ROBOTICS

Product manual

IRP

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Product manual

IRP A
IRP B
IRP C
IRP K
IRP R
IRP L

OmniCore

Document ID: 3HAC088963-001

Revision: B

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Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the manipulator system
- maintenance of the manipulator system
- mechanical and electrical repair of the manipulator system.

It also contains reference information for all procedures described in the manual.

Usage

This manual should be used during:

- installation, from lifting the manipulator to its work site and securing it to the foundation, to making it ready for operation
- maintenance work
- operation
- repair work and calibration.

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

A maintenance/repair/installation technician working with an ABB manipulator must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.

Product manual scope

The manual covers covers all variants and designs of the IRP. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Safety	Safety information that must be read through before performing any installation or service work on the manipulator. Contains general safety aspects as well as more specific information on how to avoid personal injuries and damage to the product.
System description	Useful information when performing installation.
Installation and commissioning	Required information about lifting and installation of the manipulator.

Continues on next page

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Chapter	Contents
Maintenance	Step-by-step procedures that describe how to perform the maintenance of manipulator. Based on a maintenance schedule that may be used to plan periodical maintenance.
Repair	Step-by-step procedures that describe how to perform repair activities of the manipulator. Based on available spare parts.
Operation	Step-by-step procedures for starting and stopping programs.
Calibration information	Procedures that do not require specific calibration equipment. General information about calibration.
Decommissioning	Environmental information about the manipulator and its components.
Reference information	Useful information when performing installation, maintenance or repair work. Includes lists of necessary tools, additional documents, safety standards etc.

References

Reference	Document ID
Product manual, spare parts - IRP	*3HAC088964-001*
Product specification - IRBP /D2009	*3HAC088965-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller [i]	*3HAC031045-001*
Product manual - OmniCore V250XT Type B	*3HAC087112-001*
Product manual - OmniCore V400XT	*3HAC081697-001*
Operating manual - OmniCore	*3HAC065036-001*
Operating manual - Integrator's guide OmniCore	*3HAC065037-001*
Application manual - Additional axes	*3HAC082287-001*
Technical reference manual - System parameters	*3HAC065041-001*
Operating manual - RobotStudio	*3HAC032104-001*

[i] This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Circuit diagrams

Product	Article numbers for circuit diagrams
Circuit diagram - IRP C	*3HAC091012-001*
Circuit diagram - IRP L	*3HAC091012-002*
Circuit diagram - IRP K/R	*3HAC091012-003*
Circuit diagram - IRP A	*3HAC091012-004*
Circuit diagram - IRP B	*3HAC091012-005*

Revisions

Revision	Description
A	First edition.

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Revision	Description
B	Published in release 24C. The following updates are done in this revision: • Added the missing link to the safety configuration template, see *Safety configuration on page 93*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

Manipulators, controllers, DressPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.

Continues on next page

- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

How to read the product manual

Reading the procedures

The procedures contain references to figures, tools, material, and so on. The references are read as described below.

References to figures

The procedures often include references to components or attachment points located on the manipulator/controller. The components or attachment points are marked with *italic text* in the procedures and completed with a reference to the figure where the current component or attachment point is shown.

The denomination in the procedure for the component or attachment point corresponds to the denomination in the referenced figure.

The table below shows an example of a reference to a figure from a step in a procedure.

	Action	Note/Illustration
8.	Remove the *rear attachment screws, gearbox.*	Shown in the figure *Location of gearbox on page xx*.

References to required equipment

The procedures often include references to equipment (spare parts, tools, etc.) required for the different actions in the procedure. The equipment is marked with *italic text* in the procedures and completed with a reference to the section where the equipment is listed with further information, that is article number and dimensions.

The designation in the procedure for the component or attachment point corresponds to the designation in the referenced list.

The table below shows an example of a reference to a list of required equipment from a step in a procedure.

	Action	Note/Illustration
3.	Fit a new *sealing, axis 2* to the gearbox.	Art. no. is specified in *Required equipment on page xx.*

Safety information

The manual includes a separate safety chapter that must be read through before proceeding with any service or installation procedures. All procedures also include specific safety information when dangerous steps are to be performed.

Read more in the chapter *Safety on page 15*.

Illustrations

The robot is illustrated with general figures that does not take painting or protection type in consideration.

Likewise, certain work methods or general information that is valid for several robot models, can be illustrated with illustrations that show a different robot model than the one that is described in the current manual.

1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

The information does not cover how to design, install and operate a robot system, nor does it cover all peripheral equipment that can influence the safety of the robot system.

In particular, liability cannot be accepted if injury or damage has been caused for any of the following reasons:

- Use of the robot in other ways than intended.
- Incorrect operation or maintenance.
- Operation of the robot when the safety devices are defective, not in their intended location or in any other way not working.
- When instructions for operation and maintenance are not followed as intended.
- Non-authorized design modifications of the robot.
- Repairs on the robot and its spare parts carried out by in-experienced or non-qualified personnel.
- Foreign objects.
- Force majeure.

Spare parts and equipment

ABB supplies original spare parts and equipment which have been tested and approved for their intended use. The installation and/or use of non-original spare parts and equipment can negatively affect the safety, function, performance, and structural properties of the robot. ABB is not liable for damages caused by the use of non-original spare parts and equipment.

1.1.2 Requirements on personnel

General

Only personnel with appropriate training are allowed to install, maintain, service, repair, and use the robot. This includes electrical, mechanical, hydraulics, pneumatics, and other hazards identified in the risk assessment.

Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, service, repair, or use the robot.

The plant liable must make sure that the personnel is trained on the robot, and on responding to emergency or abnormal situations.

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

This section specifies all safety signals used in the user manuals. Each signal consists of:

- A caption specifying the hazard level (DANGER, WARNING, or CAUTION) and the type of hazard.
- Instruction about how to reduce the hazard to an acceptable level.
- A brief description of remaining hazards, if not adequately reduced.

Hazard levels

The table below defines the captions specifying the hazard levels used throughout this manual.

Symbol	Designation	Significance
	DANGER	Signal word used to indicate an imminently hazardous situation which, if not avoided, will result in serious injury.
	WARNING	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in serious injury.
	ELECTRICAL SHOCK	Signal word used to indicate a potentially hazardous situation related to electrical hazards which, if not avoided, could result in serious injury.
	CAUTION	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in slight injury.
	ELECTROSTATIC DISCHARGE (ESD)	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in severe damage to the product.
	NOTE	Signal word used to indicate important facts and conditions.

Continues on next page

1.2.1 Safety signals in the manual
Continued

Symbol	Designation	Significance
	TIP	Signal word used to indicate where to find additional information or how to do an operation in an easier way.

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

This section describes safety symbols used on labels (stickers) on the manipulator.

Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.

> **Note**
>
> The symbols on the labels on the product must be observed. Additional symbols added by the integrator must also be observed.

Types of symbols

Both the manipulator and the controller are marked with symbols, containing important information about the product. This is important for all personnel handling the robot, for example during installation, service, or operation.

The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 19*.

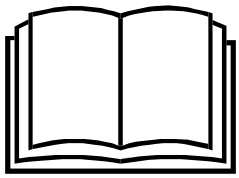
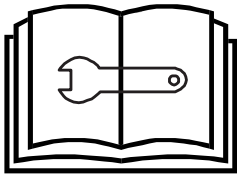
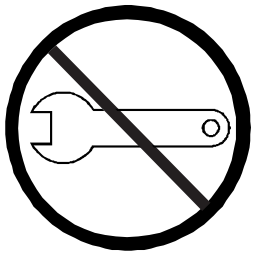
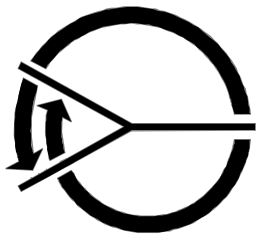
The information labels can contain information in text.

Symbols on safety labels

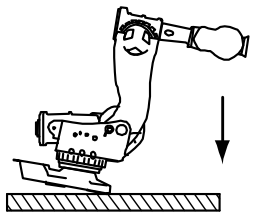
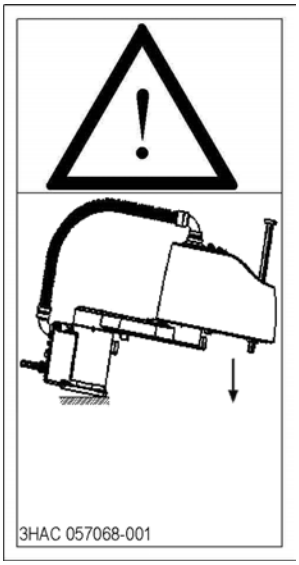
Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0900000811	**Caution!** Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0900000839	**Prohibition** Used in combinations with other symbols.

Continues on next page

1.2.2 Safety symbols on manipulator labels
Continued

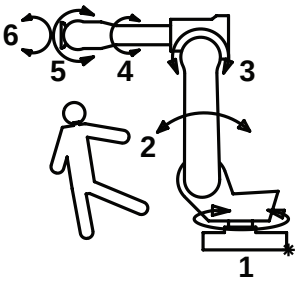
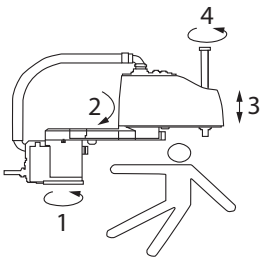
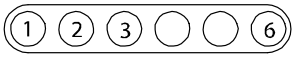
Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause injury.
 xx0900000814	**Extended rotation** This axis has extended rotation (working area) compared to standard.
 xx0900000808	**Brake release** Pressing this button will release the brakes. This means that the robot arm can fall down.

Continues on next page

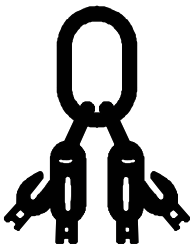
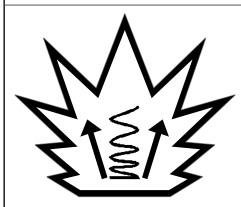
Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

Continues on next page

1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx2400000736  xx1500002616	**Moving robot** The robot can move unexpectedly.
 xx0900000820  xx1000001140	**Brake release buttons**

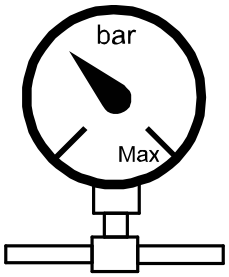
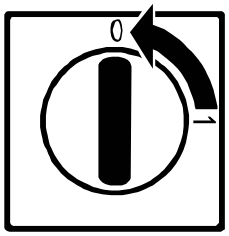
Continues on next page

Symbol	Description
 xx0900000821	**Lifting bolt**
 xx1000001242	**Adjustable chain sling with shortener**
 xx0900000822	**Lifting of robot**
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**
 xx1000001144	**No mechanical stop**
 xx0900000825	**Stored energy** Warns that this part contains stored energy. Used in combination with *Do not disassemble* symbol.

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000826	**Pressure** Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	**Shut off with handle** Use the power switch on the controller.
 xx1400002648	**Do not step** Warns that stepping on these parts can cause damage to the parts.

1.3 Robot stopping functions

Protective stop and emergency stop

The protective stops and emergency stops are described in the product manual for the controller.

For more information see:

- *Product manual - OmniCore V250XT Type B*
- *Product manual - OmniCore V400XT*

1.4 Safety during installation and commissioning

National or regional regulations

The integrator of the robot system is responsible for the safety of the robot system.

The integrator is responsible that the robot system is designed and installed in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

The integrator of the robot system is required to perform a risk assessment.

Layout

The robot integrated to a robot system shall be designed to allow safe access to all spaces during installation, operation, maintenance, and repair.

If robot movement can be initiated from an external control panel then an emergency stop must also be available.

If the manipulator is delivered with mechanical stops, these can be used for reducing the working space.

A perimeter safeguarding, for example a fence, shall be dimensioned to withstand the following:

- The force of the manipulator.
- The force of the load handled by the robot if dropped or released at maximum speed.
- The maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

The maximum TCP speed and the maximum velocity of the robot axes are detailed in the section *Robot motion* in the product specification for the respective manipulator.

Consider exposure to hazards, such as slipping, tripping, and falling.

Hazards due to the working position and posture for a person working with or near the robot shall be considered.

Hazards due to noise emission from the robot needs to be considered.

Consider hazards from other equipment in the robot system, for example, that guards remain active until identified hazards are reduced to an acceptable level.

Allergenic material

See *Environmental information on page 200* for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

The robot must be properly fixed to its foundation/support, as described in the respective product manual.

When the robot is installed at a height, hanging, or other than mounted directly on the floor, there will be additional hazards.

Continues on next page

Using lifting accessories and other external equipment

Ensure that all equipment used during installation, service and all handling of the robot are in correct condition for the intended use.

Electrical safety

Incoming mains must be installed to fulfill national regulations.

The power supply wiring to the robot must be sufficiently fused and if necessary, it must be possible to disconnect it manually from the mains power.

The power to the robot must be turned off with the main switch and the mains power disconnected when performing work inside the controller cabinet. Lock and tag shall be considered.

Harnesses between controller and manipulator shall be fixed and protected to avoid tripping and wear.

Wherever possible, power on/off or rebooting the robot controller shall be performed with all persons outside the safeguarded space.

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot.

Safety devices

The integrator is responsible for that the safety devices necessary to protect people working with the robot system are designed and installed correctly.

When integrating the robot with external devices to a robot system:

- The integrator of the robot system must ensure that emergency stop functions are interlocked in accordance with applicable standards.
- The integrator of the robot system must ensure that safety functions are interlocked in accordance with applicable standards.

Other hazards

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

The risk assessment should also consider other hazards arising from the application, such as, but not limited to:

- Water
- Compressed air
- Hydraulics

End-effector hazards require particular attention for applications which involve close human collaboration with the robot.

Continues on next page

Pneumatic or hydraulic related hazards

Note

The pressure in the complete pneumatic or hydraulic systems must be released before service and maintenance.

All components in the robot system that remain pressurized after switching off the power to the robot must be marked with clearly visible drain facilities and a warning sign that indicates the hazard of stored energy.

Loss of pressure in the robot system may cause parts or objects to drop.

Dump valves should be used in case of emergency.

Shot bolts should be used to prevent tools, etc., from falling due to gravity.

All pipes, hoses, and connections have to be inspected regularly for leaks and damage. Damage must be repaired immediately.

Safety measures for arc welding

The following points should be observed:

- Consider the welding robot equipment as a single unit.
- Do not mix up the phase and grounding conductors when connecting the equipment to the main supply.
- The workpiece, fixtures, and positioner are usually in direct contact with the welding circuit, and should therefore be regarded as live.
- Do not touch live parts of the equipment with your bare hands or with damp gloves.
- The welding circuit shall not be grounded without necessary measures being taken to ensure proper functioning of the grounding conductor.
- The welding circuit must not be broken during the welding process.

WARNING

The welding wire is live during the welding process even before the arc is ignited.

Personal protective equipment

Use personal protective equipment, based on the risk assessment for the robot system.

Do not wear loose-fitting garments or belts, bracelets, etc., that can become entangled in the robot or positioner. Always use the prescribed personal protective equipment.

Welding fumes and any gases formed or used when welding can be dangerous to inhale.

Verify the safety functions

Before the robot system is put into operation, verify that the safety functions are working as intended and that any remaining hazards identified in the risk assessment are mitigated to an acceptable level.

1.5 Safety during operation

Automatic operation

Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

1.6 Safety during maintenance and repair

1.6.1 Safety during maintenance and repair

General

Corrective maintenance must only be carried out by personnel trained on the robot.

Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

Hazards due to stored mechanical energy in the manipulator for the purpose of counterbalancing axes must be considered before maintenance or repair.

Never use the robot as a ladder, which means, do not climb on the controller, manipulator, including motors, or other parts. There are hazards of slipping and falling. The robot might be damaged.

Make sure that there are no tools, loose screws, turnings, or other unexpected parts remaining after maintenance or repair work.

When the work is completed, verify that the safety functions are working as intended.

Hot surfaces

Surfaces can be hot after running the robot, and touching these may result in burns. Allow the surfaces to cool down before maintenance or repair.

Allergic reaction

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.

Gearbox lubricants (oil or grease)

When handling oil, grease, or other chemical substances the safety information of the respective manufacturer must be observed.

 **Note**

Take special care when handling hot lubricants.

Warning	Description	Elimination/Action
 **Hot oil or grease**	Changing and draining gearbox oil or grease may require handling hot lubricant heated up to 90 °C.	Make sure that protective gear like goggles and gloves are always worn during this activity.

Continues on next page

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 **Possible pressure build-up in gearbox**	When opening the oil or grease plug, there may be pressure present in the gearbox, causing hot lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling. Put oil absorbent cloth, bags or paper at appropriate locations to catch any oil residues. Use appropriate protective gear such as heat-resistant gloves, goggles/protective visor, or a body suit if necessary.
 **Do not overfill**	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling it with oil or grease. After filling, verify that the level is correct.
 **Do not mix types of oil**	Mixing types of oil may cause severe damage to the gearbox.	When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified for the product.
 **Oil residues**	Oil residues might be present in a drained gearbox and spilled when separating a motor and gearbox during repair.	Make sure that protective gear like goggles/protective visor, gloves and arm protection are always worn during this activity. Put oil absorbent cloth, bags or paper at appropriate locations to catch any oil residues.
 **Heat up the oil**	Warm oil drains quicker than cold oil.	Run the robot before changing the gearbox oil, if possible.
 **Specified amount depends on drained volume**	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.

Continues on next page

1.6.1 Safety during maintenance and repair
Continued

Warning	Description	Elimination/Action
 **Contaminated oil in gearboxes**	For lifetime reasons always drain as much oil as possible from the gearbox. The magnetic oil plugs will gather residual metal chips.	

Hazards related to batteries

Under rated conditions, the electrode materials and liquid electrolyte in the batteries are sealed and not exposed to the outside.

There is a hazard in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. As a result under certain circumstances, electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow.

Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.

Operating temperatures are listed in *Operating conditions on page 50*.

See safety instructions for the batteries in *Material/product safety data sheet - Battery pack* (*3HAC043118-001*).

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation and operation.

1.6.2 Brake testing

When to test

During operation, the holding brake of each axis normally wears down. A test can be performed to determine whether the brake can still perform its function.

How to test

The function of the holding brake of each axis motor may be verified as described below:

1. Run each axis to a position where the combined weight of the manipulator and any load is maximized (maximum static load).
2. Switch the motor to the MOTORS OFF.
3. Inspect and verify that the axis maintains its position.

   If the manipulator does not change position as the motors are switched off, then the brake function is adequate.

Note

It is recommended to run the service routine *BrakeCheck* as part of the regular maintenance, see the operating manual for the robot controller.

For robots with the option SafeMove, the *Cyclic Brake Check* routine is recommended. See the manual for SafeMove in *References on page 10*.

1.7 Safety during troubleshooting

General

When troubleshooting requires work with power switched on, special considerations must be taken:

- Safety circuits might be muted or disconnected.
- Electrical parts must be considered as *live*.
- The manipulator can move unexpectedly at any time.

DANGER

Troubleshooting on the controller while powered on must be performed by personnel trained by ABB or by ABB field engineers.

CAUTION

Risk of hot surfaces that can cause burns.

A risk assessment must be done to address both robot and robot system specific hazards.

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation, operation, maintenance, and repair.

1.8 Safety during decommissioning

General

See section *Decommissioning on page 199*.

If the robot is decommissioned for storage, take extra precaution to reset safety devices to delivery status.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

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2 System description

2.1 IRP positioner

2.1.1 Positioner overview

Positioner

A positioner is used to position work pieces optimally for welding joints and robots. The positioner is equipped with maintenance-free AC motors with electro-magnetic brakes.

The letter in the positioner name indicates the positioner type and the number indicates its maximum handling capacity in Kg.

Movement without drive power

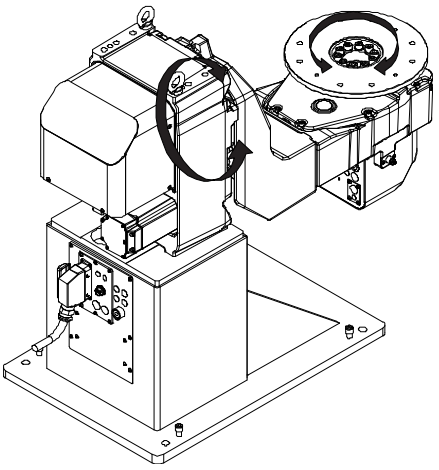
There are no brake release buttons on the positioners to use in an emergency situation. Due to positioner kinematics and payload, releasing the brake can cause additional hazards. This needs to be considered while doing a risk assessment of the complete installation. If a brake release function is needed, then this shall be solved by the integrator.

In order to rescue a trapped person, a suitable device should be used to overcome motor brake force such as a crane, a forklift, a jack, etc.

Axis limiting

There are no adjustable mechanical stops on the IRP. This needs to be considered while doing a risk assessment of the complete installation.

Positioner models

Positioner type	Illustration
A: • 250 • 500 • 750	 xx0900000830

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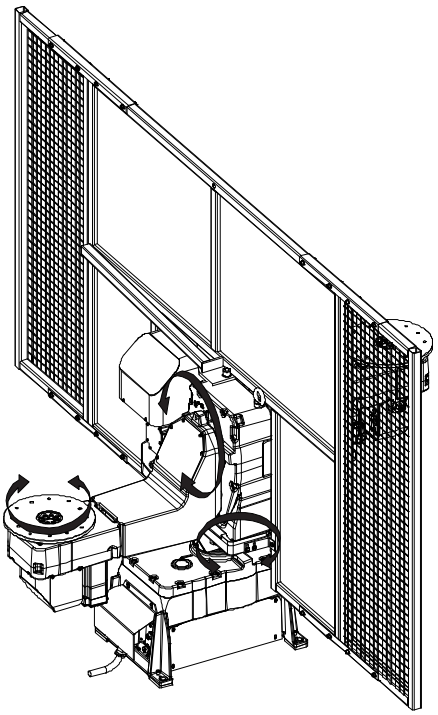
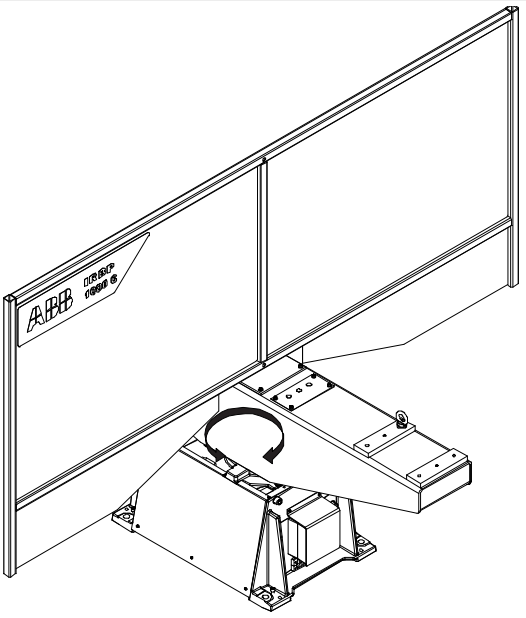
2.1.1 Positioner overview
Continued

Positioner type	Illustration
B: • 250 • 500 • 750	 xx0900000840
C: • 500 • 1000	 xx0900000846

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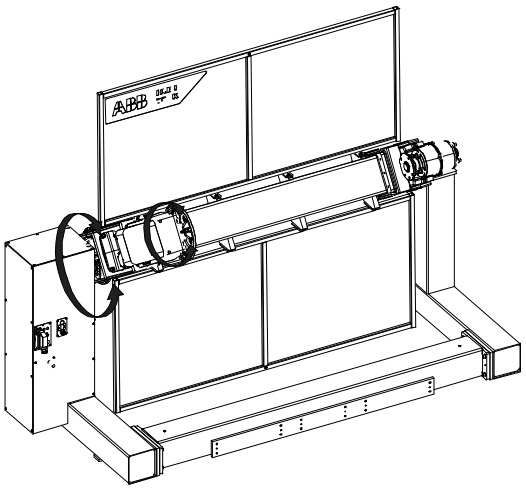
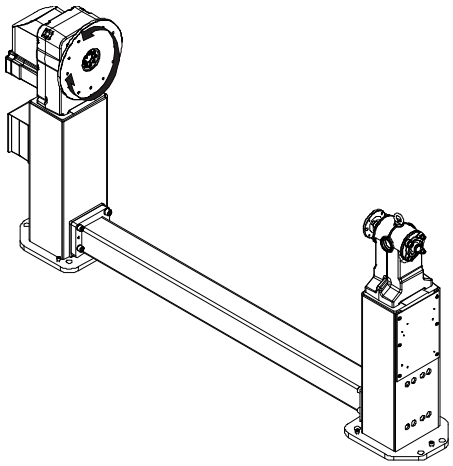
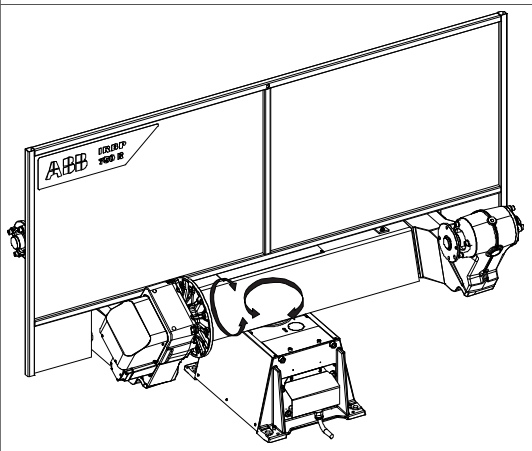
Positioner type	Illustration
K: • 300 • 600 • 1000	 xx0900000832
L: • 300 • 600 • 1000 • 2000 • 5000	 xx0900000845
R: • 300 • 600 • 1000	 xx0900000838

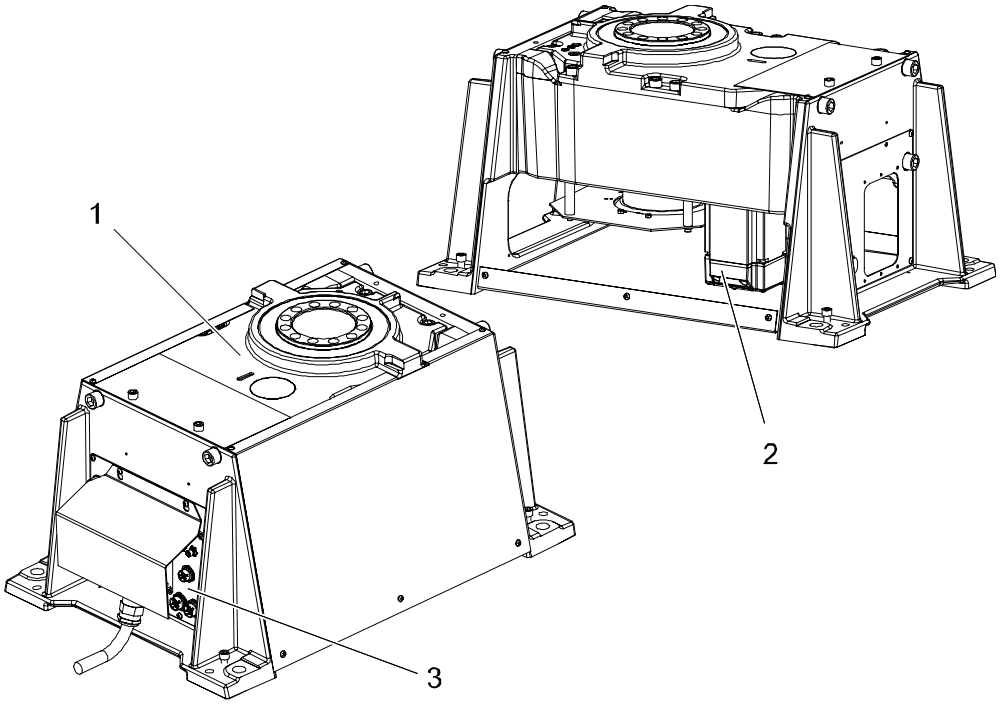
2.1.2 Station interchange unit MID

Station interchange unit componets

The station interchange unit MID is a modular unit specifically developed for robot applications and is intended for indexed movement.

Station interchange unit MID 2.1

The station interchange unit for two stations consists of the following:



xx2300001925

1	Gear drive
2	AC servo motor with integrated resolver and brake
3	Connection panel

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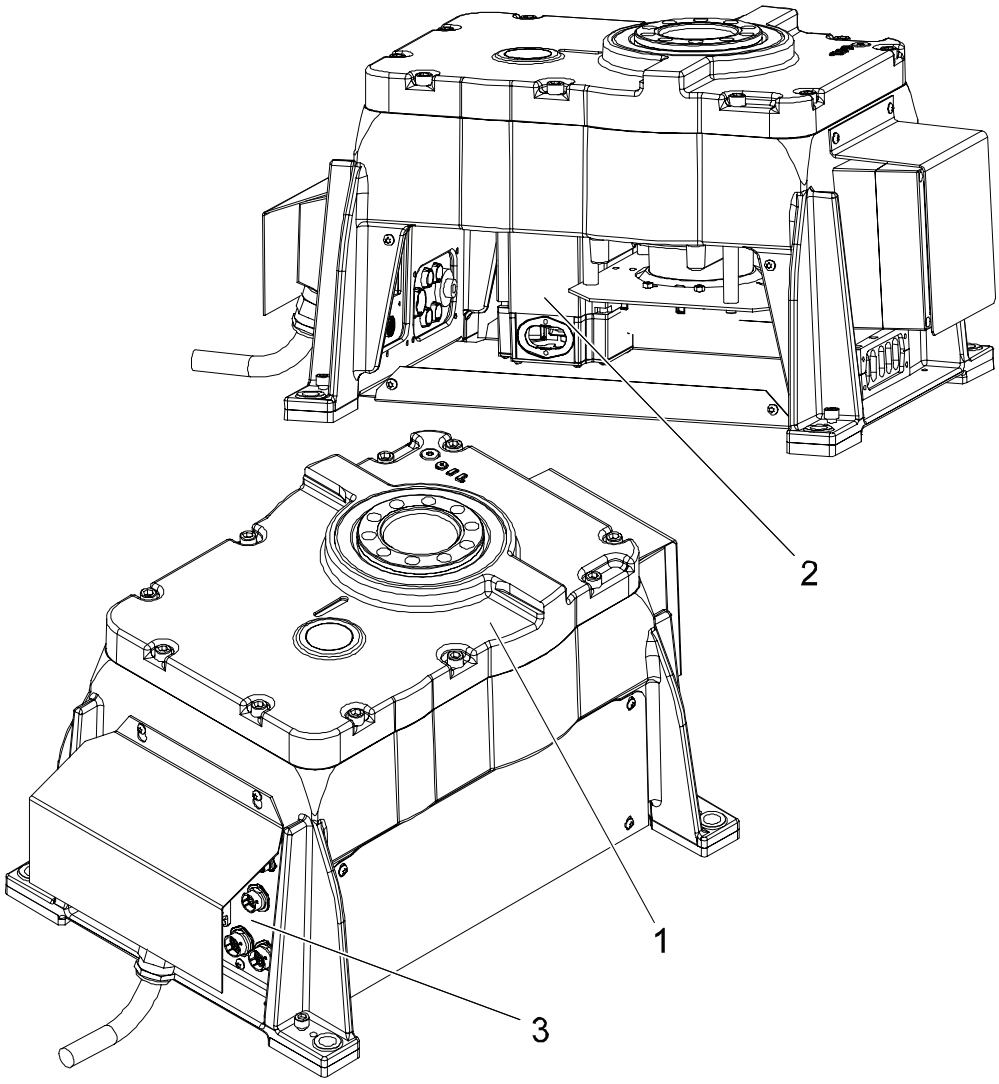
Station interchange unit MID 1.1



xx2300001928

1	Gear drive
2	AC servo motor with integrated resolver and brake
3	Connection panel

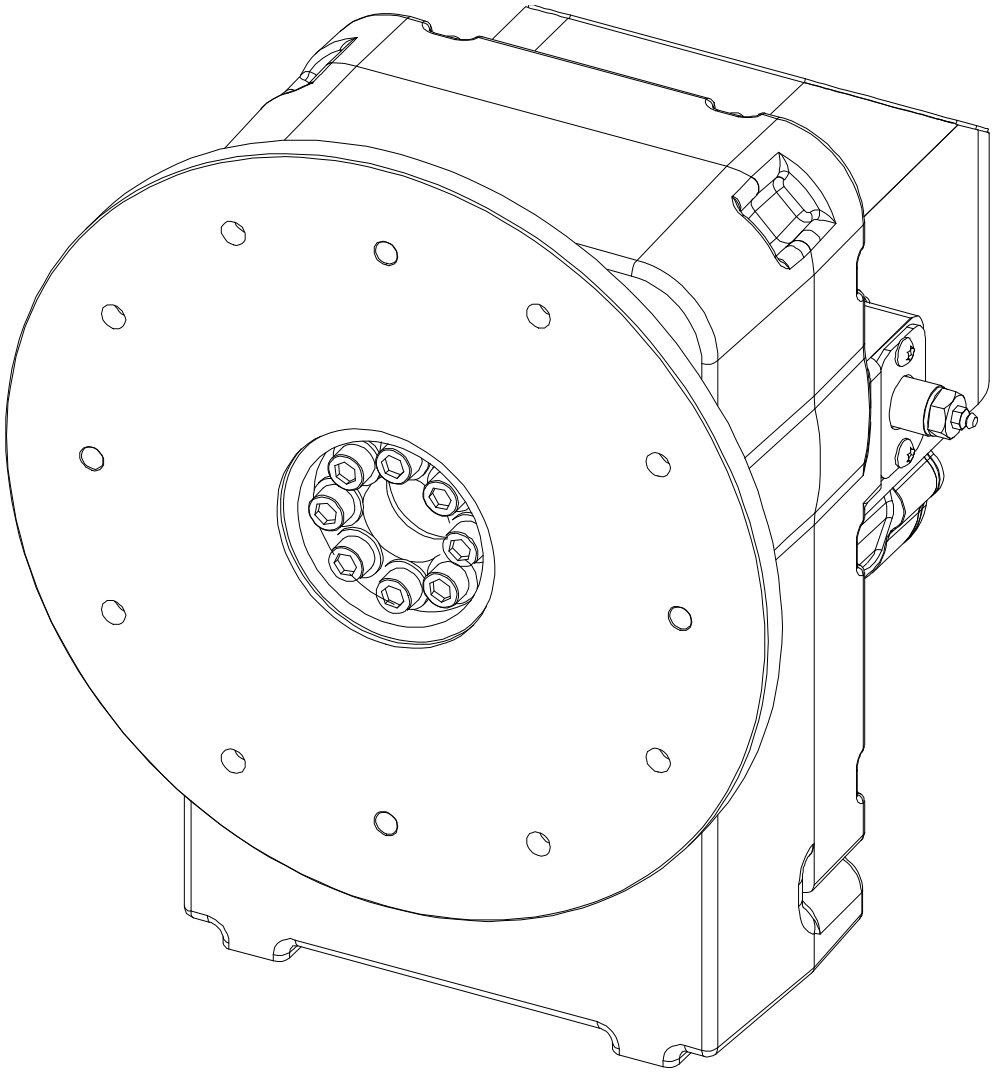
2.1.3 Rotary units

Rotary unit components

Overview

The rotary unit MTD is a modular unit, developed specifically for robot applications and is intended for positioning the workpiece.

MTD units



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MTD 250
MTD 500/750
MTD 2000
MTD 5000

Continues on next page

Components

The rotary unit consists of the following components.

Gearbox MTD

The gearbox is a precision gear drive specifically developed to withstand the high demands placed on robot applications, among others, rigidity and torsional strength, speed and accuracy. The gearbox is virtually free of play and never needs to be adjusted; conforming to requirements during its entire life. The gearbox is maintenance free and the lubricant is sufficient for the gearbox's entire life, equivalent to 40000 hours of operation.

Current collector

The function of the current collector is to transfer the weld current through the rotary unit. This takes place through a spring-loaded contact bar against the shaft. The contact bar needs to be lubricated after approximately 400 hours of operation. This should be done using a special grease, article number 501 869-001.

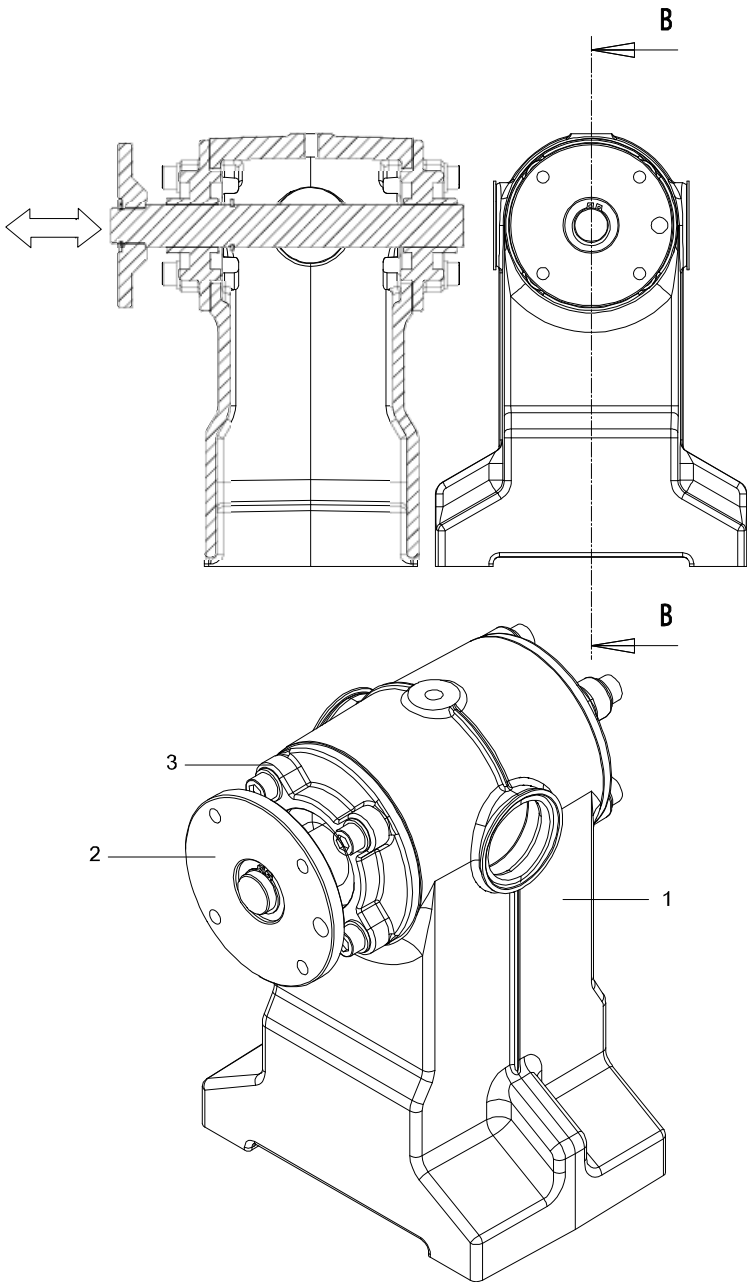
AC servo motor

The AC-servo motor is a permanent magnetized 3-phase AC motor and runs smoothly throughout the entire speed range. The motor is equipped with high-grade permanent magnets that are marginally affected by the temperature. The motor has a resolver for motor feedback and position indication. The motor is equipped with a brake for locking into a position when the rotary unit is not actuated and to provide braking with an emergency or operating stop. **This brake is not an operating brake**. This means that with normal operations the FlexPendant or the operator’s panel are to be used to stop. The motor is grounded and electrically insulated from other parts in order to prevent the weld current from being conducted through the motor's protective conductor in the event of a malfunction. The motor is maintenance free.

2.1.4 Support collar

Components

The support collar allows axial movement during rotation.



