KUKA

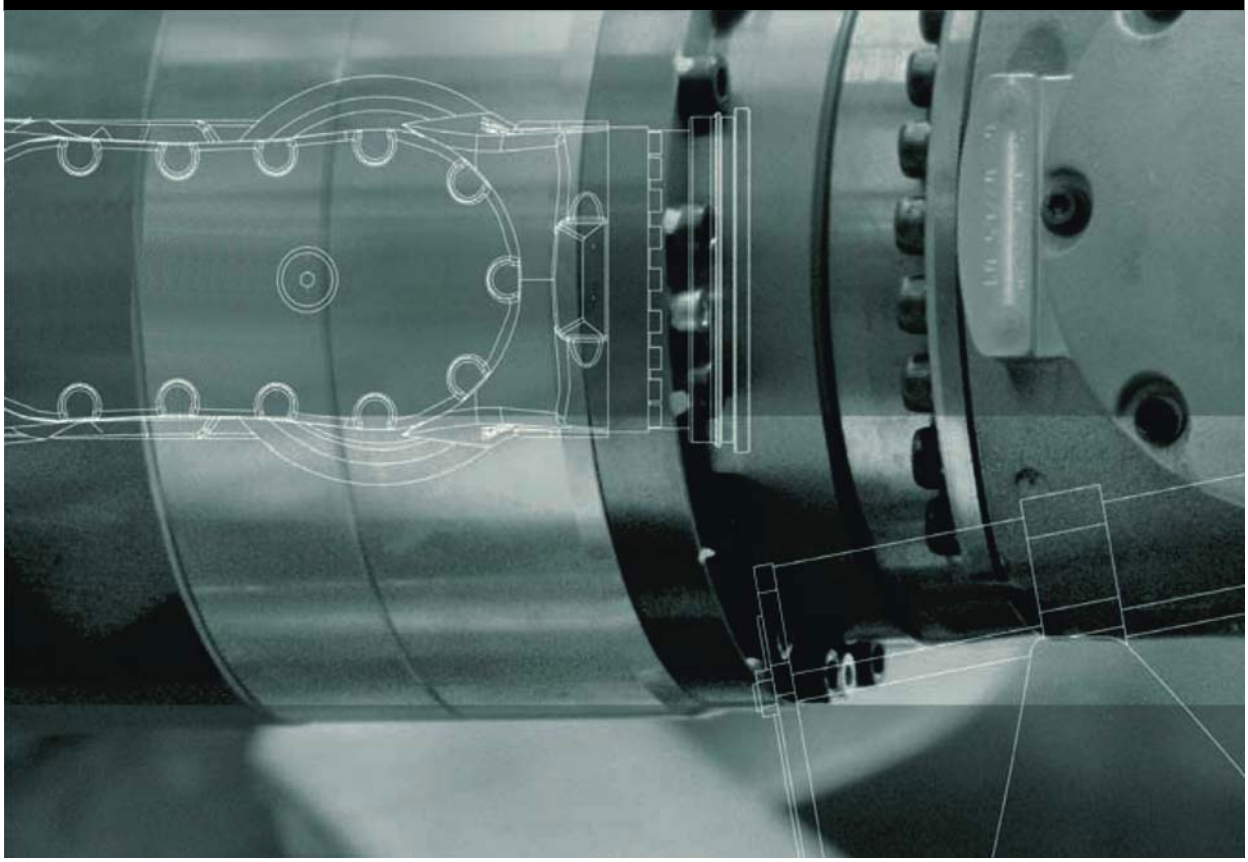
Controller Option

KUKA Roboter GmbH

KR C4 PROFIBUS CP 5614 1.0

For KUKA System Software 8.2

For VW System Software 8.2



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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

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Contents

1 Introduction

1.1 Target group

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

- Advanced KRL programming skills
- Advanced knowledge of the robot controller system
- Advanced knowledge of field buses
- Knowledge of WorkVisual

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 physical injury **will** occur, if no precautions are taken.

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

CAUTION These warnings mean that minor physical 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.

Notes

These hints 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 Trade mark

Windows is a trade mark of Microsoft Corporation.

Step 7 is a trademark of Siemens AG.

