SW5D3070x4x2-xx - Controller

Installation instructions

Refer to installation use and maintenance manual for more information.

TITANIO
VECTOR - STEPPER - DRIVES

2 Axis bipolar stepper drive technical data:

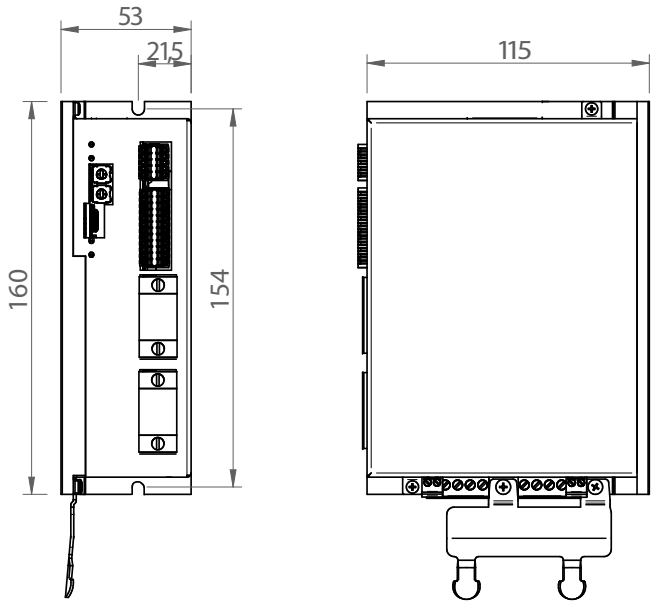
- *DC power supply: 24 ÷ 80 Vdc*
- *DC logic supply: 24 Vdc (mandatory and isolated)*
- *Phase current: up to 10 Apeak for each motor*
- *Chopper frequency: ultrasonic 40KHz*
- *Stepless Control Technology (65536 position per turn)*
- *Protections against: over current, over/under voltage, overheating, short circuit between motor phase-to-phase and phase-to-ground*
- *Industrial Ethernet interfaces (see ordering codes)*
- *Incremental Encoder (isolated): 5V Differential (RS422) or Single-Ended (TTL/CMOS) (SW5D3070R4T2-30 model)*
- *Absolute Encoder (isolated): 5V Endat2.2 or BiSS-C or SSI interface (SW5D3070R4T2-35 model)*
- *USB Service interface for programming and real time debugging (isolated)*
- *Safe Torque Off (STO) inputs (opto-coupled)*
- *8 digital inputs (opto-coupled)*
- *4 digital outputs (opto-coupled)*
- *2 analog inputs (isolated)*
- *2 analog outputs (isolated)*
- *Dimensions: 160 x 115 x 53 mm (without connectors)*
- *Protection degree: IP20*
- *Pollution degree: 2*
- *Overvoltage Category II (not directly connected to supply mains)*
- *Short Circuit Current: 5 KA*
- *Protection Class: Class I Equipment*
- *Category C3 following standard EN 61800-3*
- *Working temperature: 5°C ÷ 40°C*
- *Storage temperature: -25°C ÷ 55°C*
- *Humidity: 5% ÷ 85% not condensing*

