KUKA System Technology

KUKA.DeviceConnector pre-installed 2.1

For KUKA System Software 8.3, 8.5, 8.6 and 8.7
For VW System Software 8.3, 8.6 and 8.7

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KUKA.DeviceConnector pre-installed 2.1 V4
KUKA Deutschland GmbH

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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

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Translation of the original documentation

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1 Introduction

1.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of the robot controller system
- Advanced knowledge of network connections

For optimal use of KUKA products, we recommend the training courses offered by KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

1.2 Industrial robot documentation

The industrial robot documentation consists of the following parts:

- Documentation for the robot arm
- Documentation for the robot controller
- Documentation for the smartPAD-2 (if used)
- Operating and programming instructions for the System Software
- Instructions for options and accessories
- Spare parts overview in KUKA Xpert

Each of these sets of instructions is a separate document.

1.3 Representation of warnings and notes

Safety

These warnings are provided for safety purposes and **must** be observed.

DANGER

These warnings mean that it is certain or highly probable that death or severe injuries **will** occur, if no precautions are taken.

WARNING

These warnings mean that death or severe injuries **may** occur, if no precautions are taken.

CAUTION

These warnings mean that minor injuries **may** occur, if no precautions are taken.

NOTICE

These warnings mean that damage to property **may** occur, if no precautions are taken.

These warnings contain references to safety-relevant information or general safety measures.
These warnings do not refer to individual hazards or individual precautionary measures.

This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

SAFETY INSTRUCTION
The following procedure must be followed exactly!

Procedures marked with this warning **must** be followed exactly.

Notices

These notices serve to make your work easier or contain references to further information.

Tip to make your work easier or reference to further information.

1.4 Terms used

Term	Description
KLI	KUKA Line Interface Ethernet interface of the robot controller for external communication.
KONI	KUKA.OptionalNetworkInterface Optional Ethernet interface of the robot controller for external communication.
MQTT	Message Queuing Telemetry Transport Open messaging protocol for transferring telemetry data between devices, which can be used even with high delays and limited networks
OPC UA	Open Platform Communications - Unified Architecture Open standard for data exchange between devices (vendor- and platform-independent)
S.M.A.R.T.	Self-Monitoring, Analysis and Reporting Technology Industry standard for monitoring hard disk drives (HDD) and solid state drives (SSD)

1.5 Trademarks

PROFINET® is a trademark of the PROFIBUS users' organization.

Windows is a trademark of Microsoft Corporation.

1.6 Licenses

The KUKA license conditions and the license conditions of the open-source software used can be found in the following folders:

- Under .\LICENSE on the data storage medium with the installation files of the KUKA software
- On the KUKA smartHMI, in the main menu under **Help** > **Info**, tab **Licenses**
- Under D:\KUKA_OPT*Option package name*\LICENSE on the robot controller

- In the license folder under the name of the option package in the **Options** catalog in WorkVisual

Further information about open-source licenses can be requested from the following address: opensource@kuka.com

2 Product description

2.1 Product description

Description

The KUKA.DeviceConnector pre-installed 2.1 option package installs an OPC UA interface and an MQTT interface on the robot controller. These interfaces enable the robot to communicate with KUKA Cloud services.

- KUKA.DeviceConnector pre-installed 2.1 provides a predefined set of robot data and sends these data to the cloud via the OPC UA interface.
- The robot controller can connect to the cloud via the MQTT interface and access the data.

On newly delivered robot controllers, KUKA.DeviceConnector pre-installed 2.1 is pre-installed as standard. In the case of older robot controllers, KUKA.DeviceConnector pre-installed 2.1 can be installed subsequently.

2.2 Scope of data

The following data are provided by KUKA.DeviceConnector pre-installed 2.1:

- All process data, i.e. all KRL variables
- Basic information about the kinematic system and robot controller:
  - Robot name
  - Serial number of the robot
  - Robot type
  - Operating system (System Software)
  - Robot controller type
  - Serial number of the robot controller (if available)
  - WorkVisual project name
  - WorkVisual project activation time
  - WorkVisual project description
  - IP address of the robot controller (KLI or KONI)
  - Installed software options
- Basic information about the PROFINET periphery:
  - Device name
  - IP address
  - I&M data
  - Energy consumption

  Precondition: KUKA.PROFINET® -/S or KUKA.PROFINET® M/S is installed.
- Information about modules installed in the electrical enclosure, such as inverters or I/O devices
- Access to log files, configuration files, KRCDiag and traces
- Access to the diagnostic data of the KSS/VSS such as log events and all diagnostic monitor data
- State of the hard disk according to S.M.A.R.T.
- Controller runtime
- State of the robot programs

- State of the robot, including axis positions, load data and coordinate systems
- State of the safety controller, including operator safety
- Size of the hard drive partitions and amount of memory space used
- Windows registry entries
- Windows event logs
- ProConOS variables

  Precondition: KUKA.PLC ProConOS or KUKA.PLC ProConOS ltd is installed.

