



**KUKA TRAINING COURSES
OFFERED BY JENDAMARK**

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**JendamarK currently offers the following
KUKA robot training courses at their
training facility in Pretoria, South Africa:**

Upgrade KR C4	2 Days	R9,172.90
Robot Operation Pro	4 Days	R18,345.80
Programming 1 KR C4	5 Days	R22,932.25
Programming 2 KR C4	5 Days	R22,932.25
Service Electrical KR C4	4 Days	R18,345.80
Kuka System Integration KR C4	5 Days	R22,932.25
Kuka Fieldbus Technology Profibus KR C4	2 Days	R9,172.90
Kuka Fieldbus Technology Profinet KR C4	2 Days	R9,172.90
IW6 KR C4	3 Days	R13,759.35

- **Minimum of 4 persons / course**
- **All prices are per person and exclude VAT**
- **Prices valid until 31 December 2022**
- **Payment terms: 100% payment required before course start date**
- **KR C4 Programming 1 course is a prerequisite of any other course**
- **Enquiries to be sent to: leatitia@jendamarK.co.za**

Upgrade KR C4

Software version: KSS 8.x (KR C4)

Target group

Operator, set-up man, robot programmer

Study outcome

The goal of this seminar is to transfer the existing robot programming and/or operating skills of the participants into the KR C4 environment.

Preconditions

- Seminar "Robot Operation" (KR C2) or
- Seminar "Basic Robot Programming" (KR C2)

Duration

Two days

Content

1. Safety when working with KUKA robots in a KUKA college
2. Overview hard- and software structure KR C4
3. Smart Pad control elements
4. GUI differences KSS 4.x, 5.x – KSS 8.x
5. Hand-jogging the robot
6. Starting and executing robot programs manually and in automatic mode
7. Reading structured programs and program flowcharts
8. Introduction into the KRL-editor integrated in Work Visual
9. Working with program files
10. Mastering using EMD
11. Linking new programs with the cell. src

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

Robot Operation Pro KR C4

Software version KSS 8.x (KRC4)

Target group

This course is aimed at students with no knowledge of industrial robots or students who have experience on other robot types but who have not worked on the KUKA KR C4.

Study outcome

The goal of the seminar is to acquire basic skills required to operate a KUKA robot system.

Preconditions

- Basic computer skills

Duration

Four days

Content

1. Description of a KUKA robot
 - 1.1. Introduction to robotics
 - 1.2. Manipulator
 - 1.3. KR C4 robot controller
 - 1.4. The KUKA Smart PAD
 - 1.5. Robot programming
 - 1.6. Robot safety
 - 1.7. Coordinate systems in conjunction with robots
2. Moving the robot
 - 2.1. Reading and interpreting robot controller messages
 - 2.2. Selecting and setting the operating mode
 - 2.3. Moving individual robot axes
 - 2.4. Moving the robot in the world coordinate system
 - 2.5. Moving the robot in the tool coordinate system
 - 2.6. Moving the robot in the base coordinate system
 - 2.7. Displaying the current robot position
 - 2.8. Jogging with a fixed tool
 - 2.9. Tracking program modifications and changes of state by means of the logbook
3. Start-up
 - 3.1. Mastering principle
4. Executing robot programs
 - 4.1. Performing an initialization run
 - 4.2. Selecting and starting robot programs
 - 4.3. Preparation for program start from PLC
 - 4.4. Program start from PLC

5. Modifying programmed motions
 - 5.1. Creating new motion commands
 - 5.2. Modifying motion commands

6. Working with program files
 - 6.1. Creating program modules
 - 6.2. Editing program modules
 - 6.3. Archiving and restoring robot programs

7. Creating and modifying programmed motions
 - 7.1. Creating cycle-time optimized motion (axis motion)
 - 7.2. Creating CP motion
 - 7.3. Motion programming with external TCP

8. Logic function in robot programs
 - 8.1. Displaying robot states
 - 8.2. Introduction to logic programming
 - 8.3. Displaying and modifying values

9. Using technology packages
 - 9.1. Gripper operation with KUKA.GripperTech
 - 9.2. Gripper programming with KUKA.GripperTech

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

Programming 1 KR C4

Software version KSS 5.x (KRC2)

Target group

Course aimed at students with no knowledge of industrial robots or students who have experience on other robot types but who have not worked on the KUKA KRC2.

Study outcome

The goal of the seminar is to acquire basic skills required for programming a KUKA robot system.

