P-Connect connection gateway

BP series

Operating instructions

ZE_FOG148A24-ENG

Index

1 INFORMATION ON THIS DOCUMENT

1.1 Function

These operating instructions provide information on installation, connection and safe use for the following articles: BP ••••••. The articles described in this document are also identified with the commercial name "P-Connect".

1.2 Target audience

The operations described in these operating instructions must be carried out by qualified personnel only, who are fully capable of understanding them, and with the technical qualifications required for operating the machines and plants in which the safety devices are to be installed.

1.3 Application field

These operating instructions apply exclusively to the products listed in paragraph FUNCTION, and their accessories.

1.4 Original instructions

The Italian language version is the original set of instructions for the device. Versions provided in other languages are translations of the original instructions.

1.5 Notes about this document

This document shows how to configure a BP unit using a Siemens PLC S7-1200 Failsafe.

The use of the BP gateway is only allowed in combination with the devices listed in paragraph WIRING INSTRUCTIONS for their respective versions.

Unauthorised use or changing system components is not allowed.

The client is responsible for all safety functions, especially for safety integration in the PROFIsafe environment.

It is the responsibility of the installer to make sure that the configuration of the BP unit is correct and compliant with the relevant risk assessment for the application, safety standards, and applied regulations. Pizzato Elettrica holds no responsibility if the following manual is used improperly.

Information contained in this document is subject to change without notice. Pizzato Elettrica assumes no responsibility for possible errors that may be present in this document.

2 Symbols used


This symbol indicates any additional information.


Attention: Any failure to observe this warning note can cause damage or malfunction, including possible loss of the safety function.

3 Description

3.1 Device description

The BP series P-Connect gateway is an I/O interface device based on the PROFINET network; the safety information is exchanged through PROFIsafe extensions. For correct operation, the controller must be compatible with PROFIsafe v2.6.

The unit can connect the following devices to a PROFINET/PROFIsafe network:

- Up to two NG/NS series safety switches with a wide selection of options using modular adapters, heads, and actuators from the range of products. The safety switches are connected safely using PROFIsafe standards for activating solenoid valves and monitoring safety outputs.
- A chain of emergency stop devices.
- Up to two BN series control device units.
- Up to two AN series handles.

The gateway integrates a network switch that facilitates "daisy-chain" connection without any additional hardware.

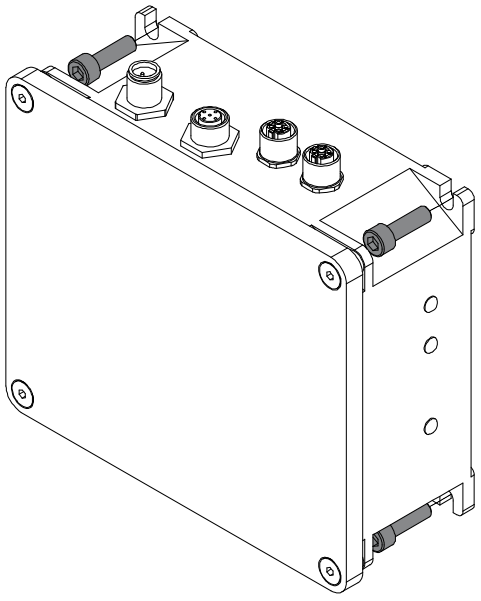
The safe "F - Address" is set through two DIP switches inside the gateway.

3.2 Intended use of the device

- The device described in these operating instructions is designed to be applied on industrial machines for state monitoring of movable guards.
- The direct sale of this device to the public is prohibited. Installation and use must be carried out by qualified personnel only.
- The use of the device for purposes other than those specified in these operating instructions is prohibited.
- Any use other than as expressly specified in these operating instructions shall be considered unintended by the manufacturer.
- Also considered unintended use:
  a) Using the device after having made structural, technical, or electrical modifications to it;
  b) Using the product in a field of application other than as described in paragraph TECHNICAL DATA.

4 Installation instructions

⚠ Attention: Installing a safety device is not sufficient to ensure operator safety or compliance with machine safety standards or directives. Before installing a safety device, perform a specific risk analysis in accordance with the key health and safety requirements in the Machinery Directive. The manufacturer guarantees only the safe functioning of the product to which these operating instructions refer, and not the functional safety of the entire machine or entire plant.



The device must always be fixed to the machine using at least two M6 screws with resistance class 4.6 or higher, with flat seating heads. The screws must have at least a number of threads engaged equal to or greater than their own diameter. The device must never be fixed with less than the specified number of screws.

5 Instructions for proper use

5.1 Installation

⚠ Attention: Installation must be carried out by qualified staff only.

- Do not modify the device for any reason.
- Do not exceed the tightening torques specified in the present manual.
- The safety category of the system (according to EN ISO 13849-1), including the safety device, also depends on the external components connected to it and their type.
- Before installation, make sure the device is not damaged in any part.
- Before installation, ensure that the connection cables are not powered.
- Avoid excessive bending of connection cables in order to prevent any short circuits or power failures.
- Do not paint or varnish the device.
- Do not drill the device.
- Do not use the device as a support or rest for other structures, such as raceways, sliding guides or similar.
- Before commissioning, make sure that the entire machine (or system) complies with all applicable standards and EMC Directive requirements.
- The fitting surface of the device must always be smooth and clean.
- The documentation required for correct installation and maintenance is available online in various languages on the Pizzato Elettrica website.
- - Should the installer be unable to fully understand the documents, the product must not be installed and the necessary assistance may be requested from the manufacturer (see paragraph SUPPORT).
- Always attach the following instructions to the manual of the machine in which the device is installed.
- These operating instructions must be kept available for consultation at any time and for the whole period of use of the device.

5.2 Maintenance and functional tests

⚠ Attention: Do not disassemble or try to repair the device. In case of any malfunction or failure, replace the entire device.

⚠ Attention: In case of damages or wear it is necessary to change the whole device. Correct operation cannot be guaranteed if the device is deformed or damaged.

- Perform all the foreseen safety functions prior to commissioning the machine and at least once a year (or after a prolonged shutdown).
- The device has been created for applications in dangerous environments, therefore it has a limited service life. Although still functioning, after 20 years from the date of manufacture the device must be replaced completely. The date of manufacture is placed next to the product code (see paragraph MARKINGS).

5.3 Wiring

⚠ Attention: Check that the supply voltage is correct before powering the device.

- Keep the charge within the values specified in the electrical operation categories.
- Only connect and disconnect the device when the power is off.
- Discharge static electricity before handling the product by touching a metal mass connected to earth. Any strong electrostatic discharge could damage the device.
- Power the safety device and the other components connected to it from a single SELV/PELV source and in accordance with the applicable standards.
- Always connect the protection fuse (or equivalent device) in series with the power supply for each device.
- During and after the installation do not pull the electrical cables connected to the device.

5.4 Additional requirements for safety applications with operator protection functions

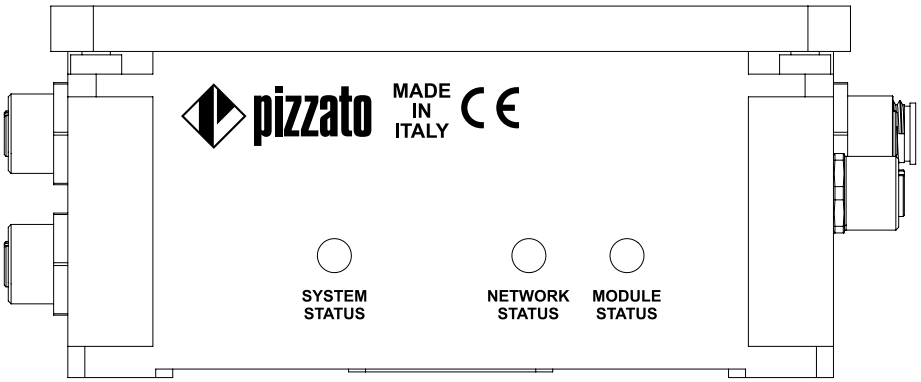
Provided that all previous requirements for the devices are fulfilled, for installations with operator protection function additional requirements must be observed:

- Utilization implies knowledge of and compliance with following standards: EN 60947-1, EN ISO 13849-1, EN 62061.

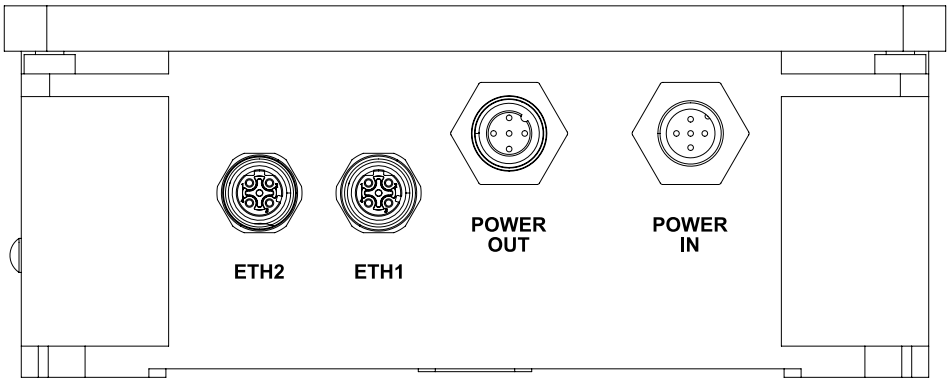
5.5 Limits of use

- Use the device following the instructions, complying with its operation limits and the standards in force.
- The devices have specific application limits (min. and max. ambient temperature, IP protection degree, etc.). These limitations are met by the device only if considered individually and not as combined with each other.
- The manufacturer's liability is to be excluded in the following cases:
  1) Use not conforming to the intended purpose;
  2) Failure to adhere to these instructions or regulations in force;
  3) Mounting not performed by qualified and authorised personnel;
  4) Omission of functional tests.
- For the cases listed below, before proceeding with the installation contact our technical assistance service (see paragraph SUPPORT):
  a) In nuclear power stations, trains, airplanes, cars, incinerators, medical devices or any application where the safety of two or more persons depend on the correct operation of the device;
  b) Applications not contemplated in this instruction manual.

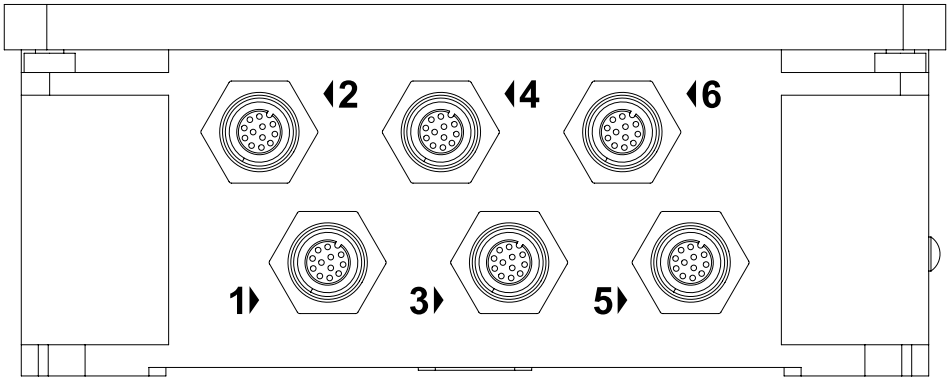
6 Device views



View “Side with LEDs”



View “Side with network and power connectors”



View “Side with device connectors”

Note: the images may vary in in terms of shape, position, and numbering of the connectors on the selected device.

7 Signalling LEDs

On the BP series connection box there are three LEDs to indicate the state of the device during normal operation:

- System status: multicolour signal, which through sequences of lighting, flashing and colour changes, indicates the various operating states of the device to the user, as well as any warnings or errors concerning internal electronic components;
- Network status: State monitoring of the connected Ethernet network;
- Module status: Signalling for diagnostic events.

7.1 Signalling LED “SYSTEM STATUS”

The predefined sensor operating states (OFF, RUN, ERROR, SET) are indicated by a constantly lit LED.

Every Warning / Error event is managed according to priority. A flashing LED always signals the highest priority event (lowest priority code = highest priority).

LED state	Description	Notes / Troubleshooting
Off	Not powered	No power supply: • Check the supply voltage • Check that the power supply cable is properly connected
Green	Online (RUN)	Normal device operation
Yellow	Wait	Waiting for PROFINET network start-up • Check for possible signals on “NETWORK STATUS” and “MODULE STATUS” LEDs
Red	Error state	If steady red: serious internal error. • Restart the gateway • If the error persists, contact technical assistance If flashing red, see Table 2

Table 1

If an ERROR event is identified, the LED cycles between continuous light corresponding to the ERROR state (see Table 1) with one of the illumination sequences listed in Table 2, each of which corresponds to a different message type.

Priority code	LED flashing	Description	Notes / Troubleshooting
0	Red-Red	Voltage error	Voltage out of permitted range: • After the gateway voltage has returned within the permitted threshold, restart the gateway
1	Red	Temperature error	Temperature out of permitted range: • After the gateway operating temperature has returned within the permitted threshold, restart the gateway
2	Red-Yellow	Error - Supply current of connected devices	Device current exceeds permitted limit: • Separate the connected devices from the gateway, check for malfunctioning, and restart the gateway
3	Red-Yellow-Yellow	Error - Current at non-safety outputs	Current of connected devices exceeds permitted limit: • Separate the connected devices from the gateway, check for malfunctioning, and restart the gateway • Check that the load connected to the non-safety outputs is within the permitted threshold
4	Reserved		
5	Yellow-Blue-Blue	Error - Safe "F - Address"	Wrong Safe F - Address: • Check that the DIP switch is correctly set with a value that is not Zero and that corresponds to the setting in the PLC configuration software. Changing the safe address requires a restart of the gateway

Table 2

If a WARNING event is identified, the LED cycles between continuous light corresponding to the current operating state (see Table 1) with the corresponding illumination sequence listed in Table 3.

