UNIVERSAL ROBOTS

Universal Robots Academy

Published in September 2024

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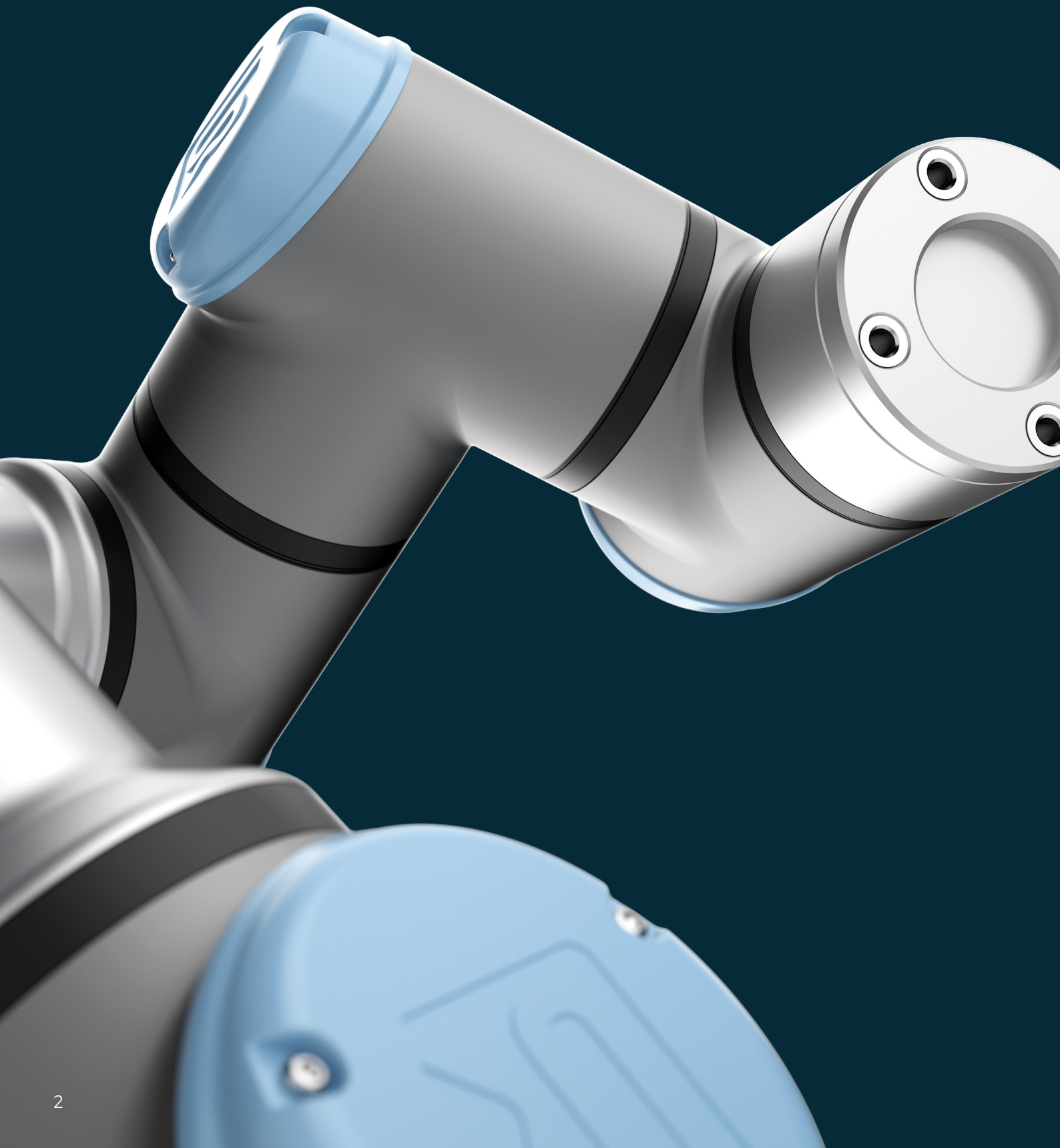


Contents

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 260,000 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.

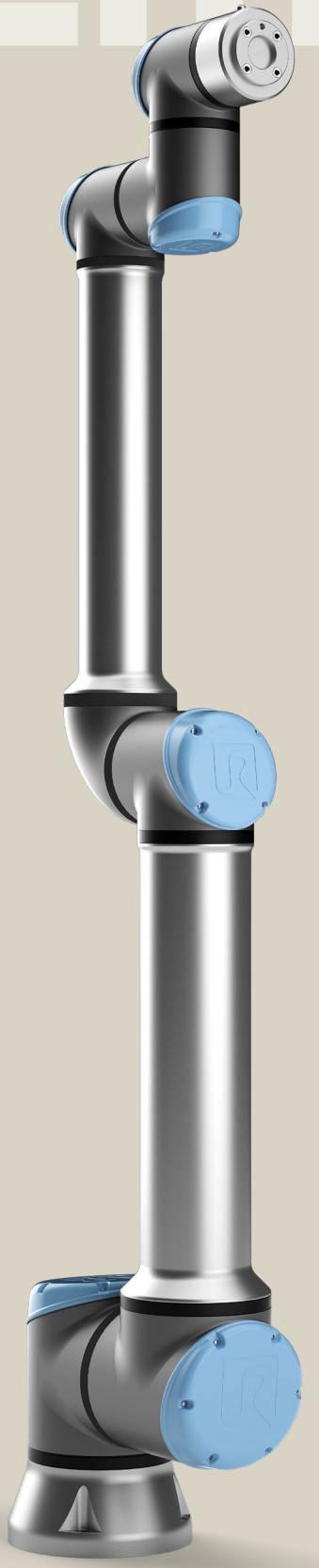
Take the opportunity to learn how to program our robots. Our easy-to-understand training modules are designed to help users acquire practical know-how in interactive simulations, thereby maximizing their learning success.

