C93112 MPS®TS Compact Trainer I4.0



MPS transfer system

On the way to Industry 4.0

Workbook



Festo Didactic Workbook EN 03/2017 R0.7

Order number: C93112 (FE.TW.OOXX) Revision level: 03/2017 Author: Jürgen Helmich, Adiro Layout: 10/2015, Frank Ebel

© Festo Didactic SE, Rechbergstr. 3, D-73770 Denkendorf, Germany, 2016

 \mathbf{X}

2 +49 711 3467-0 +49 711 34754-88500

www.festo-didactic.com did@de.festo.com

Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte vorbehalten, insbesondere das Recht, Patent-, Gebrauchsmuster- oder Geschmacksmusteranmeldungen durchzuführen.

Reproduction, distribution and utilization of this document, as well as the communication of its contents to others without explicit authorization, is prohibited. Offenders will be held liable for damages. All rights reserved, in particular the right to file patent, utility model and registered design applications.

Sin nuestra expresa autorización, queda terminantemente prohibida la reproducción total o parcial de este documento, así como su uso indebido y/o su exhibición o comunicación a terceros. De los infractores se exigirá el correspondiente resarcimiento de daños y perjuicios. Reservados todos los derechos, en especial los de patentes, de modelos registrados y estéticos.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sont interdites, sauf autorisation écrite expresse. Tout manquement à cette règle expose son auteur au versement de dommages et intérêts. Tous nos droits sont réservés, notamment pour le cas de l'attribution d'un brevet ou celui de l'enregistrement d'un modèle d'utilité.

Table of Contents

1 General prerequisites for operating the devices	5
2 Pictograms	6
3 Use for intended purpose	6
4 For your safety	7
4.1 Important information	7
4.2 Obligations of the operating company	7
4.3 Obligations of the trainees	7
4.4 Dangers associated with the modular production system	7
4.5 Working safely	8
5 Technical data	11
5.1 General data	11
6 Transport, unpacking, scope of delivery	12
6.1 Transport	12
6.2 Unpacking	12
6.3 Scope of delivery	12
7 Layout and function	13
7.1 The MPS® TS Compact Trainer I4.0	13
7.2 Production scenario	14
7.2.1 Process sequence	15
7.2.2 The intelligent workpiece	15
7.2.3 Order entry	16
7.3 The transfer system	16
7.4 The drilling module	17
7.5 The insertion module	18
7.6 The pick-by-light manual workstation module	19
7.7 Raspberry Pi single-board computer data center	20
7.8 Automation network	21
7.9 Software tools	22
8 Commissioning	23
Exercise 1: Commissioning report	24
Exercise2: Establishing connections	25
Exercise 3: Commissioning and loading S71512SP-1F and KTP400 controller hardware	28
Exercise 4: Commissioning and loading the KTP400	33
Exercise4: Assigning a Profinet IO device name for ET200SP IM155-6	37
Exercise 5: Loading the "manual workstation" sample project to the LOGO!8 mini control system	43
Exercise 6: Configuring the IP address and measured value display at the DC wattmeter	47
Exercise 7: Configuring the IO-Link communication module and the RFID readers	48
Exercise 8: Restoring the operating system of the Raspberry Pi single-board computer	54
Exercise 9: Remote controlling the Raspberry Pi single-board computer	55
Exercise 10: Localizing the Raspberry Pi single-board computer	56
9 Production process: getting started	59
Exercise 1: Order entry	60
Exercise 2: Starting the demo sequence	67
Exercise 3: Starting a production work order	69

Exercise 4: Using the data center	72
10 Maintenance and care	77
11 Additional information and updates	77

1 General prerequisites for operating the devices

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 within, and one outside of the laboratory or classroom.
- The laboratory or classroom must be secured so that operating voltage and compressed air supply cannot be activated by any unauthorized persons, for example with:
 - A key switch
 - Lockable on-off valves
- The laboratory or classroom must be protected by residual current devices (RCDs).
 - Type B residual current circuit breakers with a residual current of ≤ 30 mA
- The laboratory or classroom must be protected by overcurrent protection devices.
 - Fuses or circuit breakers
- 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.
- No damaged or defective devices may be used.
 - Damaged devices must be barred from further use and removed from the laboratory or classroom.

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 cables and devices must not be exceeded.
 - Always compare the current ratings of the device, the cable and the fuse.
 - In the event that these are not the same, use a separate upstream fuse in order to provide appropriate overcurrent protection.
- Devices with an earth terminal must always be grounded.
 - If an earth connection (green-yellow laboratory socket) is available, it must always be connected to protective earth. Protective earth must always be connected first (before voltage), and must always be disconnected last (after voltage).
- The device is not equipped with an integrated fuse unless otherwise specified in the technical data.

2 Pictograms

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



Warning

This pictogram indicates that non-observance may result in serious personal injury or damage to property

3 Use for intended purpose

The stations of the modular production system may only be used:

- For their intended purpose in teaching and training applications
- When their safety functions are in flawless condition

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

The learning system from Festo Didactic has been developed and manufactured exclusively for training and vocational education in the field of automation and technology. The training company and/or instructors must ensure that all trainees observe the safety precautions described in this workbook.

Festo Didactic hereby excludes any and all liability for damages suffered by trainees, the training company and/or any third parties, which occur during use of the equipment sets 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.

4 For your safety

4.1 Important information

Fundamental prerequisites for safe use and trouble-free operation of the MPS[®] include knowledge of basic safety precautions and safety regulations. This manual includes the most important instructions for safe use of the MPS[®].

In particular the safety precautions must be adhered to by all persons who work with the MPS[®]. Beyond this, all pertinent accident prevention rules and regulations which are applicable at the respective location of use must be adhered to.

4.2 Obligations of the operating company

The operating company undertakes to allow only those persons to work with the MPS[®] who:

- Are familiar with the basic regulations regarding work safety and accident prevention and have been instructed in the use of the MPS[®]
- Have read and understood the section concerning safety and the safety precautions

Personnel should be tested at regular intervals for safety-conscious work habits.

4.3 Obligations of the trainees

All persons who have been entrusted to work with the MPS[®] undertake to complete the following steps before beginning work:

- Read the section concerning safety and the safety precautions in this manual
- Familiarize themselves with the basic regulations regarding work safety and accident prevention

4.4 Dangers associated with the modular production system

The MPS[®] has been manufactured in accordance with the latest technology and recognized safety rules. Nevertheless, life and limb of the user and third parties may be endangered, and the machine or other property may be damaged during its use.

The MPS[®] may only be used:

- For its intended purpose
- When its safety functions are in flawless condition



Faults which may impair safety must be eliminated immediately!

4.5 Working safely

General

- Trainees should only work with the training device under the supervision of a trainer.
- Electrical devices (e.g. power packs, compressors and hydraulic units) may only be operated in training rooms which are equipped with residual current devices (RCDs).
- Observe specifications included in the technical data for the individual components, and in particular all safety instructions!
- Faults which may impair safety must not be generated in the training environment and must be eliminated immediately.
- Wear personal safety gear (safety glasses, safety shoes) when working on circuits.

Mechanical safety

- Switch off the power supply!
 - Switch off working and control power before working on the training device.
 - Only reach into the setup when it's at a complete standstill.
 - Be aware of potential overtravel times for the drives.
- Mount all of the components securely to the slotted profile plate.
- Make sure that limit valves are not actuated from the front.
- Danger of injury during troubleshooting!
 - Use a tool to actuate the limit switches, for example a screwdriver.
- Set all components up so that activation of switches and disconnectors is not made difficult.
- Adhere to the instructions regarding positioning of the components.

Electrical safety

- Disconnect from all sources of electrical power!
 - Switch off the power supply before working on the training device.
 - Please note that electrical energy may be stored in individual components.
 Further information on this issue is available in the data sheets and operating instructions included with the components.
- Use only extra-low voltage: maximum 24 V DC.
- Establishing and disconnecting electrical connections
 - Electrical connections may only be established in the absence of voltage.
 - Electrical connections may only be interrupted in the absence of voltage.
- Maximum permissible current loads for cables and devices must not be exceeded.
 - Always compare the current ratings of the device, the cable and the fuse.
 - In the event that these are not the same, use a separate upstream fuse in order to provide appropriate overcurrent protection.
- Only use connecting cables with safety plugs for electrical connections.
- When laying connecting cables, make sure they are not kinked or pinched.
- 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 an earth terminal must always be grounded.
 - If an earth connection (green-yellow laboratory socket) is available, it must always be connected to protective earth. Protective earth must always be connected first (before voltage), and must always be disconnected last (after voltage).
 - Some devices have high leakage current. These devices must be additionally grounded with a protective conductor.
- The device is not equipped with an integrated fuse unless otherwise specified in the technical data.
- Only pull the safety plugs when disconnecting connecting cables never pull the cable.

Pneumatic safety

- Depressurize the system!
 - Switch off the compressed air supply before working on the training device.
 - Check the system with pressure gauges to make sure that the training device is fully depressurized.
 - Please note that energy may be stored in air reservoirs.
 Further information on this issue is available in the data sheets and operating instructions included with the components.
- Do not exceed the maximum permissible pressure of 6 bar (600 kPa).
- Do not activate compressed air until all of the tubing connections have been completed and secured.
- Do not disconnect tubing while under pressure.
- Do not attempt to connect tubing or push-in connectors with your hands or fingers.
- Danger of injury when switching compressed air on! 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 over the entire stroke range.
 - Make sure that the piston rod cannot collide with any rigid components of the setup.
- Danger of accident due to tubing slipping off!
 - Use shortest possible tubing connections.
 - In the event that tubing slips off:
 - Switch off the compressed air supply immediately.
- Pneumatic circuit setup: Connect the devices with plastic tubing with an outside diameter of 4 or 6 mm. Push the tubing into the push-in connector as far as it will go.
- Switch compressed air supply off before dismantling the circuit.
- Pneumatic circuit dismantling Press the blue release ring down, after which the tubing can be pulled out.
- Noise due to escaping compressed air
 - Noise caused by escaping compressed air may damage your hearing. Reduce the noise by using silencers, or wear hearing protection if the noise cannot be avoided.
 - All of the exhaust ports for the components included in the equipment set are equipped with silencers.

Do not remove these silencers.