Priority code	LED flashing	Description	Notes / Troubleshooting
6	Red-Red	Warning - Voltage	Voltage close to permitted limits: • Check the supply voltage of the gateway and adjust it to within the allowed range
7	Red	Warning - Temperature	Temperature close to permitted limits: • Check the operating temperature of the gateway and bring it back to within the allowed range
8	Red-Yellow	Warning - Supply current of connected devices	Current close to permitted limits: • Check that there are no malfunctions on the devices connected to the gateway
9	Red-Yellow-Yellow	Warning - Total current on non-safety outputs above limit	Total current delivered on non-safety outputs close to permitted limits: • Check that there are no malfunctions on the devices connected to the gateway • Check that the load connected to the non-safety outputs is within the permitted threshold
10	Red-Yellow-Green	Warning - Overcurrent of device connected to non-safety outputs	Current drawn by device connected to the non-safety outputs close to the permitted limits: • Check the wiring of the connected devices, restart the gateway • Check that the load connected to the non-safety outputs is within the permitted threshold
11	Reserved		
12	Red-Yellow-Red	Warning - Safety inputs or outputs	Check inputs and outputs for short circuits

Table 3

7.2 Signalling LED “NETWORK STATUS”

LED state	Description	Notes / Troubleshooting
Off	Offline	No power supply: • Check the supply voltage • Check that the power supply cable is properly connected No connection to the PLC: • Check that the network cable is properly connected
Green	Online (RUN)	• Connection to the PLC established • PLC in RUN state
Green, 1 flash	Online (STOP)	Connection to the PLC established PLC in STOP state or faulty IO data: • Check the state of the PLC as well as the types of exchanged data IRT synchronisation not terminated
Flashing green	Flashing	Used by PLC to identify the node on the network
Red	Internal error	Serious internal error: • Restart the gateway • If the error persists, contact technical assistance
Red, 1 flash	Error - Station name	Name of station not set: • Check the name of the node assigned to the BP gateway in the PLC software
Red, 2 flashes	Error - IP address	IP address not set: • Check that the IP address in the project matches the one in the actual configuration
Red, 3 flashes	Configuration error	Expected configuration is different from the real one: • Check that the submodules entered in the PLC software are in the correct order: 1) Safety Inputs/Safety Outputs 2) Error Flags 3) Warning Flags 4) Non-Safety Inputs 5) Non-Safety Outputs 6) Diagnostic Data Monitor

7.3 Signalling LED “MODULE STATUS”

LED state	Description	Notes / Troubleshooting
Off	Not initialized	No power supply: • Check the supply voltage • Check that the power supply cable is properly connected Gateway not yet started up
Green	Online (RUN)	Gateway started up
Green, 1 flash	Diagnostic Event	Presence of diagnostic events
Red	Internal error	Serious internal error: • Restart the gateway • If the error persists, contact technical assistance

8 Wiring instructions

8.1 Wiring article BP A1PL2001

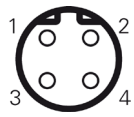
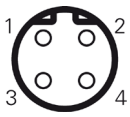
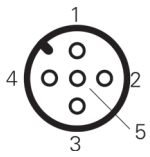
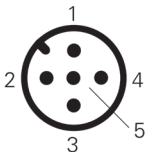
8.1.1 List of components BP gateway A1PL2001

Devices that can be connected:

- NG series safety switch (only articles of batches produced after 06/2021)
- NS series safety switch (only articles of batches produced after 06/2019)
- BN series control device unit
- AN series safety handle

8.1.2 Connectors for power supply and data network

The connectors for power supply and data transmission are positioned on the “Side with network and power connectors” and are labelled with the markings POWER IN, POWER OUT, ETH 1 and ETH 2.

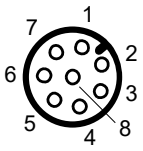
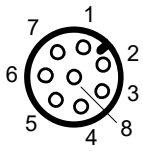
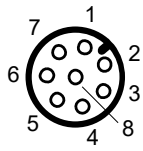
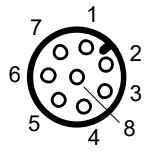
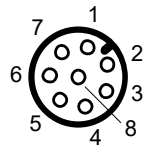
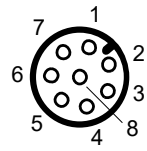
			
ETH 2 M12, 4-pole, female D-coded	**ETH 1** M12, 4-pole, female D-coded	**POWER OUT** M12, 5-pole, female A-coded	**POWER IN** M12, 5-pole, male A-coded

DATA connectors			POWER SUPPLY connectors		
ETH 1	ETH 2	Function	POWER IN	POWER OUT	Function
1	1	TX +	1	1	+24 Vdc
2	2	RX +	2	2	0 Vdc
3	3	TX -	3	3	0 Vdc
4	4	RX -	4	4	+24 Vdc
			5	5	GND

The device must be connected to earth using the conductor connected to the GND pin.

8.1.3 Safety device connectors

The connectors for connecting the devices are positioned on the "Side with device connectors" and are indicated with the numbers 1, 2, 3, 4, 5, 6.

					
Connector no. 1	**Connector no. 2**	**Connector no. 3**	**Connector no. 4**	**Connector no. 5**	**Connector no. 6**
M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded

Connector no. 1: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
1	O	+24 Vdc power supply	A1
2	I	Actuator enabled signal input	O3
3	O	0 Vdc power supply	A2
4	I	Safety input IS1	OS1
5	O	Solenoid activation command OS1	IE2
6	O	Actuator programming / reset	I3
7	I	Safety input IS2	OS2
8	O	Solenoid activation command OS2	IE1

Connector no. 2: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
1	O	+24 Vdc power supply	A1
2	I	Actuator enabled signal input	O3
3	O	0 Vdc power supply	A2
4	I	Safety input IS3	OS1
5	O	Solenoid activation command OS1	IE2
6	O	Actuator programming / reset	I3
7	I	Safety input IS4	OS2
8	O	Solenoid activation command OS2	IE1

Connectors no. 3 & 4: BN AC3•••• series control device units			
Pin	Type	P-Connect side	BN side
1	O	+24 Vdc power supply	+24 Vdc power supply
2	I	Non-safety input for contact of button 1	Button 1 contact
3	-	Disconnected	Disconnected
4	I	Non-safety input for contact of button 2	Button 2 contact
5 (2)	O	Test output TO1	Emergency stop button test input
6 (2)	I	Safety input IS5 for NC contact of emergency stop button	Emergency stop button NC safety contact
7 (2)	O	Test output TO2	Emergency stop button test input
8 (2)	I	Safety input IS6 for NC contact of emergency stop button	Emergency stop button NC safety contact

Connectors no. 5 & 6: AN series safety handles			
Pin	Type	P-Connect side	AN side
1	I	0 Vdc power supply	Power supply 0 V
2	O	+24 Vdc power supply	Power supply +24 V
3	O	Control output LED 1	Control input green LED (G)
4	O	Control output LED 4	Button LED control input
5 (1)	O	+24 V output for button contact	Button NO voltage-free contact input
6 (1)	I	Input for button contact	Button NO voltage-free contact output
7	O	Control output LED 2	Control input blue LED (B)
8	O	Control output LED 3	Control input red LED (R)

Legend:

A1 = Supply input +24 Vdc

A2 = Supply input 0 V

IE1, IE2 = Solenoid activation inputs

O3 = Signalling output, actuator inserted

O4 = Signalling output, actuator inserted and locked

ISx = Safety inputs

OSx = Safety outputs

I3 = Actuator programming input/reset

I5 = EDM input (cannot be used on BP series)

I = Device input

O = Device output

NC = Normally Closed contact

(1) Note: The output of pin 5 is intended for the control of a pulsed signal for testing a voltage-free contact. Pin 5 must be enabled by the PLC to supply 24 V at the input contact of the button. Monitoring of the contact commutation takes place via pin 6.

(2) Note: Test outputs TO1 and TO2 supply signals to the NC safety contacts of the emergency stop button. Safety inputs IS5 and IS6 are used to read the TOx signals fed through the NC safety contacts of the emergency stop button.

For more information about electrical connections of the safety devices, refer to the respective instructions for use, available on our website www.pizzato.com

8.2 Wiring article BP A1PL2002

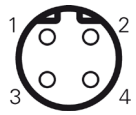
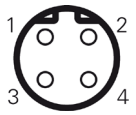
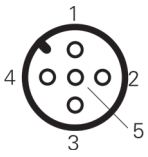
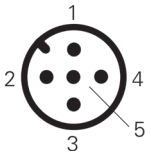
8.2.1 List of components BP gateway A1PL2002

Devices that can be connected:

- NG series safety switch (only articles of batches produced after 06/2021)
- NS series safety switch (only articles of batches produced after 06/2019)
- BN series control device unit
- AN series safety handle
- Control unit with emergency stop and ES AC series luminous disc
- 1 safety device with OSSD safety outputs, at the user's choice
- 1 signalling device (for example: indicator light tower), at the user's choice

8.2.2 Connectors for power supply and data network

The connectors for power supply and data transmission are positioned on the "Side with network and power connectors" and are labelled with the markings POWER IN, POWER OUT, ETH 1 and ETH 2.

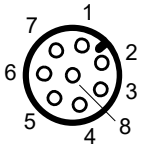
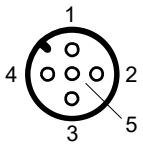
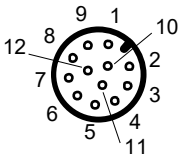
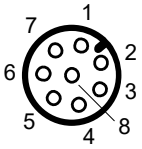
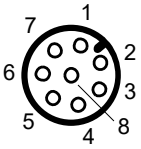
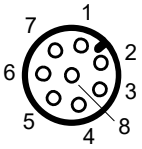
			
ETH 2 M12, 4-pole, female D-coded	**ETH 1** M12, 4-pole, female D-coded	**POWER OUT** M12, 5-pole, female A-coded	**POWER IN** M12, 5-pole, male A-coded

DATA connectors			POWER SUPPLY connectors		
ETH 1	ETH 2	Function	POWER IN	POWER OUT	Function
1	1	TX +	1	1	+24 Vdc
2	2	RX +	2	2	0 Vdc
3	3	TX -	3	3	0 Vdc
4	4	RX -	4	4	+24 Vdc
			5	5	GND

The device must be connected to earth using the conductor connected to the GND pin.

8.2.3 Safety device connectors

The connectors for connecting the devices are positioned on the "Side with device connectors" and are indicated with the numbers 1, 2, 3, 4, 5, 6.

					
Connector no. 1	**Connector no. 2**	**Connector no. 3**	**Connector no. 4**	**Connector no. 5**	**Connector no. 6**
M12, 8-pole, female, A-coded	M12, 5-pole, female, A-coded	M12, 12-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded

Connector no. 1: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
1	O	+24 Vdc power supply	A1
2	I	Actuator enabled signal input	O3
3	O	0 Vdc power supply	A2
4	I	Safety input IS1	OS1
5	O	Solenoid activation command OS1	IE2
6	O	Actuator programming / reset	I3
7	I	Safety input IS2	OS2
8	O	Solenoid activation command OS2	IE1

Connector no. 2: Safety sensor with OSSD outputs			
Pin	Type	P-Connect side	Sensor side
1	O	+24 Vdc power supply	A1
2	I	Safety input IS3	OS1
3	O	0 Vdc power supply	A2
4	I	Safety input IS4	OS2
5	O	Signalling input	O3

Connector no. 3: BN AC4•••• series control device units			
Pin	Type	P-Connect side	BN side
1	O	+24 Vdc power supply	Power supply +24 V
2	O	Position 1 LED control output	Position 1 LED control input
3	I	0 Vdc power supply	Power supply 0 V
4	I	Input for button 1 contact	Button 1 contact
5	I	Input for button 2 contact	Button 2 contact
6	O	Position 2 LED control output	Position 2 LED control input
7	I	Input for button 3 contact	Button 3 contact
8	O	Position 3 LED control output	Position 3 LED control input
9	I	Input for button 4 contact	Button 4 contact
10	-	Disconnected	Disconnected
11	-	Disconnected	Disconnected
12	O	Position 4 LED control output	Position 4 LED control input

Connector no. 4: Luminous disc and emergency stop unit			
Pin	Type	P-Connect side	Luminous disc and emergency stop unit side
1	-	Disconnected	Disconnected
2	O	Control output luminous disc +24 Vdc	Control input luminous disc +24 V
3	O	Luminous disc power supply 0 Vdc	Power supply 0 V
4	-	Disconnected	Disconnected
5 (2)	O	Test output TO1	Emergency stop button test input
6 (2)	I	Safety input IS5 for NC contact of emergency stop button	Emergency stop button NC safety contact
7 (2)	O	Test output TO2	Emergency stop button test input
8 (2)	I	Safety input IS6 for NC contact of emergency stop button	Emergency stop button NC safety contact

Connector no. 5: AN series safety handles			
Pin	Type	P-Connect side	AN side
1	I	0 Vdc power supply	Power supply 0 V
2	O	+24 Vdc power supply	Power supply +24 V
3	O	Control output LED 1	Control input green LED (G)
4	O	Control output LED 4	Button LED control input
5 (1)	O	+24 V output for button contact	Button NO voltage-free contact input
6 (1)	I	Input for button contact	Button NO voltage-free contact output
7	O	Control output LED 2	Control input blue LED (B)
8	O	Control output LED 3	Control input red LED (R)

Connector no. 6: Indicator light tower (reference wiring diagram)			
Pin	Type	P-Connect side	Indicator light tower side
1	I	0 Vdc power supply	Power supply 0 V
2	O	+24 Vdc power supply	Power supply +24 V
3	O	Control output LED 1	Control input LED 1
4	O	Control output LED 4	Control input LED 4
5	O	Buzzer control output	Buzzer control input
6	I	Signalling input	Signalling output
7	O	Control output LED 2	Control input LED 2
8	O	Control output LED 3	Control input LED 3

Legend:

A1 = Supply input +24 Vdc

A2 = Supply input 0 V

IE1, IE2 = Solenoid activation inputs

O3 = Signalling output, actuator inserted

O4 = Signalling output, actuator inserted and locked

ISx = Safety inputs

OSx = Safety outputs

I3 = Actuator programming input/reset

I5 = EDM input (cannot be used on BP series)

I = Device input

O = Device output

NC = Normally Closed contact

(1) Note: This function is dedicated to the control of a button with a voltage-free contact. Pin 5 must be enabled by the PLC to supply 24 V at the input contact of the button. Monitoring of the contact commutation takes place via pin 6.

