8062568

MR buffer and palletizing robot

Translation of the original instructions

Where only pronouns such as he and him are used in these operating instructions, these pronouns are of course intended to refer to both male and female persons. The use of a single gender (e.g. he, him) should not be construed as gender discrimination; it is intended solely to make the manual easier to read and the formulations easier to understand.

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

Main document
Associated documents attached:

Safety instructions concerning transport (print/electronic)
Component datasheets (print/electronic)
Circuit diagram (print/electronic)

Contents

Contents

1 Safety instructions

1.1 Warning notice system

These operating instructions contain notes that must be observed for your personal safety and in order to prevent property damage. The notes concerning your personal safety are indicated by a safety symbol. Notes that only concern property damage are not indicated by a safety symbol.
The notes below are listed in order of hazard level.

⚠	⚠ **DANGER**
	... indicates an **imminently** hazardous situation that will result in fatal or severe personal injury if not avoided.

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

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

⚠	*NOTE*
	... indicates a **potentially** hazardous situation that may result in property damage or loss of function if not avoided.

In cases where more than one hazard level applies, the safety note with the highest hazard level will be shown. A safety note may concern both personal injury and property damage.
Hazards that will only result in property damage are indicated with the word "Note".

1.2 Pictograms

This document and the hardware described in it include warnings concerning possible hazards which may arise if the system is used incorrectly.

The following pictograms are used:

	Hazard warning
	Warning - dangerous electric voltage
	Read and observe the operating and safety instructions prior to commissioning.
	Switch off the device and unplug the connection for power supply from the plug socket before commencing installation, repair, maintenance or cleaning work.
	Warning – hand injuries
	Warning – risk of entanglement
	Warning – lifting heavy loads
	Electrostatically sensitive devices
	Information and/or references to other documentation

1.3 General prerequisites for installing the product

- Festo Didactic products must only be used for the applications specified in their respective operating instructions. Products or components supplied by other manufacturers must only be used if recommended or approved by Festo.
- The products must be transported, stored, installed, assembled, commissioned, operated and maintained properly in order to ensure their safe operation.
- The approved ambient conditions must be observed. The specifications in the relevant operating instructions must be observed.
- The safety equipment must be tested every working day.
- Connecting cables must be checked for damage before each use. In case of damage, they must be replaced.

Connecting cables must correspond to the minimum specifications.

1.4 General prerequisites for operating the devices

General requirements for safe operation of the system:

- In industrial facilities, the national accident prevention regulations must be observed.
- The laboratory or classroom must be overseen by a 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 laboratory or the classroom must be equipped with the following devices:

- An emergency-off device must be provided.
    – At least one emergency-off device must be located inside the laboratory or the classroom, and at least one outside it.
- The laboratory or classroom must be secured so that the operating voltage and compressed air supply cannot be activated by any unauthorized persons, for example by means of:
    – e.g. a keyswitch
    – e.g. lockable shut off valves
- The laboratory or classroom must be protected by residual current devices (RCDs).
    – RCDs with a differential current of ≤ 30 mA, Type B. When operating machinery with unavoidable leakage current, suitable measures must be implemented and documented in the corresponding workplace risk assessment.
- The laboratory or classroom must be protected by overcurrent protection devices.
    – Fuses or circuit breakers
- Devices must not be used if they are damaged or defective.
    – 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.
- Safety devices must be checked every working day to ensure that they are fully functional.
- Connecting cables and accessories must be checked for damage before each use.

2 Intended use

Festo Didactic systems and components must only be used:
- For their intended use in teaching and training applications
- When their safety functions are in perfect condition

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

The Festo Didactic learning system has been developed and produced exclusively for education and training in the field of automation technology. The training company and/or trainers must ensure that all trainees observe the safety precautions described in these operating instructions.

Training with complex machinery is a highly hazardous activity. The operating company must draw up and document a workplace risk assessment. The trainees must be briefed on all the relevant safety aspects before work commences.

Festo Didactic hereby excludes any and all liability for damages suffered by apprentices, 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 due to malicious intent or gross negligence.

All extensions and accessories must be approved by Festo Didactic, and are only permitted for use for their intended purpose.

The machine fulfils the requirements of the European directives that applied when it was commissioned. Any modification to the machine shall render the manufacturer's CE Declaration of Conformity null and void. The CE Declaration of Conformity must be renewed following each major modification.

3 For your safety

3.1 Important information

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

These operating instructions include the most important instructions 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 rules and regulations that are applicable at the respective place of use must be adhered to.

⚠	⚠ **WARNING**
	• **Malfunctions which could impair safety must be eliminated immediately!**

⚠	⚠ **CAUTION**
	• **Improper repairs or modifications may result in unforeseeable operating statuses. Do not carry out any repair or alternation work on components or systems that is not described in these operating instructions.**

3.2 Qualified persons

- The product described in these operating instructions is only permitted for operation by persons who are qualified for the task in question in accordance with the operating instructions, especially the safety instructions.
- Qualified persons are defined as persons whose training and experience enables them to recognize risks and avoid potential dangers when working with this product.

3.3 Obligations of the operating company

It is the responsibility of the operating company to ensure that the station is operated safely.

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

- Are familiar with the basic regulations regarding occupational safety, with the safety instructions, and with the accident prevention regulations, and who have been instructed in the use of the components and systems
- Have read and understood the safety chapter and warnings in these operating instructions
- Are qualified to operate the components and systems in question
- Are governed by and trained in suitable organizational measures to ensure safe training

Personnel should be tested at regular intervals to ensure that they are safety-conscious in their work habits.

3.4 Obligations of the trainees

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

- Read the chapter concerning safety and the warnings in these operating instructions
- Familiarize themselves with the basic regulations regarding occupational safety and accident prevention

4 Basic safety instructions

4.1 General information

	⚠ **CAUTION**
⚠	• **Trainees must be supervised by an instructor at all times when working with the components and systems.** • **Observe the specifications included in the technical data for the individual components and in particular all the 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.**

4.2 Mechanical components

	⚠ **WARNING**

⚠	• **Switch off the power supply!**
	  – Switch off both the operating power and the control power before commencing work on the circuit.
	  – Never reach into the setup unless it is at a complete standstill.
	  – Be aware of potential overtravel times for the actuators.
	• **Risk of injury during troubleshooting!**
	  – Use a tool such as a screwdriver for actuating sensors.

	⚠ **CAUTION**

⚠	• **Risk of burns due to hot surfaces**
	  – Devices can reach high temperatures during operation, as a result of which they can cause burns if touched.
	• **Measures to take when maintenance is required.**
	  – Allow the device to cool off before commencing work.
	  – Use suitable personal protective clothing, e.g. safety gloves.

4.3 Electrical components

	⚠ **DANGER**

⚡	• **Risk of fatal injury in case of interrupted protective grounding conductor!**
	   – The protective grounding conductor (yellow-green) must not be interrupted, either inside or outside of the device.
	   – The insulation of the protective grounding conductor must never be damaged or removed.
	• **Risk of death from connecting power supply units in series!**
	Contact voltages of greater than 25 V AC or 60 V DC are not permissible.
	Contact with voltages of greater than 50 V AC or 120 V DC may be fatal.
	   – Do not connect power supplies in series.
	• **Risk of death due to electric shock!**
	Protect the outputs of the power supplies (output sockets/terminals) and cables connected to them from direct contact.
	   – Always use connector cables with adequate insulation and electric strength.
	   – Use safety sockets with fully shrouded contact points.

	⚠ **WARNING**

⚡	• **Disconnect from all sources of electrical power!**
	  – Switch off the power supply before working on the circuit.
	  – 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.
	  – **Warning!**
	  Capacitors inside the device may still be charged even after being disconnected from all sources of voltage.
	• **Danger due to malfunction**
	  – 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.
	• **Electric shock due to connection to unsuitable power supply!**
	  – 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.
	• **Electric shock when there is no protective grounding in place**
	  – If there is no protective grounding terminal in place for a Protection Class I device, or if the protective grounding terminal has not been installed correctly, exposed, conductive parts may carry high voltages, thus causing severe or fatal injury if touched.
	  – Ground the device in accordance with the applicable regulations.

	⚠ **WARNING**

♨	• **Risk of fire due to use of unsuitable power supply**
	  – If a device i 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**
⚡	• **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 identified with a corresponding warning symbol. • **Make sure that connecting cables are not subjected to continuous tensile loads.** • **Devices with a grounding terminal must always be grounded.** – If a ground connection (green-yellow laboratory socket) is available, it must always be connected to the protective grounding. The protective grounding must always be connected first (before voltage) and disconnected last (after disconnecting the voltage). – Some devices have high leakage current. These devices must be fitted with a grounding conductor for additional grounding. • **When replacing fuses, always use specified fuses with the correct current rating and tripping characteristics.** • **The device is not equipped with a built-in fuse unless otherwise specified in the technical data.** • **Safe operation of the device is not possible in the event of any of the following circumstances:** – Visible damage – Malfunction – Inappropriate storage – Incorrect transport • **Switch off the power supply immediately.** • **Protect the device to prevent it from being restarted accidentally.**

4.4 Pneumatic components

	⚠ **WARNING**

⚠	• **Depressurize the system!**
	   – Switch off the compressed air supply before working on the circuit.
	   – Check the system using 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.
	• **Risk of injury when switching on compressed air!**
	   – Cylinders may advance and retract automatically.
	• **Risk of accident due to advancing cylinders!**
	   – Always position pneumatic cylinders so that the piston rod's working space is unobstructed along its entire stroke range.
	   – Make sure that the piston rod cannot collide with any of the rigid components in the setup.
	• **Risk of accident due to pneumatic tubing slipping off!**
	   – Use shortest barbed tubing connectors possible.
	   – If pneumatic tubing slips off, switch off the compressed air supply immediately.
	• **Do not exceed the maximum permissible pressure of 600 kPa (6 bar).**
	• **Do not switch on the compressed air until all the barbed tubing connectors have been connected and secured.**
	• **Do not disconnect pneumatic tubing while it is under pressure.**
	   – Do not attempt to seal or plug pneumatic tubing or plug 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.**

<table>
<tr><td></td><td colspan="2">⚠️ **CAUTION**</td></tr>
<tr><td rowspan="2">⚠️</td><td></td></tr>
</table>

⚠️	⚠️ **CAUTION**

	• **Setting up pneumatic circuits**
	   – 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.
	• **Dismantling pneumatic circuits**
	   – Switch off the compressed air supply before dismantling the circuit.
	   – Press the blue release ring down so that the tubing can be pulled out.
	• **Noise due to escaping compressed air**
	   – Noise caused by escaping compressed air may damage your hearing. Reduce noise by using mufflers, or wear hearing protection if the noise cannot be avoided.
	   – All of the exhaust ports on the components included in the equipment set are equipped with mufflers. Do not remove these mufflers.

4.5 Guarantee and liability for application examples

The application examples are not legally binding, and we cannot guarantee their completeness in terms of their configuration, their equipment or any events that may occur. The application examples are not representations of any specific customer solution; they are merely intended to illustrate typical tasks for which the product in question could be used. You bear the responsibility for ensuring that the products described here are operated properly. These application examples do not in any way relieve you of your responsibility to ensure that the system is handled safely when it is being used, installed, operated or maintained.

4.6 Cyber security
Note

Festo Didactic offers products with industrial security functions that aid the safe operation of plants, systems, machines and networks. In order to protect plants, systems, machines and networks from cyber threats, a comprehensive industrial 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) are in place. Furthermore, Festo's guidelines on suitable security measures should be observed. Festo products and solutions are constantly being developed further in order to make them more secure. Festo 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.

⚠	⚠ **WARNING**
	• **Unsecure operating conditions due to software tampering**
	– Forms of software tampering (e.g. viruses, Trojans, malware and worms) can lead to unsecure operating conditions in your system, which may in turn lead to severe or fatal injury or property damage.
	– Keep your software up to date.
	– Integrate the automation and actuator components into an overarching and comprehensive industrial security concept for the installation or machine in question that is in line with the latest technological developments.
	– Make sure that all the products you have installed are incorporated into your overarching industrial security concept.
	– Use suitable measures, such as a virus scanner, to protect files save on exchangeable storage media from malware.

4.7 Additional safety instructions

General requirements for safe operation of the devices:

- Do not lay cables over hot surfaces.
    - Hot surfaces are identified with a corresponding warning symbol.
- Maximum permissible current loads for connector cables and devices must not be exceeded.
    - Always compare the current ratings of the device, the cable and the fuse to ensure that they match.
    - If they do not match, use a separate upstream fuse in order to provide appropriate overcurrent protection.
- Devices with a grounding terminal must always be grounded.
    - If a ground terminal (green-yellow laboratory socket) is available, it must always be connected to protective ground. The protective grounding must always be connected first (before voltage) and disconnected last (after disconnecting the voltage).
- The device is not equipped with a built-in circuit unless otherwise specified in the technical data.

⚠	⚠ **WARNING**
	• **This product is designed for use in industrial environments, and may cause malfunctions if used in domestic or small commercial environments.**

4.8 Guarantee and liability

Our General Terms and Conditions of Sale and Delivery shall apply at all times. These shall be made available to the operating company no later than upon conclusion of the sales contract. Guarantee and liability claims resulting from personal injury and/or property damage are excluded if they can be traced back to one or more of the following causes:

- Use of the equipment for purposes other than its intended use
- Improper installation, commissioning, operation or maintenance of the system
- Operation of the system with defective safety equipment, or with improperly attached or non-functional safety equipment and protective guards
- Non-compliance with directions included in the operating instructions with regard to transport, storage, installation, commissioning, operation, maintenance and setup of the system
- Unauthorized modifications to the system
- Improperly executed repairs
- Disasters resulting from the influence of foreign bodies and acts of God
- Dust generated during construction work must be kept away from the system (use coverings).
  See the Environmental Requirements section (contamination level) for more details.

4.9 Transport

	⚠ **WARNING**

⚠	• **Danger due to tipping over**
	  – 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.
	  – Take care to avoid tipping over during transportation.

	⚠ **CAUTION**
⚠	• **Danger due to broken castors!** The castors on the device are not designed to be used for transportation. The castors are designed merely for positioning the station. The screw feet must relieve the castors of all the station's weight before commissioning begins. The screw feet must be set so that the station is horizontal and aligned at the same height as its neighboring station. – Safety shoes must be worn when transporting the station!

	NOTE

⚠	• **Station contains delicate components!**
	  – Take care not to shake during transportation
	  – The station is only permitted for installation on solid, non-vibrating surfaces.
	  – Make sure that the ground underneath the station has sufficient load-bearing capacity.

4.10 Name plates stations

Name plate example

Position	Description
1	Description / Configuration
2	Intern material number
3	Order number, charge code, year of construction
4	Data electrical connection
5	Current consumption, short-circuits strength, input pressure compressed air (bar / psi)
6	Unique-ID, unique machine identification
7	Manufacturer's address
8	Data matrix code of a link to the website of the product
9	CE Identification

4.11 General 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 checksums of the safety function are listed in the operating instructions for the respective stations.
	   – Changes to programs may 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 operating company will need to re-evaluate the safety of the machine and confirm its CE conformity.

4.12 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.

4.12.1 Panel doors on underground control cabinet

Transparent, impact-resistant, polycarbonate plate 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 door is not monitored! Make sure the safety door is always closed.
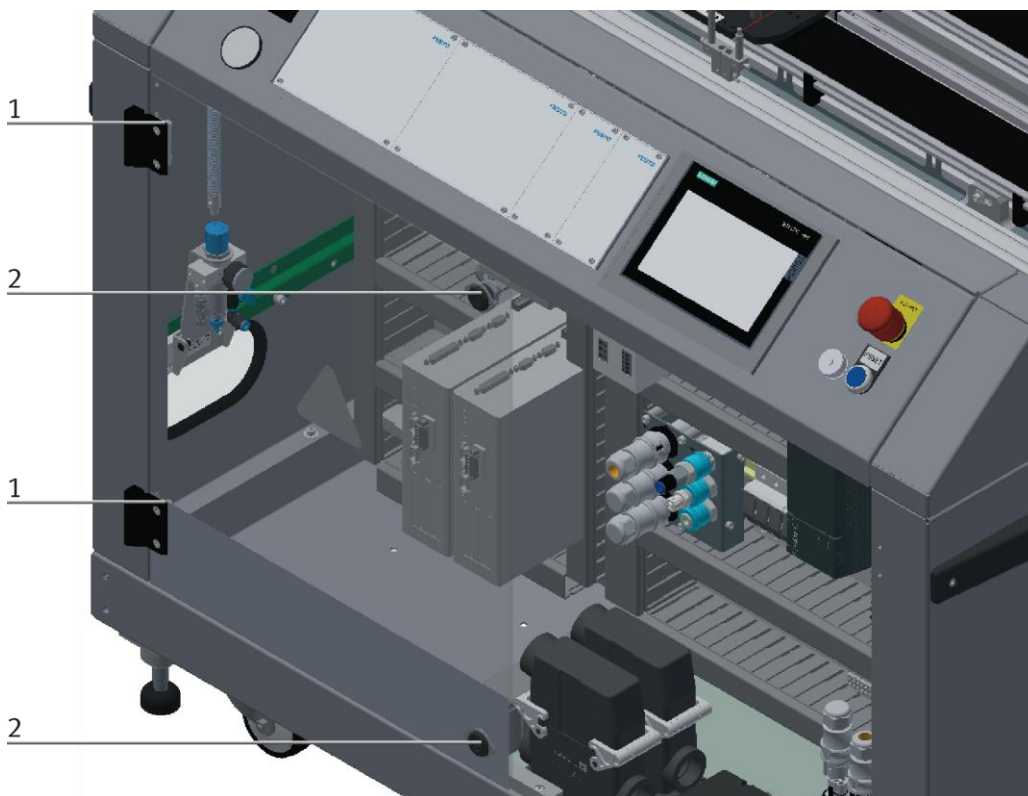
Illustration similar

The hinges of the control cabinet doors are provided with spring steel sheets (1). If the switch cabinet locks (2) are not locked, the door is automatically opened a crack and reminds the user to firmly lock the door with the switch cabinet locks.

4.12.2 Robot enclosure – fixed element

Transparent, impact-resistant, polycarbonate plate on sides and top

4.12.3 Robot enclosure – service doors

Transparent, impact-resistant, polycarbonate plate

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 closed

4.12.4 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.

4.12.5 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 Technical datas

Parameter	Value
Electrics	
Operating voltage	3-phase 400 V AC±10%, 50 Hz
Power supply system	TNC-S, mains conductor L1, L2, L3, neutral conductor N, protective grounding PE
Full load power	3 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 plug
Protection class	I, Operation with protective grounding only. 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
Compressed air	
Supply pressure	6 bar, 90 psi
Supply rate	>= 40 l/min
Compressed air quality	EN ISO 8573-1
Pressure dew point (Class 4)	<= +3ºC
Ambient conditions	
Operating environment	Use inside building only
Ambient temperature	5ºC ... 40ºC
Rel. air humidity	80% up to 31ºC
Pollution degree	2, Dry, non-conductive contamination
Operating height	Up to 2000 m above NN (sea level)
Noise emission level	L_{pA} < 70 dB
Certification	
CE marking in accordance with:	Machinery Directive EMC Directive RoHS Directive
EMC environment	Industrial environment, Class A (in acc. with EN 55011)
Subject to change	

5.1 Setup
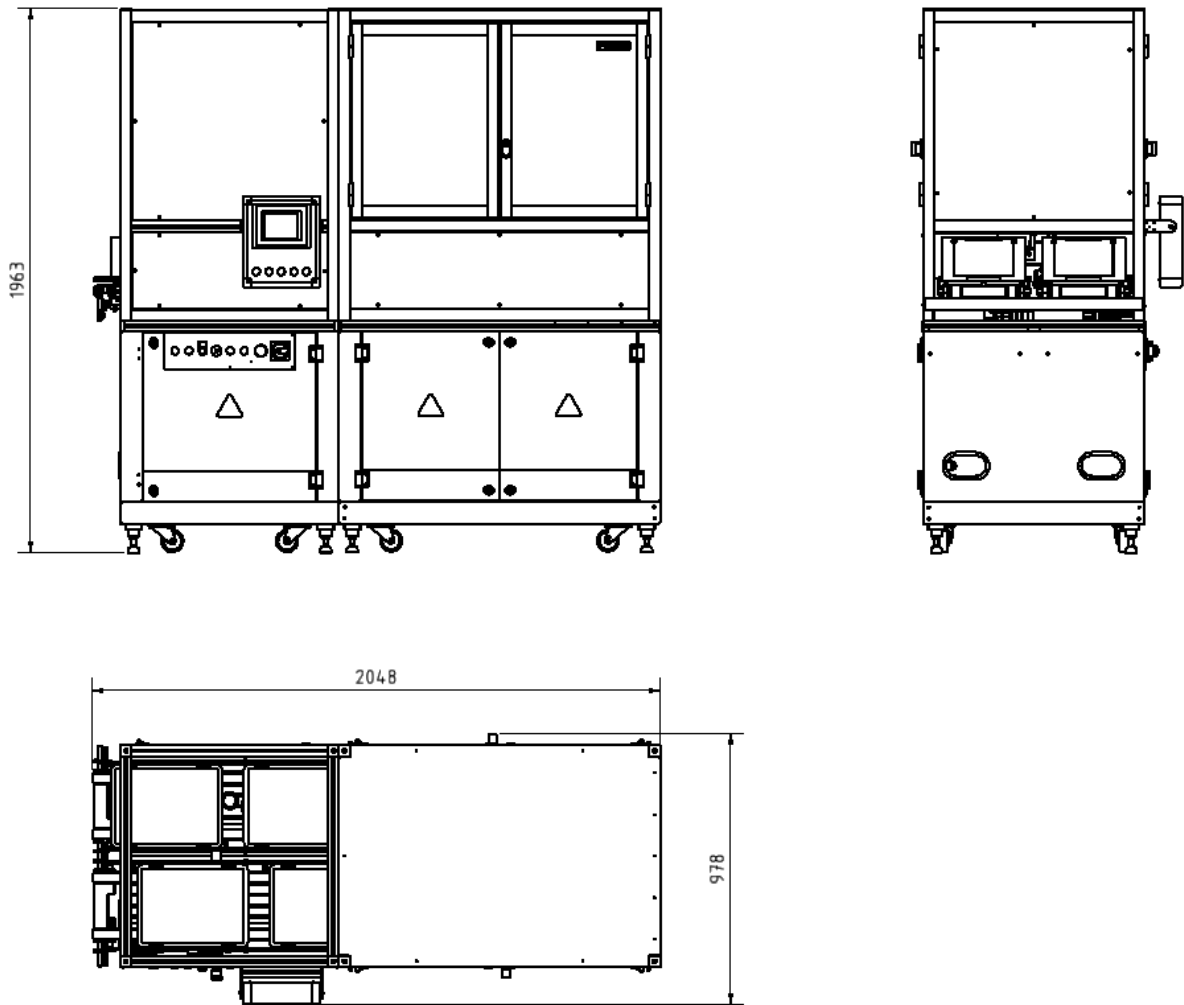
illustration similar

Recommended minimum distance from the spatial boundary is 1.2 m

6 Introduction

6.1 General information about CP Factory

The CP Factory has been developed in close co-operation with teachers and instructors. The result is a training system meeting all demands on modularity, mobility, flexibility and openness due to its completely new characteristics.

The station provides an appropriate system for practice-orientated tuition of the following key qualifications

- Social competence,
- Professional competence and
- Methodological competence,

Which are required in today's complex world of employment. This is much easier now with use of the CP Factory.

The two-sided symmetrical basic modules with accompanying control board and control unit are identical. With their technical system „transfer line with drive unit and stopper unit", they are ideal for the training in SPS programming and drive technology from basics to medium level.

Due to the patented passive pallet return systems, the continuous working process „pallet circulation" is already possible when using one single basic module.

The industrial-relevant basic process „pallet circulation" already contains a large number of important course contents such as:

- drive technology with DC geared motor
- drive technology with asynchronous motor and converter (optional)
- drive technology with servo motor and servo converter (optional)
- pallet-stop setting
- pallet-stroke setting and pallet-indexing (optional)
- pallet identification by binary coding
- pallet identification by RFID
- speed and position recording by pulse generating disc (optional)
- basics on electro pneumatics (stop-cylinder model)
- basics on SPS programming
- SPS programming in steps
- SPS programming operating modes
- SPS programming binary coding
- SPS programming communication by frequency converter (optional)
- SPS programming communication by RFID (optional)
- SPS programming/visualization by touch panel (optional)

The basic module becomes a station by adding technology-specific application modules like magazines, handling or machining units. The standardized mechanical and electrical interface of application and basic module allows an unproblematic starting-up.

The CP Factory is a perfect platform for nearly all course contents. It helps to improve the co-operation of different teams and to extend the ability of understanding processes.

On this system, especially the topics about networking, communication and data acquisition can be shown in an easily comprehensible way and can be further trained.

6.2 Resources

The training equipment of the system consists of several resources. They are used depending on the process selection.

The following resources are available:
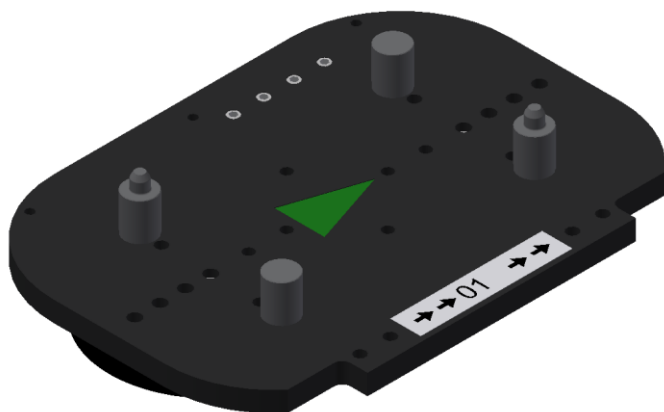
Pallet carrier / illustration similar

These pallet carriers are available for transporting the pallets.

Partnumber in MES - 31
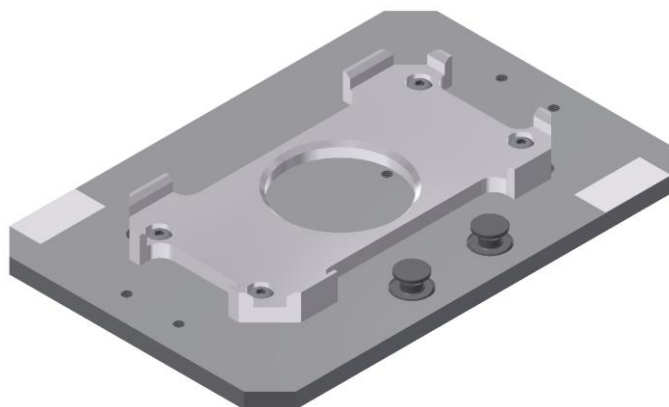
Pallet / illustration similar

These pallets are available for receiving always one workpiece.

Partnumber in MES - 25
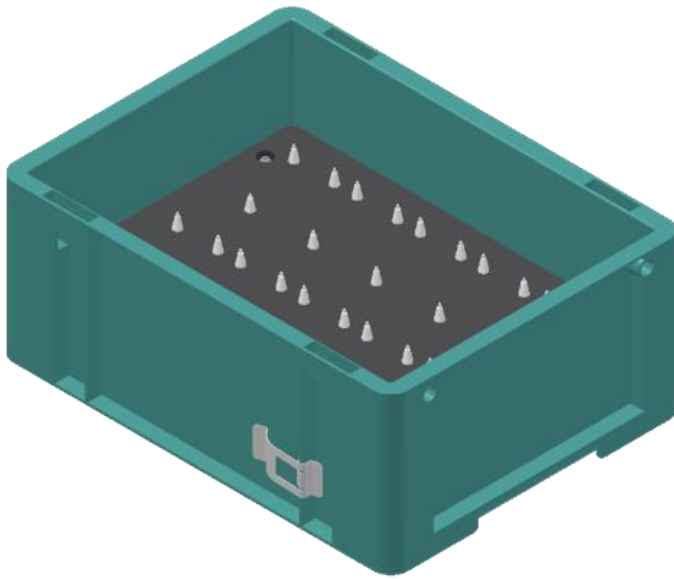
Illustration similar

Box with retainer for 10 PCB´s
Partnumber in MES – 27
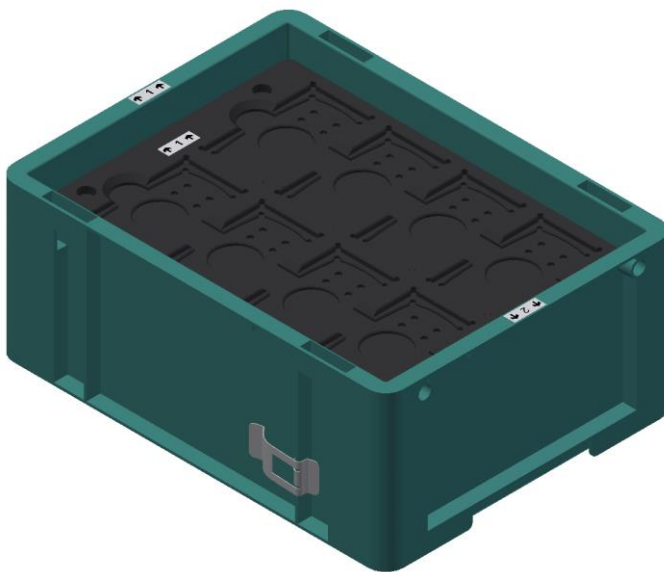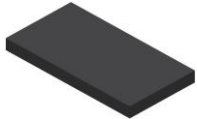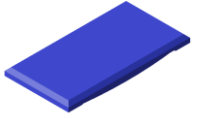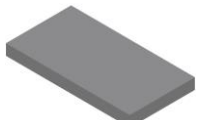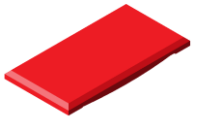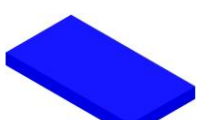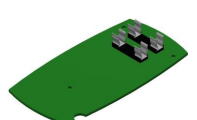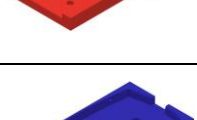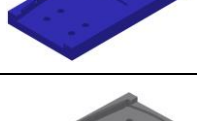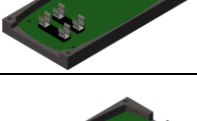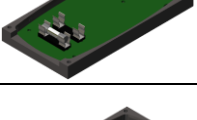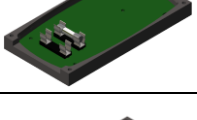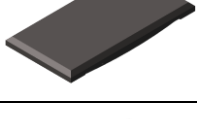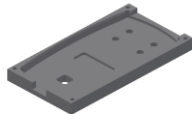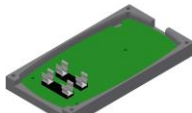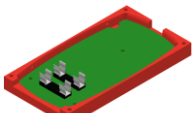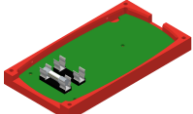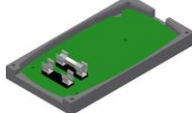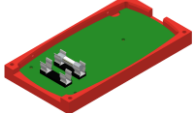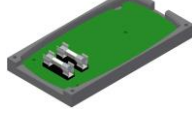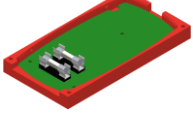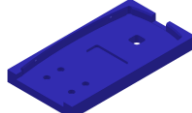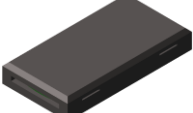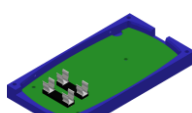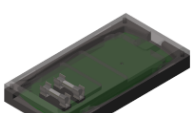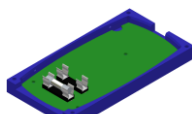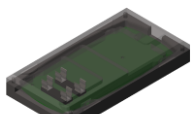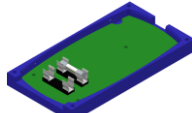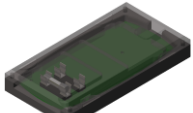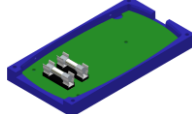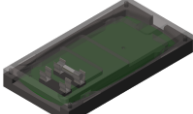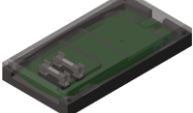
Illustration similar

Box with retainer for 8 front/backcovers or assembled workpieces
Partnumber in MES – 28

Workpieces

The workpieces are differentiated according to the project into production parts and external production parts.

Workpieces	Description	Workpieces	Description
	CP raw material black No. 101		CP back cover blue No. 113
	CP raw material grey No. 102		CP back cover red No. 114
	CP raw material blue No. 103		CP – board No. 120
	CP raw material red No. 103		CP fuse No. 130
	CP front cover red No. 107		CP front cover black No. 210 – if there is a CNC milling machine integrated in the system, the front cover can also be produced there , thus becoming a production part.
	CP front cover blue No. 108		CP front cover black without fuses No. 211
	CP front cover grey No. 109		CP front cover black with fuse left No. 212
	CP front cover black No. 110		CP front cover black with fuse right No. 213
	CP back cover black No. 111		CP front cover black with both fuses No. 214
	CP back cover grey No. 112		

Workpieces	Description	Workpieces	Description
	CP front cover grey No. 310 – if there is a CNC milling machine integrated in the system, the front cover can also be produced there , thus becoming a production part.		CP front cover red No. 510 – if there is a CNC milling machine integrated in the system, the front cover can also be produced there , thus becoming a production part.
	CP front cover grey without fuses No. 311		CP front cover red without fuses No. 511
	CP front cover grey with fuse left No. 312		CP front cover red with fuse left No. 512
	CP front cover grey with fuse right No. 313		CP front cover red with fuse right No. 513
	CP front cover grey with both fuses No. 314		CP front cover red with both fuses No. 514
	CP front cover blue No. 410 – if there is a CNC milling machine integrated in the system, the front cover can also be produced there , thus becoming a production part.		CP black complete without board No. 1200
	CP front cover blue without fuses No. 411		CP part customer No. 1210 freely selectable
	CP front cover blue with fuse left No. 412		CP part black with no fuse No. 1211
	CP front cover blue with fuse right No. 413		CP part black with fuse on the left No. 1212
	CP front cover blue with both fuses No. 414		CP part black with fuse on the right No. 1213
			CP part black with both fuses No. 1214

7 Design and Function

7.1 Transport

	⚠ **WARNING**
⚠	• **Damage to transport equipment when moving heavy machines/machine sections** 　– 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 when handling the machine, as there is an increased risk of hands or feet getting crushed or trapped in these areas. 　– When setting down the station, make sure no persons have their feet under the machine's feet.

	NOTE
⚠️	– 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.

7.2 Overview of the System

CP Lab Conveyor, CP Factory Linear, CP Factory Shunt and CP Factory Bypass are called basic modules. If an application module, e.g. the CP Application Module measuring is attached to a basic module, it becomes a station.

