KUKA System Technology

KUKA.LoadDataDetermination 6.2

For KUKA System Software 8.1, 8.2 and 8.3

Issued: 19.06.2013

Version: KST LoadDataDetermination 6.2 V2 en (PDF)
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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
1 Introduction

1.1 Target group

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

- Knowledge of robotics
- Advanced knowledge of the robot controller system
- Advanced knowledge of dynamic and static loading on the robot

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 Trademarks

**Windows** is a trademark of Microsoft Corporation.

### 1.5 Terms used

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis range</td>
<td>Range, in degrees or millimeters, within which an axis may move. The axis range is defined by a lower and an upper axis limit.</td>
</tr>
<tr>
<td>Measurement trajectory</td>
<td>Measurement path</td>
</tr>
<tr>
<td>Trajectory</td>
<td>Path</td>
</tr>
<tr>
<td>KCP</td>
<td>The KCP (KUKA Control Panel) teach pendant has all the operator control and display functions required for operating and programming the industrial robot. The KCP variant for the KR C4 is called KUKA smartPAD. The general term “KCP”, however, is generally used in this documentation.</td>
</tr>
</tbody>
</table>
2 Product description

2.1 KUKA.LoadDataDetermination overview

Function
For model-compatible path planning – higher motion profile, acceleration adaptation, and also for high-accuracy robot models – it is absolutely vital that the correct load data (mass, center of gravity, moment of inertia) are entered. In this way, overloading of the robot, e.g. of the gear units and bearings, is avoided.

The data can be determined quickly and easily using KUKA.LoadDataDetermination.

This is done by carrying out certain measurement motions with a load mounted on the robot and recording the currents resulting from the axis motor torques. These data are used as a basis for calculating the load data.

The mass, center of gravity and moment of inertia of the tools mounted on the robot flange are identified in this way.

The payload can either be determined automatically or entered manually.

2.2 Robot model and physical situation

The robot controller plans optimal PTP motions using a dynamic model which calculates time-optimized PTP motions. This ensures that the mechanical stress limits of the robot are never exceeded.

In order to be able to take into account the acceleration adaptation for the higher motion profile, or the robot-specific load when positioning the high-accuracy robot model, it is important to know the mass and center of gravity of the load mounted on the robot flange.

As well as data for the mechanical components of the robot, the load data also play an important role here. Correct specification of the load is therefore of decisive importance in order for the model to agree with the given physical situation, and thus for the quality of the calculation.
2.3 Load data

The load data are factored into the calculation of the paths and accelerations and help to optimize the cycle times. The load data must be entered in the robot controller.

**WARNING** If a robot is operated with incorrect load data or an unsuitable load, this can result in danger to life and limb and/or substantial material damage.

2.3.1 Loads on the robot

**Description** Various loads can be mounted on the robot:
- Payload on the flange
- Supplementary load on axis 3
- Supplementary load on axis 2
- Supplementary load on axis 1

All loads added together give the overall load.

**Parameters** The load data are defined using the following parameters:

There is a payload diagram for every robot. This can be used to make a quick preliminary check of whether the robot is suitable for the payload. The diagram is not, however, a substitute for checking the payload with KUKA.Load.

![Fig. 2-2: Loads on the robot](image)

1. Payload
2. Supplementary load on axis 3
3. Supplementary load on axis 2
4. Supplementary load on axis 1

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2 Product description

2.3.2 Static overloading of the robot

Description
Static analyses are carried out to check the static load on the overall robot and compared with maximum permissible values. In particular, this includes the gear and motor holding torques which are mapped to a specific axis. If these are not sufficient for an overall static evaluation of the robot, equivalent structural loads are considered, which can also be mapped to a corresponding axis. For example, there is no static torque on axis 6 of a palletizing robot, but a load is nonetheless documented.

If the maximum permissible values are exceeded, this is referred to as static overloading of the robot. This overloading can be prevented by means of the following measures:

- Shifting the position of the center of gravity towards the flange center point
- Using a robot with a higher rated payload
- Reducing the mass/weight

⚠️ KUKA Roboter GmbH must always be consulted in the case of overloading.

