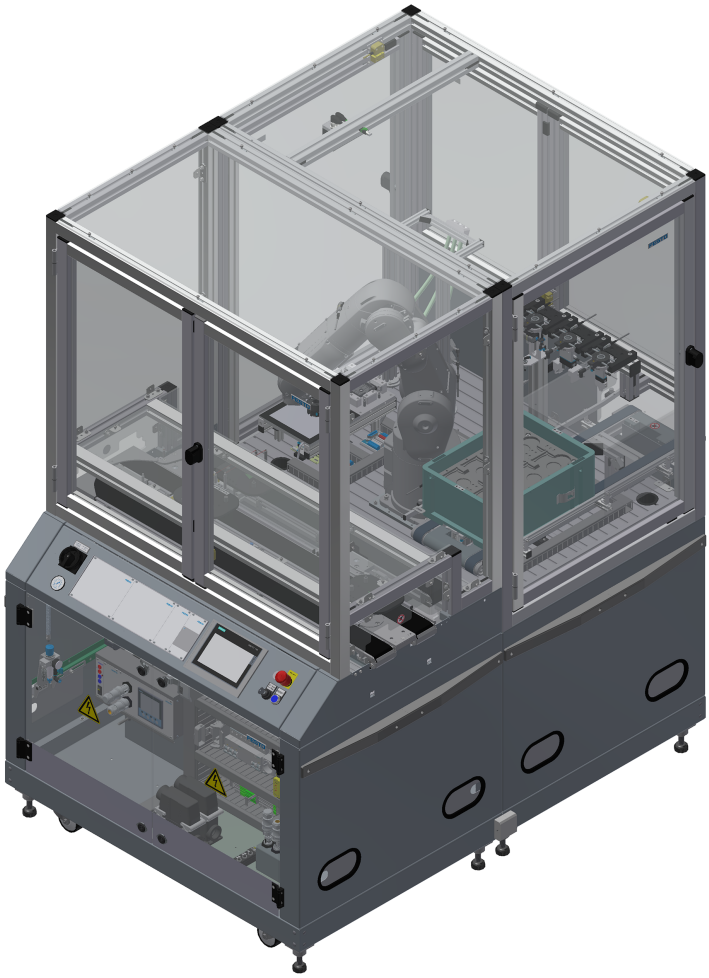
8178477

Robot assembly

FESTO

CP systems

Operating instruction



Festo Didactic SE

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Original operating instructions

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1 About this document

1.1 General information

This documentation must be available to the user at all times. This documentation must be read before commissioning. The safety instructions must be observed. Non-observance may result in severe personal injury or damage to property.

For information, documentation, and software updates, visit:➦ *https://ip.festo-didactic.com*

1.2 Software updates for third-party components

For products from Festo Didactic SE components from third-party manufacturers (e.g. controllers, motor controllers, HMI, etc.) can be installed with the firmware of the delivery status of the third-party manufacturer. The operator is responsible for ensuring that the latest firmware is always installed. This can be obtained from the respective manufacturer.

2 Security

2.1 General prerequisites for operating the devices

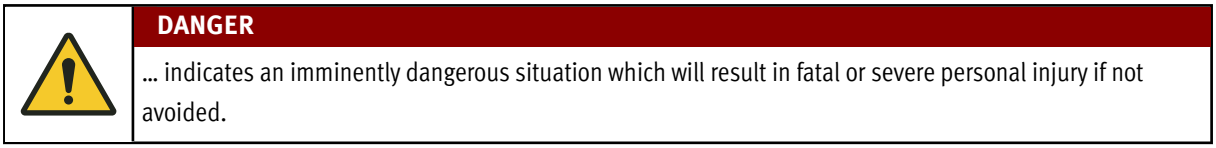
- The national and company accident prevention regulations must be observed.
- The laboratory or classroom must be overseen by a qualified supervisor.
  - A supervisor is a qualified electrician or a person who has been trained in electrical engineering, knows the respective safety requirements and safety regulations, and whose training has been documented accordingly.
- The permissible current loads for cables and devices must not be exceeded.
  - Always compare the current ratings of the device, the cable and the fuse.
  - If these are not the same, use a separate upstream fuse in order to provide appropriate overcurrent protection.
- Devices with a ground connection must always be grounded.
  - If a ground connection (green and yellow laboratory socket) is available, it must always be connected to protective ground. The protective ground must always be connected first (before voltage), and must always be disconnected last (after disconnecting the voltage).

The laboratory or classroom must be equipped with the following devices:

- An EMERGENCY-OFF device must be provided.
  - At least one emergency-off device must be located within, and one outside of, the laboratory or the classroom.
- The laboratory or classroom can be secured so that the operating voltage and compressed air supply cannot be activated by unauthorized persons, for example by means of:
  - E.g. key actuator
  - E.g. lockable on/off valves
- The laboratory or classroom must be protected by residual current devices (RCDs).
  - RCD circuit breaker with residual current ≤ 30 mA, type B.
- The laboratory or classroom must be protected by overcurrent protection devices.
  - Fuses or circuit breakers
- No damaged or defective devices may be used.
  - Damaged devices must be barred from further use and removed from the laboratory or classroom.
  - Damaged connecting cables, pneumatic tubing and hydraulic hoses represent a safety risk and must be removed from the laboratory or classroom.

2.2 Safety instructions and pictograms

2.2.1 Safety instructions



	**WARNING** ... indicates a potentially dangerous situation which may result in fatal or severe personal injury if not avoided.

	**CAUTION** ... indicates a potentially dangerous situation which may result in moderate or slight personal injury or severe property damage if not avoided.

	NOTICE ... indicates a potentially dangerous situation which may result in property damage or loss of function if not avoided.

2.2.2 Pictograms

This document and the hardware described herein include warnings about possible hazards which may arise if the product is used incorrectly. The following pictograms are used:

Warning signs	Type of danger
	Warning – danger zone.
	Warning – hand injuries.
	Warning – dangerous electrical voltage.
	Warning – hot surface.

2.3 Intended use

The components and sysytems may be used only:

- For its intended use in teaching and training applications
- In perfect condition from a safety engineering perspective
- Under observation (no unattended continuous operation!)

The components and systems are designed in accordance with the latest technology and recognized safety rules. However, the life and limb of the user or third parties can be endangered and the components impaired if they are used incorrectly.

The learning system from Festo Didactic SE has been developed and produced exclusively for basic and further training in the field of automation technology. The training company and/or trainers must ensure that all trainees observe the safety precautions described in this document.

Festo Didactic SE hereby excludes any and all liability for damages suffered by trainees, the training company and/or any third parties, which occur during use of the device in situations which serve any purpose other than training and/or vocational education, unless such damages have been caused by Festo Didactic SE due to malicious intent or gross negligence.

2.4 For your safety

2.4.1 Important Notes

Knowledge of the basic safety instructions and safety regulations is a fundamental prerequisite for safe handling and trouble-free operation of Festo Didactic SE components and systems.

This documentation includes the most important information for safe use of the components and systems. In particular, the safety instructions must be adhered to by all persons who work with these components and systems. Furthermore, all pertinent accident prevention regulations and instructions that are applicable at the respective place of use must be adhered to.

WARNING

Malfunctions which may impair safety must be eliminated immediately!

CAUTION

Improper repairs or modifications may result in unforeseeable operating statuses. Do not carry out any repairs or modifications to the components and systems that are not described in these operating instructions.

2.4.2 Obligations of the operating company

The operating company undertakes to allow only those persons to work with the components and systems of Festo Didactic SE who:

- Are familiar with the basic instructions regarding occupational safety and accident prevention and have been instructed in the handling of the components and systems of Festo Didactic SE,
- Have read and understood the chapter concerning safety and the warnings in this document.

Personnel should be tested at regular intervals for safety-conscious work habits.

2.4.3 Obligations of trainees

All persons who have been entrusted to work with the components and systems of Festo Didactic SE undertake to complete the following steps before beginning work:

- Read the chapter concerning safety and the warnings in this document.
- Familiarizing themselves with the basic regulations regarding occupational safety and accident prevention.

2.5 Cyber Security

Festo Didactic SE offers products and solutions with security functions that assist in the safe operation of plants, systems, machines and networks. In order to protect plants, systems, machines and networks from cyber threats, a comprehensive security concept must be implemented and continuously updated. Festo's products and services only constitute one part of such a concept.

The customer is responsible for preventing unauthorized access to their plants, systems, machines and networks. Systems, machines and components should only be connected to a company's network or the Internet if and as necessary, and only when the suitable security measures (e.g. firewalls and network segmentation, Defense in Depth) are in place. Connecting a product to the company network or internet without suitable security measures can lead to vulnerabilities that can allow unwanted, remote access into the network – even beyond the system boundaries of the Festo Didactic SE solution – with the intention of causing data loss or for manipulating or sabotaging installations and systems. Typical forms of attack include: denial of service (putting a product out of operation), remote execution of a malicious code, privilege escalation (executing program code with higher access rights than expected), ransomware (encrypting data and requesting payment for its decryption).

In the context of industrial systems and machines, this can also lead to unsafe machine conditions with hazards for people and equipment. Furthermore, Festo's guidelines on suitable security measures should be observed. Festo Didactic SE Festo products and solutions are constantly being developed further in order to make them more secure. Festo Didactic SE strongly recommends that customers install product updates as soon as they become available and always use the latest versions of its products. Any use of product versions that are no longer supported or any failure to install the latest updates may render the customer vulnerable to cyber attacks.

Support Festo Didactic SE in ensuring your safety at all times. Should you find any security vulnerabilities in our products, please inform the Festo Product Security Incidence Response Team (PSIRT) in German or English by sending an email to psirt@festo.com or by using the online contact form at➦ *https://www.festo.com/psirt*.

WARNING

Unsecure Operating Statuses Due to Software Tampering

Unsafe operating states of the system.

- Keep software up to date.
- Include installed products in the overarching safety concept.
- Protect storage media from malicious software using suitable protection measures.

2.6 Work Instructions and Safety Precautions

2.6.1 General

CAUTION

- Trainees should work with the components and systems only under the supervision of an instructor.
- Observe the specifications included in the datasheet for the individual components, and in particular all safety instructions!
- Wear your personal protective equipment (safety goggles, safety shoes).
- Never leave objects lying on the top of protective enclosures. Vibrations could cause such objects to fall off.
- In the event of
  - visible damage
  - defective function
  - inappropriate storage or
  - inappropriate transport

  safe operation of the device is no longer possible.
- Switch off the power supply immediately.
- Protect the device against being accidentally switched on again.

2.6.2 Mechanical safety instructions

WARNING

Danger due to moving parts

Crushing and pinching injuries

- Switch off both the operating power and the control power before working on the circuit.
- Reach into the setup only when it is at a standstill.
- Be aware of potential overtravel times of the actuators.

WARNING

Risk of injury during troubleshooting

Crushing

- Use a tool such as a screwdriver for actuating sensors.
- Protect the device against being accidentally switched on again.

2.6.3 Electrical safety instructions

WARNING

Product is not de-energized

Electric shock

- Switch off the power supply before working on the circuit.
- Protect the product against being accidentally switched on again.
- Please note that electrical energy may be stored in individual components. Further information on this issue is available in the datasheets and operating instructions included with the components.
- Capacitors inside the product may still be charged even after the device has been disconnected from all sources of voltage.

WARNING

Malfunctioning

Electric shock

- Never place or leave liquids (e.g. drinks) on the station in open containers.
- The machine must not be switched on if there is condensation (moisture) on its surface.
- Never lay pipes/hoses designed to carry liquid media near the machine.

WARNING

Electric Shock Due to Unsuitable Power Supply

Electrical components can be destroyed.

When devices are connected to an unsuitable power supply, exposed components can cause dangerous electrical voltage that can lead to severe or fatal injury.

- Always use power supplies that provide SELV (safety extra-low voltage) or PELV (protective extra-low voltage) output voltages for all the connections and terminals on the electronics modules.

WARNING

Fire Hazard Due to Unsuitable Power Supply

If a device is connected to an unsuitable power supply, this can cause components to overheat, leading to a breakout of fire.

- Always use limited power supplies (LPSs) for all the connections and terminals on the electronics modules.

CAUTION

Electrical Cables

Electric shock.

- Always ensure that your connecting cables are designed for use with the electrical connections in question.
- When laying connecting cables, make sure they are not kinked, sheared or pinched. Cables laid on the floor must be covered with a cable bridge to protect them
- Do not lay cables over hot surfaces. – Hot surfaces are indicated by a corresponding warning symbol.
- Make sure that connection cables and leads are not subjected to continuous tensile loads.
- Devices with a ground connection must always be grounded.
- If a ground connection (green-yellow laboratory socket) is present, it must always be connected to the protective grounding. The protective ground must always be connected first (before voltage), and must always be disconnected last (after disconnecting the voltage). – Some devices have a high leakage current. These devices must be fitted with a PE conductor for additional grounding.

2.6.4 Pneumatic safety instructions

WARNING

Uncontrolled Movement of Mechanical Components

Crushing

- Switch off the compressed air supply before working on the circuit.
- Check the system with pressure gauges to make sure that the entire circuit is fully depressurized.
- Please note that energy may be stored in reservoirs. Further information on this issue is available in the datasheets and operating instructions included with the components.

WARNING

Cylinder movement with compressed air activation

Crushing

- Slowly increase the compressed air.
- Keep work areas clear of cylinders.

WARNING

Extending cylinders

Crushing

- Always position pneumatic cylinders so that the piston rod's working space is unobstructed over the entire stroke range.
- Make sure that the piston rod cannot collide with any rigid components of the setup.

WARNING

Tubing slipping off

Risk of injury / eye injury

- Use the shortest possible connections.
- If tubing slips off, switch off the compressed air supply immediately.
- Tighten and check barbed tubing connectors during assembly according to specifications.

WARNING

Additional safety instructions

Injuries

- Do not exceed the maximum permissible pressure of 6 bar (600 kPa).
- Do not switch on the compressed air until all the barbed tubing connectors have been joined and secured.
- Do not disconnect tubing while under pressure. – Do not attempt to connect tubing or push-in connectors with your hands or fingers.
- Check the condition of the condensate in the service unit regularly. If necessary, drain the condensate and dispose of it properly.

CAUTION

Improper circuit construction

Injuries

- Switch off the compressed air supply before dismantling the circuit.
- Press the blue release ring down so that the tubing can be pulled out.
- Connect the devices with plastic tubing with an outside diameter of 4 or 6 mm.
- Push the pneumatic tubing into the push-in connector as far as it will go.

2.6.5 Machine Safety

WARNING

General Machine Safety, CE Conformity

- The individual modules of this system contain control programs for which the safety of the machine has been evaluated.
- The safety-related parameters and check sums of the safety function are listed in the operating instructions for the respective stations.
- If programs are changed, this could impair the safety of the machine. A modified control program may constitute a major change to the machine.
- In such cases, the manufacturer's CE – Declaration of Conformity shall be rendered null and void. The operator must reassess machine safety and determine CE conformity

3 General Information about CP Factory

The CP Factory system was developed in close cooperation with teachers and trainers. This has resulted in an instruction system that meets the requirements for modularity, mobility, flexibility and openness with completely new features.

Achieving the training objectives required in today's complex working world

- Social skills,
- Field expertise and
- Methodological expertise

is made considerably easier when using the CP Factory system.

The two-sided symmetrical basic modules with associated control board and operating panel are identical and, with the technical system "transfer line with drive and stopper", are ideal for training in PLC programming and drive technology from basic to intermediate levels.

Thanks to the patented passive pallet diverter, the "pallet circulation" process, which can run continuously, is already possible when using a single basic module.

The industry-relevant "pallet circulation" basic process already contains a great deal of important training content such as

- Drive technology with DC gear motor
- Drive technology with asynchronous motor and inverter (optional)
- Drive technology with servo motor and servo inverter (optional)
- Pallets - Stop - Setup
- Pallet lifting and indexing device (optional)
- Pallet identification via binary coding
- Pallet identification with RFID
- Basics of electropneumatics (using the example of stop cylinders)
- Basic PLC Programming
- PLC programming, sequencers
- PLC programming, modes of operation
- PLC programming, binary coding
- PLC programming, communication with RFID
- PLC programming/visualization with touch panel
- PLC programming, communication with frequency converter (optional)

By adding technology-specific application modules such as magazines, handling units or processing units, the basic linear module transforms into a station. The standardized mechanical and electrical interface between the application module and the basic module enables problem-free commissioning.

The CP Factory system is the ideal platform for virtually all learning fields. Cooperation between different teams is fostered and process understanding is deepened.

In particular, topics relating to networking, communication and data acquisition can be presented and practiced in an understandable way using this system.

4 Resources

4.1 Introduction

The system's training equipment consists of several different resources. Depending on the process, different resources are required.

The following resources are available:

4.2 Universal Box

Fig. 1: Universal box / similar to illustration

Universal box with holder for 10 PCBs/front covers/back covers

Part number 29 in MES

4.3 Pallet

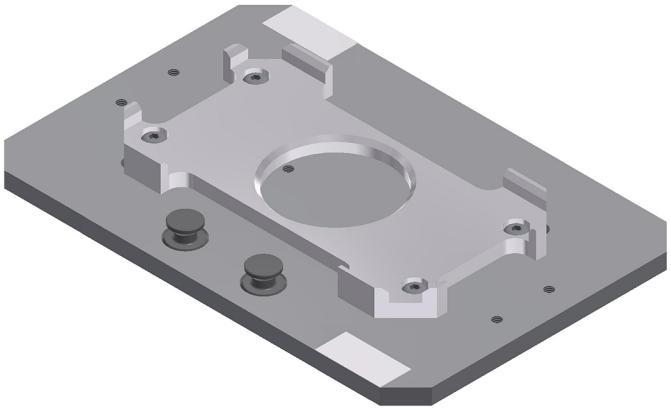


Fig. 2: Pallet/similar to illustration

These pallets are available for retaining one workpiece at a time.

Part number 25 in MES

4.4 Workpiece carrier

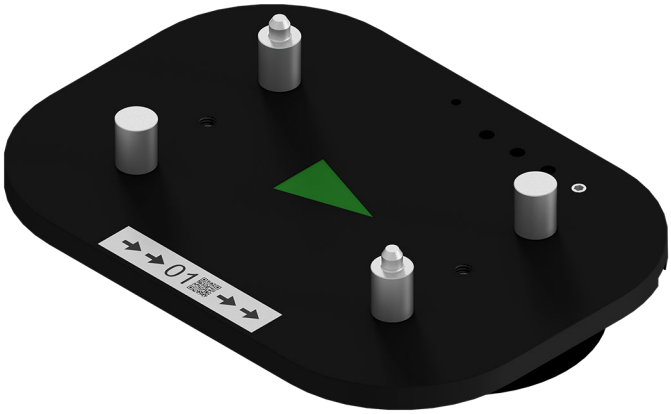


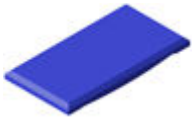
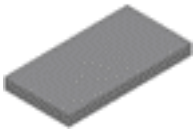
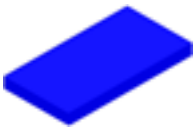
Fig. 3: Workpiece carrier/similar to illustration

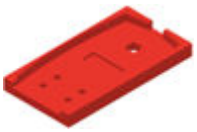
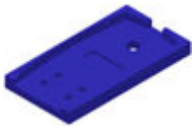
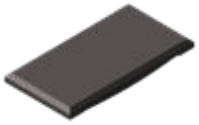
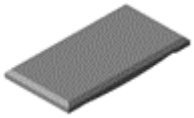
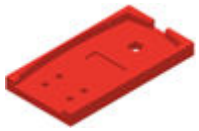
These workpiece carriers are available for transporting the pallets.

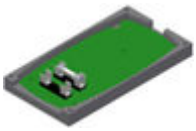
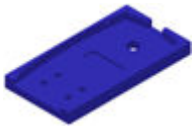
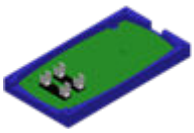
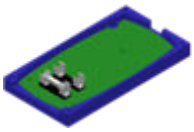
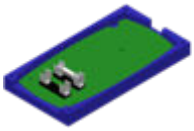
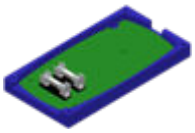
Part number 31 in MES

4.5 Workpieces

Depending on the project, the workpieces are divided into production parts and external production parts.

Workpieces	Designation	Workpieces	Designation
	CP raw material black NO. 101		CP back cover blue NO. 113
	CP raw material gray NO. 102		CP back cover red NO. 114
	CP raw material blue NO. 103		CP – PCB No. 120
	RP raw material red NO. 104		CP fuse No. 130

Workpieces	Designation	Workpieces	Designation
	CP front cover raw material red NO. 107		CP front cover black No. 210 – if a CNC milling machine is in the system, the front cover can also be produced there and thus becomes a production part.
	CP front cover raw material blue NO. 108		CP front cover black no fuse No. 211
	CP front cover raw material gray NO. 109		CP front cover black fuse left No. 212
	CP front cover raw material black NO. 110		CP front cover black fuse right No. 213
	CP back cover black NO. 111		CP front cover black, both fuses No. 214
	CP back cover gray NO. 112		CP front cover no. 510 – if a CNC milling machine is in the system, the front cover can also be produced there and thus becomes a production part.
	CP front cover gray No. 310 – if a CNC milling machine is in the system, the front cover can also be produced there and thus becomes a production part.		CP front cover red, no fuse No. 511
	CP front cover gray, no fuse No. 311		CP front cover red, fuse left No. 512

Workpieces	Designation	Workpieces	Designation
	CP front cover gray, fuse left No. 312		CP front cover red, fuse right No. 513
	CP front cover gray, fuse right No. 313		CP front cover red, both fuses No. 514
	CP front cover gray, both fuses No. 314		CP black complete without PCB No. 1200
	CP front cover blue No. 410 – if a CNC milling machine is in the system, the front cover can also be produced there and thus becomes a production part.		CP part customer No. 1210 freely selectable
	CP front cover blue, no fuse No. 411		CP black part, no fuse, no. 1211
	CP front cover blue, fuse left No. 412		CP black part, fuse left No. 1212
	CP front cover blue, fuse right No. 413		CP black, part, fuse right No. 1213
	CP front cover blue, both fuses No. 414		CP black part, both fuses No. 1214

5 Design and Function

5.1 Transport

WARNING

- **Moving heavy machines/machine parts can cause damage to the musculoskeletal system**
  - When the stations are shipped out, extra care must be taken to ensure that heavy machines/ machine sections are always transported using a suitable fork-lift truck. A single station can weigh up to 500 kg.
  - Always use suitable transport equipment
  - Always use the lifting points provided to move the machine/machine sections
  - Always use the designated load take-up point

WARNING

- **Securing transit routes**
  - The supply routes must be cleared prior to transport, and must be suitable for the forklift truck to pass through. If necessary, warning signs or barrier tape must be set up to keep the routes clear.
- **Caution**
  - When opening transport boxes, care must be taken to ensure that any additional components delivered in the same box, such as computers, do not fall out.

WARNING

- **Danger of crushing for hands/feet**
  - It is not permitted to grip onto or under the feet of the station, as there is an increase risk of hands or feet getting crushed or trapped.
  - When setting down the station, make sure no persons have their feet under the machine's feet.

WARNING

Danger of tipping over during transport

Risk of crushing and injury.

- Suitable packaging and transport equipment must be used when transporting the station.
- The station can be lifted from underneath using a forklift truck. Please note that eccentric centers of gravity can cause the station to tip over.
- Stations with attachments at height will have a high center of gravity; watch out for tipping during transport.
- Wear appropriate protective clothing such as safety shoes.

NOTICE

- When opening the transport box, any additional components must be secured to prevent them from falling out, and removed first.
- Once this is done, the transport box can be removed/opened up fully, and the station can be taken out and moved to its intended location.
- Care must be taken with all components projecting from the machine, as sensors and similar small parts can easily be damaged if the machine is not transported correctly.
- Check that all the profile connectors are seated correctly using a size 4 – 6 Allen key. Unavoidable vibrations can loosen the connectors during transport.

5.1.1 Moving the Station

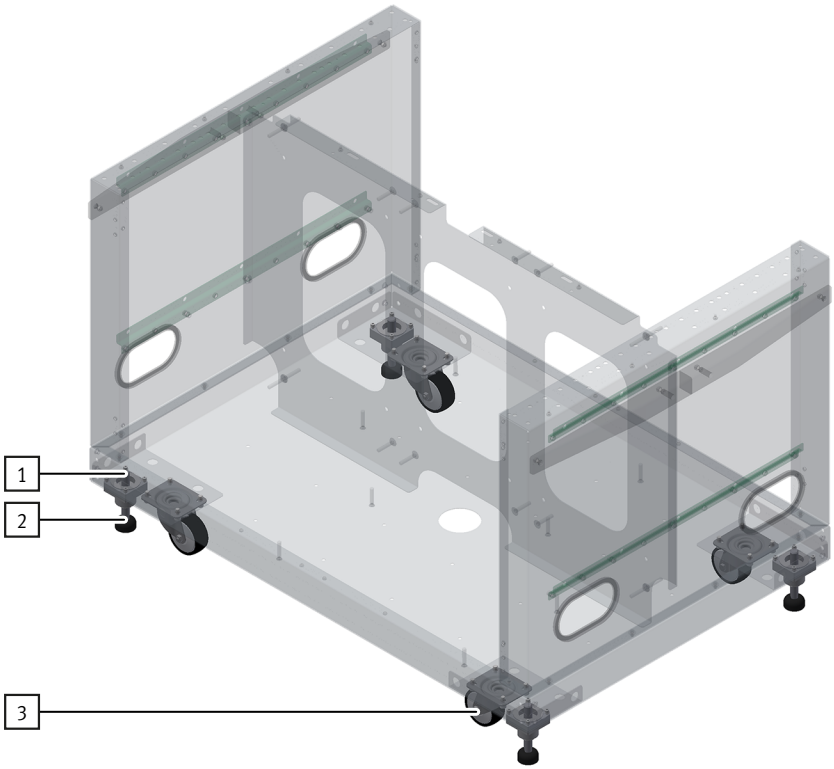


Fig. 4: CP Factory transport option / Similar to illustration

1 Star knob used to adjust the height of the levelling foot.
2 Levelling foot with lock nut to lock the levelling foot in the desired position.
3 Castor wheels

The module can be lowered and placed on the castor wheels using the mechanical levelling feet. This enables easy transport. Once the levelling feet are screwed in, the module can be moved.

5.2 Protective Devices

In order to reduce risks, this machine contains guards to prevent access to dangerous areas. These guards must not be removed or tampered with.

WARNING

- **Damage to the safety window**
  - Windows must not be cleaned using aggressive or alcoholic cleaning agents. Risk of brittleness and breakage!
  - This protective device must be replaced if it shows any signs of damage. Please contact our Service department to arrange this.

5.2.1 Hinged Doors on Underfloor Control Cabinets

Transparent, impact-resistant polycarbonate panels with lock.

Can only be accessed with tool (control cabinet key); tool must be kept in a secure place!

Access reserved for qualified electricians. The safety doors are not monitored! Ensure that the safety doors are always closed.

The station must be set up in such a way that all safety doors can be fully opened and do not block escape routes.

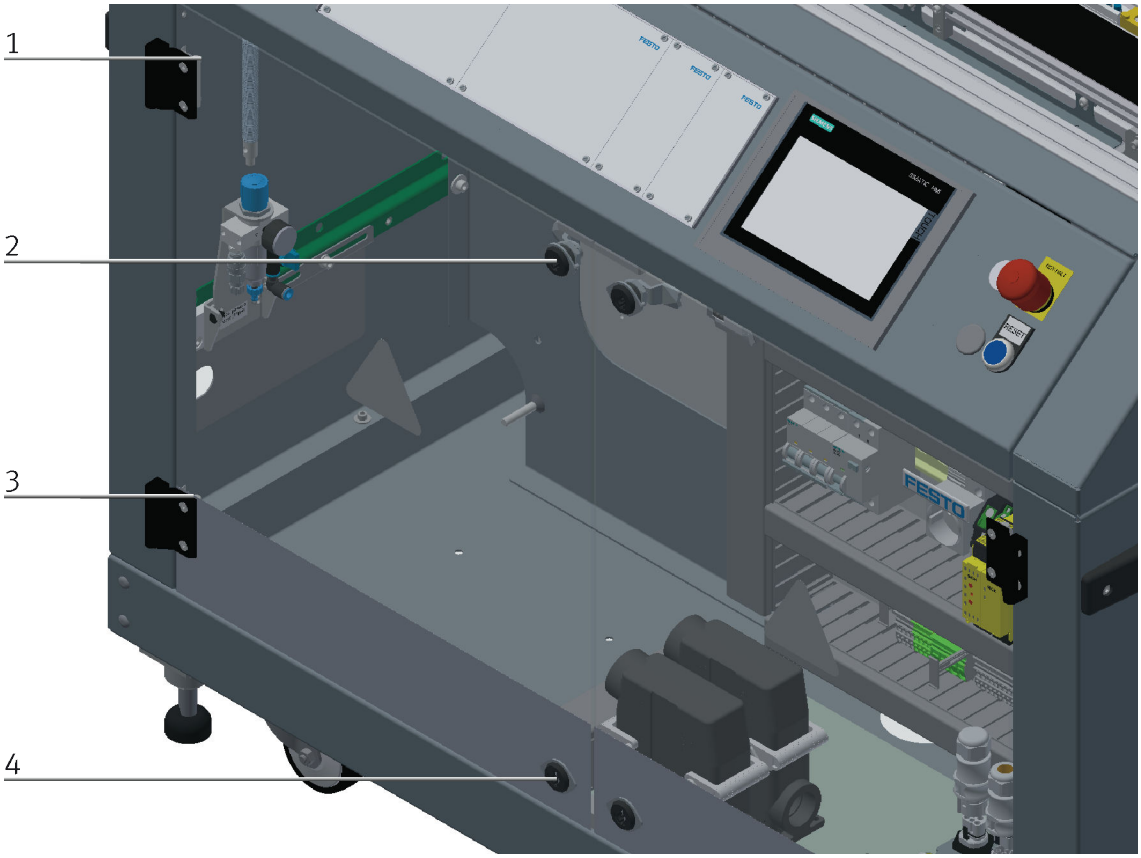


Fig. 5: Similar to illustration

The hinges of the control cabinet doors are fitted with spring plates (1, 3). If the control cabinet locks (2, 4) are not locked, the door is automatically opened a crack, reminding the user to lock the door firmly with the control cabinet locks.

5.2.2 Emergency stop

Every station contains an emergency stop mushroom actuator. All the emergency stop actuators in the system are interconnected. The emergency stop signal shuts off all the actuators. Operator confirmation is required to restart the system; there is no automatic restart.

5.2.3 Additional Protective Devices

The individual components, such as the power supplies and the controllers, possess built-in safety functions such as short-circuit protection, overcurrent protection, overvoltage protection and thermal monitoring. If necessary, consult the instruction manual for the device in question for more information.

5.2.4 Robot Assembly Station Protective Devices

5.2.4.1 Fixed Elements of Robot Enclosures

Transparent, impact-resistant, polycarbonate plate on sides and tops.

5.2.4.2 Service Doors of Robot Enclosures

Transparent, impact-resistant polycarbonate panels

- Can be opened for service purposes.
- Fitted with safety switches, 2-channel.
- Functional safety for robot circuit in accordance with EN ISO 13849-1, PL=d, Cat. 3.
- Automatic operation only possible when door is closed.

5.2.4.3 Reliable Box Detection

If there is no box in the cell, someone could reach into the robot's workspace with a hand. To prevent this, appropriate warning signs are attached to each box position. In addition, the box is detected using safe inductive sensors. As soon as there is no box, a safety stop 1 is triggered so that the robot cannot move at all.

5.2.4.4 RASS Protective Bell Belt Engagement

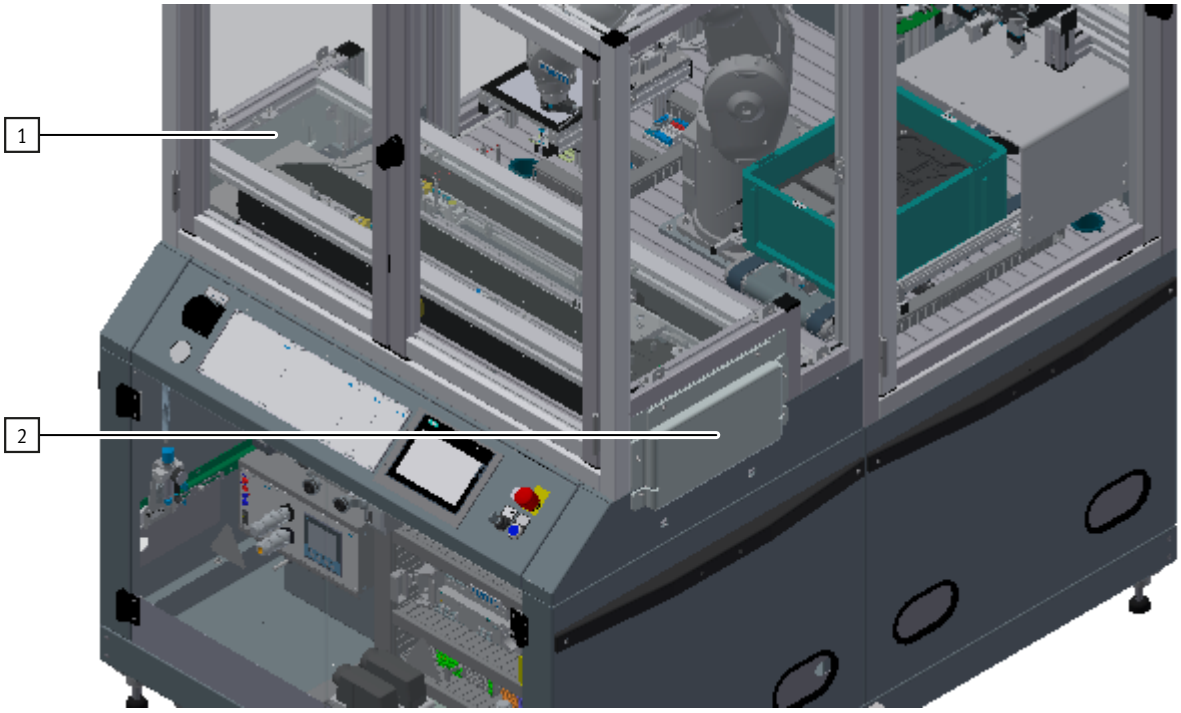


Fig. 6: Similar to illustration

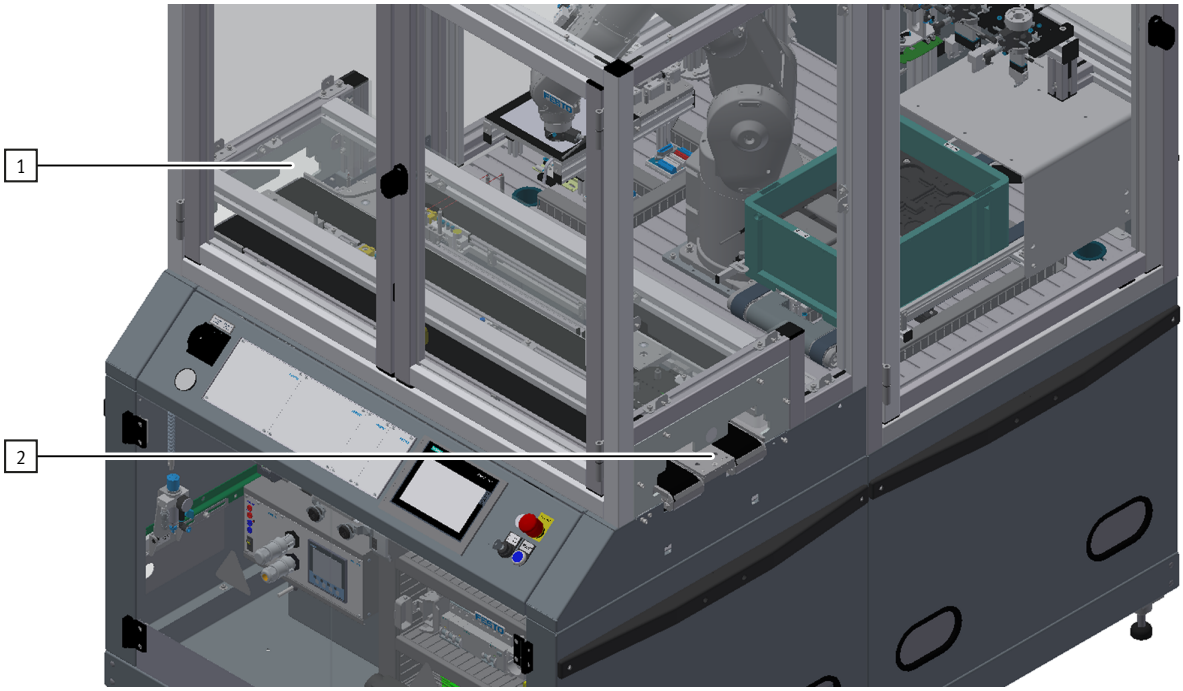


Fig. 7: Similar to illustration

1. If no further station is fitted and the product carriers are not transferred to a subsequent station, the protective bell (1, 2) must be fitted to prevent access to the station. This applies to both sides of the station.

2. If another station is installed and the product carriers are transferred to a subsequent station, the protective bell of the station must be removed. However, the intervention guard (1, 2) remains installed. This applies to both sides of the station.

5.3 General information

The robot assembly module consists of a two-lane transport section with bypass and an assembly cell. The conveyor belts have a width of 80 mm and a length of 1200 mm. The bypass belt is for shorter throughput times; goods carriers can pass through the station without stopping as the goods carrier to be processed stands on the bypass belt.

The conveyors transport PCBs on goods carriers.
The goods carriers are equipped with a read/write identification system. This identification system is an important part of the CP Factory system. The goods carriers are labeled with the current data of the workpiece to be transported. All the information required for the process is carried along with the workpiece/goods carrier and is available at every work position.

An aluminum plate is mounted on a base frame on the transport section. A 6-axis robot and the associated peripherals are located on this plate. The robot is responsible for handling all processes within the module.
An interchangeable gripper system is integrated so that the various workpieces can be gripped securely. The task of the station is to fit the workpiece with a circuit board and several fuses. A visual inspection completes the installation work; a separate camera is available for this purpose.

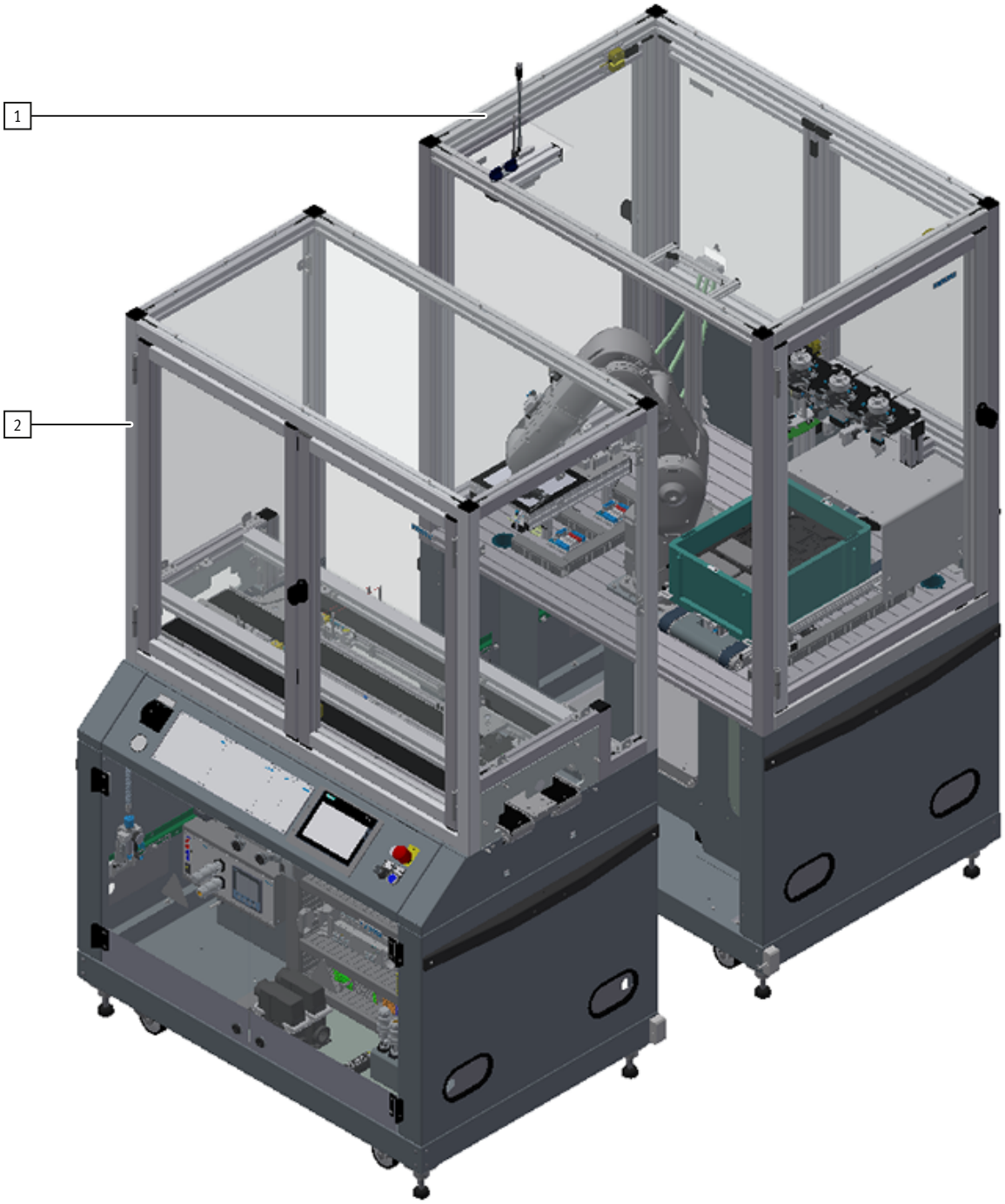


Fig. 8: Similar to illustration

1 Assembly cell with robot

2 Basic module with bypass

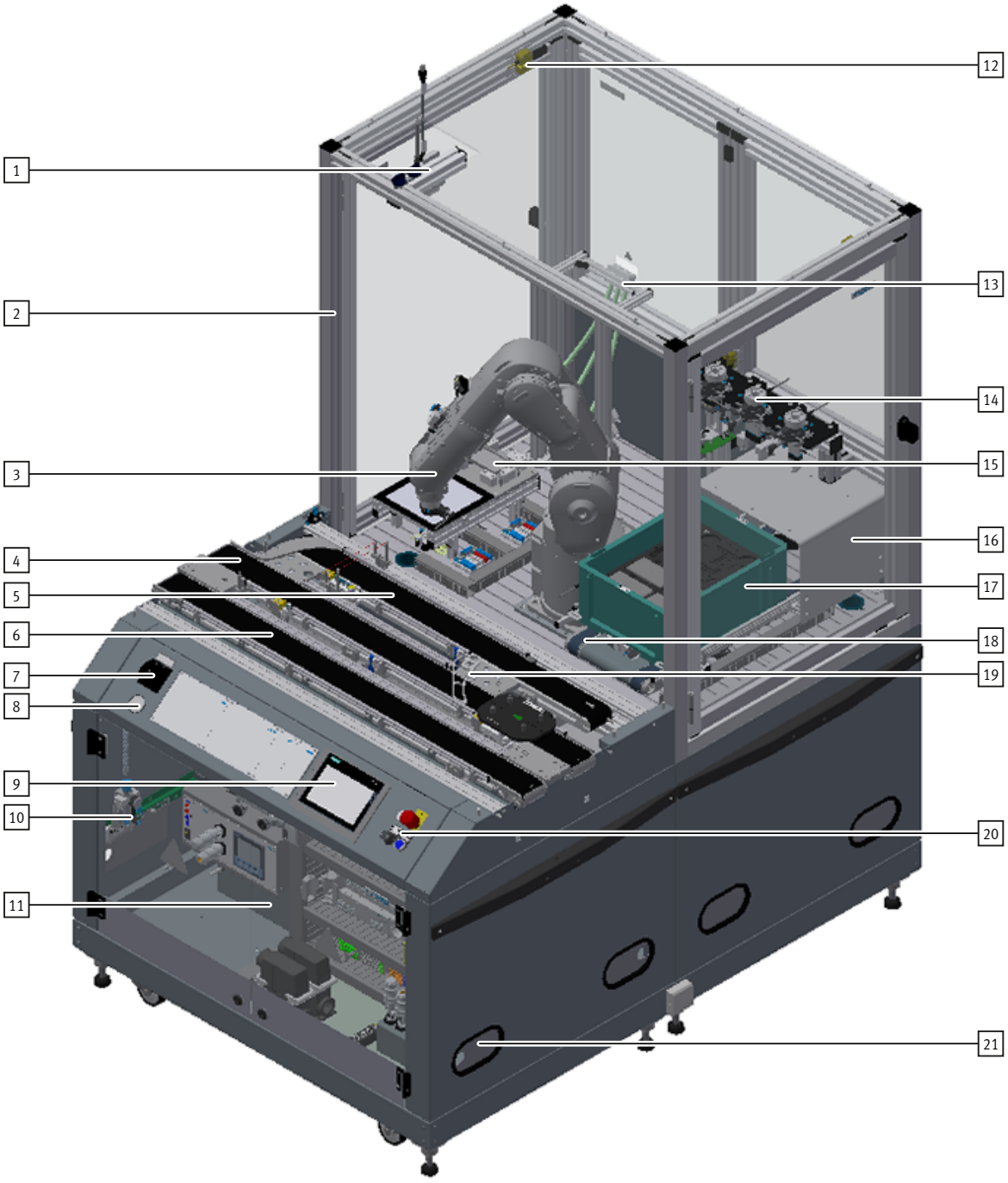


Fig. 9: CP Factory robot assembly / Similar to illustration

1 Camera: Festo SBSA-U-PF-R6C-FM-W / 8143672 (Sensopart V20C-ALL-P3-W-M-M2-L-90)
2 Safety housing / partially hidden
3 Mitsubishi robot RV-4FL
4 Conveyor rear
5 Conveyor bypass
6 Conveyor front
7 Main switch control panel
8 Pressure gauge
9 Touch panel
10 Service unit
11 Substructure of module trolley for E-boards
12 Example of safety switch for doors
13 Hose magazine for fuses
14 Gripper changing system for 3 grippers
15 Assembly location
16 Safety cover of conveyor belt for pallet supply
17 Box working position on conveyor belt for pallet supply
18 Conveyor belt for pallet supply
19 Outfeed bypass deflector

20 Control panel
21 Passage for supply cable

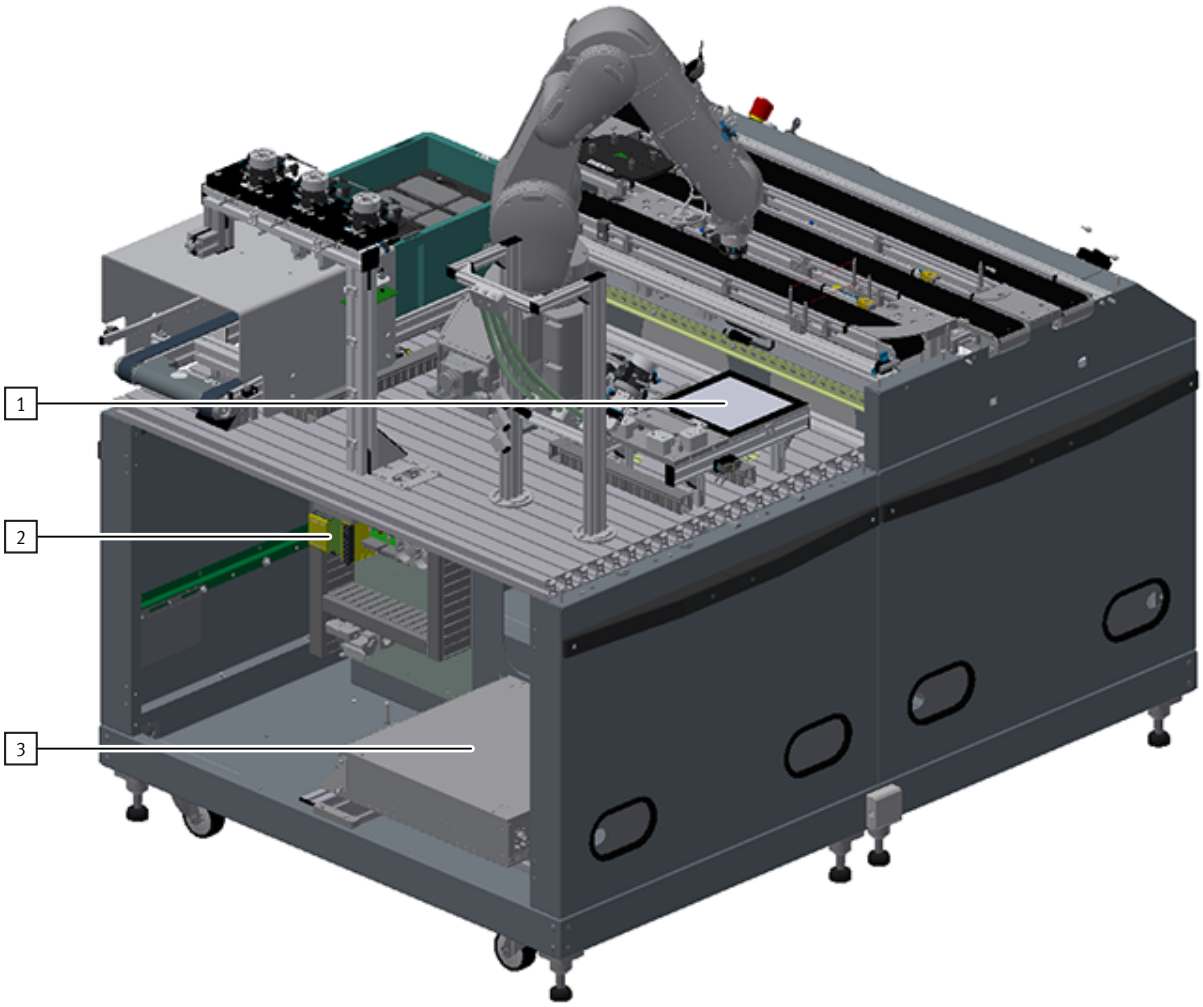


Fig. 10: CP Factory application robot assembly cell / Similar to illustration

1 LED surface light for visual inspection (rear with adjustment surface for camera)
2 E-board application
3 Drive unit CR800

5.4 Mechanical Setup

The robot assembly cell is designed to be operated from one side (1). The module is equipped with mechanically adjustable feet. If the module needs to be moved, it can be lowered onto the rollers and transported without problems.

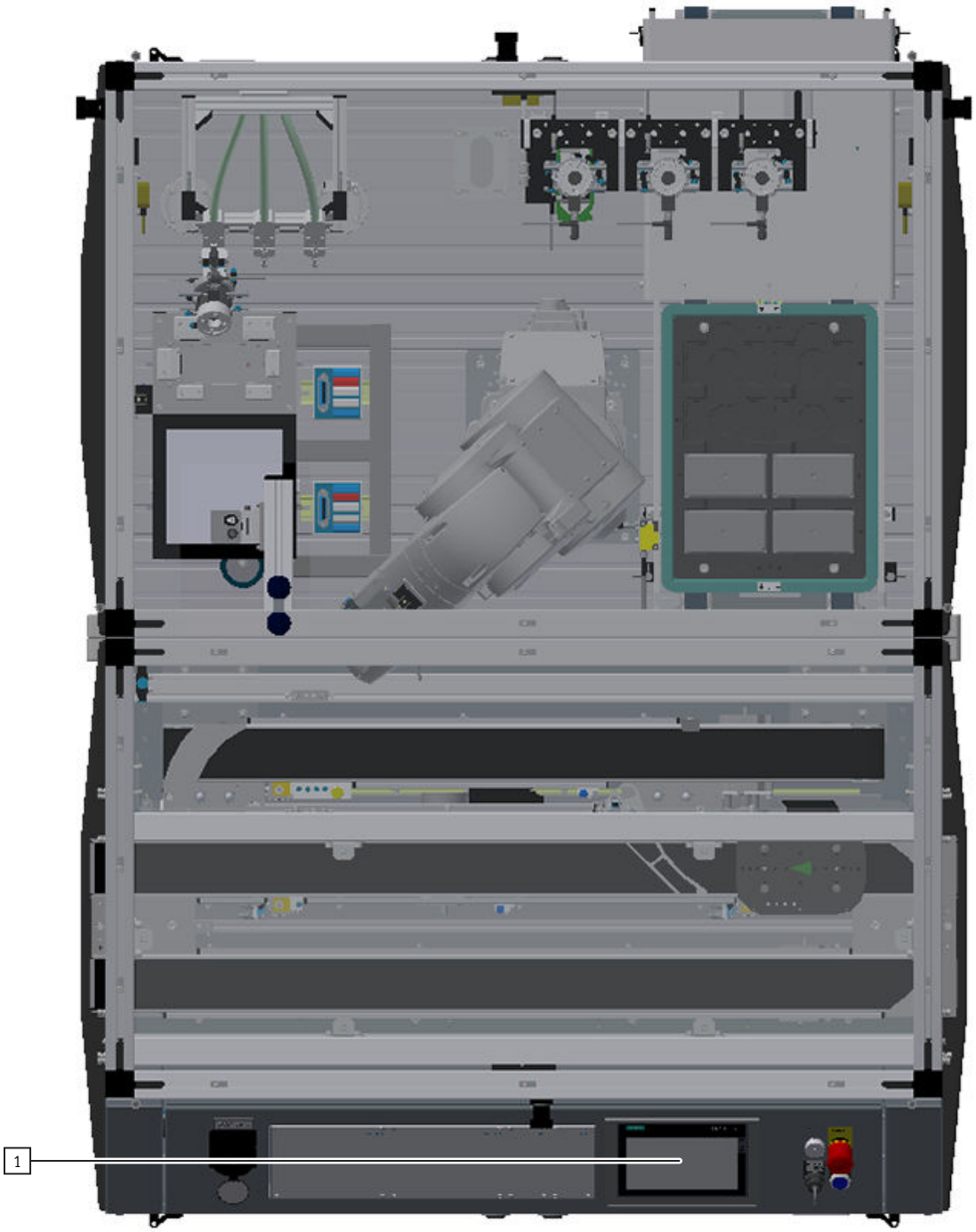


Fig. 11: Similar to illustration

The modules can be operated in two ways – as a single station or linked with other modules. When combining with another module, it is necessary to replace the ball return at the end of the belt with a support plate. The deflector is an exception; if it is operated as a single station, it is not possible to feed workpieces in or out via the deflectors.

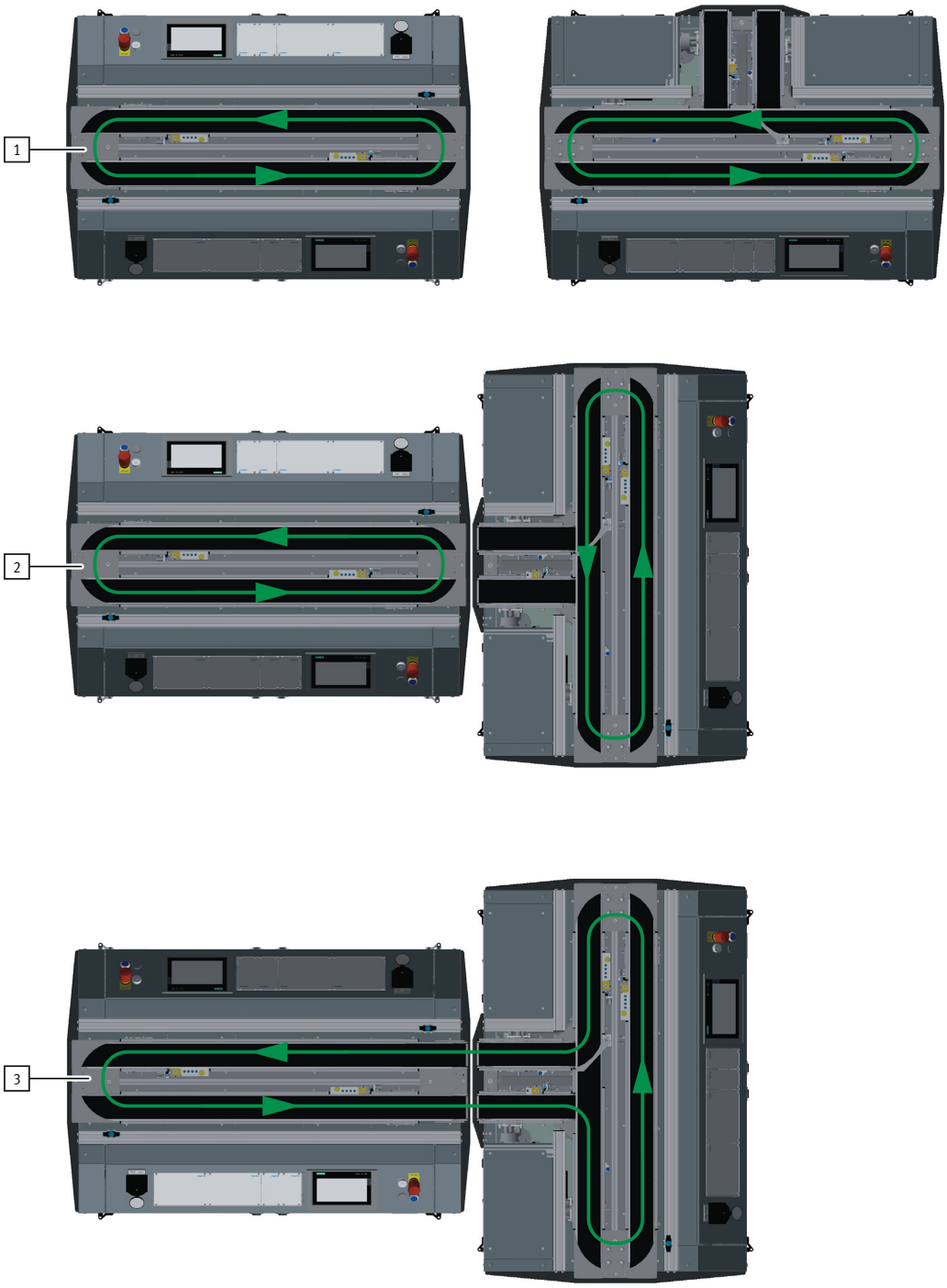


Fig. 12: Example of body variants / Similar to illustration

1 Operation as single station / Not combined
2 Operation as a single station / Stations stand together
3 Operation linked with another station

The plug-in belt reversals offer various options for controlling the transport flow. Depending on the application, different modules can be operated individually or in linkage.

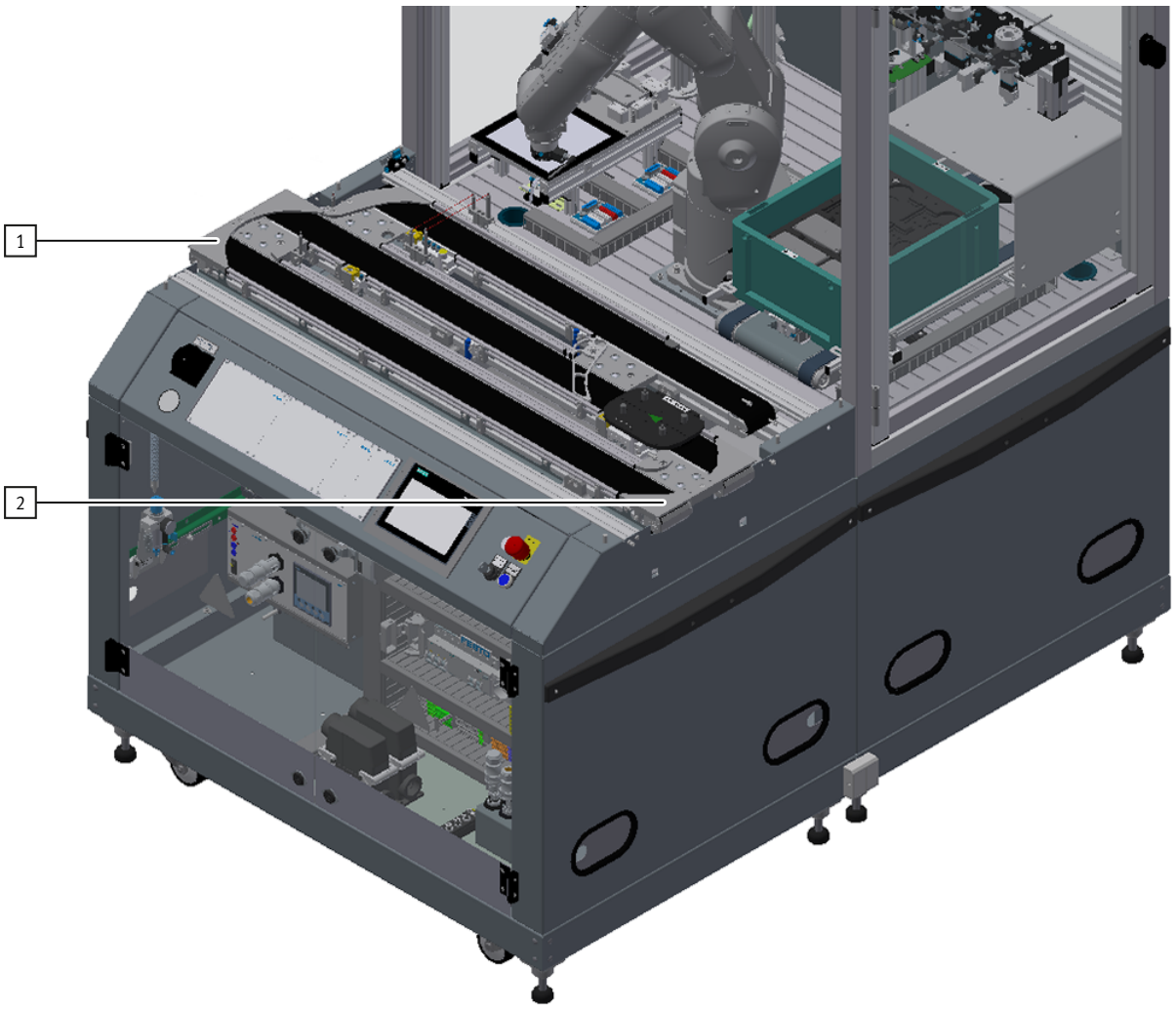


Fig. 13: Example of an independent module / Similar to illustration

1+2 Ball return – the goods carrier is redirected from one conveyor to the other on the basic module.

