motion control technologies



Axis Controller with integrated PLC

SU112 -Technical Manual

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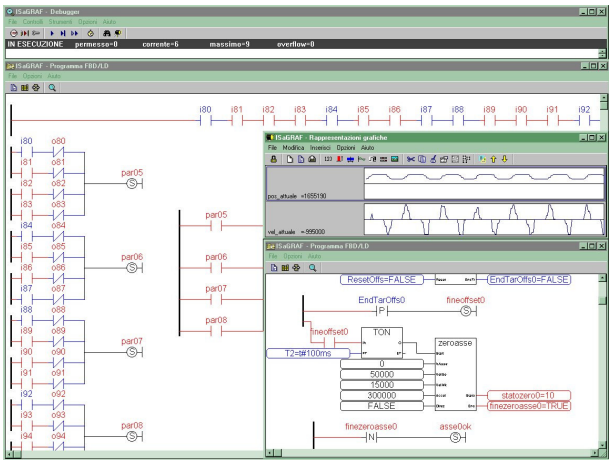
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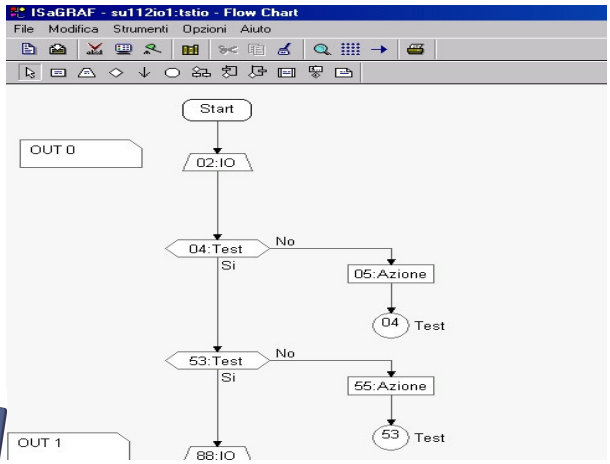
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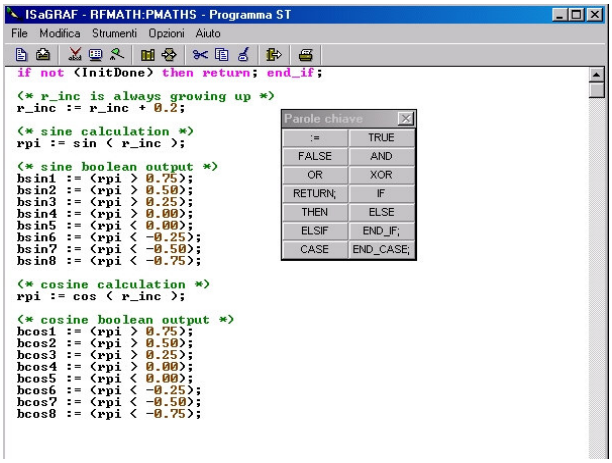
Product Line of Axis Controller with integrated PLC SU112

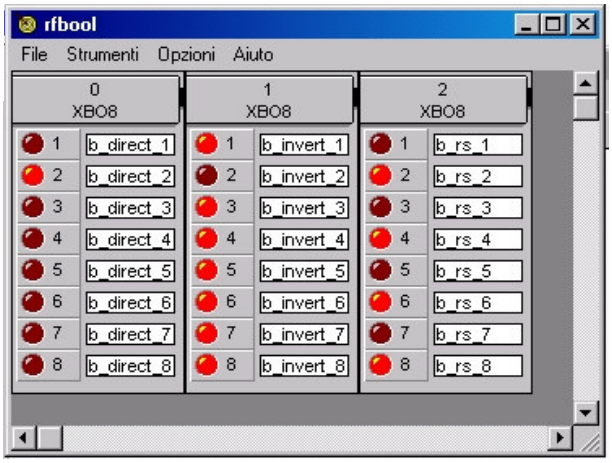
On site programming
ISaGRAF
(Software technical manual)





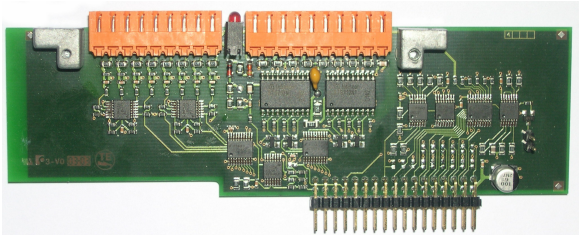




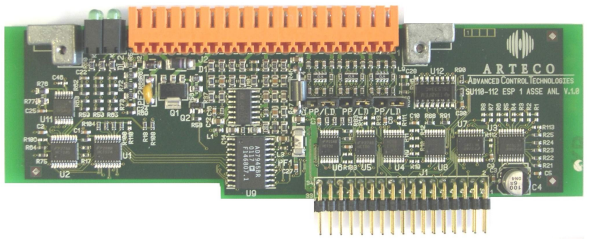




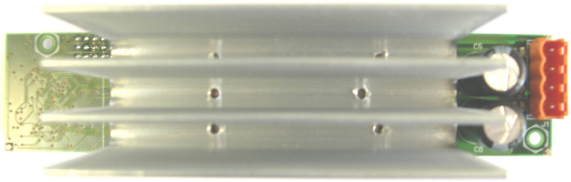
CPU Unit SU112
(Chapters 1-7)



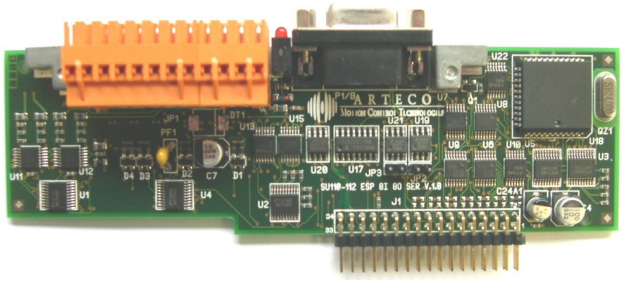
8 IN 8 OUT Expansion
(Chapter 8)



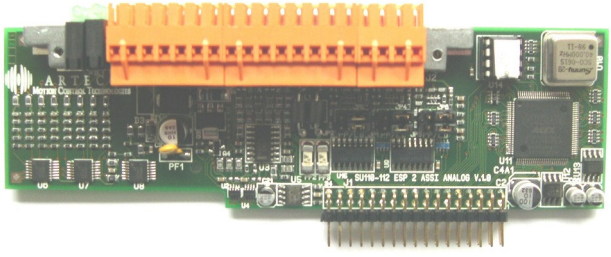
1 Analogue Axis Expansion
(Chapter 9)



1 PWM Axis Expansion
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Chapter 1 – GENERALITIES

1.1 - Purpose of the manual and basic concepts

This manual provides information to the user relative to the principal hardware specifications of the Axis Controller with integrated PLC SU112 unit and to the procedure for the correct installation of the SU112 system.
The Axis Controller with integrated PLC SU112 is an extremely flexible system that allows the control of elements that are normally present on board the machine, such as, for example, digital inputs and outputs and axes with incremental encoder control.
Calibration, configuration and maintenance procedures must be performed by specialised personnel.
Information contained in this manual regard the installation and the start up of the system. In any event, technical regulations relative to the application must be respected.

1.2 - Packaging and Storage Information

Parameter	Units of measure	Min.	Max.
Operational temperature	**Degrees Celsius**	**+5° C**	**+40° C**
Storage temperature	**Degrees Celsius**	**-10° C**	**+55° C**
Humidity (without condensation)	**%**	**30**	**90**



Adopt all antistatic precautions in the event that it becomes necessary, for whatever reason, to open the SU 110 unit.

1.3 - Conformity to CE Directives

The Axis Controller with integrated PLC Su112 system and its modules conform to the EN50082-2 directives for application in industrial environments for susceptibility and the EN50081 directives for emissions.

Chapter 2 – INSTALLATION AND POWER SUPPLY

2.1 - Installation of the SU112 unit

It is the responsibility of the end user that the installation of the unit responds to the criteria and requirements described in this manual.

- Installation, commissioning and maintenance must be performed only by qualified personnel.
- The SU112 unit must be installed in a protected environment, free from dust, condensation, corrosive vapours, gases or liquids.
- The SU112 unit has been manufactured to be installed inside of a machine or to be assembled with other parts so as to construct a machine considered in the 89/392/EEC Machinery Directive.
- The installation must always respect safety regulations in force.

Arteco S.p.A. declines any responsibility in the event of damage to persons or things due to an incorrect use of the SU112 unit.



Do not remove or insert any connectors while the system is powered

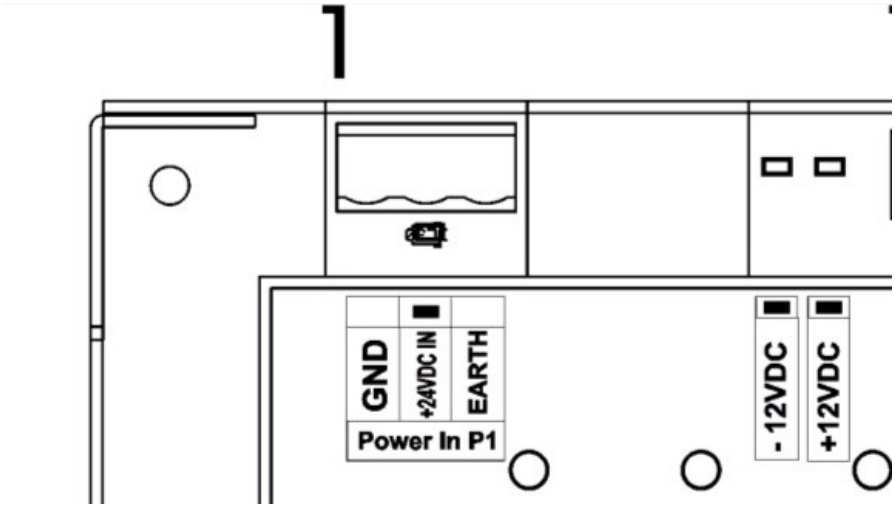
2.2 - Power Supply

The power supply casing has the following specifications:

- **Protection against power surges**
- **Protection against electrostatic charges**
- **Protection against power supply inversions**
- **Protection against electrical fast transients**
- **Signalling in the event of abrupt drops in voltage**
- **Detection in the application program of power supply voltage**
- **Visible indicator of voltage presence**

The power supply must be provided by way of the **P1** connector and the voltage value must be 24 Volts direct current with a maximum tolerance of ±20%.
Besides the power supply the earth must be connected to pin 1 and the GND on pin 3 of the **P1** connector by way of a wire with a section not less than 1.5 mm² (internally the GND data card and Earth are connected to one another).

Power supply connection detail:



2.2.2 – Table of current absorption

Electrical power supply voltage provided to connector P1: 24 V dc ±20%

State	Current absorption
No load (without encoder connected)	300 mA
With encoder connected	500mA

2.3 - Battery Back-Up

- **Internal super-capacitor for data conservation in absence of battery power**
- **Explosion protection in case of short circuit inversion or battery overload.**

Battery replacement may be performed with the unit turned on or else with unit turned off as long as the substitution time is less than 2 minutes.

2.3.1 – Back-Up Battery specifications

BATTERY TECHNICAL SPECIFICATIONS			
Type	V nominal	Battery type	
Lithium not rechargeable	3.6 Volt	CR2032	



EXPLOSION HAZARD!
The battery must not be short circuited, nor undergo recharging, nor be exposed to heat sources, incineration processes or mechanical stress such as opening of its casing or compression of its container.

When it must be replaced, refer to the local regulations regarding battery disposal.

Chapter 3 – CONNECTORS AND SIGNALS

On axis connectors **P2** and **P3** all of the signals relative to actuation command and encoder signal reception are present.

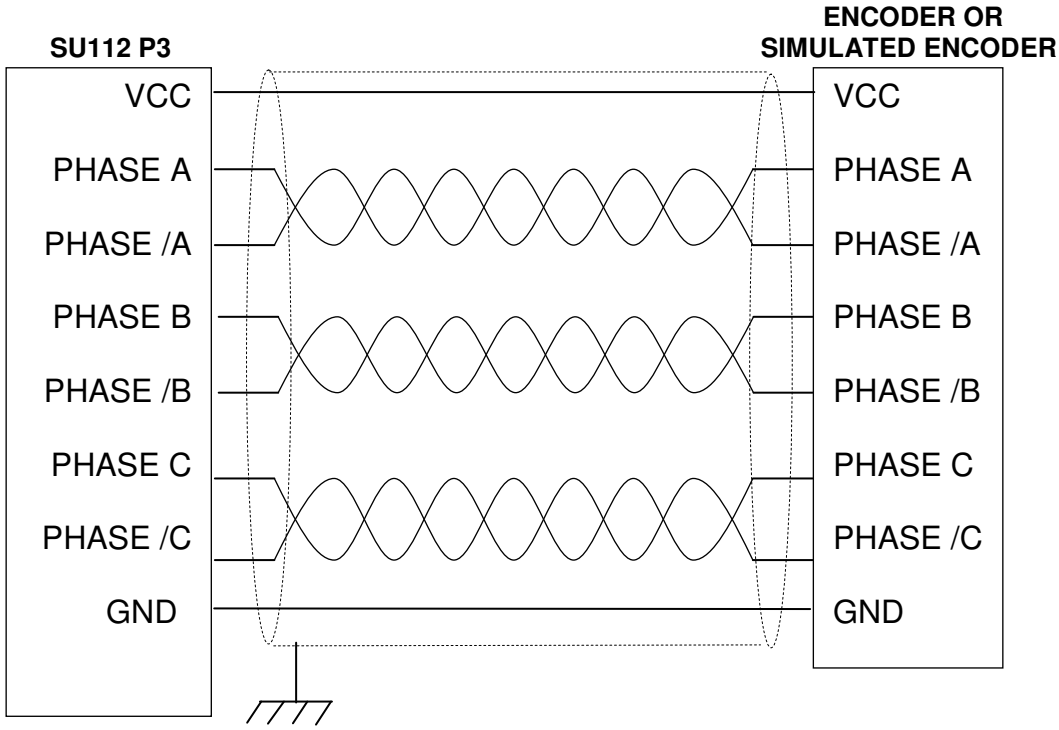
3.1 - Encoder

The encoder casing has the following specifications:

- **Power supply furnished by the unit: 5 V 300 mA Max fuse protected**
- **Protection against electrostatic charges**
- **Analogue filters on encoder inputs for noise elimination**
- **Digital filters on encoder inputs for spike elimination**
- **Maximum external counting frequency 200KHz, with option 400KHz**

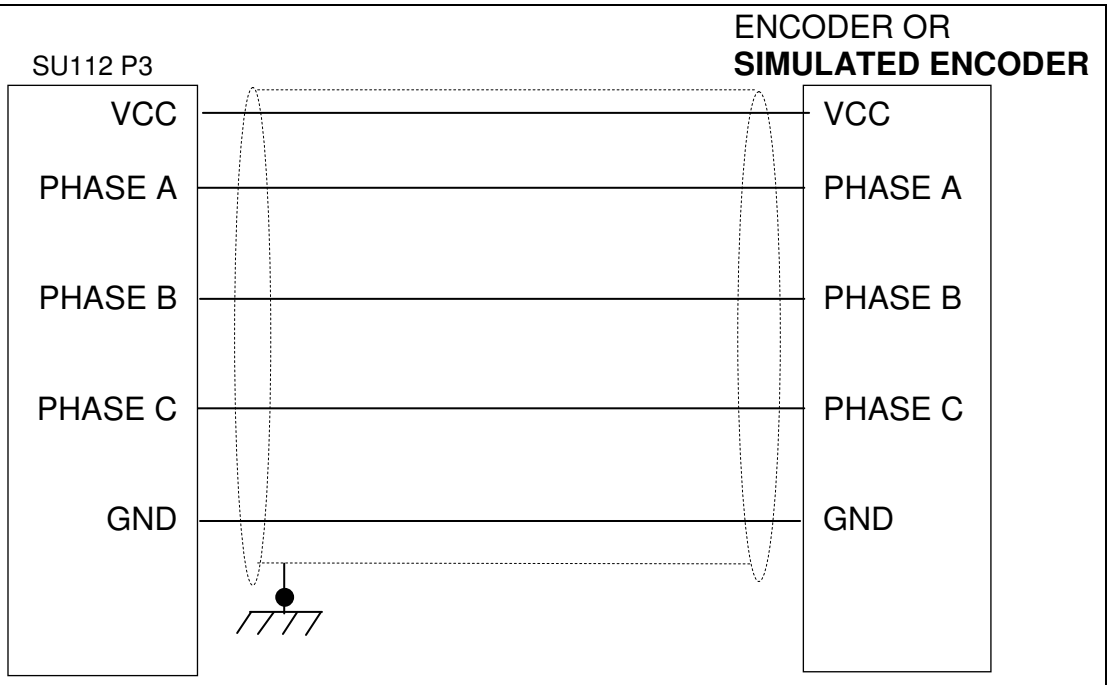
The Axis Controller with integrated PLC SU112 is capable of receiving signals from an incremental type encoder either with Push-Pull output or else a Line-Driver at a power supply, provided by the unit, of +5 Volt with a tolerance of $\pm$ 5%.

