ROBOTICS

Product specification

IRB 1010

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Product specification
IRB 1010-1.5/0.37
OmniCore

Document ID: 3HAC081966-001
Revision: C

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 specification

About this product specification

This product specification describes the performance of the manipulator or a complete family of manipulators in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety, and operating equipment
- The load diagrams, mounting or extra equipment, the motion, and the robot reach
- The specification of available variants and options

The specification covers the manipulator using the OmniCore controller.

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

The specification is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel

References

Documentation referred to in the manual, is listed in the table below.

Document name	Document ID
Product manual - IRB 1010	*3HAC081964-001*
Product manual - OmniCore E10	*3HAC079399-001*
Product specification - OmniCore E line	*3HAC079823-001*
Operating manual - OmniCore	*3HAC065036-001*

Revisions

Revision	Description
A	First edition.
B	Published in release 22D. The following updates are done in this revision: • Minor changes.
C	Published in release 23C. The following updates are done in this revision: • The updated robot stopping distances and times are moved to this document, and removed from the generic document, see *Robot stopping distances and times on page 56*.

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1 Description of IRB 1010

1.1 About the IRB 1010

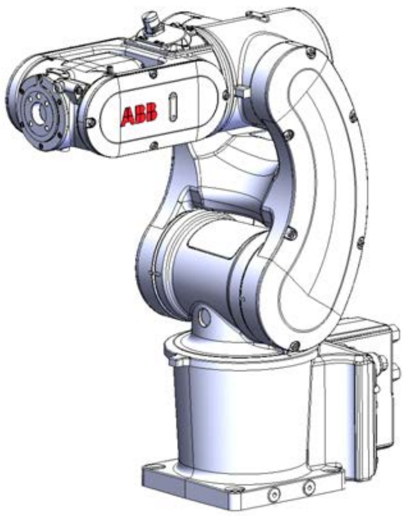
General introduction

The IRB 1010 is one of ABB Robotics latest generation of 6-axis robot, with a payload of 1.5 kg, designed specifically for manufacturing industries that use flexible robot-based automation, e.g. 3C industry. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems. Benefit from its smaller size and lighter weight, the IRB 1010 is easy for deployment and suitable for manufacturing processes in limited spaces, e.g. film peeling.

The robot is equipped with the OmniCore E10 controller and robot control software, RobotWare 7.

Available variants

The IRB 1010 is available in the following variant.



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Robot variant	Handling capacity (kg)	Reach (m)
IRB 1010-1.5/0.37	1.5 kg	0.37 m

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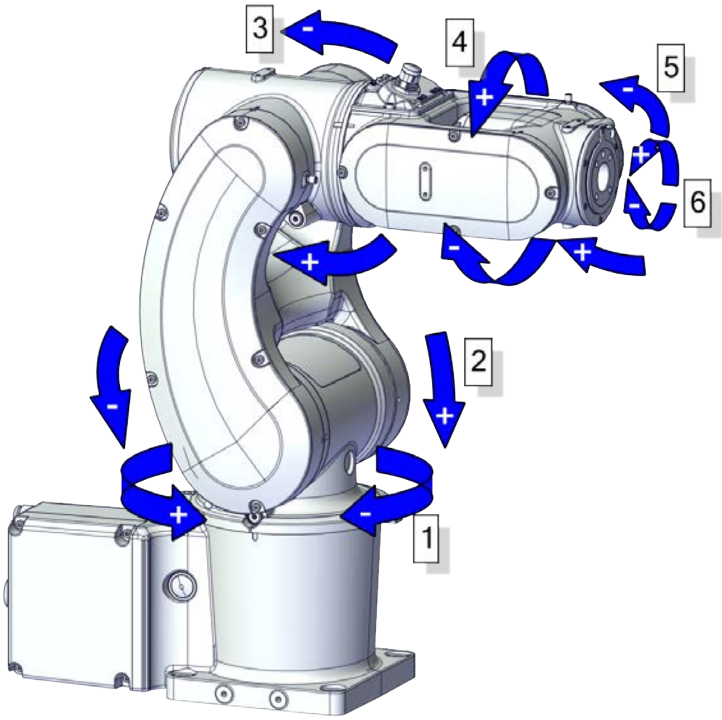
Robot axes



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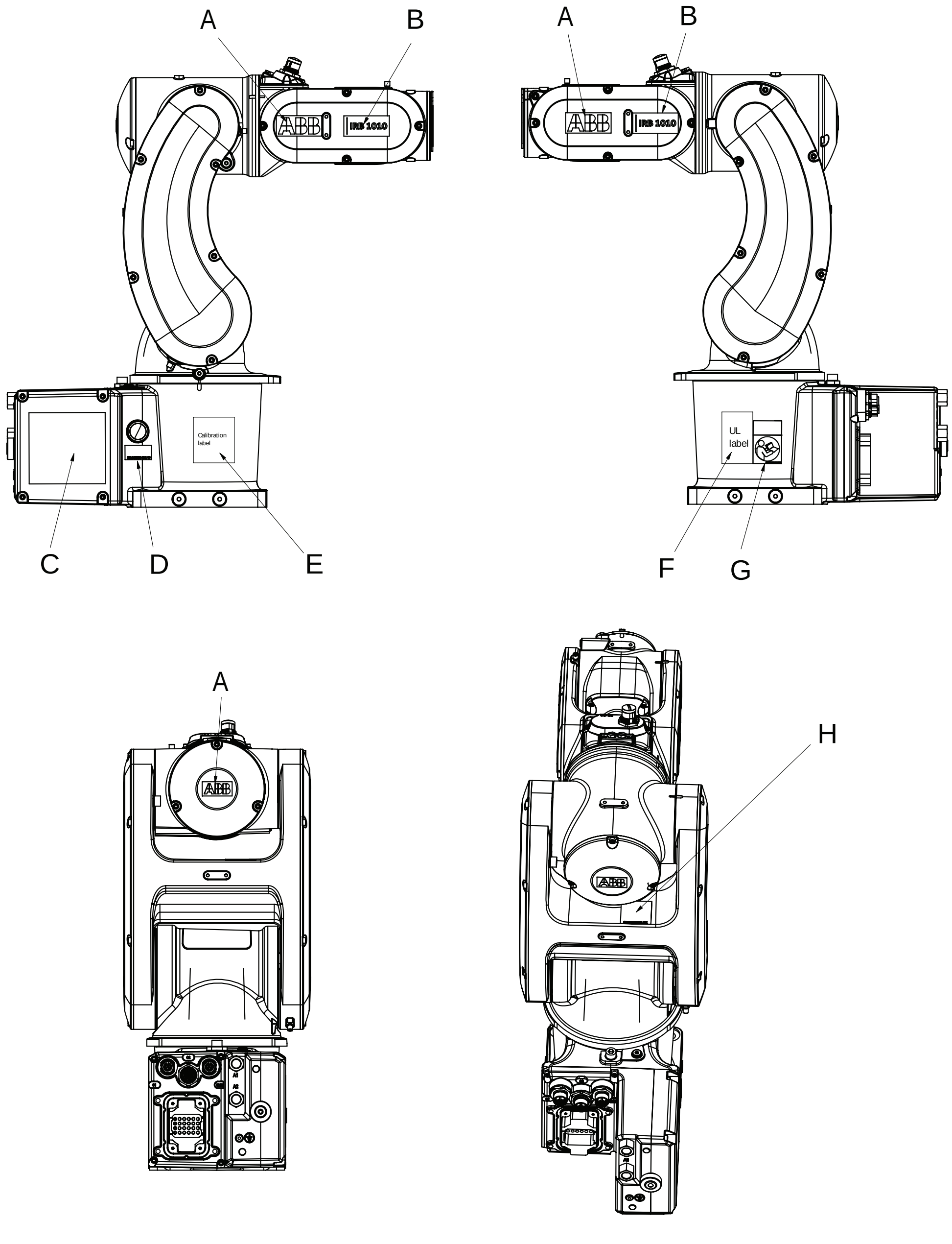
Location of labels

These figures show the location of the information labels to be inspected.



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A	ABB logo
B	Robot model
C	Rating label, CE label and AbsAcc label
D	Instruction label **Brake release**
E	Calibration label
F	UL label

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G	Read manual label, also specifying warning labels
H	Warning label **Crush**

Control system

The robot is equipped with the OmniCore controller and robot control software, RobotWare. RobotWare supports every aspect of the robot system, such as motion control, development and execution of application programs, communication etc. See *Operating manual - OmniCore*.

We have added a range of software products - all falling under the umbrella designation of Active Safety - to protect not only personnel in the unlikely event of an accident, but also robot tools, peripheral equipment and the robot itself.

The IRB 1010 manipulator can be connected to the following robot controllers:

- OmniCore E10

Safety

Safety standards valid for complete robot, manipulator and controller.

Additional functionality

For additional functionality, the robot can be equipped with optional software for application support - for example communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see the *Product specification - OmniCore E line*.

1.2 Standards

1.2.1 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
IEC 61340-5-1	Protection of electronic devices from electrostatic phenomena - General requirements

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements
ANSI/ESD S20.20	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

1.3 Maintenance and troubleshooting

General

The robot requires only minimum maintenance during operation. It has been designed to make it as easy to service as possible:

- Maintenance-free AC motors are used.
- Oil is used for the gearboxes.
- The cabling is routed for longevity, and in the unlikely event of a failure.

Maintenance

The maintenance intervals depend on the use of the robot. The required maintenance activities also depend on the selected options. For detailed information on maintenance procedures, see the maintenance section in *Product manual - IRB 1010*.

Troubleshooting

The robot has built-in communication that shows information on the FlexPendant. These messages facilitates troubleshooting and are an integral part of the control system. Troubleshooting procedures are describes in the product manual for the manipulator and the controller respectively.

2 Technical data for IRB 1010

2.1 Introduction to the technical data

Installation instructions

The complete installation instructions are detailed in the product manual for the manipulator.

2.2 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
IRB 1010	13.5 kg

Note

The weight does not include additional options, tools and other equipment fitted on the robot.

Mounting positions

The table shows valid mounting positions and the installation (mounting) angle for the manipulator.

Mounting position	Installation angle
Floor mounted	0° [i]
Suspended	180°

[i] A tilt of up to 5° does not affect the payload or reach, but it can have a negative impact on performance and lifetime. The actual value must be set in the system parameters.

Note

The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected. See the product manual for details.

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

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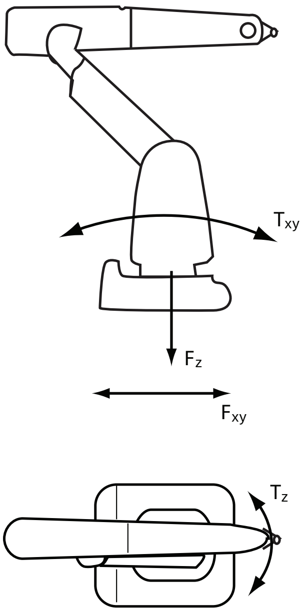
The directions are valid for all floor mounted, table mounted, wall mounted and suspended robots.



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F_{xy}	Force in any direction in the XY plane
F_z	Force in the Z plane
T_{xy}	Bending torque in any direction in the XY plane
T_z	Bending torque in the Z plane

The table shows the various forces and torques working on the robot during different kinds of operation.

Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!

WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Floor mounted

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	150 N	264 N
Force z	200 N	353 N
Torque xy	70 Nm	121 Nm
Torque z	30 Nm	51 Nm

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Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	150 N	340 N
Force z	340 N	493 N
Torque xy	70 Nm	121 Nm
Torque z	30 Nm	51 Nm

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.1/500 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy.
Minimum resonance frequency	22 Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment.[i] For information about compensating for foundation flexibility, see the description of *Motion Process Mode* in the manual that describes the controller software option, see *References on page 7*.
Minimum foundation material yield strength	150 MPa	

i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25°C (-13°F)
Maximum ambient temperature	+55°C (+131°F)
Maximum ambient temperature (less than 24 hrs)	+70°C (+158°F)

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Parameter	Value
Maximum ambient humidity	95% at constant temperature (gaseous only)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	0°C[i] (32°F)
Maximum ambient temperature	+45°C (113°F)
Maximum ambient humidity	95% at constant temperature

i At low environmental temperature (below 10° C) a warm-up phase is recommended to be run with the robot. Otherwise there is a risk that the robot stops or runs with lower performance due to temperature dependent oil and grease viscosity.

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class [i]
Manipulator, protection type Standard	IP40[ii]

i According to IEC 60529.
ii The IRB 1010 has IP40 as default. And the IRB 1010 fulfill clean room class 5 standard according to DIN EN ISO14644-1, -14.

Environmental information

The product complies with IEC 63000. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*.

2.3 Other technical data

Airborne noise level

Description	Note	Data
Airborne noise level	The sound pressure level outside the working space.	56.2 dB (A) Leq (acc. to machinery directive 2006/42/EC)

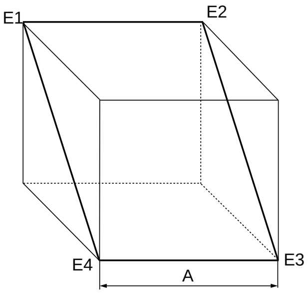
Note

The noise emission from a robot system, actual application, depends on programmed path, payload, cycle time, mounting position, environment etc.

