KUKA System Technology

KUKA.OPC Server 4.1

For KUKA System Software 8.2 and 8.3

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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.

Translation of the original documentation

KIM-PS5-DOC
Contents

1 Introduction .................................................................................................................. 5
  1.1 Target group .................................................................................................................. 5
  1.2 Industrial robot documentation ...................................................................................... 5
  1.3 Representation of warnings and notes ............................................................................. 5
  1.4 Terms used .................................................................................................................... 6
  1.5 Trademarks ................................................................................................................... 7

2 Product description ................................................................................................. 9
  2.1 Overview of KUKA.OPC Server .................................................................................... 9
  2.2 Reading and writing industrial robot variables ............................................................. 11

3 Safety ..................................................................................................................... 13
  3.1 Safety measures for “single point of control” ............................................................... 13

4 Installation .................................................................................................................. 15
  4.1 System requirements ..................................................................................................... 15
  4.2 Installing or updating KUKA.OPC Server .................................................................... 15
  4.3 Uninstalling KUKA.OPC Server .................................................................................. 15

5 Operation ................................................................................................................... 17
  5.1 Starting the OPC server manually ............................................................................... 17
  5.2 Connecting an OPC DA client to the OPC server ....................................................... 17
  5.3 Connecting an OPC XML DA client to the OPC server .............................................. 18

6 Configuration for OPC clients .............................................................................. 21
  6.1 Configuration for OPC XML DA clients ....................................................................... 21
  6.2 Configuration for OPC DA clients ............................................................................... 21
  6.3 Configuring global DCOM settings .............................................................................. 21
    6.3.1 Users and user groups ............................................................................................. 22
    6.3.2 Default Properties tab ............................................................................................. 23
    6.3.3 COM Security tab .................................................................................................... 24
      6.3.3.1 Assigning access permissions ............................................................................ 24
      6.3.3.2 Assigning launch and activation permissions ..................................................... 25
    6.3.4 Default Protocols tab ............................................................................................... 27
    6.3.5 DCOM settings for “OpcEnum” and “KUKA OPC Server” .................................. 29
      6.3.5.1 Changing the “KUKA OPC Server Properties” in the DCOM configuration .... 29
      6.3.5.2 Changing the “OpcEnum Properties” in the DCOM configuration .................. 30
  6.4 Configuring the KUKA Line Interface (KLI) ............................................................. 31
  6.5 Declaring the OPC server in the Window system directory ....................................... 32

7 Configuring the OPC server ..................................................................................... 33
  7.1 “OPC configuration” user interface ............................................................................. 33
    7.1.1 Creating OPC items ............................................................................................... 34
    7.1.2 Changing OPC Items .............................................................................................. 34
    7.1.3 Deleting OPC Items ............................................................................................... 35
  7.2 Configuration parameters ............................................................................................. 35
    7.2.1 Configuration parameters: “KRC variables” .......................................................... 35
    7.2.2 Configuration parameters: “Proxies” ..................................................................... 36
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.3</td>
<td>Configuration parameters: “Messages”</td>
<td>36</td>
</tr>
<tr>
<td>7.2.4</td>
<td>Configuration parameters: “Registry”</td>
<td>37</td>
</tr>
<tr>
<td>7.3</td>
<td>Example configurations for communication with OPC</td>
<td>38</td>
</tr>
<tr>
<td>7.3.1</td>
<td>Grouping variables</td>
<td>38</td>
</tr>
<tr>
<td>7.3.2</td>
<td>Serial data transfer</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>KUKA Service</td>
<td>43</td>
</tr>
<tr>
<td>8.1</td>
<td>Requesting support</td>
<td>43</td>
</tr>
<tr>
<td>8.2</td>
<td>KUKA Customer Support</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>51</td>
</tr>
</tbody>
</table>
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 Windows
- Advanced knowledge of network connections

For optimal use of our products, we recommend that our customers take part in a course of training at 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 manipulator
- Documentation for the robot controller
- Operating and programming instructions for the KUKA System Software
- Documentation relating to options and accessories
- Parts catalog on storage medium

Each of these sets of instructions is a separate document.

1.3 Representation of warnings and notes

Safety

These warnings are relevant to safety 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 INSTRUCTIONS**: Procedures marked with this warning must be followed exactly.

Notes

These hints serve to make your work easier or contain references to further information.
### 1.4 Terms used

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
</table>
| ACL      | Access Control List  
Access control lists are used to control access rights, e.g. for access to files and programs in operating systems.                                                                                       |
| DCOM     | Distributed Component Object Model  
Protocol for direct communication of software components via a network. DCOM is a component of the Windows operating system.                                                                                   |
| KLI      | Line bus for the integration of the system in the customer network (KUKA Line Interface)  
The KLI is the Ethernet interface of the robot controller for external communication.                                                                                                                      |
| KR C     | KUKA Robot Controller                                                                                                                                                                                      |
| CRR      | Controlled Robot Retraction  
CRR is an operating mode only available when KUKA.SafeOperation or KUKA.SafeRangeMonitoring is used. If the robot has violated a monitoring function and been stopped by the safety controller, it can only be moved out of the violated area in CRR mode. |
| KUKA Cross | Interface between the real-time operating system VxWorks and the Windows operating system of the KUKA System Software                                                                                       |
| KUKA smartHMI | User interface of the KUKA System Software (KUKA smart Human-Machine Interface)                                                                                                                            |
| KUKA smart-PAD | Teach pendant for the industrial robot                                                                                                                 |
| OLE      | Object Link Embedding  
Object system and protocol that enables the interaction of different applications within a Windows environment. The objects can be linked or embedded in a document.                                               |
| OPC      | OLE for Process Control  
Standardized software interface for data exchange between applications within a Windows environment. OPC uses the DCOM protocol.                                                                               |
<p>| OPC client | An OPC client accesses the data made available by an OPC server.                                                                                                                                            |
| OPC DA   | Specification for transferring real-time values via OPC (DCOM-based)                                                                                                                                         |
| OPC XML-DA | Specification for XML-based transfer of real-time values (DCOM-independent)                                                                                                                                  |
| OPC item | An OPC item maps a real process variable. A process variable is an element of the address space of the OPC server, e.g. the input module of a PLC.                                                                   |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item ID</td>
<td>An OPC item is identified by its item ID. The item ID is the defined name of the OPC item that must be unique in the address space of the OPC server.</td>
</tr>
<tr>
<td>OpcEnum</td>
<td>Service program that can be used by an OPC client to poll and display the OPC servers installed on a server computer.</td>
</tr>
<tr>
<td>Polling</td>
<td>Polling types for reading a variable (OPC item)</td>
</tr>
<tr>
<td>Event</td>
<td>- With “Polling”, the state or value of a variable is polled and updated cyclically (synchronous reading).</td>
</tr>
<tr>
<td></td>
<td>- With “Event”, the state or value of a variable is polled and updated when this changes (event-dependent reading).</td>
</tr>
<tr>
<td>SPOC</td>
<td>Single Point of Control</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
</tr>
<tr>
<td></td>
<td>The PLC is a module for higher-level control tasks in a plant bus system.</td>
</tr>
<tr>
<td>Subnet</td>
<td>Subnetwork in the Internet Protocol (IP)_</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol</td>
</tr>
<tr>
<td></td>
<td>Protocol of the data exchange between devices of a network. TCP constitutes a virtual channel between two sockets in a network connection. Data can be transmitted on this channel in both directions.</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td></td>
<td>The Internet protocol is used to define subnetworks by means of physical MAC addresses.</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td></td>
<td>URLs identify and locate a resource via the access method to be used, eg. the network protocol HTTP, and the location of the resource in the network.</td>
</tr>
<tr>
<td>VxWorks</td>
<td>Real-time operating system</td>
</tr>
</tbody>
</table>