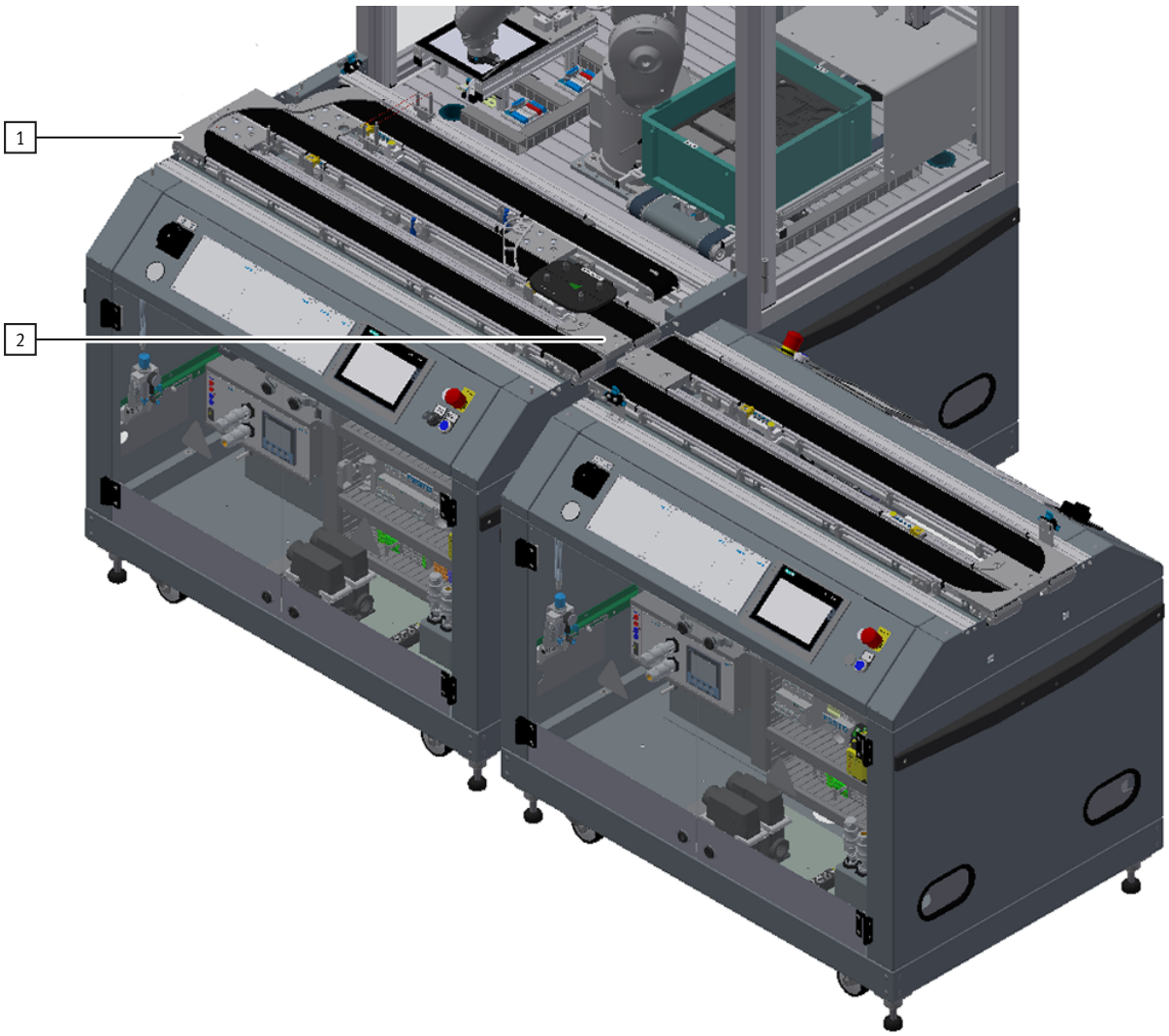


Fig. 14: Example of setup in combination with another basic module / Similar to illustration

1 Ball return – the goods carrier is redirected from one conveyor to the other on the basic module.

2 Replacement guard rail (support plate) when connecting a further basic module – the goods carrier is not diverted in this way, but is guided to the following basic module.

The ball return and the support plate are only plugged in and can be replaced at any time without tools.

5.4.1 Anti-Tamper Tunnel

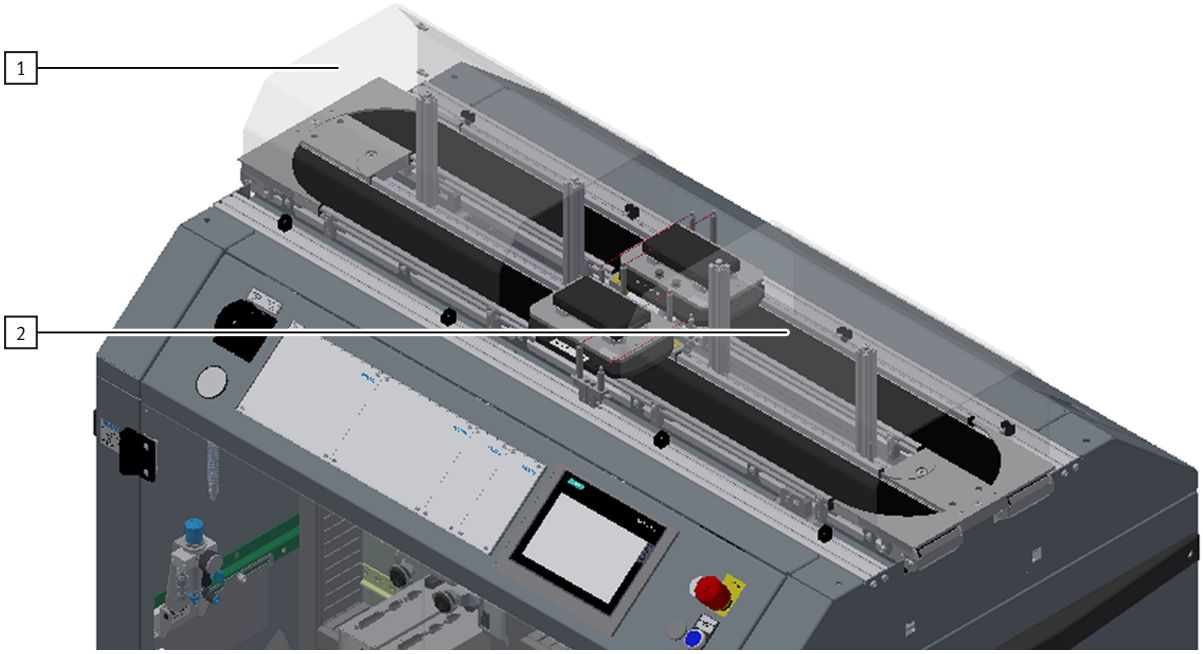


Fig. 15: Similar to illustration

1 Anti-tamper tunnel – to avoid reaching into the danger zone
2 Anti-tamper tunnel - to avoid reaching into the danger zone

5.4.2 Moving the Control Panel to the Inspection Position

To make the components in the base frame of the module more easily accessible, it is possible to hinge the entire control panel upwards.

Grip the panel at the bottom and fold it upwards. When the panel is completely hinged up, the springs are vertical and support the panel against folding down.

	**WARNING** – Danger of crushing – Make sure that the springs are vertical and the panel is thus secured against falling down. – Also ensure that no one else can hinge down the panel. – Failure to observe the instructions might result in injury.

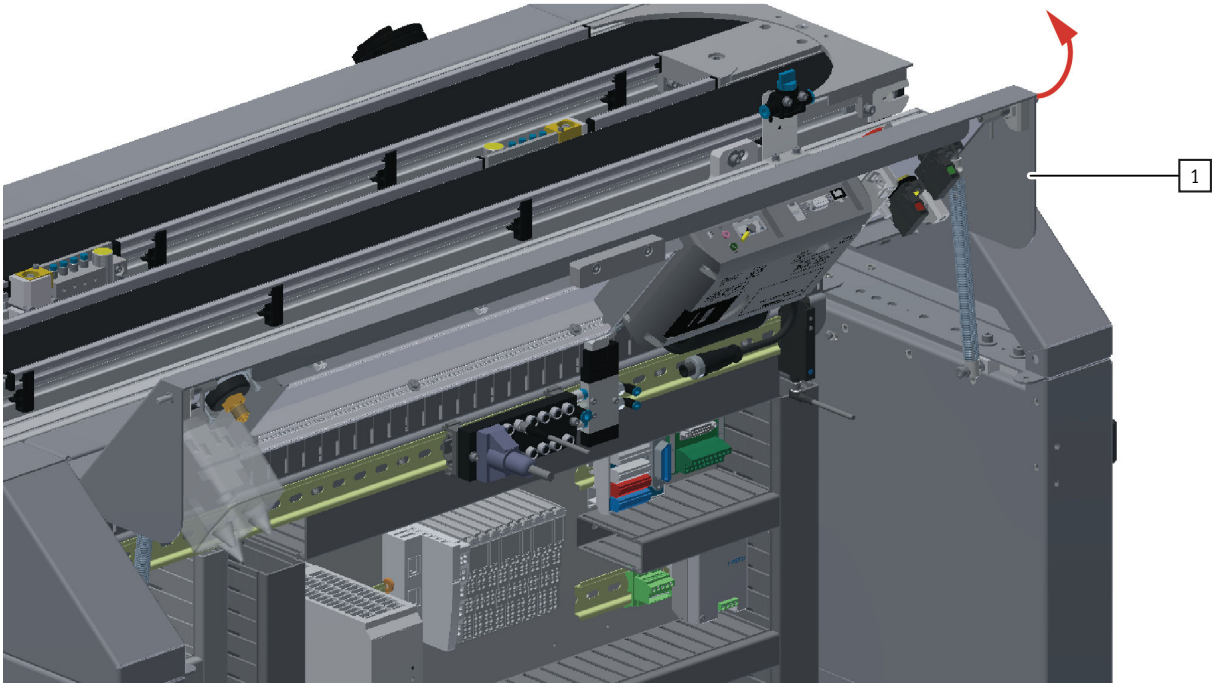


Fig. 16: Similar to illustration

1 Grasp the panel at the bottom and fold it upwards.

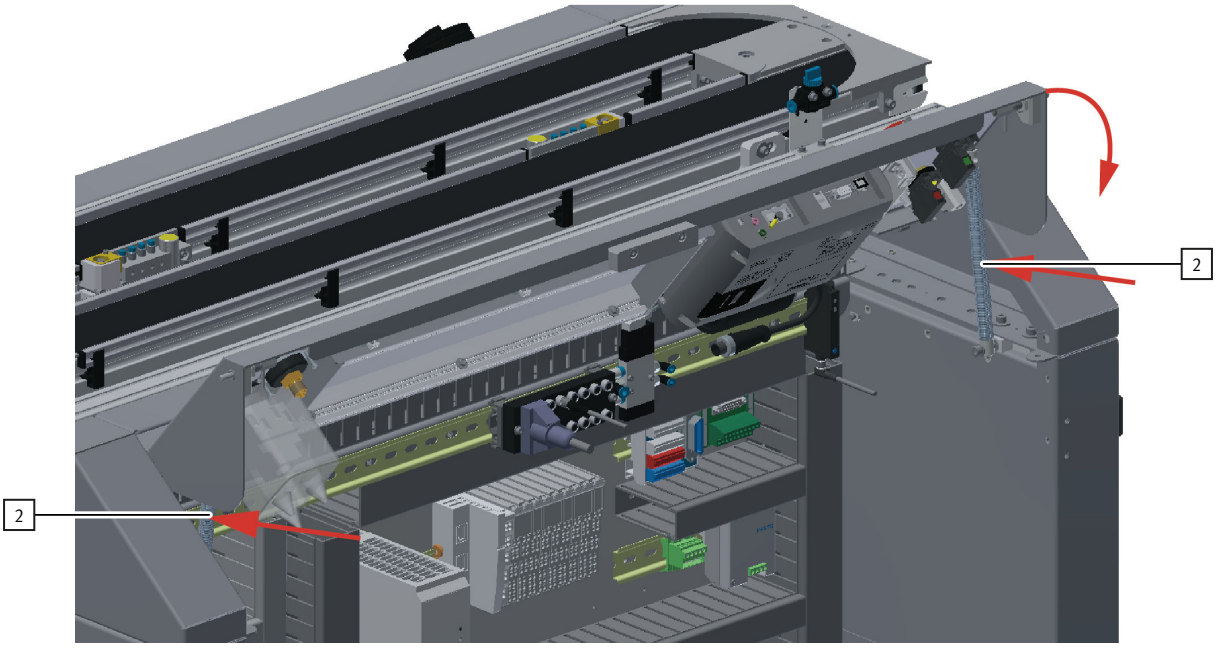


Fig. 17: Similar to illustration

2 Press the springs backwards in the middle and hinge down the control panel.

5.5 The supply of the robot assembly station

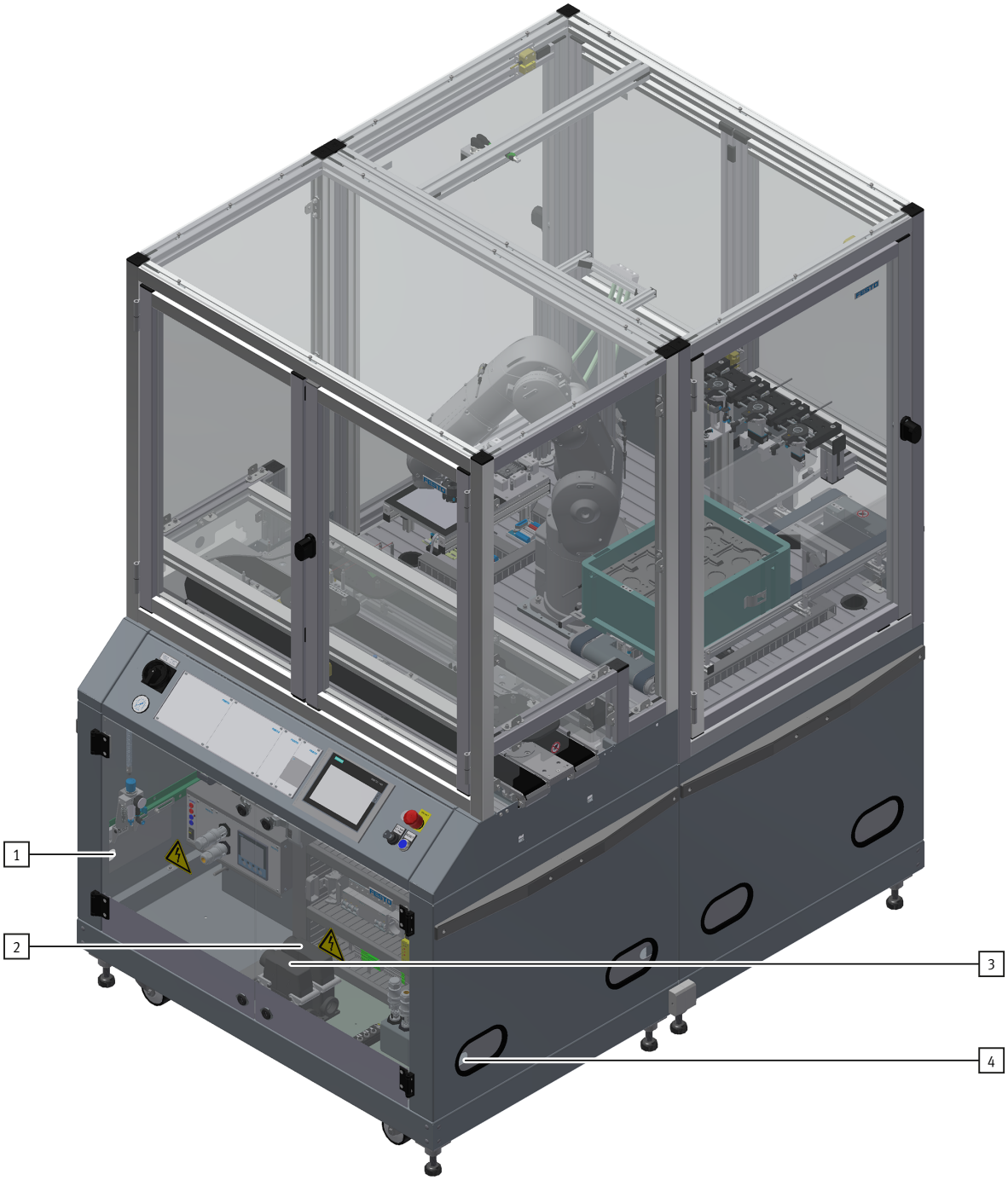


Fig. 18: CP Factory supply / Similar to illustration

1 Basic module feeder line with voltage, communication and pneumatics
2 Connection K2 XZ1
3 Connection K2 XZ2
4 Inlet/outlet opening for connecting additional basic modules

WARNING

– **Electric shock when reaching into the inlet/outlet openings**
  – A plate secures the inlet/outlet openings against tampering.

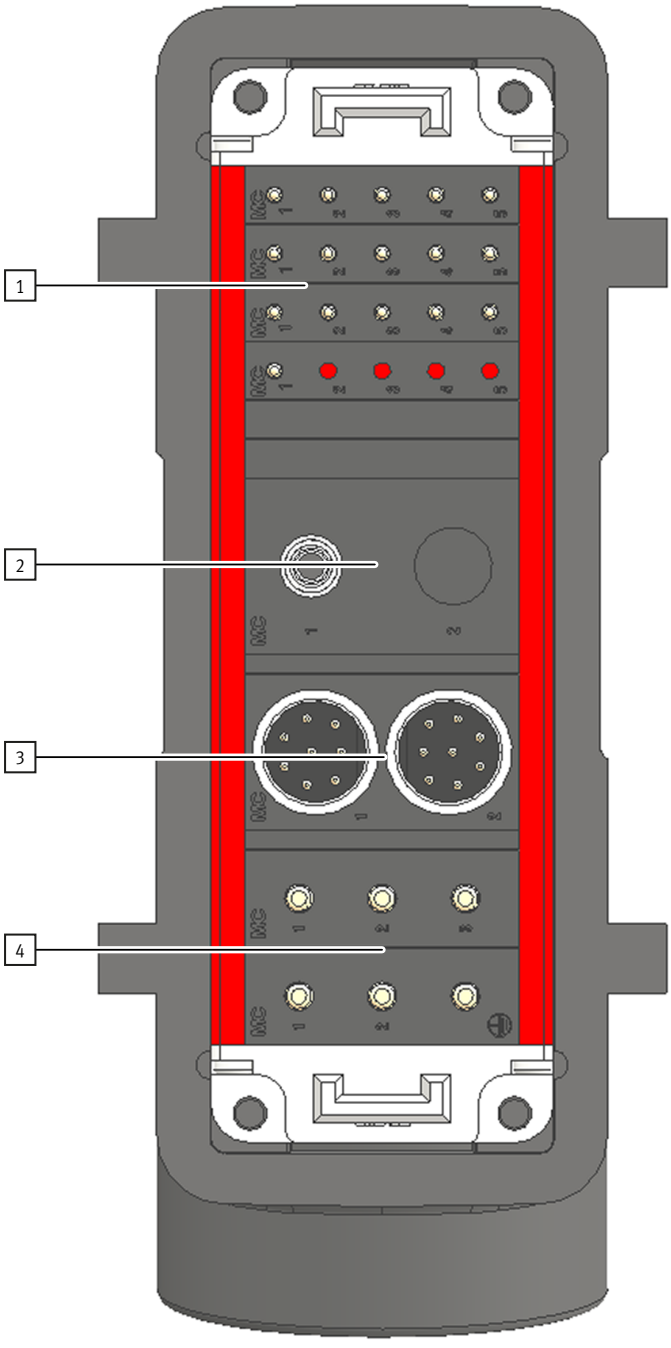


Fig. 19: Similar to illustration

1 Emergency stop connection chain
2 Compressed air
3 Network
4 Power supply 400 V

5.6 Electrical Structure

The robot assembly cell has two electric boards. The main electric board is mounted on the front of the base frame and is responsible for the conveyor belt with the bypass. The electric board for the assembly cell is mounted on the back. The drive unit for the robot is also located on the back of the base frame.

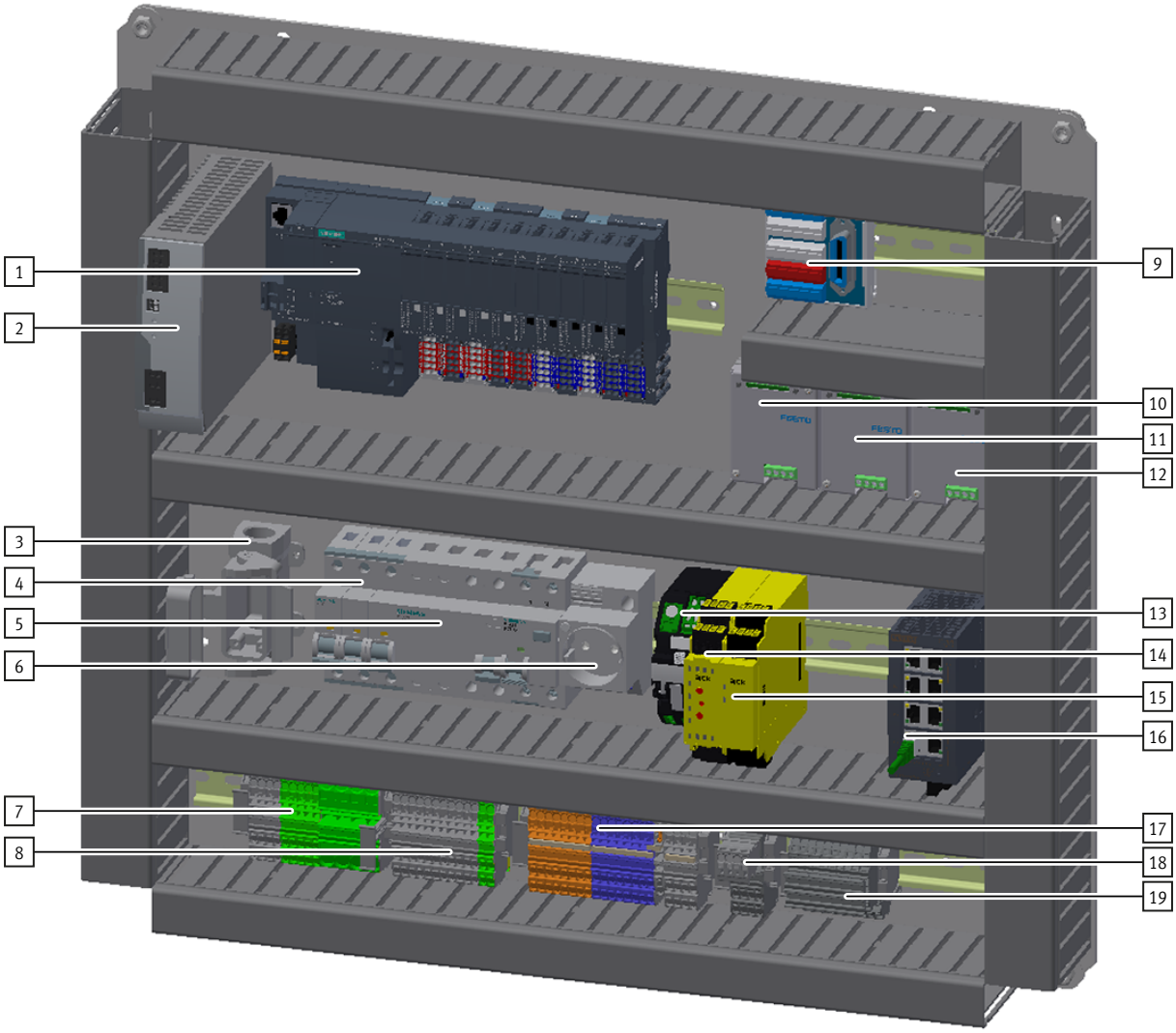


Fig. 20: Electric board, front, conveyor belt with bypass / Similar to illustration

1 SPS, K1-K5KF1- K1-K5KF21, Siemens ET200 SP CPU 1512 / 1516 SP F-1 P
2 24 V fixed power supply, TB1, Festo CACN-3A-1-10 / 2247682
3 Application board supply, XJ3, HAR0048
4 Circuit-breaker, FC1, Siemens 5SY6310-7
5 Residual current circuit breaker, FC2, Siemens 5SU1354-6KK06
6 230 V plug socket, K1-XJ4, 709-581
7 Terminals, K1-XD0
8 Terminals, K1-XD1
9 I/O terminal, XD15
10 Starting current limiter, K1-QA1, Kaleja M-MZS-4-30 / 06.05.020
11 Starting current limiter, K1-QA2, Kaleja M-MZS-4-30 / 06.05.020
12 Starting current limiter, K1-QA3, Kaleja M-MZS-4-30 / 06.05.020
13 Circuit breakers / electronic overcurrent protection devices, FC4, Mico 2.6
14 Emergency stop device, F2-KF1, Sick UE410-GU4 / 1094339
15 Emergency stop device, F2-KF2, Sick UE410-4RO4 / 6032676

16 Ethernet switch, K1-XF1, Siemens Scalance XB008 / 6GK5008-0BA00-1AB2
17 Terminals, K1-XD10
18 Terminals, K1-XD13
19 Terminals, K1-XD14

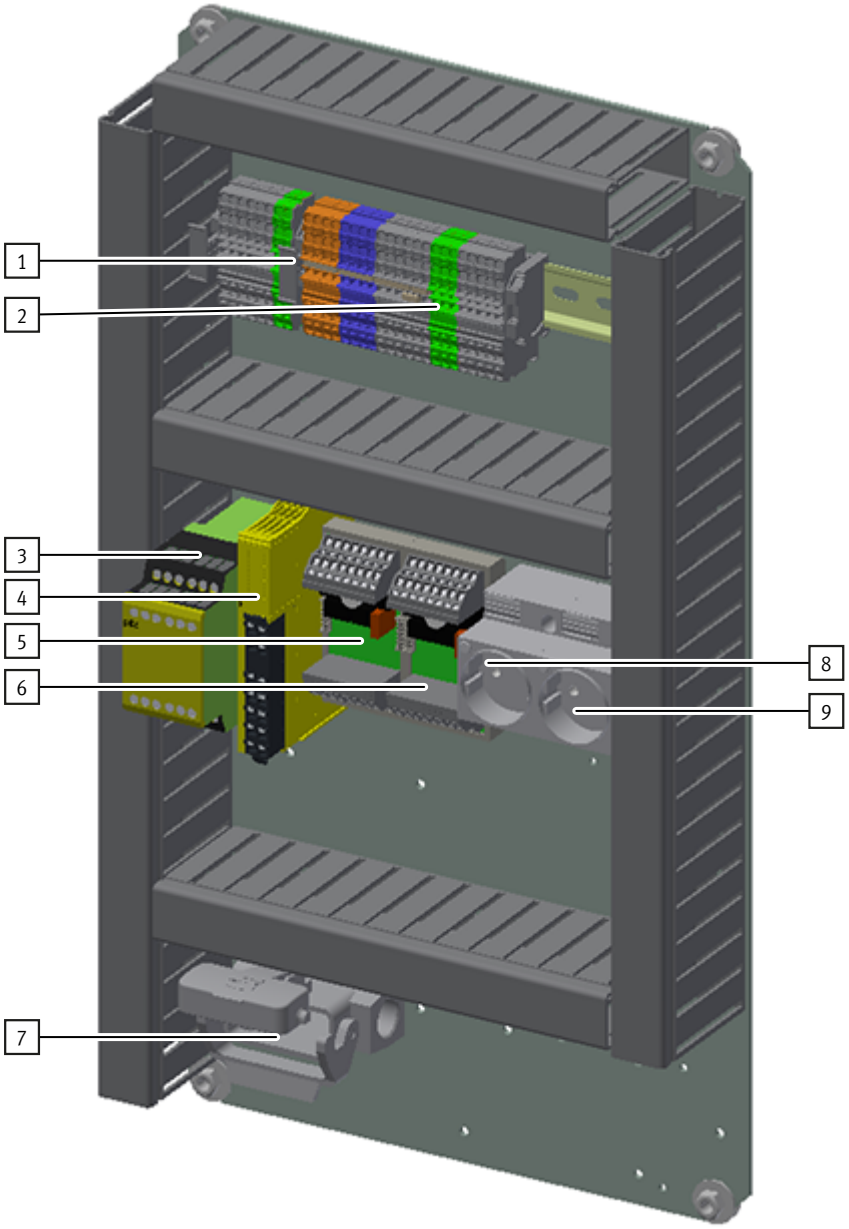


Fig. 21: Electric board, back, robot assembly cell / Similar to illustration

1 Terminals for voltage distribution, XD1
2 Terminals for voltage distribution, XD10
3 Mushroom PNOZ X8P, F2-KF2
4 Emergency stop unit Sick RLY3-OSSD200, F2-KF10
5 Mushroom PSEN iX1, F2-KF3
6 Mushroom PSEN iX1, F2-KF4
7 Harting plug, XJ4
8 Plug socket 230 V, XD3
9 Plug socket 230 V, XD4

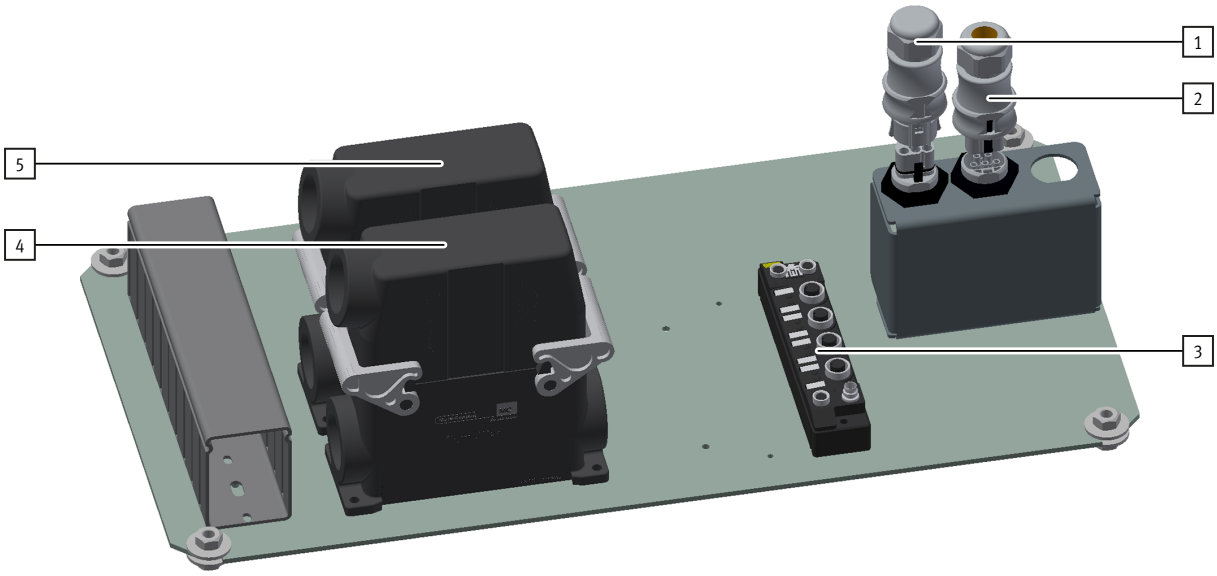


Fig. 22: Supply electric board basic module / Similar·to·illustration

1 Supply plug, K2-XJ1, WIE96.051.5053.0 / RST2015S B1 M01 GL
2 Supply plug, K2-XJ2, WIE96.052.5053.0 / RST2015S S1 M01V GL
3 RFID, K2-KF80, Turck TBEN-S2-2RFID-4DXP / 6814029
4 Supply plug forwarding, K2-XZ2, MUC60851
5 Supply plug power supply, K2-XZ1, MUC#61038

5.7 Electrical Connection

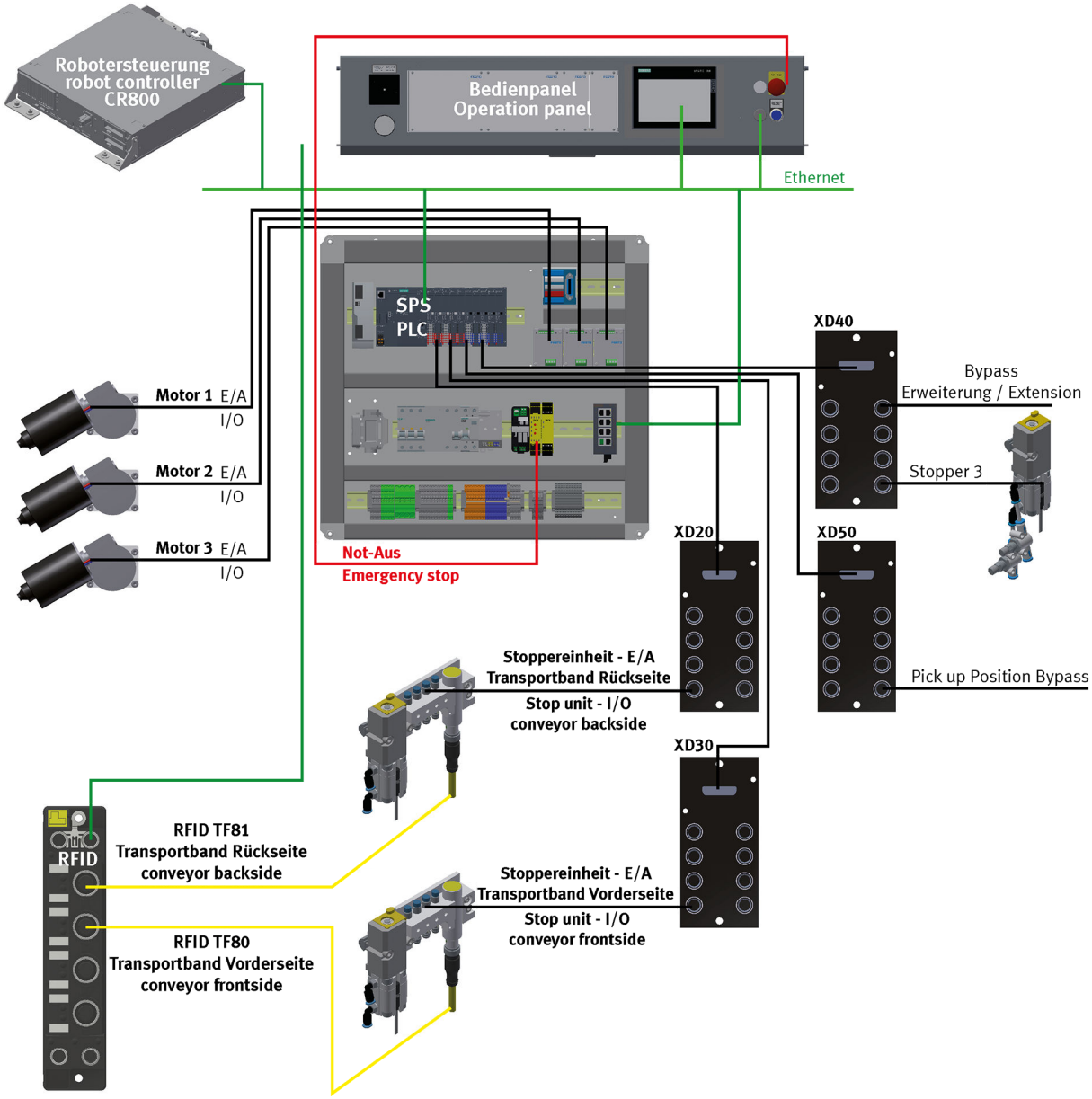


Fig. 23: Overview of cabling / Similar to illustration

5.8 Setting up the Robot Assembly Station Emergency Stop

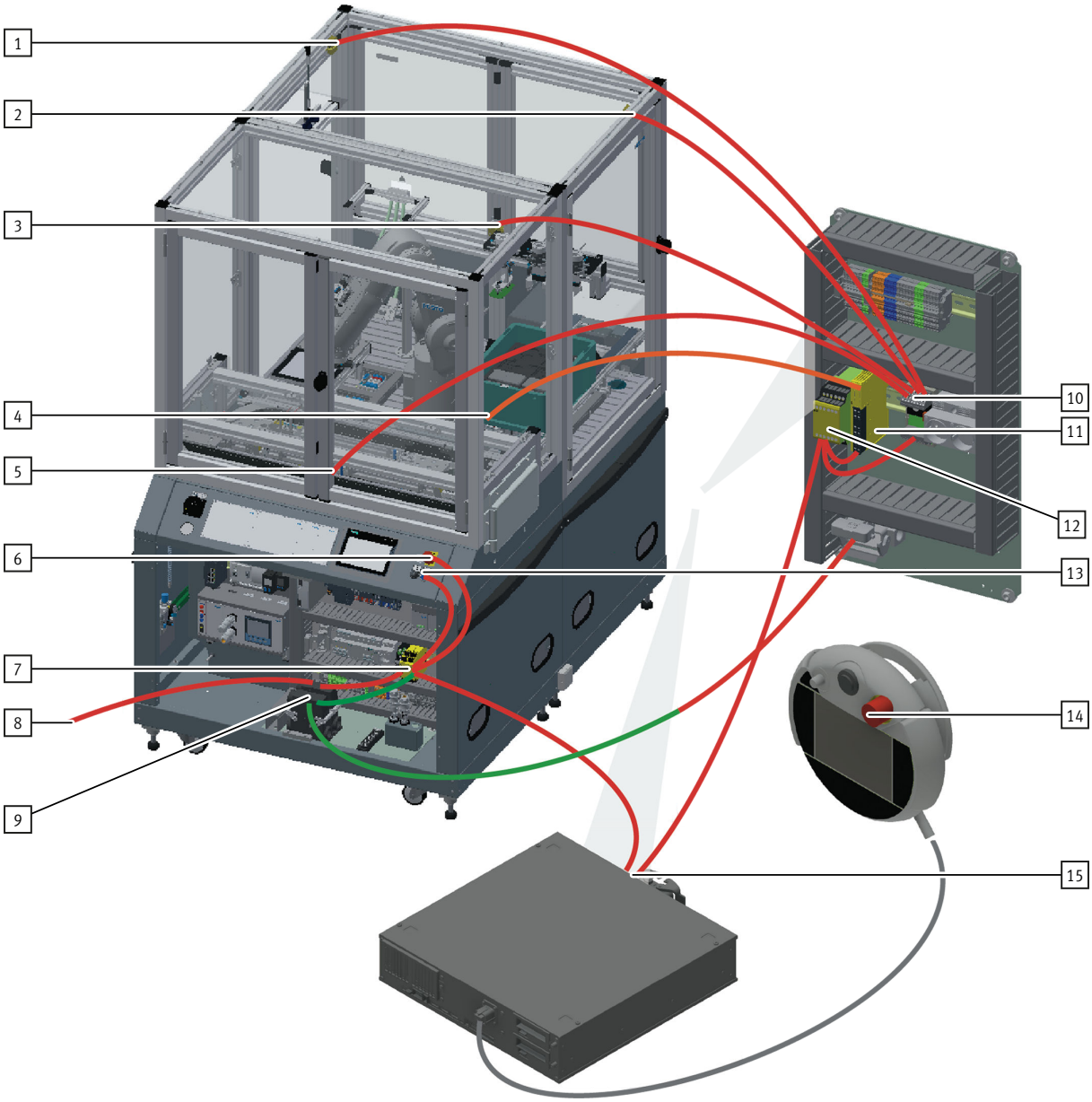


Fig. 24: Structure of the emergency stop system / Similar to illustration

1 Safety door / F2-FQ3
2 Safety door / F2-FQ4
3 Safety door / F2-FQ2
4 Safety sensor box / H1-F2-FQ10
5 Safety door / F2-FQ1
6 Emergency stop pressure switch F2-FQ1 / for emergency stop relay UE410-GU/ F2-KF1
7 Emergency stop board for the emergency stop linkage / F2-KF2
8 Connecting cable to previous station
9 Push-in connector XZ1 front electrical board K2
10 PSEN iX1 / F2-KF3
11 Emergency stop safety relay Sick RLY3-OSSD200 / F2-KF10
12 PNOZ X8P / F2-KF2
13 Aligning pressure switch F2-SF1 / to emergency stop relay UE410-GU/ F2-KF1
14 Control panel R56 TB / Emergency stop only affects the robot
15 Robot controller / K6-KF1

Servo drive behavior

The emergency stop acts on the Sick relay (11) and thus also on the controller enable, including the servo drive. Devices (6) and (7) are only responsible for the safety door function; they only switch off the servo drives (STO input of the servo controller).

5.8.1 Emergency Stop Configuration

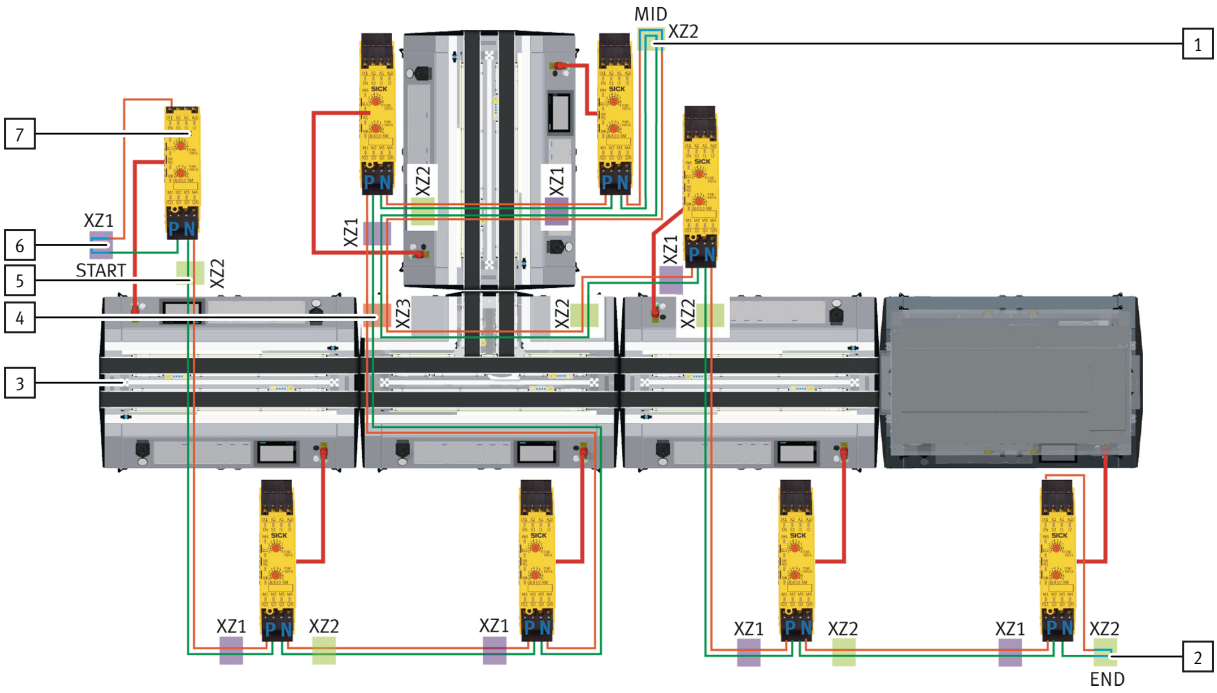


Fig. 25: Sample structure of the emergency stop system / Similar to illustration

1. Outgoing push-in connector XZ2 / MID, last emergency stop on branch section (bridge required)
2. Outgoing push-in connector XZ2 / END, last emergency stop on main section (bridge required)
3. Basic module example linear
4. Outgoing push-in connector XZ3 (only possible on deflector)
5. Outgoing push-in connector XZ2
6. Incoming push-in connector XZ1 / START, first emergency stop on main section (bridge required)
7. Emergency stop Sick FlexiClassic UE410-GU
   Identification P (IP/OP = in/out Previous)
   Identification N (IN/ON = in/out Next)
   Sick FlexiClassic UE410-4RO4 for the emergency stop linkage is not shown graphically

The emergency stop system acts on the entire line; if an emergency stop is pressed, all stations on the line come to a standstill.

Each system must have 1 START and 1 END plug, all plugs in between are MID plugs. The direction always goes from the feed along output X2.

If the configuration of the emergency stop system is changed, it will be necessary to teach in the emergency stop relays again. This is necessary for initial commissioning or when an emergency stop cable is reconnected. In this case, proceed as follows

1. Switch off the power supply (terminals A1, A2) on all main modules.

2. Use a screwdriver to set the switch positions on the rotary switches to 1 on all modules of the system. (Is always 1 in this system, can also be different for other purposes)

3. Press and hold the ENTER key on the main module UE410-GU to switch on the power supply to all modules.
4. When the ERR display starts flashing, release the ENTER key again within 3 seconds.
5. The selected operating mode is saved and active with zero voltage protection.

5.8.2 Acknowledging Emergency Stop after Restart

1. Emergency stop is pressed, station is switched off
2. Turn on the main switch (wait 5 seconds)
3. RESET button flashes quickly
4. Pull out emergency stop to unlock
5. RESET button flashes slowly
6. Press RESET button – emergency stop is acknowledged
7. RESET button lamp goes out
8. Acknowledge HMI

This procedure must be carried out at all stations!

5.8.3 Acknowledge emergency stop after emergency stop

1. Emergency stop is pressed at a station
2. RESET button on the station with emergency stop flashes quickly
3. RESET button on all other stations lights up
4. Pull out pressed emergency stop to unlock
5. RESET button flashes slowly
6. Press RESET button – emergency stop is acknowledged
7. RESET button lamp goes out
8. Acknowledge HMI at all stations

6 Commissioning

6.1 Commissioning

!	**NOTICE** What applies below to commissioning also applies to recommissioning.

- The CP Factory robot assembly station is supplied pre-assembled.
- All attachments are individually packaged.
- All components, tubing connections and wiring are clearly identified, so that all of the connections can be readily restored.

An "initial commissioning" has already been carried out ex works for the CP Factory robot assembly station. Work through the following chapters to put the station into operation.

6.2 Electrical commissioning

Supply the station with electrical voltage (400 V).

Ensure that the supply cable is laid professionally.

6.3 Pneumatic commissioning

First the mechanical setup of the station must be completed.

At the beginning, the station must be connected to the room's pneumatic system. The maintenance unit for this should be located in the immediate vicinity. The quick coupling plug has a nominal width of 5 mm. If the local system has a nominal width of 7.9 mm, the service unit's quick coupling plug can be replaced with a larger one (adapter from ⅛ to ¼ required).

The station is supplied with approx. 0.6 MPa / 6 bar / 87 psi compressed air. During initial commissioning, ensure that the pressure is increased slowly. This prevents unpredictable processes.

6.4 Adjusting Sensors

6.4.1 Proximity switch (stopper identification sensor)

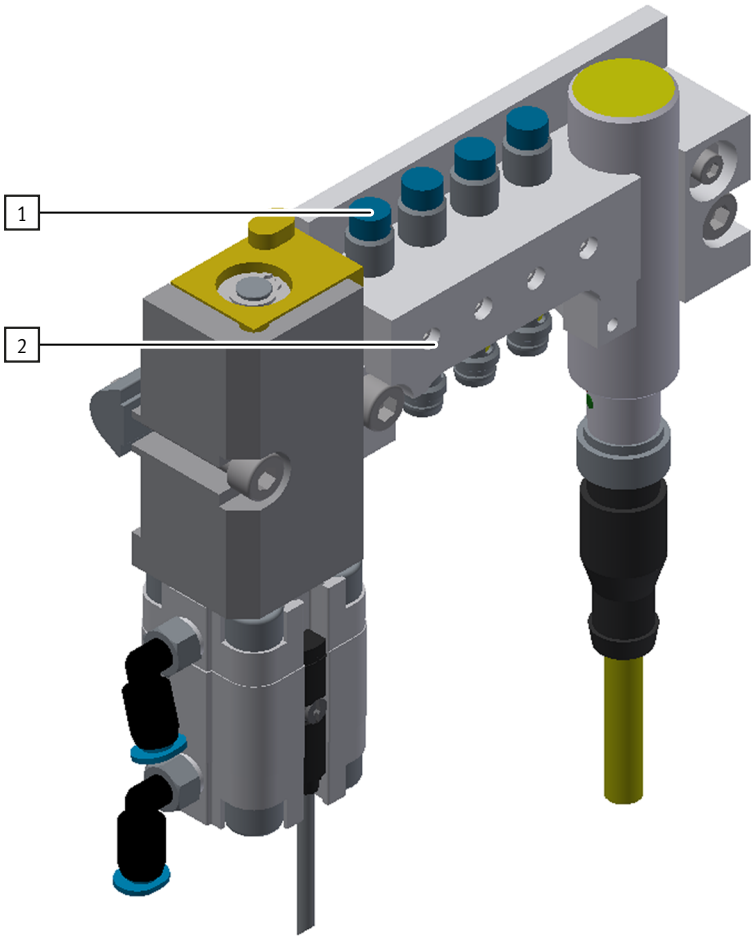


Fig. 26: Similar to illustration

1 Sensor stopper identification sensor / 150395
1-position BG21/BG31/BG41
2-position BG22/BG32/BG42
3-position BG23/BG33/BG43
4-position BG24/BG34/BG44

2 Screw to clamp the sensor.

The proximity switches are used to check the workpiece carrier.

Prerequisites

- Stopper unit is mounted on the belt
- Electrical connection of the proximity switch established.
- Variable power supply switched on.

Procedure

1. The stopper is in the extended position and a workpiece carrier has been stopped at the stopper.

2. Move the proximity switch until the switching status indicator (LED) comes on.

3. Move the proximity switch a few millimeters in the same direction until the switching status indication goes out.
4. Move the proximity switch at the halfway point between the switch-on and switch-off points.
5. Tighten the clamping screw of the proximity switch with a 1.3 AF hexagon screwdriver.
6. Check the positioning of the proximity switch by repeated picking up and depositing of the workpiece carrier.

6.4.2 Proximity switch (stopper cylinder)

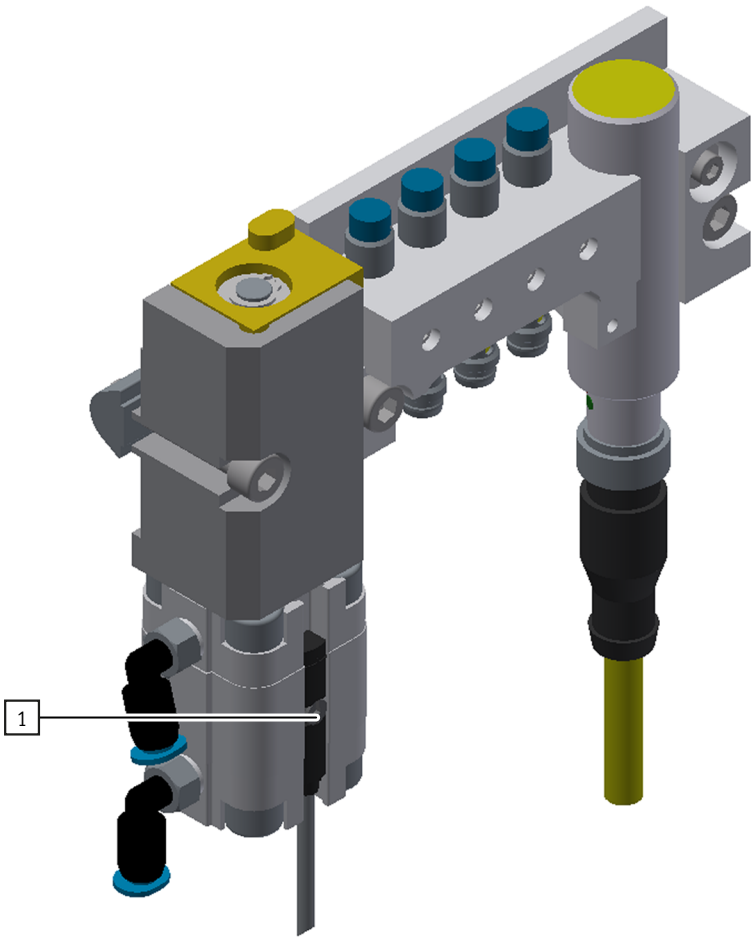


Fig. 27: Similar to illustration

1 Sensor stopper in lower position / 574334, BG20 / BG30 / BG30 / BG40

The proximity switches are used to check the end position of the stopper cylinder. The proximity switches react to a permanent magnet on the piston of the cylinder.

Prerequisites

- Cylinder is mounted on the conveyor.
- Pneumatic connection of the cylinder established.
- Compressed air supply switched on.
- Electrical connection of the proximity switch established.
- Variable power supply switched on.

Procedure

1. The cylinder is in the end position that is to be queried.
2. Move the proximity switch until the switching status indicator (LED) comes on.
3. Move the proximity switch a few millimeters in the same direction until the switching status indication goes out.
4. Move the proximity switch at the halfway point between the switch-on and switch-off points.
5. Tighten the clamping screw of the proximity switch with a 1.3 AF hexagon screwdriver.
6. Check the positioning of the proximity switch through repeated test runs of the cylinder.

6.4.3 Fiber-optic cable (workpiece detection – start / end of belt)

Fig. 28: Similar to illustration

1+2 Fiber-optic cable, SOEG-L-Q30-P-A-S-2L, 165327, (BG1 / pallet at the front in station)
3+4 Fiber-optic cable, SOEG-L-Q30-P-A-S-2L, 165327, (BG2 / pallet at the rear in loading position)

The light barrier for detecting the tray on the conveyor belt consists of the fiber-optic unit and the fiber-optic cable. The fiber-optic unit operates using visible red light. The fiber-optic cable can be moved via the fiber-optic cable holder to adjust the position on the belt. If the tray is placed at the start of the conveyor belt or moves to the end of the conveyor belt, it interrupts the light barrier and the fiber-optic unit reports this to the controller.

Requirements

- Fiber-optic unit installed.
- The fiber-optic unit is electrically connected.
- Variable power supply switched on.

1. Screw the two fiber-optic cable heads into the sensor brackets.

2. Align the fiber-optic cables with each other.

3. Attach the fiber-optic cables to the fiber-optic unit.

4. Adjust fiber-optic cable: Standard 1-signal if no tray is present at the "Start/end of the conveyor belt";

   If there is no 1-signal, align the fiber-optic cable heads to each other and adjust the fiber-optic cable potentiometer until 1-signal is present;

   If a tray is present at the start/end of the tape, the signal must be interrupted (0 signal)

   Note
   Do not turn the adjust screw more than a maximum of 12 revolutions.

5. Check the setting by inserting a tray.

   Note
   All trays must be reliably detected.

6.4.4 Proximity Switches (Indexing Units)

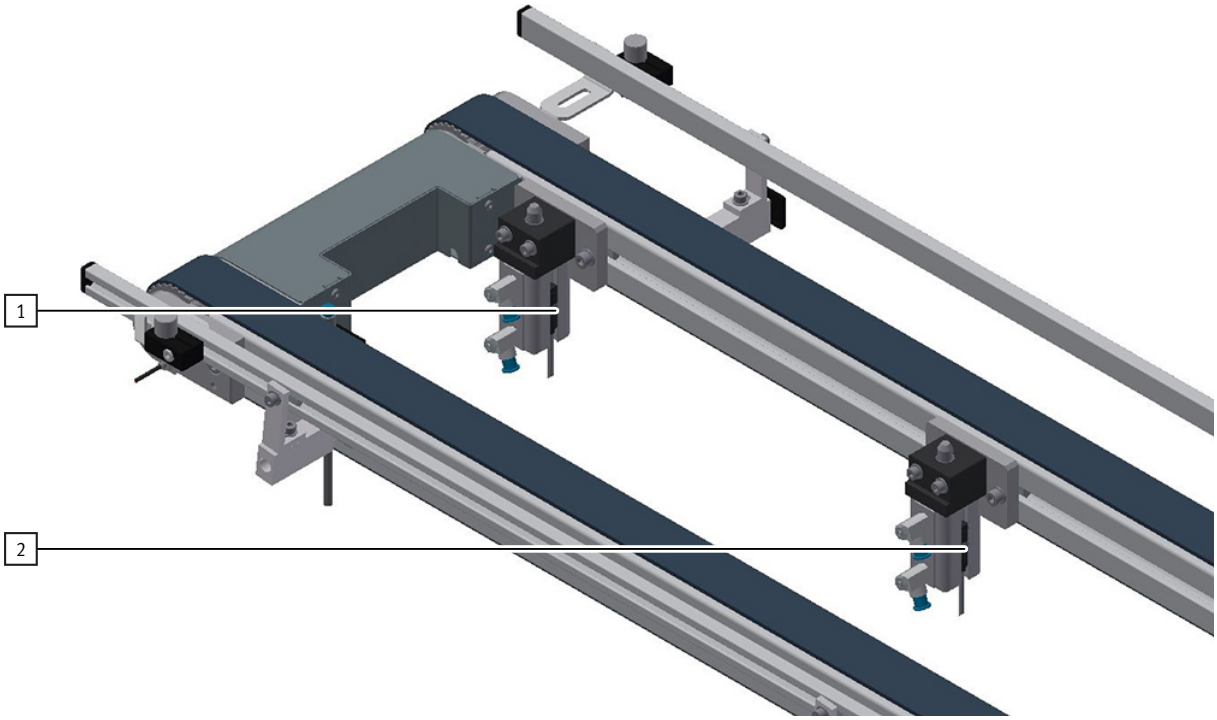


Fig. 29: Similar to illustration

1 Proximity switch, SMT-8M-A-PS-24V-E-0.3-M8D, 175436, (BG5 / indexing unit 1 bolt extended)
2 Proximity switch, SMT-8M-A-PS-24V-E-0.3-M8D, 175436, (BG6 / indexing unit 2 bolts retracted)

The proximity switches are used to check the end position of the cylinder for the indexing unit. The proximity switches react to a permanent magnet on the piston of the cylinder.

Requirements

- Indexing unit mounted.
- Pneumatic connection of the cylinder established.
- Compressed air supply switched on.
- Electrical connection of the proximity switches established.
- Power supply is present

Procedure

1. The cylinder is in the end position that is to be queried.
2. Move the proximity switch until the switching status indicator (LED) comes on.
3. Move the proximity switch a few millimeters in the same direction until the switching status indication goes out.
4. Move the proximity switch at the halfway point between the switch-on and switch-off points.
5. Tighten the clamping screw of the proximity switch with a 1.3 AF hexagon screwdriver.
6. Check the positioning of the proximity switch through repeated test runs of the cylinder.

6.4.5 Fiber-Optic Cable (Fuse Detection)

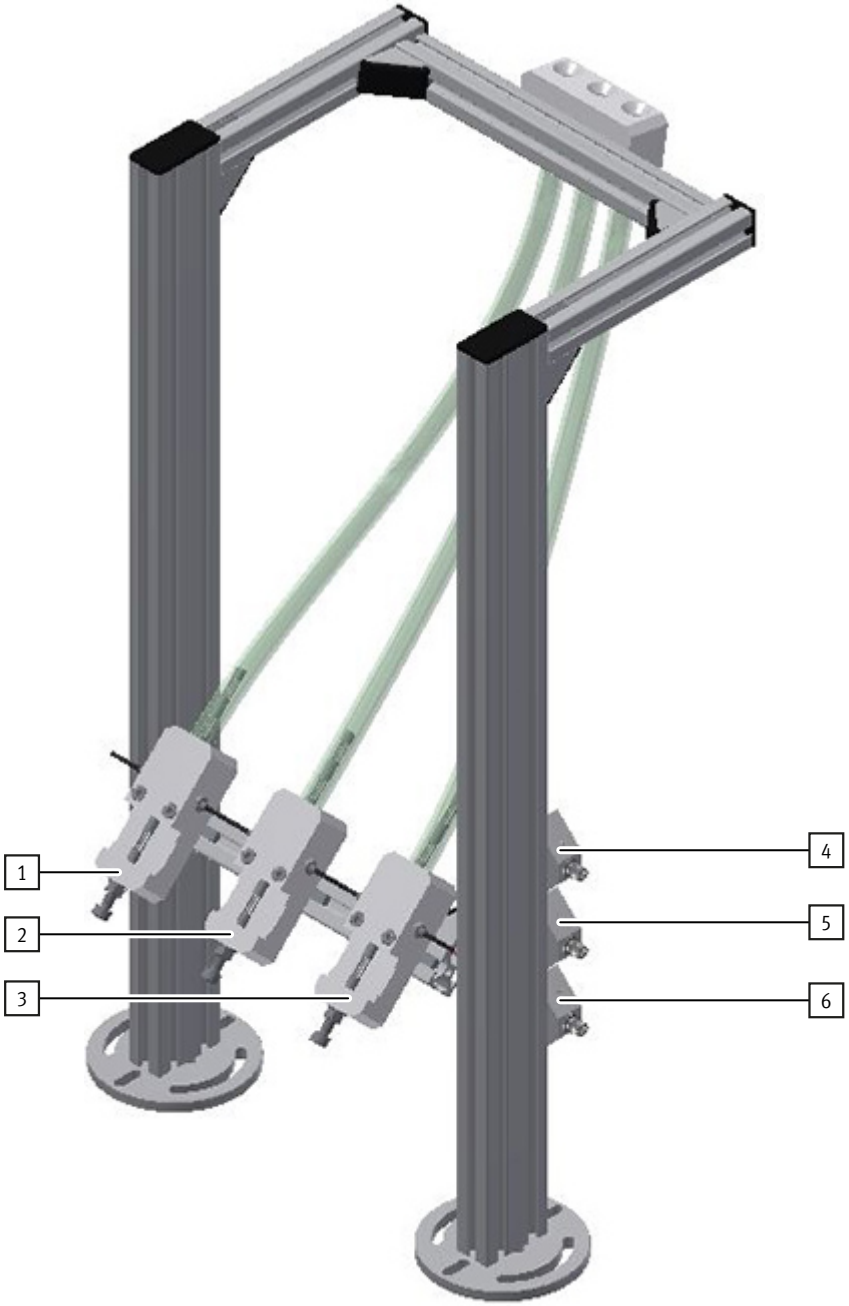


Fig. 30: Similar to illustration

1 Fiber-optic cable, SOOC-TB-M4-2-R25, 552812 , (BG14, pipe 1, fuse present)
2 Fiber-optic cable, SOOC-TB-M4-2-R25, 552812 , (BG15, pipe 2, fuse present)
3 Fiber-optic cable, SOOC-TB-M4-2-R25, 552812 , (BG16, pipe 3, fuse present)
4 Fiber-optic unit, SOEG-L-Q30-P-A-S-2L, 8127556, (BG16, pipe 3, fuse present)
5 Fiber-optic unit, SOEG-L-Q30-P-A-S-2L, 8127556, (BG15, pipe 2, fuse present)
6 Fiber-optic unit, SOEG-L-Q30-P-A-S-2L, 8127556, (BG14, pipe 1, fuse present)

The light barrier (1) for detecting a fuse. If a fuse is placed in one of the hoses, the light barrier detects this and the associated fiber-optic unit reports this to the controller.
The light barrier for detecting the fuse in the fuse unit also consists of a fiber-optic cable and the fiber-optic unit. The

fiber-optic cables work with visible infrared and can be moved into the fuse unit and thus adjusted.
If there is only one fuse in the fuse unit, the fiber-optic unit reports this to the controller; if there are two fuses in the fuse unit, the light beam is interrupted and there is no report to the controller.

Requirements

- Fiber-optic unit installed
- The fiber-optic unit is electrically connected.
- Variable power supply switched on.

