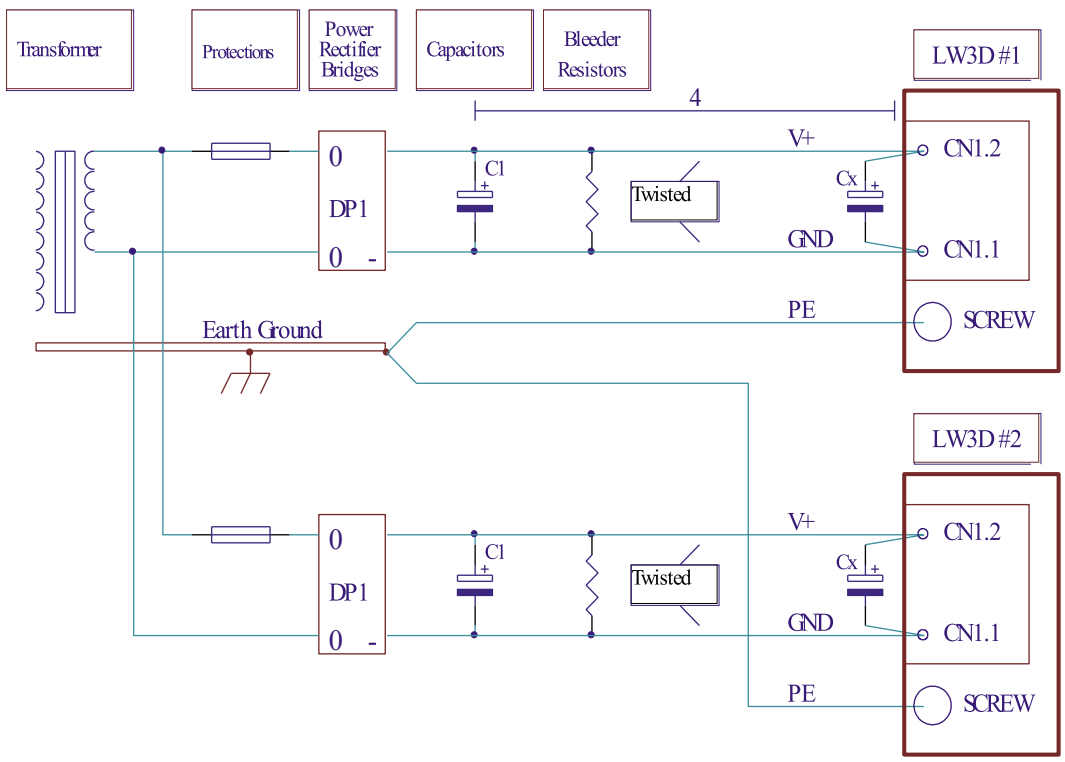
Make sure that the switching power supply is adapted to the expected load capacity.

The dynamic motor performances depend on the power supply voltage: at a higher voltage the performances increase.

In multi-axles installations, it's recommended to provide a rectifier + capacity for every drive. Every rectifier must be positioned as close as possible to the concerning drive.

An additional capacitor is required near every drive with a distance of more then 1mt from the rectifier.

Power supply schematic of a multi-axles installation:



3.3 Choosing the stepper motor

The drives have been designed to function with 2 phase stepper motors with the following characteristics:

• the nominal winding current depends on drives model:

	LW3D3032			LW3D3070			U.M.	Notes
	MIN.	TYP.	MAX	MIN.	TYP.	MAX		
Motor current	0.21		3.20	1.70		7.10	Arms	Dip-Switches setting
	0.3		4.50	2.40		10.0	Apeak	

• with connection of the Bipolar Parallel windings: the motor is supplied by the drive with a winding current equal to 1.41 times the unipolar nominal current (IPHASE * 1.41);

• with connection of the Bipolar Series windings: the motor is powered by the drive with a winding current equal to 0.7 times the unipolar nominal current (IPHASE * 0.70).

The stepper motor is chosen on base of a series of variables that depend on the application: torque required by the shaft, speed, dimension of the motor, current, inductance etc.

The dinamic performaces of the motors depend on the power supply: higher power supply----> higher performances.

3.4 Assembling of the drive

For the mounting refers to paragraph: ***2.1 Mechanical and Environmental***.
Use the M4 screws to fix the drive to a wall of the electric cabinet.

The environment in which the drive will be installed needs to be free of impurities, corrosive vapour, gases or liquids. Avoid environments where in vapour and humidity will condensate.

