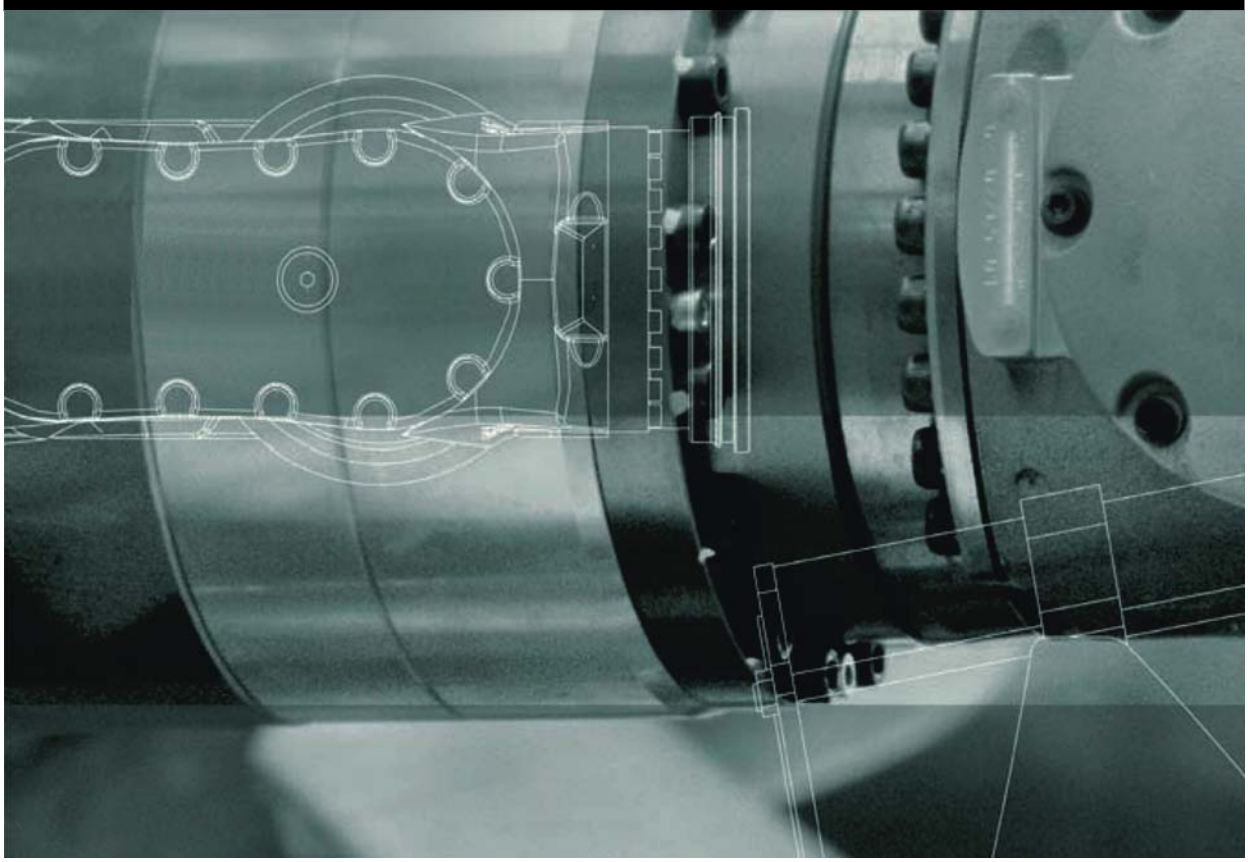
KUKA

KUKA System Technology

KUKA Roboter GmbH

KUKA.LoadDataDetermination 6.1

For KUKA System Software 8.1 and 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:

- 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 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.

Hints

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 Trademarks

Windows is a trademark of Microsoft Corporation.

1.5 Terms used

Term	Description
Axis range	Range, in degrees or millimeters, within which an axis may move. The axis range is defined by a lower and an upper axis limit.
Measurement trajectory	Measurement path
Trajectory	Path
KCP	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.

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.

