

OPENcontrol

Control Units

Installation Guide

DOCUMENT NUMBER: 45006604R
EDITION: 00
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DATE: January 2018

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Edition	Date	Note	Author
00	January 2018		Prima Electro SpA

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1. SAFETY INSTRUCTIONS

1.1 Introduction

This manual contains the necessary information for the correct installation of the control unit of the OPENcontrol family of numerical controls.

The Handbook is addressed to the technicians in charge of the design of the electrical panel and of the connection between the machine tool and numerical control. For the application of the contents of this manual it is assumed that the reader has the necessary technical knowledge for the use of numerical controls, even if using Prima Electro OPENcontrol series for the first time.

1.2 Warning and Notes

This manual distinguishes two types of safety instructions:

WARNING is used to draw attention to situations that can lead to serious error conditions, injury and death.

Notes are used to draw the attention of the reader or provide additional information on the topics discussed. The notes are less critical of the **WARNINGS**, but should not be overlooked.

1.3 Legend

ATTENTION: the reader is informed of situations that can cause serious physical damage and/or serious damage to the equipment with the following symbols:



WARNING! Dangerous Voltage: warns of situations in which a voltage level that can cause physical damage and/or equipment damage. The text next to the symbol explains how to avoid the danger of damage.



WARNING! Generic Danger: warns of situations that may cause physical damage and/or damage to the equipment but due to non-electrical causes. The text next to the symbol explains how to avoid danger.



Note: provides or highlights more information on the topic

1.4 Updates related to this edition

This is the first issue.

The manual contains the descriptions of the new control units **OPENsmart**, **OPENkey** e **OPENprime**.

2. INSTRUCTIONS FOR INSTALLING THE CONTROL UNITS

The Control Unit must be mounted in a cabinet protected against dust, oil and other agents that can damage the module.

The module must not be cooled with air coming directly from outside.

OPENsmart, **OPENkey** e **OPENprime** control units must be mounted in a vertical position, as in the following figures.

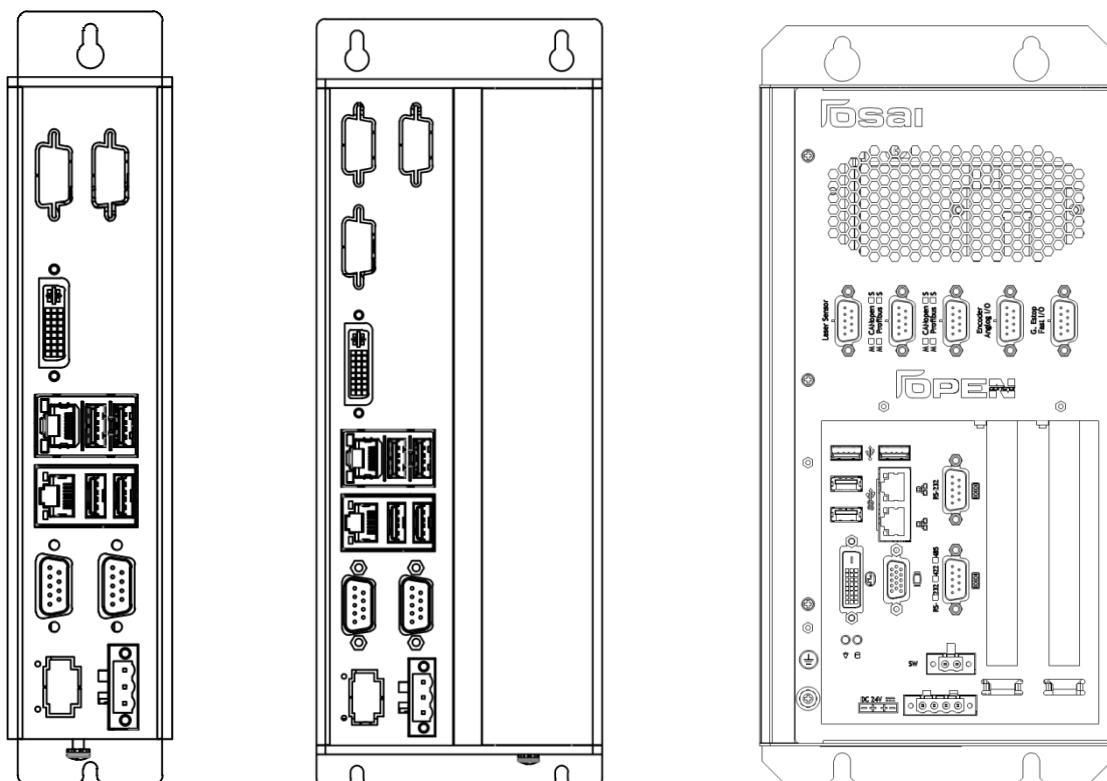


Figure 1:Mounting position of **OPENsmart**, **OPENkey** e **OPENprime**, front view

Leave a space of at least 10 cm around the module to ensure proper ventilation.
 In addition, at the top and bottom, it is necessary to leave sufficient space for the passage of cables and fastening them with a screwdriver.

If the Control Unit is installed in the electrical cabinet that houses the power units, it is recommended to isolate it using metal sheets or placing it at a minimum distance of 30 cm from other equipments such as drives, transformers, power groups typically. This is a precaution to minimize the effects of radiated interference.

Since spindle and axis drives dissipate much heat, it is recommended to place them above the control unit or sideways.

Once installed, the Control Unit should be easily accessible for maintenance technicians to facilitate troubleshooting and reduce the time and cost of interventions.

2.1 General installation guide

To ensure proper installation of the control, which will affect the operations of the whole system, it is good to follow some rules in the design phase of the installation:

- › Carefully inspect the path of the cables so as not to exceed the maximum lengths allowed for the connection between components.
- › Separate the path of the low-voltage signal cables from those of high-voltage power
- › if necessary, provide good ventilation or cooling of the electrical cabinet.
- › Place the cabinet that houses the control unit in such a way that the doors can open completely. These must always be closed, except during maintenance operations.
- › Mount the control inside the cabinet ensuring easy access to the connectors and other elements.

3. GROUNDING AND DISTURBANCE

All the devices of a machine tool with OPENcontrol control unit must be properly grounded. This prevents electric shock to operators who are in contact and reduce the effects caused by electromagnetic interference. All ground connections must be continuous and permanent.

For any reason, a ground connection must not be interrupted by using switches.

The connections of the protective conductors must comply with article 13 of the publication IEC 204-1.



It is recommended to use copper wires in the construction of the ground conductors
If the conductors are insulated, the insulation must be yellow and green.



For the correct connection and use of third-party devices, refer to the documentation
of the manufacturer.

3.1 Earth grounding

Each sub-group installed in a control cabinet must have a separate ground connection that is, the ground terminal of each subgroup must be connected separately with a suitable and as short as possible conductor, to the ground busbar of the cabinet. If the AC power connector block of a sub-group requires a ground connection, also this point must be connected to the ground busbar of the Cabinet. If the installation includes more cabinets, the ground busbar of each cabinet must be connected separately to the ground busbar of the main power distribution cabinet which will be connected to the ground cockpit of the building.

3.1.1 Electrical cabinet earth grounding

Connect the cabinet of each application to the internal busbar. It is possible to make a grounding connection using any bolt of the body of the cabinet.

Remove all traces of paint or other insulating material from the contact area and ensure the wire through eyelet lugs.

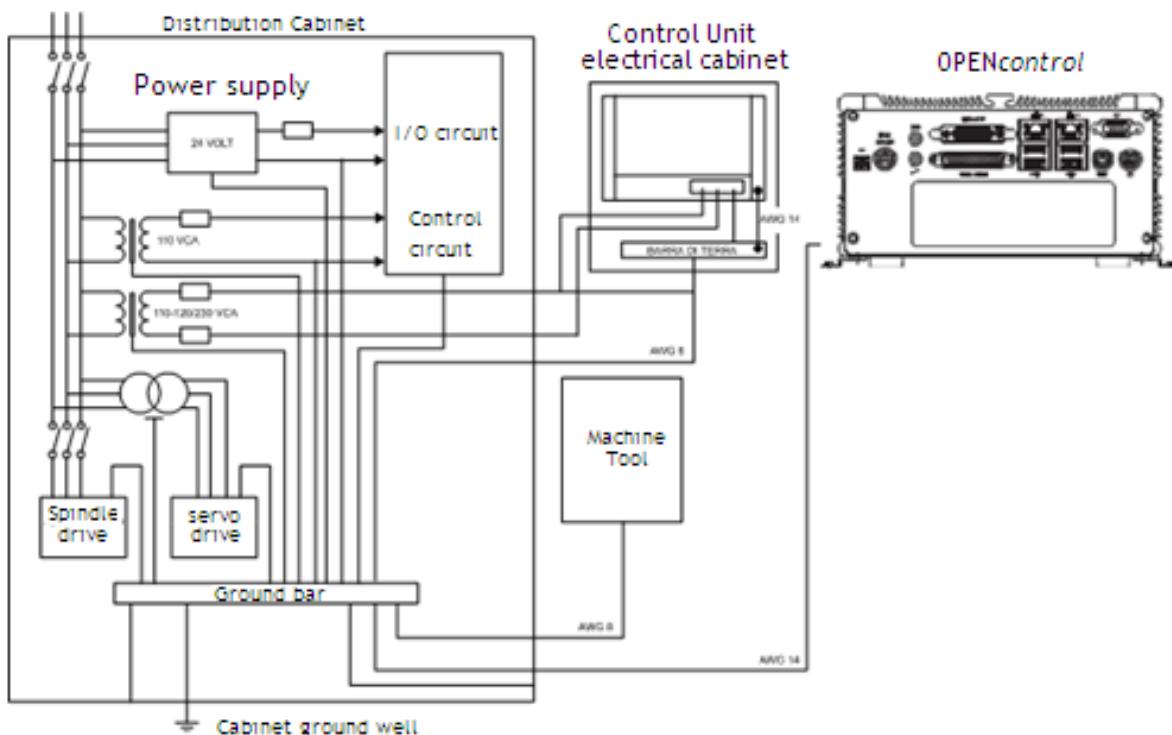


Figure 2: Grounding general scheme

3.2 Disturbances

3.2.1 General information

Any unwanted signal is defined as a disturbance.

Electrical noises are always present in proximity of electric devices under voltage, these can be of varying intensity, frequency and waveform.

There are three main types of disturbance:

1. Electrical

It is created when there is a variation in the electric field and it is transferred to the circuit by capacitive action

2. Magnetic

It is created when there is a variation in the magnetic field and it is introduced by inductive action

3. Electromagnetic

It is a combination of electric and magnetic disturbances

3.2.2 Noise generation

One of the main sources of electrical noise is represented by the rapid change of the current in an inductive circuit; the maximum current exchange takes place when the circuit opens.

This generates overcurrent which causes an abrupt increase in the voltage on the circuit opening contact, effect evidenced by a spark

3.2.3 Reduction of noises caused by opening overvoltage

L'extra tensione generata dall'apertura di un circuito di tipo induttivo deve sempre essere smorzata; l'elemento smorzante deve essere sempre posto il più vicino possibile al generatore della sovrattensione come illustrato nella figura seguente.

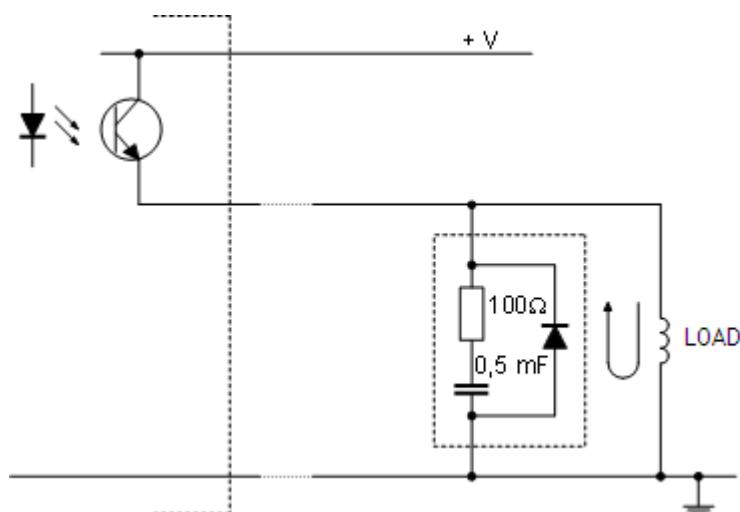


Figure 3: Noise suppressor device connection

3.2.4 Noise suppression in d.c.

The noise suppression element consists of three components with these characteristics:

Diode = 1A 800V inversi

Resistance = 100 Ω

Capacitor = 0.8 µF

Max voltage = 400 Volt

Our Company may provide a preassembled group (p/n 5091137F) whose physical characteristics are given in the following figure.

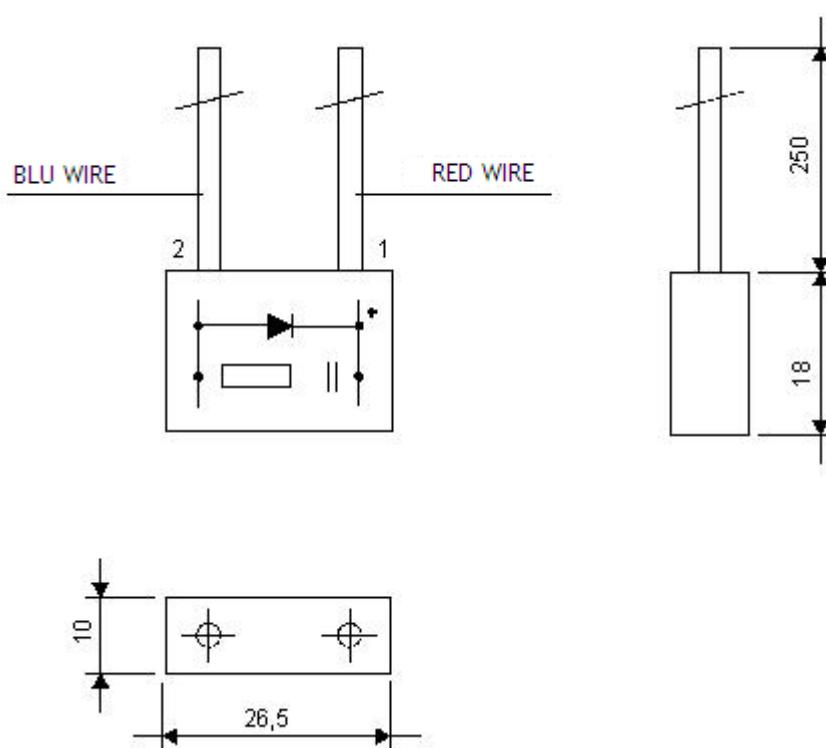


Figure 4: dc noise suppressor

3.2.5 Noise suppression in a.c

The typical spark suppressor to be connected in parallel to a.c. inductive loads is a group RC (resistor-capacitor), with the following characteristics:

R = 100 Ω

C = 0.5 µF

Max voltage = 400 Volt

Our Company may provide this group with p/n 5091137F.

The following figure shows the wiring diagram and the dimensions of the device.

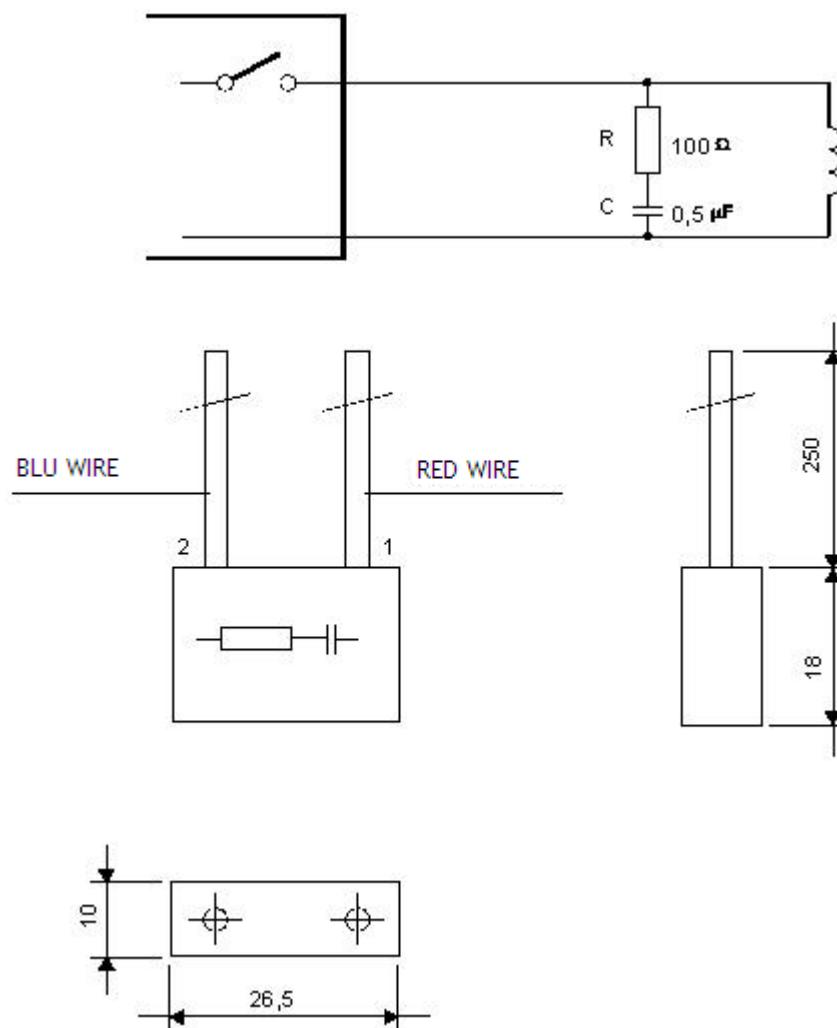


Figure 5: ac noise suppressor

3.2.6 Noise suppression for a.c. motors

For motors, noise suppression must be carried out nearby them by means of RC groups connected between phase and phase as shown in the following figure.

The element of three-phase suppression is composed of resistors and capacitors with the following characteristics:

R = 22 Ω
 C = 0.22 μF
 Max voltage = 500 Volt

The three-phase pre-assembled group RC is available at our Company with p/n 9327045X code. The diagram of the electrical connections and the size of the group are shown in the following figure.

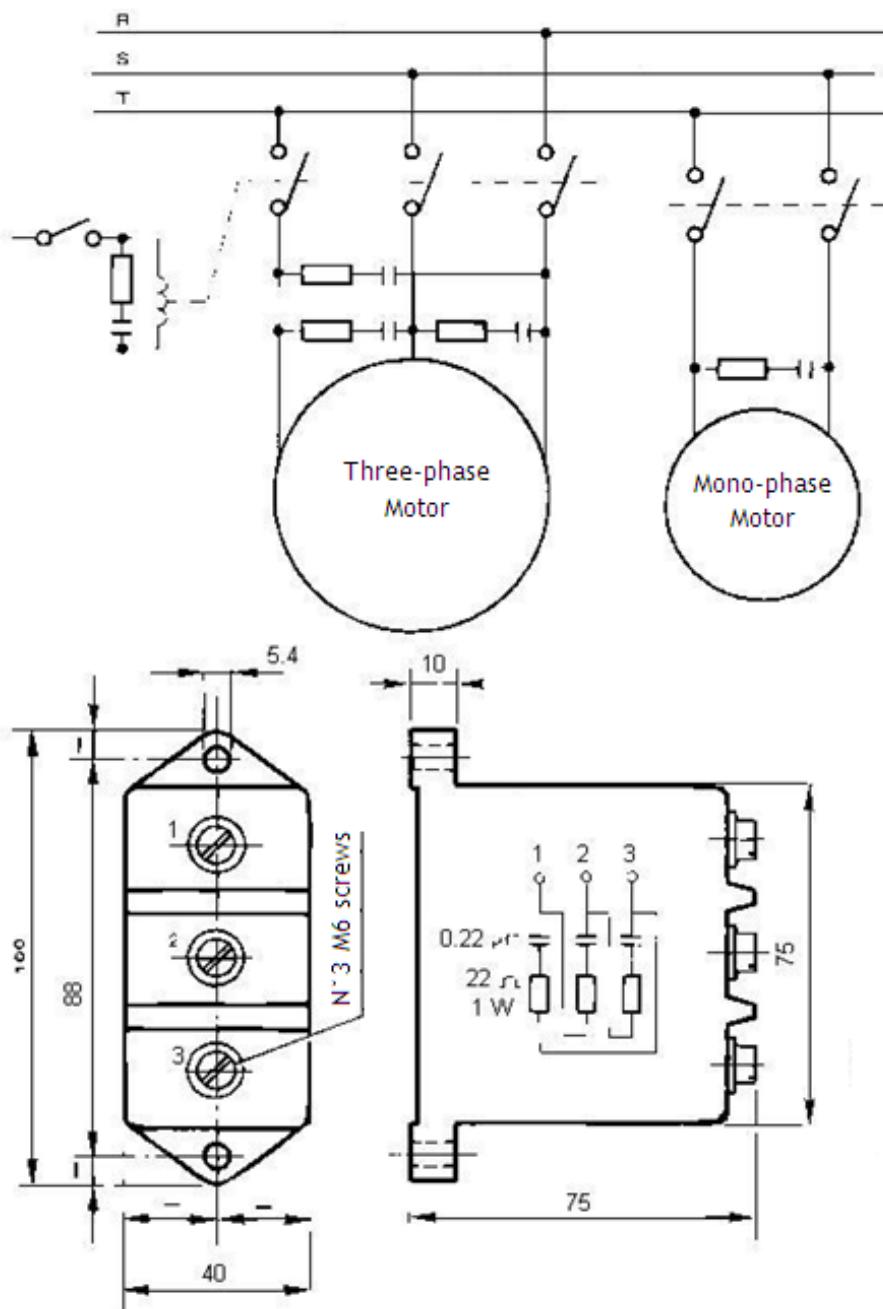


Figure 6: 3-phase noise suppressor for A.C. motors

3.3 Earth grounding

Proper grounding contributes greatly to the reduction of noise, for this reason it must be done carefully, respecting in particular the following points:

- › Ground all units that belong to the plant.
- › Do not connect in series to the ground more electrical cabinets but use individual connections to the main ground.
- › Connect the earth of the AC line to the control chassis; returns must be grounded only through the chassis.