1.5 Terms used

Term	Description
GSD	Device description file for PROFIBUS
PLC	Programmable logic controller
DP	Decentralized periphery
PA	Process automation
Step 7	Configuration software from Siemens for field bus configuration and diagnosis
NCM	Free extract from Step 7 with the same range of functions for PROFIBUS configuration
WorkVisual	Configuration software from KUKA for field bus configuration
LDB	Local database: configuration file for the CP 5614 A2 with hardware information
CFG	Configuration file with information about the hardware configuration

2 Product description

PROFIBUS is a universal field bus which enables communication between devices from different manufacturers without special interface adaptations. Data exchange is carried out on a master-slave basis.

The CP 5614 A2 is a PCI card for connecting the robot controller to the PROFIBUS. The card has a master ring and a slave ring. The master and slave rings may be operated individually or in parallel.

The card is connected to slot 1 of the robot controller:

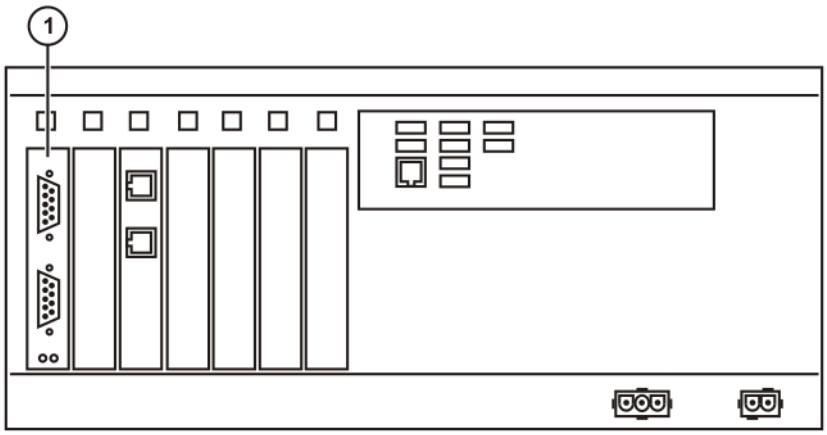

Fig. 2-1: Slot for the CP 5614 A2

1 CP 5614 A2 in slot 1

Compatibility

KR C4 PROFIBUS CP 5614 1.0 is compatible with the following field buses:

- KR C4 PROFINET 2.2
- KR C4 EtherCAT

Restrictions

Only the device class PROFIBUS DP-V0 is supported.

The following device classes / functions are not supported, for example:

- PROFIBUS DP-V1 (includes the function “acyclic communication”)
- PROFIBUS DP-V2
- PROFIBUS PA
- Profiles, e.g. PROFIdrive or PROFIsafe
- Gateway devices (for converting PROFIBUS to other field buses)

Configuration software

KR C4 PROFIBUS CP 5614 is configured on a laptop or PC. The following software is required for configuration:

- Step 7 from Siemens, version 5.4 or higher
- WorkVisual 2.4 or higher
- With use of a higher-level controller, the corresponding configuration software from the manufacturer of the higher-level controller is also required, e.g. Step 7 from Siemens.

3 Safety

This documentation contains safety instructions which refer specifically to the product described here. The fundamental safety information for the industrial robot can be found in the “Safety” chapter of the operating or assembly instructions for the robot controller.

⚠ WARNING The “Safety” chapter in the operating instructions or assembly instructions of the robot controller must be observed. Death to persons, severe physical injuries or considerable damage to property may otherwise result.

4 Installation

4.1 System requirements

Robot controller

Hardware:

- KR C4

Software:

- KUKA System Software 8.2.17 or higher
- Or VW System Software 8.2.17 or higher

Laptop/PC

- WorkVisual 2.4 or higher

  The requirements for installation of WorkVisual are contained in the WorkVisual documentation.
- Step 7, version 5.4 or higher

  The requirements for installation of Step 7 are contained in the documentation of this software.

4.2 Routing the data cables

- The PROFIBUS cables are routed linearly from the master to the slaves. In the line structure, all devices are connected in parallel.

4.3 Installing or updating PROFIBUS CP 5614

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

Preparation

- Copy the folder with the software from the CD to the USB stick.

NOTICE Recommendation: Use a KUKA stick. Data may be lost if any other stick is used.

Precondition

- “Expert” user group

Procedure

1. Connect the USB stick to the robot controller.
2. In the main menu, select **Start-up** > **Install additional software**.
3. Press **New software**. The entry **KR C4 Profibus-CP5614** must be displayed in the **Name** column and drive **E:** in the **Path** column.

