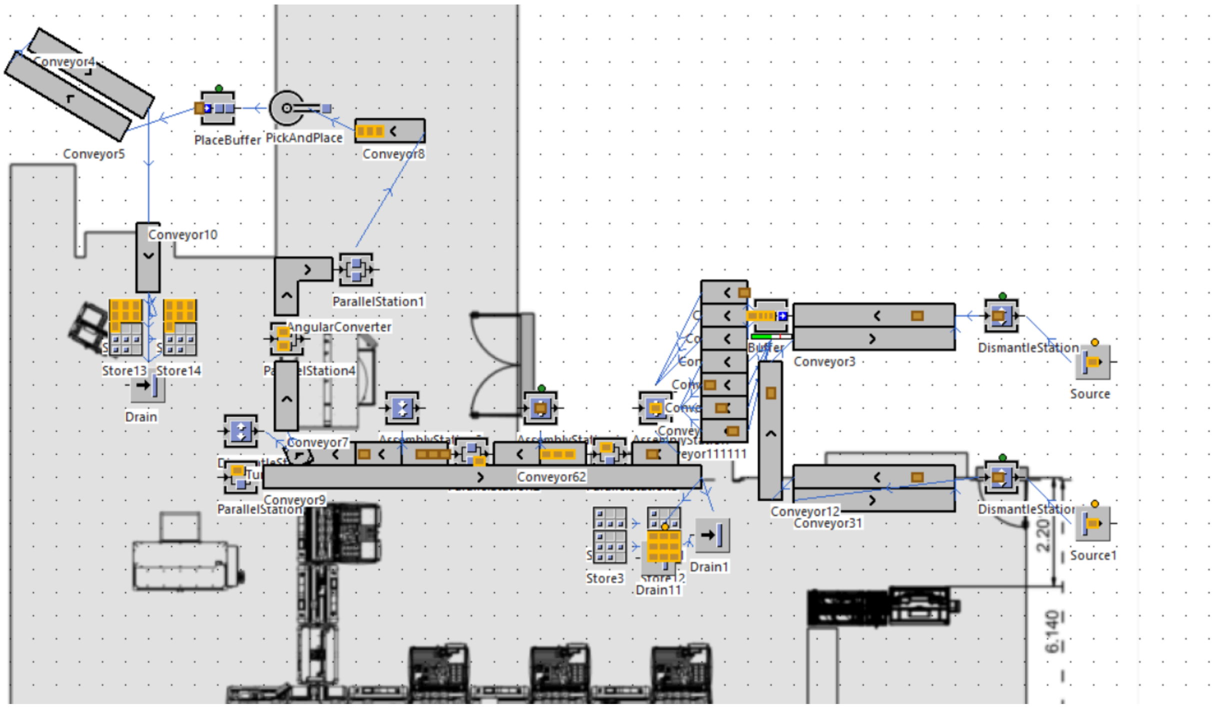
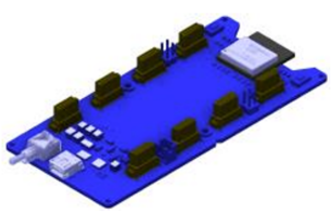
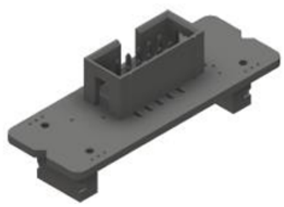
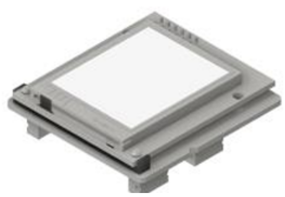
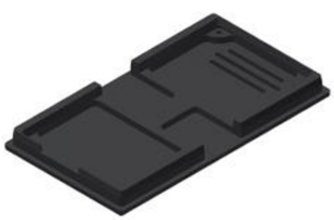
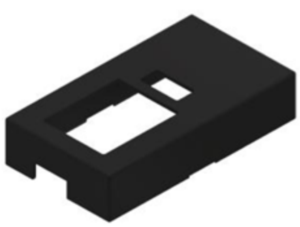


Disassembly - Reassembly concept model for circular system of the Iot factory using Siemens Tecnomatrix Plant Simulation.

