CAMOZZI
Automation

Series CSPT

USE AND MAINTENANCE MANUAL

Version: 1.0

Revision history

Table 1.1: Document revision history.

Date	Revision	Changes
20-04-2026	1.0	First release.

Contents

Introduction

2.1 About this manual

This manual provides the technical description of the smart pneumatic collaborative gripper Series CSPT, designed by Camozzi Automation S.p.A.

⚠ Failure to observe the information contained in this manual can result in injury or equipment damage.

Please contact Camozzi Automation S.p.A. for technical assistance.

PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

2.2 Unit overview

The smart pneumatic collaborative gripper Series CSPT is composed of a long stroke gripper, a proportional valve module, pressure sensors, a rotative encoder, four Time of Flight sensors, electronic boards and it is covered by robust plastic covers. The design and performance of the gripper make the system suitable also for collaborative applications.
The following chapters describe the system's technical specifications and operating guidelines.

General recommendations

- The components must be fixed correctly, using, where available, the special brackets and checking that the fixing remains effective even when the gripper operates at high cyclic stress or under strong vibrations.
- Where there are strong vibrations, special devices/systems must be used to reduce the effect on the component.
- Install dryers in order to avoid the formation of rust in the internal components.
- Make sure that the air ducts are properly connected to their respective connectors once the component is installed.
- Always ensure that the surrounding equipment and persons are not at risk of harm from unexpected movements of the grippers.

The products comply with the following technical standards:

- **ISO 12100:2010 - Safety of machinery**
- **ISO 10218:2011 - Robots and robotic devices**
- **ISO/TS 15066:2016 - Collaborative industrial robotic package**
- **ISO 4414:2010 - Pneumatic fluid power**
- **IEC 61000-6-2:2016 - Electromagnetic compatibility: Generic standards - Immunity standard for industrial environments**
- **IEC 61000-6-4:2018 - Electromagnetic compatibility: Generic standards - Emission standard for industrial environments**

Please comply with the recommendations for safe use described in this document. These recommendations are classified so as to identify the level of danger and the possible associated risk.

⚠DANGER

In extreme conditions, errors or carelessness could lead to serious injury or death.

- Some hazards can be associated with the product only after it has been installed on the machine/equipment. It is the responsibility of the end user to identify these hazards and reduce the risks associated with them.
- The products covered by this manual can be used in circuits that must comply with ISO 13849-1.
- 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 life cycle.
- Pass this document on to any subsequent holder or user.

- The instructions in this manual must be followed in combination with the instructions and further information regarding the product described in this manual, which can be found using the following references:
  - Website www.catalogue.camozzi.com
  - Camozzi Automation Handling and Vacuum Catalogue
  - Customer Service
- Assembly and commissioning must be performed by qualified and authorised personnel only, according to these instructions.
- It is the responsibility of the system/machine designer to choose correctly the most appropriate pneumatic component according to the required use.
- It is the responsibility of the system/machine designer to ensure the correct electrical connection through adequate systems and protections.
- The use of appropriate personal protection is recommended to minimise the risk of injury.
- For all those situations of use not covered in this manual and in situations in which damage could be caused to property, persons or animals, contact Camozzi Automation before use.
- Do not make unauthorised modifications to the product. In the event of any such modifications, the user shall be liable for any possible damage caused to property, persons or animals.
- It is recommended to comply with all safety regulations that apply to the product.
- Do not perform any maintenance on the machine/system until you have verified the safety of work conditions.
- Before installation or maintenance, make sure that the specifically designed safety locks have been activated, then shut down the electricity power supply (where necessary) and the system pressure supply, draining all the residual compressed air from the system and deactivating the residual energy stored in springs, condensers, containers and gravity.
- After installation or maintenance, reconnect the system's pressure and electricity supply (where necessary) and check the proper operation and tightening of the product. In case of leaks or malfunctioning, the product must not be put into operation.
- Do not wash the product with aggressive substances or varnish it before consulting Camozzi Automation.

3.1 Use

- Make sure that the pressure of the compressed air distribution network and all operating conditions are within the permissible values.
- The product can be put into operation only in compliance with the specifications shown; where these specifications are not followed, the product can be put into operation only after authorisation by Camozzi Automation. Observe the maximum static loads indicated on the catalog.
- Follow the indications shown on the identification label.
- The product must only be supplied with compressed air at least of 7.4.4 quality according to ISO 8573-1 provisions.
- Pneumatic grippers are mainly used for gripping and handling objects.

3.2 Limitations of use

WARNING

- Do not exceed the technical specifications shown under “General characteristics” and in the general Camozzi Automation catalogue. Where these specifications are not followed, the product can be put into operation only after authorisation by Camozzi Automation.
- 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.
- Do not scratch the surface of the product or force any mechanism, do not alter the tightening elements on the product.

3.3 Maintenance

WARNING

Before performing any maintenance operation, the product must be isolated from any energy source. Check the conditions to prevent the sudden release of parts, then switch off the air supply and allow the discharge of residual pressures before proceeding.

- Incorrectly performed maintenance operations can compromise the good working order of the product and harm surrounding persons.
- Make sure the condensate is removed continuously from the filters found on the line.
- Never disassemble a pressurised unit.
- Always remove accessories before maintenance.
- Always make sure that you are wearing the correct safety equipment required by local authorities and by applicable legislation.
- In the event of maintenance, do not disassemble without the authorisation of qualified Camozzi Automation personnel. Unauthorised repair attempts compromise the guarantee of conformity of the product to the specifications, with the total invalidation of the relative right to repair under warranty or replacement of the product or part thereof.

3.4 Gripper accessory

- When designing gripper accessories, refer to the technical drawings of the gripper contained in this manual and comply with the gripper’s operating conditions in order for it to function properly.
- It is possible to attach accessories to the grippers to improve the grip.
- Dimensions, weight and gripping point of the accessories must not compromise the operation and duration of the gripper.

Product specifications

4.1 Coding example

The gripper and its accessories are identified by a specific product code that defines the configuration in terms of size, stroke, electrical interface, and optional components. The following example illustrates the structure of the product code and the corresponding meanings of each element.

Gripper

`CSPT - 20 - 80 - 1`

- **CSPT**: series
- **20**: size
- **80**: stroke
- **1**: electrical interface

Electrical interface

Code	Description
1	RS 485 MODBUS

4.2 Gripper accessory

Robot-gripper mechanical interface

The accessory code `P - CSPT` identifies the mechanical interface between the robot and the gripper. It is designed in accordance with the **ISO 9409-1-50-4-M6** standard and includes:

- A positioning (centering) pin
- Screws to fix the flange to the robot wrist

This interface provides secure and standardized mechanical coupling with a wide range of collaborative robots.

Robot-gripper mechanical interface

Manufacturer	Robot Models
UNIVERSAL ROBOT	UR3e, UR5e, UR10e, UR16e
ABB	GoFa (CRB 15000)
FANUC	CRX 5ia, CRX 10ia, CRX 10ia/L, CRX 20ia/L, CRX 25ia
DOOSAN	M0609, M0617, M1013, M1509, H2017, H2515
OMRON	TM5, TM5S, TM7S, TM12, TM12S, TM14, TM14S, TM16, TM20
DOBOT	CR3 A, CR5 A, CR7 A, CR10 A, CR12 A, CR16 A

Table 4.1: Robots compatible with the mechanical interface

Robot-gripper electrical interface

To ensure plug-and-play integration with supported robots, specific cables are available for each robot model. Each cable features an **M8 8-pin male connector** on the gripper side and a special connector on the robot side.
The table below lists the available cable models and their compatibility:

Cable Model	Robot Manufacturer	Compatible Robot Models
CS-DL08MC-E020U	UNIVERSAL ROBOT FANUC DOBOT	UR3e, UR5e, UR10e, UR16e CRX 5ia, CRX 10ia, CRX 10ia/L, CRX 20ia/L, CRX 25ia CR3 A, CR5 A, CR7 A, CR10 A, CR12 A, CR16 A
CS-DY08MC-E020A	ABB	GoFa (CRB 15000)
CS-DN08MC-E020D	DOOSAN	M0609, M0617, M1013, M1509, H2017, H2515
CS-DM08MC-E300O	Universal connection cable with free wires at one end	

Table 4.2: Available robot-gripper electrical interface cables

Fingers

The accessory code `F - CSPT` includes two standard fingers designed for immediate mounting on the gripper jaws.Each finger is equipped with pre-assembled caps and comes with the necessary screws for fastening.
These fingers are optimized for general-purpose gripping applications and can serve as a reference design for customized gripping tools if needed.

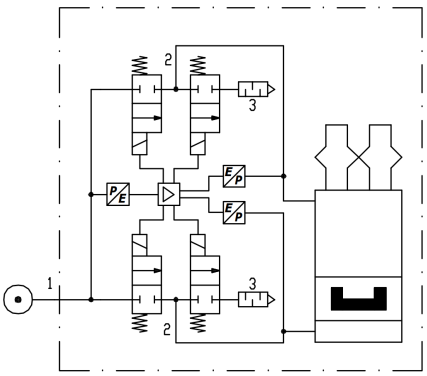
4.3 Specifications

Function	Description
Construction	Self-centering parallel collaborative gripper with T-guide
Operation	Double acting
Pneumatic ports	M5 (tube ⌀ 4mm)
Operating temperature	5°C ÷ 50°C
Storage temperature	-10°C ÷ 60°C
Maximum use frequency	0.75Hz
Repeatability (part clamped)	0.05 mm
Medium	Filtered air in class 7.4.4 according to ISO 8573-1. In case lubricated air is used, we recommend ISOVG32 oil and to never interrupt lubrication.
Protection class	IP 40
Compatibility	ROHS and REACH Directives
Certifications	ISO 12100, ISO 10218, ISO TS 15066, ISO 4414 IEC 61000-6-2, IEC 61000-6-4
Operating pressure	2 ÷ 10 bar
Voltage	24V
Maximum peak current	0.230 A
RMS (root mean square) current	0.125 A
Closing force per jaw at 0 mm (@6 bar)	150 N
Opening force per jaw at 0 mm (@6 bar)	150 N
Stroke per jaw	40 mm
Weight	1640g

Table 4.3: Technical data

4.4 Pneumatic circuit diagram

The pneumatic circuit of the CSPT gripper integrates proportional valves and pressure sensors, enabling independent control of the opening and closing chambers. The system allows for pressure, force, or position control—also in combination within the same work cycle. An integrated encoder adjusts the stroke, optimizing opening and closing times. Open-loop force control and intermediate positioning are achieved by pressure balancing, ensuring high precision and operational flexibility.



4.5 Notes on Functioning

Thanks to the integration of proportional valves, it is possible to adjust the desired pressure in both chambers and achieve the required force based on the application. Additionally: thanks to the integrated encoder it is possible to control the position of the jaws, optimizing opening and closing times by limiting the gripper's stroke.
Depending on the application, it is possible to choose whether to control the gripper by adjusting the pressure, force, or position. Different controls can be combined within a single working cycle of the gripper. For instance, controlling the pressure during closing and then the position during opening.

The gripper operates in four distinct states, defined as follows:

- Work: normal operating condition. All functions are available and the device operates within nominal parameters.
- Warning: a non-critical fault condition is present. The gripper remains operational and basic control is maintained, although some functionalities may be limited.
- Alarm: critical fault condition. Safe operation cannot be guaranteed. The valves are closed and no control actions can be executed.
- Manual: the gripper is controlled locally via UVIX. Commands from the fieldbus are ignored in this state.

The gripper status can be monitored through the following interfaces: UVIX, fieldbus communication, and diagnostic registers (error and warning registers). In addition, a status LED installed on the device provides a visual indication of the current state.

The LED color coding is defined as follows:

- Green: Work state (normal operation).
- Yellow: Warning state (non-critical condition).
- Red: Alarm state (critical condition, operation inhibited).
- White: both external ToF sensors are occluded.