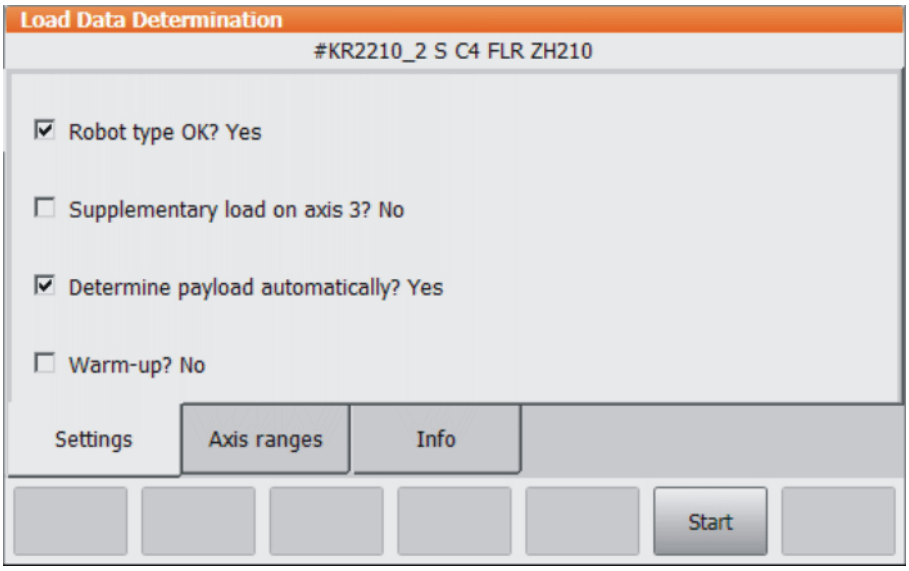

Fig. 2-1: User interface

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.

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.

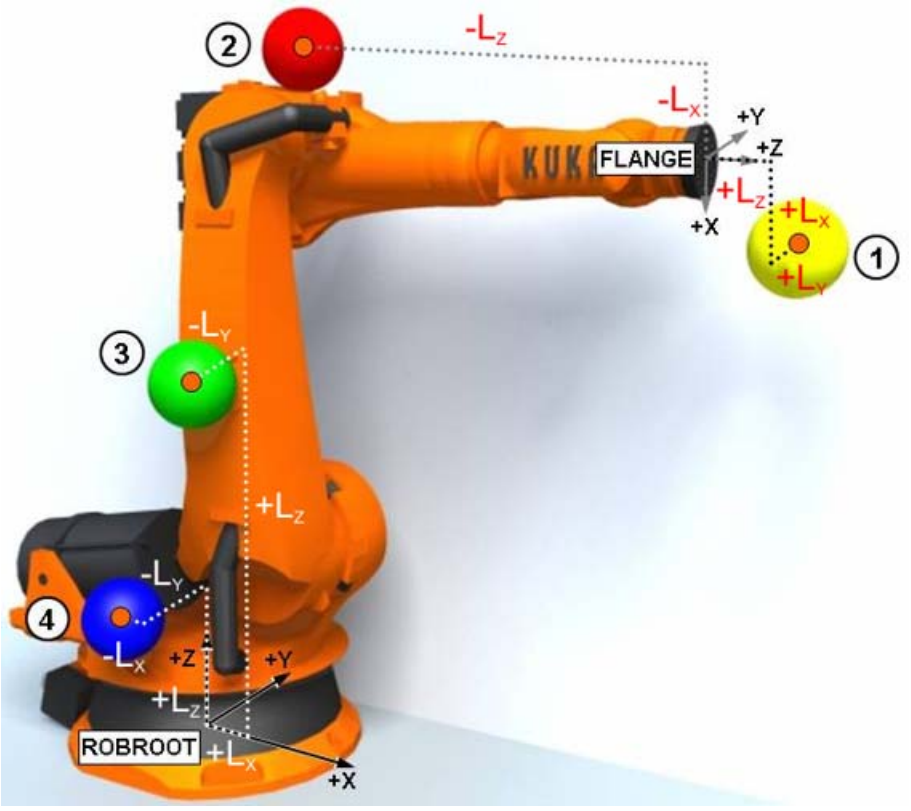

Fig. 2-2: Loads on the robot

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

Parameters

The load data are defined using the following parameters:

Parameter		Unit
Mass	m	kg
Distance to the center of gravity	L_x, L_y, L_z	mm
Mass moments of inertia at the center of gravity	I_x, I_y, I_z	kg m^2

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

Load	Reference system
Payload	FLANGE coordinate system
Supplementary load A3	FLANGE coordinate system A4 = 0°, A5 = 0°, A6 = 0°
Supplementary load A2	ROBROOT coordinate system A2 = -90°
Supplementary load A1	ROBROOT coordinate system A1 = 0°

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

2.3.2 Static overloading of the robot

Description

If the maximum permissible motor holding torques and gear torques 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
  - Reducing the mass
  - Using a robot with a higher rated payload

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

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 17). 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

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 physical 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
- Windows XP embedded

4.2 Installing or updating KUKA.LoadDataDetermination

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

Precondition
- Expert user group
- Software on KUKA.USB data stick

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

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

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

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:

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

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.

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.

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.

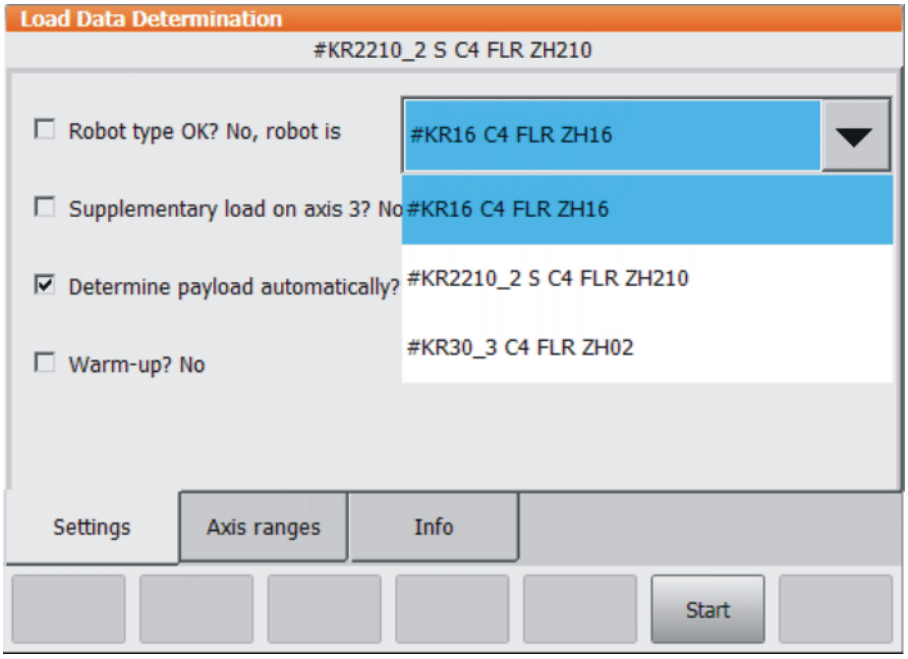

Fig. 5-1: Selection box

NOTICE 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.