Table of content

Key

Component image	Component Name	Component Identification Colour
	IoT main PCB	Blue

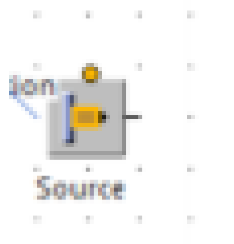
	IoT Gyroskop	Green
	IoT Weatherstation / Wettertation	Prink
	IoT analog PCB / 0-10V analog	Red
	IoT Display	Purple
	IoT back black	Orange
	IoT front black	Black

Note: In designing this simulation a free creative liberties were taken into consideration, as this model is not a direct replica of the Iot factory.

Structure of the Model of the Iot Factory

The Source

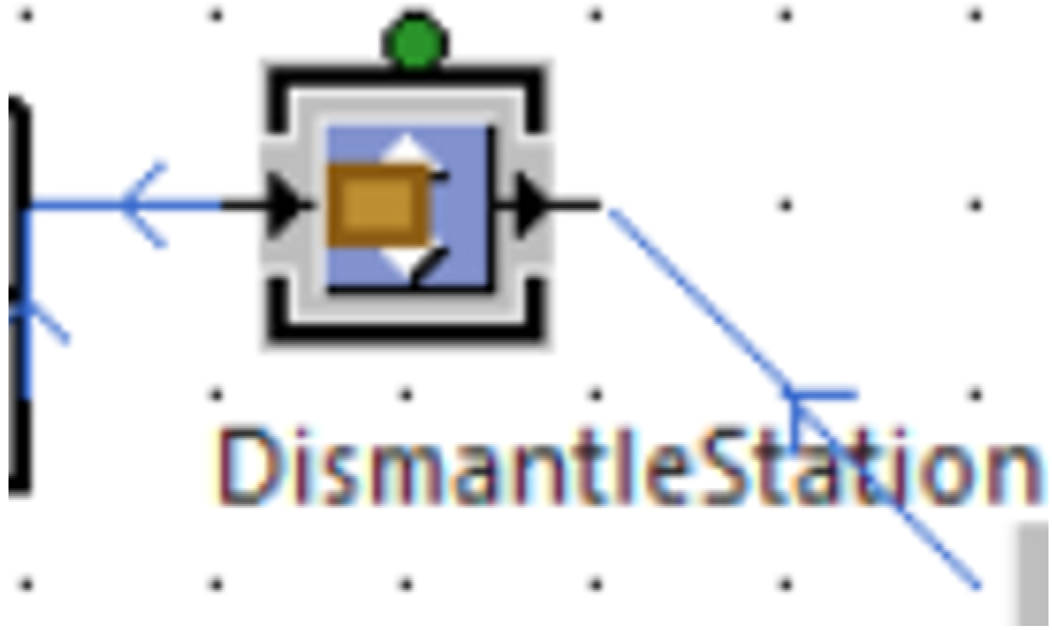
The structure begins with a source.



The source simply represents products which customers have returned. This source is directly connected to the Human testing and dismantling station.

The DIsmantling Station (Human testing , sorting)

The dismantling station contains storage units and testing used to determine if components are functional or have incurred damages. It also represents where returned or end-of-life products are **disassembled into reusable components**. It plays a crucial role in the circular economy model by enabling material recovery and component reuse.



The table receives products from the **Human Testing Station** or directly from the **Source**, Each product entering the dismantling table undergoes a **disassembly process**, where it is broken down into its constituent parts. The process time of the station is obtained from real Iot factory data giving a near accurate representation of the IOT factory human assisted disassembly process . Due to the Human assisted nature of the dismantling process, the model was designed to simulate this behavior, causing the dismantling process to only work when a human operator is present. From the dismantling station the component moves into a conveyor belt consisting of multiple sensors which in turn trigger the distributed and storage components to be released,sorted , retested and placed into the assembly station.

