

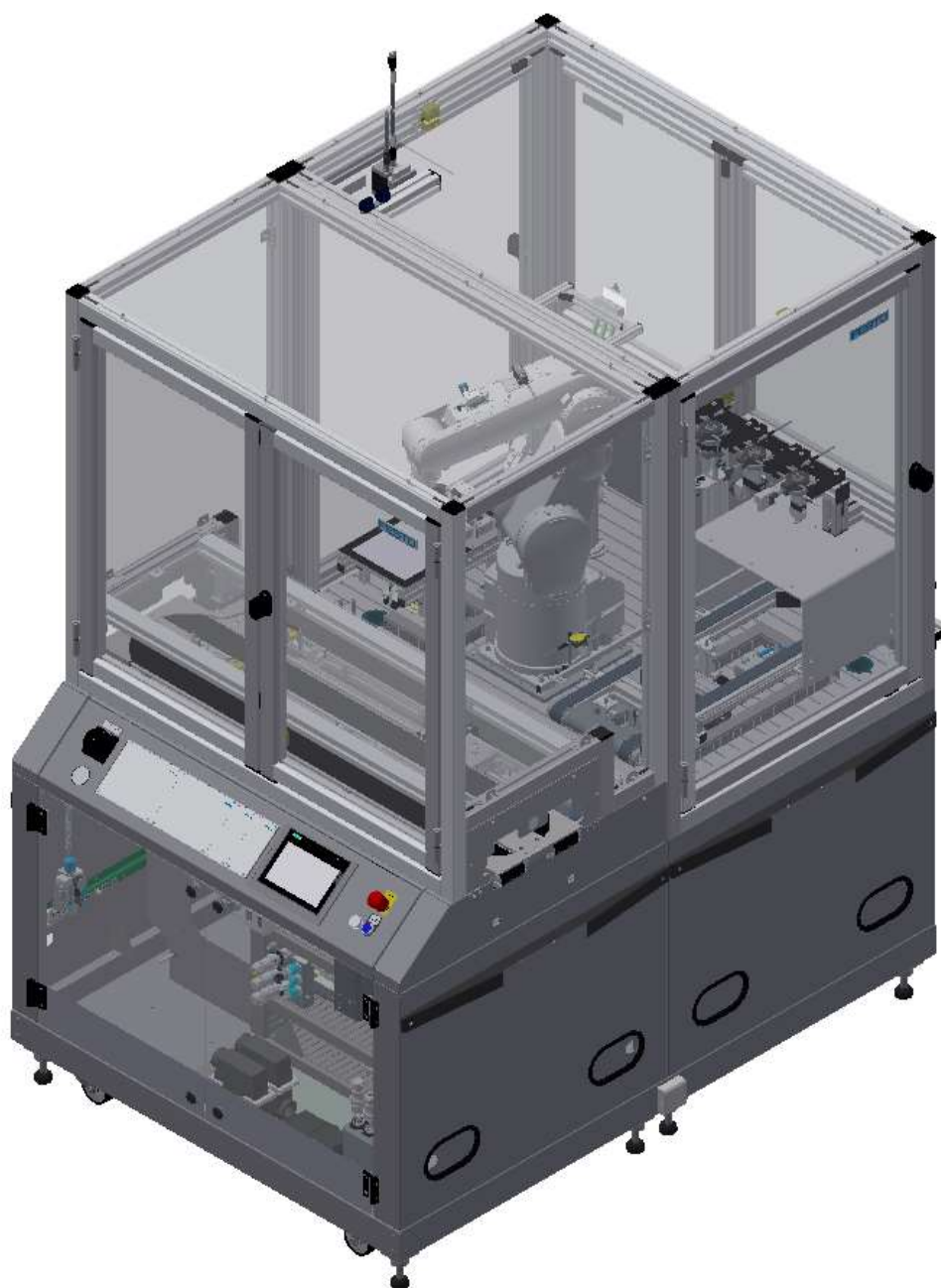
8049083

Robot assembly

FESTO

CP Factory

Original operating
instructions



Festo Didactic
8049083 en
10/2021



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original operating instructions

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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.

	<p style="text-align: center;"> CAUTION</p> <p>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.</p>
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Main document

Associated documents attached:

Safety instructions concerning transport (print/electronic)

Component datasheets (print/electronic)

Circuit diagram (print/electronic)

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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
	<p>... indicates an imminently hazardous situation that will result in fatal or severe personal injury if not avoided.</p>

	 WARNING
	<p>... indicates a potentially hazardous situation which may result in fatal or severe personal injury if not avoided.</p>

	 CAUTION
	<p>... indicates a potentially hazardous situation that may result in moderate or slight personal injury or severe property damage if not avoided.</p>

	NOTE
	<p>... indicates a potentially hazardous situation that may result in property damage or loss of function if not avoided.</p>

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 – hot surface



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
	<ul style="list-style-type: none">• Malfunctions which could impair safety must be eliminated immediately!

	 CAUTION
	<ul style="list-style-type: none">• 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
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Switch off the power supply! <ul style="list-style-type: none"> – 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! <ul style="list-style-type: none"> – Use a tool such as a screwdriver for actuating sensors.

	 CAUTION
	<ul style="list-style-type: none"> • Risk of burns due to hot surfaces <ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> – Allow the device to cool off before commencing work. – Use suitable personal protective clothing, e.g. safety gloves.

4.3 Electrical components

	 DANGER
	<ul style="list-style-type: none">• Risk of fatal injury in case of interrupted protective grounding conductor!<ul style="list-style-type: none">– 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!<p>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.</p><ul style="list-style-type: none">– Do not connect power supplies in series.• Risk of death due to electric shock!<p>Protect the outputs of the power supplies (output sockets/terminals) and cables connected to them from direct contact.</p><ul style="list-style-type: none">– Always use connector cables with adequate insulation and electric strength.– Use safety sockets with fully shrouded contact points.



	 WARNING
	<ul style="list-style-type: none"> • Disconnect from all sources of electrical power! <ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> – 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! <ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> – 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
	<ul style="list-style-type: none"> • Risk of fire due to use of unsuitable power supply <ul style="list-style-type: none"> – If a device is connected to an unsuitable power supply, this can cause components to overheat, leading to a breakout of fire. – Always use limited power supplies (LPSs) for all the connections and terminals on the electronics modules.

**CAUTION**

- **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
	<ul style="list-style-type: none"> • Depressurize the system! <ul style="list-style-type: none"> – 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! <ul style="list-style-type: none"> – Cylinders may advance and retract automatically. • Risk of accident due to advancing cylinders! <ul style="list-style-type: none"> – 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! <ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> – 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.

 CAUTION	
	<ul style="list-style-type: none">• Setting up pneumatic circuits<ul style="list-style-type: none">– 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<ul style="list-style-type: none">– 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<ul style="list-style-type: none">– 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
	<ul style="list-style-type: none"> • Unsecure operating conditions due to software tampering <ul style="list-style-type: none"> – 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.






	<p data-bbox="756 797 1027 853"> WARNING</p> <ul style="list-style-type: none">• This product is designed for use in industrial environments, and may cause malfunctions if used in domestic or small commercial environments.
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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

	<div style="background-color: #c85130; color: white; padding: 5px; text-align: center;">  WARNING </div> <ul style="list-style-type: none"> • Danger due to tipping over <ul style="list-style-type: none"> – 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.
	<div style="background-color: #f1c40f; color: black; padding: 5px; text-align: center;">  CAUTION </div> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> – Safety shoes must be worn when transporting the station!
	<div style="background-color: #2980b9; color: white; padding: 5px; text-align: center;"> NOTE </div> <ul style="list-style-type: none"> • Station contains delicate components! <ul style="list-style-type: none"> – 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 CE Declaration of Conformity

	 WARNING
	<ul style="list-style-type: none">• General machine safety, CE conformity<ul style="list-style-type: none">– 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	
	<ul style="list-style-type: none">• Damage to the safety window<ul style="list-style-type: none">– 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.

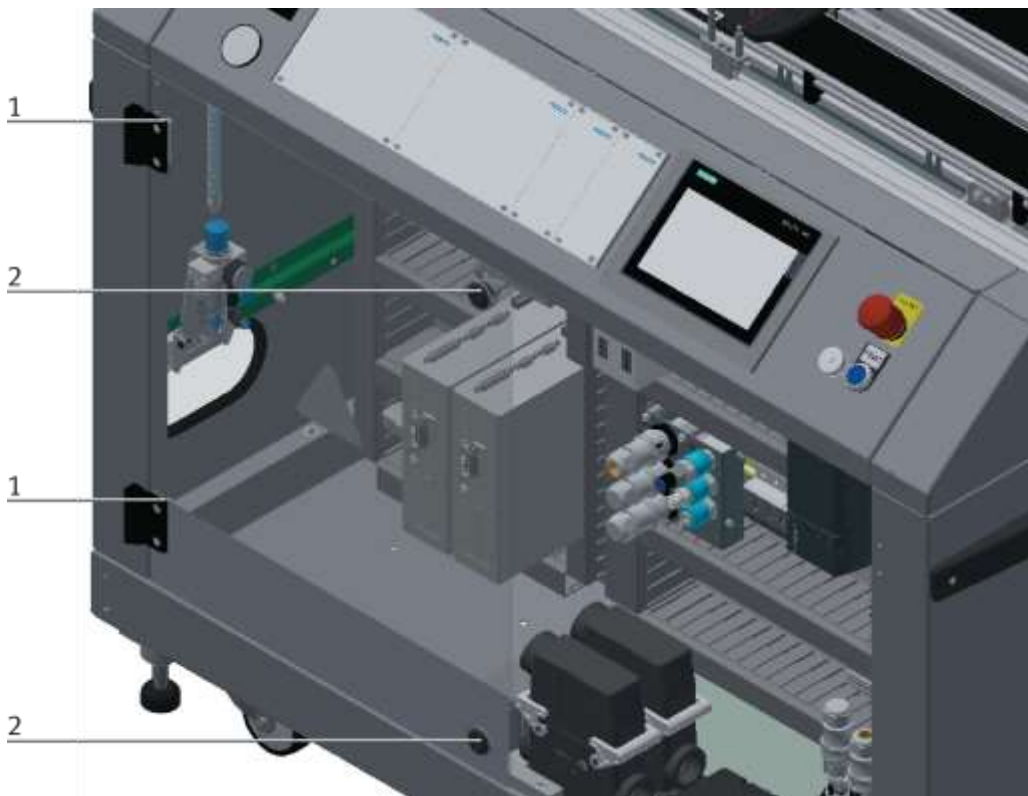


Illustration similar

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 Safe box detection

If there is no box in the cell, one could reach into the working area of the robot with the hand. To prevent this, warning notices are attached to each box position. In addition, the box is detected with safe inductive sensors. As soon as there is no box, a safety stop 1 is triggered so that the robot cannot move at all.

4.12.5 Protective unit at robot station



Illustration similar

1. If no other station is installed and the workpiece carriers are not transferred to a following station, the protective unit must be installed to prevent access to the station. This applies to both sides of the station.



Illustration similar

2. If another station is installed and the workpiece carriers are transferred to a following station, the protective unit of the station must be removed. This applies to both sides of the station.

4.12.6 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.

4.12.7 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 data

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	2,5 A
Control voltage, Voltage for small actuators	24 V DC Protective extra-low voltage (PELV)
Power supply connection	IEC 60309, CEE 16 A
Max. backup fuse for installation	16 A
Leakage current	≤ 18 mA
Connecting cable between stations	System 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)	≤ +3°C
Ambient conditions	
Operating environment	Use inside building only
Ambient temperature	5°C ... 40°C
Rel. air humidity	80% up to 31°C
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	

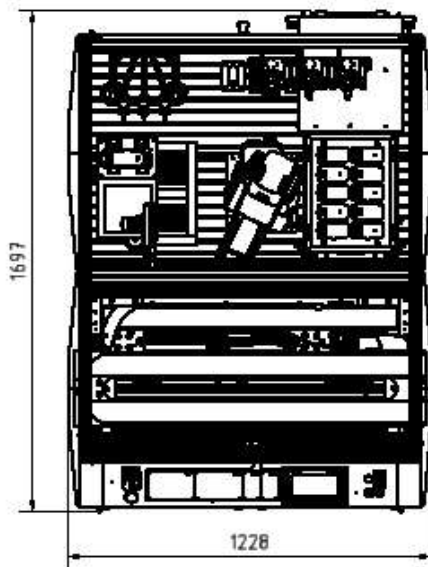
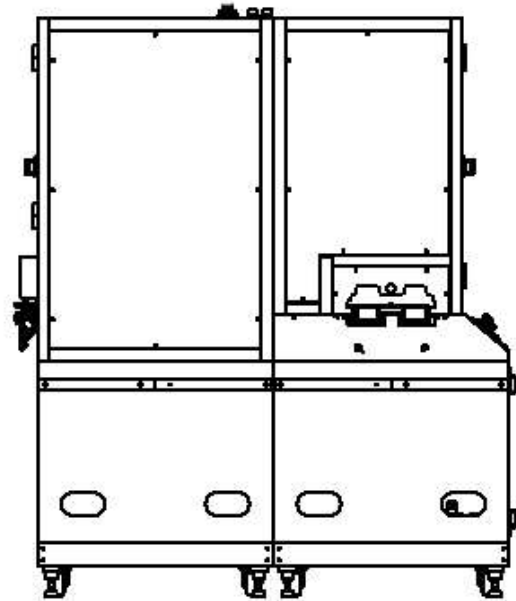
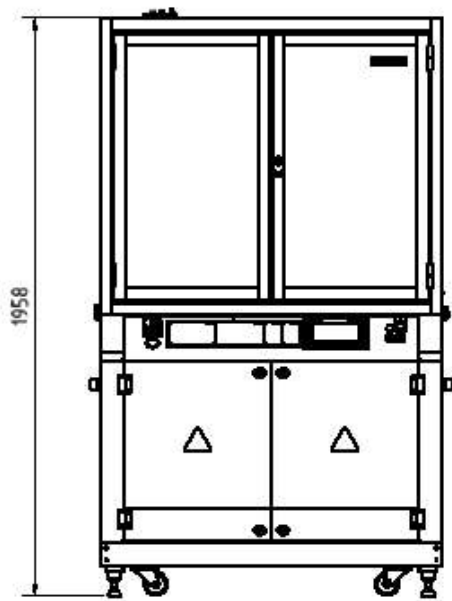


Illustration similar

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

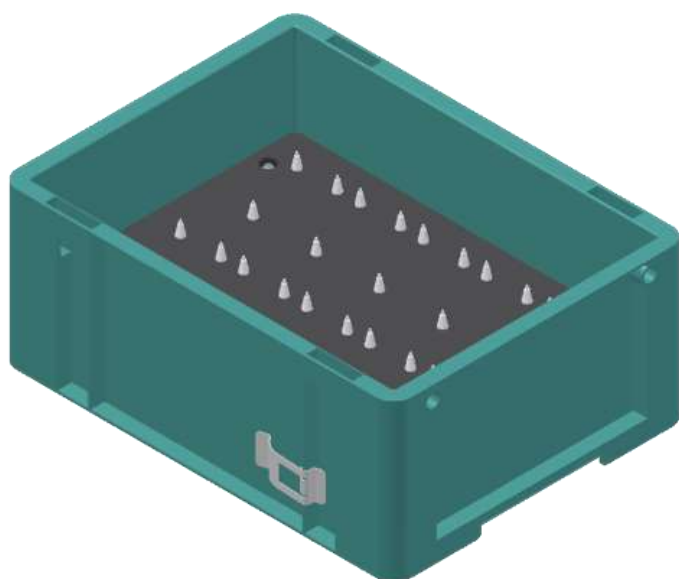


Illustration similar

Box with retainer for 10 PCB's
Partnumber in MES – 27




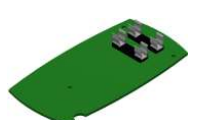



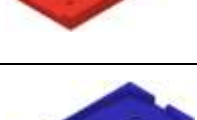






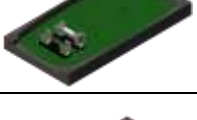




Illustration similar

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
	<ul style="list-style-type: none">• Damage to transport equipment when moving heavy machines/machine sections<ul style="list-style-type: none">– When the stations are shipped out, extra care must be taken to ensure that heavy machines/machine sections are always transported using a suitable forklift 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
	<ul style="list-style-type: none">• Securing transit routes<ul style="list-style-type: none">– 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<ul style="list-style-type: none">– 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
	<ul style="list-style-type: none">• Danger of crushing for hands/feet<ul style="list-style-type: none">– 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.

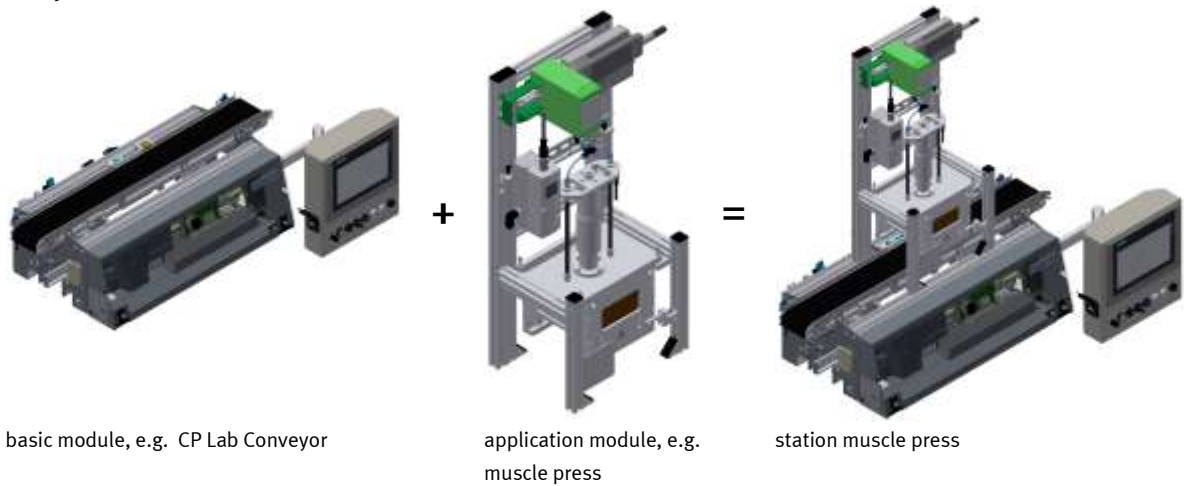
**NOTE**

- 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 muscle press is attached to a basic module, it becomes a station.

Example

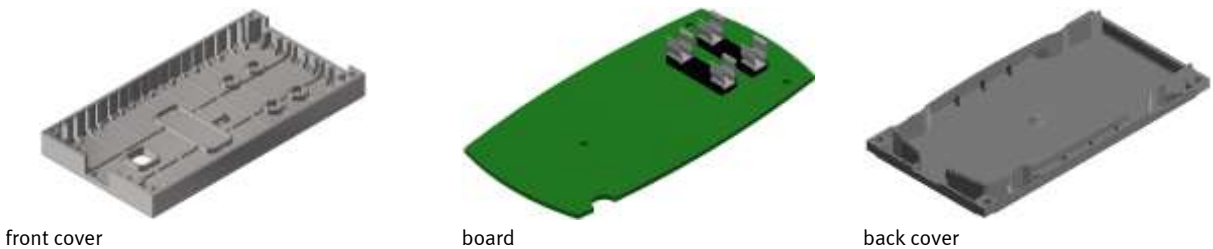


If several stations are put in a row one behind the other, this will form a production line.



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.



7.3 Robot assembly

7.3.1 General information

The robot assembly consists of a 1200 mm long two-track conveyor line with bypass and a assembly cell.

The conveyors are 80 mm wide. On the conveyors, there are boards transported on pallet carriers.

The bypass is for shorter cycle time, because the carrier is on a third conveyor and other conveyors can pass the station without operation.

The conveyors are for transporting boards on carriers.

The pallet carriers are equipped with a read/write ID system. This ID system represents a very important part of the CP Factory System. The pallet carriers are written with the current data of the workpiece to be transported. Thus all information required for the process is carried together with the workpiece/pallet carrier and is available at every operating position.

An aluminum board on a basic frame has been attached to the conveyor line. On this board, there is a 6 axis robot as well as the corresponding peripheral equipment. The robot is responsible for the handling of all processes within the module.

A change-over gripper system has been built in so that the different workpieces can be gripped reliably. The station is designed for equipping the workpiece with a printed circuit board as well as with several fuses.

Having finished all mounting works, there will be a final visual inspection. You can use the separate camera which is available for this.

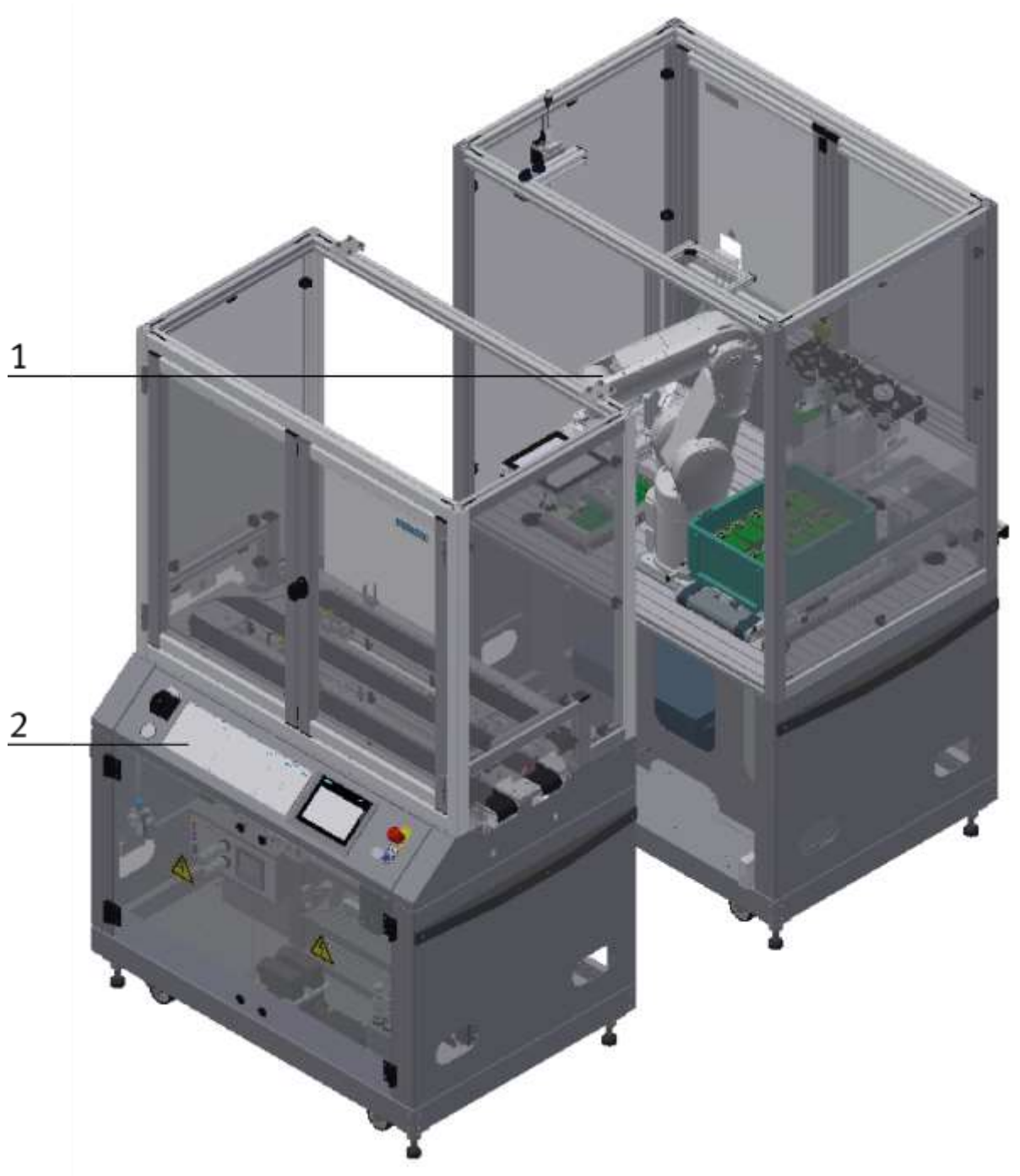
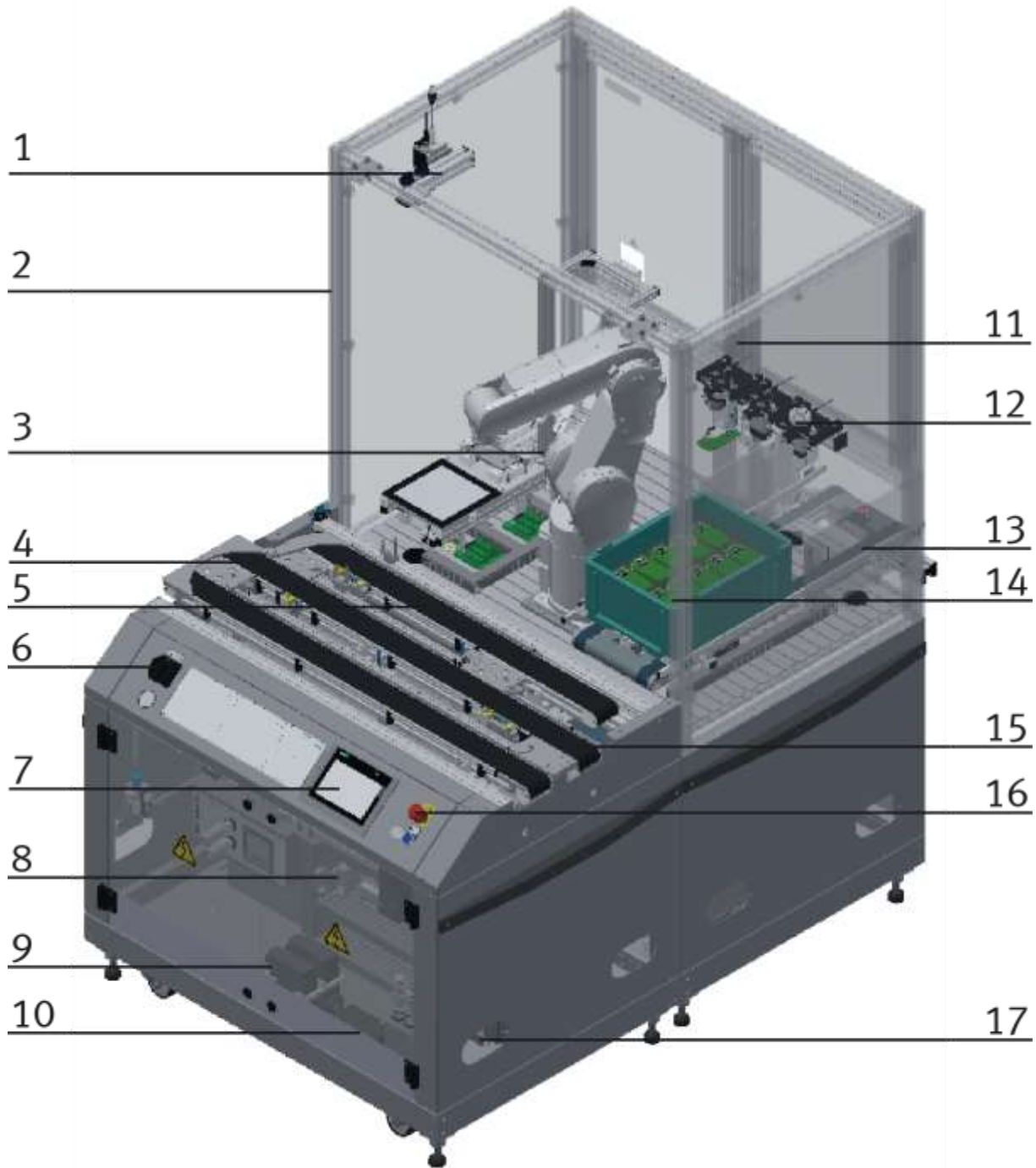


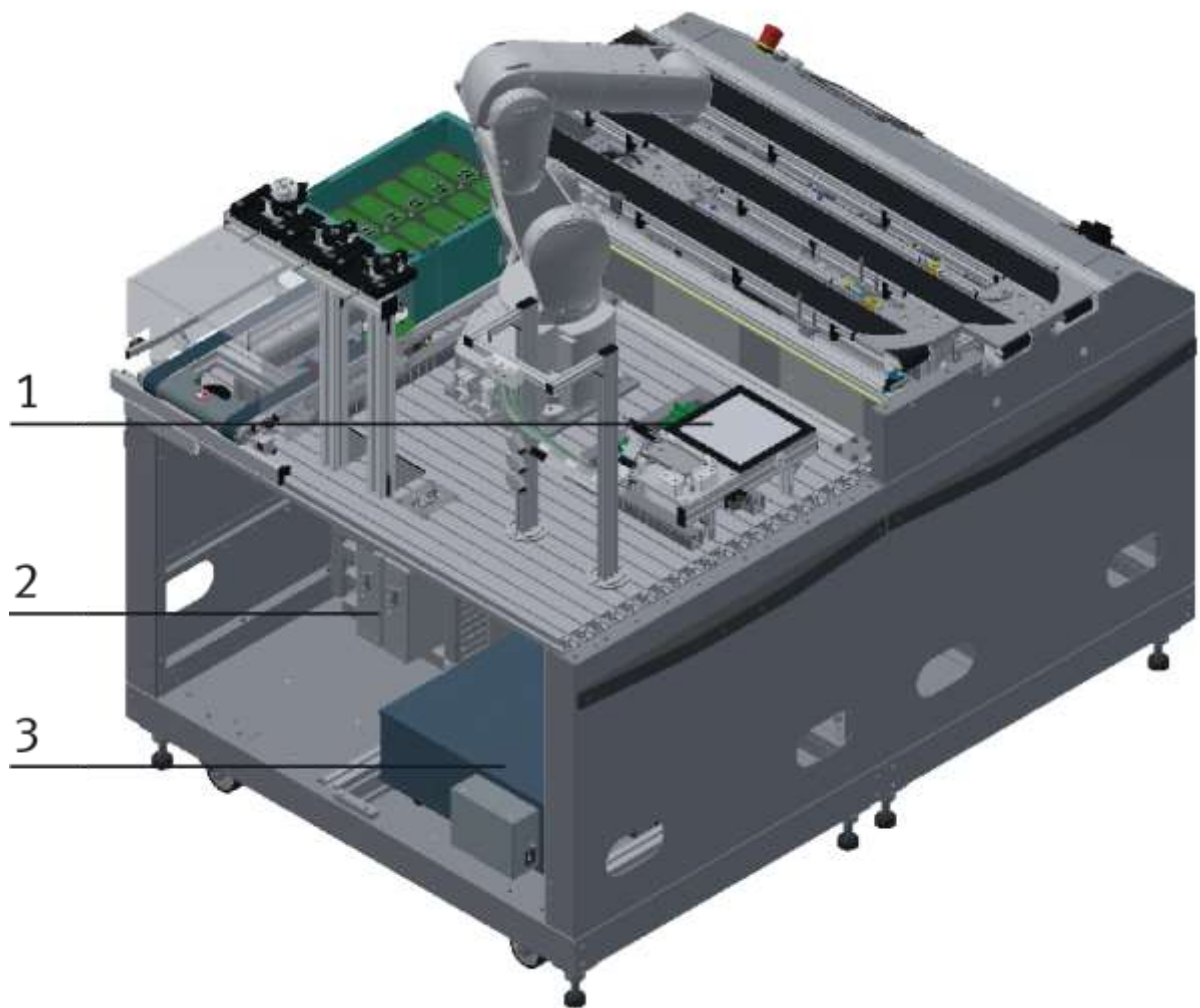
Illustration similar

Position	Designation
1	Robot Assembly cell with robot
2	Conveyor with bypass



CP Factory Robot Assembly Cell / illustration similar

Position	Designation
1	Camera: Festo SBSA-U-PF-R6C-FM-W / 8143672 (Sensopart V20C-ALL-P3-W-M-M2-L-90)
2	Safety housing / partly faded out
3	Robot
4	Conveyor
5	Operating position / pallet carrier
6	Main switch control panel
7	Touch panel / Control panel
8	E-Board for basic module bypass
9	Multicontact plugs
10	Pressure switches (option for energy monitoring) and RFID
11	Safety switch doors rear side
12	Change-over gripper system for 3 grippers
13	Conveyor for pallet supply
14	Pallet with waiting workpieces
15	Replacement guide board / additional module attached
16	Emergency-stop control panel
17	Supply line



CP Factory Robot Assembly Cell / illustration similar

Pos	Designation
1	LED-floodlight for visual inspection
2	E-Board Application
3	Drive Unit CR750 D

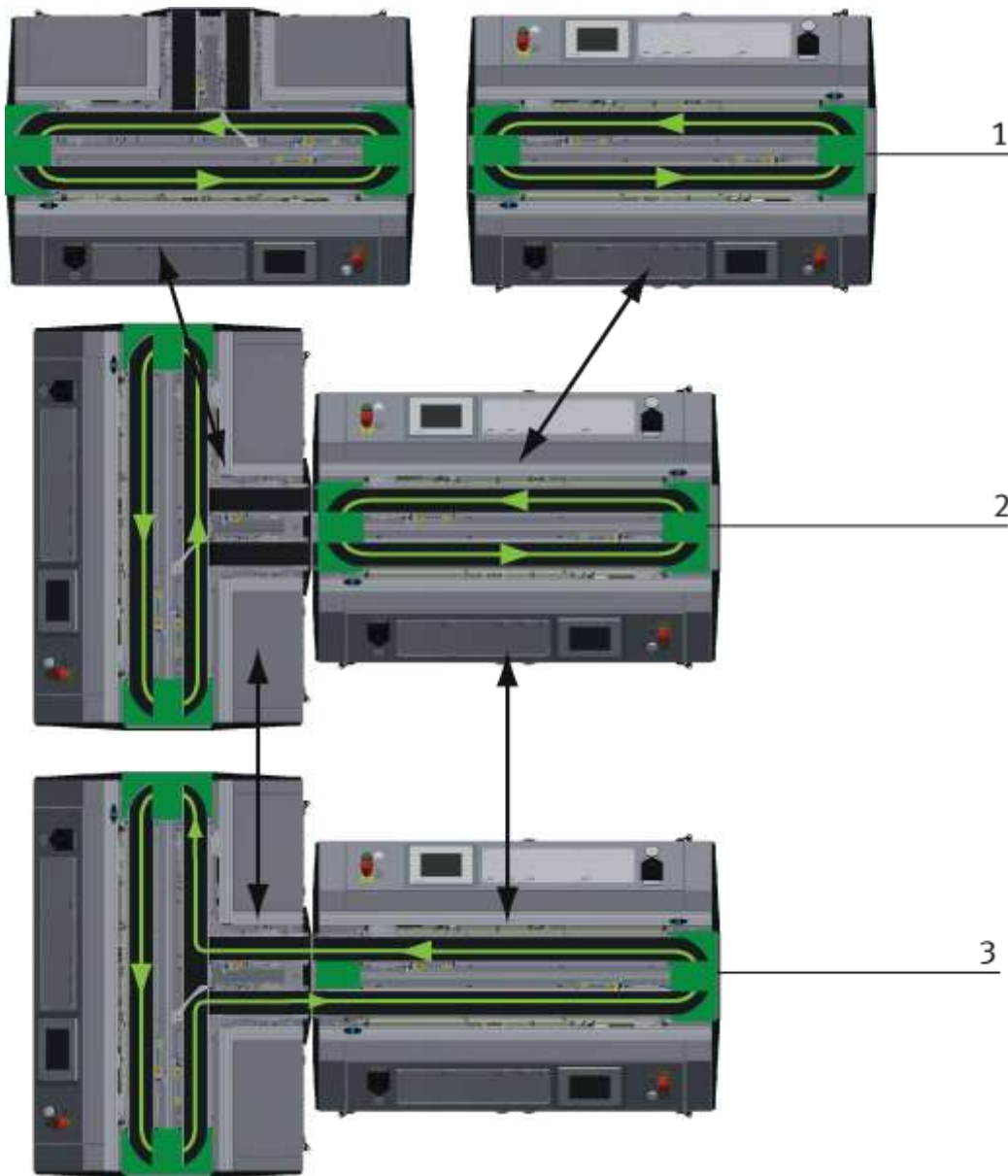
7.4 Mechanical setup general

The robot assembly cell is designed for operation from one side (1). The module is equipped with mechanically adjustable feet. If it is necessary to move the module, the module can be lowered onto the rollers and easily transported.



Illustration similar

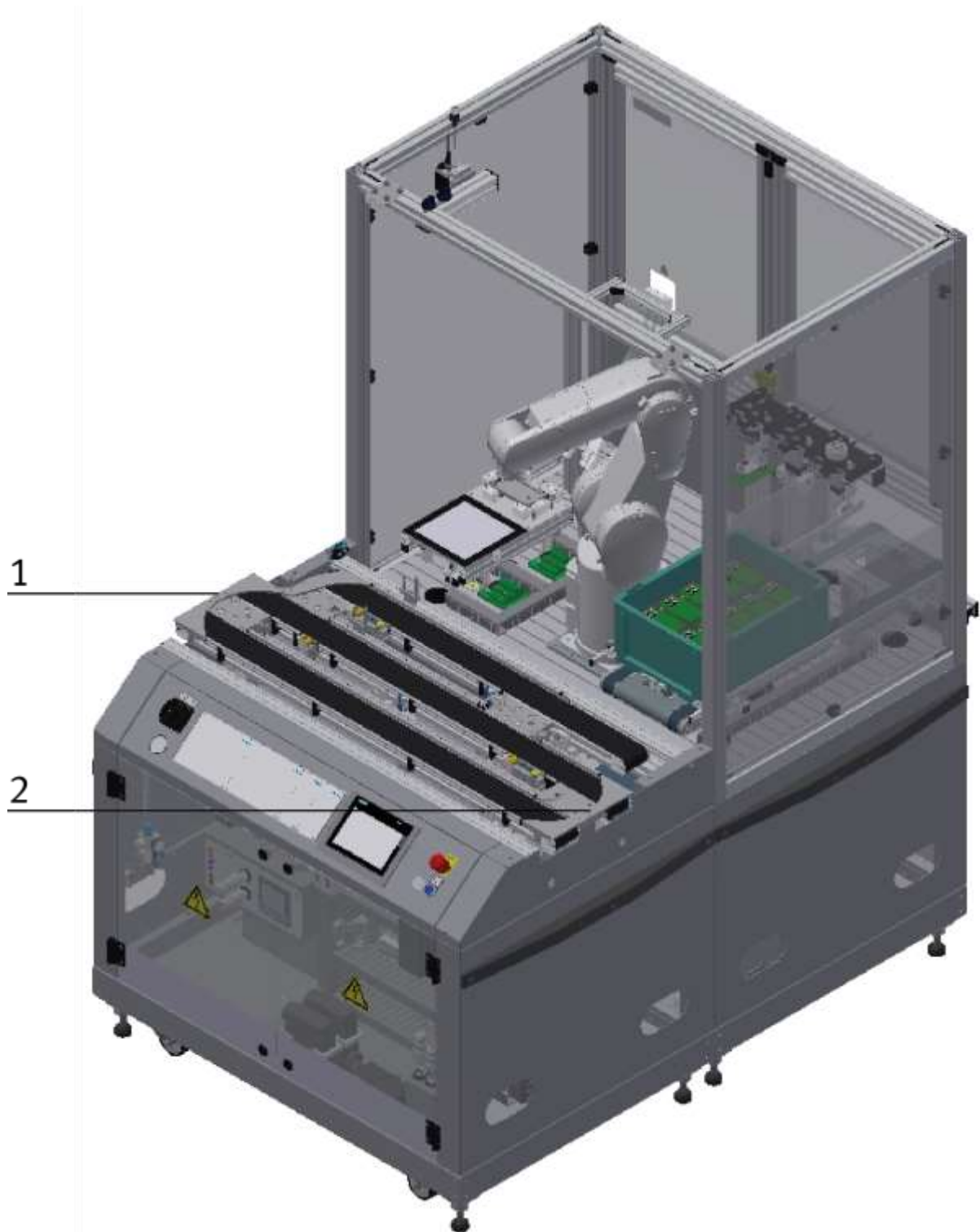
The modules can be operated in two ways - as a single station or in a chain with further modules. When connected to a further module, it is necessary to replace the deflection at the end of the band by means of a support plate. The switch is an exception, if this is operated as a single station, it is not possible to eject or introduce workpieces via the switches.



