UNIVERSAL ROBOTS

Universal Robots Academy

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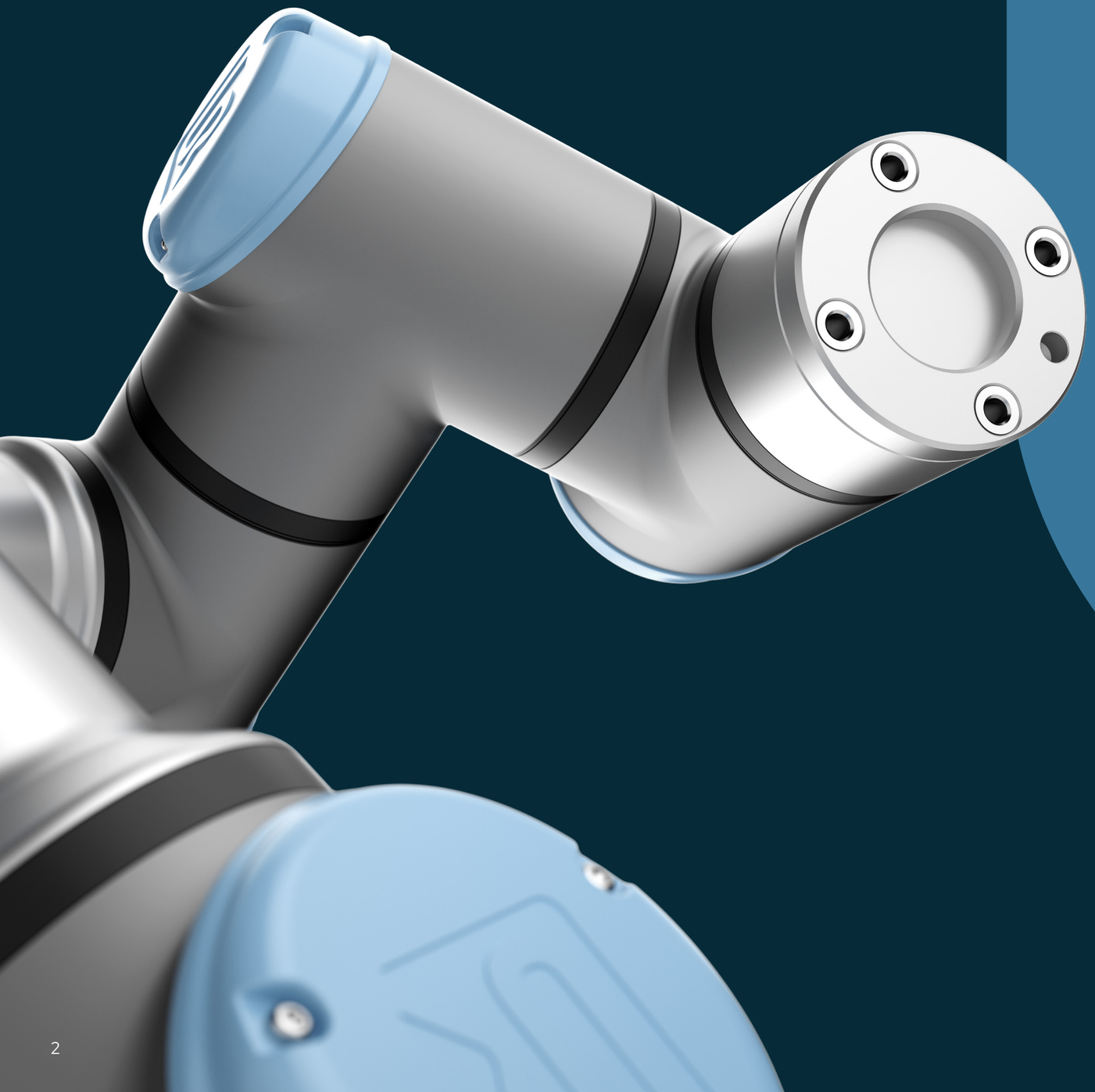


Contents

Not all trainings are offered in all countries and durations can vary.

Step into the world of automation

At Universal Robots, we believe that training is one of the corner-stones of our success when it comes to our robots' applications. Our goal is to make automation accessible to everyone and this is why we created a unique and award-winning training platform that is already being used by more than 350,000 people around the world. The combination of our free e-Learning with hands-on, in-class training sessions means that our users can acquire the know-how required for the implementation and programming of our collaborative robots (cobots). This training catalog provides a full and detailed overview of our training portfolio. You can use this catalog to learn more about the training content in advance and to choose the training courses that fit your needs and interests.

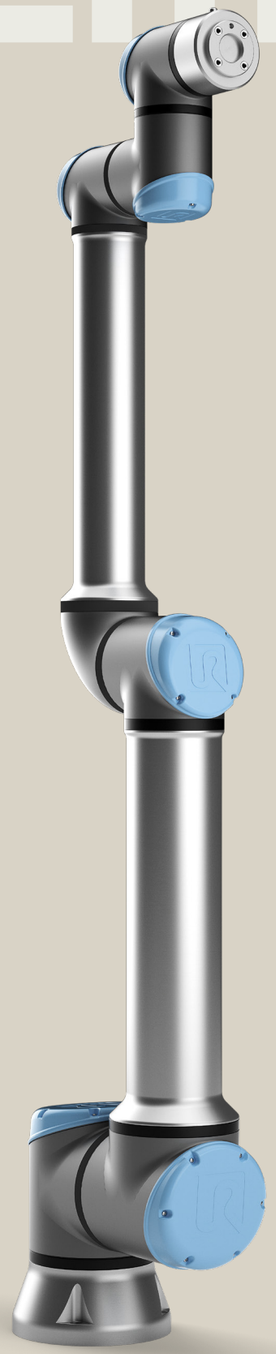
Take the opportunity to learn how to program our robots. Our easy-to-understand training modules are designed to help users acquire practical know-how in interactive simulations, thereby maximizing their learning success.

More than

350.000

users worldwide

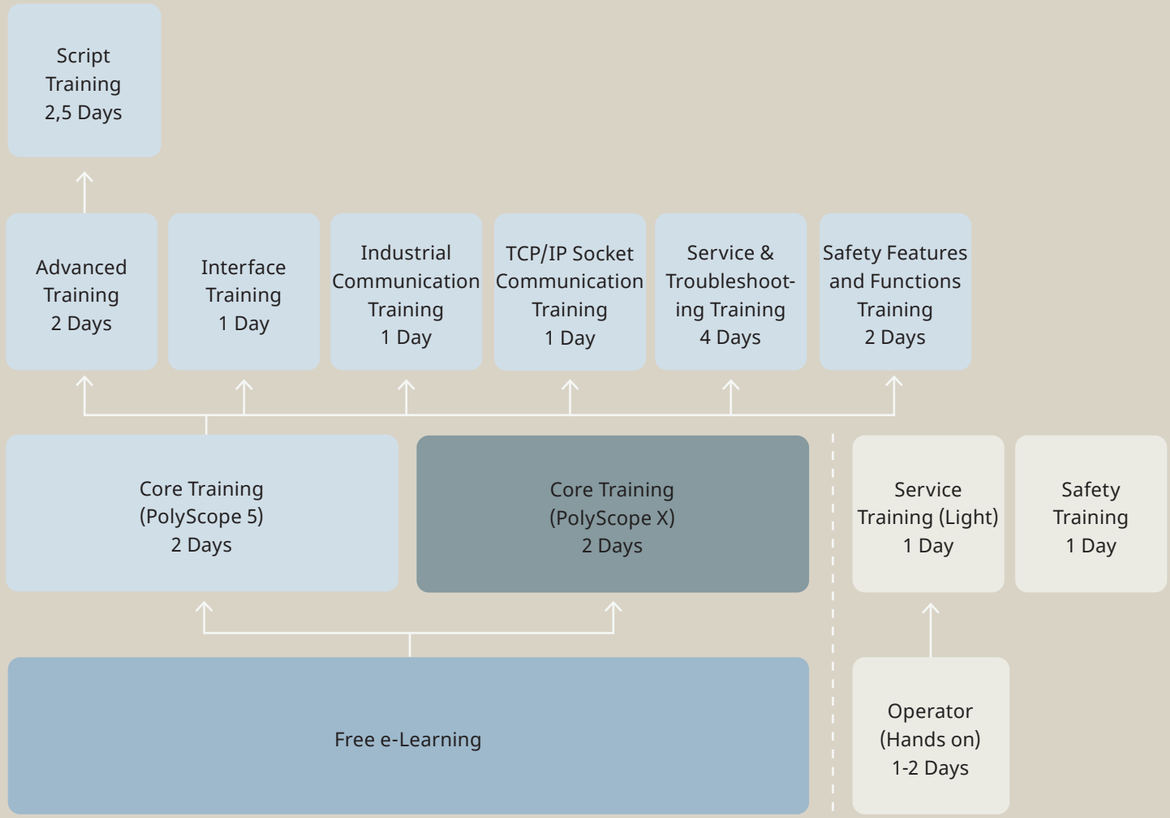
Empowering people



We want our users to be able to utilize the full potential of automation and believe that this can be achieved with the aid of a high-quality training platform. Therefore, in addition to the e-Learning, you also have the option to take part in our hands-on, in-person training courses. In all authorized training centers, our training concept is based on the following foundations:

1. High-quality training based on up to date teaching concepts
2. Practice-oriented, hands-on training according to the motto of “Learning by doing”
3. Authorized trainers and training partners working according to strict certification guidelines

→ **Link to UR Academy:**



Note:
1: Our training courses are designed to build on one another.
2: Not all Trainings are offered in all countries and durations can vary.

Free e-Learning

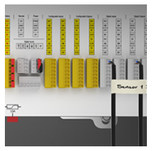
Our free e-Learning modules are designed to help you quickly acquire the knowledge you need to program your first cobot. With state-of-the-art robot simulations, our free e-Learning modules give you the opportunity to learn the basics of cobot programming, palletizing and safety without having to access the physical robot. We make robot programming easy so that anyone can automate. Set up your Academy account to take our free e-Learning today.

The 14 modules of our e-series e-Learning offer fast, practical learning success through interactive simulations. You will learn how to create a program and configure a tool and safety settings for your robot, as well as learn how to optimize a simple and more complex applications.

Get started now:

e-Series Core Track

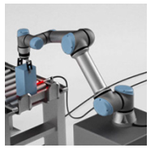
Module 1
First look: The robot at a glance
7 mins



Module 2
Preparing a robot task
6 mins

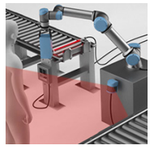
Module 3
Setting up a tool
17 mins

Module 4
Creating a program
12 mins

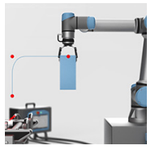


Module 5
Interaction with external devices
11 mins

Module 6
Controlling conveyors
10 mins



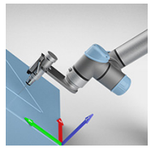
Module 7
Safety settings
15 mins



Module 8
Optimizing
6 mins

e-Series Pro Track

Module 9
Program flow
16 mins



Module 10
Feature coordinates
13 mins

Module 11
Force control
12 mins

e-Series Application Track

Module 12
Palletizing
15 mins

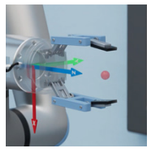
Module 13
Screwdriving
13 mins

Module 14
Machine tending
25 mins

UR20/30 e-Learning

Learn hands-on skills by tackling real-life tasks as the virtual instructor guides you through every step of setting up and programming a UR20/UR30 robot.

