MANUAL
Series D Valve Island Fieldbus and Series CX4
PROFIBUS/DP

<table>
<tr><td rowspan="2">$C\epsilon$</td><td>Made in Italy</td></tr>
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The products are in compliance with the requirements stated in the following directives:

- 2004/108/EC

The products comply either fully, or for the applicable parts, with the following standards:

- IEC EN 61131-2

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</table>

The EC Compliance Declarations can be downloaded from www.camozzi.it

Summary

1   General recommendations

Please comply with the recommendations for safe use described in this document:

- Some hazards can only be associated with the product after it has been installed on the machine/equipment. It the responsibility of the end user to identify these hazards and reduce the risks associated with them.
- For information regarding the reliability of the components, contact Camozzi Automation.
- Read the information in this document carefully before using the product.
- Keep this document in a safe place and close at hand for the whole of the product's life cycle.
- Pass this document on to any subsequent owner or user.
- The instructions in this manual must be observed in conjunction with the instructions and additional information concerning the product in this manual, available from the following reference links:
  - Website http://www.camozzi.com
  - Camozzi general catalogue
  - Technical assistance service
- Assembly and commissioning must be performed exclusively by qualified and authorised 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.
- Use of appropriate personal protective equipment is recommended to minimise 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 property, or injury to persons or animals, contact Camozzi for advice.
- Do not make unauthorised modifications to the product. In this case, any damage or injury to property, persons or animals will be the responsibility of the user.
- It is recommended to comply with all safety regulations that apply to the product.
- Never intervene on the machine/system until you have verified that all working conditions are safe.
- Before installation or maintenance, ensure that the required 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, and the regular operation and sealing of the product must be checked. In the event of leaks or malfunction, the product must not be used.
- The product may only be used in observance of the specifications provided; if these requirements are not met, the product may only be used upon authorisation by Camozzi.
- Avoid covering the equipment with paint or other substances that may reduce heat dissipation.

1.1 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.

1.2 Use

- Make sure that the distribution network voltage and all operating conditions are within the permissible 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 upon authorisation by Camozzi.
- Follow the indications shown on the identification plate.

1.3 Limitations of use

- Do not exceed the technical specifications given in paragraph 2 (General characteristics and conditions of use) and in the Camozzi general catalogue.
- Do not install the product in environments where the air itself may cause hazards.
- With the exception of specific intended uses, do not use the product in environments where direct contact with corrosive gases, chemicals, salt water, water or steam may occur.

1.4 Maintenance

- Incorrectly performed maintenance operations can compromise the good working order of the product and harm surrounding persons.
- Check conditions to prevent sudden release of parts, then suspend the power supply and allow residual stresses to discharge before taking action.
- Assess the possibility of having the product serviced by a technical service centre.
- Never disassemble a live unit.
- Isolate the product electrically 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, or replacement of worn parts, exclusively use the original Camozzi kits and ensure that operations are performed by specialised and authorised personnel. Otherwise product approval will be rendered invalid.

1.5 Ecological Information

- At the end of the product's life cycle, it is recommended to separate the materials for recycling.
- Follow the waste disposal regulations in force in your country.
- The product and relative parts all comply with the ROHS and REACH standards.

2   General characteristics and conditions of use

PNEUMATIC SECTION				
Versions	D1	D2	D4	D5
Valve construction	Spool with seals			
Valve functions	5/2 monostable and bistable 2x3/2 NC 2x3/2 NO 5/3 CC – CP – CO 1X3/2 NC+1X3/2 NO			
Materials	Body	Aluminium			
	Spool	Aluminium			
	Sub-base	Technopolymer	Technopolymer	Aluminium	Technopolymer
	End cover	Technopolymer			
	Seal	HNBR			
Connections	Uses 2 and 4 Thread (only D4) or bushings, tube size variable according to the pitch			
Temperature	0 ÷ 50 °C			
Air feature	Compressed air filtered and not lubricated in class 7.4.4 according to ISO 8573-1: 2010. If lubrication is required, use only oils with max. viscosity. 32 Cst and the version with external servo drive. The servo drive air quality must be in class 7.4.4 according to ISO 8573-1: 2010 (do not lubricate).			
Valve pitch	10.5 mm	16 mm	25 mm	10.5 e 16 mm
Working pressure	-0.9 ÷ 10 bar			
Drive pressure	2.5 ÷ 7 bar 4.5 ÷ 7 bar (with working pressure higher than 6 bar for the 2x3/2 version)			
Flow rate	250 Nl/min (10.5 mm)	950 Nl/min (16 mm)	2000 Nl/min (25 mm)	250 Nl/min (10.5 mm) / 950 Nl/min (16 mm)
Assembly position	Any			
Degree of protection	IP65			

ELECTRICAL SECTION	
Power and bus connection type	M12 – 5 poli
Supply voltage Logic	24 V DC +/-25%
Supply voltage Power	24 V DC +/-10%
Valve maximum absorption	2.5 A
Maximum no. valve positions	64 (128 coils)
Coil power	1W (reduction to 0.5W after 100ms)
Maximum cable length	20 m
Protocol	PROFIBUS/DP

3   General description of the system

The CX4 PROFIBUS/DP module is a device for driving valves and/or managing digital and/or analogue I/O by connecting it to a PROFIBUS/DP network. The CX4 consists of power connectors, input and output connectors for the PROFIBUS/DP field bus and LEDs for system diagnostics. It is possible to connect the Series D coil valves on the right side of the CX4, while on the left side it is possible to connect the digital and analogue I/O modules.

Nomenclature

*The CX4 module can be used by just connecting the input and output modules; in this case the device will take the name of **Series CX4 Stand Alone** module. If coil valves (with or without I/O modules) are connected to the CX4 on the pneumatic side, the device becomes a valve island and is called **Series D Valve Island Fieldbus**.*

The CX4 module, both in Series CXA and Series D valve island fieldbus configurations, is a solution dedicated to Industry 4.0 because it is a SMART device capable of connecting to other devices or networks (ex. WiFi, USB, NFC) for information exchange. The system can transmit data of the main variables, the diagnostics of all the components of which the island is made. In addition, the system can configure the island and each connected module. The smart interfaces with the system are:

- Camozzi UVIX (Universal visual interface), a software that can be installed on a PC/server/gateway used by USB or included in a company network and accessible from other PCs (ch. Error! Reference source not found.).

- NFCamApp (NFC Camozzi Application), smartphone application for Android and iOS (ch. Error! Reference source not found.).
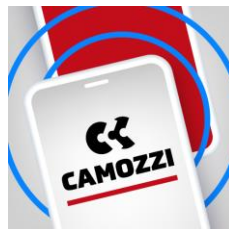
NOTE. In addition, in the Series D Serial valve island configuration, the system has **COILVISION** technology which monitors the correct operation of the coil valve. Each actuation of the coil, in different cyclic configurations and environmental conditions, is analysed to acquire information which, when processed by software algorithms, allows the health of the component to be diagnosed and predicted (par. 8.1.2).

4 Recipients

The manual is intended exclusively for qualified experts in control and automation technologies who have experience in the installation, commissioning, programming and diagnostics of programmable logic controllers (PLCs) and fieldbus systems.

5 Installation

5.1 General installation instructions

For reasons of operator safety and to prevent functional damage to the system, before starting any installation or maintenance operation, disconnect:
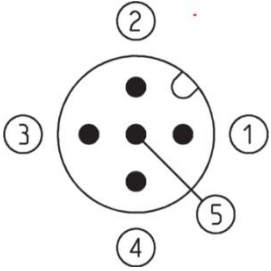
- The air supply.
- The power supply of the control electronics and outputs/coil valves.

5.2 Connecting and warning components

Connector to the Profibus network- OUT
(M12B 5-pole female connector)

Diagnostic LEDs

Connector to the Profibus network- IN
(M12B 5-pole male connector)

SYS island status LED
Probus COM LED

Power Supply
(M12A 5-pole male connector)

Micro USB Connector
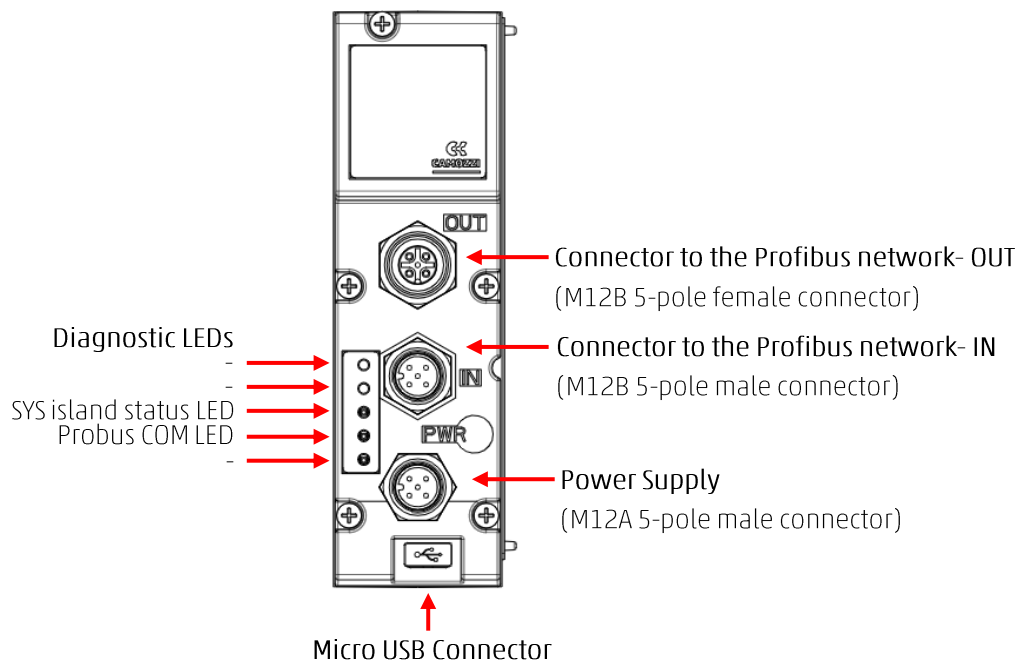
5.2.1 Power Supply Connector

The Power Supply connector is a 5-pole M12A male.

Pin	Signal	Description	Symbol
1	L24V	24 Vdc power supply (logic, digital inputs, analogue I/O): connect to the positive pole of the 24 Vdc power supply (referred to GND).	
2	P24V	24 Vdc power supply (digital outputs and valves): connect to the positive pole of the 24 Vdc power supply (referred to GND).	
3	GND	Common (reference pin 1 and 2): connect to the negative pole of the 24 Vdc power supply (required).	
4	EARTH	Earth connection	
5	NC	Not Connected	
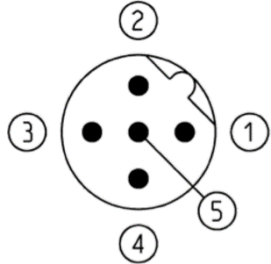
NOTE. To connect the system to the mains it is recommended to use the connectors from the Camozzi catalogue:
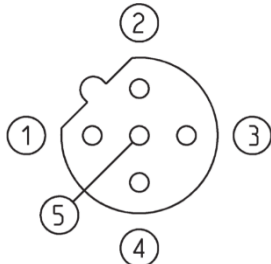
- CS-LF04HB, straight connector for power supply.

5.2.2   Connector to the PROFIBUS/DP network

The connectors for the PROFIBUS/DP network IN are M12B 5-pole male.

Pin	Signal	Description	Symbol
1	NC	Not Connected	
2	A	PROFIBUS/DP channel A	
3	NC	Not Connected	
4	B	PROFIBUS/DP channel B	
5	EARTH	Earth connection	

The connectors for the PROFIBUS/DP network OUT are M12B 5-pole female.

Pin	Signal	Description	Symbol
1	+5V	5 V voltage supplied by the board	
2	A	PROFIBUS/DP channel A	
3	GND5V	Common to the 5 V (reference pin 1)	
4	B	PROFIBUS/DP channel B	
5	EARTH	Earth connection	

N.B. To avoid malfunctions due to faulty wiring, it is recommended to connect the system to the network using the pre-wired PROFIBUS/DP cables from the Camozzi catalogue:

- CS-MF05HC, straight female M12 connector for Bus-IN.
- CS-MM05HC, straight female M12 connector for Bus-OUT.
- CS-MQ05H0, male M12 termination resistor.

5.2.3   USB Connector

The USB communication connector is a standard micro version. The connector allows the CX4 to be connected to the UVIX interface for monitoring or configuration.

NOTE. The dedicated USB connector can be found in the Camozzi catalogue:

- G11W-G12W-2, standard cable with micro-USB connector length 2m.

5.3 Power supply

The power supply is separated into *logic* (L24V), which allows the communication buses, the sub-bases of the pneumatic part and the I/O modules to be powered, and into *power* (P24V), which powers the valves and digital outputs. Therefore, for the system to work, it is essential to connect the *logic* power supply, otherwise the CX4 remains off. The two separate power supplies make it possible, if necessary, to disconnect the power supply to the valves while the bus power line remains active. The lack of *power* supply is signalled by the flashing red SYS island status LED. This problem is also signalled through a message via the network to provide for proper alarm management.

If the loads or inputs connected to the initial node require tighter tolerances of the supply voltage value, the node power supply voltage must respect these.

NOTE. The nominal power supply voltage of the CPU module is 24 Vdc ± 10%.

5.3.1 Voltage drop in the valve island (rules for activating the coils)

In normal standard operation, the coil valves are activated, for 100 ms, with a power of 1 W (@ 24 V the absorbed current is therefore 41.6 mA). Subsequently, the coil valves are kept activated by reducing the absorbed power to 50% of the initial value, by means of a PWM control technique.

The permitted power supply voltage for the series D valve island is 24 Vdc ± 10%, therefore the useful range is 21.6 Vdc ÷ 26.4 Vdc. The currents absorbed by the coil valve coils corresponding to the power supply range are 39 mA ÷ 48 mA (in typical conditions) in the first 100 ms of activation and subsequently 19.5 mA ÷ 24 mA in the power reduction phase due to the use of PWM.

The continuous operation of the valve island is guaranteed for a maximum absorption of 2.5 A.

In the worst conditions (maximum current absorption for 26.4 Vdc power supply) it is possible to activate up to 50 coils simultaneously with all the valves of the island off. Subsequently, it is possible to proceed by using the following formula:

No. of coils to be controlled simultaneously = 50 - (0.6 x No. active coils)

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Example

- *If 10 coils are already active, 44 coils can be activated simultaneously.*
- *If 20 coils are already active, 38 coils can be activated simultaneously.*

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NOTE. The maximum number of simultaneously active coils is 80. Each subsequent activation with respect to the previous group of coils must happen after 150 ms.

5.4 Connectable accessories

Series D pneumatic coil valves or I/O modules can be connected to the CX4 module.

Here is the complete list of devices that can be connected to the CX4, with the respective references to the technical details in the manual.

- Series D sub-bases and coil valves in three different sizes (par. 8.1)
- 8- or 16-channel digital input modules (par. 8.2).
- 8- or 16-channel digital output modules (par. 8.2).
- Analog input modules (par. 8.4):
    - o RTD modules (par. 8.4.4).
    - o Thermocouple modules (par. 8.4.5).
    - o Bridge modules (par. 8.4.6).
    - o Voltage/Current modules (par. 8.4.7).
- Analog output modules (par. 8.5).

5.5 Assembly

5.5.1 Dismantling and fitting CX4 module

Dismantle the CX4 module as follows:

1. Switch off the power supply of the CX4 module to avoid problems for the device or user.
2. Loosen the 5 screws.
3. Pull the cover of the CX4 module carefully and without tilting from the manifold base.

Fit the CX4 module as follows:

1. Switch off the operating voltage supply of the CX4 module to avoid problems for the device or user.
2. Make sure that the gaskets are tight and not damaged.
3. Push the cover of the CX4 module carefully and without tilting as far as possible into the manifold base.
4. Tighten the 5 screws (Torque max 0.6 Nm).

NOTE. After an island modification, the mapping procedure is required (par. 6.3).

5.5.2   Series D subbases assembly

Dismantle and fit the Series D subbases as follows:

1. Switch off the power supply of the CX4 module to avoid problems for the device or user.
2. Unscrew the 3 screws to the cover at the end of the island and open the valves subbases pack.
3. Remove the valves subbases from the tie-rods and replace with the new modules.
4. Push the valves subbases as far as possible to allow a correct electrical contact.
5. Mount the cover at the end of the island and tighten the 3 screws (Torque max 0.9 Nm)
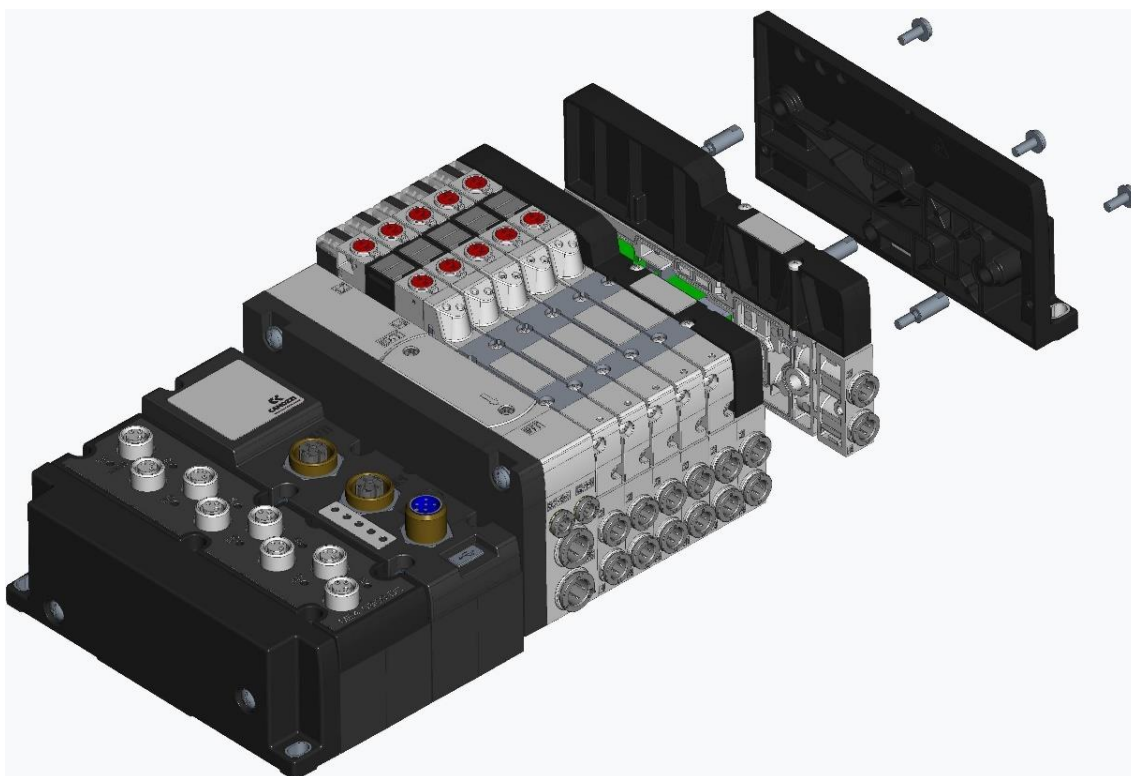
* Example for Series D1 Valve Island.

NOTE. The mapping procedure must be carried out in all those cases in which the I/O modules are added, removed, or moved (par. 6.3).

5.5.3 Dismantling and fitting Serie D coil valves

Dismantle and fit the Serie D coil valves on the same size sub-bases as follows:

1- Unscrew the 2 screws above the Serie D coil valves.
2- Pull the valves carefully and without tilting from the sub-base to avoid damages.
3- Add the new valves carefully and without tilting to the sub-base to avoid damages.
4- Tighten the 2 screws (Torque max 0.25 Nm (D1/D5), 0.5 Nm (D2), 2.0 Nm (D4)).
4. Reset the sub-base information from UVIX interface or controller/PLC.

* Example for Series D1 Valve Island.

5.5.4 I/O modules assembly

Dismantle and fit the I/O modules as follows:

1. Switch off the power supply of the CX4 module to avoid problems for the device or user.
2. Unscrew the 2 screws to the cover at the end of the island and open the I/O pack.
3. Remove the I/O modules from the tie-rods and replace with the new modules.
4. Push the I/O modules as far as possible to allow a correct electrical contact.
5. Mount the cover at the end of the island and tighten the 2 screws (Torque max 0.9 Nm)
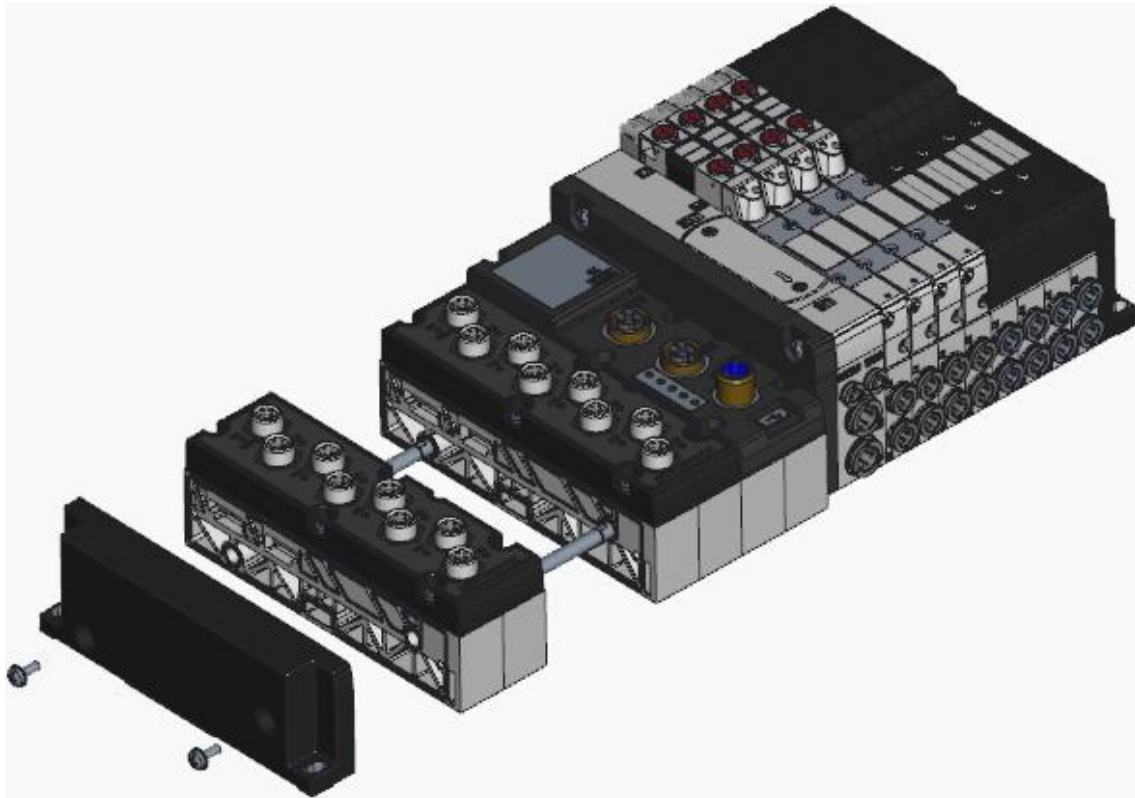
* Example for Series D1 Valve Island.