### 1.5 Trademarks

**InTouch** is a trademark of Wonderware GmbH.

**Mac Os** is a trademark of Apple Inc.

**Softing OPC Toolbox Demo Client** is a trademark of Softing AG.

**VxWorks** is a trademark of Wind River Systems Inc.

**Windows** is a trademark of Microsoft Corporation.
2 Product description

2.1 Overview of KUKA.OPC Server

KUKA.OPC Server is an add-on technology package. The OPC server makes it possible to communicate and exchange data with the robot controller from a local or remote OPC client.

Functions
- Reading and writing of system and program variables of the industrial robot
- Reading of robot controller messages
- Reading of keys from the registration database
- Reading of variables from other OPC servers via the proxy interface

Communication without OPC

Without OPC, 2 machines or applications must know each other’s communications options in order to be able to exchange data.

Communication with OPC

With OPC, it suffices to configure an OPC-compliant driver for each machine or application. All programs that can request data as OPC clients work together with the OPC server. This simplifies and standardizes access.

KUKA.OPC Server uses the network protocol TCP/IP. The network connection is established via the Windows interface of the KUKA Line Interface (KLI) of the robot controller.

It is not possible to browse to the OPC server in Windows.
**Areas of application**

KUKA.OPC Server defines the data exchange between applications within a Windows environment with an OPC client. This application can be a program, such as a process visualization program or Soft PLC, or a field bus interface that supplies process data via the OPC server.

Examples of the use of the OPC server:

- Control of simple process sequences. Real-time process control is not possible.
- Visualization and monitoring of process sequences in a robot cell, e.g. in order to optimize the production process on the basis of the analysis results.
- Use of the smartPAD as operator panel for the robot cell.

**OPC client**

KUKA.OPC Server supports OPC DA clients and OPC XML DA clients. An OPC DA client uses the DCOM protocol for network communication. The XML-based communication via an OPC XML DA client is DCOM-independent.

An OPC DA client can start KUKA.OPC Server. With an OPC XML DA client, KUKA.OPC Server must be started manually.

The OPC client, for example a control system, is integrated by the user. The open OPC standard makes it possible to use commercially available visualization components such as InTouch.
The scope of supply of KUKA.OPC Server includes the source code for various example clients, as well as for the Softing OPC Toolbox Demo Client.

- The source code of the example clients is located in the Tool.zip archive under Tools on the CD-ROM. The source code can be used as a template to create your own OPC clients:
  - C# client (MS Visual C#)
  - C++ client (MS Visual C++)
  - VB client (MS Visual Basic)
- The Softing Demo Client is located in the folder Tools\Demo-Client. The Demo Client can be used to test the communication with the OPC Server. The following specifications are supported:
  - Data Access V1.0, V2.0 and V3.0 (DA)
  - XML Data Access V1.0 (XML DA)

![WARNING] The Softing Demo Client is not SPOC-compliant and must not be used in a system. The Softing Demo Client must only be used to test whether the client and server are communicating.

User administration

KUKA.OPC Server does not include any user administration. If required, this must be integrated with the OPC client by the user.

2.2 Reading and writing industrial robot variables

![WARNING] The OPC server can be used with write access to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system. If the OPC server is used, safety measures must be taken to ensure complete implementation of the principle of "single point of control" (SPOC). It must be ensured that potentially hazardous signals (e.g. the opening/closing of a gun) can only be executed if AUT or AUT EXT mode is set and the safety gate is closed. For this, the variables $USER_SAF and $SPOC_MOTION_ENABLE must be polled accordingly. Failure to implement these safety measures may result in death to persons, severe injuries or considerable damage to property.

In AUT EXT mode, the setting of outputs is not possible by default.

Access functions

When it comes to reading and writing system and program variables of the industrial robot, a basic distinction is made between synchronous and event-dependent access to the VxWorks real-time operating system.

- Synchronous reading and writing are implemented using the Cross functions ShowVar and SetVar. A variable is updated at a defined interval.
- Event-dependent reading is implemented using the Cross function SetInfo. The OPC item is read via SetInfo whenever the value of a variable changes.

The number of event-dependent access operations is limited by the kernel system (max. 40). Once the maximum number of SetInfos has been reached, all further OPC items are read synchronously.

A module that is connected via SetInfo cannot be edited or deleted.
Configuration tips

The update interval of the OPC server cannot be changed by the OPC client and is dependent on the following factors:

- Number of variables (OPC items) created
  During reading and writing, the variables are transferred one by one in data packets via the KUKA Cross interface. The time required for the complete transfer of the variables is roughly proportional to the number of the variables.
  To reduce the transfer time, it is recommended to group variables, e.g. several Boolean variables can be grouped together as an integer variable, or several inputs or outputs as a signal.

- Variable type
  Complex variables such as data structures or arrays are broken down into a number of data packets. This increases the transmission time.
  If only one array element needs to read, e.g. the input $IN[1]$, it is recommended that only this element is polled and not the entire array, in order to reduce the transmission time. To read several inputs, it is appropriate to poll the complete $IN[]$ array.

- Polling type
  - **Polling**: Cyclically via ShowVar (synchronous reading)
  - **Event**: Acyclically via SetInfo (event-dependent reading)
  Polling (ShowVar) generally causes more data traffic on the KUKA Cross interface than Event (SetInfo). The reason for this is that the “Polling” type entails regular polling, irrespective of whether the state or value of the OPC item has changed.
  If SetInfo is set for an OPC item that changes its value frequently, the data traffic may be just as high as with ShowVar. This is the case when reading the variable $TIMER[x]$, for example.
3 Safety

This documentation contains safety instructions which refer specifically to the software described here.