Module 1
Hardware overview and setting up
15 mins



Module 2
Confguring a tool
20 mins

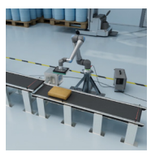
Module 3
Movement and motion types
8 mins

Module 4
Creating a program
17 mins

Module 5
Picking and placing
11 mins

Module 6
Communication between robots
8 mins

Module 7
Conveyor Control
11 mins



Module 8
Force control
12 mins

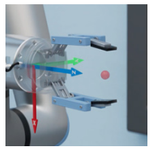
Module 9
Palletizing
10 mins

Module 10
Setting up for production
10 mins

PolyScope X e-Learning

This PolyScope X e-Learning provides a hands-on, virtual learning experience where you actively work in the interface while an instructor guides you throughout the course.

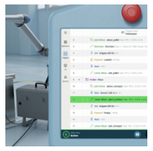
Module 1
Hardware overview and setting up
15 mins



Module 2
Confguring a tool
20 mins

Module 3
Movement and motion types
8 mins

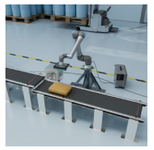
Module 4
Creating a program
15 mins



Module 5
Picking and placing
11 mins

Module 6
Communication between robots
8 mins

Module 7
Conveyor Control
11 mins



Module 8
Force control
12 mins

Module 9
Palletizing
12 mins

Module 10
Setting up for production
10 mins

Risk Assessment e-Learning

Module 1
Introduction
20 mins

Module 2
Palletizing application
30 mins

Risk Assessment e-Learning

Learn how to assess risks in a robot application and how to make your application safer. Get an introduction to a structured risk assessment process, see real-world examples of how to reduce risks and download a risk assessment template to use in your own risk assessment.

Palletizing Learning Path

Module 1
Planning
Documenting your existing process
17 mins

Module 2
Planning
Cell layout and reachability test
45 mins

Module 3
Planning
Gripper selection and test
39 mins

Module 4
Deployment
Safeguarding your palletizing application
24 mins

Module 5
Deployment
Application, assembly and final installation
11 mins

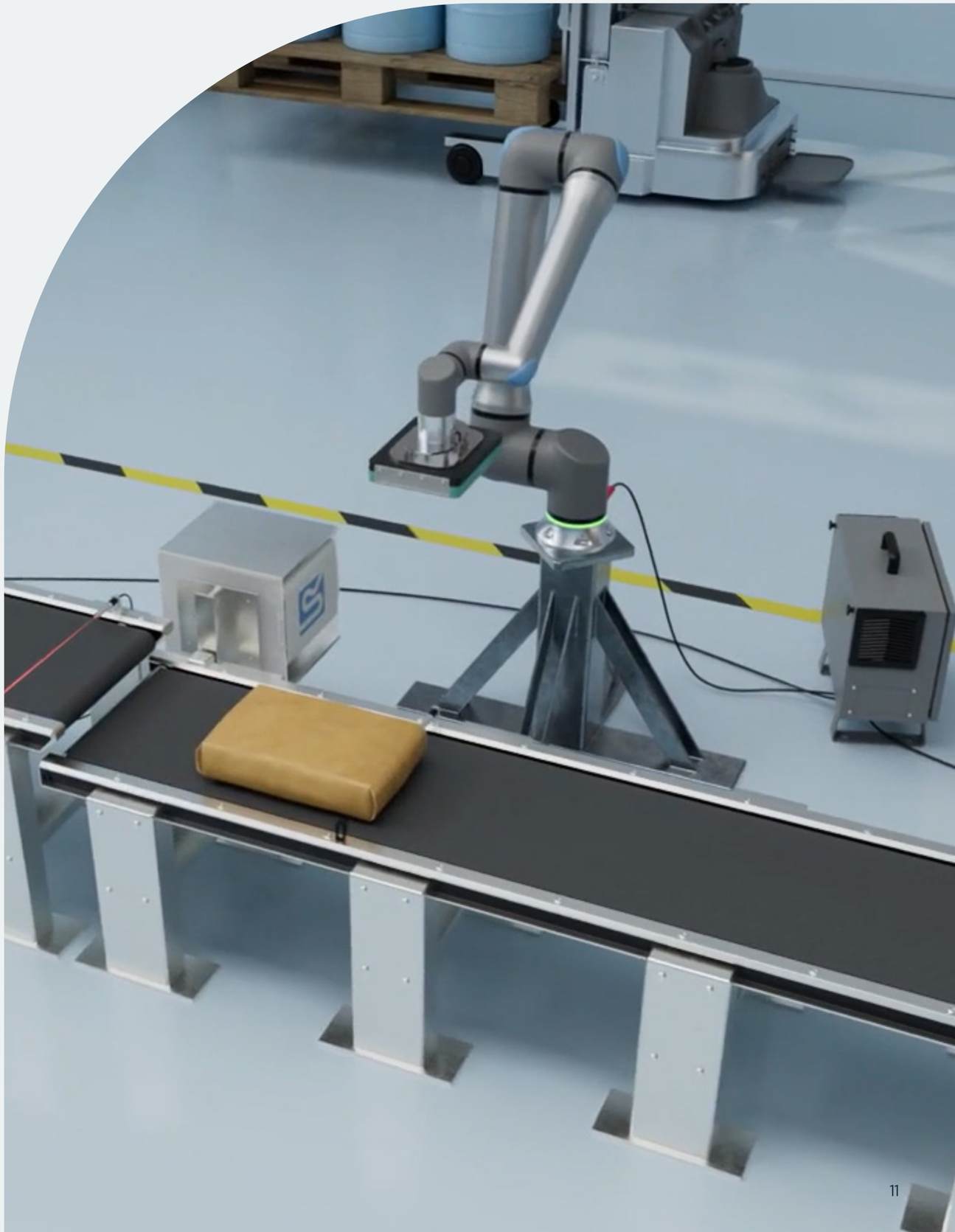
Module 6
Deployment
Programming you palletizing application
16 mins

Module 7
Operation
Operating and maintaining your equipment
5 mins

Palletizing Learning Path

Explore this free learning path to master the automation of palletizing processes with cobots. Gain insights into cell layout, end-of-arm tooling, feasibility testing, and simulation, ensuring you're equipped to optimize your end-of-line and palletizing tasks.

Get started now:



Becoming a cobot expert one step at a time

We want to make it as easy as possible for you to exploit the full potential of your cobots. Building on our free e-Learning, you can expand your cobot knowledge in our in-person training sessions under the guidance of real experts. Train in small groups with state-of-the-art training cells!

More than

150

Training centers

UNIVERSAL ROBOTS

Core Training
PolyScope X

2 Days
8 Modules

Once you have completed our free e-Learning, Core Training offers you the opportunity to build practical skills by programming a real UR cobot using the latest PolyScope X interface. Guided by our certified trainers, you will learn to program applications in training cells under realistic conditions.

This course focuses on developing your ability to create, adapt, and optimize robot programs with PolyScope X. You will gain hands-on experience in programming typical collaborative robot applications and learn how to use the tools and features unique to PolyScope X.

Once you have completed the two day training course, you will be able to

- safely program the robot in its basic functions,
- create and optimize programs for a wide variety of typical applications like pick-and-place, grid-based programming, polishing or operator screen setup,
- connect peripheral devices such as sensors, grippers or conveyor belts to the robot and control and query them from the robot program,
- integrate logics into your robot program,
- correctly configure the safety settings of the robot and
- use the tools and online resources that are available to you when programming applications.

Requirements:
- Successful completion of the free e-Learning modules
- NO programming knowledge required

Description of the modules
To enhance the learning experience, each training module is divided into smaller sub-modules that combine theory with practice. After each theory segment, participants engage in hands-on exercises to immediately apply what they've learned. This structure ensures a more interactive and effective learning process. At the end of each full module, participants are encouraged to perform a self-assessment to reflect on their progress and understanding.

Module 1:
Application Configuration

You are ready to set up your first application. In this module, you will prepare the robot for operation in PolyScope X by initializing the system and configuring key components needed to start programming.

Learning goals:
- Apply the skills acquired in the e-Learning to the real robot
- Configure essential components for your application
- Gain a clear understanding of the setup process before starting programming

Module 2:
Programming Basics

You are ready to start programming your first application. In this module, you will learn the basic tools and concepts for creating robot programs in PolyScope X.

Learning goals:
- Define and teach robot movements
- Optimize motion paths
- Use variables to build flexible and repeatable applications

Module 3:
Safety and Cyber Security

In this module, you will configure safety settings in PolyScope X by defining protective zones, setting movement limits, and connecting safety hardware. You will also learn about the built-in cyber security features that protect your system from unauthorized access.

Learning goals:
- Define protective zones and set movement limits
- Where to connect and configure safety hardware
- Understand and apply cyber security measures

Module 4:
Program Structure and Logic

In this module, you will learn how to write clear, structured, and maintainable programs in PolyScope X. By applying best practices for program structure and logic, you will create applications that are easier to understand, troubleshoot, and expand.

Learning goals:
- Apply good programming habits
- Building programs in Modules and Functions
- Use core logic tools to enable your robot to make decisions and respond dynamically

Module 5:
Optimize for Redeployment

In this module, you will learn how to build programs that can quickly adjust to changes in your setup, reducing reprogramming time and speeding up redeployment.

Learning goals:
- Use offsets to adjust positions without re-teaching every pose
- Create and work with Custom Frames to define your own coordinate systems for easier reuse
- Build and use grids to manage repeated tasks like palletizing or inspections

Module 6:
Operator Screen

In this module, you will learn how to create a user-friendly Operator Screen that lets operators run programs without changing the code. You will set up input, selection, and status items to make operation safe and easy.

Learning goals:
- Create items to let operators view or adjust key variables like counts or dimensions
- Configure items to guide operators with fixed choices on the screen
- Use items to provide clear feedback about program states, errors, or current action

Module 7:
Simple Force

In this module, you will learn how to use force-based control in PolyScope X to make your robot more responsive to contact and external forces. Program the robot to apply controlled force in specific directions and run parallel actions using threads.

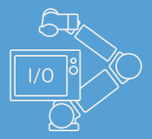
Learning goals:
- Set up and apply force using different Direction conditions
- Control the robot's behavior during force-sensitive tasks like polishing
- Use Threads to run concurrent processes and manage multiple actions at the same time

Module 8:
Online Resources

In this module, you will learn how to access key online tools and platforms that support your programming and troubleshooting needs beyond training.

Learning goals:
- Find resources to deepen your knowledge
- Find tools to troubleshoot issues
- Explore new features and updates from Universal Robots

Core Training
PolyScope 5



2 Days
11 Modules

Once you have completed our free e-Learning, Core Training offers you the chance to deepen the knowledge you have acquired on a real cobot and to learn the basic skills for programming. Under the guidance of our certified trainers, you will learn how to program various applications in training cells under realistic conditions. Unlike Operator Training, Core Training delves deeper into the programming of the cobot and does not primarily focus on the operation and handling of the robot.

This course is suitable for you if, once you have completed the free e-Learning, you would like to learn how to program a robot in a practical way and implement the applications that are used the most. It is also useful for those who want to experiment with the robot's capabilities to explore possible applications in their own production processes.

Once you have completed the two day training course, you will be able to

- safely program the robot in its basic functions,
- create and optimize programs for a wide variety of typical applications like pick-and-place, palletizing, polishing or dosing,
- connect peripheral devices such as sensors, grippers or conveyor belts to the robot and control and query them from the robot program,
- integrate logics into your robot program,
- correctly configure the safety settings of the robot and
- use the tools and online resources that are available to you when programming applications.