Example

| basic module, e.g. CP Lab Conveyor | application module, e.g. press | station press |
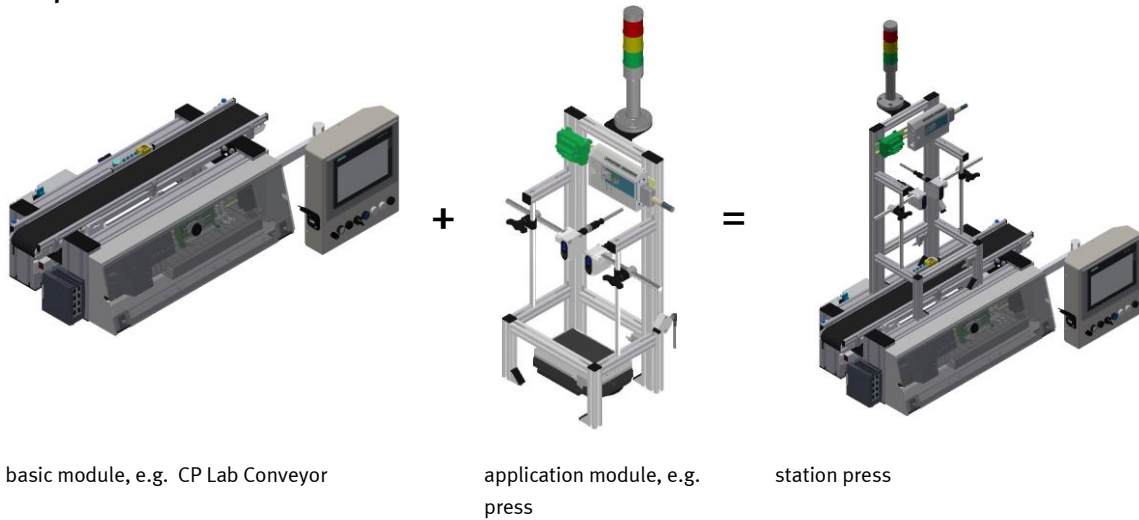
If several stations are put in a row one behind the other, this will form a production line.

| carrier | pallet | workpiece |
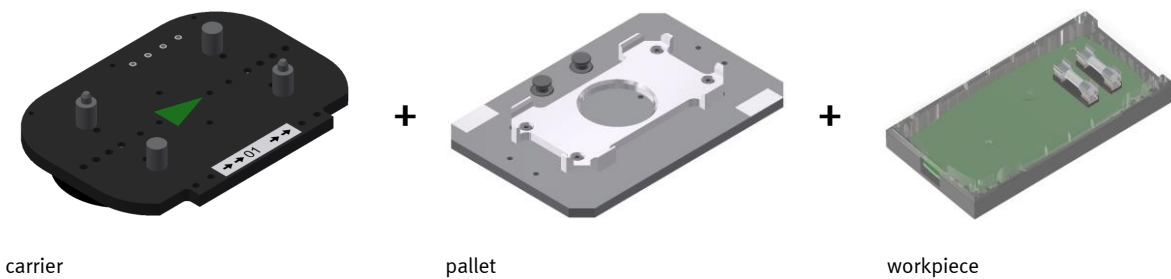
Carriers are transported on the conveyors of the basic modules. And on the carriers, there are pallets with a fixed workpiece reception placed. The workpieces are placed on the workpiece reception or taken from it. Pallets can also be placed on a carrier in some stations or gripped from there.

The typical workpiece of a CP Factory/Lab System is the roughly simplified version of a mobile phone. The workpiece consists of a front cover, of a back cover, of a board and of a maximum of two fuses.

| front cover | board | back cover |
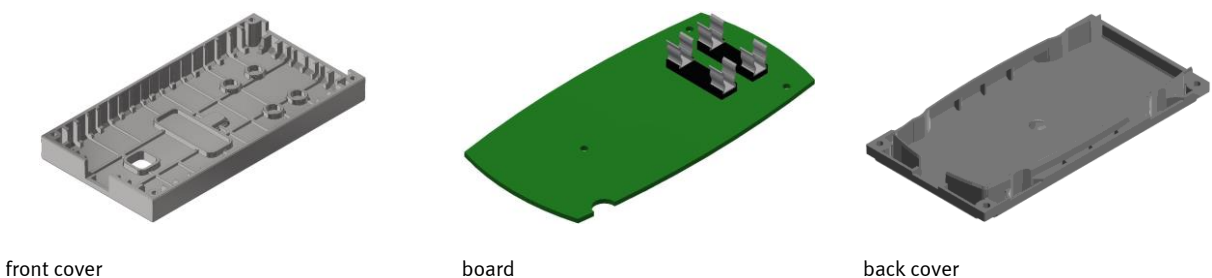
7.3 MR Buffer module with palletizing robot

7.3.1 General Information

The module MR Buffer with palletizing robot is designed for supplying and removing workpieces into the system. The module is directly located at a basic module bypass. For feeding the system, the boxes are supplied manually or by a robotino into the module MR Buffer. The robot takes the workpieces from the boxes and hands them over to the basic module bypass.

For removing workpieces from the system, the workpieces are picked up by the robot at the basic module bypass. Any boxes requested before are first equipped with these workpieces and then output at the buffer.
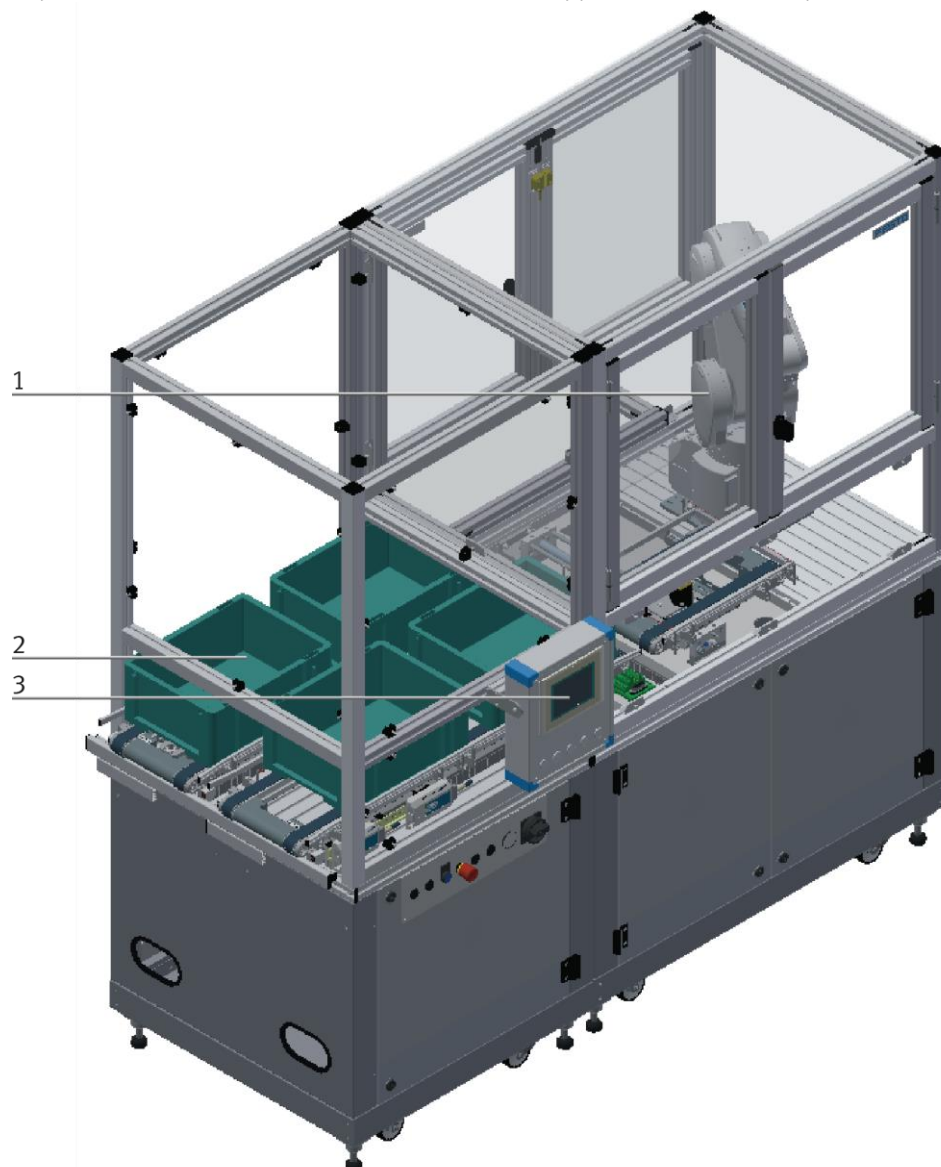
Illustration similar

Position	Description
1	Module robot box moving with safety housing
2	Module box buffer with safety housing
3	touch panel
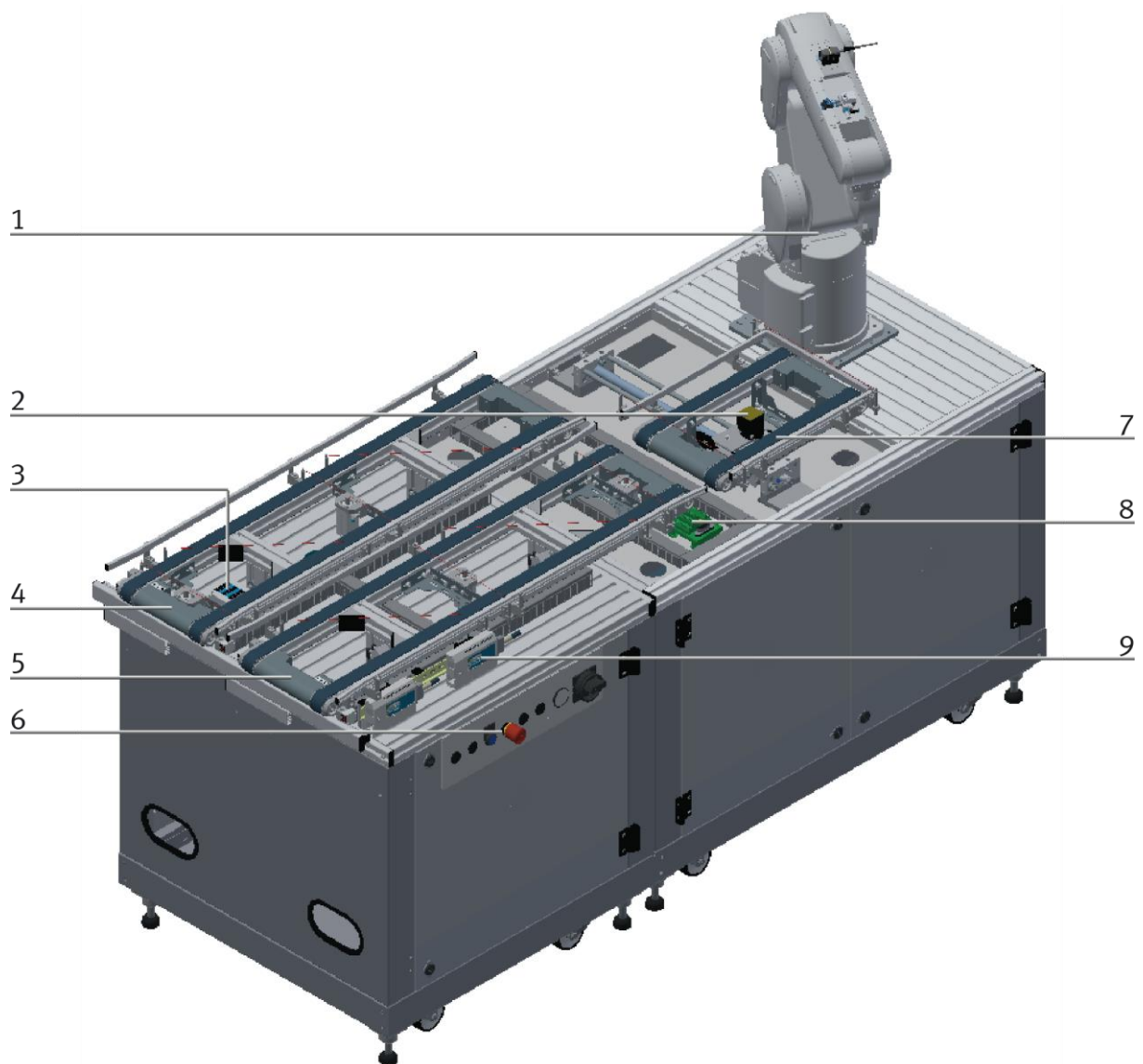
Illustration similar

Position	Description
1	Robot
2	RFID-Sensor
3	Valve terminal
4	conveyor output
5	conveyor input
6	Operation panel
7	Shift unit
8	I/O terminal
9	I/O module (2x)

7.3.2 Interface to basic module bypass
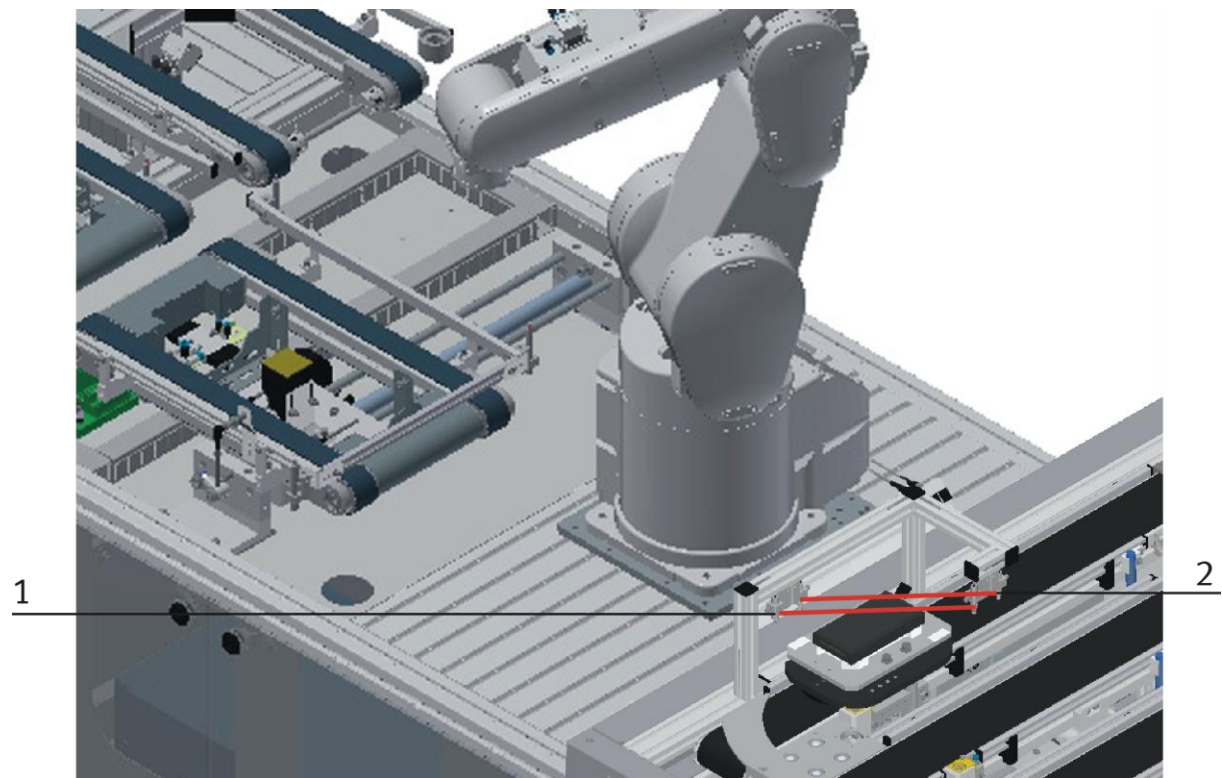
Illustration similar

The interface of the module consists of 2 sensors which have been attached to the basic module bypass, but are connected with the palletizing robot at the MR Buffer. The sensors are designed for checking if there is a front or a back cover on the carrier.

Pos.	Description
1	sensor BG5 – front cover
2	sensor BG6 – back cover

7.3.3 Supply of the MR Buffer with palletizing robot
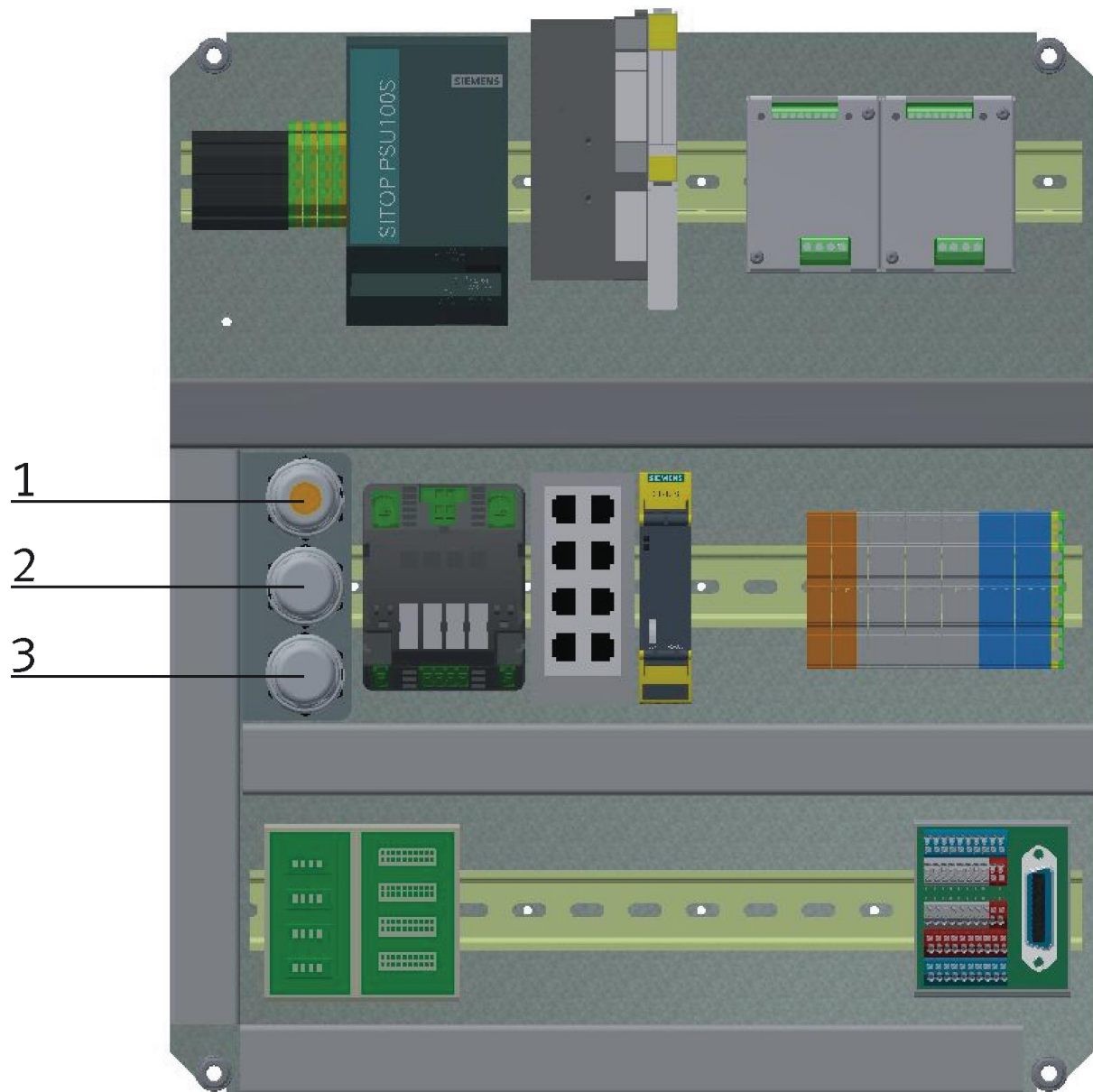
power supply / illustration similar

Position	Station
1	power supply 110V / 230V / 400V
2	power supply to another station (optional)
3	power supply to another station (optional)

7.4 Electrical installation

The station MR Buffer with palletizing robot has got three electric boards.
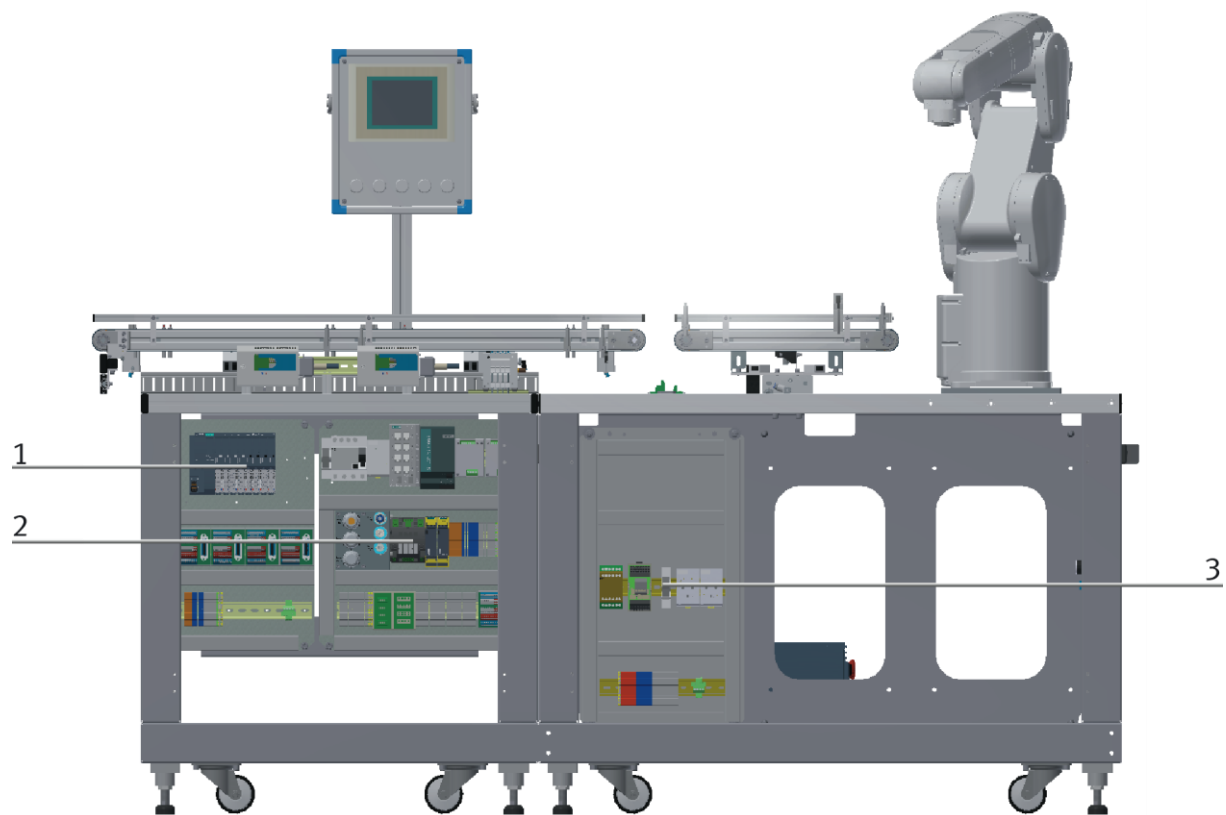
Electric boards / illustration similar

Position	Station
1	I/O board ET200SP 32IN/32OUT / +K1
2	board for power supply / +T1
3	board for power supply / +K4

1
2
3
4

5
6
7
8
9

10
11
12

13
14

15

16
17
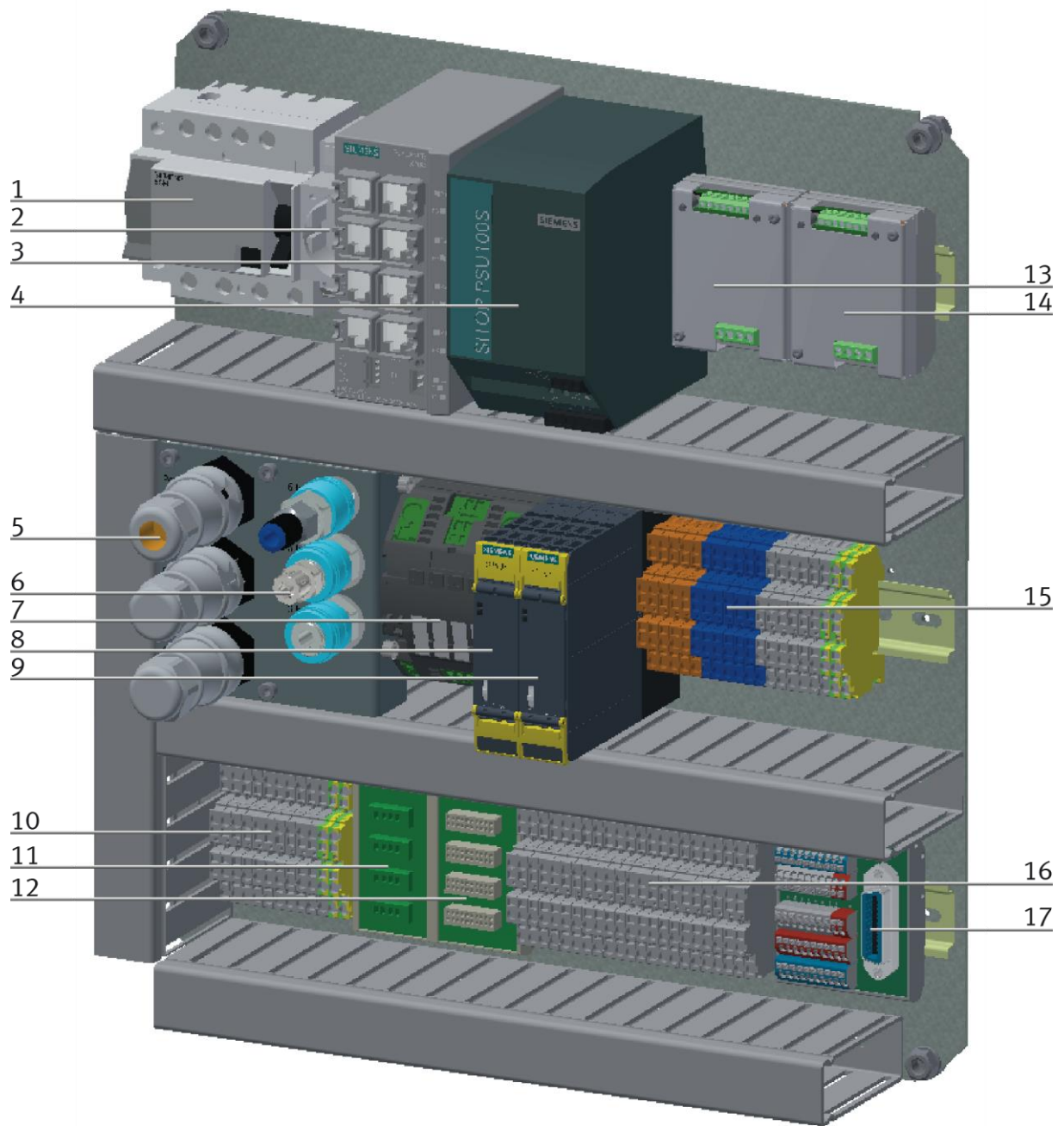
Board for power supply -T1 / illustration similar

Position	Description	Equipment identifier	Name/Order number
1	Clamps	XD1	
2	protective contact socket 230 V	XJ2	Hager SN01 / 2055242
3	Ethernet switch	XF1	Siemens Scalance XB008 / 6GK5008-OBAOO-1AB2
4	Sitop power supply	TB1	Sitop 85-550V – 24V / 10 A
5	Ethernet Switch	XF1	Siemens Scalance XB008 / 6GK5008-OBAOO-1AB2
6	Air supply		
7	24 V allocation	FC1	MICO 4.6/24VDC/4*1/2/4/6A Murr.9000-41034-0100600
8	Emergency Stop unit	FZ1	Siemens Sirius / 3SK1111-2AB30
9	Emergency Stop unit	FZ2	Siemens Sirius / 3SK1111-2AB30 (option)
10	Clamps	XD1	
11	Switchboard 24V	XZ1	
12	Emergency stop board	XZ2	
13	Start-up current limiters	QA1	Kaleja M-MZS-4-30 / 06.05.020
14	Start-up current limiters	QA1	Kaleja M-MZS-4-30 / 06.05.020
15	Clamps	XD2	
16	Clamps	XG1	
17	I/O terminal	XD11	
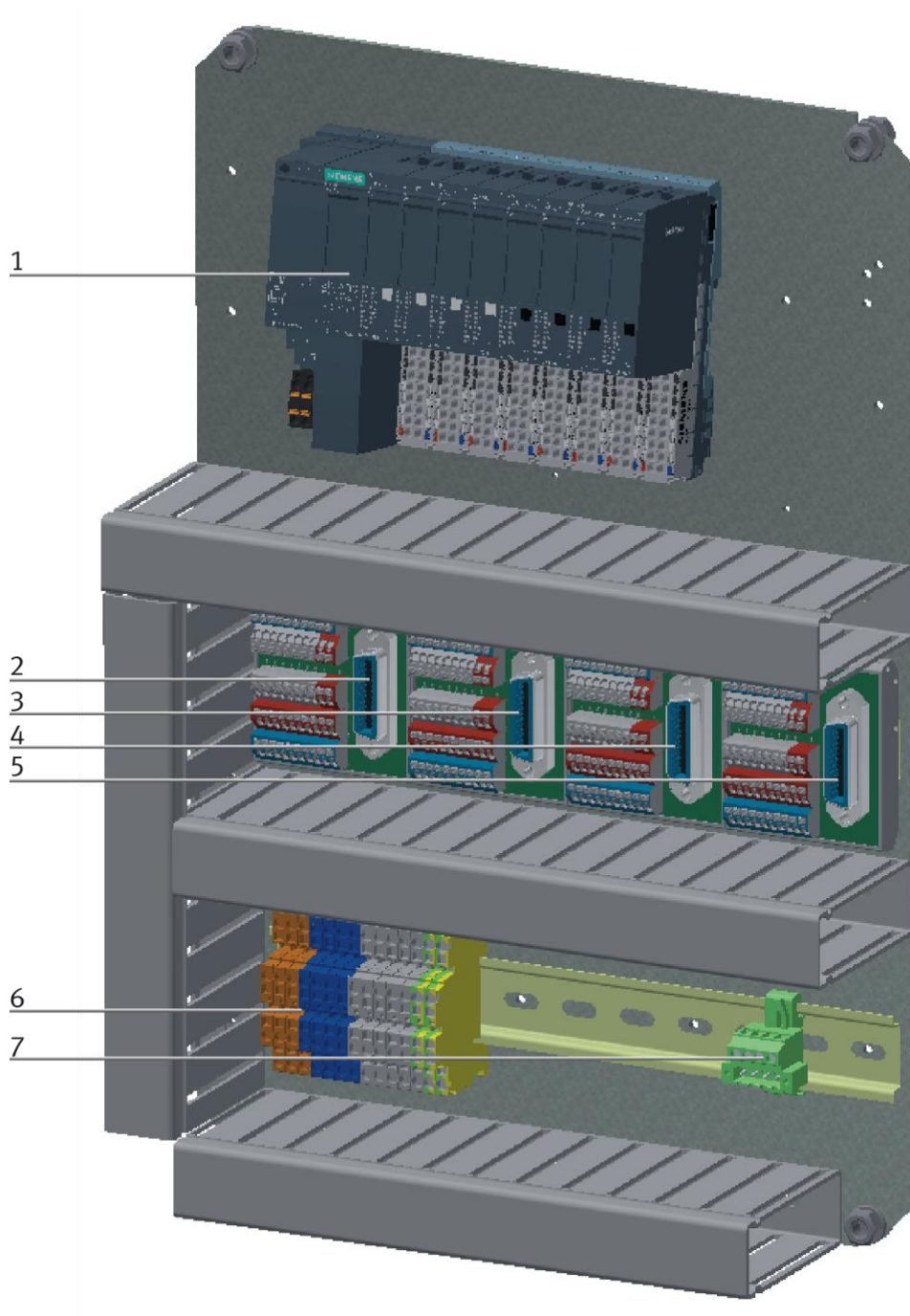
PLC board / illustration similar

Position	Description	Equipment identifier	Name/ Order number
1	PLC	KF1	Siemens ET200SP / CPU 1512SP F-1PN
2	I/O terminal	XD11	
3	I/O terminal	XD12	
4	I/O terminal	XD13	
5	I/O terminal	XD14	
6	clamps	XD1	
7	connecting plug 24V distributor	XJ1	UMSTBVK 2,5 / 5 GF-5, 08
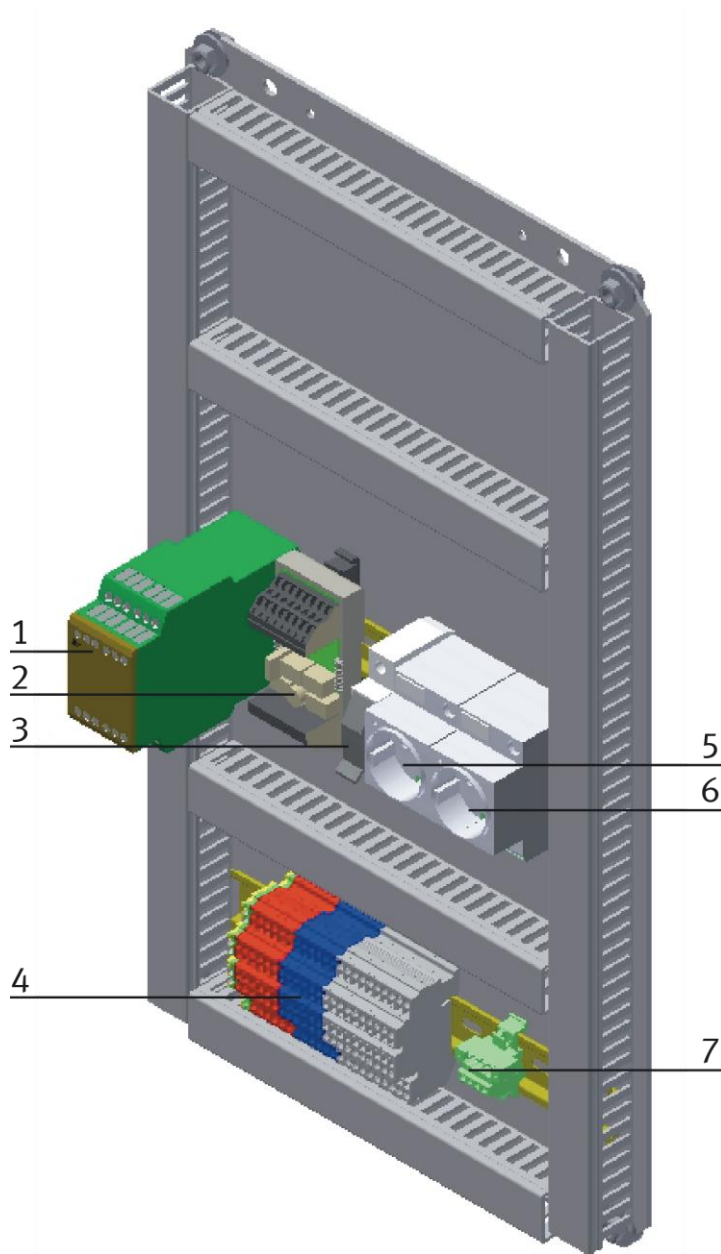
Board for power supply robot- K4 / illustration similar

Position	Description	Equipment identifier	Name/Order Number
1	PNOZ X8P / Emergency Stop	F2-KF1	Pilz 787760
2	PSEN iX1 for door switch	F2-FZ2	Pilz 0003
3	automatic circuit breaker C-6A 1-pin	FC2	
4	clamps	XD1 / XD2	
5	protective contact socket 230 V	XJ2	Hager SN01 / 2055242
6	protective contact socket 230 V	XJ3	Hager SN01 / 2055242
7	connecting plug 24V terminal block	XJ1	UMSTBVK 2,5 / 5 GF-5, 08