2.3.3 Dynamic overloading of the robot

Description
If the load data are out of specification, this is referred to as dynamic overloading of the robot. This overloading can be prevented by means of the following measures:

- Reduce the mass moments of inertia by:
  - Using a more geometrically compact load

---

### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>m</td>
</tr>
<tr>
<td>Distance to the center of gravity</td>
<td>L_x, L_y, L_z mm</td>
</tr>
<tr>
<td>Mass moments of inertia at the center of gravity</td>
<td>I_x, I_y, I_z kg m^2</td>
</tr>
</tbody>
</table>

Reference systems of the X, Y and Z values for each load:

<table>
<thead>
<tr>
<th>Load</th>
<th>Reference system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload</td>
<td>FLANGE coordinate system</td>
</tr>
<tr>
<td>Supplementary load A3</td>
<td>FLANGE coordinate system</td>
</tr>
<tr>
<td></td>
<td>A4 = 0°, A5 = 0°, A6 = 0°</td>
</tr>
<tr>
<td>Supplementary load A2</td>
<td>ROBROBOT coordinate system</td>
</tr>
<tr>
<td></td>
<td>A2 = -90°</td>
</tr>
<tr>
<td>Supplementary load A1</td>
<td>ROBROBOT coordinate system</td>
</tr>
<tr>
<td></td>
<td>A1 = 0°</td>
</tr>
</tbody>
</table>

Sources
Load data can be obtained from the following sources:

- Software option KUKA.LoadDataDetermination (only for payloads on the flange)
- Manufacturer information
- Manual calculation
- CAD programs
Reducing the mass
Using a robot with a higher rated payload

KUKA Roboter GmbH must always be consulted in the case of over-loading.

2.4 Limits to this method of load data determination

The results of the load data determination may be influenced by the following constraints:

- Operating state of the machine
  The robot must be at operating temperature. The warm-up function can be selected for this.
- Mass of the mounted tool
  The lower the mass of the tool mounted on the robot flange, the greater the measurement tolerance. The value for the load should therefore not be less than 20% of the rated payload of the robot.
- Robot path
  The angular ranges covered are permanently defined. Only the start position of the robot can be modified within the defined range.
  - Axis 3 swings ± 2 degrees about the start position.
  - Axis 5 swings ± 40 degrees about the start position.
  - Axis 6 swings ± 60 degrees about the start position.
  - Axis 4 does not move (exception: Transpressors)

The start positions must be as close as possible to the default values (>>> 5.3.2 “Axis ranges” tab Page 19). The greater the deviation, the poorer the quality of the identified load data.

KUKA.LoadDataDetermination determines the current loads with the accuracy required to ensure the best possible path planning and optimal rating of the robot. The following accuracy can typically be achieved:

- Low payload category
  20% of rated payload of robot
- Medium payload category
  10% of rated payload of robot
- High payload category
  10% of rated payload of robot
- Heavy-duty category
  5% of rated payload of robot

2.5 Intended use

KUKA.LoadDataDetermination may only be used on a KR C4 robot controller with the following software:

- KUKA System Software 8.1, 8.2 or 8.3

Using it for any other or additional purpose is considered impermissible misuse. The manufacturer cannot be held liable for any damage resulting from such use. The risk lies entirely with the user.

Operation in accordance with the intended use also involves compliance with the installation and operating instructions in this documentation.
**Misuse**

Any use or application deviating from the intended use is deemed to be impermissible misuse; examples of such misuse include:

- Incorrect configuration (not in compliance with this documentation). This can result in it not being possible to determine the load data as described or with the described accuracy.
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.

