# SW4D2070M231-00 - Controller
# SW4D2070C231-00 - Controller

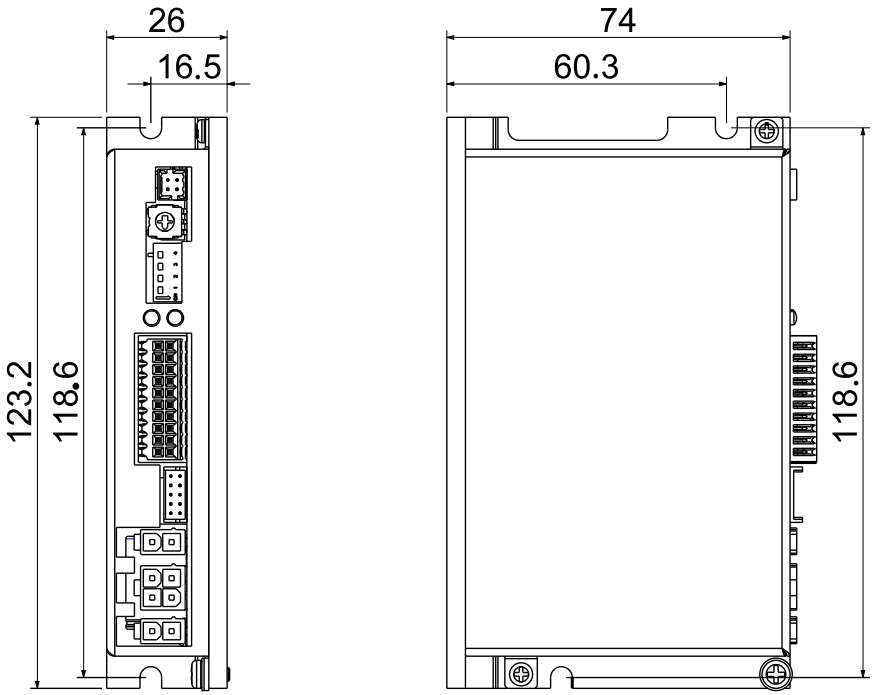
## Installation instructions

Refer to installation use and maintenance manual for more information.

## 2 phase bipolar stepper drive technical data:

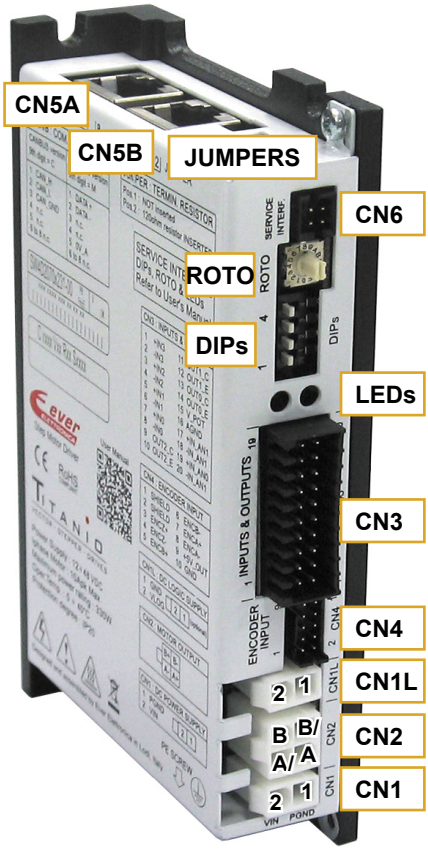
- *DC power supply: 12 ÷ 48 Vdc*
- *DC logic supply: 12 ÷ 48 Vdc (optional and not isolated)*
- *Phase current: up to 10 Apeak*
- *Chopper frequency: ultrasonic 40KHz*
- *Stepless Control Technology (65536 position per turn)*
- *Protections against: over current, over/under voltage, overheating, short circuit between motor phase-to-phase and phase-to-ground.*
- *Modbus or Canbus communication interfaces*
- *Encoder input (not isolated): 5V Differential (RS422) or 5V Single-Ended (TTL/CMOS) incremental encoder*
- *Service SCI interface for programming and real time debugging*
- *4 digital inputs (opto-coupled)*
- *3 digital outputs (opto-coupled)*
- *2 analog inputs*
- *Dimensions: 123.2 x 74 x 26 mm (without connectors)*
- *Protection degree: IP20*
- *Pollution degree: 2*
- *Category C3 following standard EN 61800-3*
- *Working temperature 5°C ÷ 40°C; Storage temperature -25°C ÷ 55°C*
- *Humidity: 5% ÷ 85% not condensing*