7.4.1 RFID connections
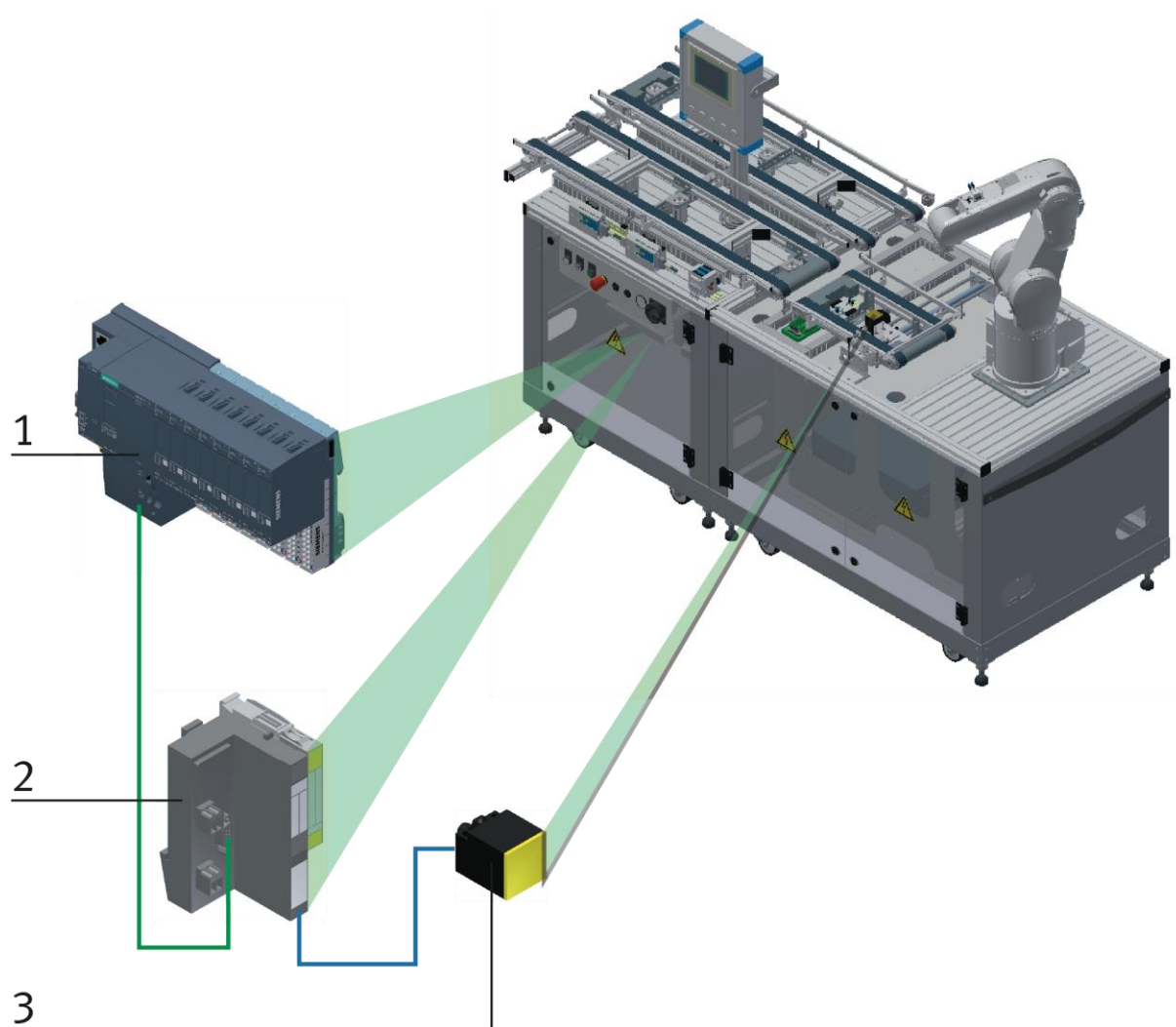
Illustration similar

Position	Station
1	Siemens PLC
2	Turk Gateway Profinet IO / BL20-GW-EN-PN
3	RFID Sensor (G2 –TF1) / TN-CK40-H11147

7.4.2 Emergency-Stop structure
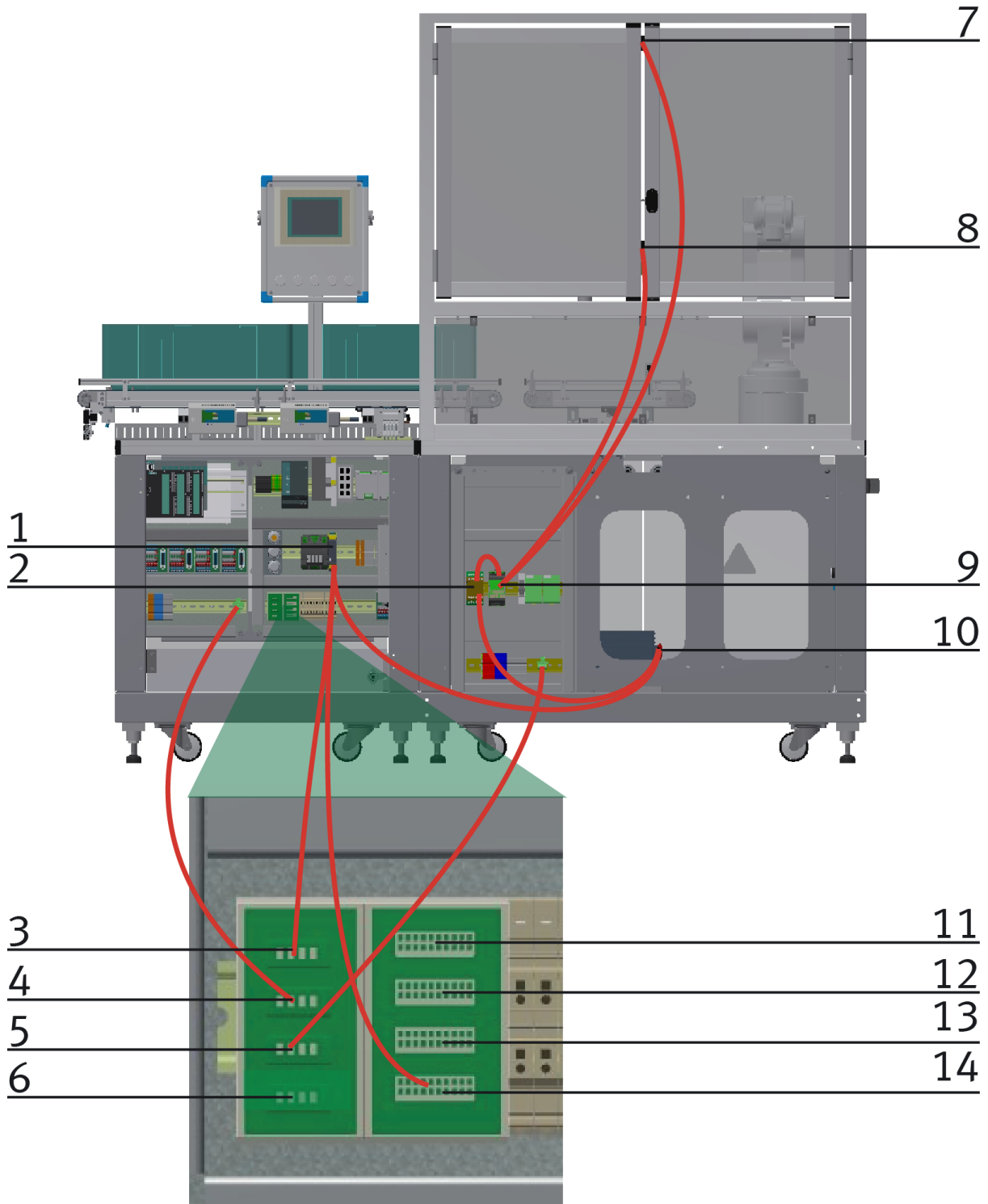
Example emergency-stop connections with emergency-stop terminal block / illustration similar

Position	Description
1	Emergency-stop unit
2	PNOZ X8P
3	clamp 1 / 24V emergency-stop terminal block to station
4	clamp 2 / 24 V emergency-stop terminal block to station
5	clamp 3 / 24 V emergency-stop terminal block to station
6	clamp 4 / 24 V emergency-stop terminal block to station
7	guard door switch 1
8	guard door switch 2
9	PSEN for guard door switch
10	Emergency-stop Drive Unit Robot
11	IN1 clamp emergency-stop button – distributor from another station
12	OUT1 clamp emergency-stop button - distributor from another station
13	OUT2 clamp emergency-stop button -distributor from another station
14	24 V clamp emergency-stop button
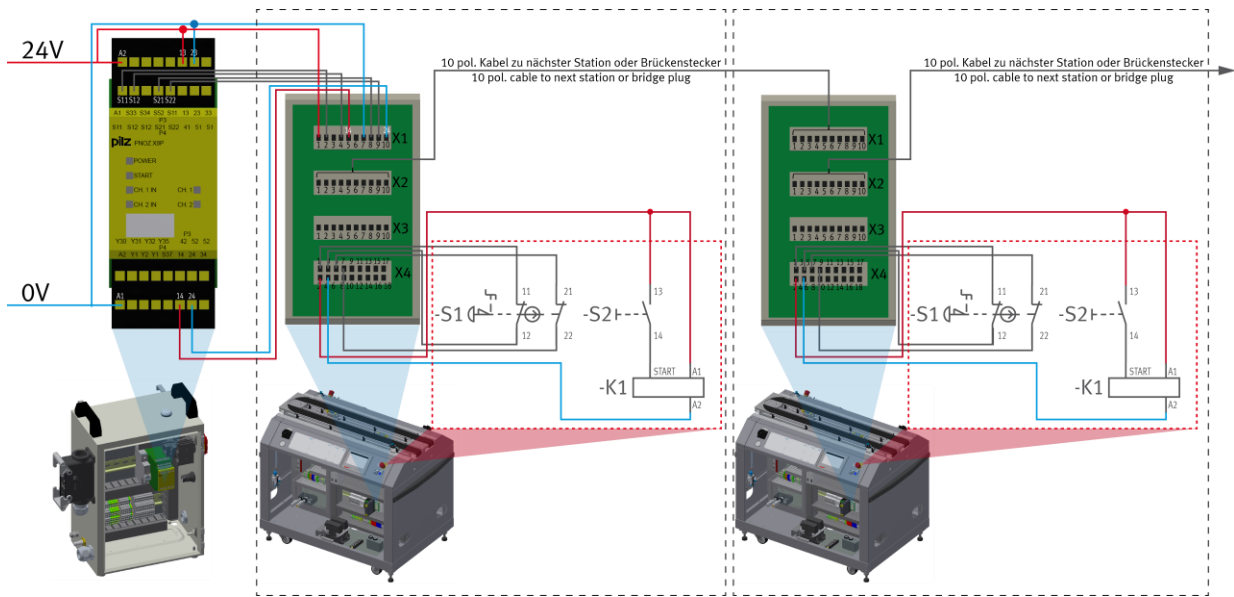
Setup emergency stop system / illustration similar

The emergency stop system affects the whole line, so if an emergency stop is pressed, all stations in the line stop.

The emergency stop boards which are used in each station are used to connect one station to the next. These are connected with 10-pin cables and route all emergency stop information from one station to the next.
Starting at the power cabinet, a 10-pin cable is plugged into the X1 interface of the emergency stop board at the first station, from there it goes from the X2 of the emergency stop board to the X1 interface of the Emergency stop board from the next station. If no other station is connected, a jumper plug must be plugged into X2 of the emergency stop board at the last station.
The information is processed internally by X4 on the emergency stop board.

F2-XZ2-X1
F2-XZ2-X2
F2-XZ2-X3
F2-XZ2-X4
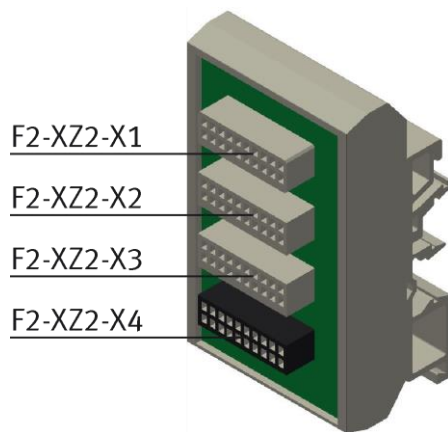
Illustration similar

Circuit board emergency stop circuit

- F2 XZ2-X1

  Emergency stop coupling input / If no predecessor station is present, a bridge plug is to be installed here or at the system plug.

- F2 XZ2-X2

  Emergency stop coupling Output 1 / If there is no following module, a bridge plug is to be installed here or at the system plug.

- F2 XZ2-X3

  Emergency stop coupling output 2 / for the connection of a further module or an external machine (for example for basic module branch - here a further module can be installed at the branch or a CNC processing machine can be provided at a bypass) otherwise a bridge plug is to be provided.

- F2 XZ2-X4

  Connection terminals for control panel, power supply, emergency stop relay

7.5 Commissioning

The module has got several components which have to be connected on commissioning. The procedure will be described in the following chapters.

7.5.1 Pneumatic commissioning

The mechanic assembly must be finished. First you have to connect the module to the pneumatic system of the room. The service unit required has to be provided by the customer and should be within close proximity. The quick coupling plug has got a nominal size of 5 mm. If the respective system is equipped with 7.9 mm nominal size it will be possible to exchange the coupling plug of the service unit by a bigger one (adapter 1/8 to 1/4 required). Then the station can be supplied with 6 bar and the pneumatic commissioning is finished.

7.5.2 Electrical commissioning

Now the module must be supplied with electric voltage (400 V). The voltage has to be provided by the customer. Furthermore, an expert installation must be guaranteed.

7.6 Visual inspection

The visual inspection must always be performed prior to every commissioning!
Before you start the station, please check:
- the electrical connections
- the correct fit and condition of the supply ports
- the mechanic components regarding visible faults (cracks, loose connections etc.)
- the functioning of the Emergency stops

Please eliminate any discovered damages before you start the station!

7.7 Adjusting the sensors

7.7.1 Fibre-optic (workpiece detection)
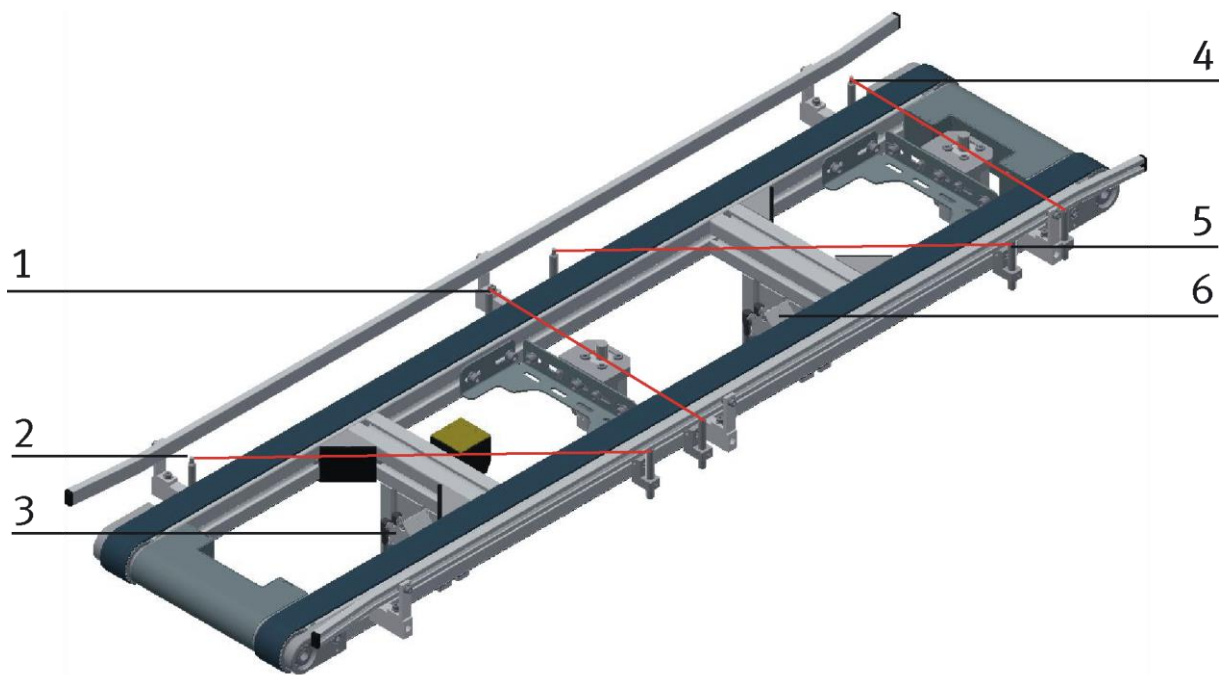
Illustration similar

Position	Description
1	Light barrier – 2 stoppers in the middle occupied (BG2 conveyor 1/ BG12 conveyor 2)
2	Light barrier – 1 feed line occupied (BG1 conveyor 1/ BG11 conveyor 2)
3	Fibre optic unit (BG1+2 / BG 11+12)
4	Light barrier – 4 stoppers outlet occupied (BG3 conveyor 1/ BG13 conveyor 2)
5	Light barrier – box on front position (BG7 conveyor 1/ BG17 conveyor 2)
6	Fibre optic unit (BG3+7 / BG 13+17)

The light barrier for detecting the boxes on the conveyor consists of the fibre optic unit and the fibre optics. The fibre optic unit works with visible infrared. You can move the fibre optics by the fibre optics reception in order to adjust the position on the conveyor. If the box is placed on the start position of the conveyor or if it is transported to the end of the conveyor, it will interrupt the light barrier, and the fibre optic unit will send a message to the control system.

Requirements
– the fibre optic unit has been attached
– the electrical connection of the fibre optic unit has been effected
– the power supply unit has been switched on

Procedure
1. Screw the two light guide heads into the sensor holders.
2. Adjust the fibre optics towards each other.
3. Attach the fibre optics to the fibre optic unit.
4. Setting the fibre optics: standard 1-signal if there is no box „at the start/the end of the conveyor"; if there is no 1-signal, the light guide heads have to be adjusted towards each other and the fibre optics potentiometer has to be adjusted until a 1-signal appears. If there is a box available at the start/end of the conveyor, the signal must be interrupted (0-signal).

   Remark
   The maximum permissible number of turns of the adjusting screw is 12.

5. Please check the setting by inserting a box.

   Remark
   The recognition of all boxes must be guaranteed.

Documents
• Data sheets / operating instructions
  fibre optic unit SOEG_L and fibre optics SOEZ-SE

7.7.2 Proximity Switch (transfer unit)
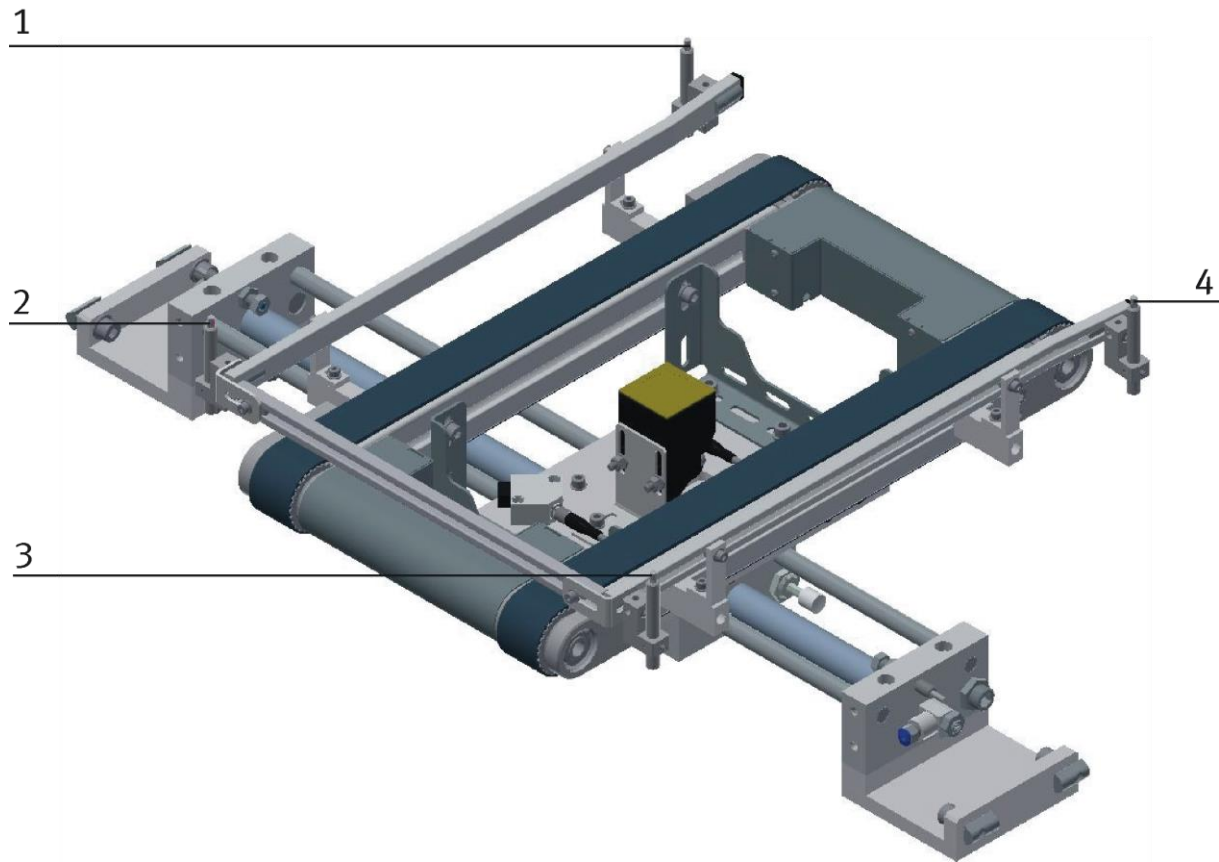
Illustration similar

Pos	Description
1+4	light barrier (BG4 / (box has completely been moved in)
2+3	light barrier (BG3 / (box has partially been moved in)

The light barrier for detecting the boxes on the conveyor consists of the fibre optic unit and the fibre optics. The fibre optic unit works with visible infrared. You can move the fibre optics by the fibre optics reception in order to adjust the position on the conveyor. If the box is placed on the start position of the conveyor or if it is transported to the end of the conveyor, it will interrupt the light barrier, and the fibre optic unit will send a message to the control system.

Requirements
– the fibre optic unit has been attached
– the electrical connection of the fibre optic unit has been effected
– the power supply unit has been switched on

Procedure
1. Screw the two light guide heads into the sensor holders.
2. Adjust the fibre optics towards each other.
3. Attach the fibre optics to the fibre optic unit.
4. Setting the fibre optics: standard 1-signal if there is no box „at the start/the end of the conveyor"; if there is no 1-signal, the light guide heads have to be adjusted towards each other and the fibre optics potentiometer has to be adjusted until a 1-signal appears. If there is a box available at the start/end of the conveyor, the signal must be interrupted (0-signal).
   Remark
   The maximum permissible number of turns of the adjusting screw is 12.
5. Please check the setting by inserting a box.
   Remark
   The recognition of all boxes must be guaranteed.

Documents
• Data sheets / operating instructions
   fibre optic unit SOEG_L and fibre optics SOEZ-SE

7.7.3 Proximity switch (Indexing units)
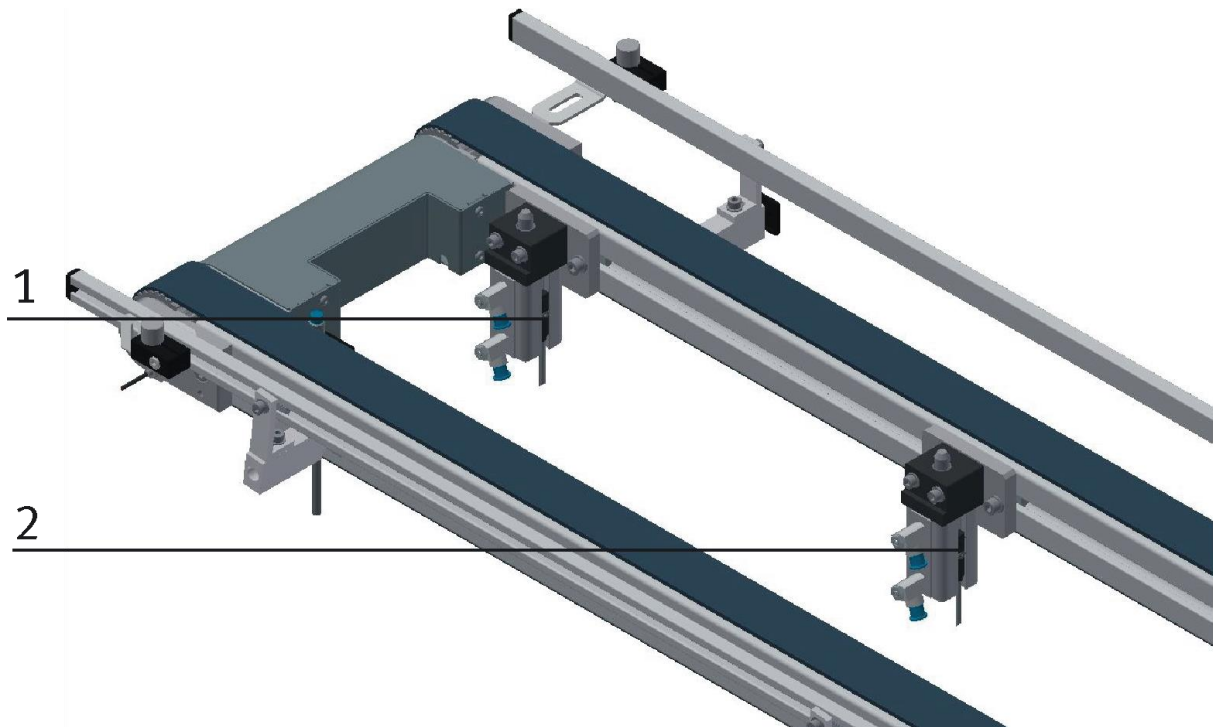
Illustration similar

Position	Description
1	Sensor Indexing Unit 1 bolt extended (BG4) / 574334 (SMT-8M-A-PS-24V-E-0,3-M8D)
2	Sensor Indexing Unit 2 bolts extended (BG5) / 574334 (SMT-8M-A-PS-24V-E-0,3-M8D)

The proximity switches are used for checking 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
– the indexing unit has been attached
– the pneumatic connection of the cylinder has been established
– the compressed air supply has been switched on
– the electrical connection of the proximity switches has been established
– power supply is available

Procedure
1. The cylinder is in the end position to be queried.
2. Move the proximity switch until the switching status display (LED) appears.
3. Move the proximity switch into the same direction by a few millimetres until the switching status display disappears.
4. Move the proximity switch halfway between the switch-on and the switch-off position.
5. Tighten the locking screw of the proximity switch with an Allen key WAF 1.3.
6. Check the positioning of the proximity switch by repeated test runs of the cylinder.

Documents
• Data sheets / operating instructions
  proximity switch 574334 (SMT-8M-A-PS-24V-E-0,3-M8D)

7.7.4 Proximity switch (transfer unit)
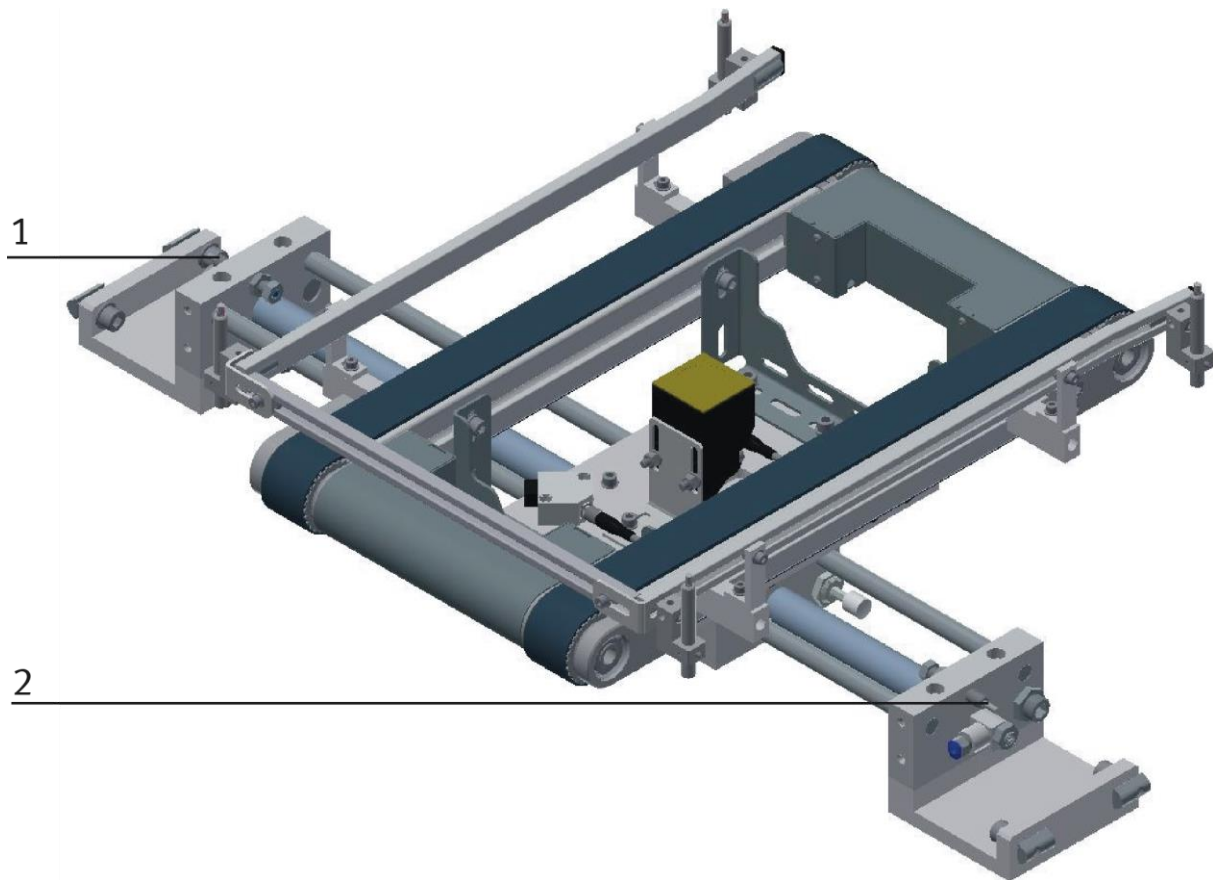
Illustration similar

Position	Description
1	sensor x-axis (transfer unit) in push-out position (BG2) / 150362 (SEIN-4B-PS-K-L)
2	sensor x-axis (transfer unit) in basic setting (BG1) / 150362 (SEIN-4B-PS-K-L)

The proximity switches are used for checking the end position of the x-axis/transfer unit. The proximity switches react to the stop at the transfer unit. They do not require any settings but are integrated within the stop of the axis.

Documents
• Data sheets / operating instructions
  Proximity switch 150362 (SEIN-4B-PS-K-L)

7.8 Adjusting the one-way flow control valves
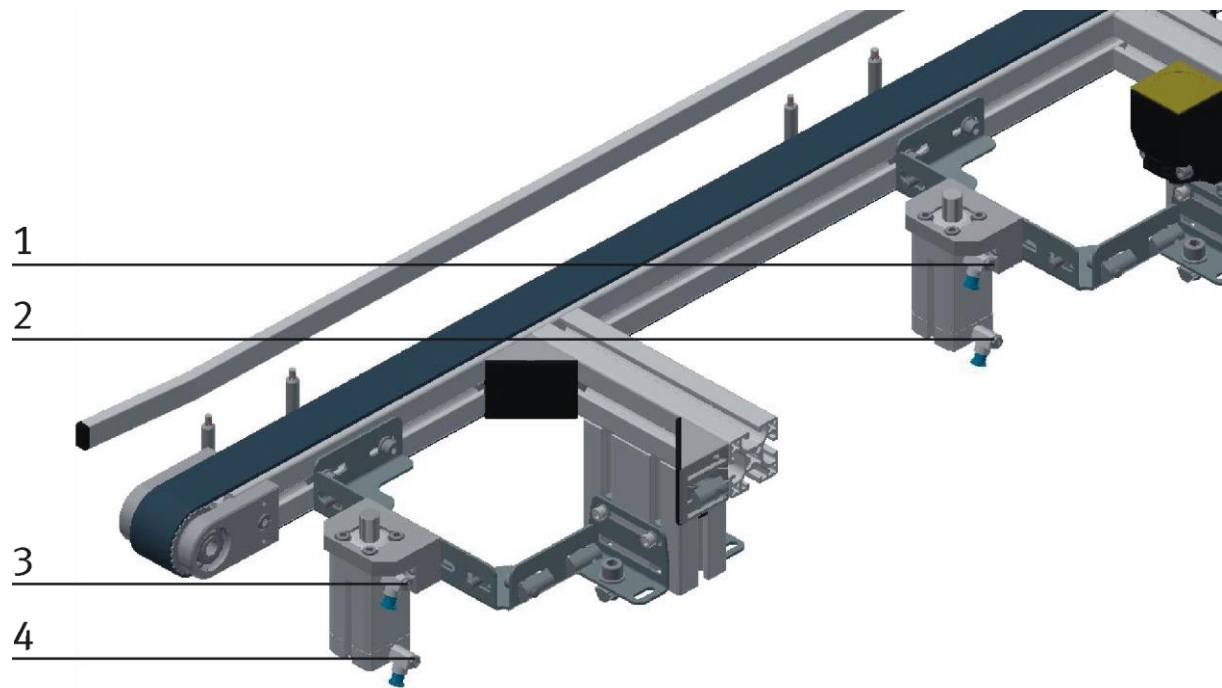
One-way flow control valves / illustration similar

Position	Description
1+2	one-way flow control valves GRLA for indexing unit 1
3+4	one-way flow control valves GRLA for indexing unit 2
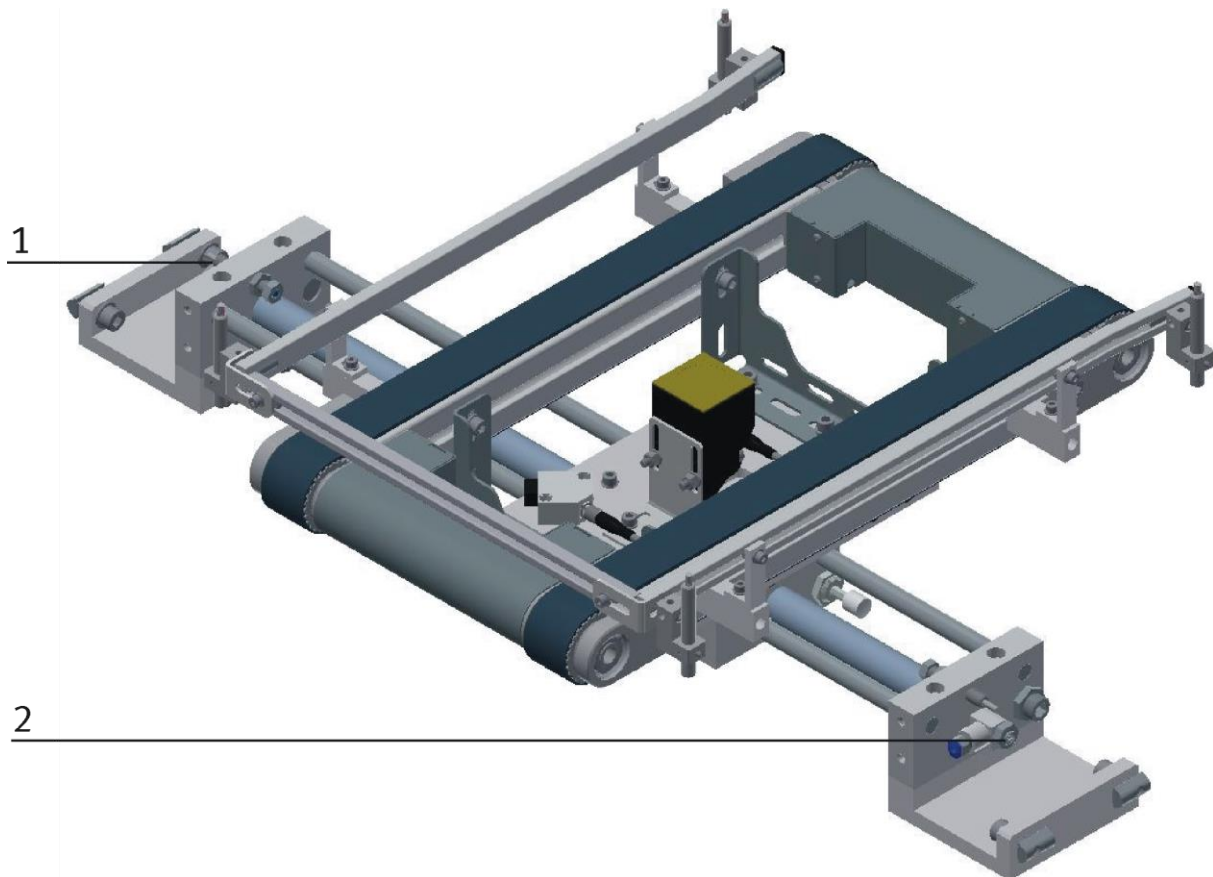
Illustration similar

Position	Description
1	one-way flow control valves GRLA for transfer unit
2	one-way flow control valves GRLA for transfer unit

One-way flow control valves are used for regulating the exhaust air volume with double-acting drive units. In the opposite direction, the air flows through the flow control valve having a full cross-sectional flow. The piston is clamped between air cushions by free supply air and throttled exhaust air (improvement of the operating behaviour even if the load changes).