4.5.1 Pressure Control

Inside the gripper, there are three pressure sensors. The first monitors the supply pressure, while the other two monitor the pressure in the opening and closing chambers, respectively. Thanks to these sensors and the integration of proportional valves, proportional pressure control can be performed independently in both chambers.
The force exerted by the gripper, which depends on the pressure, is represented in the graph. Using the tables in the next chapter, it is possible to determine the resulting force for a given pressure and a given distance of the piece to be handled.

4.5.2 Force Control

To simplify the installation and commissioning of the gripper, an open-loop force control has been developed, allowing the user to specify the target force to be reached at a given distance from the gripper body. The system will adjust the pressures to achieve the chosen target force.

4.5.3 Position Control

This control enables the gripper jaws to be positioned at an intermediate position. The system adjusts the pressures to move the jaws, and once the target is reached, it creates a static condition with equal pressure in both chambers.

4.6 Gripping force per single jaw

The gripping force refers to a single jaw of the gripper. To calculate the total force generated by the gripper, the measured value must be multiplied by two:

$$F_{\text{total}} = F \times 2$$

The graphs below show the trend of the gripping force F, per single jaw, as a function of distance b, where:

- F is the force generated by a single jaw, both during opening and closing;
- L is the distance, in millimetres, between the gripping point on the workpiece and the finger-jaw contact surface (used as the lever arm reference point).

Notes:

- The curves apply to both opening and closing force;
- Performance is not affected by the jaw stroke.

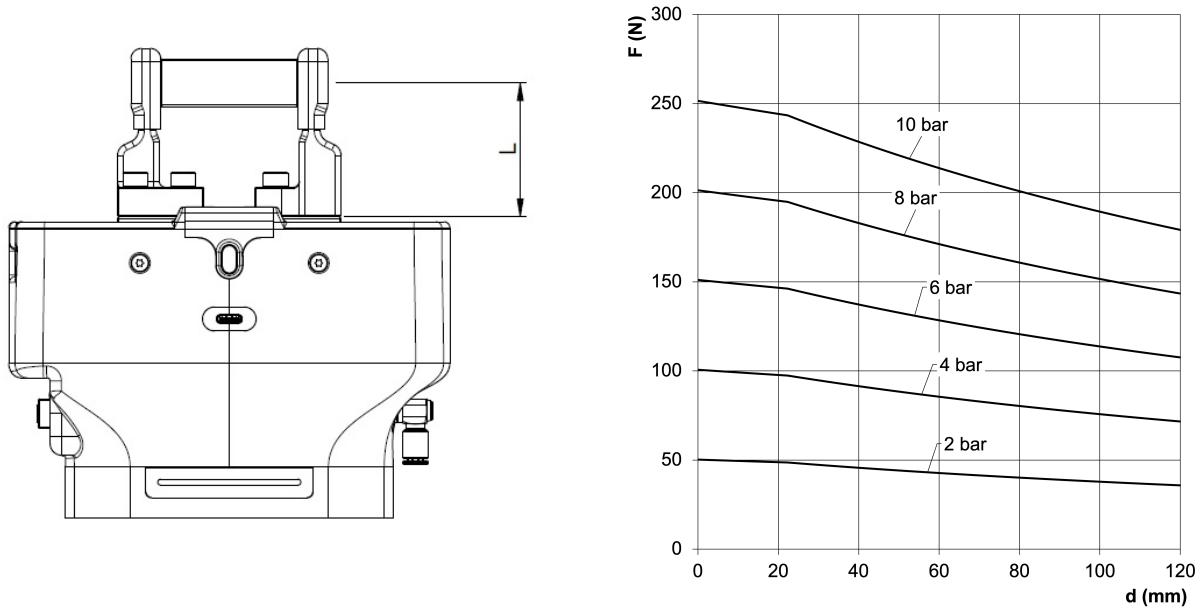


Figure 4.1: Gripping configuration (left) and gripping force trend (right)

Load Limit

	Yield Load Limit (1)	Fatigue Load Limit (2)
F (N)	1950	1600
Mx (Nm)	25	21
My (Nm)	17	14
Mz (Nm)	29	24

Table 4.4: Load limits

(1) Allowable yield load limits evaluated under static conditions; they are valid for a low number of cycles.
(2) Allowable fatigue load limits evaluated under static conditions; they are valid for 10 million cycles.

4.7 Gripper's use area

The effective gripping force developed by the gripper is affected by the position of the gripping point, defined by:

- L is the distance, in millimetres, between the gripping point on the workpiece and the finger-jaw contact surface (used as the lever arm reference point);
- e is the eccentricity, i.e. the misalignment of the load with respect to the longitudinal axis of the gripper.

To calculate the total force developed by the gripper, the measured value must be multiplied by two:

$$F_{\text{total}} = F \times 2$$

The graphs below show the working force areas as a function of the distance L and the eccentricity e of the gripping point. Each curve represents the maximum combination of distance and eccentricity that ensures a specific gripping force F per jaw. Below the curve, the gripper applies a force greater than the indicated level; above the curve, the force is lower.

Notes:

- Each curve corresponds to an operating pressure of 6 bar.

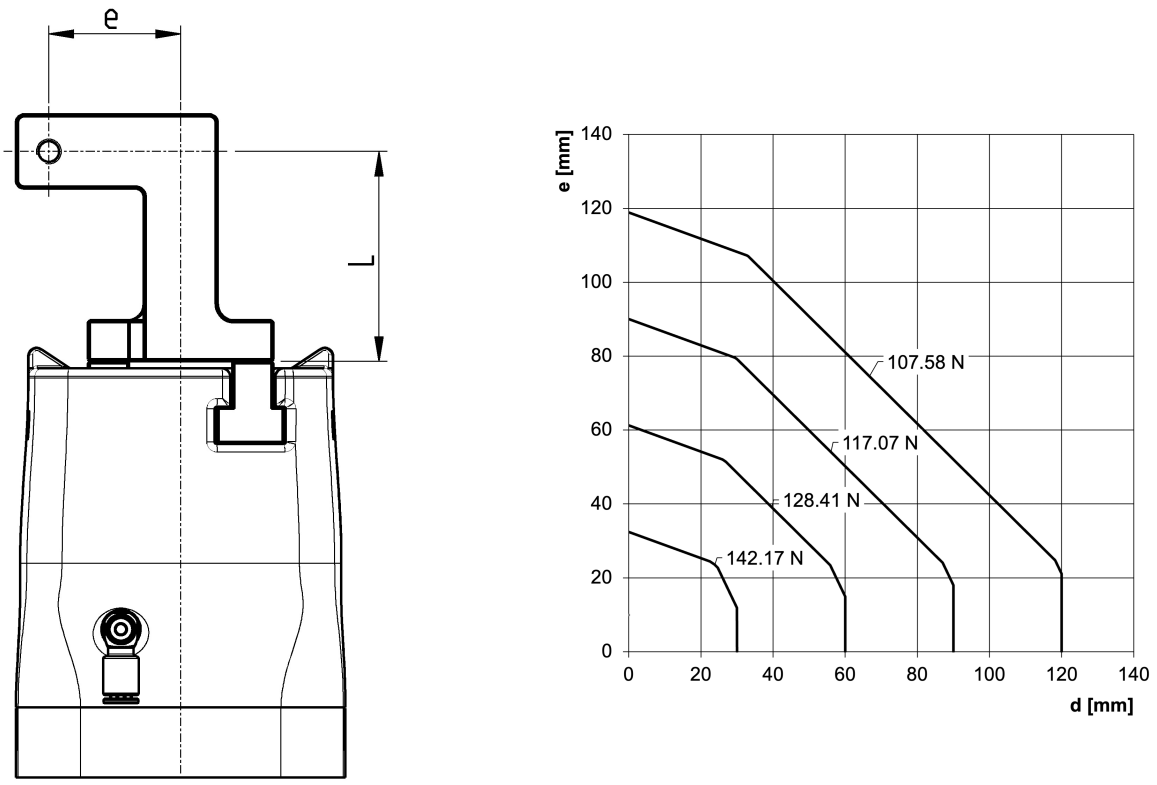
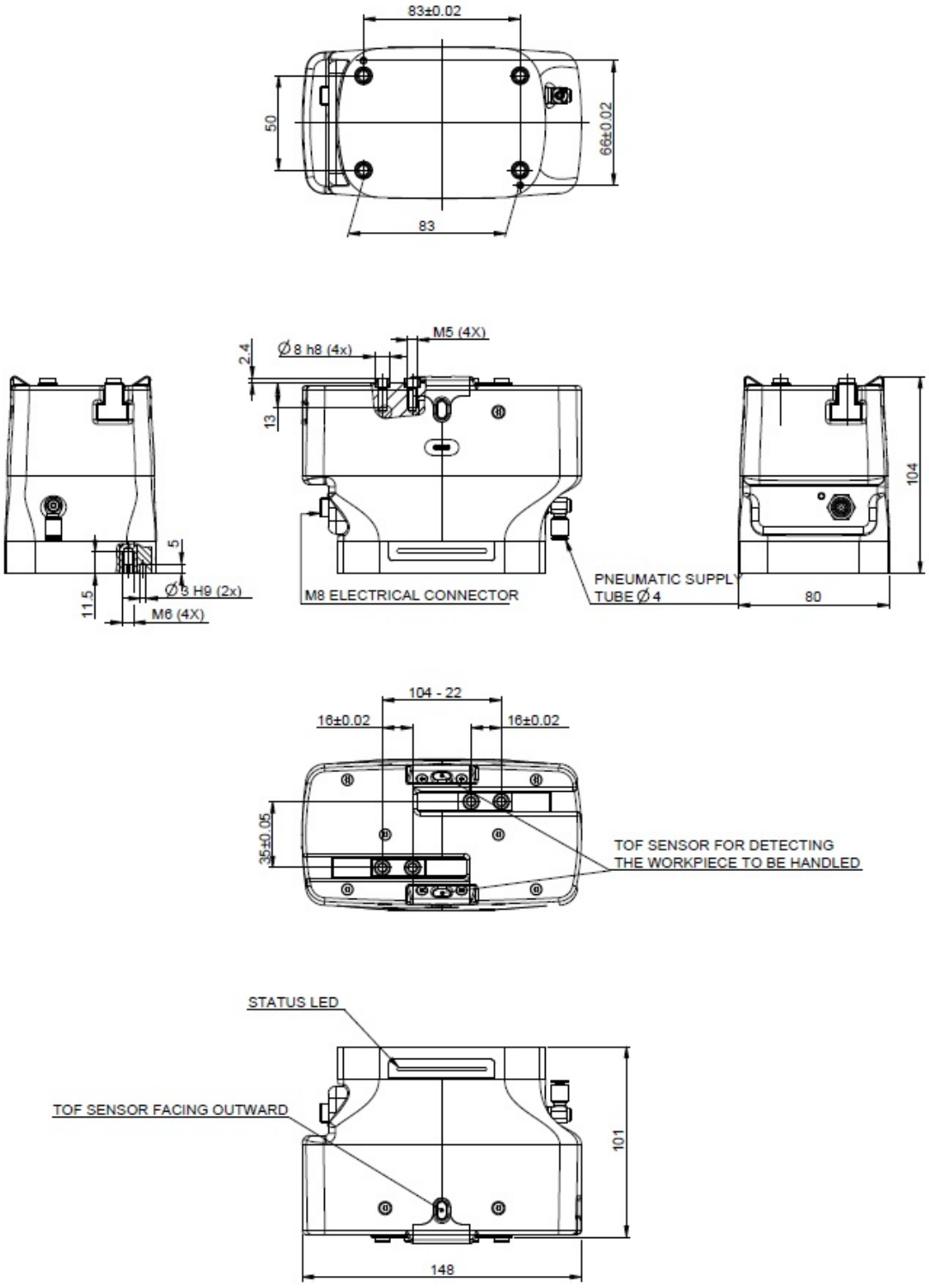


