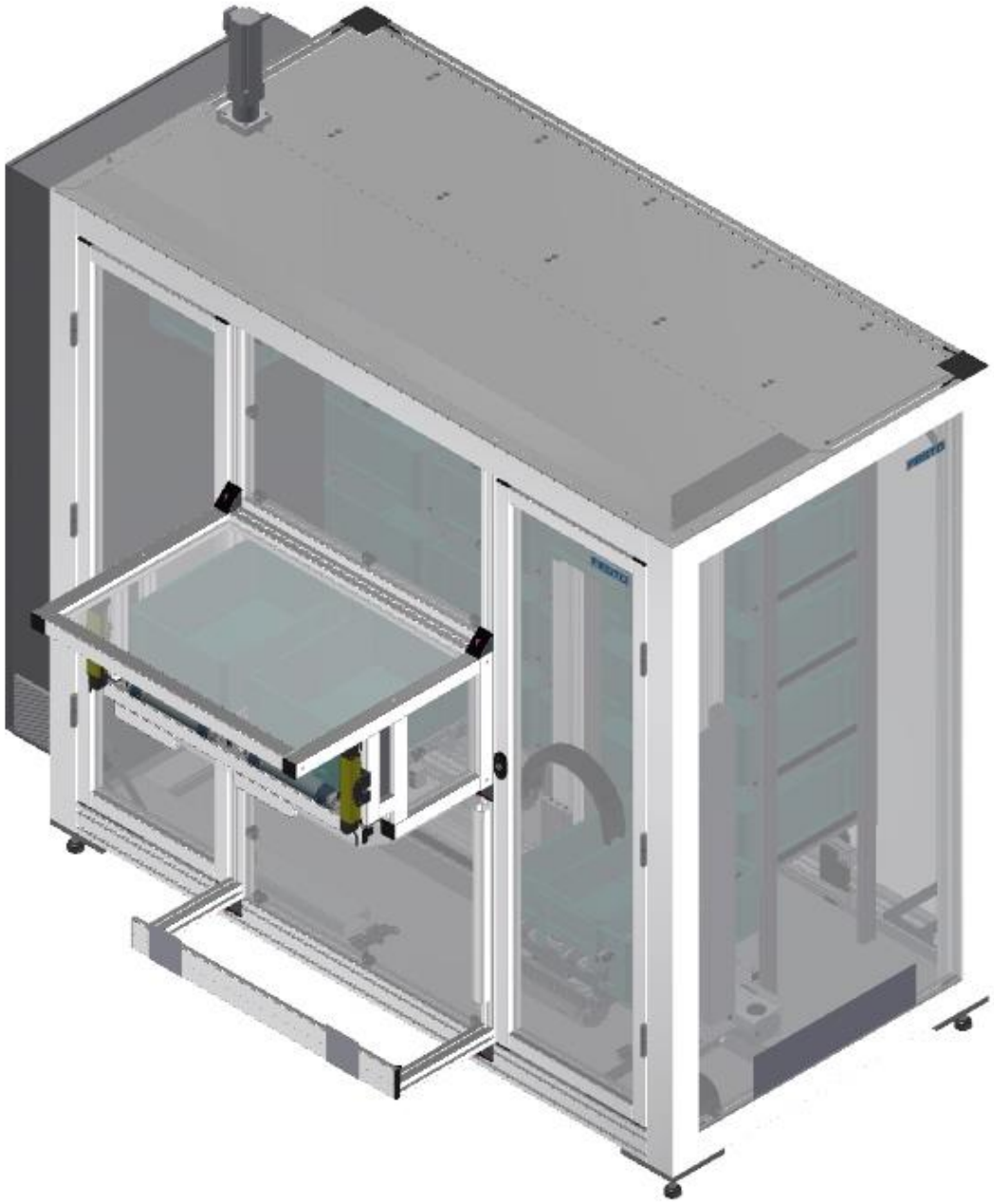
8061620

AS/RS for boxes

FESTO

CP Factory

Manual



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Translation of the original instructions

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

⚠ CAUTION

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

Main document
Associated documents attached:

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

Contents

1 Safety instructions

1.1 Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTE

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

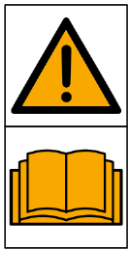
In cases where more than one hazard level applies, the safety note with the highest hazard level will be shown. A safety note may concern both personal injury and property damage.
Hazards that will only result in property damage are indicated with the word "Note".

1.2 Pictograms

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

Hazard warning

Warning - dangerous electric voltage



Read and observe the operating and safety instructions prior to commissioning.

Switch off the device and unplug the connection for power supply from the plug socket before commencing installation, repair, maintenance or cleaning work.

Warning – 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

- **Malfunctions which could impair safety must be eliminated immediately!**

CAUTION

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

3.2 Qualified persons

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

3.3 Obligations of the operating company

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

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

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

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

3.4 Obligations of the trainees

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

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

4 Basic safety instructions

4.1 General information

CAUTION

- **Trainees must be supervised by an instructor at all times when working with the components and systems.**
- **Observe the specifications included in the technical data for the individual components and in particular all the safety instructions!**
- **Wear your personal protective equipment (safety goggles, safety shoes).**
- **Never leave objects lying on the top of protective enclosures. Vibrations could cause such objects to fall off.**

4.2 Mechanical components

WARNING

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

CAUTION

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

4.3 Electrical components

DANGER

- **Risk of fatal injury in case of interrupted protective grounding conductor!**
  - The protective grounding conductor (yellow-green) must not be interrupted, either inside or outside of the device.
  - The insulation of the protective grounding conductor must never be damaged or removed.
- **Risk of death from connecting power supply units in series!**

  Contact voltages of greater than 25 V AC or 60 V DC are not permissible.

  Contact with voltages of greater than 50 V AC or 120 V DC may be fatal.
  - Do not connect power supplies in series.
- **Risk of death due to electric shock!**

  Protect the outputs of the power supplies (output sockets/terminals) and cables connected to them from direct contact.
  - Always use connector cables with adequate insulation and electric strength.
  - Use safety sockets with fully shrouded contact points.

WARNING

- **Disconnect from all sources of electrical power!**
  - Switch off the power supply before working on the circuit.
  - Please note that electrical energy may be stored in individual components. Further information on this issue is available in the datasheets and operating instructions included with the components.
  - **Warning!**
    Capacitors inside the device may still be charged even after being disconnected from all sources of voltage.
- **Danger due to malfunction**
  - Never place or leave liquids (e.g. drinks) on the station in open containers.
  - The machine must not be switched on if there is condensation (moisture) on its surface.
  - Never lay pipes/hoses designed to carry liquid media near the machine.
- **Electric shock due to connection to unsuitable power supply!**
  - When devices are connected to an unsuitable power supply, exposed components can cause dangerous electrical voltage that can lead to severe or fatal injury.
  - Always use power supplies that provide SELV (safety extra-low voltage) or PELV (protective extra-low voltage) output voltages for all the connections and terminals on the electronics modules.
- **Electric shock when there is no protective grounding in place**
  - If there is no protective grounding terminal in place for a Protection Class I device, or if the protective grounding terminal has not been installed correctly, exposed, conductive parts may carry high voltages, thus causing severe or fatal injury if touched.
  - Ground the device in accordance with the applicable regulations.

WARNING

- **Risk of fire due to use of unsuitable power supply**
  - If a device i connected to an unsuitable power supply, this can cause components to overheat, leading to a breakout of fire.
  - Always use limited power supplies (LPSs) for all the connections and terminals on the electronics modules.

⚠ CAUTION

- **Always ensure that your connecting cables are designed for use with the electrical connections in question.**
- **When laying connecting cables, make sure they are not kinked, sheared or pinched. Cables laid on the floor must be covered with a cable bridge to protect them.**
- **Do not lay cables over hot surfaces.**
  - Hot surfaces are identified with a corresponding warning symbol.
- **Make sure that connecting cables are not subjected to continuous tensile loads.**
- **Devices with a grounding terminal must always be grounded.**
  - If a ground connection (green-yellow laboratory socket) is available, it must always be connected to the protective grounding. The protective grounding must always be connected first (before voltage) and disconnected last (after disconnecting the voltage).
  - Some devices have high leakage current. These devices must be fitted with a grounding conductor for additional grounding.
- **When replacing fuses, always use specified fuses with the correct current rating and tripping characteristics.**
- **The device is not equipped with a built-in fuse unless otherwise specified in the technical data.**
- **Safe operation of the device is not possible in the event of any of the following circumstances:**
  - Visible damage
  - Malfunction
  - Inappropriate storage
  - Incorrect transport
- **Switch off the power supply immediately.**
- **Protect the device to prevent it from being restarted accidentally.**

4.4 Pneumatic components

WARNING

- **Depressurize the system!**
  - Switch off the compressed air supply before working on the circuit.
  - Check the system using pressure gauges to make sure that the entire circuit is fully depressurized.
  - Please note that energy may be stored in reservoirs. Further information on this issue is available in the datasheets and operating instructions included with the components.
- **Risk of injury when switching on compressed air!**
  - Cylinders may advance and retract automatically.
- **Risk of accident due to advancing cylinders!**
  - Always position pneumatic cylinders so that the piston rod's working space is unobstructed along its entire stroke range.
  - Make sure that the piston rod cannot collide with any of the rigid components in the setup.
- **Risk of accident due to pneumatic tubing slipping off!**
  - Use shortest barbed tubing connectors possible.
  - If pneumatic tubing slips off, switch off the compressed air supply immediately.
- **Do not exceed the maximum permissible pressure of 600 kPa (6 bar).**
- **Do not switch on the compressed air until all the barbed tubing connectors have been connected and secured.**
- **Do not disconnect pneumatic tubing while it is under pressure.**
  - Do not attempt to seal or plug pneumatic tubing or plug connectors with your hands or fingers.
- **Check the condition of the condensate in the service unit regularly. If necessary, drain the condensate and dispose of it properly.**

CAUTION

- **Setting up pneumatic circuits**
  - Connect the devices with plastic tubing with an outside diameter of 4 or 6 mm.
  - Push the pneumatic tubing into the push-in connector as far as it will go.
- **Dismantling pneumatic circuits**
  - Switch off the compressed air supply before dismantling the circuit.
  - Press the blue release ring down so that the tubing can be pulled out.
- **Noise due to escaping compressed air**
  - Noise caused by escaping compressed air may damage your hearing. Reduce noise by using mufflers, or wear hearing protection if the noise cannot be avoided.
  - All of the exhaust ports on the components included in the equipment set are equipped with mufflers. Do not remove these mufflers.

4.5 Guarantee and liability for application examples

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

4.6 Cyber security

Note

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

The customer is responsible for preventing unauthorized access to their plants, systems, machines and networks. Systems, machines and components should only be connected to a company's network or the Internet if and as necessary, and only when the suitable security measures (e.g. firewalls and network segmentation) are in place. Furthermore, Festo's guidelines on suitable security measures should be observed. Festo products and solutions are constantly being developed further in order to make them more secure. Festo strongly recommends that customers install product updates as soon as they become available and always use the latest versions of its products. Any use of product versions that are no longer supported or any failure to install the latest updates may render the customer vulnerable to cyber attacks.

WARNING

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

4.7 Additional safety instructions

General requirements for safe operation of the devices:

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

⚠ WARNING

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

4.8 Guarantee and liability

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

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

4.9 Transport

WARNING

- **Danger due to tipping over**
  - Suitable packaging and transport equipment must be used when transporting the station. The station can be lifted from underneath using a forklift truck. Please note that eccentric centers of gravity can cause the station to tip over.
  - Stations with attachments at height will have a high center of gravity.
  - Take care to avoid tipping over during transportation.

CAUTION

- **Danger due to broken castors!**

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

NOTE

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

4.10 Name plates stations

Name plate example

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

4.11 CE Declaration of Conformity

WARNING

- **General machine safety, CE conformity**
  - The individual modules of this system contain control programs for which the safety of the machine has been evaluated.
  - The safety-related parameters and checksums of the safety function are listed in the operating instructions for the respective stations.
  - Changes to programs may impair the safety of the machine. A modified control program may constitute a major change to the machine.
  - In such cases, the manufacturer's CE Declaration of Conformity shall be rendered null and void. The operating company will need to re-evaluate the safety of the machine and confirm its CE conformity.

4.12 Protective devices

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

WARNING

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

4.12.1 Panel doors on underground control cabinet

Transparent, impact-resistant, polycarbonate plate with lock.
Can only be accessed with tool (control cabinet key); tool must be kept in a secure place!
Access reserved for qualified electricians.
The safety door is not monitored! Make sure the safety door is always closed.

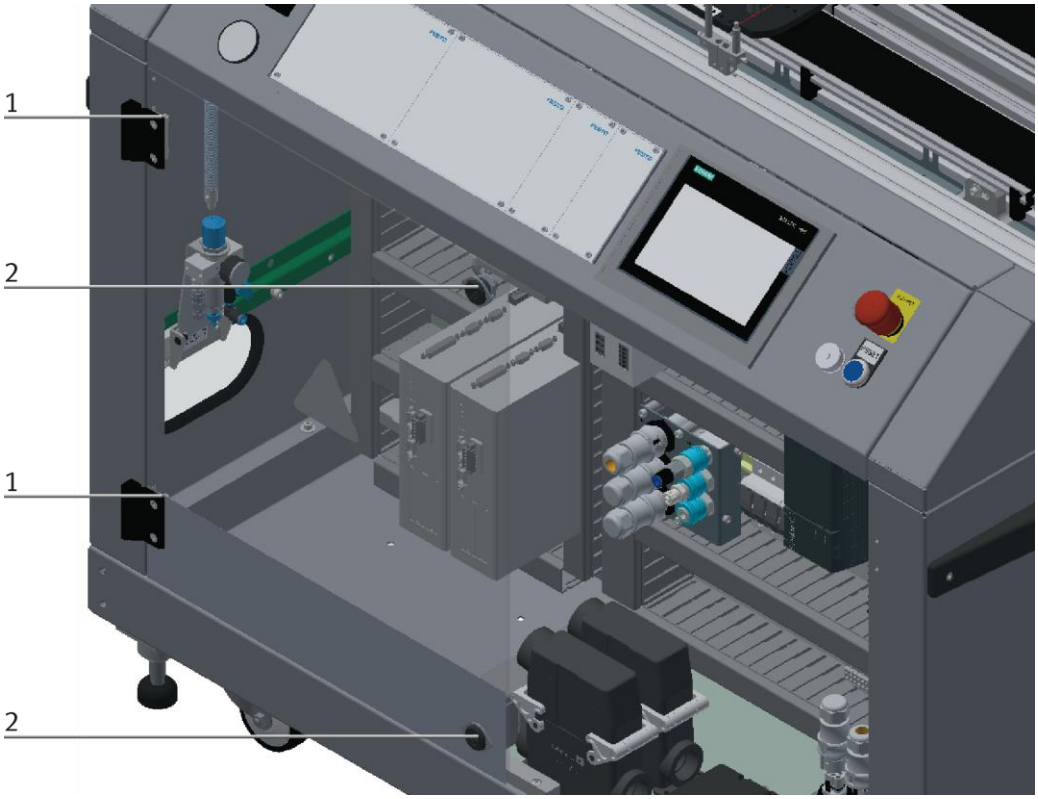


Illustration similar

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

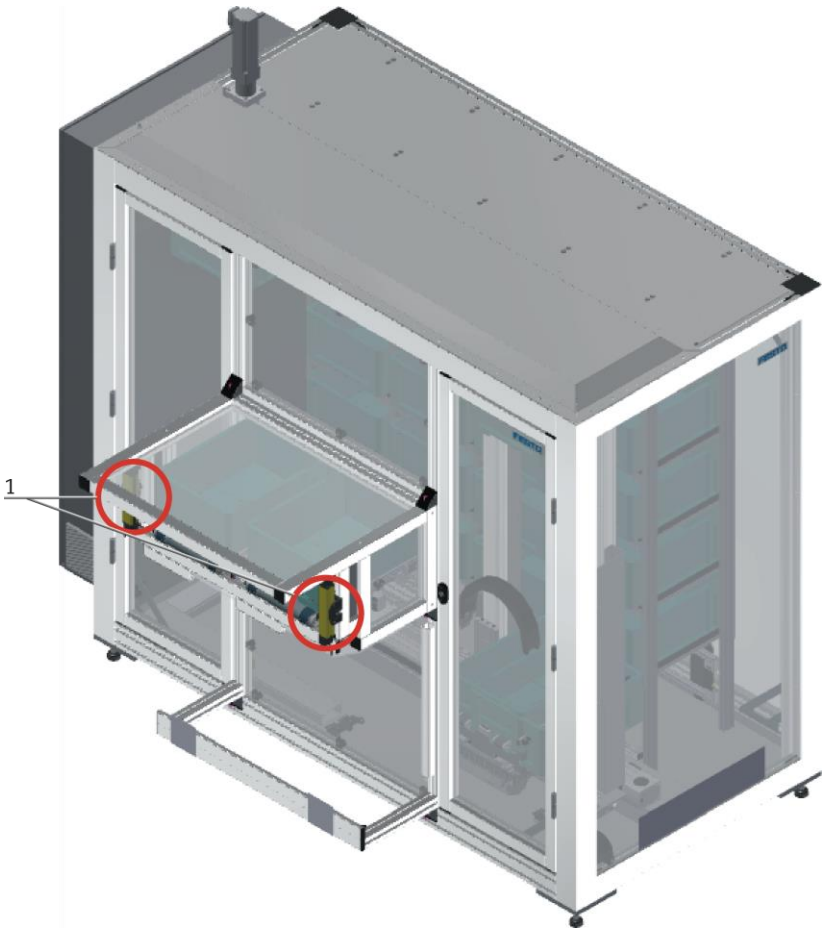
4.12.2 Emergency stop

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.

4.12.3 Additional protective devices

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

4.12.4 Light curtain transfer unit robotino

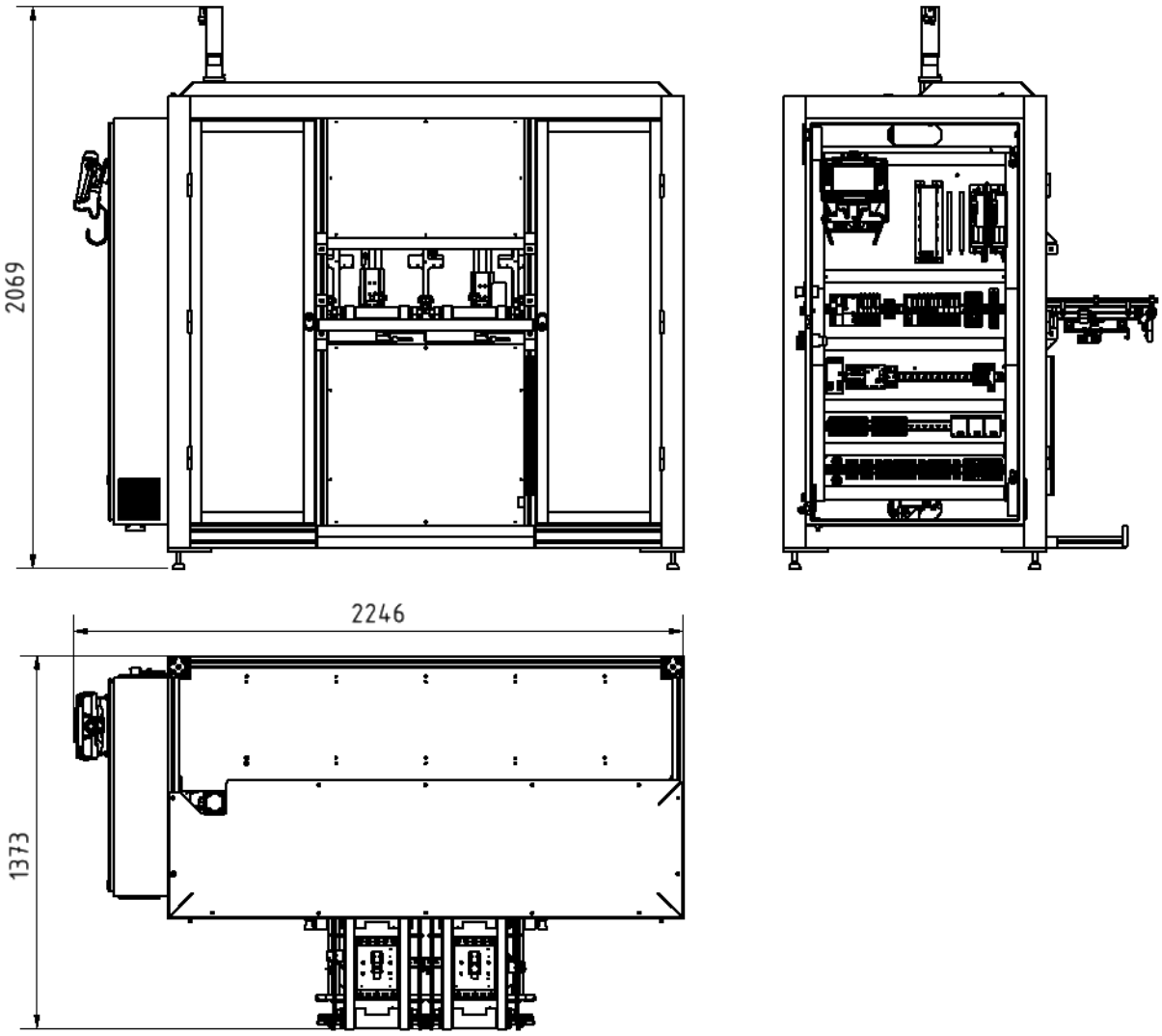


The transfer unit is equipped with a light curtain to stop the portal axes in a safety-oriented manner in the event of accidental engagement. The engagement area is monitored in a finger-safe manner. The safety function is designed in accordance with ISO 13855. The speed of the portal axes is taken into account in the safety function and must not be changed without re-evaluating the safety.
The safety function complies with performance level PL d.

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	3 A
Control voltage, Voltage for small actuators	24 V DC Protective extra-low voltage (PELV)
Power supply connection	IEC 60309, CEE 16 A
Max. backup fuse for installation	16 A
Leakage current	<= 18 mA
Connecting cable between stations	System plug
Protection class	I, Operation with protective grounding only. Second protective grounding conductor required due to high leakage current
Overvoltage category	CAT II, Operation in building installation only
Short circuit current rating (SCCR)	10 kA
Compressed air	
Supply pressure	6 bar, 90 psi
Supply rate	>= 40 l/min
Compressed air quality	EN ISO 8573-1
Pressure dew point (Class 4)	<= +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	

5.1 Setup



Drawing with closed doors / illustration similar

Recommended minimum distance from the spatial boundary is 1.2 m

6 Introduction

6.1 General information about CP Factory

The CP Factory has been developed in close co-operation with teachers and instructors. The result is a training system meeting all demands on modularity, mobility, flexibility and openness due to its completely new characteristics.
The station provides an appropriate system for practice-orientated tuition of the following key qualifications

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

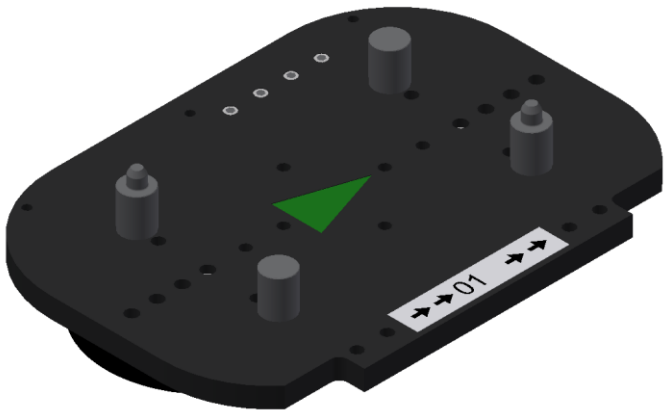
Which are required in today's complex world of employment. This is much easier now with use of the CP Factory.
The two-sided symmetrical basic modules with accompanying control board and control unit are identical. With their technical system „transfer line with drive unit and stopper unit“, they are ideal for the training in SPS programming and drive technology from basics to medium level.
Due to the patented passive pallet return systems, the continuous working process „pallet circulation“ is already possible when using one single basic module.
The industrial-relevant basic process „pallet circulation“ already contains a large number of important course contents such as:

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

The basic module becomes a station by adding technology-specific application modules like magazines, handling or machining units. The standardized mechanical and electrical interface of application and basic module allows an unproblematic starting-up.
The CP Factory is a perfect platform for nearly all course contents. It helps to improve the co-operation of different teams and to extend the ability of understanding processes.
On this system, especially the topics about networking, communication and data acquisition can be shown in an easily comprehensible way and can be further trained.

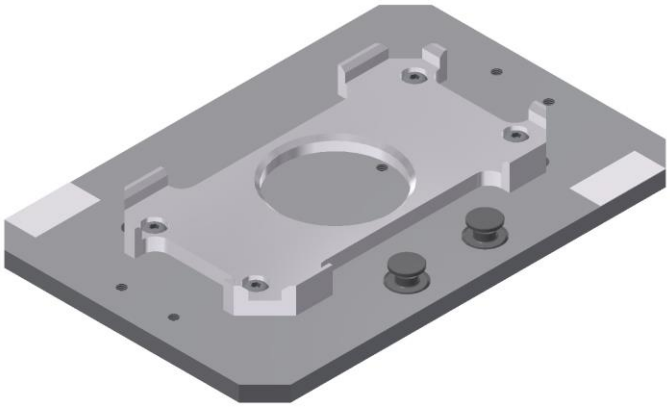
6.2 Resources

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



Pallet carrier / illustration similar

These pallet carriers are available for transporting the pallets.
Partnumber in MES - 31



Pallet / illustration similar

These pallets are available for receiving always one workpiece.
Partnumber in MES - 25

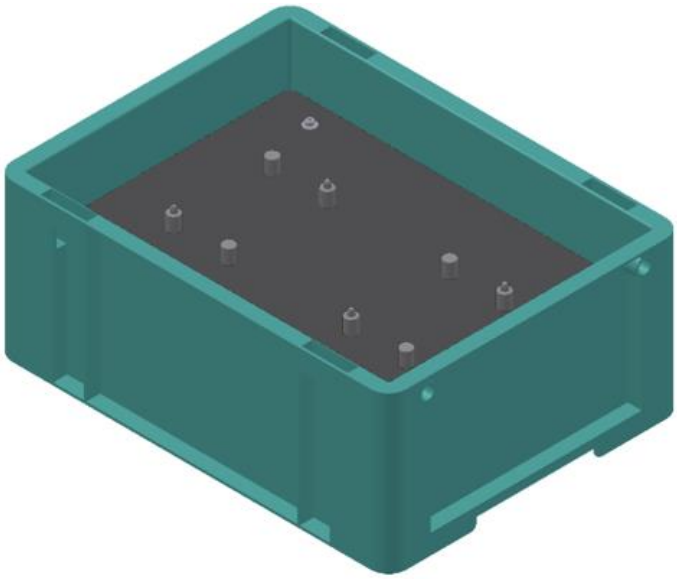


Illustration similar

Box with retainer for 2 pallet carriers
Partnumber in MES – 20

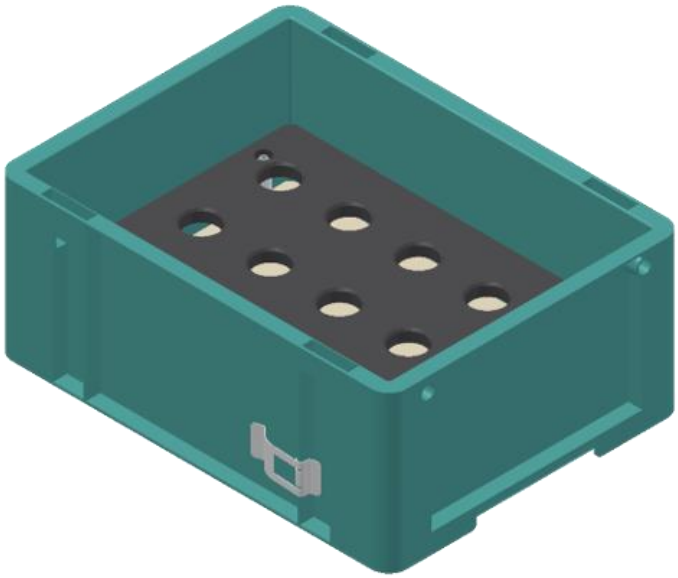


Illustration similar

Box with retainer for 15 raw turning pieces
Partnumber in MES – 26

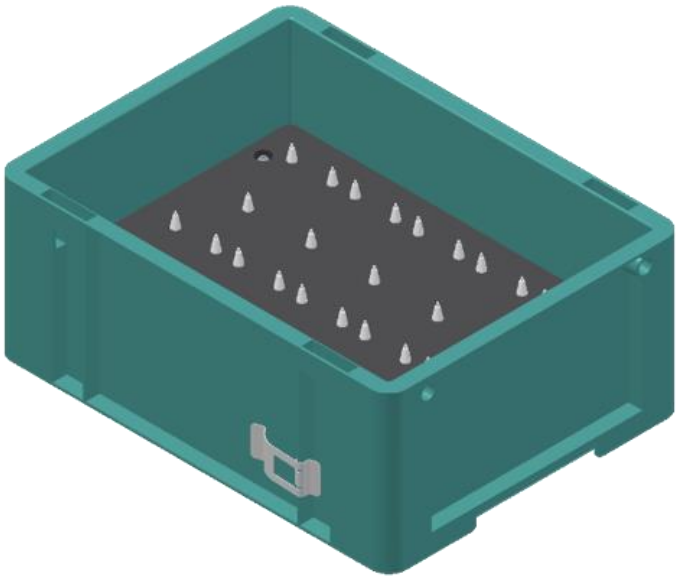


Illustration similar

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

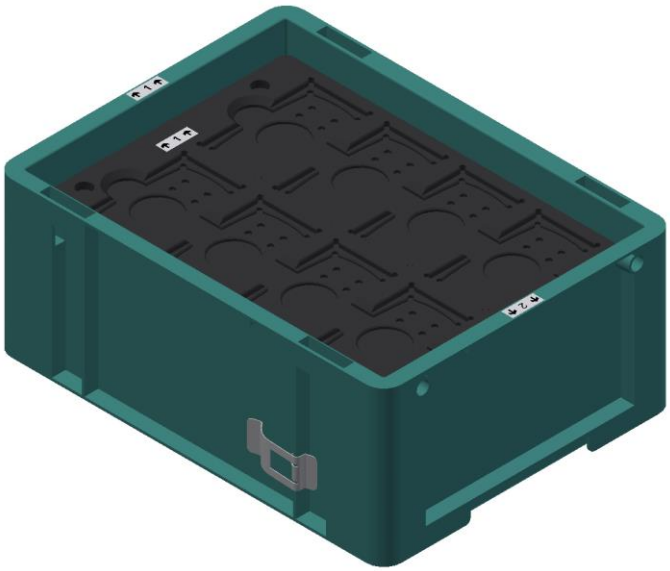
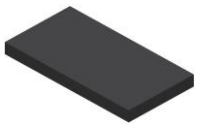
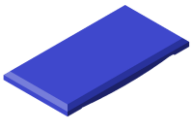
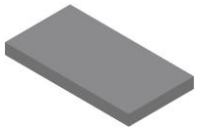
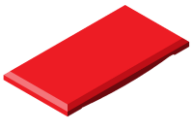
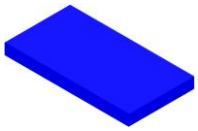
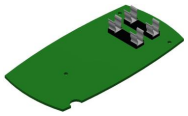
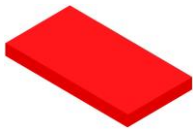
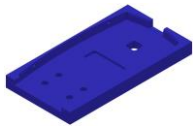
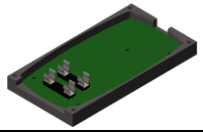
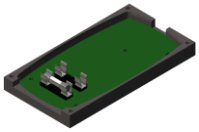
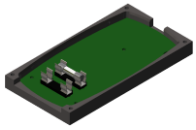
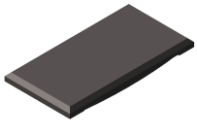
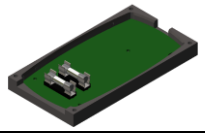
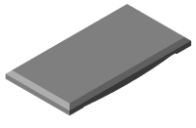


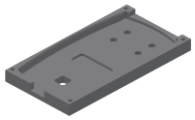
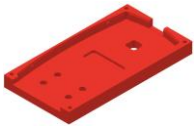
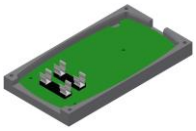
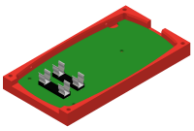
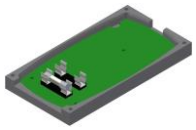
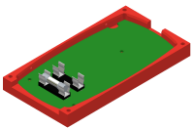
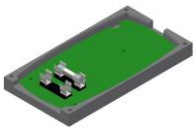
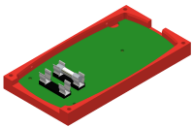
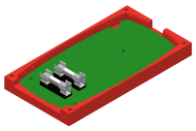
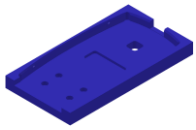
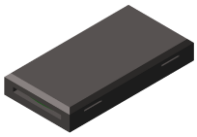
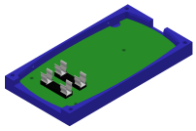
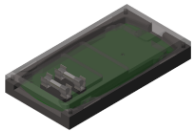
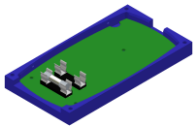
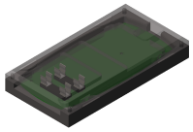
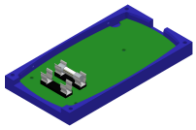
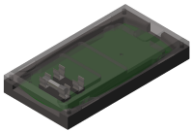
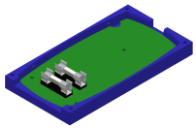
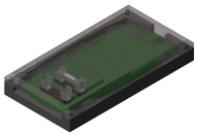
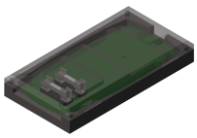
Illustration similar

Box with retainer for 8 front/backcovers or assembled workpieces
Partnumber in MES – 29

Workpieces

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

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

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

7 Design and Function

7.1 Transport

WARNING

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

WARNING

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

WARNING

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

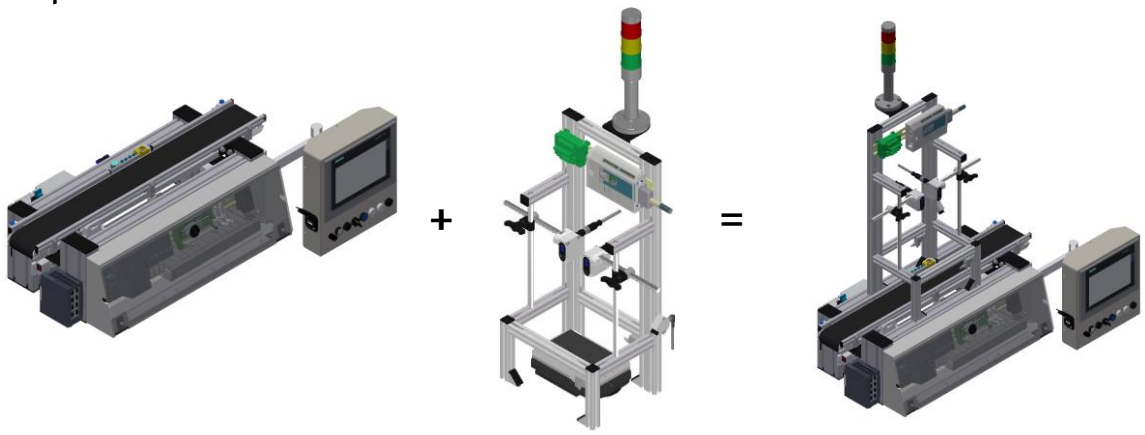
NOTE

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

7.2 Overview of the System

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

Example



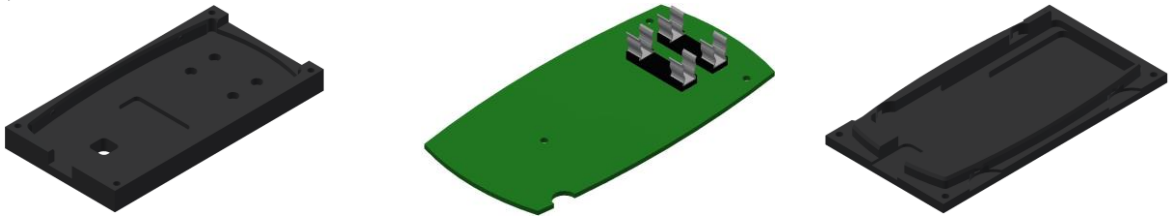
basic module, e.g. CP Lab Conveyor | application module, e.g. press | station press

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

carrier | pallet | workpiece

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

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



front cover | board | back cover

7.3 The ASRS for Boxes

The AS/RS for boxes consists of a base frame into which an X/Z handling system and the frame of the storage shelfs are mounted. A telescope is attached to the handling unit, which can pick up a box. The frame of the boxes is equipped with shelfs for the storage of 20 boxes. The shelfs are scanned by sensors in horizontal direction. This ensures that the handling system is only moved when the boxes are fully inserted into the shelfs. In addition, an ultrasonic sensor on the telescope determines whether the respective storage shelf is occupied or not during filling/unloading. The occupancy of the shelfs and boxes is managed exclusively in the software (SPS/MES).