Requirements
– the pneumatic connection of the cylinders has been set up
– the compressed air supply has been switched on

Procedure
1. At first turn off both one-way control valves, then turn them on again by about one rotation.
2. Start a test run.
3. Turn on the one-way flow control valves slowly until you reach the desired speed of the piston.

Documents
- Data sheets
  One-way flow control valve (193138)

8 Operation

8.1 Starting the station

An initial commissioning has already been carried out ex works for the station.

Follow these steps to work with the station:

1. Establish mains supply 400 V AC.
2. The station is supplied with approx. 6 bar compressed air. When commissioning for the first time, make sure to increase the pressure slowly. (Prevents unpredictable events).
3. Now you can work with the station.

8.2 The operation panel of the station

For supplying the station and starting it, the power supply must be activated. After starting the control system, the station can be operated with the operation panel. The functions on the operation panel are identical to the touch panel.
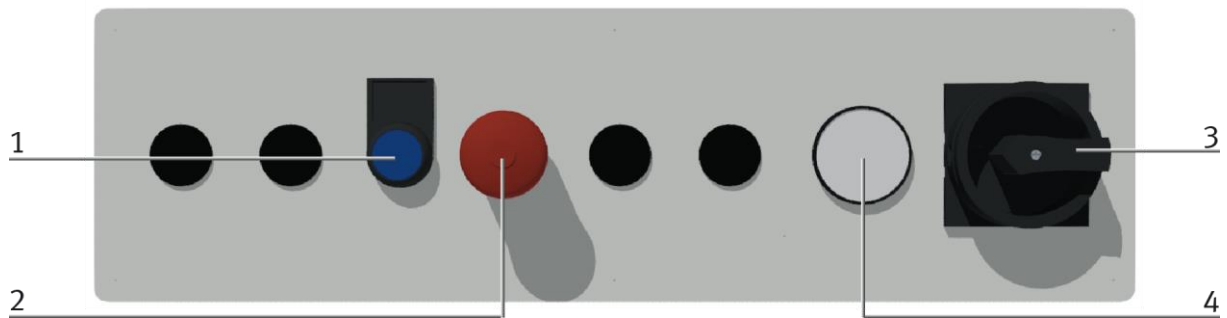
CP Factory operation panel / illustration similar

No.	Name	Element	Function	
1	Controller on	SF1	Light on	Reset ready
			Light off	Waiting for reset
2	Emergency stop	FQ1	Emergency stop function	
3	Main Switch	QB1	Main switch power supply	
4	Manometer	Announce air pressure		

8.3 Process description
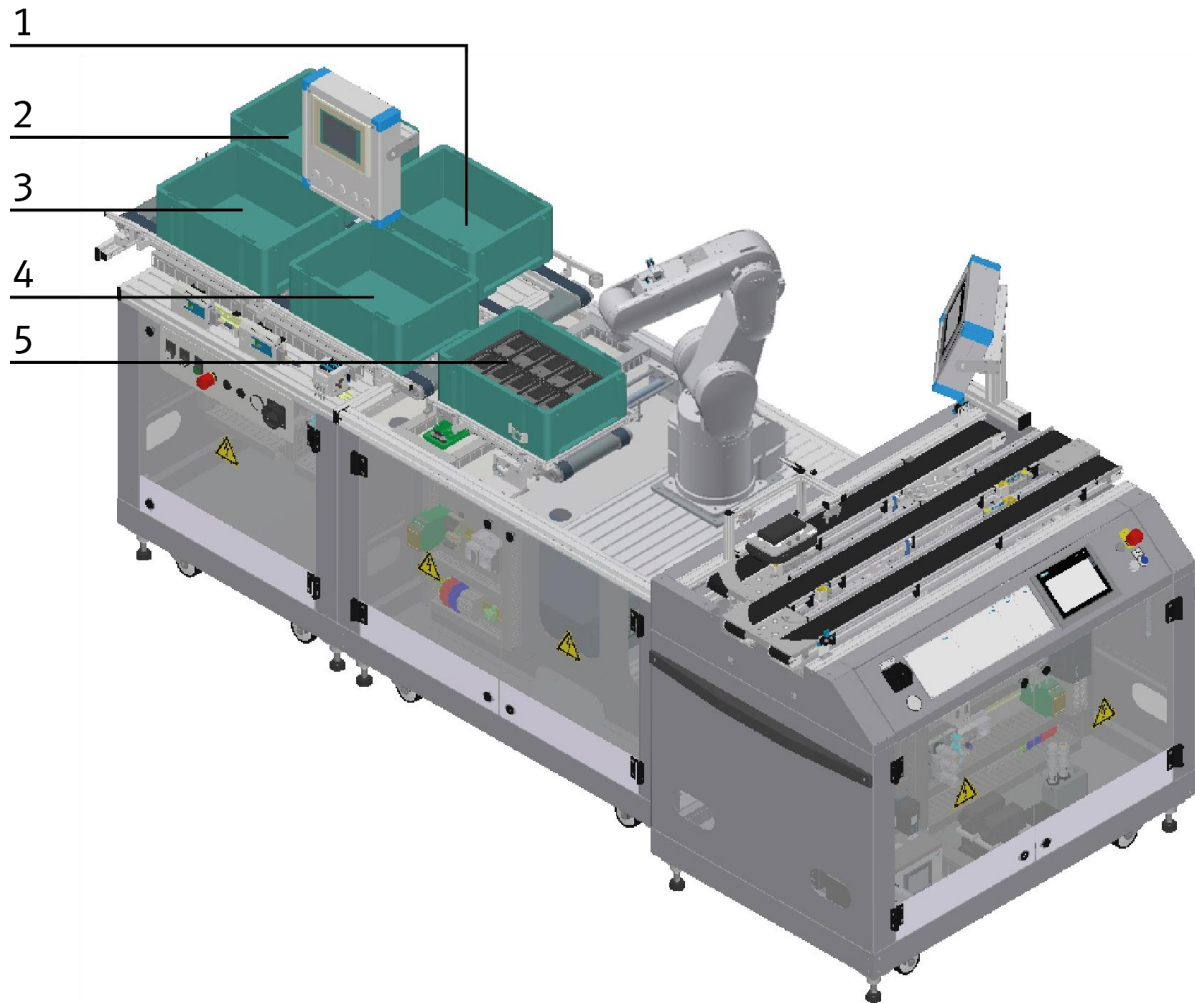
Illustration similar

Position	Description
1	Box Stopper 3
2	Box Stopper 4
3	Box Stopper 1
4	Box Stopper 2
5	Transfer Unit

8.3.1 Process description box Stopper 1-4

```
                    ┌─────────────────────────────┐
                    │      execute movement       │
                    └─────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │    Box is physical available │
                    └─────────────────────────────┘
                                  │
                         No ──────┴──────────────────┐  ┌──────────────────────────┐
                                                      └──│     discharge buffer     │
                                                         └──────────────────────────┘
                         Yes
                    ┌─────────────────────────────┐
                    │        move box and         │
                    │        open stopper         │
                    └─────────────────────────────┘
                                  │
              ┌───────────────────────────────────────┐
              │   wait til box has passed the stopper  │
              └───────────────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │       Stop conveyor &       │
                    │        close stopper        │
                    └─────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │          MES ready          │
                    └─────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │    move box to next buffer  │
                    │           in MES            │
                    └─────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │          MES ready          │
                    └─────────────────────────────┘
                                  │
                    ┌─────────────────────────────┐
                    │            IDLE             │
                    └─────────────────────────────┘
```
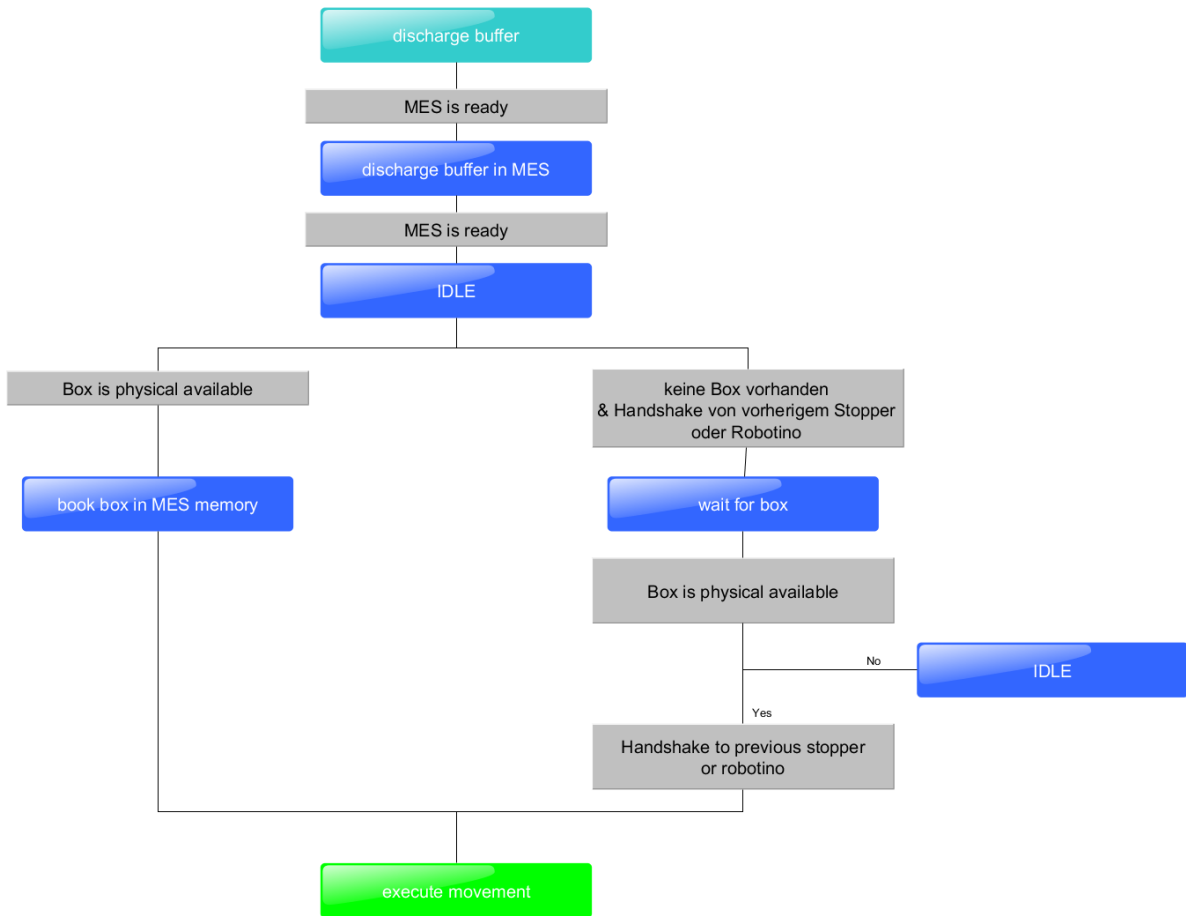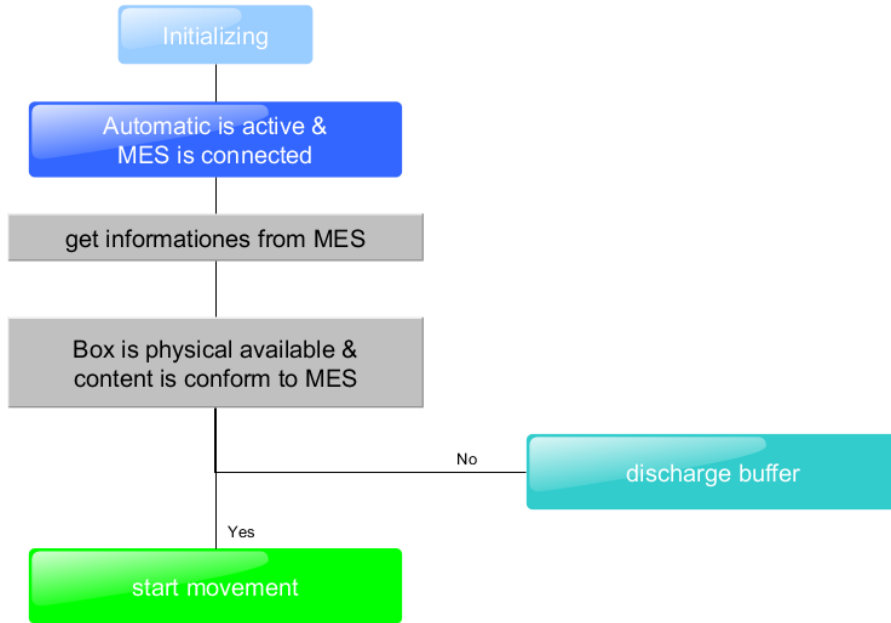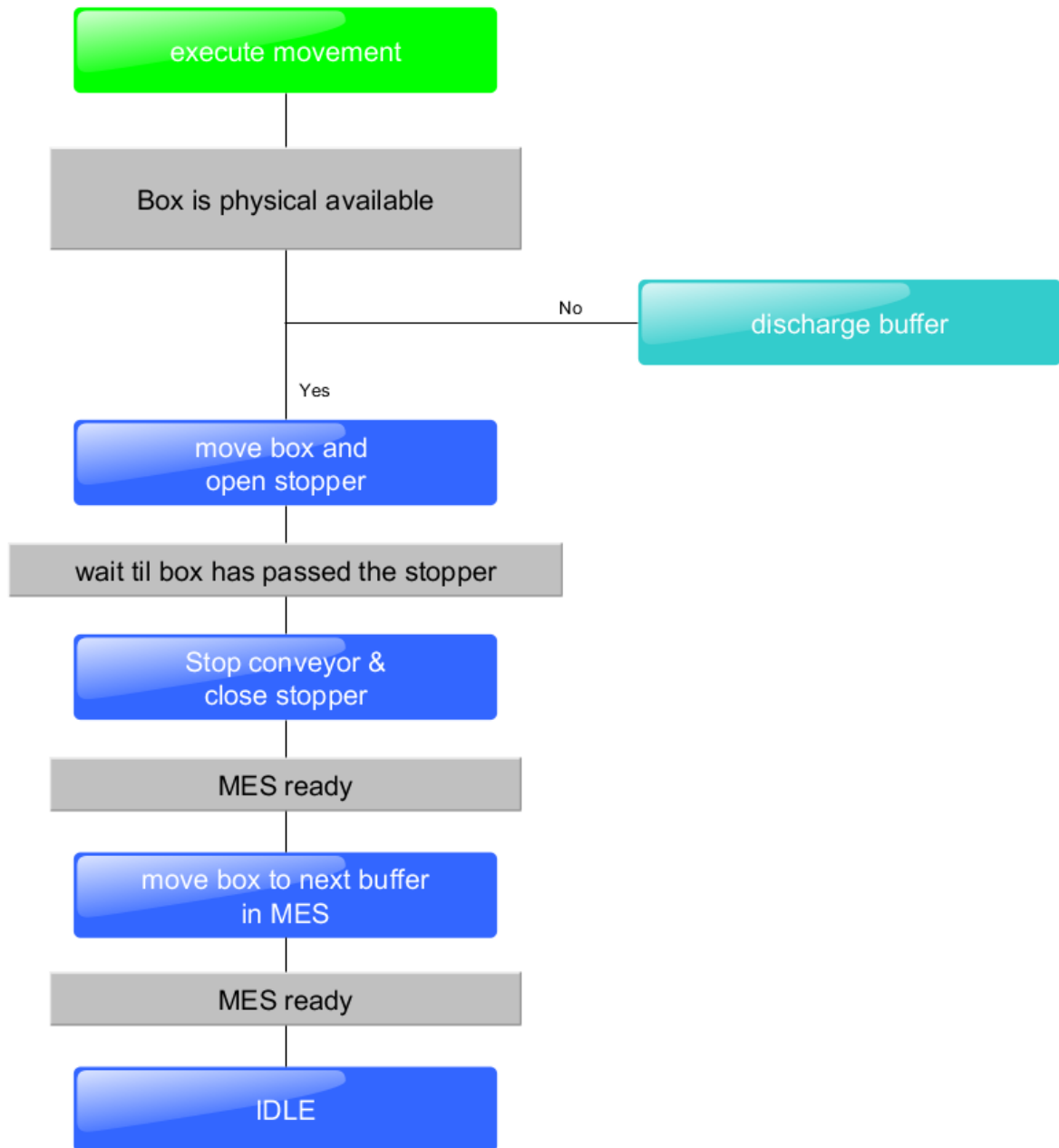
8.3.2 Process description transfer unit

```
                          ┌──────────────────┐
                          │  initialization  │
                          └──────────────────┘
                                   │
                          ┌──────────────────┐
                          │       IDLE       │
                          └──────────────────┘
                                   │
                          ┌──────────────────┐
                          │ Automatic is active & │
                          │  MES is connected │
                          └──────────────────┘
                                   │
                          ┌──────────────────┐
                          │ Box is physical available │
                          └──────────────────┘
                                   │
            Yes ────────────────────┴──────────── No
             │                                     │
   ┌──────────────────┐                  ┌──────────────────┐
   │ read RFID from box │                │    MES ready     │
   └──────────────────┘                  └──────────────────┘
             │                                     │
   ┌──────────────────┐                  ┌──────────────────┐
   │  RFID is readout  │                 │ discharge memory │
   └──────────────────┘                  └──────────────────┘
             │                                     │
   ┌──────────────────┐                  ┌──────────────────┐
   │ store box in MES buffer │           │    MES ready     │
   └──────────────────┘                  └──────────────────┘
             │                                     │
   ┌──────────────────┐                  ┌──────────────────┐
   │ Box part number = 28 │              │ move transfer unit to │
   │     & ID <>0      │                 │  working position │
   └──────────────────┘                  └──────────────────┘
             │                                     │
   Yes ──────┴────── No                  ┌──────────────────┐
    │              │                     │ transfer unit in working position │
    │       ┌──────────────────┐        └──────────────────┘
    │       │     get out      │                 │
    │       └──────────────────┘        ┌──────────────────┐
    │                                    │       IDLE       │
┌──────────────────┐                    └──────────────────┘
│ move transfer unit to │
│  working position │
└──────────────────┘
    │
┌──────────────────┐
│ transfer unit in working position │
└──────────────────┘
    │
┌──────────────────┐
│  wait for order  │
└──────────────────┘
```

```
                          wait for order


                                              carrier at conveyor available
                                              & order for this ressource available

        MES checks cyclically whether for
              this box is a task                       start robot
                            No
                                    hand out    wait till robot has executed his order
              Yes
        Order to store is available                    wait for order
                            No
              Yes                   wait for order

        Start order
        & execute order

           wait for order



              hand out


        move transfer unit to goods issue


        wait till tranfer unit is ready


           switch on conveyor


        wait till box is hand out


           stor box in nest
              MES buffer


              MES ready



                IDLE
```

8.4 Menu structure of the operating panel

Position	Description
1	Description of menu (main or submenu) OR in case of an active Error or an error message, this field is also for announcement
2	Main menu (always shown the same) Home: Here the module can be controlled, the mode (default / MES) can be selected, the automatic or the set-up mode can also be operated. Setup: Here, the application can be operated manually in setup mode Parameter: The parameters of the application are set here, a simulation can be started, the transitions can be defined, or the tape can be set System: Here the system parameters such as language, time, etc. are set
3	Submenu Changing content, depending on the main menu
4	Changing content, depending on the main or submenu
5	Announcement of operation mode or mode (MES or default)
6	Announcement of actual date and time

Log in as an administrator

There are 2 functions in the operation of the HMI that are only available when the operator logs on to the HMI. These functions are the I/O test in the setup mode and the user area.

If one of the functions has been logged in, the other function is also available without the user having to log in again.

The process is explained using the user function as an example.
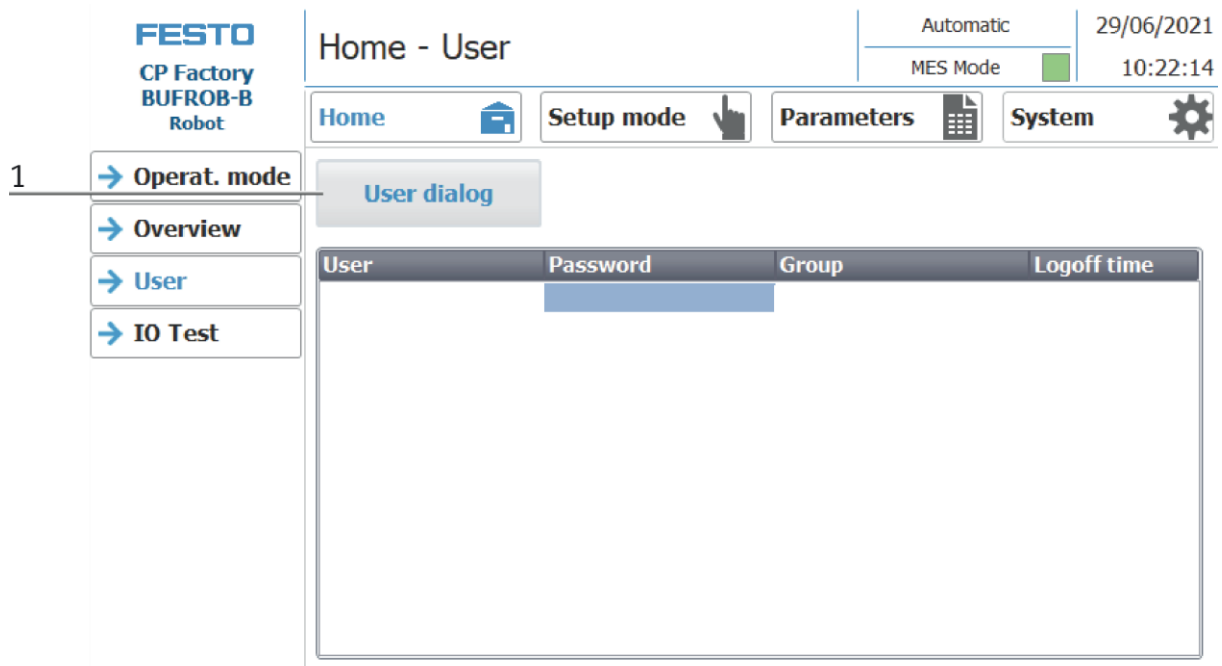
1. With a click on the User Dialog button the following window is opened.
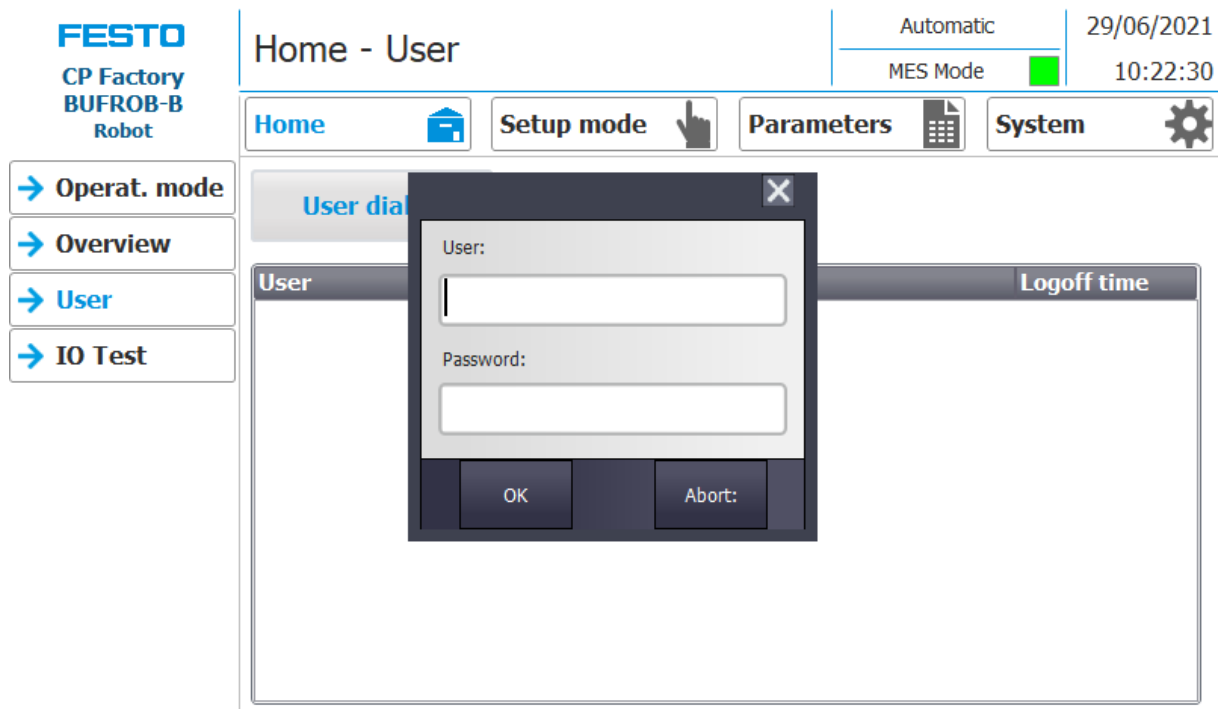
2. If you click in the User or Password fields, the input window opens and the user data can be entered.
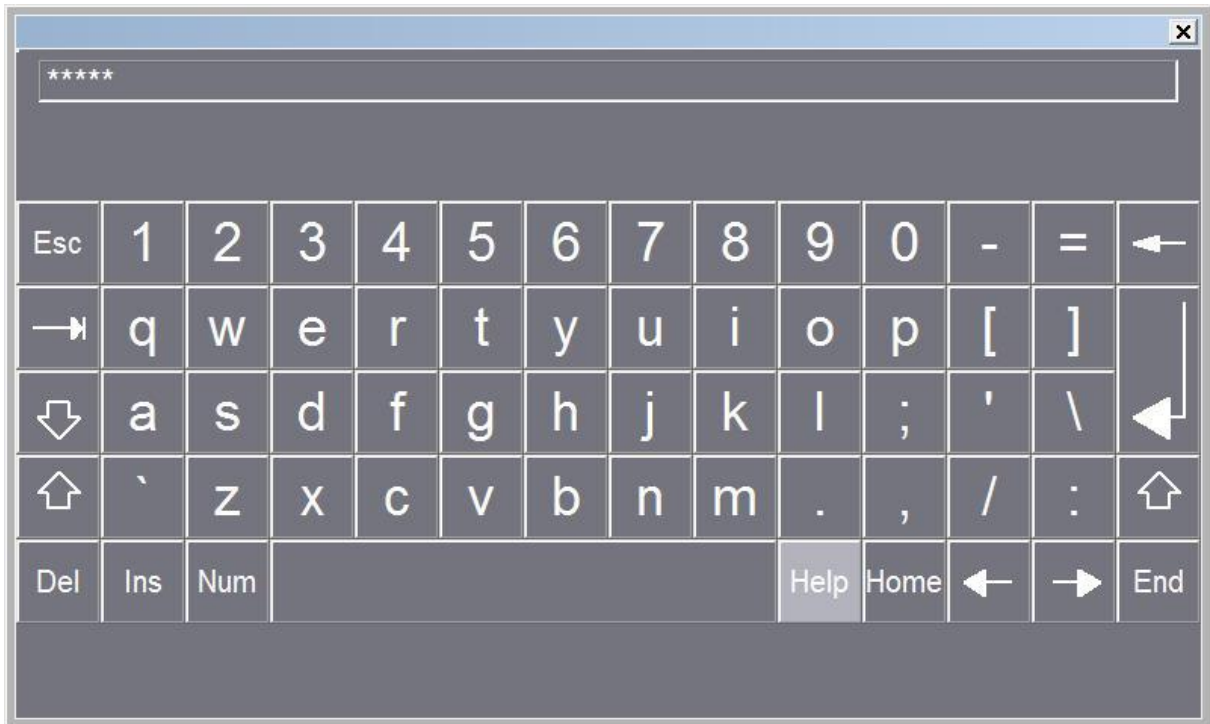
3. The user data can be entered here. The entry is confirmed with the Return key.
   User: festo
   Password: festo

User	Password	Group	Logoff time
Administrator	********	Bedienen	5
festo	********	Bedienen	5
PLC User	********		5

4. The user is now logged in as "Administrator" and the functions User and I / O test are available.

8.5 Operation modes

The following operation modes are available

- Reset

  The station is moved to its home position

- Setup

  The station runs in set-up mode, actuators can be controlled and monitored

- Automatic

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

  There are two modes in the automatic mode: the default mode and the MES mode.

8.5.1 Mode

There is no default mode at this station, the following description is just an example, but it is not possible to change the mode.

1. Clicking on the blue marked area opens a pop-up window in which the operating mode can be selected. Other functions are also integrated in the pop-up.
2. The mode can also be set on the Home / Operating mode page.

Possibilities of mode

- MES mode

  In the MES mode, all processes are centrally started, executed and monitored by the MES software. All stations must be set to MES mode and automatic start.

- Default Mode

  The automatic sequence is not centrally controlled in the default mode, all information from the transition tables (see chapter "Schematic process flow") is read and processed separately at each station.

8.5.2 Operation mode Reset

In the operation mode Reset, the station is moved to its home position.
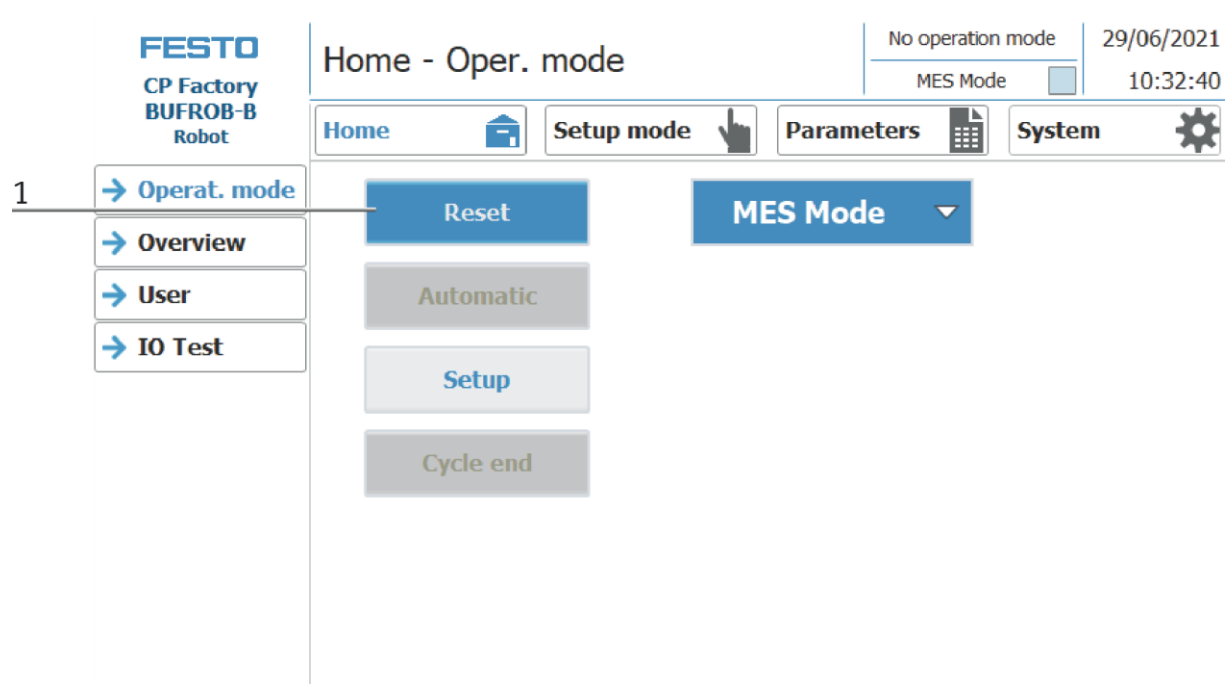
1. After switching on the station, the Reset button flashes, press this to move the station into its home position.
2. The operating mode Reset is displayed here during the process.