The following figures show two examples, correct and incorrect, of connections of machine tools to the electrical system.

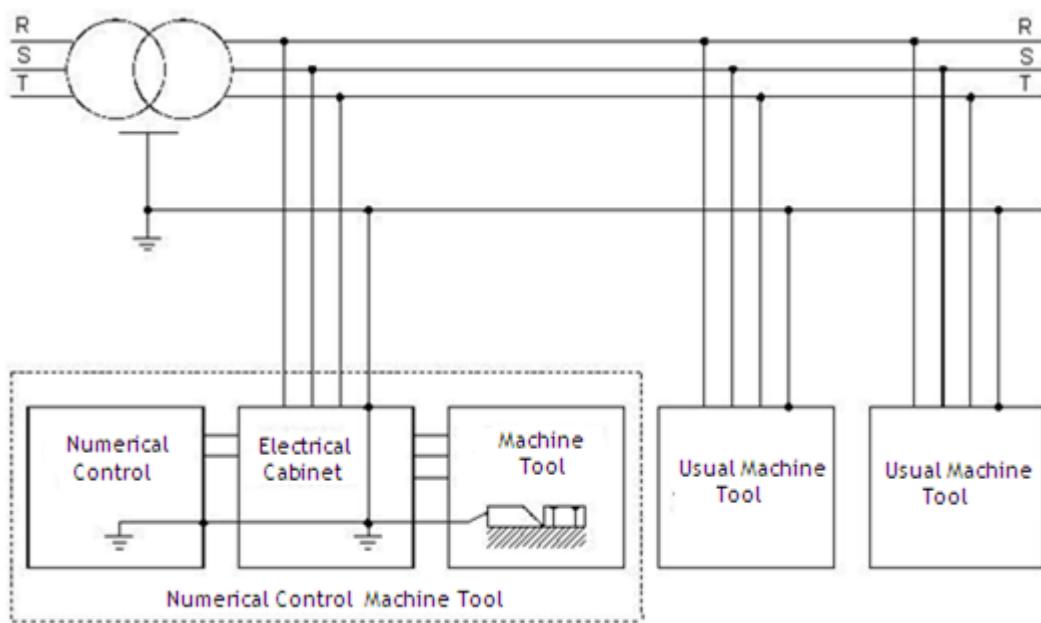


Figure 7: Example of correct connection

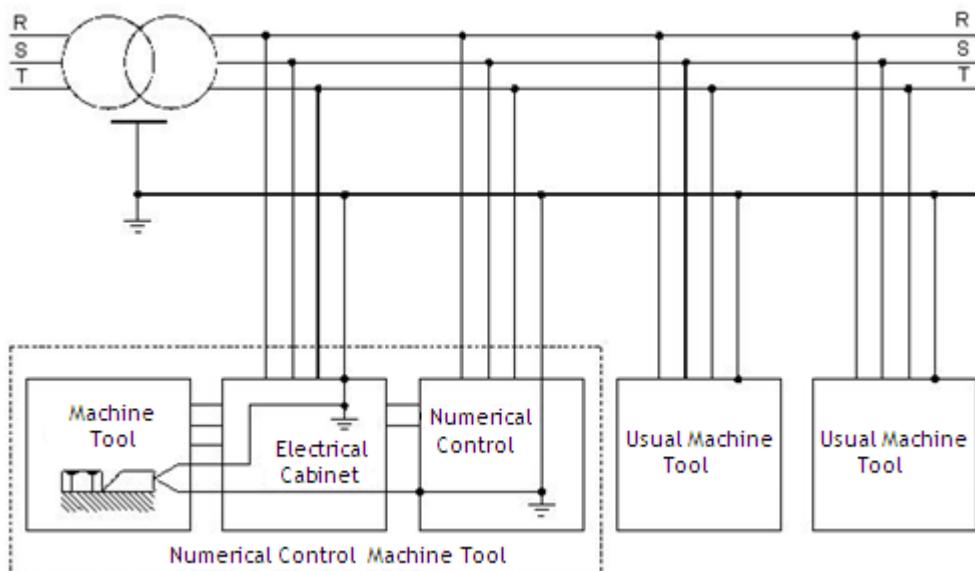


Figure 8: Example of incorrect connection

3.4 Section of protective conductors

The protective conductor, between each module and the earth bar, must have a resistance lower of 0.1Ω .

For its section use:

AWG14 for lengths up to 3 meters

AWG12 for lengths from 3 to 15 meters

AWG10 for lengths from 15 to 25 meters

3.5 Cable Shielding

Always use shielded cables wherever requested in the manual in order to block electromagnetic coupling.

In reference to the following figure, note that:

- Every time that a shield must be interrupted at a terminal or a connector, cut the wires no longer shielded as short as possible and use a terminal or a connector to give continuity to the shielding.
- Use twisted and shielded pairs, especially for connecting analog signals or low-level signals.

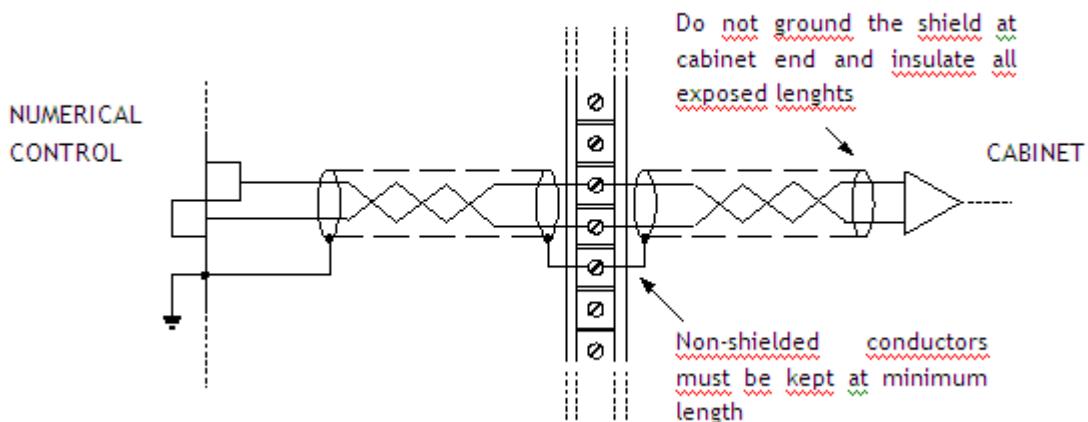


Figure 9: Use of shielded cables



To prevent damage to the machine **NEVER** use the shields as common returns or ground conductors. If the screen is not used exclusively for its own function, the noise that is created could cause uncontrolled movements of the machine.

3.6 Cable routing

When designing the machine wiring, the following points should be considered as guarantee of good results of the application:

- › The low- and high-level signals (voltage and/or current) should have separate paths and must arrive at opposite sides of the cabinet.
- › In wireways, wires should be grouped according to their functions or signal levels.
- › Cables with low-level critical signals must not be installed near high voltage power cables.
- › Use metal wireways among the various components of the installation. Do not use aluminum or any other non-ferrous material. Do not use different metals together.
- › Always use separate wireways for power signals and for low-voltage signals.

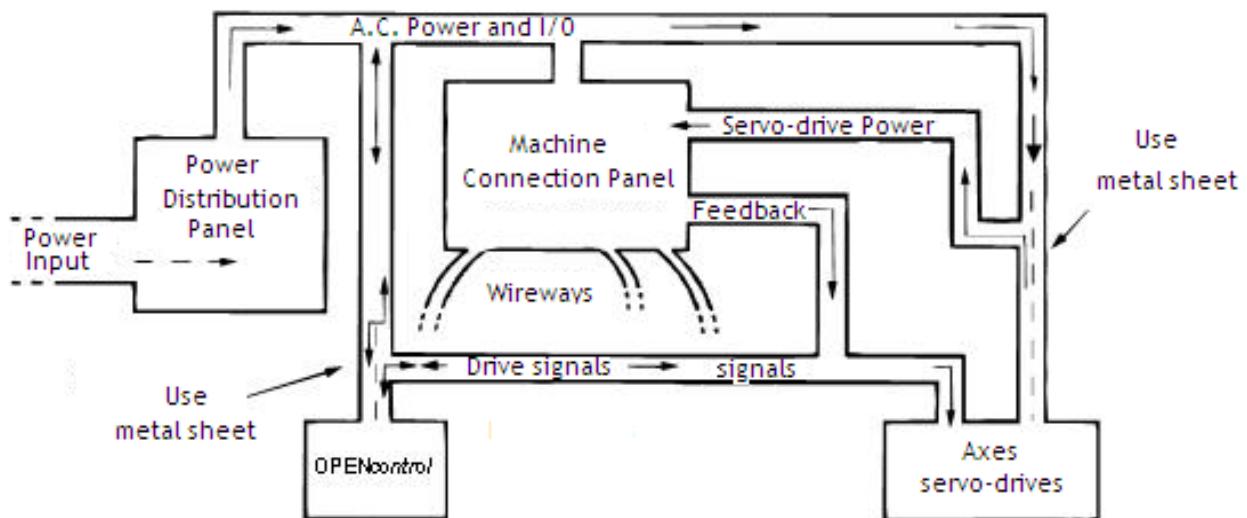


Figure 10: Installing signal wireways

3.7 Electrical cabinets

In the construction of cabinets for electronic devices use steel sheets.

Avoid, as much as possible, openings or large windows.

In the arrangement of the components, place devices sensitive to disturbances away from sources of energy at high intensity and interpose metal screens if necessary.

3.8 Notes about the proper electrical connection of the devices

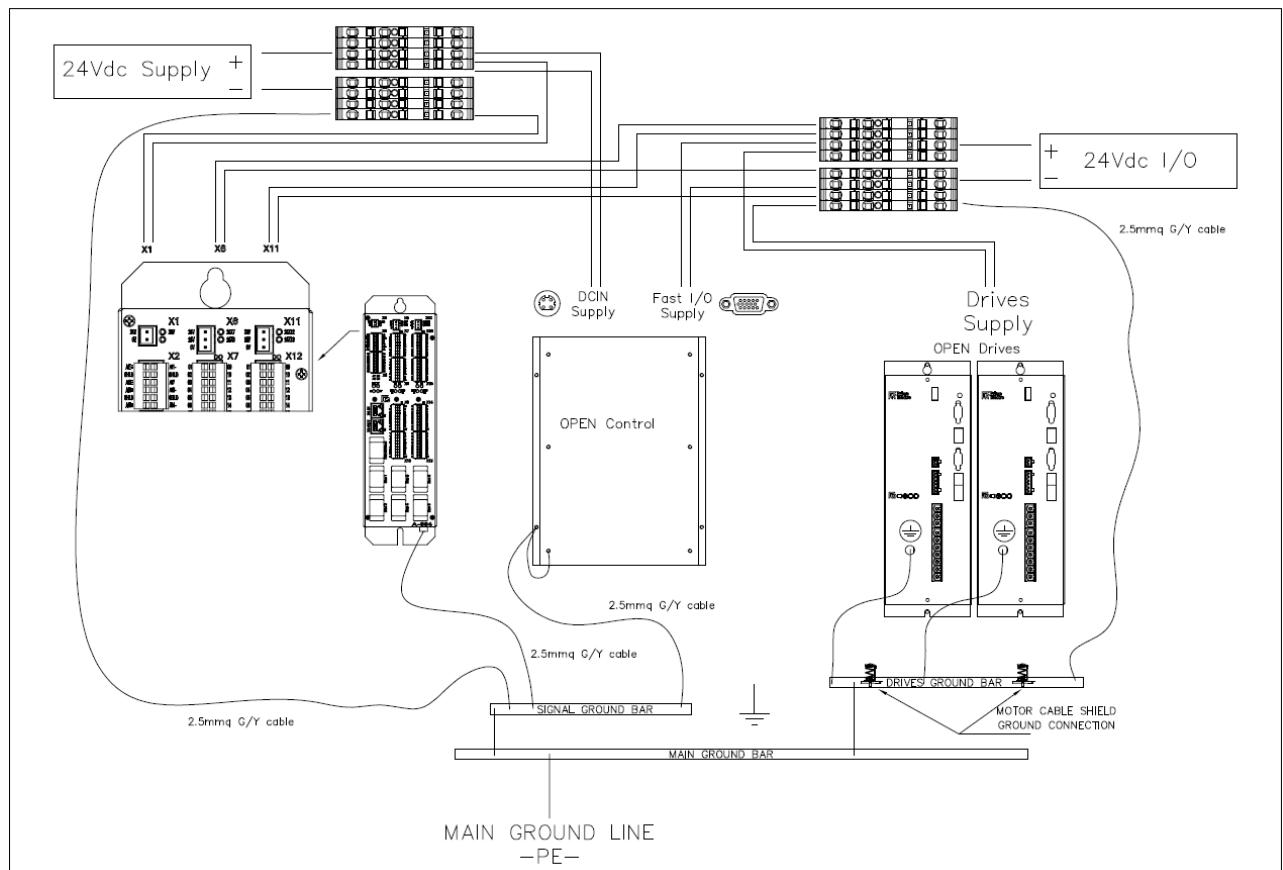
In order to make the devices work in the best possible way, a typical application is shown below where CNC, I/O device (Bridge) and drives are connected through a fieldbus.

Particular attention is given to the placement of the devices, their auxiliary 24Vdc power supply and their grounding.

The goal is to design a control cabinet in which any interferences, radiated or conducted during the movement of the machine, do not affect the low voltage devices.

Referring to the block diagram shown below, the essential points to be met are:

- Connect the auxiliary 24Vdc power supply to the devices in a Y configuration
- Locally ground the chassis of each individual device on the common ground bar
- Ground the 0V of the auxiliary power supply
- Use separate ground rods for power devices and signal devices.
- Provide different paths for signal cables and supply/power cables.
- Use shielded and twisted cables for the interconnection of devices.
- Connect to ground the screen of the motor cables.
- Prefer insulated connections between the devices (eg. ethernet network, EtherCAT, etc.).



When using a single 24Vdc power supply, maintain the same separation as above and connect the powers of the devices to the power supply directly or to the distribution terminal block which in any case must be located beside the power supply.

As regards the distribution of the cables, use different paths and different ducts for signal and power connections. If some area must be shared, prevent that signal cables are placed side by side in parallel to power cables (motors or powers other than the 24Vdc) but make sure that the two types of cables cross each other perpendicularly.

Each signal cable must be shielded (preferably with braid and not with foil) and twisted in pairs.

Also, avoid that signal communication cables pass nearby electromechanical components equipped with a coil as contactors, magneto-thermal breakers, etc.

Put the devices on the metal plate bottom following a theoretical “star” distribution dividing the plate (although it is only one) in a “power” area and a “control” area and placing the main grounding bar between the two areas. The goal is to discharge everything that comes from the power devices (which are the main sources of noises) through the main ground in the shortest possible path without passing through the area where the control devices (more sensitive to the electrical disturbance) are placed.

To connect the motor, always use a shielded cable whose braiding must be connected on one side to a ground bar located next to the drive and the other to the motor chassis.

Use motor cable made of 4 wires: 3 for the phases and 1 for the ground that must be connected to the specific drive ground screw.

Refer to the manual of the drives for their proper connection and for any recommended ferrite filters.



For proper connection and use of third-party devices, refer to the documentation of the manufacturer.

4. EMERGENCY CIRCUIT

To avoid damage to the machine or injury to the operators, it must be possible that the plant emergency circuit is activated also by the control unit

Depending on the numerical control used, the emergency signal is located on the connector X1 of OPENsmart, on the connector F I/O of OPENkey or on the connector G. Estop of OPENprime. Refer to the following chapters for its correct identification.



If the emergency circuit is activated, it is necessary to disable all axes and spindle drives because uncontrolled movements of the machine may cause accidents to the operators and possible damages to the machine.

4.1 Emergency Signal connection

The following figure shows an example of correct connection of the emergency circuit in OPENcontrol unit.



The emergency signal **G. Estop** is provided by the numerical control and it is a 24V digital signal. The maximum output current depends on the axis card model used (see the following chapters regarding the specific versions of systems). The emergency relay is not present on the axis control board, it must be inserted externally into the emergency circuit.

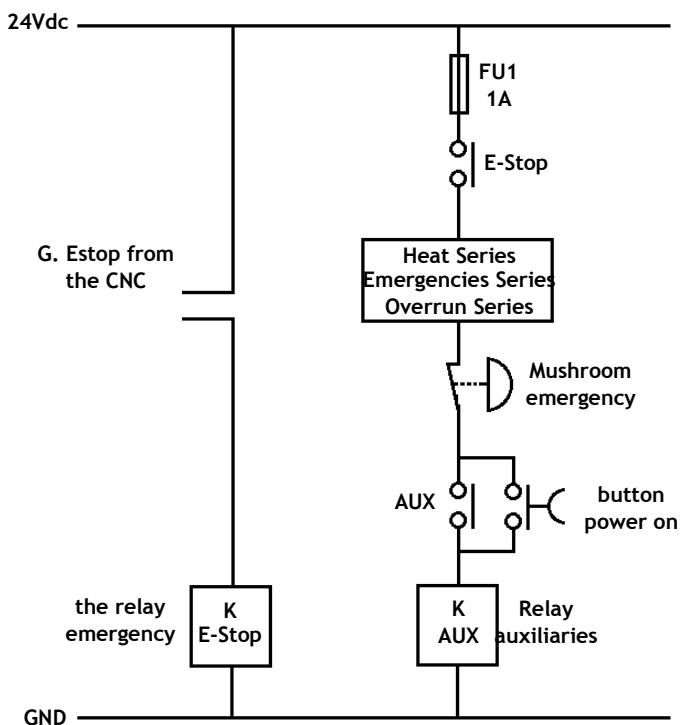


Figure 11: G. Estop connection example

It may be noted that on the 24V dc line the emergency circuit is connected in series with:

- The emergency relay contact that opens in case of anomaly of the numerical control or emergency request generated by the control unit
- The power ON button, which is connected in parallel to the self-sealing contacts of the auxiliary relay.
- The emergency button (or buttons), defined upon installation whose contacts open when it is

pressed to generate the emergency.

- › The axes overtravels which are activated when the axes exceed the extreme position.
- › A contact connected to a series of devices (breakers, temperature sensors etc.) placed in the plant. The detection of a malfunction opens the contact.
- › The emergency circuit ends at the 24V dc common line.

The activation of the auxiliary relay is possible only if the entire series of contacts of the circuit is closed.

NOTE:

- › All emergency buttons must comply with standard EN418, ie be "positive mechanical opening."
- › To avoid sticking of the contacts in the event of overcurrent (normal current of 10A contacts), it is advisable to insert in series with the emergency circuit, a fuse (see figure "Connection Example G. Estop" in this chapter).
- › In any case, the press of the emergency button guarantees the opening (breaking) of possibly stucked contacts.

4.2 Management of anomalies associated to the emergency

Following a severe control internal fault (for example, a Watch dog), a dedicated hardware circuit blocks all the functions of the system, in particular the movement of the axes and the execution of the part program; the G. Estop contact is opened.

The system enters into a state of **non-recoverable emergency** to exit from which it is necessary to turn off and on the control after having eliminated the cause of the anomaly (for a broader and more detailed description of the non-recoverable emergencies refer to Winplus Application Manual).

Following a process anomaly (for example, servo error, axes that are not in tolerance...), the system software blocks certain functions, in particular the movement of the axes and the execution of the part program;

If necessary the machine logic requests the system to enter in the state of **recoverable emergency** with consequent reset (deactivation) of the digital signal G. Estop.

For machine device anomalies such as: circuits in alarm, faulty drives, thermal tripped (protection of pumps, brakes, etc.), these must be reported to the system through the digital inputs using the contacts associated to the auxiliary relay.

If necessary the machine logic requests the system to enter in the state of **recoverable emergency** with consequent block of functions such as the movement of the axes and the execution of the part program; the G-Estop digital signal will be reset (deactivated).

If, in cases of anomaly of the process or machine plant, the machine logic (implemented by the user) requests a reset of G. Estop signal, the same logic may request to close it again, after the removal of the anomaly, thus allowing the restart of the plant without the general shutdown of the system (for a more extensive and detailed description relating to the cycle of **recoverable emergency** refer to Winplus Application manual).

5. OPENsmart CONTROL UNIT

Opensmart is a vertical mounting control unit which presents all the connectors on the front panel facilitating the connection.

Opensmart It is available in versions EtherCAT, CANopen + EtherCAT or EtherCAT + Mechatrolink III and offers all the necessary resources for the management of the machine tool (fieldbus, machine logic and HMI).