MULTIPROTOCOL

c UL us
E363861

STO
Safe Torque Off
SIL3
PLe

Mechanical data

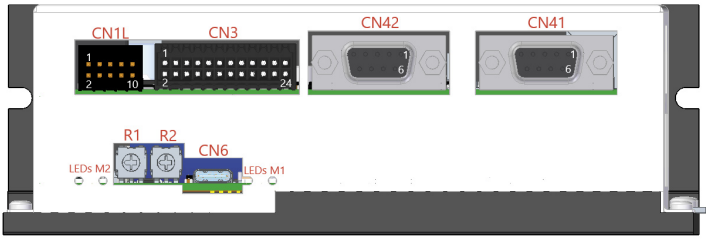


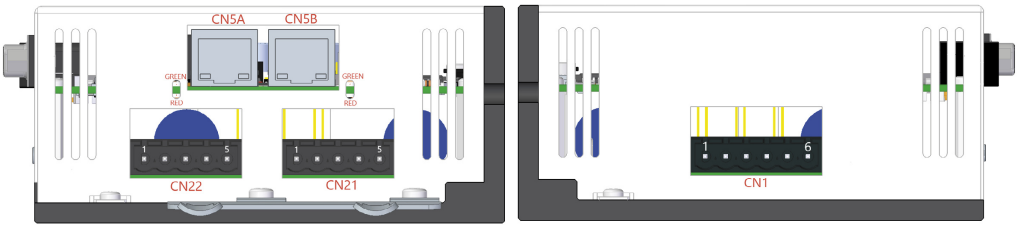
Ordering codes

System code	Fieldbus	Feedback
SW5D3070**R**4T2-3**0**	Powerlink	Incremental encoder
SW5D3070**R**4T2-3**5**		Absolute encoder
SW5D3070**E**4T2-3**0**	Modbus TCP/IP	Incremental encoder
SW5D3070**E**4T2-3**5**		Absolute encoder
SW5D3070**H**4T2-3**0**	EtherCAT	Incremental encoder
SW5D3070**H**4T2-3**5**		Absolute encoder
SW5D3070**T**4T2-3**0**	Profinet	Incremental encoder
SW5D3070**T**4T2-3**5**		Absolute encoder
SW5D3070**I**4T2-3**0**	Ethernet/IP	Incremental encoder
SW5D3070**I**4T2-3**5**		Absolute encoder

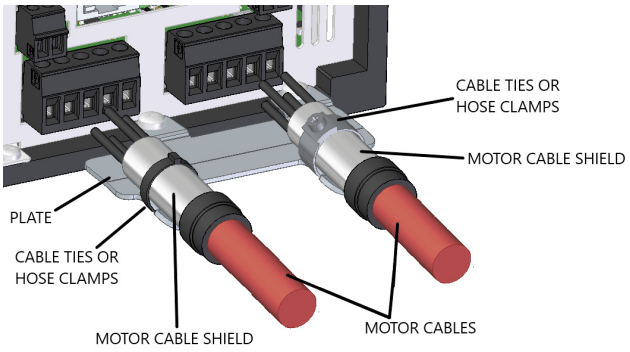
System connections

Connectors:





This plate must be used to fix motor cable and to connect shield of the motor cable to PE using cable ties or hose clamps.



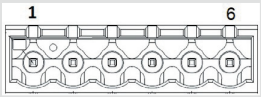
Refer to installation use and maintenance manual for more information.

System connection

CN1: Power supply

6 positions, pitch 5.08mm, PCB header connector

CN1.1	Vin	PWR_IN	**Positive DC power supply input**
CN1.2	Vin	PWR_IN	**Positive DC power supply input**
CN1.3	PGND	PWR_IN	**Negative DC power supply input**
CN1.4	PGND	PWR_IN	**Negative DC power supply input**
CN1.5	N.C.		Not connected
CN1.6	PE		Protective Earth input



Drives are intended for installation in Overvoltage Category II not connected directly to supply mains.

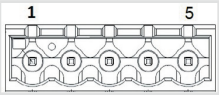
Mandatory External Fuse
A Branch-circuit Fuse must be used with current calibrated depending on the application.
See paragraph UL REGULATION REQUIREMENTS for type of fuse that fulfils UL requirements.

Discharge time of the internal capacitors on the DC power supply.
Wait at least No.15 seconds after disconnecting DC power supply
Time required for the capacitors to a safe discharge to a level below 60 Vdc.

CN21: Motor M1 connection

5 positions, pitch 5.08mm, PCB header connector

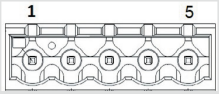
CN21.1	Phase A	PWR_OUT	Motor M1 output phase A
CN21.2	Phase A/	PWR_OUT	Motor M1 output phase A/
CN21.3	Phase B	PWR_OUT	Motor M1 output phase B
CN21.4	Phase B/	PWR_OUT	Motor M1 output phase B/
CN21.5	PE_M1		Motor M1 protective Earth input



CN22: Motor M2 connection

5 positions, pitch 5.08mm, PCB header connector

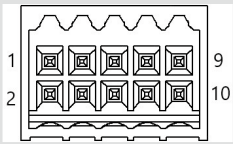
CN22.1	Phase A	PWR_OUT	Motor M2 output phase A
CN22.2	Phase A/	PWR_OUT	Motor M2 output phase A/
CN22.3	Phase B	PWR_OUT	Motor M2 output phase B
CN22.4	Phase B/	PWR_OUT	Motor M2 output phase B/
CN22.5	PE_M2		Motor M2 protective Earth input