More than

260.000

users worldwide

Empoweri

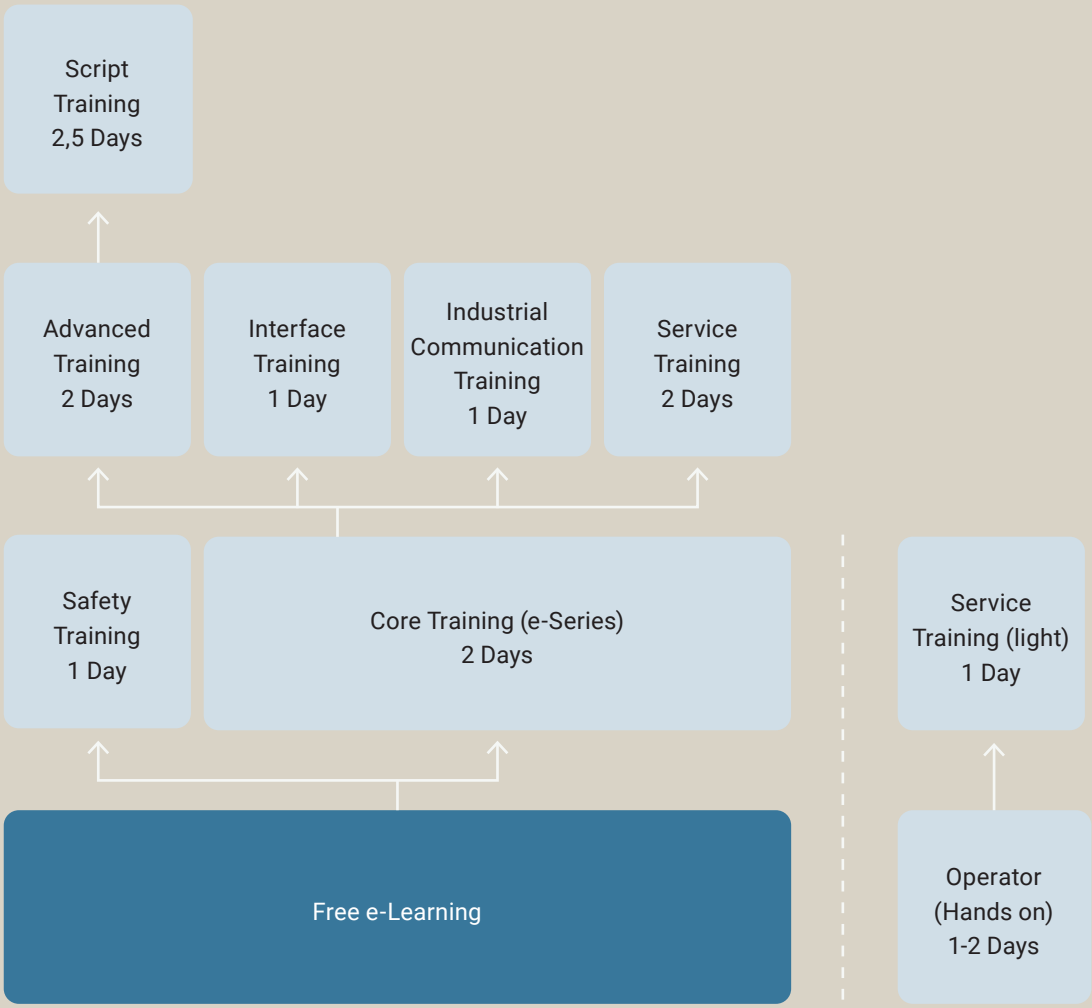


We want our users to be able to utilize the full potential of automation and believe that this can be achieved with the aid of a high-quality training platform. Therefore, in addition to the e-Learning, you also have the option to take part in our hands-on, in-person training courses. In all authorized 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:**
https://academy.universal-robots.com/

ng people



Note: Our training courses are designed to build on one another.

*) Not all Trainings are offered in all countries and durations can vary.