NOTE. The mapping procedure must be carried out in all those cases in which the I/O modules are added, removed, or moved (par. 6.3).
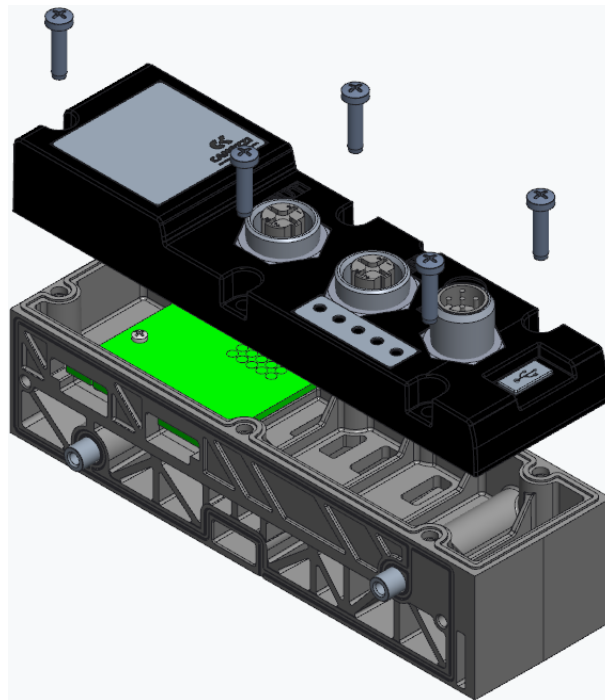
5.5.1   Dismantling and fitting I/O modules

Dismantle the cover of the I/O module as follows:

1. Switch off the power supply of the CX4 module to avoid problems for the device or user.
2. Loosen the 5 screws.
3. Pull the cover of the I/O module carefully and without tilting from the manifold base.

Fit the cover of the I/O module as follows:

1. Switch off the operating voltage supply of the CX4 module to avoid problems for the device or user.
2. Make sure that the gaskets are tight and not damaged.
3. Push the cover of the I/O module carefully and without tilting as far as possible into the manifold base.
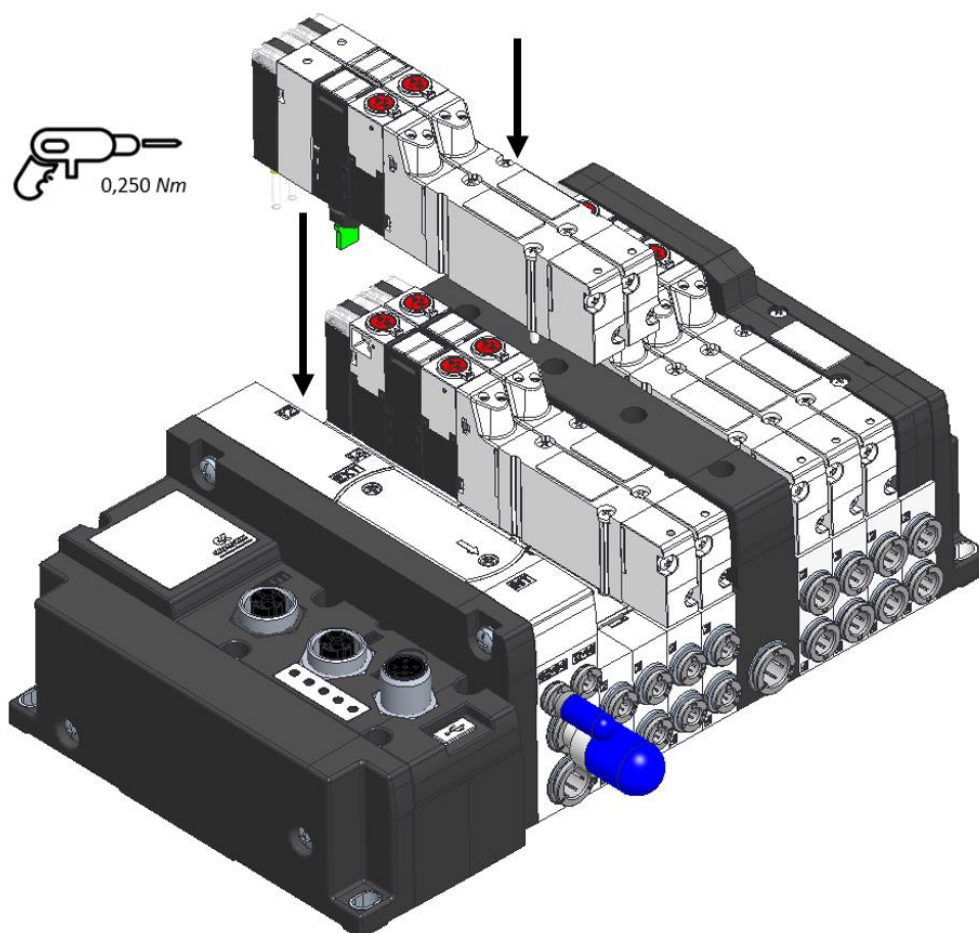4. Tighten the 5 screws (Torque max 0.6 Nm).

NOTE. After an island modification, the mapping procedure is required (par. 6.3).

6   Commissioning

6.1 Electrical connections

The following steps are recommended for the correct electrical connection of the system:

- Connect the IN connector to the PROFIBUS/DP network coming from the controller (or PLC).
- Connect the OUT connector to the next device in the PROFIBUS/DP network. If this connector is not used, close with the appropriate cap to ensure IP65 protection.
- Connect the POWER SUPPLY connector.

NOTE. The dedicated caps for IP65 protection of our connectors (for digital and analogue input/output modules and subnet) can be found in the Camozzi catalogue:

- CS-DFTP, M8 connector cover cap.
- CS-LFTP, M12 connector cover cap.

6.2 Start-up operation

The CX4 module performs a system-wide configuration check at start-up. This is called *mapping*. Specifically, the system configuration is determined by the type and position of the coil valve sub-bases and connected I/O modules. The system mapping is saved in the CX4 module's internal memory. If the mapping has never been stored or the configuration of the system has been modified, a new mapping request must be made (par. 6.3). During the mapping operation, the general diagnostic LEDs of each connected accessory device light up in sequence, first on the coil valve side and then on the I/O module side.

- If the mapping finishes successfully, the CX4 moves on to the next stage. Furthermore, the diagnostic LEDs of each recognized module are switched off.
- If the mapping is not completed correctly, a diagnostic alarm will be triggered (par. 7.1.2) and the CX4 module will not proceed with any other operations.

The second step at system start-up is the configuration of parameters. The CX4 will wait for a maximum of 1 minute for any parameters from the controller/PLC, otherwise the parameters saved in internal memory or the default parameters will be loaded. While waiting for the configuration parameters, the LEDs of the I/O modules flash until this operation is complete (The type of flashing is defined for each individual accessory module in chapter 0).

At the end of this second start-up phase, the system, managed by the CX4 module, switches into normal operation mode and is ready to perform the required operations.

6.3 Mapping procedure

The CX4 module, in CX4 Series serial module or Series D serial valve island configuration, is extremely flexible and its configuration can be modified by removing, replacing or changing the positions of the coil valve sub-bases and/or I/O modules. Each time a change is made, the mapping procedure must be carried again out to correctly configure the entire system. The CX4 module must be aware of the composition of the entire island: number, type and location of coil valve sub-bases and I/O modules.

The mapping operation can be performed with the use of software, by sending a request for new mapping, without having to physically work with the island. A new mapping can be requested in the following ways:

- Camozzi UVIX as Gateway-USB (par. 9.7.3).
- NFCamApp, smartphone app (par. **Error! Reference source not found.**).

NOTE. Once the mapping request has been made, the CX4 module must be restarted.

6.4 PROFIBUS/DP network addressing

In order to communicate with the PROFIBUS/DP DP-Master, each PROFIBUS/DP DP-Slave must be assigned an address *Node id*, i.e. a numerical value between 0 and 126. The CX4 module leaves the factory with address 4 pre-set, and also supports changes to the address using the *Set Station Address* package (if managed by the DP-Master).

Furthermore, a new *Node id* can be set in the following ways:

- Camozzi UVIX as Gateway-USB (par. **Error! Reference source not found.**)
- NFCamApp, smartphone app (par. **Error! Reference source not found.**).

With regard to the *baud rate*, the CX4 automatically adapts to the speed set by the DP-Master; this must be compatible with the baud rates documented in the GSD file.

6.5 Address assignment

The volume of addresses of the Series D valve island in the PROFIBUS/DP network is limited as shown in the table.

Modules	Number of channels	Bytes per single module	Number of modules that can be connected	Assigned address volume	Maximum number of I/Os
Valve sub-bases	2	2 bit per valve	64	16 bytes	128 coils
8-channel digital input modules	8	1 byte	16	16 bytes	128 digital inputs
16-channel digital input modules	16	2 bytes	8	16 bytes	128 digital inputs
8-channel digital output modules	8	1 byte	16	16 bytes	128 digital outputs
16-channel digital output modules	16	2 bytes	8	16 bytes	128 digital outputs
Analogue input modules for RTD	2	4 bytes	8	32 bytes	16 analogue inputs for RTD
Analogue input modules for Thermocouples	2	4 bytes	8	32 bytes	16 analogue inputs for Thermocouples
Analogue input modules for BRIDGE	2	8 bytes	4	32 bytes	8 analogue inputs for BRIDGE
Analogue input modules for Voltage/Current	2	4 bytes	8	32 bytes	16 Analogue inputs for Voltage/Current
Analogue output modules for Voltage/Current	2	4 bytes	8	32 bytes	16 Analogue outputs for Voltage/Current
Diagnostic module			1	1 byte	System error code

NOTE. The total number of 2-byte analogue modules that can be connected per channel (RTD, Voltage/Current, Thermocouples) is 8. For example, you could connect 8 RTDs, or 8 Thermocouples, or 8 Voltage/Currents, or even arbitrary combinations of these types of modules up to a maximum of 8 units.

The PROFIBUS/DP protocol imposes limitations on frame lengths, so the maximum number of modules that can be connected is less than the sum of the values in the second column of the table above. You must consider that each accessory that can be connected to the CX4 (coil valve sub-bases and input/output modules) is assigned a defined number of parameters (application data), and that these are sent from the PLC to the CX4 by means of a special package (*Parameterization Telegram*) which has a data section for transporting all the parameters of a maximum length of 237 bytes.

The bytes per module for parameterization are defined in the following table.

Modules	Parameter size for module	Number of modules that can be connected	Total number of parameterization bytes
Valve sub-bases	4 bits per sub-base	64	32
8-channel digital input modules	4 bytes	16	64
16-channel digital input modules	6 bytes	8	48
8-channel digital output modules	5 bytes	16	80
16-channel digital output modules	9 bytes	8	72
Analogue input modules for RTD	4 bytes	8	32
Analogue input modules for Thermocouples	3 bytes	8	24
Analogue input modules for BRIDGE	4 bytes	4	16
Analogue input modules for Voltage/Current	3 bytes	8	24
Analogue output modules for Voltage/Current	6 bytes	8	48

NOTE. Adding up the bytes in the last column would give you a value that far exceeds the 237-byte limit, so this constraint must be respected when adding modules.

6.6 Configuration via GSDML file

To configure the valve island on the PROFIBUS/DP network, the CAMO1175.GSD file must be imported to the programming software used for the controller. The configuration file describes the characteristics of the PROFIBUS/DP valve island and allows the input/output modules to be configured correctly.

The GSD file can be found on the Camozzi website at:

http://catalogue.camozzi.com/Downloads

6.6.1 Modules defined in the GSD

The following modules can be added in the PLC programming software and will make up the two input and output streams of the cyclic communication. The order presented here is the same as that displayed in the GSD. For their parameterization, see section 6.9.

Module	Description	Identif.	Dimension	Direction
Diagnostics	Diagnostic status	0x10	1 Byte	Input
8 Coils Valve	Valve with 8 coils	0x20	1 Byte	Output
16 Coils Valve	Valve with 16 coils	0x21	2 Bytes	Output
32 Coils Valve	Valve with 32 coils	0x23	4 Bytes	Output
64 Coils Valve	Valve with 64 coils	0x27	8 Bytes	Output
DI8	8-channel digital inputs	0x90	1 Byte	Input
DI16	16-channel digital inputs	0x91	2 Bytes	Input
DO8	8-channel digital outputs	0xA0	1 Byte	Output
DO16	16-channel digital outputs	0xA1	2 Bytes	Output
AI-RTD	Analogue inputs for RTD	0x51	4 Bytes	Input
AI-V/C	Analogue inputs for Voltage/Current	0xD1	4 Bytes	Input
AI-TH	Analogue inputs for Thermocouples	0x40,0x41	4 Bytes	Input
AI-BRG	Analogue inputs for BRIDGE	0x53	8 Bytes	Input
AO-V/C	Analogue outputs for Voltage/Current	0xE1	4 Bytes	Output

For the coil valve modules, different types (8, 16, 32, 64 coil) have been implemented to allow greater flexibility and ease of configuration. The user can insert the coil valve modules in the desired combination of types, respecting the maximum of 128 outputs.

6.6.2 Configuration errors

During I/O configuration, failure to observe the rules listed below will inhibit normal communication between the CX4 and the connected modules. This configuration error is reported in the standard PROFIBUS/DP diagnostics package (DP-V0 standard).

By uploading the supplied GSD to the configuration tool, the following modules are presented by default as an integral part of the CX4:

- The *Diagnostics* module, in the first available slot.
- The *32 Coils Valve* module, in the second available slot.

The *Diagnostics* module, which represents the diagnostic status of the CX4 (see section 7 and following for the values it can take) must always be present, and only in the first slot, i.e. in the first position of the configuration package. Absence or accidental removal will result in a configuration error.

From the second slot onwards, you can insert any of the other modules required, in the desired order and grouping (you don't have to insert the modules in the exact order of their physical positioning), taking into account the constraints mentioned in section 6.5, in terms of both maximum number of modules and maximum size of the parameters. Exceeding these limits will result in a configuration error.

6.7 Variables in read mode

You can use acyclic packages (DP-V1 protocol, see the PLC manufacturer's manual), to retrieve certain information concerning the functioning of the CX4 module; to do so, you have to specify suitable values for the *Slot* and *Index* fields, as indicated in the table.

Description	Slot	Index	Dimension	Value
Firmware version CX4 module	0	1	2 bytes	Byte 0 = Major version Byte 1 = Minor version
Generic variables CX4 module	0	2	5 bytes	Byte 0-1: Power supply [dV]. Byte 2-3: Logic supply [dV]. Byte 4: Temperature [°C]
Valve health status	0	3	1 byte for coil (relative to the sub-bases detected on the bus)	0÷100 %
Valve cycle counter (Sub-bases 1-30)	0	4	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of cycles]
Valve cycle counter (Sub-bases 31-60)	0	5	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of cycles]
Valve cycle counter (Sub-bases 61-64)	0	6	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of cycles]
Valve error counter (Sub-bases 1-30)	0	7	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of errors]
Valve error counter (Sub-bases 31-60)	0	8	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of errors]
Valve error counter (Sub-bases 61-64)	0	9	4 bytes per coil (max 240 bytes)	$0÷2^{32}$ [No. of errors]

6.8 Commands

You can use acyclic packages (DP-V1 protocol - see the PLC manufacturer's manual), to send certain commands to the CX4 module; to do so, you have to specify suitable values for the *Slot* and *Index* fields, as well as a data payload.

Description	Slot	Index	Dimension	Value
Mapping request	0	1	0 byte	
Reset sub-base information	0	2	1 byte	1-64 (ID number of the sub-base to be reset)

6.9 Module parameterization

The module parameters can be configured, on the controller/PLC side, using the *Parameterization Telegram* package (sent by the PLC in the start-up phase).

The parameters are described in the GSD file: the following paragraphs show the configurable parameters for each module that can be connected to the CX4 module.

NOTE. For the application parameters to be effectively implemented, you must ensure the following conditions are met.

- The System Start head parameter must be set to 1.
- The module does not already have to be in operation, as the parameters are only applied in the boot phase.

NOTE. The subbases parameters for Series D valves and I / O modules, which can be connected to the CX4 main module, can also be configured via the UVIX user interface (ch. **Error! Reference source not found.**).

6.9.1 CX4 PROFIBUS/DP module

The following parameters configure some general behaviours of the CX4 module.

The *System Start* allows the CX4 head to work in two alternative modes: if left at the default value (0), all the application parameters described in the following paragraphs, although still transmitted, are ignored by the CX4 module software, which instead will apply the values already stored in its own non-volatile memory; this is because a CX4 module can normally be configured not only with a PLC, but also using UVIX, and because of this we wanted to add the option not to overwrite any pre-existing configuration. If, on the other hand, this parameter is set to 1, any parameterization carried out on the master tool will be applied by the head software at the end of the boot phase.

The *Under Voltage Alarm Severity* parameter specifies a behaviour which only relates to the power supply undervoltage alarm, which can be detected by the CX4 module but also by any digital output modules connected to it. In the default case (1 = fault), the alarm, if detected, is also transmitted as a PROFIBUS/DP diagnostic package, otherwise (0) will only be present in the *Diagnostic State* of the system, i.e. in the first byte of the cyclic image of the input (par. 7.1.2).

Description	Parameter	Dimension	Value
Parameter use mode	System Start	1 bit	1 = parameters set by PLC 0 = internal memory parameters
Severity management of the undervoltage alarm (CX4, Digital outputs)	Under Voltage Alarm Severity	1 bit	1 = fault (maximum severity, alarm sent via PROFIBUS/DP diagnostic) 0 = no Error (the alarm is not sent via PROFIBUS/DP diagnostic)

6.9.2 Series D valve sub-bases

The sub-bases that control the Series D coil valves can be configured both in the management of the failsafe operation and in the management of piloting errors in the coil valves themselves.

Failsafe allows the sub-base, in the absence of communication with the CX4 module, to set the status of the commands that drive the coil valves in order to avoid harmful and dangerous situations for devices or users. The parameters that can be configured are the ability to enable failsafe (*Fail Safe Enable*), which is disabled by default, and the state you want to set the valve coils to (*Fail Safe Status*). By default, the coil is off.

Description	Parameter	Dimension	Value
Fail safe enable	Fail Safe Enable - Coil n	1 bit per coil [n]	Disabled (0) = failsafe not enabled Enabled (1) = failsafe enabled
Fail safe status	Fail Safe Status - Coil n	1 bit per coil [n]	Reset (0) = status not active Set (1) = active status in case of failsafe enabled

6.9.3 Digital inputs

The configuration parameters for the digital input modules make it possible to act on both the input reading logic and on the temporal characteristics of the signals read.

For signal logic, it is possible to choose the polarity of each channel, i.e. the activation mode: each channel can be active high or active low (*Activation Mode*). In the first case, the channel will assume a high logic state in the presence of input voltage and a low logic state in the absence of voltage; in the second case, the reverse will apply.

Regarding the temporal characteristics of the input signals, configuration does not take place on a channel-by-channel basis: the values associated with the parameters in question have an effect on all input channels of the module. In particular, it is possible to specify two parameters: the minimum activation time and the minimum input re-reading period. The first parameter (*Minimum Activation Time*) indicates the amplitude of the minimum time interval in which the input signal to a certain channel must maintain the same state in order for that channel to be associated with the corresponding logical state: the purpose of this procedure is to filter out signals with an unstable level (anti-bounce). The second parameter (*Extension Time*) takes over after the anti-bounce filter has accepted the input value and is described as follows.

- At time t_0 there is a variation in the inputs not filtered by the anti-bounce system.
- At time $t_1 > t_0$ there is a further variation. At this point, two conditions can occur:
  - $t_1 - t_0 \geq$ *Extension Time:* the channel will assume the state determined by the value of input signal at time t_1.
  - $t_1 - t_0 <$ *Extension* Time: the channel is placed in a waiting state for re-reading: at time $t2 = t0 + Extension Time$ the input is forcibly read and if the detected value differs from that acquired at time t_0, the channel assumes the new state, associated with the current signal value. If this not the case (i.e. at time t_2 the input value has returned to the same value as at time t_0), the channel will not detect any change in the signal.

Description	Parameter	Dimension	Value
Polarity of a channel	Activation Mode Channel n	1 bit per channel [n]	High (1) = high active input Low (0) = low active input
Minimum dwell time of the input level (anti-bounce filter)	Minimum Activation Time	1 byte	0 = filter disabled 1÷255 [ms]
Minimum period for re-reading the inputs	Extension Time	2 bytes	0 = filter disabled 1÷1023 [ms]
Power source*	Power Source	1 bit	Internal (0) = power connected to internal source External (1) = power connected to external source

* Parameter configurable only for 16-channel digital inputs.

6.9.4 Digital outputs

The configuration parameters of the digital output modules can be divided into two categories: activation mode and safety management with failsafe.

The parameters belonging to the first category consist of bit masks with different meanings, which are described below.

- *Module settings*: the value of this parameter is used to activate or deactivate individual functions related to the behaviour of the entire module (not the individual channels). Currently, only the least significant bit is set, which enables (1) or disables (0) the detection of no load by the power driver when a channel is activated. If detection is activated and at least one output is activated without the presence of a load, the module detects the fault, which is then signalled by a specific alarm.

- Channel enabling (*Enable output channels*): the single bits that make up the parameter value describe the enabling (1) or disabling (0) of individual output channels. If a non-enabled channel is activated during normal operation, the output driver does not supply voltage to the channel.