   If not, press **Refresh**.
4. If the specified entries are now displayed, continue with step 5.

   If not, the drive from which the software is being installed must be configured first:
   - Click on the **Configuration** button. A new window opens.
   - Select a line in the **Installation paths for options** area.

     Note: If the line already contains a path, this path will be overwritten.
   - Press **Path selection**. The available drives are displayed.
   - Select **E:**.
   - Press **Save**. The window closes again.

   The drive only needs to be configured once and then remains saved for further installations.

5. Mark the entry **KR C4 Profibus-CP5614** and click on **Install**. Answer the request for confirmation with **Yes**.
6. Confirm the reboot prompt with **OK**.
7. Remove the stick.
8. Reboot the robot controller.

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

4.4 Uninstalling PROFIBUS CP 5614

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

Precondition

- "Expert" user group

Procedure

1. In the main menu, select **Start-up** > **Install additional software**.
2. Mark the entry **KR C4 Profibus-CP5614** 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 Configuration

5.1 Overview

If the CP 5614 A2 is operated exclusively as a slave, steps 1 to 3 can be skipped.

Step	Description
1	Configure PROFIBUS with Step 7 or NCM. (>>> 5.2 "Configuring PROFIBUS with Step 7 or NCM" Page 13)
2	Export the bus configuration and LDB file from Step 7 or NCM. (>>> 5.3 "Exporting the bus configuration and LDB file from Step 7 or NCM" Page 14)
3	Import the bus configuration and LDB file into WorkVisual. (>>> 5.4 "Importing the bus configuration and LDB file into WorkVisual" Page 14)
4	Configure the drivers for the master and slave part of the CP 5614 A2 in WorkVisual. (>>> 5.5 "Configuring the driver for the master part of the CP 5614 A2 in WorkVisual" Page 15) (>>> 5.6 "Configuring the driver for the slave part of the CP 5614 A2 in WorkVisual" Page 17)
5	Map the inputs and outputs in WorkVisual. (>>> 5.7 "Mapping inputs/outputs in WorkVisual" Page 18)
6	Transfer the bus configuration from WorkVisual to the robot controller.
7	Reconfigure the PROFIBUS driver or reboot the controller.

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

5.2 Configuring PROFIBUS with Step 7 or NCM

Procedure

1. Create a new project in the Simatic Manager.
2. Right-click in the empty space and select **Insert New Object** > **SIMATIC PC-Station** from the context menu.
3. Enter a name for the PC station.
4. Right-click on the PC station and select **Open Object**.
   The program HW Config opens. The virtual PC is displayed.
5. Right-click on slot 1 and select **Insert Object...** > **CP Profibus** > **CP 5614 A2** > **Firmware 6.2** from the context menu.
6. Select a PROFIBUS number for the bus configuration and create a new PROFIBUS network. The card is inserted.
7. Right-click on slot 2 and select **Insert Object...** > **User Application** > **Application** > **SW V6.3** from the context menu. The application is inserted.
8. Right-click on **CP 5614 A2** and select **Add Master System** from the context menu.

9. Select the application and confirm with **OK**. The master system of the PROFIBUS master is displayed.
10. Add all the PROFIBUS devices to the master system.
11. In HW Config, right-click on **CP 5614 A2** and select **Object Properties...** from the context menu.
12. On the **Operating Mode** tab, activate the **Create LDB file** check box.
13. Via **Browse...**, specify the directory in which the LDB file is to be created and confirm the selection with **OK**.

Supported baud rates

The following baud rates are supported for operation of the master ring:

- 19.2 kbaud
- 45.45 kbaud
- 93.75 kbaud
- 187.5 kbaud
- 500 kbaud
- 1.5 MBaud
- 3 MBaud
- 6 MBaud
- 12 MBaud

The following baud rates are supported for operation of the slave ring:

- 9.6 kbaud
- 19.2 kbaud
- 45.45 kbaud
- 93.75 kbaud
- 187.5 kbaud
- 500 kbaud
- 1.5 MBaud
- 3 MBaud
- 6 MBaud

5.3 Exporting the bus configuration and LDB file from Step 7 or NCM

Procedure

1. In HW Config, select **Station** > **Export**.
2. Activate the check boxes **Export default values**, **Export symbols** and **Export subnets**.
3. Activate the radiobox **Readable**.
4. Confirm with **Save**.