UNIVERSAL ROBOTS

Free e-Learning

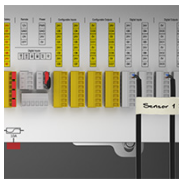
Our free e-Learning modules are designed to help you quickly acquire the knowledge you need to program your first cobot. With state-of-the-art robot simulations, our free e-Learning modules give you the opportunity to learn the basics of cobot programming, palletizing and safety without having to access 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 at:
academy.universal-robots.com/free-e-learning/

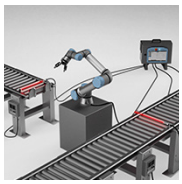
e-Series Core Track

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

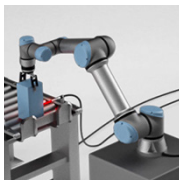


Module 2
Preparing a robot task
6 mins

Module 3
Setting up a tool
17 mins

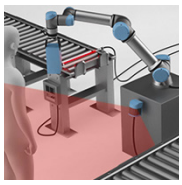


Module 4
Creating a program
12 mins

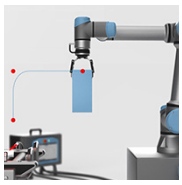


Module 5
Interaction with external devices
11 mins

Module 6
Controlling conveyors
10 mins



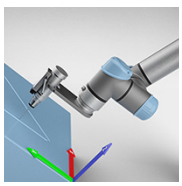
Module 7
Safety settings
15 mins



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

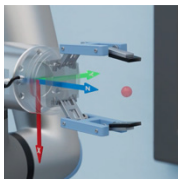
Module 12
Palletizing
15 mins

Module 13
Screwdriving
13 mins

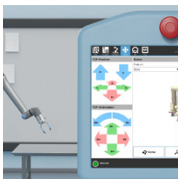
Module 14
Machine tending
25 mins

UR20/30 e-Learning

Module 1
Hardware overview and setting up
15 mins

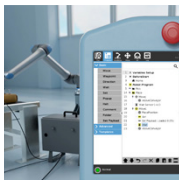


Module 2
Confguring a tool
20 mins

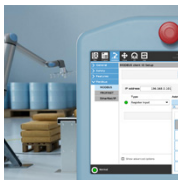


Module 3
Movement and motion types
8 mins

Module 4
Creating a program
17 mins



Module 5
Picking and placing
11 mins



Module 6
Communication between robots
8 mins

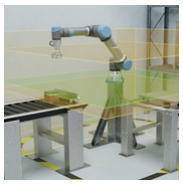
Module 7
Conveyor Control
11 mins

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.

Risk Assessment e-Learning

Module 12
Introduction
20 mins



Module 13
Palletizing application
30 mins

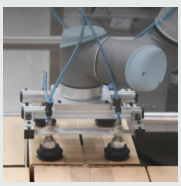
Risk Assessment e-Learning

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.

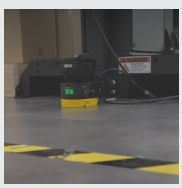
Palletizing Learning Path

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 at:
academy.universal-robots.com/learning-paths/palletizing/

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!

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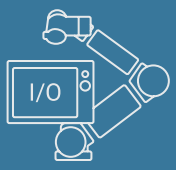
Training centers

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

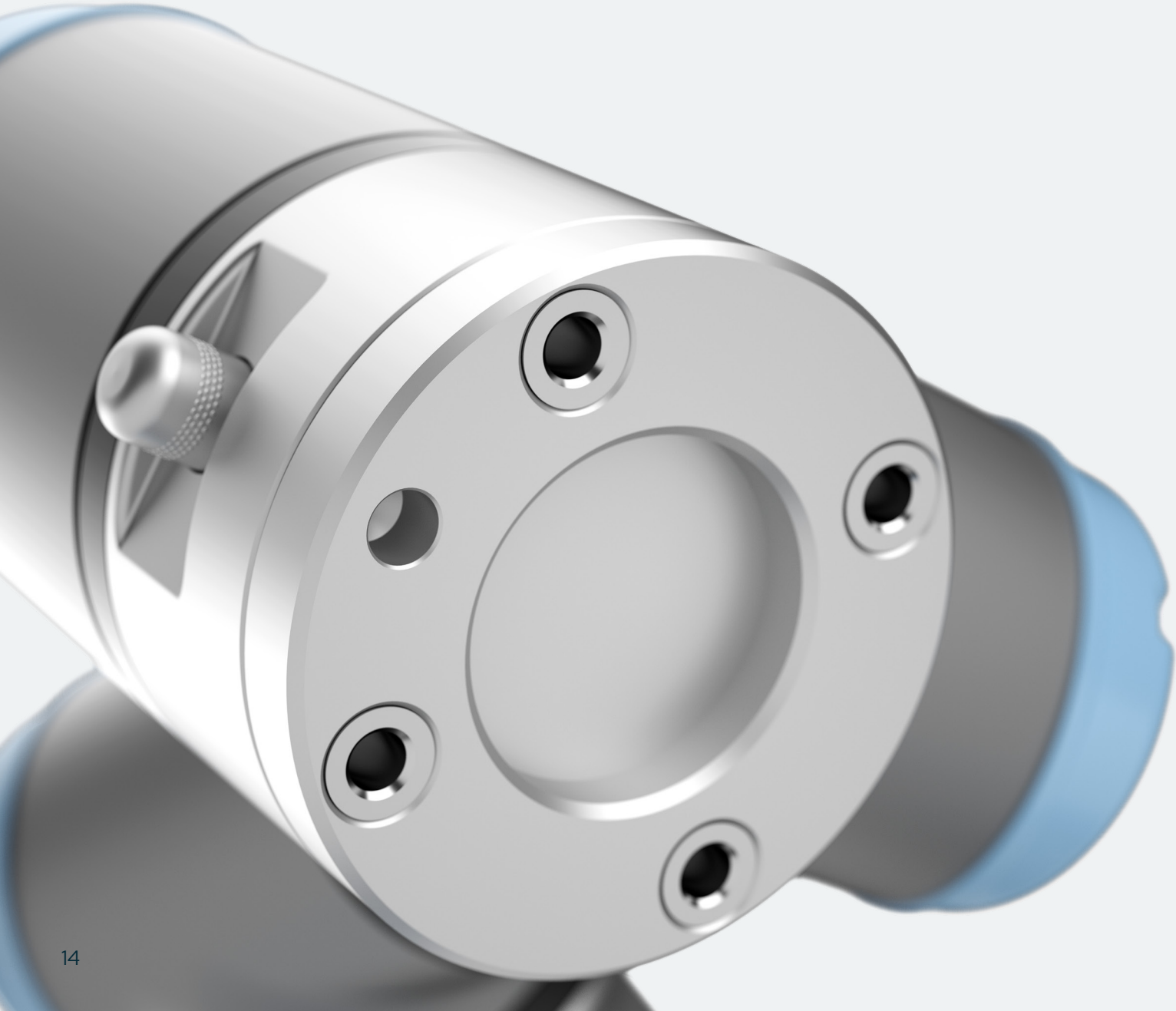
Thanks to the high flexibility of the robot, it can be used for a wide range of tasks. This module demonstrates how the respective programs can be created, saved and loaded again. You will also create your first simple program on a real robot.

