



Operation and maintenance instructions CPU CANOPEN Series CX03 fieldbus node



Made in Italy

The products are designed and manufactured in conformity with the following directives:

- 2004/108/CE

They also comply partially or totally with regard to the applicable parts of the following standards:

- CEI EN 61131-2

The website www.camozzi.it contains a section to download the relative CE Declarations of Conformity

1. Product identification

		Tabella di conversione della data di produzione.		86-1400-0001 Rev. D																																																																																																																																																																																											
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2. General recommendations

The recommendations regarding safe use in this document should be observed at all times.

- Some hazards can only be associated with the product after it has been installed on the machine/equipment. It is the task of the final user to identify these hazards and reduced the associated risks accordingly.
- The products dealt with in this manual may be used in circuits that must comply with the standard EN ISO 13849-1.
- For information regarding component reliability, contact Camozzi.
- Before proceeding with use of the product, carefully read all information in this document.
- Conserve this document in a safe place accessible to all personnel throughout the product life cycle.
- This document should accompany the product in the event of transfer to a new owner or user.
- The instructions in this manual must be observed together with the instructions and additional information regarding the product in this manual, available from the following reference links:
 - web site <http://www.camozzi.com>
 - Camozzi general catalogue
 - Technical assistance service
- Assembly and start-up operations must be performed exclusively by qualified and authorized personnel on the basis of these instructions.
- It is the responsibility of the system/machine designer to ensure the correct selection of the most suitable pneumatic component according to the intended application.
- It is recommended to use suitable protections to minimize the risk of physical injury.
- For all situations not contemplated in this manual and in situations in which there is the risk of potential damage to objects, or injury to persons or animals, contact Camozzi for advice.
- Never make unauthorized modifications to the product. In this case, any damage or injury to objects, persons or animals will be the responsibility of the user.
- All relevant product safety standards must be observed at all times.
- Never intervene on the machine/system before verifying that all working conditions are safe.
- Before installation and maintenance, ensure that the specific envisaged safety locks are active, and then disconnect the electrical mains (if necessary) and system pressure supply, discharging all residual compressed air from the circuit and deactivating residual energy stored in springs, condensers, recipients and gravity.
- After installation or maintenance, the system pressure and electrical power supply (if necessary) must be reconnected, after which the operator must check correct operation and sealing efficiency of the product. In the event of sealing failure or malfunction, the product must not be used.

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- The product may only be used in observance of the specifications provided; if these requirements are not met, the product may only be used on authorization by Camozzi.
- Avoid covering the equipment with paint or other substances that may reduce heat dissipation.

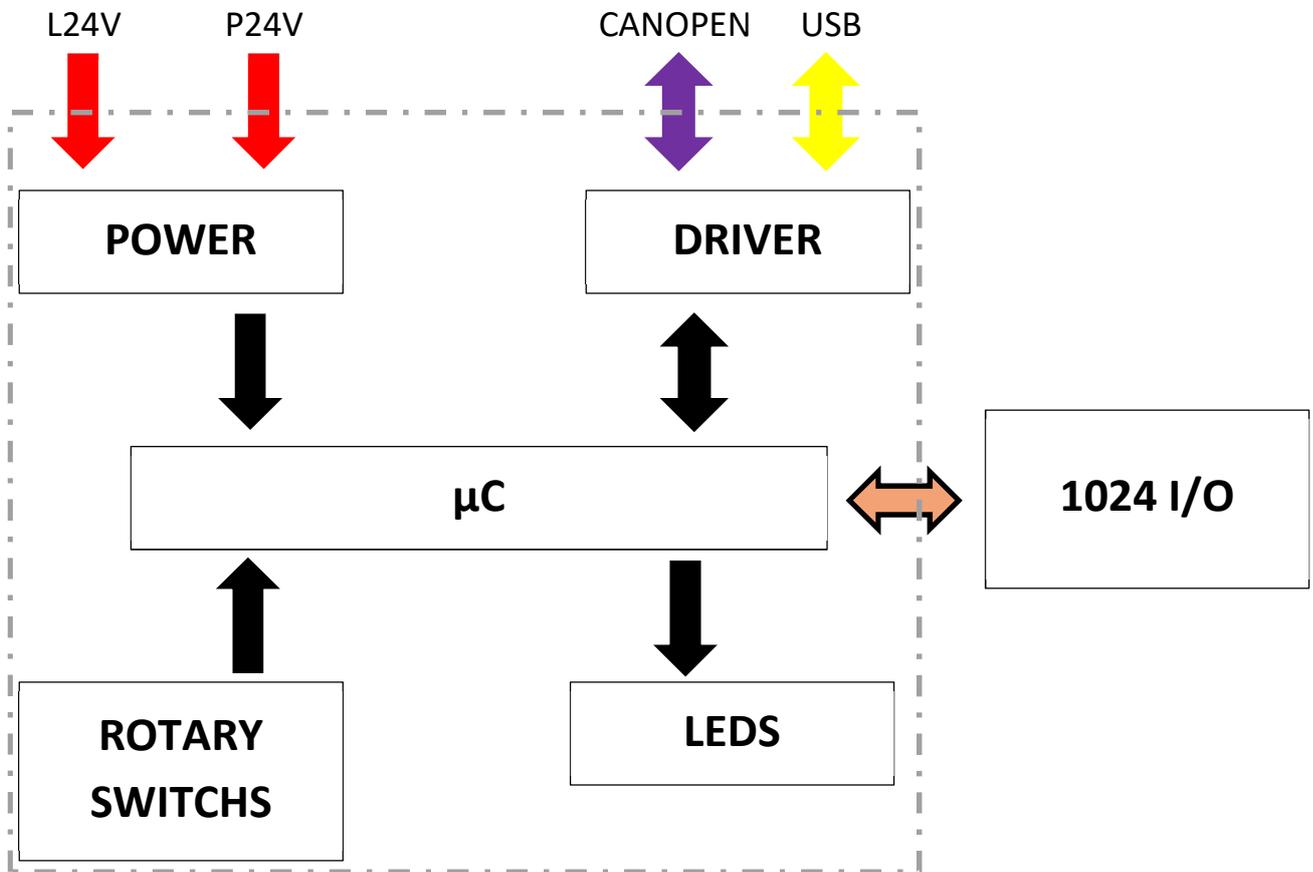
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3. General characteristics and conditions of use