Figure 4.2: Gripping configuration (left) and graph (right)

4.8 Dimensions

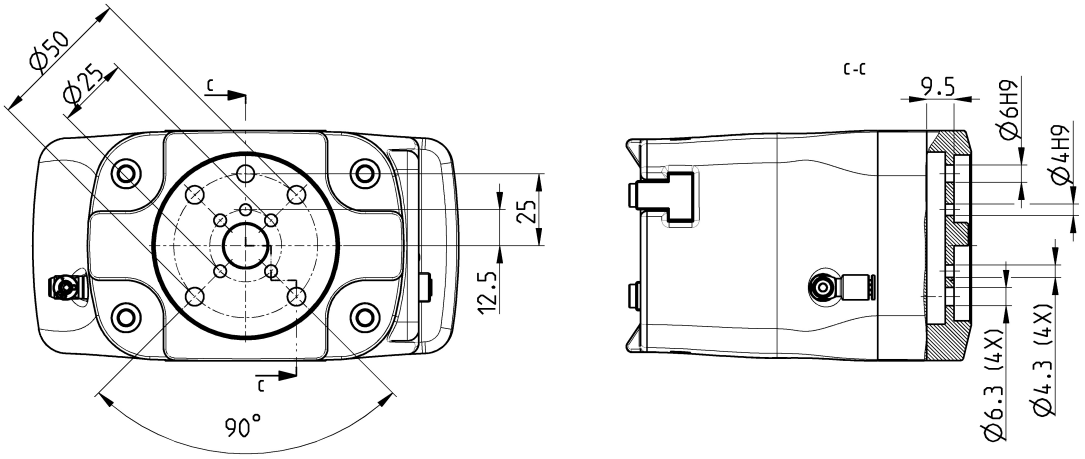
4.8.1 Gripper

Below you will find the overall dimensions of the gripper.



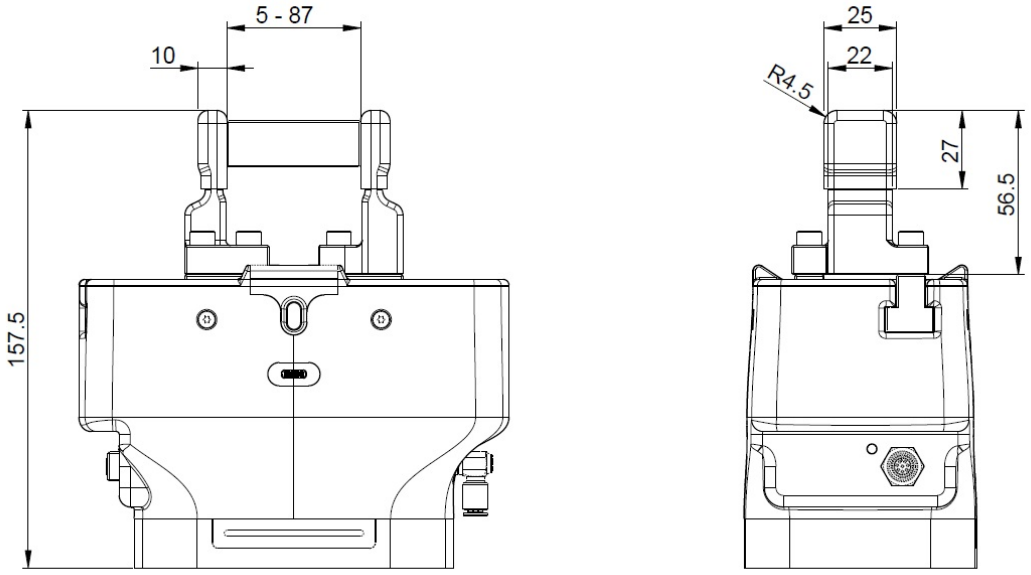
4.8.2 Robot-gripper mechanical interface

The diagram below shows the dimensions of the mechanical interface between the robot and the gripper, compliant with ISO 9409-1-50-4-M6.



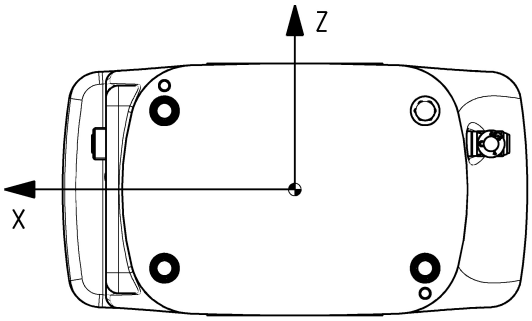
4.8.3 Fingers

The diagram shows the overall dimensions of the fingers included in accessory F-CSPT, as mounted on the gripper.

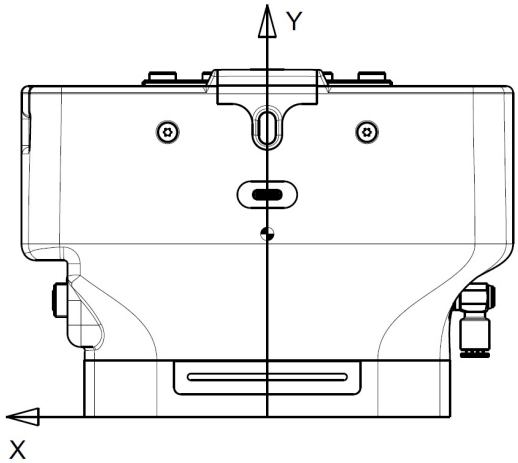


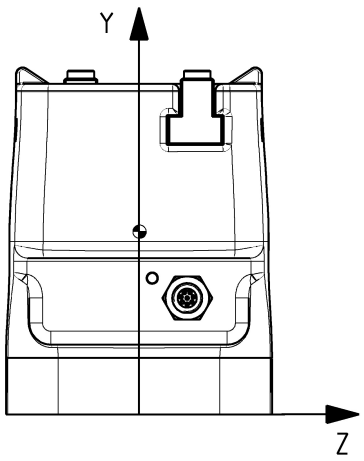
4.9 Centre of gravity

The centre of gravity is calculated with the robot flange and standard fingers; the support surface between the robot interface flange and the robot wrist is used as a plane of the reference system.



Centre of gravity			
	X[mm]	Y[mm]	Z[mm]
CSPT-20-80	0	55	0





4.10 Electrical interface

4.10.1 Gripper connection

The gripper is provided with an 8-pin M8 female connector, represented in figure 4.3. The eight wires inside the cable have different colours representing different functions, listed in the table 4.5.

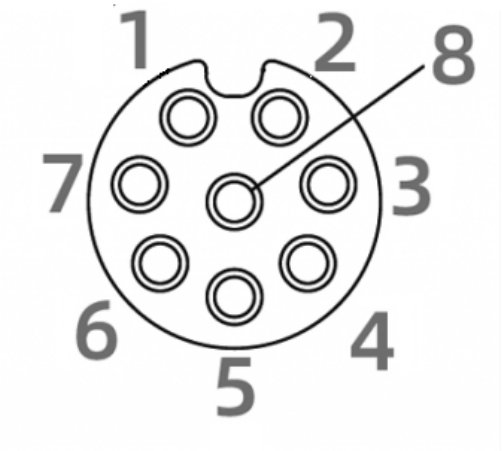


Figure 4.3: Gripper M8 8-pin female connector

Pin number	Function	Cable colour
1	RS 485 A+	White
2	RS 485 B-	Brown
3	General purpose output (DO PNP +24V)	Green
4	General purpose output (DO PNP +24V)	Yellow
5	Power supply + 24 V DC ± 10 %	Gray
6	General purpose input (DO 0 V | +24V)	Pink
7	General purpose input (DO 0 V | +24V)	Blue
8	Power supply reference 0 V DC	Red

Table 4.5: Electrical information

4.10.2 Robot cable

To be plug and play, it is possible to choose a cable depending on the robot type. In the following table you will find more detailed information.

Robot manufacturer	Robot	Gripper side	Robot side	Length [mm]
UNIVERSAL ROBOT	UR3e | UR5e UR10e | UR16e	M8 8pin male	M8 8pin female	230
FANUC	CRX 5ia | CRX 10ia CRX 10ia/L | CRX 20ia/L CRX 25ia	M8 8pin male	M8 8pin female	230
ABB	GoFa	M8 8pin male	M8 3pin male M8 4pin male	275 245
DOOSAN	M0609 | M0617 | M1013 M1509 | H2017 | H2515	M8 8pin male	M8 8pin male	230

Table 4.6: Robot cable information

Operating method

⚠WARNING

- When unpacking, take great care not to damage the product.
- Check for any defects caused by transport or storage of the product.
- Remove all the securing/locking devices of the moving parts.
- Use appropriate overpressure protection devices when installing the component.
- Prevent, as far as possible, any sudden changes in pressure in the circuit on which the component is installed.
- Before operating the component, check that the characteristics and performance stated in the catalogue correspond to those required.
- Use a "PELV" system for power and logic supply.
- Make sure that the component is grounded correctly.
- When installing the component, make sure that there is no danger due to mechanical movements.
- Separate the packaging materials for recycling or disposal according to the regulations in force in your country.

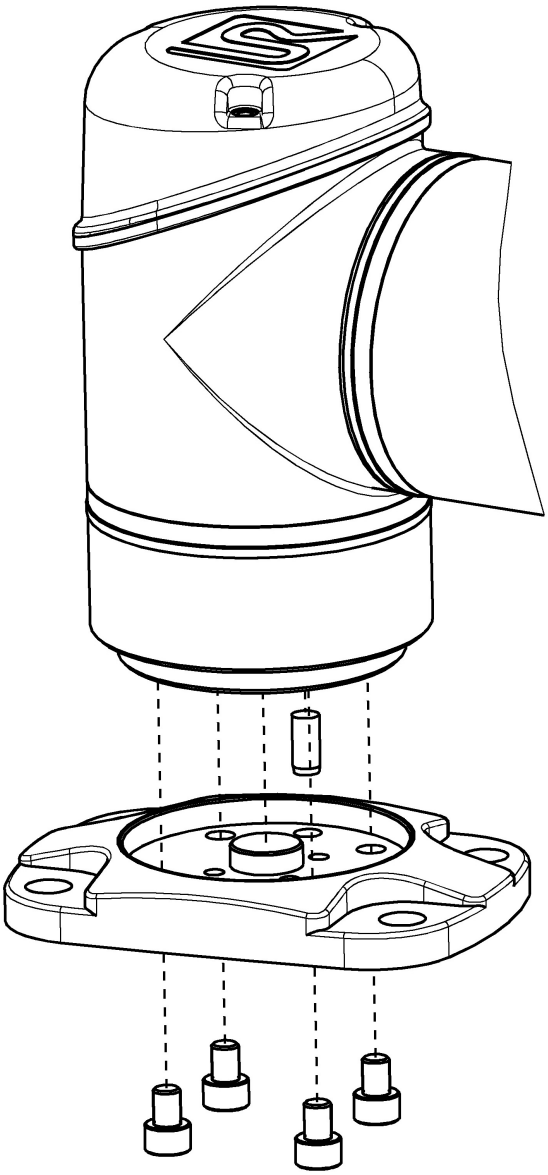
5.1 Installation

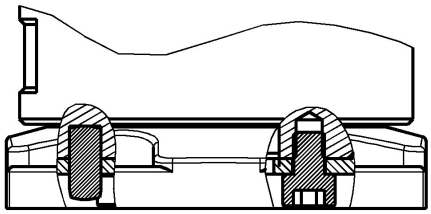
⚠WARNING

- Before installation shut down the electricity power supply (where necessary) and the system pressure supply, draining all the residual compressed air from the system and deactivating the residual energy stored in springs, condensers, containers and gravity.
- After installation reconnect the system's pressure and electricity supply (where necessary) and check the proper operation of the product. In case of leaks or malfunctioning, the product must not be put into operation.
- Do not install the product in environments where the air itself may cause hazards.
- Do not install the product in the presence or proximity of strong electromagnetic fields or large masses of ferromagnetic material.
- Install the component in an area where set-up and maintenance can be easily performed and do not lead to hazards for the operator.
- Tighten the screw within the specified torque range when mounting the gripper and the attachments.