3.1.1 - Line Driver Encoder Connection Diagram



The figure shows the shield connection to the SU112 system.

3.1.2 - Push-Pull Encoder Connection Diagram



The figure shows the shield connection to the SU112 system.

3.1.3 - Shielding

When it is desired that a shield be connected to the SU112 system the **GND** terminal is available on the P2 and P3 connectors.

As for the actuation, consult the respective manual for the correct connection of the shield.

3.1.4 - Levels

The levels provided by the encoder must fall within the table found below:

Encoder +5 Volt	
Level Zero	Level One
Max 0.8 Volt	Min 4.0 Volt

Maximum absorption for the encoder is 300 mA. So as to improve the precision of the encoder an internal multiplier has been applied. For example, if an encoder with 500 impulses/revolution is utilised, it is actually like having one of 500 impulses/revolution * 4 = 2,000 impulses/revolution.

3.1.5 Simulated Encoder Interface

The Axis Controller with integrated PLC SU112 also interfaces with simulated interfaces provided by the actuation. It is necessary to remember that the actuation must provide impulses even when put in emergency stop otherwise the axis could lose its position. See the figure at paragraph 3.1.1 with the variant where the VCC power supply need not be connected.

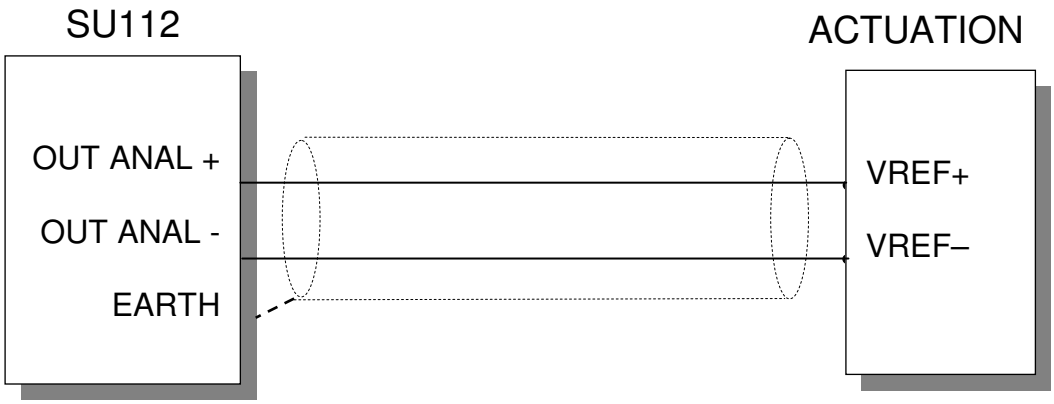
3.2 - Analogue output

Specifications:

- **Differential range output ±10 Volt 12 Bit resolution**
- **Short circuit protection**
- **Protection against electrostatic charges**

The analogue output provides speed reference to the actuation.
The load resistance on the line must be greater or equal to 10 K ohms.
The actuation connection must be performed by way of a shielded and eventually also twisted cable. The cable path must be as far as possible from power devices or cables (at least 30 cm).

Example of a connection from the analogue output to the actuation.



3.3 - Actuation Enabling Output

- **PNP 24 V direct current output**
- **Visual indication for output status**

The output is a 24 Volt type PNP with 100 mA max. As for what regards the management of this output refer to the "AXIS CONTROL" software manual.

3.4 - Output CN OK

- **PNP 24 Volt direct current output**
- **Visual indication for output status**

The CN OK output is provided for the indication of the operational status of the SU112 system.
This output is a 24 volt PNP type with 100 mA max., and is protected against inductive loads. If problems of the blockage of the of the data card occur, the CN OK output is automatically deactivated.

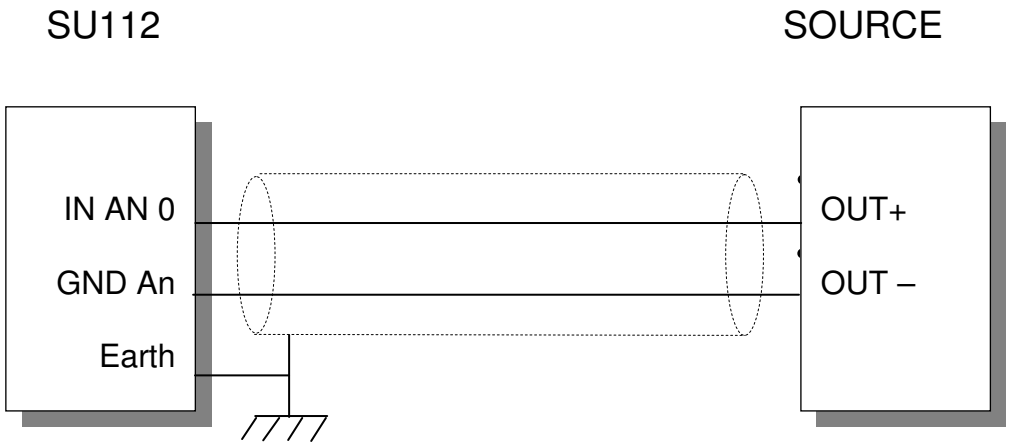
3.5 - Analogue Inputs

The analogue inputs have the following specifications.

- **Input in common range mode from 0 to 10 Volts**
- **Protection against electrostatic charges**
- **Analogue filter at casing ingress for noise elimination**
- **Analogue input impedance 1KΩ**

On each **P2** and **P3** axis connector there is analogue input manageable by the application program.

Example of analogue input connection



The figure shows the shield connection to the SU112 system.

3.6 - User Inputs

Specifications:

- **PNP 24 Volt direct current output**
- **Protection against electrostatic charges**
- **Analogue filter at casing ingress for spike elimination**
- **Visible indicator of input status**

The user inputs are available on the **P8** and **P9** connectors. They are type PNP at 24 V DC. The input casing is equipped with a filter that recognises a valid signal with a duration of at least 1 msec at 24V DC. The absorption of each single input at a voltage of 24 V DC is 4 mA.

Logic levels:

Logic level 0		*Logic level 1*	
Minimum Value	Maximum Value	Minimum Value	Maximum Value
0 Volt	9.0 Volts	18 Volts	30 Volts

3.7 - Special Inputs

Specifications:

- **PNP 24 Volt direct current input**
- **Protection against electrostatic charges**
- **Analogue filter at casing input for spike elimination**
- **Visible indicator for input status**

Special inputs are available on the **P7** connector. They are type PNP at 24 V DC protected from power surges and electrostatic charges.
The input is equipped with a filter that recognises a valid signal with a duration of at least 0.1 msec at 24 V DC. Compared to the user inputs, this filter is dimensioned for a lesser time in that, installed into the special inputs besides the axis limit stops and the emergency stops, there are also two interrupt inputs which require greater speed precisely for the intrinsic operations that they offer. The absorption of each single input at a voltage of 24 V DC is 4 mA.

Logic levels:

Logic level 0		*Logic level 1*	
Minimum Value	Maximum Value	Minimum Value	Maximum Value
0 Volt	9.0 Volts	18 Volts	30 Volts

3.8 - User Outputs

Specifications:

- **Overload Protection**
- **Current Limiter**
- **Short circuit protection**
- **Overheating protection**
- **Electrical power supply voltage inversion protection**
- **Visual indicator with red LED for protection of outputs**
- **Visual indicator of the status of each individual output**
- **Fast demagnetisation of inductive loads**

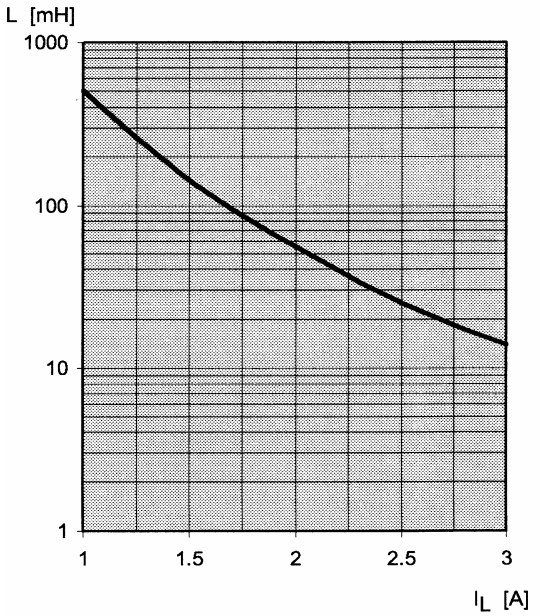
The user outputs are available on the **P5** and **P6** connectors.
The outputs are type PNP at 24 V DC. The electrical power supply must be provided externally and must be dimensioned in function of the maximum load connected.

If the conditions of overload, short circuit or over heating of the drivers occur, the commanded output is automatically deactivated and the red LED lights up, as indicated in the serigraph as **Prot. Out.**
The LED **Prot. Out** is turned off when the output that generated the alarm is deactivated by the application program.



If there is the need to disconnect the emergency output power supply, it is possible to disconnect the power from the **P5** and **P6 pin 1 (+24 V DC)** connectors with a consequent deactivation of the outputs. In this case, however, it would also be suitable to deactivate the outputs in the application as well. This is because if the command status remains memorized, at the return of the power supply, the outputs would go back to being turned on, causing movement or actuation which could prove to be dangerous for the machine operator.

In the following figure there is the graphic representation of the current that may be supplied as a function of the maximum inductive load.



Graph of the current that may be supplied as a function of maximum inductive load.

Each output driver provides for the piloting of the resistance, inductive and also the capacitive loads. The current that may be supplied by each output is 1.9 A with a limitation of 4 A for each group of four outputs grouped as illustrated in the figure below. If a greater current is desired, it is possible to connect the outputs (at a level of wiring) and their relative commands (at a level of the application program) in parallel up to a maximum of four outputs. The output groups that may be connected in parallel are the following

- **Out 0-3**
- **Out 4-7**
- **Out 8-11**
- **Out 12-15**

In alarm status, if the output command is maintained, the driver will cyclically pilot the load for a time of 500 µSec so as to detect the alarm status.

3.9 - Serial Port P4

Protection:

- **Overloads**
- **Electrostatic charges**
- **Protection against electrical fast transients**

Specifications:

- **Standard RS-232**
- **Standard RS-422/485 Full duplex**

The basic serial port is available on the **P4** connector at 9 poles Sub-D female.
The serial port satisfies the RS-232, RS-485, RS-422 standards.
The selection between the RS-232 and the RS-485/422 comes about automatically based on the type of wiring. This selection is carried out on the reception while as regards the transmissions the data are sent at both standards.

3.9.1 - Standard RS-232

The **RS-232** standard provides the RX and TX signals. Being a "single-ended" transmission, that is, with a single terminal point, connection is indicated exclusively for a single RS-232 input as indicated by the **EIA/TIA-232E** regulations.

Logic level 0		Logic level 1	
Minimum Value	Maximum Value	Minimum Value	Maximum Value
+5 Volts	+8 Volts	- 5 Volts	- 8 Volts

Transmission signal levels for the RS-232 standard to the SU210 system referred at impedance for the minimum load admissible of 3 K ohm

3.9.2 – RS-485 Standard

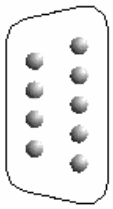
The **RS-485** standard provides the RX and TX signals in differential mode. Besides the signals with high active logic the relative complementary signals are also present so as to reduce disturbance in the same way assuring greater immunity, higher transmission speed and a greater communication distance.



Do not insert or remove the connector when the system is powered.

3.9.3 –RS-232 / RS-485 / RS-422Connections

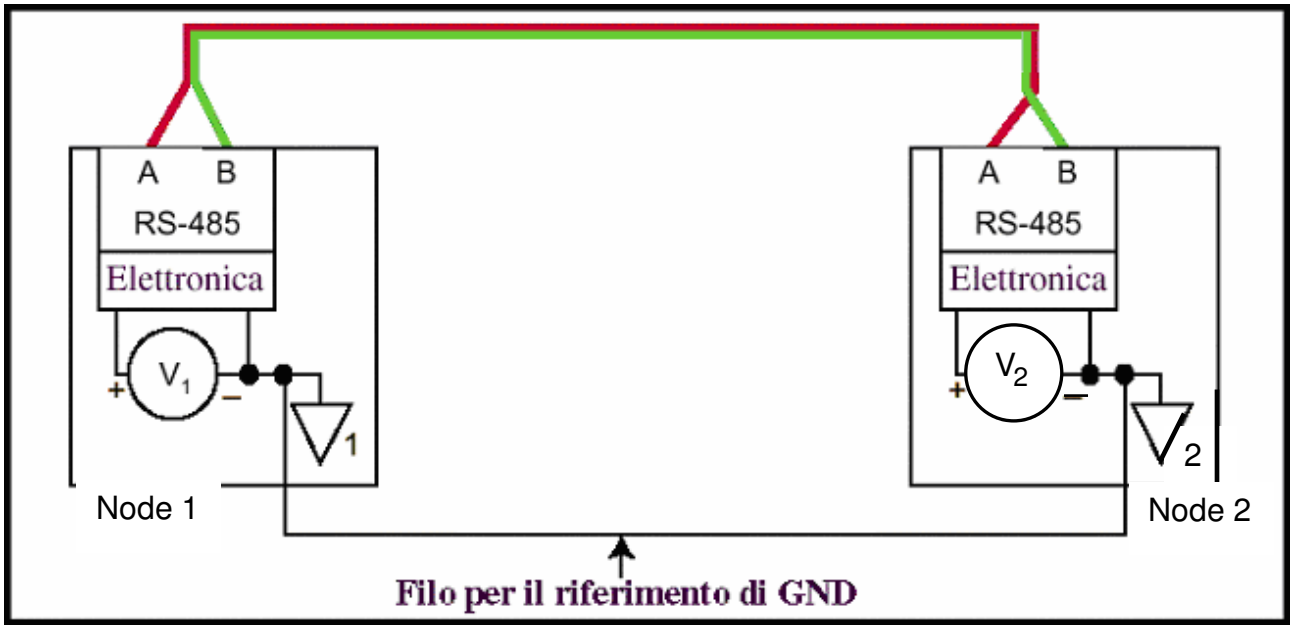
P4 Serial Port Connector



RX- (RS-485)	9	5	GND
RX+ (RS-485)	8	4	+ 5Volt (Max 50mA)
TX- (RS-485)	7	3	TX (RS-232)
TX+ (RS-485)	6	2	RX (RS-232)
		1	GND

TYPE OF CONNECTOR

3.9.4 - Utilisation of the GND connection for the RS-485 connection



Chapter 4 – SU112 CONNECTIONS

4.1 - P1: Data card power supply connector

Terminal Number	*Signal Description*	*Wire Number*
1	GND	
2	+24 V DC to provide to the terminal	
3	Earth to connect to the Earth terminal of the panel	

4.2 - P4: Serial Port Connector

Terminal Number	*Signal Description*	*Wire Number*
1	GND	
2	Rx (RS-232)	
3	Tx (RS-232)	
4	+5VDC (Max 50mA) provided to the terminal	
5	GND	
6	Tx+ (RS-485)	
7	Tx- (RS-485)	
8	Rx+ (RS-485)	
9	Rx/ (RS-485)	

4.3 - P2: Connector X axis

Terminal Number	*Signal Description*	*Wire Number*
1	Marker+ Marker Signal	
2	Marker- Marker Signal denied	
3	Clk A+ Channel A clock signal	
4	Clk A- Channel A clock signal denied	
5	Clk B+ Channel B clock signal	
6	Clk B- Channel B clock signal denied	
7	Vcc Enc Encoder power supply provided by terminal	
8	GND Gnd encoder power supply / 0 Volts for CNOK signal and Enable	
9	An Out 0+ Positive differential analogue output	
10	An Out 0- Negative differential analogue output	
11	In An 0 Analogue input 0	
12	GND Analogue Gnd / 0Volt for CNOK signal and Enable	
13	Enable Actuation enabling output (24 V DC 100 mA Max)	
14	CN OK CN OK output (24 V DC 100mA Max)	