Installation Options example / illustration similar

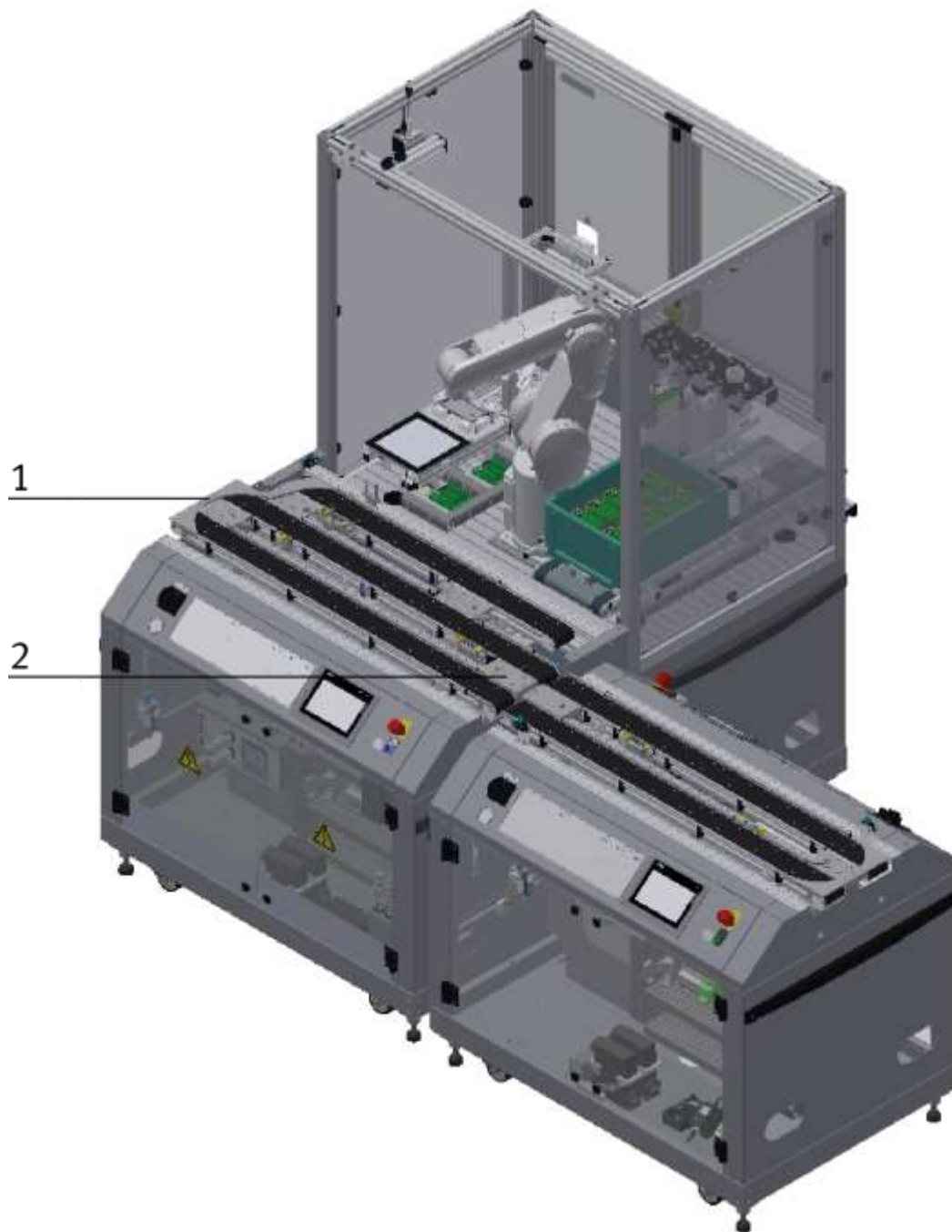
With the pluggable tape deflections there are different possibilities to control the transport flow. Depending on this, different modules can be operated individually or in combination.

Position	Description
1	Operation as independent Basic Module /not put together
2	Operation as independent Basic Module /Basic Module put together
3	Operation connected with another Basic Module



Installation as independent module / illustration similar

Position	Description
1+2	corner pulley – the pallet carrier is reversed from one conveyor to the other on the basic module



Installation in combination with a basic module / illustration similar

Position	Description
1	Replacement guide board (support plate) if connected to another basic module – the pallet carrier is not reversed but directed to the next basic module
2	corner pulley – the pallet carrier is reversed from one conveyor to the other conveyor on the basic module

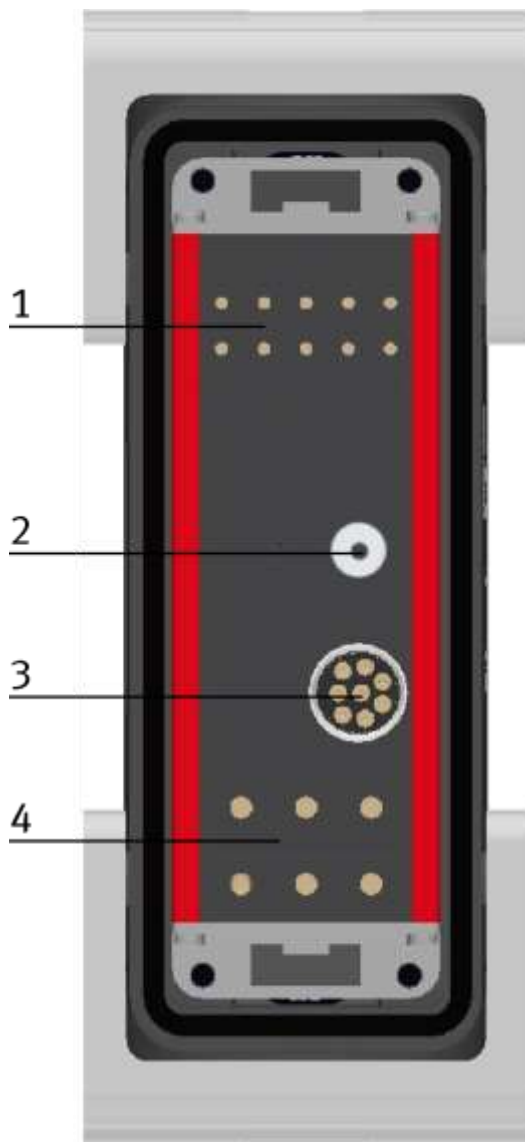
The corner pulley and the support plate are only pinned and can be changed easily without tools.

7.4.1 Supply of the basic module general



CP Factory supply / illustration similar

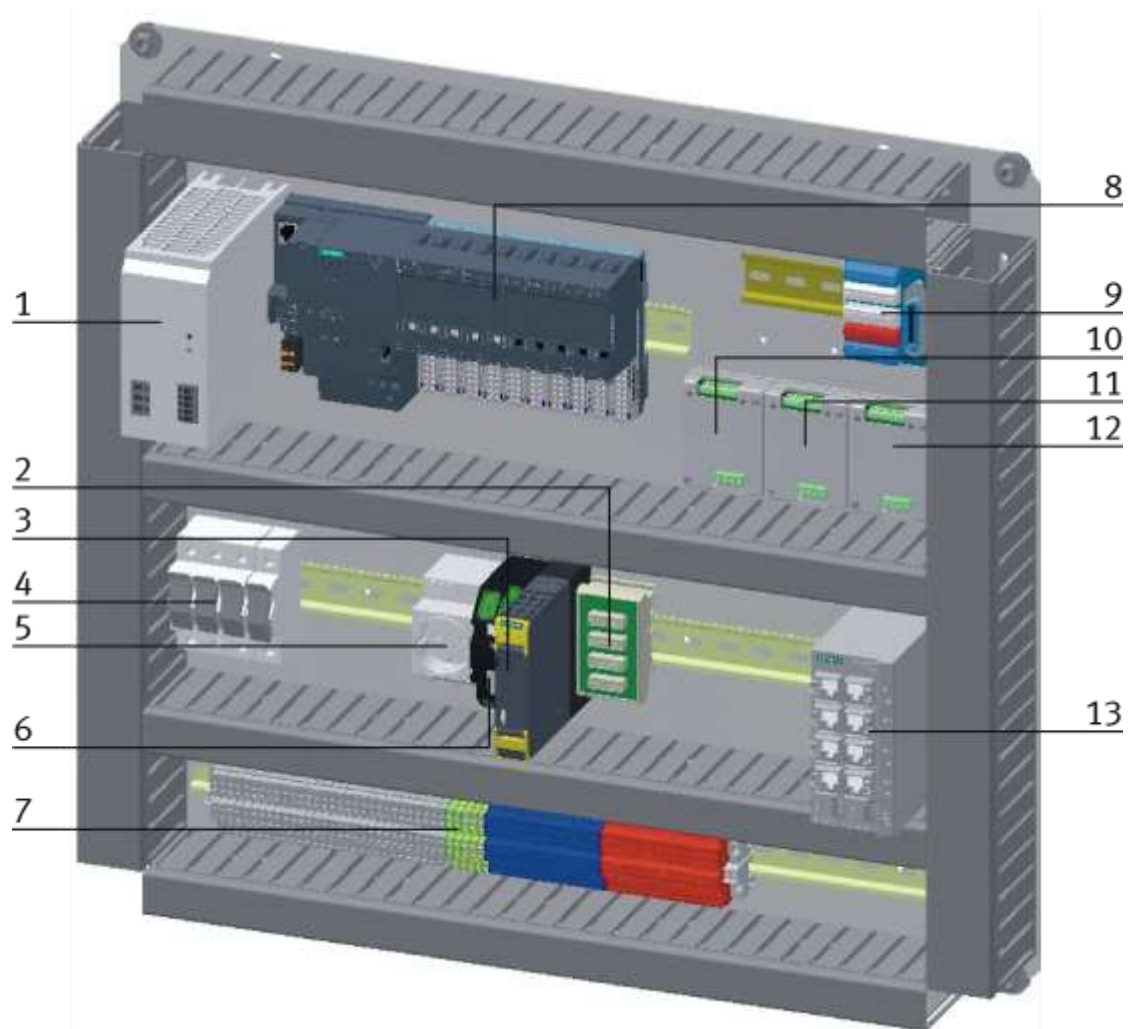
Position	Description
1	Inlet port for connection tube with voltage, communication and pneumatics
2	Connection plug K2-XZ1
3	Connection plug K2-XZ2
4	Outlet port for the connection tube of a further basic module



Position	Description
1	Emergency chain linking
2	Pressure
3	Network
4	400 V

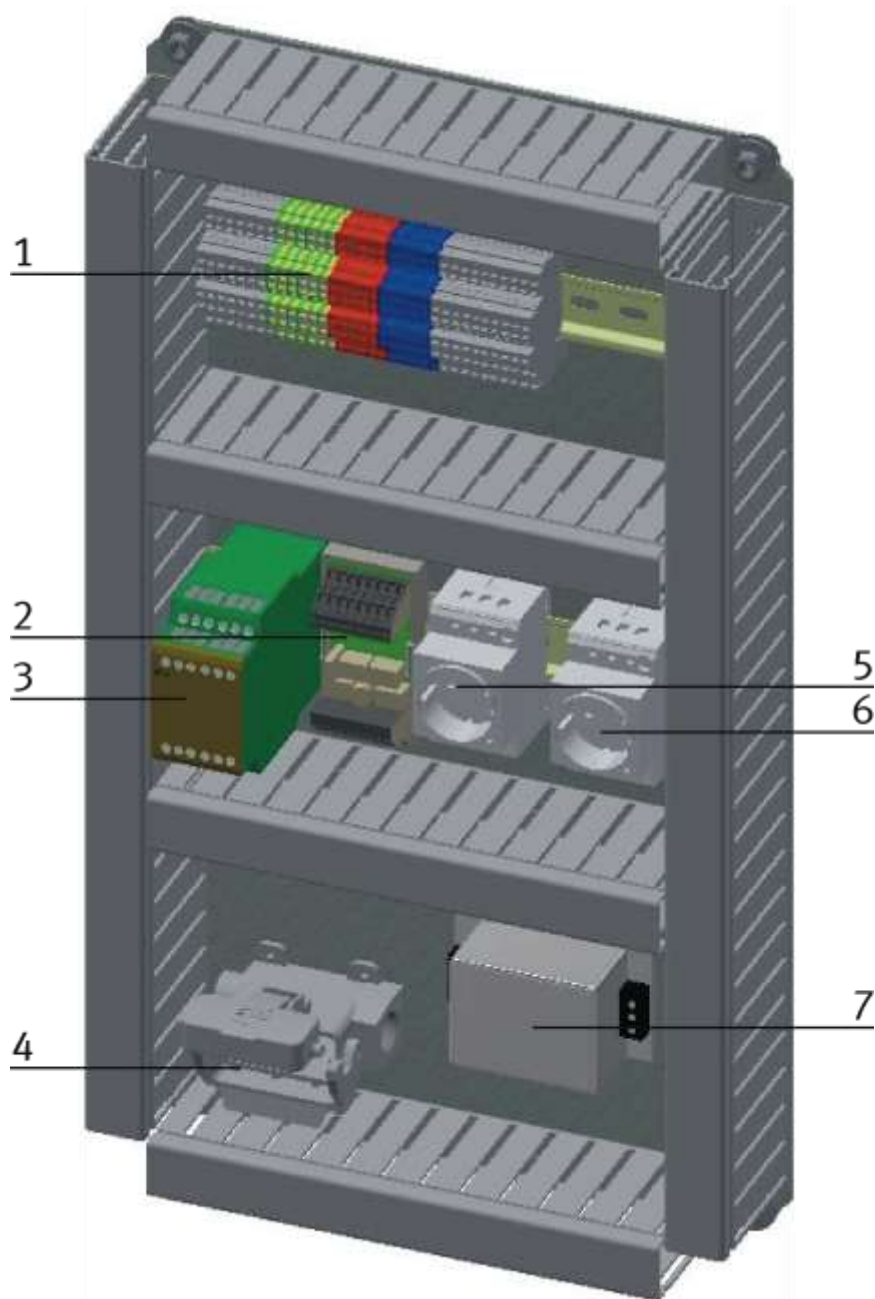
7.5 Electrical Setup

The Robot Assembly Cell has got two electric boards. The main electric board has been mounted in the front side of the housing (conveyor with bypass). On the back side (assembly cell), the electric board for the assembly application is built in. Also the drive unit is placed in the back side of the robot assembly cell.



Electric board Robot Assembly front side with bypass / illustration similar

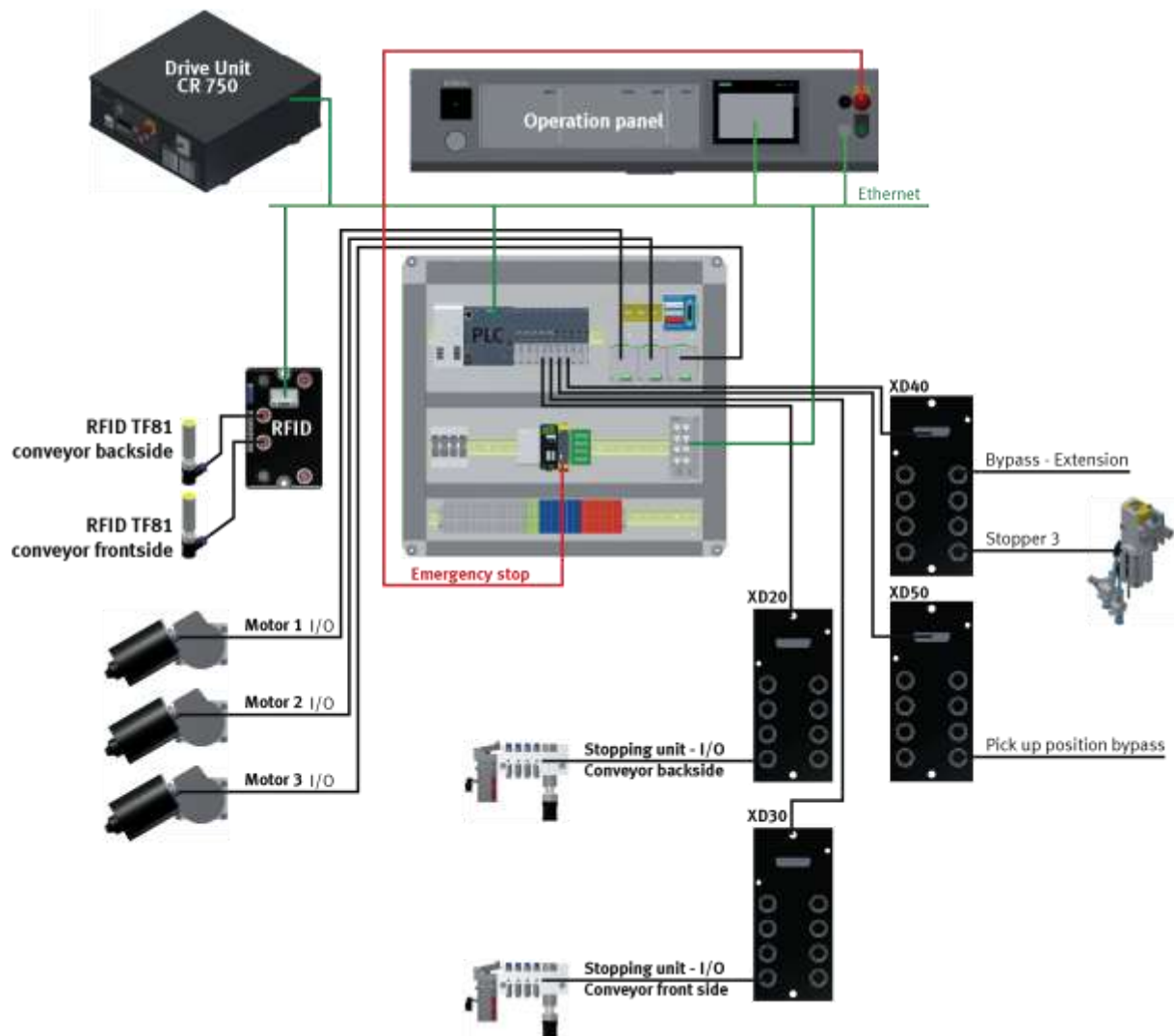
Position	Designation	BMK	Description / Ordernumber
1	Power supply unit 24 V	K1-TB1	Festo CACN-3A-1-10 / 2247682
2	Emergency stop board	K1-F2-XZ2	
3	Emergency stop Unit	K1-F2-KF1	Siemens / 3SK1111-2AB30
4	Fuses	K1-FC1 + K1-FC2	
5	Receptacle	K1-XJ4	
6	ELEC AUX CIRCUIT	K1-FC4	Murr Elektronik / 9000-41042-0100600
7	Clamps	K1 XD0-K1-XD13	
8	CPU	K5-KF1	ET 200 SP CPU 1512SP F-1 P
9	I/O Terminal	K1-XD15	
10	Start-up current limiter	K1-QA1	Kaleja M-MZS-4-30 / 06.05.020
11	Start-up current limiter	K1-QA2	Kaleja M-MZS-4-30 / 06.05.020
12	Start-up current limiter	K1-QA3	Kaleja M-MZS-4-30 / 06.05.020
13	Ethernet switch	K1-XF1	Siemens Scalance XB008 / 6GK5008-OBA00-1AB2



Electric board backside assembly cell /illustration similar

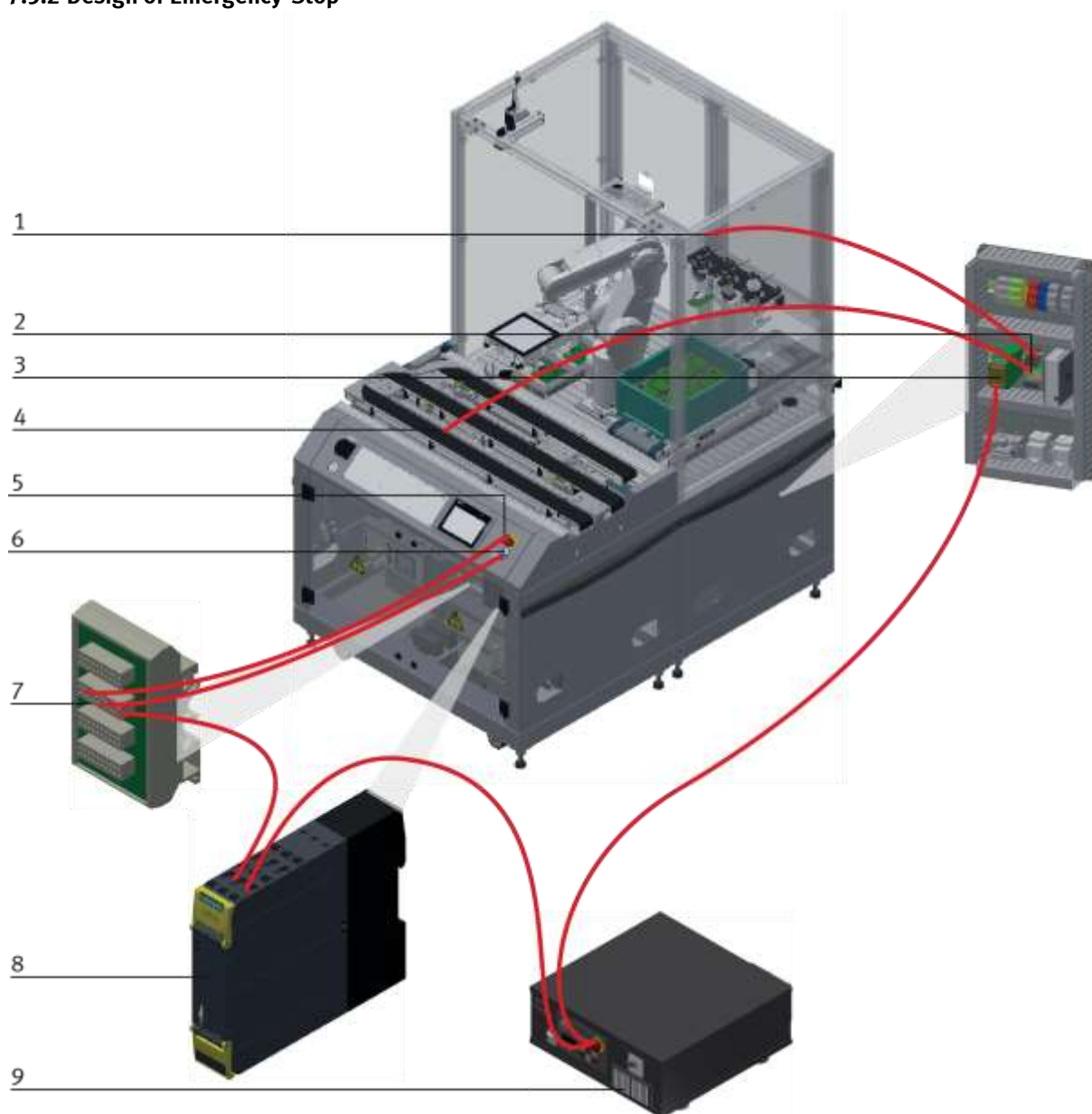
Position	Designation	BMK
1	Clamps	XD1 / XD10
2	PSEN iX1	F2-KF3
3	Emergency stop unit PNOZ X8P	F2-KF2
4	Harting Plug	XJ4
5	Receptacle	XD3
6	Receptacle	K6-XD6
7	Netfilter MIT-SUP-EL20-ER-6	K6-KF2

7.5.1 Cabling chart



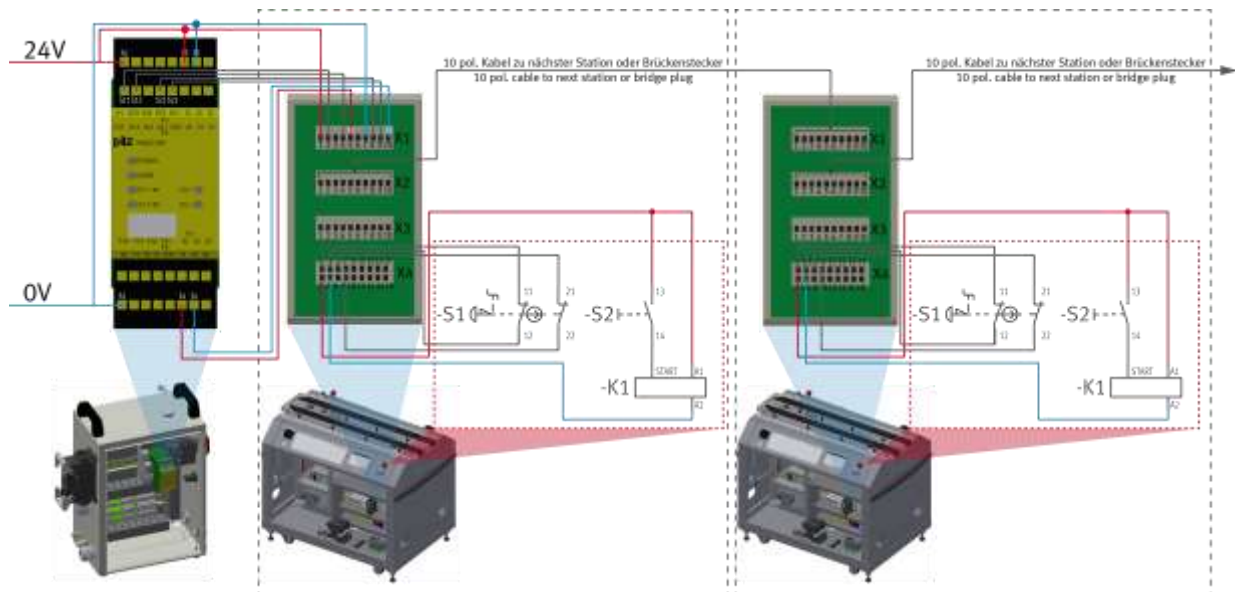
Cabling chart Mitsubishi / Siemens / illustration similar

7.5.2 Design of Emergency-Stop



Design of the Emergency-Stop system / illustration similar

Position	Name
1	Safety door/ F2-FQ1
2	PSEN iX1 / F2-KF3
3	PNOZ X8P / F2-KF2
4	Safety door / F2-FQ2
5	Emergency-stop pushbutton F2-FQ1 / to emergency stop board X4:1; X4:3; X4:5; X4:7
6	Reset Pushbutton 1S2 / to PNOZ S33+S34; indicator light terminal strip 24VNA/0V+
7	Emergency stop board for emergency chain linking / F2-XZ2
8	Emergency stop Unit / F2-KF1
9	Drive unit / K6-KF1



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.

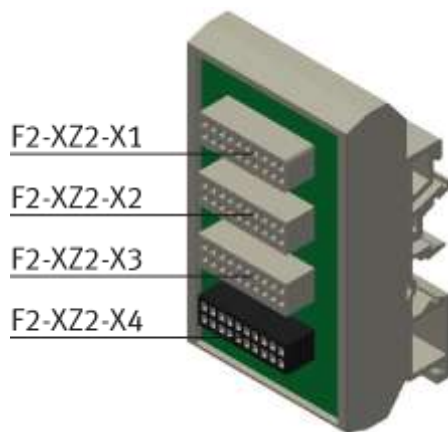


Illustration similar

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

7.6 Commissioning

The Robot Assembly Cell has got several components which have to be attached on starting up. The procedure will be described on the following pages.

7.6.1 Pneumatic Commissioning

The mechanical setup must be finished and completed. At first, you have to connect the module to the pneumatic system of the room. The corresponding service unit has to be provided by the customer and should be placed right next to it. The quick coupling plug has got a nominal size of 5 mm. If the local system has got a nominal size of 7.9 mm, it is possible to exchange the quick coupling plug of the service unit for a bigger one (adapter 1/8 to 1/4 necessary).

Now the station can be supplied by 6 Bar and the pneumatic commissioning is completed.

7.6.2 Electrical Commissioning

Now the Robot Assembly Cell has to be supplied with electric voltage (400 V). The voltage has to be provided by the customer. Professional installation must be guaranteed as well.

7.7 Visual inspection

The visual inspection must be carried out before each start-up!

Before starting the station, check:

- the electrical connections
- the correct fit and the condition of the compressed air connections
- the mechanical components for visible defects
(Cracks, loose connections, etc.)
- the emergency stop devices are working

Eliminate any damage found before starting the station!

7.8 Adjusting Sensors

7.8.1 Proximity switch (stopper Identsensor)

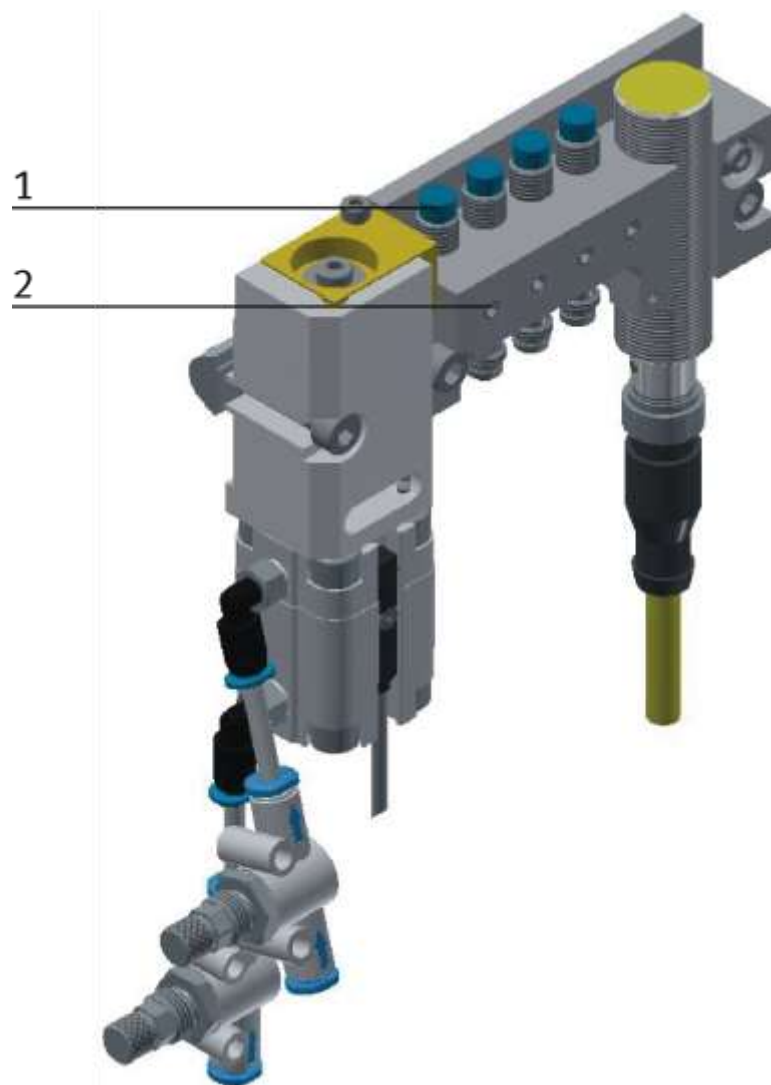


Illustration similar

Position	Description
1	Sensor stopper identify sensor / 150395 (SIEN-M8NB-PS-S-L) 1 position (BG21/BG31/BG41) 2 position (BG22/BG32/BG42) 3 position (BG23/BG33/BG43) 4 position (BG24/BG34/BG44)
2	Screw to clamp the sensor

The proximity switches are used for controlling the pallet.

Requirements

- Stopper unit is attached to the conveyor.
- Electrical connection of the proximity switches is set up.
- Power supply is available.

Procedure

1. The stopper is in upper position, a pallet is stopped at the stopper.
2. Shift the switch as long as the switching status display (LED) appears.
3. Shift the proximity switch into the same direction by a few millimeters as long as the switching status display disappears.
4. Shift the proximity switch halfway between the start-up and end position.
5. Tighten the locking screw of the proximity switch with an Allen key SW 1,3.
6. Check the position of the proximity switch by repeated removing the pallet.

Documents

- Data sheets / operating instructions
Proximity Switch 150395 (SIEN-M8NB-PS-S-L)

7.8.2 Fibre-optic (workpiece detection – conveyor start/end)



Illustration similar

Pos	Designation
1+2	Fibre-optic (BG1 / pallet at the front)
3+4	Fibre-optic (BG2 / pallet at the back)

The through-beam sensor for detecting the tray on the conveyor consists of the fibre-optic unit and the fibre-optic. The fibre-optic unit works with visible infrared. You can move the fibre-optic by the fibre-optic reception in order to adjust the position on the conveyor. When the tray is placed on the start position of the conveyor or when the tray moves to the end of the conveyor, it will disconnect the through-beam sensor, and the fibre-optic unit will send a message to the control system.

Requirements

- Fibre-optic unit has been attached.
- Electrical connection of the fibre-optic unit has been made.
- Power supply unit has been switched on.

Procedure

1. Screw the two fibre-optic heads into the sensor holder.
2. Align the fibre-optics towards each other.
3. Attach the fibre-optics to the fibre optic unit.
4. Adjusting the fibre-optics: standard 1-signal if there is no tray „available at conveyor start/conveyor end“; if there is no 1-signal, please align the fibre-optic heads towards each other and adjust the fibre-optic potentiometer until 1-signal appears.

If there is a tray available at the start/end of the conveyor, the signal will have to be interrupted (0-signal).

Remark

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

5. Please check the adjustment by inserting a tray. .

Remark

It must be guaranteed that all trays are recognized.

Documents

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

7.8.3 Proximity switch (indexing units)



Illustration similar

Position	Designation
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

- Indexing unit has been attached.
- Pneumatic port of the cylinder has been made.
- Compressed air supply has been switched on.
- Electrical connection of the proximity switches has been made.
- Power supply is available.

Procedure

1. The cylinder is in its end position to be queried.
2. Move the proximity switch as far as the switching status display (LED) appears.
3. Move the proximity switch into the same direction by a few millimeters as far as 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 SW1.3.
6. Please check the position 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)

7.8.4 Proximity switch (tray request)



Illustration similar

Position	Description
1	Sensor tray inserted correctly (BG3) / 150395 (SIEN-M8NB-PS-S-L)

The proximity switch is used for checking the tray. On the right front side, the tray has got a threaded pin. By this threaded pin you can query the pallet's position; the proximity switch will recognize the threaded pin and then indicate the correct position of the tray.

Requirements

- Proximity switch with holder has been attached.
- Electrical connection of the proximity switches has been made.
- Power supply is available.

Procedure

1. The tray with the threaded pin on the front right side is positioned above the proximity switch.
2. Move the proximity switch as far as the switching status display (LED) appears.
3. Move the proximity switch into the same direction by a few millimeters as far as 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 holder.
6. Please check the position of the proximity switch by repeatedly placing the tray on.

Documents

- Data sheets/ operating instructions
Proximity switch SIEN -M8NB (150395)

7.8.5 Fibre-optic (fuse detection)

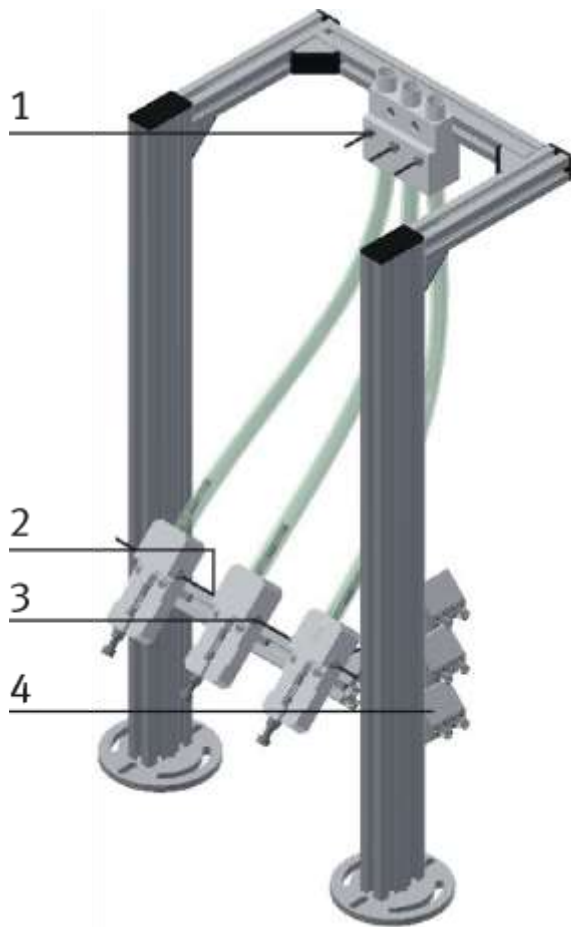


Illustration similar

Pos	Designation
1	Through beam sensor / 552812 (SOOC-TB-M4-2-R25) this exemplifies
2+3	Through beam sensor / 552812 (SOOC-TB-M4-2-R25) this exemplifies
4	Fibre-optic (BG60 / Tube fuse available) / 8127556 (D: SOEG-L-Q30-P-A-S-2L)

The top through beam sensor (1) is also for detecting the fuse, if a fuse is coming into the tube, the sensor recognize the fuse and the fibre optic unit will send a message to the control system.

The through-beam sensor for detecting the fuse in the fuse unit (2), consists of the fibre-optic unit and the fibre-optic. The fibre-optic unit works with visible infrared. You can move the fibre-optic by the fibre-optic reception in order to adjust the position. When there is only one fuse in the tube, it will connect the through-beam sensor, and the fibre-optic unit will send a message to the control system. With two fuses the sensor is disconnected and there is no message.