Figure 12: OpenSmart control unit

5.1 Dimensions of OPENsmart control unit

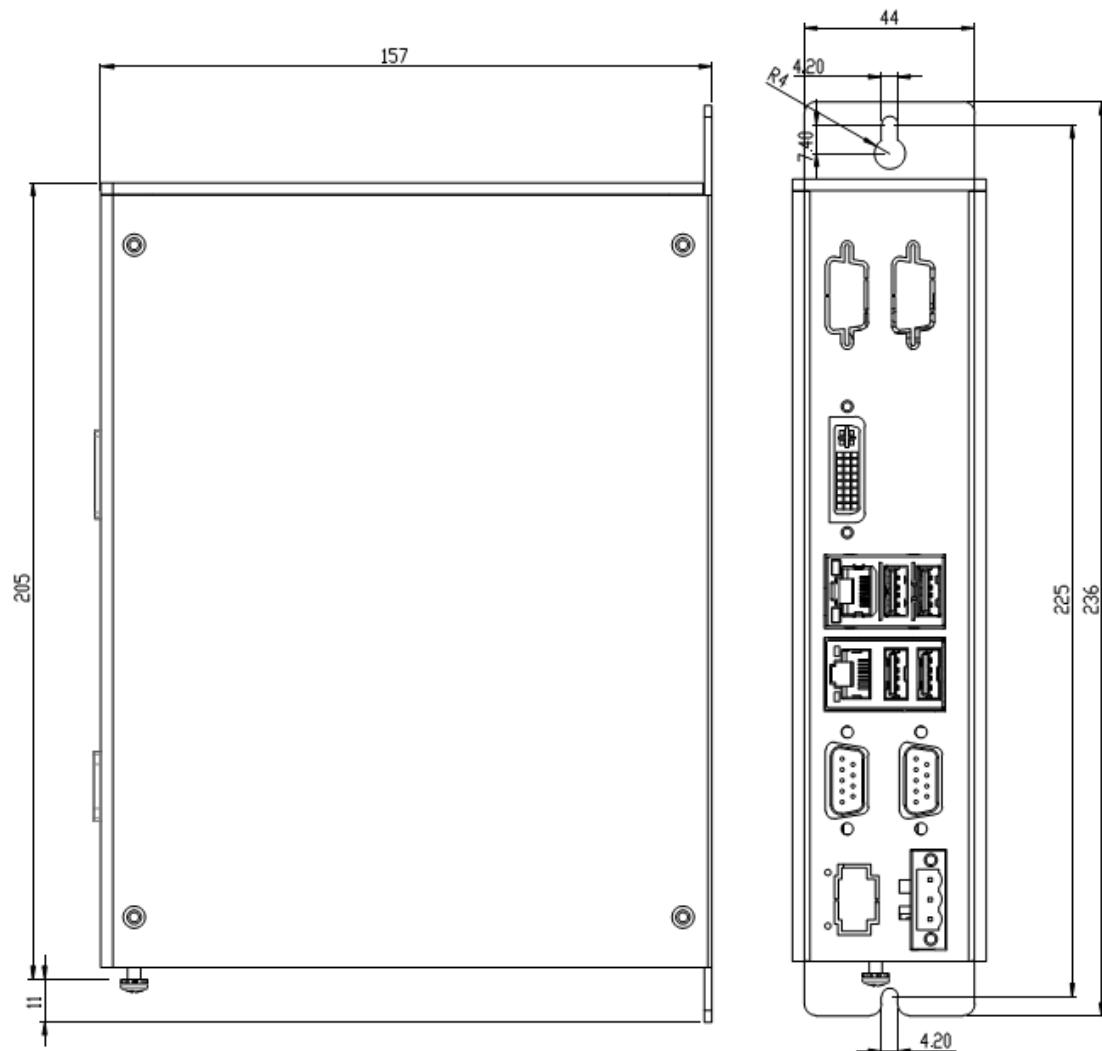


Figure 13: Dimensions of OpenSmart

5.2 OPENsmart environmental characteristics

Operating temperature:	0 ° C - + 50 ° C ambient temperature with air circulation
Storage temperature:	-20 ° C - + 80 ° C
Operating relative humidity	10% - 95% (non-condensing) max 40 ° C
Storage relative humidity:	10% - 95% (non-condensing)
Degree of protection	IP20
Weight	2Kg

5.3 Front Panel

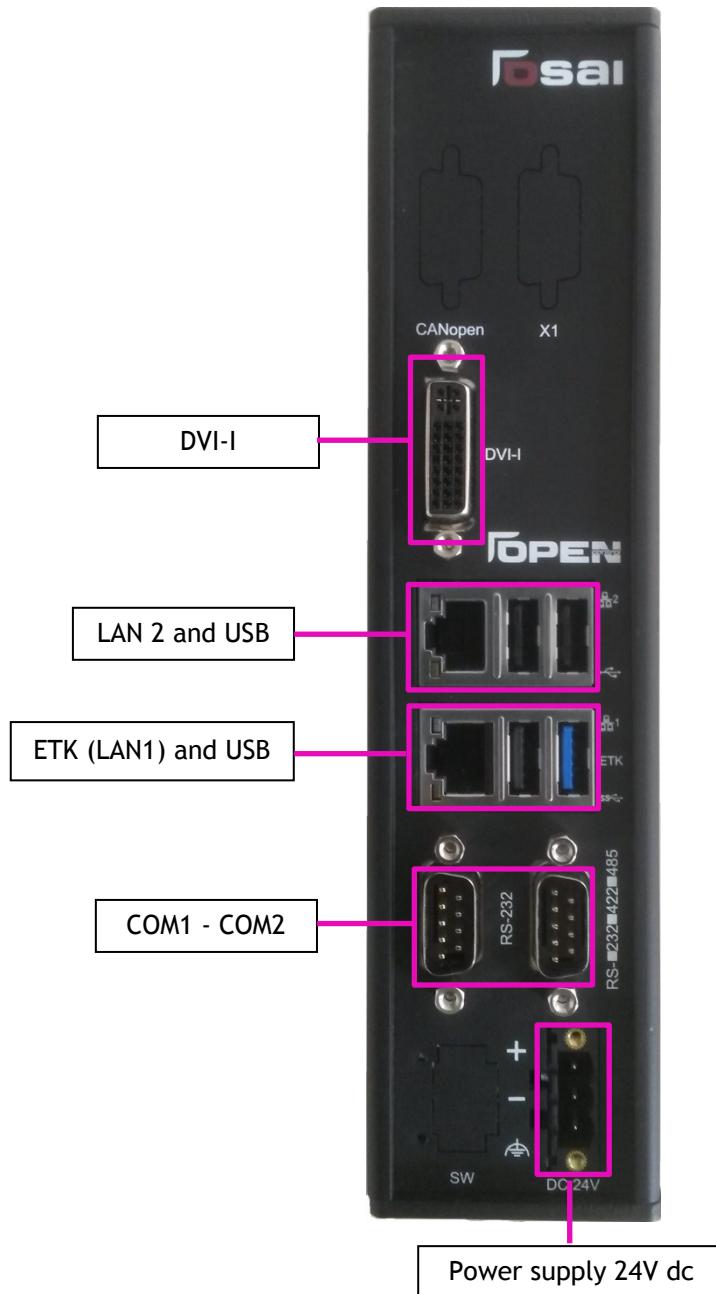


Figure 14: Connector position on the front panel of OpenSmart

5.4 OPENsmart Control Unit electrical connections

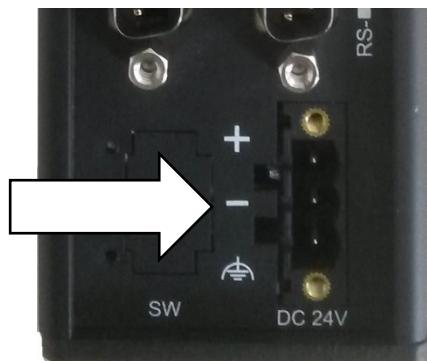
OPENsmart control unit must be fed in continuous current with a nominal voltage of 24V dc ($\pm 20\%$). The maximum absorption is 2A at 24Vdc (excluding G. Estop that must be supplied separately).

The power connector is placed in the front of the unit as shown in the following figure:



Figure 15: Power connector of OpenSmart

The following is the pinout of the power connector.



Pin	Signal
1	+ 24V dc power supply
2	0V power
3	GND

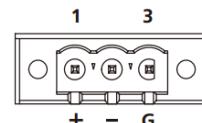


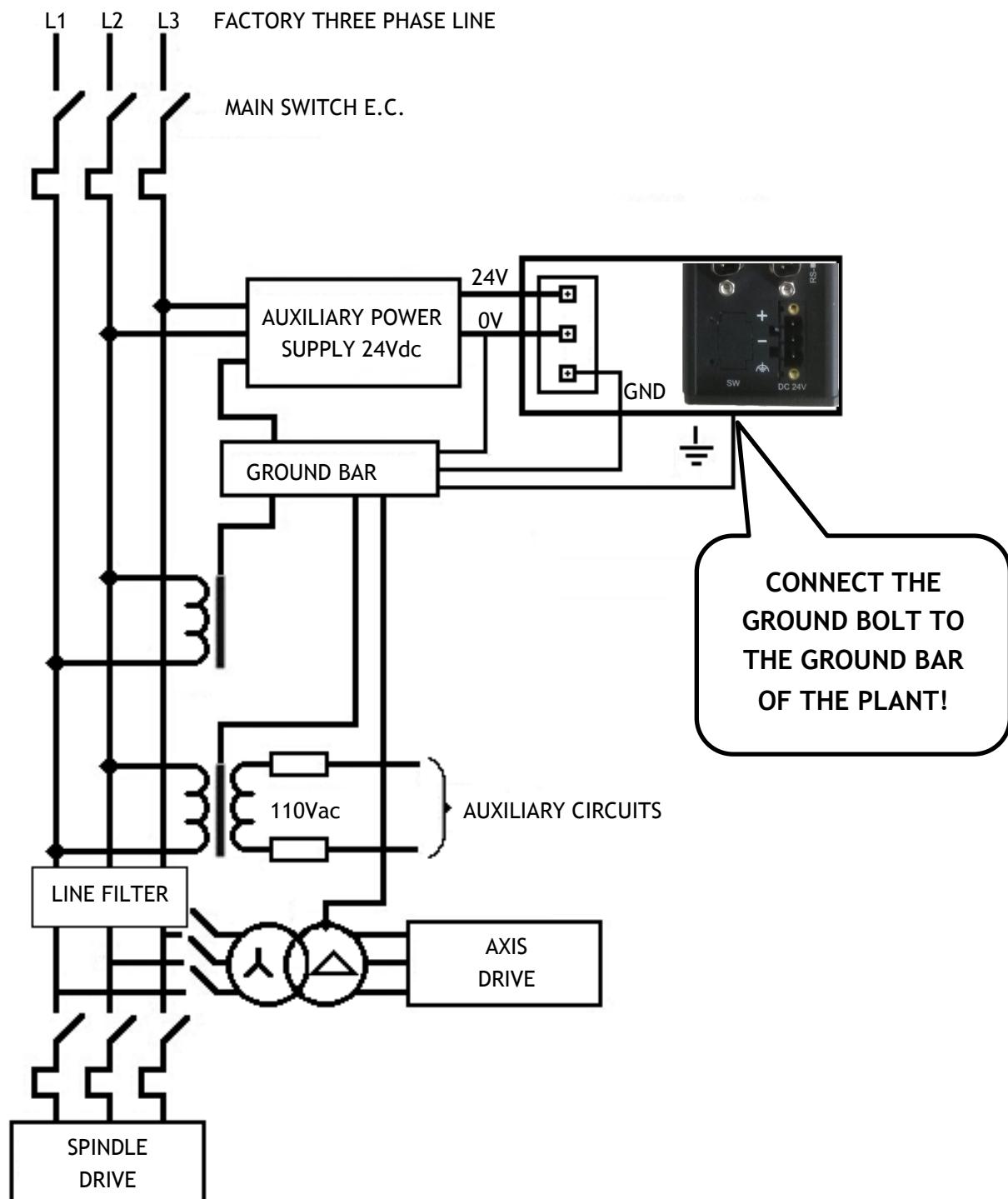
Figure 16: Power connector layout

The ground bolt is placed in the middle of the lower side:



Figure 17: Ground connection of OpenSmart

5.5 OPENsmart general wiring diagram



For proper connection and use of third-party devices, refer to the documentation of the manufacturer.

5.6 CPU Resources

- > 24V dc power input ± 20%
- > 1 x DVI-I port
- > 1 x 1Gb LAN port (LAN 2)
- > 3 x USB 2.0 ports
- > 1 x USB 3.0 port
- > 2 x DB9 serial ports (RS232 COM1 - COM2 RS232/422/485)
- > 1 x EtherCAT connector (LAN1)
- > 1 x Digital Output Power Enable "Global Emergency Stop" (G. Estop)
- > 1 x Fieldbus connector (optional, CANopen or Mechatrolink III versions only)
- > 1 x Fast Digital Inputs (CANopen or Mechatrolink III versions only)

5.7 Connector description

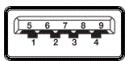
5.7.1 *USB connectors*

There are 3 USB 2.0 connectors and one USB 3.0 connector

When the Control Unit uses a local HMI up to three USB connectors might be used by the system: one for the keyboard and up to two for the pointing devices (mouse, touch screen or both).

The pin-out of USB connectors complies with the USB standard:

		standard USB 2.0 connector
PIN	Signal	
1	VCC (+ 5V)	
2	DATA -	
3	DATA +	
4	GND	

		standard USB 3.0 connector
PIN	Signal	
1	VCC (+ 5V)	
2	DATA -	
3	DATA +	
4	GND	
5	Rx -	
6	Rx +	
7	GND	
8	Tx -	
9	Tx +	



Note: The USB 3.0 connectors are blue

5.7.2 LAN Connectors (Ethernet/EtherCAT)

Two RJ45 connectors are present: LAN1 to connect to the EtherCAT network and LAN 2 to connect to the Ethernet network.



Note: The connector LAN1 manages the EtherCAT network only.
The connector LAN2 manages the Ethernet network only.

The following is the description of the LEDs on the connector and its pinout.

Description of the LED associated with the port.

ACT	Status
Flashing yellow	Activities
Off	No activity

LINK	Status
Solid green	Link to 1GB
Solid orange	Link to 100Mb
Off	Link to 10Mb or no link

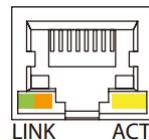


Figure 18: RJ45 connector with LEDs

Pin-out of the standard Ethernet connector

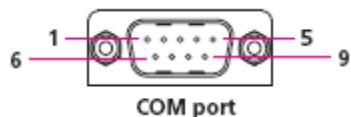
Pin	Signal
1	LAN_TXD0P
2	LAN_TXD0N
3	LAN_TXD1P
4	LAN_TXD2P
5	LAN_TXD2N
6	LAN_TXD1N
7	LAN_TXD3P
8	LAN_TXD3N

OPENsmart control unit uses a 1GB LAN controller. To connect to a PC that has a similar LAN controller, you can use either a straight or crossover cable.

It is advisable to use a CAT5E or CAT6 straight cable that has all the necessary handshake signals. If the PC has a 10/100 MB network connection it is necessary to use a crossover LAN cable.

5.7.3 Serial Interface COM1 and COM2 connectors

The following tables show the pin assignment of the 2 9-way D-Sub connectors.



RS232 - COM1 and COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1		

The following tables show the pin assignment of connector COM2 when configured as a serial line RS422 or RS485.

RS422 - COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	TXD-	2	TXD +
3	RXD +	4	RXD -
5	GND	6	RTS -
7	RTS #	8	CTS +
9	CTS -		GND



For the proper management of the serial line RS422, it is necessary to configure the corresponding FB in the PLC logic. Refer to the manual "Winplus - System Library" (p/n 45006608A), Chapter "Functions related to the serial line - 4C_SerialComm".

RS485 - COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	TXD -	2	TXD +
	RXD -		RXD +
3	Reserved	4	Reserved
5	GND	6	Reserved
7	Reserved	8	Reserved
9	Reserved		Reserved



For the proper management of the serial line RS485, it is necessary to configure the corresponding FB in the PLC logic. Refer to the manual "Winplus - System Library" (p/n 45006608A), Chapter "Functions related to the serial line - 4C_SerialComm".

5.7.4 DVI-I connector

The following figure shows the pinout of the DVI-I connector.

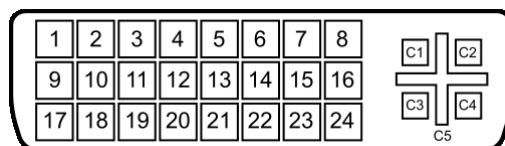


Figure 19: DVI-I connector

Pin	Signal	Description
1	TMDS data 2-	Red dig. - (Link 1)
2	TMDS data 2+	Red dig. + (Link 1)
3	Shielding	for TMDS 2
4	Not connected	
5	Not connected	
6	DDC Clock	
7	DDC data	
8	Synchronous analog vertical	
9	TMDS Data 1-	Green dig. - (Link 1)
10	TMDS Data 1+	Green dig. + (Link 1)
11	Shielding	for TMDS 1
12	Not connected	
13	Not connected	
14	+ 5V	for Standby Power
15	Ground	Ground for pins 8, 14 and C4
16	Hot plug detect	Detects hot insertion
17	TMDS data 0-	Blue dig. - (Link 1) and synchronous digital
18	TMDS data 0+	Blue dig. + (Link 1) and synchronous digital
19	Shielding	for TMDS 0
20	Not connected	
21	Not connected	
22	Shielding	for TMDS clock
23	TMDS Clock +	Clock dig. + (Link 1)
24	TMDS Clock -	Clock dig.- (Link 1)
C1	Analog Red	
C2	Analog Green	
C3	Analog Blue	
C4	Synchronous analog horizontal	
C5	Ground	for C1, C2 and C3

5.8 OPENsmart EtherCAT

5.8.1 Connector Position

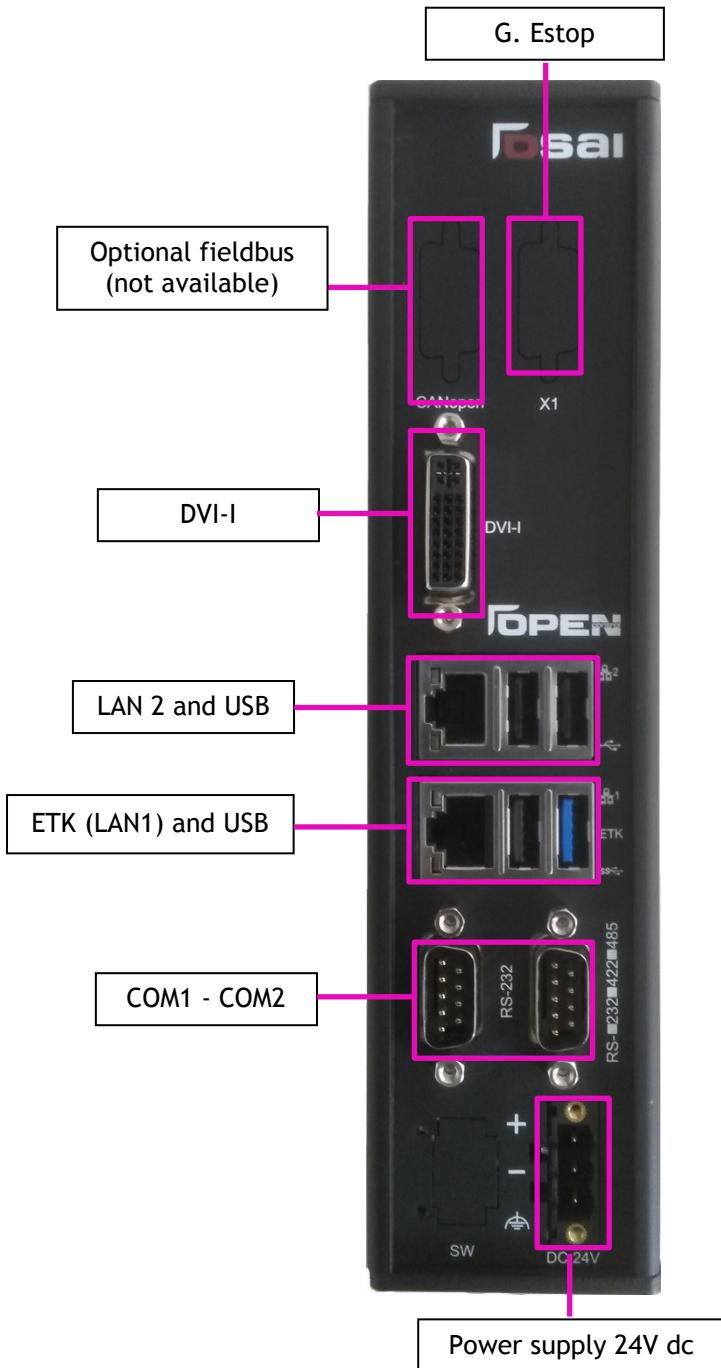


Figure 20: Connector position on the front panel of OpenSmart EtherCAT

5.8.2 Signal characteristics

EtherCAT

The signals comply with the EtherCAT standard.

G. Estop

Maximum current: 100 mA

Response time: $t_{on}/t_{off} \approx 2$ ms max

Protection: overloads up to 400mA



Note: direct short circuits between 24V and GND can damage the output

5.8.3 X1 G.Estop connector

Following is the connector pin assignment.

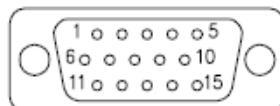


Figure 21: Fast Input and G.Estop output 15 pin HD male connector

PIN	First name	Description
1		
2	+ 24_Ext	External power supply + 24V dc
3		
4		
5		
6		
7		
8	FOU4 - G.Estop	Fast Output - Power enable (CNC Ready)
9		
10		
11	+ 24_Ext	External power supply + 24V dc
12		
13		
14		
15	GND_24V	0V of the external power supply 24V dc



The G. Estop Enabling Power is a digital signal at 24V 100mA.