1. Screw the two fiber-optic cable heads into the sensor brackets.
2. Align the fiber-optic cables with each other.
3. Attach the fiber-optic cables to the fiber-optic unit.
4. Set the fiber-optic cable: Standard 1-signal if there is no fuse or only one fuse in the fuse unit"; If there is no 1-signal, align fiber-optic cable heads with each other and adjust fiber-optic cable potentiometer until 1-signal is present;

   If there are at least two fuses in the fuse unit, the signal must be interrupted (0-signal)

   Note
   Do not turn the adjust screw more than a maximum of 12 revolutions.
5. Check the setting by inserting/removing fuses.

6.4.6 Fiber-optic cable (workpiece detection)

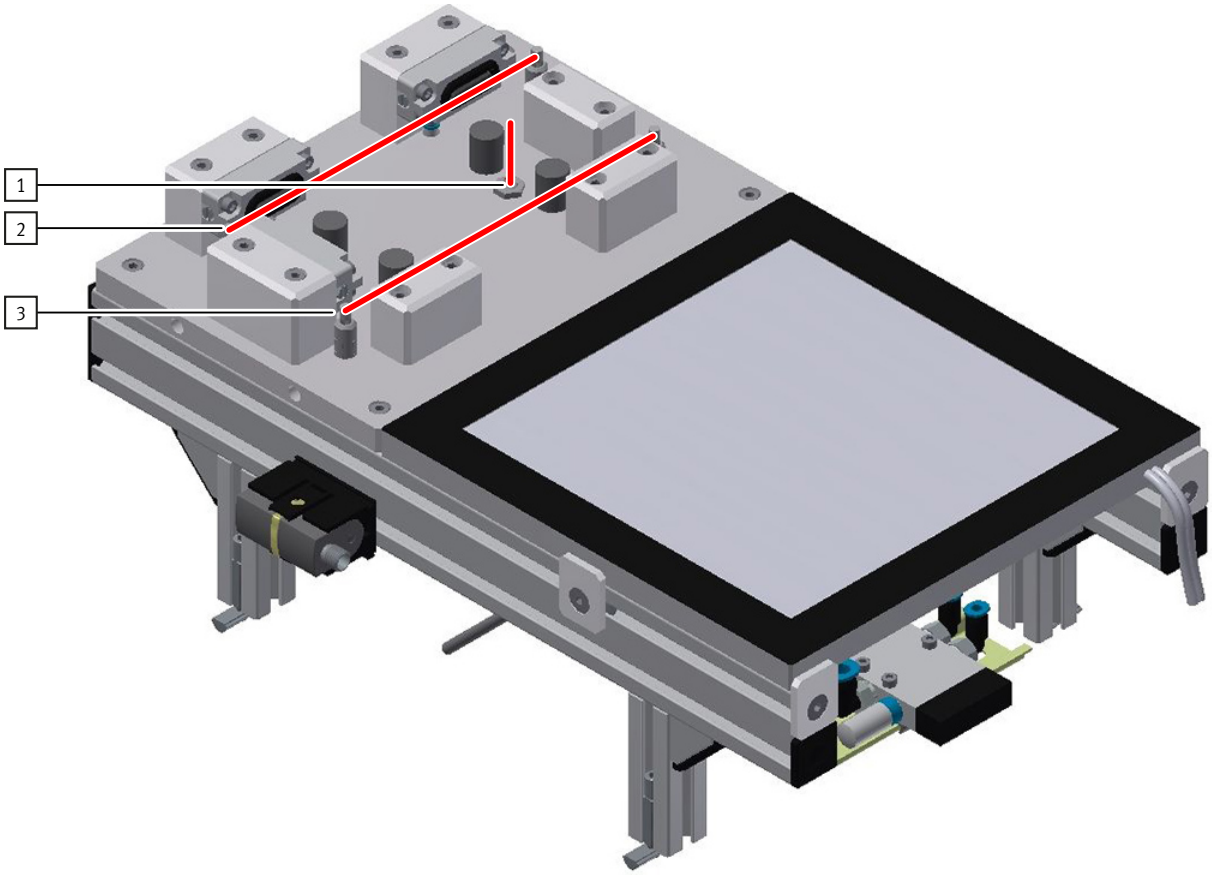


Fig. 31: Similar to illustration

1 Fiber-optic cable, SOOC-DS-M6-2-R25, textvar object does not exist , (BG12 / mounting position housing correctly inserted 2)
2 Fiber-optic cable, SOOC-DS-M6-2-R25, textvar object does not exist , (BG10 / mounting position housing present)
3 Fiber-optic cable, SOOC-DS-M6-2-R25, textvar object does not exist , (BG11 / mounting position housing correctly inserted 1)

The light barrier for detecting the housing in the mounting position consists of the fiber-optic unit and the fiber-optic cable. The fiber-optic unit operates using visible red light. The fiber-optic cable can be moved via the fiber-optic cable holder to adjust the position. If a housing is inserted into the mounting position, this interrupts the light barrier and the fiber-optic unit reports this to the controller.

Requirements

- Fiber-optic unit installed.
- The fiber-optic unit is electrically connected.
- Variable power supply switched on.

Procedure

1. Screw the two fiber-optic cable heads into the sensor brackets.
2. Align the fiber-optic cables with each other.
3. Attach the fiber-optic cables to the fiber-optic unit.

4. Adjust fiber-optic cable: Standard 1-signal, if no housing is present in the mounting position"; If there is no 1-signal, align fiber-optic cable heads to each other and adjust fiber-optic cable potentiometer until 1-signal is present; If a housing is present in the mounting position, then the signal must be interrupted (0-signal)

   Note
   Do not turn the adjust screw more than a maximum of 12 revolutions.

5. Check the setting by inserting a housing.

   Note
   All housings must be reliably recognized.

6.4.7 Pressure sensor (workpiece clamping)

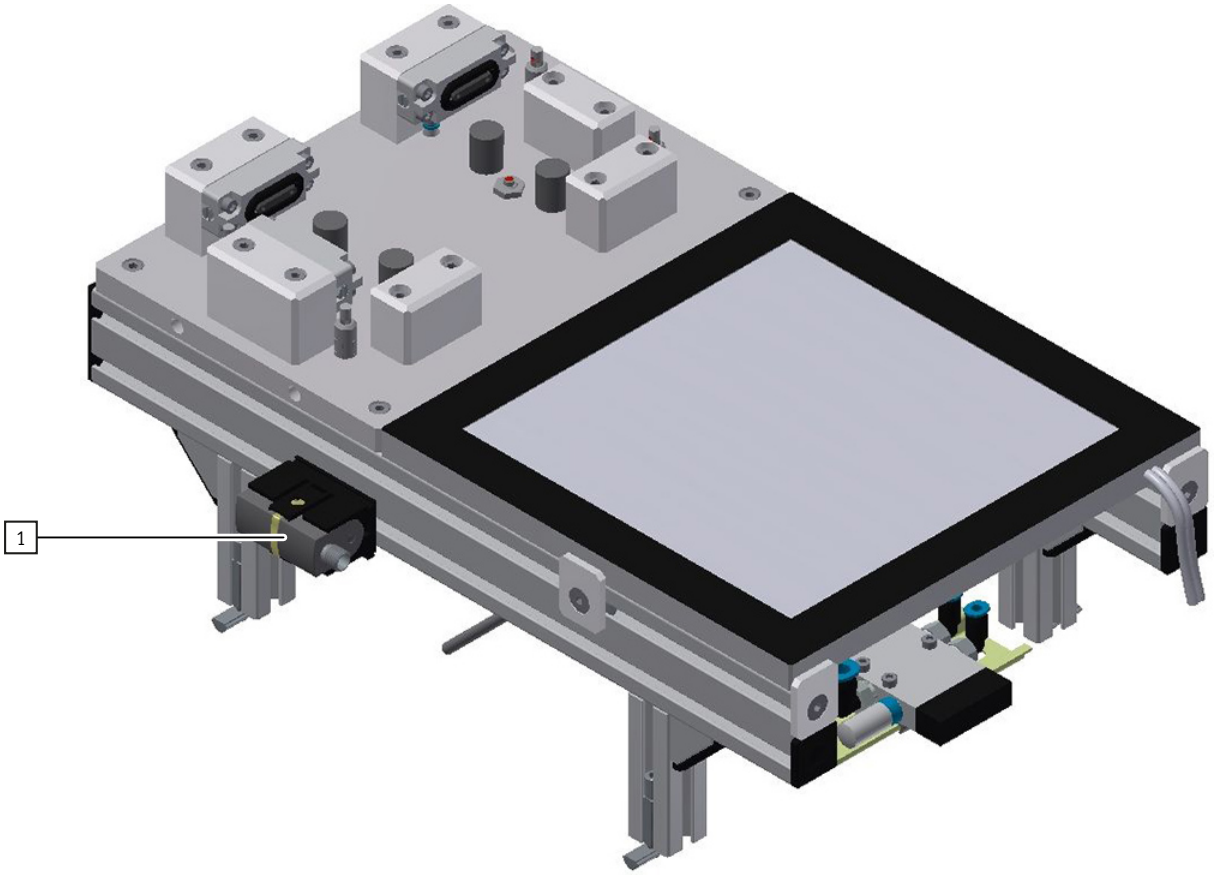


Fig. 32: Similar to illustration

1 Pressure sensor, SDE5-D10-O-Q4E-P-M8, 527466 , (BG9 / mounting plate is clamped)

1. Set the switching pressure SP to TP1 with a teach-in pressure
2. Switch the operating voltage on.
3. Pressurize the SDE5 with the desired teach pressure TP1.
4. Press and hold the Edit button (> 2 s) until the LED flashes.
5. Release the Edit button. The current teach-in pressure TP1 is saved as switching pressure SP.

6. Ensure that power supply is maintained for at least 10 seconds.

7. Perform a test run with alternating pressure to check whether the SDE5 switches as desired. The LED also lights up when the switching signal is output.

6.4.8 Proximity Switch (Gripper Detection)

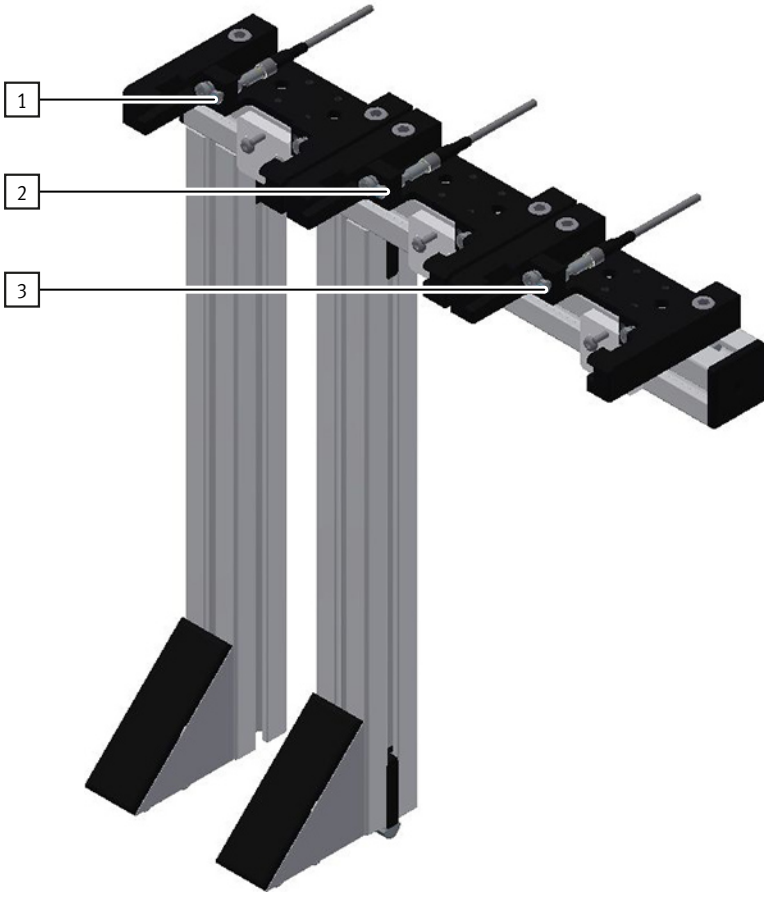


Fig. 33: Similar to illustration

1 Proximity switch, SIEN-M5B-PS-S-L, 150371 , (BG18 / storage location gripper 1 vacuum)
2 Proximity switch, SIEN-M5B-PS-S-L, 150371 , (BG19 / storage location gripper 2 workpiece)
3 Proximity switch, SIEN-M5B-PS-S-L, 150371 , (BG20 / storage location gripper 3 fuse)

The proximity switch is used to control the gripper.

Requirements

- Proximity switch mounted with retainer.
- Electrical connection of the proximity switch established.
- Power supply is present

Procedure

1. The gripper is positioned in front of the proximity switch

2. Move the proximity switch until the switching status indicator (LED) comes on.

3. Move the proximity switch a few millimeters in the same direction until the switching status indication goes out.
4. Move the proximity switch at the halfway point between the switch-on and switch-off points.
5. Tighten the clamping screw of the retainer.
6. Check the positioning of the proximity switch by repeatedly positioning the gripper in front of the proximity switch

7 Operation

7.1 The control elements of the robot assembly station

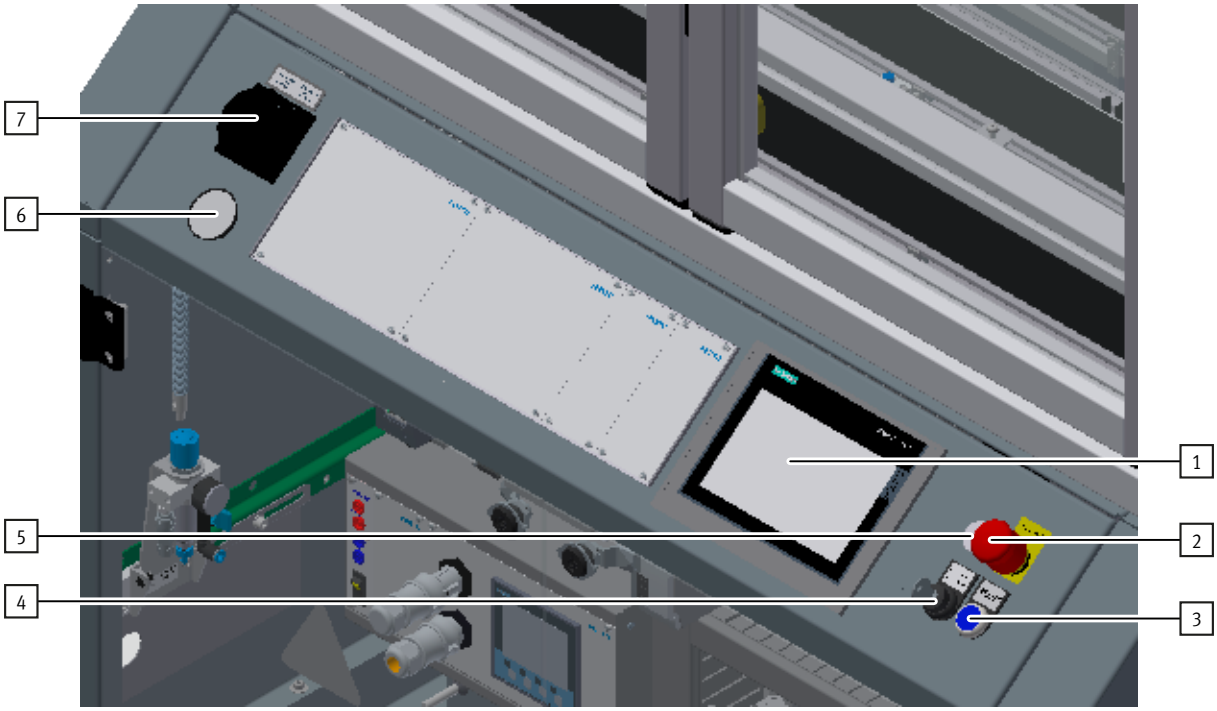


Fig. 34: CP Factory control panel / Similar to illustration

1 Touch panel – PH1
2 Emergency stop switch – F2-FQ1
3 Reset pressure switch – F2-SF1
4 Key actuator F2-SF2 (vertical = auto mode/horizontal = teach mode)
5 Network socket
6 Pressure gauge
7 Main switch – QB1

7.2 Description of the Robot Assembly Process

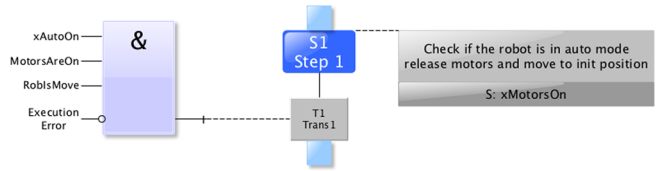


Fig. 35: Straightening process

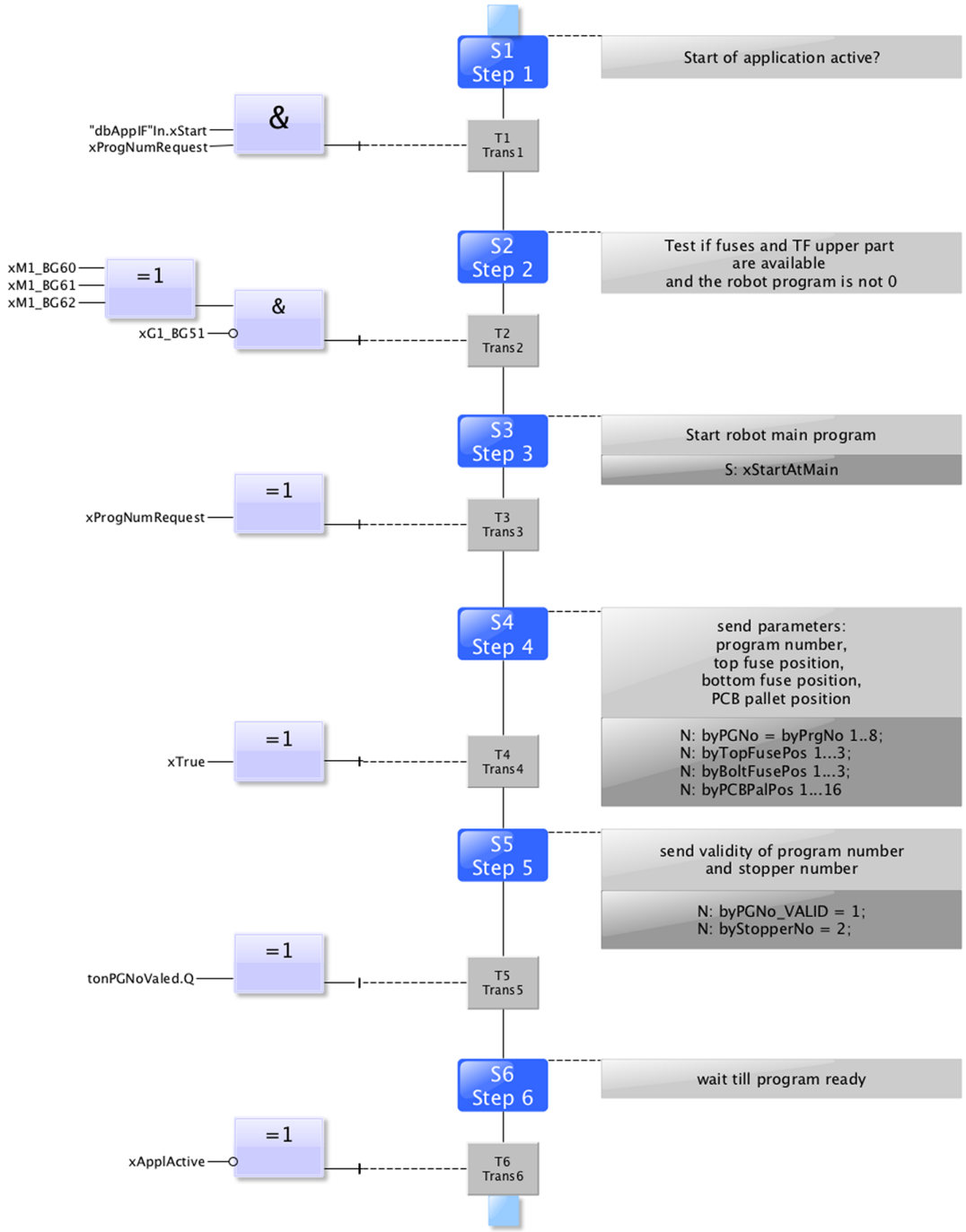


Fig. 36: Automatic sequence

7.3 Basic Module Bypass Sequence Description

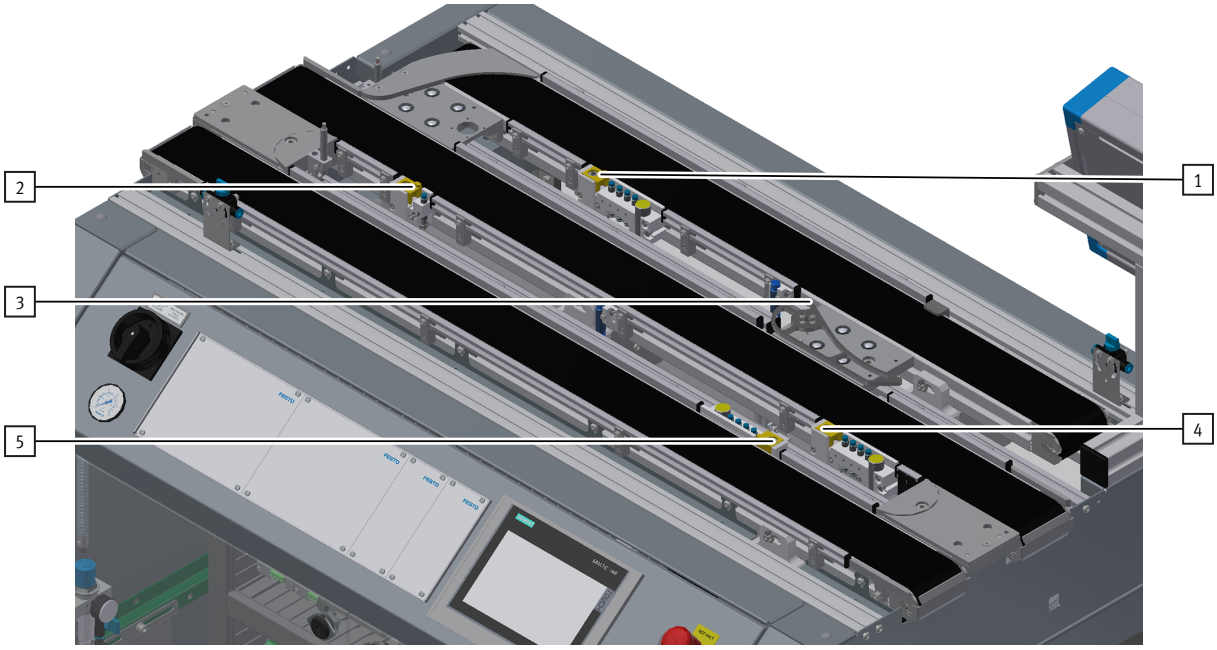


Fig. 37: Similar to illustration

1. Stopper in bypass
2. Stopper without RFID
3. Deflector
4. Stopper deflector bypass
5. Stopper front of basic module

Bypass sequence description

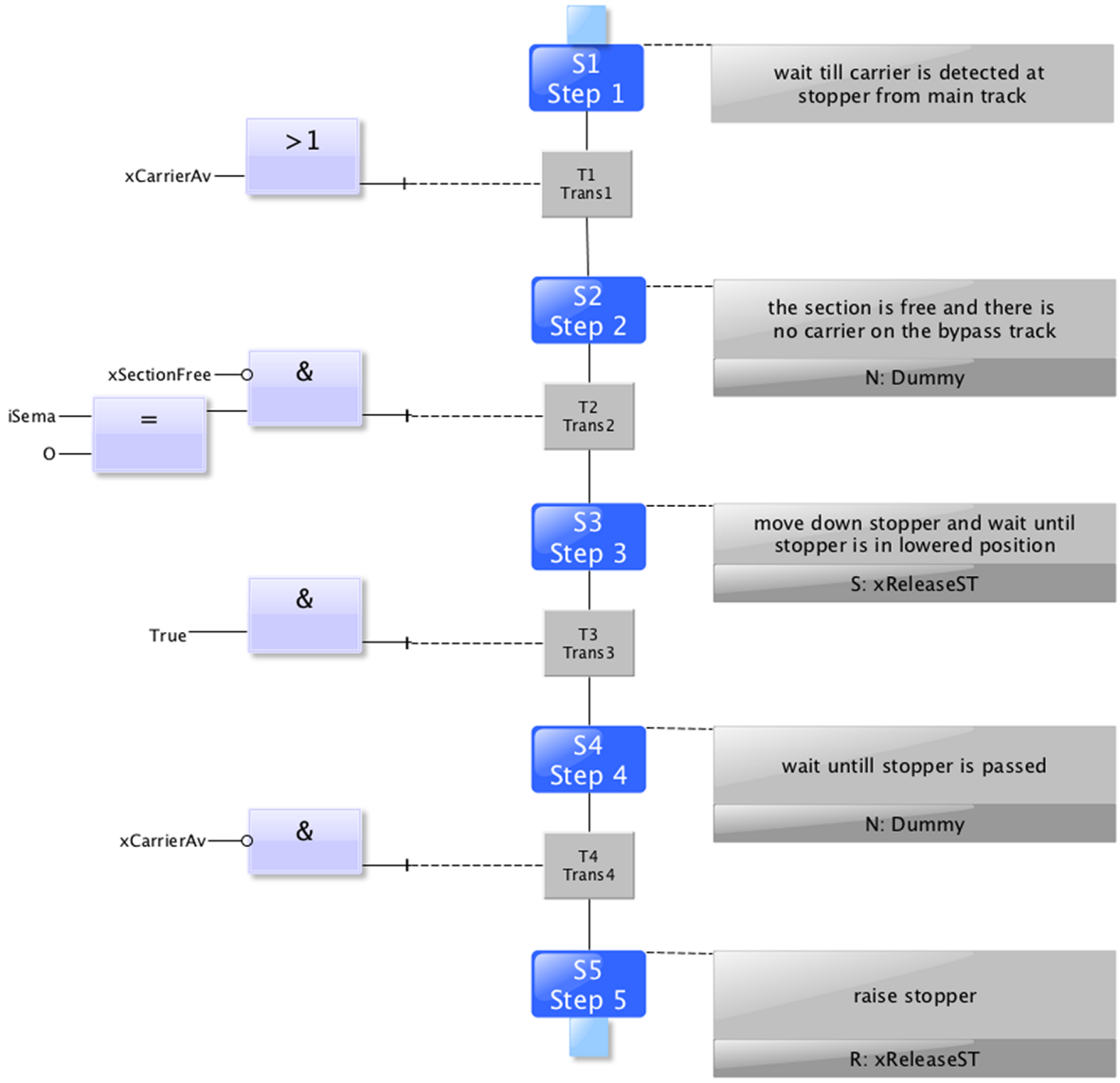


Fig. 38: Stopper without RFID

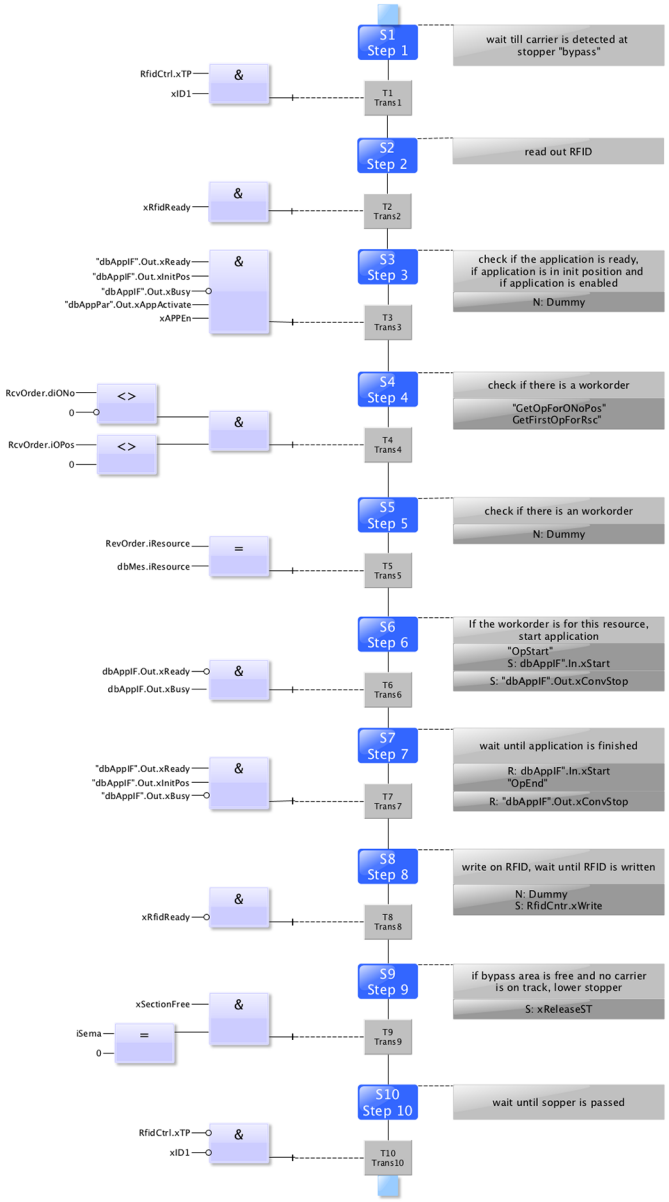


Fig. 39: Automatic stopper in the bypass area

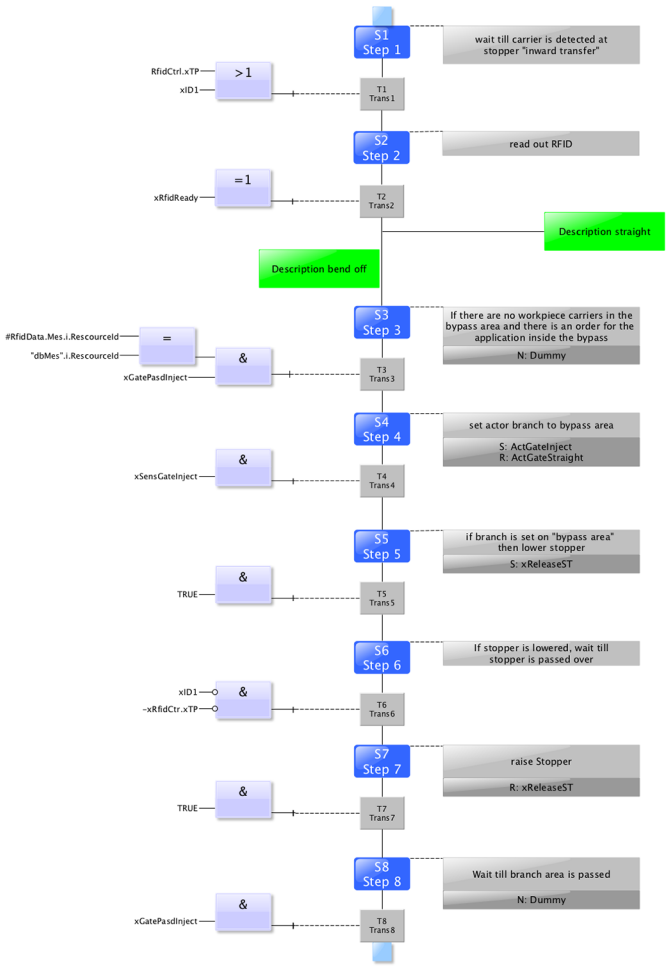


Fig. 40: Turn off bypass

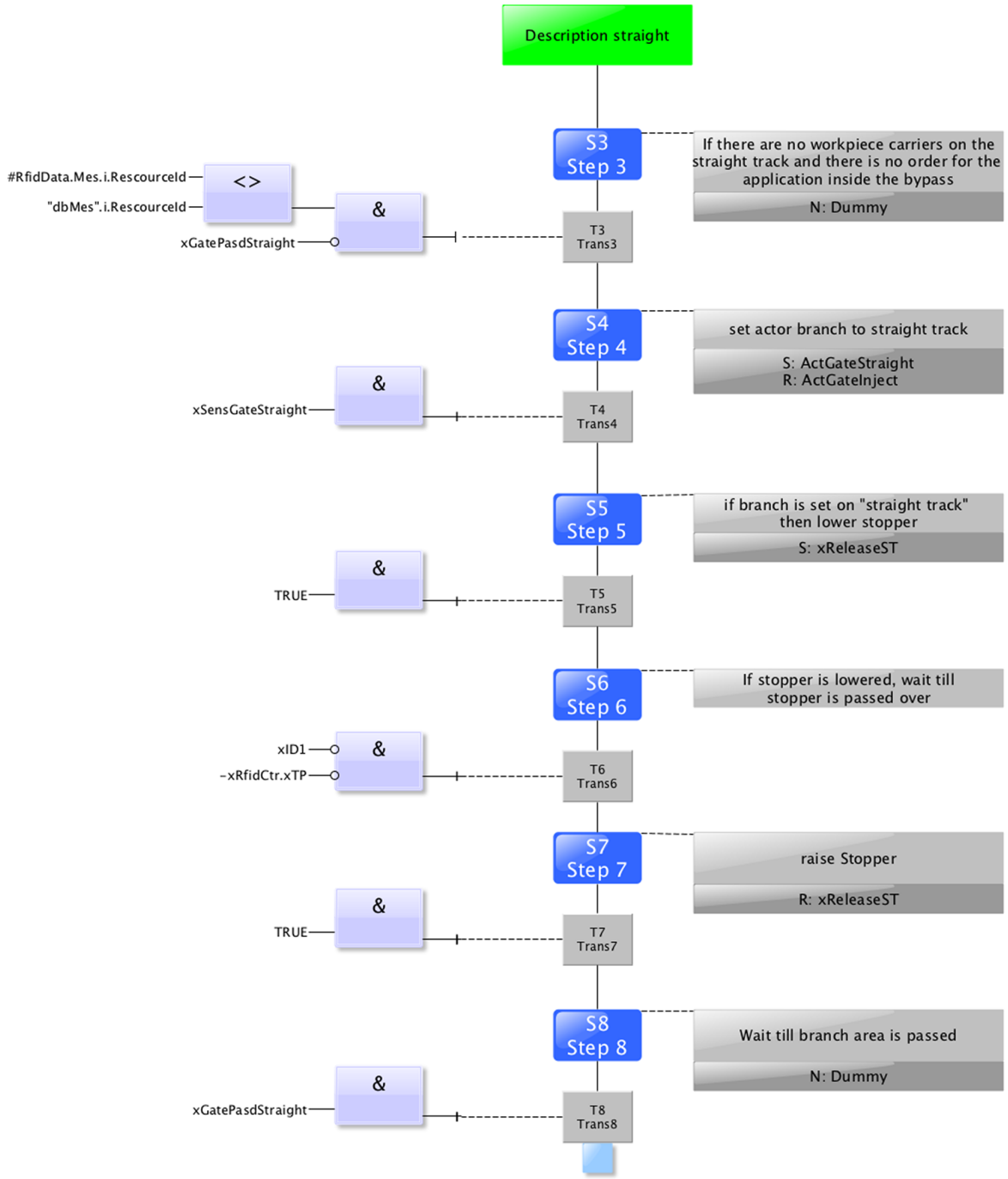
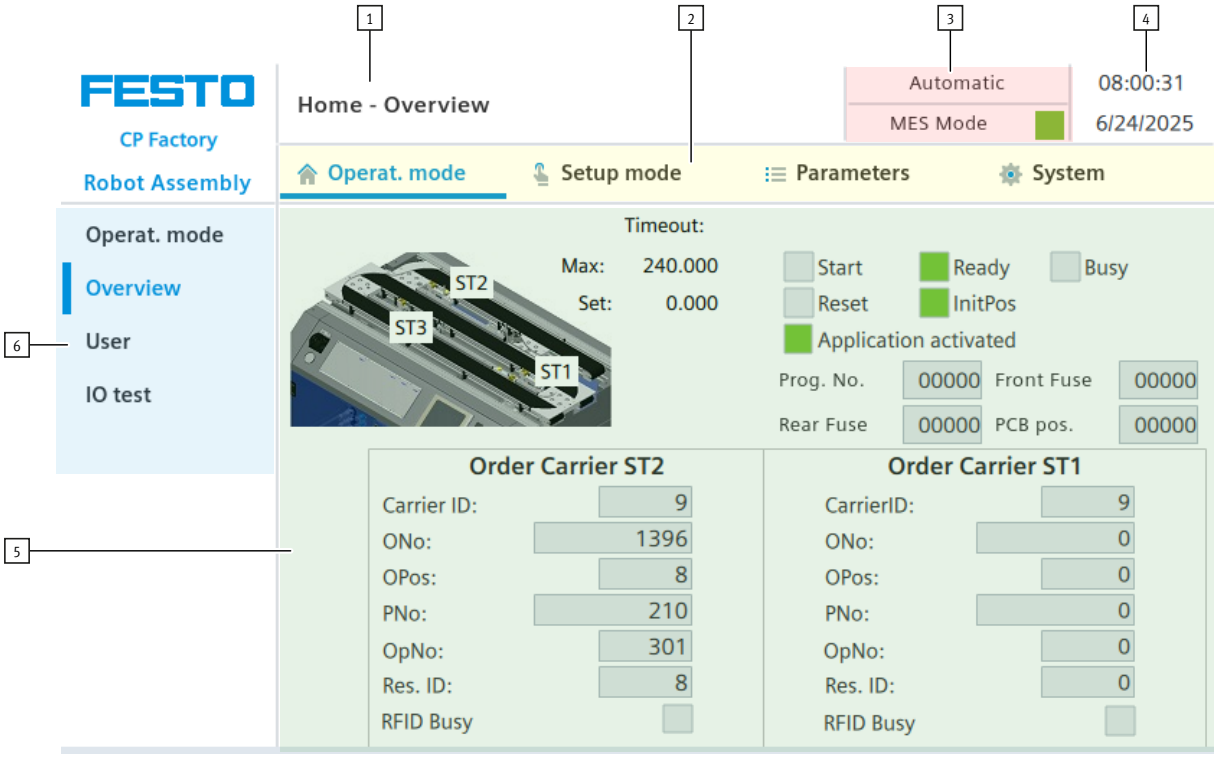


Fig. 41: Bypass straight ahead

7.4 Menu Structure of the Control Panel



1 Display / description of the menu and display of message texts. (see also Error messages and message texts on the HMI chapter)

2 Main menu (always displayed in the same way)
Home: The module can be controlled here, the mode (default/MES) can be selected and automatic or setup mode can also be operated.
Setup: The application can be operated manually in setup mode here.
Parameters: Parameters of the application are set here, a simulation can be started, the transitions are defined or the belt is adjusted.
System: System parameters such as language, time etc. are set here.

3 Display of operating type and operating mode.

4 Display of the date and current time.

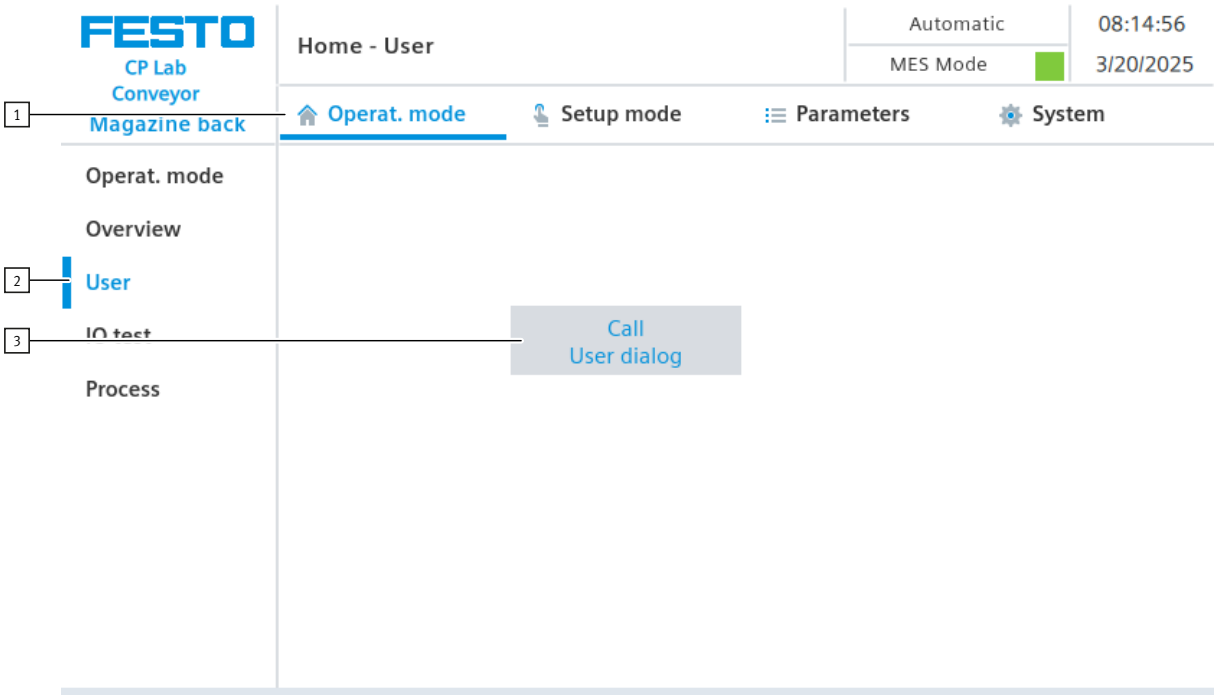
5 Changing content, depending on the main menu or submenu.

6 Submenu with changing content, depending on the main menu.

7.4.1 Registration on the HMI

Registration on the HMI using the example of the CP Lab Conveyor and the Magazine application module

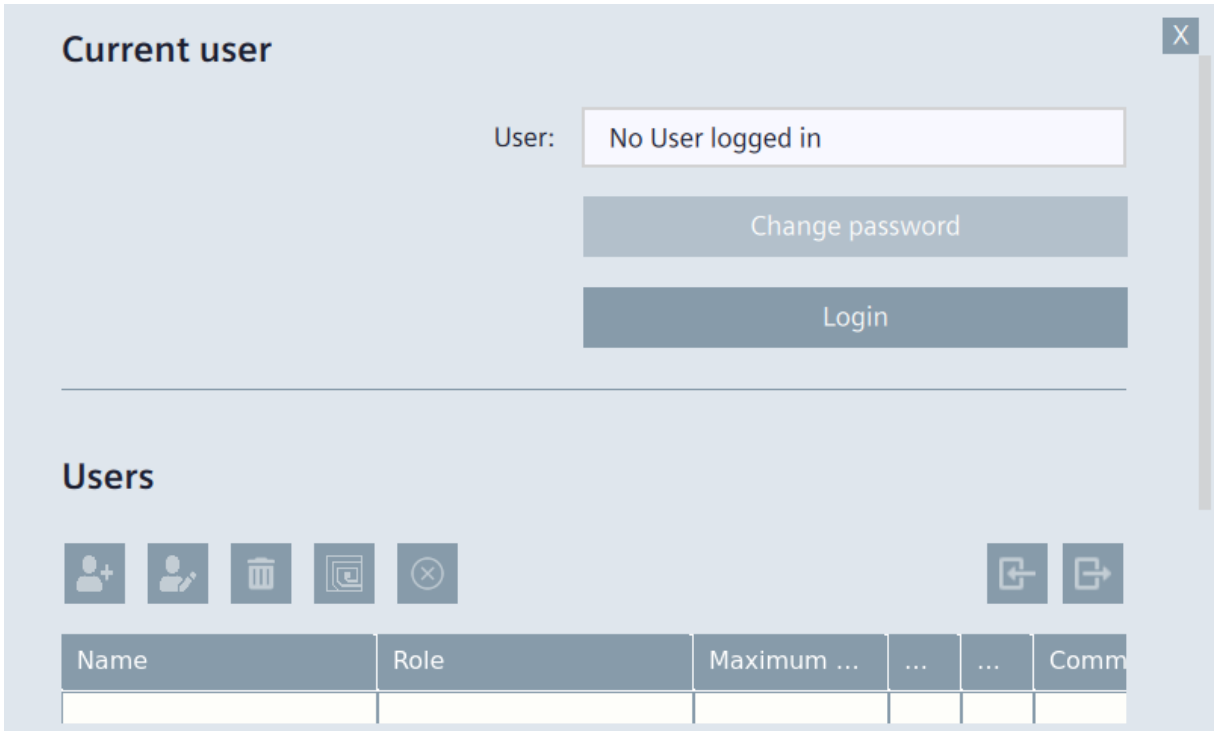
During operation of the HMI, the I/O test function and the User function are only available if the operator has logged onto the HMI. Once you have logged onto the HMI, all functions are available.



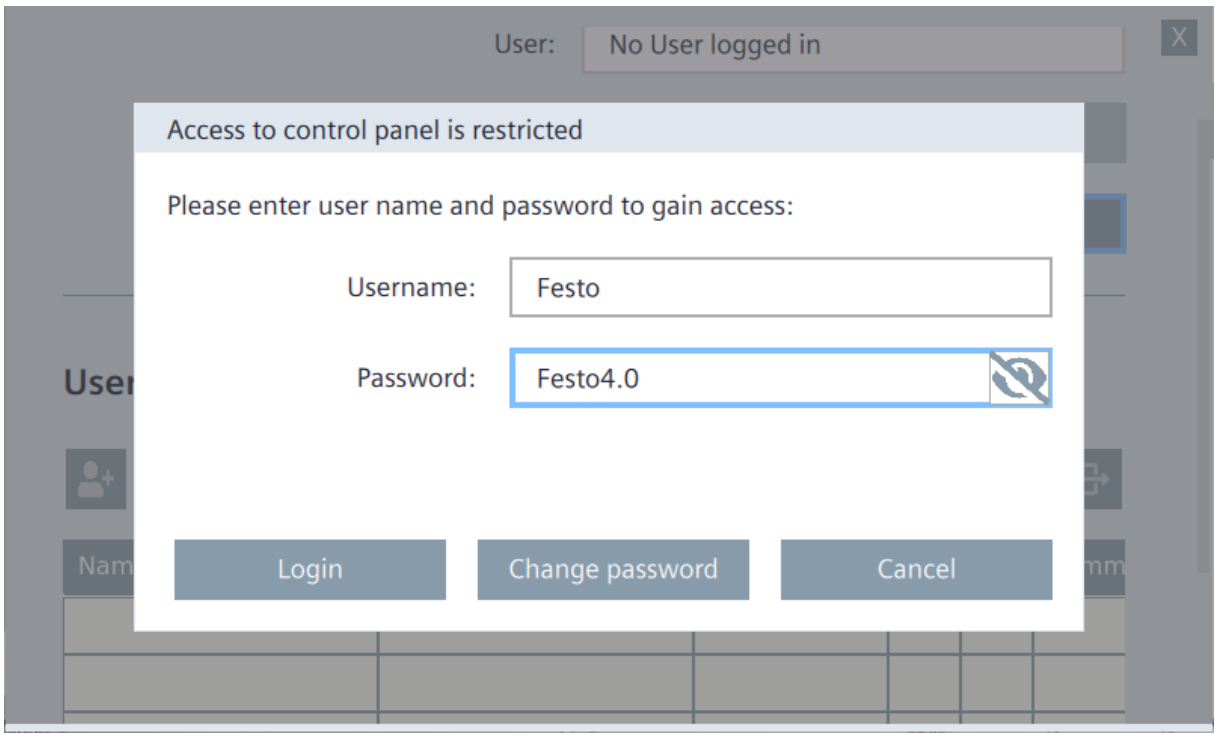
1. Select *"HOME"* in the main menu.

2. Select *"User"* in the submenu.

3. Clicking the *"Call User Dialog"* button opens the following window.

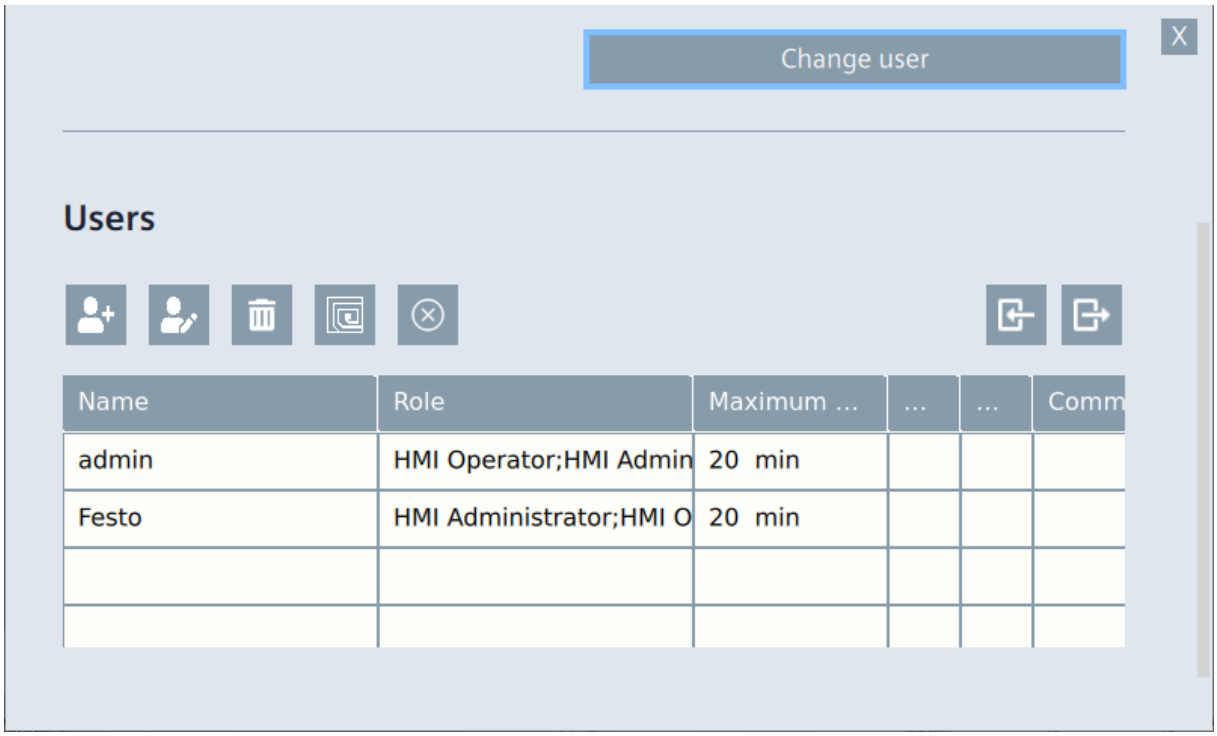


4. If you click the *"Login"* button, the input window opens and the user data can be entered.



5. The user data can now be entered and confirmed with the *"Login"* key.

- User: Festo
- Password: Festo4.0



6. The user is now logged on and the User and I/O test functions are available.

7.5 Operating Mode on CP Factory Robot Assembly

The default operating mode and the MES operating mode are available on the CP Factory robot assembly.

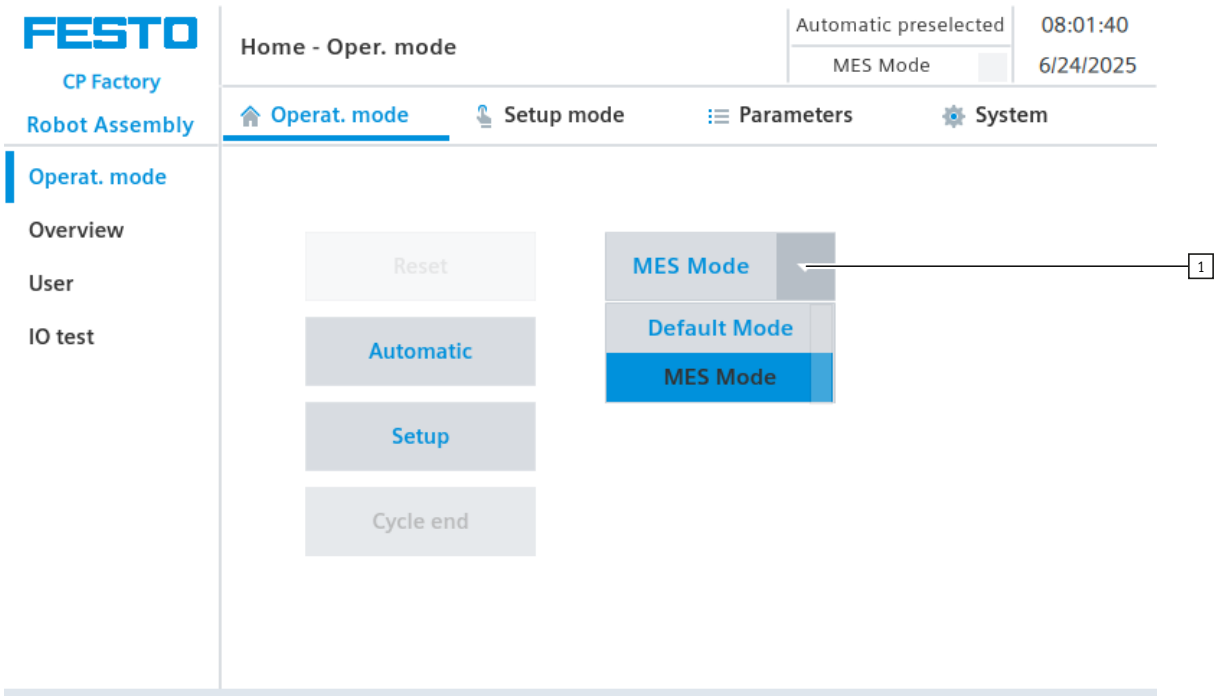
- MES mode

  In MES mode, all processes are started, carried out and monitored centrally by the MES software. All stations must be in the MES operating mode for this, and the automatic operating mode must be started.

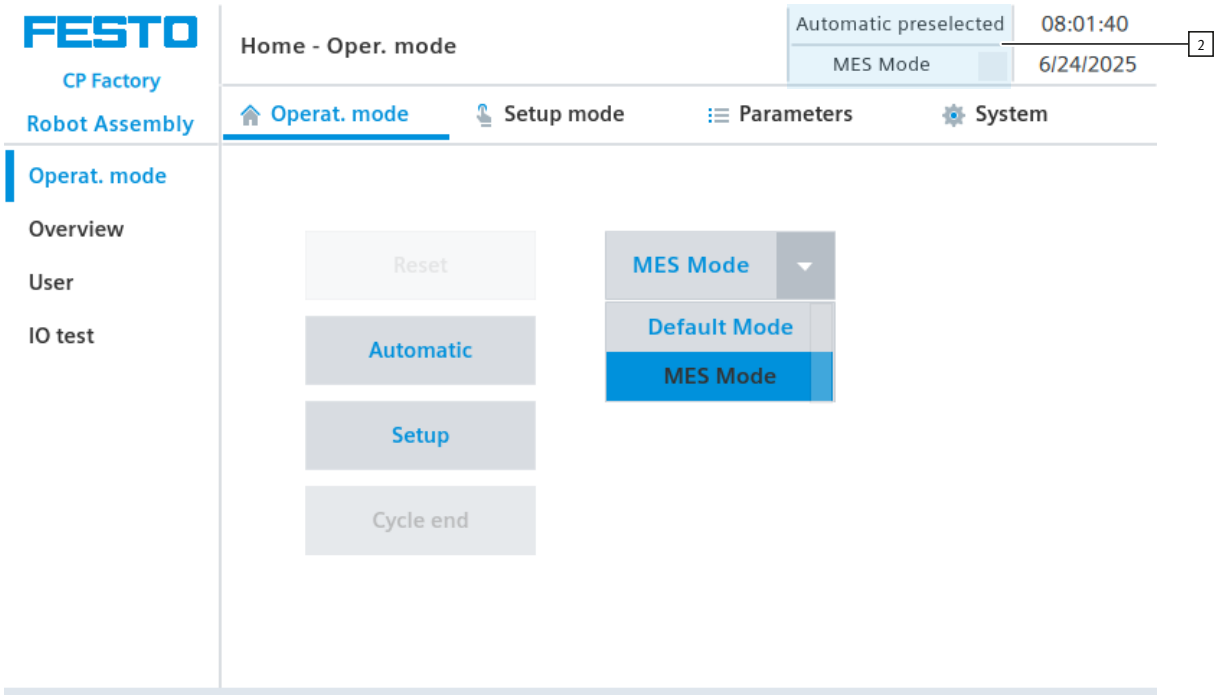
- Default Mode

  In default mode, the automatic sequence is not controlled centrally; all information comes from the transition tables of the respective station / CP application modules (see chapter Schematic process sequence) and is read out and processed separately at each station.

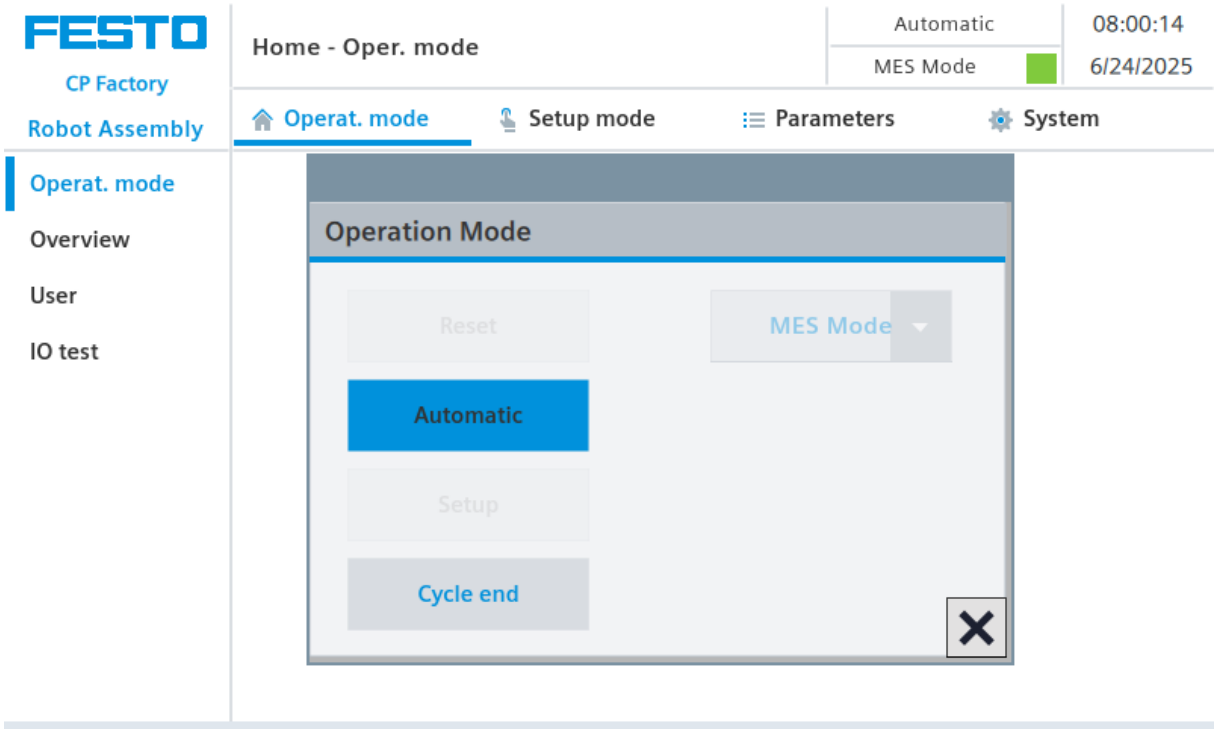
There are two ways to set the operating mode.



1. The operating mode can be set in the main menu under Home => Operating mode.



2. Click the marked area to open a pop-up window (see following illustration).



3. The operating mode can also be selected in the pop-up window.

Display in MES operating mode

In the home operating mode in the Overview menu, various statuses and functions are displayed in MES mode.

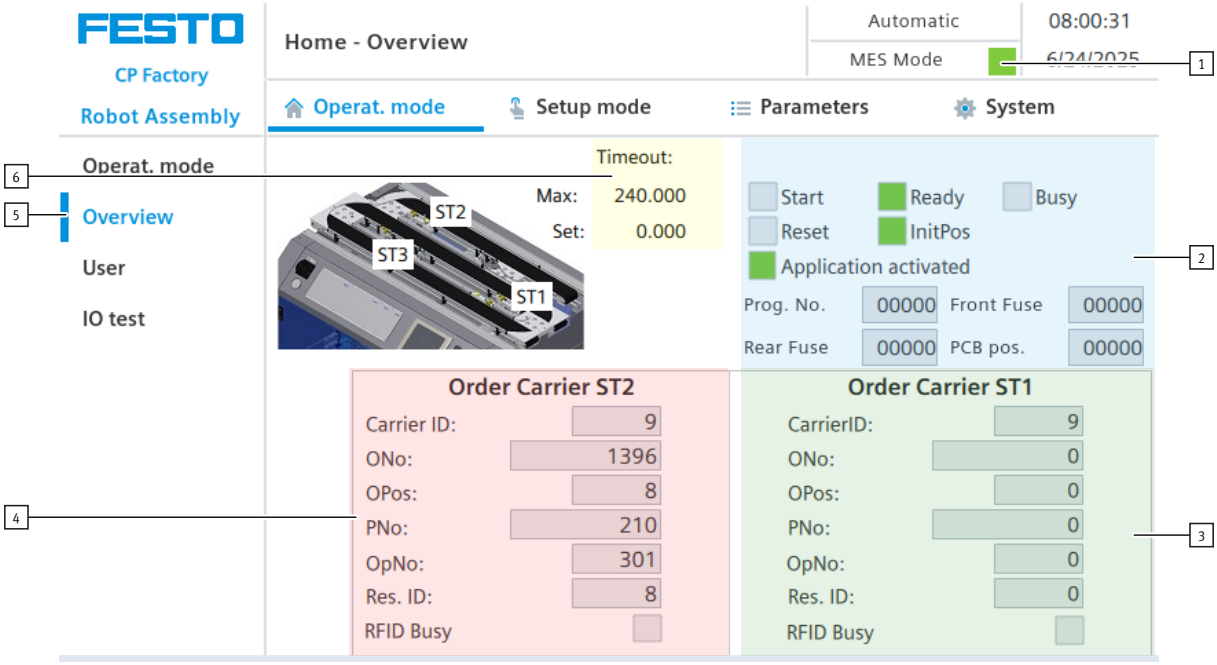


Fig. 42: MES mode

1 Display of MES operating mode active.
2 Display of various functions (highlighted in green when active) and the parameters.
3 Display of the order data of the current workpiece carrier ST1.
4 Display of the order data of the current workpiece carrier ST2.
5 Switch to the Overview submenu item.
6 Display of various information about the station.

Display in default operating mode

In the home operating mode in the Overview menu, various statuses and functions are displayed in default mode.