When installing the drive in an electrical switchboard, make sure that the opening of the air stream or the cooling system of the switchboard doesn't make the internal temperature rise above the maximum allowed working temperature.

Every local security aspect concerning the installation of the drive has to be considered a project standard for the electrical switchboard.

Assembling guide

The installation has to meet at least the following requirements:

- *maintain the vertical orientation of the drive;*
- *avoid excessive vibrations or shocks;*
- *foresee free space for the air stream above and under the drive;*
- *respect the minimal distances indicated in the following figure.*

The cooling of the drives occurs mainly through radiation of the heat sink fins and secondary, by means of contact through the clamping surface of the electrical switchboard.
An insufficient heat exchange can increase the drive temperature until the threshold of the heat protection, including a system block reported by the display. In the installation project, this two dissipation channels need to be optimized.

3.5 onnections, user settings and visualizations

*Please refer to paragraph **3 DRIVE INSTALLATION** for position of connectors, dip-switches and roto-switches.*

3.5.1 Connection to the drive

3.5.1.1 Pinout of the connectors

CN1 : DC power supply and motor – 6 positions connector, pitch 5.08mm			
Pos.	**Name**	**Characteristics**	
1	GND	PWR_INPUT	Negative power supply
2	+ V	PWR_INPUT	Positive power supply
3	A	PWR_OUTPUT	Motor phase A
4	A /	PWR_OUTPUT	Motor phase A/
5	B	PWR_OUTPUT	Motor phase B
6	B /	PWR_OUTPUT	Motor phase B/

CN2 : Digital inputs and output – 10 positions connector, pitch 3.81mm			
Pos.	**Name**	**Characteristics**	
1	BOOST+	DIGITAL_INPUT	Positive terminal digital input BOOST
2	BOOST-	DIGITAL_INPUT	Negative terminal digital input BOOST
3	EN+	DIGITAL_INPUT	Positive terminal digital input EN (ENABLE)
4	EN-	DIGITAL_INPUT	Negative terminal digital input EN (ENABLE)
5	STEP+	DIGITAL_INPUT	Positive terminal digital input STEP (STEP orCLK_UP)
6	STEP-	DIGITAL_INPUT	Negative terminal digital input STEP (STEP or CLK_UP)
7	DIR+	DIGITAL_INPUT	Positive terminal digital input DIR (Direzione or CLK_DWN)
8	DIR-	DIGITAL_INPUT	Negative terminal digital input DIR (Direzione or CLK_DWN)
9	OUT+	PWR_INPUT	Power supply of digital output (24Vdc)
10	OUT-	DIGITAL_OUTPUT	Open Emitter output (Source Current) FAULT

3.5.1.2 Mating connectors

The mating connectors are supplied with the drive.

In case it is necessary to purchase more mating connectors, the client can order them also from third parties with the codes:

CN1: PHOENIX CONTACT 1757051

CN2: PHOENIX CONTACT 1803659

3.5.1.3 Cables section

Function	Cable	
	Minimum	Maximum
Power supply and PE	0.5 mm² (AWG20)	1.5 mm² (AWG15)
Motor output	0.5 mm² (AWG20)	1.5 mm² (AWG15)
Digital inputs	0.14 mm² (AWG25)	0.5 mm² (AWG20)
Digital outputs	0.14 mm² (AWG25)	0.5 mm² (AWG20)

3.5.1.4 Guideline for wiring

For a correct drive installation:

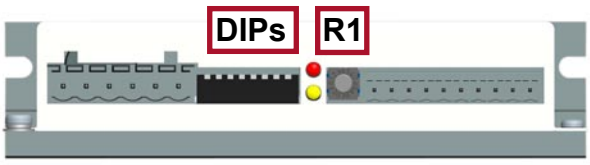
Guideline for wiring	Effects
Establish the PE connection on the drives by means of a mechanical screw.	Necessary electrical safety connection. Increases the immunity against irradiated disturbances and electrostatic discharges (ESD).
Connect both ends of the signal cables shields to the earthing.	Increases the immunity against disturbances and reduces the irradiated and conducted emissions.
It is recommended to use shielded cables for the motor connection. When a shielded cable is used for the motor, connect the screen to PE screw on the drive. AVOID the connection of the screen to the motor body.	Increases the immunity against disturbances and reduces the irradiated and conducted emissions.
Connect the body of the motor to the earthing with a special cable. The motor body and the cable shield must be connected to the ground terminal by means of 2 separated cables.	Necessary electrical safety connection. Reduces the conducted emissions.
When powering different drives with a single power supply, create a star connection of every drive to the terminals of the filter capacitor of the power supply (star center).	Reduce the disturbances due to pulse current.
Keep the connections (cables) as short as possible and avoid ground loops.	Increases the immunity against disturbances and reduces the irradiated and conducted emissions.
The paths of the signal cables and controls must be separated and/or shielded from the motor cables and power supply to avoid that the inductive coupling can cause incorrect operations.	Increases the immunity against disturbances.