5 Technical data

5.1 General data

Parameter	Value
Operating pressure	600 kPa (6 bar)
Operating voltage	24 V DC, 4.5 A
Main controller: S7-CPU1512SP-1PN	
Digital inputs/outputs Inputs: 4 Outputs: 5 IO-Link	Max. 24 V DC Max. 2 A per output Max. 4 A total
Inputs: 2	RFID reader: Siemens RF240R
Drilling module ET200SP Profinet IO device Digital inputs/outputs Inputs: 3 Outputs: 3	Max. 24 V DC Max. 2 A per output Max. 4 A total
Insertion module ET200SP Profinet IO device Digital inputs/outputs Inputs: 7 Outputs: 6	Max. 24 V DC Max. 2 A per output Max. 4 A total
Pick-by-light module – manual workstation LOGO!8 Ethernet device Digital inputs/outputs Inputs: 5 Outputs: 4	Max. 24 V DC Relay outputs
KTP400 display and control unit	Image size: 480 x 272 pixels 64,000 colors, 4 function keys
Industrial Ethernet switch: SCALANCE XB005, unmanaged	5 ports with RJ45 sockets Transmission speed:10 Mbit/s, 100 Mbit/s
DC wattmeter (power meter)	Max. measuring voltage: 30 V DC Max. measuring current: 5 A (can be switched to 2.5 A) Ethernet TCP, V4, configuration via web interface
Raspberry Pi2 data center, single-board computer in top-hat rail mount housing with voltage transformer: 24 to 5 V DC for micro USB connection Broadcom BCM2836 chip ARM Cortex-A7 processor, 4 x 900 MHz Dual-core VideoCore IV Multimedia co-processor with OpenGL ES 2.0 OpenVG, 1080p30 h.264 high-profile decoder	1 GB RAM Video outputs: HDMI TM Audio Output: 3.5 mm jack, HDMI TM 8 GB micro SD memory card 10/100 Ethernet RJ45 on-board 4 x USB 2.0
Electrical connection	Direct wiring of sensors and actuators Distributed periphery via Ethernet/Profinet
Pneumatic connection	Plastic tubing with 6 mm outside diameter
Compressed air consumption at 600 kPa (continuous cycle)	3 l/min.
Dimensions (W x D x H)	700 x 400 x 635 mm
Weight	24 kg
Subject to change	

6 Transport, unpacking, scope of delivery

6.1 Transport

MPS[®] stations are delivered in a crate on a pallet base.

The crate may only be transported with a suitable pallet jack or forklift. The crate must be secured against tipping over and falling.

The freight forwarder and Festo Didactic must be notified of any transport damage without delay.

6.2 Unpacking

Carefully remove the padding material from the crate when unpacking the station. When unpacking the station, make sure that none of the station assemblies have been damaged.

Examine the station for possible damage after unpacking. The freight forwarder and Festo Didactic must be notified of any damage without delay.

6.3 Scope of delivery

Check delivered items against the packing slip and your purchase order. Festo Didactic must be notified of any deviations without delay.

7 Layout and function

7.1 The MPS® TS Compact Trainer I4.0



The MPS® transfer system serves as a basis for the MPS® TS Compact Trainer I4.0. A CPS (cyber-physical system) is set up with currently available automation components. A modern S7-1500 industrial controller is at the heart of this autonomous and highly communicative unit. The PLC is programmed via the TIA Portal. The KTP400 display and control unit serves as a user interface for intuitive operation and machine operator guidance. Data is exchanged with the intelligent workpiece (a bearing roller) via an RFID read-write system which communicates with the controller via an IO-Link interface. The PLC is equipped with an integrated web server for fast process diagnostics with standard IT technologies.

The MPS® TS Compact Trainer I4.0 integrates the following main components in the spirit of the smart factory:

- Conveyor with 2 RFID sensors
- Integrated S7-1500 CPU1512SPF-1PN controller with 8 digital inputs and 8 digital outputs and an IO-Link communication module
- KTP400 Basic display and control unit
- Drilling module with ET200SP Profinet IO device
- Insertion module with ET200SP Profinet IO device
- Pick-by-light module manual workstation with LOGO!8 Ethernet device
- Bearing roller workpiece set with RFID tag
- Bearing hub workpiece set with 3 different materials

It provides a turnkey learning scenario for quick and safe introduction to the issue of "On the way to Industry 4.0". Compatibility with already existing MPS transfer systems and MPS stations must be clarified on a project-specific basis.

7.2 Production scenario



Overview MPS® TS Compact Trainer I4.0

- 1 Transfer line, beginning of conveyor
- 2 S71512SP F 1PN main controller
- 3 Emergency off pushbutton
- 4 RJ45 network access
- 5 KTP400 display and control unit
- 6 RFID reader, end of conveyor
- 7 DC wattmeter, at back
- 8 RFID reader, beginning of conveyor
- 9 Drilling module with ET200SP Profinet IO device
- 10 Insertion module with ET200SP Profinet IO device
- 11 Pick-by-light module manual workstation with LOGO!8 mini control system
- 12 Raspberry Pi single-board computer
- 13 Manual workplace, tray
- 14 Scalance XB005 network switch, at back

7.2.1 Process sequence

The operator starts the production process for a bearing roller with a bearing hub at the display and control unit (5). The workpiece, which keeps its own work plan in digital product memory, is positioned at the beginning of the conveyor (1). The RFID reader (8) scans the order data and the work plan from the workpiece's product memory and transmits them to the main controller (2). The workpiece is transported to the next process step. The drilling process is executed at the drilling module (9) in accordance with the number of drilling strokes specified in the work plan. The work plan in product memory specifies the required type of bearing hub. The workpiece is transported either to automatic assembly of the steel bearing hub at the insertion module (10) or the manual workstation module (11). The operator manually assembles the aluminum or POM bearing hubs in accordance with the work plan at this workstation. Machine operator guidance by means of pick-by-light indicates correct assembly and storage locations to the operator. The operator removes the workpiece (bearing roller) from the assembly conveyor and positions it at the indicated assembly position in the workpiece tray (13). The order-specific stock picking location is signaled to the operator. During final assembly of the roller, the operator inserts the bearing hub into the roller, places the assembly back onto the assembly conveyor and acknowledges completion of the operation. The finished product is transported further. Digital product memory is updated with process data by means of an RFID write operation at the end of the conveyor (6), after which the workpiece is unloaded.



Process sequence overview

7.2.2 The intelligent workpiece

Utilized workpieces have a digital product memory based on an RFID data carrier which is compliant with ISO 15693. This memory contains complete production data as a tabular process plan. During the production process, process-relevant production data are additionally stored to product memory such as the current production step, time stamps for the beginning and completion of production, and quality data. After completion of the production process, traceability is made possible by means of unique serial numbers. And thus individual production with a lot size of 1 can be implemented.

7.2.3 Order entry

One of the characteristics of Industry 4.0 is the storage of order data to the workpiece. In order to transfer this data out of the MPS® TS Compact Trainer I4.0 to the workpiece's RFID chip and check it, an RFID write/read module with USB port and an RFID PC application are included in the scope of delivery. The data records can be loaded as a text file and saved.

7.3 The transfer system



The transfer system is used to transport the workpieces. Presence of the workpieces at the beginning and end of the conveyor is substantiated by optical through-beam sensors with fiber-optic cables.

The module is fully assembled. Clockwise and counterclockwise motor operation (forward/reverse), as well as low-speed operation, can be selected with the integrated motor controller.

The conveyor belt is driven by means of a DC geared motor.

An emergency off mushroom actuator interrupts power supply to the actuators directly, and must be unlocked after actuation.

Similar to photo

The Simatic S7-1500 CPU1512SP-1PN main controller and the KTP400 Basic display and control unit are installed to the front panel of the carrier system. The DC wattmeter for measuring power at electrical power consumers is located on the inside of the front panel. A network switch is mounted at the back.

Equipped with the MPS SensLink interface, the MPS® TS Compact Trainer I4.0 can be integrated into a broad range of learning scenarios.

ID	ET200SP Profinet device	Designation	
+BDG	IP address: 192.168.0.1	Installation location	
-8B1	11.0	Coupling sensor receiver (0 = right follow-up conveyor is occupied)	
-1B1	11.4	Through-beam sensor at beginning of the transfer line	
-S5	11.5	Emergency stop button, transfer line	
-1B3	11.6	Through-beam sensor at end of the transfer line	
-8K1	Q1.0 SensLInk sender (1=transferline is busy)		
-2Q1_A1	Q1.4	Conveyor drive clockwise rotation (forward)	
-2Q1_A2	Q1.5	Conveyor drive counter-clockwise rotation (backward)	
-2Q1_A3	Q1.6	Conveyor drive slow speed	
-2Q1_ST0	Q1.7	Conveyor drive stop	

7.4 The drilling module



The task of the drilling module is to:

- Move workpieces to the correct position
- Machine the workpiece by adding a drill hole (simulation)

The module drills workpieces (symbolically). The workpieces are detected on the conveyor belt by an optical diffuse sensor. The drilling machine is moved down by means of a pneumatic slide.

Advancing and retracting speed of the linear slide can be infinitely adjusted with the help of one-way flow control valves.

If a workpiece is positioned underneath the drilling machine by the transfer system via the baffle plate, and if the fiber-optic cable at the baffle plate detects the workpiece, the conveyor belt is stopped and an automatic sequence is started. The linear slide moves down and symbolically drills a hole. The linear cylinder then travels back up to its initial position.

When the linear slide is at the top, the conveyor belt is re-started and the workpiece leaves the module.

ID	ET200SP Profinet device	Designation
+BOF	IP address: 192.168.0.11	Installation location
-1B1	1100.0	Reed switch, linear slide, drill up
-1B2	I100.1 Reed switch, linear slide, drill down	
-4B1	1100.3	Through-beam sensor, workpiece in module
-1M1	Q100.0	Solenoid coil, linear slide, drilling machine up
-1M2	Q100.1	Solenoid coil, linear slide, drilling machine down
-11Q1	Q100.2	Starting current limiter for drilling machine power-up

7.5 The insertion module



The insertion module inserts bearing hubs into a workpiece (bearing roller). The workpieces are advanced to a precisely defined position by the transfer line with the help of a baffle plate and an advancing stopper cylinder. A through-beam sensor detects the workpiece. The transfer line is stopped. The bearing hub can now be removed from the gravity-feed magazine. A handling device (linear gantry) with gripper grasps the bearing hubs and inserts them into the waiting roller. When the insertion process has been completed and the linear gantry has returned to its initial position, the transfer line is started, the stopper cylinder is retracted and the workpiece moves on.

ID	ET200SP Profinet device	Designation
+EFF	IP address: 192.168.0.12	Installation location
-1B1	1110.0	Reed switch, X-axis at conveyor belt
-1B2	1110.1	Reed switch, X-axis at magazine
-2B1	1110.2	Reed switch, Z-axis, gripper up
-2B2	1110.3	Reed switch, Z-axis, gripper down
-3B1	1110.4	Reed switch, gripper open
-4B1	1110.5	Through-beam sensor, workpiece in magazine
-5B1	1110.6	Through-beam sensor, workpiece in module
-1M1	Q110.0	Solenoid coil, linear slide, X-axis to conveyor belt
-1M2	Q110.1	Solenoid coil, linear slide, X-axis to magazine
-2M1	Q110.2	Solenoid coil, linear slide, Z-axis up
-2M2	Q110.3	Solenoid coil, linear slide, Z-axis down
-3M1	Q110.4	Solenoid coil, gripper, open
-5M1	Q110.5	Solenoid coil, stopper cylinder, advance

7.6 The pick-by-light manual workstation module



An operator manually inserts bearing hubs into the unfinished bearing roller at the pick-by-light manual workstation module. The workpieces are advanced to a defined position by the transfer line with the help of a baffle plate. A through-beam sensor detects the workpiece (bearing roller). The transfer line is stopped. The operator then removes the bearing roller from the conveyor belt and places it into the assembly tray.

The assembly tray has two assembly locations. The required assembly location in the assembly tray is indicated by means of a blue LED:

Position 1 (-7P1): assembly Position 2 (-8P1): rework

The gravity-feed magazine for the bearing hubs allocated to the respective work step is indicated to the operator at the pick-by-light module by an LED. The operator grasps the bearing hubs and inserts them into the roller. The finished assembly is then returned to its previous conveyor belt position. The workpiece is detected by the through-beam sensor, the transfer line is started and the workpiece advances to the RFID reader.

