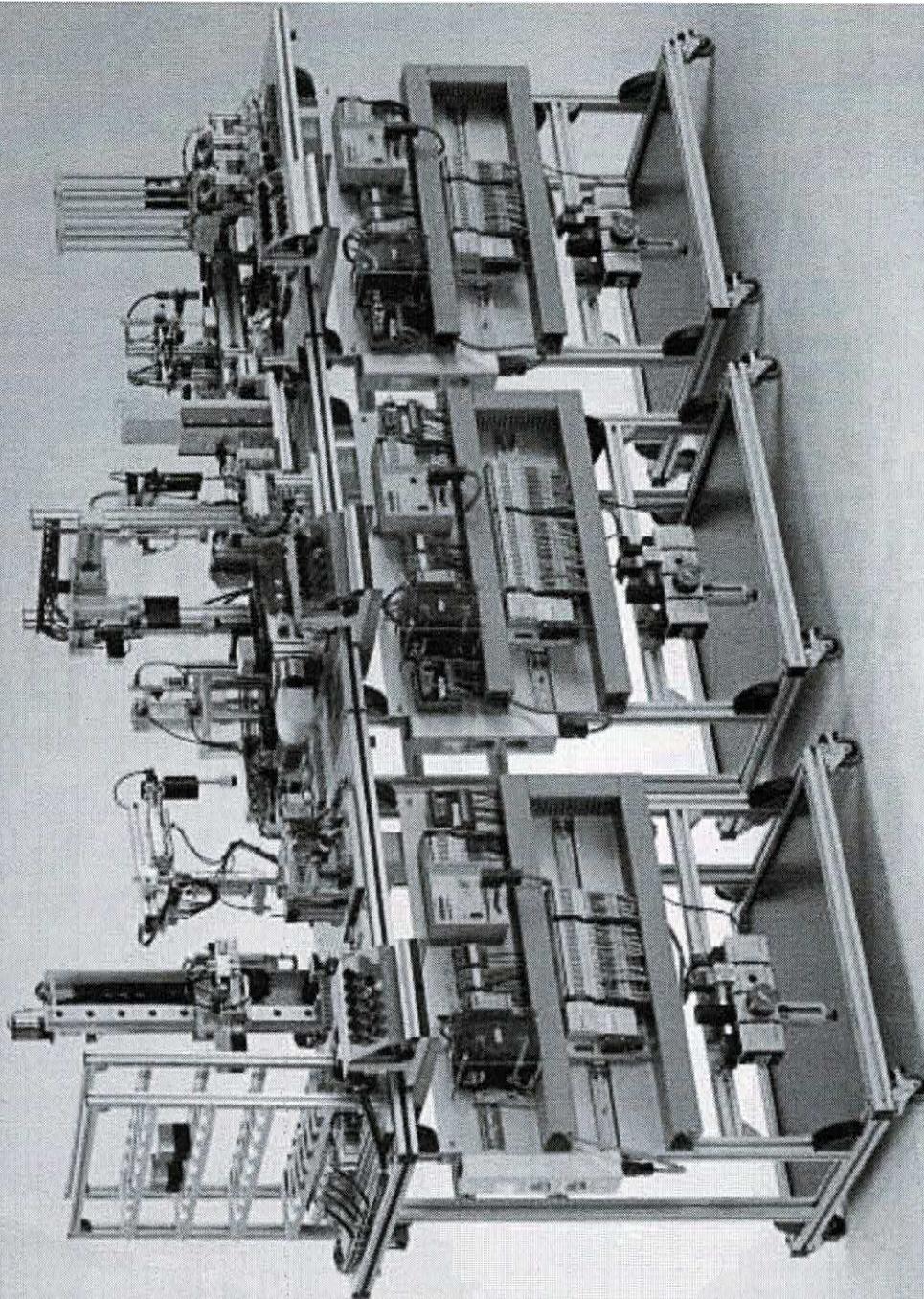


modular mechatronics system mMS
system: cube assembly
with pneumatic press

Operating Manual

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1 About this operating manual

General information

This operating manual describes the "modular mechatronics system mMS – system for cube assembly" teaching system. For reasons of simplicity, we will refer to it as teaching system in the rest of the operating manual.

This operating manual will make it easier to get to know the teaching system and use it as intended.

The manual contains important instructions on using the teaching system safely and correctly. Observing the manual will help:

- Prevent hazards
- Reduce repair costs and downtime
- Increase the reliability and operating lifetime of the machine

This manual must be read and applied by all persons who have been authorised to carry out one of the following on the teaching system:

- Operation
- Rectifying faults during the work process
- Inspection, care and maintenance work

In addition to the instructions in this operating manual, local regulations regarding accident prevention and environmental protection for the country where it is to be used must also be observed.

Signs and symbols used

This manual uses the following signs and symbols:

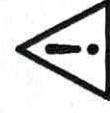
- Action symbol: The text after this symbol lists actions that are to be carried out in the order specified (top downwards).
- ✓ Result symbol: The text after this symbol explains the result a certain action has.
- ⇒ Cross reference symbol: The text after this symbol refers the reader to another chapter, more detailed documentation or similar.

Warning signs

Special safety warnings appear in appropriate places. These have symbols as follows:

General hazard

This sign denotes actions where a risk of injury exists and/or serious material damage may occur.



Where a clear source of hazard exists, one of the following symbols is used.

High Voltage

This sign indicates tasks where there is a risk of electric shock or even fatal electrocution.



Danger of Crushing

This sign can be found before tasks where a risk of being crushed exists.



Additional documentation

The following documentation provides more information on the teaching system:

- Assembly instructions for function sub-assemblies
- Manual for the programmable logic controller
- Circuit diagrams
- Terminal diagrams
- Fluid diagrams

2 Safety

2.1 Proper use

Modular mechatronics system mMS may be used solely to teach automation processes as part of industrial engineering training. The maximum permissible air pressure for the operation of the teaching system is 6 bar.

Possible misuse
It is not permitted to introduce any parts into the teaching system other than the half cubes and tension pins supplied. An overload of the actuators can occur.
Avoid any unplanned or playful operation of the operating units.

2.2 Organisational measures

The teaching system requires the following amount of space so that it can be used for teaching and learning mechatronic processes:

Space requirements of the system

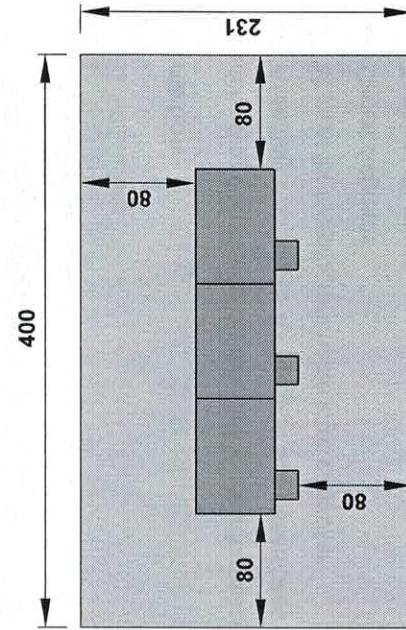


Fig. 2.1 Space requirements of the system – accessible everywhere (units given in cm)

Space requirements of one station

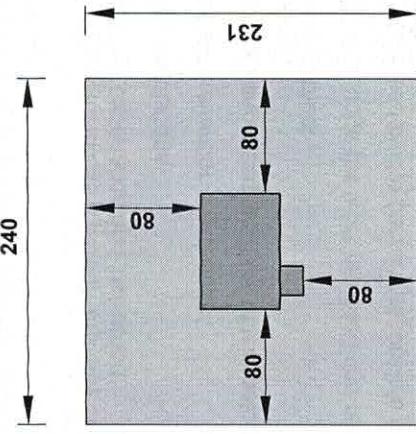


Fig. 2.2 Space requirements of a station (units given in cm)

Protective earth

The teaching system may only be used on a power supply network with protective earthing or protected via an RCD circuit breaker.

Spaces for teaching

Depending on how the system or stations are used, the following number of spaces is available:

Spaces station	Phase	Number of persons
Set up		1-3
Operation		1

Table 2.1 Teaching spaces per station

Spaces system	Phase	Number of persons
Set up		1-3
Operation		1

Table 2.2 Teaching spaces on the system

No more than 3 persons may work simultaneously on the system and at one station during set-up. Only one person may work during operation. That person must ensure that there is nobody in the work space of the system or station.

2 Safety

Personnel qualification

The teacher must be a trained specialist and an expert in mechanics and pneumatics, so mechatronics.

A specialist is defined as a person who has sufficient knowledge of the following due to specialist training, experience and instruction:

- Safety regulations
- Accident prevention regulations
- Directives and accepted rules of technology.

The specialist must

- be able to judge the work provided and recognise and avoid any hazards
- be authorised by the person responsible for the safety of the system to carry out any necessary work and tasks required
- pass on knowledge to the assigned trainees, students and other learners in a responsible manner.

2.3 Safety devices

The teaching system is provided with the following safety devices for the protection of personnel:

- Emergency stop buttons on each station
- Pneumatic pressure limits
- Emergency stop chain for the system
- Safety devices

Emergency stop button

The emergency stop button is located on the right of the control panel of each station.

The emergency button must be pressed to prevent danger to persons or to the system or station.

When the emergency stop button is pressed the system or station stop as the power supply and compressed air are switched off.

Pneumatic pressure limits

The maximum permissible pneumatic operating pressure for the operation of the teaching system during training is 6 bar. The pressure is set on the pressure reducer; afterwards the adjustment cap of the pressure control valve must be secured with a lock.

Emergency stop chain for the system

If the stations are connected to form a system the stations must be connected by connecting cables. This causes signal transfer, and the emergency stop buttons of the individual stations form an emergency stop chain.

The complete system stops if one of the emergency stop button is pressed as the power supply and compressed air are switched off.

Safety devices

The following safety devices are provided:

- Covers
- Protective door
- Two-hand operation

Covers are mounted over the toothed belt and the threaded rod of the high bay racking to prevent anyone from reaching in.

The protective door and the plexiglass windows on the side of the pneumatic press make it possible to view the pressing process and prevent anyone from reaching in.

The two-hand operation of the pneumatic press prevents anyone from reaching into the press during manual operation.

2.4 Remaining potential dangers

The teaching system uses state-of-the-art technology and meets all the recognised safety regulation requirements. Nevertheless, it can still be a potential source of danger to the operator or others and can cause damage to property.

Fatal injury
Only qualified electricians may carry out work on the electrical equipment of the teaching system!