General characteristics and conditions of use	
Assembly position	Any
Overall dimensions	L = 122,6 mm; W = 90,7 mm; H = 48,9 mm
Weight	425 gr approximately
Ambient temperature	0 ÷ 50 °C
Ambient humidity	Max 90%
IP protection rating according to EN 60529	IP65 (full system)
Vibrations	In according with CEI EN 61131-2
Continuous shock	In according with CEI EN 61131-2
Electrical connection	M12
Electrical power supply	24Vdc -15%/+20%
Digital Output Current consumption	Max 4,5A (limited by fuse)
Logic, Digital Input and Analog I/O Current consumption	Max 2,0A (limited by fuse)
Total Current consumption	Max 4,8A @ 20°C (not limited by fuse)
Output maximum number	1024
Input maximum number	1024
Slave address selectable	From 1 to 127
Protocol	CanOpen 301

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4. Electrical circuit



5. Product storage and transport

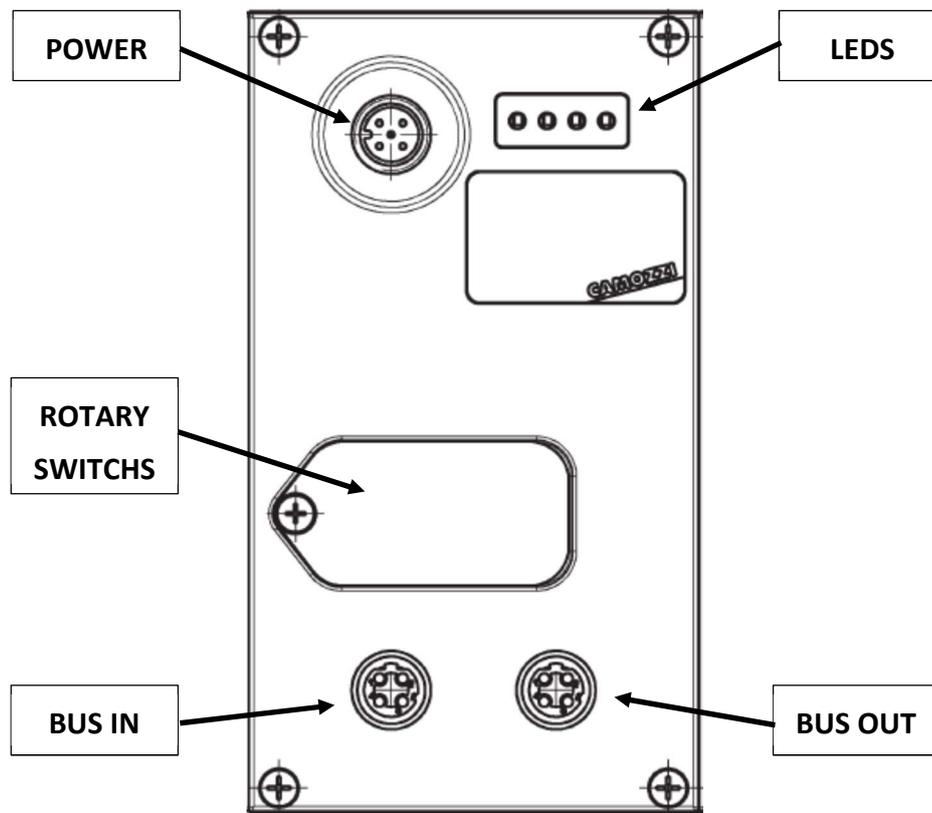
- Adopt all measures possible to avoid accidental damage to the product during transport, and when available use the original packaging.
- Observe the specified storage temperature range of -10 - 50 °C.