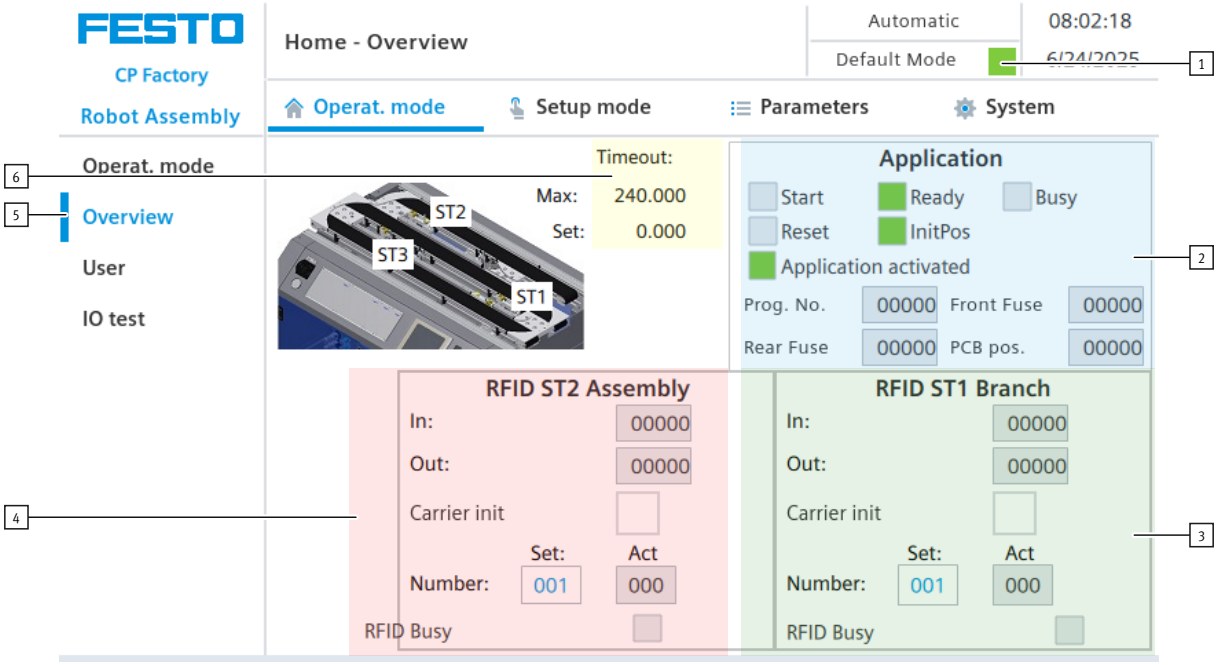


Fig. 43: Default mode

1 Display of default operating mode active.
2 Display of various functions (highlighted in green when active) and the parameters.
3 Display of the RFID status code of the current workpiece carrier ST1.
4 Display of the RFID status code of the current workpiece carrier ST2.
5 Switch to the Overview submenu item.
6 Display of various information about the station.

7.6 Operating Modes on CP Factory Robot Assembly

The following operating modes are available on the HMI of the CP Factory basic module:

- Align

  The station is moved to its home position.

- Setup

  The station runs in setup mode, actuators can be controlled and monitored.

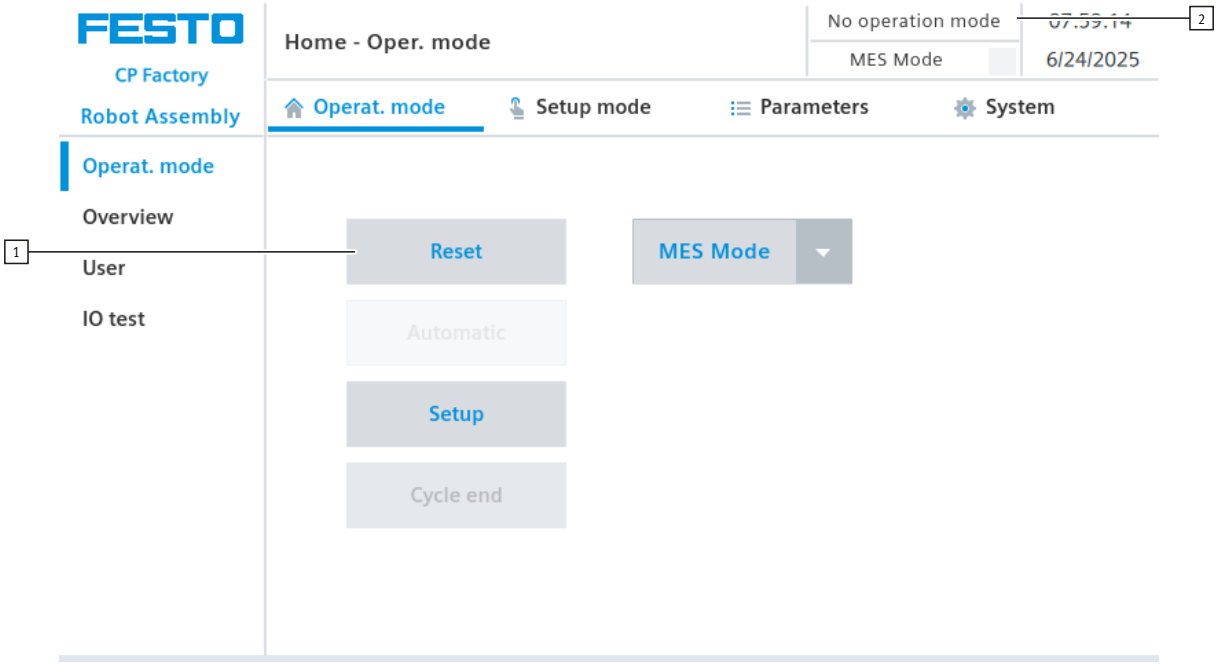
- Automatic

  The station runs in automatic mode, all processes run automatically, no actuators can be controlled.

  In automatic mode, the default operating mode and the MES operating mode are available.

7.6.1 Reset Operating Mode

In the reset operating mode, the station is moved to its home position.

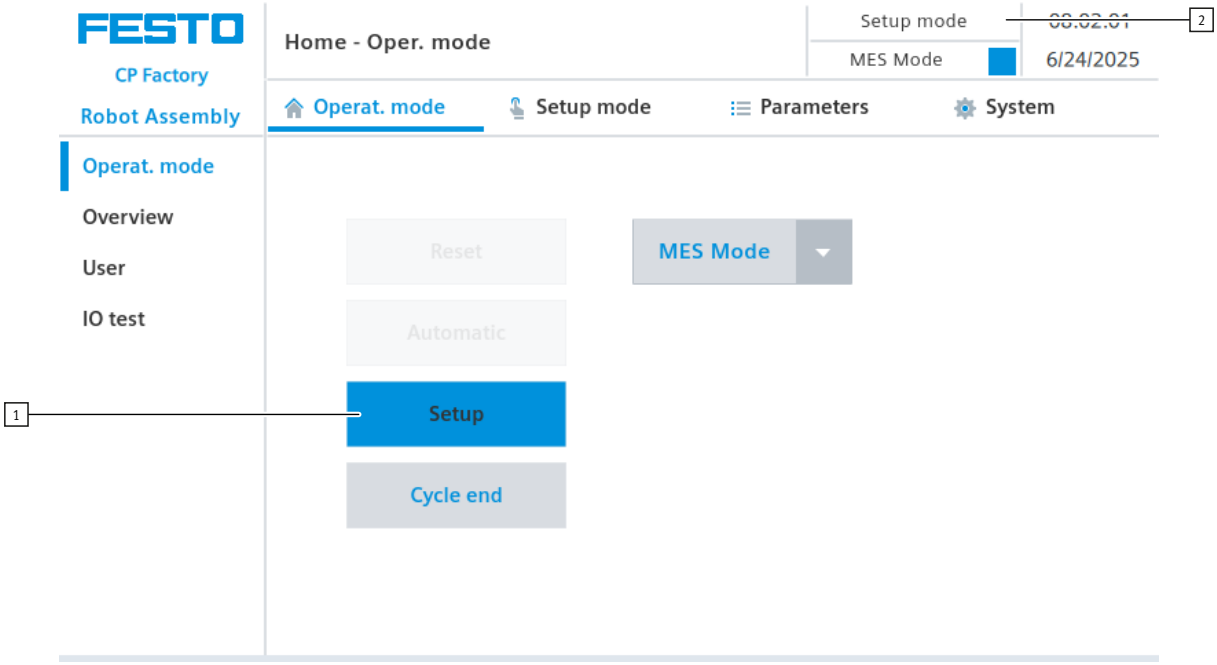


1 After switching on the station, the *"Reset"* button is activated. Press the *"Reset"* button to move the station to its home position.

2 If the reset operating mode is active, this is displayed here.

7.6.2 Setup Operating Mode

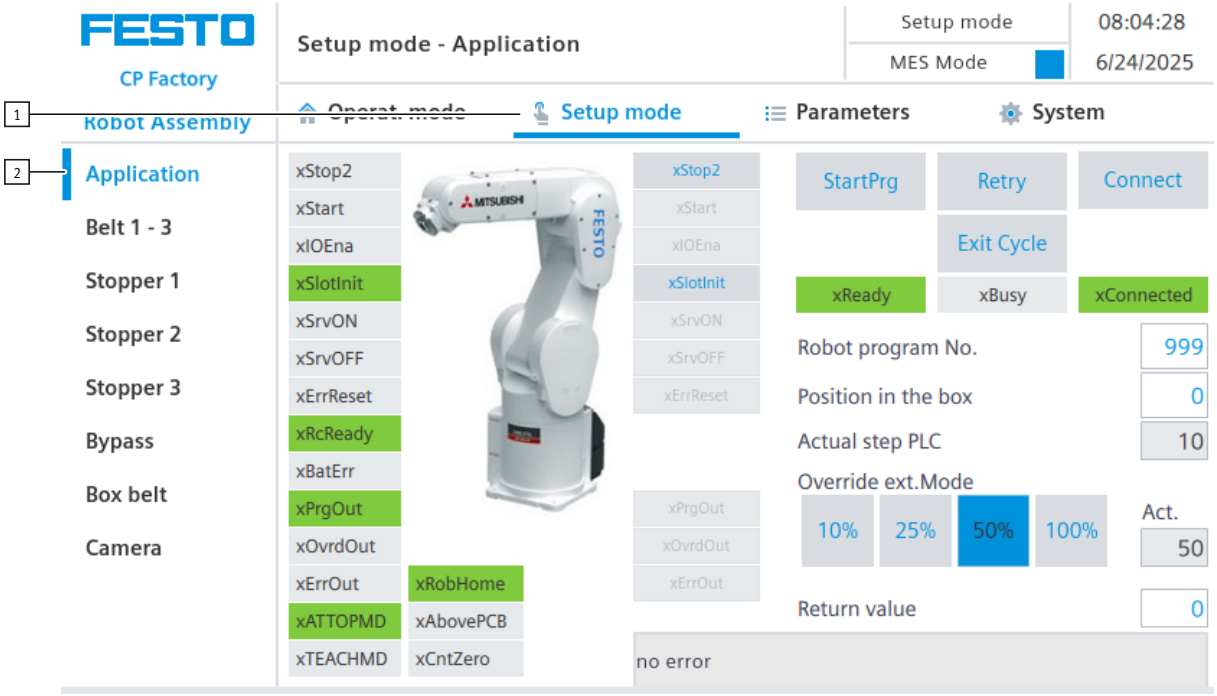
In setup operating mode, all sensors can be displayed and actuators can be controlled from the HMI. This is used for troubleshooting or during commissioning.



1 The automatic mode is not active. Press the *"Setup"* button to activate the setup operating mode.

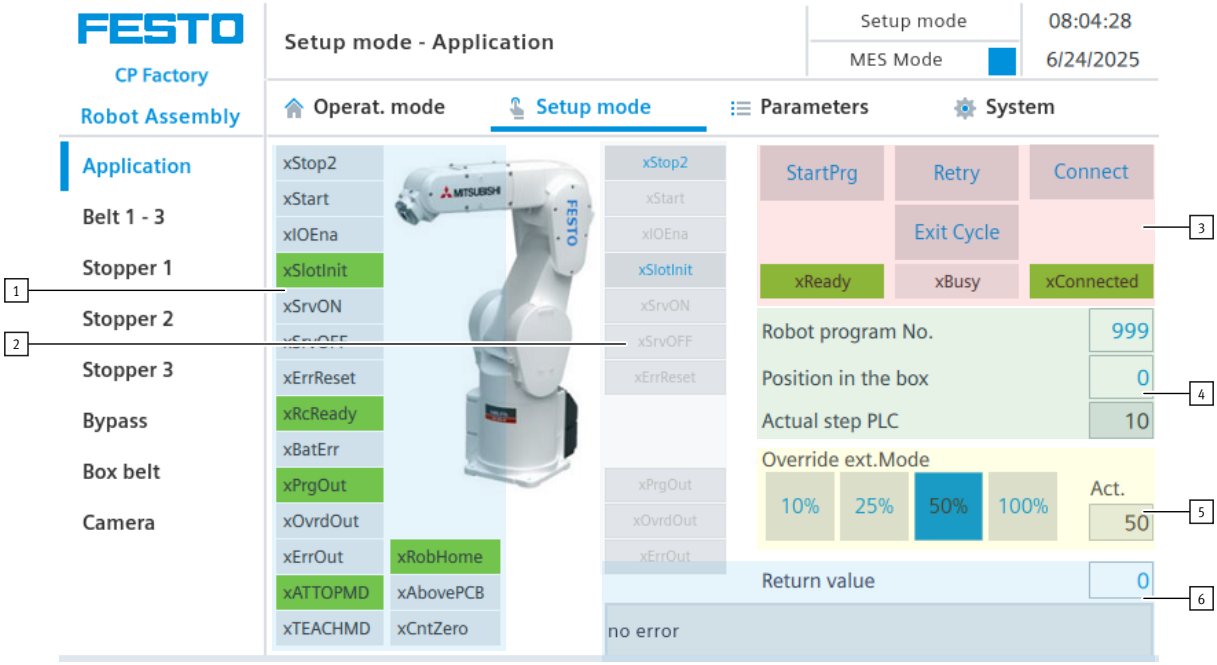
2 Display of active setup mode.

Set up application



1 Click on the *"Setup mode"* button in the main menu to activate the setup operating mode.

2 Press the *"Application"* button.



1 Robot inputs display (green when active)

xStop2 – Movement stopped

xStart – Movement started

xIOEna – The robot is controlled by an external controller

xSlotInit – Slot 1 of the robot is initialized

xSrvON – Servo mode switched on

xSrvOFF – Servo mode switch off

xErrReset – Reser error

xRcReady – Robot drive unit is ready

xBatErr – The robot's battery is empty

xPrgOut – Outputs program area is selected

xOvrdOut – Outputs override area is selected

xErrOut – The robot has an error

xATTOMPD – The robot is in automatic mode

XTEACHMID – The robot is in manual mode

XRobHome – The robot is in initial position

xAbovePCB – The robot is over the PCB

XCntZero – Reset counter to zero

2 Robot outputs display (blue when active)

xStop2 – Stop movement

xStart – Start movement

xIOEna – Operate the robot via an external controller

xSlotInit – Initialize slot 1 of the robot

xSrvON – Switch on servo mode

xSrvOFF – Switch off servo mode

xErrReset – Reset error

xPrgOut – Select outputs program area

xOvrdOut – Select overwrite outputs area

xErrOut – The robot has an error

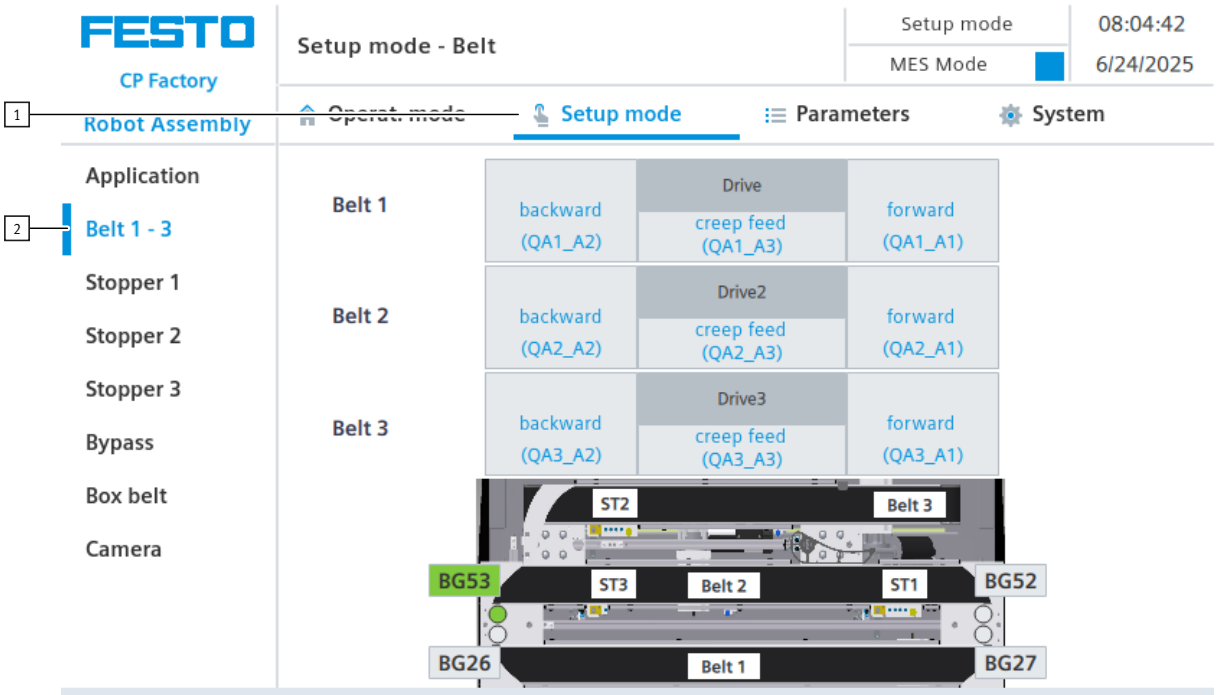
3 Control robot (blue if active)
Start Prog. – Start the robot program
Repeat – Try again
Connect – Connect to the drive unit
Exit Cycle – End the current cycle
xReady – The robot is ready
xBusy – The robot is busy (display of current step)
xConnected – Drive unit connection established

4 Robot further information
Program number – Program number as in the drive unit
Position in the box– Position of the PCB within the box
Current step PLC – Display of the current step of the control system

5 Override: Adjust the speed of the robot

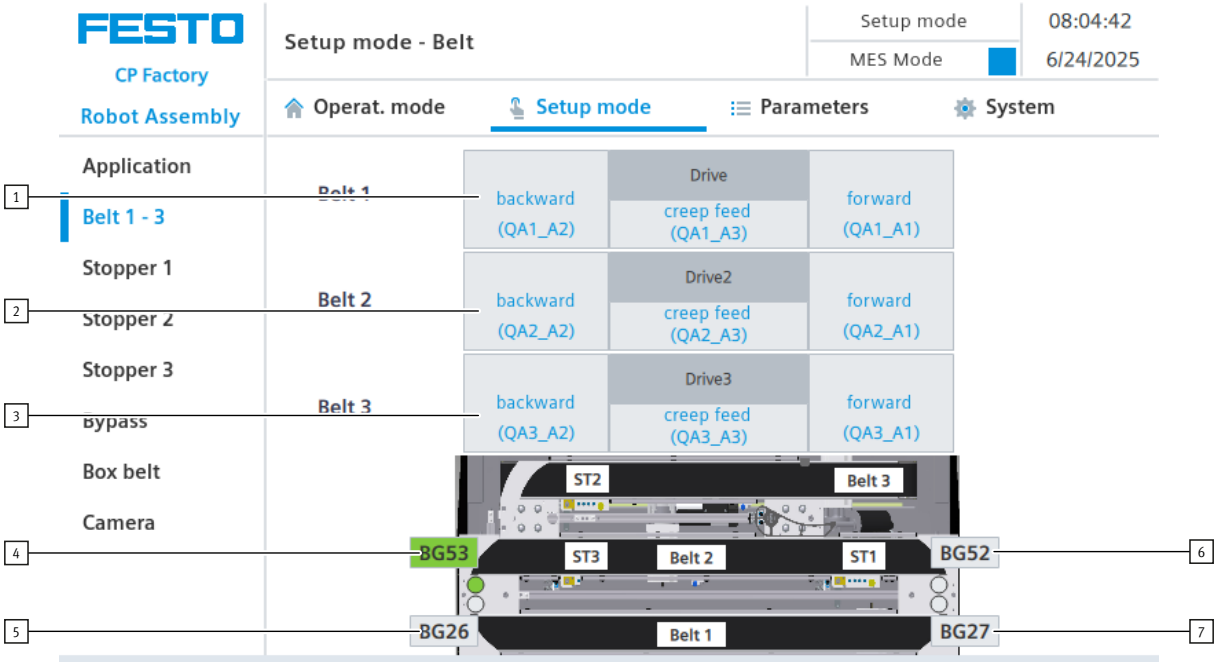
6 Return value – Return value of the robot program
Text description of the return value

Setup belt 1-3



1 Click the *"Setup mode"* button.

2 Select the *"Belt 1-3"* button – the functions of the conveyor are displayed and/or controlled here.



1 *"backward"* button: Move belt 1 to the left (actuator QA1_A2 is activated, lights up blue when active); Drive 1 display
"creep feed" button: Set belt speed to slow; Move belt 1 slowly (actuator QA1_A3 is activated, lights up blue when active);
"forward" button: Move belt 1 to the right (actuator QA1_A1 is activated, lights up blue when active)

2 *"backward"* button: Move belt 2 to the left (actuator QA2_A2 is activated, lights up blue when active); Drive 2 display
"creep feed" button: Set belt speed to slow; Move belt 2 slowly (actuator QA2_A3 is activated, lights up blue when active);
"forward" button: Move belt 2 to the right (actuator QA2_A1 is activated, lights up blue when active)

3 *"backward"* button: Move belt 3 to the left (actuator QA3_A2 is activated, lights up blue when active); Drive 3 display
"creep feed" button: Set belt speed to slow; Move belt 1 slowly (actuator QA3_A3 is activated, lights up blue when active);
"forward" button: Move belt 3 to the right (actuator QA3_A1 is activated, lights up blue when active)

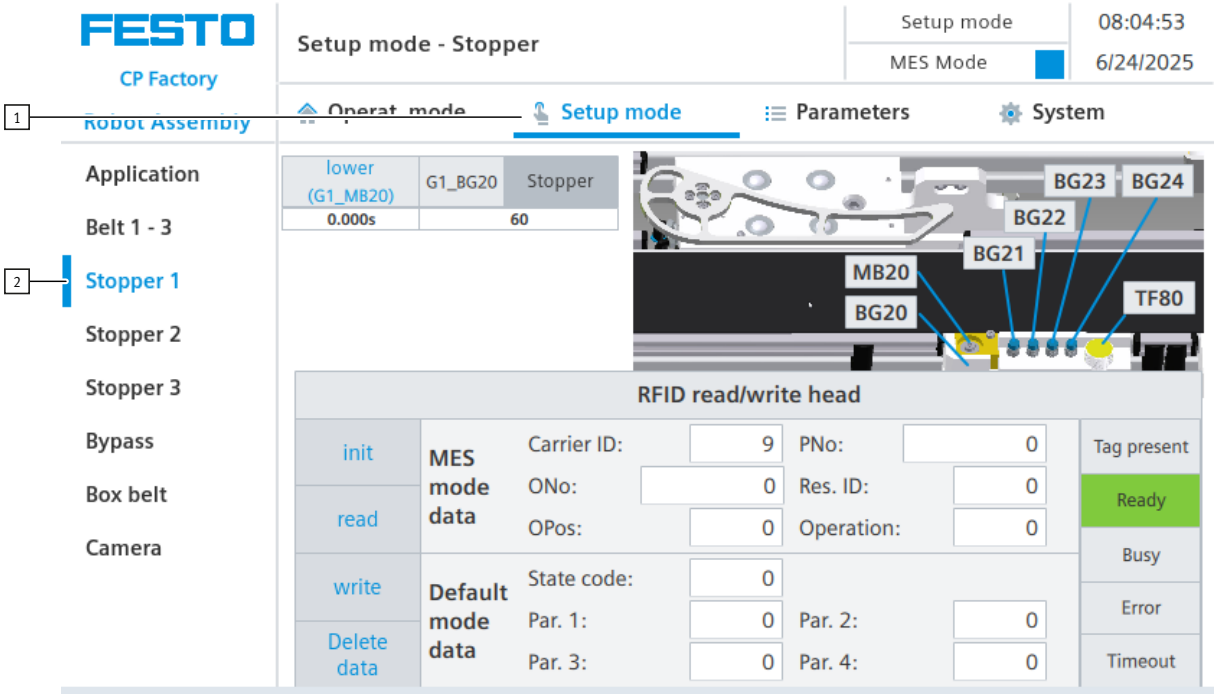
4 Sensor BG53 outfeed belt display (lights up green when active).

5 Sensor BG26 infeed belt display (lights up green when active).

6 Sensor BG52 infeed belt display (lights up green when active).

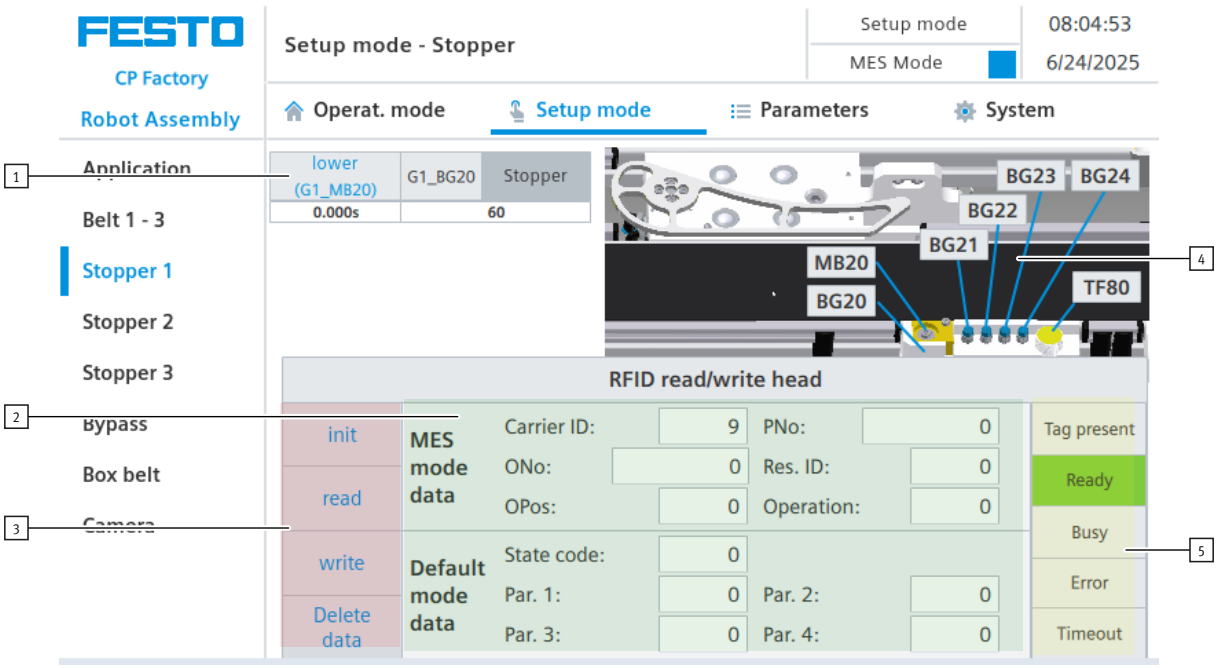
7 Sensor BG27 outfeed belt display (lights up green when active).

Set up stopper 1



1 Click the *"Setup mode"* button.

2 Select the *"Stopper 1"* button – the functions of stopper position 1 are displayed and/or controlled here.



1 *"Lower"* button: Move stopper 1 down (actuator G1_MB20 is activated, lights up blue when active) / G1_BG20: Sensor G1_BG20 stopper down (lights up green when active) / Stopper: Stopper display

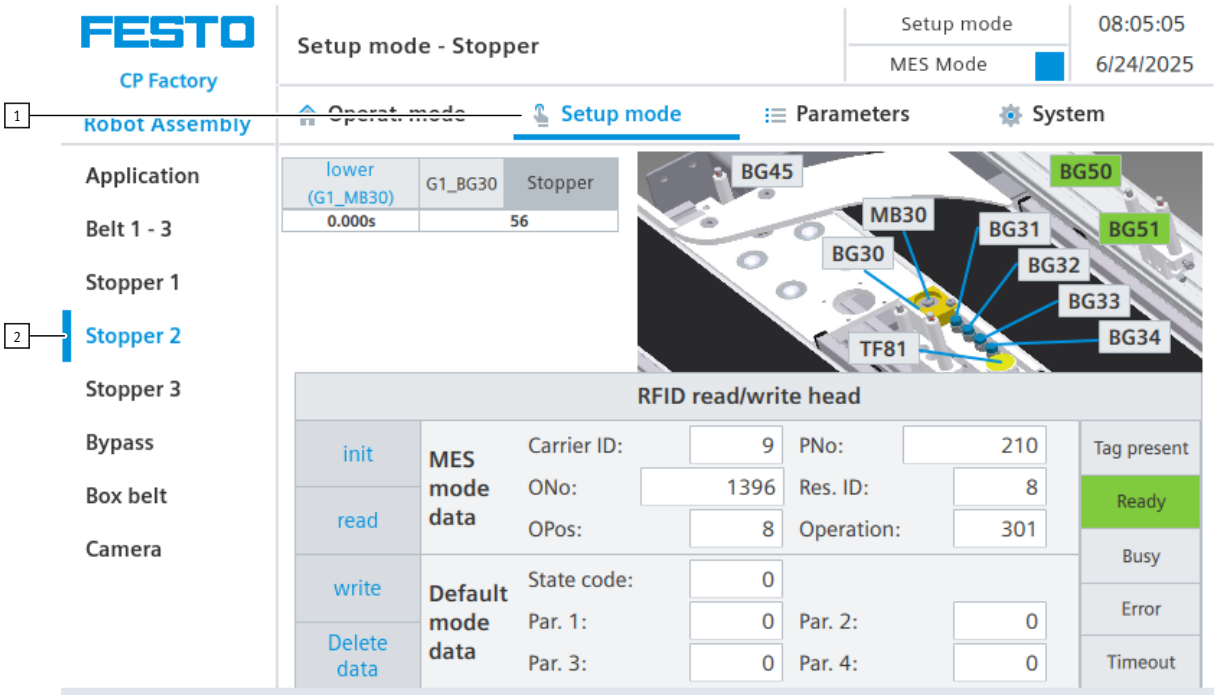
2 Area RFID data / MES mode: Display of order data / Default mode: Display of RFID status

3 Area Write and read RFID
Initialize: Set RFID data to zero
Read: Read RFID data
Write: Write current data to RFID
Delete display: All data in the input screen is deleted – not directly on the RFID (for easier input)

4 Area Display of active sensors (lights up green when active) and actuators (lights up orange when active) on the stopper

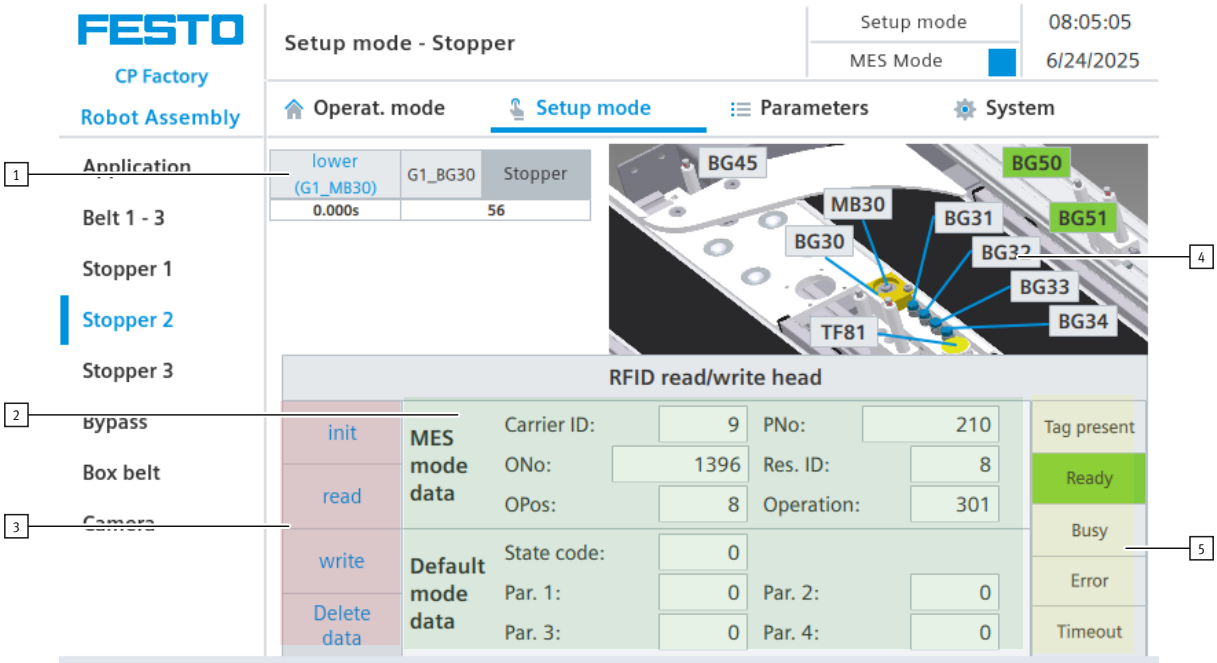
5 Display of the RFID read status

Set up stopper 2



1 Click the *"Setup mode"* button.

2 Select the *"Stopper 2"* button – the functions of stopper position 1 are displayed and/or controlled here.



1 *"Lower"* button: Move stopper 2 down (actuator G1_MB30 is activated, lights up blue when active) / G1_BG30: Sensor G1_BG30 stopper down (lights up green when active) / Stopper: Stopper display

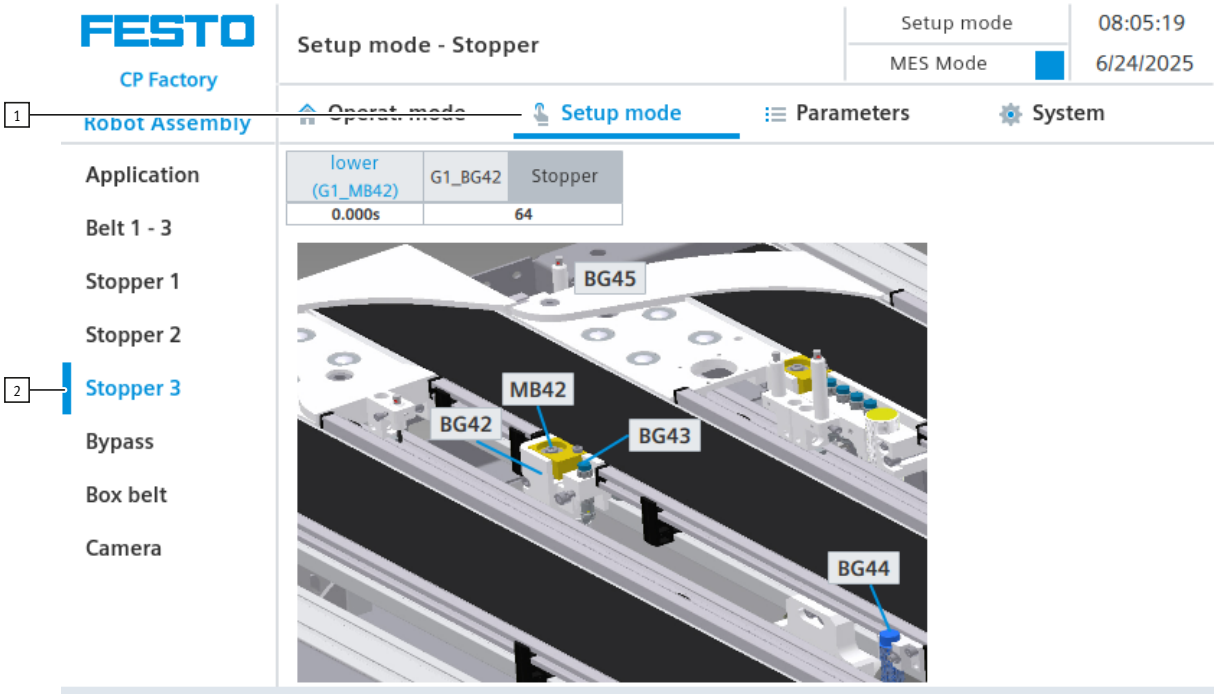
2 Area RFID data / MES mode: Display of order data / Default mode: Display of RFID status

3 Area Write and read RFID
Initialize: Set RFID data to zero
Read: Read RFID data
Write: Write current data to RFID
Delete display: All data in the input screen is deleted – not directly on the RFID (for easier input)

4 Area Display of active sensors (lights up green when active) and actuators (lights up orange when active) on the stopper

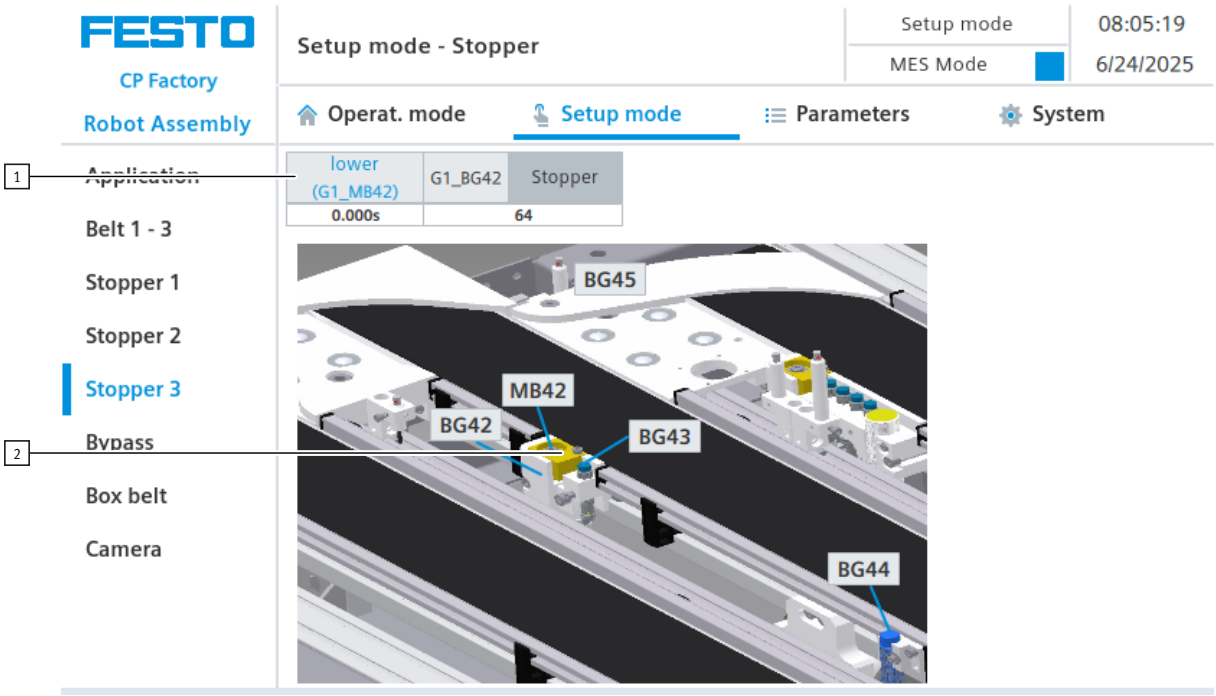
5 Display of the RFID read status

Set up stopper 3



1 Click the *"Setup mode"* button.

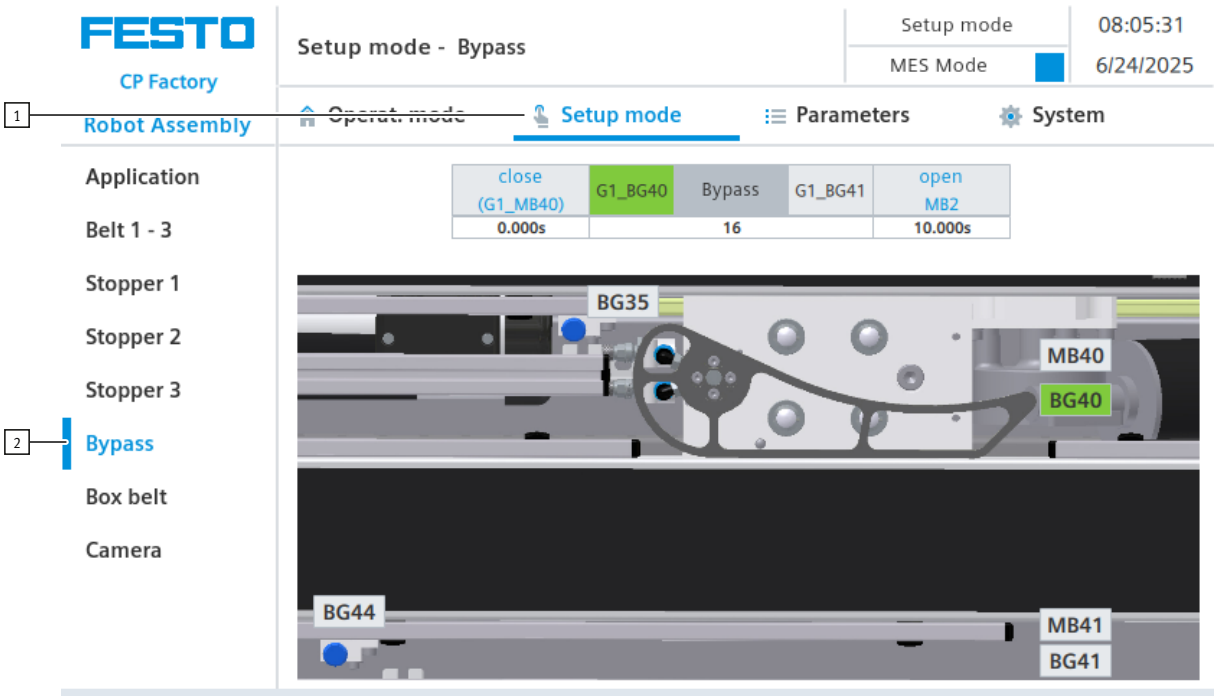
2 Select the *"Stopper 3"* button – the functions of stopper position 1 are displayed and/or controlled here.



1 *"Lower"* button: Move stopper 1 down (actuator G1_MB42 is activated, lights up blue when active) / G1_BG42: Sensor G1_BG42 stopper down (lights up green when active) / Stopper: Stopper display

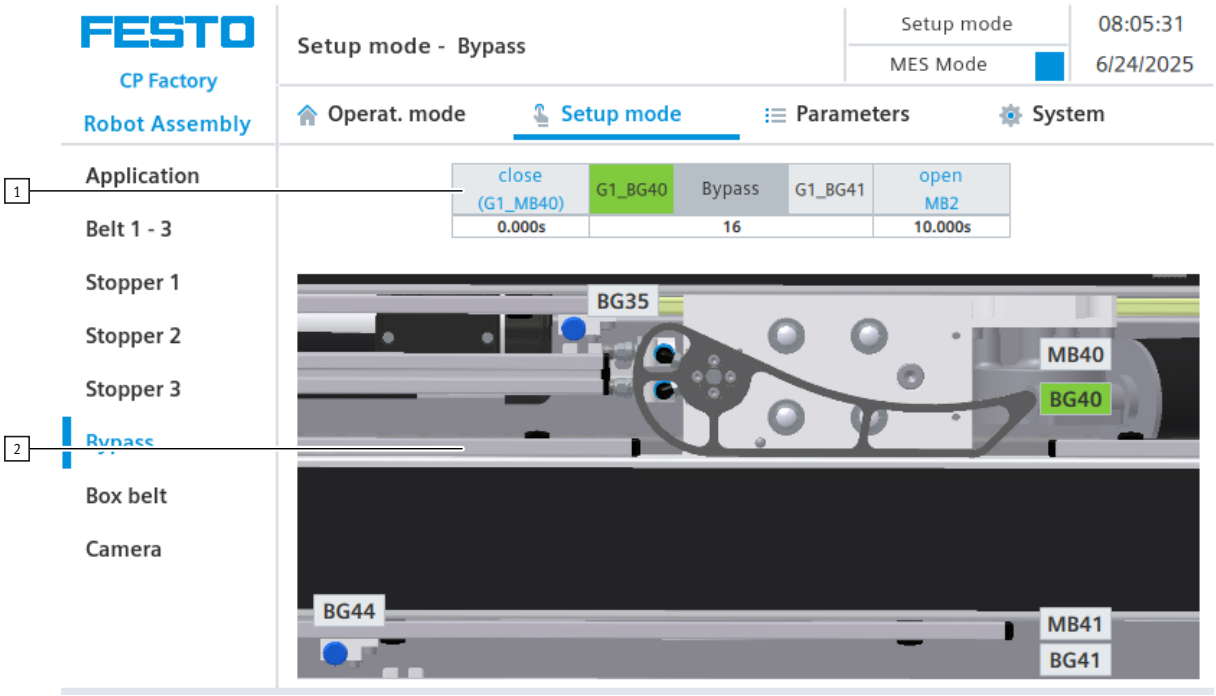
2 Area Display of active sensors (lights up green when active) and actuators (lights up orange when active) on the stopper

Set up bypass



1 Click the *"Setup mode"* button.

2 Select the *"Bypass"* button – the bypass functions are displayed and/or controlled here.



1 Operate bypass

"close" button: Set bypass to close position (actuator G1_MB40 is activated, lights up blue when active)

G1_BG40: Sensor G1_BG40 bypass in closed position (lights up green when active)

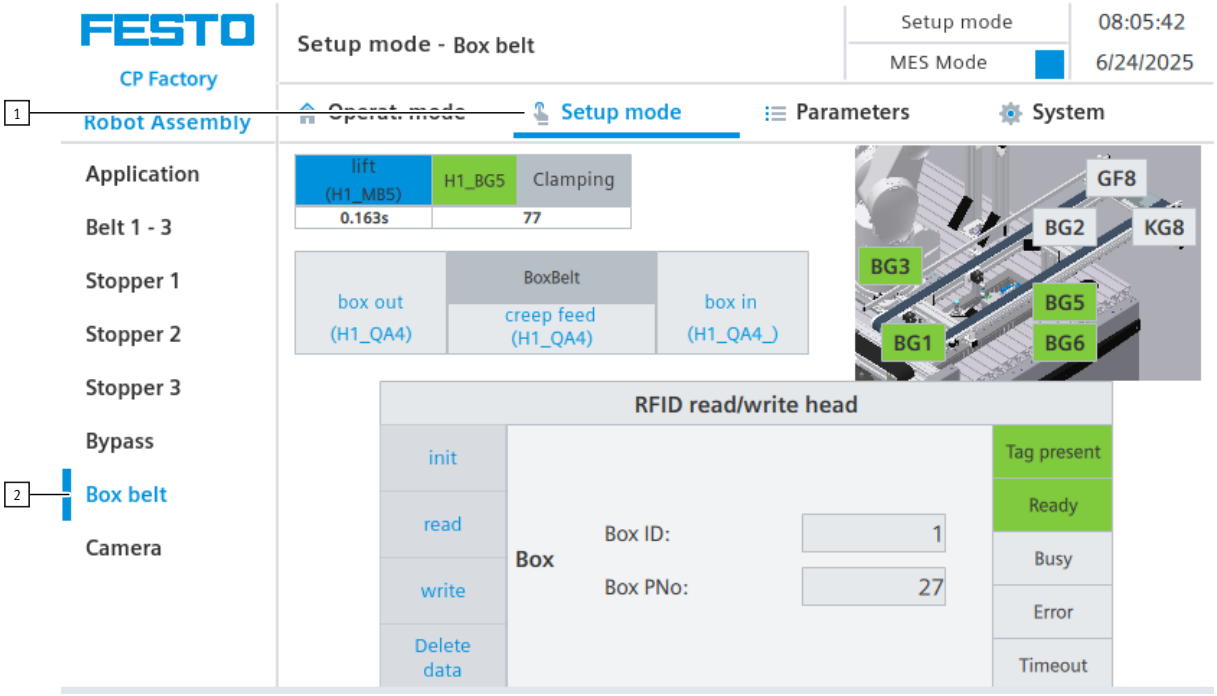
Bypass: Bypass display

G1_BG41: Sensor G1_BG41 turn off outfeed

"open" button: Set bypass to close position (actuator MB2 is activated, lights up blue when active)

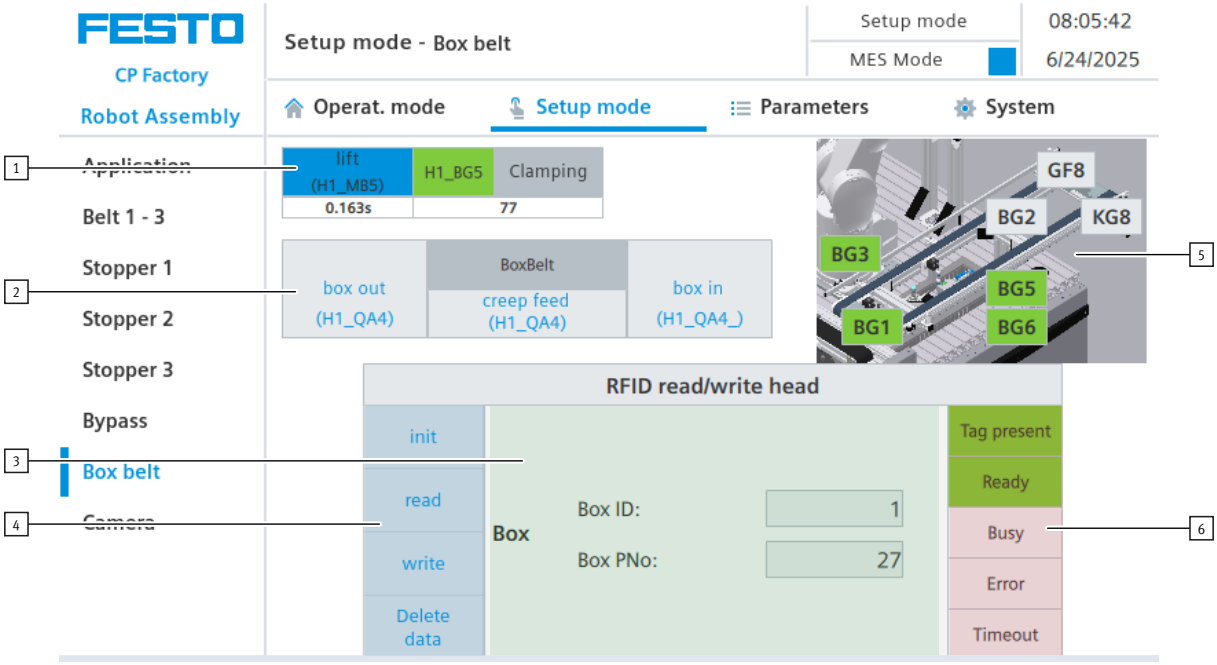
2 Area Display of active sensors (lights up green when active) and actuators (lights up orange when active) on the stopper

Set up Box belt



1 Click the *"Setup mode"* button.

2 Select the *"Box belt"* button – the Box belt functions are displayed and/or controlled here.



1 Clamping
Lift: Extend clamping (actuator H1_MB5 is activated, lights up blue when active)
H1_BG5: Sensor H1_BG5 clamping extended (lights up green when active)
Clamping: Clamping display

2 Box belt
box out: box out belt moves anticlockwise to the left (actuator H1_QA4 is activated, lights up blue when active)
BoxBelt:: box belt display
"creep feed" button: Set belt speed slowly; move belt 2 slowly (actuator H1_QA4 is activated, lights up blue when active)
Box in: box in belt moves clockwise to the right (actuator H1_QA4 is activated, lights up blue when active)

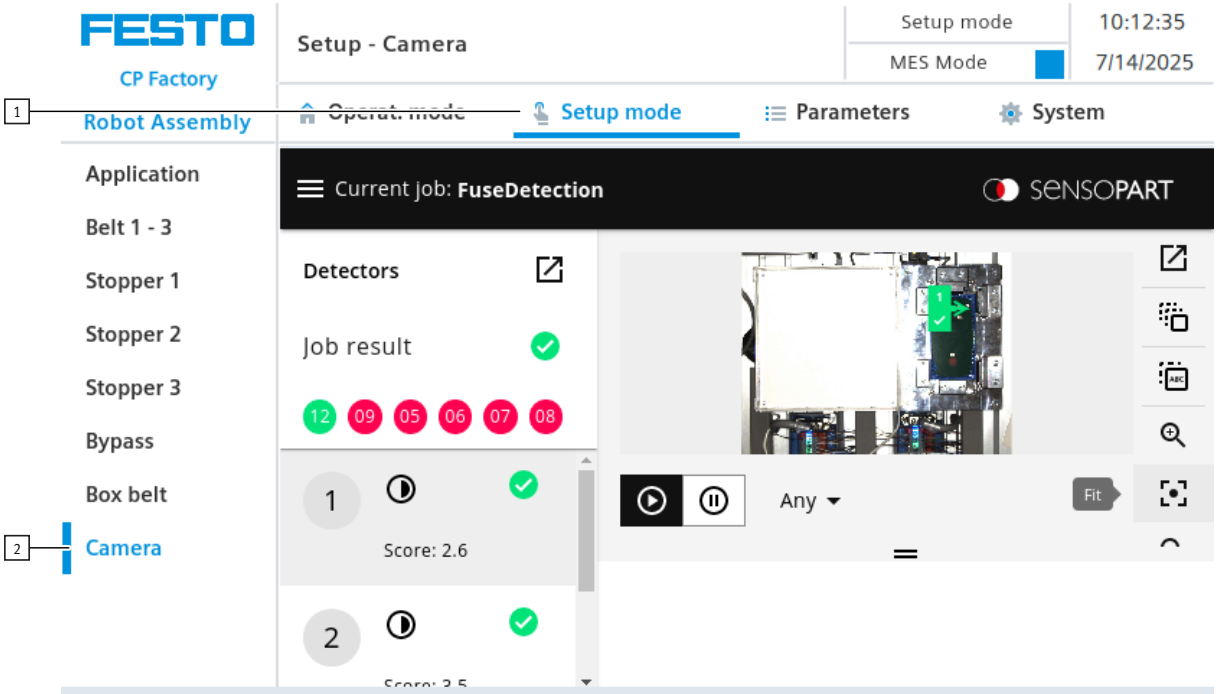
3 Area RFID data
MES mode: Display of order data
Default mode: Display of RFID status

4 Area Write and read RFID
Initialize: Set RFID data to zero
Read: Read RFID data
Write: Write current data to RFID
Delete display: All data in the input screen is deleted – not directly on the RFID (for easier input)

5 Area Display of active sensors (lights up green when active) and actuators (lights up orange when active)

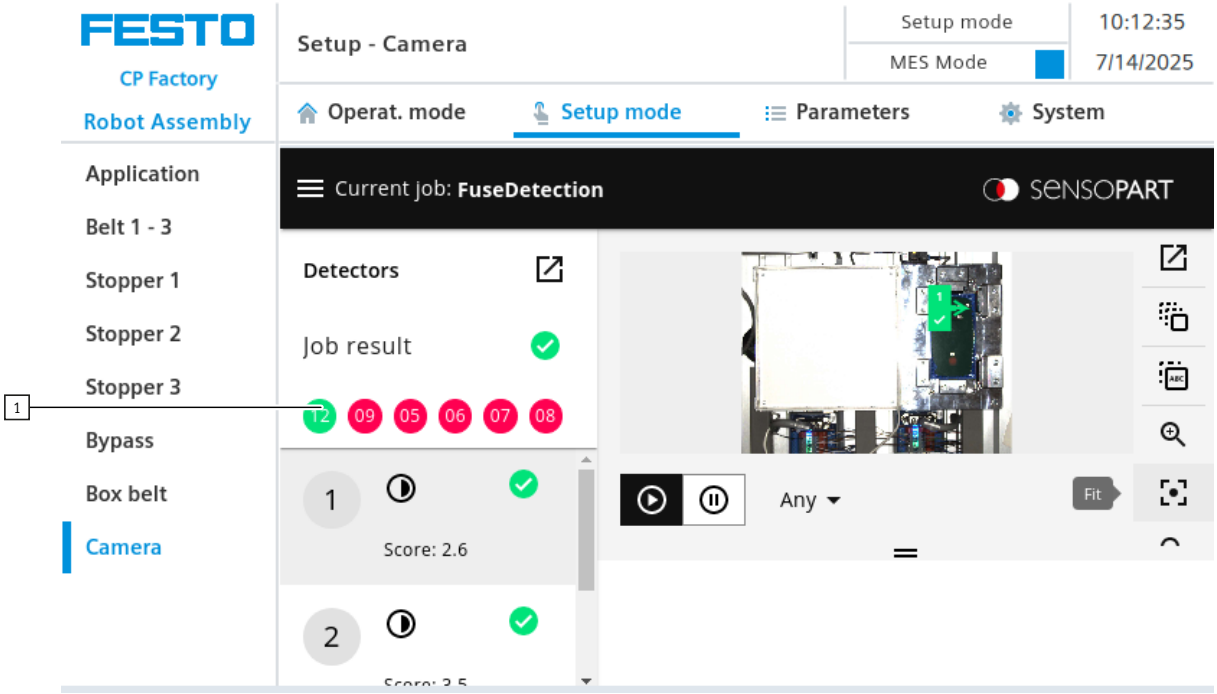
6 Display of the RFID read status

Set up the camera



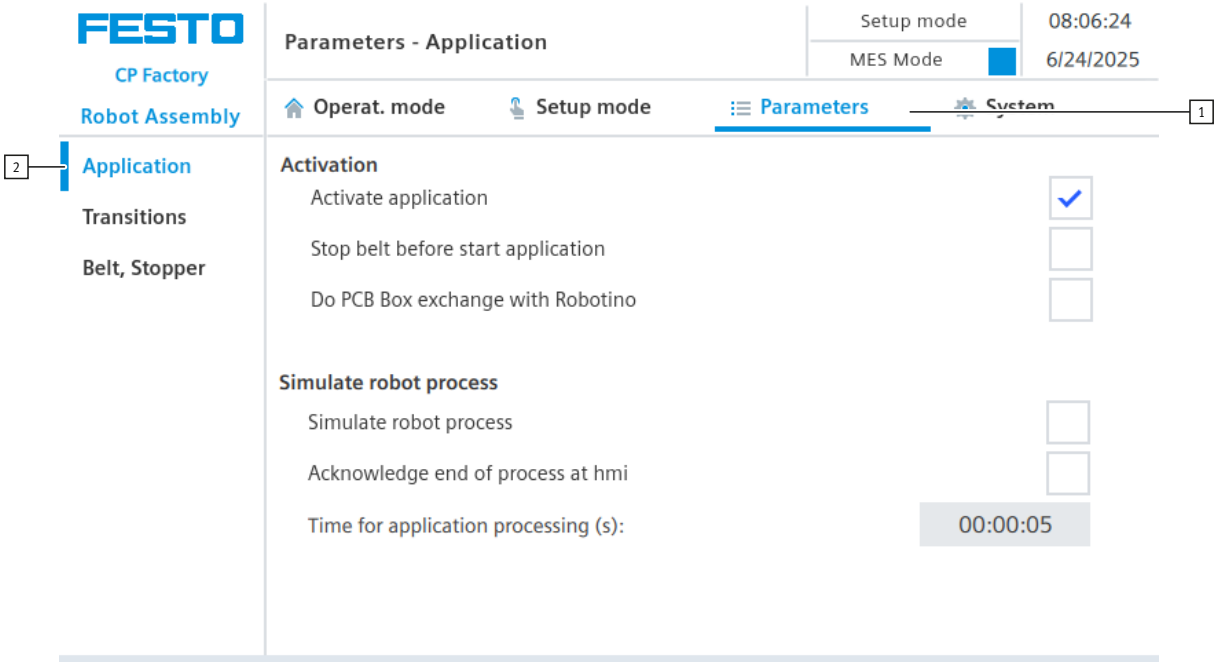
1 Click the *"Setup mode"* button.

2 Select the *"Camera"* button – the camera functions are displayed and/or controlled here.



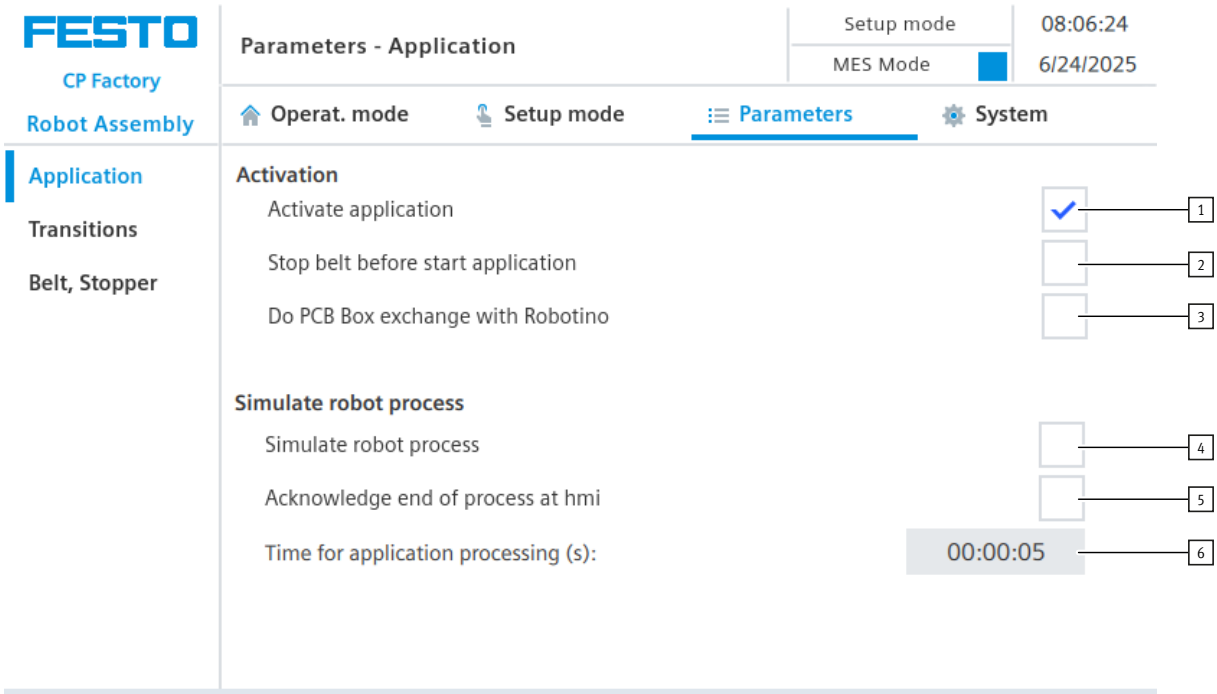
1 Display of camera information from the camera website. More detailed information can be found in the camera manual.