During a storage process, a box is moved onto the handling system via the infeed conveyor and then positioned on the storage shelf position with a Z offset. The telescope is extended by a pneumatic cylinder and guides the box into the storage shelf. The two-track conveyor belt is switched on and the box is pushed out. The telescope is lowered so that the box lies on the conveyor of the storage shelf, then the telescope is retracted again. In a retrieval process, the upper sequence is in reverse order. The box is pushed out over the removal conveyor.

The boxes are equipped with an RFID-tag, on which the box identification is available. The telescope and the infeed conveyor of the AS/RS are equipped with an RFID identification system and read the box identification. This identification system is an important part of the CP Factory System. All order data can be viewed and managed in the MES system using this box identification.
The station has an operating panel and an operating function on the control cabinet.
The station can be optionally equipped with an energy recovery system.

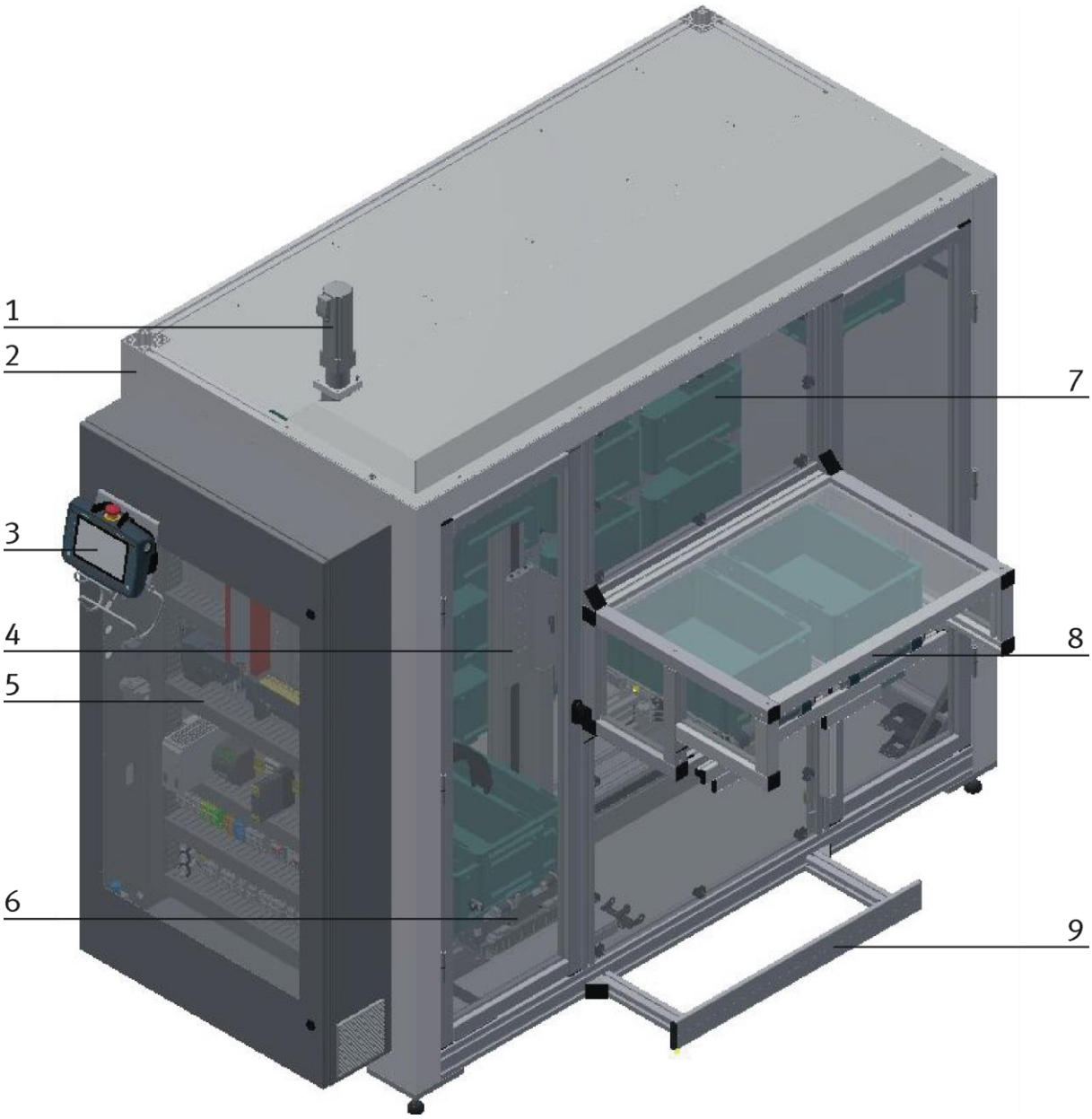


Illustration similar

Position	Description
1	motor x-axis
2	basic framework
3	operating panel
4	Z-axis / handling
5	control cabinet
6	telescope
7	storage slot with box
8	transfer unit for Robotino
9	guide for robotino

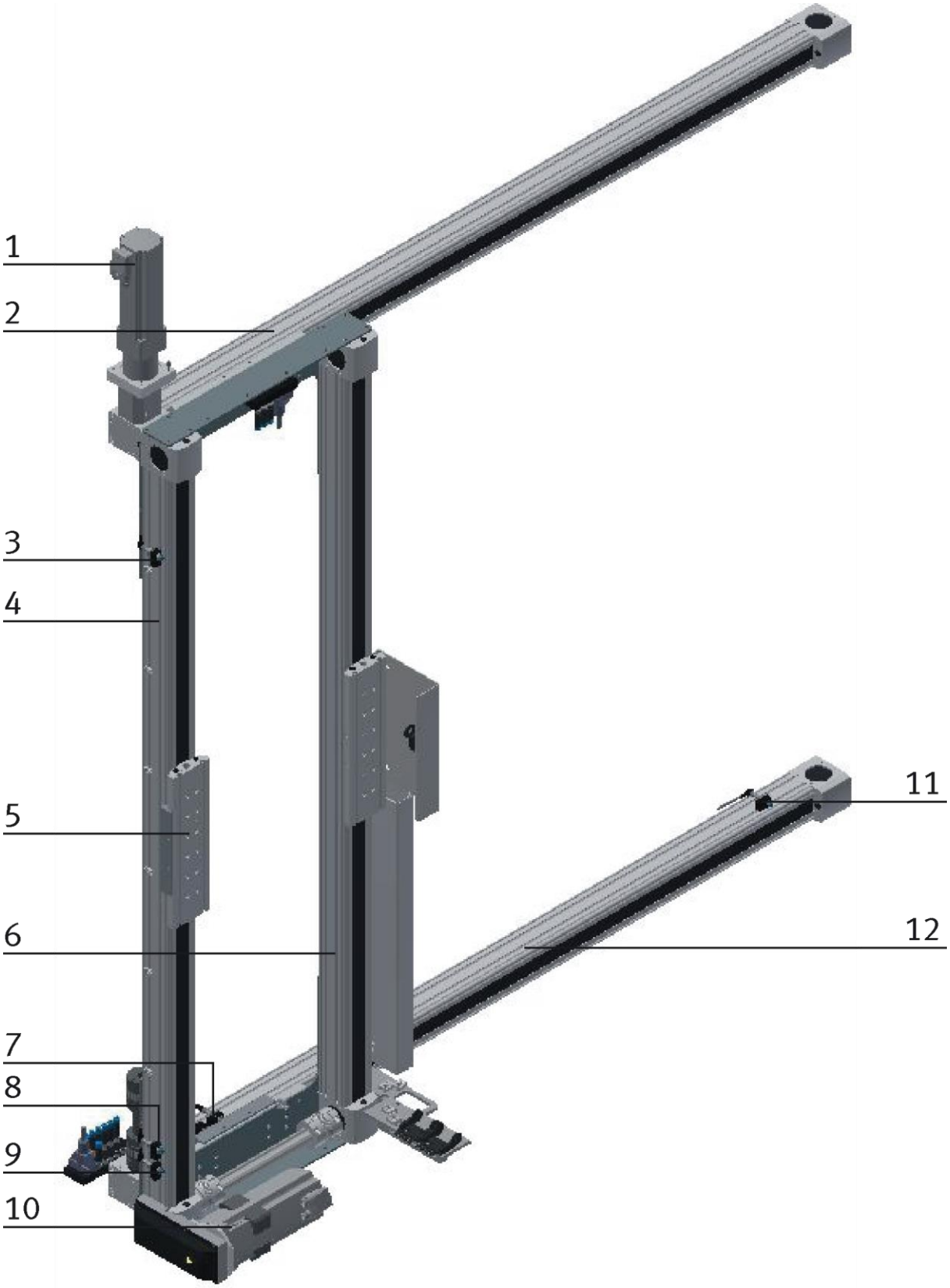


Illustration similar

Pos.	Description	Order Name	Order Number	Equipment Identifier
1	motor X-axis	EMME-AS-60-M-LS-ASB	2089732	+CM1.M1
2	X-axis	DGE-40-987-ZR-RF-LB-RK-GK	534392	
3	sensor Z-axis end position positive (on top)	SIEN-M8NB-PS-S-L	150395	BG22
4	Z-axis	DGE-40-947-ZR-RF-LB-RK-GK	534392	
5	driver			
6	Z-axis	DGE-40-947-ZR-RF-LB-RK-GK	534392	
7	sensor X-axis reference switch sensor X-axis end position negative (hidden)	SIEN-M8NB-PS-S-L	150395	BG13 BG11
8	sensor Z-axis reference switch	SIEN-M8NB-PS-S-L	150395	BG23
9	sensor Z-axis end position negative (at the bottom)	SIEN-M8NB-PS-S-L	150395	BG21
10	motor Z-axis	EMME-AS-80-M-LS-AMB	2093171	+CM1.M2
11	sensor X-axis end position positive	SIEN-M8NB-PS-S-L	150395	BG12
12	X-axis	DGE-40-987-ZR-RF-LB-RK-GK	534392	

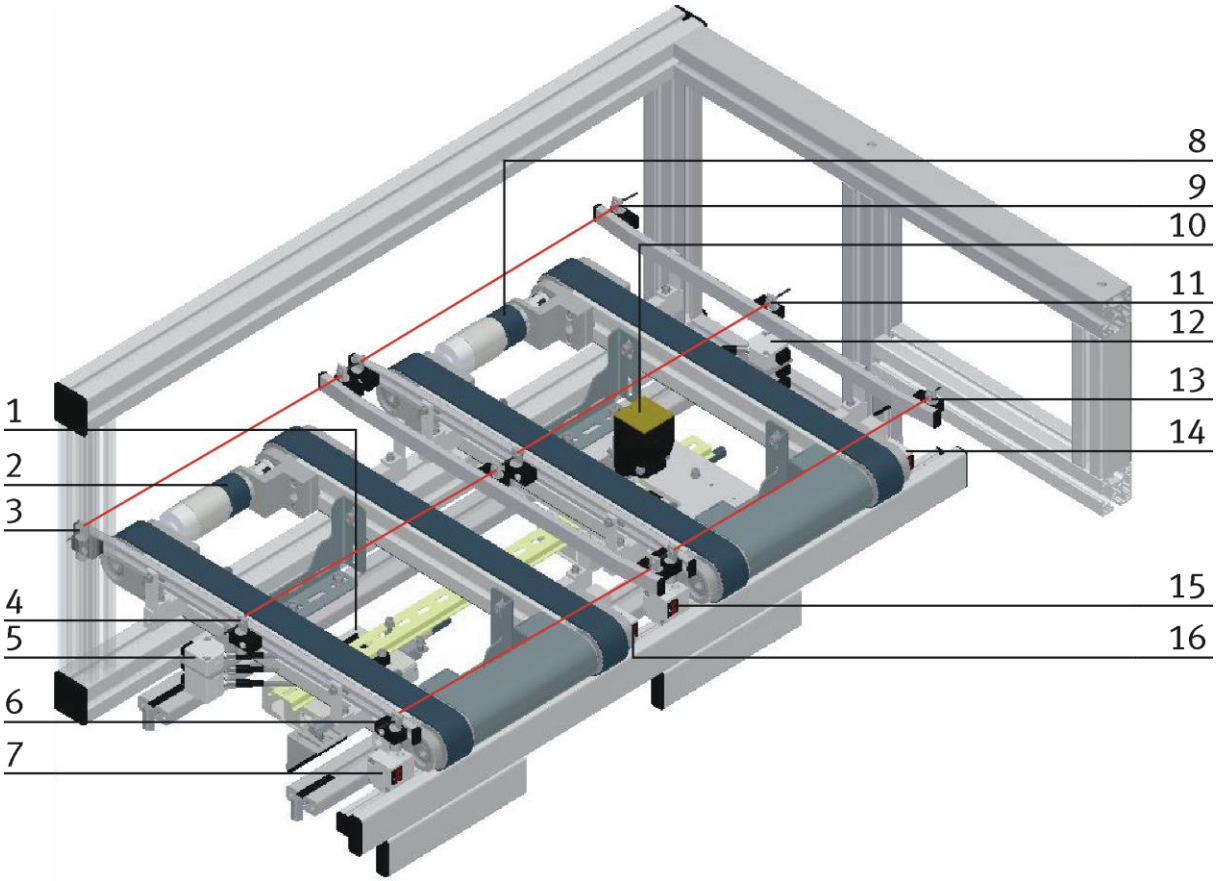


Illustration similar

Pos.	Description	Order Name	Order Number	Equipment Identifier
1	SysLink module			XD21
2	conveyor motor output	Ott geared motor	XDP037007-01	MA3
3	output box protrusion in direction of ASRS	SOOC-TB-M4-2-R25	552812	BG67
4	output box centred on conveyor	SOOC-TB-M4-2-R25	552812	BG66
5	fibre-optic units 3x	D: SOEG-L-Q30-P-A-S-2L	8127556	BG65-BG67
6	output box protrusion in direction of Robotino	SOOC-TB-M4-2-R25	552812	BG65
7	output coupling sensor Robotino	SOEG-E-Q30-PS-S-2L	165323	BG68
8	conveyor motor output	Ott geared motor	XDP037007-01	MA2
9	supply box protrusion in direction of ASRS	SOOC-TB-M4-2-R25	552812	BG63
10	Turck RFID read-write head	TN-CK40-H1147		TF1
11	supply box centred on conveyor	SOOC-TB-M4-2-R25	552812	BG62
12	fibre-optic units 3x	D: SOEG-L-Q30-P-A-S-2L	8127556	BG61-BG63
13	supply box protrusion in direction of Robotino	SOOC-TB-M4-2-R25	552812	BG61
14	coupling sensor sender Robotino supply	SOEG-S-Q30-S-L	165353	PF64
15	supply coupling sensor Robotino	SOEG-E-Q30-PS-S-2L	165323	BG64
16	coupling sensor sender Robotino output	SOEG-S-Q30-S-L	165353	PF68

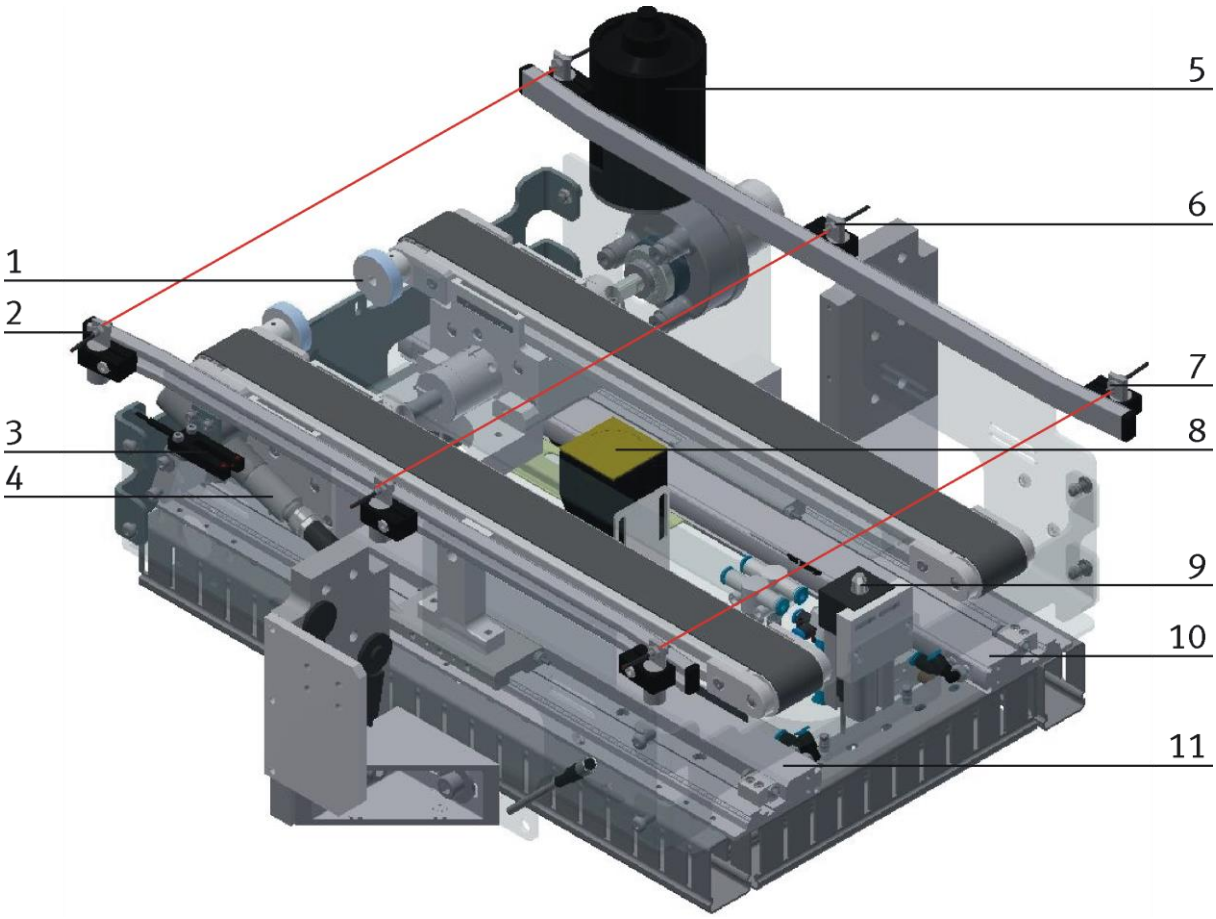
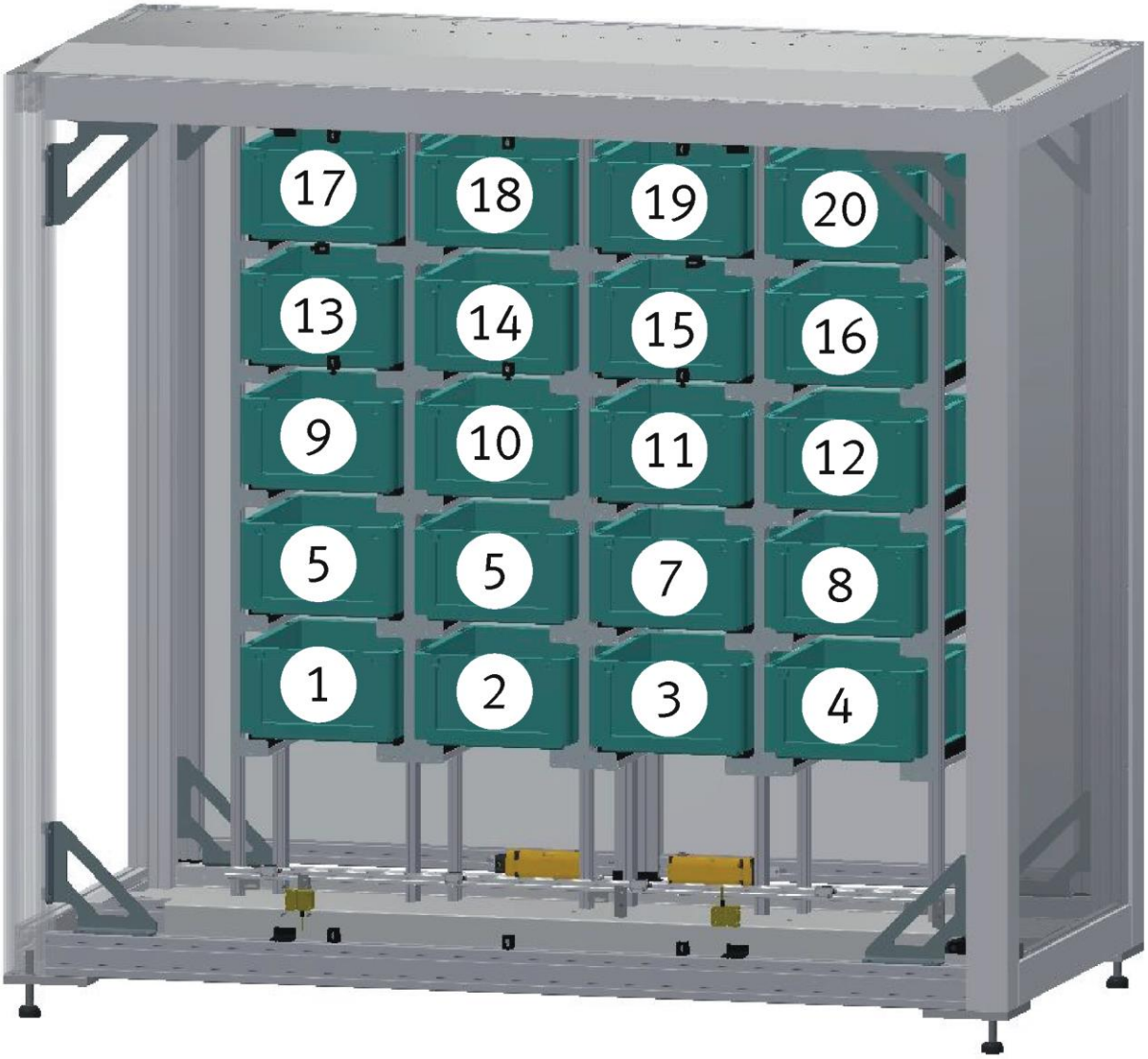


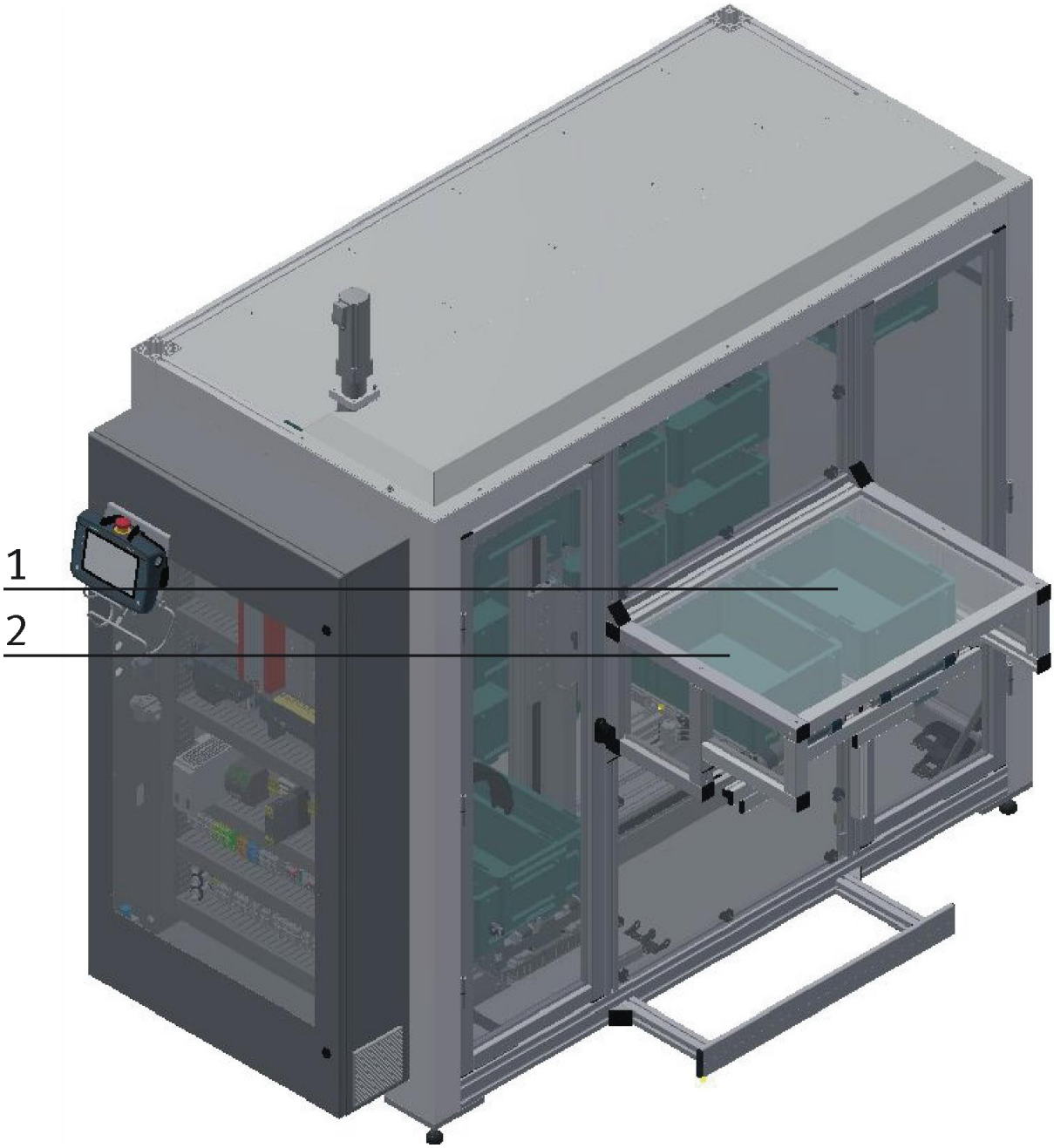
Illustration similar

Pos.	Description	Order Name	Order Number	Equipment Identifier
1	Driving pulley			
2	Sensor box protruding at storage slots side	SOOC-TB-M4-2-R25	552812	BG37
3	Sensor 1= switch strip Z axis in position	SOOC-TB-P-C5-2-R10	552828	BG38
4	ultrasound sensor box available in storage slot	UM18-60-250-CD-HP	690-51541	BG33
5	geared motor		097-117	MA1
6	sensor box is on telescope	SOOC-TB-M4-2-R25	552812	BG36
7	sensor box protruding at Docking side	SOOC-TB-M4-2-R25	552812	BG35
8	Turck RFID read-write head	TN-CK40-H1147		TF2
9	cylinder – stopper sensor stopper is down	AEVUZ-16-10-P-A SMT-8M-A-PS-24V-E-0,3-M8D	157212 574334	BG34
10	cylinder telescope	SLG-12-300-YSR-A	187855	
11	cylinder telescope sensor telescope has moved into a storage slot sensor telescope is in starting position	SLG-12-300-YSR-A SMT-10M-PS-24V-E-2,5-L-OE SMT-10M-PS-24V-E-2,5-L-OE	187855 551373 551373	 BG32 BG31

7.3.1 Operating positions



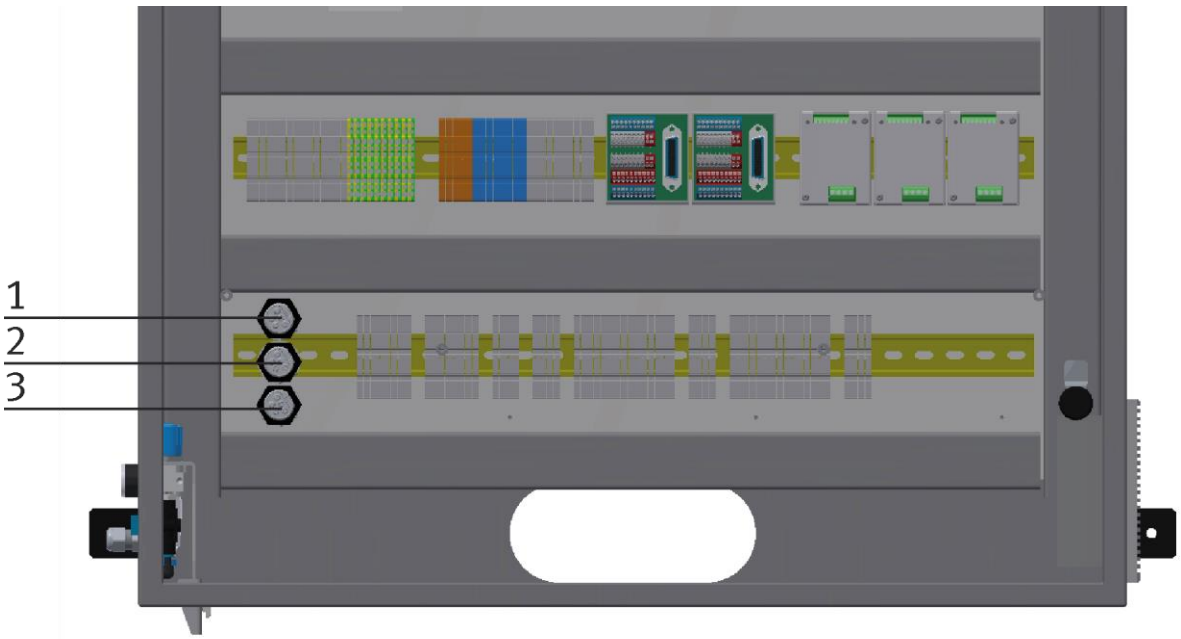
storage slots ASRS for Boxes / Illustration similar



Example for operating positions at the ASRS for Boxes / Illustration similar

Position	Description
1	Pos. 91 storage position
2	Pos. 90 outsourcing position

7.3.2 Supply of the ASRS for Boxes



CP Factory supply / Illustration similar

Position	Description
1	XJ1 / feed plug with voltage 400V / 20A
2	XJ2 / output 1 / 20A
3	XJ3 / output 2 / 20A

The supply with air and for the network is effected via the lower port in the control cabinet with separate cables respectively with a tube.