Inspect the electrical equipment of the teaching system regularly! Immediately deal with any danger caused by loose connections and damaged cables!

Only operate the system when the power supply unit is covered!
The multiple outlet socket is powered even when the teaching system is switched off! Disconnect the multiple outlet socket from the power supply before working on it!

Danger of injury
Risk of crushing due to the many moving elements of the teaching system. Even though the operating pressure is set to a maximum of 6 bar, fingers can be injured when reaching between fixed and moving parts.

3 System for cube assembly

3.1 System structure

The system for cube assembly consists of three stations:

- Magazine station
- Pneumatic press processing station
- Storage station

The three stations, magazine, pneumatic press processing and storage, are set up next to one another. They are then connected mechanically, pneumatically and electrically. The system for cube assembly makes it possible to set up, operate and observe a complete automation process.

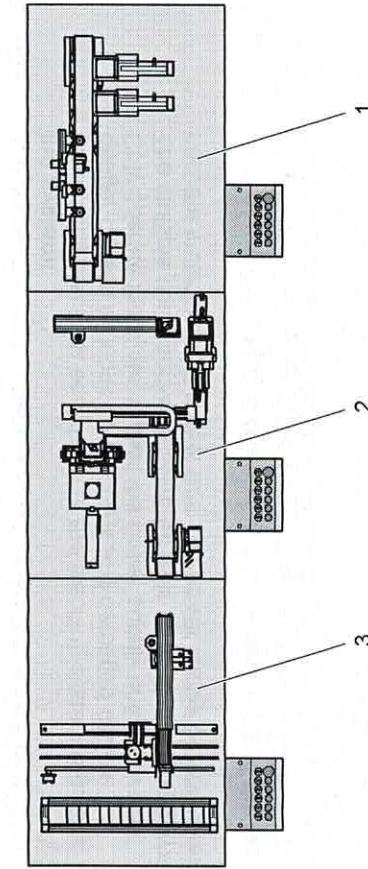
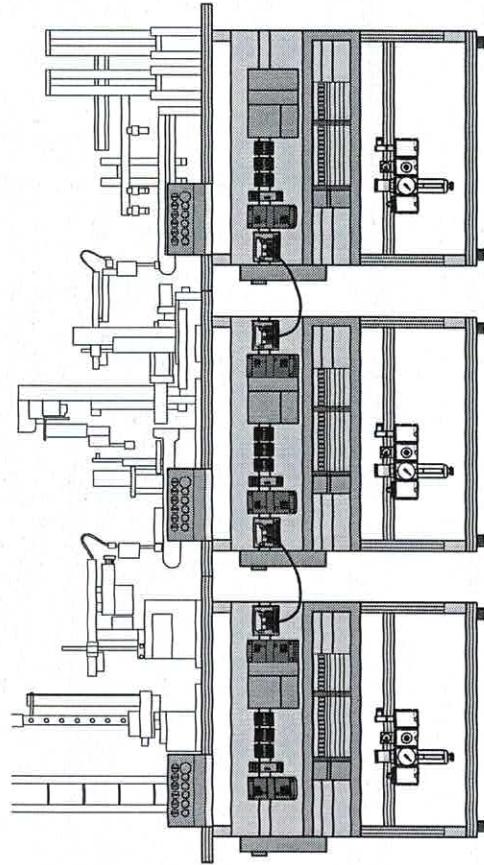


Fig. 3.1 Overview of the system for cube assembly

1. Magazine station

2. Pneumatic press processing station

3. Storage station

Technical specifications

Designation	Unit	Value
Weight	kg	190
Dimensions	Length	mm 2400
	Width	mm 780
	Height	mm 1480
Min. operating temperature	°C	+5
Max. operating temperature	°C	+30
Relative air humidity	%	25-70
Maximum height of location	m	1000 above NN
Pneumatics	Min. operating pressure	bar 5
	Max. operating pressure	bar 6
	Compressed air quality	4
Power supply	Operating voltage	V 200-240
	R961003177	
	Operating voltage	V 100-120
	R961004148	
Frequency	Hz	50-60
Capacity	VA	750
Protective earth		PE (protective earth or RCD circuit breaker)
A-evaluated continuous sound pressure level at the operating personnel's workstation – during conveyance	dB (A)	< 70

Table 3.1 Technical specifications for the system for cube assembly

System identification

The type plate for the system for cube assembly is located on each station, on the bottom right of the base plate, and also contains a station identification number.

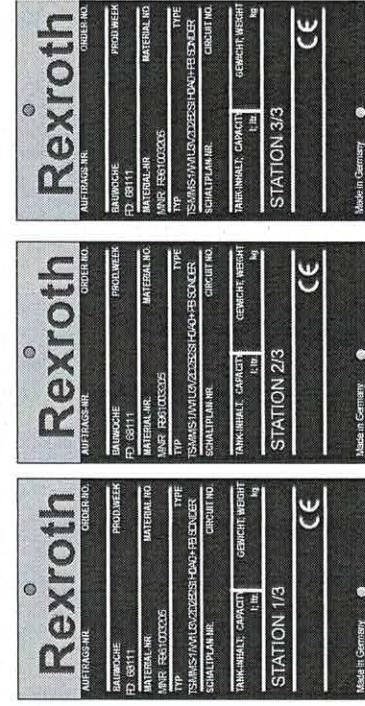


Fig. 3.2 Example of type plate for the system, consists of one plate on each station

3 System for cube assembly

The type code is decoded as follows:

Fig. 3.3 Time code

3.2 Magazine station

Form

The magazine station consists of a table with fixable castors and the following function sub-assemblies:

- Separating magazine (x2)
- Long conveyor belt
- Testing unit
- Control panel
- Maintenance unit
- Electrical supply with signal processing
 - Main switch on the multiple outlet socket
 - Terminating plug on the transfer module
 - Power supply
 - Emergency stop relay
 - Profibus coupler
- Programmable logic controller with supplied PLC software

Two separating magazines offer space for 10 workpieces each. A micro switch monitors how many pieces are in the magazines. A pneumatic cylinder pushes the workpiece at the bottom of the pile onto a conveyor belt, which then conveys it past four testing units. Three sensors, one optical, one capacitive and one inductive, measure the properties of the materials and a pneumatic cylinder measures the contours. The test results are saved in the controller.

Material flow

One cube half is pushed from the separating magazine onto a conveyor belt by a pneumatic cylinder. The conveyor belt moves it past the testing unit. A sensor at the end of the conveyor belt senses that a workpiece has arrived, and the conveyor belt stops.

3 System for cube assembly

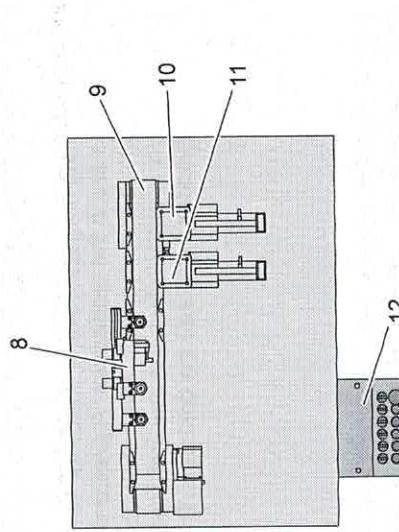
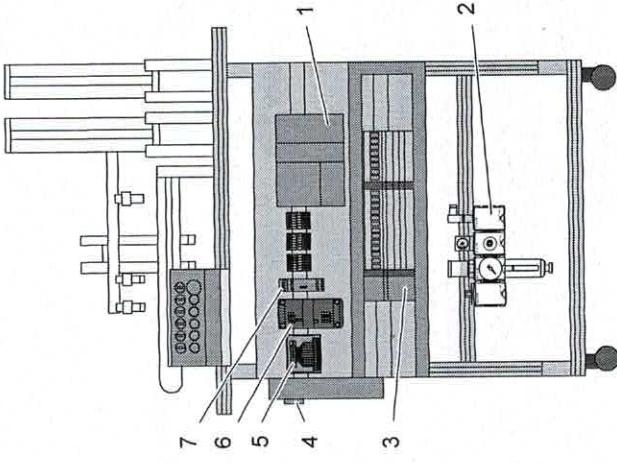


Fig. 3.4 Overview of the magazine station

1. Programmable logic controller
2. Maintenance unit
3. Profibus coupler
4. Main switch
5. Terminating plug on the transfer module
6. Power supply
7. Emergency stop relay
8. Testing unit
9. Conveyor belt long
10. Separator magazine 1
11. Separator magazine 2
12. Control panel

Technical specifications

Designation	Unit	Value
Weight	kg	57
Dimensions	Length	mm 800
	Width	mm 780
	Height	mm 1260
Min. operating temperature	°C	+5
Max. operating temperature	°C	+30
Relative air humidity	%	25-70
Maximum height of location	m	1000 above NN
Pneumatics	Min. operating pressure	bar 5
	Max. operating pressure	bar 6
	Compressed air quality	4
Power supply	Operating voltage R961003177	V 200-240
	Operating voltage R961004148	V 100-120
	Frequency	Hz 50-60
	Capacity	VA 250
	Protective earth	PE (protective earth or RCD circuit breaker)
	A-evaluated continuous sound pressure level at the operating personnel's workstation during conve	dB (A) < 70

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The type plate of the magazine station is located on the bottom right of the base plate. In addition to the system tune plate, station specific characteristics are listed here.

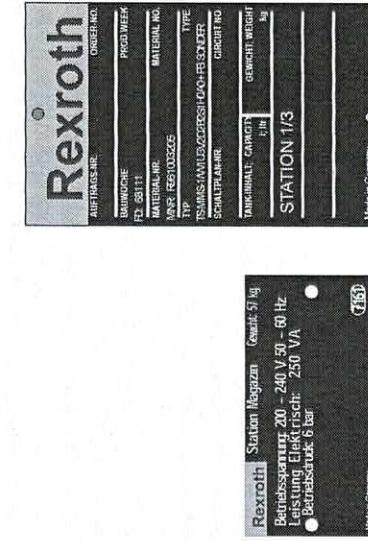


Fig. 3.5 Example of type plates on the magazine station

3 System for cube assembly

3.3 Pneumatic press processing station

Form

The pneumatic press processing station consists of a table with fixable castors and the following function sub-assemblies:

- Handling device
- Portal with vacuum sucker
- Pins unit
- Pneumatic press
- Turning unit
- Conveyor belt
- Maintenance unit
- Control panel
- Electrical supply with signal processing
- Main switch on the multiple outlet socket
- Terminating socket on the transfer module (x2)
- Power supply
- Emergency stop relay
- Profibus coupler
- Programmable logic controller with supplied PLC software

The workpiece is transported on the station by the vacuum sucker of the handling device and the vacuum sucker of the portal. A pneumatic rotation cylinder turns the workpiece by 90° in the turning unit. In the pins unit, a pneumatic cylinder sticks two tension pins into one of the cube halves. The workpieces are then pressed together by a pneumatic cylinder in the portal. Plexiglass panes make it possible to observe this process. The vacuum sucker of the portal transfers the workpiece to a conveyor belt for further transport.