Process Flow: Source → Human Testing → Dismantling → Sorting → Reassembly

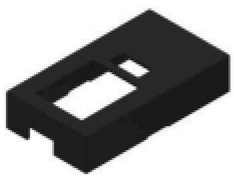
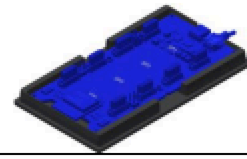
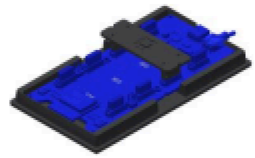
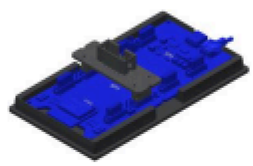
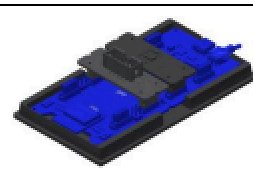
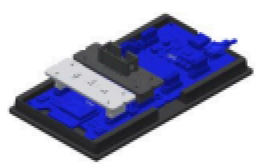
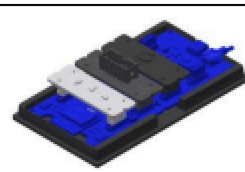
Stage	Function	Key Simulation Behavior
1 Source	Represents the entry point for returned or end-of-life products.	Products are generated and sent to the Human Testing Station for evaluation.
2 Human Testing Station	Checks product condition and determines if dismantling is required.	Uses decision logic to route items either for reuse or dismantling.

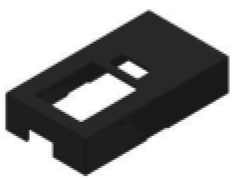
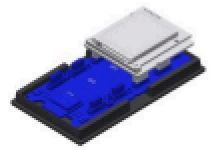
3️⃣ Dismantling Table	Disassembles products into components.	Operates only when a human operator is present; process time is based on real factory data.
4️⃣ Sorting Conveyor	Transfers dismantled components to appropriate destinations	Sensors trigger sorting logic — reusable parts go to storage, defective ones to disposal.
5️⃣ Reassembly Station	Reuses recovered components in new product builds.	integrating dismantled parts back into production.

The Assembly line(Assembly stations, Testing station, label printing stations)

This line begins as the first assembly station.The Assembly Station represents the core of the production process where individual components are joined together to form a complete product.The station is modeled as **Assembly object** with multiple input connectors .The components are assembled together as demonstrated below;

Varianten

IoT front	Bezeichnung	Platine bestückt mit	Bezeichnung
	Front black PNo. 831		Variante 1 Steckplatz 1: leer Steckplatz 2: leer Steckplatz 3: leer Steckplatz 4: leer
			Variante 2 Steckplatz 1: leer Steckplatz 2: Gyroskop Steckplatz 3: leer Steckplatz 4: leer
			Variante 3 Steckplatz 1: leer Steckplatz 2: leer Steckplatz 3: leer Steckplatz 4: Wetterstation
			Variante 4 Steckplatz 1: leer Steckplatz 2: Gyroskop Steckplatz 3: leer Steckplatz 4: Wetterstation
			Variante 5 Steckplatz 1: leer Steckplatz 2: leer Steckplatz 3: 0-10V / Analog Steckplatz 4: leer
			Variante 6 Steckplatz 1: leer Steckplatz 2: Gyroskop Steckplatz 3: 0-10V / Analog Steckplatz 4: leer
			Variante 7 Steckplatz 1: leer Steckplatz 2: leer Steckplatz 3: 0-10V / Analog Steckplatz 4: Wetterstation
			Variante 8 Steckplatz 1: leer Steckplatz 2: Gyroskop Steckplatz 3: 0-10V / Analog Steckplatz 4: Wetterstation