The fundamental 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.

**WARNING** The “Safety” chapter in the operating and programming instructions must be observed. It is particularly important to observe those safety measures which are required to ensure complete implementation of the principle of “single point of control” (SPOC). It must be ensured that potentially hazardous signals (e.g. the opening/closing of a gun) can only be executed if AUT or AUT EXT mode is set and the safety gate is closed. For this, the variables $USER_SAF and $SPOC_MOTION_ENABLE must be polled accordingly. Failure to implement these safety measures may result in death to persons, severe injuries or considerable damage to property.

**NOTICE** DA enables many clients to connect to the OPC server and manipulate the robot controller. To reduce the risk of unauthorized access to the robot controller, it is recommended to limit the number of authorized users to the necessary minimum in the DCOM safety settings.

**NOTICE** XML DA enables many clients to connect to the OPC server and manipulate the robot controller. To reduce the risk of unauthorized access to the robot controller, it is recommended to limit the number of authorized users to a few devices in a subnet. The client and server computers must be present in the subnet.

3.1 Safety measures for “single point of control”

**Overview** If certain components in the industrial robot are operated, safety measures must be taken to ensure complete implementation of the principle of “single point of control” (SPOC).

Components:
- Submit interpreter
- PLC
- OPC Server
- Remote control tools
- Tools for configuration of bus systems with online functionality
- KUKA.RobotSensorInterface

The implementation of additional safety measures may be required. This must be clarified for each specific application; this is the responsibility of the system integrator, programmer or user of the system.

Since only the system integrator knows the safe states of actuators in the periphery of the robot controller, it is his task to set these actuators to a safe state, e.g. in the event of an EMERGENCY STOP.

**T1, T2, CRR** In the test modes T1, T2 and CRR, the components referred to above may only access the industrial robot if the following signals have the following states:
Submit interpreter, PLC

If motions, (e.g. drives or grippers) are controlled with the submit interpreter or the PLC via the I/O system, and if they are not safeguarded by other means, then this control will take effect even in T1, T2 and CRR modes or while an EMERGENCY STOP is active.

If variables that affect the robot motion (e.g. override) are modified with the submit interpreter or the PLC, this takes effect even in T1, T2 and CRR modes or while an EMERGENCY STOP is active.

Safety measures:

- In T1, T2 and CRR, the system variable $OV_PRO must not be written to by the submit interpreter or the PLC.
- Do not modify safety-relevant signals and variables (e.g. operating mode, EMERGENCY STOP, safety gate contact) via the submit interpreter or PLC.
- If modifications are nonetheless required, all safety-relevant signals and variables must be linked in such a way that they cannot be set to a dangerous state by the submit interpreter or PLC.

OPC server, remote control tools

These components can be used with write access to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system.

Safety measures:

- KUKA stipulates that these components are to be used exclusively for diagnosis and visualization.
  - Programs, outputs or other parameters of the robot controller must not be modified using these components.
- If these components are used, outputs that could cause a hazard must be determined in a risk assessment. These outputs must be designed in such a way that they cannot be set without being enabled. This can be done using an external enabling device, for example.

Tools for configuration of bus systems

If these components have an online functionality, they can be used with write access to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system.

- WorkVisual from KUKA
- Tools from other manufacturers

Safety measures:

- In the test modes, programs, outputs or other parameters of the robot controller must not be modified using these components.

<table>
<thead>
<tr>
<th>Signal</th>
<th>State required for SPOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>$USER_SAF</td>
<td>TRUE</td>
</tr>
<tr>
<td>$SPOC_MOTION_ENABLE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>
4 Installation

4.1 System requirements

Hardware
- KR C4

Software
- Robot controller:
  - KUKA System Software 8.2 and 8.3
- External computer:
  - Operating system Windows XP, Windows XPe or Windows 7 for OPC DA clients

OPC XML DA clients are DCOM-independent and can also be operated on other operating systems than the Windows operating system, e.g. Mac OS or Linux.

4.2 Installing or updating KUKA.OPC Server

Preparation
- Copy the software from the CD to the KUKA.USBData stick.

Precondition
- “Expert” user group

Procedure
1. Plug in USB stick.
2. In the main menu, select Start-up > Additional software.
3. Click on New software. If a software package that is on the USB stick is not displayed, click on Refresh.
4. Mark the entry KUKA.OPC Server and click on Install. Reply to the request for confirmation with Yes. The files are copied onto the hard drive.
5. Remove USB stick.
6. It may be necessary to reboot the controller, depending on the additional software. In this case, a corresponding prompt is displayed. Confirm with OK and reboot the robot controller. Installation is resumed and completed.

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

4.3 Uninstalling KUKA.OPC Server

Precondition
- “Expert” user group

Procedure
1. In the main menu, select Start-up > Additional software. All additional programs installed are displayed.
2. Mark the entry KUKA.OPC Server and click on Uninstall. Reply to the request for confirmation with Yes. Uninstallation is prepared.
3. Reboot the robot controller. Uninstallation is resumed and completed.
LOG file

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

5.1 Starting the OPC server manually

Procedure

1. Select Configuration > OPC configuration from the main menu. The OPC configuration window is opened.
2. Select the Diagnostic screen and click on Start Server/ Connect Server.

Description

The OPC server is started as an application and the connection is established with the server. Once the connection is established, the KRC OPCServer window is opened, displaying the current status of the server.

If the OPC configuration window is closed via the Close symbol, the connection to the OPC server is terminated and the KRC OPCServer for status display is closed. This does not stop the OPC server.

Fig. 5-1: Starting the OPC server manually

The following buttons are available:

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Server/ Connect Server</td>
<td>Starts the OPC server as an application and establishes the connection to the OPC server in order to poll the status of the server. (LED lights up green - status running.) If the server has already been started, the connection to the server is established automatically. The button is only active if the server has not been started. (LED lights up red - status unknown)</td>
</tr>
</tbody>
</table>

5.2 Connecting an OPC DA client to the OPC server

Precondition

- The robot controller is running.
- The IP address of the active Windows interface is known.
- The DCOM settings on the server and client computers are configured. (>>> 6.2 "Configuration for OPC DA clients" Page 21)
- Only if a remote client is being used:
  - The Windows user is logged in to the client and server computer with the same user name and password. If this is not the case, further DCOM settings are required to declare the user in DCOM.
Port 135 and the dynamic ports for communication via DCOM are activated for TCP on the Windows interface of the KLI.

(>>> 6.4 "Configuring the KUKA Line Interface (KLI)" Page 31)

**Procedure**

- Enter the following URL: `opcda://IP address/KUKASrvr.DA.1`
  
  The OPC client connects to the OPC server. If the OPC server is not yet running, it is started by the OPC client.