Power consumption at max load

Type of movement	IRB 1010-1.5/0.37
ISO Cube Max. velocity (W)	156

Robot in calibration position	IRB 1010-1.5/0.37
Brakes engaged (W)	58
Brakes disengaged (W)	61



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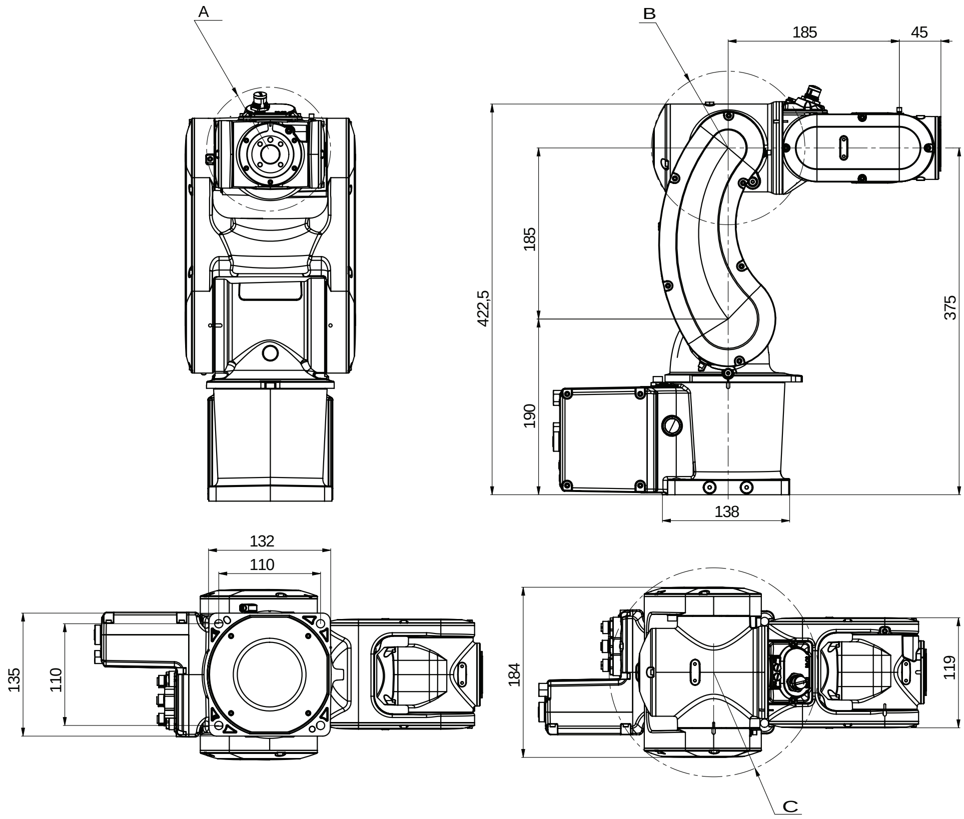
Pos	Description
A	170 mm

2.4 Fitting equipment on the robot (robot dimensions)

Robot dimensions

The figure shows the dimension of the IRB 1010-1.5/0.37.



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Pos	Description
A	Turning radius: R67
B	Turning radius: R83
C	Turning radius: R113

Attachment holes and dimensions

Extra loads can be mounted on robot. Definitions of dimensions and masses are shown in the following figures. The robot is supplied with holes for fitting extra equipment.

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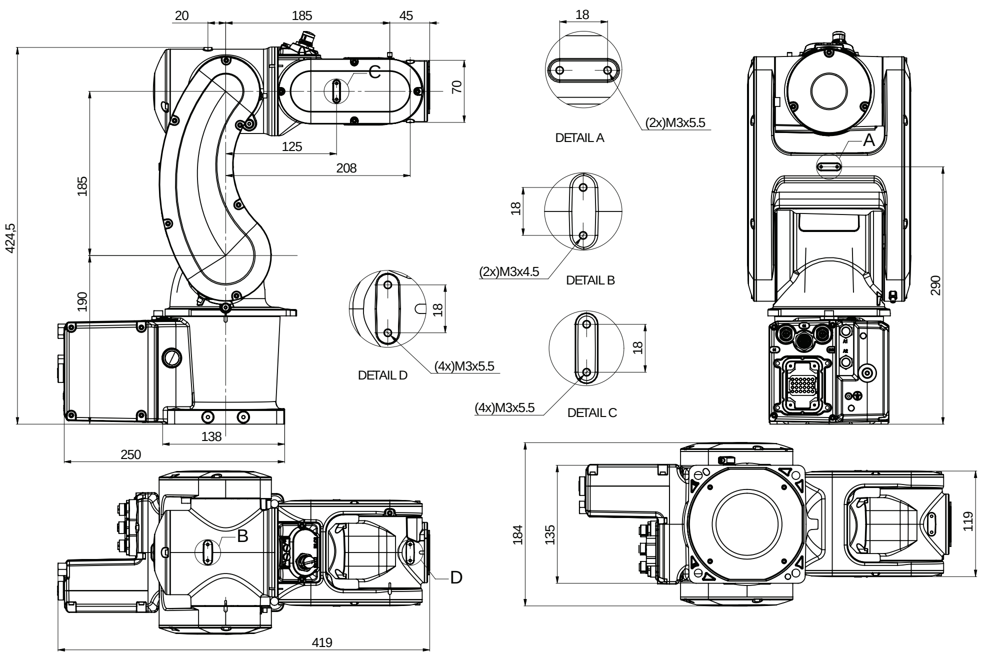
Maximum allowed arm load depends on center of gravity of arm load and robot payload.

Holes for fitting extra equipment



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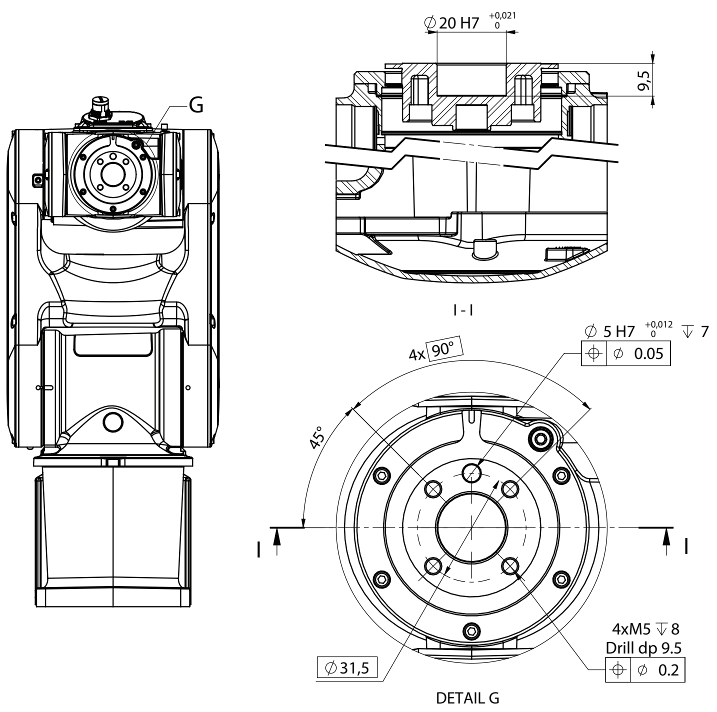
Tool flange standard



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CAUTION

To calibrate the axis 6, the notch on the wrist must be aligned with the marked pin hole on the tool flange. Before installing a tool on the tool flange, make sure a visible mark has been made to the tool at the corresponding position.

For details about the synchronization mark, see *Synchronization marks and synchronization position for axes on page 35*.

Fastener quality

When fitting tools on the tool flange, only use screws with quality 12.9. For other equipment use suitable screws and tightening torque for your application.

2.5 Additional installation information

General

IRB 1010 is available in one variant and it can be floor mounted, inverted, or tilted mounted.

Detailed installation instructions

All detailed installation instructions are described in *Product manual - IRB 1010*.

Attachment screws

The table below specifies the type of securing screws and washers to be used for securing the robot to the base plate/foundation.

Suitable screws	M8x30 (robot installation directly on foundation)
Quantity	4 pcs
Quality	8.8
Suitable washer	8.4 x 16 x 1.6
Guide pins	2 pcs, D6x20, ISO 2338 - 6m6x20 - A1
Tightening torque	20 Nm±2 Nm
Length of thread engagement	Minimum 14 mm for ground with material yield strength 150 MPa
Level surface requirements	0.1/500 mm

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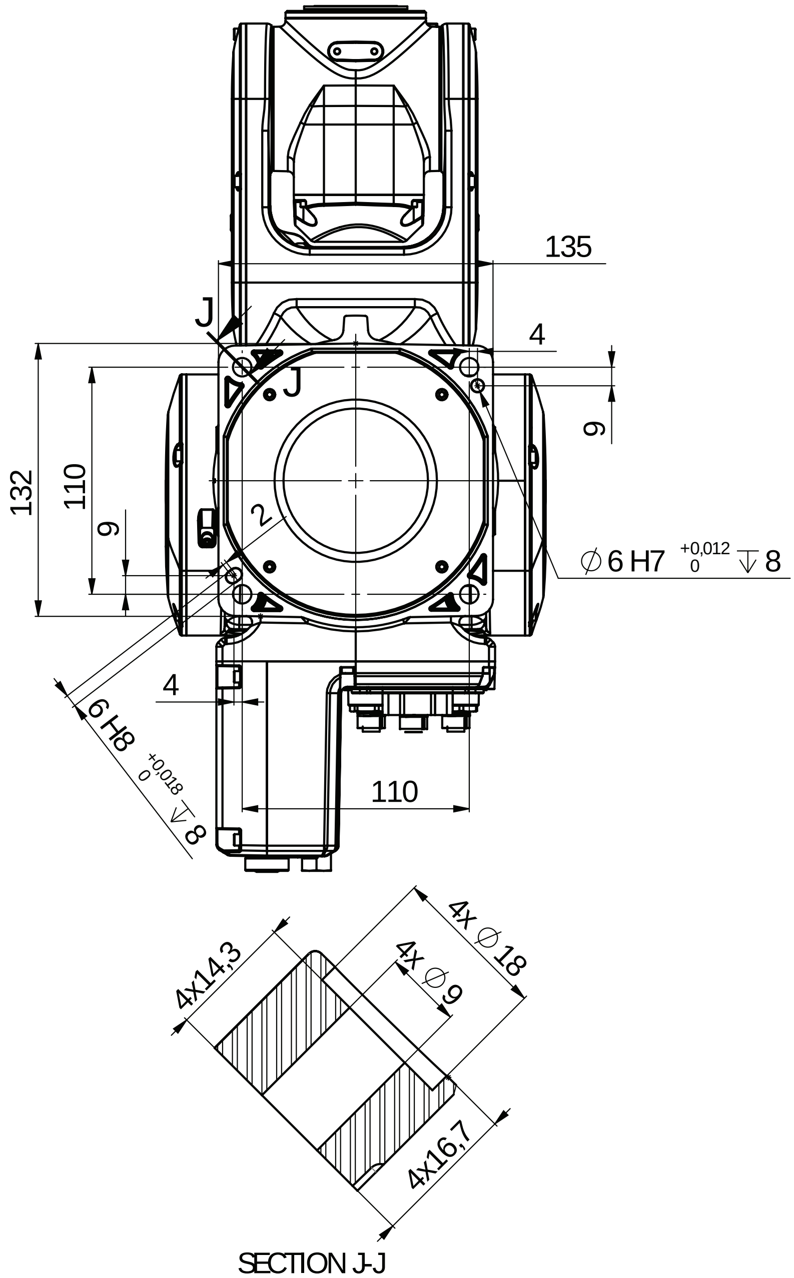
Hole configuration, base

This illustration shows the hole configuration used when securing the robot.



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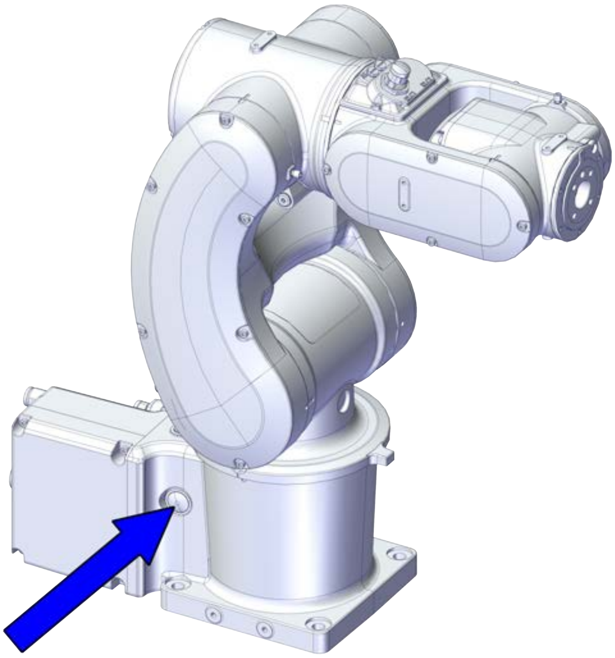
Location of the brake release unit

The brake release unit is located as shown in the figure.



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2.5.1 Setting the system parameters for an inverted or a tilted robot

General

The robot is configured for mounting parallel to the floor, without tilting, on delivery. If the robot is mounted in any other angle than 0°, then the system parameters that describe the mounting angle (how the robot is oriented relative to the gravity) must be re-defined.

Note

With inverted installation, make sure that the gantry or corresponding structure is rigid enough to prevent unacceptable vibrations and deflections, so that optimum performance can be achieved.

Note

The mounting positions are described in *Mounting positions on page 16*, and the requirements on the foundation are described in *Requirements, foundation on page 18*.

System parameters

Note

The mounting angle must be configured correctly in the system parameters so that the robot system can control the movements in the best possible way. An incorrect definition of the mounting angle will result in:

- Overloading the mechanical structure.
- Lower path performance and path accuracy.
- Some functions will not work properly, for example *Load Identification* and *Collision detection*.

Gravity Beta

When the robot is mounted other than floor-standing (rotated around the y-axis), the robot base frame and the system parameter *Gravity Beta* must be redefined.

If the robot is mounted upside down (inverted), then *Gravity Beta* should be π (+3.141593).

The *Gravity Beta* is a positive rotation direction around the y-axis in the base coordinate system. The value is set in radians.

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Gravity Alpha

The *Gravity Alpha* is a positive rotation direction around the x-axis in the base coordinate system. The value is set in radians.

Note

The system parameter *Gravity Alpha* is not supported for all robot types.

If the robot does not support *Gravity Alpha*, then use *Gravity Beta* along with the re-calibration of axis 1 to define the rotation of the robot around the x-axis.