## Mechanical data



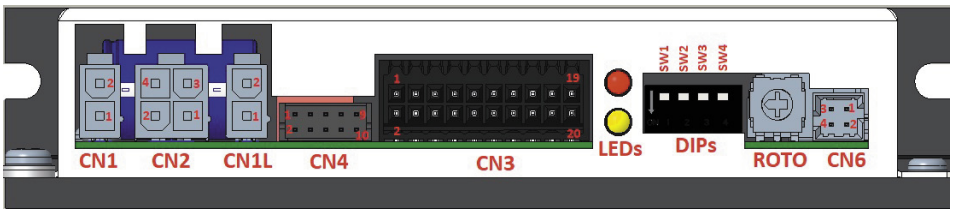
# System connections

Connectors:





***Power and Logic supplies are not isolated but they have common reference inside the drive. (GND and PGND are in common).***



# System connection

**CN1: Power supply**

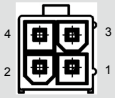
2 positions, pitch 4.2mm double row, PCB header connector

| | | | |
|---|---|---|---|
| CN1.1 | PGND | PWR_IN | Negative DC power supply input |
| CN1.2 | VIN | PWR_IN | Positive DC power supply input |


**CN2: Motor connection**

4 positions, pitch 4.2mm double row, PCB header connector

| | | | |
|---|---|---|---|
| CN2.1 | B/ | PWR_OUT | Motor output phase B/ |
| CN2.2 | A | PWR_OUT | Motor output phase A |
| CN2.3 | B | PWR_OUT | Motor output phase B |
| CN2.4 | A/ | PWR_OUT | Motor output phase A/ |




**CN1L: Logic supply**

2 positions, pitch 4.2mm double row, PCB header connector

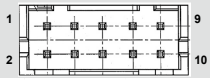
| | | | |
|---|---|---|---|
| CN1L.1 | GND | PWR_IN | Negative DC logic supply input |
| CN1L.2 | VLOG | PWR_IN | Positive DC logic supply input |


***Not isolated from the power.***

**CN4: Encoder input connection**

10 positions, pitch 2mm double row, PCB header connector

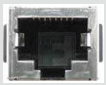
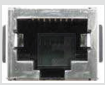
| | | | |
|---|---|---|---|
| CN4.1 | SHIELD | / | Cable shield connection |
| CN4.2 | SHIELD | / | Cable shield connection |
| CN4.3 | ENCZ+ | DIG_IN | Encoder Zero input positive |
| CN4.4 | ENCZ- | DIG_IN | Encoder Zero input negative |
| CN4.5 | ENCB+ | DIG_IN | Encoder phase B input positive |
| CN4.6 | ENCB- | DIG_IN | Encoder phase B input negative |
| CN4.7 | ENCA+ | DIG_IN | Encoder phase A input postive |
| CN4.8 | ENCA- | DIG_IN | Encoder phase A input negative |
| CN4.9 | +5V | PWR-OUT | +5Vdc power supply output |
| CN4.10 | GND | PWR-OUT | Negative side of supply |