8.5.3 Operation mode Setup

In operation mode Setup, all sensors can be displayed and actuators can be controlled from the HMI. This is used for troubleshooting or during commissioning.
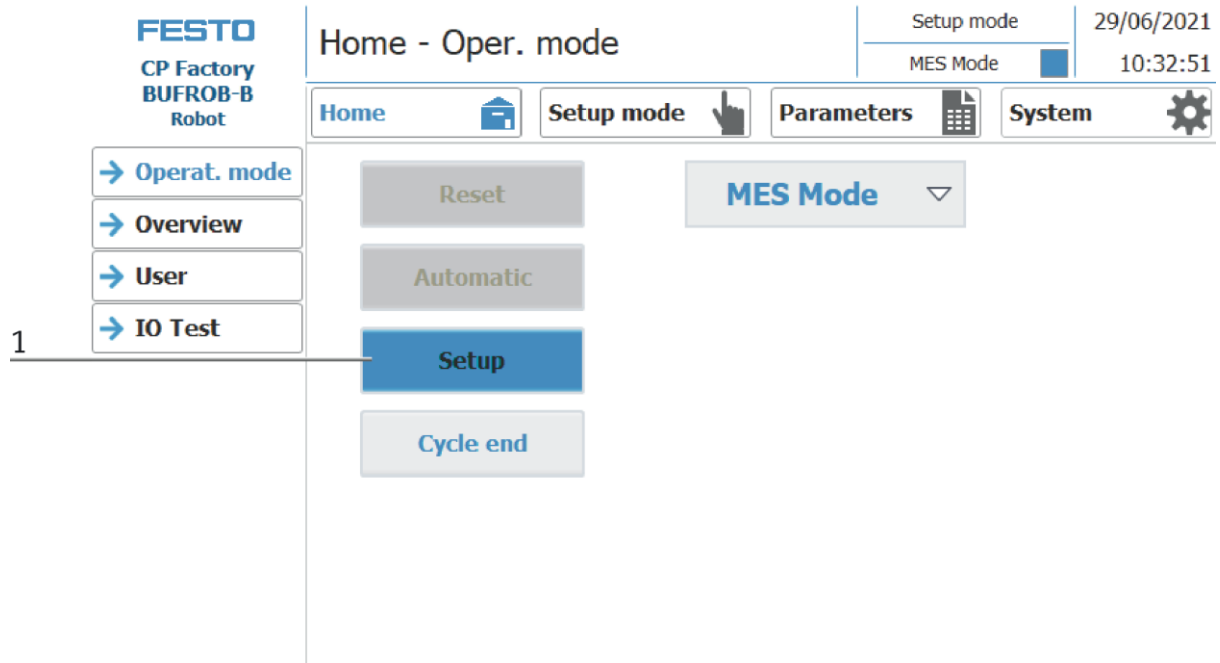
1. Automatic mode is not active and the Setup button is not greyed out - press the Setup button to activate the Setup mode.
2. The current operation mode is displayed here

Set up Robot

1. Click the Setup mode button
2. Select robot.

Pos. No	Description
1	display robot inputs (green when active) xStop2 – movement is stopped xStart – movement is started xIOEna – the robot is controlled by an external control xSlotInit – Slot 1 of the robot is initialized xSrvON – servo operation is switched on xSrvOFF – servo operation is switched off xErrReset – reset error xRcReady – Drive Unit of the robot is ready xBatErr –the battery of the robot is empty xPrgOut – programme area outputs is selected xOvrdOut – Override area outputs is selected xErrOut – there is an error with the robot xATTOMPD – the robot is in the automatic operation mode XTEACHMID – the robot is in the manual operation mode XRobHome – the robot is in its basic position xAbovePCB – the robot is above the PCB xCntZero – reset counter
2	Display robot outputs (blue if active) xStop2 – stop movement xStart – start motion xIOEna – control the robot by 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 program area outputs xOvrdOut – select override range outputs xErrOut - the robot has an error
3	Controlling the robot (blue when active) StartProg. – starting the robot program xReady – the robot is ready Retry – try it again Exit Cycle – finishing the present cycle xBusy - the robot is busy connect – connecting with the Drive Unit PLCStep – announcement acutal PLC step xConnected – connection Drive Unit is established program number – program number as in the Drive Unit source position: indicates the start position of the workpiece target position: indicates the end position of the workpiece Offset X – OffsetC: indicate the offset values
4	Return value message: indicates the number of the return value Textual description of the return value

Notes for robot handling

Blue "Connect" button - active if the robot is connected to the PLC

Blue "StartPrg" button - is blue until a program is running

"StartPrg" button - the robot makes the program which is define in the "byPrograNum" parameter

- By default the byStopperPos is a constant and equal to 1, because there is no other position is defined (this should be changed from the PLC program)
- "xExitCycle" is exit from the actual program which is running
- xRetryCycle" retries the actual state of the program
- "ClearError" reset the connection and state of the PLC (not resetting the return value, that is handle by the robot)
- In setup mode there is no interactive message in case of a return value appears
- In automatic in case of an error, an interactive message window appears with the Exit and Retry buttons
- In case the door is opened a warning message appears in the top of the screen with yellow background: "Safety doors opened"
- If the robot controller is not in manual mode, the PLC recognize this as well as "Safety doors opened"
- The doors can be opened while the robot is running. In this case there is no interactive error message, only the yellow warning message. The robot stops, until the doors are opened. After closing them, the robot keep continues its actual task

Set up Box Input

1. Click the Setup mode button
2. Select Box Input.

Position	Description
1	Left: conveyor moves to the left counter clockwise Box Out: move conveyor to the left (activator T1_QA1 is activated, flashing blue when active) T1QA1: display conveyor Presel. slow: setting the conveyor speed to slow Creep feed: move the conveyor slowly (flashing blue when active) Right: conveyor moves to the right clockwise Box In: move the conveyor to the right (activator T1_QA1_ is activated, flashing blue when active)
2	To bottom: move down stopper ST1 (G1_MB1 is activated – flashing blue when active) not GB5: stopper down - sensor BG5 must not be active (flashing green when not active) Stopper: Display stopper ST1 G1_BG5: sensor BG5 indicates when stopper is up (flashing green when active) To top: move up stopper ST1 (G1_MB2 is activated – flashing blue when active)
3	To bottom: move down stopper ST2 (G1_MB3 is activated – flashing blue when active) not GB6: stopper down - sensor BG6 must not be active (flashing green when not active) Stopper: display stopper ST2 G1_BG6: sensor BG6 indicates when stopper is up (flashing green when active) To top: move up stopper ST2 (G1_MB4 is activated – flashing blue when active)

Setup Box Output

1. Click the Setup mode button
2. Select Box Output

Position	Description
1	Left: conveyor moves to the left counter clockwise Box Out: move conveyor to the left (activator T1_QA2 is activated, flashing blue when active) T1QA2: display conveyor Presel. slow: setting the conveyor speed to slow Creep feed: move the conveyor slowly (flashing blue when active) Right: conveyor moves to the right clockwise Box In: move the conveyor to the right (activator T1_QA2_ is activated, flashing blue when active)
2	To bottom: move down stopper ST3 (G1_MB11 is activated – flashing blue when active) not GB5: stopper down - sensor BG15 must not be active (flashing green when not active) Stopper: Display stopper ST3 G1_BG15: sensor BG15 indicates when stopper is up (flashing green when active) To top: move up stopper ST3 (G1_MB12 is activated – flashing blue when active)
3	To bottom: move down stopper ST4 (G1_MB13 is activated – flashing blue when active) not GB16: stopper down - sensor BG16 must not be active (flashing green when not active) Stopper: display stopper ST4 G1_BG16: sensor BG16 indicates when stopper is up (flashing green when active) To top: move up stopper ST4 (G1_MB14 is activated – flashing blue when active)

Setup Box Shift Unit

1. Click the Setup mode button
2. Select Box Shift unit

Position	Description
1	Left: conveyor of shift unit moves anti-clockwise to the left G2QA1: display shift unit Right: conveyor of shift unit moves clockwise to the right
2	Box Out: move the conveyor of the shift unit to the left (activator G2_QA1 is activated, flashing blue when active) Preselection slow: set conveyor speed to slow Creep feed: move the conveyor slowly (flashing blue when active) Box In: move the conveyor of the shift unit to the right (activator G2_QA1_ is activated, flashing blue when active)
3	To left: shift unit into output direction (G2_MB2 is activated, flashing blue when active) G2_BG2: Sensor G2_BG2 shift unit at output position (flashing green when active) X-Axis: display shift unit G2_BG1: Sensor G2_BG1 shift unit in input position (flashing green when active) To right: shift unit into input direction (G2_MB1 is activated – flashing blue when active)
4	RFID area MES Mode: display of order data Default Mode: display RFID state
5	writing and reading the RFID area initializing: setting the RFID data to zero reading: reading the RFID data out writing: write current data on RFID delete data: all data in the input mask are deleted – not directly on the RFID (for an easier entry)
6	area display of the active sensors (flashing green when active) and activators (flashing orange when active) at the stopper
7	display of the RFID reading status

I/O Test

Position number	Description
1	Setup mode must be active
2	Choose Home
3	Choose I/O Test
4	By clicking in this area, the outputs are enabled and can be activated. A login as "Administrator" is required.

Position number	Description
1	By clicking in a field, this digital output is activated (orange if active)
2	By clicking again in this field, the outputs are blocked again

Exit operation mode setup
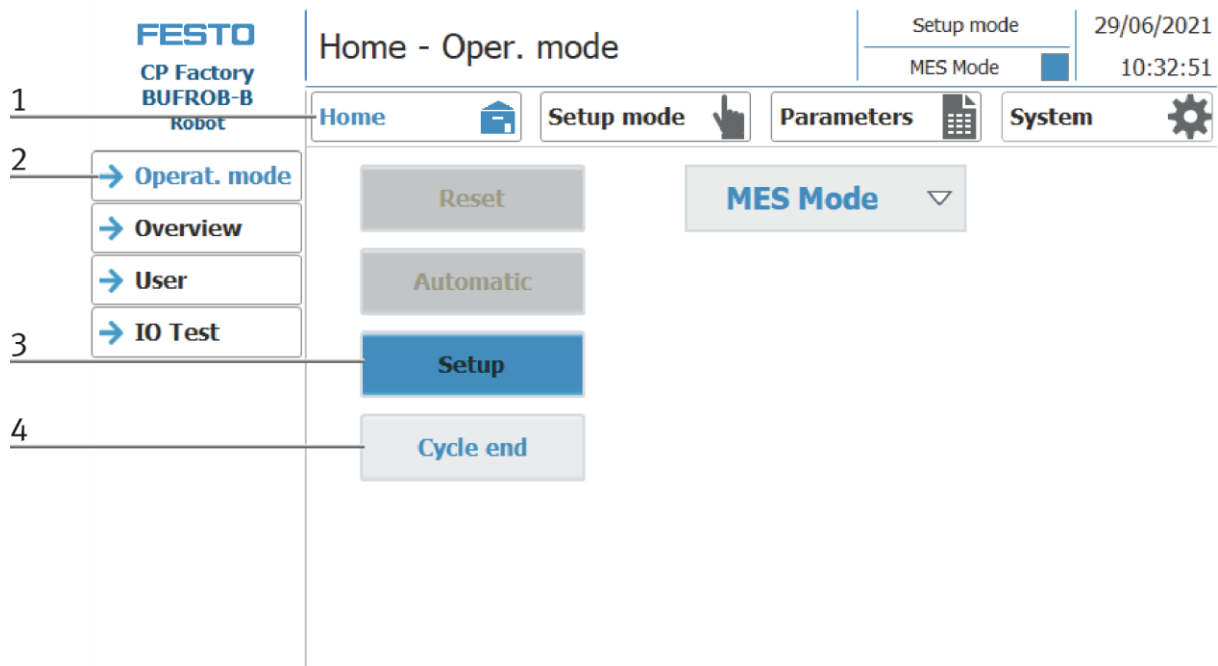
1. Press Home button
2. Press Operat. mode
3. Setup mode is active, button lights up blue
4. Press the cycle end button to end the operation mode setup.

8.5.4 Operation mode automatic

In automatic mode, the chosen automatic processes can be processed at the station. Depending on the selection of the mode, the processes are controlled via the transition tables (default – if available) or via MES.
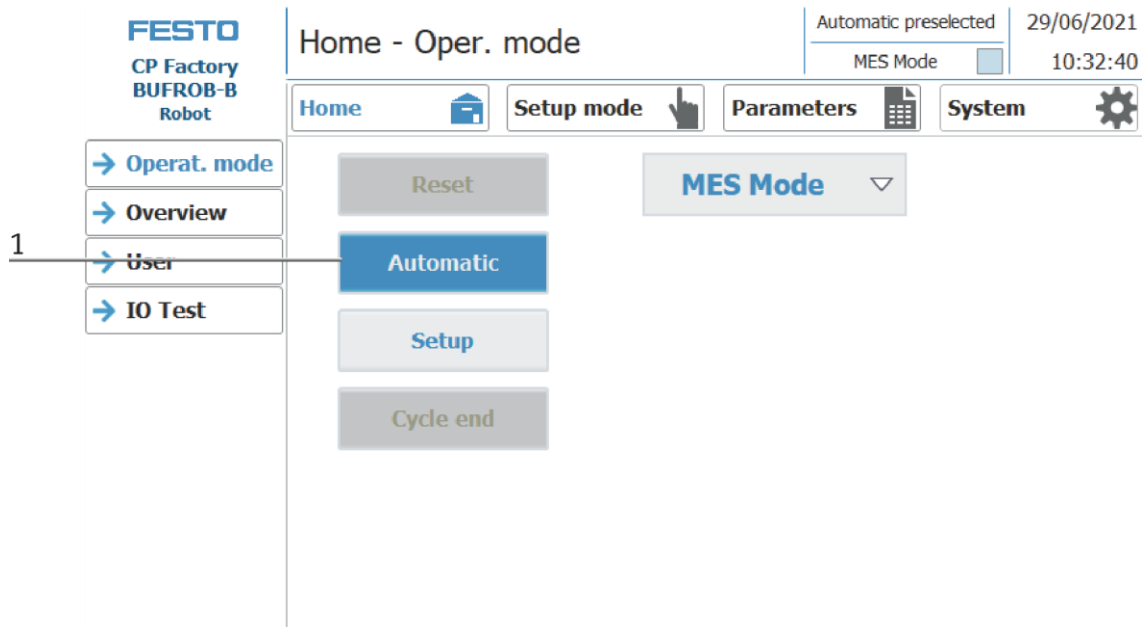
1. Automatic button flashing blue – Press Button to activate operation mode automatic
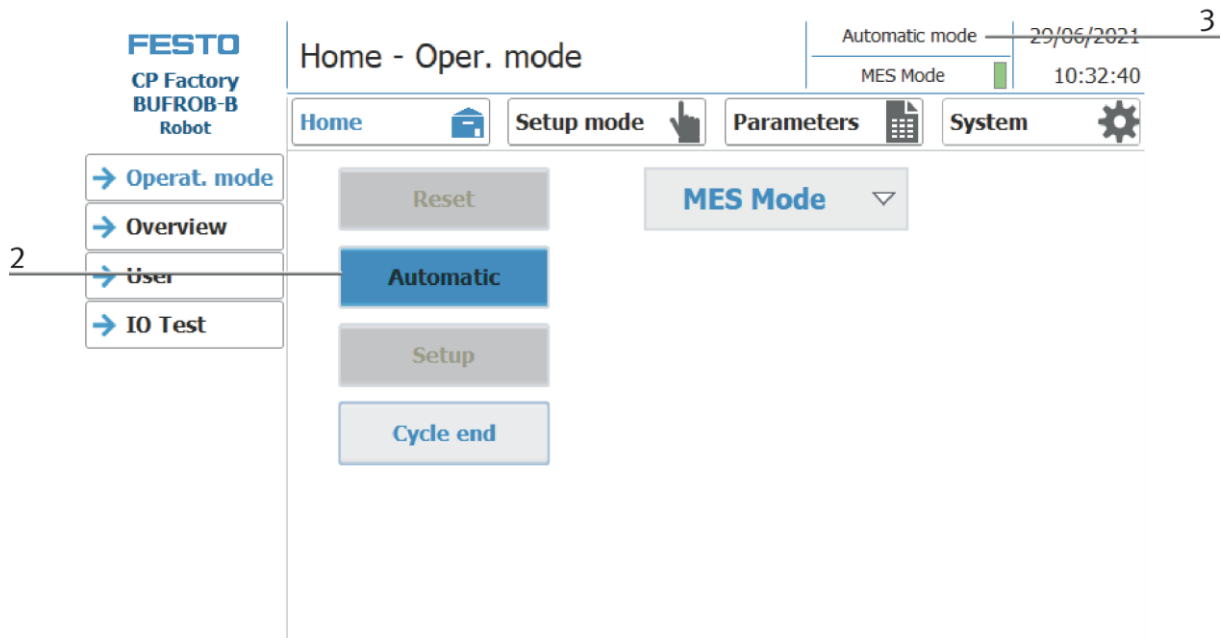
2. Operation mode automatic is active, button lights up blue
3. Announcement of active operation mode automatic

8.5.5 Main menu - Home
Sub menu operation mode
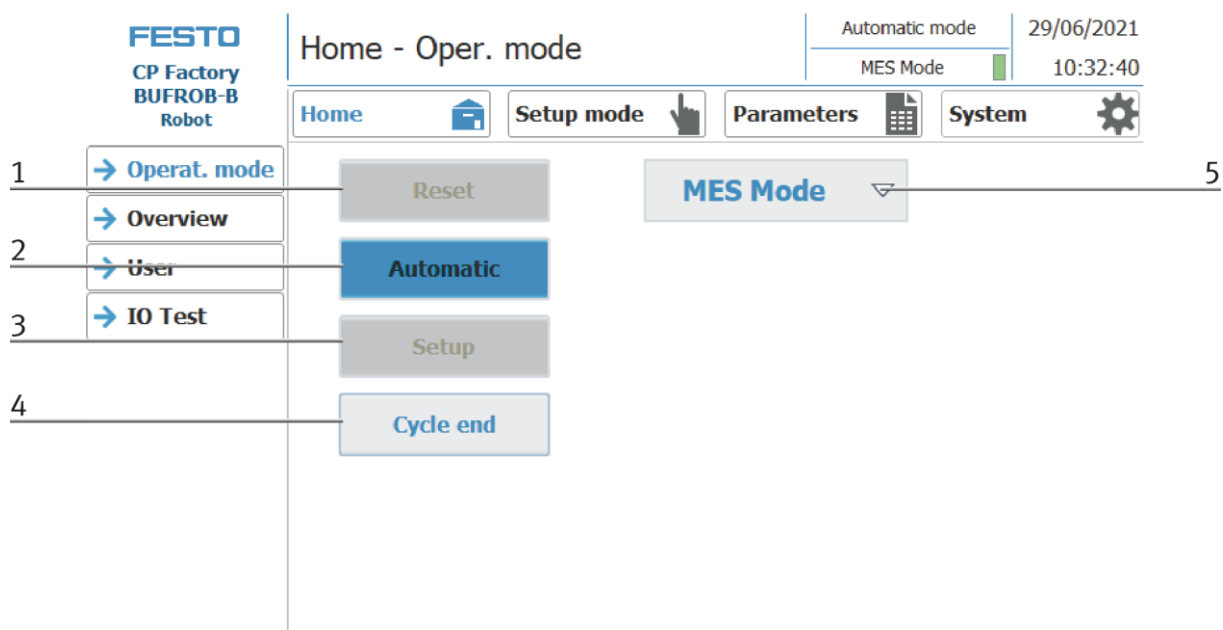
In the operating mode Home, the operating mode and the wished mode (MES or Default) can be selected and started.

Position	Description
1	Reset button: Start reset sequence
2	Automatic button: the automatic sequence in dependent from the mode (Default/MES) is started here
3	Setup button: Here the application module can be controlled manually and sensors can be displayed. Suitable for commissioning an application module or for troubleshooting. There is no difference in mode - setup mode is independent of default or MES mode.
4	Cycle end button: The currently active operating mode is stopped here.
5	Selection of the mode: Default - automatic sequence is processed with the stored transitions (not available) MES - automatic process is completely controlled by MES software

Submenu Overview
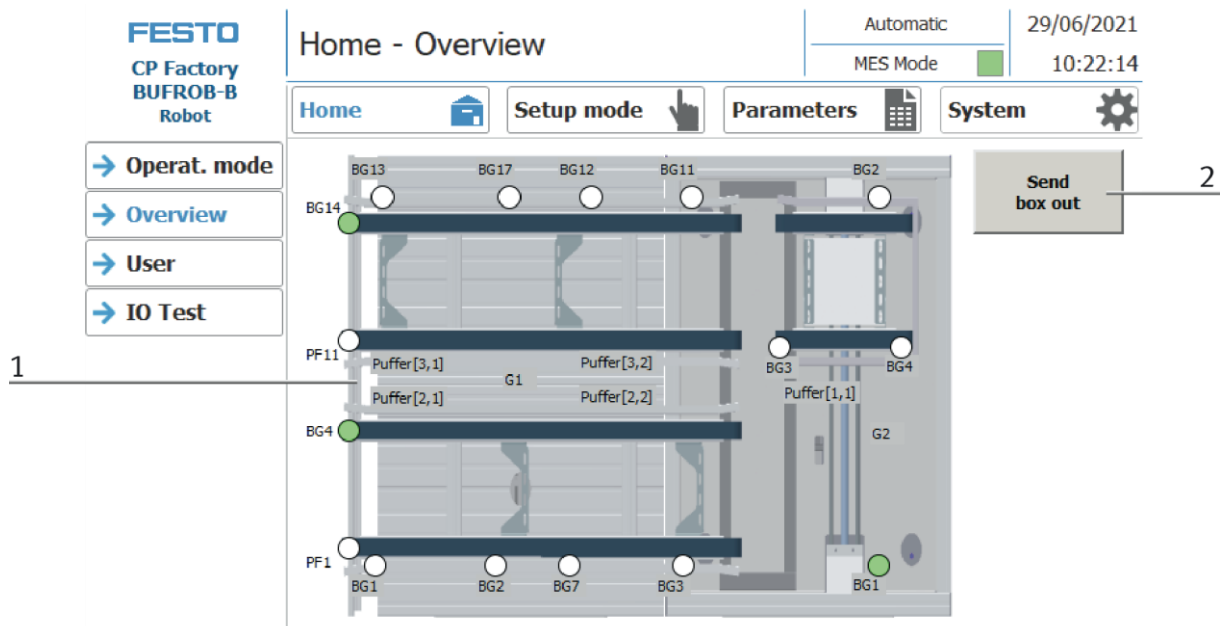
Position	Description
1	The inputs/outputs of the station are displayed here.
2	Button send out box – in an indefinable status the box can be given out manually here.

Sub menu user

Different users can be created here. The function is independent of the selected mode (MES - or default)

| Automatic | 29/06/2021 |
| MES Mode | 10:23:36 |

FESTO
CP Factory
BUFROB-B
Robot

Home - User

Home | **Setup mode** | **Parameters** | **System**

→ **Operat. mode**
→ **Overview**
→ **User**
→ **IO Test**

User dialog

User	Password	Group	Logoff time
Administrator	********	Bedienen	5
festo	********	Bedienen	5
PLC User	********		5

Display / editing of all users, a login as "Administrator" is required.

Sub menu I/O Test

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

8.5.6 Main menu - Setup

See chapter operation mode setup.

8.5.7 Main menu – Parameter

Set up application parameters

1. Click on the Parameter button
2. Select application - the parameters of the application can now be set up here.

Position number	Description
1	Application Timeout (s): Here you can enter a time in seconds for a timeout situation
2	MES IP as Webserver
3	Webserver IP Address
4	Simulate robot process: if the robot process is to be simulated, a check must be made here so that a process can be run even without a robot. If the function is activated, an indicator appears at the bottom left (7)
5	Acknowledge end of process at HMI: If a check is made here, the process end of the robot process must be actively confirmed on the HMI.
6	Time for simulation process (s): the time which the simulation process should take is entered / displayed here (see next screen)
7	Display Robot Simulation active

Simulation of robot process

The application is simulated!

		Parameters of application:	
Processing time nominal	**10.000**		
Processing time actual	**1.184**	Par. 1: no. of loading prog.	3
Return value	**+0**	Par. 5: Source position	0

Progress

This screen is displayed during the simulation when the robot is simulated.

8.5.8 Main menu – System

Sub menu - Settings
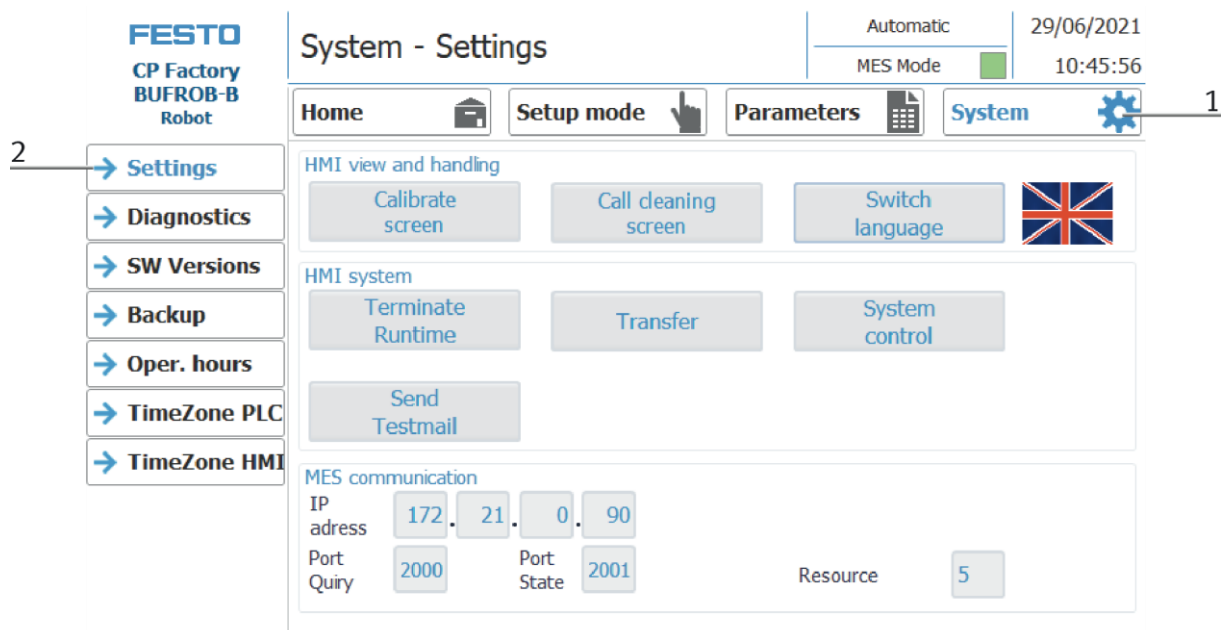
1. To get to the system settings, the System button must be selected
2. Click on Settings
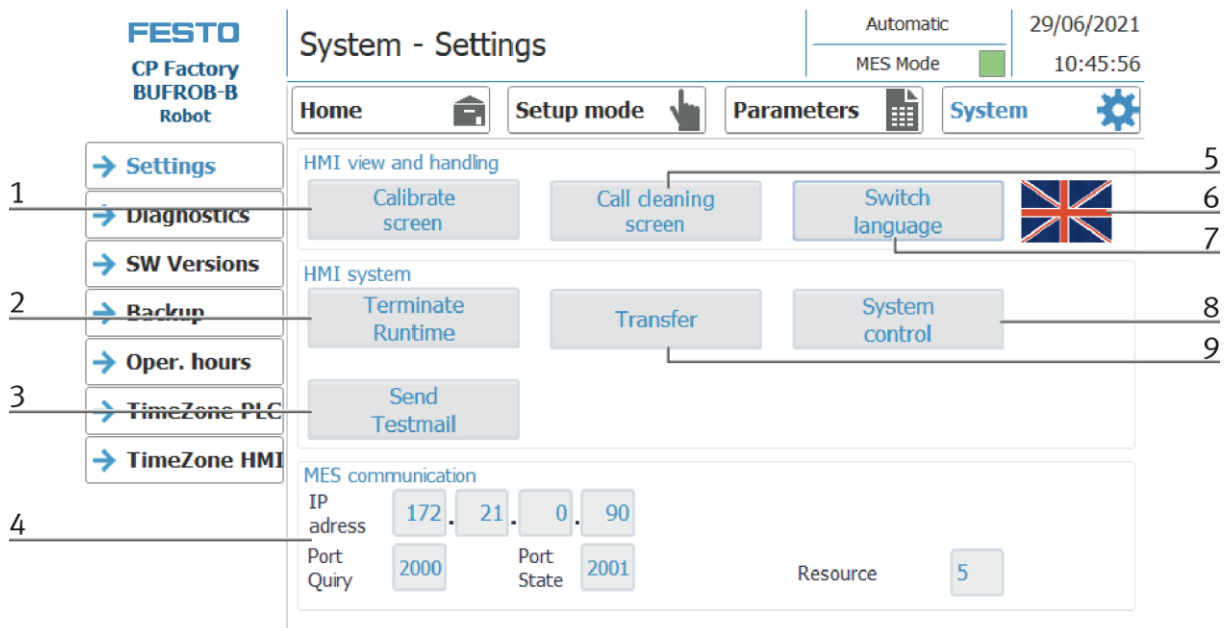
The system can be set in this operating mode.

Position number	Description
1	Button Calibrate Screen - If buttons react inaccurately, calibration of the touch screen can be restored
2	Button Terminate Runtime: The runtime is terminated and returned to Windows.
3	Button send test mail – send test mail to eMailserver (all error messages are sent from the hmi to a eMailserver on the MES4 PC – this function is to test if the configuration is ok.)
4	Display of the MES IP address additionally the IP of the MES can be set here. (Password protected) User: festo, PW: festo) Input fields for your own resource number, query port and status port of the MES connection
5	Button call cleaning screen - the screen can be cleaned here. The touch function is interrupted and unintentional operation is excluded
6	Flag displays only current language. By clicking on button next to the flag language can be switched
7	Button switch language: here the language can be changed
8	Button system control: Windows system control is opened
9	Button Transfer: Runtime is closed and the transfer mode of the HMI is called

Sub menu diagnostics
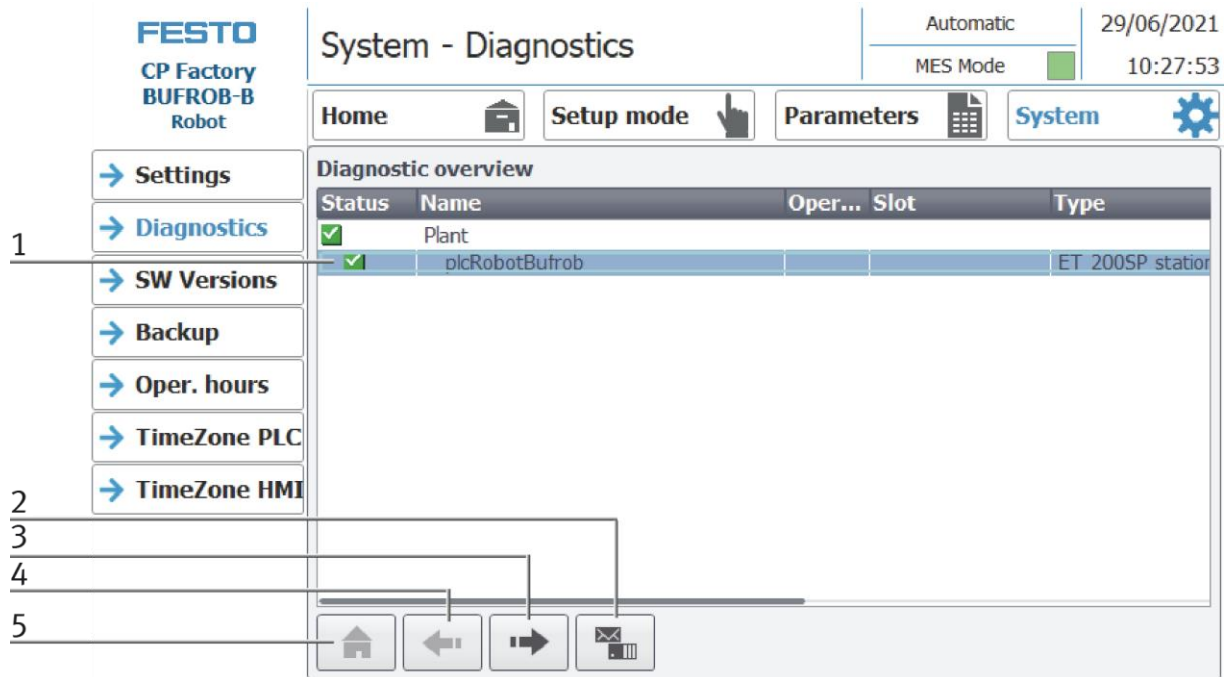
Position number	Description
1	Announcement overview plant
2	Send diagnostic message via mail
3	Next diagnostic message
4	Previous diagnostic message
5	Home Button

Sub menu software versions

FESTO	System - Version		Automatic	29/06/2021	
CP Factory BUFROB-B Robot			MES Mode	10:28:07	

Home   Setup mode   Parameters   System

→ Settings
→ Diagnostics
→ SW Versions
→ Backup
→ Oper. hours
→ TimeZone PLC
→ TimeZone HMI

actual library version:

V4.03

Display of the current library version.

Sub menu Backup

Position number	Description
1	Save parameters button: all parameters are saved, for this it is necessary to press the button 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 press the button for at least 2 seconds The display shows the date on which the parameters were last loaded.

Submenu operating hours counter
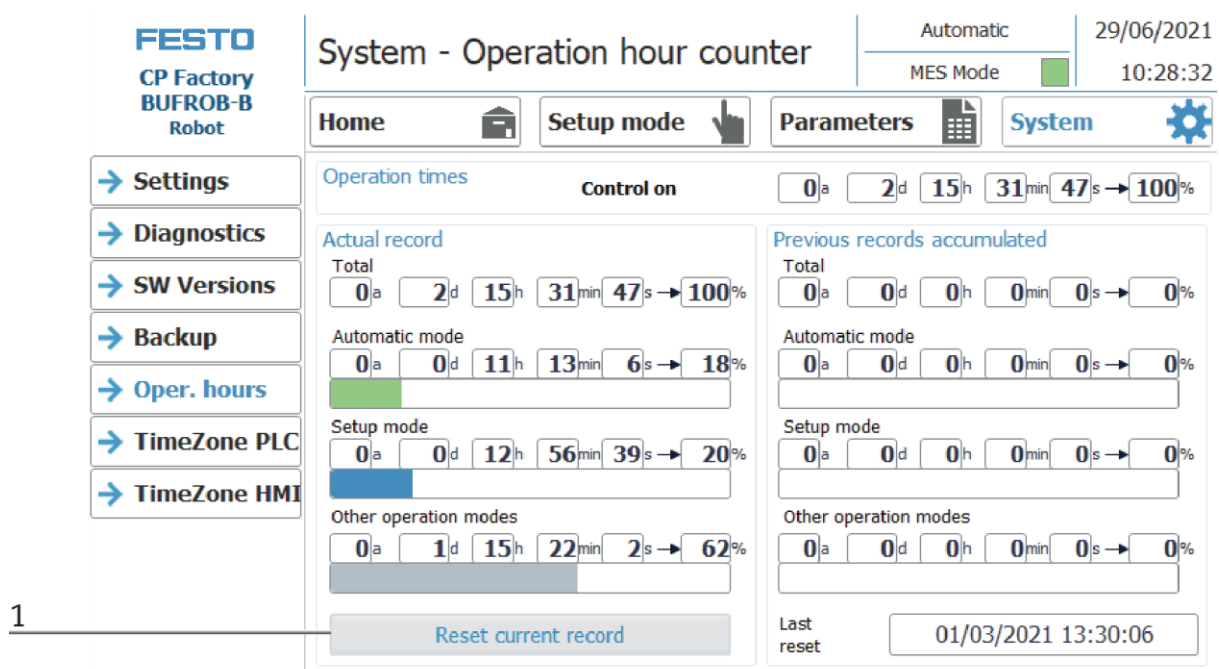
Display of the operating times with allocation to the respective operating mode.

In the "Operation times" area, the time since the control was switched on is counted.
In the "Actual record" 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 mode", Setup mode and "Other operating modes". The times are counted under the heading "Other operating modes" while the station is in the operating mode "Automatic preselection", "Setup" and "No operating mode". The value in the "Total" line represents the total of the operating times differentiated according to the operating mode. The percentage refers to the proportion of the operating mode in the total time.

With the button (1) "Reset current record", the current recording is set to 0 and the operating times contained therein are added to the "Previous recordings accumulated" area. The current recording can thus be used, for example, for daily recordings.

All counter values are saved in a retentive data block. These are lost when the controller is booted. If they are to be retained, the values must be saved beforehand.

Time zone submenu in the PLC
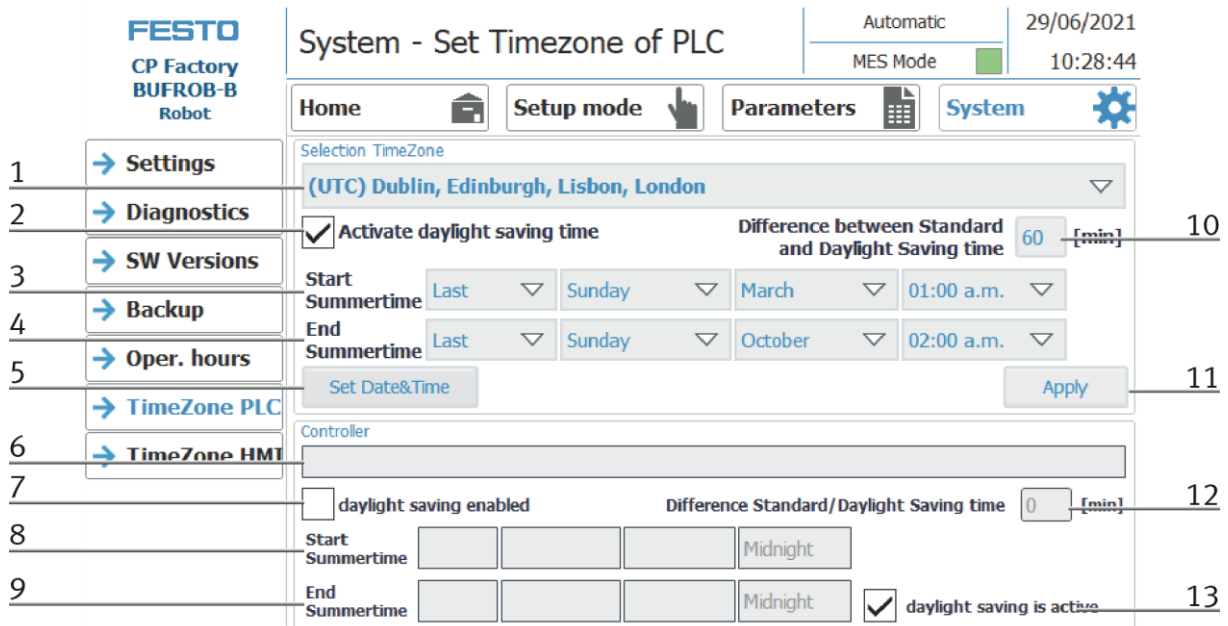
The time and time zone of the PLC can be set in this menu. The default settings of the PLC are overwritten when you click the "Apply" button.