Material flow

The tri-axial handling device picks the aluminium cube half up with the help of a vacuum sucker and places it onto the pneumatic turning unit after turning it by 90°. There it is turned. Afterwards, the aluminium cube half is placed into the pins unit by the handling device. There, two tension pins are inserted into the cube half. Then the aluminium cube half is transported back to the turning unit by the handling device, where it is turned back by 90°.

The handling device then picks up this cube half again, and, by turning it, transfers it to the pneumatic press, where the aluminium cube half is placed with the pins facing upwards. Then the handling device collects a black POM cube half and places it on the waiting aluminium cube half.

The receiver transfers both cube halves to the press, where they are pressed together. When the cube leaves the press, the vacuum sucker of the portal sucks in the cube and places it onto the conveyor belt. From there it is moved to the end of the conveyor belt. A sensor detects that the cube has arrived and stops the conveyor belt.

System for cube assembly 3

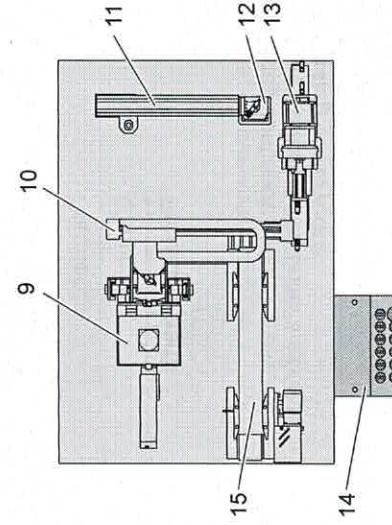
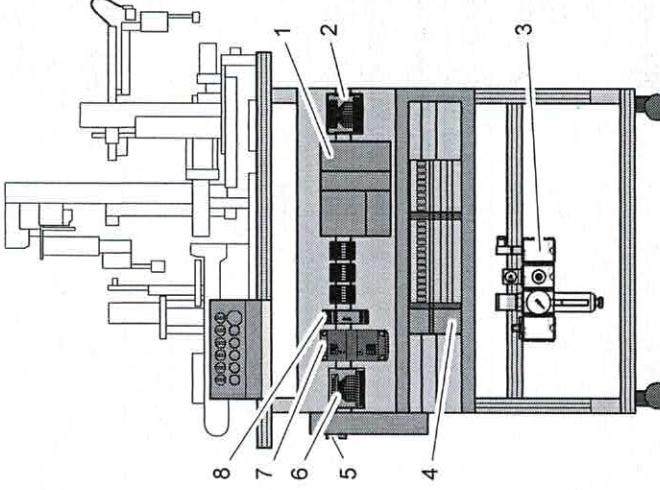


Fig. 3.6 Overview of the pneumatic press processing station

1. Programmable logic controller
2. Terminating socket on the transfer module
3. Maintenance unit
4. Profibus coupler
5. Main switch
6. Terminating socket on the transfer module
7. Power supply
8. Emergency stop relay
9. Pneumatic press
10. Portal
11. Handling device
12. Turning unit
13. Pins unit
14. Control panel
15. Conveyor belt short

3.4 Storage station

Form

The storage station consists of a table with fixable castors and the following function sub-assemblies:

- High bay racking
- Cartesian robot
- Handling device
- Maintenance unit
- Control panel
- Electrical supply with signal processing
 - Main switch on the multiple outlet socket
 - Terminating plug on the transfer module
 - Power supply
 - Emergency stop relay
 - Profibus coupler
- Programmable logic controller with supplied PLC software

There are 28 storage spaces on the high bay racking. A Cartesian robot transports the workpieces to their storage spaces and a pneumatic arm puts them down. Fork light barriers and micro switches carry out the positioning, the sledge is driven by a DC gear motor, a toothed belt and a threaded rod.

Material flow

The vacuum sucker of the handling device picks up the workpiece, turns it by 180° and transfers it to the high bay racking robot. The robot stores the workpiece at its assigned storage space.

3.4 Storage station

Form

The storage station consists of a table with fixable castors and the following function sub-assemblies:

- High bay racking
- Cartesian robot
- Handling device
- Maintenance unit
- Control panel
- Electrical supply with signal processing
 - Main switch on the multiple outlet socket
 - Terminating plug on the transfer module
 - Power supply
 - Emergency stop relay
 - Profibus coupler
- Programmable logic controller with supplied PLC software

There are 28 storage spaces on the high bay racking. A Cartesian robot transports the workpieces to their storage spaces and a pneumatic arm puts them down. Fork light barriers and micro switches carry out the positioning, the sledge is driven by a DC gear motor, a toothed belt and a threaded rod.

Material flow

The vacuum sucker of the handling device picks up the workpiece, turns it by 180° and transfers it to the high bay racking robot. The robot stores the workpiece at its assigned storage space.

Technical specifications

Designation	Unit	Value
Weight	kg	60
Dimensions	Length	mm 800
	Width	mm 780
	Height	mm 1480
Min. operating temperature	°C	+5
Max. operating temperature	°C	+30
Relative air humidity	%	25-70
Maximum height of location	m	1000 above NN
Pneumatics	Min. operating pressure	bar 5
	Max. operating pressure	bar 6
	Compressed air quality	4
Power supply	Operating voltage	V 200-240
	Operating voltage R961003177	V 100-120
	Frequency	Hz 50-60
	Capacity	VA 250
	Protective earth	PE (protective earth or RCD circuit breaker)
A-evaluated continuous sound pressure level at the operating personnel's workstations – during conveyance	dB (A)	< 70

Table 3.4 Technical specifications for the storage station

Station identification

The type plate of the storage station is located on the bottom right of the base plate. In addition to the system type plate, station specific characteristics are listed here.

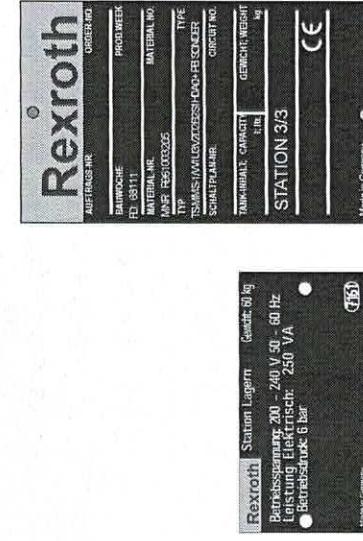


Fig. 3.9 Example of type plates on the storage station

4 Transport

4 Transport

4.1 Extent of supply

The stations are delivered individually packed. Each station is strapped tightly onto a pallet. The castors are free. Each station is in a wooden crate with a lid on the front. The lid is fastened with nails.

Dimensions of the crate	Designation	Unit	Value
Dimensions	Length	mm	980
	Width	mm	880
	Height	mm	1760

Table 4.1 Dimensions of the crate

A label with the following information is attached to the wooden crate:

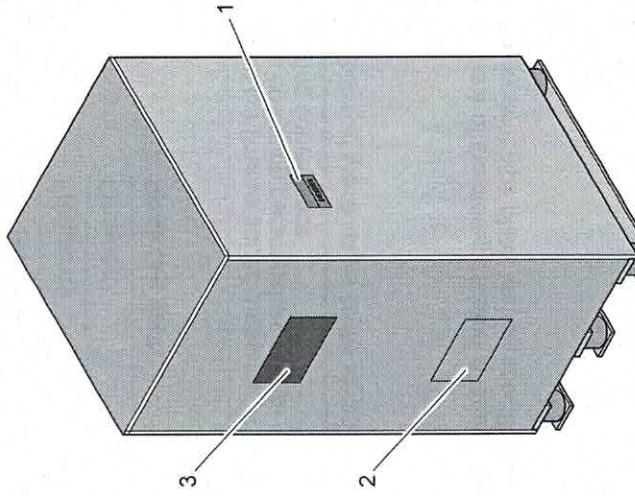


Fig. 4.1 Crate with label

1. Coordination number
2. Delivery note in plastic envelope
3. Red warning sign Attention

System

The system for cube assembly is delivered in three crates. Each station is wrapped individually.

Extent of supply:

- 1 magazine station (⇒ extend of supply for magazine station)
- 1 pneumatic press processing station (⇒ extent of supply for pneumatic press processing station)
- 1 storage station (⇒ extend of supply for storage station)

Magazine station

Extent of supply:

- Table with mounted function components
- 1 terminating plug
- 1 lock for pressure valve
- 6 aluminium cube halves
- 6 POM cube halves, white
- 6 POM cube halves, black
- 12 tension pins

Pneumatic press processing station

Extent of supply:

- Table with mounted function components
- 2 terminating sockets
- 1 lock for pressure valve
- 2 aluminium cube halves
- 2 POM cube halves, black
- 4 tension pins
- 2 connecting cables for signal transfer

Storage station

Extent of supply:

- Table with mounted function components
- 1 terminating plugs
- 1 lock for pressure valve
- 2 aluminium cube halves
- 2 POM cube halves, black
- 4 tension pins

4.2 Delivery and unpacking



CAUTION!

Danger of tilting, the station is too heavy for one person!

Danger of injury when lifting the station! Damage to the station if it tilts or falls down!

- Always move the station carefully and in pairs.

Tools: Crowbar, knife (for cutting the plastic straps)

- Transport the wooden crate to its unpacking place in an upright position using a forklift truck or a jack lift.
- Prise the lid off the front of the crate using a crowbar and put aside.
- Cut the plastic straps and remove them.
- Two persons may then lift the station from the pallet and out of the crate.
- Remove the binders and adhesive tape carefully and dispose of properly.
- Dispose of the pallet and wooden crate properly or store them properly for future storage purposes.
- ✓ The station can now be brought to the site of operation.

4.3 Transport within a building

Moving stations

The stations can be moved to another place at any time. Proceed as follows:

- Switch off the main switch of the station.
- Pull out the power plug.
- Disconnect the station from the air supply.
- Release the brakes on the castors.
- Push the station to its new position on the castors.
- Place the station on a firm and level surface.
- Fix the brakes on the castors.
- ✓ The station can now be stored (⇒ chapter 4.5, page 28) or reconnected to the power supply (⇒ chapter 5.1, page 29).