⚠️ The “Safety” chapter in the operating and programming instructions must be observed. Death to persons, severe injuries or considerable damage to property may otherwise result.
4 Installation

4.1 System requirements

Hardware
- KR C4 robot controller

Software
- KUKA System Software 8.1 or 8.2 with Windows XP Embedded
- KUKA System Software 8.3 with Windows Embedded Standard 7 V4.x

4.2 Installing or updating KUKA.LoadDataDetermination

Precondition
- Software on KUKA.USBData stick
- No program is selected.
- T1 or T2 operating mode
- "Expert" user group

Procedure
1. Plug in USB stick.
2. Select Start-up > Install additional software in the main menu.
3. Press New software. If a software package that is on the USB stick is not displayed, press Refresh.
4. Select the entry LoadDataDetermination and press Install. Reply to the request for confirmation with Yes. The files are copied onto the hard drive.
5. Repeat step 4 if another software package is to be installed from this stick.
6. Remove USB stick.
7. 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.LoadDataDetermination

Precondition
- Expert user group

Procedure
1. Select Start-up > Install additional software in the main menu. All additional programs installed are displayed.
2. Select the entry LoadDataDetermination and press 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 Graphical user interface

5.1 Menus

The following menu is specific to this technology package:

- Start-up
  - Service
  - Load Data Determination

This menu is only available if no program has been selected.

5.2 Overview of buttons

The following buttons are available:

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Starts the KRL pendulum program.</td>
</tr>
<tr>
<td>Load ldf</td>
<td>Opens the axis angle ranges from the directories \C:\KRC\ROBOTER\IR_SPEC\IDF and E:.</td>
</tr>
<tr>
<td>Save ldf</td>
<td>Saves the axis angle ranges.</td>
</tr>
<tr>
<td>Read axes</td>
<td>Calculates the axis angle ranges on the basis of the current robot position.</td>
</tr>
<tr>
<td>Save</td>
<td>Confirms an action, such as Save ldf, or entries in the Supplementary load A3 tab.</td>
</tr>
<tr>
<td>Default</td>
<td>Resets entered values to the original values.</td>
</tr>
<tr>
<td>Assign tool</td>
<td>Assigns the displayed load data automatically in $CONFIG.DAT to the tool selected in the selection box.</td>
</tr>
<tr>
<td>New meas</td>
<td>Rejects the calculated load data and switches to the Settings tab.</td>
</tr>
<tr>
<td>USB</td>
<td>Saves the load data determination onto the KUKA.USB data stick.</td>
</tr>
<tr>
<td>Backup</td>
<td>Creates a backup of the data under D:\LoadDataDetermination....</td>
</tr>
<tr>
<td>Logging</td>
<td>Opens log entries on the Info tab.</td>
</tr>
</tbody>
</table>

5.3 Overview of the graphical user interface

5.3.1 “Settings” tab

Description

The “Settings” tab has the following functions:

- **Robot type OK?**
  
The robot types are optimized for load data determination with the standard set of motors. It is therefore necessary to specify the correct robot type. On starting the load data determination, the motor set is checked together with the robot name. If the robot is available in the current load data version, “Robot type OK?” is automatically set to Yes.
  
  If the robot with its motor set is not recognized (e.g. due to a change in the robot’s motor set for technical reasons, which has not yet been updated in the LDD database), the message “Robot with this set of motors not adjusted for LDD” is displayed in the message window.
Using the checkbox “Robot type OK? Yes”, it is possible to select manually from a selection box a different robot from the one shown above, but which has the same motor set.

*Fig. 5-1: Selection box*

**NOTICE**
Always consult KUKA Roboter GmbH if the message “Robot with this set of motors not adjusted for LDD” is generated. Damage to property may otherwise result.

To avoid damage to the robot, it must be ensured that the correct robot type has been selected.

The number of robot types supported by load data determination is constantly being expanded. Information on which robot types are currently supported can be obtained from KUKA Roboter GmbH.

- **Supplementary load on axis 3?**
  If “Supplementary load on axis 3?” is activated, the “Supplementary load A3” tab is opened. Supplementary load data can be entered here.

- **Determine payload automatically?**
  If the payload should be determined automatically, this box must be activated.
  If the payload should not be determined automatically, this box must be deactivated. The payload can then be entered manually.

- **Warm-up?**
  If the robot is not at operating temperature, a warm-up can be set.