Position number	Description
1	Select TimeZone
2	Checkmark set - the daylight saving time changeover is automatically changed at the times "Beginning of daylight saving time" and "End of daylight saving time" Checkmark not set - there is no daylight saving time changeover
3	Setting the start of daylight saving time
4	Setting the end of summer time
5	Set time & date: When this button is pressed, a pop-up window opens for setting the time of the PLC
6	Display of the current time zone of the controller *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*
7	Display of whether daylight saving time changeover is active in the PLC. *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*
8	Display of the current start of daylight saving time in the control *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*
9	Display of the current end of daylight saving time in the control *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*
10	Enter the time difference between summer and winter time in minutes.
11	Accept the selected settings for the time zone and time change by pressing the button.
12	Display of the time difference between summer and winter time in minutes. *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*
13	Display of whether daylight saving time is currently active. *(Only valid if the time zone of the PLC has been set once using the "Apply" button)*

Time zone submenu in 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 get a different time stamp. (e.g. sending emails)

Position number	Description
1	System pop-up window of the HMI for selecting the time zone. The selected time zone in the Time Zone drop-down field is transferred to the HMI by pressing the "Apply" button.
	Before exiting the menu item, close the system pop-up window by pressing the X at the top right.

8.6 Switching on the station

1. All EMERGENCY STOP signal transmitters (push buttons, door contact, light barriers, etc.) are not activated and unlocked.
2. Check any installed application for visual damage and repair if necessary.
3. Switch on compressor
4. Switch on the main switch
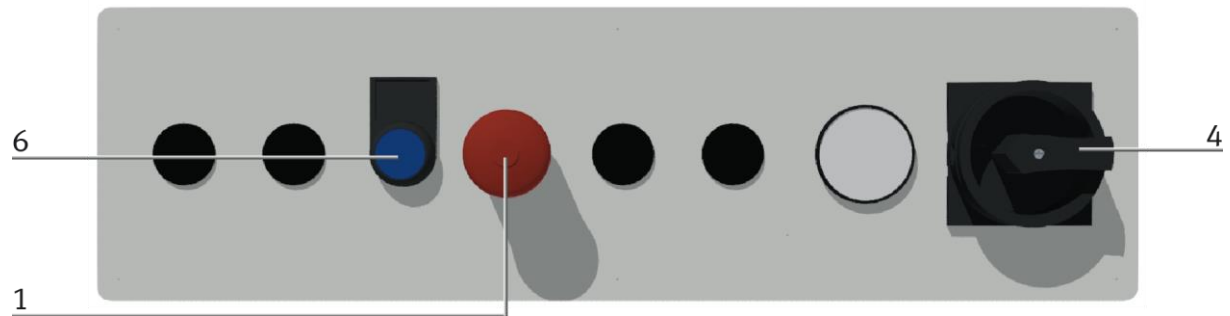
5. HMI starts and boots up.
6. Blue RESET illuminated pushbutton is not lit. Press RESET button, RESET illuminated button lights up blue.
7. Acknowledge the error message on the HMI.

8.6.1 Mitsubishi Robot homing

1. Reset error if there is any

2. Select Manual mode with the key switch on the robot controller

3. Enable the robot Teachpendant

4. Press half-way and hold the deadman switch during the complete operation

5. Turn on the servo

6. Open the Jog window

7. Take care to choose the right tool (TOOL1) and press continously the Home button until the robot moves to its home position

8. After the robot has finished its movement disable the Teachpendant

9. Finally turn the key switch on the robot controller back to Automatic mode
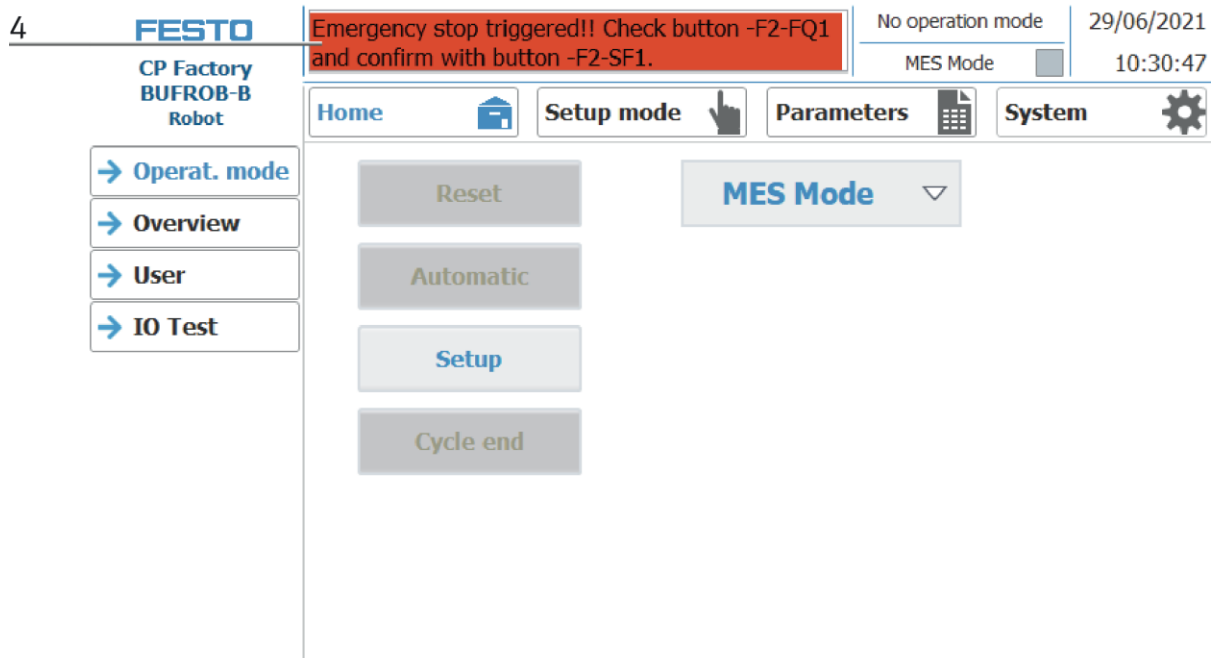
8.6.2 Start automatic

	⚠ **WARNING**

⚠	• **Danger of being pulled in at the conveyors**
	    – When the automatic mode starts, the belts of the conveyor belts start to move, creating a risk of being pulled in.
	    – When starting, do not stand directly at the ends of the belt or hold on to them, keep enough distance.
	    – Failure to heed the information given can lead to injuries.

1. Pull out the emergency stop button
2. Press the blue reset button
3. Remove any existing workpieces
4. Acknowledge errors on the HMI by clicking on the error message.

5. The error message is displayed in the main window. After the error situation has been remedied, it can be acknowledged by pressing the RESET button.
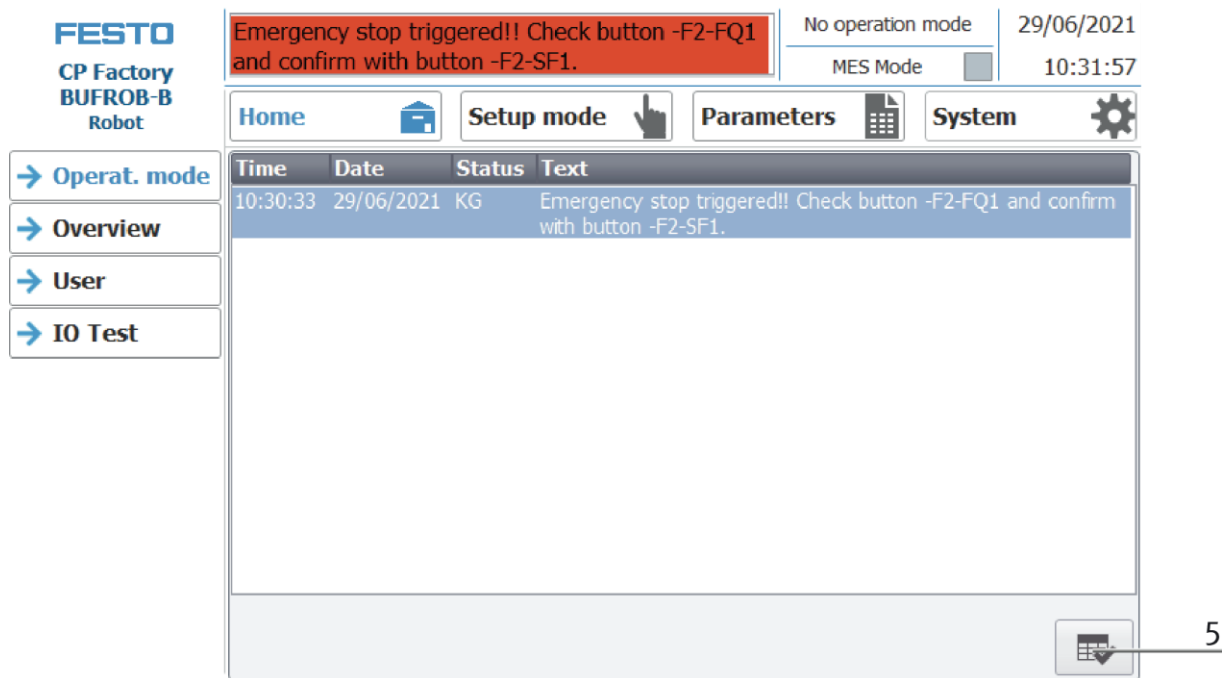
6. Press Home Button
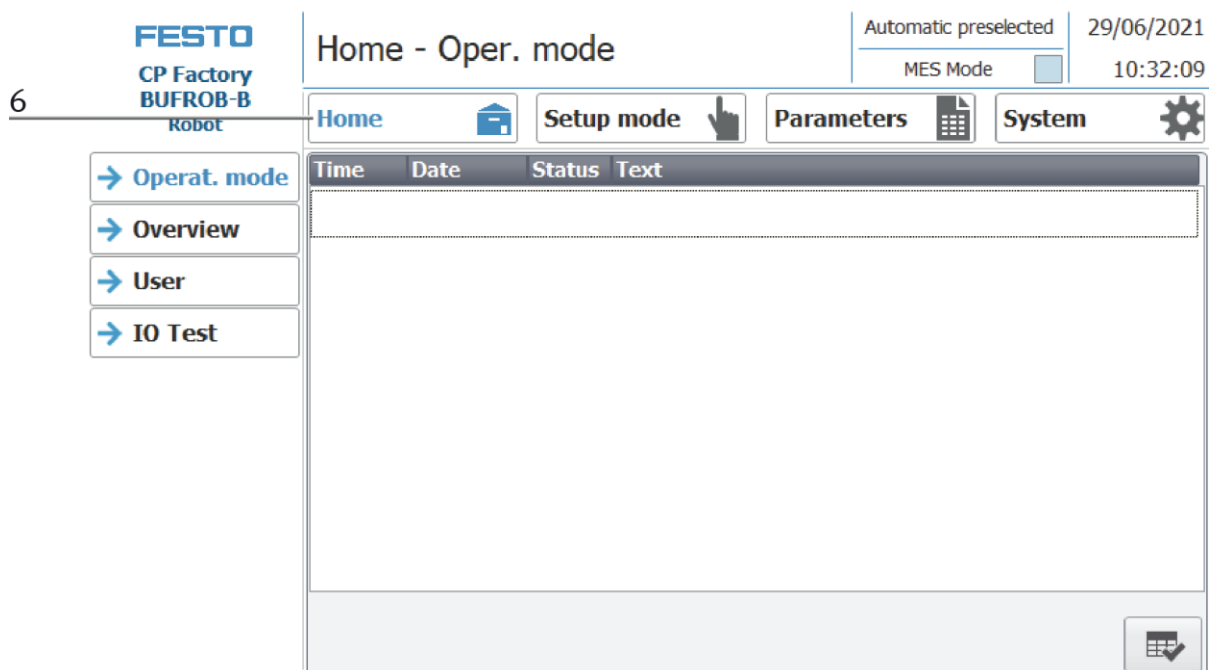
7. Press the flashing RESET Button. Station/application moves in home position. (optional)
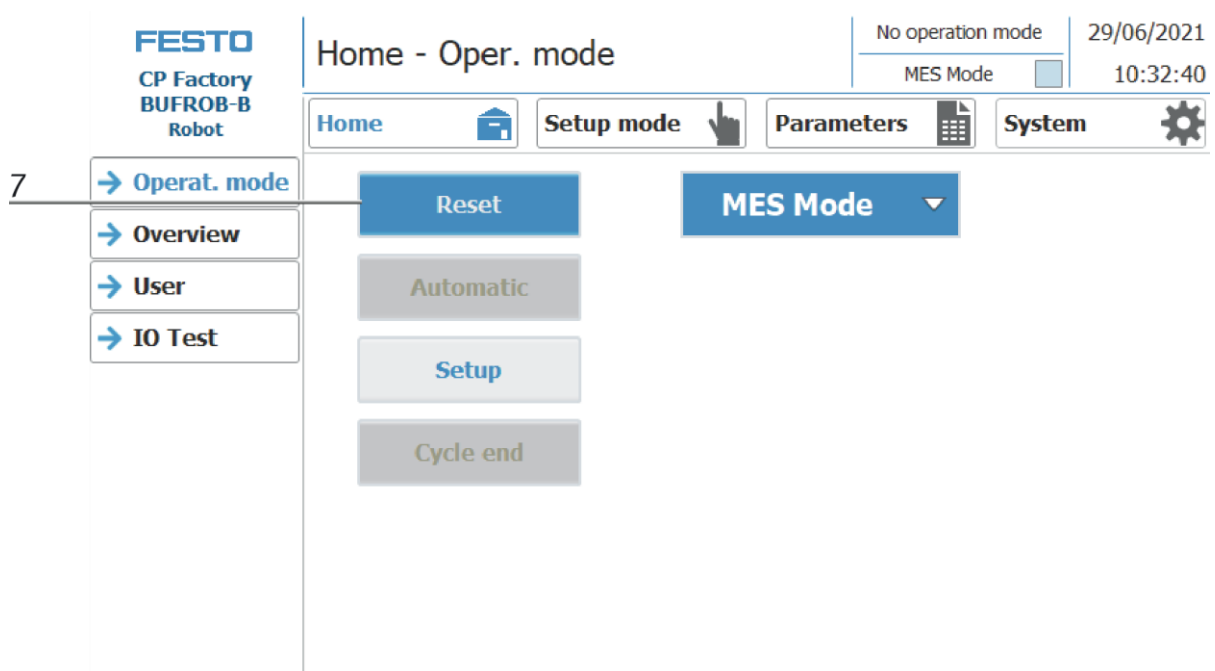
8. Press the flashing AUTOMATIC Button
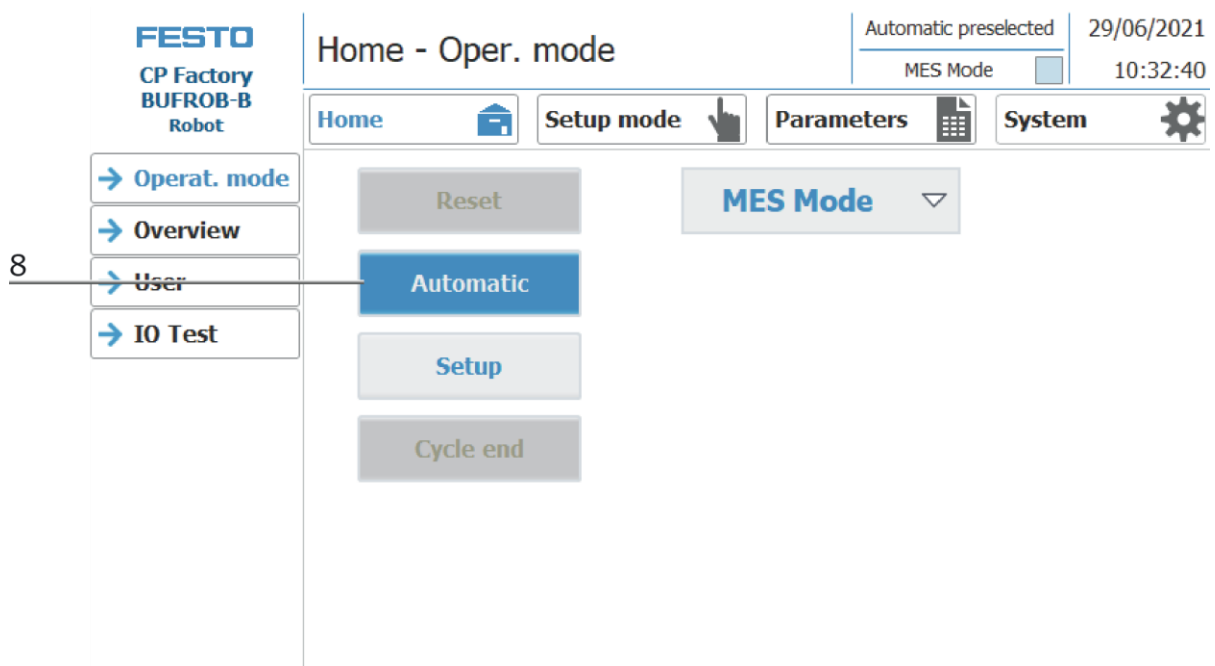
9. AUTOMATIC Button lights up
10. Automatic mode is active
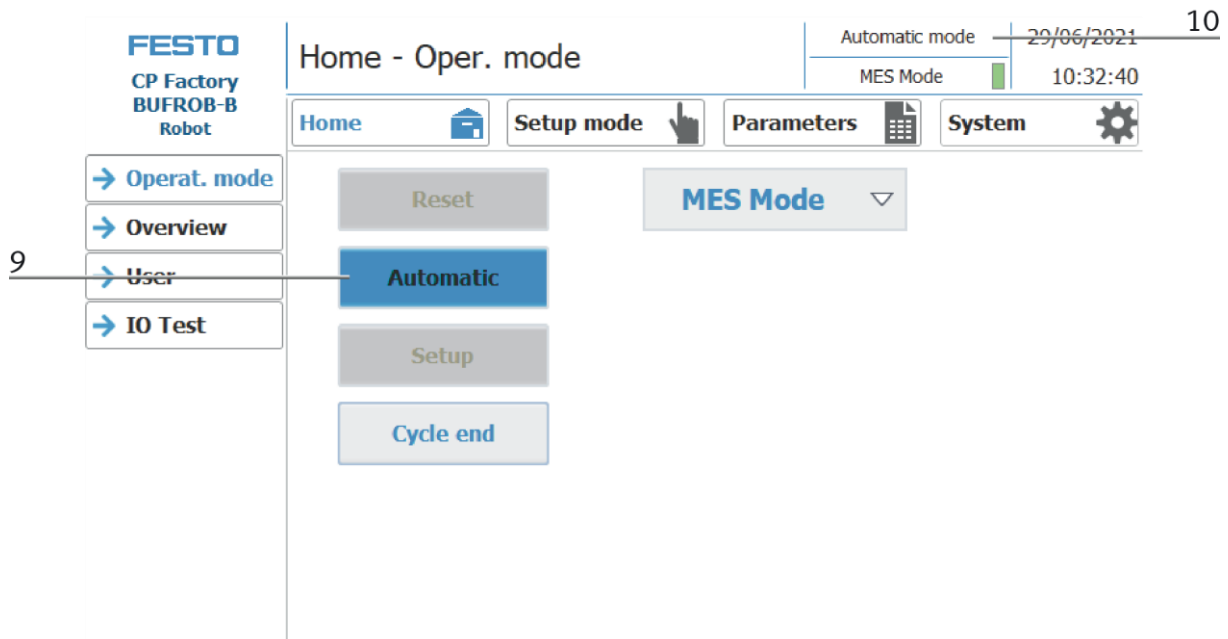
8.6.3 Process description Cycle End

1. An automatic cycle is active.
2. Press the button Cycle End.
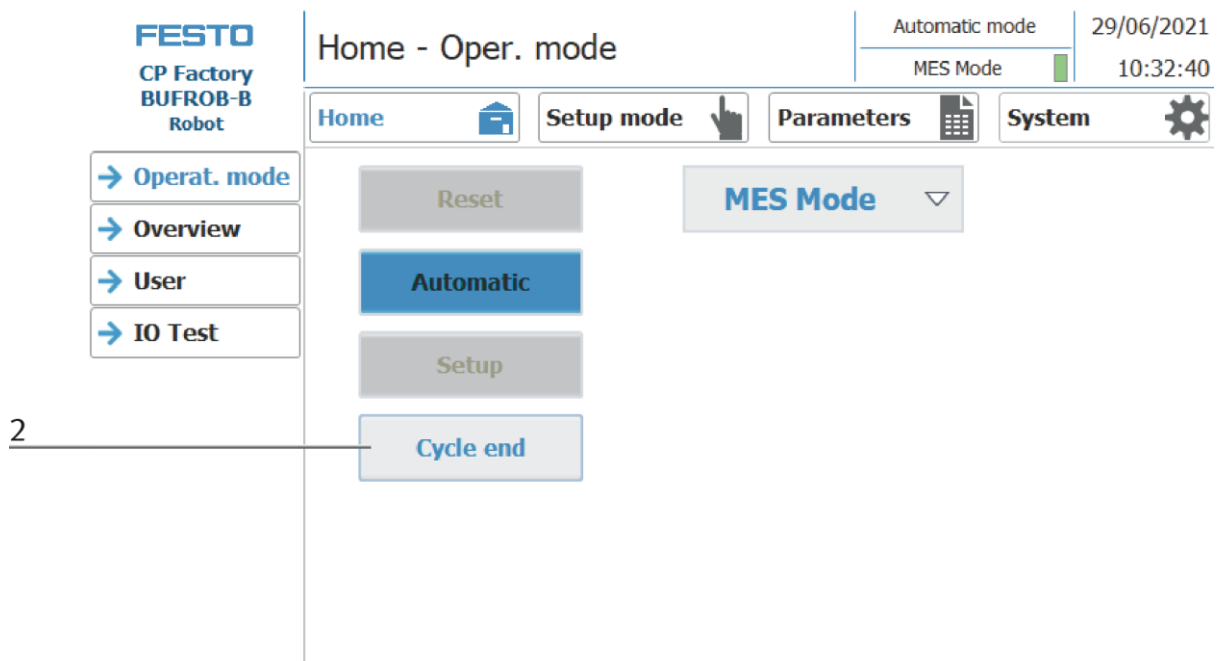
3. The module will execute the run until cycle end. During this time, the button Cycle End has got a red background.
4. The stoppers are extended.
5. The conveyors are stopped.

8.7 Writing on the RFID tag manually

In order to describe a box with a certain ID, or to get information about what data is on the box, it is possible to read this data or to describe the tag.

For this it is necessary that a box with a working tag is located at one of the readout positions and the station is switched on.

The following example applies to all readout positions that can read an ID of boxes.
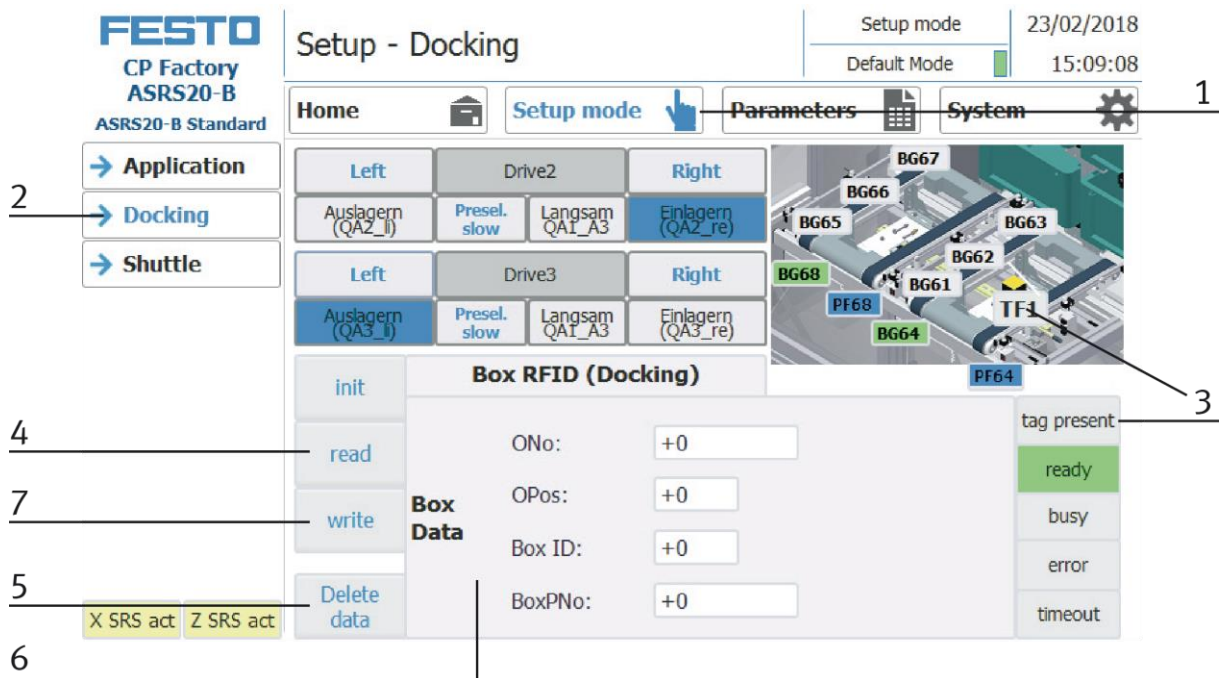
1. Select the Setup mode
2. Select the module with the read out position from the menu on the left
3. If an RFID is detected, this is indicated by "tag present". (TFxx and button "tag present" are green)
4. The data of the RFID tag can be read out and displayed by pressing the "read" button.
5. Press the Delete Data button
   For easier input, all data is only deleted in the input mask, the data remains on the tag itself.
6. Entry of the desired data in the field (all fields with a white background can be edited)
   MES Mode and default mode are identically
   ONo – without function
   OPos – without function
   BoxID – here the IB number of the box is displayed or entered
   BoxPNo – Here, the part number of the box and the retainer for the workpieces to be picked up are displayed or entered.
7. Press the „write" button in order to write the performed modifications on the tag.

8.7.1 Parameter (BUFROB-B)
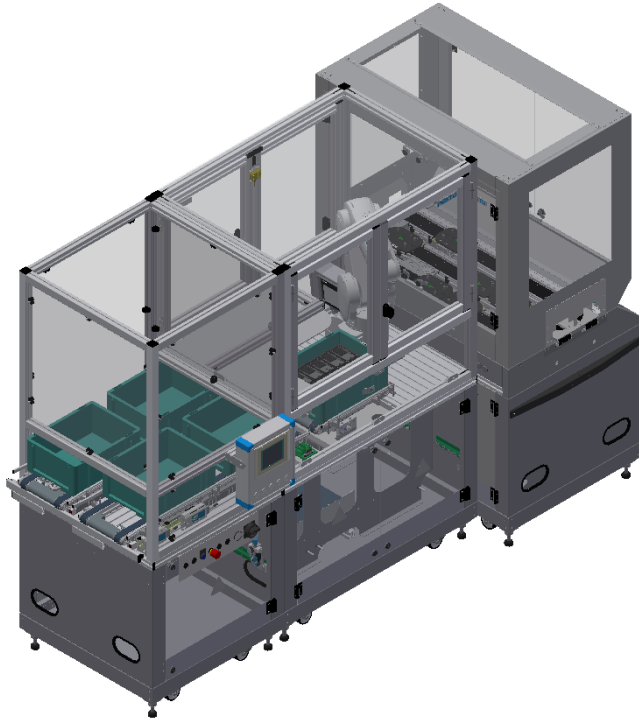
Default: not available

MES:

Operation		Parameter	Description
215	Store box	1	**Source** Value: 91 Type: constant
		2	**Target** Value: 0 Type: on runtime

Operation		Parameter	Description
217	Feed from box	1	**Source** Value: 0 Type: on runtime
		2	**Target** Value: 0 Type: constant
		3	**Load robot program** Value: 0 Type: on runtime
		4	**Offset X** Value: 0 Type: changeable
		5	**Offset Y** Value: 0 Type: changeable
		6	**Offset Z** Low Limit: 8 High Limit:-20 Value: 0 Type: changeable
		7	**Offset C** Value: 0 Type: changeable
218	Feed into box	1	**Source** Value: 1 Type: constant
		2	**Target** Value: 0 Type: on runtime
		3	**Load robot program** Value: 2 Type: changeable
		4	**Offset X** Value: 0 Type: constant
		5	**Offset Y** Value: 0 Type: constant
		6	**Offset Z** Value: 0 Type: constant
		7	**Offset C** Value: 0 Type: constant

9 Components

9.1 Mitsubishi Robot RV-4FL

For the transport of the workpieces, a vertical- articulated arm robot is used. This is an industrial robot with 6 axis. The repetition accuracy of the robot positioning is
± 0.02mm. Its maximum speed amounts to 9900 mm/s. There is an end position and overload monitoring programme integrated. The maximum reach of the robot arm is 648,7 mm.
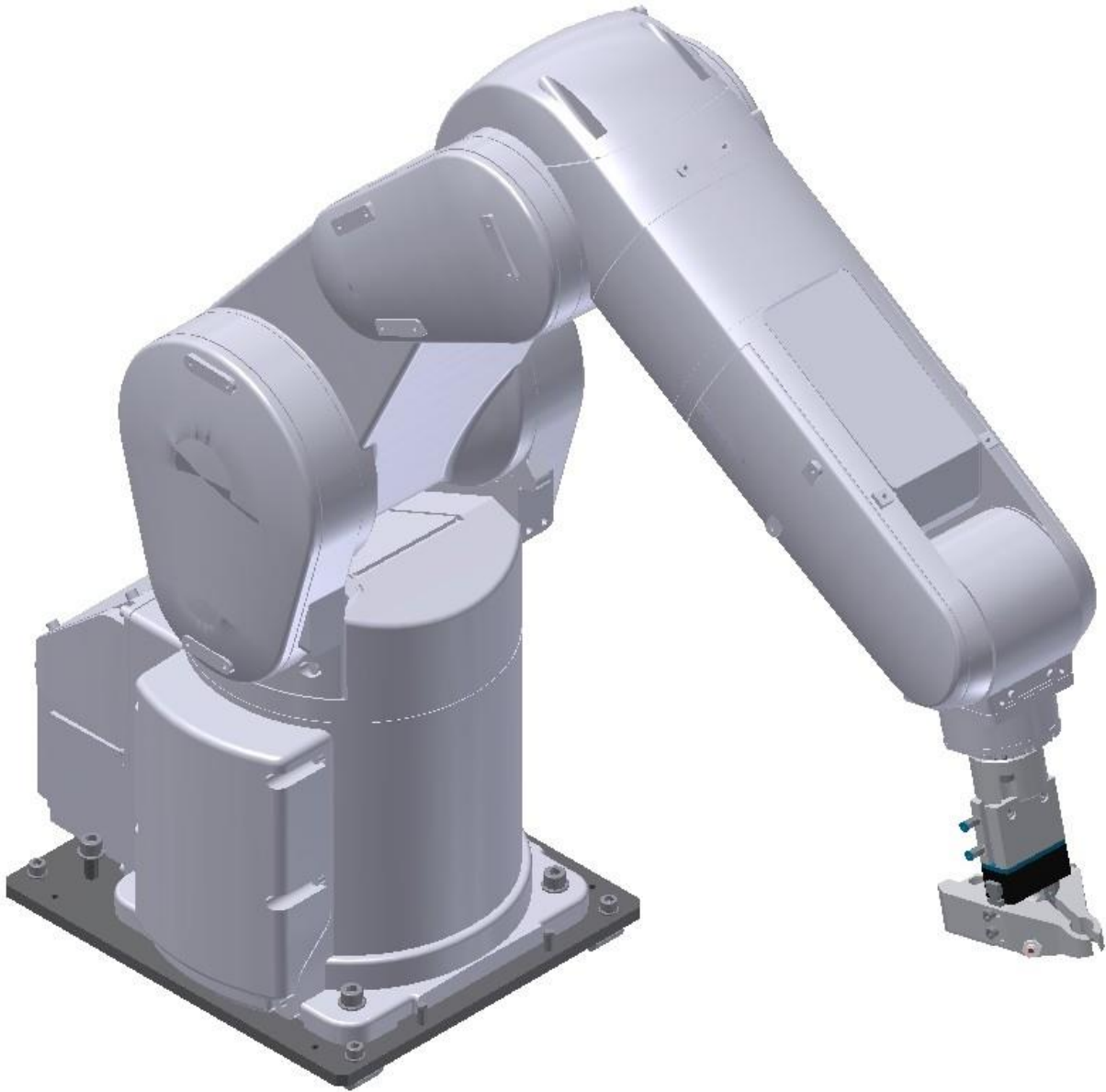
RV-4FL / illustration similar

Performance	
Inputs	32 Inputs for communication
Outputs	32 Outputs for communication
Max. reservation	1 work piece/pallet

9.1.1 Drive Unit CR750-D
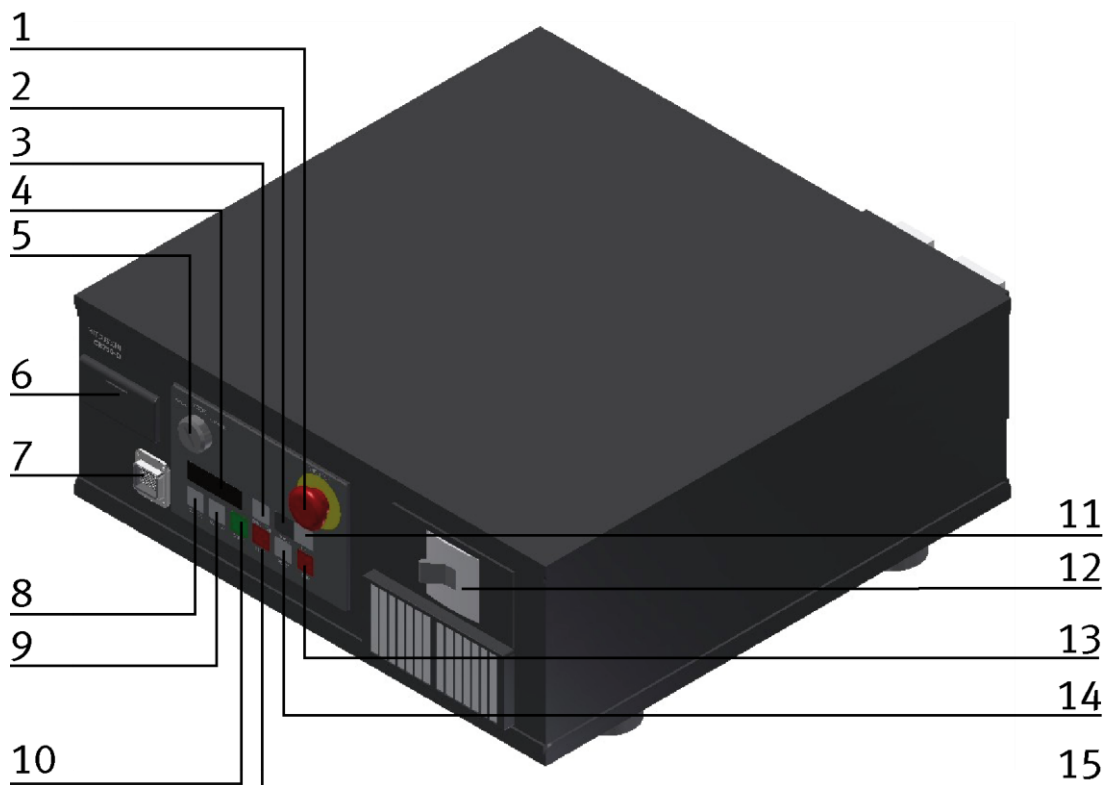
The Drive Unit is the controller for the robot / illustration similar

Position	Description
1	Emergency stop
2	Down button
3	CHNG button
4	Display
5	Key switch for teach or auto modes
6	Interface cover for USB and battery
7	Plug for teach pendant
8	Servo on button
9	Servo off button
10	Start button
11	Up button
12	Main switch
13	END button
14	RESET button
15	Stop button
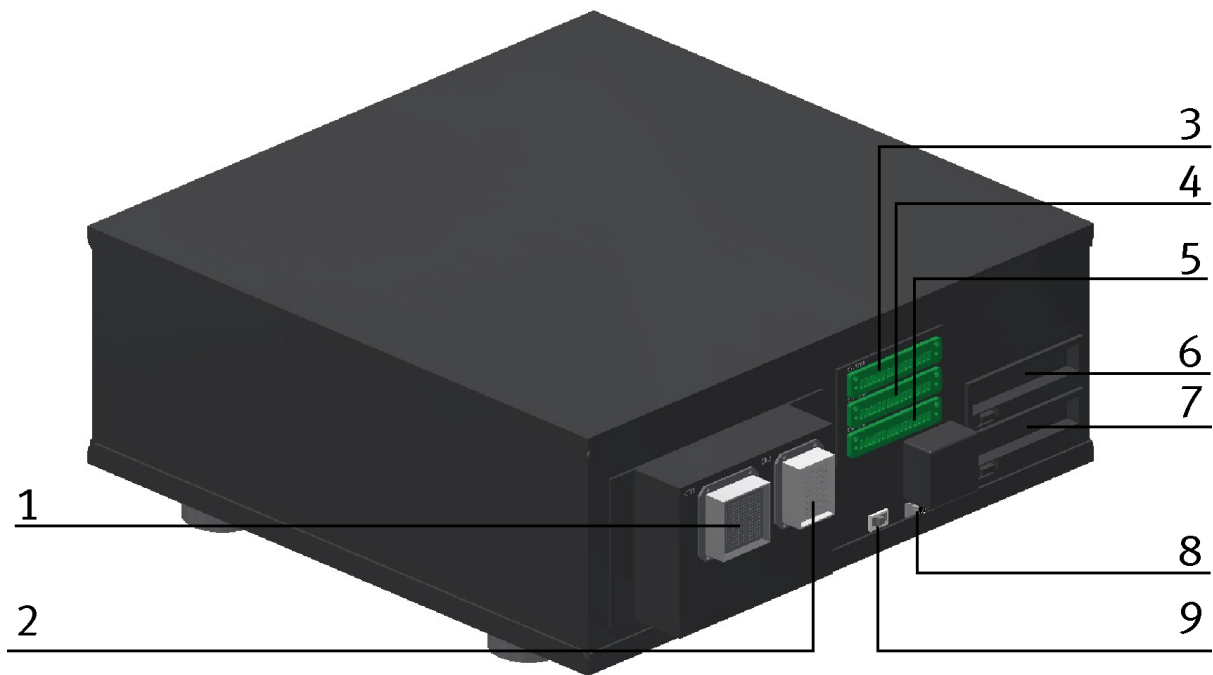
Illustration similar

On the backside of the drive unit, there are some more plugs and interfaces.