- Channel type setting (*Output channels mode*): each bit constituting the parameter value describes how the individual channels are activated. Each channel can be configured to supply type P (1) or type N (0) loads.

Below are the parameters involved in the second category: here too, the values represent bit masks with different meanings in each case.

- Enabling the failsafe (*Fail safe enable*): the bits that make up the parameter value describe whether the failsafe is enabled (1) or disabled (0) on the relevant channel. The purpose is to ensure that the outputs assume a certain state if a communication alarm occurs: in the presence of such a fault, the channels with failsafe enabled will assume the value prescribed by the failsafe status parameter, while those with failsafe disabled will maintain the state they had at the time the communication alarm occurred.

- Failsafe status (*Fail safe status*): the bit mask representing the value of this parameter describes the status of the channels for which failsafe is enabled, should a communication alarm occur. In particular: 1 indicates that the corresponding channel should be activated, 0 that the corresponding channel should be deactivated.

Description	Parameter	Dimension	Value
Open Load Detection	Open Load Alarm Detection	1 byte	Bit 0 = Open Load Detection (1 = Enabled, 0 = Disabled) Remaining Bits = t.b.d.
Enable channels	Enable Output Channel n	1 bit per channel [n]	Disabled (0) = channel disabled Enabled (1) = channel enabled
Channel Type Setting (N/P)	Mode Output Channel n	1 bit per channel [n]	Mode N (0) = type N channel Mode P (1) = type P channel
Fail safe enable	Fail Safe Enable Channel n	1 bit per channel [n]	Disabled (0) = fs not enabled Enabled (1) = fs enabled on channel
Fail safe status	Fail Safe Status Channel n	1 bit per channel [n]	Reset (0) = status not active on channel Set (1) = active status on channel in case of fs enabled

6.9.5   Analogue inputs

The configurable parameters are the type of inputs, the transmission parameters and the filters to be applied to the inputs.

6.9.5.1   Input configuration

Each input must be appropriately configured, depending on the type of module used. For example, in the case of an RTD module, we could decide to have the following configuration:

- Channel 1: 4-wire PT100
- Channel 2: 2-wire PT1000

Or, for a Thermocouple module, the following configuration may be required:

- Channel 1: Type K thermocouple
- Channel 2: disabled

For a detailed description of the input configuration for the different analogue inputs, refer to the following paragraphs.

6.9.5.2   Transmission parameters configuration

The modules can transmit data to the head in two different ways: in frequency and threshold.

When the transmission is configured in frequency (*Sampling Threshold* and *Sampling Threshold Timeout* parameters disabled), it is possible to set a transmission frequency (*Sampling Rate*) with which the module regularly transmits the acquired data to the head.

NOTE. This parameter has nothing to do with the sampling frequency of the module inputs, which is fixed. To find out this frequency, refer to the Technical Data tables in this manual (par. 0).

When the transmission is configured as threshold (*Sampling Threshold* parameter other than zero), the module transmits the data to the head only if the current value is higher than the previous value of that set as threshold. If the input does not undergo changes beyond the threshold, the module still transmits the data when the timeout expires (*Sampling Threshold Timeout*). In the case of threshold operation, the *Sampling Frequency* parameter can be used to impose a limit on the frequency variation of the signal with respect to the threshold. In this way it is possible to reduce the shared bus occupation by the modules.

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Example

Let's consider an RTD module with both channels enabled and with the following transmission configuration:

- *Sampling Frequency: 5 Hz*
- *Sampling Threshold: disabled*
- *Sampling Threshold Timeout: disabled*

the module sends the data acquired by the inputs and the related diagnostics to the PLC every 200 milliseconds.

If the configuration were instead:

- *Sampling Frequency: 1 Hz*
- *Sampling Threshold: 0.2°C*
- *Sampling Threshold Timeout: 5 seconds*

The module transmits the data acquired by the inputs and the related diagnostics to the PLC in the following cases:

- *If the temperature measurement at the current time of either input exceeds the previous one by at least 0.2° C.*
- *If there is no temperature variation beyond the threshold for more than 5 seconds.*

In the first case, if the temperature variation frequency with respect to the threshold were higher than 1 Hz, the transmission would be limited to 1 Hz.

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6.9.5.3   Filter configuration

Each input is equipped with a digital moving average filter. The maximum length of the filter impulse response is 128 samples. In the default configuration the filters are disabled.

NOTE. Filters can only be configured using the UVIX system.

6.9.5.4   Analogue inputs - RTD

Description	Parameter	Dimension	Value
RTD sensor type Channel 1	Sensor Type Channel 1	4 bits	0000 = not connected 0001 = PT100 (385) 0010 = PT200 (385) 0011 = PT500 (385)
RTD sensor type Channel 2	Sensor Type Channel 2	4 bits	0100 = PT1000 (385) 0101 = Ni100 (618) 0110 = Ni120 (672) 0111 = Ni1000 (618) 1000 = PT100 (3926)
RTD number of wires Channel 1	Sensor Wires Channel 1	2 bits	0= 2 wires
RTD number of wires Channel 2	Sensor Wires Channel 2	2 bits	1= 3 wires 2= 4 wires
Board transmission threshold in relative units 1 U = 0.1 °C	Sampling Threshold	4 bits	0000 = disabled 0001 = 1 U (**0.1 °C**) 0010 = 2 U 0011 = 3 U 0100 = 4 U 0101 = 5 U 0110 = 10 U 0111 = 20 U 1000 = 30 U 1001 = 40 U 1010 = 80 U 1011 = 100 U 1100 = 160 U 1101 = 500 U 1110 = 1000 U 1111 = 2000 U
Threshold transmission timeout	Sampling Timeout	4 bits	1- 15 s
Transmission frequency to the master (timed mode) or upper frequency limit (threshold mode)	Sampling Frequency	4 bits	0000 = disabled 0001 = 1 Hz 0010 = 2 Hz 0011 = 5 Hz 0100 = 10 Hz 0101 = 25 Hz 0110 = 50 Hz 0111 = 100 Hz 1000 = 250 Hz 1001 = 500 Hz 1010 = 1000 Hz

6.9.5.5 Analogue inputs - Thermocouples

Description	Parameter	Dimension	Value
Sensor type TC Channel 1	Sensor Type Channel 1	4 bits	0000 = not connected 0001 = B 0010 = E 0011 = J
Sensor type TC Channel 2	Sensor Type Channel 2	4 bits	0100 = K 0101 = N 0110 = R 0111 = S 1000 = T
Board transmission threshold in relative units 1 U = 0.1 °C	Sampling Threshold	4 bits	0000 = disabled 0001 = 1 U (**0.1 °C**) 0010 = 2 U 0011 = 3 U 0100 = 4 U 0101 = 5 U 0110 = 10 U 0111 = 20 U 1000 = 30 U 1001 = 40 U 1010 = 80 U 1011 = 100 U 1100 = 160 U 1101 = 500 U 1110 = 1000 U 1111 = 2000 U
Threshold transmission timeout	Sampling Timeout	4 bits	1- 15 s
Transmission frequency to the master (timed mode) or upper frequency limit (threshold mode)	Sampling Frequency	4 bits	0000 = disabled 0001 = 1 Hz 0010 = 2 Hz 0011 = 5 Hz 0100 = 10 Hz 0101 = 25 Hz 0110 = 50 Hz 0111 = 100 Hz 1000 = 250 Hz 1001 = 500 Hz 1010 = 1000 Hz

6.9.5.6 Analogue inputs - Bridge

Description	Parameter	Dimension	Value
Bridge Factor Channel 1 (Value in mV/Vdc)	Bridge Factor Channel 1	1 byte	0 = not connected 1-255 mV/Vdc
Bridge Factor Channel 2 (Value in mV/Vdc)	Bridge Factor Channel 2	1 byte	
Board transmission threshold in relative units 1 U = **1 uV**	Sampling Threshold Bridge	4 bits	0000 = disabled 0001 = 1 U (1 uV) 0010 = 2 U (2 uV) 0011 = 3 U 0100 = 4 U 0101 = 5 U 0110 = 10 U 0111 = 20 U 1000 = 30 U 1001 = 40 U 1010 = 80 U 1011 = 100 U 1100 = 160 U 1101 = 500 U 1110 = 1000 U 1111 = 2000 U
Threshold transmission timeout	Sampling Timeout	4 bits	1- 15 s
Transmission frequency to the master (timed mode) or upper frequency limit (threshold mode)	Sampling Frequency	4 bits	0000 = disabled 0001 = 1 Hz 0010 = 2 Hz 0011 = 5 Hz 0100 = 10 Hz 0101 = 25 Hz 0110 = 50 Hz 0111 = 100 Hz 1000 = 250 Hz 1001 = 500 Hz 1010 = 1000 Hz

6.9.5.7   Analogue inputs - Voltage/Current

Description	Parameter	Dimension	Value
Input type V/C Channel 1	Sensor Type Channel 1	3 bits	000 = not connected 001 = 0...10 V 010 = -10...+10 V
Input type V/C Channel 2	Sensor Type Channel 2	3 bits	011 = 4...20 mA 100 = 0...20 mA 101 = -20...+20 mA
Board transmission threshold in relative units 1 U = **1 mV or 1 uA**	Sampling Threshold	4 bits	0000 = disabled 0001 = 1U 0010 = 2U 0011 = 3U 0100 = 4U 0101 = 5U 0110 = 10U 0111 = 20U 1000 = 30U 1001 = 40U 1010 = 80U 1011 = 100U 1100 = 160U 1101 = 500 U 1110 = 1000 U 1111 = 2000 U
Threshold transmission timeout	Sampling Timeout	4 bits	1- 15 s
Transmission frequency to the master (timed mode) or upper frequency limit (threshold mode)	Sampling Frequency	4 bits	0000 = disabled 0001 = 1 Hz 0010 = 2 Hz 0011 = 5 Hz 0100 = 10 Hz 0101 = 25 Hz 0110 = 50 Hz 0111 = 100 Hz 1000 = 250 Hz 1001 = 500 Hz 1010 = 1000 Hz

6.9.6 Analogue outputs

The configurable parameters are the type of outputs and the **safety management with failsafe**. In fact, each output must be suitably configured as a voltage or current channel. In case of loss of communication with the PLC, it is also possible to assign default values, both in voltage and in current, to the analogue outputs (failsafe). In particular, for each channel you can:

- assign the value it had before the communication failure (failsafe disabled).
- Assign a desired value, configurable in the master configuration tool (failsafe enabled).

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Example

Considering an analogue outputs module with both channels enabled in voltage and failsafe enabled only on the second channel. In this case, the parameters configuration is as follows:

- *Channel Configuration Channel 1: 1 (0 ÷ 10 V)*
- *Channel Configuration Channel 2: 2 (0 ÷ 5 V)*
- *Fail Safe Enable Channel 1: 0*
- *Fail Safe Enable Channel 2: 1*
- *Fail Safe Value Channel 1: 0*
- *Fail Safe Value Channel 2: 3500*
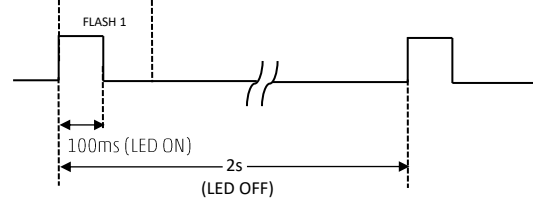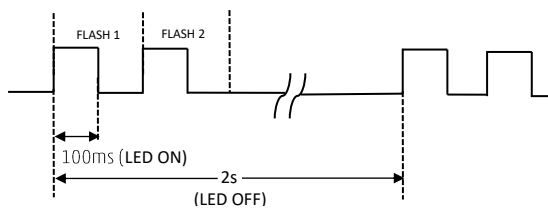
In case of loss of communication with the PLC, the value of channel 1 is equal to the last data received from the PLC before the failure, while on channel 2 the value of 3500 mV is set as a consequence of enabling the failsafe and setting the failsafe value.

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Description	Parameter	Dimension	Value
Output type V/C Channels 1-2	Configuration Channel 1-2	1 byte	0 = disabled 1 = 0÷10 V 2 = 0÷5 V 3 = 4÷20 mA 4 = 0÷20 mA
Enable failsafe Channel 1-2	Fail Safe Enable Channel 1-2	1 byte	0 = disabled 1 = channel enabled
Failsafe value Channel 1	Fail Safe Value Channel 1	2 bytes	In mV/uA: 0÷10000 if channel 0÷10 V 0÷5000 if channel 0÷5 V 4000÷20000 if channel 4÷20 mA 0÷20000 if channel 0÷20 mA
Failsafe value Channel 2	Fail Safe Value Channel 2	2 bytes	

7 Diagnostics

The diagnostics of the CX4 PROFIBUS/DP module, in Stand Alone configuration or as a Series D Serial valve island, is defined in three different ways.

- The status of the LEDs on the CX4 or on the individual modules connected to it (see details in the chapter 0). The following table provides the typical behaviour of the LEDs on our modules. The colour of the LEDs can be different for each module (the table refers to a red LED).

Symbol	Led status	Description
◯	RED OFF	Led is OFF
●	RED ON	Led is ON
☀	FLASHING	The led flashes with a specified sequence for each diagnostic state: @XX [ms/Hz] every YY [s] ■ XX is the ON time of a led flashing. The flashing sequence is represented by an ON state and an OFF state of the same time. ■ YY is the time of the repeated flashing sequence. **Example**: 1 flash @100 ms every 2 s FLASH 1 100ms (LED ON) 2s (LED OFF) **Example**: 2 flashes @100 ms every 2 s FLASH 1 FLASH 2 100ms (**LED ON**) 2s (**LED OFF**)

- Software messages are routed over the PROFIBUS/DP network.
- The UVIX user interface (ch. **Error! Reference source not found.**).

7.1 CX4 PROFIBUS/DP module

7.1.1 PROFIBUS/DP node

Diagnostics of the PROFIBUS/DP node are defined by the status of the BF (Bus Failure) LED dedicated to the PROFIBUS/DP network.

PROFIBUS/DP LED	Description
🟢 GREEN ON	RUN, cyclic communication.
🔴 RED ON	Incorrect configuration on the DP master.
🔴☀ Flashing cyclic RED	STOP, no communication, connection error.
🔴☀ Flashing cyclic RED	Not configured.

The CX4 can also send alarms to the DP-Master by means of messages with customized format, exploiting one of the possibilities offered by the DP-V1 diagnostic model.

In fact, we can distinguish between standard DP-V0 diagnostics, a 6-byte packet present within the cyclic communication of any DP-Slave device, and extended diagnostics, of variable length depending on the number of active alarms, which can be appended to the standard message. and which contains a "custom" code of the anomalies detected by the CX4 module during its operation.

The DP-V0 standard diagnostics is described by the official PROFIBUS/DP documentation.

Extended diagnostics are based on the DP-V1 "Extended Status" message standard; it provides that for each active alarm there are N bytes of which the first 4 are mandatory, and the remaining freely usable, for a maximum size of 63 bytes.

In the coding of the CX4 status message, therefore in the DP-V1 "Extended Status" package, we have provided 6 fixed bytes for each active alarm, 4 standard and 2 additional extra bytes whose meaning is as follows.

	Byte	Value	Description
Standard DP-V1	0	0x06	Header: indicates the length of the packet, including the first byte
	1	0x81	Status Type: "Status Report"
	2	>=0	Slot Number 0: CX4 module >0: module position within the configuration package
	3	0	Status Specifier
Extra	4	>=0	ID channel within the form ("Extra Info PROFIBUS/DP" column in the following paragraphs) 0: CX4 module
	5	>0	CX4 error code ("PROFIBUS/DP messages" column in the following paragraphs)

The Slot Number (Byte 2) uniquely identifies the module by expressing its position within the configuration package.

The following paragraphs indicate the operation of the SYS LED (island status LED) and the PROFIBUS/DP message codes (Byte 4 and Byte 5 of the previous table) that manage the diagnostics of the entire system; the information is divided into the various modules allowed.

7.1.2 CX4 system diagnostics

CX4 system diagnostics is managed by the SYS diagnostic LED, by messages transmitted to the controller/PLC defined in the PROFIBUS/DP protocol and by the display on the UVIX interface.

Module status and alarms	SYS LED	PROFIBUS/DP messages			UVIX
		Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Normal operation	1 flash GRREN @100 ms every 1 s	0x00			
I/O modules absent	1 flash GRREN @100 ms every 1 s	0x01			I/O modules absent
Valves absent	1 flash GRREN @100 ms every 1 s	0x02			Valves absent
Valves substitution	1 flash GRREN @100 ms every 1 s	0x03			Valve Subbase Substitution
Fieldbus fatal error	(Alternated flashing) 1 flash GREEN @400 ms every 0.5 s 1 flash RED @400 ms every 0.5 s	0xF0			Fieldbus fatal error

Module status and alarms	SYS LED	PROFIBUS/DP messages			UVIX
		Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Overheating CX4 module	RED ON	0xFB	3 (0x03)	0x00	Overheating CX4 module
Undervoltage CX4 module	RED ON	0xFC	4 (0x04)	0x00	Undervoltage CX4 module
Alarm of mapping I/O modules error	2 flashes RED @100 ms every 1 s	0xFD	5 (0x05)	0x00	Mapping I/O modules error
Alarm of mapping valves error	2 flashes RED @100 ms every 1 s	0xFE	2 (0x02)	0x00	Mapping valves error
Alarm of mapping absent	1 flash RED @100 ms every 1 s	0xFF	1 (0x01)	0x00	Mapping absent
Alarms of valve errors or I / O module errors	3 flashes RED @100 ms every 1 s	**NB.** The diagnostic states and PROFIBUS/DP codes are specified for each single module in the following tables.			

7.1.3 CX4 module diagnostic solutions

7.1.3.1 Replace solenoid valve

This warning indicates that the optimal performance of at least one solenoid valve has deteriorated and is no longer guaranteed.

Solution: replace the deteriorated solenoid valve.

N.B. To find out which solenoid valves on the island are in these conditions, you need to connect to the Camozzi user interface (UVIX) and check the health status of the individual solenoid valves (par. 9.2.2.1).

7.1.3.2 Fieldbus fatal error

This alarm can occur for two reasons.

- The fieldbus has been programmed incorrectly and the board has no MAC address.
- The fieldbus version loaded on the board is incorrect.

Solution: reprogram the board with the correct firmware (par. **Error! Reference source not found.Error! Reference source not found.**). If the problem persists, contact Camozzi support.

7.1.3.3 Over-temperature alarm

The CX4 module has reached or exceeded the limit temperature over which the normal operation of the device is not guaranteed and, if the condition persists, this can lead to the failure of a component on the board.

Solution: restart the island; if the problem persists, contact Camozzi support.

7.1.3.4 Undervoltage alarm

The CX4 module is powered with a voltage lower than the minimum acceptable value; therefore, correct operation of the system is not guaranteed.

Solution: check that the wiring is correct and that the wires are properly inserted into the connector. Check that the logic supply (pins 1 and 3) and power supply (pins 2 and 5) are physically present on the connector. If the problem persists, contact Camozzi support.

7.1.3.5 Alarm - I/O module mapping error

During the mapping phase (par. **Error! Reference source not found.**), an error has occurred on the I/O modules. The mapping has failed at the first I/O module with the diagnostic LED off.

Solution: repeat the mapping procedure and replace where necessary the I/O module where the mapping ends (first I/O module with diagnostic LED off). If the problem persists, contact Camozzi support.

7.1.3.6 Alarm - Solenoid valve mapping error

During the mapping phase (par. **Error! Reference source not found.**), a solenoid valve error has occurred on the sub-base. The mapping has failed at the first sub-base with the diagnostic LED off.

Solution: repeat the mapping procedure and replace where necessary the sub-base where the mapping ends (first sub-base with diagnostic LED off). If the problem persists, contact Camozzi support.

7.1.3.7 Alarm - *No mapping*

After requesting a new system mapping (par. **Error! Reference source not found.**), an error has occurred both on the I/O modules and on the solenoid valve sub-bases. The mapping ends at the first accessory module (I/O module or sub-base) with the diagnostic LED off.

Solution: repeat the mapping procedure and replace where necessary the sub-base where the mapping ends (first accessory module with diagnostic LED off). If the problem persists, contact Camozzi support.

7.1.3.8 *Solenoid valve or I/O module alarms*

These alarms are specific for each individual accessory module. The UVIX and PROFINET/IO messages are specified in the following tables, while the diagnostics via LEDs - found on each individual module - and the specific solutions are detailed in the accessories section (cap. **Error! Reference source not found.**).

7.2 Series D valve sub-bases

The following table shows the diagnostic status of the Series D coil valves, with the respective PROFIBUS/DP messages and the display on the UVIX interface. The coil valves display a diagnostic signal through LED signalling directly on the sub-base where they are mounted. For details regarding LED diagnostics and possible solutions to any alarms, refer to the Accessories chapter (par. 0).

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Configuration parameters	0xE6	29 (0x1D)	Absolute progressive of the first coil (1-128) of the sub-base. The number of the sub-base in error is: (Id coil+1)/2	
Overheating subbase	0xE8	28 (0x1C)	Absolute progressive of the first coil (1-128) of the sub-base. The number of the sub-base in error is: (Id coil +1)/2	Overheating subbase
Overheating coil (Position 14/12)	0xE9	26 (0x1A)	Absolute progressive of the coil (1-128)	Overheating coil 14/12
Overcurrent coil (Position 14/12)	0xEA	25 (0x19)	Absolute progressive of the coil (1-128)	Overcurrent coil 14/12
Interrupted coil (Position 14/12)	0xEB	24 (0x18)	Absolute progressive of the coil (1-128)	Interrupted coil 14/12
Fault coil (Position 14/12)	0xEC	23 (0x17)	Absolute progressive of the coil (1-128)	Fault coil 14/12
Communication alarm	0xEF	20 (0x14)	Absolute progressive of the first coil (1-128) of the sub-base. The number of the sub-base in error is: (Id coil +1)/2	Communication alarm

7.3 Digital Input Modules

The following table shows the diagnostic statuses of the digital inputs, with the respective PROFIBUS/DP messages and the display on the UVIX interface. The digital inputs also display a diagnostic signal via LED signalling directly on the module. Details on LED diagnostics and possible solutions to any alarms can be found in the chapter Accessories (par. 8.2.5).

