ROBOTICS

# Product specification

## IRB 1090

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# Product specification

# IRB 1090-3.5/0.58

OmniCore

Document ID: 3HAC088057-001

Revision: B

Original instructions.

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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 specification - OmniCore E line* | *3HAC079823-001* |
| *Product manual - OmniCore E10* | *3HAC079399-001* |
| *Product manual - IRB 1090* | *3HAC088056-001* |

## Revisions

| Revision | Description |
|---|---|
| A | First edition. |
| B | Published in release 23D. The following updates are done in this revision:<br>• A label indicating that the robot is used only in educational applications is added. |

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# 1 Description

## 1.1 Structure

**Introduction**

The IRB 1090 is a 6-axis robot with a payload of 3.5 kg, designed specifically for use in educational applications for training purpose.

**Note**

The IRB 1090 can only be used in educational applications, with a label attached on the robot base as a reminder, and the warranty is also limited to using in such applications. Using the IRB 1090 in any other kinds of applications will lead to reduced reliability and shortened lifetime, and will also void the warranty.


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Always contact ABB for advise if you are not sure whether your application is suitable to use for the IRB 1090.

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### 1.1.1 Robot variants

**General**

The IRB 1090 is available in one variant.

| Robot variant | Handling capacity (kg) | Reach (m) |
|---|---|---|
| IRB 1090-3.5/0.58 | 3.5 kg | 0.58 m |

## 1.1.2 Technical data

### Weight, robot

The table shows the weight of the robot.

| Robot model | Nominal weight |
| --- | --- |
| IRB 1090 | 21.1 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 | Any angle |
| Suspended | Any angle |

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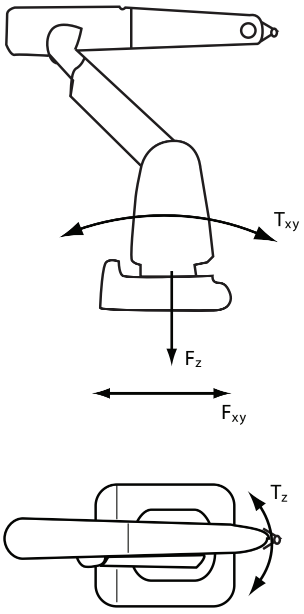
The directions are valid for all floor mounted, table mounted, wall mounted and suspended robots.

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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 | ±230 N | ±600 N |
| Force z | +210±380 N | +210±570 N |
| Torque xy | ±120 Nm | ±310 Nm |
| Torque z | ±40 Nm | ±110 Nm |

*Continues on next page*

Suspended

| Force | Endurance load (in operation) | Max. load (emergency stop) |
|---|---|---|
| Force xy | ±230 N | ±600 N |
| Force z | -210±380 N | -210±570 N |
| Torque xy | ±120 Nm | ±310 Nm |
| Torque z | ±40 Nm | ±110 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.<br>The value for levelness aims at the circumstance of the anchoring points in the robot base.<br>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<br>**Note**<br>It may affect the manipulator lifetime to have a lower resonance frequency than recommended. | The value is recommended for optimal performance.<br>Due to foundation stiffness, consider robot mass including equipment.[i]<br>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) |

*Continues on next page*

| Parameter | Value |
| --- | --- |
| Maximum ambient humidity | 85% at constant temperature (gaseous only) |

## Operating conditions, robot

The table shows the allowed operating conditions for the robot:

| Parameter | Value |
| --- | --- |
| Minimum ambient temperature | +5°C[i] (41°F) |
| Maximum ambient temperature | +40°C (104°F) |
| Maximum ambient humidity | 85% 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 |

[i] According to IEC 60529.

## 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*.

## Other technical data

| Data | Description | Note |
| --- | --- | --- |
| Airborne noise level | The sound pressure level outside the working space. | < 70 dB(A) Leq (acc. to machinery directive 2006/42/EC) |

## Power consumption at max load

| Type of movement | IRB 1090-3.5/0.58 |
| --- | --- |
| ISO Cube<br>Max. velocity (W) | 331 |

| Robot in calibration position | IRB 1090-3.5/0.58 |
| --- | --- |
| Brakes engaged (W) | 60 |
| Brakes disengaged (W) | 130 |

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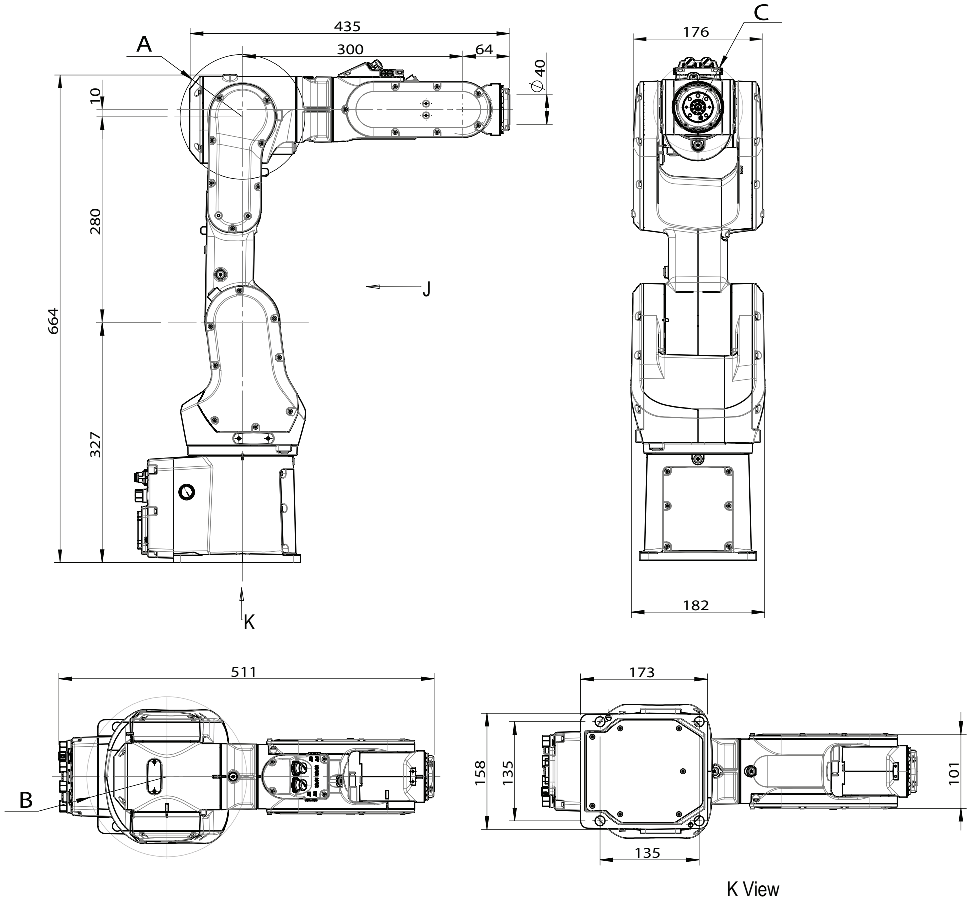
### Main dimensions of IRB 1090-3.5/0.58

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| Pos | Description |
| --- | --- |
| A | Turning radius: R85 |
| B | Turning radius: R109 |
| C | Turning radius: R61 |

## 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 |

#### 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 |
| EN ISO 10218-1 | Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots |

# 1.3 Installation

## 1.3.1 Introduction to installation

### General

IRB 1090 is available in one variant and can be floor mounted and suspended mounted. Depending on the robot variant, an end effector with a max. weight of 3.5 kg including payload, can be mounted on the tool flange (axis 6). See *Load diagrams on page 30*.

### Extra loads

The upper arm can handle an additional load of 0.5 kg.

See *Fitting equipment to the robot on page 37*.

### Working range limitation

The working range of axes 1 can be limited by mechanical stops as option. See *Working range on page 41*.

## 1.3.2 Assembling the manipulator

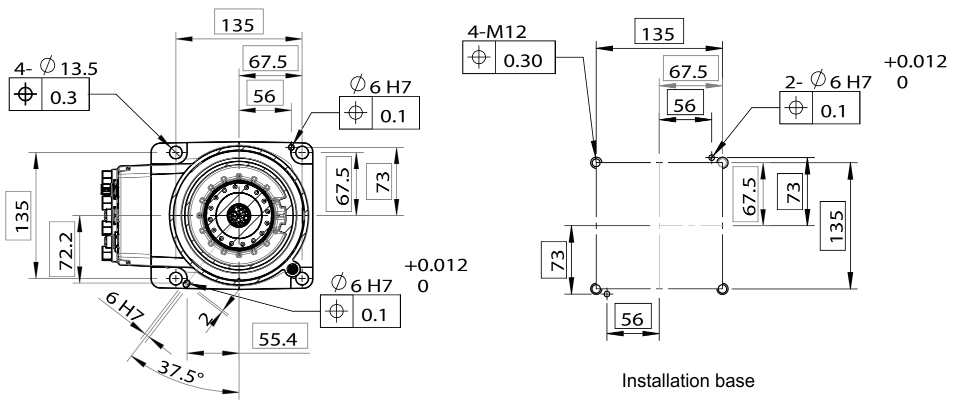
### Attachment screws

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 | M12x25 (robot installation directly on foundation) |
| Quantity | 4 pcs |
| Quality | 8.8 |
| Suitable washer | 24 x 13 x 2.5, steel hardness class 200HV |
| Guide pins | 2 pcs, D6x20, ISO 2338 - 6m6x20 - A1 |
| Tightening torque | 50 Nm±5 Nm |
| Length of thread engagement | Minimum 12.5 mm for ground with material yield strength 150 MPa |
| Level surface requirements | 0.1/500 mm |

### Hole configuration, base

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

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## 1.4 Calibration and references

### 1.4.1 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.<br>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:<br>• Mechanical tolerances in the robot structure<br>• Deflection due to load<br>Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot.<br>Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory.<br>A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore).<br>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.<br>Wrist optimization will update standard calibration data for axes 4, 5 and 6.<br>**Note**<br>For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction `WristOpt`, see *Technical reference manual - RAPID Instructions, Functions and Data types*.<br>This instruction is only available for OmniCore robots. | Wrist Optimization |

*Continues on next page*

### Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 1090. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- 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.