Requirements

- Fibre-optic unit has been attached.
- Electrical connection of the fibre-optic unit has been made.
- Power supply unit has been switched on.

Procedure

1. Screw the two fibre-optic heads into the sensor holder.
2. Align the fibre-optics towards each other.
3. Attach the fibre-optics to the fibre optic unit.
4. Adjusting the fibre-optics: standard 1-signal if there is no or just one fuse in the fuse unit available; if there is no 1-signal, please align the fibre-optic heads towards each other and adjust the fibre-optic potentiometer until 1-signal appears.
If there is are minimum 2 fuses in the fuse unit, the signal will have to be interrupted (0-signal).

Remark

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

5. Please check the adjustment by inserting and extracting the fuses. .

Documents

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

7.8.6 Fibre-optic (workpiece detection)

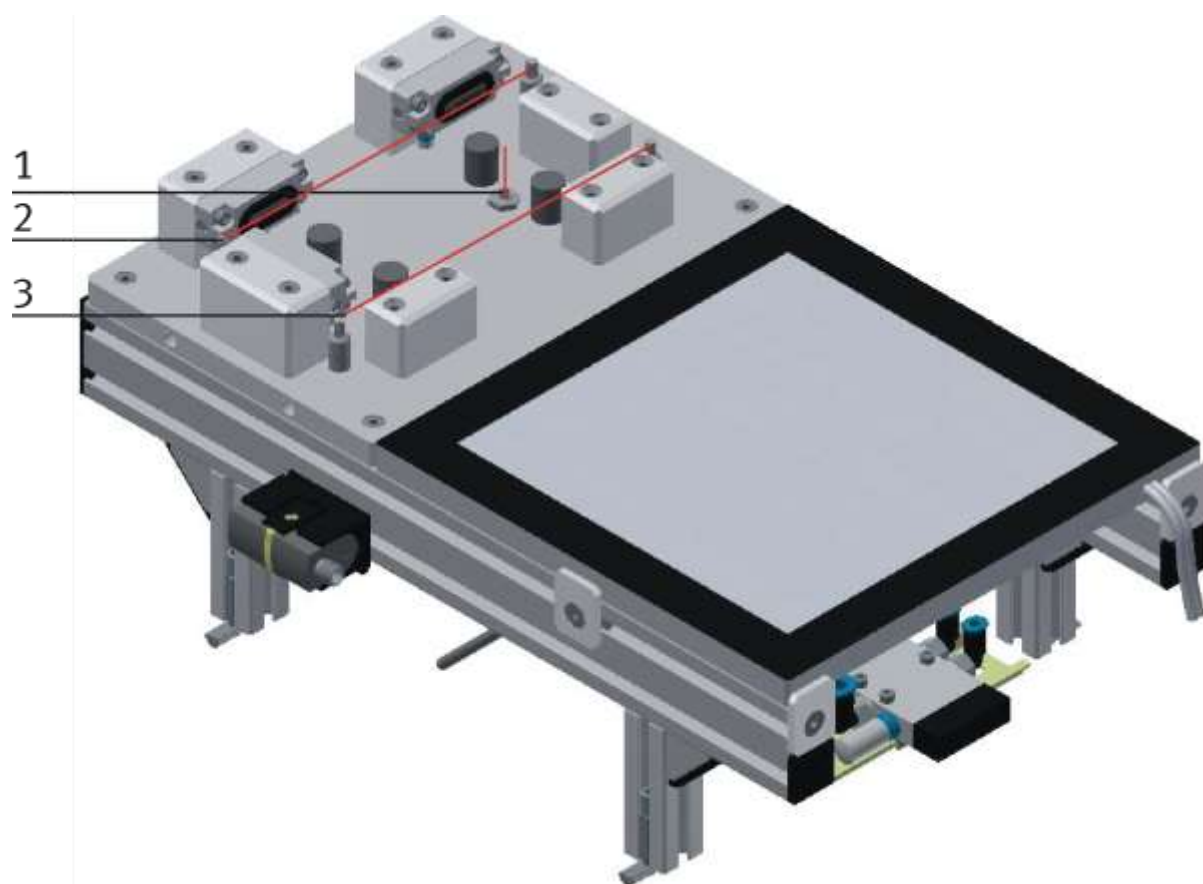


Illustration similar

Pos	Designation
1	Through beam sensor (BG12 / Mounting position housing loaded correctly 2) 552836 (SOOC-DS-M6-2-R25)
2	Through beam sensor (BG10 / mounting position housing available) / 552812 (SOOC-TB-M4-2-R25)
3	Through beam sensor (BG11 / mounting position housing available) / 552812 (SOOC-TB-M4-2-R25)

The through-beam sensor for detecting the housing in the mounting position, consists of the fibre-optic unit and the fibre-optic. The fibre-optic unit works with visible infrared. You can move the fibre-optic by the fibre-optic reception in order to adjust the position. When there is an housing in the position, it will disconnect the through-beam sensor, and the fibre-optic unit will send a message to the control system.

Requirements

- Fibre-optic unit has been attached.
- Electrical connection of the fibre-optic unit has been made.
- Power supply unit has been switched on.

Procedure

1. Screw the two fibre-optic heads into the sensor holder.
2. Align the fibre-optics towards each other.
3. Attach the fibre-optics to the fibre optic unit.
4. Adjusting the fibre-optics: standard 1-signal if there is no housing available; if there is no 1-signal, please align the fibre-optic heads towards each other and adjust the fibre-optic potentiometer until 1-signal appears.
If there is a housing available at the mounting position, the signal will have to be interrupted (0-signal).

Remark

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

5. Please check the adjustment by inserting a housing.

Remark

It must be guaranteed that all housings are recognized.

Documents

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

7.8.7 Pressure sensor (workpiece clamped)

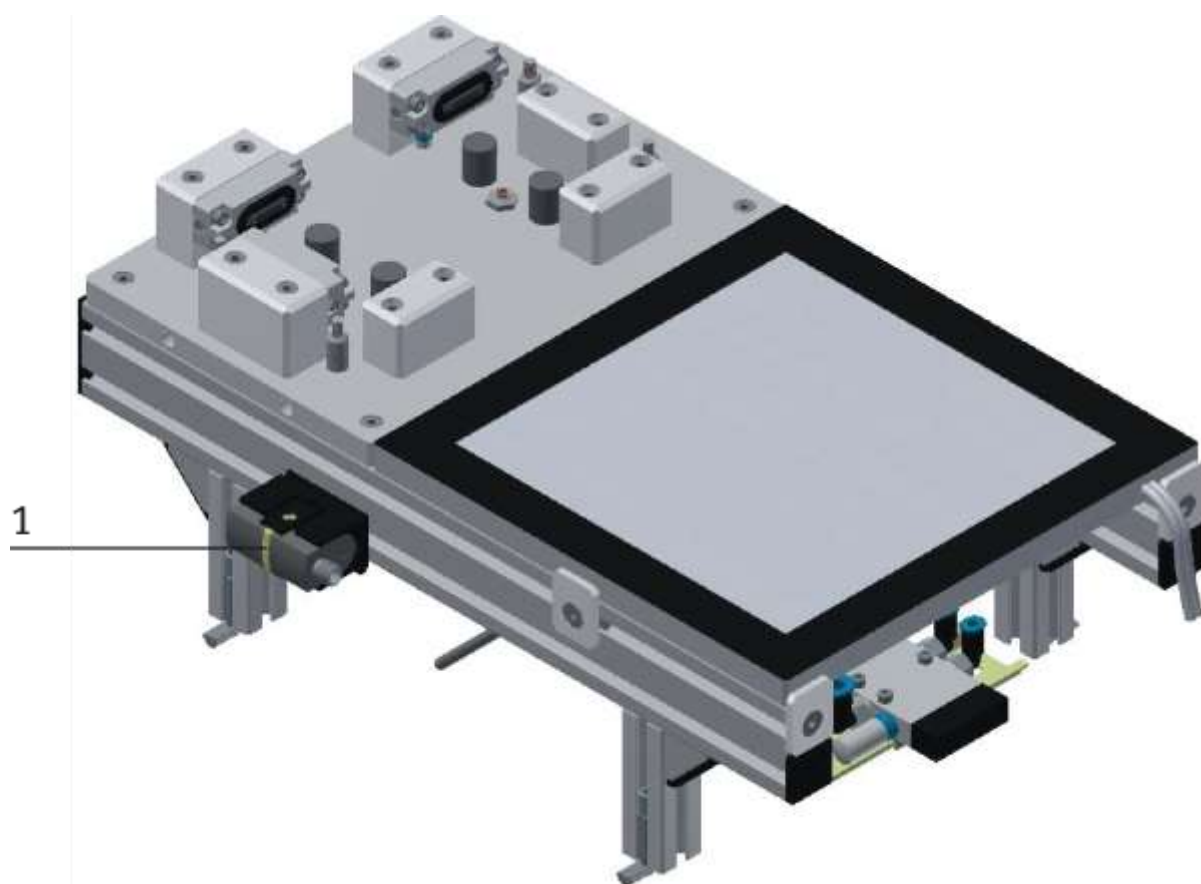


Illustration similar

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

1. Set the switching pressure SP with one teach pressure TP1
2. Switch on the operating voltage.
3. Pressurize the SDE5 with the desired teach pressure TP1.
4. Press the Edit button (> 2 s) until the LED flashes.
5. Let go of the Edit button.
The current teach pressure TP1 is saved as the switching pressure SP.
6. Ensure that there is power supply for at least 10 seconds.
7. Carry out a test run with various pressures to ascertain whether the SDE5 switches as desired. When the switching signal is emitted, the LED also lights up.

7.8.8 Proximity switch (gripper detection)

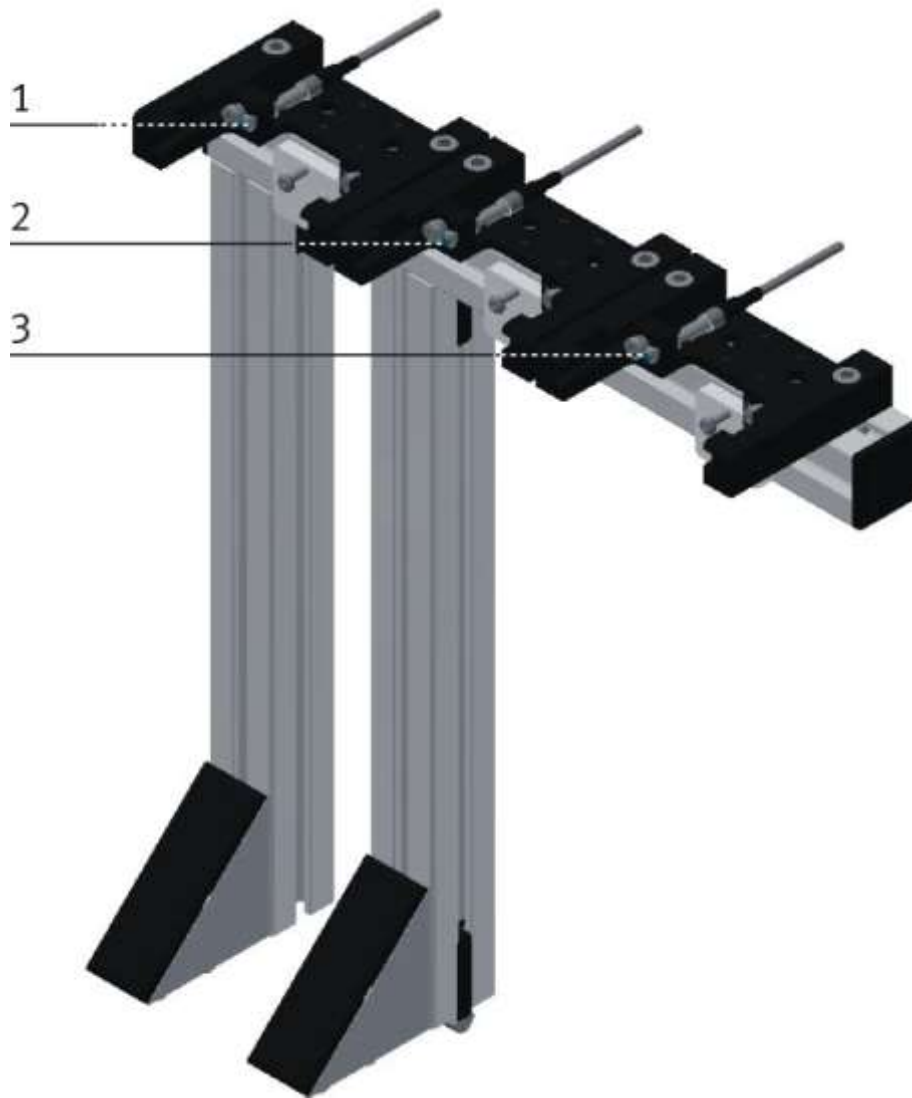


Illustration similar

Pos	Designation
1	Proximity switch (BG13 / depositing place gripper 1 vacuum) / 150371 (SIEN-M5B-PS-S-L)
2	Proximity switch (BG14 / depositing place gripper 2 workpiece) / 150371 (SIEN-M5B-PS-S-L)
3	Proximity switch (BG15 / depositing place gripper 3 fuse) / 150371 (SIEN-M5B-PS-S-L)

The proximity switch is used for checking the gripper.

Requirements

- Proximity switch with holder has been attached.
- Electrical connection of the proximity switches has been made.
- Power supply is available.

Procedure

1. The gripper is positioned in front of the proximity switch.
2. Move the proximity switch as far as the switching status display (LED) appears.
3. Move the proximity switch into the same direction by a few millimeters as far as 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 holder.
6. Please check the position of the proximity switch by repeatedly placing the pallet on.

Documents

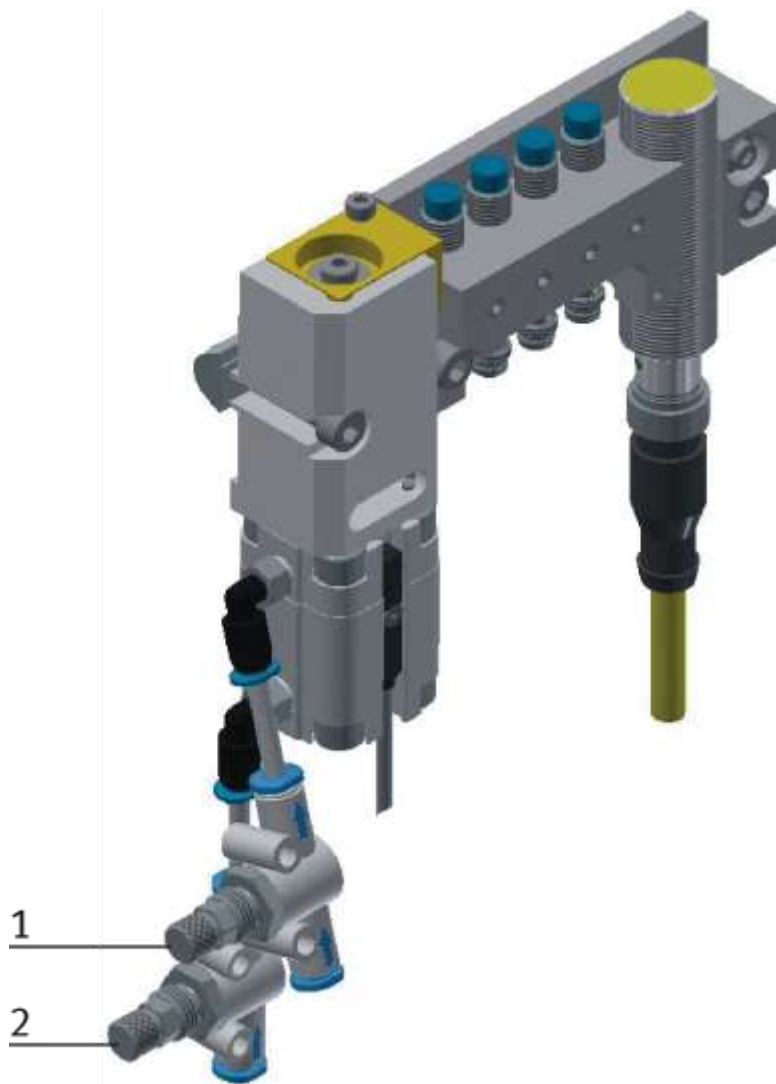
- Data sheets/ operating instructions
150371 (SIEN-M5B-PS-S-L)

7.9 Adjusting the one-way flow control valves



One-way flow control valves / illustration similar

Position	Designation
1	One-way flow control valves GRLA for indexing unit 1
2	One-way flow control valves GRLA for indexing unit 2



One-way flow control valves / illustration similar

Pos	Description
1	One-way flow control valves GRLA for stopper cylinder
2	One-way flow control valves GRLA for stopper cylinder

One-way flow control valves are used for the regulation of the exhaust air volume of 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 behavior even if the load changes).

Requirements

- Pneumatic port of the cylinders is set up.
- Compressed air supply is switched on.

Procedure

1. At first, turn off both one-way control valves completely. Then turn them on by about one rotation.
2. Start a test run.
3. Turn on the one-way flow control valves slowly as long as the required piston speed has been reached.

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 and the applications:

1. Establish mains supply 400 V AC.

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).

Now you can work with the station.

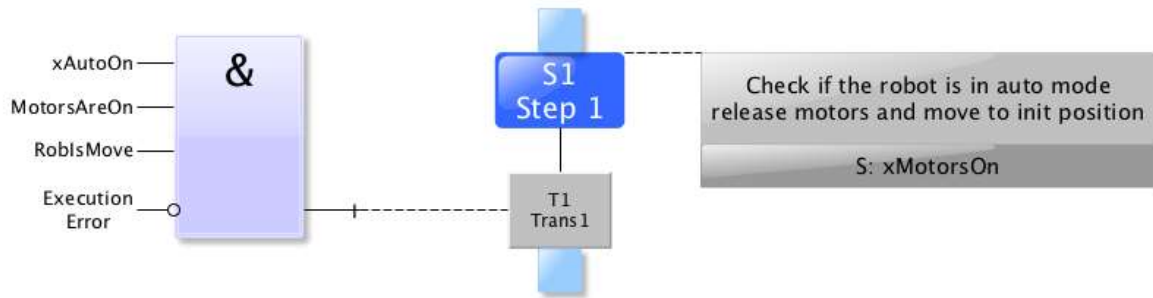
8.2 The control units of the Robot Assembly Cell



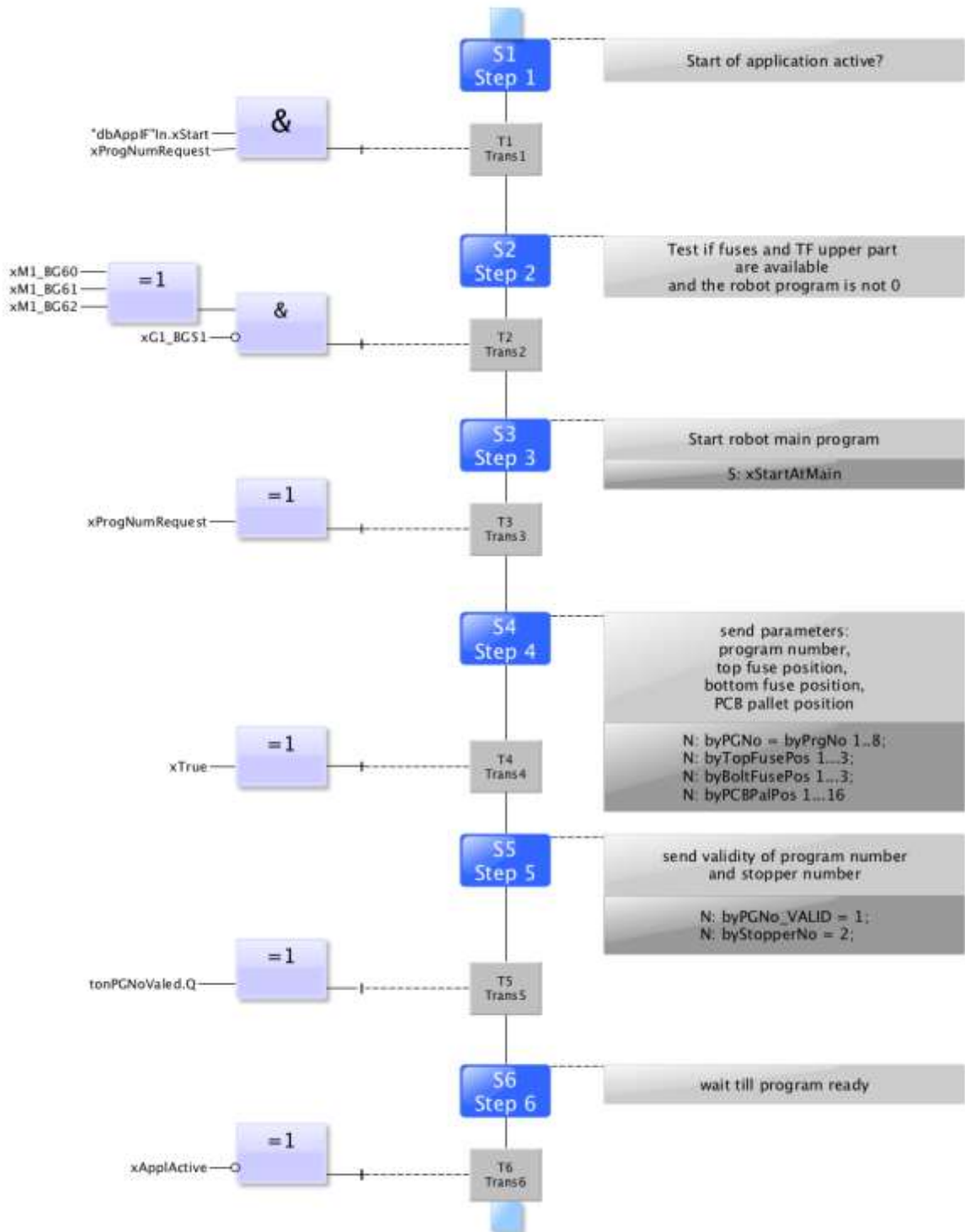
CP Factory control panel / illustration similar

Position	Description
1	Main switch - QB1
2	Manometer
3	Touch Panel – PH1 / Festo panel or Siemens panel possible
4	Network socket- XPN3
5	Emergency- stop switch – F2-FQ1
6	Reset pushbutton – F2-SF1
7	Switch operation mode (option)

8.3 Sequence Description of the Robot Assembly Cell



Adjust sequence



Automatic Mode

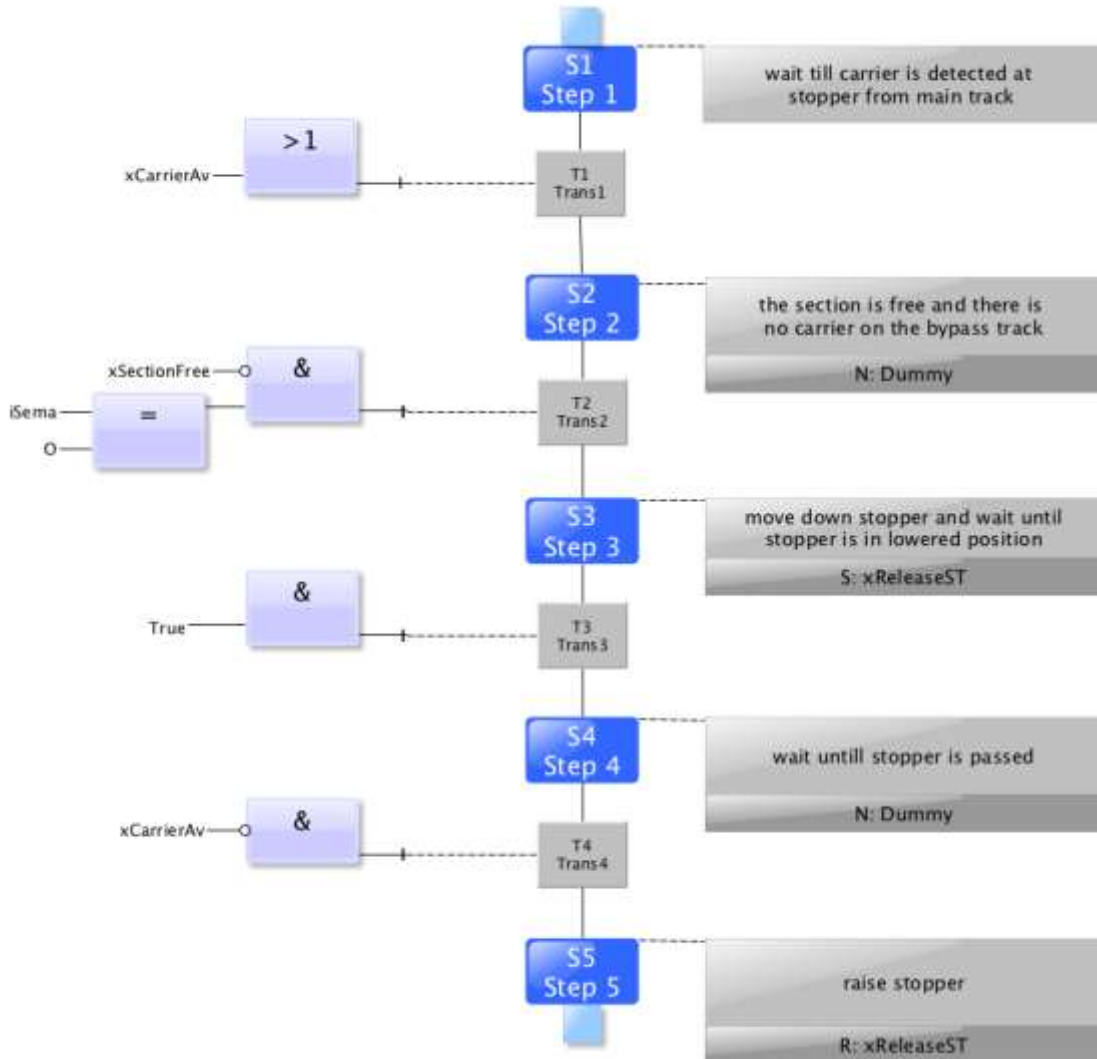
8.4 Sequence description of the Basic Module ByPass



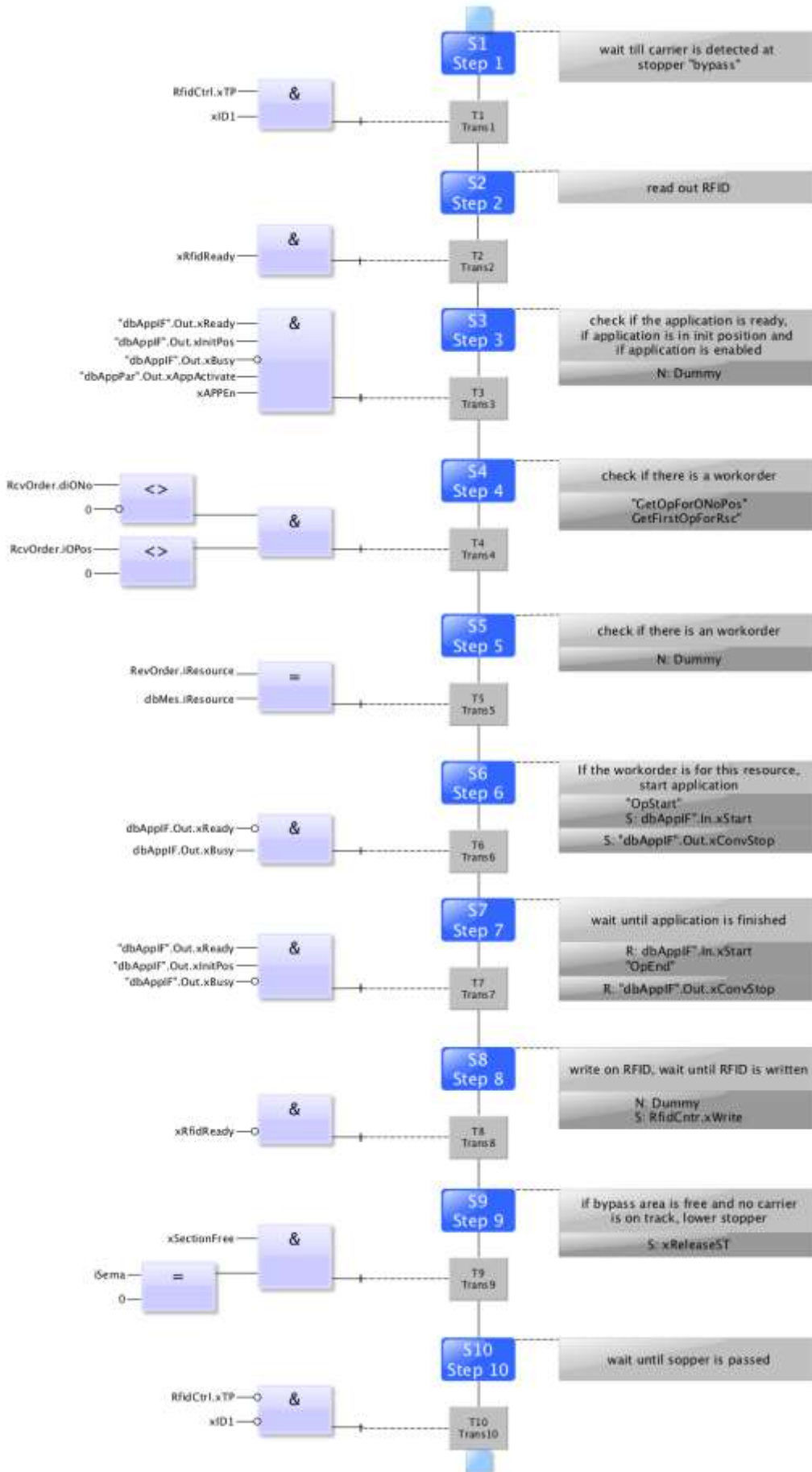
Illustration similar

Position	Description
1	Stopper in bypass
2	Stopper without RFID
3	Branch
6	Stopper branch bypass

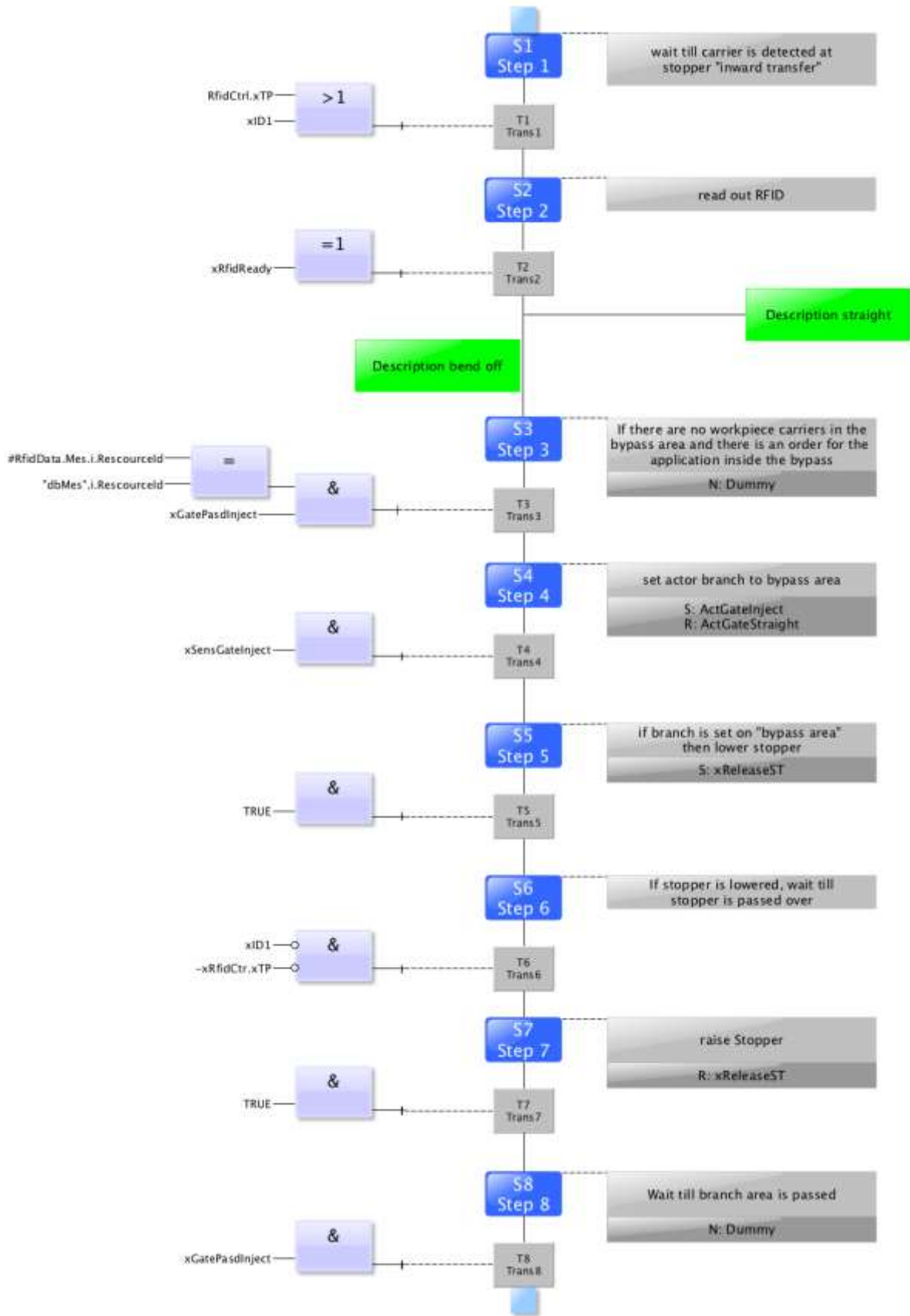
Sequence description bypass



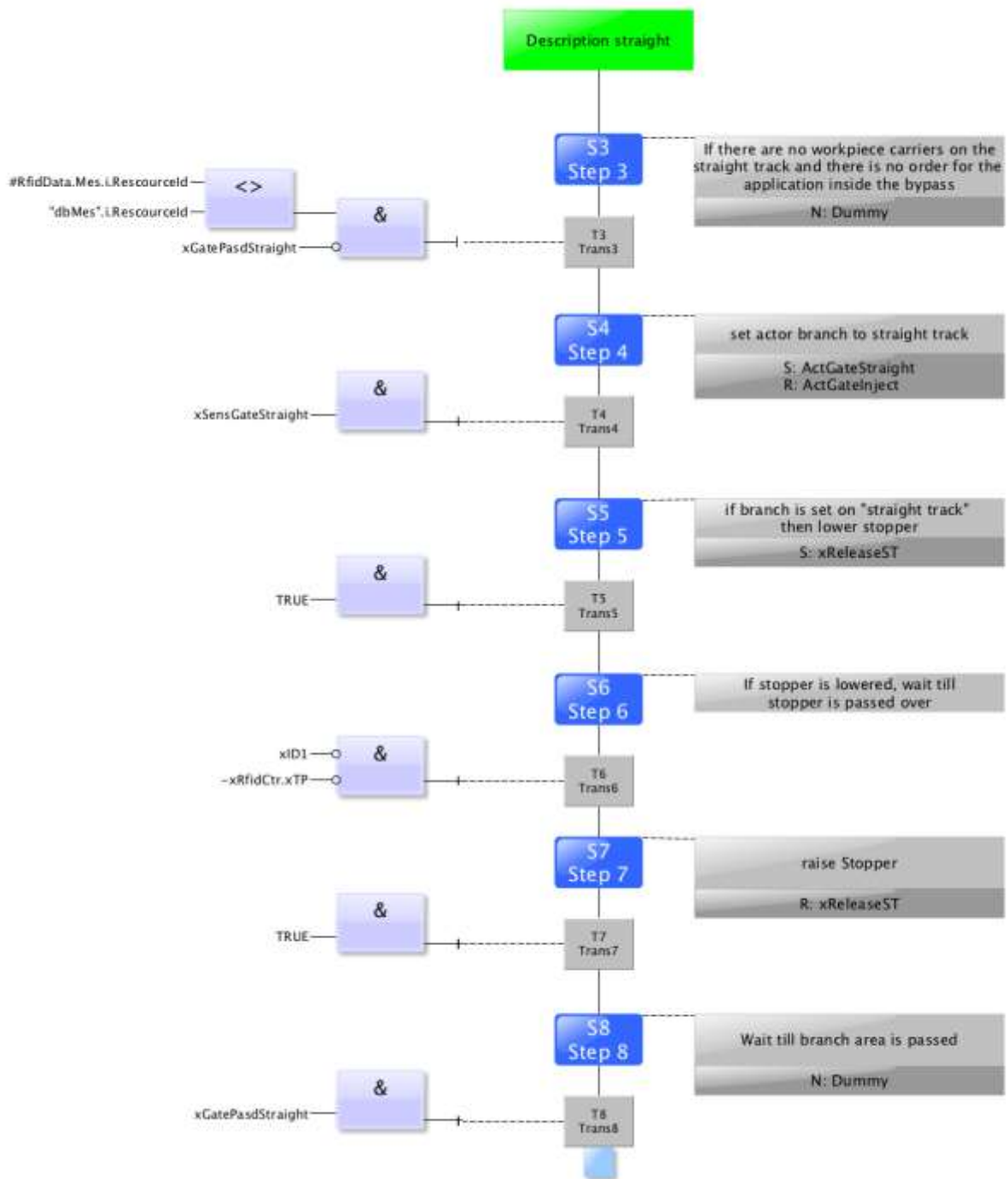
stopper without RFID



Automatic stopper in bypass area

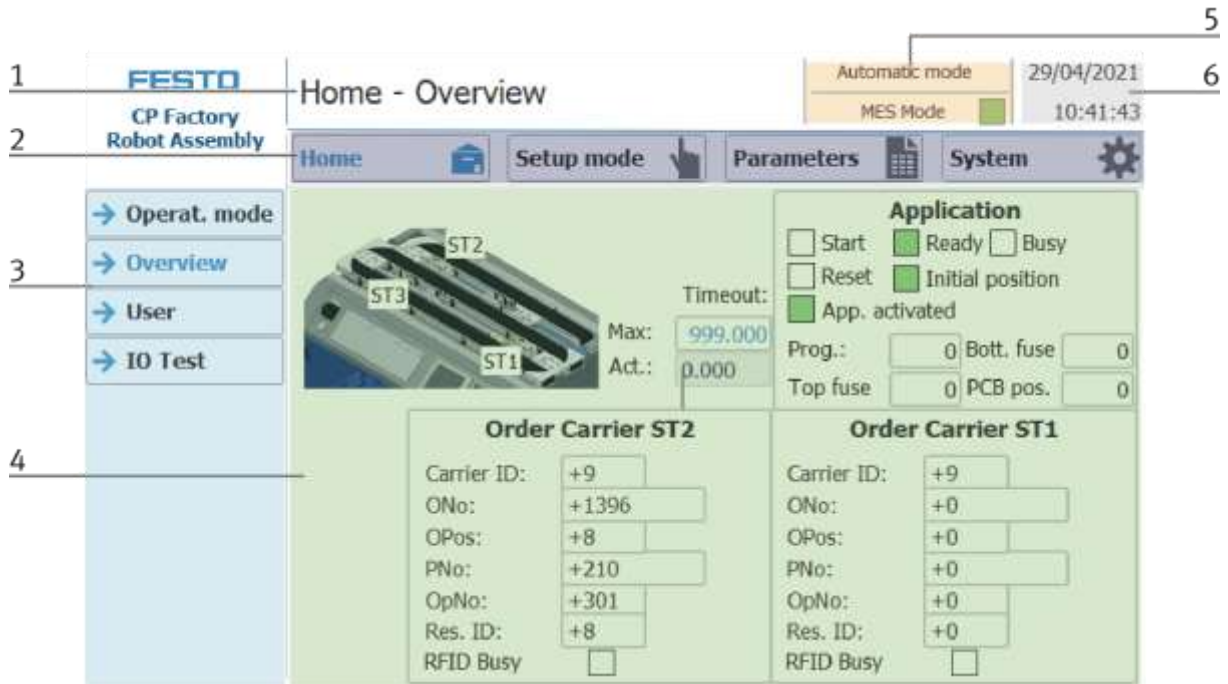


Bypass bend off



Bypass straight

8.5 Menu architecture from operation 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 and mode (MES or default)
6	Announcement of actual date and time

Log in as an administrator

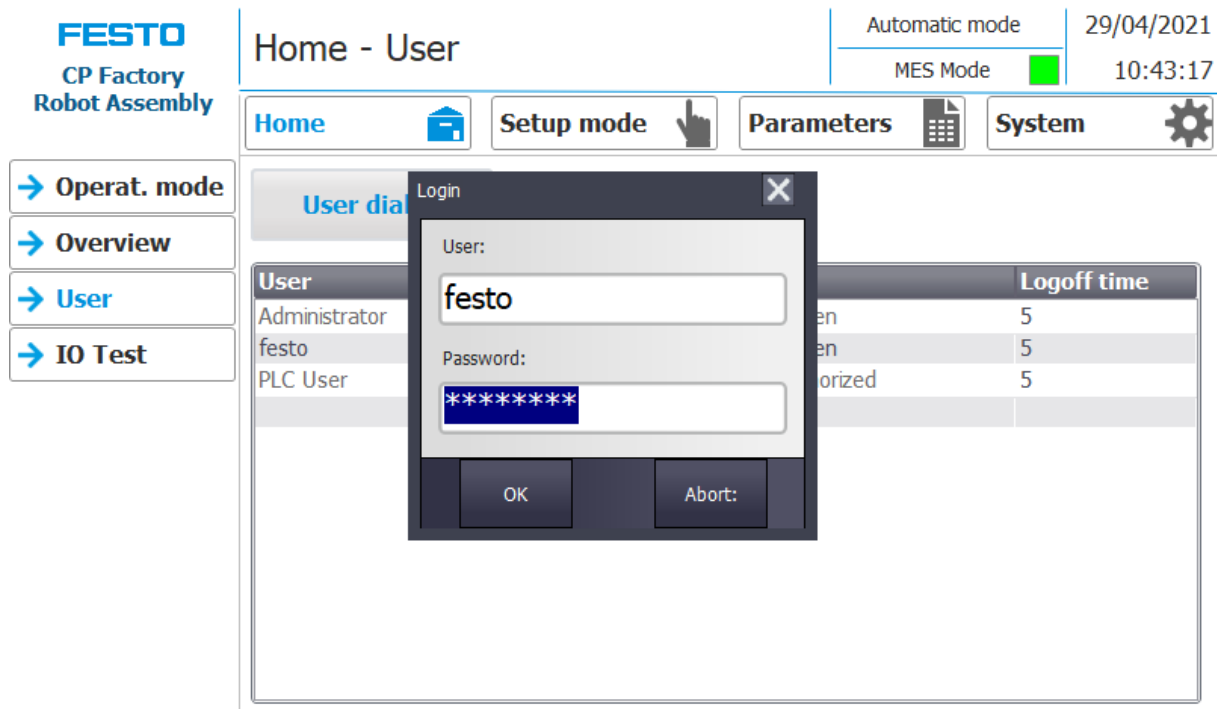
There are 2 functions in the operation of the HMI that are only available when the operator logs on to the HMI. These functions are the I/O test in the setup mode and the user area.