7.4 Electrical installation

The ASRS has got a control cabinet which is attached to the basic framework of the module.

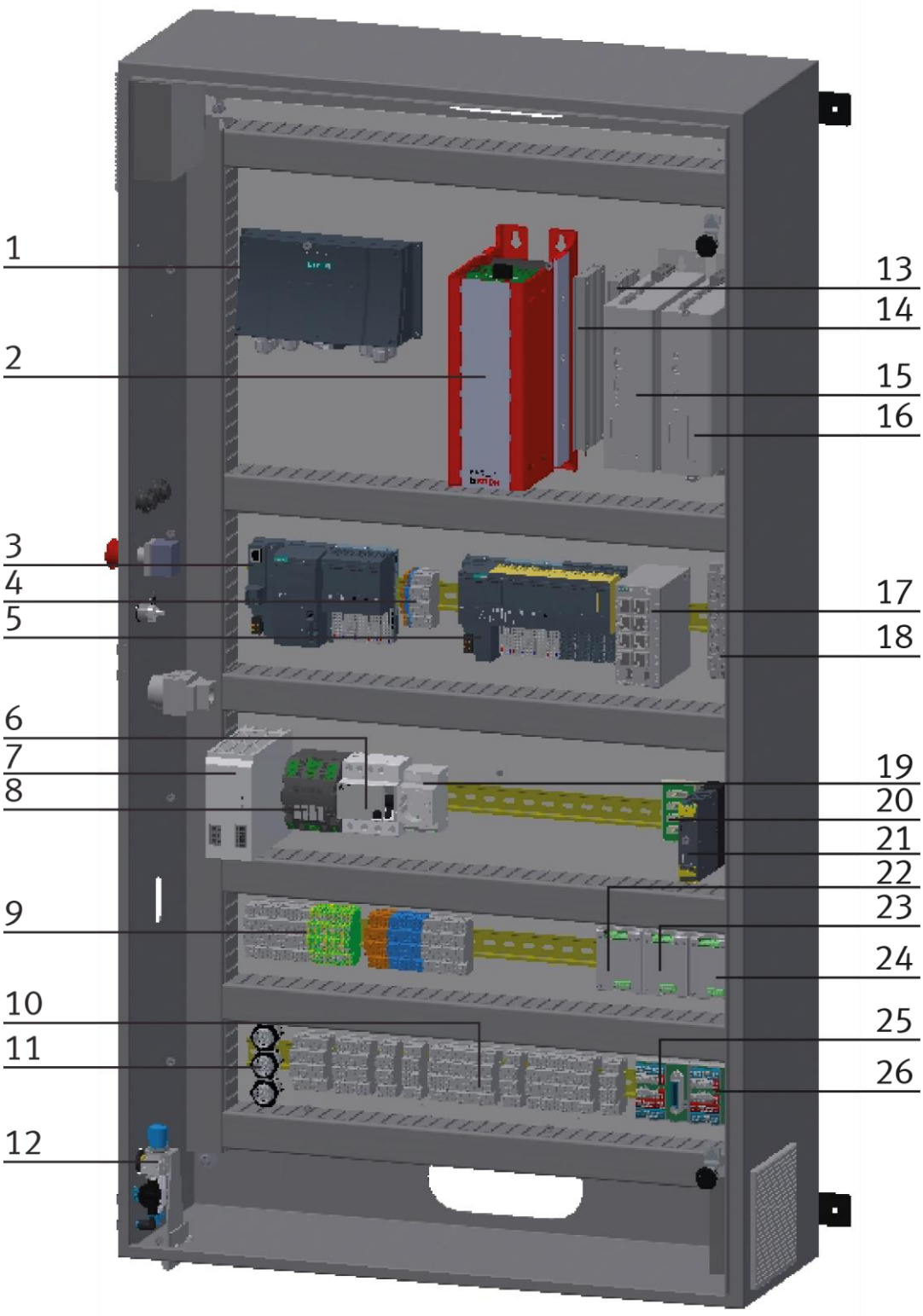
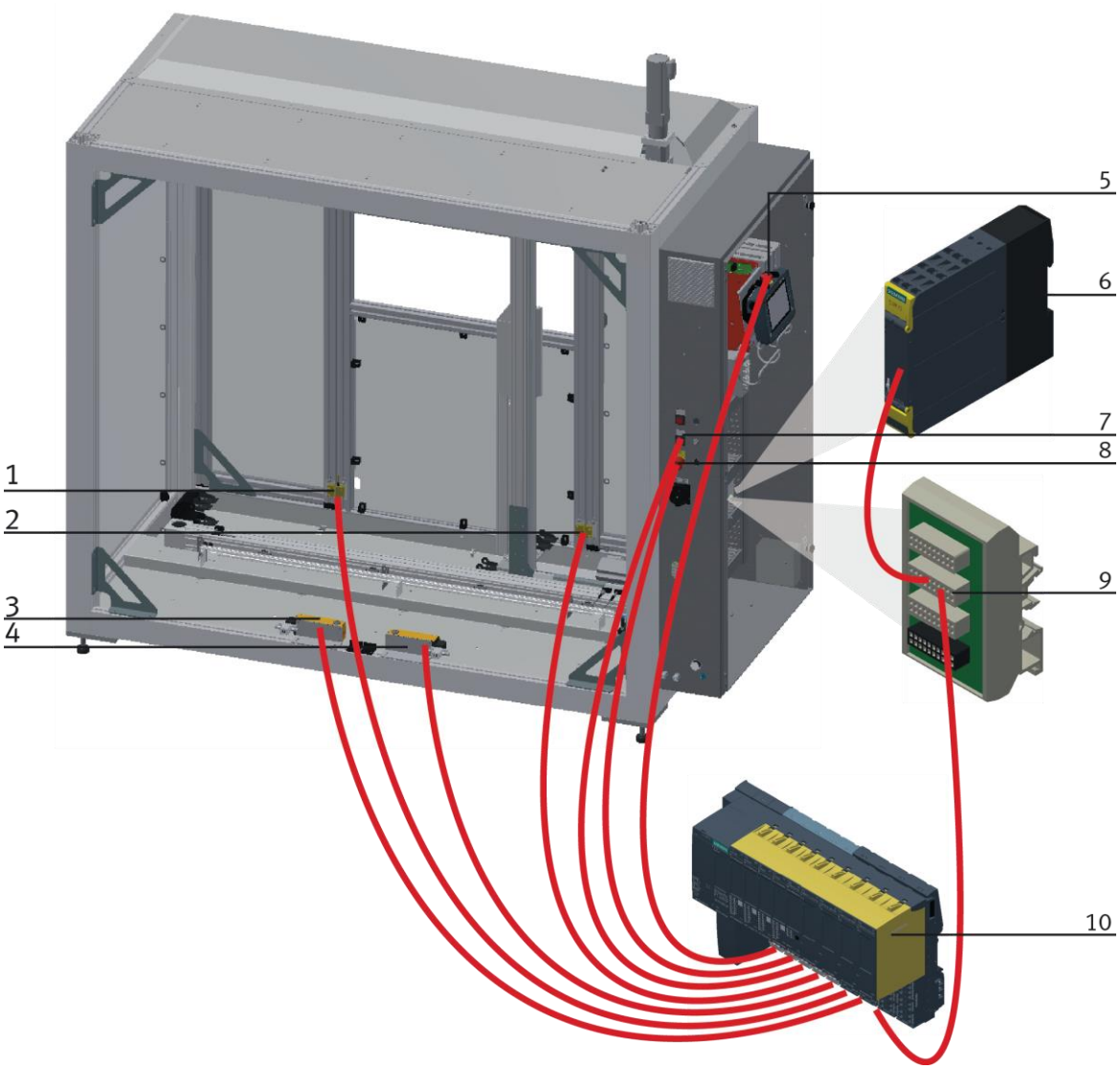


Illustration similar

Position	Description	Equipment Identifier	Description / Order Number
1	connection box	-KF3	SIE#6AV2125-2AE23-0AX0
2	energy storage (optional)	CA1	Koch KES 2.0
3	PLC	KF1 – KF5	Siemens ET200SP / CPU 1512SP F-1PN
4	Clamps	XG2	
5	PLC	KF11-KF20	Siemens ET200SP / IM155-6 PN HF
6	fuse	FC1	circuit breaker 2 pin C-10A
7	power supply unit	TB1	2247682 / CACN-3A-1-10
8	24V distributor	FC2	MICO 4.6 / 24VDC/4* 1/2/4/6A / 9000-41034-0100600
9	clamps	XD1/ XD2	
10	clamps	XJ5/ XJ22	
11	Feed	XJ1	
12	service unit		
13	brake resistors	RA21	FESTO 1336611 / 500W
14	brake resistors	RA11	FESTO 1336611 / 500W
15	motor controller	QA11	CMMP-AS-C5-3A-M3
16	motor controller	QA21	CMMP-AS-C5-3A-M3
17	Ethernet Switch	XF1	Siemens Scalance XB008 / 6GK5008-OBAOO-1AB2
18	RFID	KF31	Turck TBEN-S2-2RFID-4DXP
19	Socket 230 V	XJ4	WAGO 709.581
20	Emergency-stop unit	XZ2	
21	Emergency-stop unit	FZ1	Siemens / 3SK1111-2AB30
22	start-up current limiters	QA1	Kaleja M-MZS-4-30 / 06.05.020
23	start-up current limiters	QA2	Kaleja M-MZS-4-30 / 06.05.020
24	start-up current limiters	QA3	Kaleja M-MZS-4-30 / 06.05.020
25	I/O terminal	XD11	
26	I/O terminal	XD12	

7.4.1 Emergency-stop structure



structure of the Emergency-stop system / illustration similar

Pos.	Name
1	safety door 4 / FQ4
2	safety door S 3 / FQ3
3	safety door 1 / FQ1
4	safety door 2 / FQ2
5	Emergency-stop operating panel / KF3
6	Emergency-stop control unit /FZ1
7	control on / SF1
8	Emergency-stop / FQ1
9	Emergency-stop unit for the emergency-stop concatenation /-XZ2
10	Emergency-stop PLC / KF11-KF20

7.4.2 Gripping protection

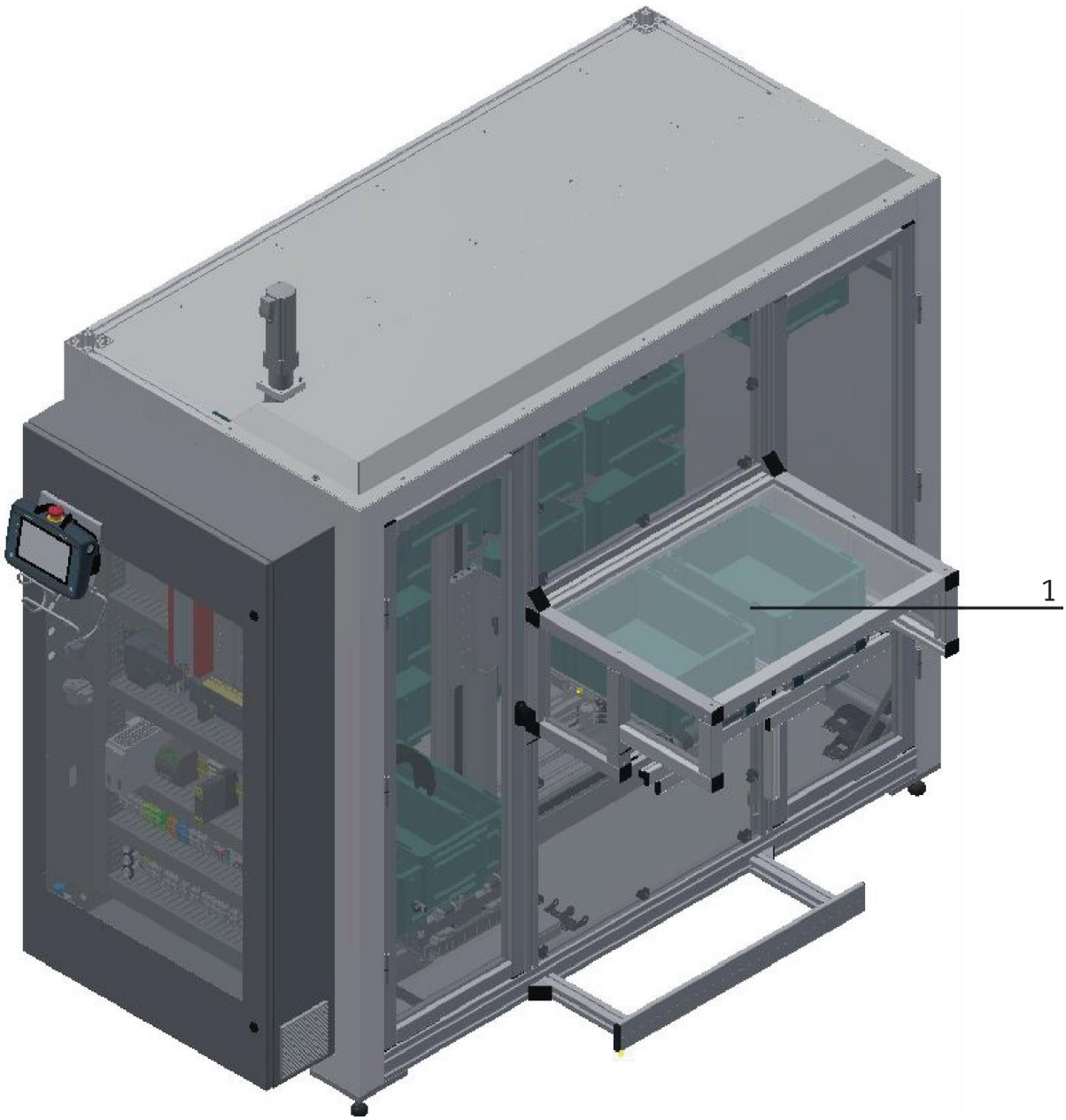


Illustration similar

Pos.	Description
1	Gripping protection – in order to avoid gripping into the hazard area

7.5 Commissioning

The ASRS for boxes has got several components which have to be attached when starting up. The procedure will be described on the following pages.

7.5.1 Pneumatic commissioning

The mechanic mounting must be finished and completed. At first you have to connect the ASRS for boxes 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.

7.5.2 Electrical commissioning

Now the ASRS for boxes 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.

7.6 Adjusting the sensors

7.6.1 Proximity switch (Z-axis cylinder)

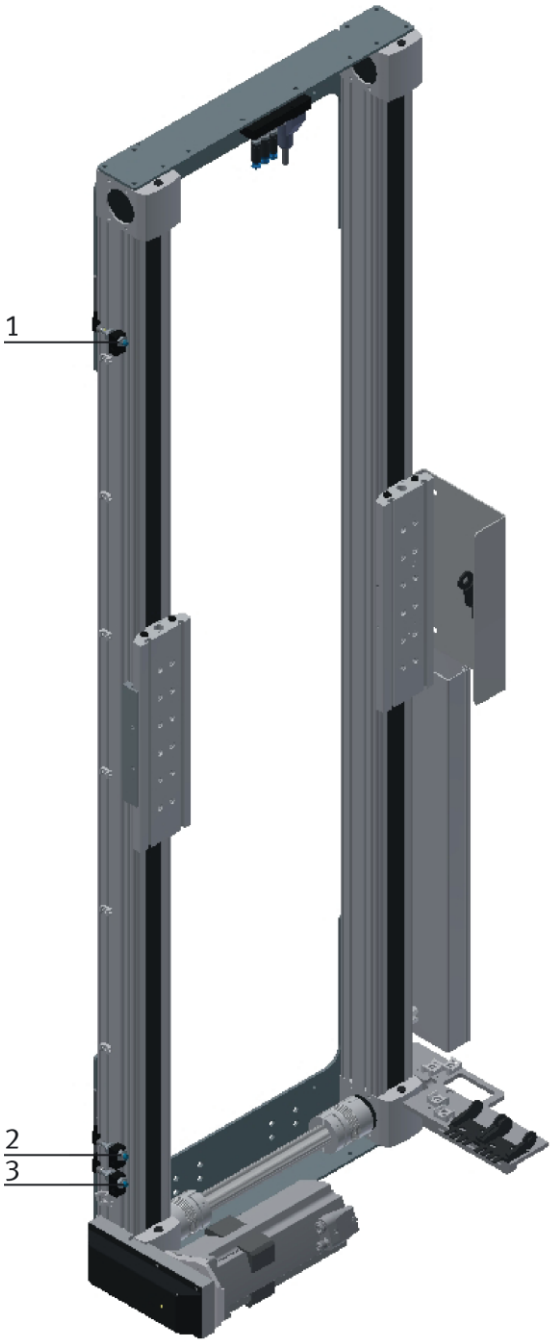


Illustration similar

Position	Description
1	Sensor Z-axis top end position (BG22) / 150395 (SIEN-M8NB-PS-S-L)
2	Sensor Z-axis reference position (BG23) / 150395 (SIEN-M8NB-PS-S-L)
3	Sensor Z-axis bottom end position (BG21) / 150395 (SIEN-M8NB-PS-S-L)

The proximity switches are used for controlling the end position of the cylinder for the Z-axis. The proximity switches react to a permanent magnet on the piston of the cylinder.

Requirements

– Cylinder Z-axis is attached to Y-axis and to swivel/gripper unit.
– Pneumatic port of the cylinder is set up.
– Compressed air supply is switched on.
– Electrical connection of the proximity switches is set up.
– Power supply is available.

Procedure

1. The cylinder is in its end position to be queried.
2. Shift the proximity switch as long as the switching status display (LED) appears.
3. Shift the proximity switch into the same direction by a few millimetres 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 test runs of the cylinder.

Documents

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

7.6.2 Proximity switch (cylinder X-axis)

Illustration similar

Position	Description
1	Sensor X-axis left end position (BG12) / 150399 (SIEN-M8NB-PO-S-L)
2	Sensor X-axis reference position (BG13) / 150399 (SIEN-M8NB-PO-S-L)
3	Sensor X-axis right end position (BG11) / 150399 (SIEN-M8NB-PO-S-L)

The proximity switches are used for controlling the end position of the cylinder for the X-axis. The proximity switches react to a permanent magnet on the piston of the cylinder.

Requirements

– Cylinder X-axis is attached to the swivel/gripper unit.
– Pneumatic port of the cylinder is set up.
– Compressed air supply is switched on.
– Electrical connection of the proximity switches is set up.
– Power supply is available.

Procedure

1. The cylinder is in its end position to be queried.
2. Shift the proximity switch as long as the switching status display (LED) appears.
3. Shift the proximity switch into the same direction by a few millimetres 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 test runs of the axis.

Documents

- Data sheets / Operating instructions
  Proximity switch 150399 (SIEN-M8NB-PO-S-L)

7.6.3 Fibre-optic (workpiece detection)

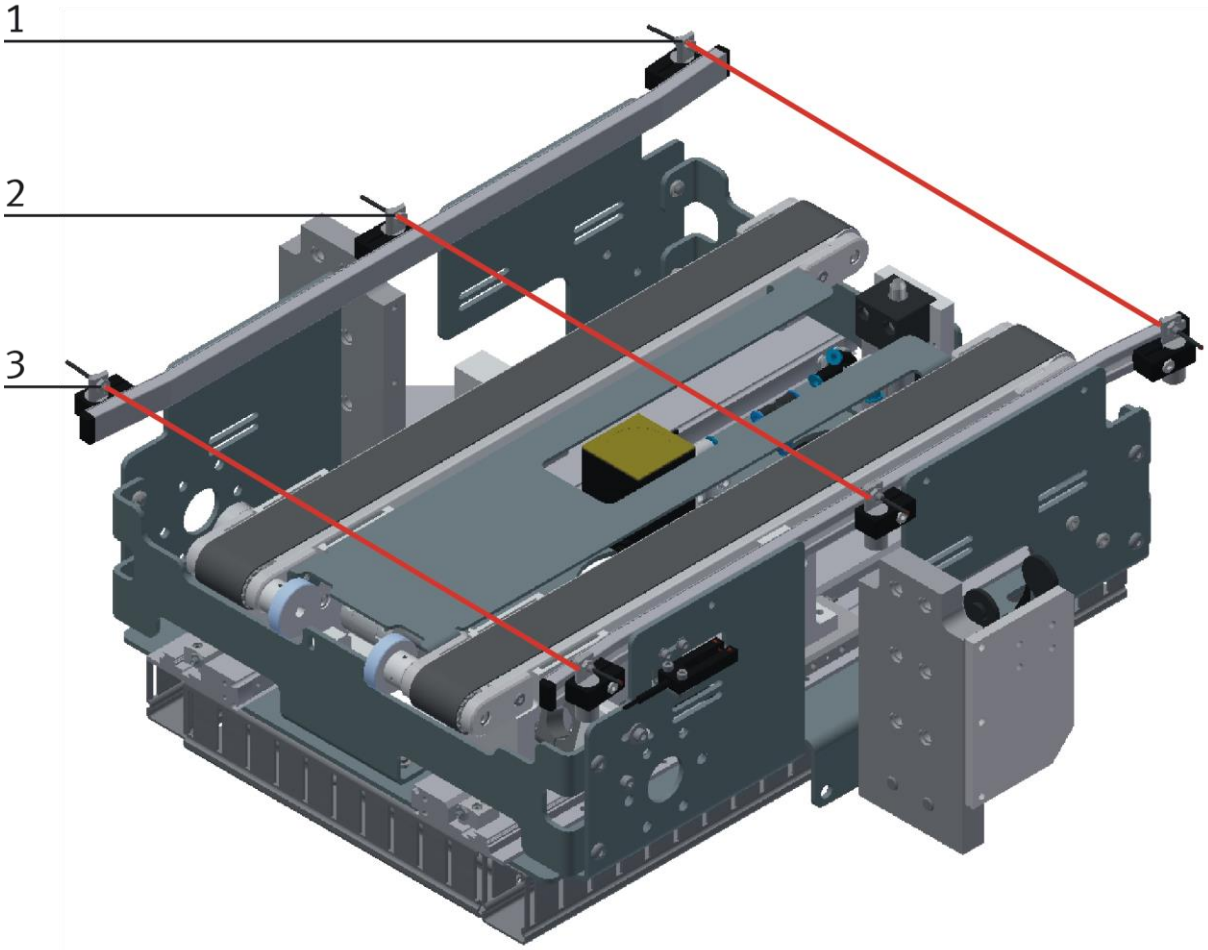


Illustration similar

Position	Description
1	fibre-optic BG35 / box is protruding at Docking side 552812 (SOOC-TB-M4-2-R25)
2	fibre-optic BG36 / box is located at telescope 552812 (SOOC-TB-M4-2-R25)
3	fibre-optic BG37 / box is protruding at storage slot side 552812 (SOOC-TB-M4-2-R25)

The through-beam sensor for detecting the box 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 box is placed on the start position of the conveyor or when the box 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 box „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 box 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 box. .

   Remark
   It must be guaranteed that all trays are recognized.

Documents

- Data sheets / operating instructions
  fibre-optic unit 552812 (SOOC-TB-M4-2-R25)

7.6.4 Proximity switch (telescope)

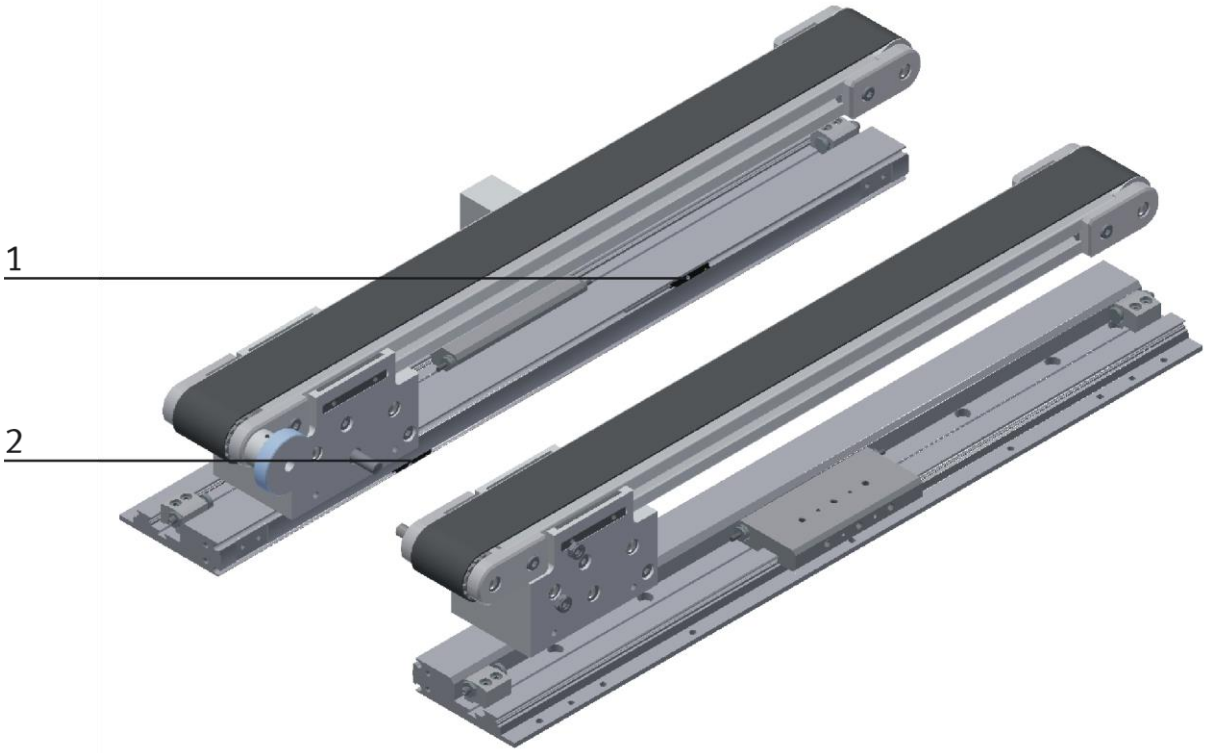


Illustration similar

Position	Description
1	Telescope is moved in shelf BG32 / 551373 (SMT-10M-PS-24V-E-2,5-L-OE)
2	Telescope is in initial position BG31 / 551373 (SMT-10M-PS-24V-E-2,5-L-OE)

The proximity switches are used for controlling the end position of the cylinder for the X-axis. The proximity switches react to a permanent magnet on the piston of the cylinder.

Requirements

– Cylinder X-axis is attached to the swivel/gripper unit.
– Pneumatic port of the cylinder is set up.
– Compressed air supply is switched on.
– Electrical connection of the proximity switches is set up.
– Power supply is available.

Procedure

1. The telescope is in its end position to be queried.
2. Shift the proximity switch as long as the switching status display (LED) appears.
3. Shift the proximity switch into the same direction by a few millimetres 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 test runs of the telescope.

Documents

- Data sheets / Operating instructions
  Proximity switch 551373 (SMT-10M-PS-24V-E-2,5-L-OE)

7.6.5 Switch Strip (Z-axis)

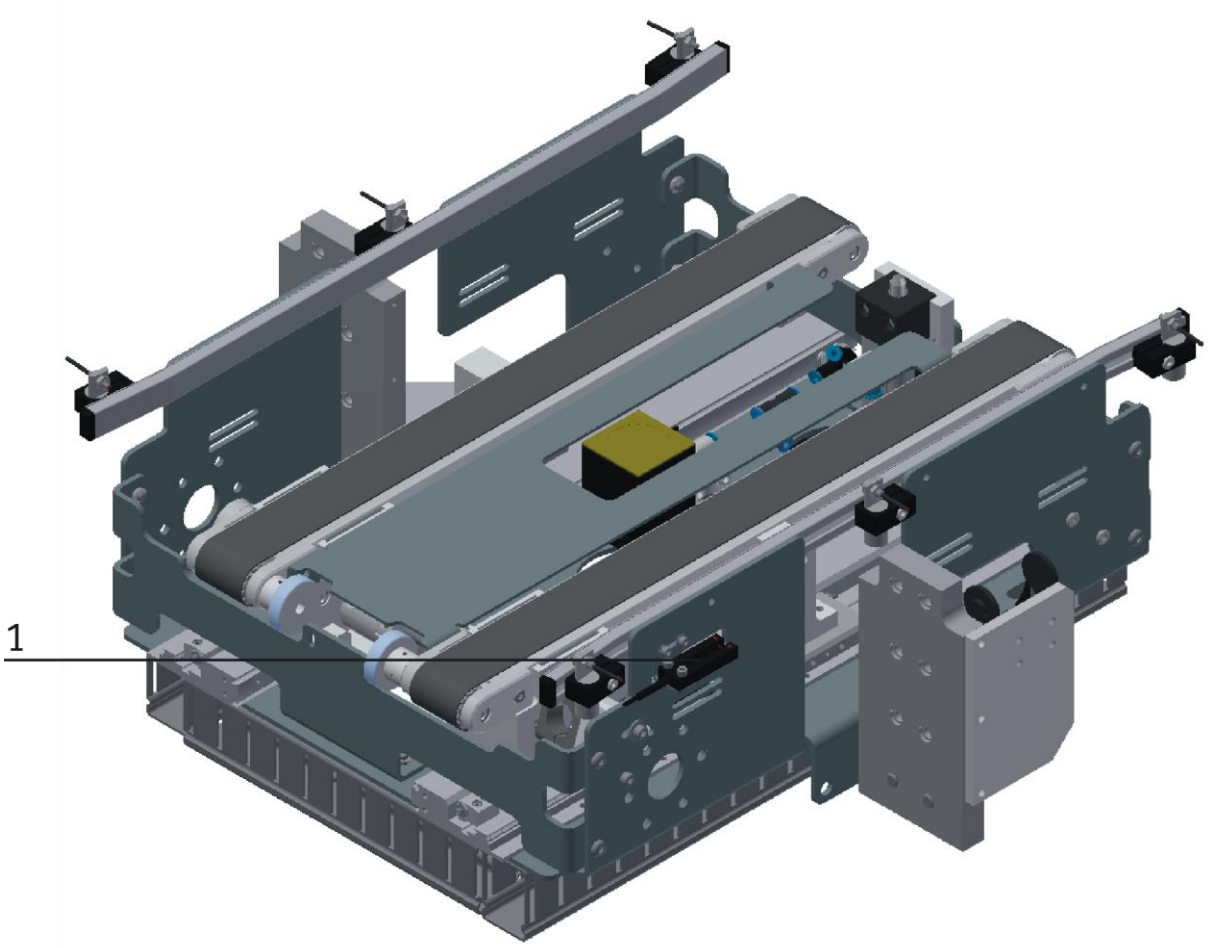


Illustration similar

Position	Description
1	1 = switch strip Z axis in position BG38 / 552828 (SOOC-TB-P-C5-2-R10)

The switch strip itself does not require any settings, you have to make sure that the switching lug of the Z-axis can move freely between the arms of the switch strip. The vertical alignment of the switching lug has to be effected in this way that the cut-out of the switching lug can be screened without obstruction.

7.6.6 Ultrasonic Sensor

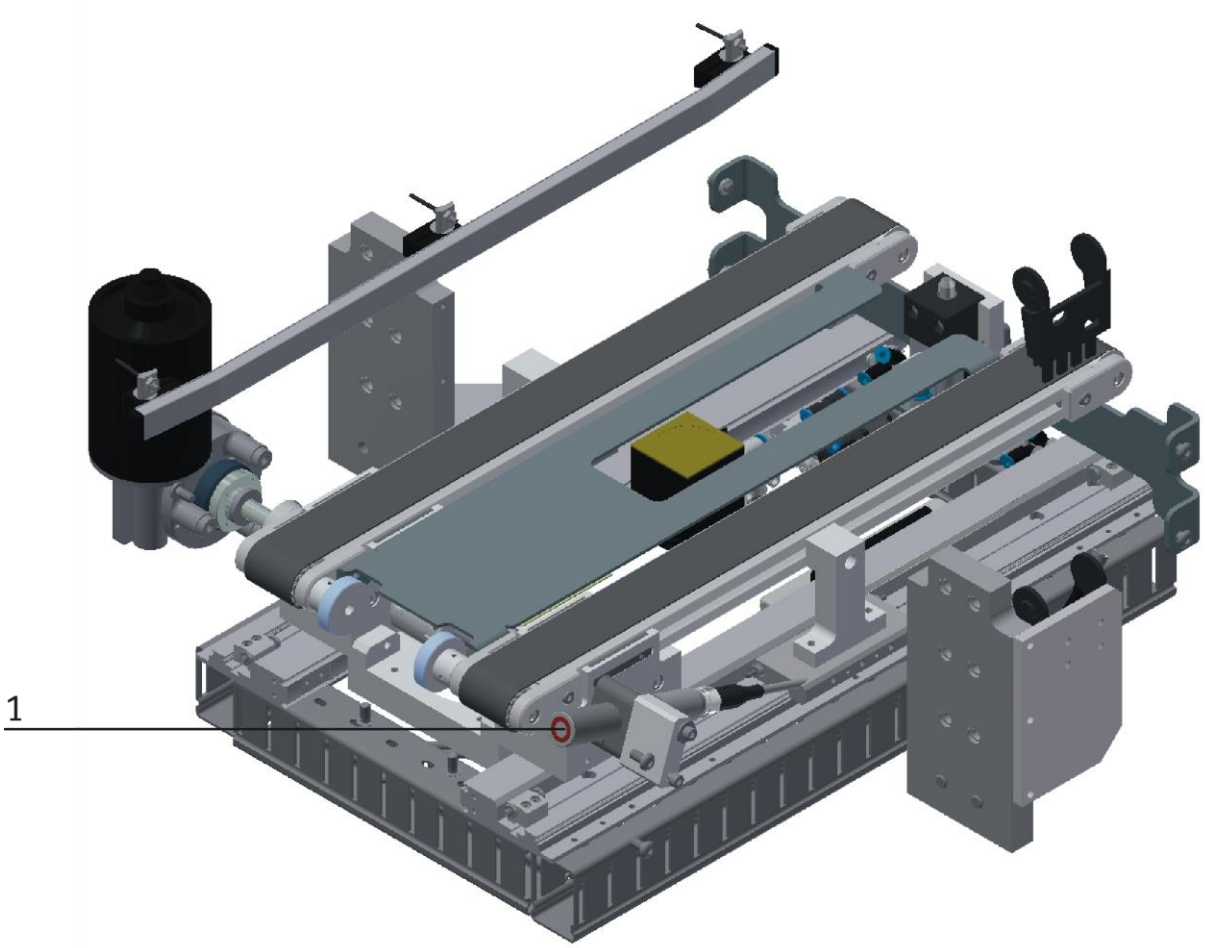


Illustration similar

Position	Description
1	Ultrasonic sensor box available in storage slot BG33 / 690-51541 UM18-60-250-CD-HP

The ultrasonic sensor itself does not require any settings. You have to make sure that the sensor does not protrude over the edge of the telescope and that a position is selected that guarantees a safe recognition of the boxes in the storage slots.