An OPC server that has been started by a client is stopped automatically when the last connected OPC client is closed.

**Example**

1. Start the OPC server manually.
2. Enter the following URL: `http://IP address:8081/DA`
   
   The OPC client connects to the OPC server.

**5.3 Connecting an OPC XML DA client to the OPC server**

**Precondition**

- The robot controller is running.
- The IP address of the active Windows interface is known.
- Only if a remote client is being used:
  
  Port 8081 is activated for TCP on the Windows interface of the KLI.
  
  (>>> 6.4 "Configuring the KUKA Line Interface (KLI)" Page 31)

**Procedure**

1. Start the OPC server manually.
2. Enter the following URL: `http://IP address:8081/DA`
   
   The OPC client connects to the OPC server.
Example

Fig. 5-3: Softing Demo Client – URL for OPC XML DA
6  Configuration for OPC clients

6.1  Configuration for OPC XML DA clients

Overview

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Activate port 8081 for TCP on the Windows interface of the KLI. (&gt;&gt;&gt; 6.4 &quot;Configuring the KUKA Line Interface (KLI)&quot; Page 31)</td>
</tr>
<tr>
<td>2</td>
<td>Recommended if remote clients access the OPC server: Configure the network so that the number of users that can connect to the OPC server as a client is limited to the necessary minimum.</td>
</tr>
</tbody>
</table>

6.2  Configuration for OPC DA clients

Overview

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1    | Configure global DCOM settings.  
  - Activate DCOM on the server and client computers.  
  - Define users or user groups that are authorized to start or use DCOM applications.  
  - If remote clients access the OPC server: Define the port range for DCOM communication on the server computer. |
| 2    | If remote clients access the OPC server: In the DCOM configuration, assign the **Interactive user** the right to start the OPC server. |
| 3    | If necessary, change the properties of **OpcEnum** in the DCOM configuration. |
| 4    | Activate port 135 and the dynamic ports for communication via DCOM for TCP on the Windows interface of the KLI. (>>> 6.4 "Configuring the KUKA Line Interface (KLI)" Page 31) |
| 5    | In the Windows system directory of the client computer, declare the network names and IP addresses of the OPC servers accessed by a remote client. (>>> 6.5 "Declaring the OPC server in the Window system directory" Page 32) |

6.3  Configuring global DCOM settings

- The configuration of the DCOM settings is described here for Windows XP e SP3. The procedures and software texts may differ, depending on the Windows operating system and the installed Windows language.

Precondition
- "Expert" user group
- Administrator privileges on the Windows user interface

Procedure
1. In the main menu, select **Start-up** > **Service** > **Minimize HMI**.
2. In the Windows Start menu, select **Run**....
3. In the Open box, enter “DCOMCNFG” and confirm with OK. The Component Services window opens.

4. Open the Component Services\Computers folder in the tree structure and select the element My Computer.

![Component Services window](image)

Fig. 6-1: Component Services window

5. Right-click on My Computer and select Properties. The My Computer Properties window is opened.

6. Make the required settings on the tabs.
   - >>> 6.3.2 "Default Properties tab" Page 23
   - >>> 6.3.3 "COM Security tab" Page 24
   - >>> 6.3.4 "Default Protocols tab" Page 27

7. Save the settings with OK and reboot the PC.

### 6.3.1 Users and user groups

In order to connect to the OPC server, a Windows user must be logged in to the client and server computers with the same user name and password. If this is not the case, further DCOM settings are required to declare the user in DCOM.

For operating and configuring OPC servers, the users and user groups specified here are required, at least:

<table>
<thead>
<tr>
<th>Windows language: German</th>
<th>Windows language: English</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>Administrator</td>
<td>The Administrator is the default user group. This user group is protected by means of a password. Note: The password of the default user group should not be changed if at all possible. Changing the password causes the automatic booting of the robot controller to be interrupted by the Window logon.</td>
</tr>
<tr>
<td>INTERAKTIV</td>
<td>INTERACTIVE</td>
<td>Interactive user (= user currently logged on)</td>
</tr>
<tr>
<td>SYSTEM</td>
<td>SYSTEM</td>
<td>User account of the operating system (only used for starting services)</td>
</tr>
<tr>
<td>ANONYMOUS-ANMELDUNG</td>
<td>ANONYMOUS LOGON</td>
<td>——</td>
</tr>
</tbody>
</table>
6.3.2 Default Properties tab

Description The default safety settings for DCOM are defined here.

Fig. 6-2: My Computer Properties – Default Properties window

The following setting is required:
- Enable DCOM (Distributed COM) on this computer (set check mark).

The DCOM protocol must be enabled on the robot controller and on each of the networked computers from which the OPC server is to be accessed.

The following settings are recommended:
- Default Authentication Level:
  - Connect: Authentication is carried out the first time the client accesses the server.
- Default Impersonation Level:
  - Identify: The client can be identified by the server and perform ACL checks.

Depending on the system or application, other settings than those recommended here may be required in the default properties for DCOM communication. The DCOM protocol must always be activated.
6.3.3 COM Security tab

Description

The users or user groups that are authorized to start or use DCOM applications are defined here.

The Access, Launch and Activation Permissions must be defined on the robot controller and on each of the networked computers from which the OPC server is to be accessed.

![Fig. 6-3: My Computer Properties – COM Security window](image)

6.3.3.1 Assigning access permissions

Description

The following users or user groups must be present, at least:

- Administrator
- ANONYMOUS LOGON
- INTERACTIVE
- SYSTEM

For each of these users, Local Access must be activated. If remote clients are to access the OPC server, Remote Access must also be activated for each user.
6. Configuration for OPC clients

Procedure

1. Under **Access Permissions**, click on the **Edit Default** button. The **Access Permission** window is opened. The default permissions can be edited.

2. If required, use the **Add…** button to add further users or user groups, or remove them using the **Remove** button.

3. For each user, activate Local Access:
   - Select the user in the **Group or user names** box and activate **Local Access** permission via the check box **Allow** (set the check mark).

4. If remote clients are to access the OPC server, activate Remote Access for each user:
   - Select the user in the **Group or user names** box and activate **Remote Access** permission via the check box **Allow** (set the check mark).

5. Save settings with **OK**.

6. Under **Access Permissions**, click on the **Edit Limits…** button. The **Access Permission** window is opened. The security limits can be edited.

7. If required, use the **Add…** button to add further users or user groups, or remove them using the **Remove** button.

8. In the Security Limits, assign the users or user groups the same permissions as previously for the default permissions.