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Short circuit on the channel n	0xDD	30 (0x1E)	Bit mask c.c. ID of the channels group where the short circuit is occurred. Bit0: channel group 0-3 Bit1: channel group 4-7 Bit2: channel group 8-11 Bit3: channel group 12-15	Short circuit Group 0-3 Short circuit Group 4-7 Short circuit Group 8-11 Short circuit Group 12-15
Configuration parameters alarm	0xDE	32 (0x20)	0x00	Configuration alarm
Communication alarm	0xDF	31 (0x1F)	0x00	Communication alarm

7.4 Digital Output Modules

The following table shows the diagnostic statuses of the digital outputs, with the respective PROFIBUS/DP messages and the display on the UVIX interface. The digital outputs display a diagnostic signal via LED signalling directly on the module. Details on LED diagnostics and possible solutions to any alarms can be found in the chapter Accessories (par. 8.3.4).

NOTE. 16-channel digital output modules require an external power supply.

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Short circuit on the channel n	0xCA	50 (0x32)	ID channel (1-8)	Short Circuit Channel n
Open circuit on the channel n	0xCB	51 (0x33)	ID channel (1-8)	Open Load Channel n
Undervoltage power line	0xCC	52 (0x34)	Bit mask of the module alarms: Bit0: Zero V. Power Line Bit1: Under V. Power Line	Under Voltage Power Supply
No external power line	0xCD	53 (0x35)	Bit mask of the module alarms: Bit0: Zero V. Power Line Bit1: Under V. Power Line	Zero Voltage Power Supply
Configuration parameters alarm	0xCE	55 (0x37)	0x00	Configuration alarm
Communication alarm	0xCF	54 (0x36)	0x00	Communication alarm

* Power supply alarms refer to the external power supply for 16-channel modules.

7.5 Analogue Input Modules

7.5.1 Data format

Each channel restores the conversion of the corresponding input into a 16-bit or 32-bit word. The datum is represented in 2's complement and, depending on the module, corresponds to different values.

Module	Word transmitted	Data format	Size
RTD	16 bit	16 bit, 2's complement	°C/10
THERMOCOUPLES	16 bit	16 bit, 2's complement	°C/10
BRIDGE	32 bit	24 bit, 2's complement	uV
VOLTAGE/CURRENT	16 bit	16 bit, 2's complement	mV, uA

Each channel is also associated with a diagnostics byte which reports the errors indicated in the diagnostic. In case of correct operation, the diagnostics byte is equal to 0. Otherwise, it is possible to analyse the error by referring to the paragraph on the field bus.

If the diagnostics byte is different from 0, the bridge module will send data equal to 0x7FFFFF while all the others will transmit the value 0x7FFF.

The data format used by the CX4 for communication with the PLC is of the *little endian* type for the PROFIBUS/DP protocol.

— —

Example

In the "little endian" format, the least significant byte (LSB) is sent first. For example, the value 100000 uV (0x186A0) received from a BRIDGE module will be sent as follows:

	LSB	*MID*	*MSB*
Address	*0x00*	*0x01*	*0x02*
Datum	*0xA0*	*0x86*	*0x01*

— —

7.5.2 Diagnostic messages

The following table shows the diagnostic statuses of the analogue inputs, with the respective PROFIBUS/DP messages and the display on the UVIX interface. The analogue inputs display a diagnostic signal via LED signalling directly on the module. Details regarding LED diagnostics and possible solutions to any alarms can be found in the chapter Accessories (par. 8.4.3).

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	PROFIBUS/DP Code (Byte 5 Extended Diagnostic)	Extra Info PROFIBUS/DP (Byte 4 Extended Diagnostic)	
Sensor fault on channel 1	0xB6	40 (0x28)	**ID channel = 1**	Sensor fault channel 1
Missing bridge on channel 1	0xB7	41 (0x29)	**ID channel = 1**	Missing bridge channel 1
ADC communication alarm	0xB8	42 (0x2A)	0x00	ADC communication error
Alarm on the voltage reference 3.3V	0xB9	43 (0x2B)	0x00	RESDCDC error
Sensor fault on channel 2	0xBA	40 (0x28)	**ID channel = 2**	Sensor fault channel 2
Missing bridge on channel 2	0xBB	41 (0x29)	**ID channel = 2**	Missing bridge channel 1
Configuration parameters alarm	0xBE	45 (0x2D)	0x00	Configuration alarm
Communication alarm	0xBF	44 (0x2C)	0x00	Communication alarm

7.6 Analogue Output Modules

7.6.1 Data format

Each channel restores the conversion of the corresponding input into a 16-bit.

Module	Word transmitted	Data format	Size
VOLTAGE/CURRENT	16 bit	16 bit, 2's complement	mV, uA

The data format used by the CX4 for communication with the PLC is of the *little endian* type for the PROFIBUS/DP protocol.

- -

Example

In the "little endian" format, the least significant byte (LSB) is sent first. For example, the value 5000 mV (0x1388) received from a V/C module will be sent as follows:

	LSB	*MSB*
Data	*0x88*	*0x13*

- -

7.6.2 Diagnostic messages

The following table shows the diagnostic statuses of the analogue outputs, with the respective PROFIBUS/DP messages and the display on the UVIX interface. The analogue outputs display a diagnostic signal via LED signalling directly on the module. Details regarding LED diagnostics and possible solutions to any alarms can be found in the chapter Accessories (par. **Error! Reference source not found.**).

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	Diagnostic Status (Byte 0 stream IN)	Diagnostic Status (Byte 0 stream IN)	
Internal error	0xA9	66 (0x42)	0x00	Internal Error
Open circuit on the channel n	0xAA	60 (0x3C)	Id channel (1-2)	Channel n Open Load
Over Heating	0xAB	61 (0x3D)	0x00	Board Over Heating
Power Supply Short Circuit	0xAC	62 (0x3E)	0x00	Power Supply Short Circuit

Module status and alarms	PROFIBUS/DP messages			UVIX
	Diagnostic Status (Byte 0 stream IN)	Diagnostic Status (Byte 0 stream IN)	Diagnostic Status (Byte 0 stream IN)	
Power Supply Under Voltage	0xAD	63 (0x3F)	0x00	Power Supply Under Threshold
Configuration parameters alarm	0xAE	65 (0x41)	0x00	Configuration alarm
Communication alarm	0xAF	64 (0x40)	0x00	Communication alarm

8 Accessories

8.1 Series D valve sub-bases

The CX4 can be used to create a Series D Serial valve island by connecting the sub-bases on the pneumatic side to allow the new Camozzi Series D coil valves to be connected.

Series D valves are available in three sizes depending on the pitch:

- Series D1 coil valves, 10.5 mm pitch
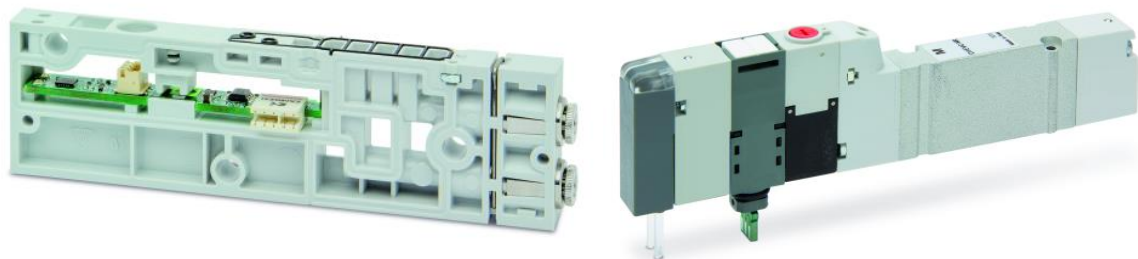
- Series D2 coil valves, 16 mm pitch

- Series D4 coil valves, 25 mm pitch

8.1.1 Technical Data

Key feature	Value
Construction	Balanced spool
Valve functions	2x3/2 NC/NO/NC+NO; 5/2; 5/3 CC/CO/CP
Materials	body, spool= AL; bases, end cover = technopolymer; bases = AL only D4; seals = HNBR
Attachments	Variable Bushings Ø (D1-D2-D5) Thread G3/8 (D4)
Ambient temperature	0÷50 °C
Fluid	• Compressed air filtered and not lubricated in class 7.4.4 according to ISO 8573-1: 2010. • If lubrication is required, use only oils with max. viscosity. 32 Cst and the version with external servo drive. • The servo drive air quality must be in class 7.4.4 according to ISO 8573-1:2010.
Voltage	24 Vdc
Voltage tolerance	± 10%
Absorption	1 W
Insulation class	class F

8.1.2 Coilvision

The sub-bases of Series D valves are equipped with **COILVISION** technology. This technology was developed to constantly monitor the functional parameters of the coil that drives the spool. Each actuation of the coil, in different cyclic configurations and environmental conditions, is analysed to acquire information which, when processed by software algorithms, allows the health of the component to be diagnosed and predicted.

The information on the health status of the solenoid valve is data supplied by the CX4 module to the PLC and via the UVIX browser interface in the form of a percentage and gauge indicator (par. 9.2.2.1). Via UVIX, you can also receive a replace solenoid valve warning when its performance has deteriorated (par. 9.2.2.2).

8.1.3 Sub-base diagnostics

The diagnostics of the sub-bases for the coil valves are defined by coded flashing of the yellow LED associated with the single coil (the sub-base D4 is associated to two yellow LEDs with the same behaviour for each single coil).

Module status and alarms	LED status	Description of the status and solutions of the alarms
Normal operation without alarms	⚪ YELLOW OFF	The valve is not controlled.
	🟡 YELLOW ON	The valve has been operated correctly.
Fault coil (Position 14/12)	☀️ 1 flash YELLOW @100 ms every 1 s	The coil did not energise properly. **Solution**: the alarm is not blocking, so try operating the coil valve again. If the problem persists, replace the coil valve.
Interrupted coil (Position 14/12)	☀️ 2 flashes YELLOW @100 ms every 1 s	The coil is interrupted or missing. This alarm may be blocking (if configured as such) and therefore the island must be restarted. **Solution**: replace the coil valve.
Overcurrent coil (Position 14/12)	☀️ 3 flashes YELLOW @100 ms every 1 s	The current consumption of the coil is excessive and therefore the coil valve is automatically switched off. **Solution**: replace the coil valve.
Overheating coil (Position 14/12)	☀️ 3 flashes YELLOW @100 ms every 1 s	The coil temperature is too high. This alarm may be blocking (if configured as such) and therefore the island must be restarted. **Solution**: remove the ON control on the coil valve and allow the coil to cool down. If the problem persists, replace the coil valve.
Overheating subbase	☀️ 5 flashes YELLOW @100 ms every 1 s	The sub-base electronics temperature is too high. **Solution**: switch off the island and let the device cool down. If the problem persists, contact support and replace the sub-base.

NOTE. The interrupted coil and overcurrent alarms can block operation (configurable feature) and can only be reset by restarting the entire system.

8.2 Digital Input Modules

8.2.1 General operation

The digital input module allows 8 or 16 digital signals to be monitored. 2-wire or 3-wire digital sensors can be connected, with the option of powering the sensors directly through the module (24 V power supply).

After being connected to the CX4 module, the digital input module must be mapped from the island (par. 6.3). If the mapping procedure ends successfully, the digital input module waits to receive the configuration parameters from the CX4 module (maximum wait 1 minute). Upon receipt of these parameters, the module enters the normal operating state and the digital inputs can be read. Otherwise, if the mapping procedure is not completed successfully, the module remains in an error state, deactivating any operational function.

There is a dedicated diagnostic LED for each input, although the LED of the first channel is used for general diagnostics. (par. 8.2.5).

8.2.2 Connections and signals of the 8 digital input modules (M8 version)

Dual function LED
1.Yellow for signalling input 1 status
2.Red for signalling module diagnostics — Input 1 connector

Input 2 connector — Input 2 status yellow LED

Input 3 status yellow LED — Input 3 connector

Input 4 connector — Input 4 status yellow LED

Input 5 status yellow LED — Input 5 connector

Input 6 connector — Input 6 status yellow LED

Input 7 status yellow LED — Input 7 connector

Input 8 connector — Input 8 yellow LED

8.2.2.1 M8 connectors pinout

Pin	Signal	Description	Symbol
1	VCC	24 Vdc power supply supplied by the module to outside	
3	GND	Reference	4 / 3 1
4	Input	Input (max 100 mA for each input)	

NOTE. For the digital input modules, the M8 3-pole male connector for wiring is available in the Camozzi catalogue (cod. CS-DM03HB

8.2.3 Connections and signals of the 8 digital input modules (M12 version)

Inputs 1 and 2 connector

Dual function LED
1.Yellow for signalling input 1 status
2.Red for signalling module diagnostics

Input 2 status yellow LED

Inputs 3 and 4 connector

Input 3 status yellow LED

Input 4 status yellow LED

Inputs 5 and 6 connector

Input 6 status yellow LED

Input 5 status yellow LED

Inputs 7 and 8 connector

Input 7 status yellow LED

Input 8 yellow LED

8.2.3.1 M12 connectors pinout

Pin	Signal	Description	Symbol
1	VCC	24 Vdc power supply supplied by the module to outside	
2	Input n+1	Input n+1 (max 100 mA for each input)	
3	GND	Reference	
4	Input n	Input n (max 100 mA for each input)	

NOTE. For the digital input modules, the M12 5-pole male connector for wiring (DUO version, with two possible cables to wire) is available in the Camozzi catalogue (code CS-LD05HF). Also, the M12 5-pole male connector for single wiring (CANopen Bus-Out) is available in the Camozzi catalogue (code CS-LM05HC).
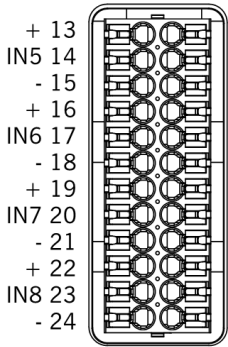
8.2.4 Connections and signals of the 16 digital input modules

Inputs 1 - 8 connector

Dual function LED
1.Yellow for signalling input 1 status
2.Red for signalling module diagnostics

Input 5 status yellow LED
Input 6 status yellow LED
Input 7 status yellow LED
Input 8 status yellow LED

Input 2 status yellow LED
Input 3 status yellow LED
Input 4 status yellow LED

Inputs 9 – 16 connector

Input 13 status yellow LED
Input 14 status yellow LED
Input 15 status yellow LED
Input 16 status yellow LED

Input 9 status yellow LED
Input 10 status yellow LED
Input 11 status yellow LED
Input 12 status yellow LED

External Power LED

External Power Connector

ME4-1600-DT

8.2.4.1 Input connectors pinout

The 16-channel connector is a RTB (DFMC and FMC series from Phoenix). The cables must have a cross-section of 0.5mmq and a 0.4x2 screwdriver can be used to remove the terminal block from the module as per the datasheet.

Pin	Signal	Description	Symbol
1	VCC	24 Vdc power supply supplied by the module to outside	+ 13 1 + IN5 14 2 IN1 - 15 3 - + 16 4 + IN6 17 5 IN2 - 18 6 - + 19 7 + IN7 20 8 IN3 - 21 9 - + 22 10 + IN8 23 11 IN4 - 24 12 -
2	Input	Channel 1 input (max 50 mA for each input with internal power supply; 125 mA with external power supply)	
3	GND	Reference	

8.2.4.2   External power supply connector pinout

Pin	Signal	Description	Symbol
1	+	Input 24Vdc	**+ -**
2	-	GND reference	

8.2.5   Module diagnostics

8.2.5.1   General diagnostic LED

The signalling LED of the first channel has the dual function of indicating the module diagnostics, as well as the activation status of the channel itself. When the module experiences certain conditions, the LED behaves as described in the following table.

Module status and alarms	LED status	Description of the status and solutions of the alarms
Start-up End of the mapping or configuration phase	⚪ RED OFF	The module enters this state upon power-up and at the end of the mapping phase or the reception of configuration parameters.
Mapped module	🔴 RED ON	The LED is lit during the mapping phase and is turned off if this procedure is completed successfully.
Waiting for configuration parameters	🔴 1 flash RED @100 ms every 2 s	The module is waiting for configuration parameters (maximum duration 1 minute).
Communication alarm	🔴 2 flashes RED @100 ms every 2 s	The alarm indicates that there is no communication between the digital input module and the CX4 module. **Solution**: Try restarting the whole island and verifying that the physical connection to the digital input module is secure. If the problem persists, contact support and replace the digital input module.
Short circuit on digital input channels	🔴 RED ON	At least one of the digital inputs is short-circuited. **Solution**: Remove the input sensor and check the connection. If the problem persists, replace the sensor.

8.2.5.2 Inputs status LED

When the module is in normal operating mode (fully operational and with no particular critical issues), the LED of the first channel behaves like the signalling LEDs of the remaining channels (from 2 to 16), i.e. it is lit and yellow when the input is active and off when the input is inactive.

Input status	LED status	Description
Input n inactive	⚪ YELLOW OFF	The LED indicates that the corresponding digital input is not active.
Input n activated	🟡 YELLOW ON	The LED indicates that the corresponding digital input has activated successfully.

8.2.5.3 Diagnostic LED of the external power supply

In the 16-channel configuration, the digital input module is equipped with a connector for the external power supply with associated signalling LED.

NOTE. The external power supply can be enabled or disabled through the configuration parameters from the controller/PLC or from UVIX.

External power status	LED status	Description of the status and solutions of the alarms
Not configured	⚪ LED OFF	Power for the digital inputs is supplied directly from the digital input module.
External power supply present	🟢 GREEN ON	External power is present, and the digital inputs are externally powered. For this mode, the parameter for using the external power supply must be configured correctly.
No external power supply	🔴 RED ON	The module is configured to receive an additional external power supply but this is not being detected by the module. **Solution**: Check that the power is reaching the module correctly and that the connection has been made correctly.
Configured (External power supply out of range)	☀️ 1 flash RED @100 ms very 1 s	The module is configured to receive an additional external power supply but this has a value of <21 Vdc or >27 Vdc. **Solution**: change the value of the power supply from the outside, bringing it within the proper operating range (21 Vdc ≤ Vcc ≥ 27 Vdc).

8.3 Digital Output Modules

8.3.1 General operation

The digital output module allows 8 or 16 digital signals to be provided outside the system. 2-wire or 3-wire digital actuators, type P or N, can be connected.

NOTE. The 16-channel digital output module must be externally powered.

The digital output module, after being connected to the CX4 module, must be mapped by the island (par. 6.3). If the mapping procedure is completed successfully, the digital output module waits to receive the configuration parameters from the CX4 module (maximum wait 1 minute). Once these parameters have been received, the module enters the normal operational state and the digital outputs can be activated. Otherwise, if the mapping procedure is not end successfully, the module remains in an error state, deactivating any operational functionality.
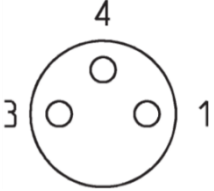
For each input there is a dedicated diagnostic LED, while for general diagnostics the LED of the first channel is used (par. 8.3.4).

8.3.2 Connections and signals of the8 digital output modules

8.3.2.1 M8 connectors pinout

Pin	Signal	Description	Symbol
1	VCC	24 Vdc power supply supplied by the module to outside	
3	GND	Reference	
4	Output	Output (max 125 mA for each output)	

NOTE. For the digital output modules, the M8 3-pole male connector for wiring is available in the Camozzi catalogue (cod. CS-DM03HB).
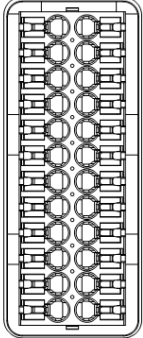
8.3.3 Connections and signals of the 16 digital output modules
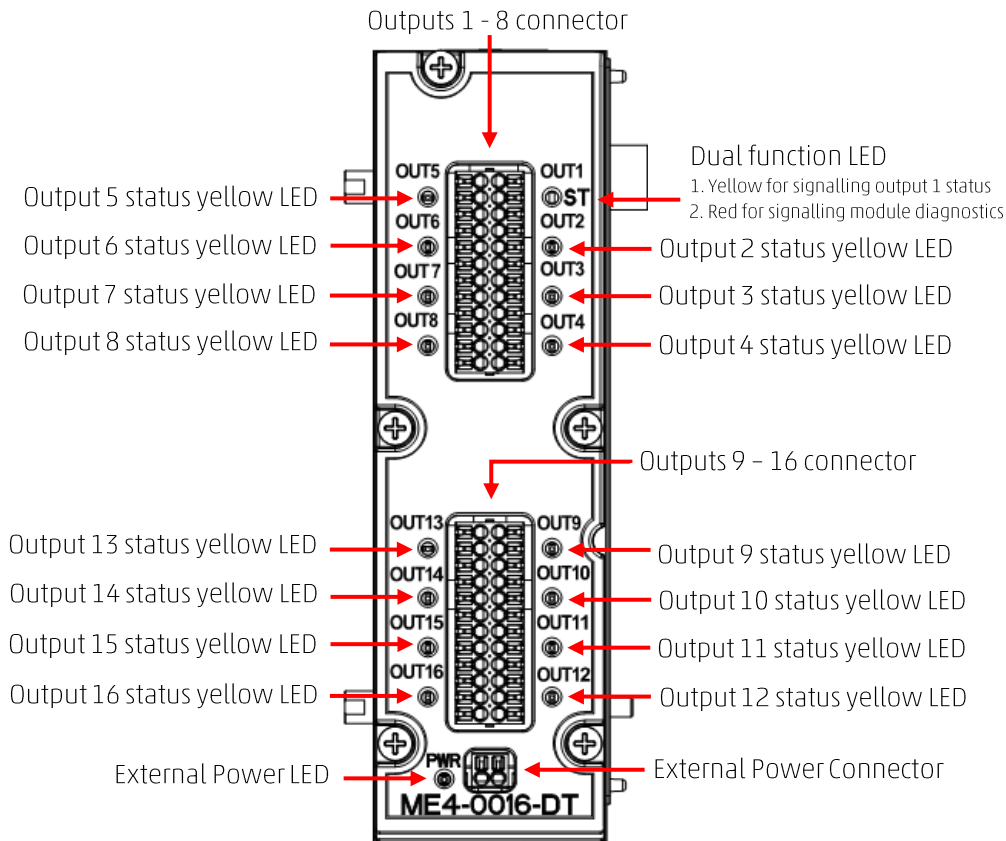
8.3.3.1 Output connectors pinout

The 16-channel connector is a RTB (DFMC and FMC series from Phoenix). The cables must have a cross-section of 0.5 mm2 and a 0.4x2 screwdriver can be used to remove the terminal block from the module as per the datasheet.