(2) Note: Test outputs TO1 and TO2 supply signals to the NC safety contacts of the emergency stop button. Safety inputs IS5 and IS6 are used to read the TOx signals fed through the NC safety contacts of the emergency stop button.

For more information about electrical connections of the safety devices, refer to the respective instructions for use, available on our website www.pizzato.com

8.3 Wiring article BP A1PL2003

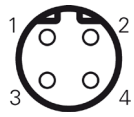
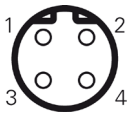
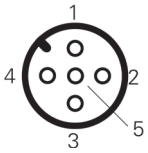
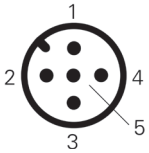
8.3.1 List of components BP gateway A1PL2003

Devices that can be connected:

- 2 NG/NS series safety switches with integrated command devices (only articles of batches produced after 06/2021)
- 2 AN series safety handles

8.3.2 Connectors for power supply and data network

The connectors for power supply and data transmission are positioned on the "Side with network and power connectors" and are labelled with the markings POWER IN, POWER OUT, ETH 1 and ETH 2.

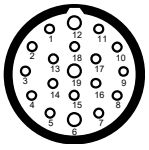
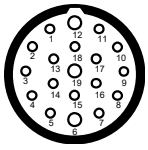
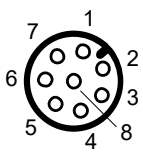
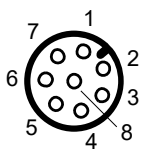
			
ETH 2 M12, 4-pole, female D-coded	**ETH 1** M12, 4-pole, female D-coded	**POWER OUT** M12, 5-pole, female A-coded	**POWER IN** M12, 5-pole, male A-coded

DATA connectors			POWER SUPPLY connectors		
ETH 1	ETH 2	Function	POWER IN	POWER OUT	Function
1	1	TX +	1	1	+24 Vdc
2	2	RX +	2	2	0 Vdc
3	3	TX -	3	3	0 Vdc
4	4	RX -	4	4	+24 Vdc
			5	5	GND

The device must be connected to earth using the conductor connected to the GND pin.

8.3.3 Safety device connectors

The connectors for connecting the devices are positioned on the "Side with device connectors" and are indicated with the numbers 1, 2, 3, 4.

			
Connector no. 1	**Connector no. 2**	**Connector no. 3**	**Connector no. 4**
M23, 19-pole, female, A-coded	M23, 19-pole, female, A-coded	M12, 8-pole, female, A-coded	M12, 8-pole, female, A-coded

Connector no. 1: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
1	O	Single-channel solenoid activation output	I4
2	O	Short circuit +24 VDC	IS1
3	O	Short circuit +24 VDC	IS2
4	I	Safety input IS1	OS1

Connector no. 1: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
5	I	Safety input IS2	OS2
6	O	+24 Vdc power supply	A1
7	O	Actuator programming / reset	I3
8	I	Signalling input, actuator inserted	O3
9	I	Locked guard signal input	O4
10 (2)	O	Test output TO1	Emergency stop button test input
11 (2)	I	Safety input IS5 for NC contact of emergency stop button	Emergency stop button NC safety contact
12	-	Not connected	I5
13 (2)	O	Test output TO2	Emergency stop button test input
14 (2)	I	Safety input IS6 for NC contact of emergency stop button	Emergency stop button NC safety contact
15	I	Input for position 2 contact	Position 2 contact
16	O	Position 2 LED control output	Position 2 LED control input
17	I	Input for position 1 contact	Position 1 contact
18	O	Position 1 LED control output	Position 1 LED control input
19	I	0 Vdc power supply	A2

Connector no. 2: NG/NS series safety switches			
Pin	Type	P-Connect side	NG/NS side
1	O	Single-channel solenoid activation output	I4
2	O	Short circuit +24 VDC	IS1
3	O	Short circuit +24 VDC	IS2
4	I	Safety input IS3	OS1
5	I	Safety input IS4	OS2
6	O	+24 Vdc power supply	A1
7	O	Actuator programming / reset	I3
8	I	Signalling input, actuator inserted	O3
9	I	Locked guard signal input	O4
10 (2)	O	Test output TO1	Emergency stop button test input
11 (2)	I	Safety input IS5 for NC contact of emergency stop button	Emergency stop button NC safety contact
12	-	Not connected	I5
13 (2)	O	Test output TO2	Emergency stop button test input
14 (2)	I	Safety input IS6 for NC contact of emergency stop button	Emergency stop button NC safety contact
15	I	Input for position 2 contact	Position 2 contact
16	O	Position 2 LED control output	Position 2 LED control input
17	I	Input for position 1 contact	Position 1 contact
18	O	Position 1 LED control output	Position 1 LED control input
19	I	0 Vdc power supply	A2

Connectors no. 3 & 4: AN series safety handles			
Pin	Type	P-Connect side	AN side
1	I	0 Vdc power supply	Power supply 0 V
2	O	+24 Vdc power supply	Power supply +24 V
3	O	Control output LED 1	Control input green LED (G)
4	O	Control output LED 4	Button LED control input
5 (1)	O	+24 V output for button contact	Button NO voltage-free contact input
6 (1)	I	Input for button contact	Button NO voltage-free contact output
7	O	Control output LED 2	Control input blue LED (B)
8	O	Control output LED 3	Control input red LED (R)

Legend:

A1 = Supply input +24 Vdc

A2 = Supply input 0 V

IE1, IE2 = Solenoid activation inputs

O3 = Signalling output, actuator inserted

O4 = Signalling output, actuator inserted and locked

ISx = Safety inputs

OSx = Safety outputs

I3 = Actuator programming input/reset

I5 = EDM input (cannot be used on BP series)

I = Device input

O = Device output

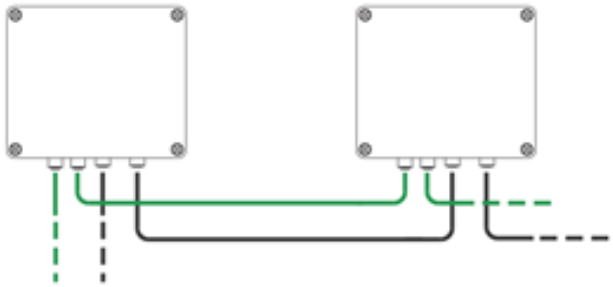
NC = Normally Closed contact

(1) Note: This function is dedicated to the control of a button with a voltage-free contact. Pin 5 must be enabled by the PLC to supply 24 V at the input contact of the button. Monitoring of the contact commutation takes place via pin 6.

(2) Note: Test outputs TO1 and TO2 supply signals to the NC safety contacts of the emergency stop button. Safety inputs IS5 and IS6 are used to read the TOx signals fed through the NC safety contacts of the emergency stop button.

For more information about electrical connections of the safety devices, refer to the respective instructions for use, available on our website www.pizzato.com

9 Series connection of the device



All P-Connect gateways are equipped with a double connector for the power supply of the device and for the fieldbus network connection. This makes it easy to install several P-Connect gateways in series by simply connecting the input and output connectors together. This feature was specially designed to reduce the time required for installation, disassembly and replacement of components during maintenance.

If the devices are powered independently, the limit of gateways that can be connected in series depends on the number of nodes supported by the PLC. If, on the other hand, power is supplied via series connection, then the limit of connected devices results from the voltage drop in the 'POWER IN' and 'POWER OUT' cables.

Pay attention to the wire cross-section (mm^2) and to the cable length to guarantee that the device will operate in the specified operating voltage range. The connectors integrated in the gateway are provided with two pins for 24 Vdc and two pins for 0 Vdc.

Pin	Function
1	+24 Vdc
2	0 Vdc
3	0 Vdc
4	+24 Vdc
5	GND

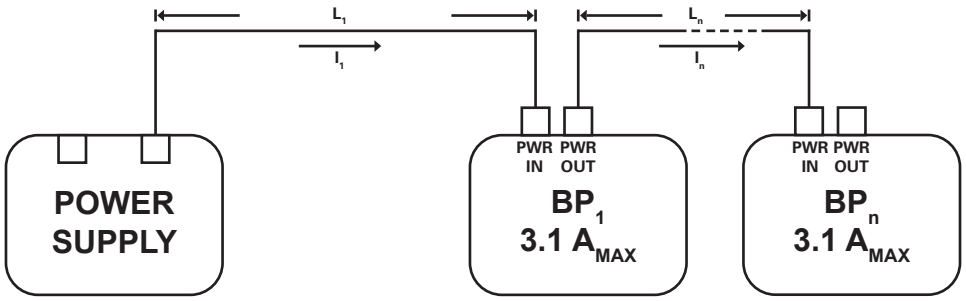
⚠ Attention: Make sure that all power supply input pins are connected. Pin 1 and 4 connected to +24 V, Pin 2 and 3 connected to 0 V. This doubles the wire cross-section (0.25 mm^2 x 2) and results in less voltage drop along the series connection of the devices.

An example for the calculation of the voltage drop is presented in paragraph EXAMPLE OF VOLTAGE DROP CALCULATION.

9.1 Example of voltage drop calculation

Wire cross-section of Pizzato cables: 0.25 mm² (23 AWG) for 5 poles.

The rated operating voltage of the module is indicated in paragraph TECHNICAL DATA in this manual.



$$V_{BP1} = V_{PWR} - \rho \times \frac{L_1 \times I_1}{S}$$

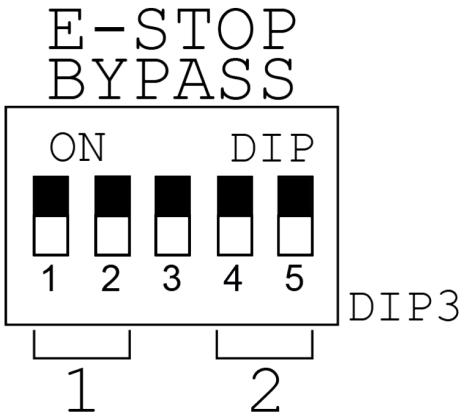
$$V_{BP\,n} = V_{BP\,n-1} - \rho \times \frac{L_n \times I_n}{S}$$

$$\rho\ (copper\ resistivity\ @\ 20\ °C) = 0.018\ \left[\frac{\Omega \times mm^2}{m}\right]$$

$$S = conductor\ section\ [mm^2]$$

10 Bypassing of emergency stop buttons

Some of the BP gateway configurations can be used to manage up to two emergency stop buttons, but these are connected in series to each other inside the gateway. If you are not going to use both emergency stop buttons, it is necessary to bypass one of them using the "DIP3" switch (called "E-STOP BYPASS") located under the cover of the BP gateway.



If the first two switches "1" and "2" are switched "ON" this bypasses the first emergency stop button connected. The two switches "4" and "5" bypass the second emergency stop button connected. The switches must only be operated when the BP gateway is OFF, in order to prevent incoherent input test signal readings.

⚠ Attention: Always check on the machine that the actual emergency stop configuration works as expected.

11 P-CONNECT configuration with a Siemens TIA Portal project

P-Connect configuration starts with the project view screen (Fig.1)

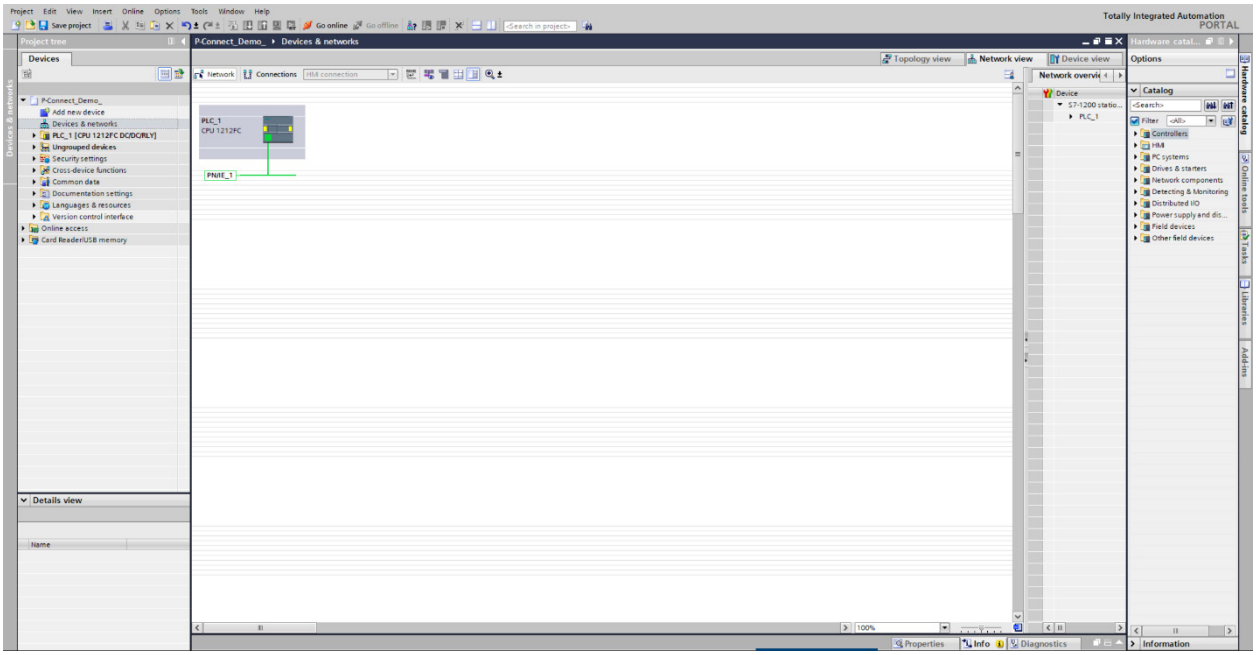


Fig. 1

11.1 Installation of configuration file

To install the GSDML configuration file, enter the "Options" menu and click on "Manage general station description files (GSD)".