ID	LOGO!8 Ethernet device	Designation	
+HAL	IP address: 192.168.0.13	Installation location	
-4B1	11	Through-beam sensor, workpiece in module	
-5B1	12	Magazine 1, aluminum bearing hub in pick position	
-6B1	13	Magazine 2, POM bearing hub in pick position	
-7B1	14	Magazine 1, aluminum bearing hub fill-level, 7 pieces remaining	
-8B1	15	Magazine 2, POM bearing hub fill-level, 7 pieces remaining	
-5P1	Q1	LED indicator, pick-by-light, magazine 1: pick aluminum bearing hub	
-6P1	Q2	LED indicator, pick-by-light, magazine 2: pick POM bearing hub	
-7P1	Q3	LED indicator, tray position 1: assembly	
-8P1	Q4	LED indicator, tray position 2: rework	

7.7 Raspberry Pi single-board computer data center

The Raspberry Pi is a single-board computer which is used to archive and evaluate the statuses of the LOGO, and display them via its own web server. The raspberry Pi also functions as an NTP time server within the local network.

LogoControl has been installed so that the Raspberry Pi can access data at the LOGOI8. LogoControl expands the Siemens LOGO into an external web server for individual visualization based on HTML and an open web service API for connection of third party programs. LogoControl provides an open API on the basis of a web service (REST/JSON) for the connection of any number of external clients.



Overview of data communication with LogoControl

Data can be read out from the LOGO via simple http commands with the help of LogoControl. *http://192.168.0.10:8088/rest/devices/{deviceld}/attributes/{attributeld}/value*

The data are read out to a sample application, namely "HAL.exe" (C++ program), and written cyclically (0.5 s) to the MySQL database.

The data are made available within the local network via a web server. *http://192.168.0.10*

The "HAL.exe" sample program also provides the option of setting system time at the Raspberry Pi. The program checks once every 0.5 seconds to determine whether or not a new time has been saved to the database to this end. Time (local time) can be set on the data center's website at http://192.168.0.10.

Notes:

The Raspberry Pi doesn't have an internal battery, which means that system time (UTC) stops in the event that supply power is interrupted. As a result, it must always be set when the device is started.

And thus local time is read out of the LOGO!8 by the Raspberry when it's restarted and then used as system time on the basis of the time zone selected in the system settings.

Upon delivery, the following applications are included in the Raspberry Pi:

- Raspbian (operating system)
- Eclipse (C++)
- Apache web server
- MySQL / PHP MyAdmin
- VNC server
- LogoControl
- NTP server
- WiFi access point with SSID: WLANraspberry, password: Raspberry, IP address: 192.168.10.1 DHCP IP address space: 192.168.10.2-254, lease 2h

ID	Raspberry Pi data center	Designation
+RPI	IP address: 192.168.0.10	Installation location
-WF2	WiFi stick	EDIMAX EW-7811Un
-TA1	Voltage transformer	Power pack, 24 V DC \rightarrow 5 V DC, 3.5 A, 15 W, with micro USB cable

7.8 Automation network

The devices of the MPS® TS Compact Trainer I4.0 are connected to a network switch via network cables. There's an RJ45 panel mount socket for the programming unit on the front panel.



System overview of the devices

7.9 Software tools

The use of software development tools can be practiced in an extremely small space with the MPS® TS Compact Trainer I4.0.



Software tools of the MPS® TS Compact Trainer I4.0

The following software is included in scope of delivery:

- TIA Portal STEP7 V13 SP1 or higher
- TIA Portal WinCC Basic V13 SP1 or higher
- S7-PCT V3.4 HF1 and higher
- LOGO!Soft Comfort V8.0 and higher
- RFID application and driver for USB reader
- FluidLab energy light

The following sample applications are included in the scope of delivery:

- S7 sample project, main controller for S7-1500 CPU1512SP-1PN, KTP400 Basic display and control unit and IO-Link Master ET200SP
- Sample project, manual workstation for LOGO!8
- Sample application for Raspberry Pi as image file

8 Commissioning

Learning objectives

After completing this section:

- You'll be able to create a commissioning report.
- You'll be able to establish the connections necessary for operation.
- You'll be able to load a sample project to the PLC and the display and control unit, and test it.
- You'll be able to assign a Profinet device name.
- You'll be able to load a sample project to a mini control system and test it.
- You'll be able to configure a device via the web interface.
- You'll be able to load an IO-Link master module by means of a PC tool.
- You'll be able to restore the operating system of single-board computer.
- You'll be able to remote control the Raspberry Pi single-board computer.
- You'll be able to configure the basic settings of the Raspberry Pi single-board computer.

Commissioning is normally limited to visual inspection in order to ensure correct tubing connections, wiring and operating voltage supply. All components, tubing connections and cabling are unambiguously identified, so that all of the connections can be readily restored as required.

Work assignments

- 1. Document your commissioning work steps in the commissioning report.
- 2. Prepare your PC and your workstation, and connect the MPS® TS Compact Trainer I4.0 to supply power and compressed air supply.
- 3. Load the sample project for the Siemens S7-1500 CPU1512SP-1PN controller with Siemens programming software TIA Portal Step7 V13 or higher.
- 4. Load the sample project for the KTP400 Basic display and control unit with Siemens programming software TIA Portal Step7 V13 or higher.
- 5. Assign the Profinet device name to the drilling and insertion modules with ET200SP Profinet IO device using Siemens pro software TIA Portal (V13 SP1 Up9).
- 6. Load the "manual workstation" sample project to the LOGO!8 mini control system with Siemens programming software LogoSoft! Comfort (V8.0).
- 7. Configure the IP address and measured value display at the DC wattmeter via the web interface.
- 8. Load the configuration of the IO-Link communications module of the ET200SP and the RFID readers with TIA Portal tool S7-PCT.
- 9. Restore the operating system of the Raspberry Pi single-board computer.
- 10. Set the local time zone and, if necessary, the system language of the Raspberry Pi single-board computer.

Work aids

• Utilized hardware: MPS® TS Compact Trainer I4.0, compressed air supply, 24 V DC power pack, PC

• Utilized software:

- TIA Portal STEP7 V13 SP1 update 9 and higher, TIA Portal WinCC Basic V13 SP1 update 9 and higher, S7-PCT V3.4 HF1 and higher
- LOGO!Soft Comfort V8.0 and higher
- Internet browser, VNC viewer etc.
- Commissioning report
- Documentation, TIA Portal help system, workbook, Internet

Exercise 1: Commissioning report

All phases of initial commissioning and recommissioning of the MPS® TS Compact Trainer I4.0 should be documented with the help of a commissioning report.

Create the commissioning report:

• Document the required commissioning steps in the following commissioning report and confirm completion by entering the date and signing the report.

	Commissioning report	Project:	
Location	Activity	Completed	Note/observation
=CT4	Establish connections – power supply.		
=CT4	Establish connections – compressed air supply.		
PC	Set the project computer within the respective IP address range, for example 192.168.0.100.		
+BDG	Commission S71512SP-1F controller hardware and load sample application.		
-PH1	Commission KTP400 controller hardware and load sample application.		
+BOF	Assign Profinet IO device name for drilling module ET200SP IM155-6.		
+EFF	Assign Profinet IO device name for insertion module ET200SP IM155-6.		
+HAL	Load "manual workstation" sample project to the LOGO!8 mini control system.		
-BJ1	Configure the IP address and measured value display at the DC wattmeter.		
+BDG	Configuring the IO-Link communication module and the RFID readers.		
+RPI	Restore the operating system of the Raspberry Pi single-board computer.		
+RPI	Remote control of the Raspberry Pi single-board computer		
+RPI	Localization of the Raspberry Pi single-board computer		
+BOF	Set end position queries for the drilling cylinder. Adjust stroke motion of the drilling cylinder.		
+EFF	Set end position queries for the handling unit / gripper. Adjust stroke motion of the handling unit / gripper.		
Date		Completed by:	

Exercise2: Establishing connections

You'll need the following in order to commission the MPS® TS Compact Trainer I4.0 with the sample programs:

- The assembled and adjusted MPS® TS Compact Trainer I4.0
- Power pack: 24 V DC, 4.5 A
- Compressed air supply with 600 kPa (6 bar)
- A PC with installed PLC programming software
- A network cable

Analyzing the setup

 Analyze the setup shown below with regard to the utilized components and enter the missing numbers for the components in the sketch.



1: MPS® TS Compact Trainer I4.0, 2: power pack, 3: compressed air supply, 4: PC, 5: network cable,

6: insertion module with ET200SP, 7: RJ45 socket with network cable, 8: pick-by-light module with LOGO!,

9: CPU1512SP-1F, 10: KTP400 display and control unit, 11: drilling module with ET200SP, 12: data center with Raspberry Pi

Information: power supply

- The MPS® TS Compact Trainer I4.0 is supplied with electrical power from a 24 V DC power pack (max. 5 A).
- 24 V DC supply power for modules and the device is hard-wired in the carrier system for the transfer line.
- 5 V DC is supplied to the Raspberry Pi2 data center by a DC-DC voltage converter via the USB port of the IOT device.

Cable and tubing connections

1. CompactTrainer power pack: Insert the 4 mm safety plugs into the sockets in the power pack.



2. Connect the 5-way pneumatic manifold of the Syslink distribution board on the back to compressed air supply using 6 mm compressed air tubing (on-site) and set to a system pressure of ~ 5 to 6 bar.



3. PC to CompactTrainer: Connect the PC to the RJ45 socket in the front panel of the MPS® TS Compact Trainer I4.0 via a network cable. The RJ45 socket is directly connected to the Ethernet interface of the S7-1500 CPU1512SP-1PN, and is looped through to the Industrial Ethernet switch.



Preparing the workstation

Configure the IP address of the project computer. An IP address within the same address space as the training device is recommended for connection to the PLC, the HMI and the Profinet IO devices, for example: IP 192.168.0.100, subnet mask: 255.255.255.0

In order to avoid errors within the network, please contact your IT administrator if you want to connect the training device in your local area network.

If the DC wattmeter has been reset to its default value (192.168.1.199), connection to the device via the device website can only be established with a PC whose IP address lies within the same address space, for example IP 192.168.0.100, subnet mask: 255.255.255.0.

Expert tip: deleting PLC data

Proceed as follows if you want to make sure that your PLC (S7-1500) is set to the default factory settings.

Prerequisite:

PC with MMC memory card reader.

Information concerning the described components can be found in the manual for the ET200SP.

- 1. Switch off controller supply power.
- 2. Remove the Simatic memory card (e.g. 512 MB) from the CPU slot.



- 3. Insert the Simatic memory card into the memory card reader at the PC.
- 4. If your Simatic memory card is not empty, delete the "SIMATIC.S7S" folder as well as the "S7_JOB.S7S" file from the memory card, e.g. with the help of the Windows Explorer.
- 5. Switch controller supply power back on again.
- 6. Perform a general reset manually at the mode selector switch of the S7-1500 CPU.
- 7. Switch controller supply power back off again.
- 8. Insert the Simatic memory card back into the CPU slot.
- 9. Switch on controller supply power and set the mode selector switch of the S7-1500 CPU to "RUN".