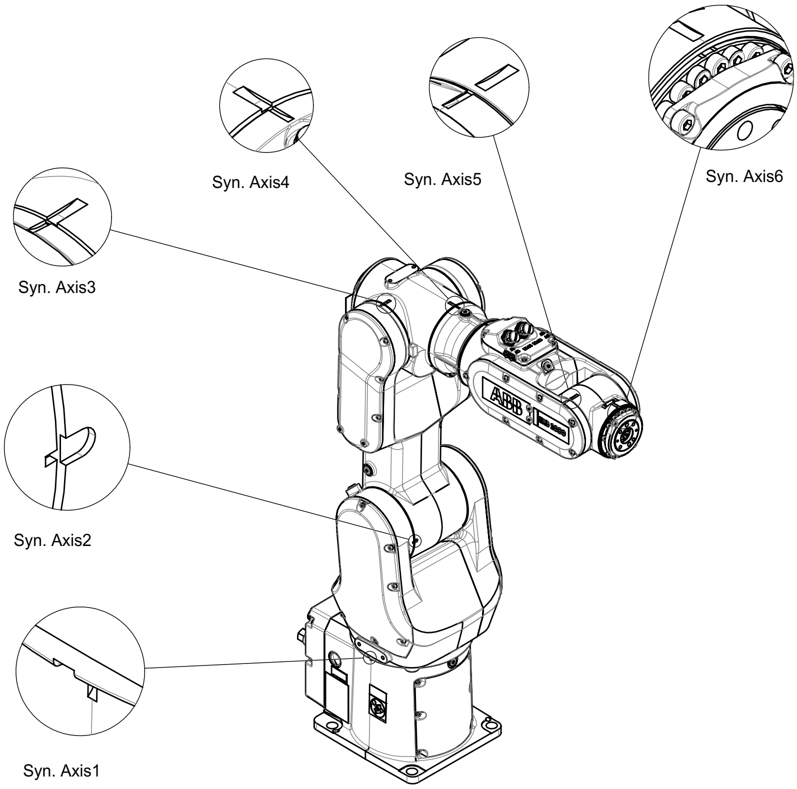
The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

## 1.4.2 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 1090

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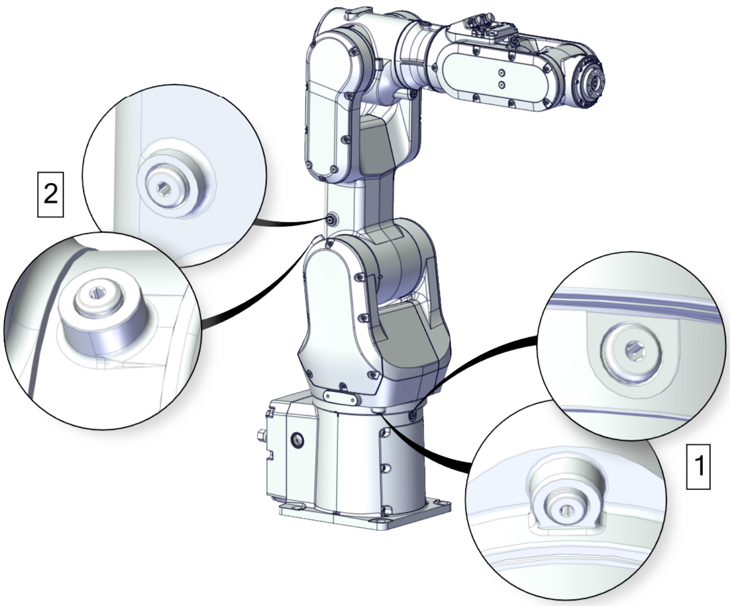
> **CAUTION**
>
> To calibrate the axis 6, the notch on the wrist must be aligned with the marked pin hole on the tool flange. Before installing a tool on the tool flange, make sure a visible mark has been made to the tool at the corresponding position.

## 1.4.3 Fine calibration

### General

The fine calibration is done with the Axis calibration method.

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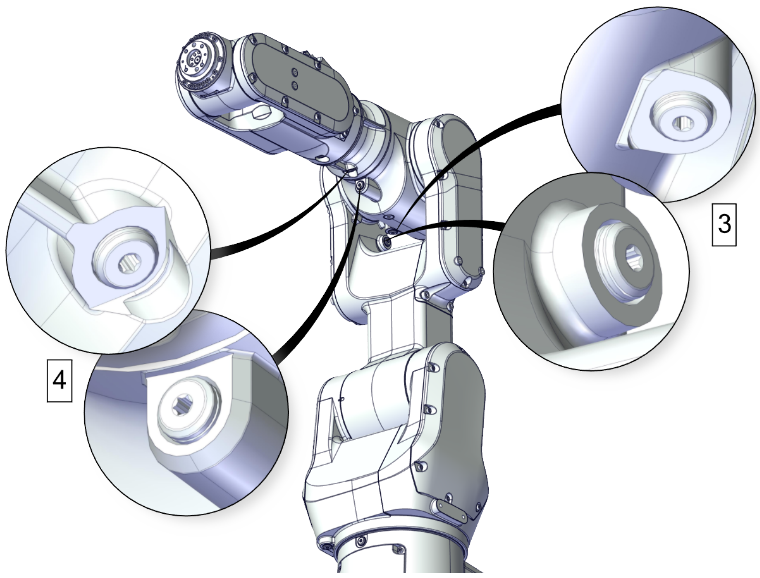


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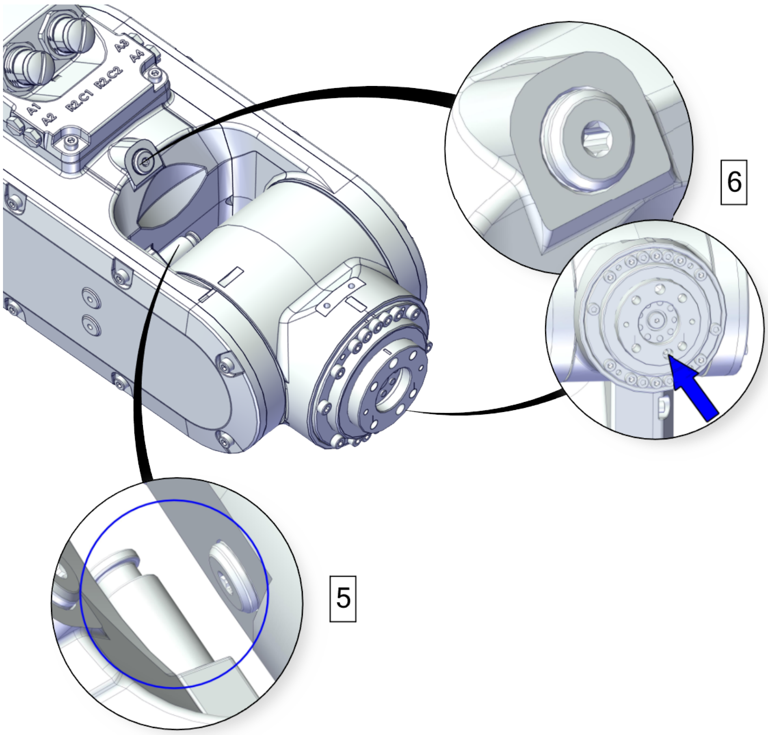


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## Axes

| Pos | Description | Pos | Description |
|---|---|---|---|
| 1 | Axis 1 | 2 | Axis 2 |
| 3 | Axis 3 | 4 | Axis 4 |
| 5 | Axis 5 | 6 | Axis 6 |

### 1.4.4 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.

**What is included**

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved in the robot memory
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

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

Absolute Accuracy supports floor mounted, wall mounted, and ceiling mounted installations. The compensation parameters that are saved in the robot memory differ depending on which Absolute Accuracy option is selected.

**When is *Absolute Accuracy* being used**

Absolute Accuracy works on a robot target in Cartesian coordinates, not on the individual joints. Therefore, joint based movements (e.g. `MoveAbsJ`) will not be affected.

If the robot is inverted, the Absolute Accuracy calibration must be performed when the robot is inverted.

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

- Any motion function based on robtargets (e.g. `MoveL`) and ModPos on robtargets
- Reorientation jogging

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- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

### Absolute Accuracy not active

The following are examples of when Absolute Accuracy is not active:

- Any motion function based on a jointtarget (`MoveAbsJ`)
- Independent joint
- Joint based jogging
- Additional axes
- Track motion

> **Note**
>
> In a robot system with, for example, an additional axis or track motion, the Absolute Accuracy is active for the manipulator but not for the additional axis or track motion.

## 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 1090-3.5/0.58 | 0.10 | 0.25 | 100 |

## Calibration tool

### 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.

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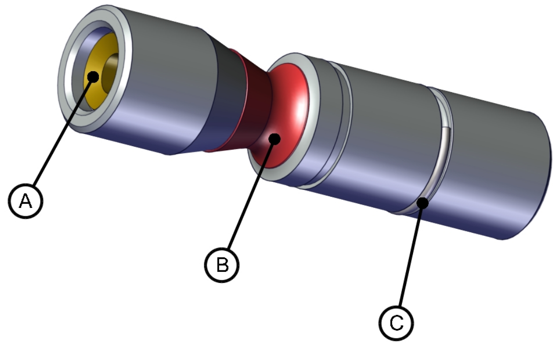


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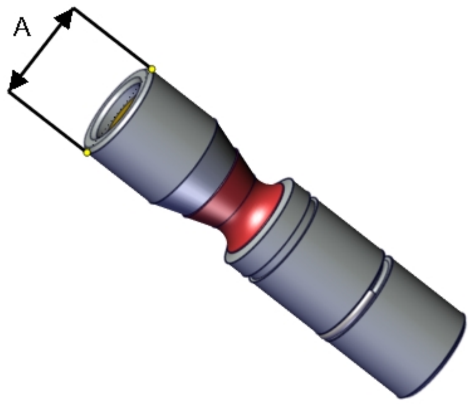
| | |
|---|---|
| A | Tube insert |
| B | Plastic protection |
| C | Steel spring ring |

## 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.

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| | |
|---|---|
| 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.