IoT front	Bezeichnung	Platine bestückt mit	Bezeichnung
	Front black PNo. 831		Variante 9 Steckplatz 1+2: Display Steckplatz 3: leer Steckplatz 4: leer
			Variante 10 Steckplatz 1+2: Display Steckplatz 3: leer Steckplatz 4: Gyroskop
			Variante 11 Steckplatz 1+2: Display Steckplatz 3: leer Steckplatz 4: Wetterstation
			Variante 12 Steckplatz 1+2: Display Steckplatz 3: Gyroskop Steckplatz 4: Wetterstation
			Variante 13 Steckplatz 1+2: Display Steckplatz 3: 0-10V / Analog Steckplatz 4: leer
			Variante 14 Steckplatz 1+2: Display Steckplatz 3: 0-10V / Analog Steckplatz 4: Gyroskop
			Variante 15 Steckplatz 1+2: Display Steckplatz 3: 0-10V / Analog Steckplatz 4: Wetterstation

Based on the diagram above each component is placed to its respective position on the PCB with careful precision by the robot arm. The time taken for each process is obtained from real world factory data. From the obtained factory data it can be determined that the assembly process is above or equal 98.04% accurate with a minimal margin for error .The station’s efficiency is measured by utilization rate, throughput, and accuracy percentage .

Testing Stations

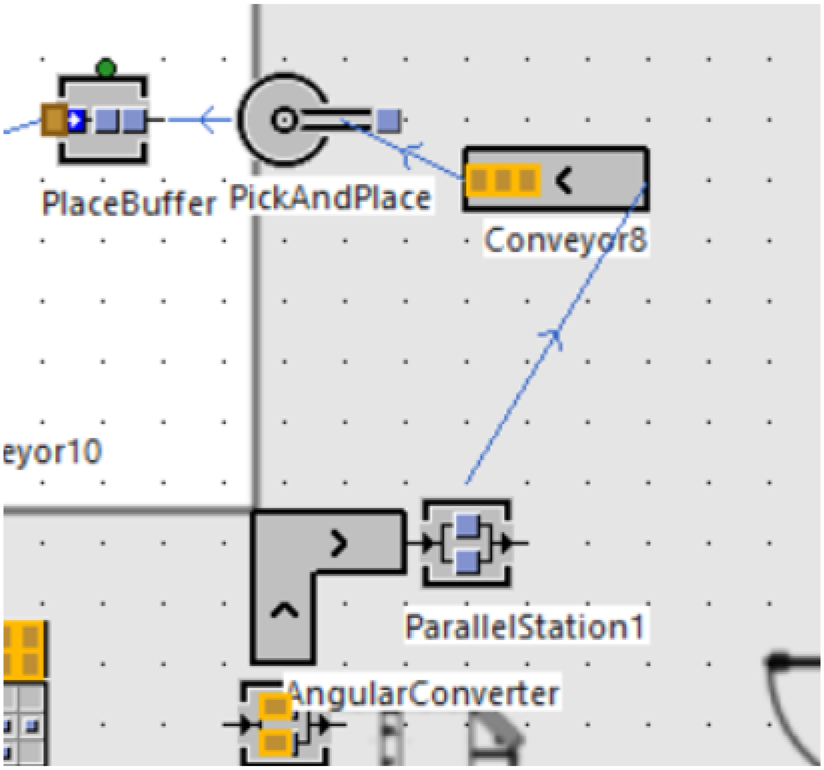
The **Testing Station** is the quality assurance point of the production line. It ensures that every assembled product meets the required functional and performance standards before being released to the label printing station. After the assembly station the product is sent to multiple testing stations along the assembly line. Each testing station is designed to test alignment of component , functionality of component, and component damage. The entire process is represented below