**CN5A e CN5B: CANbus interface (“C” version)**

RJ45, 8 positions shielded, PCB header connector

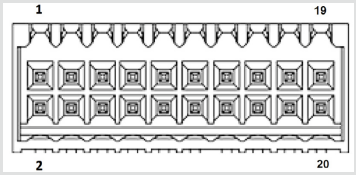
| | | | |
|---|---|---|---|
| CN5.1 | CAN_H | Digital I/O | |
| CN5.2 | CAN_L | Digital I/O | |
| CN5.3 | CAN_GND | PWR_OUT | |
| CN5.4 | N.C. | | Not connected |
| CN5.5 | N.C. | | Not connected |
| CN5.6 | N.C. | | Not connected |
| CN5.7 | N.C. | | Not connected |
| CN5.8 | N.C. | | Not connected |

CN5A  CN5B 

**CN3: Inputs and outputs**

16 positions, pitch 3.5mm double row, PCB header connector

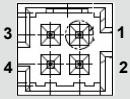
| | | | |
|---|---|---|---|
| CN3.1 | +IN3 | DIG_IN | Digital input 3 positive side |
| CN3.2 | -IN3 | DIG_IN | Digital input 3 negative side |
| CN3.3 | +IN2 | DIG_IN | Digital input 2 positive side |
| CN3.4 | -IN2 | DIG_IN | Digital input 2 negative side |
| CN3.5 | +IN1 | DIG_IN | Digital input 1 positive side |
| CN3.6 | -IN1 | DIG_IN | Digital input 1 negative side |
| CN3.7 | +IN0 | DIG_IN | Digital input 0 positive side |
| CN3.8 | -IN0 | DIG_IN | Digital input 0 negative side |
| CN3.9 | OUT2_C | DIG_OUT | Digital output 2 collecor side |
| CN3.10 | OUT2_E | DIG_OUT | Digital output 2 emitter side |
| CN3.11 | OUT1_C | DIG_OUT | Digital output 1 collecor side |
| CN3.12 | OUT1_E | DIG_OUT | Digital output 1 emitter side |
| CN3.13 | OUT0_C | DIG_OUT | Digital output 0 collector side |
| CN3.14 | OUT0_E | DIG_OUT | Digital output 0 emitter side |
| CN3.15 | V_POT | PWR_OUT | Voltage supply output for potentiometer |
| CN3.16 | AGND | PWR_OUT | Output negative reference for potentiometer |
| CN3.17 | +IN_AN1 | AN_IN | Analog input 1 positive side |
| CN3.18 | -IN_AN1 | AN_IN | Analog input 1 negative side |
| CN3.19 | +IN_AN0 | AN_IN | Analog input 0 positive side |
| CN3.20 | -IN_AN0 | AN_IN | Analog input 0 negativ e side |




**CN6: Service SCI interface**

4 positions, pitch 2mm double row, PCB header connector

| | | |
|---|---|---|
| CN6.1 | TX/RX | Transmit / Receive Line |
| CN6.2 | $\overline{DE}$/RE | Drive Enable Negated / Receive Enable |
| CN6.3 | +5V | +5V power out |
| CN6.4 | GND | DNG power out |