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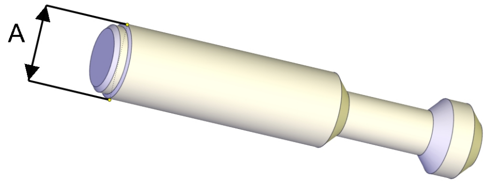
.

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| | |
|---|---|
| A | Outer diameter |

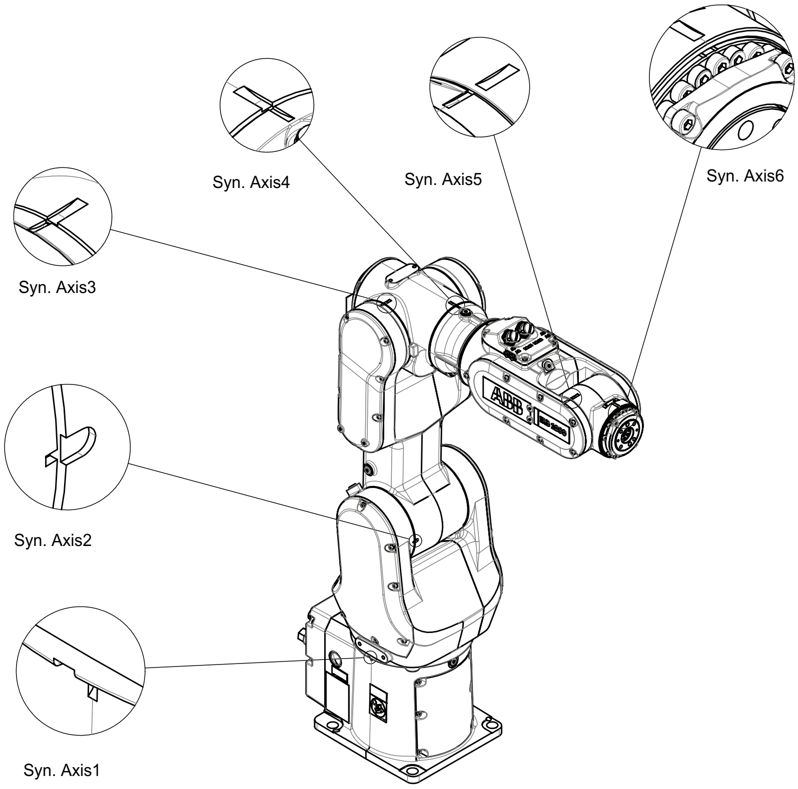
## 1.4.5 Synchronization marks and axis movement directions

### 1.4.5.1 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 1090

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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.

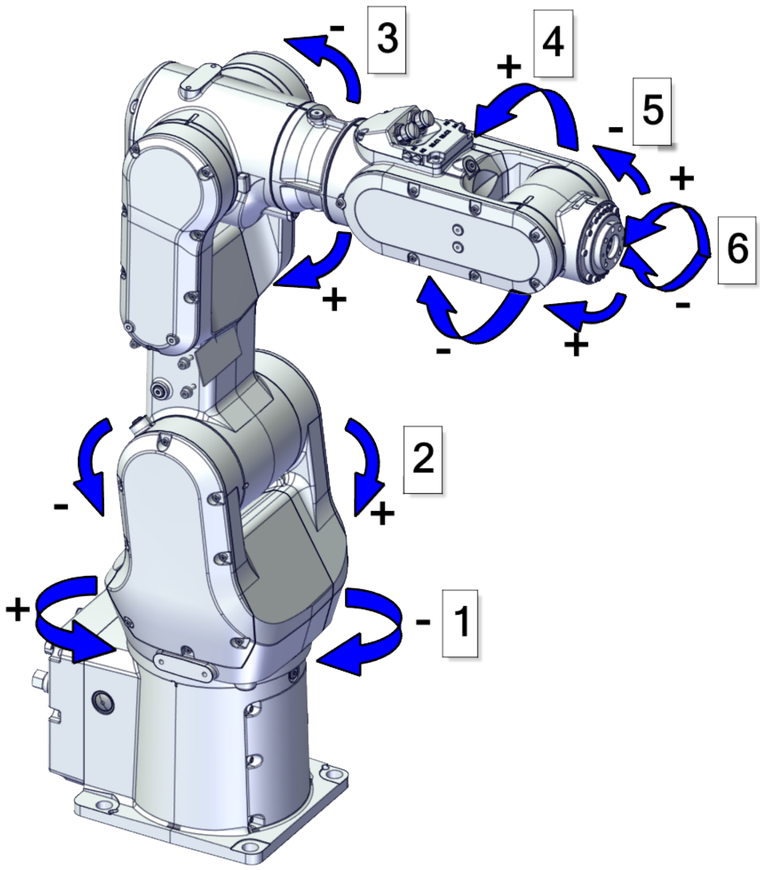
## 1.4.5.2 Calibration movement directions for all axes

**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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## 1.5 Load diagrams

### 1.5.1 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 is used, and/or if loads outside the load diagram are used, the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure

**WARNING**

In RobotWare, the service routine LoadIdentify can be used to determine correct load parameters. The routine automatically defines the tool and the load.

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

**WARNING**

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

#### General

The load diagrams include a nominal payload inertia, $J_o$ of 0.012 $kgm^2$, and an extra load of 0.5 kg at the upper arm housing.

At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, wall 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 with 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.

## 1.5.2 Diagrams

### Diagrams of IRB 1090-3.5/0.58

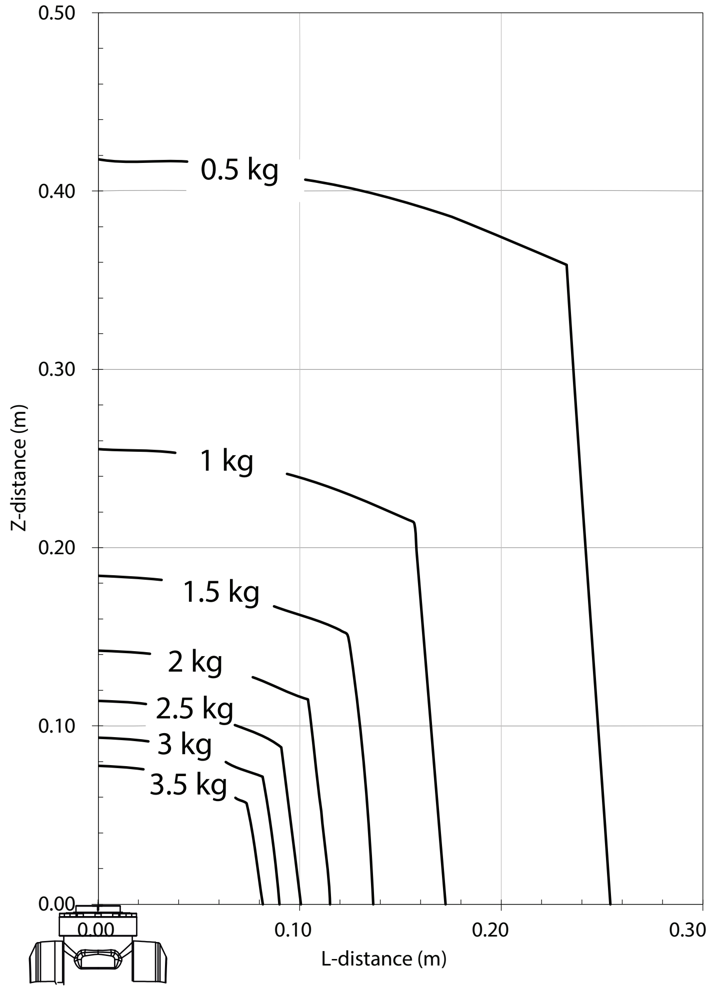


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*Figure 1.1:*

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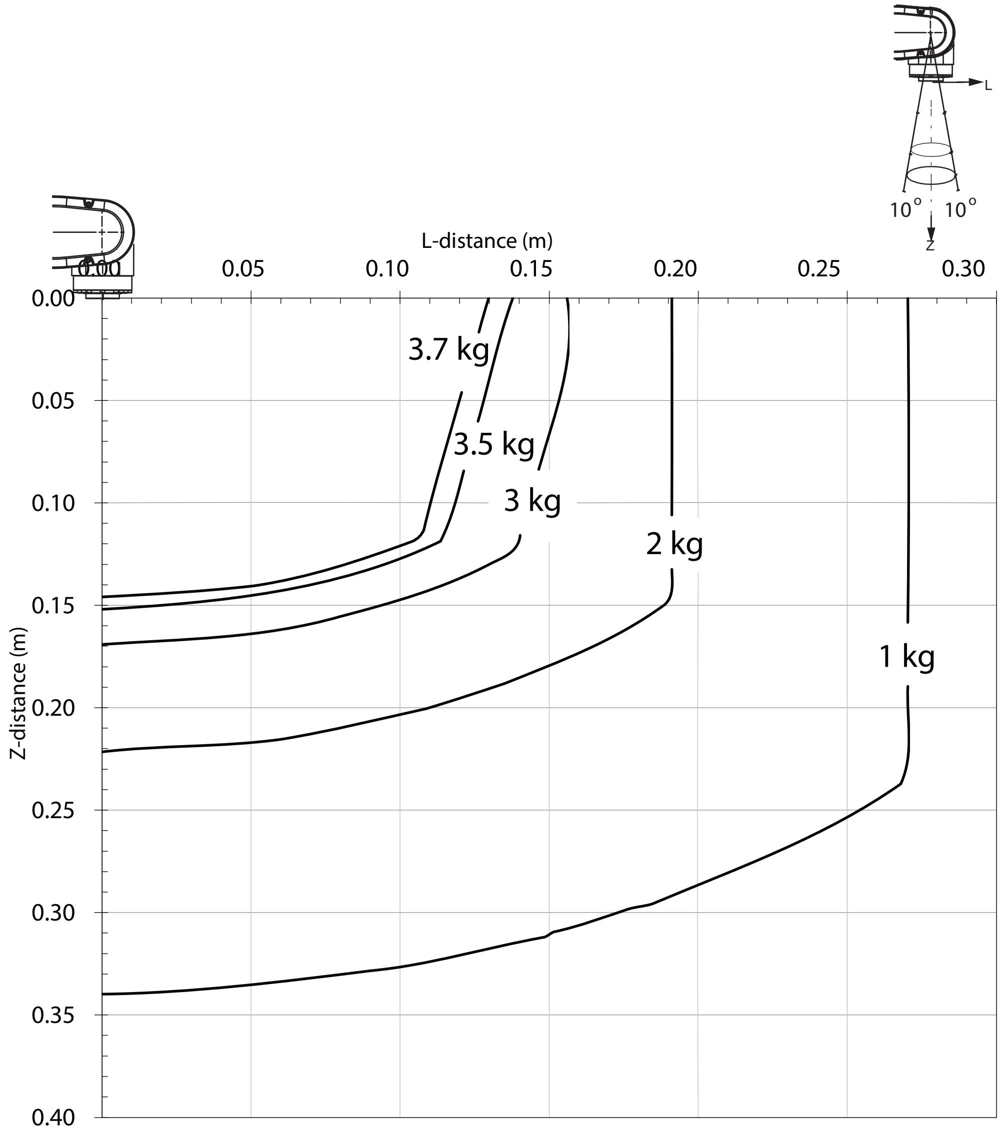
### Diagrams of IRB 1090-3.5/0.58 "Vertical Wrist" (±10°)