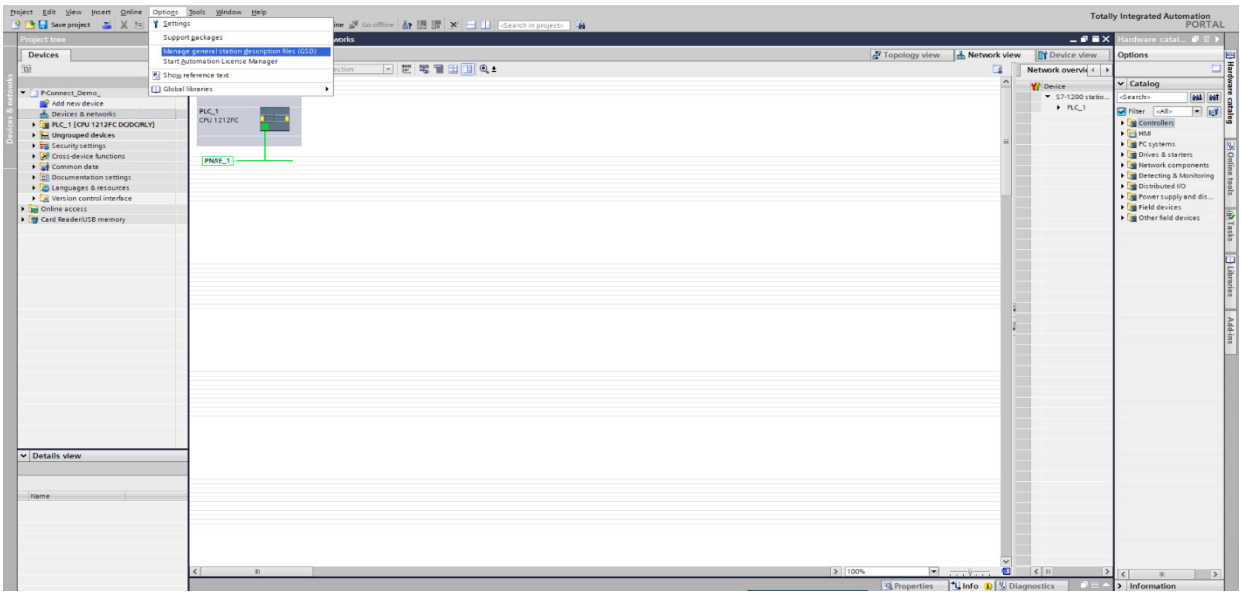


Fig. 2

After downloading the configuration file for the correct BP model from the Pizzato website, go to the download folder and select the GSDML file that is not yet installed. Then press "Install".

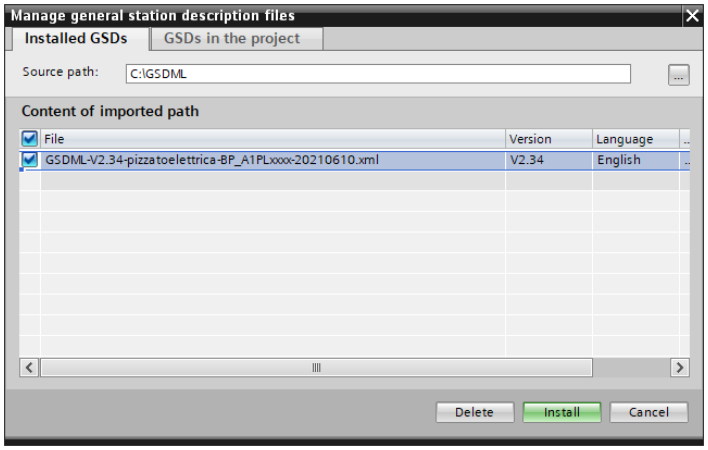


Fig. 3

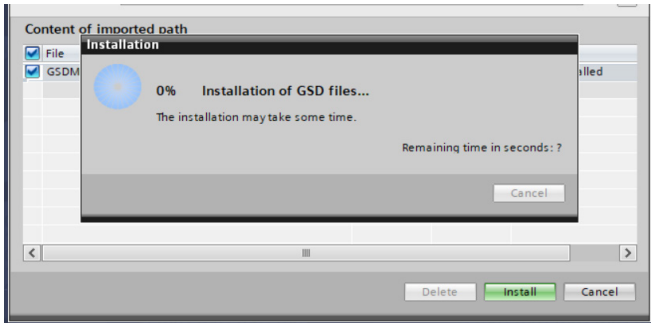


Fig. 4

11.2 Configuration of the BP gateway

Open the hardware catalogue and navigate to "Other field devices – PROFINET IO – I/O" (Fig. 5). In the I/O folder, enter the path "Pizzato Elettrica – Pizzato Connection Box". The installed GSDML file is located in this folder. Drag the BL gateway in the tab "Devices & networks" (Fig. 6).

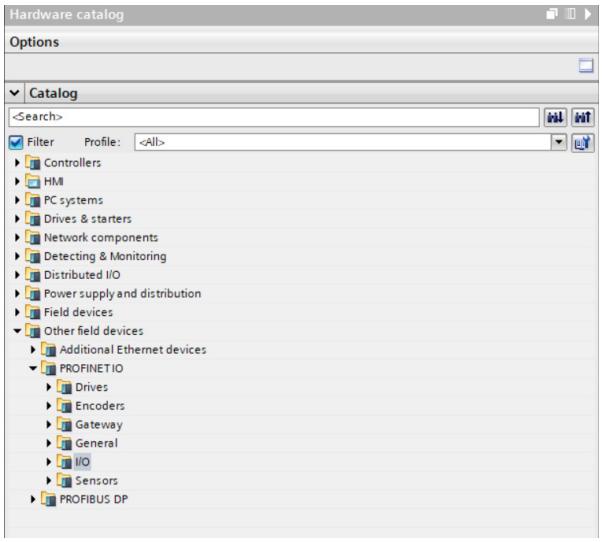


Fig. 5

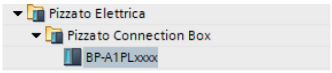


Fig. 6

After importing the BP gateway into the screen "Devices and networks", create a connection to the PLC.

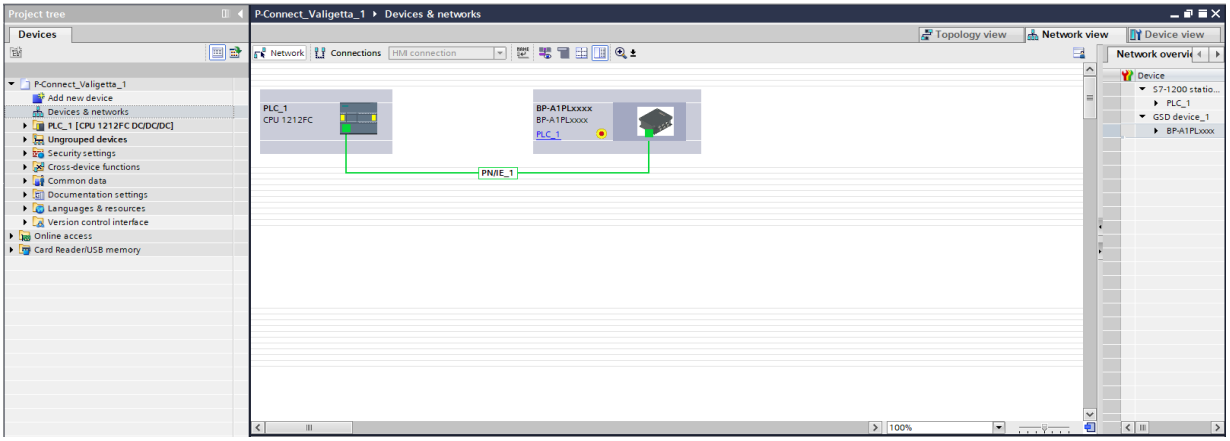


Fig. 7

Once the BP device is imported, the "Device overview" screen shows the modules available for data reading/writing as indicated in Fig. 8.

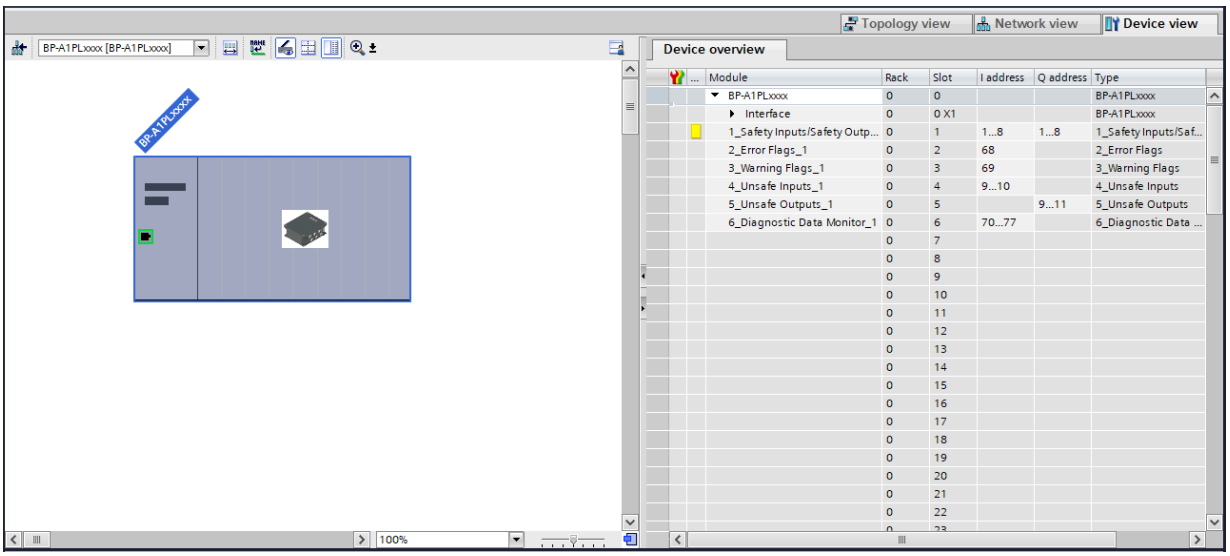


Fig. 8

To configure communication between the gateway and the PLC, it is necessary to set following parameters:

- IP address
- Device name

To do this, right-click on the BP device and go to "Properties" (Fig. 9). Go to "PROFINET Interface" – "Ethernet Address": set the IP address, which must be in the same subnet as the PLC, and leave the automatically generated name PROFINET (Fig. 10).

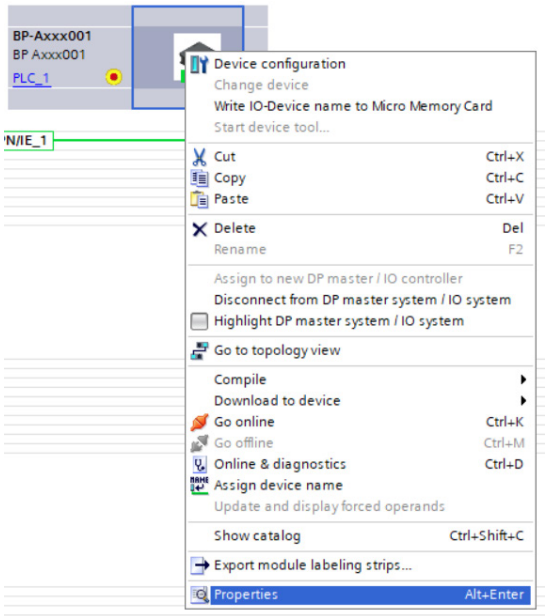


Fig. 9

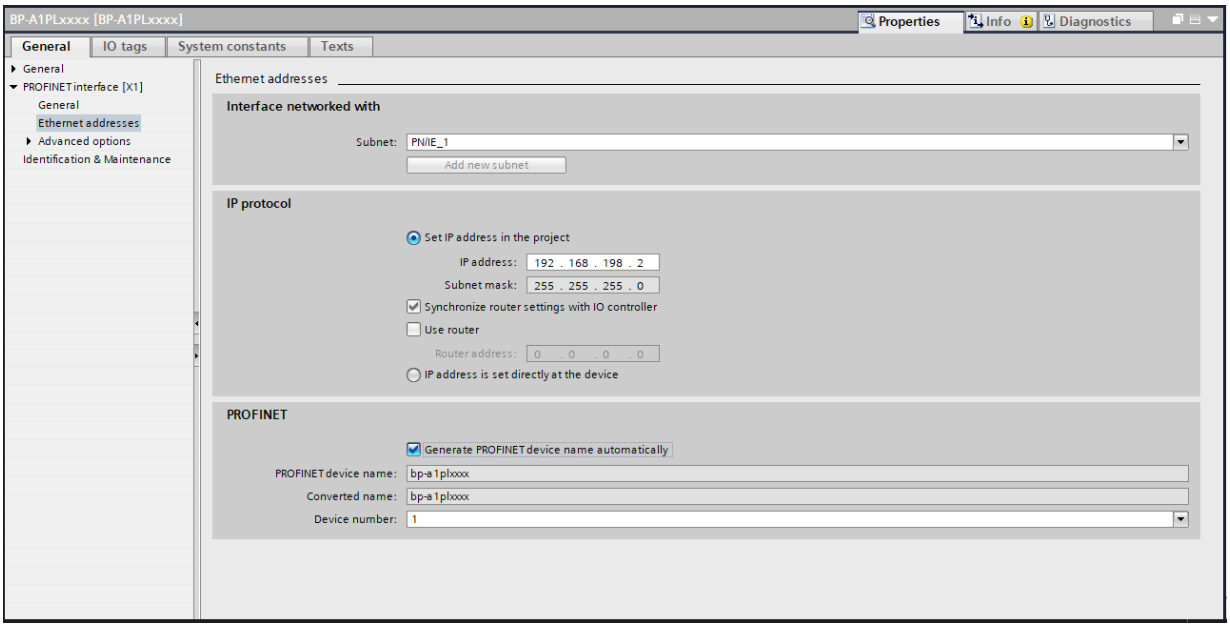


Fig. 10

After setting the configurations in the device properties, make certain that the address and name of the physical device are correct. Right-click on the BP device and select “Online & diagnostics” with one of the methods illustrated in Fig. 11a or Fig. 11b. Under the functions section, assign the IP address and the name according to the project (Fig. 12).

Attention: If the online configuration is different from the project configuration, the system will not function correctly and the PLC will report an error on the BP device.