6. System general description

The CPU module allow to control and manage the activation of digital and / or analog outputs according to the commands received from the CanOpen external bus and to transmit on the external bus diagnostic information provided by the system and the digital and/or analog inputs.

The system consists of a CPU module (CanOpen slave device) that communicates with a CanOpen Master via the bus up to 1 Mb/s.

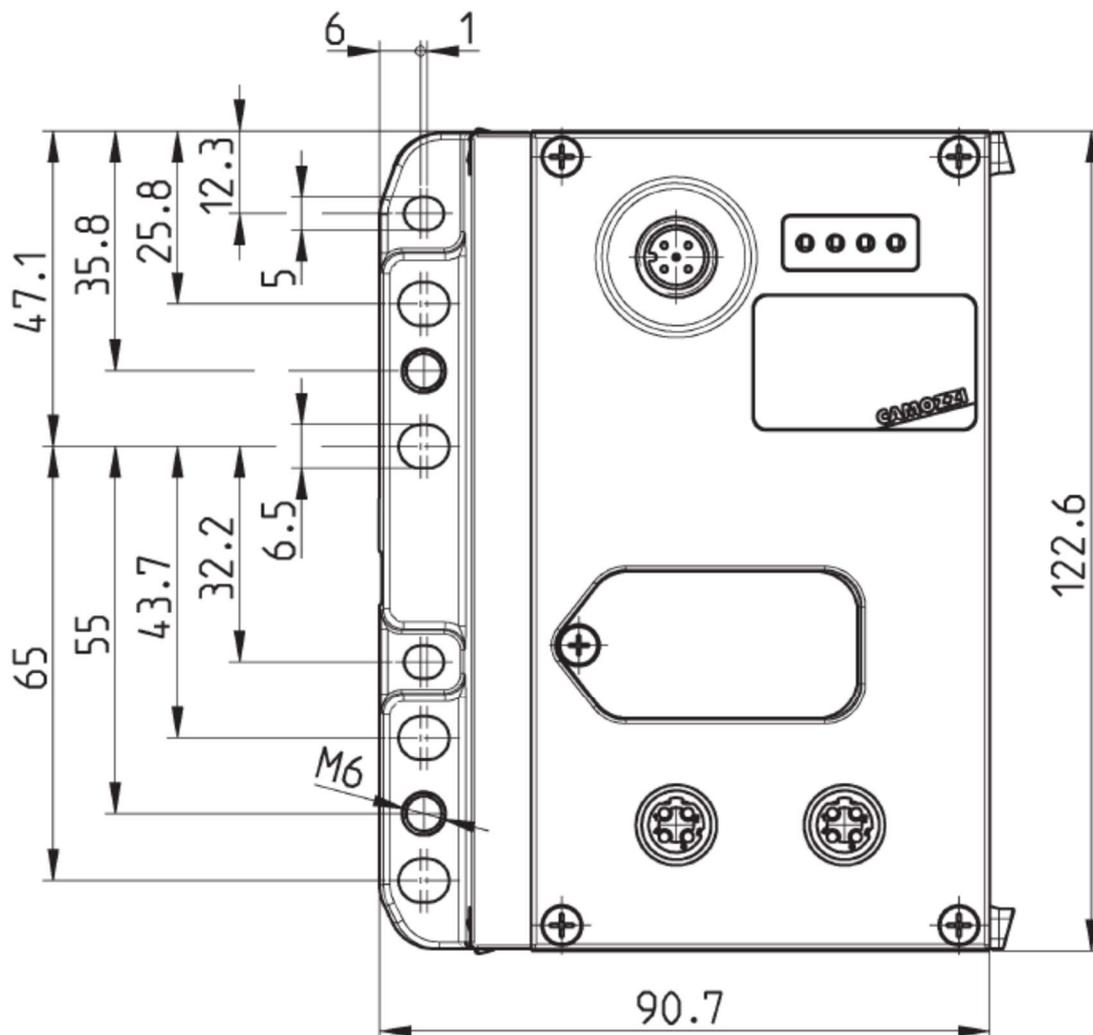
On the right side of the CPU module you can connected the input and output modules, analog and digital, and adapters that allow you to connect integrally the island a few series of valves. In addition a number of modules that allow you to remotely locate the modules above. For more details refer to the "**Operation and maintenance - Bus System Internal Camozzi**" manual.