Exercise 3: Commissioning and loading S71512SP-1F and KTP400 controller hardware

Procedure

Start the TIA Portal in the project view and retrieve/open the sample project for the MPS® TS Compact Trainer I4.0 for the Siemens S7-1500 CPU1512SP-1PN controller and the KTP400 display and control unit from the technical documentation: ...\CompactTrainer_I40_Sources\S7-1500\

For example CompactTrainer I4.0 VX.X.zap13

The following project parameters are set: failsafe CPU password: "Festo"

rojektnavigation 🗉 🗲	CompactTrainer I4.0 V0.6 Geräte & Netze	_ # =>
Geräte	🚰 Topologiesicht 🛛 📥 Netzsicht	Gerätesicht
100 E #	r Vernetzen 🚺 Verbindungen (Hittiverbindung (+) 📰 📳 🔍 🗉	-
CompectInsiner H & V0.6 Neues Gerat hiroufugen Gerate & Nette BDG (CPU 15125P F-1 PN) PH1 [KTP40D Basic PN] Germeinname Daten Cokumentationseinstellungen Sprachen & Ressourcen Online-Zugänge Card Reader/USB-Speicher	BOP-IM155-DIN IM 155-6 PN HF BOG PN/NE_1: 192.168.0.11 PN/NE_1: 192.168.0.12 Pt/NE_1	
	BDG CPU 15125F F-1. PH1 KTP400 Basic FN PNNE_1: 192.168.0.1]	

Note regarding symbols

Right click é

- 1. Loading the main controller:
- \rightarrow Select PLC \rightarrow e \rightarrow load to device

→ Hardware and software (changes only)



 \rightarrow Hardware and software (changes only)

2. Select the PD/PC interface. In our example, the PD/PC interface is the existing LAN adapter for your network connection. Compare this with the settings in the Windows Control Panel under "Network and Sharing Center".



→ Start search

3. Select a device.

		Konfigurierte Zugr	iffsknoten von "BDG"						17
Geräte		Gerät	Gerätetyp	Steckpl.	Тур	Adresse	Subne	12	
100		BOG	CPU 15125P F-1 PN	1 X1	PNRE	192168.0.1	PN/IE	1	- S-
Compect									1
Gerat			Typ der PGPC-Schwitte	telle:	Phile			-1	1000
PH10			PGPC-Schotts	telle	Intel(#) 82	567LM Gigabit Network	k Cannection	1000	
) 🖬 Geme		Verbin	dung mit Schnittstelle/Sul	netz:	PNIE 1		6		to a little
+ Dokur		1000	1. Lar	T. ST.				18	1000
) Sprec					-		-		
Card Real		and the second second				alle kompatibler	- Tellnehmer at	1000	
and the sea		Kompatible reiner	hinter im Zielsubnetz	120		Multine southanness	I femetimer a	lobyen	100
		Ger#	Geratetyp	Typ		Adresse	Zielgerät		1
		Teitherumer	37/1300	150		20-03-30-34-F0-03			
				-		e agricine e cons			
	and the second s								
	CONTRACTOR OF STREET								
	I ILED CHINEN								
-		-					-	Construction of the local division of the lo	
							Such	e starten	
	Online-Statusinformat	tion:							THE ALL
	1 Suche beendet 1	kompatible Teilnehme	r von 4 erreichbaren Teilnr	ehmem	gefunden.				
	12 Gerateinformation	hen werden eingehalt.							
	Scan und Informa	tionsathage abgeschir	issen.					8	
_	NAME TO DESCRIPTION OF THE OWNER.	igen enzeigen							Da.

 \rightarrow Load

4. Select "Overwrite all".

Vorscha	u Lao or der	ien m Laden überprüfen			×		
Status	!	Ziel	Meldung	Aktion			
↓	%	▼ BDG	Bereit für den Ladevorgang.		^		
	4	 Schutz 	Schutz vor unbefugtem Zugriff				
	4		Geräte, die an ein Firmennetzwerk oder an das Internet angeschlossen werden, müssen gegen unbefugten Zugriff angemessen geschützt sein, z.B. durch die Verwendung von Firewalls und Netzwerksegmentierung. Weiterführende Informationen über Industrial Security finden Sie unter http://www.siemens.com/industrialsecurity	rätz vor unberugtern zugnin räte, die an ein Firmennetzwerk oder an das Internet geschlossen werden, müssen gegen unbefugten Zugriff gemessen geschützt sein, z.B. durch die Verwendung von ewalls und Netzwerksegmentierung. Weiterführende ormationen über Industrial Security finden Sie unter tri/www.siemens.com/industrialsecurity			
	0	Software	Software in Gerät laden	Konsistent laden			
	×	, Solimarc		Konsistent laden			
	0	 Zusatzinformation 	Es gibt Unterschiede zwischen den Einstellungen für das Projekt	🛃 Alle überschreiben			
	0	Textbibliotheken	Laden aller Meldetexte und Textlisteneinträge	Konsistentes Laden	~		
<			111	>			
				Aktualisiere	en		
			Fertig stellen	Laden Abbrecher	n		

 \rightarrow Load

5. Select "Overwrite all".

Ergebnis	ise d	es Ladevorgangs		×
? s	tatus i	und Aktionen nach Ladevorga	ng	
Status	!	Ziel	Meldung	Aktion
4	%	▼ BDG	Ladevorgang fehlerfrei beendet.	
	Å	 Baugruppen starten 	Baugruppen nach dem Ladevorgang starten.	🖌 Alle starten
<			111	>
			Fertig stellen	Laden Abbrechen

→ Finish

Exercise 4: Commissioning and loading the KTP400

- Procedure
- 1. Select the display and control unit $\rightarrow @\rightarrow$ load to device



→ Software (load completely)

2. Select the PD/PC interface. In our example, the PD/PC interface is the existing LAN adapter for your network connection. Compare this with the settings in the Windows Control Panel under "Network and Sharing Center".

Gerät	Gerätetyp	Steckpl	Тур	Adresse	Subnet
PH1.IE_CP_1	PROFINET Schnitt	5 X1	PN/IE	192.168.0.2	PN/IE_1
	Typ der PG/PC-Schnitts	telle:	PN/IE		•
	PG/PC-Schnitts		💹 Intel(R) 8:	Intel(R) 82567LM Gigabit Network C	
Ve	rbindung mit Schnittstelle/Sul	onetz: [Direkt an St	eckplatz '5 X1'	
	1. Gati	eway: [
-	-	PN/IE		Zugriffsadresse	-
ken ken					
Jken					
nken					Suche
nken Isinformation:					Suche
nken sinformation:					Suche
inken usinformation:					Suche

 \rightarrow Start search

3. Select detected device.

Erweitertes Laden	Konfigurierte Zugriffski	noten von "PH1"				
	Gerät	Gerätetyp		TVD	Adresse	Subnetz
	PH1.IE_CP_1	PROFINET Schnitt	5 ×1	PN/IE	192.168.0.2	PN/IE_1
		Typ der PG/PC-Schnittstelle: PG/PC-Schnittstelle: PG/PC-Schnittstelle:		PN/IE		•
				2567LM Gigabit Network	rk Connection 💌 💎 🔯	
	Verbindung	g mit Schnittstelle/Sul	onetz: [Direkt an St	eckplatz '5 X1'	▼ (€)
		1. Gati	eway: [💎
	Kompatible Teilnehme	r im Zielsubnetz:			🛃 Alle kompatiblen	Teilnehmer anzeigen
	Gerät	Gerätetyp	Тур		Adresse	Zielgerät
	Teilnehmer —	SIMATIC-HMI —	ISO PN/IE		E0-DC-A0-04-9A-66 Zugriffsadresse	-
LED blinken						
						Suche starten
Suche beendet: 1 kor	noatible Teilnehmervor	4 erreichbaren Teiln	ehmern a	efunden		
· Geräteinformationen	werden eingeholt	enclonderen teim	ennen g	enviroen.		
🗹 Scan und Information	sabfrage abgeschlosse	n.				*
Nur Fehlermeldunger	n anzeigen					
					Lad	en <u>A</u> bbrechen

 \rightarrow Load

4. Overwrite all values.

Status 40	!	Ziel	Meldung	Aktion	
	<u> </u>	▼ PH1	Bereit für den Ladevorgang.		
	▲	 Schutz 	Schutz vor unbefugtem Zugriff		
	4		Geräte, die an ein Firmennetzwerk oder an das Internet angeschlossen werden, müssen gegen unbefugten Zugriff angemessen geschützt sein, z.B. durch die Verwendung von Firewalls und Netzwerksegmentierung. Weiterführende Informationen über Industrial Security finden Sie unter http://www.siemens.com/industrialsecurity		
	0	Überschreiben	Überschreiben, wenn das Objekt online existiert?	🗹 Alle Überschreiben	
	0	▶ HMI-Runtime	Informationen		
¢			III		

 \rightarrow Load
Exercise4: Assigning a Profinet IO device name for ET200SP IM155-6 Procedure

Start Siemens TIA Portal programming software and retrieve/open the sample project for the Siemens

S7-1500 CPU1512SP-1PN controller and the KTP400 Basic display and control unit. The project file is included in the technical documentation:

...\CompactTrainer_I40_Sources\S7-1500\CompactTrainer I4.0 VX.X.zap13

The Profinet device name should be assigned to the Profinet IO drilling and insertion devices IM155-6PN-HF. Open the project's network view to this end: 2×6 Devices & networks \rightarrow select BOF-IM155 drilling $\rightarrow 6$



→ Assign device name

Select the first device from table \rightarrow Blinking LED (for purpose of identification).

 \rightarrow If the drilling module's LEDs blink \rightarrow select/highlight the device

(or select another device from the list and test with "Blinking LED").

PROFINET-Gerätename v	/ergeben				_			×
		Konfiguriertes F	ROFINET-	Gerät				
		DOCINET. Com		bofim155 drilling			-	
		rkOrinei-Gera	atename:	bolim southing				
		G	ieratetyp.	IM 155-6 PN HF				
		Online-Zugang						
		Typ der PG/PC-Schi	nittstelle:	👤 PN/IE			-	
		PG/PC-Schi	nittstelle:	💹 Intel(R) 82567LM	1 Gigabit I	Network Conn	ection 💌 💎 ⊴	
Ļ		Gerätefilter						
<u>د</u>		🛃 Nur Geräte	gleichen Ty	ps anzeigen				
		🗌 Nur falsch	parametrier	te Geräte anzeigen				
		Nur Geräte	ohne Neme	en enzeigen				
			: onne Narne	en anzeigen				
	Erreichbare Tei	Inehmer im Netzwerk:						
	IP-Adresse	MAC-Adresse	Gerät	PROFINET-Gerätena	ame	Status		
	0.0.0.0		28-63-36-39-0B-B7 ET200SP		— 🔥 Kein Geräte		name zugewiesen	
	0.0.0.0	28-63-36-39-0A-3B	ET200SP	-	<u> </u>	Kein Geräten	ame zugewiesen	
🛃 LED blinken								
	<							>
					Liste aktu	Jalisieren	Name zuweiser	
Online-Statusinformation:								
 Suche abgeschlos 	sen. 2 von 4 Gerä	ten wurden herausgefi	ltert.					
<								>
							Schließen	_
							Johneben	

 \rightarrow Assign name

The device name has now been assigned and displayed.

