

KUKA



Controller Option
KUKA smartPAD-2
teach pendant
Operating instructions



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KUKA smartPAD-2 V2
KUKA Deutschland GmbH

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

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

Subject to technical alterations without an effect on the function.

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1 Introduction

1.1 Industrial robot documentation

The industrial robot documentation consists of the following parts:

- Documentation for the robot arm
- Documentation for the robot controller
- Documentation for the smartPAD-2
- Operating and programming instructions for the System Software
- Instructions for options and accessories
- Spare parts in KUKA.Xpert

Each of these sets of instructions is a separate document.

1.2 Representation of warnings and notes

Safety

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



DANGER

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



WARNING

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



CAUTION

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

NOTICE

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



These warnings contain references to safety-relevant information or general safety measures.

These warnings do not refer to individual hazards or individual precautionary measures.

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

SAFETY INSTRUCTION

The following procedure must be followed exactly!

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

Notices

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



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

1.3 Terms used

Term	Description
KUKA smartHMI	Smart human-machine interface smartHMI is the user interface on the smartPAD.
KUKA smartPAD-2	see "smartPAD"
smartPAD	The smartPAD is the teach pendant for the robot. It provides all the operator control and display functions required by the system integrator and the operator for operator control of the robot during start-up, maintenance and operation. There are several variants available, which differ in terms of connecting cable length and robot controller. In this document, all variants are hereinafter referred to as "smartPAD".

2 Purpose

2.1 Target group

This documentation is aimed at the following users:

- User
- Start-up personnel with the following qualifications:
 - Advanced knowledge of robot programming
 - Advanced knowledge of electrical engineering
 - Knowledge of the robot controller system
 - System knowledge of the Windows operating system
- Operating personnel with the following qualifications:
 - Basic knowledge of robot operation

Persons working with the smartPAD-2 must have read and understood the documentation, including the safety chapters, of the robot, robot controller and smartPAD-2.



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.

2.2 Intended use

Use

The smartPAD is the teach pendant for the robot. The smartPAD has all the operator control and display functions required for operation. The smartPAD is intended exclusively for the operation of KUKA robots in conjunction with a KUKA controller.

Each version of the smartPAD must be operated exclusively in accordance with the specified system requirements.

Operation in accordance with the intended use also requires continuous compliance with the operating and assembly instructions of the robot system and the operating and programming instructions of the System Software.

Misuse

Any use or application deviating from the intended use is deemed to be misuse and is not allowed. Examples of such misuse include:

- Operation outside the specified operating parameters
- Operation in potentially explosive environments
- Outdoor operation
- Operation in underground mining

KUKA Deutschland GmbH is not liable for any damage resulting from such misuse. The risk lies entirely with the user.

3 Product description

3.1 Product description

Description

The smartPAD is the teach pendant for the robot. The smartPAD has all the operator control and display functions required for operation.

The smartPAD has a capacitive touch screen: the smartHMI can be operated with a finger or capacitive stylus. An external mouse or external keyboard is not necessary.