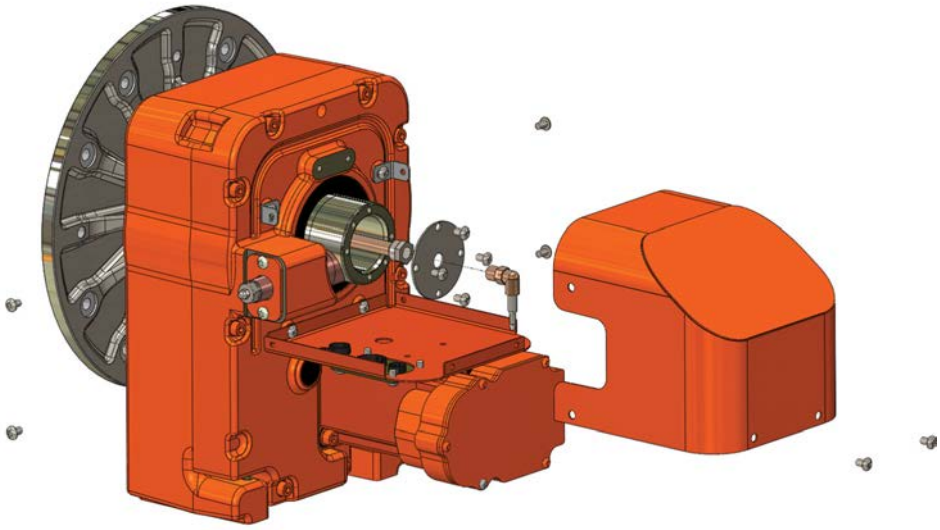
xx0900000844

1	Support collar
2	Shaft with the mounting flange
3	Flange bearing with spherical bearing position.

2.2 Customer options

2.2.1 Optional swivels

Air swivel, 1 channel



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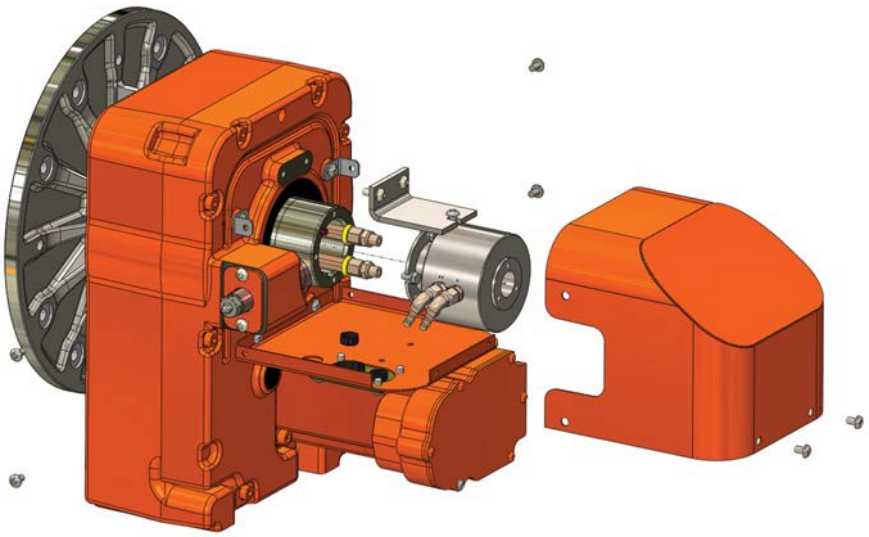
Air swivel, 2 channel



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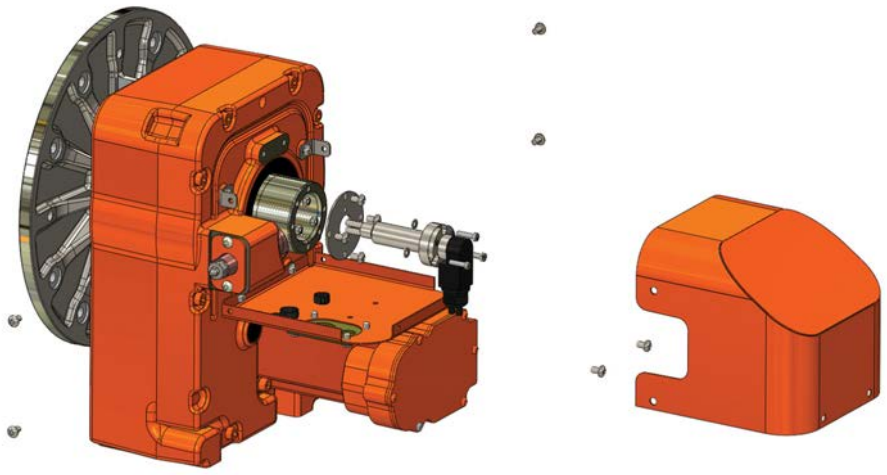
2.2.1 Optional swivels
Continued

Electrical swivel



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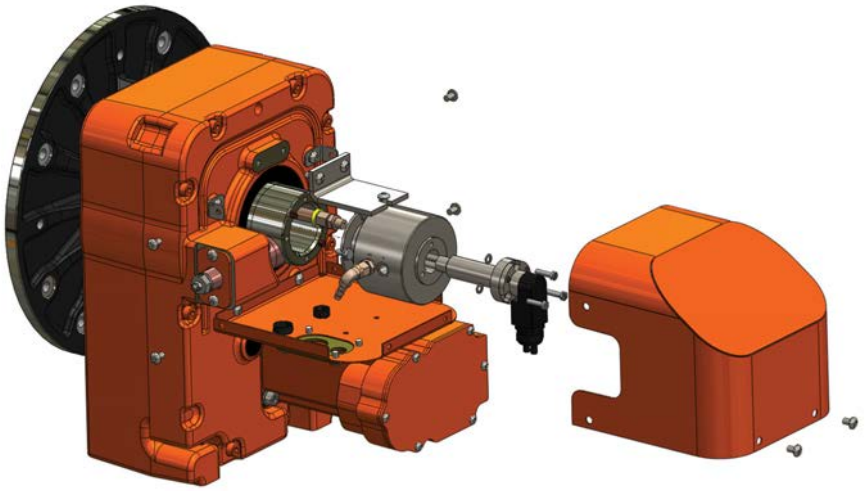
Air swivel, 1 channel and 1 electrical channel



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3 Installation and commissioning

3.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the IRP at the working site.

See also the product manual for the robot controller.

The installation must be done by qualified installation personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

Safety information

Before any installation work is commenced, all safety information must be observed.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any installation work.

Note

Always connect the IRP and the robot to protective earth and residual current device (RCD) before connecting to power and starting any installation work.

For more information see:

- *Product manual - OmniCore V250XT Type B*
- *Product manual - OmniCore V400XT*

3.2 Installation and set-up

WARNING

This work must only be carried out by persons trained in the complete installation, who are aware of the particular risks associated with its different parts.

CAUTION

Caution must be observed. All work carried out on the system shall be done professionally and conform to the applicable safety regulations.

Transport and unpacking

WARNING

The safety instructions and other instructions should be studied carefully before initiating transport and unpacking of the safety equipment. These can be found under a separate tab in the System Manual.

Unpacking

- Check that the equipment is not damaged in any way.
- Report any visible transport damage immediately.

Lifting instructions

Lifting of the safety equipment must only:

- be carried out using equipment that corresponds with the applicable lifting standards.
- be carried out by authorized personnel.

Note

Lifting eyes (standard as well as with swivel) are not delivered with the positioner. Use lifting eyes and/or swiveled lifting eyes in the proper positions as described in the lifting instructions for each positioner. Always use lifting eyes with the correct lifting capacity according to the part being lifted.

WARNING

Do not walk under a suspended load!

3.3 Unpacking and handling

3.3.1 Pre-installation procedure

General

This section is intended for use when unpacking and installing the IRP system for the first time. It also contains information useful during later re-installation of the IRP system.

Checking the pre-requisites for installation

The checklist below details what must be observed before proceeding with the actual installation of the positioner system:

	Action
1	Make sure only qualified installation personnel conforming to all national and local codes are allowed to perform the installation.
2	Visually inspect the robot to make sure it is not damaged.
3	Make sure the lifting accessory used is suitable to handle the weight of the system units.
4	If the positioner system is not installed directly, it must be stored.
5	Before taking the positioner system to its installation site, make sure the foundation conforms to the requirements.
6	Before moving the positioner system, please observe and read the sections regarding lifting of the positioner system.
7	When these prerequisites are met, the positioner system may be taken to its installation site:

Requirements, foundation

The positioner requires a good foundation and/or a concrete floor with strength according to standard C20/25 or better according to ENV 206. If necessary, use shims under the foundation of the positioner to avoid alignment problem. The bolts can be either anchor or chemical type. For more detailed information regarding installation please see section *Forces on foundation on page 58*.

Storage conditions

The table below shows the allowed storage conditions for the robot:

Parameter	Value
Min. ambient temperature	-25° C
Max. ambient temperature	+55° C
Max. ambient temperature (less than 24 h)	+70° C
Max. ambient humidity	Max. 95% at constant temperature

Continues on next page

3.3.1 Pre-installation procedure
Continued

Operating conditions

The table below shows the allowed operating conditions for the robot:

Parameter	Value
Min. ambient temperature	+5° C 0° C [1)]
Max. ambient temperature	+50° C [1)]
Max. ambient humidity	Max. 95% at constant temperature

[1)] At cold start (0° C - 5° C), see note in the product specification on how to warm up the robot.

Protection classes

The table below shows the protection class of the manipulators:

Equipment	Protection class
Manipulator IRP A	IP 42
Manipulator IRP B	IP 42
Manipulator IRP C	IP 42
Manipulator IRP L	IP 65
Manipulator IRP K	IP 42
Manipulator IRP R	IP 42

3.3.2 Lifting the positioner

Actions before lifting

See section *Lifting instructions on page 213* before lifting.

Note

Lifting eyes (standard as well as with swivel) are not delivered with the IRP. Use lifting eyes and/or lifting eyes with swivel in the proper positions as described in the lifting instructions for each IRP. Always use lifting eyes with the correct lifting capacity according to the part being lifted.

WARNING

Always lift the manipulator in a safe manner, using lifting tools according to the specified lifting weight in section *Lifting weight*.

WARNING

Do not walk under a suspended load!

WARNING

In order to prevent damage, only use the pre-mounted lifting eyes.

Lifting weight

The table below shows the minimum and maximum weights of the different IRP models, for exact weight see the silver tags on the manipulator:

Weight IRP

Type	Handling weight/kg	Weight min.	Weight max, kg
A	250		470
	500		870
	750		870
B	250		915
	500		1,750
	750		1,750
C	500		380
	1000		660

Continues on next page

3.3.2 Lifting the positioner
Continued

Type	Handling weight/kg	Weight min.	Weight max, kg
L	300	250	300
	600	465	515
	1000	465	515
	2000	700	740
	5000		
K	300	1090	1,515
	600	1980	2,570
	1000	1980	2,570
R	300	620	645
	600	1285	1,380
	1000	1285	1,380

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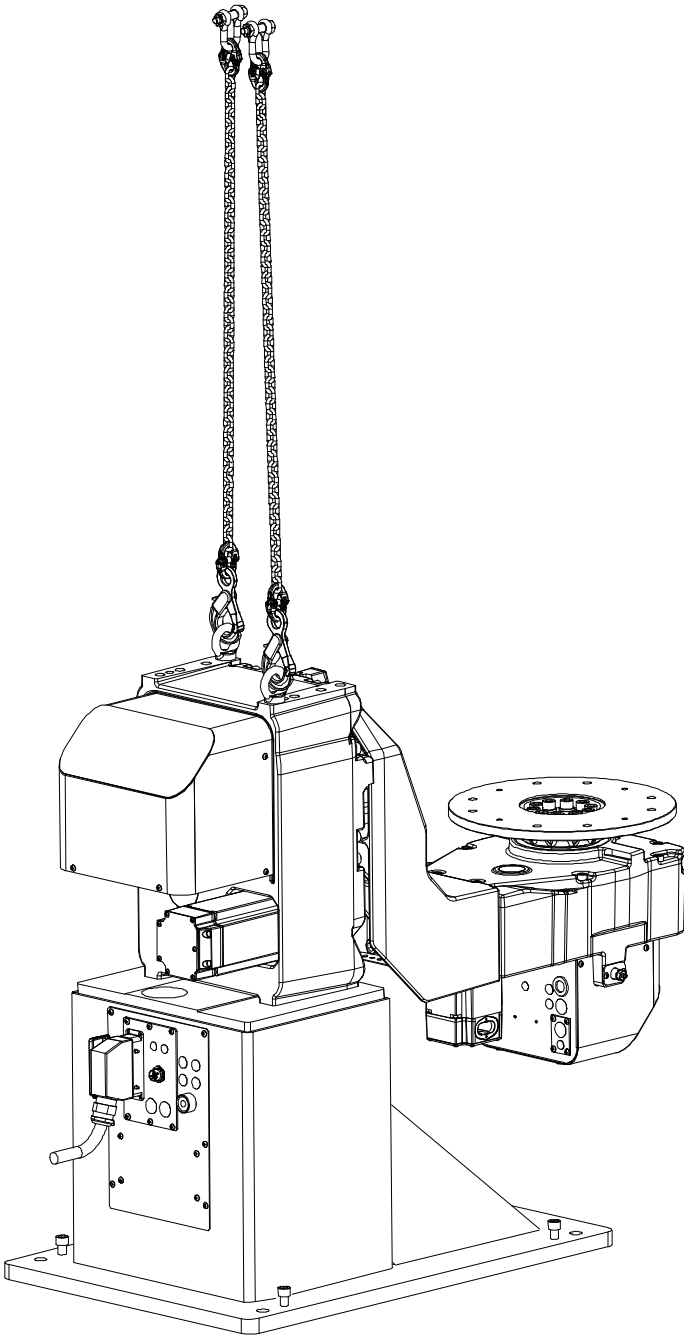
Lifting type A



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3.3.2 Lifting the positioner
Continued

Lifting type B

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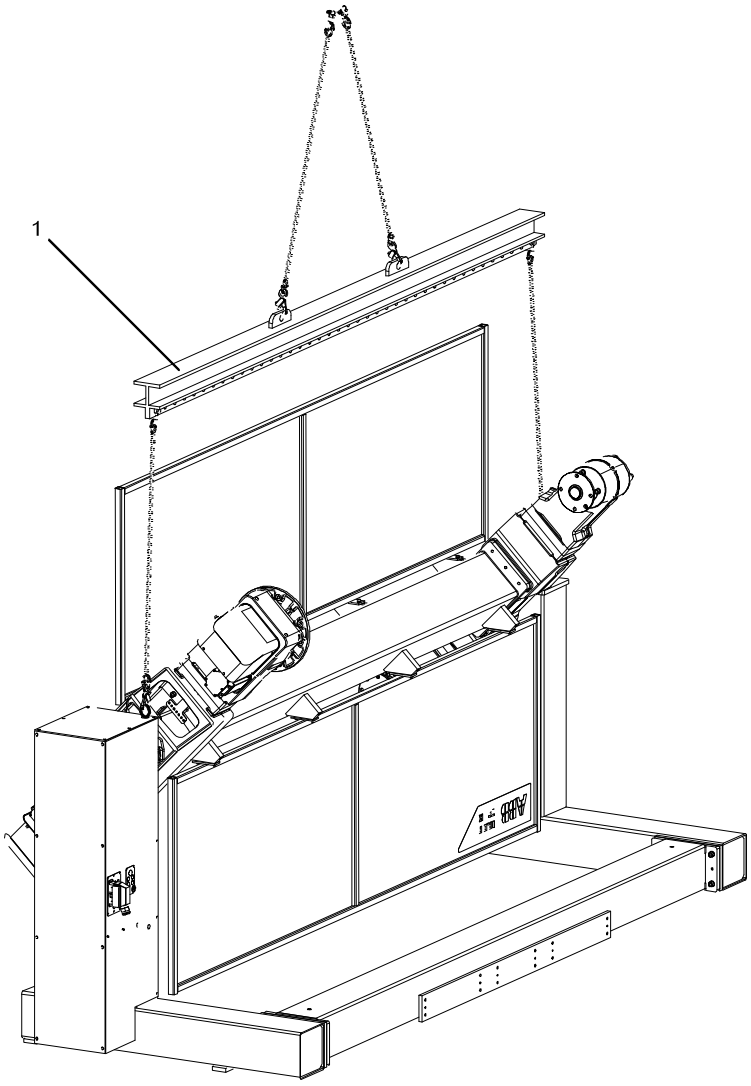
Continues on next page

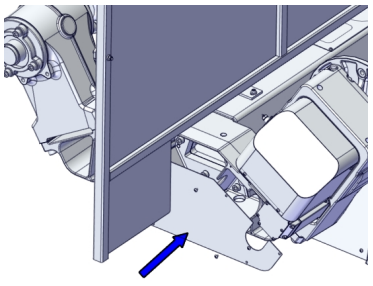
Lifting type R, K



xx1000000092

1	Lifting beam 4000 mm

Fitting the lifting eyes on IRP R

	Action	Note
1	Remove the plates to get access to the lifting eye holes in the frame.	 xx1700001322

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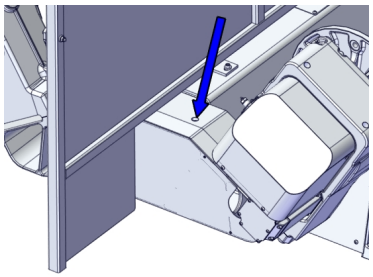
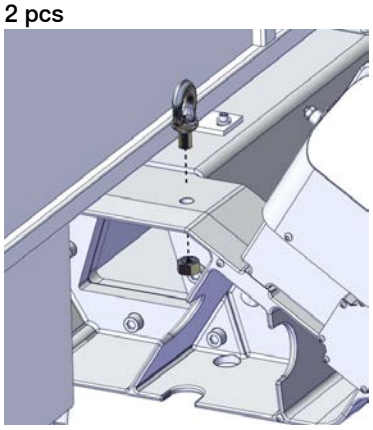
3.3.2 Lifting the positioner
Continued

	Action	Note
2	Remove the protection plugs from the lifting eye holes. **Note** Save the plugs for refit after installation.	 xx1700001324
3	Attach the lifting eyes.	2 pcs  xx1700001323

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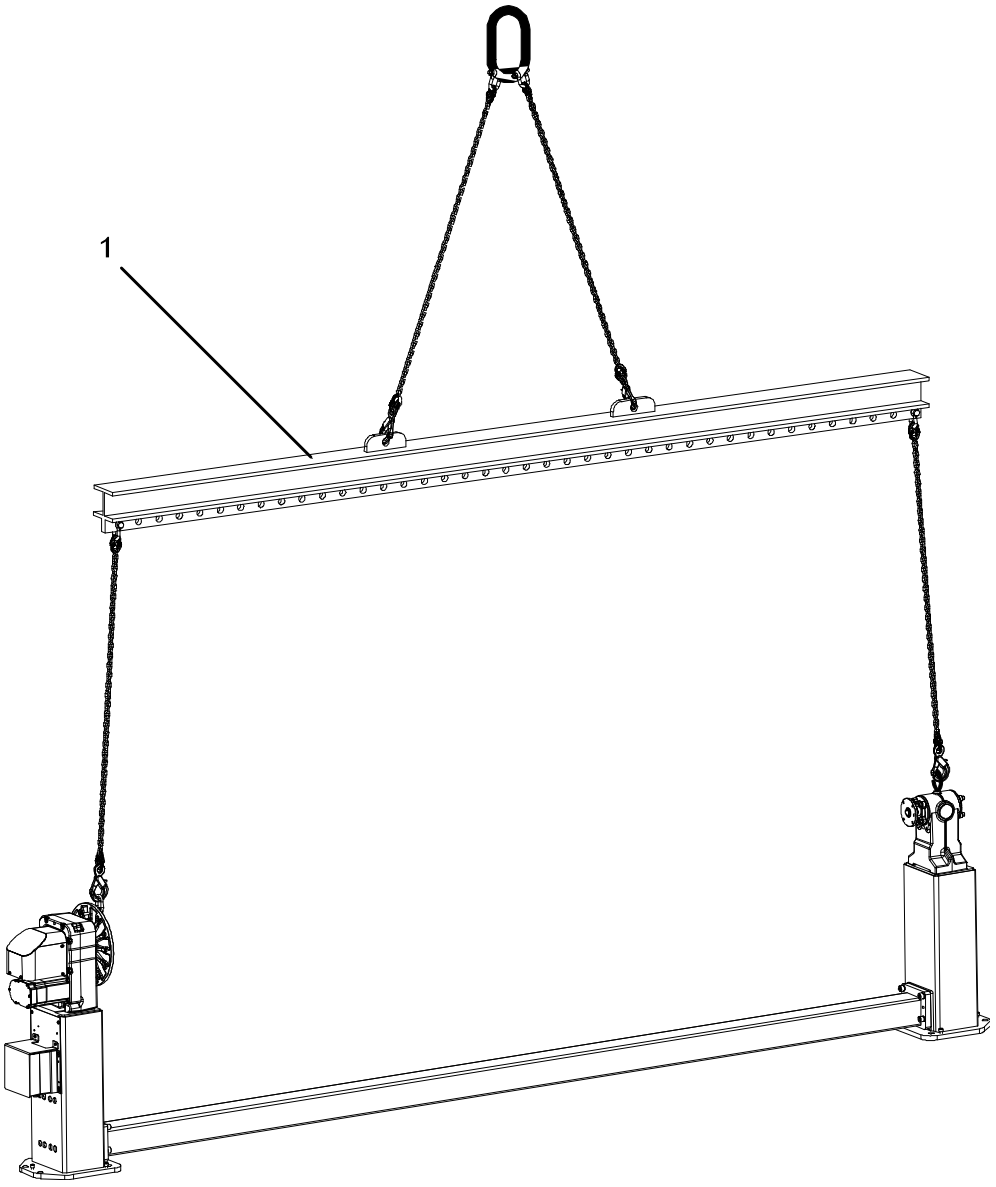
Lifting type L



xx1000000093

1	Lifting beam 4000 mm

3.3.3 Forces on foundation

Robustness

The foundation must withstand the static loads caused by the weight of the equipment, and the dynamic loads generated by the movement of the manipulator.

Incline

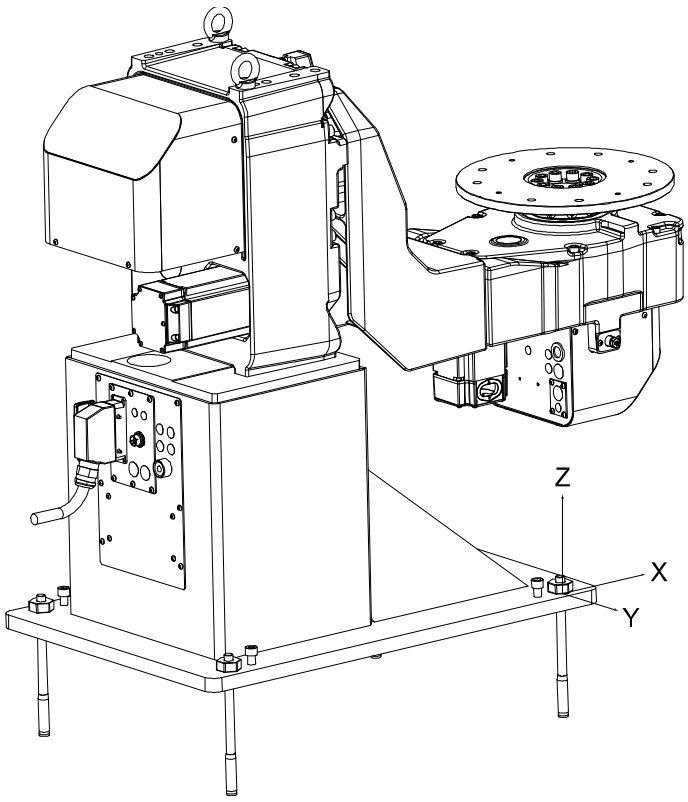
The foundation must be designed, so that the manipulator can be mounted without the incline exceeding 0.5 mm/m.

Maximum floor loads

When a floor mounting base (FMB) is used, then the floor load is the combined load from both the positioner and the robot. The forces are the sum of the maximum component for each direction.

Maximum floor loads in relation to the base coordinate system and indicated per each screw of the base on the positioner, see figure below.

Forces IRP A



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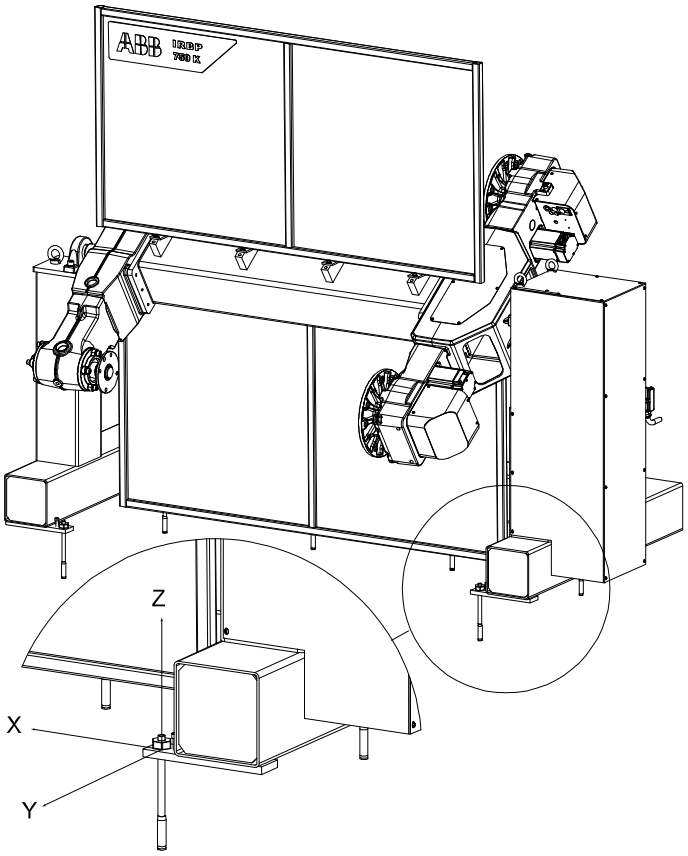
Rotation unit	Endurance load in operation (N)		Max load at emergency stop (N)		Screw dimension
	Fxy	Fz	Fxy	Fz	
A-250	800	6300	1930	11500	M16
A-500	3300	12900	6700	23200	M20

Continues on next page

Rotation unit	Endurance load in operation (N)		Max load at emergency stop (N)		Screw dimension
	Fxy	Fz	Fxy	Fz	
A-750	4400	17200	9000	31000	M20

Forces IRP K



xx0900000906

Rotation unit	Endurance load in operation (N)		Max load at emergency stop (N)		Screw dimension
	Fxy	Fz	Fxy	Fz	
K-300	1000	3100	1500	5000	M20
K-600	2000	7000	2000	10200	M20
K-1000	2000	7000	2000	10200	M20

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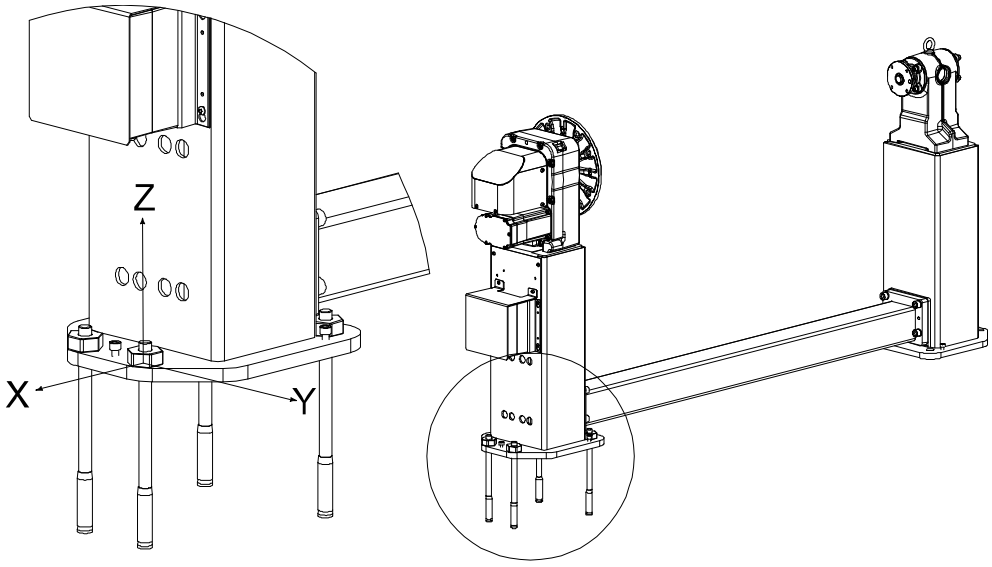
3.3.3 Forces on foundation

Continued

Forces IRP L



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Rotation unit	Endurance load in operation (N)		Max load at emergency stop (N)		Screw dimension
	Fxy	Fz	Fxy	Fz	
L-300	500	5200	1800	8900	M20
L-600	1200	12000	2200	18800	M20
L-1000	1200	12000	2200	18800	M20
L-2000	1700	25700	3700	36700	M20
L-5000	3000	35000	9000	44500	M20

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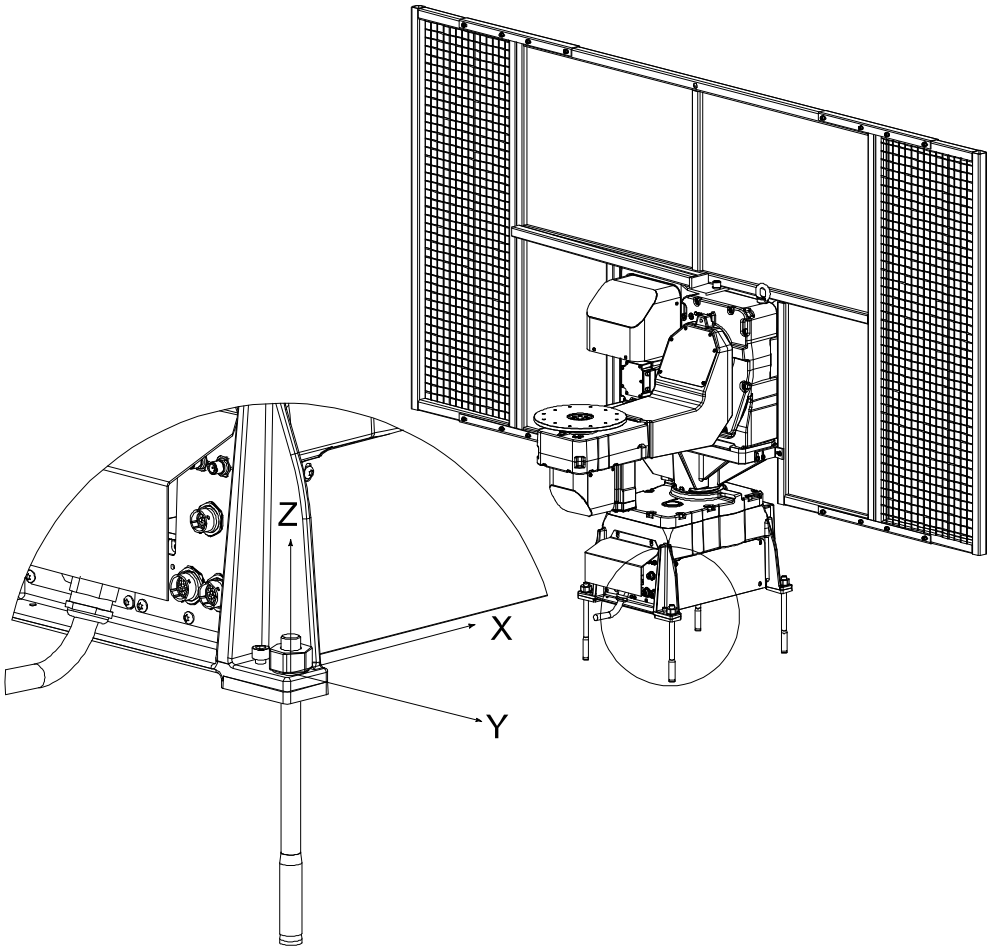
Forces IRP B/C/R



xx0900000908

Rotation unit	Endurance load in operation (N)		Max load at emergency stop (N)		Screw dimension
	Fxy	Fz	Fxy	Fz	
B-250	2000	8300	3600	12400	M16
B-500	5000	20600	9000	30900	M20
B-750	5000	20600	9000	30900	M20
C-500	1500	6000	3000	8000	M16
C-1000	2700	15000	6400	22300	M20
R-300	1380	5400	3000	7800	M16
R-600	2700	15000	6400	22300	M20
R-1000	2700	15000	6400	22300	M20

3.3.4 Recommendations for attachment bolts and screws

Attachment bolts

Chemical anchor bolts or expansion-shell bolts are recommended for securing the manipulator to the floor. However, the attachment bolts are not supplied since they must be selected based on the material or the foundation.

Choose attachment bolts so that they are suitable for and fit inside the holes in the foundation. Choose attachment bolts that can handle the dynamic loads.

The bolts must be able to bear the combined dynamic loads that can occur when the manipulator is stopped with the emergency brake.

Instructions for tightening screw joints

Recommended screws for securing the manipulator to the base	Note
Steel structure	See section *Screw joints on page 63*
Concrete floor	See section *Screw joints on page 63*

Note

Expansion shell anchor bolts with a notch or chemical anchor are recommended for the IRP.

CAUTION

It is of the utmost importance that all screw joints be tightened with the correct torque.

Application

The following tightening torques are to be used for all screw joints in metallic materials unless otherwise specified in the text. See section *Screw joints on page 63*. These instructions do not apply to screw joints composed of soft or brittle materials. For screws with a higher property class than 8.8, the data for 8.8 must be used unless otherwise specified.

3.3.5 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 720*	3-5 µm
M20x60	*Gleitmo 603* + *Geomet 500*	8-12 µm
M20x60	*Gleitmo 603* + *Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Continues on next page

3.3.5 Screw joints
Continued

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Tightening torque for oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Tightening torque for oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

Continues on next page

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

[i] Lubricated with Molycote 1000, Gleitmo 603 or equivalent

3.3.6 The unit is sensitive to ESD

Description

ESD (electrostatic discharge) is the transfer of electrical static charge between two bodies at different potentials, either through direct contact or through an induced electrical field. When handling parts or their containers, personnel not grounded may potentially transfer high static charges. This discharge may destroy sensitive electronics.

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

  Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
- Use an ESD protective floor mat.

  The mat must be grounded through a current-limiting resistor.
- Use a dissipative table mat.

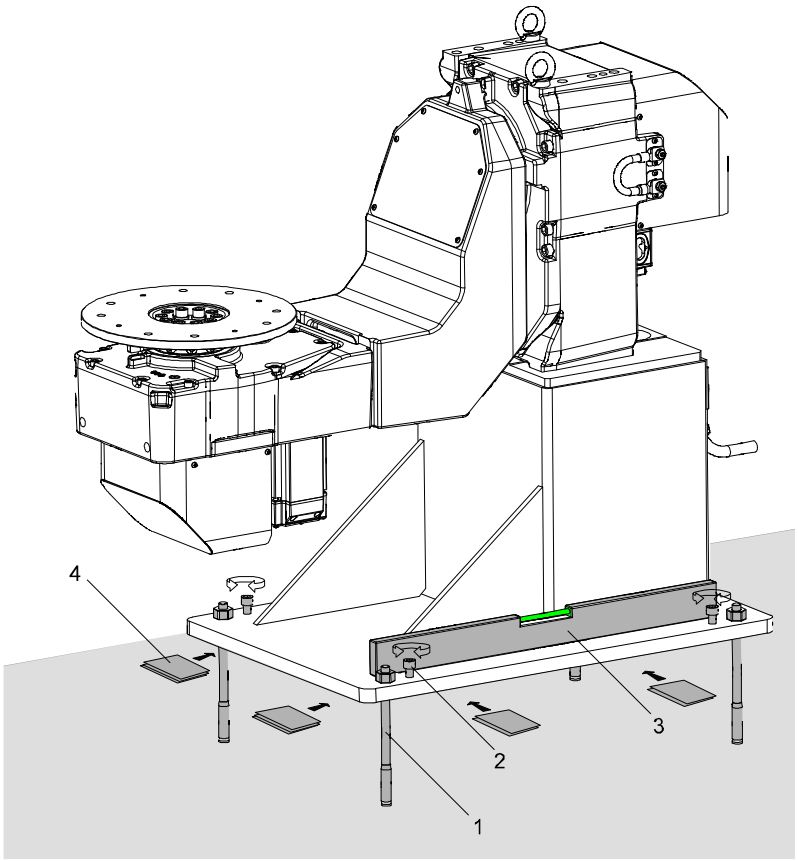
  The mat should provide a controlled discharge of static voltages and must be grounded.

3.4 On-site installation

3.4.1 Orienting and securing the manipulator

Illustration, positioning the manipulator

> **Note**
>
> The illustration shows IRP A, but the principle for orienting and securing the positioner is the same for all variants.



xx0900000914

1	Screws for fastening (floor bolts)
2	Adjusting screws
3	Machine level meter
4	Shim

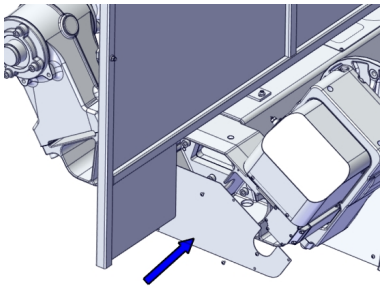
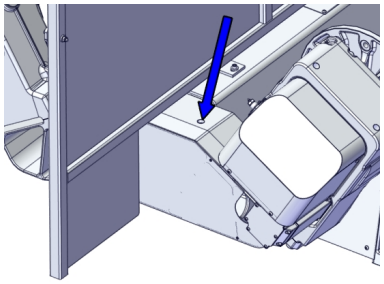
Securing the manipulator IRP

Use this procedure to secure the manipulator.

	Action	Note
1	Position the IRP at the intended work site.	

Continues on next page

3.4.1 Orienting and securing the manipulator
Continued

	Action	Note
2	Drill all holes according to the screw manufactures recommendation for the specific foundation. Facts and drilling recommendations are found in section *Recommendations for attachment bolts and screws on page 62*	
3	Adjust the foot to level using a machine level meter and the level screws.	
4	Insert shims to fill the gap between the pedestal foot and the floor. **CAUTION** Always loosen the adjusting screws before tightening the floor bolts.	**Note** Never use any shims between gear unit and the pedestal.
5	Tighten all the floor bolts.	Tightening torque according to screw manufactures.
6	Remove all lifting accessories used.	
7	**Valid for IRP R** Refit the plates at the frame ends.	 xx1700001322
8	**Valid for IRP R** Refit the protection plugs to the lifting eye holes.	 xx1700001324

Securing the manipulator IRP using fixture laser

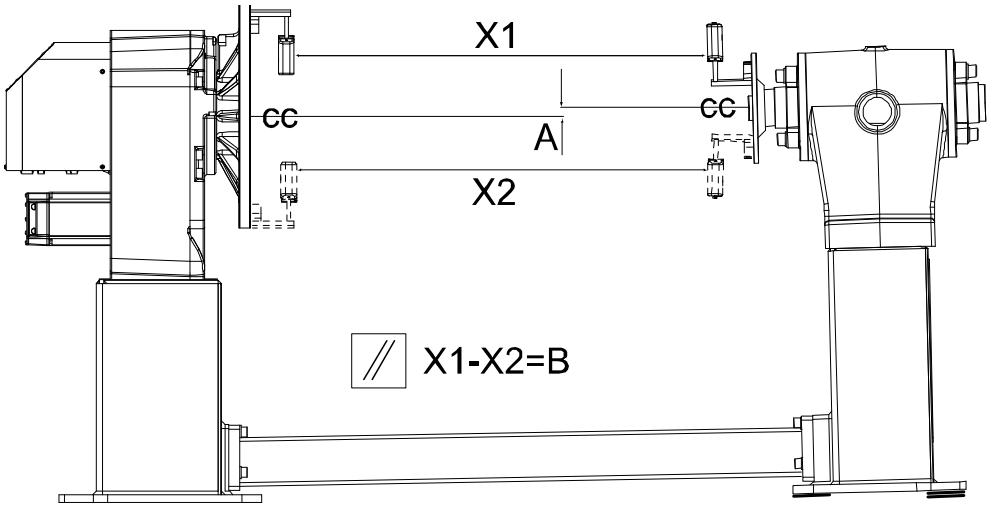
Use this procedure to secure the IRP L using a fixture laser.

	Action	Note
1	Position the IRP L at the intended work site.	
2	Drill all holes according to the screw manufactures recommendation for the specific foundation. Facts and drilling recommendations are found in section *Recommendations for attachment bolts and screws on page 62*	
3	Adjust the level screws in the foot to level using a fixture laser.	Recommended data in the table below.

Continues on next page

	Action	Note
4	Insert shims to fill the gap between the foot and the floor. **CAUTION** Always loosen the adjusting screws before tightening the floor bolts.	
5	Tighten all the floor bolts.	Tightening torque according to screw manufactures.
6	Check the reading on the laser after tightening the floor bolts.	See recommendations for bearing units, *Adjusting the bearing units for IRP L-300, L-600, L-1000 och L-2000 on page 70*.

Example of fixture laser aligning



xx1000000984

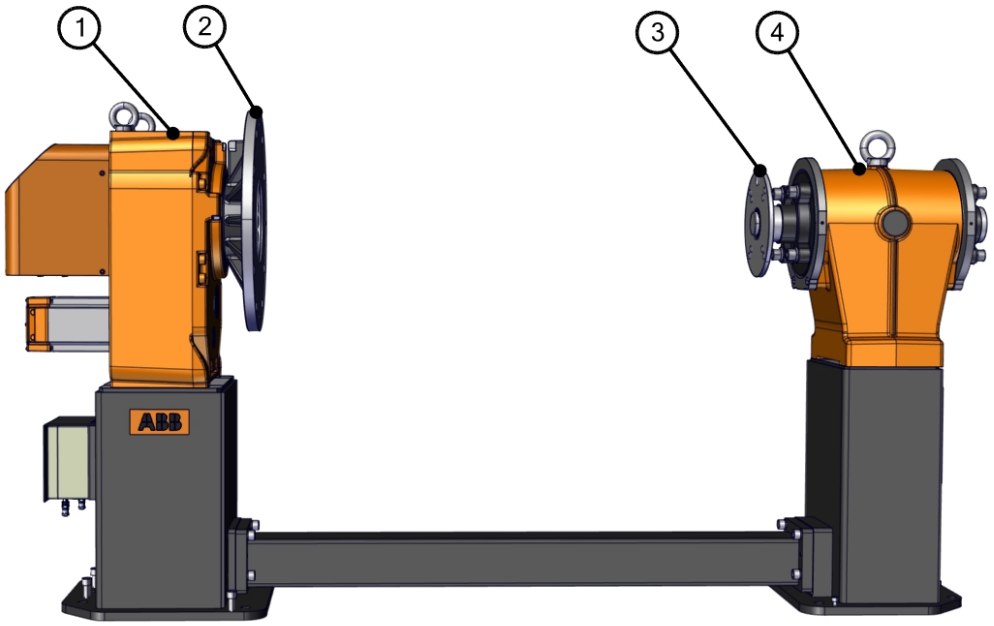
The figure shows an example of aligning the bearing units using laser sensors for example, NXA by Fixturlaser or TKSA41 from SKF, turning disc adapters and adjustment tool. For more information, see *Adjusting the bearing units for IRP L-300, L-600, L-1000 och L-2000 on page 70*

Continues on next page

3.4.1 Orienting and securing the manipulator
Continued

Adjusting the bearing units for IRP L-300, L-600, L-1000 och L-2000

After securing the positioner to the foundation the bearing units may need adjustments. This is an example on how to use the adjustment tool when adjusting the bearing units on the IRP L positioner. The adjustment tool can be ordered from ABB as a spare part. Other equipment mentioned in this example, for example laser sensors and turning disc adapter, is to be considered generic and therefore not available as spare parts delivered by ABB.



xx1700001361

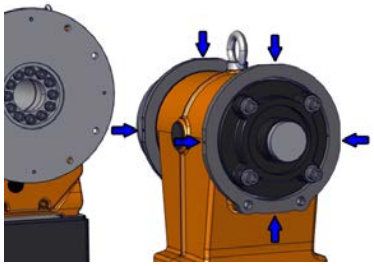
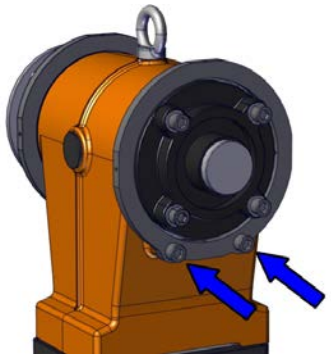
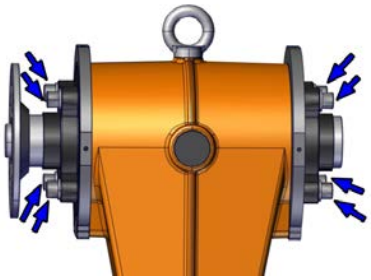
1	Gearbox
2	Rotary disc
3	Bearing disc
4	Bearing house

Required equipment

Equipment	Article number
Adjustment tool, MTD 250	3HAC036527-001
Adjustment tool, MTD 750	3HAC036532-001
Adjustment tool, MTD 2000	3HAC037846-001

Continues on next page

Fitting the adjustment tools and the laser sensor on to the bearing house

	Action	Note
1	Fit the adjustment tool on both sides of the bearing house using the set screws.	 xx1700001363
2	Fasten the adjustment tools using the adjustment screws.	 xx1700001364
3	Loosen the bearing screws from both sides of the bearing house.	 xx1700001365

Measuring the positioner

	Action	Note
1	Fit the laser sensor on to the gearbox turning plate, and tailstock turning flange.	**Note** The fitting of the laser sensors varies depending on the equipment used.
2	Start the laser sensors.	
3	Attach the motor cable to the gearbox.	

