

Installation instructions

i Refer to installation use and maintenance manual for more information.
Available user manual at link <http://www.everelettronica.it/manhw.html>



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
- Steplss 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

TITANIO
VECTOR - STEPPER - DRIVES

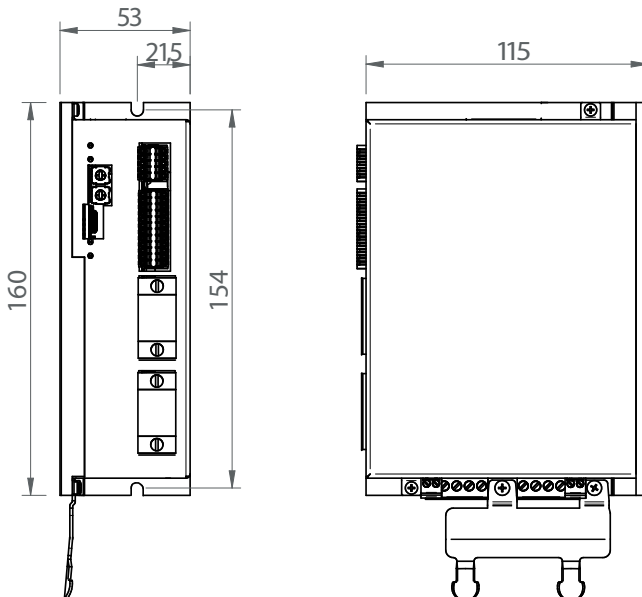
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CE **UL** **US**
E363861



Mechanical data

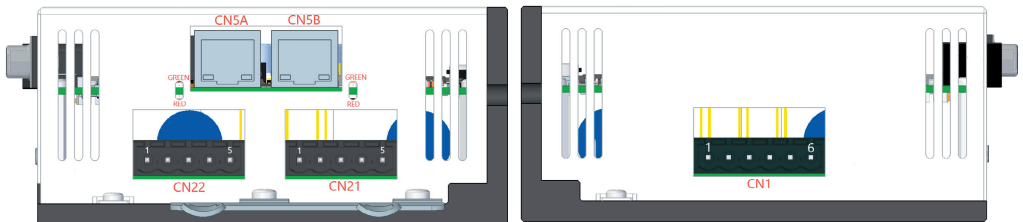
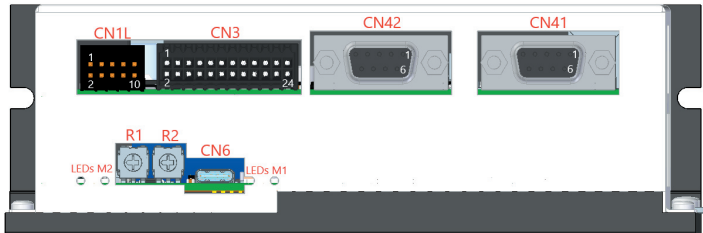


Ordering codes

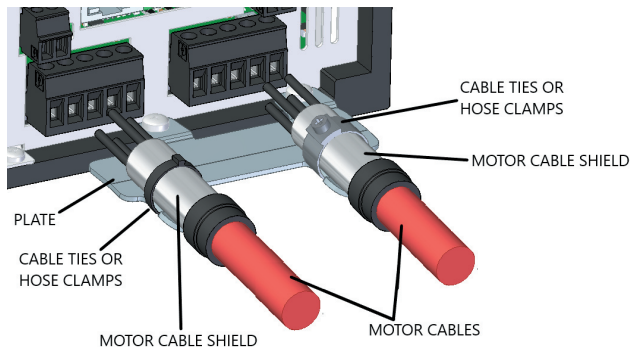
| System code | Fieldbus | Feedback |
|-----------------|---------------|---------------------|
| SW5D3070R4T2-30 | Powerlink | Incremental encoder |
| SW5D3070R4T2-35 | | Absolute encoder |
| SW5D3070E4T2-30 | Modbus TCP/IP | Incremental encoder |
| SW5D3070E4T2-35 | | Absolute encoder |
| SW5D3070H4T2-30 | EtherCAT | Incremental encoder |
| SW5D3070H4T2-35 | | Absolute encoder |
| SW5D3070T4T2-30 | Profinet | Incremental encoder |
| SW5D3070T4T2-35 | | Absolute encoder |
| SW5D3070I4T2-30 | Ethernet/IP | Incremental encoder |
| SW5D3070I4T2-35 | | 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.