4.4 - P3: Connector Y axis

Terminal Number	*Signal Description*		*Wire Number*
1	Marker+	Marker Signal	
2	Marker-	Marker Signal denied	
3	Clk A+	Channel A clock signal	
4	Clk A-	Channel A clock signal denied	
5	Clk B+	Channel B clock signal	
6	Clk B-	Channel B clock signal denied	
7	Vcc Enc	Encoder power supply provided by terminal	
8	GND	Gnd encoder power supply / 0 Volts for enable signal	
9	An Out 1+	Positive differential analogue output	
10	An Out 0-	Negative differential analogue output	
11	In An 1	Analogue input 0	
12	GND	Analogue Gnd / 0Volt for enable signal	
13	Enable	Actuation enabling output (24 V DC 100 mA Max)	

4.5 - P5: User output connector

Terminal Number	*Signal Description*			*Wire Number*
1	+24 V DC	I/O power supply to be provided at terminal		
2	Out 8	User output n.8	(0-24 V DC)	
3	Out 9	User output n.9	(0-24 V DC)	
4	Out 10	User output n.10	(0-24 V DC)	
5	Out 11	User output n.11	(0-24 V DC)	
6	Out 12	User output n.12	(0-24 V DC)	
7	Out 13	User output n.13	(0-24 V DC)	
8	Out 14	User output n.14	(0-24 V DC)	
9	Out 15	User output n.15	(0-24 V DC)	
10	GND	Gnd I/O		

4.6 - P6: User output connector

Terminal Number	*Signal Description*			*Wire Number*
1	+24 V DC	I/O power supply to be provided at terminal		
2	Out 0	User output n.0	(0-24 V DC)	
3	Out 1	User output n.1	(0-24 V DC)	
4	Out 2	User output n.2	(0-24 V DC)	
5	Out 3	User output n.3	(0-24 V DC)	
6	Out 4	User output n.4	(0-24 V DC)	
7	Out 5	User output n.5	(0-24 V DC)	
8	Out 6	User output n.6	(0-24 V DC)	
9	Out 7	User output n.7	(0-24 V DC)	
10	GND	Gnd I/O		

4.7 - P7: Special user input connectors

Terminal Number	*Signal Description*			*Wire Number*
1	GND	Gnd power supply		
2	FC MinY	Y axis minimum limit stop input	(0-24 V DC)	
3	FC ZeroY	Y axis zero input	(0-24 V DC)	
4	FC MaxY	Y axis maximum limit stop input	(0-24 V DC)	
5	FC MinX	X axis minimum limit stop input	(0-24 V DC)	
6	FC ZeroX	X axis zero input	(0-24 V DC)	
7	FC MaxX	X axis maximum limit stop input	(0-24 V DC)	
8	IN SP Cnt	Special input	(0-24 V DC)	
9	Emerg	Emergency input	(0-24 V DC)	
10	IN SP1	Special user input n.1	(0-24 V DC)	
11	IN SP0	Special user input n.0	(0-24 V DC)	

4.8 - P8: Special user input connectors

Terminal Number	*Signal Description*			*Wire Number*
1	GND	Gnd I/O		
2	In15	User input n.15	(0-24 V DC)	
3	In14	User input n.14	(0-24 V DC)	
4	In13	User input n.13	(0-24 V DC)	
5	In12	User input n.12	(0-24 V DC)	
6	In11	User input n.11	(0-24 V DC)	
7	In10	User input n.10	(0-24 V DC)	
8	In9	User input n.9	(0-24 V DC)	
9	In8	User input n.8	(0-24 V DC)	

4.9 - P9: Special user input connectors

Terminal Number	*Signal Description*			*Wire Number*
1	GND	Gnd I/O		
2	In7	User input n.7	(0-24 V DC)	
3	In6	User input n.6	(0-24 V DC)	
4	In5	User input n.5	(0-24 V DC)	
5	In4	User input n.4	(0-24 V DC)	
6	In3	User input n.3	(0-24 V DC)	
7	In2	User input n.2	(0-24 V DC)	
8	In1	User input n.1	(0-24 V DC)	
9	In0	User input n.0	(0-24 V DC)	

4.10 - P10: Motor drive Connector

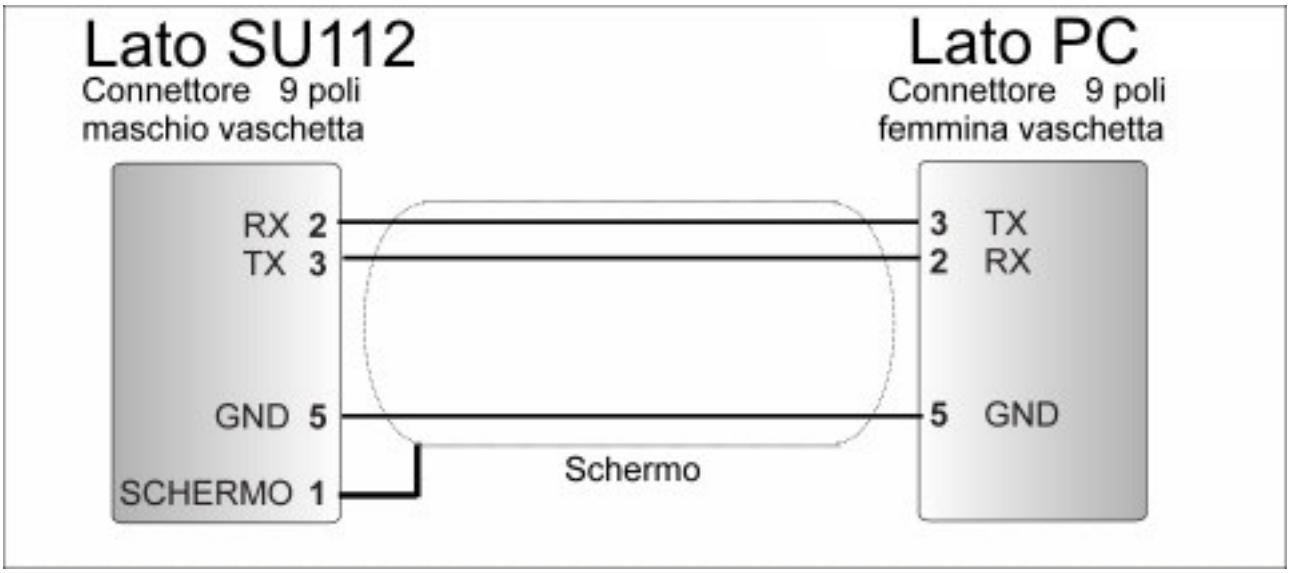
Terminal Number	*Signal Description*		*Wire Number*
1	GND	Gnd motor power supply	
2	MT-	Motor signal -	
3	MT+	Motor signal +	
4	48 V DC	Motor power supply to be provided at the terminal	

4.11 - P10: Motor drive Connector

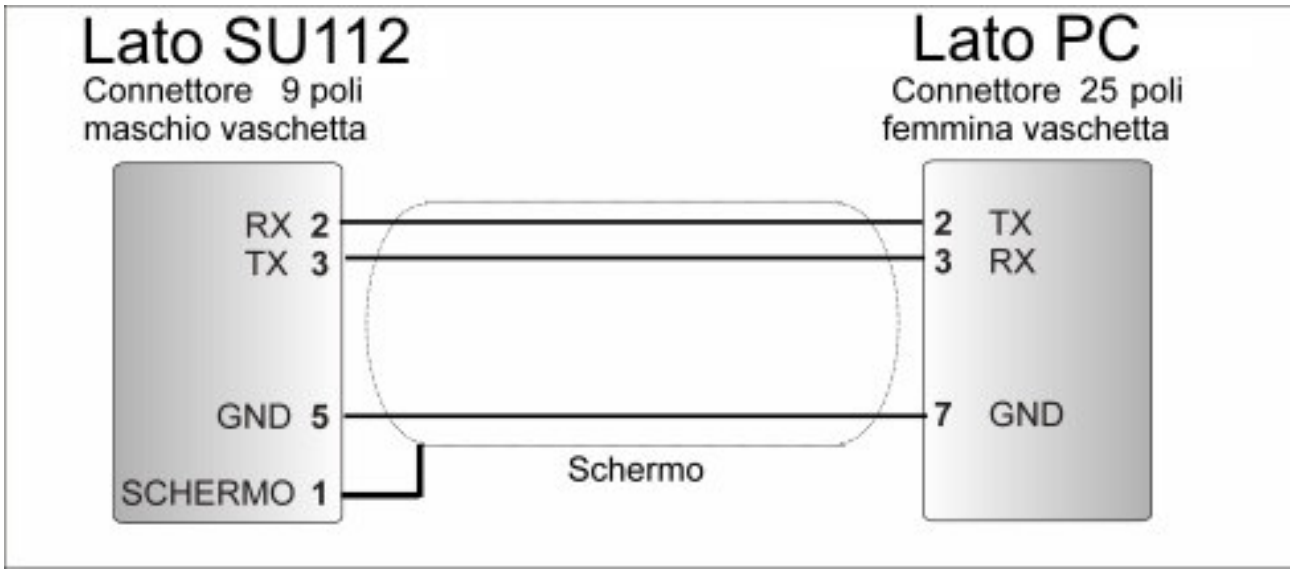
Terminal Number	*Signal Description*		*Wire Number*
1	GND	Gnd motor power supply	
2	MT-	Motor signal -	
3	MT+	Motor signal +	
4	48 V DC	Motor power supply to be provided at the terminal	

Chapter 5 – Connection cables

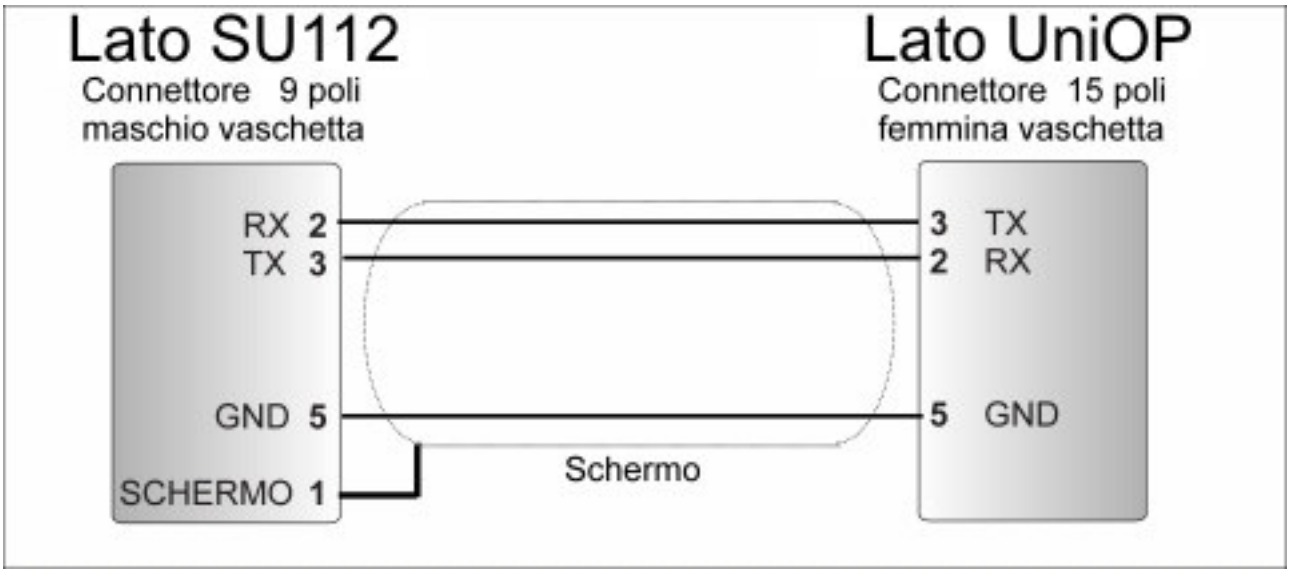
5.1- RS-232 Cable: SU112 – Personal Computer with 9 pole connector



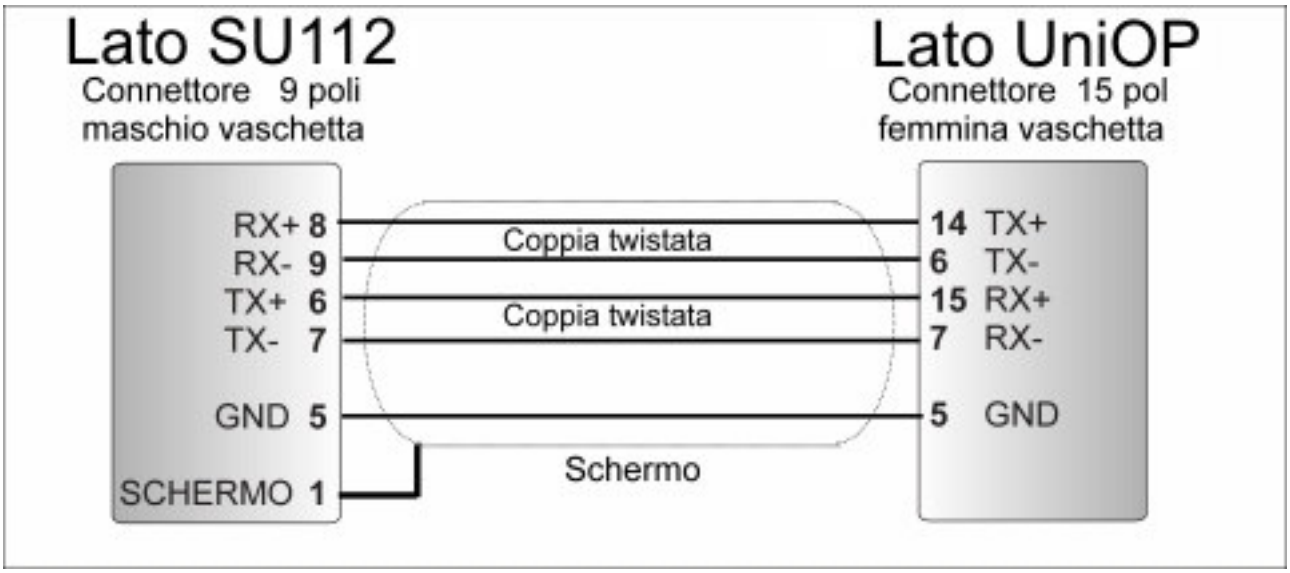
5.2- RS-232 Cable: SU112 – Personal Computer with 25 pole connector



5.3- RS-232 Cable: SU112 and UniOP keyboard



5.4 - RS-485 Cable: SU112 and UniOP keyboard



Chapter 6 – SU112 layout, set jumpers and LED function

In this chapter different diagrams that describe the functions of the various parts of the Axis Controller with integrated PLC SU112 in a fast and practical manner may be consulted.

6.1 - SU112 unit rear view connectors

In figure 6.1 the name and function of the different connectors may be noted.