Continues on next page

3.4.1 Orienting and securing the manipulator
Continued

	Action	Note
4	Rotate the bearing disc to -90 degrees (9 o'clock).	**Note** Adjust the position of the disc during the measuring process by rotating the set screws attached to the adjustment tool if needed. It is possible to adjust up to 2.5 mm.
5	Rotate the rotary disc to -90 degrees (9 o'clock).	
6	Measure the laser position as position 1.	
7	Rotate the bearing disc to +90 degrees (3 o'clock).	
8	Rotate the rotary disc to +90 degrees (3 o'clock).	
9	Measure the laser position as position 2.	
10	Rotate the bearing disc to 0 degrees (12 o'clock).	
11	Rotate the rotary disc to 0 degrees (12 o'clock).	
12	Measure the laser position as position 3.	
13	Calibrate the positioner.	

Calibrating the positioner

	Action	Note
1	Measure the IRP L.	
2	Rotate the bearing disc to 0 degrees (12 o'clock).	
3	Rotate the rotary disc to 0 degrees (12 o'clock).	
4	Adjust the laser value by rotating the vertically aligned set screws.	
5	Rotate the bearing disc to -90 degrees (9 o'clock).	
6	Rotate the rotary disc to -90 degrees (9 o'clock).	
7	Adjust the laser value by rotating the horizontally aligned set screws.	
8	Repeat the measurement process to make sure that the calibration is correct. **Note** If the values from the laser reading is not within the allowed deviation during calibration, then re-calibrate and measure again. If the problem remain, please contact ABB.	For more information about the allowed deviations, see *Deviations on page 73*.
9	Remove any equipment fitted on the IRP L positioner.	
10	Fasten the bearing screws to the bearing house using the correct torque.	For more information about the correct torque, see *Screw joints on page 63*

Continues on next page

Deviations

Type	L1 [mm]	L2 [mm]	L3 [mm]	Position deviation [mm]			Parallel deviation [mm/100mm]		
				Preferred (X,Y)	Acceptable (X,Y)	Not OK (X,Y)	Preferred (X,Y)	Acceptable (X,Y)	Not OK (X,Y)
L-300 L=1250	1150	46.5	160	0-0.22	0.23-0.44	>0.44	0-0.04	0.05-0.08	>0.08
L-300 L=1600	1500	46.5	160	0-0.28	0.29-0.56	>0.56	0-0.04	0.05-0.08	>0.08
L-300 L=2000	1900	46.5	160	0-0.35	0.36-0.70	>0.70	0-0.04	0.05-0.08	>0.08
L-300 L=2500	2400	46.5	160	0-0.44	0.45-0.88	>0.88	0-0.04	0.05-0.08	>0.08
L-300 L=3150	3050	46.5	160	0-0.55	0.56-1.10	>1.10	0-0.04	0.05-0.08	>0.08
L-300 L=4000	3900	46.5	160	0-0.70	0.71-1.40	>1.40	0-0.04	0.05-0.08	>0.08
L-600/1000 L=1250	1160	83	266	0-0.22	0.23-0.44	>0.44	0-0.04	0.05-0.08	>0.08
L-600/1000 L=1600	1510	83	266	0-0.28	0.29-0.56	>0.56	0-0.04	0.05-0.08	>0.08
L-600/1000 L=2000	1910	83	266	0-0.35	0.36-0.70	>0.70	0-0.04	0.05-0.08	>0.08
L-600/1000 L=2500	2410	83	266	0-0.44	0.45-0.88	>0.88	0-0.04	0.05-0.08	>0.08
L-600/1000 L=3150	3060	83	266	0-0.55	0.56-1.10	>1.10	0-0.04	0.05-0.08	>0.08
L-600/1000 L=4000	3910	83	266	0-0.70	0.71-1.40	>1.40	0-0.04	0.05-0.08	>0.08
L-2000 L=1250	1160	98	366	0-0.22	0.23-0.44	>0.44	0-0.04	0.05-0.08	>0.08
L-2000 L=1600	1510	98	366	0-0.28	0.29-0.56	>0.56	0-0.04	0.05-0.08	>0.08
L-2000 L=2000	1910	98	366	0-0.35	0.36-0.70	>0.70	0-0.04	0.05-0.08	>0.08
L-2000 L=2500	2410	98	366	0-0.44	0.45-0.88	>0.88	0-0.04	0.05-0.08	>0.08
L-2000 L=3150	3060	98	366	0-0.55	0.56-1.10	>1.10	0-0.04	0.05-0.08	>0.08
L-2000 L=4000	3910	98	366	0-0.70	0.71-1.40	>1.40	0-0.04	0.05-0.08	>0.08

Adjusting the bearing units for IRP L-5000

The L5000 differs from the smaller L models in that sense that the support bearing side is not attached to the rotary unit with a distance beam.

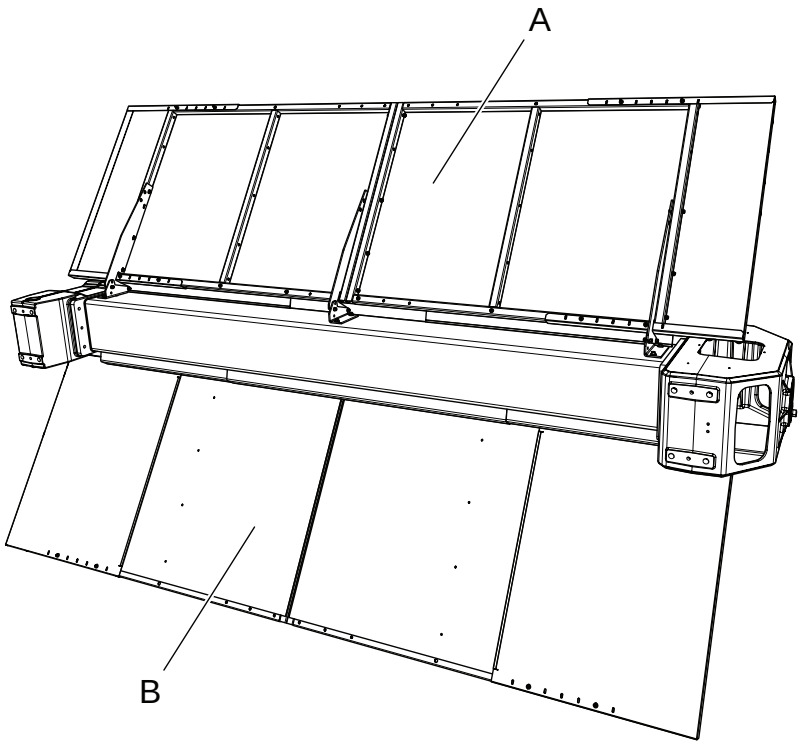
Since the length between Rotary disc and Bearing disc is unknown, no fixed values can be provided. The figures in the table could be used as a guidance, see *Deviations*.

Laser adjustment on turning disk can be used. Adjustment is done by using shims between the floor and the bottom of the tailstock foot.

3.4.2 Mounting of secondary shield on IRP-K

Location of the shield

The secondary shield is located as shown in the figure.



xx1700000439

A	Secondary shield
B	Primary shield

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 209*.

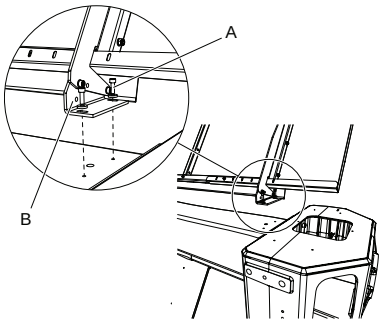
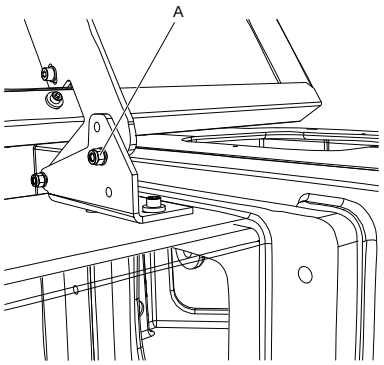
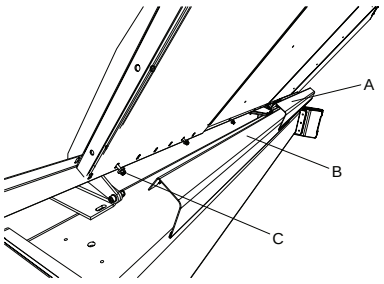
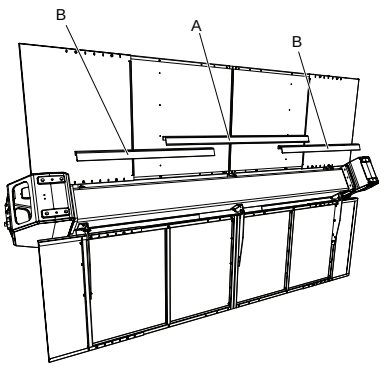
Mounting the shield

Note

It's important to check tightening torque on all pre-mounted fixings.

	Action	Note
1	Attach a lifting device to the shield and align it to the beam.	

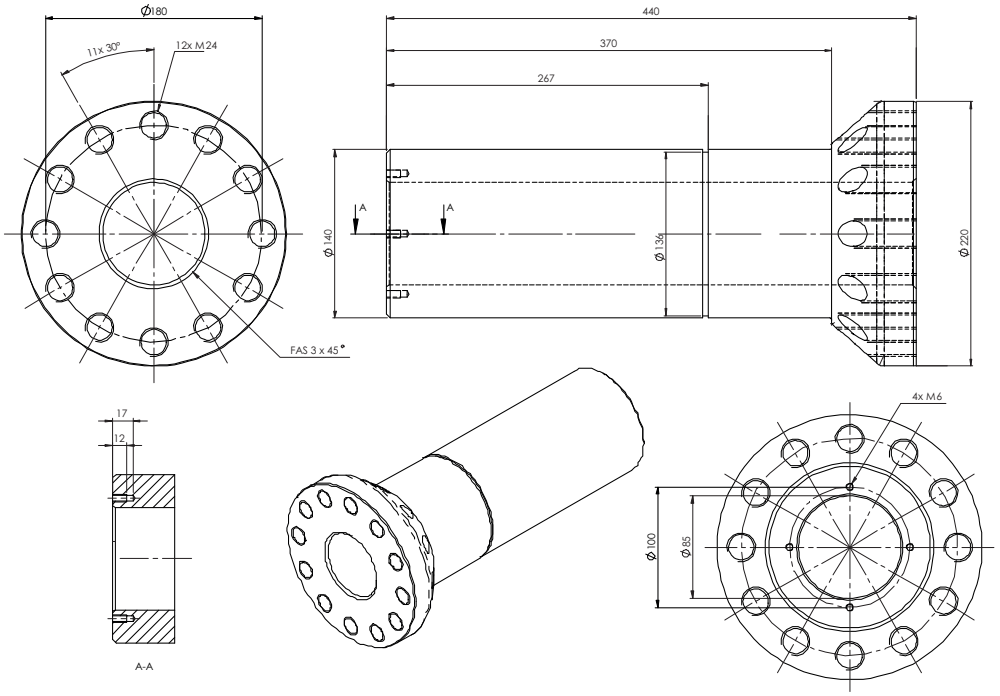
Continues on next page

	Action	Note
2	Fit the six screws with washers (A) through the pre-mounted bracket (B).	 xx1700000440 Screw: M8x25 (6 pcs) Washer: 8.4x21x4 (6 pcs)
3	Tighten the screws.	Tightening torque: 25 Nm
4	Tighten the screws (A) with nuts (6 pcs) on the pre-mounted shield brackets.	 xx1700000447 Tightening torque: 10 Nm
5	Loosen the locking nut with washer (C) from the screws in the back of the shields and push the washer towards the nut creating a space of 5-8 mm between the shield and washer.	 xx1700000441
6	Push down the two inner covers (B) first, and then the outer cover (A) between the shield and the washer (C).	 xx1700000446
7	Tighten the locknuts.	

3.4.3 Dimensions of the tailstock IRP L-5000

Tailstock dimensions

The tailstock on the IRP L-5000 has a centered hole to be able to, for example, pull cable harness through.



xx1800001201

3.5 Electrical connections

Introduction

Connect the positioner to motor connection box and motor connection box to controller after securing them to the foundation.

The lists below specify which cables to use for each respective application.

DANGER

Turn off the main power before connecting any cables.

CAUTION

Verify that the positioner serial number is according to the number(s) in the *Declaration of Incorporation* (DoI).

Protecting cables

Protect all flexible cables from weld spatter. Place the cables so the risk of mechanical wear is minimized.

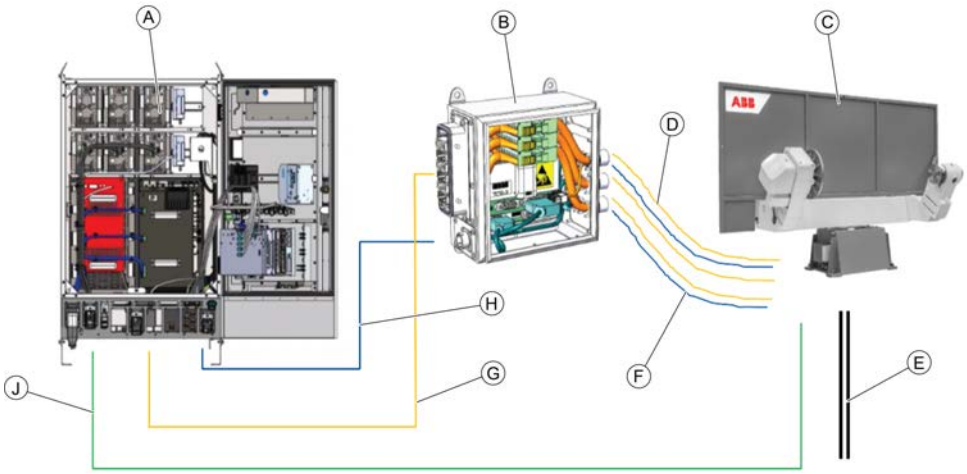
Connect power connectors on MCB

When fasten power connectors, wobble the connector body while tightening the connectors to make sure that they are fully fastened.

Continues on next page

3.5.1 Electrical connections

Robot system



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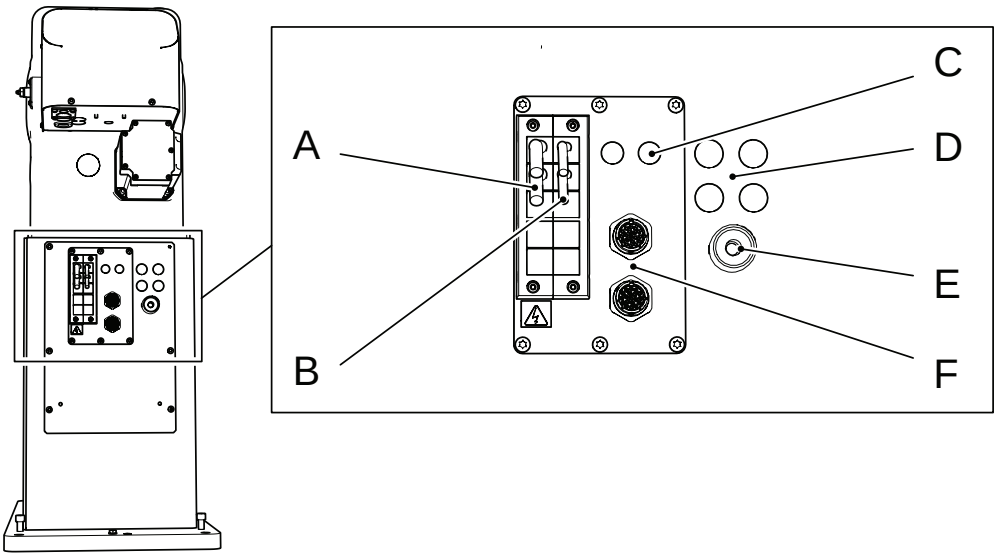
Position	Description
A	V250XT/V400XT Controller, with external drives
B	Motor connection box (3 or 6 axis)
C	IRP
D	Power
E	Weld return cable
F	Resolver signal
G	Cable harness power
H	Cable harness resolver, bus
J	Profibus, Customer power

Continues on next page

Connection interface

Positioners type A



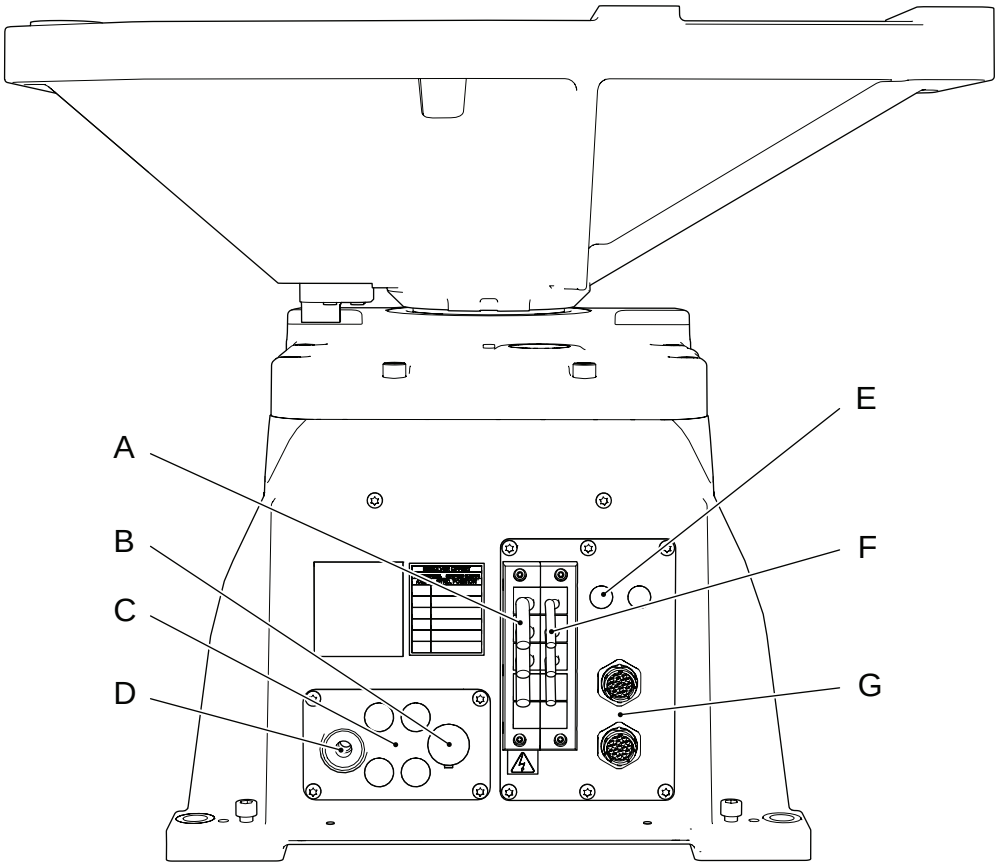
xx2300001481

Pos	Description	Pos	Description
A	Power, axis 1-2	D	Air (option)
B	Resolver signal, axis 1-2	E	Weld return cable
C	Profibus (option)	F	Customer power (option)

Continues on next page

3.5.1 Electrical connections
Continued

Positioners type B

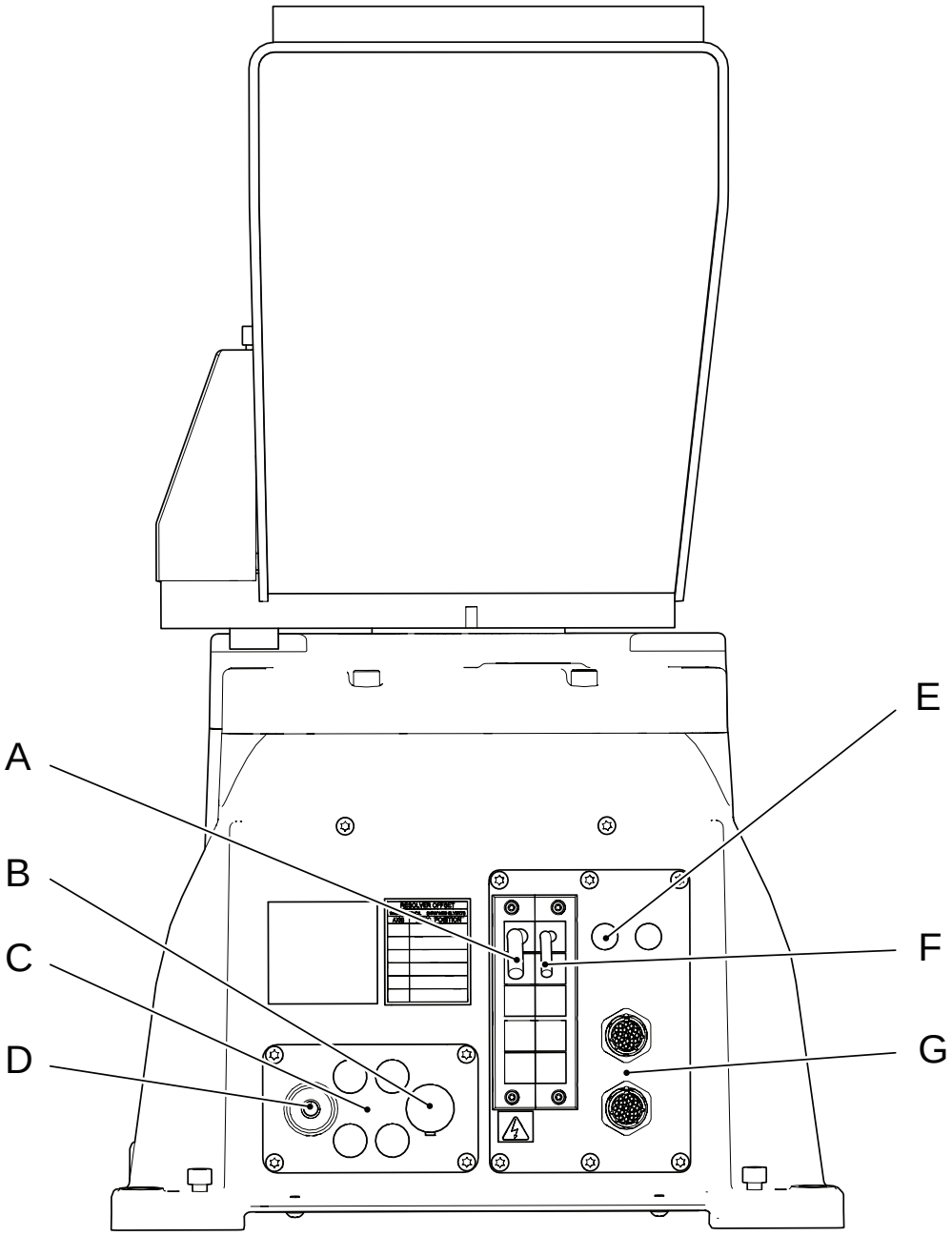


xx2300001482

Pos	Description	Pos	Description
A	Power, axis 1 (IRP C) Power, axis 1-5 (IRP B)	E	Profibus (option)
B	Extra weld return cable (option)	F	Resolver signal, axis 1 (IRP C) Resolver signal, axis 1-5 (IRP B)
C	Air (option)	G	Customer power (option)
D	Weld return cable		

Continues on next page

Positioners type C



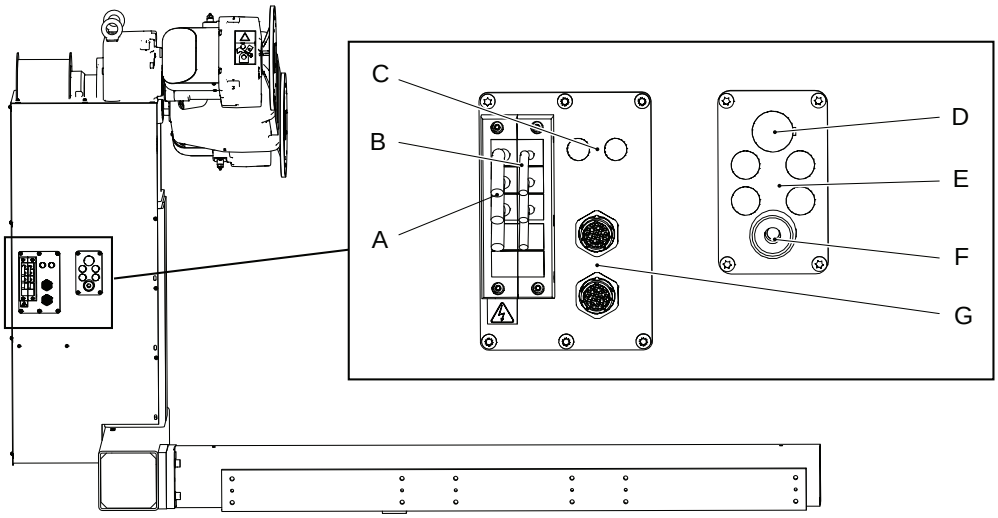
xx2300001483

Pos	Description	Pos	Description
A	Power, axis 1 (IRP C) Power, axis 1-5 (IRP B)	E	Profibus (option)
B	Extra weld return cable (option)	F	Resolver signal, axis 1 (IRP C) Resolver signal, axis 1-5 (IRP B)
C	Air (option)	G	Customer power (option)
D	Weld return cable		

Continues on next page

3.5.1 Electrical connections
Continued

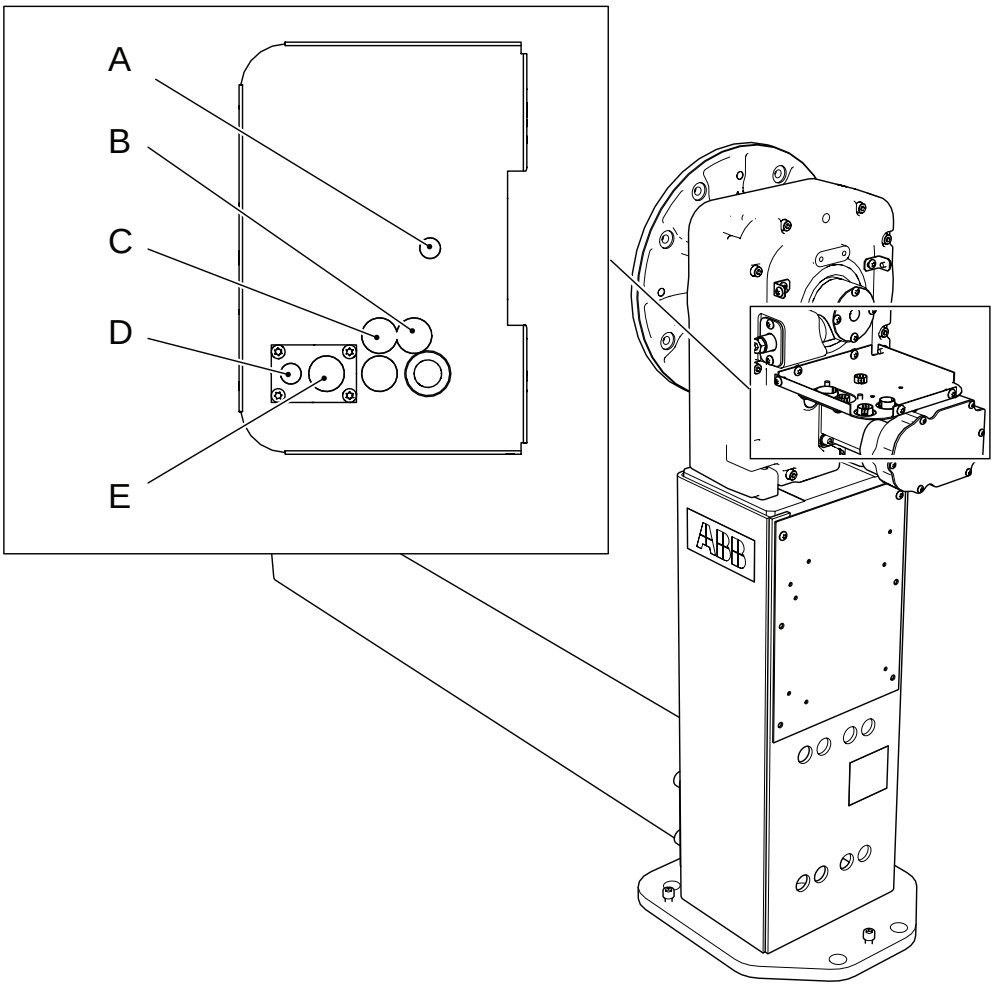
Positioners type K



Pos	Description	Pos	Description
A	Power axis, 1-3	E	Air (option)
B	Resolver signal, axis 1-3	F	Weld return cable
C	Profibus (otion)	G	Customer power (option)
D	Extra weld return cable (option)		

Continues on next page

Positioners type L



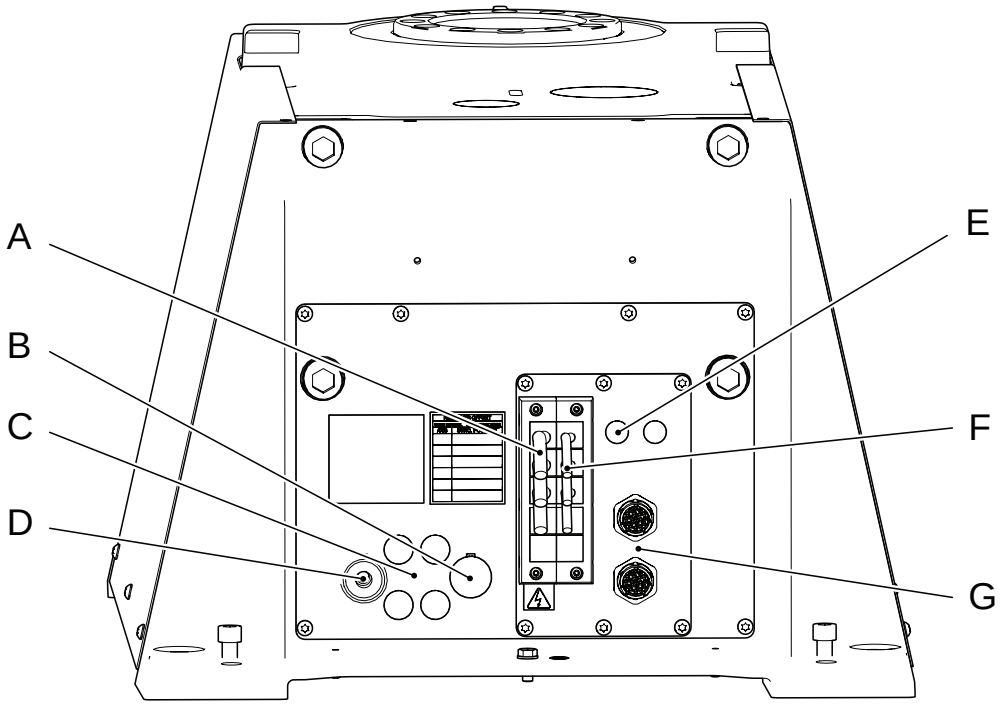
xx2300001485

Pos	Description	Pos	Description
A	T1 (swivel 1 air)	D	Station 1 (CS1) Station 2 (CS2)
B	T1 (swivel 1 el/1 air)	E	Station 1 (CP1) Station 2 (CP2)
C	T2		

Continues on next page

3.5.1 Electrical connections
Continued

Positioners type R

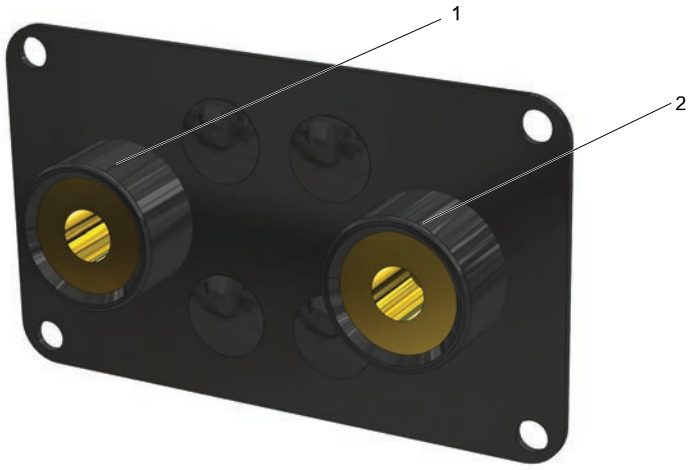


xx2300001486

Pos	Description	Pos	Description
A	Power axis 1 (IRP C) Power axis 1-5 (IRP B)	E	Profibus (option)
B	Extra weld return cable (option)	F	Resolver signal, axis 1 (IRP C) Resolver signal, axis 1-5 (IRP B)
C	Air (option)	G	Customer power (option)
D	Weld return cable		

Continues on next page

Current collectors

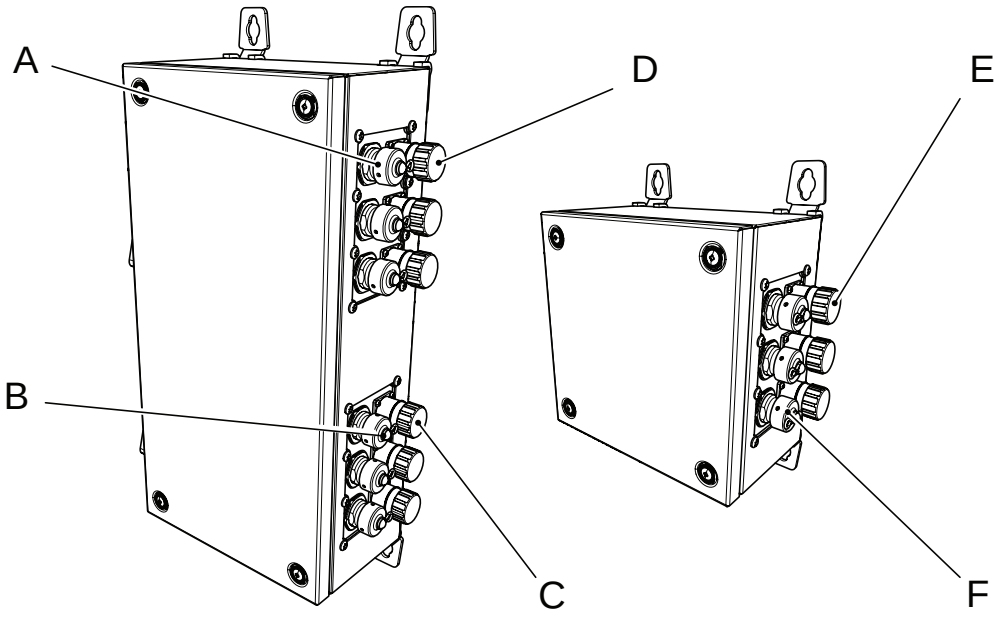


xx0900000990

1	Current collector connection 1
2	Current collector connection 2

3.5.2 Positioner interface to MCB

Interface for positioner



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Pos	Description
A	Resolver connector axis 1-3 (6 axis version)
B	Resolver connector axis 4-6 (6 axis version)
C	Power connector axis 1-3 (6 axis version)
D	Power connector axis 4-6 (6 axis version)
E	Power connector axis 1-3 (3 axis version)
F	Resolver connector axis 1-3 (3 axis version)

3.6 Installing fixtures and testing with corresponding workpieces

3.6.1 Installing fixtures

Introduction

If there is a difference between the loads on each side of the positioner IRP K, then special care must be taken when installing fixtures or workpieces.

> **Note**
>
> The values for *Max load difference between sides 1 and 2* are listed in the technical data in *Product specification - Product.ProductName*.

Load difference sides 1 and 2 does not exceed specified maximum value

If the positioner is in a horizontal position or not at the end of the working range when installing fixtures, make sure that the value of *Max load difference sides 1 and 2* is not exceeded.

Fixtures can be installed in any positioner position.

Load difference sides 1 and 2 exceeds specified maximum value

If the weight of the fixture exceeds the value of *Max load difference sides 1 and 2*, run the positioner to the working range end when positioner side 2 is oriented towards the operator side (positioner side 1 is toward the welding robot). Then the positioner cannot move further downwards when the first fixture is installed.

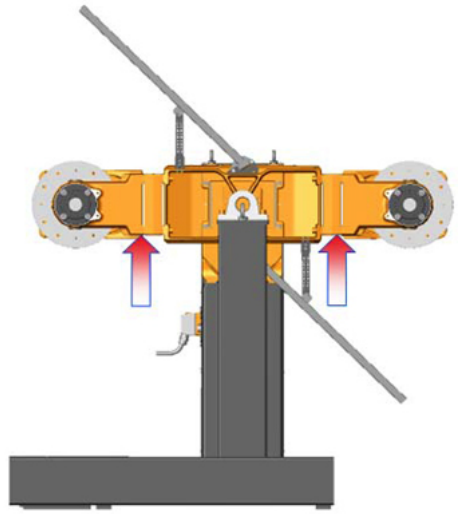
1 Install the fixture on positioner side 2.
2 Install the fixture on positioner side 1.

> **WARNING**
>
> Do not move the positioner before both fixtures are installed.

> **Note**
>
> If the fixtures must be installed in another position then the positioner must be supported on the surfaces shown with arrows in the graphic below.

Continues on next page

3.6.1 Installing fixtures
Continued



xx1100000143

Brake testing

After installing fixtures, always test the brakes, see *Brake testing on page 33*.

3.6.2 Removing or changing fixtures

Introduction

If there is a difference between the loads on each side of the positioner IRP K, then special care must be taken when removing or changing fixtures or workpieces.

Note

The values for *Max load difference between sides 1 and 2* are listed in the technical data in *Product specification - Product.ProductName*.

Load difference sides 1 and 2 does not exceed specified maximum value

If the positioner is in a horizontal position or not at the end of the working range when removing or changing fixtures, make sure that the value of *Max load difference sides 1 and 2* is not exceeded.

Fixtures can be installed in any positioner position.

Load difference sides 1 and 2 exceeds specified maximum value

If the weight of the fixture exceeds the value of *Max load difference sides 1 and 2*, run the positioner to the working range end when positioner side 2 is oriented towards the operator side (positioner side 1 is toward the welding robot). Then the positioner cannot move further downwards when the first fixture is removed.

1. Remove the fixture on positioner side 1.
2. Remove the fixture on positioner side 2.
3. If changing fixtures, then install the new fixture on side 2 and finally the new fixture on side 1.

WARNING

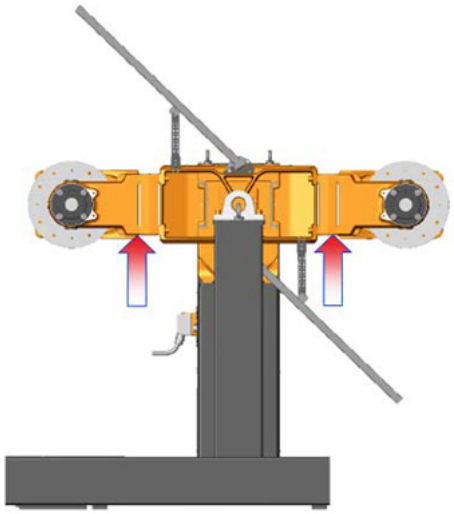
Do not move the positioner before both fixtures are removed or replaced by new fixtures!

Note

If the fixtures must be installed in another position then the positioner must be supported on the surfaces shown with arrows in the graphic below.

Continues on next page

3.6.2 Removing or changing fixtures
Continued



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Brake testing

After installing fixtures, always test the brakes, see *Brake testing on page 33*.

3.7 Test run after installation, maintenance, or repair

Safe handling

Use the following procedure after installation, maintenance, or repair, before initiating motion.

DANGER

Initiating motion without fulfilling the following aspects, may increase the risk for injury or cause damage to the robot.

	Action
1	Remove all tools and foreign objects from the positioner and its working area.
2	Verify that the positioner is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the positioner motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that all safety equipment is installed, as designed for the application.
6	Verify that the brake release tool is in its intended place.
7	Verify that no personnel are inside the safeguarded space before initiating motion. **Note** A positioner may perform unexpected limited movement.
8	The manual mode of operation shall be performed with all persons outside the safeguarded space.
9	Power on/off or rebooting the robot controller shall be performed with all persons outside the safeguarded space.
10	If maintenance or repair has been done, verify the function of the part that was maintained.
11	Always verify the results after calibrating any positioner axis, to verify that all calibration positions are correct.
12	Verify the application in the operating mode manual reduced speed.
13	When programming the movements of the positioner,always identify potential collision risks before initiating motion

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4 Configuration of RobotWare

4.1 Creating and downloading a system

Introduction

RobotStudio is used for modifying and downloading systems to the controller, and to download the add-in **Positioner** that contains configuration data for the different positioner variants.

The robot is delivered with a RobotWare system installed and configured according to the order specification. The positioner must be added to the RobotWare system, as described in the following procedure.

Before modifying the system

Before modifying the system it is recommended to take a backup of the system and put all axes of the robot and any external axes are in their zero positions.

Creating a system for RobotWare 7

In RobotWare 7, the positioner is loaded as an add-in. The add-in **Positioner** is available in the RobotStudio **Gallery**.

For more detailed instructions on using the function Modify Installation, see *Operating manual - Integrator's guide OmniCore*.