Stage	Description	Flow Direction
1️⃣ Input – Components from Dismantling & Sorting Stations	Reusable parts and new materials arrive at the assembly station. Each component carries attributes like type, variant, and position.	Sends components to Assembly Station
2️⃣ Assembly Station	The robot arm assembles components onto the PCB according to variant type. Sensors ensure correct placement and alignment	Sends products to Quality Check
3️⃣ Quality Check Station	Sensors and control logic verify assembly accuracy (≥ 98.04 %). Data is logged for performance analysis.	Sends products to Output
4️⃣ Output	Assembled products are transferred to label printing station ; damaged products are sent to disassembly	Sends products to label printing station / Sends products to be disassembly

Label printing station

The **Label Printing Station** represents the final identification step in the production process. It ensures that each tested and approved product receives a **unique label** containing essential information for tracking, logistics, and quality assurance.Each product carries attributes such as variant type, serial number, and test results.This station ürints and applies a label that includes:
Product name and variant
Unique serial or batch number
Quality status (e.g., “Passed” or “Repaired”)
Date and time of production
QR or Data Matrix code for digital traceability

The printing process is triggered automatically once the product passes the test station's output control.This station also records data on **label accuracy** and **cycle time**.Below are visual aids to represent this process,



Storage

With the help of the factory boxes and AGVs Storage is achieved as the product is placed into the boxes and transported to the High-Bay warehouse for boxes.

High-Bay Warehouse for Boxes

The High-Bay Warehouse for Boxes consists of a base frame into which an X/Z-handling unit and the rack structure for the storage compartments are mounted. Attached to the handling unit is a telescopic arm that can pick up a box. The rack is designed with compartments that can hold 20 boxes.

The compartments are monitored by horizontal sensors. These sensors ensure that the handling unit only moves when the boxes are fully inserted into their positions. In addition, an ultrasonic sensor on the telescopic arm detects whether the respective storage compartment is occupied or empty during loading and unloading. The occupancy of compartments and boxes is managed exclusively in the software (PLC/MES).

Storage Process

During a storage process, a box is transported via the infeed conveyor onto the handling unit and then positioned at the storage location with a Z-offset.
The telescopic arm extends using a pneumatic cylinder and inserts the box into the storage compartment.
The two-lane conveyor inside the compartment is activated and pushes the box into place.The telescopic arm is then lowered so the box rests on the compartment's roller track, and finally the arm retracts.

Retrieval Process

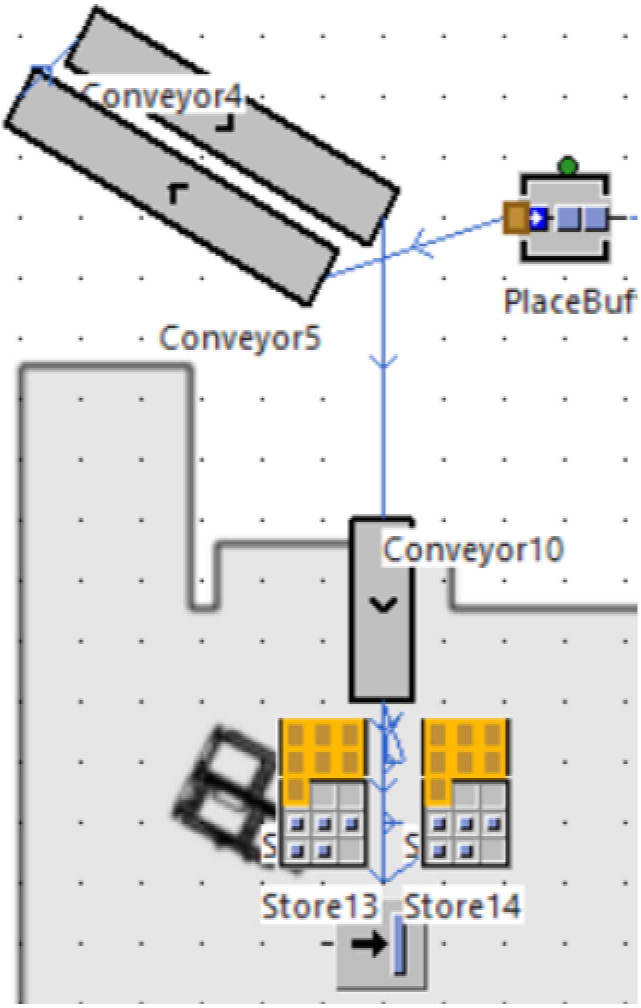
During retrieval, the above sequence is performed in reverse order.The box is pushed out via the outfeed conveyor.