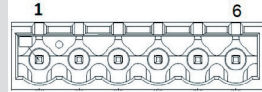
Refer to installation use and maintenance manual for more information.

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.

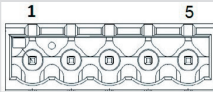
Wait at least No.15 seconds after disconnecting DC power supply

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

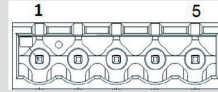
| | | | |
|--------|----------|---------|---------------------------------|
| CN21.1 | Phase A | PWR_OUT | Motor M1 output phase A |
| CN21.2 | Phase A/ | PWR_OUT | Motor M1 output phase A/ |
| CN21.3 | Phase B | PWR_OUT | Motor M1 output phase B |
| CN21.4 | Phase B/ | PWR_OUT | Motor M1 output phase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



CN22: Motor M2 connection

5 positions, pitch 5.08mm, PCB header connector

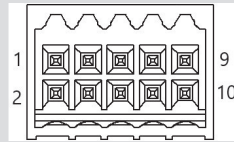
| | | | |
|--------|----------|---------|---------------------------------|
| CN22.1 | Phase A | PWR_OUT | Motor M2 output phase A |
| CN22.2 | Phase A/ | PWR_OUT | Motor M2 output phase A/ |
| CN22.3 | Phase B | PWR_OUT | Motor M2 output phase B |
| CN22.4 | Phase B/ | PWR_OUT | Motor M2 output phase 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 |

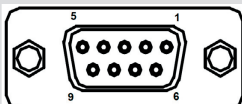


Logic Supply and STO inputs are 24 Vdc MANDATORY and ISOLATED.

CN41: Encoder M1 input connection

9 positions, D-SUB Female, PCB header connector

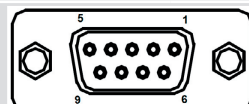
| Type | Incremental | Absolute |
|---------|-------------------------|----------|
| CN41.1 | | +5V |
| CN41.2 | | N.C. |
| CN41.3 | ENCZ+ | N.C. |
| CN41.4 | ENCB+ | DATA+ |
| CN41.5 | ENCA+ | CLK+ |
| CN41.6 | | 0V |
| CN41.7 | ENCZ- | N.C. |
| CN41.8 | ENCB- | DATA- |
| CN41.9 | ENCA- | CLK- |
| Chassis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



CN42: Encoder M2 input connection

9 positions, D-SUB Female, PCB header connector

| Type | Incremental | Absolute |
|---------|-------------------------|----------|
| CN42.1 | | +5V |
| CN42.2 | | N.C. |
| CN42.3 | ENCZ+ | N.C. |
| CN42.4 | ENCB+ | DATA+ |
| CN42.5 | ENCA+ | CLK+ |
| CN42.6 | | 0V |
| CN42.7 | ENCZ- | N.C. |
| CN42.8 | ENCB- | DATA- |
| CN42.9 | ENCA- | CLK- |
| Chassis | Cable shield connection | |

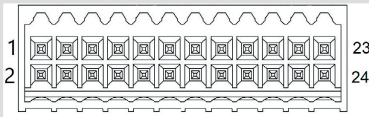


System connections

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 Electronics.

Kit code: [USBC_SERVOEE-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)



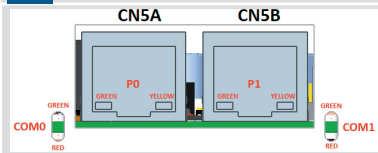
CN5B (P1)



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 |

R1 (MSD): Most Significant Digit that must be multiplied per 16.

R2 (LSD): Least Significant Digit that must be multiplied per 1.