**NOTICE**
The robot must be at operating temperature so that the data determined correspond to the actual parameters. If the robot is not at operating temperature, a warm-up must be carried out. Damage to the robot may otherwise result.
5.3.2 “Axis ranges” tab

Description
In practice, there are often work envelope constraints such that the robot is only able to execute motions within certain angular ranges in order to avoid the risk of colliding with obstacles in the work envelope. Despite such predefined angular ranges, it is nonetheless possible to influence the work envelope required for the load data determination:

- Axis A3 must be positioned more-or-less horizontal in relation to the floor. This means that the sum of A2 and A3 must be practically zero.
- The start position of axis A5 can be shifted by ± 40 degrees about the zero position. The following conditions relating to the start position must be met:
  - -2 degrees < A2 + A3 < 2 degrees (e.g. also A2 = -80 degrees and A3 = 80 degrees)
  - -40 degrees < A5 < 40 degrees
  - A6 at any position up to the software limit switches

Optimal start position:
- A2 = -90 degrees
- A3 = 90 degrees
- A4 = 0 degrees
- A5 = 0 degrees
- A6 = 0 degrees

Different intervals apply to the Transpressors.

If the work envelope permits this, the cannon position should be selected for the identification process.

For the pendulum motions, axis A4 is always moved to 0 (zero) degrees by the program. The user should therefore check beforehand that this position is compatible with the work envelope.

If axis A4 is not at 0 (zero) degrees, the message “Caution: The angles for axis 4 were set to zero degrees!” is displayed.
The start position of axis A5 should be as close as possible to 0 (zero) degrees. The greater the deviation from 0 (zero) degrees, the poorer the quality of the identified load data.

Since the current robot position is used to calculate the intervals, it is possible that a software limit switch may be violated. This is checked by the program and the start position must be modified as required. Violation of the software limit switches is indicated by a status message.

The midpoint of the axis range for axis A6 is automatically set to the multiple of 90 degrees nearest to the current axis position (e.g. from 87 degrees to 90 degrees, or from 145 degrees to 180 degrees). For the second motion, the midpoint of the axis range is offset +90 degrees from the first motion.

**Axis angle ranges**

On the “Axis ranges” tab, the axis positions of axes A1 and A2 and the motion ranges of axes A3 to A6 are displayed. Using the buttons Read axes, Save Idf and Load Idf, the current axis angles can be read in and the settings can be saved or loaded, respectively.

The entries in the boxes for axes A1 and A2 correspond to the current robot position.

Axis A4 is not moved and is thus always set to 0 degrees during the identification process, irrespective of its current position.

For axes A3, A5 and A6, the interval is calculated from the current robot position and a predefined angular range. The following applies here:

- Axis A3 ± 2 degrees, i.e. [curr.pos. -- 2 degrees, curr.pos. + 2 degrees]
- Axis A5 ± 40 degrees, i.e. [curr.pos. -- 40 degrees, curr.pos. + 40 degrees]
- Axis A6 ± 60 degrees, i.e. [curr.pos. -- 60 degrees, curr.pos. + 60 degrees]

The identification process consists of three separate measurements.

- In the first measurement, only axes A3 and A5 are moved.
- In the second measurement, axis A6 is rotated through 90 degrees and only axis A5 is moved.
- In the third measurement, an individual motion of axis A6 about the starting position of the robot is carried out.

**Path planning (Transpressors)**

For Transpressors, the following axes are moved:

- First motion: Axes A3 + A5
- Second motion: Axis A4
- Third motion: Axis A6 with A4 rotated through 90 degrees.

**Overview of default angular ranges**

The default angular ranges are contained in the following IDF files:

- DEFAULT.IDF
  Default angular ranges for standard robots
- DEFAULT_WIH.IDF
  Default angular ranges for Transpressors

<table>
<thead>
<tr>
<th>Axis</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0 degrees</td>
<td>0 degrees</td>
<td>0 degrees</td>
<td>0 degrees</td>
</tr>
<tr>
<td>A2</td>
<td>-90 degrees</td>
<td>-90 degrees</td>
<td>-90 degrees</td>
<td>-90 degrees</td>
</tr>
<tr>
<td>A3</td>
<td>88 degrees</td>
<td>92 degrees</td>
<td>90 degrees</td>
<td>94 degrees</td>
</tr>
<tr>
<td>A4</td>
<td>0 degrees</td>
<td>0 degrees</td>
<td>-40 degrees</td>
<td>40 degrees</td>
</tr>
<tr>
<td>A5</td>
<td>-40 degrees</td>
<td>40 degrees</td>
<td>30 degrees</td>
<td>110 degrees</td>
</tr>
<tr>
<td>A6</td>
<td>-60 degrees</td>
<td>60 degrees</td>
<td>-40 degrees</td>
<td>40 degrees</td>
</tr>
</tbody>
</table>
5.3.3 “Supplementary load A3” tab