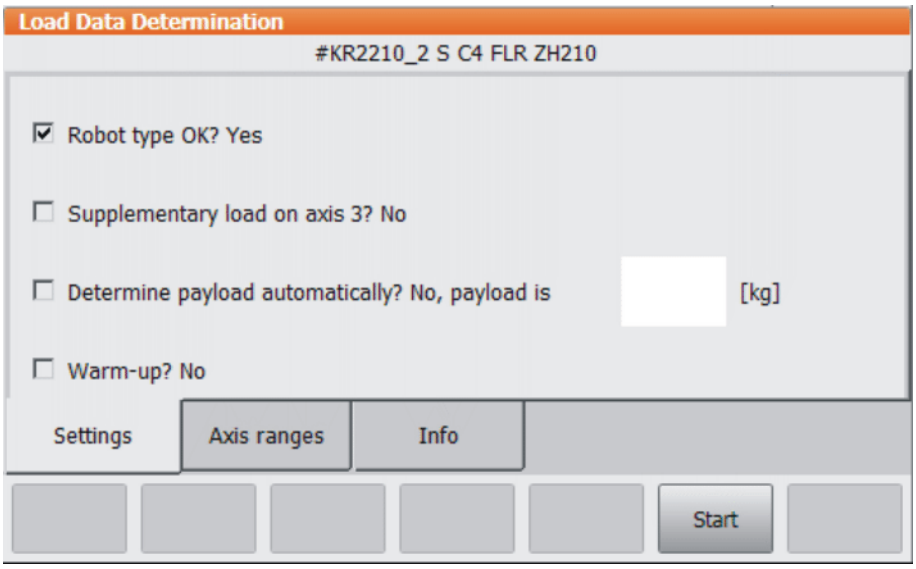

Fig. 5-2: “Settings” tab

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:

Maximum intervals

- **- 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

*.idf	DEFAULT.IDF		DEFAULT_WIH.IDF	
Axis	**Minimum**	**Maximum**	**Minimum**	**Maximum**
A1	0 degrees	0 degrees	0 degrees	0 degrees
A2	-90 degrees	-90 degrees	-90 degrees	-90 degrees
A3	88 degrees	92 degrees	90 degrees	94 degrees
A4	0 degrees	0 degrees	-40 degrees	40 degrees
A5	-40 degrees	40 degrees	30 degrees	110 degrees
A6	-60 degrees	60 degrees	-40 degrees	40 degrees

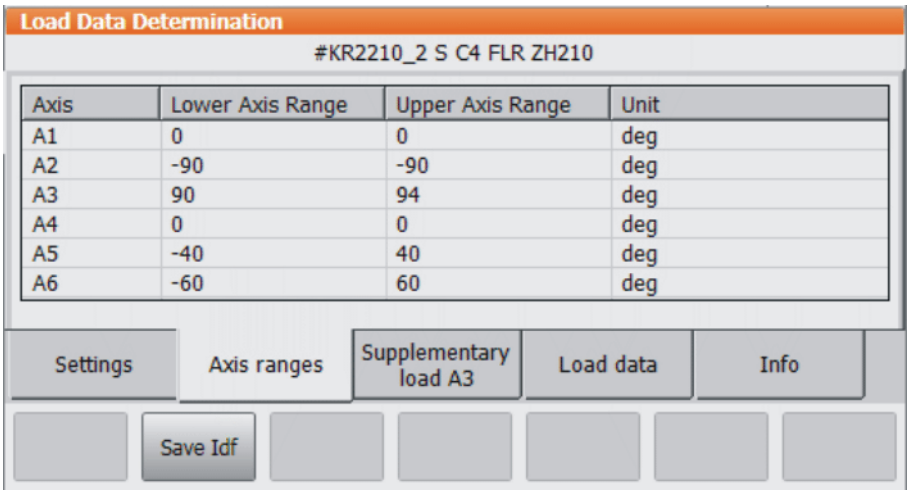

Fig. 5-3: “Axis ranges” tab

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 m^2 for Ix, Iy, Iz

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.