   The CFG file is generated.

The LDB file is located in the directory that was selected during creation of the LDB file.

5.4 Importing the bus configuration and LDB file into WorkVisual

Precondition

- A project is open.
- A robot controller has been added and set as active.

Procedure

1. Select the menu sequence **File** > **Import / Export**.

   The **Import/Export Wizard** window is opened.
2. Select **Profibus CP 5614 Import** and click on **Next >**.

3. Click on **Browse...** and specify a directory.
4. Confirm with **Next >**.
5. Click on **Finish**.
   The LDB and CFG files are imported.
6. Close the **Import/Export Wizard** window.

It is possible to reimport a configuration. The Profibus address is used for the comparison between the existing and the newly imported configuration. In the case of a reimport, it is always the data in the CFG file that are relevant:

- If a device is contained in the CFG file but not in WorkVisual, the device will be created in WorkVisual.
- If a device is contained in WorkVisual but not in the CFG file, the device and its I/O mappings will be deleted in WorkVisual.
- If a device is contained in the CFG file and in WorkVisual, the device name will be taken from the CFG file and the I/O mappings will be retained.

5.5 Configuring the driver for the master part of the CP 5614 A2 in WorkVisual

Precondition

- The bus configuration and the LDB file have been imported into WorkVisual.
- The robot controller has been set as the active controller.

Procedure

1. Expand the tree structure of the robot controller on the **Hardware** tab in the **Project structure** window.
2. Right-click on **CP 5614 A2** in the tree structure and select **Settings...** from the context menu.
3. A window opens. Select the **Master settings** tab.
   (>>> 5.5.1 "“Master settings” tab" Page 15)
4. Set the data as required and save with **OK**.
5. Right-click on the device in the tree structure and select **Settings...** from the context menu. A window with device settings is displayed.
   (>>> 5.5.2 "“Device settings” tab" Page 16)
6. Set the data as required and save with **OK**.

5.5.1 “Master settings” tab

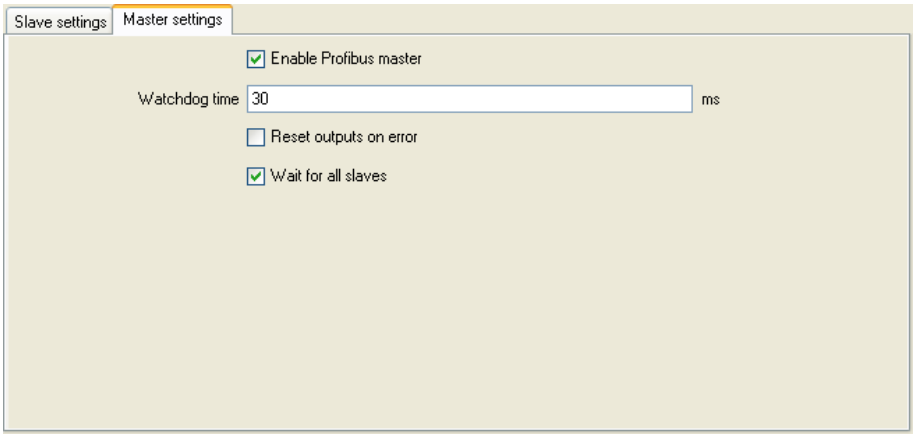

Fig. 5-1: “Master settings” tab

Box	Description
Activate Profibus master	■ **Activated:** Master ring of the CP 5614 A2 is used in I/O mode. ■ **Deactivated:** Master ring of the CP 5614 A2 is not used.
Watchdog time	The CP 5614 A2 checks internally whether the cycle time for I/O data exchange can be adhered to. The value should only be changed if necessary. Default value: 30 ms **Note**: Only values ≥ 30 ms can be entered. The value entered must be divisible by 10. If a value is entered that is not divisible by 10, the value is rounded down automatically on closing.
Reset outputs in the event of an error	■ **Activated:** The outputs of all slaves are set to zero in the event of a communication error of a slave in the master ring. ■ **Deactivated:** A communication error of a slave in the master ring has no effect on the outputs of the other slaves.
Wait for all slaves	■ **Activated:** On booting, the master ring waits approx. 5 seconds for the connected slaves to reach the READY work mode. If a slave has not yet reached the READY work mode after this time, a communication error is output. ■ **Deactivated:** On booting, the master ring starts cyclical data exchange immediately. If a slave has not yet reached the READY work mode, a communication error is output. **Note**: It is recommended to activate the check box, as the master ring often boots more quickly than the slaves.