Pin	Signal	Description	Symbol
1	VCC	24 Vdc power supply supplied by the module to outside	+ 13 1 + OUT5 14 2 OUT1 - 15 3 - + 16 4 + OUT6 17 5 OUT2 - 18 6 - + 19 7 + OUT7 20 8 OUT3 - 21 9 - + 22 10 + OUT8 23 11 OUT4 - 24 12 -
2	Output	Output channel 1 (125 mA)	
3	GND	Reference	

8.3.3.2   *External power supply connector pinout*

Pin	Signal	Description	Symbol
1	+	Input 12÷32 Vdc	+ -
2	-	GND reference	

8.3.4   Module diagnostics

8.3.4.1   *General diagnostic LED*

The signalling LED of the first channel has the dual function of indicating the module diagnostics, as well as the activation status of the channel itself. When the module experiences certain conditions, the LED behaves as described in the following table.

Module status and alarms	LED status	Description of the status and solutions of the alarms
Start-up End of the mapping or configuration phase	⚪ RED OFF	The module enters this state when it is switched on, at the end of the mapping phase and when the configuration parameters are received.
Mapped module	🔴 RED ON	The LED is lit during the mapping phase and is switched off if this procedure is completed successfully.
Waiting for configuration parameters	☀ 1 flash RED @100 ms every 2 s	The module is waiting for configuration parameters (maximum duration 1 minute).

Module status and alarms	LED status	Description of the status and solutions of the alarms
Short circuit on digital output channels	🔴 RED ON	At least one of the digital outputs is short-circuited. **Solution**: check the connection and, if necessary, remove the output load and replace it.
Open circuit on digital output channels	☀️ 3 flashes RED @100 ms every 2 s	At least one output is not connected to the load and the open circuit is detected. **Solution**: check the load connection with the output connector.
Undervoltage voltage supply*	☀️ 4 flashes RED @100 ms every 2s	The supply voltage is less than 4.5 V. **Solution**: change the power supply value and return to the correct operating range (Vcc = 24 V).
No voltage supply*	☀️ 4 flashes RED @100 ms every 2 s	Circuit power is missing or shorted. **Solution**: check that the power reaches the module correctly and that the connection has been made correctly.
Communication alarm	☀️ 2 flashes RED @100 ms every 2 s	No response from the CX4 to output status and diagnostic signalling. **Solution**: contact support and replace the digital output module cover.

* Power supply alarms refer to external power supply for 16-channel modules.

8.3.4.2 Outputs status LED

When the module is in normal operating mode (fully operational and with no particular critical issues), this LED behaves like the signalling LEDs of the remaining channels (from 2 to 16), i.e. it is lit and yellow when the output is active and off when the output is inactive.

Output status	LED status	Description
Output n inactive	⚪ YELLOW OFF	The LED indicates that the corresponding digital output is not active.
Output n activated	🟡 YELLOW ON	The LED indicates that the corresponding digital output has activated successfully.

8.3.4.3   *Diagnostic LED of the external power supply*

In the 16-channel configuration, the digital output module is equipped with a connector for the external power supply with associated signalling LED.

NOTE. It is mandatory for the external power supply to be connected.

External power status	LED status	Description of the status and solutions of the alarms
External power supply ok	🟢 GREEN ON	The module is correctly receiving the additional external power supply.
No external power supply	⚪ GREEN OFF	The module does not detect the additional power supply and therefore cannot work. **Solution**: verify that power is reaching the module properly. If the problem persists, contact support and replace the module.

8.4 Analogue Input Modules

8.4.1 General operation

The analogue input module can monitor two analogue sensors simultaneously. The types of sensors that can be connected are:

- Resistance thermometers (RTD) for temperature measurement.
- Thermocouples for temperature measurement.
- Bridge for resistance measurement.
- Generic sensors with voltage or current outputs.

The analogue input module, after being connected to the CX4 module, must be mapped from the island (par. 6.3). If the mapping procedure is completed successfully, the module waits to receive the configuration parameters from the CX4 module. Upon receipt of these parameters, the module enters the normal operating state and the analogue inputs can be read out. Otherwise, if the mapping procedure is not completed successfully, the module remains in an error state, deactivating any operational function.

8.4.2 Connections and signals of the modules

The analogue modules can have two types of connectors for connections with sensors. In the following figure, the left side shows an analogue module with 5-pole coded M12 A female connectors, while the right side shows an analogue module with 5-pole female TB connectors. The different types of analogue input modules have specific pinouts dedicated to their functionality. Visual indication of operation and diagnostics is via three LEDs.

8.4.3 Module diagnostics

Module status and alarms	LED STATUS	LED IN1	LED IN2	Description of the status and solutions of the alarms
Waiting for configuration parameters	1 flash RED @100 ms every 2 s	YELLOW OFF	YELLOW OFF	The module is waiting for configuration parameters (maximum duration 1 minute).
Sensor working on channel 1	RED OFF	YELLOW ON	YELLOW OFF	The sensor connected to channel 1 is functioning correctly.
Sensor working on channel 2	RED OFF	YELLOW OFF	YELLOW ON	The sensor connected to channel 2 is functioning correctly.
Sensor alarm on channel 1	2 flashes RED @100 ms every 2 s	2 flashes YELLOW @100 ms every 2 s	YELLOW OFF	Sensor fault enabled and connected on channel 1. **Solution**: check the correct connection of the sensor and its power supply.
Bridge sensor missing on channel 1	3 flashes RED @100 ms every 2 s	3 flashes YELLOW @100ms every 2s	YELLOW OFF	Bridge sensor missing or faulty when configuring the module on channel 1. (This error is only valid for bridge type modules and remains in place until the module is restarted) **Solution**: Check sensor connections and restart the module.
Sensor alarm on channel 2	2 flashes RED @100 ms every 2 s	YELLOW OFF	2 flashes YELLOW @100 ms every 2 s	Sensor fault enabled and connected on channel 2 **Solution**: check that the sensor and its power supply are connected correctly.

Module status and alarms	LED STATUS	LED IN1	LED IN2	Description of the status and solutions of the alarms
Bridge sensor missing on channel 2	☀ 3 flashes RED @100 ms every 2 s	◯ YELLOW OFF	☀ 3 flashes YELLOW @100 ms every 2 s	Bridge sensor missing or faulty when configuring the module on channel 2. (This error is only valid for bridge type modules and remains in place until the module is restarted) **Solution**: Check sensor connections and restart the module.
ADC communication error	☀ 4 flashes RED @100 ms every 2 s	◯ YELLOW OFF	◯ YELLOW OFF	It occurs in the event of communication problems between the microcontroller and the ADC that measures the physical input quantity. **Solution**: Contact support and replace the module.
Reference voltage 3.3V error	● RED ON	◯ YELLOW OFF	◯ YELLOW OFF	Occurs when there is a problem with the logic voltage (3.3V). **Solution**: Contact support and replace the module.

NOTE. For a detailed description of the sensor faults, refer to the specific paragraphs of each module (RTD, thermocouples, bridge and V/C modules).

8.4.4 RTD Module (Resistance Temperature Detector)

Resistance temperature detectors (RTDs) can be connected to these analogue modules for temperature measurement. It is possible to configure some parameters individually to take the measurements.
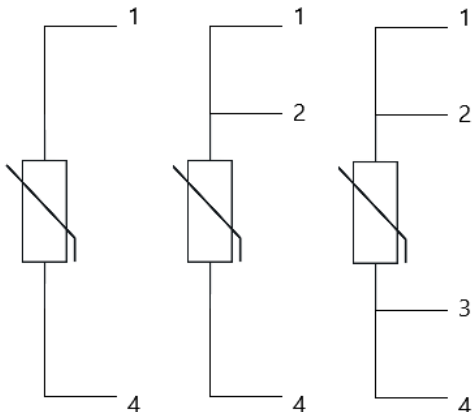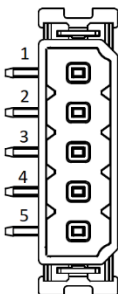
8.4.4.1 Technical Data

Key feature	Value		
	Type	**Temperature [°C]**	
		Minimum	**Maximum**
	PT100 (385)	-200	850
	PT100 (3926)	-200	630
	PT200 (385)	-200	850
Sensor types	PT500 (385)	-200	850
	PT1000 (385)	-200	850
	Ni100 (618)	-60	180
	Ni120 (672)	-80	260
	Ni1000 (618)	-60	250
Type of connections	2/3/4 wires		
Number of inputs	2		
Sensor connections	M12 A-coded 5 pole female connectors for each input TB 5 pole female connectors for each input		
Converter resolution	16 bit		
Reading resolution	0.1 °C		
Measurement error	< ±1 °C		
Sampling frequency	4 Hz for each input		
Digital filter	Moving average filter (configurable up to 128 samples) for each input		
Signalling and diagnostics	Board diagnostics red LED Yellow LED for each input		

8.4.4.2 Electrical connections

The RTD wiring diagram is different depending on the number of wires used:

- 2-wire RTDs must be connected between pin 1 and pin 4 of the connector.
- 3-wire RTDs must be connected between pin 2 and pin 4 of the connector, compensation wire to pin 1.
- 4-wire RTDs must be connected between pin 2 and pin 3 of the connector, compensation wires to pin 1 and 4.

Possible types of connections (2/3/4 wires)	M12A female connector 5 poles	TB female connector 5 poles

8.4.4.3 Faults

The module is able to detect the following faults:

- RTD sensor disconnected or broken.
- Sensor temperature range exceeded by more than ± 1° C.

NOTE. Detection of compensation wire disconnection (A4- input for 3-wire RTD, A1 + and/or A4 + inputs for 4-wire RTD) can take several seconds.

8.4.5 Thermocouple module

Thermocouples can be connected to these analogue modules for temperature measurement. It is possible to configure some parameters individually to take the measurements.

8.4.5.1 Technical Data

Key feature	Value		
Sensor types		Temperature [°C]	
	Type	Minimum	Maximum
	B	250	1820
	E	-200	1000
	J	-210	1200
	K	-200	1372
	N	-200	1300
	R	-50	1768.1
	S	-50	1768.1
	T	-200	400
Number of inputs	2		
Sensor connections	M12 A-coded 5 pole female connectors for each input		

Key feature	Value
	TB 5 pole female connectors for each input
Converter resolution	16 bit
Reading resolution	0.1 °C
Measurement error	< ±2°C for thermocouples E, J, K, N, T < ±4°C for thermocouples B, R, S
Sampling frequency	4 Hz for each input
Digital filter	Moving average filter (configurable up to 128 samples) for each input
Signalling and diagnostics	Board diagnostics red LED Yellow LED for each input

8.4.5.2   Electrical connections

The thermocouple must be connected to pins 2 (positive) and 4 (negative) of the M12 or TB connector. Between pins 1 and 3 there is an RTD (PT100) on the circuit, which is needed to perform CJC (Cold Junction Compensation) fully automatically.

Pin	Signal	Description	M12A female connector 5 poles	TB female connector 5 poles
1	CJC	PT100 for cold junction compensation (do not connect)		
2	TC+	Thermocouple positive input		
3	CJC	PT100 for cold junction compensation (do not connect)		
4	TC-	Thermocouple negative input		
5	GND	Earth		

8.4.5.3   Faults

The module is able to detect the following faults:

- Thermocouples sensor disconnected or broken.
- Sensor temperature range exceeded by more than ± 2° C.

NOTE. Detection of thermocouple sensor disconnection may take several seconds.
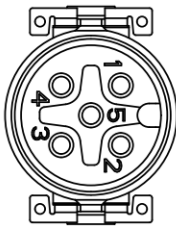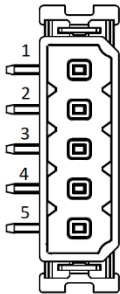
8.4.6 Bridge module

Bridge modules are based on resistive bridge operation with variable sensitivity (e.g. load cells).

8.4.6.1 *Technical Data*

Key feature	Value
Sensor types	4-wire resistor bridges (e.g. load cells) with variable bridge factor (sensitivity) are supported: from 2 mV/V to 255 mV/V at intervals of 1 mV/V
Number of inputs	2
Sensor connections	M12 A-coded 5 pole female connectors for each input TB 5 pole female connectors for each input
Converter resolution	24 bit
Reading resolution	1 uV
Measurement error	Dependent on the bridge factor
Sampling frequency	1 kHz for each input
Bridge excitation voltage	5 V
Digital filter	Moving average filter (configurable up to 128 samples) for each input
Signalling and diagnostics	Board diagnostics red LED Yellow LED for each input

8.4.6.2 *Electrical connections*

Pin	Signal	Description	M12A female connector 5 poles	TB female connector 5 poles
1	ECC1+	Positive excitation voltage of the resistor bridge (+ 5V)		
2	ECC1-	Negative excitation voltage of the resistor bridge (0V)		
3	SBR1+	Positive differential signal of the resistor bridge		
4	SBR1-	Negative differential signal of the resistor bridge		
5	GND	Earth		

8.4.6.3 Load cells

The load cells can be connected to the Bridge module to measure a force applied to an object by reading the voltage made by the resistor bridge. The voltage to weight conversion formula for load cells is as follows:

$$F = \frac{F_N \cdot U}{C \cdot U_{EXC}}$$

Where:

- F is the force detected by the load cell (Kg)
- F_N is the capacity of the load cell (Kg)
- C is the sensitivity of the load cell (mV/V)
- U_{EXC} is the excitation voltage of the resistor bridge, this value is fixed and equal to 5V
- U is the voltage read by the load cell

Example

A load cell has the following characteristics:

C = 2mV/V

$F_N = 5Kg$

Following the application of a force on the load cell, the module detects a voltage of 100 uV. Obtain the corresponding weight value:

$$F = \frac{5\,Kg\ \cdot 0.1mV}{2mV/V \cdot 5V} = 0.05\,Kg$$

Therefore the weight value read corresponds to 50 grams.

8.4.6.4 Measurement error

The AD converter on the module includes a PGA (Programmable Gain Amplifier) whose gain is optimised according to the bridge factor set. This gain determines the full scale of the measurement and the related noise. The following table shows the full-scale errors for the most common bridge factors.

Bridge factor (mV/V)	Full scale (mV)	Error % (referring to full scale)
< 8	78.1	±0.0243
16	156.3	±0.0128
32	312.5	±0.0067
64	625.0	±0.0062
128	1250.0	±0.0056
256	2500.0	±0.0064

8.4.6.5   Faults

The module is able to detect the following faults:

- Short circuit between ECC + and ECC- pin (excitation voltage).
- Resistor bridge disconnected.
- Exceeding the full scale value of the resistor bridge ($U_{EXC} \cdot C$) by 1%.

NOTE. the disconnection of the resistor bridge can only be detected at the moment the module is configured and not while in operating mode. The error remains set until a resistor bridge is inserted and a subsequent reconfiguration is performed.

8.4.7   Voltage/Current module
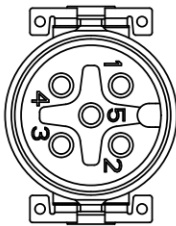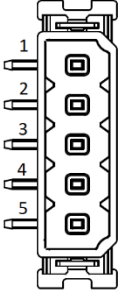
The voltage/current (V/C) modules are analogue input modules that allow both analogue current and voltage measurements.

8.4.7.1   Technical Data

Key feature	Value
Sensor types	The following voltage and current inputs are supported: 0÷10 V ±10 V 4÷20 mA 0÷20 mA ±20 mA
Number of inputs	2
Sensor connections	▪ M12 A-coded 5 pole female connectors for each input ▪ TB 5 pole female connectors for each input
Converter resolution	16 bit
Reading resolution	1 mV 1 uA
Measurement error	▪ <±0.3% (relative to the full scale ±10 V) ▪ <±0.3% (relative to the full scale 0÷20mA)
Sampling frequency	100 Hz for each input
Digital filter	Moving average filter (configurable up to 128 samples) for each input
Signalling and diagnostics	▪ Board diagnostics red LED ▪ Yellow LED for each input

8.4.7.2 Electrical connections

Pin	Signal	Description	M12A female connector 5 poles	TB female connector 5 poles
1	+24EX	24 Vdc auxiliary voltage. Maximum absorption value: 200 mA per channel or 400 mA if there is only one sensor powered by the board		
2	IN+	Positive voltage or current signal differential input		
3	GND	Earth		
4	IN-	Negative voltage or current signal differential input		
5	GND	Earth		

8.4.7.3 Faults

The module is able to detect the following faults:

- Minimum and maximum voltage/current exceeded by ± 60mV or ± 60uA.
- Open circuit (if channel configured with voltage).

NOTE. Open circuit detection (voltage configured channel) can take several seconds.

8.5 Analogue Output Modules

8.5.1 General operation

The analogue output module can control two independent outputs with the following configurations:

- 0÷10 V voltage
- 0÷5 V voltage
- 0÷20 mA current
- 4÷20 mA current

The analogue output module, after being connected to the CX4 module, must be mapped from the island (par. 6.3). If the mapping procedure ends correctly, the module waits for the reception of the configuration parameters from the CX4 module. Once these parameters have been received, the module enters normal operating status and the outputs, if enabled, can be set. Otherwise, if the mapping procedure does not finish correctly, the module remains in an error state by disabling any operational functionality.

8.5.1.1 Technical Data

Key feature	Value
Sensor types	0÷10 V 0÷5 V 0÷20 mA 4÷20 mA
Number of outputs	2
Sensor connections	▪ M12 A-coded 5 pole female connectors for each input ▪ TB 5 pole female connectors for each input
Converter resolution	16 bits
Reading resolution	1 mV 1 uA
Measurement error	
Signalling and diagnostics	▪ Board diagnostics red LED ▪ Yellow LED for each input
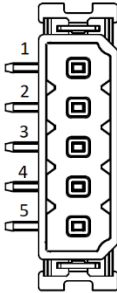
8.5.2 Connections and signals of the modules

The analogue modules can have two types of connectors for connections with sensors. In the following figure, the left side shows an analogue module with 5-pole coded M12 A female connectors, while the right side shows an analogue module with 5-pole female TB connectors. The different types of analogue output modules have specific pinouts dedicated to their functionality. Visual indication of operation and diagnostics is via three LEDs.

8.5.2.1 Electrical connections

Pin	Signal	Description	M12A female connector 5 poles	TB female connector 5 poles
1	+24EX	24V auxiliary voltage. Maximum absorption value: 200mA per channel or 400mA if there is only one sensor powered by the board		
2	OUT	Voltage or current signal output		
3	GND	Earth		
4	NC	Not connected		
5	NC	Not connected		

8.5.3 Module diagnostics

Module status and alarms	LED STATUS	LED IN1	LED IN2	Description of the status and solutions of the alarms
Waiting for configuration parameters	1 flash RED @100 ms every 2 s	YELLOW OFF	YELLOW OFF	The module is waiting for configuration parameters (maximum duration 1 minute).
Output working on channel 1	RED OFF	YELLOW ON	YELLOW OFF	The output to channel 1 is functioning correctly.
Output working on channel 2	RED OFF	YELLOW OFF	YELLOW ON	The output to channel 2 is functioning correctly.
Communication fault	2 flashes RED @100 ms every 2 s	2 flashes YELLOW @100 ms every 2 s	2 flashes YELLOW @100 ms every 2 s	Communication fault between head and module. **Solution**: Contact support and replace the module.
No load on channel 1	3 flashes RED @100 ms every 2 s	3 flashes YELLOW @100 ms every 2 s	YELLOW OFF	Load on the output 1 not present. (This error is valid only for the current configuration) **Solution**: Check connections with the load and restart the module.
No load on channel 2	3 flashes RED @100 ms every 2 s	YELLOW OFF	3 flashes YELLOW @100 ms every 2 s	Load on the output 2 not present. (This error is valid only for the current configuration) **Solution**: Check connections with the load and restart the module.
Module error	4 flashes RED @100 ms every 2 s	4 flashes YELLOW @100 ms every 2 s	4 flashes YELLOW @100 ms every 2 s	Occurs in case of the following problems: ▪ Overheating ▪ Undervoltage power supply ▪ Internal DAC error **Solution**: Contact support and replace the module.

9 UVIX

Camozzi's proprietary environment, called UVIX, allows the user to monitor and configure all new generation Camozzi devices *(Camozzi Smart Devices)* that support connection to it.

Devices can be connected to UVIX in two ways: wireless or USB. This system has been implemented with a web-based architecture so that information can be accessed straightforwardly using a browser.

Monitoring consists of displaying all the device variables, whether they relate to operation, diagnostics, or parameterization.

For details on the UVIX architecture, its installation, and general operations, see the UVIX Manual.

9.1 General information

The devices connected to the UVIX are displayed in a tree diagram ❶ consisting of Device Groups, Family and Devices. Select one of the components to view in the main window ❷ all the information on the various devices and perform configuration operations or manual commands.
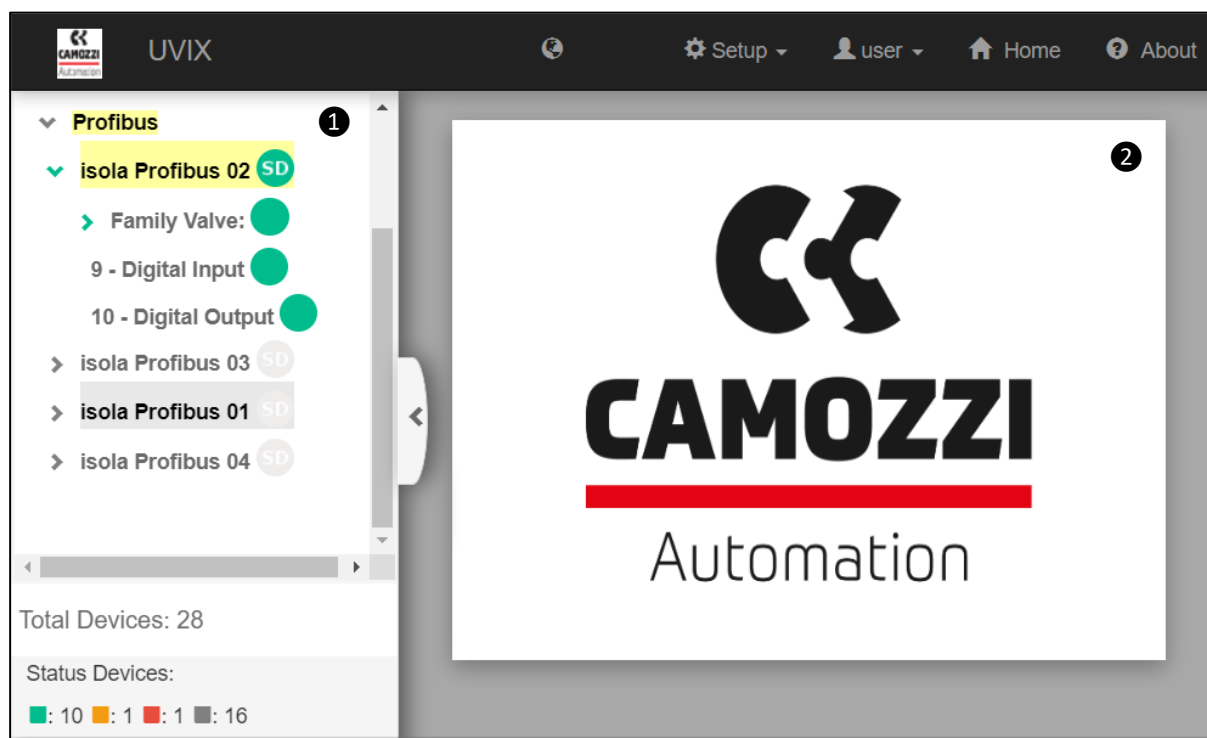
Select the CX4 module - in Stand-Alone or Valve Island configuration - or the individual accessory modules, Series D solenoid valve sub-bases or I/O modules, to view the general status information and details. The details are divided into variables, alarms, and commands (only for solenoid valves, digital outputs and analogue outputs).