3.2 smartPAD, front view

Overview

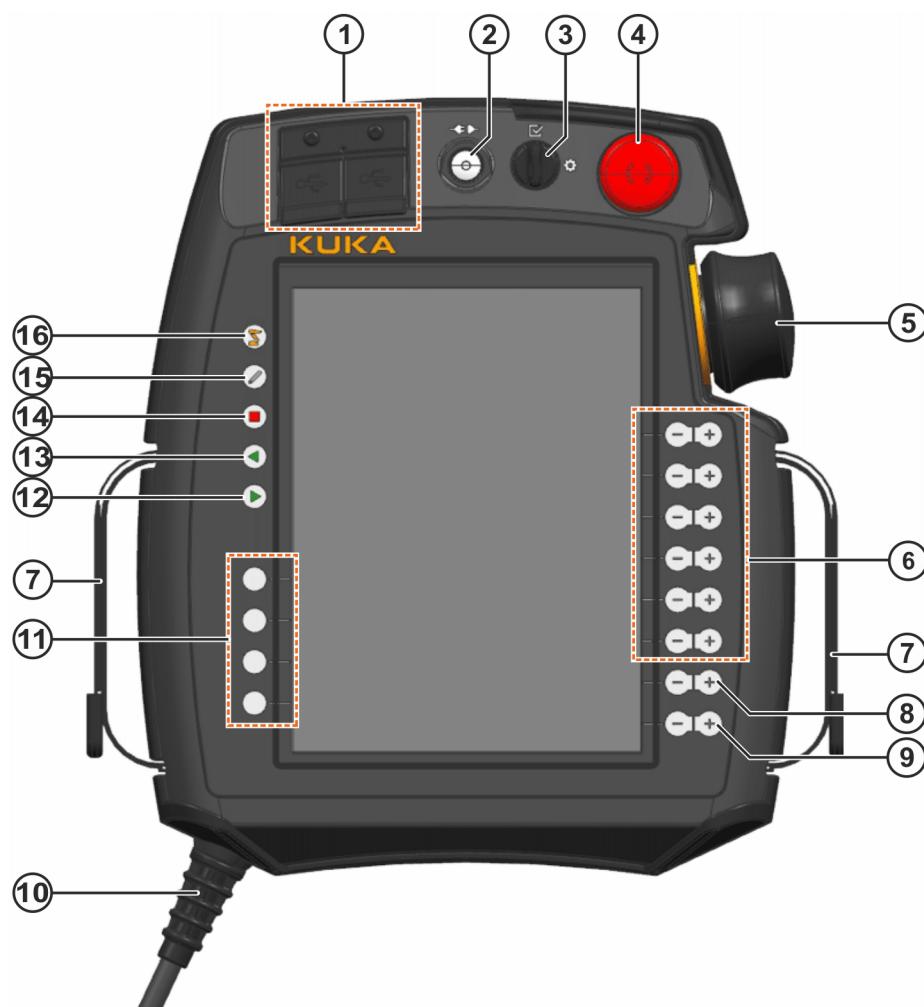


Fig. 3-1: Front view

Item	Description
1	2 USB 2.0 interfaces with cover The USB connection is used for archiving data, for example. USB sticks formatted for NTFS and FAT32.
2	Button for disconnecting the smartPAD (>>> <i>6.1 "Disconnecting and connecting the smartPAD"</i> <i>Page 19</i>)
3	Mode selector switch. The switch may be one of the following variants: <ul style="list-style-type: none"> • With key • Without key The connection manager is called by means of the mode selector switch. The connection manager is used to change the operating mode. smartPAD with key: The switch can only be turned if the key is inserted.
4	EMERGENCY STOP device The robot can be stopped in hazardous situations using the EMERGENCY STOP device. The EMERGENCY STOP device locks itself in place when it is pressed.
5	The 6D mouse can be used to move the robot manually.
6	Jog keys The jog keys are used to move the robot manually.
7	Hand strap with Velcro fastener When the hand straps are not in use, they can be pulled in completely.
8	Key for setting the program override
9	Key for setting the jog override
10	Connecting cable
11	User keys The function of the user keys is freely programmable. Uses of the user keys include controlling peripheral devices or triggering application-specific actions.
12	Start key The Start key is used to start a program. The Start key is also used to manually address frames and to move the robot back onto the path.
13	Start backwards key This key can be used to execute the frames in the program backwards.
14	STOP key The STOP key is used to stop a program that is running.
15	Keyboard key Displays the keyboard.

Item	Description
16	Main menu key The main menu key shows and hides the main menu on the smartHMI.



The following applies to the jog keys, the user keys and the Start, Start backwards and STOP keys:

- The current function is displayed next to the key on the smartHMI.
- If there is no display, the key is currently without function.