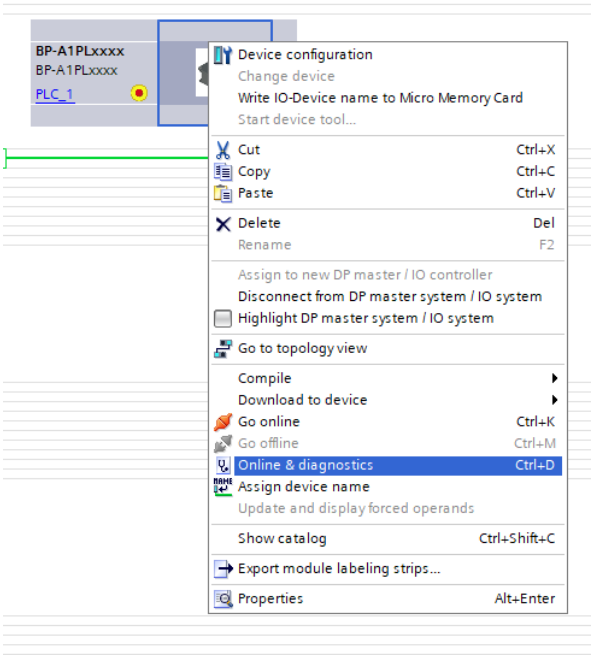


Fig. 11a

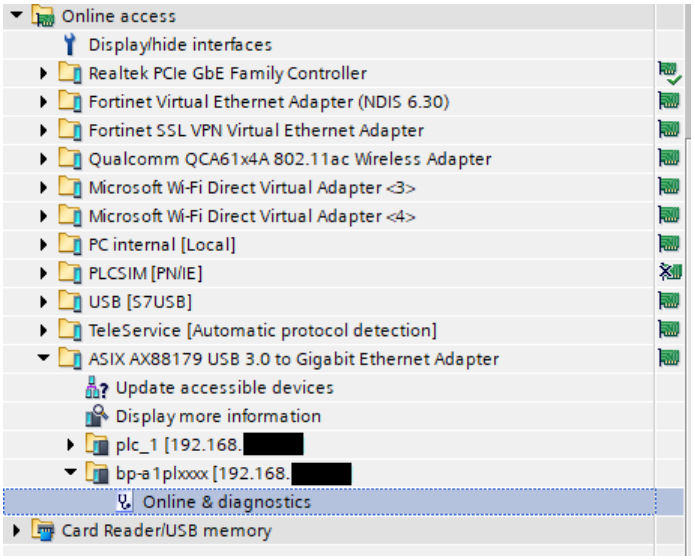


Fig. 11b

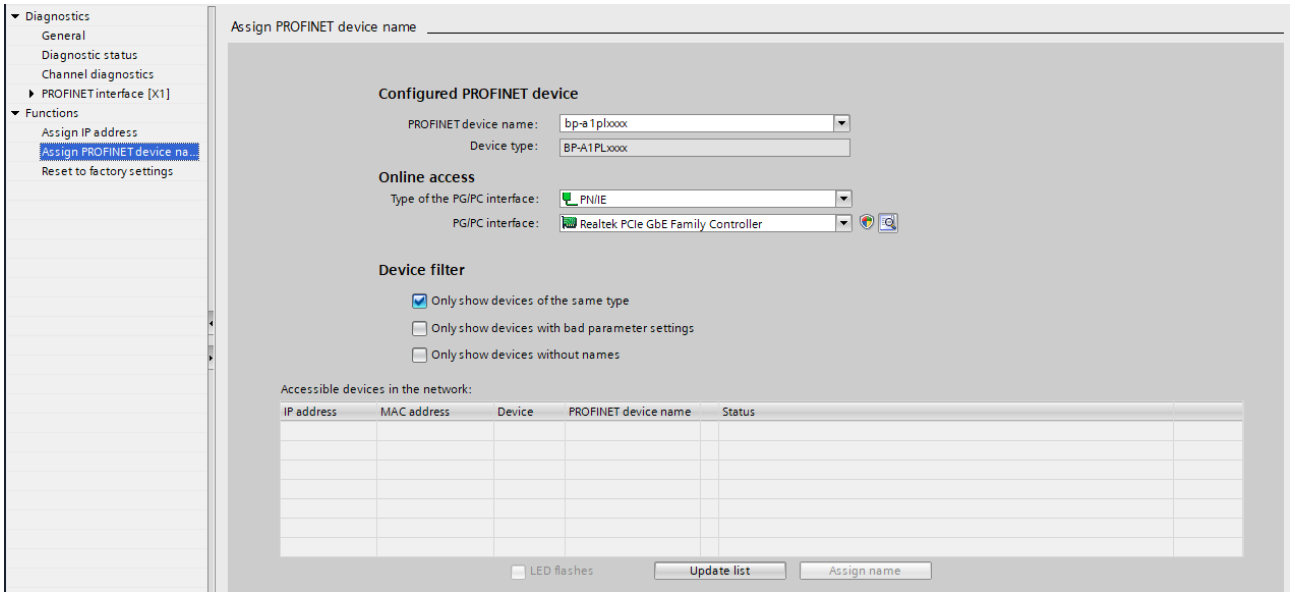


Fig. 12

11.3 Setting Safe “F - Address”

The safe address (F - Address) provides a unique identification of the device on the PROFIsafe network.

Setting the safe F - Address in the TIA Portal takes place in the properties of the safe data.

To do this, select the “BP_Safety Inputs/Safety Outputs” gateway on the “Device overview” tab and go to the properties window. The parameter to be set is “F_Dest_Add”, which must correspond to the physical address set within the BP housing.

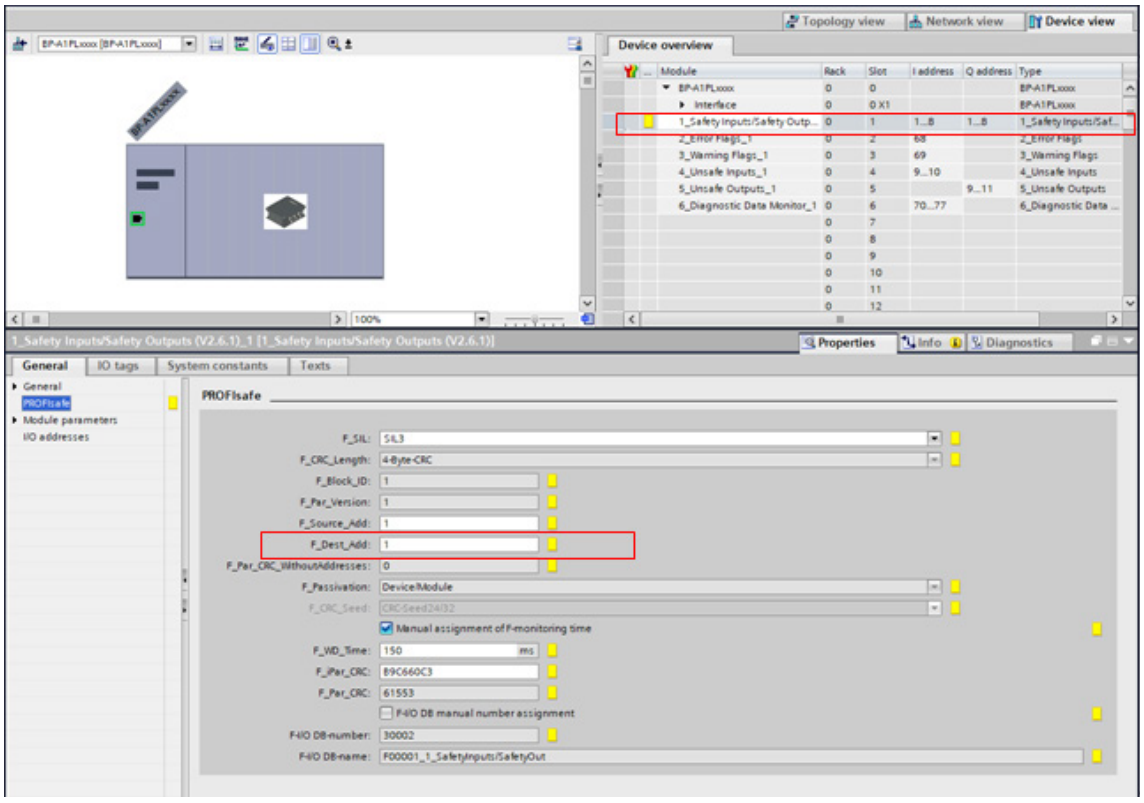
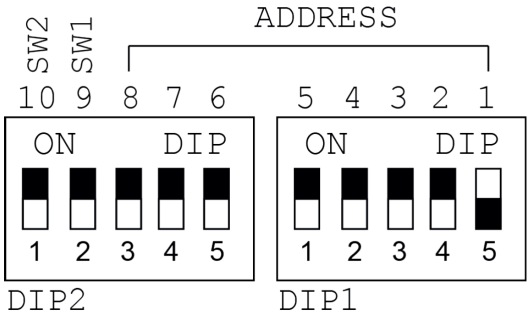


Fig. 13

The setting of the safe address must also be performed by means of two DIP switches located inside the housing. The F - Address can be set from 1 to 255 and must be unique for each network device. After setting the safe address, the device must be restarted.

How to set the F - Address:

- Remove the 4 screws from the cover
- Set the F - Address using the switches from 1-8
- The default address is set to 1.



The two remaining switches (9 and 10) called SW1 and SW2 are reserved and not used for the safe address.

After setting the safe address, close the cover and fasten the screws with a tightening torque of 1.2 Nm.

⚠ Attention: The F - Address set through the DIP switch must not be zero.

11.4 Setting of gateway safety parameters

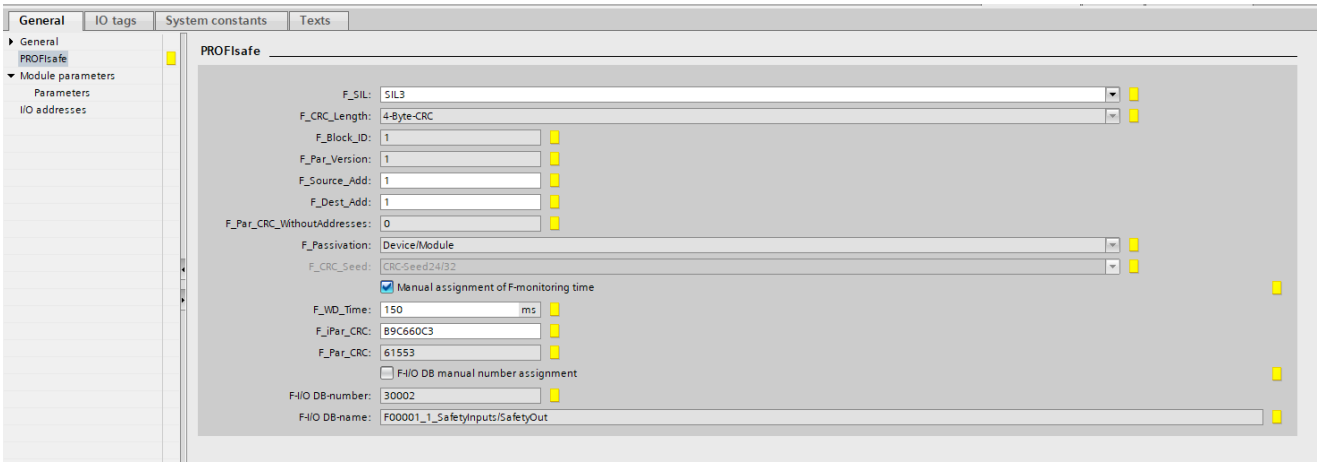


Fig. 14

"F_SIL": Selection of the device's SIL level. It can be selected up to SIL 3.

"F_Source_Add": PROFIsafe address of the PROFIsafe master. The default value is "1".

"F_Dest_Add": PROFIsafe address that identifies the device in the network. The software allows selecting the address in a range from 1 to 65534 but, as only one 8-bit DIP switch is available in the BP device, it can only be set from 1 to 255. Each address can be used only once in the PROFIsafe network and it must correspond to the physical address set in the device as illustrated in paragraph SETTING SAFE "F - ADDRESS". If a device is replaced, the F_Dest_Add must be set accordingly in the new device only through the DIP switch. The configuration data are transmitted by the controller whenever communication is restarted. The default value is "1".

"F_WD_Time": Parameter used to set the watchdog time of the device. If this time expires without reception of a valid PROFIsafe telegram, the device switches to the safe state. The default value is "150 ms".

"F_iPar_CRC": Value necessary for guaranteeing the correct transmission of gateway parameters for a safety device. The software "Pizzato DevicesCrc32Calculator" generates the CRC (see paragraph PIZZATO DEVICESCRC32CALCULATOR), which is inserted into the field F_iPar_CRC and verified in the device when it is connected.

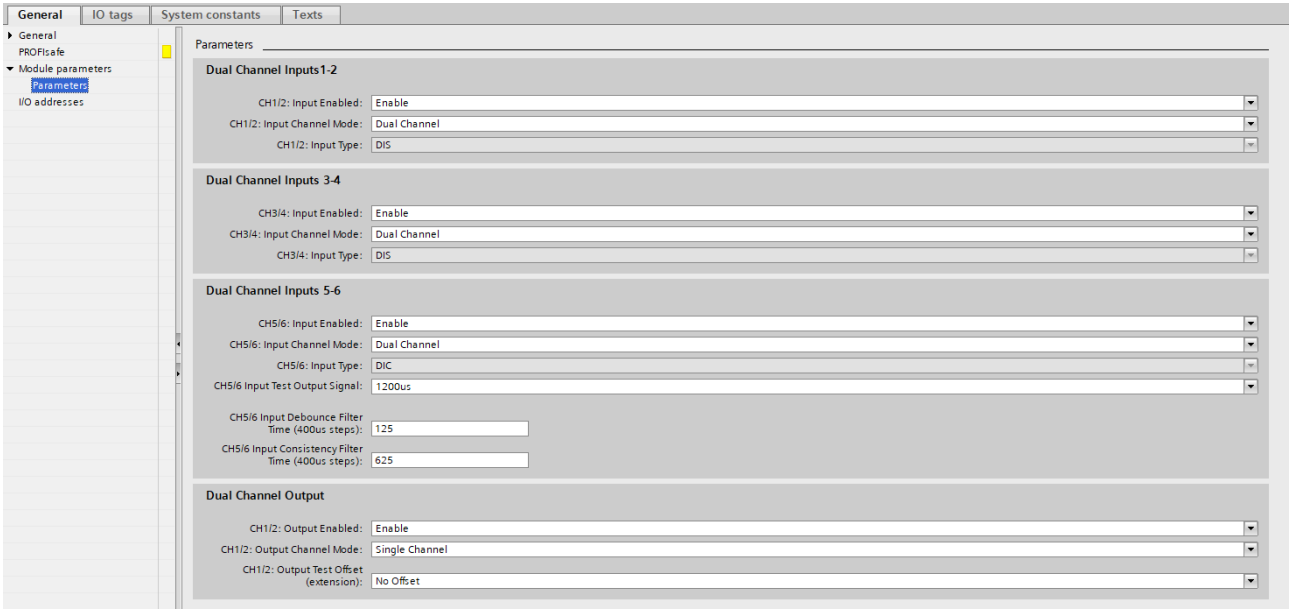


Fig. 15

In addition to the PROFIsafe safety parameters, also the following parameters must be configured and transferred to the BP gateway for correct operation.