Disassembling and moving the system

To move the system within a room on a level surface, you must first disassemble the individual stations:

1. Switch off the main switch of the system.
2. Pull out the power plug.
3. Disconnect the system from the air supply.
4. Release the brakes on the castors.
5. Disassembling the system into stations:

- Pneumatics**
- Pull the end of the storage station's air hose out of the double connection on the maintenance unit of the pneumatic press processing unit.
 - Close the opening of the double plug.
 - Pull the end of the pneumatic press processing unit's air hose out of the double connection on the maintenance unit of the pneumatic press processing unit.
 - Close the opening of the double plug.
 - ✓ The stations are separated.

- Electrical system**
- Unscrew the D-sub plug of the connecting cable from the transfer modules of the magazine and pneumatic press processing stations and remove.
 - Unscrew the D-sub plug of the connecting cable from the transfer modules of the storage and pneumatic press processing stations and remove.
 - Plug the terminating plugs/sockets into the transfer modules of each station and screw them tight.
 - Pull the mains plug of the pneumatic press processing station out of the multiple output socket of the magazine station.
 - Pull the mains plug of the storage station out of the multiple output socket of the pneumatic press processing station.
 - ✓ The stations are electrically separated.

- Mechanical connection**
- Use a width 3 allen key to unscrew both screws of the profile connector at the front and back of the profile strip on the stations.
 - Release the bracket locks.
 - Push the stations apart.
 - Remove the profile connector from the groove and store safely.
 - Place caps on the front and back of the connections on the profile strip.
 - ✓ The stations are mechanically separated.
 - 6. Push the stations to their new position on the castors.
 - 7. Place the stations on a firm and level surface.
 - 8. Fix the brakes on the castors.
 - ✓ The stations can now be combined into a system (⇒ chapter 5.3, page 34) or stored (⇒ chapter 4.5, page 28).

4 Transport

4.4 Transport between two buildings

Proceed as follows to transport the system or a station from one building to another:

Precondition:

- Main switch of the system or station is switched off.
- Power plug is unplugged.
- The system or station are disconnected from the air supply.

- Disassemble the system into individual stations, ⇨ chapter *Disassambing and moving the system*, page 27
- Move the station onto a pallet in pairs.
- Secure the station against falling down using belts or plastic straps, use the original crate where possible.
- Protect the station against moisture.
- Transport the pallet with the station using a forklift truck.

4.5 Storage

Designation	Unit	Value
Footprint per station	Length	mm 800
	Width	mm 780
	Height	mm 1500
<i>Features of the storage location</i>		
Min. storage temperature	°C	+5
Max. storage temperature	°C	+30
Relative air humidity	%	25-70
Maximum height of location	m	1000 above NN

Table 4.2 Storage conditions

The teaching system can be stored as follows:

- If necessary, disamble the system into individual stations, ⇨ chapter *Disassambling and moving the system*, page 27
- Release the brakes on the castors.
- Move the station to its storage location.
- Fix the brakes on the castors.
- Protect the station from dust and moisture, use the original crate if possible.
- ✓ The station is stored.

5 Installation and commissioning

5.1 Installing the station

Pneumatic supply

- Connect the air supply house of the maintenance unit to the external air supply.
- ✓ The station is supplied with air.

Setting the pressure reducer

Note: The pressure reducer is set to 6 bar when it is delivered.

Proceed as follows to reset the pressure reducer:

- Pull the cap upwards.
- Twist the cap to set the pressure.
- Press the cap downwards.

Note: The safety eyes must be completely withdrawn to enable a resetting of the pressure.

Locking the pressure reducer

The cap of the pressure valve must be secured with a lock to prevent unauthorised adjustments to pressure.

- Press the cap downwards.
- Turn the upper annulus of the cap into the locking position.
The safety eyes are extended.
- Attach a lock to one eye and lock it.
- ✓ No unauthorised person can change the pressure settings.

5 Installation and commissioning

Electrical supply



DANGER

Dangerous voltage!

Death or serious injury if a person is struck!

➤ The power supply unit may not be powered.

➤ Check whether the terminating plug/s or terminating socket/s is/are connected to the transfer module/s.

➤ If this is not the case, plug the terminating plug/socket into the transfer module and screw tight.

✓ The emergency-stop circuit of the station is only closed once the terminating plugs/sockets are connected to the transfer modules.

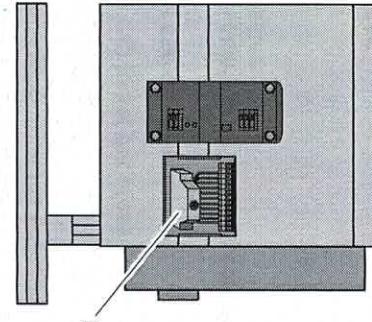


Fig. 5.1 Terminating plug on the transfer module

1. Terminating plug

➤ Check that all plug connectors are plugged in and the brackets are closed.

➤ If not, plug in the plug connectors and close the brackets.

- Check whether the plug of the power supply is plugged into the multiple socket outlet of the main switch.
If not, plug in the plug.

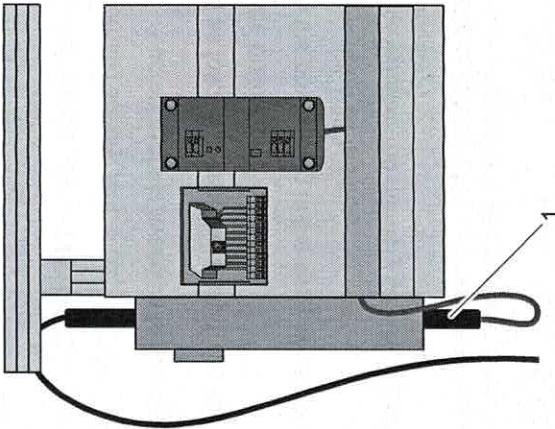


Fig. 5.2 Connecting the power supply

1. Power supply plug
- Plug the power plug of the main switch into a suitable socket (230 V / 115 V).
 - ✓ The station is supplied with electricity.

5 Installation and commissioning

5.2 Putting the station into operation

Preconditions:

- Use of the supplied PLC software
- Electrical supply: 200 – 240 V / 100 – 120 V, 50 – 60 Hz
- Pneumatic supply: Min. 6 bar

Note: A compressor is available for situations where there is no air supply.

Proceed as follows to take the station into operation:

- Fix the brakes on the castors.
- Plug the power plug of the main switch into a suitable socket (230 V / 115 V).
- Connect the air supply.
- Check whether the memory card is plugged into the PLC. Plug the memory card in if necessary.
- Turn the arm of the handling device so that it is within the highlighted semi circle (⇒ fig. 5.3 and fig. 5.4).
- ✓ The handling device is now in the movement space.

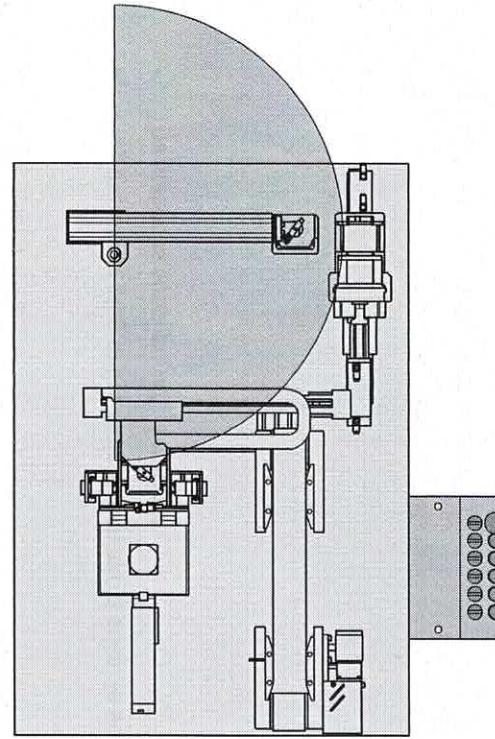


Fig. 5.3 Alignment of the handling device on the pneumatic press processing station

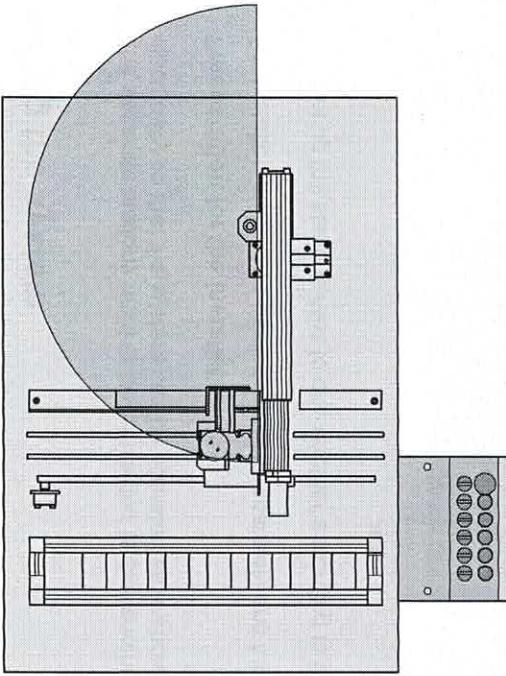


Fig. 5.4 Alignment of the handling device on the storage station

5 Installation and commissioning

5.3 Assembling the system

The separate stations have to be connected to one another mechanically, pneumatically and electrically so that the system can be operated as a whole.

Precondition for the installation:

Each station must have been operated separately and function perfectly.

- Set up the stations next to one another according to the assembly plan.

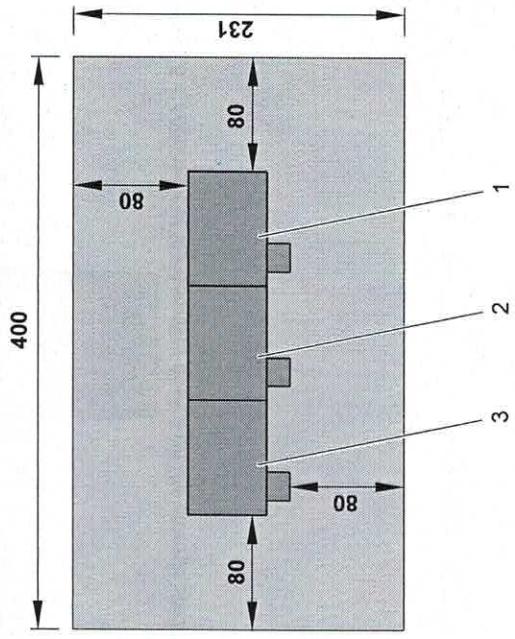


Fig. 5.5 Assembly plan for the system – accessible everywhere (units given in cm)

1. Magazine station
2. Pneumatic press processing station
3. Storage station

Mechanical connection

Precondition: The stations are next to one another.