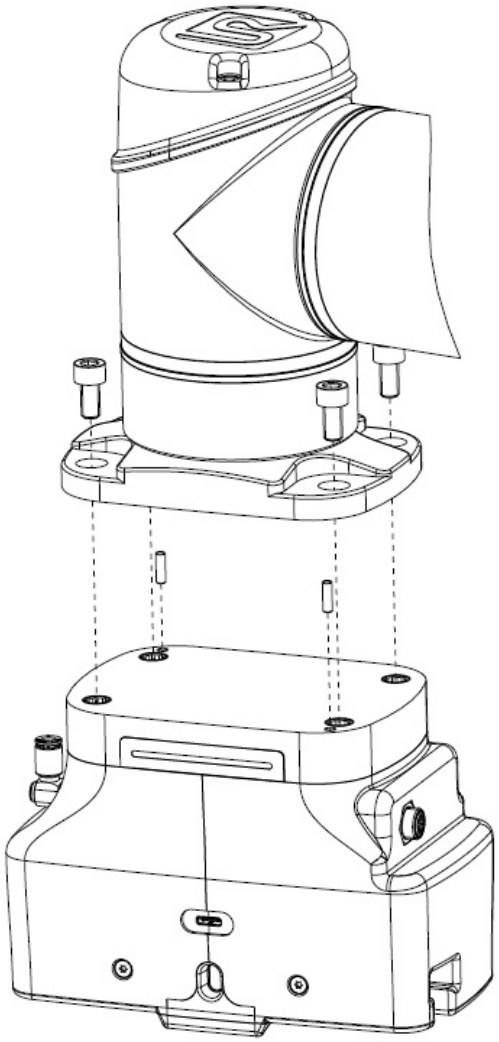
5.1.1 Gripper mounting

Insert the centering pin into the hole on the robot wrist and position the interface plate. Secure the plate using four M6x10 UNI5931 screws. The centering pin must remain flush with the plate surface.



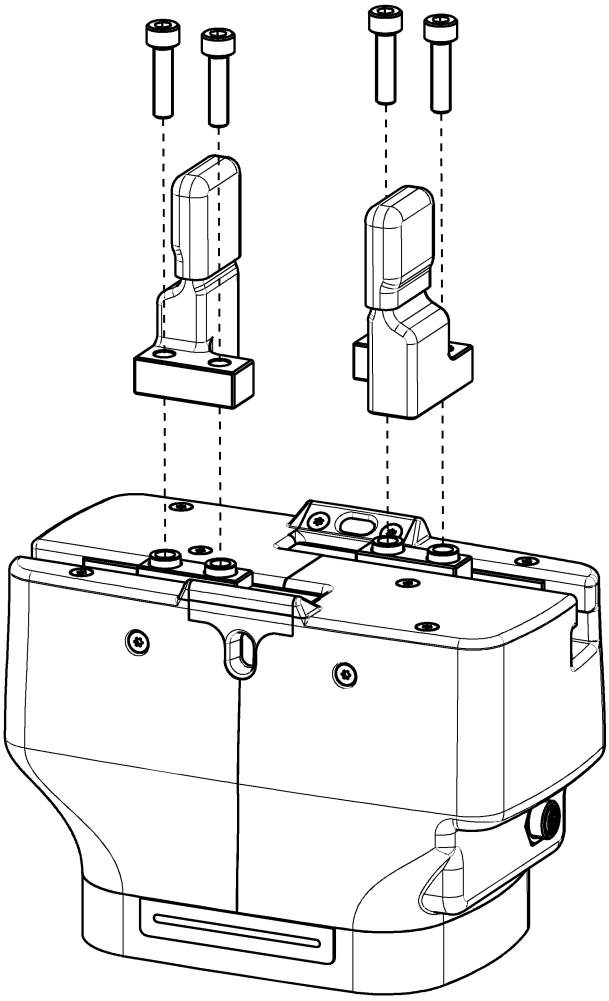


Align the gripper with the two centering pins on the plate and fasten it using four screws.



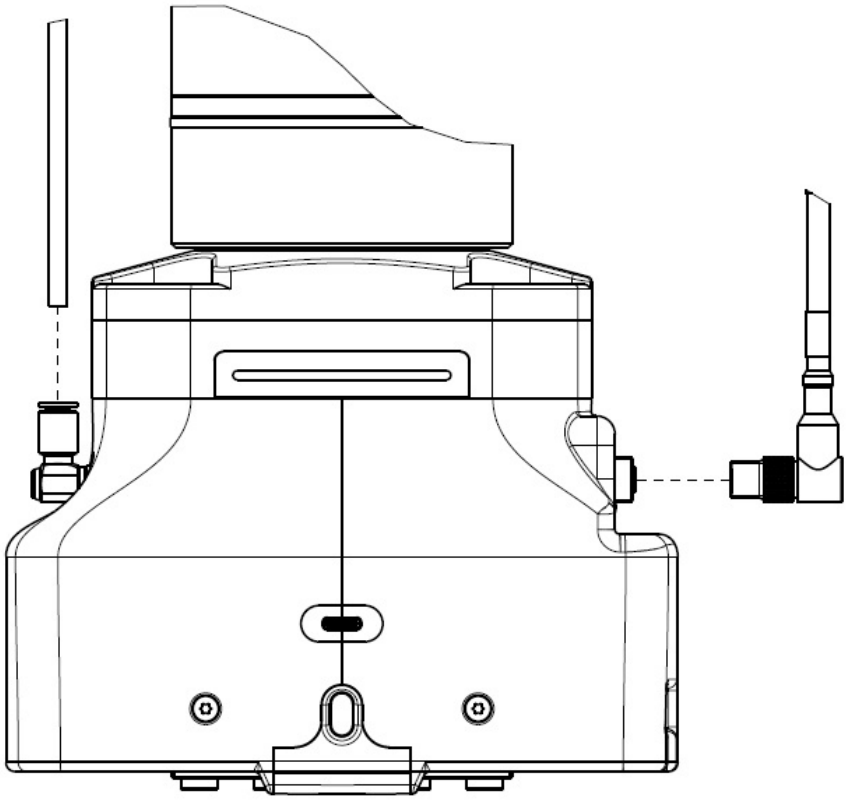
5.1.2 Finger mounting

Mount the standard fingers (accessory F-CSPT) directly onto the gripper jaws using the provided hexagon socket head cap screws. Ensure proper alignment of the fingers with the jaw surfaces before tightening.



5.1.3 Cable connection

In case the connectors at both ends of the cable look identical, please refer to the label on the cable to plug each connector to the right device.
Connect the T side of the cable to the gripper connector.



5.1.4 Operative status

The gripper has a status LED which is related to the status of the gripper:

- Green: gripper is working fine.
- Yellow: gripper is in warning status. The control of the gripper can be executed, but performances is not guaranteed.
- Red: gripper is in alarm state. In those condition, the gripper can not perform any action.

To check which error or warning is active, take as reference the Modbus chapter.

MODBUS RTU Communication

This chapter explains how to communicate with the CSPT gripper.

6.1 Modbus communication

The gripper communicates via Modbus RTU on RS485. The default values of the serial communication are:

Node id:	2
Baud rate:	115200
Data:	8 bit
Stop Bit:	1
Parity:	None
RTS:	Disable

Admissible node-id: 1 - 127.

Admissible baud rate (bps):

- 9600,
- 19200,
- 38400,
- 57600,
- 115200,
- 230400,
- 460800,
- 921600.

With the Uvix program it is possible to change the node-id and baud rate value (7.7).

6.2 Register

The allowed Modbus functions are:

- 0x3 read holding register,
- 0x10 write multiple registers.

The registers are composed of 2 bytes each. The following table describes their functionalities:

Table 6.1: Register information

Register number	Description	Unit of measure	Access type	Range
40001	Desired Opening Pressure	mbar	Write	0 - 10000
40002	Opening Pressure	mbar	Read	0 - 10000
40003	Desired Closing Pressure	mbar	Write	0 - 10000
40004	Closing Pressure	mbar	Read	0 - 10000
40005	Desired Pressure single setpoint	mbar	Write	-10000 | + 10000
40006	Desired Position (single finger)	mm * 1000	Write	0 - 40000
40007	Desired Force	N	Write	-270 | + 270
40008	Real Position	mm * 1000	Read	0 - 40000
40009	Controller Type	–	Write	• 1 - Single set point pressure Control • 2 - Position Control • 3 - Force Control • 4 - Double set point pressure Control
40010	Valve off option	boolean	Write	• 0 - valve always active • 1 - deadzone active
40011	Distance Force	mm	Write	0 - 150
40012	Status	–	Read	TBD
40013	Error	–	Read	Table 6.2
40014	Warning	–	Read	Table 6.3
40015	Stable Measure	boolean	Read	• 0 - Target not reached • 1 - Target reached
40016	Enable control	boolean	Write	• 0 - Control not enabled • 1 - Control enabled
40017	Line Pressure	mbar	Read	0 - 10000

Continua nella pagina successiva

Register number	Description	Unit of measure	Access type	Range
40018	Internal ToF 1	mm	Read	0 - 400 | 65535: error measure out of range
40019	Internal ToF 2	mm	Read	0 - 400 | 65535: error measure out of range
40020	External ToF 1	mm	Read	0 - 4000 | 65535: error measure out of range
40021	External ToF 2	mm	Read	0 - 4000 | 65535: error measure out of range
40022	Object presence and centred	boolean	Read	0 - 1 • 0 - Item not present or not centred • 1 - Item present and centred
40023	External ToF occluded	boolean	Read	0 - 1 • 0 - External ToFs not occluded • 1 - External ToFs occluded
40024	Double Tap recognition activation	boolean	Write	0 - 1 • 0 - Double Tap recognition not active and reset • 1 - Double Tap recognition active
40025	Double Tap recognition	boolean	Read	0 - 1 • 0 - Double Tap not recognized or not active • 1 - Double Tap recognized on ToF1 • 2 - Double Tap recognized on ToF2

The gripper starts with the pressure controller with 0 bar as target for both chambers. Once the gripper is ready, it can execute commands. The control is enabled via the **Enable Control** register (40016 6.1). This parameter can be set also via UVIX and stored into the gripper, so that at startup, the control can be automatically enabled.

One of the three available **base controllers** must always be active. This means that the gripper always controls the pressure in the chamber or the position of the finger or the open loop force applied to the finger. To change the controller, you need to change the respective register. Once the controller is changed, the new target value (until it is changed) is the actual value of the new setting; for instance: if the controller changes from pressure to position and the gripper finger is at 2mm, the first target is

2mm. Then it can be changed as desired. Basic controllers are mutual exclusive.

The set point for different base control can be set via different modbus registers. In particular:

- 1 - Single set point pressure control works with register 40001 (6.1). If pressure is set greater than 0, the set pressure is related to the closing chamber, opening chamber otherwise. The opposite pressure set point is automatically set to 0 bar. For instance, if the single set point pressure is set to 1000, it means that the pressure in closing chamber is controlled to 1000 mbar and the opening to 0 mbar. If the single set point pressure is set to -1000, it means that the pressure in opening chamber is controlled to 1000 mbar and the closing to 0 mbar.
- 2 - Position control works with register 40008 (6.1). The set point is directly the desired position of the finger.
- 3 - Force control works with register 40007 and 40011 (6.1). The pressure set point for the chamber is automatically evaluated internally. If the Desired Force register is greater than 0, the gripper applies a target in the closing direction, if smaller than 0 in the opening direction. The open loop force is evaluated on distance force of the item that should be gripped. The more this distance is precise, the more the actual force applied will be close to the target.
- 4 - Double set point pressure Control works with 40002 and 40004 (6.1). The pressure inside the different chambers can be set independently. This allows the user to choose different set points for different chambers. It is used in advanced applications.

