

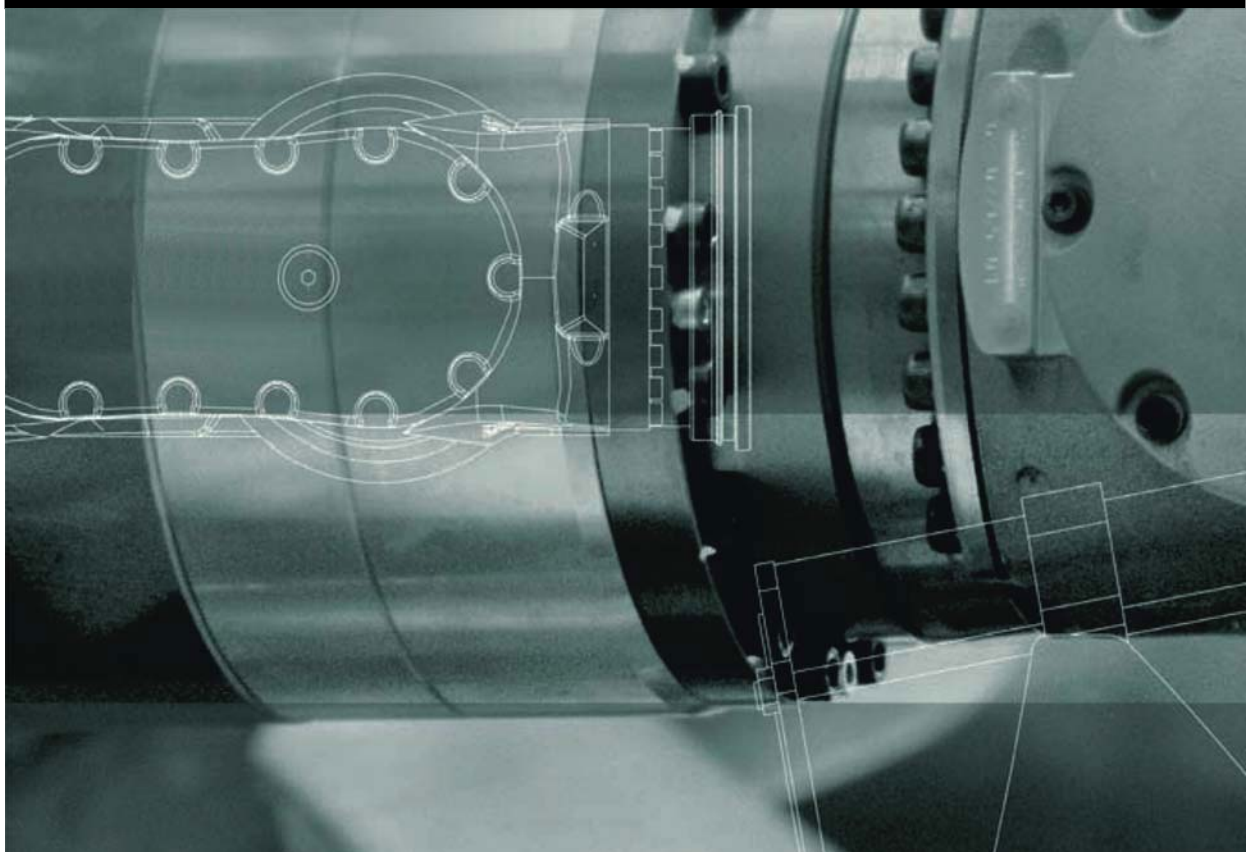
Robot Option

KUKA Roboter GmbH

Working Range Limitation A1

For Product Family KR AGILUS

Assembly and Operating Instructions



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Version: Option KR AGILUS Working Range Limitation A1 V1 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

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1 Introduction


1.1 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.

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

2 Purpose

2.1 Target group

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

- Advanced knowledge of mechanical engineering
- Advanced knowledge of electrical and electronic systems
- Knowledge of the robot controller system



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 working range limitation for axis 1 enables additional limitation of the working range.

The range of motion of axis 1 is limited by one or two supplementary stops that can be retrofitted by means of screws.

Operating the system within the limits of its intended use also involves continuous observance of the operating instructions of the robot and the options, with particular attention to the maintenance work.

Misuse

Any use or application deviating from the intended use is deemed to be impermissible misuse. The manufacturer cannot be held liable for any damage resulting from such use. The risk lies entirely with the user.

3 Product description

3.1 Overview

Description The range of motion of axis 1 is limited by one or two supplementary stops that can be retrofitted to the base frame using support segments.

This mechanical working range limitation takes effect if the software limit switches are exceeded.