2.3 Intended use and misuse

Use

The KUKA.DeviceConnector pre-installed 2.1 option package enables a robot to communicate with KUKA Cloud services.

Misuse

Any use or application deviating from the intended use is deemed to be misuse and is not allowed. It will result in the loss of warranty and liability claims. KUKA is not liable for any damage resulting from such misuse.

3 Safety

The safety information for the industrial robot can be found in the “Safety” chapter of the Operating and Programming Instructions for System Integrators or the Operating and Programming Instructions for End Users.

Comply with safety-relevant information
The safe use of this product requires knowledge of and compliance with fundamental safety measures. Death, severe injuries or damage to property may otherwise result.

- The “Safety” chapter in the operating and programming instructions of the system software must be observed.

4 Installation

The option package can either be installed on the robot controller via the smartHMI or via WorkVisual.

4.1 System requirements

Hardware

- KR C4 or KR C5 robot controller
- or VKR C4 robot controller
- Laptop/PC

Software

Robot controller:

- KUKA System Software 8.3, 8.5, 8.6 and 8.7
- Or VW System Software 8.3, 8.6 and 8.7
- When used with CPC: KUKA.CPC 3.1.4 or higher

Laptop/PC:

- For KUKA and VW System Software 8.3:
  - WorkVisual 4.0 or higher
- For KUKA System Software 8.5 or higher:
  - WorkVisual 5.0 or higher
- For KUKA and VW System Software 8.6 and 8.7:
  - WorkVisual 6.0

Compatibility

KUKA.DeviceConnector pre-installed 2.1 must not be installed on a robot controller together with the following option package:

- KUKA.OPC Server
- KUKA.OPC UA

4.2 Installation via smartHMI

4.2.1 Installing or updating the option package

It is advisable to archive all relevant data before updating a software package.

Precondition

- User rights:
  - KSS: function group **General configuration**
    But at least the user group “Expert”
  - VSS: user group “User”
- T1 or T2 mode
- No program is selected.
- USB stick with the option package (KOP file)

NOTICE

Data loss due to USB sticks from third-party manufacturers
Data may be lost if USB sticks from manufacturers other than KUKA are used for activities on the robot controller.

- For activities on the robot controller requiring a USB stick, use a KUKA stick.

  The KUKA sticks are validated for use with the robot controller.

Procedure

1. Connect the USB stick to the robot controller or smartPAD.
2. In the main menu, select **Start-up** > **Additional software**.
3. Press **New software**: an entry for the option package (name and version) must be displayed in the **Name** column and drive **E:** or **K:** in the **Path** column.

   If not, press **Refresh**.
4. If the entry for the option package is now displayed, continue with step 5.

   Otherwise, the path from which the software is to be installed must be configured first:

   a. Press the **Configure** button.
   b. Select a line in the **Installation paths for options** area.

      Note: If the line already contains a path, this path will be overwritten.
   c. Press **Path selection**. The available drives are displayed.
   d. If the stick is connected to the robot controller: Select **E:**.

      If the stick is connected to the smartPAD: **K:** instead of **E:**
   e. Press **Save**. The **Installation paths for options** area is displayed again. It now contains the new path.
   f. Mark the line with the new path and press **Save** again.
5. Activate the check box next to the option package and press **Install**. Confirm the installation query with **OK**.
6. The request for confirmation *Do you want to activate the project […]?* is displayed. The active project is overwritten during activation. If no relevant project will be overwritten: answer the query with **Yes**.
7. An overview with the changes and a request for confirmation are displayed. Answer this with **Yes**. The option package is installed and the robot controller carries out a reboot.
8. Remove the stick.

LOG file

A LOG file is created under C:\KRC\ROBOTER\LOG.

4.2.2 Uninstalling the option package

It is advisable to archive all relevant data before uninstalling a software package.