3.5.2 User configurations

The drives are equipped with a series of Dip-Switches with 8 contacts and two Roto-Switches with 16 positions.

In factory default ***all DIPs are OFF, R1 is in 2 position and R2 is in 0 position****.*
This condition set the minimum current, a standard value of the step angle and none torque filter.

NOTE: the device reads the Dips and Roto-Switch R1 only during the Power up.
If it's necessary a settlng change, shut down the system, change the settings and start up the system again to make the changes operating.



3.5.2.1 Motor current

The motor current can be set by means of the **DIP 1-2-3-4** on 16 different levels.

Factory default = minimum phase current (DIP1-2-3-4 all OFF).

NOTE: the drives regulate the peak current (Apk) of the sinusoidal phase current waveform whose RMS (Arms) value is Apk/√2 .

DIP				LW3D3032		LW3D3070		Default	Function
1	2	3	4	Arms	Apk	Arms	Apk		
OFF	OFF	OFF	OFF	0.21	0.3	1.70	2.4	X	Motor Phase Current Selection
ON	OFF	OFF	OFF	0.28	0.4	1.98	2.8		
OFF	ON	OFF	OFF	0.42	0.5	2.12	3.0		
ON	ON	OFF	OFF	0.57	0.6	2.26	3.2		
OFF	OFF	ON	OFF	0.49	0.7	2.47	3.5		
ON	OFF	ON	OFF	0.71	1.0	2.69	3.8		
OFF	ON	ON	OFF	0.85	1.2	2.97	4.2		
ON	ON	ON	OFF	1.06	1.5	3.18	4.5		
OFF	OFF	OFF	ON	1.27	1.8	3.54	5.0		
ON	OFF	OFF	ON	1.41	2.0	3.96	5.6		
OFF	ON	OFF	ON	1.56	2.2	4.24	6.0		
ON	ON	OFF	ON	1.77	2.5	4.45	6.3		
OFF	OFF	ON	ON	2.12	3.0	4.95	7.0		
ON	OFF	ON	ON	2.47	3.5	5.67	8.0		
OFF	ON	ON	ON	2.83	4.0	6.36	9.0		
ON	ON	ON	ON	3.20	4.5	7.10	10.0		

3.5.2.2 Step angle

The type of step angle could be selected by the **Roto-switch R1** on 15 different levels.
It possible to select step angle base “2” : 1/2, 1/4 ,1/8, 1/16, 1/32, 1/64, 1/128, 1/256 and step angle base “5” : 1/5, 1/10, 1/25, 1/50, 1/125, 1/250 and also the Full Step.

The factory default is in position 2 = 1/4 step angle.

Position	Step angle	Default	Function
0	**Full step**		**Step Angle Selection**
1	**1/2**		
2	**1/4**	**X**	
3	**1/8**		
4	**1/16**		
5	**1/32**		
6	**1/64**		
7	**1/128**		
8	**1/256**		
9	**1/5**		
A	**1/10**		
B	**1/25**		
C	**1/50**		
D	**1/125**		
E	**1/250**		

The formula : F = (RPM / 60) x ((360° / Full Step Degrees) x Step Setting))
is useful to calculate the step frequency F(Hz) at a determined motor velocity (RPM).

For example, the step frequency to obtain a rotation velocity of 150 RPM with a motor of 1.8° driven at 1/8 step is:

F = (150 / 60) x ((360° / 1.8°) x 1/8)) = 4000 Hz

3.5.2.3 Clock Test

For the Automatic Clock Test the user has to set the **Roto-Switch R1 in position** F and by leds it is possible to check the frequency of the digital input. (see ***3.5.3 Operational statuses and their signals***).
During the Clock Test the drive is disabled.

3.5.2.4 Automatic Reduction of the motor current (RWC)

Allows to reduce consumption and heating of the motor and drives when is not required a movement. The motor is stopped with a reduced current manteining also a detent torque.

DIP5	Default	Function
OFF	**X**	The **motor current will be reduced to 70% of the nominal value** 1 second after the last step pulse. The current in the motor returns atutomatically to the nominal value after the first pulse of the external step has been sent to the drive.
ON		The **motor current will be reduced to 30% of the nominal value** 1 second after the last step pulse. The current in the motor returns atutomatically to the nominal value after the first pulse of the external step has been sent to the drive.