Components The working range limitation consists of the following components:

- Support segment part 1
- Support segment part 2
- Support blocks
- Supports
- Supplementary stops

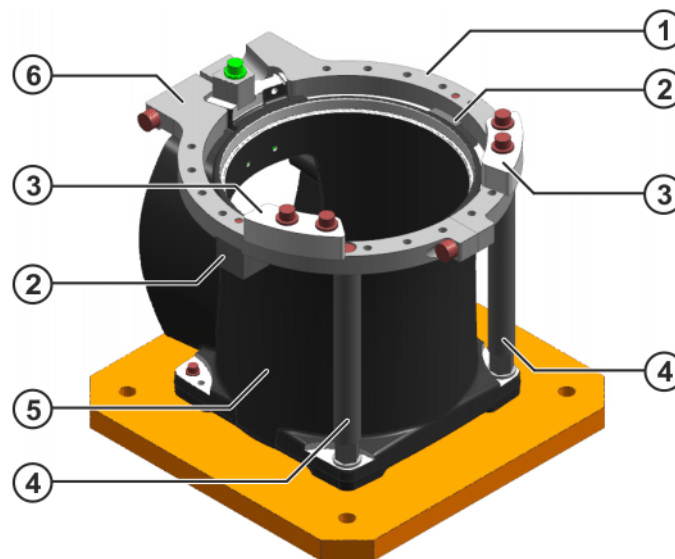


Fig. 3-1: Components

- | | | | |
|---|------------------------|---|------------------------|
| 1 | Support segment part 2 | 4 | Support |
| 2 | Support block | 5 | Base frame |
| 3 | Supplementary stop | 6 | Support segment part 1 |

4 Technical data

4.1 Basic data, working range limitation A1

Basic data

Type	Working range limitation A1
Total weight	4.5 kg

Ambient temperature

Operation	283 K to 328 K (+10 °C to +55 °C)
Storage and transportation	233 K to 333 K (-40 °C to +60 °C)
Humidity rating	DIN EN 60721-3-3, Class 3K3

5 Safety

For this assembly or option, the safety instructions of the higher-level system with which it is operated apply. In addition, the safety instructions contained in this documentation apply. All applicable safety measures required by national law, as well as all regulations and ordinances for the avoidance of personal injury and material damage, must likewise be observed at all times.

The relevant personal protective equipment must be worn during performance of all work on the system, system components or equipment.

⚠ WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP device.
Warn all persons concerned before starting to put it back into operation.

NOTICE When installing components and assemblies, the fastening screws (standard, strength class 8.8) must be tightened with the specified KUKA tightening torque. Exceptions to this will be clearly marked.
The specified screw sizes and strength classes are those valid at the copy deadline. The specifications contained in the Parts Catalog are, however, always to be taken as the most up-to-date information.
Screws of strength class 10.9 and higher may only be tightened once with the rated tightening torque. When the screws are next slackened they must be replaced with new ones.

⚠ WARNING The standard stops of all axes must not be removed. The working range limitation is always installed in addition to the existing stops.
Death, severe injuries or considerable damage to property may otherwise result.

NOTICE The software limit switches must always be adapted to the new mechanical range of motion. If they are not adapted, an operating error could cause the axis concerned to hit the mechanical stop, resulting in damage to property.

NOTICE If the manipulator or an external axis hits an obstruction or a mechanical end stop or axis range limitation, this can result in material damage to the industrial robot. The manipulator must be taken out of operation and KUKA Roboter GmbH must be consulted before it is put back into operation (>>> 12 "KUKA Service" Page 39).

6 Planning

6.1 Angle settings, working range limitation A1

Description

The available working range limits are shown in the following illustration (>>> Fig. 6-2). The angle of $\pm 170^\circ$ is achieved when no supplementary stop is installed and thus corresponds to the standard design. The supplementary stops can be used to limit the angle of the working range in 7.5° steps.

Under no circumstances may the standard stop be removed or relocated.

Depending on the installation position of the supplementary stops, various angles can be restricted (>>> Fig. 6-1):

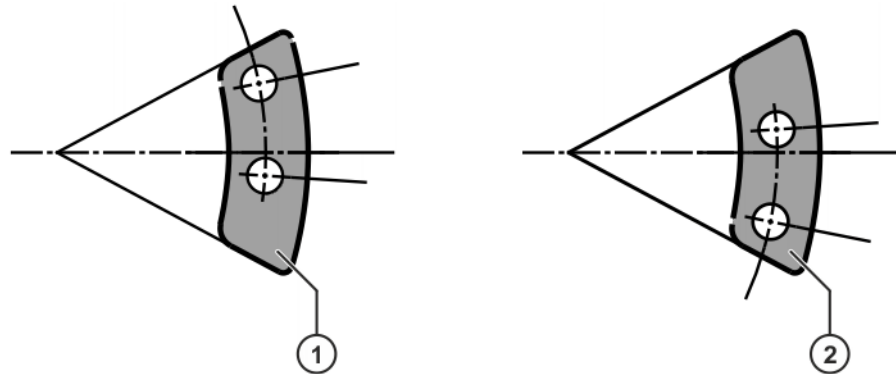


Fig. 6-1: Installation position, supplementary stop

Item	Installation position	Largest angle setting	Smallest angle setting
1	A (both stops)	220°	10°
2	B (both stops)	235°	25°
-	A and B B and A (one stop each)	220° 235°	10° 25°

The mounting positions of the stops can be freely combined.