	Action
1	On the **Gallery** tab, install the add-in **Positioners**.
2	On the **Home** tab, choose **Virtual Controller** > **New controller** to create a new virtual controller accordingly.
3	On the **Controller** tab, choose **Installation** > **Modify Installation** to modify the system.
4	In the **Software** tab, click **Available** and locate the add-in. Click **Include**. Add other software, if needed.
5	In the **Options** tab, scroll down to **Positioners** and select the positioner family. Then select the variant.
6	Select **Joint configuration** to modify which measurement channel and what drive unit to use for each joint.
7	Select other options, such as the ADU (in **Controller**).
8	Click **Apply** to accept the changes. **Tip** If the PC is connected to the controller, then the system can be transferred using *Installation Utilities*, see *Operating manual - Integrator's guide OmniCore*, or create a package and transfer it with a USB memory.

Safety configuration

The required safety logic, for example, interchange positions, pre-reset, can be configured using an external safety PLC or using the safety logic in **Visual SafeMove** (requires SafeMove Pro license).

Continues on next page

All axes of the positioner should be configured to use Safe Disable of Drive Unit in **Visual SafeMove**.

The interchange positions can be configured using Axis Position Supervision in **Visual SafeMove**.

A pre-reset functionality can be set up using a template, see *LINK*[1]. This template must be modified and tested as part of the safety verification for the actual installation. This is the responsibility of the integrator.

1 *https://search.abb.com/library/Download.aspx?DocumentID=9AKK108469A9002&LanguageCode=en&Action=Launch*

4.2 Safe Disable of Drive Unit

Safe Disable of Drive Unit

Safe Disable of Drive Unit is a function that can be used to disable a robot or additional axis, by safely setting its drive unit in a state with all brakes applied and servo control switched off.

Functionality

While the function is activated by safe input signal, the drive unit controlling the robot or additional axis is set in a safe state with all brakes applied and servo control switched off. If the function is activated while one or more axes of the robot or additional axis are moving, a violation is triggered with a stop category 0 or category 1, depending on the configuration.

Related information

More information about the safety function *Safe Disable of Drive Unit* is available in *Application manual - Functional safety and SafeMove*.

4.3 Axis Position Supervision

Axis Position Supervision

Axis Position Supervision is an active supervision function that triggers a violation if any axis is outside of the defined ranges.

Functionality

Supervision of up to 9 axes (robot axes and additional axes) in each set. Up to 8 sets can be configured, one for each safe axis range.

If an axis in an active set exceeds its allowed range, the safety controller triggers. This violation will cause a stop category 0, a stop category 1, and/or set an output signal, depending on the configuration.

Related information

More information about the safety function *Axis Position Supervision* is available in *Application manual - Functional safety and SafeMove*.

5 Maintenance

5.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRP.

It is based on the maintenance schedule found at the beginning of the chapter. The schedule contains information about required maintenance activities including intervals, and refers to procedures for the activities.

Each procedure contains all the information required to perform the activity, including required tools and materials.

The procedures are gathered in different sections and divided according to the maintenance activity.

Safety information

Observe all safety information before conducting any maintenance work.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any maintenance work.

The maintenance must be done by qualified personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

Note

If the IRP is connected to power, always make sure that the IRP is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - OmniCore V250XT Type B*
- *Product manual - OmniCore V400XT*

5.2 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRP:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.

Robots with the functionality *Service Information System* activated can show active counters in the device browser in RobotStudio, or on the FlexPendant.

5.3 Maintenance schedule and expected component life

5.3.1 Maintenance schedule

General

This chapter details all maintenance activities recommended for the IRP. It is based on the maintenance schedule located at the beginning of the chapter. The schedule contains information about required maintenance activities including intervals, and refers to procedures for the activities. Each procedure contains all information required to perform the activity, e.g. required tools and materials. The procedures are gathered in different sections and divided according to the maintenance activity.

Activities and intervals, standard equipment

The sections referred to in the table can be found in the different chapters for every maintenance activity. The table below specifies the required maintenance activities and intervals:

Maintenance activity	Equipment	Interval
Inspection	Positioner harness	Running
Inspection	Current collector	Running
Inspection	Interchange gearbox, oil leak	Running
Inspection	Rotary gearbox, oil leak	Running
Clean	Positioner	Running
Lubrication	Current collector	400h
Lubrication	Gearbox, oil	40,000h
Replacement	Battery pack, measurement system with 2-pole battery contact, e.g. DSQC633A	Battery low alert [i]
Replacement	Battery pack, measurement system of type RMU101 or RMU102 (3-pole battery contact)	36 months or battery low alert [ii]

[i] The battery low alert (38213 **Battery charge low**) is displayed when remaining backup capacity (robot powered off) is less than 2 months. The typical lifetime of a new battery is 36 months if the robot is powered off 2 days/week or 18 months if the robot is powered off 16 h/day. The lifetime can be extended with a battery shutdown service routine. See *Operating manual - OmniCore* for instructions.

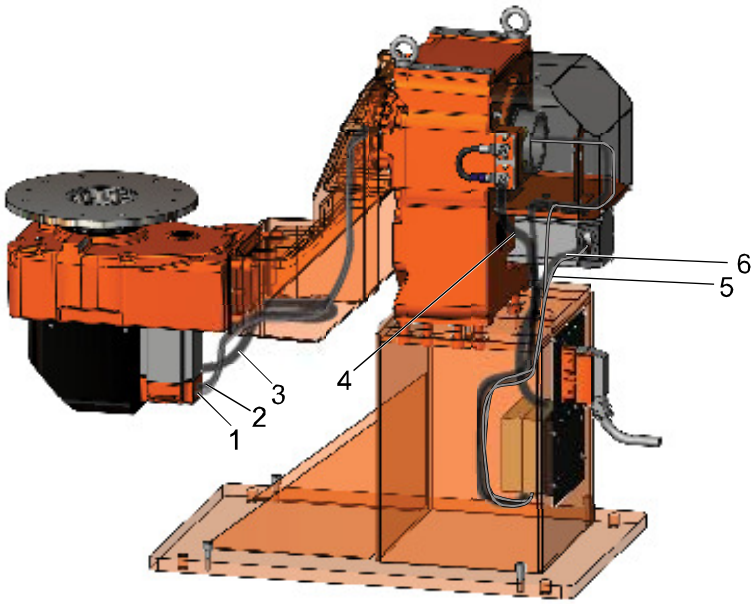
[ii] The battery low alert (38213 **Battery charge low**) is displayed when the battery needs to be replaced. The recommendation to avoid an unsynchronized robot is to keep the power to the controller turned on until the battery is to be replaced.

See the replacement instruction for more details.

5.4 Inspection activities

5.4.1 Inspection, cables

Location



xx0900001055

1	Motor power axis 2
2	SMB 2 signals axis 2
3	Current collector rotary unit 2
4	Current collector rotary unit 1
5	Motor power axis 1
6	SMB 1 signals axis 1

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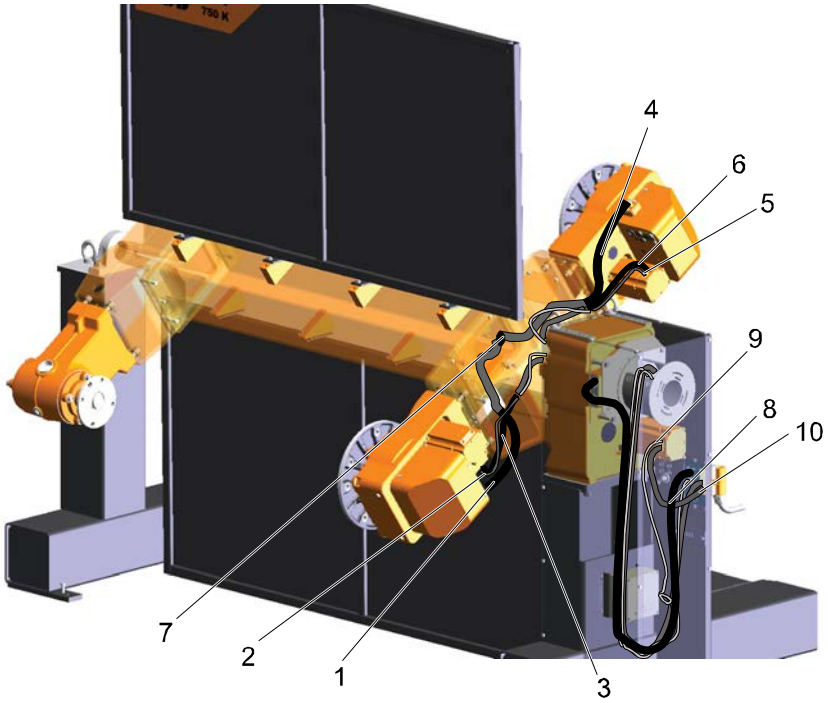

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1	Current collector rotary unit 3
2	SMB signals axis 3
3	Motor power axis 3
4	Current collector rotary unit 2
5	SMB signals axis 2
6	Motor power axis 2
7	Current collector connection point
8	Current collector rotary unit 1
9	SMB signals axis 1
10	Motor power axis 1

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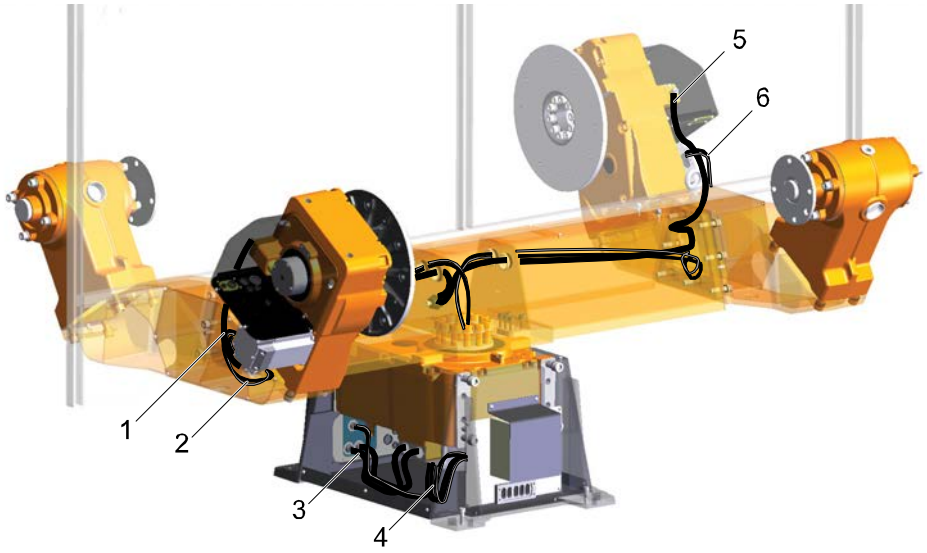
5.4.1 Inspection, cables

Continued



xx1000000010

1	Current collector rotary unit 3
2	SMB signals axis 3/ Motor power axis 3
3	Current collector rotary unit 1
4	SMB signals axis 1/ Motor power axis 1
5	Current collector rotary unit 2
6	SMB signals axis 2/ Motor power axis 2

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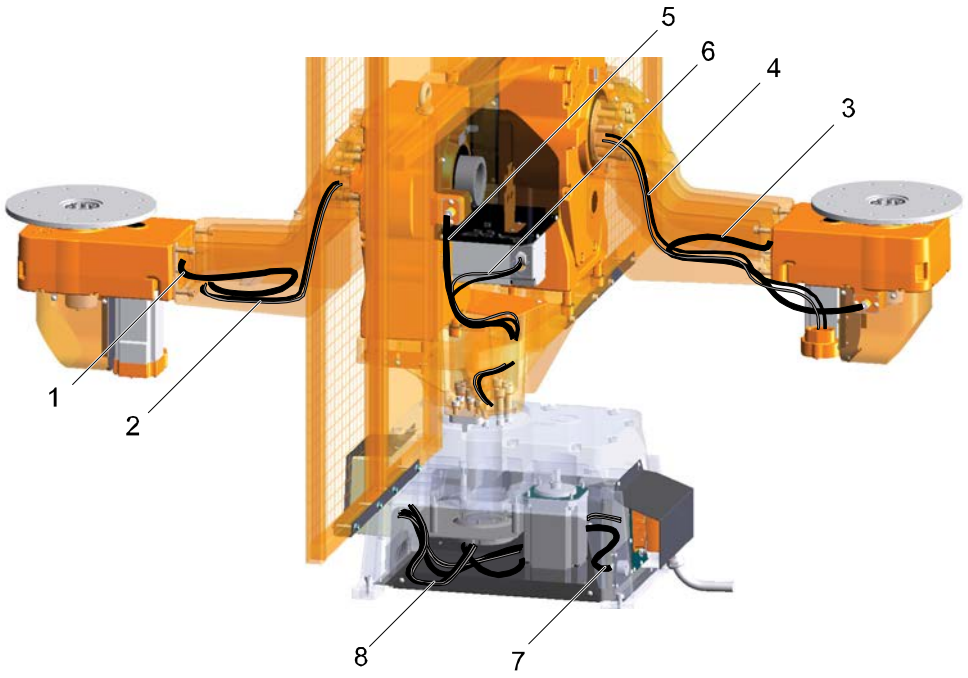


xx1000000011

1	Current collector rotary unit 4
2	SMB signals axis 4/ Motor power axis 4
3	Current collector rotary unit 5
4	SMB signals axis 5/ Motor power axis 5
5	Current collector rotary unit 2
6	SMB signals axis 2/ Motor power axis 2
7	Current collector rotary unit 1
8	SMB signals axis 1/ Motor power axis 1

Inspection procedure

WARNING

Turn off all electrical power supplies to the manipulator before entering its work space.

	Action	Note
1	Make an overall visual inspection of the cable harness, in order to detect wear and damage.	
2	Replace the cable harness if wear, cracks or damage is detected.	

5.4.2 Inspecting, weld return path

General

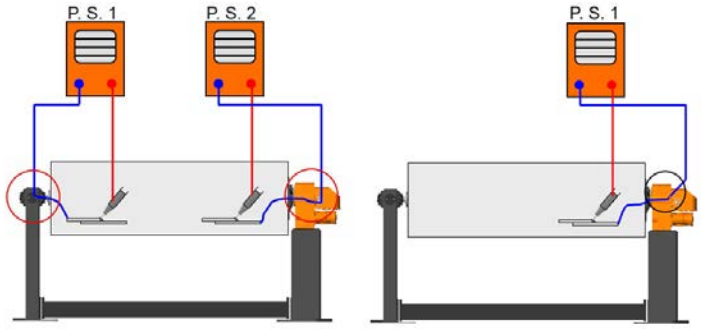
Make an overall visual inspection of weld return path all the way from welding fixture to welding power source. There must be proper contact between fixture and welding power source. Lack of above might lead to a situation when welding current can bypass normal path and pass though e.g. gearbox or support collar bearings reducing bearing or gearbox life time.

ELECTRICAL SHOCK

An inadequate contact between the current collector and the shaft may result in stray welding currents can pass through the earthing and lead to dangerous situations that can result in serious personal injury, damage to the control unit or other safety risks.

Location

Welding equipment connected to a positioner with one and a second current collector.



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Note

Current from one weld circuit is transferred through the current collector in the gearbox.

Two seperated weld circuits gives less risk for interference.

Required tools and equipment

Equipment	Article number	Note
Multimeter	-	-

Inspection procedure

	Action	Note
1	Check current collector.	See section *Inspection, support collar current collector on page 108*

Continues on next page

	Action	Note
2	Check weld return cable. Is intact, connection between cable and current collector is tight. Bayonet connector is tight at positioner foot and at welding power source side.	
3	Check weld return cable is intact.	
4	Check that the connection between cable and current collector is tight.	
5	Check that the bayonet connector is tight at positioner foot and at welding power source side.	

5.4.3 Inspection, rotary unit current collector

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

See also *Safety on page 15*.

General

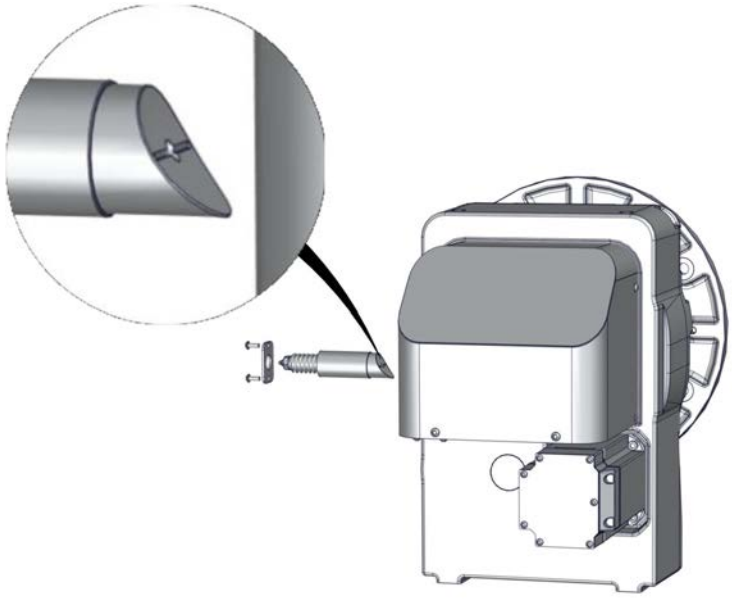
The function of the current collector is to transfer the weld current through the rotary unit. The contact bar needs to be check for damage caused by sparking during welding start after approximately 1000 hours of operation.

To ensure a good contact between the current collector and the shaft, the surface of the current collector must be thoroughly cleaned and lubricated according to *Lubricating the current collector on page 113*.

ELECTRICAL SHOCK

An inadequate contact between the current collector and the shaft may result in stray welding currents can pass through the earthing and lead to dangerous situations that can result in serious personal injury, damage to the control unit or other safety risks.

Location MTD



xx2300001343

Inspection procedure

	Action	Information
1	Remove the Current Collector cable.	

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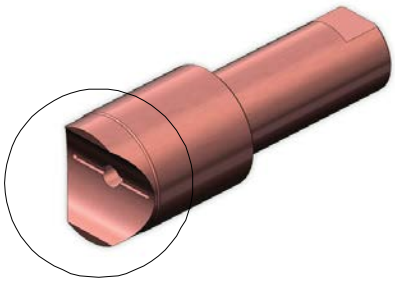
	Action	Information
2	Remove the Current Collector.	Open key 46 mm
3	Check the collector surface for damage.	 xx1000000113
4	For assemble see *Replacing support collar axis on page 155*.	

5.4.4 Inspection, support collar current collector

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

See also *Safety on page 15*.

General

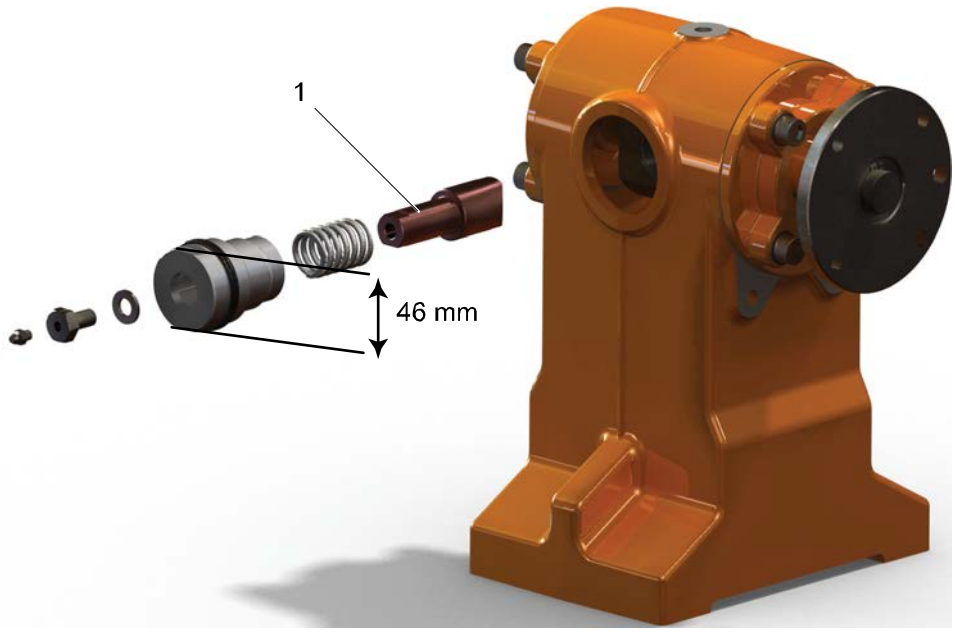
The function of the current collector is to transfer the weld current through the support collar. The contact bar needs to be check for damage caused by sparking during welding start after approximately 1000 hours of operation.

To ensure a good contact between the current collector and the shaft, the surface of the current collector must be thoroughly cleaned and lubricated according to *Lubricating the current collector on page 113*.

ELECTRICAL SHOCK

An inadequate contact between the current collector and the shaft may result in stray welding currents can pass through the earthing and lead to dangerous situations that can result in serious personal injury, damage to the control unit or other safety risks.

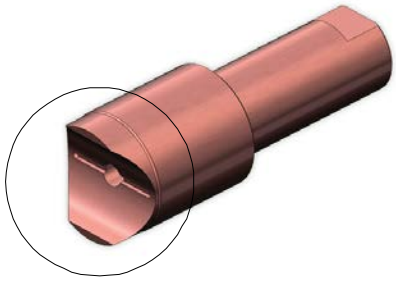
Inspection procedure



xx1000000043

1	Current Collector

Continues on next page

	Action	Information
1	Remove the Current Collector cable.	
2	Remove the Current Collector.	Open key 46 mm
3	Check the collector surface for damage.	 xx1000000113
4	For assemble see *Replacing support collar axis on page 155*.	

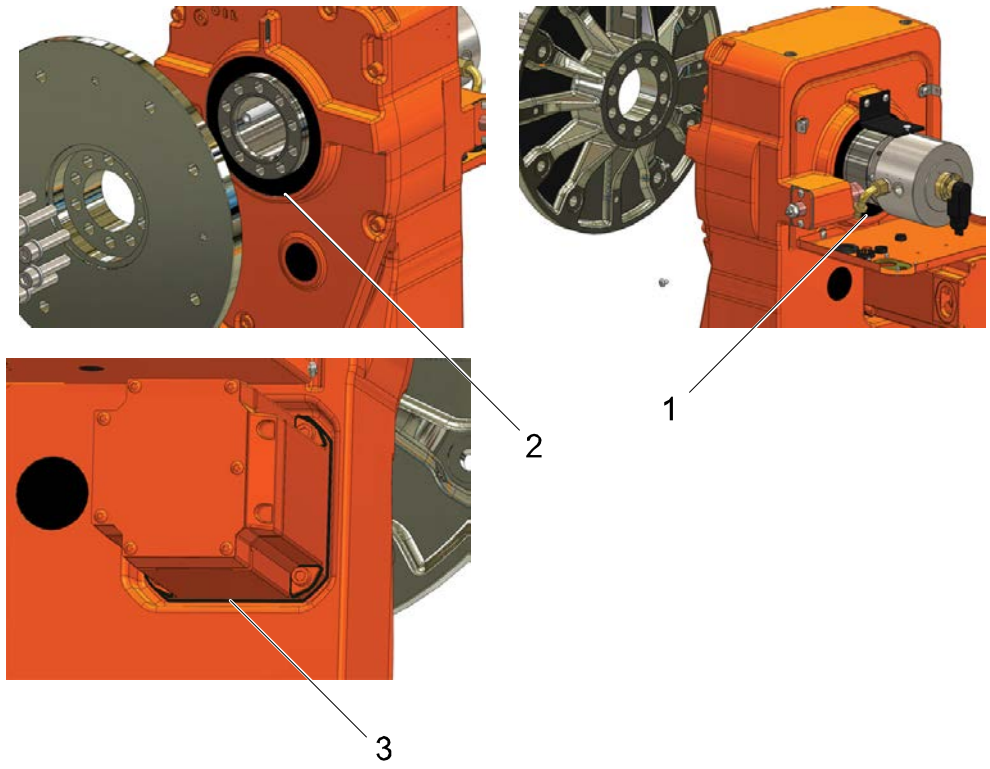
5.4.5 Inspection, gearbox oil leak

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

See also *Safety on page 15*.

Location MTD



xx1000000250

1	Axis sealing
2	Axis sealing
3	Motor sealing

Inspection procedure

	Action	Information
1	Check all sealing areas for oil leak.	

5.5 Cleaning activities

5.5.1 Cleaning the IRP

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

General

To secure high uptime it is important that the IRP is cleaned regularly. The frequency of cleaning depends on the environment in which the product works.

Different cleaning methods are allowed depending on the type of protection of the IRP.

Note

Always verify the protection type of the robot before cleaning.

Oil spills

Oil spills from gearboxes

Use the following procedure if any oil spills are detected that can be suspected to originate from a gearbox.

1. Inspect that the oil level in the suspected gearbox is according to the recommendations, see *Inspection activities on page 100*.
2. Write down the oil level.
3. Inspect the oil level again after, for example, 6 months.
4. If the oil level is decreased then replace the gearbox.

Special cleaning considerations

This section specifies some special considerations when cleaning the robot.

- Always use cleaning equipment as specified. Any other cleaning equipment may shorten the life of the robot.
- Always check that all protective covers are fitted to the robot before cleaning.
- Never point the water jet at connectors, joints, sealings, or gaskets.
- Do not use compressed air to clean the robot.
- Never use solvents that are not approved by ABB to clean the robot.
- Do not spray from a distance closer than 0.4 m.
- Do not remove any covers or other protective devices before cleaning the robot.

Continues on next page

5.5.1 Cleaning the IRP
Continued

Cleaning methods

The following table defines what cleaning methods are allowed depending on the protection type.

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water or steam
Standard	Yes	Yes. With light cleaning detergent.	Yes. It is highly recommended that the water contains a rust-prevention solution and that the manipulator is dried afterwards.	No

Cleaning with water and steam

Instructions for rinsing with water

ABB robots with protection types *Standard*, *Foundry Plus*, *Wash*, or *Foundry Prime* can be cleaned by rinsing with water (water cleaner), provided that the robot is not equipped with the option of motor cooling fans. [2]

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 700 kN/m^2 (7 bar) [I]
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum flow: 20 liters/min [I]

I Typical tap water pressure and flow

Cables

Movable cables need to be able to move freely:

- Remove waste material, such as sand, dust and chips, if it prevents cable movement.
- Clean the cables if they have a crusty surface, for example from dry release agents.

2 See *Cleaning methods on page 112* for exceptions.

5.6 Lubrication activities

5.6.1 Lubricating the current collector

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

See also *Safety on page 15*.

Current collector

The function of the current collector is to transfer the weld current through the rotary unit. This takes place through a spring-loaded contact bar against the shaft. The contact bar needs to be lubricated approximately after 400 hours of operation. This should be done using a special grease, P34 from Nies, article number: 0501869-001.

Required equipment

Equipment	Note
Grease	Grease type: P34 from Nies. Article number: 0501869002.
Standard tools	*Standard toolkit on page 209*
Grease gun	

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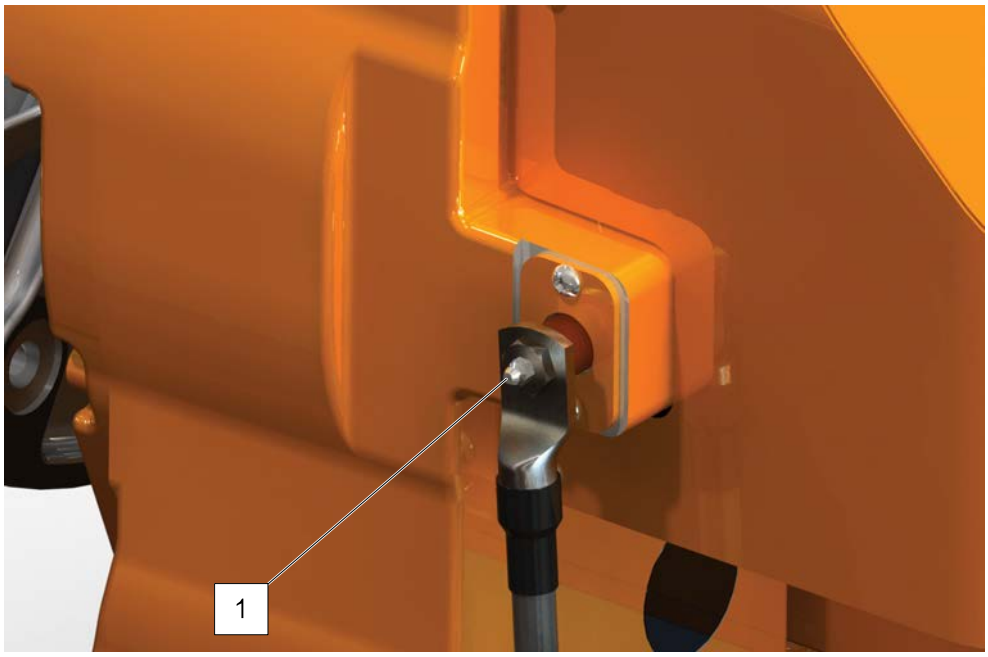
5.6.1 Lubricating the current collector

Continued

Lubricate



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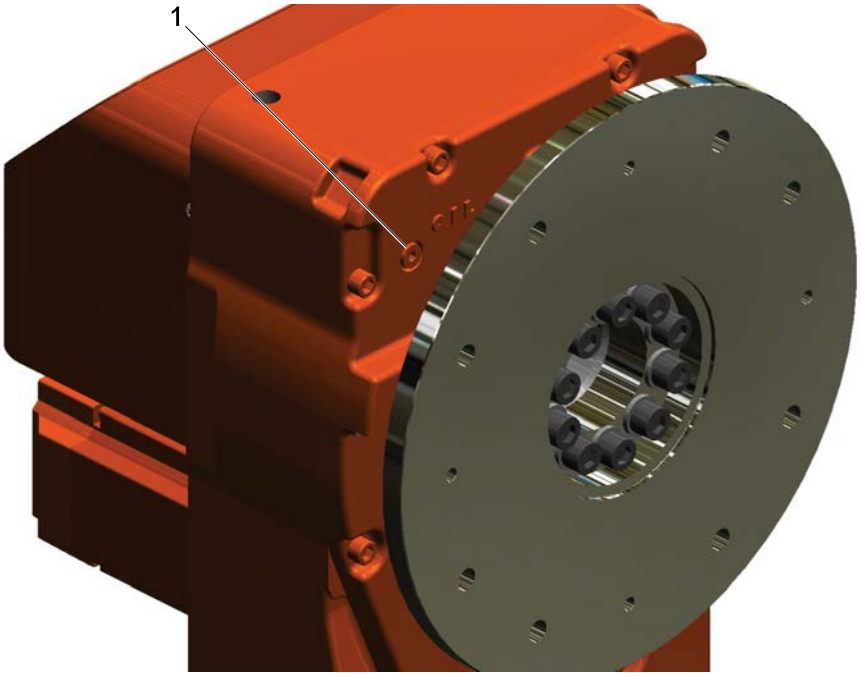
1	Lubrication nipple (4 mm)

	Action	Information
1	Lubricate the current collector using a grease gun.	**Note** Amount of grease: 12 ml.

5.6.2 Oil in gearboxes

Location of oil plugs

MTD/MID



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1	Oil plug

Oil in gearbox MTD/MID

The oil in the gearbox does not need to be changed during the lifetime of the gearbox.

Type and amount of oil in gearboxes

Information about the type of lubrication, article number as well as the amount in the specific gearbox can be found in *Technical reference manual - Lubrication in gearboxes* available for registered users on myABB Business Portal, *www.abb.com/myABB*.

Before starting any inspection, maintenance, or changing activities of lubrication, **always** contact the local ABB Service organization for more information.

For ABB personnel: Always check ABB Library for the latest revision of the manual *Technical reference manual - Lubrication in gearboxes*, in order to always get the latest information of updates about lubrication in gearboxes. A new revision will be published on ABB Library immediately after updates.

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6 Repair

6.1 General procedures

6.1.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRP. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

> **WARNING**
>
> Repair activities not described in this chapter must only be carried out by ABB.

Report replaced units

> **Note**
>
> When replacing a part on the IRP, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.
>
> This is particularly important for safety equipment to maintain the safety integrity of the installation.

Safety information

Make sure to read through the chapter *Safety on page 15* before commencing any service work.

> **Note**
>
> If the IRP is connected to power, always make sure that the IRP is connected to protective earth and a residual current device (RCD) before starting any repair work.
>
> For more information see:
>
> - *Product manual - OmniCore V250XT Type B*
> - *Product manual - OmniCore V400XT*

6.1.2 Mounting instructions for bearings

General

This section describes how to mount and grease different types of bearings on the robot.

Equipment

Equipment, etc.	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2 Used to grease the bearings, if not specified otherwise.

Assembly of all bearings

Attend to the following instructions while mounting a bearing on the robot.

	Action	Note
1	To avoid contamination, let a new bearing remain in its wrapping until it is time for fitting.	
2	Ensure that the parts included in the bearing fitting are free from burrs, grinding waste, and other contamination. Cast components must be free of foundry sand.	
3	Bearing rings, inner rings, and roller elements must not be subjected to direct impact. The roller elements must not be exposed to any stresses during the assembly work.	

Assembly of tapered bearings

Follow the preceding instructions for the assembly of the bearings when mounting a tapered bearing on the robot.

In addition to those instructions, the following procedure must be carried out to enable the roller elements to adjust to the correct position against the race flange.

	Action	Note
1	Tension the bearing gradually until the recommended pre-tension is achieved. **Note** The roller elements must be rotated a specified number of turns before pre-tensioning is carried out and also rotated during the pre-tensioning sequence.	
2	Make sure the bearing is properly aligned as this will directly affect the durability of the bearing.	

Greasing of bearings

Note

This instruction is not valid for solid oil bearings.

Continues on next page

The bearings must be greased after assembly according to the following instructions:

- The bearings must not be completely filled with grease. However, if space is available beside the bearing fitting, the bearing may be totally filled with grease when mounted, as excessive grease will be pressed out from the bearing when the robot is started.
- During operation, the bearing should be filled to 70-80% of the available volume.
- Ensure that grease is handled and stored properly to avoid contamination.

Grease the different types of bearings as following description:

- *Grooved ball bearings* must be filled with grease from both sides.
- *Tapered roller bearings* and axial needle bearings must be greased in the split condition.

6.1.3 Mounting instructions for sealings

General

This section describes how to mount different types of sealings.

Equipment

Consumable	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2

Rotating sealings

The following procedures describe how to fit rotating sealings.

CAUTION

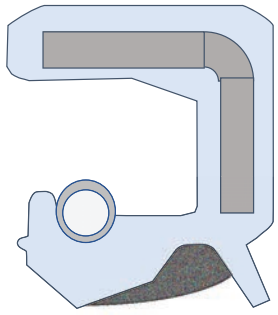
Please observe the following before commencing any assembly of sealings:

- Protect the sealing during transport and mounting, especially the main lip on radial sealings.
- Keep the sealing in its original wrappings or protect it well before actual mounting.
- The fitting of sealings and gears must be carried out on clean workbenches.
- Use a protective sleeve for the main lip during mounting, when sliding over threads, keyways or other sharp edges.
- Do not lubricate a static side of a sealing with grease, since this may result in movement of the sealing during operation.

  The only exception for lubrication of static sides of a sealing, is to use P-80 rubber lubrication gel against certain aluminium surfaces. If usage of P-80 is relevant, it is stated in the repair procedures.

Radial sealings

A radial sealing consists of a flexible rubber lip bonded to a rigid metal case. Only one side of the sealing is static with a metal insert.



xx2300000433

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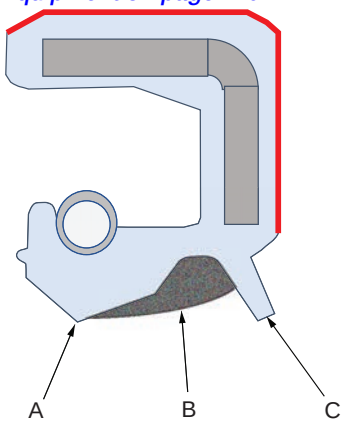
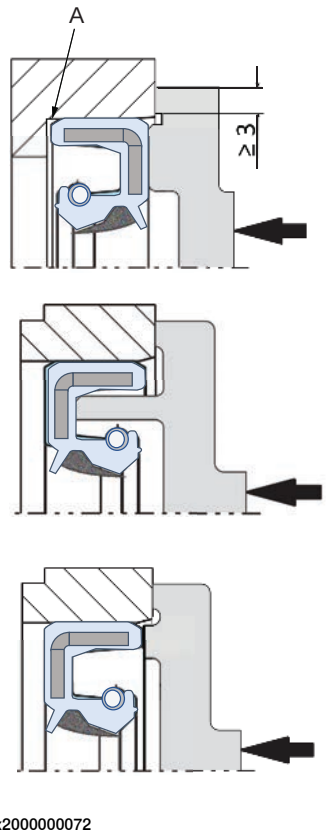
	Action	Note
1	Check the sealing to ensure that: • The sealing is of the correct type. • There is no damage on the main lip.	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	
3	Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.) Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.	Article number is specified in *Equipment on page 120*.  xx2000000071 A Main lip B Grease C Dust lip **Note** Ensure that no grease is applied to the red marked surface.

Continues on next page

6.1.3 Mounting instructions for sealings
Continued

	Action	Note
4	Mount the sealing correctly with a mounting tool. Never hammer directly on the sealing as this may result in leakage.	 xx2000000072 A Gap

Flange sealings and static sealings

The following procedure describes how to fit flange sealings and static sealings.

	Action
1	Check the flange surfaces. They must be even and free from pores. It is easy to check flatness using a gauge on the fastened joint (without sealing compound). If the flange surfaces are defective, the parts may not be used because leakage could occur.
2	Clean the surfaces properly in accordance with the recommendations of ABB.
3	Distribute the sealing compound evenly over the surface.
4	Tighten the screws evenly when fastening the flange joint.

O-rings

The following procedure describes how to fit o-rings.

	Action	Note
1	Ensure that the correct o-ring size is used.	
2	Check the o-ring for surface defects, burrs, shape accuracy, or deformation.	Defective o-rings, including damaged or deformed o-rings, may not be used.

Continues on next page

	Action	Note
3	Check the o-ring grooves and mating surfaces. They should be free of pores, contamination and obvious scratches/damage.	
4	Lubricate the o-ring with grease.	
5	Tighten the screws evenly while assembling.	
6	Check that the o-ring is not squashed outside the o-ring groove.	

6.1.4 Cut the paint or surface on the robot before replacing parts

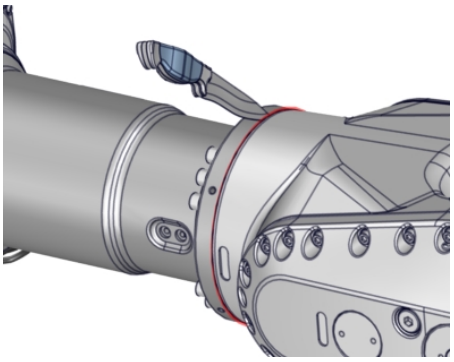
General

Follow the procedures in this section whenever breaking the paint of the robot during replacement of parts.

Required equipment

Equipment	Spare parts	Note
Cleaning agent		Ethanol
Knife		
Lint free cloth		
Touch up paint Standard/Foundry Plus	3HAC067974-001	Graphite White

Removing

	Action	Description
1	Cut the paint with a knife in the joint between the part that will be removed and the structure, to avoid that the paint cracks.	 xx2300000950
2	Carefully grind the paint edge that is left on the structure to a smooth surface.	

6.2 Frame parts

6.2.1 Replacing frame parts

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

Continues on next page

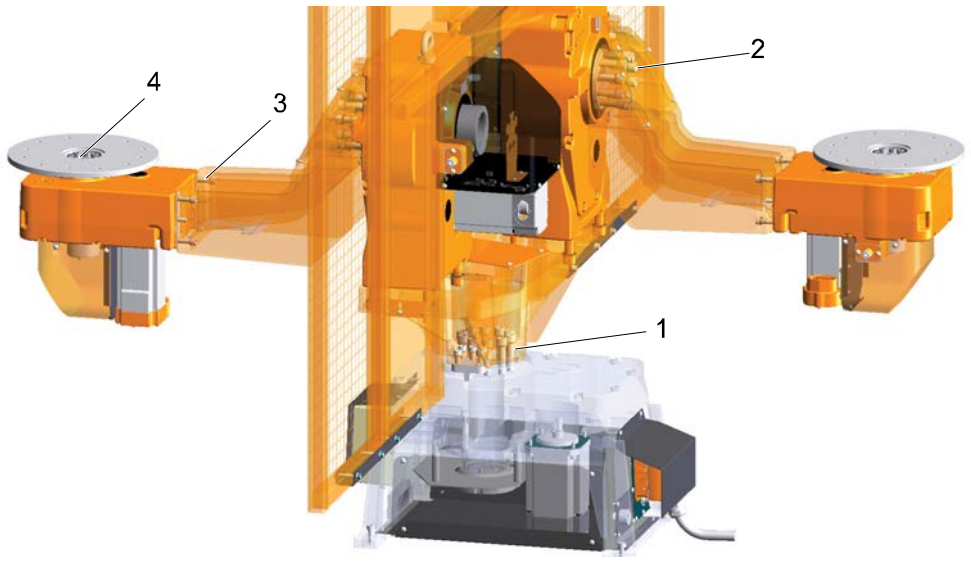
6.2.1.1 Overview

General

The following procedures in this section details how to remove the gearbox axes 1-3.

- *Remove the station frame on page 128*
- *Refit station frame on page 128*
- *Remove the station frame on page 128*
- *Remove the frame and covers on page 132*
- *Refit the frame and covers on page 134*
- *Remove the turning disc, MTD unit on page 135*
- *Refit turning disc, MTD unit on page 135*

Frame parts



xx1000000019

1	Base frame screws
2	Station frame screws
3	Rotary units screws
4	Turning disc screws

Required equipment

Equipment	Note
Standard tools	For more information, see *Standard toolkit on page 209*.