7. Installation and start-up

- During unpacking, take great care not to damage the product.
- Check whether there are any fault caused by product transport or storage.
- Separate all packaging material to enable the recovery or disposal in accordance with current standards in the country of use.
- Before operating the component, ensure that the stated specifications and performance correspond to requirements.
- During component installation, ensure suitable voltage overload protection devices are fitted.
- During component installation, ensure that no hazards are generated due to mechanical movements.
- Install the component in an area where the set-up and maintenance phases are easily performed without generating hazards for the operator.
- Close off any connections with suitable safety caps/covers.
- The components must be fixed correctly using, where possible, the specific anchors and ensuring that the fixture remains efficient even when the actuator is repeatedly used at a high frequency and in the presence of strong vibrations.
- In the case of strong vibrations envisage suitable devices/systems able to dampen the effect on the component.

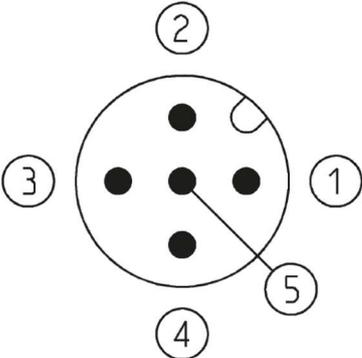
- Envisage the installation of dehumidifiers to avoid the formation of humidity or condensation on internal components.
- If the device is used to activate an actuator on which any accidental movement can generate a hazard, envisage suitable locking devices on the mobile section of the actuator.
- Ensure that the connectors are correctly connected and secured.
- The device can be connected to DIN rails using the relative elements PCF-E520 fitted on the rear of the body.
- The component can be directly fixed to a support using the 8 holes (of which 2 threaded M6) present on the side of the body

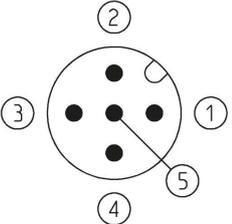
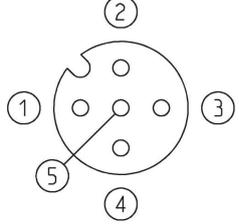


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- This illustrates the pins of the M12 connector located on the upper section CPU module:

POWER Connector M12A 5 poles male		
Pin	Segnale	Descrizione
1	L24V	24Vdc power supply (logic, digital input, analog I/O): connect to the positive pole of the 24Vdc power supply (ref. GND).
2	P24V	24Vdc power supply (digital output): connect to the positive pole of the 24Vdc power supply (ref. GND).
3	GND	Common (reference pin 1 and 2): connect to the negative pole of the 24Vdc power supply (compulsory).
4	EARTH	Earth connection
5	NC	Not connected



Connettore BUS M12A 5 poli			IN (maschio)	OUT (femmina)
Pin	Segnale	Descrizione		
1	EARTH	Earth connection		
2	V+	Bus positive power (24 V)		
3	V- / GND	Pin 2 reference (0V)		
4	CAN_H	Bus-line CAN-H		
5	CAN_L	Bus-line CAN-L		

For electrical connection are available the following wired connectors.

CONNETTORE	CODICE	DESCRIZIONE
POWER	CS-LF04HB	Power supply straight connector
	CS-LR04HB	Power supply angled connector
BUS IN	CS-LF05HC	Bus-In M12 female straight connector
	CS-LR05HC	Bus-In M12 female angled connector
BUS OUT	CS-LM05HC	Bus-Out M12 male straight connector
	CS-LS05HC	Bus-Out M12 male angled connector

- Use only power able to ensure a reliable electrical isolation of the supply voltage according to IEC 742 / EN 60742 / VDE 0551 with a minimum strength of 4 kV isolation Protected Extra Low Voltage, PELV.
- The user must take the necessary measures to prevent damage to the system caused by non-periodic overvoltage spikes on the power lines produced by power break to high-energy equipment.
- The voltage interruptions are permitted according to the severity level PS2.
- About electromagnetic compatibility, the CPU module is designed to work in area A.

- The board implements a protection against inversion of polarity on the power supply voltage.

- The power supply voltage must be within the range of $24V \pm 10\%$.

The rated voltage of the CPU module is 24 VDC -15% / + 20% (as indicated by the Standard IEC 61131-2). If the loads connected to the initial node may require severest tolerances of the value of the supply voltage, the power supply voltage must comply with these. If the inputs connected to the initial node may require in the severest tolerances of the value of the supply voltage, the logic supply voltage of the node must comply with these.