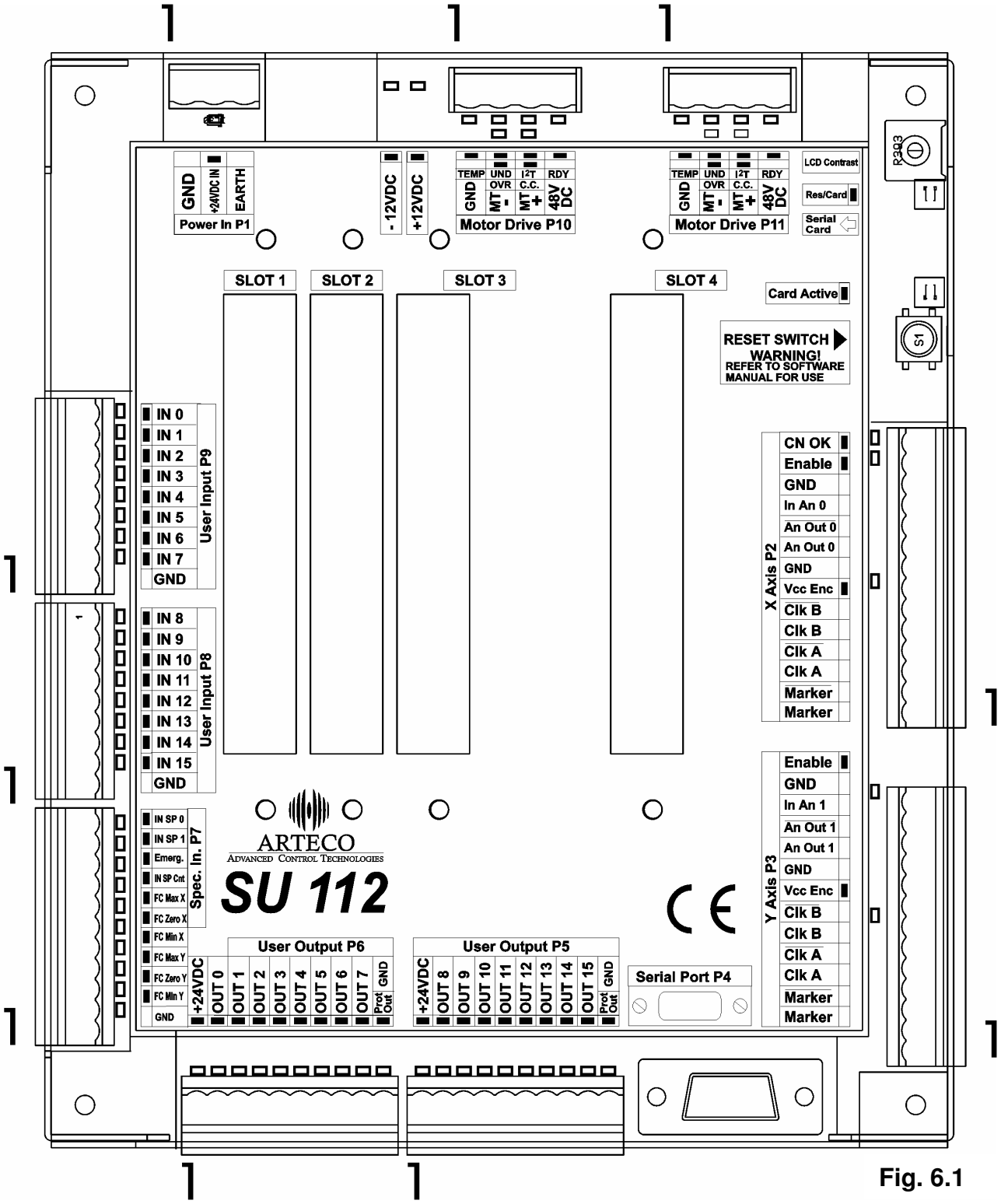
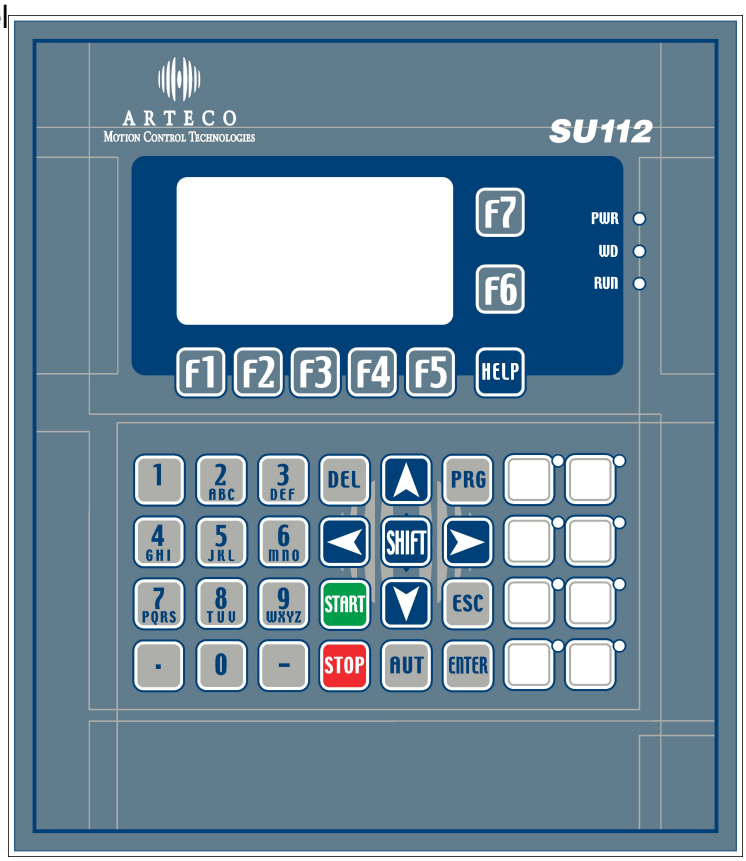


Fig. 6.1

6.2 - SU112 keyboard panel

Figure 6.2 shows the SU112 unit keyboard panel. The Axis Controller with integrated PLC SU112 may be provided in a configuration without the keyboard. In this case the unit is set up with a closed aluminium panel in its place, which allows a simple installation of the equipment in the electrical control panel.



As may be seen in figure 6.2, besides the number pad for entering operational data, there are also function buttons from F1 to F7 located along two sides of the graphic display. This allows the programmer to organise an interactive application program that will suggest, at any one time, the function buttons for the end user of the SU112 unit.
Eight customisable buttons have also been arranged by way of a special strip that may be installed by the end user. The tab for extracting the white button customisation strip is accessible in the rear of the SU112 unit without having to disassemble the protective casing.
Next to each of the eight customisable buttons there is an LED available that may be turned on or off directly from the application program, in this way allowing the end user to visualise or to be offered a suggestion regarding situations or choices to be made during the cycle of the device actuated by the Axis Controller with integrated PLC SU112.

6.2.1 - LED function on the front panel

As indicated in figure 6.2, three LEDs are visible for the following indications.

PWR LED:
Indicates the presence of electrical power voltage to the internal logic circuits.
During normal operation it must be lit up.

WD LED:
The Watch Dog LED provides the operator an indication of the status of the machine in function of the modality of its flashing. This modality is described below.
Flashing: indicates the correct operation of the SU112 unit. The flashing rate is faster when an application program is being executed.

Fast flashing with LED interruption turned on: indicates the blockage of the data card due to a mathematical error. It is necessary to turn off the device and then turn it back on again. Upon the device being turned back on "target error 103" will be visualised in the ISaGRAF environment.

Fast flashing with LED interruption turned off: Indicates a blockage of the unit due to an internal error. It is necessary to turn off the device and then turn it back on again. Upon the device being turned back on "target error 129 to 235" will be visualised and the application program will not be present.
Very fast flashing without interruption: indicates blockage of the device due to a temporary but significant drop in electrical power voltage. It is necessary to turn off the SU112 unit and then turn it back on again.

RUN LED:
The RUN LED provides the operator an indication of the status of the device relative to the application program.
Off: indicates that the application program is not present in the SU112 unit memory.
Synchronised flashing with the WD (Watch dog) LED: indicates that the application program is present in the SU112 unit memory.
Flashing with a higher frequency than the WD (Watch dog) LED: indicates that the application program is in progress of being loaded from the personal computer to the SU112 unit.
Loading from personal computer to the SU112 unit comes about in the ISaGRAF environment by way of the RS-232 or RS-485 serial port connections.

6.3 - Function and setting of the internal jumpers

By way of specific internal jumpers certain functions may be set, such as operation with a line driver or push pull type encoder or else the operational mode of the SU112 unit in RUN or else in BOOT.

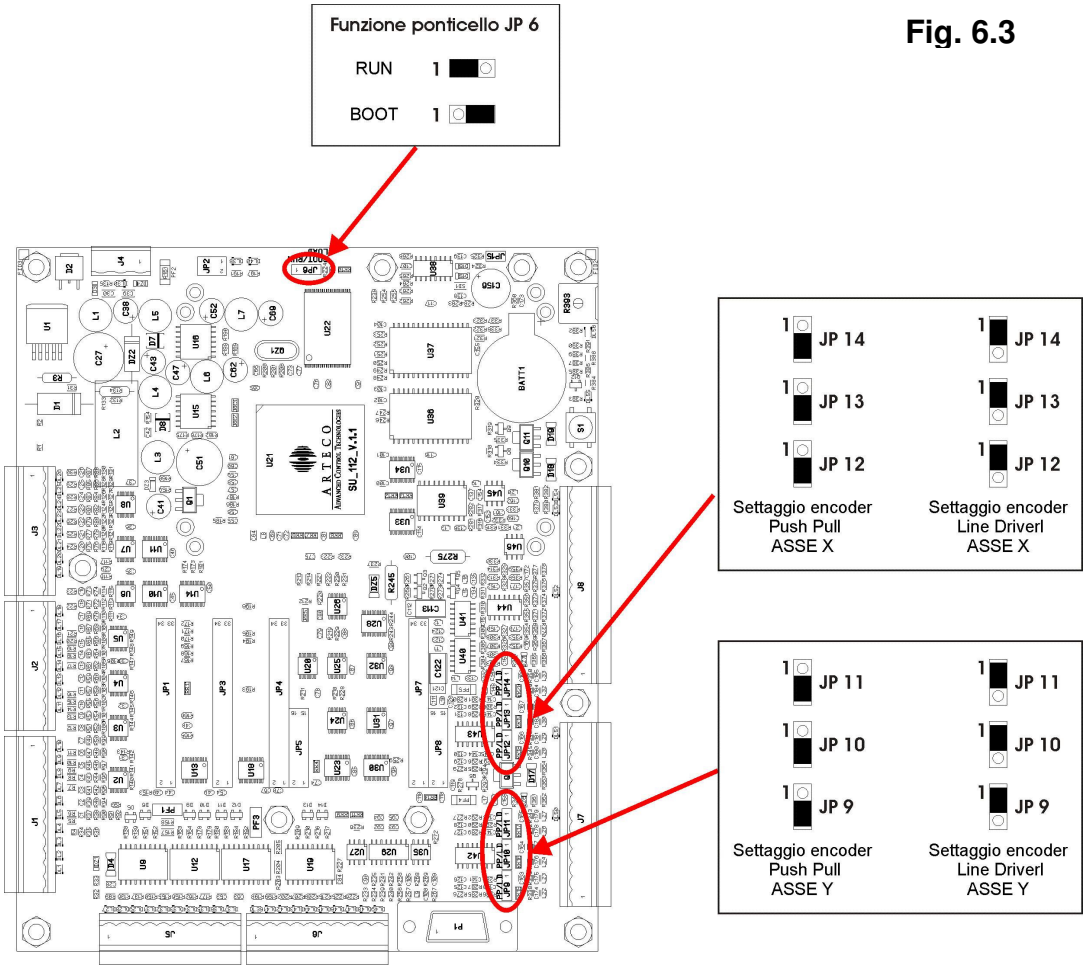


Fig. 6.3

X axis encoder setting:
As indicated in figure 6.3 by way of the JP12, JP13 and JP14 jumpers the type of encoder for the detection of the position of the X axis is set.
Y axis encoder setting:
As indicated in figure 6.3 by way of the JP9, JP10 and JP11 jumpers the type of encoder for the detection of the position of the Y axis is set.
RUN/BOOT mode setting:
The mode **RUN** is that of the normal operation of the SU112 unit.
the mode **BOOT** (restricted) is used for the loading of firmware in the SU112 unit only by ARTECO personnel.

6.4 - Diagnostic LED function

The function of the different diagnostic LEDs is described by the serigraphed labels on the protective casing found on the rear of the unit. In front of each signal input and each signal output there is an LED that indicates the status of the signal in question.
See figure 6.1 for references to the diagnostic LEDs.

Prot Out LED:
The LEDs that are found in front of the GND terminal of the P5 and P6 connectors indicate the status of the protection fuses relative to the outputs that are refer to that connector. Actually, besides the printed "GND", the serigraph reads the words "Prot Out" indicating the function of that LED.
If the LED is lit up it means that the self-resetting electronic fuse has tripped protecting the system from overloads. In this case the Axis Controller with integrated PLC SU112 must be turned off, the problem resolved and the system re-started.

Res Card LED:
This LED indicates the status of the management of the sim card that is used to download and upload application programs or internal firmware. Furthermore it indicates the status of the reset wait.
Reset wait status:
If upon turning the unit on, the "RESET SWITCH" is pushed (see figure 6.1) the Res Card LED begins to flash indicating the condition of the "reset wait". If in this state the "RESET SWITCH" is pushed a second time, an internal reset of the CPU card of the SU112 unit is performed.
Sim card status:
In the event that a sim card is used, for example during the saving or the loading of an application program, this LED flashes indicating that access to the writing or reading of the sim card is occurring
Card Active LED:
When this LED flashes slowly it indicates that the sim card reading or writing procedure has been initiated. When it is lit up steadily it indicates that said reading or writing is in progress.

6.5 - Sim Card

The sim card allows the loading and saving of both the firmware and the application program.
This is an electronic memory mounted on a small support of the dimensions of 45 millimetres in length, 15 millimetres in width and 2 millimetres in thickness. There are gold contacts on one face of the sim card. The sim card is inserted in its apposite slot on the upper right side of the casing (viewing it from the serigraph side) taking care to insert it with the golden contacts facing the side opposite to the keyboard.

Chapter 7 – Connections

All of the GND terminals of the different connectors of the SU112 unit are electrically connected amount themselves inside of the device. Below are different examples of connections relative to each section managed by the SU112 unit