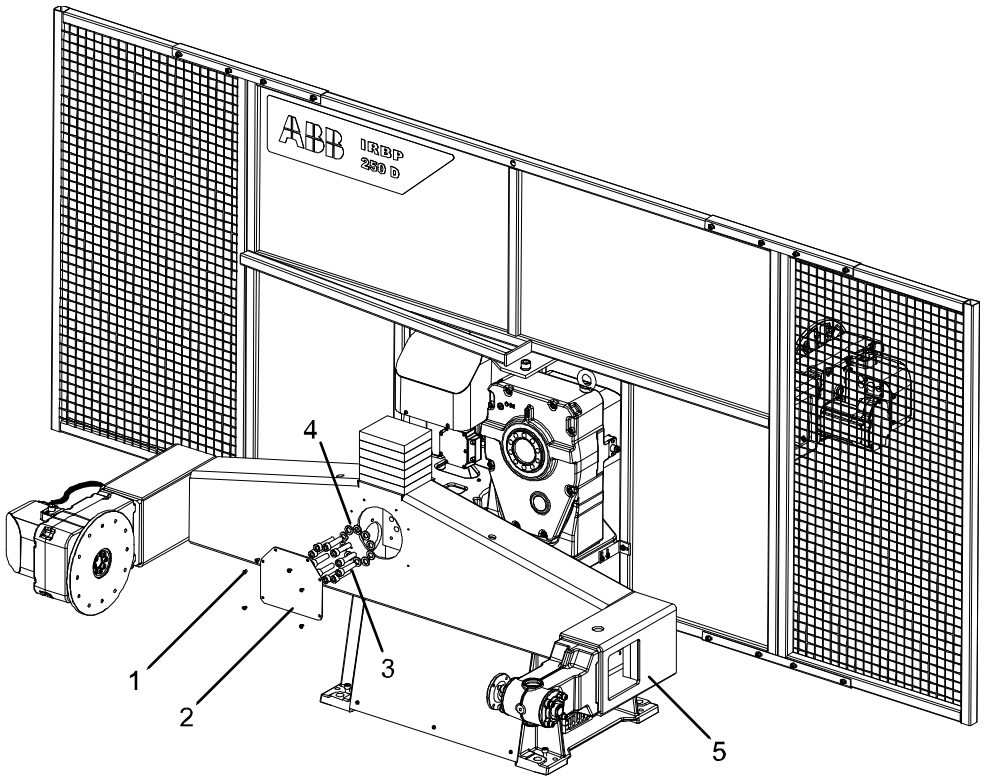
Continues on next page

Screw joints axis

MTD/MID	Axis	Screw dim. 12.9 UNB	Screw dim. 12.9	Tightening torque (Nm)
MTD 250	Turning axis	10x40		70
MTD 500	Turning axis	16x70		300
MTD 750	Turning axis	16x70		300
MTD 2000	Turning axis	20x90		550
MTD 5000	Turning axis	24x110		950
MID 2.1	Foot - Frame		20x90	550
Support collar MTD 250	Spherical bearing		10x40	70
Support collar MTD 500	Spherical bearing		16x70	300
Support collar MTD 750	Spherical bearing		16x70	300
Support collar MTD 2000	Spherical bearing		20x90	550

6.2.1.2 Replacing the station frame

Remove the station frame



xx1000000015

1	Screw
2	Cover plate
3	Attachment screws M16x70 12.9 Gleitmo
4	Washers
5	Station frame

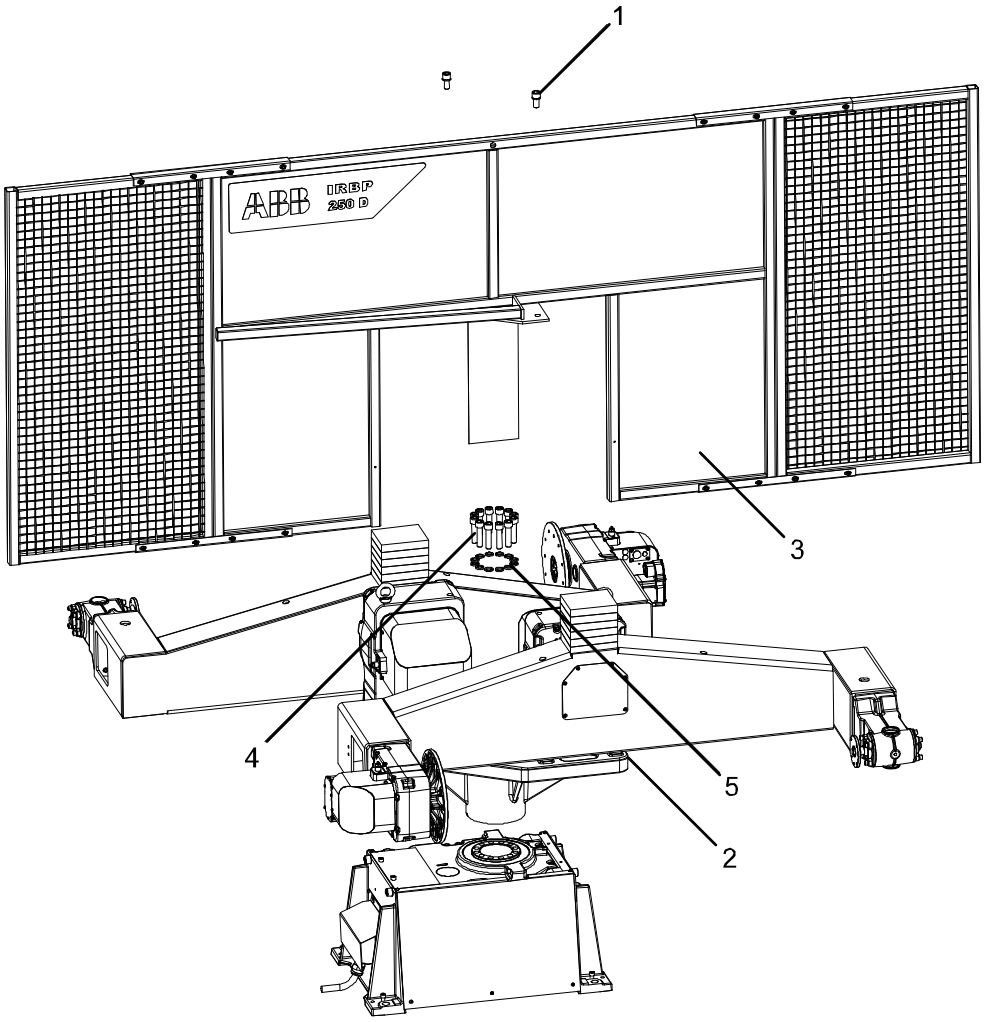
	Action	Note
1	Loosen the screws (1) and remove the cover plate (2).	
2	Loosen the attachment screws.	
3	Lift the station frame.	Described in section *Lifting frame parts on page 136*.

Refit station frame

	Action	Note
1	Clean the contact surface	
2	Lift the station frame.	Described in section *Lifting frame parts on page 136*.
3	Mount the attachment screws	Tightening torque according to table in Screw joints MTD axis.

6.2.1.3 Replacing the base frame

Remove the base frame



xx1000000014

1	Screws
2	Base frame
3	Station shield
4	Attachment screws M20x90 Steel 12.9
5	Washers

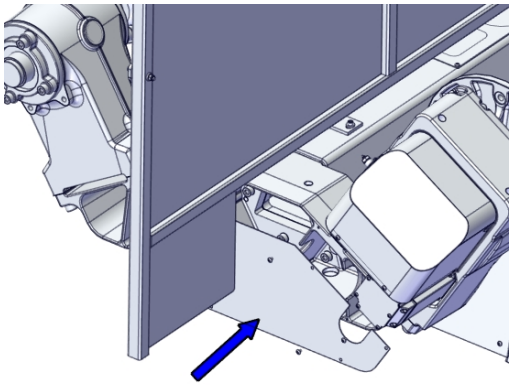
	Action	Note
1	Remove the screws holding the station shield.	

Continues on next page

6.2.1.3 Replacing the base frame
Continued

	Action	Note
2	Remove the cover on the base frame	 xx1000000115
3	Remove the attachment screws	
4	Lift the base frame.	Described in section *Lifting frame parts on page 136*.

Refit base frame

	Action	Note
1	Clean the contact surface.	
2	Lift the base frame.	Described in section *Lifting frame parts on page 136*.
3	Mount the attachment screws.	Tightening torque according to table in Screw joints MTD axis.
4	Remove the lifting accessories from the frame.	
5	**Valid for IRP R** Refit the plates at the frame ends.	 xx1700001322

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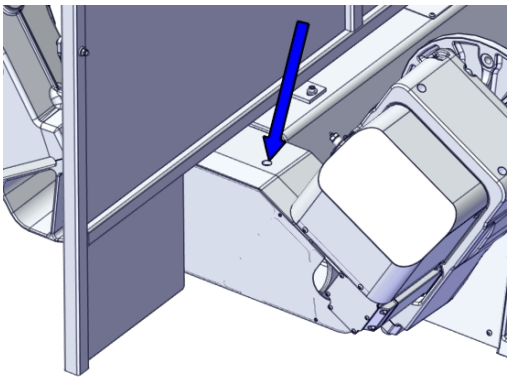
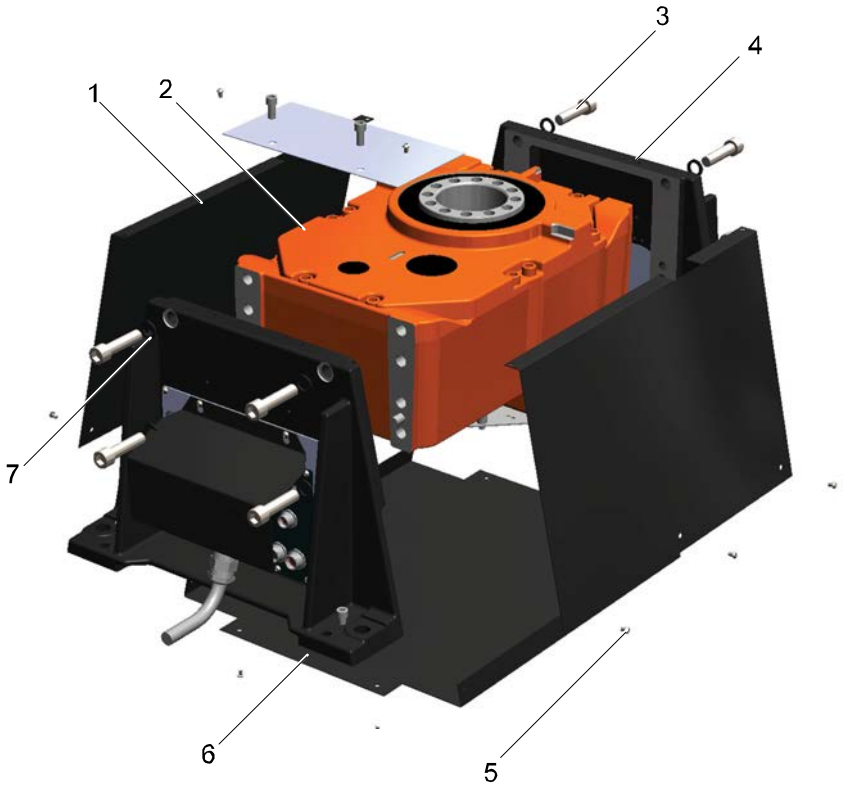
	Action	Note
6	**Valid for IRP R** Refit the protection plugs to the lifting eye holes.	 xx1700001324
7	Refit the station shield.	

6.2.1.4 Replacing the frame and covers

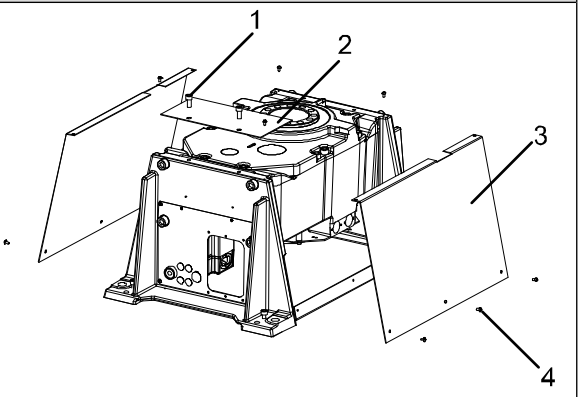
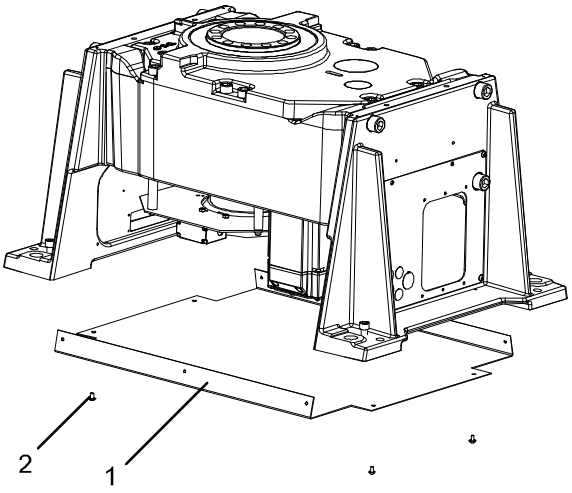
Remove the frame and covers



xx1000000020

1	Side cover
2	Rotary Unit
3	Attachment screw M20x90 Steel 12.9
4	Frame
5	Screw M6x10
6	Bottom plate
7	Washer 21x31/ 4 mm

Continues on next page

	Action	Note
1	1 Unscrew (4) and remove the side covers (3). 2 Unscrew (1) and remove the cover plate (2).	 xx1000000006 1 Screw 2 Cover plate 3 Side cover 4 Screw M6x10
2	Unscrew (2) and remove the bottom plate (1).	 xx1000000007 1 Bottom plate 2 Screw M6x10
3	Remove the electrical connection.	

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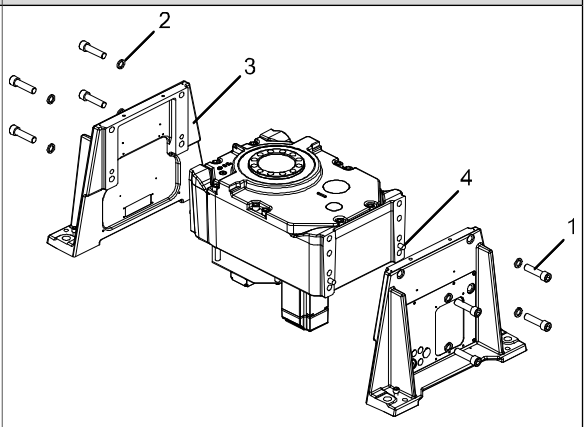
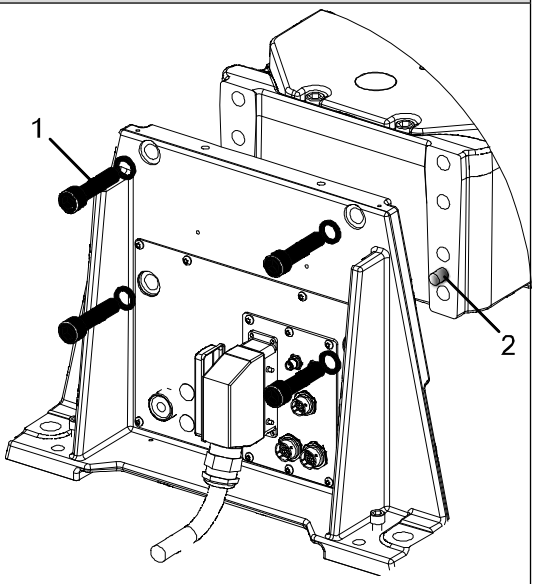
6.2.1.4 Replacing the frame and covers
Continued

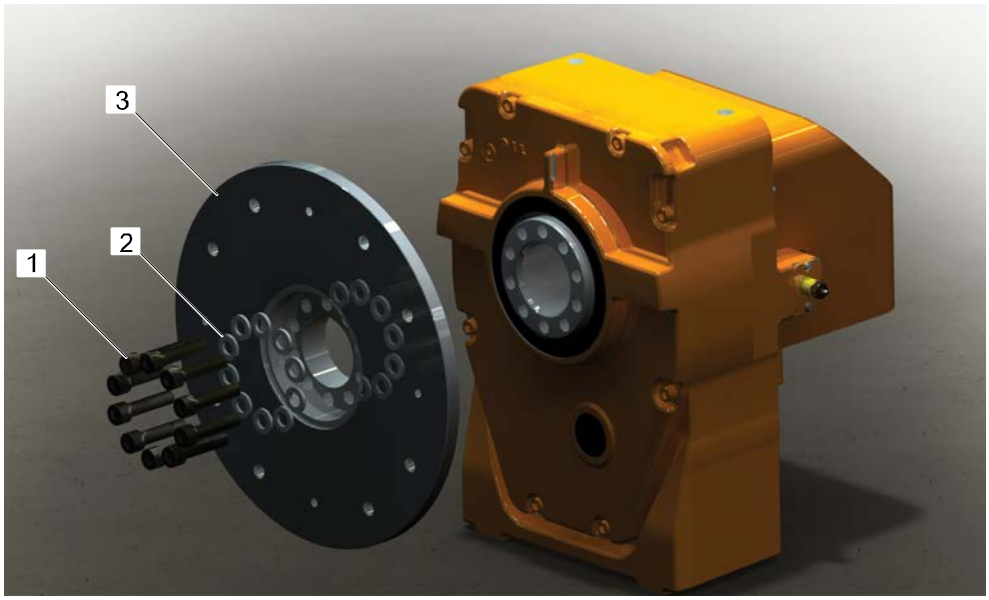
	Action	Note
4	Unscrew (1) and loose the washers (2) and remove the two frames (3).	 xx1000000008 1 Attachment screw M20x90 Steel 12.9 2 Washers 3 Frame 4 Guide pin

Refit the frame and covers

	Actions	Note
1	Mount the frames using the attachment screws M20x90. • Tightening torque is 550 Nm **Note** Use Molycote-lubricant for the screw joints.	 xx1000000077 1 Attachment screw M20x90 Steel 12.9 2 Guide pin
2	Mount all electrical connections.	
3	Mount the bottom plate.	
4	Mount the side plates and cover.	

6.2.1.5 Replacing the turning disc

Remove the turning disc, MTD unit



xx1000000023

1	Attachment screws
2	Washers
3	Turning disc

	Action	Note
1	Remove the screws (1) by holding the turning disc (3).	

Refit turning disc, MTD unit

	Action	Note
1	Refit the turning disc (3) with screws (1).	Tightening torque according to the table in *Screw joints axis on page 127*.

6.2.2 Lifting frame parts

General

This section describes about the lifting of frame parts.

For information about the lifting of manipulator, see the section *Lifting the positioner on page 51*. For information about replacing rotary units see the section *Replacing rotary unit on page 153*.

Note

Lifting eyes (standard as well as with swivel) are not delivered with the IRP. Use lifting eyes and/or lifting eyes with swivel in the proper positions as described in the lifting instructions for each IRP. Always use lifting eyes with the correct lifting capacity according to the part being lifted.

WARNING

Do not work or walk under a suspended load!

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

WARNING

Always lift the manipulator in a safe manner, using lifting tools according to the specified lifting weight in section *Lifting weight*.

Required equipment

Equipment	Note
Standard tools	See section *Standard toolkit on page 209*.
Lifting accessories	Suitable for the specified lifting weight.
Lifting eyes	Suitable for the specified lifting weight.
Lifting eyes, swivel	Suitable for the specified lifting weight.
Winch min. 500 kg	

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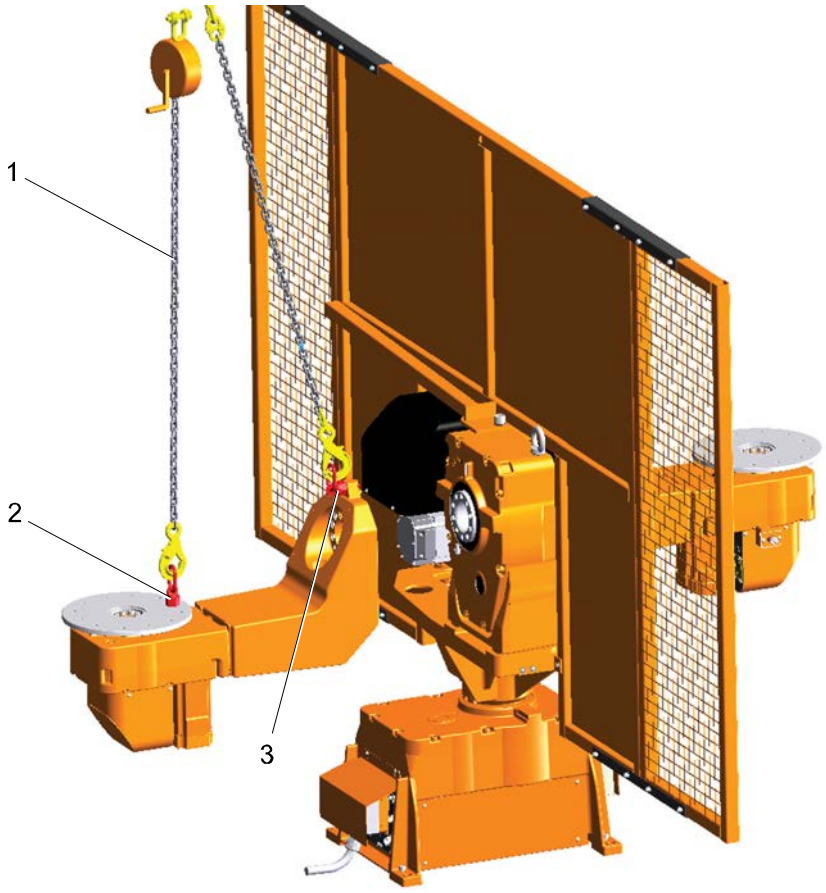
Lifting A, B station arm



xx1000000078

1	Winch min. 500 Kg
2	Lifting eye, swivel
3	Lifting eye, swivel 14 mm

Frame parts	Lifting weight
250 A/B	117 kg
500/750A, dist. =1000	250 kg
500/750 A/B	270 kg

	Action	Note
1	Attach the lifting eyes with swivel, as shown in the figure.	
2	Stretch the lifting chains.	
3	Remove the attachment screws.	
4	Lift the gearbox and the frame.	

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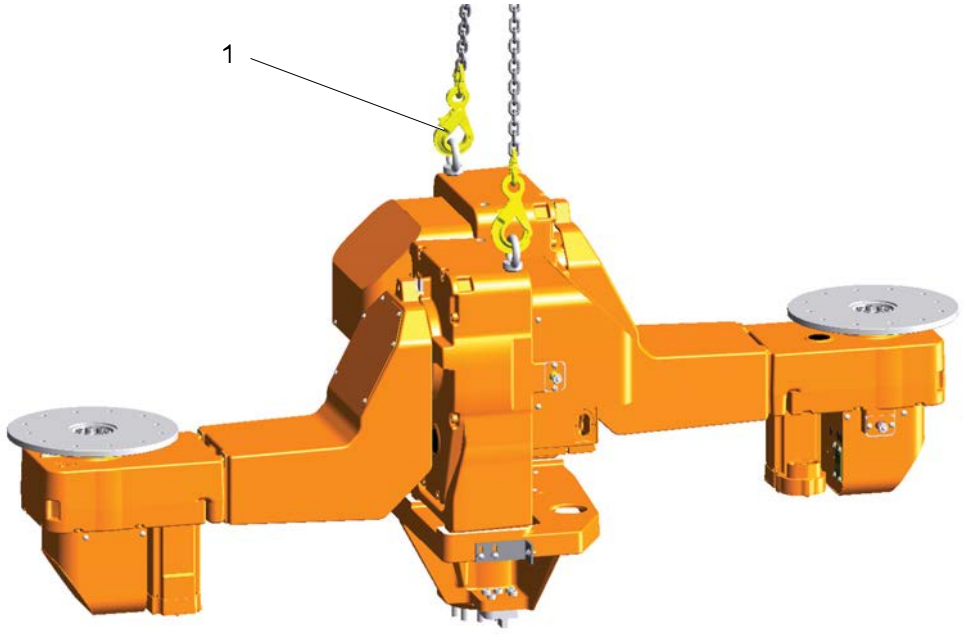
6.2.2 Lifting frame parts
Continued

Lifting A, B station frame



xx1000000125

1	Lifting eye (2 pcs)

Frame parts	Lifting weight
250B	640 kg
500/750B	1,250 kg

	Action	Note
1	Attach the lifting eyes as shown in the figure.	
2	Stretch the lifting chains	
3	Remove the attachment screws	
4	Lift the gearbox and the frame	

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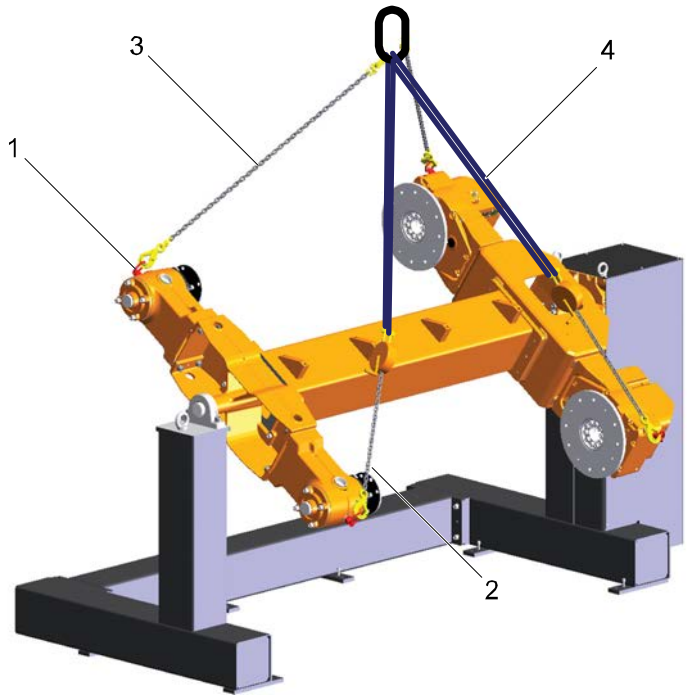
Lifting K stations



xx1000000080

1	Lifting eyes, swivel (4 pcs)
2	Winch min.500 Kg
3	Lifting chain
4	Lifting sling

Frame parts	Lifting weight
250K, D=1000, L=1600	454 kg
250K, D=1000, L=4000	606 kg
250K, D=1200, L=1600	500 kg
250K, D=1200, L=4000	652 kg
500/750K, D=1200, L=1600	975 kg
500/750K, D=1200, L=4000	1,188 kg
500/750K, D=1400, L=1600	1,036 kg
500/750K, D=1400, L=4000	1,248 kg

	Action	Note
1	Attach the lifting eyes as shown in the figure.	
2	Stretch the lifting chains	
3	Remove the attachment screws	
4	Lift the gearbox and the frame	

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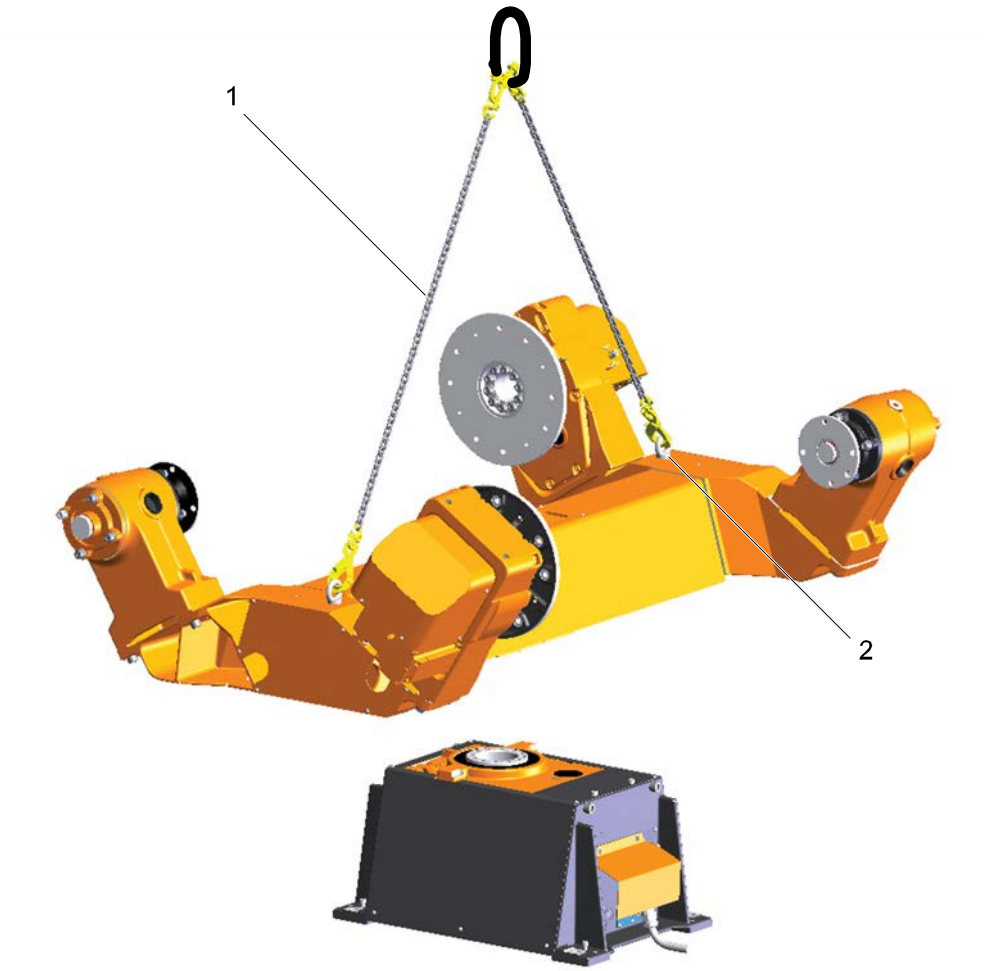
6.2.2 Lifting frame parts
Continued

Lifting R stations



xx1000000081

1	Lifting chain
2	Lifting eye 24 mm (2 pcs)

Frame parts	Lifting weight
300R, L=1250	376 kg
300R, L=1600	394 kg
600/1000R, D=1000, L=1600	828 kg
600/1000R, D=1000, L=2000	853 kg
600/1000R, D=1200, L=1600	884 kg
600/1000R, D=1200, L=2000	909 kg

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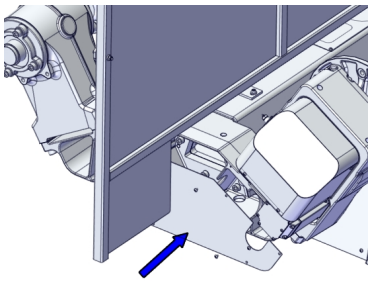
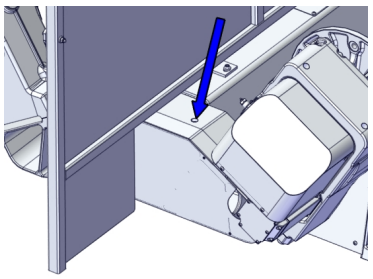
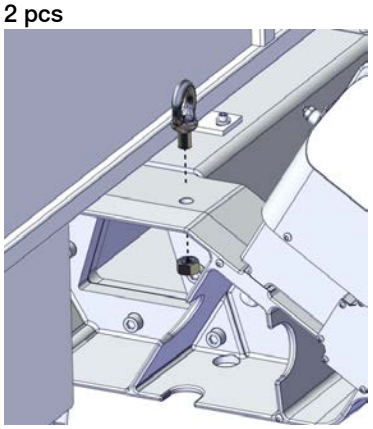
	Action	Note
1	Remove the plates to get access to the lifting eye holes in the frame.	 xx1700001322
2	Remove the protection plugs from the lifting eye holes.	 xx1700001324
3	Attach the lifting eyes.	2 pcs  xx1700001323
4	Stretch the lifting chains	
5	Remove the attachment screws	
6	Lift the gearbox and the frame	

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6.2.2 Lifting frame parts
Continued

Lifting rotary units

xx1000000116

Frame parts	Lifting weight
MTD 5000	770 kg
MTD 2000	340 kg
MTD 750	180 kg
MTD 500	180 kg
MTD 250	70 kg
MID 1.1	180 kg
MID 1.2	165 kg
MID 2.1	370 kg
MID 2.2	285 kg

	Action	Note
1	Attach the lifting eyes as shown in the figure.	
2	Stretch the lifting chains	
3	Remove the attachment screws	
4	Lift the gearbox	

6.3 Lower frame and base

6.3.1 Replacing stop lugs

General

The function of the stop lug is to allow the positioner after station interchange to be positioned in an accurate position.

Replace the station stop lug immediately if it is damaged.

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

Note

Keep the contact surfaces clean.

Required equipment

Equipment	Note
Standard tools	For more information, see *Standard toolkit on page 209*.
Stop lug	Product Manual Sparepart IRP

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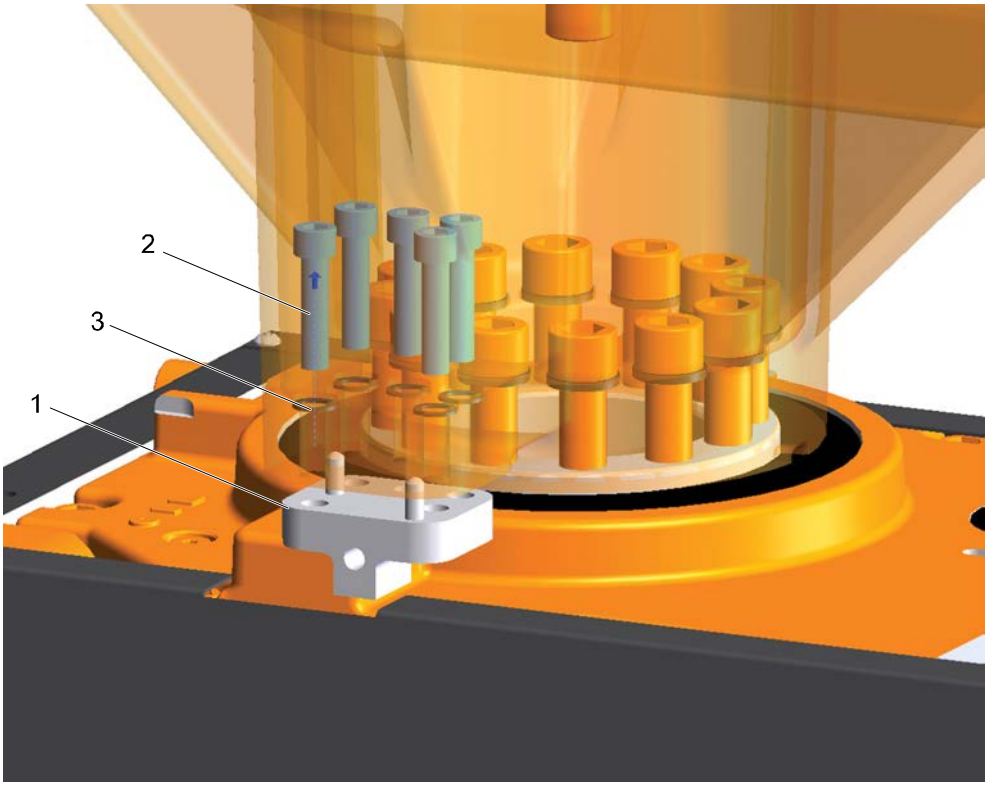
6.3.1 Replacing stop lugs
Continued

Remove stop lug



xx1000000082

1	Stop lug
2	Attachment screw M12 x 50/12.9
3	Washer

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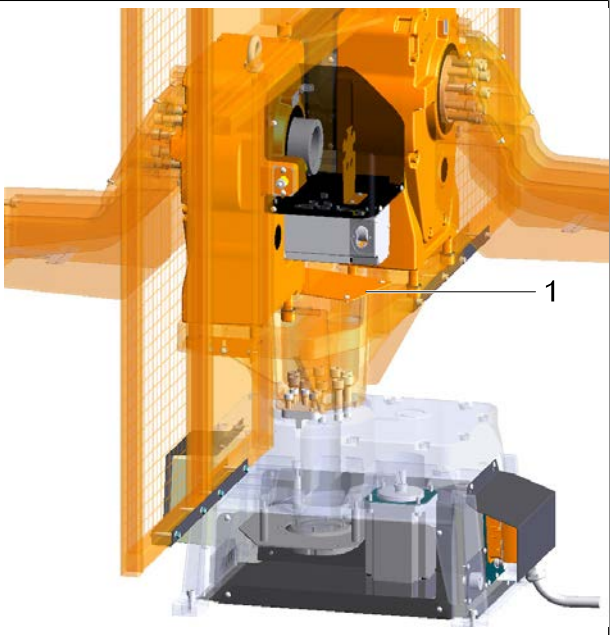
	Action	Mote
1	Remove the cover (1).	 xx1000000298 1 Cover
2	Remove the attachment screws.	Use standard tools
3	Remove the stop lug.	

Refit stop lug

	Action	Note
1	Mount the stop lug. **Note** Always use the two locking pins	
2	Mount the attachment screws.	Use standard tools, Tightening torque 140 Nm.
3	Mount the cover (1)	Use standard torque, see section *Screw joints on page 63*.

6.4 Motors

6.4.1 Replacing motors

General

The procedure below details how to remove and refit motors, and how to isolation check the motor.

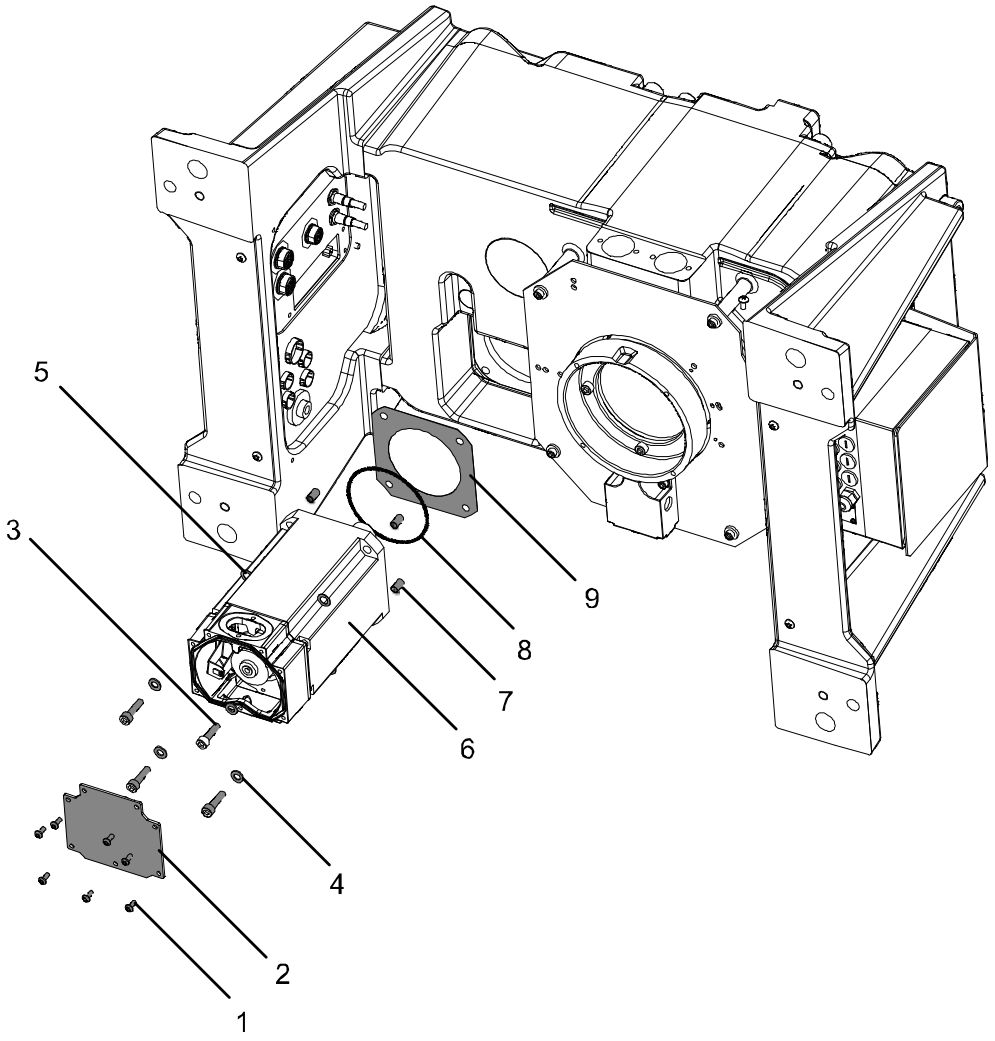
> **CAUTION**
>
> Galvanic contact between the gearbox and the motor can seriously damage the motor, see section *Checking insulation on page 152*.

Required equipment

Equipment	Note
Standard tools	For more information, see *Standard toolkit on page 209*.
Spareparts	

Continues on next page

Remove motor rotary units axis 1



xx1000000017

1	Screws
2	Cover plate
3	Attachment screws
4	Plain washers
5	Insulating washer
6	Motor
7	Insulating tube
8	O-ring
9	Insulating material

Continues on next page

6.4.1 Replacing motors
Continued

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Remove all the covers on the manipulator foot. **Not required on rotary units for axis two or three.**	Detailed in the section *Replacing frame parts on page 125*.
3	Remove the cover plate on top of the motor by unscrewing the attachment screws (1-2).	
4	Remove the cable gland cover at the cable exit by unscrewing its the attachment screws.	
5	Disconnect all connectors.	
6	Remove the motor by unscrewing the attachment screws and plain washers (3-4).	
7	Remove the o-ring (8).	
8	Remove the insulating material and insulating tubes (5, 7, 9).	

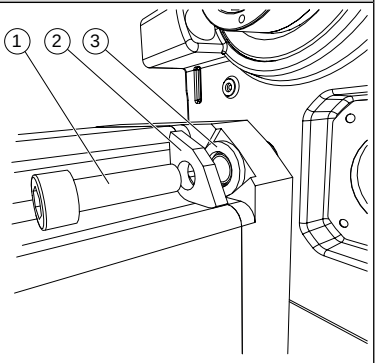
Refit motor rotary units axis 1

CAUTION

Do not mix motors *valid from* serial number SEROP POF-110001- & CNAUS POF-510001-, with motors *valid up to* serial numbers SEROP -POF 110000 & CNAUS -POF 510000. They are not compatible.

	Action	Note
1	Refit the insulating material and insulating tubes (7-9).	
2	Refit the o-ring (8) on the motor.	Replace the o-ring if necessary. See superport in the spare parts manual.