Requirements:
- Successful completion of the free e-Learning modules
- NO programming knowledge required

Description of the modules
In order to maximize the learning effect, the theory is first presented in each training module and subsequently implemented through practical exercises. At the end of each module, each participant can perform a self-assessment of their results.

Module 1:
Pick-and-place application

You are ready to program your first application. The pick-and-place application, which you already worked on during the e-Learning, will now be implemented with a real robot and real equipment.

Learning goals:
- Apply the skills acquired in the e-Learning to the real robot
- Move the robot using the "Move" tab
- Configuration of TCP, orientation and payload using the available assistants

Module 2:
Safety settings

You already have a functional application, but it still needs to be designed so that it is safe. In this module, your task is to apply the safety functions available on the robot to the existing pick-and-place application in order to minimize the risk of collisions in the work area. To do this, you use, for example, safety levels, joint limits, speed limits and force limits.

Learning goals:
- Correct use and configuration of the available safety functions

Module 3:
Optimizing a pick-and-place Application

In Module 1, you created the pick-and-place application and you also applied the safety settings to this application. Your next task is optimization in terms of the waypoints, program structure and cycle time.

Learning goals:
- Use the correct types of movement
- Understanding of and use of blend radii
- Configure speed and acceleration for movements and individual waypoints
- Creation of a clear program structure

Module 4:
Easy startup

For some applications, it can make sense for the robot to automatically load and start a specific program after switching on. Your task in this module is to configure the robot in such a way that it is initialized automatically or via defined inputs when it is switched on and your program from Module 3 starts.

Learning goals:
- Configure a standard program that is automatically loaded and started when the robot is switched on

Module 5:
Program flow

The task in this module is to integrate quality control into your application. To do this, you must add a subprogram that uses an if/else command to extract every fifth workpiece for quality control.

Learning goals:
- Use and configure the if/else command
- Create and use variables
- Insert and call up programs

Module 6:
Palletizing

It is now your task to add a pallet to your application in order to be able to store the finished, packaged workpieces. The integrated Palletizing Template is available to you to perform this task. It allows you to program a complete palletizing within a short period of time.

Learning goals:
- Use and configure the Palletizing Template

Module 7:
Force control (simple)

In this module, you will learn how to (simply) configure the Force Template and read out the data from the force torque sensor. Program the cobot to detect the height of a stack and pick up the workpiece from the detected height.

Learning goals:
- Insert and use threads
- Configuration of the Force Template (simple)
- Read out and use the data from the integrated force torque sensor

Module 8:
Process application with operator selection

In this module, you will create a new application in which you will simulate applying glue to three different parts. By means of an input using the teach pendant, you can decide which workpieces the adhesive should be applied to.

Learning goals:
- Use of loops and switch/case commands
- Assignment of a variable value by the user

Module 9:
Flexible redeployment

Your next task is to apply simulated glue again. The challenge with this application is that the logo can be in different positions. As it doesn't make sense to perform the programming from scratch each time, another solution must be found: Programming relative to a coordinate system.

Learning goals:
- Creation of a coordinate system (level)
- Programming relative to a coordinate system

Module 10:
Implementation plan

To ensure that no important points are forgotten, we will provide you with an implementation plan. This is intended to serve as an aid or guideline for the implementation of applications.

Learning goals:
- Use of a structured method (10 steps) to identify and evaluate the complexity of the automation options with your cobot

Module 11:
Online resources

The last module shows you how to use the support website and access important information. Our support website is a tool that contains a lot of useful information, such as:

- Free software updates, user manuals, service manuals and script manuals
- CAD data for the robots, teach pendant and controller
- Free offline simulator
- Digital documentation
- Help articles on various topics

Simulator-based
Core Training (PolyScope 5)

The scope and content of this training is the same as that of the Core Training described above, and it is implemented as usual under the direction of our certified trainers – it's just 100% virtual. Thanks to our browser-based simulator, the practical tasks of Core Training can be completed fully virtually.
You are connected to the trainer and to the other participants via a video conferencing system such as Microsoft Teams, Zoom or similar.

As is the case with our in-person training courses, the theoretical basics are explained by certified trainers and illustrated using live demos on real robots. This is also the format of the online version of our Simulator-based Core Training.

With a click of the mouse, the trainer switches from the PowerPoint to the robot camera during demonstrations, and you can follow the steps on the teach pendant at the same time.

Even when performing the practical tasks, the effort for you as a participant is minimal, since the simulation environment runs in the browser and there is no installation necessary. The access data for the simulator and the online meeting will be sent to you automatically a few days before the training.

- Identical duration and content to the in-person Core Training
- Comfortably from home or from the office
- No travel expenses

UNIVERSAL ROBOTS

Advanced Training

2 Days
8 Modules

The purpose of Advanced Training is to deepen the knowledge you acquired in Core Training and to master more complex challenges when programming cobots. In this training course, and under the guidance of certified trainers, you implement your theoretical knowledge in practical tasks directly on the robot.

This course is aimed at users who would like to perform complex applications with their cobots in order to evaluate their implementation in their own production processes.

After completing Advanced Training, you will be able to

- create robot programs in a professional and structured way,
- use basic functions in URScript programming,
- work with pose transformations and some important URScript functions,
- create programming relative to your own coordinate system and perform a shifting of the coordinate system within the robot program,
- create applications with multiple TCPs (Tool Center Points),
- use the Conveyor Tracking Template

in addition to the force function (simple) from Core Training, you will

- also be able to use the force functions motion, frame and point,
- use Remote TCP with Linear, Circle and Toolpath Moves
- execute G-code commands for complex toolpath generation, ensuring high-accuracy machining and advanced path planning.

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of Core Training

Description of the modules
Advanced Training is structured like Core Training where the theory is first presented in each training module and subsequently implemented through practical exercises. At the end of each module, each participant can perform a self-assessment of their results.

Module 1:
Program structure

It is always best practice to maintain a well-organized structure in your program by using meaningful naming, folder organization and sub-programs. When developing a complex program with multiple steps, having a good structure becomes essential, especially if you or others need to review, modify or troubleshoot. In this example, we are working with a program, which involves various steps both before and after processing a part. You will learn how to use flowcharts and adopt best practices for program structuring.

Learning goals:
- Creating a program flowchart
- Programming with a clear and maintenance friendly program structure
- Programming in a performance saving way

Module 2:
Advanced use of TCP

In previous e-Learning and Core Training, you learned about the Tool Center Point (TCP) and how to configure it. In Advanced Training, we will explore this topic in greater depth. You will learn how to configure complex tools, switch between TCPs, and set up the TCP directly from the robot program.

Learning goals:
- How to teach TCP and orientation
- How to adjust the Center of Gravity in a program
- Switching between TCPs in a program

Module 3:
Conveyor tracking

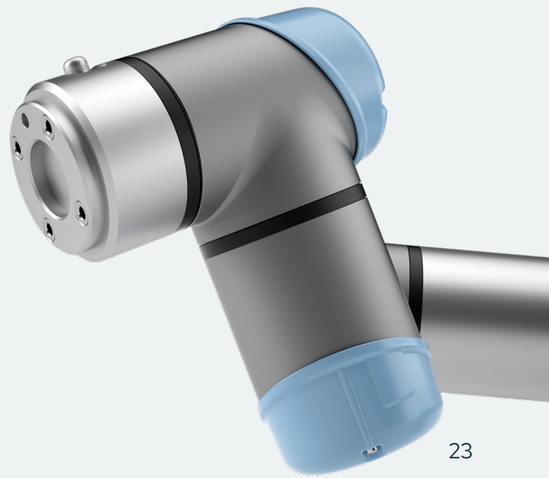
In this application, you will use the Conveyor Tracking template to enable the robot to pick up workpieces from a moving conveyor belt. The robot will synchronize its movement with the conveyor, matching both speed and direction. This allows for seamless part retrieval from the running belt.

Learning goals:
- How to set up conveyor tracking in installation
- How to program conveyor tracking
- Extension options

Module 4:
Basics of URScript

When the functionalities of PolyScope reach its limits, URScript becomes a valuable tool. URScript offers enhanced possibilities, greater functionality, and increased flexibility in your programming. This allows for the implementation of more complex applications, such as advanced mathematical calculations.

Learning goals:
- How to create your own URScript Functions
- How an argument can be handed over to a Function
- How a Function can return arguments
- How to index a list or a pose



Module 5:
Force control

In the Core Training, you were introduced to the Force Simple function. However, you may have noticed that its functionality has certain limitations. In this module, we will explore advanced applications of other force-related functions. These are commonly used in tasks such as assembly, deburring and polishing.

Learning goals:
- How to configure and use the different types of Force control
- How to measure forces during a cycle
- How to activate and use compliance mode

Module 6:
Pose transformation

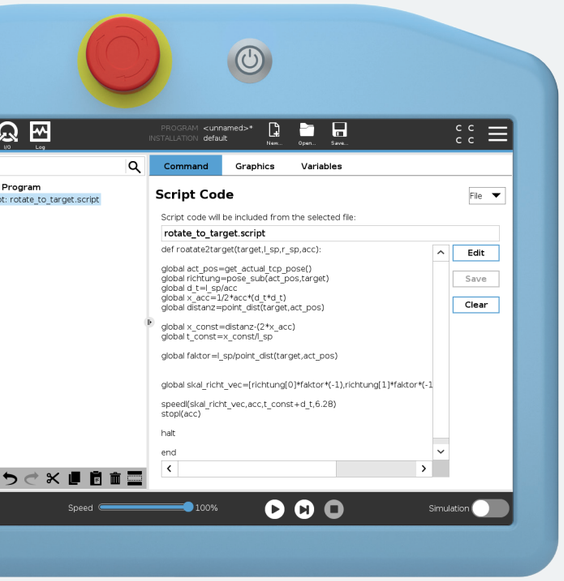
In certain applications, working with the robot pose, defined by X, Y, Z, RX, RY, and RZ, can be highly beneficial. For instance, knowing the robot's position or manipulating it for more complex tasks, such as creating a Safe Home routine or performing feature shifts for position patterns, is essential. Functions like pose_add() and pose_trans() are particularly useful in these scenarios. This module will cover how and when to utilize the robot pose effectively.

Learning goals:
- Indexing of pose variables
- How to use pose_add() and pose_trans()
- Difference between pose_add() and pose_trans()

Module 7:
Toolpath (G-Code)

By using Toolpath G-Code import, programming time can be significantly reduced. Robot paths can be generated directly from CAD models of workpieces, regardless of their complexity. This module will guide you through the process of creating a program using Toolpath.