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

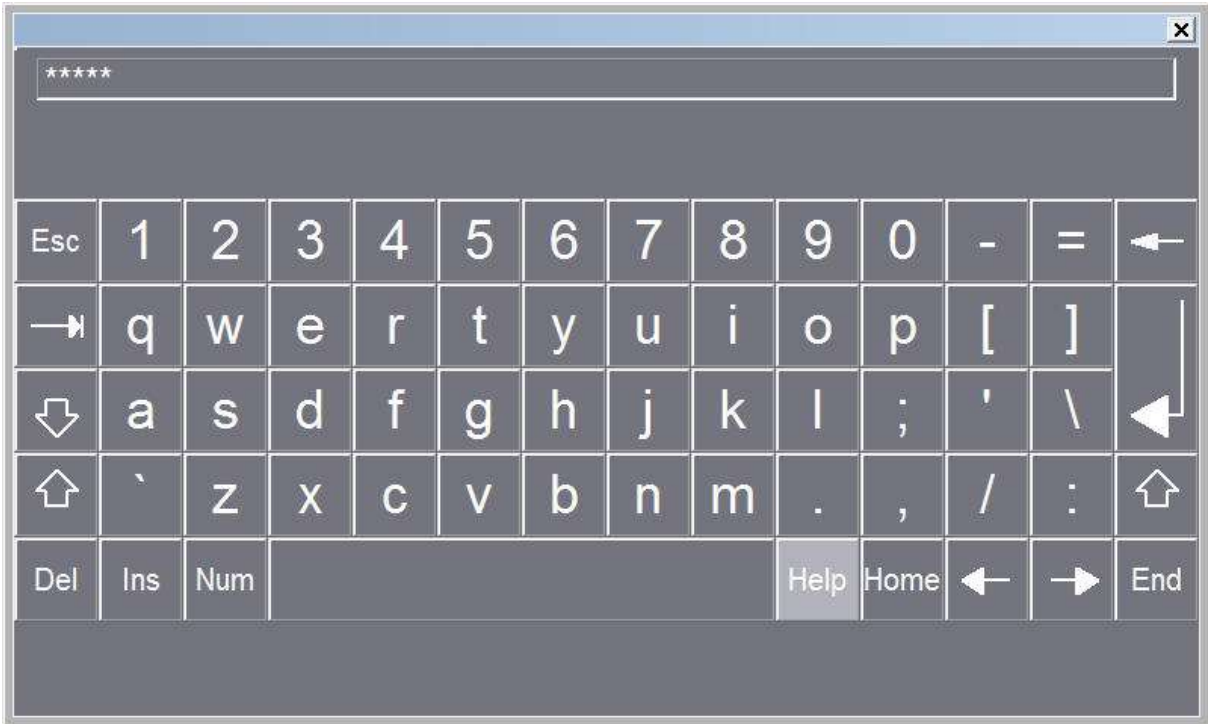
The process is explained using the user function as an example.



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

FESTO
 CP Factory
 Robot Assembly

Home - User

Automatic mode 29/04/2021
 MES Mode ■ 10:42:44

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	*****	Unauthorized	5

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

8.6 Operation modes

The following operation modes are available

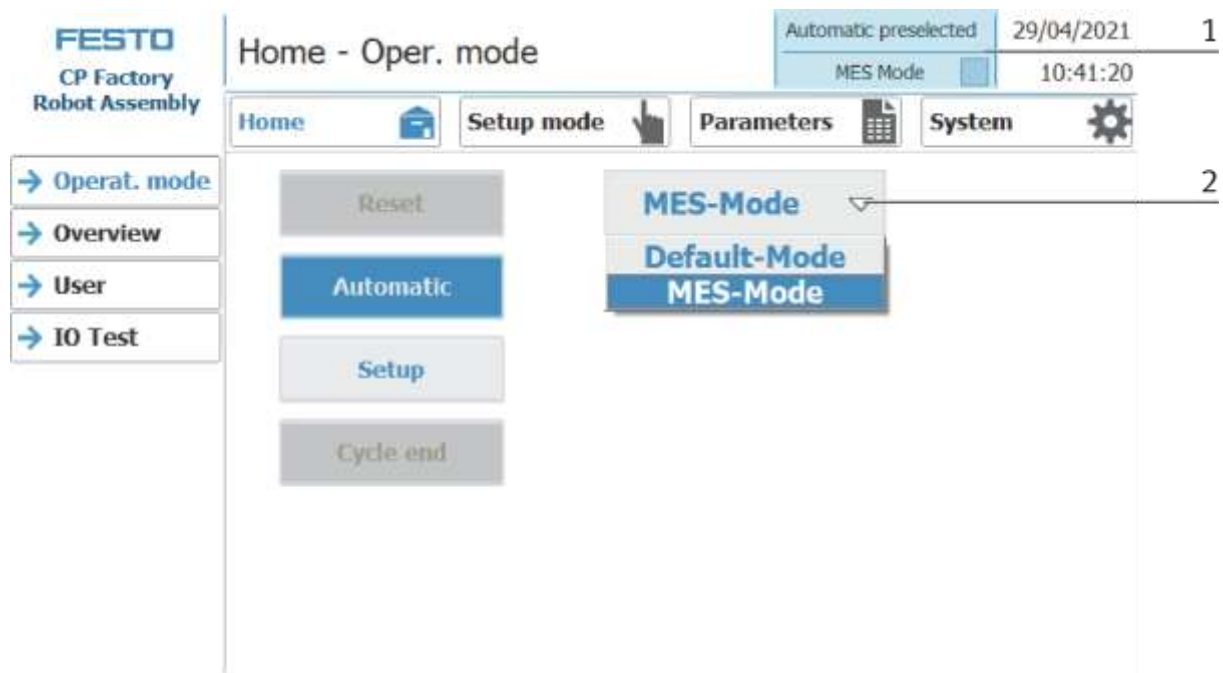
- Reset
The station is moved to its home position
- Setup
The station runs in set-up mode, actuators can be controlled and monitored
- Automatic
The station runs in automatic mode, all processes run automatically, no actuators can be controlled.
There are two modes in the automatic mode: the default mode and the MES mode.

8.6.1 Mode

The mode can be set between MES and default, there are two ways to set it.

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.

The mode can also be set on the Home / Operating mode page.

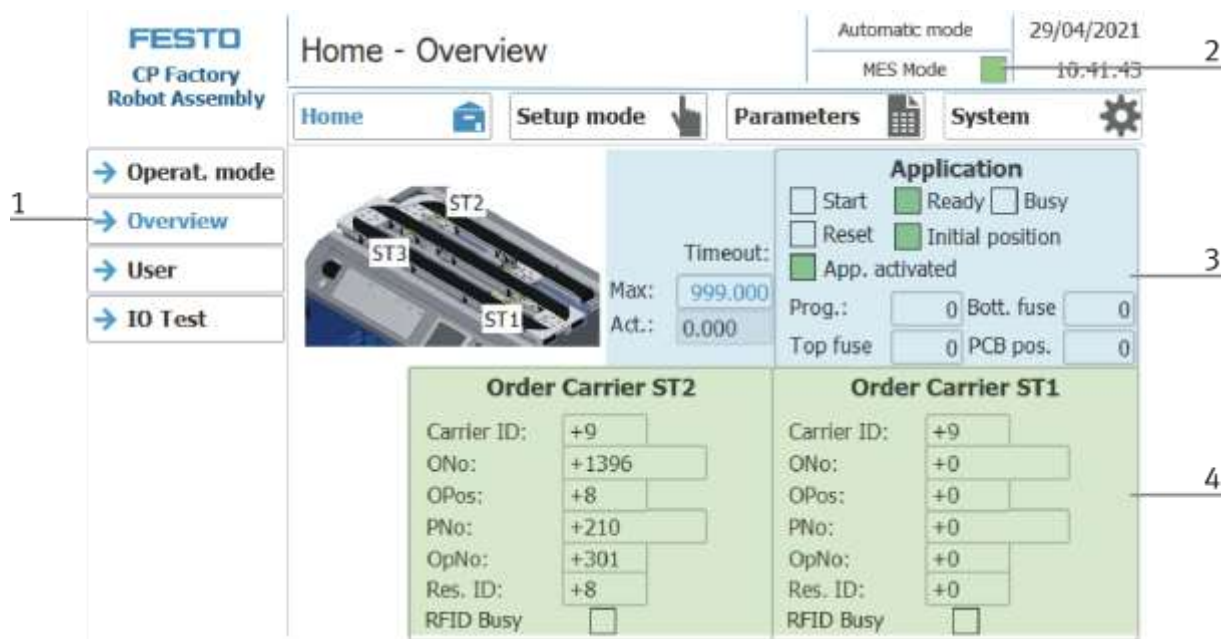


Possibilities of mode

- 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.

Display MES Mode

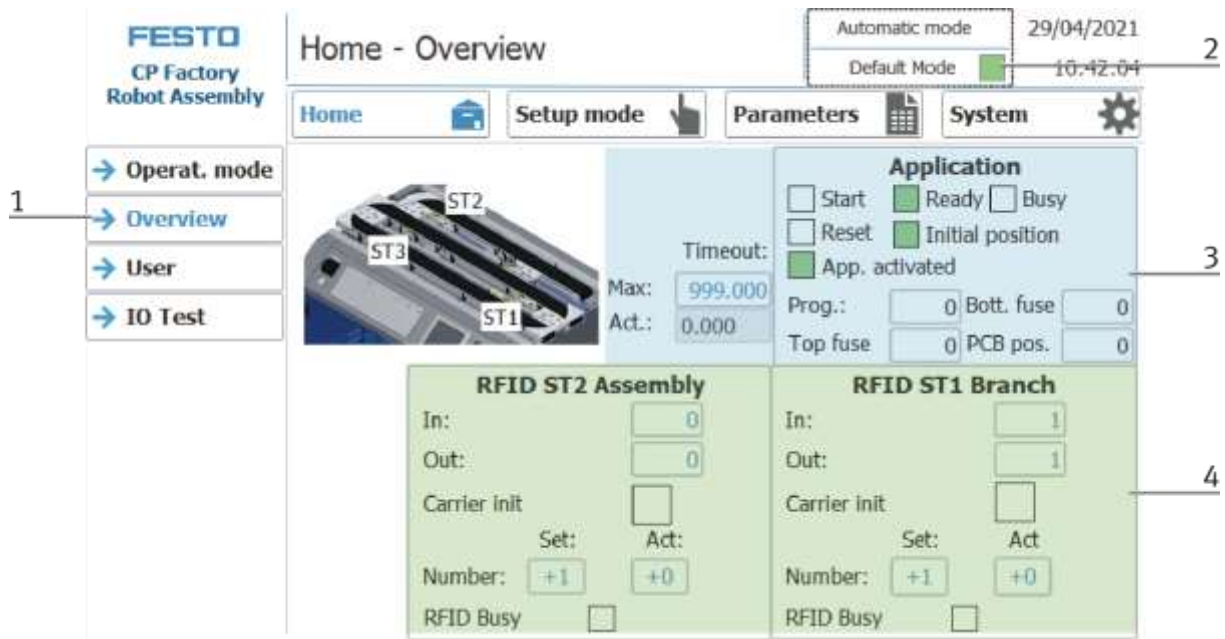
Various states are displayed in the Home operating mode on the Overview page.



Position	Description
1	Change to sub menu Overview
2	Display operation state MES is active
3	Display of various functions (marked green if active) Display of various information about the station and its parameters
4	Display of the order data of the current carrier at stopper 1 and stopper 2

Display Default mode

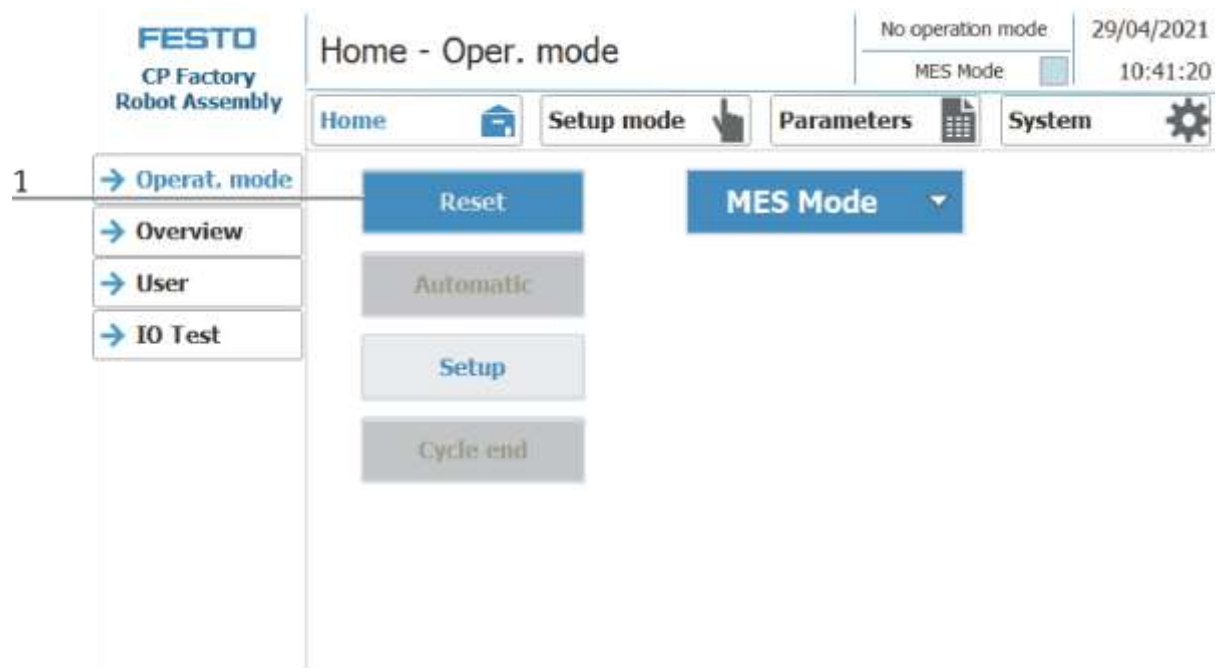
Various states are displayed in the Home operating mode on the Overview page.



Position	Description
1	Change to sub menu Overview
2	Display default mode is active
3	Display of various functions (marked green if active) Display of various information about the station and its parameters
4	Display of RFID state code at stopper 1 and stopper 2

8.6.2 Operation mode Reset

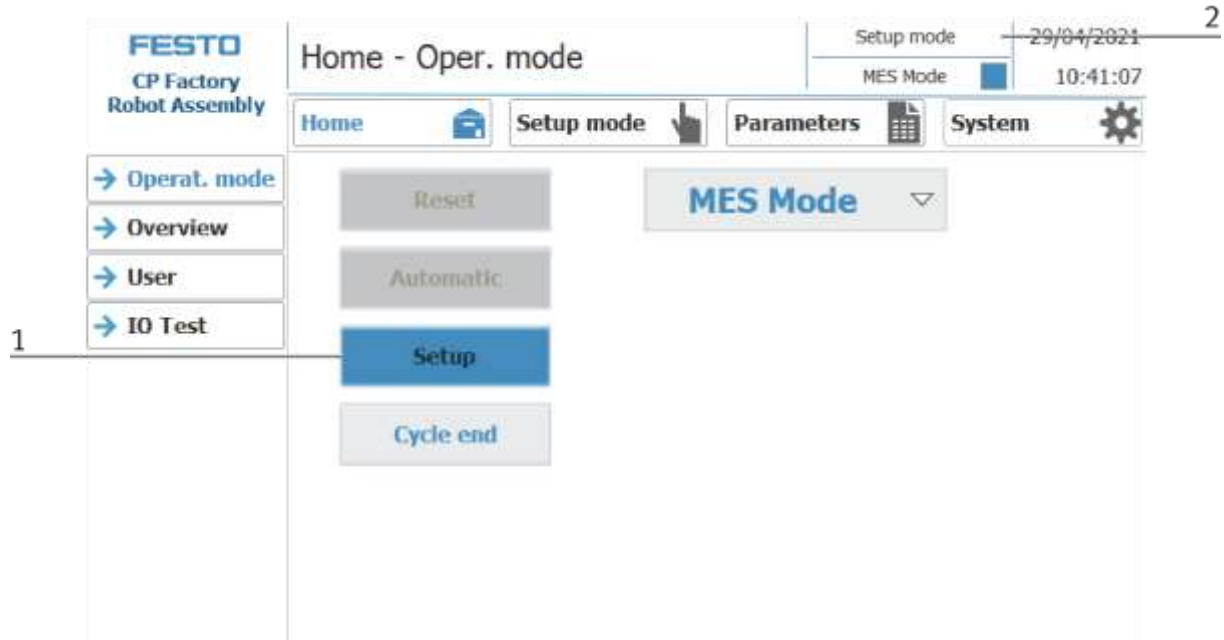
In the operation mode Reset, the station is moved to its home position.



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.

8.6.3 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.

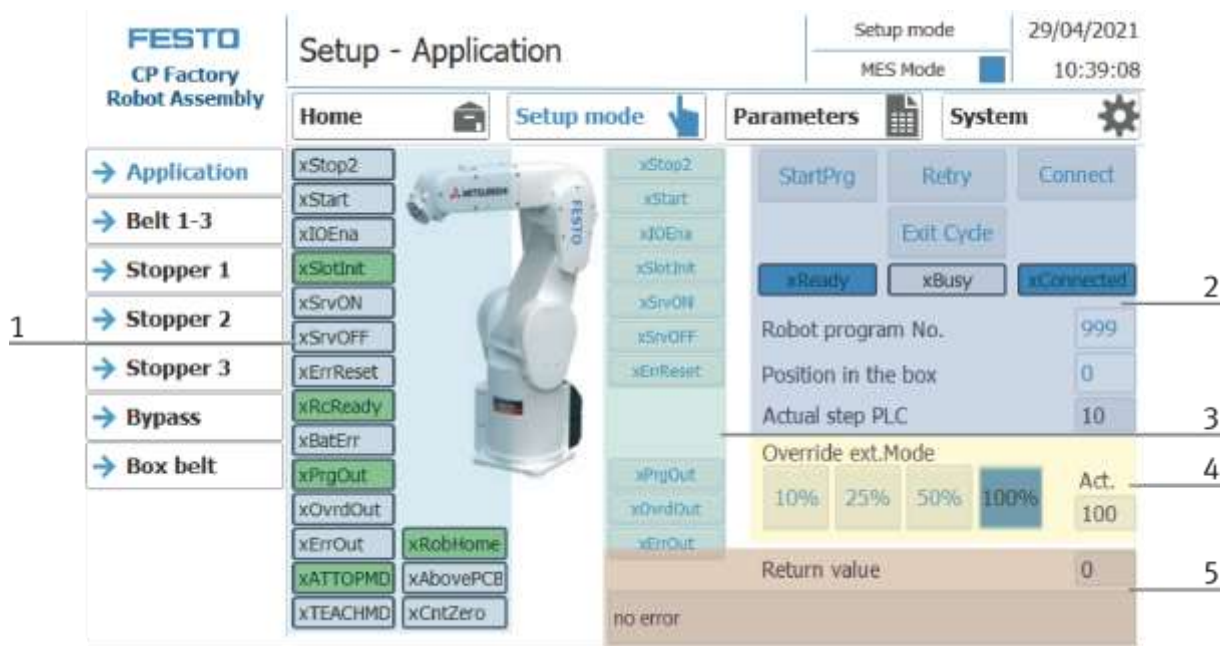


1. Automatic mode is not active and the Setup button is not greyed out - press the Setup button to activate the Setup mode.
2. The current operation mode is displayed here

Set up application

1. Click the Setup mode button
2. Select application

The screenshot displays the 'Setup - Application' interface. At the top right, it shows 'Setup mode' and the date '29/04/2021', along with 'MES Mode' and the time '10:39:08'. The main navigation bar includes 'Home', 'Setup mode' (highlighted), 'Parameters', and 'System'. On the left, a menu lists several options: 'Application' (selected), 'Belt 1-3', 'Stopper 1', 'Stopper 2', 'Stopper 3', 'Bypass', and 'Box belt'. The central area features a white FESTO robot arm and a grid of buttons for various functions such as 'xStop2', 'xStart', 'xIOEna', 'xSrvON', 'xSrvOFF', 'xErrReset', 'xRcReady', 'xBatErr', 'xPrgOut', 'xOvrdOut', 'xErrOut', 'xRobHome', 'xATOPMD', 'xAbovePCB', 'xTEACHMD', and 'xCntZero'. The right-hand panel contains control buttons like 'StartPrg', 'Retry', 'Connect', 'Exit Cycle', 'xReady', 'xBusy', and 'xConnected'. It also displays system parameters: 'Robot program No.' (999), 'Position in the box' (0), 'Actual step PLC' (10), 'Override ext.Mode' (100%), and 'Return value' (0). An error status bar at the bottom indicates 'no error'.



The functions can be activated in the Setup menu under Application by clicking the buttons.

Position number	description
1	Display robot inputs (green if active) xStop2 - movement stopped xStart - motion started xIOEna - the robot is controlled by an external controller xSlotInit - Slot 1 of the robot is initialized xSrvON - Servo mode switched on xSrvOFF - Servo mode switched off xErrReset - Reset error xRcReady - Drive Unit of the robot is ready xBatErr - the battery of the robot is empty xPrgOut - Program area outputs is selected xOvrOut - Override range Outputs is selected xErrOut - the robot has an error xATTOMPD - The robot is in automatic mode XTEACHMID - the robot is in manual mode XRobHome - the robot is in the home position xAbovePCB - the robot is above the board XCntZero - reset counter to zero
2	Control robot (blue if active) Start Prog. - start the robot program Retry – try again Connect - connect to the Drive Unit Exit Cycle – stop actual cycle xReady - the robot is ready xBusy - the robot is busy (display current step) xConnected - connection drive unit made Program number - Program number as in the drive unit Position in the box. - Position of the board inside the box Actual step PLC – Announce the actual step in the PLC
3	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 xOvrOut – select override range outputs xErrOut - the robot has an error
4	Override: set speed of robot
5	Return value - Return value of the robot program Textual description of the return value

Setup Belt

1. Click the Setup mode button
2. Select belt - the functions of the conveyor belt are displayed and / or controlled here.

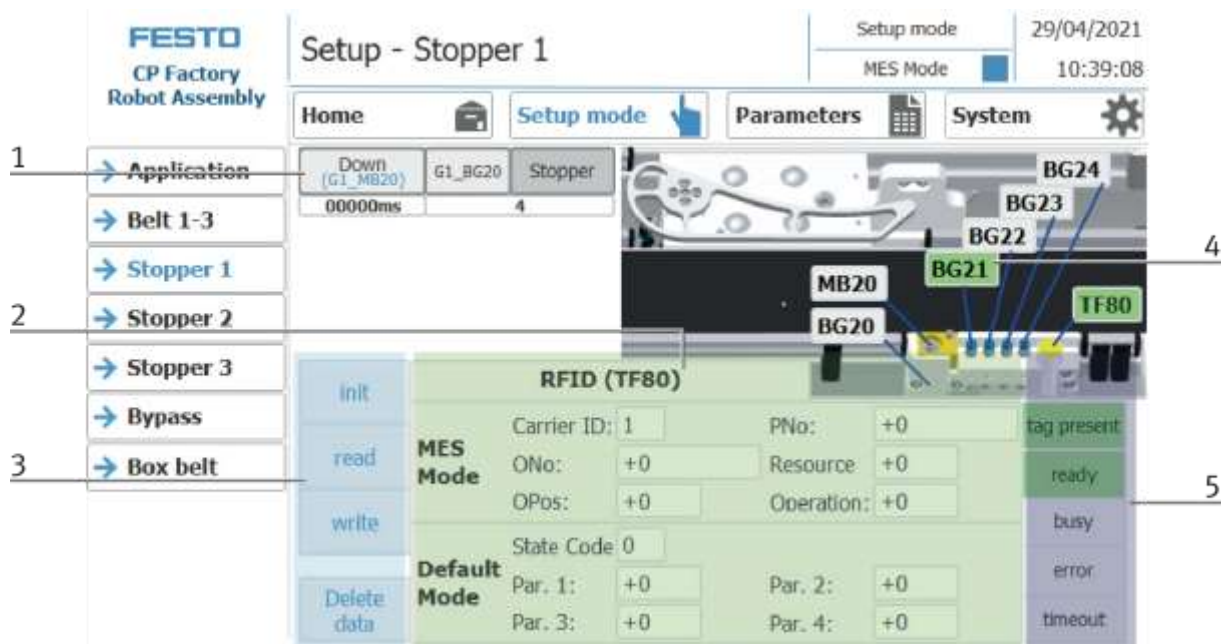
The screenshot shows the 'Setup - belt 1-3' interface. At the top left is the 'FESTO CP Factory Robot Assembly' logo. The title 'Setup - belt 1-3' is centered at the top. On the right, it shows 'Setup mode' and 'MES Mode' (indicated by a blue square), along with the date '29/04/2021' and time '10:39:08'. A navigation bar contains 'Home', 'Setup mode' (highlighted with a hand icon), 'Parameters', and 'System'. A left-hand menu lists: 'Application', 'Belt 1-3' (highlighted), 'Stopper 1', 'Stopper 2', 'Stopper 3', 'Bypass', and 'Box belt'. The main control area for each belt (Belt 1, Belt 2, Belt 3) has three columns: 'Left', 'Drive', and 'Right'. Under 'Left' are buttons for 'To left (QA1_A2)', 'To left (QA2_A2)', and 'To left (QA3_A2)'. Under 'Drive' are 'Presel. slow' and 'Slow (QA1_A3)' for Belt 1, and 'Presel. slow' and 'Slow (QA2_A3)' for Belt 2, and 'Presel. slow' and 'Slow (QA3_A3)' for Belt 3. Under 'Right' are buttons for 'To right (QA1_A1)', 'To right (QA2_A1)', and 'To right (QA3_A1)'. Below this is a schematic diagram of the conveyor belt system with components labeled: ST2, Band 3, BG53, ST3, Band 2, ST1, BG52, BG26, Band 1, and BG27.

Position number	description
1	Drive conveyor 1 right / left Left: Conveyor moves counterclockwise to the left Drive 1: Display conveyor belt 1 Right: conveyor moves clockwise to the right
2	To left: move conveyor to the left (actuator QA1_A2 is activated, lights up blue when active) Slow pre selection: set the conveyor speed slowly Slow: move the conveyor slowly (actuator QA1_A3 is activated, lights up blue when active) To right: move conveyor to the right (actuator QA1_A1 is activated, lights up blue when active)
3	Drive conveyor 2 right / left Left: Conveyor moves counterclockwise to the left Drive 2: Display conveyor belt 2 Right: conveyor moves clockwise to the right
4	To left: move conveyor to the left (actuator QA2_A2 is activated, lights up blue when active) Slow pre selection: set the conveyor speed slowly Slow: move the conveyor slowly (actuator QA2_A3 is activated, lights up blue when active) To right: move conveyor to the right (actuator QA2_A1 is activated, lights up blue when active)
5	Drive conveyor 3 right / left Left: Conveyor moves counterclockwise to the left Drive 3: Display conveyor belt 3 Right: conveyor moves clockwise to the right
6	To left: move conveyor to the left (actuator QA3_A2 is activated, lights up blue when active) Slow pre selection: set the conveyor speed slowly Slow: move the conveyor slowly (actuator QA3_A3 is activated, lights up blue when active) To right: move conveyor to the right (actuator QA3_A1 is activated, lights up blue when active)
7	Display conveyors and stoppers (light up green when active)

Setup Stopper 1

1. Click the Setup mode button
2. Select stopper - the functions of the stopper position are displayed and / or controlled here.

The screenshot displays the 'Setup - Stopper 1' configuration window. On the left, a navigation menu lists options: Application, Belt 1-3, Stopper 1 (selected), Stopper 2, Stopper 3, Bypass, and Box belt. The main area shows the 'RFID (TF80)' configuration. The 'MES Mode' section includes fields for Carrier ID (1), PNo (+0), ONo (+0), OPos (+0), and Operation (+0). The 'Default Mode' section includes State Code (0) and four parameters (Par. 1-4), all set to +0. On the right, status indicators show 'tag present', 'ready', 'busy', 'error', and 'timeout'. The top right corner shows 'Setup mode' and 'MES Mode' (checked) with the date 29/04/2021 and time 10:39:08. A navigation bar at the top contains 'Home', 'Setup mode' (selected), 'Parameters', and 'System'.



Position number	description
1	Move down the stopper Lower: Move stopper down (actuator G1_MB20 is activated, lights up blue when active) G1_BG20: Sensor G1_BG20 Stopper lowered (lit green when active) Stopper: Indicator stopper
2	RFID area MES Mode: Displays the job data Default Mode: Displays the RFID status
3	Write and read RFID area Initialize: Set RFID data to zero read: Read RFID data write: Write current data on RFID Delete data: all data in the input mask are deleted - not directly on the RFID (for easier entry)
4	Range Display of the active sensors (lit green when active) and actuators (lit orange when active) at the stopper
5	Display of RFID reading status

Setup Stopper 2

1. Click the Setup mode button
2. Select stopper - the functions of the stopper position are displayed and / or controlled here.

FESTO CP Factory Robot Assembly

Setup - Stopper 2

Setup mode: 29/04/2021
MES Mode: 10:39:08

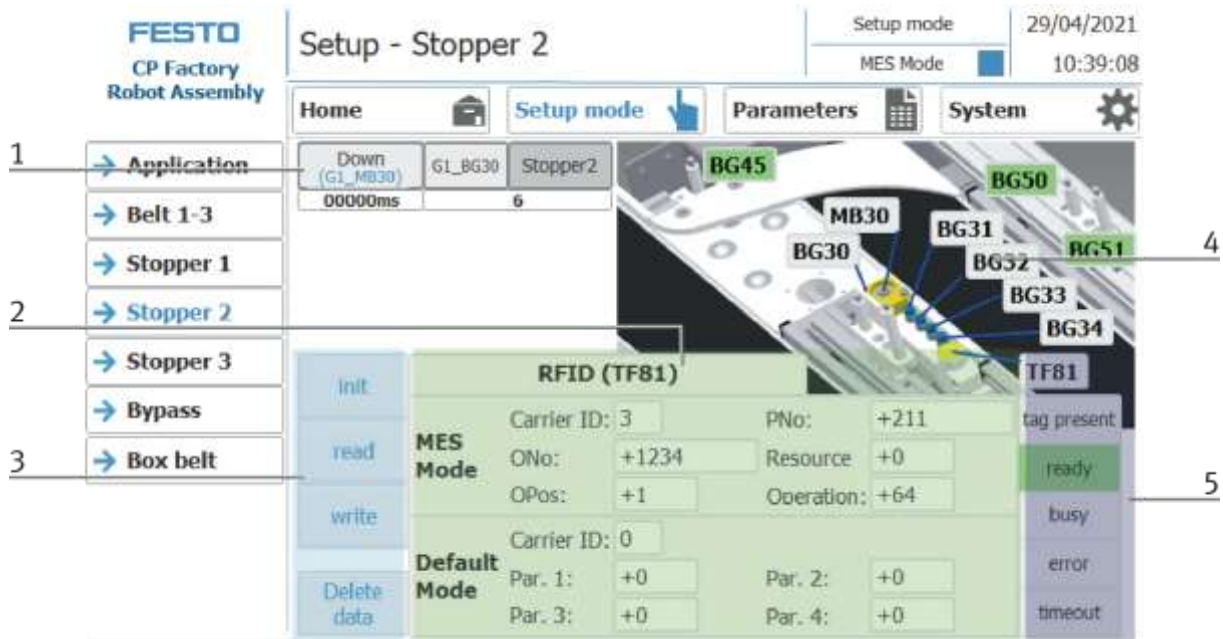
1 Home Setup mode Parameters System

2 Application
Belt 1-3
Stopper 1
Stopper 2
Stopper 3
Bypass
Box belt

Down (G1_MB30)	G1_BG30	Stopper2
00000ms		6

RFID (TF81)

init	Carrier ID: 3	PNo: +211	tag present
read	ONo: +1234	Resource: +0	ready
write	OPos: +1	Operation: +64	busy
Delete data	Carrier ID: 0		error
	Par. 1: +0	Par. 2: +0	timeout
	Par. 3: +0	Par. 4: +0	



Position number	description
1	Shut down stopper down: Move stopper downwards (actuator G1_MB30 is activated, lights up blue when active) G1_BG30: Sensor G1_BG30 stopper down (lit green when active) Stopper: display stopper
2	Area RFID MES Mode: Display of order data Default Mode: Display of the RFID state
3	Describe and read the RFID area initialize: set RFID data to zero read: Read out RFID data write: write current data on RFID Delete data: all data in the input mask is deleted - not directly on the RFID (for easier entry)
4	Area Display of the active sensors (lit green when active) and actuators (lit orange if active) on the stopper
5	Display of the RFID read status

Setup - Stopper 3

1. Click the Setup mode button
2. Select stopper - the functions of the stopper position are displayed and / or controlled here.

1

FESTO
CP Factory
Robot Assembly

Setup - Stopper 3

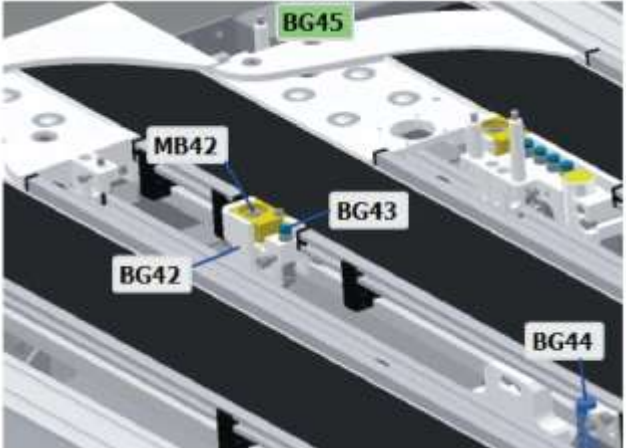
Setup mode 29/04/2021
MES Mode 10:39:08

Home Setup mode Parameters System

Down (G1_MB42)	G1_BG42	Stopper3
00000ms		4

2

- Application
- Belt 1-3
- Stopper 1
- Stopper 2
- Stopper 3
- Bypass
- Box belt



The image shows a 3D CAD model of a mechanical assembly. The components are labeled as follows: MB42 (a black stopper), BG42 (a yellow stopper), BG43 (a black stopper), BG44 (a blue stopper), and BG45 (a green stopper). The assembly is mounted on a white base with various slots and holes.