- Remove the caps on the front and back of the connections on the profile strip.
- Press one profile connector into the groove of the profile strip for each connection.
- Close the bracket locks at the four connection points.
- Use an allen key, width 3, to fasten the two screws of the profile connector on each of the four connection points, thereby fixing the profile connector.
- ✓ The three stations are now connected to each other.

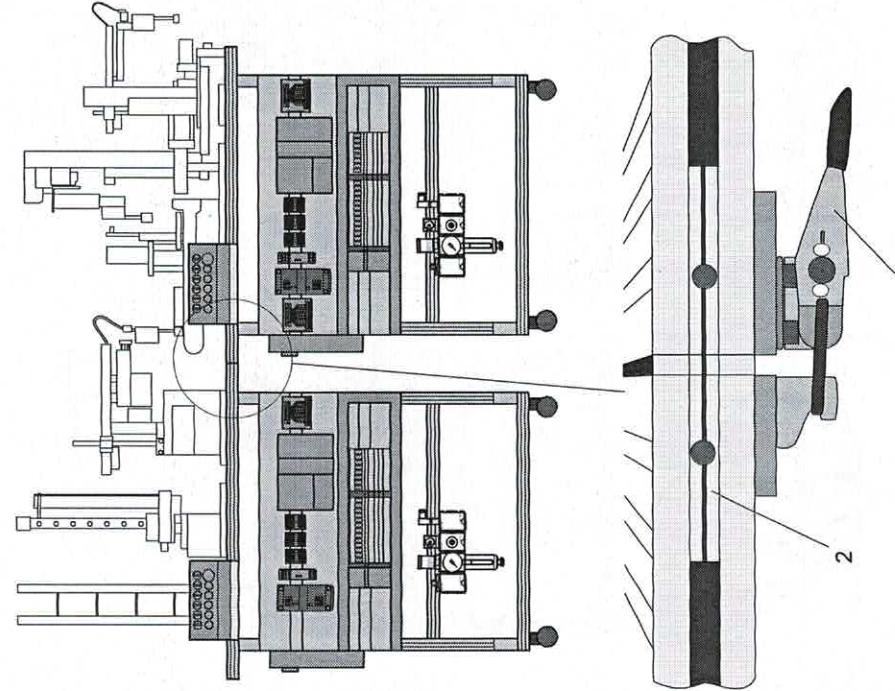


Fig. 5.6 Mechanical connection of the stations

1. Bracket lock
2. Profile connector

5 Installation and commissioning

Pneumatic supply

Precondition: The stations are next to one another.

- Put the end of the storage station's air hose into one opening of the double connection on the maintenance unit of the pneumatic press processing unit.
- Put the loose end of the pneumatic press processing unit's air hose into one of the openings of the double connection on the maintenance unit of the pneumatic press processing unit.
- Connect the loose end of the magazine station's air hose to the external air supply.
 - ✓ All three stations are supplied with air.

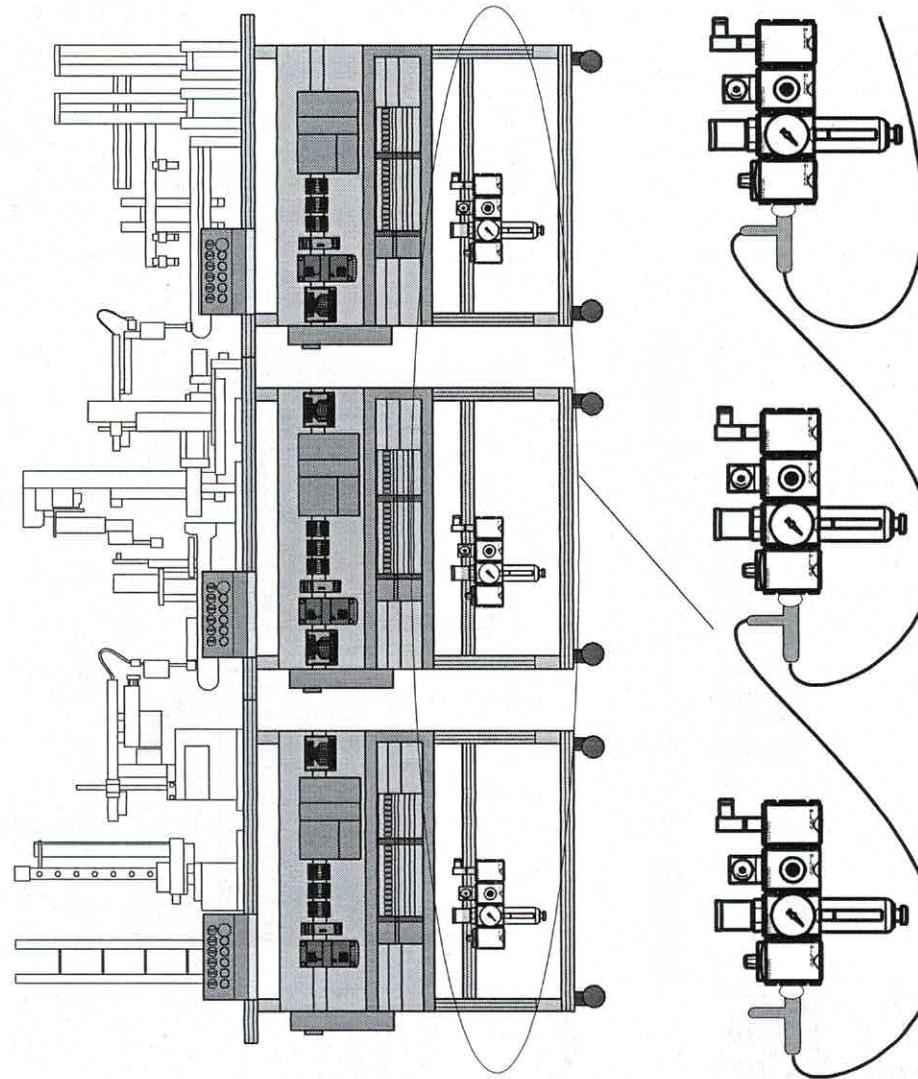


Fig. 5.7 Pneumatic connection of the stations

Electrical supply

- Remove the terminating plugs/sockets from the transfer modules of each station. To do this, release the screws and unplug the terminating plug/socket.
- Plug the D-sub plug of the connecting cable into the transfer modules of the magazine and pneumatic press processing stations and secure them.
- Plug the D-sub plug of the connecting cable into the transfer modules of the storage and pneumatic press processing stations and secure them.

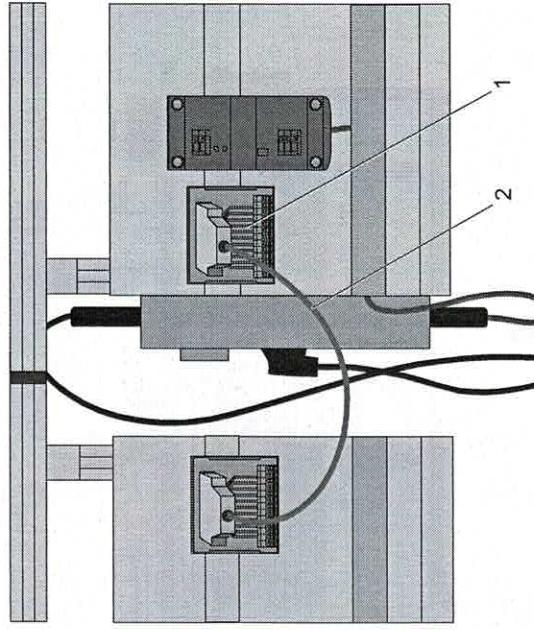


Fig. 5.8 Connector cables

- 1. Transfer module
- 2. Connector cable with D-sub plugs

5 Installation and commissioning

- Plug the mains plug of the storage station into the multiple output socket of the pneumatic press processing station.
- Plug the mains plug of the pneumatic press processing station into the multiple output socket of the magazine station.
- Plug the power plug of the magazine station into a suitable socket (230 V / 115 V).
 - ✓ The system is supplied with electricity.

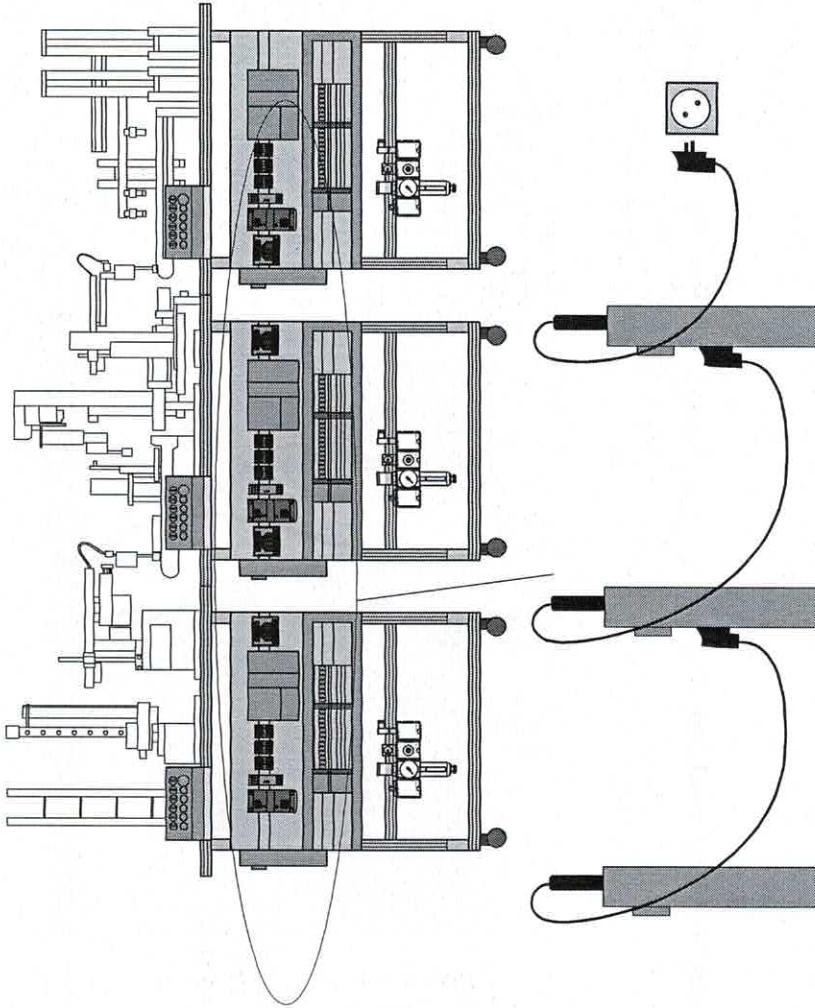


Fig. 5.9 Electrical connection of the stations

5.4 Putting the system into operation

Preconditions:

- Use of the supplied PLC software
- Electrical supply: 200 – 240 V / 100 – 120 V, 50 – 60 Hz
- Pneumatic supply: Min. 6 bar

Note: A compressor is available for situations where there is no air supply.