Learning goals:
- Import of nc-files
- Create a program using Toolpath
- figuration of the various force functions



Module 8:
Remote TCP

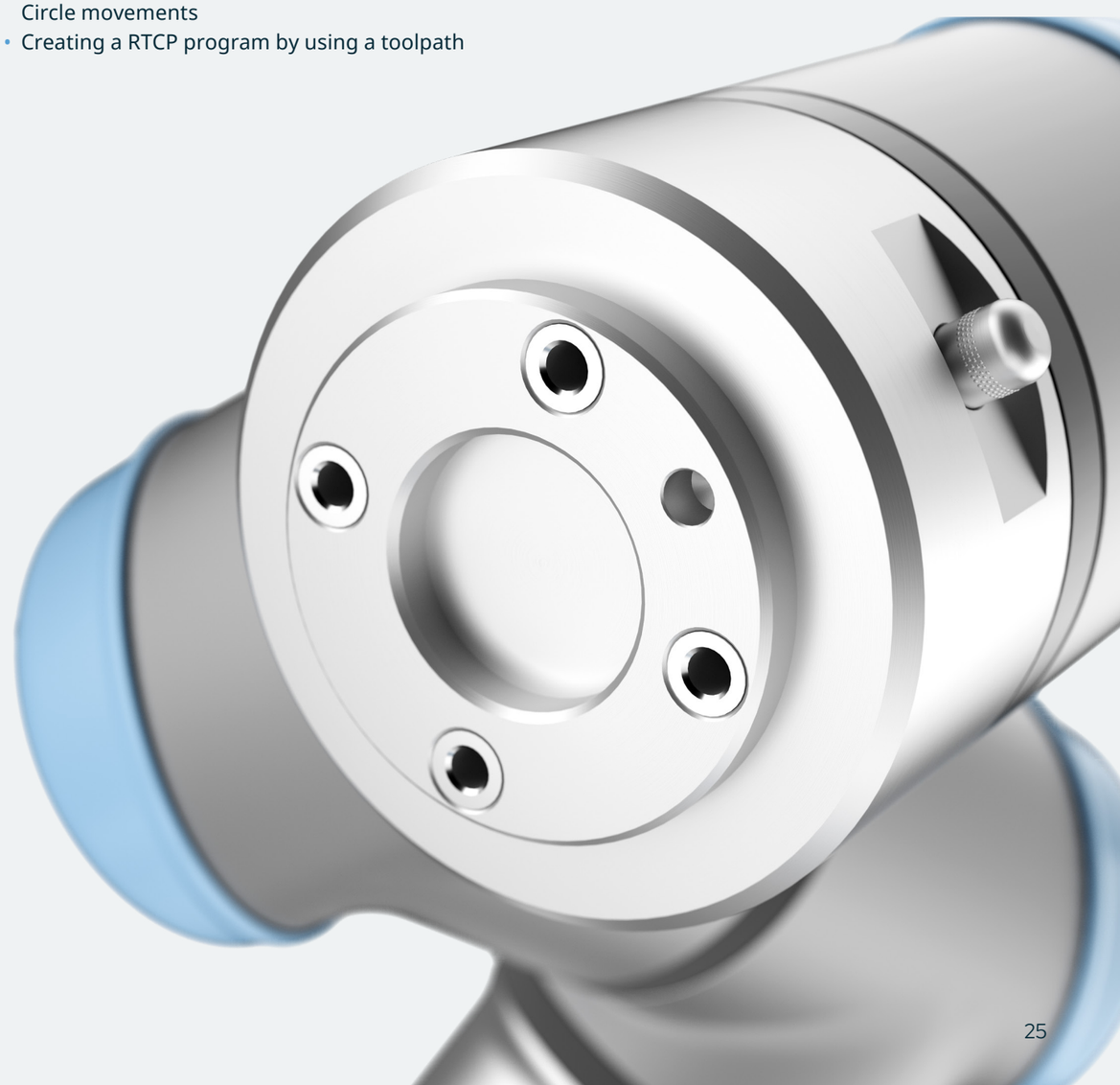
In many process applications, such as gluing, deburring, sewing, and polishing, it is often more efficient for the robot to hold the part and move it at a constant speed around a fixed tool, such as a sanding belt, deburring tool, sewing machine, or polishing wheel. This can be achieved using a Remote TCP (RTCP). This module will cover how RTCP can be applied to solve these tasks.

Learning goals:
- Setting up a Remote TCP
- Creating a RTCP program with Linear and Circle movements
- Creating a RTCP program by using a toolpath

Module 9 (Optional):
path_offset

The path_offset functionality enables runtime modifications to the motions produced by a robot program. This feature is particularly useful when the robot needs to execute a predefined, repetitive pattern, such as during welding or glue dispensing. This module will explore how to effectively use path_offset for these applications.

Learning goals:
- How to use path_offset to modify robot movements in realtime.



Robot Safety Features and Functions Training

This hands-on training course introduces participants to the built-in safety features and Functions of Universal Robots. Through practical exercises and expert guidance, attendees will learn how to configure and apply safety functions to create safer, more efficient robot applications.

2 Days
10 Modules

Once you have completed the two day training course, you will be able to

- Understand and apply essential safety concepts for UR robots.
- Use built-in safety features to create safer applications.
- Determine when to use built-in safety functions versus additional safety equipment.
- Streamline the safety approval process for robot installations.

Target Audience:
Automation engineers, robot programmers, and safety specialists who are working with UR robots.

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of Core Training

Description of the modules
In order to maximize the learning effect, the theory is first presented in each training module and subsequently implemented through practical exercises. At the end of each module, each participant can perform a self-assessment of their results.

Module 1:
Safety Introduction

This module introduces the importance of safety in automation, highlighting the differences between cobots and traditional robots. Participants will learn about the risk reduction process and the six steps to creating a safe machine.

Learning goals:

- Understand why safety is critical in automation
- Differentiate between cobots and traditional robots

Module 2:
Joint Limits & Safety Planes

Explore how to restrict the robot's workspace using joint limits and safety planes. Learn to configure trigger planes that activate reduced mode and prevent the robot from entering unsafe zones.

Learning goals:

- Limit the robot's workspace using joint limits
- Configure safety planes to block the robot and trigger mode changes

Module 3:
Robot Limits

Understand how to apply robot limits in both Normal and Reduced modes. Learn to use factory presets and custom configurations to control speed, force, power, and stopping behavior for safer operation.

Learning goals:

- Understand limits in Normal vs. Reduced mode
- Apply factory presets and custom limits
- Understand the impact of limits on robot behavior

Module 4:
Tool Restrictions

Learn how to define the tool's position and orientation to prevent unsafe movements. This module covers how to configure tool spheres and directional limits to enhance safety during operation.

Learning goals:

- Define tool positions and orientations
- Restrict tool movement to enhance safety

Module 5:
Safety I/O

Understand the differences between dedicated and configurable safety I/O. Learn how to connect and configure emergency stops, safeguard inputs, and utilize OSSD capabilities for enhanced safety integration.

Learning goals:

- Differentiate between digital I/O and configurable safety I/O
- Utilize OSSD capabilities of the robot
- Connect and configure external safety equipment

Module 6:
3-Position Enabling Device & Freedrive

Discover how to integrate a 3-position enabling device and configure Freedrive functionality. Learn the benefits of safety-configured Freedrive in Manual mode for safe robot manipulation.

Learning goals:
- How to integrate a 3-position enabling device
- Configure Freedrive functionality in Manual mode

Module 7:
Mode Changes

Gain insights into switching between Normal/Reduced and Manual/Automatic modes. Learn how mode changes affect robot behavior and how to configure mode transitions safely.

Learning goals:
- Understand the difference between Normal/Reduced and Manual/Automatic modes
- Apply mode changes for safe operation

Module 8:
Emergency Stop & Safeguard Functions

Learn the distinctions between robot and system emergency stops. Understand how to share safety signals between robots and configure safeguard functions for both Manual and Automatic modes.

Learning goals:
- Distinguish between system safety and robot safety
- Exchange safety signals with other machines
- Determine when to implement a safety PLC

Module 9:
Safety Outputs

Explore the robot's safety output signals, such as Safe Home, Robot Moving, and Reduced Mode indicators. Learn how to use these outputs to synchronize safety states with external equipment.

Learning goals:
- Configure safety-related output functions
- Understand signal behaviors and use cases

Module 10:
Hardware

Understand the hardware options available for UR robots, including Teach Pendant configurations, IMMI, and PROFIsafe interfaces. Learn how these components support safety integration.

Learning goals:
- How to replace or configure the Teach Pendant
- Explore the interface options IMMI and PROFIsafe

Service Training (Light)

1 Day
7 Modules

To keep your cobot productive and avoid unnecessary downtime, your maintenance/service team needs a solid foundation in safe service routines and structured first-level diagnostics.

After completing Core Training, Service Training (Light) provides a practical introduction to service fundamentals for factory maintenance and service teams. Together with our certified trainers, participants learn how to identify common issues, interpret symptoms and messages, and perform the right checks to determine the next step, without going into component repair or replacement.

This training is ideal for participants who are responsible for keeping cobot cells running day-to-day and who need to assess faults efficiently, collect the right information, and escalate effectively when needed. The course focuses on “what to check, why it matters, what good looks like,” and how to apply a consistent routine across the team.

Once you have completed the Service Training (light), you will be able to:

- recognize and interpret common system messages at a first-level service scope
- apply a structured approach to diagnosing issues
- gather and communicate the right information for escalation to support
- understand the key robot and controller elements at a functional level

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of the Operator (Hands-on) Training

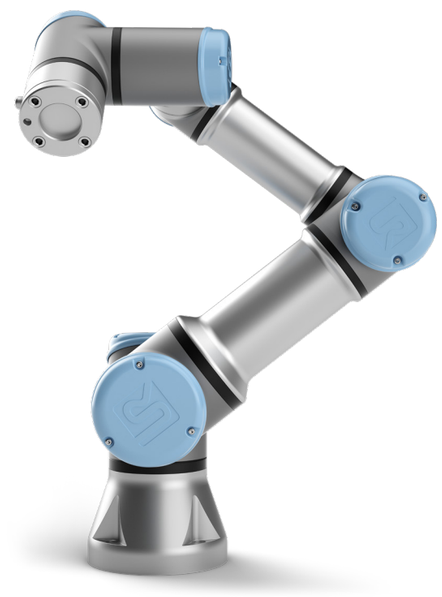
Description of the modules
In order to maximize the learning effect, the training modules are first presented in theory so that these can then be explored further in practical exercises.

Module 1: Service Foundations

This module introduces the fundamental safety principles, tools, and reference practices required for service activities on UR robots. It establishes the essential foundation needed before performing maintenance and troubleshooting tasks in both training and real service situations.

Learning goals:

- Understand mechanical and electrical safety when working with UR robots
- Learn how to prevent ESD damage through correct handling and procedures
- Gain an overview of service tools and approved service products



Module 2: Basic Programming

This module introduces the fundamentals of programming UR robots. Participants learn how to move the robot safely, set up simple programs, and configure basic tool settings as a foundation for further application development and service-related tasks.

Learning goals:

- Learn how to move the robot using basic motion commands
- Set up and run a simple robot program
- Perform basic tool setup for correct robot operation

Module 3: Preventive Maintenance

This module explains the purpose and value of preventive maintenance and how regular, structured checks help ensure safe operation, reliability, and long service life of UR robots. Participants are introduced to a systematic, step-by-step preventive maintenance approach applicable in both training and real service situations.

Learning goals:

- Understand why preventive maintenance is performed
- Recognize how preventive maintenance helps reduce downtime
- Follow a structured, step-by-step Preventive Maintenance Checklist

Module 4:
Software

This module focuses on essential software-related service tasks required to maintain system safety, stability, and recoverability. Participants are introduced to key software concepts and procedures used during service activities on UR robots.

Learning goals:
- Understand the role of the Safety System in relation to robot operation
- Learn how to perform system backups and updates
- Understand the purpose and use of Magic files during service and recovery tasks

Module 5:
Troubleshooting

This module introduces a structured approach to troubleshooting UR robots using available diagnostic tools and information sources. Participants learn how to collect, interpret, and analyze relevant data to support first-level fault analysis and efficient escalation.

Learning goals:
- Interpret robot error codes and system messages
- Analyze system data using the UR Log Viewer
- Apply a structured approach to troubleshooting and fault analysis

Module 6:
Good Deployment Practices

This module focuses on applying good deployment practices throughout the full robot lifecycle. Participants learn how to ensure safe, efficient, and consistent deployment of UR robots during installation, motion, maintenance, and troubleshooting activities.