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Robot Assembly

Setup - Stopper 3

Setup mode: 29/04/2021
MES Mode: 10:39:08

Home Setup mode Parameters System

1 → Application
→ Belt 1-3
→ Stopper 1
→ Stopper 2
→ Stopper 3
2 → Bypass
→ Box belt

Down (G1_MB42)	G1_BG42	Stopper3
00000ms		4

3D Model Labels: MB42, BG42, BG43, BG44, BG45

Position number	description
1	Shut down stopper down: Move stopper downwards (actuator G1_MB42 is activated, lights up blue when active) G1_BG42: Sensor G1_BG42 stopper down (lit green when active) Stopper: display stopper
2	Area Display of the active sensors (lit green when active) and actuators (lit orange if active) on the stopper

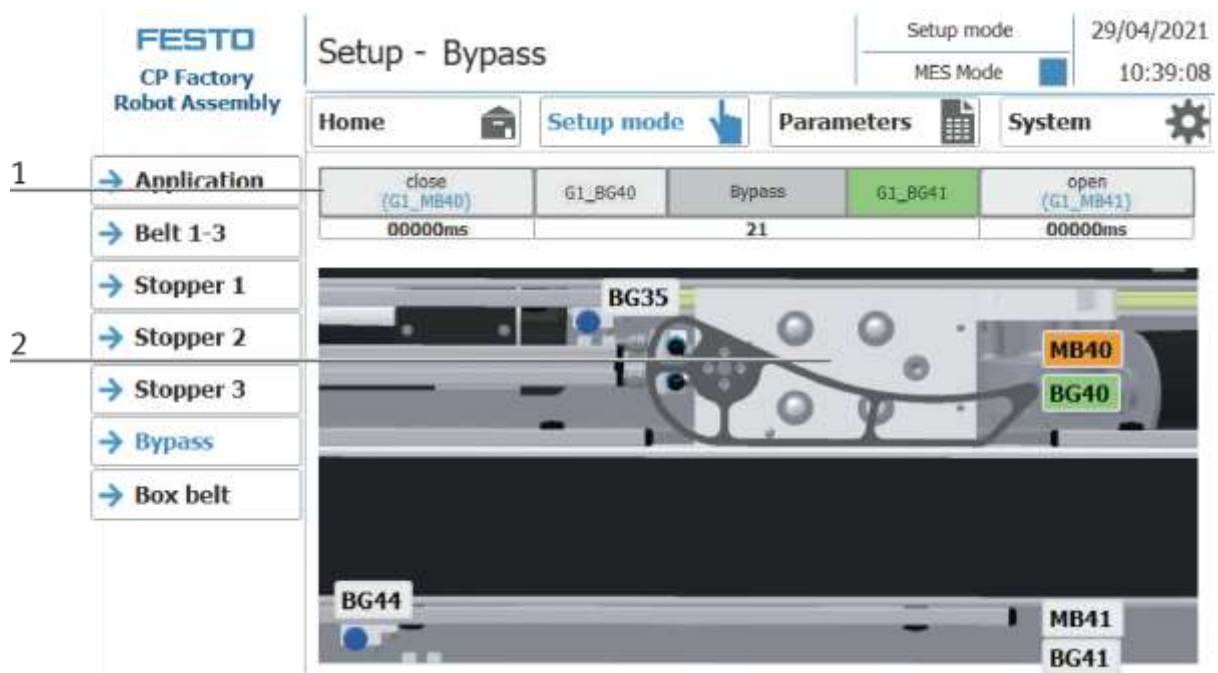
Setup - Bypass

1. Click the Setup mode button
2. Select stopper - the functions of the stopper position are displayed and / or controlled here.

The screenshot shows the 'Setup - Bypass' interface. At the top right, it displays 'Setup mode' and 'MES Mode' (indicated by a blue square), along with the date '29/04/2021' and time '10:39:08'. Below this is a navigation bar with 'Home', 'Setup mode' (highlighted with a hand icon), 'Parameters', and 'System' buttons. A left-hand navigation menu lists: Application, Belt 1-3, Stopper 1, Stopper 2, Stopper 3, Bypass (selected), and Box belt. The main content area features a table of stopper parameters:

close (G1_MB40)	G1_BG40	Bypass	G1_BG41	open (G1_MB41)
00000ms		21		00000ms

Below the table is a 3D CAD model of the robot assembly. Labels in the model include BG35, MB40, BG40, BG44, and MB41. The 'Bypass' button in the left menu is highlighted with a blue arrow and the number '2'.



Position number	description
1	<p>operate Bypass</p> <p>Close: set the bypass to close position (Actuator G1_MB40 is activated, lights blue when active)</p> <p>G1_BG40: Sensor G1_BG40 bypass closed into position (lights up green when active)</p> <p>Gate: Display bypass</p> <p>G1_BG41: Sensor G1_BG41 set bypass to open position (lit green when active)</p> <p>Open: set bypass to open position (Actuator G1_MB41 is activated, lights blue if active)</p>
2	Area Display of the active sensors (lit green when active) and actuators (lit orange if active) on the stopper

Setup - Box belt

1. Click the Setup mode button
2. Select stopper - the functions of the stopper position are displayed and / or controlled here.

The screenshot shows the 'Setup - Box belt' interface. On the left, a navigation menu is visible with the following items: Application, Belt 1-3, Stopper 1, Stopper 2, Stopper 3, Bypass, and Box belt. The 'Box belt' item is selected and highlighted. The main area displays the 'Box Belt' configuration, including a 3D model of the assembly with components labeled BG1, BG2, BG3, BG5, BG6, GFB, and KG8. The configuration table below the model shows the following data:

Function	Parameter	Value
Init	ONo:	+0
read	OPos:	+0
write	Box ID:	+1
Delete data	BoxPNo:	+27

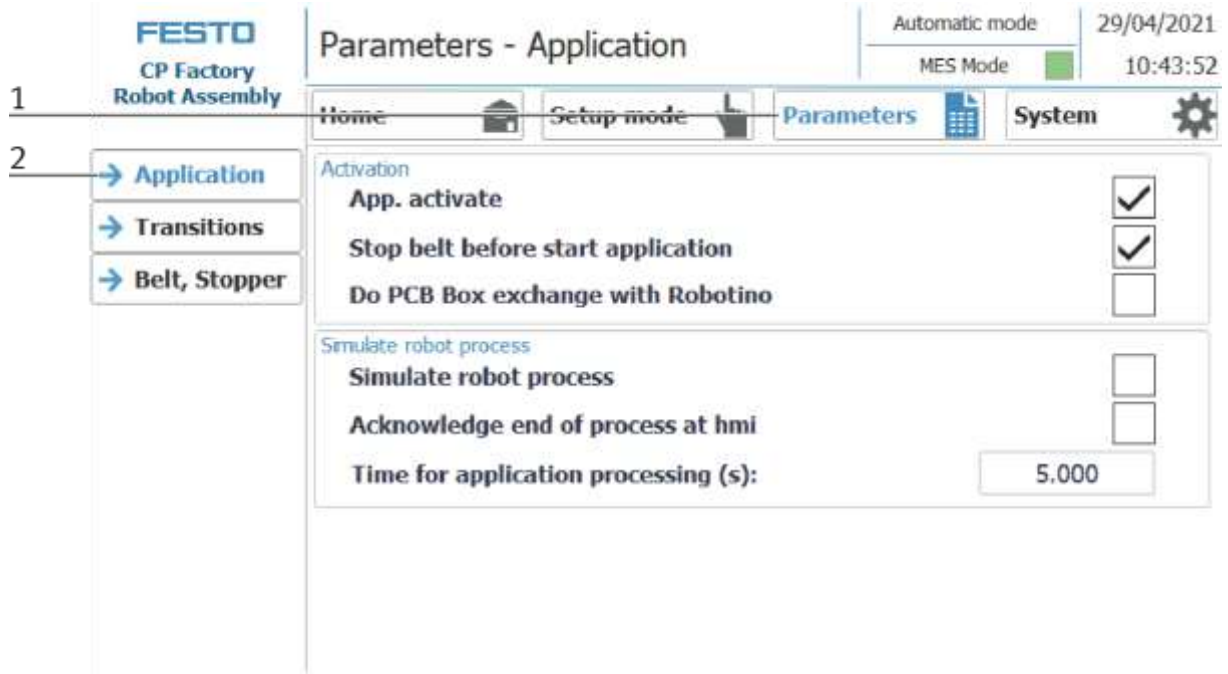
On the right side of the configuration table, there are status indicators: tag present, ready, busy, error, and timeout. The 'tag present' and 'ready' indicators are currently active (green).



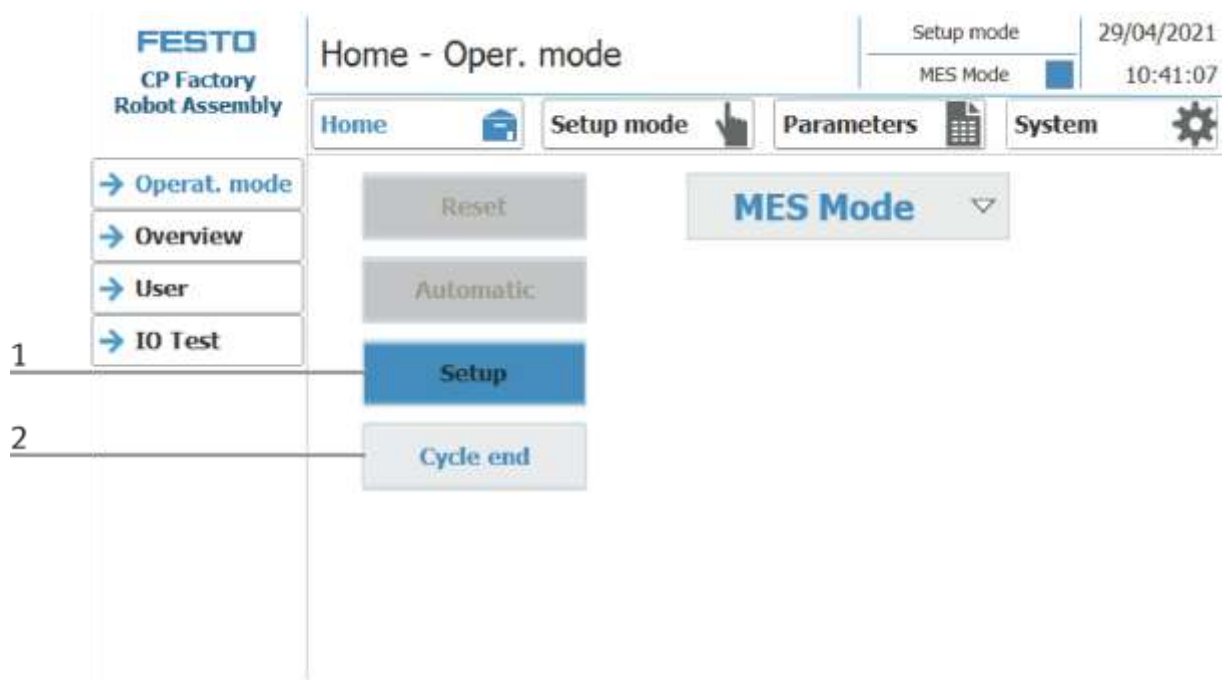
Position number	description
1	Clamp clamping unit Lift: lift clamping unit (actuator H1_MB5 is activated, lights up blue when active) H1_BG5: Sensor H1_BG5 clamping unit is clamped (lights up green when active) Clamping: Display Clamping unit
2	Box belt for boxes Left: conveyor moves counterclockwise to the left BoxBelt: Display conveyor belt boxes Right: Band moves clockwise to the right
3	Box Out: move conveyor to the left (actuator H1_QA4 is activated, lights up blue when active) Presel. slow: set the conveyor speed slowly Creep feed: move the conveyor slowly (actuator H1_QA4_lights blue if active) Box In: move conveyor to the right (actuator H1_QA4_ is activated, lights up blue when active)
4	Box RFID data MES Mode: Display of order data Default Mode: Display of the RFID state
5	Describe and read the RFID area initialize: set RFID data to zero read: Read out RFID data write: write current data on RFID Delete data: all data in the input mask is deleted - not directly on the RFID (for easier entry)
6	Area Display of the active sensors (lit green when active) and actuators (lit orange if active) on the stopper
7	Display of the RFID read status

Set up application parameters

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



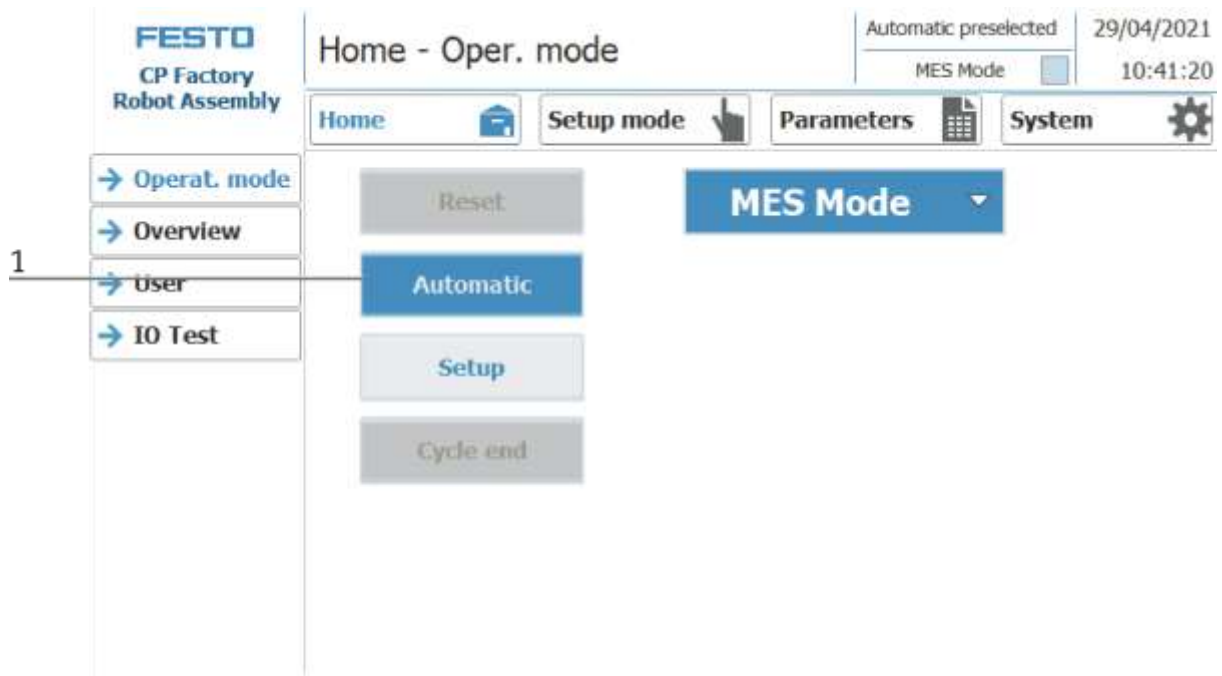
Position number	description
1	Here the application module can be activated (tick set). If no application module is activated, the carrier is stopped at the stopper and released again without processing.
2	Stop belt before start application: The conveyor is stopped before the application starts to work - set the tick for this
3	Do PCB box exchange with robotino: tick set when the supply of boxes is not done manually but via the robotino
4	Simulate robot process: set tick if the process is not done in real
5	If the processing end is to be confirmed, a check mark must be set here. The process is only continued if this has been confirmed at the HMI, otherwise the process is automatically continued after the end of processing.
6	Here you can enter the time required for the simulation.

Exit operation mode setup

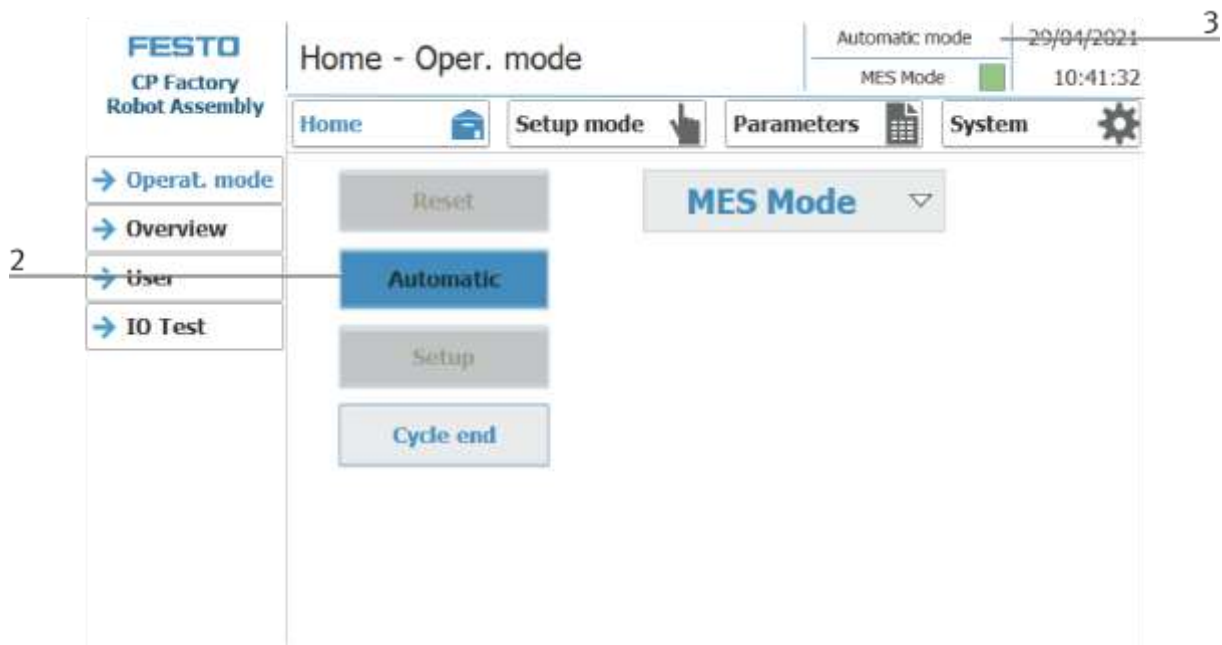
1. Setup mode is active, button lights up blue
2. Press the cycle end button to end the operation mode setup.

8.6.4 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) or via MES.

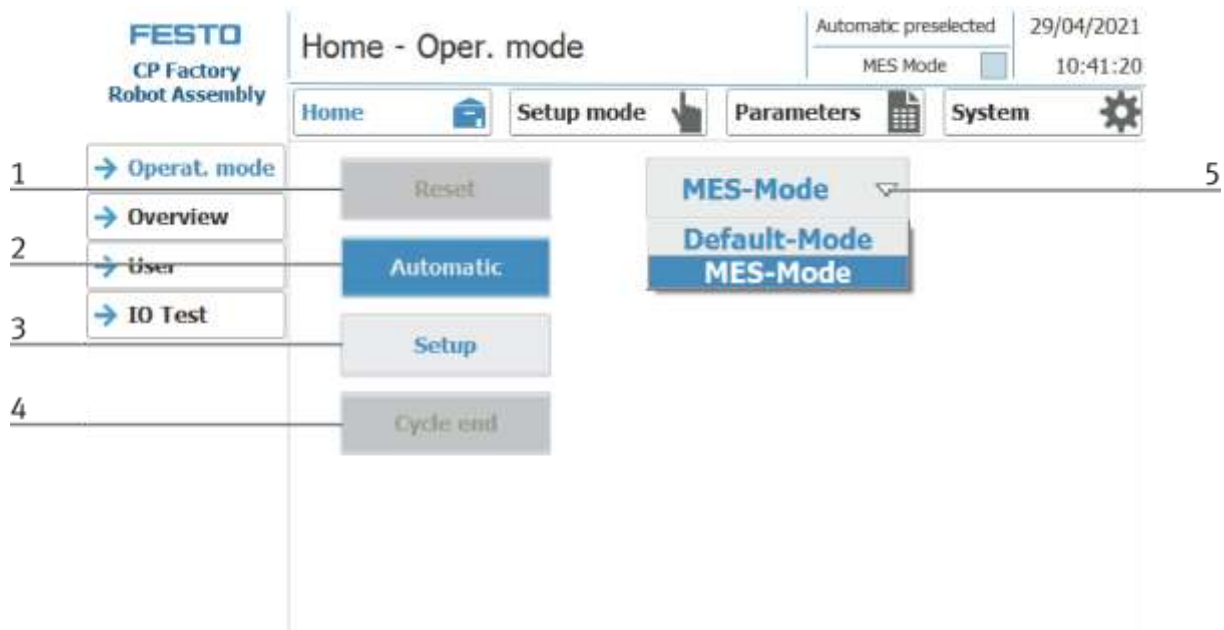


1. Automatic button flashing blue – Press Button to activate operation mode automatic



2. Operation mode automatic is active, button lights up blue
3. Announcement of active operation mode automatic

8.6.5 Main menu - Home
Sub menu operation mode



In the operation mode Home, the operating mode and the 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 MES - automatic process is completely controlled by MES software

Submenu overview

Various states are displayed in the operation mode home on the Overview page.
(changing content depending on the selected operating mode)



Position	Description
1	<p>Application area: here the status of the station is displayed</p> <p>Start: Green when started</p> <p>Ready: Green when ready</p> <p>Init Pos.: Green when the basic setting is reached</p> <p>Reset: Green when the application is directed</p> <p>Busy: Green when the application processes an order</p> <p>RFID Busy: green when an RFID code is read or written</p> <p>Application active: green when the application is logged on to the basic module</p> <p>Timeout: The max. timeout and the actual timeout are announced here</p>
2	<p>Area Order Carrier ST1- here the information provided by MES on the carrier</p> <p>Carrier ID: Carrier number</p> <p>ONo: Order number</p> <p>OPos: Order position</p> <p>PNo: Part number</p> <p>OpNo: Operation Number</p> <p>Resc ID: Resource</p> <p>Area Order Carrier ST2- here the information provided by MES on the carrier</p> <p>Carrier ID: Carrier number</p> <p>ONo: Order number</p> <p>OPos: Order position</p> <p>PNo: Part number</p> <p>OpNo: Operation Number</p> <p>Resc ID: Resource</p>

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Conveyor Stop by Sensor / Energy-Mode: conveyor belt instance Drive1 is stopped!

Automatic mode 29/04/2021
MES Mode ■ 10:42:04

Home Setup mode Parameters System

→ Operat. mode
→ Overview
→ User
→ IO Test

Time	Date	Status	Text
09:29:13	22/02/2021	K	Conveyor Stop by Sensor / Energy-Mode: conveyor belt instance Drive1 is stopped!

Error messages are also displayed in the overview window.

Sub menu user

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

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

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Home - IO test

Setup mode 29/04/2021
MES Mode ■ 10:39:53

Home

Setup mode

Parameters

System

Eingänge

Byte				
0	1	2	3	4
0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1
0.2	0.2	0.2	0.2	0.2
0.3	0.3	0.3	0.3	0.3
0.4	0.4	0.4	0.4	0.4
0.5	0.5	0.5	0.5	0.5
0.6	0.6	0.6	0.6	0.6
0.7	0.7	0.7	0.7	0.7

Ausgänge

Byte				
0	1	2	3	4
0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1
0.2	0.2	0.2	0.2	0.2
0.3	0.3	0.3	0.3	0.3
0.4	0.4	0.4	0.4	0.4
0.5	0.5	0.5	0.5	0.5
0.6	0.6	0.6	0.6	0.6
0.7	0.7	0.7	0.7	0.7

**Enable
Outputs
CAUTION
Program
return
of OB1
No cyclic
program
call**

→ Operat. mode

→ Overview

→ User

→ IO Test

8.6.6 Main menu - Setup

See chapter operation mode setup.

8.6.7 Main menu – Parameter

Submenu application

See chapter operation mode setup.

Sub menu transitions

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Robot Assembly

Parameters - Transitions

Automatic mode 29/04/2021
Default Mode ■ 10:33:44

Home
Setup mode
Parameters
System

- Application
- Transitions
- Belt, Stopper

No.	Start Condition	execute	Prog. No.	Parameter			End condition	
				---	---	---	OK	NOK
Init	none	<input type="checkbox"/>	0	0	0	0	1	0
1	1	<input checked="" type="checkbox"/>	1	0	0	0	2	0
2	2	<input checked="" type="checkbox"/>	2	0	0	0	3	0
3	3	<input checked="" type="checkbox"/>	3	0	0	0	4	0
4	4	<input checked="" type="checkbox"/>	4	0	0	0	1	0
5	0	<input type="checkbox"/>	0	0	0	0	0	0
6	0	<input type="checkbox"/>	0	0	0	0	0	0
7	0	<input type="checkbox"/>	0	0	0	0	0	0
8	0	<input type="checkbox"/>	0	0	0	0	0	0
9	0	<input type="checkbox"/>	0	0	0	0	0	0
10	0	<input type="checkbox"/>	0	0	0	0	0	0

If the sub menu transitions is selected, the transitions of the installed application module are displayed. The transitions of all other application modules can be found in the associated manuals for the application modules.

Sub menu belt, stopper

FESTO
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Robot Assembly

Parameters - Belt, Stopper

Automatic mode: 29/04/2021
MES Mode 10:44:21

Home Setup mode Parameters System

- Application
- Transitions
- Belt, Stopper

Transport, Energy, Stopper			
Belt 1 start/stop by sensors	<input type="checkbox"/>	1	
Belt 1 energy saving by sensors	<input type="checkbox"/>	2	
Reduce belt speed	<input type="checkbox"/>	3	
Stopper 1&2: Switch stopper without MES connection	<input type="checkbox"/>	4	
Transport, Energy, Stopper			
Belt 2 start/stop by sensors	<input type="checkbox"/>	5	
Belt 2 energy saving by sensors	<input type="checkbox"/>	6	
Reduce belt speed	<input type="checkbox"/>	7	
Transport, Energy			
Belt 3 energy saving by sensors	<input type="checkbox"/>	8	
Reduce belt speed	<input type="checkbox"/>	9	

Position number	description
1	Belt 1 Start / Stop by sensors: Hook set when the belt should be switched automatically with the sensors. Switch on when Sensor at belt beginning signals a carrier, switch off when the sensor at the end of the belt signals the carrier passing by
2	Belt 1 energy saving mode with sensors: If no workpiece is detected on the belt via the sensors, the belt is switched off
3	Reduce belt speed: Here the belt speed is reduced to save energy
4	Stopper 1 & 2: Switch stopper without MES connection Function active MES in – workpiece carriers run through / MES out - workpiece carriers run through constantly Function not active MES in - workpiece carriers run continuously / MES out - workpiece carriers stop
5	Belt 2 Start / Stop by sensors: Hook set when the belt should be switched automatically with the sensors. Switch on when Sensor at belt beginning signals a carrier, switch off when the sensor at the end of the belt signals the carrier passing by
6	Belt 2 energy saving mode with sensors: If no workpiece is detected on the belt via the sensors, the belt is switched off
7	Reduce belt speed: Here the belt speed is reduced to save energy
8	Belt 3 energy saving mode with sensors: If no workpiece is detected on the belt via the sensors, the belt is switched off
9	Reduce belt speed: Here the belt speed is reduced to save energy

FESTO
CP Factory
Robot Assembly

Conveyor Stop by Sensor / Energy-Mode: conveyor belt instance Drive2 is stopped!

Automatic mode | 29/04/2021
MES Mode ■ | 10:44:37

→ Application

→ Transitions

→ Belt, Stopper

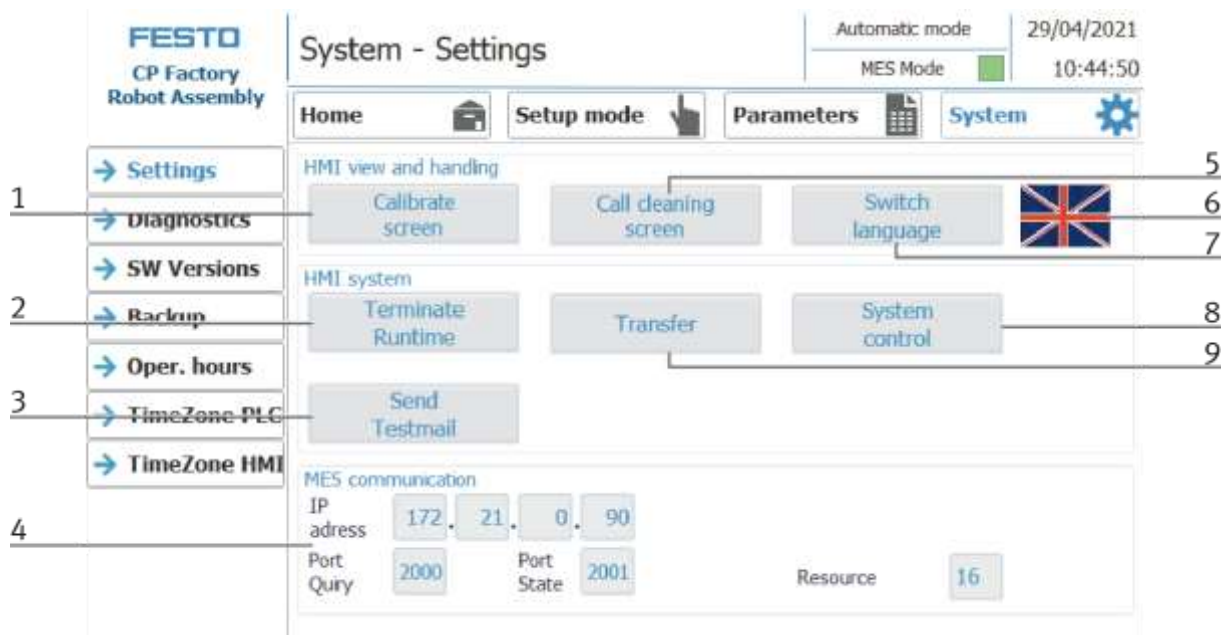
Home
Setup mode
Parameters
System

<p style="color: blue; font-size: small;">Transport, Energy, Stopper</p> <p>Belt 1 start/stop by sensors</p> <p>Belt 1 energy saving by sensors</p> <p>Reduce belt speed</p> <p>Stopper 1&2: Switch stopper without MES connection</p>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<p style="color: blue; font-size: small;">Transport, Energy, Stopper</p> <p>Belt 2 start/stop by sensors</p> <p>Belt 2 energy saving by sensors</p> <p>Reduce belt speed</p>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
<p style="color: blue; font-size: small;">Transport, Energy</p> <p>Belt 3 energy saving by sensors</p> <p>Reduce belt speed</p>	<input type="checkbox"/> <input type="checkbox"/>

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

8.6.8 Main menu – System Sub menu - Settings

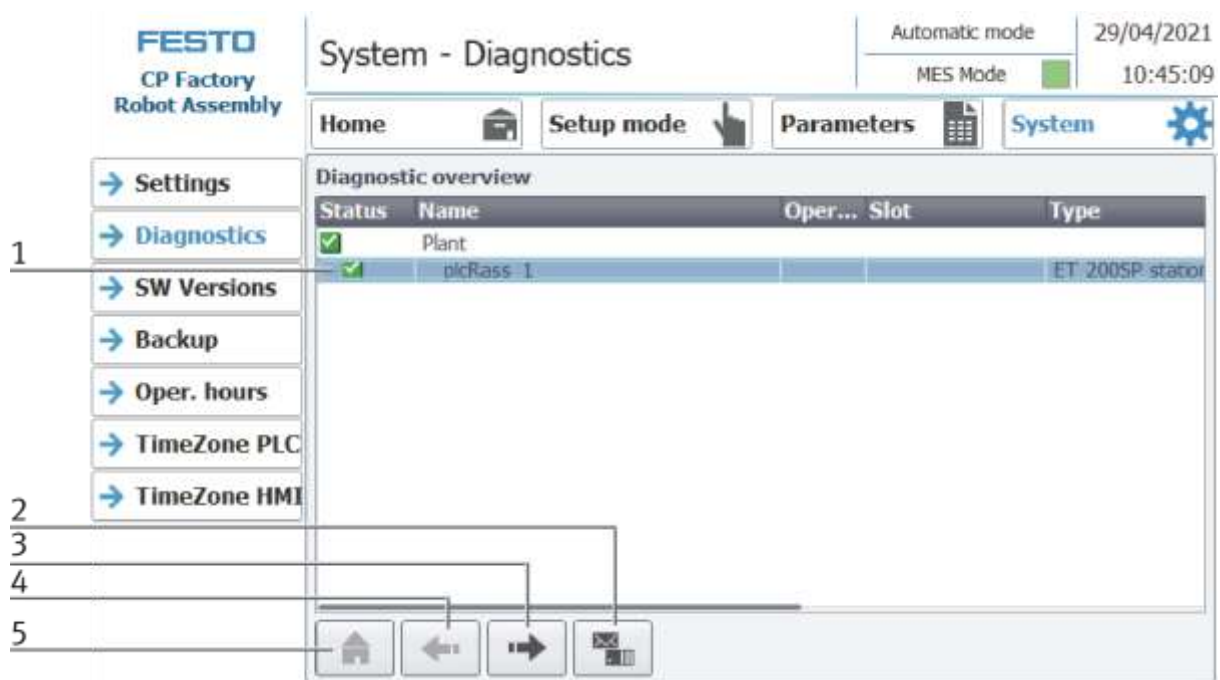
1. To get to the system settings, the System button must be selected
2. Click on Settings



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
CP Factory
Robot Assembly

System - Version

Automatic mode 29/04/2021
MES Mode ■ 10:45:22

Home Setup mode Parameters System

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

actual library version:
V4.00

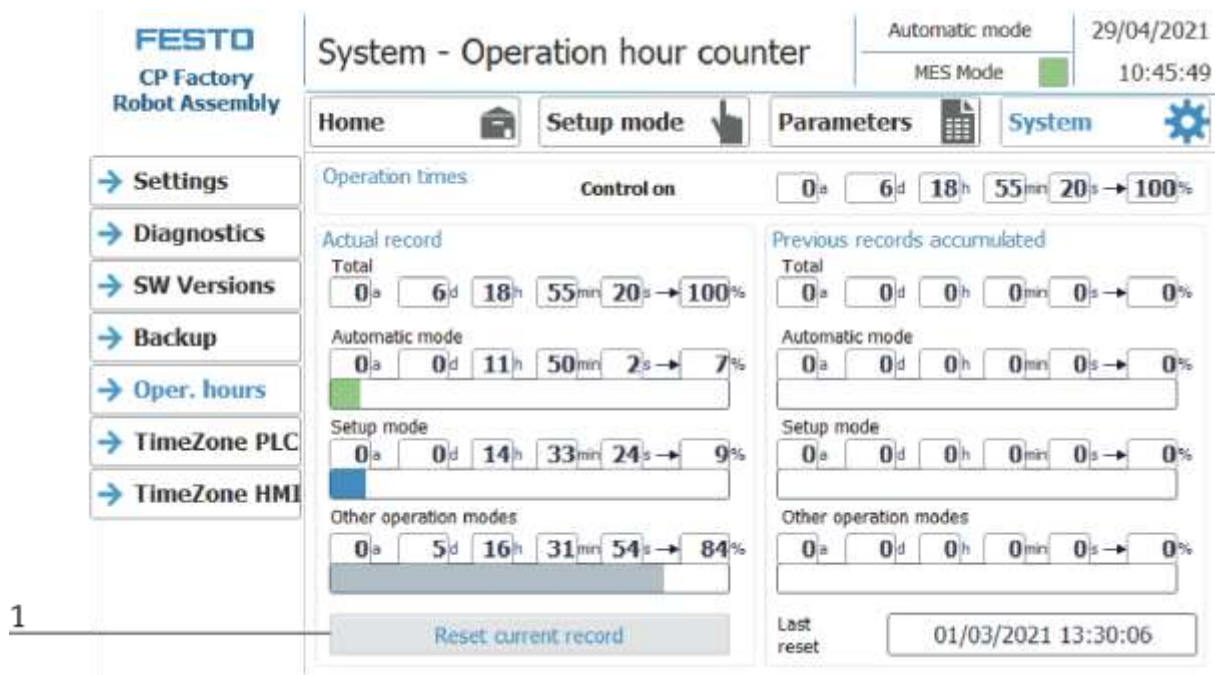
Display of the current library version.

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.

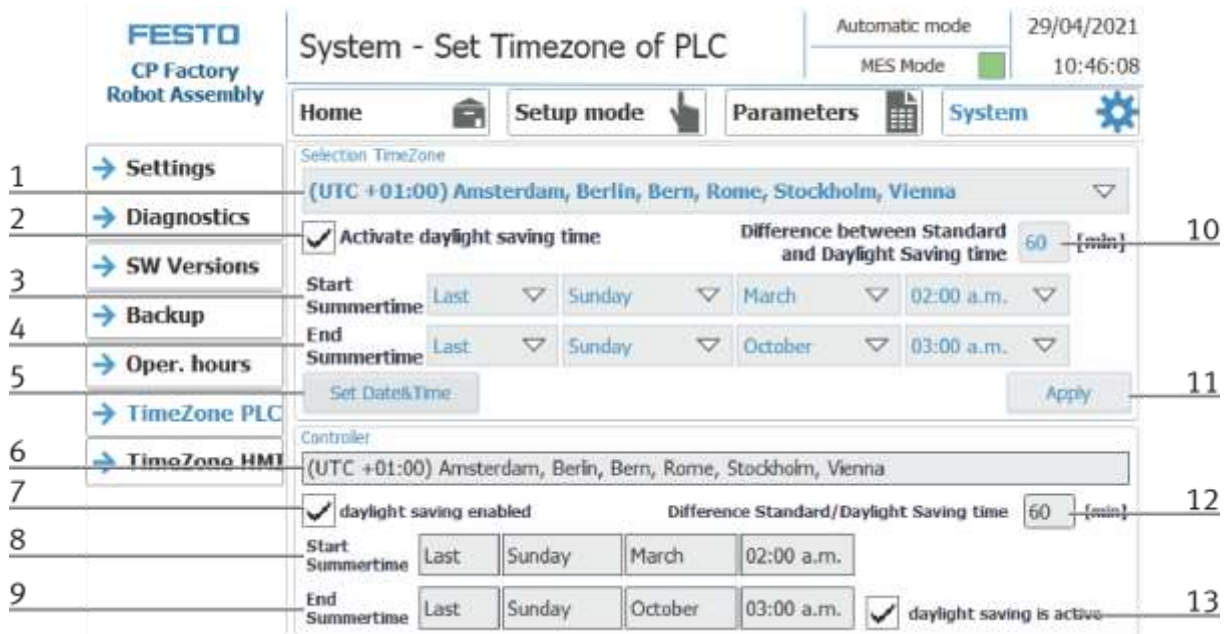
In the "Operation times" area, the time since the control was switched on is counted.

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.