7.6.7 Proximity switch (stopper cylinder)

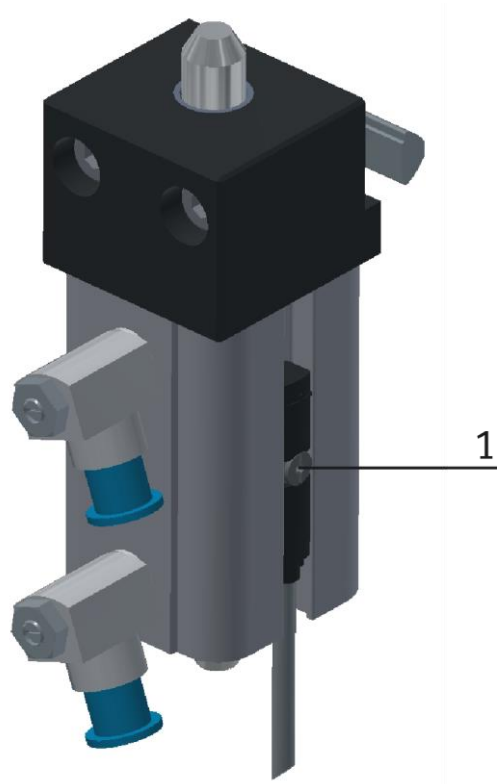


Illustration similar

Position	Description
1	Sensor stopper is closed Bg34 / 574334 (SMT-8M-A-PS-24V-E-0,3-M8D)

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

Requirements

– Cylinder stopper is attached to the conveyor.
– Pneumatic port of the cylinder is set up.
– Compressed air supply is switched on.
– Electrical connection of the proximity switches is set up.
– Power supply is available.

Procedure

1. The cylinder is in its end position to be queried.
2. Shift the proximity switch as long as the switching status display (LED) appears.
3. Shift the proximity switch into the same direction by a few millimetres 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 test runs of the cylinder.

Documents

- Data sheets / operating instructions
  Proximity Switch 574334 (SMT-8M-A-PS-24V-E-0,3-M8D)

7.6.8 Fibre optics (workpiece recognition)

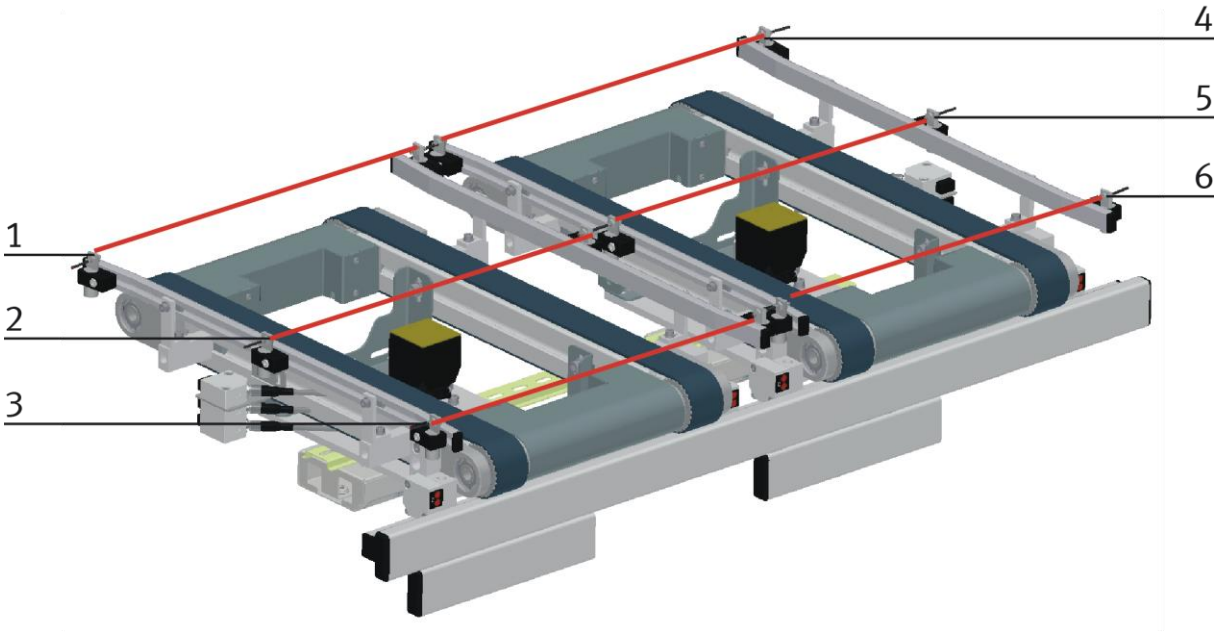


Illustration similar

Position	Description
1	fibre-optic BG67 / output box, protrusion in direction of Robotino 552812 (SOOC-TB-M4-2-R25)
2	fibre-optic BG66 / output box, protrusion in direction of Robotino 552812 (SOOC-TB-M4-2-R25)
3	fibre-optic BG65 / output box, protrusion in direction of Robotino 552812 (SOOC-TB-M4-2-R25)
4	fibre-optic BG63 / supply box, protrusion in direction of ASRS 552812 (SOOC-TB-M4-2-R25)
5	fibre-optic BG62 /, supply box, centered on conveyor 552812 (SOOC-TB-M4-2-R25)
6	fibre-optic BG61 / supply box, protrusion in direction of Robotino 552812 (SOOC-TB-M4-2-R25)

The through-beam sensors for detecting the boxes on the conveyors consist 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. If a box is placed on the start position of the conveyor or if the box 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 box „available at fibre optic“; 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 box available at the fibre-optic, then the signal must be interrupted (0-signal).

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

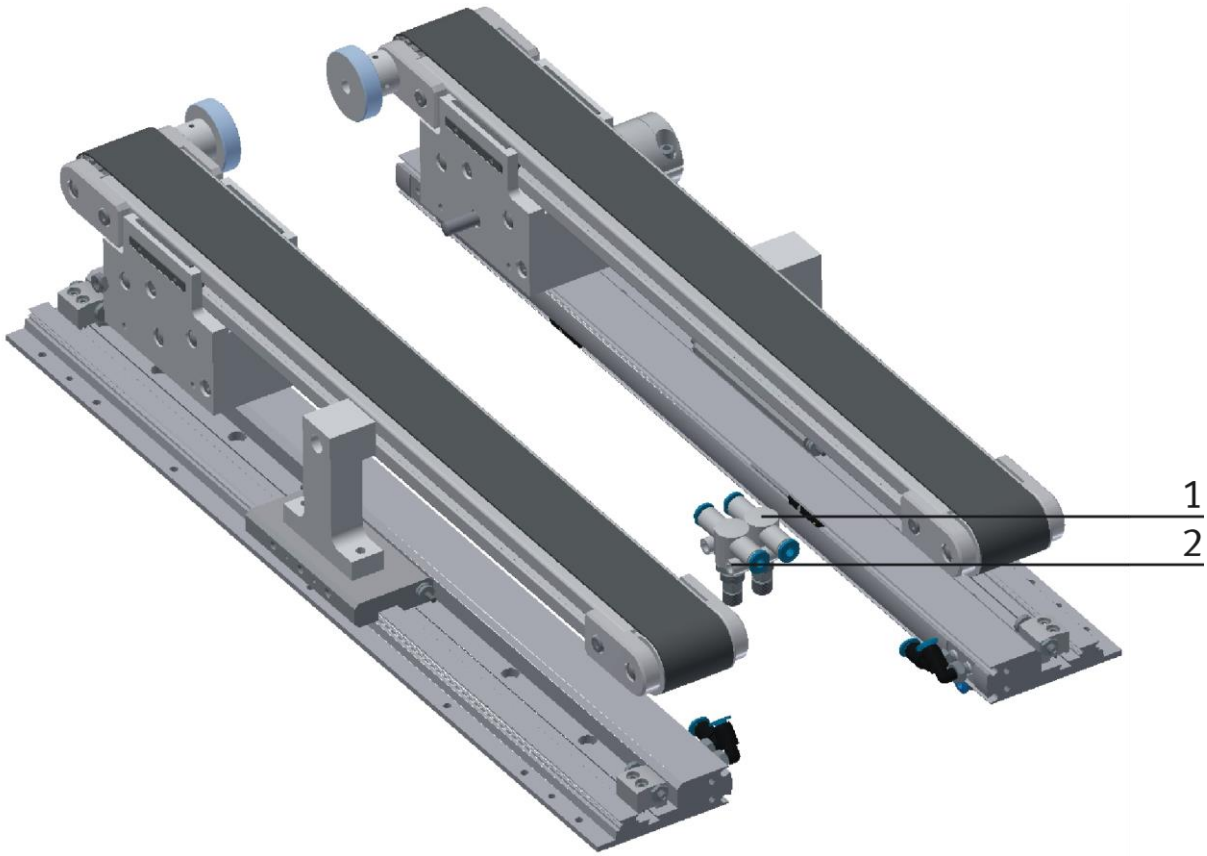
5. Please check the adjustment by inserting a box.

   Remark
   It must be guaranteed that all boxes are recognized.

Documents

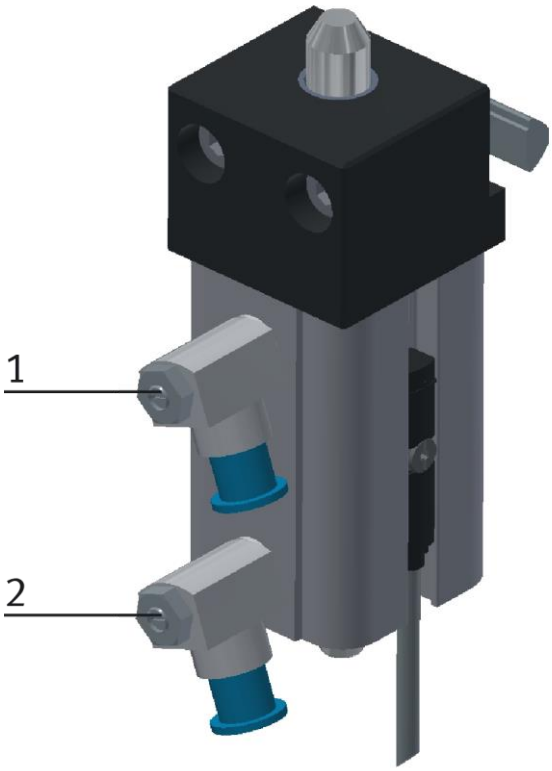
- Data sheets / operating instructions
  fibre-optic unit SOEG_L and fibre-optics SOEZ-SE

7.7 Adjusting the one-way flow control valves



One-way flow control valves / Illustration similar

Pos	Description
1	One-way flow control valves GRLO for telescope
2	One-way flow control valves GRLO for telescope



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 behaviour 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)

7.8 Visual inspection

Visual inspection must always be done before starting up!
Before starting the station, please check:

- the electrical connections
- the correct fit and condition of the supply ports
- the mechanic components regarding visible faults (cracks, loose connections etc.)
- the function of the Emergency Stop

Please make sure that all damages discovered are removed before starting the station!

8 Operation

DANGER

The AS/RS may only be operated in automatic mode with the protective doors closed. It must be ensured that there are no persons in the interior of the warehouse before the protective doors are closed.
In setup mode, the handling can also be operated with the protective doors open. No persons may be in the danger area! Pay attention to crushing and clamping points before the handling or other actuators are moved!

Failure to follow these instructions can result in severe physical injury or death!

8.1 The control units of the ASRS

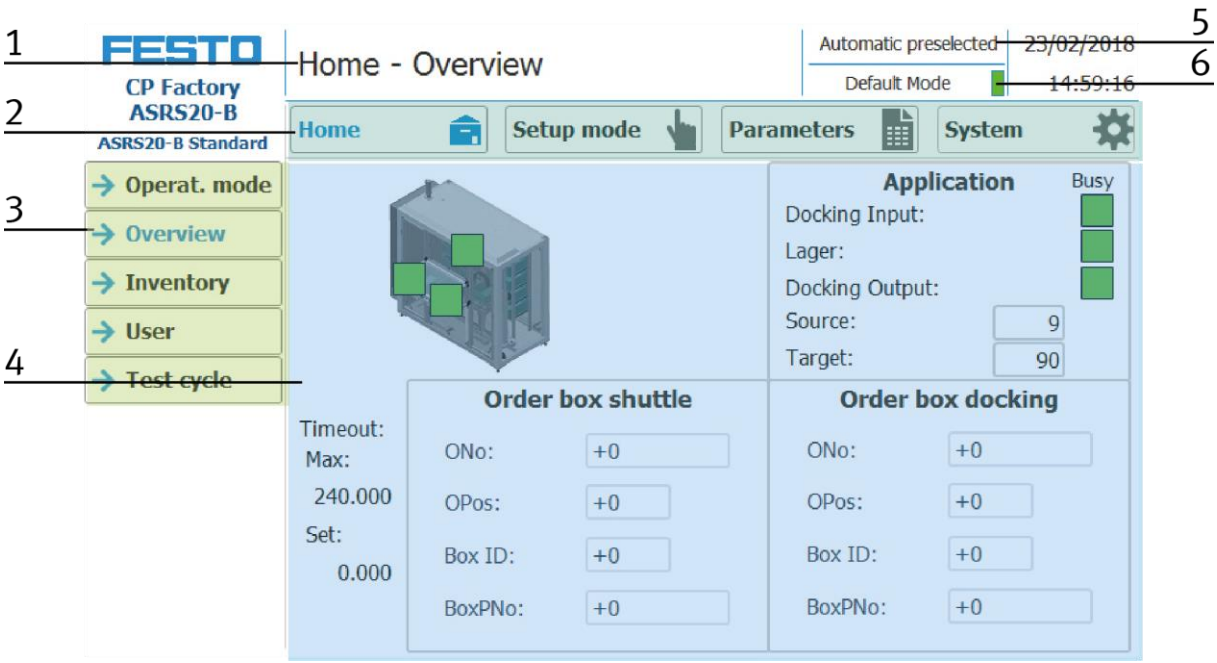
Operating panel / illustration similar

CP Factory ASRS for boxes – operating elements control cabinet / illustration similar

Position	Description
1	acknowledging Emergency-stop
2	Emergency-stop
3	Ethernet interface
4	key actuator automatic/manual
5	master switch

8.2 Operation

8.2.1 Menu architecture from operation panel



Position	Description
1	Display/ description of the menu (main menu or submenu). An active error or an error message is also displayed here.
2	main menu
3	submenu in main menu
4	variable content depending on the main menu or submenu
5	display of operating mode
6	display whether default or MES operating mode is selected

8.3 Operation modes

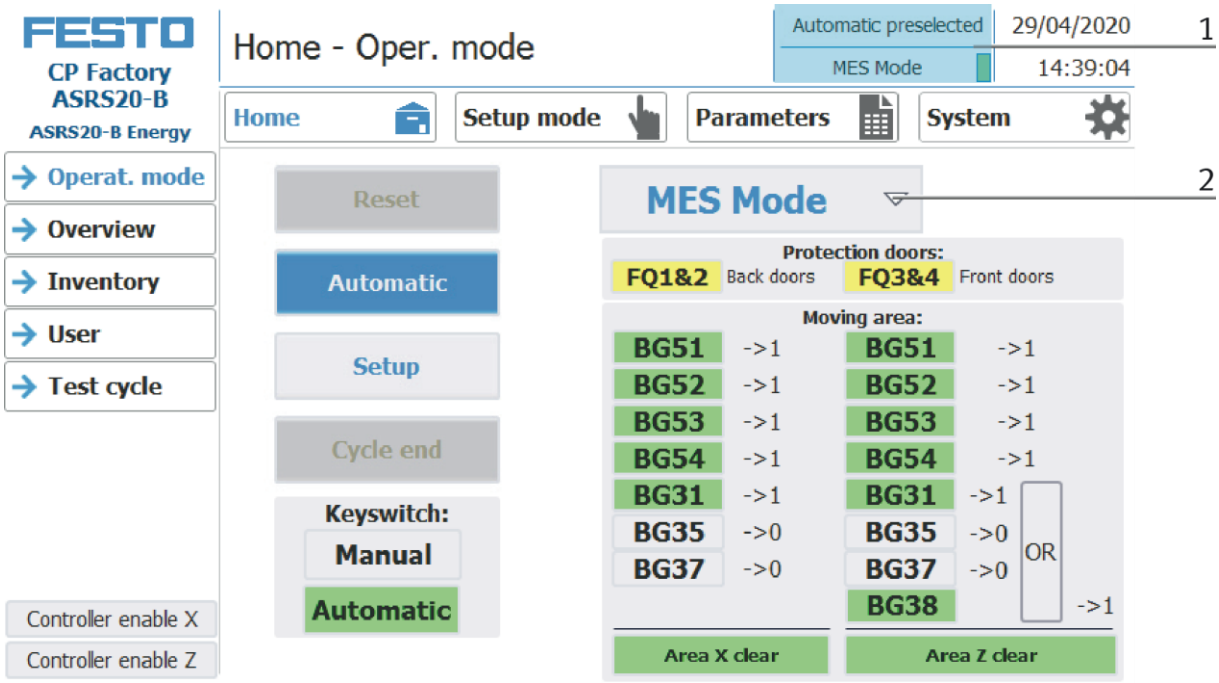
The following operation modes are available

- 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.

8.3.1 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.
2. The mode can also be set on the Home / Operating mode page.

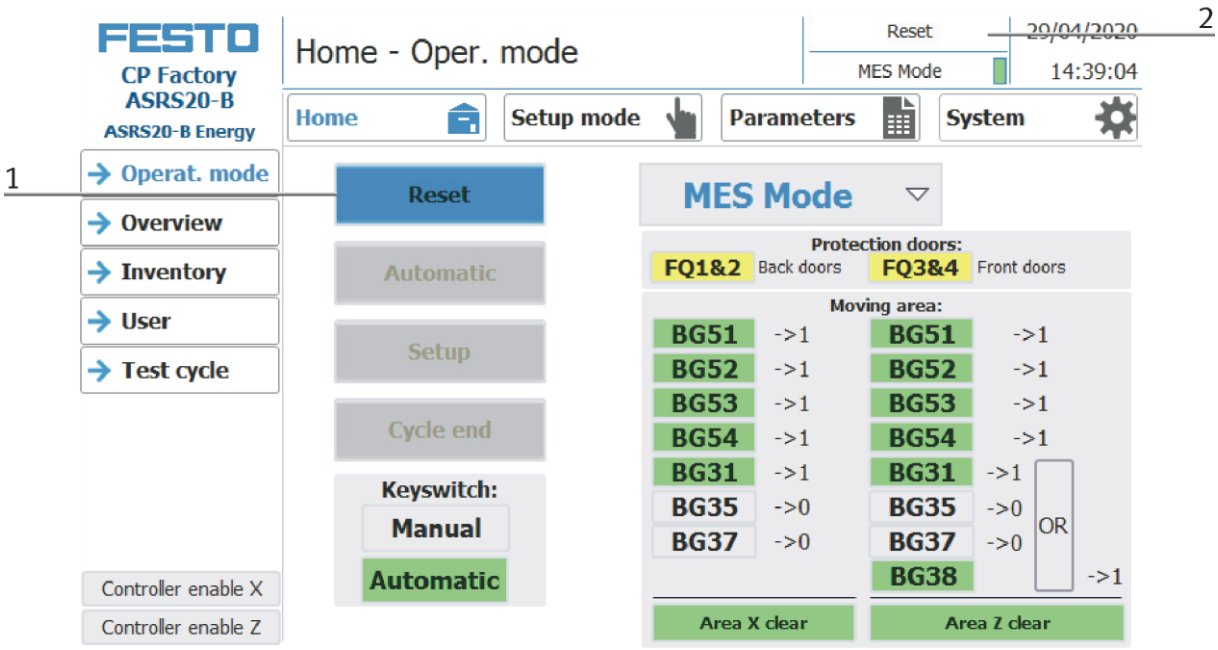


- MES mode
  In MES mode, all processes are started, executed and monitored centrally by the MES software. For this purpose, all stations must be set to MES mode and automatic start.
- Default mode
  In the default mode, the automatic process is not centrally controlled, stock movements are made from the HMI menu / Home stock or when a box is detected at the docking input. The AS/RS management of the boxes takes place locally in the PLC.

Note: When switching from MES to default mode and vice versa, the stock is not automatically compared. Always compare the physical inventory with the inventory in the MES before starting orders.

8.3.2 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.

	**⚠ WARNING** In reset mode, before closing the protective doors, check that there are no people inside the warehouse! Do not reach into the interior of the warehouse and keep the protective doors closed!

8.3.3 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.

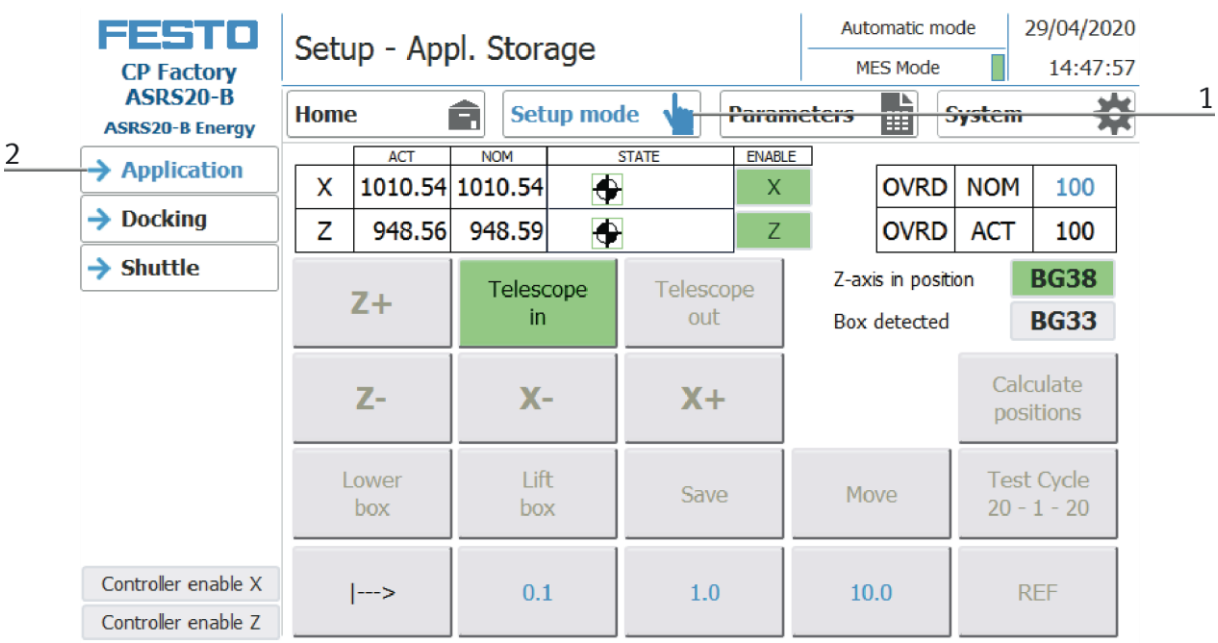
	**WARNING** In setup mode, the handling can be operated manually using the consent button on the control panel, even with the safety doors open. It must always be ensured that there are no persons in the moving range of the handling! Pay attention to crushing and shearing points!

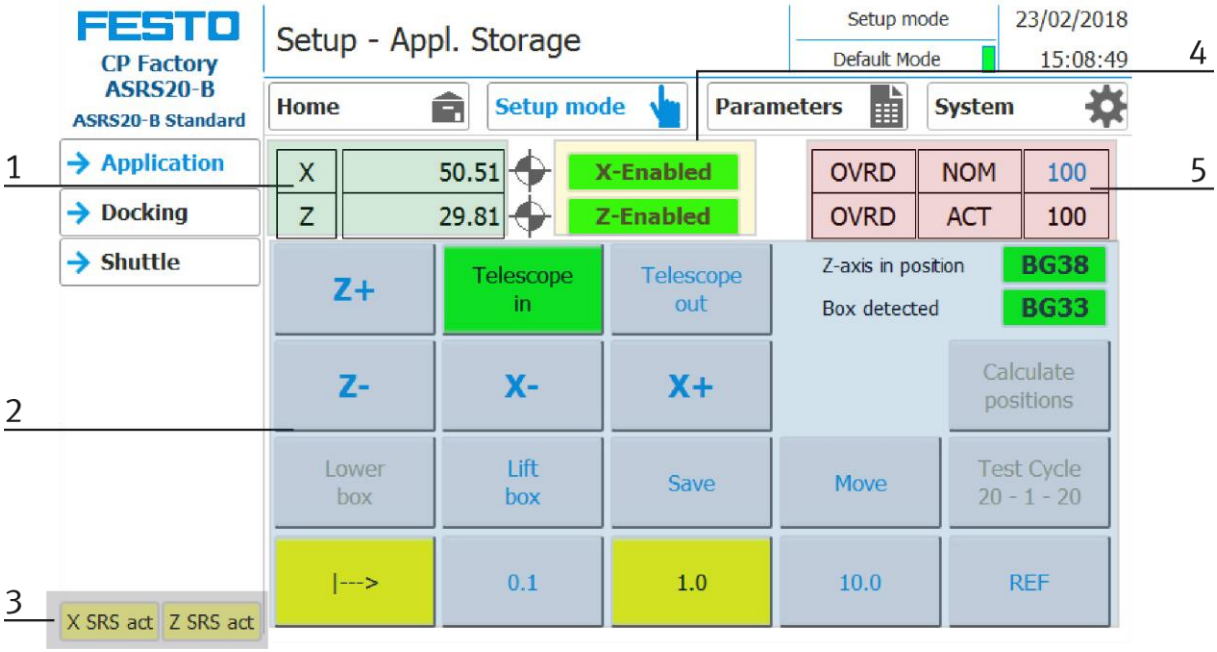
Submenu Application

In order to set up the ASRS for boxes, it has to be brought into set-up mode.

1. Set the key switch on the control cabinet front to position 0 for setup mode.
2. Press the reset button to acknowledge the change in operating mode.
3. Acknowledge the error messages on the HMI.
4. For movement movements, the dead man's switch on the rear of the mobile panel must be operated before the movement is carried out by pressing the respective softkey on the panel.

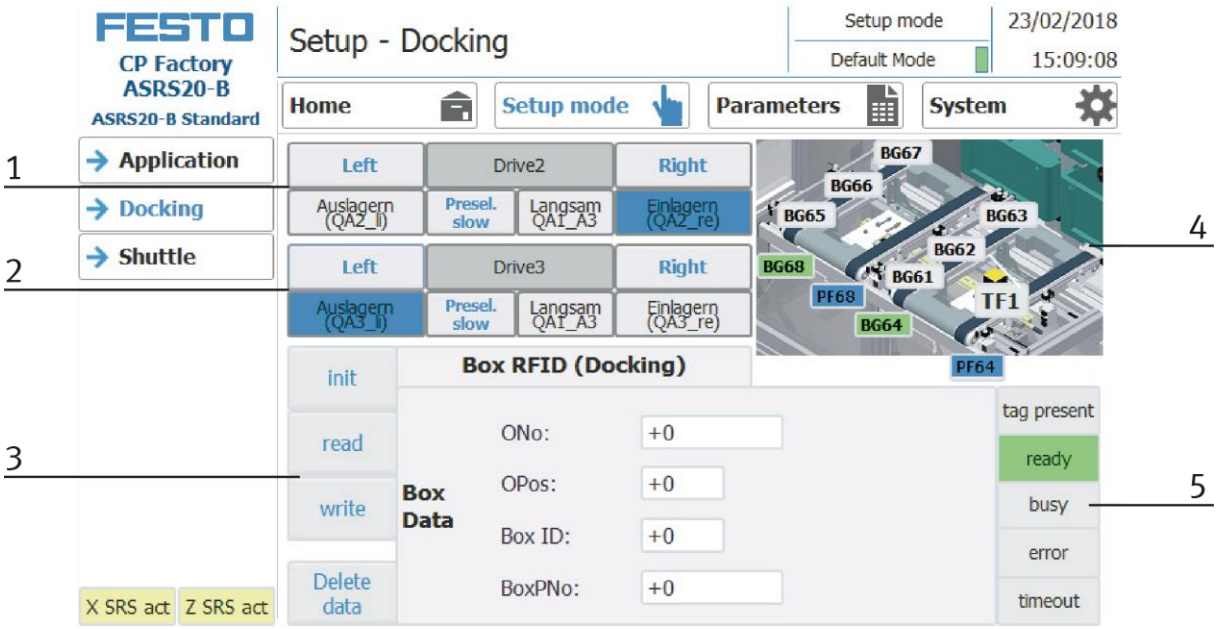
Change to Setup page (1) and select application (2).