Learning goals:
- Apply good deployment practices during installation and robot motion
- Follow recommended practices during maintenance and troubleshooting
- Ensure consistent, safe, and reliable robot operation across deployment scenarios

Module 7:
Case Handling

This module focuses on structured and efficient handling of service cases. Participants learn how to create, manage, and update cases using the Partner Portal to ensure clear communication, proper documentation, and consistent service execution.

Learning goals:
- Understand how to manage service cases in the Partner Portal
- Learn how to document and update cases with the required information
- Apply a structured approach to case handling to support efficient service resolution

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Service & Troubleshooting Training

4 Days
9 Modules

Once you have completed Core Training, Service & Troubleshooting Training provides a deeper, hands-on understanding of service concepts through practical work on real robots under the guidance of our certified trainers. The training covers the UR Series and e-Series, with CB Series content available as an optional module depending on the selected scope.

This training is intended for participants who need to identify and resolve issues in hardware and robot programs, and for those who are responsible for performing service work when required. Compared to Service Training (Light), this course goes further by introducing component-level service and troubleshooting, including how to replace selected components such as joints, safety control board, motherboard, and power supply.

Through structured, practical troubleshooting, you will learn to connect error symptoms to likely root causes and determine the appropriate corrective action.

Once you have completed the Service & Troubleshooting Training, you will be able to:

- understand the electrical and mechanical structure of the robot arm and controller
- explain the interaction of key hardware components and how failures typically present
- understand the structure and operation of the UR software in a service context
- perform practical troubleshooting and repairs on the robot arm and controller using a structured approach, supported by hands-on exercises

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of the Core Training

Description of the modules
In order to maximize the learning effect, the theory is first presented in each training module and then subsequently implemented in practical exercises. In our Service & Troubleshooting Training course, most of the time is spent on exercises. These exercises give you the opportunity to perform real troubleshooting and repair on real robots.

Module 1: Service Foundations

This module introduces the fundamental safety principles, tools, and reference practices required for service activities on UR robots. It establishes the essential foundation needed before performing maintenance, troubleshooting, or service tasks in both training and real service situations.

Learning goals:

- Understand mechanical and electrical safety when working with UR robots
- Learn how to prevent ESD damage through correct handling and procedures
- Gain an overview of service tools and approved service products

Module 2: Preventive Maintenance

This module explains the purpose and value of preventive maintenance and how regular, structured checks help ensure safe operation, reliability, and long service life of UR robots. Participants are introduced to a systematic, step-by-step preventive maintenance approach applicable in both training and real service situations.

Learning goals:

- Understand why preventive maintenance is performed
- Recognize how preventive maintenance helps reduce downtime
- Follow a structured, step-by-step Preventive Maintenance Checklist

Module 3: Troubleshooting

This module introduces a structured approach to troubleshooting UR robots using available diagnostic tools and information sources. Participants learn how to collect, interpret, and analyze relevant data to support first-level fault analysis and efficient escalation.

Learning goals:

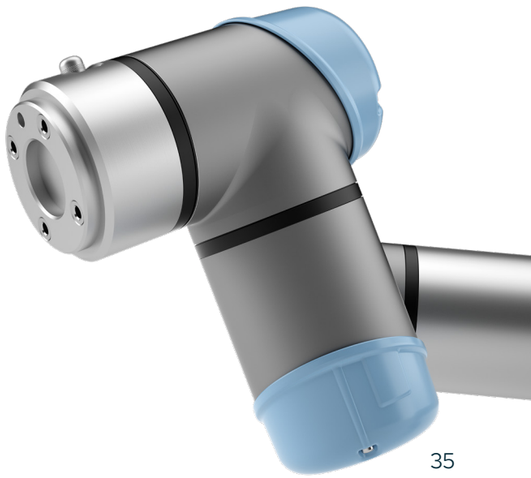
- Interpret robot error codes and system messages
- Analyze system data using the UR Log Viewer
- Apply a structured approach to troubleshooting and fault analysis

Module 4: Robot Arm Repairs

This module covers essential robot arm repair activities, focusing on safe replacement and restoration of UR robot arms. Participants are introduced to approved repair methods used in service situations, including robot swapping, joint replacement, and calibration to restore correct robot operation.

Learning goals:

- Learn the principles of joint replacement on UR robot arms
- Perform calibration to ensure correct robot accuracy and functionality
- Apply repair procedures in a safe and systematic manner



Module 5:
Teach Pendant Repairs

This module focuses on common Teach Pendant repair activities required during service situations. Participants learn how to safely replace and restore Teach Pendants to ensure correct operation and system availability.

Learning goals:
- Understand how and when to swap Teach Pendants
- Learn how to replace the Teach Pendant cable
- Learn how to replace the Teach Pendant frame

Module 6:
Software

This module focuses on essential software-related service tasks required to maintain system safety, stability, and recoverability. Participants are introduced to key software concepts and procedures used during service activities on UR robots.

Learning goals:
- Understand the role of the Safety System in relation to robot operation
- Learn how to perform system backups and updates
- Understand the purpose and use of Magic files during service and recovery tasks

Module 7:
Control Box Repairs

This module covers key control box repair activities performed during service assignments. Participants are introduced to approved methods for replacing and servicing control boxes, with a strong focus on safety-relevant components and correct handling of control box hardware.

Learning goals:
- Understand how and when to perform a Control Box swap
- Identify safety-relevant components inside the Control Box
- Learn how to replace selected Control Box components using approved procedures

Module 8:
Case Handling

This module focuses on structured and efficient case handling during service engagements. Participants learn how to manage service cases using the Partner Portal and how to ensure consistent, high-quality field service execution from initial case review through customer wrap-up.

Learning goals:
- Understand how to manage service cases in the Partner Portal
- Learn how to review, document, and update cases using the required information
- Apply a consistent approach to field service execution from case review to customer handover

Module 9:
Packing and Shipping

This module focuses on correct preparation of UR robots and components for transport during service activities. Participants learn how to safely pack down systems, follow approved shipping procedures, and recognize good and bad practices to prevent transport damage and delays.

Learning goals:
- Learn how to prepare robots and components for shipment according to shipping procedures
- Recognize good and bad practices when packing and shipping service items
- Ensure safe transport and proper handling during shipping

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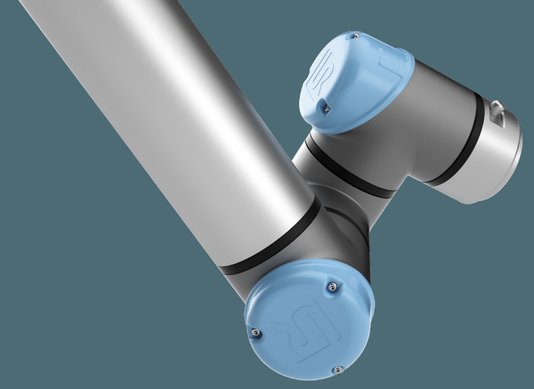


Safety Training

1 Day
7 Modules

As with any other type of machine, safety is a mandatory legal requirement for robot applications. Collaborative robotics is changing the traditional paradigm when it comes to the use of industrial robots, namely by making it possible to dispense with a protective housing under certain circumstances. Unlike traditional industrial robots, the required level of safety for human-robot collaboration is achieved by limiting the force and power that can be exerted by the robot so that it does not cause injury if a collision occurs. The advantages of this type of cooperation are obvious: less space is required, lower plant and equipment costs, higher productivity and higher quality of the manufactured products.

Compliance with European guidelines is mandatory for the commissioning of a collaborative application. This training serves as an aid for designers, manufacturers and users of machines as well as all associated staff to ensure that the requirements of the European Machinery Directive 2006/42/EC and its harmonized standards are fulfilled.

Once you have completed the Safety Training,

- you will know the connection between technically relevant legal regulations and rules,
- you will have an overview of 42/2006/EC (Machinery Directive),
- you will be familiar with the 9th Ordinance on Product Safety Act,
- you will understand the connections and legal significance of the relevant standards and legal regulations (EN ISO 10218 / EN ISO 13849 /
  TS 15066) and
- you will know the relevant content of the aforementioned standards and legal regulations.

Requirements:

- There are no requirements for this training. However, we would still recommend that you complete our free e-Learning modules.

Description of the modules
In order to maximize the learning effect, the training modules are first presented in theory so that these can be explored further through practical exercises.

Module 1:
Legal basis

Before we go into the topic of “Cobot Safety”, you will first get to know the most important building blocks in this area. The modules that follow later will build on these. In Module 1, the connections between directives and standards are discussed, as well as the legal status of these two crucial components in the EU harmonization concept.

Learning goals:
- Get to know the EU harmonization concept and how it is structured
- Become familiar with the legal status of directives and regulations
- Understand vague legal terms in technical law

Module 2:
Product liability

There are two types of product liability in German law: Liability pursuant to the Civil Code and to the Product Safety Act. In this module, you will learn about the differences between the two types of liability and the resulting obligations. In addition, the types of product defects and possible liability exclusions are discussed.

Learning goals:
- Distinguish between the types of product liability
- Become familiar with the legal duty to maintain safety according to the Product Liability Act
- Know the possible liability exclusions

Module 3:
Risk assessment

Risk assessment is a key pillar of the Machinery Directive. Therefore, the knowledge of how to perform a risk assessment is essential for every integrator and mechanical engineer. Together, we will look at the interactive process for implementation in accordance with EN ISO 12100 and the content and sub-disciplines in accordance with EN ISO 12100.

Learning goals:
- Correct designation of the sub-disciplines of a risk assessment
- Get to know the contents of a risk assessment
- Carry out a risk assessment based on the severity of the damage and the probability of occurrence

Module 4:
Sample risk assessment

When it comes to collaborative applications, ISO TS 15066 is the current standard for carrying out a risk assessment. This technical specification is often used in risk assessments in particular. As misinterpretations can occur in the design phase, the correct application of Appendix A of ISO TS 15066 is dealt with in this module.

Learning goals:
- Evaluate collision scenarios
- Interpret force and pressure values of Appendix A
- Perform a measurement to determine force and pressure
- Calculate the transfer energies for collisions in free space

Module 5:
Performance level and category

A frequently discussed topic in the field of robotics is the requirement for a certain performance level and a system architecture. These requirements will be examined here in more detail. The composition and background of the performance level as well as the structure and functioning of the safety system will be discussed.

Learning goals:
- Gain a better understanding of the performance level and how it is calculated
- Get to know the structure of the safety system
- Distinguish between performance level category 3 and category 2

Module 6:
Enabling device

The wish for an enabling device is something that comes up time and again. It is correct that EN ISO 10218:2011 includes a requirement for an enabling device. However, this is qualified in ISO TS 15066 for collaborative robot systems. So what now? When do I need an enabling device and when do I not? This question is answered in this module.

Learning goals:
- Know the cases where an enabling device is required and when collaborative applications can also be operated without an enabling device

Module 7:
CE declaration

At the end of each application, a CE declaration of conformity is produced once the risk assessment has been successfully carried out. However, the robot manufacturer also supplies a CE declaration of incorporation. What are the differences and what does the content look like? In this module, you will learn about this and the options that are available for determining conformity with the Machinery Directive.

Learning goals:
- Get to know methods of determining conformity
- Become familiar with the CE declaration of conformity and incorporation

Script Training

You want to program your cobot via the GUI, but you also want to utilize all the possibilities and functionalities? Then we recommend our Script Training, in which you will learn how to program your cobot with URScript.