Preconditions

- Basic computer skills

Duration

Five days

Content

1. Safety when working with KUKA robots
 - 1.1. Recognising and avoiding hazards when operating KUKA robots
 - 1.2. Overview of safety facilities when operating KUKA robots
2. Advanced knowledge of the structure of a robot system
3. Executing robot programs manually, in automatic mode and via an external controller
 - 3.1. Selecting and setting the correct operating mode
 - 3.2. Performing an initialization run
 - 3.3. Selecting, starting and executing robot programs
 - 3.4. Executing a program start via a PLC
4. Human-machine communication
 - 4.1. Displaying and configuring the logbook
 - 4.2. Displaying robot states (signals, timers, cyclical flags, counters)
 - 4.3. Reading and interpreting robot controller messages
 - 4.4. Displaying the current robot position
5. Using technology packages (KUKA.GripperTech)
 - 5.1. Gripper operation and programming gripper commands with KUKA inline forms
 - 5.2. Configuration for simple programming of gripper commands
6. Working with program files
 - 6.1. Creating user-defined program modules
 - 6.2. Integrating newly created programs into the (configured) PLC interface on the robot side
 - 6.3. Creating, deleting, renaming, duplicating robot programs and files of various types
 - 6.4. Archiving and restoring robot programs

7. Displaying and adapting saved values (variables)
 - 7.1. Successful programming with KRL (KUKA Robot Language)
 - 7.2. Reading structured programs and program charts and creating simple program flowcharts
 - 7.3. Structuring and streamlining robot programs by implementing global sub-programs
 - 7.4. Linking robot programs

8. Modifying existing or creating new programmed motions with KUKA macros
 - 8.1. Moving the robot manually
 - 8.2. Creating and modifying programmed motions with the aid of KUKA inline forms
 - 8.3. Programming and applying logical functions in motion program
 - 8.4. Programming wait functions with the aid of KUKA inline forms
 - 8.5. Programming simple switching functions with the aid of KUKA inline forms
 - 8.6. Programming path-related switching functions with the aid of KUKA inline forms

9. Performing commissioning tasks on the robot
 - 9.1. Mastering the robot
 - 9.2. Setting up a tool: measuring the geometry and assigning the load data
 - 9.3. Entering supplementary load data for the robot
 - 9.4. Setting up, calibrating and offsetting a work piece base
 - 9.5. Calibrating a fixed tool / robot-guided work piece

End of seminar

- The course ends with an assessment test
- A certificate is issued on successful completion of the course

Programming 2 KR C4

Software version: KSS 8.x (KR C4)

Target group

Programmers, service technicians

Study outcome

The aim of the seminar is to build on the basic skills taught previously and to learn the basics of the KUKA high-level programming language. KRL and apply it in structured robot programs.

Preconditions

- Seminar: "Robot Programming 1"

Duration

Five days

Content

1. Successful programming with KRL (KUKA Robot Language) and Work Visual
2. Workflow of a programming project for robot programs
3. Creating program flowcharts for robot programs
4. Structuring and streamlining robot programs with KRL
5. Programming with conditional statements and branches
6. Programming with loops and jumps
7. Linking robot programs with parameter transfer
8. Working with variables
9. Correct use of various variable types
10. Declaring, initialising and manipulating simple data types
11. Declaring, initialising and manipulating arrays
12. Defining, declaring, initialising and manipulating enumeration data
13. Defining, declaring, initialising and manipulating composite data types (structures)
14. Human-machine communication
15. Programming with important system variables
16. Creating and modifying programmed motions in KRL
17. Calculating and manipulating robot positions
18. Programming relative motions
19. Programming logical functions in KRL
20. Programming wait functions
21. Programming simple switching functions
22. Programming path-related switching functions (e.g. for adhesive application, welding)
23. Path-related calling of sub-programs in the program sequence
24. Linking robot programs
25. Using global and local subprograms
26. Program links with parameter transfer
27. Programming project: cycle time optimisation using the example of a palletising application
28. Robot and PLC
29. Reconfiguring the interface of the robot to the PLC
30. Reaction to state changes during program execution (interrupts)

31. Programming interrupt routines
32. Collision avoidance
33. Programming motions taking collision detection into account
34. Limiting motions – configuring workspaces and limiting motion ranges
35. Programming user- and application-specific messages
36. Successful programming with KRL (KUKA Robot Language) and Work Visual
37. Selecting and using system algorithms of the KUKA System Software
38. Using logical functions in programs
39. Coupling CP motions with analog signals
40. Programming control commands (Submit interpreter)

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

Service Electrical KR C4

Software version: KSS 8.x (KR C4)

Controller type: KR C4

Target group

Robot service technicians

Study outcome

The participants in this seminar are trained in the fundamentals of proper fault diagnosis and troubleshooting for the electrical equipment of the robot system KR C4 including the necessary network basics for re-commissioning a KR C4 system after repair work.