CN1L: Logic Supply & STO

10 positions, pitch 2.54mm double row, PCB header connector

CN1L.1	24VDC_IN	PWR_IN	**24Vdc logic supply input**
CN1L.2	VSS_IN	PWR_IN	**VSS logic supply input**
CN1L.3	24VDC_OUT	PWR_OUT	**24Vdc output**
CN1L.4	VSS_OUT	PWR_OUT	**VSS output**
CN1L.5	24VDC_OUT	PWR_OUT	**24Vdc output**
CN1L.6	VSS_OUT	PWR_OUT	**VSS output**
CN1L.7	STO1+	DIG_IN	**STO1 positive input side**
CN1L.8	STO1-	DIG_IN	**STO1 negative input side**
CN1L.9	STO+2	DIG_IN	**STO2 positive input side**
CN1L.10	STO-2	DIG_IN	**STO2 negative input side**

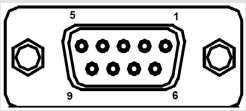


Logic Supply and STO inputs are 24 Vdc MANDATORY and ISOLATED.

CN41: Encoder M1 input connection

9 positions, D-SUB Female, PCB header connector

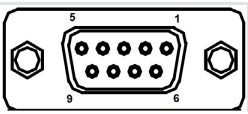
Type	Incremental	Absolute
CN41.1	+5V	
CN41.2	N.C.	
CN41.3	ENCZ+	N.C.
CN41.4	ENCB+	DATA+
CN41.5	ENCA+	CLK+
CN41.6	0V	
CN41.7	ENCZ-	N.C.
CN41.8	ENCB-	DATA-
CN41.9	ENCA-	CLK-
Chassis	Cable shield connection	



CN42: Encoder M2 input connection

9 positions, D-SUB Female, PCB header connector

Type	Incremental	Absolute
CN41.1	+5V	
CN41.2	N.C.	
CN41.3	ENCZ+	N.C.
CN41.4	ENCB+	DATA+
CN41.5	ENCA+	CLK+
CN41.6	0V	
CN41.7	ENCZ-	N.C.
CN41.8	ENCB-	DATA-
CN41.9	ENCA-	CLK-
Chassis	Cable shield connection	

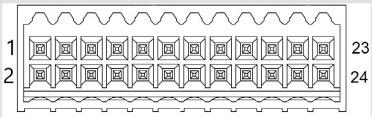


System connections

CN3: Inputs and Outputs

24 positions, pitch 2.54mm double row, PCB header connector

CN3.1	VSS_OUT	PWR_OUT	VSS output
CN3.2	VSS_OUT	PWR_OUT	VSS output
CN3.3	OUT1_M2	DIG_OUT	Digital output OUT1 M2
CN3.4	OUT0_M2	DIG_OUT	Digital output OUT0 M2
CN3.5	OUT1_M1	DIG_OUT	Digital output OUT1 M1
CN3.6	OUT0_M1	DIG_OUT	Digital output OUT0 M1
CN3.7	COM_IN	PWR_IN	Common reference input
CN3.8	COM_IN	PWR_IN	Common reference input
CN3.9	IN3_M2	DIG_IN	Digital input IN3 M2
CN3.10	IN2_M2	DIG_IN	Digital input IN2 M2
CN3.11	IN1_M2	DIG_IN	Digital input IN1 M2
CN3.12	IN0_M2	DIG_IN	Digital input IN0 M2
CN3.13	IN3_M1	DIG_IN	Digital input IN3 M1
CN3.14	IN2_M1	DIG_IN	Digital input IN2 M1
CN3.15	IN1_M1	DIG_IN	Digital input IN1 M1
CN3.16	IN0_M1	DIG_IN	Digital input IN0 M1
CN3.17	OUT_AN1	AN_OUT	Analog output 1
CN3.18	AVSS	AN_OUT	Reference for analog output 1
CN3.19	OUT_AN0	AN_OUT	Analog output 0
CN3.20	AVSS	AN_OUT	Reference for analog output 0
CN3.21	IN_AN1+	AN_IN	Analog input 1 positive side
CN3.22	IN_AN1-	AN_IN	Analog input 1 negative side
CN3.23	IN_AN0+	AN_IN	Analog input 0 positive side
CN3.24	IN_AN0-	AN_IN	Analog input 0 negative side



CN6: USB Service Interface

USB 2.0 Type C, PCB header connector

This connection is possible only with software provided by Ever Motion Solutions.