Description

The following values can be entered on the “Supplementary load A3” tab:

- Mass in kg
- Center of gravity in mm for Lx, Ly, Lz
- Inertia in kg m² for lx, ly, lz

The input boxes for the mass, inertia and center of gravity already contain the preset values from the file $CONFIG.DAT.

If the values entered in the file $CONFIG.DAT are the default values (mass = -1), the values from the file $ROBCOR.DAT are used.

WARNING

These values are not saved in the file $CONFIG.DAT. Incorrect supplementary load data will lead to inaccuracy and deviation when determining the load data.
5.3.4 “Info” tab

Description
The “Info” tab displays the following version information and log entries:

- Version information:
  - Load data determination
  - Path planning
  - Robot types

- Log entries:
  - Log date
  - Log entry

To show the log entries, it is necessary to switch to the user group “Administrator”.

Procedure
1. Select Configuration > User group in the main menu.
2. Press Log On and select the user group “Administrator”.
3. Enter password and confirm with Log On.
   The Logging button then appears. If this is pressed, a selection box opens, in which the log date can be selected.
Fig. 5-5: “Info” tab

Fig. 5-6: Log entries
5.3.5 “Load data” tab

Description

Once the load data determination is completed, this tab is generated and added. Here the calculated load data are shown.

The following settings can be made here:

- Discard the calculated load data
  
Pressing the **New meas** button discards the calculated load data. The program switches to the Settings tab.

- Assign the load data to a tool
  
Pressing the **Assign tool** button assigns the displayed load data automatically in $CONFIG.DAT to the tool number selected in the selection box.

To show more than just the tool number here, a tool name can be assigned to the tool number.

In the main menu, select **Start-up > Measure > Tool > Change name**. Mark the tool number and press **Name**. Enter a tool name and confirm with **Save**. The tool name is saved.

- Save load data to disk
  
Pressing the **USB** button saves the load data in the file load.txt to the USB stick.

**NOTICE** Only the KUKA.USB data stick may be used. Data may be lost or modified if any other USB stick is used.

- Create a backup of the load data determination
  
Pressing the **Backup** button saves a backup of the load data determination process on D:\LoadDataDetermination.

When a backup is created, the load data determined and other project information (as in KUKA.Load) are saved in the project file KukaLoadProject.*serialnumber*.XML. This XML file is saved in the directory C:\KRC\RoboterIR_SPEC\_IDENT.
Fig. 5-7: “Load data” tab
6 Operation

6.1 Overview of load data determination

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1    | Assign payload data manually  
(Only for payloads below 20% of the rated load)  
(>>> 6.2 "Assigning payload data manually" Page 27) |
| 2    | External energy supply system – preparation  
(>>> 6.3 "External energy supply system" Page 28) |
| 3    | Start load data determination  
(>>> 6.4 "Carrying out load data determination" Page 28) |
| 4    | Make the required settings on the tabs.  
(>>> 6.4 "Carrying out load data determination" Page 28) |
| 5    | Carry out a test run  
(>>> 6.5 "Carrying out a test run" Page 29) |
| 6    | Run the measurement program.  
(>>> 6.6 "Carrying out the measurement run" Page 29) |
| 7    | Assign the load data  
(>>> 6.7 "Assigning the load data" Page 31) |
| 8    | Save the load data  
(>>> 6.8 "Saving the load data" Page 31) |

6.2 Assigning payload data manually

**Description**

Payloads which are less than 20% of the rated load of the robot must be assigned manually to the tool.

**Precondition**

- The mass of the tool is known.
- The center of gravity of the tool is known.