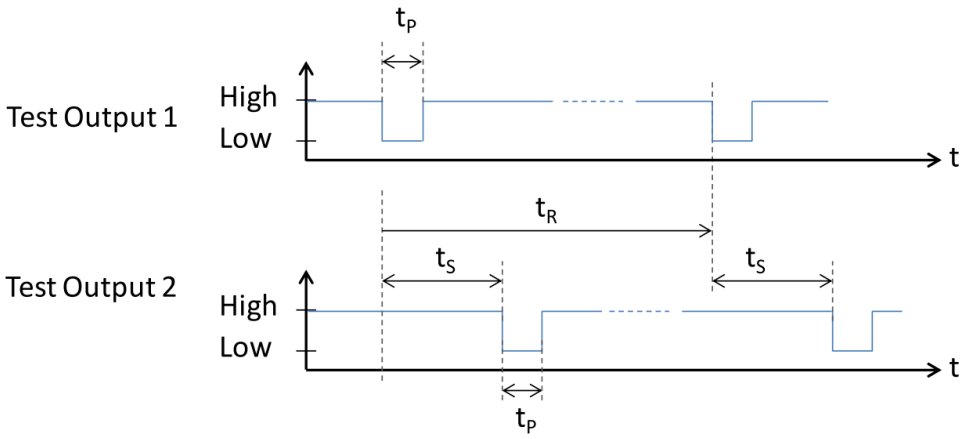
Each BP gateway can manage up to a maximum of three dual channel safety inputs (six single-channel) and one dual channel safety output (two single-channel). The input and output channels are managed by the software in pairs and it is possible to select their states and set some operating parameters.

The channels are divided into the following groups:

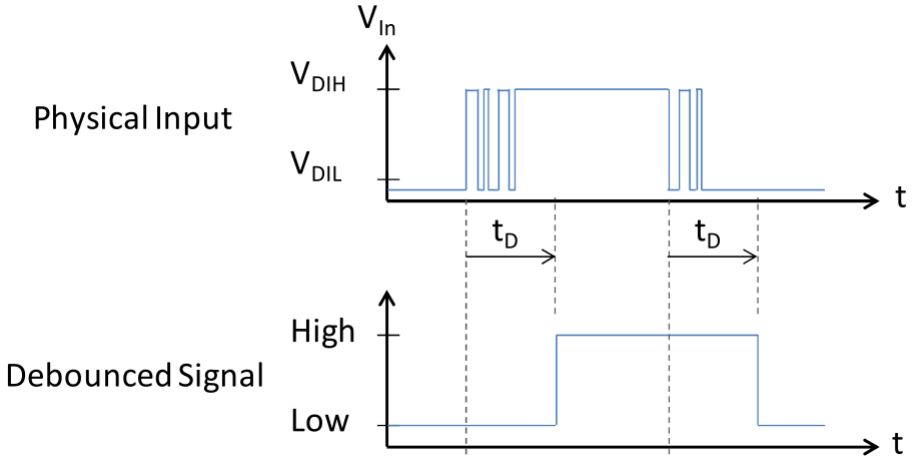
- CH1/2: Management of safety device connected to connector 1
- CH3/4: Management of safety device connected to connector 2
- CH5/6: Management of emergency mushroom buttons

On the "Safety Parameters" tab, it is possible to modify the following parameters concerning the safety-relevant part of the device:

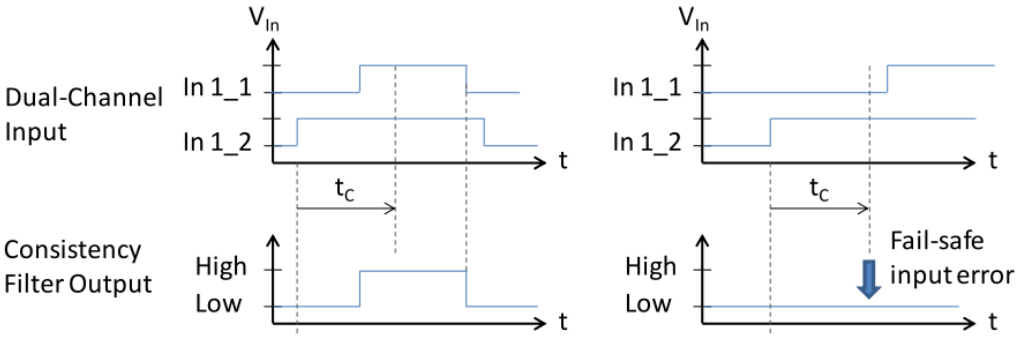
- **"CH*n*: Input Enabled":** Activation of the input channel. If no device is connected to the input connector, it can be set to the status "Disable".
- **"CH*n/m*: Input Channel Mode":** Selection of the channel mode (Single Channel or Dual Channel).
- **"CH*n*: Input Type":** Setting of the type of the channel input signal. This parameter cannot be changed.
  - DIS = semiconductor input
  - DIC = input for electro-mechanical contact
- **"CH*n*: Input Test Output Signal":** Length of pulsed test signal (t_P). Can be configured from 400 µs to 2400 µs. To this time the hardware delay (HW_Delay) must be added, which varies from 227 µs to 447 µs. The repetition time t_R = 1 s and the phase t_S between the two test signals are constant values. Test signals are only operational if the channel is set to "DIC" mode.



- **"CH*n*: Input Debounce Filter Time (400 µs steps)":** The debounce filter (t_D) can be configured to filter out short drops in the input signal caused by opening or closing of mechanical contacts or to be robust against external test pulses. The value is calculated with "x * 400 µs" and the default value is "125" equal to 50 ms.



- **"CH*n* Input Consistency Filter Time (400 µs steps)":** The consistency time filter is only functional if the channel is set to dual-channel mode. In this mode, each safety input must transmit identical input signals for a specified period of time (t_C) to be interpreted as valid "active". The consistency filter is used to control this period of time. Whenever the two channels of a dual-channel input differ by a time > t_C, the safe state is set for this pair of input channels.



- **"CH1/2: Output Enable":** enables the output channel. If no device is connected to the corresponding output connector, set the status to "Disable".
- **"CH1/2: Output Channel Mode":** Selection of the channel mode (Single Channel or Dual Channel).
- **"CH1/2: Output Test Offset":** Extends the duration of the test signal. Set it to "No Offset" if this is not required.

11.5 Pizzato DevicesCrc32Calculator

The parameterisation tool "Pizzato DevicesCrc32Calculator" is used to check the correctness of the BP gateway parameters in the Engineering Tool for safe control (for example: SIMATIC Manager or TIA Portal). This is necessary for validating the safety-related parameters previously set. Without this check the device will not function, since it will not be able to verify the CRC data. The software checks the parameters for coherence and correctness, enabling simultaneous detection of any logical errors in the parameterisation. All of these parameters must be correct before start-up.

The software must be installed before it can be used. To start installation, download the software from the website www.pizzato.com and run the file "Pizzato_DevicesCrc32Calculator_x_x_xxx_x_Setup.exe". The following operating systems are supported: Windows 7, Windows 8.1, Windows 10 for both 32- and 64-bit systems.

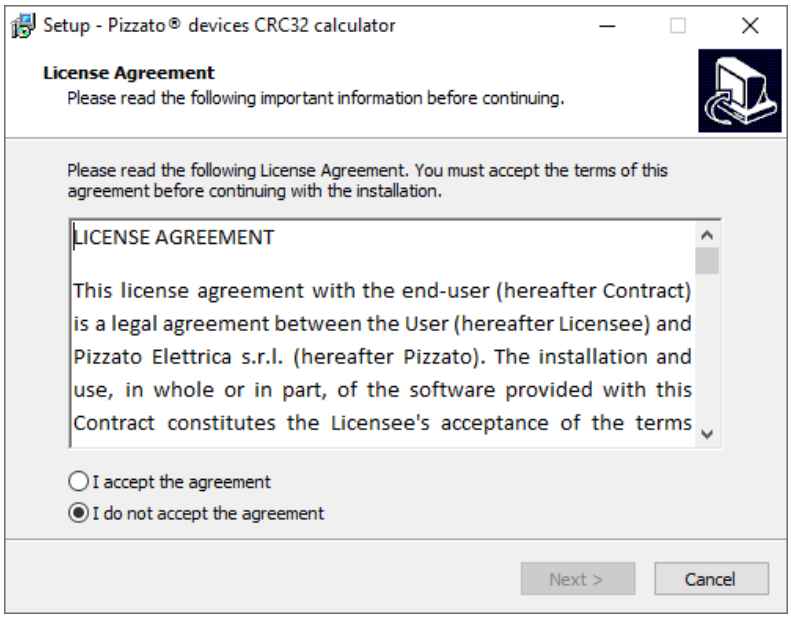


Fig. 16

Before installation, read the entire license terms and accept them by checking the box "I accept the agreement". Click "Next" to continue.

The next screen starts installation and must be confirmed by pressing the button "Install". After installation, upon restarting the TIA Portal or SIMATIC Manager software, the tool will be integrated into them and can be started according to the following procedure.

Check that the correct drivers are used for the graphics card when installing the software on a Virtual Machine (VM).

To start the validation software through the TIA Portal, select the gateway "BP_Safety Inputs/Safety Outputs", right click the mouse and press "Start device tool" (Fig. 17).

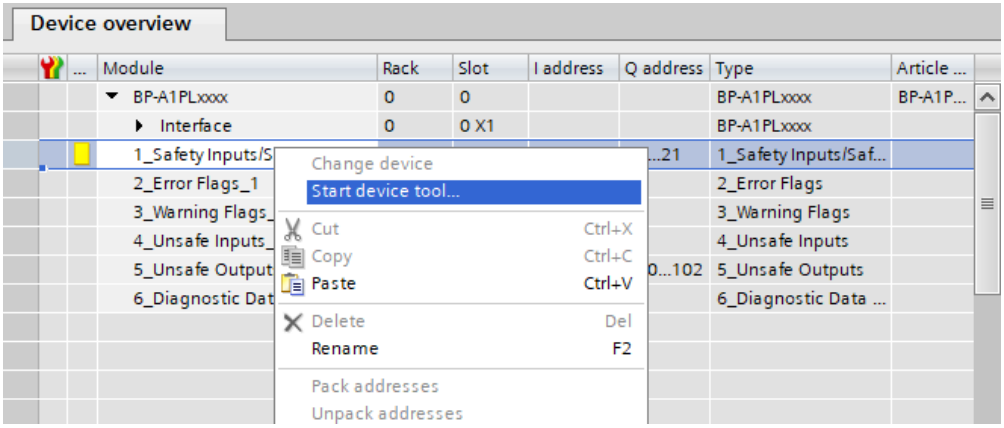


Fig. 17

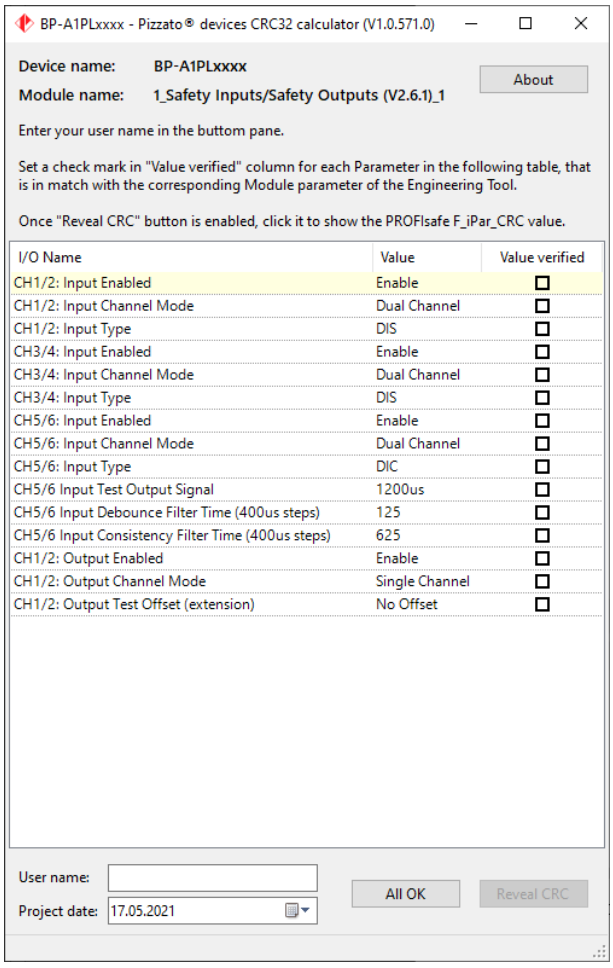


Fig. 18

Once the tool is started, the screen in Fig. 18 will appear, where it is possible to check the correctness of the set parameters. To validate the system, check the values by clicking "All Ok" or click the single selection boxes, insert the "Username" and then press "Reveal CRC".