PROFINET-Gerätenar	ne vergeben					×
		Konfiguriertes F	PROFINET-	Gerät		
		PROFINET-Gerà	itename:	bof-im155-drilling		•
		G	erätetyp:	IM 155-6 PN HF		
		Online-Zugang				
		Typ der PG/PC-Sch	nittstelle:	🖳 PN/IE		•
		PG/PC-Sch	nittstelle:	💹 Intel(R) 82567LM Gi	gabit Network Conr	nection 💌 💎 🔯
L.		Gerätefilter				
₩ 		🛃 Nur Geräte	e gleichen Ty	ps anzeigen		
		Nur falsch	parametrier	te Geräte anzeigen		
		🗌 Nur Geräte	ohne Name	en anzeigen		
	Environ Frank and Frail					
	IP-Adresse	MAC-Adresse	Gerät	PROFINET-Gerätename	e Status	
	0.0.0.0	28-63-36-39-0B-B7	ET200SP	-	Kein Geräter	name zugewiesen
	192.168.0.11	28-63-36-39-0A-3B	ET200SP	bof-im155-drilling	🥑 ок	
🔄 LED blinken						
	<					>
				List	e aktualisieren	Name zuweisen
Online-Statusinforma	ition:					
 Suche abgeso 	chlossen. 2 von 4 Gerät	en wurden herausgefi	ltert.			
Der PROFINET-	Gerätename "bof-im15	5-drilling" wurde der N	/IAC-Adresse	"28-63-36-39-0A-3B" erf	olgreich zugewiese	n.
Suche abgesc	mossen. 2 von 4 Gerat	en wurden nerausgen	itert.			
•						>
						Schließen

 \rightarrow Close

The Profinet device name should be assigned to the Profinet IO insertion device IM155-6PN-HF. \rightarrow Select EFF-IM155 drilling \rightarrow



 \rightarrow Assign device name

Select the device from table \rightarrow blinking LED (for purpose of identification). \rightarrow If the insertion module's LEDs blink \rightarrow select/highlight the device (or select another device from the list and test with "Blinking LED").

e e a certa de la file ve	rgeben				×
		Konfiguriertes F	PROFINET-	Gerät	
		PROFINET-Gerà	ätename:	eff-im155-inserting	-
		G	Gerätetyp:	IM 155-6 PN HF	
		Online-Zugang			
		Typ der PG/PC-Sch	nittstelle:	📒 PN/IE	•
		PG/PC-Sch	nittstelle:	💹 Intel(R) 82567LM Giga	abit Network Connection 💌 💽 國
لي ا		Gerätefilter			
•		🛃 Nur Geräte	e gleichen Ty	ps anzeigen	
		Nur falsch	parametrier	te Geräte anzeigen	
		Nur Geräte	e ohne Name	en anzeigen	
	Everialshave Teile				
	IP-Adresse	MAC-Adresse	Gerät	PROFINET-Gerätename	Status
	II Harebbe	IIIIIIoridicesse	derat	inter deratendine	ordras
	0.0.0.0	28-63-36-39-0B-B7	ET200SP	—	🔥 Kein Gerätename zugewiesen
I	0.0.0.0 192.168.0.11	28-63-36-39-0B-B7 28-63-36-39-0A-3B	ET200SP ET200SP	— bof-im155-drilling	Kein Gerätename zugewiesen Gerätename ist unterschiedlich
LED blinken	0.0.0.0	28-63-36-39-0B-B7 28-63-36-39-0A-3B	ET200SP ET200SP		Kein Gerätename zugewiesen Gerätename ist unterschiedlich
LED blinken	0.0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	bof-im155-drilling	Kein Gerätename zugewiesen Gerätename ist unterschiedlich
LED blinken	0.0.0	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	 bof-im155-drilling	Kein Gerätename zugewiesen Gerätename ist unterschiedlich saktualisieren Name zuweisen
LED blinken	0.0.0	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP		Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen
LED blinken	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP		Kein Gerätename zugewiesen Gerätename ist unterschiedlich saktualisieren Name zuweisen
LED blinken	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	bof-im155-drilling	Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen
LED blinken Online-Statusinformation: Suche abgeschlosse	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP		Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen
LED blinken Online-Statusinformation: Suche abgeschlosse	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP		Kein Gerätename zugewiesen Gerätename ist unterschiedlich saktualisieren Name zuweisen
LED blinken Online-Statusinformation: Suche abgeschlosse	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	bof-im155-drilling bit interval interva	Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen
LED blinken Online-Statusinformation: Suche abgeschlosse	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	bof-im155-drilling bof-im155-drilling Liste	Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen
LED blinken Online-Statusinformation: Suche abgeschlosse	0.0.0 192.168.0.11	28-63-36-39-08-87 28-63-36-39-0A-38	ET200SP ET200SP	bof-im155-drilling Liste	Kein Gerätename zugewiesen Gerätename ist unterschiedlich aktualisieren Name zuweisen >

 \rightarrow Assign name

The device name has now been assigned and displayed.

PROFINET-Gerätename v	vergeben					×
-		Konfiguriertes F	PROFINET-	Gerät		
		PROFINET-Ger	itename:	eff-im155-inserting		•
		G	erätetyp:	IM 155-6 PN HF		
		Online-Zugang				
		Typ der PG/PC-Sch	nittstelle [.]	📮 PNÚE		.
		PG(PC-Sch	nittstelle:	Intel(P) 82567LM Gias	abit Network Conr	ection 💌 🛞 🔯
		14/10/301	mustene.	www.incer(ky.ozso/con.org	abit Network Coni	
Ļ		Gerätefilter				
1		🛃 Nur Geräte	e gleichen Ty	ps anzeigen		
		📃 Nur falsch	parametrier	te Geräte anzeigen		
		Nur Geräte	e ohne Name	en anzeigen		
	Erreichbare Teilr	hehmer im Netzwerk:				
	IP-Adresse	MAC-Adresse	Gerät	PROFINET-Gerätename	Status	
	192.168.0.11	28-63-36-39-0A-3B	ET200SP	off im155-drilling	Geratename	ist unterschiedlich
L	192.166.0.12	20-03-30-39-00-07	EIZUUSP	einmissning	V OK	
🗆 i ED blinkon						
	<					>
				Liste	aktualisieren	Name zuweisen
Online-Statusinformation:	:					
 Suche abgeschlos 	sen. 2 von 4 Gerät	en wurden herausgefi	ltert.			
Der PROFINET-Gerä	itename "eff-im155	-inserting" wurde der	MAC-Adress	e "28-63-36-39-0B-B7" erfo	olgreich zugewies	en.
Suche abgeschlos	sen. 2 von 4 Gerät	en wurden herausgefi	ltert.			
<						>
						Schließen

 \rightarrow Close

Exercise 5: Loading the "manual workstation" sample project to the LOGO!8 mini control system

Note

Logo Comfort software as of V8.1 is required for LOGO!8 hardware version FS04.

- 1. Manually configure the IP address of the LOGO!8:
- LOGO display \rightarrow Network + OK \rightarrow IP address + OK \rightarrow OK
- \rightarrow Use the scroll keys $\uparrow \downarrow$ to configure the IP address: 192.168.0.13 + OK \rightarrow ESC \rightarrow ESC
- 2. Start LOGO! Soft Comfort and open the LOGO project (similar to screenshot shown below).

LOGO/Soft ComPart					_ 3
ei Bearbeten Format Ansi	icht Extras Perister H	To			
1 · · · · · · · · · · · · · · · · · · ·	御殿ので一番	- 語 記 記 Ny			
Xagramm-Modus Netzwe	rkprojekt				
tais .	4 Diagramite	Editor			
Diagramme	1 Million and Control of Control				
Neues Diagramm hinzufügen					
	100 Altono			~1	
	E Connep			-	
	Suchen inc	Modu_Hendarbeitsplatz	T A A		
	67	C Modul_Handarbeitsplatz_V1:3.hp			
	Sulator.				
	-erwendet				
	1000				
	Deviation				
	12				
Anleitungen	Eigerw Dykumente				
	Contraction of the				
	Compute				
		Datemane: Modul Handarbet splatz VI. I. k	0	Offnen	
	Netzment	Datebarr	the state of the state of	Abbrachart	
	And the owner of the owner own	Locorson Datesen (~.isc, ~.on)	(*//go,*//d,*///d,*///p) <u>*</u>	Abbroden	

With LOGO Soft Comfort up to V8.0, the program name is: Module_manual-workstation_V1.1.lnp As of Logo Soft Comfort V8.1, the program name is: Module_manual-workstation_1-2.mnp

In the open project, the manual workstation sequence is projected in communication with the main controller (S7-1512SPF-1PN).



Load the program to the LOGO.

→ Extras → Transfer → PC -> LOGO!



→ PC -> LOGO!

Check the communications connection.

 \rightarrow Test \rightarrow the connection test must be completed successfully!

™ Sch	nittstelle							×
Schn	ittstelle							
	Verbinden	durch: Ethernet	Inf	tel(R) 82567LM Gigal	bit Network Conr	ection	-	
Ziel								—
	_						********	
				•			- 3	
		<u> </u>		Test				
		Ziel-IP-Adre	sse: 192.168. 0	. 13	Adressbuch			
	LOGO! em	eichbar:					8	
	Name	IP-Adresse	Subnetzmaske	Gateway	MAC-Adi	resse	Status	
		Karta kaniaran						
	I Aur SD-	Kane kopieren						
						ОК	Abbreche	:n

\rightarrow OK

LOGO!So	ft Comfort X
?	Die Positionseinstellungen für Al weichen im Schaltprogramm und im Gerät voneinander ab. Möchten Sie die Al-Positionseinstellung des Geräts ändern? Wenn ja, wird das Gerät nach Abschluss des Downloads neu gestartet, damit die Änderung wirksam wird.
	Ja Nein Abbrechen

→ Yes



→ Yes

The program of the LOGO controller can now be tested.

Exercise 6: Configuring the IP address and measured value display at the DC wattmeter

If the DC wattmeter has been reset to its default value (192.168.1.199), connection to the device via the device website can only be established with a PC whose IP address lies within the same address space, for example IP 192.168.1.100, subnet mask: 255.255.255.0.

Configure the IP address to the project setting: MAC address: IP 192.168.0.3 Subnet IP mask: 255.255.255.0 Gateway: 192.168.0.10 Analog output: unidirectional (important: if the field is empty the device doesn't boot!) http TCP port: 23

OC-Wattmeter - Internet Explorer		
C 💽 🖛 🕅 (#1): //192.168.0.199-23)	Wattrieter 🛪	(A 🔶 D)
		FESTO
	DC-Wattmeter Network Configuration MAC address PC-00155-15:50.0d P-oddress 192.168.0.3 × Submet IP Mask 255.255.255.0 Geteway IP address 192.168.0.10 enaloge cuput unidirectional HTTP	
	HTTP TCP pert 23 submit In cooperation with ADIRO Automatislerungstechnik Gm2H - Competence Center Proc	est Automation of Fests Didactic

\rightarrow Submit

The device must now be rebooted ("power cycle" or "turn off, turn on, works again").