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

| | Description |
|---|---|
| **Max load** | **3.5 kg** |
| $Z_{max}$ | **0.078 m** |
| $L_{max}$ | **0.082 m** |

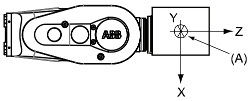
## 1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

**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°/+120°)

| Axis | Robot type | Maximum moment of inertia |
|---|---|---|
| 5 | IRB 1090-3.5/0.58 | $Ja_5$ = Load x $((Z + 0.064)^2 + L^2)$ + max ($J_{ox}$, $J_{oy}$) ≤ 0.175 $kgm^2$ |
| 6 | IRB 1090-3.5/0.58 | $Ja_6$ = Load x $L^2 + J_{oz}$ ≤ 0.085 $kgm^2$ |




xx1400002028

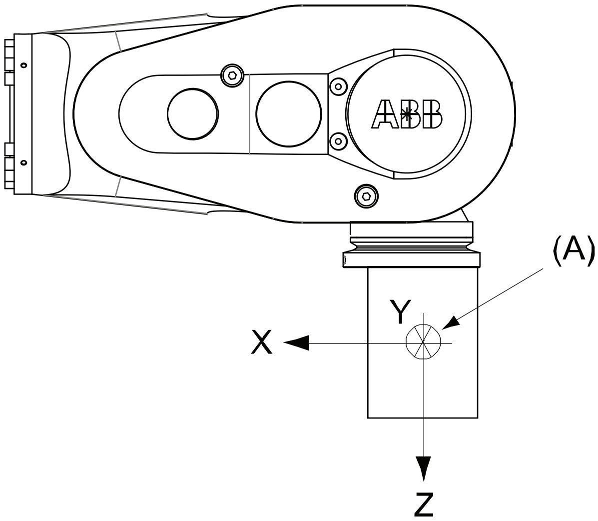
| Pos | Description |
|---|---|
| A | Center of gravity |

| | 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

| Axis | Robot type | Maximum moment of inertia |
|---|---|---|
| 5 | IRB 1090-3.5/0.58 | $Ja_5$ = Load x $((Z + 0.064)^2 + L^2)$ + max $(J_{ox}, J_{oy}) \leq 0.175$ $kgm^2$ |
| 6 | IRB 1090-3.5/0.58 | $Ja_6$ = Load x $L^2 + J_{oz} \leq 0.085$ $kgm^2$ |




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. |

## 1.5.4 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 type | Max wrist torque axis 4 and 5 | Max wrist torque axis 6 | Max torque valid at load |
|---|---|---|---|
| IRB 1090-3.5/0.58 | 5.0 Nm | 2.9 Nm | 4 kg |

## 1.5.5 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<br>Max acceleration at nominal load COG [m/s$^2$] | Controlled Motion<br>Max acceleration at nominal load COG [m/s$^2$] |
|---|---|---|
| IRB 1090-3.5/0.58 | 137 | 71 |

**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).

# 1.6 Fitting equipment to the robot

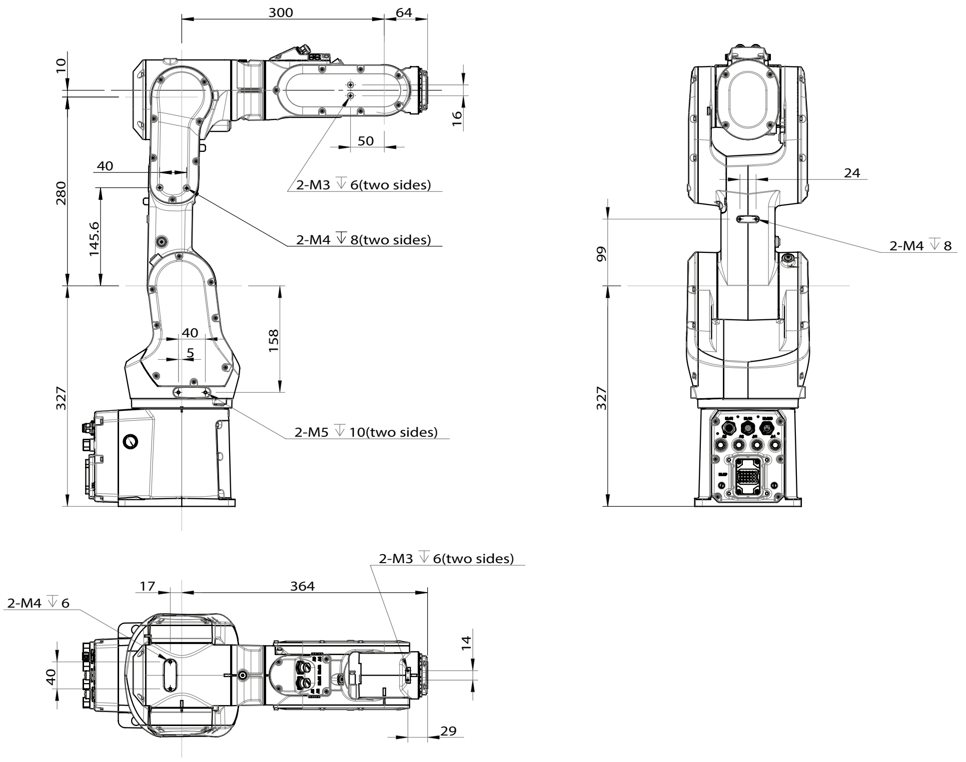
## Attachment holes and dimensions

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.

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

| Variant | Max Armload (kg) |
|---|---|
| IRB 1090-3.5/0.58 | 0.5 |

Holes for fitting extra equipment

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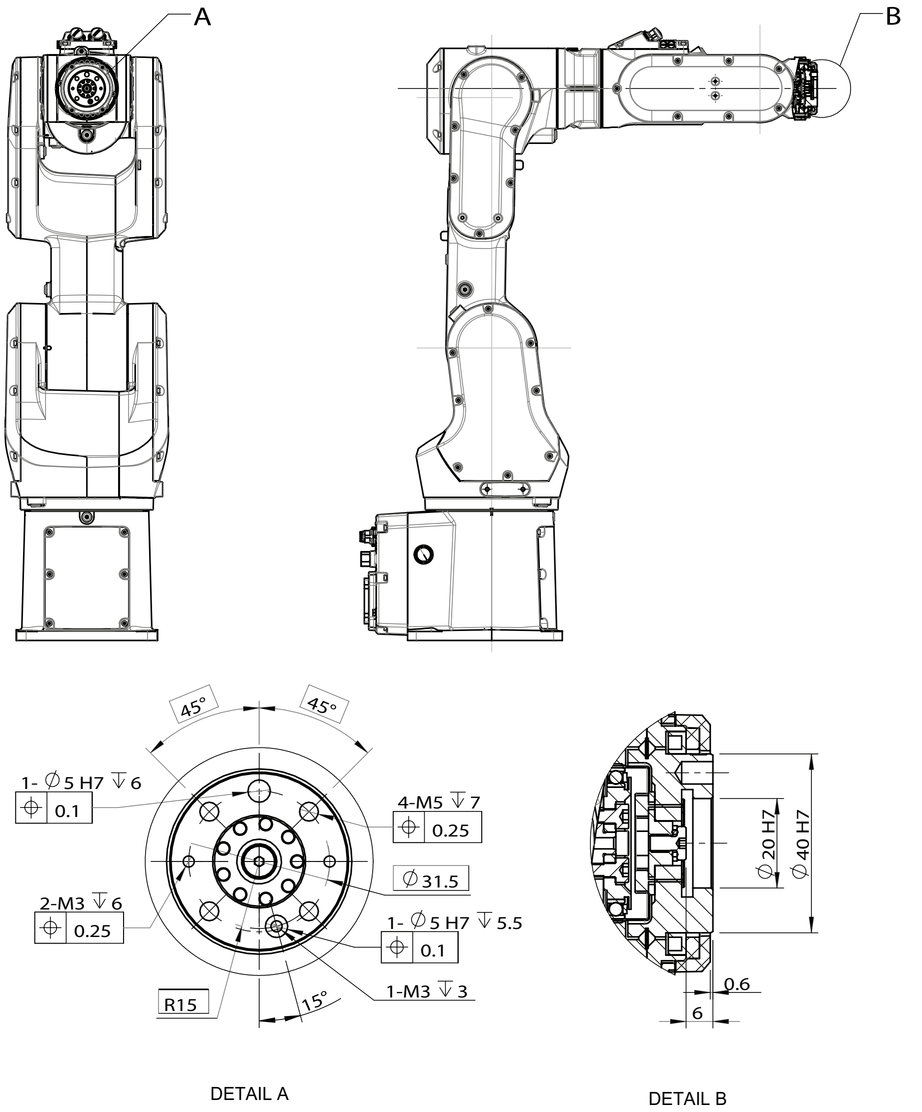
Continues on next page