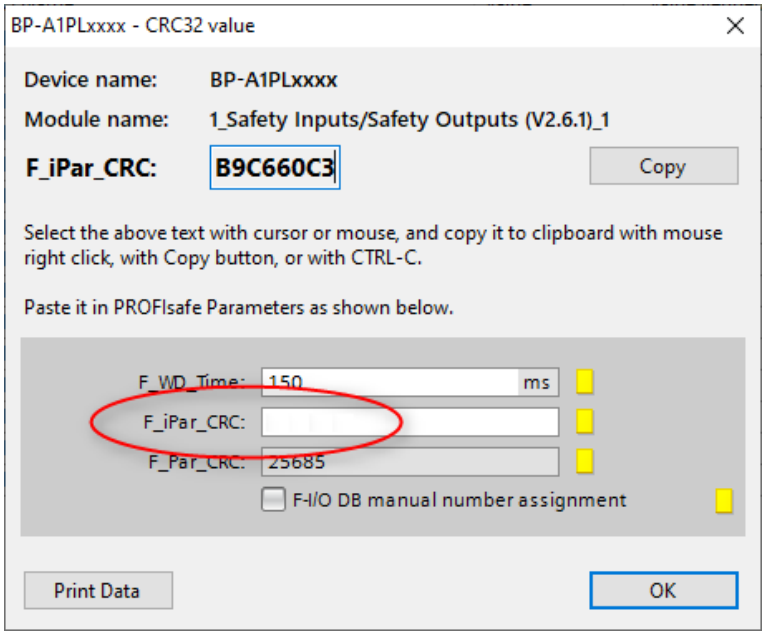


Fig. 19

The CRC value must then be copied in the safety parameters field "F_IPar_CRC".

TROUBLESHOOTING COMMUNICATION PROBLEMS:

After having configured the device, if it is not possible to read/write the device data, perform a reset to factory settings and re-enter the configuration.

To view the input and output values exchanged with the BP gateway "online", at least one data point must be connected to a controller variable or the data point itself must be used within the program.

12 Communication data

The communication data that can be read in the various gateway configurations is explained in the following paragraphs.

The process image of the exchanged safety data contains both the data and the status of the input or output to be read.

Input	Function
DI1, DI3, DI5	Current state of the safety inputs
DI2, DI4, DI6	
QDI1, QDI3, QDI5	Safety input qualifiers
QDI2, QDI4, QDI6	
QDO1	Safety output qualifier
QDO2	

The signals marked with DI indicate the status of the safety inputs in real time. The qualification bits QDIx and QDOx indicate whether a safety-relevant error has been detected on the corresponding input or output channel of the BP gateway. The value "0" indicates that the state of the respective input or output has switched to fail-safe state due to a malfunction caused, for example, by a short circuit. The value "1" of the qualifier indicates proper functioning.

Bit	Value	Description
DIx	0	Input not active (safe state)
	1	Input active
QDIx	0	Corresponding input is in error state
	1	Corresponding input is in normal state
QDOx	0	Corresponding safety output is in error state
	1	Corresponding safety output is in normal state

The output process image data is used, on the one hand, to check the states of the digital safety outputs of the BP gateway and, on the other hand, to send acknowledgement data for safety-relevant errors regarding the digital inputs and outputs of the gateway. If the safety input or output switches to fail-safe state, a reset of the associated qualifier is required to acknowledge the failsafe state of the PLC by setting the ERDIx/ERDOx bit to "1". Once the reset operation has been performed, reset the ERDIx/ERDOx bits to "0".

Output	Function
DO1	Activation of safety output
DO2	Activation of safety output
ERDI1, ERDI3, ERDI5	Reset of safety input qualifiers
ERDI2, ERDI4, ERDI6	
ERDO1	Reset of safety output qualifiers
ERDO2	

Bit	Value	Description
DOx	0	Output not active (safe state, low)
	1	Output active
ERDIx	0	Input error reset not requested
	1	Input error reset requested
ERDOx	0	Output error reset not requested
	1	Output error reset requested

12.1 Communication data BP A1PL2001

12.1.1 Non-safety inputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	I0	I1	I2	I3	I4	I5	I6	I7
Byte 1	I8	I9	I10	I11	I12	I13	N.A.	N.A.

Input	Device	Function
I0	1	State of output O3 (guard closed) of safety interlock 1
I1	-	N.A.
I2	2	State of output O3 (guard closed) of safety interlock 2
I3	-	N.A.
I4	3	State of button 1 of the BN1 control device unit
I5	3	Status of button 2 of the control device unit BN1
I6	-	N.A.
I7	-	N.A.
I8	4	Status of button 1 of the control device unit BN2
I9	4	Status of button 2 of the control device unit BN2
I10	-	N.A.
I11	-	N.A.
I12	5	Status of button 1 of the AN1 safety handle
I13	6	Status of button 1 of the AN2 safety handle

12.1.2 Non-safety outputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	O0	O1	O2	O3	O4	O5	O6	O7
Byte 1	O8	O9	O10	O11	O12	O13	O14	O15
Byte 2	O16	O17	O18	O19	O20	O21	O22	O23

Output	Device	Function
O0	1	Programming actuator / reset of interlock 1 (Input I3)
O1	2	Programming actuator / reset of interlock 2 (Input I3)
O2	-	N.A.
O3	-	N.A.
O4	-	N.A.
O5	-	N.A.
O6	-	N.A.
O7	-	N.A.
O8	-	N.A.
O9	-	N.A.
O10	-	N.A.
O11	-	N.A.
O12	-	N.A.

Output	Device	Function
O13	-	N.A.
O14	5	Control of Green colour (G) of the AN1 safety handle
O15	5	Control of button LED of the AN1 safety handle
O16	5	Output signal of NO contact of the AN1 safety handle
O17	5	Control of Blu colour (B) of the AN1 safety handle
O18	5	Control of Red colour (R) of the AN1 safety handle
O19	6	Control of Green colour (G) of the AN2 safety handle
O20	6	Control of button LED of the AN2 safety handle
O21	6	Output signal of NO contact of the AN2 safety handle
O22	6	Control of Blu colour (B) of the AN2 safety handle
O23	6	Control of Red colour (R) of the AN2 safety handle

12.1.3 Safety inputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DI1	DI2	DI3	DI4	DI5	DI6	N.A.	N.A.
Byte 1	QDI1	QDI2	QDI3	QDI4	QDI5	QDI6	N.A.	N.A.
Byte 2	QDO1	QDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Input	Device	Function
DI1	1	State of safety output (OS1) of safety interlock 1
DI2	1	State of safety output (OS2) of safety interlock 1
DI3	2	State of safety output (OS1) of safety interlock 2
DI4	2	State of safety output (OS2) of safety interlock 2
DI5	3/4	State of emergency stop button
DI6	3/4	State of emergency stop button
QDIx	All	State of the qualifiers of the safety inputs
QDOx	All	State of the qualifiers of the safety outputs

12.1.4 Safety outputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DO1	DO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Byte 1	ERDI1	ERDI2	ERDI3	ERDI4	ERDI5	ERDI6	N.A.	N.A.
Byte 2	ERDO1	ERDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Output	Device	Function
DO1	1	Electromagnet release command of safety interlock 1
DO2	2	Electromagnet release command of safety interlock 2
ERDIx	All	Reset bit for the qualifier of the safety inputs
ERDOx	All	Reset bit for the qualifier of the safety outputs

12.2 Communication data BP A1PL2002

12.2.1 Non-safety inputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	I0	I1	I2	I3	I4	I5	I6	I7
Byte 1	I8	I9	I10	I11	I12	I13	N.A.	N.A.

Input	Device	Function
I0	1	State of output O3 (guard closed) of safety interlock 1
I1	-	N.A.
I2	2	State of output O3 (guard closed) of safety interlock 2
I3	-	N.A.
I4	3	State of button 1 of the BN1 control device unit
I5	3	Status of button 2 of the control device unit BN1
I6	3	Status of button 3 of the control device unit BN1
I7	3	Status of button 4 of the control device unit BN1
I8	-	N.A.
I9	-	N.A.
I10	-	N.A.
I11	-	N.A.
I12	5	Status of button 1 of the AN1 safety handle
I13	6	Status of button 1 of the AN2 safety handle

12.2.2 Non-safety outputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	O0	O1	O2	O3	O4	O5	O6	O7
Byte 1	O8	O9	O10	O11	O12	O13	O14	O15
Byte 2	O16	O17	O18	O19	O20	O21	O22	O23

Output	Device	Function
O0	1	Programming actuator / reset of interlock 1 (Input I3)
O1	-	N.A.
O2	3	Control of LED 1 of control device unit BN1
O3	3	Control of LED 2 of control device unit BN1
O4	3	Control of LED 3 of control device unit BN1
O5	-	N.A.
O6	-	N.A.
O7	3	Control of LED 4 of control device unit BN1
O8	4	Control of LED of emergency stop button luminous disc
O9	-	N.A.
O10	-	N.A.
O11	-	N.A.
O12	-	N.A.

Output	Device	Function
O13	-	N.A.
O14	5	Control of Green colour (G) of the AN1 safety handle
O15	5	Control of button LED of the AN1 safety handle
O16	5	Output signal of NO contact of the AN1 safety handle
O17	5	Control of Blu colour (B) of the AN1 safety handle
O18	5	Control of Red colour (R) of the AN1 safety handle
O19	6	Control of LED 1 of the signalling device
O20	6	Control of LED 4 of the signalling device
O21	6	Output signal of auxiliary NO contact
O22	6	Control of LED 2 of the signalling device
O23	6	Control of LED 3 of the signalling device

12.2.3 Safety inputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DI1	DI2	DI3	DI4	DI5	DI6	N.A.	N.A.
Byte 1	QDI1	QDI2	QDI3	QDI4	QDI5	QDI6	N.A.	N.A.
Byte 2	QDO1	QDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Input	Device	Function
DI1	1	State of safety output (OS1) of safety interlock 1
DI2	1	State of safety output (OS2) of safety interlock 1
DI3	2	State of safety output (OS1) of safety interlock 2
DI4	2	State of safety output (OS2) of safety interlock 2
DI5	3/4	State of emergency stop button
DI6	3/4	State of emergency stop button
QDIx	All	State of the qualifiers of the safety inputs
QDOx	All	State of the qualifiers of the safety outputs

12.2.4 Safety outputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DO1	DO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Byte 1	ERDI1	ERDI2	ERDI3	ERDI4	ERDI5	ERDI6	N.A.	N.A.
Byte 2	ERDO1	ERDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Output	Device	Function
DO1	1	Electromagnet release command of safety interlock 1, channel 1
DO2	1	Electromagnet release command of safety interlock 1, channel 2
ERDIx	All	Reset bit for the qualifier of the safety inputs
ERDOx	All	Reset bit for the qualifier of the safety outputs

12.3 Communication data BP A1PL2003

12.3.1 Non-safety inputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	I0	I1	I2	I3	I4	I5	I6	I7
Byte 1	I8	I9	I10	I11	I12	I13	N.A.	N.A.

Input	Device	Function
I0	1	State of output O3 (guard closed) of safety interlock 1
I1	-	State of output O4 (guard locked) of safety interlock 1
I2	2	State of output O3 (guard closed) of safety interlock 2
I3	-	State of output O4 (guard locked) of safety interlock 2
I4	3	State of button 1 of safety interlock 1
I5	3	State of button 2 of safety interlock 1
I6	-	N.A.
I7	-	N.A.
I8	4	State of button 1 of safety interlock 2
I9	4	State of button 2 of safety interlock 2
I10	-	N.A.
I11	-	N.A.
I12	5	Status of button 1 of the AN1 safety handle
I13	6	Status of button 1 of the AN2 safety handle

12.3.2 Non-safety outputs – PROFINET (Standard)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	O0	O1	O2	O3	O4	O5	O6	O7
Byte 1	O8	O9	O10	O11	O12	O13	O14	O15
Byte 2	O16	O17	O18	O19	O20	O21	O22	O23

Output	Device	Function
O0	1	Programming actuator / reset of interlock 1 (Input I3)
O1	2	Programming actuator / reset of interlock 2 (Input I3)
O2	-	N.A.
O3	1	Control of button LED 1 of interlock 1
O4	1	Control of button LED 2 of interlock 1
O5	-	N.A.
O6	-	N.A.
O7	-	N.A.
O8	-	N.A.
O9	2	Control of button LED 1 of interlock 2
O10	2	Control of button LED 2 of interlock 2
O11	-	N.A.
O12	-	N.A.

Output	Device	Function
O13	-	N.A.
O14	3	Control of Green colour (G) of the AN1 safety handle
O15	3	Control of button LED of the AN1 safety handle
O16	3	Output signal of NO contact of the AN1 safety handle
O17	3	Control of Blu colour (B) of the AN1 safety handle
O18	3	Control of Red colour (R) of the AN1 safety handle
O19	4	Control of Green colour (G) of the AN2 safety handle
O20	4	Control of button LED of the AN2 safety handle
O21	4	Output signal of NO contact of the AN2 safety handle
O22	4	Control of Blu colour (B) of the AN2 safety handle
O23	4	Control of Red colour (R) of the AN2 safety handle

12.3.3 Safety inputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DI1	DI2	DI3	DI4	DI5	DI6	N.A.	N.A.
Byte 1	QDI1	QDI2	QDI3	QDI4	QDI5	QDI6	N.A.	N.A.
Byte 2	QDO1	QDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Input	Device	Function
DI1	1	State of safety output (OS1) of safety interlock 1
DI2	1	State of safety output (OS2) of safety interlock 1
DI3	2	State of safety output (OS1) of safety interlock 2
DI4	2	State of safety output (OS2) of safety interlock 2
DI5	1/2	State of emergency stop button
DI6	1/2	State of emergency stop button
QDIx	All	State of the qualifiers of the safety inputs
QDOx	All	State of the qualifiers of the safety outputs

12.3.4 Safety outputs – PROFIsafe (Safe)

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	DO1	DO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Byte 1	ERDI1	ERDI2	ERDI3	ERDI4	ERDI5	ERDI6	N.A.	N.A.
Byte 2	ERDO1	ERDO2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Output	Device	Function
DO1	1	Electromagnet release command of safety interlock 1
DO2	2	Electromagnet release command of safety interlock 2
ERDIx	All	Reset bit for the qualifier of the safety inputs
ERDOx	All	Reset bit for the qualifier of the safety outputs

13 Diagnostic functions

13.1 Warning monitoring

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	PWR_GD	TEMP	PWR_CS	SIG_CS	OUT_SIG	N.A.	N.A.	SAFETY_ MOD

Input	Function	Notes / Troubleshooting
PWR_GD	Supply voltage exceeds specified limits	Bring the voltage back within the specified limits and restart the gateway
TEMP	Temperature exceeds specified limits	Bring the temperature back within the specified limits and restart the gateway
PWR_CS	Power supply current of the connected devices exceeds the specified limits	• Check for faults in the connected devices • Check that connected devices comply with the specified maximum current consumption
SIG_CS	Current of non-safety outputs exceeds the specified range	• Check for faults in the connected devices • Check that connected devices comply with the specified maximum current consumption
OUT_SIG	Overtemperature of transistors of non-safety outputs. Possible short circuit in output circuits	• Check for faults in the connected devices • Check that connected devices comply with the specified maximum current consumption
SAFETY_ MOD	Error in safe channel	Problem detected during exchange of safety data or safety-relevant part on start-up: • Check connection of at least one safety variable • Check that all qualifiers are high • Check configuration of safety-relevant part

13.2 Error monitoring

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	PWR_GD	TEMP	PWR_CS	SIG_CS	N.A.	N.A.	N.A.	N.A.