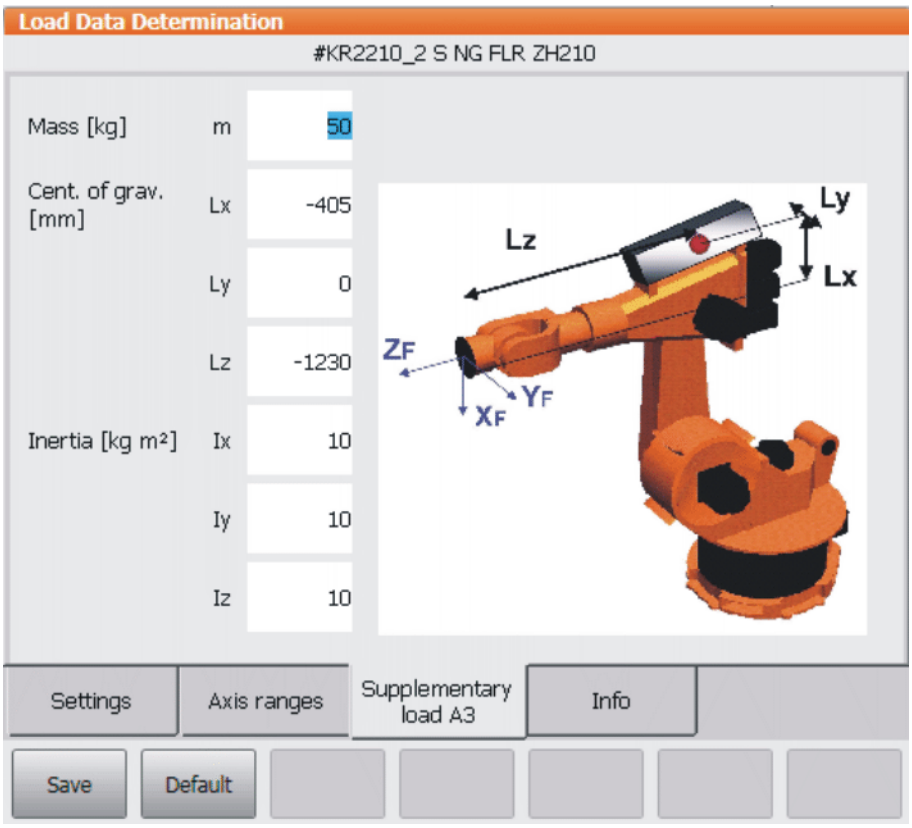

Fig. 5-4: “Supplementary load A3” tab

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.