Preconditions

- Electric specialist
- Seminar "Robot Operation PRO" or "Robot Programming 1"

Duration

Four days

Content

1. Safety when working with KUKA training robots
2. Recognising and avoiding hazards when handling electrical components of the KR C4
3. Avoiding hazards when handling ESD components of the KR C4
4. Basic knowledge of the structure of a KR C4 controller
5. Technical data and control concept
6. Cooling and energy saving
7. Basic knowledge of the structure of a KR C4 control computer
8. Exchanging the control PC properly
9. Exchanging the individual PC components
10. Overview of the bus systems of the KR C4 controller
11. Exchanging drive components on the KUKA Controller Bus
12. Interfacing capability of the KR C4 controller using the KUKA Extension Bus and the KUKA Line Interface
13. Troubleshooting by evaluating the display on the Controller System Panel
14. Basic knowledge of networks
15. Familiarisation with various network components
16. Selecting and assigning IP addresses and subnet masks
17. Configuring the KUKA Line Interface
18. Establishing a remote desktop connection to the KR C4 controller
19. Basic principles of Ethernet-based field buses of the KR C4
20. Familiarisation with passive components of the KR C4
21. Exchanging passive components of the KR C4
22. Safety concept of the KR C4
23. Safety by means of Profisafe or the Safety Interface Board
24. Overview of the functionality and interface of the KUKA Safe Operation option
Software concept and data handling
25. Installing software by means of KRC System Recovery
26. Data archiving by means of images

27. Diagnostic options and troubleshooting directly at the controller
28. Reading block diagrams, wiring diagrams and circuit diagrams
29. Practical troubleshooting using circuit diagrams
30. Work Visual, Controller System Panel, KRC Diag and diagnostic monitor
31. Trace function for troubleshooting
32. Configuring, recording and analysing traces
33. Maintenance table and maintenance intervals
34. Practical performance of maintenance on the controller
35. Overview of Work Visual and its potential use for diagnosis
36. Downloading and comparing projects, transferring them to the controller
37. Performing diagnosis using Work Visual
38. Recording a trace using Work Visual
39. Preview of other potential applications of Work Visual

End of seminar

- The course ends with an assessment test
- A certificate is issued on successful completion of the course

System Integration KR C4

Software version: KSS 8.x (KR C4)

Controller type: KSS 8.x (KR C4)

Target group

System integrators, commissioning engineers

Study outcome

System integrators who have ample experience with the integration of robot systems shall be enabled to transfer their knowledge within a short time into the KR C4 environment with the focus on commissioning KRC4 systems. The topics covered on the first seminar day enable system integrators who have good skills in commissioning robots and fieldbus systems.

Please note: This course is specially tailored to the needs of experienced robot system integrators and definitely not suitable for beginners in the robot business. In this case we suggest choosing our subject-specific courses. Please do not hesitate to contact us if unsure which course to choose.

Preconditions

- Experience in commissioning and configuration of robot systems
- Experience in commissioning of Profibus
- Recommended: Seminar "Basic Robot Programming" (KR C2)
- Recommended: Seminar "Advanced Robot Programming"
- Recommended: Seminar "FBT Profibus"
- Recommended: Seminar "Safety-Start-up KUKA Safe Operation2.x"

Please note: Taking part in this course without previous knowledge in "Safety-Start-up KUKA Safe Operation 2.x" is possible. In this case, the achieved level of knowledge will be sufficient for start-up and configuration of "KUKA Safe Range Monitoring" but not for "KUKA Safe Operation 3.x"

Duration

Five days

Content

1. Introduction into the operation of a KR C4 system, mastering and tool calibration
2. Overview: Hard- and software KR C4
3. Basic network skills for KR C4
4. Overview: Interface structure KR C4
5. Differences KUKA Smart Pad and KUKA KCP
6. KR C System Recovery
7. Differences KUKA Safe Operation 2.x and 3.x
8. Configuration KUKA Safe Range Monitoring
9. Commissioning PROFINET using KUKA Work Visual
10. KUKA Work Visual for commissioning purposes: Profibus Master via Gateway

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

Fieldbus Technology Profibus KR C4

Software version: KSS 8.x (KR C4)