9. Save settings with **OK**.

6.3.3.2 Assigning launch and activation permissions

**Description**

The following users or user groups must be present, at least:

- Administrator
- INTERACTIVE
- SYSTEM
For each of these users, Local Access must be activated. If remote clients are to access the OPC server, Remote Access must also be activated for each user.

**Procedure**

1. Under **Launch and Activation Permissions**, click on the **Edit Default…** button.
   The window **Launch and Activation Permission** is opened. The default permissions can be edited.
2. If required, use the **Add…** button to add further users or user groups, or remove them using the **Remove** button.
3. For each user, activate Local Access:
   - Select the user in the **Group or user names** box and activate Local Launch and Local Activation permissions via the check box **Allow** (set the check mark).
4. If remote clients are to access the OPC server, activate Remote Access for each user:
   - Select the user in the **Group or user names** box and activate Remote Launch and Remote Activation permissions via the check box **Allow** (set the check mark).
5. Save settings with **OK**.
6. Under **Launch and Activation Permissions**, click on the **Edit Limits…** button.
   The **Launch Permission** window is opened. The security limits can be edited.
7. If required, use the **Add…** button to add further users or user groups, or remove them using the **Remove** button.
8. In the Security Limits, assign the users or user groups the same permissions as previously for the default permissions.
9. Save settings with **OK**.
6.3.4 Default Protocols tab

Description
The network protocol TCP/IP is defined here for DCOM communication, including the port range in which this communication takes place.

By default, DCOM uses dynamic ports, i.e. communication takes place via a randomly assigned port, which can lie between port 1,024 and 65,534. This port range must be limited, since the ports defined here must be enabled for the TCP protocol on the Windows interface of the KLI. (A maximum total of 40 ports can be enabled on the interface.)

(>>> 6.4 "Configuring the KUKA Line Interface (KLI)" Page 31)

The port range 20,000 ... 20,300 is reserved by KUKA for communication with the OPC server. It is recommended to use ports from this range to avoid conflicts with other DCOM applications.

If the port range 20,000 ... 20,300 is already used by the customer for other applications, it is recommended to request other KUKA reserved port ranges from KUKA Roboter GmbH. Faults in the operation of the OPC server may otherwise result. (>>> 8 "KUKA Service" Page 43)

The number of ports required depends on the expected number of simultaneous client connections. Overly restricting the number of ports can result in there being insufficient ports available for communication in the event of access by multiple clients. It must also be considered that it can take 1 to 2 minutes before a port is available again after an OPC client has terminated its connection with the OPC server. It is therefore not enough to enable the same number of ports as OPC clients. The number of ports must always be at least the number of OPC clients accessing the OPC server, plus a sufficiently large buffer.

For stable operation of the OPC server, at least 10 ports are required for most applications. In tests, the best results were achieved with approx. 20 ports.

Procedure
1. Under DCOM Protocols, select the entry Connection-oriented TCP/IP.
2. Select the Properties… button. The Properties for COM Internet Services window is opened.
3. Select the Add… button. The Add port range window is opened.
4. Under Port Ranges, enter the desired port range, e.g. 20100-20110, and confirm with OK.
5. Under Port range assignment and Default dynamic port allocation, activate the radio button Internet range in each case.

Fig. 6-6: My Computer Properties – Default Protocols window

Fig. 6-7: Properties for COM Internet Services window
6. Save settings with OK.
7. Check that the defined port range has been added in the window Properties for COM Internet Services. If the port range is not displayed, enter and save the port range again.

6.3.5 DCOM settings for “OpcEnum” and “KUKA OPC Server”

Overview
This section describes the DCOM settings required on the server computer for the services OpcEnum and KUKA OPC Server.
The properties of OpcEnum are preset so that the default settings can be used without changes. This also applies to the properties of KUKA OPC Server, with one exception: the identity of the user who is authorized to start the OPC server as an application must be changed. Only the interactive user is authorized to do this.

<table>
<thead>
<tr>
<th>Tab</th>
<th>OpcEnum</th>
<th>KUKA OPC Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Authentication Level:</td>
<td>Authentication Level:</td>
</tr>
<tr>
<td></td>
<td>■ None: No authentication is carried out.</td>
<td>■ Default: Authentication is carried out the first time an OPC client accesses the OPC server.</td>
</tr>
<tr>
<td>Location</td>
<td>The applications are only to be executed locally.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The check box Run application on this computer must be activated (check mark is set).</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>The default permissions entered for OpcEnum may be used. It is not necessary to add any more users or assign any permissions.</td>
<td>The default permissions configured in the global DCOM settings (COM Security tab) are inserted here. It is not necessary to add any more users or assign any permissions.</td>
</tr>
<tr>
<td>Endpoints</td>
<td>The default protocol is used. No other DCOM protocol needs to be added.</td>
<td></td>
</tr>
<tr>
<td>Identity</td>
<td>OpcEnum is started by default by the user account of the operating system.</td>
<td>Only the interactive user may start the OPC server as an application.</td>
</tr>
<tr>
<td></td>
<td>The radio button This system account (services only) must be activated.</td>
<td>The radio button Interactive user must be activated.</td>
</tr>
</tbody>
</table>

6.3.5.1 Changing the “KUKA OPC Server Properties” in the DCOM configuration

Description
Every OPC DA client which connects to the OPC server starts it. To ensure that the OPC server is only started once as an application, it must be defined in the DCOM configuration that only the Interactive user may execute the application.

Precondition
■ “Expert” user group
■ Administrator privileges on the Windows user interface

Procedure
1. In the main menu, select Start-up > Service > Minimize HMI.
2. In the Windows Start menu, select Run….
3. In the Open box, enter “DCOMCNFG” and confirm with OK. The Component Services window opens.
4. In the tree structure, open the folder Component Services\Computer\My Computer\DCOM Config.
5. Confirm the DCOM Configuration Warning with Yes.
6. Select the element KUKA OPC Server and select Action > Properties from the menu. The KUKA OPC Server Properties window is opened.

7. Select the Identity tab and activate the radio button Interactive user.

8. Save the settings with OK and reboot the PC.

6.3.5.2 Changing the “OpcEnum Properties” in the DCOM configuration

**Description**

The service OpcEnum can be used to poll and display the OPC servers that are installed on a server computer. OpcEnum can only be configured in such a way that either all or none of the installed OPC servers are displayed to the user. OpcEnum cannot be used to display only selected OPC servers, e.g. in order to hide safety-critical data sources.

The configuration of OpcEnum is not covered by this documentation. The properties of OpcEnum are preset on the server computer so that the default settings can be used without changes, although the settings may also be adapted.

**Precondition**

- “Expert” user group
- Administrator privileges on the Windows user interface

**Procedure**

1. In the main menu, select Start-up > Service > Minimize HMI.
2. In the Windows Start menu, select Run….
3. In the Open box, enter “DCOMCNFG” and confirm with OK. The Component Services window opens.
4. In the tree structure, open the folder Component Services\Computer\My Computer\DCOM Config.
5. Confirm the DCOM Configuration Warning with Yes.