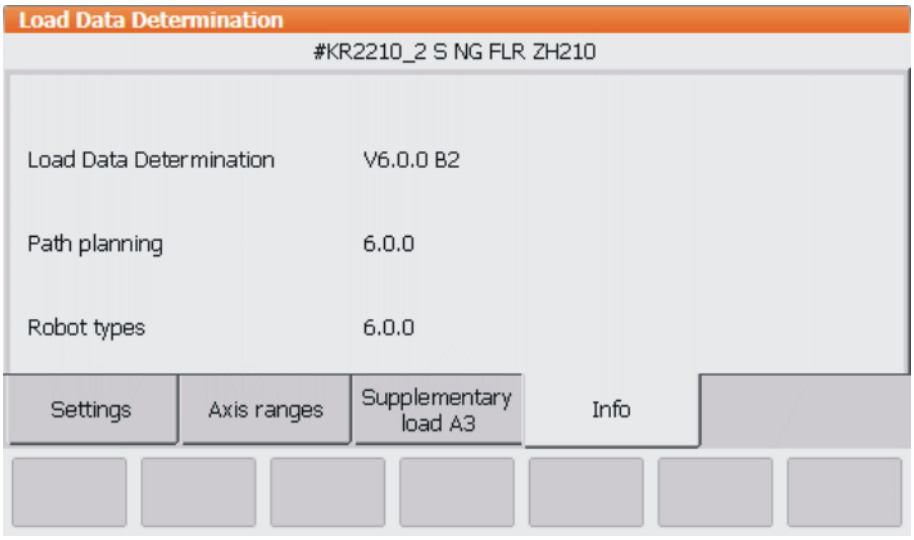

Fig. 5-5: “Info” tab

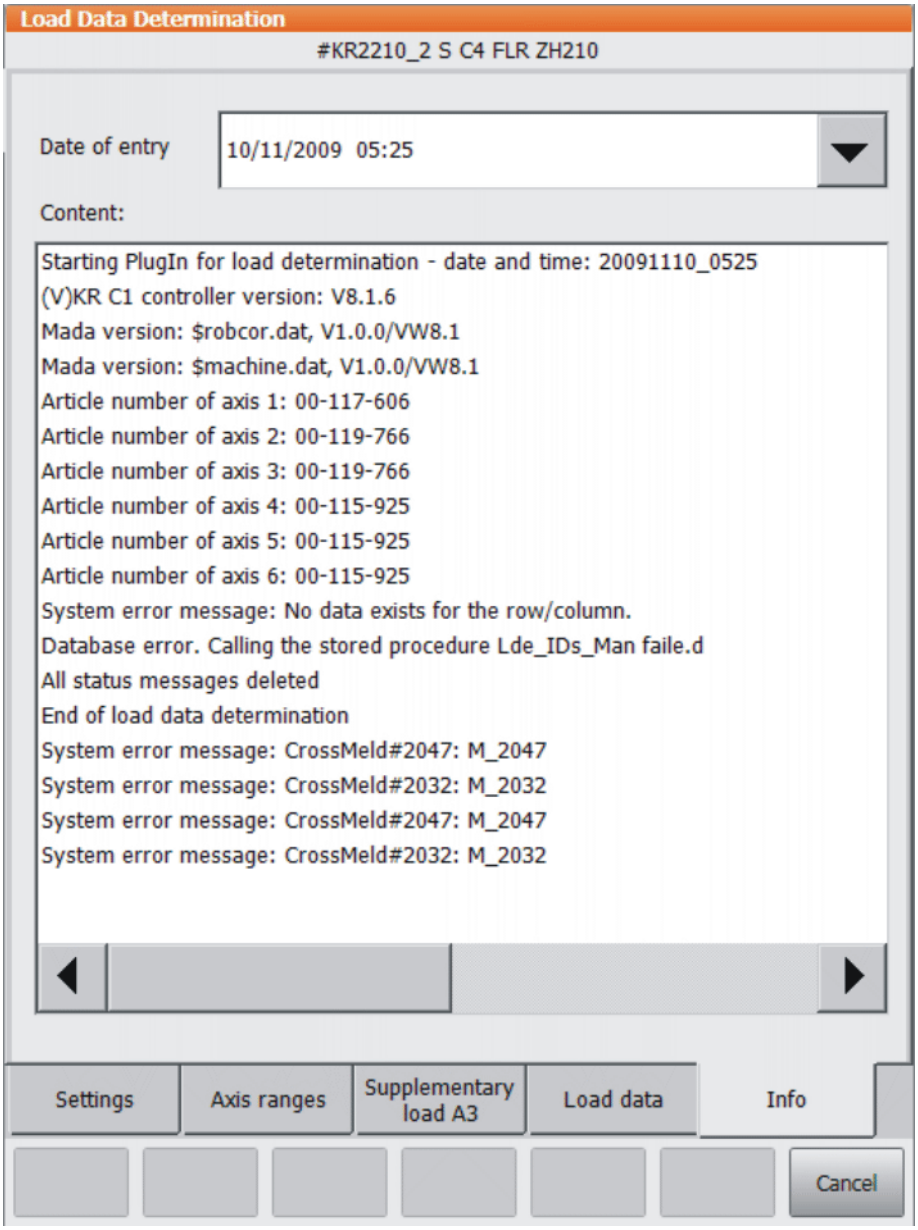

Fig. 5-6: Log entries

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\Roboter\IR_SPEC\L_IDENT.

