






Course description

From Object Identification to Product Memory with RFID

	Level of difficulty	Intermediate
	Learning time	12 h
	Additionally recommended learning media	Introduction to RFID Technology (eTheory)
	Course type	eLab
	Theme category	Sensors and Smart Sensors

The practical training optimally prepares the trainees for the industrial application of RFID technology. They are enabled to design and integrate RFID for existing production facilities. A major focus is also on the development of troubleshooting strategies. This enables the learners to anticipate and avoid known challenges and sources of errors and to develop adequate solutions. The learners know about the advantages and limitations of this technology, including in the context of data security.

No.	Task	Method	Competency level	Content	Competencies	Learning time	HW/ SW depend
Learning unit 1: Basics of Object Identification							
1	Comparison of identification technologies	Guidance text supported Method	Apply	<ul style="list-style-type: none"> ▪ Identification systems ▪ Binary Code ▪ Barcode ▪ Barcode ▪ HCCB code ▪ QR code ▪ 1D code ▪ 2D code ▪ 3D code ▪ RFID 	<ul style="list-style-type: none"> ▪ Know different industrial identification systems. ▪ Can describe the structure and function of different identification systems. ▪ Know the advantages and disadvantages of the different identification systems. ▪ Know the application areas of a barcode. ▪ Know the term stacked barcodes. ▪ Know the HCCB code as an example of 3D code. ▪ Can describe the structure and function of an RFID. ▪ Can distinguish different approaches to object identification. 	90 min.	No
2	Selection of an RFID system	Guidance text supported Method	Evaluate	<ul style="list-style-type: none"> ▪ RFID technology ▪ Reader/writer ▪ Transponder ▪ Areas of application ▪ Disruptive factors ▪ Frequencies ▪ Standards ▪ Technical documentation ▪ ISO 15693 ▪ Optical code 	<ul style="list-style-type: none"> ▪ Know the structure and function of an RFID reader/writer. ▪ Know the type of communication between transponder and RFID reader/writer. ▪ Know the difference between an active and passive transponder. ▪ Can describe the operation of an active and passive transponder. ▪ Know the transmission frequencies with which RFID technology works internationally. ▪ Can describe different couplings (inductive, capacitive, electromagnetic) between RFID read/write devices and transponders. ▪ Know the RFID standards and the different application areas. ▪ Can classify writing/reading devices with the help of technical documentation. ▪ Know the importance of ISO 15693 standards in production automation. ▪ Know different types of optical codes. ▪ Can distinguish optical codes from RFID technology. 	60 min.	No

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Learning unit 2: RFID in Production Automation

3	Write and read transponder	Guided text Method	Evaluate	<ul style="list-style-type: none"> ▪ RFID technology ▪ Transponder ▪ Technical documentation ▪ Decimal notation ▪ Hexadecimal notation ▪ Byte ▪ Addresses 	<ul style="list-style-type: none"> ▪ Can interpret the operation of an RFID using technical documentation. ▪ Can write to an RFID transponder manually. ▪ Can read data from an RFID transponder independently. ▪ Know the difference between decimal and hexadecimal notation. ▪ Can decompose decimal numbers into bytes. ▪ Can convert a decimal notation to a hexadecimal notation. ▪ Know the common terms of an RFID system (start address, byte address). 	90 min.	Yes
4	RFID in a production process with MES	Guided text Method	Apply	<ul style="list-style-type: none"> ▪ MES ▪ RFID data structure ▪ Orders ▪ Records ▪ Production cycle ▪ Transponder ▪ Decimal notation ▪ Hexadecimal notation ▪ Byte ▪ Addresses 	<ul style="list-style-type: none"> ▪ Know the term data structure in the context of RFID technology. ▪ Can create orders in the MES. ▪ Can trace partial steps of the orders in the MES. ▪ Can create an RFID record for a component. ▪ Can transfer the RFID data set to an MES. ▪ Know the common terms such as start address, address length. ▪ Can reproduce the context of the terms start address, address length in the context of an RFID transponder. ▪ Know the conversion steps between decimal and hexadecimal notation. ▪ Can read and interpret data to reflect the number of production cycles. 	45 min	Yes