Precondition

- User rights:
  - KSS: function group **General configuration**

    But at least the user group “Expert”

  - VSS: user group “User”
- T1 or T2 mode
- No program is selected.

Procedure

1. In the main menu, select **Start-up** > **Additional software**.
2. Activate the check box next to the option package and press **Uninstall**. Answer the request for confirmation with **Yes**.
3. Answer the request for confirmation *Do you want to activate the project […]?* with **Yes**.
4. An overview with the changes and a request for confirmation are displayed. Answer this with **Yes**. The option package is uninstalled and the robot controller carries out a reboot.

LOG file

A LOG file is created under C:\KRC\ROBOTER\LOG.

4.3 Installation via WorkVisual

4.3.1 Installing or updating the option package

Description

The option package is installed in WorkVisual and added to the project. During project deployment, the option package is automatically installed on the robot controller.

It is advisable to archive all relevant data before updating a software package.

Precondition

- User rights:
  - KSS: user group “Expert”
  - VSS: user group “User”
- T1 or T2 mode
- No program is selected.
- Network connection to the robot controller
- The option package is available as a KOP file.

Procedure

1. Install the option package in WorkVisual.
2. Load the active project from the robot controller.
3. Insert the option package into the project.
4. Deploy the project from WorkVisual to the robot controller and activate it.
5. The request for confirmation *Do you want to activate the project […]?* is displayed on the smartHMI. The active project is overwritten during activation. If no relevant project will be overwritten: Answer the query with **Yes**.
6. An overview with the changes and a request for confirmation are displayed on the smartHMI. Answer this with **Yes**. The option package is installed and the robot controller carries out a reboot.

Information about procedures in WorkVisual is contained in the WorkVisual documentation.

LOG file

A LOG file is created under C:\KRC\ROBOTER\LOG.

4.3.2 Uninstalling the option package

Description

The option package can be uninstalled via WorkVisual.

It is advisable to archive all relevant data before uninstalling a software package.

Precondition

- User rights:
  - KSS: user group “Expert”
  - VSS: user group “User”
- T1 or T2 mode
- No program is selected.
- Network connection to the robot controller

Procedure

1. Load the project from the robot controller.
2. Remove the option package from the project. A window with modifications is displayed.
3. Deploy the project from WorkVisual to the robot controller and activate it.
4. Answer the request for confirmation *Do you want to activate the project […]?* on the smartHMI with **Yes**.
5. An overview with the changes and a request for confirmation are displayed on the smartHMI. Answer this with **Yes**. The option package is uninstalled and the robot controller carries out a reboot.

Information about procedures in WorkVisual is contained in the WorkVisual documentation.

LOG file

A LOG file is created under C:\KRC\ROBOTER\LOG.

5 Configuration

5.1 Connecting to KUKA Cloud

Description

The connection to the KUKA Cloud can be established via an MQTT broker. The following variables must be configured for this purpose (via variable display on KUKA smartHMI):

Variable	Description
KUKACONNECT_BROKERIP	Enter IP address of the MQTT broker.
KUKACONNECT_ENABLED	Set to TRUE to activate MQTT.

Precondition

The following user rights are required for modifying a variable:

- KSS 8.5 or higher: Function group **General configuration**
- KSS 8.3: User group “Expert”
- VSS: User group “User”

Procedure

1. In the main menu, select **Display** > **Variable** > **Single**.

   The **Variable display – Single** window opens.
2. Enter the name of the variable in the **Name** box and confirm with the Enter key.
3. The current value of the variable is displayed in the **Current value** box. If nothing is displayed, no value has yet been assigned to the variable.
4. To modify the variable: Enter the desired value in the **New value** box.
5. Press the **Set value** button. The new value is displayed in the **Current value** box.

6 Messages

6.1 Information about the messages

The “Messages” chapter contains selected messages. It does not cover all the messages displayed in the message window.

6.2 System messages from module: DeviceConnector

6.2.1 DeviceConnector 00001

Message code	DeviceConnector 00001
Message text	Unable to establish connection {0} to {1}.
Message type	Status message
Possible cause(s)	**Cause:** URL address of the MQTT broker is incorrect (>>> Page 19) **Solution:** Adjusting the address of the MQTT broker via the variable display (>>> Page 19) **Cause:** URL address of the MQTT broker is incorrect (>>> Page 20) **Solution:** Adjusting the address of the MQTT broker via the configuration file (>>> Page 20)

Cause: URL address of the MQTT broker is incorrect

Description

If the URL address of the MQTT broker is specified incorrectly, it is not possible to establish a connection between the robot controller and the cloud.