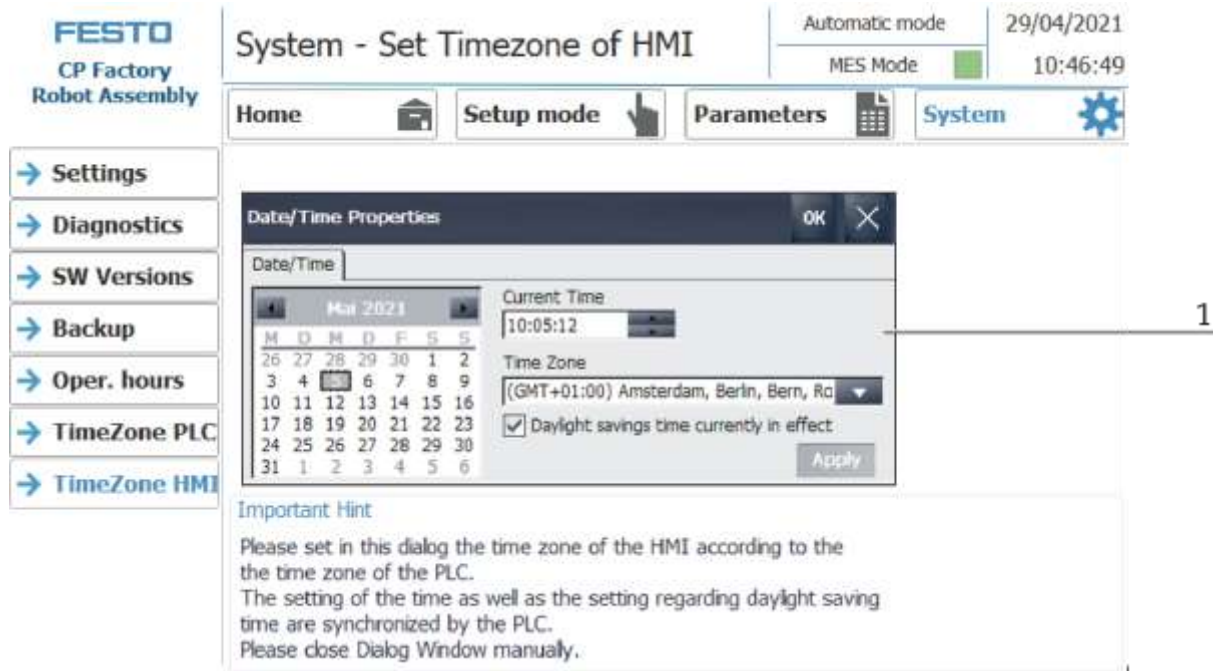
Time zone submenu in the PLC



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 <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>
7	Display of whether daylight saving time changeover is active in the PLC. <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>
8	Display of the current start of daylight saving time in the control <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>
9	Display of the current end of daylight saving time in the control <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>
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. <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>
13	Display of whether daylight saving time is currently active. <i>(Only valid if the time zone of the PLC has been set once using the "Apply" button)</i>

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.



8.7 Switching on the station



Illustration similar

1. The station is supplied with voltage.
2. The station is supplied with 6 bar air pressure.
3. All EMERGENCY STOP signal transmitters (pushbuttons, door contacts, light barriers, etc.) are not actuated and unlocked.
4. Turn on the main switch from station and from robot.
5. Press the RESET button, the RESET button lights up blue, the HMI starts and starts up.
6. Wait till HMI is ready
7. Now align the robot straightening and the key switch on the Drive Unit to Auto Mode

8.7.1 Start automatic

	 WARNING
	<ul style="list-style-type: none"> • Danger of being pulled in at the conveyors <ul style="list-style-type: none"> – 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.

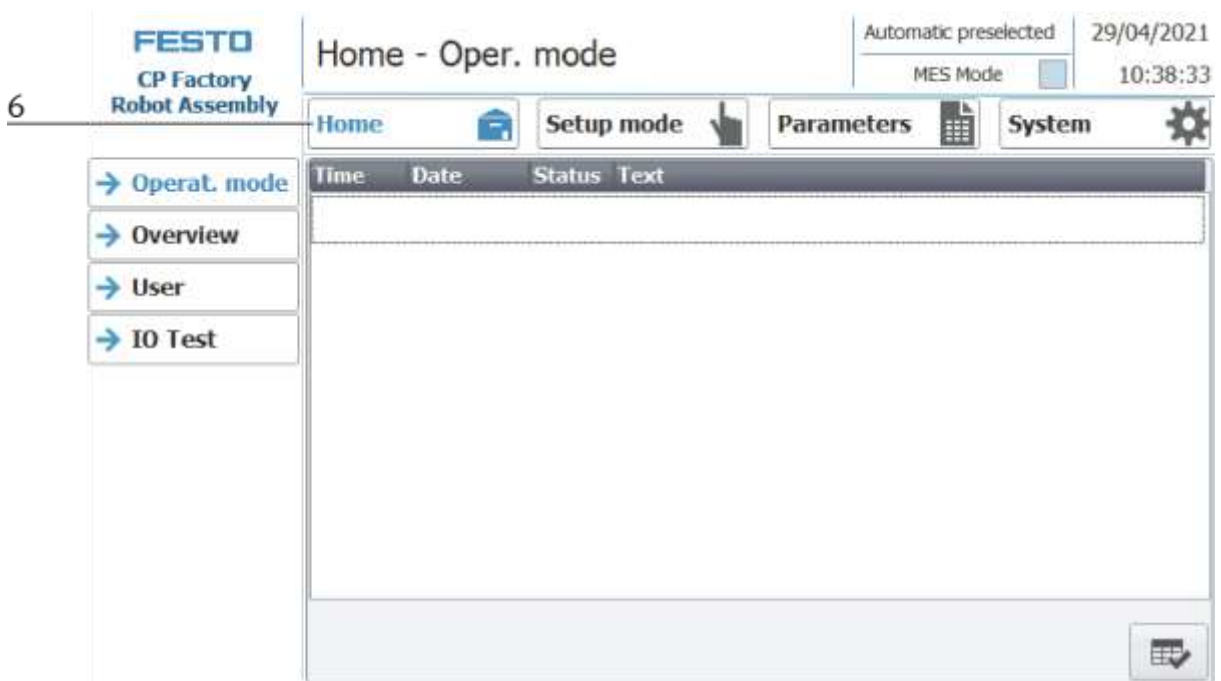
4



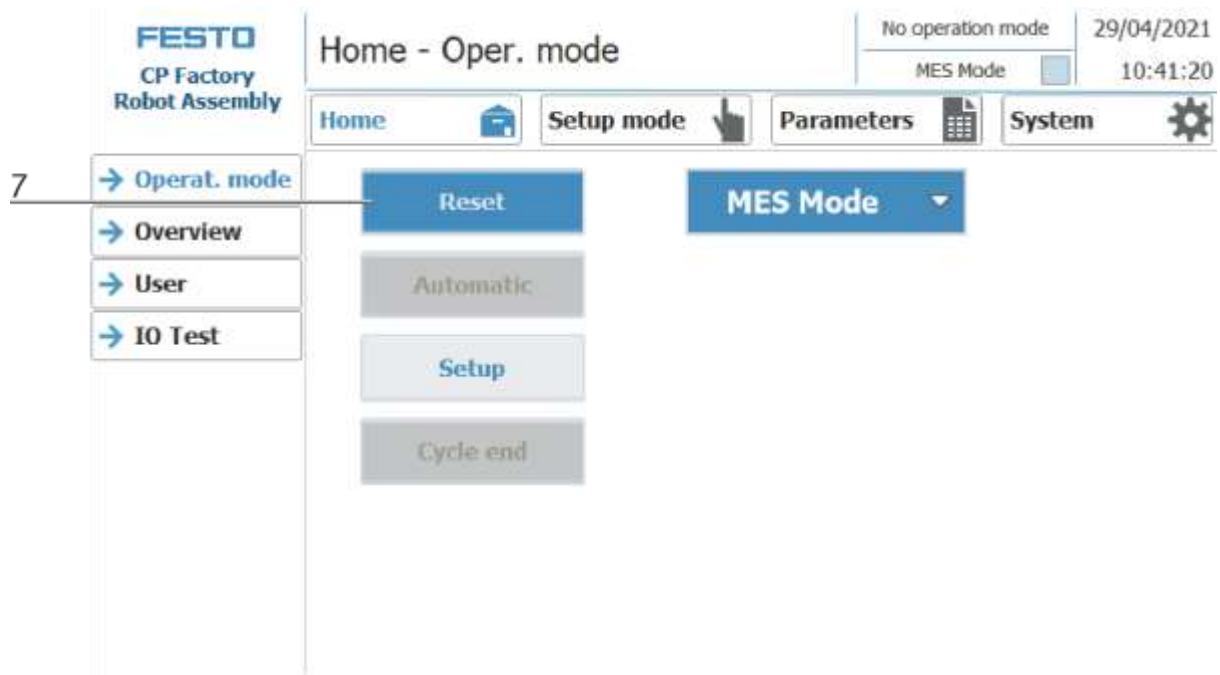
- The error message is displayed in the main window. After the error situation has been remedied, it can be acknowledged by pressing the RESET button.



- Press Home Button

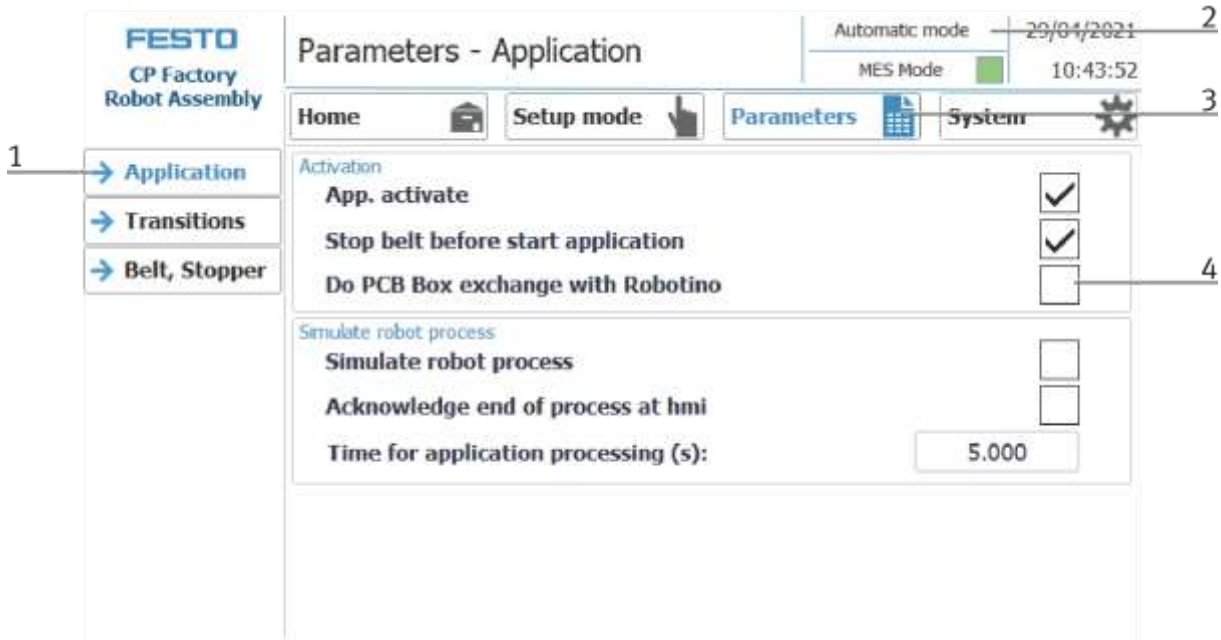


7. Press the flashing RESET Button. Station/application moves in home position.



8. If the station is loaded by hand, boxes can be manually fed by pressing the "Box Change" button on the back side of the station. Similarly, boxes can be hand out manually, this is also the button „Box change“ to press.

9. If the station is to be automatically feed by a Robotino, the application (1) must be selected in the setup mode (2) for the parameters (3) and in the field "Box change over Robotino run" (4) a hook has to be set.



10. Press the flashing AUTOMATIC Button



- 11. AUTOMATIC Button lights up
- 12. Automatic mode is active



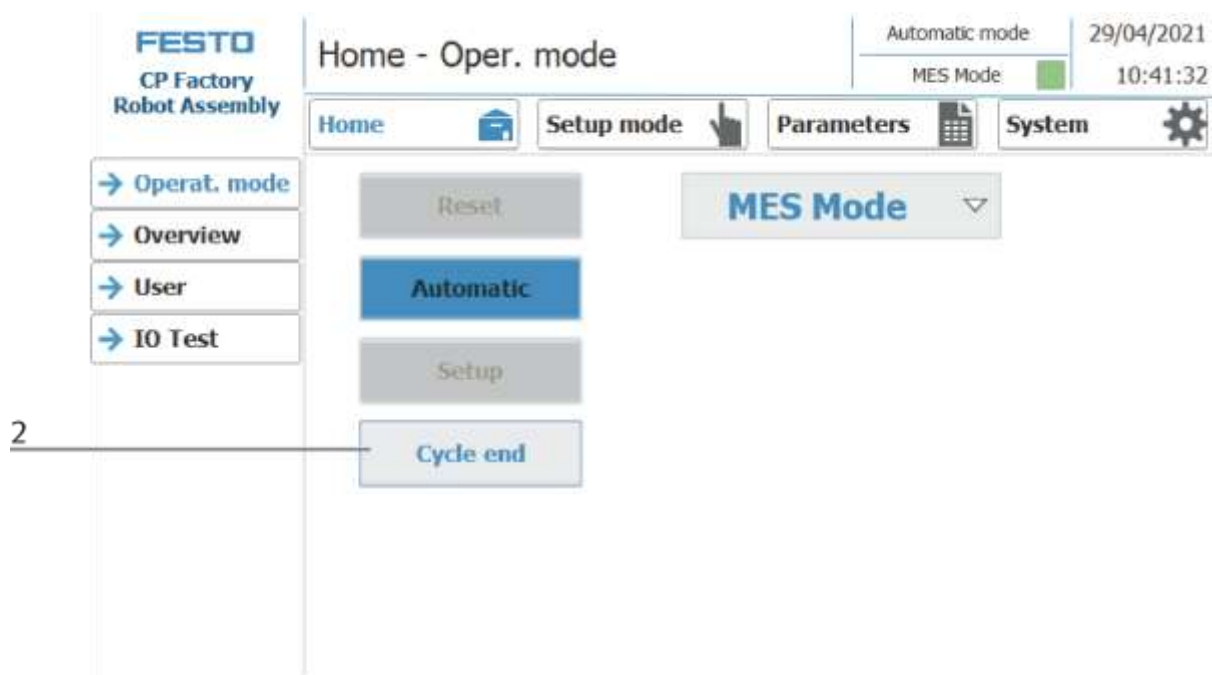
8.7.2 Sequence Description Automatic

If the automatic sequence was started,

1. The automatic button lights up blue
2. Stoppers are retracted
3. The workpiece is transported in circulation mode
4. If a carrier moves into the module / application module, this will execute your automatic process. The operation of the module / application module is, however, only started if the operation in MES is intended for this resource and the resource can also carry out this operation.
5. The Busy displays become active.
6. During this time, the automatic sequence is executed in the application.
7. The next resource and operation are written to the RFID chip
8. When the module / application module is ready, the display changes back to the original state and the stopper is retracted
9. The product carrier moves out of the working position and is available to further modules / application modules.

8.7.3 Process description Cycle End

1. An automatic cycle is active.
2. Press the button Cycle End.



3. The module/application 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.

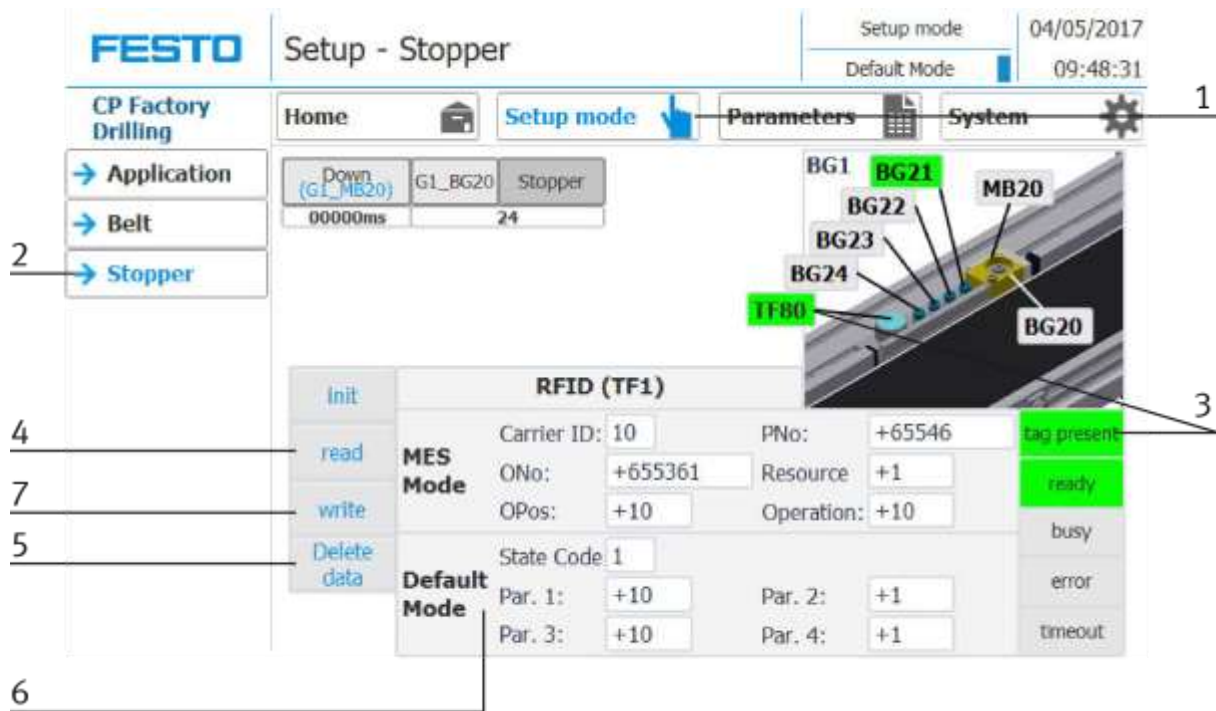
8.8 Writing on the RFID tag manually

8.8.1 Pallet carriers

In order to describe a pallet carrier with a specific ID, or to get information on which data is stored on the pallet carrier, it is possible to read this data or to describe the tag.

For this, it is necessary that a pallet carrier with a functioning tag is at one of the stopper positions and the station is switched on.

The following example is guilty for all read out positions where pallet carriers can be read out.



1. Select the Setup mode
2. Select the stopper from the setup menu on the left
3. If an RFID is detected, this is indicated by "tag present". (TF80 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. Enter the desired data in the field (all fields which are white in background can be edited)

MES Mode

Carrier ID - displays or enter the carrier number

ONo - the order number is displayed or entered here

OPos - the order position is displayed or entered here

PNo - the part number is displayed or entered here

Resource - here the resource is displayed or entered

Operation - the number of the operation is displayed or entered here

DefaultMode

State code - here the state code for the start condition is entered, if these match the transition tables, the parameters are read out and the automatic sequence of the application is started.

Parameter 1 = Input of parameter value (e.g., 1 / left side drilling)

Input of parameter value (e.g., 2 / right side drilling)

Input of parameter value (e.g., 3 / both sides drilling)

Parameters 2 - 4 - not used in this example

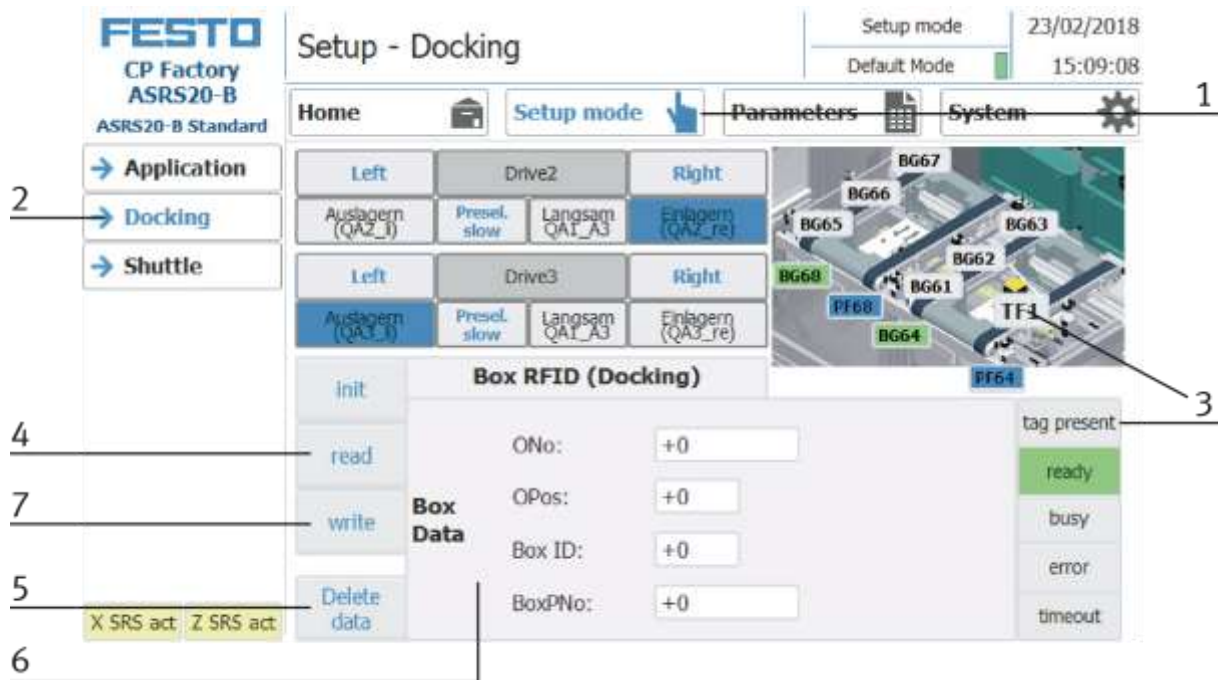
7. Press the "Write" button to write the changes made to the tag.

8.8.2 Boxes

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.


8.8.3 Parameter (RASS)



Illustration similar

Default:

Parameter-No.	Description
1	<p>Program number</p> <p>1: assemble no fuse 2: assemble front fuse (line of sight front view CP Factory robot assembly: left fuse) 3: assemble back fuse (line of sight front view CP Factory robot assembly: right fuse) 4: assemble both fuses</p> <p>Limitation: No limitation of the value in the transition table</p>
2	Not used
3	Not used
4	Not used

	NOTE
	<p>The board position in the box (parameter 4) is managed by the robot in default mode. For this purpose, the PLC reads the current board position from the robot before the program start and transfers this at the program start as a parameter 4 to the robot. Parameter 4 is therefore not to be configured, even if it is listed as "PCB Pos" in the transition table.</p>

MES:

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

Operation		Parameter	Description
300	Assemble part with defined PCB	1	Program number Value: 0 Type: on runtime
		2	Position fuse 1 Value: 0 Type: on runtime
		3	Position fuse 2 Value: 0 Type: on runtime
		4	Position PCB Value: 0 Type: on runtime
		5	Partnumber fuse 1 Value: 0 Type: on runtime
		6	Partnumber fuse 2 Value: 0 Type: on runtime
		7	Partnumber PCB Value: 120 Type: changeable

Operation		Parameter	Description
301	Assemble PCB no fuse	1	Program number Value: 1 Type: constant
		2	Position fuse 1 Value: 0 Type: on runtime
		3	Position fuse 2 Value: 0 Type: on runtime
		4	Position PCB Value: 0 Type: on runtime
		5	Partnumber fuse 1 Value: 0 Type: constant
		6	Partnumber fuse 2 Value: 0 Type: constant
		7	Partnumber PCB Value: 120 Type: changeable

Operation		Parameter	Description
302	Assemble PCB front fuse	1	Program number Value: 2 Type: constant
		2	Position fuse 1 Value: 0 Type: on runtime
		3	Position fuse 2 Value: 0 Type: on runtime
		4	Position PCB Value: 0 Type: on runtime
		5	Partnumber fuse 1 Value: 130 Type: constant
		6	Partnumber fuse 2 Value: 0 Type: constant
		7	Partnumber PCB Value: 120 Type: constant
303	Assemble PCB rear fuse	1	Program number Value: 3 Type: constant
		2	Position fuse 1 Value: 0 Type: on runtime
		3	Position fuse 2 Value: 0 Type: on runtime
		4	Position PCB Value: 0 Type: on runtime
		5	Partnumber fuse 1 Value: 0 Type: constant
		6	Partnumber fuse 2 Value: 130 Type: constant
		7	Partnumber PCB Value: 120 Type: constant

Operation		Parameter	Description
304	Assemble PCB both fuse	1	Program number Value: 4 Type: constant
		2	Position fuse 1 Value: 0 Type: on runtime
		3	Position fuse 2 Value: 0 Type: on runtime
		4	Position PCB Value: 0 Type: on runtime
		5	Partnumber fuse 1 Value: 130 Type: constant
		6	Partnumber fuse 2 Value: 130 Type: constant
		7	Partnumber PCB Value: 120 Type: constant



NOTE

The board position in the box (parameter 4) is managed by MES in the MES mode.

8.9 Vision Module

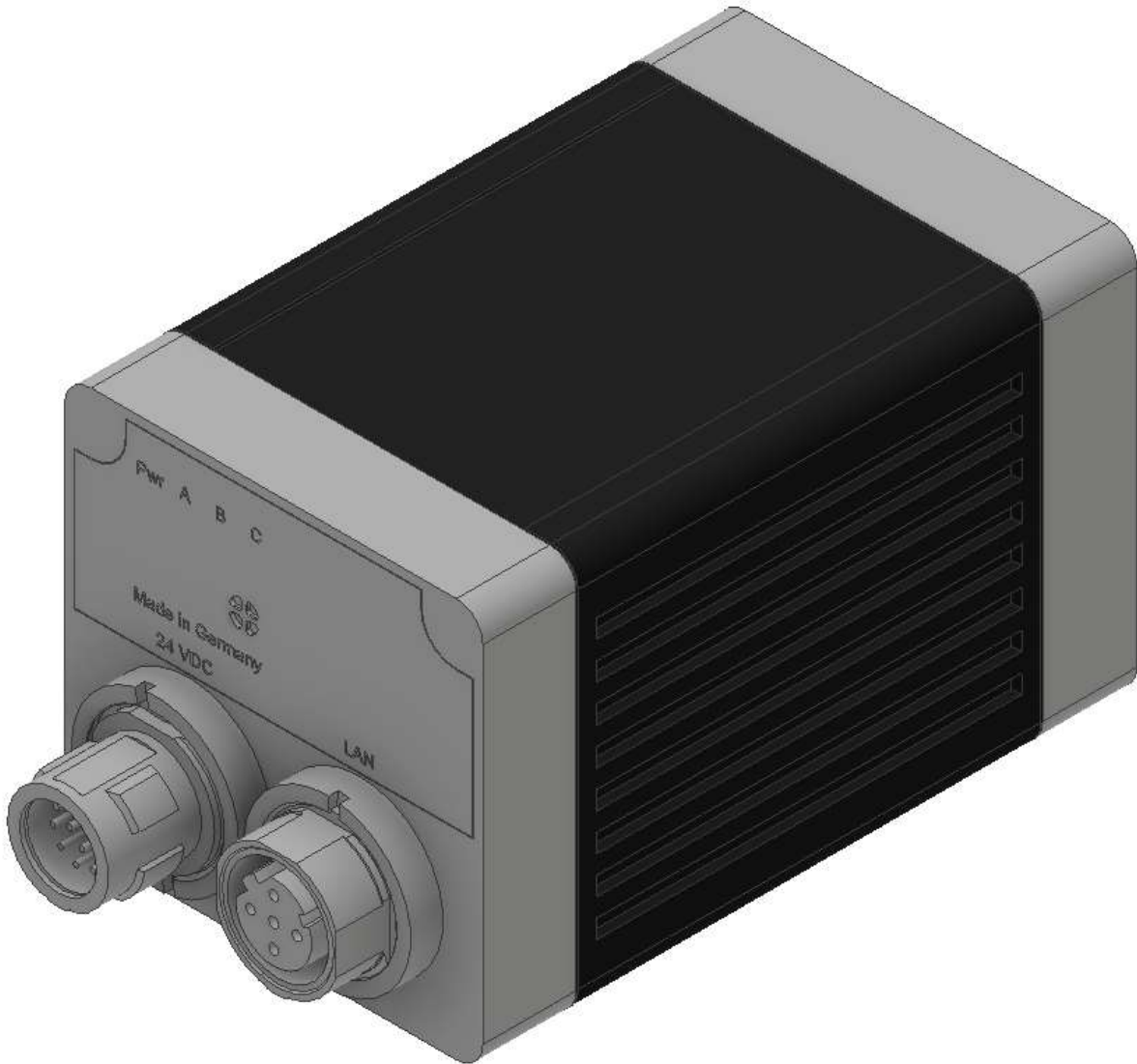


Illustration similar

The camera is designed for the optical inspection of the workpieces. Therefore the colour and the orientation of the workpieces is collected.

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

8.9.1 Install camera

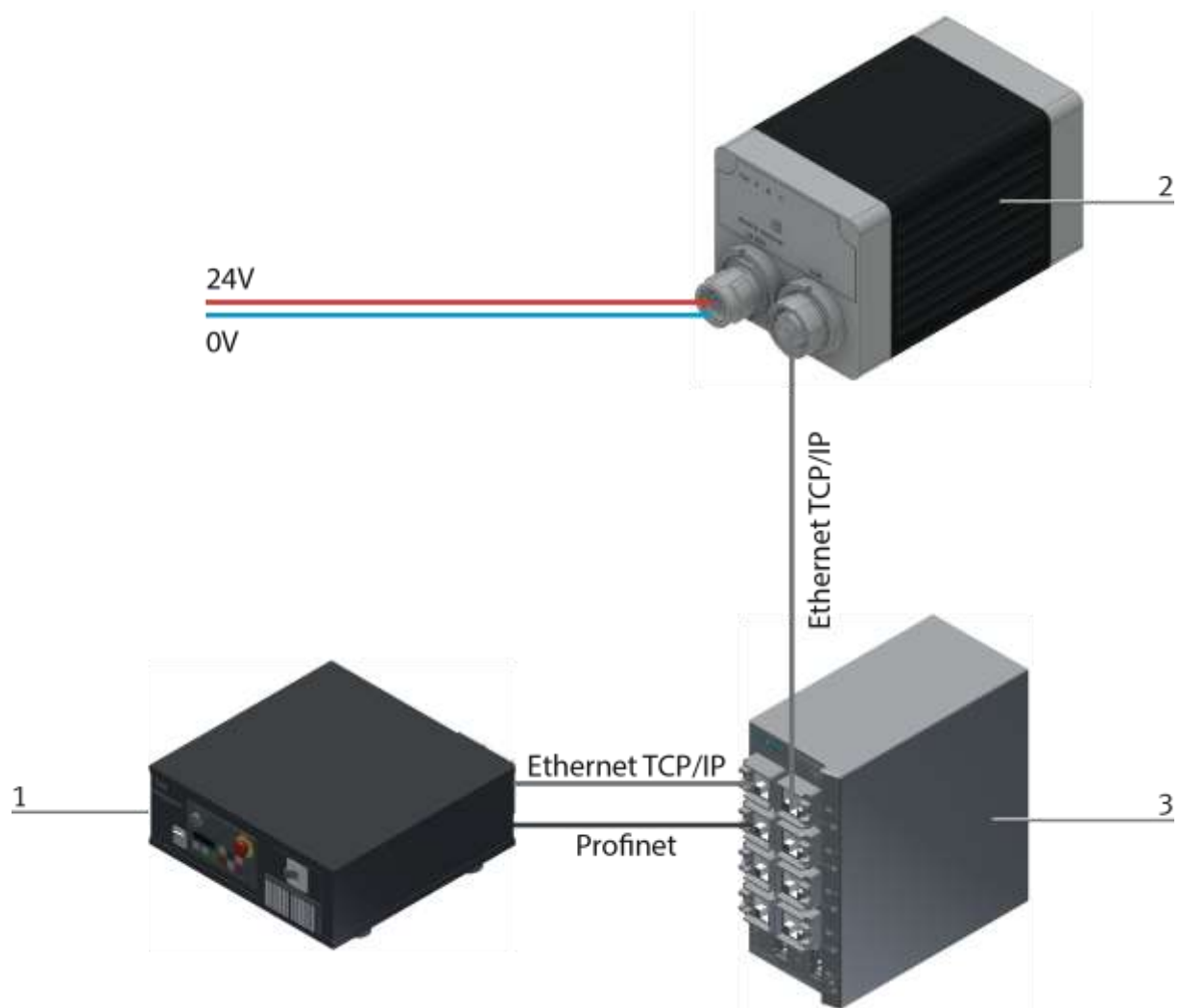
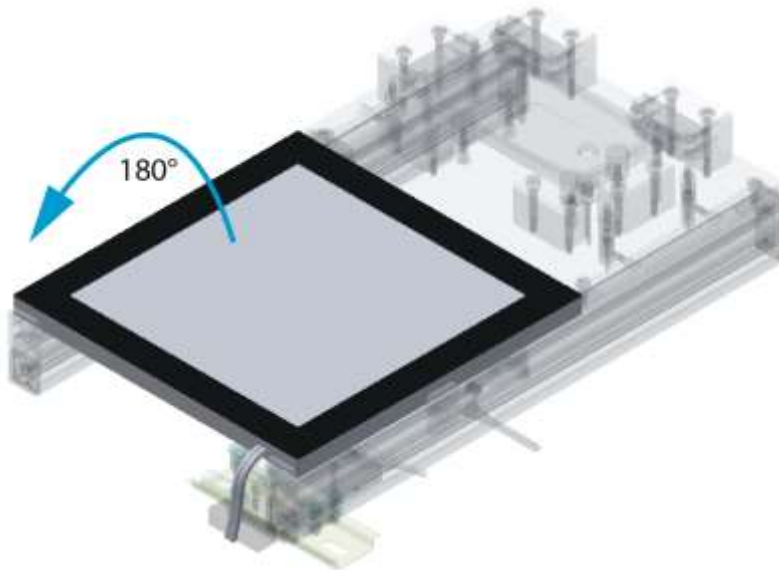


Illustration similar

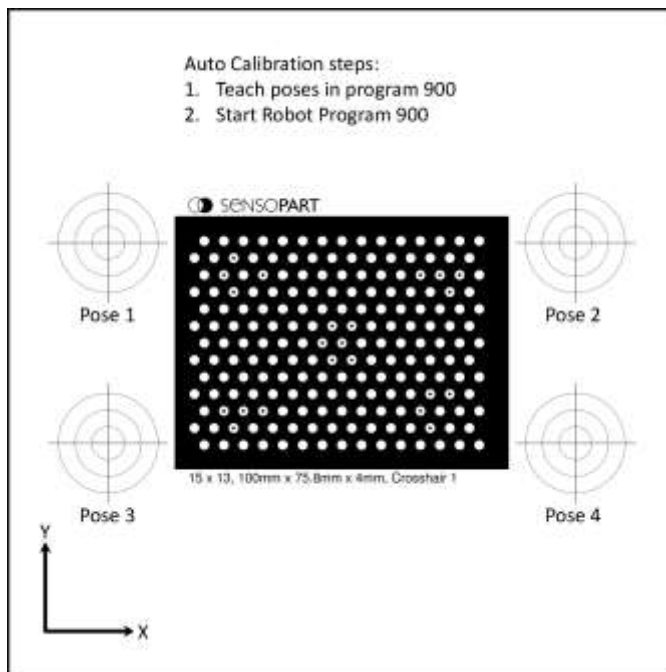
No.	Name	IP Address	Protocol	Port
1	Robot Controller Mitsubishi	172.21.Res.ID.40 172.21.Res.ID.41	TCP/IP Profinet	10001 -
2	Camera	172.21.Res.ID.50	TCP/IP	2006
3	Switch			

8.9.2 Calibrate camera

1. Turn light panel (Calibration plate) for 180°



2. The following graphic is on the bottom side of the light panel



3. Now pick up the calibration tool with the workpiece gripper (Tool2).
4. Load program number 900 on the robot and teach positions 1 - 4 on the calibration plate one after the other.
5. move robot to home position
6. set robot to Auto mode (key switch on robot controller)
7. start program 900 on HMi
8. calibration runs automatically