Fuse 1A slow on external 24Vdc power supply



Note: direct short circuits between 24V and GND can damage the output

5.9 OPENsmart EtherCAT + CANopen

5.9.1 Connector Position

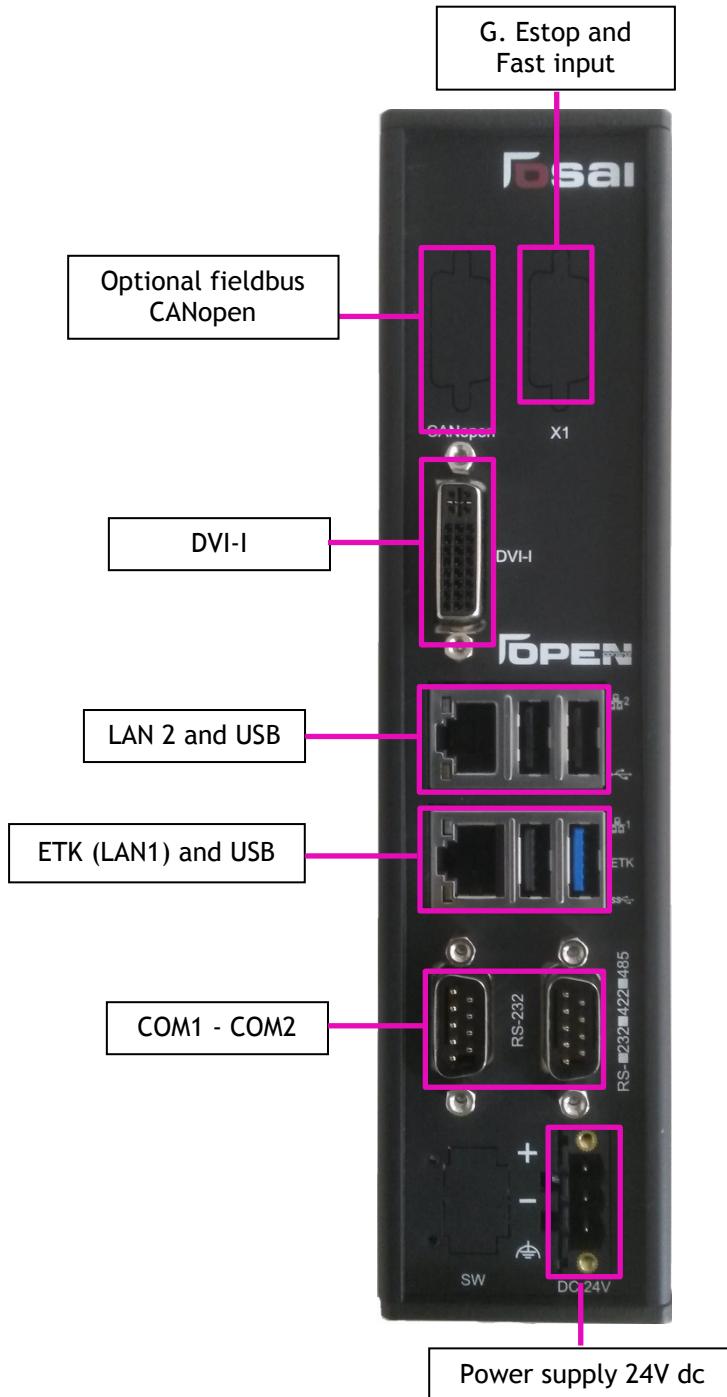


Figure 22: Connector position on the front panel of OPENsmart CANopen

5.9.2 *Signal characteristics*

EtherCAT

The signals comply with the EtherCAT standard.

CANopen

Data rate: up to 1Mbit/s

G. Estop

Power (ext): 24Vdc ± 20%
Maximum current: 100 mA
Response time: $t_{on}/t_{off} \approx 100\mu s$ max
Protection: overloads and switch-off of inductive loads
Type: high side driver type

Fast input

Input voltage: -30 + 30V dc
Range 0 logical: from -30V to + 5V
Range 1 logical: from + 15V to + 30V
Current consumption: about 6mA @ 24V dc
Response time: $t_{on}/t_{off} \approx 100\mu s$ max

5.9.3 X1 connector - Fast Input and G.Estop

Following is the connector pin assignment.

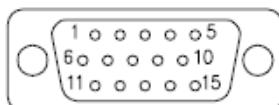


Figure 23: Fast Input and G.Estop output 15 pin HD male connector

PIN	First name	Description
1		
2	+ 24_Ext	External power supply + 24V dc
3		
4		
5		
6		
7		
8	FOU4 - G.Estop	Fast Output - Power enable (CNC Ready)
9	FIN1	Fast Input
10		
11	+ 24_Ext	External power supply + 24V dc
12		
13		
14		
15	GND_24V	0V of the external power supply 24V dc



The G. Estop signal Enabling Power is a digital signal at 24V 100mA.



Fuse 1A slow on external 24Vdc power supply

5.9.4 CANopen connector

The connector CANopen is present only in version OPENsmart EtherCAT + CANopen.
Following is the connector pin assignment.

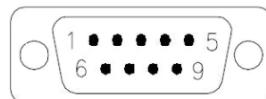


Figure 24: CANopen 9 pin male connector

PIN	First name	Description
1		
2	CAN_L	Line CAN_L (low)
3	CAN_GND	Line CAN Ground (GND)
4		
5		
6		
7	CAN_H	Line CAN_H (high)
8		
9		



The shield of the CANopen cable must be connected to the metal casing of the cable connector



Pins without name and description must not be connected



The termination of the CANopen network (120 Ohm) is already inserted

5.10 OPENsmart EtherCAT + Mechatrolink III

5.10.1 Connector Position

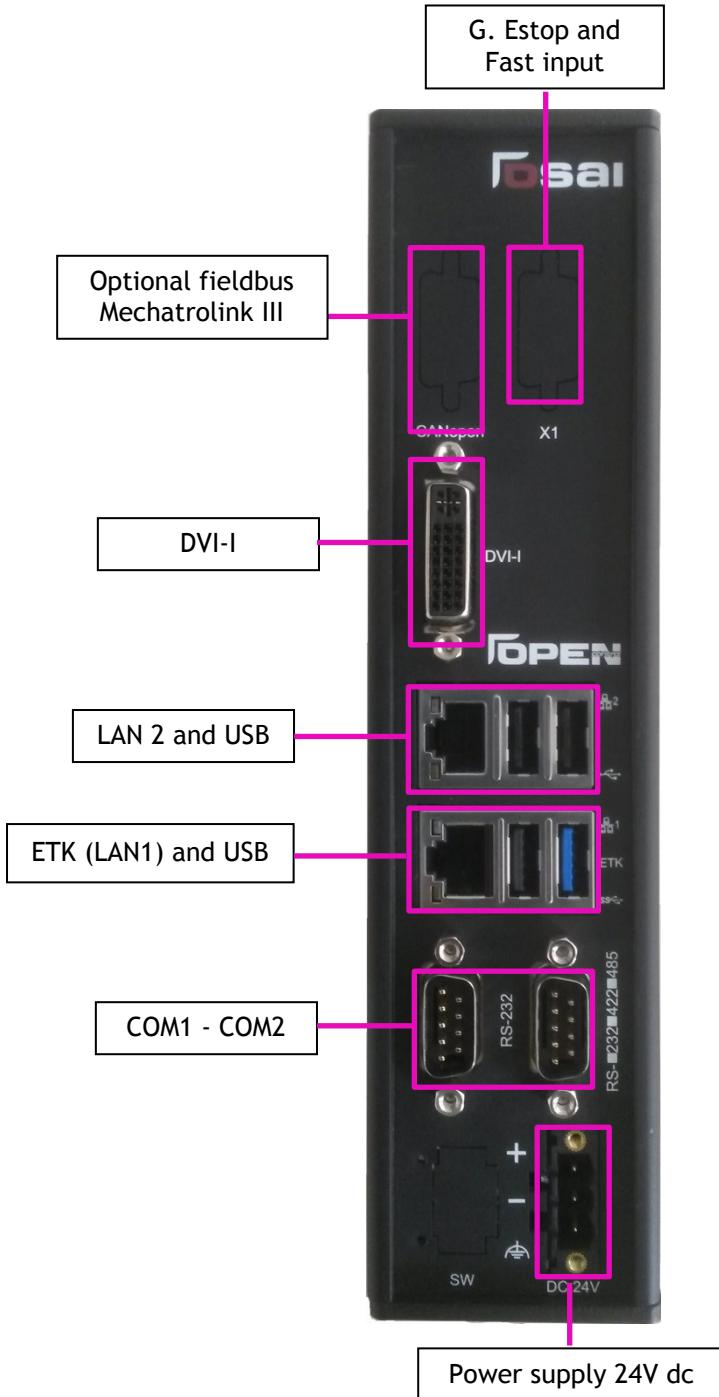


Figure 25: Connector position on the front panel of OPENsmart Mechatrolink III

5.10.2 Signal Features

EtherCAT

The signals comply with the EtherCAT standard.

Mechatrolink

The signals comply with the MECHATROLINK standard III.

G. Estop

Power (ext):	24Vdc ± 20%
Maximum current:	100 mA
Response time:	$t_{on}/t_{off} \approx 100\mu s$ max
Protection:	overloads and switch-off of inductive loads
Type:	high side driver type

Electrical characteristics Fast input

Input voltage:	-30 + 30V dc
Range 0 logical:	from -30V to + 5V
Range 1 logical:	from + 15V to + 30V
Current consumption:	about 6mA @ 24V dc
Response time:	$t_{on}/t_{off} \approx 100\mu s$ max

5.10.3 X1 FAST Input and G.Estop Output Connector

Following is the connector pin assignment.

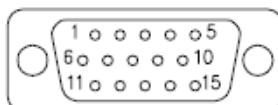


Figure 26: Fast Input and G.Estop output 15 pin HD male connector

PIN	First name	Description
1		
2	+ 24_Ext	External power supply + 24V dc
3		
4		
5		
6		
7		
8	FOU4 - G.Estop	Fast Output - Power enable (CNC Ready)
9	FIN1	Fast Input
10		
11	+ 24_Ext	External power supply + 24V dc
12		
13		
14		
15	GND_24V	0V of the external power supply 24V dc



The G. Estop Enabling Power is a digital signal at 24V 100mA.



Fuse 1A slow on external 24Vdc power supply

5.10.4 Mechatrolink III Connector

The Mechatrolink III connector is present only in version OPENsmart EtherCAT + Mechatrolink III. The connector is type Mini I/O with standard MECHATROLINK-III pin-out.

6. OPENkey CONTROL UNIT

OPENkey It is constituted by a CNC board (CPU) and a board installed on the expansion bus for the management of axes and I/O.

Available fieldbuses are: Mechatrolink III, EtherCAT, CANopen Master, Mechatrolink I/II and OS-Wire.

Also, in versions Mechatrolink I/II and OS-Wire, optional piggy back are available for the management of a fieldbus chosen from CANopen Master, Profibus Master and Profibus slave.



Figure 27: View of OPENkey control unit

6.1 Dimensions of OPENkey control unit

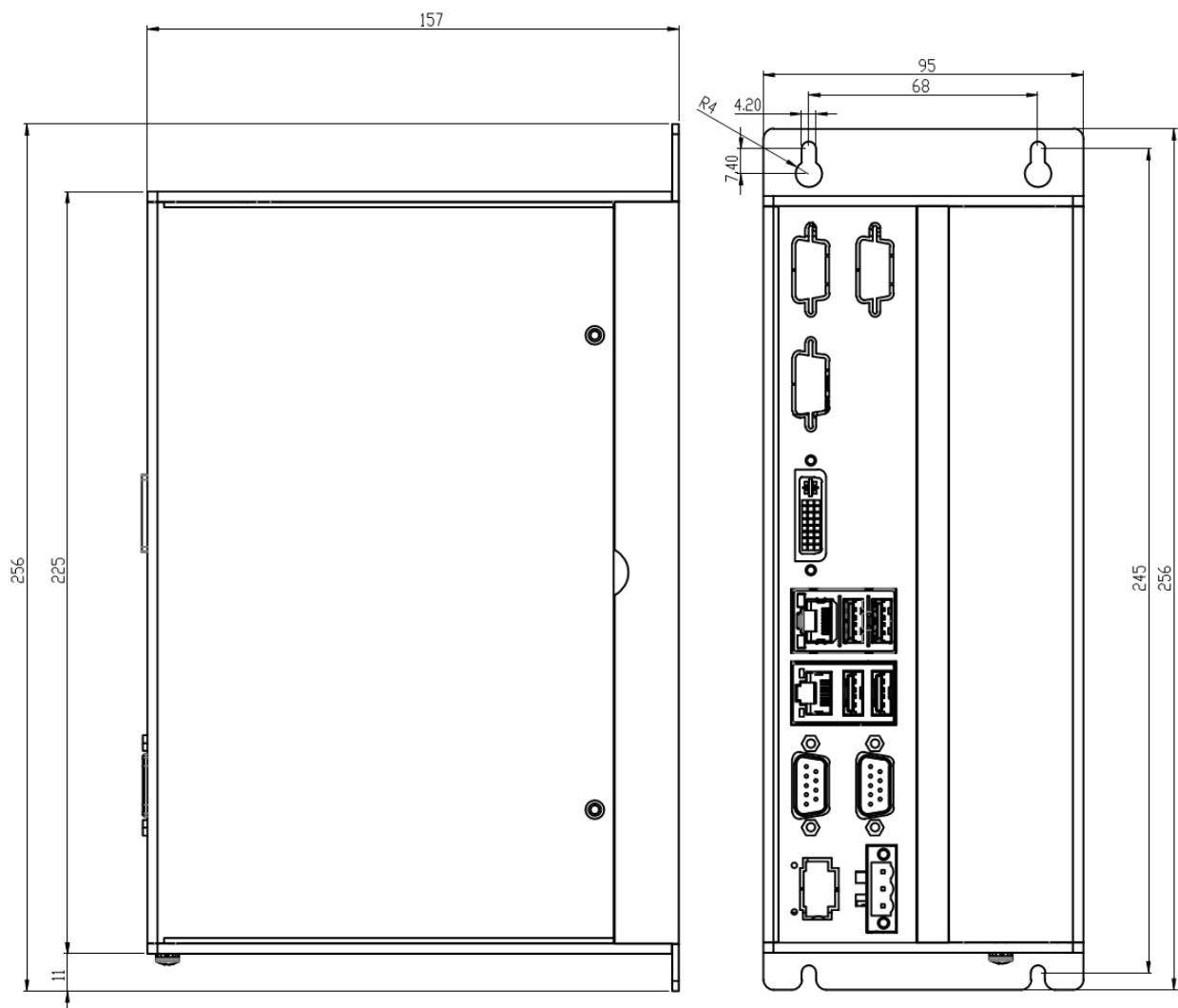


Figure 28: Dimensions of OPENkey

6.2 OPENkey environmental characteristics

Operating temperature:	0 ° C - + 50 ° C ambient temperature with air circulation
Storage temperature:	-20 ° C - + 80 ° C
Operating relative humidity	10% - 95% (non-condensing) max 40 ° C
Storage relative humidity:	10% - 95% (non-condensing)
Degree of protection	IP20
Weight	3kg

6.3 Front panel

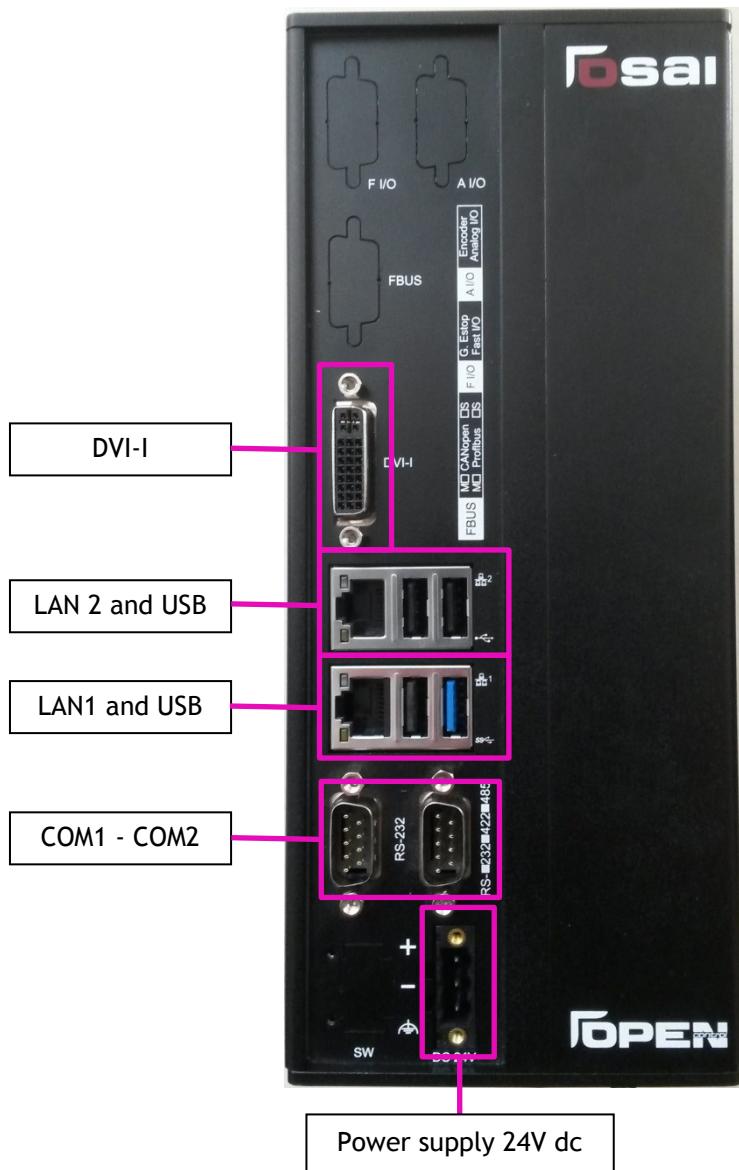


Figure 29: Connector position on the front panel of OPENkey

The number of connectors on the front panel depends on the configuration.

See the following chapters, relating to specific configurations, for the connector locations.

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.4 OPENkey control unit electrical connections

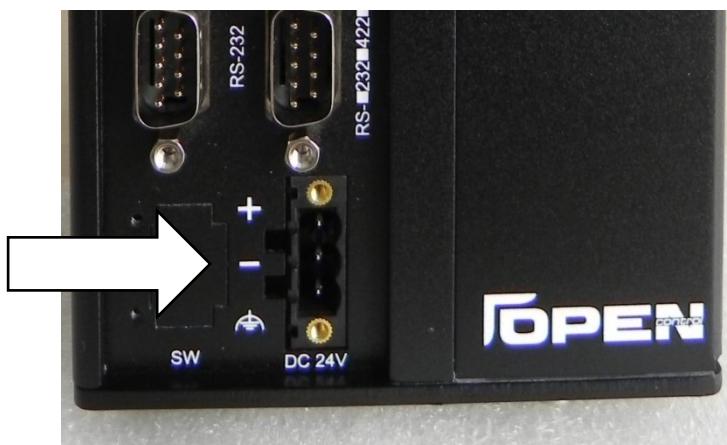
OPENkey control unit must be fed in continuous current with a nominal voltage of 24V dc ($\pm 20\%$). The maximum absorption is 2.5A at 24V dc (excluding the Fast Output that must be powered separately).

The power connector is placed in the front of the unit as shown in the following figure:



Figure 30: Power connector of OPENkey

The following is the pinout of the power connector.



Pin	Signal
1	+ 24V dc power supply
2	0V power
3	GND

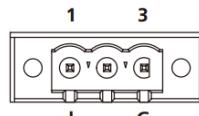


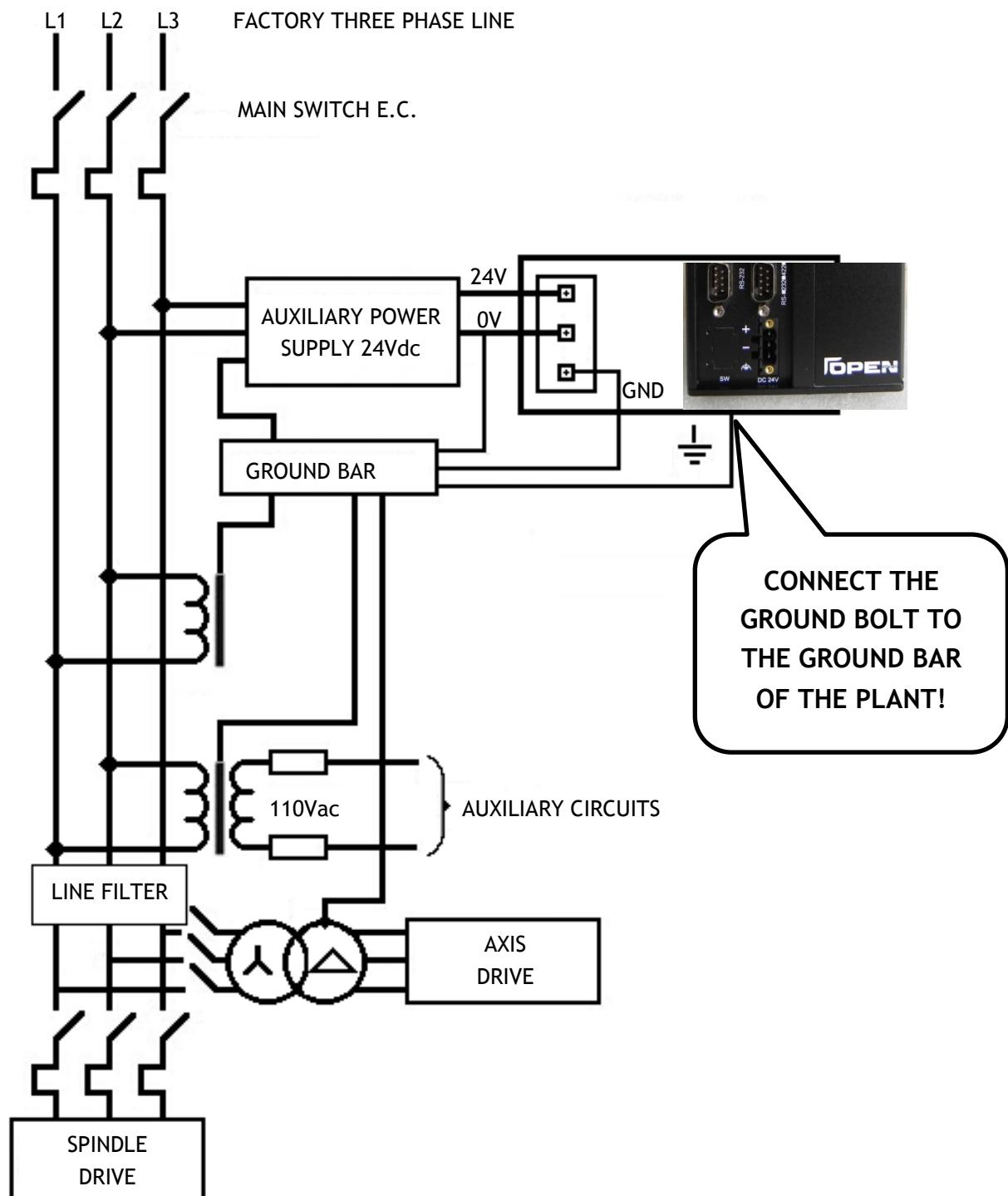
Figure 31: Power connector layout

The grounding bolt is placed in the lower side on the right:



Figure 32: Ground connection of OPENkey

6.5 OPENkey general wiring diagram



For proper connection and use of third-party devices, refer to the documentation of the manufacturer.