Installation position A

The following diagram (>>> Fig. 6-2) shows the available angles for installation position A in the plus and minus directions. The mounting positions of the stops can be freely combined, for example, position 5 with 11 or position 2 with 16.

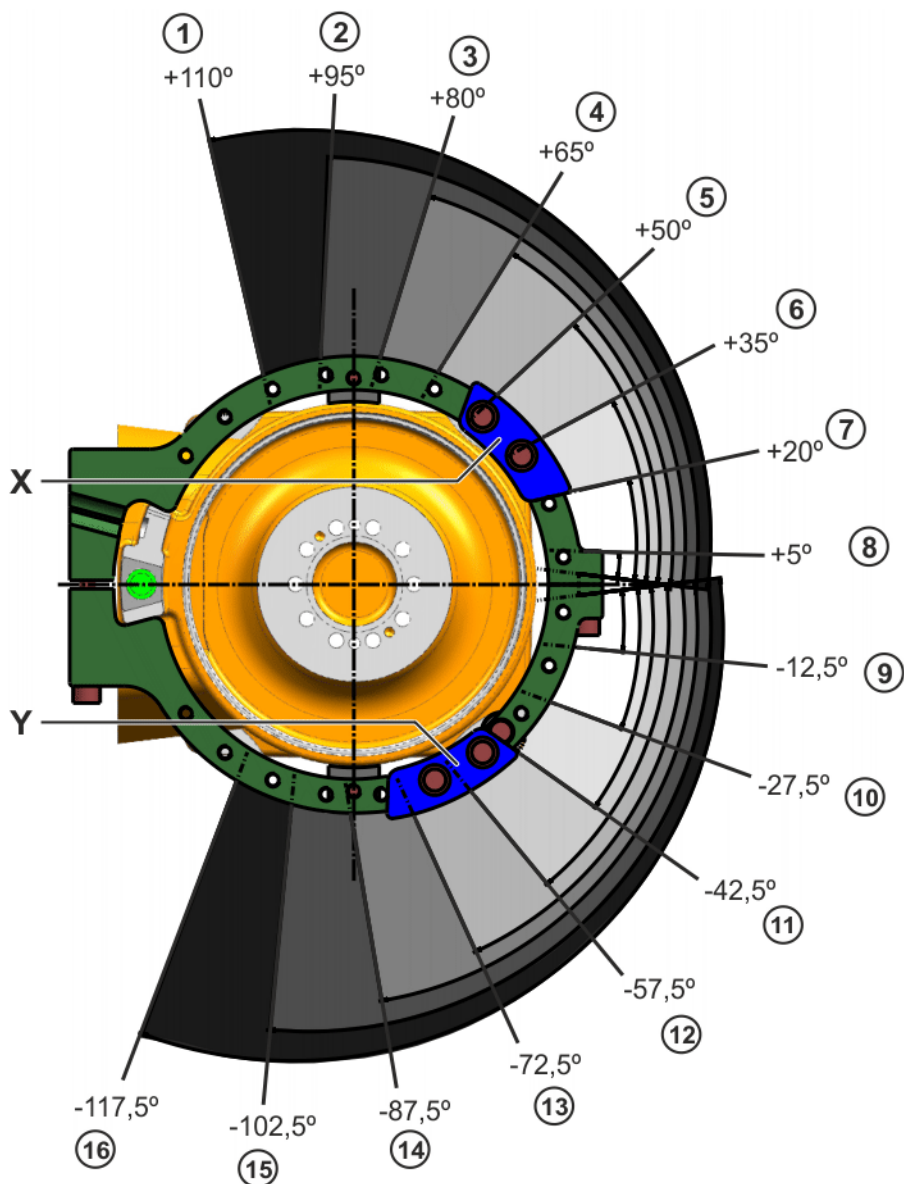


Fig. 6-2: Available angles for installation position A

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
1	9	+110°	-12.5°
2	10	+95°	-27.5°
3	11	+80°	-42.5°
4	12	+65°	-57.5°
5	13	+50°	-72.5°
6	14	+35°	-87.5°
7	15	+20°	-102.5°
8	16	+5°	-117.5°
1	none	+110°	-170°
2	none	+95°	-170°
3	none	+80°	-170°
4	none	+65°	-170°
5	none	+50°	-170°

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
6	none	+35°	-170°
7	none	+20°	-170°
8	none	+5°	-170°
none	9	+170°	-12.5°
none	10	+170°	-27.5°
none	11	+170°	-42.5°
none	12	+170°	-57.5°
none	13	+170°	-72.5°
none	14	+170°	-87.5°
none	15	+170°	-102.5°
none	16	+170°	-117.5°

Installation position B

The following diagram (>>> Fig. 6-3) shows the available angles for installation position B in the plus and minus directions. The mounting positions of the stops can be freely combined, for example, position 5 with 11 or position 2 with 16.