The **Valve off** option switches off the valve once the target has been achieved, and they are activated once the controlled variable is greater than a certain value. This means that at the steady state the gripper is silent, but the accuracy of the controller is less than when the option is switched off.

The **distance force** parameter represents the distance in mm at which the piece is gripped. This parameter is used to evaluate the open loop requested force. Thus, not setting this parameter correctly, may lead to a different value with respect to the one expected (if the distance set is less than the real one, the force will be less than expected; higher vice versa).

Each bit of the **Error** register represents a different error which does not allow the gripper to work correctly, so that the gripper stops to work, closes the valve and the LED status becomes RED.

Double Tap recognition is an advanced functionality related to the external ToF. When the Double Tap recognition activation register is set, this functionality becomes active. It allows the gripper to recognize a double tap when the sensor measures a distance below 300 mm twice within 1 second, regardless of whether the external ToF is activated.

Bit number	Alarm name	Description
0	Under-voltage	Under-voltage condition: 24V - 10%
1	Under-pressure	Under-pressure condition: Line pressure below 2.0 bar
2	Fault open load solenoid	Signals an open circuit of the loading valve for the opening chamber
3	Fault close exhaust solenoid	Signals an open circuit of the exhaust valve for the opening chamber
4	Fault close load solenoid	Signals an open circuit of the loading valve for the closing chamber
5	Fault open exhaust solenoid	Signals an open circuit of the exhaust valve for the closing chamber
6	Reserved	–
7	Reserved	–
8	Reserved	–
9	Reserved	–
10	Reserved	–
11	Reserved	–
12	Reserved	–
13	Reserved	–
14	Reserved	–
15	Reserved	–

Table 6.2: Error information

Each bit of the **Warning** register represents a different error which does not allow the gripper to work correctly, but the error does not compromise the main functions of the gripper. So the gripper continues to work, but there might be unwanted behaviour. The LED status becomes BLUE.

Bit number	Alarm name	Description
0	Internal ToF 1	The first ToF that looks inside the gripper has a malfunction
1	Internal ToF 2	The second ToF that looks inside the gripper has a malfunction
2	External ToF 1	The first ToF that looks outside the gripper has a malfunction
3	External ToF 2	The second ToF that looks outside the gripper has a malfunction
4	LED malfunction	The LED could not represent the actual status of the gripper
5	Serial number missing	The serial number of the gripper is missing
6	Line pressure low	The required pressure to properly work is higher than the line pressure
7	Encoder	The position sensor has a malfunction
8	Reserved	–
9	Reserved	–
10	Reserved	–
11	Reserved	–
12	Reserved	–
13	Reserved	–
14	Reserved	–
15	Reserved	–

Table 6.3: Warning information

To **measure the length of a piece**, here there is a list of action to be as fine as possible:

- (A) Closing:
  1. Fully close the gripper using the same force that will be applied when grasping the part.
  2. Store the value of register 40006, representing the actual finger position. This operation is performed only once at the beginning of the program.
  3. Open the gripper.
  4. Close the gripper with the part using the desired gripping force.
  5. Wait for the measurement to stabilize.
  6. Read the value of register 40006.
  7. Compute the part dimension by subtracting the value stored in step 2 from the value obtained

in step 6.

8. To evaluate another measurement, restart the procedure from step 3.

- (B) Opening:
  1. Close the gripper.
  2. Open the gripper using the desired force.
  3. Wait for the measurement to stabilize.
  4. Read the value of register 40006; this corresponds to the length of the gripped part.

Uvix

7.1 Introduction

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

7.2 General information

The devices connected to 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.

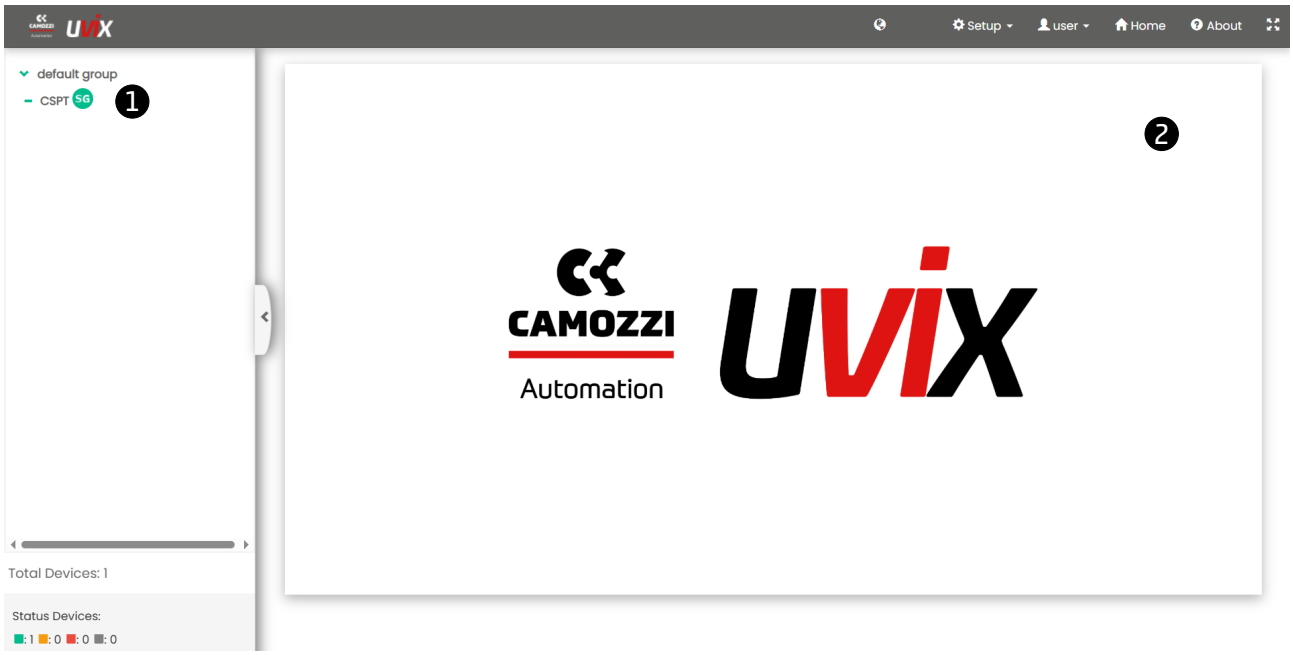


Figure 7.1: Main page of the UVIX interface.

Select the CSPT device to view the general status information 7.3 and details 7.4. Furthermore, it is possible to set the CSPT parameters (*Configuration*) and to communicate with the device in real-time (*Commissioning*).

7.3 Status information

- 1 Image of the Series CSPT.
- 2 Assigned name of the device.
- 3 Identification number of the device (17 chars).
- 4 Family name of the device: *CSPT gripper*.
- 5 Subtype of the device family: *Pneumatic Smart Gripper*.
- 6 Firmware version.
- 7 Date and time of the last data transmission.
- 8 General status of the device: Not available, Ok, Warning, Alarm.
- 9 Operational status of the device:
  - *Work*: normal operation.
  - *Manual*: manual operation.
- 10 Connection status: Ok, Offline.
- 11 Fieldbus communication: Modbus RTU.
- 12 Communication status of the Fieldbus: Ok, Offline.
- 13 Fieldbus configuration (par. 7.7).
- 14 Access *Configuration* page (par. 7.5) to set the CSPT parameters.
- 15 Access *Commissioning* page (par. 7.6) to communicate with the device in real-time.

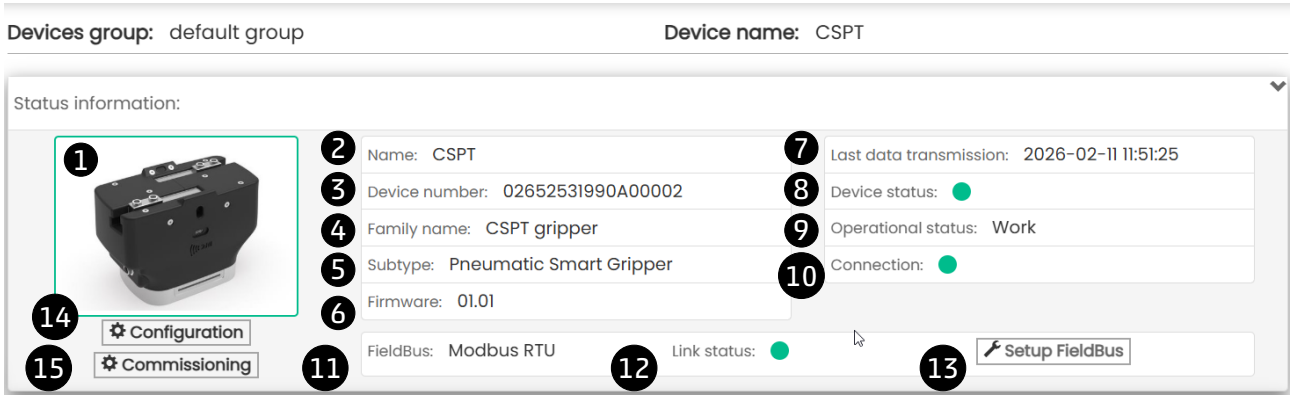


Figure 7.2: Main page of the UVIX interface.

7.4 Details

The details section is divided into five tabs:

- Variables 7.4.1
- Alarms 7.4.2
- Commands 7.4.3
- Error History 7.4.4
- Graphs 7.4.5

7.4.1 Variables

The first tab of details shows the variables that are monitored by the CSPT device as shown in Figure 7.3.

The variables are listed below:

- Hardware version.
- MAC address.
- Commercial code.
- Device power supply.
- Line pressure.
- Opening pressure.
- Closing pressure.
- Finger position.
- Controlled force.
- Active base control:
  - *Pressure*
  - *Position*
  - *Force*
- Opening pressure reference.
- Closing pressure reference.
- Finger position reference.
- Force reference.
- Gripping distance for force control.
- Valve off.

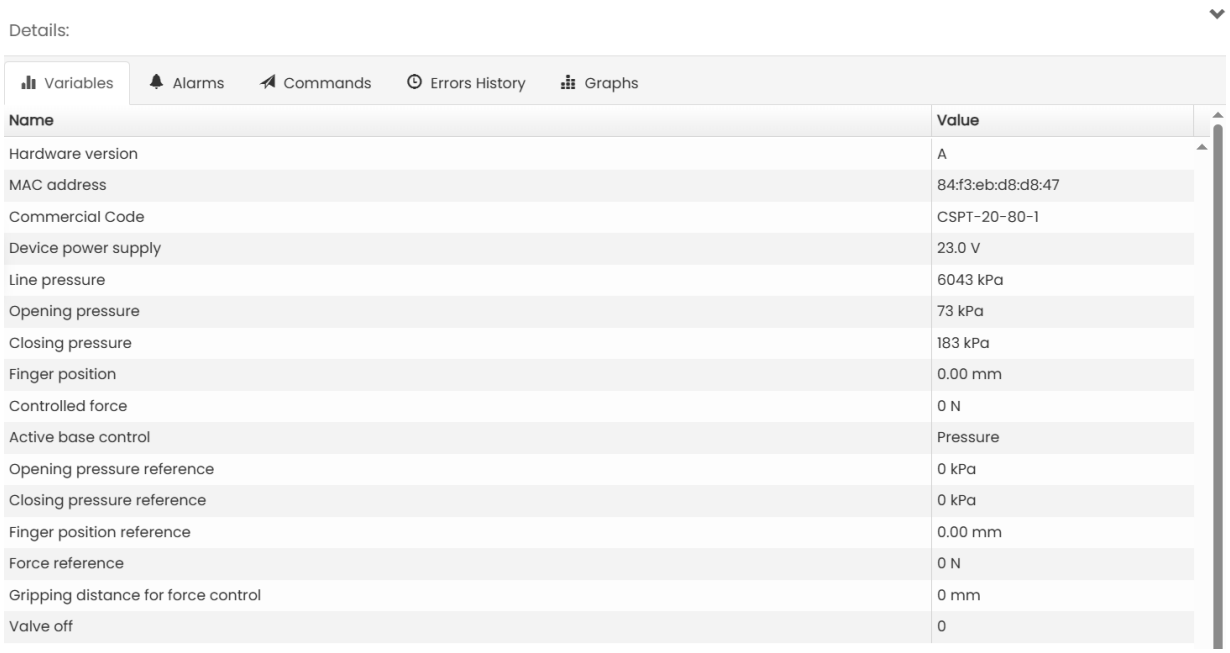


Figure 7.3: Section for the variables monitored by the CSPT device.