The user has to make an evaluation about the necessary manteinance torque needed for every single application.

3.5.2.5 Functioning mode of the EN input

Define the functioning mode of the EN (ENABLE) digital input.

DIP6	Default	Function
OFF	**X**	**DISABLE MODE:** the motor will be energized when the EN input is open. Closing the EN input the power stage of the drive will be disable dropping the motor current to zero. It's possible to leave the EN input disconnected to have the functioning of the Drive.
ON		**ENABLE MODE:** the motor will be energized closing the EN input. It's necessary to engage the EN input to enable to power stage of the Drive.

3.5.2.6 STEP/DIR or CLK_UP/CLK_DWN Mode

Define the functioning mode of the STEP and DIR digital inputs.

DIP7	Default	Function
OFF	**X**	**STEP/DIR:** a step sequence must be supplied to the STEP input, while the rotation direction of the motor depends on the DIR status (Direction).
ON		**CLK_UP/CLK_DWN:** a motor movement in a direction is obtained by applying a pulse sequence to the STEP input (CLK_UP). When applying a pulse sequence to the DIR input (CLK_DWN) a movement in the opposite direction is obtained.

3.5.2.7 Automatic detection of the motor stall

Allows to enable the automatic motor stall detection.

DIP8	Default	Function
OFF	**X**	Automatic motor stal detection DISABLE.
ON		Automatic motor stal detection ENABLE**.**

3.5.2.8 Torque Filter

With **Roto-Switch R2** is possible to set a Torque Filter in order to reduce vibrations, resonance and noise of the motor.

Roto-Switch R2 position	Torque filter level
0	**None (Default)**
....	
7	**Medium**
....	
F	**High**

NOTE : the Roto-Switches R2 is read and executed in real time.
If it's necessary a setting change, take all necessary measures to avoid possible dangerous contacts.

ATTENTION : depending on the used motors and velocity, the choice of different Torque Filter values can increase the variation of the torque to the motor shift. The user must evaluate for every motor type and specific application what the best compromise is between low noise and maximum torque. It's good practice to execute tests starting without torque filter (R2 in position 0) and to increase this value until the most suitable value has been defined.

3.5.3 Operational statuses and their signals

The operational statuses of the drive is displayed by 2 leds:

- **Green led** (mono-color)
- Red/Yellow **led** (bi-color)

The possible statuses are:

- **Driver enable:** GREEN ON
- **Drive disable:** GREEN blinking (1s)
- **Motor open phase:** RED ON
- **Motor phase shortcut**: RED blinking (200ms)
- **Overvoltage**: RED ON (2s) – YELLOW ON (1s)
- **Undervoltage**: RED ON (2s) – YELLOW ON (1s) – YELLOW ON (1s)
- **Overtemperature**: RED ON (2s) – YELLOW ON (1s) – YELLOW ON (1s) – YELLOW ON (1s)
- **Motor stall**: YELLOW blinking (200ms)
- **Clock Test** (activable only with roto-switch R1): see following table:

Clock [Hz]	Green Led	Red Led	Yellow Led
0	ON	ON	OFF
1< CLOCK <1000	Blinking (200ms)	OFF	ON
CLOCK ≥1000	Blinking (200ms)	ON	OFF

3.6 First start up procedure

- *Check all connections: power supply and motor.*

- *Make sure that the application settings are correct.*

- *Attention : the default condition of the Dip-Switches and Roto-Switches set the minimum motor phase current and 1/4 of step angle. Take into consideration this settings in the final installation.*

- *Make sure that the DC power supply characteristics are suitable for the drive.*

- *If possible, remove the load from the motor shaft to avoid that wrong movements cause damage.*

- *Power the drive and make sure that the green LED is switched on.*
  If the green LED remain off, turn down the system immediately and verify if all connections are present and if they are correct.

- *Enable the current to the motor and verify if the torque is present.*

- *Execute a movement of some steps and verify if the rotation direction is the desired one.*

To reverse the rotation direction of the motor shaft, reverse the connection of one of the motor phases, for example A with A/, after having removed the power supply.

- *Remove the power supply, fixate the motor to the load and check the full functionality.*

3.7 Analyses of malfunctions

The green LED power ON or blinking indicates that the drives are powered correctly.

When one of the following situations occurs, the drive enters an alarm status signalled by leds and the FAULT output is opened.