For example, if you connect the valves HN Series, the tolerance of the power supply voltage must be $\pm 10\%$. If you connect the CSH sensors with power supply 10-30V (-58% / + 25%), the tolerance of the logic supply voltage is -15% / + 20%.

For the system it is mandatory to connect the logic voltage (pin 1), otherwise the initial module remains off.

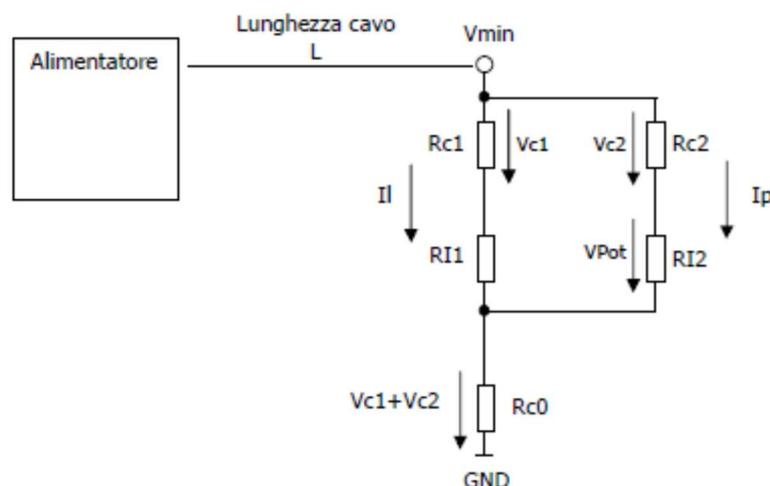
For the correct operation of the system is mandatory to connect to the initial module the logic voltage (pin 1), the power voltage (pin 2), the reference to 0 V (GND, pin 3) and the earth.

- On supply cables of a valve group, it produces a voltage drop that dependent by load. This can create that the supply voltage (logic and power) does not fall within the allowable tolerance. If the sections of the cables for the power supply and for the logic power supply are the same, it is possible to apply the following formula in order to calculate the length. To limit the effects of induced noises, it is recommended to limit the length of the power cable to 3 mt.

Before is necessary to calculate:

- The maximum current value for Logic+Input (I_1) and for Power (I_2)
- The minimum power supply value expected during operation (V_{min}), whereas it depends on the load connected and that the mains voltage can have oscillations.

Use the value below in the following formula explained by the electrical drawing.



- I_l = Logic currente + SPI input current
- I_p = Power current (loads)
- $R_{c1} + R_{c2}$ = Cable resistance
- R_{c0} = Common cable resistance
- L = Cable length

In order to calculate the cable length use this formula:

$$L \leq \frac{[(V_{\min} - V_{p\min}) \times S \times K_{cu}]}{(2I_p + I_l)}$$

Where:

- $V_{p\min}$: minimum tension necessary for output
- V_{\min} : minimum tension expected from power supply
- I_l : corrent necessary for logic and sensor
- I_p : corrent necessary for output
- S : cable section
- K : cable conductance (copper conductance $K_{cu} = 56 \text{ m}/(\text{mm}^2 * \Omega)$)

Example:

$V_{\min} = 24 \text{ V}$

$V_{p\min} = 21.6 \text{ V}$

$I_l = 1 \text{ A}$

$I_p = 1 \text{ A}$ (40 Series H coils)

$S = 0,75 \text{ mm}^2$

$K_{cu} = 56 \text{ m}/(\text{mm}^2 * \Omega)$

$$L \leq \frac{[(24 - 21,6) \times 0,75 \times 56]}{(2+1)} = 33,6m$$

- To improve immunity to disturbance and prevent damage, it is recommended to connect the device to the circuit earthing system using any one of the holes on the aluminium body.
- Using the rotary switches under the transparent cover, you are able to set the CanOpen slave address. The rotary switch on the right side indicates the unit while the rotary switch on the left side indicates the address tens to set. For the tens an hexadecimal rotary switch is used, so you can set up to 127 CanOpen addresses (1 to 127).