6.6 CPU Resources

- > 1 x expansion slot
- > 3 x USB 2.0 ports
- > 1 x USB 3.0 port
- > 2 x DB9 serial ports (COM1 COM2 RS232 RS232/422/485)
- > 1 x DVI-I port
- > 2 x 1Gb LAN ports
- > 24V dc power input

6.7 Connector Description

6.7.1 *USB connectors*

There are 3 USB 2.0 connectors and one USB 3.0 connector

When the Control Unit uses a local HMI up to three USB connectors might be used by the system: one for the keyboard and up to two for the pointing devices (mouse, touch screen or both).

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.7.2 *LAN Connectors*

There are two RJ45 connectors (LAN1 and LAN2) for the connection to the Ethernet network.



Note: in Mechatrolink I/II and OS-Wire configurations (ie with no EtherCAT interface in the axes card), the EtherCAT fieldbus can be made available on the LAN1 connector.

The connector LAN2 manages the Ethernet network only.

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

OPENkey control unit uses a 1GB LAN controller. To connect to a PC that has a similar LAN controller, it is possible to use either a straight or crossover cable.

It is advisable to use a CAT5E or CAT6 straight cable that has all the necessary handshake signals. If the PC has a 10/100 MB network connection it is necessary to use a crossover LAN cable.

6.7.3 *Serial Interface COM1 and COM2 connectors*

OPENkey is equipped with two RS232 serial interfaces COM1 and COM2.

The serial port COM2 can also be configured as RS422 or RS485, requesting one of the following codes at the order:

TAR6385_0009 calibration COM2 as RS422

TAR6385_0010 calibration COM2 as RS485

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.7.4 *DVI-I connector*

OPENkey is equipped with a DVI-I output for connecting a monitor.

For the description of the connector please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.8 OPENkey EtherCAT

OPENkey EtherCAT is equipped with the expansion card OS2021 p/n 1SMPC6911/0C for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC6911/1C



The EtherCAT functionality must be activated with the software option OPZ6016_0037

6.8.1 *Optional CANopen fieldbus*

It is possible to manage the optional CANopen fieldbus



The CANopen functionality must be activated with the software option OPZ6016_0038

The following resources are also available:

- 4 Fast Digital inputs one of which can be configured as a touch probe input
- 3 Fast Output 24V
- 1 Digital Signal Global Emergency Stop (G. Estop) Power enable
- 2 Analog Input 12 bits. The channel 1 can be set as current input.
- 1 Analog Output 16 bits.
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.8.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

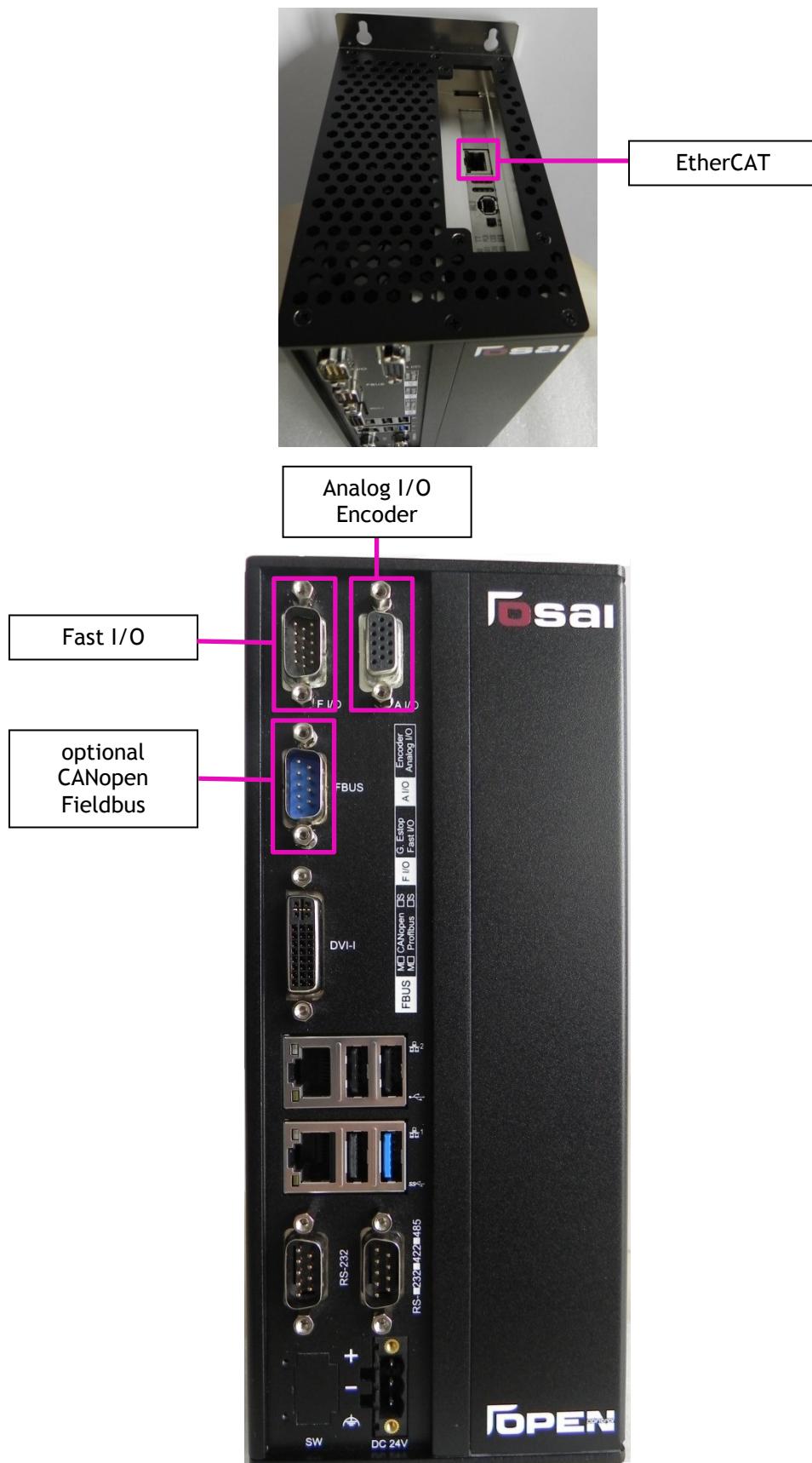


Figure 33: OPENkey EtherCAT connector position

6.8.3 Signal characteristics

EtherCAT

The signals comply with the EtherCAT standard.

CANopen

Data rate: up to 1Mbit/s

Fast input

Number of channels: 4 Fast Input or 3 + 1 Touch-probe Input

Maximum response time: $t_{on}/t_{off} \approx 5\mu s$

Threshold logic 0: from -30V to + 5V

Threshold logic 1: from + 15V to + 30V

Current consumption: 4 mA @ 24V dc



The channel "1" can be configured (in AMP) as a normal Fast Input, or as Touch-Probe input.

Fast output and G. Estop

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)

Maximum response time: $t_{on}/t_{off} \approx 5\mu s$

Supply: 19,2-30V dc with reverse polarity protection

Maximum current: 100 mA per channel

Protection: Overload and switch-off of inductive loads



Note: The 24V dc power supply must be connected even if the outputs are not used

A/D 12 bit analog input

Input voltage:

Resolution: 12-bit

Input voltage: +/- 10V

Input impedance: 20 K Ω

Input current:

Resolution: 12-bit

Loop current: 0 ÷ 20 mA

Input resistance: 50 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0002 at the order.

D/A 16 bit analog output

Resolution: 16-bit

Output Hike: +/- 10V

Maximum output current: 20 mA (max load 500 Ω)

Protections: Overload

Encoder Channel

Encoder type: Differential 0-5V
 Power output: 5V (200 mA max), protected from overloads
 Power supply protection: 750 mA self-restorable fuse
 Max input frequency of signals A, B with OSAI cable cod. 285123K: 8 MHz in counting
 2 MHz during marker search

6.8.4 Diagnostic of the board

On the front panel of the board there are two LED arrays that carry the following information:

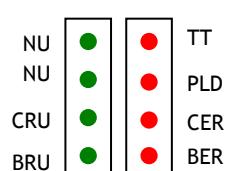


Figure 34: EtherCAT axis board

The LEDs have the following meaning:

NU	Not used
CAN RUN and CAN-ERR	Standard LED "RUN" and "ERROR" of the CANopen port.
TT	It turns ON when the laser tip-touch sensor (proprietary) is touching.
PLD	It turns ON when the board watchdog elapsed.
BRD-ERR	Fixed ON immediately after the power on, It flashes like BRD-RUN if the system watchdog elapsed
BRD-RUN	OFF immediately after power-on, lights flashing indicates the version of the board.

6.9 OPENkey Mechatrolink III

OPENkey Mechatrolink III is equipped with the expansion card OS2021 p/n 1SMPC6912/0C for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC6912/1C

6.9.1 *Optional EtherCAT and CANopen fieldbus*

It is possible to manage the optional EtherCAT and CANopen fieldbus



The EtherCAT functionality must be activated with the software option OPZ6016_0037



The CANopen functionality must be activated with the software option OPZ6016_0038

The following resources are also available:

- 4 Fast Digital inputs one of which can be used as a touch probe input
- 3 Fast Output 24V
- 1 Digital Signal Global Emergency Stop (G. Estop) Power enable
- 2 Analog Input 12 bits. The channel 1 can be set as a current input.
- 1 Analog Output 16 bits.
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.9.2 Connector Position

The position of the specific connectors for this configuration is shown in the following figures.

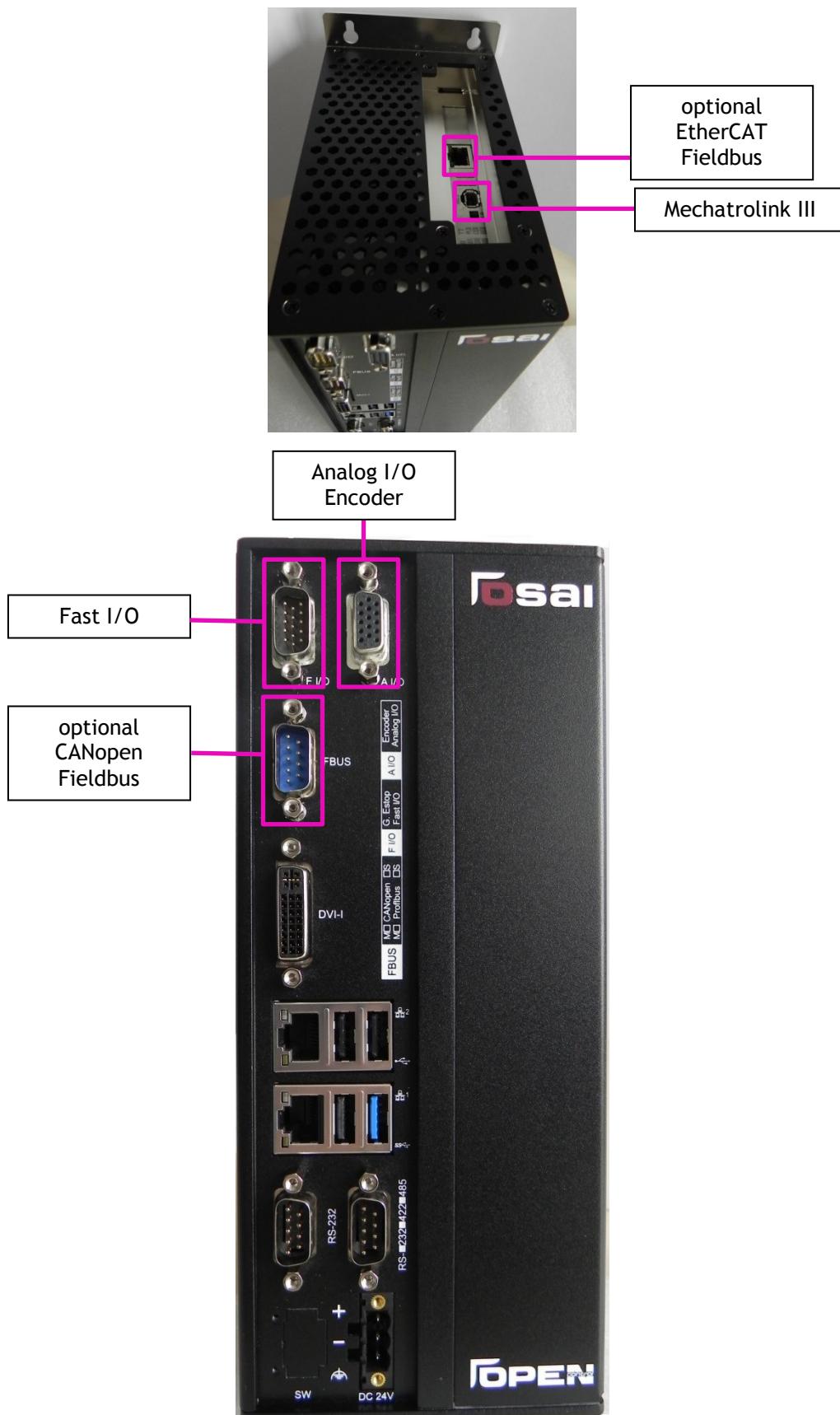


Figure 35: OPENkey Mechatrolink III connector position

6.9.3 Signal characteristics

Mechatrolink III

The signals comply with the Mechatrolink III standard.

EtherCAT

The signals comply with the EtherCAT standard.

CANopen

Data rate: up to 1Mbit/s

Fast input

Number of channels: 4 Fast Input or 3 + 1 Fast Input Input Touch-probe
Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
Threshold logic 0: from -30V to + 5V
Threshold logic 1: from + 15V to + 30V
Current consumption: 4 mA @ 24V dc



The channel "1" can be configured (in AMP) as a normal Fast Input, or as Touch-Probe input.

Fast output and G. Estop

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)
Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
Supply: 19,2-30V dc with reverse polarity protection
Maximum current: 100 mA per channel
Protection: Overload and switch-off of inductive loads



Note: The 24V dc power supply must be connected even if the outputs are not used

A/D 12 bit analog input

Input voltage:

Resolution: 12-bit
Input voltage: +/- 10V
Input impedance: 20 KΩ

Input current:

Resolution: 12-bit
Loop current: 0 ÷ 20 mA
Input resistance: 50 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0002 at the order.

D/A 16 bit analog output

Resolution:	16-bit
Output Hike:	+/- 10V
Maximum output current:	20 mA (max load 500 Ω)
Protections:	Overload

Encoder Channel

Encoder type:	Differential 0-5V
Power output:	5V (200 mA max), protected from overloads
Power supply protection:	750 mA self-restorable fuse
Max input frequency of signals A, B with OSAI cable cod. 285123K:	8 MHz in counting 2 MHz during marker search

6.9.4 Diagnostic of the board

On the front panel of the board there are two LED arrays that carry the following information:

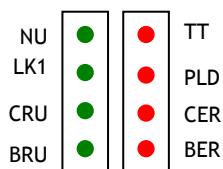


Figure 36: Mechatrolink III axis board

The LEDs have the following meaning:

NU	Not used
LK1	Standard LED of the MECHATROLINK-III port. It is ON when the link is active.
CAN RUN and CAN-ERR	Standard LED "RUN" and "ERROR" of the CANopen port.
TT	It turns ON when the laser tip-touch sensor (proprietary) is touching.
PLD	It turns ON when the board watchdog elapsed.
BRD-ERR	Fixed ON immediately after the power on, It flashes like BRD-RUN if the system watchdog elapsed
BRD-RUN	OFF immediately after power-on, lights flashing indicates the version of the card.

6.10 OPENkey Mechatrolink I/II

OPENkey Mechatrolink I/II is equipped with the expansion card OS2005 p/n 93000807P for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC5540/1C

6.10.1 Optional CANopen and Profibus fieldbus

It is possible to manage an additional fieldbus chosen from the following requesting its commercial code at the order:

- CANopen Master (p/n 93000760P)
- Profibus Master (p/n 93000761G)
- Profibus Slave (p/n 93000762A)

The following resources are also available:

- 4 Fast digital input (one used as a Touch Probe input)
- 3 Fast Output 24V
- 1 Digital Signal G. Estop (Global Emergency Stop) Power enable
- 2 Analog Input 12 bits (one channel can be set as current input)
- 1 Analog Output 16-bit
- 1 Encoder Input

For a description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.10.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

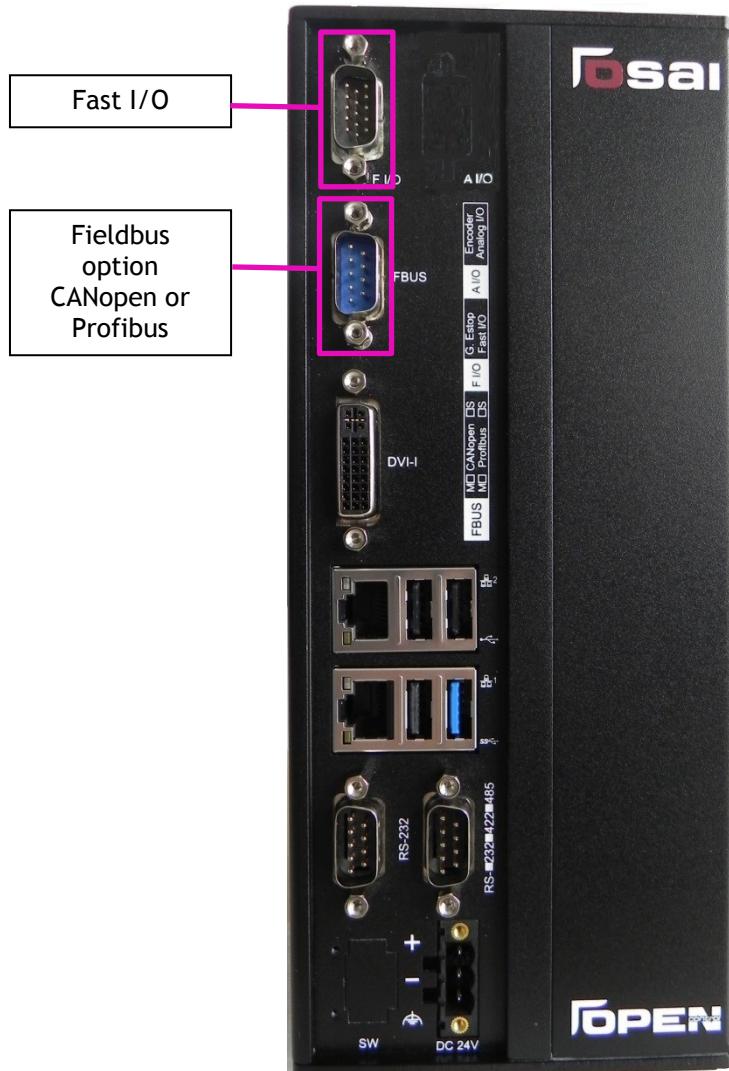
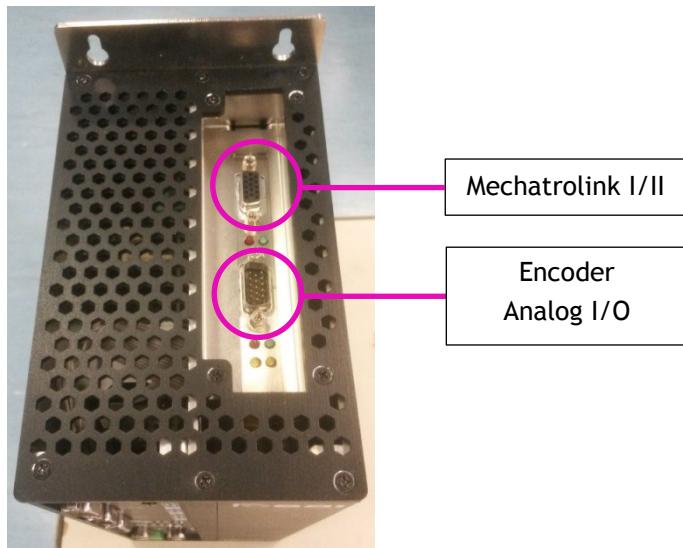


Figure 37: OPENkey Mechatrolink I/II connector position

6.10.3 Signal characteristics

Fast input

Number of channels: 4 or 3 Fast Input + Input Touch-probe
 Input voltage: 18-30V A.D
 Current consumption: 7.6 mA @ 24V dc
 Fast Response Time Input: about 20 uSec (filter to a pole with $T \approx 20$ usec.).
 Response time TP Input: $t_{on} \approx 1$ uSec. 5V.



The setting of the fast input 1 as Touch Probe must be requested with the p/n TAR6385_0003 at the order.

Fast output

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)
 Supply: 18-30V dc
 Maximum current: 250 mA per channel
 Response time: $t_{on,max} = 350$ usec./Toff max = 70 usec.



Note: The 24V dc power supply must be connected even if the outputs are not used

Input voltage

Resolution: 12-bit
 Input voltage: +/- 10V
 Input impedance: 20 KΩ

Input current

Resolution: 12-bit
 loop current: 0 ÷ 20 mA
 Input resistance: 250 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0001 at the order.