RFID Identification

All boxes are equipped with an RFID tag containing the box ID.
Both the telescopic arm and the infeed conveyor are equipped with RFID readers that read this ID.
This identification system is a key element of the CP Factory system.All order-related data can be viewed and managed in the MES based on this box ID.

Additional Features

The station includes an operator panel as well as a control function on the control cabinet.
Optionally, the station can be equipped with an energy recovery system.
Below are visual aids to represent this process,


Conveyor4
PlaceBuf
Conveyor5
Conveyor10
Store13
Store14

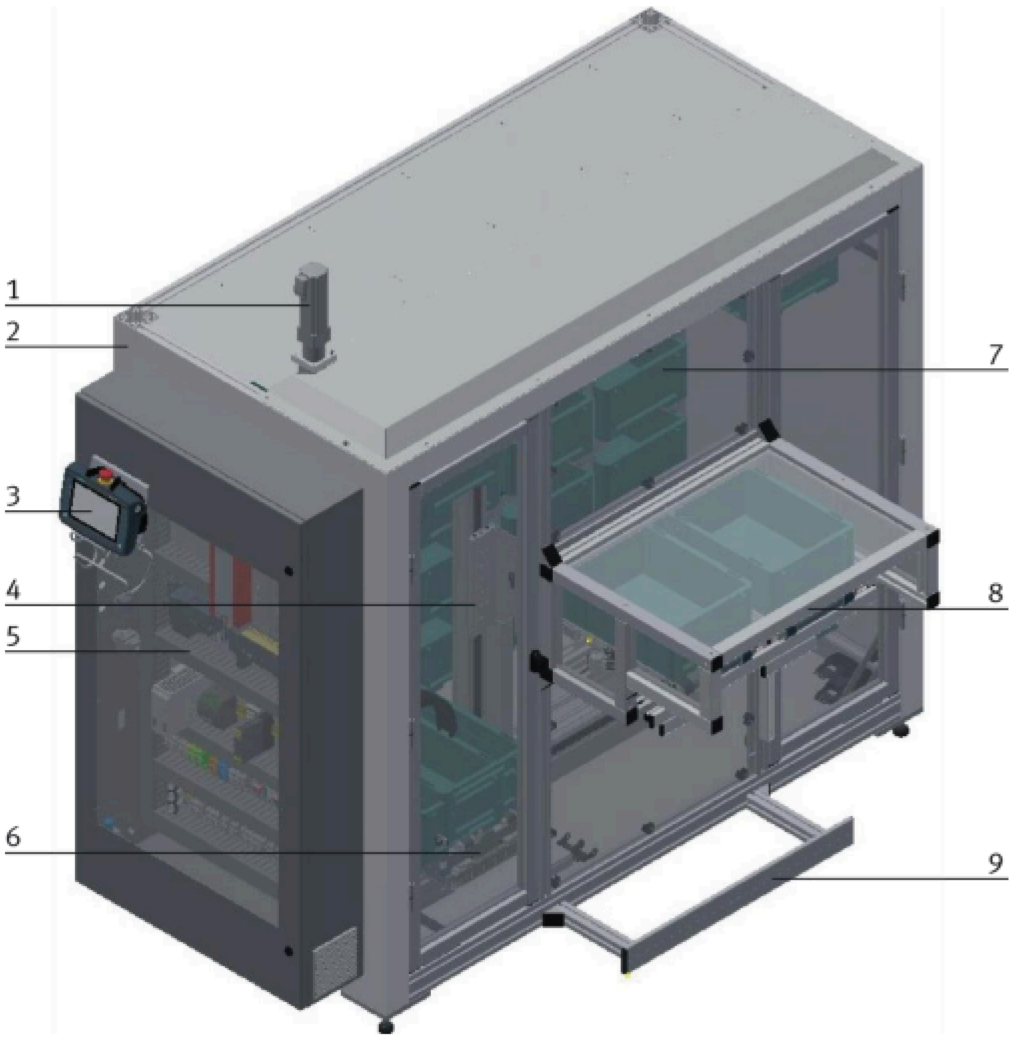
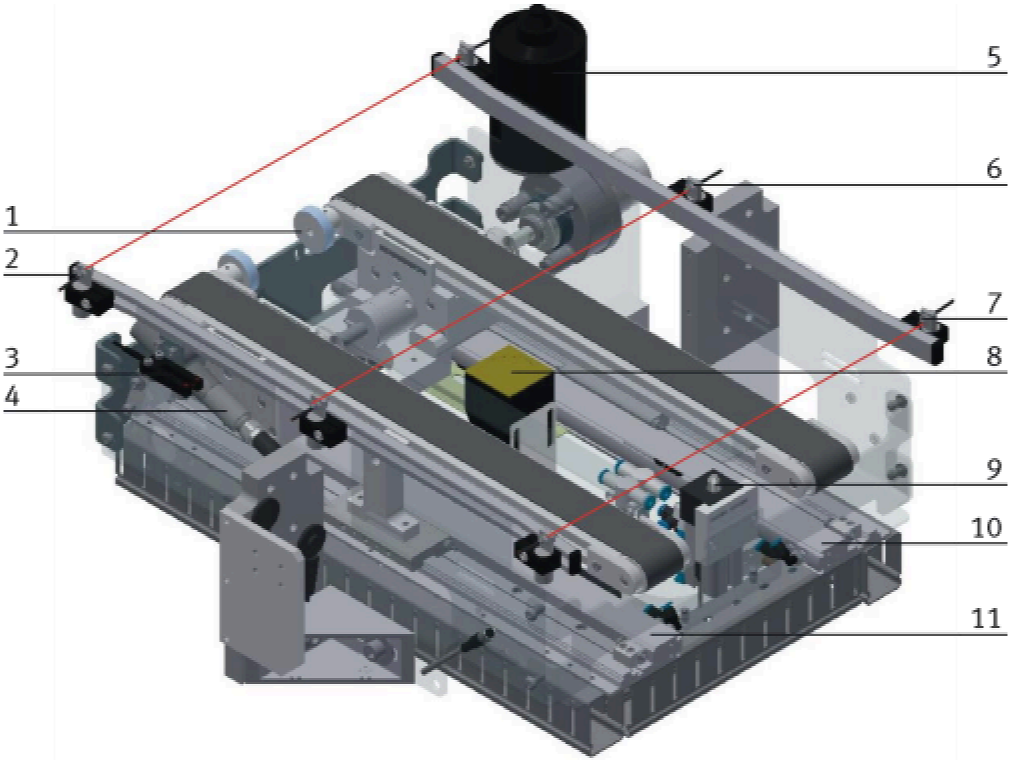