Proceed as follows to take the station into operation:

- Fix the brakes on the castors.
- Plug the power plug of the main switch into a suitable socket (230 V / 115 V).
- Connect the air supply.
- Check that the connecting lines are laid in a way that will not present a danger of tripping.
- Check whether the memory card is plugged into the PLC. Plug the memory card in if necessary.

The following is necessary to enable the vacuum sucker of the handling device on the pneumatic press processing and storage stations to drive to home position:

- Turn the arm of the handling device so that it is within the highlighted semi circle (⇒ chapter 5.2, page 32, fig. 5.3 and fig. 5.4).
- ✓ The handling device is in the movement space.

6 Training operation

6 Training operation

Note: All information and every procedure in this chapter refers to the PLC software supplied.

6.1 Control panel with display elements



CAUTION!

Unintended actuator movements!

There is a danger of crushing or bruising body parts!

- Label switches and buttons on the control panel with the functions assigned in teaching mode.

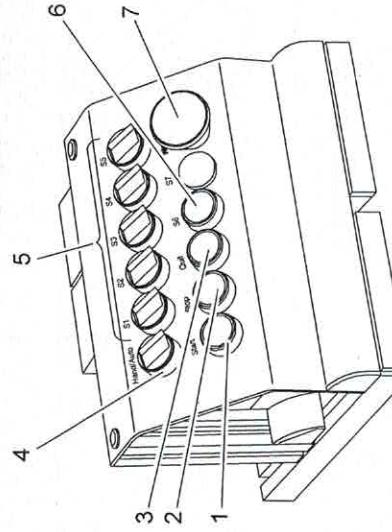


Fig. 6.1 Control panel

1. Start button
2. Stop button
3. Quit button
4. Manual/automatic selector switch
5. Knob switches S1-S5
6. S6 button
7. Emergency stop button

Operating and display element	Colour	Light	Function
<i>Manual/automatic</i> selector switch	Black	-	Manual operations, initial position and automatic operation
Knob switches S1 - S5	Black	-	Can be assigned
Know switch S2			In storage station: S2 "empty high bay racking"
Start button	Green	Flashes	Begins single steps in manual mode
		Flashes	Begins cube assembly in automatic mode
		Lights up	During an actuator action
Stop button	Red	Off	Stops the process in automatic operation
		Lights up	Process has been stopped
Quit button	Blue	Flashes	A fault has occurred
		Lights up	Fault has been acknowledged, but another fault has occurred.
S6 button	White	Flashes	Starts the reference run in the processing and storage stations
			Can be assigned for magazine station
Emergency stop button	Red	-	Activate emergency stop

Table 6.1 Operating and display elements

Operating modes

The following operating modes are available:

- Initial position
- Manual operation
- Automatic operation

The *Manual/automatic* selector switch is used to set the operating mode.

Initial position

The *Initial position* (middle position) operating mode drives all valves and electric motors into their initial positions. After that there is no further movement.

Manual operation Selector switch points to the left (Hand):
In manual operation, each process step can be carried out individually.

- Press the flashing *Start* button.
- ✓ The next step in the process is carried out, while the green button lights up.

Automatic operation Selector switch points to the right (Auto):
Automatic mode runs through the complete process, one step after the other.

Filling the pin magazine

1. Use one hand to pull the bolt at the back of the pin magazine back and
 2. Use the other hand to pull the pin magazine out of the holder.
 3. Put the pin magazine down level.
 4. Pull out the plexiglass pane.
 5. Pull the press pads of both magazines sideways until exactly one pin fits in.
 6. Push in one pin after the other.
 7. Push the plexiglass pane back once all the pins are filled in.
 8. Put the pin magazine back into the holder.
Use one hand to pull the bolt and the other to push the magazine back into the holder.
- ✓ The pin magazine is filled and ready for operation.

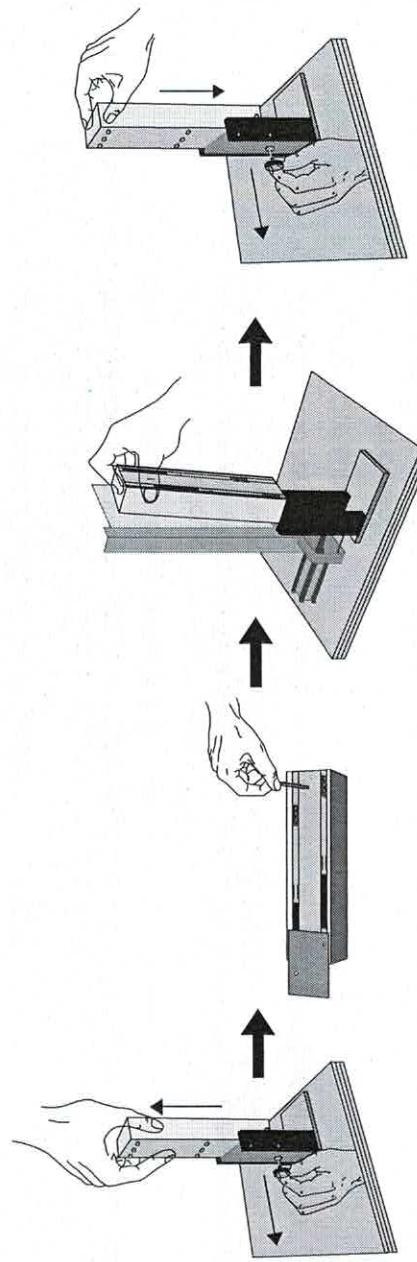


Fig. 6.2 Filling the pin magazine

6 Training operation

6.3 Switching the station on

Precondition:

- The separator magazines are filled in the magazine station (⇒ chapter 6.2, page 42).
- The pin magazine is filled in the pneumatic press processing station (⇒ chapter 6.2, page 42).
- The high bay racking is empty in the storage station.

Switching on with selector switch *Manual/automatic* in initial position

Precondition: Selector switch *Manual/automatic* is in initial position (middle position)

- Open the mechanical faucet of the air supply.
 - Check that the pressure is 6 bar.
 - Switch on the main switch.
 - ✓ The system is supplied with power and air.
 - ✓ The programmable logic controller starts up.
As soon as it is operational, the blue *Quit* button, the green *Start* button and the white *S6* button (for the pneumatic press processing and storage stations) start flashing.
 - Check that the handling device can move back freely, and turn it by hand if necessary.
 - Press the *Quit* button.
 - Press the *Start* button.
 - ✓ The emergency-stop chain is complete, all valves and the electric motor of the high bay racking move to the initial position.
 - ✓ The lights in the *Quit* and *Start* buttons go out.
 - Press the flashing *S6* button.
- Processing station, storage station
- ✓ The electrical motors of the handling device are referenced and drive to initial position.
 - ✓ The light in the *S6* button goes out.

Switching on in manual or automatic operation

Precondition: The *Manual/automatic* selector switch is on *Manual* or *Automatic*.

- Open the mechanical faucet of the air supply.
- Check that the pressure is 6 bar.
- Switch on the main switch.
- ✓ The system is supplied with power and air.
- ✓ The programmable logic controller starts up.
As soon as it is operational, the blue *Quit* button, the green *Start* button and the white *S6* button (for the pneumatic press processing and storage stations) start flashing.
- Check that the handling device can move back freely, and turn it by hand if necessary.
- Press the *Quit* button.
- Press the *Start* button.
- ✓ The emergency-stop chain is complete, all valves and the electric motor of the high bay racking move to the initial position.
- ✓ The lights in the *Quit* and *Start* buttons go out.
- Press the flashing *S6* button.
- Processing station, storage station**
 - ✓ The electrical motors of the handling device are referenced and drive to initial position.
 - ✓ The light in the *S6* button goes out.
 - ✓ The green *Start* button flashes.

6 Training operation

6.4 Operating the stations



CAUTION!

Unintended actuator movements!

There is a danger of crushing or bruising body parts!

- Set operating pressure to a maximum of 6 bar.
- Only one person may operate the station.
- The operator must ensure that nobody reaches into or works in the effective range of the actuators.

Magazine station

Station task A cube halfit is dispensed by the separator magazine, moved past the inspection unit on a conveyor belt, checked, and moved to the end of the conveyor belt if it passes the inspection.

Manual operation

Initial position: The green *Start* button flashes.

1. Press the *Start* button.
 - ✓ The first actuator is active.
The green *Start* button lights up during this action. As soon as the step is completed, it begins to flash again.
2. Press the *Start* button again for the next step.
3. Carry out steps 1 and 2 until the task of the station has been fulfilled.
 - ✓ One cube halfit is lying at the end of the conveyor belt.
4. Remove the cube halfit.
5. The green *Start* button flashes again.
5. Begin again from the start.

Automatic operation

Initial position: The green *Start* button flashes.

- Press the *Start* button.

- ✓ The process starts and runs through independently.

Note: If one of the separator magazines is empty, a fault message is generated, and the blue *Quit* button and green *Start* button flash.

If that happens

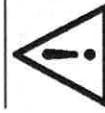
- Fill the separator magazine, ⇨ chapter 6.2, page 42.

Pneumatic press processing station

Station task The aluminium cube half is collected by the vacuum sucker of the handling device and placed on the turning unit. There the cube half is turned by 90°.

The handling device places the cube half into the pin station. There, two tension pins are inserted into the cube half. Afterwards the handling device transfers the cube half back to the turning unit where it is turned back by 90°. The handling device then transports the aluminium cube half to the pneumatic press.