D/A 16 bit analog output

Resolution: 16-bit
 Output range: +/- 10V
 Output resistance: <0.5 Ω
 Maximum output current: 20 mA (max load 5 KΩ)

Encoder Channel

Encoder type: ABZ differential 0 ÷ 5V
 Power output: 5V (150 mA max)
 Power protection: 1,35A self-restorable fuse

Max input frequency signals A, B with OSAI cable cod. 285123K: Clock counter 12 MHz, A, B offset 90 °

6.10.4 Diagnostic of the board

LEDs on the front panel

On the faceplate there are 3 dual LED (D1, D2, D3) having the following meaning:

D1	red led	= OS-WIRE fault
	green led	= OS-WIRE active
D2	red led	= Fieldbus module error(CanOpen/Profibus)
	green led	= Fieldbus module run (CanOpen/Profibus)
D3	yellow led	= Reserved
	yellow led	= Reserved

6.10.5 Connection to the EtherCAT fieldbus

In Mechatrolink I/II configuration (ie with the axis card without EtherCAT interface) the EtherCAT fieldbus can be made available on the LAN1 connector by configuring the AMP.



The EtherCAT functionality must be activated via the software option OPZ6016_0037



The LAN 2 connector exclusively manages the Ethernet network

6.11 OPENkey OS-Wire

OPENkey OS-Wire is equipped with the expansion card OS2005 p/n 93000808A for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the board is 1SMPC5672/1C

6.11.1 Optional CANopen and Profibus fieldbus

It is possible to manage an additional fieldbus chosen from the following requesting its commercial code at the order:

- CANopen Master (p/n 93000760P)
- Profibus Master (p/n 93000761G)
- Profibus Slave (p/n 93000762A)

The following resources are also available:

- 4 Fast digital input (one used as a Touch Probe input)
- 3 Fast Output 24V
- 1 Digital Signal G. Estop (Global Emergency Stop) Power enable
- 2 Analog Input 12 bits (one channel can be set as current input)
- 1 Analog Output 16-bit
- 1 Encoder Input

For a description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

6.11.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

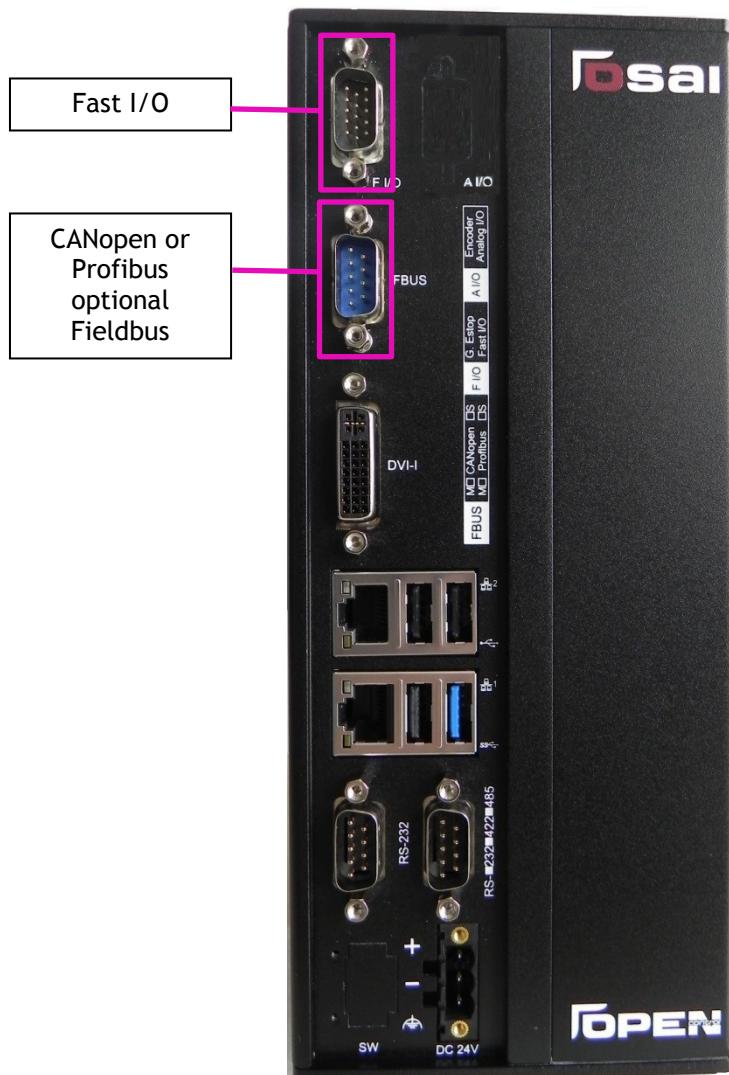
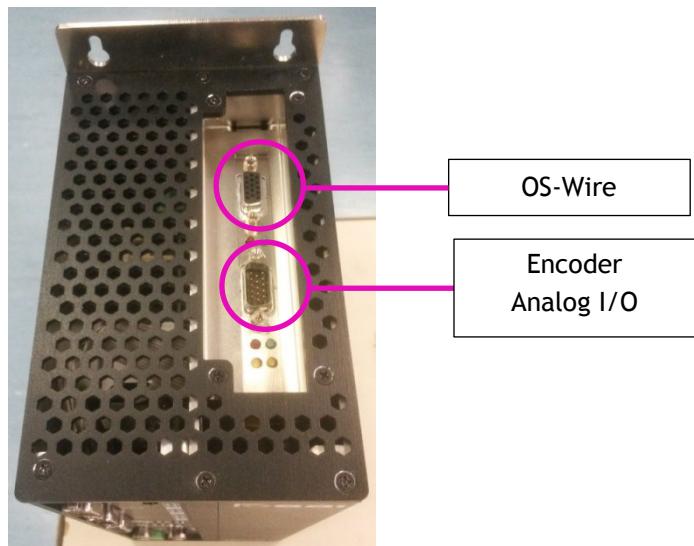


Figure 38: OPENkey OS-Wire connector position

6.11.3 Signal characteristics

Fast input

Number of channels:	4 or 3 Fast Input + Input Touch-probe
Input voltage:	18-30V A.D
Current consumption:	7.6 mA @ 24V dc
Fast Response Time Input:	about 20 uSec (filter to a pole with $T \approx 20$ usec.).
Response time TP Input:	$t_{on} \approx 1$ uSec. 5V.



The setting of the fast input 1 as Touch Probe must be requested with the p/n TAR6385_0003 at the order.

Fast output

Number of channels:	3 + 1 power enable signal to + 24V (G. Estop)
Supply:	18-30V dc
Maximum current:	250 mA per channel
Response time:	$t_{on,max} = 350$ usec./ $T_{off,max} = 70$ usec.



Note: The 24V dc power supply must be connected even if the outputs are not used

Input voltage

Resolution:	12-bit
Input voltage:	+/- 10V
Input impedance:	20 KΩ

Input current

Resolution:	12-bit
loop current:	0 ÷ 20 mA
input resistance:	250 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0001 at the order.

Output analog D/A 16 bit

Resolution:	16-bit
Output range:	+/- 10V
Output resistance:	<0.5 Ω
Maximum output current:	20 mA (max load 5 KΩ)

Encoder channel

Encoder type:	ABZ differential 0 ÷ 5V
Power output:	5V (150 mA max)
Power protection:	1,35A self-restorable fuse

Max input frequency signals A, B with OSAI cable cod. 285123K: Clock counter 12 MHz, A, B offset 90 °

6.11.4 Diagnostic of the board

LEDs on the front panel

On the faceplate there are 3 dual LED (D1, D2, D3) having the following meaning:

D1	red led	= OS-WIRE fault
	green led	= OS-WIRE active
D2	red led	= Fieldbus module error(CanOpen/Profibus)
	green led	= Fieldbus module run (CanOpen/Profibus)
D3	yellow led	= Reserved
	yellow led	= Reserved

6.11.5 Connection to the EtherCAT fieldbus

In OS-Wire configuration (ie with the axis card without EtherCAT interface) the EtherCAT fieldbus can be made available on the LAN1 connector by configuring the AMP.



The EtherCAT functionality must be activated with the software option OPZ6016_0037



The LAN 2 connector manages the Ethernet network only

7. OPENprime CONTROL UNIT

OPENprime looks like a metal box with all connectors on the front panel for easy installation. Inside it is housed the CNC tab (CPU) and two expansion slots for the management of axes and I/O.

Depending on the configurations, **OPENprime** is able to handle the following fieldbus:

EtherCAT (with optional CANopen Master)

Mechatrolink III (with optional EtherCAT and/or CANopen Master)

Mechatrolink I/II (with optional CANopen or Profibus Master/Slave)

OS-Wire (with optional CANopen or Profibus Master/Slave)



Figure 39: View of OPENprime control unit

7.1 Dimensions of OPENprime control unit

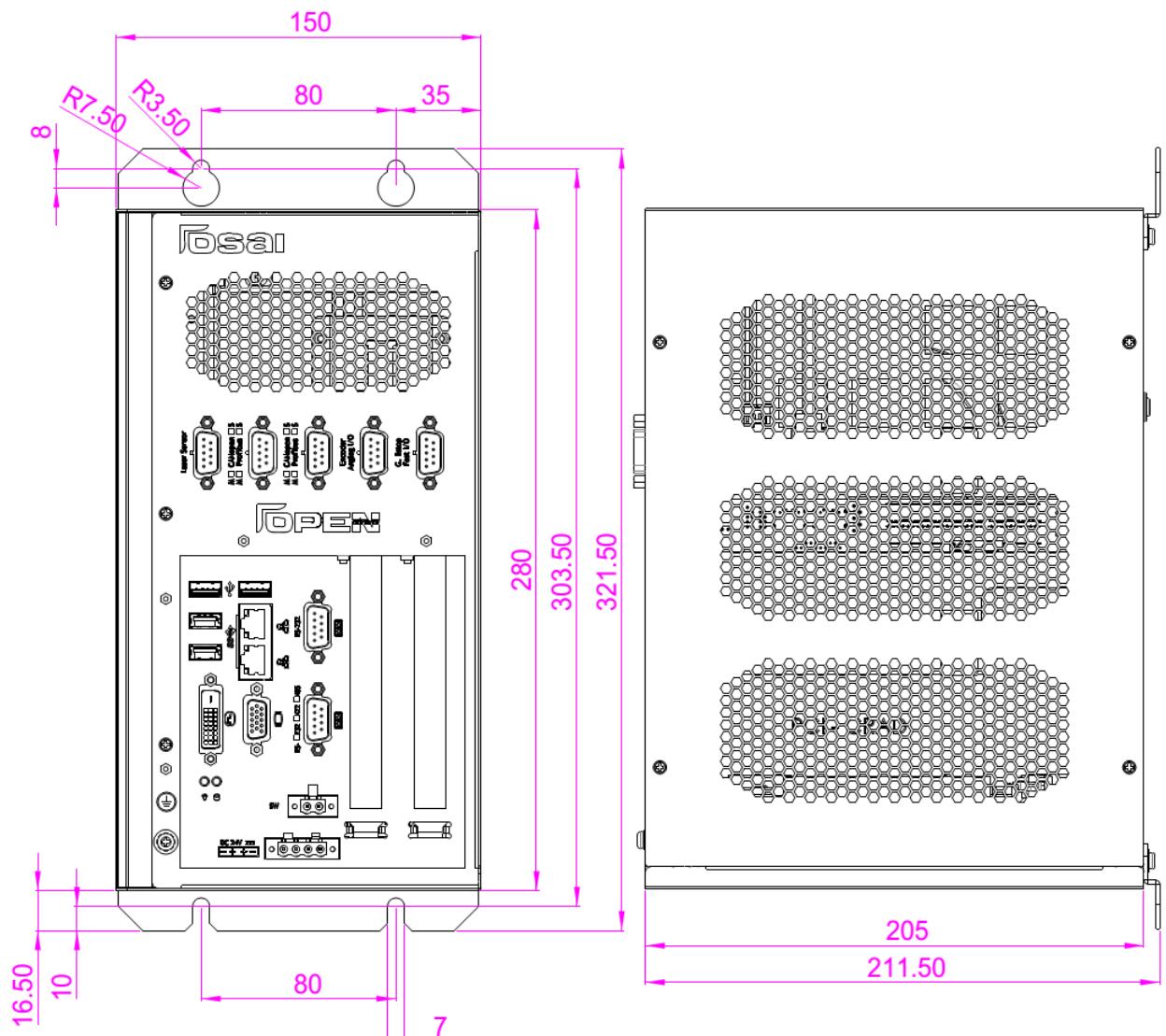


Figure 40: Dimensions of OPENprime

7.2 OPENprime environmental characteristics

Operating temperature:	0 ° C - + 50 ° C ambient temperature with air circulation
Storage temperature:	-20 ° C - + 80 ° C
Operating relative humidity	10% - 95% (non-condensing) max 40 ° C
Storage relative humidity:	10% - 95% (non-condensing)
Degree of protection	IP20
Weight	6Kg

7.3 Front panel

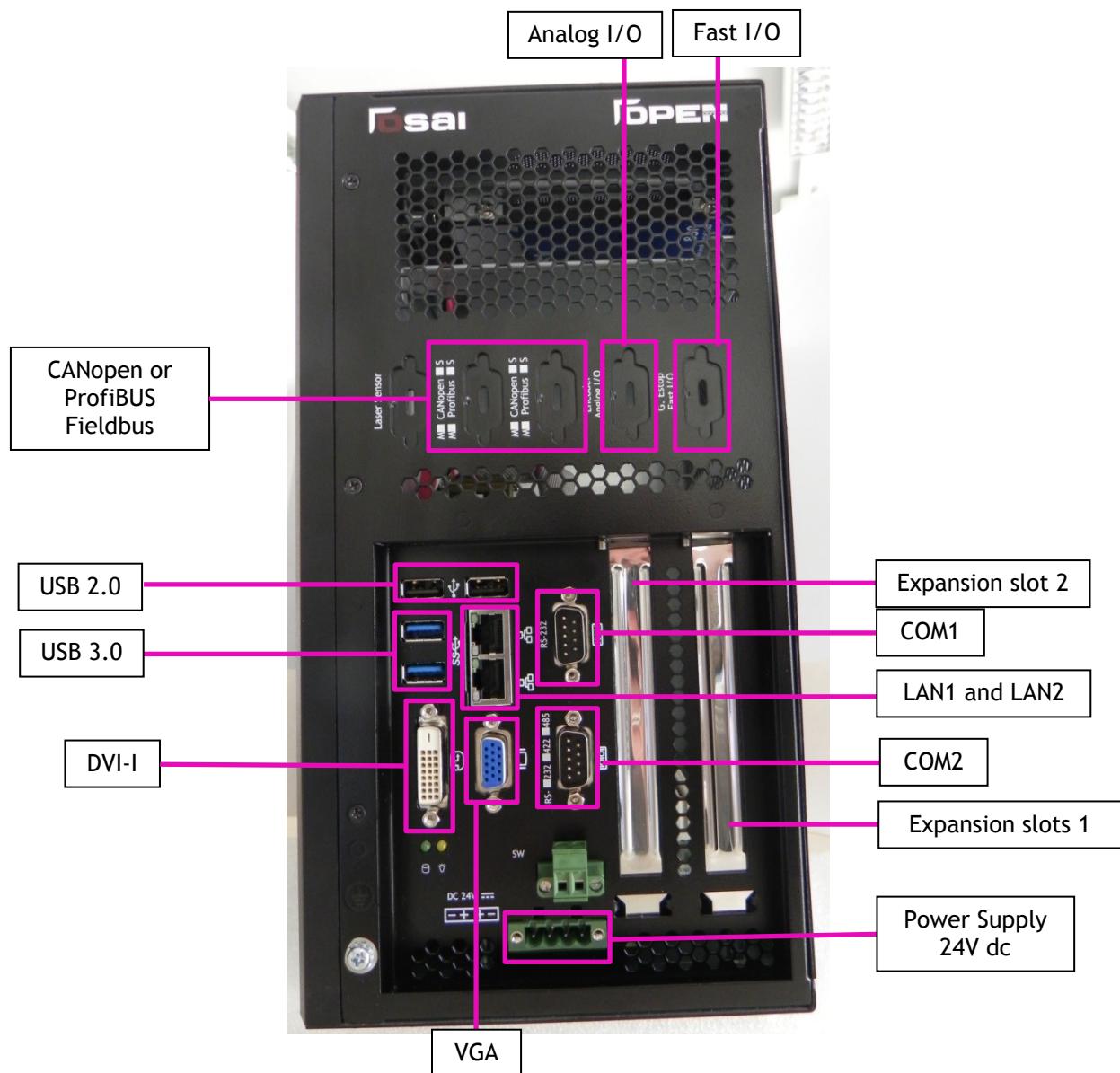


Figure 41: Connector position on the front panel of OPENprime

The number of connectors on the front panel depends on the configuration.

See the following chapters, relating to specific configurations, for the connector locations.

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.4 OPENprime control unit electrical connections

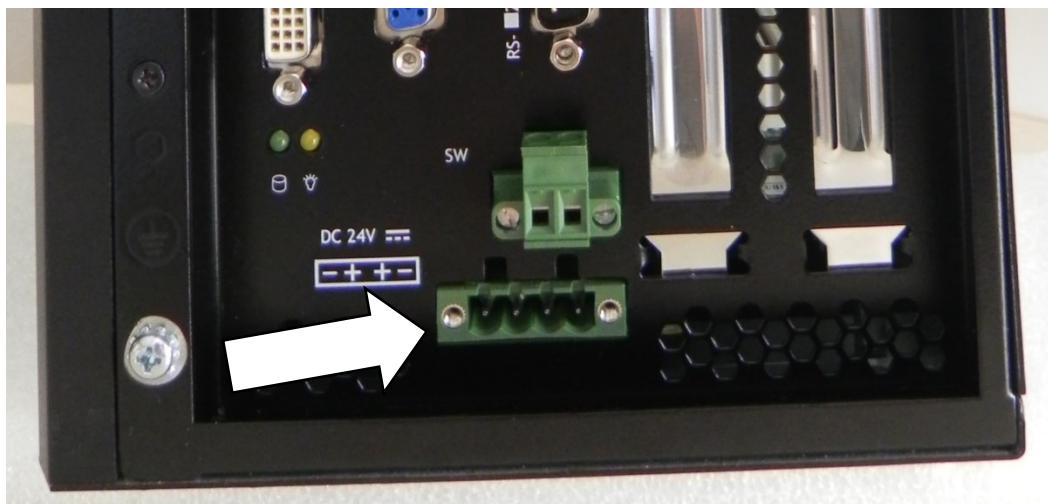
OPENprime control unit must be fed in continuous current with a nominal voltage of 24V dc ($\pm 20\%$). The maximum absorption of 8A at 24V dc (excluding the Fast Output of the axis board that must be powered separately).

The power connector is placed on the front of the unit as shown in the following figure:



Figure 42: Power connector of OPENprime

The following is the pinout of the power connector.



Pin	Signal
1	0V power
2	+ 24V dc power supply
3	+ 24V dc power supply
4	0V power

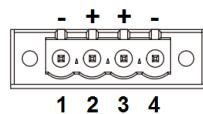


Figure 43: Power connector layout

The grounding bolt is located on the front panel on the bottom left.