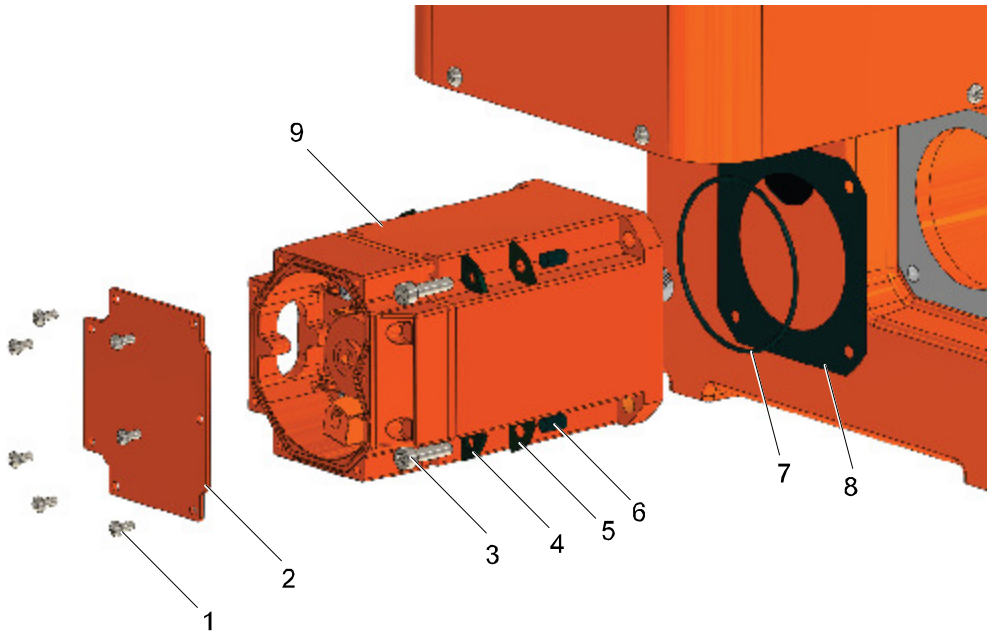
Continues on next page

	Action	Note
3	Refit the insulating washer (5). **Note** If countersunk holes in motor flange. Make sure that the plane washer is mounted before the insulating washer to fill out the recess.	 xx1500002519 1 Attachment screw 2 Insulating washer 3 Plane washer
4	Refit the motor using the attachment screws and plain washers (3-4).	Use standard torque, see section *Screw joints on page 63*.
5	Connect all connectors.	
6	Refit the cable gland cover at the cable exit.	
7	Refit the cover plate (2).	
8	Refit all the covers on the manipulator foot. **Only axis one.**	Detailed in the section *Replacing frame parts on page 125*.

Continues on next page

6.4.1 Replacing motors
Continued

Remove MTD rotary unit motor, axis 2-3



xx1000000206

1	Torx screw M5x12
2	Cover plate
3	Hex socket head cap screw M8x30
4	Washer
5	Insulating material
6	Insulating tube
7	O-ring
8	Insulating material
9	Motor

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Remove the cover plate (2) on top of the motor by unscrewing the attachment screws (1).	
3	Remove the cable gland cover at the cable exit by unscrewing its the attachment screws.	
4	Disconnect all connectors.	
5	Remove the motor by unscrewing the attachment screws and washers (3-4).	

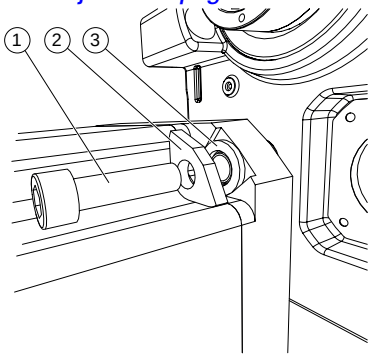
Continues on next page

	Action	Note
6	Remove the motor (9).	
7	Remove the o-ring (7).	
8	Remove the insulating material and insulating tubes (5, 6, 8).	

Refit MTD rotary unit motor, axis 2-3

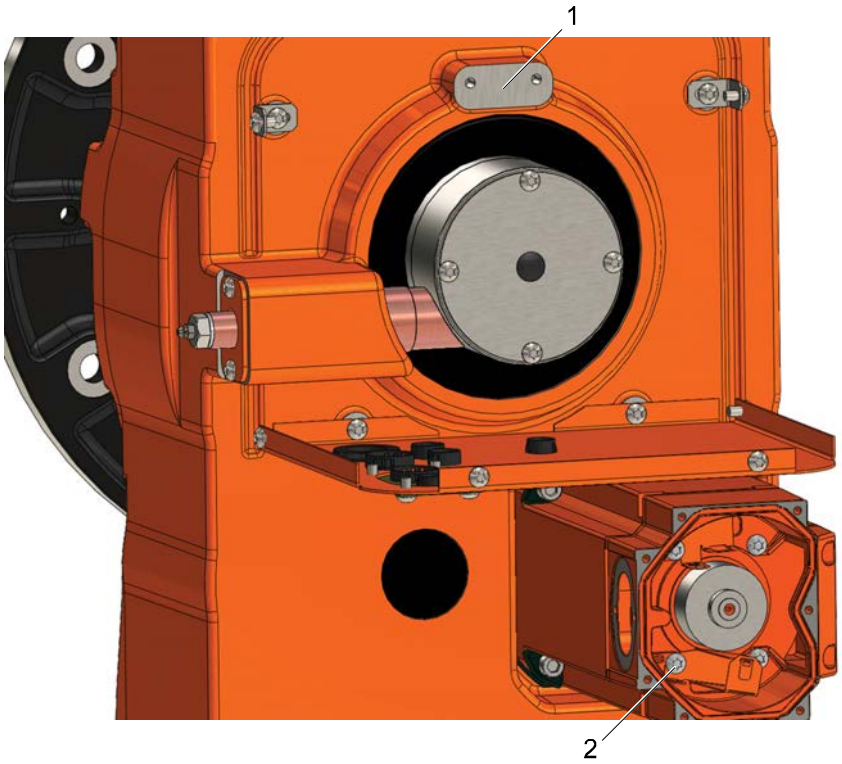
CAUTION

Do not mix motors *valid from* serial number SEROP POF-110001- & CNAUS POF-510001-, with motors *valid up to* serial numbers SEROP -POF 110000 & CNAUS -POF 510000. They are not compatible.

	Action	Note
1	Refit the insulating material and insulating tubes (5, 6, 8).	
2	Refit the o-ring (7) on the motor.	
3	Refit the motor using the attachment screws and plain washers (4-5). **Note** If countersunk holes in motor flange. Make sure that the plane washer is mounted before the insulating washer to fill out the recess.	Use standard torque, see section *Screw joints on page 63*.  xx1500002519 1 Attachment screw 2 Insulating washer 3 Plane washer
4	Connect all connectors.	
5	Refit the cable gland cover at the cable exit.	
6	Refit the cover plate (2).	

6.4.2 Checking insulation

Measuring points



xx1000000209

1	Gearbox body (clean surface)
2	Ground point in the AC motor.

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

Insulation resistance tests

Insulation resistance greater than 2.5 MOhm at 500 V DC between the output shaft (Gearbox body) and the ground point in the AC motor.

Voltage tests

1 kVolt AC 50/60 Hz - 1 sec. between the output shaft (gearbox body) and the ground point in the AC motor. The test voltage is to be supplied from a transformer with a minimum rating of 500 VA.

6.5 Rotary units

6.5.1 Replacing rotary unit

General

The gearbox is a precision gear drive specifically developed to withstand the high demands placed on robot applications, among others, rigidity and torsional strength, speed and accuracy. The gearbox is virtually free of play and never needs to be adjusted; conforming to requirements during its entire life. The gearbox is maintenance free and the lubricant is sufficient for the gearbox's entire life, equivalent to 40,000 hours of operation. For lifting instructions, see section *Lifting rotary units on page 142*

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

WARNING

Always lift the manipulator in a safe manner, using lifting tools according to the specified lifting weight in section *Lifting weight*.

Required equipment

Equipment	Note
Standard tools	For more information, see *Standard toolkit on page 209*.

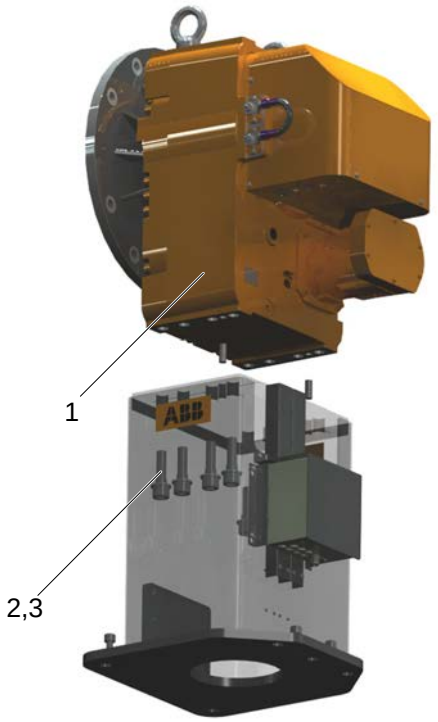
Screw joints

MTD/MID	Screw quality	Screw dim.	Qty.	Tightening torque (Nm)
MTD 250	12.9	M12	4	140
MTD 500	12.9	M20	4	550
MTD 750	12.9	M20	4	550
MTD 2000	12.9	M20	8	550
MTD 5000	12.9	M24	12	1150

Continues on next page

6.5.1 Replacing rotary unit
Continued

Remove rotary unit



xx1000000013

1	Rotary unit
2	Attachment screws
3	Washers

	Action	Information
1	Remove the cable harness from the motor, slip-ring.	
2	Attach the lifting accessories.	
3	Remove the attachment screws.	Use standard tools
4	Lift the rotary unit according to section *Lifting rotary units on page 142*.	

Refit rotary unit

	Action	Information
1	Lift the rotary unit according to section *Lifting rotary units on page 142*.	
2	Refit the attachment screws and washers.	Use standard tools, For Tightening torque see table *Screw joints on page 153*
3	Assemble the cable harness.	

6.6 Support collar

6.6.1 Replacing support collar axis

General

DANGER

Turn off all:

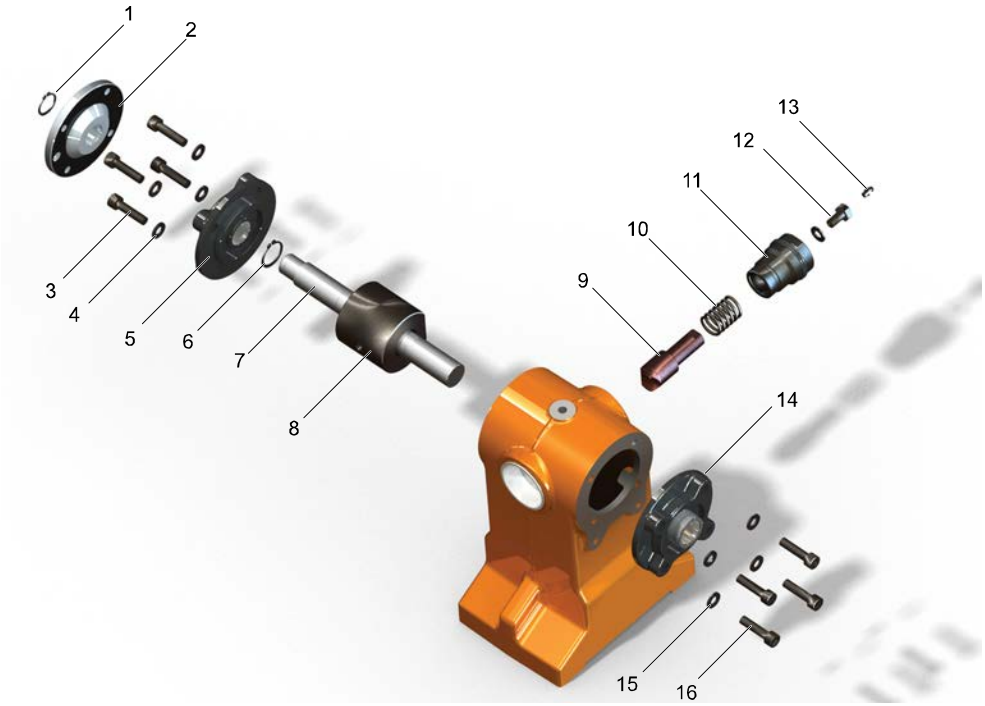
- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

Required equipment

Equipment	Note
Standard tools	*Standard toolkit on page 209*
Spare parts	Product Manual Sparepart IRP

Replacing support collar



xx1000000028

	Action	Note
1	Remove screw (12) to loosen the current collector cable.	Standard tools.

Continues on next page

6.6.1 Replacing support collar axis
Continued

	Action	Note
2	Remove the spring housing with the current collector and spring.(9, 10, 11).	Standard tools, open key 46mm.
3	Remove the attachment screws with washers (15,16).	
4	Loosen the flange bearing locking screw.	
5	Remove the back flange bearing(14).	
6	Remove the bearing housing (8) from the axis.	
7	Loosen the flange bearing locking screw.	
8	Remove the axis with the turning disk and the front bearing housing (1, 2, 5, 6, 7) from the collar house.	

Refitting support collar

	Action	Note
1	Mount the axis with the turning disk and the front bearing housing (1, 2, 5, 6, 7) in to the collar house.	
2	Refit the attachment screws with washers (3,4).	Use standard torque, see section *Screw joints on page 63*.
3	Refit the bearing housing (8) to the axis.	
4	Refit the back flange bearing(14).	
5	Refit the attachment screws with washers (15,16).	Use standard torque, see section *Screw joints on page 63*.
6	Tightening the flange bearing locking screw.	Use standard torque, see section *Screw joints on page 63*.
7	Remove the spring housing with the current collector and spring.(9, 10, 11).	Standard tools, open key 46mm.
8	Refit the screw (12) and attach the current collector cable.	
9	Lubricate the current collector.	See *Lubricating the current collector on page 113*

6.7 Electrical

6.7.1 Replacing current collector

General

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

Required equipment

Equipment	Note
Standard tools	See section *Standard toolkit on page 209*.
Current collector	Product Manual Sparepart IRP

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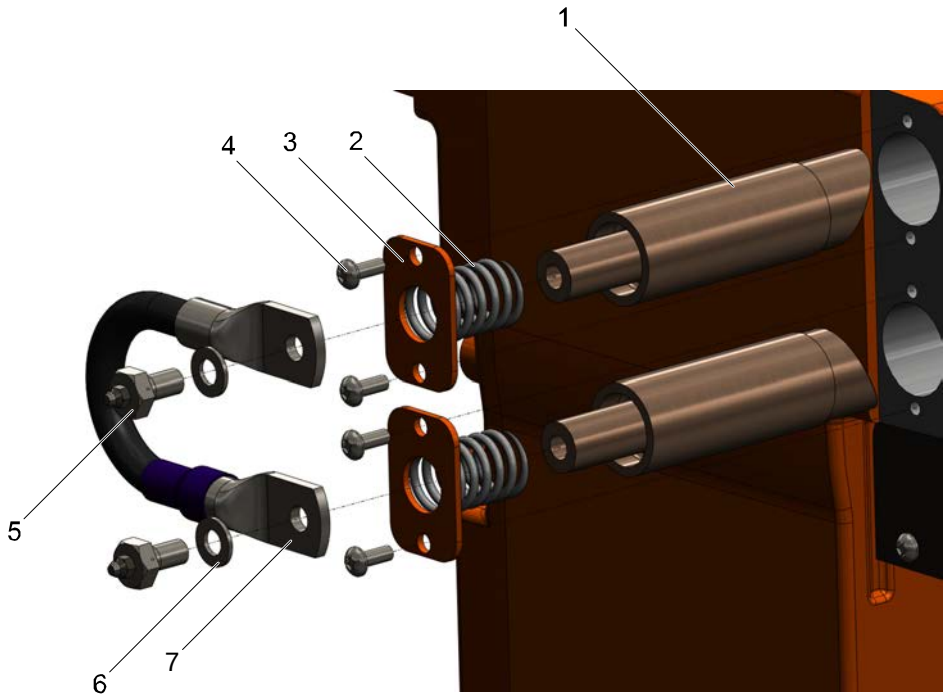
6.7.1 Replacing current collector
Continued

Replacing current collector



xx1000000016

1	Current collector
2	Spring
3	Spring support
4	Screw
5	Lubrication nipple
6	Washer
7	Current collector cable

	Action	Note
1	Remove the lubrication nipple and the current collector cable.	
2	Remove the screws holding the spring support.	
3	Remove the spring and the current collector.	

Assemble current collector

	Action	Note
1	Assemble the new current collector.	
2	Assemble the spring and the spring support using the screws.	
3	Assemble the lubrication nipple and the current collector cable.	Lubricate the current collector, see section *Lubricating the current collector on page 113*.

7 Calibration information

7.1 When to calibrate

When to calibrate

The system must be calibrated if any of the following situations occur.

The resolver values are changed

If resolver values are changed, the robot must be re-calibrated using the calibration methods supplied by ABB. Calibrate the robot carefully with standard calibration, according to information in this manual.

The resolver values will change when parts affecting the calibration position are replaced on the robot, for example motors or parts of the transmission.

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See *Updating revolution counters on OmniCore robots on page 162*. This will occur when:

- The battery is discharged
- A resolver error occurs
- The signal between a resolver and measurement board is interrupted
- A robot axis is moved with the control system disconnected

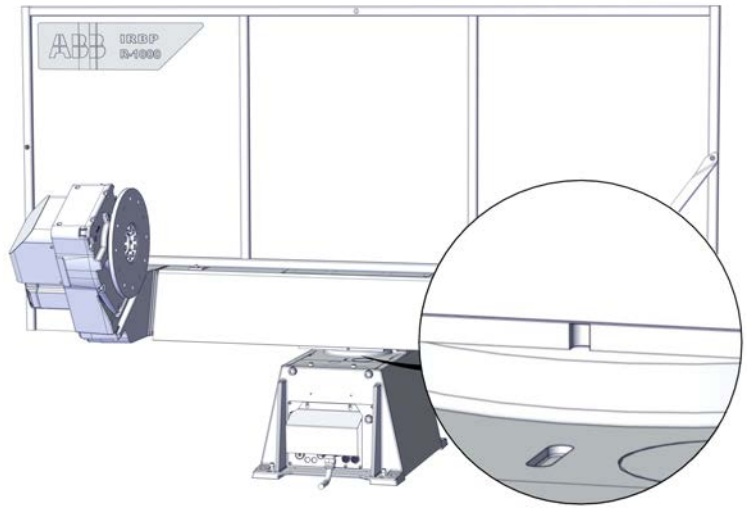
The revolution counters must also be updated after the robot and controller are connected at the first installation.

The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reachability of a robot is changed, it needs to be re-calibrated for new resolver values.

7.2 Calibration marks

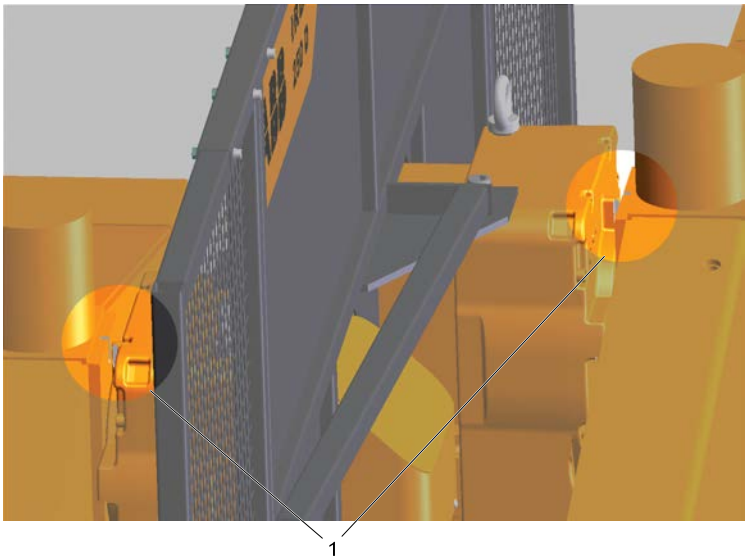
Synchronization mark MID station foot



xx1000000121

1	Synchronization mark MID 2.1

Synchronization mark MTD station unit



xx1000000122

1	Synchronization mark MTD

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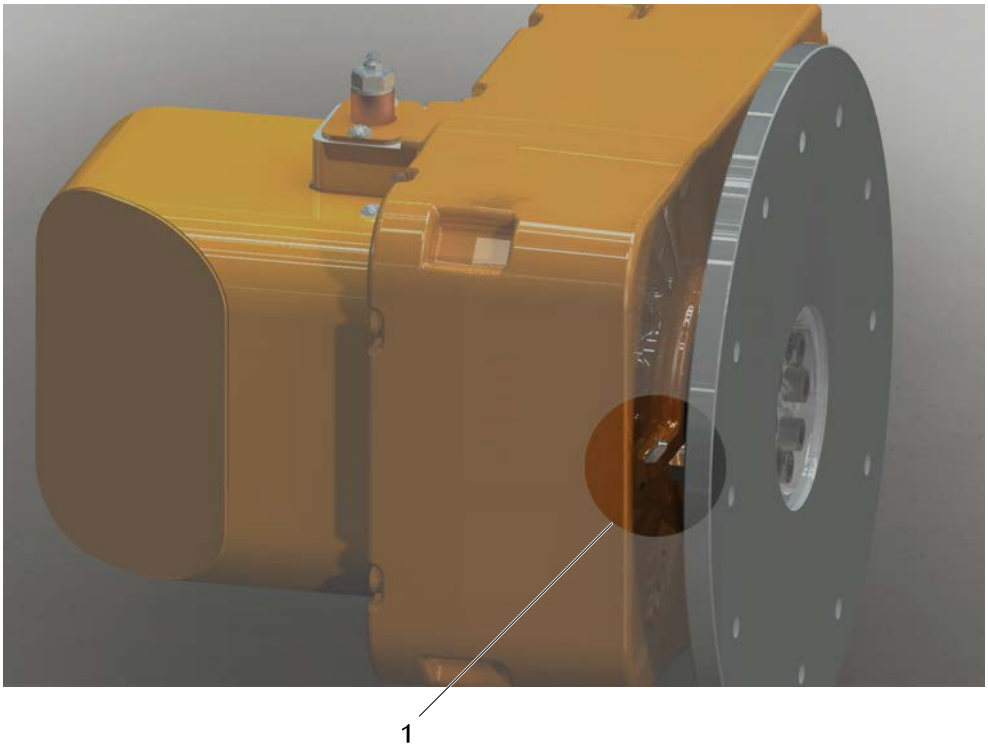
Synchronization mark MTD rotary unit



xx1000000117

1	Synchronization mark MTD

7.3 Updating revolution counters on OmniCore robots

Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Step 1 - Manually running the manipulator to the synchronization position

Use this procedure to manually run the manipulator to the synchronization position.

	Action	Note
1	Select axis-by-axis motion mode.	
2	Jog the manipulator to align the synchronization marks.	See *Calibration marks on page 160*.
3	When all axes are positioned, update the revolution counter.	*Step 2 - Updating the revolution counter with the FlexPendant on page 162*.

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (OmniCore).

	Action
1	On the start screen, tap **Calibrate**. The calibration summary page for the mechanical unit is displayed.
2	In the **Calibration Methods** menu, select **Revolution Counters**.
3	In the **Selection** column select the axes for which revolution counters need to be updated.
4	Tap **Update**. A dialog box is displayed warning that the updating operation cannot be undone.
5	Tap **OK** to update the revolution counter.
6	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See *Checking the synchronization position on page 166*.

7.4 Manual setting of the calibration values

General

This chapter describes how to make manual settings for calibration values and recalibrate the axes. The measure is only necessary if the system has lost the calibration values (resolver values). The chapter describes the procedure for all robot and positioner axes where there are calibration values are available.

Manual setting of the calibration values, procedure

	Action	Note
1	Tap **ABB**, to open the service window.	
2	Tap **Calibration**.	
3	Tap on the mechanical unit to be calibrated. When the unit concerned is not visible in the window, use the scroll bar arrows, in the lower part of the window.	
4	Tap **Calibration Parameters**.	
5	Tap **Edit Motor Calibration**.	
6	The system awaits a response: • Tap **Yes** to proceed.	
7	Tap on the axis where the value is to be modified. • Enter the new value with the help of the keypad.	
8	Confirm the value by tapping **OK**.	
9	The system awaits a response: • Tap **Yes** to restart.	

7.5 Recalibrating the axes

General

This measure is necessary when the external axes lack calibration values or you wish to recalibrate the axes.

You should be aware that the programmed positions can change depending on whether the new calibrated position differs from the previous position. The chapter describes the procedure for the positioner, not for the robot. (Specialist know-how, which is not described here, and equipment are required to calibrate the robot's axes.) Calibration of the external axes is performed in different ways depending on the type of positioner in question.

Note

This procedure should not be used if calibration values already exist for the axis in question.

Positioners of the types A, L and MTD

	Action	Note
1	Move the positioner's axes (axis) to respective zero positions (synchronization marking). • Be precise when adjusting the position of the axis so that it lies in the centre of the marking. The marking is made up of a machined groove or a machined notch on the gearbox respective faceplates.	
2	Tap **ABB**, to open the service window.	
3	Tap **Calibration**.	
4	Tap on the mechanical unit to be calibrated. When the unit concerned is not visible in the window, use the scroll bar arrows, in the lower part of the window.	
5	Tap **Calibration Parameters.**	
6	Tap **Fine Calibration**.	
7	The system awaits a response: • Tap **Yes** to proceed.	
8	Select one or more axes, to be recalibrated.	
9	Tap **Calibrate**.	
10	The system awaits a response: • Tap **Calibrate**, to confirm recalibration.	
11	Tap **Close**.	

7.6 Calibration of the station interchange unit for positioner IRP

General

Applies to IRP positioners, types B, C, D, K or R, with mechanical stop. The position for the mechanical stop for side 1 and side 2 must be adjusted to attain the right torque. The program guides you through the adjustment.

Calibration procedure

	Action
1	Call and start the routine *CalibIntch1* from the **Program Editor**.
2	Tap **OK** to start the calibration.
3	Tap **OK**, then jog the robot to a position that is free from the positioners working area.
4	Start the routine again.
5	A warning is displayed that the station interchange will move to side 1. **CAUTION** Make sure that you are at a safe distance. Tap **OK** to continue.
6	Wait while station side 1 is calibrated.
7	A warning is displayed that the station interchange will move to side 2. **CAUTION** Make sure that you are at a safe distance. Tap **OK** to continue.
8	Wait while station side 2 is calibrated.
9	Station interchange calibration is finished. Measured values are displayed on the screen. Tap **OK** to finish.

Note

The calibration procedure can also be started from the **Setup** icon in *Production Manager*.

7.7 Checking the synchronization position

Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a `MoveAbsJ` instruction with argument zero on all axes.
- Using the **Jog** window on the FlexPendant.

Continues on next page

7.7.1 Checking the synchronization position on OmniCore robots

Using a MoveAbsJ instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	Tap **Code**.	
2	Create a new program.	
3	Use **MoveAbsJ** in the **Add Instruction** menu.	

4	Create the following program:
	`MoveAbsJ [[0,0,0,0,0,0],`
	`[9E9,9E9,9E9,9E9,9E9,9E9]]`
	`\NoEOffs, v1000, fine, tool0`	

5	Run the program in manual mode.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See *Calibration marks on page 160* and *Updating revolution counters on OmniCore robots on page 162*.

Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

	Action	Note
1	Tap **Jog**.	
2	From the **Mechanical unit** list select a mechanical unit.	
3	From the **Motion mode** section, select an axis-set that need to be jogged. For example, to jog axis 2, select the axis set **Axis 1-3**.	
4	Follow the screen instruction on joystick movements to understand the direction of the axis that you want to move and move the joystick.	
5	Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See *Calibration marks on page 160* and *Updating revolution counters on OmniCore robots on page 162*.

7.8 Multi-arc calibration (not IRP C)

7.8.1 Introduction

General

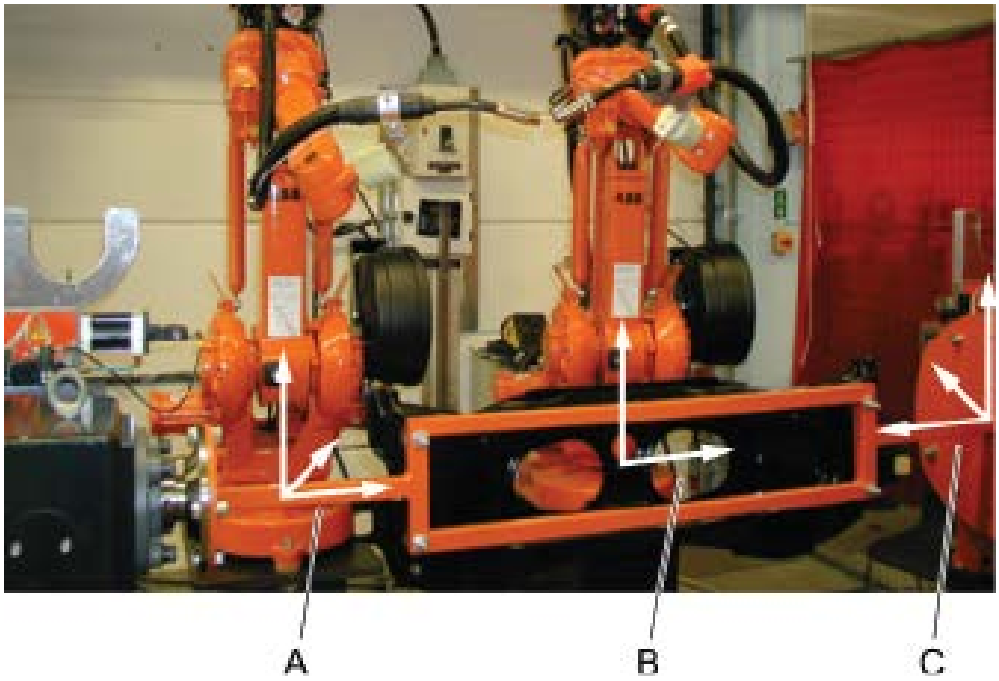
Before the system can be used, the system has to be calibrated. The calibration principle is based on tools with defined TCPs that are moved together a number of times.

This method will move and rotate the base frame in relation to the world frame. Normally the base frame is centered and aligned with the world frame.

Positioner IRP C is not calibrated for base frame (it has no stations).

> **Note**
>
> Note that the base frame is fixed to the base of the robot.

Overview



xx1400000897

A	Base coordinate system for robot 2
B	Base and world coordinate system for robot 1
C	Base Frame for positioner

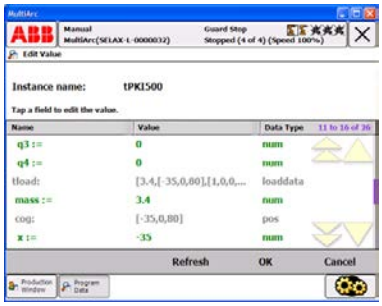
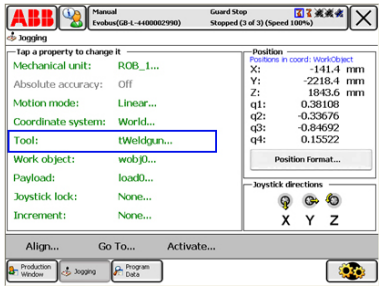
7.8.2 Calibrating the multi-arc system

Required equipment

Equipment	Article number	Note
Pointer	-	Make a pointer that screws into the tip adapter. The point of the pointer should be in exactly the same position as the defined TCP, e.g. 15 mm from the end of the nozzle.  xx1800000747
Centre punch and hammer	-	Used for making a punch mark on the turning disc and the bearing disc spigot (if available).

Tool calibration

Start to calibrate the welding tool TCP using BullsEye.

	Action	Note
1	Change the mass in the tool data from the negative value to the correct value for your tool, see figure.	 xx1400000898
2	Activate the tool.	 xx1800000746

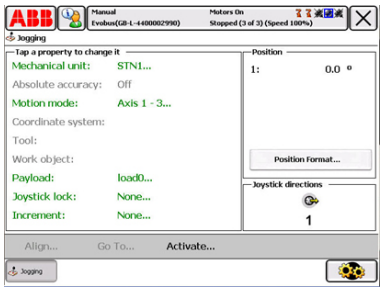
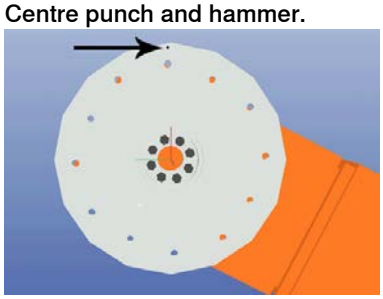
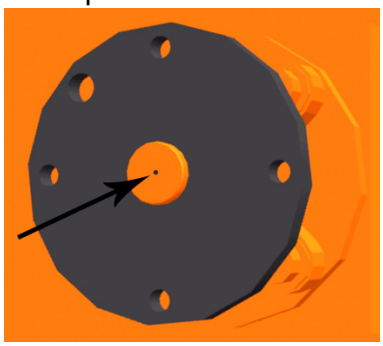
Continues on next page

7.8.2 Calibrating the multi-arc system
Continued

Preparing the robot

	Action	Note
1	Attach the pointer to the tip adapter on the robot. The point of the pointer should be in exactly the same position as the defined TCP, e.g. 15 mm from the end of the nozzle.	 xx1800000747

Preparing the positioner discs

	Action	Note
1	Activate the station, then jog the turning disc to 0°.	 xx1800000748
2	Make a small punch mark at the top dead centre on the turning disc.	Centre punch and hammer.  xx1800000749
3	Valid for positioners that have a tailstock (IRP K, IRP L, IRP R): Mark out the centre of the bearing disc spigot and carefully make a small punch mark there.	Centre punch and hammer.  xx1800000750

Calibrating the base frame of robot 1

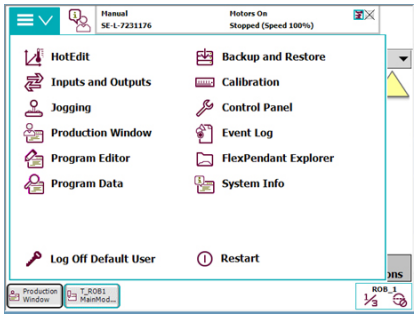
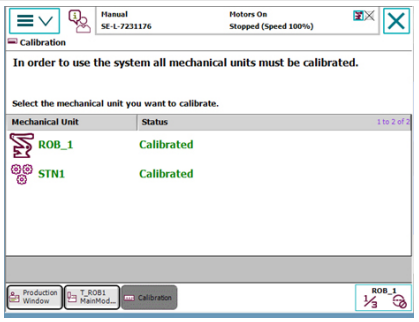
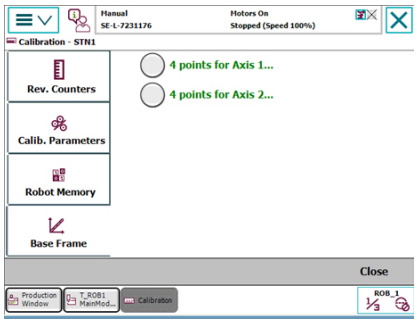
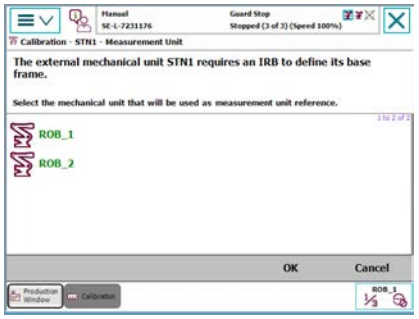
Use the procedure to calibrate the base frame of robot 1. The FlexPendant images shown in the procedure can differ between the positioner variants.

Continues on next page

Base frame calibration can be done with any robot, but only on one of the robots.

Note

If robot 1 (**ROB_1**) is selected, you cannot do the base frame calibration between robot 2 (**ROB_2**) and positioner.

	Action	Note
1	On the FlexPendant, select **Calibration**.	 xx1800000751
2	Select Mechanical Unit **STN1**.	 xx1800000752
3	Select **Base Frame** and then select which points to calibrate. The number of axes and points to calibrate differ depending on positioner variant. IRP A, IRP B, IRP D: **4 points for Axis 1** or **4 points for Axis 2**. (Both axes need to be calibrated. Choose axis 1 first and run the complete procedure according to the following steps. When done, repeat the procedure for axis 2, keeping axis 1 at 0° meanwhile.) IRP K, IRP L, IRP R: **4 points Z**	 xx1800000753
4	Select the robot you will use to measure the base frame. **Note** If robot 1 (**ROB_1**) is selected you cannot do the base frame calibration between robot 2 and positioner.	 xx1800000785

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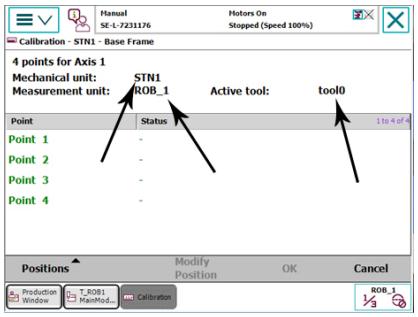
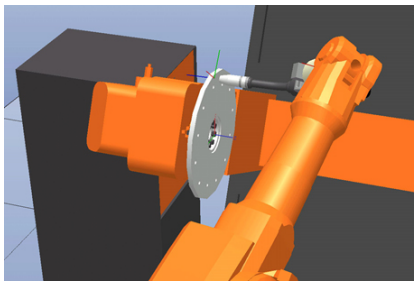
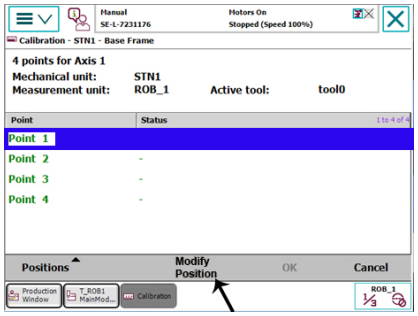
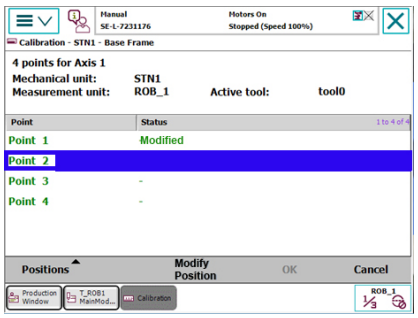
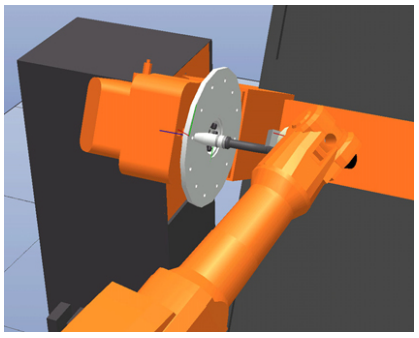
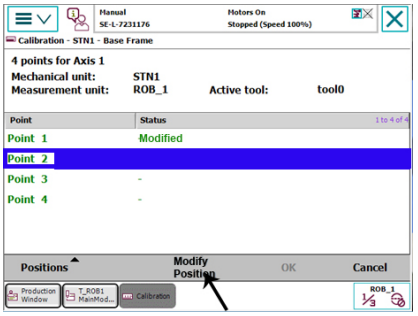
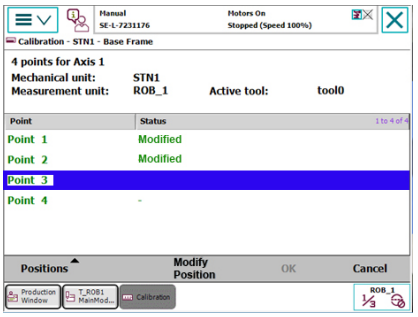
7.8.2 Calibrating the multi-arc system

Continued

	Action	Note
5	Check that the correct **Mechanical unit**, **Measurement unit** and **Active tool** are selected.	 xx1800000754
6	With the station at 0°, jog the robots TCP to position the pointer exactly onto the punch mark.	 xx1800000755
7	Highlight **Point 1** and tap **Modify Position**.	 xx1800000756
8	**Point 1** will now show **Modified** and **Point 2** will automatically be highlighted.	 xx1800000757

Continues on next page

	Action	Note
9	Rotate the turning disc to 60°, using the jogging window to see the exact position information.	 xx1800000758
10	Position the pointer exactly on the punch mark.	 xx1800000759
11	Ensure that **Point 2** is highlighted and tap **Modify Position**.	 xx1800000760
12	**Point 2** will now show **Modified** and **Point 3** will automatically be highlighted.	 xx1800000761

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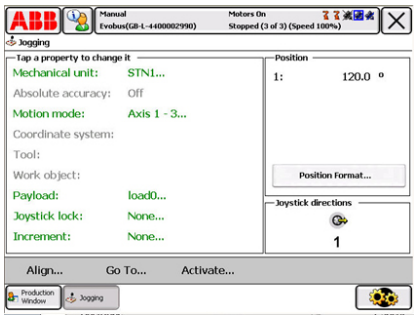
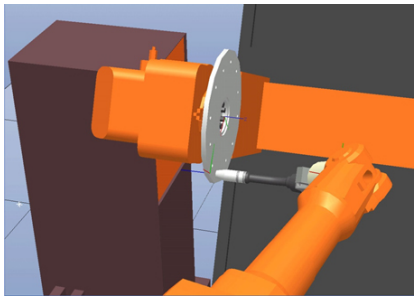
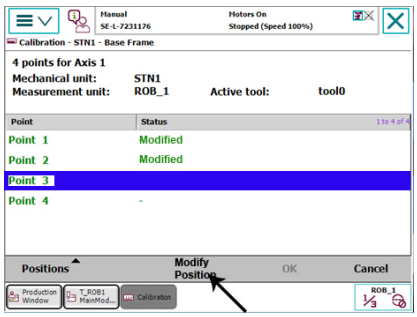
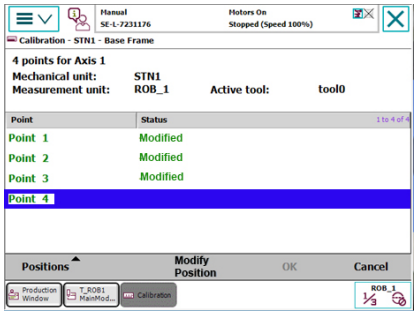
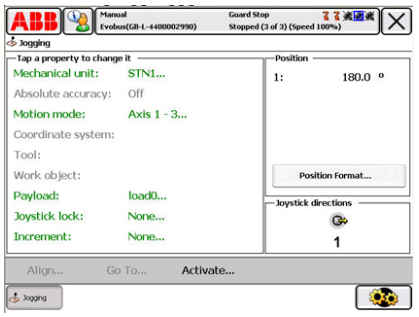
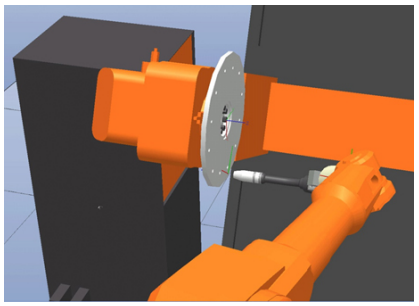
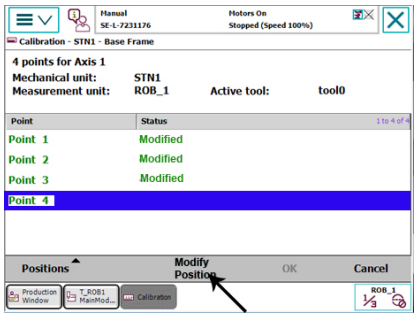
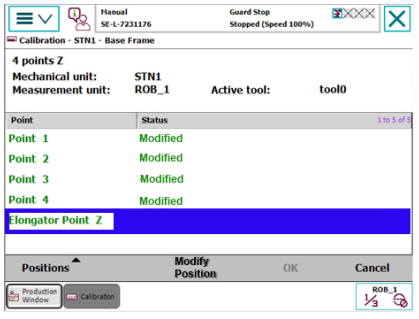
7.8.2 Calibrating the multi-arc system