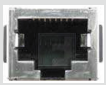



***This connection is <u>only</u> possible with hardware and software provided by Ever Motion Solutions.***

**CN5A e CN5B: Modbus interface (“M” version)**

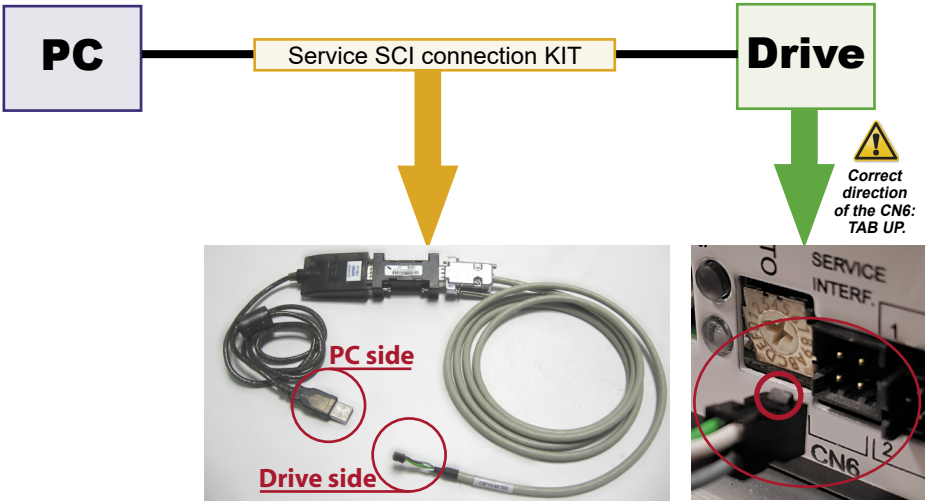
RJ45, 8 positions shielded, PCB header connector

| | | | |
|---|---|---|---|
| CN5.1 | Data + | Digital I/O | Positive RS485 signal |
| CN5.2 | Data - | Digital I/O | Negative RS485 signal |
| CN5.3 | N.C. | | Not connected |
| CN5.4 | N.C. | | Not connected |
| CN5.5 | 0V_A | PWR_OUT | Signal ground |
| CN5.6 | N.C. | | Not connected |
| CN5.7 | N.C. | | Not connected |
| CN5.8 | N.C. | | Not connected |

CN5A  CN5B 

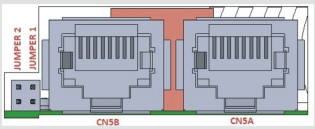
## Service SCI connection

***This connection is <u>only</u> possible with hardware and software provided by Ever.***
***Kit code: SW4_SERV00-SL or SW4_SERV00-EE***

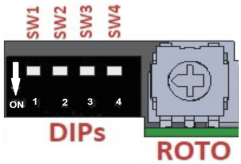



## Dip-Switches, Roto-Switch and Jumpers settings

| Jumpers - Termination Resistor | |
|---|---|
| Position 1 | 120 ohm resistor NOT inserted |
| Position 2 | 120 ohm resistor INSERTED |




| Dip-Switches - Baud Rate Selection | | | |
|---|---|---|---|
| **SW1** | **SW2** | **Modbus** | **Canbus** |
| OFF | OFF | 115200 | 1M |
| ON | OFF | ***57600 (default)*** | ***500K (default)*** |
| OFF | ON | 38400 | 250K |
| ON | ON | 19200 | 125K |




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

| Dip-Switches & Roto-Switch - Node-ID Selection | | | | |
|---|---|---|---|---|
| **SW3** | OFF | ON | OFF | ON |
| **SW4** | OFF | OFF | ON | ON |
| **ROTO** | **Node-ID#** | **Node-ID#** | **Node-ID#** | **Node-ID#** |
| **0** | **Reserved** | **16** | **32** | **48** |
| ***1 (default)*** | ***1*** | **17** | **33** | **49** |
| **2** | **2** | **18** | **34** | **50** |
| **3** | **3** | **19** | **35** | **51** |
| **4** | **4** | **20** | **36** | **52** |
| **5** | **5** | **21** | **37** | **53** |
| **6** | **6** | **22** | **38** | **54** |
| **7** | **7** | **23** | **39** | **55** |
| **8** | **8** | **24** | **40** | **56** |
| **9** | **9** | **25** | **41** | **57** |
| **A** | **10** | **26** | **42** | **58** |
| **B** | **11** | **27** | **43** | **59** |
| **C** | **12** | **28** | **44** | **60** |
| **D** | **13** | **29** | **45** | **61** |
| **E** | **14** | **30** | **46** | **62** |
| **F** | **15** | **31** | **47** | **63** |