A second cube half (black plastic) is collected by the handling device and placed onto the aluminium cube half in front of the press. The receiver of the press moves into the press, and both cube halves are pressed together. Once the cube has been moved out of the press, the portal transfers the cube to the conveyor belt. From there it is moved to the end of the conveyor belt.



CAUTION!

Blows from the moving axle of the handling device.

The movements of the axle of the handling device can cause blows to body parts or the face!

- Keep a safe distance from the working area of the handling device.
- Only one person may operate the station.

Manual operation

Initial position: The green *Start* button flashes.

1. Press the *Start* button.
 - ✓ The first actuator is active. The green *Start* button lights up during this action. As soon as the step is completed, it begins to flash again.
2. Press the *Start* button again for the next step.
3. Carry out steps 1 and 2 until both cube halves are lying in front of the press. Both blue buttons on the two-hand operation flash.
4. Walk around the station and press both blue buttons (two-hand operation) of the pneumatic press simultaneously. The press presses as long as you push the buttons.
5. Return to the control panel and press the *Start* button again.
6. Carry out steps 1 and 2 until the task of the station has been fulfilled.
 - ✓ You can begin a new cycle now.

Automatic operation

Initial position: The green *Start* button flashes.

- Press the *Start* button.
 - ✓ The process starts and runs through independently.

6 Training operation

Storage station

Station task A cube is collected by the handling device and transferred to the robot of the high bay racking. The robot transfers the cube to an empty space in the high bay racking.

Before you operate the storage station, you must

- empty the high bay racking.
- turn knob switch S2 *Empty high bay racking* to the right and back.
- ✓ The high bay racking detects the empty state.



CAUTION!

Twisting of hair by the turning spindle.

The rotating spindle of the high bay racking can catch long hair and twist it!

- Wear a protective cap or a hairnet when working on the high bay racking.



CAUTION!

Blows from the moving axle of the handling device.

The movements of the axle of the handling device can cause blows to body parts or the face!

- Keep a safe distance from the working area of the handling device.
- Only one person may operate the station.

Manual operation

Initial position: The green *Start* button flashes.

1. Press the *Start* button.

✓ The first actuator is active.
The green *Start* button lights up during this action. As soon as the step is completed, it begins to flash again.

2. Press the *Start* button again for the next step.
3. Carry out steps 1 and 2 until the task of the station has been fulfilled.
4. You can begin a new cycle now.

Initial position: The green *Start* button flashes.

- Automatic** ➤ Press the *Start* button.
operation ✓ The process starts and runs through independently.

- Note:** If the high bay racking is full, a fault message is generated, and the blue *Quit* button and green *Start* button flash.
- Empty the high bay racking.
 - Turn knob switch S2 *Empty high bay racking* to the right and back.
 - ✓ The high bay racking detects the *empty* state.

6.5 Switching the station off

Switching off when in automatic mode

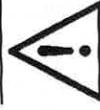
- Turn the *Manual/automatic* selector switch to initial position (middle position).
- ✓ The *Quit* and *Start* buttons flash.
- Press the *Quit* button.
- Press the *Start* button.
- ✓ All valves move to the initial position.
- ✓ No buttons are lit up.
- Switch off the main switch.
- Close the mechanical faucet of the air supply.
- ✓ The station can now be left.

Switching off when in manual mode

- Turn the *Manual/automatic* selector switch to initial position (middle position).
- ✓ The *Quit* and *Start* buttons flash.
- Press the *Quit* button.
- Press the *Start* button.
- ✓ All valves move to the initial position.
- ✓ No buttons are lit up.
- Switch off the main switch.
- Close the mechanical faucet of the air supply.
- ✓ The station can now be left.

6 Training operation

6.6 Combining the stations to a system



CAUTION!

The station can fall over.

Unintended moving of individual stations can cause reflex movements of the operator and thereby cause injuries!

- Fix the brakes of the castors when working on the stations.
 - Connect the stations to one another using the profile connectors and close the bracket locks when working on or operating the system!
-
- Put the magazine, pneumatic press processing and storage stations next to one another according to the set-up diagram ⇒ chapter 5.3, page 34.

6.7 Switching the system on

Precondition:

- The separator magazines are filled in the magazine station (⇒ chapter 6.2, page 42).
- The pin magazine is filled in the pneumatic press processing station (⇒ chapter 6.2, page 42).
- The high bay racking is empty in the storage station.

Switching on with selector switch *Manual/automatic* in initial position

Precondition: Selector switch *Manual/automatic* is in initial position (middle position)

1. Open the three mechanical faucets of the air supply.
2. Check that the pressure is 6 bar.
3. Switch on all three main switches.
 - ✓ The system is supplied with power and air.
4. Check that the handling devices can move back freely, and turn by hand if necessary.
5. Press the *Quit* button on one station.
6. Press the *Start* button on the same station.
 - ✓ The emergency-stop chain is completed.
 - ✓ The valves of all stations move to the initial position. In the storage station, the electrical motor of the high bay racking moves to initial position.

- ✓ The *Quit* buttons of all stations go out. On the first station, the *Start* button also goes out.
- 7. Press the *Start* buttons on the other two stations.
- 8. Press the flashing S6 button on the processing and storage stations.
- ✓ The electrical motors of the handling devices are referenced and drive to initial position.
- ✓ The light in the S6 buttons go out.

Switching on in manual mode

Precondition: The *Manual/Automatic* selector switch is on *Manual*

1. Open the three mechanical faucets of the air supply.
2. Check that the pressure is 6 bar.
3. Switch on all three main switches.
- ✓ The system is supplied with power and air.
- ✓ The programmable logic controller starts up.
As soon as they are operational, the blue *Quit* button, the green *Start* button and the white S6 button (for the pneumatic press processing and storage stations) start flashing on all stations.
4. Check that the handling devices can move back freely, and turn by hand if necessary.
5. Press the *Quit* button on one station.
6. Press the *Start* button on the same station.
- ✓ The emergency-stop chain is completed.
- ✓ The valves of all stations move to the initial position. In the storage station, the electrical motor of the high bay racking moves to initial position.
- ✓ The *Quit* buttons of all stations go out. On the first station, the *Start* button also goes out.
7. Press the *Start* buttons on the other two stations.
8. Press the flashing S6 button on the processing and storage stations.
- ✓ The electrical motors of the handling devices are referenced and drive to initial position.
- ✓ The light in the S6 buttons go out.
- ✓ The green *Start* button flashes on all stations.

6 Training operation

Switching on in automatic mode

Precondition: The *Manual/automatic* selector switch is on *Automatic*

1. Open the three mechanical faucets of the air supply.
2. Check that the pressure is 6 bar.
3. Switch on all three main switches.
 - ✓ The system is supplied with power and air.
 - ✓ The programmable logic controller starts up.
 - As soon as they are operational, the blue *Quit* button, the green *Start* button and the white *S6* button (for the pneumatic press processing and storage stations) start flashing on all stations.
 - 4. Check that the handling devices can move back freely, and turn by hand if necessary.
 - 5. Press the *Quit* button on one station.
 - 6. Press the *Start* button on the same station.
 - ✓ The emergency-stop chain is completed.
 - ✓ The valves of all stations move to the initial position. In the storage station, the electrical motor of the high bay racking moves to initial position.
 - ✓ The *Quit* buttons of all stations go out. On the first station, the *Start* button also goes out.
 - 7. Press the *Start* buttons on the other two stations.
 - 8. Press the flashing *S6* button on the processing and storage stations.
 - ✓ The electrical motors of the handling device are referenced and drive to initial position.
 - ✓ The light in the *S6* buttons go out.
 - ✓ The green *Start* button flashes on all stations.

6.8 Operating the system



CAUTION!

Unintended actuator movements!

There is a danger of crushing or bruising body parts!

- Set operating pressure to a maximum of 6 bar.
- Only one person may operate the station.
- The operator must ensure that nobody reaches into or works in the effective range of the actuators.

General information

- The stations are connected by the connector cables, the emergency-stop chain is closed.
- The operating mode can be set independently for each station.
- The material flow goes from the magazine station to the storage station.
- The workpiece runs through its cycle at each station. Once it has arrived at its end position, the signal goes out to the next station. The workpiece is connected by the next station and the process continues.
- If a fault occurs in a station, the *Quit* and *Start* buttons only flash on this station. Once the fault has been removed, the *Quit* and *Start* buttons must be pressed at this station to make this station ready for operation again.

Manual operation

Initial position: The green *Start* button flashes up at the station.

- Press the *Start* button on one station.
 - ✓ The first actuator is active.
 - ✓ The green *Start* button lights up during this action. As soon as the step is completed, it begins to flash again.
- Press the *Start* button again for the next step.

6 Training operation

Automatic operation

Initial position: The green *Start* button flashes up at the station.

- Press the *Start* button on **every** station.
- ✓ The process starts and runs through independently.

Stopping the process

- Press the *Stop* button.
- ✓ The process is only stopped at the station where the *Stop* button was pressed. The other stations continue their processes.
- ✓ The red *Stop* button lights up, the green *Start* button flashes.

Restarting the process

- Press the *Start* button at the station that was stopped.
- ✓ The process continues, the *Start* button lights up green.

Switching from initial position to manual operation

- Turn the *Manual/automatic* selector switch to the left, to *Manual*.
- ✓ The green *Start* button flashes.

Switching from initial position to automatic operation

- Turn the *Manual/automatic* selector switch to the right, to *Automatic*.
- ✓ The green *Start* button flashes.

Switching from manual or automatic operation to initial position

- Turn the *Manual/automatic* into the middle, to initial position.
- ✓ The green *Start* button and the blue *Quit* button flash.
- Press the *Quit* button to acknowledge.
- Press the *Start* button.
- ✓ All valves, and the electric motor in the storage station, move to initial position.

Switching from manual to automatic operation

- Turn the *Manual/automatic* selector switch from left to right, to *Automatic*.
- ✓ The green *Start* button and the blue *Quit* button flash.
- Press the *Quit* button to acknowledge.
- Press the *Start* button.
- ✓ All valves, and the electric motor in the storage station, move to initial position.
- ✓ The green *Start* button flashes.
- Press the *Start* button.
- ✓ The process starts and runs through independently.

Switching from automatic to manual operation

- Turn the *Manual/automatic* selector switch from right to left, to *Manual*.
- ✓ The green *Start* button and the blue *Quit* button flash.
- Press the *Quit* button to acknowledge.
- Press the *Start* button.
- ✓ All valves, and the electric motor in the storage station, move to initial position.
- ✓ The green *Start* button flashes.
- Press the *Start* button.
- ✓ The first actuator is active.
- ✓ The green *Start* button lights up during this action. As soon as the step is completed, it begins to flash again.
- Press the *Start* button again for the next step.