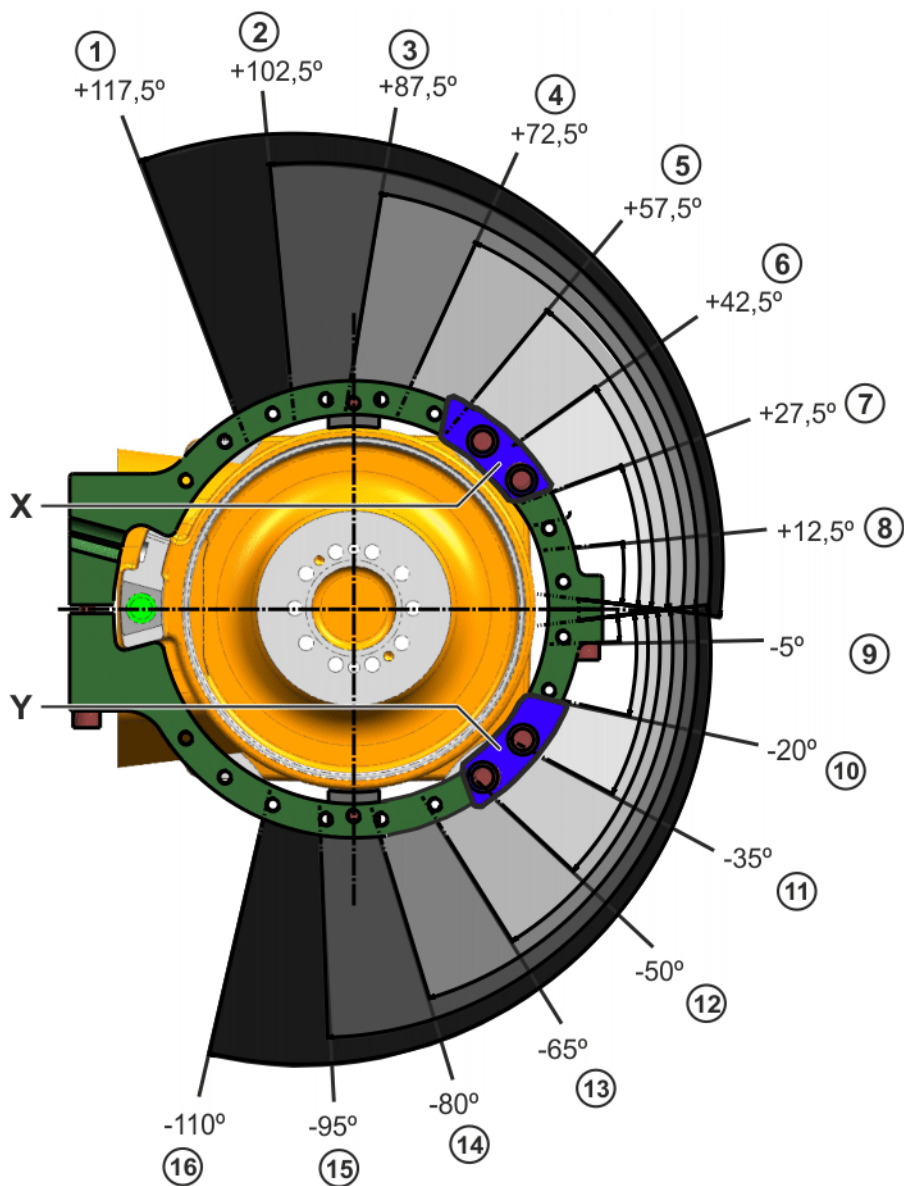


Fig. 6-3: Available angles for installation position B

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
1	9	+117.5°	-5°
2	10	+102.5°	-20°
3	11	+87.5°	-35°
4	12	+72.5°	-50°
5	13	+57.5°	-65°
6	14	+42.5°	-80°
7	15	+27.5°	-95°
8	16	+12.5°	-110°
1	none	+117.5°	-170°
2	none	+102.5°	-170°
3	none	+87.5°	-170°
4	none	+72.5°	-170°
5	none	+57.5°	-170°

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
6	none	+42.5°	-170°
7	none	+27.5°	-170°
8	none	+12.5°	-170°
none	9	+170°	-5°
none	10	+170°	-20°
none	11	+170°	-35°
none	12	+170°	-50°
none	13	+170°	-65°
none	14	+170°	-80°
none	15	+170°	-95°
none	16	+170°	-110°

Installation position A-B

The following diagram (>>> Fig. 6-4) shows the available angles for installation position A-B in the plus and minus directions. The mounting positions of the stops can be freely combined, for example, position 5 with 11 or position 2 with 16.