![Fig. 6-10: DCOM Configuration Warning](image)

6. Select the element OpcEnum and select Action > Properties from the menu. The OpcEnum Properties window is opened.

![Fig. 6-11: OpcEnum Properties - General window](image)

7. Make the desired settings on the tabs.
8. Save the settings with OK and reboot the PC.

6.4 Configuring the KUKA Line Interface (KLI)

In order for an external PC to be able to connect to the robot controller via the network, the KUKA Line Interface (KLI) of the robot controller must be configured accordingly.

Detailed information about network configuration via the KUKA Line Interface (KLI) of the robot controller is contained in the Operating and Programming Instructions for System Integrators.
The Windows interface is a virtual interface of the KLI. For communication between the OPC client and OPC server, the following ports of the Windows interface must be enabled for the TCP protocol:

For XML DA clients:
- Port 8081 for XML-based communication

For DA clients:
- Port 135 for establishing connections via DCOM
- Dynamic ports for communication via DCOM

6.5 Declaring the OPC server in the Window system directory

**Description**
The IP addresses and the network names of the OPC servers accessed by a remote client must be declared in the Windows system directory of the client computer.

**Procedure**
1. Open the file C:\WINDOWS\system32\drivers\etc\hosts in a text editor.
2. Enter the IP address and network name of the OPC server.
3. Close the file and save the changes.

**Example**

```
10.129.221.221  Robi1
10.129.221.222  Robi2
10.129.221.223  Robi3
```

Each entry must be written on a separate line. The IP address should be in the first column, followed by the corresponding network name. The IP address and network name must be separated by at least one space.
7 Configuring the OPC server

7.1 "OPC configuration" user interface

Call

- Select Configuration > OPC configuration from the main menu.

In the user group "User", the current configuration of the OPC server can be displayed but not edited.

Overview

The following configuration screens are available:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item list</td>
</tr>
<tr>
<td></td>
<td>The configured OPC items are displayed here.</td>
</tr>
<tr>
<td></td>
<td>The following OPC items are preconfigured by default:</td>
</tr>
<tr>
<td></td>
<td>- SPOC_MOTION_ENABLE</td>
</tr>
<tr>
<td></td>
<td>- USER_SAF</td>
</tr>
<tr>
<td></td>
<td>The OPC items can be used to poll the signals $USER_SAF and $SPOC_MOTION_ENABLE.</td>
</tr>
<tr>
<td>2</td>
<td>Configuration parameters</td>
</tr>
</tbody>
</table>

Fig. 7-1: OPC configuration user interface
The following buttons are available. The buttons are not active in the user group “User”:

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Creates a new OPC item in the item list.</td>
</tr>
<tr>
<td>Delete</td>
<td>Deletes the selected OPC item from the item list.</td>
</tr>
<tr>
<td>Save</td>
<td>Saves the configuration of the OPC Server.</td>
</tr>
<tr>
<td></td>
<td>The button only becomes active if the configuration is changed.</td>
</tr>
</tbody>
</table>

### 7.1.1 Creating OPC items

**Precondition**
- “Expert” user group

**Procedure**
1. In the main menu, select **Configuration > OPC configuration** and then select the desired configuration screen.
2. Click on **Add** and configure the parameters as required.
3. Click on **Save** and answer the request for confirmation with **Yes**. The newly created item is saved.

The configuration of the OPC server is applied immediately. The OPC server is automatically closed and all open client connections are terminated.

### 7.1.2 Changing OPC items

**Precondition**
- “Expert” user group

**Procedure**
1. In the main menu, select **Configuration > OPC configuration** and then select the desired configuration screen.
2. Select the OPC item in the item list and change the parameters as required.
3. Click on **Save** and answer the request for confirmation with **Yes**. The modified item is saved.

The configuration of the OPC server is applied immediately. The OPC server is automatically closed and all open client connections are terminated.
7 Configuring the OPC server

7.1.3 Deleting OPC items

Precondition

- “Expert” user group

Procedure

1. In the main menu, select Configuration > OPC configuration and then select the desired configuration screen.
2. Select an OPC item in the item list, click on Delete and answer the request for confirmation with Yes. The item is deleted from the item list.
3. Click on Save and answer the request for confirmation with Yes. The change is saved.

The configuration of the OPC server is applied immediately. The OPC server is automatically closed and all open client connections are terminated.

7.2 Configuration parameters

7.2.1 Configuration parameters: “KRC variables”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| DA identifier  | Name of the OPC item (item ID)  
The name can be freely chosen and must be unique. |
| KRL variable   | Name of the system or program variable  
All specified variables can be browsed hierarchically with an OPC client.  
**Note:** The variables that OPC is to access must be globally valid. The syntax of the variables is not monitored and no check is made as to whether the variable exists. |
| Variable type  | Data type of the variable  
- String  
- Enum  
- Integer  
- Real  
- Boolean  
- StringArray  
- IntegerArray  
- RealArray  
- BooleanArray  
- EnumArray  
- StructArray |
| Access rights  | Access rights  
- Read: Read only (write-protected)  
- ReadWrite: Read and write  
**Note:** Arrays and structures can only be read. |
| Access type    | Polling type for reading the variable (OPC item)  
- Event: Acyclically via SetInfo (event-dependent reading); max. 40 access operations  
- Polling: Cyclically via ShowVar (synchronous reading)  
**Note:** A module that is connected via SetInfo cannot be edited or deleted. |
### 7.2.2 Configuration parameters: “Proxies”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DA identifier</strong></td>
<td>Name of the OPC item (item ID)</td>
</tr>
<tr>
<td></td>
<td>The name can be freely chosen and must be unique.</td>
</tr>
<tr>
<td><strong>URL</strong></td>
<td>URL of the OPC server in the network</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>opcda://XSrv.DA.1</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: The syntax of the URL is not monitored.</td>
</tr>
<tr>
<td><strong>DA Item</strong></td>
<td>Name of the OPC item on the OPC server in the network</td>
</tr>
<tr>
<td></td>
<td>The name can be structured as follows:</td>
</tr>
<tr>
<td></td>
<td>- <code>group_name.item_name</code></td>
</tr>
<tr>
<td></td>
<td>A number of OPC items are grouped under a common name, e.g. KRC.IN1, KRC.IN2, KRC.OUT3, etc.</td>
</tr>
<tr>
<td></td>
<td>- <code>item_name</code></td>
</tr>
<tr>
<td></td>
<td>Individual OPC item that is not assigned to a group, e.g. TOOL</td>
</tr>
<tr>
<td><strong>Variable type</strong></td>
<td>Data type of the OPC item on the OPC server in the network</td>
</tr>
<tr>
<td></td>
<td>- <code>Double</code></td>
</tr>
<tr>
<td></td>
<td>- <code>Integer</code></td>
</tr>
<tr>
<td></td>
<td>- <code>Bool</code></td>
</tr>
<tr>
<td></td>
<td>- <code>String</code></td>
</tr>
<tr>
<td></td>
<td>- <code>IntArray</code></td>
</tr>
<tr>
<td></td>
<td>- <code>DoubleArray</code></td>
</tr>
<tr>
<td></td>
<td>- <code>StringArray</code></td>
</tr>
</tbody>
</table>