7.1 – Example electrical power source and user outputs connection

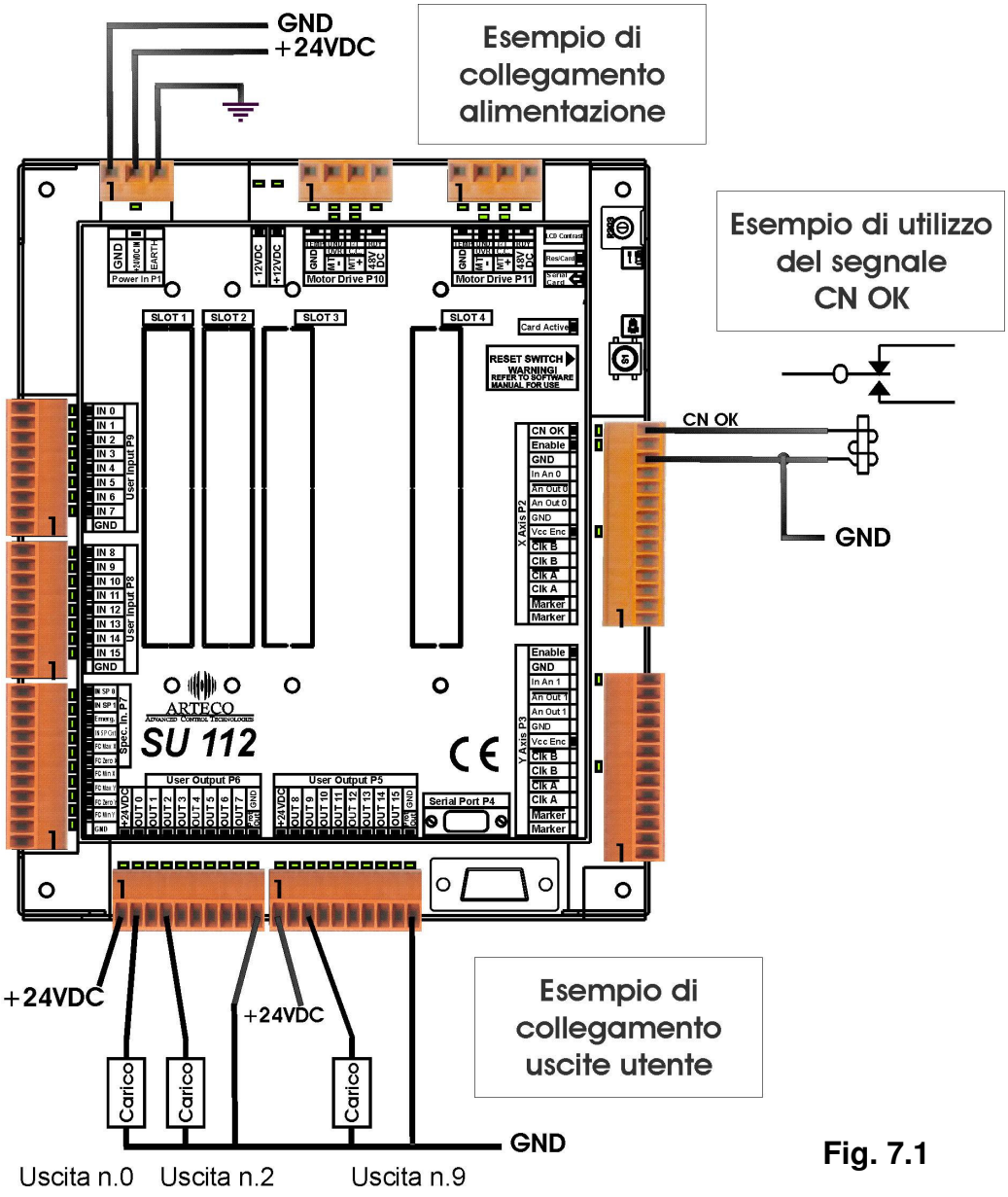


Fig. 7.1

7.2 – Example user inputs connection

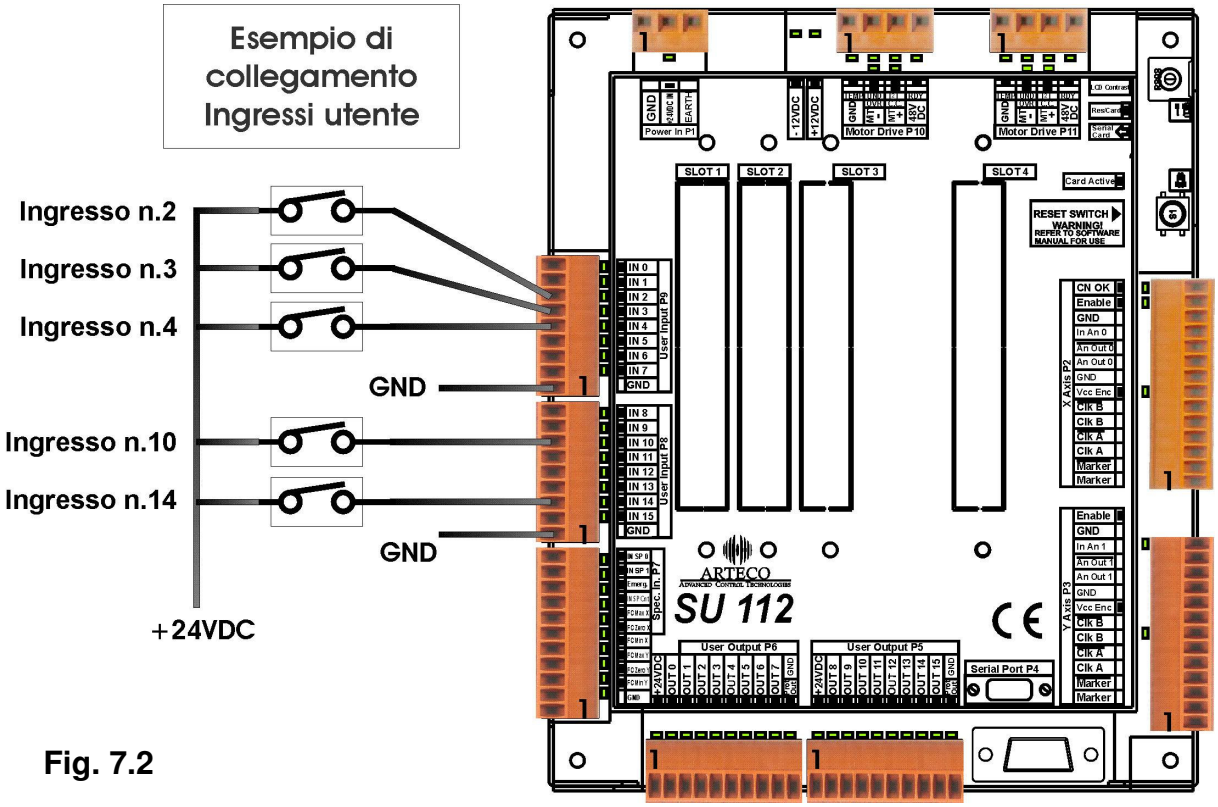
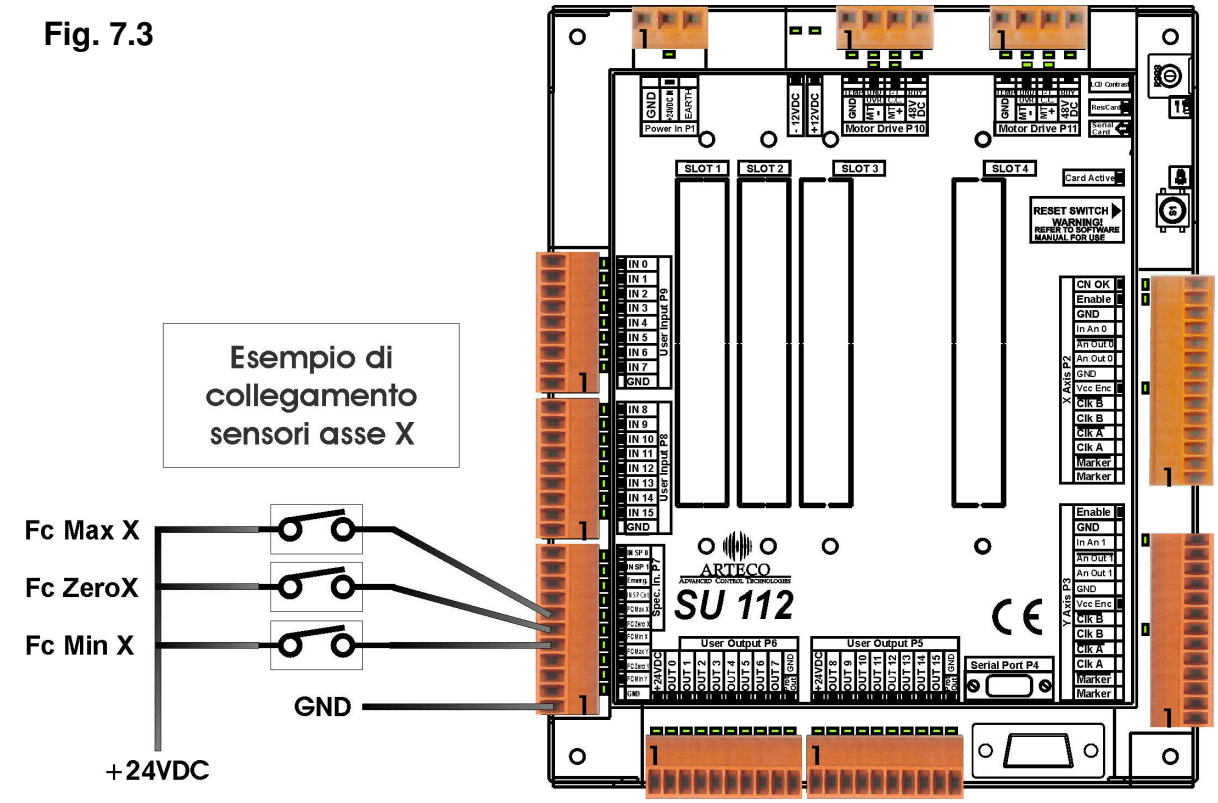


Fig. 7.2

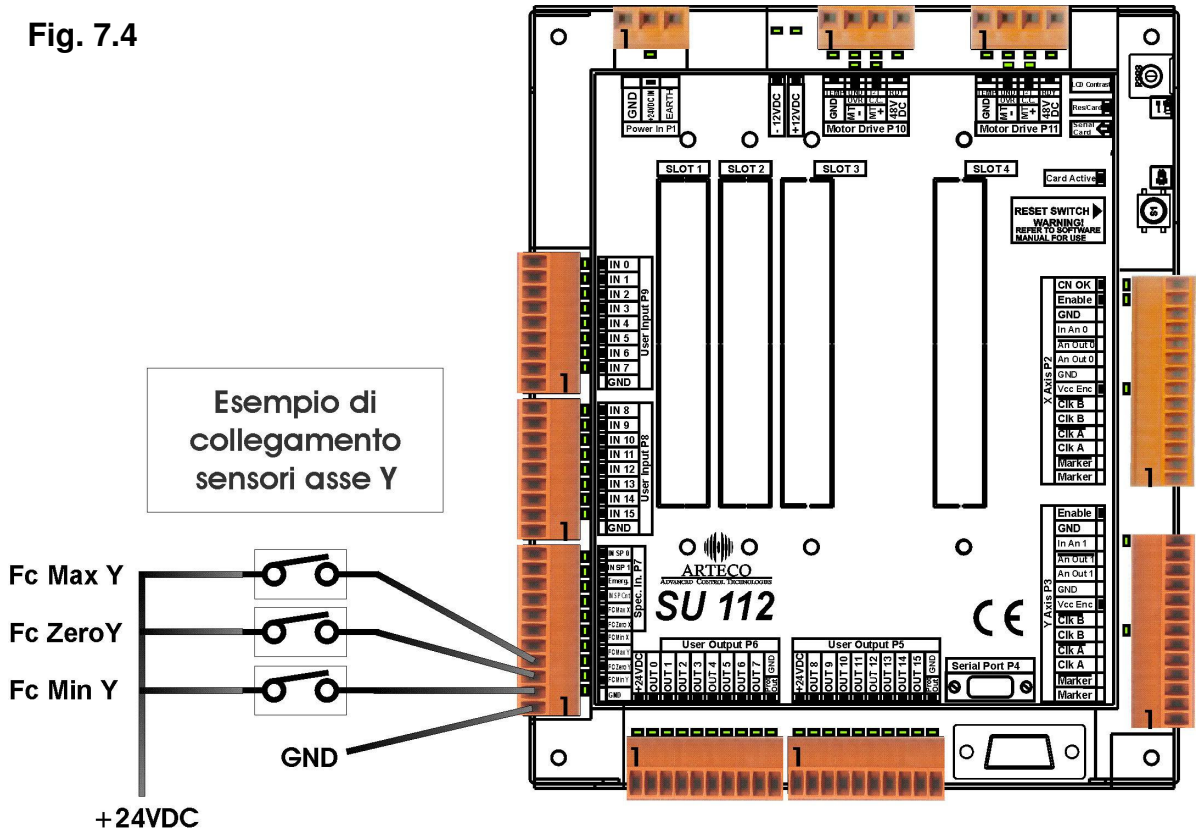
7.3 – Example X axis sensors connection

Fig. 7.3



7.3 – Example Y axis sensors connection

Fig. 7.4



7.5 – Example X and Y axes encoder and actuation connections

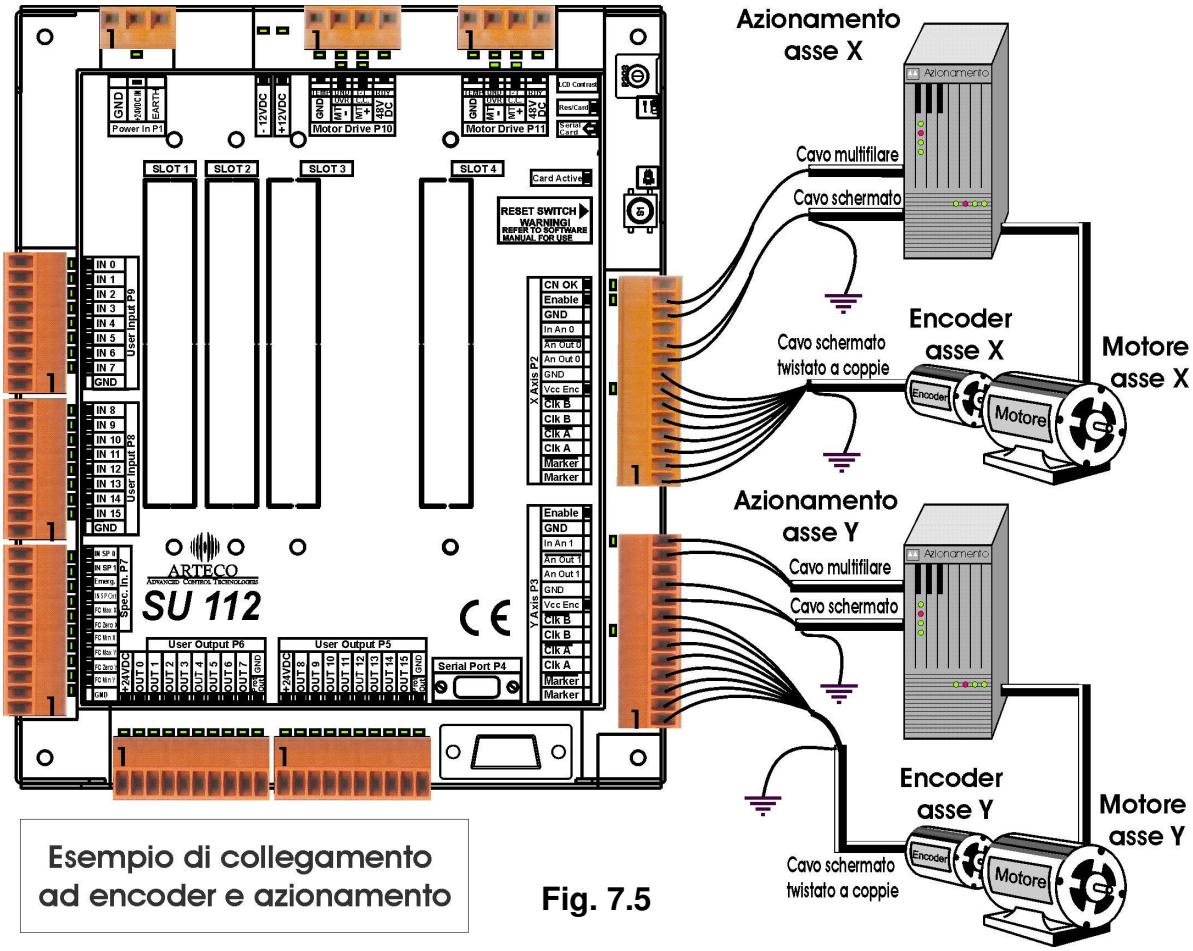
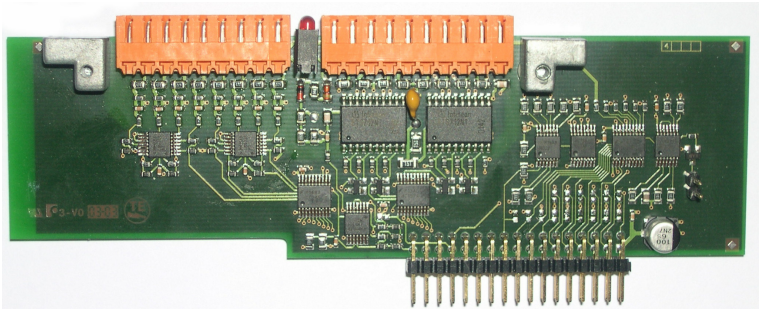


Fig. 7.5

Chapter 8 – 8 input and 8 output expansion



To increase the number of I/Os managed, the Axis Controller with integrated PLC SU112 is able to hold from one up to four expansions for 8 digital inputs and 8 digital outputs. The slots that are able to hold these expansions are SLOT 1, SLOT 2, SLOT 3 and SLOT 4.
The configuration of the expansion in the ISaGRAF environment comes about by loading the corresponding library as a function of the slot utilised. Therefore there are four libraries for the 8 input 8 output expansions: one for each slot.
The following table indicates the different I/O configurations obtainable inserting the 8 input 8 output expansions into the SU112 unit.

Product	Total number of 0-24 V DC digital inputs	Total number of 0-24 V DC digital outputs
Basic SU112	16	16
Basic SU112 + 1 16I 16O expansion	24	24
Basic SU112 + 2 16I 16O expansions	32	32
Basic SU112 + 3 16I 16O expansions	40	40
Basic SU112 + 4 16I 16O expansions	48	48

The 8 input 8 output expansions may be installed in any slot up to a maximum of 4 expansions.