3.3 smartPAD, rear view

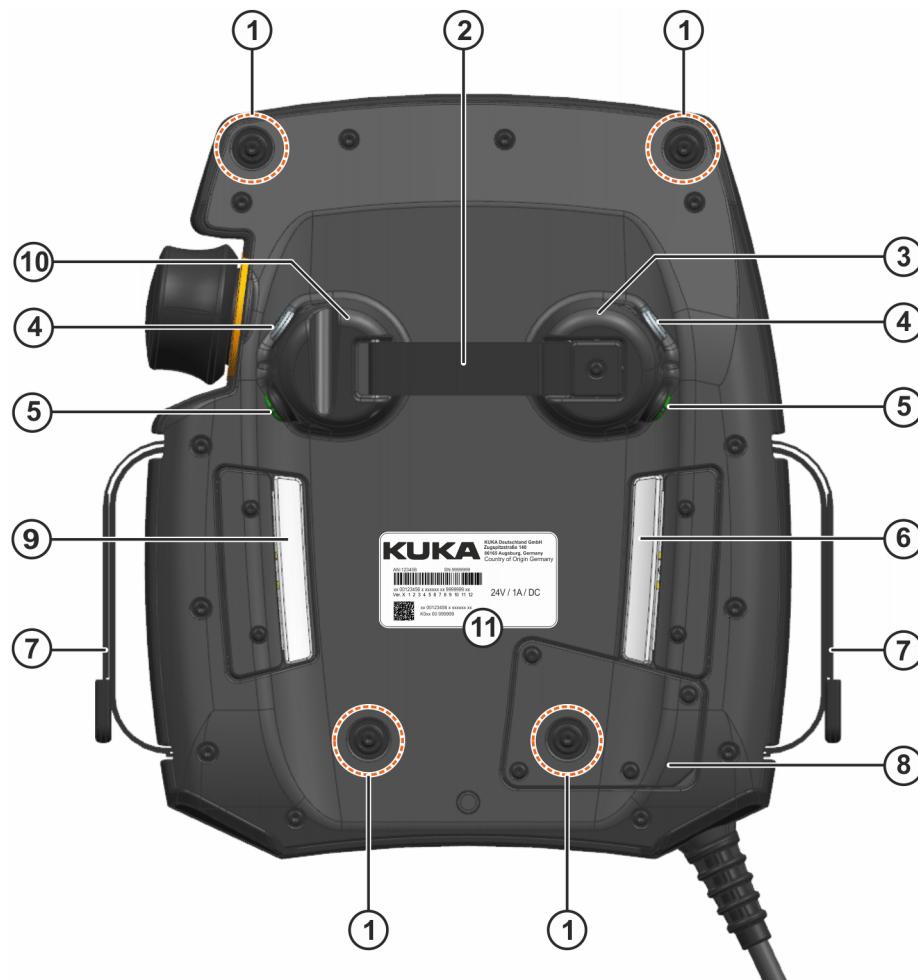


Fig. 3-2: Rear

Item	Description
1	Press studs for fastening the (optional) carrying strap
2	Strap, dome
3	Left-hand dome: holding the smartPAD with the right hand

Item	Description
4	<p>Enabling switch</p> <p>The enabling switch has 3 positions:</p> <ul style="list-style-type: none"> • Not pressed • Center position • Fully pressed (panic position) <p>The enabling switch must be held in the center position in operating modes T1, T2 and CRR in order to be able to jog the manipulator.</p> <p>As standard, the enabling switch has no function in Automatic mode.</p>
5	<p>Start key (green)</p> <p>The Start key is used to start a program. The Start key is also used to manually address frames and to move the robot back onto the path.</p>
6	Enabling switch
7	Hand strap with Velcro fastener
8	Cover (connection cable cover)
9	Enabling switch
10	Right-hand dome: holding the smartPAD with the left hand
11	Identification plate