Continued

	Action	Note
13	Rotate the turning disc to 120°, using the jogging window to see the exact position information.	 xx1800000762
14	Position the pointer exactly on the punch mark.	 xx1800000763
15	Ensure that **Point 3** is highlighted and tap **Modify Position**.	 xx1800000764
16	**Point 3** will now show **Modified** and **Point 4** will automatically be highlighted.	 xx1800000765

Continues on next page

	Action	Note
17	Rotate the turning disc to 180°, using the jogging window to see the exact position information.	 xx1800000766
18	Position the pointer exactly on the punch mark.	 xx1800000767
19	Ensure that **Point 4** is highlighted and tap **Modify Position**.	 xx1800000768
20	Valid for positioners that have a tailstock (IRP K, IRP L, IRP R): **Point 4** will now show **Modified** and **Elongator Point Z** will automatically be highlighted.	 xx1800000769

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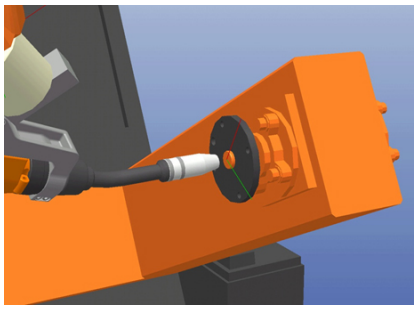
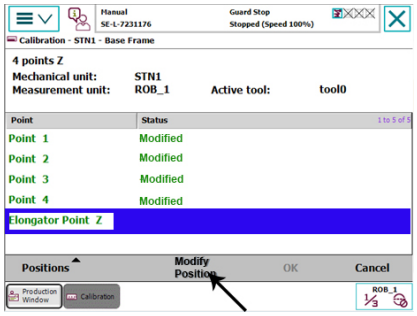
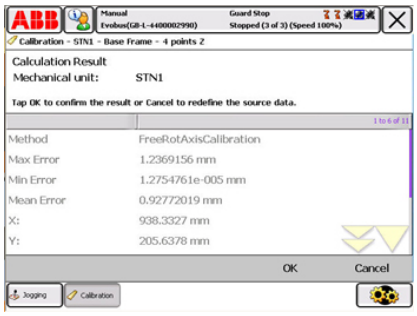
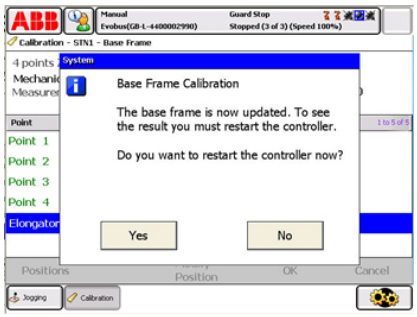
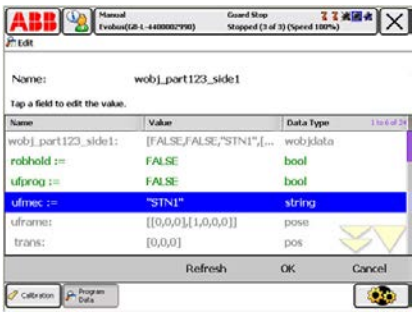
7.8.2 Calibrating the multi-arc system

Continued

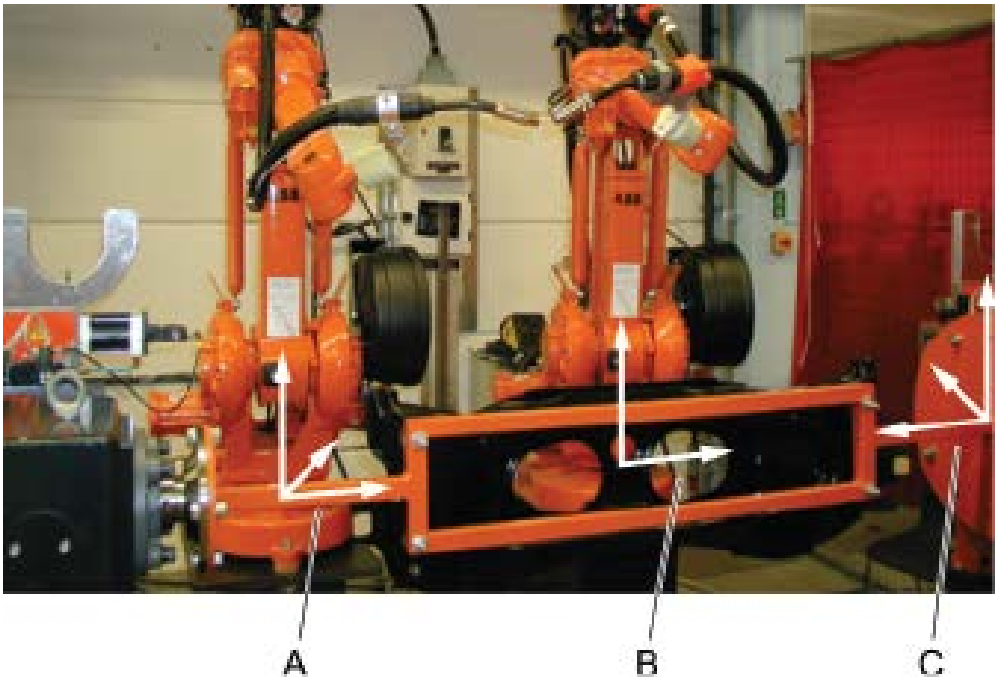
	Action	Note
21	Valid for positioners that have a tailstock (IRP K, IRP L, IRP R): Jog the robots TCP to position the pointer exactly onto the punch mark on the bearing disc spigot.	 xx1800000770
22	Valid for positioners that have a tailstock (IRP K, IRP L, IRP R): Ensure that **Elongator Point Z** is highlighted and tap **Modify Position**.	 xx1800000771
23	The **Calculation Result** will be shown. Tap **OK**.	 xx1800000772
24	Restart the controller by tapping **Yes**.	 xx1800000773
25	Valid for positioners IRP A, IRP B, IRP D: Go to step *2* and repeat the calibration procedure for the 4 points of the second axis.	

Continues on next page

	Action	Note
26	To use the base frame in your WorkObject: 1 Change the **ufprog** to **FALSE**. 2 Insert the station name in the **ufmec** field and then define your fixture or part WorkObject.	 xx1800000774

Calibrating the base coordinate for robot 2

Calibrate the robot 1 base coordinate system to the robot 2 world coordinate system.



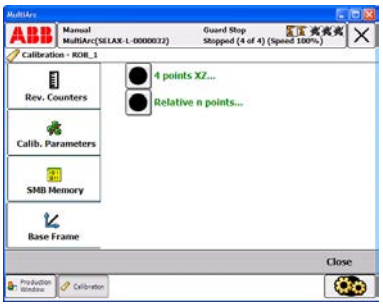
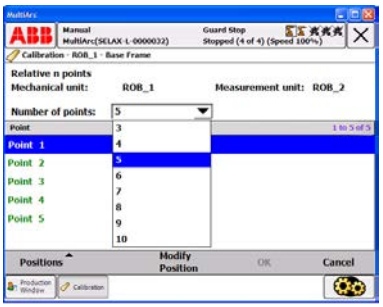
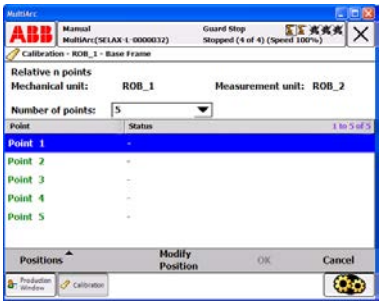
xx1400000897

A	Base coordinate system for robot 2
B	Base and world coordinate system for robot 1
C	Base Frame for positioner

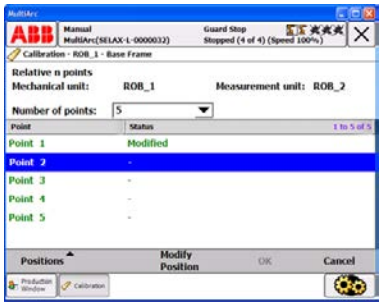
	Action	Note
1	On the FlexPendant, select **Calibration**.	 xx1400000905

Continues on next page

7.8.2 Calibrating the multi-arc system
Continued

	Action	Note
2	Select robot 1 (**ROB_1**).	 xx1400000906
3	Select **base frame** and then **Relative n points**.	 xx1400000907
4	Select **Number of points**.	 xx1400000908
5	Point the TCPs of the robots towards each other.	 xx1400000909
6	Tap **Modify position**.	 xx1400000910

Continues on next page

	Action	Note
7	For each of the steps: Move the robots to a new position where they are far apart compared to the previous position.	
8	Tap **Modify position**.	
9	When all postions are modified, tap **OK**.	 xx1400000911
10	Create a work object according to *Operating manual - OmniCore*, to confirm that the calibration is correct.	

7.9 Tool and speed data

Definition of the tool data (tload)

These are the movement related data that should be defined first. All movement is dependent on this definition.

WARNING

It is very important to always define correct actual load data and correct payload of the positioner. Incorrect definitions of load data can result in overloading of the positioner.

If incorrect load data and/or loads are outside load diagram is used the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure

Note

When using the option *Collision Detection*, it is very important to have the right tool load in the tool data.

The following data components are recommended for the tool.

robhold	true
tframe	*5-point TCP&Z* is normally used with weaving during MIG/MAG welding. Without weaving, the *4-point TCP* is sufficient.
tload	Values for the supplied standard welding guns and guns with a swan neck.

Welding guns with swan neck

Welding gun type	Swan neck	Weight /kg	X mm	Y mm	Z mm
ESAB PSF 315R	22 degrees	3.3	-60	0	57
ESAB PSF 500R	22 degrees	3.3	-60	0	57
Dinse PKI 500	22 degrees	3.3	-35	0	90
Binzel WH 455	22 degrees	3.3	-35	0	55
Dinse PP Alu.	22 degrees	4.4	-20	0	120

The five standard welding gun types above are predefined with the right tload in the module `Tooldata.sys`.

- Always use one of these tools when using a standard welding gun.

Continues on next page

- Duplicate and change the name of the tool data if you want to make your own tool.
- If you use a non-standard welding gun it is necessary to run the load identification service routine, see *Identification of load data for positioners IRP on page 182*.

Setup welding gun without BullsEye

The position of the robot and its movements are always related to its tool coordinate system, that is the TCP and tool orientation. To get the best performance, it is important to define the tool coordinate system as correctly as possible.

Speed data for external axes

Use the following maximum speed data for IRP.

IRP positioner	Maximum speed of rotation
MTD 250	180 degree/s
MTD 250	150 degree/s
MTD 750	150 degree/s
MTD 2000	90 degree/s
MTD 5000	39 degree/s
MID 500	90 degree/s
MID 1000	90 degree/s

7.10 Drivers

7.10.1 Identification of load data for positioners IRP

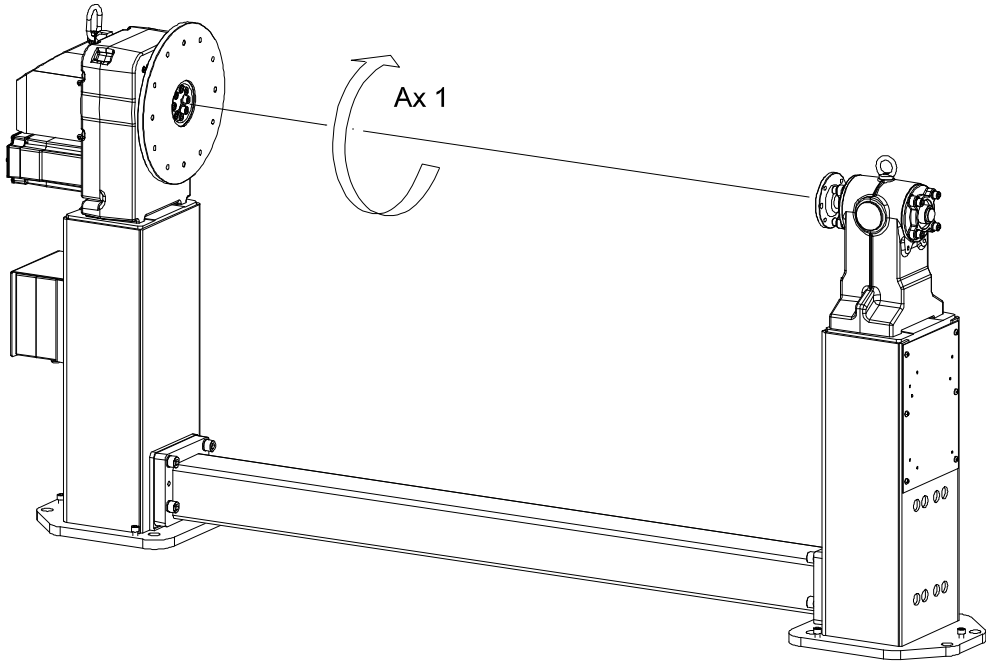
Introduction

Since the data of the different loads that can be mounted on the external positioner can be quite difficult to compute, there is a load identification service routine (*ManLoadIdentify*) that computes the necessary load data by moving the positioner. Here we will describe which parameters are identified with the load identification.

> **Note**
>
> If you run the load identification for the first time on a specific type of positioner, it is recommended that you first run the procedure in slow test mode to prevent any collisions.

Load identification for IRP L

A simplified view of positioner IRP L is shown in figure. Load identification can be performed in any position for this positioner.



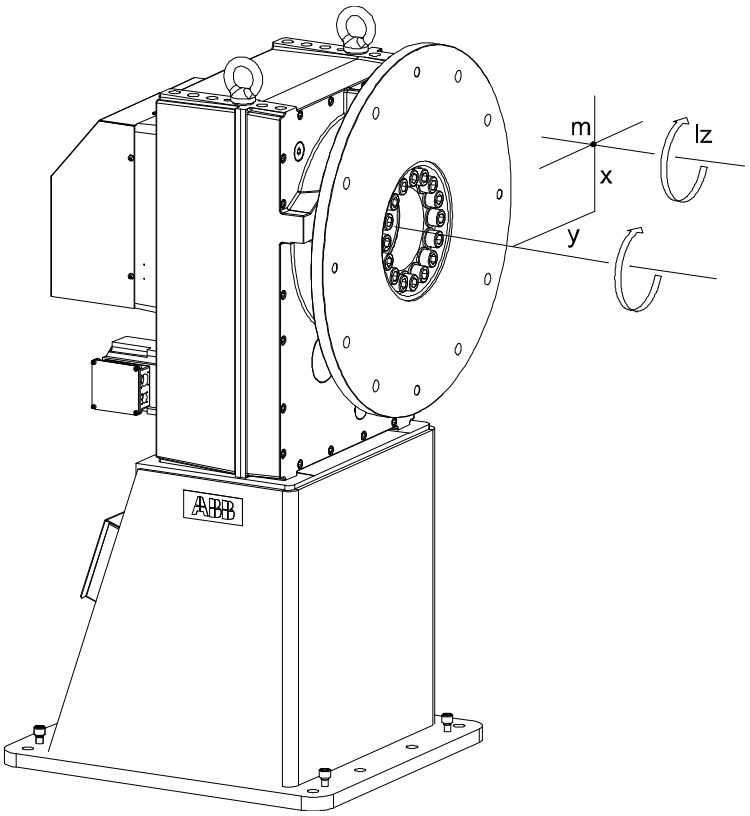
xx1000000139

Parameters and movements

> **Note**
>
> The mass of the load must be known in advance. The mass data is entered when performing the load identification.

Continues on next page

Parameters



xx1000000140

The parameters that are identified are the center of gravity in a plane perpendicular to the axis, and moments of inertia around the axis, see figure.

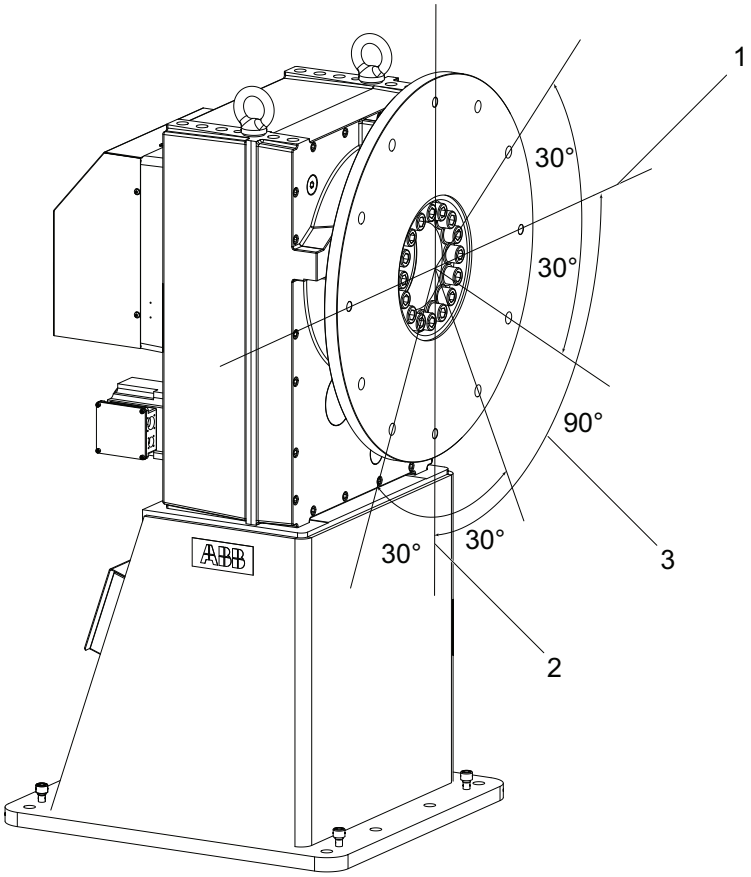
To perform the identification the positioner moves the load and computes the parameters.

Continues on next page

7.10.1 Identification of load data for positioners IRP
Continued

Movements

The movements for the axis are performed around two configuration points as described in the following figure. At each configuration, the maximum motion for the axis is approximately 30 degrees up and 30 degrees down. The optimum value for the configuration angle is 90 degrees.



xx1000000142

1	Configuration 2
2	Configuration 1 (start position)
3	Configuration angle

Load identification for IRP C

Load identification can be performed in positions according to load identification service routine (*ManLoadIdentify*).

Note

The data entered when performing the load identification is the sum of the loads applied. Load identification should be performed separately for all different load scenarios that is used.

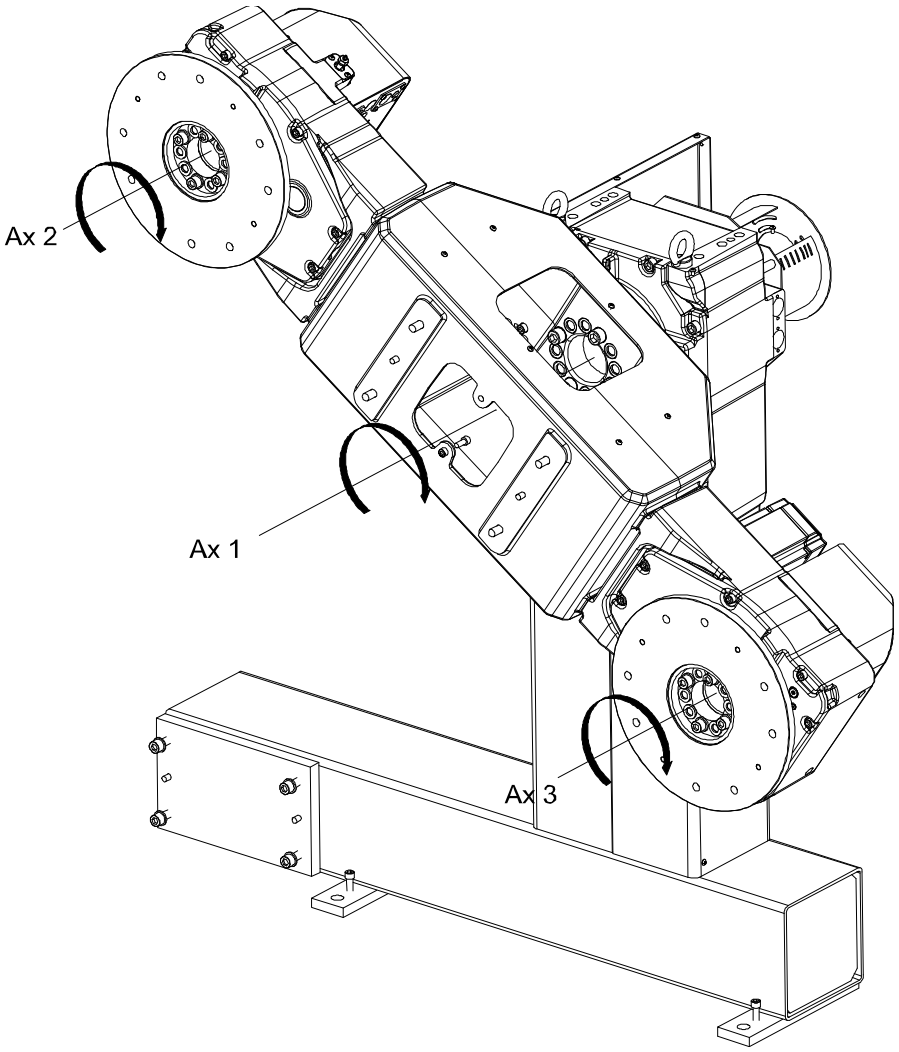
Parameters

The parameter identified is the total moments of inertia around the axis. Note that the mass of the loads must be known in advance.

Continues on next page

Load identification for IRP K

A simplified view of positioner IRP K is shown in the following figure. Load identification is allowed on axes 2 and 3 for this positioner. Load identification can only be performed when axis 1 is in one of its end positions. This is checked by the load identification procedure.



xx1000000144

Parameters

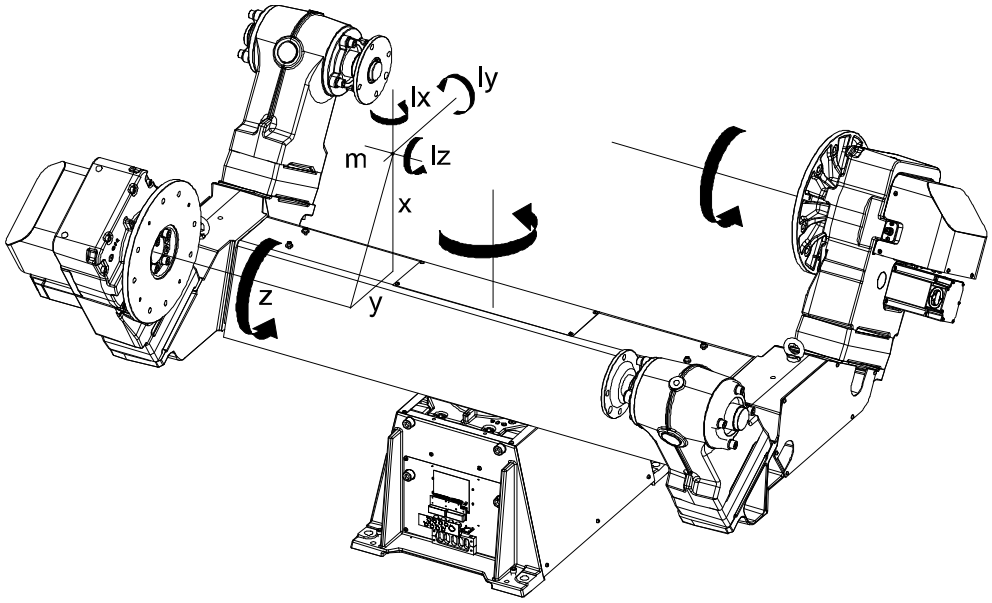
The identified parameters and movements for each axis are the same as for the IRP L positioner. See *Parameters and movements on page 182*.

Continues on next page

7.10.1 Identification of load data for positioners IRP
Continued

Load identification for IRP R

A simplified view of the positioner IRP R is shown in the following figure.



xx1000000149

Parameters

The parameters identified are the center of gravity in a plane perpendicular to the axis, and three moments of inertia at the center of gravity. Note that both the mass of the load and the distance z to the center of gravity must be known in advance. These data are entered when performing the load identification.

Movements

One part of the identification movements for one axis is the same as for the positioner IRP L. To find the extra moment of inertia we also move the interchange axis with the load to two different positions. The movements for the interchange axis are the movements described in the figure in section *Parameters and movements on page 182*, but only at one configuration point.

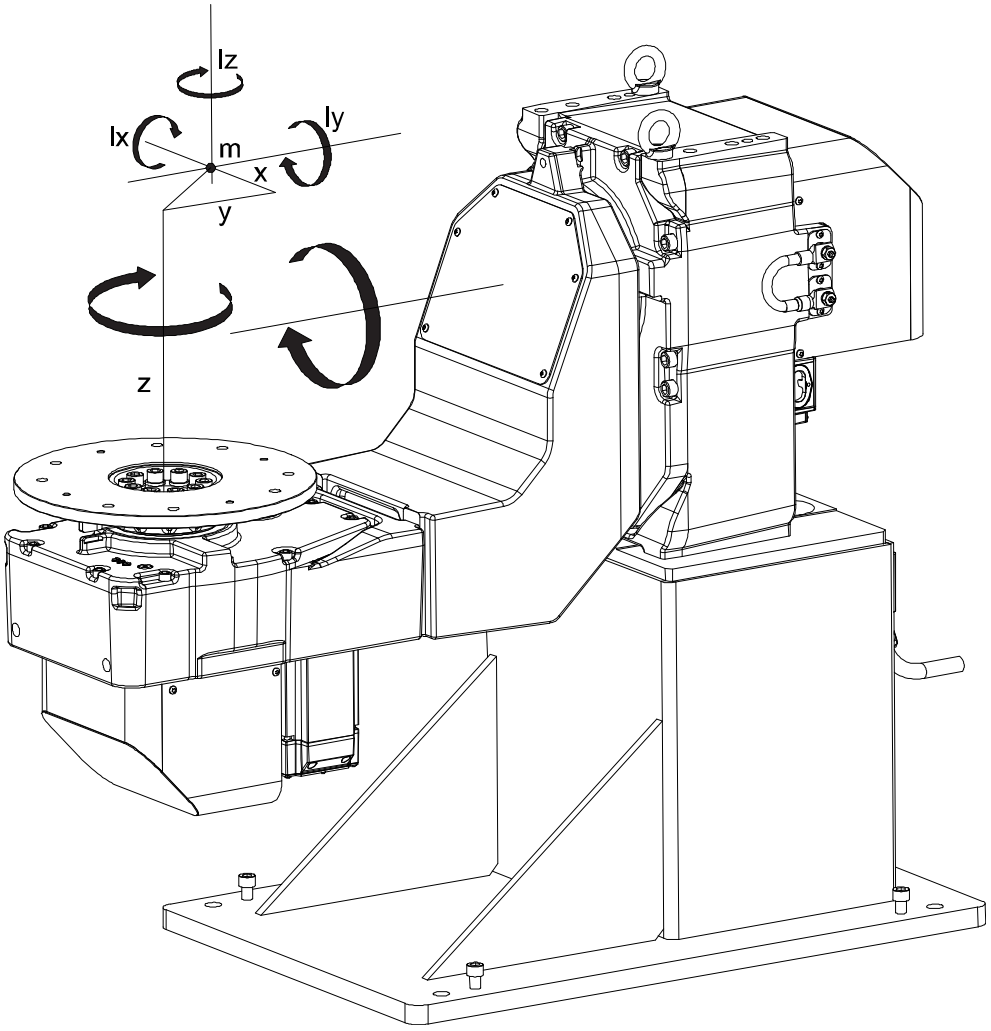
CAUTION

The identification on one axis will be correct only if there is no load mounted on the other axis.

Continues on next page

Load identification for IRP A/B/D

A simplified view of positioner IRP A/B/D is shown in the following figure. When the identification is performed, the positioner must be positioned so that the z axis is horizontal. This is verified by the load identification procedure. If axis 1 is too far from this position the load identification procedure will suggest which angle it should be moved to.



xx1000000150

Parameters

The parameters identified are the center of gravity and three moments of inertia at the center of gravity, see figure.

The mass of the load must be known in advance. The mass data is entered when performing the load identification.

Movements

The motion for each axis is, in principal, the same as for the positioner IRP L, see figure in section *Parameters and movements on page 182*. However, axis 1 only performs its movements around one configuration point.

7.10.2 Safe position

General

The safe position should be a position where the robot is free from the IRP positioner working area. The first time that you start the program execution you will be asked to setup the safe position for the robots.

Procedure

	Action	Note
1	Tap **OK**. First, the Robot Safe Position is teached. The driver requires this position to safely perform a station interchange.	
2	Move the robot to a safe position for the positioner's work area. Tap **Start**.	
3	To update the safe position or if you want to do it manually you can move PP to the procedure `SetSafePos`. Tap **Debug** and then **Move PP to routine**.	

7.10.3 Work positions

Introduction

These positions speed up and simplify the process. Settings for load position, process position and service position for all included mechanical units. In order to define the working positions, a part must be activated on the station and refer to a data type *advPart*.

Load position

A load position is the position the positioner side/positioner is in after station interchange or that it can ran to after a finished work program. Set the load position so that it is in a suitable position for the operator to load/remove the workpiece. The value is saved in data type *partadv* in the component *loadAngle*, which the pertinent part refers to in the component *advPart*.

Procedures

	Action	Note
1	To change load position, the ABB menu must be opened. • Tap **Production Manager**.	
2	Tap **Setup**	
3	Choose the station for which the load position will be changed. • Tap **GO**	
4	If a part is not activated for the selected station, one must be activated for the station.	
5	Specify the desired load position in degrees.	

7.10.4 Process position

General

A process position is the position the positioner or positioner side is in after station interchange. Set the process position so that it is in a suitable position for the first position in the work program. The value is saved in data type *partadv* in the component *procAngle*, which the pertinent part refers to in the component *advPart*.

Procedures

	Action	Note
1	To change process position, the ABBmenu must be opened. • Tap **Production Manager.**	
2	Tap **Setup**.	
3	Choose the station for which the process position will be changed. • Tap **GO**.	
4	If a part is not activated for the selected station, one must be activated for the station. See section “Parts handling” section 5.1.2 on how to do this.	
5	Specify the desired process position in degrees.	

7.10.5 Service position

General

A service position is a position at which the operator or service technician can perform inspections or service to a workpiece or fixture. The value is saved in data type *partadv* in the component *serviceAngle*, which the pertinent part refers to in the component *advPart*.

Procedures

	Action	Note
1	To change service position, the ABB menu must be opened. • Tap **Production Manager.**	
2	Tap Setup.	
3	Choose the station for which the service position will be changed. • Tap **GO**.	
4	If a part is not activated for the selected station, one must be activated for the station. See section “Parts handling” section 5.1.2 on how to do this.	
5	Specify the desired service position in degrees.	

7.10.6 Define payload for a mechanical unit

Description of MechUnitLoad

The instruction `MechUnitLoad` is used to define a payload for an additional axis (external mechanical unit). The payload for the robot is defined with instruction `GripLoad`. When using the drivers `MechUnitLoad` is built in.

This instruction should be used for all mechanical units with dynamic model in servo to achieve the best motion performance.

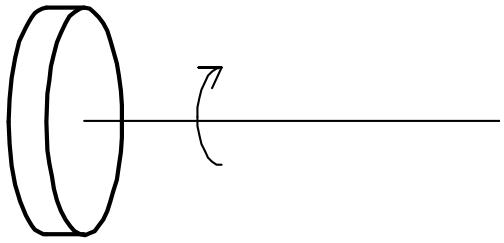
The `MechUnitLoad` instruction should always be executed after execution of the instruction `ActUnit`.

The axis closest to the payload should be selected in the `MechUnitLoad` instruction. While executing `ActUnit INTERCH` one `MechUnitLoad` should be executed for axis 2 and axis 3.

Examples

Basic examples of the instruction `MechUnitLoad` are illustrated below.

The following figure shows axis 1 on a mechanical unit named STN1 of type IRP L.



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Example 1

```
ActUnit STN1;
MechUnitLoad STN1, 1, load0;
```

Activate mechanical unit STN1 and define the payload *load0* corresponding to no load (at all) mounted on axis 1.

Example 2

```
ActUnit STN1;
MechUnitLoad STN1, 1, fixture1;
```

Activate mechanical unit STN1 and define the payload *fixture1* corresponding to fixture *fixture1* mounted on axis 1.

Example 3

```
ActUnit STN1;
MechUnitLoad STN1, 1, workpiece1;
```

Activate mechanical unit STN1 and define the payload *workpiece1* corresponding to fixture and work piece named *workpiece1* mounted on axis 1.

Arguments

```
MechUnitLoad MechUnit AxisNo Load
```

Continues on next page

`MechUnit`

Mechanical Unit

Data type: `mecunit`

The name of the mechanical unit

`AxisNo`

Axis Number

Data type: `num`

The axis number, within the mechanical unit, that holds the load.

`Load`

Data type: `loaddata`

The load data that describes the current payload to be defined.

Program execution

After execution of `MechUnitLoad`, when the robot and additional axes have come to a standstill, the specified load is defined for the specified mechanical unit and axis. This meansthat the payload is controlled and monitored by the control system.

The default payload at cold start for a certain mechanical unit type, is the predefined maximalpayload for this mechanical unit type.

When another payload is used the actual payload for the mechanical unit and axis should beredefined with this instruction. This should always be done after activation of the mechanicalunit.

The defined payload will survive a power failure restart. The defined payload will also survive a restart of the program after manual activation of other mechanical units from the jogging window.

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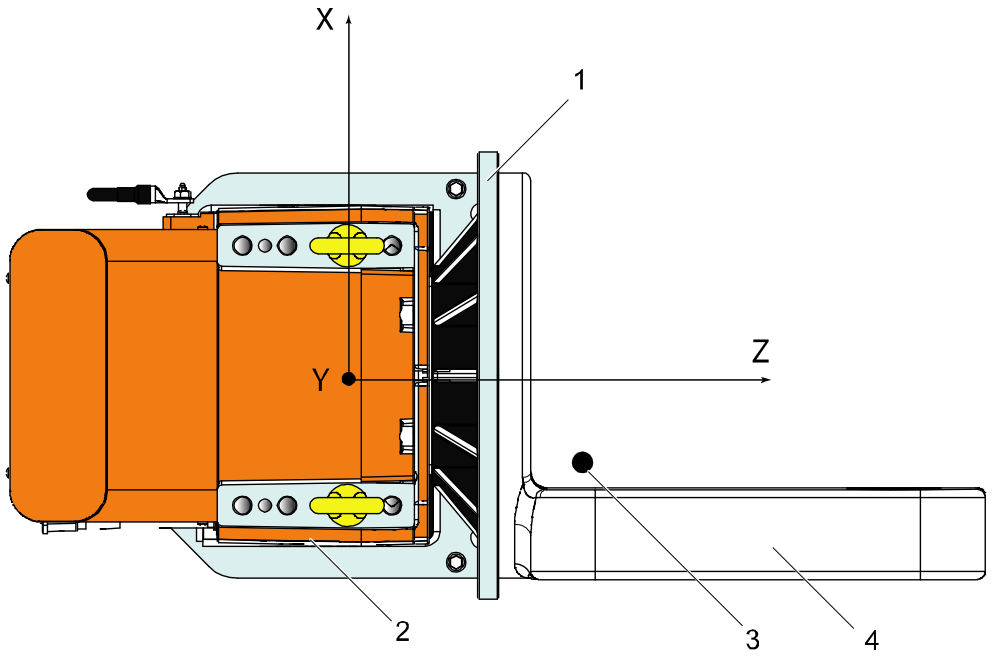
7.10.6 Define payload for a mechanical unit
Continued

The following graphic shows a payload mounted on the end-effector of a mechanical unit (end-effector coordinate system for the mechanical unit).



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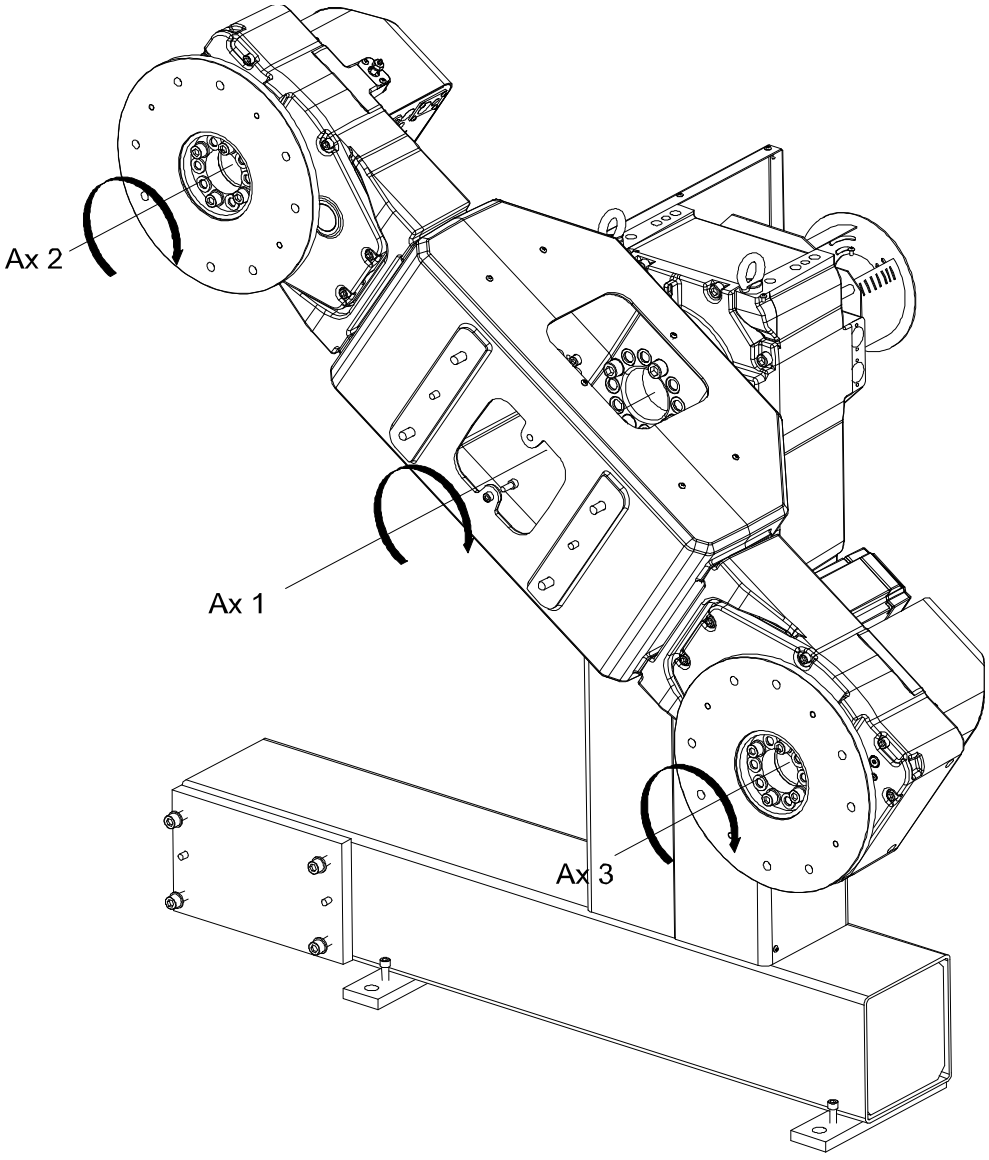
1	Fixture
2	Mechanical unit
3	Center of gravity for the payload (fixture + work piece)
4	Work piece

Continues on next page

More examples

More examples of how to use the instruction `MechUnitLoad` are illustrated below.

The following figure shows a mechanical unit named INTERCH of type IRP K with three axes (1, 2, and 3).



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Example 1

```
MoveL homeside1, v1000, fine, gun1;
....
ActUnit INTERCH;
```

The whole mechanical unit *INTERCH* is activated.

Example 2

```
MechUnitLoad INTERCH, 2, workpiece1;
```

Defines payload *workpiece1* on the mechanical unit *INTERCH* axis 2.

Continues on next page

7.10.6 Define payload for a mechanical unit
Continued

Example 3

```
MechUnitLoad INTERCH, 3, workpiece2;
```

Defines payload *workpiece2* on the mechanical unit *INTERCH* axis 3.

Example 4

```
MoveL homeside2, v1000, fine, gun1
```

The axes of the mechanical unit *INTERCH* move to the switch position *homeside2* with mounted payload on both axes 2 and 3.

Limitations

If this instruction is preceded by a move instruction, that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise restart after power failure will not be possible.

`MechUnitLoad` cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart or Step.