Defect	Cause	Action
Intervention of the thermal protection.	May be caused due to a heavy working cycle or high current.	Improve the thermal exchange by facilitating the air stream on the heatsink or by applying a fan.
Intervention of the over/under voltage protection.	Supply voltage out of range.	Check the value of the supply voltage.
Intervention by the current protection.	Short circuit on the motor outputs.	Control the motor windings and cables, remove the short circuit replacing the broken cable or the broken motor.
Open phase motor protection.	Open circuit from motor windings and drive.	Check motor cables and connections to the drive.

When any of the following situations occur, the drive doesn't work and doesn't enter in an error condition.

Defect	Cause	Action
Noisy motor movement with vibrations.	Can be caused due to a missing power supply to a motor phase, or to a situation of resonance.	Check the motor cables, and/or change the velocity of the motor to exit a resonance region.
The external fuse on the power supply of the drive is burned.	Can be caused due to a wrong connection of the power supply.	Connect the power supply correctly and replace the fuse. Use only fuse with characteristic indicated in paragraph ***3.2 Planning the power supply.***
At high speed, the motor hasn't sufficient torque.	It can be due to a motor current self-limitation.	Increase the motor current (always within the limits), increase the supply voltage, change motor connection from series to parallel.

3.8 Return procedure

In case it's not possible to resolve the problem and thinking that the system isn't damaged, contact the EVER technical support dpt providing the following information:

- The system version (LW3D___) and serial number printed on the label.
- The complete problem description and the conditions where in the problem occurs.
- The description of the drive configuration in the application (Current, step type, functioning type, etc.).
- The value of the power supply voltage and the characteristics (single phase, three phase,ripple....).
- The description of the power feeding and the control signals cabling and the presence of other components in the installation.
- The description of the application (motor movements, loads, velocity, etc.).

Return procedure

To return a damaged drive to EVER please fill the RMA form available at www.everelettronica.it or through this direct link:

http://www.support-everelettronica.com/en/rma.asp

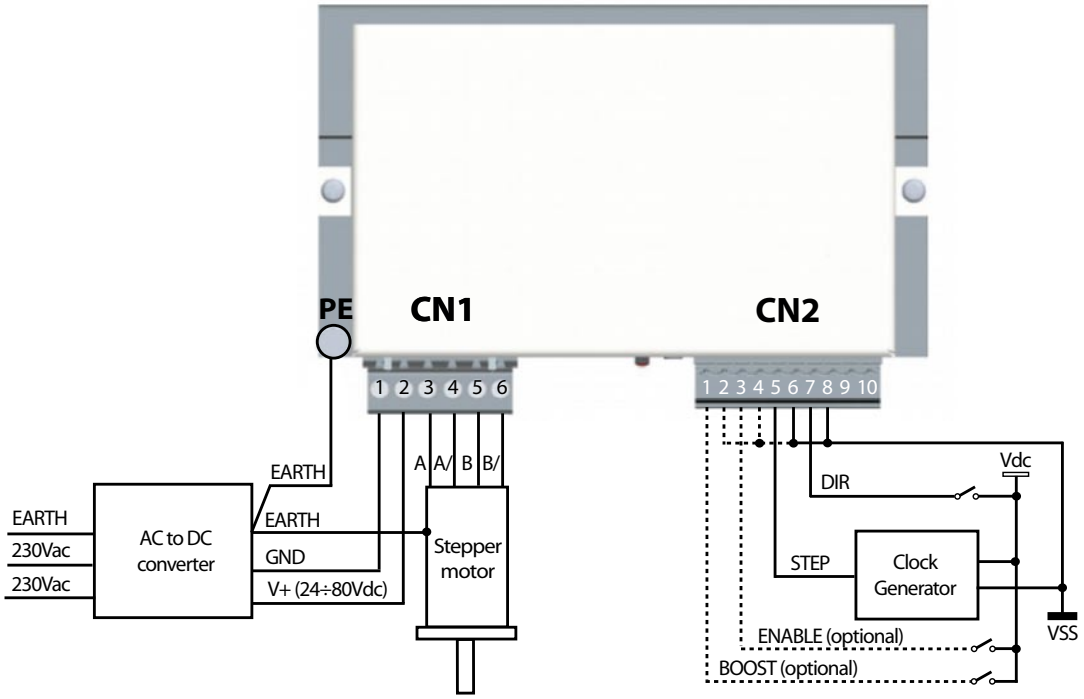
An email including the RMA number and the return procedure will be send by EVER to the customer.

APPENDICES

A.1 Basic connections

The following figures show examples of typical connections.

A.1.1 Step / Direction



A.1.2 CLK_UP / CLK_DWN