Note

The parameter is supported for all robots on track when the system parameter *7 axes high performance motion* is set, see *Technical reference manual - System parameters*.

Gamma Rotation

Gamma Rotation defines the orientation of the robot foot on the travel carriage (track motion).

Mounting angles and values

The parameter *Gravity Beta* (or *Gravity Alpha*) specifies the mounting angle of the robot in radians. It is calculated in the following way.

`Gravity Beta = A° x 3.141593/180 = B radians`, where `A` is the mounting angle in degrees and `B` is the mounting angle in radians.

Example of position	Mounting angle (A°)	Gravity Beta
Floor mounted	0°	0.000000 (Default)
Inverted mounting	180°	3.141593

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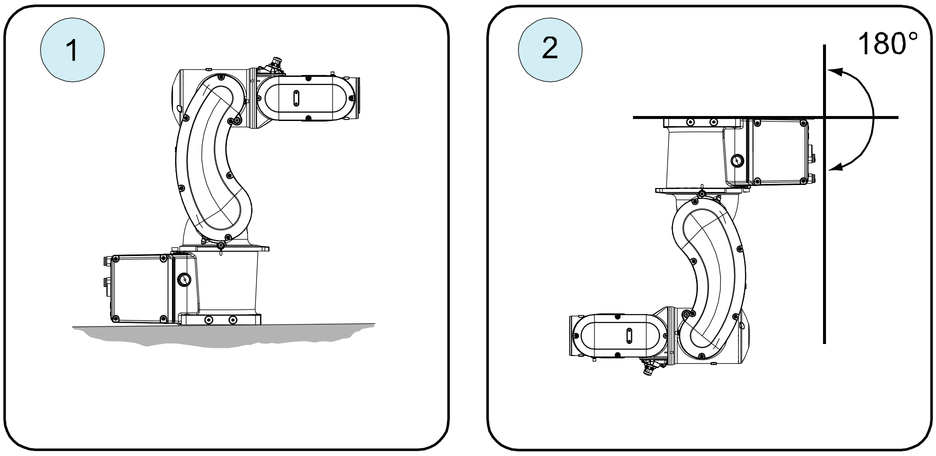
Examples of mounting angles tilted around the Y axis (*Gravity Beta*)



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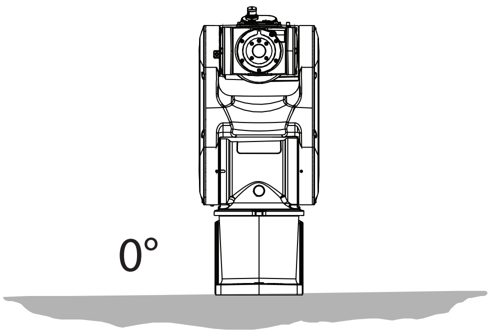
Pos 1	Floor mounted
Pos 2	Mounting angle 180° (Suspended)

Examples of mounting angles tilted around the X axis (*Gravity Alpha*)

The following illustration shows the IRB 120, but the same principle applies for all robots.



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Mounting angle	Gravity Alpha
0° (Floor mounted)	0

Note

For suspended robots (180°), it is recommended to use *Gravity Beta* instead of *Gravity Alpha*.

Defining the system parameters in RobotWare

The value of the system parameters that define the mounting angle must be redefined when changing the mounting angle of the robot. The parameters belong to the type *Robot*, in the topic *Motion*.

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The system parameters are described in *Technical reference manual - System parameters*.

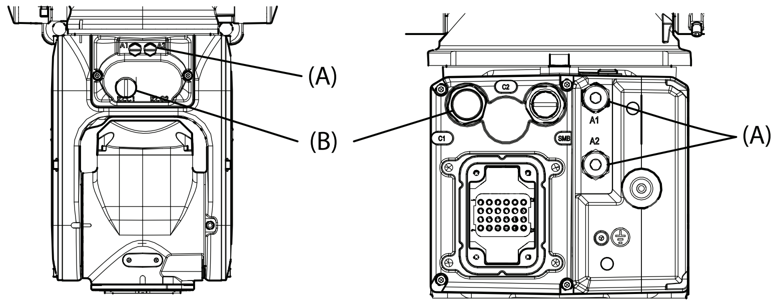
The system parameters are configured in RobotStudio or on the FlexPendant.

2.5.2 Customer connections

Introduction to customer connections

The cables for customer connection are integrated in the robot and the connectors are placed on the wrist and at the base. There is one connector R2.C1 at the wrist. Corresponding connector R1.C1 is located at the base.

Hose for compressed air is also integrated into the manipulator. There are 2 inlets at the base (R1/8”) and 2 outlets (M5) on the wrist.



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Position	Connection	Description	Number	Value
A	Air	Max. 5 bar	2	Outer diameter of air hose: 4 mm
B	(R1)R2.C1	Customer power/signal	12 wires	30 V, 1.54 A

Connector kits (optional)

Connector kits, base

R1.C1 connector on the base is part of the CP/CS cable. For details about the robot cabling, see "Robot cabling and connection points" in robot product manual.

Connector kits, wrist

The table describes the CP/CS connector kits for wrist.

Position	Description		Art. no.
Connector kits	CP/CS	M12 CPCS Male straight connector kits	3HAC066098-001
		M12 CPCS Male angled connector kits	3HAC066099-001

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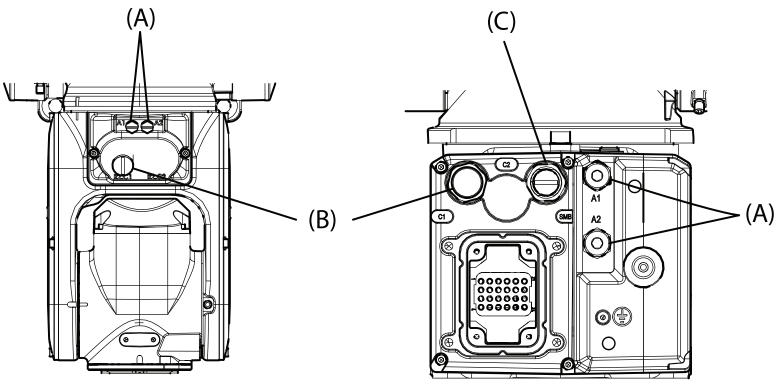
Protection covers

Protection covers for water and dust proofing

Protection covers are delivered together with the robot and must be well fitted to the connectors in any application requiring water and dust proofing.

Always remember to refit the protection covers after removing them.



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A	Air hose connector protection covers
B	CP/CS connector protection covers
C	SMB connector protection cover

2.6 Calibration and references

2.6.1 Calibration methods

Overview

This section specifies the different types of calibration and the calibration methods that are supplied by ABB.

The original calibration data delivered with the robot is generated when the robot is floor mounted. If the robot is not floor mounted, then the robot accuracy could be affected. The robot needs to be calibrated after it is mounted.

More information is available in the product manual.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Axis Calibration
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5.	Wrist Optimization

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 1010. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration

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- Update revolution counters
- Reference calibration

The calibration equipment for Axis Calibration is delivered as a toolkit.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing and is a complement to the standard calibration method.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

CalibWare - Absolute Accuracy calibration

The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

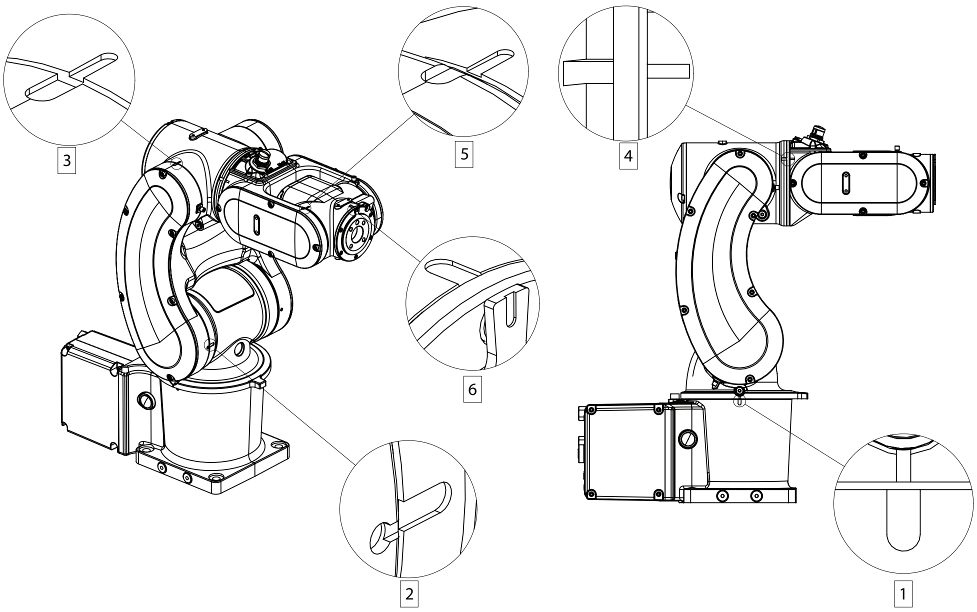
2.6.2 Synchronization marks and axis movement directions

2.6.2.1 Synchronization marks and synchronization position for axes

Introduction

This section shows the position of the synchronization marks and the synchronization position for each axis.

Synchronization marks, IRB 1010



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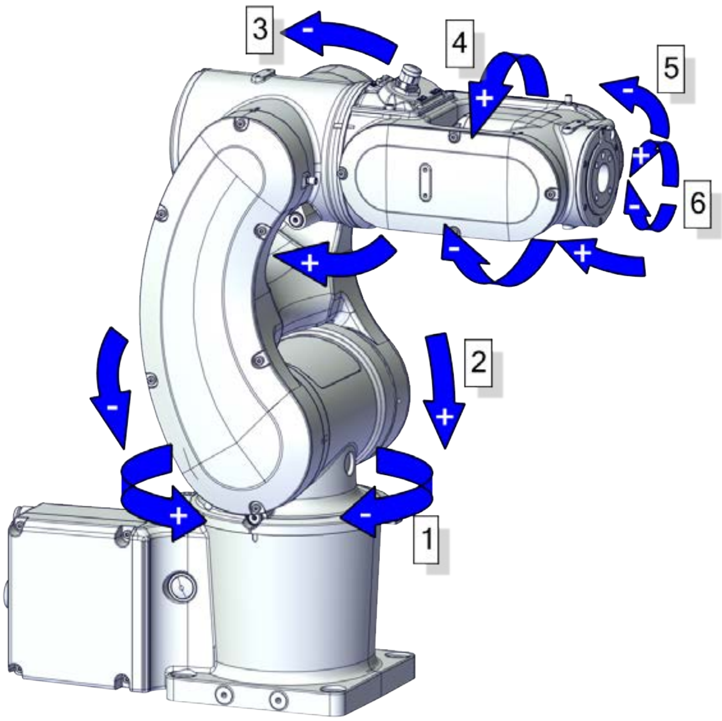
2.6.2.2 Calibration movement directions for all axes

Overview

When calibrating, the axis must consistently be run towards the calibration position in the same direction in order to avoid position errors caused by backlash in gears and so on. Positive directions are shown in the graphic below.

Calibration service routines will handle the calibration movements automatically and these might be different from the positive directions shown below.

Manual movement directions



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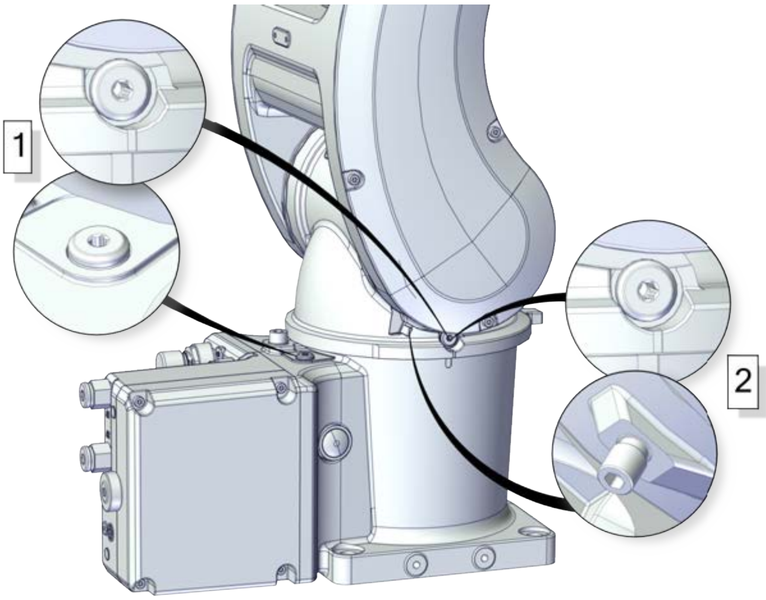
2.6.3 Fine calibration

General

The fine calibration is done with the Axis calibration method.