5.5.2 “Device settings” tab

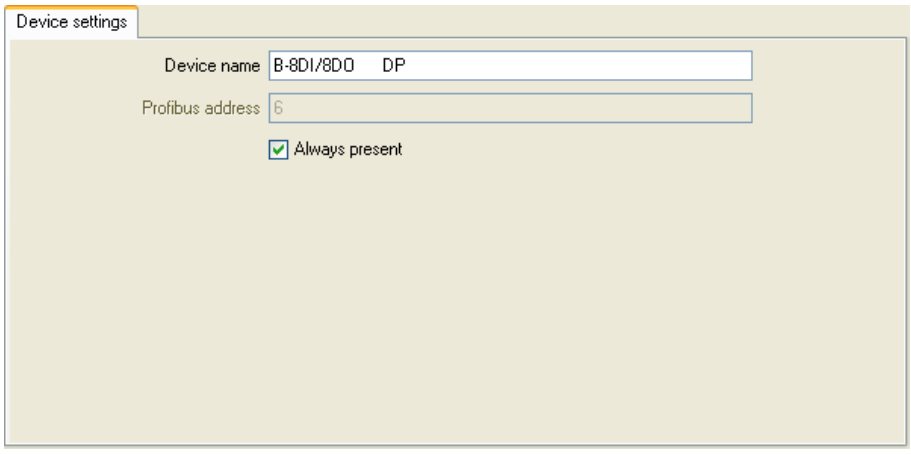

Fig. 5-2: “Device settings” tab

Box	Description
Device name	Enter the name of the device (optional). **Note**: By default, the name of the device type from the Step 7 configuration is entered here; this can be changed. The name can have a maximum length of 32 characters.
Profibus address	Address of the device in accordance with the PROFIBUS configuration. This is taken from the CFG file during import and cannot be changed.
Is Active	■ **Activated:** The robot controller expects the device to be active when the controller boots up. If the device is not active, the robot controller issues an error message. ■ **Deactivated:** The robot controller does not expect the device to be active when the controller boots up.

5.6 Configuring the driver for the slave part of the CP 5614 A2 in WorkVisual

Precondition

- A robot controller has been added and set as active.

Procedure

1. Expand the tree structure of the robot controller on the **Hardware** tab in the **Project structure** window.
2. Right-click on **Bus structure** and select **Add…** from the context menu.
3. A window opens. Select the entry **CP 5614 A2** in the **Name** column and confirm with **OK**. The entry is inserted in the tree structure.
4. Right-click on **CP 5614 A2** in the tree structure and select **Settings…** from the context menu.
5. A window opens. Select the **Slave settings** tab.
   (>>> 5.6.1 "“Slave settings” tab" Page 17)
6. Activate the check box **Activate Profibus slave**.
7. Set the remaining data as required and save with **OK**.