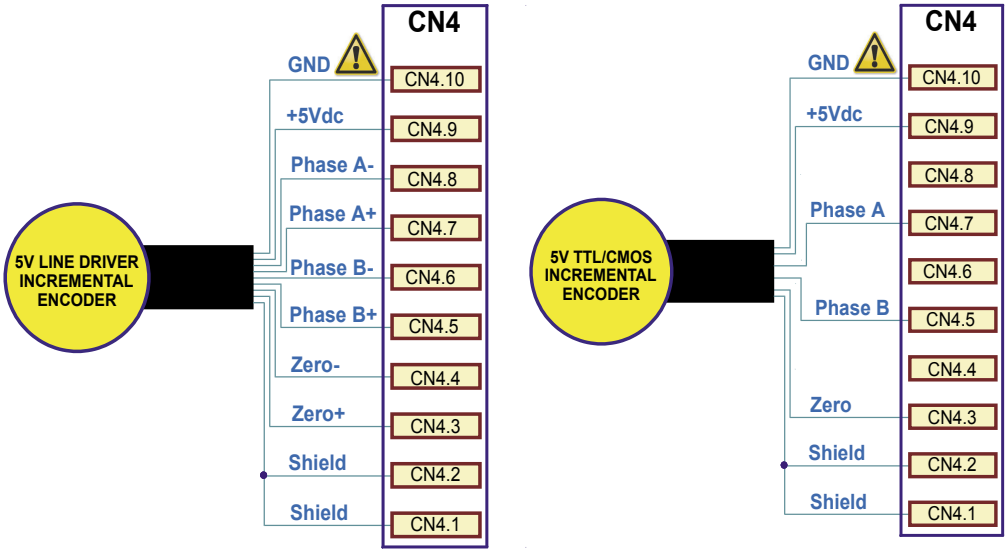
## Working Status (Led)

| | Visualization status | Description |
|---|---|---|
| 1 | Green ON | Correct functioning |
| 2 | Green Blinking | Enable OFF, current zero |
| 3 | Blue ON | Error: connect with Service SCI kit and check with software |
| 4 | Blue ON - Yellow ON | Drive in boot mode. A new firmware should be downloaded to drive |
| 5 | Blue ON - Red Blinking (200ms) | Initialization phase. Should last few seconds. While in this condition the drive is not fully operational |
| 6 | Yellow ON - Red OFF - Blue OFF | Missing setting of Inominal |
| 7 | Yellow Blinking (500ms) - Red OFF - Blue OFF | Warning: connect with Service SCI kit and check with software |
| 8 | Red ON | Protection: Motor is in open phase condition |
| 9 | Red Blinking (200ms) | Current protection |
| 10 | Red ON (1sec) + Yellow 1 Blink | Undervoltage protection |
| 11 | Red ON (1sec) + Yellow 3 Blink | Thermal protection |
| 12 | Red ON (1sec) + Yellow 4 Blink | Motor Feedback Error |
| 13 | Red ON (1sec) + Yellow 5 Blink | Missing Torque Enable (missing Safe Torque Off) |
| 14 | Red ON (1sec) + Yellow 6 Blink | Motor Current Regulation is out of range |
| 15 | 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, Yellow and Blue are all OFF. In general:***
- ***Led Blue indicates a software internal fault or a non-operative condition***
- ***Led Red indicates an alarm or a drive protection***
- ***Led Yellow indicates a warning***

## Encoder input connection

Electrically NOT-isolated digital inputs :
- Differential 5Vdc that meet the RS422 standard
- Single-Ended 5Vdc TTL/CMOS

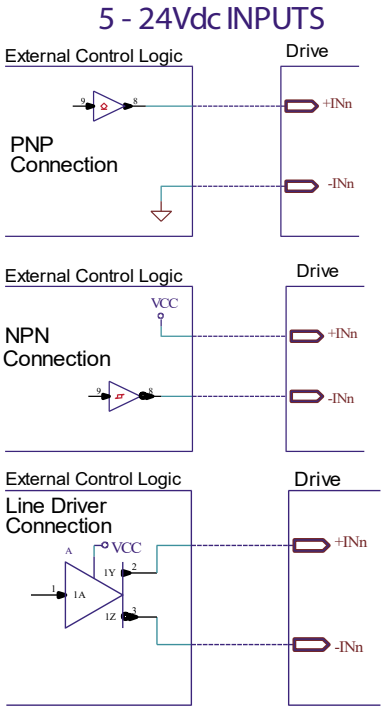



Maximum suplpy current 100 mA.