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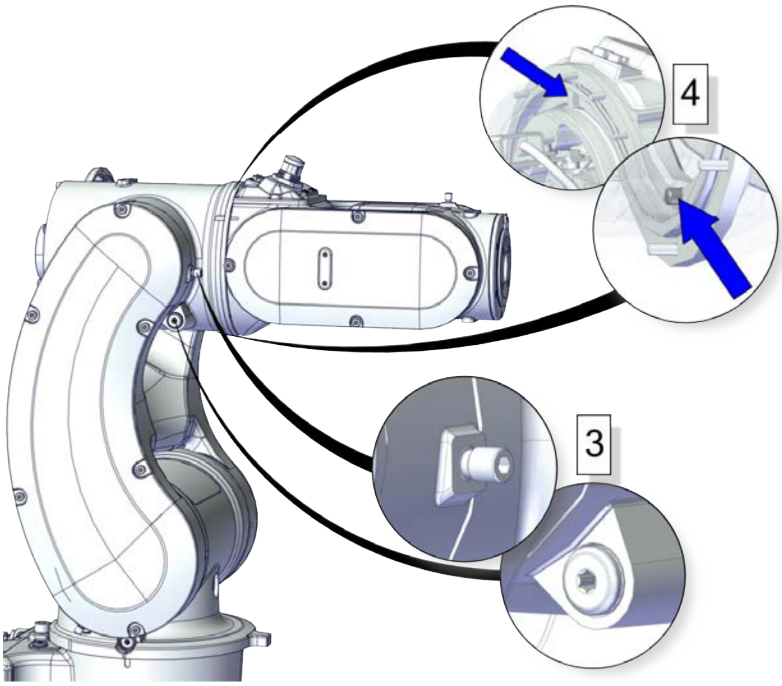

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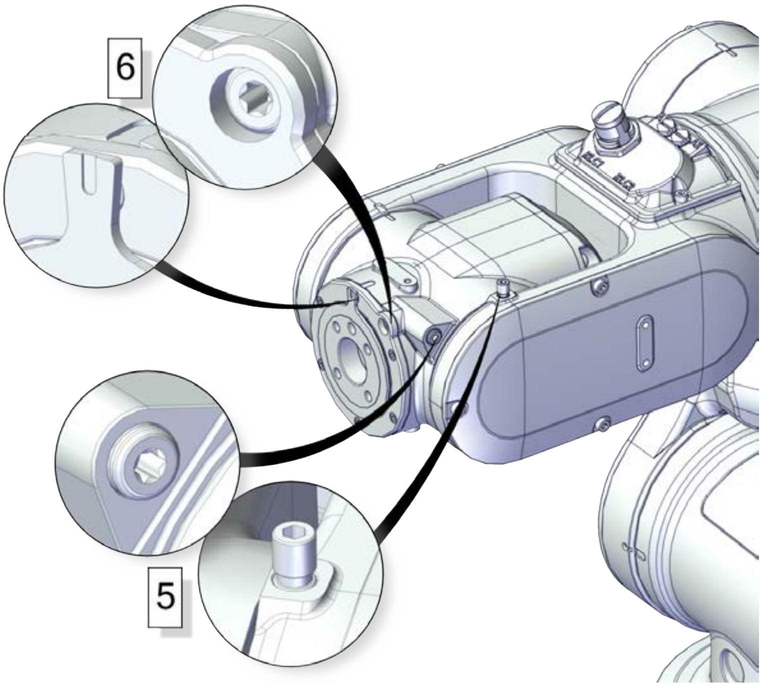

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2.6.4 Absolute Accuracy calibration

Purpose

Absolute Accuracy is a calibration concept that improves TCP accuracy. The difference between an ideal robot and a real robot can be several millimeters, resulting from mechanical tolerances and deflection in the robot structure. *Absolute Accuracy* compensates for these differences.

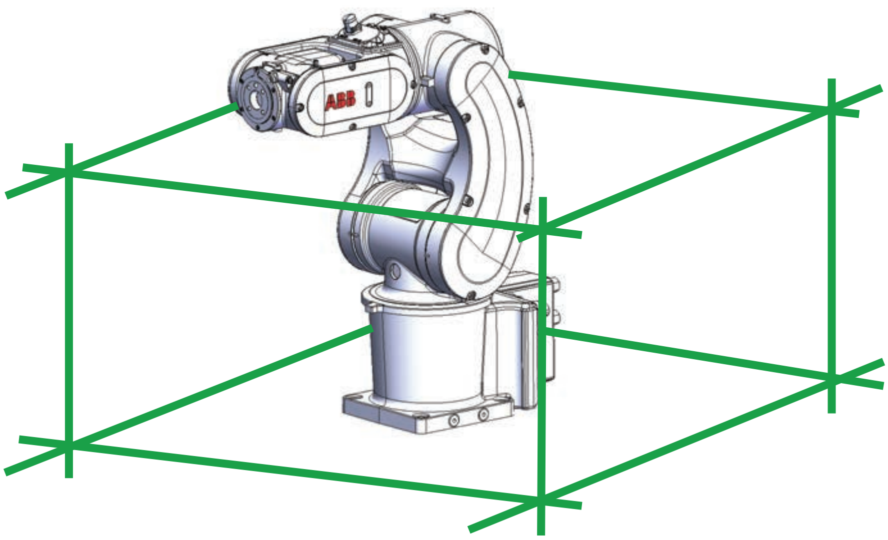
Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to eg. vision system or offset programming
- Re-use of programs between applications

The option *Absolute Accuracy* is integrated in the controller algorithms and does not need external equipment or calculation.

Note

The performance data is applicable to the corresponding RobotWare version of the individual robot.



xx2200000571

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved on the robot's serial measurement board
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

Continues on next page

A robot with *Absolute Accuracy* calibration has a label with this information on the manipulator.

Absolute Accuracy supports floor mounted installations. Compensation parameters saved in the robot's serial measurement board differ depending on which Absolute Accuracy option is selected.

RAPID instructions

There are no RAPID instructions included in this option.

Production data

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 1010-1.5/0.37	N/A	N/A	N/A

2.6.5 Calibration tools for Axis Calibration

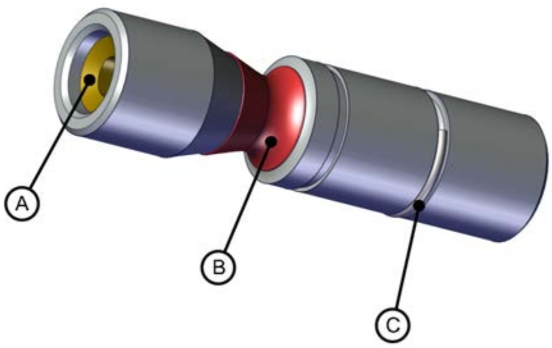
Calibration tools

Check prior to usage

Before using the calibration tool, make sure that the tube insert, the plastic protection and the steel spring ring are present.

WARNING

If any part is missing or damaged, the tool must be replaced immediately.



xx1500001914

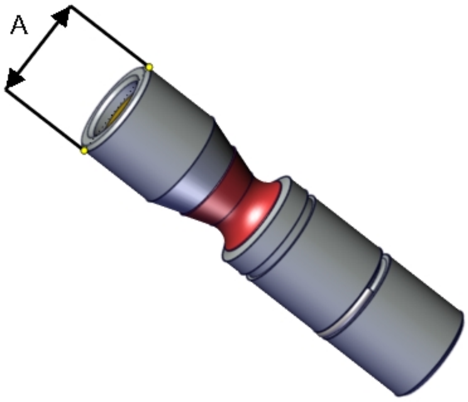
A	Tube insert
B	Plastic protection
C	Steel spring ring

Periodic check of the calibration tool

If including the calibration tool in a local periodic check system, the following measures should be checked.

- Outer diameter within Ø12g4 mm, Ø8g4 mm or Ø6g5 mm (depending on calibration tool size).
- Straightness within 0.005 mm.

Continues on next page



xx1500000951

A	Outer diameter

Periodic check of the calibration tool for the tool flange (3HAC058238-001)

If including the tool flange calibration tool in a local periodic check system, the following measures should be checked.

- Outer diameter within Ø5g5 mm.
- Straightness within 0.005 mm.

.

xx1600001142

A	Outer diameter

2.7 Load diagrams

2.7.1 Introduction

WARNING

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

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

WARNING

In the robot system the service routine LoadIdentify is available, which allows the user to make an automatic definition of the tool and load, to determine correct load parameters.

See *Operating manual - OmniCore*, for detailed information.

WARNING

Robots running with incorrect load data and/or with loads outside diagram, will not be covered by robot warranty.

General

At different moment of inertia the load diagram will be changed. For robots that are allowed floor, tilted or inverted mounted, the load diagrams as given are valid and thus it is also possible to use RobotLoad within those tilt and axis limits.

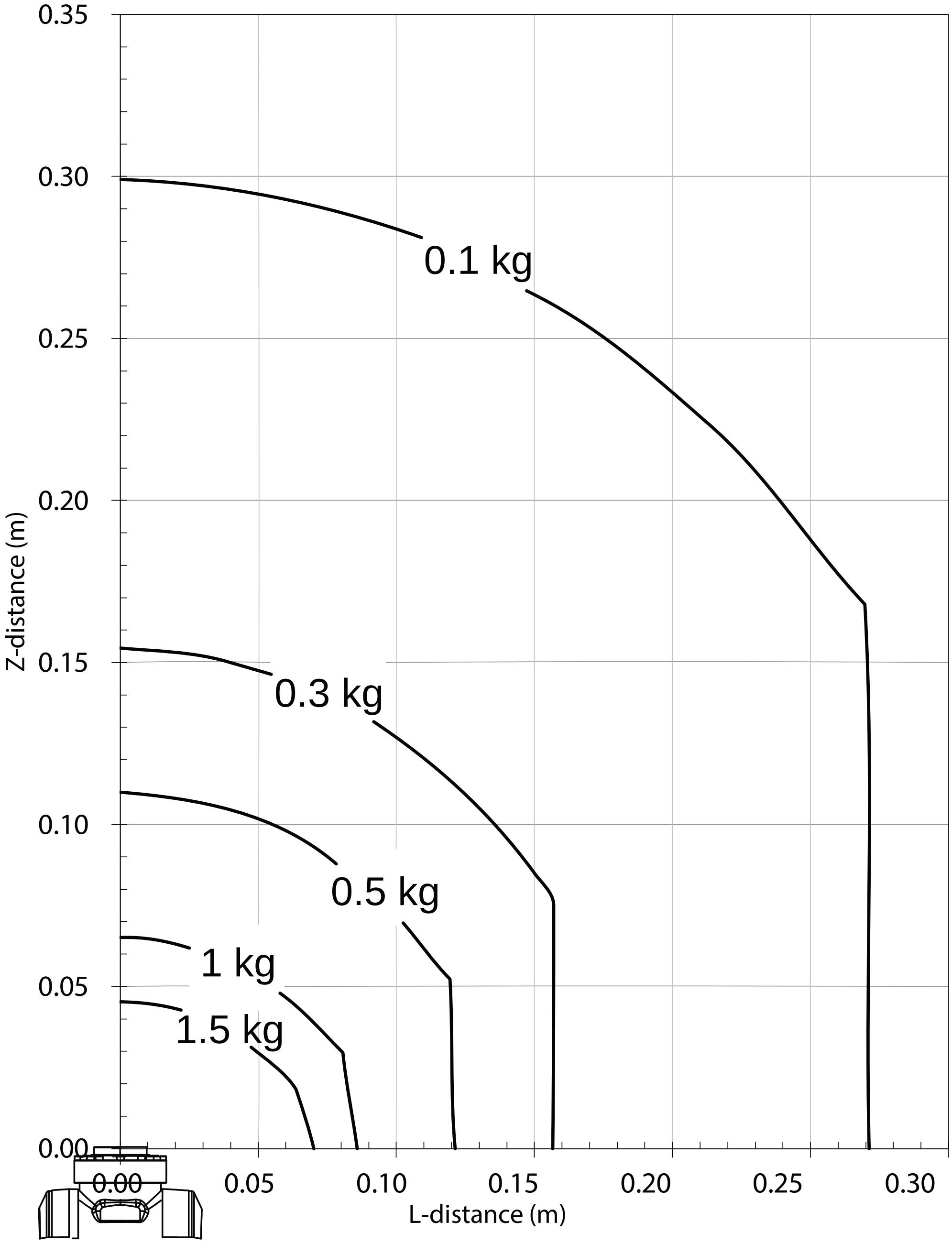
Control of load case by "RobotLoad"

To verify a specific load case, use the RobotStudio add-in RobotLoad.

The result from RobotLoad is only valid within the maximum loads and tilt angles. There is no warning if the maximum permitted arm load is exceeded. For over-load cases and special applications, contact ABB for further analysis.

2.7.2 Diagrams

Diagrams of IRB 1010-1.5/0.37



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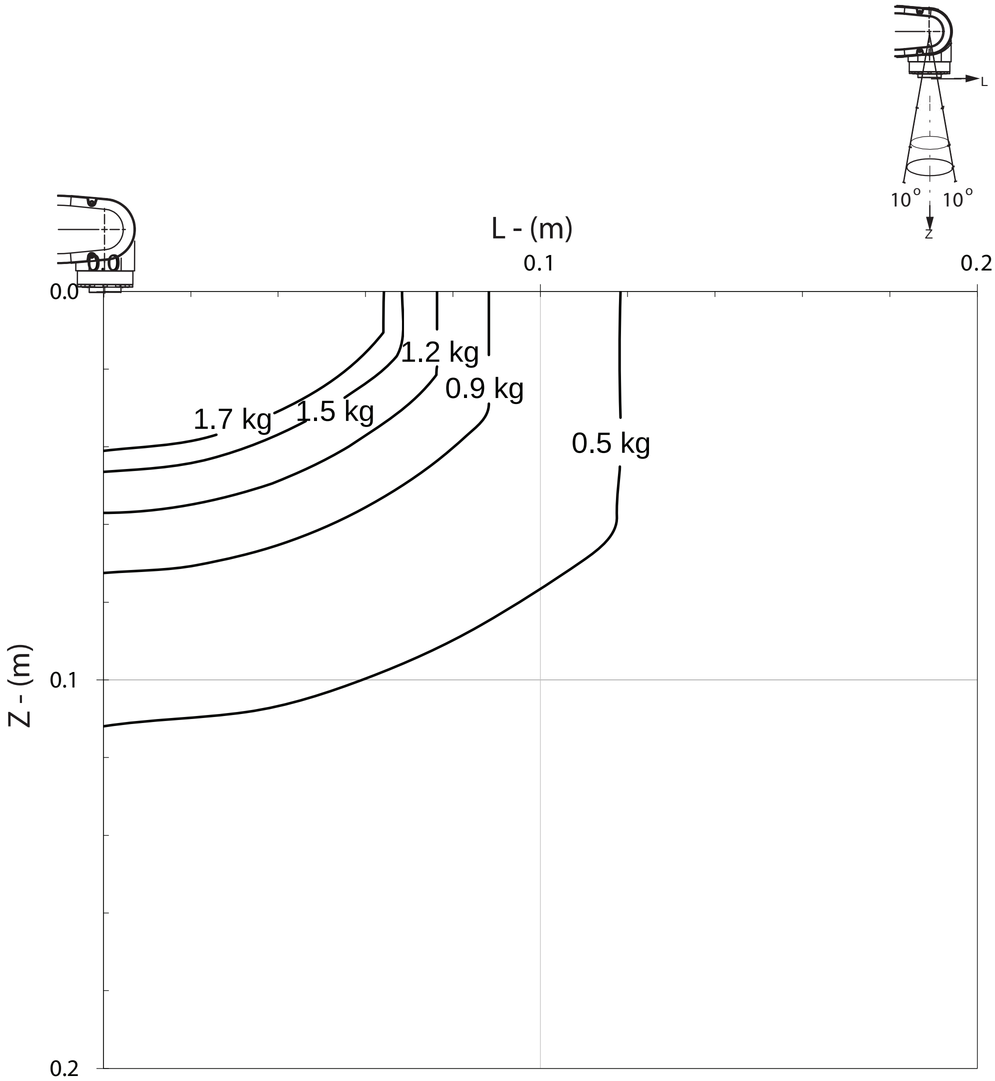
Diagrams of IRB 1010-1.5/0.37"Vertical Wrist" (±10°)



xx2200000278

For wrist down (0° deviation from the vertical line).