Exercise 7: Configuring the IO-Link communication module and the RFID readers

Information

IO-Link is a point-to-point connection between a master and a device. Conventional as well as intelligent sensors/actuators connected via unshielded 3-wire standard cables can be used as devices with the IO-Link master. IO-Link is downward compatible with conventional digital sensors and actuators. Switching status and data channels are laid out in 24 V DC technology.

Together with the IO-Link master module, the SIMATIC ET 200SP distributed periphery integrates fast and simple IO-Link communication with sensors and actuators into the well-established PROFIBUS and PROFINET fieldbus systems for Totally Integrated Automation.

Visit the following websites for more information concerning IO-Link: <u>http://www.io-link.com/en/Technology/what_is_IO-Link.php?thisID=76</u> <u>http://w3.siemens.com/mcms/automation/en/industrial-communications/io-link/Pages/Default.aspx</u>

IO-Link software: Port Configuration Tool

With its <u>Port Configuration Tool</u> ("S7 PCT"), STEP7 Engineering permits parameterization of Siemens IO-Link master modules and IO-Link devices. S7 PCT is integrated into STEP7 as of V5.4 SP5 and is invoked via the hardware configuration of the IO-Link master. In addition to this program format which is integrated into STEP7 Engineering, a separately installable stand-alone version of S7-PCT is available as well.

With the help of the Port Configuration Tool, the parameter data of the IO-Link devices can be set, changed, copied and saved to the STEP7 project: in this way, all configuration data and parameters are stored consistently all the way down to the device level.

Prerequisites

- TIA Portal STEP7 V13 SP1 update 9 and higher, TIA Portal WinCC Basic V13 SP1 update 9 and higher
- S7-PCT V3.4 HF1 (Port Configuration Tool) and higher
- Ethernet network adapter

Procedure

The configuration of the IO-Link master is included in the S7 sample project. The configuration data must be loaded to the IO-Link master and the two IO-Link devices (RFID reader RF240R).

Start the TIA Portal in the project view and retrieve/open the sample project for the MPS® TS Compact Trainer I4.0 for the Siemens S7-1500 CPU1512SP-1PN controller and the KTP400 display and control unit from the technical documentation: ...\CompactTrainer_I40_Sources\S7-1500\

For example: CompactTrainer I4.0 VX.X.zap13

Open the project's network view to this end: 2×6 Devices & networks \rightarrow select BDG (CPU1512SP F-1PN) $\rightarrow 6$



 \rightarrow Device configuration

🌇 Siemens – C:Users@ublic@ocumentsAutomatisierung@ompactTrainer 14.0 V0.6/CompactTrainer 14.0 V0.6 JX 6 ekt Bearbeiten Ansicht Einfligen Online Extras Werkzeuge Fenster Hilfe Totally Integrated Automation PORTAL 🞐 🎦 🞧 Projekt speichem 🚢 🎽 📜 🕞 🗙 🍤 🛨 (* 1 🐴 🔃 🔛 🔛 🖉 Online verbinden * CompactTrainer I4.0 V0.6 > BDG [CPU 1512SP F-1 PN] - PEX Geräte 🖉 Topologinsicht 🚠 Netzsicht 📑 Gerätesicht Hardware-Katalog 900 맨 발 A 80G • = = 6 = 9.: 3 D SUNDODS 1 O PLANDLIN) 💌 🔄 CompactTrainer I4.0 V0.6 ai. 💕 Neues Gerzt hinzufügen 📥 Geräte & Netze 805 BDG [CPU 15125P F-1 PN] + 🔄 PH1 (KTP400 Basic PN) 🕨 🚺 Gemeinsame Daten 3 Online-Tools 2 3 4 5 6 7 8 ×. + Dokumentationseinstellungen 🕨 🙇 Sprechen & Ressourcen Baugruppenträge. -🕨 📷 Online Zugänge • 📴 Card Reader/USB-Speicher Gerät tauschen. Device 1 X Ausschneiden Sug.X (N Aufgaben Strg+C Kopieren 💽 Einfügen Strg+V X Löschen Ent Umbenennen Adressen pacient 1 Adressen entpacken Übersetzen . Laden in Gerät 🝠 Online verbinden Strg+K. < 1 m 1 . -J. Online-Verbiodung trentien 10-Link [CM 4=10 🖞 Ordine & Diagnose Strg+D Linfo Diagnose Germeneme zuweiden Allgemein 16 Meldungen empfengen Allgemein Gebrote Operanden aktualisieren und anzeigen Potenzialgruppe Quesienieiz-informationen 56(1)1 Baugrupperparam 💐 Eigenschaften Alt+Eingabe > Detailansicht CM 4x10-Link 芛 Beschritzungsstreilen für Module exportieren. Portalansicht 🗄 Übersicht th BDG Das Projekt Co mpactTrainer 14.0 V0.0

 \rightarrow Select the IO-Link master module in the device view (4xIO-Link).

→ Start Device Tool

Device Tool starten	X
Tool oder Zugriffspunkt wählen	
S7-PCT	
Ermöglicht die Konfiguration für IO-Link Geräte.	
Statt Abbrachan	
Start Abbrechen	

→ Start

 \rightarrow Configure interface \rightarrow Type: PN/IE \rightarrow PD/PC interface: <network adapter>

 \rightarrow Connection: PN/IE_1

Schnittstelle einstellen	×
Schnittstelle für BDG einstellen	
Typ der PG/PC-Schnittstelle:	PN/IE
PG/PC-Schnittstelle:	🔝 Intel(R) 82567LM Gigabit Network Connection 💌 💎 ဩ
Verbindung mit Schnittstelle/Subnetz:	PN/IE_1
1. Gateway:	▼ ⑦
	OK Abbrechen

→ OK

10-Link konf	igurieren X
Tool-Name:	S7-PCT
Status:	Warte auf Verbindung zu S7-PCT
000000000	
	Abbrechen

The Simatic S7-PCT is started \rightarrow Target system.

SH B G A S	-	Lader	n		Cb/HL								
BOG Bechalarz 4) 4410 Link [1] SIMATIC RF240R [2] SIMATIC RF240R	-	Lader	n mit Ge	erāten			Commands						Katalog (
		Lader	n in PG,	14 :		-							Suthen
	(1)	Lager	Laden in PG rult Geräten			_	10 Link V2.1						Texts.k7re
		Autor	inter.			- 3	OBAD						
		ADCUA	aliaenen	ana an	180	3	Inpassung a	ul F	F240R Reader				Profit: V1.0 und
		Crim	E-JORTH	ne-verges.	n	1							10 Link VI
	-	Diant	ALC: NO POINT										10 Link V1.
		Benet	and the	o The sector	with a								
			to A the	5 aveoustai	20111	-	Zykkabeta	ıb:	Zykkuzet (ms)	Name	ID-Link Vention	Pil	
		VHIM	antroana	arke acdem	Net .	_	Asynchron		2.3	SIMATIC RF240R ID-Enk	V1.0	gleic	
		Ether	net-Tel	inehmer be	arbeiten		Asynchron		2.3	SIMATIC RE240B ID Link	V1.0	gleic	
			3		Deakhviert	-						ken	
			4		Dealtiviert	-		_				kem	
			Hen Hen Gesl Beo	dellervane deller URL idename chreibung	r r r								
			Ark IOD	einummen Di Diateiner	 	_						J	

 \rightarrow Load to PD with devices

SIMATIC	57-PCT (1:247)	\times
<u>^</u>	Durch das Laden in das PG wird die Offline-Projektierung überschrieben. Wollen Sie fortfahren?	
	Ja Nein	

→ Yes

Project parameters have been transferred successfully.

BDG* BIGS Steck plaz 4) 440 Link I) SMATIC RF240R IO Link [2] SMATIC RF240R IO Link	Ports Align	Adressen mein	Statue 15A	1 Comm	Suchen	a ×				
	Leta	e Aktion			Status	aktualisiesen erfolg	reich 🔀		Testsuche	-
	Verabeliet					E-Cod		Profit [V1.0 und V1.1	•	
		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	274.) -					Li	E SIEMENS AG	
	Path	Informationen	Wanan	Distance	In Battish	PROFierman	Zakanet Incl.	Status	 Ident systems SIMATIC RF210R ID-L 	ä.
	1	F	F	IT.	F	F THOMAS PLANE	3.60	Geratet	SIMATIC RF220R ID-L	×
	2	Г	E	Г	F	E	3.60	Geratety	SIMATIC RESOR IOL	# k
	3	Г	٣	П	F	Г	0.00	Deshtiv	SIMATIC RE250R ID-L	ŵ.
	4	Г	Г	Г	Г	E	0.00	Dealtiv	III III SIRIUS ALT Gelate	
	Ereig	Elegnicarceige							Contraction of the second second	1
	12.3	Vie Parts	F	ait Typ		Instanz	Modur	Besit	6672 821-44C32 SIMATIC RE24/8 VUL et BED Baster	*
								1	1336Min, 1507963, IH-7, Males Di x 50 min, Firmware, Hardware, Geoldramie Ide potenzi, Aurgabeidaum 2015/0516 IDOD Dateiname: Siemens HF2409 201505	*
Communi Autometrgebruses Communi Autometrgebruses 20116-12:2016-14:06:39 [Steck John 14] 20116-12:2016-14:06:48 [2] Steck John 14 20116-12:2016-14:06:52 [Steck John 4] 20116-12:2016-14:06:52 [Steck John 4]	HO LAC RF240R RF240R HO-Link	Laden ettölgis 10-Unik : Ladi 10-Unik : Ladi Status aktualis	ich: m erlokgeic en erlokgeic isten erlokg	h h eich						* X
Kommonikationswoebniss										

Exercise 8: Restoring the operating system of the Raspberry Pi single-board computer

Procedure

Win32 Disk Imager freeware, for example, is available for generating a backup of the Raspberry Pi with Windows. Win32 Disk Imager creates bootable USB sticks and SD cards.

The download link is included in the technical documentation:\CompactTrainer_I40_Software\DiskImager

Upon delivery, the micro SD card (8GB) with the Raspbian V4.x operating system and the software applications required for operation of the CT4 is preinstalled.

The image file is included in the technical documentation: ...\CompactTrainer_I40_Sources\RaspberryPi

When commissioning for the first time or in the event of data loss, the image can be restored as follows:

- 1. Disconnect the Raspberry Pi from supply power by removing the micro USB cable.
- 2. Remove the micro SD card from the card slot in the Raspberry Pi.
- 3. Insert the micro SD card (in the micro SD card adapter) into an SD card slot at your PC, or use a USB card reader.
- 4. Select the destination drive under "Device".
- 5. Select the image file from the data storage medium with the technical documentation.

😼 Win32 Disk Imager	
Image File	Device
/CompactTrainer_I40/_Sources/RaspberryPi/RPI.img	
Copy MD5 Hash:	
Progress	
Version: 0.9.5 Cancel Read W	rite Exit
	H.

 \rightarrow Write

- 6. The write process lasts about 15 minutes.
- 7. After completion, insert the micro SD card back into the Raspberry Pi card slot and reconnect supply power.