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.

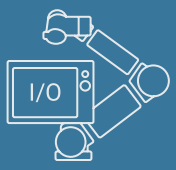
Learning goals:
- Correctly diagnose and assess error messages
- Initiate the correct measure

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

Core Training



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 (e-Series)

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 Power-Point 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

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:

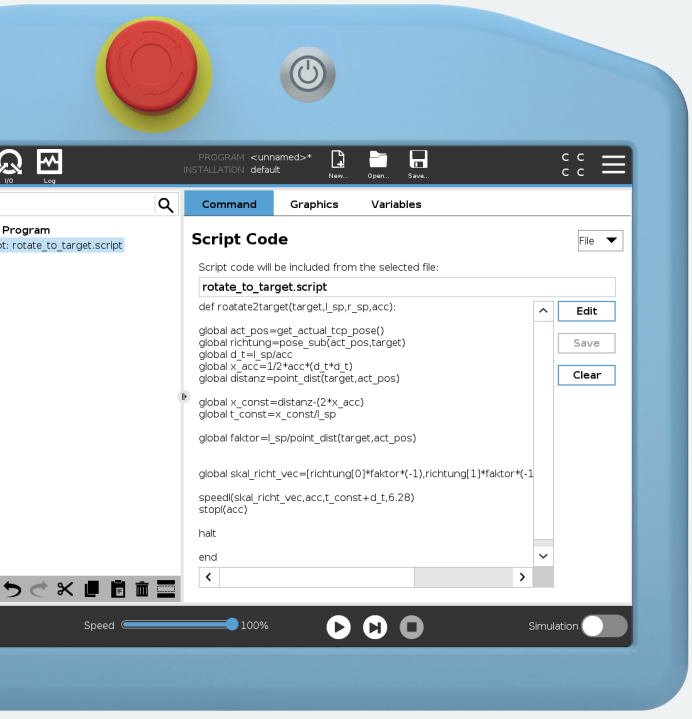
- How to create your own URScript Functions
- How an argument can be handed over to a Function
- How a Function can return arguments
- How to index a list or a pose

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:

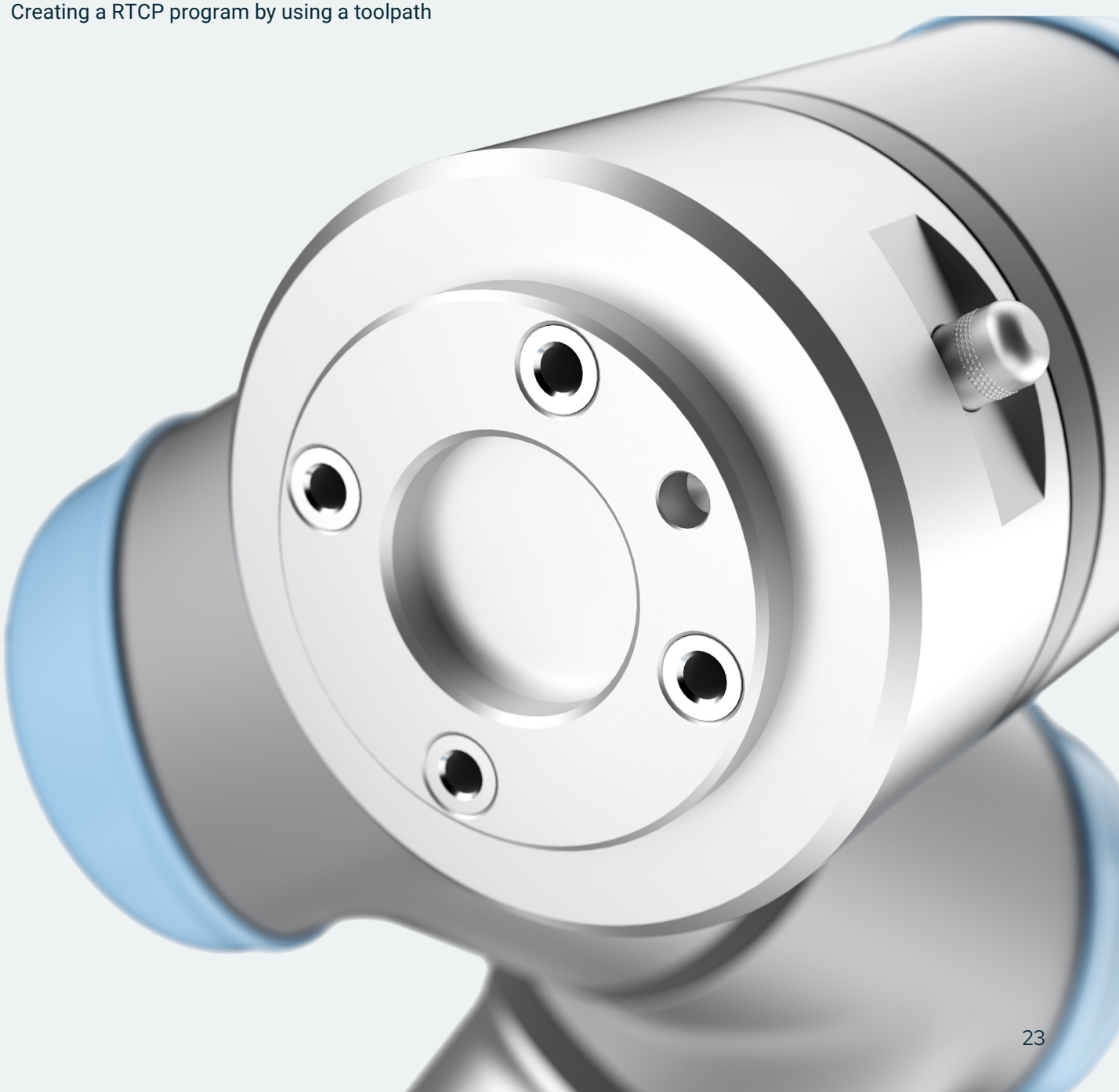
- Setting up a Remote TCP
- Creating a RTCP program with Linear and Circle movements
- Creating a RTCP program by using a toolpath

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.



Industrial Communication Training

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.

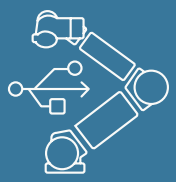
This training is suitable for you if, once you have completed Core Training, you would like to learn how to integrate the robot into a fieldbus communication system.

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



1 Days
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:
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

UNIVERSAL ROBOTS

Interface Training

1 Day
6 Modules

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.

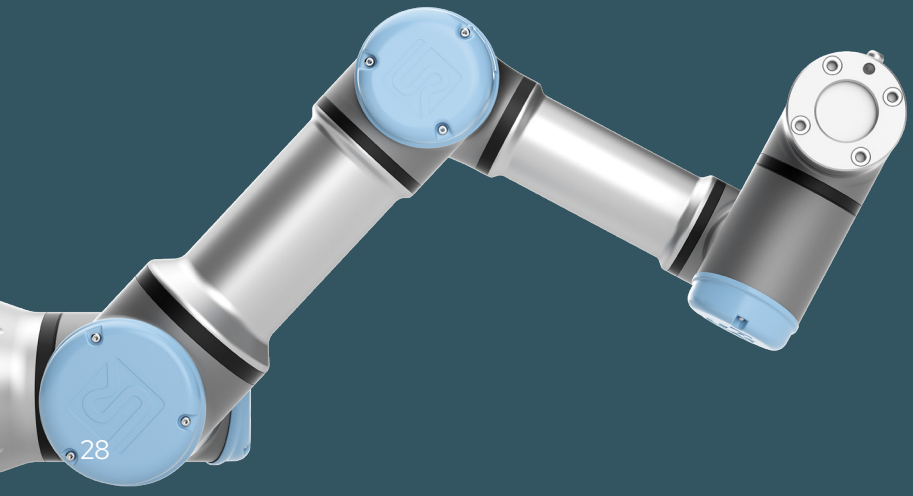
This training is suitable for you if, once you have completed Core Training, you would like to externally monitor the status of your cobot, control it completely using external software or exchange specific process data with PC's or other devices via TCP/IP Ethernet sockets.

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



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


UNIVERSAL ROBOTS

Service
Training (light)

1 Day
7 Modules

The first applications can be implemented with our cobots within hours or a few days. In order for your cobot to remain productive at all times, you should be able to efficiently diagnose and resolve any errors.

Once you have completed the Core Training, our Service Training (light) will give you an introduction to the service topic. Together with our certified trainers, you will use practical exercises to learn how to diagnose and resolve errors in a targeted manner.