## 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.

## 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.

## 1.7 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:

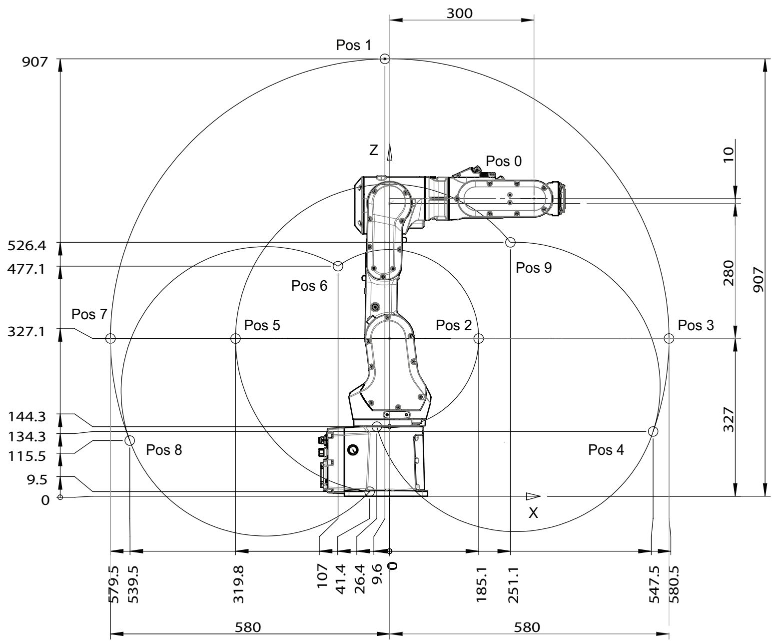
- Maintenance-free AC motors are used.
- Grease is used for the gearboxes.
- The cabling is routed for longevity, and in the unlikely event of a failure, its modular design makes it easy to change.

# 1.8 Robot motion

## 1.8.1 Working range

### Illustration, working range IRB 1090-3.5/0.58

This illustration shows the unrestricted working range of the robot.

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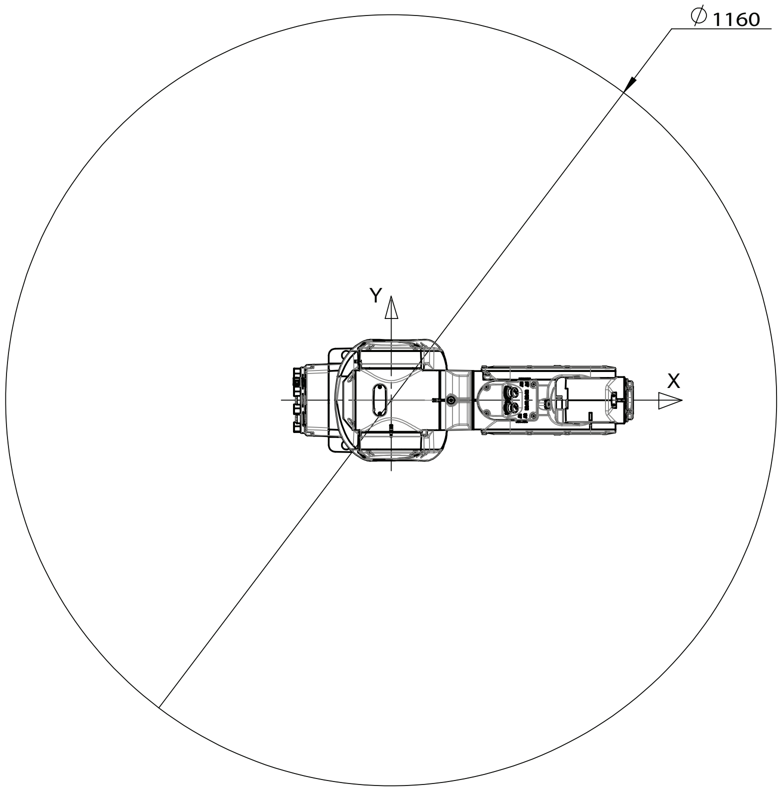
Positions at wrist center and angle of axes 2 and 3

| Position in the figure | Positions at wrist center (mm) | | Angle (degrees) | |
|---|---|---|---|---|
| | X | Z | axis 2 | axis 3 |
| pos0 | 364 | 617 | 0° | 0° |
| pos1 | 0 | 907.2 | 0° | -88° |
| pos2 | 184.6 | 327 | 12.5° | 55° |
| pos3 | 580 | 327 | 90° | -88° |
| pos4 | 534 | 100.3 | 113° | -88° |
| pos5 | -304 | 327 | -28.3° | -205° |
| pos6 | -112.4 | 473.5 | -115° | 55° |
| pos7 | -580 | 327 | -90° | -88° |
| pos8 | -525.8 | 81.8 | -115° | -88° |
| pos9 | 237.3 | 517.1 | 113° | -205° |

*Continues on next page*

## Top view of working range

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## Working range

| Axis | Working range | Note |
|---|---|---|
| Axis 1 | ±230° | |
| Axis 2 | -115°/+113° | |
| Axis 3 | -205°/+55° | |
| Axis 4 | ±230° | |
| Axis 5 | -125°/+120° | |
| Axis 6 | ±400° | Default value. |
| | ±242 | Maximum revolution value. The default working range for axis 6 can be extended by changing parameter values in the software. |

## 1.8.2 Axes with restricted working range

### 1.8.2.1 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 41*.

#### 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 | no |
| Axis 2 | yes | no |
| Axis 3 | yes | no |
| Axis 4 | no | no |
| Axis 5 | yes | no |
| Axis 6 | no | no |

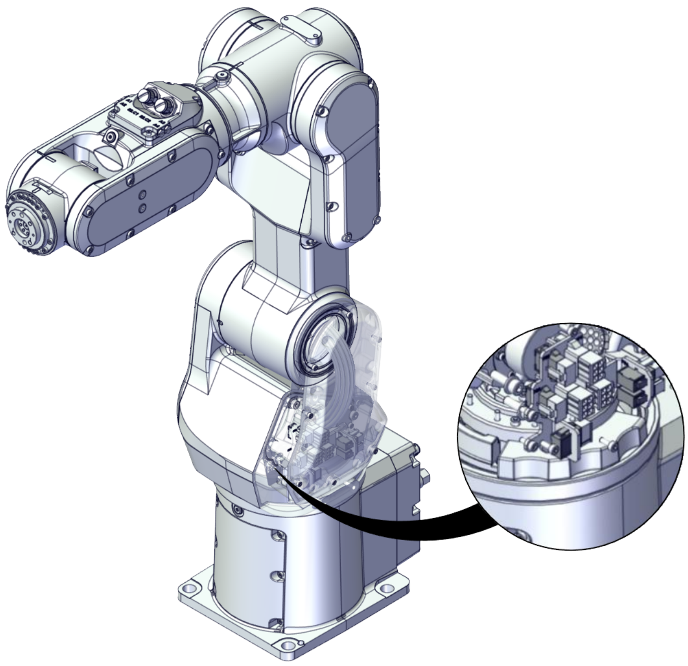
i Part of the casting or fixed on the casting and can not /should not be removed.

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.

## 1.8.2.2 Mechanically restricting the working range

### Location of the mechanical stops

Only axis 1 has a replaceable mechanical stop.



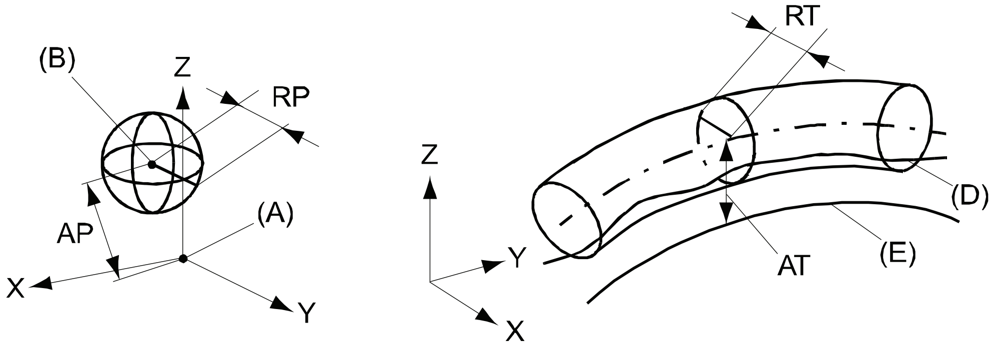
xx1800002452

## 1.8.3 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.




xx0800000424

| 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 1090 | 3.5/0.58 |
|---|---|
| Pose accuracy, AP[i] (mm) | 0.05 |
| Pose repeatability, RP (mm) | 0.05 |
| Pose stabilization time, PSt (s) within 0.1 mm of the position | 0.2 |
| Path accuracy, AT (mm) | 1.5 |
| Path repeatability, RT (mm) | 0.05 |

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.

## 1.8.4 Velocity

### Maximum axis speed

| Robot type | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 |
|---|---|---|---|---|---|---|
| IRB 1090-3.5/0.58 | 250 °/s | 250 °/s | 250 °/s | 320 °/s | 320 °/s | 420 °/s |

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

## 1.9 Robot stopping distances and times

### 1.9.1 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 48*.

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.