7.4.2 Alarms

The second tab of details displays possible CSPT alarms as shown in Figure 7.4.

All possible alarms are listed below:

- Error alarms: *Alarm active* , *Alarm not active* .
  - Supply voltage out of range.
  - Pressure out of working range.
  - Fault valve charge opening chamber.
  - Fault valve discharge opening chamber.
  - Fault valve charge closing chamber.
  - Fault valve discharge closing chamber.
- Warning alarms: *Alarm active* , *Alarm not active* .
  - Internal ToF1 acquisition error.
  - Internal ToF2 acquisition error.
  - External ToF1 acquisition error.
  - External ToF2 acquisition error.
  - Unexpected LED behaviour.
  - Missing serial number.

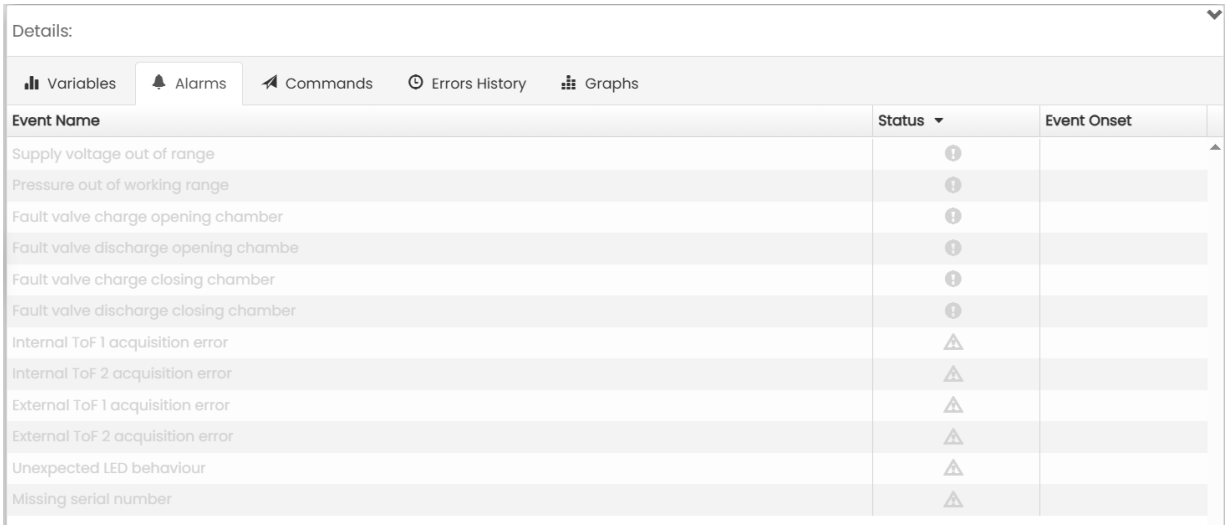


Figure 7.4: Section for the alarms monitored by the CSPT device.

7.4.3 Commands

The third tab of details shows the commands that can be sent via UVIX to the device. The manual mode command ❶ allows you to control the system manually from UVIX. The manual mode command ❷ allows you to return in Operational status Work.

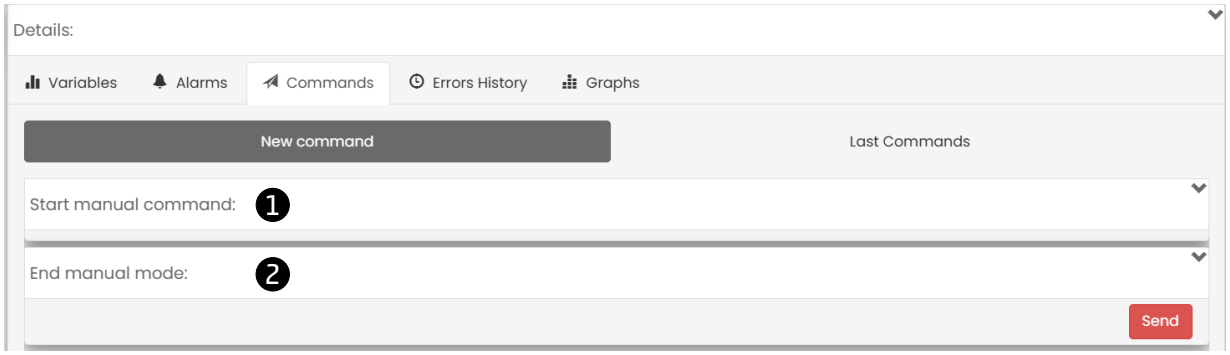


Figure 7.5: Section for the commands managed by the CSPT device.

7.4.4 Errors History

Not yet implemented for CSPT.

7.4.5 Graphs

The fifth tab of details on the CSPT device contains graphs that show the trend of same variables 7.4.1 over time, as shown in Figure 7.6. It is possible to choose the variables to acquire ❶, start acquisition ❷, stop acquisition ❸, clear graph ❹, add custom graph ❺ Figure 7.8 and save data in *.csv* format ❻.

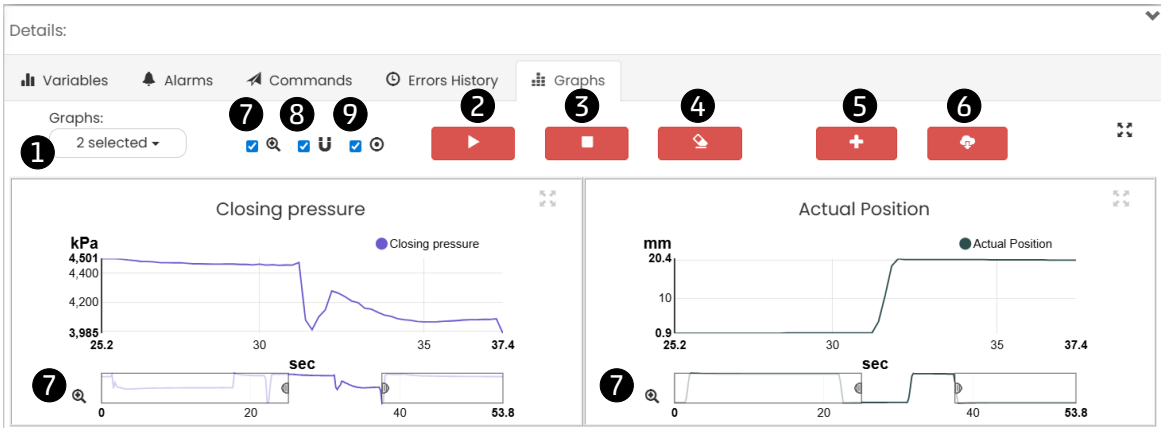


Figure 7.6: Section for graphing variables over time. In this example flag ❼ is set so the zoom bar is activated, ,flag ❽ is set so *Closing pressure* and *Actual position* are graphed over the same observation interval, and flag ❾ is set so data is automatically saved in the .csv file.

Below the graph there is a thumbnail ❼ that allows to select an observation interval over time when the flag is selected. There is also a flag ❽, which gives the possibility to select the same observation interval for all variables under acquisition. Otherwise, if the flag is not set, the observation interval can be chosen independently for each variable, as shown in Figure 7.7.
The graphs are printed starting from the values saved in a circular buffer. When the buffer fills up it is rewritten from the beginning, overwriting the old data. To avoid losing data it is possible to set a flag ❾, which enables automatic saving of data in *.csv* format every time the circular buffer is filled. The time it takes for the buffer to fill corresponds to 4 minutes with a sampling period of 200 milliseconds.

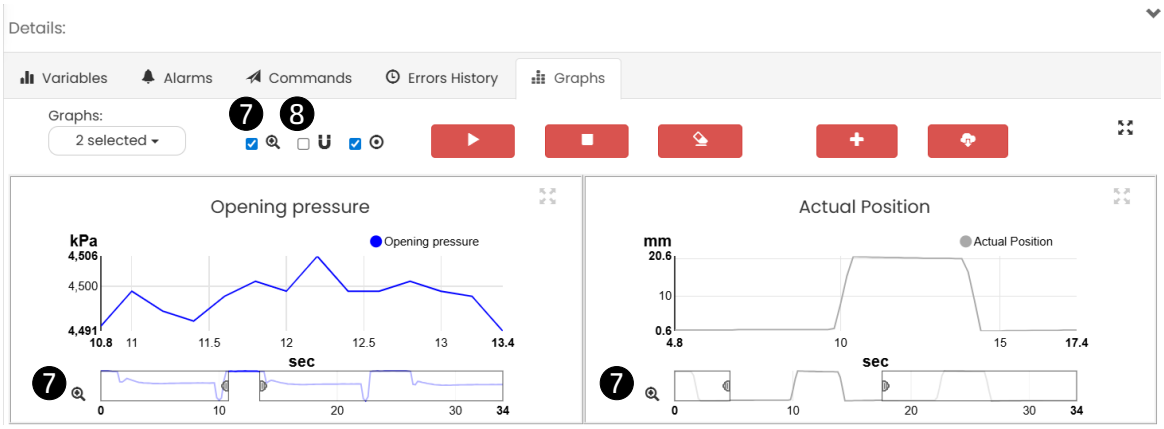


Figure 7.7: Section for graphing variables over time. In this example flag ❽ is not set, so *Opening pressure* and *Actual Position* are graphed over different observation intervals when the flag ❼ is set.

Using the appropriate command it is possible to add custom graphs, the window that appears is shown in figure 7.8.

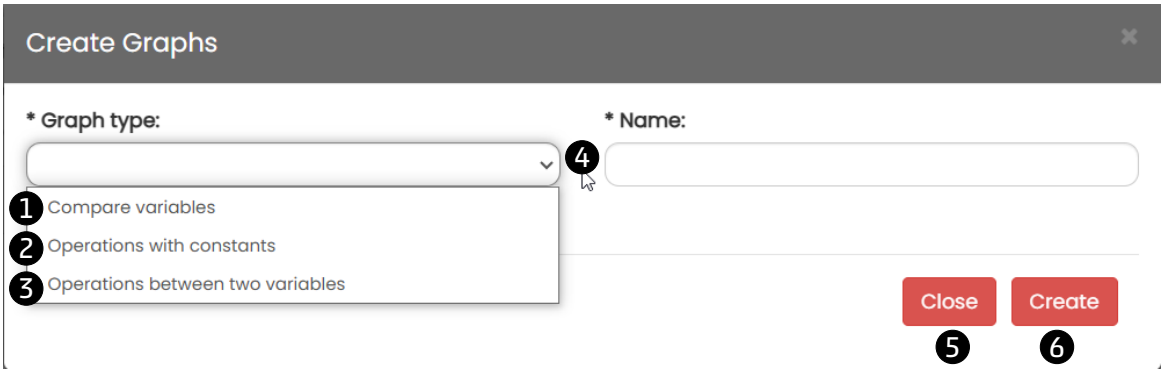


Figure 7.8: Window for adding custom graphs

The available commands are as follows:

1. Adds a custom graph that compares two or more variables (up to a maximum of four).
2. Adds a custom graph that adds or subtracts a constant value to a variable.
3. Adds a custom graph that adds or subtracts two variables (they must have the same unit of measurement).
4. Sets the name of the graph.
5. Closes the window, canceling creation.
6. Closes the window, adding the custom graph.