4 Technical data

4.1 Technical data

Basic data

Rated supply voltage	24 V DC
Dimensions (width x height x depth)	247 mm x 292 mm x 63 mm
Weight	approx. 1.1 kg
Protection rating	IP54 (only if the USB stick is disconnected and the cover for the connections is closed)
Interfaces	2 USB 2.0 interfaces
Display	Touch-sensitive color display Resolution of 600 x 800 pixels, capacitive
Display size	8.4"

Ambient conditions

Ambient temperature during operation	0 °C to 55 °C (273 K to 328 K)
Ambient temperature during storage/transportation	-25 °C to 70 °C (248 K to 343 K)
Temperature change	max. 1 K/min
Classification of ambient conditions (EN 60721-3-3)	3K3
Altitude without derating	max. 1000 m above mean sea level
Altitude with derating	max. 4000 m above mean sea level (derating 5%/1000 m)

Cable lengths

For cable designations, standard lengths and optional lengths, please refer to the operating instructions or assembly instructions of the manipulator.



When using smartPAD cable extensions, only two extensions may be used. An overall cable length of 50 m must not be exceeded.

5 Safety

This documentation contains safety instructions which refer specifically to the product described here. The fundamental safety information can be found in the “Safety” chapter of the following documentation:

- Documentation for the robot arm
- Operating and programming instructions for the System Software

5.1 General safety measures

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons. Operator errors can result in personal injury and damage to property.

It is important to be prepared for possible movements of the industrial robot even after the robot controller has been switched off and locked out. Incorrect installation (e.g. overload) or mechanical defects (e.g. brake defect) can cause the manipulator or external axes to sag. If work is to be carried out on a switched-off industrial robot, the manipulator and external axes must first be moved into a position in which they are unable to move on their own, whether the payload is mounted or not. If this is not possible, the manipulator and external axes must be secured by appropriate means.



DANGER

In the absence of operational safety functions and safeguards, the industrial robot can cause personal injury or material damage. If safety functions or safeguards are dismantled or deactivated, the industrial robot may not be operated.



DANGER

Standing underneath the robot arm can cause death or injuries. For this reason, standing underneath the robot arm is prohibited!



CAUTION

The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

smartPAD

The user must ensure that the industrial robot is only operated with the smartPAD by authorized persons.

If more than one smartPAD is used in the overall system, it must be ensured that it is clearly recognizable which smartPAD is connected to which industrial robot. They must not be interchanged.



WARNING

The operator must ensure that decoupled smartPADs are immediately removed from the system and stored out of sight and reach of personnel working on the industrial robot. This serves to prevent operational and non-operational EMERGENCY STOP devices from becoming interchanged.

Failure to observe this precaution may result in death, severe injuries or considerable damage to property.

In certain cases, and at least every 12 months, the enabling switches on the smartPAD must be subjected to a function test.

Modifications

After modifications to the industrial robot, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety functions must also be tested.

New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).

After modifications to the industrial robot, existing programs must always be tested first in Manual Reduced Velocity mode (T1). This applies to all components of the industrial robot and includes e.g. modifications of the external axes or to the software and configuration settings.

Faults

The following tasks must be carried out in the case of faults in the industrial robot:

- Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
- Indicate the fault by means of a label with a corresponding warning (tagout).
- Keep a record of the faults.
- Eliminate the fault and carry out a function test.

5.2 Enabling device

The enabling devices of the industrial robot are the enabling switches on the smartPAD.

Two variants are possible:

- smartPAD: 3 enabling switches
- smartPAD-2: 4 enabling switches

The enabling switches have 3 positions:

- Not pressed
- Center position
- Fully pressed (panic position)

In the test modes, the manipulator can only be moved if one of the enabling switches is held in the central position.

- Function test with KUKA System Software (KSS):
 - Releasing the enabling switch triggers a safety stop 2.
 - Pressing the enabling switch down fully (panic position) triggers a safety stop 1.
 - It is possible to hold several enabling switches in the center position. This makes it possible to adjust grip from one enabling switch to another one.
- Function test with KUKA Sunrise.OS:
 - Releasing the enabling switch triggers a safety stop 1 (path-maintaining).
 - Fully pressing the enabling switch triggers a safety stop 1 (path-maintaining).
 - It is possible to hold several enabling switches in the center position. This makes it possible to adjust grip from one enabling switch to another one.