	Description
Max load	1.7 kg
Z_{max}	0.041 m
L_{max}	0.064 m

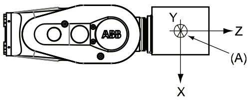
2.7.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

Note

Total load given as: mass in kg, center of gravity (Z and L) in meters and moment of inertia (J_{ox}, J_{oy}, J_{oz}) in kgm^2. L= sqr ($X^2 + Y^2$), see the following figure.

Full movement of axis 5 (±125°)

5	IRB 1010-1.5/0.37	Ja_5 = Load x $((Z + 0.043)^2 + L^2)$ + max (J_{0x}, J_{0y}) ≤ 0.016 kgm^2
6	IRB 1010-1.5/0.37	Ja_6 = Load x $L^2 + J_{0Z}$ ≤ 0.011 kgm^2



xx1400002028

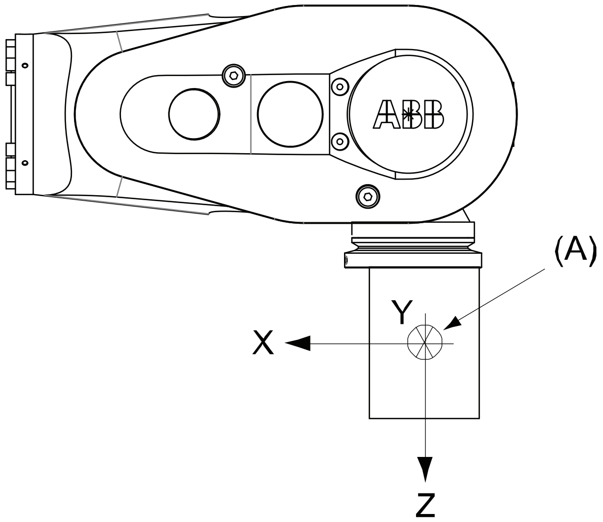
Pos	Description
A	Center of gravity

	Description
J_{ox}, J_{oy}, J_{oz}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

Continues on next page

Limited axis 5, center line down

5	IRB 1010-1.5/0.37	Ja_5 = Load x $((Z + 0.043)^2 + L^2)$ + max $(J_{0x}, J_{0y}) \leq 0.016$ kgm^2
6	IRB 1010-1.5/0.37	Ja_6 = Load x $L^2 + J_{0Z} \leq 0.011$ kgm^2



xx1400002029

Pos	Description
A	Center of gravity

	Description
J_{ox}, J_{oy}, J_{oz}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

2.7.4 Wrist torque

Note

The wrist torque values are for reference only, and should not be used for calculating permitted load offset (position of center of gravity) within the load diagram, since those also are limited by main axes torques as well as dynamic loads. Furthermore, arm loads will influence the permitted load diagram. To find the absolute limits of the load diagram, use the RobotStudio add-in RobotLoad.

Torque

The table below shows the maximum permissible torque due to payload.

Robot variant	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 1010-1.5/0.37	1.3 Nm	1 Nm	1.5 kg

2.7.5 Maximum TCP acceleration

General

Higher values can be reached with lower loads than the nominal because of our dynamical motion control QuickMove2. For specific values in the unique customer cycle, or for robots not listed in the table below, we recommend to use RobotStudio.

Maximum Cartesian design acceleration for nominal loads

Robot type	E-stop Max acceleration at nominal load COG [m/s^2]	Controlled Motion Max acceleration at nominal load COG [m/s^2]
IRB 1010-1.5/0.37	80.6	44.7

Note

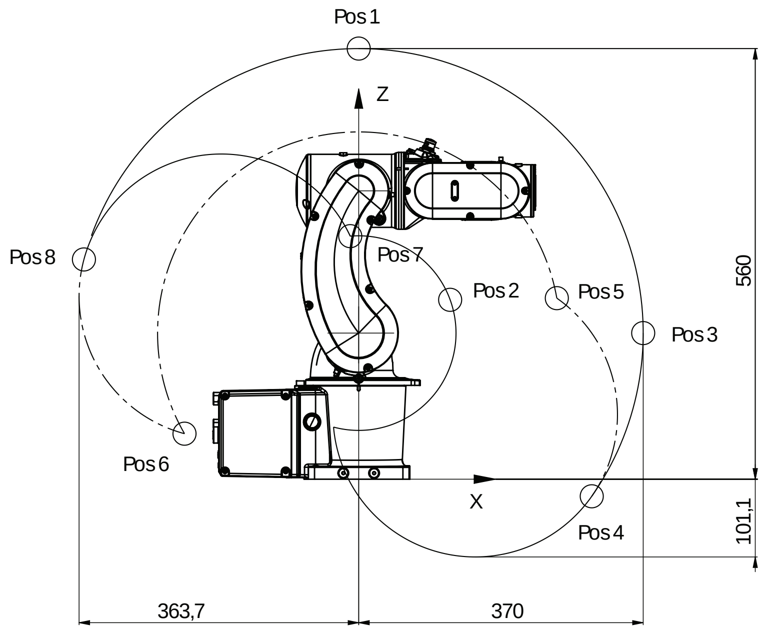
Acceleration levels for emergency stop and controlled motion includes acceleration due to gravitational forces. Nominal load is defined with nominal mass and cog with max offset in Z and L (see the load diagram).

2.8 Robot motion

2.8.1 Working range

Illustration, working range IRB 1010-1.5/0.37

This illustration shows the unrestricted working range of the robot.



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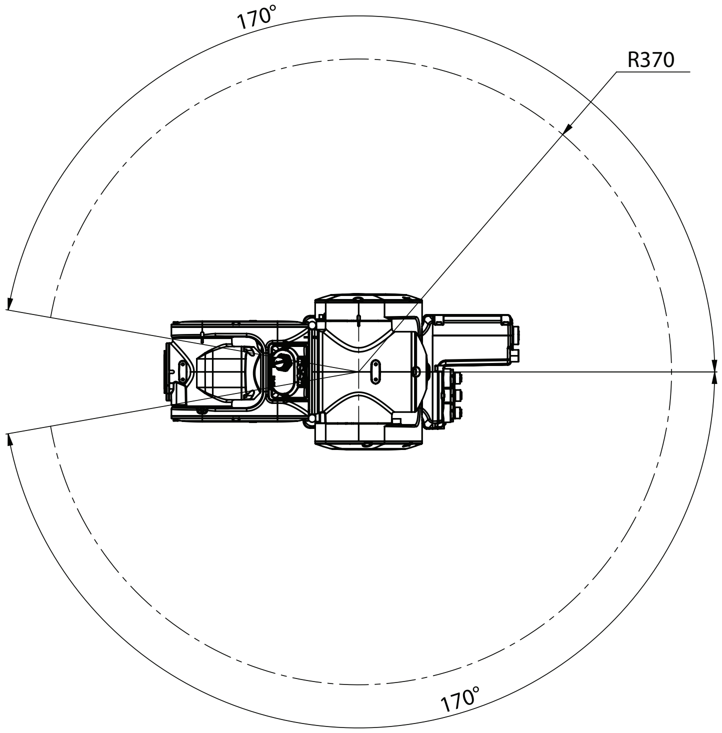
Positions at wrist center and angle of axes 2 and 3

Position in the figure	Positions at wrist center (mm)		Angle (degrees)	
	X	Z	axis 2	axis 3
pos0	+185	+375	0°	0°
pos1	0	+560	0°	-90°
pos2	+118.9	+233.3	0°	+50°
pos3	+370	+190	+90°	-90°
pos4	+303.1	-22.2	+125°	-90°
pos5	+270.5	+225.6	+125°	-180°
pos6	-226.6	+59.2	-75°	-180°
pos7	-11.0	+316.1	-75°	+50°
pos8	-357.4	+285.8	-75°	-90°

Continues on next page

Top view of working range



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Working range

Axis	Working range	Note
Axis 1	±170°	
Axis 2	-75°/+125°	
Axis 3	-180°/+50°	
Axis 4	±170°	
Axis 5	±125°	
Axis 6	±360°	Default value.
	±242°	Maximum revolution value. The default working range for axis 6 can be extended by changing parameter values in the software.

2.8.2 Axes with restricted working range

2.8.2.1 Adjusting the working range

Reasons for adjusting the manipulator working range

The working range of each manipulator axis is configured in the software. If there is a risk that the manipulator may collide with other objects at installation site, its working space should be limited. The manipulator must always be able to move freely within its entire working space.

Working range configurations

The parameter values for the axes working range can be altered within the allowed working range and according to available options for the robot, either to limit or to extend a default working range. Allowed working ranges and available options for each manipulator axis are specified in *Working range on page 51*.

Mechanical stops on the manipulator

Mechanical stops are and can be installed on the manipulator as limiting devices to ensure that the manipulator axis does not exceed the working range values set in the software parameters.

Note

The mechanical stops are only installed as safety precaution to physically stop the robot from exceeding the working range set. A collision with a mechanical stop always requires actions for repair and troubleshooting.

Axis	Fixed mechanical stop [i]	Movable mechanical stop [ii]
Axis 1	yes	yes The working range can be reduced by altering the parameter values. Installation of additional mechanical stops is recommended as a safety measure. Addition mechanical stops are not delivered with the robot and shall be designed according to actual applications and site requirements. See *Installing movable mechanical stops on axis 1 on page 53* for hole dimensions when designing and preparing the stops. Contact ABB for more information.
Axis 2	yes	no
Axis 3	yes	no
Axis 4	yes	no
Axis 5	yes	no
Axis 6	no	no

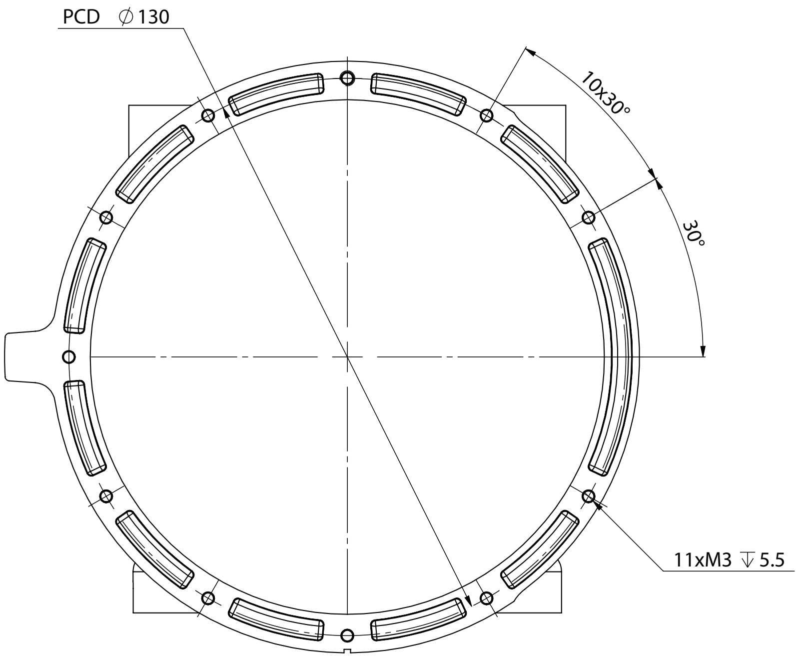
i Part of the casting or fixed on the casting and can not /should not be removed.
ii Can be installed in one or more than one position, to ensure a reduced working range, or be removed to allow extended working range.

2.8.2.2 Installing movable mechanical stops on axis 1

Reduction of the axis-1 working range

The working range of axis 1 is limited by system parameter configuration. To reduce the working range from default range, first adjust the parameter values and then install additional mechanical stops as a safety measure.

Additional mechanical stops shall be designed according to actual application and site requirements. Refer to the following hole dimension on swing bottom to prepare the stops.



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Note

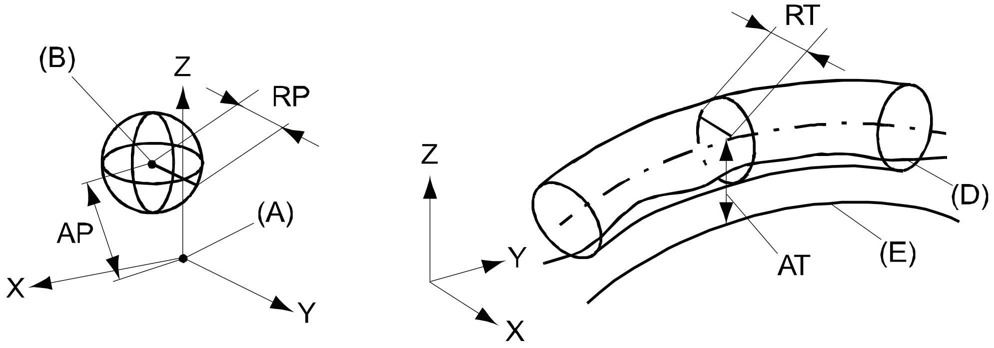
Additional mechanical stops are not delivered with the robot. Contact ABB for more information.