### 7.2.3 Configuration parameters: “Messages”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DA identifier</strong></td>
<td>Name of the OPC item (item ID)</td>
</tr>
<tr>
<td></td>
<td>The name can be freely chosen and must be unique.</td>
</tr>
<tr>
<td><strong>Type of message task</strong></td>
<td>Type of message task</td>
</tr>
<tr>
<td></td>
<td>- <code>Message</code>: The message is generated individually.</td>
</tr>
<tr>
<td></td>
<td>- <code>MessageArray</code>: The message is output in a message table.</td>
</tr>
<tr>
<td><strong>Array size</strong></td>
<td>Size of the message table</td>
</tr>
<tr>
<td></td>
<td>Default: 10</td>
</tr>
<tr>
<td></td>
<td>This parameter is only available for the message type <code>MessageArray</code>.</td>
</tr>
</tbody>
</table>
7 Configuring the OPC server

7.2.4 Configuration parameters: “Registry”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| DA identifier | Name of the OPC item (item ID)  
Example:  
Version of the KR C  
The name can be freely chosen and must be unique. |
| Root | Main key  
| | HKEY_CURRENT_USER  
| | HKEY_CLASSES_ROOT  
| | HKEY_LOCAL_MACHINE  
| | HKEY_USERS  
| | HKEY_CURRENT_CONFIG |
7.3 Example configurations for communication with OPC

The available OPC resources are limited. The following examples show how the utilization of OPC resources can be reduced by skilful configuration and programming.

7.3.1 Grouping variables

In a palletizing system, the setpoint package coordinates on the pallet are to be sent from a Windows OPC application to the robot and the current actual package coordinates on the pallet are to be sent from the robot to the Windows OPC application.

Configuration of OPC items

Usual configuration:

For this application, the user configures 6 OPC integer variables (OPC items):

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LineIndex</td>
<td>Variables for specifying the setpoint package coordinates:</td>
</tr>
<tr>
<td>RowIndex</td>
<td>■ Column number</td>
</tr>
<tr>
<td>LayerIndex</td>
<td>■ Row number</td>
</tr>
<tr>
<td>cLineIndex</td>
<td>■ Layer number</td>
</tr>
<tr>
<td>cRowIndex</td>
<td></td>
</tr>
<tr>
<td>cLayerIndex</td>
<td></td>
</tr>
</tbody>
</table>

Alternative configuration:

Provided that the value of the individual coordinates never exceeds 1023 and is greater than or equal to zero, the setpoint coordinates and actual coordinates can each be grouped together as a 32-bit integer variable.

Fig. 7-2: Grouping as a 32-bit integer variable
1 10 bits for the layer  
2 10 bits for the row  
3 10 bits for the column  

By grouping the package coordinates, the user now only requires 2 OPC integer variables (OPC items):  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CommonIndex</td>
<td>Variable for specifying the 3 setpoint package coordinates</td>
</tr>
<tr>
<td>cCommonIndex</td>
<td>Variable for reading the 3 actual package coordinates</td>
</tr>
</tbody>
</table>

Programming the OPC client

Example code in C# for the OPC client for grouping the 3 setpoint package coordinates as a specification for the robot:

```csharp
INT RowIndex, LineIndex, LayerIndex ;// Int32 but actually only 10 bits to use
LineIndex = 3; // condition >=0 & <1024
RowIndex = 7; // condition >=0 & <1024
LayerIndex = 15; // condition >=0 & <1024
// Output as OPC variable
INT CommonIndex = (LineIndex | RowIndex <<10 | LayerIndex<<20);
```

Example code in C# for the OPC client for reading the 3 actual package coordinates:

```csharp
INT cCommonIndex = 0; // Input as OPC variable - current Coordinates
...  
INT cLineIndex = (cCommonIndex & 1023); // extracts index line from cCommonIndex
INT cRowIndex = (cCommonIndex >> 10 & 1023); // extracts index row from cCommonIndex
INT cLayerIndex = (cCommonIndex >> 20 & 1023); // extracts index layer from cCommonIndex
```

Programming the robot

Example code in KRL for the robot for ungrouping the 3 setpoint package coordinates:

```krl
DEFDAT $CONFIG
...
DECL INT CommonIndex = 0; this variable must be global available and mapped to OPCServer
...
DEM DAT TEST
...
DECL INT LineIndex = 0; local copy of index line
DECL INT RowIndex = 0; local copy of index row
DECL INT LayerIndex = 0; local copy of index layer
...
DEF TEST{}
...
LineIndex = (CommonIndex) B_AND 'B1111111111'; extracts index line from CommonIndex
RowIndex = (CommonIndex / 'B10000000000') B_AND 'B1111111111'; extracts index row from CommonIndex
LayerIndex = (CommonIndex / 'B100000000000000000000') B_AND 'B1111111111'; extracts index layer from CommonIndex
```

Example code in KRL for the robot for grouping the 3 actual package coordinates:

```krl
DEFDAT $CONFIG
...
DECL INT cCommonIndex = 0; this variable must be global available and mapped to OPCServer
...
7.3.2 Serial data transfer

The weight data of 20 packages are to be transferred from a Windows OPC application to a robotic palletizing system.

**Programming the robot**

**Usual programming:**

For this application, the user declares one real variable per package weight in $CONFIG.DAT and defines these as readable and writable OPC items in the OPC configuration:

```krl
DEFDAT $CONFIG
... DECL Real Package1Weight=0.0
DECL Real Package2Weight=0.0
... DECL Real Package20Weight=0.0
```

The variables configured in this way can be read and written directly as OPC items by the OPC client. The resource utilization rate is high, however, as 20 OPC real variables are required.

**Alternative programming:**

Provided that the information is not time-critical, the weight data can be transferred serially. By grouping the weight data as an array, the user needs only a few OPC variables.

The user declares the following variables in $CONFIG.DAT:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PackageWeight_t</td>
<td>Temporary real variable to which the package weight is written</td>
</tr>
<tr>
<td>PackageIndex</td>
<td>Integer variable for the package index</td>
</tr>
</tbody>
</table>