Further information about the enabling device and configuration of the safety functions is contained in the operating and programming instructions for the System Software.

**WARNING**

The simultaneous use of multiple enabling switches is potentially dangerous if not all enabling switches are released following an accident. In this case, enabling is still active.

To stop the robot, all enabling switches must be released or at least one enabling switch must be fully pressed.

Irrespective of the System Software used, the manipulator can be stopped using the following methods if an enabling switch malfunctions (e.g. jams in the center position):

- Press the enabling switch down fully.
- Actuate the EMERGENCY STOP device.
- Release the Start key.

**WARNING**

The enabling switches must not be held down by adhesive tape or other means or tampered with in any other way.
Death, injuries or damage to property may result.



The function test for all enabling switches must be carried out before start-up and at least once every 12 months.

6 Start-up and recommissioning

6.1 Disconnecting and connecting the smartPAD



WARNING

If the smartPAD is disconnected, the system can no longer be switched off by means of the EMERGENCY STOP device on the smartPAD. If the smartPAD is configured as unpluggable, at least one external EMERGENCY STOP device must be installed that is accessible at all times.

Failure to observe this can lead to death, injury or property damage.



WARNING

The system integrator must ensure that disconnected smartPADs are immediately removed and stored out of sight and reach of personnel working on the robot. This prevents operational and non-operational EMERGENCY STOP devices from becoming interchanged.

Failure to observe this can lead to death, injury or property damage.



WARNING

If the smartPAD is disconnected after the EMERGENCY STOP has been pressed, this EMERGENCY STOP remains active, but only until the robot controller is rebooted. For this reason, disconnection of the smartPAD must not be used to prevent the EMERGENCY STOP device on the smartPAD from being released.

If an EMERGENCY STOP is to be active with the smartPAD disconnected, this EMERGENCY STOP must always be triggered via an external EMERGENCY STOP device.

Failure to observe this can lead to death, injury or property damage.



It must be ensured that the 6D mouse is not deflected when connecting the smartPAD to a controller that is running or when switching on the controller. Otherwise the 6D mouse will not function correctly.

6.1.1 Disconnecting the smartPAD

Description

If disconnection of the smartPAD is configured as allowed in the station configuration of the project that is active on the robot controller, the smartPAD can be disconnected while the robot controller is running.

Precondition

- Disconnection of the smartPAD is allowed.

Procedure

1. Press the disconnect button on the smartPAD.



Fig. 6-1: Disconnecting the smartPAD

A message and a counter are displayed on the smartHMI. The counter runs for 25 s. During this time, the smartPAD can be disconnected from the robot controller.

If the counter expires without the smartPAD having been disconnected, this has no effect. The disconnect button can be pressed again at any time to display the counter again.

2. Disconnect the smartPAD from the robot controller.



If the smartPAD is disconnected without the counter running, this triggers an EMERGENCY STOP. The EMERGENCY STOP can be canceled by reconnecting the smartPAD.

6.1.2 Connecting the smartPAD

Description

A smartPAD can be connected at any time. The connected smartPAD assumes the current operating mode of the robot controller. The smartHMI is automatically displayed again.

Procedure

1. Connect the smartPAD to the robot controller.
 - The EMERGENCY STOP and enabling switches are operational again 30 s after connection.
 - The smartHMI is automatically displayed again. (This may take longer than 30 s.)
 - The connected smartPAD assumes the current operating mode of the robot controller.
2. Check the functions. The following checks must be performed:
 - Function test of EMERGENCY STOP
 - Function test for the enabling switches
(>>> [10.2 "Function test" Page 30](#))
 - Check whether the smartHMI is displayed again. (This may take longer than 30 s.)