6.9 Switching the system off

Switching off when in automatic mode

- Turn the *Manual/automatic* selector switch to initial position (middle position).
- ✓ The *Quit* and *Start* buttons flash.
- Press the *Quit* button.
- Press the *Start* button.
- ✓ All valves move to the initial position.
- ✓ No buttons are lit up.
- Switch off the main switches on all three stations.
- Close the mechanical faucets for air supply on all three stations.
- ✓ The system can now be left.

6 Training operation

Switching off when in manual mode

- Turn the *Manual/automatic* selector switch to initial position (middle position).
- ✓ The *Quit* and *Start* buttons flash.
- Press the *Quit* button.
- Press the *Start* button.
- ✓ All valves move to the initial position.
- ✓ No buttons are lit up.
- Switch off the main switches on all three stations.
- Close the mechanical faucets for air supply on all three stations.
- ✓ The system can now be left.

6.10 Resetting an emergency stop

Station When the emergency-stop button has been pressed, the blue *Quit* button and the green *Start* button light up.

System When the emergency-stop button has been pressed, the blue *Quit* button and the green *Start* button light up on all stations.

Basic procedure

Proceed as follows to continue working after an emergency-stop:

1. Remove all cube halves and cubes from the stations.
2. Rectify the fault.
3. Check that the handling device can move back freely, and turn it by hand if necessary.
4. Turn the emergency-stop button and pull upwards (unlock)
5. Press the blue *Quit* button to acknowledge.
- ✓ The *Quit* button lights up.
6. Press the *Start* button.
- ✓ The *Quit* button goes out when all faults have been rectified.
- ✓ If the *Quit* button is still lit up, the fault has not been rectified.
- ✓ If the *Quit* button begins to flash again, there is another fault that must be rectified.
7. Rectify the fault and then repeat step 5.
8. Press the flashing green *Start* button.
- ✓ The emergency-stop circuit is closed again, the three LEDs (LED Power, LED CH.1 and LED CH.2) on the emergency-stop relay light up.
- ✓ The teaching system is ready for operation again.

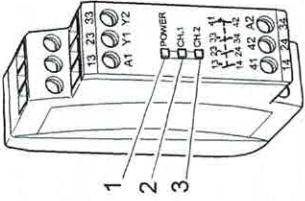


Fig. 6.3 LEDs on the emergency-stop relay

1. LED Power
2. LED CH.1 (channel 1)
3. LED CH.2 (channel 2)

Cubes in the press

There is still a cube in the press after an emergency-stop in automatic operation:

1. Remove all cube halves and other cubes from the stations.
2. Rectify the fault.
3. Turn the emergency-stop button and pull upwards (unlock).
4. Press the blue *Quit* button on the pneumatic press processing station to acknowledge the fault.
 - ✓ The *Quit* button lights up.
5. Press the *Start* button.
 - ✓ The *Quit* button goes out when all faults have been rectified.
 - ✓ If the *Quit* button is still lit up, the fault has not been rectified.
 - ✓ If the *Quit* button begins to flash again, there is another fault that must be rectified.
6. Rectify the fault and then repeat step 4.
7. Press the flashing green *Start* button on the pneumatic press processing station.
 - ✓ The receiver of the press is extended.
8. Press the emergency stop button.
9. Remove the cube from the receiver of the press.
10. Turn the emergency-stop buttons and pull upwards (unlock).
11. Press the blue *Quit* button on the pneumatic press processing station to acknowledge the fault.
12. Press the flashing green *Start* button on the pneumatic press processing station.
 - ✓ The emergency-stop circuit is closed again, the three LEDs (LED Power, LED CH.1 and LED CH.2) on the emergency-stop relay light up.
 - ✓ The teaching system is ready for operation again.

6 Training operation

After an air failure in automatic operation

An air failure, and the resulting pressure loss, will cause an emergency-stop on the teaching system. The blue *Quit* button and the green *Start* button flash on every station.

1. Remove all cube halves and cubes from the stations.
 2. Rectify the fault.
 3. Press the blue *Quit* button at one of the stations to acknowledge.
 4. Press the green *Start* button on the same station.
- ✓ The *Quit* buttons of all stations go out.
 - ✓ The emergency-stop circuit is closed again, the three LEDs (LED Power, LED CH.1 and LED CH.2) on the emergency-stop relay light up.
 - ✓ Press the *Start* buttons on the other two stations.
 - ✓ The teaching system is ready for operation again.

7 Fault rectification

Fault message If a fault occurs on the teaching system, the blue *Quit* button and the green *Start* button only light up on the station/s where the fault has occurred.

7.1 Faults

The following faults can occur:

Display	Cause	Solution
The LED CH.1 and CH.2 on the emergency-stop module do not light up.	Terminating plug/socket is not on the transfer module.	Plug the terminating plug/socket into the transfer module and screw tight.
LED on the pressure switch lights up green.	The pressure switch on the maintenance unit is displaced, the pressure is less than required.	Adapt the pressure switch to the pressure reducer.
The <i>Quit</i> and <i>Start</i> buttons flash.	The time span between the signals of two sensors is too long.	Check the process, check at the sensors whether the LED is lit up, adjust if necessary.
The <i>Quit</i> and <i>Start</i> buttons flash.	Two sensors are emitting a signal at the same time.	Check at the sensors whether the LED is lit up, adjust if necessary.
The <i>Quit</i> and <i>Start</i> buttons flash.	Sensor is wrongly adjusted outside of the work area.	Adjust the sensor.
No display possible.	Sensor is wrongly adjusted within the work area.	Adjust the sensor.
The LED of the sensor is not lit.	Sensor is defective.	Replace the sensor.
Sensors seem to react at random.	Soiled or worn conveyor belt interferes with the optical sensor.	Clean the conveyor belt or replace if necessary.
The <i>Quit</i> and <i>Start</i> buttons flash.	Separator magazine is empty.	Fill the separator magazine.
The <i>Quit</i> and <i>Start</i> buttons flash.	High bay racking is full.	Empty the high bay racking and turn knob switch S2 <i>high bay racking empty</i> to the right and back.

Table 7.1 Faults

7.2 Troubleshooting

Basic procedure

- Remove all cube halves and cubes from the stations.
- Check
 - all electrical connections for defects,
 - the pneumatic and mechanical components for defects.

Note: If faults occur that cannot be rectified by the teacher or an electrician, please contact

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trainingsystems.brs@boschrexroth.de

After trouble shooting

Once the fault has been rectified:

1. Press the *Quit* button to acknowledge.
 - ✓ The *Quit* button lights up.
2. Press the *Start* button.
 - ✓ The *Quit* button goes out when all faults have been rectified.
 - ✓ If the *Quit* button is still lit up, the fault has not been rectified.
 - ✓ If the *Quit* button begins to flash again, there is another fault that must be rectified.
3. Rectify the fault and then repeat step 1.
4. Press the flashing green *Start* button.
 - ✓ The process can be continued.

Restart after a power failure

- Remove all cube halves and cubes from the stations.
- Empty the high bay racking.
- Reconnect the power.
 - ✓ The programmable logic controller starts up.
As soon as it is operational, the blue *Quit* button, the green *Start* button and the white S6 button (for the pneumatic press processing and storage stations) start flashing.
 - chapter 6.3 *Switching the station on*, page 44 or chapter 6.7 *Switching the system on*, page 50.

8 Maintenance and inspection

8.1 Inspection plan for safety devices

The operator of the teaching system must carry out the following tests:

Safety device	What to test?	When?
Emergency stop button	Functionality	
Pressure limiting	Pressure settings	
Emergency stop chain for system operation	Functionality	Before starting work
Safety devices (Covers, protective door)	Provided according to the rules	

Table 8.1 Inspection plan for safety devices

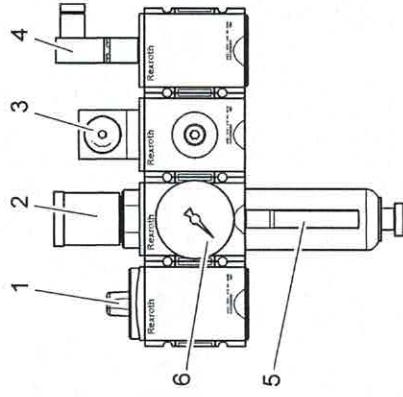


Fig. 8.1 Maintenance unit

1. Mechanical shut-off cock
2. Pressure reducer
3. Pressure switch
4. Electric valve for emergency-stop
5. Water separator
6. Display

8.3 Cleaning and care

- Clean plastic components only with a slightly damp cloth!
Use only water, and a mild cleaning agent without chemical additives if necessary. **Never use solvents or aggressive cleaning agents!**
- **Never blast the teaching system with pressurised air**, as sensors and valves of the function components could be damaged.

- Protect the teaching system from moisture and dust to avoid soiling so that it can be used for a long time.

9 Disposal

The system is made from materials that can be recycled and reused. Specialist companies can recycle this system, gain reusable materials and minimise waste material.

Dispose of the teaching system in accordance with local regulations in your country.

10 Declaration of conformity

Rexroth
Bosch Group

EC Declaration of Conformity
according to EC machinery directive 98/37/EC, Appendix II A

We hereby declare that the machine described below conforms to the applicable health and safety requirements of the EC directives, in concept and design, and as well as in the version we have brought into circulation. Any changes to the machine that have not been agreed with us will invalidate this declaration. The declaration of conformity will still apply to those parts that are not affected by these changes.

Manufacturer / Distributor:
Bosch Rexroth AG
Department: BRH / SVT 42
Maria Theresien Straße 23
97816 Lohr am Main, Germany

Machine description:
mMS Mechatronics System - Systems / Stations

Machine type / number:
TS-MMS-1X / ...

EC directives complied with:

EC low voltage directive (73/23/EEC)
 EC directive relating to electromagnetic compatibility (89/336/EEC)

Applied harmonised norms

EN 1050/1996
EN ISO 12100-1: 2003
EN ISO 12100-2: 2003

© Bosch Rexroth AG 2005

06.02.2006 
Date, signature (Michael Doll)
Bosch Rexroth AG
BRH / SVT 421

06.02.2006 
Date, signature (Helmut Endrich)
Bosch Rexroth AG
BRH / SVT 42

mMS-CE-Konformeklärung_EN.doc

Fig. 10.1 Declaration of conformity

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