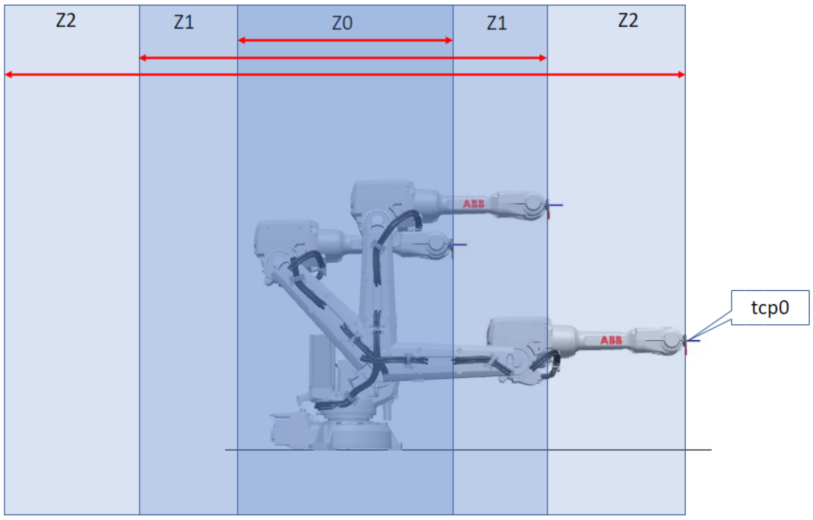
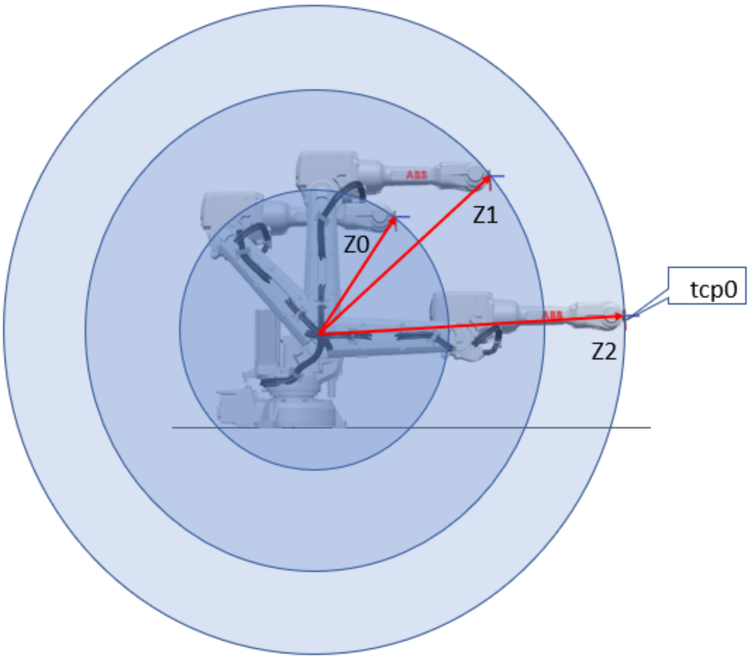
The used loads represent the rated load. No arm load is used. See the *Load diagrams on page 30*.

*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 |

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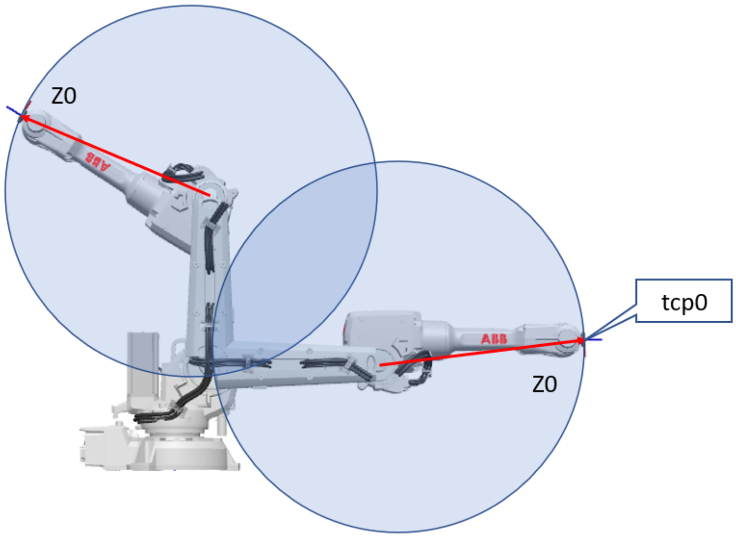
| | Illustration |
|---|---|
| Axis 3 |  xx2300000862 |

## 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

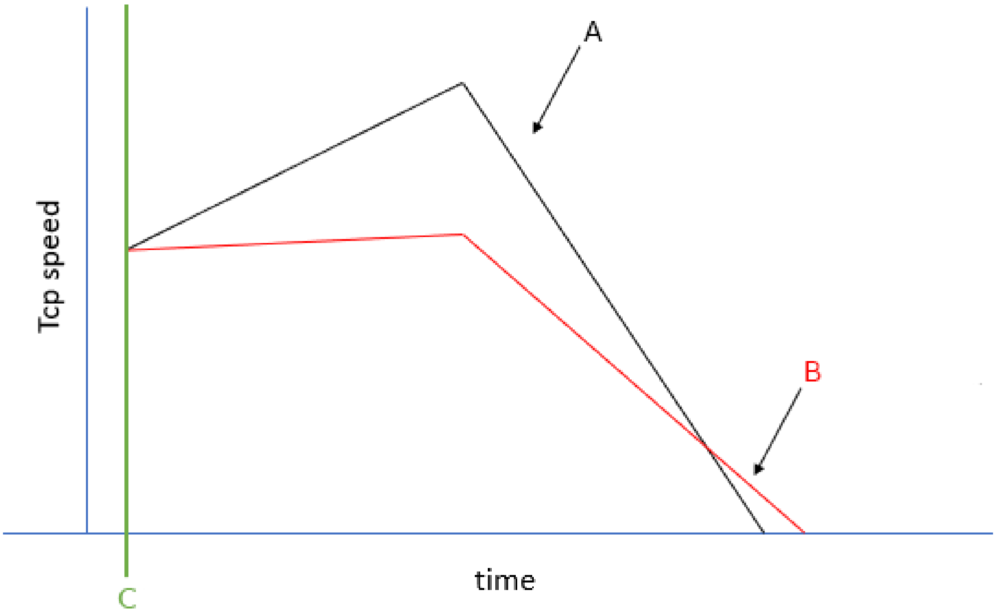
The data for stop category 0 is presented in tables, with distance and time for each axis.

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).

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

## 1.9.2 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.

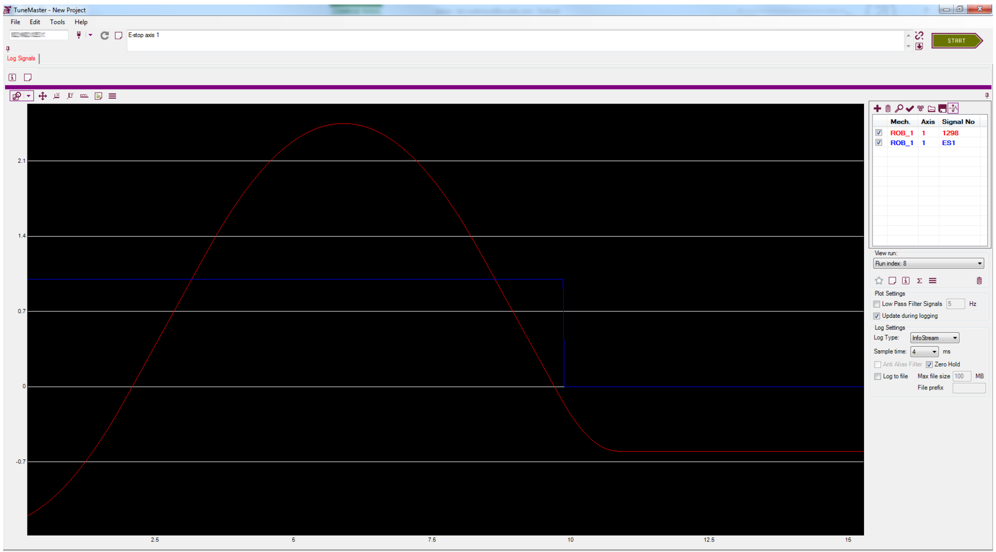
*Continues on next page*

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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## 1.9.3 IRB 1090-3/0.58

### Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [3.5, [0,
     0, 78], [1, 0, 0, 0], 0.0035, 0.0035, 0.0035]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [2.3, [0,
     0, 52], [1, 0, 0, 0], 0.0016, 0.0016, 0.0016]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [1.2, [0,
     0, 26], [1, 0, 0, 0], 0.00039, 0.00039, 0.00039]];
```

### Category 0

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

| Axis | Distance | Stop time |
|---|---|---|
| 1 | 35.0° | 0.2 s |
| 2 | 25.1° | 0.16 s |
| 3 | 32.4° | 0.19 s |

### Category 1, extension zones

For definitions of the zones, see *Extension zones on page 47*.

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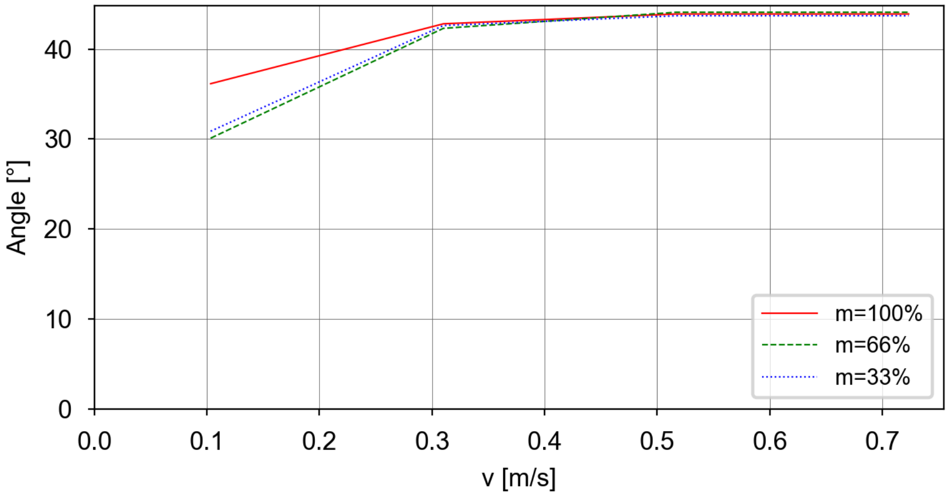
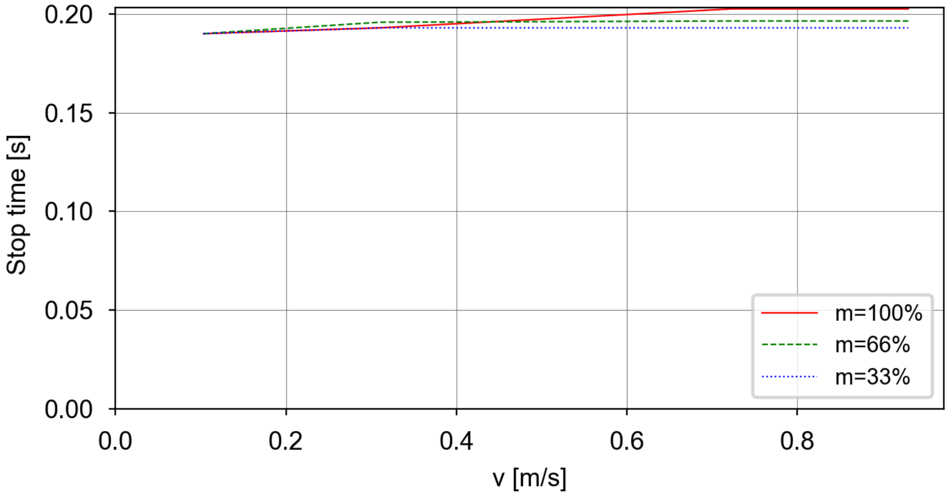
### Category 1, Axis 1, Extension zone 0, stopping distance and stopping time

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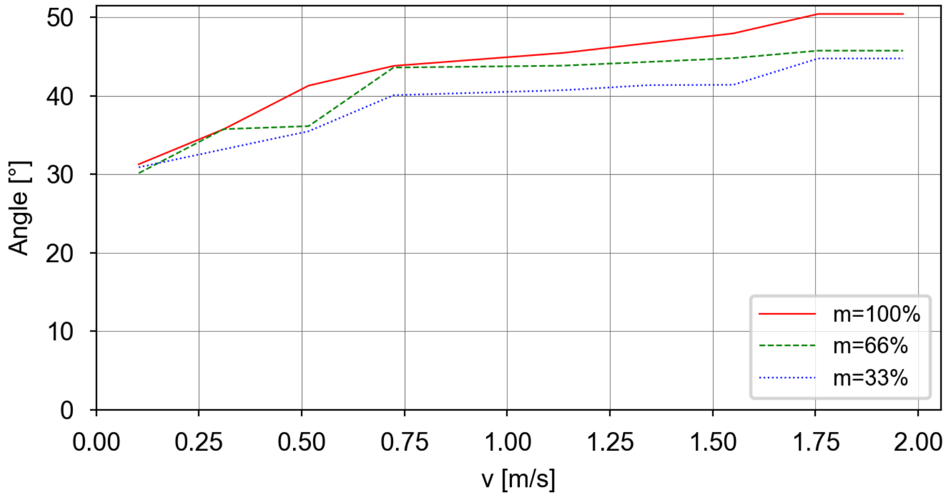
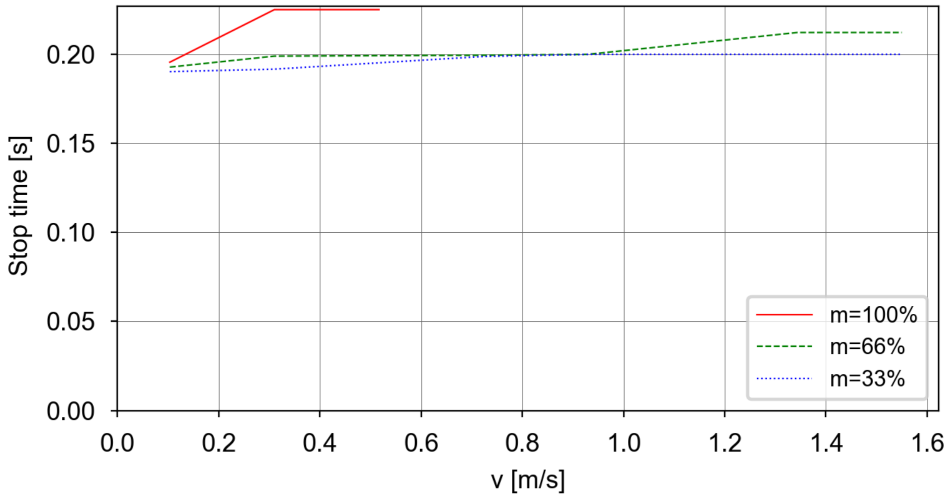