Target group

Robot service technician, start-up engineer, project engineer

Study Outcome

PROFIBUS configuration at the KR C4, embedding Profibus via Ethercat gateway

Preconditions

- Seminar: Robot Programming 1 KSS 8.x

Duration

Two days

Content

1. Familiarisation with the field bus system PROFIBUS
2. Principle of operation PROFIBUS
3. PROFIBUS devices
4. PROFIBUS cabling
5. Configuration of the KUKA Line Interface
6. Configuration
7. Diagnosis
8. Working with Work Visual
9. Loading and installing of projects from and to the KRC4
10. Comparing of different projects
11. Integration of device description files in Work Visual
12. Configuring the KR C4 as PROFIBUS (EtherCat Gateway) Master
13. Introducing the PROFIBUS interfaces
14. Physical configuration in Work Visual
15. Logical mapping of I/Os
16. Assigning long texts
17. Coupling and decoupling of PROFIBUS slaves
18. Configuring the KR C4 as PROFIBUS slave (EtherCat Gateway)
19. Physical configuration in Work Visual
20. Logical mapping of I/Os
21. Diagnosis
 - 21.1. over the Smart Pad HMI
 - 21.2. over WorkVisual
 - 21.3. over Webbrowser

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

Fieldbus Technology Profinet KR C4

Software version: KSS 8.x (KR C4)

Target group

Robot service technicians, start-up engineers, project engineers

Study Outcome

PROFINET configuration at a robot system

Preconditions

- Seminar: "Programming 1"

Duration

Two days

Content

1. How PROFINET works
2. Structure of a PROFINET-system
3. PROFINET components
4. PROFINET and the KRC-system
5. Operation of Work Visual for the configuration of the fieldbus
6. Generate a PROFINET configuration with Work Visual
7. Transfer a PROFINET configuration with Work Visual
8. Coupling of PROFINET modules
9. Diagnosis and error tracking

End of seminar

- The course ends with an assessment test
- A certificate is issued upon successful completion of the course

IW6 KR C4

Software version: KSS 8.x (KR C4)

Target group

Start-up personnel installing and configuring a KR C4 cell in compliance with the Group standard (IW6) at Daimler.

Study Outcome

Compliance with the relevant DAIMLER Group standards during start-up. Training covers working with Daimler's Enterprise Content Management (ECM).

Preconditions

- KR C4 PROFINET
- Control cabinet-specific KR C4 knowledge
- As an alternative to the first two items:
 - Start-up of KR C4-based robots.
- Seminar "Robot Programming 1" and "Robot Programming 2"
- Seminar "Safety Start-Up – SafeOperation 3.x"
- Knowledge of customer-specific technology

Duration

Three days

Content

1. Daimler Supplier Portal & Enterprise Content Management (ECM)
 - 1.1. Login and registration
 - 1.2. Working in the ECM portal
2. Installing a backup image on the KR C4
 - 2.1. Working with the KUKA.Recovery 3.0 USB stick
3. Initial start-up steps on the smartPAD
 - 3.1. Executing RobotSetupManager
4. Option package management in WorkVisual
 - 4.1. Project-related organisation of the iKOPs
5. Integrating "DAI_Baseproject_1024bit" into the WorkVisual project
 - 5.1. Working with DAI_DynPlc in WorkVisual
 - 5.2. Adapting the hardware configuration in WorkVisual
6. Configuring the KR C4 as a PROFINET device
 - 6.1. Importing the interface to the PROFINET PLC
 - 6.2. Configuring system safety
7. Configuring the KR C4 as a PROFINET master
 - 7.1. Configuring the FESTO CPX (example)
 - 7.2. Naming modules via WorkVisual

8. New features in KSS 8.5
 - 8.1. User groups
 - 8.2. Working with global positions
 - 8.3. New jog mode “Track”
 - 8.4. Tool and base management
9. Technology: SafeOperation 3.4
 - 9.1. Adapting the cell in accordance with the specifications
 - 9.2. Completing the acceptance check log (example)
10. Working with DaiGripOfflineConfigurator
 - 10.1. Importing and exporting Eplan
 - 10.2. Manual configuration of a gripper (example)
11. Technology: Servo clinching
 - 11.1. Importing the technology package
 - 11.2. Familiarization with the inline forms
12. Technology: Semi-tubular self-pierce riveting (TOX)
 - 12.1. Importing the technology package
 - 12.2. Familiarization with these inline forms
13. Technology: External axes with KL4000 as example
 - 13.1. Overview of the configuration plug-in
 - 13.2. Completing the acceptance check log (example)
14. Selection and configuration of hardware components
 - 14.1. Overview of the kinematic systems available
 - 14.2. KR C4 assembly instructions
 - 14.3. Robot assembly instructions
15. Programming guidelines (Daimler)
 - 15.1. Overview of and reference to the ECM server
 - 15.2. Program execution and selection via DAI_SPS.SUB.

End of seminar

- The course ends with an achievement test.
- A certificate is issued upon successful completion of the course.