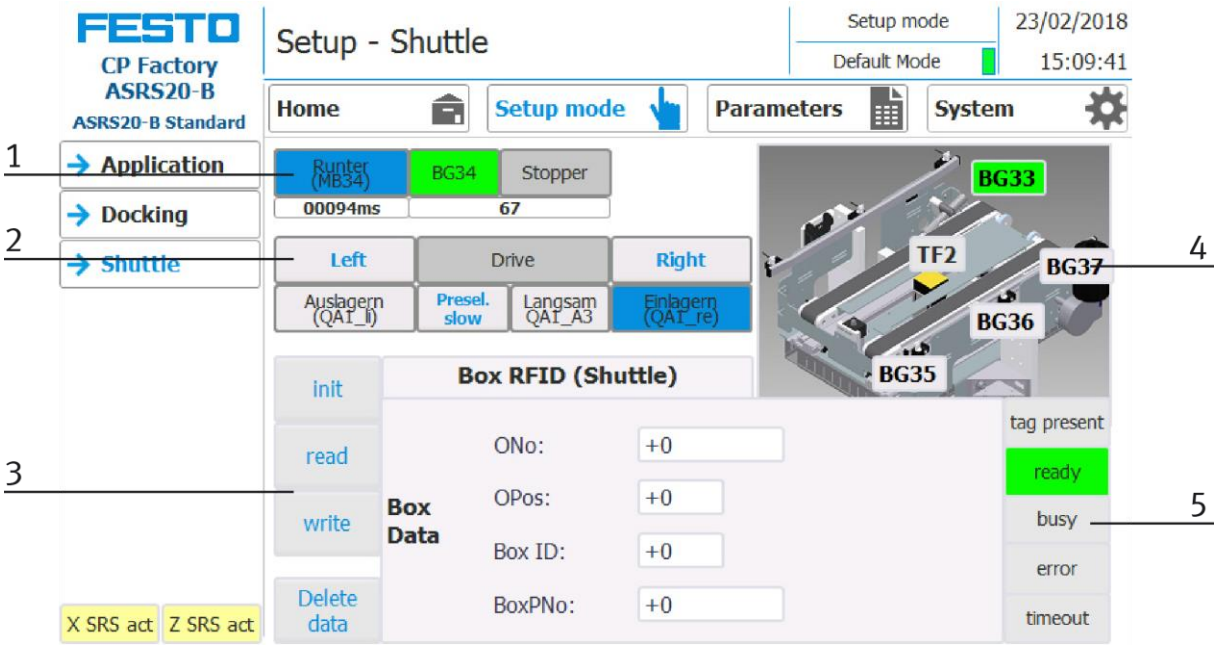
Position	Description
1	display of the X and Z coordinates
2	Button Z+: move Z-axis upward (flashing green when active) Button Telescope in: the telescope is being moved in (flashing green when active) Button Telescope out: the telescope is being moved out (flashing green when active) Button Z-:move Z-axis downward (flashing green when active) Button X-: move X-axis to the left (flashing green when active) Button X+: move X-axis to the right (flashing green when active)) Calculate Position : calculates the positions of the other storage slots while taking the slots 1 & 20 as a starting point Lower Box: put the box on the rack or on the conveyor (flashing green when active) Lift Box : lift the box from conveyor or rack (flashing green when active) Button Save: save the position where stopped (window for position number opens up- see following screen) Button Move: move to the position (window for position number opens up – see following screen) Button Test Cycle 20-1-20: execute test cycle, move from position 20 to position 1 and again to 20 Button I→: preselection of the relative positioning (flashing yellow when active) Button 0.1: preselection of the relative positioning by 0.1 mm (flashing yellow when active) Button 1.0: preselection of the relative positioning by 1 mm (flashing yellow when active) Button 10.0: preselection of the relative positioning by 10 mm (flashing yellow when active) Button REF: In the Setup mode, the reference run of the axes is started here (therefore it is required to press the Deadman's switch at the back of the operating panel)
3	If you see these displays, the safe reduced speed for these axes has been activated
4	X Enable – flashing green if the enabling for the X-axis is available Z Enable – flashing green if the enabling for the Z-axis is available
5	Input and display of the override OVRD nominal value – target override OVRD actual value – display of the actual override

Submenu Docking



Position number	Description
1	Drive 2 (output conveyor Docking) 1 allow a left/right move Left: conveyor moves anti-clockwise to the left Drive : display conveyor Right: conveyor moves clockwise to the right Outsource: move conveyor to the left (actuator QA2_li is activated, flashing blue when active) Preselection Slow: set conveyor speed to slow Slow: move the conveyor slowly (actuator QA1_A3 is activated, flashing blue when active) Store: move conveyor to the right (actuator QA2_re is activated, flashing blue when active)
2	Drive 3 (Input Conveyor Docking) allow a left/right move Left: conveyor moves anti-clockwise to the left Drive 3 : display conveyor Right: conveyor moves clockwise to the right Outsource: move conveyor to the left (actuator QA3_li is activated, flashing blue when active) Preselection Slow: set conveyor speed to slow Slow: move the conveyor slowly (activator QA1_A3 is activated, flashing blue when active) Store: move conveyor to the right (actuator QA3_re is activated, flashing blue when active)
3	field write and read RFID initialize: set the RFID data to zero read: read the RFID data write: write the current data on the RFID Delete Data: all data in the input mask are deleted – not directly on the RFID (for an easier input)
4	field display of the active sensors (flashing green when active) and actuators (flashing orange when active) at the stopper display / manual operation: If you click the sensor, the sender for the Robotino can be activated. This is essential for the transfer of the boxes from the docking module to the Robotino.
5	display of the RFID reading status

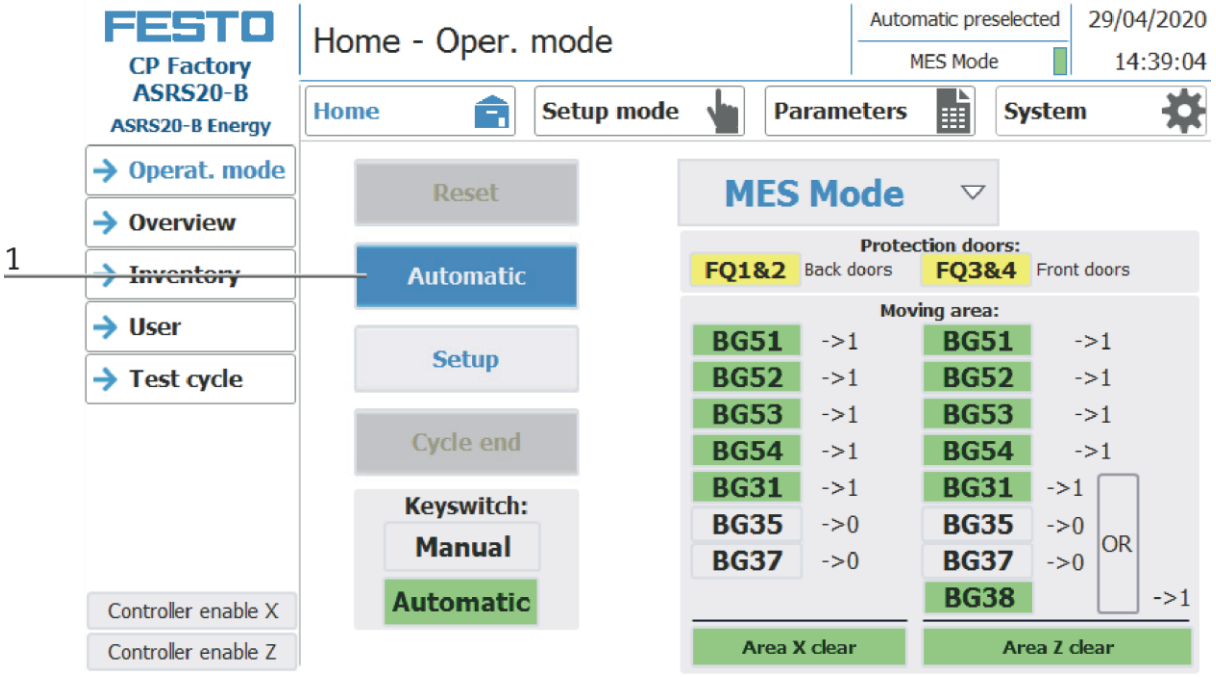
Submenu Shuttle



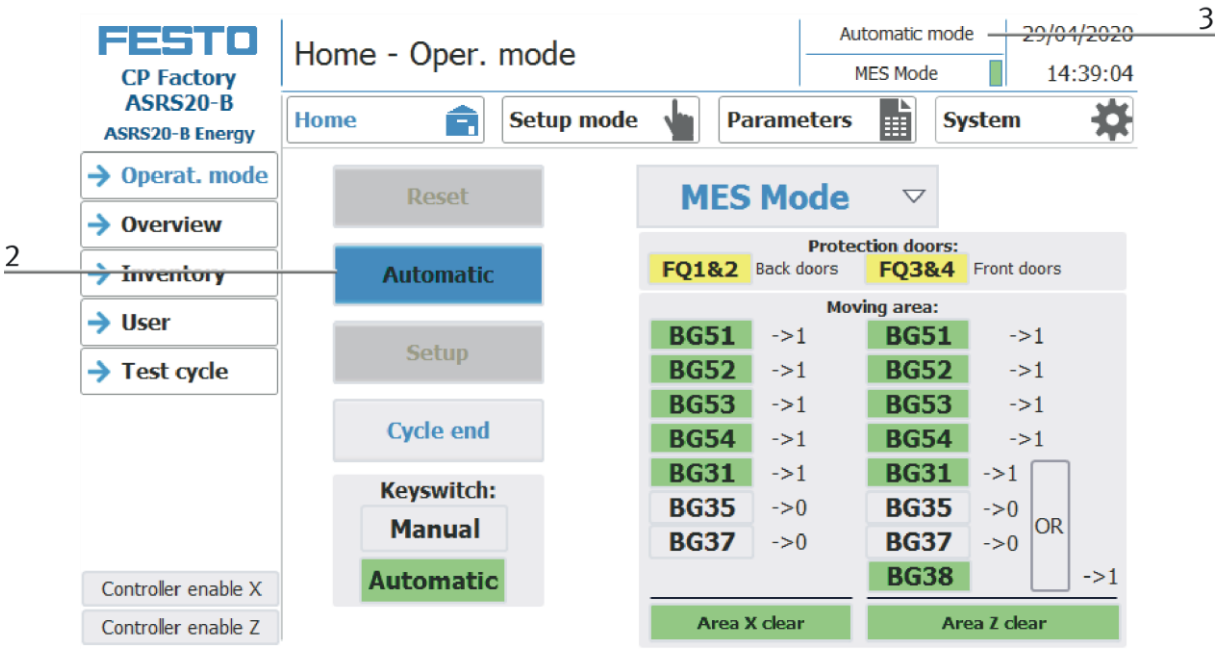
Position number	Description
1	move stopper down Down: move stoppers downward (actuator MB34 is activated, flashing blue when active) BG34:Sensor BG34 Stopper down (flashing green when active) Stopper: display stopper
2	Drive (Handling Shuttle) allow a left/right move Left: conveyor moves anti-clockwise to the left Drive : display conveyor Right: conveyor moves clockwise to the right Outsource: move conveyor to the left (actuator QA1_li is activated, flashing blue when active) Preselection Slow: set conveyor speed to slow Slow: move the conveyor slowly (actuator QA1_A3 is activated, flashing blue when active) Store: move conveyor to the right (actuator QA1_re is activated, flashing blue when active)
3	field write and read RFID 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 an easier input)
4	field display of the active sensors (flashing green when active) and actuators (flashing orange when active) at the stopper
5	display of the RFID reading status

8.3.4 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.



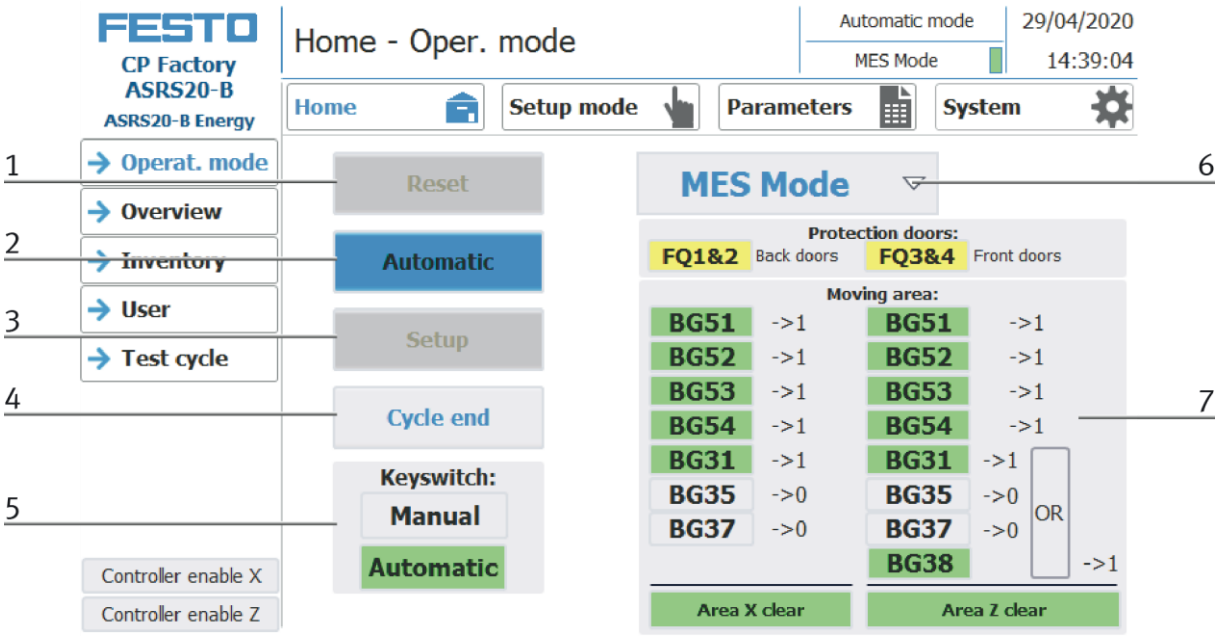
1. Automatic button flashing blue – Press Button to activate operation mode automatic



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

8.3.5 Main menu - Home

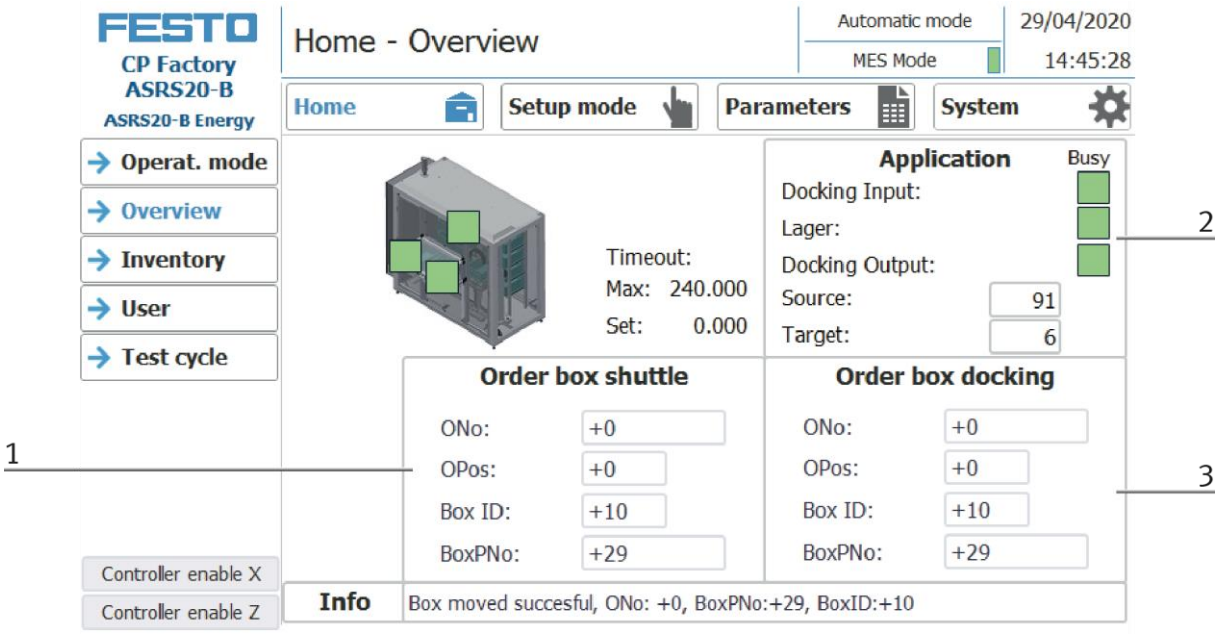
Submenu operation mode



In the operating mode Home, you can select the operation mode as well as the desired mode (MES or default) and start it.

Position	Description
1	Reset Button: If the X-axis and the Z-axis have not been referenced yet, herewith the reference run is started.
2	Automatic Button: Here you start an automatic run, depending on the mode (Default/MES).
3	Setup Button: Here you can operate the application module manually and sensors can be displayed. Suitable for commissioning an application module or for fault finding. There is no difference in the mode – the setup operation is independent from the default or MES mode.
4	End Button: the presently active operating mode is stopped here
5	display of the key actuator at the control cabinet: key vertical = Setup (flashing green when active) key turned to the right = Automatic (flashing green when active)
6	Selection of the mode: Default – automatic run is operated as described in the automatic operation MES – automatic run is completely operated by the MES software
7	Display of the sensors for releasing the axes. If there is a -› 1 behind the sensor it must be green, if there is a -›0 behind the sensor it must not be green. All essential sensors are queried here so that the X and Z-axis can be moved without causing a crash. If one of the sensors is not in its required position, it will not be possible to move the handling.

Submenu overview

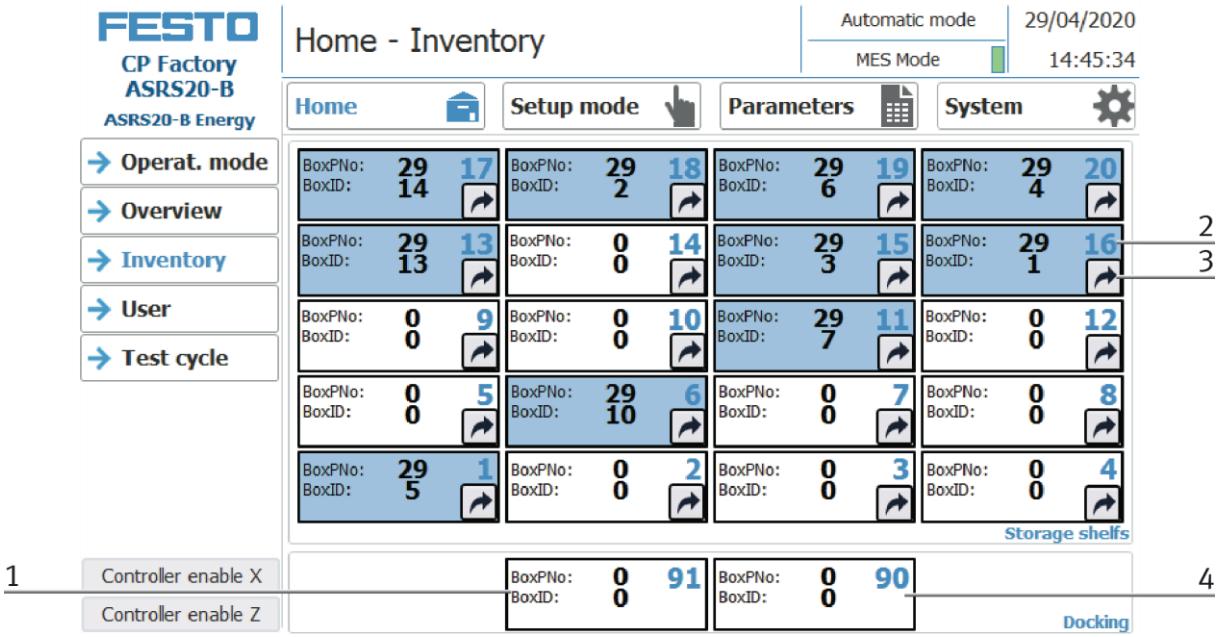


There is no difference made between Default and MES Mode

This page is only for display purposes and you cannot select anything.

Position	Description
1	Field order box shuttle: here you find all information on the handling read by the RFID tag ONo: order number not used OPs: order position not used BoxID: ID number of the box BoxPNo: part number of the box with corresponding reception for different workpieces
2	Field application: here the states of the attached application module are displayed or the parameters are entered Docking input : busy green when active Lager: busy when active Docking output: green when active Source: input of start position Target: input of target position
3	Field order box Docking: here you find all information on the transfer handling to the Robotino read by the RFID tag ONo: order number not used OPs: order position not used BoxID: ID number of the box BoxPNo: part number of the box with corresponding reception for different workpieces

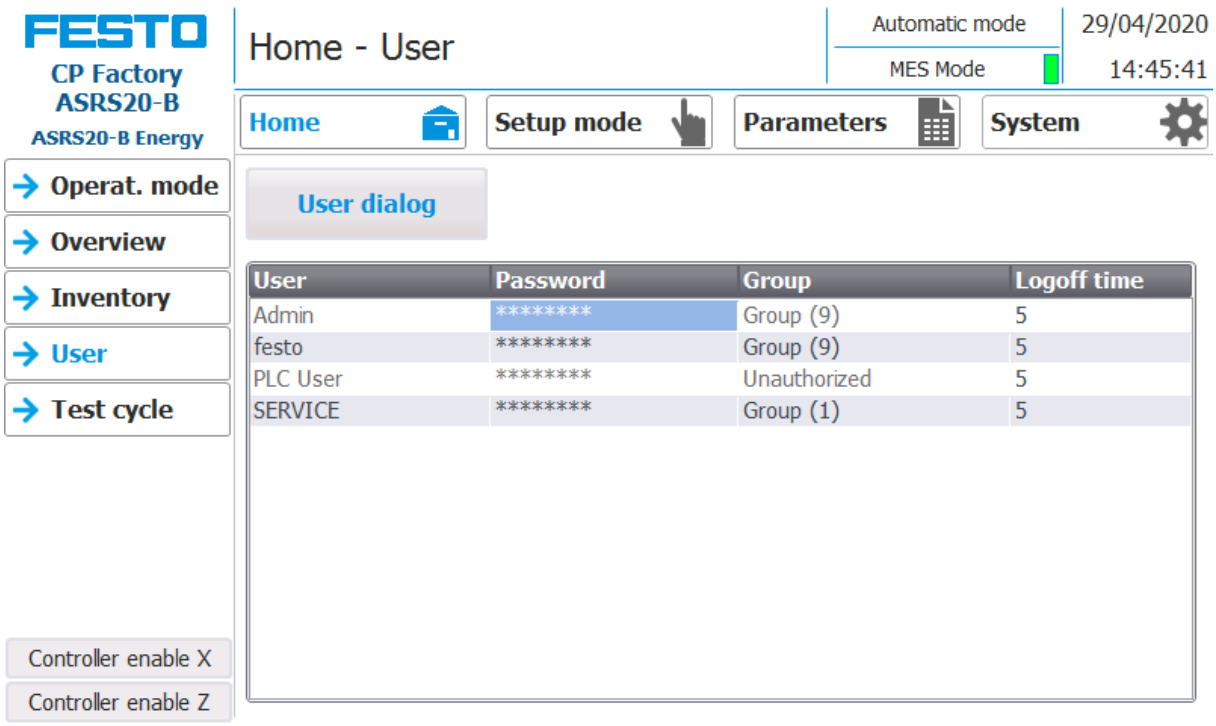
Submenu Inventory



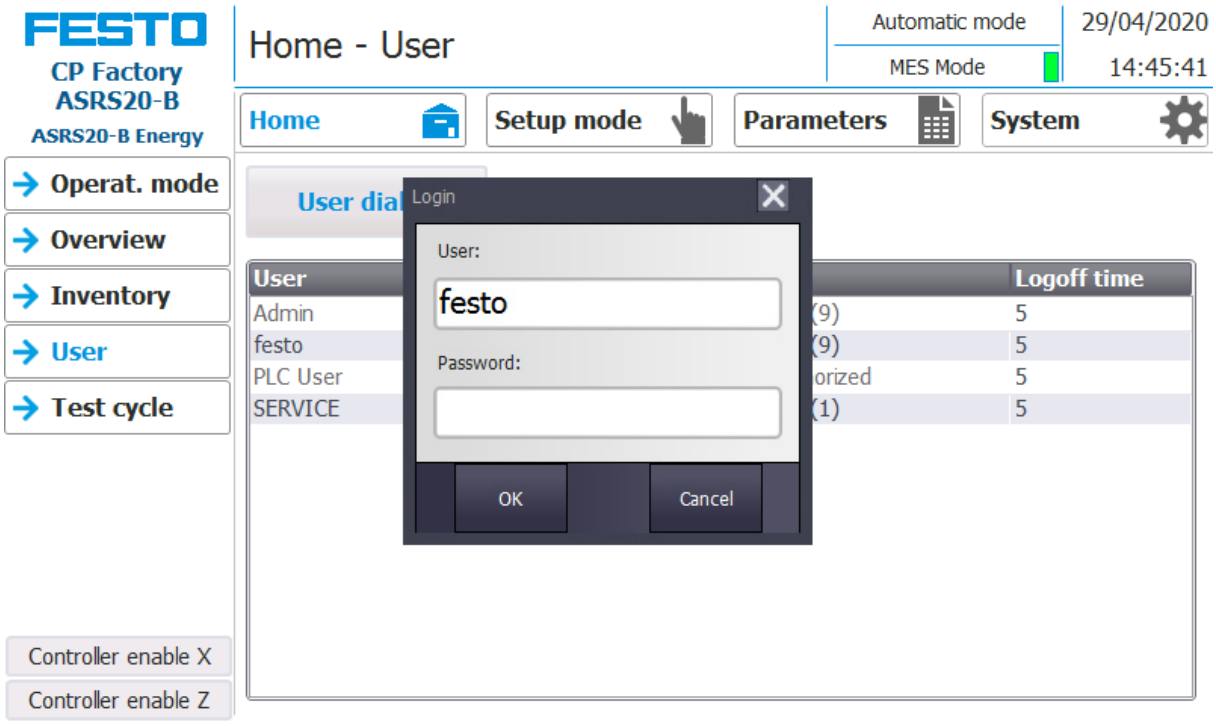
Position	Description
1	Retrieve: If you click this button, the entry screen opens up and you can select a box. This box is now outsourced- the storage slot with the lowest slot number and the corresponding required content is selected.
2	Display of all storage slots. You will find the storage slot number in the upper right corner. BoxPNo: part number of the box with corresponding reception for different workpieces BoxID: ID number of the box
3	Clear store: deletes all boxes from the storage and sets all storage slots to 0
4	field Out / In Out: display of the output conveyor of the Docking unit In: display of the input conveyor of the Docking unit

Submenu User

Here you can create different users. The function is not dependent on the selected mode (MES – or Default).



If you click the button User Dialog, the following window will open up.

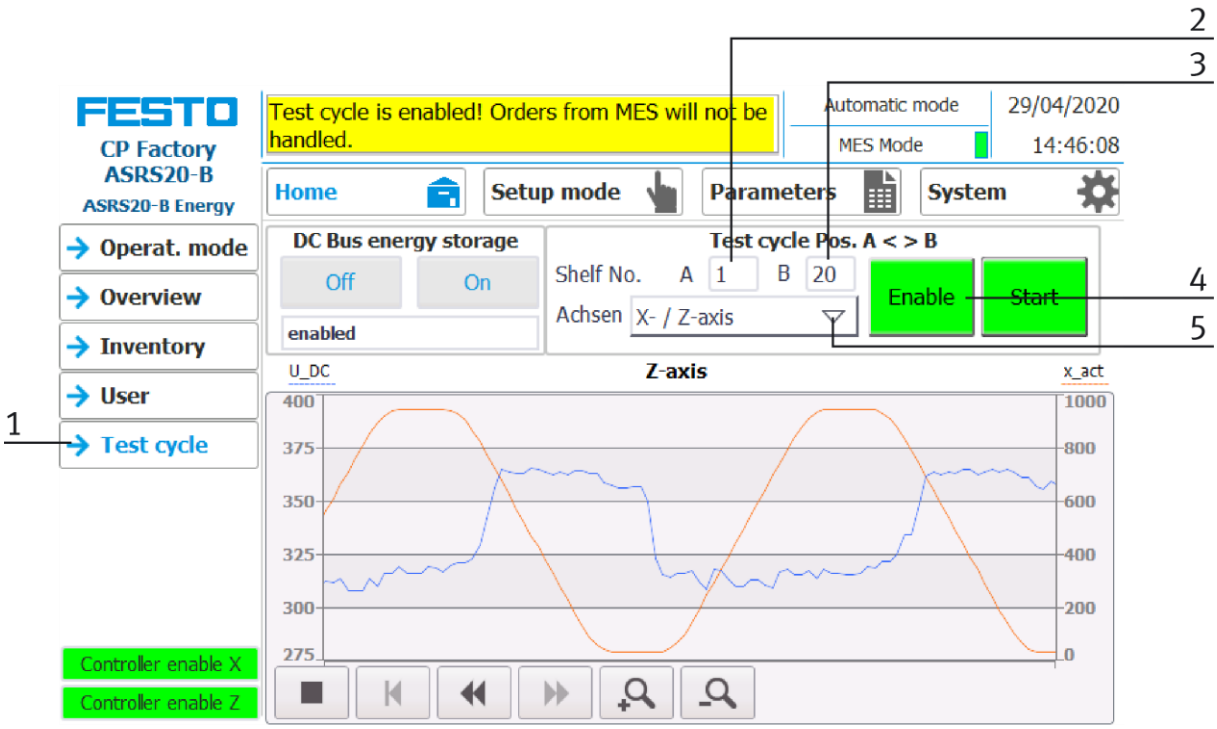


If you click the fields user or password, the input window will open up and you can enter the user data.

Here you can enter the user data and acknowledge the input with the Return Button.

Submenu Test Cycle

Here you can test the functions of the ASRS. The test cycle is only possible in the automatic mode.



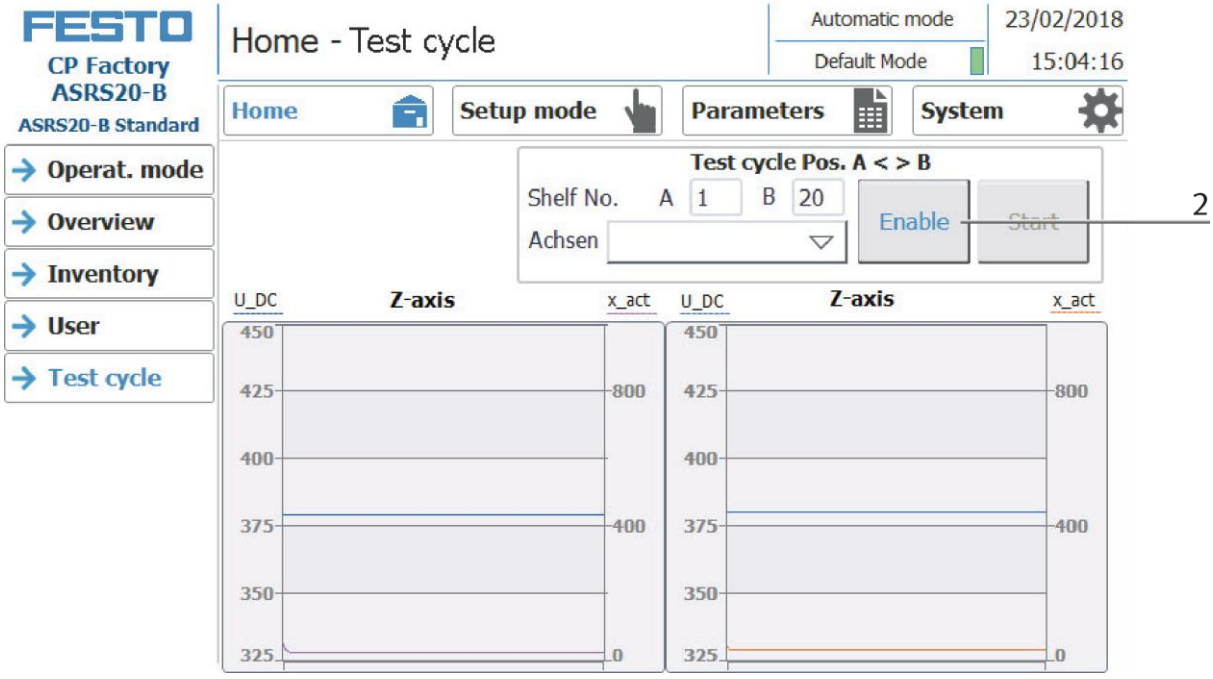
Position	Description
1	Select submenu Test Cycle
2	Specification of the first storage slot number – the handling moves from slot number A to slot number B
3	Specification of the second storage slot number
4	Enable Button, the start button can only be pressed after activating this button
5	Selection of the axis to be moved in the test cycle you can select the following axes: only the X-axis only the Z-axis X- and Z-axis together

NOTE

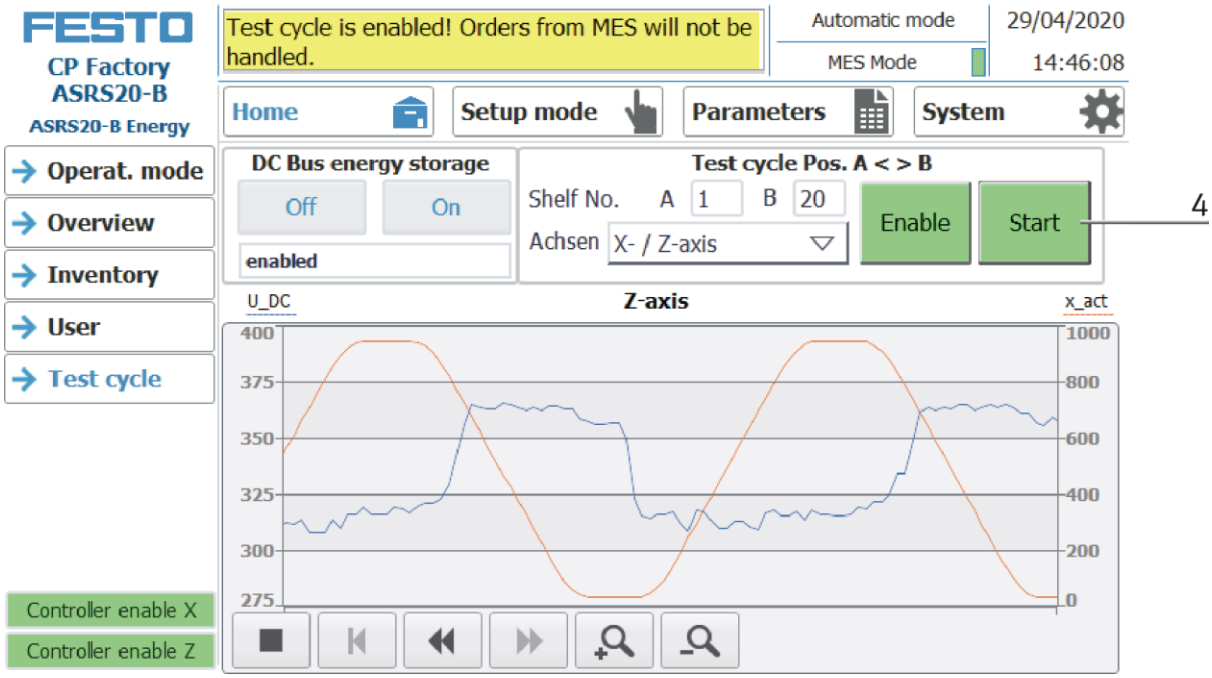
In an active test cycle there is no MES operation possible.