5.6.1 “Slave settings” tab

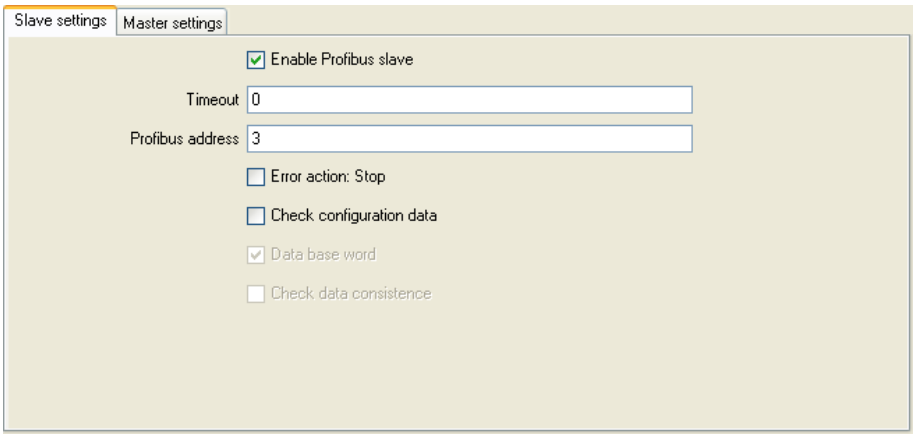

Fig. 5-3: “Slave settings” tab

Box	Description
Activate Profibus slave	■ **Activated:** Slave ring of the CP 5614 A2 is used for I/O data exchange with a higher-level slave. ■ **Deactivated:** Slave ring of the CP 5614 A2 is not used.
Timeout	The value influences the start-up behavior of the slave ring when establishing communication with the higher-level master. Default value: 0 **Note**: It is advisable not to change this value.
Profibus address	Enter the address assigned to the slave ring of the CP 5614 A2 in the PROFIBUS configuration of the higher-level master.
Error reaction: No stop	■ **Activated:** Communication errors in the slave ring result in stop-triggering error reactions in the robot controller. ■ **Deactivated:** Communication errors in the slave ring do not result in stop-triggering error reactions in the robot controller.
Check the configuration data	■ **Activated:** The configuration settings are additionally checked. ■ **Deactivated:** The configuration settings are not checked.
Word database	■ **Activated:** The system checks whether the configured data width corresponds to the database of the slave configuration. ■ **Deactivated:** No check is carried out.
Check data consistency	■ **Activated:** The system checks whether data consistency is activated in the database assigned to the slave part by the higher-level master. ■ **Deactivated:** No check is carried out. **Note**: This check is only carried out if **Check the configuration data** is activated.

5.7 Mapping inputs/outputs in WorkVisual

Procedure

- Map the inputs/outputs in WorkVisual.

Signal names

The signal names of PROFIBUS CP 5614 have the following structure in WorkVisual:

Example **001 Input**

I/O	Name	Type	Address
	001 Input	BYTE	0
	001 Output	BYTE	0
	002 Input	BYTE	1
	002 Output	BYTE	1
	003 Input	BYTE	2
	003 Output	BYTE	2

Fig. 5-4: Signal names of PROFIBUS CP 5614 in WorkVisual

Name	Meaning	In the example
Value	Index number (consecutive ascending numbering of the individual inputs/outputs)	001
Input/Output	Direction of processing	Input

6 Operation

6.1 Coupling/decoupling devices

For certain applications, e.g. tool change, it is necessary to couple and decouple devices. Coupling and decoupling can only be carried out via KRL.

Decoupling

Properties of decoupled devices:

- If decoupled devices are disconnected from PROFIBUS or the power supply, no error is triggered.
- All I/O operations on decoupled devices remain without effect.
- Decoupled devices cannot carry out error treatment in the case of read/write errors.

Coupling

The ioCtl function is executed synchronously. It only returns when the device is functional and can be written to once again.

If a coupled device is not functional, e.g. because it is disconnected from the bus or supply voltage, a message is displayed after a timeout of 5 s.

Is Active

The option **Is Active** affects the way the robot controller reacts to a decoupled device in the event of a cold start or I/O reconfiguration. **Is Active** can be set on the **Device settings** tab in WorkVisual.

(>>> 5.5.2 ""Device settings" tab" Page 16)

	Is Active: Yes	**Is Active**: No
Device coupled	No error message	No error message
Device decoupled	Error message	No error message

Syntax

`ret = ioCtl("`*[bus instance name]*`", `*[command code]*`, `*[Profibus address]*`)`

Description

[Profibus address]: The Profibus address of a device is displayed in WorkVisual on the **Device settings** tab in the **Profibus address** box.

(>>> 5.5.2 ""Device settings" tab" Page 16)

Return values for RET:

Value	Meaning
-1	Device could not be coupled/decoupled.
0	Device successfully coupled/decoupled

Examples

Here, the device with the Profibus address 3 is decoupled.

```
...
  Ret = ioCtl("ProfibusMasterInstance",60,3)
...
```

Here, the device with the Profibus address 5 is coupled.

```
...
  Ret = ioCtl("ProfibusMasterInstance",50,5)
...
```

Check state

The state of a device can be checked using the command code 1001. Here, the state of the device with the Profibus address 4 is checked:

```
Ret = ioCtl("ProfibusMasterInstance",1001,4)
```

Return values for RET:

Value	Meaning
0	The device is ready.
1	The device is not ready.