Input	Function	Notes / Troubleshooting
PWR_GD	Supply voltage exceeds the specified range	Readjust the voltage to within the permitted threshold
TEMP	Temperature exceeds the specified range	Bring the temperature back to within the permitted threshold
PWR_CS	Current of connected devices exceeds the specified range	Excessive current consumption detected. Check consumption of connected devices and replace them if necessary.
SIG_CS	Current at non-safety outputs exceeds the specified range	Detection of excessive current consumption at non-safety outputs. Check consumption of connected devices and replace them if necessary.

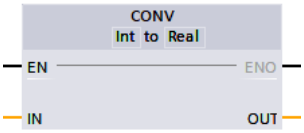
13.3 Monitoring data

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0 Byte 1	Supply voltage [mV]							
Byte 2 Byte 3	Device internal temperature [°C +100]							
Byte 4 Byte 5	Current consumption of connected devices [mA] (1)							
Byte 6 Byte 7	Reserved							

(1) Note: Peak of current consumption updated every second.

To monitor the parameters of cyclically exchanged data, it is possible to perform operations to optimise their display.

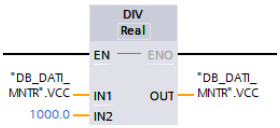
First, it is necessary to convert raw data, which is provided in an "Integer" (INT) format, to a "Real" format.



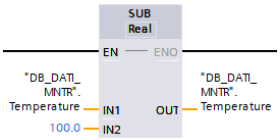
This allows you to see the data using all available digits.

After conversion to "Real", data can be further processed to be more easily readable:

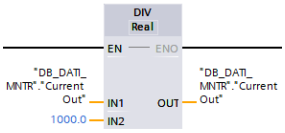
- The power supply voltage is expressed in [mV] and to display it in [V] the value must be divided by "1000"



- The temperature is given in [°C + 100] and so it is necessary to subtract "100"



- The current consumption is expressed in [mA] and to display it in [A] the value must be divided by



14 Safety application rules

Warning 1	The BP gateway is designed to be used in the industrial automation sector or in process control systems. The BP gateway final user must verify if it is allowed to use the gateway in the final application.
Warning 2	The maximum supply voltage must not be exceeded to prevent permanent damage to the BP gateway.
Warning 3	When the DI-C input mode is used (for example, for emergency stop buttons), for correct detection of errors, the BP gateway must use the test outputs as the only test signal for the electro-mechanical contact of the external sensor. The test pulse length must be configured to a value other than "Always High".
Warning 4	An active sensor, connected to a DI-S input, must use the same VSS reference level as the BP gateway.
Warning 5	The minimum time between the change of a single safe input and the transmission to the safety field bus is 6 ms. In the case of simultaneous changes of the input level on all 6 digital safety inputs, the maximum reaction time of the safety application is 16 ms (approx. 2 ms processing time per changed input). The delay time introduced by the input and debounce filters must be added to the maximum reaction time.
Warning 6	The diagnostic test interval for dual channel DI-C inputs is 1 hour.
Warning 7	The test output signals are not isolated. They all use the same VSS ground potential.
Warning 8	When the safety signal is deactivated (safe state), the corresponding pin is not set to the VSS reference voltage.
Warning 9	The safe state of the digital outputs of the BP gateway is "off" (high impedance). Therefore, it is not permitted to connect a device or an external safety function (like a valve or a switch) that needs a "High" level to keep the safe state.
Warning 10	To obtain a safety protection level equal to SIL 3, PL e, Cat. 4, the digital outputs of the BP gateway must be activated and connected in dual channel mode.
Warning 11	The safety devices connected to the digital outputs of the BP gateway must be resistant to the test pulses of the safety outputs.
Warning 12	The diagnostic test interval for the safety outputs is 1 hour.
Warning 13	The maximum time between the reception of a safety telegram and the setting of the corresponding digital safety output is 7.7 ms.
Warning 14	Depending on the value of the debounce filter time for the selected input, the response time of the input (i.e. the response time of the safety function) will be increased by the processing time of the specified debounce filter.
Warning 15	Deactivation of the consistency filter in dual channel mode must be carried out in conformity with the safety application. If the coherence filter is switched off, potential errors such as a short-circuit to Vss or ground of the contacts in dual-channel DI-S mode, or a cross-circuit short in dual-channel DI-C mode on an input line, are not detected and therefore do not result in a fail-safe input error indication.
Warning 16	The test impulses of the outputs are generated only if the output is set to HIGH/"enabled". In safe state (LOW/"disabled", high impedance), test pulses are not generated.
Warning 17	For the proper functioning of the filter, the filter time parameter must be set to a value greater than the value set in the filter time parameter of the input debounce filter time.

Warning 18	For the proper functioning of a contact input (DI-C), the input debounce filter time must be set according to the following formula for TestOutput Signal values > 1: Debounce filter time extension > Test output signal (3-bit value). Note: To achieve SIL 3, PL e and Cat. 4 classification, two digital inputs (Input X_1SS and Input X_2SS) must be combined into one digital safety input (Input XDS).
Warning 19	The deviation of the input coherence filter time from the actual elapsed time is at most ±1 % for filter time values < 128. The absolute deviation is reduced for higher filter time values.
Warning 20	The documentation (and review) of the safety parameters configured for a given safety application is mandatory and requires the safe generation and storage of the iParameter data set as a supplement for the safety evaluator of the entire safety system.
Warning 21	The replacement of a faulty BP gateway can only be carried out by authorised and properly trained personnel. After replacement it is necessary to perform testing and validation of all the safety functions.
Warning 22	The internal temperature of the BP gateway has to be regarded as non-safety data and therefore must not be used to control any safety function on the safety controller side.
Warning 23	The BP gateway only accepts addresses of type 1 (see PROFIsafe Profile Version 2.6.1). As a result, only the "F-Destination" address is verified. The "F-Source" address is passed on but not verified locally by the BP gateway.
Danger 1	No repairs or changes to the BP gateway are allowed.
Danger 2	The BP gateway must be powered by a 24 V SELV/PELV power supply unit according to EN 60950-1, which limits maximum voltage in case of failure to 60 V.
Danger 3	The maximum operating life of the BP gateway must not exceed the 'mission time' (20 years). When the limit of the mission time is reached, the BP gateway must be replaced and permanently taken out of service.
Danger 4	The safety inputs must be configured as dual channel safe input to obtain a safety protection level of SIL 3, PL e, Cat 4. Additional measures may be necessary to exclude wiring faults or for the use of certified components.
Danger 5	The single-channel safety inputs of the BP gateway should only be used for safety applications if special precautions are applied. The safe operation of a single-channel input always requires additional safety measures or fault exclusions which must be taken into account in the overall design concept of the safety system. The values for SIL/PL are affected by the single-channel architecture. With single-channel applications, SIL 3/PL e cannot be achieved.
Danger 6	After detecting a safety-critical error, the BP gateway must not be kept in a safe state for more than 1 hour.
Danger 7	A faulty BP gateway must be replaced immediately.
Danger 8	If the BP gateway is on and does not correctly switch to the RUN state within a maximum of 8 hours, the gateway must be restarted. Subsequently, it must be checked by experienced service personnel to ensure safe operation.
Danger 9	The maximum operating altitude of 2000 m must not be exceeded.
Danger 10	The error bits signalled by the BP gateway through PROFIsafe must not be used to activate the safety function of a device or system.
Attention 1	The digital inputs not connected in dual channel mode will cause the BP gateway to signal inactive safety state for both channels.

Attention 2	Due to hardware limitations, the BP gateway with 3 dual channel inputs and a dual channel output has only one pair of configurable Test Outputs (TO). These two Test Outputs (TO) are set through configuration parameters (see paragraph SETTING OF GATEWAY SAFETY PARAMETERS).

15 Technical data

1) Housing

Housing:	Metal housing, powder-coated
Protection degree:	IP65 acc. to EN 60529 (with connectors of equal or higher protection degree)
Dimensions:	See paragraph DIMENSIONED DRAWING

2) Environmental data

Operating temperature:	-15°C … +50°C
Storage temperature:	-30°C … +70°C
Pollution degree:	2
Overvoltage category:	III

3) General data

Safety parameters	Maximum SIL	PL	Cat.
Monitoring function for the safety outputs	3	e	4
Locking function of the single channel actuator	1	c	1
Locking function of the dual channel actuator	3	e	4

4) Power supply

Rated voltage (U_e):	24 Vdc SELV/PELV
Supply voltage tolerance:	±15%
Operating current at U_e voltage:	
- no devices connected:	0.1 A
- maximum supported current:	3.1 A
Insulation voltage U_i:	32 V
Shock and vibration resistance:	acc. to EN 60947-1
EMC protection:	acc. to EN 61000-4 and EN 61326-3-1
External protection fuse:	4 A type gG for a single BP gateway; for series connection the total load must be calculated
Features approved by UL:	
Electrical ratings:	24 Vdc, Class 2, 3.1 A Max
Environmental Ratings:	Type 1

Functional safety has not been evaluated by UL Solutions.

5) Input and output circuits:

Number of safety inputs:	3 dual-channel
Number of safety outputs:	1 dual channel (or 2 single channel)
Number of non-safety inputs:	14
Number of non-safety outputs:	24
Number of test outputs:	2
Maximum voltage that can be applied to non-safety inputs:	24 Vdc ± 10%
Rated voltage of non-safety outputs:	24 Vdc
Maximum control current at non-safety outputs:	50 mA
Maximum current at test outputs:	100 mA
Maximum current at safe outputs:	250 mA

6) Compliance with standards:

EN 60947-1, EN 61326-1, EN 61326-3-1, EN IEC 63000, EN 60529, IEC 61784-3-3, EN 61508, EN 62061, EN ISO 13849-1, UL 61010-1, CSA NO. 61010-1, EN 61131-2.

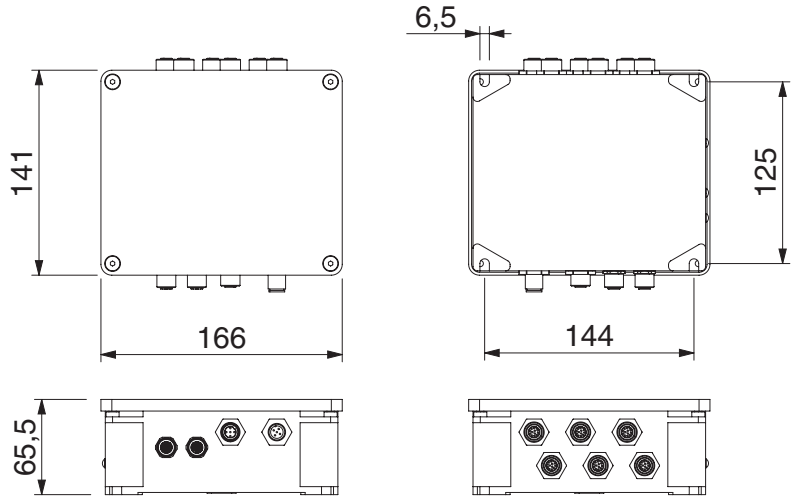
7) Compliance with the requirements of:

Machinery Directive 2006/42/EC, EMC Directive 2014/30/EU, RoHS Directive 2011/65/EU.

8) Compatibility:

PROFIsafe version: v2.6

16 Dimensioned drawing



All values in the drawings are in mm.

17 Markings

The outside of the device is provided with external marking positioned in a visible place. Marking includes:

- producer trademark
- product code
- batch number and date of manufacture. Example: A23 CS1-123456. The batch's first letter refers to the month of manufacture (A=January, B=February, etc.). The second and third letters refer to the year of manufacture (23 = 2023, 24 = 2024, etc…).

18 Disposal

At the end of its service life, the product must be disposed of properly, according to the rules in force in the country in which the disposal takes place.

19 Support

The device has been created for safeguarding people's physical safety, therefore in case of any doubt concerning installation or operation methods, always contact our technical support service:

Pizzato Elettrica Srl - Italy

Via Torino, 1 - 36063 Marostica (VI)

Telephone +39.0424.470.930

E-mail tech@pizzato.com

www.pizzato.com

Our support service provides assistance in Italian and English.

20 Declaration of Conformity

I, the undersigned, as a representative of the following manufacturer:

Pizzato Elettrica Srl - Via Torino, 1 - 36063 Marostica (VI) – ITALY

hereby declare that the product is in conformity with whatever prescribed by the 2006/42/EC Machine Directive. The complete version of the present conformity declaration is available on our website www.pizzato.com

Marco Pizzato

DISCLAIMER:

Subject to modifications without prior notice and errors excepted. The data given in this sheet are accurately checked and refer to typical mass production values. The device descriptions and its applications, the fields of application, the external control details, as well as information on installation and operation, are provided to the best of our knowledge. This does not in any way mean that the characteristics described may entail legal liabilities extending beyond the "General Terms of Sale", as stated in the Pizzato Elettrica general catalogue. Customers/users are not absolved from the obligation to read and understand our information and recommendations and pertinent technical standards, before using the products for their own purposes. Taking into account the great variety of applications and possible connections of the device, the examples and diagrams given in the present manual are to be considered as merely descriptive; the user is deemed responsible for checking that the specific application of the device complies with current standards. This document is a translation of the original instructions. In case of discrepancy between the present sheet and the original copy, the Italian version shall prevail.