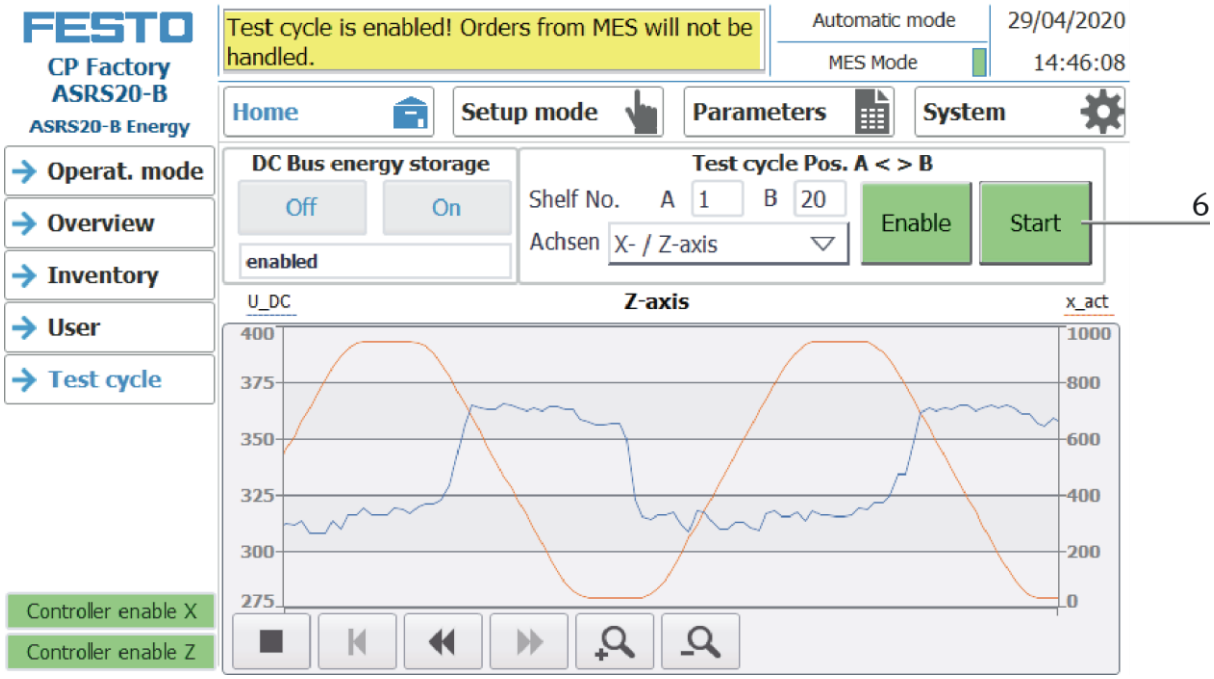
Test cycle sequence

1. Position A and B for the test run as well as the desired axes have been determined.
2. Press the Enable Button.



3. The test cycle has been enabled, the Enable Button is green.
4. The Start Button is available. Please press it.





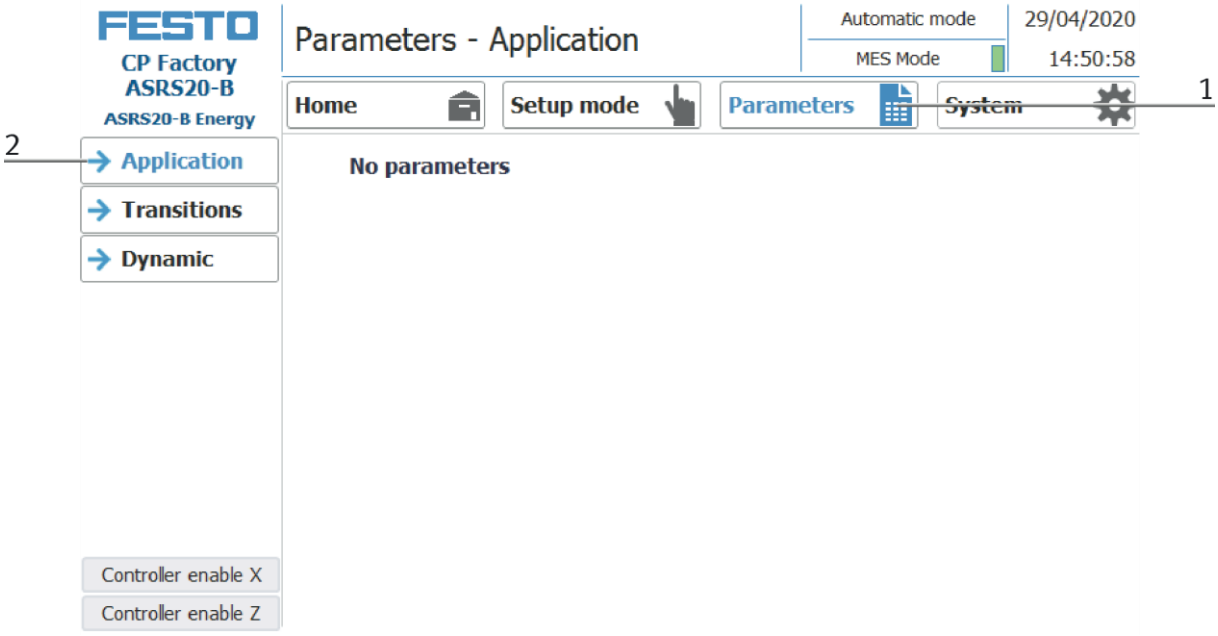
5. In this case, the handling moves bidirectional between slot 1 and slot 2. The X and Z-axis are executing this movement. You can see the stress curve of the X and Z axis in the diagrams.
6. If you press the Start Button again, the cycle will end.

8.3.6 Main menu - Setup

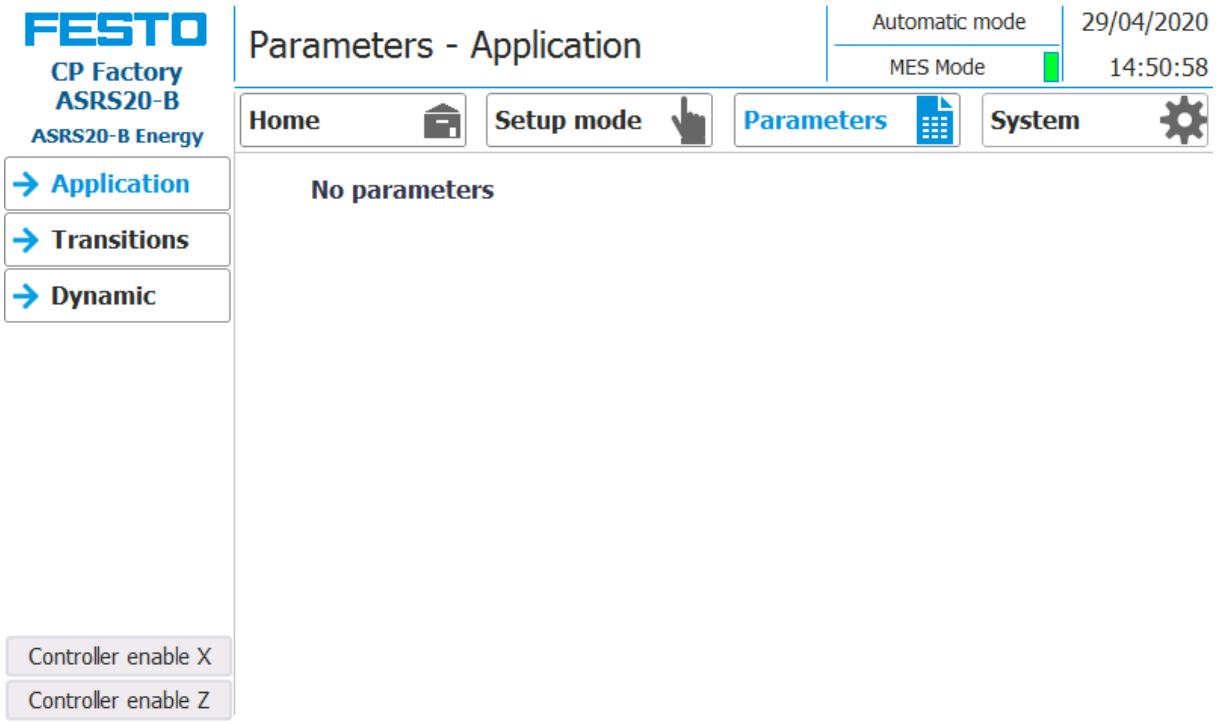
See chapter operation mode setup.

8.3.7 Main menu - Parameter

Change to parameter page (1) and select application (2).

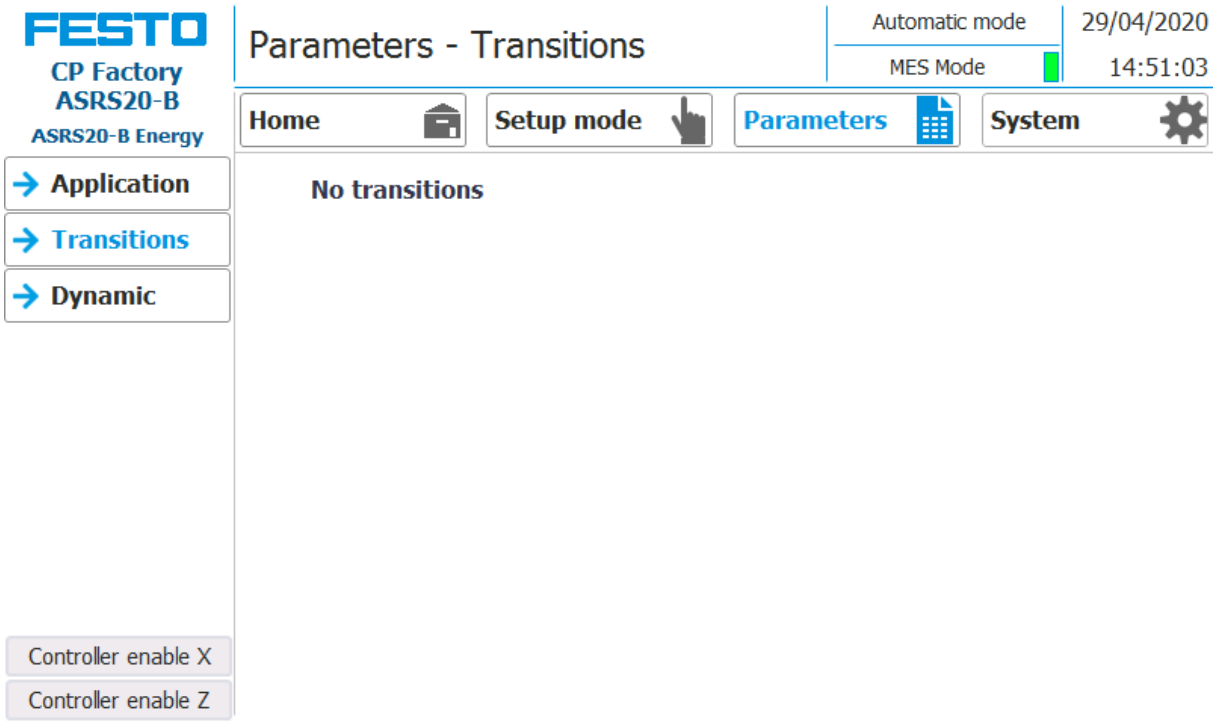


Submenu Application



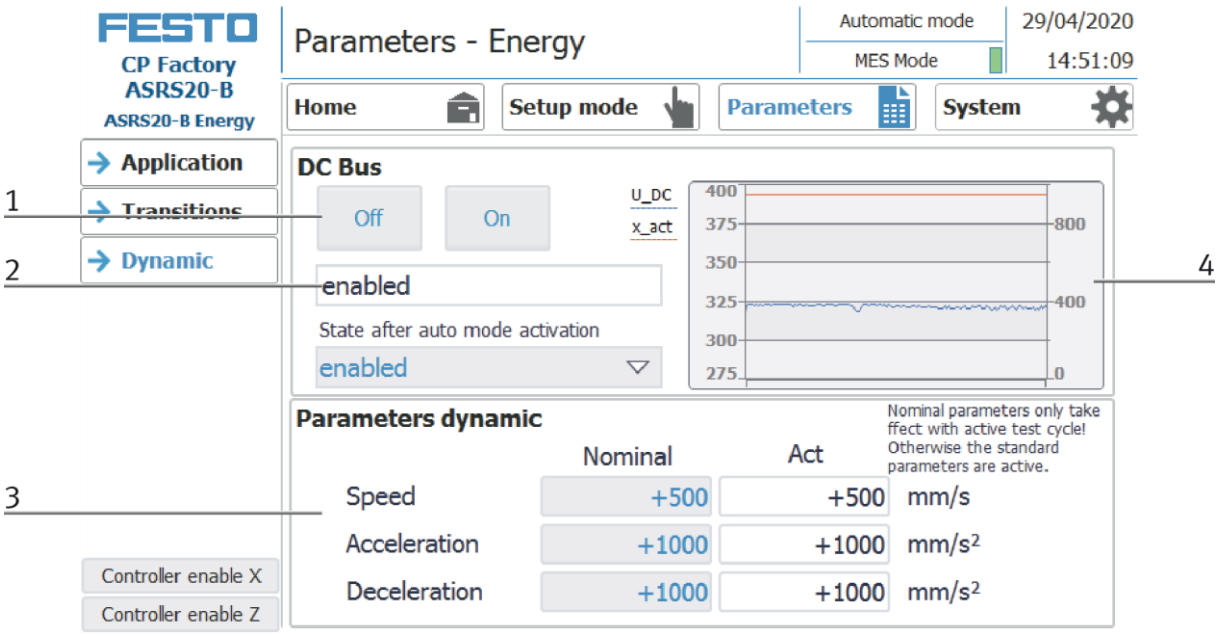
The ASRS for Boxes does not have any parameters in the submenu of the application.

Submenu Transitions



The ASRS for Boxes does not have any parameters in the submenu of the transitions.

Submenu Dynamic



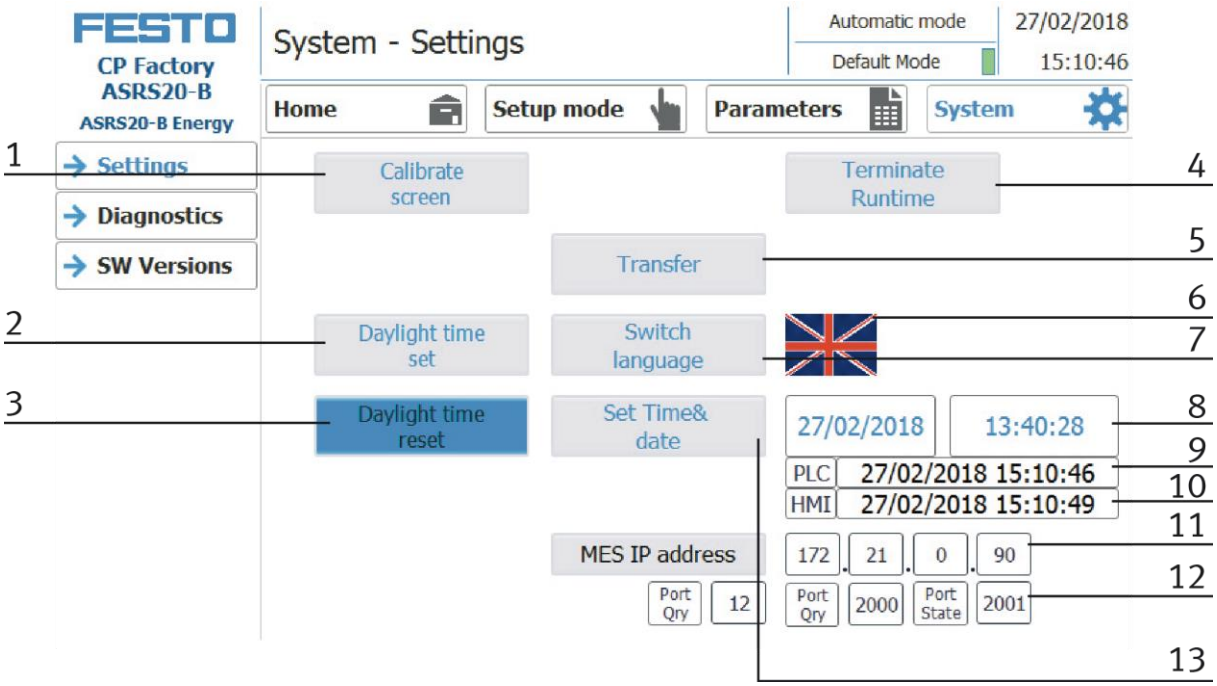
Position number	Description
1	Switch on/off
2	Command: enable State after activating the automatic mode
3	Dynamic parameter Z-axis You can adjust the nominal range for the test cycle, and if you click this field you can change the values. Actual range – display of the actual values
4	Display DC intermediate circuit U_ZK = voltage of the DC intermediate circuit of the Z-axis x_act = position of the Z-axis

Depending on the structure of the ASRS, there are two options in the field of dynamic:

- ASRS with DC intermediate circuit buffer
  The upper graph shows the voltage resulting from the movement of the handling which is temporarily stored in a storage battery for further movements.
  The lower graph shows the values for speed, acceleration and deceleration.
- ASRS without DC intermediate circuit buffer
  Display as described above, but there is no storage and the voltage line is not active.

8.3.8 Main menu -System

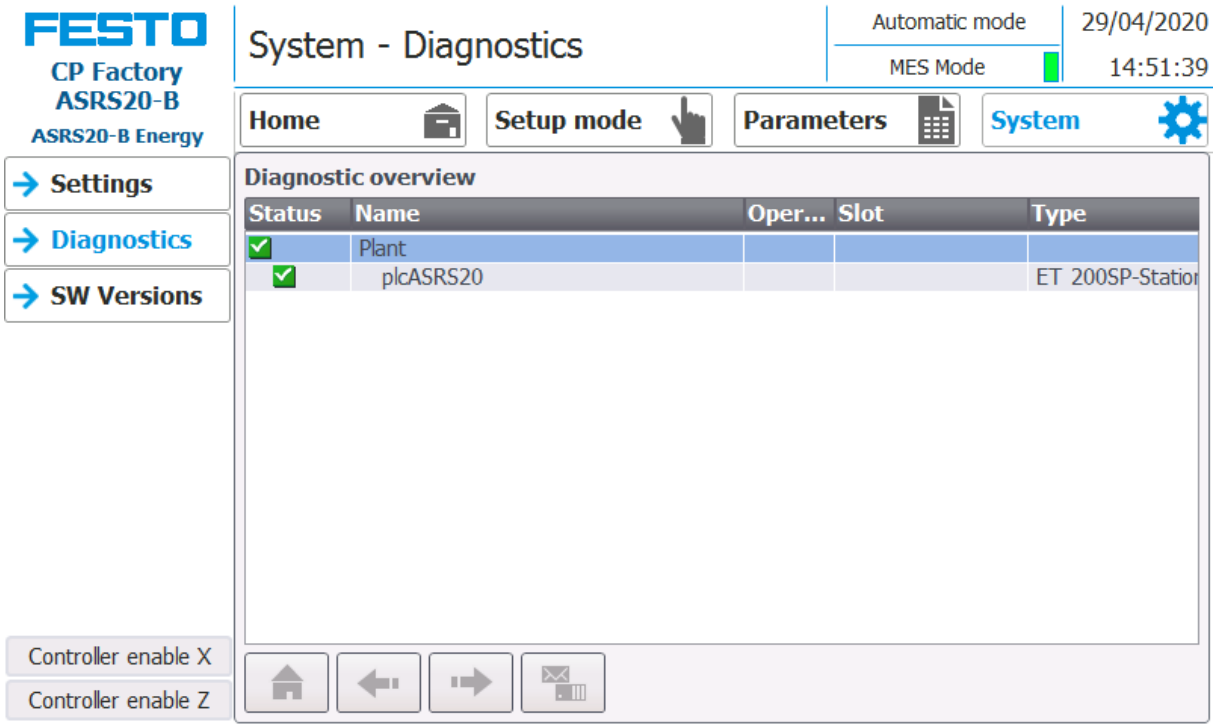
Sub menu Settings



The system can be set in this operation mode

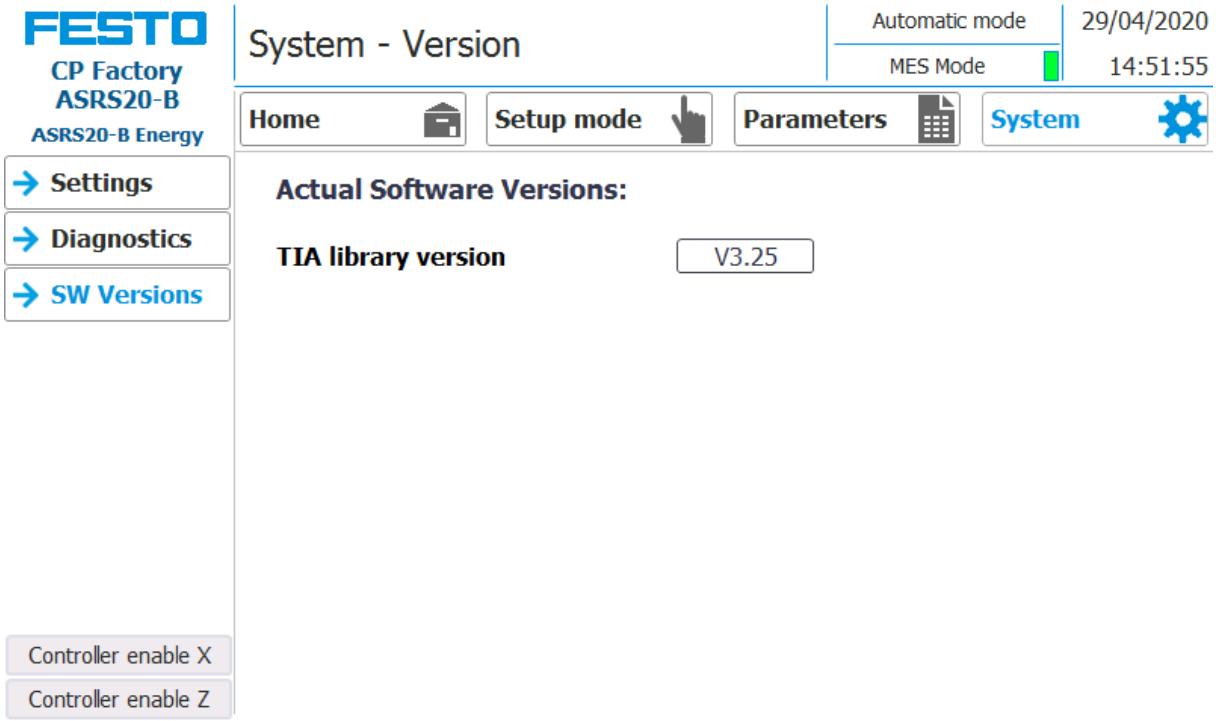
Position number	Description
1	Button Calibrate Screen - If buttons react inaccurately, calibration of the touch screen can be restored
2	Daylight time set – activate summer time
3	Daylight time reset – activate winter time
4	Terminate Runtime: The runtime is terminated and returned to Windows.
5	Button Transfer: Runtime is closed and the transfer mode of the HMI is called
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	Input field for date / time. Click on the "Set time & date" button to accept date / time
9	Display date and time of the PLC
10	Display date and time of the HMI touch panel
11	Display of the MES IP address additionally the IP of the MES can be set here. (Password protected) User: festo, PW: festo)
12	Input fields for your own resource number, query port and status port of the MES connection
13	Button set time & date: The time and date of the HMI touch panel can be set here.

Sub menu diagnostics



Display of all diagnostics.

Sub menu software versions



Display of the presently installed software.

8.4 Switch on station

WARNING

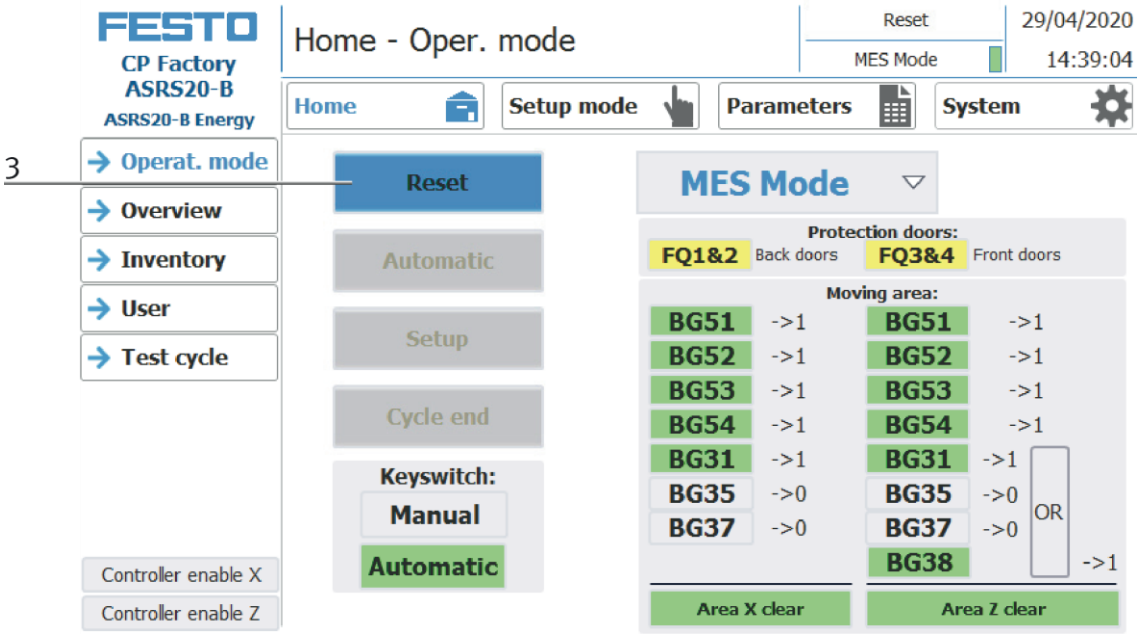
In automatic mode, before closing the protective doors, check that there are no people inside the ASRS! Do not reach into the interior of the ASRS and keep the protective doors closed!

Illustration similar

1. All emergency stop signal transmitters (pushbuttons, door contacts, light barriers, etc.) are not actuated or activated and unlocked. If the emergency stop is active, the blue RESET lamp goes out.
2. Turn on the main switch
   If available, remove boxes from the travel area.
   Wait for the PLC and HMI to boot.
3. Set the key switch to position 1 (automatic).

8.4.1 Reset station

1. Press the RESET button (item 4 - previous graphic), the RESET button lights up blue.
2. Acknowledge the error message on the HMI.
3. Start the reset mode on the HMI by pressing the RESET button.



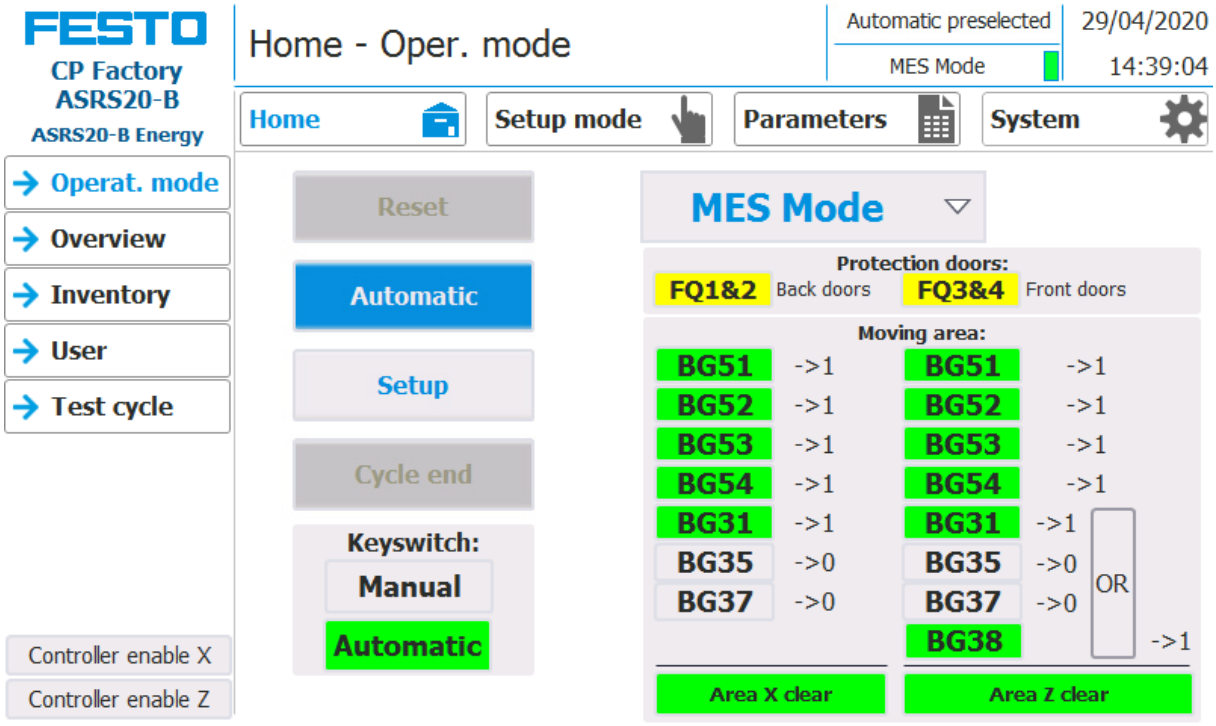
4. The ASRS carries out a reference run

8.4.2 Start the automatic process

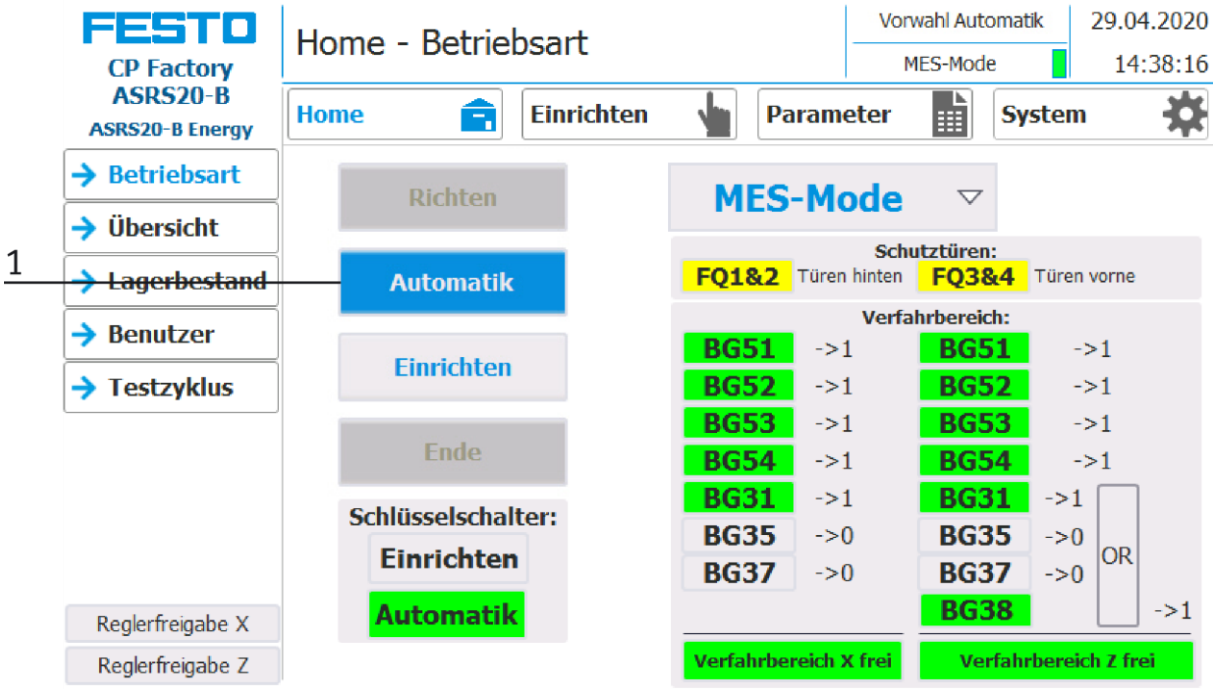
To start the automated ASRS processes, the key switch on the ASRS switch cabinet must be in position "1".

The general rule:
A flashing button is a request to start an action.
A button with a glowing background indicates that the action described on the button is currently being carried out.
A gray button with blue letters shows that this function can be selected.

1. Switch on the station and wait until the HMI has started up. The following screen appears after the pending error messages have been acknowledged and a reference run has been carried out by pressing the "Adjust" button.