Kit code: **USBC_SERV0EE-1M**

CN5A / CN5B: Industrial Ethernet Interface

RJ45 connectors

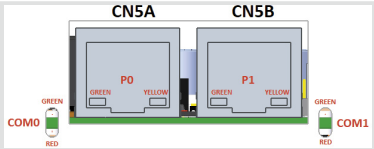
Dual RJ45 connectors (P1 - P2)
100BASE-TX (100Mb/sec) ports
Accept standard Ethernet cable (CAT5 or higher)

CN5A (P0)

CN5B (P1)

Industrial Ethernet Leds

The meaning of these LEDs is defined by the Industrial Ethernet protocol used.
Refer to Software manual for more details.



Led	Powerlink	EtherCAT	ModbusTCP	Profinet	Ethernet/IP
COM0	BS - Green	RUN - Green	SF - Red	SF - Red	MS - Green/Red
COM1	BE - Red	ERR - Red	BF - Red	BF - Red	Ns - Green/Red
P0 (on CN5A)	L/A P0 - Green	L/A IN - Green	LINK - Green ACT - Yellow	LINK - Green RX/TX - Yellow	LINK - Green ACT - Yellow
P1 (on CN5B)	L/A P1 - Green	L/A OUT - Green	LINK - Green ACT - Yellow	LINK - Green RX/TX - Yellow	LINK - Green ACT - Yellow

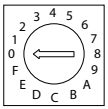
Roto-Switches settings

Drives are equipped with two Roto-Switches within it's possible to set the Node ID.

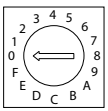
Node-ID selection from Roto-Switches are not used in all Industrial Ethernet Protocol.
Refer to the Software Manual for more details.

Node ID Selection (Hexadecimal Value)										
R1 x 16 (MSD)	0	0	0	0	....	2	2	....	F	F
R2 x 1 (LSD)	0	1	2	3	....	C	D	....	E	F
Node ID #	**SW settings (default)**	**1**	**2**	**3**	**....**	**44**	**45**	**....**	**254**	**255**

x 16 (MSD) R1



x1 (LSD) R2



R1 (MSD): Most Significant Digit that must by multiplied per 16.
R2 (LSD): Least Significant Digit that must by multiplied per 1.
Example: 5C

R1 = 5 ----> 5x16 = 80
R2 = C ---> 12x1 = 12
Node ID = 92

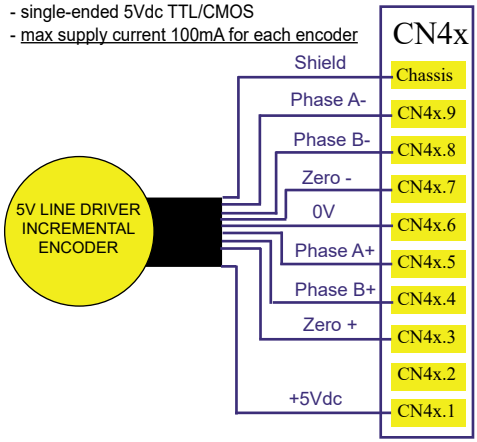
Working Status (LEDs)