Solution: Adjusting the address of the MQTT broker via the variable display

Description

The connection to the cloud is established via an MQTT broker. The following variables must be configured for this purpose (via variable display on KUKA smartHMI):

Variable	Description
KUKACONNECT_BROKERIP	Enter IP address of the MQTT broker.
KUKACONNECT_ENABLED	Set to TRUE to activate MQTT.

If the address to the MQTT cannot be established, it is essential to check whether the set variable values are correct.

Precondition

The following user rights are required for modifying a variable:

- KSS 8.5 or higher: Function group **General configuration**
- KSS 8.3: User group “Expert”
- VSS: User group “User”

Procedure

1. In the main menu, select **Display** > **Variable** > **Single**.
   The **Variable display – Single** window opens.
2. Enter the name of the variable in the **Name** box and confirm with the Enter key.
3. The current value of the variable is displayed in the **Current value** box. If nothing is displayed, no value has yet been assigned to the variable.
4. To modify the variable: Enter the desired value in the **New value** box.
5. Press the **Set value** button. The new value is displayed in the **Current value** box.

Cause: URL address of the MQTT broker is incorrect

Description

If the URL address of the MQTT broker is specified incorrectly, it is not possible to establish a connection between the robot controller and the cloud.

Solution: Adjusting the address of the MQTT broker via the configuration file

Description

The connection of the robot controller to the MQTT broker is configured via the configuration file. The connection settings can be defined in the configuration file via the following parameters:

Object	Use	Description
Address	Required	A ConnectionParameter that specifies the protocol (mqtt or mqtts), the IP and the port of the broker.
PublisherId	Required	ID of the host.
ConnectionName	Required	**Placeholder** which is substituted by the network name of the controller
Enabled	Optional	

If the address to the MQTT cannot be established, check whether the set connection settings are correct.

Configuration file

Directory	C:\KRC\Roboter\User\Common
File	*.pscj

Procedure

1. Open the configuration file.

2. Check whether the connection settings are correctly configured.

6.2.2 DeviceConnector 00003

Message code	DeviceConnector 00003
Message text	Unable to find KRL variable “{0}” ({1})
Message type	Status message
Possible cause(s)	**Cause:** Configuration file contains errors (>>> Page 21) **Solution:** Check configuration file (>>> Page 21)

Cause: Configuration file contains errors

The KRL variable cannot be found if the configuration file does not meet the following three conditions:

- The configuration file must be of the file type *.pscj.
- The file path of the KRL variable must be correctly specified in the configuration file.
- The URL for the file path of the KRL variables must be of the data type String.

Solution: Check configuration file

Procedure

1. Call the storage location of the configuration file: C:\KRC\Roboter\User\Common
2. Ensure that the file ends in *.pscj.
3. Open the configuration file.
4. Check the file path under **Address** and adjust if necessary.

6.2.3 DeviceConnector 00006

Message code	DeviceConnector 00006
Message text	Failed to read file "{0}".
Message type	Notification message
Possible cause(s)	**Cause:** Configuration file contains errors (>>> Page 21) **Solution:** Check configuration file (>>> Page 22)

Cause: Configuration file contains errors

The KRL variable cannot be found if the configuration file does not meet the following three conditions:

- The configuration file must be of the file type *.pscj.
- The file path of the KRL variable must be correctly specified in the configuration file.
- The URL for the file path of the KRL variables must be of the data type String.

Solution: Check configuration file

Procedure

1. Call the storage location of the configuration file: C:\KRC\Roboter\User\Common
2. Ensure that the file ends in *.pscj.
3. Open the configuration file.
4. Check the file path under **Address** and adjust if necessary.

6.2.4 DeviceConnector 00007

Message code	DeviceConnector 00007
Message text	Unexpected error in “{0}”
Message type	Notification message
Possible cause(s)	**Cause:** Unexpected error (>>> Page 22) **Solution:** Contact KUKA Service (>>> Page 22)

Cause: Unexpected error

If the OPC UA or MQTT communication breaks off during the restart of the controller, an unexpected error message is displayed.