Set up application parameters



1 Click the *"Parameters"* button

2 Select the *"Application"* button – the parameters of the CP application module can now be set here.



1 The application module can be activated here (checkbox activated). If no CP application module is activated, the workpiece carrier is stopped at the stopper and released again without being processed.

2 Stop belt before start application: The belt is stopped before the application starts.

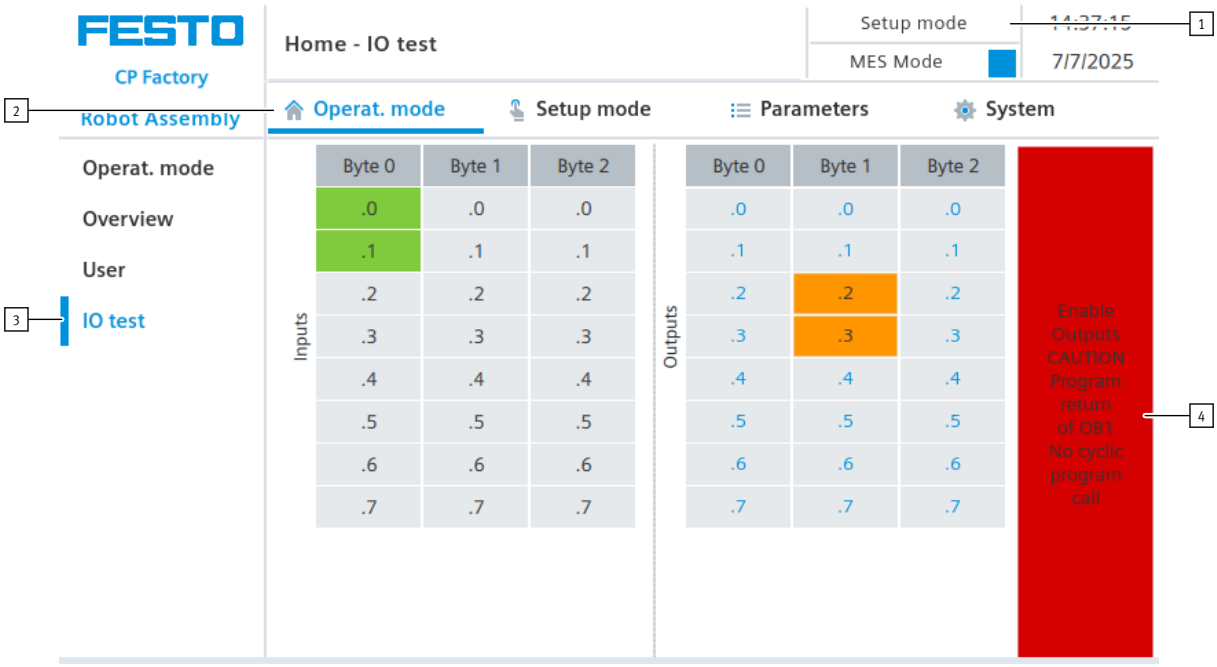
3 Do PCB Box exchange with robotino: Check this box if the boxes are not fed manually but via Robotino

4 In simulation mode, it is possible to specify whether a manual workstation or the application module should be simulated. See chapter Worker guidance and process simulation on free AP.

5 If you want to confirm the end of processing, activate this checkbox. The process is only continued once this has been confirmed on the HMI, otherwise the process is continued automatically after processing has ended.

6 The processing time for a simulation can be entered here.

I/O test

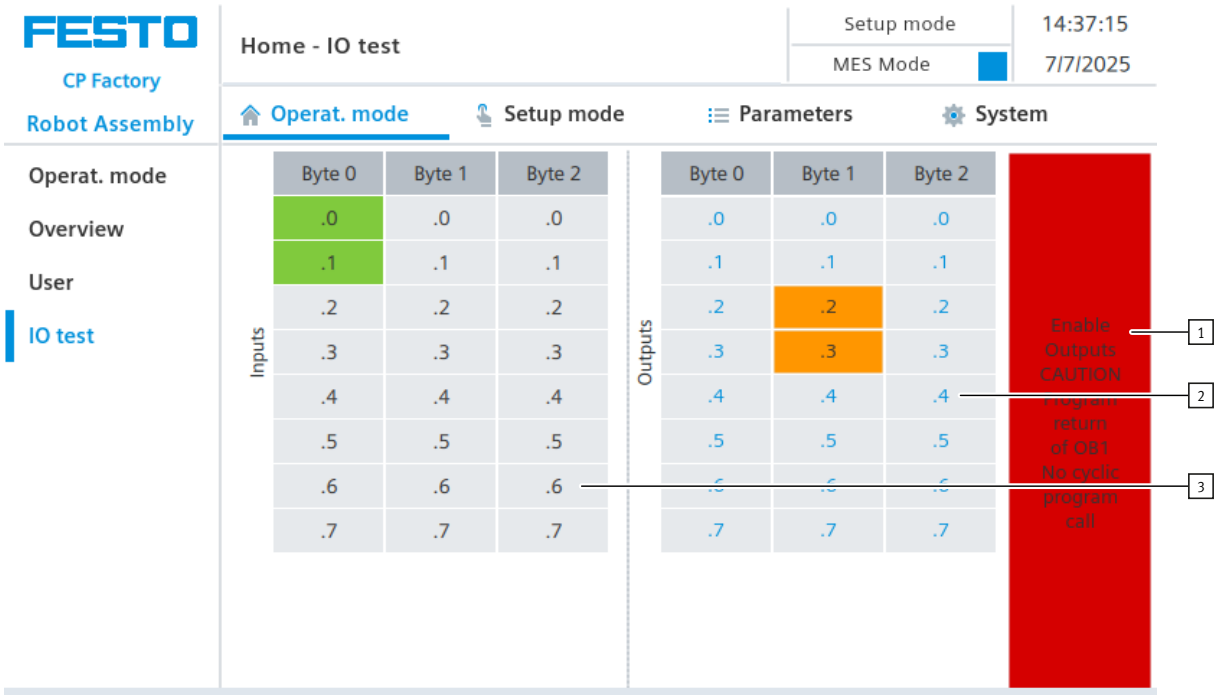


1 Setup mode must be active.

2 Select Operation mode.

3 Select IO test.

4 Clicking this area enables the outputs and they can be activated. Registration as "Administrator" is required.

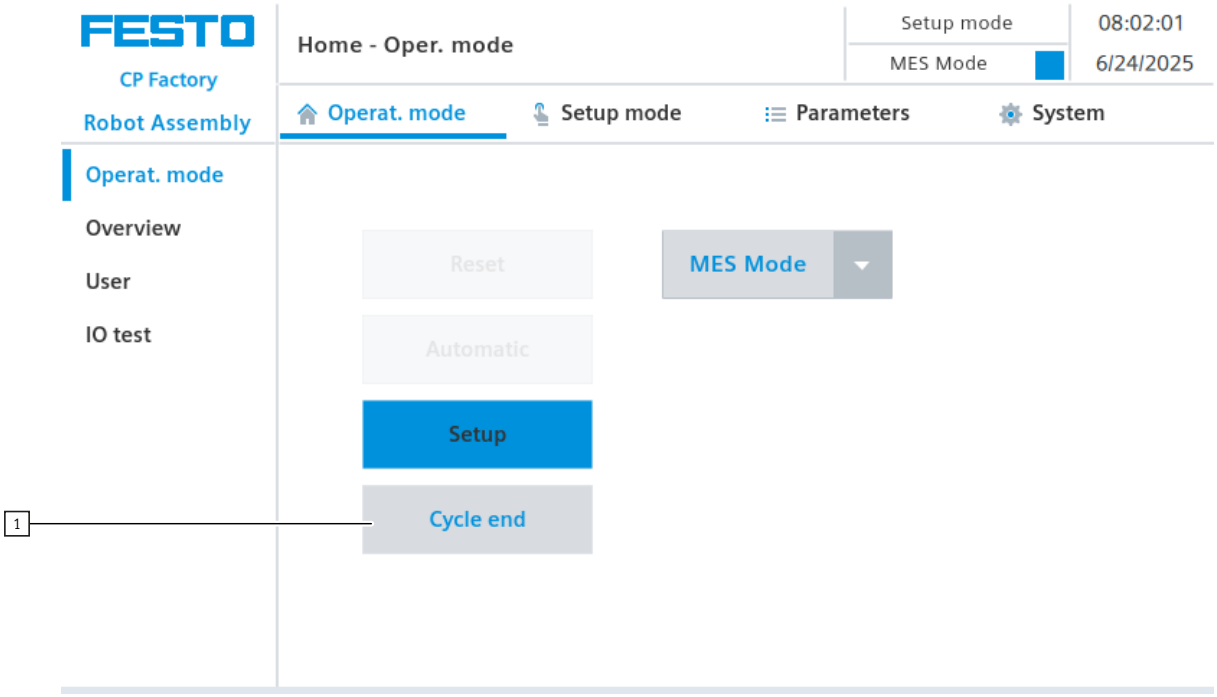


1 The outputs are blocked again by clicking this box again.

2 Clicking a box activates this digital output (orange if active).

3 Display of the inputs (green when active).

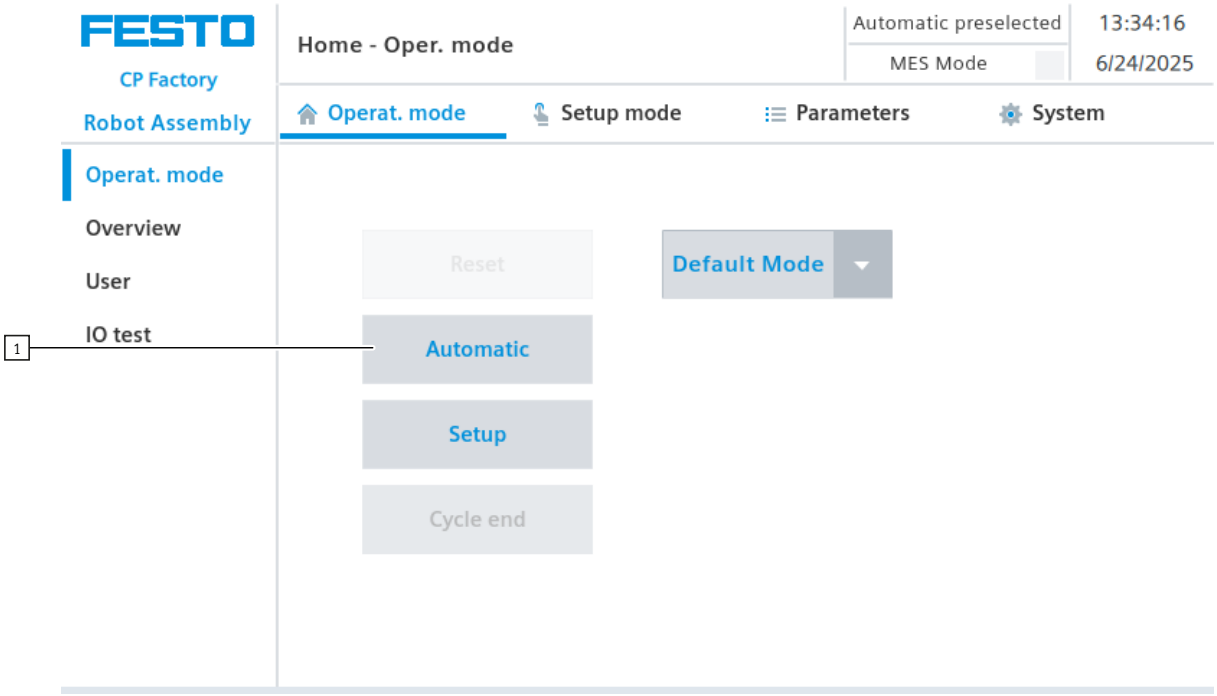
Exit Setup operating mode



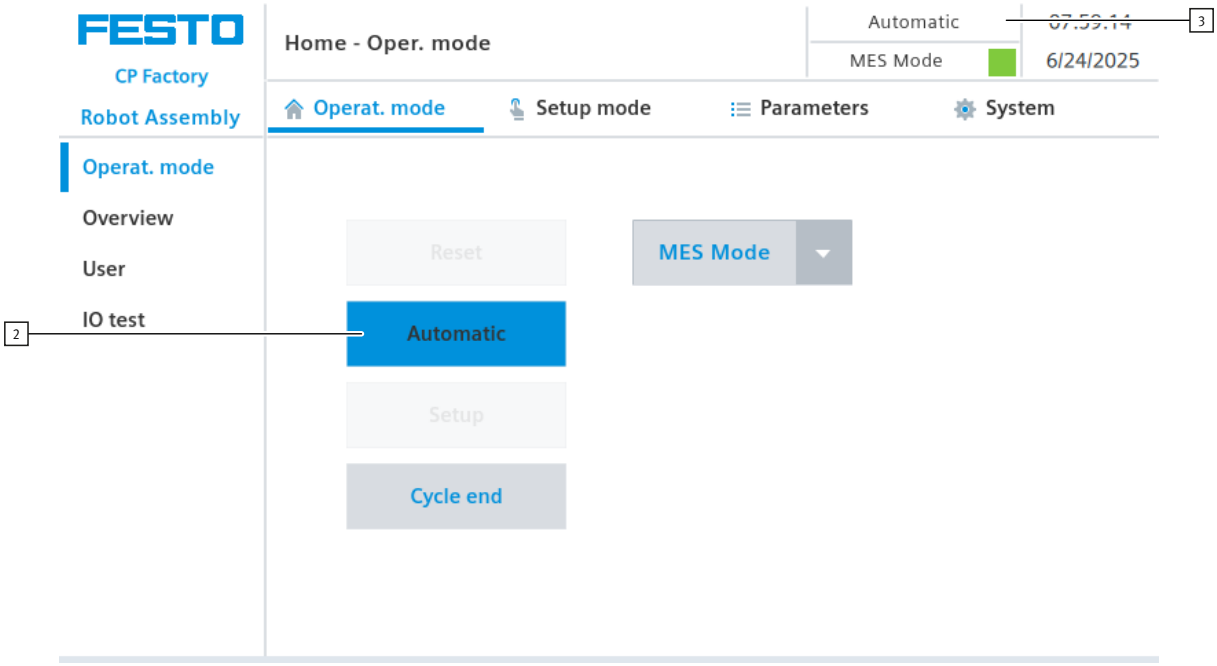
1 To exit the Setup operating mode, press the *"Cycle end"* button.

7.6.3 Automatic Operating Mode

In automatic mode, the desired automatic sequences can be carried out on the station. Depending on the selected operating mode, the processes are controlled via the transition tables (default) or via MES.



1 *"Automatic"* button – Press the button to activate the automatic mode.

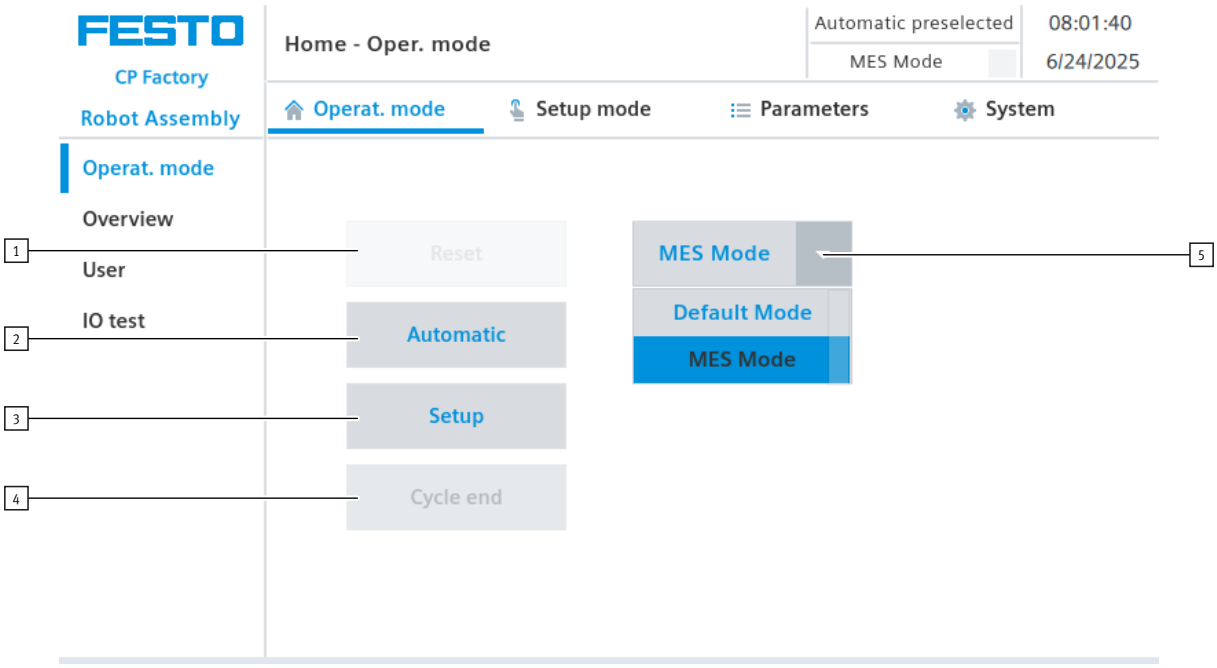


2 Automatic mode is activated, the button lights up blue.

3 Display of active automatic mode.

7.6.3.1 Main Menu – Home

Operating mode submenu



1 *"Reset"* button: Start aligning process.

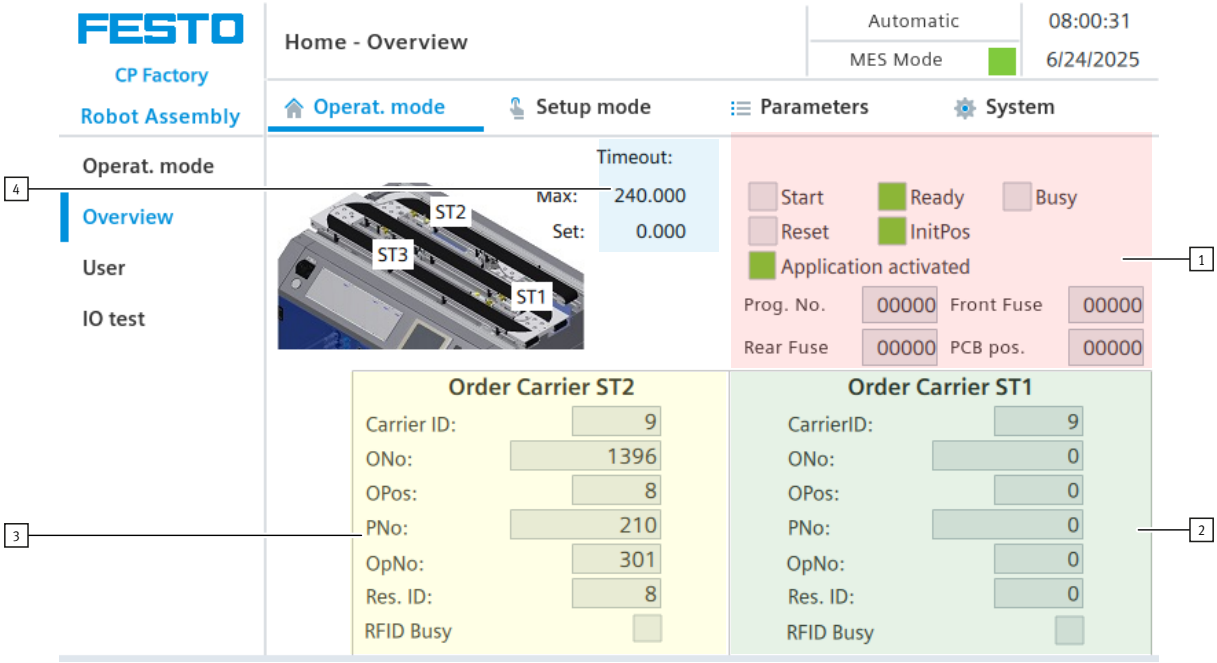
2 *"Automatic"* button: An automatic process is started here depending on the mode (Default/MES).

3 *"Setup"* button: The application module can be controlled manually and sensors can be displayed here. Suitable for commissioning an application module or for troubleshooting. There is no difference in terms of mode – setup mode is independent of default or MES mode.

4 *"Cycle end"* button: The currently active operating mode is stopped here.

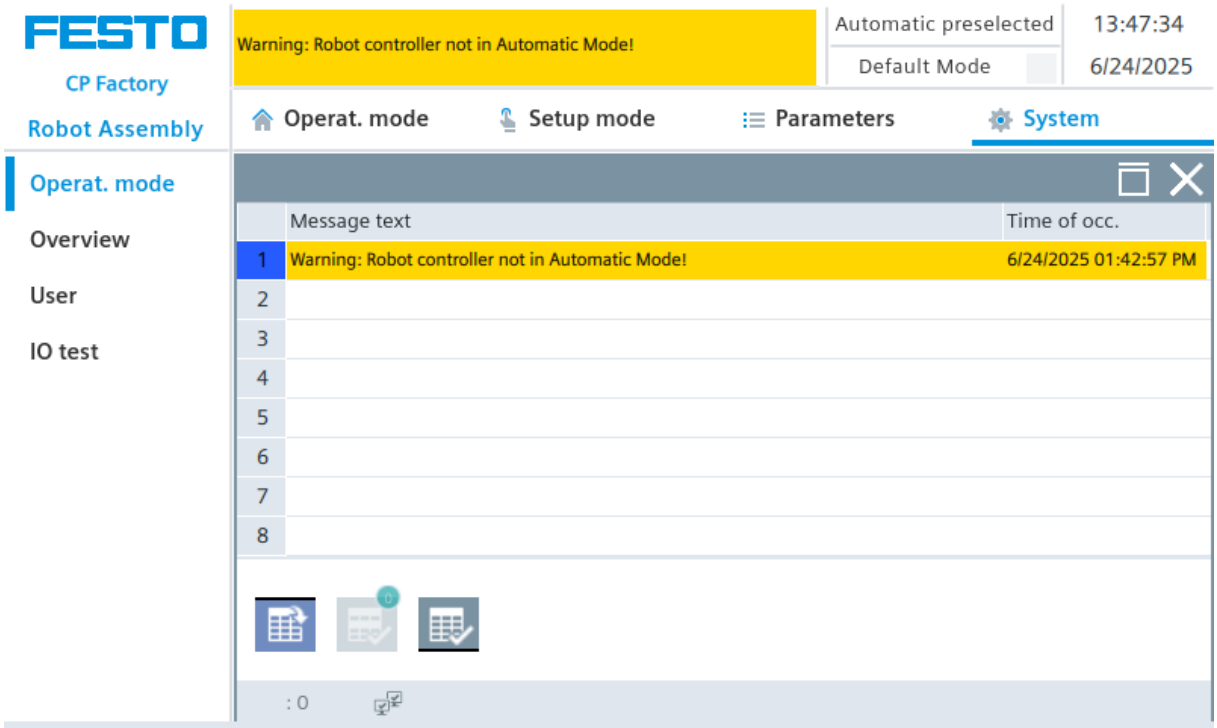
5 Mode selection:
Default – automatic sequence is processed with the stored transitions; MES – automatic sequence is completely controlled by the MES software.

Overview submenu



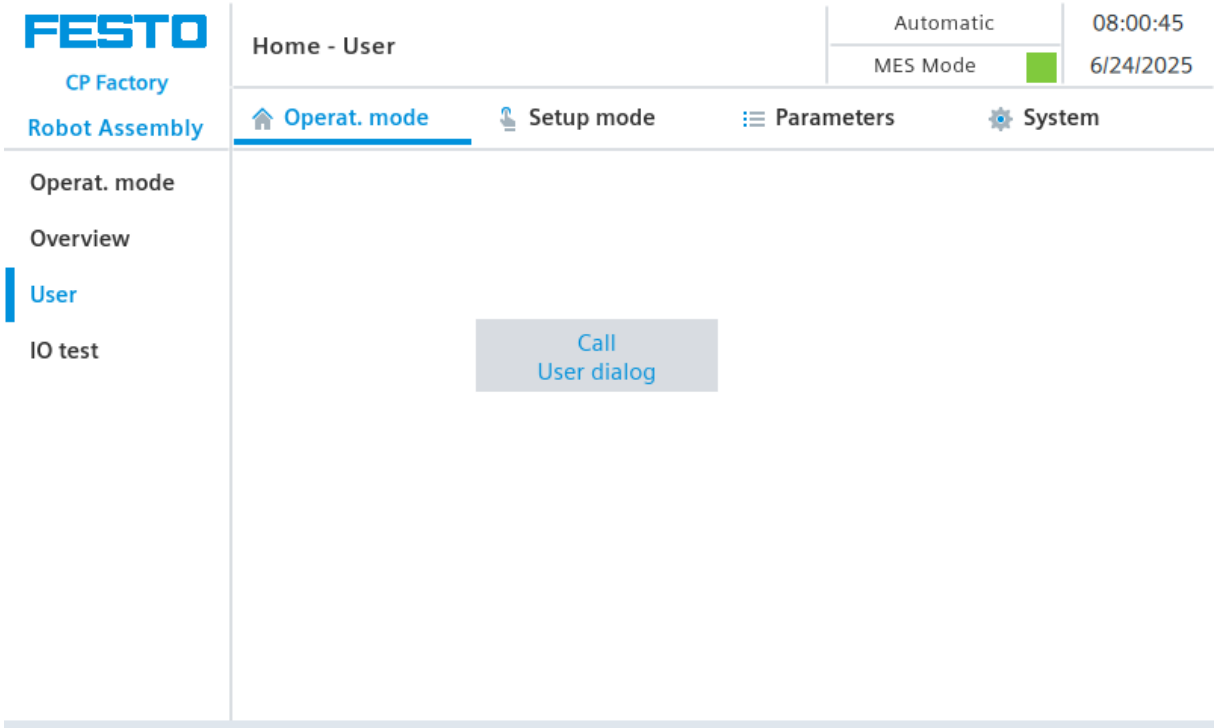
1 Display of various functions (highlighted in green when active).
2 Display of the order data of the current workpiece carrier ST1.
3 Display of the order data of the current workpiece carrier ST2.
4 Display of various information about the station and its parameters.

Various statuses are displayed in the home operating mode on the overview page. (changing content depending on the selected operating mode)



Error messages are also displayed in the overview window.

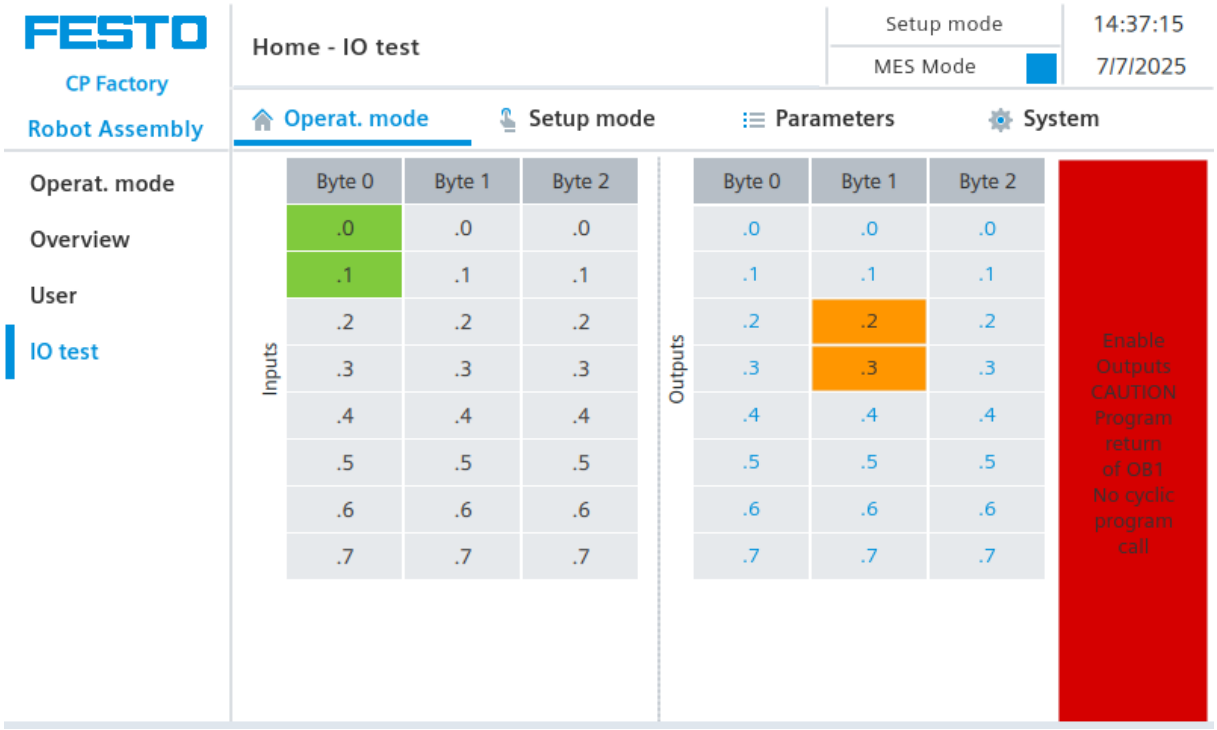
User submenu



It is possible to create different operators here. The function is independent of the selected mode (MES or default)

Display/edit all users, logon as "Administrator" is required.

I/O test submenu



The inputs/outputs are displayed here. The outputs can also be activated in setup mode.

7.6.3.2 Main Menu – Setup

See chapter Set up operating mode.

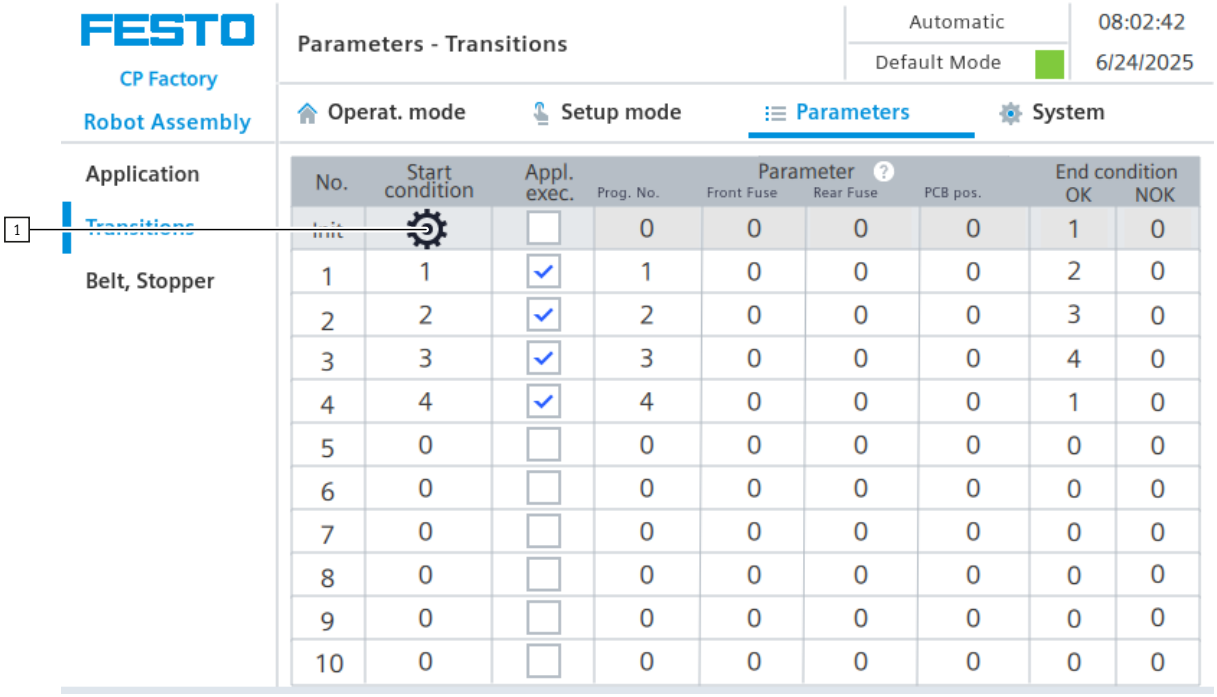
7.6.3.3 Main Menu – Parameters

Application submenu

See chapter Set up operating mode.

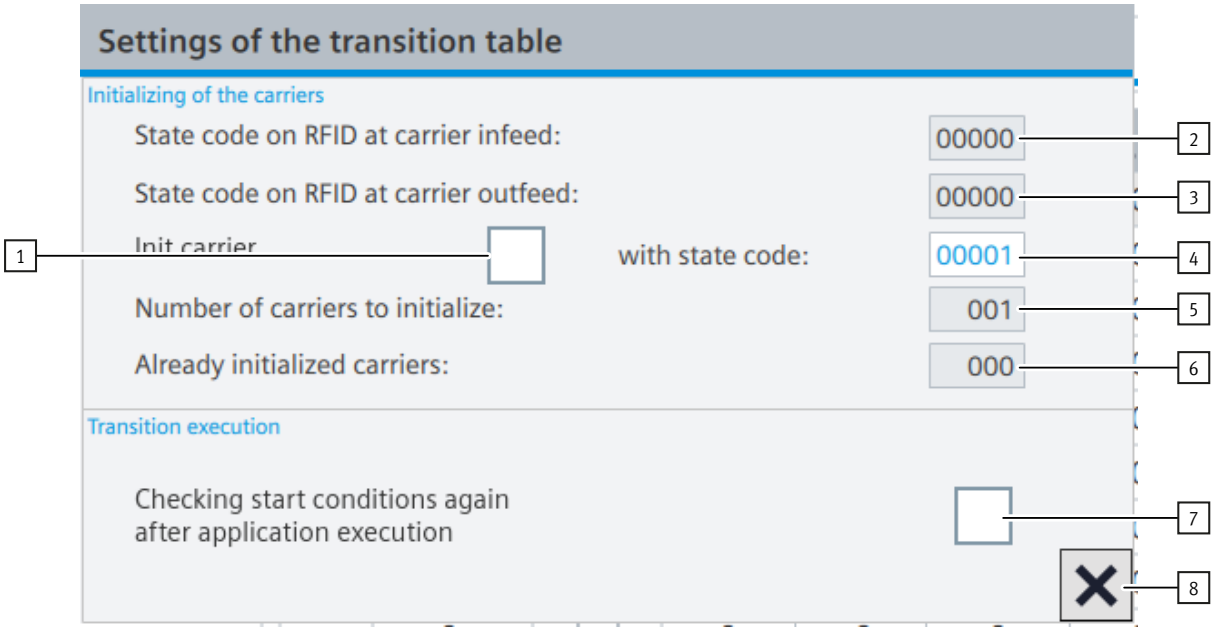
Transitions submenu

If the "Transitions" submenu is selected, the transitions of the CP application module are displayed.



No.	Start condition	Appl. exec.	Parameter: Prog. No.	Front Fuse	Rear Fuse	PCB pos.	End condition: OK	NOK
Init	⚙	☐	0	0	0	0	1	0
1	1	☑	1	0	0	0	2	0
2	2	☑	2	0	0	0	3	0
3	3	☑	3	0	0	0	4	0
4	4	☑	4	0	0	0	1	0
5	0	☐	0	0	0	0	0	0
6	0	☐	0	0	0	0	0	0
7	0	☐	0	0	0	0	0	0
8	0	☐	0	0	0	0	0	0
9	0	☐	0	0	0	0	0	0
10	0	☐	0	0	0	0	0	0

1 Click the gear to access the transition settings. (see following image)



1 Initialize workpiece carrier: The next workpiece carrier that arrives at the stopper position is initialized with the finished state (status code can be entered under item 4) of the first line of the transition table.

2 Status code on the RFID at the workpiece carrier infeed: Display of the start condition for application processing.

3 Status code on the RFID at workpiece carrier outfeed: Display of the final status after application processing.

4 With status code: During initialization (Item 1 / Initialize workpiece carrier), the workpiece carrier is initialized with the status code entered here

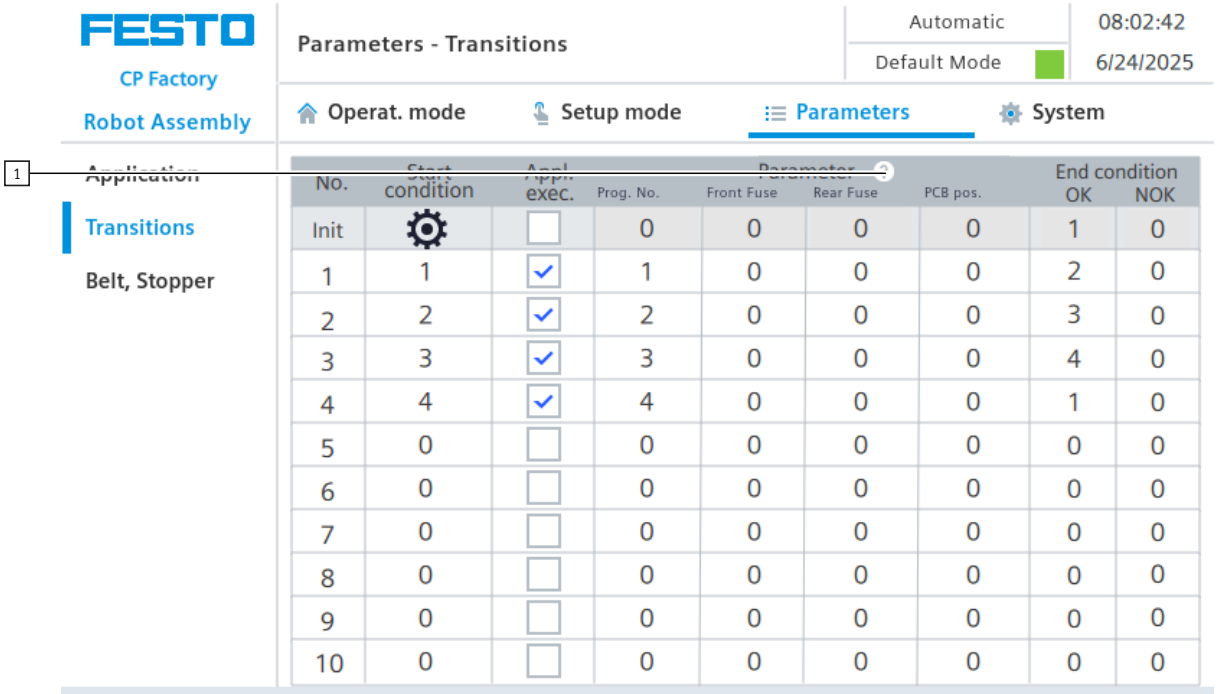
5 Number of workpiece carriers to be initialized: Editable, the number of workpiece carriers to be initialized can be entered here.

6 Already initialized workpiece carriers: Display of the already initialized workpiece carriers.

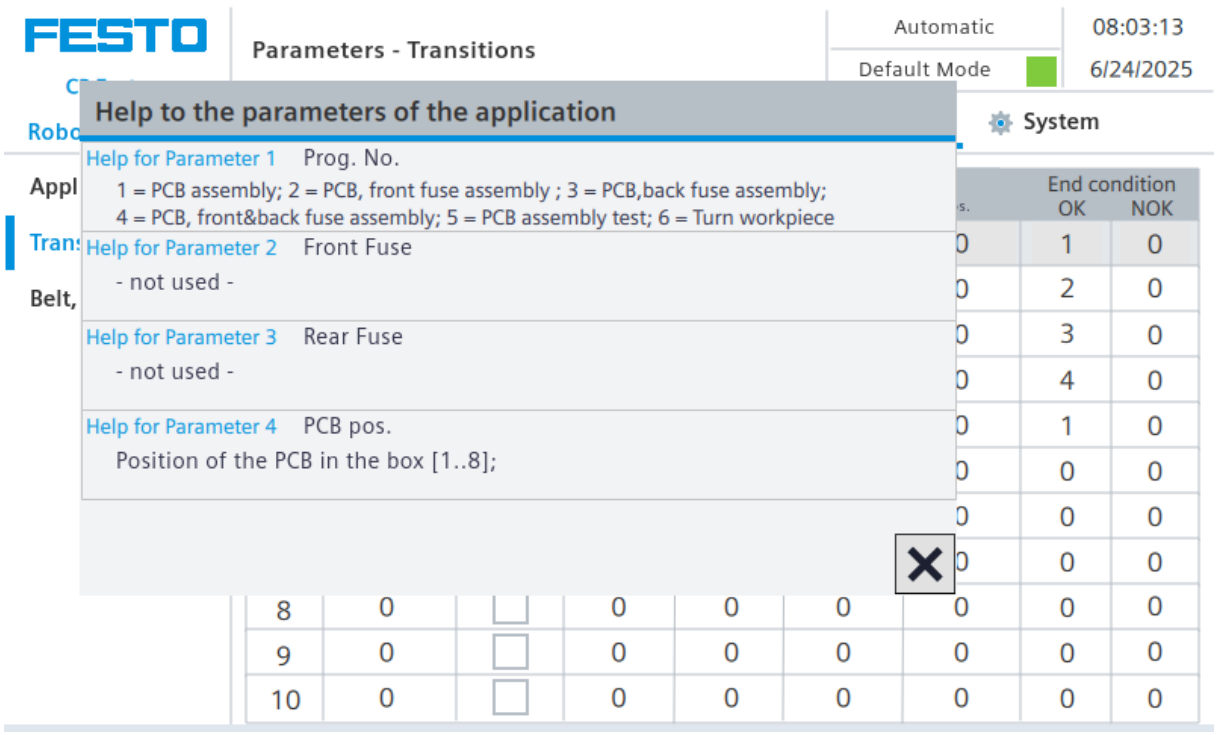
7 Re-check start conditions after application execution: If this function is activated, the start conditions are checked again after a transition condition has been processed. This makes it possible to run an application several times without the workpiece carrier leaving the working position

8 Exit settings.

Help for the parameters

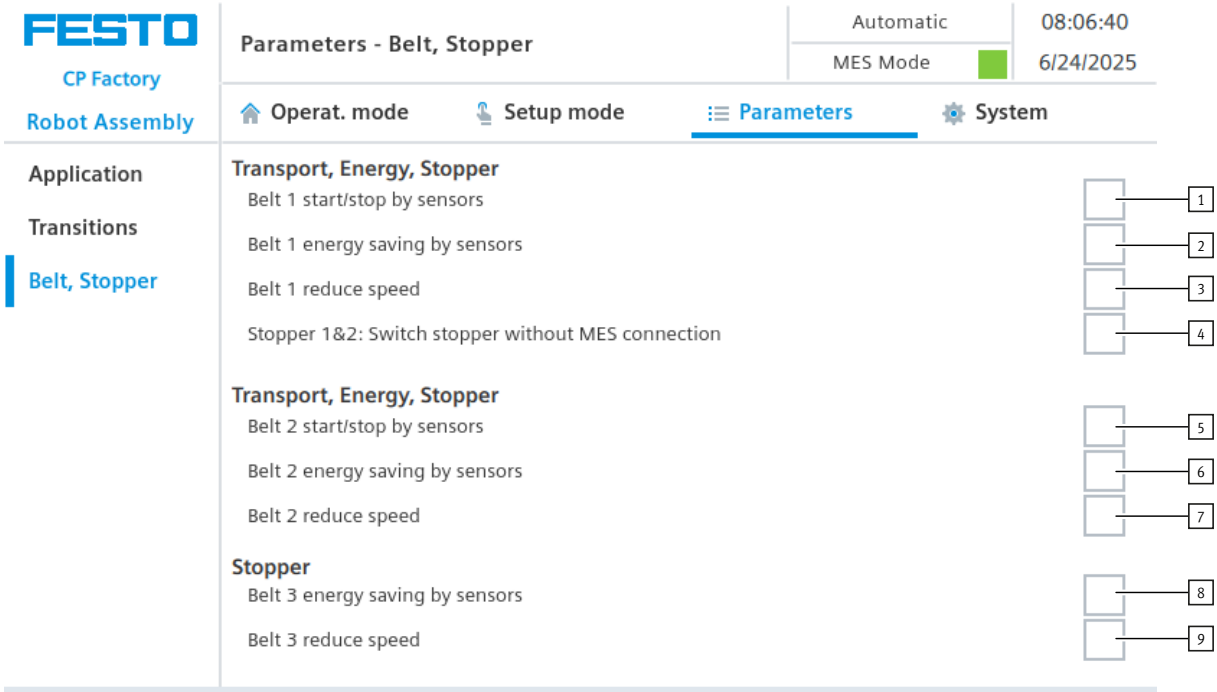


1. Press the question mark to open a help window.



2. All parameters are listed in detail in the help window.

Belt, stopper submenu



1 Belt 1 start/stop by sensors:
Check this box if the belt should be switched automatically using the sensors at the ends of the belt. Switch on when the sensor at the start of the belt detects a product carrier, switch off when the sensor at the end of the conveyor detects that a product carrier has passed by

2 Belt 1 energy-saving mode with sensors:
If no more workpieces are detected on the belt via the sensors, the belt is switched off
See the following graphic

3 Reduce belt speed:
The belt speed is reduced here to save energy

4 Stoppers 1 & 2: Switch stopper without MES connection
Function active:
MES on – goods carriers run through continuously /
MES off – goods carriers run through continuously
Function not active:
MES on – goods carriers run through continuously /
MES off – goods carriers stop

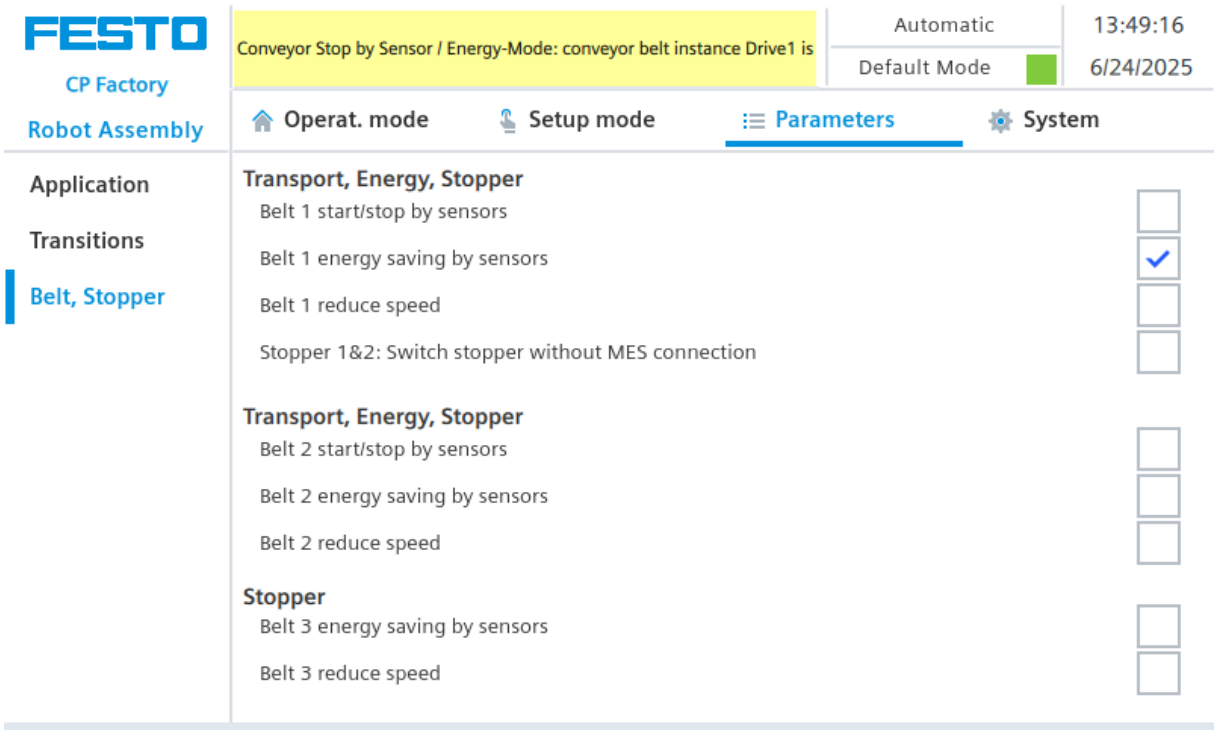
5 Belt 2 start/stop by sensors:
Check this box if the belt should be switched automatically using the sensors at the ends of the belt. Switch on when the sensor at the start of the belt detects a product carrier, switch off when the sensor at the end of the conveyor detects that a product carrier has passed by

6 Belt 2 energy-saving mode with sensors:
If no more workpieces are detected on the belt via the sensors, the belt is switched off
See the following graphic

7 Reduce belt speed:
The belt speed is reduced here to save energy

8 Belt 3 start/stop by sensors:
Check this box if the belt should be switched automatically using the sensors at the ends of the belt. Switch on when the sensor at the start of the belt detects a product carrier, switch off when the sensor at the end of the conveyor detects that a product carrier has passed by

9 Reduce belt speed:
The belt speed is reduced here to save energy

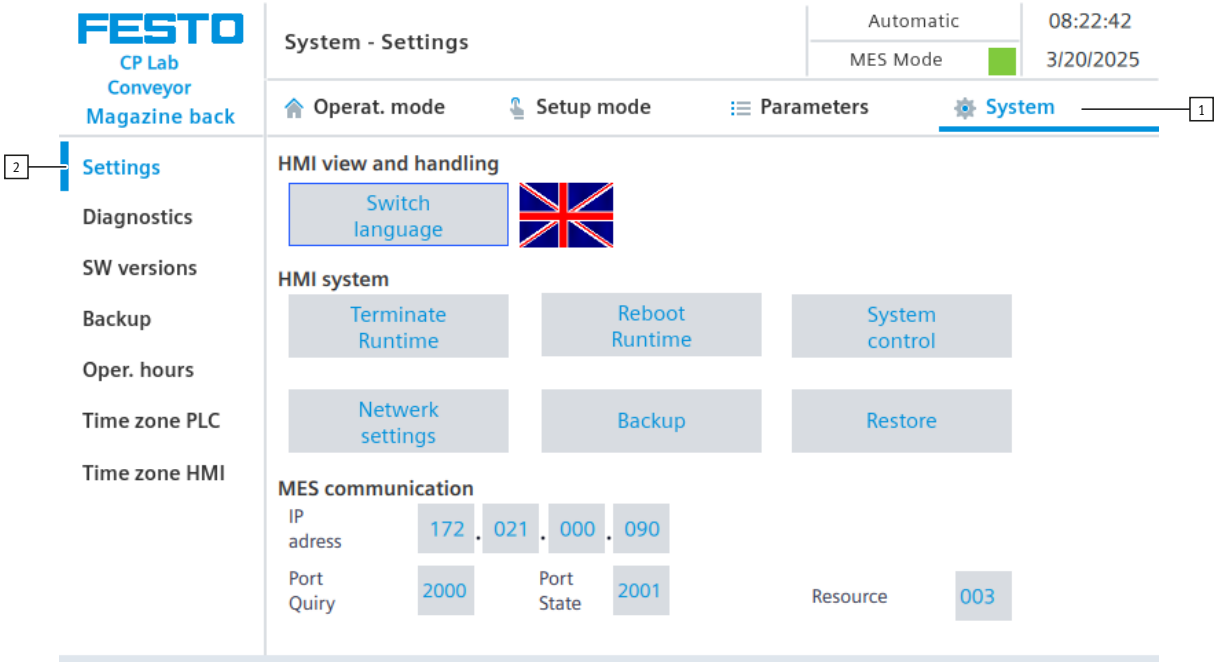


If the function of belt energy-saving mode with sensors is activated and the belts stop when there are no workpiece carriers on the belt, this is displayed in the upper message window.

7.6.3.4 Automatic Operating Mode – System Main Menu

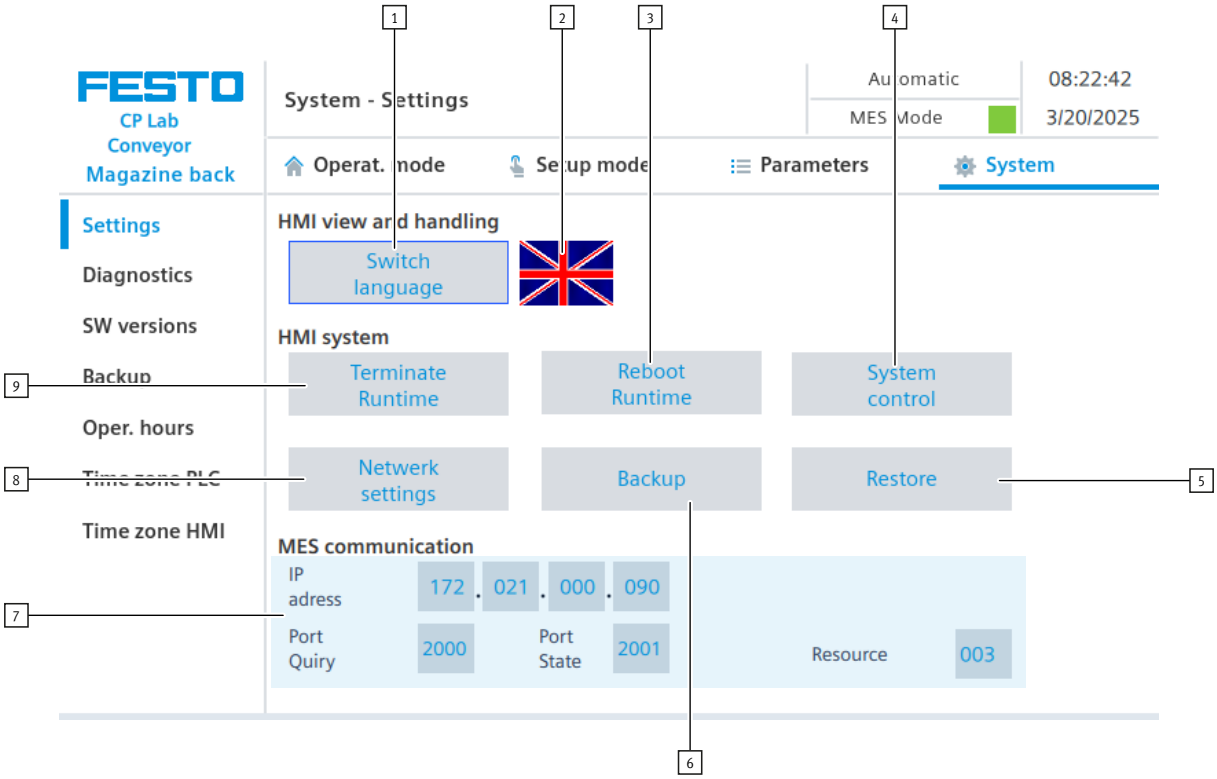
The System main menu has the same structure at all stations; the CP Lab Conveyor with the magazine application module therefore serves as an example.

Settings submenu



1. To access the system settings, press the *"System"* button

2. Select Settings.



1 *"Switch language"* button:
The language of the user interface can be changed here.

2 The flag shows the current language.

3 *"Reboot runtime"* restart:

4 *"System control"* button:
Windows Control Panel is opened

5 *"Restore"* button:

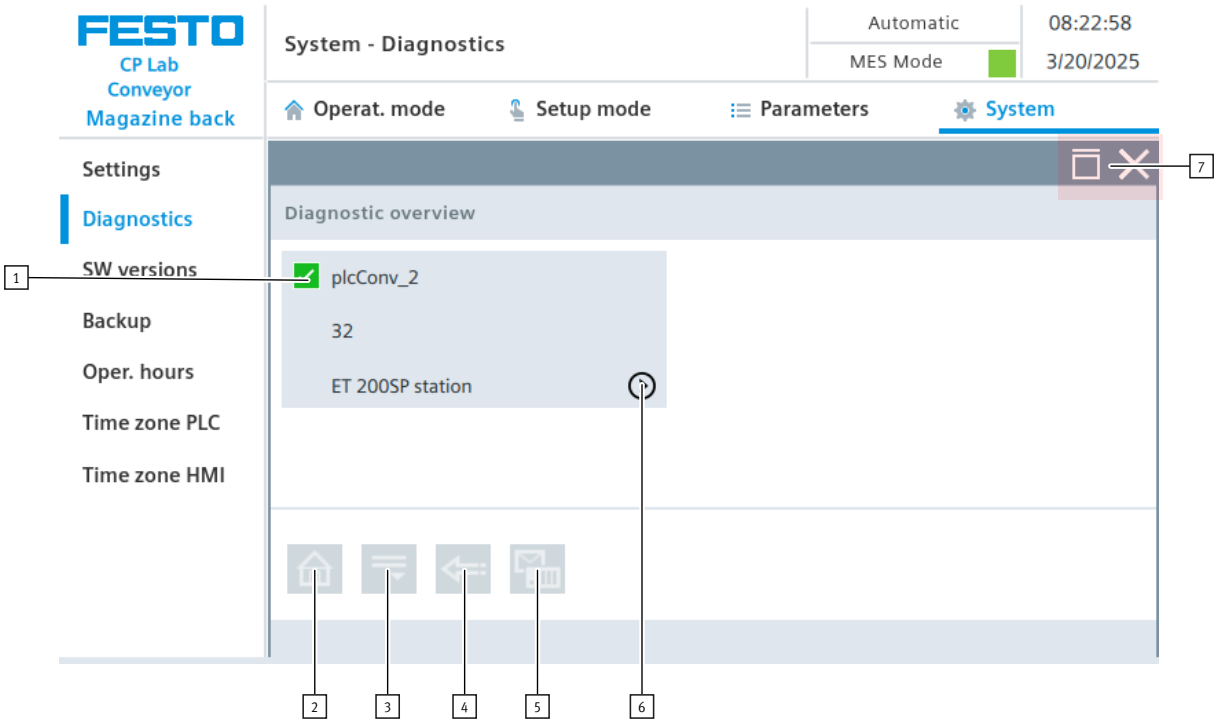
6 *"Backup"* button

7 Display of the MES communication:
The IP of the MES can also be set here. (Password protected. User: festo, PW: festo). Input boxes for own resource no., query port and status port of the MES connection.

8 *"Network settings"* button:

9 *"Terminate Runtime"* button:
The Runtime is ended and you are returned to Windows.

Diagnostics submenu



1 Display of the control component.

2 Home button – back to the top control component.

3 Show/hide details.

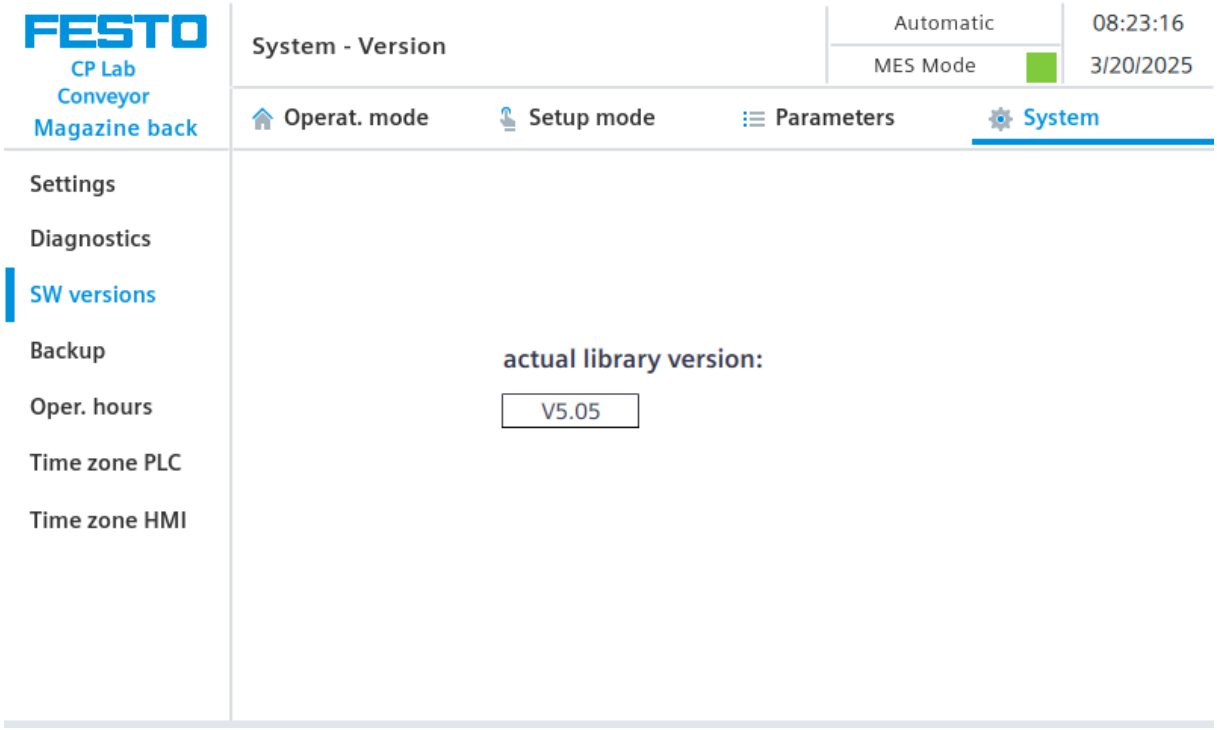
4 One level back (in the control hierarchy).

5 Display the diagnostic buffer of the control component.

6 One level lower (in the control component.

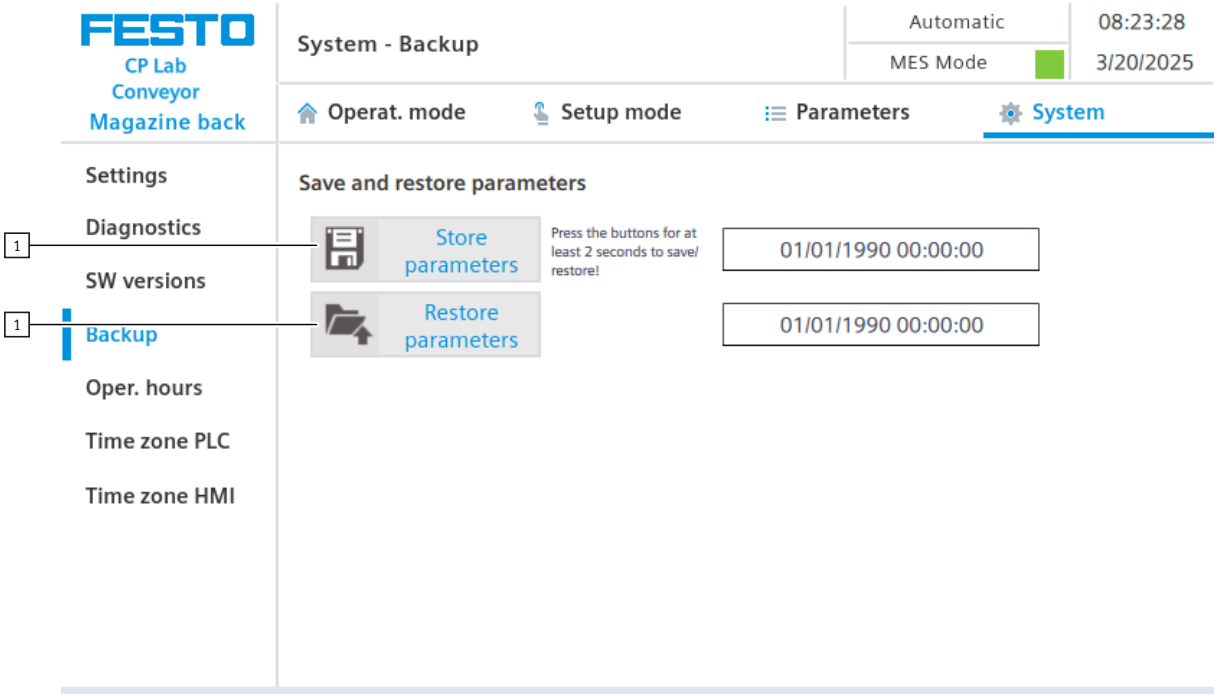
7 Maximize window / close window.