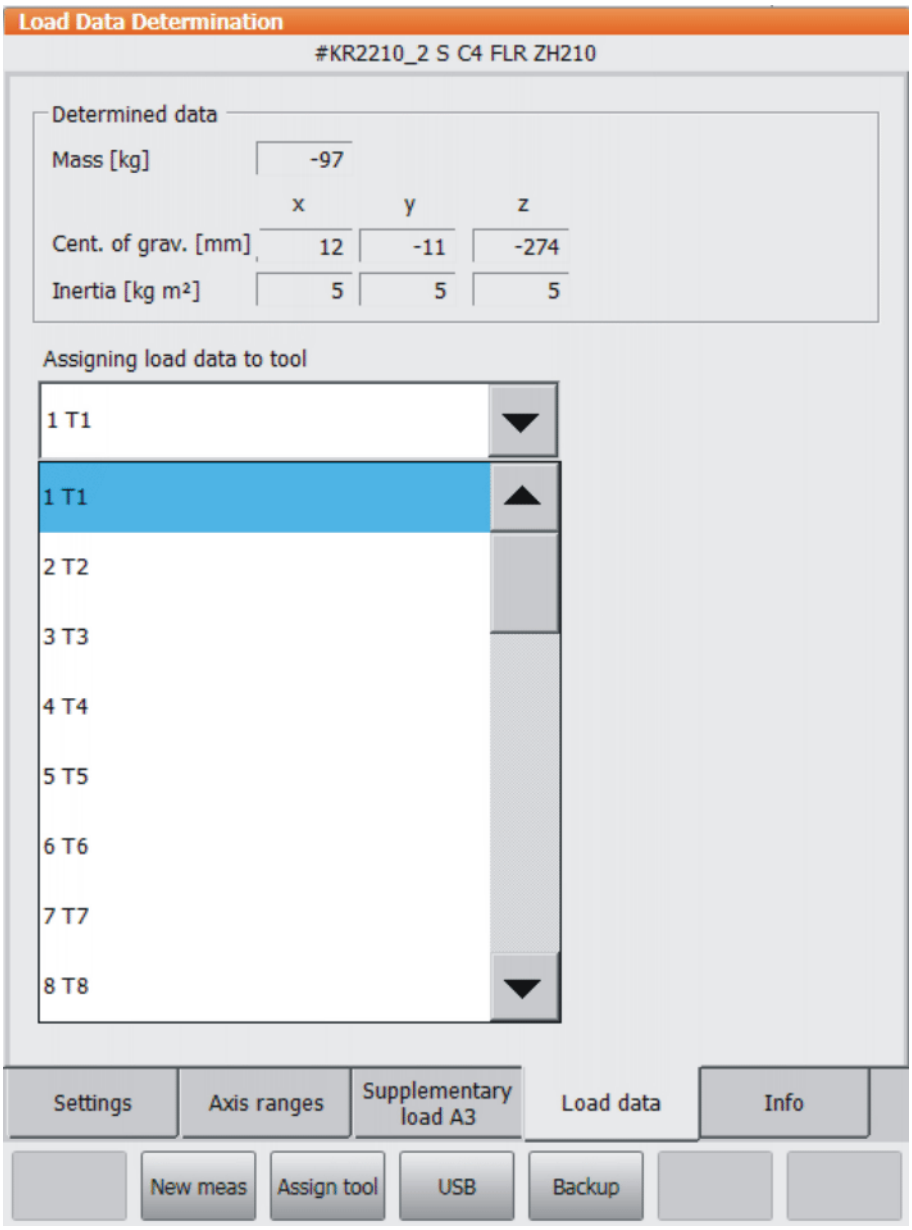

Fig. 5-7: “Load data” tab

6 Operation

6.1 Overview of load data determination

Overview

Step	Description
1	Assign payload data manually (Only for payloads below 20% of the rated load) (>>> 6.2 "Assigning payload data manually" Page 25)
2	External energy supply system – preparation (>>> 6.3 "External energy supply system" Page 26)
3	Start load data determination (>>> 6.4 "Carrying out load data determination" Page 26)
4	Make the required settings on the tabs. (>>> 6.4 "Carrying out load data determination" Page 26)
5	Carry out a test run (>>> 6.5 "Carrying out a test run" Page 27)
6	Run the measurement program. (>>> 6.6 "Carrying out the measurement run" Page 27)
7	Assign the load data (>>> 6.7 "Assigning the load data" Page 29)
8	Save the load data (>>> 6.8 "Saving the load data" Page 29)

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.