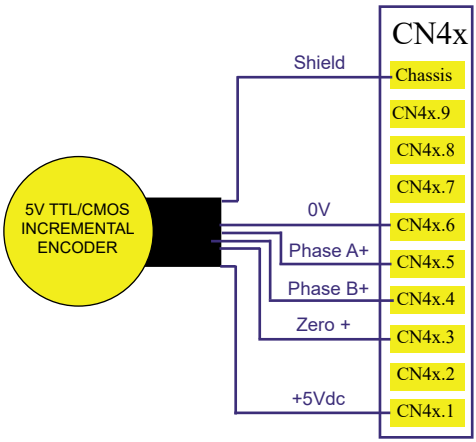
		Description
●	**Green ON**	Correct functioning
○	**Green Blinking**	Enable OFF, current zero
●	**Yellow ON - Red OFF**	Missing setting of Inominal
○	**Yellow Blinking (500ms) - Red OFF**	Warning: connect with USB and check with software
●	**Red ON**	Protection: Motor is in open phase condition
○	**Red Blinking (200ms)**	Current protection
●○	**Red ON (1sec) + Yellow 1 Blink**	Under/Over voltage protection
●○○○	**Red ON (1sec) + Yellow 3 Blink**	Thermal protection
●○○○○	**Red ON (1sec) + Yellow 4 Blink**	Motor Feedback Error
●○○○○○	**Red ON (1sec) + Yellow 5 Blink**	Missing Safe Torque Off
●○○○○○○	**Red ON (1sec) + Yellow 6 Blink**	Motor Current Regulation is out of range
●○○○○○○○	**Red ON (1sec) + Yellow 7 Blink**	eePLC User Protection (generated by setting bit #0 of eePLC_User_Settings)

NOTE: Drive could be considered in a correct status if leds Red and Yellow are all OFF.
In general:
- ***Led Red indicates an alarm or a drive protection***
- ***Led Yellow indicates a warning***

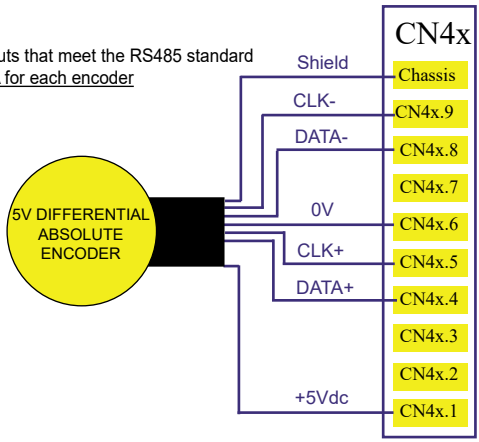
Incremental and Absolute Encoder input connection (isolated)

Incremental encoder inputs:
- differential 5Vdc that meet the RS422 standard
- single-ended 5Vdc TTL/CMOS
- max supply current 100mA for each encoder



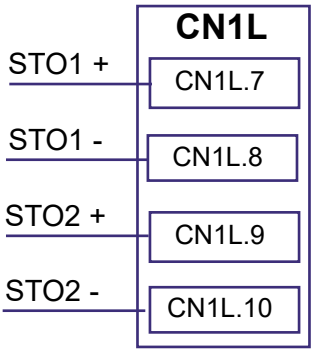


Absolute encoder input:
- differential 5Vdc digital inputs that meet the RS485 standard
- max supply current 100mA for each encoder



Safe Torque Off inputs (STO)

2 terminals, 24V compatible (optoisolated)



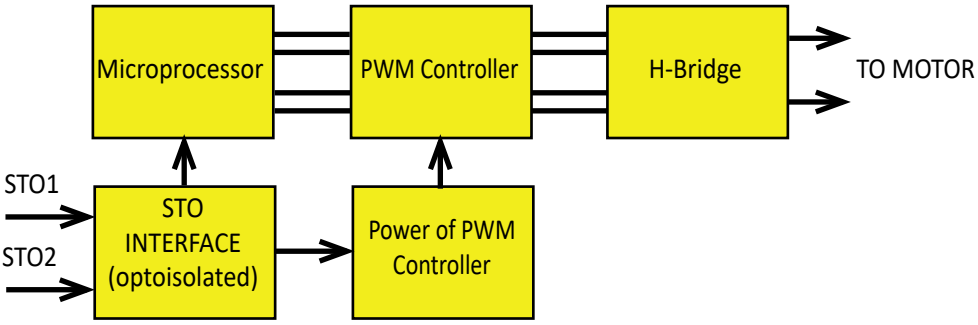
STO1	STO2	Drive Status	Motor Status
+24Vdc	+24Vdc	Enable	SW controlled
+24Vdc	Not connected	Disable	Stop for inertia
Not connected	+24Vdc	Disable	Stop for inertia
Not connected	Not connected	Disable	Stop for inertia

STO inputs are optoisolated.