9.1.1   Status information

Select a Series CX4 module to view the main information.

- ❶ Series CX4 identification image.
- ❷ Device name, assigned when recognized and added in UVIX.
- ❸ Device identification number (17 characters).
- ❹ Device family name: *Series CX4*.
- ❺ Type of Series D Fieldbus according to the connected accessory modules:
    - ○ *Stand-Alone*, with only I/O modules connected.
    - ○ *D1* with at least one Series D1 solenoid valve connected.
    - ○ *D2* with at least one Series D2 solenoid valve connected.
    - ○ *D4* with at least one Series D4 solenoid valve connected.
    - ○ *D5* with at least one Series D1 and one Series D2 solenoid connected.
- ❻ Firmware version.
- ❼ Date and time of the last transmission between CX4 module and UVIX.
- ❽ General status of the module: ⚪ *Not available,* 🟢 *OK,* 🔴 *Alarm.*
- ❾ Operating status of the module:
    - ○ *Init* → initialization of the CX4 module and accessory modules.
    - ○ *Enumeration* → numbering of the accessory modules connected to the CX4 module (required if modules are replaced or moved with respect to the original configuration).
    - ○ *Mapping* → mapping of the accessory modules connected to the CX module (required to check that there have been no changes since the last system configuration).
    - ○ *Work* → normal operation.
    - ○ *Manual* → manual operation.
    - ○ *Configuration* → configuration of the parameters of the CX4 module and the accessory modules.
    - ○ *Fatal error* → fatal error that renders the CX4 module inoperative
- ❿ WiFi connection status: 🟢 *Online,* 🔴 *Offline.*
- ⓫ Fieldbus used by the module: *PROFIBUS/DP.*
- ⓬ Fieldbus communication status: 🟢 *Online,* 🔴 *Offline.*

9.1.1.1 PROFIBUS/DP network configuration

From the status information page, you can access the window for configuring certain fieldbus parameters ⑬. In the specific case of PROFIBUS/DP, you can configure the identification number of the node ⑭ (defult: 4) on the PROFIBUS/DP network (par. **Error! Reference source not found.**).

Using the buttons in the bottom bar of the configuration window ⑱, the configured parameters can be sent to the module, saved on the PC, saved on the device, or reset to default values.
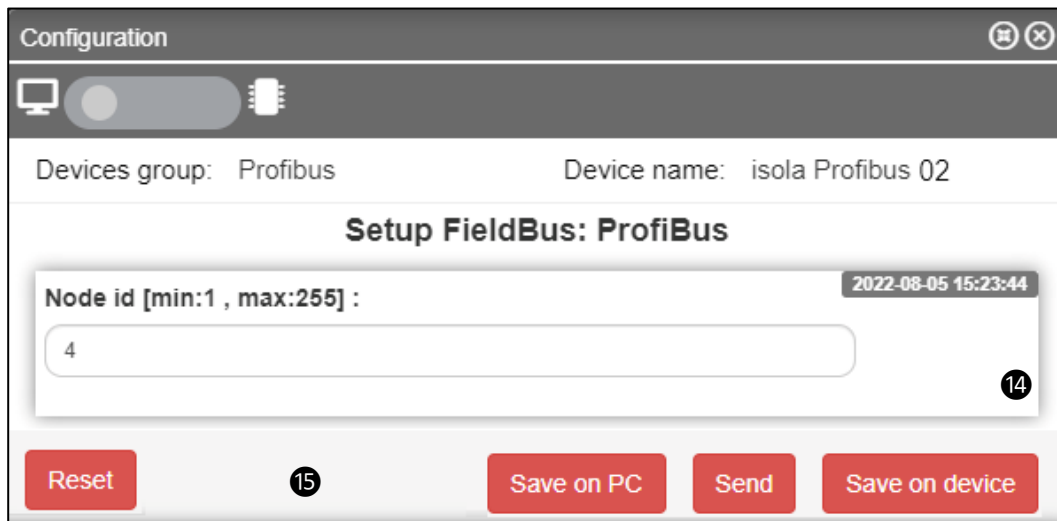
9.1.2 Details

9.1.2.1 Variables

The first tab of the details page deals shows the variables that are monitored by the CX4 module.

- ❶ Internal temperature of the module.
- ❷ Power voltage that supplies the sub-bases of the solenoid valves: the measurement is made by the first sub-base connected (position 1) and is sent via serial communication. If there are no valves connected, this voltage is not displayed.
- ❸ Logic voltage that powers the module circuit board. Without this supply voltage, the entire system is without power and, therefore, turned off.

9.1.2.2   Alarms

The second tab on the details page displays possible CX4 module alarms.

- **❹** No mapping: indicates that there are no accessory modules connected to the CX4 module.
- **❺** Valve mapping error: this can occur if the positions of the sub-bases of the solenoid valves have been changed, moving them from their original position or adding new ones, or if a sub-base fails to respond to the mapping request from the CX4 module.
- **❻** CX4 module overheating.
- **❼** Supply voltage of the CX4 module lower than the voltage given in the specifications.
- **❽** I/O module mapping error: this can occur if the positions of the I/O modules have been changed, moving them from their original position or adding new ones, or if an I/O module fails to respond to the mapping request from the CX4 module.
- **❾** Fatal error on fieldbus: this occurs if the fieldbus protocol stack is incorrect.
- **❿** Configuration error
- **⓫** No valve mapping: indicates that there are no solenoid valve sub-bases connected to the CX4 module.
- **⓬** No I/O module mapping: indicates that there are no I/O modules connected to the CX4 module.

9.1.2.3 Commands

The third tab of details on the CX4 module shows the commands that can be sent via UVIX to the device. The Manual Mode command ⑬ allows you to control the system manually from UVIX, sending configuration parameters to the CX4 module and to the individual connected accessory modules. In manual mode, you can command the modules that include outputs (if present), such as the solenoid valves ⑭ (par. 9.2.3), digital outputs ⑮ (par. 9.4.3) and analogue outputs ⑯ (par. 9.6.3). The history of the commands sent to the CX4 module from when communication with UVIX was started can be viewed under Last Commands ⑰.
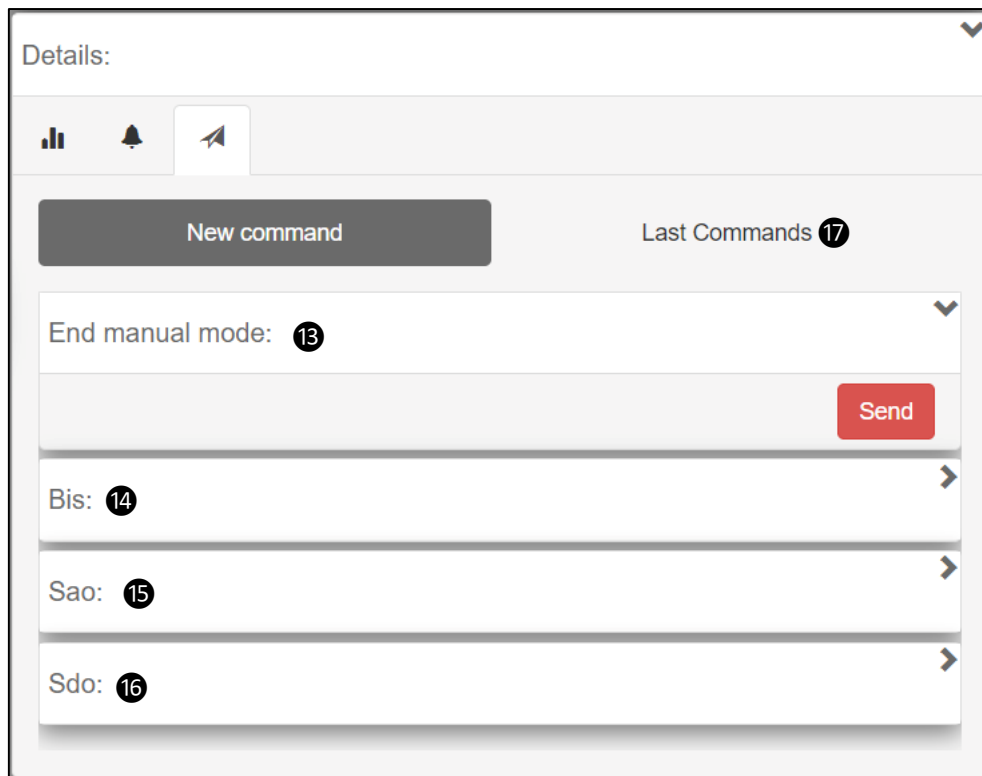
NOTE. If there are solenoid valve sub-bases connected to the CX4 module, the valve information can be reset at any time, without activating manual mode.

9.2 Series D coil valves and sub-bases

9.2.1 Status information

On the first page of UVIX, you can select one of the solenoid valves connected to the CX4 module in the configuration of a Series D valve island to view the general information of the individual sub-base.

- ❶ Identification images of the coil valve mounted on the sub-base.
- ❷ Position of the sub-base in the assigned valve island after mapping.
- ❸ Name of the accessory module family: Valve.
- ❹ Solenoid valve family sub-type: 10 mm, 16 mm, 25 mm.
- ❺ Firmware version.
- ❻ Date and time of the last transmission of the variables between the sub-base and UVIX.
- ❼ General status of the solenoid valve: ⚪ *Not available,* 🟢 *OK,* 🔴 *Alarm.*
- ❽ Operating status of the sub-base:
  - ○ *Init* → initialization (mapping and configuration of parameters).
  - ○ *Work* → normal operation.
  - ○ *Error* → sub-base error.
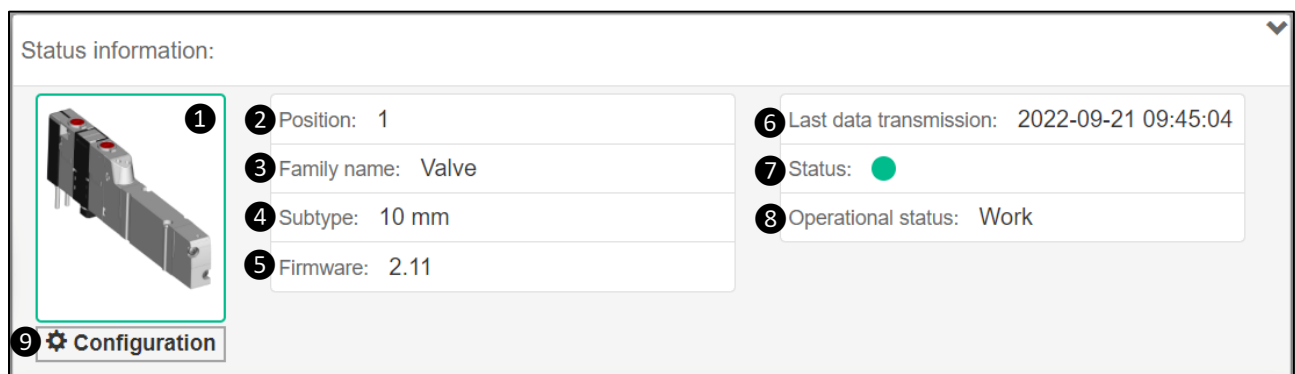
9.2.1.1 Configuration of Series D coil valve sub-base

From the status information page, you can configure certain operating-related parameters of the solenoid valves ❾.

- ❿ Enable/disable the alarms that the valve can generate (default: all alarms enabled).
- ⓫ Enable/disable the Failsafe for each individual pilot: *Yes* enabled, *No* disabled (default).
- ⓬ Set the Failsafe status for each pilot for which the Failsafe has been enabled: *On* pilot activated, *Off* pilot deactivated (default).
- ⓭ Set the behaviour of the valve failure error (Coil Fault): *Latched*, *Not Latched* (default).
- ⓮ The buttons in the bottom bar of the tab allow you to send the configuration parameters to the module, save them on the PC, save them on the device or reset them to default values.

9.2.2 Details

9.2.2.1 Variables

The first tab on the details page shows the variables that are monitored by the sub-base of an individual solenoid valve. These variables can be reset using the commands by selecting the CX4 module to which the sub-bases are connected (par. 9.2.3).

- ❶ Sub-base temperature.
- ❷ Cycles performed by the pilots in position 14 and position 12.
- ❸ Percentage health status of the pilots in position 14 and position 12.
- ❹ Status of the pilots in position 14 and position 12 (*On/Off*).
- ❺ Temperature of the pilots in position 14 and position 12.
- ❻ Errors of the pilots in position 14 and position 12.
- ❼ Communication errors between the CX4 module and the selected sub-base.
- ❽ Gauge indicators that show graphically the percentage health status of the two pilots.
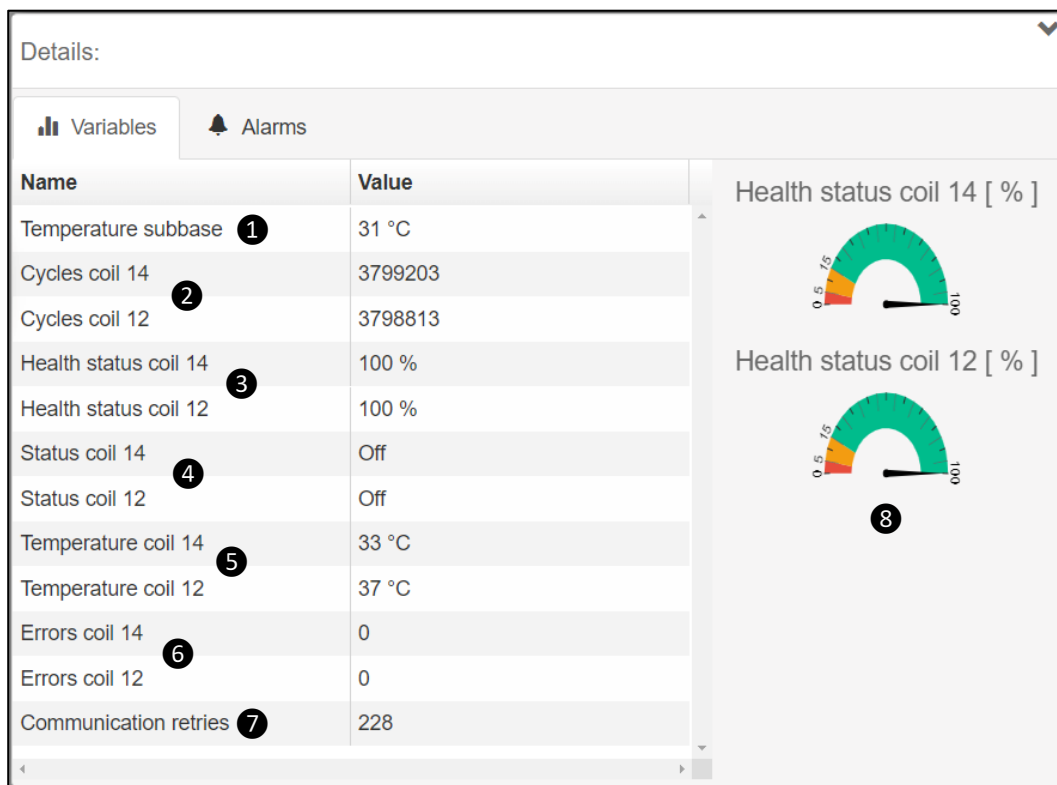
9.2.2.2   *Alarms*

The second details tab displays the alarms of the sub-base of the selected valve.

- ▪ **8** Communication alarm due to communication failure between CX4 module and sub-base.
- ▪ **9** Sub-base overheating.
- ▪ **10** Overheating of the pilots in position 14 and position 12.
- ▪ **11** Overcurrent of the pilots in position 14 and position 12.
- ▪ **12** Alarm - solenoid valves closed in position 14 and position 12.
- ▪ **13** Energization malfunction of the solenoid pilots in position 14 and position 12.
- ▪ **14** Alarm - configuration of sub-base parameters.
- ▪ **15** Replace valve warning.

9.2.3 Commands

On the main page of the CX4 module (par.9.1.2.2), there is a tab showing the commands for the solenoid valves. In particular, you can reset the valve information ❶ (cycles, errors, health status). This operation needs to be performed when the valve connected to the sub-base is replaced and can also be performed in normal working mode.

You can also control the individual pilots (position 12 and 14) of the solenoid valves ❷. For this operation, the island must be in manual mode.
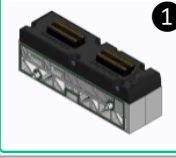
9.3 Digital Input Modules

9.3.1 Status information

On the first page of UVIX, select one of the digital inputs connected to the CX4 module to view the general information of the accessory module.

- ❶ Identification images of the digital input module (8 or 16 channels).
- ❷ Module position assigned after mapping.
- ❸ Name of the accessory module family: *Digital Input*.
- ❹ Subtype of the family of the digital input module: 8 CH, 16 CH.
- ❺ Firmware version.
- ❻ Date and time of the last transmission of the variables between the module and UVIX.
- ❼ General status of the module: ⚪ *Not available*, 🟢 *OK*, 🔴 *Alarm*.
- ❽ Operating status of the module:
    - o *Init* → initialization (mapping and configuration of parameters).
    - o *Work* → normal operation.
    - o *Error* → module error.

Status information:

❶	❷ Position: 12	❻ Last data transmission: 2022-09-21 09:40:57
	❸ Family name: Digital Input	❼ Status: 🟢
	❹ Subtype: 16 CH	❽ Operational status: Work
❾ ⚙ Configuration	❺ Firmware: 1.11	

9.3.1.1 Configuration of digital input modules

From the status information page, you can configure certain operating-related parameters of the digital input modules ❾.

- ❿ Parameter for the polarity of each channel, High or Low (default).
- ⓫ Minimum input level activation time in milliseconds (anti-bounce filter, default: 0).
- ⓬ Minimum input rereading time in milliseconds (default: 0).
- ⓭ Using the buttons in the bottom bar of the configuration window, the configured parameters can be sent to the module, saved on the PC, saved on the device or reset to default values.

9.3.2   Details

9.3.2.1   Variables

The first tab on the details page displays the status of the digital inputs ❶: 🟢 active, ⚪ not active.
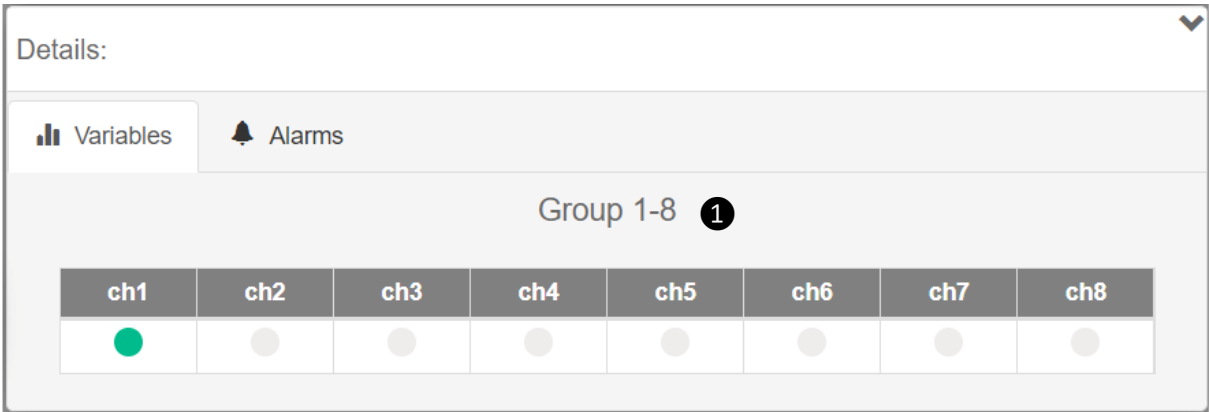
9.3.2.2 Alarms

The second details tab displays the alarms of the digital input module.

- ❷ Alarm - communication failure between the digital input module and the CX4 module.
- ❸ Alarm - configuration of module parameters.
- ❹ Short-circuit of at least one digital input belonging to an input group. This alarm can be divided into two groups for modules with 8 channels or into four groups for modules with 16 channels.
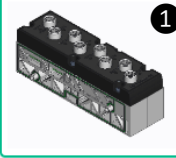
9.4 Digital Output Modules

9.4.1 Status information

On the first page of UVIX, select one of the digital outputs connected to the CX4 module to view the general information of the accessory module.

- ❶ Identification images of the digital output module (8 or 16 channels).
- ❷ Module position assigned after mapping.
- ❸ Name of the accessory module family: *Digital Output*.
- ❹ Subtype of the family of the digital output module: 8 CH, 16 CH.
- ❺ Firmware version.
- ❻ Date and time of the last transmission of the variables between the module and UVIX.
- ❼ General status of the module: ⚪ *Not available*, 🟢 *OK*, 🔴 *Alarm*.
- ❽ Operating status of the module:

    o *Init* → initialization (mapping and configuration of parameters).

    o *Work* → normal operation.

    o *Error* → module error.