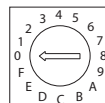
Example: 5C

R1 = 5 ----> 5x16 = 80

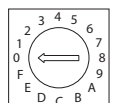
R2 = C ----> 12x1 = 12

Node ID = 92

x 16
(MSD)
R1



x1
(LSD)
R2



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.

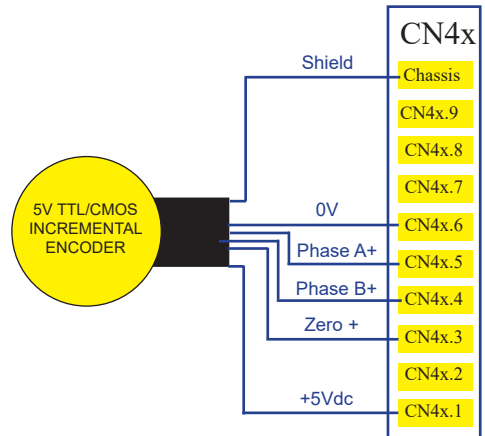
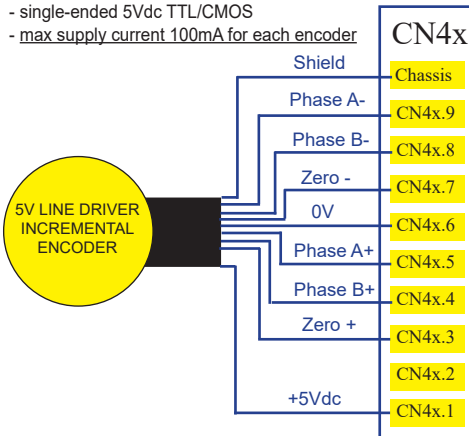
In general:

- Led Red indicates an alarm or a drive protection
- Led Yellow indicates a warning

Incremental and Absolute Encoder input connection (isolated)

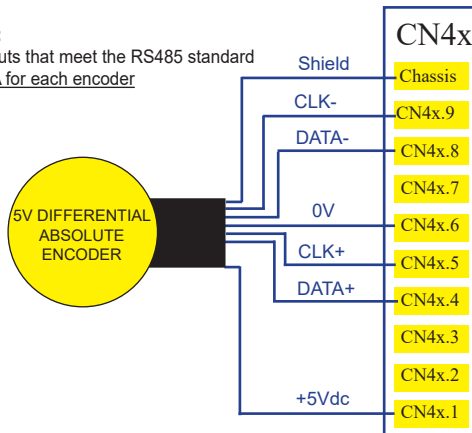
Incremental encoder inputs:

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



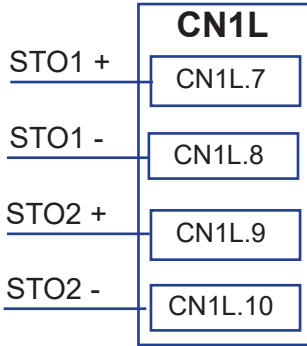
Absolute encoder input:

- 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.

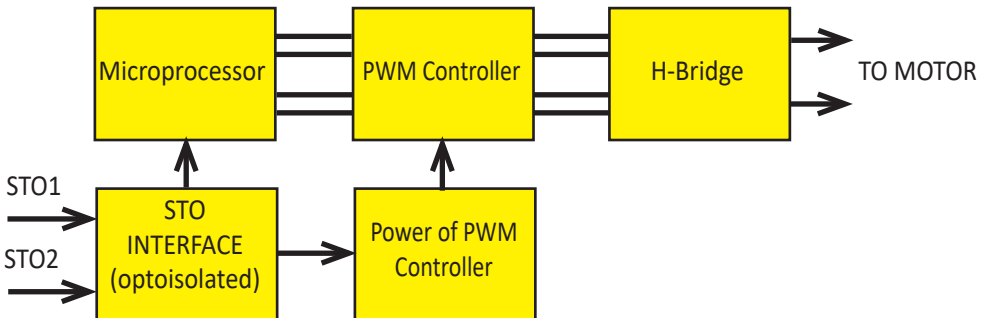
Safety specifications

| | | |
|------------------------|---|---|
| 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 x 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 signals 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.