This training is suitable for you if you are responsible for maintaining a system, whereby you replace defective parts on the robot yourself rather than repairing them. In order for you to be able to do this, we will teach you all you need to know with respect to the software and hardware of your cobot, particularly in the area of error messages.

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

- exchange complete assemblies (robot arm or controller),
- correctly perform any necessary data transfer,
- resolve common error messages and
- understand the software and hardware of your cobot.

Requirements:

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

Description of the modules

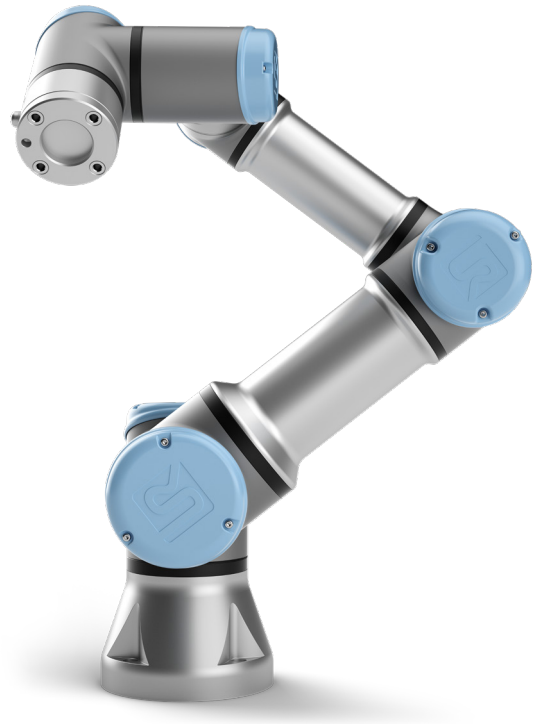
In order to maximize the learning effect, the training modules are first presented in theory so that these can then be explored further in practical exercises.

Module 1:
Overview and insights

In this module, we will give you an overview of the different robot generations and their special features. We will also show you the distinguishing features and the structure of serial numbers so that you can confidently identify the robot you are working with. You will also be shown the inside of a controller.

Learning goals:

- Know the distinguishing features of the different robot generations
- Interpret serial numbers



Module 2:
Updates

In this module, we will show you how to perform software updates on your robot and how you can decide whether a software update is necessary. We will also provide you with practical tips on what to look out for when updating software.

Learning goals:

- Download software updates
- Knowledge of how to carry out software updates and what to look out for
- Perform software updates

Module 3:
Error analysis

The error analysis module presents strategies that you can use to analyze and localize errors. You will also find out which errors occur or can be made on the robot arm, controller, teach pendant and in programs. You will also gain interesting insights into the hardware and useful background knowledge.

Learning goals:

- Recognize and localize errors
- Knowledge of error phenomena and how to respond to them

Module 4:
Using the UR Log Viewer

The UR Log Viewer is a software and a helpful tool when it comes to identifying errors and analysing LogFiles. In these so-called LogFiles, all errors that have occurred during the robot's lifetime are stored chronologically. With the UR Log Viewer you can analyse and evaluate these files. In this module, we familiarise you with the specific application and use of this software.

Learning goals:
- Knowledge of the structure of LogFiles
- Handling the UR Log Viewer

Module 5:
Data backup and creation of data carriers

If a cobot is replaced due to an error, the programs must be transferred from the memory card of the defective robot to the memory card of the new robot. Your task is to safely perform such a data backup and transfer. You will also learn about the various options for backing up data.

Learning goals:
- Knowledge of the different types of data backup
- Creation of a new data carrier

Module 6:
Compatibility of assemblies

If an error occurs, it can be useful to take components from a robot that is currently not being used and to use these on the defective robot. However, it is important to know which components are compatible with one another.

Learning goals:
- Get to know the compatibility of components
- Replacement of components

Module 7:
Service processes and preventative maintenance

The last module introduces you to our service processes. We will show you how to communicate with our Technical Support via the myUR platform and explain the service advantages you can benefit from. You will also learn how to prepare your robot for shipping and which preventative maintenance measures you can implement.

Learning goals:
- Get to know the service processes
- Prepare the robot for shipping
- Correctly implement measures for preventative maintenance

Service & Troubleshooting Training

2 Days
10 Modules

Once you have completed Core Training, Service & Troubleshooting Training will give you a deeper insight into the service topic. Here, you will receive practical training on our cobots under the guidance of our certified trainers. Both the CB3 series and the e-Series will be discussed. UR20 is also included.

This training is suitable for you if you want to identify and resolve errors in the hardware and in robot programs. It is also targeted at individuals who have to carry out service work on the cobot when needed. In contrast to our Service Training (light), this Service & Troubleshooting Training course will teach you how to replace individual components such as joints, safety control board, motherboard or power supply. By performing practical troubleshooting on the robot, you will learn which error symptoms indicate which component is defect.

Once you have completed the Service & Troubleshooting Training,

- you will be familiar with the electrical and mechanical structure of the robot arm and controller,
- you will be familiar with the interaction of the hardware components,
- you will understand the structure and operation of the UR software,
- you will be able to carry out practical troubleshooting on the robot arm and controller (this is the primary part of the training along with practical, small project work on a real robot) and
- you will be able to update the hardware of a CB3.0 robot to a CB3.1.