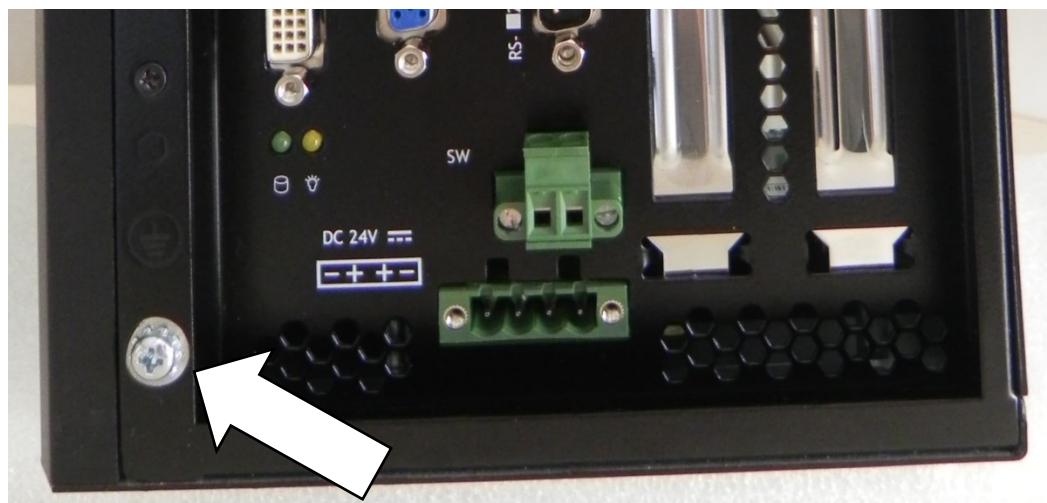
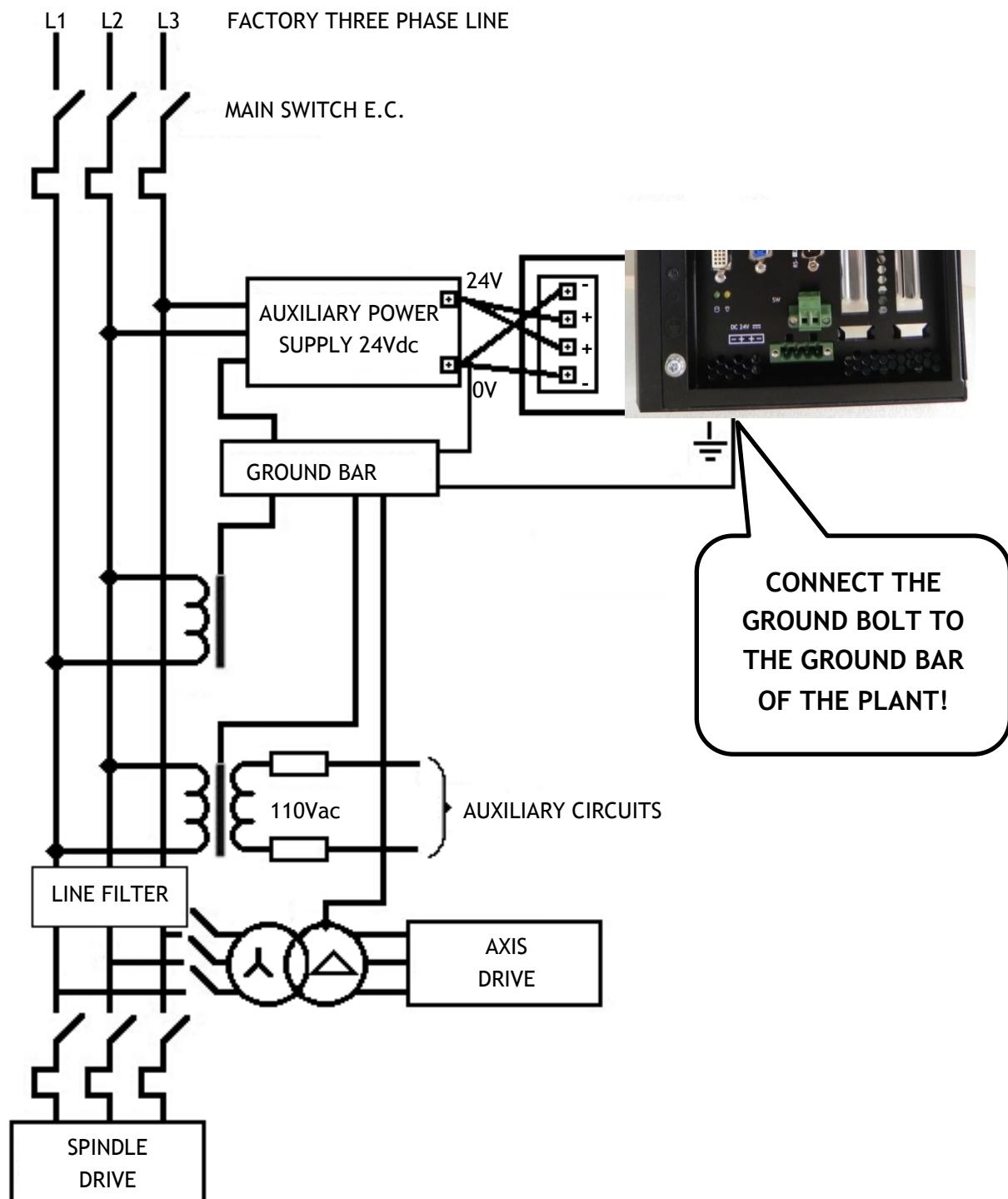


Figure 44: Ground connection of OPENprime

7.5 OPENprime general wiring diagram



For proper connection and use of third-party devices, refer to the documentation of the manufacturer.

7.6 CPU Resources

- › 2 x expansion slot
- › 2 x USB 2.0 ports
- › 2 x USB 3.0 port
- › 2 x DB9 serial ports (COM1 COM2 RS232 RS232/422/485)
- › 1 x VGA port
- › 1 x DVI-I port
- › 2 x 1Gb LAN ports
- › 24V dc power input

7.7 Connector description

7.7.1 *USB connectors*

There are 2 USB 2.0 connectors and two USB 3.0 connectors

When the Control Unit uses a local HMI up to three USB connectors might be used by the system: one for the keyboard and up to two for the pointing devices (mouse, touch screen or both).

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.7.2 *LAN Connectors (Ethernet)*

There are two RJ45 connectors (LAN1 and LAN2) for the connection to the Ethernet network.

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

OPENprime control unit uses a 1GB LAN controller. To connect to a PC that has a similar LAN controller, it is possible to use either a straight or crossover cable.

It is advisable to use a CAT5E or CAT6 straight cable that has all the necessary handshake signals. If your PC has a 10/100 MB network connection is necessary to use a crossover LAN cable.

7.7.3 *Serial Interface COM1 and COM2 connectors*

OPENprime is equipped with two RS232 serial interfaces COM1 and COM2.

The serial port COM2 can also be configured as RS422 or RS485, requesting one of the following codes at the order:

TAR6385_0011 calibration COM2 as RS422

TAR6385_0012 calibration COM2 as RS485

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.7.4 *DVI-I connector*

OPENprime is equipped with a DVI-I output for connecting a monitor.

For the description of the connector please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.8 OPENprime EtherCAT

OPENprime EtherCAT is equipped with the expansion card OS2021 p/n 1SMPC6911/0C for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC6911/1C



The EtherCAT functionality must be activated with the software option OPZ6016_0037

7.8.1 Optional CANopen fieldbus

It is possible to manage the optional CANopen fieldbus



The CANopen functionality must be activated via the software option OPZ6016_0038

The following resources are also available:

- 4 Fast Digital inputs one of which can be used as a touch probe input
- 3 Fast Output 24V
- 1 Digital Signal Power enable Global Emergency Stop (G. Estop)
- 2 Analog Input 12 bits. The channel 1 can be calibrated as a current input.
- 1 Analog Output 16 bits.
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.8.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

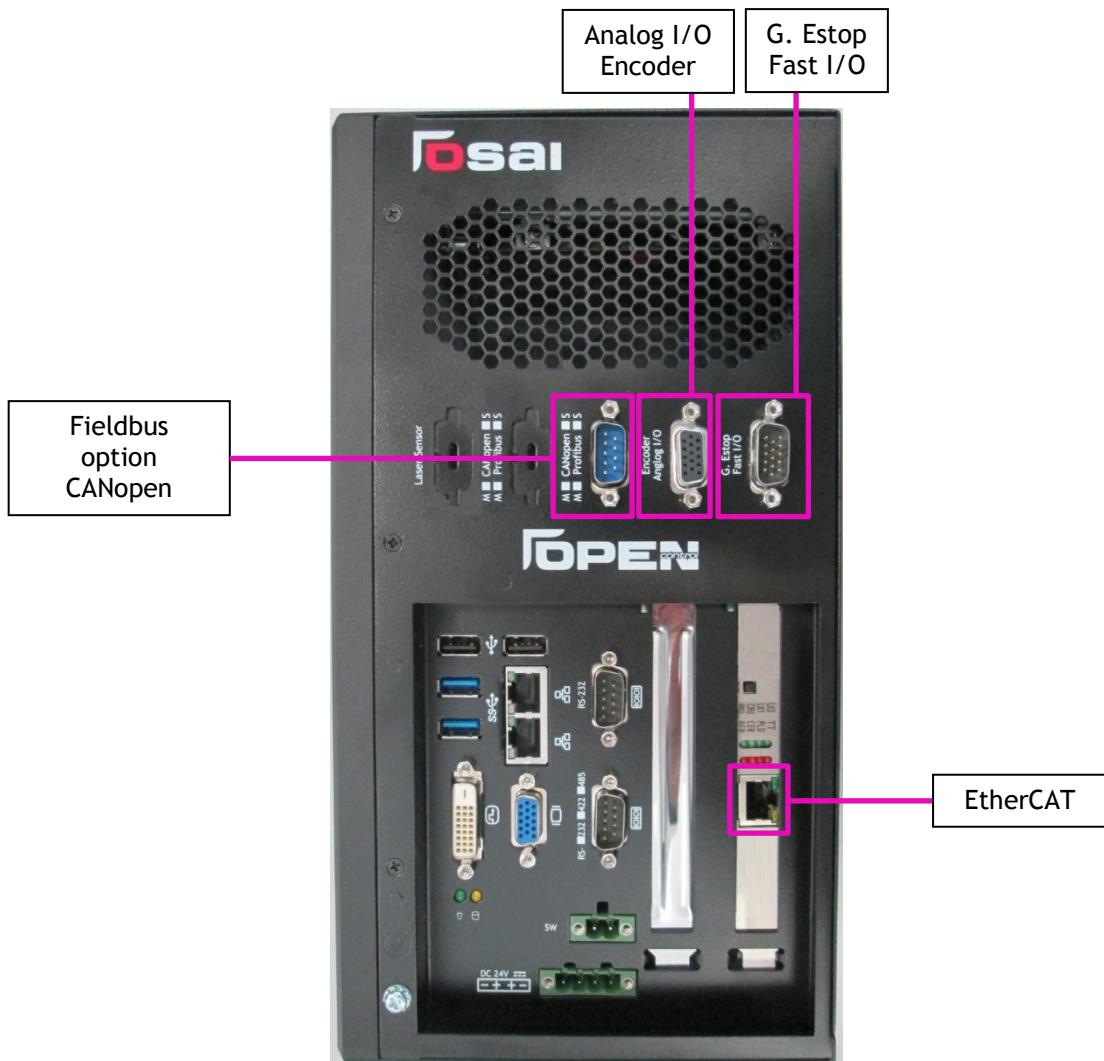


Figure 45: OPENprime EtherCAT connector position

7.8.3 Signal characteristics

EtherCAT

The signals comply with the EtherCAT standard.

CANopen

Data rate: up to 1Mbit/s

Fast input

Number of channels: 4 Fast Input or 3 Fast Input + 1 Touch-probe Input
 Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
 Threshold logic 0: from -30V to + 5V
 Threshold logic 1: from + 15V to + 30V
 Current consumption: 4 mA @ 24V dc



The "1" channel can be configured (AMP) as a normal Fast Input, or as an input for Touch-Probe.

Fast output and G. Estop

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)
 Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
 Supply: 19,2-30V dc with reverse polarity protection
 Maximum current: 100 mA per channel
 Protection: Overload and switch-off of inductive loads



Note: The 24V dc power supply must be connected even if the outputs are not used

A/D 12 bit analog input

Input voltage:
 Resolution: 12-bit
 Input voltage: +/- 10V
 Input impedance: 20 KΩ

Input current:

Resolution: 12-bit
 Loop current: 0 ÷ 20 mA
 Input resistance: 50 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0002 at the order.

D/A 16 bit analog output

Resolution: 16-bit
 Output Hike: +/- 10V
 Maximum output current: 20 mA (max load 500 Ω)
 Protections: Overload

Encoder Channel

Encoder type: Differential 0-5V
 Power output: 5V (200 mA max), protected from overloads
 Power supply protection: 750 mA self-restorable fuse
 Max input frequency of signals A, B with OSAI cable cod. 285123K: 8 MHz in counting

2 MHz during marker search

7.8.4 Diagnostic of the board

On the front panel of the board there are two LED arrays that carry the following information:

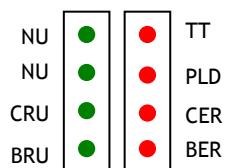


Figure 46: EtherCAT axis board

The LEDs have the following meaning:

NU	Not used
CAN RUN and CAN-ERR	Standard LED "RUN" and "ERROR" of the CANopen port.
TT	It turns ON when the laser tip-touch sensor (proprietary) is touching.
PLD	It turns ON when the board watchdog elapsed.
BRD-ERR	Fixed ON immediately after the power on, It flashes like BRD-RUN if the system watchdog elapsed
BRD-RUN	OFF immediately after power-on, lights flashing indicates the version of the board.

7.9 OPENprime Mechatrolink III

OPENprime Mechatrolink III is equipped with the expansion card OS2021 p/n 1SMPG6912/0C for the connection of axes and I/O



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPG6912/1C

7.9.1 *Optional EtherCAT and CANopen fieldbus*

It is possible to manage the optional EtherCAT and CANopen fieldbus



The EtherCAT functionality must be activated via the software option OPZ6016_0037



The CANopen functionality must be activated via the software option OPZ6016_0038

The following resources are also available:

- 4 Fast Digital inputs one of which can be used as a touch probe input
- 3 Fast Output 24V
- 1 Digital Signal Global Emergency Stop (G. Estop) Power enable
- 2 Analog Input 12 bits. The channel 1 can be set as a current input.
- 1 Analog Output 16 bits.
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.9.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

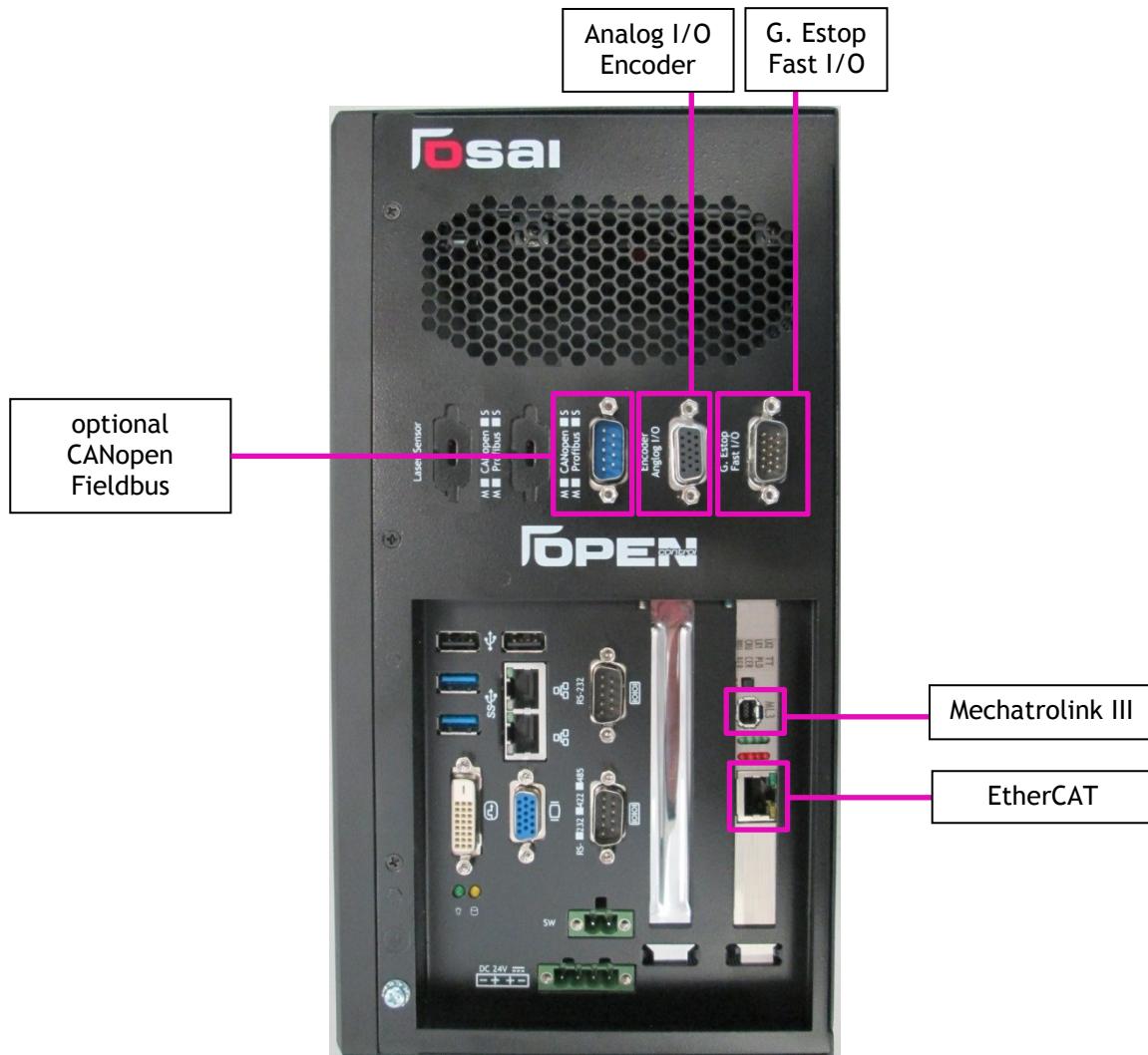


Figure 47: OPENprime Mechatrolink III connector position

7.9.3 Signal characteristics

Mechatrolink III

The signals comply with the MECHATROLINK III standard.

EtherCAT

The signals comply with the EtherCAT standard.

CANopen

Data rate: up to 1Mbit/s

Fast input

Number of channels: 4 Fast Input or 3 + 1 Fast Input Input Touch-probe
Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
Threshold logic 0: from -30V to + 5V
Threshold logic 1: from + 15V to + 30V
Current consumption: 4 mA @ 24V dc



The channel "1" can be configured (in AMP) as a normal Fast Input, or as Touch-Probe input.

Fast output and G. Estop

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)
Maximum response time: $t_{on}/t_{off} \approx 5\mu s$
Supply: 19,2-30V dc with reverse polarity protection
Maximum current: 100 mA per channel
Protection: Overload and switch-off of inductive loads



Note: The 24V dc power supply must be connected even if the outputs are not used

A/D 12 bit analog input

Input voltage:

Resolution: 12-bit
Input voltage: +/- 10V
Input impedance: 20 KΩ

Input current:

Resolution: 12-bit
Loop current: 0 ÷ 20 mA
Input resistance: 50 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0002 at the order.

D/A 16 bit analog output

Resolution:	16-bit
Output Hike:	+/- 10V
Maximum output current:	20 mA (max load 500 Ω)
Protections:	Overload

Encoder Channel

Encoder type:	Differential 0-5V
Power output:	5V (200 mA max), protected from overloads
Power supply protection:	750 mA self-restorable fuse
Max input frequency of signals A, B with OSAI cable cod. 285123K:	8 MHz in counting 2 MHz during marker search

7.9.4 Diagnostic of the board

On the front panel of the board there are two LED arrays that carry the following information:

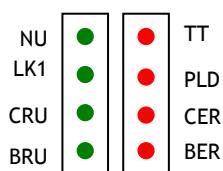


Figure 48: Mechatrolink III axis board

The LEDs have the following meaning:

NU	Not used
LK1	Standard LED of the MECHATROLINK-III port. It is ON when the link is active.
CAN RUN and CAN-ERR	Standard LED "RUN" and "ERROR" of the CANopen port.
TT	It turns ON when the laser tip-touch sensor (proprietary) is touching.
PLD	It turns ON when the board watchdog elapsed.
BRD-ERR	Fixed ON immediately after the power on, It flashes like BRD-RUN if the system watchdog elapsed
BRD-RUN	OFF immediately after power-on, lights flashing indicates the version of the card.

7.10 OPENprime Mechatrolink I/II

OPENprime Mechatrolink I/II is equipped with the expansion card OS2005 p/n 93000807P for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC5540/1C

7.10.1 Optional CANopen/Profibus fieldbus

It is possible to manage an optional fieldbus chosen from the following requesting its commercial code when ordering:

- CANopen Master (p/n 93000760P)
- Profibus Master (p/n 93000761G)
- Profibus Slave (p/n 93000762A)

The following resources are also available:

- 4 Fast digital input (one used as a Touch Probe input)
- 3 Fast Output 24V
- 1 Digital Signal G. Estop (Global Emergency Stop) Power enable
- 2 Analog Input 12 bits (one channel can be set as current input)
- 1 Analog Output 16-bit
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.10.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

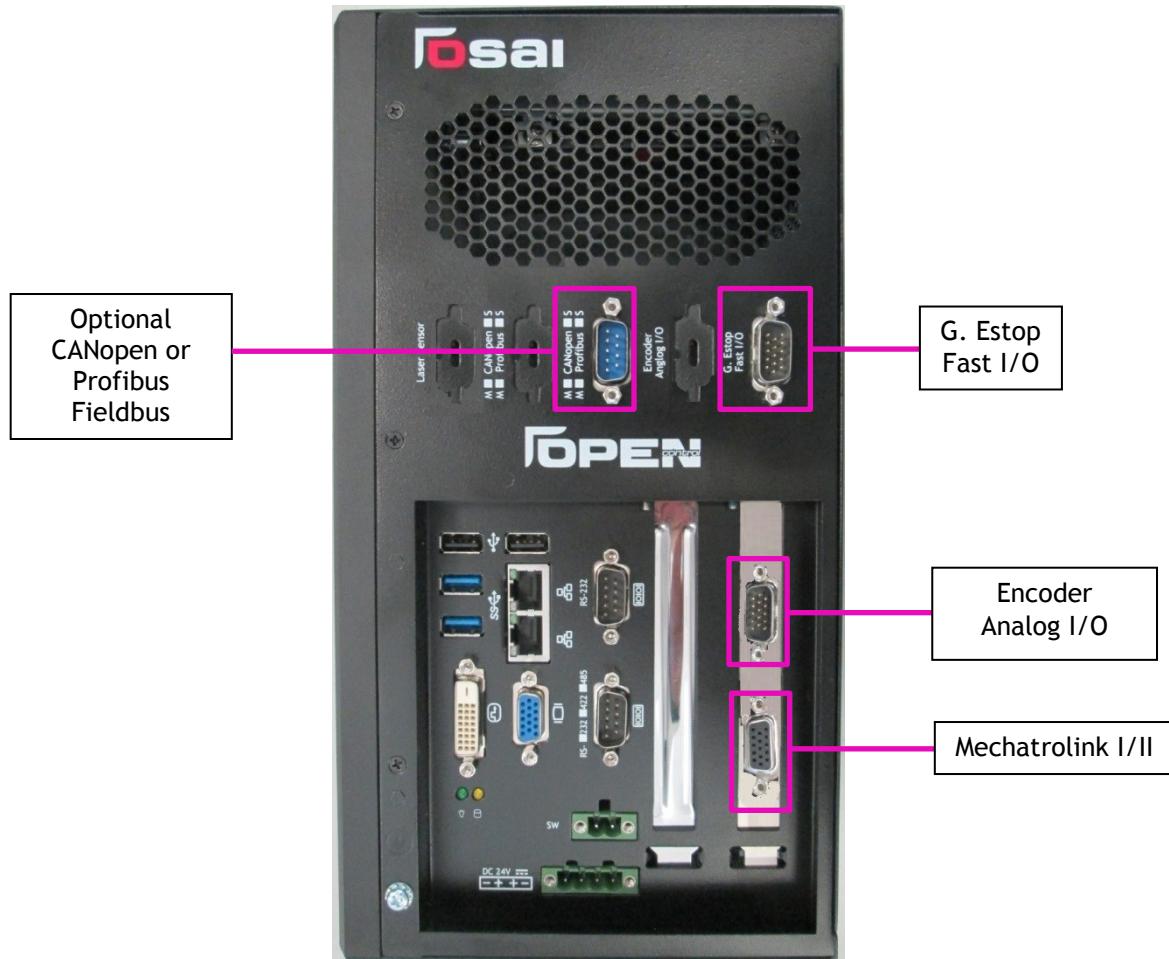


Figure 49: OPENprime Mechatrolink I/II connector position

7.10.3 Signal characteristics

Fast input

Number of channels: 4 or 3 Fast Input + 1 Touch-probe Input
 Input voltage: 18-30V A.D.
 Current consumption: 7.6 mA @ 24V dc
 Fast Response Time Input: about 20 uSec (filter to a pole with $T \approx 20$ usec.).
 Response time TP Input: $t_{on} \approx 1$ uSec. 5V.