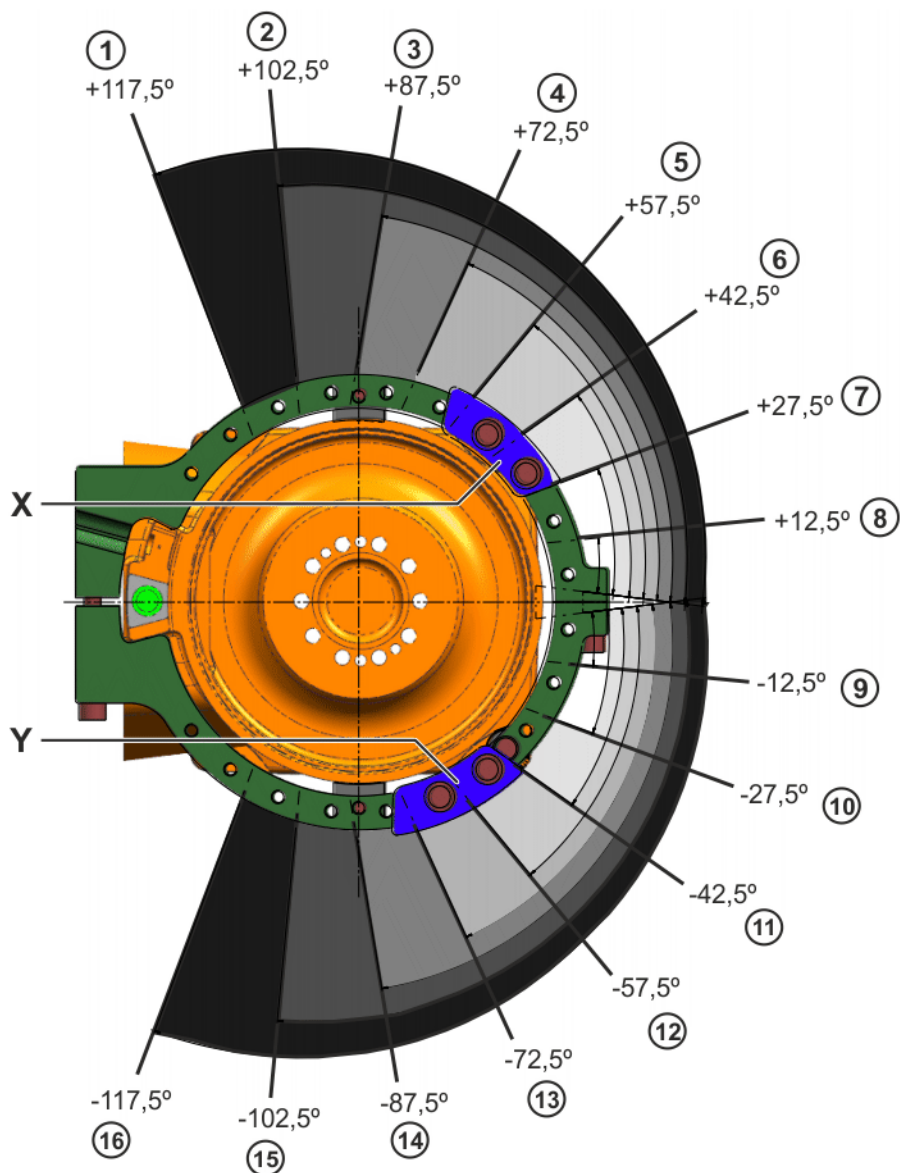


Fig. 6-4: Available angles for installation position A-B

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
		Angle 1	Angle 2
1	9	+117.5°	-12.5°
2	10	+102.5°	-27.5°
3	11	+87.5°	-42.5°
4	12	+72.5°	-57.5°
5	13	+57.5°	-72.5°
6	14	+42.5°	-87.5°
7	15	+27.5°	-102.5°
8	16	+12.5°	-117.5°
1	none	+117.5°	-170°
2	none	+102.5°	-170°
3	none	+87.5°	-170°
4	none	+72.5°	-170°
5	none	+57.5°	-170°

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
6	none	+42.5°	-170°
7	none	+27.5°	-170°
8	none	+12.5°	-170°
none	9	+170°	-12.5°
none	10	+170°	-27.5°
none	11	+170°	-42.5°
none	12	+170°	-57.5°
none	13	+170°	-72.5°
none	14	+170°	-87.5°
none	15	+170°	-102.5°
none	16	+170°	-117.5°

Installation position B-A

The following diagram (>>> Fig. 6-5) shows the available angles for installation position A-B in the plus and minus directions. The mounting positions of the stops can be freely combined, for example, position 5 with 11 or position 2 with 16.