```krl
DEFDAT $CONFIG
... DECL Real PackageWeight[20]
PackageWeight[1]=0.0
PackageWeight[2]=0.0
... PackageWeight[19]=0.0
PackageWeight[20]=0.0
DECL Real PackageWeight_t=0.0
DECL Int PackageIndex=1
```

For reading and writing the weight data sent by the OPC client to the robot, the user writes a KRL program that is called cyclically. For this, the program is in-
Integrated into the Submit interpreter. This is usually the SUB program SPS.SUB.

When a package index between 1 and 20 is read from the PackageIndex variable, the program writes the package weight from the variable PackageWeight_t to the array PackageWeight[20] in $CONFIG.DAT, this is, to the variable with the corresponding package index. Finally, the PackageIndex variable is overwritten with zero to prevent further write operations.

**Example code in C# for the OPC client for setting the package weight:**

```csharp
bool SetPackageWeight(int pi, double pw)
{
    int _pi;
    if (PackageIndex.read(out _pi) == true)
    {
        if (_pi == 0)
        {
            if (PackageIndex.write(pw) == true)
            {
                //insert if necessary a delay
                if (PackageIndex.write(pi) == true)
                {
                    return true;
                }
                else
                {
                    return false;
                }
            }
            else
            {
                return false;
            }
        }
        else
        {
            return false;
        }
    }
    return false;
}
```

**Example code in C# for the OPC client for reading the package weight:**

```csharp
DEF Read_Weight()
IF (PackageIndex > 0) AND (PackageIndex < 21) THEN
    PackageWeight[PackageIndex] = PackageWeight_t
    PackageIndex = 0
ENDIF
END
```

The user configures the following OPC variables (OPC items):

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable type</th>
<th>Access type</th>
<th>Polling type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PackageWeight_t</td>
<td>Real</td>
<td>ReadWrite</td>
<td>Event</td>
</tr>
<tr>
<td>PackageIndex</td>
<td>Integer</td>
<td>ReadWrite</td>
<td>Event</td>
</tr>
</tbody>
</table>

**Fig. 7-3: Transferring weight data to the robot (example)**

**Extended configuration**

The weight data of the packages is to be determined in the robotic palletizing system and sent to the OPC client.

Example code in C# for the OPC client for reading the package weight:
The user additionally configures the following OPC variable (OPC item):

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable type</th>
<th>Access type</th>
<th>Polling type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PackageWeight</td>
<td>RealArray</td>
<td>Read</td>
<td>Event</td>
</tr>
</tbody>
</table>

```csharp
bool GetPackageWeight(int pi, out double pw)
{
    int _pi;
    if (PackageIndex.read(out _pi) == true)
    {
        if (_pi == 0)
        {
            double[] pwArray;
            if (PackageIndex.read(out _pi) == true)
            {
                if (PackageWeight.read(out pwArray) == true)
                {
                    if (pwArray != null)
                    {
                        if (pwArray.Count() >= pi)
                        {
                            pw = pwArray[pi - 1];
                            return true;
                        }
                    }
                }
            }
            return true;
        }
    }
    return false;
}
```

Extended overview

Fig. 7-4: Transferring weight data to the robot (extended example)
8 KUKA Service

8.1 Requesting support

Introduction
The KUKA Robot GmbH documentation offers information on operation 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:

- Model and serial number of the robot
- Model and serial number of the controller
- Model and serial number of the linear unit (if applicable)
- Model and serial number of the energy supply system (if applicable)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software
  For KUKA System Software V8: instead of a conventional archive, generate the special data package for fault analysis (via KrcDiag).
- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

8.2 KUKA Customer Support

Availability
KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.

Argentina
Ruben Costantini S.A. (Agency)
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Index

Symbols
$SPOC_MOTION_ENABLE 11, 13, 33
$USER_SAF 11, 13, 33

A
Access functions 11
Access permissions, assigning 24
ACL 6
Activation permissions, assigning 25
Areas of application, OPC server 10

C
COM Security, tab 24
Communication 9
Configuration tips 12
Configuration, OPC client 21
Configuration, OPC server 33
CRR 6

D
Data, serial transfer 40
DCOM 6
DCOM settings, configuration 21
DCOM, enabling 23
Default Properties, tab 23
Default Protocols, tab 27
Documentation, industrial robot 5

E
Event 7, 12, 35
Event-dependent reading 35
Example clients 11

F
Functions, OPC server 9

I
Installation 15
Installation, OPC Server 15
Introduction 5
IP 7
Item ID 7

K
KLI 6
KLI, configuration 31
Knowledge, required 5
KR C 6
KUKA Cross 6
KUKA Customer Support 43

L
Launch permissions, assigning 25

O
OLE 6
OPC 6
OPC client 6, 10
OPC DA 6
OPC DA client 10
OPC DA client, configuration 21
OPC DA client, connecting 17
OPC Item 6
OPC items, changing 34
OPC items, creating 34
OPC items, deleting 35
OPC server, configuration 33
OPC server, manual start 17
OPC XML DA client 10
OPC XML DA client, configuration 21
OPC XML DA client, connecting 18
OPC XML-D A 6
OpcEnum 7, 29, 30
Operation 17
Overview, OPC Server 9
Overview, user interface 33

P
PLC 7
Polling 7, 12, 35
Port range, DCOM communication 27
Product description 9

S
Safety 13
Safety instructions 5
Service, KUKA Roboter 43
SetInfo 11
SetVar 11
ShowVar 11
Single point of control 13
smartHMI 6
smartPAD 6
SPOC 7, 13
Subnet 7
Support request 43
Synchronous reading 7, 35
System requirements 15
System requirements, hardware 15
System requirements, software 15

T
Target group 5
TCP/IP 7
Terms used 6
Trademarks 7
Training 5

U
Uninstallation, OPC Server 15
Updating, OPC Server 15
URL 7
User administration 11
User groups 22
User interface, OPC configuration 33
Users 22

Knowledge, required 5
Service, KUKA Roboter 43
SetInfo 11
SetVar 11
ShowVar 11
Single point of control 13
smartHMI 6
smartPAD 6
SPOC 7, 13
Subnet 7
Support request 43
Synchronous reading 7, 35
System requirements 15
System requirements, hardware 15
System requirements, software 15

T
Target group 5
TCP/IP 7
Terms used 6
Trademarks 7
Training 5

U
Uninstallation, OPC Server 15
Updating, OPC Server 15
URL 7
User administration 11
User groups 22
User interface, OPC configuration 33
Users 22
V
Variables, grouping 38
Variables, reading and writing 11
VxWorks 7

W
Warnings 5