The setting of the fast input 1 as Touch Probe must be requested with the p/n TAR6385_0003 at the order.

Fast output

Number of channels: 3 + 1 power enable signal to + 24V (G. Estop)
 Supply: 18-30V dc
 Maximum current: 250 mA per channel
 Response time: $t_{on,max} = 350$ usec./ $t_{off,max} = 70$ usec.



Note: The 24V dc power supply must be connected even if the outputs are not used

Input voltage

Resolution: 12-bit
 Input voltage: +/- 10V
 Input impedance: 20 KΩ

Input current

Resolution: 12-bit
 Loop current: 0 ÷ 20 mA
 Input resistance: 250 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0001 at the order.

D/A 16 bit analog output

Resolution: 16-bit
 Output range: +/- 10V
 Output resistance: <0.5 Ω
 Maximum output current: 20 mA (max load 5 KΩ)

Encoder Channel

Encoder type: ABZ differential 0 ÷ 5V
 Power output: 5V (150 mA max)
 Power protection: 1,35A self-restorable fuse

Max input frequency signals A, B with OSAI cable cod. 285123K: Clock counter 12 MHz, A, B offset 90 °

7.10.4 Diagnostic of the board

LEDs on the front panel

On the faceplate there are 3 dual LED (D1, D2, D3) having the following meaning:

D1	red led	= OS-WIRE fault
	green led	= OS-WIRE active
D2	red led	= Fieldbus module error(CanOpen/Profibus)
	green led	= Fieldbus module run (CanOpen/Profibus)
D3	yellow led	= Reserved
	yellow led	= Reserved

7.10.5 Connection to the EtherCAT fieldbus

An auxiliary card, mounted in the second slot, allows the use of an EtherCAT channel (profiles CoE and SoE). Only with Mechatrolink I/II or OS-Wire fieldbus.

sheet	Code	secondary Fieldbus	Note
EtherCAT AUX	8SMPC7392/0C	EtherCAT (CoE and SoE)	To be used with the axis card Mechatrolink I/II or OS-Wire only

The EtherCAT connector is type RJ45 with standard pin out of the Ethernet port 10/100/1000 Base-T.

Meaning of the LEDs on the front panel board:

- Yellow LED: on = link to 1000Mbit/s
- Green LED 1: on = link to 100Mbit/s
- Green LED 2: on = this link
Blinking = Activity in progress link.



Use standard Ethernet shielded CAT5E cable, NO cross-over, MAX length = 100m.

7.11 OPENprime OS-Wire

OPENprime OS-Wire is equipped with the expansion card OS2005 p/n 93000808A for the connection of axes and I/O.



In the export version (max 4 interpolated axes) the p/n of the card is 1SMPC5672/1C

7.11.1 *Optional CANopen/Profibus fieldbus*

It is possible to manage an additional fieldbus chosen from the following requesting its commercial code at the order:

- CANopen Master (p/n 93000760P)
- Profibus Master (p/n 93000761G)
- Profibus Slave (p/n 93000762A)

The following resources are also available:

- 4 Fast digital input (one used as a Touch Probe input)
- 3 Fast Output 24V
- 1 Digital Signal G. Estop (Global Emergency Stop) Power enable
- 2 Analog Input 12 bits (one channel can be set as current input)
- 1 Analog Output 16-bit
- 1 Encoder Input

For the description of the connectors please refer to chapter 8 "LAYOUT OF THE CONNECTORS".

7.11.2 Connector position

The position of the specific connectors for this configuration is shown in the following figures.

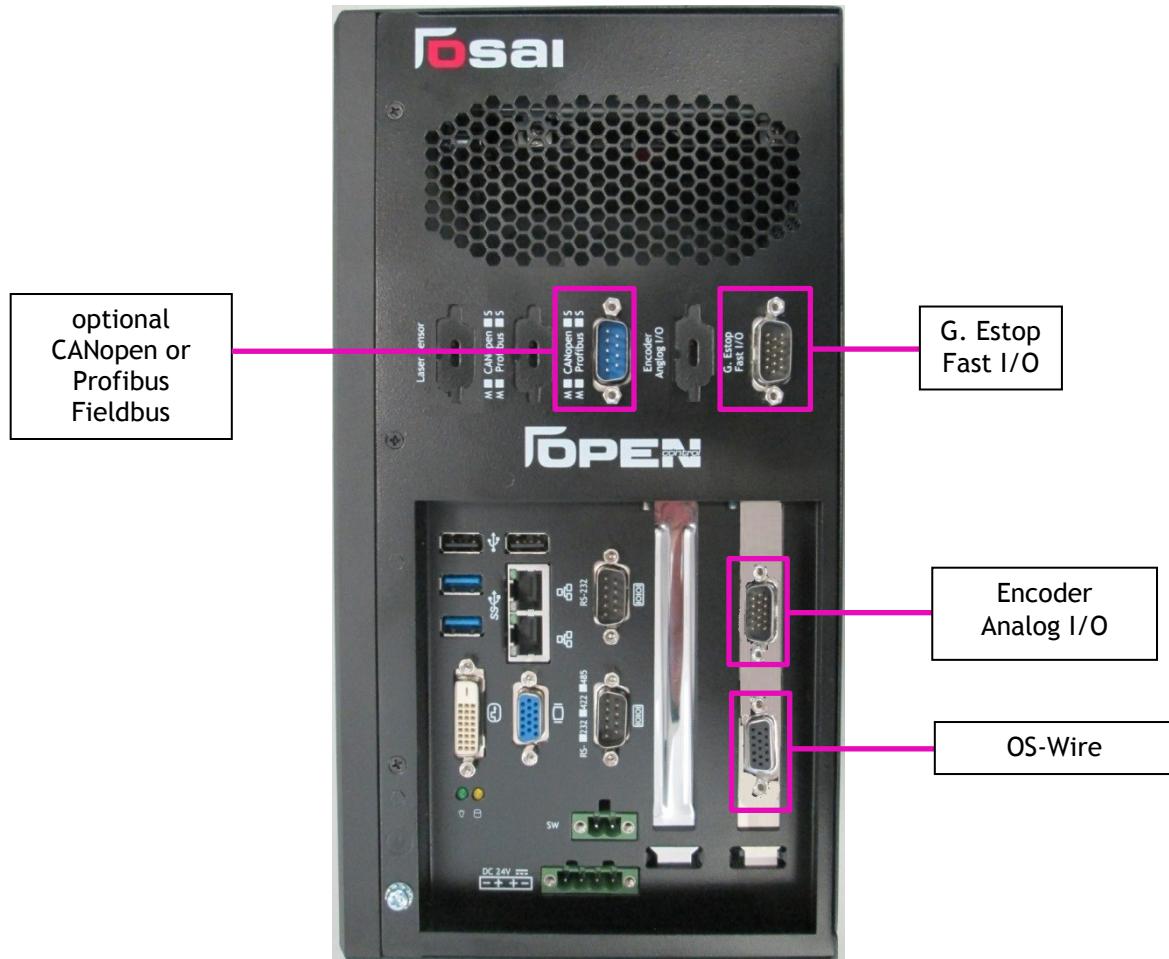


Figure 50: OPENkey OS-Wire connector position

7.11.3 Signal characteristics

Fast input

Number of channels:	4 or 3 Fast Input + Input Touch-probe
Input voltage:	18-30V dc
Current consumption:	7.6 mA @ 24V dc
Fast Response Time Input:	about 20 uSec (filter to a pole with $T \approx 20$ usec.).
Response time TP Input:	$t_{on} \approx 1$ uSec. 5V.



The setting of the fast input 1 as Touch Probe must be requested with the p/n TAR6385_0003 at the order.

Fast output

Number of channels:	3 + 1 power enable signal to + 24V (G. Estop)
Supply:	18-30V dc
Maximum current:	250 mA per channel
Response time:	$t_{on,max} = 350$ usec./ $T_{off,max} = 70$ usec.



Note: The 24V dc power supply must be connected even if the outputs are not used

Input voltage

Resolution:	12-bit
Input voltage:	+/- 10V
Input impedance:	20 KΩ

Input current

Resolution:	12-bit
loop current:	0 ÷ 20 mA
input resistance:	250 Ω



The setting of Input 1 as current input must be requested with the p/n TAR6385_0001 at the order.

Output analog D/A 16 bit

Resolution:	16-bit
Output range:	+/- 10V
Output resistance:	<0.5 Ω
Maximum output current:	20 mA (max load 5 KΩ)

Encoder channel

Encoder type:	ABZ differential 0 ÷ 5V
Power output:	5V (150 mA max)
Power protection:	1,35A self-restorable fuse

Max input frequency signals A, B with OSAI cable cod. 285123K: Clock counter 12 MHz, A, B offset 90 °

7.11.4 Diagnostics of the board

LEDs on the front panel

On the faceplate there are 3 dual LED (D1, D2, D3) having the following meaning:

D1	red led	= OS-WIRE fault
	green led	= OS-WIRE active
D2	red led	= Fieldbus module error(CanOpen/Profibus)
	green led	= Fieldbus module run (CanOpen/Profibus)
D3	yellow led	= Reserved
	yellow led	= Reserved

7.11.5 Connection to the EtherCAT fieldbus

An auxiliary card, mounted in the second slot, allows the use of an EtherCAT channel (profiles CoE and SoE). Only with Mechatrolink I/II or OS-Wire fieldbus.

sheet	Code	secondary Fieldbus	Note
EtherCAT AUX	8SMPC7392/0C	EtherCAT (CoE and SoE)	To be used with the axis card Mechatrolink I/II or OS-Wire only

The EtherCAT connector is type RJ45 with standard pin out of the Ethernet port 10/100/1000 Base-T.

Meaning of the LEDs on the front panel board:

- Yellow LED: on = link to 1000Mbit/s
- Green LED 1: on = link to 100Mbit/s
- Green LED 2: on = this link
Blinking = Activity in progress link.



Use Ethernet CAT5E unshielded standard cables, NO cross-over, MAX length = 100m

8. LAYOUT OF THE CONNECTORS

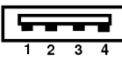
The following describes the connectors of OPENkey and OPENprime control unit.

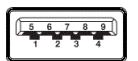


The connectors of OPENsmart control unit are described in their specific chapters.

8.1 USB connectors

The layout of the USB connectors complies with the USB standard

 standard USB 2.0 connector	
PIN	Signal
1	VCC (+ 5V)
2	DATA -
3	DATA +
4	GND

 standard USB 3.0 connector	
PIN	Signal
1	VCC (+ 5V)
2	DATA -
3	DATA +
4	GND
5	Rx -
6	Rx +
7	GND
8	Tx -
9	Tx +



The USB 3.0 connectors are blue

8.2 LAN Connectors (Ethernet)

The following is the description of the LEDs on the connector and its pinout.

Description of the LED associated with the port

ACT	Status
flashing yellow	Activities
Turned off	No activity

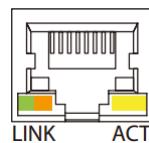


Figure 51: RJ45 connector with LEDs

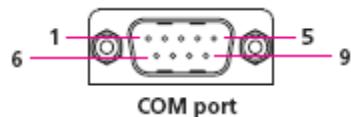
LINK	Status
steady green	Links to 1GB
Solid orange	Links to 100Mb
Turned off	Links to 10Mb or no link

Pin-out of the standard Ethernet connector

Pin	Signal
1	LAN_TXD0P
2	LAN_TXD0N
3	LAN_TXD1P
4	LAN_TXD2P
5	LAN_TXD2N
6	LAN_TXD1N
7	LAN_TXD3P
8	LAN_TXD3N

8.3 Serial Interface COM1 and COM2 connectors

The following tables show the pin assignment of the 2 9-way D-Sub connectors



RS232 - COM1 and COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1		

The following tables show the connector pin relative to COM2 in the case of configuration as a serial RS422 or RS485.

RS422 - COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	TXD-	2	TXD +
3	RXD +	4	RXD -
5	GND	6	RTS -
7	RTS #	8	CTS +
9	CTS -		GND



For the proper management of the serial line RS422, it is necessary to configure the corresponding FB in the PLC logic. Refer to the manual "Winplus - System Library" (p/n 45006608A), Chapter "Functions related to the serial line - 4C_SerialComm".

RS485 - COM2			
DB9 Pin #	Def.	DB9 Pin #	Def.
1	TXD -	2	TXD +
	RXD -		RXD +
3	Reserved	4	Reserved
5	GND	6	Reserved
7	Reserved	8	Reserved
9	Reserved		Reserved



For the proper management of the serial line RS485, it is necessary to configure the corresponding FB in the PLC logic. Refer to the manual "Winplus - System Library" (p/n 45006608A), Chapter "Functions related to the serial line - 4C_SerialComm"

8.4 DVI-I connector

The following figure shows the pinout of the DVI-I connector.

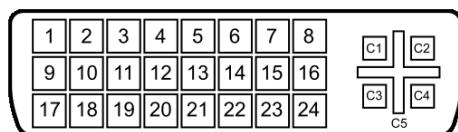


Figure 52: DVI-I connector

Pin	Signal	Description
1	TMDS data 2-	Red dig. - (Link 1)
2	TMDS data 2+	Red dig. + (Link 1)
3	Shielding	for TMDS 2
4	Not connected	
5	Not connected	
6	DDC Clock	
7	DDC data	
8	Synchronous analog vertical	
9	TMDS Data 1-	Green dig. - (Link 1)
10	TMDS Data 1+	Green dig. + (Link 1)
11	Shielding	for TMDS 1
12	Not connected	
13	Not connected	
14	+ 5V	for Standby Power
15	Mass	Ground for pins 8, 14 and C4
16	Hot plug detect	Detects hot insertion
17	TMDS data 0-	Blue dig. - (Link 1) and synchronous digital
18	TMDS data 0+	Blue dig. + (Link 1) and synchronous digital
19	Shielding	for TMDS 0
20	Not connected	
21	Not connected	
22	Shielding	for TMDS clock
23	TMDS Clock +	Clock dig. + (Link 1)
24	TMDS Clock -	Clock dig.- (Link 1)
C1	analog Red	
C2	analog Green	
C3	analog Blue	
C4	Synchronous analog horizontal	
C5	Mass	for C1, C2 and C3

8.5 Fast I/O and G_Estop connector

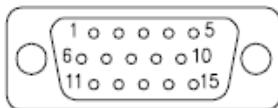


Figure 53: Fast I/O and G-Estop 15-way HD male connector

PIN	First name	Description
1		
2	+ 24_Ext	Input + 24V dc for external output power supply
3	FOU3	Fast Output 3
4		
5	FIN3	Fast Input 3
6		
7	FOU1	Fast Output 1
8	G-ESTOP	Power enabling (CNC Ready)
9	FIN1	Fast Input 1/Touch Probe
10	FIN4	Fast Input 4
11	+ 24_Ext	Input + 24V dc for external output power supply
12	FOU2	Fast Output 2
13		
14	FIN2	Fast Input 2
15	GND_24V	0V of the external 24V dc power supply



The G_Estop power Enable is a digital signal at 24V.

Its maximum current is 250mA in versions Mechatrolink I/II and OS-Wire; 100mA in versions EtherCAT and Mechatrolink III



Provide an external fuse on the external 24Vdc: 5A slow in versions Mechatrolink I/II and OS-Wire; 3A slow in versions EtherCAT Mechatrolink III

8.6 Encoder and Analog I/O connector

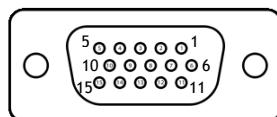


Figure 54: Encoder and Analog Input/Output 15-way HD male connector

PIN	First name	Description
1	INP1C	positive input channel 1 / current loop output
2	INP2C	positive input channel 2
3	A +	Positive input encoder phase A
4	B +	Positive input encoder B phase
5	Z +	Positive input encoder Z phase
6	INAN1-	Negative input channel 1/ Current Loop Input
7	INAN2-	Negative input channel 2
8	TO-	Negative input encoder phase A
9	B-	Negative input encoder B phase
10	Z-	Negative input encoder Z phase
11	ANGND	Analog ground (not isolated from digital ground)
12	OUT AN1	analog output
13	ANGND	Analog ground (not isolated from digital ground)
14	+ 5V_ENC	+ 5V Encoder power supply
15	GND	Digital ground for inputs and encoder power supply

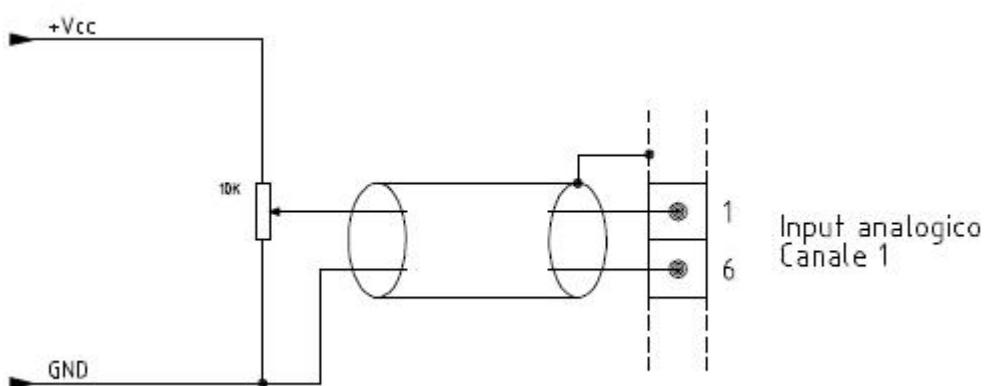


Figure 55: Example of Analog Input connection with potentiometer

8.7 Mechatrolink III connector

The connector type Mini I/O with standard pin-out for MECHATROLINK-III.

For external connection the following connector is suggested:

- Mini I/O IMI Tyco AMP connector, P/N 2040008-1.

8.8 CANopen connector

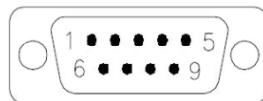


Figure 56: CANopen 9 pin male connector

PIN	First name	Description
1		
2	CAN_L	Line CAN_L (low)
3	CAN_GND	Line CAN Ground (GND)
4		
5		
6		
7	CAN_H	Line CAN_H (high)
8		
9		



The shield of the CANopen cable must be connected to the metal casing of the cable connector



Pins without name and description must not be connected

8.9 Mechatrolink I/II connector

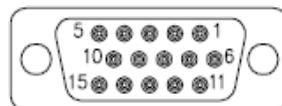


Figure 57: Mechatrolink I/II 15 pin HD female connector

PIN	MKTRL signals	Description
1		
2		
3		
4		
5		
6		
7	GND	Mass
8	Line +	Line 1
9	Line -	Line 2
10		
11		
12		
13		
14		
15		

USB type connector on Yaskawa drive	Pin	Description
CN6A & CN6B	1	
	2	/ S
	3	S
	4	SH

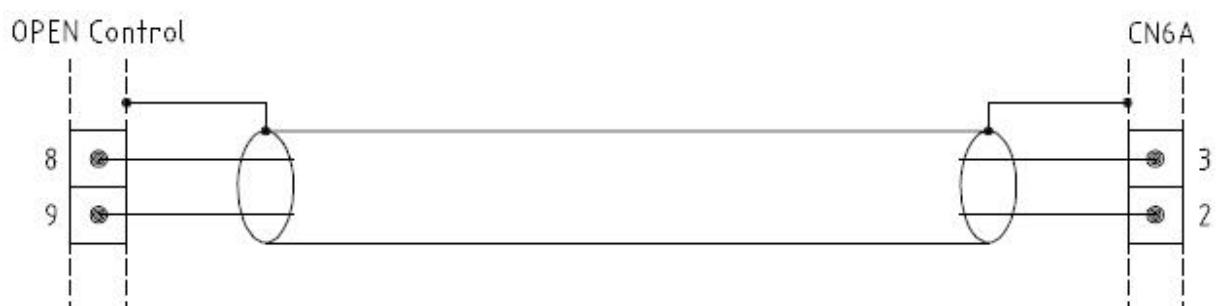


Figure 58: Example of Mechatrolink connection with a Yaskawa drive - Sigma V

8.10 OS-Wire Connector

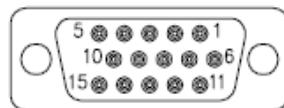


Figure 59: OS-Wire 15 pin HD female connector

PIN	OS-Wire Signals	Description
1	DTP00	Data 0 "right"
2	DTN00	Data 0 "inverted"
3	GND	Mass
4	DTP01	Data 1 "right"
5	DTN01	Data 1 "inverted"
6	GND	Ground
7		
8		
9		
10		
11	DTP02	Data 2 "right"
12	DTN02	Data 2 "inverted"
13	GND	Ground
14	DTP03	Data 3 "right"
15	DTN03	Data 3 "inverted"

8.11 Profibus connector

PIN	First name	Description
1		
2		
3	RxD/TxD-P	Data Rx/Tx +
4	CNTR-P	Control
5	DGND	Digital ground (referred to VP)
6	VP	+ 5V
7		
8	RxD/TxD-N	Data Rx/Tx -
9		



Pins without name and description must not be connected

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