**Procedure**

1. In the main menu, select **Start-up > Measure > Tool > Payload data**.
2. Select the tool in the box **Tool no.** and confirm with **Next**.
3. Enter the values for mass and center of gravity in the corresponding boxes.
4. In boxes A, B and C for the angle values, enter 0 (zero) degrees.
5. Enter 5% of the nominal moments of inertia in the boxes JX, JY and JZ and confirm with **Next**.
6. Press **Save**.  
The load data are assigned to the tool.
6.3 External energy supply system

It is possible for an external energy supply system mounted on the tool to take part in the pendulum motions. For this, the following steps must be taken:

- Slacken the spring of the dress package.
- Select the start position of the robot in such a way that the dress package is subjected to minimal stress for the start positions of all 3 measurement motions.

If a weld gun is mounted, the weld gun electrodes and any other parts mounted on the tool must be immobilized, e.g. by means of fasteners.

Riveting guns with pneumatic compensation must be pressurized with compressed air during the pendulum motions.

6.4 Carrying out load data determination

Precondition

- KUKA.LoadDataDetermination is correctly installed.
- No program is selected

Payloads which are less than 20% of the rated load of the robot must be assigned manually to the tool (>>> 6.2 "Assigning payload data manually" Page 27).

Procedure

1. In the main menu, select **Start-up > Service > Load data determination**. The LdePlugIn is opened.
2. Carry out the desired settings on the "Settings" and "Axis ranges" tabs.  
   (>>> 5.3.1 "Settings" tab Page 17)  
   (>>> 5.3.2 "Axis ranges" tab Page 19)
3. Press **Start**.
   The system program is opened.

4. Hold down the Start key and one of the enabling switches on the KCP until **Programmed path reached (BCO)** appears in the message window.

5. Press the Start key and one of the enabling switches on the KCP. The prompt **Test runs before measurement?** appears in the message window.
   If the prompt is confirmed with Yes, the test run is started. If the prompt is answered with No, the measurement run is started. Pressing the **End** button terminates the program.

   (>>> 6.5 "Carrying out a test run" Page 29)
   (>>> 6.6 "Carrying out the measurement run" Page 29)

6. **Carrying out a test run**

   **Description**
   During the test run, the workspace required for all three measurement motions can be checked for collisions. First, the axes are moved to the maximum angular positions of the second and third measurement trajectories at 10% over-ride. This is followed by the complete mixed motion of axes A3 and A5 at 100% override in T1, otherwise at 30% override.

   **Procedure**
   - Confirm the message **Test runs before measurement?** with Yes.
     The test run is performed.
   - At the end of the test run, confirm the message **Start the measurement runs** with Yes. (>>> 6.6 "Carrying out the measurement run" Page 29).

6. **Carrying out the measurement run**

   **Overview**
   Once the program has been started, the normal user interface is displayed on the KCP. A system program is displayed in the program window. The program displayed depends on the language selected in the input mask.

<table>
<thead>
<tr>
<th>Language</th>
<th>System program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deutsch</td>
<td>$DE_IDENT.SRC</td>
</tr>
<tr>
<td>English</td>
<td>$EN_IDENT.SRC</td>
</tr>
</tbody>
</table>
**Description**

The measurement program is executed as follows:

<table>
<thead>
<tr>
<th>Program execution structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program item</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Activation, BCO, test motion</td>
<td>Initialization of the program, motion to the start point and possible test motions.</td>
</tr>
<tr>
<td>Measurement trajectory, axes A3 and A5</td>
<td>Measurement run of axes A3 and A5.</td>
</tr>
<tr>
<td>Calculation, part 1</td>
<td>The first part of the load data is calculated.</td>
</tr>
<tr>
<td>Activation of the second motion</td>
<td>Initialization of the next motion.</td>
</tr>
<tr>
<td>Measurement trajectory, axis A5</td>
<td>Motion to start point and measurement run for axis A5. Axis A6 is rotated by 90 degrees from its start position.</td>
</tr>
<tr>
<td>Calculation, part 2</td>
<td>The second part of the load data is calculated.</td>
</tr>
<tr>
<td>Activation of the third motion</td>
<td>Initialization of the third motion.</td>
</tr>
<tr>
<td>Measurement trajectory, axis A6</td>
<td>Motion to start point and measurement run for axis A6.</td>
</tr>
<tr>
<td>Calculation, part 3</td>
<td>The third part of the load data is calculated.</td>
</tr>
<tr>
<td>Motion to start point</td>
<td>Motion to the start position of the robot.</td>
</tr>
</tbody>
</table>