Software version submenu



Display of the current library version.

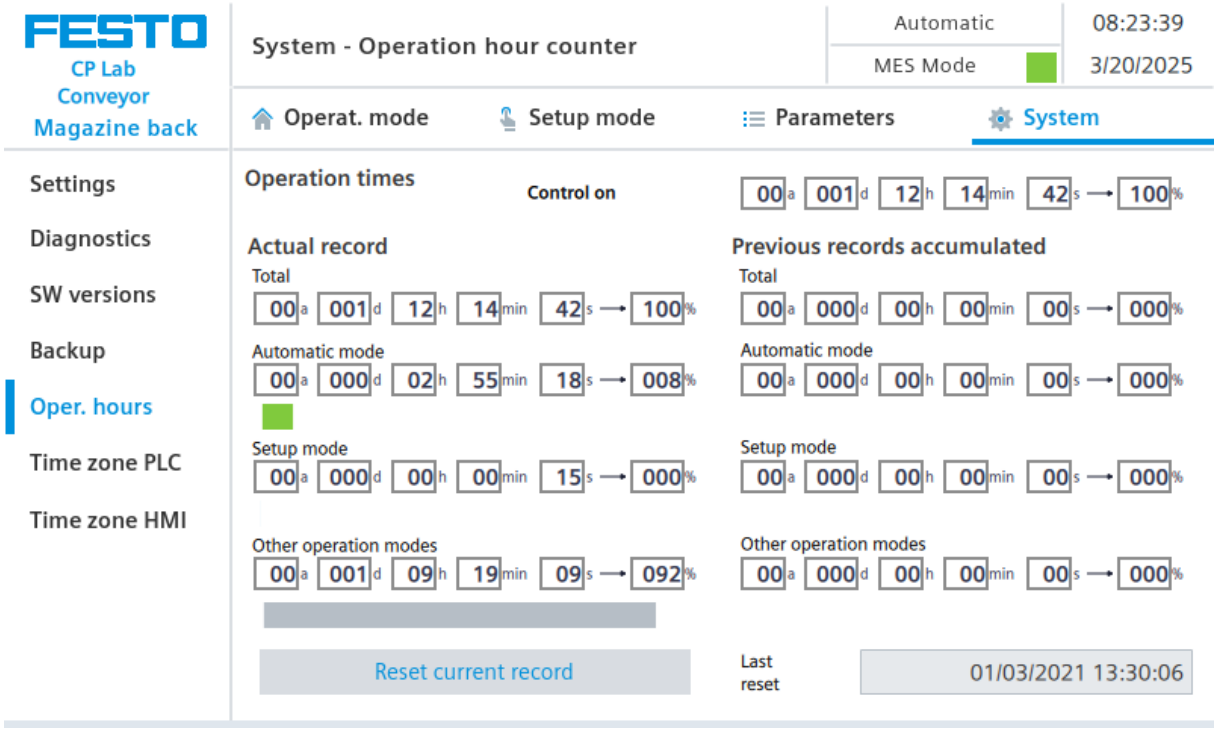
Backup submenu



1 *"Store parameters"* button:
All parameters are saved, for this it is necessary to keep the button pressed for at least 2 seconds. The display shows the date of the last storage.

2 *"Restore parameters"* button:
All parameters are loaded, for this it is necessary to keep the button pressed for at least 2 seconds. The display shows the date on which the parameters were last loaded.

Operating hours counter



Display of the operating times with allocation to the respective operating mode.

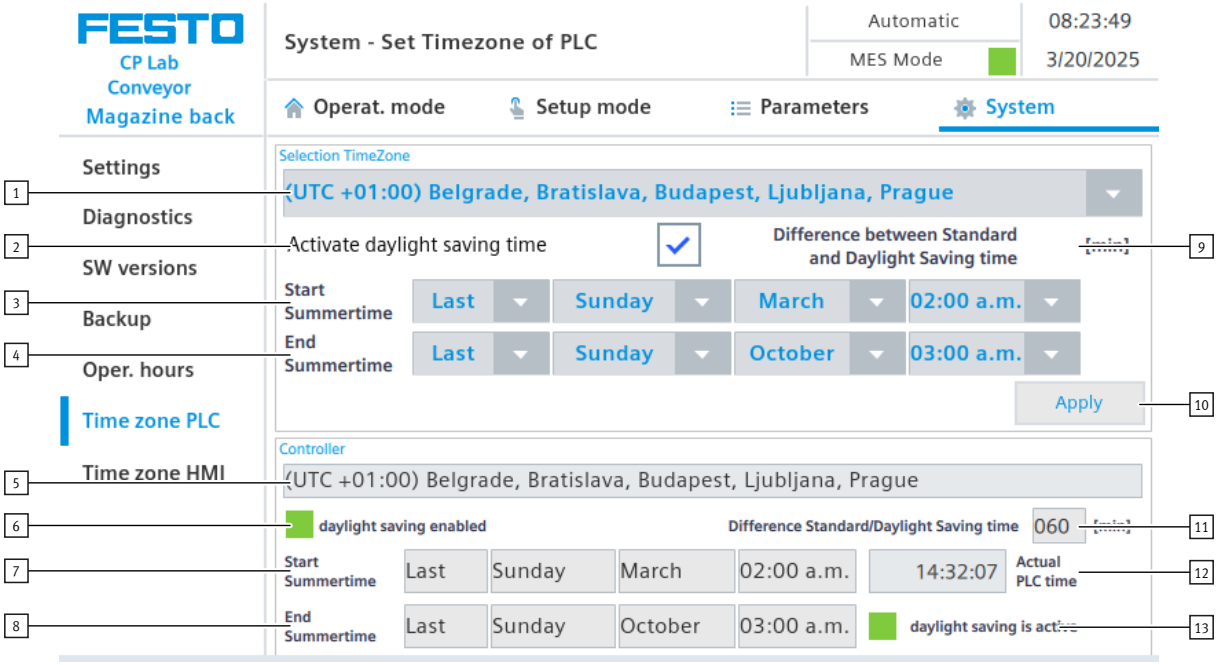
In the "Operating times" area, the time since the controller was switched on is counted. In the "Current recording" area, the time until the next time the *"Reset current record"* button is pressed is counted. The times are divided into the categories "Total", "Automatic operating mode" and "Other operating modes". Under the heading "Other operating modes", the times are counted while the station is in the "Automatic preselection", "Reseting" and "No operating mode" operating modes. The value in the "Total" line represents the sum of the operating times broken down by operating mode. The percentage refers to the share of the operating mode in the total time.

The *"Reset current record"* button resets the current recording to 0 and the operating times it contains are added to the "Cumulative previous recordings" area. This means the current recording can be used for daily recordings, for example.

All counter values are stored in a data block in the non-volatile memory. These are lost when an initial program load is carried out on the controller. If they should be retained, the values must be saved beforehand.

Time zone submenu in the PLC

The time and time zone of the PLC can be set in this menu. The default settings of the PLC are overwritten when the *"Apply"* button is pressed.



1 Selection of the time zone.

2 Activate daylight saving time changeover: Checkbox activated – the daylight saving time changeover is carried out automatically at the times "Start daylight saving time" and "End daylight saving time".
Checkbox not activated – there is no daylight saving time changeover.

3 Start daylight saving time: Setting the start of daylight saving time.

4 End of daylight saving time: Setting the end of daylight saving time.

5 Display of the controller's current time zone.
(Only valid once the time zone of the PLC has been set once using the "Apply" button)

6 Enable daylight saving time changeover: Checkbox activated –
Checkbox not activated –

7 Start daylight saving time: Display of the current start of daylight saving time in the controller.
(Only valid if the time zone of the PLC has been set once using the "Apply" button)

8 End daylight saving time: Display of the current end of daylight saving time in the controller.
(Only valid if the time zone of the PLC has been set once using the "Apply" button)

9 Display of the time difference between daylight saving time and winter time in min.
(Only valid if the PLC's time zone has been set once using the "Apply" button)

10 *"Apply"* button: Accept the selected settings for the time zone and time changeover by pressing the button.

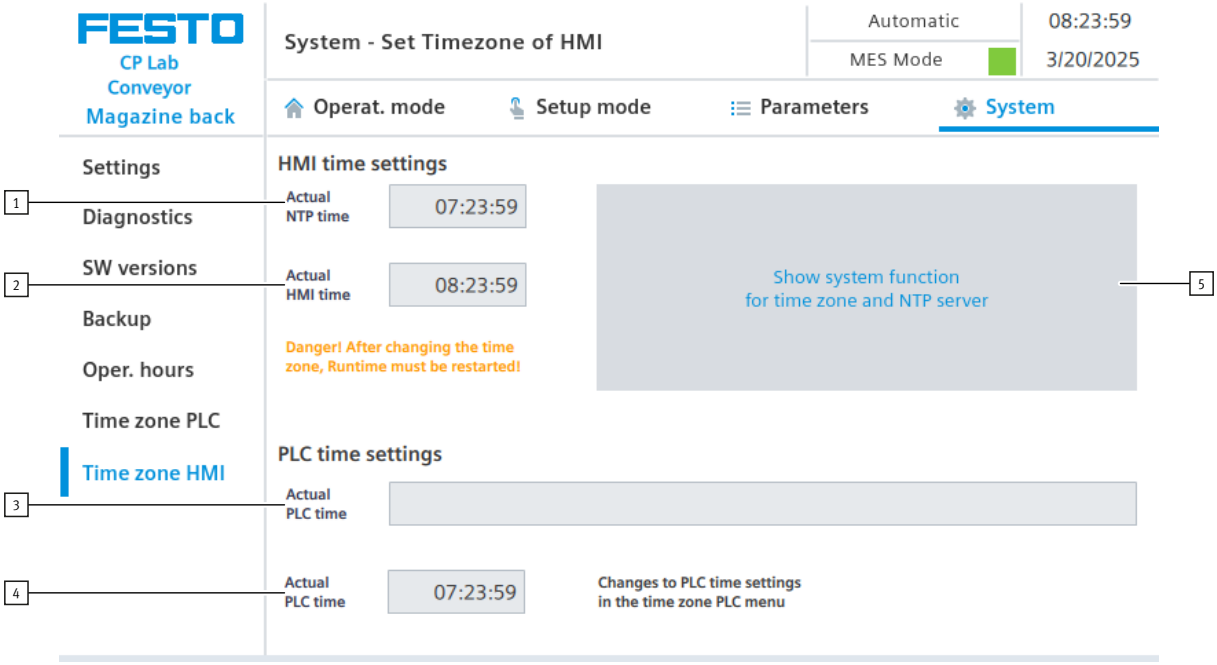
11 Enter the time difference between daylight saving time and winter time in minutes.

12 Display of the current time in the PLC.

13 Daylight saving time is active: Checkbox activated – Displays whether daylight saving time is currently active.
(Only valid if the PLC time zone has been set once using the "Apply" button)

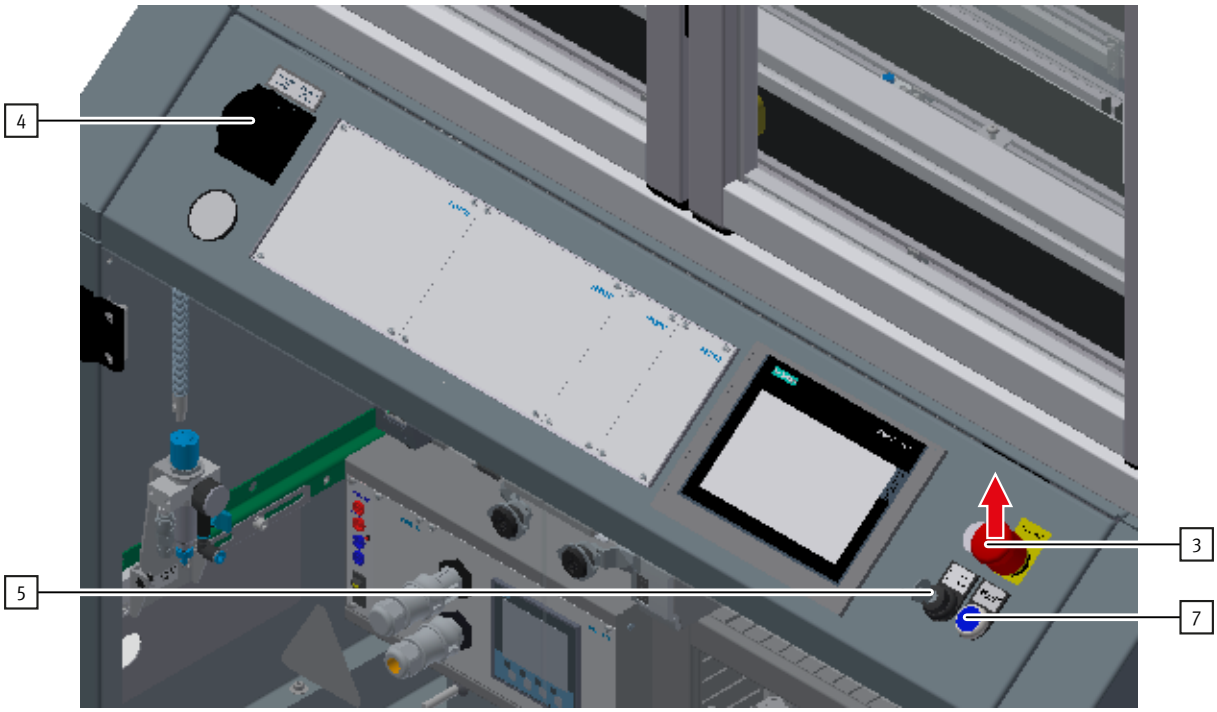
Time zone submenu on the HMI

The time and time zone of the HMI can be set in this menu. The default settings of the HMI are overwritten. It is important to set the time zone in the HMI the same as it is set in the PLC, otherwise certain functions will have a different time stamp. (e.g., e-mail dispatch)



1 Current time in the user's NTP server.
2 Current time on the HMI touch panel.
3 Current PLC time zone:
4 Current PLC time:
5 Display system function:

7.7 Switch on Station



1. The station is supplied with power.
2. The station is supplied with 6 bar air pressure.

3. All emergency stop signal generators (pushbutton actuator, door contact, light barriers, etc.) are not actuated and unlocked.

4. Switch on the main switch of the station and the robot.

5. Set the key switch to the vertical/automatic position.

Note that the robot moves directly to its HOME position. To avoid collisions, you may also need to move the robot manually using the jog buttons.

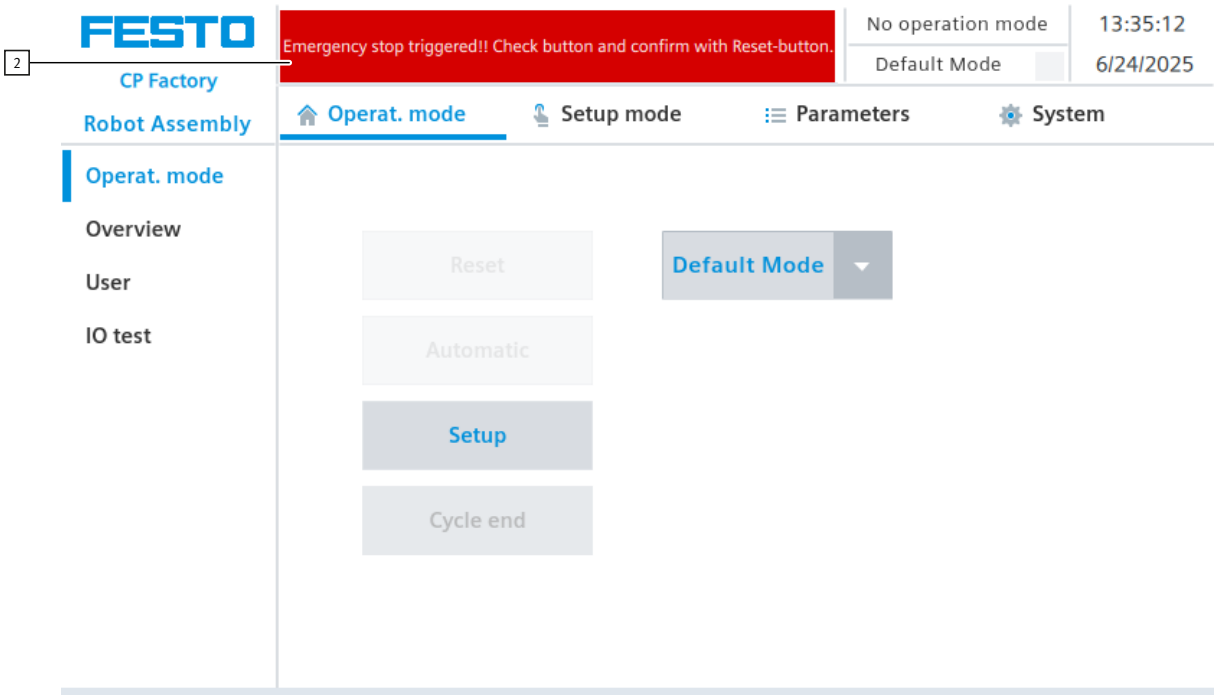
6. If the robot is not in its home position, a warning is displayed on the HMI. If this is the case, move the robot manually to its home position.
   a. Set the key actuator (pos. 5 in the figure above) to manual/horizontal.
   b. Switch on R56 TB TeachBox.
   c. Start JOG mode.
   d. Change the TCP to tool 4.
   e. Activate the robot drives.
   f. Press the Home button to move the robot to its home position.
   g. Deactivate the robot drives.
   h. Set the key actuator on the control bar (position 5. in the picture above) to automatic/vertical.

7. Press Align button, the Align button lights up blue, the HMI is started and boots up.

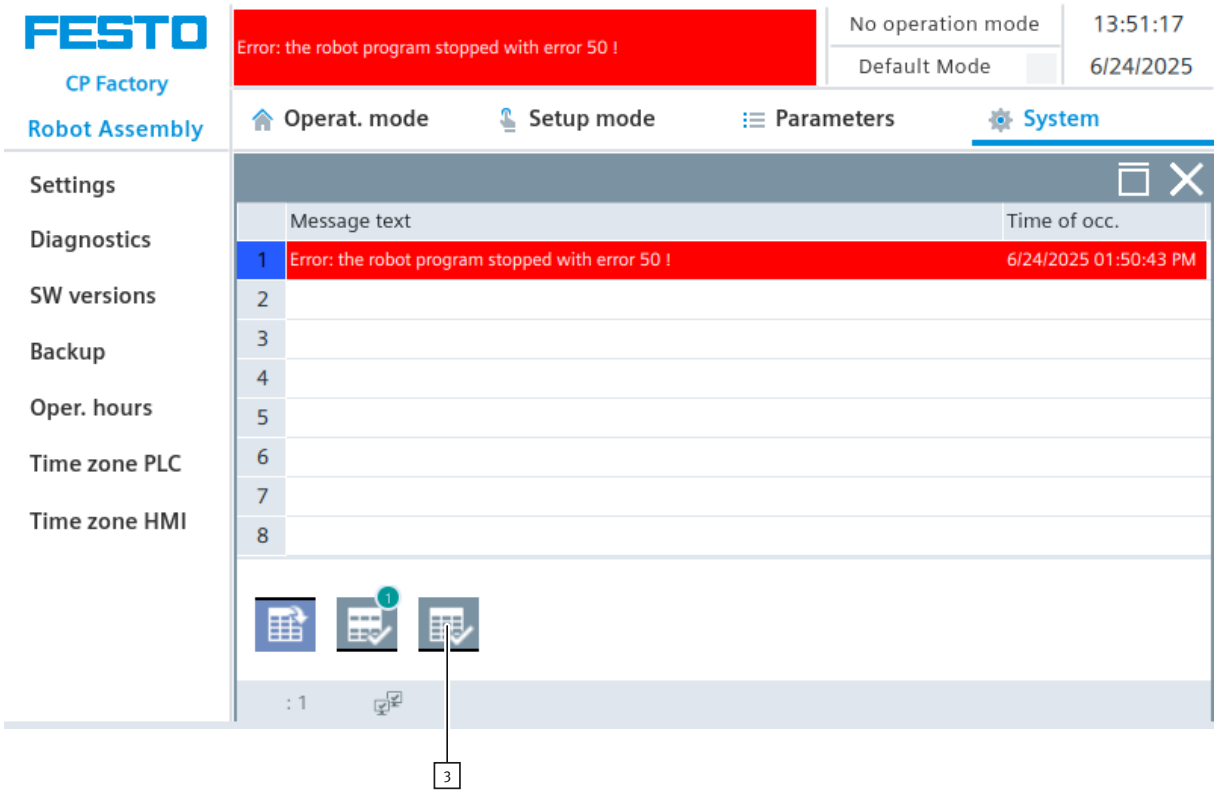
8. Wait until the HMI is ready.

7.7.1 Start Robot Assembly Automatic Station

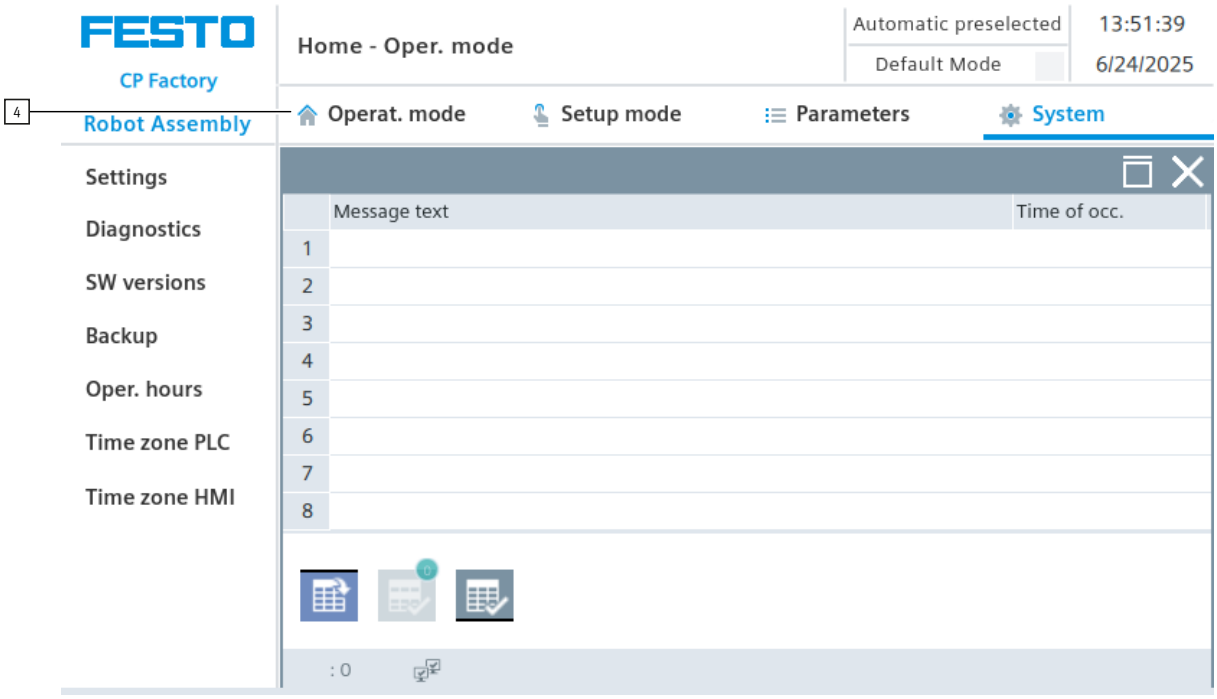
1. Remove all existing workpieces.



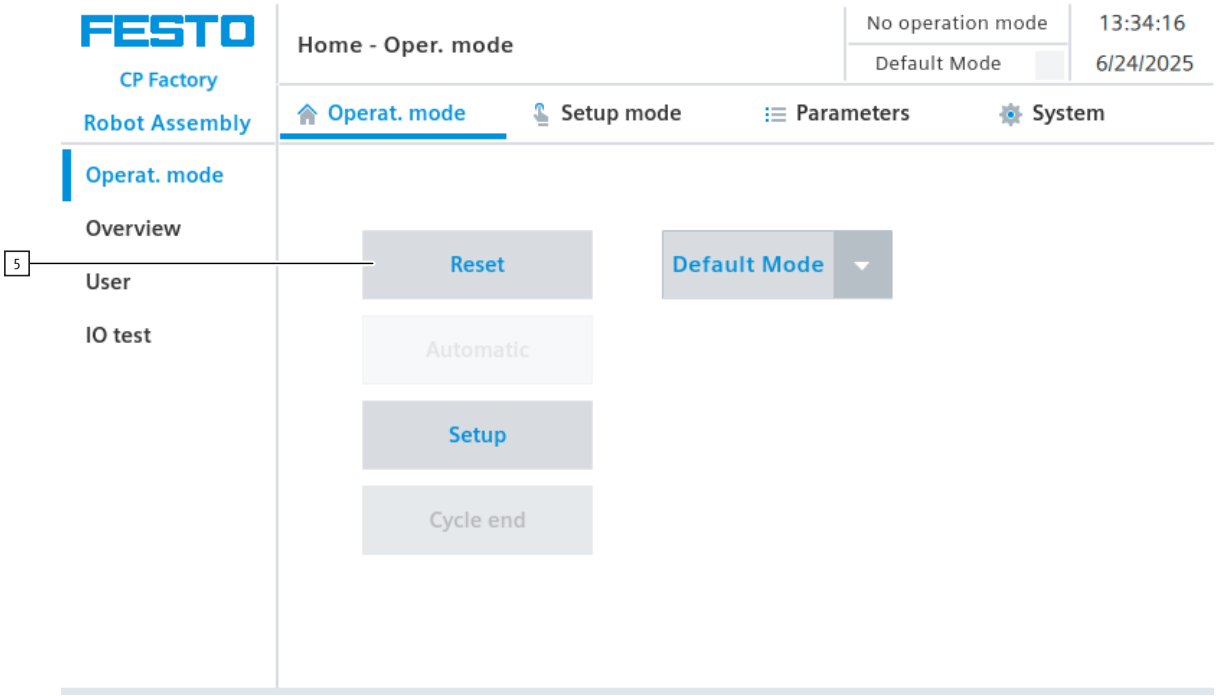
2. Confirm errors on the HMI by clicking the error message.



3. The error message is displayed in the main window. Once the error situation has been rectified, it can be confirmed by pressing the *"RESET"* button.

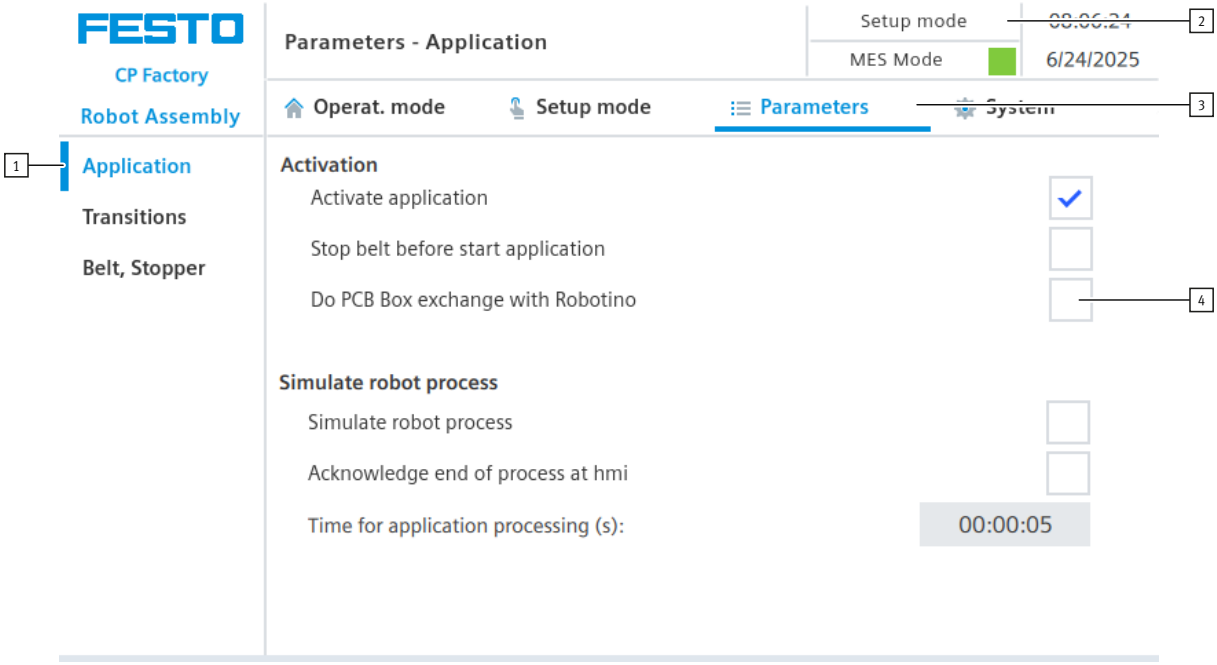


4. Press the *"Operation mode"* button.

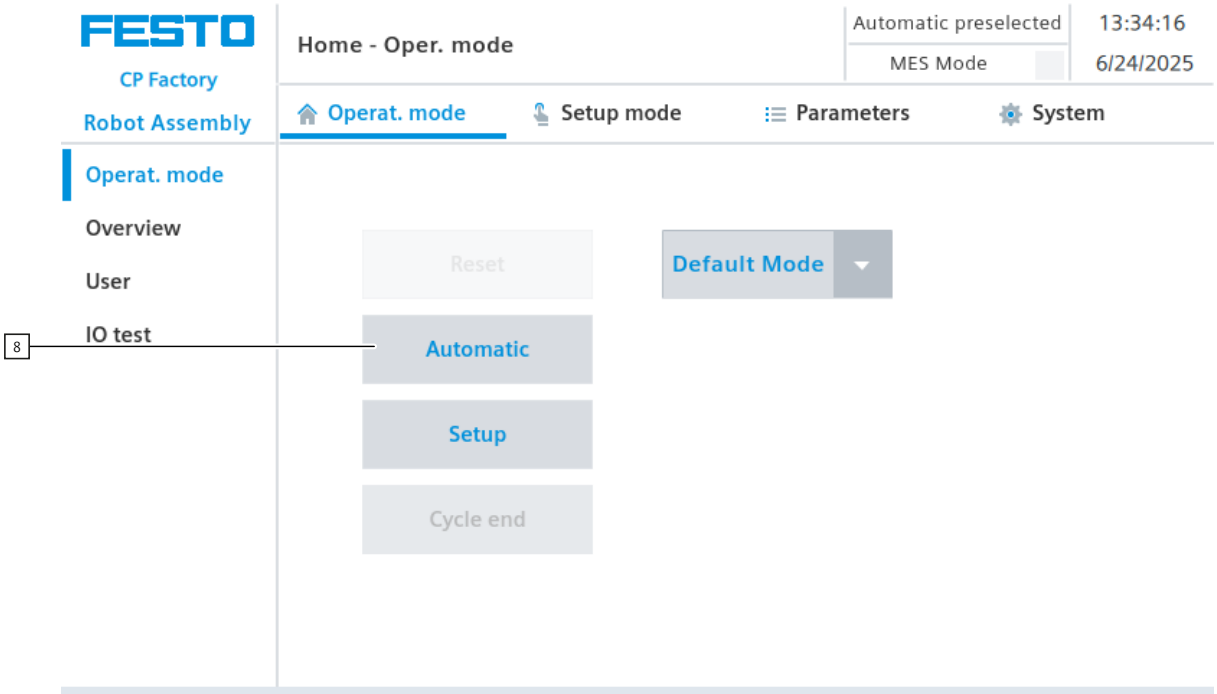


5. Now press the *"Reset"* button.

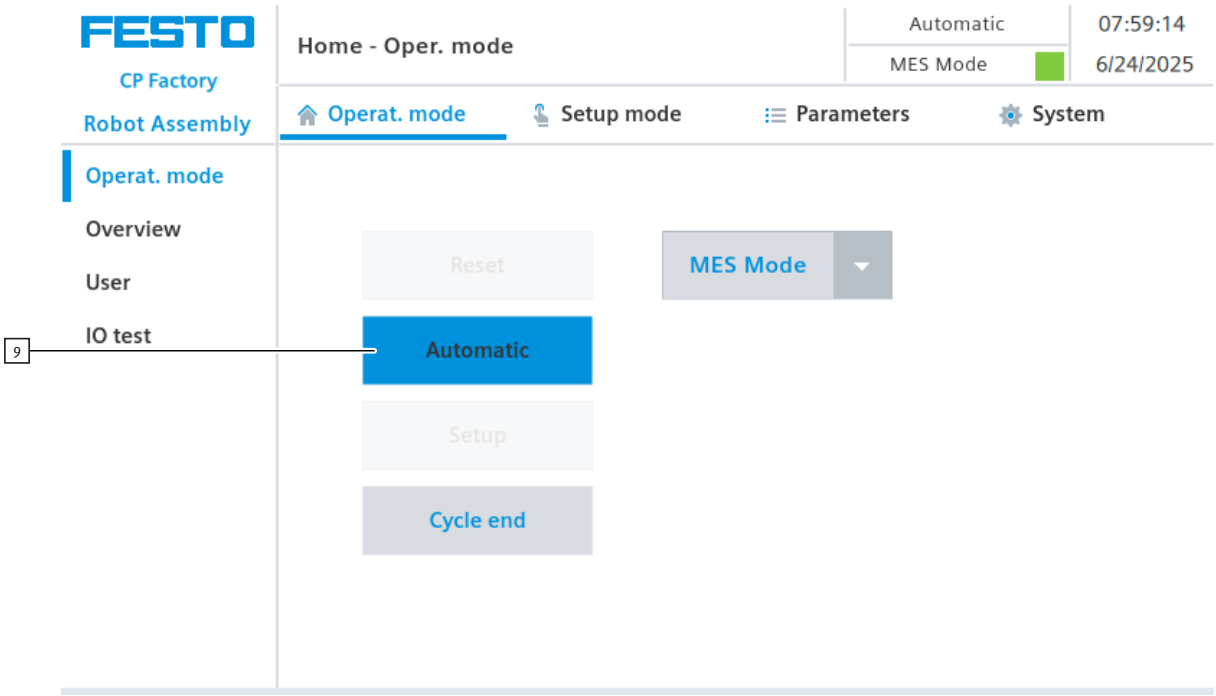
6. If the station is loaded manually, the boxes can be entered manually by pressing the "Do PCB Box exchange with robotino" button on the back of the station. Boxes can also be handed out manually; in this case the "Do PCB Box exchange with robotino" button should also be pressed.



7. If the station is to be loaded automatically by a Robotino, the application (1) must be activated in *"Setup mode"* (2) in the Parameters (3), and a check mark must be placed in the "Do PCB Box exchange with robotino" field (4).



8. Then press the *"Automatic"* button.



9. The *"Automatic"* button lights up.

Automatic mode is active

7.7.2 Description of the Automatic Sequence

After the automatic sequence has been started on the HMI:

1. The automatic button is highlighted in blue

2. The stoppers are retracted

3. The workpiece is transported in circulation mode

4. If a workpiece carrier now enters the module/application module, it carries out your automatic sequence. However, the module/application module process is only started if the operation in MES is intended for this resource and the resource can also carry this out operation.

5. The Busy display becomes active.

6. During this time, the automatic sequence is carried out in the application

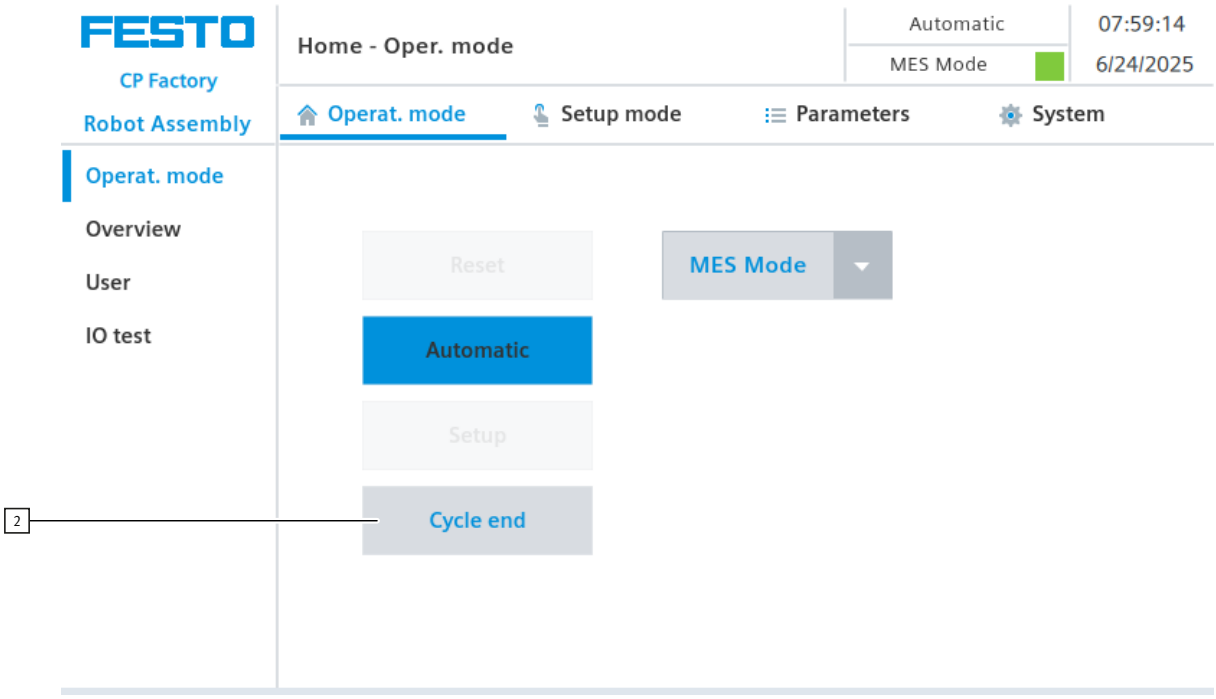
7. The next resource and the operation are written to the RFID chip

8. If the module/application module is finished, the display returns to its original state and the stopper is retracted

9. The workpiece carrier moves out of the working position and is available for other modules/application modules.

7.7.3 End Cycle Sequence Description

1. An automatic sequence is active



2. Press the *"Cycle end"* button.

3. The station carries out its sequence to the end of the cycle. During this time, the end button flashes.

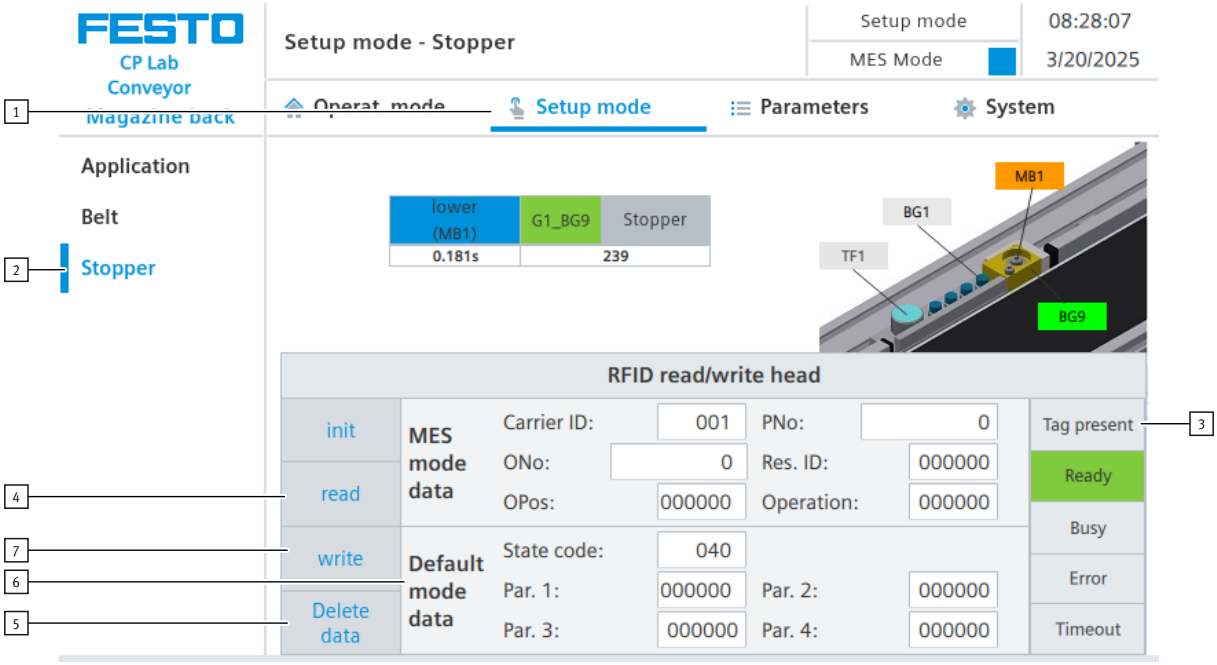
4. The stoppers are extended.

5. The conveyors stop.

7.8 Writing to RFID Tag Manually

To write a workpiece carrier with a specific ID, or to obtain information about the data on the workpiece carrier, it is possible to read out this data or write the tag. This requires a workpiece carrier with a functioning tag to be located at one of the stopper positions, and the station to be switched on.

The following example applies to all readout positions that can read out an ID from workpiece carriers.



1. Selecting *"Setup mode"* operating mode.

2. Select the *"Stopper"* in the Setup menu on the left.

3. If an RFID is detected, this is indicated by "Tag detected". (TF80 and "Tag detected" button are highlighted in green).

4. The RFID tag data can be read and displayed by pressing the *"Read"* button.

5. Press *"Delete data"* button.

For easier input, all data is only deleted in the input screen, the data on the tag itself remains available.

6. Enter the desired data in the box (all boxes with a white background can be edited).

MES mode

Carrier ID – the workpiece carrier number is displayed or entered here.

ONo – the order number is displayed or entered here.

OPos – the order item is displayed or entered here.

PNo – the part number is displayed or entered here.

Resource – the resource is displayed or entered here.

Operation – the number of the operation is displayed or entered here.

Default mode

State code – the state code for the start condition is entered here; if it matches the transition tables, the parameters are read out and the automatic sequence of the application is started.

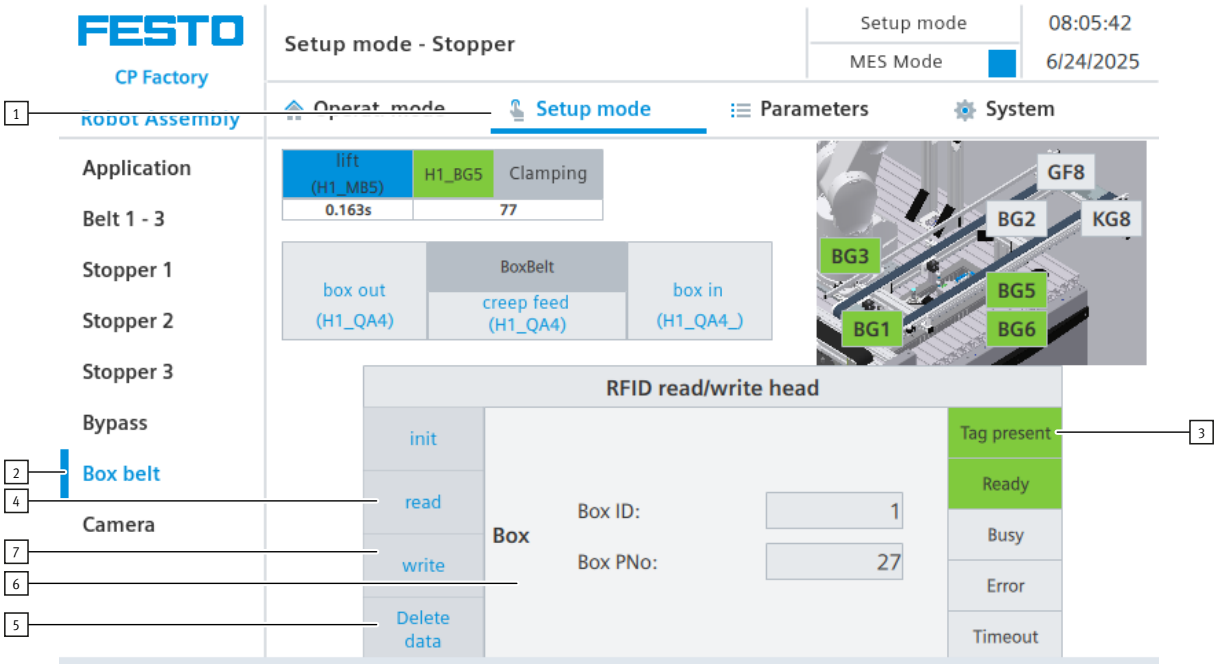
Parameter 1 = Enter the parameter value (e.g. 100 / feed front tray).

Parameters 2 – 4 – not used in this example.

7. Press *"Write"* button to write the changes you have made to the tag.

7.9 Write to RFID box Manually

To write to a box with a specific ID or to obtain information about the data on the box, it is possible to read out this data or to write to the tag.
To do this, a box with a functioning tag must be located at one of the readout positions and the station must be switched on.
The following example applies to all readout positions that can read out an ID from box.



1. Select setup operating mode

2. Select the module with the readout position in the Setup menu on the left

3. If an RFID is detected, this is indicated by tag present. (TFxx and "tag present" button are highlighted in green)

4. The RFID tag data can be read and displayed by pressing the *"read"* button.

5. Press the *"Delete data"* button For easier input, all data is only deleted in the input mask; the data on the tag itself remains available.

6. Enter the desired data in the field (all fields with a white background can be edited)
MES mode/Default mode are identical
Box ID – the ID number of the box is displayed or entered here
BoxPNo: The part number of the box and the holder for the workpieces to be picked up is displayed or entered here.

7. Press the *"write"* button to write the changes you have made to the tag.

7.10 Vision Module

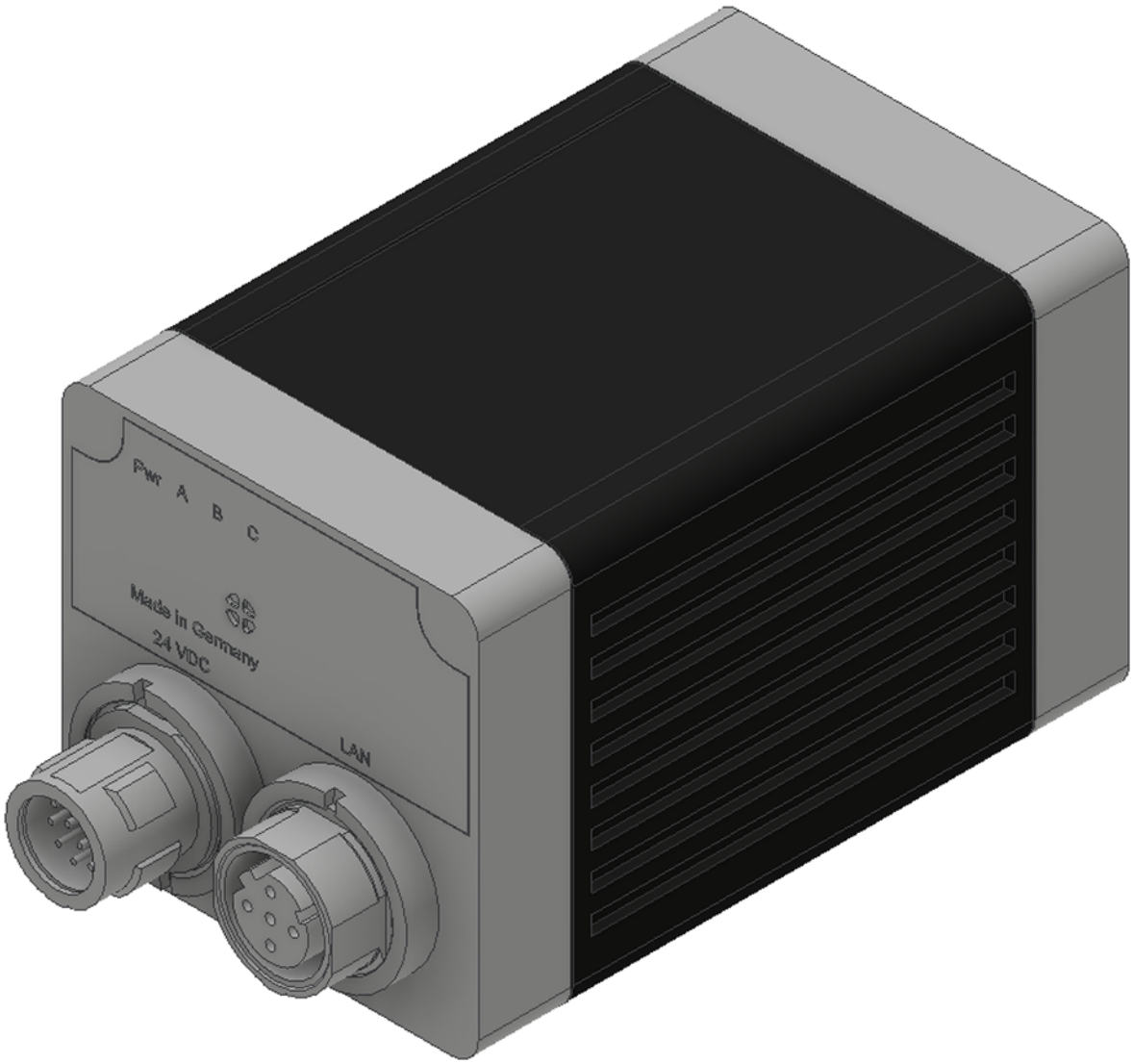


Fig. 44: Similar to illustration

The camera is responsible for the visual inspection of the workpieces. The color and orientation of the workpieces are recorded for this purpose.

Description	Name
Camera	SBSA-U-PF-R6C-FM-W/ 8143672 (Sensopart V20C-ALL-P3-W-M-M2-L-90)

7.10.1 Connect camera

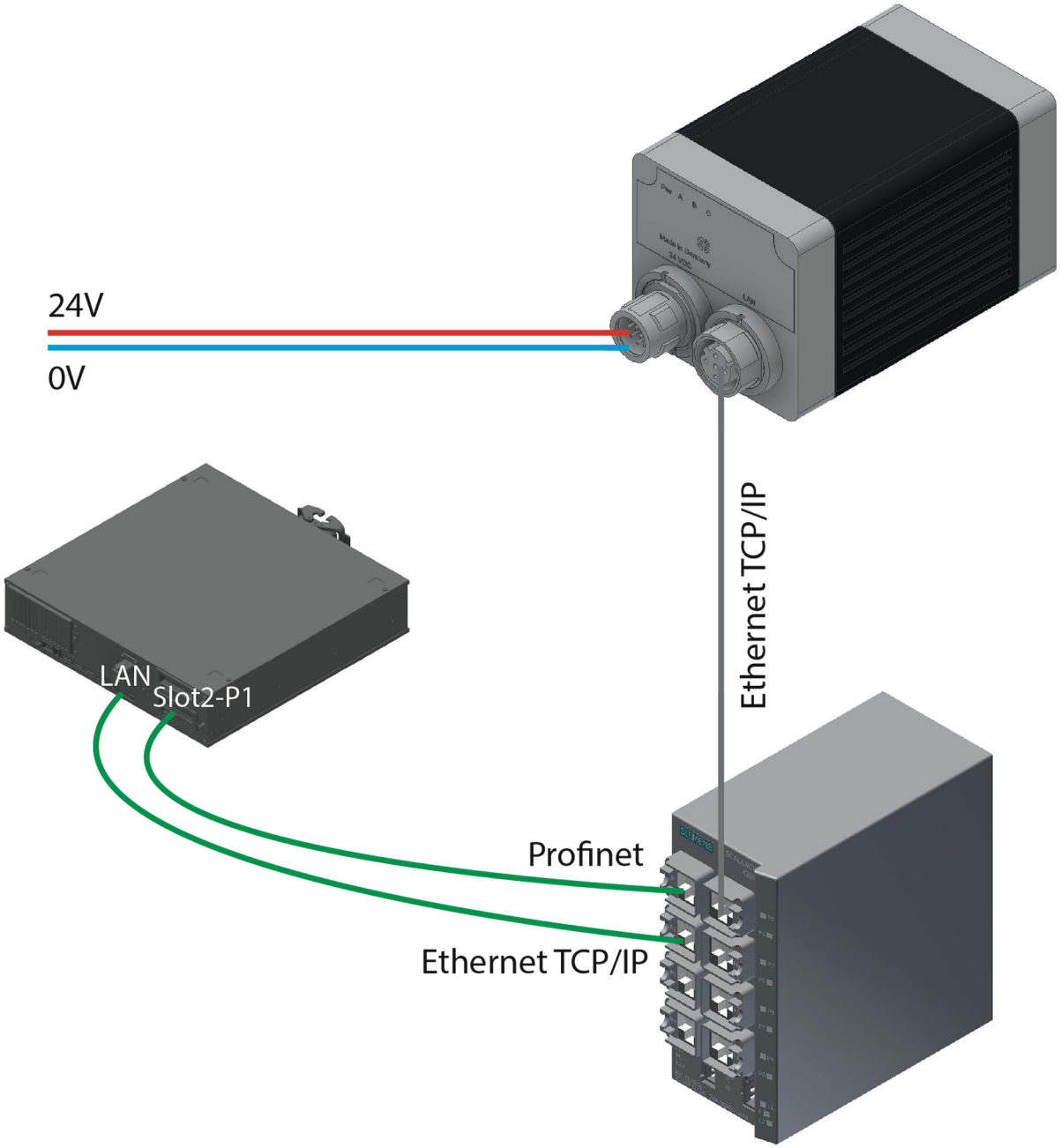
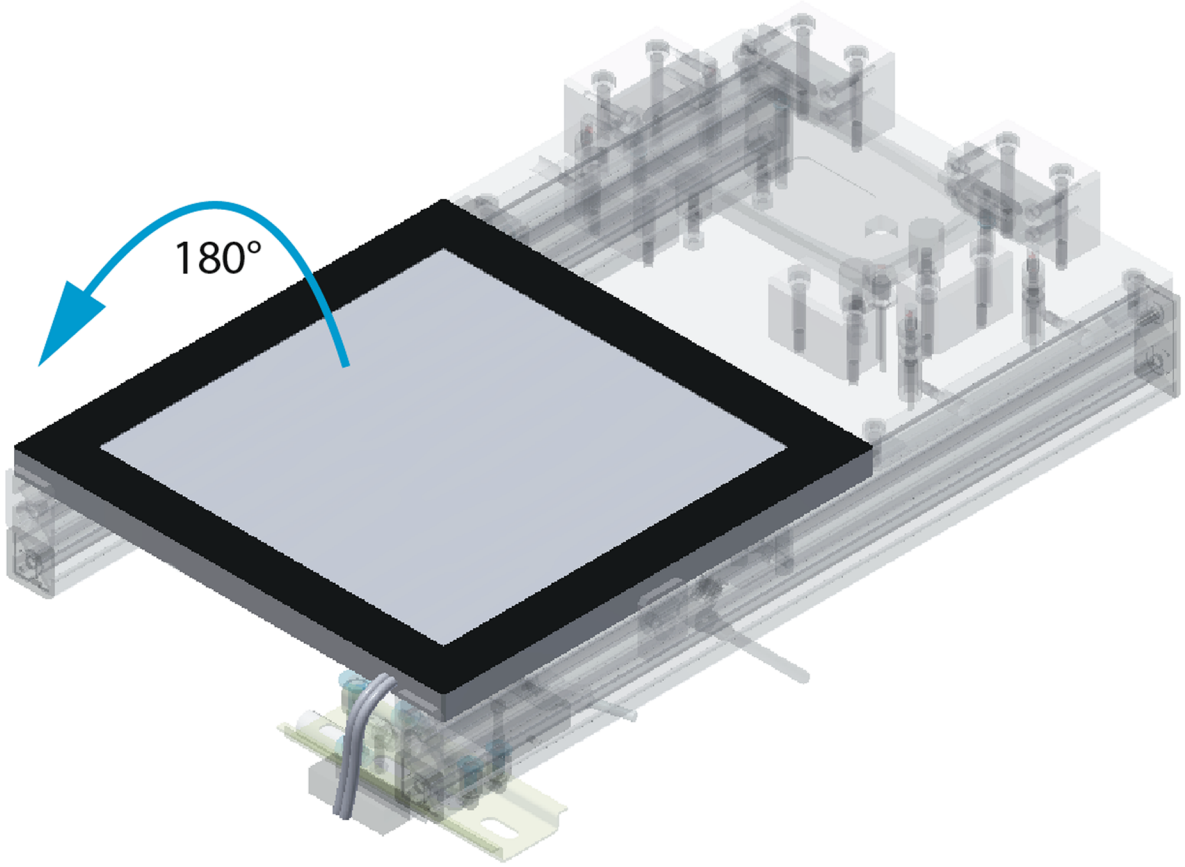


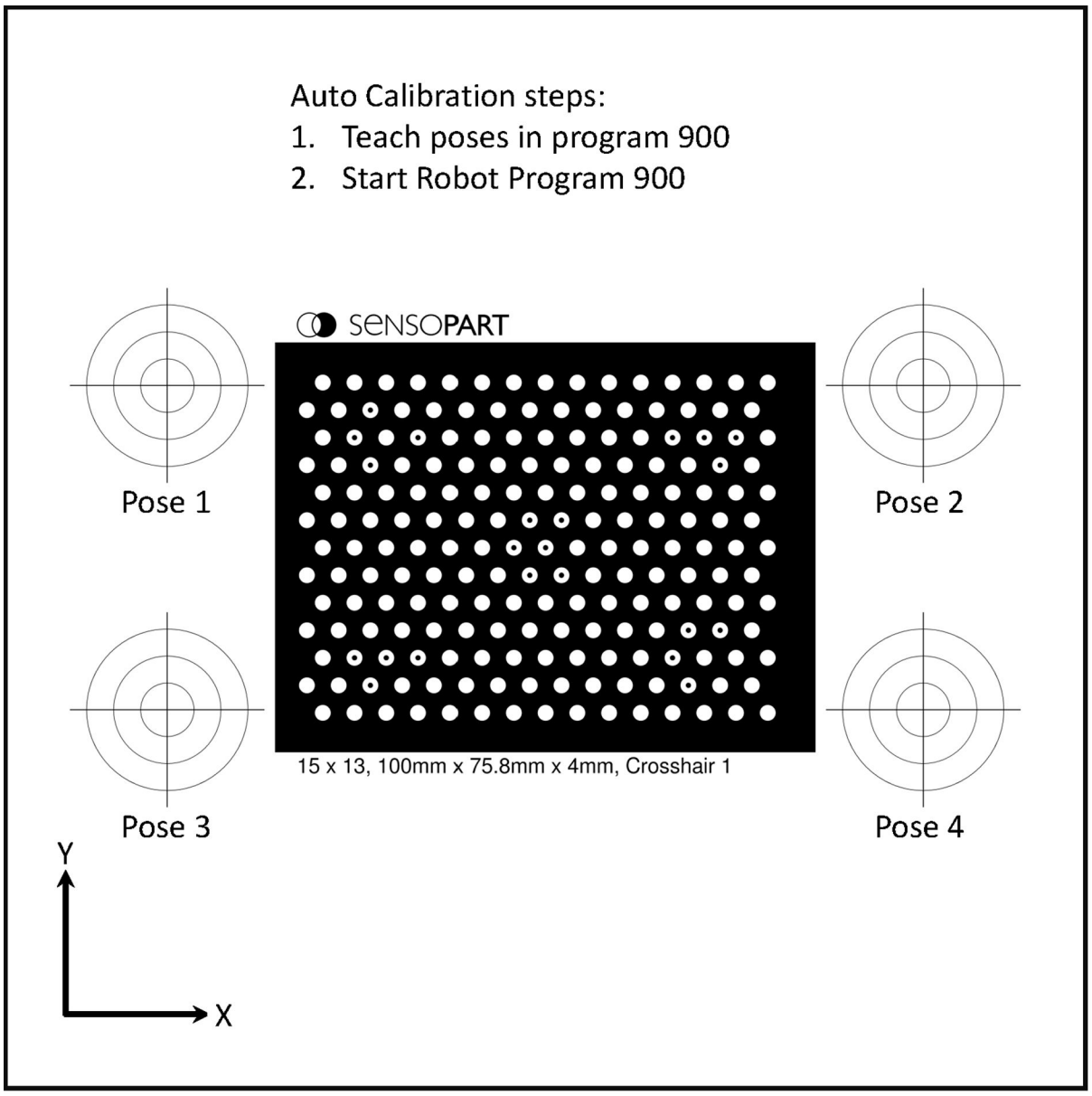
Fig. 45: Similar to illustration

No.	Designation	IP address	Minutes	Port
1	Mitsubishi robot controller	172.21.Res.ID.40 172.21.Res.ID.41	TCP/IP Profinet	10001 -
2	Camera	172.21.Res.ID.50	TCP/IP	2006
3	Switch			

7.10.2 Calibrate Camera



1. Rotate the light surface (calibration plate) 180°



2. The following graphic is on the underside of the light surface

3. Now pick up the calibration tool with the workpiece gripper (Tool2).

4. Load program number 900 on the robot and teach positions 1–4 on the calibration plate consecutively

5. Drive the robot to the initial position

6. Set robot to auto mode (key actuator on robot controller)

7. Start program 900 on the HMI

8. Calibration runs automatically

7.10.3 Robot Program for Camera

The robot programs all use the same camera program (program no. 1)

Program 1: Check no fuse present
Program 2: Check left fuse present
Program 3: Check right fuse present
Program 4: Check both fuses present
Program 5: Demo program

8 Message Texts and Interactive Error Messages on the HMI

There are generally three different message classes. These are laid out as follows

- Message class 0 (displayed with a red background in the message line)
  - the program is stopped immediately and automatic mode is ended
  - the cause of the error must be rectified
  - Then acknowledge the error and restart the station
- Message class 1 (displayed with a red background in the message line)
  - the program and automatic mode are stopped at the end of the cycle
  - the cause of the error must be rectified
  - Then acknowledge the error and restart the station
- Message class 2 (displayed with a yellow background in the message line)
  - the program and automatic mode continue to run
  - if the cause of the error is rectified, the error is automatically acknowledged
- Information
  - Displayed on the HMI but not processed in MES

8.1 Message texts

8.1.1 Message Texts for CP Factory RASS-MITS

Report class	Location	Alarm name	Report text	Fix error
2	PcbBoxChange	WarnBoxBeltFull	Error: 2 boxes detected in the PCB feeding belt!	Remove one box
0	Error	ErrSchutztuer	Safety doors open!!	Close the safety doors and acknowledge the message on the control panel and robot control.
2	Error	WarnRobotBatt	Charge state robot battery low!	Please change battery
0	Error	ErrNotAusRobot	Emergency stop at robot is active	Check the emergency stop button on the robot and acknowledge the message.
2	Error	WarnRobotHome	Robot not in home position!	Move to home position

Report class	Location	Alarm name	Report text	Fix error
2	Error	WarnRobotHomeInit	Robot not in home position for request referencing	Move to home position
2	Error	WarnRobotExec	Error in the robot program processing.	Check drive unit.
2	Error	WarnRobotAuto	Robot not in automatic!	Switch on automatic at drive unit
2	Error	ErrFusesEmpty	All fuse magazines are empty, no program start!	Fill up magazines
2	Error	WarnNoPcbBox	Warning: no PCB box available!	Provide box
2	HsKuka	WarnRobOpMode	Warning: Robot control is not in automatic mode!	Place robot in automatic
2	HsKuka	WarnRobReady	Warning: Robot control is not ready!	Check drive unit
2	HsKuka	WarnRobHome	Warning: Robot not in home position.	Please move robot with Teach-Box in basic position!
2	HsKuka	WarnRobNotReady	Warning: The robot has not yet released for external start!	Issue release
2	HsKuka	WarnSafetyDoorOpen	Warning: Safety door of the robot is not closed!	Close safety doors
0	HsKuka	ErrRobRuntime	Error: EMERGENCY-STOP on robot Teach-Box is activated!	Quit emergency stop at Teach Box

8.2 Interactive Error Messages on the HMI

There are generally three different notification classes. These are laid out as follows

- Notification class 0 (displayed with a red background in the message line)
  - the program is stopped immediately and automatic mode is ended
  - the cause of the error must be rectified
  - Then acknowledge the error and restart the station
- Notification class 1 (displayed with a red background in the message line)
  - the program and automatic mode are stopped at the end of the cycle
  - the cause of the error must be rectified
  - Then acknowledge the error and restart the station
- Notification class 2 (displayed with a yellow background in the message line)
  - the program and automatic mode continue to run
  - if the cause of the error is rectified, the error is automatically acknowledged
- Notes
  - Displayed on the HMI but not processed in MES

8.2.1 Default operation

Interactive messages are displayed via a pop-up window on the HMI.