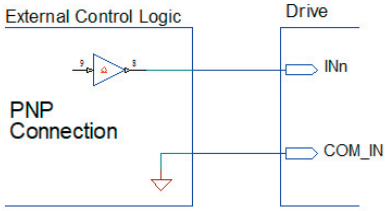
If not using the STO feature, the interface must be connected to an external +24Vdc supply in order enabled the drive.



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)

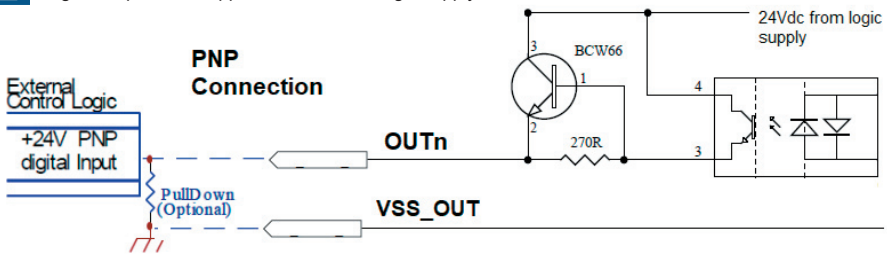
i 24V PNP type, $F_{max} = 1\text{kHz}$



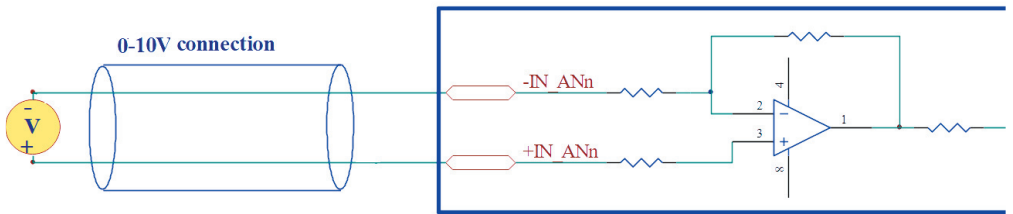
| Characteristics | MIN. | MAX. | Unit |
|-----------------------------|------|------|------|
| Supply voltage | 19 | 24 | Vdc |
| Inputs frequency | -- | 1 | kHz |
| Threshold switching voltage | 10 | -- | Vdc |
| Current at 24 Vdc | -- | 10 | mA |

Digital outputs connection (opto-coupled)

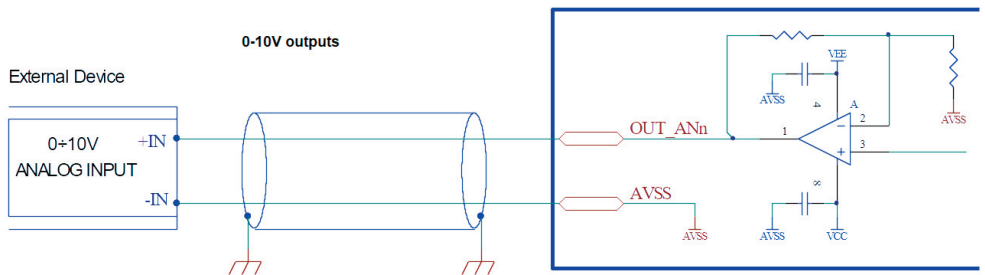
i 24Vdc PNP, $I_{OUTmax} = 100\text{mA}$, $F_{max} = 1\text{kHz}$
Digital outputs are supplied from 24 Vdc logic supply



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 mm ² (AWG24) | 2.50 mm ² (AWG12) |
| Motor outputs | 0.20 mm ² (AWG24) | 2.50 mm ² (AWG12) |
| Logic supply & STO | 0.14 mm ² (AWG26) | 0.50 mm ² (AWG20) |
| Feedback | 0.20 mm ² (AWG24) | 0.50 mm ² (AWG20) |
| Digital Inputs / Outputs | 0.14 mm ² (AWG26) | 0.50 mm ² (AWG20) |
| Fiedbus 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 or fan 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 for 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:



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 courts-circuits 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.

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