In figure 7.9 three example custom graphs are shown, one for each type.

Figure 7.9: Example of custom graphs

7.5 Configuration

From the status information page 7.3, it is possible to access the configuration page, where it is possible to configure certain operating-related parameters of the CSPT. All these parameters can be stored into the non volatile memory of the drive by clicking the buttons *Send* and subsequently *Save on device*.

7.5.1 Parameter

In this section it is possible to set the following parameters:

- ❶ *Enable control startup*.This parameter enables or disables the CSPT control mode at power on.
- ❷ *Enable valve off startup*. This parameter enables or disables the valve off option at power on.
- ❸ *Enable termination resistence RS485*. This parameter enables or disables the termination resistence between the pins of the RS485 connection.
- ❹ *Pressure threshold* measured in kPa. This is the value used in pressure mode to validate the target achieved.
- ❺ *Position threshold* measured in mm. This is the value used in position mode to validate the target achieved.

Figure 7.10: Section CSPT configuration.

7.6 Commissioning

From the status information page 7.3, it is possible to access the commissioning page, where it is possible to manually control the CSPT. When manual control is active, all commands received via Fieldbus are ignored.

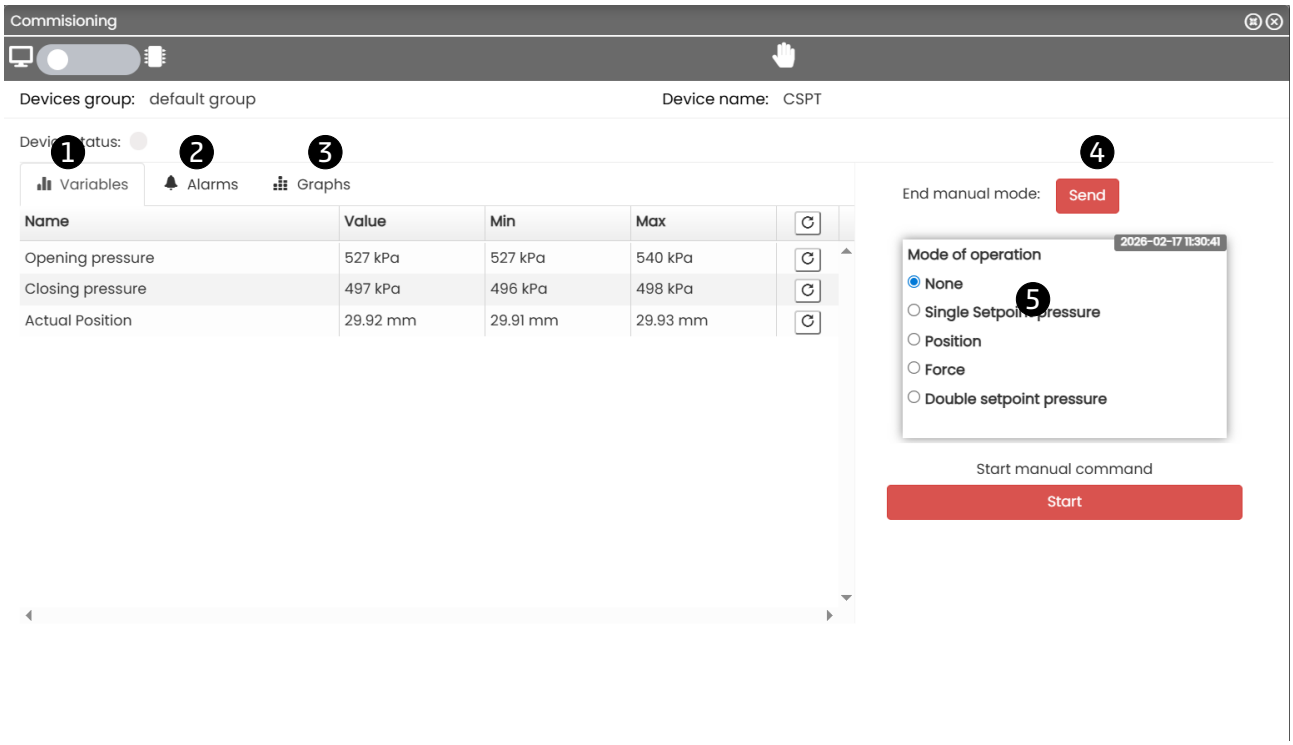


Figure 7.11: Commissioning page.

The page is composed of:

- 1 Tab Variable. Shows the value of the variable.
- 2 Tab Alarms. Shows the error or warning present.
- 3 Tab Graphs 7.4.5. Shows the trend of variables over time.
- 4 Start or Stop the manual mode control.
- 5 Select the CSPT Mode of operation.

7.6.1 Single Setpoint Pressure

In this mode of operation it is possible to command the CSPT in pressure mode with a single setpoint value.

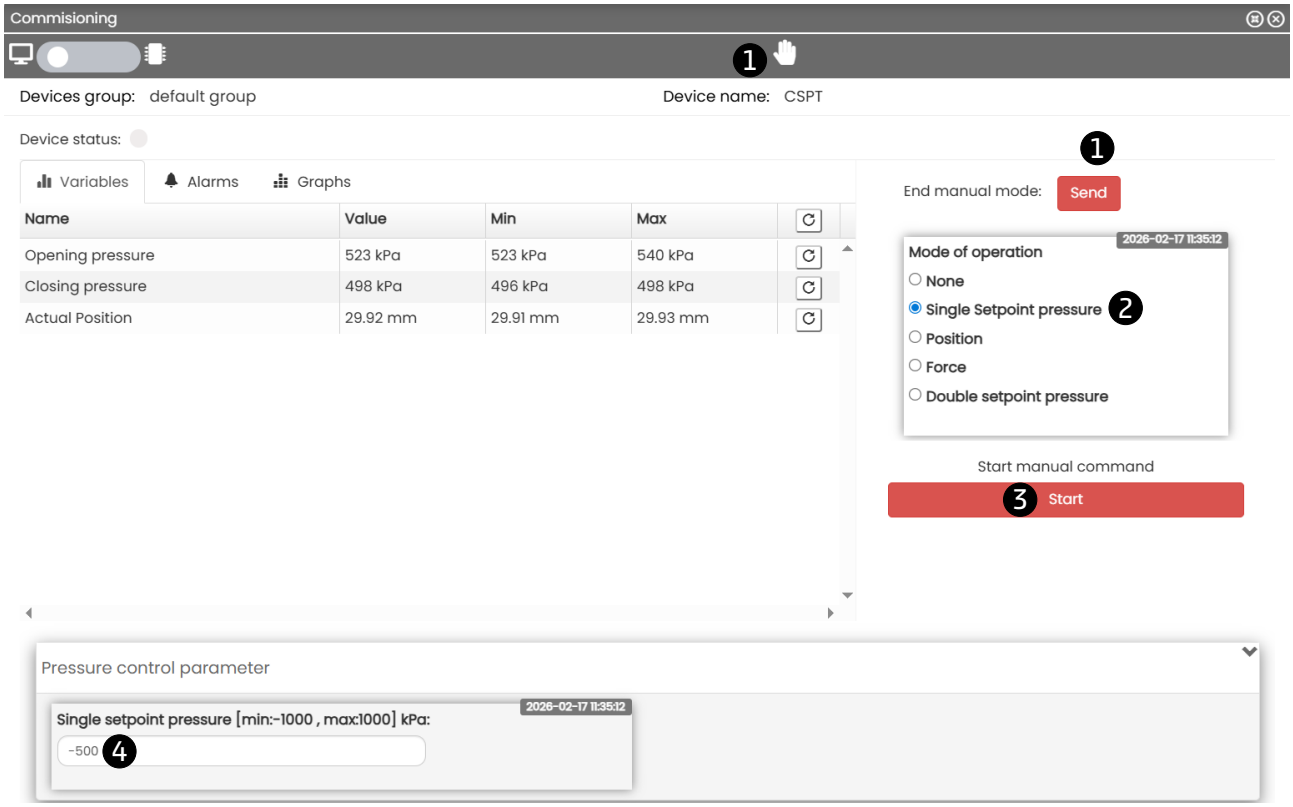


Figure 7.12: Single Setpoint Pressure command

- 1 Manual mode activation.
- 2 Single Setpoit Pressure selected.
- 3 When it is pressed the setpoint is sent to CSPT.
- 4 Pressure set point value. A negative value opens the finger. A positive value closes the finger.

7.6.2 Position

In this mode of operation is possible command the CSPT in position mode. The set poit is the position required.

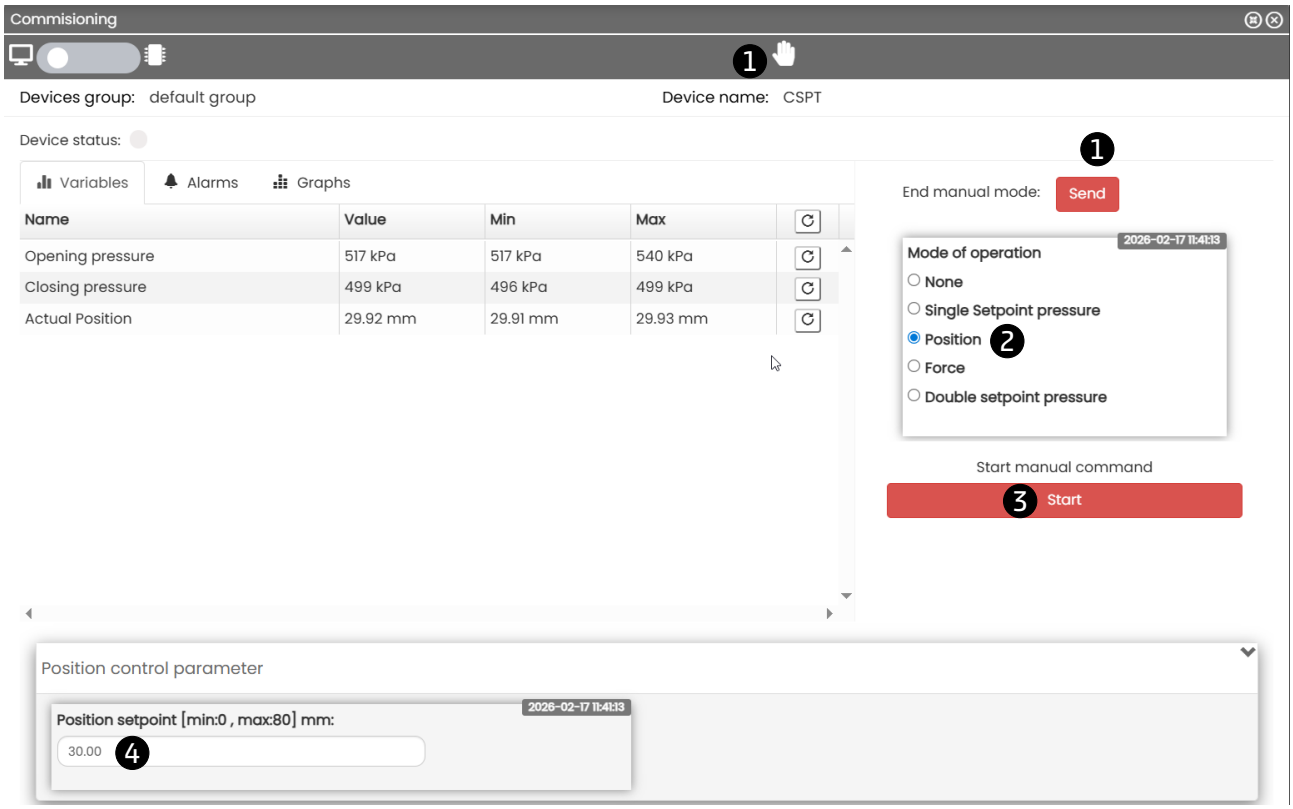


Figure 7.13: Position command

- 1 Manual mode activation.
- 2 Position selected.
- 3 When it is pressed the setpoint is send to CSPT.
- 4 Position set point value.