The pop-up window has 3 buttons.

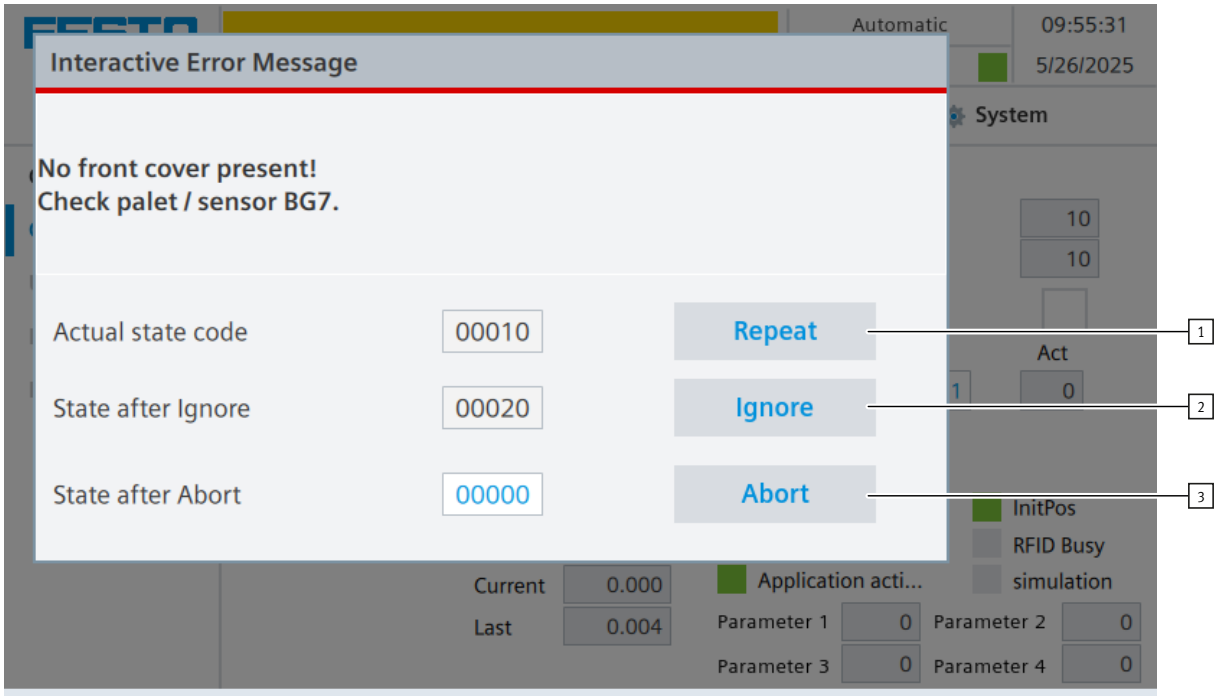


Fig. 46: Example – interactive messages in default mode

1 *"Repeat"* Button - An attempt is made to run the application again.

2 *"Ignore"* Button – The error status is ignored, the workpiece carrier receives the status code as specified in the "Initial status" column in the transition table. The application is no longer executed.

3 *"Abort"* Button – The error status is ignored, the workpiece carrier receives the status code as shown in the input/output field next to the button. This can be changed in this interactive error message window.

8.2.2 MES operation

Interactive messages are displayed via a pop-up window on the HMI.

The pop-up window has 4 buttons.

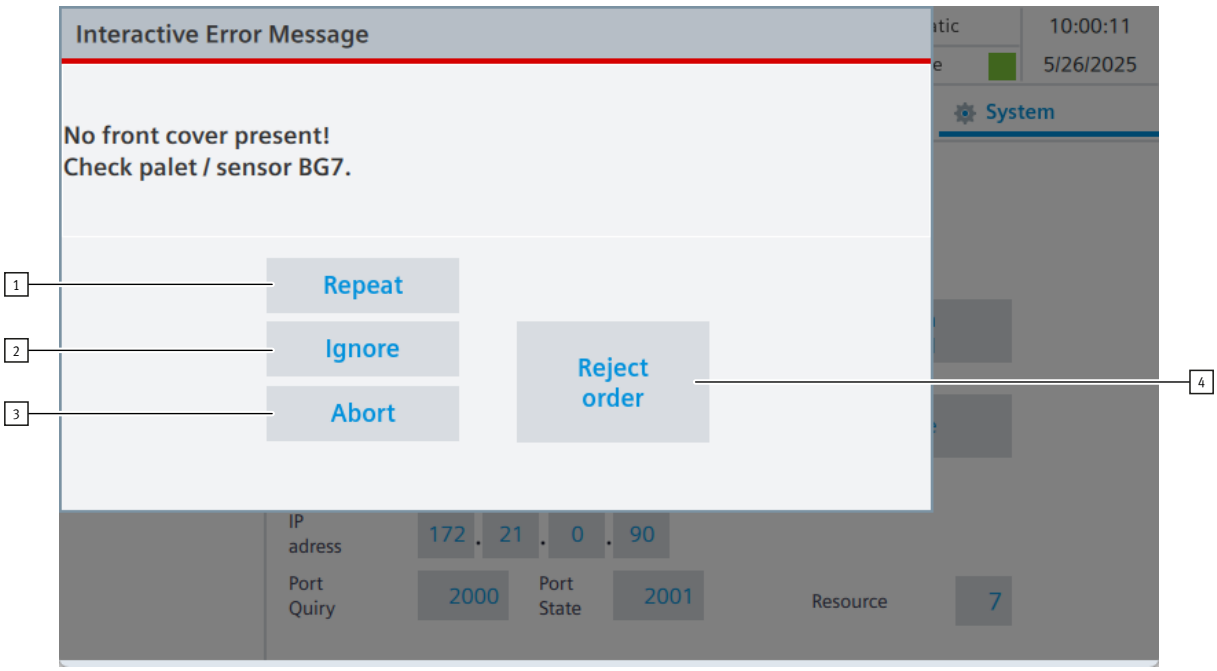


Fig. 47: Example – interactive messages in MES mode

1 *"Repeat"* Button - An attempt is made to run the application again with the same parameters.

2 *"Ignore"* Button – The application is not executed but is treated in the MES as if the order step has been completed without errors.

3 *"Abort"* Button – The application is no longer executed. In the MES, this order item is terminated with an error and canceled, depending on whether an error step is defined or not. Reject order – The application is not executed. The step for this order item is reset in the MES and restarted the next time the workpiece carrier arrives.

4 *"Reject order"* Button – The application will not be executed. In the MES, the step of this order position is reset and restarted the next time the workpiece carrier arrives.

8.2.3 General

Value	Error	Eliminating the Fault
100	Order canceled incorrectly	Restart order

8.2.4 CP Factory RASS-MITS

Value	Text	Fix error
0	No error	
1	Robot gripper closed	Open gripper
2	Safety doors opened (front /back)	Close safety doors
11	Unknown gripper type	Assemble correct gripper
20	Camera is not in online mode	

Value	Text	Fix error
21	Undefinied stopper number!	Check parameter
22	Unknown program number!	Check parameter
23	No workpiece on the pallet at stopper!	
31	Camera found no workpiece	Check camera settings, apply workpiece
40	Wrong gripper typ	
41	Workpiece assemble position is occupied	Remove workpiece
42	No workpiece at assembly position available	Apply workpiece
43	Workpiece is turned in wrong position	Turn workpiece
44	Orientation of workpiece is not correct	Align workpiece
45	No board inside workpiece found	Insert board
51	Orientation of PCB tray is not correct	Turn PCB Tray
52	Unknown PCB pallet number	Check parameter
53	No board at ordered pallet number available	Charge pallet
54	Board at pallet place available	Remove board from pallet holder
61	All fuse magazines are empty	Fill up magazine
62	Unknown fuse magazine number	Check parameter
63	Fuse magazine is completely full	Remove fuses from magazine (for disassembly)

9 Components

9.1 Mitsubishi Robot RV-4FL

A vertical articulated robot is used to transport the workpieces. This is an industrial robot with 6 axes. The repeat accuracy of the robot positioning is 0.02 mm. The maximum speed is 9900 mm/s. End position monitoring and overload monitoring are integrated. The maximum reach of the robot arm is 648.7 mm.

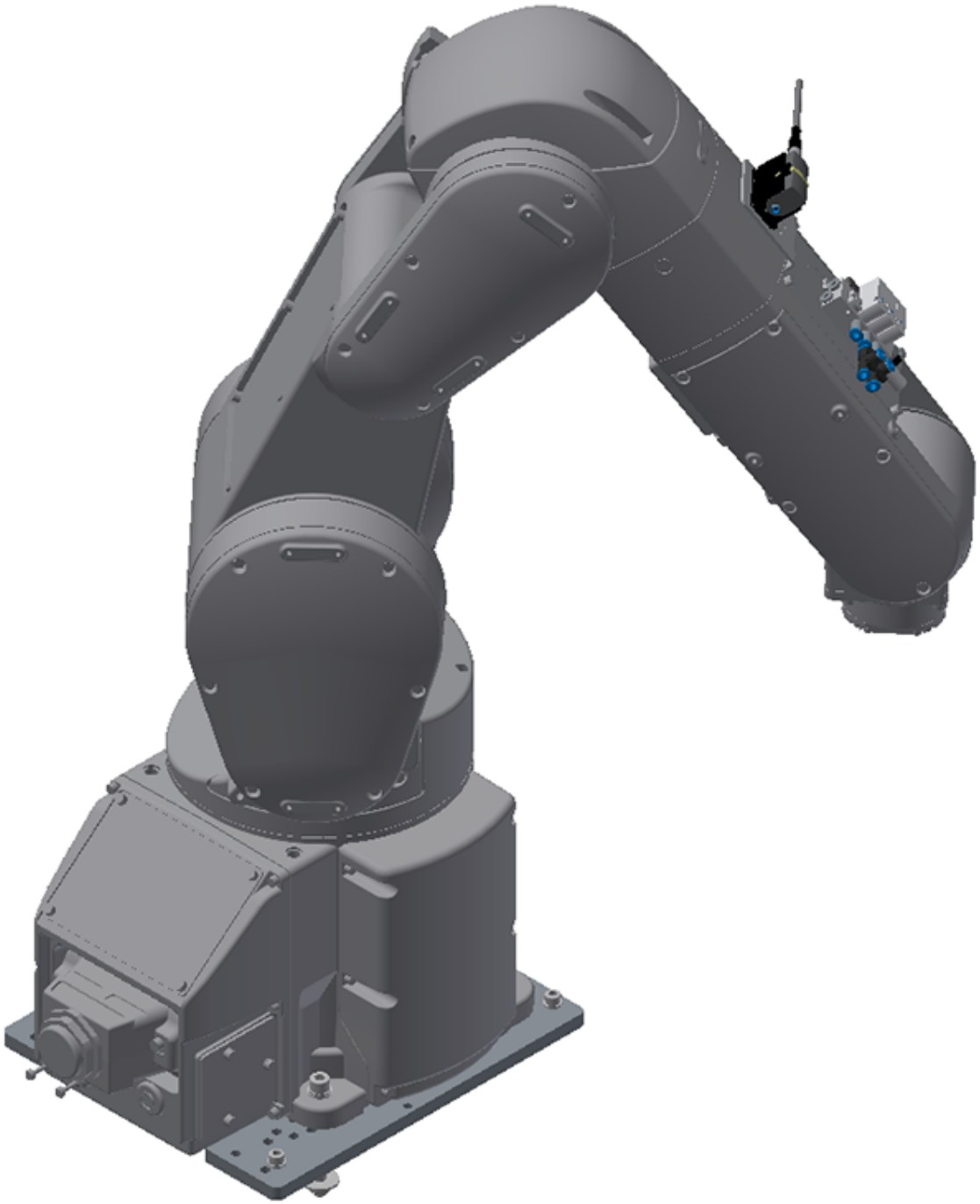


Fig. 48: RV-4FL / Similar to illustration

Services	
Inputs	32 inputs for communication
Outputs	32 outputs for communication

9.1.1 Drive Unit CR800

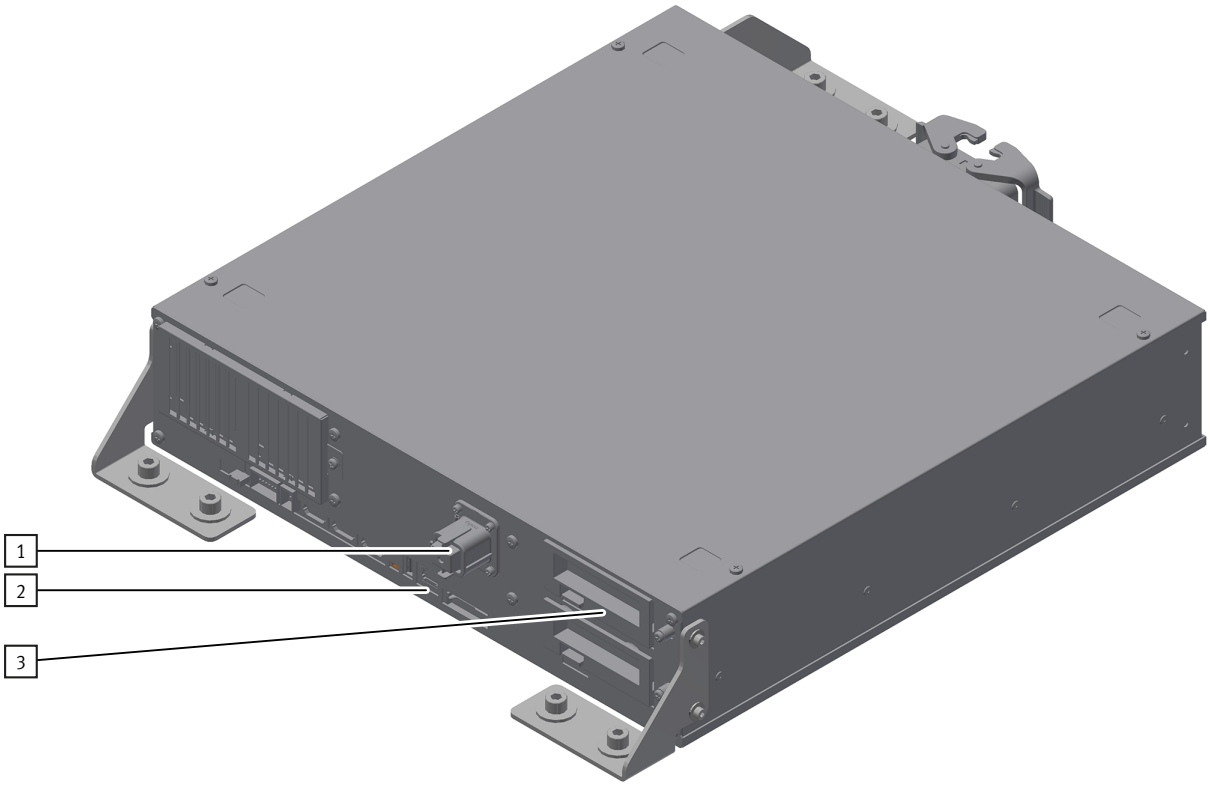


Fig. 49: Similar to illustration

1 TB1 – Slot for TeachBox
2 LAN interface
3 Slot 1.2 for communication to the station

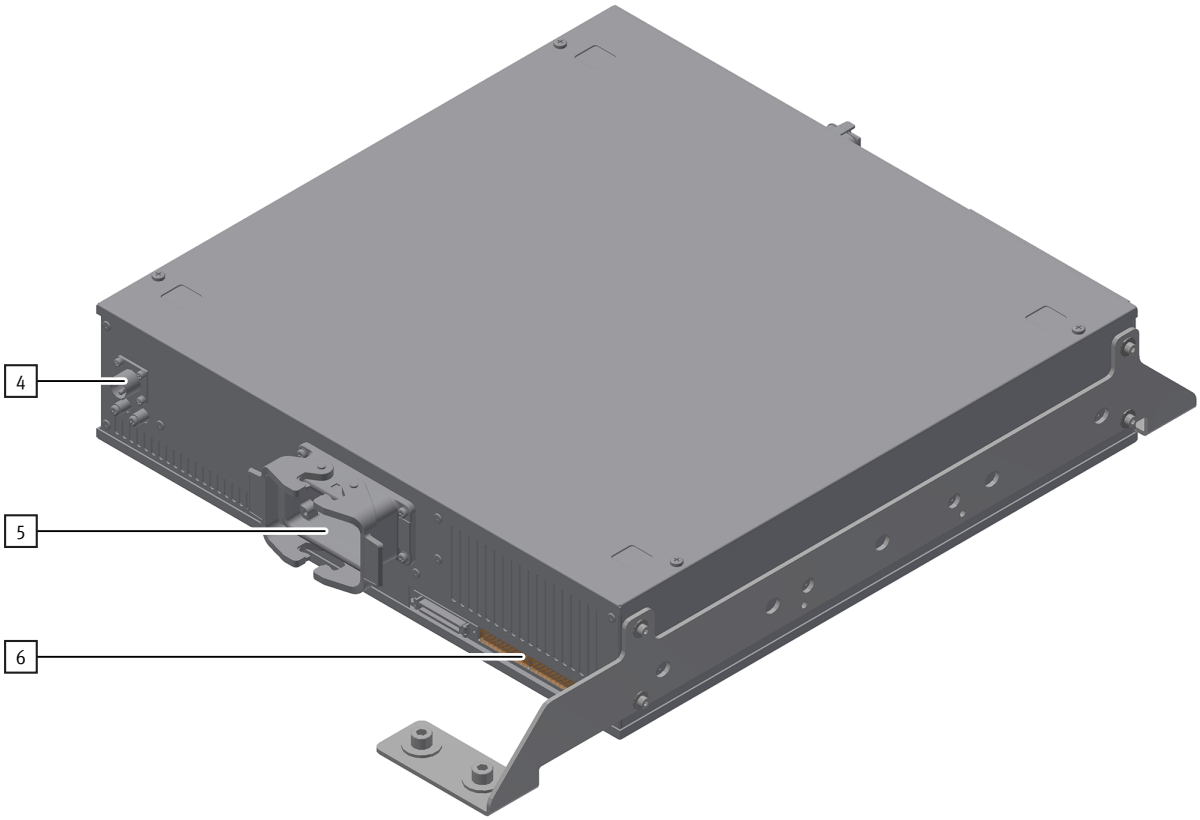


Fig. 50: Similar to illustration

4 AC input – for power supply
5 CN1 – for robot communication/gripper
6 CNUSER 11 – for emergency stop connection

9.1.2 TeachBox R56 TB

This TeachBox is required to work with the robot in standalone mode. The key actuator on the drive unit can be used to select from the following operating modes

- Position auto (AUTO) for standalone operation.
- Position auto (EXT) for communication with other controllers.
- Position teach (MAN) for teach mode.

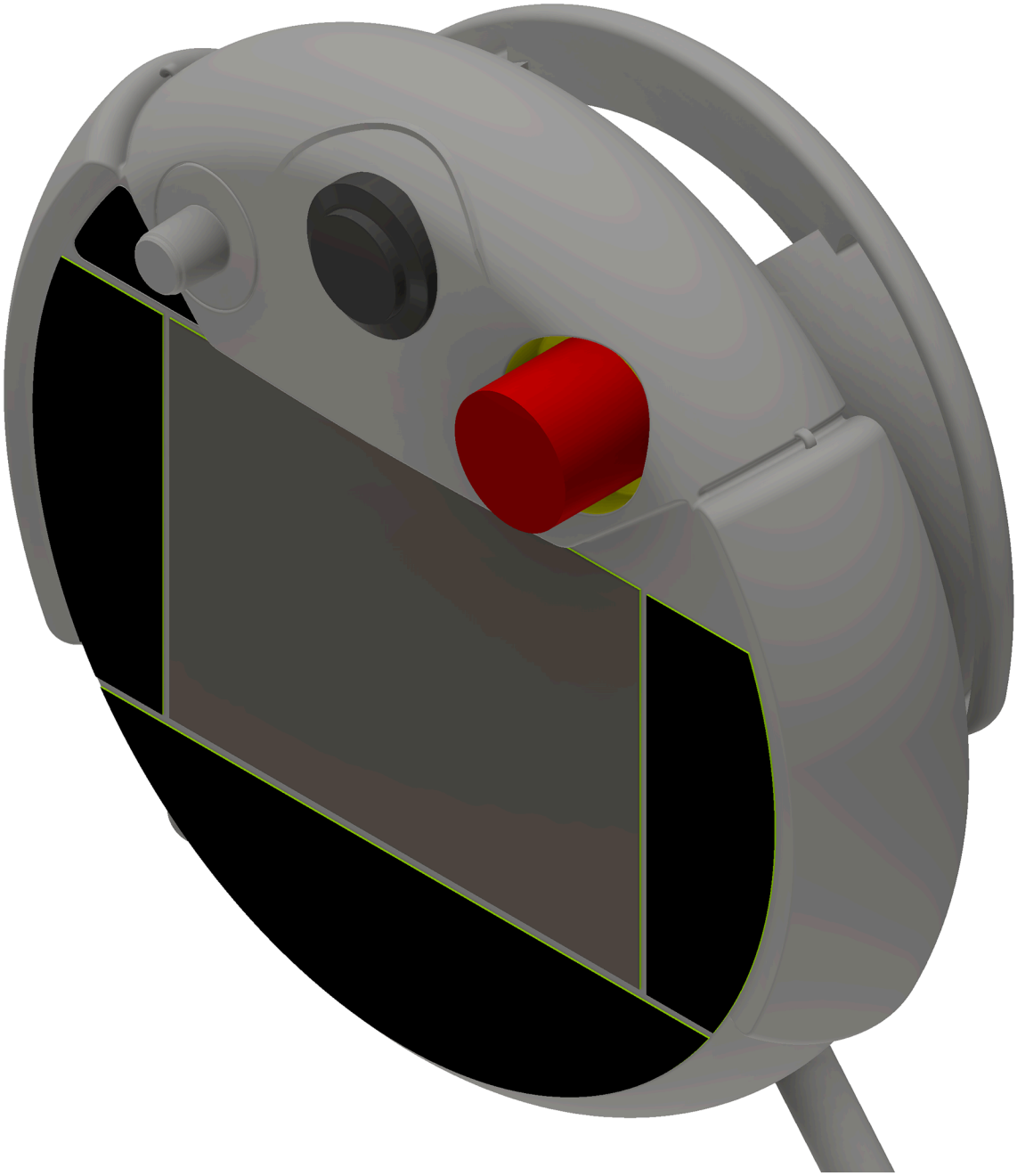
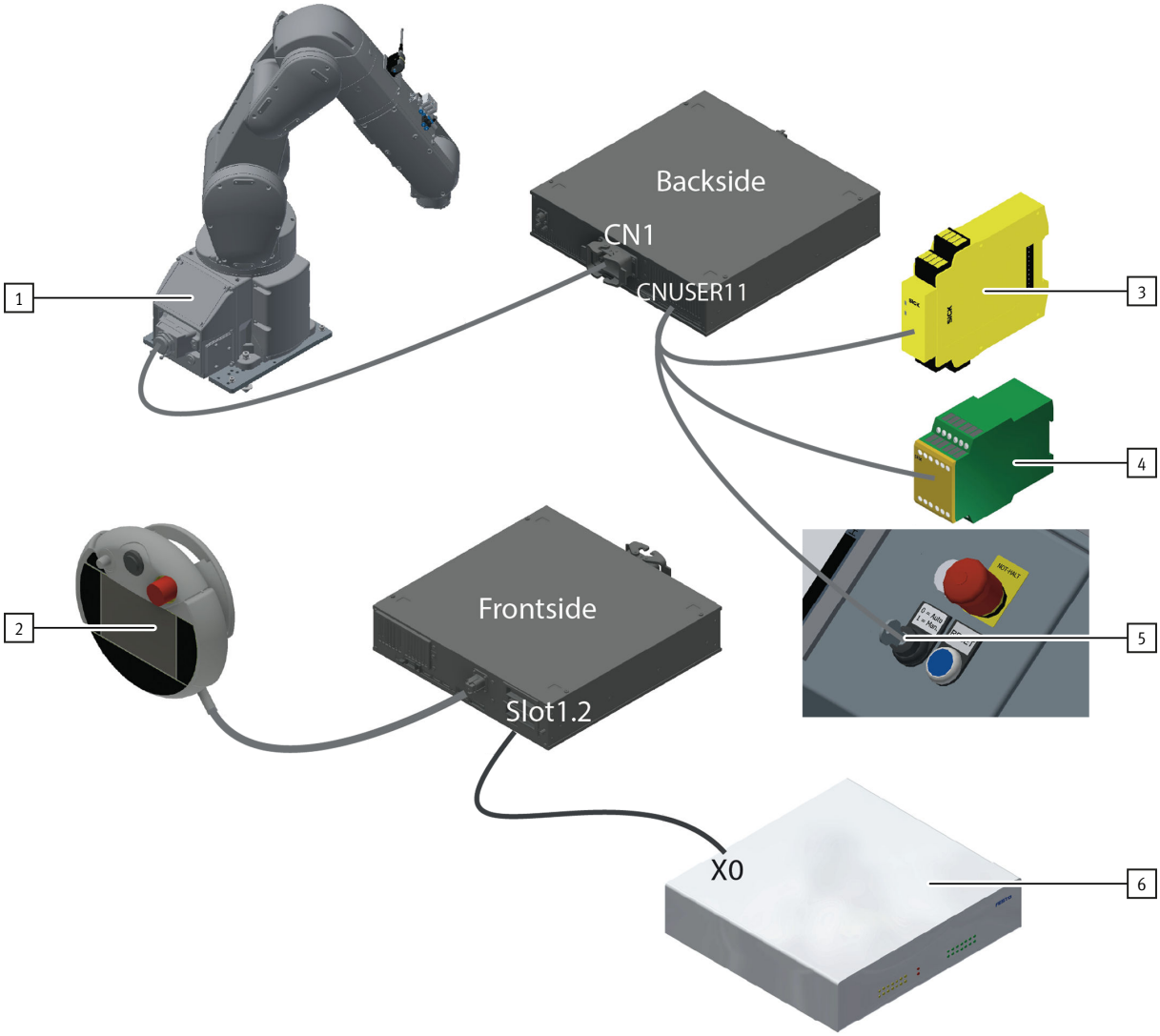


Fig. 51: Similar to illustration

Note

For information on operating the teaching box, please refer to the technical manual for MELFA industrial robots from Mitsubishi Electric.

9.1.3 Setup



1 Robot with cable connection to CR800 on CN1
2 TeachBox R56 TB with cable connection to CR800 controller
3 Emergency stop unit on main e-board with cable connection to CR800 on CNUSER 11
4 PNOZ emergency stop F2-KF2 on robot e-board with cable connection to CR800 on CNUSER 11
5 Automatic/manual key actuator
6 RIA box XD14 with cable connection to CR800 in slot 1.2

9.1.4 Drive Unit Interface

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
I/O card connected to robot	BG9	DI_WPClamped	Input	16	Bit	Top part is clamped at the mounting position	
	BG10	DI_WPAvail	Input	17	Bit	Top part present at the mounting position	
	BG11	DI_WPOrientOk	Input	18	Bit	Top part is not upside down in the mounting position	
	BG12	DI_WPHoleOk	Input	19	Bit	Drilled hole found on the top part	
	BG14	DI_FuseMag1Avail	Input	21	Bit	Fuse present in fuse magazine 1	
	BG15	DI_FuseMag2Avail	Input	22	Bit	Fuse present in fuse magazine 2	
	BG16	DI_FuseMag3Avail	Input	23	Bit	Fuse present in fuse magazine 3	
	BG18	DI_Grp1VacStore	Input	25	Bit	Vacuum gripper available on gripper magazine 1	

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
	BG19	DI_Grp2Wrk Store	Input	26	Bit	Workpiece gripper present on gripper magazine2	
	BG20	DI_Grp3Fus eStore	Input	27	Bit	Safety gripper present on gripper magazine 3	
	k6-BG3	DI_Gripper-Open	Input	900	Bit	Gripper is open	
	K6-BG1	DI_GrpAvail-able	Input	902	Bit	Gripper clamped by the gripper changing system	

Sensor name	Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
Robot Status Info Region	#STOP2	Input	2000	Bit	Stop	100.0
	#START	Input	2001	Bit	Start program	100.1
	#IOENA	Input	2002	Bit	Operating rights available	100.2
	#SLOTINIT	Input	2003	Bit	Reset program	100.3
	#SRVON	Input	2004	Bit	Servo voltage ON	100.4
	#SRVOFF	Input	2005	Bit	Servo voltage Off	100.5
	#ERRRESET	Input	2006	Bit	Reset error input signal	100.6
	#PRGSEL	Input	2007	Bit	Program selection input signal	100.7

Sensor name	Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
	#OVRDSEL	Input	2008	Bit	Override input signal selection	101.0
	#PRGOUT	Input	2009	Bit	No output requested program	101.1
	#OVRDOUT	Input	2010	Bit	Override value requested	101.2
	#ERROUT	Input	2011	Bit	No output requested error	101.3
	#Reserved	Input	2012–2015		Reserved	
	#IODATA	Input	2016–2031	Word	Numerical value input	102–103
	DI_RetryLastStep	Input	2032	Bit	Try an aborted step again	104.0
	DI_ExitCurrCycle	Input	2033	Bit	Exit current program cycle	104.1
	IsRobotinoUsed	Input	2034	Bit	Robotino is used to transport the PCB pallet	104.2
	Reserve_RobState1	Input	2035–2039		Reserved for extensions	
	Reserve_RobState2	Input	2040–2047	Byte	Reserved for extensions	105

Sensor name	Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
Robot Variables Info Region	Reserved-Word1	Input	2048–2063	Word	Reserved word 1	106–107
	DI_StopperNo	Input	2064–2071	Byte	Stopper number to pick up workpiece	108

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
		DI_PCBPal-letNo	Input	2072–2079	Byte	PCB pallet number to accommo-date PCB	109
		Reserve-Byte2	Input	2080–2087	Byte	Reserved byte 2	110
		Reserve-Byte3	Input	2088–2095	Byte	Reserved byte 3	111
		Reserve-Byte4	Input	2096–2103	Byte	Reserved byte 4	112
		Reserve-Byte5	Input	2104–2111	Byte	Reserved byte 5	113
		Reserve-Byte6	Input	2112–2119	Byte	Reserved byte 6	114
		Reserve-Byte7	Input	2120–2127	Byte	Reserved byte 7	115
		Reserve-Byte8	Input	2128–2135	Byte	Reserved byte 8	116
		Reserve-Byte9	Input	2136–2143	Byte	Reserved byte 9	117
Connected to PLC via Profinet	BG1	DI_PalletIn-Front	Input	2144	Bit	PCB pallet in front posi-tion	118.0
	BG2	DI_PalIn-LoadPos	Input	2145	Bit	PCB pallet at manual placement position	118.1
	BG3	DI_PalOr-ientOk	Input	2146	Bit	PCB pallet orientation is correct	118.2
	BG5	DI_Pal-Index1Up	Input	2147	Bit	PCB pallet clamped with front cylinder	118.3

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
	BG6	DI_Pal-Index2Up	Input	2148	Bit	PCB pallet clamped with rear cylinder	118.4
	SF7	DI_PalChangeAck	Input	2149	Bit	Change PCB pallet confirmation	118.5
	BG50	DI_WPPalAvail	Input	2150	Bit	Pallet available at the stopper	118.6
	BG51	DI_WPAtStopAvail	Input	2151	Bit	Workpiece available on pallet at the stopper	118.7
		Reserve-Sensor2	Input	2152–2159	Byte	Reserved for sensor group 2	119
		Reserve-Sensor3	Input	2160–2167	Byte	Reserved for sensor group 3	110
		Reserve-Sensor4	Input	2168–2175	Byte	Reserved for sensor group 4	111

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
I/O card connected to robot	MB9	DO_WPMountLock	Output	16	Bit	Clamp the top part in the assembly position	
	K_IN0	DO_StartCamera	Output	24	Bit	Start camera	
	K6-MB1	Hand1	Output	900	Bit	Hand 1 output	

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
	K6-MB2	Hand2	Output	901	Bit	Hand 2 output	
	k6-MB3	Hand3	Output	902	Bit	Clamp the gripper on the robot flange	
Robot Status Info Region		#STOP2	Output	2000	Bit	Stopping	100.0
		#START	Output	2001	Bit	Start program	100.1
		#IOENA	Output	2002	Bit	Enable operating rights	100.2
		#SLOTINIT	Output	2003	Bit	Enable program selection	100.3
		#SRVON	Output	2004	Bit	Servo on	100.4
		#SRVOFF	Output	2005	Bit	Do not release servo on	100.5
		#ERRRESET	Output	2006	Bit	Error present, output signal	100.6
		#RCREADY	Output	2007	Bit	Controller voltage on is ready	100.7
		#BATERR	Output	2008	Bit	Battery voltage is not present	101.0
		#PRGOUT	Output	2009	Bit	Program no output signal	101.1
		#OVRDOUT	Output	2010	Bit	Override value, output signal	101.2

Sensor name	Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
	#ERROUT	Output	2011	Bit	Error number, output signal	101.3
	#ATTOPMD	Output	2013	Bit	Teach mode output	101.5
	#TEACHMD	Output	2014	Bit	Teach mode output	101.6
	#IODATA	Output	2016–2031	Word	Numerical value output	102–103
	Homeo-stasis	Output	2032	Bit	Robot arm is in home position	104.0
	IsRbtAbo-vePCB	Output	2033	Bit	Robot arm is above PCB pallet	104.1
	Reserve_Rob State1	Output	2034–2039		Reserved for robot status	

Sensor name	Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
Robot Variable Info Region	Reserve_Rob State2	Output	2040–2047	Byte	Reserved for expansion	105
	Reserved-Word1	Output	2048–2063	Word	Reserved word 1	106–107
	ReturnValue	Output	2064–2071	Byte	Return value of the robot	108
	Reserve-Byte1	Output	2072–2079	Byte	Reserved byte 1	109
	Reserve-Byte2	Output	2080–2087	Byte	Reserved byte 2	110
	Reserve-Byte3	Output	2088–2095	Byte	Reserved byte 3	111

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
		Reserve-Byte4	Output	2096–2103	Byte	Reserved byte 4	112
		Reserve-Byte5	Output	2104–2111	Byte	Reserved byte 5	113
		Reserve-Byte6	Output	2112–2119	Byte	Reserved byte 6	114
		Reserve-Byte7	Output	2120–2127	Byte	Reserved byte 7	115
		Reserve-Byte8	Output	2128–2135	Byte	Reserved byte 8	116
Connected to PLC via Profinet	MB5	Reserve-Byte9	Output	2136–2143	Byte	Reserved byte 9	117
	MA4	DO_ExtIn-dexBolt	Output	2144	Bit	Extend clamping cylinder PCB pallet	118.0
	MA4	DO_BeltO-nInDir	Output	2145	Bit	Bringing the PCB pallet into the cell	118.1
	SF7	DO_BeltO-nOutDir	Output	2146	Bit	Removing the PCB pallet from the cell	118.2
		DO_PalAck-LampOn	Output	2147	Bit	Indicator lamp for manual con-firmation	118.3
		Reserve-Sensor1	Output	2148–2151		Reserved for sensor 1	
		Reserve-Sensor2	Output	2104–2011	Byte	Reserved for sensor 2	119
		Reserve-Sensor3	Output	2160–2167	Byte	Reserved for sensor group3	110

Sensor name		Name of variable	Input/ output	Robot address	Data type	Comment	PLC address
		Reserve-Sensor4	Output	2168–2175	Byte	Reserved for sensor group 4	111

9.1.5 Parameter

The following parameters must be set for the configuration of a new drive unit. After configuration, the drive unit must be switched off and then on again.

Tool offsets:

- MEXTL1= 0,0,205,0,0,0
- MEXTL2= 0,0,170,0,0,0
- MEXTL3= 0,0,151.50,0,0,0
- MEXTL4= 0,0,0,0,0,0

Communication parameter DP

- PBNUM=10;
- STOP2=2000,2000;
- START=2001,2001;
- IOENA=2002,2002;
- SLOTINIT=2003,2003;
- SRVON=2004,2004;
- SRVOFF=2005,2005;
- ERRRESET=2006,2006;
- PRGSEL=2007;
- RCREADY=-1,2007;
- OVRDSEL=2008;
- BATERR=-1,2008;
- PRGOUT=2009,2009;
- OVRDOUT=2010,2010;
- ERROUT=2011,2011;
- ATTOPMD=-1,2013;
- TEACHMD=-1,2014;
- IODATA=2016,2031,2016,2031;

Ethernet camera communication parameters:

- COMDEV=Us,"","OPT12","OPT13","","","","","";
- NETH-STIP=Us,"192.168.0.2","192.168.0.3","Camera_IP_Address","192.168.0.5","192.168.0.6","192.168.0.7","192.168.0.8","192.168.0.9","192.168.0.10";
- NETPORT=10000, 10001, 10002, Camera_Port, 10004, 10005, 10006, 10007, 10008, 10009
- NETMODE=Ud,1,1,0,1,1,1,1,1,1;

Slot parameters:

- SLT1=Us,"3","CYC","START","1";
- SLT2=Us, "MONITORHOME", "REP", "ALWAYS", "1";
- SLT3=Us, "ENRGSAVEVACU", "REP", "ALWAYS", "1";
- SLT4=Us, "PCBTRAYCNTRL", "REP", "ALWAYS", "1";
- SLT5=Us, "MONITORPALWS", "REP", "ALWAYS", "1";

9.1.6 Main Tasks/Programs

The following programs must be loaded into the drive unit and must be available there.

Program name	Program description
1.MB5	Program to install the fuse
2.MB5	Program to install the left fuse
3.MB5	Program to install the right fuse
4.MB5	Program to install both fuses
999.MB5	Program to reset the global variable values
UBP.MB5	Global variables list program
EnrgSaveVacu.MB5	Subprogram to switch on the energy-saving function of the vacuum gripper
GetCamResult.MB5	Subprogram to query the camera results
GetCurToolNo.MB5	Subprogram to query the tool number currently gripped by the robot
GetFuseMagNo.MB5	Subprogram to query the available fuse magazine numbers
GrpClose.MB5	Subprogram to close the gripper
GrpLock.MB5	Subprogram to fix the gripper to the robot flange
GrpOpen.MB5	Subprogram to open the gripper

Program name	Program description
GrpRelease.MB5	Subprogram to detach the gripper from the robot flange
GrpVacOff.MB5	Subprogram to switch off the vacuum of the vacuum gripper
GrpVacOn.MB5	Subprogram to switch on the vacuum of the vacuum gripper
Initialize.MB5	Subprogram to initialize the robot cell
MonitorHome.MB5	Parallel program for monitoring when the robot is in the home zone
MonitorPalWS.MB5	Parallel program for monitoring when the robot is in the bypass zone
MountBotFuse.MB5	Subprogram to install the lower fuse
MountPCB.MB5	Subprogram to mount the PCB
MountTopFuse.MB5	Subprogram to install the upper fuse
PickFrmStopr.MB5	Subprogram to pick up the upper housing part from the stopper
PickFrmVision.MB5	Subprogram to pick up the upper part of the housing from the vision area
PickFusFrMag.MB5	Subprogram to pick up a fuse from the fuse magazine
PickNewTool.MB5	Subprogram to pick up a new tool from the tool magazine
PickPCBFrmPal.MB5	Subprogram to pick up a PCB from the PCB pallet
PickWPFrmAss.MB5	Subprogram to pick up an upper housing part from the assembly position
PlaceToStopr.MB5	Subprogram to place the upper housing part at the stopper position
PlaceToVision.MB5	Subprogram to place the upper housing part in the vision area
PlaceWPToAss.MB5	Subprogram to place the upper housing section at the assembly position
SensorCheck.MB5	Subprogram to query all required sensors for the main program

9.1.7 Return messages

Return code	Description
1	Robot gripper closed
11	Unknown gripper type
21	Undetermined stopper number
22	Unknown program number
23	No workpiece on the pallet stopper
31	Camera finds no workpiece
41	Workpiece assembly position is occupied
42	No workpiece present at the mounting position
43	Workpiece is inserted upside down
44	Alignment of the workpiece is not correct
45	No PCB found within the workpiece
52	Unknown PCB pallet number
53	No PCB found on the requested pallet number
63	Fuse magazine is full

9.1.8 More information about the robot

Please refer to the robot manual for operating information.

9.2 Robot Positions

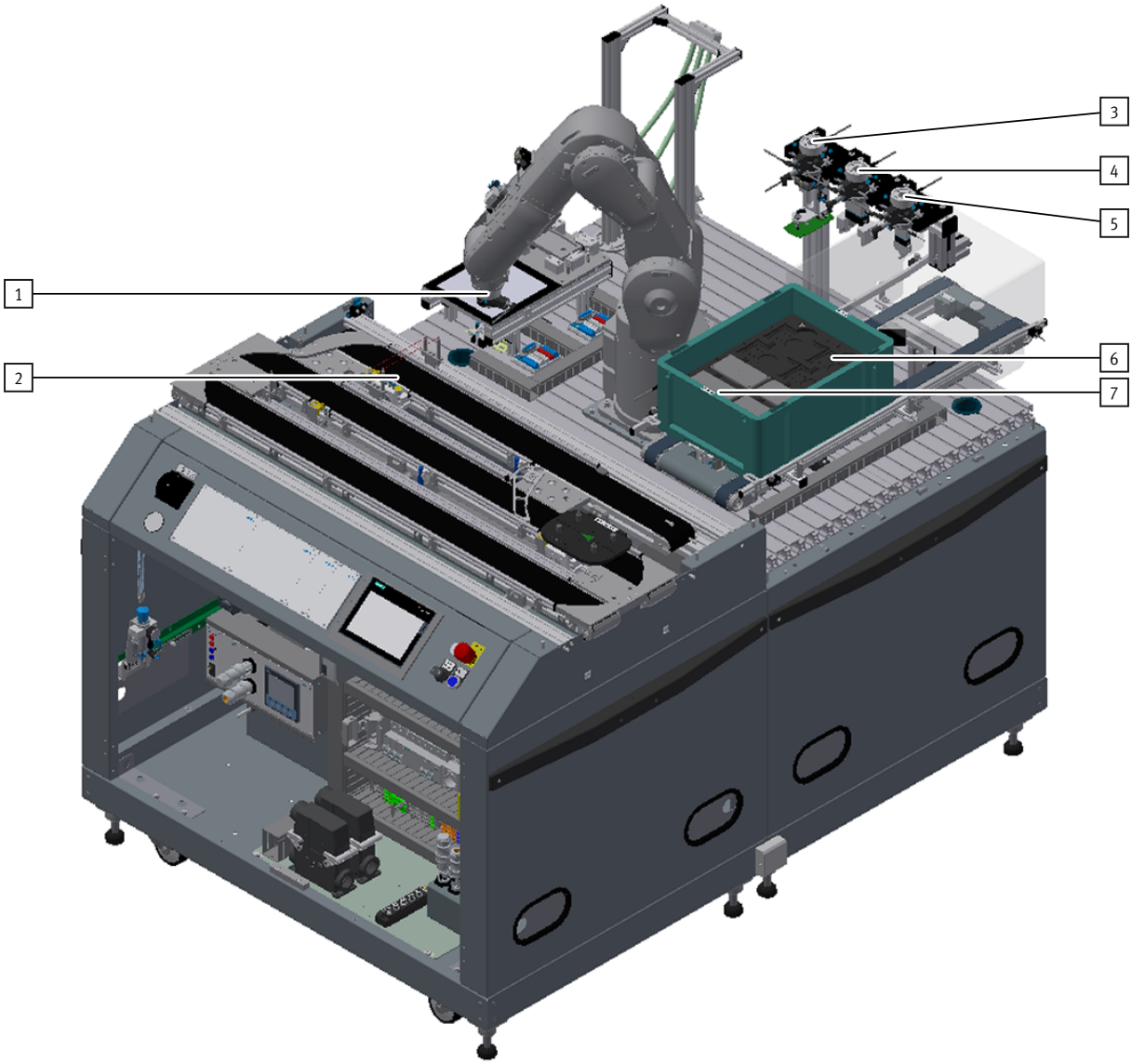


Fig. 52: Similar to illustration

1 PINIT_HOME = no gripper (TOOL 4) initial position
2 CarrierStop1 = workpiece gripper (TOOL2) workpiece position on the pallet
3 GrpStorageVac = no gripper (TOOL 4) vacuum gripper (TOOL1) storage position
4 GrpStorageWp = no gripper (TOOL 4) workpiece gripper (TOOL 2) storage position
5 GrpStorageFuse = no gripper (TOOL 4) fuse gripper (TOOL 3) storage position
6 XPPAL[10] = Vacuum gripper (TOOL1) end position pallet spaces (rear right) / all 10 pallet spaces must be taught.
7 XPPAL[1] = Vacuum gripper (TOOL 1) start position for pallet spaces (front left) / all 10 pallet spaces must be taught.

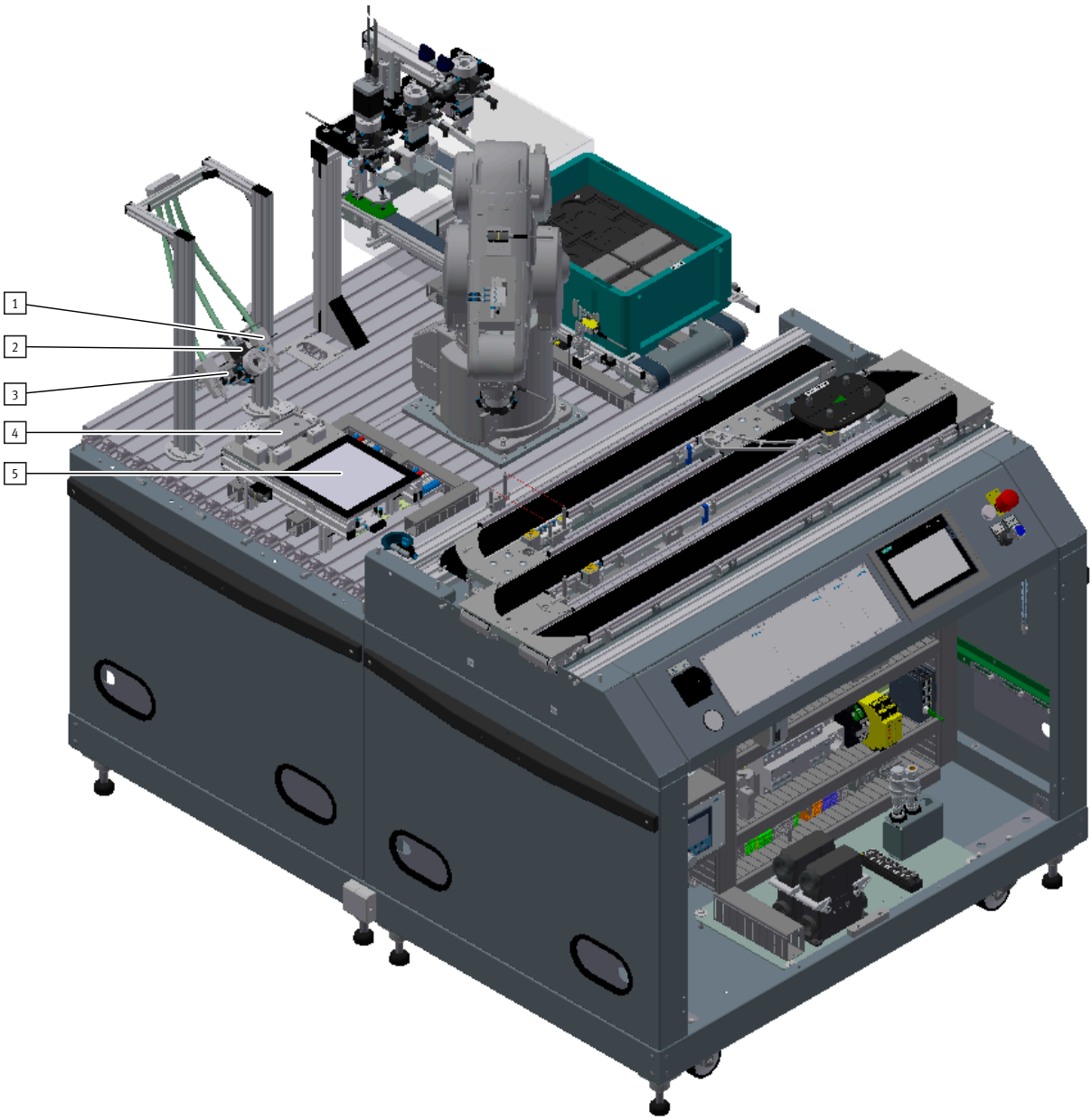


Fig. 53: Similar to illustration

1 FuseMagazine3 = safety gripper (TOOL3) magazine removal position 3
2 FuseMagazine2 = safety gripper (TOOL3) magazine removal position 2
3 FuseMagazine1 = safety gripper (TOOL3) magazine removal position 1
4 AssembleFuse1/AssembleFuse2 = fuse gripper (TOOL3) assembly position 1/2
5 VISION = workpiece gripper (TOOL2) workpiece position on transmitted light unit.

9.3 Electrical Components

9.3.1 2-Quadrant Regulator

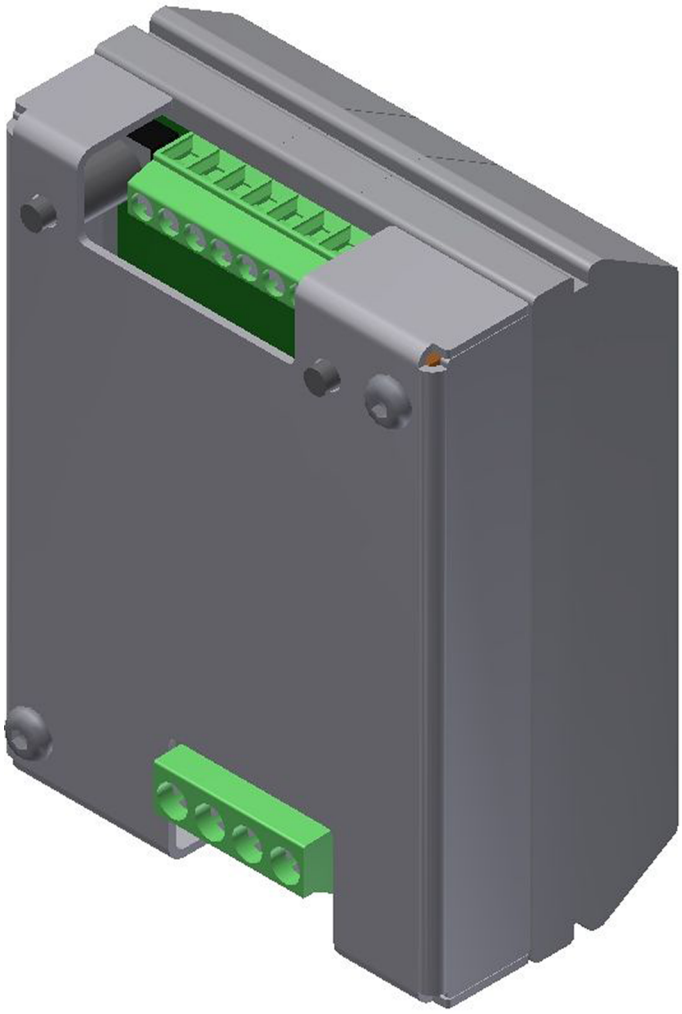


Fig. 54: Similar to illustration

Description

Electronics for permanent magnet DC motors up to 200 W

The M-MZ-4-30 module is a two-quadrant motor controller for DC motors with counterclockwise/clockwise rotation. It ensures that motors are switched on and off safely, and that the direction of rotation is controlled. In the off state, the load is short-circuited, resulting in dynamic braking. The SLOW input can be used to switch between slow speed (setting on Tr1) and full rotational speed. A limit switch can be connected to the STOP input.

Application:

Motor controllers for motors with brushes

Electronic load relay for solenoid valves and various loads

Characteristics

- Counterclockwise/clockwise rotation
- Switching between full rotational speed and the rotational speed set on the TR.1

- Connection for limit switch for stop
- Short-circuit proof and temperature-protected
- Starting current limitation

Technical Data

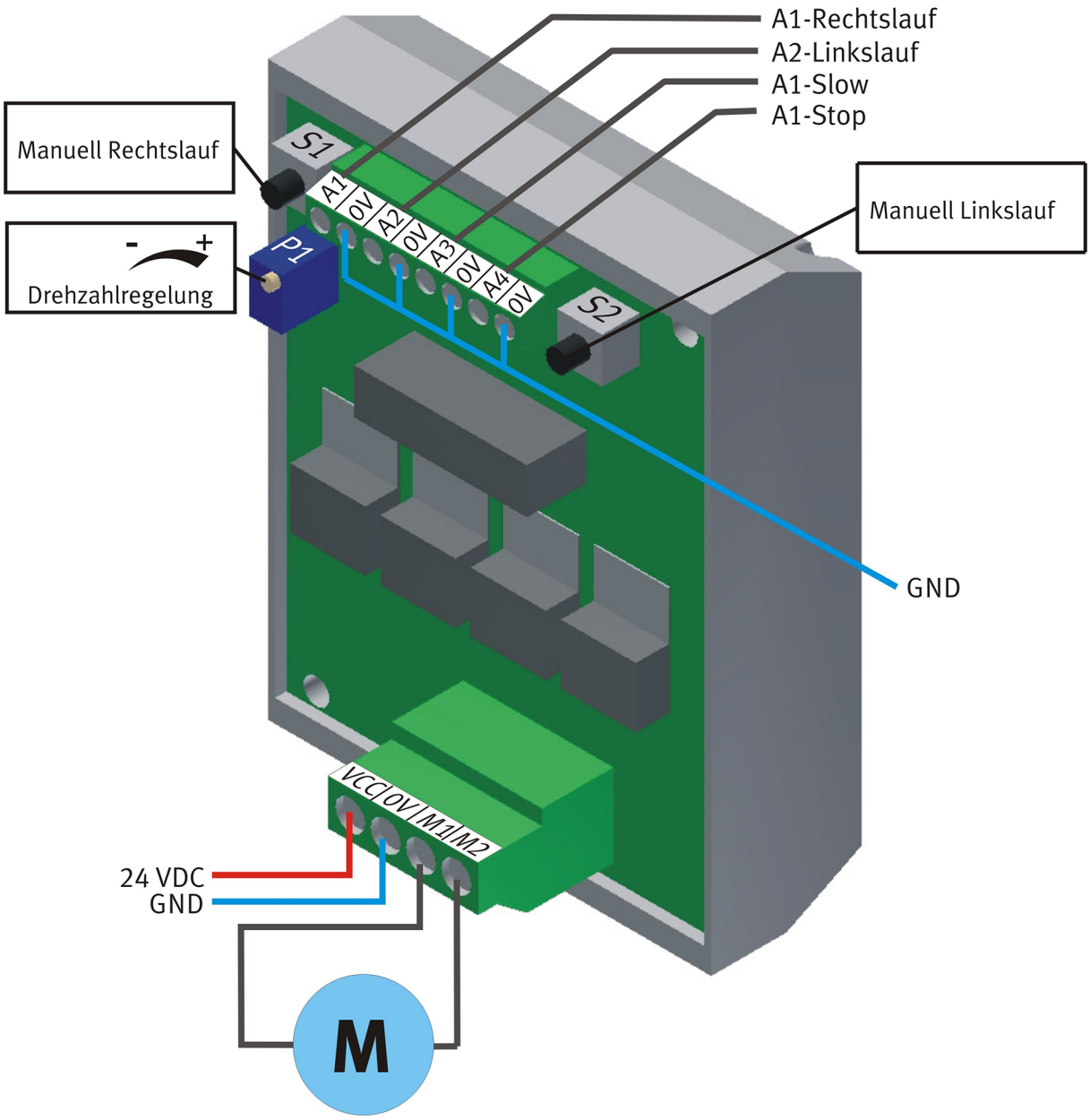
Type: M-MZS-4-30

Technical data				
Control circuit	Input A1/A2 A1=Start clockwise rotation A2=Start counter-clockwise rotation	Switch-on shaft	8	(V)
		Switch-off shaft	5	(V)
		Perm. range	0-35	(V)
	Input A3/A4 A3=Slow speed A4=Stop	Control shaft	8	(V)
		Perm. range	0-35	(V)
	Rotational speed setting range with trimmer on front plate (typical)		0 to max. rotational speed	
	Switch-on delay for A1 and A2 to 24 V		< 2	(ms)
Load circuit	Nominal voltage (supply voltage) Ub/range		24 (19-30)	(VDC)
	Load current/continuous load		3/5 depending on switching frequency	(A)
	Input current with Un / without load circuit		10 mA	(mA)
	Load current Imax. T=1 sec.		20	(A)
	Current detection short circuit		95 typ. (45-140)	A
	Switch-off time short circuit		80-400	µs
Other data	Power supply at stop		<20	(mA)
	Approved ambient temperature		-20 to +40	(°C)
	Safety standard		EN 61010-1	
	Any installation position / DIN rail can be snapped on		No / Yes	
	Case		Plastic housing light gray	

Technical data			
	Dimensions	59x77x50	mm
	Weight	approx. 100	gr
	Temp./short-circuit protection	Yes / Yes	
	Connection type Screw connector	Single wire ≤ 4 mm², fine wire ≤ 2.5 mm² Yes	

Article number 06.05.020

Connection diagram



Input/output	Starting current limiter	Description
Controller – K5-KF10 / Q0.0 / 0x:1	QA1 / X1:cw	Belt drive 1 clockwise
Controller – K5-KF10 / Q0.1 / 0x:2	QA1 / X1:ccw	Belt drive 1 counterclockwise
Controller – K5-KF10 / Q0.2 / 0x:3	QA1 / X1:cs	Belt drive 1 creep speed
Belt motor DC / -XJM1:4	QA1 / X2:M1	Belt motor connection
Belt motor DC / -XJM1:3	QA1 / X2:M2	Belt motor connection

Table 1: Motor MA1

Input/output	Starting current limiter	Description
Controller – K5-KF10 / Q0.4 / 0x:5	QA2 / X1:cw	Belt drive 2 clockwise
Controller – K5-KF10 / Q0.5 / 0x:6	QA2 / X1:ccw	Belt drive 2 counterclockwise
Controller – K5-KF10 / Q0.6 / 0x:7	QA2 / X1:cs	Belt drive 2 creep speed
Belt motor DC / -XJM2:4	QA2 / X2:M1	Belt motor connection
Belt motor DC / -XJM2:3	QA2 / X2:M2	Belt motor connection

Table 2: Motor MA2

Input/output	Starting current limiter	Description
Controller – K5-KF10 / Q0.6 / 0x:7	QA3 / X1:cw	Belt drive 3 clockwise
Controller – K5-KF10 / Q0.7 / 0x:8	QA3 / X1:ccw	Belt drive 3 counterclockwise
Controller – K5-KF10 / Q1.7 / 0x:8	QA3 / X1:cs	Belt drive 3 creep speed
Belt motor DC / -XJM3:4	QA3 / X2:M1	Belt motor connection
Belt motor DC / -XJM3:3	QA3 / X2:M2	Belt motor connection

Table 3: Motor MA3

9.3.2 Gripper Changing System

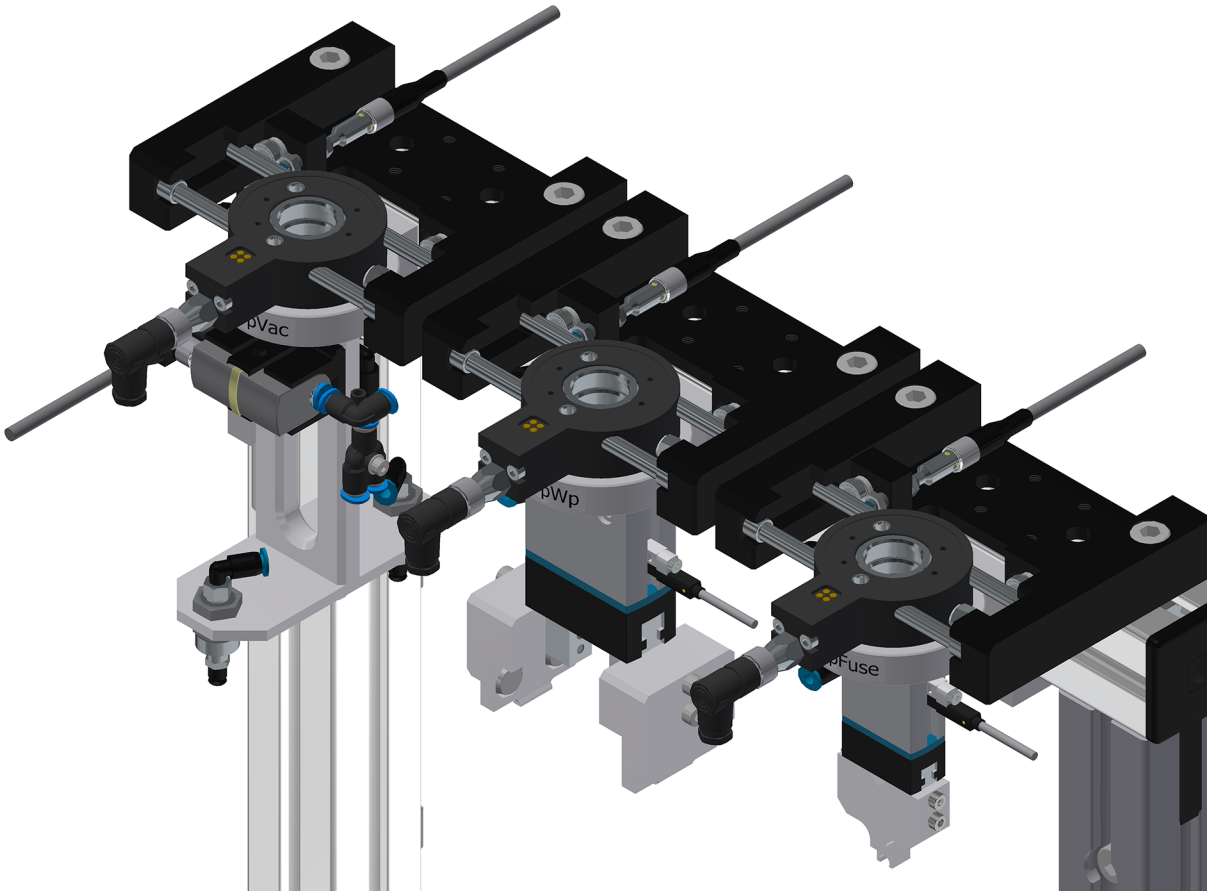


Fig. 55: Example of gripper changing system with storage station / Similar to illustration

The loose part (tool) has the designation WWR-40L-B and the energy element has the designation WER 02-LF04

- TK40 in accordance with EN ISO 9409-1
- Pneumatic energy transmission*: 4x
- Electrical/hydraulic energy transmission: optional optional
- Self-locking during interlocking: mechanical mechanical
- Axle offset during coupling max. in X,Y [mm]: 1.3 mm
- Operating temperature min./max. [°C]: 5–80 ° C
- Moment of inertia [kg/cm2]: 0.28 • Weight [g]: 90 g

All data at 6 bar

9.3.3 LED surface light

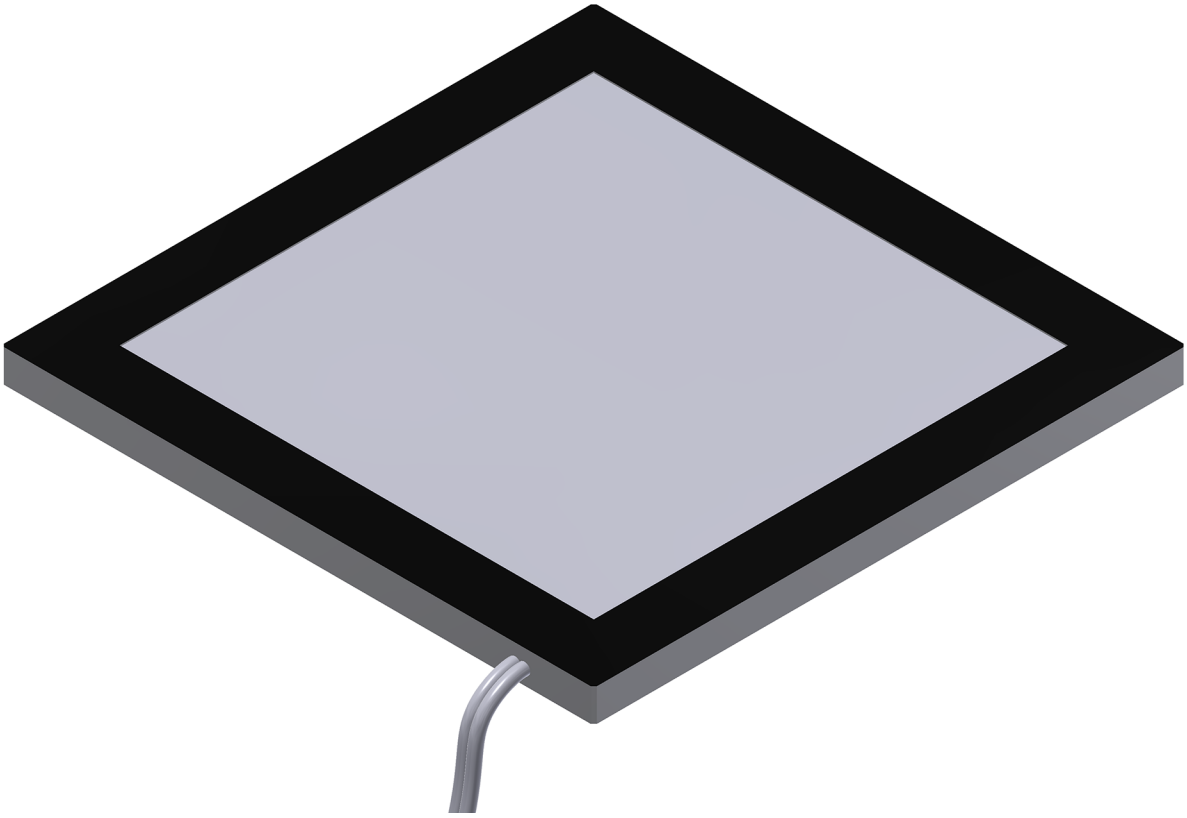


Fig. 56: Hansen Neon / Similar to illustration

The LED surface light is used to illuminate the workpiece. The workpiece can be placed anywhere on the light surface. The camera system easily recognizes the workpiece on the surface.