8.9.3 Robot program for camera

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

Program 1: Check no fuse present

Program 2: Check left fuse present

Program 3: Check right fuse present

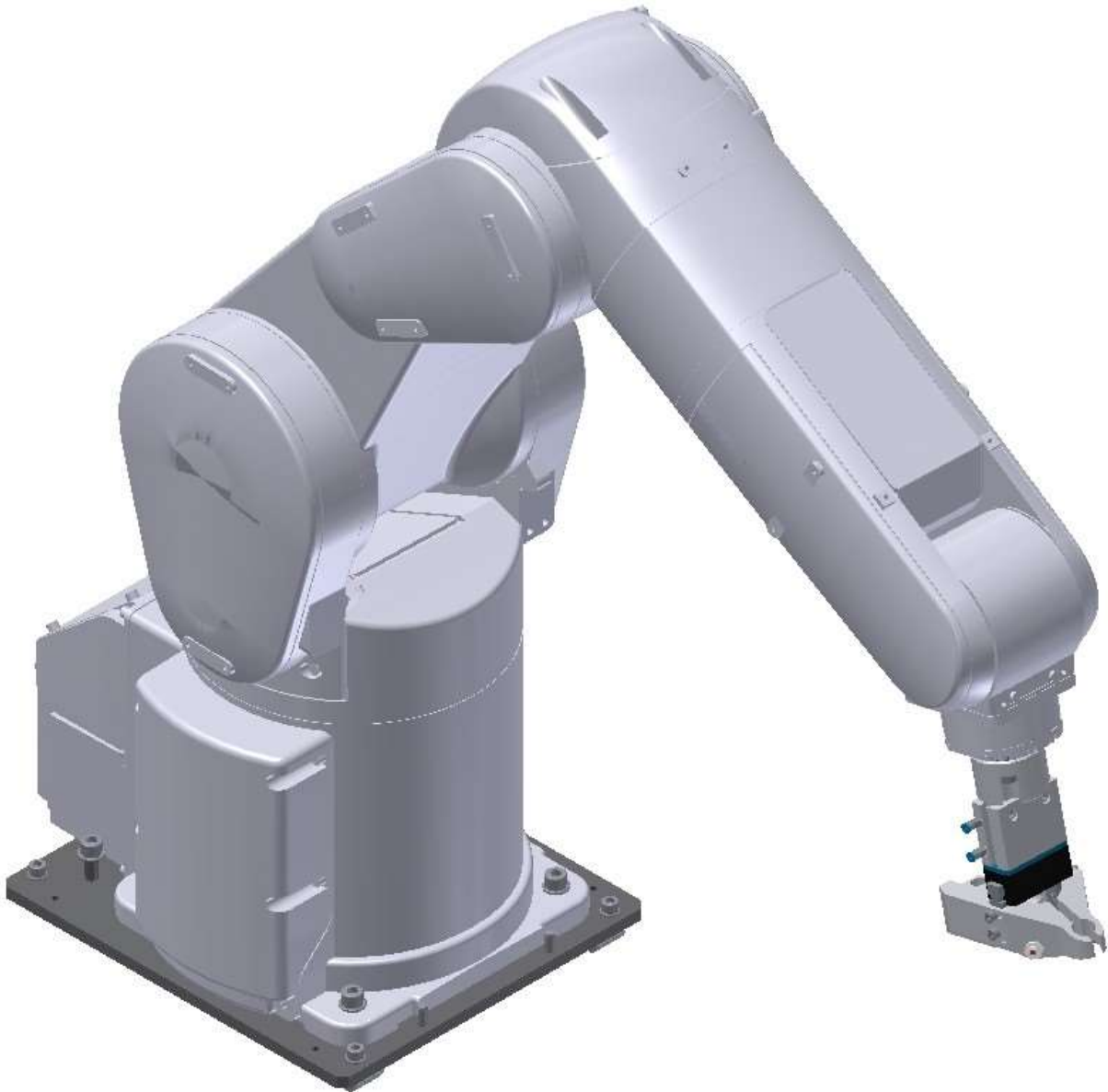
Program 4: Check both fuses present

Program 5: Demo program

9 Components

9.1 Mitsubishi Robot RV-4FL

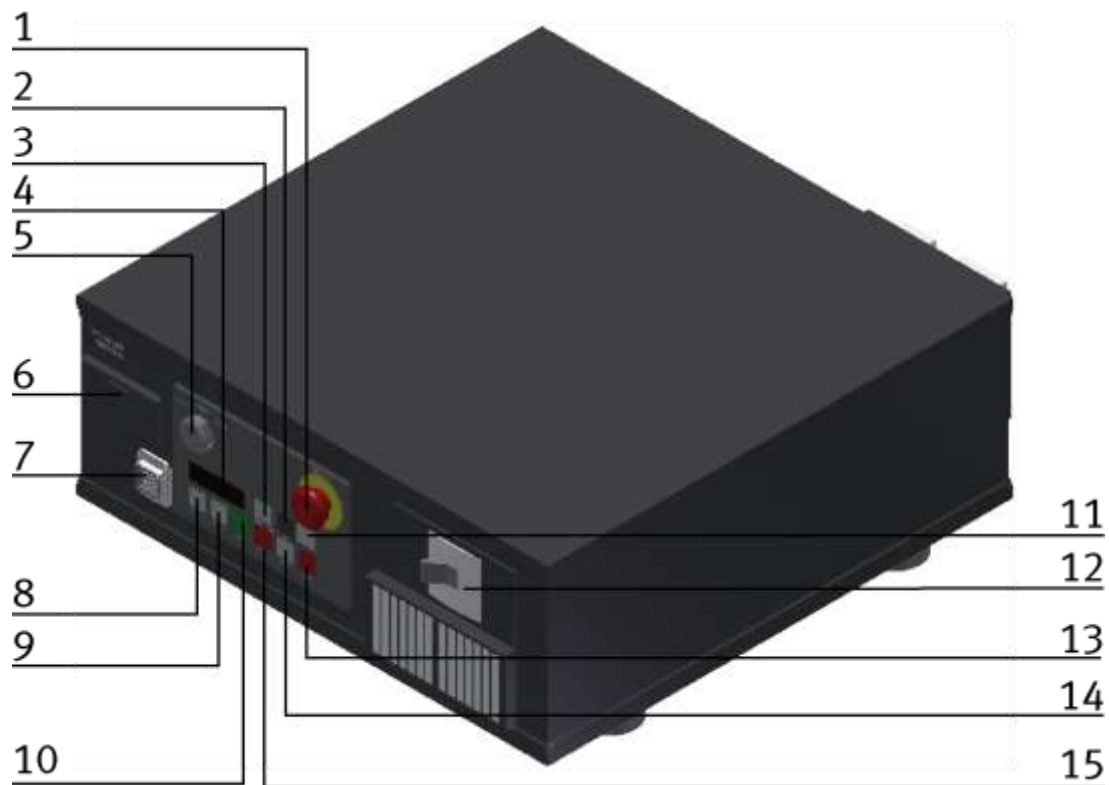
For the transport of the workpieces, a vertical- articulated arm robot is used. This is an industrial robot with 6 axis. The repetition accuracy of the robot positioning is $\pm 0.02\text{mm}$. Its maximum speed amounts to 9900 mm/s. There is an end position and overload monitoring program integrated. 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

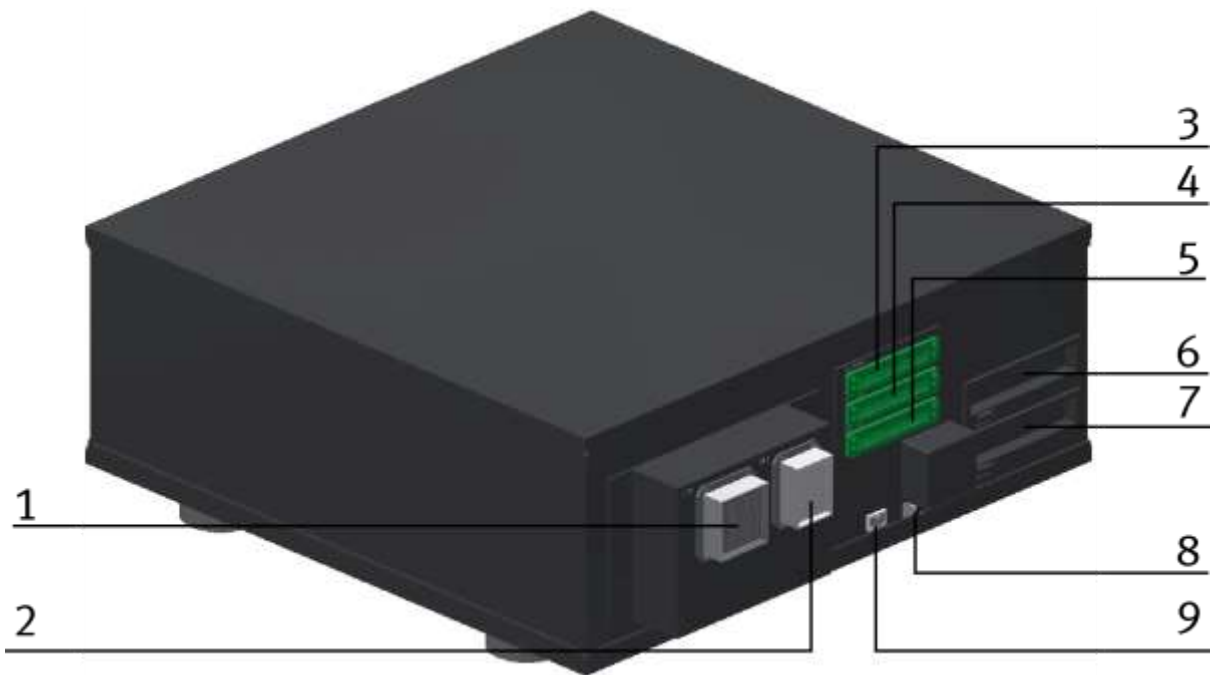


Illustration similar

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 Teachpendant R56TB

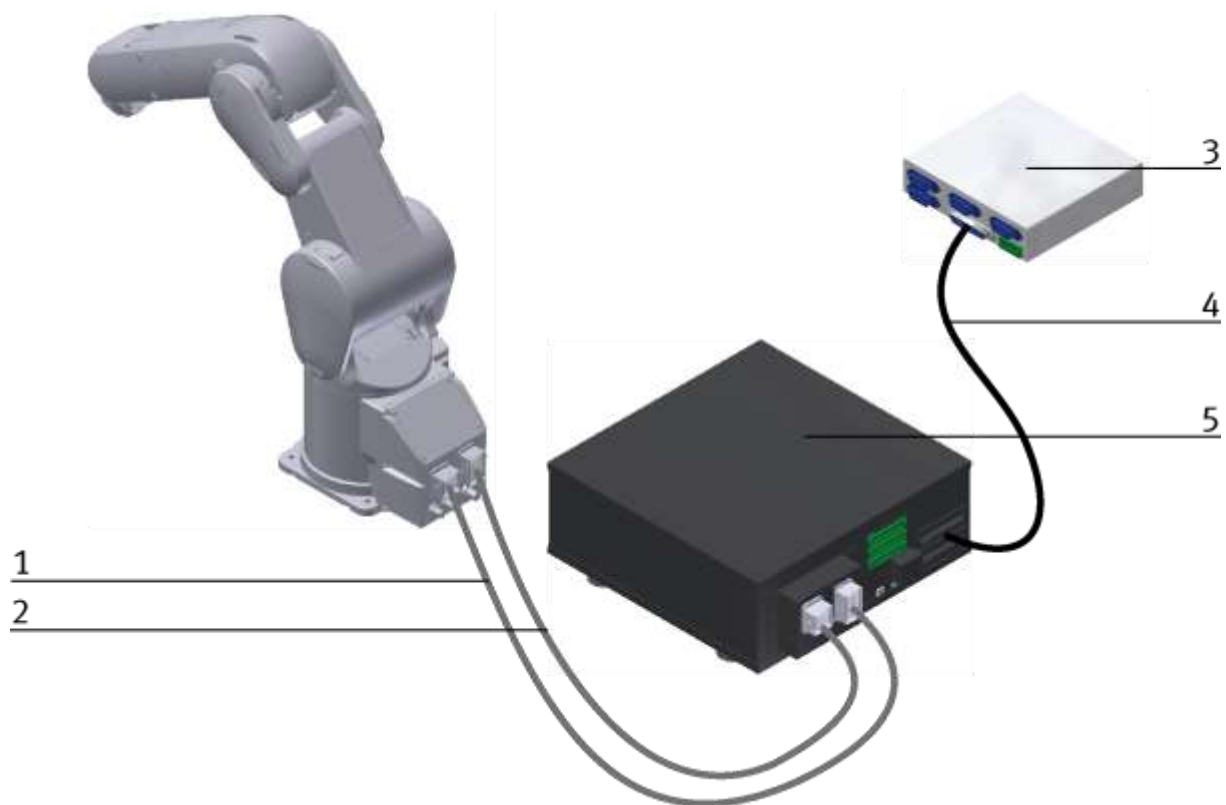
To operate the robot in standalone mode, the teach pendant is necessary. The buttons have different functions, depending on the different modes. With the key switch at the Drive unit, it is possible to choose the following three modes.

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



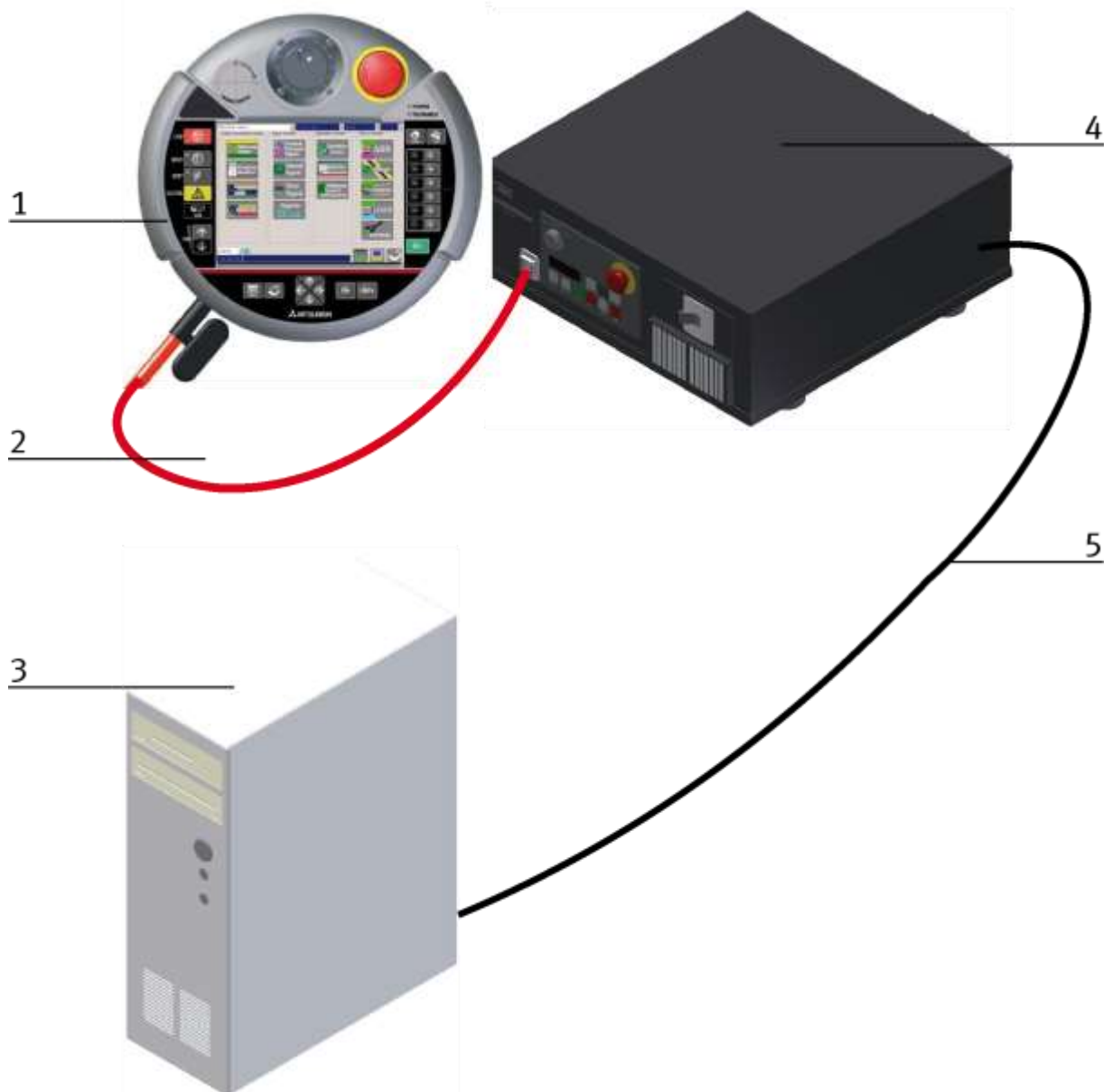
Teachpendant

9.1.3 Set up



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

Position	Description
1	CN1 cabel
2	CN 2 cabel
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 Interface Drive Unit

Sensor Name	Variable Name	Input/Output	Robot Address	Data Type	Comment	PLC Address	
connected to robot IO card	BG9	DI_WPClamped	Input	16	Bit	Upper part is clamped at assembly position	
	BG10	DI_WPAvail	Input	17	Bit	upper part available at assembly position	
	BG11	DI_WPOrientOk	Input	18	Bit	upper part not upside down at assembly position	
	BG12	DI_WPHoleOk	Input	19	Bit	Hole found on the upper part	
	BG14	DI_FuseMag1Avail	Input	21	Bit	Fuse available in fuse magazine 1	
	BG15	DI_FuseMag2Avail	Input	22	Bit	Fuse available in fuse magazine 2	
	BG16	DI_FuseMag3Avail	Input	23	Bit	Fuse available in fuse magazine 3	
	BG18	DI_Grp1VacStore	Input	25	Bit	Vacuum gripper present at tool location1	
	BG19	DI_Grp2WrkStore	Input	26	Bit	Workpiece gripper present at tool location 2	
	BG20	DI_Grp3FuseStore	Input	27	Bit	Fuse gripper present at tool location 3	
	k6-BG3	DI_GripperOpen	Input	900	Bit	Gripper is opened	
	K6-BG1	DI_GrpAvailable	Input	902	Bit	Gripper clamped by the gripper change system	

Sensor Name	Variable Name	Input/Output	Robot Address	Data Type	Comment	PLC Address
Robot State Info Region	#STOP2	Input	2000	Bit	Stop	100.0
	#START	Input	2001	Bit	Program start	100.1
	#IOENA	Input	2002	Bit	Operation rights enable	100.2
	#SLOTINIT	Input	2003	Bit	Program reset	100.3
	#SRVON	Input	2004	Bit	Servo power ON	100.4
	#SRVOFF	Input	2005	Bit	Servo power Off	100.5
	#ERRRESET	Input	2006	Bit	error reset input signal	100.6
	#PRGSEL	Input	2007	Bit	Program selection input signal	100.7
	#OVRDSEL	Input	2008	Bit	Override selection input signal	101.0
	#PRGOUT	Input	2009	Bit	Program no output request	101.1
	#OVRDOUT	Input	2010	Bit	override value request	101.2
	#ERROUT	Input	2011	Bit	Error no output request	101.3
	#Reserved	Input	2012 - 2015		Reserved	
	#IODATA	Input	2016 - 2031	Word	Numeric value input	102 - 103
	DI_RetryLastStep	Input	2032	Bit	Retry the previously failed step	104,0
	DI_ExitCurrCycle	Input	2033	Bit	Exit current program cycle	104,1
	IsRobotinoUsed	Input	2034	Bit	Robotino is used to transport PCB pallet	104,2
	Reserve_RobState1	Input	2035 - 2039		Reserved for future expansion	
Reserve_RobState2	Input	2040 - 2047	Byte	Reserved for future expansion	105	

Sensor Name	Variable Name	Input/Output	Robot Address	Data Type	Comment	PLC Address	
Robot Variable Info Region	ReservedWord1	Input	2048 - 2063	Word	Reserved word 1	106 - 107	
	DI_StopperNo	Input	2064 - 2071	Byte	Stopper number to pick work piece	108	
	DI_PCBPalletNo	Input	2072 - 2079	Byte	PCB pallet number to pick PCB	109	
	ReserveByte2	Input	2080 - 2087	Byte	Reserved byte 2	110	
	ReserveByte3	Input	2088 - 2095	Byte	Reserved byte 3	111	
	ReserveByte4	Input	2096 - 2103	Byte	Reserved byte 4	112	
	ReserveByte5	Input	2104 - 2111	Byte	Reserved byte 5	113	
	ReserveByte6	Input	2112 - 2119	Byte	Reserved byte 6	114	
	ReserveByte7	Input	2120 - 2127	Byte	Reserved byte 7	115	
	ReserveByte8	Input	2128 - 2135	Byte	Reserved byte 8	116	
	ReserveByte9	Input	2136 - 2143	Byte	Reserved byte 9	117	
Connected to PLC Via. Profinet	BG1	DI_PalletInFront	2144	Bit	PCB pallet in front position	118,0	
	BG2	DI_PalInLoadPos	2145	Bit	PCB pallet at manual feed position	118,1	
	BG3	DI_PalOrientOk	2146	Bit	PCB pallet orientation is correct	118,2	
	BG5	DI_PalIndex1Up	2147	Bit	PCB pallet locked by front cylinder	118,3	
	BG6	DI_PalIndex2Up	2148	Bit	PCB pallet locked by back cylinder	118,4	
	SF7	DI_PalChangeAck	2149	Bit	PCB pallet change acknowledge	118,5	
	BG50	DI_WPPalAvail	2150	Bit	Pallet available at stopper	118,6	
	BG51	DI_WPAtStopAvail	2151	Bit	WP available on pallet at stopper	118,7	
		ReserveSensor2	Input	2152 - 2159	Byte	Reserved for sensor group 2	119
		ReserveSensor3	Input	2160 - 2167	Byte	Reserved for sensor group 3	110
		ReserveSensor4	Input	2168 - 2175	Byte	Reserved for sensor group 4	111

Sensor Name		Variable Name	Input/Output	Robot Address	Data Type	Comment	PLC Address
connected to robot IO card	MB9	DO_WPMountLock	Output	16	Bit	Lock the upper part at assembly position	
	K_IN0	DO_StartCamera	Output	24	Bit	Start camera	
	K6-MB1	Hand1	Output	900	Bit	Hand 1 output	
	K6-MB2	Hand2	Output	901	Bit	Hand 2 output	
	k6-MB3	Hand3	Output	902	Bit	Clamp gripper to flange	
Robot State Info Region		#STOP2	Output	2000	Bit	Stopping	100.0
		#START	Output	2001	Bit	Program starting	100.1
		#IOENA	Output	2002	Bit	Operation rights enabled	100.2
		#SLOTINIT	Output	2003	Bit	Program selection enabled	100.3
		#SRVON	Output	2004	Bit	Servo on	100.4
		#SRVOFF	Output	2005	Bit	Servo on disabled	100.5
		#ERRRESET	Output	2006	Bit	error occuring output signal	100.6
		#RCREADY	Output	2007	Bit	controller power on ready	100.7
		#BATERR	Output	2008	Bit	Battery voltage drop	101.0
		#PRGOUT	Output	2009	Bit	Program no output signal	101.1
		#OVRDOUT	Output	2010	Bit	Override value output singal	101.2
		#ERROUT	Output	2011	Bit	Error no. Output signal	101.3
		#ATTOPMD	Output	2013	Bit	Teaching mode output	101,5
		#TEACHMD	Output	2014	Bit	Teaching mode output	101,6
		#IODATA	Output	2016 - 2031	Word	Numeric value output	102 - 103
		IsRbtArmHome	Output	2032	Bit	Robot arm is in Home position	104,0
		IsRbtAbovePCB	Output	2033	Bit	Robot arm is above PCB pallet	104,1
	Reserve_RobState1	Output	2034 - 2039		Reserved for robot state		

Sensor Name	Variable Name	Input/Output	Robot Address	Data Type	Comment	PLC Address	
Robot Variable Info Region	Reserve_RobState2	Output	2040 - 2047	Byte	Reserved for future expansion	105	
	ReservedWord1	Output	2048 - 2063	Word	Reserved word 1	106 - 107	
	ReturnValue	Output	2064 - 2071	Byte	Return code 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	
Connected to PLC Via. Profinet	MB5	ReserveByte9	Output	2136 - 2143	Byte	Reserved byte 9	117
	MA4	DO_ExtIndexBolt	Output	2144	Bit	Extend the PCB pallet lock cylinder	118,0
	MA4	DO_BeltOnInDir	Output	2145	Bit	Move the PCB pallet inside the cell	118,1
	SF7	DO_BeltOnOutDir	Output	2146	Bit	Move the PCB pallet outside the cell	118,2
		DO_PalAckLampOn	Output	2147	Bit	Indication lamp for manual ack	118,3
		ReserveSensor1	Output	2148 - 2151		Reserved for sensor 1	
		ReserveSensor2	Output	2104 - 2011	Byte	Reserved for sensor 2	119
		ReserveSensor3	Output	2160 - 2167	Byte	Reserved for sensor group 3	110
		ReserveSensor4	Output	2168 - 2175	Byte	Reserved for sensor group 4	111

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,1,1,0,1,1,1,1,1,1;

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/Programs

The following programs have to be loaded into the Drive Unit and must be available there:

Program Name	Program Description
1.MB5	Program to mount no fuse
2.MB5	Program to mount left fuse
3.MB5	Program to mount right fuse
4.MB5	Program to mount both fuse
999.MB5	Program to reset the global variable values
UBP.MB5	Global variable list program
EnrgSaveVacu.MB5	sub program to enable energy saving mode of the vacuum gripper
GetCamResult.MB5	sub program to get the results from the camera
GetCurToolNo.MB5	sub program to get the current tool no gripped by the robot
GetFuseMagNo.MB5	sub program to get the available fuse magazine no
GrpClose.MB5	sub program to close the gripper
GrpLock.MB5	sub program to lock the gripper to the robot flange
GrpOpen.MB5	sub program to open the gripper
GrpRelease.MB5	sub program to release the gripper from the robot flange
GrpVacOff.MB5	sub program to turn off the vacuum of the vacuum gripper
GrpVacOn.MB5	sub program to turn on the vacuum of the vacuum gripper
Initialize.MB5	sub program to initialize the robot cell
MonitorHome.MB5	Parallel program to monitor, if robot tcp inside the home zone
MonitorPalWS.MB5	Parallel program to monitor, if robot tcp inside the bypass zone
MountBotFuse.MB5	sub program to mount the bottom fuse
MountPCB.MB5	sub program to mount the PCB
MountTopFuse.MB5	sub program to mount the top fuse
PickFrmStopr.MB5	sub program to pick the upper part from the stopper
PickFrmVision.MB5	sub program to pick the upper part from the vision field
PickFusFrMag.MB5	sub program to pick up a fuse from the fuse magazine
PickNewTool.MB5	sub program to pick the new tool from the tool storage area
PickPCBFrmPal.MB5	sub program to pick the PCB from the PCB pallet
PickWPFrmAss.MB5	sub program to pick the upper part from the assembly position
PlaceToStopr.MB5	sub program to place the upper part at the stopper position
PlaceToVision.MB5	sub program to place the upper part at the vision field
PlaceWPToAss.MB5	sub program to place the upper part at the assembly area
SensorCheck.MB5	sub program to check all the required sensors for the main program

9.1.7 Return message

Return Code	Description
1	Robot gripper closed
11	Unknow tool type gripped
21	Undefined Stopper Number
22	Unknown Program number
23	No workpiece on the Pallet at stopper
31	Camera found no workpiece
41	Workpiece assembly position occupied
42	No workpiece placed at the assembly position
43	Workpiece upside down oriented
44	Workpiece orientation not correct
45	Workpiece not clamped at assembly position
52	Unknow PCB pallet number
53	No PCB found at the ordered Pallet Number
63	All Fuse magazines empty

9.1.8 Further information to robot

To operate and further information to robot, see Mitsubishi robot manual.

9.2 Robot positions

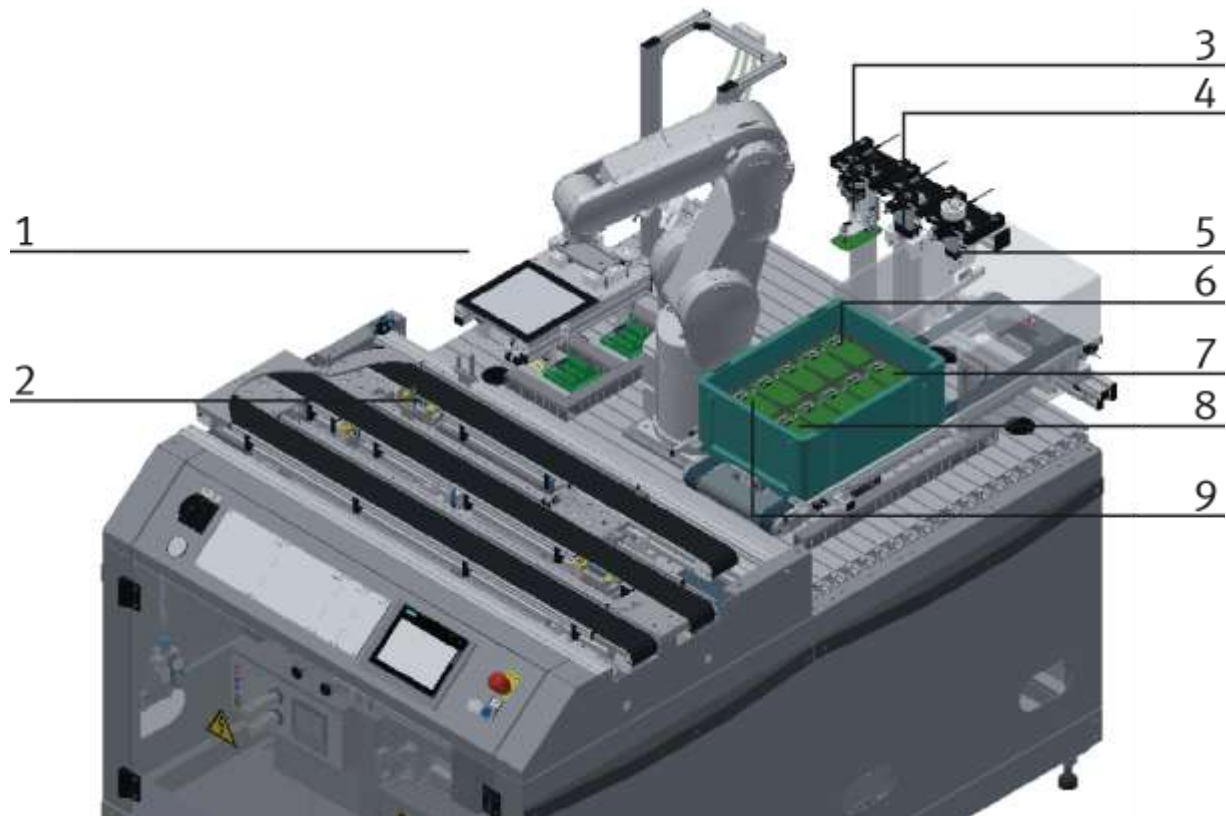


Illustration similar

Position	Designation
1	PINIT_HOME = no gripper (TOOL 4) initial position
2	CarrierStop1 = workpiece gripper (TOOL2) workpiece position on pallet
3	GrpStorageVac = no gripper (TOOL 4) buffer position vacuum gripper
4	GrpStorageWp = no gripper (TOOL 4) buffer position workpiece gripper
5	GrpStorageFuse = no gripper (TOOL 4) buffer position fuse gripper
6	PCBPallet[9] = vacuum gripper (TOOL1) end position row B (back left)
7	PCBPallet[12] = vacuum gripper (TOOL 1) end position diagonal (back right)
8	PCBPallet[4] = vacuum gripper (TOOL1) end position row A (front right)
9	PCBPallet[1] = vacuum gripper(TOOL 1) start position pallet (front left)

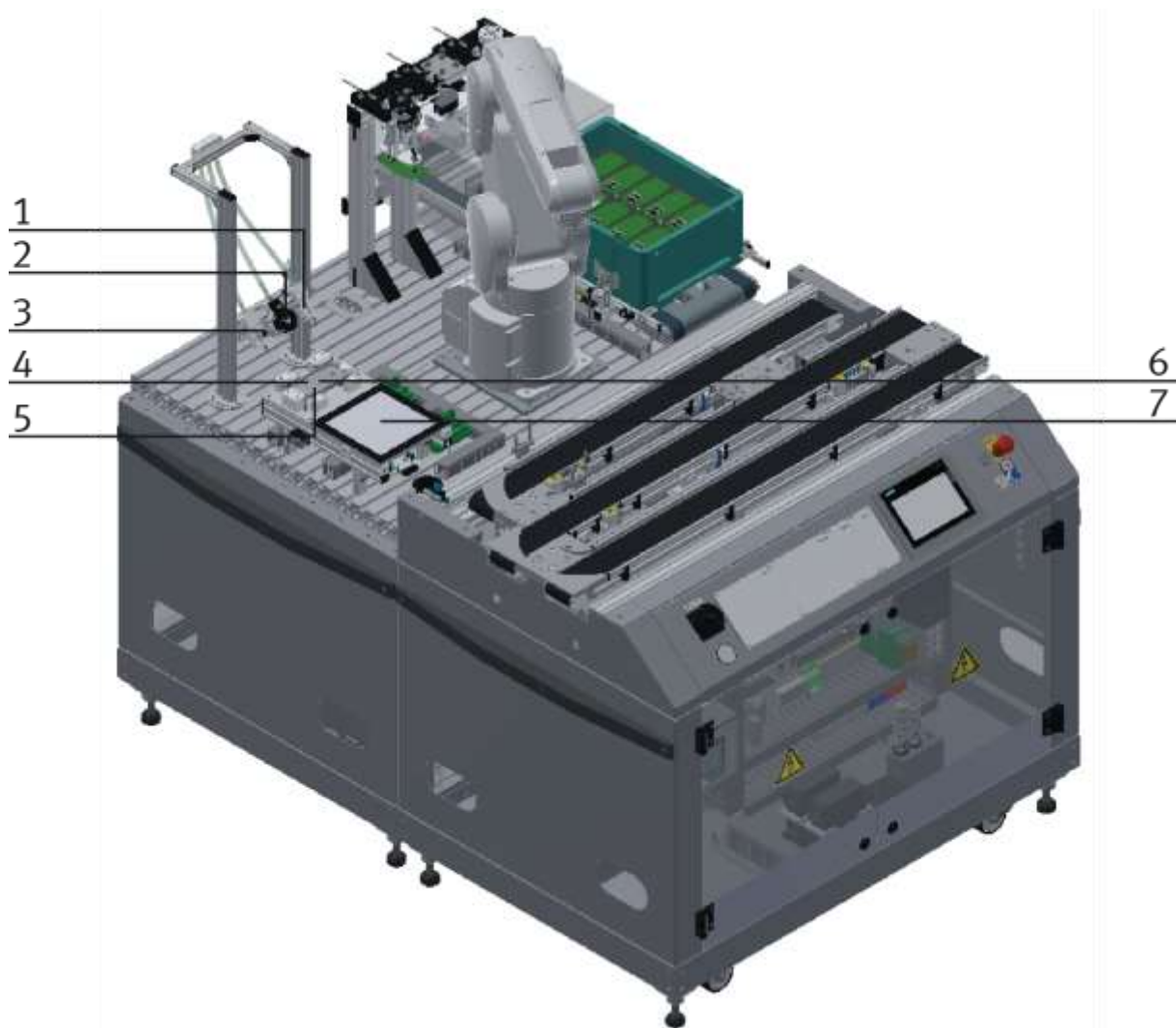


Illustration similar

Position	Designation
1	FuseMagazine3 = fuse gripper (TOOL3) magazine retrieve position 3
2	FuseMagazine2 = fuse gripper (TOOL3) magazine retrieve position 2
3	FuseMagazine1 = fuse gripper (TOOL3) magazine retrieve position 1
4	AssembleFuse1 = fuse gripper (TOOL3) assembly position 1(left)
5	AssembleFuse2 = fuse gripper (TOOL3) assembly position 2(right)
6	AssembleWP = workpiece gripper (TOOL2) assembly position with workpiece AssemblePCB = vacuum gripper (TOOL1) assembly position
7	Vision = workpiece gripper (TOOL2) workpiece position on transmitted light

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) U_b /range		24 (19-30)	(VDC)	
	Load current/constant load		3/5 depends on switching frequency	(A)	
	Input current at U_n /without load circle		T 10 mA	(mA)	
	Loading current I_{max} . 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		4mm ² , 2,5mm ² Yes		

Connection diagram

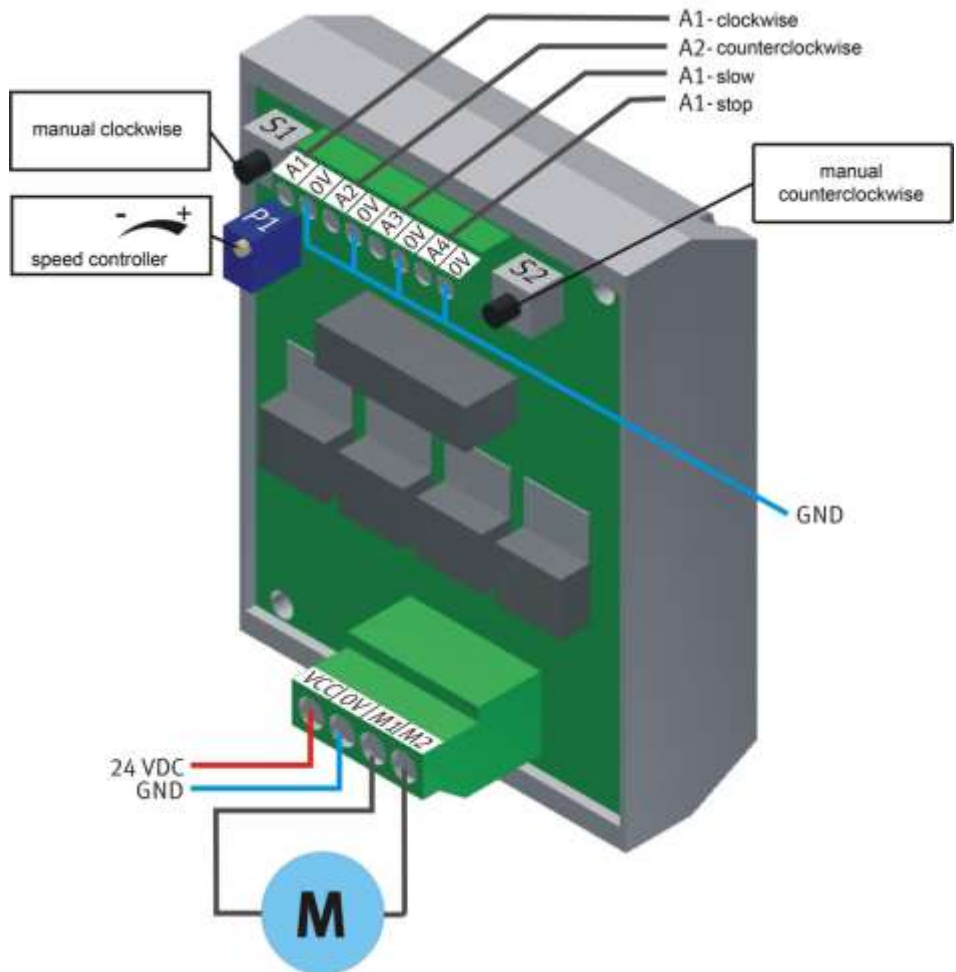
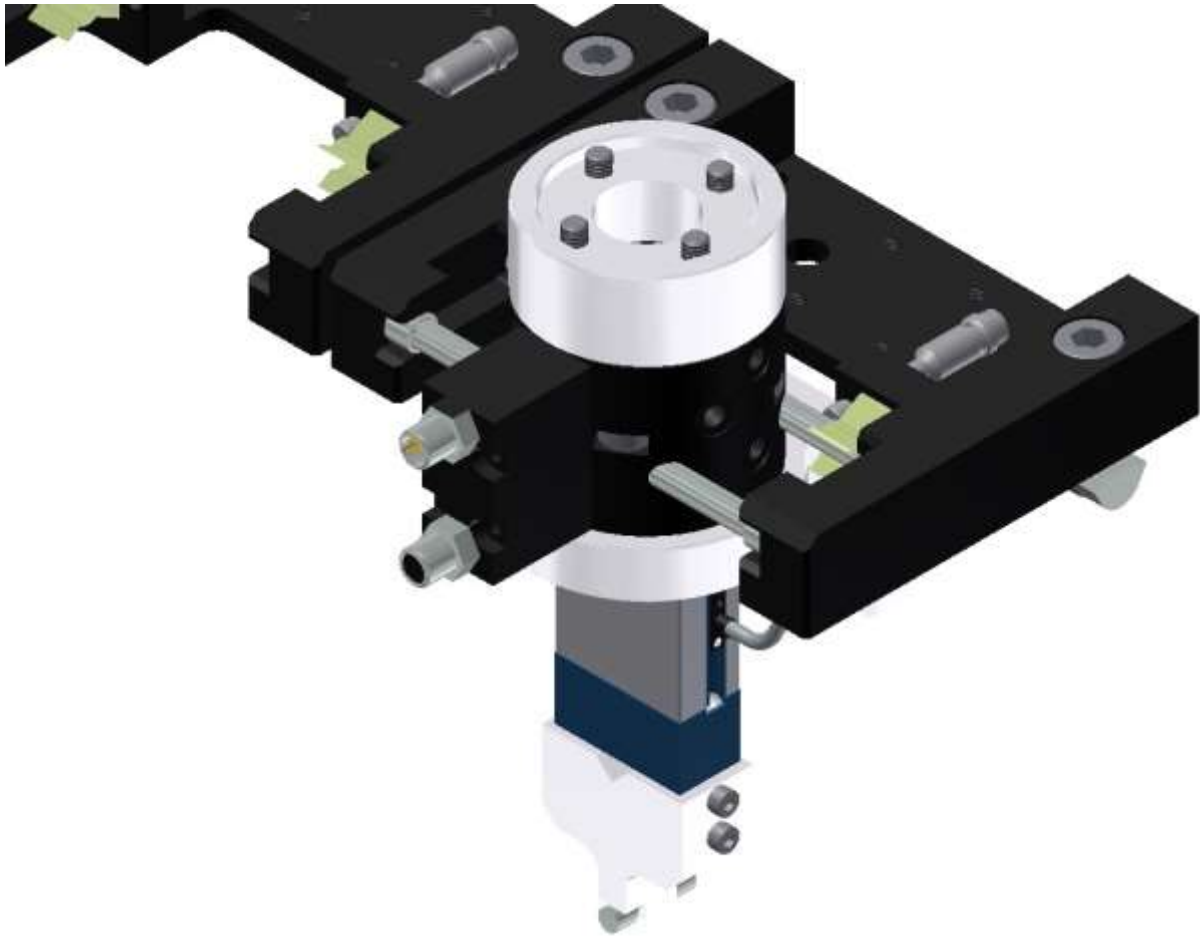


Illustration similar

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 Change-over gripper system



Example change-over gripper system with buffer station / Illustration similar

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

- TK40 to EN ISO 9409-1
- pneumatic energy transfer*: 4x
- electrical energy transfer/ hydraulic: optional
- automatic locking on bolting: mechanical
- maximum axis offset on coupling. in X,Y [mm]: 1.3mm
- operating temperature min/max [°C]: 5-80 ° C
- moment of inertia [kg/cm²]: 0.28
- weight [g]: 90 g

All data on 6 bar



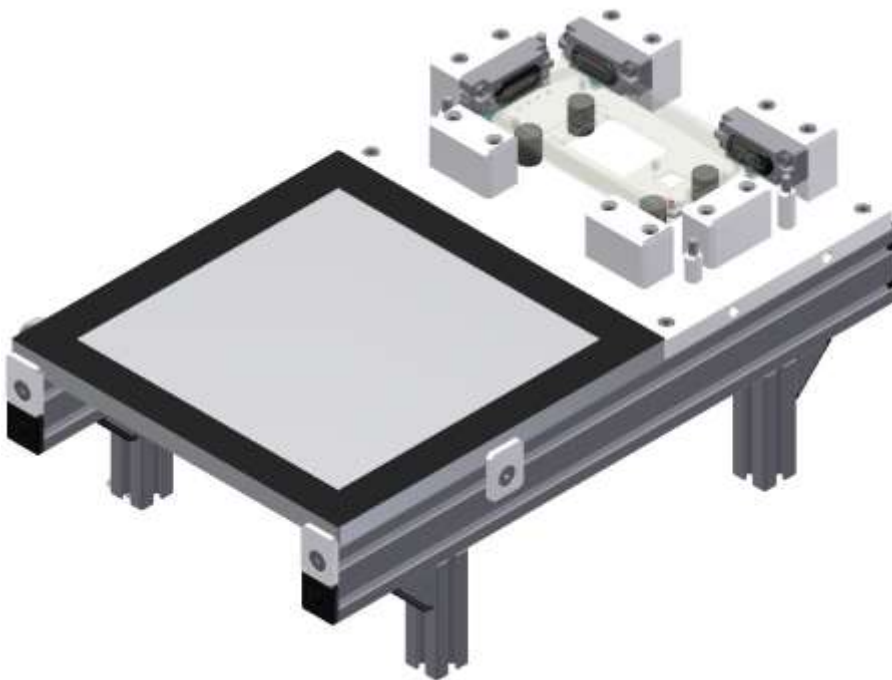
Elektrisch

Bestellnummer:	M1ER02-FSD4	M1ER02-LS04	M1ER02-FFD4	M1ER02-LFD4
Passend für:	Fest	Los	Fest	Los
Verbindungsart:	RST	RST	FST	FST
Anschlussart:	RST	RST	RST	RST
Anzahl Kontakte:	4	4	4	4
Nennstrom [A]:	4	4	3	3
Betriebsspannung AC [V]:	60	60	60	60
Betriebsspannung DC [V]*:	75	75	75	75
Gewicht [g]:	30	30	25	25
Belegung Anschluss:				
	Stift	Buchse	Stift	Buchse

*Angaben bei kundenseitiger Erdung, 60V ohne Erdung
 FST = Flachstecker
 RST = Rundstecker

Port of change-over gripper system

9.3.3 LED floodlight



Hansen-Neon / illustration similar

The LED floodlight is designed for lighting up the workpiece. The workpiece can be placed anywhere on the lighting segment. The camera system will recognize the workpiece on the lighting segment without any problems.