9.4.1.1 Configuration of digital output modules

From the status information page, you can configure certain operating-related parameters of the digital output modules ❾.
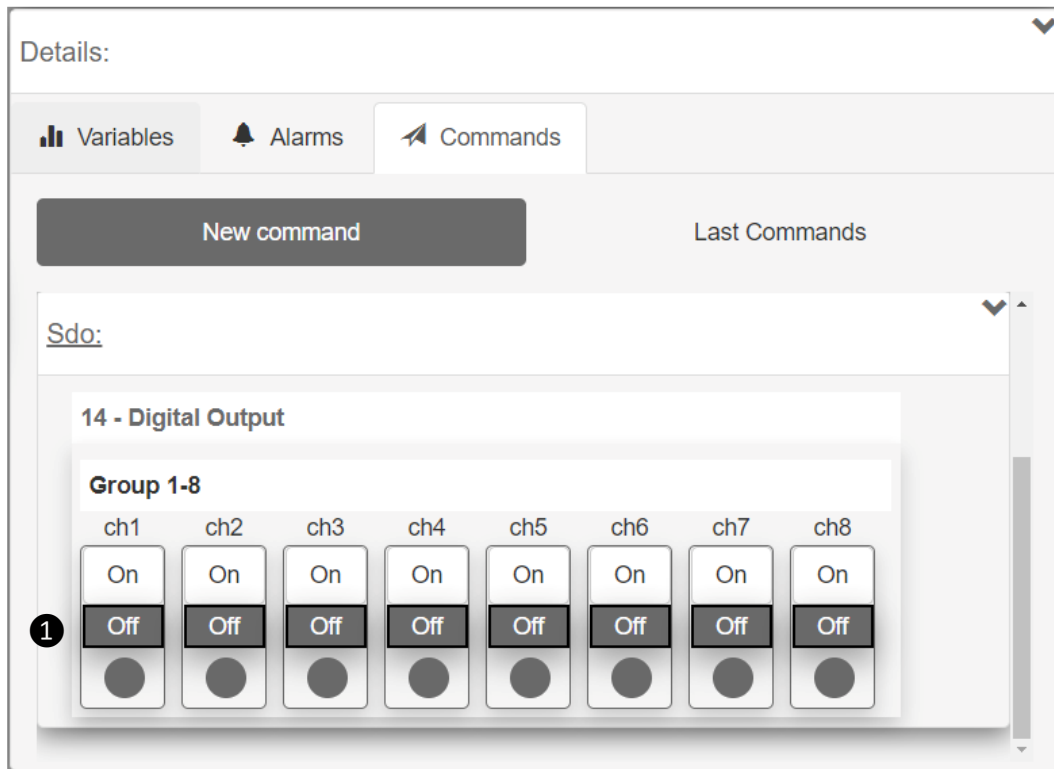
- ❿ Enable output: No disabled, Yes enabled (default).
- ⑪ Set the type of individual output channel: type N, type P (default).
- ⑫ Enable the individual functions related to the whole module, see the detection of no load by the power driver.
- ⑬ Set the PWM for individual outputs: *Yes* enabled, *No* disabled (default).
- ⑭ Enable the protection failsafe, which can be set for the individual outputs: Yes enabled, No disabled (default).
- ⑮ Failsafe status, which can be set for the individual outputs: *On*, *Off* (default).
- ⑯ Using the buttons in the bottom bar of the configuration window, the configured parameters can be sent to the module, saved on the PC, saved on the device or reset to default values.

Configuration ⊞ ⊗

Devices group: Camozzi   Device name: Series D fieldbus   Slave: 6 - Digital Output

Set enable out channel

Enable channels (1-8)   2022-01-28 11:32:57

Channel 1	Channel 2	Channel 3	Channel 4
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes
Channel 5	Channel 6	Channel 7	Channel 8
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes

⑩

Set type out channel

Channel Type (1-8)   2022-01-28 11:32:57

Channel 1	Channel 2	Channel 3	Channel 4
N ◯ P	N ◯ P	N ◯ P	N ◯ P
Channel 5	Channel 6	Channel 7	Channel 8
N ◯ P	N ◯ P	N ◯ P	N ◯ P

⑪

Module Settings   2022-01-28 11:32:57

Enable alarm n.c.

No ◯ Yes

⑫

Set enable PWM

Enable PWM (1-8)   2022-01-28 11:32:57

Channel 1	Channel 2	Channel 3	Channel 4
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes
Channel 5	Channel 6	Channel 7	Channel 8
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes

⑬

Set enable failsafe channel

Enable failsafe (1-8)   2022-01-28 11:32:57

Channel 1	Channel 2	Channel 3	Channel 4
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes
Channel 5	Channel 6	Channel 7	Channel 8
No ◯ Yes	No ◯ Yes	No ◯ Yes	No ◯ Yes

⑭

Set state failsafe channel

Failsafe state (1-8)   2022-01-28 11:32:57

Channel 1	Channel 2	Channel 3	Channel 4
Off ◯ On	Off ◯ On	Off ◯ On	Off ◯ On
Channel 5	Channel 6	Channel 7	Channel 8
Off ◯ On	Off ◯ On	Off ◯ On	Off ◯ On

⑮

Reset   ⑯   Save on PC   Send   Save on device

9.4.2   Details

9.4.2.1   Variables

The first tab on the details page displays the status of the digital outputs ❶: 🟢 active, ⚪ not active.

9.4.2.2   Alarms

The second details tab displays the alarms of the digital output module.

- ▪ ❷ Alarm - communication failure between the digital input module and the CX4 module.
- ▪ ❸ Alarm - configuration of module parameters.
- ▪ ❹ No external power supply, required to power the digital outputs.
- ▪ ❺ The supply voltage is less than 4.5V.
- ▪ ❻ Circuit open on an output channel.
- ▪ ❼ Short circuit on an output channel.

9.4.3 Commands

On the main page of the CX4 module (par.9.1.2.2) there is a tab showing the commands to pilot the individual channels of the digital outputs ❶. This tab is only visible in manual mode and if it has at least one digital output module.
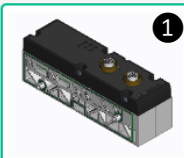
9.5   Analogue Input Modules

9.5.1   Status information

On the first page of UVIX, select one of the analogue inputs connected to the CX4 module to view the general information of the accessory module.

- ❶ Identification images of the analogue input module.
- ❷ Module position assigned after mapping.
- ❸ Name of the accessory module family: *Analogue Input*.
- ❹ Subtype of the family of the analogue input module: RTD, Thermocouple, Bridge, Voltage/Current.
- ❺ Firmware version.
- ❻ Date and time of the last transmission of the variables between the module and UVIX.
- ❼ General status of the module: ⚪ *Not available,* 🟢 *OK,* 🔴 *Alarm.*
- ❽ Operating status of the module:
  - *Init* → initialization (mapping and configuration of parameters).
  - *Work* → normal operation.
  - *Error* → module error.

Status information:

❶ ❷ Position: 8   ❻ Last data transmission: 2022-09-21 08:59:51

❸ Family name: Analog Input   ❼ Status: 🟢

❹ Subtype: RTD   ❽ Operational status: Work

❺ Firmware: 1.07
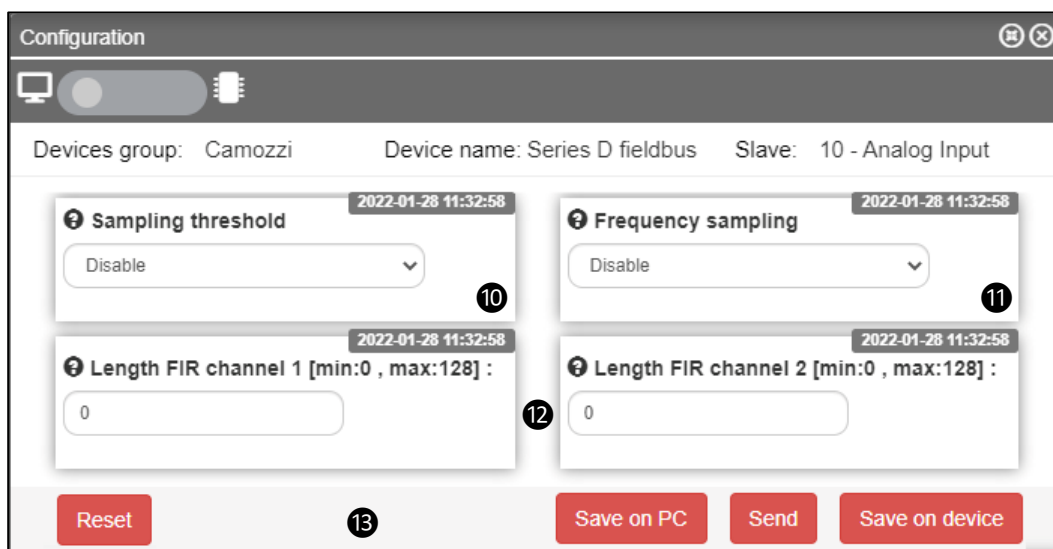
❾ ⚙ Configuration

9.5.1.1 Configuration of analogue input modules

From the status information page, you can configure certain operating-related parameters of the analogue input modules ❾.

Some of these parameters are specific to individual subtypes, while others are common to all subtypes of the analogue input family.

- ❿ Enable threshold-based transmission (default: *Disable*).
- ⓫ Enable frequency-based transmission (default: *Disable*).
- ⓬ Length of the impulse response of the FIR filter on channel 1 and channel 2.
- ⓭ Using the buttons in the bottom bar of the configuration window, the configured parameters can be sent to the module, saved on the PC, saved on the device or reset to default values.

- ⓮ Type of RTD for channel 1 and for channel 2
- ⓯ Number of wires for the RTD sensor on channel 1 and channel 1.
- ⓰ Type of Thermocouple for channel 1 and for channel 2.
- ⓱ Type of Bridge for channel 1 and for channel 2.
- ⓲ Type of Voltage/Current module for channel 1 and for channel 2

Configuration

Devices group: Camozzi   Device name: Series D fieldbus   Slave: 10 - Analog Input

2022-01-28 11:32:58
❷ Sensor Type RTD channel 1
PT1000 (385)

2022-01-28 11:32:58
❷ Sensor Type RTD channel 2
PT100 (385) ⑭

2022-01-28 11:32:58
❷ Number of wires RTD channel 1
2 wires

2022-01-28 11:32:58
❷ Number of wires RTD channel 2
4 wires ⑮

Reset   Save on PC   Send   Save on device

Configuration

Devices group: Camozzi   Device name: Series D fieldbus   Slave: 11 - Analog Input

2022-01-28 11:32:58
❷ Sensor Type TH channel 1
K

2022-01-28 11:32:58
❷ Sensor Type TH channel 2
T ⑯

Reset   Save on PC   Send   Save on device

Configuration

Devices group: default group   Device name: Series D fieldbus   Slave: 3 - Analog Input

2022-09-14 13:24:09
❷ Bridge factor channel 1 [min:0 , max:255] :
0

2022-09-14 13:24:09
❷ Bridge factor channel 2 [min:0 , max:255] :
0 ⑰

Reset   Save on PC   Send   Save on device
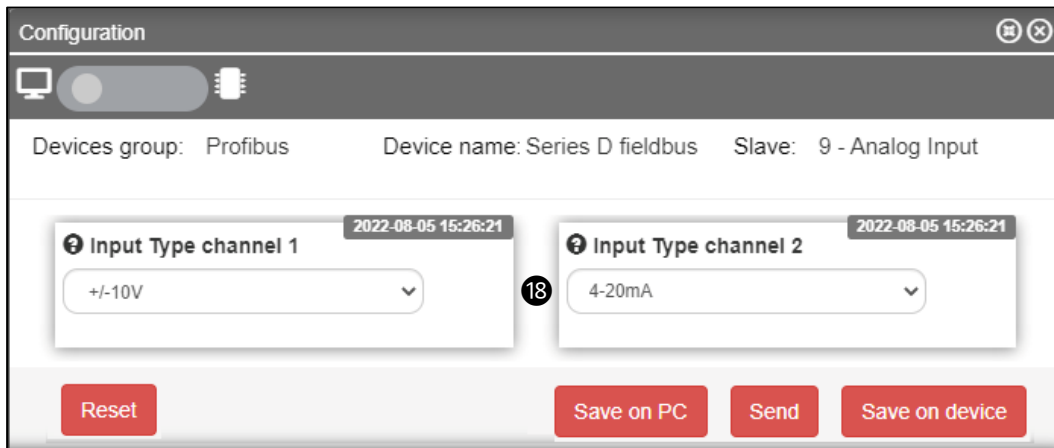
9.5.2   Details

9.5.2.1   *Variables*

The first tab on the details page displays the variables monitored by the analogue input module for both channels: temperatures ❶ for RTD and Thermocouples, currents or voltages ❷ for Voltage/Current modules and voltages ❸ for the Bridges.
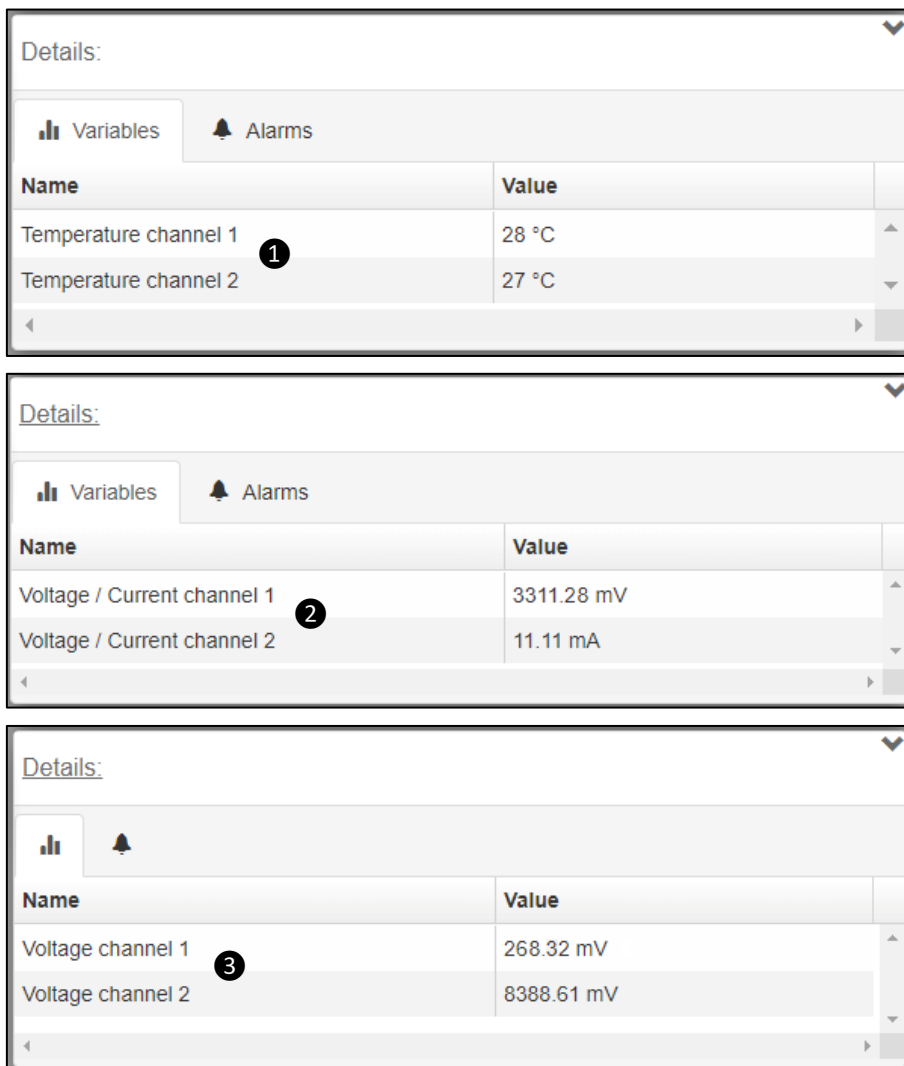
9.5.2.2 Alarms

The second details tab displays the alarms of the analogue input module.

- ▪ ❹ Malfunction of the sensor connected to channel 1.
- ▪ ❺ Bridge sensor connected to channel 1 missing or faulty (alarm for bridges only).
- ▪ ❻ Communication error with the internal ADC converter, which measures the relevant physical quantities.
- ▪ ❼ Error in 3.3V logic supply voltage.
- ▪ ❽ Malfunction of the sensor connected to channel 2.
- ▪ ❾ Bridge sensor connected to channel 2 missing or faulty (alarm for bridges only).
- ▪ ❿ Alarm of communication between the analogue input module and the CX4 module.
- ▪ ⓫ Alarm - configuration during parameterization.

9.6 Analogue Output Modules

9.6.1 Status information

On the first page of UVIX, select one of the analogue outputs connected to the CX4 module to view the general information of the accessory module.

- ❶ Identification images of the analogue output module.
- ❷ Module position assigned after mapping.
- ❸ Name of the accessory module family: *Analogue Output*.
- ❹ Subtype of the family of the analogue output module: 2 CH.
- ❺ Firmware version.
- ❻ Date and time of the last transmission of the variables between the analogue output module and UVIX.
- ❻ Date and time of the last transmission of the variables between the module and UVIX.
- ❼ General status of the module: ⚪ *Not available*, 🟢 *OK*, 🔴 *Alarm*.
- ❽ Operating status of the module:
  - o *Init* → initialization (mapping and configuration of parameters).
  - o *Work* → normal operation.
  - o *Error* → module error.
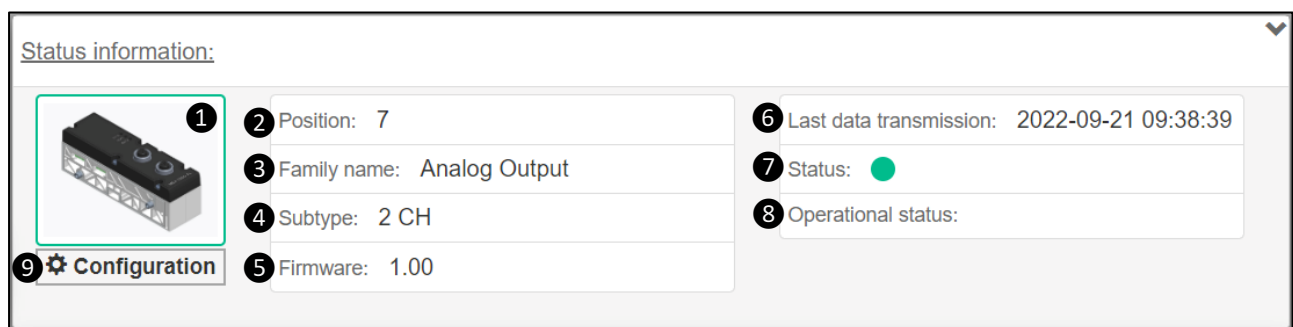
9.6.1.1 Configuration of analogue output modules

From the status information page, you can configure certain operating-related parameters of the digital output modules ❾.

- ❿ Type of analogue output (voltage or current) on channel 1.
- ⓫ Type of analogue output (voltage or current) on channel 2.
- ⓬ Enable Failsafe for channel 1: *Yes* enabled, *No* disabled (default).
- ⓭ Enable Failsafe for channel 2: *Yes* enabled, *No* disabled (default).
- ⓮ Failsafe value if enabled on the corresponding channel (mV/mA).

9.6.2 Details

9.6.2.1 Variables

The first tab on the details page displays the analogue output module variables for both channels depending on how they are configured ❶.

9.6.2.2   Alarms

The second tab on the details page displays the alarms of the analogue input module.

- ❷ Alarm of communication between the analogue output module and the CX4 module.
- ❸ Alarm - configuration during parameterization.
- ❹ Alarm - open circuit on channel 1.
- ❺ Alarm - open circuit on channel 2.
- ❻ Alarm - overheating of analogue output module.
- ❼ Alarm - short circuit of module supply voltage.
- ❽ Alarm - module supply voltage too low.
- ❾ Internal error.

Details:			⌄
📊 Variables	🔔 Alarms		
Event Name	**Status** ▾	**Event Onset**	
Communication alarm ❷	ⓘ		
Configuration alarm ❸	ⓘ		
Channel 1 Open Load ❹	ⓘ		
Channel 2 Open Load ❺	ⓘ		
Board Over Heating ❻	ⓘ		
Power Supply Short Circuit ❼	ⓘ		
Power Supply Under Threshold ❽	ⓘ		
Internal Error ❾	ⓘ		

9.6.3   Commands

On the main page of the CX4 module (par.9.1.2.2), there is a tab showing the commands for piloting the analogue output channels (❶ and ❷) by setting the value of the output in the corresponding unit of measurement. This tab is only visible in manual mode and if it has at least one analogue output module.

9.7 UVIX USB Gateway

The CX4 module can be connected to a PC via a USB cable. This connection - subject to prior installation of UVIX on the PC - allows you to communicate with the module through the Camozzi USB Gateway.