**Procedure**

1. Hold down the Start key and one of the enabling switches until the message “Programmed path reached (BCO)” appears in the message window.
2. Press the Start key and one of the enabling switches on the KCP.
   
   The following query appears in the message window: “Test runs before measurement?”.
   
   If the query is confirmed with Yes, the test run is started. If the query is answered with No, the message “Start the measurement runs” is displayed. Press **OK**.
   
   Pressing **End** terminates the program.

**WARNING** Always perform a test run before the measurement run. Serious injuries or damage to property may otherwise result.
3. The message “Start the measurement runs” appears before the first measurement motion.
4. Press OK to confirm the message.

   The robot now executes the first measurement motion and then calculates part of the load data.

   Before each subsequent measurement motion, the following message is displayed: “Move to start point of second (or third) path and start measurement”.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The robot always moves to the start point of the next path. This is done at 30% override. The measurement motion is then started at once.</td>
</tr>
<tr>
<td>It is not possible to adjust the override during a measurement run. The robot always stops between the individual motions in order to carry out calculations.</td>
</tr>
<tr>
<td>Before confirming the message, always make sure that nobody is in the robot’s work envelope.</td>
</tr>
<tr>
<td>Failure to observe this precaution may result in severe injuries or considerable damage to property.</td>
</tr>
</tbody>
</table>

5. Press OK to confirm the message.

   At the end of the third calculation, the **Load data** (>>> 5.3.5 "Load data" tab Page 24) tab is displayed.

<table>
<thead>
<tr>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the load data have been determined, the load data determined and other project information (as in KUKA.Load) are automatically saved in the project file KukaLoadProject.<em>serialnumber</em>.XML. This XML file is saved in the directory C:\KRC\Roboter\IR_SPEC\L_IDENT.</td>
</tr>
</tbody>
</table>

### 6.7 Assigning the load data

**Description**

If the measurement run is completed without interruption, the actual calculation is carried out and the program is terminated. The load on the robot is then checked (corresponds to the load test in KUKA.Load).

(>>> 2.3.2 "Static overloading of the robot" Page 9)

(>>> 2.3.3 "Dynamic overloading of the robot" Page 9)

If the block pointer is situated in the program line “ENDE”, the measurement results are displayed on the “Load data” tab. The load data can then be assigned to a tool (>>> 5.3.5 "Load data" tab Page 24).

**Procedure**

1. Select a tool from the tool selection box on the **Load data** tab.
2. Press **Assign tool**.

   The load data are assigned to the tool.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overloading and damage to the robot. If the robot is overloaded, a corresponding message appears. If this load is assigned to a tool, an additional message is generated. KUKA Roboter GmbH must always be consulted in such cases.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>If a robot is operated with incorrect load data or an unsuitable load, this can result in danger to life and limb and/or substantial material damage.</td>
</tr>
</tbody>
</table>

### 6.8 Saving the load data

**Description**

The calculated load data can be saved to the USB stick or on the hard drive.
Notice

Only the KUKA.USB data stick may be used. Data may be lost or modified if any other USB stick is used.

Procedure Saving the calculated data to the USB stick

1. Plug in USB stick.
2. Press **USB** to save the calculated data to the USB stick.
   A file "Load_YYYYMMDD_HHMM.TXT" is created on the USB stick.

Procedure Saving the calculated data to the hard drive

- Press **Backup** to archive the calculated data on the hard drive.
  The file is saved as D:\LoadDataDetermination\YYYYMMDD_HHMM. All TXT files from the directory C:\KRC\Roboter\IR_SPEC\L_IDENT are then deleted in order to save disk capacity for a possible archive.
7 KUKA Service

7.1 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)
- 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

7.2 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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