2.8.3 Performance according to ISO 9283

General

At rated maximum load, maximum offset and 1.6 m/s velocity on the inclined ISO test plane, with all six axes in motion. Values in the table below are the average result of measurements on a small number of robots. The result may differ depending on where in the working range the robot is positioning, velocity, arm configuration, from which direction the position is approached, the load direction of the arm system. Backlashes in gearboxes also affect the result.

The figures for AP, RP, AT and RT are measured according to figure below.



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Pos	Description	Pos	Description
A	Programmed position	E	Programmed path
B	Mean position at program execution	D	Actual path at program execution
AP	Mean distance from programmed position	AT	Max deviation from E to average path
RP	Tolerance of position B at repeated positioning	RT	Tolerance of the path at repeated program execution

IRB 1010	IRB 1010-1.5/0.37
Pose accuracy, AP[i] (mm)	0.01
Pose repeatability, RP (mm)	0.01
Pose stabilization time, PSt (s) within 0.1 mm of the position	0.04
Path accuracy, AT (mm)	0.45
Path repeatability, RT (mm)	0.01

i AP according to the ISO test above, is the difference between the teached position (position manually modified in the cell) and the average position obtained during program execution.

2.8.4 Velocity

Maximum axis speed

Robot type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
IRB 1010-1.5/0.37	320 °/s	320 °/s	375 °/s	500 °/s	470 °/s	500 °/s

There is a supervision function to prevent overheating in applications with intensive and frequent movements (high duty cycle).

2.9 Robot stopping distances and times

2.9.1 Robot stopping distances according to ISO 10218-1

About the data for robot stopping distances and times

All measurements and calculations of stopping distances and times are done according to ISO 10218-1, with single axis motion on axes 1, 2, and 3. If more than one axis is used for the movement, then the stopping distance and time can be longer. Normal delays of the hardware and software are taken into account. See more about the delays and their impact on the results, *Reading the data on page 58*.

The stopping distances and times are presented using the tool data and extension zones presented for the respected robot variant. These variables are 100%, 66%, and 33% of the maximum values for the robot.

The stop categories 0 and 1 are according to IEC 60204-1.

Note

The category 0 stop is not necessarily the worst case (depending on load, speed, application, wear, etc.).

Note

The stop category 1 is a controlled stop and will therefore have less deviation from the programmed path compared with a stop category 0.

Loads

The tool data that is used is presented for the respective robot variant.

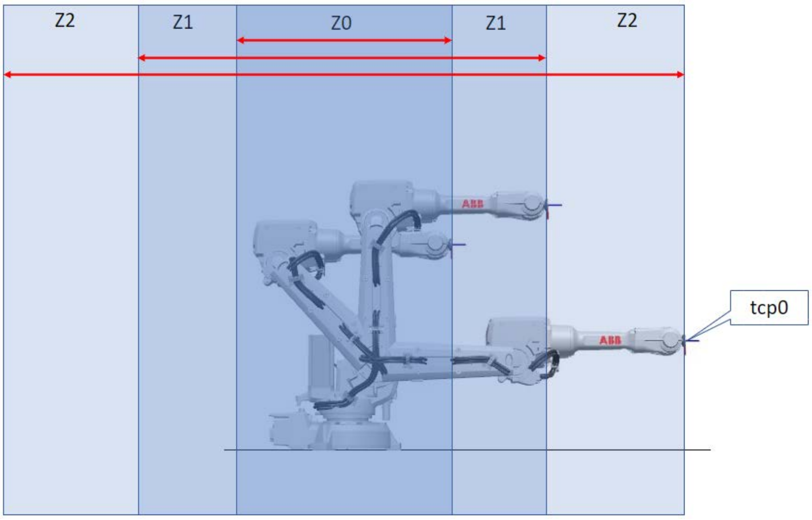
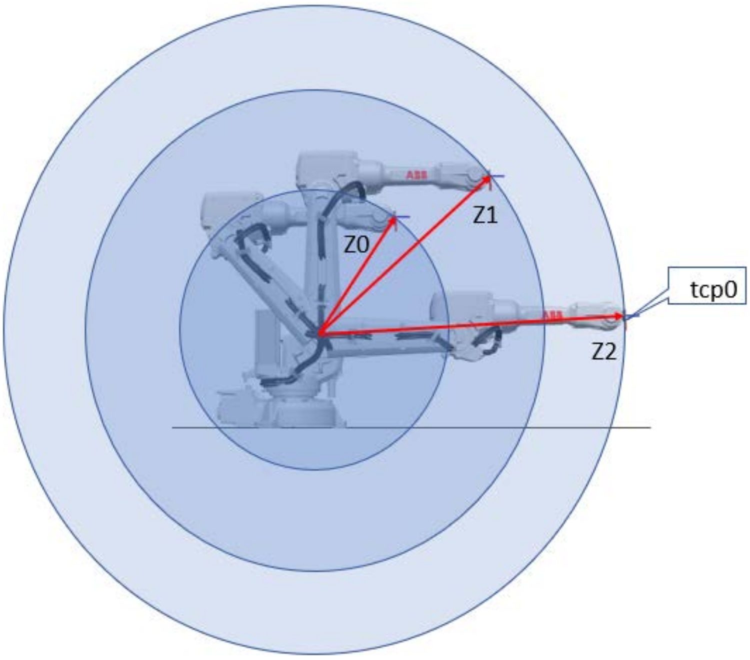
The used loads represent the rated load. No arm load is used. See the *Load diagrams on page 43*.

Continues on next page

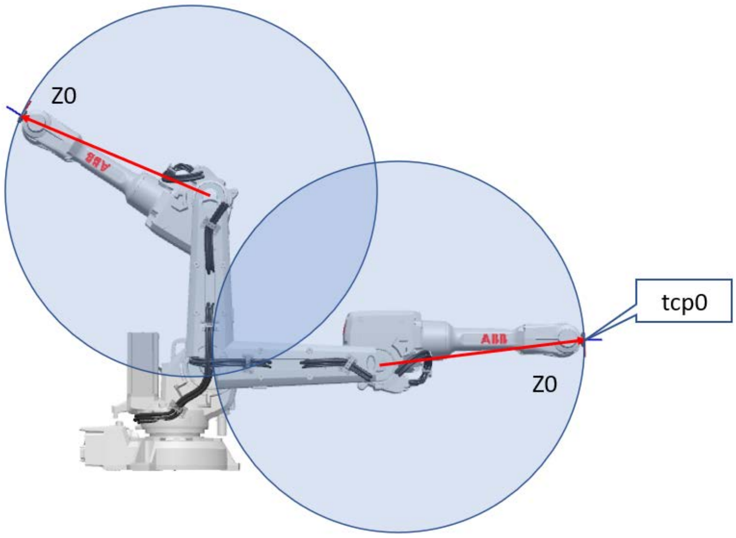
Extension zones

The extension zone for the stop category 1 is based on the tool mounting interface (tool flange) with the axis angles according to the following illustrations. The zone data is presented for the respective robot variant.

The extension zone outer limits are defined by the TCP0 position for the stated angles.

	Illustration
Axis 1	 xx2300000860
Axis 2	 xx2300000861

Continues on next page

	Illustration
Axis 3	 xx2300000862

Speed

The speed in the simulations is based on TCP0.

The TCP0 speed is measured in meters per second when the stop is triggered.

Stopping distances

The stopping distance is measured in degrees.

Stopping times

The stopping time is measured in seconds.

Limitations

The stopping distance can vary depending on additional loads on the robot.

The stopping distance for category 0 stops can vary depending on the individual brakes and the joint friction.

Reading the data

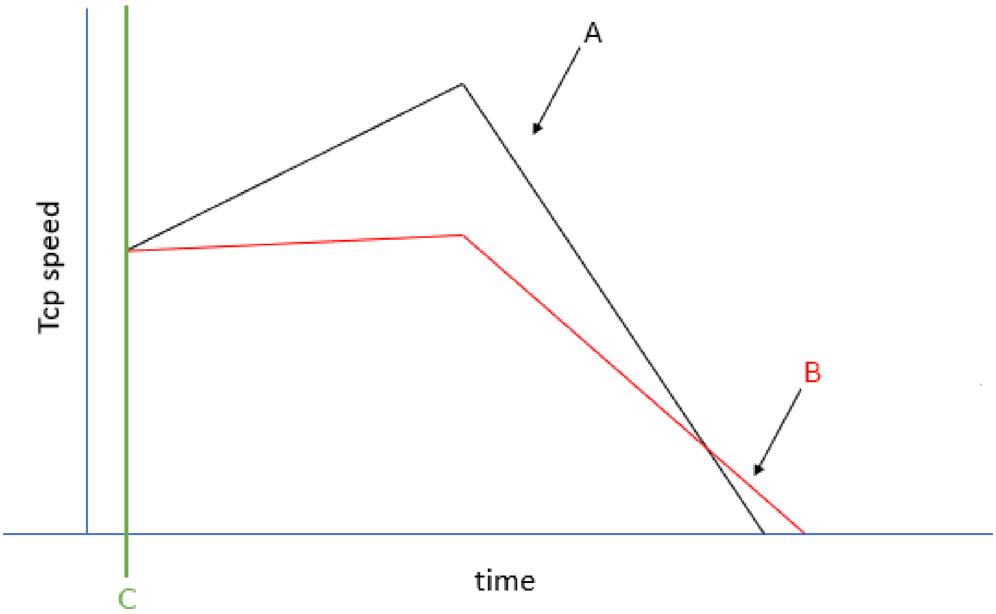
The data for stop category 0 is presented in tables, with distance and time for each axis.

The data for stop category 1 is presented as graphs with curves representing the different loads.

There is a short delay in the stop, which means that if the axis is accelerating when the stop is initiated (C), it will continue to accelerate during this delay time. This

Continues on next page

can result in graphs where a higher load (A) gives shorter stopping distance than a smaller load (B).



xx2300001041

The tcp speed is the actual speed when the stop is initiated, which is not necessarily the programmed speed.

2.9.2 Measuring stopping distance and time

Preparations before measuring

For measurement and calculation of overall system stopping performance, see ISO 13855:2010.

The measurement shall be done for the selected stop category. The emergency stop button on the robot controller is configured for stop category 0 on delivery. A risk assessment can conclude the need for another stop category. The stop category can be changed through the system parameter *Function* (topic *Controller*, type *Safety Run Chain*). In case of deviations of the default configuration of stop category 0, then this is detailed in the product specification for the respective manipulator.

CAUTION

The measurement and calculation of overall stopping performance for a robot must be tested with its correct load, speed, and tools, in its actual environment, before the robot is taken into production.

All load and tool data must be correctly defined (weight, CoG, moment of inertia). The load identification service routine can be used to identify the data.

CAUTION

Follow the safety instructions in the respective product manual for the robot.

Measuring with TuneMaster

The software TuneMaster can be used to measure stopping distances and times for ABB robots. The TuneMaster software contains documentation on how to use it.

1. Download TuneMaster from *www.abb.com/robotics*, section **RobotStudio - Downloads - RobotWare Tools and Utilities**.
2. Install TuneMaster on a computer. Start the TuneMaster app and select **Log Signals**.
3. Connect to the robot controller.
4. Define the I/O stop signal to use for measurement, for example, ES1 for emergency stop.
5. Define the signal number to use for measurement, 1298 for axis position. The value is given in radians.
6. Start the logging in TuneMaster.
7. Start the test program on the controller.

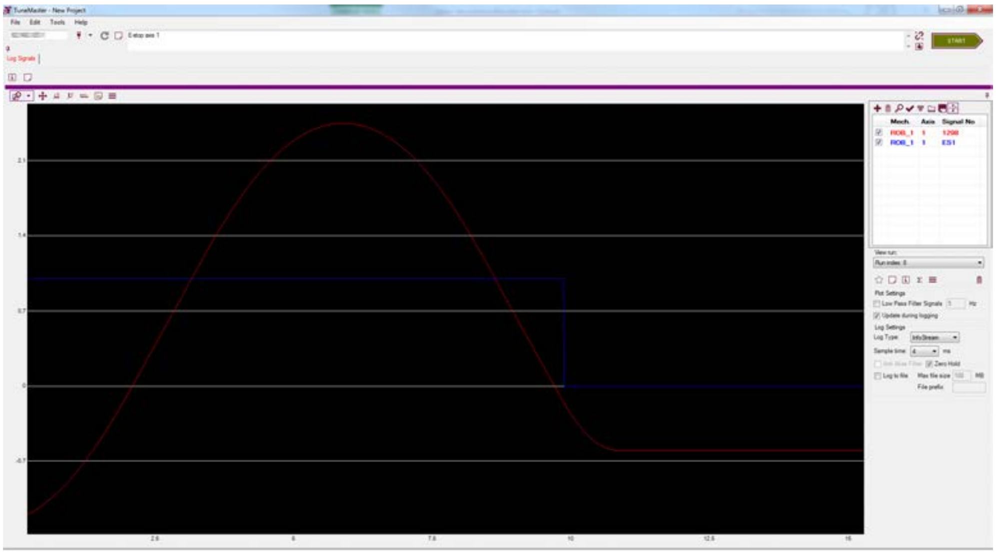
Tip

Use the tool and zone definitions for the respective variant in this document to get results that are comparable with this document.

Continues on next page

8. When the axis has reached maximum speed, press the emergency stop button.
9. In TuneMaster, measure the stopping distance and time.
10. Repeat for all installed emergency stop buttons until the identified hazards due to stopping distance and time for axes have been verified.