The primary purpose of this training is to teach you how to use our Script Manual and how you can use it to develop solutions for your cobot. In addition, this training will show you the variety of possibilities that are available when programming with the aid of URScript.

Once you have completed Script Training, you will be able to

- program variables, loops and queries in URScript,
- create and call up your own functions,
- calculate with pose variables and use corresponding existing script functions,
- program movements in URScript, ranging from linear or joint movements to your own path planning commands,
- use force commands in URScript and
- create thread handling (parallel processes) in URScript.

Requirements:
- Successful completion of the free e-Learning module
- Successful completion of Core Training
- Successful completion of Advanced Training
- Important: As our Script Training course is quite complex, we recommend that you only take part if you already have programming experience (it doesn‘t matter which programming language you have experience in).

2,5 Days
7 Modules

Description of the modules
In order to maximize the learning effect, the theory is first presented in each training module and subsequently implemented through practical exercises.

Module 1:
Variables, loops and if statements

This module gives a brief recap from Advanced Training on the variable types and comparison operators that are available in URScript, and this is then followed by a direct introduction to the programming of if-statements and loops. You will also learn how to create and index arrays. The theoretically acquired knowledge is deepened with the aid of a practical exercise.

Learning goals:
- Get to know the available variable types
- Become familiar with comparison operators
- Programming of if-statements in URScript
- Perform indexing of arrays

Module 2:
Functions

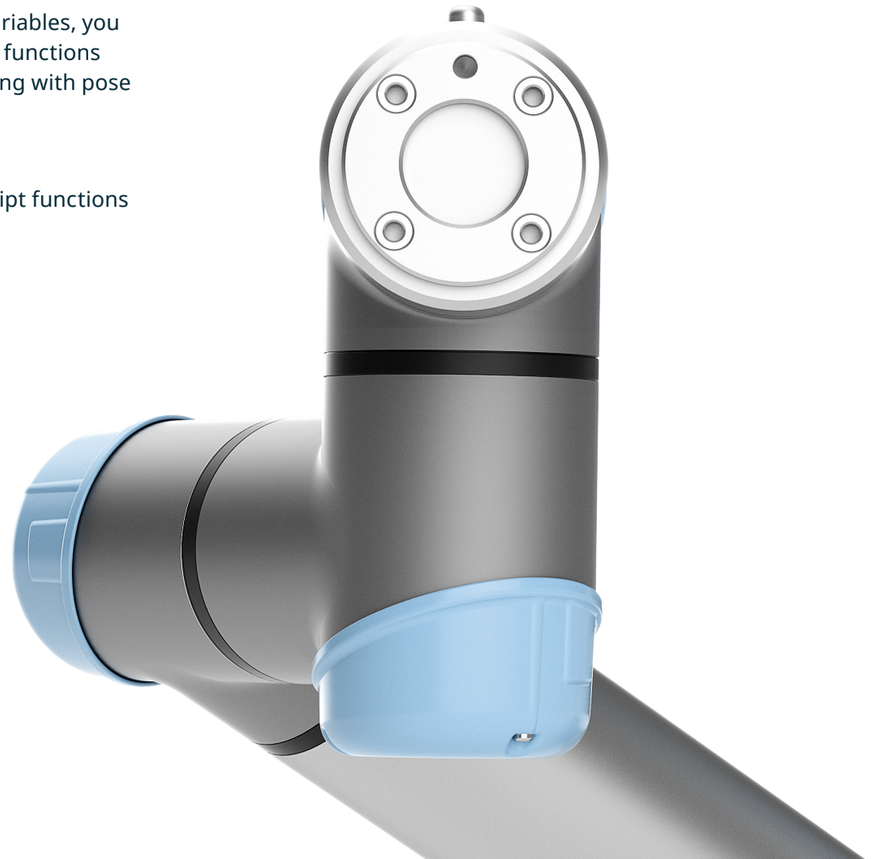
In this module, you will learn how to program your own functions and how to transfer variables and values to these functions. To do this, practice implementing a return from the function. Based on best practice examples, you will see how your own functions can significantly shorten a program. This is followed by practical tasks to deepen your theoretical knowledge. The final and most challenging task involves programming a recursive algorithm.

Learning goals:
- Create syntax for your own functions
- Program the transfer of variables and values to functions
- Return variables and values from functions
- Become familiar with recursive function calls

Module 3:
Pose manipulation

After a compact review of pose variables, you will be introduced to the URScript functions available to you when programming with pose variables.

Learning goals:
- Overview of the available URScript functions for calculating pose variables



Module 4:
Move commands 1

Up until now, we moved the cobot using PolyScope drive commands. However, this can also be done in URScript. In this module, you will learn the URScript commands to move the robot. You will also be introduced to script commands that can be used to convert a pose variable into a joint angle and vice versa. Your task is to create a palletizing function where you can practically implement the functions.

Learning goals:
- Move the robot using URScript commands
- Calculate the “Forward Kinematics” and “Inverse Kinematics”
- Program circular movements in URScript

Module 5:
Move commands 2

What happens when you press the arrow keys on the cobot‘s move screen? You move the robot‘s TCP in the selected direction as long as the button is pressed. To implement this action, you will learn about the speedl() command and its configuration in this module. You will also be introduced to the related speedj() command. In addition, you will use the servoj() command, which you can use to plan your own path. Your task is to implement this path planning and to use the commands correctly.

Learning goals:
- Learn how to use the script commands speedl(), speedj(), servoj(), stopl() and stopj()
- Implement your own path planning

Module 6:
Force commands

In this module, you will learn how to use the robot’s force function in URScript. Your task is to write a program in URScript that can react to obstacles and let the robot return to its starting point in such a situation.

Learning goals:
- Use the force function in URScript

Module 7:
Thread handling

You will already be familiar with threads from other training sessions. However, up until now we have only used these parallel processes in PolyScope. In this module, you will implement a parallel process in URScript. To do this, you will develop a palletizing application that is equipped with collision detection.

Learning goals:
- Program thread handling in URScript

Operator Hands-on Training

1-2 Days
11 Modules

Once you have completed our free e-Learning modules, the Operator Hands-on Training gives you the opportunity to learn the basics for the practical use of cobots. Under the guidance of our certified trainers, the training will teach you everything you need to know for day-to day use.

This training is suitable for individuals that have no previous programming experience and have the task of monitoring and operating machines with an integrated robot. In the Operator Hands-on Training, you will learn everything you need for the day-to-day use of our cobot.

The focus of this training is not on programming, but rather the operation of a cobot that has already been programmed.

No prior knowledge of programming is required for the training. The content and learning goals are purely oriented around the practical handling of robots in the production environment.

Once you have completed the one-day training course, you will be familiar with the basics of your cobot and

- the technical hardware design of the robot,
- you will know your way around the user interface and you will be able to load and run existing programs,
- you will be able to make small program changes and
- you will be able to assess and respond correctly to simple error messages.

Requirements:

- NO programming experience required

Description of the modules
In order to maximize the learning effect, in the modules of this training the theoretical concepts are presented first so that these can be subsequently implemented through practical exercises.

Module 0 (Optional): Free e-Learning

Since many operators do not have their own work computers, they can complete the e-learning course under the guidance of a certified trainer at the training center.

Learning goals:
- Introduction to the user interface
- Get to know the basic commands

Module 1: Hardware

The first module sets out to familiarize you with your cobot's hardware. You will learn how to assemble the robot and what types of robots there are. In addition to their respective work areas, their specifications are also explained.

Learning goals:
- Get to know the robot hardware
- Assembly of the robot

Module 2: Power up & initialize

Once you have become familiar with the technical basics of your cobot, you will be introduced to the first steps on a real robot. You will learn how to switch on and initialize the cobot. You will be given practical solutions on how to retract your cobot before it is fully switched on. Such an approach is helpful, for example, if the robot gets stuck after a collision.

Learning goals
- Correct switch-on and initialization of the cobot
- Retraction before full switch-on

Module 3: Tool setup

Depending on the application, a tool is mounted on the robot. In this module, you will learn how such tools are set up and how the robot's assistants help you with this.

Learning goals
- Application of the assistant
- Correct setting of tool data

Module 4: Move & freedrive

In this module, you will learn about the different types of movement of the robot and how it can be retracted in the event of an impending collision.

Learning goals
- Move the robot
- Get a feel for the robot

Module 5:
Handling programs

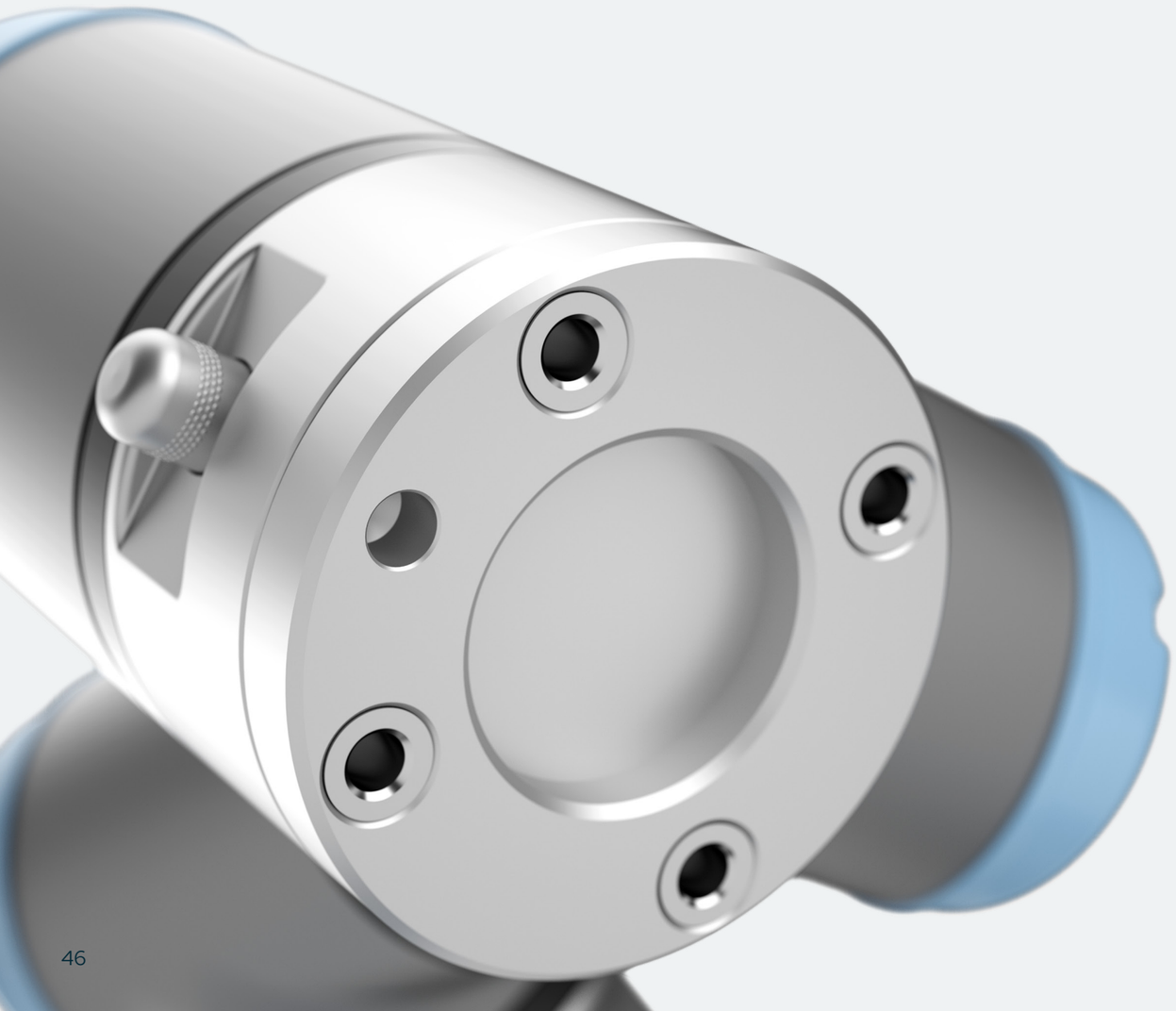
Thanks to the high flexibility of the robot, it can be used for a wide range of tasks. This module demonstrates how the respective programs can be created, saved and loaded again. You will also create your first simple program on a real robot.