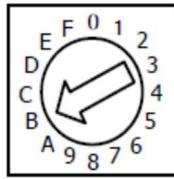
A = 10;

B = 11;

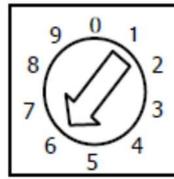
C = 12;

D, E, F = not used

For example, the following rotary switches are configured on CanOpen address 116 (B6)

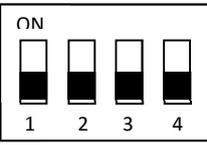
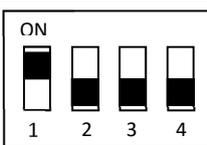
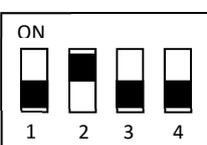
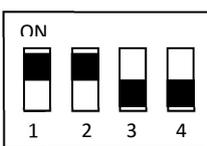
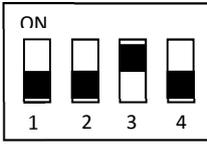
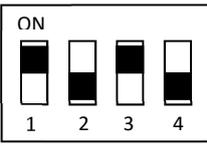
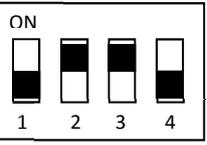


x10

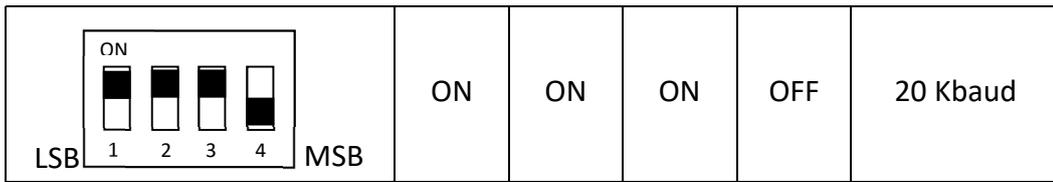


x1

- Using the 4 positions dip switch under the transparent cover, you are able to set the CanOpen slave baud rate:

	Switchs position				Baud rate
	1	2	3	4	
 LSB 1 2 3 4 MSB	OFF	OFF	OFF	OFF	1 Mbaud
 LSB 1 2 3 4 MSB	ON	OFF	OFF	OFF	800 baud
 LSB 1 2 3 4 MSB	OFF	ON	OFF	OFF	500 Kbaud
 LSB 1 2 3 4 MSB	ON	ON	OFF	OFF	250 Kbaud
 LSB 1 2 3 4 MSB	OFF	OFF	ON	OFF	125 Kbaud
 LSB 1 2 3 4 MSB	ON	OFF	ON	OFF	100 Kbaud
 LSB 1 2 3 4 MSB	OFF	ON	ON	OFF	50 Kbaud

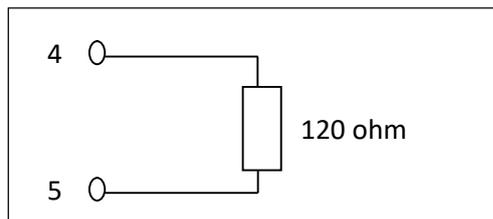
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- In order to connect the CPU module to CanOpen bus, is recommended to use a quadripole twisted and shielded cable.
- The CanOpen segment maximum length depends from selected baud rate as indicated in the following table:

Baud rate (Kbaud)	Segment maximum length (m)
20	2500
50	1000
125	500
250	250
500	100
800	50
1000	25

- If the CPU module is the last node of the CanOpen segment, it is necessary use the resistances termination for the bus: for the CPU module is provided the connector cod. CS-LP05H0, connect it to the BUS OUT connector.
The following is the connection diagram of the resistors that constitute the termination, the numbers refer to the BUS OUT connector pins.



- For configuration of the CPU module and the connected modules, download the set-up file of the software **CX-Configurator** from the web site <http://www.camozzi.com> and proceed with installation according to the instructions on screen displayed during the process. For more details, please refer to the "**Operating and Maintenance Instructions - CX Configurator**".
- In order to configure the CX03 CPU module with a programmer/PC it is necessary to use the archive Cx_Camozzi_canopen_10.eds. In addition to the slave characteristic data (ID Number, revision, etc.), this file contains the the list of CanOpen object available (sections

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[MandatoryObjects] and [OptionalObjects]). The file of the CPU module can be downloaded from the website Camozzi.

- Each CanOpen slave receives and transfers on the CanOpen network, packages of data called PDO. Each slave can receive or transfer multiple PDOs (each PDO can contain up to 8 byte of data). The CPU CX03 module receives up to 16 PDOs which contains the output (PDO Rx) and transmits to the master up to 162 PDOs which contains the input (PDO Tx). The CPU CX03 module's default configuration is 4 PDO Rx and 4 PDO Tx.

To each PDO which runs on the CanOpen network, an identification code is given (COB-ID), it indicates the kind of message and who has transmitted it. In particular, it is added to the value which indicates the kind of message, also the address value of the node which has transmitted the same message. The association between the PDO and the related COB-ID can be found in the EDS file.

The list of the PDO handled by each slave can be found in the related EDS file and the group of the handled PDO and their structure make part of the module's object dictionary.

To each element of the dictionary an address is connected.