- Power LEDs, type Nichia NFSW036
- 1 x electronic ballast unit, type EVG 12-25 (12 V, 25 W)
- Active power: 23.8 watts
- Color temperature: 6500 K
- Luminance: 380–500 cd/m2

The calibration tool is located on the back

9.3.4 Siemens controller

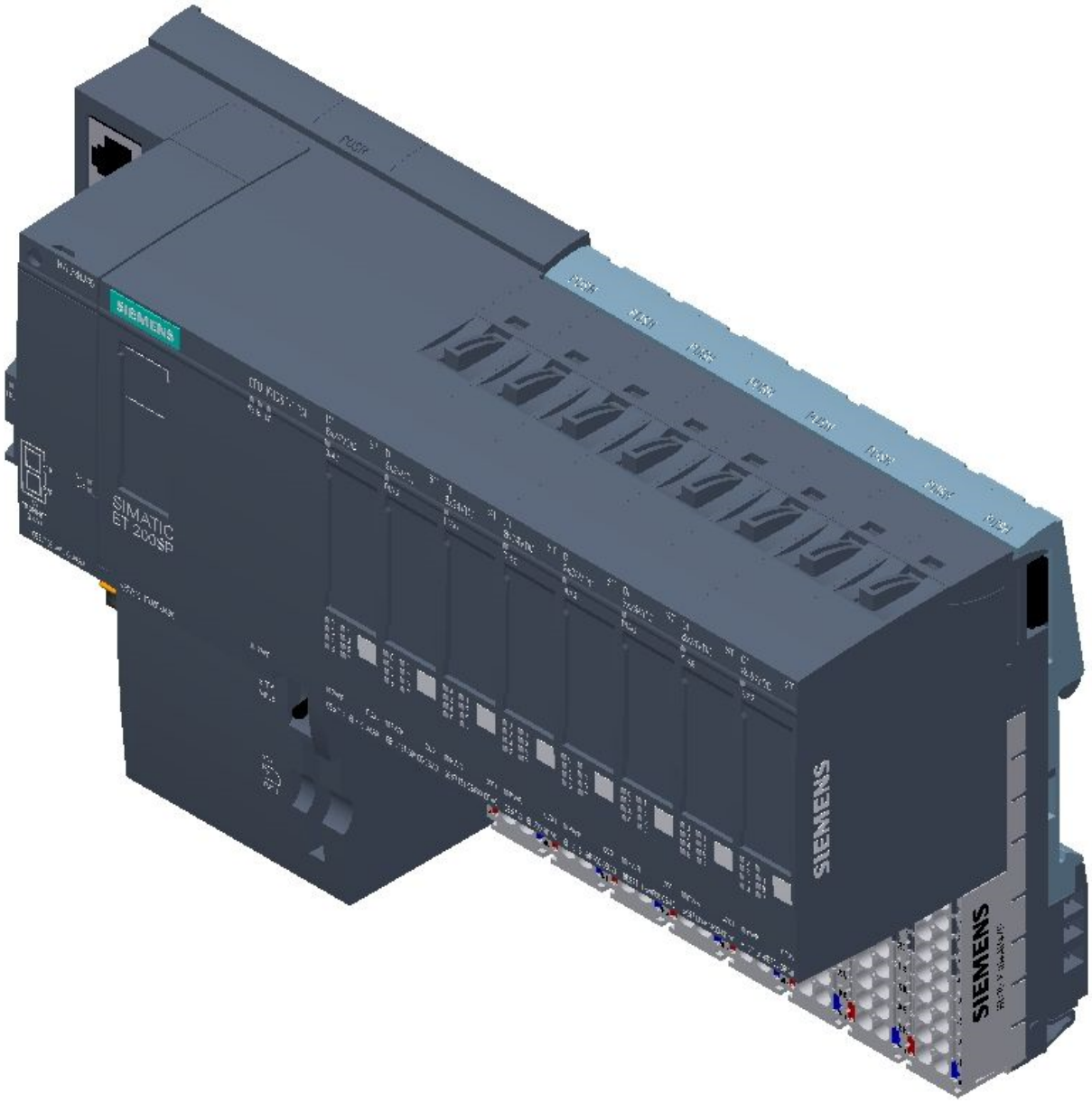


Fig. 57: Siemens ET200 SP / CPU 1512/1516 SP F-1PN / Similar to illustration

Detailed information on the controller can be found in the circuit diagram.

9.3.5 Touch panel

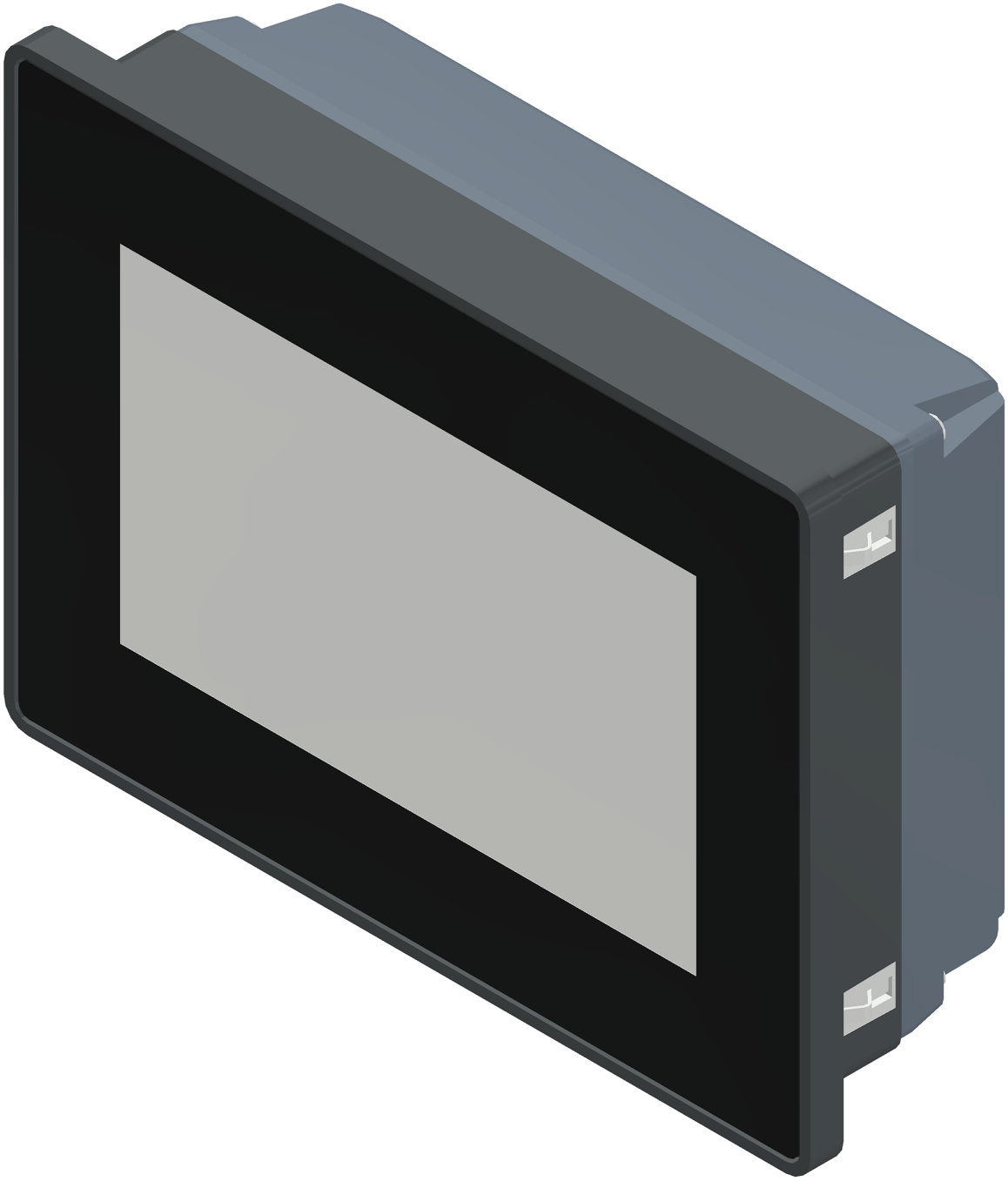


Fig. 58: Siemens MTP 700 Comfort / Similar to illustration

Power supply	
Type of power supply	DC
Value (DC)	24 V
Permitted range, lower limit (DC)	19.2 V
Permitted range, upper limit (DC)	28.8 V

Power supply	
Input current	
Current consumption	0.45 A
Starting current I^2t	0.5 $A^2 \cdot s$
Memory	
Flash	Yes
RAM	Yes

9.3.6 Scalance Ethernet switch

Fig. 59: Siemens Scalence Ethernet switch / Similar to illustration

The SCALANCE X208 has eight RJ45 sockets for connecting terminals or other network segments.

Product features

SCALANCE X208

Operating instructions, 12/2010, A5E00349864-16

TP interfaces / pin assignment

On the SCALANCE X208, the TP interfaces are configured as RJ45 sockets with MDI-X assignment (Medium Dependent

Interface Autocrossover) of a network component.

RJ45 socket

Pin number

Allocation

Pin 8 = n.c.

Pin 7 = n.c.

Pin 6 TD-

Pin 5 = n.c.

Pin 4 = n.c.

Pin 3 TD+

Pin 2 RD-

Pin 1 RD+

CAUTION

TP cords or TP-XP cords with a maximum length of 10 m can be connected to the TP port in RJ45 design.

With the IE FC Cables and IE FC RJ45 Plug 180, a total cable length of up to 100 m between two devices is permitted, depending on the cable type.

Autonegotiation

Autonegotiation is the automatic recognition of the functionality of the other party's interface. With the autonegotiation procedure, repeaters or terminals can determine which functionality the interface of the other end has, so that automatic configuration of different devices is possible. The autonegotiation procedure enables two components connected to a link segment to exchange parameters with each other and to use these parameters to adjust to the supported basic communication values.

Note

If an IE switch port that works in autonegotiation mode is connected to a partner device that does not work in autonegotiation mode, this partner device must be permanently set to half-duplex mode. If an IE switch port is permanently set to full duplex mode, the connected partner device must also be set to full duplex. If the autonegotiation function is switched off, the MDI/MDI-X autocrossover function is also not active. A crossed cable may therefore have to be used.

Note

The SCALANCE X208 is a plug and play device that does not require any settings for commissioning.

MDI/MDIX autocrossover function

The MDI/MDIX autocrossover function offers the advantage of continuous cabling without the need for external, crossed Ethernet cables. This prevents malfunctions if the transmit and receive lines are reversed. This makes installation much easier for the user. IE Switches X-200 support the MDI / MDIX autocrossover function.

CAUTION

Please note that a direct connection between two ports on the switch or an unintentional connection across several switches leads to an impermissible loop formation. Such a loop can lead to power system overload and power system failures.

Polarity reversal (Auto Polarity Exchange)

If the receiver cable pair is connected incorrectly (RD+ and RD- reversed), the polarity is automatically reversed

9.3.7 RFID

Fig. 60: Turck – TBEN-S2-2RFID-4DXP / 6814029 / Similar to illustration

I/O data mapping

The BLident RFID-A interface module cannot be controlled via the process data alone. A software function block is always required in the controller. The function block is standardized for RFID systems and is called Proxy Ident Block or PIB for short.

Input	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Channel 0	0	Status word channel 0- low byte							
	1	Status word channel 0- high byte							
Channel 1	2	Status word channel 1- low byte							
	3	Status word channel 1- high byte							

Output	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Channel 0	0	Control word channel 0- low byte							
	1	Control word channel 0- high byte							
Channel 1	2	Control word channel 1- low byte							
	3	Control word channel 1- high byte							

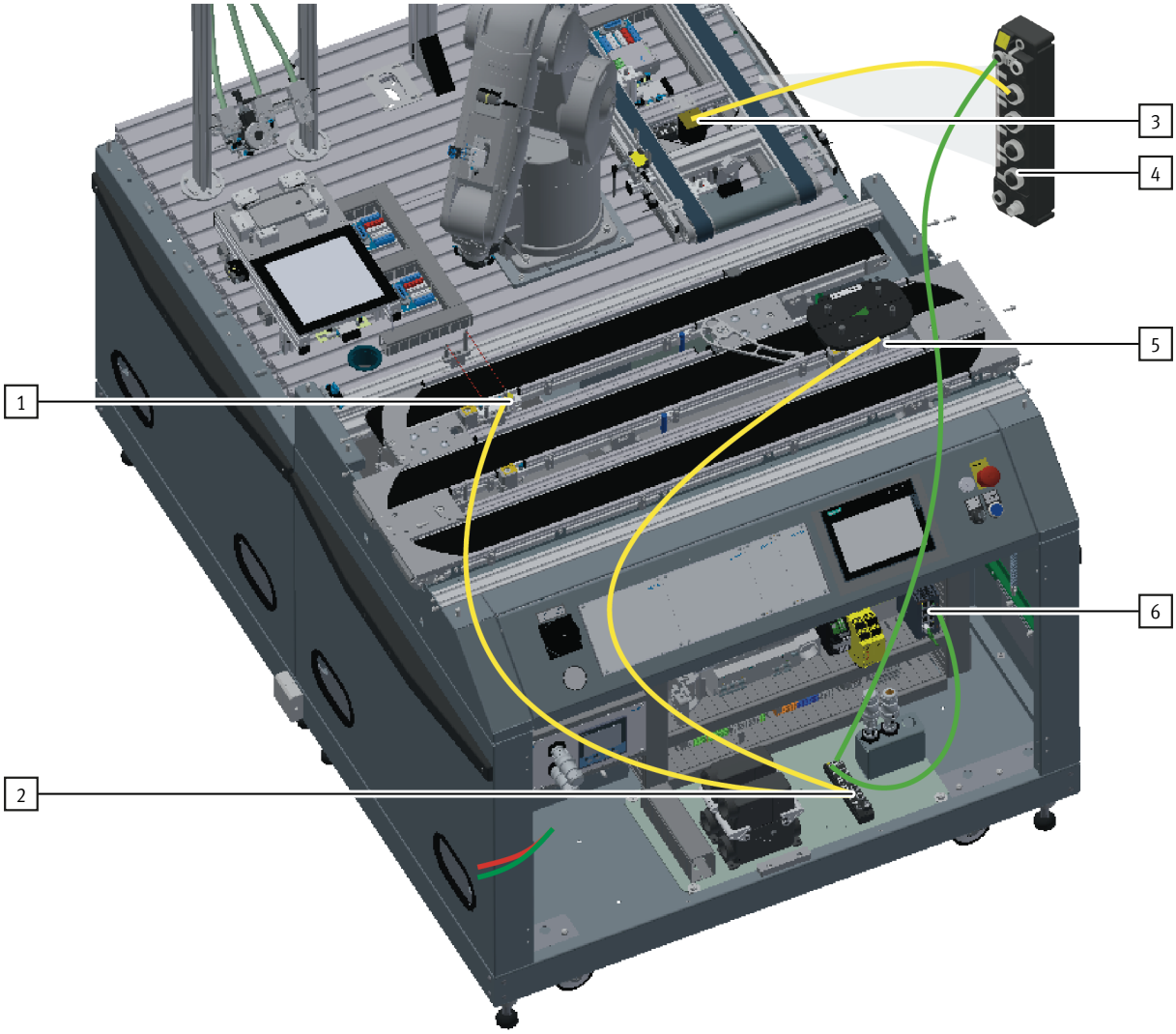


Fig. 61: Wiring RFID module with RFID interface / Similar to illustration

1 Turck read/write head TB-M18-H1147 (BMK G-TF80)
2 Turck read/write head TB-M18-H1147 (BMK G-TF80)
3 Controller ET200SP / CPU 1512SP F-1PN (BMK K5-KF1)
4 Ethernet cable from Turck module to controller
5 Turck cable from Turck read/write head to Turck module
6 Turck cable from Turck read/write head to Turck module
7 Turck Ethernet module with RFID interface (BMK -K2-KF80)

Fig. 62: RFID read/write head / Similar to illustration

The RFID read/write head from Turck is mounted in the stopper unit on the belt. The designation is TB-M18-H1147

Designation	
Operating voltage	10 ... 30 VDC
Rated DC operating current	0–80 mA
Operating voltage	DC
Data transfer	inductive coupling

Designation	
Working frequency	13.56 MHz
Read/write distance	max. 30 mm

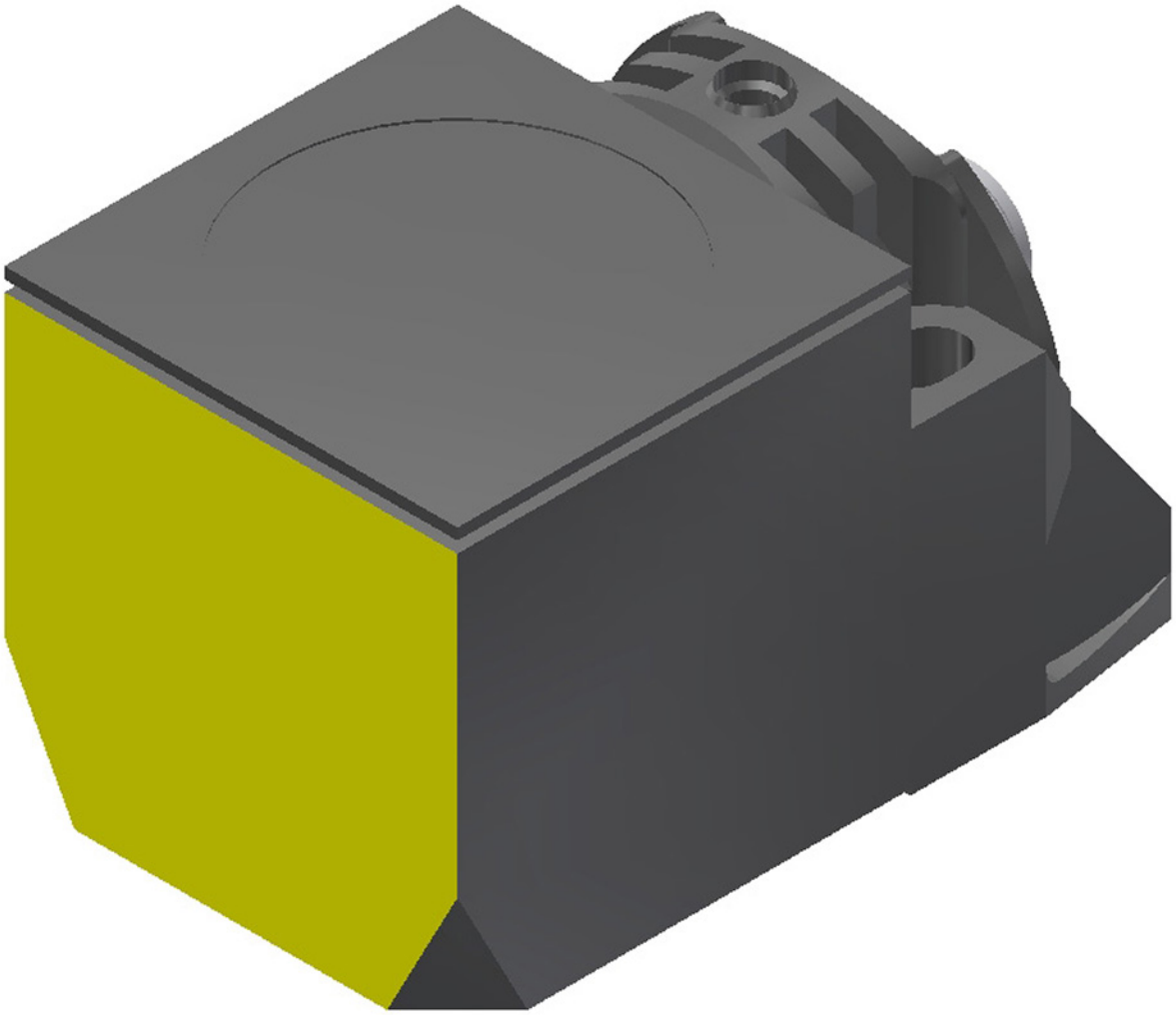


Fig. 63: RFID read/write head / Similar to illustration

The Turck RFID read/write head is mounted in the center of the box conveyor. Its designation is TN-CK40-H1147.

Designation	
Operating voltage	10 ... 30 VDC
Rated DC operating current	0–80 mA
Operating voltage	DC
Data transfer	inductive coupling
Working frequency	13.56 MHz

Designation	
Read/write distance	max. 115 mm

9.3.8 Load circuit monitoring

Fig. 64: Murr Mico load circuit monitoring 2-channel / Similar·to·illustration

Designation	
INPUT	
Operating voltage	24 VDC (18 ... 30 VDC)
CONTROL INPUTS	
Input voltage (ON)	10...30 V DC
Pulse length (ON)	min. 20 ms
CONTROL OUTPUTS	
Collective alarm output	potential-free 30 VAC/DC, 100 mA
GENERAL DATA	
Connection type	Spring terminals
Input terminals	1× 16 mm^2
Output terminals	1× 4 mm^2 per output
Signal terminals	2.5 mm^2
Bridge concept	one-sided by means of spring-cage terminal or jumper set (max. 40 A)
Type of mounting	snaps onto TH35 mounting rail (EN 60715)
Dimensions HxWxD	90×36×80 mm
Temperature range	0 ... +55 °C (storage temperature -40 ... +80 °C)
OUTPUT	
Current setting	1 A, 2 A, 4 A, 6 A, by means of recessed rotary switch, sealable
Switch-on capacity	max. 20 mF (per channel)

9.3.9 Multi-pin plug distributor

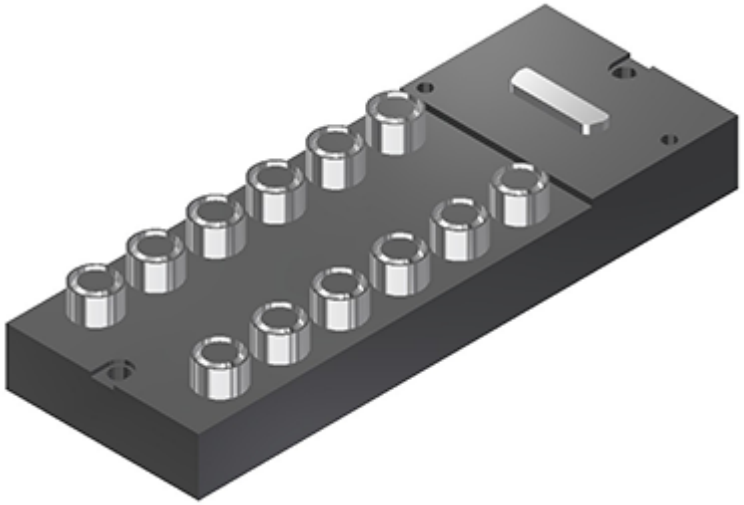


Fig. 65: MPV-E/A12-M8 / 177670 / Similar to illustration

The multi-pin plug distributor is for the station's inputs and outputs. PNP sensors and 2-pin actuators can be connected. The connection is made via 3-pin M8x1 plugs. The shared connection via 15-pin Sub-D plug. The switching status is indicated by yellow LEDs.

Pin assignment of the multi-pin plug distributor	
Contact assignment sub-D plug, 15-pin	
Signal cables	Pin 1 to pin 15
DC 24V	Pin 13
0V	Pin 14 and pin 15

Contact assignment M8 socket according to IEC 947-5-2	
Slot 0 to 11	
Data transmission line	Socket 4
DC 24V	Socket 1
0V	Socket 3

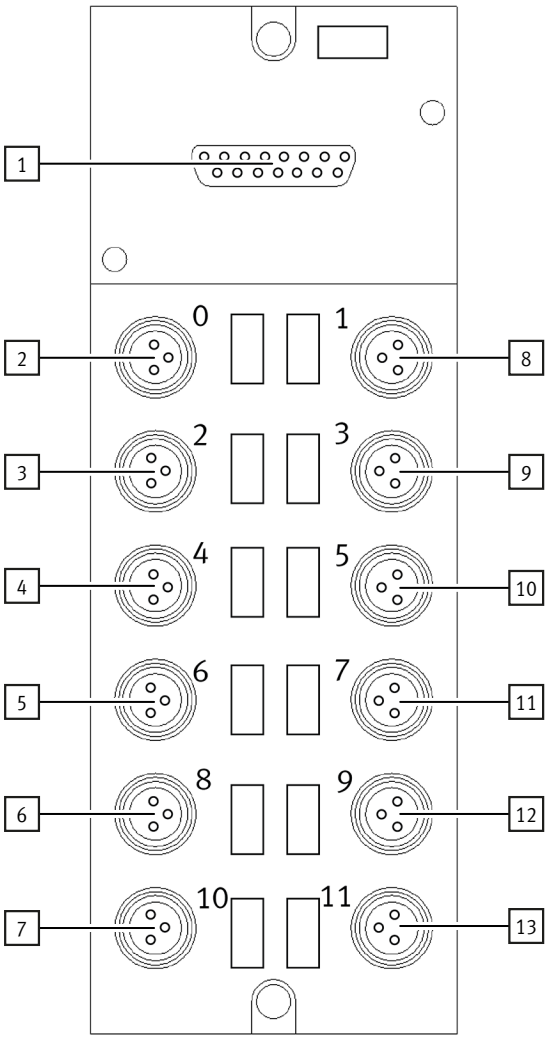


Fig. 66: Multi-pin plug distributor / Similar to illustration

Item	Designation	Item	Designation
1	Mounting hole M4	12	Inscription label
2	15-pin Sub-D plug	13	PIN 8
3	PIN 1	14	PIN 15
4	PIN 9	15	Inscription label
5	Mounting hole M3	16	OUT 0
6	IN 0	17	OUT 1
7	IN 1	18	OUT 2
8	IN 2	19	OUT 3
9	IN 3	20	OUT 4
10	IN 4	21	OUT 5

Item	Designation	Item	Designation
11	IN 5		

XD20 – multi-pin plug distributor MPV1

15-pin Sub-D/pin	Bit	Designation
1	Bit 0	Stopper 1 bottom / -BG20
2	Bit 1	Lower stopper 1 / -MB20
3	Bit 2	Pallet available/ Identification sensor 1 /-BG21
4	Bit 3	Reserve
5	Bit 4	Identification sensor 2 /-BG22
6	Bit 5	Reserve
7	Bit 6	Identification sensor 3 /-BG23
8	Bit 7	Reserve
9	Bit 8	Identification sensor 4 / -BG24
10	Bit 9	Reserve
11	Bit 10	Receiver downstream station 1 occupied (option)
12	Bit 11	Transmitter downstream station 1 occupied (option)
13	+24 V	
14 and 15	0V	

XD30 – multi-pin plug distributor MPV2

15-pin Sub-D/pin	Bit	Designation
1	Bit 0	Stopper 2 bottom / -BG30
2	Bit 1	Lower stopper 2 /-MN30
3	Bit 2	Pallet available/ Identification sensor 1 /-BG31
4	Bit 3	Reserve
5	Bit 4	Identification sensor 2 /-BG32

15-pin Sub-D/pin	Bit	Designation
6	Bit 5	Reserve
7	Bit 6	Identification sensor 3 /-BG33
8	Bit 7	Reserve
9	Bit 8	Identification sensor 4 / -BG34
10	Bit 9	Reserve
11	Bit 10	Bypass congestion sensor / BG35
12	Bit 11	Reserve
13	+24 V	
14 and 15	0V	

XD40 – multi-pin plug distributor MPV3

15-pin Sub-D/pin	Bit	Designation
1	Bit 0	Bypass closed / -BG40
2	Bit 1	Bypass closed / -MB40
3	Bit 2	Bypass open / -BG41
4	Bit 3	Bypass open / -MB41
5	Bit 4	Stopper 3 bottom / -BG42
6	Bit 5	Lower stopper 3 / -MB42
7	Bit 6	Stopper 3 pallet present / -BG43
8	Bit 7	Reserve
9	Bit 8	Belt 2 traffic jam / -BG44
10	Bit 9	Reserve
11	Bit 10	Insert WT from bypass / BG45
12	Bit 11	Reserve
13	+24 V	
14 and 15	0V	

XD50 – multi-pin plug distributor MPV4

15-pin Sub-D/pin	Bit	Designation
1	Bit 0	Pick-up position 1 pallet not available / -BG50
2	Bit 1	Reserve
3	Bit 2	Pick-up position 1 workpiece not available on pallet / -BG51
4	Bit 3	Reserve
5	Bit 4	Query carrier on belt 2 infeed / -BG52
6	Bit 5	Reserve
7	Bit 6	Query carrier on belt 2 outlet / -BG53
8	Bit 7	Reserve
9	Bit 8	Reserve
10	Bit 9	Reserve
11	Bit 10	Receiver downstream station 2 occupied (option)
12	Bit 11	Transmitter downstream station 2 occupied (option)
13	+24 V	
14 and 15	0 V	

9.3.10 SYS link interface

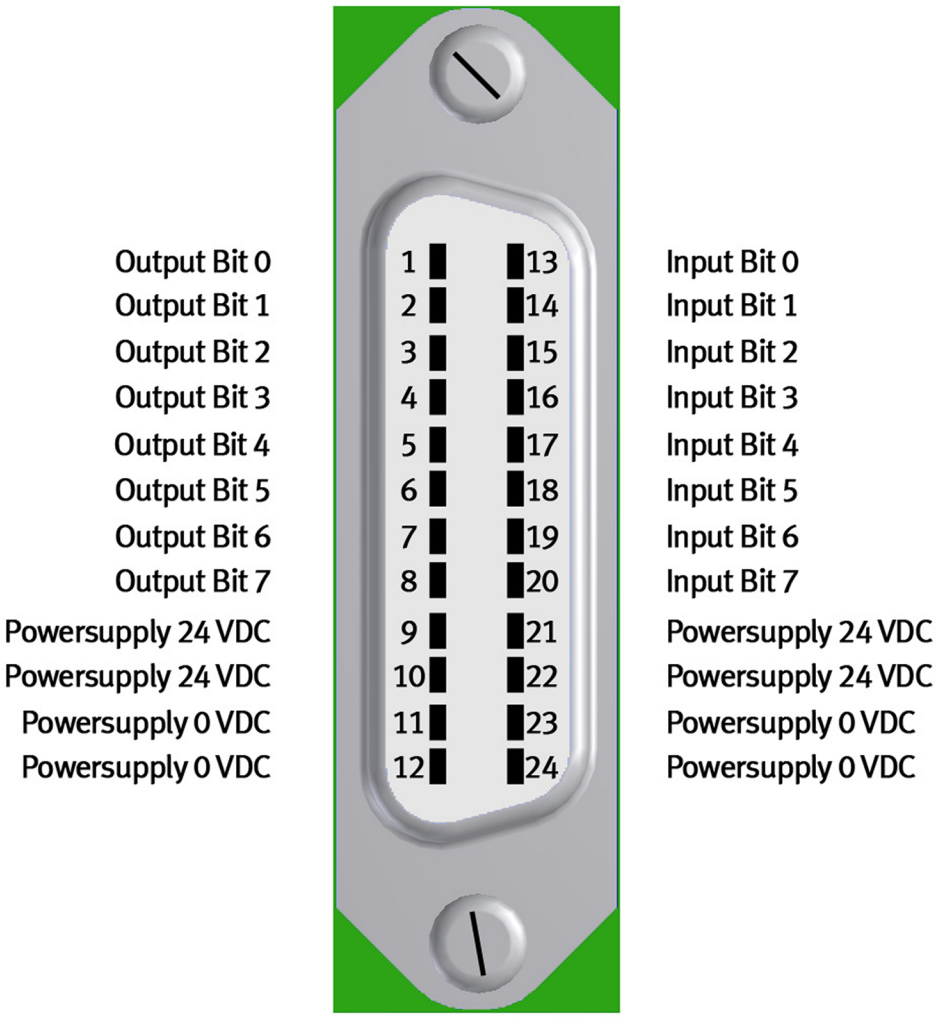


Fig. 67: Syslink – assignment

SYSlink PIN	Bit	Designation		Syslink PIN	Bit	Function
01	0	Output AX.0		13	0	Input EX.0
02	1	Output AX.1		14	1	Input EX.1
03	2	Output AX.2		15	2	Input EX.2
04	3	Output AX.3		16	3	Input EX.3
05	4	Output AX.4		17	4	Input EX.4
06	5	Output AX.5		18	5	Input EX.5
07	6	Output AX.6		19	6	Input EX.6
08	7	Output AX.7		20	7	Input EX.7
09	24 V	Power supply		21	24 V	Power supply

SYSlink PIN	Bit	Designation		Syslink PIN	Bit	Function
10	24 V	Power supply		22	24 V	Power supply
11	0 V	Power supply		23	0 V	Power supply
12	0 V	Power supply		24	0 V	Power supply

9.4 Mechanical Components

9.4.1 Conveyor motor

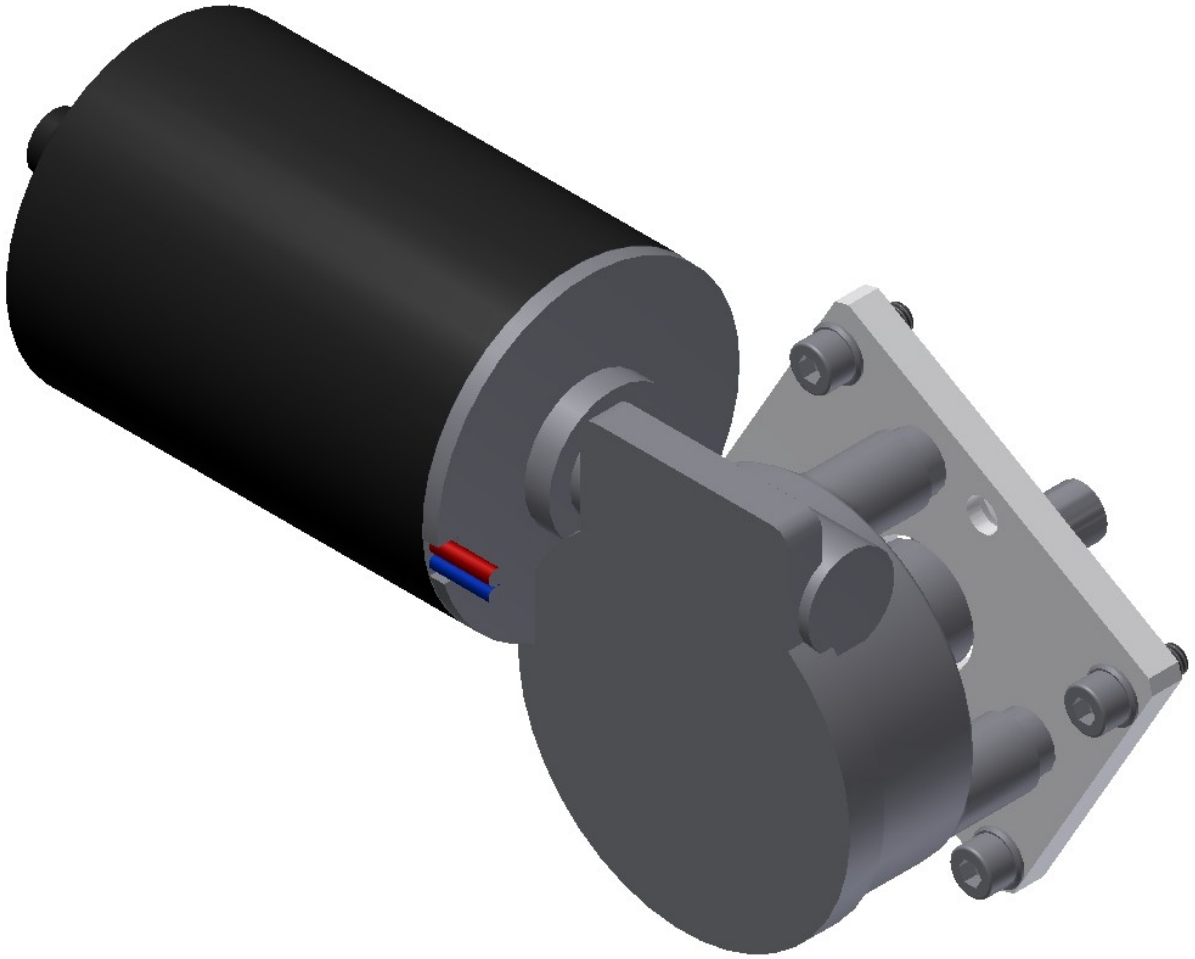


Fig. 68: Motor type SWMK 403438-3 / Similar·to·illustration

Designation	
Nominal voltage UN /Volt	36
Idling speed n0 [min-1]	120
Nominal torque MN [Nm]	2
Starting torque MA [Nm]	16

Designation	
Gear ratio i	53/2
Terminal resistance 2 slats R [m□]	3400
Terminal resistance 4 slats R [m□]	3000
IP 30 degree of protection	30
Weight [kg]	1.2

9.4.2 The stopper unit

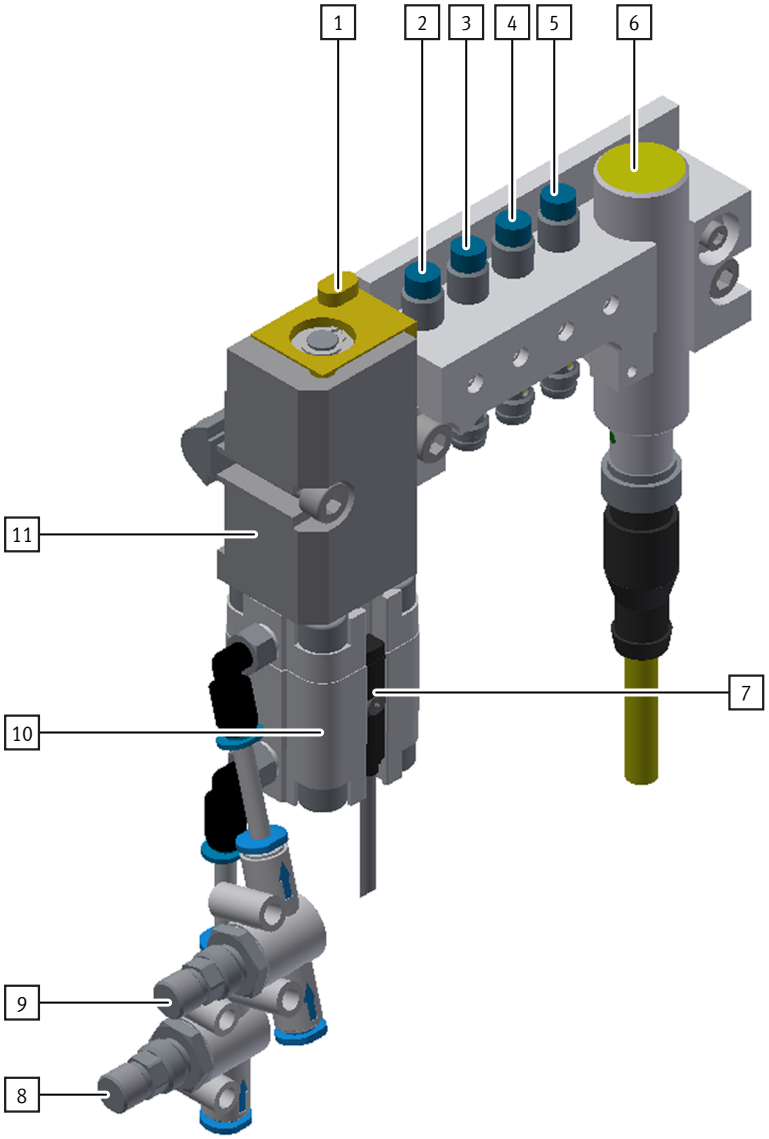


Fig. 69: Stopper unit / Similar to illustration

1 Stopper unit ratchet.

2 Pallet available identification sensor 4 / Order no. 150395 / SIEN-M8NB-PS-S-L.

3 Pallet available identification sensor 2 / Order no. 150395 / SIEN-M8NB-PS-S-L.

4 Pallet available identification sensor 2 / Order no. 150395 / SIEN-M8NB-PS-S-L.

5 Pallet available identification sensor 1 / Order no. 150395 / SIEN-M8NB-PS-S-L.

6 Turck TB-M18-H1147 RFID read/write head.

7 Sensor stopper retracted / Order no. 574334 / SMT-8M-A-PS-24V-E-0,3-M8D.

8 One-way flow control valve / Order no. 193967 / GR-QS-4.

9 One-way flow control valve / Order no. 193967 / GR-QS-4.

11 Stopper unit basic body.

10 Stopper cylinder / Order no. 157211 / AEVUZ-16-5-P-A.

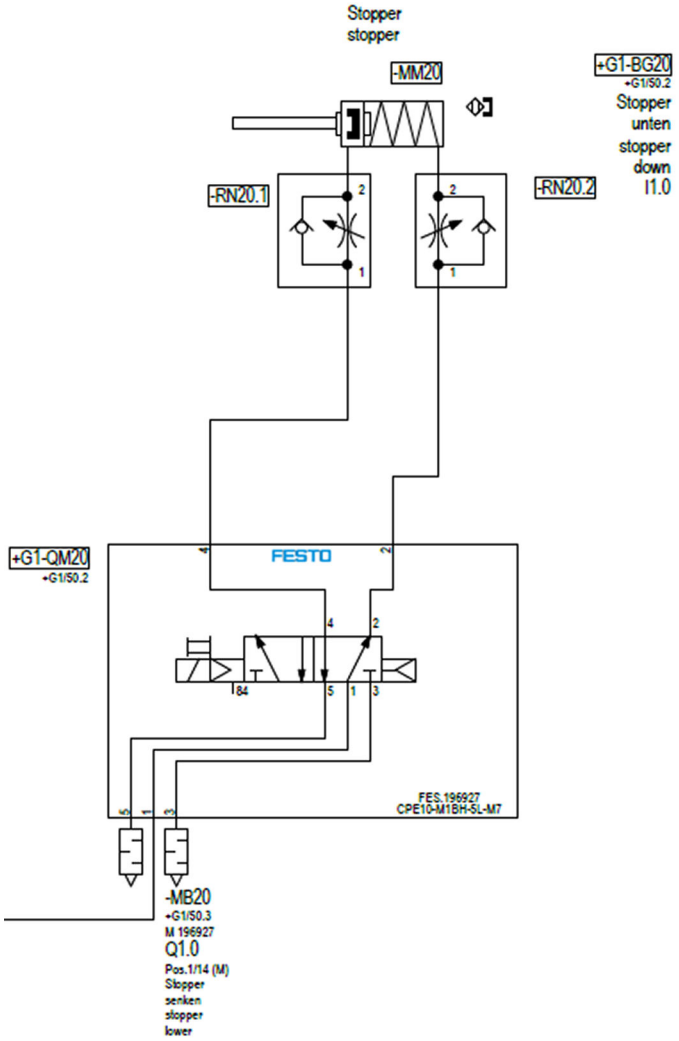


Fig. 70: Pneumatic plan stopper unit

10 Maintenance

10.1 Maintenance in the CP System

General information

The CP Factory and CP Lab systems from Festo Didactic have been developed using high-quality components to ensure a long service life. Nevertheless, any improper use can lead to failures. The purpose of this maintenance manual is to provide you with an overview of the service-related activities that need to be carried out on CP systems.

Before carrying out maintenance work, the entire system must be switched off and the power supply disconnected. Industrial robots and CP Factory bearings must be secured against being switched on again during maintenance work. Assembly work inside the CP Factory bearings is only permitted in the lower end position of the Z-axis or with the Z-axis mechanically locked. If the activities are to be carried out with the control system switched on, the operator must establish additional protective measures to ensure safe personal protection (e.g. marking with a sign on the system).

Below you will find a checklist of the inspections that Festo Didactic recommends at the end of the specified time interval. If the inspection reveals that the specified components are not in an acceptable condition, this must be rectified immediately. Maintenance work may only be carried out by qualified personnel.

Visual inspection

The visual inspection is carried out to detect external defects and must be performed every working day. Special attention should be paid to the following (if available):

- Any damage
- Contamination/dust deposits (e.g. on conveyor, workpiece carrier, camera, etc.)
- Loosening of door locks and hinges
- All cables and plugs are connected as intended
- Condition of the mains plug and the mains connectors and conductors
- Defective strain relief of the mains cable
- Defective mains cable
- Condition of the anchoring, cable clamp, accessible fuse insert
- Damage to the housing and protective cover that could allow access to live or dangerous moving parts
- Signs of overloading, overheating or improper use
- Signs of improper modifications
- Signs of contamination, corrosion and inappropriate ageing
- Contamination, blockage of the cooling openings, e.g. the air filter
- Tightness of the container for water, air or other medium
- Usability of switches, control and set-up devices
- Legibility and completeness of all safety-relevant markings or symbols, characteristic data and position indicators
- All fuses accessible from the outside correspond to the data specified by the manufacturer (rated current, characteristics)

- Evaluate the relevant accessories together with the device (e.g. detachable or fixed connection cables and protection) - Defective due to overbending the cables, lines, pipes and hoses
- Obstacles and tripping hazards in the vicinity of the system and on the Robotino's travel paths
- Safety areas free of workpieces and other material
- Signs of smoke, heat, odor, noise or deformation of (rechargeable) batteries

The above information has been compiled to the best of our knowledge and belief and has been taken in part from DIN EN 50699. Above all, the attention of those responsible for the system on a daily basis is required.

General safety maintenance table

The safety functions of the entire system should be checked monthly to ensure correct operation. The applicability of the test steps listed below depends on the respective system configuration:

Equipment	Activity	Intervals	Criterion
Emergency stop device	Carry out a cyclical function test for each individual emergency stop button. To do so, press the button and then check whether the emergency stop chain is triggered. Then use the reset button to confirm, and check that all components are unlocked.	1 month	Functional test
Operator protection	Carry out a cyclical function test for each safe door monitoring switch and for each safe inductive proximity sensor. To do so, open the safety door during operation or remove a box of material from the box conveyor so that the safety switch triggers operator protection. Check whether the components enclosed by the safety guard come to a standstill. Then close the safety door or push the material box back into position and check the automatic restart or the acknowledgement function.	1 month	Functional test

Equipment	Activity	Intervals	Criterion
Safety sensors	Cyclical function test of all safety sensors (laser scanner, light curtain, safety mat), if present, according to manufacturer's specifications	1 month	Functional test

Components maintenance table

Equipment	Activity	Intervals	Criterion
Residual current devices	Testing using suitable measuring and testing devices by a qualified electrician or an electrically trained person in non-stationary* operation	1 month	Effectiveness
	Actuation of the test device in stationary* operation	6 months	Functional test
	Actuation of the test device in non-stationary* operation	1 day	Functional test
Conveyors	Visual inspection of the condition of the conveyors for wear (fraying/small tears). Replace them if necessary.	3 weeks	Visual inspection
	Visually check that the conveyors are centered between the guard rails. If necessary, adjust using the adjusting screws on the deflection heads.	3 weeks	Visual inspection
Stopper	Check whether the stopper reaches the end positions in approx. 200 ms (see HMI), adjust pressure or throttling if necessary	3 weeks	Visual inspection
	Check that the cylinder surface and seal are clean. If necessary, clean with a dry cloth	3 weeks	Visual inspection
Fan	Cleaning the ventilation grilles of all fans (robot controller, MES PC, etc.).	6 months	Visual inspection
Linear axes	Check linear axes (e.g. CP-AM-DRILL) for contamination and clean with a dry cloth if necessary.	3 weeks	Visual inspection

Equipment	Activity	Intervals	Criterion
	Maintenance in accordance with the manufacturer's operating manual	according to the manufacturer's specifications	according to the manufacturer's specifications
Compressors	Drain condensation water	every week	Time
	Maintenance in accordance with the manufacturer's operating manual	according to the manufacturer's specifications	according to the manufacturer's specifications
Label printer	Empty label compartment	As required	Visual inspection
	Change label roll	As required	Visual inspection
MES PC	Operating system upgrade only after prior consultation with Festo Didactic technical support	According to availability	According to availability
	Operating system updates as available from the manufacturer	According to availability	According to availability
Sinema RC server	Operating system updates as available from the manufacturer	According to availability	According to availability

* After commissioning, the entire system can be treated as a stationary system. If a conversion takes place during use (e.g. CP Lab), the system must be treated once as a non-stationary system.

10.2 Maintenance Mitsubishi Robot

Robot safety maintenance table

Equipment	Activity	Intervals	Criterion
Enabling device for robot applications	Set the machine to be tested to manual operation and hold the enabling button in the mid-position. While moving an axis in any direction, press the enabling button fully once. The axis should come to an immediate standstill. Then continue to move the axis (with the enabling button in the mid-position) and release the enabling button	1 month	Functional test

Equipment	Activity	Intervals	Criterion
	in the meantime. Once again, the axis should come to an immediate standstill.		

Application maintenance table

Equipment	Activity	Intervals	Criterion
Robot applications	Check tool fastening screws	3 months	Functional test
	Check vacuum suction heads for cracks and contamination	6 months	Visual inspection
	Maintenance of the robot system in accordance with the robot manufacturer's operating manual	according to the manufacturer's specifications	according to the manufacturer's specifications

Maintenance table Mitsubishi robots

Equipment	Activity	Intervals	Criterion
Mitsubishi robot	Replace the batteries in the robot base. The batteries should **be replaced when the controller is switched on** and when the emergency stop is activated.	1 year	Time

Equipment	Activity	Intervals	Criterion
	CR750-D controller only: Check buffer battery level on TeachBox (menu: "Maintenance Forecast"). The battery should be replaced before the prediction time has expired: ● 1. Switch on the controller for approx. 1 minute. ● 2. Switch off the controller and open the battery cover. ● 3. Unplug the old battery and remove it from the battery holder. ● 4. Insert the new battery into the battery holder. Insert it so that the cable still comes out at the front. ● 5. Connect the plug of the new battery cable. Connect it so that the red cable points to the left. Complete this step within 3 minutes of removing the old battery. ● 6. Close the covering.	3 months	Visual inspection
	Check timing conveyor and replace if necessary	1 year	Time
	Lubricate the gear unit in each axis according to the manufacturer's specifications	3 years	Time

11 Cleaning

The following components in particular should be cleaned at regular intervals with a soft, lint-free cloth or brush:

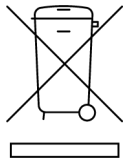
- Lenses of the optical sensors, fiber optics and reflectors.
- The active surfaces of the proximity switches.

!	**NOTICE** – Do not use any aggressive or abrasive cleaning agents. – Moisture must be prevented from entering the device. – The appliance may only be cleaned when it is switched off. – Protective covers made of plastic must not be cleaned with alcohol-based cleaning agents. There is a risk of embrittlement.

12 Further Information and Updates

Further information and updates of the technical documentation for the components and systems of Festo Didactic SE are available on the following website: ➦ *https://www.festo.com*

13 Disposal



According to European regulations, used electrical and electronic equipment may no longer be disposed of as unsorted waste. This symbol indicates that separate collection is required. Dispose of electronic waste at designated collection points.

14 Technical Data

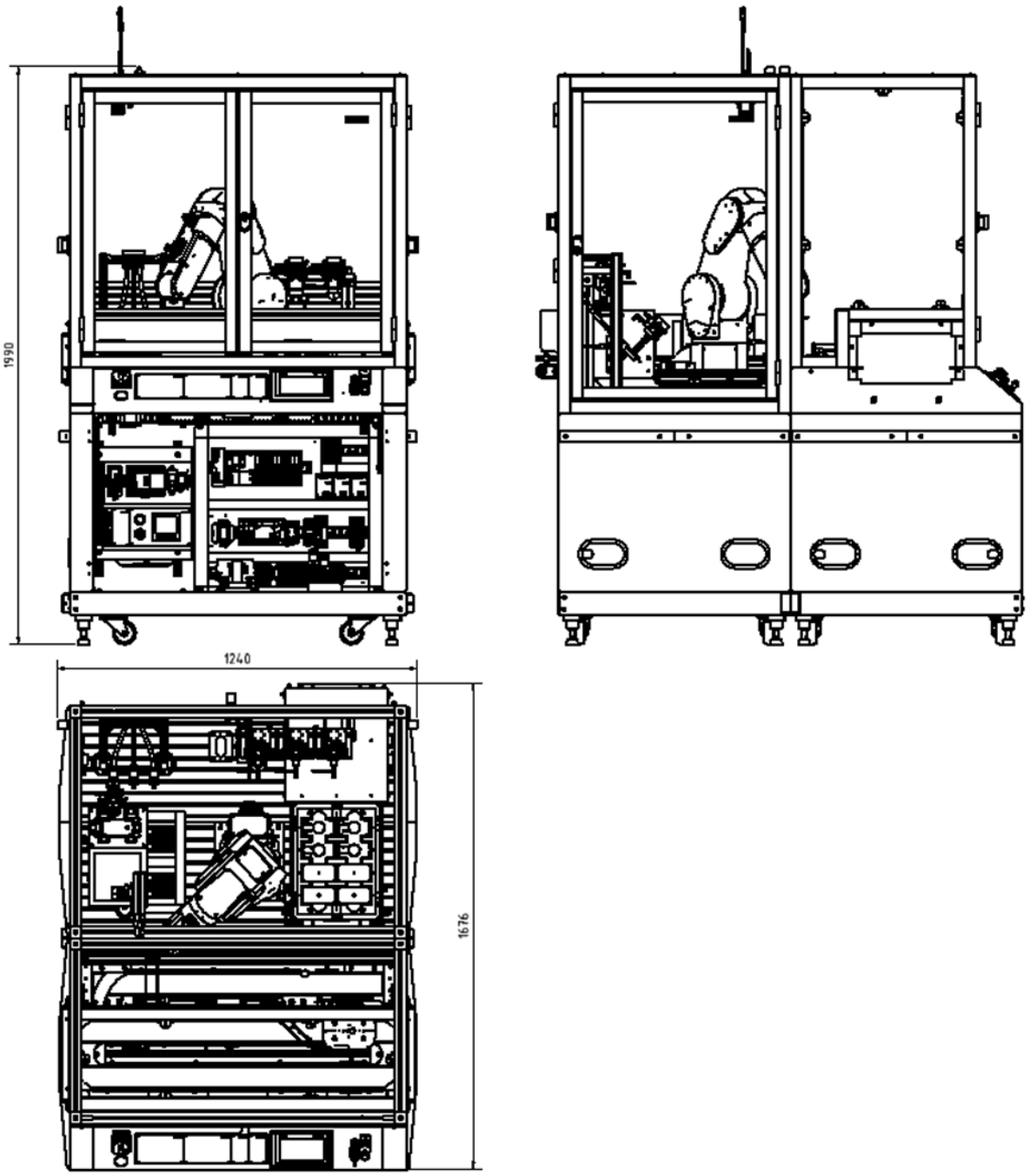


Fig. 71: Similar to illustration

Recommended minimum clearance for spatial isolation: 1.2 m.

14.1 Technical Data – General

Parameter	Value
Dimensions (L x W x H)	1676 mm x 1240 mm x 1990 mm

Parameter	Value
Weight	410 kg
CE Marking	EMC Directive RoHS Directive Machinery Directive
UKCA Marking	Electromagnetic Compatibility Regulations 2016 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 Supply of Machinery (Safety) Regulations 2008 Electrical Equipment (Safety) Regulations 2016 Radio Equipment Regulations 2017
Functional safety	
Equipment use	Indoors only, up to 2,000 m above sea level, dry environment
Ambient temperature range	+5 … +40°C
Max. rel. air humidity	80%
Wet environment	if applicable
Contamination level	2, laboratory environment
Degree of protection	IP 20

NOTICE

The device is intended for use in industrial environments and may cause radio interference in residential and small commercial environments.

Have a qualified person ensure that suitable measures are implemented to minimize interference emissions.

SIMPLIFIED EU DECLARATION OF CONFORMITY

Hereby, Festo Didactic SE declares that the radio equipment type “DALI Master, 8194017” is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: www.festo.com

14.2 Technical Data – Electrical

Parameter	Value
Operating voltage	3AC 400 V±10%, 50 Hz
Power supply system	TNC-S, mains conductor L1, L2, L3, neutral conductor N, protective grounding PE
Full load current	2.5 A
Control voltage, voltage for small actuators	24 V DC protective extra-low voltage (PELV)
Power supply connection	IEC 60309, CEE 16 A
Max. backup fuse for installation	16 A
Leakage current	<= 18 mA
Connecting cable between stations	System connector
Protection class	I, Operation with protective grounding only. Connection of a second protective grounding conductor required due to high leakage current
Overvoltage category	CAT II, Operation in building installation only
Short circuit current rating (SCCR)	10 kA

14.3 Technical Data – Pneumatic

Parameter	Value
Pneumatic port	Pneumatic tubing with an outside diameter of 4 mm
Operating pressure	0.25 … 0.8 MPa [2.5 … 8 bar; 36 … 116 psi]
Operating medium	Compressed air as per ISO 8573-1:2010 [7:-:-] Filtered, unlubricated compressed air, grade of filtration: 40 µm

15 Machine Safety

WARNING

General Machine Safety, CE Conformity

- The individual modules of this system contain control programs for which the safety of the machine has been evaluated.
- The safety-related parameters and check sums of the safety function are listed in the operating instructions for the respective stations.
- If programs are changed, this could impair the safety of the machine. A modified control program may constitute a major change to the machine.
- In such cases, the manufacturer's CE – Declaration of Conformity shall be rendered null and void. The operator must reassess machine safety and determine CE conformity

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