Learning goals:
- Create and save programs
- Load and run programs

Module 6:
Program modification

Programs can vary in complexity depending on the requirements. You will learn the commands relevant for a pick-and-place application in the sixth module. This will allow you to modify and expand your program from the previous module.

Learning goals:
- Control of UR+ products
- Modify an existing program



Module 7:
Modes / User level

When your cobot is in use, there are two different operating modes you can switch between: automatic and manual mode. In addition, the robot can be controlled locally via the teach pendant, but also externally (remote control). In this module, you will learn about the differences and when to use them. You will also find out which functions are available to you in which mode.

Learning goals:
- Distinguish between modes and user levels and know how to use them correctly

Module 8:
Safety settings

The applications with your cobot must be designed safely to minimize the risk of collisions in the work space. In this module, you will learn about the basic safety features and how they affect the robot. This knowledge will help you to correctly assess the behavior of your cobot in the production environment.

Learning goals:
- Get to know the safety settings and the effects of these settings
- Operate a robot that is restricted by its safety settings

Module 9:
Error analysis

In order to be able to resolve minor incidents with your cobot as quickly as possible and to be able to assess certain error messages, this module will teach you about some of these error messages, their causes as well as the correct remedial measures.

Learning goals:
- Correctly diagnose and assess error messages
- Initiate the correct measure

Module 10:
Support

Our support site contains a wide range of useful information and free downloadable materials to help you get the most out of your cobot. In addition, the focus in this module is on how to act in the event of an error to ensure that the application can get running again as quickly as possible.

Learning goals:
- Get to know the support resources
- Correctly use the support tools
- Correct procedure in a support case

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Interface Training

Our Interface Training will give you the necessary skills to communicate with and remotely control your cobot in real time. In this training, you will therefore get to know the different client interfaces that are available in your robot.

This training is suitable for you if, once you have completed Core Training, you would like to externally monitor the status of your cobot, control it completely using external software or exchange specific process data with PC's or other devices via TCP/IP Ethernet sockets.

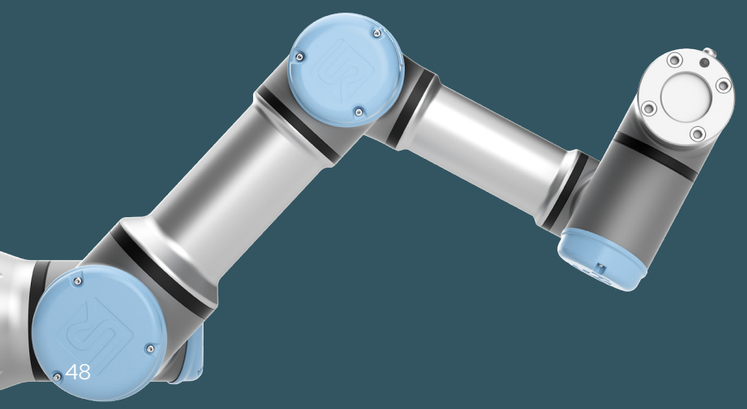
In Interfaces Training, you will explore the following topics in detail:

- Basics of programming in Python
- Basics of programming in URScript
- Ethernet socket communication
- Client interfaces (port 30001-30003)
- Real Time Data Exchange (RTDE)
- XML-RPC communication

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of Core Training
- Recommended: Successful completion of Advanced Training
- Important: Experience in programming with Python

1 Day
6 Modules



Description of the modules
In order to maximize the learning effect, the theory is first presented in each training module and subsequently implemented through practical exercises. At the end of each module, each participant can perform a self-assessment of their results.

Module 1: URScript

Many advanced applications, such as the use of interfaces, require a basic knowledge of programming with URScript. The purpose of this module is to provide a recap of the basics that were taught in Advanced Training.

Learning goals:
- Development of user-defined functions
- Use of a function or a script together with robot commands

Module 2: Socket communication

Simple TCP/IP socket communication is very helpful for communication between the cobot and other devices. With this type of communication, the robot is the client, while the other devices play the role of servers. The servers wait on the socket for a connection request from the client. In this module, the robot serves as the client and the laptop represents the server. For this exercise, use a program to test the socket connections.

Learning goals:
- Establish socket connections between the robot and external devices
- Use the robot program to accept and change input from a server
- Send and receive several types of variables

Module 3: Client interfaces (ports 30001-30003)

In this module, the cobot is the server and the laptop is the client. Script commands should be sent to the robot via the primary or secondary interface. Use the script manual to find out which script commands are required for the tasks and test them.

Learning goals:
- Use of the robot as a server
- Control of the robot using URScript

Module 4: Programming

This module explains how socket connections are programmed and how data is exchanged via these connections. The focus is on the connection between the robot interfaces and your own server or client applications.

Learning goals:
- Familiarization with some basic Python syntax
- Use of Python to generate various results.

Module 5:
Real Time Data Exchange

The RTDE (Real Time Data Exchange) interface was implemented in our cobots to facilitate the integration of external software applications and their execution in real time. For this purpose, the interface should be able to interact with the graphical user interface and the robot controller. In this module, you will learn by means of an example about the options offered by the RTDE interface and how you can use them in your application.

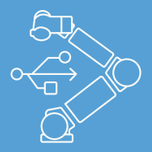
Learning goals:
- Run the RTDE example
- Change an existing script

Module 6:
XML-RPC

XML-RPC is a remote procedure call method that uses XML to transfer data between programs via sockets. This allows the controller to call methods or functions (with parameters) on a remote program or server and retrieve structured data. This module will show you how to utilize these benefits.

Learning goals:
- Run an XML/RPC example
- Change the existing script
- Add functions to a program

TCP / IP Socket Communication Training



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As automation solutions become more advanced, reliable communication between the robot and external systems is essential to keep your cell productive and flexible.

With our TCP/IP Socket Communication Training, you will get a practical introduction to socket-based communication between Universal Robots and external devices such as servers, cameras, and custom applications. Together with our certified trainers, you will work through hands-on exercises to understand how data is exchanged, how connections are configured, and how communication issues can be diagnosed and resolved.

This training is suitable for you if you are responsible for integrating or maintaining connected automation systems and need to establish reliable data exchange between the robot and external equipment. You will learn the fundamentals of client/server communication, network configuration, and real-time communication considerations in an industrial environment.

Once you have completed the TCP/IP Socket Communication Training, you will be able to

- understand the fundamentals of TCP/IP socket communication and client/server architecture,
- configure network settings for reliable Ethernet communication,
- implement socket communication using UR script functions and external tools,
- build basic robot programs that exchange data with external systems, and
- diagnose and troubleshoot common Ethernet and socket communication issues.

Requirements:

- Completed Core Training and Advanced Training
- Laptop with Ethernet port or Ethernet adaptor

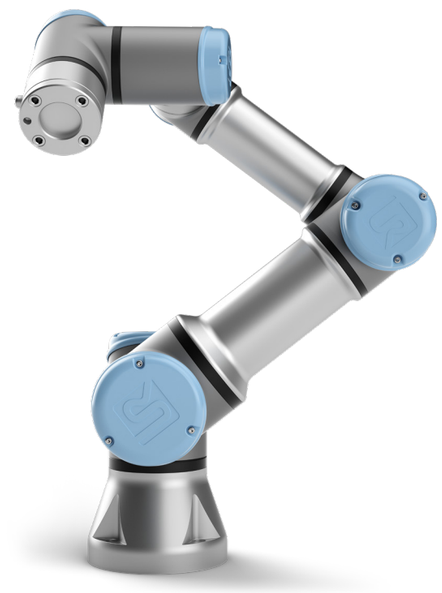
Description of the modules
In order to maximize the learning effect, the training modules are first presented in theory so that these can then be explored further in practical exercises.

Module 1: Fundamentals of Socket Communication

In this module, we will give you an introduction to TCP/IP socket communication and its role in modern industrial automation. You will learn what a socket is, why socket communication is important, and when it is appropriate to use sockets in robot applications. We will also discuss real-time communication considerations and show practical examples of how socket communication is used in industrial robot systems to exchange data with external devices and applications.

Learning goals:

- Understand the fundamentals of TCP/IP socket communication
- Recognize typical industrial use cases



Module 2: Practical Setup

In this module, we will show you how to set up the technical foundation for socket communication. You will work with network configuration, set up a YAT terminal, and get an introduction to socket script functions. Through practical exercises, you will learn how to build a basic robot program that uses socket communication to exchange data with external systems.

Learning goals:

- Configure network settings and tools required for socket communication
- Build a basic robot program using socket script functions

Module 3: Camera Application

In this module, we will show you how socket communication can be used in a camera-based application. You will work with the initial setup, including tool center points and reference planes, and learn how to configure a Python server to communicate with the robot. Through practical exercises, you will integrate camera data into a robot program using socket communication.

Learning goals:

- Set up a basic camera application using TCP/IP socket communication
- Integrate external camera data into a robot program

Module 4:
Automatic Mode

In this module, we will introduce Automatic Mode and show how socket communication can be used without manual input. You will work with a server application converted into an executable that opens a socket and waits for the robot connection. You will also explore applications that automatically generate coordinates within safe limits for continuous robot motion, as well as applications that use live camera data to dynamically generate robot target positions.