8.1 - Specifications of the 8 input 8 output expansions

Unit described in sections 3.6 and 3.8. The general specifications of the different parts of the 8 input 8 output digital expansions are the same as the basic Axis Controller with integrated PLC SU112

The user inputs have the following specifications:

- PNP 24 Volt direct current input
- Analogue filter at casing ingress for spike elimination

The user outputs have the following specifications:

- Overload Protection
- Current Limiter
- Short circuit protection
- Overheating protection
- Electrical power supply voltage inversion protection
- Visual indicator with red LED for protection of outputs
- Fast demagnetisation of inductive loads

8.2 - User input connectors

Terminal Number	*Signal Description*			*Wire Number*
1	In0	User input n.0	(0-24 V DC)	
2	In1	User input n.1	(0-24 V DC)	
3	In2	User input n.2	(0-24 V DC)	
4	In3	User input n.3	(0-24 V DC)	
5	In4	User input n.4	(0-24 V DC)	
6	In5	User input n.5	(0-24 V DC)	
7	In6	User input n.6	(0-24 V DC)	
8	In7	User input n.7	(0-24 V DC)	
9	GND	Gnd I/O		

8.3 - User output connector

Terminal Number	*Signal Description*			*Wire Number*
1	+24 V DC	I/O electrical power to be provided at terminal		
2	Out 0	User output n.0	(0-24 V DC)	
3	Out 1	User output n.1	(0-24 V DC)	
4	Out 2	User output n.2	(0-24 V DC)	
5	Out 3	User output n.3	(0-24 V DC)	
6	Out 4	User output n.4	(0-24 V DC)	
7	Out 5	User output n.5	(0-24 V DC)	
8	Out 6	User output n.6	(0-24 V DC)	
9	Out 7	User output n.7	(0-24 V DC)	
10	GND	Gnd I/O		

8.4 - Data card description

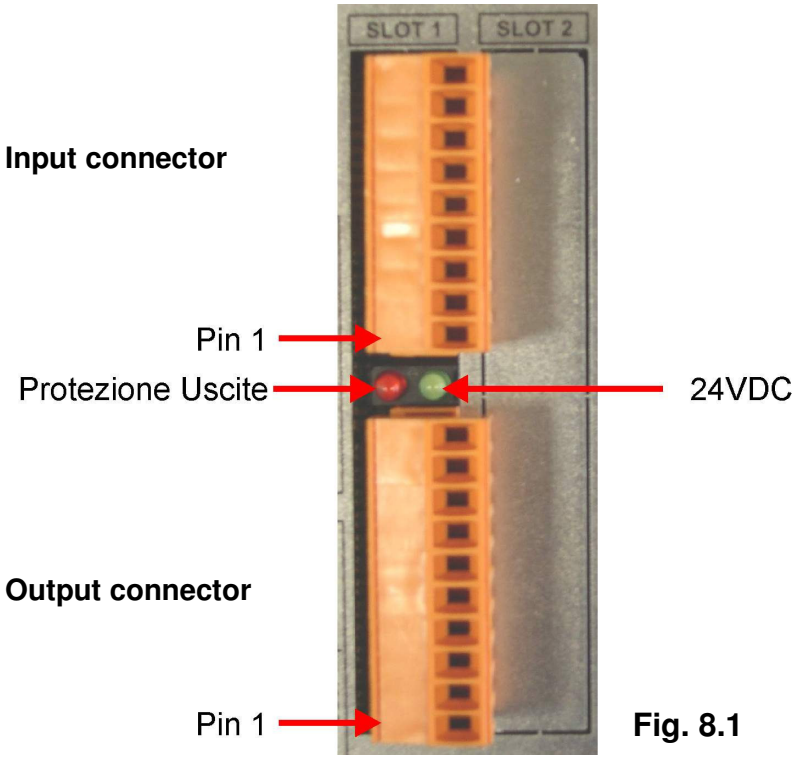


Fig. 8.1

8.5 - Overall view of the SU112 unit with slot 1 expansion

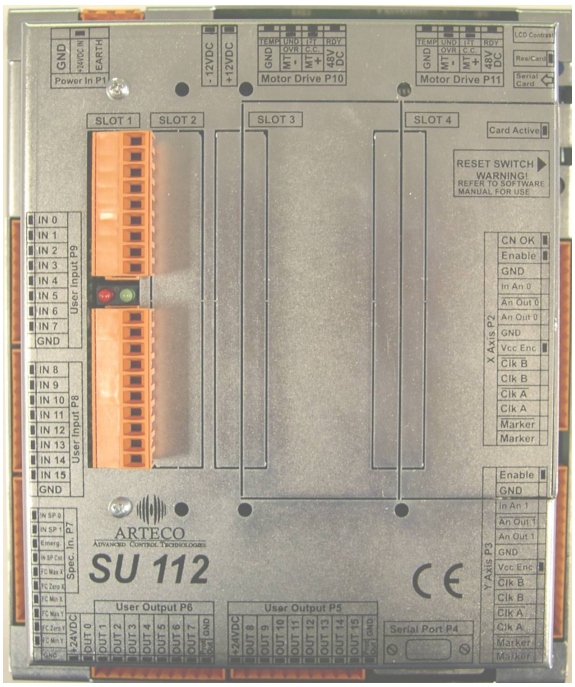
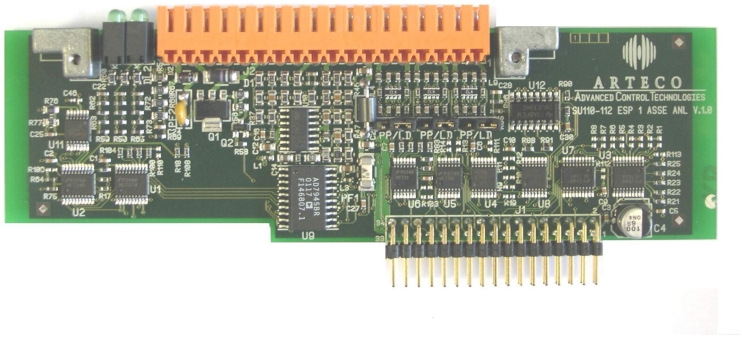


Fig. 8.2

Chapter 9 - 1 Analogue axis Expansion



To increase the number of axes managed, the SU112 unit may hold an axis expansion card. The configuration of the expansion in the ISaGRAF environment comes about by loading the corresponding library.

The 1 analogue axis expansion must be mounted in slot number 2.

9.1 - Specifications of axis expansion

The general specifications of the different parts of the 1 analogue axis expansion are the same as the basic SU112 unit described in sections 3.1, 3.2, 3.3 and 3.4.

The analogue output has the following specifications:

- Differential output range ±10 Volts
- Protection against power surges
- Protection against electrostatic charges
- Protection against electrical fast transients

The Actuation enabling output has the following specifications:

- PNP 24 V 100 mA direct current output
- Visual indication for output status

The encoder casing has the following specifications:

- Power supply furnished by the unit: 5 V 300 mA Max protected by electronic fuse
- Protection against power surges
- Protection against electrostatic charges
- Protection against electrical fast transients
- Analogue filters on encoder inputs for noise elimination
- Maximum external counting frequency 200KHz, with option 400KHz

9.2 - 1 analogue axis expansion connector

Terminal Number	*Signal Description*		*Wire Number*
1	Marker+	Z axis Encoder Marker Signal	
2	Marker-	Z axis Encoder Marker Signal denied	
3	Clk A+	Z axis encoder channel A clock signal	
4	Clk A-	Z axis encoder channel A clock signal denied	
5	Clk B+	Z axis encoder channel B clock signal	
6	Clk B-	Z axis encoder channel B clock signal denied	
7	Vcc Enc	5 V DC Z axis encoder power supply provided by terminal	
8	GND	Z axis encoder power supply Gnd	
9	An Out 0+	Z axis positive differential analogue output	
10	An Out 0	Z axis negative differential analogue output	
11	GND	analogue Gnd	
12	GND	Gnd for shield connections	
13	Enable	Z axis actuation enabling output (24 V DC 100 mA Max)	
14	FC MaxZ	Z axis maximum limit stop input (0-24 V DC)	
15	FC ZeroZ	Z axis zero input (0-24 V DC)	
16	FC MinZ	Z axis minimum limit stop input (0-24 V DC)	
17	GND	Gnd I/O	
18	+24 V DC	I/O electrical power to be provided at terminal	



All of the GNDs are electrically in common inside of the SU112 unit.
In the table found above, the use that each GND terminal must have as a function of the practicality in the wiring phase is indicated.

9.3 - encoder jumper settings

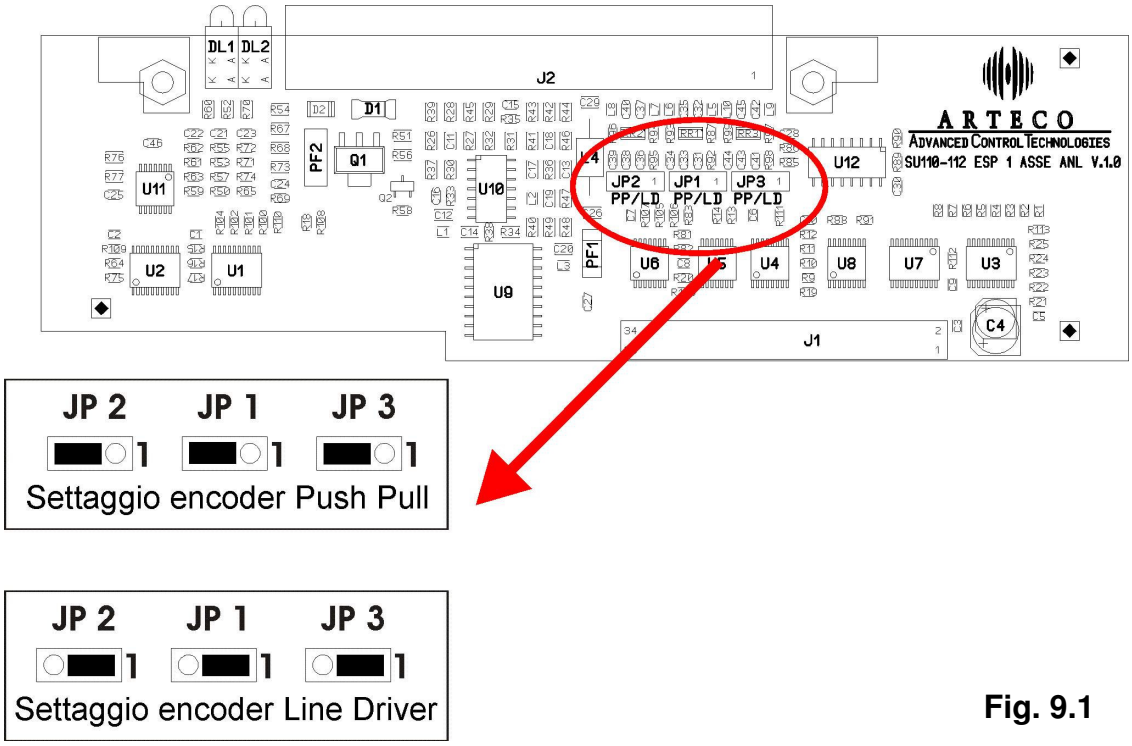


Fig. 9.1

9.4 - Diagnostic LED description

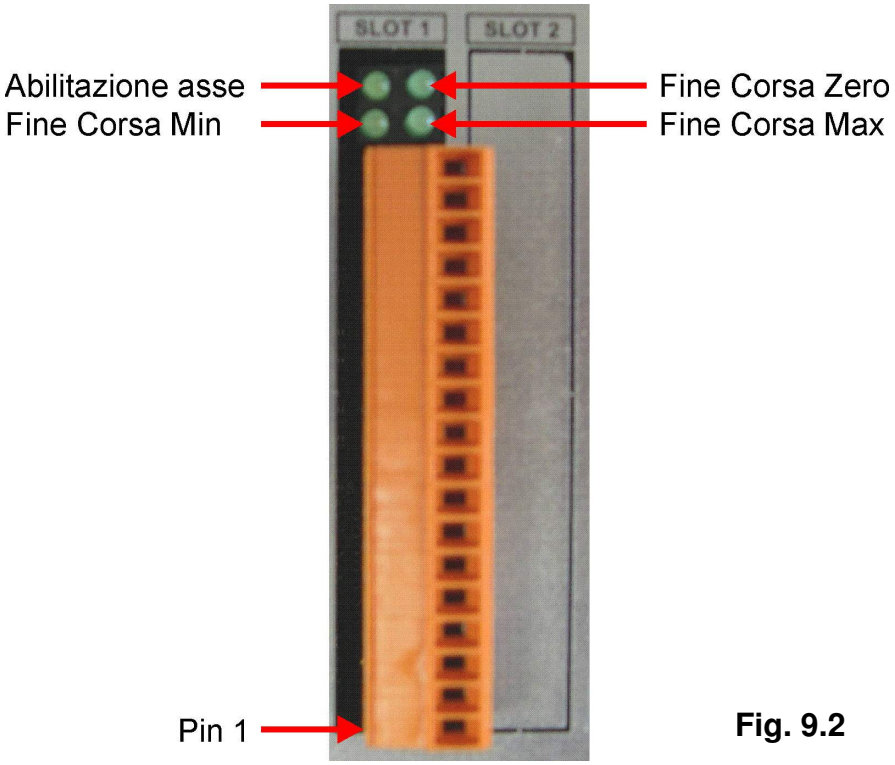
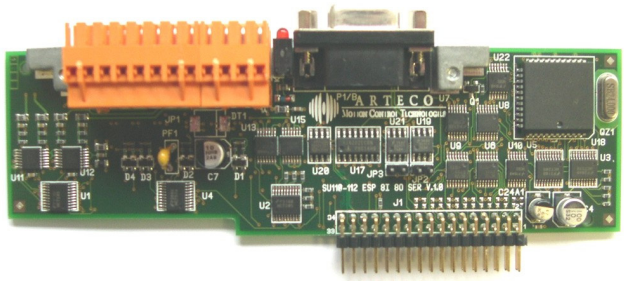


Fig. 9.2

Chapter 11 – 8 input 8 output expansions CAN serial bus



The 8IN 8OUT SERIAL CAN expansion provides a serial port, a CAN BUS interface and 8 digital inputs + 8 digital outputs 0-24 V DC.

The 8IN 8OUT SER CAN BUS expansion must be installed in the Number 1 slot (see figure 6.1).

11.1 - Specifications of the 8 input 8 output SERIAL CAN expansions

The general specifications of the digital I/O part of this expansion are the same as the digital I/O in the basic SU112 unit described in sections 3.6 and 3.8.

Inputs: Specifications:
- PNP 24 Volt direct current input
- Analogue filter at casing ingress for spike elimination

Outputs: Specifications:
- Protection against short circuit and overload. Current Limiter
- Overheating protection
- Electrical power supply voltage inversion protection
- Visual indicator with red LED for protection of outputs
- Fast demagnetisation of inductive loads

The serial port has the following protection
- **Overloads**
- **Electrostatic charges**
- **Protection against electrical fast transients**

Additionally it has the following specifications:
- **Standard RS-232**
- **Standard RS 422/485 Full duplex**

The expansion also provides the CAN BUS interface. For further information refer to section 11.3.

11.2. - Connectors

11.2.1 - User input connectors

Terminal Number	*Signal Description*		*Wire Number*
1	+24 V DC	I/O electrical power to be provided at terminal	
2	In0	User input n.0 (0-24 V DC)	
3	In1	User input n.1 (0-24 V DC)	
4	In2	User input n.2 (0-24 V DC)	
5	In3	User input n.3 (0-24 V DC)	
6	In4	User input n.4 (0-24 V DC)	
7	In5	User input n.5 (0-24 V DC)	
8	In6	User input n.6 (0-24 V DC)	
9	In7	User input n.7 (0-24 V DC)	
10	GND	Gnd I/O	
11	GND	Gnd I/O	
12	GND	Gnd for CAN BUS connection	

11.2.2 - User and CAN BUS output connectors

Terminal Number	*Signal Description*		*Wire Number*
1	+24 V DC terminal	24 V I/O power supply to be provided at	
2	Out 0	User output n.0 (0-24 V DC)	
3	Out 1	User output n.1 (0-24 V DC)	
4	Out 2	User output n.2 (0-24 V DC)	
5	Out 3	User output n.3 (0-24 V DC)	
6	Out 4	User output n.4 (0-24 V DC)	
7	Out 5	User output n.5 (0-24 V DC)	
8	Out 6	User output n.6 (0-24 V DC)	
9	Out 7	User output n.7 (0-24 V DC)	
10	GND	Gnd I/O	
11	CAN_L	CAN_L signal for CAN BUS connection	
12	CAN_H	CAN_H signal for CAN BUS connection	

11.2.3 – 9 pole female serial port connector

Terminal Number	*Signal Description*	*Wire Number*
1	GND	
2	Rx (RS-232)	
3	Tx (RS-232)	
4	+5 V DC (Max 50mA) provided to the terminal	
5	GND	
6	Tx+ (RS-485)	
7	Tx- (RS-485)	
8	Rx+ (RS-485)	
9	Rx- (RS-485)	

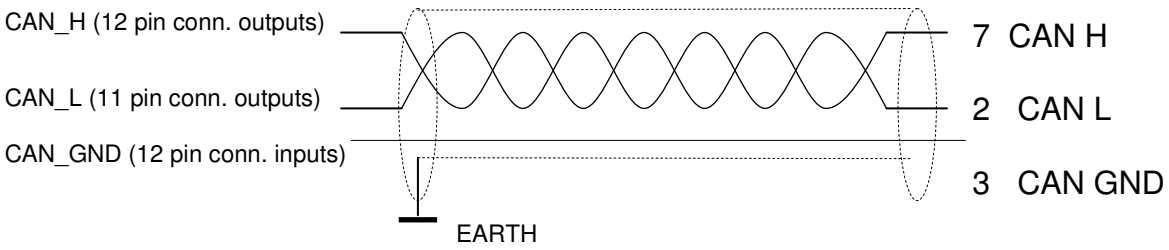
All of the GNDs are electrically in common inside of the SU112 unit.
In the table found above, the use that each GND terminal must have as a function of the practicality in the wiring phase is indicated.
The shields must be connected to the earth.

11.3 –CAN BUS

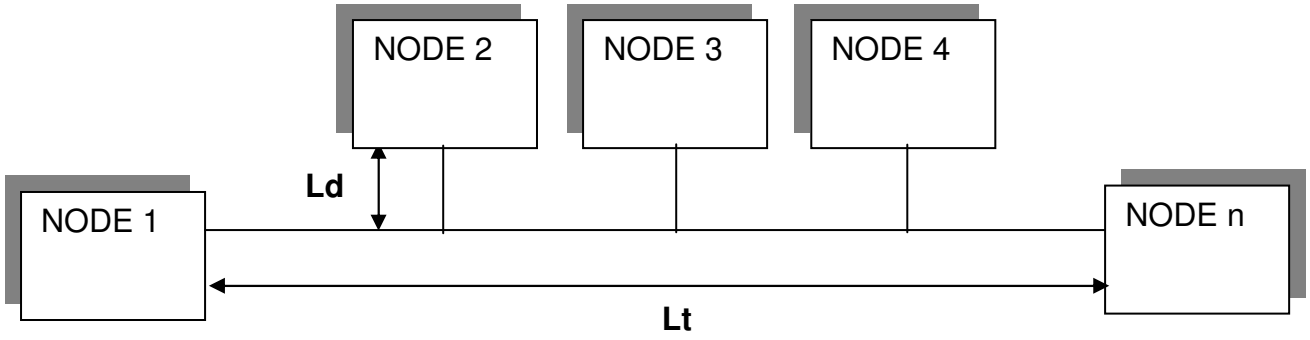
The CAN_H e CAN_L signals for the Canbus connection to the Axis Controller with integrated PLC SU112 are available on the output connector. The GND is available on the inputs connector.
For a description of the RS-232/RS-485 standards refer to the sections from 3.9.1 to 3.9.4.