Solution: Contact KUKA Service

6.2.5 DeviceConnector 00008

Message code	DeviceConnector 00008
Message text	The license file {0} is no longer valid.
Message type	Notification message
Possible cause(s)	**Cause:** License file invalid (>>> Page 23) **Solution:** Installing new license file (>>> Page 23)

Cause: License file invalid

Description

If a license file is not valid, the required data cannot be called up by the device used. This occurs when an incorrect license file is used, when the duration of validity for a license file has expired or when the license file and the serial number of the device do not match.

Solution: Installing new license file

Description

License files offer the possibility of adding functions and additional data points to the scope of KUKA.DeviceConnector.

License files are uniquely assigned to devices via the device serial number.

To allow for the license file to be used, it must be stored in the correct directory after it is acquired and the system must be reconfigured.

Precondition

- User rights: Function group **General configuration**
- T1 or T2 mode
- No program is selected.

Procedure

1. Apply for the license file at DigitalServices.Robotics.De@kuka.com.
2. Copy the license file to C:/KRC/ROBOTER/config/user/common/opcua/accessconfig/.
3. Reconfigure the I/O driver

   Further information can be found in the corresponding chapter in the system software documentation.

6.2.6 DeviceConnector 00009

Message code	DeviceConnector 00009
Message text	The license file {0} is invalid.
Message type	Notification message
Possible cause(s)	**Cause:** License file invalid (>>> Page 23) **Solution:** Installing new license file (>>> Page 24)

Cause: License file invalid

Description

If a license file is not valid, the required data cannot be called up by the device used. This occurs when an incorrect license file is used, when the duration of validity for a license file has expired or when the license file and the serial number of the device do not match.

Solution: Installing new license file

Description

License files offer the possibility of adding functions and additional data points to the scope of KUKA.DeviceConnector.

License files are uniquely assigned to devices via the device serial number.

To allow for the license file to be used, it must be stored in the correct directory after it is acquired and the system must be reconfigured.

Precondition

- User rights: Function group **General configuration**
- T1 or T2 mode
- No program is selected.

Procedure

1. Apply for the license file at DigitalServices.Robotics.De@kuka.com.
2. Copy the license file to C:/KRC/ROBOTER/config/user/common/opcua/accessconfig/.
3. Reconfigure the I/O driver

   Further information can be found in the corresponding chapter in the system software documentation.

6.2.7 DeviceConnector 00010

Message code	DeviceConnector 00010
Message text	The license file {0} is invalid. Incorrect serial number.
Message type	Notification message
Possible cause(s)	**Cause:** License file invalid (>>> Page 24) **Solution:** Installing new license file (>>> Page 24)

Cause: License file invalid

Description

If a license file is not valid, the required data cannot be called up by the device used. This occurs when an incorrect license file is used, when the duration of validity for a license file has expired or when the license file and the serial number of the device do not match.

Solution: Installing new license file

Description

License files offer the possibility of adding functions and additional data points to the scope of KUKA.DeviceConnector.

License files are uniquely assigned to devices via the device serial number.

To allow for the license file to be used, it must be stored in the correct directory after it is acquired and the system must be reconfigured.

Precondition

- User rights: Function group **General configuration**
- T1 or T2 mode
- No program is selected.

Procedure

1. Apply for the license file at DigitalServices.Robotics.De@kuka.com.
2. Copy the license file to C:/KRC/ROBOTER/config/user/common/opcua/accessconfig/.
3. Reconfigure the I/O driver

   Further information can be found in the corresponding chapter in the system software documentation.

7 KUKA Service

7.1 Requesting support

Introduction

This documentation provides information on operation and operator control, and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.

Information

The following information is required for processing a support request:

- Description of the problem, including information about the duration and frequency of the fault
- The greatest possible amount of information about the hardware and software components of the overall system

  The following list gives an indication of the information which is relevant in many cases:

  – Model and serial number of the kinematic system, e.g. the manipulator
  – Model and serial number of the controller
  – Model and serial number of the energy supply system
  – Designation and version of the system software
  – Designations and versions of other software components or modifications
  – System Software diagnosis package

    Additionally for KUKA Sunrise: Existing projects including applications

    For versions of KUKA System Software older than V8: Archive of the software (Diagnosis package is not yet available here.)
  – Application used
  – External axes used

7.2 KUKA Customer Support

The contact details of the local subsidiaries can be found at:
www.kuka.com/customer-service-contacts

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