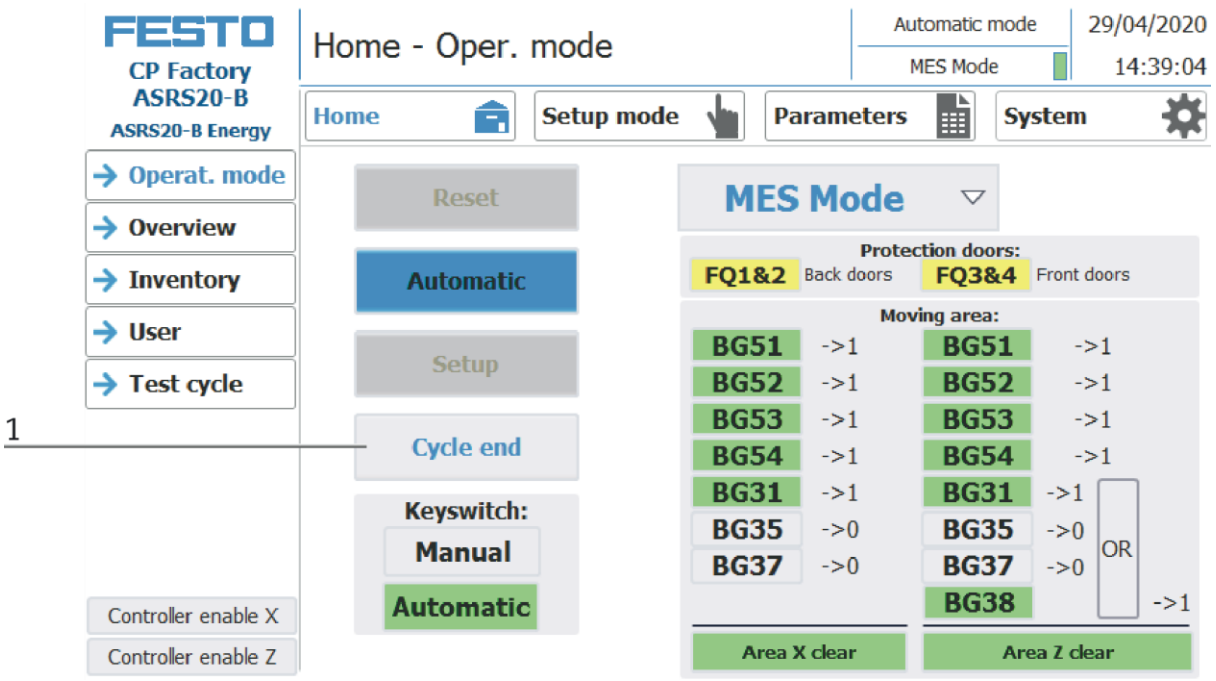


2. Select default or MES mode, MES mode is selected for the example
3. Press the automatic button



4. Automatic is active.

8.4.3 Stop automatic



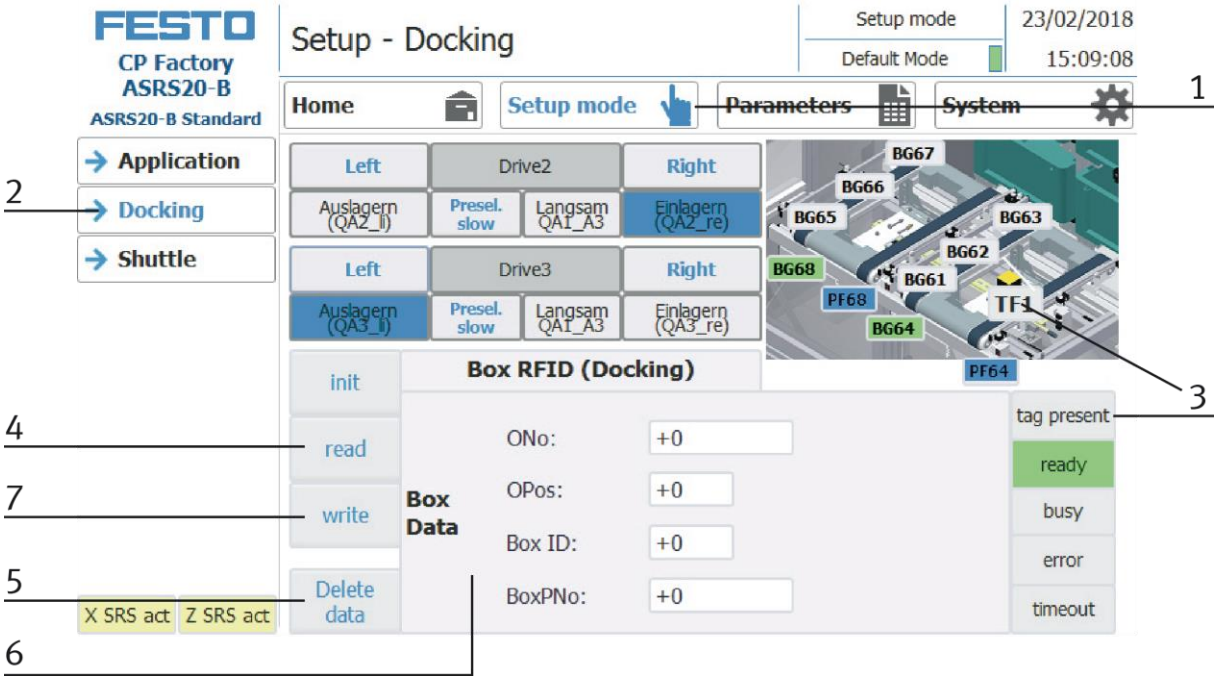
1. Press the end button, the automatic process is stopped at the end of the cycle.

8.5 Writing on the RFID tag manually

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

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

The following example applies to all readout positions that can read an ID of boxes.



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

8.5.1 Parameter (ASRS20)

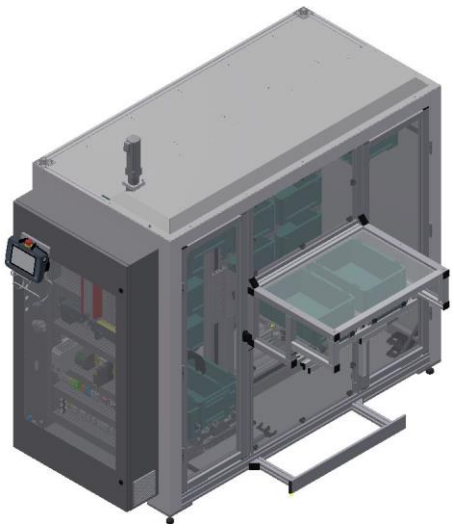


Illustration similar

Default: not available

MES:

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

9 Components

9.1 Electrical components

9.1.1 2 Quadrant Controller

Illustration similar

Description

Electronics for DC motors excited by magnet up to about 200 W
The module M-MZ-4-30 is a two-quadrant motor control for DC motors with anti-clockwise and clockwise rotation. It guarantees a safe starting and stopping as well as the control of the rotational direction of motors. In off-state, the load is short-circuited which results in a dynamic braking. By the inlet SLOW, you can switch over from slow speed (adjustment at Tr1) to high speed. At the inlet STOP a limit switch can be installed.

Use:

Motor controls for brushed motors
Electronic load relay for solenoid valves and various loads

Characteristics

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

Technical Data

Type: M-MZS-4-30 / Item No. 06.05.020

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

Connection Diagram

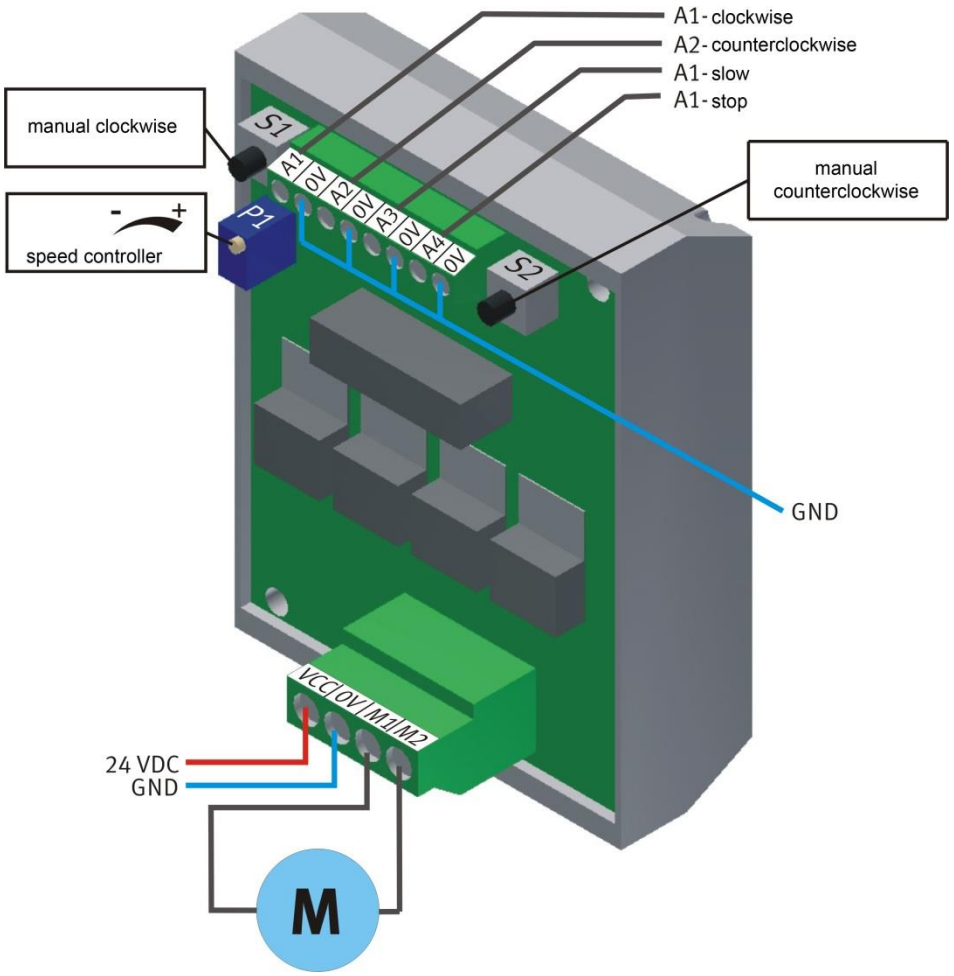


Illustration similar

Motor MA1 front side

Input/Output	Starting Current Limiter	Description
Control - K5-KF10 / Q0.0 / 0x:1	QA1 / X1:re	Conveyor drive 1 unit clockwise rotation
Control - K5-KF10 / Q0.0 / 0x:2	QA1 / X1:li	Conveyor drive 1 unit anti-clockwise rotation
Control - K5-KF10 / Q0.0 / 0x:3	QA1 / X1:sl	Conveyor drive 1 unit creep speed
Conveyor motor DC / -X3M1:4	QA1 / X2:M1	Conveyor motor connection
Conveyor motor DC / -X3M2:3	QA1 / X2:M2	Conveyor motor connection

Motor MA1 backside

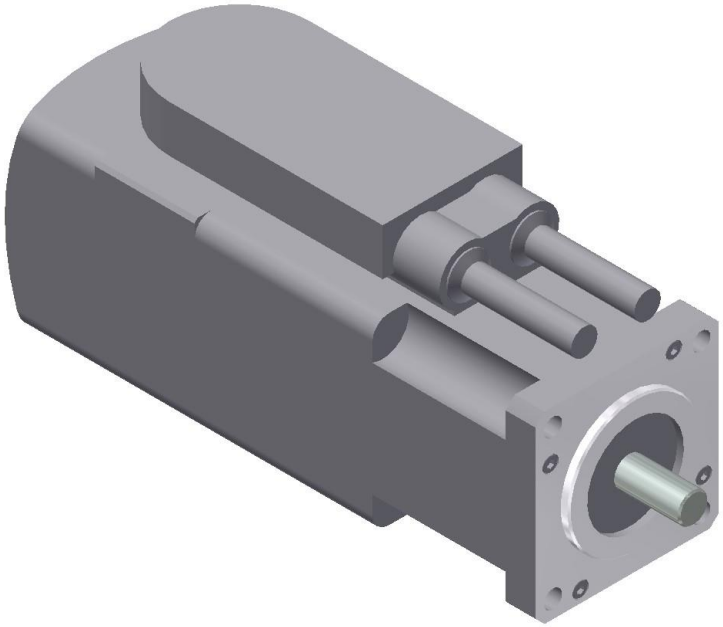
Input/Output	Starting Current Limiter	Description
Control - K5-KF10 / Q0.4 / 0x:5	QA2 / X1:re	Conveyor drive 2 unit clockwise rotation
Control - K5-KF10 / Q0.5 / 0x:6	QA2 / X1:li	Conveyor drive 2 unit anti-clockwise rotation
Control - K5-KF10 / Q0.6 / 0x:7	QA2 / X1:sl	Conveyor drive 2 unit creep speed
Conveyor motor DC / -X3M1:4	QA2 / X2:M1	Conveyor motor connection
Conveyor motor DC / -X3M2:3	QA2 / X2:M2	Conveyor motor connection

9.1.2 Servo Controller

Control unit for axis / Illustration similar

Position	Name	
1	Order number	1501325
2	Order number	cmmp-as-c2-3a-m3

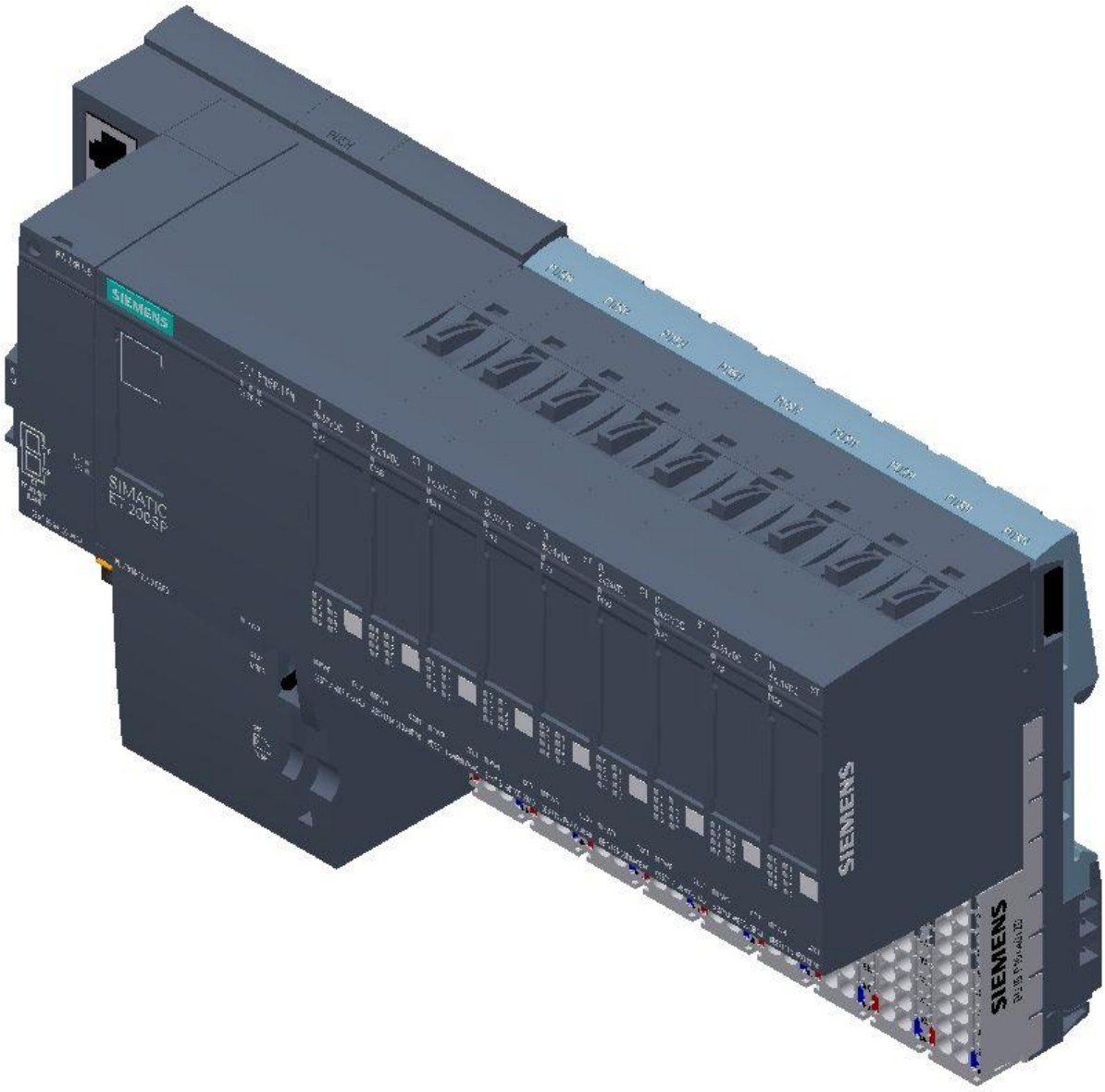
9.1.3 Servo motors



Drive motor Z/X-axis / Illustration similar

Position	Name	
1	Order number	550112
2	Order number	EMMS-AS-55-M-LS-TSB

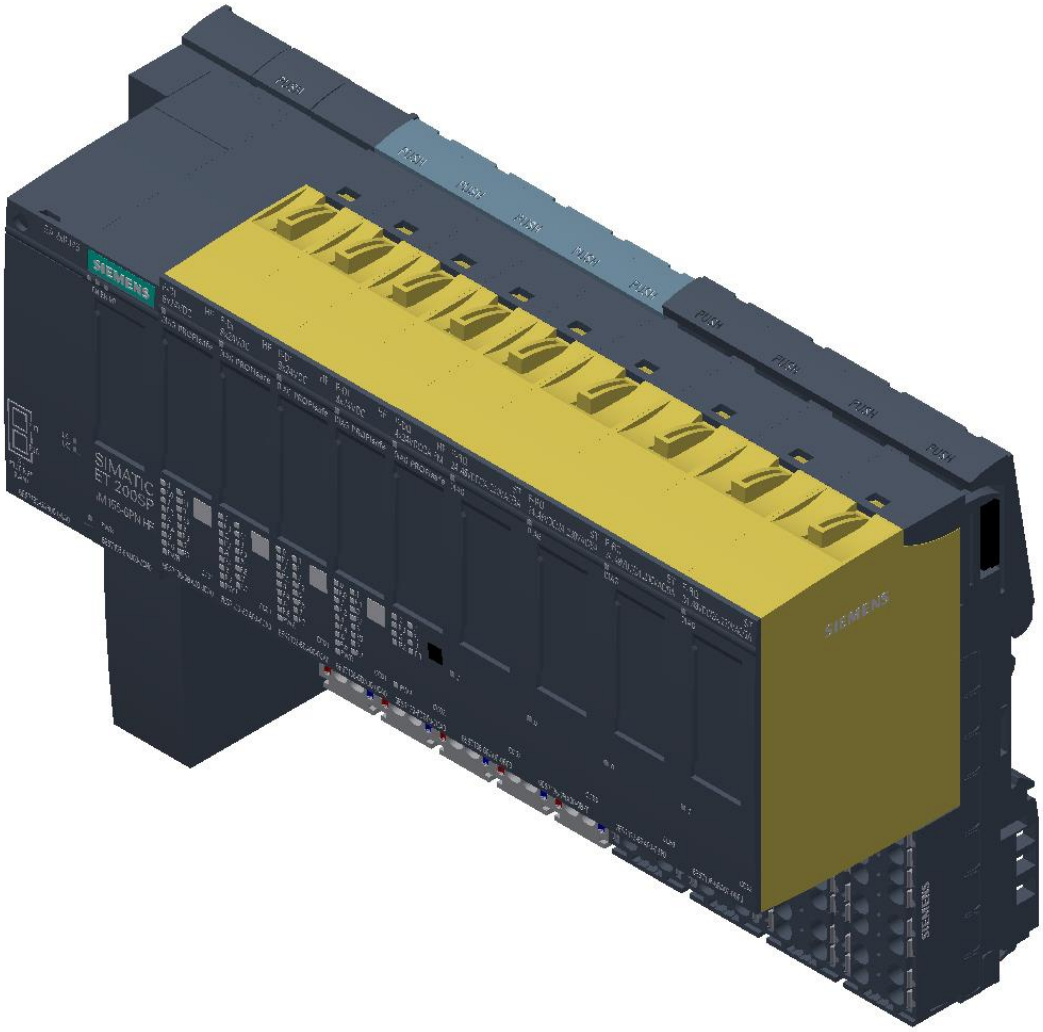
9.2 PLC



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

For detailed information see electrical circuit diagram.

9.2.1 Control safety PLC



Siemens ET200 SP / IM115-6 PN HF / Illustration similar

You will find detailed information on the control in the circuit diagram.

9.2.2 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 $A^2 \cdot s$
Power	
Power consumption, typ.	12 W
Processor	
Processor type	X86
Memory	
Flash	Yes
RAM	Yes
Memory available for user data	12 Mbyte

9.3 Scalance Ethernet Switch

Siemens S7 SPS / 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.

9.3.1 RFID

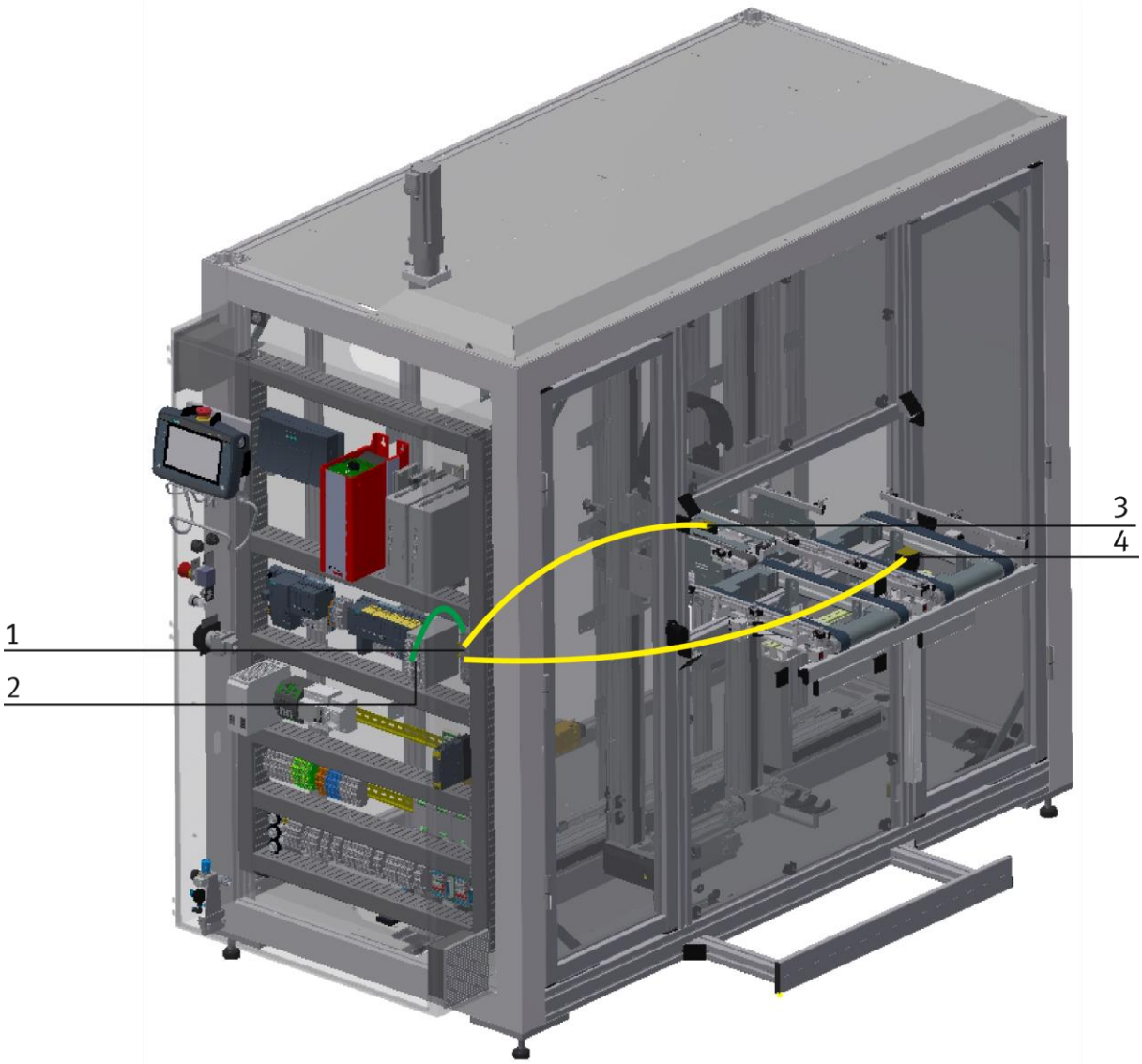
Turck – TBEN-S2-2RFID-4DXP / 6814029 / Illustration similar

I/O Data Mapping

The BLident RFID-A interface modules cannot be controlled via the process data alone. In any case, a software function block is required in the control. The function block is standardized for RFID systems and is called Proxy Ident Block or PIB for short.

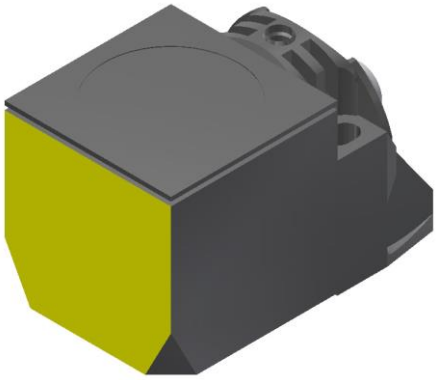
Input	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Chanel 0	0	Status word channel 0- low byte							
	1	Status word channel 0- high byte							
Chanel 1	2	Status word channel 1- low byte							
	3	Status word channel 1- high byte							

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 RFID module with the RFID interface / illustration similar

Pos	Description
1	RFID-Interface Turck TBEN-S2-2RFID-4DXP (KF31)
2	Scalance Switch (XF1)
3	Turck Read / write head TN-CK-H1147 (TF1)
4	Turck Read / write head TN-CK-H1147 (TF1)



RFID Write / read head / illustration similar

The Turck RFID read-write head is mounted on the middle of the conveyors.
Its designation is TN-CK40-H1147.

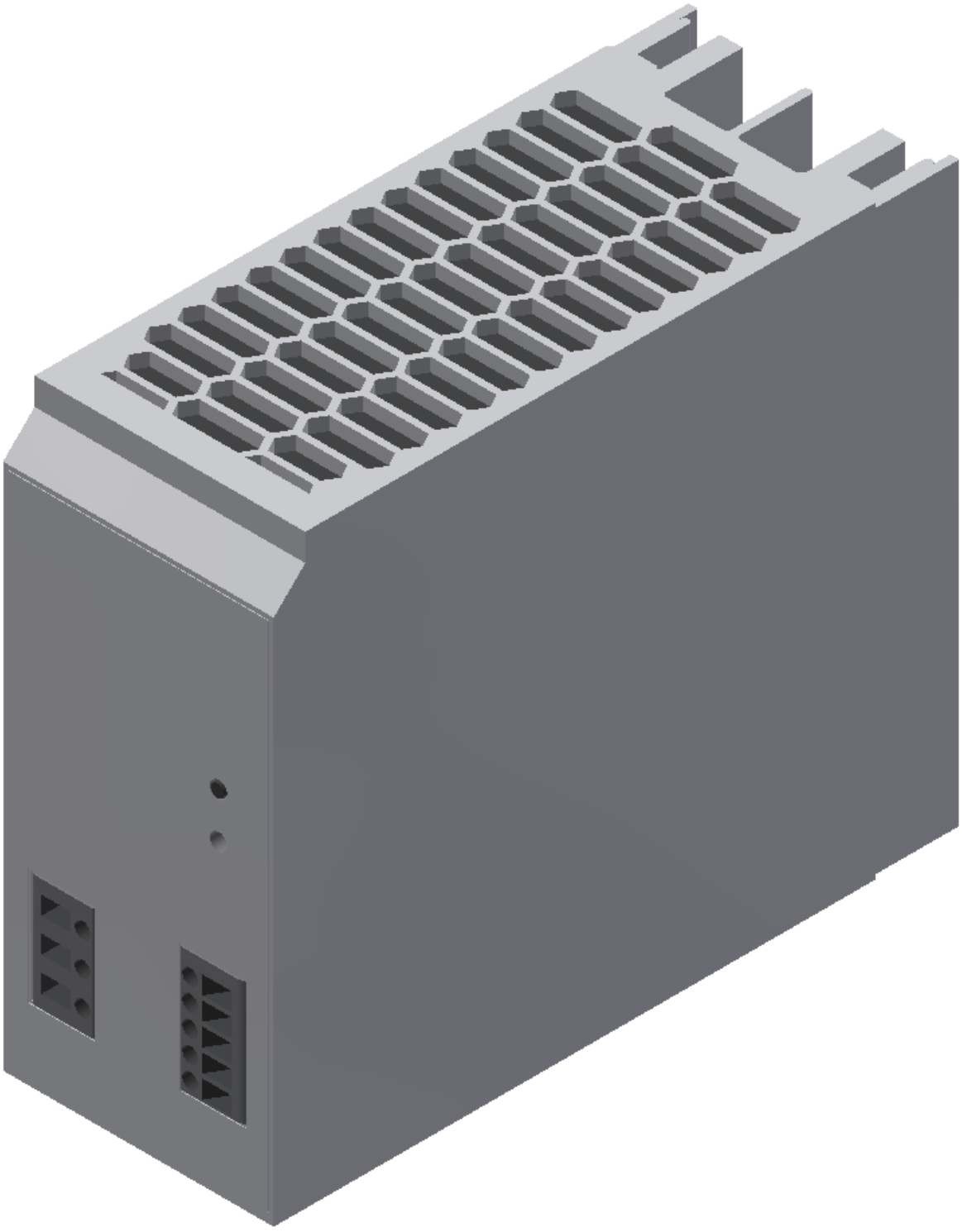
Name	
Operating voltage	10...30 VDC
DC rated operating current	0-80 mA
Operating voltage	DC
Data transfer	Inductive coupling
Working frequency	13,56 MHz
Read-write distance	max. 115 mm

9.3.2 Electronic circuit protection

Murr Mico electronic circuit protection 2-channels / illustration similar

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

9.3.3 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
Authorisation	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

9.3.4 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

9.3.5 Mini Terminal

Multi-pin plug distributor

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

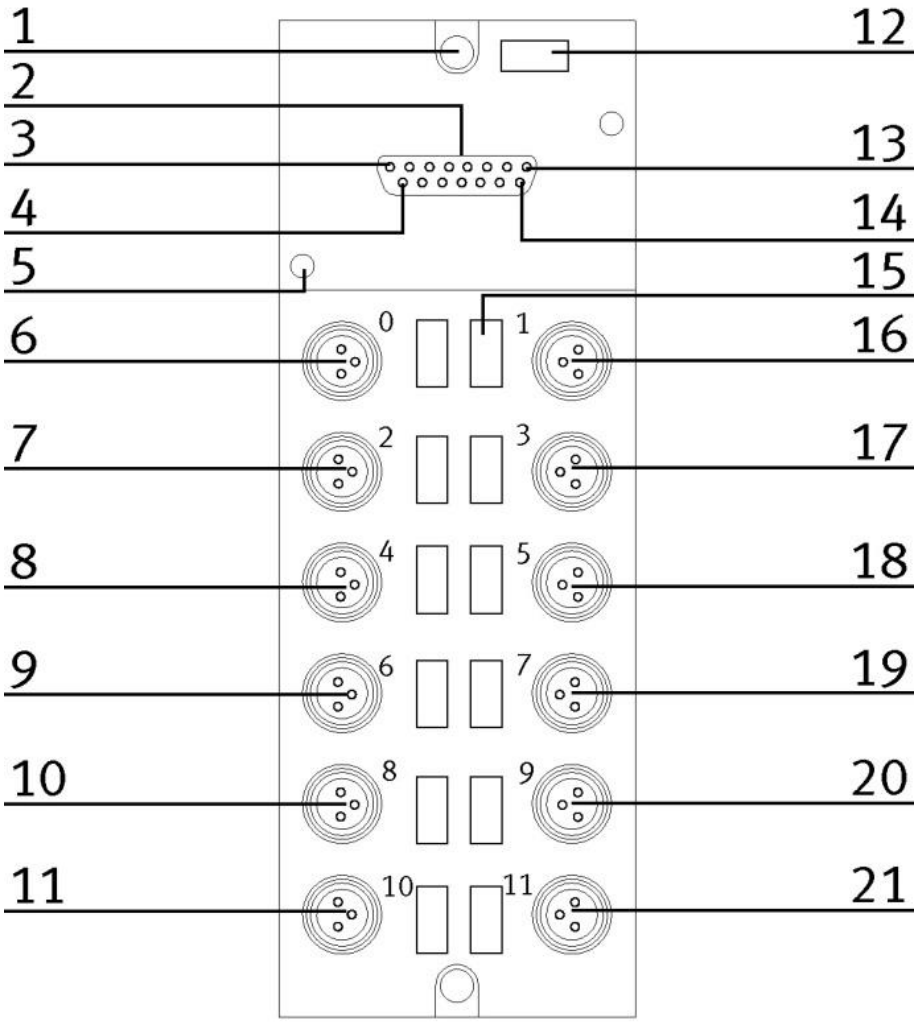
- slots 0 to 11
- Signal line socket 4
- DC 24V socket 1
- 0V socket 3

CM1.M1 – Multipole distributor X-axis

15-pole D-Sub Pin	Bit	Name
1	Bit 0	X-axis end position negative /-BG11
2	Bit 1	Light barrier 1 shelf free / BG51
3	Bit 2	X-axis end position positive /-BG12
4	Bit 3	Light barrier 2 shelf free / BG52
5	Bit 4	X-axis reference switch /-BG13
6	Bit 5	Light barrier 3 shelf free / BG53
7	Bit 6	Reserve
8	Bit 7	Light barrier 4 shelf free / BG54
9	Bit 8	Reserve
10	Bit 9	Reserve
11	Bit 10	Reserve
12	Bit 11	Reserve
13	+24 V	
14 und 15	0V	