Position	Description
1	CN1 for robot communication
2	CN2 for robot communication
3	CNUSER 11
4	CNUSER 12
5	CNUSER 13
6	Slot 1 / for connector 1 (in/output 0-15)
7	Slot 2 / for connector 2 (in/output 16-31)
8	CNUSER 2
9	LAN1 for Ethernet

9.1.2 Teach pendant R56TB

To operate the robot in standalone mode, the teach pendant is necessary. The buttons have different functions, depending on the different modes. With the key switch at the Drive unit, it is possible to choose the following three modes.

- Position Auto (OP) for standalone mode.
- Position Auto (EXT) for communication with other controller.
- Position Teach for teach mode.

Teach pendant

9.1.3 Set up
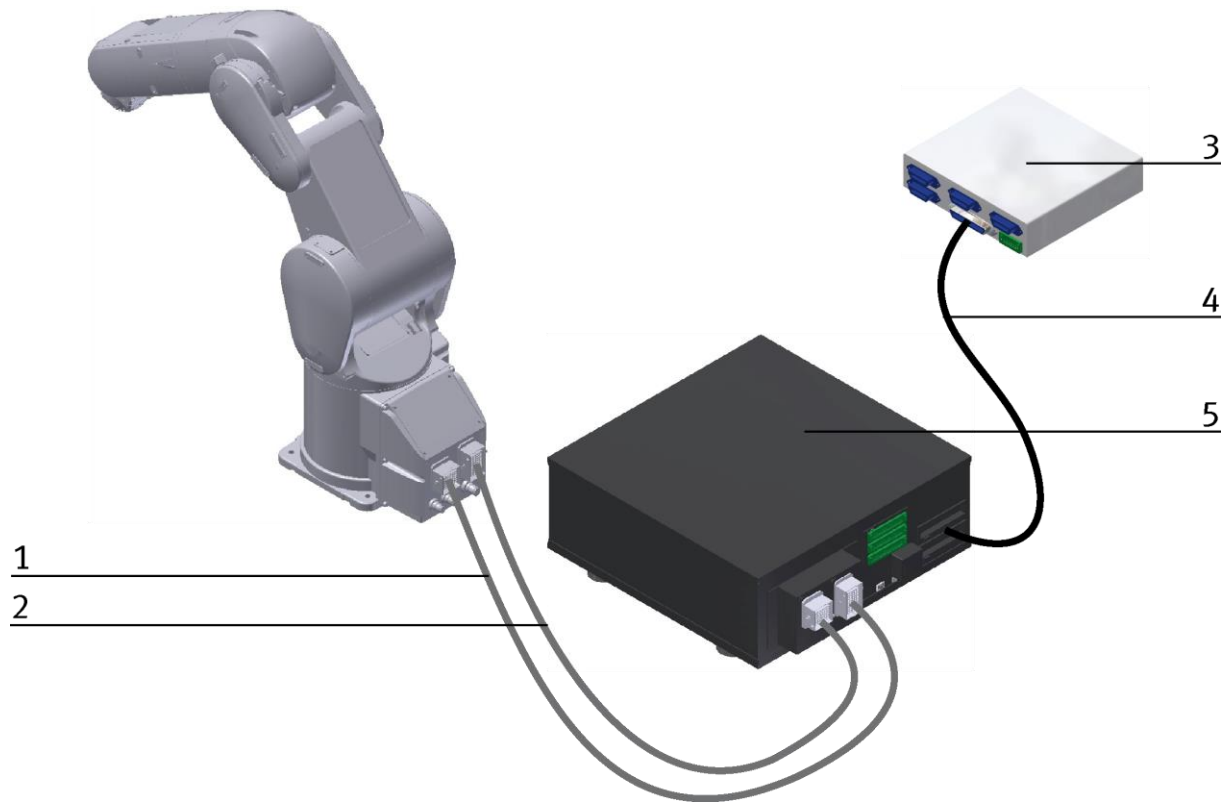
Robot RV4-FL set up example for standalone mode / illustration similar

Position	Description
1	CN1 cable
2	CN 2 cable
3	Drive Unit CR750-D
4	50 Pin cable from Ria-Box to slot 1 / there is a special cable necessary, this cable is plugged at the Drive Unit and then connected to the 50 PIN cable
5	RIA Box
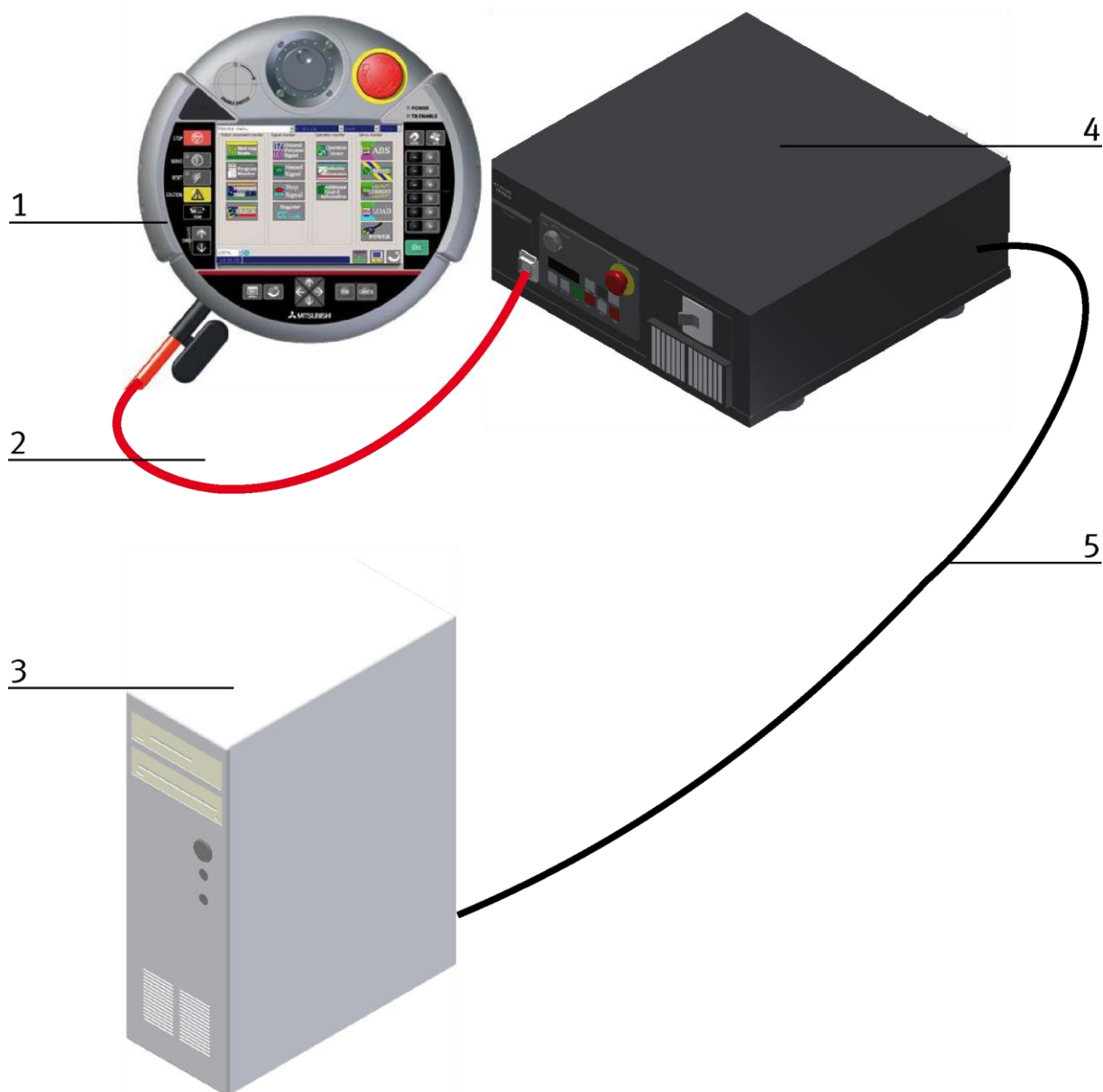
Robot RV4-FL set up example for standalone mode / illustration similar

Position	Description
1	TB
2	Cable to Drive Unit
3	Programming PC
4	Drive Unit CR750D
5	Cable to Ethernet interface

9.1.4 Drive Unit Interface

sensor name	RV-4FL robot					SIEMENS PLC
	name of variable	input/output	robot address	data type	comment	PLC address
	#STOP2	input	2000	Bit	stop	100.0
	#START	input	2001	Bit	programme is started	100.1
	#IOENA	input	2002	Bit	access rights are released	100.2
	#SLOTINIT	input	2003	Bit	reset the programme	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	programme selection input signal	100.7
robot status information region	#OVRDSEL	input	2008	Bit	override selection input signal	101.0
	#PRGOUT	input	2009	Bit	programme number output request	101.1
	#OVRDOUT	input	2010	Bit	override value request	101.2
	#ERROUT	input	2011	Bit	error number output request	101.3
	#Reserved	input	2012 - 2015		reserved	
	#IODATA	input	2016 - 2031	Word	numeric value input	102 - 103
	DI_RetryLastStep	input	2032	Bit	last step faulty, try again	104,0
	DI_ExitCurrCycle	input	2033	Bit	leave the present programme cycle	104,1
	Reserve_RobState1	input	2034 - 2039		reserved for extension	
	Reserve_RobState2	input	2040 - 2047	Byte	reserved for extension	105

sensor name		RV-4FL robot					SIEMENS PLC
	robot variable information region	ReservedWord1	input	2048 - 2063	Word	reserved Word 1	106 - 107
		ReserveByte1	input	2064 - 2071	Byte	reserved Byte 1	108
		ReserveByte2	input	2072 - 2079	Byte	reserved Byte 2	109
		ReserveByte3	input	2080 - 2087	Byte	reserved Byte 3	110
		ReserveByte4	input	2088 - 2095	Byte	reserved Byte 4	111
		ReserveByte5	input	2096 - 2103	Byte	reserved Byte 5	112
		ReserveByte6	input	2104 - 2111	Byte	reserved Byte 6	113
		ReserveByte7	input	2112 - 2119	Byte	reserved Byte 7	114
		ReserveByte8	input	2120 - 2127	Byte	reserved Byte 8	115
		ReserveByte9	input	2128 - 2135	Byte	reserved Byte 9	116
		ReserveByte10	input	2136 - 2143	Byte	reserved Byte 10	117
		BG1	input	2146 - 2151	Bit	x- axis basic setting	118.0
		BG4	input	2152 - 2159	Bit	box is completely driven in	118.1
		BG5	input	2160 - 2167	Bit	pallet available at bypass	118.2
		BG6	input	2168 - 2175	Bit	workpiece available at bypass	118.3

sensor name		RV-4FL robot					SIEMENS PLC
		#STOP2	output	2000	Bit	stopping	100.0
		#START	output	2001	Bit	starting the programme	100.1
		#IOENA	output	2002	Bit	releasing the access rights	100.2
		#SLOTINIT	output	2003	Bit	releasing the programme selection	100.3
		#SRVON	output	2004	Bit	servo on	100.4
		#SRVOFF	output	2005	Bit	servo off	100.5
		#ERRRESET	output	2006	Bit	output signal for occurring errors	100.6
		#RCREADY	output	2007	Bit	control ready	100.7
		#BATERR	output	2008	Bit	battery voltage is falling	101.0
	robot status information region	#PRGOUT	output	2009	Bit	programme number output signal	101.1
		#OVRDOUT	output	2010	Bit	override value output signal	101.2
		#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	numeric value output	102 - 103
		IsRbtArmHome	output	2032	Bit	robot arm is in basic setting	104,0
		IsRbtArmInByPass	output	2033	Bit	robot arm is above bypass	104,1
		IsRbtArmInMill	output	2034	Bit	robot arm is within the milling machine	104,2
		Reserve_RobState1	output	2035 - 2039		reserved for robot status	
		Reserve_RobState2	output	2040 - 2047	Byte	reserved for extension	105
	robot variable information region	ReservedWord1	output	2048 - 2063	Word	reserved Word 1	106 - 107
		ReturnValue	output	2064 - 2071	Byte	return value of the robot	108
		ReserveByte1	output	2072 - 2079	Byte	reserved byte 1	109
		ReserveByte2	output	2080 - 2087	Byte	reserved byte 2	110
		ReserveByte3	output	2088 - 2095	Byte	reserved byte 3	111
		ReserveByte4	output	2096 - 2103	Byte	reserved byte 4	112
		ReserveByte5	output	2104 - 2111	Byte	reserved byte 5	113
		ReserveByte6	output	2112 - 2119	Byte	reserved Byte 6	114
		ReserveByte7	output	2120 - 2127	Byte	reserved Byte 7	115
		ReserveByte8	output	2128 - 2135	Byte	reserved Byte 8	116
		ReserveByte9	output	2136 - 2143	Byte	reserved Byte 9	117

9.1.5 Parameter

For the configuration of a new Drive Unit, you have to adjust the following parameters. After the configuration, the Drive Unit has to be switched off and then switched 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;

Communication parameter Ethernet Camera:
- COMDEV=Us,"","OPT12","OPT13","","","","","";
- NETHSTIP=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;

Slot Parameter:
- 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/programmes

The following programmes have to be loaded into the Drive Unit and must be available there.

Sub programmes

Prg No	Description
1	equipping the basic module bypass with workpiece from box
2	equipping the box with workpiece from basic module bypass

9.1.7 Return messages

No	error
1	indefinable source number
2	transfer unit not in position
3	box is not at the end of the conveyor
4	no workpiece at the required position within the box
11	indefinable target number
12	no pallet at the basic module bypass
13	basic module bypass busy
14	no pallet carrier at the basic module bypass
15	no workpiece gripped by the robot

9.1.8 More information on the robot

Please refer to the robot manual in order to obtain the operating information.

9.2 Robot positions
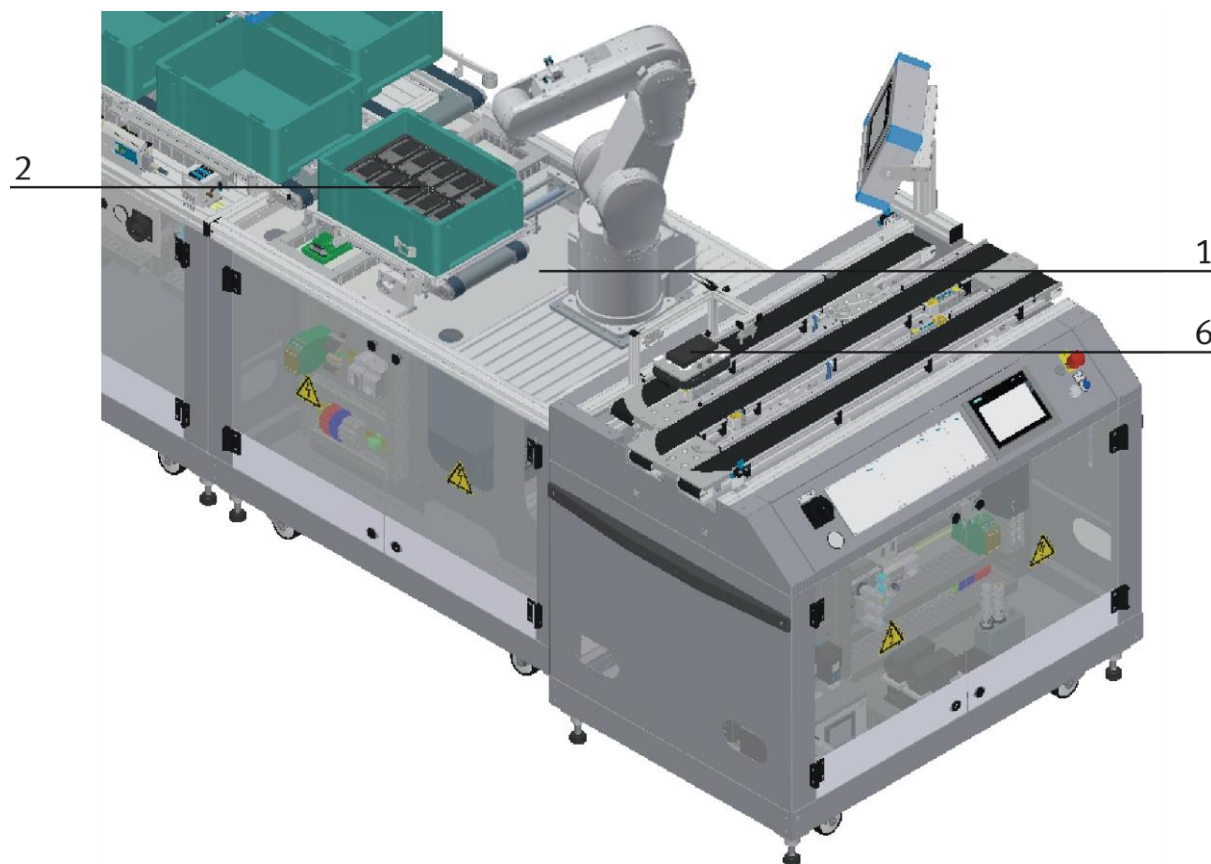
Illustration similar

Position	Description	Tool No. & Workpiece	Comment
1	P_Home	Tool 1 – Master Product	basic position
2	P_BoxPaletOrigin	Tool 1 – Master Product	basic position of the box
3	P_BoxPaletXDir	Tool 1 – Master Product	X-direction of the box
4	P_BoxPaletYDir	Tool 1 – Master Product	Y-direction of the box
5	P_BoxPaletXYDir	Tool 1 – Master Product	XY direction of the box
6	P_ByPasPlacePose	Tool 1 – Master Product	gripper position of the workpiece on the basic module bypass

9.3 Electrical components

9.3.1 2 Quadrant Controller

Illustration similar

Description

Electronics for DC motors excited by magnet up to about 200 W

The module M-MZ-4-30 is a two-quadrant motor control for DC motors with anti-clockwise and clockwise rotation. It guarantees a safe starting and stopping as well as the control of the rotational direction of motors. In off-state, the load is short-circuited which results in a dynamic braking. By the inlet SLOW, you can switch over from slow speed (adjustment at Tr1) to high speed. At the inlet STOP a limit switch can be installed.

Use:

Motor controls for brushed motors

Electronic load relay for solenoid valves and various loads

Characteristics

- Anti-clockwise and clockwise rotation
- Switch-over from high speed to the speed adjusted at the TR.1
- Port for limit switch for stop
- Short-circuit proof and temperature protected
- Limitation for starting circuit

Technical Data

Type: M-MZS-4-30

Item No. 06.05.020

Technical Data				
Control circuit	Input A1/A2 A1=Start clockwise A2=Start anticlockwise	Start wave	8	(V)
		Stop wave	5	(V)
		Allowed range	0-35	(V)
	Input A3/A4 A3=slow drive A4=Stop	Shift wave	8	(V)
		Allowed range	0-35	(V)
	Adjustment range for turning speed with trimmer at front plate (typical)		0 to max. turning speed	
	Start delay at A1 and A2 to 24V		‹ 2	(ms)
Load circle	Nominal voltage (power supply) Ub/range		24 (19-30)	(VDC)
	Load current/constant load		3/5 depends on switching frequency	(A)
	Input current at Un /without load circle		T 10 mA	(mA)
	Loading current Imax. T=1 sec.		20	(A)
	Current detection at short		95 Typ. (45-140)	A
	De-energize time at short		80-400	µs
Other data	Current entry at stop		‹20	(mA)
	Allowed surrounding temperature		-20 to +40	(C°)
	DIN VDE-regulations		0110, 0160 in parts	
	Any assembly position / DIN-rail assembly		No / Yes	
	Housing		Plastic housing light grey	
	Dimensions		59x77x50	mm
	Weight		Approx. 100	G
	Temperature / short guard		Yes / Yes	
	Connection type screw connection		4mm², 2,5mm² Yes	

Connection diagram
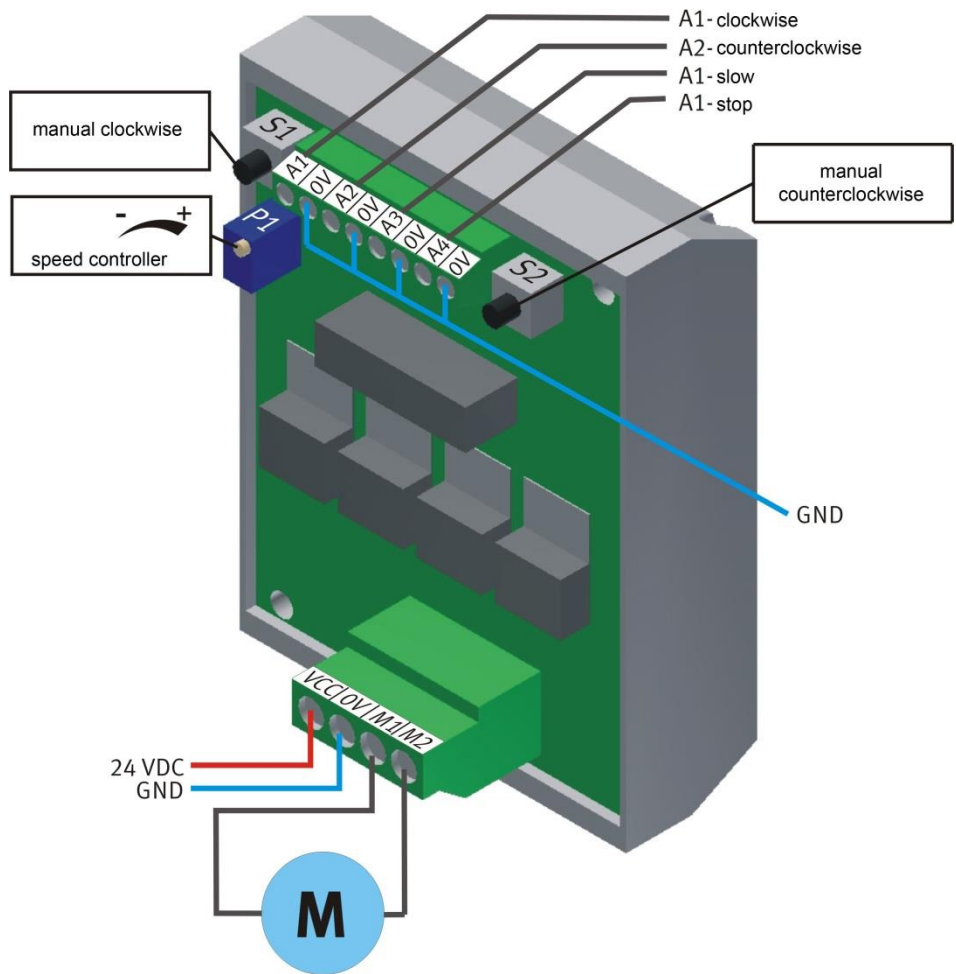
Illustration similar

Input / Output	Starting Current Limiter	Description
Control -5K2 / Q0.4:26	X1:re	Conveyor drive unit clockwise rotation
Control -5K2 / Q0.5:27	X1:li	Conveyor drive unit anti-clockwise rotation
Control -5K2 / Q0.5:28	X1:sl	Conveyor drive unit creep speed
Control -5K2 / Q0.6:29	X1:st	Conveyor drive unit Stop
Conveyor motor DC / -X3M1:4	X2:M1	Conveyor motor connection
Conveyor motor DC / -X3M2:3	X2:M2	Conveyor motor connection

9.3.2 Siemens Control

Siemens ET200 SP / CPU 1512SP F-1PN / Illustration similar

For detailed information see electrical circuit diagram.

9.3.3 Touch Panel

Siemens TP 700 Comfort / illustration similar

Supply voltage

Type of supply voltage	DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V

Input current

Current consumption (rated value)	0.5 A
Starting current inrush I^2t	0.5 A²·s

Power

Power consumption, typ.	12 W

Processor

Processor type	X86

Memory

Flash	Yes
RAM	Yes
Memory available for user data	12 Mbyte

9.3.4 Scalance Ethernet Switch

Siemens Scalance Ethernet switch / illustration similar

The SCALANCE X208 has eight RJ-45 jacks for the connection of end devices or other network segments.

Product properties

SCALANCE X-208

Operating Instructions, 12/2011, A5E00349864-19

TP ports / Connector pinout

On the SCALANCE X208, the TP ports are implemented as RJ--45 jacks with MDI-X assignment (Medium Dependent Interface–Autocrossover) of a network component.

RJ-45 jack

Pin number

Assignment

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+

NOTICE

TP cords or TP-XP cords with a maximum length of 10 m can be connected to the RJ-45 TP port. With the IE FC cables and IE FC RJ-45 plug 180, an overall cable length of up to 100 m is permitted between two devices depending on the cable type.

Autonegotiation

Autonegotiation means the automatic detection of the functionality of the port at the opposite end. Using autonegotiation, repeaters or end devices can detect the functionality available at the port of a partner device allowing automatic configuration of different types of device. With autonegotiation, two components connected to a link segment can exchange parameters and set themselves to match the supported communication functionality.

Note

If an IE switch port operating in autonegotiation mode is connected to a partner device that is not operating in autonegotiation mode, the partner device must be set permanently to half duplex mode. If an IE switch port is set permanently to full duplex, the connected partner device must also be set to full duplex. If the autonegotiation function is disabled, the MDI/MDI-X auto crossover function is also inactive. This means it may be necessary to use a crossover cable.

Note

The SCALANCE X208 is a plug-and-play device that does not require settings to be made for commissioning.

MDI /MDIX autocrossover function

The advantage of the MDI /MDIX autocrossover function is that straight-through cables can be used throughout and crossover Ethernet cables are unnecessary. This prevents malfunctions resulting from mismatching send and receive wires. This makes installation much easier for the user. IE Switches X-200 support the MDI / MDIX autocrossover function.

NOTICE

Please note that the direct connection of two ports on the switch or accidental connection over several switches causes an illegal loop. Such a loop can lead to network overload and network failures.

Auto polarity exchange

If the pair of receiving cables are incorrectly connected (RD+ and RD- swapped over), the polarity is reversed automatically.

9.4 RFID with Ethernet

Turck – TBEN-S2-2RFID-4DXP / 6814029 / illustration similar

I/O data mapping

The BLident RFID-a interface modules cannot be controlled by the process data only. In any case, there is a software functional module required in the control. The functional module has been standardized for the RFID systems and is called Proxy Ident Block (PIB).

Input	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Chanel 0	0	Status word channel 0- low byte							
	1	Status word channel 0- high byte							
Chanel 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
Chanel 0	0	Control word channel 0- low byte							
	1	Control word channel 0- high byte							
Chanel 1	2	Control word channel 1- low byte							
	3	Control word channel 1- high byte							
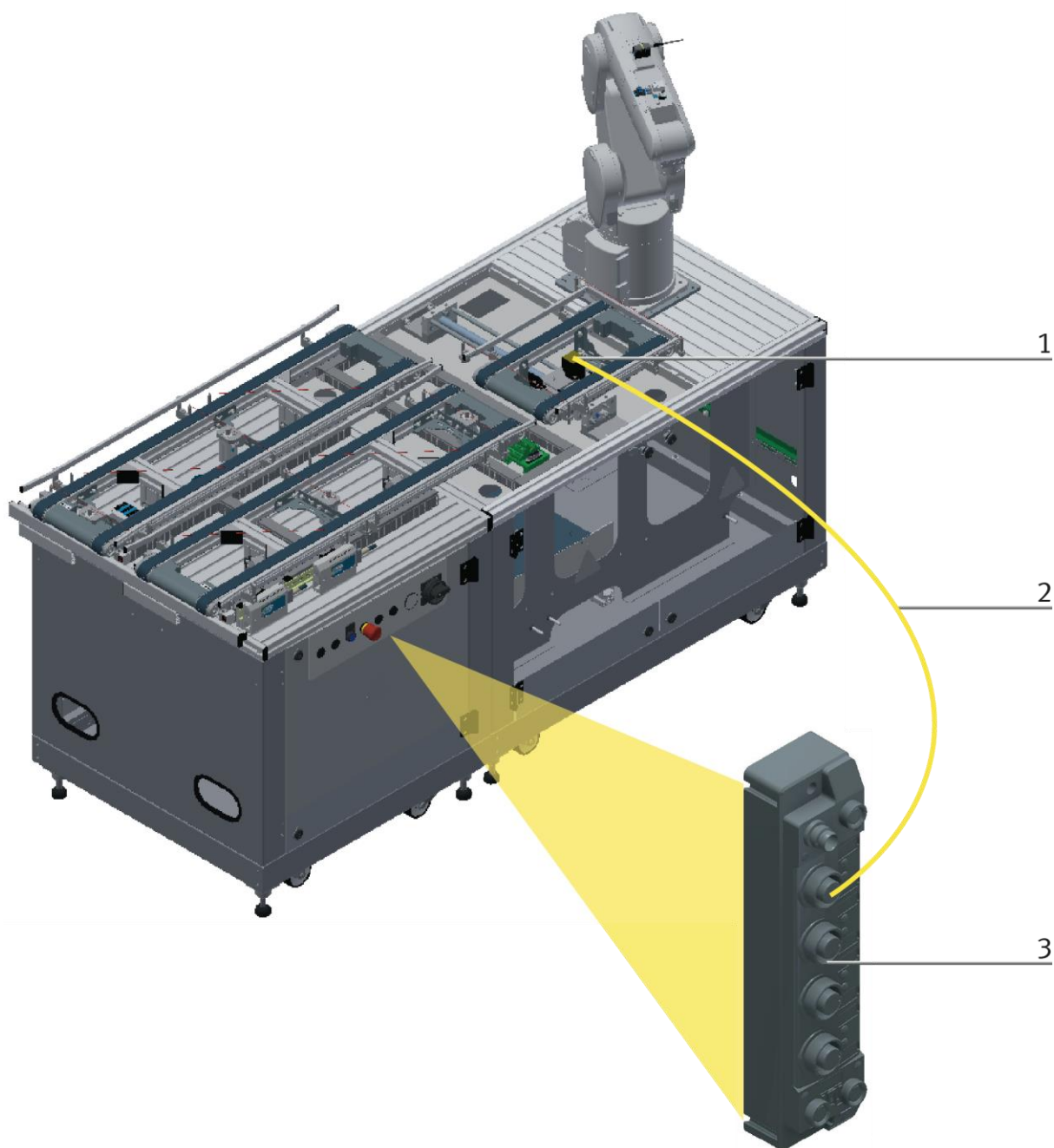
Wiring of the Ethernet module to the RFID interface / illustration similar

Pos	Name
1	Turck read-write head TN-CK40-H1147 (equipment identifier G-TF80)
2	Cable from Turck read-write head to turck module
3	Turck Ethernet module with RFID interface (equipment identifier K2-KF80)
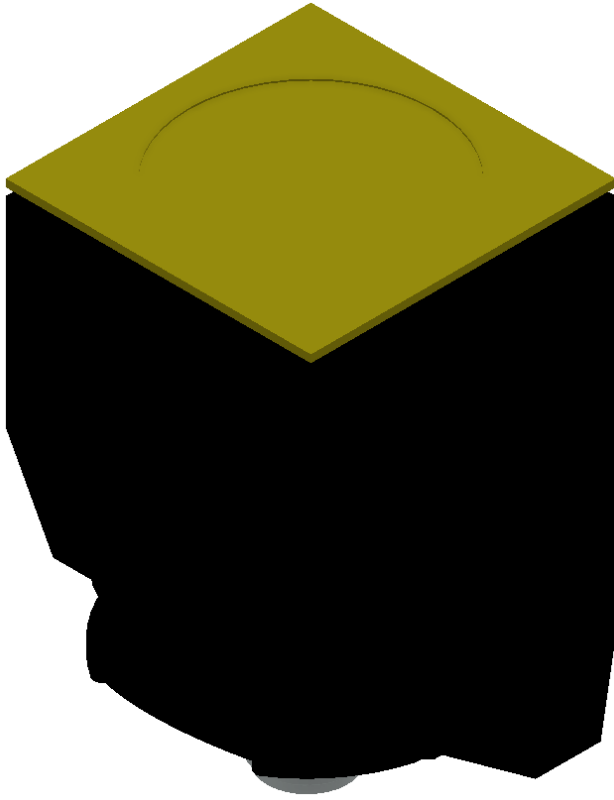
RFID read-write head / illustration similar

The Turck RFID read-write head is mounted on the shift unit.
Its designation is TN-CK40-H1147.