***GND is internally in common with power ground, this is potentially dangerous. Take all necessary measures to avoid possible contacts in the final installation.***

## Digital inputs connection

Differential PNP, NPN and Line Driver type.

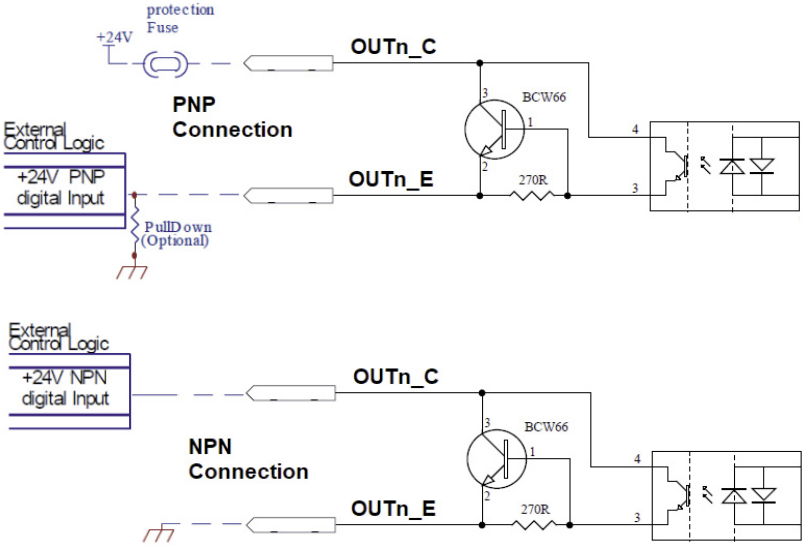



| IN0 & IN1 | | | |
|---|---|---|---|
| **Characteristics** | **MIN.** | **MAX.** | **Unit** |
| **Supply voltage** | **5** | **24** | **Vdc** |
| **Inputs frequency** | **--** | **5** | **kHz** |
| **Threshold switching voltage** | **2.5** | **-** | **Vdc** |
| **Current at 5 Vdc** | **--** | **6** | **mA** |
| **Current at 24 Vdc** | **--** | **10** | **mA** |

| IN2 & IN3 | | | |
|---|---|---|---|
| **Characteristics** | **MIN.** | **MAX.** | **Unit** |
| **Supply voltage** | **5** | **24** | **Vdc** |
| **Inputs frequency** | **--** | **250** | **kHz** |
| **Threshold switching voltage** | **1.9** | **2.4** | **Vdc** |
| **Current at 5 Vdc** | **--** | **7.52** | **mA** |
| **Current at 24 Vdc** | **--** | **10** | **mA** |