7 Diagnosis

7.1 Displaying diagnostic data

> The diagnostic data can also be displayed in WorkVisual. Information about procedures in WorkVisual is contained in the WorkVisual documentation.

Procedure

1. Select **Diagnosis** > **Diagnostic monitor** in the main menu.
2. Select the **Profibustreiber (ProfibusDrv)** module in the **Module** box.
   The diagnostic data are displayed for this module.

Description

Name	Description
Internal driver name	Internal name of the driver
Version of driver	Version of the driver and build number
LDB file name	Path and name of the LDB file
CP5614A2 HW version	Hardware version of the CP 5614 A2 card
Profibus master activated	■ **YES**: The master ring of the card is activated. ■ **NO**: The master ring of the card is not activated.
Profibus slave activated	■ **YES**: The slave ring of the card is activated. ■ **NO**: The slave ring of the card is not activated.
Operating state Master circuit	■ **DP_OPERATE**: Operational state for I/O mode **Note**: Other states are not permissible for I/O mode.
Wait for slaves	■ **YES**: On booting, the master ring waits until the connected slaves are ready. ■ **NO**: On booting, the master ring does not wait for the connected slaves.
Set output to FALSE on bus error	■ **YES**: The outputs are set to zero in the event of a communication error. ■ **NO**: The values of the outputs are not changed in the event of a communication error.
Address of slave circuit	Address of the slave part set in the configuration file. **Note**: The address must match the Profibus address assigned to the slave ring in the configuration of the higher-level master.
Status of slave circuit	■ **DPS_DATA_EX**: I/O data are transmitted to the higher-level master. **Note**: In all other states, no I/O data can be transmitted to the higher-level master.
Status of upper master	■ **DP_OPERATE**: Data are exchanged with the slave ring of the card. **Note**: In all other states, no data can be exchanged with the slave ring of the card.

Name	Description
Error reaction on errors in slave circuit	■ **ERROR_REACTION ON**: A stop-triggering message is generated on the robot controller in the event of an error in the slave ring. ■ **ERROR_REACTION OFF**: No stop-triggering message is generated on the robot controller in the event of an error in the slave ring.
Data width of configuration	■ **DATABASE DATATYPE WORD**: The database has the data width WORD. ■ **DATABASE DATATYPE BYTE**: The database has the data width BYTE.

8 Messages

No. / message text / type	Possible cause	Remedy
2858 *Ackn. Stop due to field bus error* Stop message	The power or network cable is incorrectly plugged in or defective.	Correctly plug in the power or network cable, or exchange.
	The driver is incorrectly configured or the parameters are incorrectly set.	Check and correct the configuration.
1034 **Write error, driver:***driver name* Status message	The power or network cable is incorrectly plugged in or defective.	Correctly plug in the power or network cable, or exchange.
	The driver is incorrectly configured or the parameters are incorrectly set.	Check and correct the configuration.
10056 *Profibus master is in the AUTOCLEAR state. Please execute the RESET command* Status message	The master ring is in a non-permissible state.	In the main menu, select **Configuration** > **Inputs/outputs** > **I/O drivers** and click on **Reset**.
10058 **Profibus driver: communication error in module** [*Profibus address* (*device name*)] Status message	The module is incorrectly plugged in or defective.	Correctly plug in the module, or exchange.
	The module is incorrectly configured.	Check and correct the configuration.
10059 *Profibus driver: watchdog error in the master ring* Status message	The watchdog time set for monitoring the cyclical communication was exceeded.	Increase the set watchdog time in the configuration.
10060 *Profibus driver: communication error in the slave ring* Status message	The cabling for the slave ring is incorrectly plugged in or defective.	Correctly plug in the cabling, or exchange.
	The slave ring is incorrectly configured.	Check and correct the configuration.
10069 *Profibus master is not in the OPERATE state* Status message	The LDB file contains errors.	1. Check and correct the configuration. 2. Create and load a new LDB file.
10070 **Profibus slave** [*device name*] **could not be activated** Status message	The cabling is incorrectly plugged in or defective.	Correctly plug in the cabling, or exchange.
	An incorrect Profibus address was entered during coupling.	Correct the Profibus address and execute the coupling command again.

9 KUKA Service

9.1 Requesting support

Introduction

The KUKA Roboter 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)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software
- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

9.2 KUKA Customer Support

Availability

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

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