Exercise 9: Remote controlling the Raspberry Pi single-board computer

A VNC server is installed to the Raspberry Pi for the purpose of remote control. A virtual desktop is displayed at the PC via the VNC client, thus permitting remote control and remote maintenance of the Raspberry Pi. The download link is included in the technical documentation:

...\CompactTrainer_I40_Software\VNC\

Procedure

- 1. Check to see if you have a network connection from your PC to the data center (192.168.0.10). Use the Windows command prompt with the PING command, for example.
- 2. Start the VNC viewer and enter the IP address and the port to be used for the connection:

VNC® Viewer		Va
VNC Server:	192.168.0.10:1	
Verschlüsselung:	VNC Server trifft Auswahl	-
Info	Optionen	Verbinden

3. The following warning may appear when started for the first time:

V2 VNC Viewer - Verschlüsselung				
Unverschlüsselte Verbindung				
Die Verbindung zu diesem VNC Server ist nicht verschlüsselt.				
VNC Server: 192.168.0.10::5901				
Ihre Anmeldeinformationen werden sicher übertragen, aber alle nachfolgenden, während der aktiven Verbindung ausgetauschten Daten können von Dritten abgefangen werden.				
Diese Warnung nicht mehr anzeigen.				
Fortsetzen Abbrechen				

 \rightarrow Next

4. Enter the password for remote control: raspberry.

V2 VNC Viewe	r - Authentifizierung
VNC Server:	192.168.0.10::5901
Benutzernam	e;
Kennwort:	•••••
	OK Abbrechen

 \rightarrow OK

Exercise 10: Localizing the Raspberry Pi single-board computer

Procedure

Upon delivery, the operating system of the Raspberry Pi single-board computer is set to English. System language, time zone and the country setting for the WLAN can be selected with the help of remote control via the VNC viewer during (initial) commissioning.

Establish a connection to the Raspberry Pi data center as described in exercise 9.



→ Menu → Settings



 \rightarrow Raspberry Pi configuration

The language of the user interface can be changed after clicking "Locale".

eion.			
	Bernano Repúblican	000	
	Bystem Schestisteller Lestung Loka	Deserung -	
	Sprachumpabung	Serechumgebung teatlegen	
	Zettore	Zerzone festegen	
	Tastatur	Tastatur Nistlegen	
	WFicand	WVFI-Land testregen	
		Abbrechen]	

 \rightarrow Set time zone

\rightarrow	The time zone is set	ov selecting a	region fo	or example Europe.	and a location.	for example Berlin.
	1110 11110 20110 15 501	y serecting a	r ogion, ic	n champic Europe,	and a location,	Tor example bernin.

Valer 2 deskring fragmenty in 12 Mer. Weigen				
Papertoti	Autor.			0 = 41 [23] 44
1	Testimity Fire States		(+)(*)(*)	
	System Schridstellen Leietung	Lokalisierung		
1	lprachum gebung	6	prachumgebung firestiegen .	
1	aittore		Zeitzene Neutlegen	
1	Wettefur:		Tastatur festiegen	
	Colori Colori Stanzori Refer Abbedter		Will-Land feelingen.	
			Abbechen OK	
_				

\rightarrow OK

 \rightarrow Set the WiFi country code \rightarrow Country: for example DE (Germany)

Annu 😰 📰 🗮 🌻 🔇 🧕 Raspbery P	Konfguration		0 = 90 23 212
U selat			
	-	in the second	
	Testery/T-turingsetse	<u>()</u>	
	Byttem Schrübtelen Leistung	Lokalsierung	
	Sprachumgebung	Sprachumgebung festlegen	
	Initore	Zeitzzrie festiegen	
	Testafue	Tastatur festiegen	
	WELLINE	With-Land feelingen.	
	 In the test inter- 	(10)	
	Lant OE Germany		
	Abbye	Ner OK	
		Abbecter: OK	
	1	5	



9 Production process: getting started

Learning objectives

After completing this section:

- You'll be able to read the workpiece's product memory and write work order data to it.
- You'll be able to operate the production system.
- You'll be able to manufacture finished goods.
- You'll be able to operate the data center.

Work assignments

- 1. Enter a work order with the RFID application for the USB reader and write the data to the workpiece's (roller's) digital product memory.
- 2. Operate the production system in the demo mode (continuous operation without changing the digital product memory).
- 3. Operate the production system in the automatic mode for one-off production of rollers with bearing hub.

Work aids

• Utilized hardware: MPS® TS Compact Trainer I4.0, compressed air supply, 24 V DC power pack, PC

- Utilized software:
- TIA Portal STEP7 V13 SP1 update 9 and higher
- TIA Portal WinCC Basic V13 SP1 Update 9 and higher
- S7-PCT V3.4 HF1 and higher
- LOGO!Soft Comfort V8.0 and higher
- Internet browser
- VNC viewer

Exercise 1: Order entry

Procedure: PC order entry

The work order is entered via a USB RFID reader-writer. Install the supplied driver as described in "Quick-Install_USB_BaseDriver_03DE.pdf".

...\MPS_TS_CompactTrainer_I40\Software\USB-Reader\



USB RFID reader-writer

Run the file: SampleApp_iID_interface_prot.V4_VS2010.exe ... \MPS_TS_CompactTrainer_140\Software\RFID-Applikation

dentify Textdemo	Settings	Read/Witte	CP Factory	14.0 Compile	t Iraner				
State (Byte)	0		Order (U)	nt 32):	0				
Error (Byte):	0		Customer	(String):	(
User ID (Unit 16).	0		Energy (r	(W] (Uint32):	0				
Step 1			Step 3				Tinesta	npe	
Task (Byte):	0		Task (Byte)		0		Order entry:		
Parameter (Byte):	ø		Parameter (Byte):		0		01 01 1900 00 00 00 B		191
Step 2			Step 4				01.01.1	900 00:00 00	-
Task (Byte):	0		Task (Byte):		0		Order end: 01.01.1500.00.00.00		
Parameter (Byte):	0		Parame	ter (Byte):	0	ΠÌ,		274 49 40 40	
Read	1 1	Wite	C	ancel		Lood	Save	FES	т
0-00-00-00 0-00-00-00 0-00-00-00 0-00-00	-00-00 -00-00 -00-00)-00-00-()-00-00-()-00-00-()-00	00-00-00 00-00-00 00-00-00)-00-00-0)-00-00-0)-00-00-0	00-00 00-00 00-00	-00-00-0 -00-00-0 -00-00-0	0-00-0 0-00-0 0-00-0	0-00-00-(0-00-00-(0-00-00-()0-)0-)0-

Order entry data values are displayed in popups.

Program functions

Function	Description
Read	Read RFID data from the workpiece tag
Write	Write RFID data to the workpiece tag
Cancel	Cancel the write or read operation
Load	Loading a parameter record
Save	Save a parameter record

Work order data in digital product memory

Variable	Data values	Description		
State	0 = not programmed 1 - 4 = next step 30 = work order completed	Status of the production work order After production has been completed the state byte must be reset from the value "30" back to "1", in order to conduct a new production process with the workpiece.		
Error	0 = no errors 1 = drilling error 2 = insertion error 3 = magazine empty, manual workstation	Error status of the production work order / workpiece		
User ID	1 32767	Logged on user For example 12301 = John Doe, 12303 = Jane Doe		
Or	0 - 4,294,967,295	Work order number, consecutive		
Customer	31 ASCII characters	Customer name		
Energy	0 - 4,294,967,295	Energy consumption [mW] for the production work order		
Steps 1 - 4	Task: 1 = drill 2 = insert the bearing hub 3 = discharge workpiece 4 = reserved	Work order steps, freely configurable Parameters: Drill: number of drilling strokes (1, 2) Insert bearing hub: 1 = aluminum, 2 = plastic, 3 = steel Discharge: 1 = after RFID, 2 = at light barrier		
Timestamps	Order entry	Work order entry		
	Order start	Beginning of work order processing		
	Order end	Completion of the work order		

dentify Textdemo S	Settings Read/Write	CP Factory 14.0 Compac	ct Trainer	
State (Byte):	1	Order (UInt32):	815	
Error (Byte):	0	Customer (String):	demo1	
User ID (Uint16):	0	Energy [mW] (UInt32):	0	
Step 1		Step 3		Timestamps
Task (Byte):	1	Task (Byte):	3	Order entry:
Parameter (Byte):	1	Parameter (Byte):	1	01.01.1900 00:00:00 🚖 Order start:
Step 2		Step 4		01.01.1900 00:00:00
Task (Byte):	2	Task (Byte):	0	Order end: 01.01.1900 00:00:00
Parameter (Byte):	1	Parameter (Byte):	0	
Read	Write	Cancel	Load	Save FESTO
<mark>)1</mark> -00-00-00-)0-64-65-6D-)0-00-00-00-	01-01-02-01- 6F-31-00-00-00-00-00-00-00-00-00-00-00-00-00	03-01-00-00-00-0 -00-00-00-00-00-00- 00-00-00	00-03-2F-00-0 00-00-00-00-0 00-00-00-00-0	0-00-00-00-00-00- 00-00-00-00-00-00- 0-00-0
0-00-00-00-00-00-00-00-00-00-00-00-00-0	00-00-00			

Sample parameter record 1: drill = 1 x, insert = 1 (aluminum), discharge = 1 (at RFID at end of conveyor)

Sample parameter record 2: drill = 2 x, insert = 2 (POM), discharge = 2 (at light barrier at end of conveyor)

dentify Textdemo	Settings	Read/Write	CP Factory	14.0 Compac	tTrainer			
State (Byte):	1		Order (Ulr	nt32):	815			
Error (Byte):	0		Customer	(String):	demo3			
User ID (Uint16):	0		Energy [m	W] (UInt32):	0			
Step 1			Step 3				Timestamps	
Task (Byte): 1		Task (B	yte):	3		Order entry:		
Parameter (Pate): 2			Parameter (Pute):		2		01.01.1900 00:00:0	0 ≑
Talancier (byte).	-			tor (byto).	2		Order start:	
Step 2			Step 4				01.01.1900 00:00:0	0 🚖
Task (Byte)	2		Task (B	vte)	0		Order end:	
	-			,,.	-	_	01.01.1900 00:00:0	0 🔶
Parameter (byte).	<u>ہ</u>	Wata		ter (byte).		Land	Caura EEC	
Read		white		ancei		Load	Save	3 L
01-00-00-00- 00-64-65-6D- 00-00-00-00-	01-02 6F-33	-02-03-(3-00-00- -00-00-()3-02-00 00-00-00)0-00-00)-00-00-()-00-00-)-00-00-(00-03-2F 00-00-00 00-00-00-	-00-00 -00-0 -00-00)-00-00-00-00 0-00-00-00-0)-00-00-00-00)-00- 0-00-)-00-
00-00-00-00-	00-00	-00						

...\MPS_TS_CompactTrainer_I40\Software\RFID-Applikation\ demo2_parameter.txt

^{...\}MPS_TS_CompactTrainer_I40\Software\RFID-Applikation\ demo2_parameter.txt

Sample parameter record 3: drill = 1 x, insert = 3 (steel), discharge = 2 (at light barrier at end of conveyor)

Identify Textdemo	Settings	Read/Write	CP Factory	I4.0 Compac	tTrainer			
State (Byte):	1		Order (UI	nt32):	815			
Error (Byte):	0		Customer	r (String):	demo3			
User ID (Uint16):	0		Energy [n	nW] (UInt32):	0			
Step 1			Step 3				Timestamps	
Task (Byte):	1		Task (E	Byte):	3		01 01 1900 00:00	00 🖂
Parameter (Byte):	1		Parame	eter (Byte):	2		Order start:	
Step 2			Step 4				01.01.1900 00:00:	00 🚖
Task (Byte):	2		Task (B	Byte):	0		Order end: 01.01.1900 00:00:	00 🚖
Parameter (Byte):	3		Parame	ster (Byte):	0			
Read		Write	С	ancel		Load	Save FE	STO
01-00-00-00- 00-64-65-6D 00-00-00-00- 00-00-00-00-	01-01 -6F-3 00-00 00-00	-02-03-(3-00-00-)-00-00-()-00)3-02-0(00-00-0)0-00-0()-00-00-(0-00-00-)-00-00-()0-03-2 00-00-0)0-00-0	F-00-00 10-00-0 0-00-00	0-00-00-00-0 0-00-00-00-(0-00-00-00-0 0-00-00-00-0	0-00-)0-00- 0-00-

...\MPS_TS_CompactTrainer_I40\Software\RFID-Applikation\ demo3_parameter.txt

Procedure: order entry at an Android smartphone

The RFID app can be made available to testers. Send us your Gmail address via the following QR code:



Note:

After production has been completed, the state entry must be reset from the value "Finished" back to "Next step: 1", in order to conduct a new production process with the workpiece.