For the slave and the master the association between the addresses and the different kinds of objects is fixed and determined by the CanOpen specification.

The PDO mapping objects' content must be set, for the slave it is defined in the EDS file, for the master it is automatically generated by the master (if it makes a net scan), while in other cases it must be calculated using the required tables and manually formulated in its parameters.

In the CPU CX03 module the reception PDO occupy the objects' dictionary addresses starting from 1400h an up (PDO1 -> 1400h; PDO2 -> 1401h; ...), the transmission ones occupy the objects' dictionary addresses starting from 1800h and up (PDO1 -> 1800h; PDO2 -> 1801h; ...).

Of course, the PDOs Tx transmitted from the slave (input) must be configured as received PDO Rx in the master and the PDO Rx received from the slave (output) must be configured as transmitted PDO Tx in the master

- The relationship from COB-ID, OBJECT DICTIONARY and I/O for the CanOpen 301 profile is listed below:

OBJECT	COB-ID	OBJECTS' DICTIONARY ADDRESSES	I/O
PDO1 Tx	0x180 + NODEID	1800 _h	Input byte 0-7
PDO2 Tx	0x280 + NODEID	1801 _h	Input byte 8-15
PDO3 Tx	0x380 + NODEID	1802 _h	Input byte 16-23
PDO4 Tx	0x480 + NODEID	1803 _h	Input byte 24-31
PDO5 Tx	0x8000000 (*)	1804 _h	Input byte 32-39

...
PDO16 Tx	0x8000000 (*)	180F _h	Input byte 120-127
PDO1 Rx	0x200 + NODEID	1400 _h	Output byte 0-7
PDO2 Rx	0x300 + NODEID	1401 _h	Output byte 8-15
PDO3 Rx	0x4000 + NODEID	1402 _h	Output byte 16-23
PDO4 Rx	0x500 + NODEID	1403 _h	Output byte 24-31
PDO5 Rx	0x8000000 (*)	1404 _h	Output byte 32-39
...
PDO16 Rx	0x8000000 (*)	140F _h	Output byte 120-127

- Following an example for a system with 2 CPU CX03 modules (slaves) with all default PDO configured on the master.

OBJECT	COB-ID	OBJECTS' DICTIONARY	I/O
NODE 1: CanOpen address 4			
PDO1 Rx	0x204	1400 _h	Output node 4 byte 0-7
PDO2 Rx	0x304	1401 _h	Output node 4 byte 8-15
PDO3 Rx	0x404	1402 _h	Output node 4 byte 16-23
PDO4 Rx	0x504	1403 _h	Output node 4 byte 24-31
PDO1 Tx	0x184	1800 _h	Input node 4 byte 0-7
PDO2 Tx	0x284	1801 _h	Input node 4 byte 8-15
PDO3 Tx	0x384	1802 _h	Input node 4 byte 16-23
PDO4 Tx	0x484	1803 _h	Input node 4 byte 24-31
NODE 2: CanOpen address 6			
PDO1 Rx	0x206	1400 _h	Output node 6 byte 0-7
PDO2 Rx	0x306	1401 _h	Output node 6 byte 8-15
PDO3 Rx	0x406	1402 _h	Output node 6 byte 16-23
PDO4 Rx	0x506	1403 _h	Output node 6 byte 24-31
PDO1 Tx	0x186	1800 _h	Input node 6 byte 0-7
PDO2 Tx	0x286	1801 _h	Input node 6 byte 8-15
PDO3 Tx	0x386	1802 _h	Input node 6 byte 16-23
PDO4 Tx	0x486	1803 _h	Input node 6 byte 24-31
Master: dovrà gestire 16 PDO (8 per ogni slave)			
PDO1 Tx	0x204	1800 _h	Output node 4 byte 0-7
PDO2 Tx	0x304	1801 _h	Output node 4 byte 8-15
PDO3 Tx	0x404	1802 _h	Output node 4 byte 16-23
PDO4 Tx	0x504	1803 _h	Output node 4 byte 24-31
PDO5 Tx	0x206	1804 _h	Output node 6 byte 0-7
PDO6 Tx	0x306	1805 _h	Output node 6 byte 8-15
PDO7 Tx	0x406	1806 _h	Output node 6 byte 16-23
PDO8 Tx	0x506	1807 _h	Output node 6 byte 24-31
PDO1 Rx	0x184	1400 _h	Input node 4 byte 0-7
PDO2 Rx	0x284	1401 _h	Input node 4 byte 8-15
PDO3 Rx	0x384	1402 _h	Input node 4 byte 16-23
PDO4 Rx	0x484	1403 _h	Input node 4 byte 24-31
PDO5 Rx	0x186	1404 _h	Input node 6 byte 0-7
PDO6 Rx	0x286	1405 _h	Input node 6 byte 8-15
PDO7 Rx	0x386	1406 _h	Input node 6 byte 16-23
PDO8 Rx	0x486	1407 _h	Input node 6 byte 24-31

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It isn't necessary follow a specific order in the connection between the slave's PDOs and the master's PDOs. Moreover it isn't necessary connect to the master all the PDOs that the slave can transmit o receive.