Learning goals:
- Understand how Automatic Mode is used in socket-based robot applications
- Apply socket communication in advanced applications using generated or camera-based coordinates

Module 5:
Errors and Troubleshooting

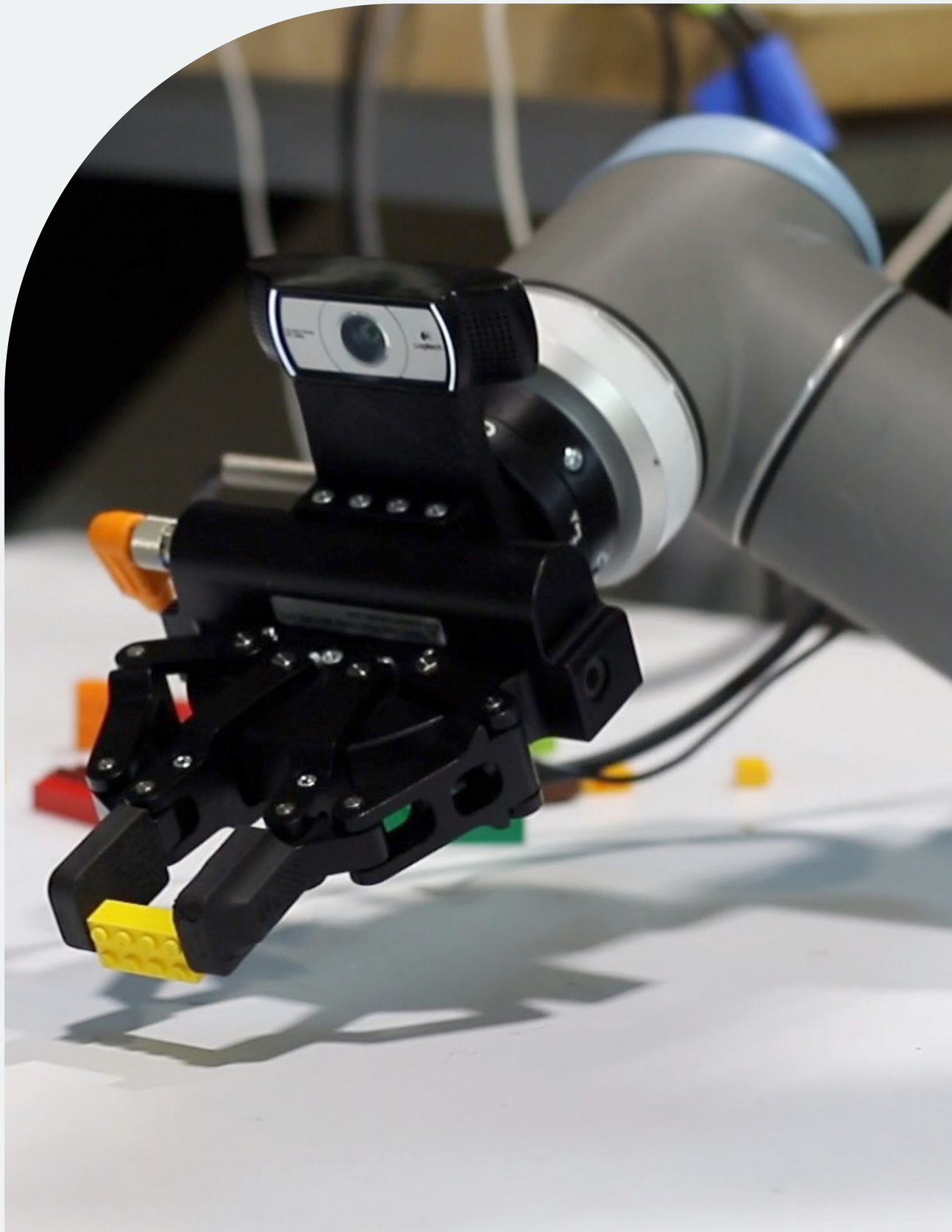
In this module, we will introduce common errors related to Ethernet and socket communication. You will learn how to diagnose network-related issues, detect socket communication failures, and use events for basic error handling. Through practical examples, you will gain an understanding of how to identify and react to communication problems in socket-based robot applications.

Learning goals:
- Diagnose common Ethernet and socket communication issues
- Understand basic error handling using events in socket communication

Module 6:
Online Resources

In this module, we will introduce the online resources available for continued learning and support related to socket communication. You will be guided through the UR Academy and Support site and shown relevant external resources for working with Python and Visual Studio Code. This will help you know where to find reliable information and examples when extending or maintaining socket-based robot applications.

Learning goals:
- Know where to find relevant UR Academy and Support resources
- Be familiar with external resources for Python and Visual Studio Code related to socket communication



Industrial Communication Training

1 Day
6 Modules

In simple applications, the cobot is able to communicate with peripheral devices such as grippers, sensors or other actuators. Here, communication takes place via simple, digital signals, while the sensors and actuators are connected directly to the I/O interface in the controller or on the robot's tool flange. For more complex applications, on the other hand, it is often necessary for the robot to communicate with a PLC, an HMI or other peripheral devices and to exchange data.

This training is suitable for you if, once you have completed Core Training, you would like to learn how to integrate the robot into a fieldbus communication system.

Once you have completed the Industrial Communication Training, you will be able to use the following communication options on your robot, whereby the "Profinet" module is given the most attention due to the current high demand in Europe:

- Modbus TCP FTP
- Ethernet Sockets
- Dashboard Server
- Ethernet/IP
- Profinet
  (full second day of training)

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of Core Training
- Recommended: Successful completion of Advanced Training
- Important: Experience in working with the TIA portal from Siemens

Description of the modules

In order to maximize the learning effect, the theory is first presented in each training module and subsequently implemented through practical exercises. At the end of each module, each participant can perform a self-assessment of their results.

Module 1:
Modbus TCP

You want to automate the palletising process in your production line. Two different products (Stock-Keeping Units, SKU for short) are running on the conveyor belt of this line, which currently need to be identified by an employee. For the automatic identification of the SKU you implement an image processing system at a fixed position, above the conveyor belt, which can only communicate via Modbus TCP.

Learning goals:

- Configure the network settings of the robot
- Connecting the robot to a Modbus device
- Create an application for the robot to send data to and receive data from the Modbus device
- Access to the internal Modbus registers of the robot

Module 2/3:
FTP and dashboard server

In your current application, programmes are to be sent via FTP and started remotely via a control unit. The status of the robot should be monitored remotely at all times and some of the functions in PolyScope are to be locked in order to restrict access by external operators.

Learning goals:

- Transferring files over the network
- Activating, loading and executing programmes via remote control

Module 4:
Socket communication

In the next step, you add additional lines to your pick-and-place application with image processing. For the new line, however, a different image processing system was selected which can only communicate via TCP/IP communication. The processes of the new application still correspond to those of the previous one. Your task is to test the new interface.

Learning goals:
- Establishing socket connections between robot and external devices
- Using the robot programme to accept/ change input from a server
- Sending and receiving multiple types of variables

Module 5:
Ethernet/IP adapter

After implementing the imaging processing system, you want the cobot to communicate with a PLC device to trigger output signals for another process in the line. In this module, this device is an Ethernet/IP PLC.

Learning goals:
- Correct configuration of the network settings of the robot and the PLC
- Send and receive different types of data between the robot and the PLC

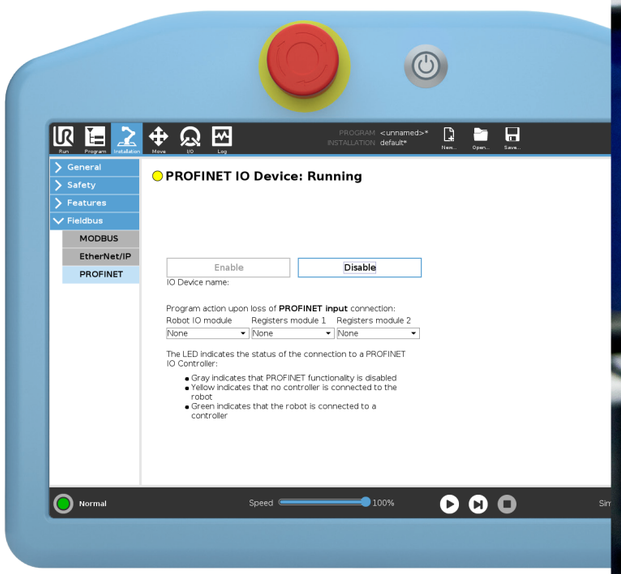
Module 6:
Profinet I/O

You would like to control your system completely via a PLC. The system consists of an infeed belt, a processing center, two robots and a conveyor belt for removal.

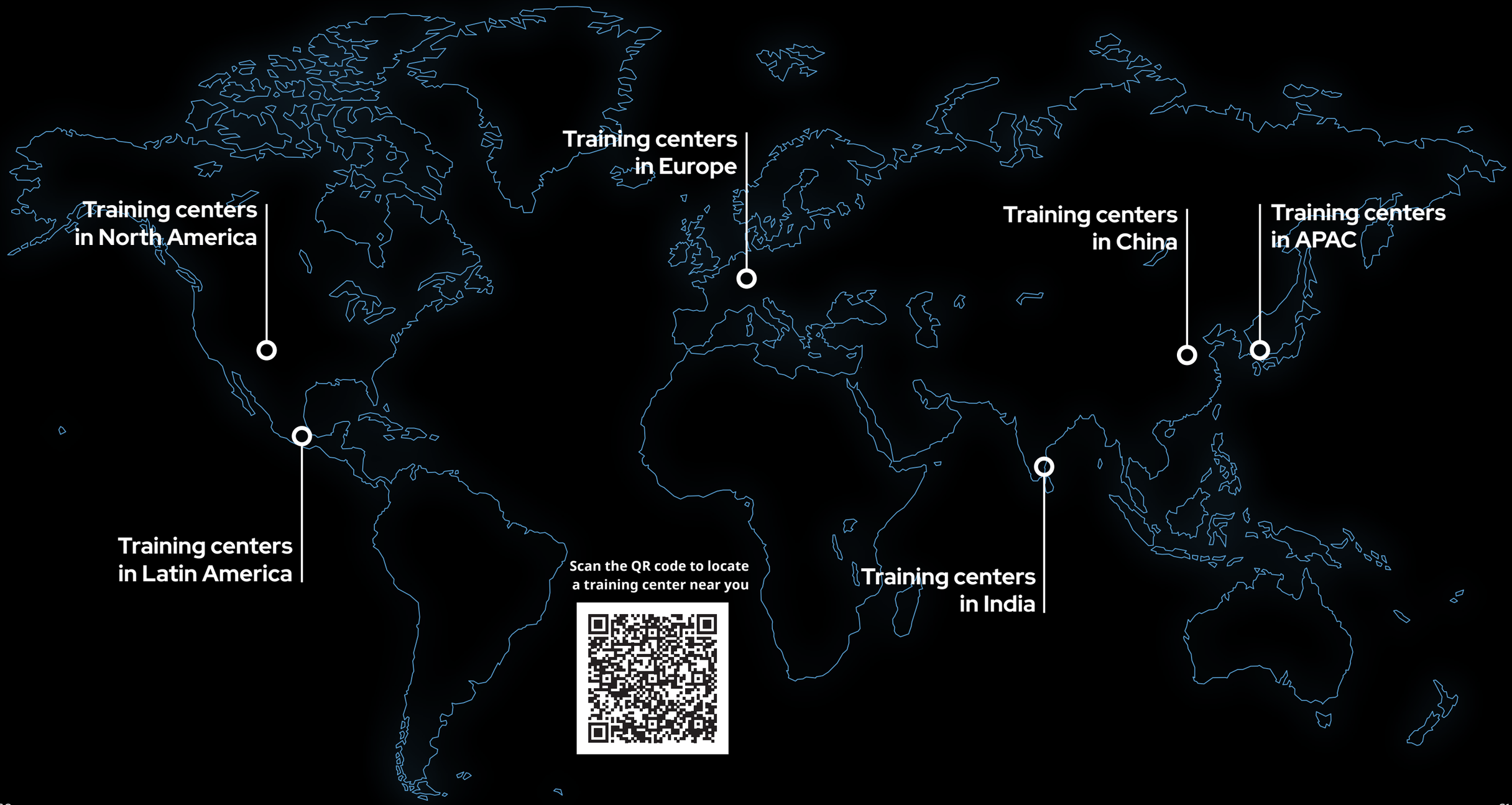
The following functions should be possible:
- Automatic initialization
- Starting, stopping and pausing the program
- Error message on an LED

Your task is to implement the requirements using a Siemens PLC and communication via Profinet I/O.

Learning goals:
- Correct configuration of the network settings for the cobot and the PLC
- Send and receive different types of data between the robot and the PLC
- Integration of dashboard communication



Are you interested in our training courses? We'd be delighted to advise you and help you find a training center near you!



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Our comprehensive training programs are designed to equip you with the skills and confidence to maximize the potential of your cobot.
We look forward to supporting your journey.

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