Safety specifications			
Safety function		STO	Safe Torque Off
	Category	4	In accordance with EN ISO 13849-1
	Performance Level	PLe	In accordance with EN ISO 13849-1
	Safety Integrity Level	SIL3	In accordance with EN ISO 13849-1 table 3
DC_{avg}	[%]	99	Average Diagnostic Coverage
PFH_D	[1/h]	$7{,}04 \times 10^{-9}$	Probability of dangerous failure per hour
T Service Life	[Years]	20	In accordance with EN ISO 13849-1
Type test		**The certification process by an independent testing body of the STO function is in progress.**	

Refer to the “Safety Manual_STO on SW5D3070-AW5D3560 Serie_GB_R00” for more details of the Safe Torque Off function characteristics.

Principle of operation:



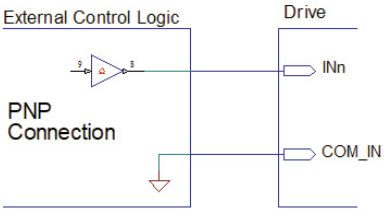
The drive has a safety feature that is designed to provide the Safe Torque Off (STO) function as defined in IEC 61800-5-2. Two input signlas are provided which, when not connected, prevent the upper and lower devices in the PWM outputs from being operated by the digital control core. This provides a positive OFF capability that cannot be overridden by the control firmware, or associated hardware components. When both STO signals are activated (current is flowing in the input diodes of the optocouplers), the control core will be able to control the on/off state of the PWM outputs.

If not using the STO feature, the inerface must be connected to an external +24Vdc supply in order enabled the drive.

If a drive in operation mode is disabled by STO signal, it immediately finish to produce torque but the motor continues to run by inertia until it can stop.

Digital inputs connection (opto-coupled)

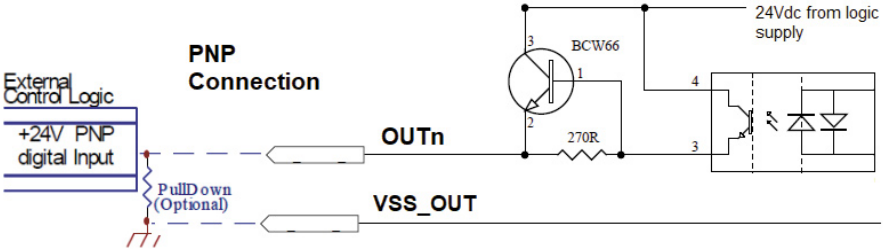
24V PNP type, Fmax = 1kHz



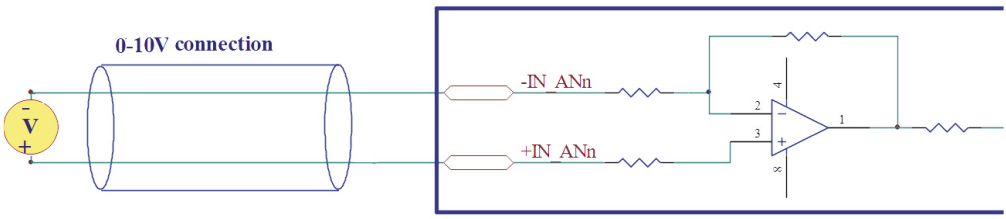
Characteristics	MIN.	MAX.	Unit
Supply voltage	19	24	Vdc
Inputs frequency	--	1	kHz
Threshold switching voltage	10	--	Vdc
Current at 24 Vdc	--	10	mA

Digital outputs connection (opto-coupled)

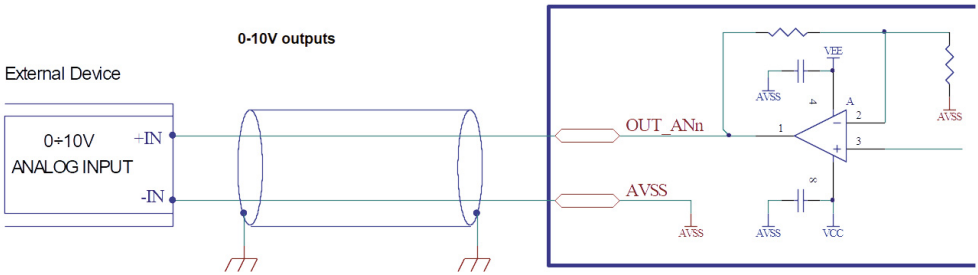
24Vdc PNP, I_{OUTmax} = 100mA, Fmax = 1kHz
Digital outputs are supplied from 24 Vdc logic supply