The COB-ID of the Master objects is the one calculated for the relative PDO slave.

- The user must calculate the minimum size of the data necessary for the functioning of CX03 node and the modules connected to it. The information regarding the size of the data occupied by the individual modules and their meaning (correspondence between bits and input / physical output) are contained in the manual "**Operating and Maintenance Instructions - Bus System Internal Camozzi**".

Furthermore the **CX-Configurator** software calculates automatically the size of the data used by the CX03 node and by the modules connected to it. For more details on using the configurator and in particular of this feature, refer to the manual "**Operating and Maintenance Instructions - CX Configurator**".

- Before starting up the configuration software **CX-Configurator**, connect the module to the PC using a standard USB cable (is available the accessory G11W-G12W-2), then connect the electrical power supply via connector M12. The CPU module is fitted with a Micro USB connector under the transparent panel. To access the connector, remove the transparent panel by loosening the screw securing it to the cover of the module. After completing all settings, exit the software **CX-Configurator**, remove the USB cable and re-fit the transparent panel to restore the specified IP protection rating.
- On start-up of the software **CX-Configurator** the system verifies communication between the device and the PC where the configuration software is installed. In the event of communication failure, an error message is displayed.

Type of fault	Causes	Remedy
Communication failure between CPU module and PC	Electrical power supply not connected	Connect the Electrical power supply by means of the M12 connector POWER.
	USB cable not connected	Connect the USB cable to one of the ports available on the PC and to the Micro USB connector under the transparent panel on the device.
	USB drivers not installed	Contact the Camozzi technical assistance service.

8. Use

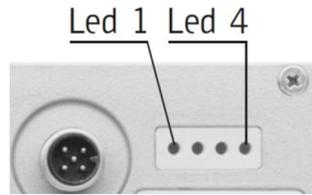
- Ensure that the electrical power supply and all other operating conditions remain within the admissible values.
- The product may only be used in observance of the specifications provided; if these requirements are not met, the product may only be used on authorization by Camozzi.

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- Observe the specifications on the identification data plate.

9. Troubleshooting and/or exceptional circumstances

- The following is the meaning of the LEDs on the top panel of the CPU Unit:



Led 2 (PWR)	Led 3 (IO)	Led 4 (MNS)	Problem	Solution
○ OFF	○ OFF	○ OFF	The logic power supply is not present.	Check the POWER connector.
 Fixed	 Fixed		OPERATIONAL: The device is in the OPERATIONAL state.	
 Fixed	 Blinking		PREOPERATIONAL: The device is in the PREOPERATIONAL state	
 Fixed	 Single flash		STOPPED: The device is in STOPPED state	
 Fixed	 Blinking	 Blinking	Auto Baud Rate Detection active: The Device is in the Auto Baud RateDetection mode	
 Fixed		 Fixed	Bus Off: The CAN controller is bus off	
 Fixed		 Single flash	Warning Limit reached: At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)	
 Fixed		 Double flash	Error Control Event: A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred	

10.Limitations on use

- Never exceed the technical specifications stated in the paragraph "General characteristics" and the Camozzi general catalogue.
- Do not install the product in environments where the air itself may generate hazards.

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- With the exception of specific intended applications, do not use the product in environments where there is the risk of direct contact with corrosive gas, chemical products, salt water, water or steam.

11.Maintenance

- If performed incorrectly, maintenance may impair efficient operation of the product and harm persons in the vicinity.
- Check all conditions to prevent the inadvertent release of parts, and disconnect the power supply to enable the discharge of residual pressure from the system before performing work.
- Check whether it is possible to have the product serviced at a technical assistance centre.
- Never disassemble units when electrically powered.
- Shut off electric supplies before maintenance.
- Always remove accessories before maintenance.
- Always wear the correct personal protective equipment as envisaged by local authorities and in compliance with current legislation.
- In the event of maintenance, replacement of worn parts, use exclusively the original Camozzi kits and ensure that operations are only performed by specialised and authorised personnel. Otherwise product approval will be rendered invalid.

12.Environmental notes

- At the end of the product's life cycle, separate the relative materials to enable recycling.
- Observe all current standards in the country of use governing waste disposal.
- The product and relative parts all comply with the standards ROHS and REACH.

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12. Contacts

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Technical assistance

Technical information

Product information

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