Name	
Operating voltage	10...30 VDC
DC rated operating current	0-80 mA
Operating voltage	DC
Data transfer	Inductive coupling
Working frequency	13,56 MHz
Read-write distance	max. 115 mm

9.4.1 Electronic circuit protection

Murr Mico electronic circuit protection 2-channels / illustration similar

Description	
Input	
Operating voltage	24 V DC (18...30 V DC)
Control inputs	
Input voltage (ON)	10...30 V DC
Impulse length (ON)	min. 20 ms
Control outputs	
Group alarm output	Potential free 30 V AC/DC, 100 mA
General data	
Connection	Spring clamp terminals
Input terminals	1× 16 mm²
Output terminals	Per output 1× 4 mm²
Alarm terminals	2.5 mm²
Bridging concept	Two sides, with spring clamp terminals or bridge set (max. 40 A)
Mounting method	DIN-rail mountable TH35 (EN 60715)
Dimensions H×B×T	90×36×80 mm
Temperature range	0...+55 ℃ (storage temperature -40...+80 ℃)
Output	
Current adjustment	1 A, 2 A, 4 A, 6 A, by counters inked rotary switch, sealed
Inrush capacity	max. 20 mF (per channel)

9.4.2 Power supply unit
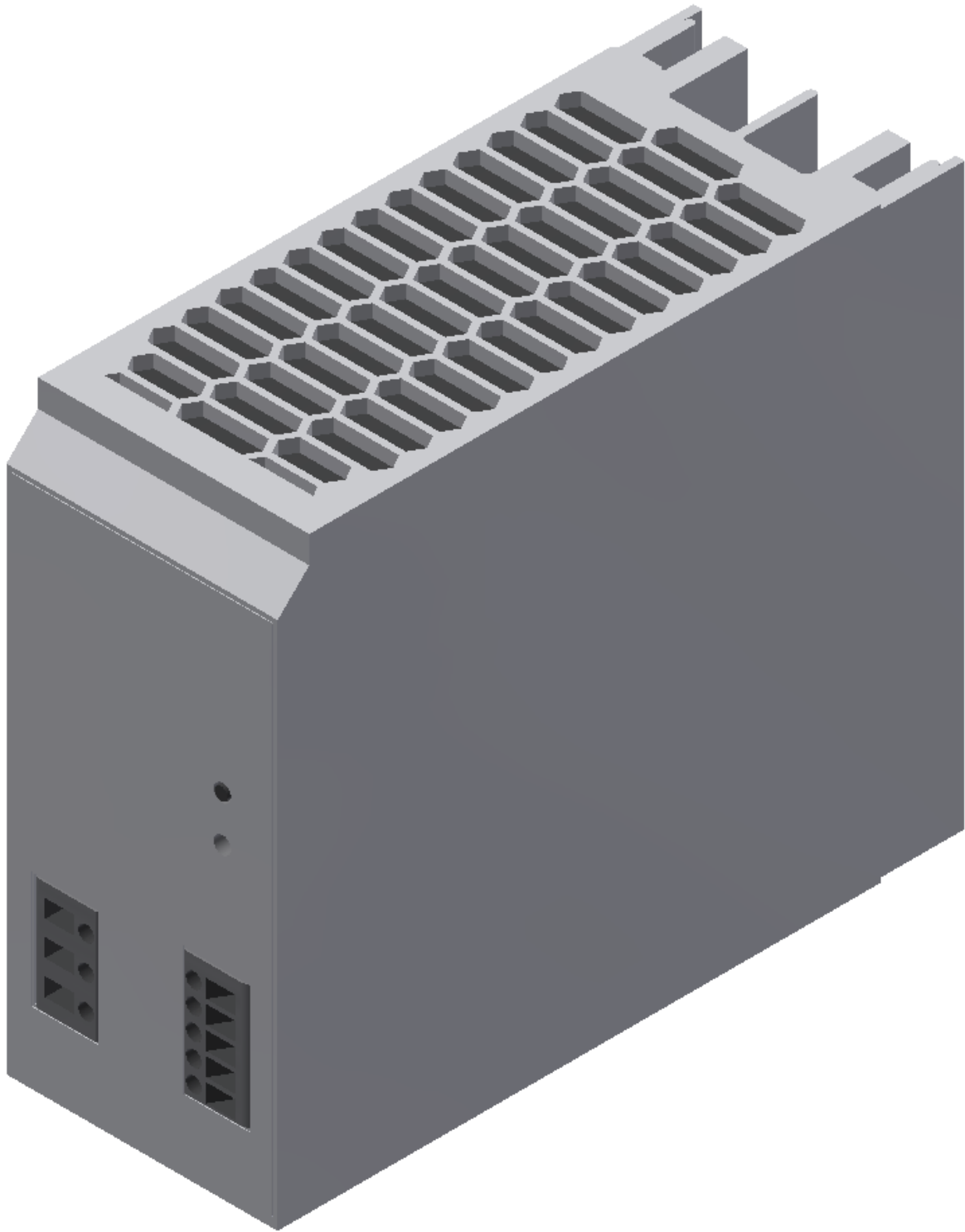
Power supply unit Festo CACN-3A-1-10 / illustration similar

Description	Value
Width	60 mm
Height	130 mm
Length	152,5 mm
Assembly position	Free convection
Primary supply	Single-phase
Input current	1,5 - 3,0 A
Nominal output voltage DC	24 V
Nominal output current	10 A
Input voltage range AC	100 ... 240 V
Power failure buffering	24 ms
Line frequency	45 ... 65 Hz
Authorization	C-Tick /c UL us - Listed (OL)
CE mark (see declaration of conformity)	to EU directive for EMC to EU directive low-voltage devices
Storage temperature	-40 ... 85 ℃
Relative air humidity	95 %
Protection class	IP20
Ambient temperature	-25 ... 70 ℃
Product weight	1.554 g
Mounting type	with top-hat rail
Materials note	PWIS substances/Conforms to RoHS

9.4.3 SAFETY RELAY

Siemens Sirius safety relay / illustration similar

Description	24 V DC/AC
Mounting type	Span on mounting
Part number	3SK1111-2AB30
Type	SIRIUS 3SK11
Depth	121.6 mm
Height	100 mm
Width	22.5 mm
Current	5 A
Power supply	24 V/DC; 24 V/AC
Max. temperature	60 ºC
Min. temperature	-25 ºC
Product-type	Safety relay

9.4.4 SYS link interface

Output Bit 0	1 ▮ ▮13	Input Bit 0
Output Bit 1	2 ▮ ▮14	Input Bit 1
Output Bit 2	3 ▮ ▮15	Input Bit 2
Output Bit 3	4 ▮ ▮16	Input Bit 3
Output Bit 4	5 ▮ ▮17	Input Bit 4
Output Bit 5	6 ▮ ▮18	Input Bit 5
Output Bit 6	7 ▮ ▮19	Input Bit 6
Output Bit 7	8 ▮ ▮20	Input Bit 7
Powersupply 24 VDC	9 ▮ ▮21	Powersupply 24 VDC
Powersupply 24 VDC	10▮ ▮22	Powersupply 24 VDC
Powersupply 0 VDC	11▮ ▮23	Powersupply 0 VDC
Powersupply 0 VDC	12▮ ▮24	Powersupply 0 VDC

Syslink allocation

SYSlink PIN	Bit	Description	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	InputEX.4
06	5	Output AX.5	18	5	Input EX.5
07	6	Output AX.6	19	6	InputEX.6
08	7	Output AX.7	20	7	Input EX.7
09	24V	Power Supply	21	24V	Power Supply
10	24V	Power Supply	22	24V	Power Supply
11	0V	Power Supply	23	0V	Power Supply
12	0V	Power Supply	24	0V	Power Supply

9.5 I/O terminal

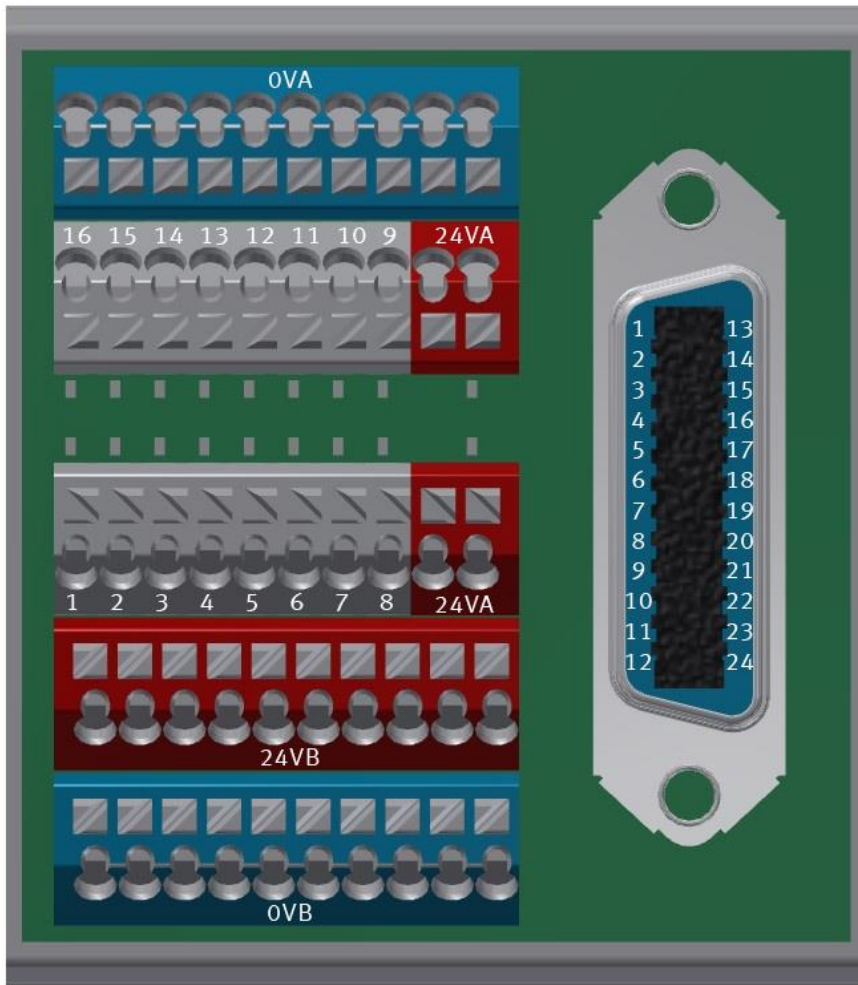The I/O interface has been standardized in order to guarantee a flawless communication. The I/O terminal is available at every working position.
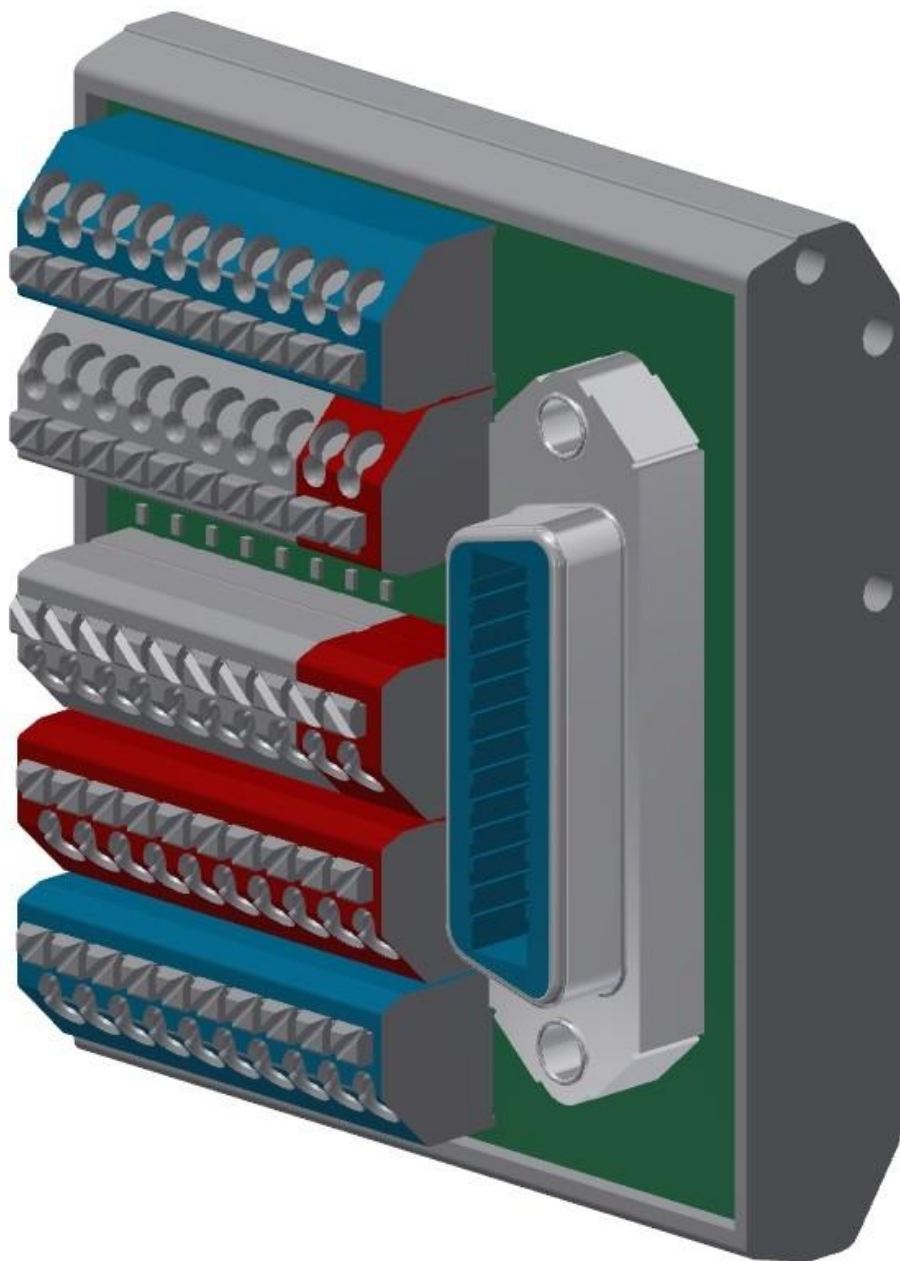
Data I/O terminal

| Technical data	
plug type	IEEE 488 - 24-pin
inputs	8 (4 of them are connected)
outputs	8 (4 of them are connected)
current consumption	maximum 1A per PIN
supply voltage	24 VDC

Allocation I/O terminal

terminal	Bit	function	colour		terminal	Bit	function	colour
01	0	output	white		13	0	input	grey-pink
02	1	output	brown		14	1	input	red-blue
03	2	output	green		15	2	input	white-green
04	3	output	yellow		16	3	input	brown-green
05	4	output	grey		17	4	input	white-yellow
06	5	output	pink		18	5	input	yellow-brown
07	6	output	blue		19	6	input	white-grey
08	7	output	red		20	7	input	grey-brown
09	24V	power supply	black		21	24V	power supply	white-pink
10					22			
11	0V	power supply	pink-brown		23	0V	power supply	white-blue
12	0V	power supply	purple		24			

9.6 Mechanic components

9.6.1 Motor of Conveyor
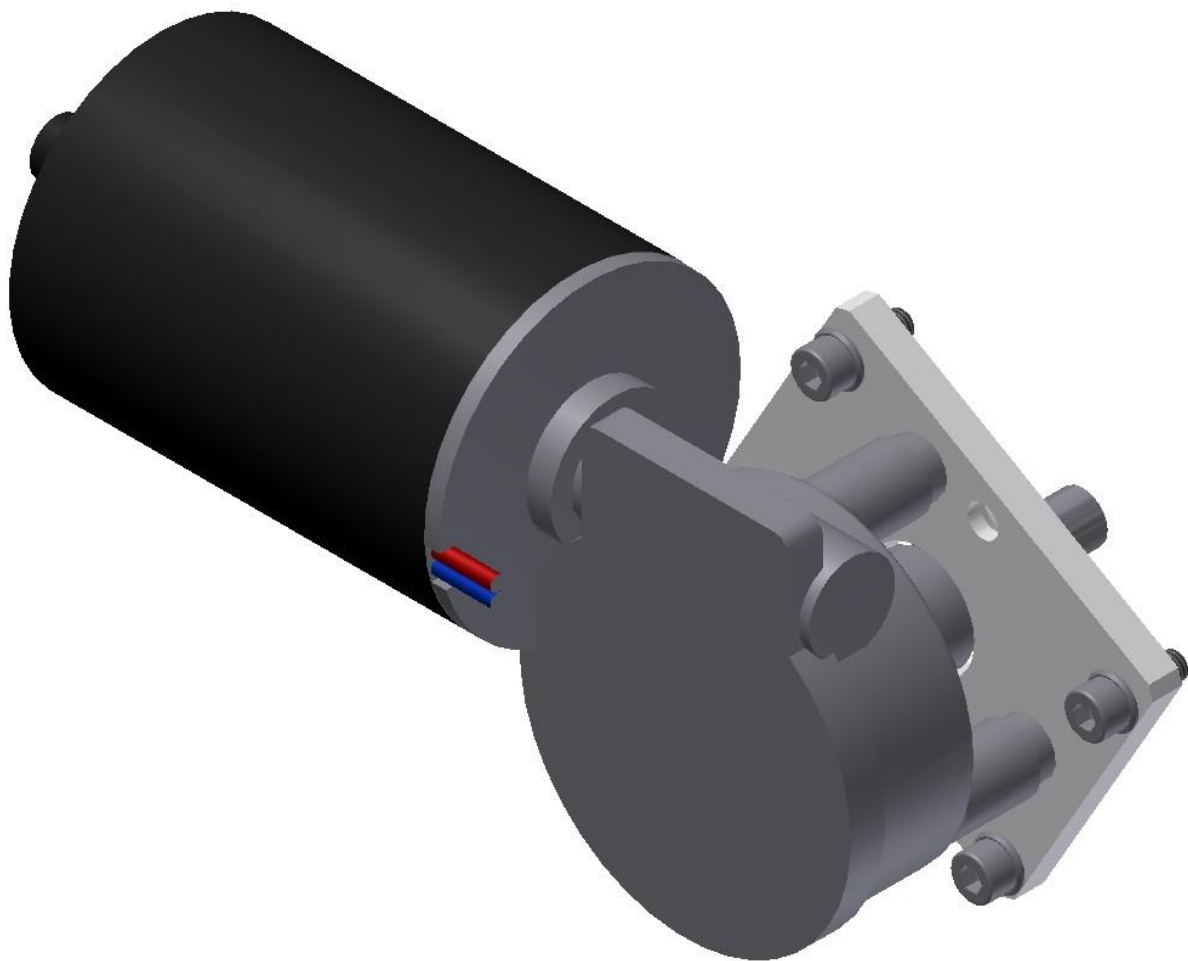
Motor type 403438 / illustration similar

The motor has got the equipment identifier / 3M1

Name	
Nominal voltage UN /Volt	36
Idling speed n0 [min-1]	120
Rated torque MN [Nm]	2
Starting torque MA [Nm]	16
Gear ratio i	53/2
Connection resistance 2 vanes R [m]	3400
Connection resistance 4 vanes R [m]	3000
Protection class IP 30	30
Weight [kg]	1

9.6.2 The stopper unit
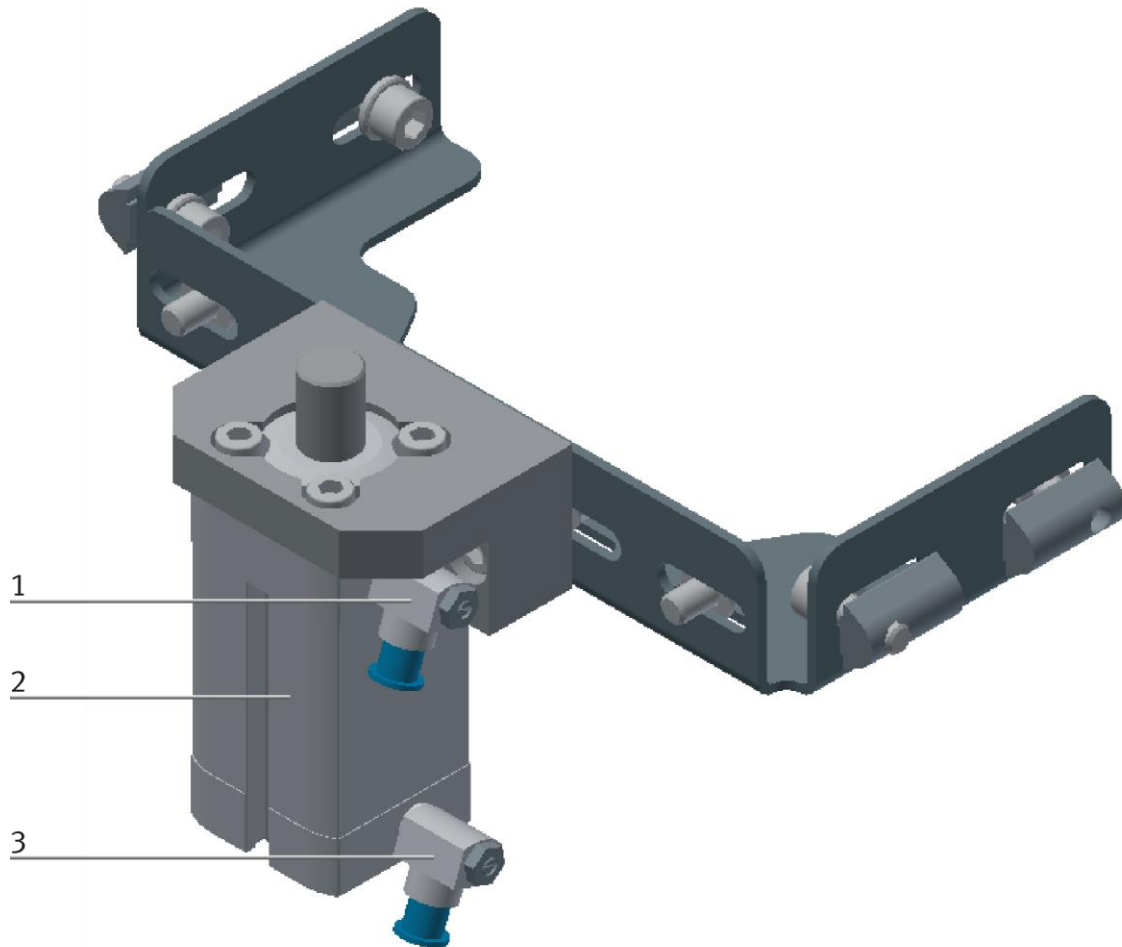
CP Factory Stopper Unit / illustration similar

Position	Description
1	one-way flow control valve / Order number. 175056 / GRLA-M5-QS-4-LF-C
2	Stopper cylinder / Order number 576079 / DFSP-20-15-PS-PA
3	one-way flow control valve / Order number. 175056 / GRLA-M5-QS-4-LF-C

conveyor
1 stopper middle is up
Band 1
Stopper Mitte ist oben
%I2.4
175436
/84.2

Band 1
Stopper Mitte
-MM1 ◁▢ -BG5

-RZ1

-RZ2

-QF1
161415 (J)

-XL1

B2/B4
3/5
1

-MB1
/85.4
Q2.1
conveyor 1
open middle stopper
Band 1
Stopper Mitte öffnen

-MB2
/85.2
Q2.0
conveyor 1
close middle stopper
Band 1
Stopper Mitte schließen

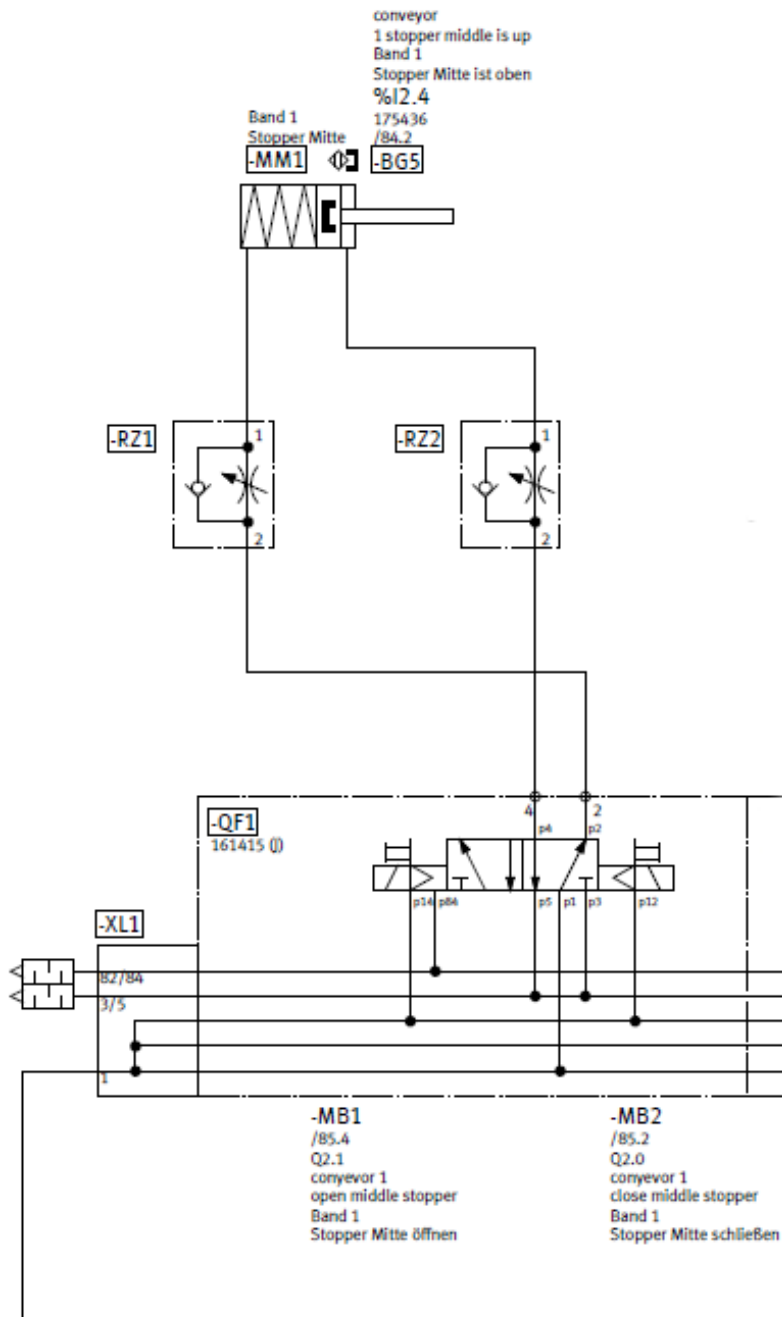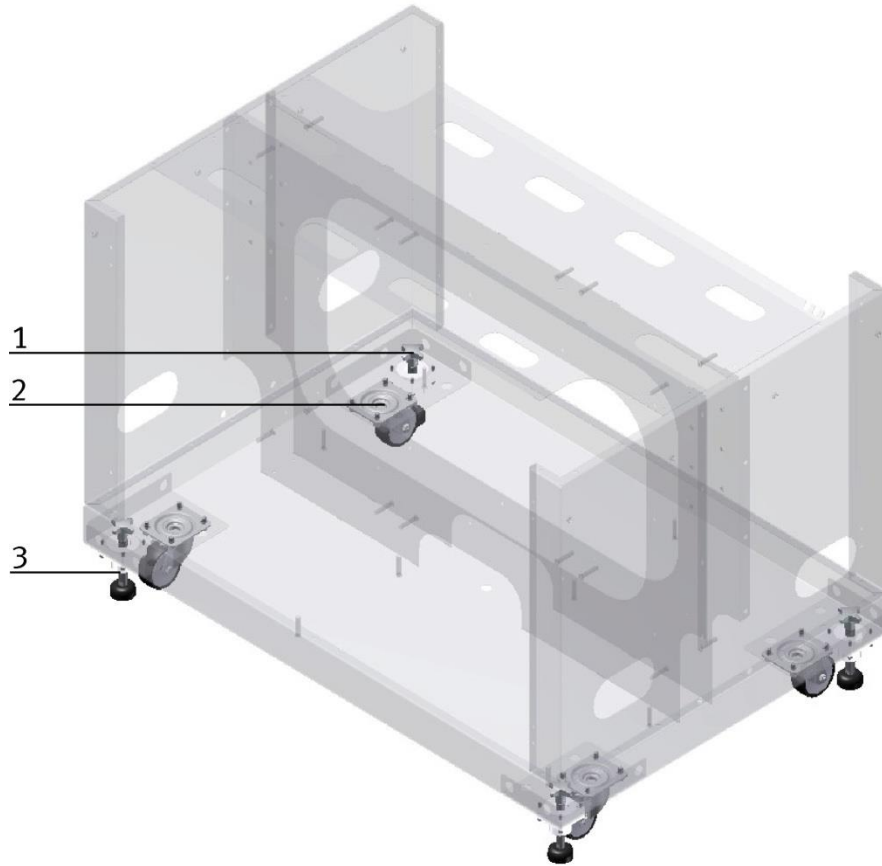p4   p2

p14 p84   p5 p1 p3   p12

Diagram of pneumatics, Stopper Unit / illustration similar

9.6.3 Transportation of the station

CP Factory Transportation method / illustration similar

With the help of mechanically adjustable feet, you can lower the basic module and then put it on the rollers. In this way, an easy transport is possible. If you wind up the machine mounts, you can move the basic module easily to another place.

Position	Description
1	Star knob for adjusting the height of the machine mount
2	Roller
3	Lock nut for locking the machine mount in the position required

	⚠ **WARNING**

⚠	• Danger of crushing for hands/feet
	  – It is not permitted to grip onto or under the feet when handling the machine, as there is an increased risk of hands or feet getting crushed or trapped in these areas.
	  – When setting down the station, make sure no persons have their feet under the machine's feet.

10 Message texts and interactive error messages at the HMI

In general, there are three different reporting classes. These are designed as follows

- Message class 0 (displayed red in the message line)
    - the program is immediately stopped and the automatic mode is terminated
    - the cause of the error has to be fixed
    - Then acknowledge the fault and restart the station
- Message class 1 (displayed red in the message line)
    - the program and the automatic mode are stopped at the end of the cycle
    - the cause of the error has to be fixed
    - Then acknowledge the fault and restart the station
- Message class 2 (displayed yellow in the message line)
    - the program and the automatic mode are executed further
    - If the cause of the fault is fixed, the error is automatically acknowledged
- Note
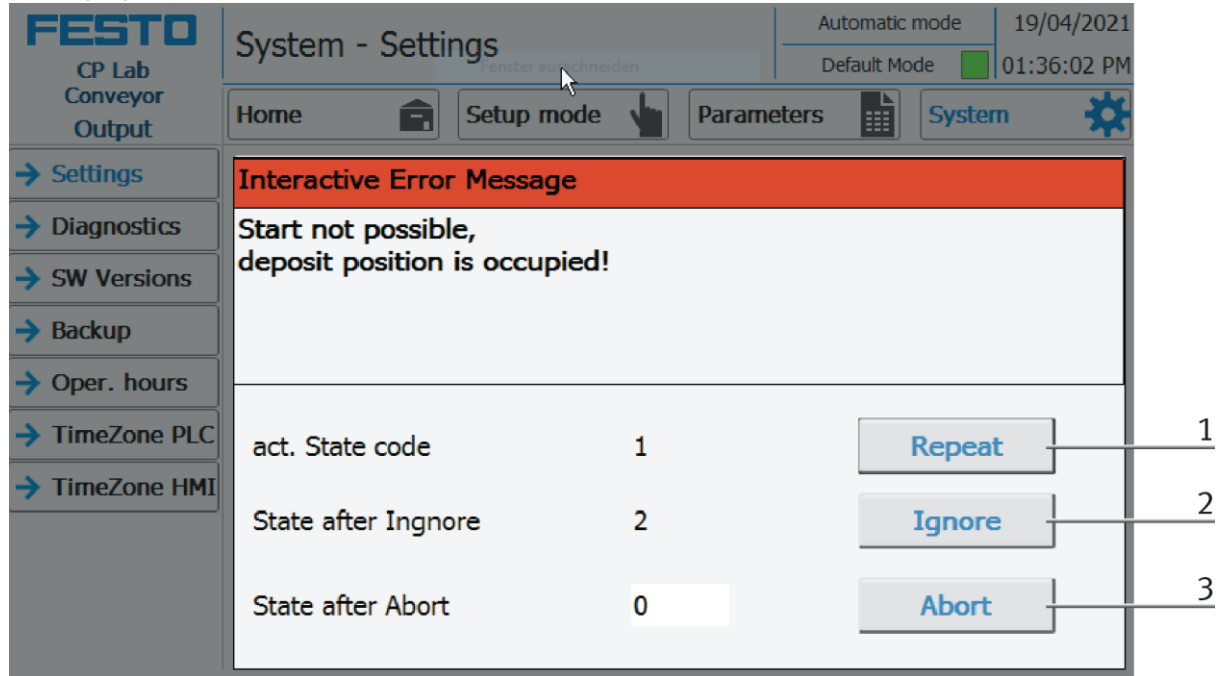   - Displayed on the HMI but not processed in MES

10.1 Message texts

Actual there are no message texts available.

10.2 Interactive error messages

10.2.1 Default operation

Interactive messages are displayed via a pop-up window at HMI
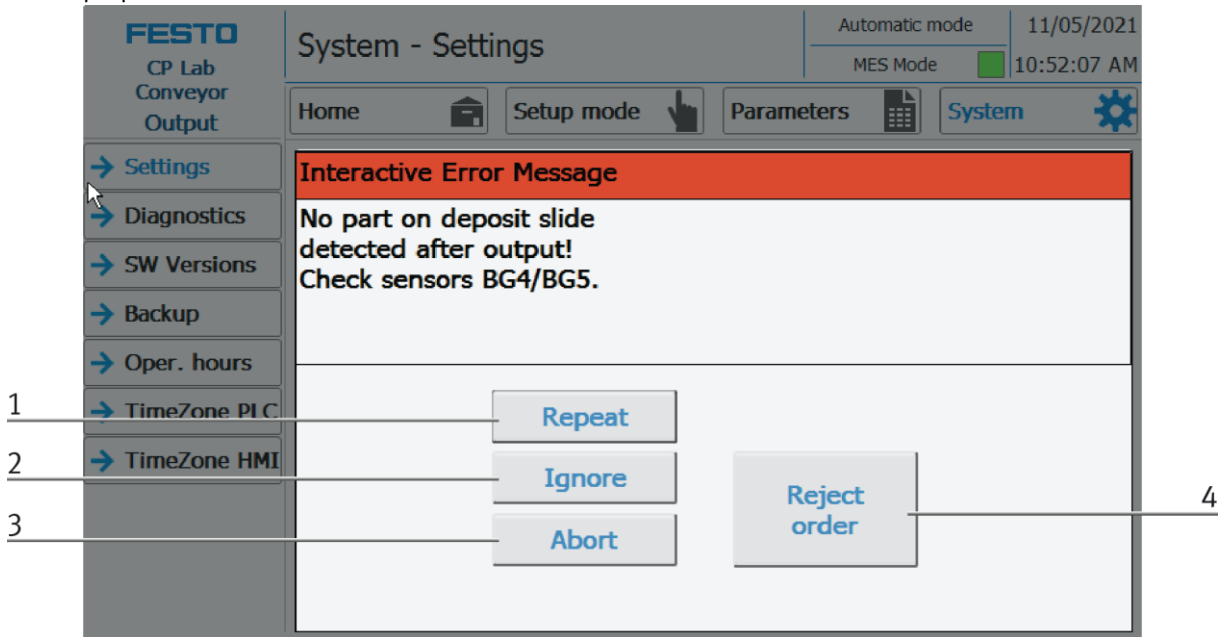
The Pop Up has three buttons.

Example application module output - interactive error message in default mode

Position	Note
1	Repeat - An attempt is made to run the application again.
2	Ignore – The error status is ignored; the workpiece carrier receives the status code as indicated in the transition table in the "Initial status" column. The application is no longer executed.
3	Abort – The error status is ignored; the workpiece carrier receives the status code as shown in the input / output field next to the value displayed. This can be changed in this interactive error message window.

10.2.2 MES Operation

Interactive messages are displayed via a pop-up window at HMI

The Pop Up has four buttons.

Example application module output - interactive error message in default mode

Position	Note
1	Repeat - An attempt is made to run the application again with the same parameters.
2	Ignore – The application is not executed, but is treated in the MES as if the order step had been executed without errors.
3	Abort – The application is no longer executed. In the MES, this order position is terminated with an error and canceled, depending on whether an error step has been defined or not.
4	Reject order - 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.

10.2.3 General

Value	Text	Fix error
100	Order aborted with errors!	Start order again

11 Service and cleaning

The components and systems from Festo Didactic are maintenance-free.

At regular intervals you should have checked:

- the lenses of the optical sensors, fibre optics and reflectors
- the active surface of the proximity switch
- the entire station

can be cleaned with a soft, lint-free cloth or brush.

⚠️	*NOTE*
	Do not use aggressive or abrasive cleaners.

Protective covers must not be cleaned with alcoholic cleaning agents, there is a risk of embrittlement.

12 Further information and updating

Further information and updates on the technical documentation of Festo Didactic components and systems can be found on the Internet at:
www.ip.festo-didactic.com

13 Disposal

	NOTE
	Electronic waste contains recyclable materials and must not be disposed of with the domestic waste. Bring electronic waste to a designated municipal collection point.

Festo Didactic SE

Rechbergstraße 3

73770 Denkendorf

Germany

📞 +49 711 3467-0   🌐 www.festo-didactic.com

🖨 +49 711 34754-88500   ✉ did@festo.com