Analog inputs connection (isolated)



Analog outputs connection (isolated)



Mating connectors

Connector	Description
CN1	Phoenix 1758830
CN1L	Dinkle 0156-1B10-BK
CN21 & CN22	Phoenix 1758814
CN3	Dinkle 0156-1B24-BK
CN41 & CN42	D-SUB 9P Male
CN5A/B	Ethernet standard cables (CAT5 or higher)
CN6	USB 2.0 Type-C

Cables section

Function	Cable	
	Minimum	Maximum
Power supply and PE	0.20 mm² (AWG24)	2.50 mm² (AWG12)
Motor outputs	0.20 mm² (AWG24)	2.50 mm² (AWG12)
Logic supply & STO	0.14 mm² (AWG26)	0.50 mm² (AWG20)
Feedback	0.20 mm² (AWG24)	0.50 mm² (AWG20)
Digital Inputs / Outputs	0.14 mm² (AWG26)	0.50 mm² (AWG20)
Fiedlbus interfaces	Ethernet standard cables (CAT5 or higher)	

N.B. : Use Copper Conductor only.
Use 60/75°C wires only.

Verify the installation

- Check all connection: power supply and inputs/outputs
- Make sure all settings right for the application.
- Make sure the power supply is suitable for the drive.
- If possible, remove the load from the motor shaft to avoid that wrong movements cause damage.
- Enable the current to the motor and verify the applied torque.
- Enable a movement of some steps and verify if the rotation direction is the desired one.
- Disconnect the power supply, connect the load on the motor and check the full functionality.

Analysis of malfunctions

When any of the following situations occur, the drive is placed in a fault condition.

DEFECT	CAUSE	ACTION
Intervention of the thermal protection.	Can be caused by a heavy working cycle or a high current in the motor.	Improve the drive cooling by natural orfan air flow. Consider to use a motor with a higher torque vs current rating.
Intervention of the current protection.	Short circuit on the motor powering stage(s) of the drive.	Check motor windings and cables to remove the short circuits replacing faulty cables or motor if necessary.
Intervention of the over/under voltage protection.	Supply voltage out of range	Check the value fo the supply voltage
Open phase motor protection.	Motor windings to drive not proper connection.	Check motor cables and connections to the drive.

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

DEFECT	CAUSE	ACTION
Noisy motor movement with vibrations.	Can be caused by a lack of power supply to a phase of the motor or a poor regulation of the winding currents.	Check the cables and connections of the motor and/or change the motor speed to avoid a resonance region.
The external fuse on the power supply of the drive is burned.	Can be caused by a wrong connection of the power supply.	Connect the power supply correctly and replace the fuse.
At high speed, the motor torque is not enough.	Can be due to a "self-limitation" of motor current and torque.	Increase the motor current (always within the limits), increase the supply voltage, change motor connection from series to parallel.

UL regulation requirements

In order to comply with cURus certification according to the UL 61800-5-1 standard, the following requirements must be met:

E363861

Electrical ratings

INPUT

Input Voltage Range	Maximum Input Current
24 - 80 Vdc	12 Arms

OUTPUT

Maximum Output Voltage	Motor Phases Number	Maximum Output Current	Numebr of motors
80 Vdc	2 or 4	7 Arms	2

Motor overload protection

The drive does not provide Motor Overload protection. External or remote Motor Overload protection shall be provided in the end-use applications.

Solid state short circuit protection

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code NFPA 70, Canadian Electrical Code CSA C22.1 and any additional local codes.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part I.

La protection intégrée contre les courtscircuits n'assure pas la protection de la dérivation. La protection de la dérivation doit être exécutée conformément au Code Canadien de l'Électricité, première partie.

External Fuse and Short Circuit Protection on Supply

Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 80 Volts maximum when protected by CC class fuse up to 30A

Group Installation

Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 80 Volts maximum when protected by Class CC fuse up to 30A.

Ever Motion Solutions
Via del Commercio, 2/4 - 9/11
Loc. San Grato Z. I
26900 - L O D I - Italy
Phone +39 0371 412318 - Fax +39 0371 412367
email:infoever@everelettronica.it
web: www.everelettronica.it