Syntax

```
MechUnitLoad
    [ MechUnit ':='] < variable (VAR) of mecunit> ','
    [ AxisNo ':='] <expression (IN) of num ','
    [ Load ':='] < persistent (PERS) of loaddata> ';'
```

Related information

Information	Described in
Mechanical units	*Technical reference manual - RAPID Instructions, Functions and Data types*, data type `mecunit`
Definition of load data	*Technical reference manual - RAPID Instructions, Functions and Data types*, data type `loaddata`
Definition of payload for the robot	*Technical reference manual - RAPID Instructions, Functions and Data types*, instruction `GripLoad` and data type `tooldata`

7.10.7 Define base frame

General

To run coordinated axes, the base frame must be defined. See *Application manual - Additional axes* (*Coordinated track motion*).

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8 Decommissioning

8.1 Introduction to decommissioning

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

> **Note**
>
> The decommissioning process shall be preceded by a risk assessment.

Disposal of materials used in the robot

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

See also *Environmental information on page 200*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

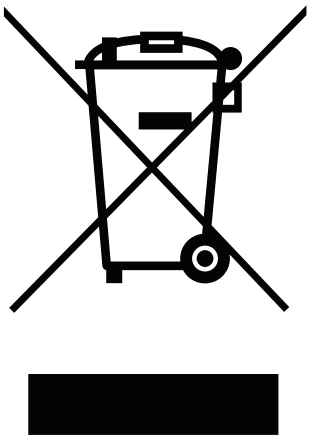
8.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials shall be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Disposal symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



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Materials used in the product

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Batteries, Lithium	Motor connection box
Cast iron/nodular iron	Gearboxes
Copper	Cables, motors
Neodymium	Brakes, motors
Oil, grease	Gearboxes
Plastic/rubber	Cables, connectors, drive belts, and so on.
Steel	Frame

Continues on next page

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

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9 Reference information

9.1 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.

9.2 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

9.3 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 720*	3-5 µm
M20x60	*Gleitmo 603* + *Geomet 500*	8-12 µm
M20x60	*Gleitmo 603* + *Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Continues on next page

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Tightening torque for oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Tightening torque for oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

Continues on next page

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

[i] Lubricated with Molycote 1000, Gleitmo 603 or equivalent

9.4 Weight specifications

Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

Example

Following is an example of a weight specification in a procedure:

	Action	Note
	CAUTION The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

9.5 Standard toolkit

General

All service (repairs, maintenance and installation) procedures contain lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the Standard toolkit and defined in the table below.

This way, the tools required are the sum of the Standard toolkit and any tools listed in the instructions.

Contents, standard toolkit

Qty	Tool	Note
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 75-400 Nm	
1	Torque wrench 500-1500 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Socket head cap no: 14, socket 40 mm bit L 100 mm	
1	Socket head cap no: 14, socket 40 mm bit L 20 mm	To be shortened to 12 mm
1	Socket head cap no: 6, socket 40 mm bit L 145 mm	
1	Socket head cap no: 6, socket 40 mm bit L 220 mm	

9.6 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but are available for registered users on myABB Business Portal, *www.abb.com/myABB*.

See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
Circuit diagram - OmniCore V250XT	*3HAC074000-008*
Circuit diagram - OmniCore V400XT	*3HAC082020-008*

Manipulators

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 120	*3HAC031408-003*
Circuit diagram - IRB 140 type C	*3HAC6816-3*
Circuit diagram - IRB 260	*3HAC025611-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Circuit diagram - IRB 390	*3HAC060545-009*
Circuit diagram - IRB 460	*3HAC036446-005*
Circuit diagram - IRB 660	*3HAC025691-001*
Circuit diagram - IRB 760	*3HAC025691-001*
Circuit diagram - IRB 1200	*3HAC046307-003*
Circuit diagram - IRB 1410	*3HAC2800-3*
Circuit diagram - IRB 1600/1660	*3HAC021351-003*
Circuit diagram - IRB 1510	*3HAC087368-003*
Circuit diagram - IRB 1520	*3HAC039498-007*
Circuit diagram - IRB 2400	*3HAC6670-3*
Circuit diagram - IRB 2600	*3HAC029570-007*
Circuit diagram - IRB 4400/4450S	*3HAC9821-1*
Circuit diagram - IRB 4600	*3HAC029038-003*
Circuit diagram - IRB 6620	*3HAC025090-001*
Circuit diagram - IRB 6620 / IRB 6620LX	*3HAC025090-001*
Circuit diagram - IRB 6640	*3HAC025744-001*
Circuit diagram - IRB 6650S	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 6660	*3HAC025744-001* *3HAC029940-001*
Circuit diagram - IRB 6700 / IRB 6790	*3HAC043446-005*

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Product	Article numbers for circuit diagrams
Circuit diagram - IRB 7600	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 14000	*3HAC050778-003*
Circuit diagram - IRB 910SC	*3HAC056159-002*

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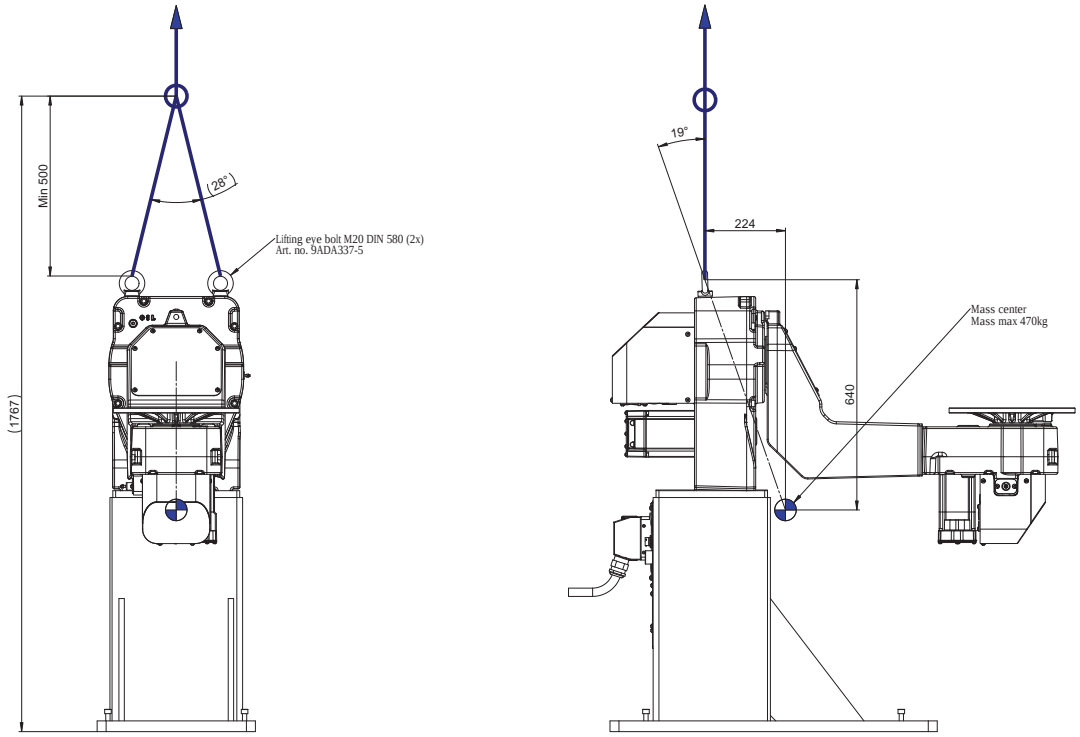
10 Lifting instructions

IRP A-250



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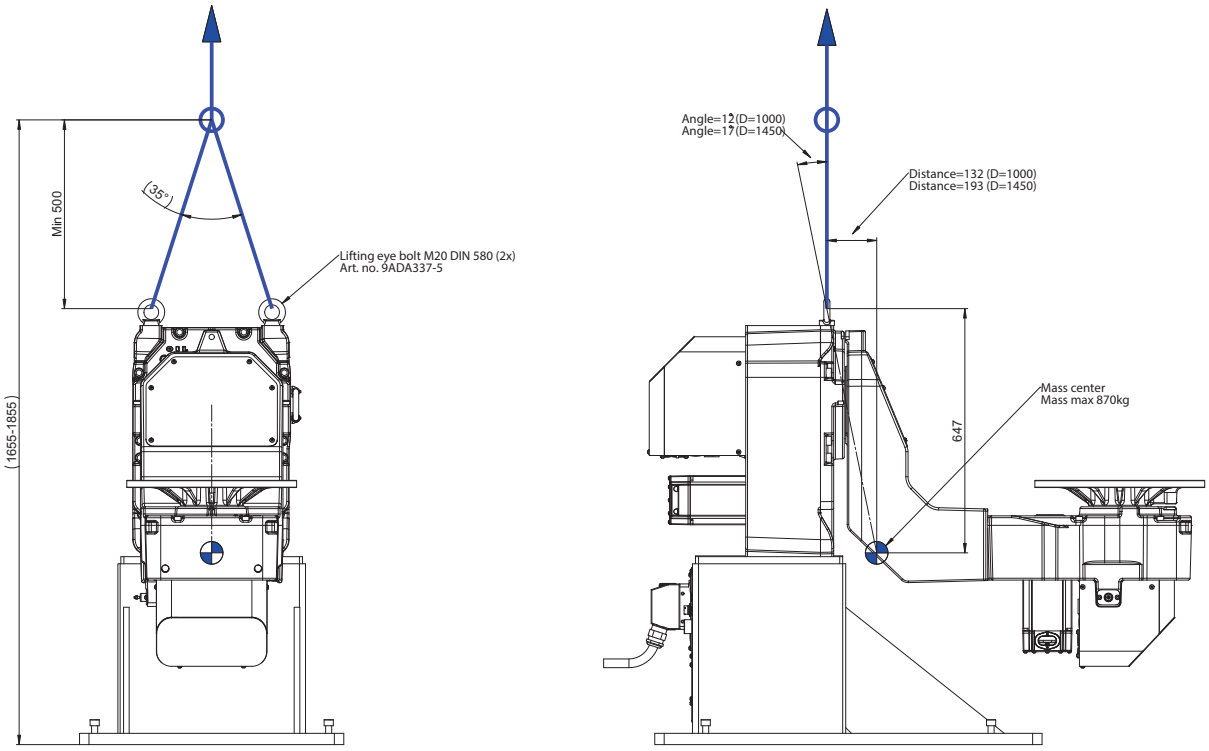
IRP A-500/750



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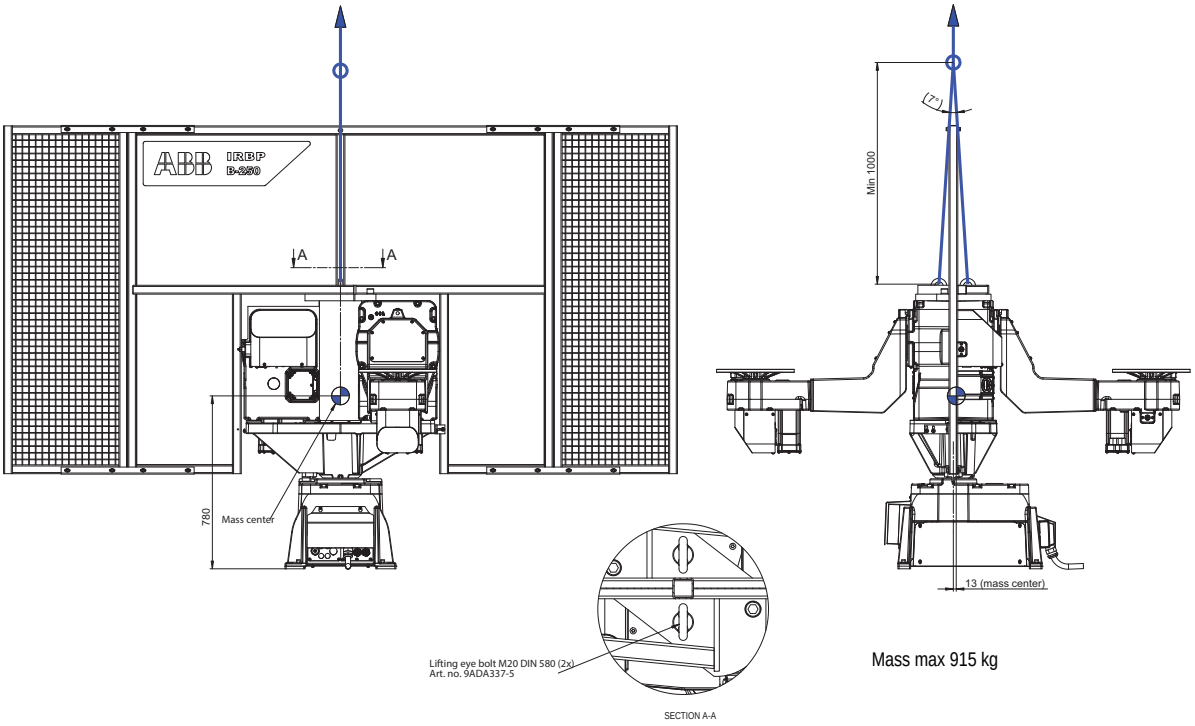
IRP B-250



Mass max 915 kg

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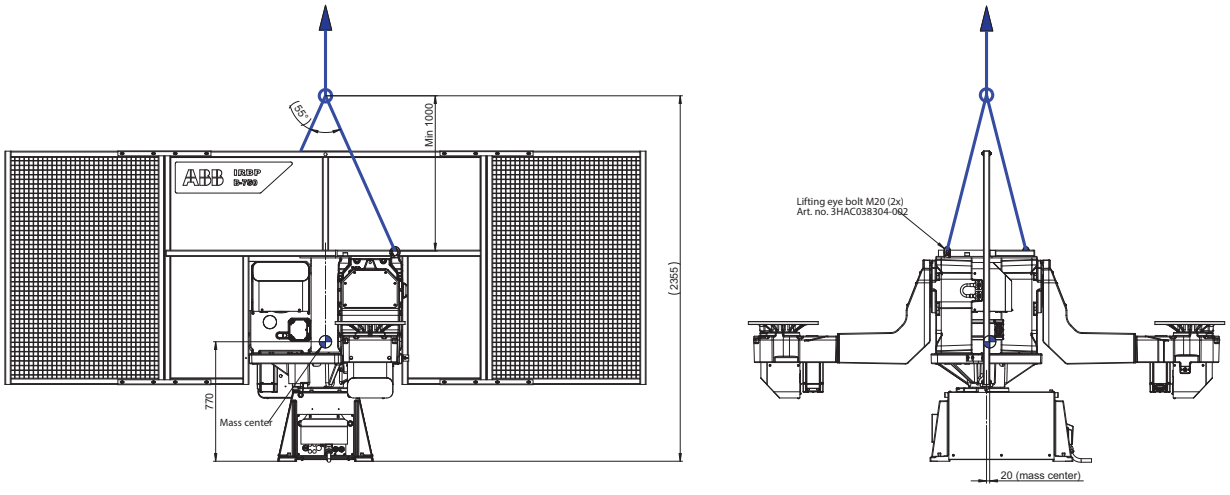
IRP B-500/750



Mass max 1750 kg

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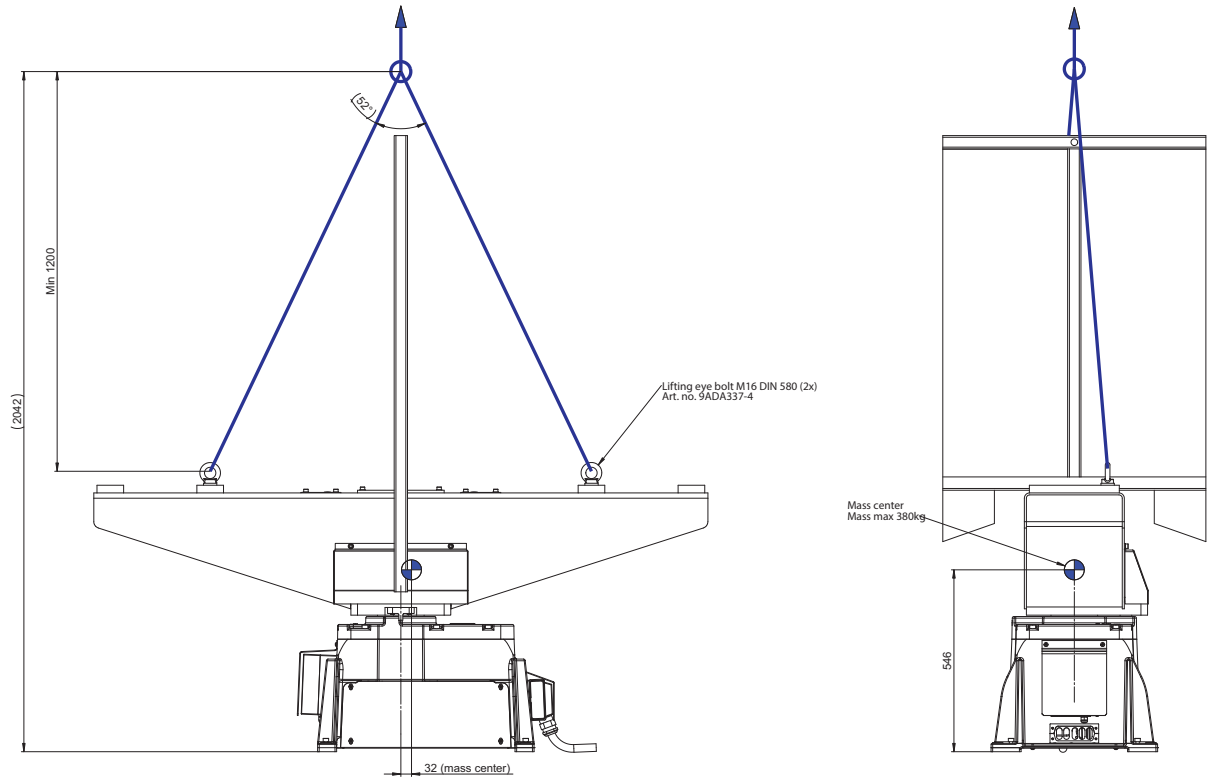
IRP C-500



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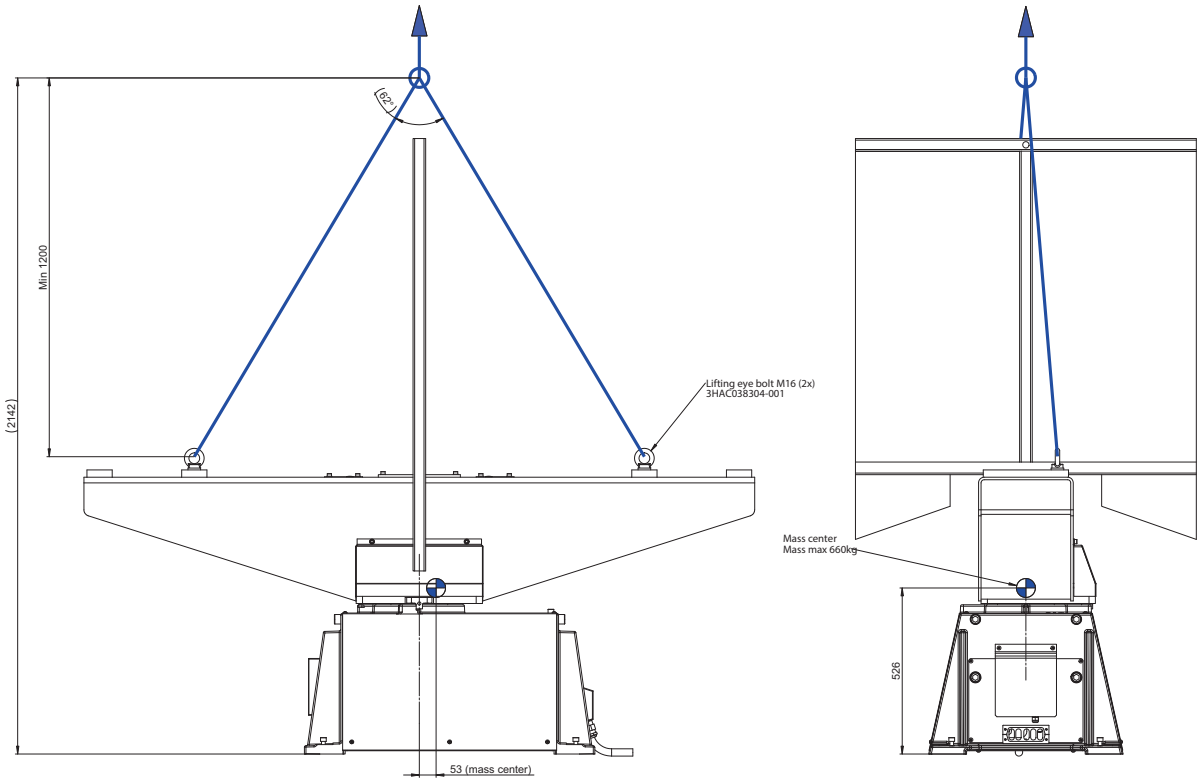
IRP C-1000



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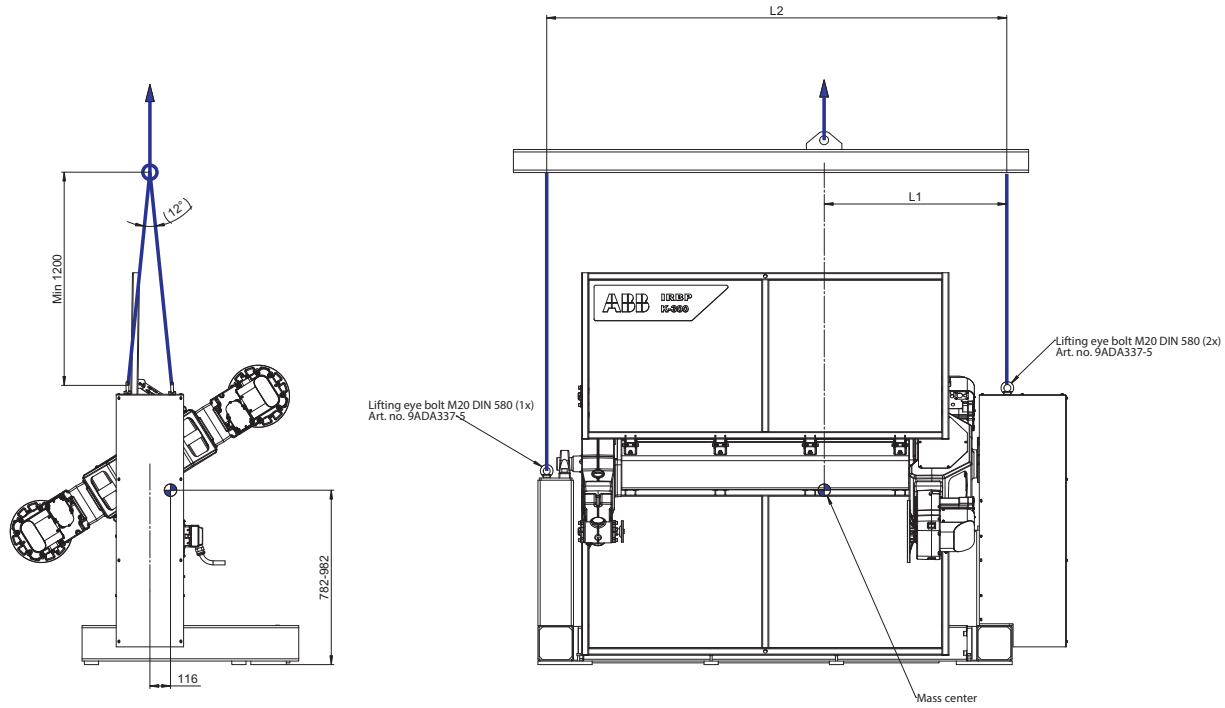
IRP K-300



Positioner length	Mass [kg]	L1 [mm]	L2 [mm]
L=1600	1170	1025	2590
L=2000	1250	1200	2990
L=2500	1310	1405	3490
L=3150	1400	1685	4140
L=3500	1450	1840	4490
L=4000	1515	2060	4990

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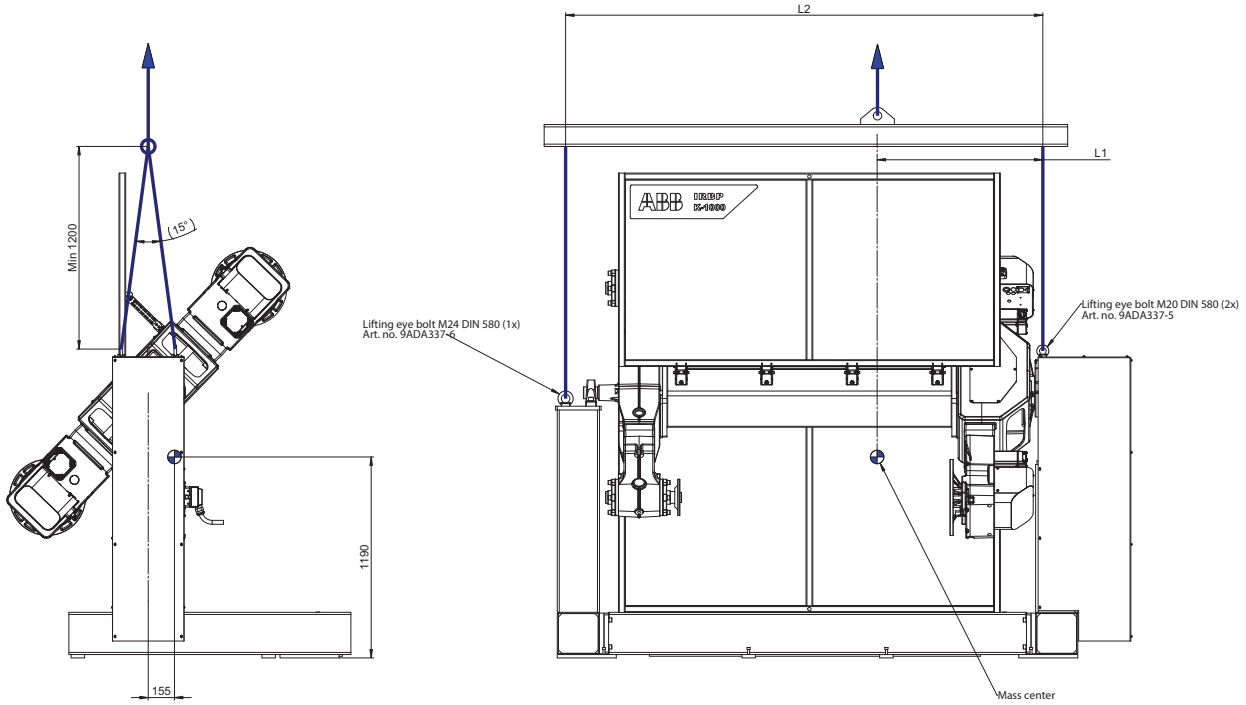
IRP K-600/1000



Positioner length	Mass [kg]	L1 [mm]	L2 [mm]
L=1600	2080	980	2826
L=2000	2190	1145	3226
L=2500	2290	1345	3726
L=3150	2410	1615	4376
L=3500	2480	1760	4726
L=4000	2570	1970	5226

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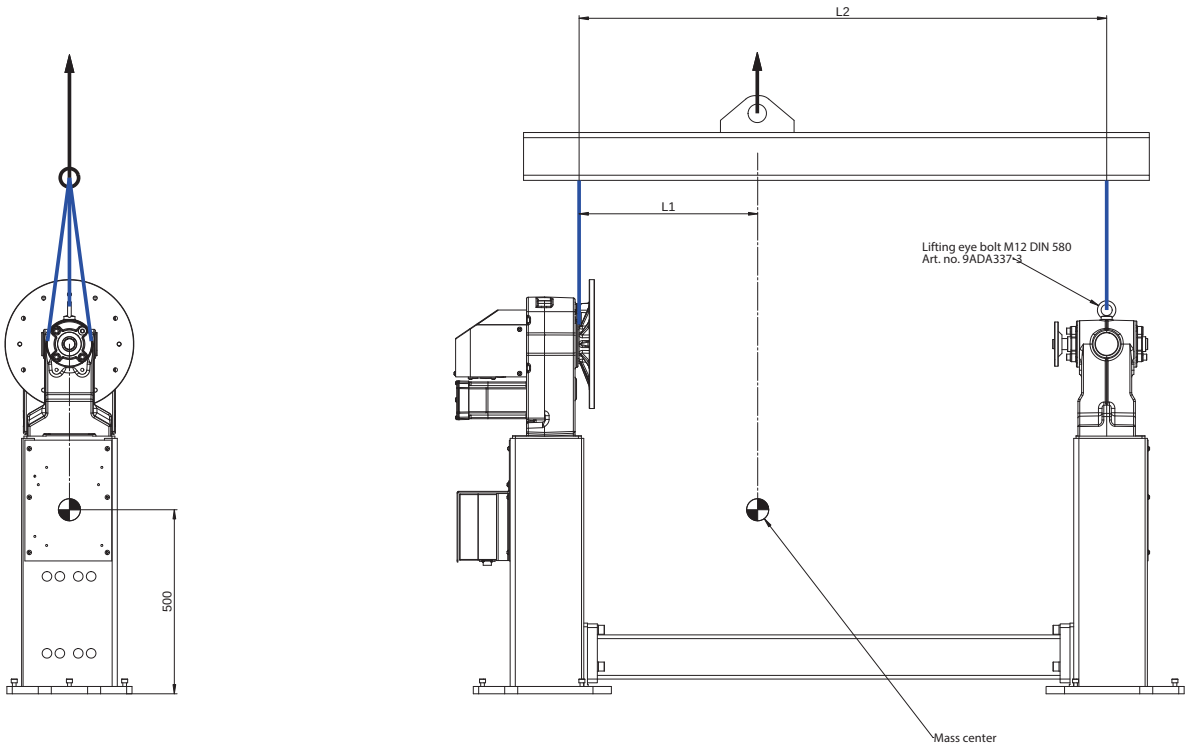
IRP L-300



Positioner length	Mass [kg]	L1 [mm]	L2 [mm]
L=1250	250	485	1433
L=1600	255	625	1783
L=2000	260	785	2183
L=2500	270	985	2683
L=3150	280	1250	3333
L=4000	300	1610	4183

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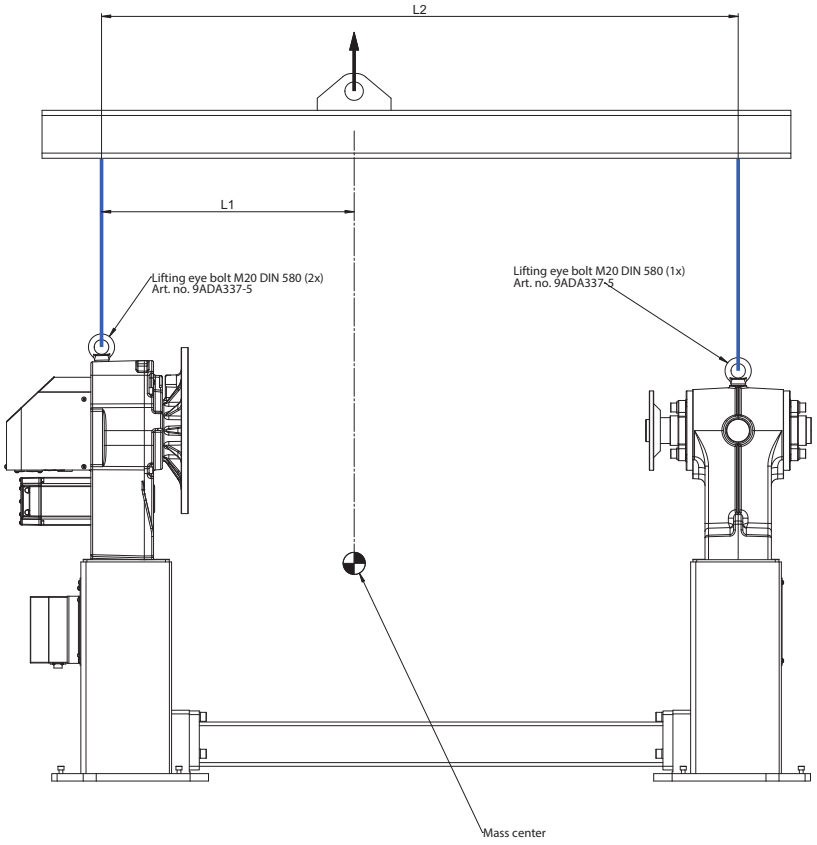
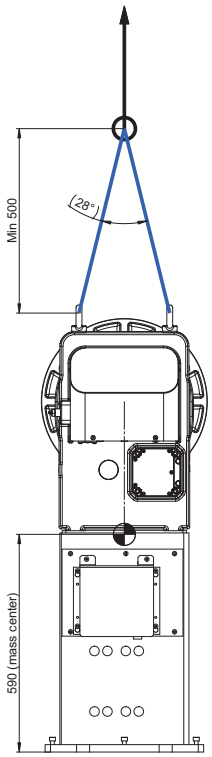
Continued

IRP L-600/1000





Positioner length	Mass [kg]	L1 [mm]	L2 [mm]
L=1250	465	685	1725
L=1600	470	820	2075
L=2000	480	975	2475
L=2500	485	1170	2975
L=3150	500	1430	3625
L=4000	515	1770	4475

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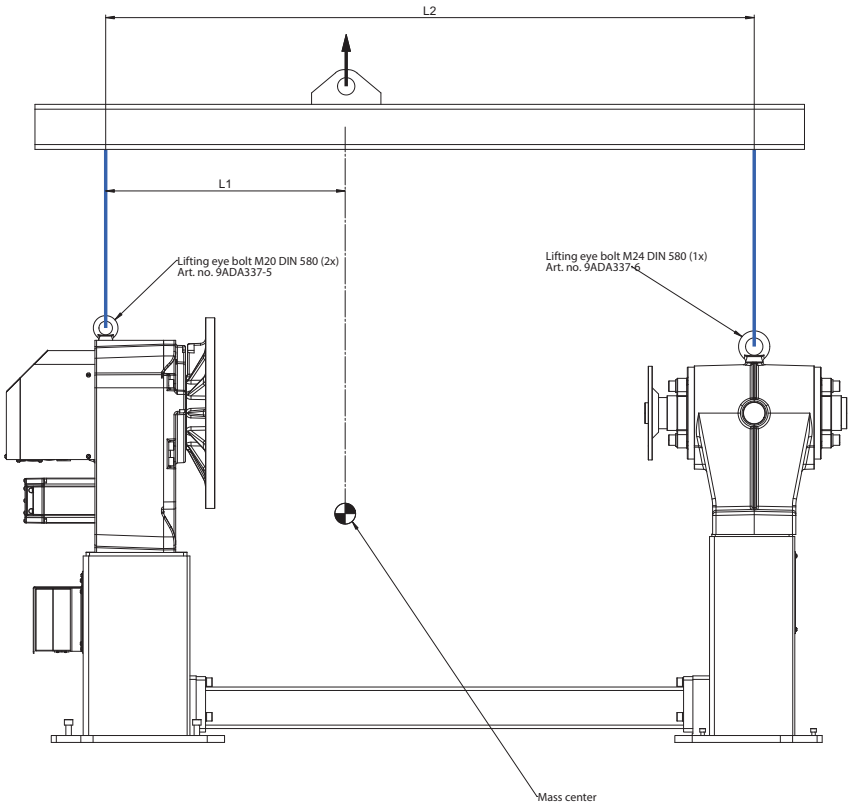
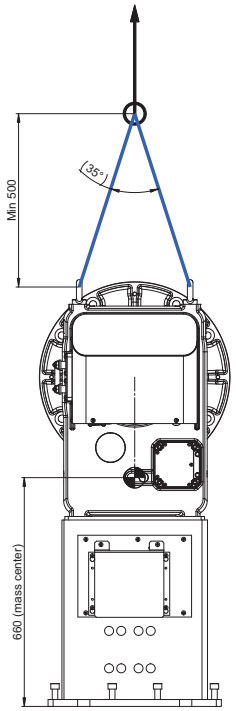
IRP L-2000





Positioner length	Mass [kg]	L1 [mm]	L2 [mm]
L=1250	700	690	1870
L=1600	705	815	2220
L=2000	710	950	2620
L=2500	720	1130	3120
L=3150	730	1360	3770
L=4000	740	1670	4620

xx1500002143

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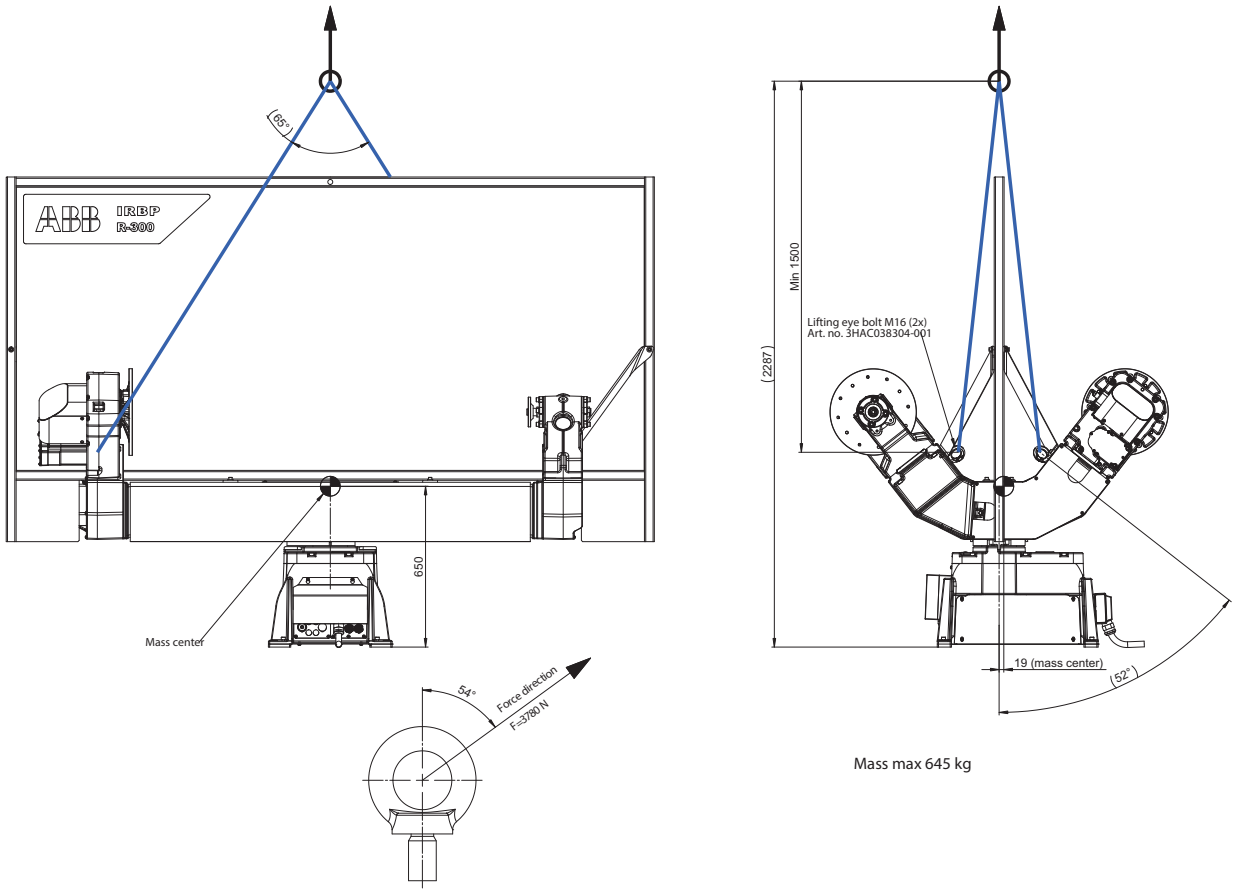
IRP R-300



Mass max 645 kg

xx1500002144

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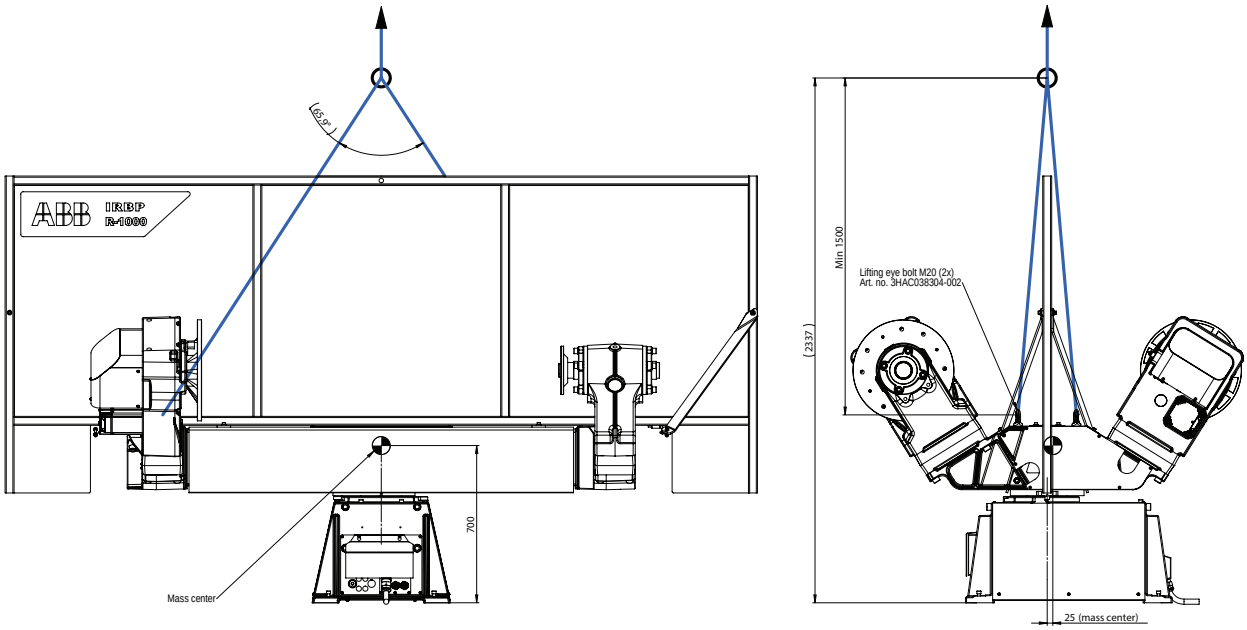
Continued

IRP R-600/1000



Mass max 1380 kg

xx1500002145

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