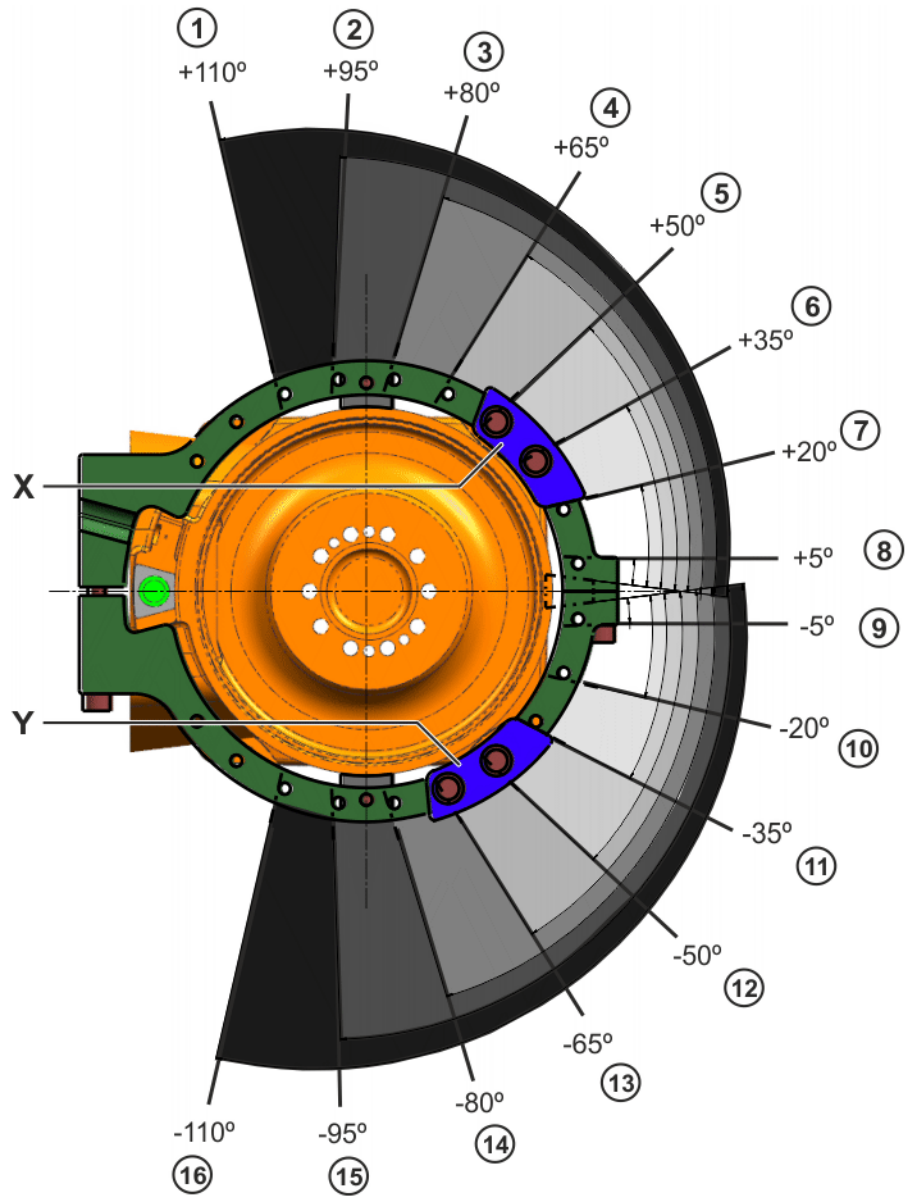


Fig. 6-5: Available angles for installation position B-A

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
1	9	+110°	-5°
2	10	+95°	-20°
3	11	+80°	-35°
4	12	+65°	-50°
5	13	+50°	-65°
6	14	+35°	-80°
7	15	+20°	-95°
8	16	+5°	-110°
1	none	+110°	-170°
2	none	+95°	-170°
3	none	+80°	-170°
4	none	+65°	-170°
5	none	+50°	-170°

Installation position of supplementary stop X	Installation position of supplementary stop Y	Remaining angle in terms of software display	
6	none	+35°	-170°
7	none	+20°	-170°
8	none	+5°	-170°
none	9	+170°	-5°
none	10	+170°	-20°
none	11	+170°	-35°
none	12	+170°	-50°
none	13	+170°	-65°
none	14	+170°	-80°
none	15	+170°	-95°
none	16	+170°	-110°

7 Transportation

The component must be suitably and properly packaged for transportation. The components must be protected against damage with shock-resistant and break-proof packaging.

The following measures are to be taken before assemblies and individual components are transported:

- Clean components.
- Assign small parts to their respective components in plastic bags to prevent them from getting lost.
- Protect components against impacts and slipping; fill gaps with suitable approved padding materials.

Mark transport cases and packing according to the sensitivity of their contents (e.g. TOP, FRAGILE, DO NOT BEND) and attach labels to ensure correct transportation (e.g. indication of center of gravity). In addition to these measures, the regulations and conditions of the company entrusted with the transportation are to be observed.

8 Start-up and recommissioning

8.1 Installing working range limitation A1

Description The working range limitation for A1 is mounted on the base frame of the robot.

Precondition

- The robot is in its transport position.
- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.

⚠ WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP device.
Warn all persons concerned before starting to put it back into operation.

Procedure

1. Remove the front 2 M10x35-8.8 Allen screws with conical spring washers from the base frame and mounting base.
2. Insert 2 supports together with conical spring washers into the holes that have thus become available, and tighten; tightening torque $M_A = 45.0 \text{ Nm}$ (>>> Fig. 8-1).