WARNING

The system integrator connecting a smartPAD to the robot controller must subsequently check whether the smartPAD is operational once again.

The smartPAD is not operational in the following cases:

- smartHMI is not displayed again.
It may take more than 30 seconds before the smartHMI is displayed again.
- An error message is displayed in the **Safety** tile, indicating that there is a connection error to the smartPAD.

Disconnect a non-operational smartPAD and remove it from the system! If a non-operational smartPAD remains connected, there is a danger of attempting to activate a non-operational EMERGENCY STOP. Death, injuries or damage to property may result.

7 Installation

7.1 Installing or updating KUKA.SoftwarePackage smartPAD-2

Description

KUKA.SoftwarePackage smartPAD-2 contains an image that is made available on the smartPAD via the robot controller. The option package is pre-installed on the System Software or can be installed or updated as needed. The currently installed version can be read via the smartHMI.

Function

The software on the smartPAD is updated by means of the software KUKA.SoftwarePackage smartPAD-2.

System requirements

- Hardware:
KR C4
- Software:
KUKA System Software (V)KSS 8.2 and higher



In the case of an update, the previously installed version is automatically overwritten. It is not necessary to uninstall the previously installed version.

Preconditions

- User rights: function group **General configuration**
But at least the user group “Expert”
- T1 or T2 mode
- No program is selected.
- The smartPAD is connected to the robot controller.



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

Preparation

Copy the software from the KUKA website <http://www.kuka.com/> to a USB stick:

- Visit <http://www.kuka.com/> and select the following filters:
Services
Download Center

Download the software **KUKA.SoftwarePackage smartPAD-2 [Version].zip**.

NOTICE

We recommend using a KUKA USB stick. Data may be lost if a stick from a different manufacturer is used.

NOTICE

The smartPAD must not be unplugged during the installation or update.

Procedure

1. Connect the USB stick to the robot controller or smartPAD.
2. In the main menu, select **Start-up > Additional software**.
3. Press **New software**: The entry KUKA.SoftwarePackage smartPAD-2 must be displayed in the **Name** column and drive **E:** or **K:** in the **Path** column.
If not, press **Refresh**.
4. If the specified entries are now displayed, continue with step 5.
Otherwise, the path from which the software is to be installed must be configured first:
 - a. Press the **Configure** button.
 - b. Select a line in the **Installation paths for options** area.
Note: If the line already contains a path, this path will be overwritten.
 - c. Press **Path selection**. The available drives are displayed.
 - d. If the stick is connected to the robot controller: On **E:**, select the level at which the software is located. This can be **E:** directly or a sublevel.
If the stick is connected to the smartPAD: **K:** instead of **E:**
 - e. Press **Save**. The **Installation paths for options** area is displayed again. It now contains the new path.
 - f. Mark the line with the new path and press **Save** again.
5. Select the entry KUKA.SoftwarePackage smartPAD-2 and press **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.

8 Operation

8.1 Holding the smartPAD

The holding position of the smartPAD can be changed.



Fig. 8-1: Holding the smartPAD

- 1 The right hand grips the left dome.
- 2 The left hand grips the right dome.

9 Maintenance and cleaning

9.1 Maintenance

The smartPAD is maintenance-free.

9.2 Cleaning

Preconditions

- Cleaning work must only be carried out with the connectors unplugged.
- Observe the ESD guidelines.

Work regulations

- The instructions provided by the manufacturer of the cleaning agent must be observed when carrying out cleaning work.
- Use a lint-free cloth and solvent-free cleaning agent.
- Do not use compressed air.
- Do not spray with water.
- Electrical components must not come into contact with water or cleaning agent.

Procedure

- Clean plastic parts with solvent-free cleaning agents.

10 Repair

10.1 Exchanging the connecting cable

Description

The following section describes the procedure for exchanging the connecting cable.