No.	Task	Method	Competency level	Content	Competencies	Learning time	HW/ SW dependent
Learning unit 3: Control of an RFID System with a PLC							
5	Device configuration of an RFID system	Guided text Method	Apply	<ul style="list-style-type: none"> PROFINET RFID system TIA Portal TIA project Commissioning Troubleshooting 	<ul style="list-style-type: none"> Know the structure and function of PROFINET. Know the variants of PROFINET. Know the structure and function of HF read/write devices. Can assign a PROFINET device in TIA Portal. Know the basic functions of a PLC (e.g. overall reset). Can translate a TIA project. Can load a TIA project into a PLC. 	90 min.	Yes
6	Programming the reading of the UID in TIA	Guided text Method	Apply	<ul style="list-style-type: none"> Energy consumption Compressed air consumption Manufacturing/production costs Optimisation measures Presentation & Communication 	<ul style="list-style-type: none"> Can perform an analysis on a subsystem in the context of normal / reduced operating pressure. Can highlight the potential challenges of error-free operation. Can derive and implement concrete measures to ensure error-free operation. Can present your results. Can evaluate the procedure and the results. 	90 min.	Yes
7	Programming the read and write errors in TIA	Guided text Method	Apply	<ul style="list-style-type: none"> RFID system Gateway TIA Portal Read / write function Function module 	<ul style="list-style-type: none"> Can call commands via an RFID gateway. Know the read and write commands of a Turck RFID system. Can implement a read command via an RFID system in the TIA Portal. Know the relevant instructions in TIA in the context of RFID. Can implement a write command via an RFID system in the TIA Portal. Know the meaning of an observation table. Can test a function block in TIA and perform troubleshooting. Can independently reflect on and review what they have learned. 	90 min.	Yes

No.	Task	Method	Competency level	Content	Competencies	Learning time	HW/ SW dependend
8	Function module for any transponder size	Guided text Method	Apply	<ul style="list-style-type: none"> ▪ Function module ▪ Array ▪ Plant program ▪ PROFINET ▪ Interfaces ▪ Data types ▪ RFID gateway ▪ Transponder ▪ Read / write function ▪ TIA Portal ▪ Function test ▪ Troubleshooting 	<ul style="list-style-type: none"> ▪ Know the term array and its properties. ▪ Can use a variable length array. ▪ Can determine the bounds of an array with a variable length. ▪ Know the difference between an exercise function block and a block for a plant program. ▪ Can load and test a program in TIA. ▪ Know different PROFINET variants and their areas of application. ▪ Can determine a PROFINET variant for a controller and an RFID gateway. ▪ Know the term UID and can reproduce it. ▪ Can read a UID of a RFID transponder. ▪ Can name suggestions as a replacement for variable length arrays. ▪ Can perform a functional test and troubleshooting. ▪ Can independently reflect on and review what they have learned. 	120 min.	Yes

No.	Task	Method	Competency level	Content	Competencies	Learning time	HW/ SW de-pend
Learning unit 4: Risks and Limits of RFID technology							
9	Ecological opportunities and risks of RFID	Case study	Evaluate	<ul style="list-style-type: none"> ▪ RFID transponder ▪ Recycling rate ▪ Sustainability ▪ Conserving resources ▪ Ecological aspects ▪ Optimization ▪ Opportunities and risks 	<ul style="list-style-type: none"> ▪ Can estimate the recyclability on the basis of a concrete example. ▪ Know the terms sustainability, recycling and can interpret them. ▪ Can explain the term recycling rate. ▪ Can develop strategies to increase recyclability using RFID technology. ▪ Know the importance of resource conservation in the production process and beyond. ▪ Can assess the impact when RFID technology is widely used in determining products. ▪ Can derive solution strategies to reduce waste. ▪ Can reflect on and evaluate the knowledge gained. ▪ Can make a transfer of gained knowledge to real problems. 	45 min	No
10	Security risks of RFID	Case study	Evaluate	<ul style="list-style-type: none"> ▪ Data security ▪ Threat ▪ Risk assessment ▪ Protective measures ▪ Disposal 	<ul style="list-style-type: none"> ▪ Know the concept of data security and can classify it. ▪ Can reflect the protection goals of data security. ▪ Know the vulnerabilities of data security externally. ▪ Can classify the threats to data security in the context of an RFID system (tampering, destroying, eavesdropping, disrupting the radio link). ▪ Can carry out a risk assessment. ▪ Can interpret the results of the risk assessment and derive measures (encryption, password protection, etc.). ▪ Can assign attack scenarios on an RFID system to a protection target. 	90 min.	No