Example from TuneMaster



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2.9.3 IRB 1010-1.5/0.37

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [1.5, [0,
     0, 50], [1, 0, 0, 0], 0.00063, 0.00063, 0.00063]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [1, [0, 0,
     33], [1, 0, 0, 0], 0.00028, 0.00028, 0.00028]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [0.5, [0,
     0, 17], [1, 0, 0, 0], 7E-5, 7E-5, 7E-5]];
```

Category 0

The following table describes the stopping distance and time for category 0 stop.

Axis	Distance	Stop time
1	33.8°	0.15 s
2	36.7°	0.17 s
3	40.6°	0.16 s

Category 1, extension zones

For definitions of the zones, see *Extension zones on page 57*.

The zone border is the mounting interface location for axis 2 and axis 3.

Axis 1

Zone border	Axis 2	Axis 3
z0-z1	-42°	42°
z1-z2	6°	-6°

Axis 2

Zone border	Axis 2	Axis 3
z0-z1	48°	30°
z1-z2	90°	-30°

Axis 3

Only one zone exists.

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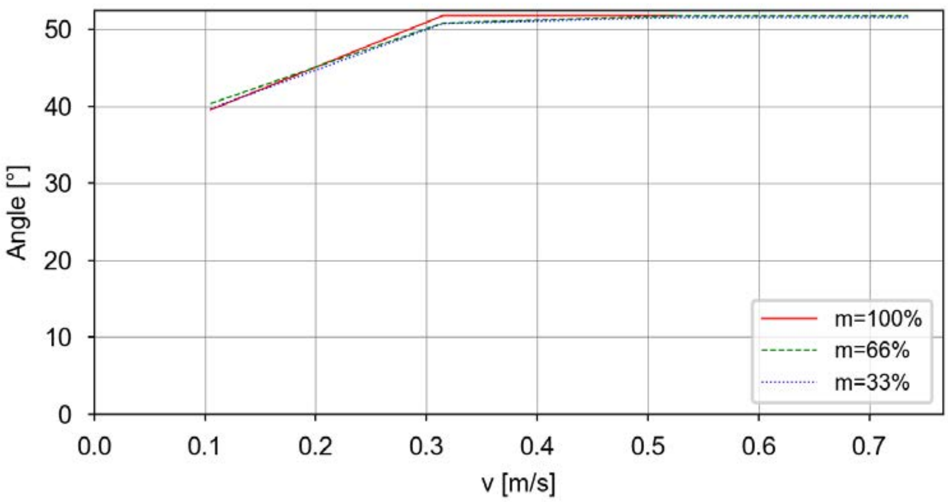
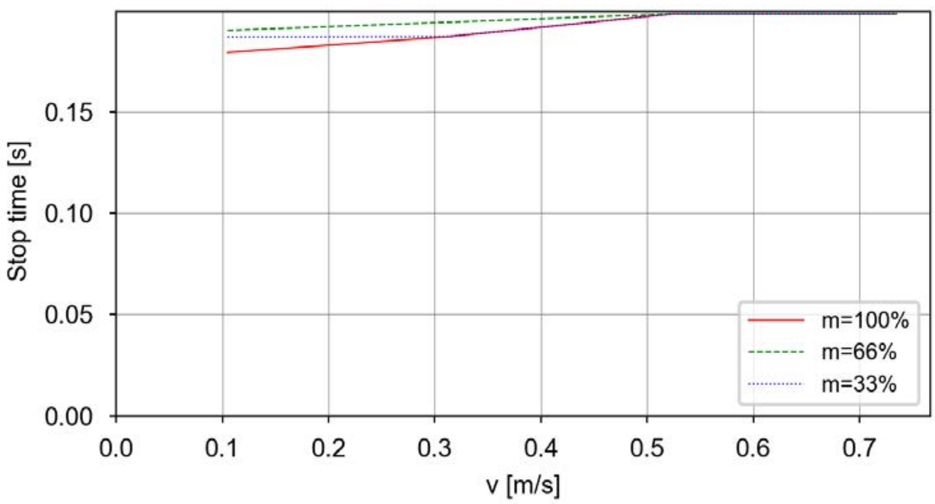
Category 1, Axis 1, Extension zone 0, stopping distance and stopping time





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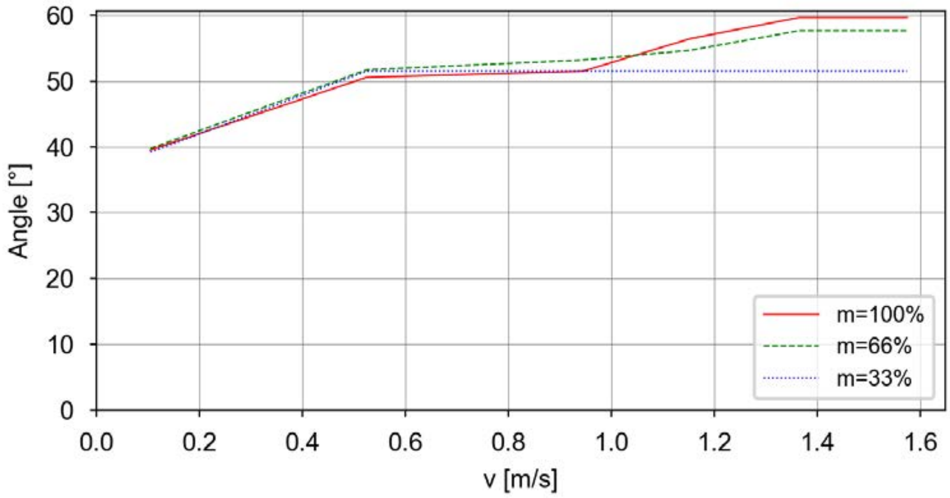
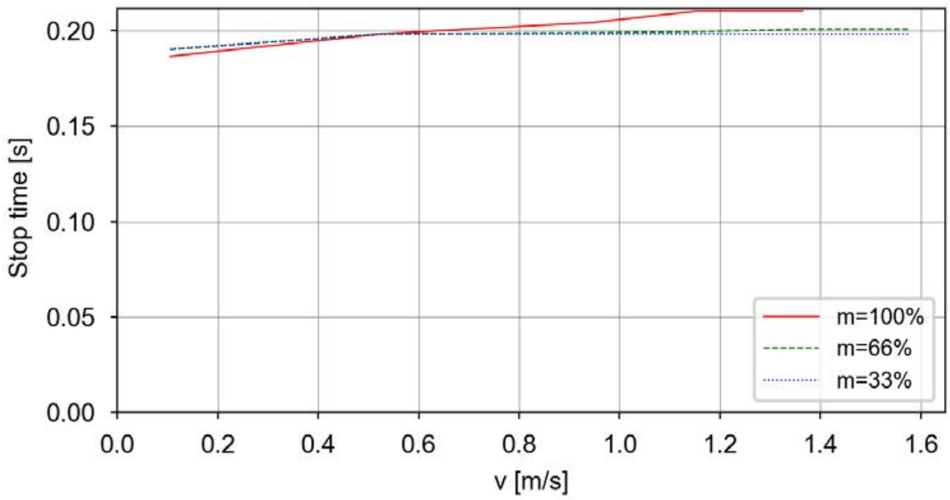
Category 1, Axis 1, Extension zone 1, stopping distance and stopping time





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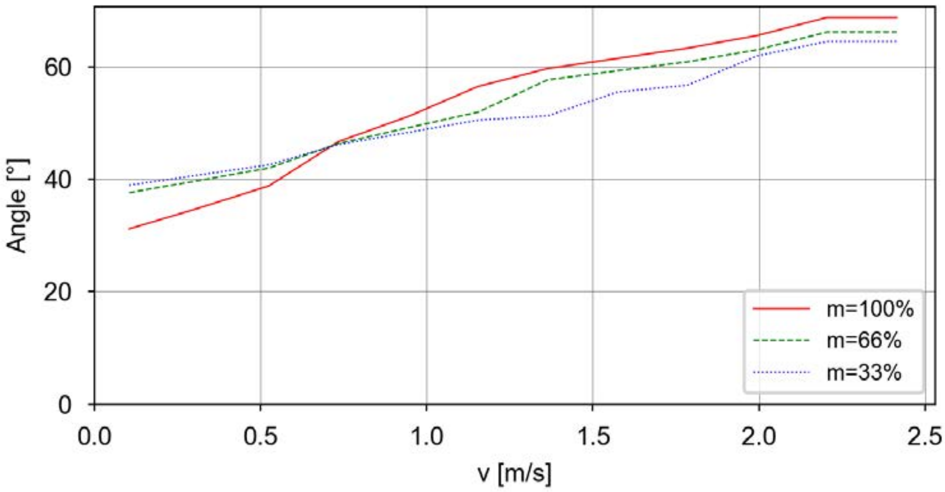
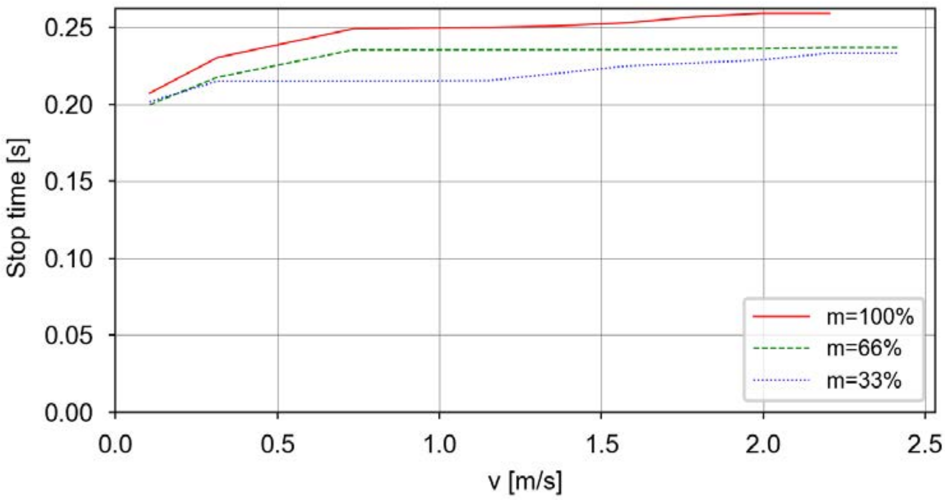
Category 1, Axis 1, Extension zone 2, stopping distance and stopping time





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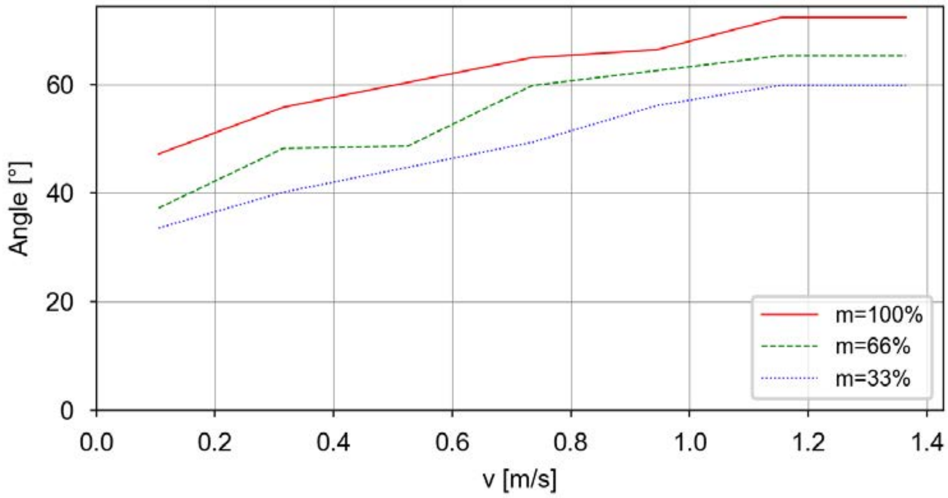
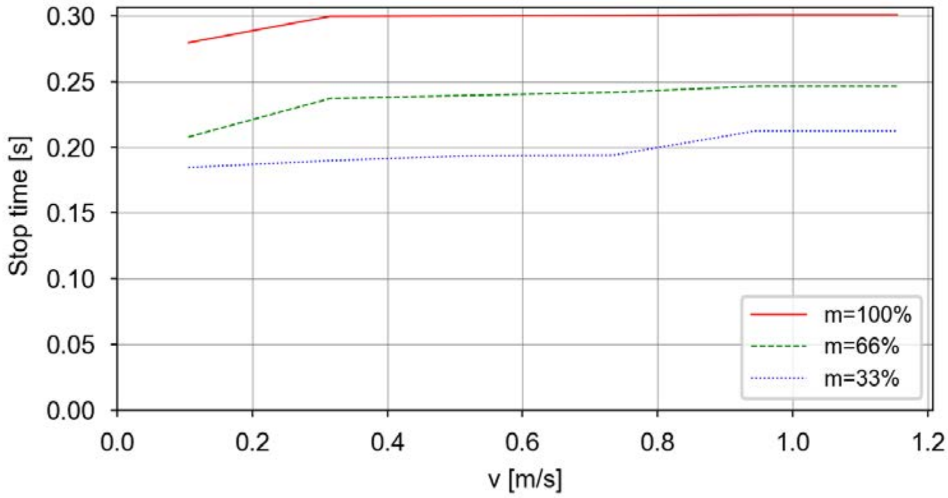
Category 1, Axis 2, Extension zone 0, stopping distance and stopping time





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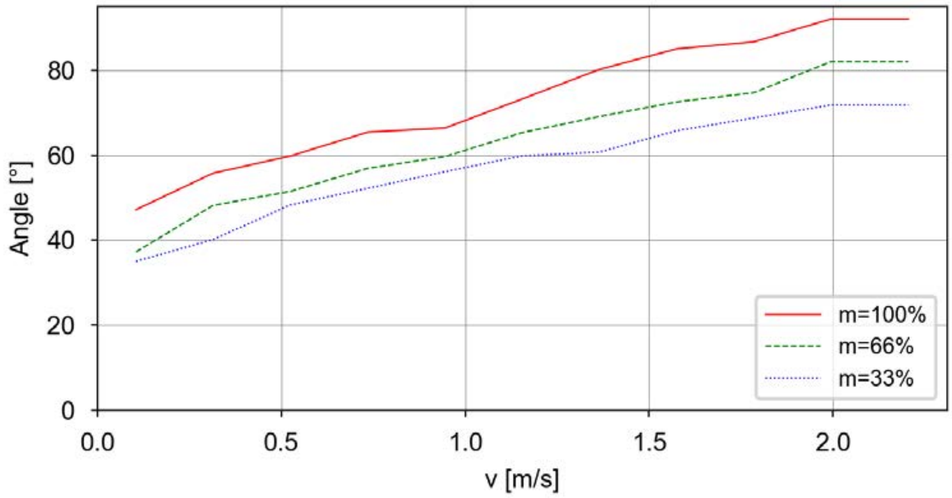
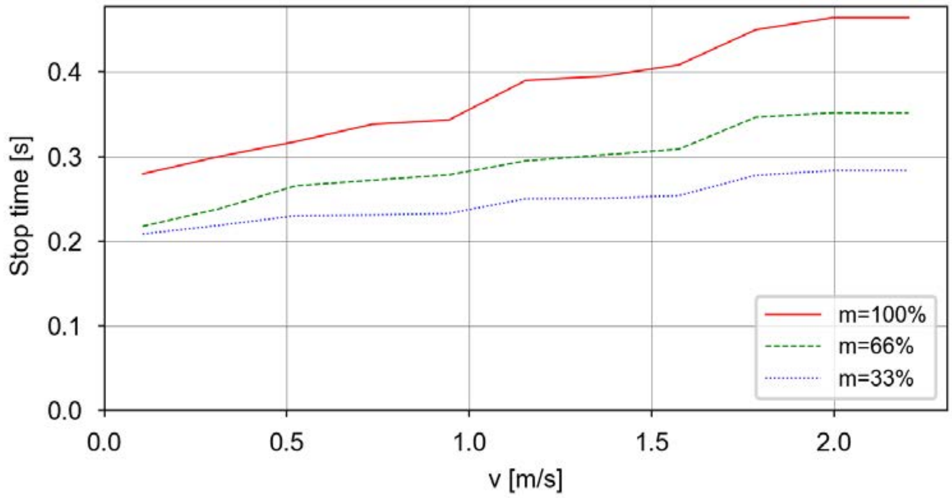
Category 1, Axis 2, Extension zone 1, stopping distance and stopping time





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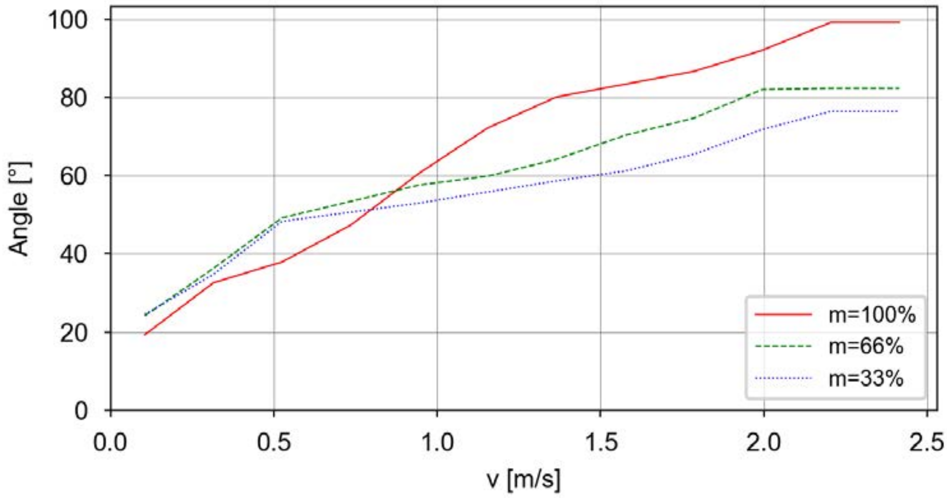
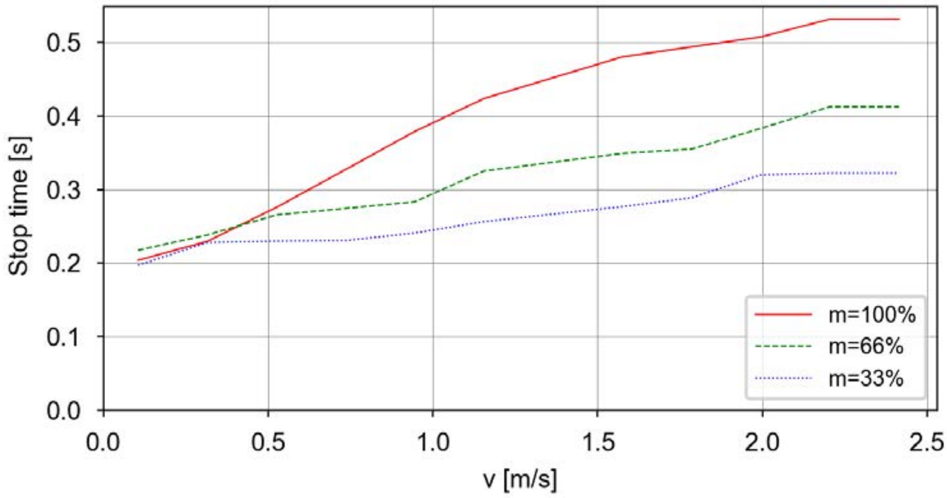
Category 1, Axis 2, Extension zone 2, stopping distance and stopping time





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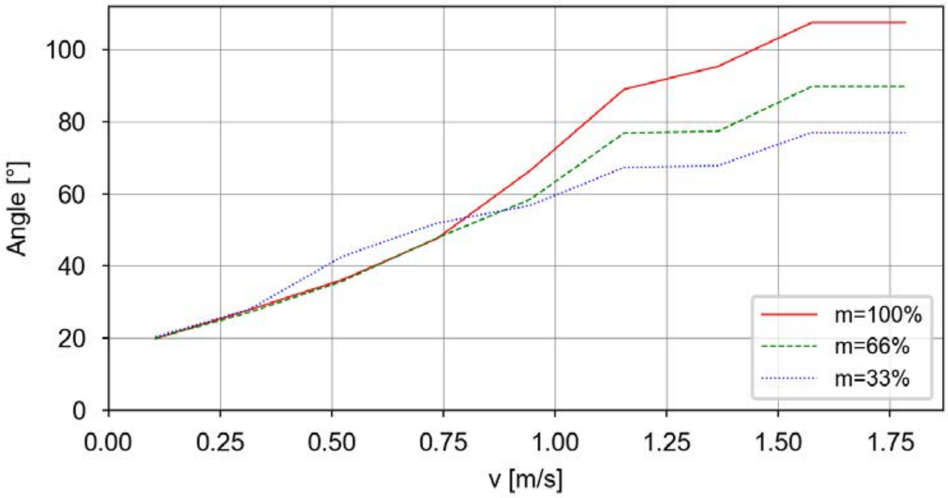
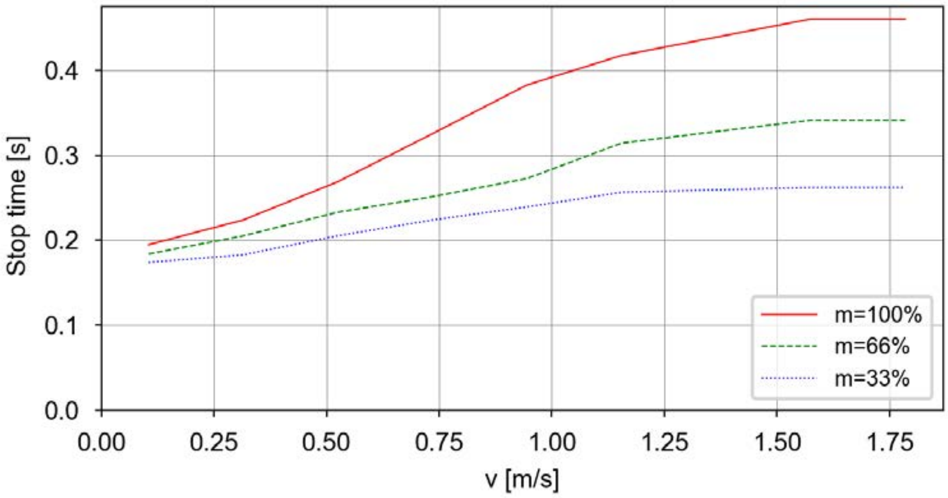
Category 1, Axis 3, Extension zone 0, stopping distance and stopping time





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3 Specification of variants and options

3.1 Introduction to variants and options

General

The different variants and options for the IRB 1010 are described in the following sections. The same option numbers are used here as in the specification form.

The variants and options related to the robot controller are described in the product specification for the controller.