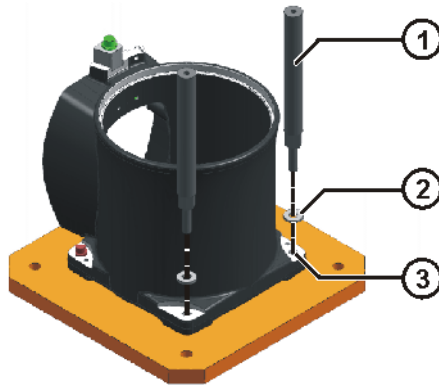


Fig. 8-1: Inserting supports

- | | |
|-------------------------|--------|
| 1 Support | 3 Hole |
| 2 Conical spring washer | |
3. Position support segment part 1 on the right-hand side of the base frame (viewed from the component) (>>> Fig. 8-2).
 4. Position support segment part 2 on the left-hand side of the base frame (viewed from the component).
 5. Join the 2 support segments at the front of the base frame:
Insert 1 M10x40-10.9 Allen screw into support segment part 1 and fasten with torque wrench; tightening torque $M_A = 60.0 \text{ Nm}$.
 6. Fasten the support segments to the supports with 1 M8x20-10.9 Allen screw in each case; tightening torque $M_A = 31.0 \text{ Nm}$.
Apply counterforce to the hexagonal part of the supports when tightening the Allen screws.
 7. Join the 2 support segments at the rear of the base frame:
Insert 1 M10x80-10.9 Allen screw into support segment part 1 and fasten with torque wrench; tightening torque $M_A = 60.0 \text{ Nm}$.
Ensure that the support segments rest evenly on the base frame.

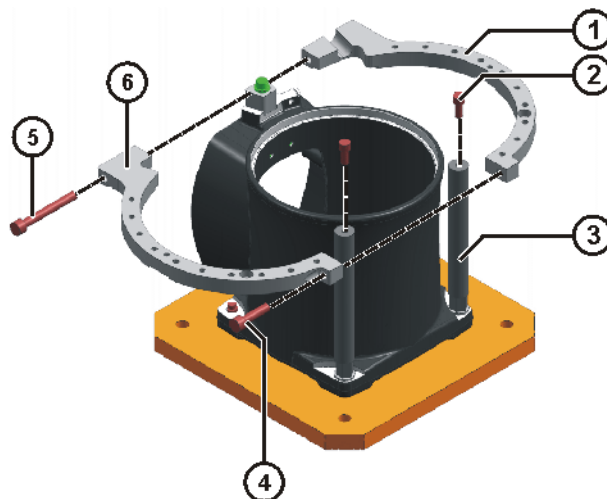


Fig. 8-2: Fastening support segments

- 1 Support segment part 2
 - 2 M8x20-10.9 Allen screw
 - 3 Support
 - 4 M10x40-10.9 Allen screw
 - 5 M10x80-10.9 Allen screw
 - 6 Support segment part 1
8. Fasten each of the support blocks by means of 1 M8x35-10.9 Allen screw inserted into the slot of the support segment from below; tightening torque $M_A = 31.0 \text{ Nm}$ (>>> Fig. 8-3).
 9. Fasten the supplementary stops to the support segments at the desired angle setting with 2 support sleeves and 2 M8x35-10.9 Allen screws each; tightening torque $M_A = 31.0 \text{ Nm}$.

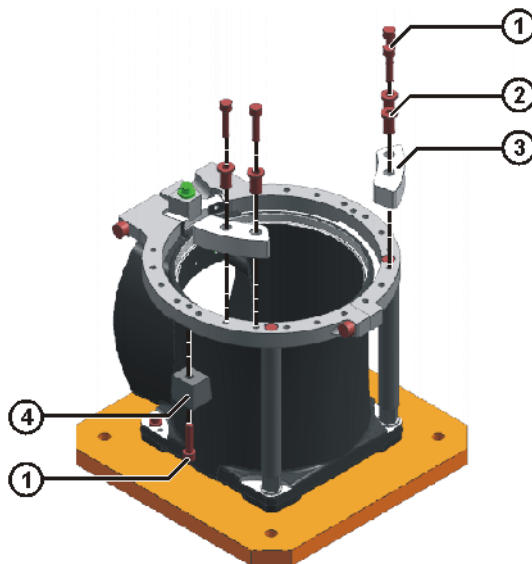


Fig. 8-3: Fastening supplementary stop and support block

- 1 M8x35-10.9 Allen screws
- 2 Support sleeve
- 3 Supplementary stop
- 4 Support block

NOTICE To check whether the supplementary stops have been aligned correctly, a test run must be carried out in T1 mode after installation of the working range limitation.

9 Maintenance

9.1 Maintaining the working range limitation


Description If used for its intended purpose, the supplementary stop requires minimal maintenance, i.e. visual inspections are recommended. In certain operating conditions, regular visual inspections may allow timely detection of changes. This enables early detection of damage, thereby preventing failure of components and assemblies. Exchange damaged components or assemblies.

9.2 Cleaning the working range limitation

Description The supplementary stops must be cleaned at regular intervals. The supplementary stops must be cleaned in compliance with the instructions given here in order to prevent damage. These instructions only refer to the supplementary stop.

The following must be taken into consideration when using cleaning agents and carrying out cleaning work:

- Only use solvent-free, water-soluble cleaning agents.
- Do not use flammable cleaning agents.
- Do not use aggressive cleaning agents.
- Do not use steam or refrigerants for cleaning.
- Do not use high-pressure cleaners.

 The section "Cleaning the robot" in the robot operating instructions must be observed when cleaning the working range limitation.