A general description of the CAN BUS connection follows.

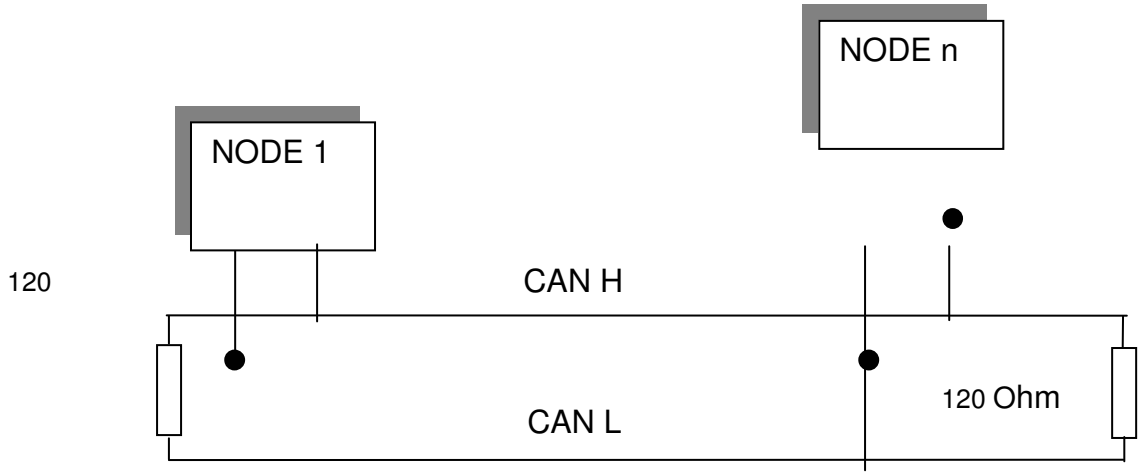
Can Bus cable connection



In the figure below there is shown the typical topology of a CAN network where cable connectors and terminators, which satisfy the ISO11898 regulations relative to CAN connections, must be used.
For a Baud-rate of 1 Mbit/sec. the maximum length of the Lt cable must not be longer than 40 mt., while the Ld cable must not be longer than 30 cm. so as to avoid reflection effects.
The two lines that carry the CAN L and CAN H signals must be twisted.



ISO11898-2 Network Setup



CAN Bus

The cable must always be terminated at its end with a 120-Ohm terminator resistor. If the total distance is to be increased it is necessary to insert signal repeaters or else lower the communication speed according to the table below.
Several data sheets that contain information regarding connections follow.

Length of the cable in function of speed

Transmission speed	Bus length	Nominal bit time
1 Mbit/s	40 m	1□s
800 Kbit/s	50 m	1.25□s
500 Kbit/s	100 m	2□s
250 Kbit/s	250 m	□□s
125 Kbit/s	500 m	8□s
62.5 Kbit/s	1000 m	20□s
20 Kbit/s	2500 m	50□s

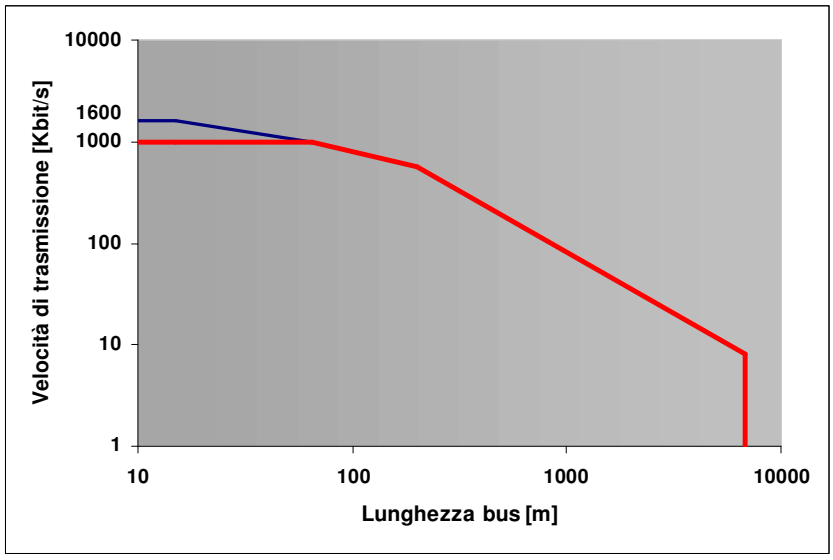
The maximum length of a cable in a CAN network essentially depends on the following cable or node specification factors:

- The nodes, connected to the line, which insert delays due to network interface components of the nodes themselves.
- The signal propagation delay is dependent upon the cable.
- The gap in the internal clock that invalidates the bit-time between one node and the next

- The resistance series of the cable and the impedance of the module inputs that influence the breadth of the signal.

The figure below represents the graph of the speed as a function of the distance if components that satisfy the ISO11898 regulations are utilised.

Graph of the ratio of the transmission speed / the length of the bus.



Specifications of the CAN-Bus according to ISO11898 regulations

DC parameters

- Relative resistance: 70 mΩ/m
- Termination resistance: nominal 120□(min. 108□. max. 132□

AC parameters

- Termination resistance: nominal 120(min. 108. max. 132
- Line delay: 5ns/m

The ISO11898-2 regulations indicate that the cable to be used have a characteristic impedance of 120 Ohms, a series resistance of 70mOhms/Mt. and a maximum propagation delay of 5ns/Mt.

The values indicated above are referred to a communication speed of 1 Mbit/sec.

CAN-Bus wire/node section

Length	32 nodes	64 nodes	100 nodes
100 m	0.25 mm^2	0.25 mm^2	0.25 mm^2
250 m	0.34 mm^2	0.50 mm^2	0.50 mm^2
500 m	0.75 mm^2	0.75 mm^2	1.00 mm^2
Maximum resistance	**21 Ohms**	**18.5 Ohms**	**16 Ohms**

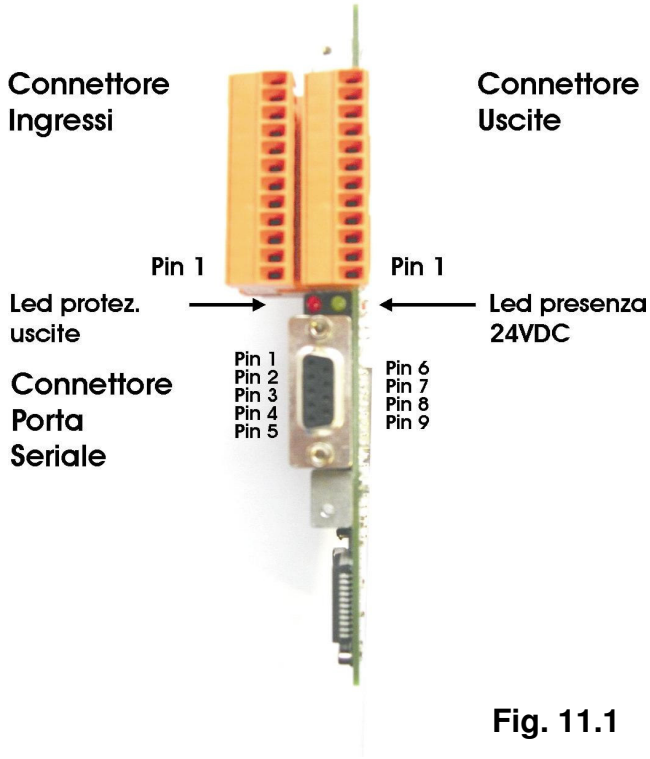
The table found above indicates the section pf the wires as a function of the number of nodes, utilising the CAN Transceiver PCA82C250 equipped with all of the CAN ARTECO modules (Philips Application Note AN96116 regarding the PCA82C250 CAN Transceiver).

Voltage variations between the GND of the different nodes must not go above 2 V.

11.4 – Connector and diagnostic LEDs positions

LED Out put protection:

When the red LED is lit up it indicates the intervention of the output driver short circuit, overload or high temperature protection

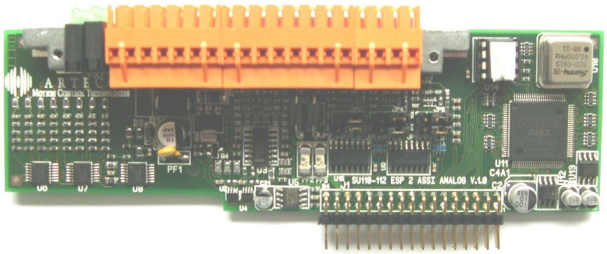


LED 24 V DC presence:

When the LED is green it indicates that the 24 V DC power is present on the input or the output connector.

Fig. 11.1

Chapter 12 - 2 analogue Axes expansion



To increase the number of axes managed, the SU112 unit may hold an axis expansion card for two analogue axes. This characteristic permits the Axis Controller with integrated PLC SU112 product to manage up to five axes. The configuration of the expansion in the ISaGRAF environment comes about by loading the corresponding library.

The 2 analogue axes expansions must be mounted in slot number 4.

12.1 - Specifications of the 2 analogue axes expansion

The general specifications of the different parts of the 2 analogue axes expansion are the same as the basic SU112 unit described in sections 3.1, 3.2, 3.3 and 3.4.

The analogue output has the following specifications:

- Differential output range ±10 Volts
- Short circuit protection
- Protection against electrostatic charges

The Actuation enabling output has the following specifications:

- PNP 24 V 100 mA direct current output
- Visual indication for output status

The encoder casing has the following specifications:

- Power supply furnished by the unit: 5 V 300 mA Max protected by electronic fuse
- Protection against electrostatic charges
- Analogue filters on encoder inputs for noise elimination
- Maximum external counting frequency 200KHz, with option 400KHz

The status of the limit stops is visualised by way of specific LEDs.

12.2 - U axis expansion connector

Terminal Number	*Signal Description*		*Wire Number*
1	Marker+	U axis Encoder Marker Signal	
2	Marker-	U axis Encoder Marker Signal denied	
3	Clk A+	U axis encoder channel A clock signal	
4	Clk A-	U axis encoder channel A clock signal denied	
5	Clk B+	U axis encoder channel B clock signal	
6	Clk B-	U axis encoder channel B clock signal denied	
7	Vcc Enc by	Output 5 V DC. U axis encoder power supply provided terminal	
8	GND	U axis encoder power supply Gnd	
9	An Out U+	U axis positive differential analogue output	
10	An Out U-	U axis negative differential analogue output	
11	GND	Analogue Gnd	
12	GND	Gnd for shield connections	
13	Enable U	U axis actuation enabling output (24 V DC 100 mA Max)	
14	FC MaxU	U axis maximum limit stop input (0-24 V DC)	
15	FC ZeroU	U axis zero input (0-24 V DC)	
16	FC MinU	U axis minimum limit stop input (0-24 V DC)	
17	GND	Gnd I/O	
18	+24 V DC	I/O electrical power to be provided at terminal	
19	Sp Input U	Special input for U height capture (0-24 V DC) (*)	

(*) This special input is used to memorise the current height of the axis during the positive or negative edge programmable in the software. Refer to the software technical manual for the use of this input.

12.3 - V axis expansion connector

Terminal Number	*Signal Description*	*Wire Number*
1	Marker+ V axis Encoder Marker Signal	
2	Marker- V axis Encoder Marker Signal denied	
3	Clk A+ V axis encoder channel A clock signal	
4	Clk A- V axis encoder channel A clock signal denied	
5	Clk B+ V axis encoder channel B clock signal	
6	Clk B- V axis encoder channel B clock signal denied	
7	Vcc Enc Output 5 V DC. V axis encoder power supply provided by terminal	
8	GND V axis encoder power supply Gnd	
9	An Out V+ V axis positive differential analogue output	
10	An Out V- V axis negative differential analogue output	
11	GND analogue Gnd	
12	GND Gnd for shield connections	
13	Enable V V axis actuation enabling output (24 V DC 100 mA Max)	
14	FC MaxV V axis maximum limit stop input (0-24 V DC)	
15	FC ZeroV V axis zero input (0-24 V DC)	
16	FC MinV V axis minimum limit stop input (0-24 V DC)	
17	GND Gnd I/O	
18	+24 V DC I/O electrical power to be provided at terminal	
19	Sp Input U Special input for V height capture(0-24 V DC) (*)	

(*) This special input is used to memorise the current height of the axis during the positive or negative edge programmable in the software. Refer to the software technical manual for the use of this input.



All of the GNDs are electrically in common inside of the SU112 unit.
In the table found above, the use that each GND terminal must have as a function of the practicality in the wiring phase is indicated.

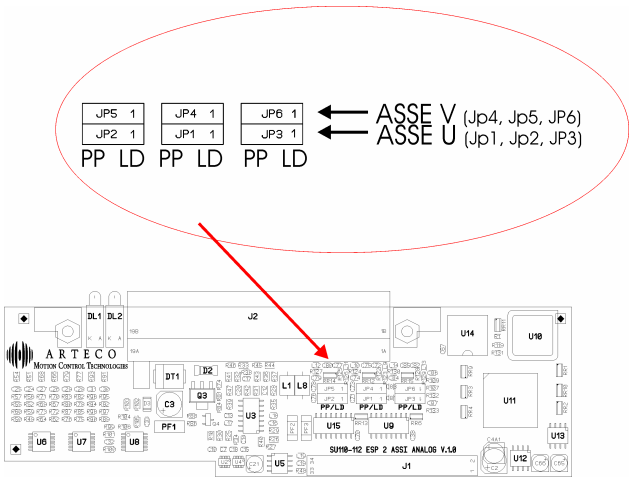
12.4 - encoder jumper settings

U axis

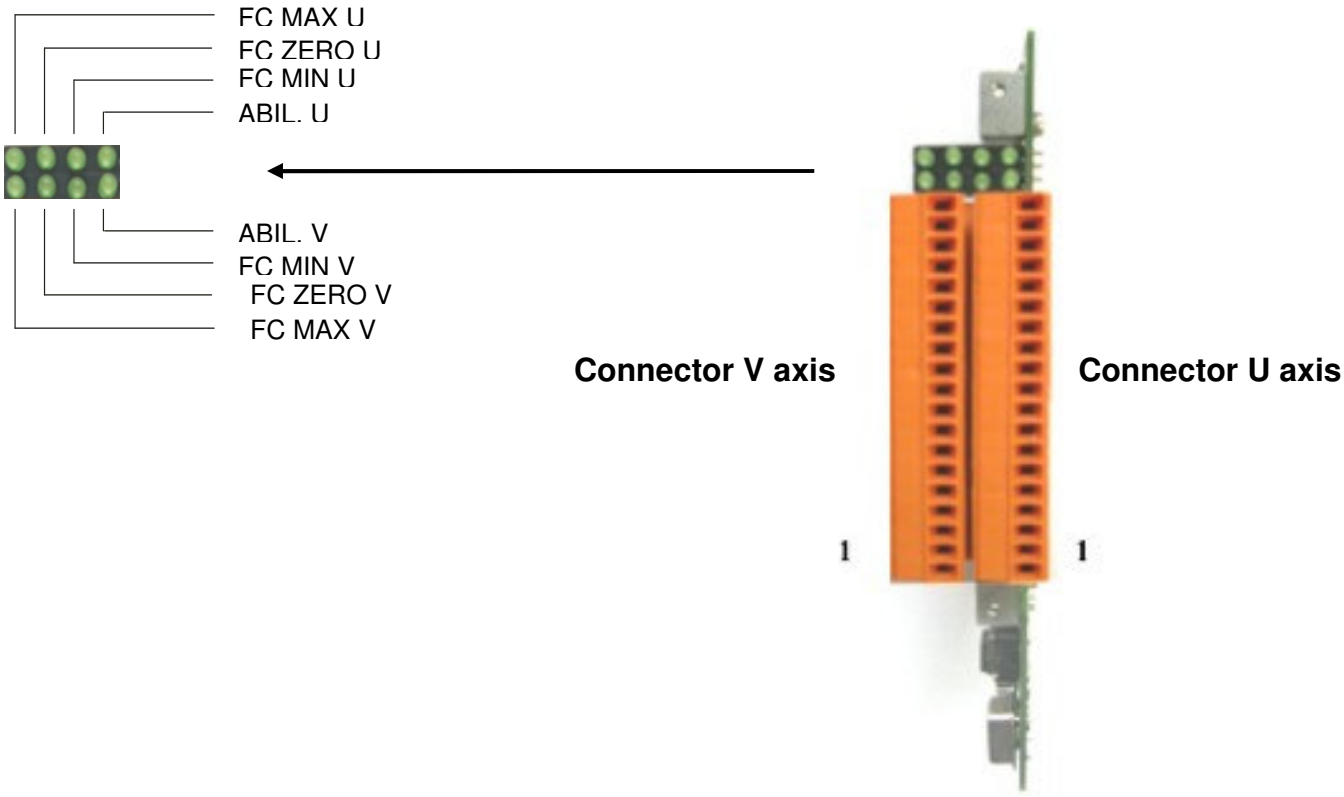
Settings	JP1	JP2	JP3
Line Driver	1-2	1-2	1-2
Push pull	2-3	2-3	2-3