3.2 Manipulator

Manipulator variants

Option	IRB Type	Handling capacity (kg)	Reach (m)
3300-56	IRB 1010	1.5	0.37

Manipulator color

Option	Description	RAL code[i]
209-202	ABB Graphite White std	RAL 7035

i The colors can differ depending on supplier and the material on which the paint is applied.

Manipulator protection

Option	Description
3350-400	Base 40,IP40

Note

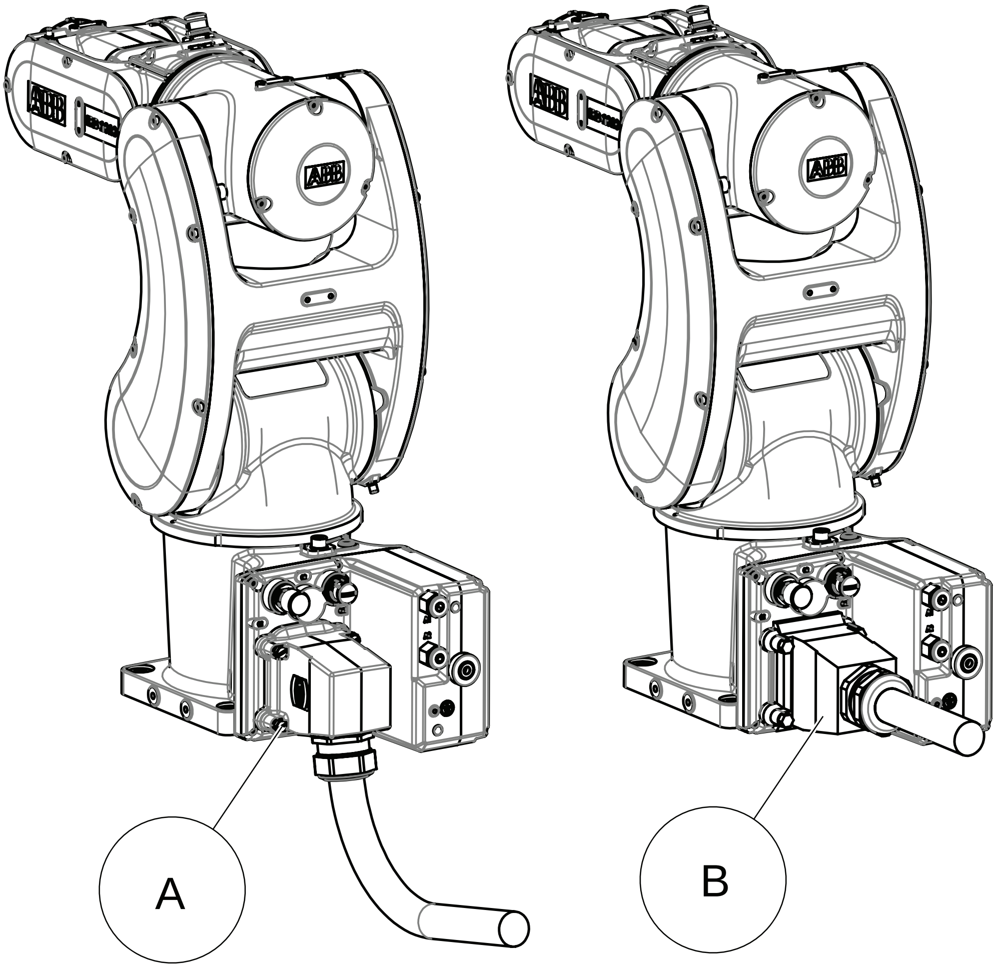
Base 40 includes IP40, according to standard IEC 60529.

The IRB 1010 has IP40 as default. And the IRB 1010 fulfill clean room class 5 standard according to DIN EN ISO14644-1, -14.

Robot cabling routing

Option	Description
3309-1	Under the base
3309-2	From side of base

Continues on next page



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Pos	Description
A	Under the base
B	From side of base

Media & Communication

Option	Type	Description
3303-1	Parallel & Air	Includes CP/CS (C1) and air.

Connector kits manipulator

The kit consists of connectors, pins and sockets. And the options required [3303-x] when choosing.

Option	Description
3304-1	Male-type, Straight arm connector kits
3305-1	Male-type, Angled arm connector kits

Continues on next page

Straight connector kits Angled connector kits

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Note

The image shown here is indicative only. If there is inconsistency between the image and the actual product, the actual product shall govern.

The kits are designed and used for connectors on upper arm.

Warranty

For the selected period of time, ABB will provide spare parts and labour to repair or replace the non-conforming portion of the equipment without additional charges. During that period, it is required to have a yearly Preventative Maintenance according to ABB manuals to be performed by ABB. If due to customer restrains no data can be analyzed in the ABB Ability service *Condition Monitoring & Diagnostics* for robots with OmniCore controllers, and ABB has to travel to site, travel expenses are not covered. The Extended Warranty period always starts on the day of warranty expiration. Warranty Conditions apply as defined in the Terms & Conditions.

Note

This description above is not applicable for option *Stock warranty* [438-8]

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.

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Option	Type	Description
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from *Factory Shipment Date* or from activation date of standard warranty in WebConfig. **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

3.3 Floor cables

Manipulator cable length

Option	Lengths
3200-1	3 m
3200-2	7 m
3200-3	15 m

Connection of parallell communication

Required 3303-1 Parallel & Air or 3303-2 Ethernet, Parallel, Air.

Option	Lengths
3201-1	3 m
3201-2	7 m
3201-3	15 m

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