Procedure

1. Shut down the robot.
2. Clean the supplementary stops.
3. Fully remove all cleaning agents.
4. Clean any areas of corrosion and reapply corrosion protection.
5. Remove cleaning agents and equipment from the workspace of the robot.
6. Dispose of cleaning agents properly.

10 Decommissioning, storage and disposal


10.1 Decommissioning

Description This section describes all the work required for decommissioning the working range limitation if the working range limitation is to be removed. After decommissioning, it is prepared for storage or for transportation to a different location.

Depending on the installation area, it may be necessary to move the robot between the individual work steps. Observe the applicable instructions.

Precondition

- The removal site is freely accessible.
- There is no hazard posed by system components.
- The robot can be moved in axis 1.

 WARNING	When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.
--	---

Procedure

1. Unscrew 2 M8x35-10.9 Allen screws and 2 support sleeves from each of the supplementary stops and remove the supplementary stops (>>> Fig. 10-1).
2. Unscrew 1 M8x35-10.9 Allen screw from each of the support blocks and remove the support blocks.
3. Unscrew 1 M10x80-10.9 Allen screw from support segment part 1.
4. Unscrew 2 M8x20-10.9 Allen screws from each of the supports.
5. Unscrew 1 M10x40-10.9 Allen screw from support segment part 1 at the front.
6. Remove both support segments and supports.
7. Insert 2 M10x35-8.8 Allen screws into the holes and tighten with torque wrench. Gradually increase the tightening torque to a value of 45 Nm.

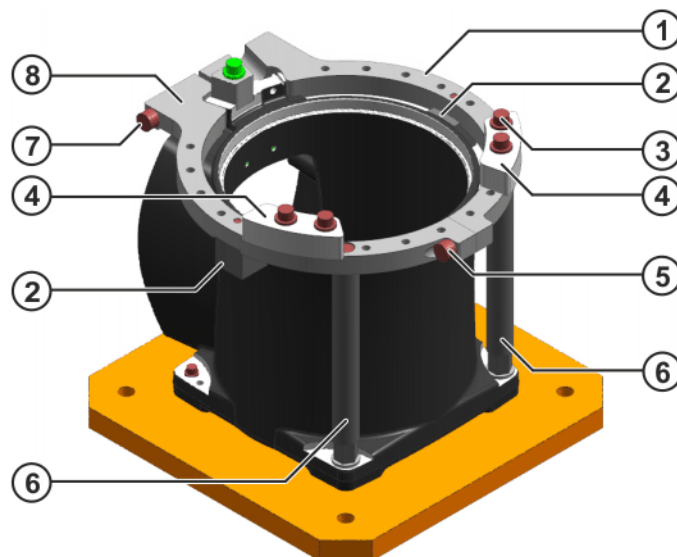


Fig. 10-1: Removing working range limitation A1

- 1 Support segment part 2
- 2 Support block
- 3 M8x35-10.9 Allen screw
- 4 Supplementary stop
- 5 M10x40-10.9 Allen screw
- 6 Support
- 7 M10x80-10.9 Allen screw
- 8 Support segment part 1

10.2 Storage

Description

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

- Clean the components and protect against corrosion.
- The place of storage must be as dry and dust-free as possible.
- Protect mechanical components against damage.
- Avoid temperature fluctuations.
- Avoid wind and drafts.
- Avoid condensation.
- Use appropriate packaging that can withstand the expected environmental conditions.
- Do not leave any loose parts on the product, especially ones that might knock against other parts.
- Do not expose to direct sunlight.
- Observe and comply with the permissible temperature ranges for storage.
- Select a storage location in which the packaging materials cannot be damaged.

Procedure

1. Remove working range limitation A1.
2. Visually inspect the components.
3. Remove any dirt.
4. Protect the components against corrosion.
5. Seal components with a dust-proof seal.

6. Store components in accordance with the storage instructions.

10.3 Disposal

Description

When the components reach the end of their useful life, they can be removed and disposed of. The materials must be disposed of in accordance with the pertinent regulations and, where possible, separated and sorted for recycling.

The following table provides an overview of the materials used.

Material, designation	Subassembly, component	Remark
Steel	Screws, supports, support blocks, support segments	Sort before disposal
PE	Supplementary stop	-

11 Appendix

11.1 Tightening torque

Tightening torque The following tightening torques are valid for screws and nuts where no other specifications are given.

Screw size	Strength class	
	8.8	10.9
M3	1.2 Nm	1.6 Nm
M4	2.8 Nm	3.7 Nm
M5	5.6 Nm	7.5 Nm
M6	9.5 Nm	12.5 Nm
M8	23.0 Nm	31.0 Nm
M10	45.0 Nm	60.0 Nm
M12	78.0 Nm	104.0 Nm
M14	125.0 Nm	165.0 Nm
M16	195.0 Nm	250.0 Nm
M20	370.0 Nm	500.0 Nm
M24	640.0 Nm	860.0 Nm
M30	1330.0 Nm	1700.0 Nm

Tighten M5 domed cap nuts with a torque of 4.2 Nm.

12 KUKA Service

12.1 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

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.

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