9.7.1 Main page
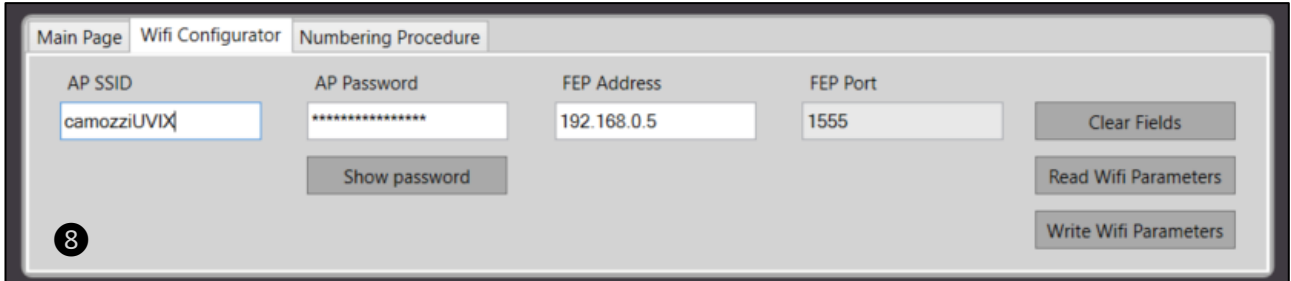
- ❶ Button to start up the USB Gateway and start communicating with the CX4 module.
- ❷ Button to stop communication with the CX4 module.
- ❸ Button to access the UVIX Browser interface (par. **Error! Reference source not found.**).
- ❹ COM ports connecting the CX4 modules.
- ❺ Virtual COM ports available and addresses of TCP connection for the connected COM ports.
- ❻ Data received from the COM port
- ❼ Data received on the FEP of the UVIX system.
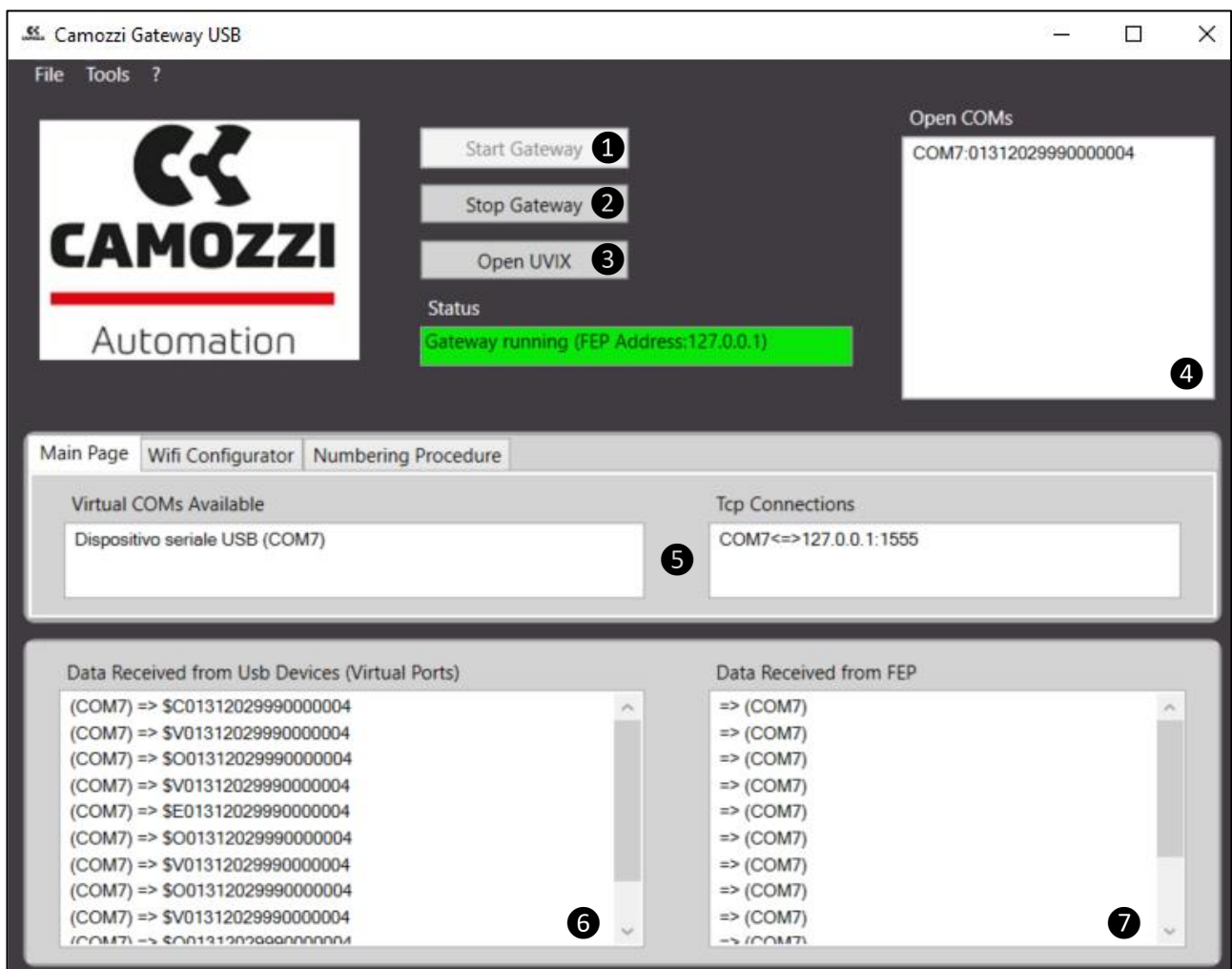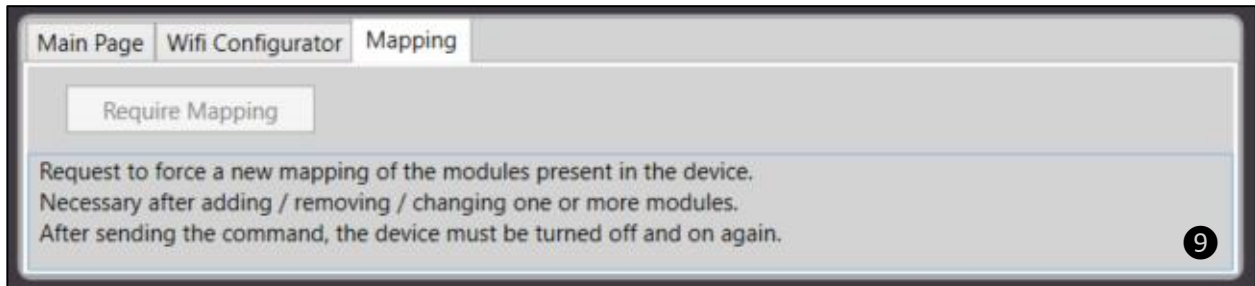
9.7.2 WiFi network configurator

In the tab for configuring the WiFi connection ❽ (if available), you can read the parameters of the current connection and write any new ones for a new connection.

9.7.3 Mapping

In the last tab that can be consulted via the USB gateway, you can send a mapping request to the CX4 module. The *Require Mapping* button remains pending until the next restart of the CX4 module.
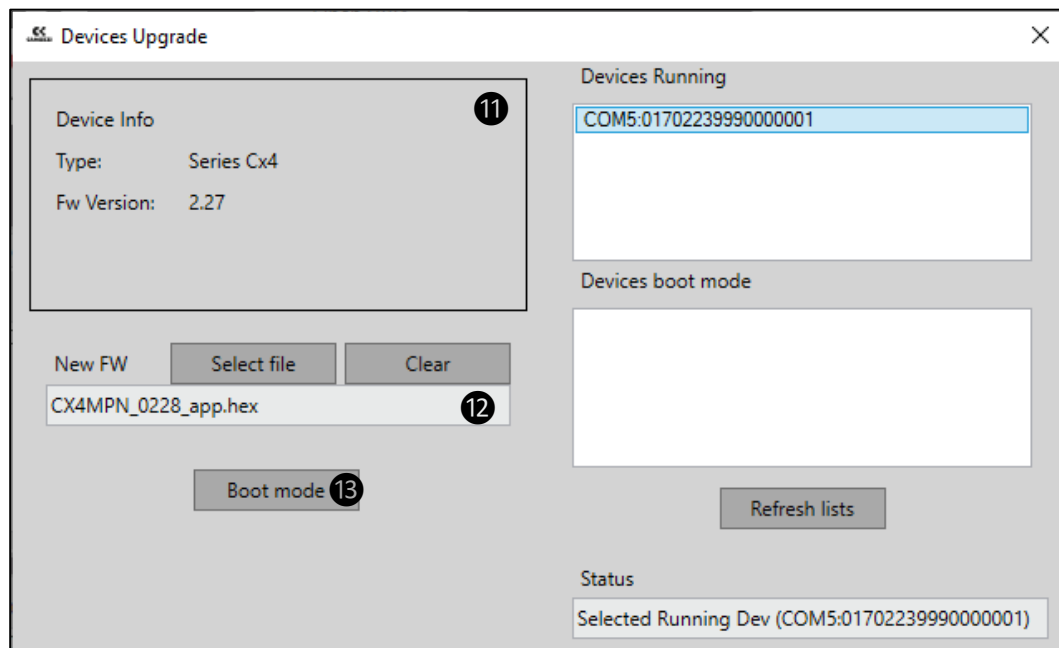

9.7.4 Firmware update

NOTE. Before carrying out this operation, you must contact Camozzi support.

The USB Gateway allows you to update the firmware of the CX4 module through the window found under Tools > Device Upgrade ❿.
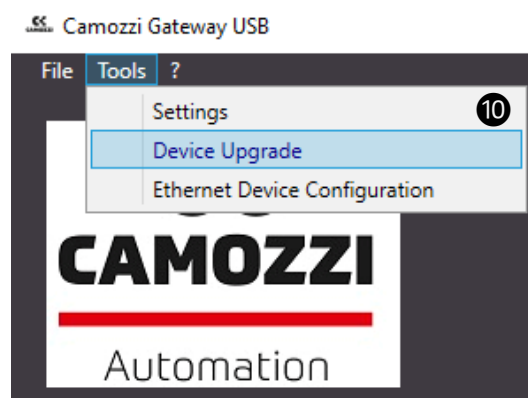
The firmware update window indicates the current version **❶** and allows you to select the new executable to upload to the module **❷**. You must then put the device in Boot mode **❸**.

Once in Boot mode, the module is ready to load the new firmware into memory **❹**.
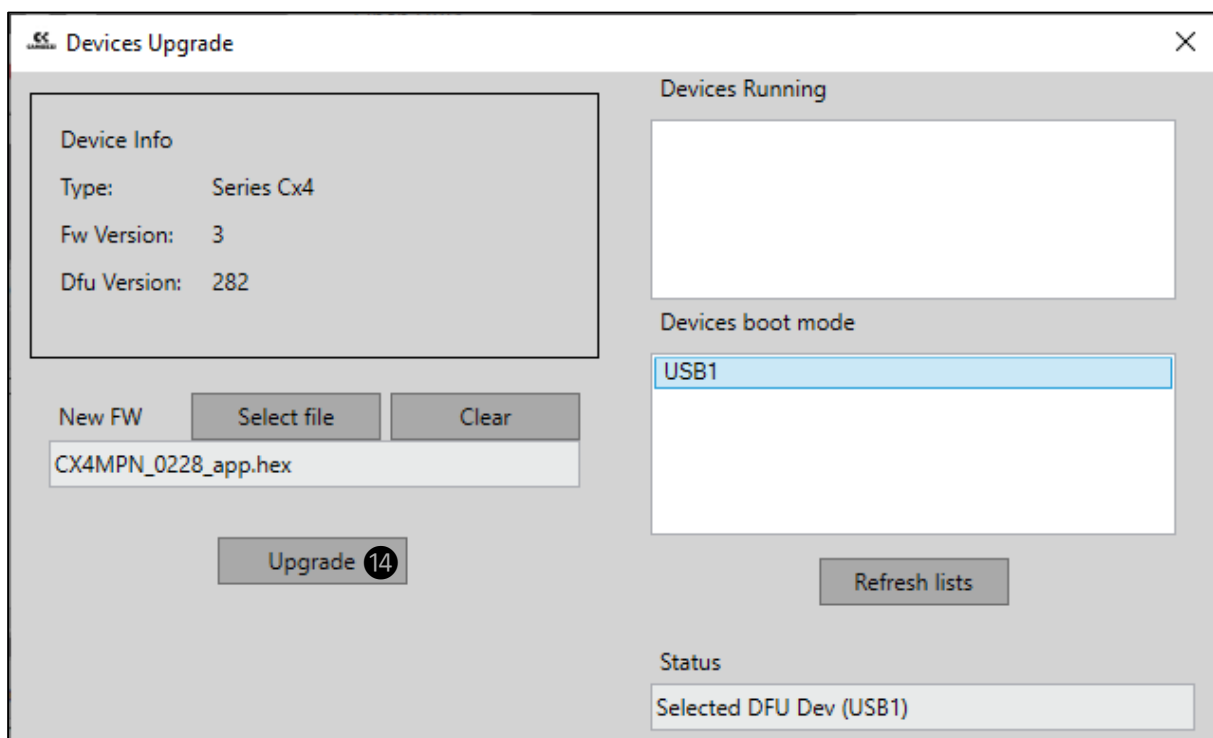
10 NFCamApp

10.1 Main overview

NFCamApp is an app for smartphones (Android and iOS) which allows you to communicate - via NFC technology - with the CX4 module to obtain general information on the module and on the valve island (if configured as such). You can also use the app for module configuration. Once the CX4 module has been scanned, on the homepage, alongside the antenna positioned under the symbol 🛜, you can view the Camozzi series of the device ❶ (*Series CX4*), assign a name to the device ❷ and clone ❸ the entire configuration (parameters of the CX4, the IO modules and the solenoid valve sub-bases) of the system, both in Stand Alone mode and as a Valve Island, to another system with a CX4 module compatible with the same fieldbus.
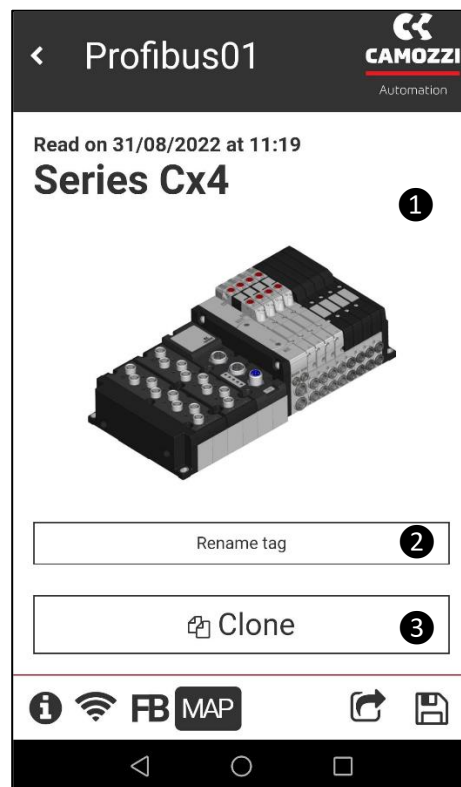
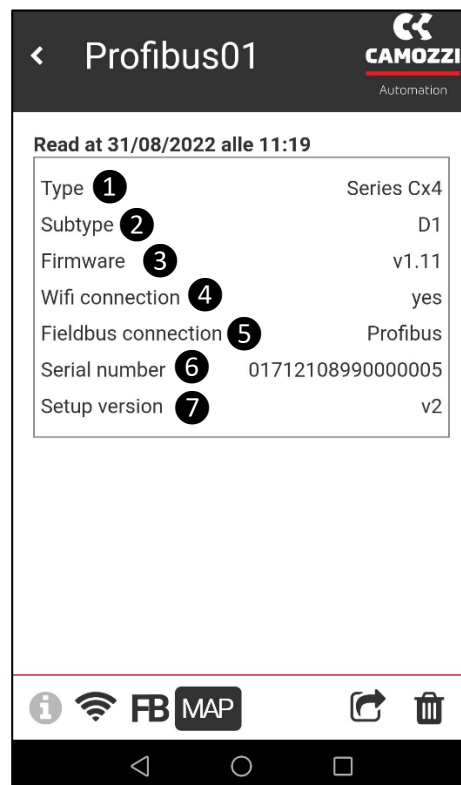You can also access other pages of the app via the icons at the bottom of the homepage.

- ▪ ❹ General module information page.
- ▪ ❺ WiFi network information page (if available).
- ▪ ❻ Bus information page.
- ▪ ❼ Page to request new mapping.
- ▪ ❽ Share module and/or island configuration.
- ▪ ❾ Save the configuration of the scanned module or island.
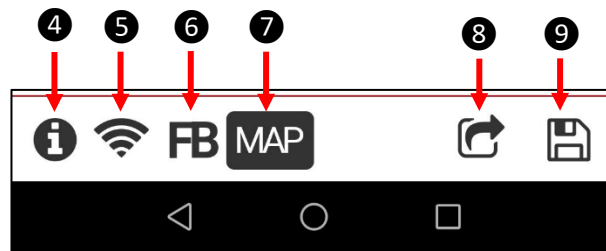
10.2 General information

The first selectable page $\mathbf{i}$ displays general information about the scanned CX4 module.

- ❶ Device family: *Series CX4*.
- ❷ Subtype of the CX4 module family: *Stand-alone*, D1, D2, D4 e D5.
- ❸ Firmware version.
- ❹ Status of the WiFi connection: *Yes* - WiFi module present, *No* – no WiFi module.
- ❺ Type of fieldbus: *PROFIBUS/DP*.
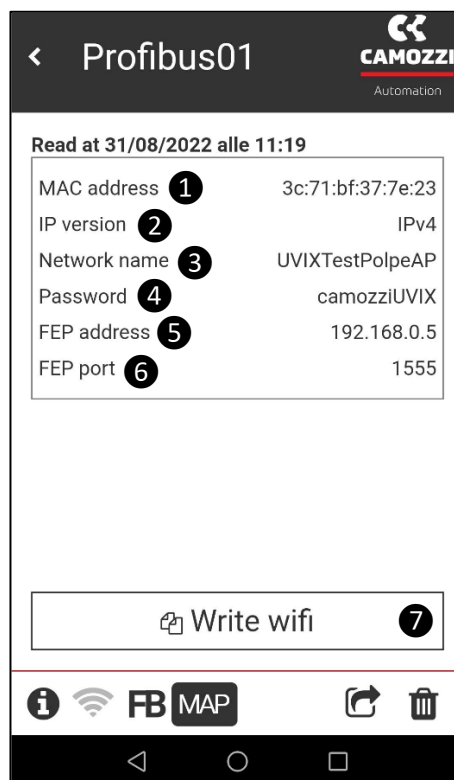- ❻ The serial number consists of 17 characters.
- ❼ Version of the app.

10.3 WiFi information

The WiFi connection information page 🛜 is found only if there is a WiFi module connected inside the CX4 module, otherwise it is not displayed.
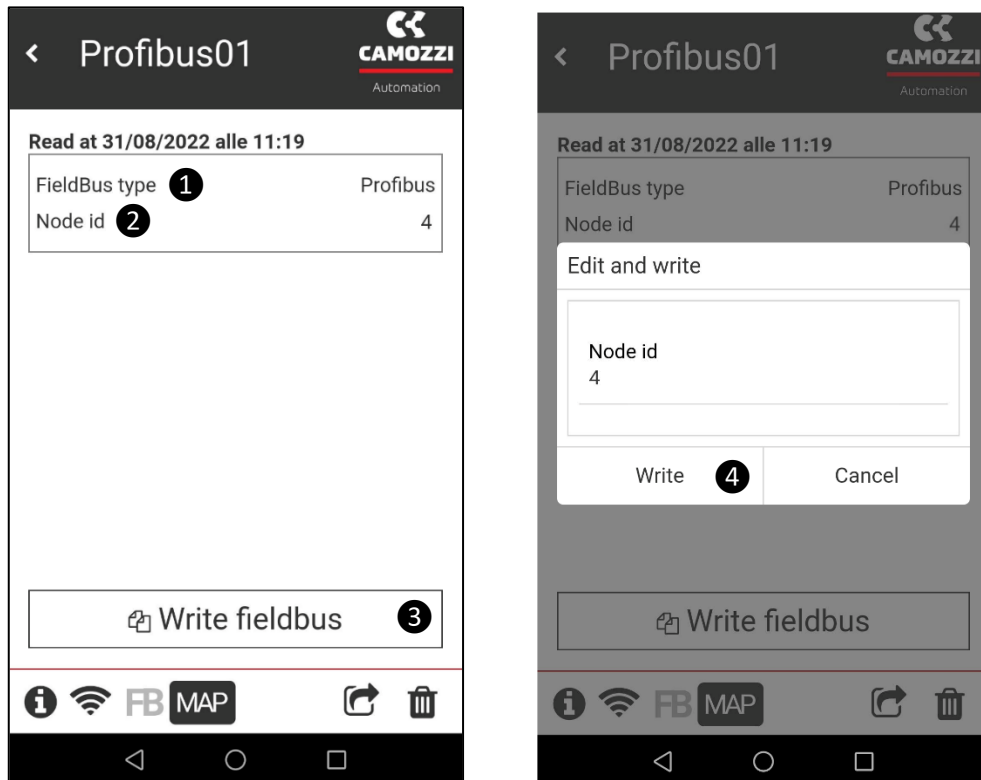
- ▪ ❶ MAC address of the WiFi module.
- ▪ ❷ IP version of the WiFi connection.
- ▪ ❸ Name of the WiFi network to which the device is connected.
- ▪ ❹ WiFi network password.
- ▪ ❺ FEP address to which the devices are connected.
- ▪ ❻ FEP port to which the device is connected.
- ▪ ❼ Button for changing the data of the WiFi network to which you want to connect the module.
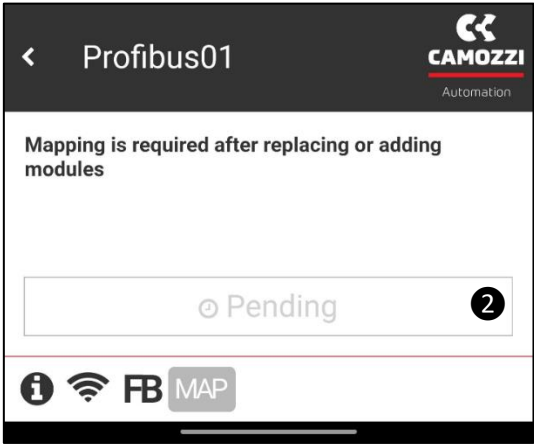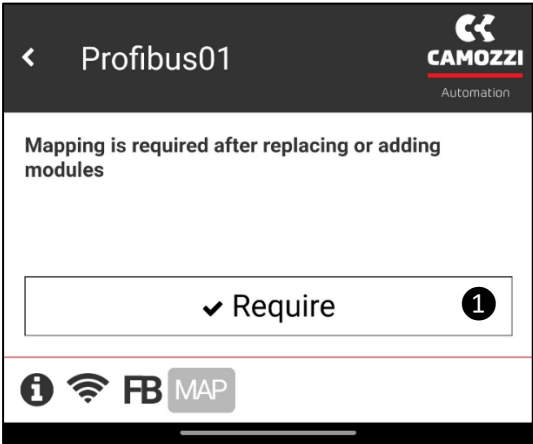
10.4 Fieldbus configuration

The PROFIBUS/DP protocol information page **FB** displays the name of the fieldbus ❶, and also the *Node id* ❷ that allows to communicate with the DP Master PROFIBUS/DP. This parameter (default 4) is configurable (par. **Error! Reference source not found.**) using the write button ❸ and writing an NFC ❹ through the app.

10.5 Mapping request

The last available page **MAP** in the app, you can request a new system mapping using the button *Require* ❶. Once the request has been made, it remains pending (the button will change to *Pending* ❷) until the next restart of the CX4 module.

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