Requirements:

- Successful completion of the free e-Learning modules
- Successful completion of Core Training
- Note: To be able to take part in practical troubleshooting, participants must be qualified electricians. If you do not meet this requirement, you CANNOT take part in the practical exercises for “Troubleshooting the controller”.

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 on real robots. Of course, this does not just include troubleshooting, but also the installation of functioning components.

Module 1:
General information

This module addresses general concepts, tools and necessary precautionary measures to be taken into account during training and during a real service assignment.

Learning goals:

- Get to know the effects of ESD on electronic components and learn the preventative measures
- Gain an overview of the UR service kit
- Use of online resources for diagnosis, service and maintenance

Module 2:
Overview of a UR robot

It is essential to know the hardware in order to be able to act efficiently and safely during diagnostic or service tasks on the cobot. In this module, you will learn about the different generations and models of our robots, as well as their main technical characteristics.

Learning goals:

- Get to know the different robot models and generations

Module 3:
Troubleshooting

We want any incidents you have with your robot to be resolved as quickly as possible. In this module, you will get to know all the tools that we make available to you in order to be able to diagnose a failure as quickly and efficiently as possible.

Learning goals:

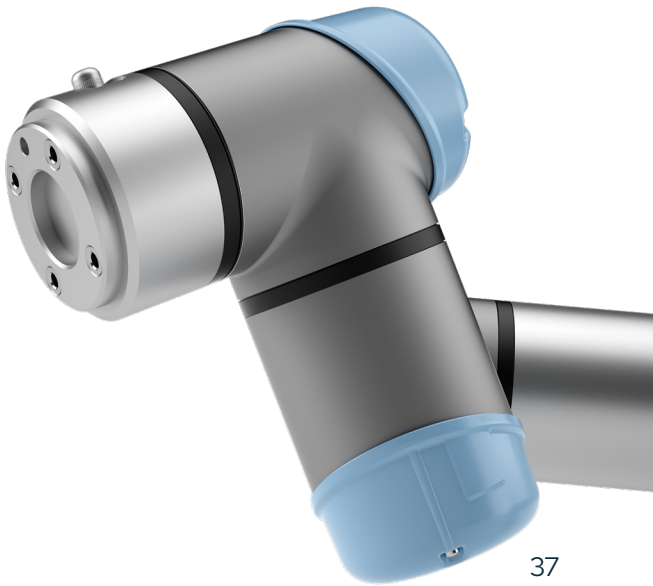
- How to deal with errors
- Get to know the log files, the support Log Reader and the Log Analyzer

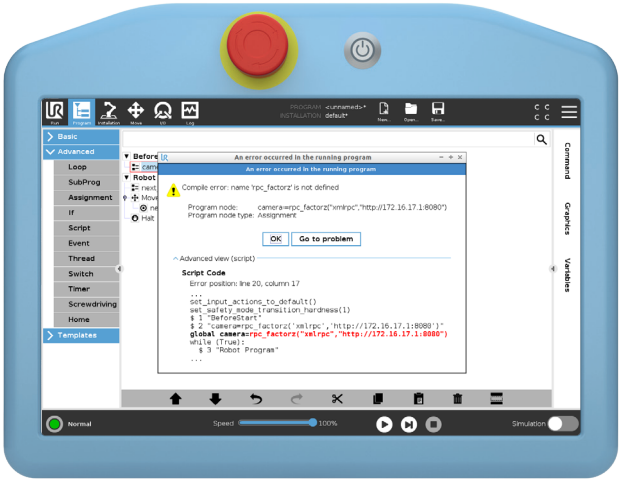
Module 4:
Structure of the robot arm

In this module, you will learn about the individual components of your robot arm and its basic functional principles. You will perform practical troubleshooting and practice diagnosing and correctly resolving the most common errors. You will learn how to replace a joint on your cobot.

Learning goals:

- Acquire detailed knowledge about the hardware of your robot arm
- Get to know the structure of the joint and transmission
- Replace a joint





Module 5:
Controller structure

In this module, you will learn about the components in our controller. You will become familiar with the functional principles of the individual components and their relationship with one another. Through practical exercises, you will acquire the knowledge necessary to diagnose, troubleshoot, and replace a component in your robot's controller.

Learning goals:

- Get to know the hardware of your controller (CB3 and e-Series)
- Replace the various components in the controller
- Upgrade a CB3.0 controller to CB3.1
- Use of the FTP server
- Diagnose and resolve the most common errors

Module 6:
Software structure

PolyScope is our graphical user interface and it is the most well-known component of the software. However, it is not the only component running on your cobot. In this module, you will get to know the entire software architecture of your cobot and how the different parts relate to each other. You will acquire the knowledge and skills to diagnose and resolve the most common software/programming problems. You will also learn how to update the software on your cobot and thus benefit from the new features that we regularly integrate free of charge.

Learning goals:

- Get to know the software architecture
- Common errors in programming and their impact

Module 7:
Safety-relevant components

Working safely with the cobot is one of its most fundamental functions. This module goes into detail on the safety system and all the safety features included in your robot. You will learn how to avoid and resolve the most common errors during commissioning of the safety systems. You will also become familiar with the interaction of the safety components.