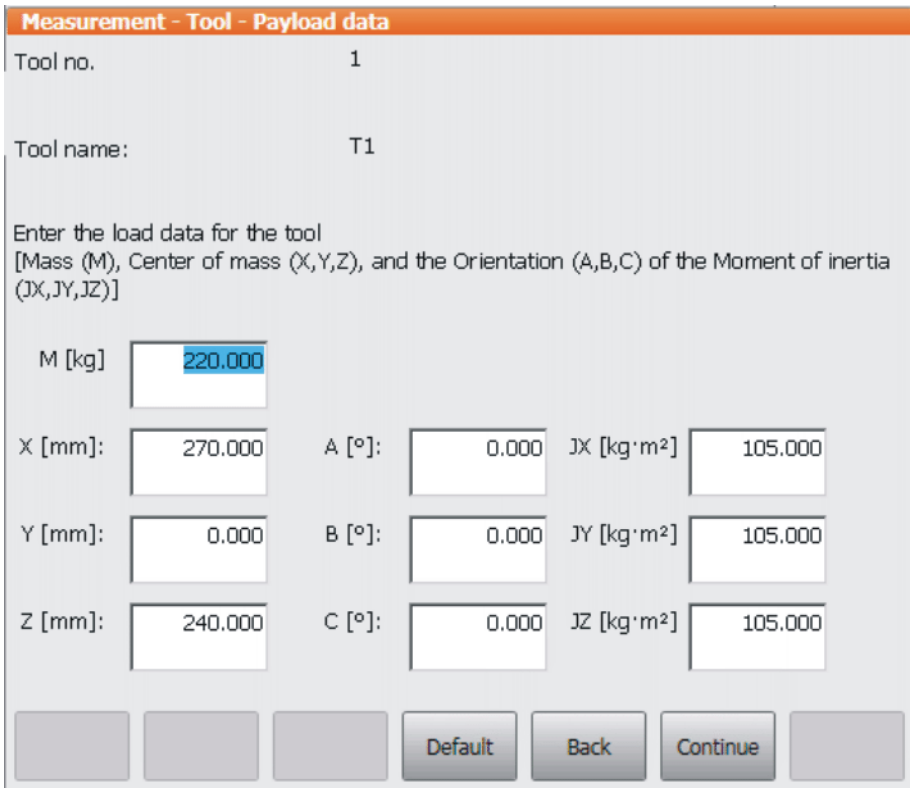

Fig. 6-1: Entering payload data

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 25).

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 15)
   (>>> 5.3.2 "“Axis ranges” tab" Page 17)

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.

3. Press **Start**.
   The system program is opened.

If there is no T2/Automatic mode available, switch to T1/Automatic External mode. For this, activate the file LdeExt.REG by double-clicking on it in the installation directory …\INTERNAT\KRCUPD.
The KRL program must be started in T1 mode. After selection, switch to Automatic External mode.

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 27)
   (>>> 6.6 "Carrying out the measurement run" Page 27)

6.5 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% override. This is followed by the complete mixed motion of axes A3 and A5 at 100% override in T1, otherwise at 30% override.

WARNING Always perform a test run before the measurement run. Severe physical injuries or damage to property may otherwise result.

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 27).

6.6 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.

Language	System program
Deutsch	$DE_IDENT.SRC
English	$EN_IDENT.SRC
Français	$FR_IDENT.SRC
Español	$ES_IDENT.SRC
Italiano	$IT_IDENT.SRC

⚠ WARNING The system programs “$DE_IDENT.SRC”, “$EN_IDENT.SRC”, “$FR_IDENT.SRC”, “$ES_IDENT.SRC” and “$IT_IDENT.SRC” must on no account be changed! Failure to observe this may result in death to persons, severe physical injuries or damage to property.

Description

The measurement program is executed as follows:

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

Procedure

The measurement run starts automatically after confirmation of the message “Start the measurement runs” with **OK**.

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. Severe physical 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”.

WARNING 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.
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.
Before confirming the message, always make sure that nobody is in the robot’s work envelope.
Failure to observe this precaution may result in severe physical injuries or considerable damage to property.

5. Press **OK** to confirm the message.
   At the end of the third calculation, the **Load data** (>>> 5.3.5 "“Load data” tab" Page 22) tab is displayed.

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.*serialnumber*.XML. This XML file is saved in the directory C:\KRC\Roboter\IR_SPEC\L_IDENT.

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 22).

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.

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.

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.

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)
- 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

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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