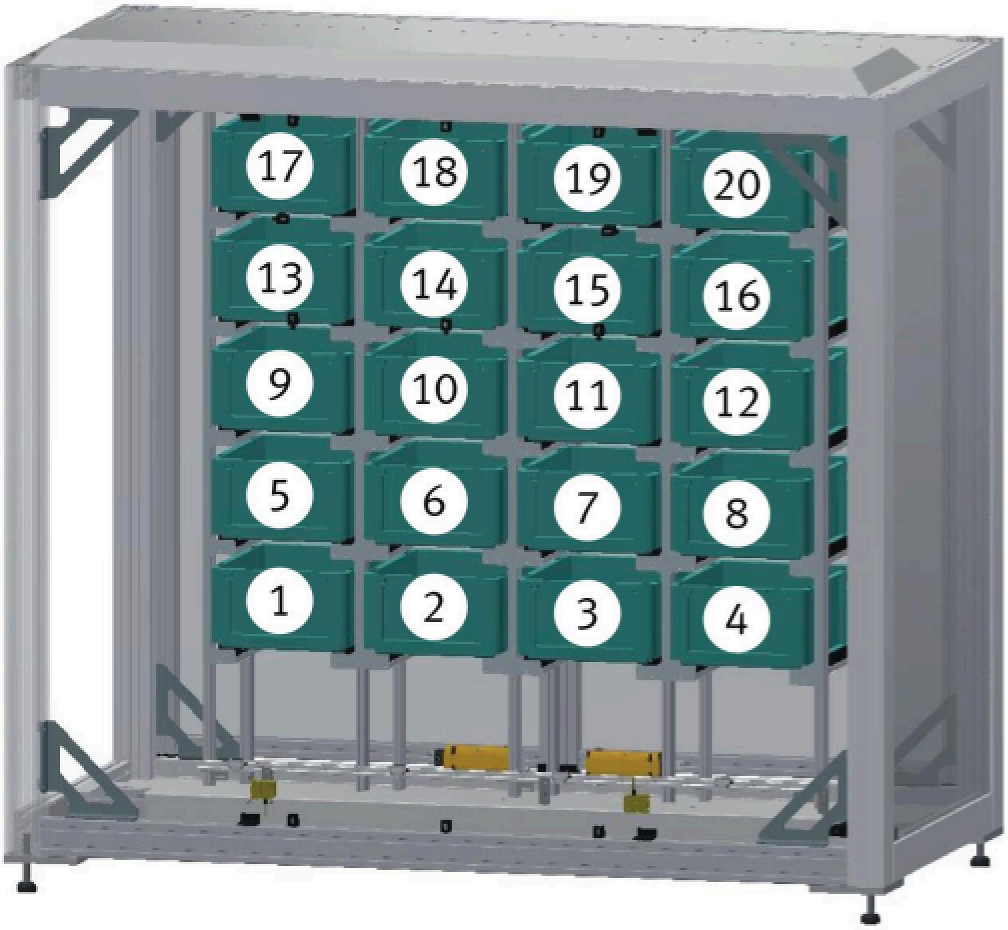
Abbildung ähnlich

Position	Beschreibung
1	Motor x-Achse
2	Grundgestell
3	Bedienpanel
4	Z-Achse / Handling
5	Schaltschrank
6	Teleskop
7	Lagerfach mit Kiste
8	Übergabeeinheit für Robotino
9	Führung für Robotino



Transportband / Abbildung ähnlich

Pos	Beschreibung	Bestellbezeichnung	Bestellnummer	BMK
1	Treibrolle			
2	Sensor Kiste steht bei Seite Lagerfächer über	SOEZ-LLK-SE-2,0-M4	165360	BG37
3	Sensor 1= Schaltleiste Z-Achse in Position	SOOC-TB-P-C5-2-R10	552828	BG38
4	Ultraschallsensor Kiste im Lagerfach vorhanden	UM18-60-250-CD-HP	690-51541	BG33
5	Getriebemotor		097-117	MA1
6	Sensor Kiste ist auf Teleskop	SOEZ-LLK-SE-2,0-M4	165360	BG36
7	Sensor Kiste steht bei Seite Docking über	SOEZ-LLK-SE-2,0-M4	165360	BG35
8	Turck RFID Schreib-Lesekopf	TN-CK40-H1147		TF2
9	Zylinder – Stopper Sensor Stopper ist unten	AEVUZ-16-10-P-A SMT-8M-A-PS-24V-E-0,3-M8D	157212 574334	 BG34
10	Zylinder Teleskop	SLG-12-300-YSR-A	187855	
11	Zylinder Teleskop Sensor Teleskop ist in Lagerfach gefahren Sensor Teleskop ist in Grundstellung	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



Lagerfächer Hochregallager für Kisten / Abbildung ähnlich