- Power-LEDs, type Nichia NFSW036
- 1 x electronical ballast, type EVG 12-25 (12V, 25W)
- Effective power: 23.8 watt
- Color temperature: 6500 K
- Luminance dense: 380 - 500 cd/m2

9.3.4 PLC Siemens



Siemens ET 200 SP / CPU 1512SP F-1PN / illustration similar

For detailed information see electrical circuit diagram.

9.3.5 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 A ² ·s

Power

Power consumption, typ.	12 W
-------------------------	------

Processor

Processor type	X86
----------------	-----

Memory

Flash	Yes
RAM	Yes
Memory available for user data	12 Mbyte

9.3.6 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



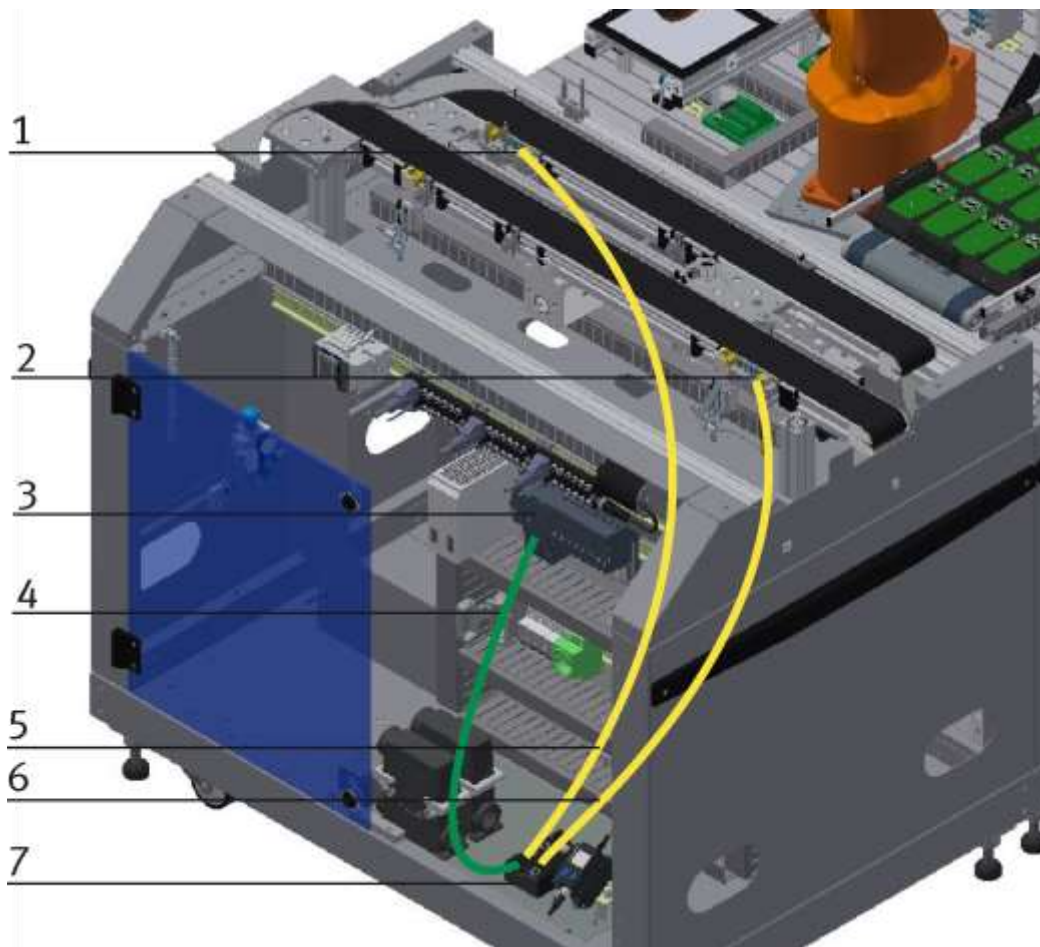
Turck – TBEN-S2-2RFID-4DXP / 6814029 / illustration similar

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 TB-M18-H1147 (equipment identifier G-TF80)
2	Turck read-write head TB-M18-H1147 (equipment identifier G-TF81)
3	Controller ET200SP / CPU 1512SP F-1PN (equipment identifier K5-KF1)
4	Ethernet cable from Turck module to controller (via Scalance)
5	Turck cable from Turck read-write head to Turck module
6	Turck cable from Turck read-write head to Turck module
7	Turck Ethernet module with RFID interface (equipment identifier K2-KF80)



RFID read-write head / illustration similar

The Turck RFID read-write head is mounted on the stopper unit on the conveyor.
Its designation is TB-M18-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. 30 mm

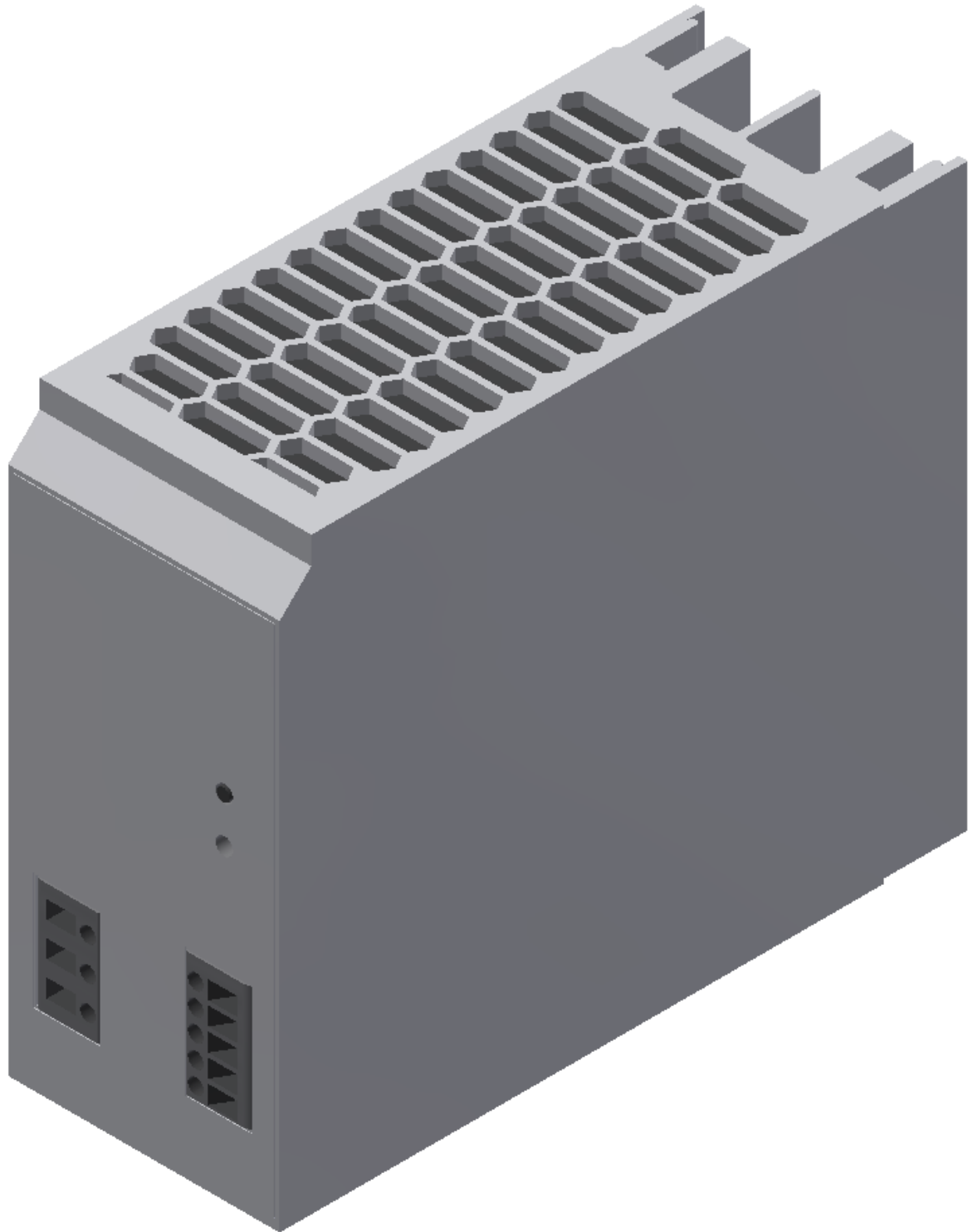
9.4.1 Electronic circuit protection



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 mm ²
Output terminals	Per output 1 × 4 mm ²
Alarm terminals	2.5 mm ²
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 °C (storage temperature -40...+80 °C)
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 °C
Relative air humidity	95 %
Protection class	IP20
Ambient temperature	-25 ... 70 °C
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 °C
Min. temperature	-25 °C
Product-type	Safety relay

9.4.4 Mini Terminal



Multi-pin plug distributor / illustration similar

The multi-pin plug distributor is designed for the inputs and outputs of the station. You can connect PNP sensors and two-pole actuators there. The connection is effected by three-pole M8x1 plugs, and the bus terminal by a 15pole sub-D plug connector. The operating status is displayed on yellow LEDs.

Pin allocation on the multi pin plug distributor

Pin allocation 15pole sub-D plug connector

- Signal lines Pin 1 to Pin 12
- DC 24V Pin 13
- 0V Pin 14 and Pin 15

Pin allocation M8 socket corresponding to IEC 947-5-2

- slots 0 to 11
- Signal line socket 4
- DC 24V socket 1
- 0V socket 3

XD20 – Multi pin distributor MPV1

15-pole D-Sub Pin	Bit	Name
1	Bit 0	Stopper 1 down / -BG20
2	Bit 1	Stopper 1 lower / -MB20
3	Bit 2	Pallet available identity sensor 1 / -BG21
4	Bit 3	Reserve
5	Bit 4	Identity sensor 2 / -BG22
6	Bit 5	Reserve
7	Bit 6	Identity sensor 3 / -BG23
8	Bit 7	Reserve
9	Bit 8	Identity sensor 4 / -BG24
10	Bit 9	Reserve
11	Bit 10	Option / downstream station free 1
12	Bit 11	Reserve / Option station occupied 1
13	+24 V	
14 and 15	0V	

XD30 – Multi pin distributor MPV2

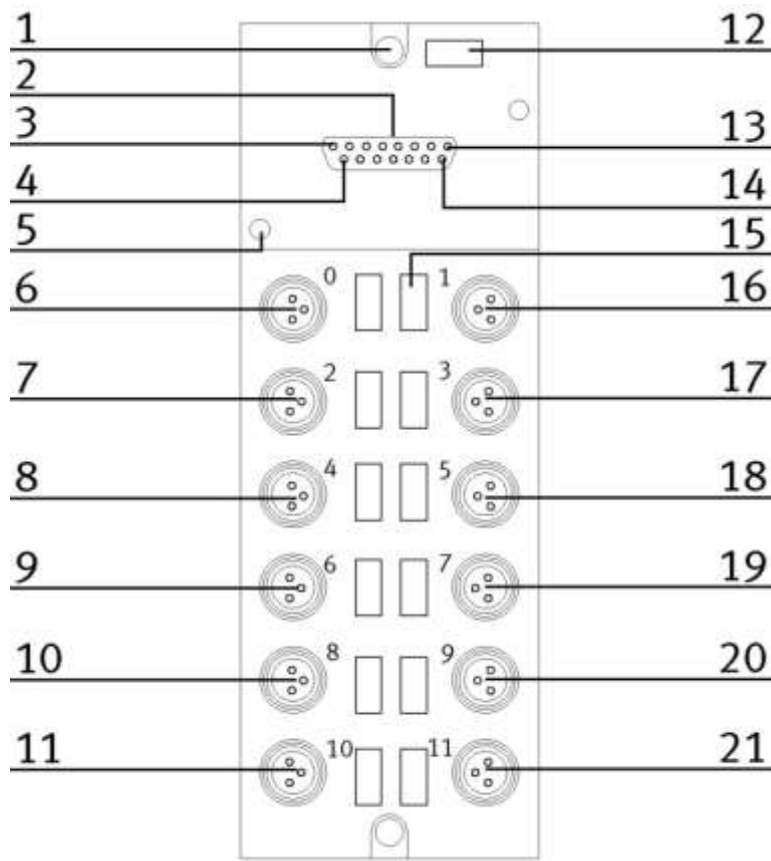
15-pole D-Sub Pin	Bit	Name
1	Bit 0	Stopper 2 down / -BG30
2	Bit 1	Stopper 2 lower / -MB30
3	Bit 2	Pallet available identity sensor 1 / -BG31
4	Bit 3	Reserve
5	Bit 4	Identity sensor 2 / -BG32
6	Bit 5	Reserve
7	Bit 6	Identity sensor 3 / -BG33
8	Bit 7	Reserve
9	Bit 8	Identity sensor 4 / -BG34
10	Bit 9	Reserve
11	Bit 10	Congestion bypass / -BG35
12	Bit 11	Reserve / Option station occupied 1
13	+24 V	
14 and 15	0V	

XD40 – Multi pin distributor MPV3

15-pole D-Sub Pin	Bit	Name
1	Bit 0	Stopper 3 down / -BG40
2	Bit 1	Stopper 3 lower / -MB40
3	Bit 2	Pallet available identity sensor 1 / -BG41
4	Bit 3	Reserve
5	Bit 4	Identity sensor 2 / -BG42
6	Bit 5	Reserve
7	Bit 6	Identity sensor 3 / -BG43
8	Bit 7	Reserve
9	Bit 8	Identity sensor 4 / -BG44
10	Bit 9	Reserve
11	Bit 10	Inject WT from bypass / -BG45
12	Bit 11	Reserve / Option station occupied 1
13	+24 V	
14 and 15	0V	

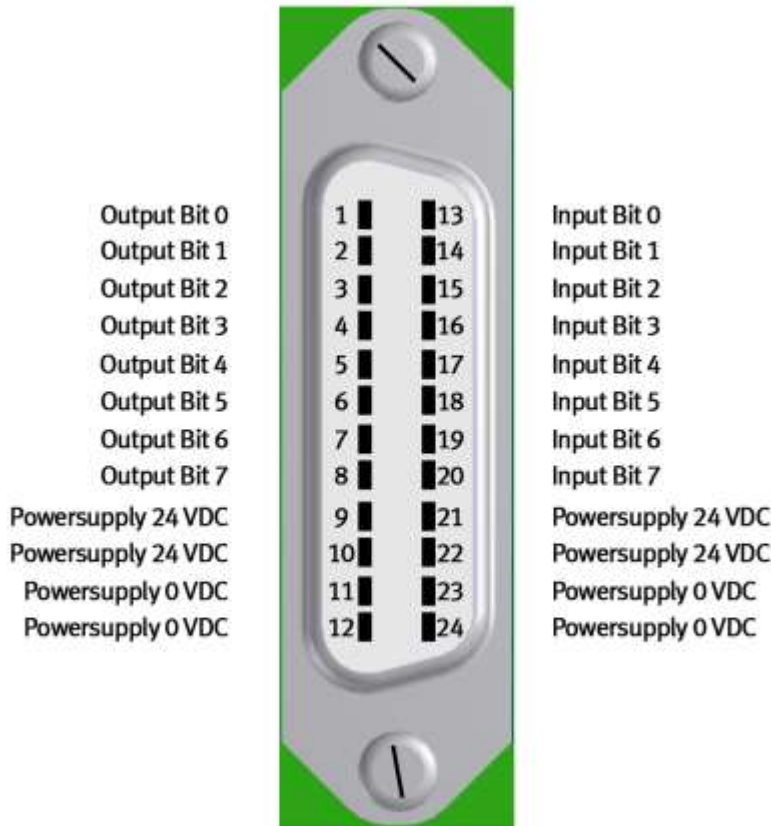
XD50 – Multi pin distributor MPV4

15-pole D-Sub Pin	Bit	Name
1	Bit 0	Pick up position 1 pallet not available / -BG50
2	Bit 1	Pick up position 1 workpiece not available / -BG51
3	Bit 2	Reserve
4	Bit 3	Reserve
5	Bit 4	Reserve
6	Bit 5	Reserve
7	Bit 6	Reserve
8	Bit 7	Reserve
9	Bit 8	Reserve
10	Bit 9	Reserve
11	Bit 10	Reserve
12	Bit 11	Reserve
13	+24 V	
14 and 15	0V	



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

9.4.5 SYS link interface



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 Mechanic components

9.5.1 Motor of Conveyor

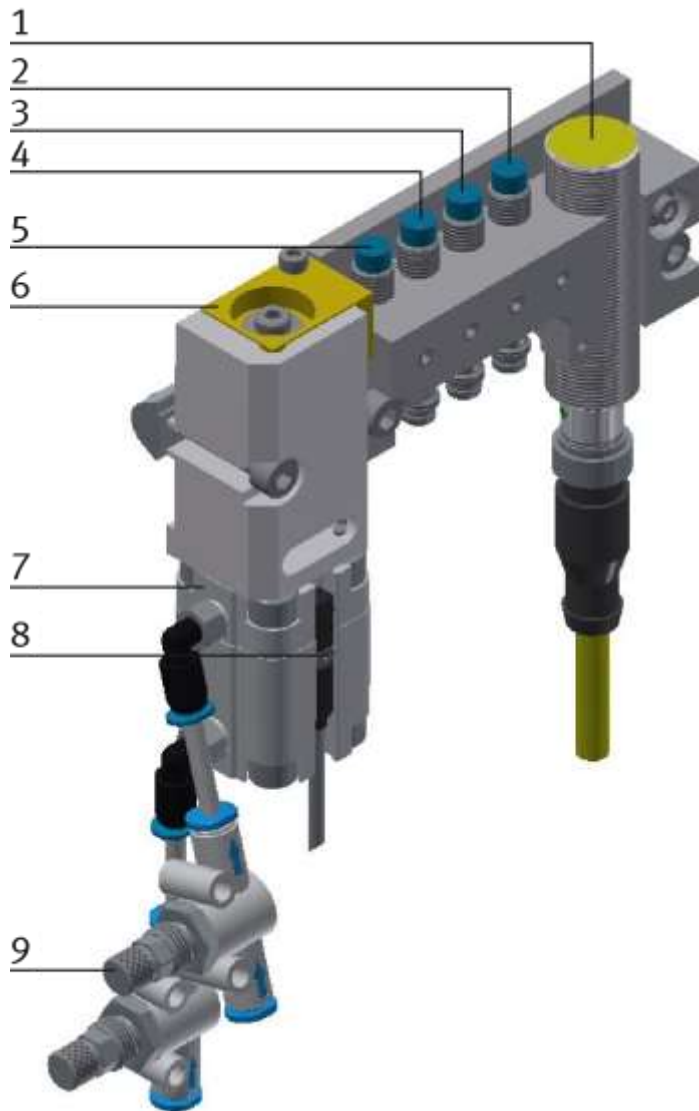


Motor type 403438 / illustration similar

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

9.5.2 The stopper unit



CP Factory Stopper Unit / illustration similar

Position	Description
1	Turck TB-M18-H1147 RFID read-write head / IFM DTM424 RFID read write head
2	Pallet available Ident sensor 1 / Order number 150395 / SIEN-M8NB-PS-S-L
3	Pallet available Ident sensor 2 / Order number 150395 / SIEN-M8NB-PS-S-L
4	Pallet available Ident sensor 3 / Order number 150395 / SIEN-M8NB-PS-S-L
5	Pallet available Ident sensor 4 / Order number 150395 / SIEN-M8NB-PS-S-
6	Stopping unit
7	Stopper cylinder / Order number 157211 / AEVUZ-16-5-P-A
8	Sensor Stopper lowered / Order number 574334 / SMT-8M-A-PS-24V-E-0,3-M8D
9	one-way flow control valve / Order number. 193967 / GR-QS-4

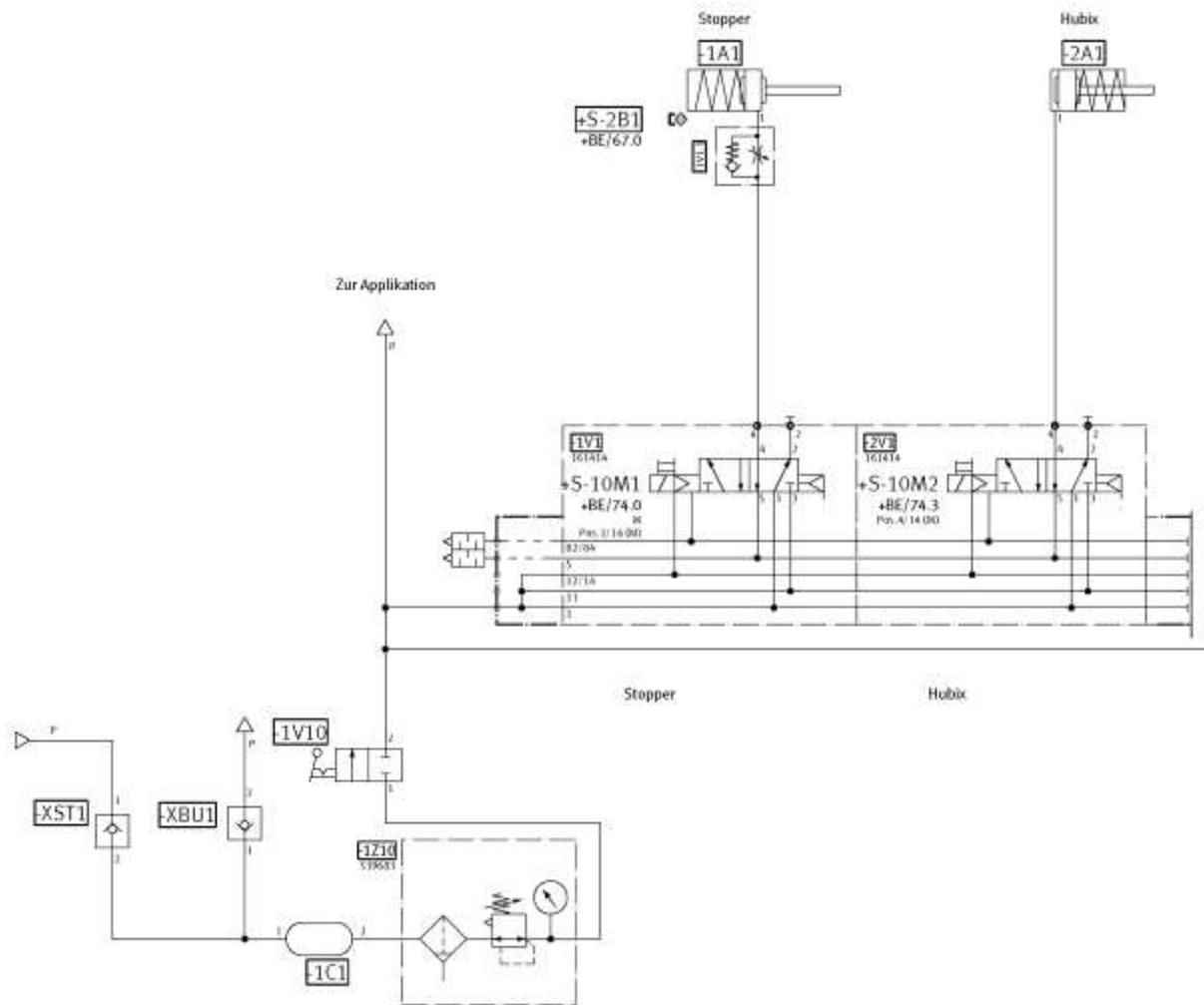
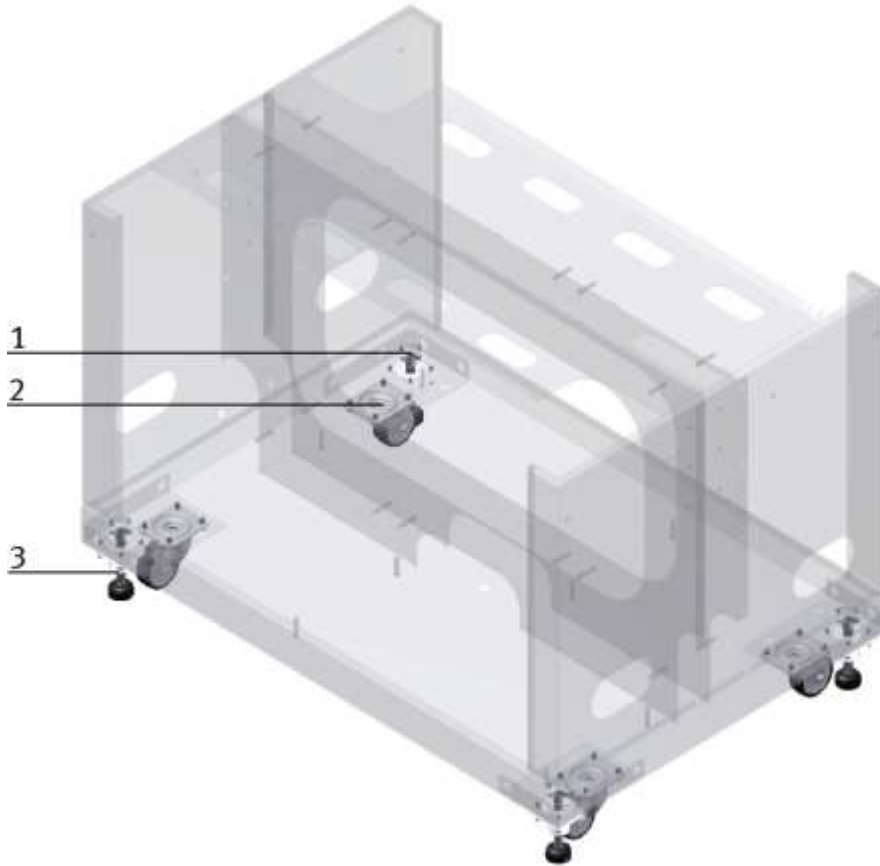


Diagram of pneumatics, Stopper Unit

9.5.3 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
	<ul style="list-style-type: none"> • Danger of crushing for hands/feet <ul style="list-style-type: none"> – 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.

9.5.4 Operation panel working position

So that the components in the base frame of the module are more easily accessible, the entire control panel can be folded up.

The panel is gripped at the bottom and folded up. When the panel is completely raised, the springs stand vertically and support the panel against folding down.

	 WARNING
	<ul style="list-style-type: none"> • Risk of crushing <ul style="list-style-type: none"> - - Make sure that the springs are vertical and that the panel is secured against folding down. - - It is also important to ensure that no third person can fold the panel down. - - Failure to heed the information given can lead to injuries.

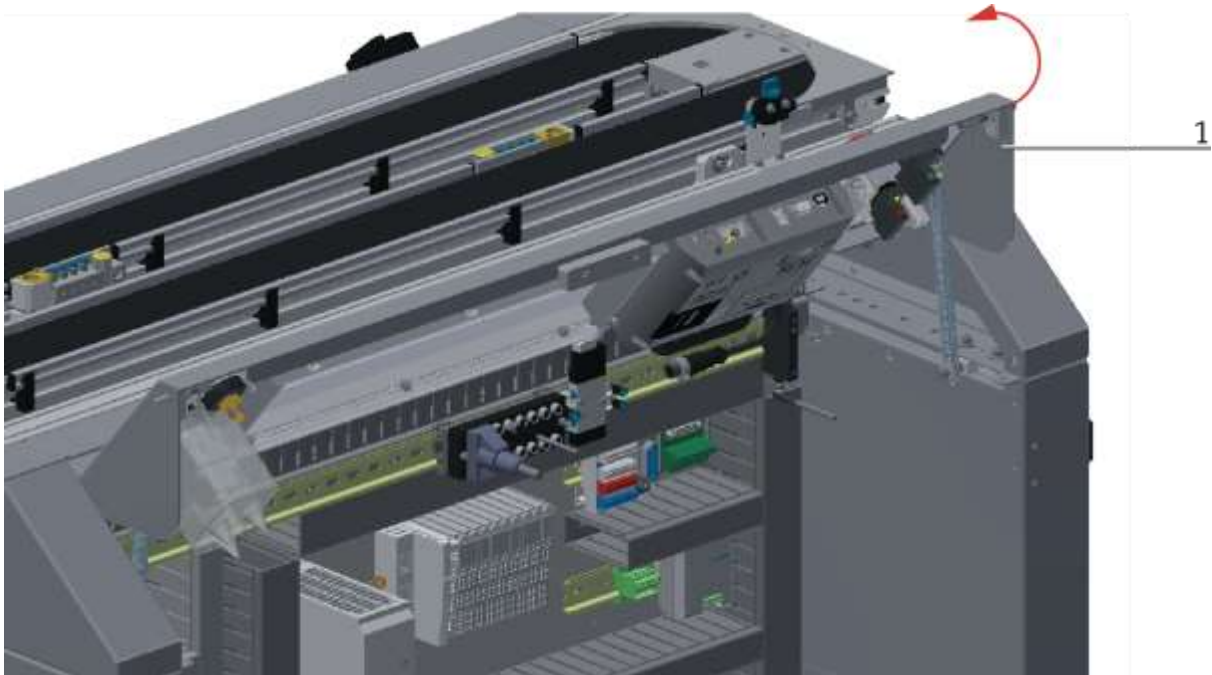


Illustration similar

1. Grip the panel at the bottom and fold it up



Illustration similar

Push the springs back in the middle and fold down the control panel

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

10.1.1 Message texts of the robot assembly

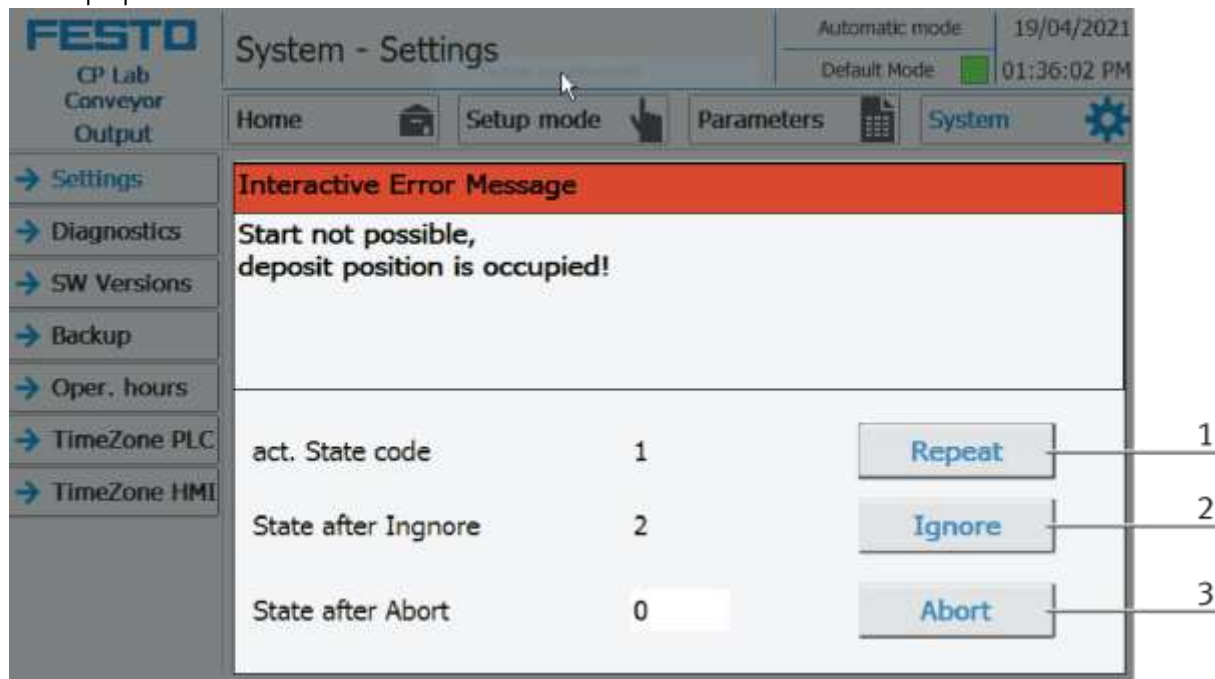
Report class	Location	Alarm name	Report text	Fix error
2	PcbBoxChange	WarnBoxBeltFull	Error: 2 boxes detected in the PCB feeding belt!	Remove one box
0	Error	ErrSchutztuer	Safety doors open!!	Close the safety doors and acknowledge the message on the control panel and robot control.
2	Error	WarnRobotBatt	Charge state robot battery low!	Please change battery
0	Error	ErrNotAusRobot	Emergency stop at robot is active	Check the emergency stop button on the robot and acknowledge the message.
2	Error	WarnRobotHome	Robot not in home position!	Move to home position
2	Error	WarnRobotHomeInit	Robot not in home position for request referencing	Move to home position
2	Error	WarnRobotExec	Error in the robot program processing.	Check drive unit.
2	Error	WarnRobotAuto	Robot not in automatic!	Switch on automatic at drive unit
2	Error	ErrFusesEmpty	All fuse magazines are empty, no program start!	Fill up magazines
2	Error	WarnNoPcbBox	Warning: no PCB box available!	Provide box
2	HsKuka	WarnRobOpMode	Warning: Robot control is not in automatic mode!	Place robot in automatic
2	HsKuka	WarnRobReady	Warning: Robot control is not ready!	Check drive unit
2	HsKuka	WarnRobHome	Warning: Robot not in home position.	Please move robot with Teach-Box in basic position!
2	HsKuka	WarnRobNotReady	Warning: The robot has not yet released for external start!	Issue release
2	HsKuka	WarnSafetyDoorOpen	Warning: Safety door of the robot is not closed!	Close safety doors
0	HsKuka	ErrRobRuntime	Error: EMERGENCY-STOP on robot Teach-Box is activated!	Quit emergency stop at Teach Box

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

10.2.4 Robot assembly

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

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

	<p style="text-align: center;"><i>NOTE</i></p> <p>Electronic waste contains recyclable materials and must not be disposed of with the domestic waste. Bring electronic waste to a designated municipal collection point.</p>
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