Learning goals:

- In-depth knowledge of the safety system in your cobot
- Diagnosing and resolving the most common errors

Module 8:
Preventative maintenance

Compared to conventional industrial robots, our cobots are low-maintenance. Nevertheless, you can take certain preventative measures to avoid unexpected downtimes that could affect your production. In this module, you will learn which options are available to you for preventative maintenance and how you can implement them yourself.

Learning goals:

- Tips for preventative maintenance on your robot

Module 9:
Case handling

Does a part of your cobot need to be replaced or sent in for repair to make it fully functional again? Our goal is to achieve this in record time. In this module, you will learn how you can positively influence the processing time for warranty or service cases.

Learning goals:

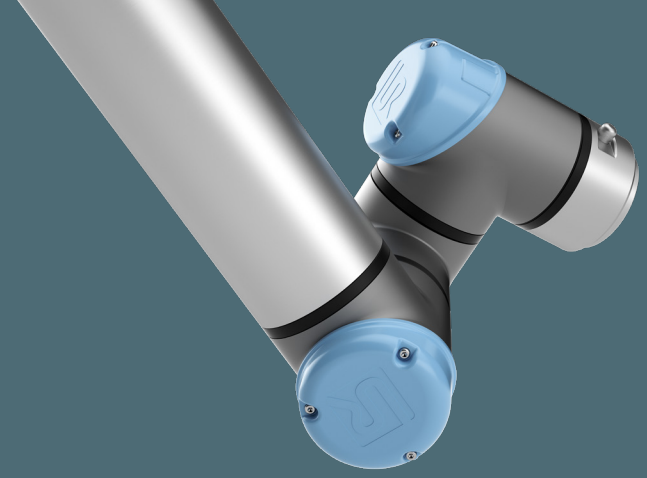
- Knowledge of the support processes and communication in cases of failure

Module 10:
Project activities

Learning success is maximized by practically implementing knowledge that has been acquired. For this reason, this module consists of small projects that are carried out in teams of two.

Learning goals:

- Calibration of a robot arm
- Data transfer
- Application check
- LogFile analysis
- Joint replacement e-Series



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
- nterpret 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.

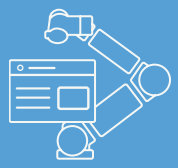
Learning goals:

- 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.



2,5 Days

7 Modules

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).

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.

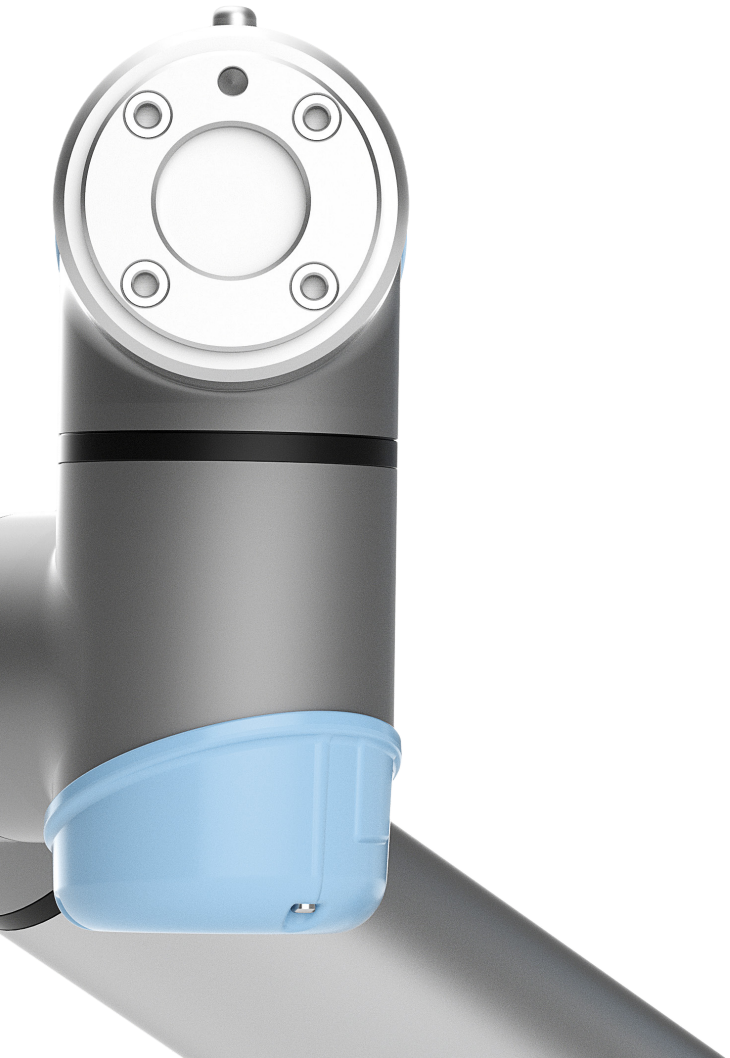
Learning goals:

- 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

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g courses?
and help you

UNIVERSAL ROBOTS

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.

Contact

Universal Robots A/S
Energivej 51
DK-5260 Odense S
Denmark

+45 89 93 89 89
academy@universal-robots.com
academy.universal-robots.com