7.6.3 Force

In this mode of operation is possible command the CSPT in force mode.

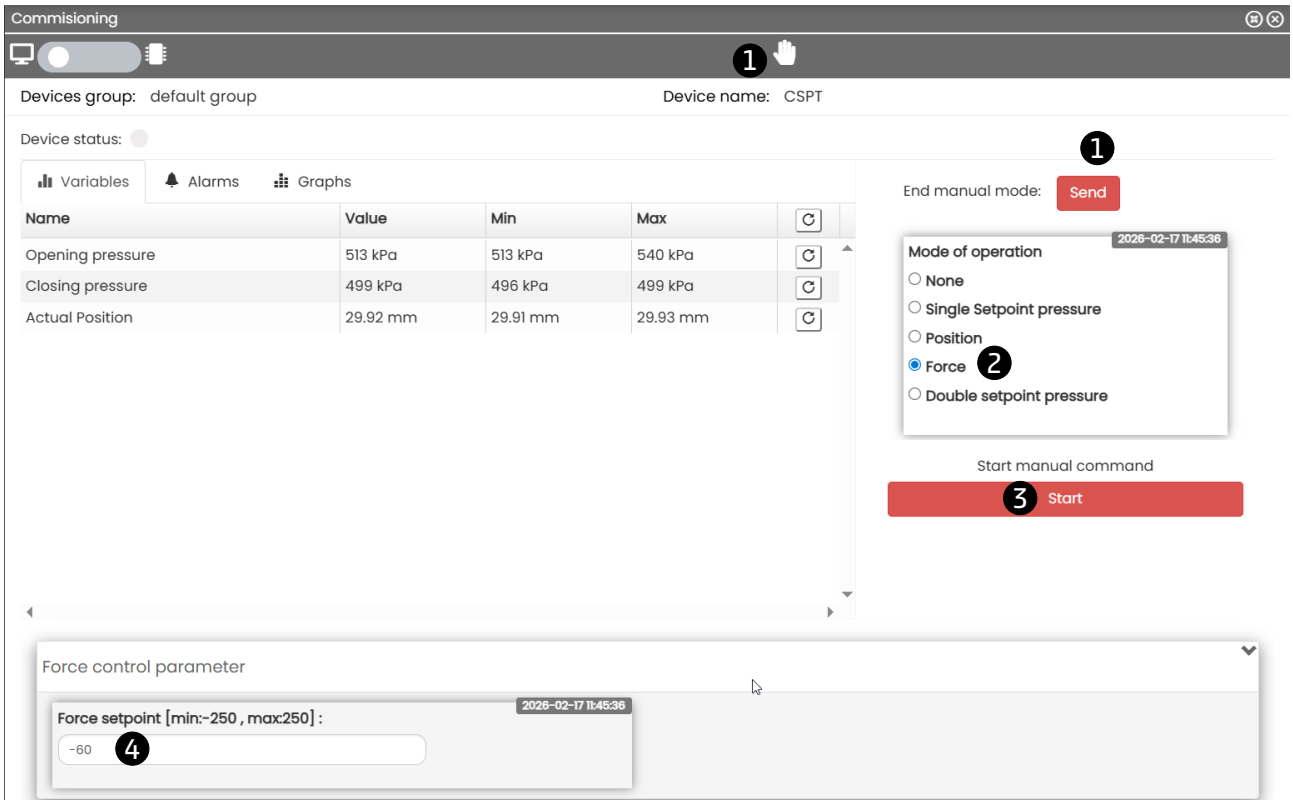


Figure 7.14: Force command

- 1 Manual mode activation.
- 2 Force selected.
- 3 When it is pressed the setpoint is send to CSPT.
- 4 Force value. Negative value open the finger. Positive value close the finger.

7.6.4 Double Setpoint Pressure

In this mode of operation is possible command the CSPT in pressure mode with a double set point value. One for the opening chamber and one for the closing chamber.

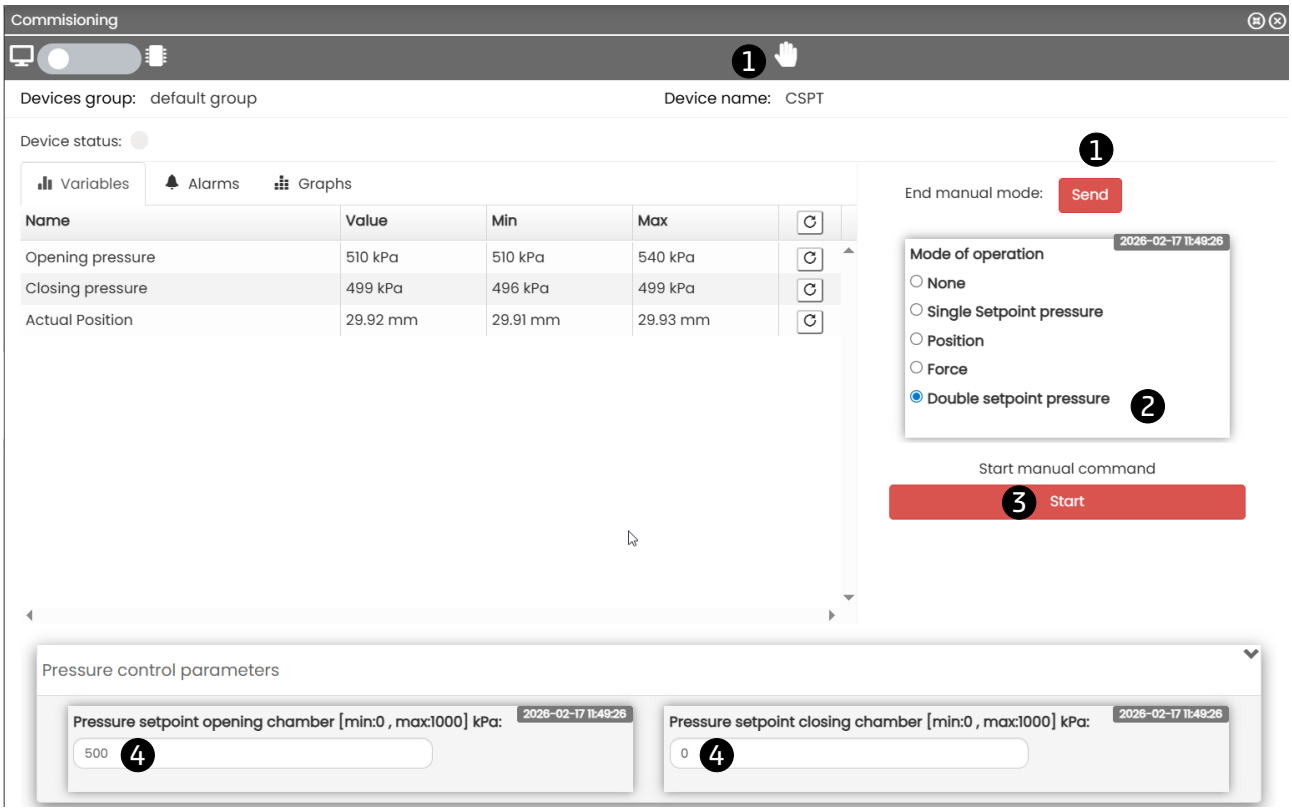


Figure 7.15: Double Setpoint Pressure command

- 1 Manual mode activation.
- 2 Double Setpoit Pressure selected.
- 3 When it is pressed the setpoints are send to CSPT.
- 4 Pressure set point value.

7.7 Setup FieldBus

From the status information page 7.3, you can access the window for configuring the ModBus RTU fieldbus parameters (6.1): Node Id ❶ and the Baud rate ❷. Using the buttons in the bottom bar of the configuration window ❸, the configured parameters can be sent to the module, saved on the PC, saved on the device, or reset to default values.

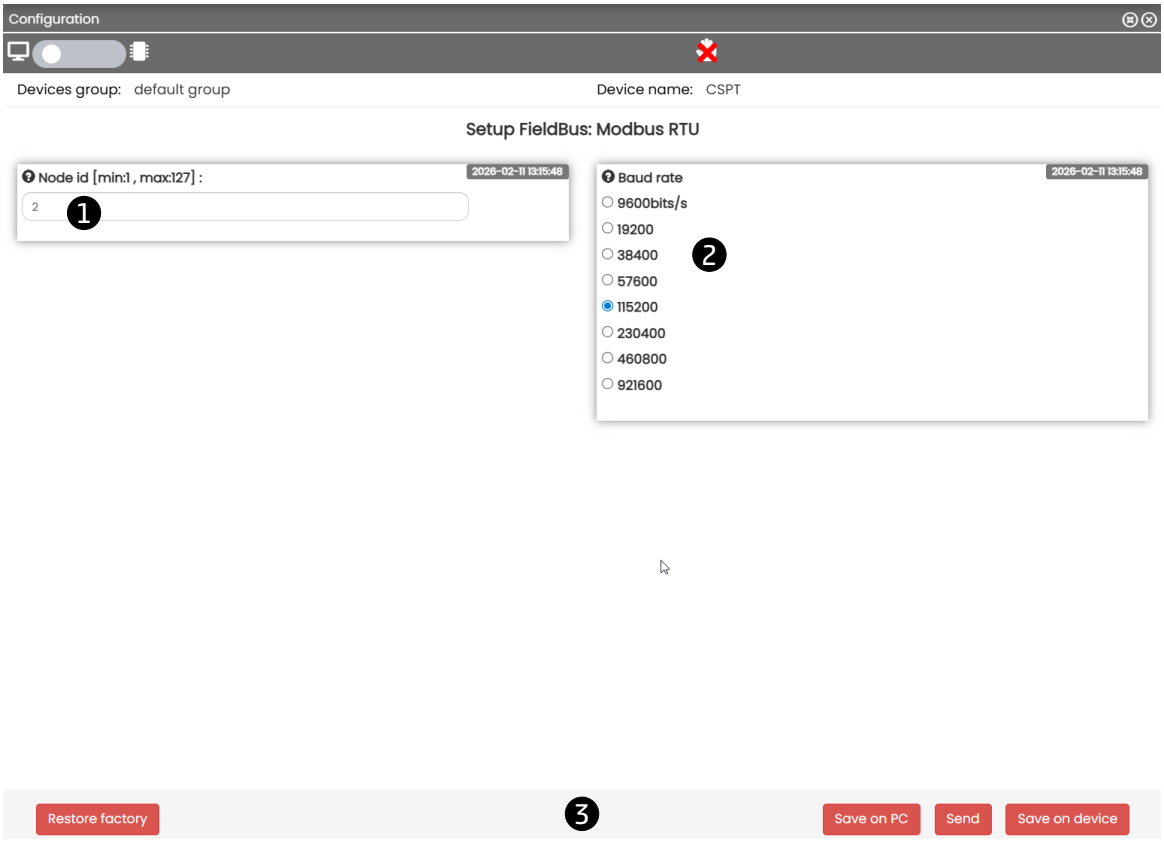


Figure 7.16: Section of the ModBus RTU parameters configuration.

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