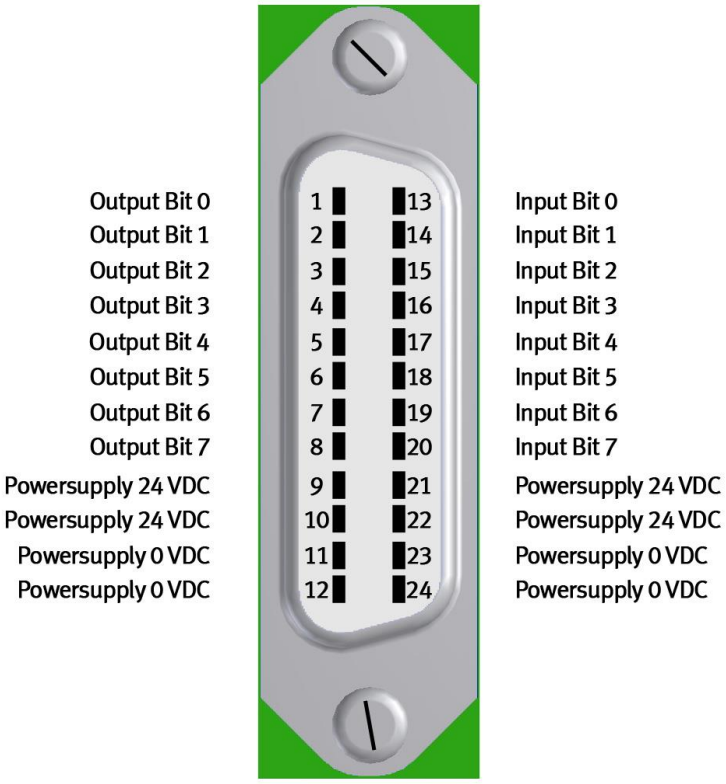
CM1.M2 – Multipole distributor Z-axis

15-pole D-Sub Pin	Bit	Name
1	Bit 0	Z-axis end position negative /-BG21
2	Bit 1	Reserve
3	Bit 2	Z-axis end position positive /-BG22
4	Bit 3	Reserve
5	Bit 4	Z-axis reference switch /-BG23
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		

9.3.6 SYS link interface

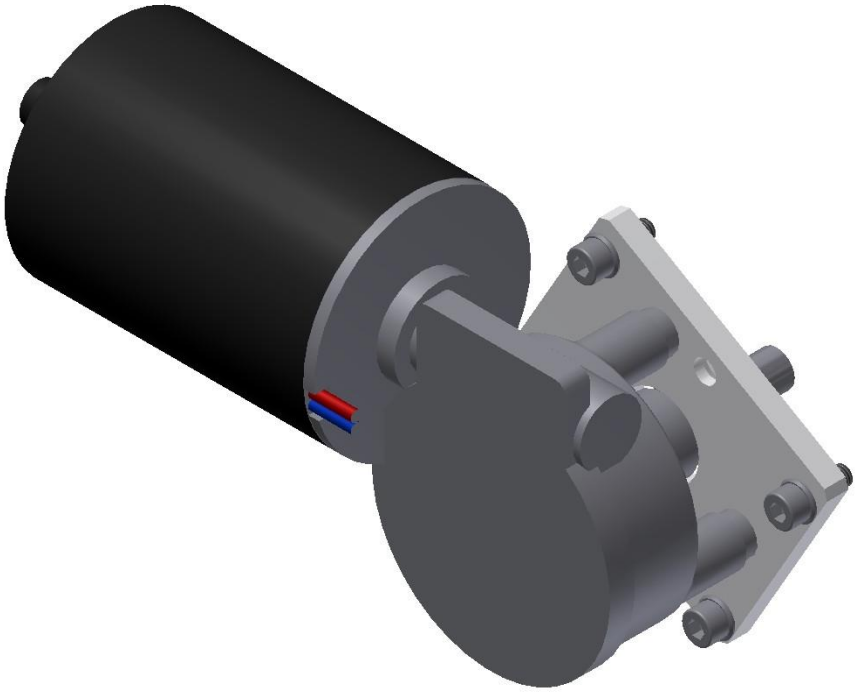


Syslink allocation

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

9.4 Mechanic components

9.4.1 Motor of Conveyor



Motor type 403438 / illustration similar

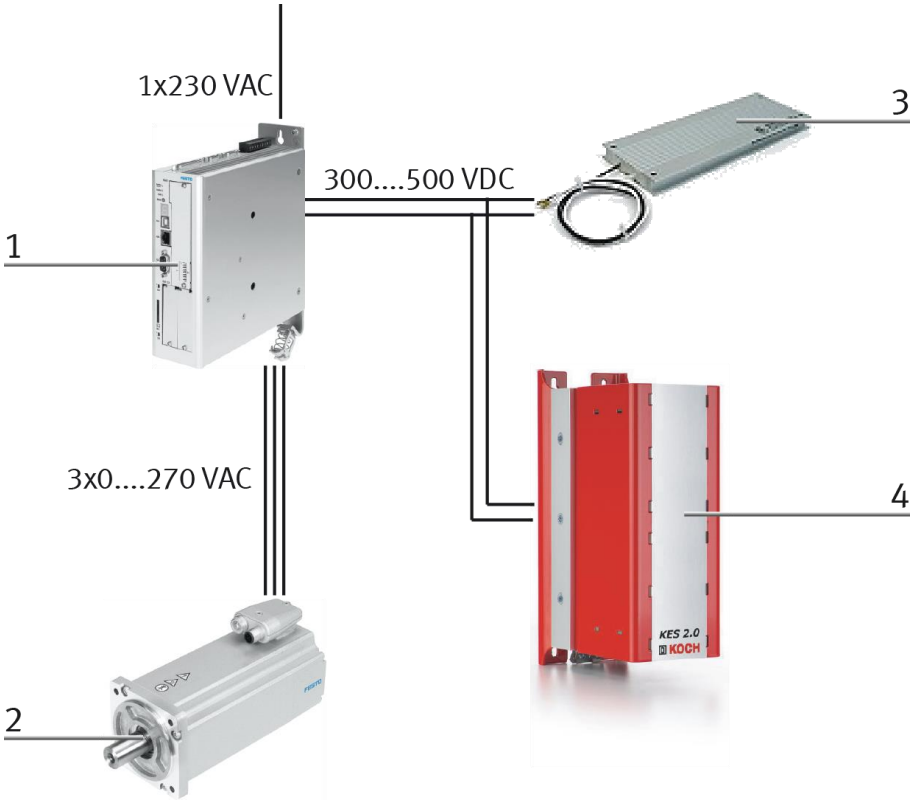
The motor has got the equipment identifier / 3M1

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

10 Extensions

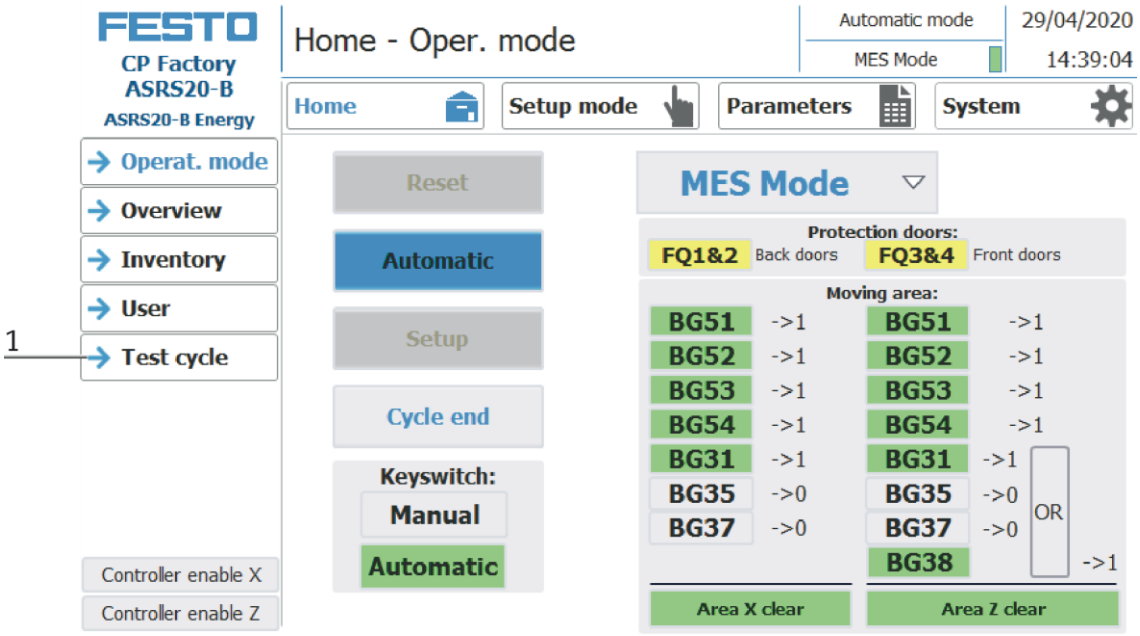
10.1 Energy recovery expansion

10.1.1 Connection principle and energy flow



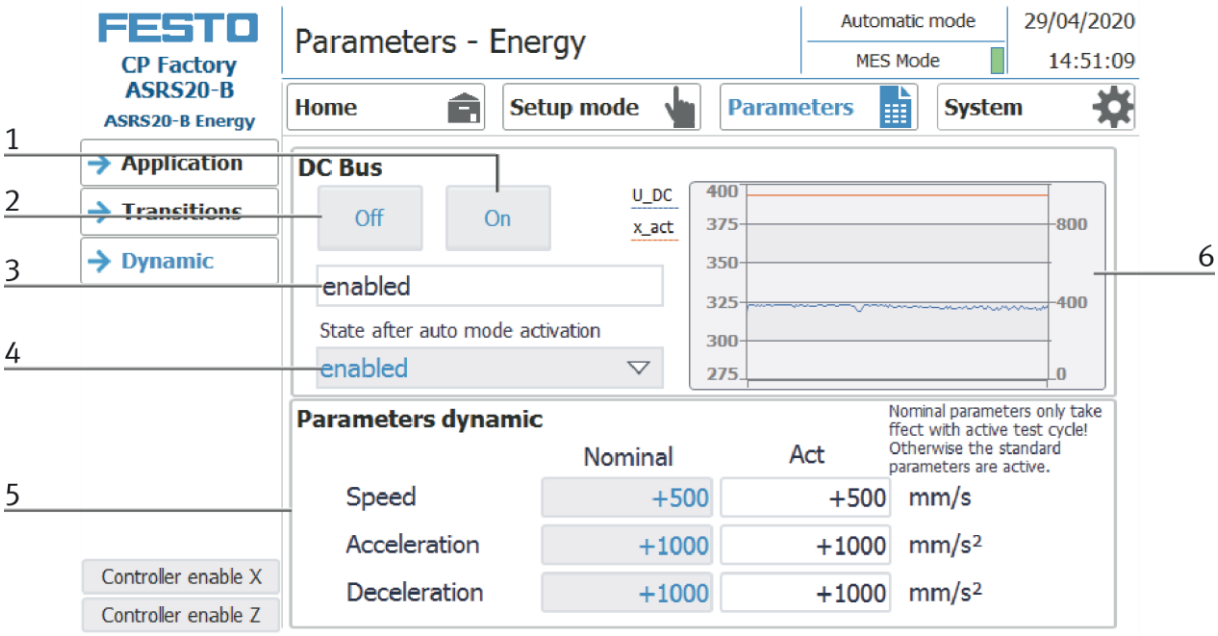
Pos.	Desription	Note
1	Motorcontroller CMMP-AS	The motor controller is supplied via a single-phase AC connection.
2	Servomotor EMME-AS	The brushless, permanent magnetically excited synchronous servo motor is controlled by the three-phase output of the motor controller.
3	Break resistor BWD 500072	The braking resistor is connected to the DC link of the motor controller. If power is fed back from the motor to the motor controller (braking energy, motor in generator mode), the braking resistor converts electrical energy into heat.
4	Energy store KES	The energy store is also connected to the DC voltage intermediate circuit of the motor controller. When activated, it temporarily stores braking energy and then transfers it back to the drive.

10.1.2 HMI: Home –Operation mode



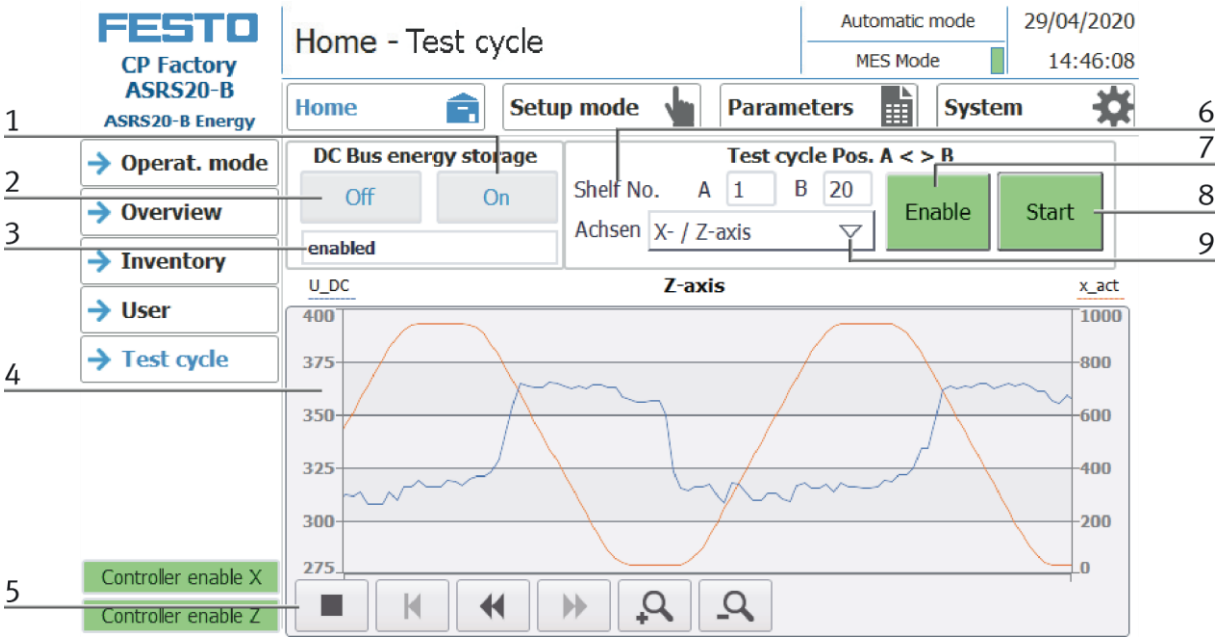
A test cycle has been implemented in the ASRS to analyze the effects of the intermediate circuit storage. This can be selected in the automatic mode. The ASRS doors must be closed and the automatic mode must be active.

10.1.3 HMI: Parameter -energy



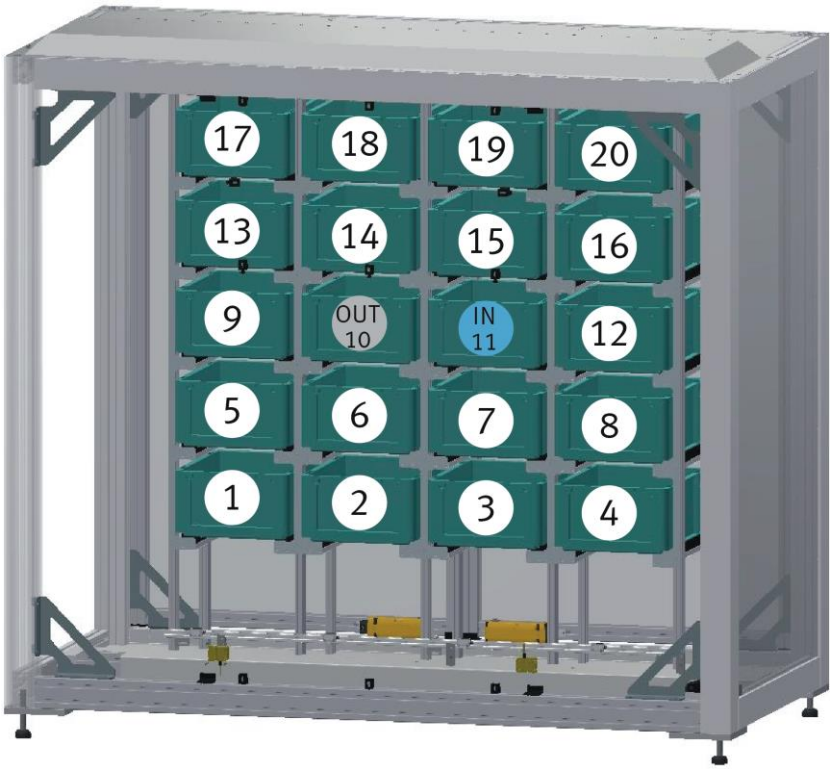
Pos.	Mode	Parameter
1	Automatic mode	Activate the intermediate circuit buffer manually
2	Automatic mode	Deactivate the intermediate circuit memory manually
3	Automatic mode	Feedback status intermediate circuit memory
4	Automatic mode	Intermediate circuit status with automatic activation: enabled: In automatic mode, energy is stored in the intermediate circuit memory if the intermediate circuit voltage exceeds 360 VDC. not enabled: In automatic mode, the intermediate circuit memory does not store any energy. If necessary, energy is emitted via the braking resistors.
5	Automatic mode	Parameters for Speed acceleration delay The Z-axis of the warehouse shuttle
6		Time course of the intermediate circuit voltage (blue, left scale, in V) Temporal course of the position of the Z-axis (red, right scale, in mm)

10.1.4 HMI: Home –Test cycle (Setup mode)



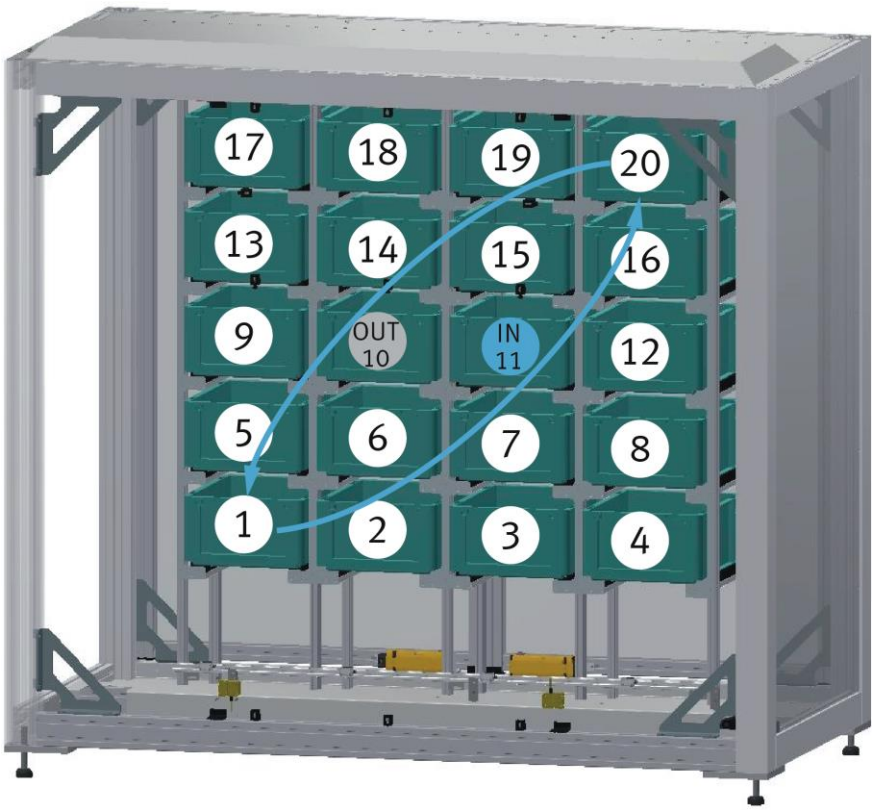
Pos.	Function
1	Activate the intermediate circuit memory (ZKS) manually
2	Deactivate intermediate circuit memory manually
3	Feedback status intermediate circuit memory (blocked: ZKS inactive, released: ZKS active)
4	Time course of the intermediate circuit voltage (blue, left scale, in V) Temporal course of the position of the Z-axis (red, right scale, in mm)
5	Chart options: stop, back to the beginning, backward, forward, zoom in, zoom out
6	Number of shelf A or B for a cyclical test drive A - B - A - etc.
7	Enable the axes: Brake released, motors energized
8	Start / stop the test cycle
9	Selection of which axes are controlled: X-axis only, Z-axis only or X- and Z-axis

Numbering of the storage shelfs



10.1.5 10.1.5 Procedure for performing test drives with deactivated and activated intermediate circuit memory

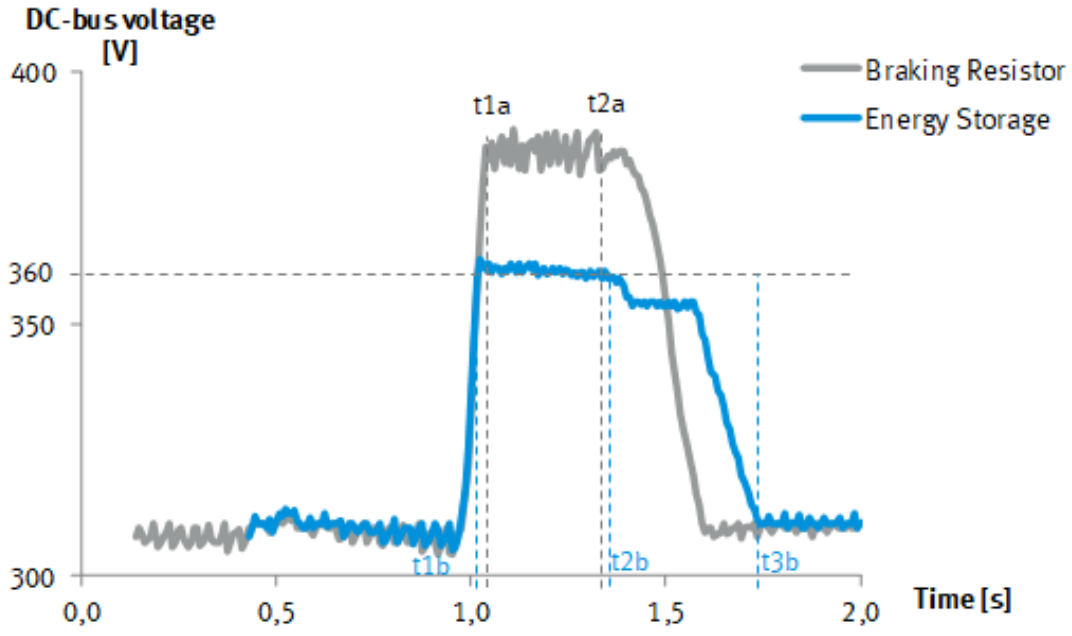
1. Select automatic mode
2. Home test cycle:
   1.) ZK energy storage off
   2.) Tray No. A: 1, B: 20
   3.) Axes: X- / Z-axis
   4.) Check the working area of the storage shuttle
   5.) Release
   6.) Start
   The storage and retrieval unit moves cyclically from compartment 1 to compartment 20. / E.g. Wait for 5 cycles
   7.) To stop, press the "Start" button again
   8.) ZK energy store on
   9.) Check the working area of the storage shuttle
   10.) Release
   11.) Start
   The storage and retrieval unit moves cyclically from compartment 1 to compartment 20. / E.g. Wait for 5 cycles
   12.) To stop, press the "Start" button again
3. If necessary Change the dynamics parameters of the Z-axis in Parameters - Dynamics and repeat step 2.
4. The energy consumption can be measured and compared with an energy measuring box from Festo Didactic.



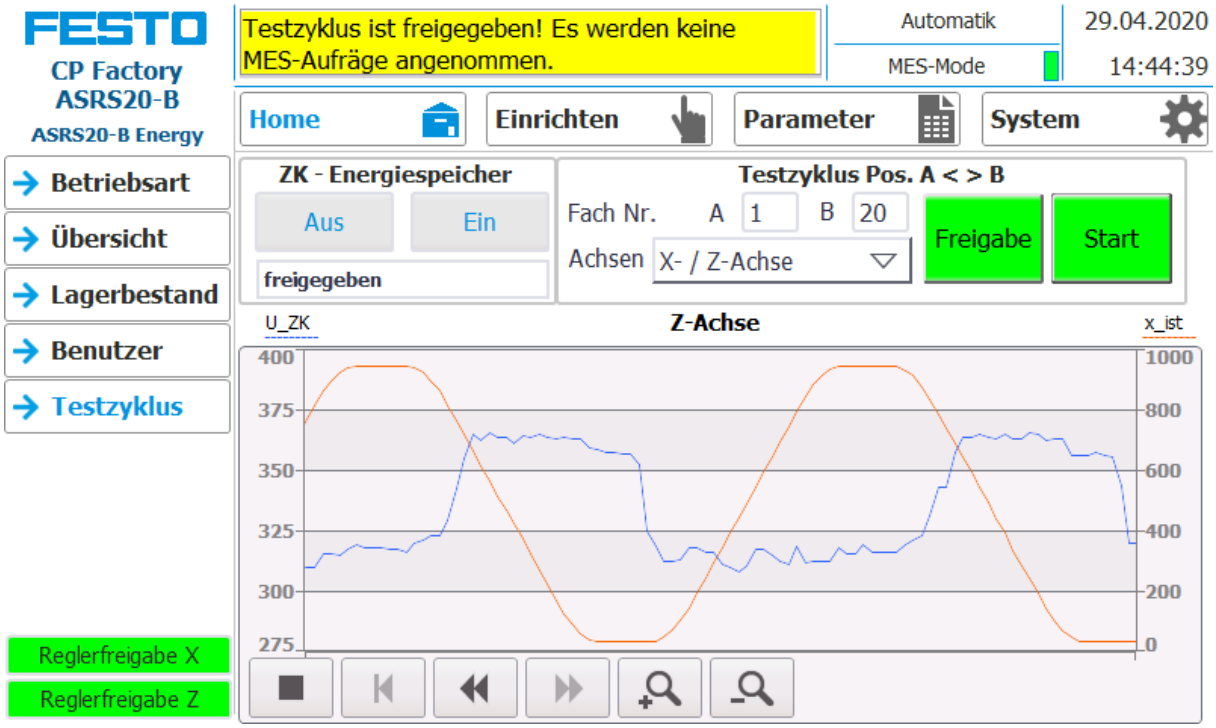
Example cycle with A=1, B=20

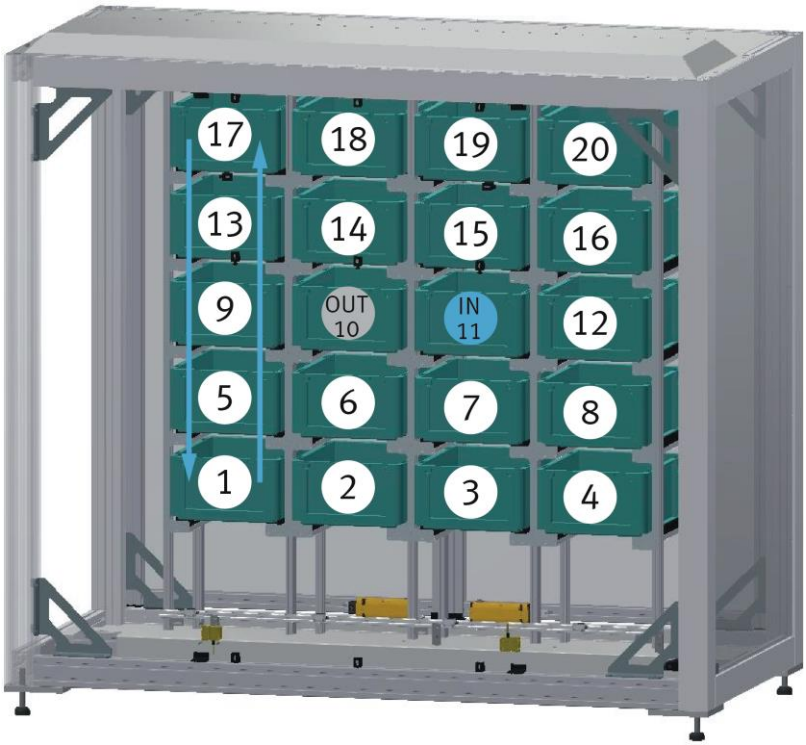
10.2 Behavior of the intermediate circuit voltage

1. When the motor starts operating as a generator (power reversal), e.g. At the beginning of the deceleration process of the Z-axis when driving down, electrical power is delivered to the motor controller. This leads to a sudden increase in the intermediate circuit voltage.
2. Without an intermediate circuit memory, the motor controller sends clocked current to the braking resistor. The energy is then released into the environment as heat (t1a to t2a).
3. If the intermediate circuit memory is active, energy is fed into the capacitors and stored at the set working voltage of approx. 360 VDC (t1b to t2b).
4. The stored energy is then transferred to the system (t2b to t3b). The intermediate circuit voltage drops until it reaches the original level again. During this period, the motor controller draws less energy from the supply network than without storage.
5. Without braking with a reversal of the power direction, the DC link voltage behaves the same with and without the DC link memory.



Exemplary course of the intermediate circuit voltage (blue, left axis in V) and the position of the Z axis (red, right scale, in mm) with activated intermediate circuit memory.





Example cyle with A=1, B=17

11 Error messages and message texts 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 paler is automatically acknowledged
- Note
  - Displayed on the HMI but not processed in MES

11.1 Reporting texts

11.1.1 General remediation texts

The "XXX" values are variables and change depending on the application. These texts can occur on all applications and modules.

Report class	Location	Alarm name	Report text	Fix error
0	ActMon_1M0B	prgSysAlarmActv	Time monitoring "XXX" Activation actuator:: "XXX" / PLC: "XXX" / instance: "XXX"	Check the actuation of the actuator
0	ActMon_1M0B_noHold	prgSysAlarmActv	Time monitoring "XXX" Activation actuator:: "XXX" / PLC: "XXX" / instance: "XXX"	Check the actuation of the actuator
0	ActMon_1M1B	prgSysAlarmExtd	No feedback of the sensor "XXX" on trigger of the activation actuator:: "XXX" / PLC: "XXX" / instance: "XXX" /	Check control / feedback!
0	ActMon_1M1B	prgSysAlarmRtrd	Feedback from sensor "XXX" without control of the actuator "XXX" PLC: ‹field ref = "0" /›; Instance: "XXX"	Check control / feedback!
0	HeatMon	prgSysAlarmActv	Time monitoring heating. Setpoint not reached. PLC: "XXX" / instance: "XXX"	Check temperature sensor Heating not enabled by the selector switch Heating resistors defective
0	CylMon_1M1B	prgSysAlarmExtd	Time monitoring movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path (exiting)
0	CylMon_1M1B	prgSysAlarmRtrd	Time monitoring movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path (retraction)
0	CylMon_2M1B	prgSysAlarmExtd	Time monitoring movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check travers path (exiting)
0	CylMon_2M1B	prgSysAlarmRtrd	Time monitoring Reset movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path (retraction)

Report class	Location	Alarm name	Report text	Fix error
0	CylMon_2M1B	prgSysAlarmSens	Time monitoring divergence cylinder sensors. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path
0	CylMon_2M2B	prgSysAlarmExtd	Time monitoring movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path (exiting)
0	CylMon_2M2B	prgSysAlarmRtrd	Time monitoring Reset movement of the cylinder. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path (retraction)
0	CylMon_2M2B	prgSysAlarmSens	Time monitoring divergence cylinder sensors. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check the air pressure Check the limit switch / setting Check traverse path
0	DriveMon_4Q	prgSysAlarmA	Time monitoring: Motor clockwise (rapid) defective. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check transducer disk / sensor motor Check the motor cable
0	DriveMon_4Q	prgSysAlarmB	Time monitoring: Motor left run (rapid traverse) defective. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check transducer disk / sensor motor Check the motor cable
0	DriveMon_4Q	prgSysAlarmC	Time monitoring: Motor clockwise (slow speed) defective. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check transducer disk / sensor motor Check the motor cable
0	DriveMon_4Q	prgSysAlarmD	Time monitoring: Motor left run (slow speed) defective. Initiator: "XXX" / PLC: "XXX" / instance: "XXX"	Check transducer disk / sensor motor Check the motor cable

Report class	Location	Alarm name	Report text	Fix error
0	Error	ErrNotAus	EMERGENCY STOP is actuated!	Check emergency stop button -F2-FQ1 and confirm with button -F2-SF1.
2	Error	WarnMES4	Communication to MES4 interrupted!	Please check connection
0	Error	ErrAppTimeout	Application Timeout!	
0	Error	PnErrKF80	PROFINET Connection to subscriber "+ K2-KF80" is interrupted	
0	Error	PnErrKF81	PROFINET Connection to subscriber "+ K2-KF81" is interrupted	
0	Error	ErrProgramm	Programming errors! OB121 was called.	Check program
2	Error	WarnRfidTout	RFID time monitoring is active!	Please check the RFID sensor and the chip.
2	Error	WarnRfidErr	RFID writing / reading with error ended!	Please check the RFID sensor and the chip.
2	Error	WarnConvStop	Conveyor start / stop by sensors Energy saving mode: conveyor is stopped!	Place the workpiece carrier at the beginning of the conveyor Waiting until a workpiece carrier comes automatically from predecessor station

11.1.2 RFID detection messages

Report class	Location	Alarm name	Report text	Fix error
0	RFID_Control	fbErrRfidTout	Timeout at RFID writing / reading to RFID- Instance: "Calling function block!"	Check workpiece carrier / RFID Chip
0	RFID_Control	fbErrRfidErr	Error at RFID writing / reading to RFID- Instance: "Calling function block!"	Check workpiece carrier / RFID Chip
0	Stopper_Default	fbErrCarrier	No RFID tag identified at RFID- Instance: "Calling function block!"	Check workpiece carrier / RFID Chip
0	Stopper_Mes	fbErrCarrier	No RFID tag identified at RFID- Instance: "Calling function block!"	Check workpiece carrier / RFID Chip

11.2 Interactive message texts

Interactive messages are displayed via a pop-up window. Pop Up has two buttons
Retry - Try to redo the action
Abort - The action is aborted and directed to the Cell Controller. There can also be a retry executed or cancelled. In this case, the order would be stored with errors in MES.

11.2.1 General

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

12 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.

13 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

14 Disposal

NOTE

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

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