Equipment

The following equipment is required:

Designation	Article number
Torx T10	-
ESD wrist strap	0000-121-401
KUKA smartPAD-2 10m	0000-291-556

Material

Depending on the specific requirements, the following material is needed:

Designation	Article number	Quantity
Cable 10m BUS-smartPAD-2 (for smart-PAD 0000-291-556)	0000-320-104	1x
Cable 0,3m BUS-smartPAD-2 (for smart-PAD 0000-312-962)	0000-320-102	1x

Overview

The instructions are subdivided into the following work steps:

Work step	Activity
1	Removing the cable with connector (>>> 10.1.1 "Removing the cable" Page 27)
2	Installing the cable with connector (>>> 10.1.2 "Installing the cable" Page 29)
3	Concluding work (>>> 10.1.3 "Concluding work" Page 29)

Precondition

- Connecting cable disconnected.
- Observe the ESD guidelines.

10.1.1 Removing the cable

Procedure

1. Remove the fastening screws from the cover.



Fig. 10-1: Loosening the screws

2. Open and remove the cover.



Fig. 10-2: Removing the cover

3. Pull cable out of cable shield clip.
4. Press the lever on the connector to release it. Unplug the connector.



Fig. 10-3: Disconnecting the cable

- 1 Cable shield clip
- 2 Connector X0300 for connecting cable

5. Carefully pull the cable out of the smartPAD. Be careful not to damage any components on the board.



Fig. 10-4: Pulling out the cable

10.1.2 Installing the cable

Procedure

Installation is carried out by reversing the removal procedure.

1. Carefully feed the cable through the housing aperture. Ensure that the connector and cable are not twisted.
2. Connect the cable. The locking lever must click into place.
3. Push cable into cable shield clip.



Fig. 10-5: Connecting the cable

4. Mount cover and screw it on. Hand-tighten the fastening screws. The surface of the cover must be flush with the surface of the housing.

10.1.3 Concluding work

After the connecting cable has been exchanged, the following tasks must be carried out:

Procedure

1. Connect the smartPAD to the robot controller.
2. Check whether the smartPAD is operational again. (>> [10.2 "Function test" Page 30](#))

10.2 Function test

The function test of the smartPAD must be carried out in the following cases:

- Following initial start-up or recommissioning of the industrial robot
- After a software update, e.g. of the System Software
- The test must be carried out at least once every 12 months.

Perform the following steps separately for each enabling switch:

1. Move the robot in test mode.
2. Press the enabling switch down fully in the panic position and hold it in the panic position for 3 seconds.

The robot motion must be stopped. At the same time, no error message may be displayed about the enabling device. If an error message appears for one or more enabling switches, the smartPAD must be exchanged.



Further information is contained in the operating and programming instructions for the System Software.

11 Decommissioning, storage and disposal

11.1 Decommissioning

Precondition

- The robot controller is switched off.

Procedure

1. Unplug the smartPAD.
2. Clean the smartPAD.
3. Prepare the smartPAD for storage.

11.2 Storage

Precondition

If the smartPAD is to be put into long-term storage, the following points must be observed:

- The place of storage must be as dry and dust-free as possible.
- Avoid temperature fluctuations.
- Avoid condensation.
- Observe and comply with the permissible temperature ranges for storage.

11.3 Disposal

When the smartPAD reaches the end of its useful life, dispose of it as electrical scrap without disassembling.

12 KUKA Service

12.1 Requesting support

Introduction

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

Information

The following information is required for processing a support request:

- Description of the problem, including information about the duration and frequency of the fault
- As comprehensive information as possible about the hardware and software components of the overall system

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

- Model and serial number of the kinematic system, e.g. the manipulator
 - Model and serial number of the controller
 - Model and serial number of the energy supply system
 - Designation and version of the system software
 - Designations and versions of other software components or modifications
 - Diagnostic package KRCDiag
- Additionally for KUKA Sunrise: existing projects including applications
- For versions of KUKA System Software older than V8: archive of the software (KRCDiag is not yet available here.)
- Application used
 - External axes used

12.2 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

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