## Digital outputs connection

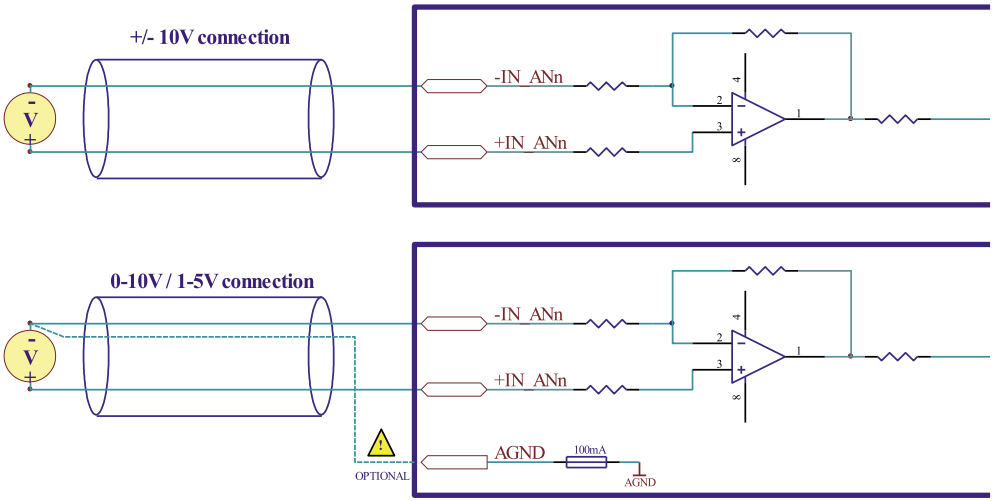
Digital outputs are 5-24 Vdc PNP/NPN, $I_{OUTmax}$ = 100 mA, $F_{max}$ = 100 kHz (OUT0 & OUT1), $F_{max}$ = 250 Hz (OUT2).



# Analog inputs connection

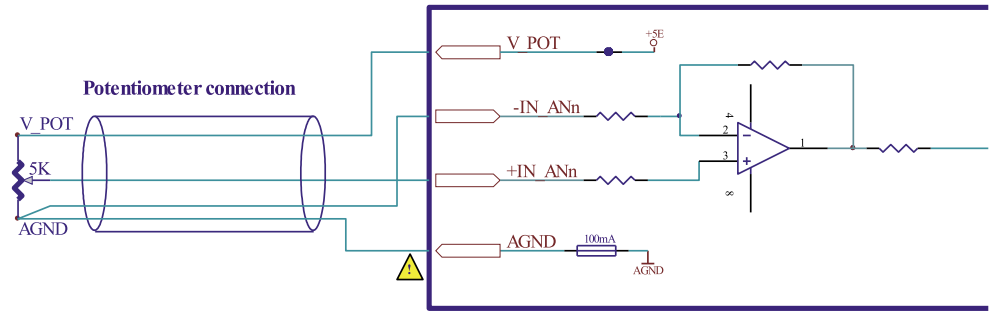
The resolution of the analog inputs depends from the type of the connection which could be defined by software: differential or potentiometer.

## DIFFERENTIAL CONNECTION




***The connection from an esternal reference and AGND should be preceded by a thorough risk analysis on the machine/circuit in which the drive will be installed.***

## POTENTIOMETER CONNECTION




***AGND is internally in common with power ground, this is potentially dangerous. Take all necessary measures to avoid possible contacts in the final installation.***

## Mating connectors

| Connector | Description |
|---|---|
| CN1 | Molex 39-01-2025 |
| CN1L | Molex 39-01-2025 |
| CN2 | Molex 39-01-2045 |
| CN3 | Dinkle 0156-1B20-BK |
| CN4 | Hirose DF11-10DS-2C |
| CN5A / CN5B | RJ45, 8 positions |

## Cables section

| Function | Cable | |
|---|---|---|
| | Minimum | Maximum |
| Power supply and PE | 0.5 mm² (AWG20) | 1.3 mm² (AWG16) |
| Motor outputs | 0.5 mm² (AWG20) | 1.3 mm² (AWG16) |
| Encoder input | 0.08 mm² (AWG28) | 0.2 mm² (AWG24) |
| Inputs and Outputs | 0.14 mm² (AWG26) | 0.5 mm² (AWG20) |
| Communication interfaces | Min. 0.25 mm² (AWG23) CANbus CiA-CANOpen | |

## 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.

## Drive's fault analysis

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

| DEFECT | CAUSE | ACTION |
|---|---|---|
| Intervention of the themal protection. | Can be caused by a heavy working cycle or a high current in the motor. | Improve the drive cooling by a 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. |

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