Axis

Settings	JP4	JP5	JP6
Line Driver	1-2	1-2	1-2
Push pull	2-3	2-3	2-3



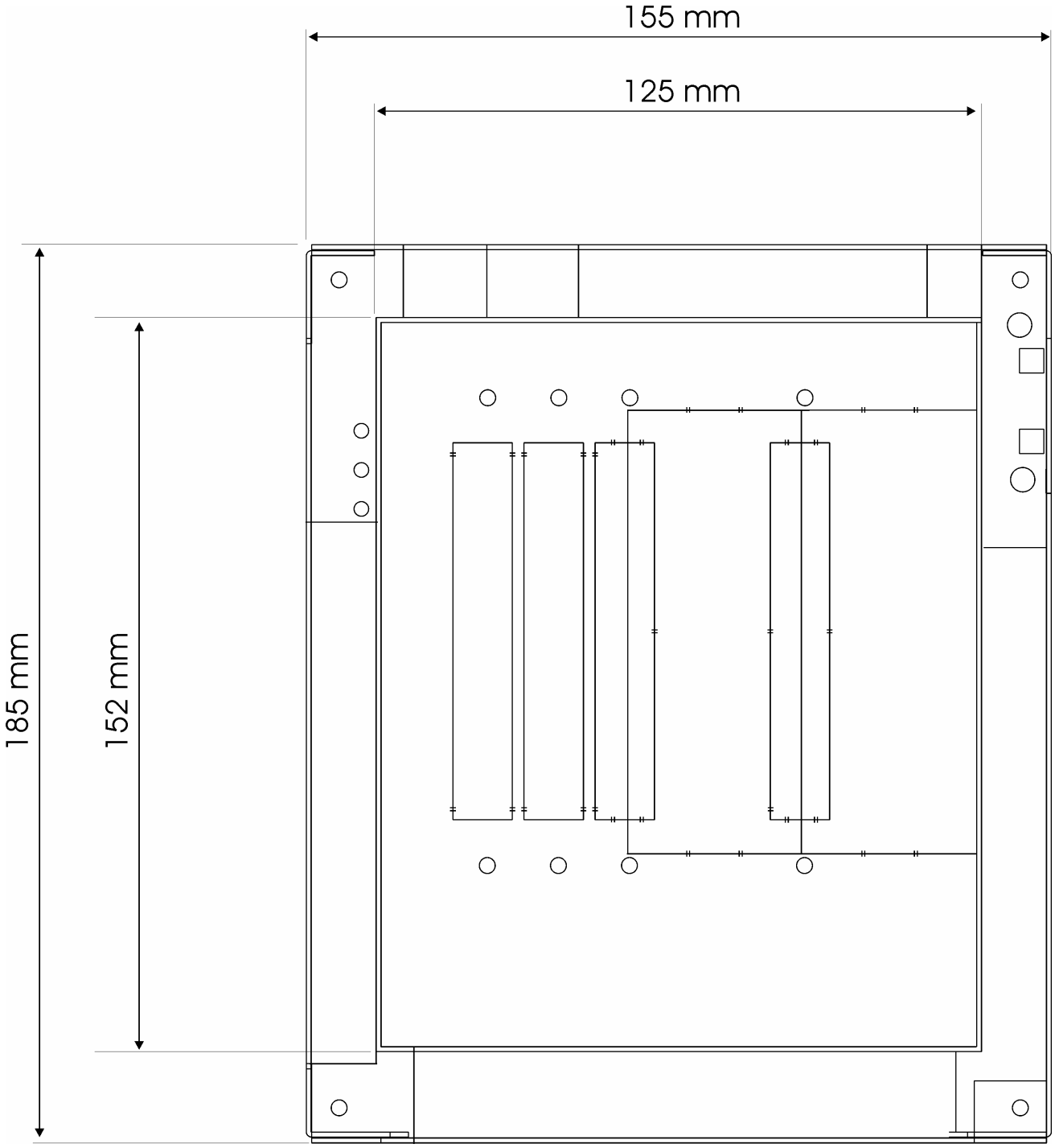
12.5 – Connectors and diagnostic LED description



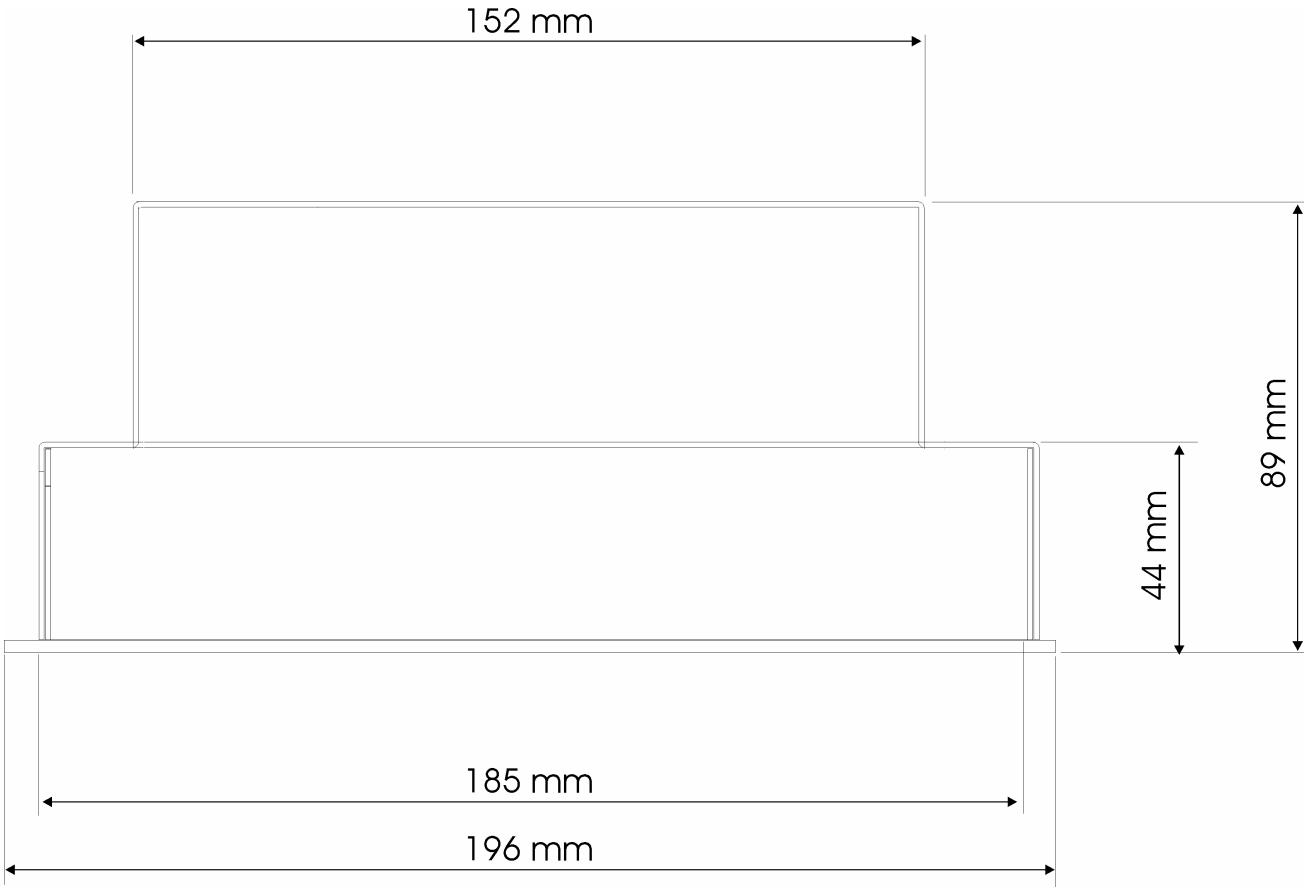
Chapter 13 - Diagrams and dimensions

Below there are some dimensioned diagrams useful for the sizing of the electrical control panel and the drilling template on its front panel for the correct assembly of the Axis Controller with integrated PLC SU112.

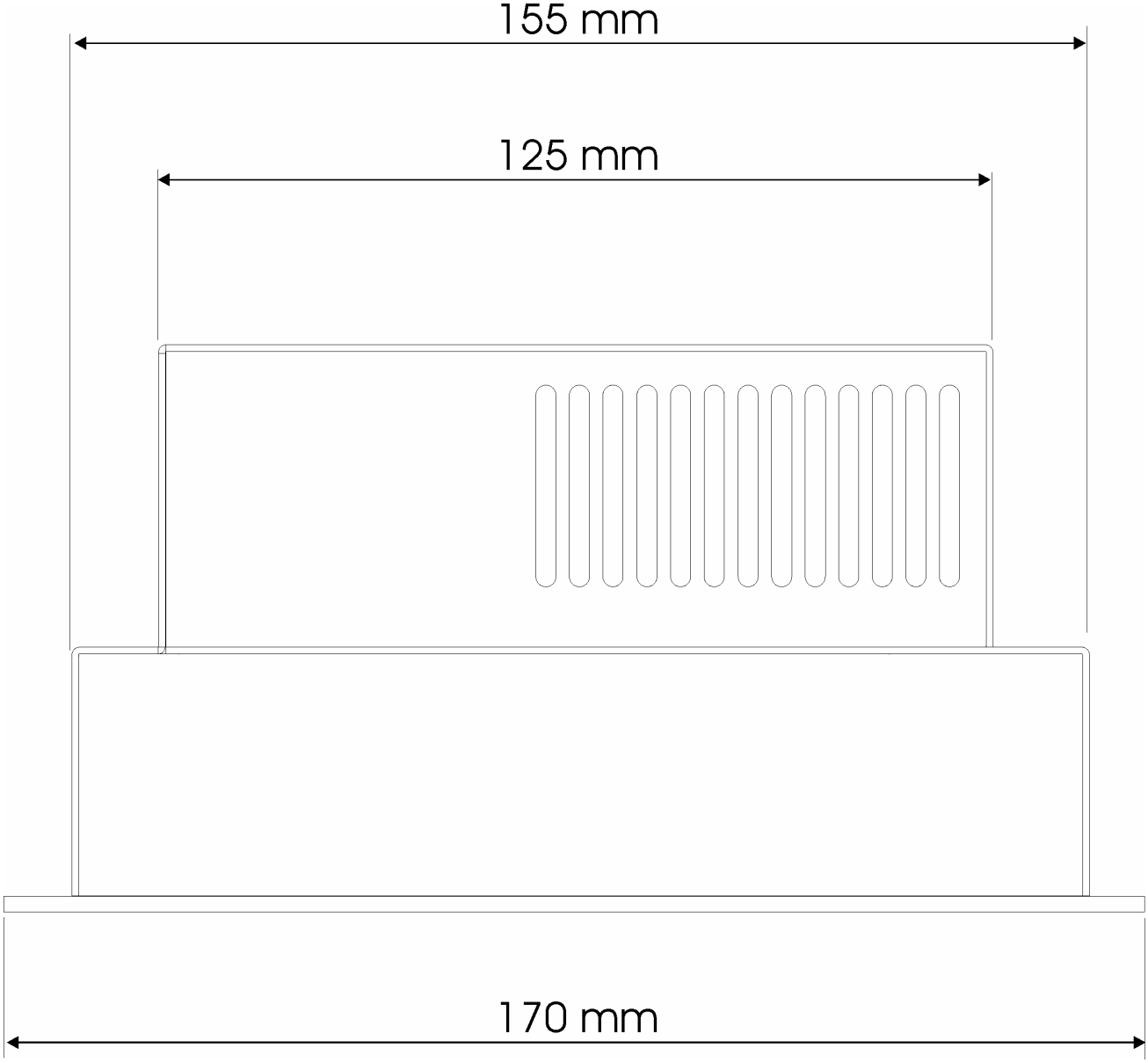
13.1 - Diagram of the rear side of the SU112 unit seen from above



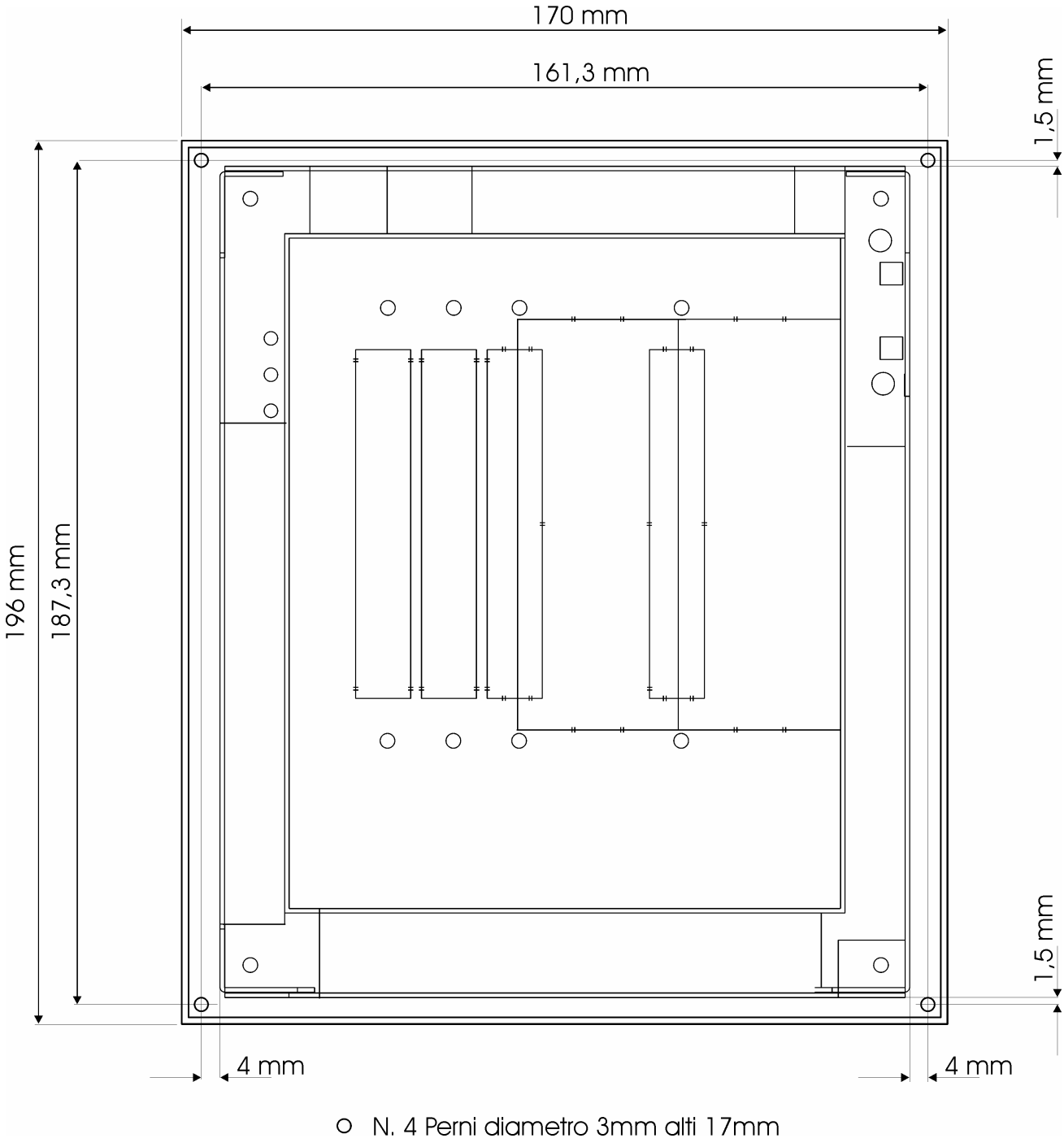
13.2 - Diagram of the side view of the P7, P8, P9 connectors of the SU112 unit



13.3 - Diagram of the side view of the P5 and P6 connectors of the SU112 unit



13.4 - Diagram of the frontal panel with the attachment pins for the panel



NOTES