Sample parameter record 1: drill = 1 x, insert = 1 (aluminum), discharge = 1 (at RFID at end of conveyor)

	*	7 .al 65%	a 09:
MPS TS Comp	oac 🕕	Ê	
Bitte einen RFID-Tag auf Schreibmodus kl zu wechseln.	berühren, um i licken, um in de	hn zu lese In Schreibi	n ode modu:
sc	HREIBMODUS		
Status	Nächster	Schritt: 1	*
Fehler	Kein Fehle	er	*
Benutzerkennung	0		
Tasknummer #1	Bohren		*
Parameter #1	1×		*
Tasknummer #2	Einlegen o Lagernab	der 8	٠
Parameter #2	Aluminiur	*	
Tasknummer #3	Werkstüc	kausgabe	*
Parameter #3	Nach RFIE	0	٠
Tasknummer #4	Nichts		*
Parameter #4	Nichts		
Auftragsnummer	521		
Kunde	demo1		
Auftragseingabe	09.01,2017	17:02:1	17:027
Auftragsbeginn	09.01.2017	17:02:4	1:270

Sample parameter record 2: drill = 2 x, insert = 2 (POM), discharge = 2 (at light barrier at end of conveyor)

	3.40	52% = 173
MPS TS Comp	ac 🛈 i	?
Bitte einen RFID-Tag t auf Schreibmodus klii zu wechseln.	berühren, um ihn zu oken, um in den Sch	lesen oder reibmodus
SCH	REIBMODUS	
Status	Nächster Schritt	1 ×
Fehler	Kein Fehler	*
Benutzerkennung	123	
Tasknummer #1	Bohren	*
Parameter #1	2x	*
Tasknummer #2	Einlegen der Lagernabe	*
Parameter #2	POM	*
Tasknummer #3	Werkstückausga	abe 💌
Parameter #3	An Lichtschrank	e •
Tasknummer ≢4	Nichts	*
Parameter #4	Nichts	-
Auftragsnummer	815	
Kunde	demo2	
Auftragseingabe	09.01.2017 17	05:57:965
Auftragsbeginn	09.01.2017 17	06:19:523
A collected and a collected at	09.01.2017	06:40:615

Sample parameter record 3: drill = 1 x, insert = 3 (steel), discharge = 2 (at light barrier at end of conveyor)

MPS TS Comp	ac 🛈	i ?
Bitte einen RFID-Tag auf Schreibmodus kl zu wechseln.	berühren, um ih icken, um in den	n zu lesen oder Schreibmodus
sc	HREIBMODUS	
Status	Nächster S	shritt: 1 💌
Fehler	Kein Fehler	*
Benutzerkennung	0	
Tasknummer #1	Bohren	*
Parameter #1	1×	*
Tasknummer #2	Einlegen de Lagemabe	r 👻
Parameter #2	Stahl	
Tasknummer #3	Werkstücka	iusgabe 👻
Parameter #3	An Lichtsch	iranke 👻
Tasknummer #4	Nichts	-
Parameter #4	Nichts	*
Auftragsnummer	815	
Kunde	demo3	
Auftragseingabe	09.01.2017	17:06:10:355
Auftragsbeginn	09.01.2017	17:06:51:396
Auftragsende	09.01.2017	17:07:14:709

Exercise 2: Starting the demo sequence

Procedure: setting up the production system

- 1. Check power supply and compressed air supply.
- 2. Remove workpieces at transfer points between modules and from the conveyor before manual reset.
- 3. The gravity-feed magazine for the insertion module must be filled with 10 steel bearing hubs.
- 4. At least 7 but no more than 10 aluminum bearing hubs must be loaded into the left gravity-feed magazine at the manual workstation and at least 7 but no more than 10 POM bearing hubs (black plastic) must be loaded into the right gravity-feed magazine.
- 5. Start the resetting process. The resetting process is carried out after clicking the RESET button.

Procedure: Starting the demo sequence

The work order data don't have to be written to the workpiece's digital product memory in order to produce the demo workpiece!

A product is produced, namely a bearing roller with steel hub.

- 1. Start the station's work sequence. The process is started after clicking the "Demo" button.
- 2. Place a workpiece onto the belt at the beginning of the conveyor (between the light barrier's emitter and receiver).



- 3. The workpiece is transported to the RFID reader at the beginning of the conveyor in the creep speed mode, and is then stopped. The parameter record for the demo work order is loaded to work order memory (see sample parameter record 3).
- 4. The unfinished roller is then transported to the drilling module and is stopped there at the module's light barrier. The drilling process is executed once.
- 5. When machining has been completed, the workpiece is transported to the insertion module and is stopped at a defined position by the flat stopper cylinder. The steel hub is removed from storage by the insertion module and is precisely inserted into the unfinished roller.

6. The workpiece is stopped at the RFID writer/reader and status and timestamps are written to its memory.



7. The finished product is transported to the end of the conveyor up to the light barrier and the conveyor belt is stopped.



- 8. If the demo sequence is not interrupted, the workpiece is returned to the beginning of the conveyor after 7 seconds.
- 9. The workpiece is stopped again at the beginning of the conveyor and the demo sequence is started over after an additional 7 seconds.

Notes

- The demo sequence can be stopped at any time by pressing the emergency stop button or by clicking the "STOP" button.
- The workpiece may only be removed from the conveyor belt after it has been stopped!
- A simulated sequence without specifying any work order data in product memory can be started by clicking the "DEMO" button.

Exercise 3: Starting a production work order

Procedure for starting the process sequence using the workflow for the manual workstation

The work order data have to be written to the workpiece's digital product memory in order run a production work order (see work order entry)!

A bearing roller with aluminum hub will be produced, for example (see sample parameter record 1).

- 1. Start the station's work sequence. The process is started after clicking the "AUTO" button.
- 2. Place a workpiece onto the belt at the beginning of the conveyor (between the light barrier's emitter and receiver).



- 3. The workpiece is transported to the RFID reader at the beginning of the conveyor in the creep speed mode, and is then stopped. The parameter record for the work order is loaded from digital product memory to work order memory.
- 4. The unfinished roller is then transported to the drilling module and is stopped there at the module's light barrier. The drilling process is executed once, for example.
- 5. When machining has been completed, the workpiece is transported to the manual workstation module and is stopped there at the module's light barrier.



6. Remove the workpiece from the conveyor and set it into the indicated tray position at the manual workstation (left).



7. The left LED at the pick by light module's gravity-feed magazine for the aluminum bearing hubs light up for withdrawal from storage. Remove the aluminum bearing hub and insert it into the roller.



8. Remove the finished assembly from the tray and place it back onto the conveyor belt upstream from the light barrier and push it into the light barrier's beam path.



Caution: the workpiece is transported further automatically!

9. The workpiece is stopped at the RFID writer/reader and individual production data are written to its memory.



10. The finished product is transported to the end of the conveyor up to the light barrier and the conveyor belt is stopped.



11. The finished product can now be removed.

Exercise 4: Using the data center

Prerequisite

Establish a connection with the Raspberry Pi data center via remote control. The procedure is described in exercise 9 of section 8, "Commissioning".



Checking data communication with the LOGO mini control system

If remote maintenance connection has been successful, the desktop of the Raspberry Pi is displayed at the host computer, from which it can be remote controlled.


Starting the "HAL.exe" sample program

The "HAL" program must be started or already running for data to be cyclically read out of the LOGO. The program is a C++ program which can be executed in the terminal.

ALL D. C. R. Reaction (Institute character	Out White a	
🍯 Minu 🕢 🔟 💻 🧳) 🔇 💻 pi@inaschamyck	0 = 4 0 1805
Paparlob		
	💻 pi@raspberrypi: ~ 📃 💌	
	Datei Bearbeiten Reiter Hilfe	
	pi@raspberrypi:~ \$ sudo ./workspace/HAL/Debug/HAL	

And thus the terminal for the Raspbian user interface is opened and the command line for starting the



The keyword "sudo" means that the program is running as an administrator. The rest of the text is the path to the .exe.

After the software has been started successfully terminal output appears, for example "*Version 0.9*", as well as information indicating how to exit the program: STRG+C.

If a date has been saved to the database for setting system time, this is acknowledged by the message "**** Set Time ****" and a display of the time. Time can be set via the Raspberry website at <u>http://192.168.0.10</u>. LOGO time is set actively with "Set Time" and is additionally made available in the network by means of NTP.

Data center website

Connection can be established with the website of the data center by means of:

- Network access via LAN
- WLAN connection with smartphone, tablet etc.
- Remote control via VNC LAN or WLAN.



Accessing the data center

The Raspberry Pi is equipped with a preinstalled Apache web server. This makes it possible to make websites available within the network. The data center's website can be accessed at <u>http://192.168.0.10</u>.



The main functions, the stock levels of the manual workstation and the language switching option (DE/EN) are displayed in the overview page.



You can set time at the Raspberry Pi (HAL.exe automatically sets LOGO time simultaneously as well), and you can read out and display the archived statuses of the LOGO.

10 Maintenance and care

MPS[®] stations are maintenance-free for the most part. The following components should be cleaned at regular intervals with a soft, lint-free cloth or brush:

- The lenses of the optical sensors, the fiber optics and the reflectors
- The active surface of the proximity sensor
- The entire station

Note

Do not use aggressive or abrasive cleaning agents.

11 Additional information and updates

Further information and updates to the technical documentation of the MPS[®] stations can be found on the Internet at:

www.festo-didactic.com \rightarrow Service \rightarrow MPS[®] mechatronic systems

Festo Didactic SE

Rechbergstr. 3 D-73770 Denkendorf Germany



+49 711 3467-0 +49 711 34754-88500



www.festo-didactic.com did@de.festo.com