**Category 1, Axis 1, Extension zone 1, stopping distance and stopping time**

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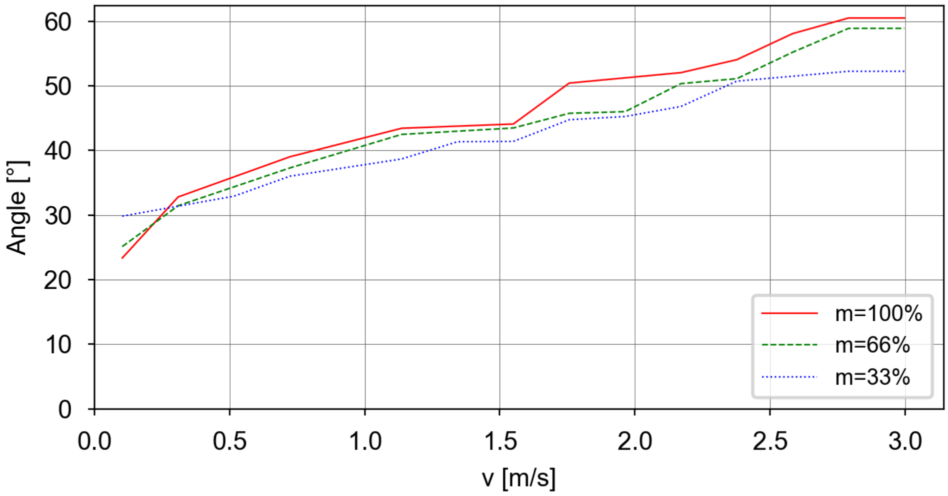
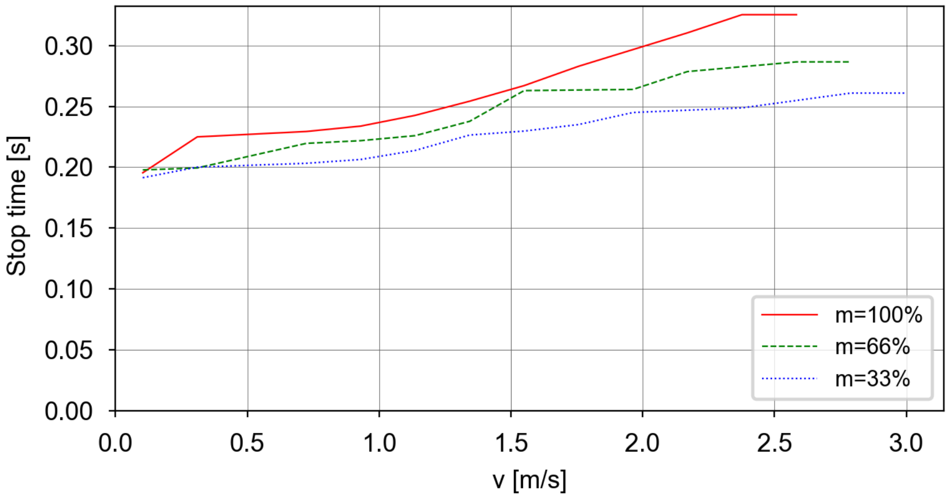
### Category 1, Axis 1, Extension zone 2, stopping distance and stopping time

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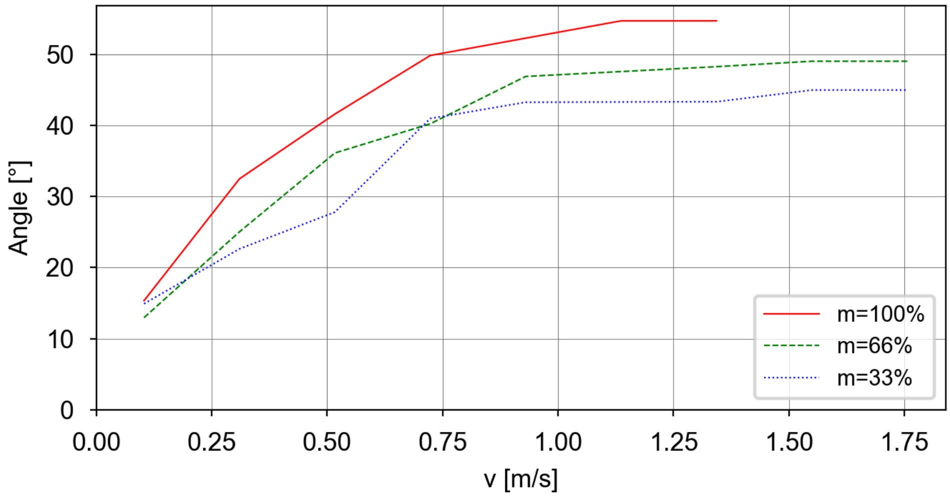
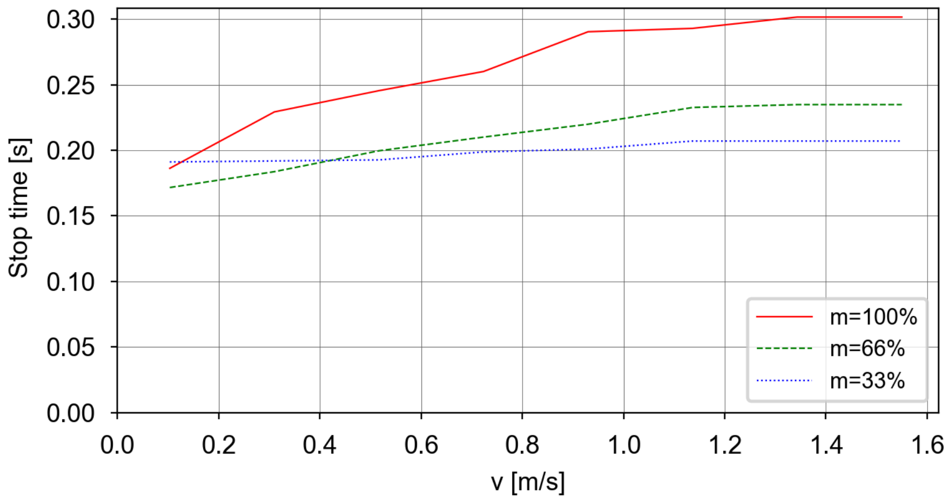
**Category 1, Axis 2, Extension zone 0, stopping distance and stopping time**

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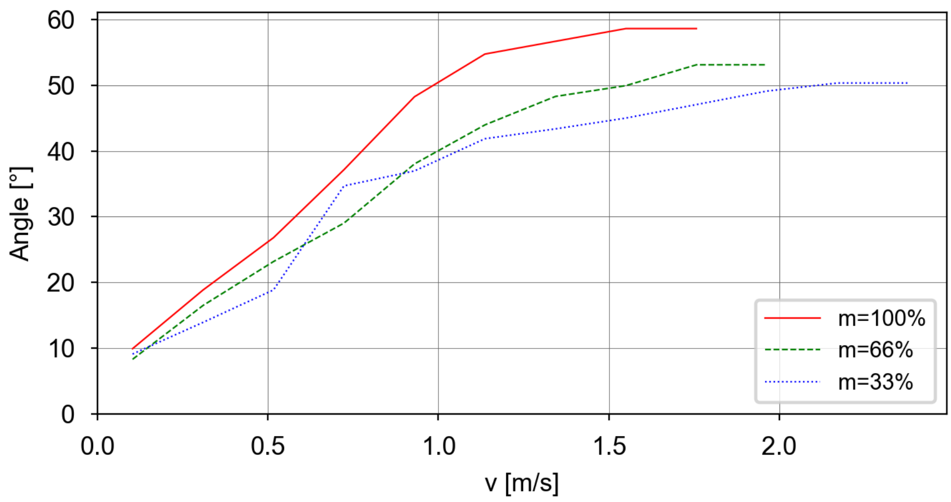
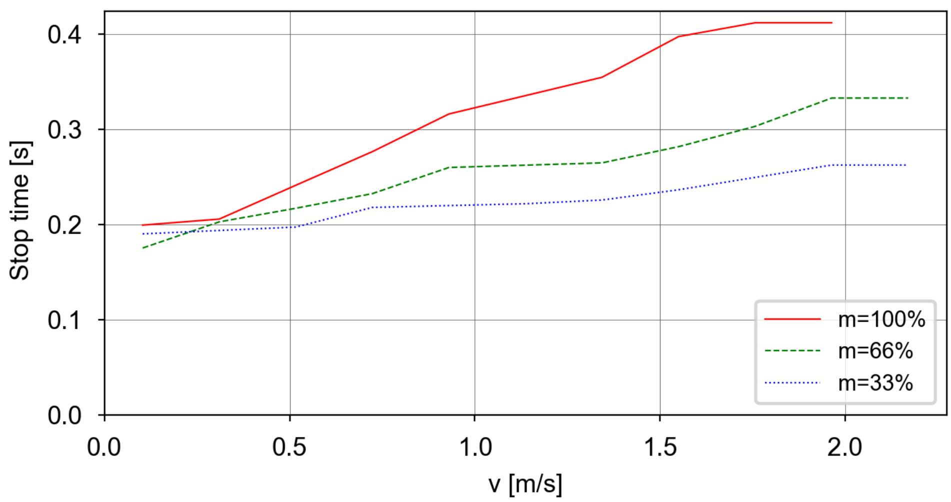
### Category 1, Axis 2, Extension zone 1, stopping distance and stopping time

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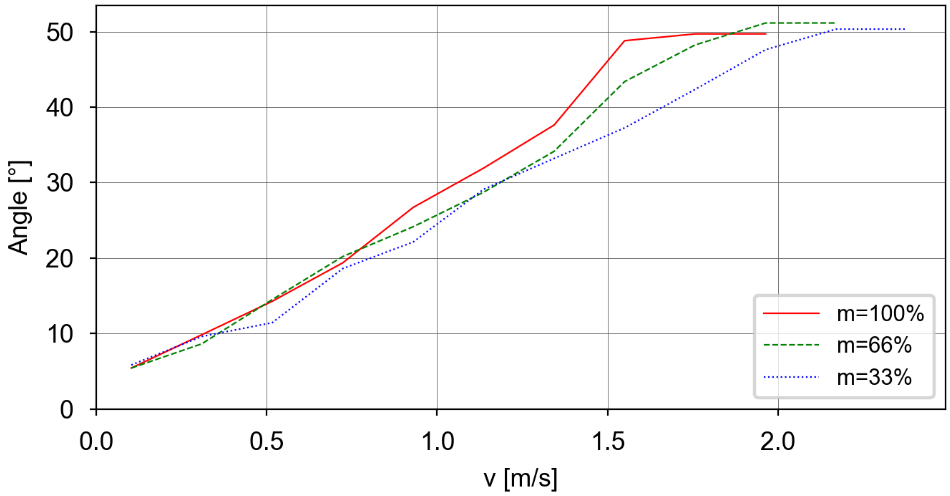
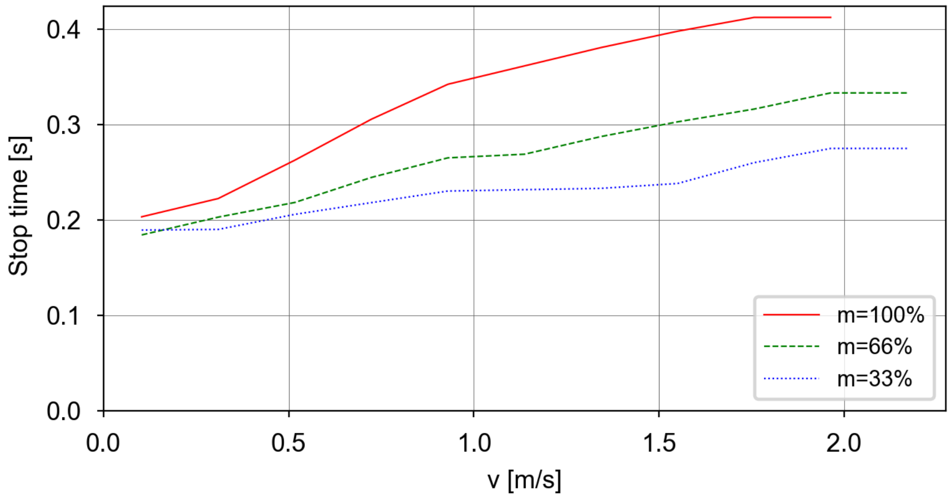
### Category 1, Axis 2, Extension zone 2, stopping distance and stopping time

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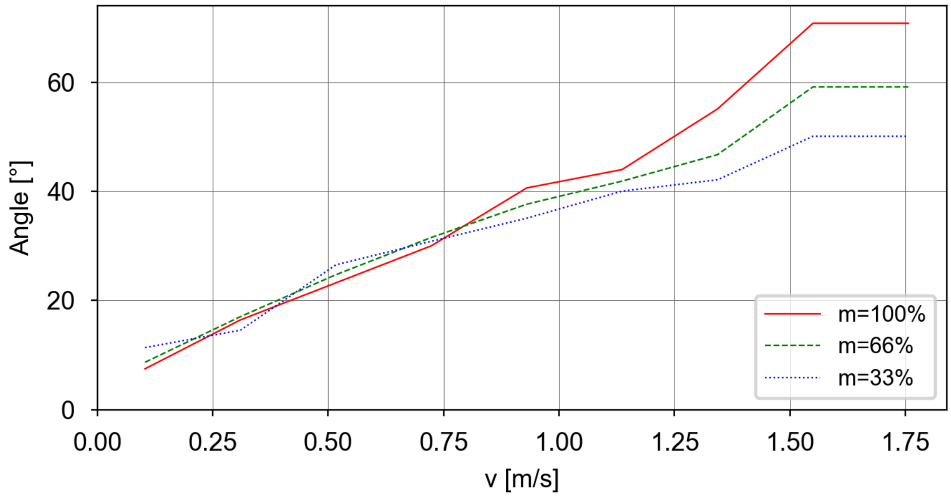
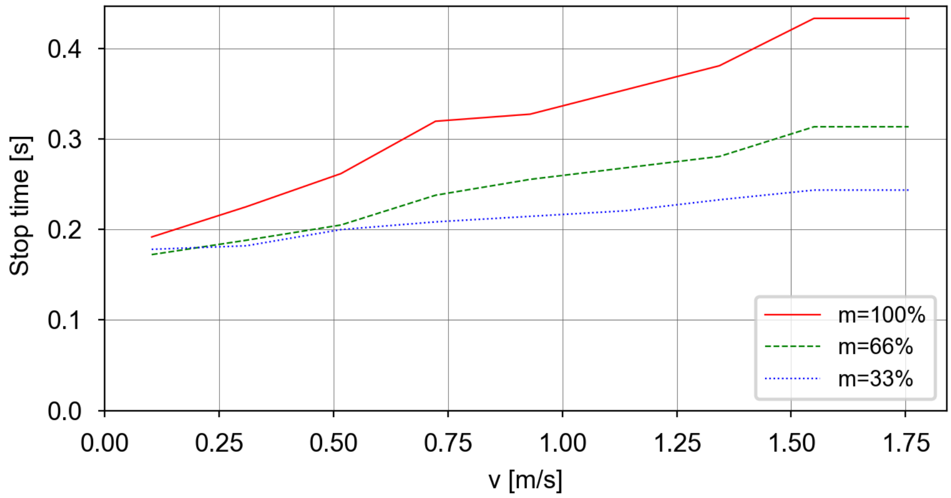
### Category 1, Axis 3, Extension zone 0, stopping distance and stopping time



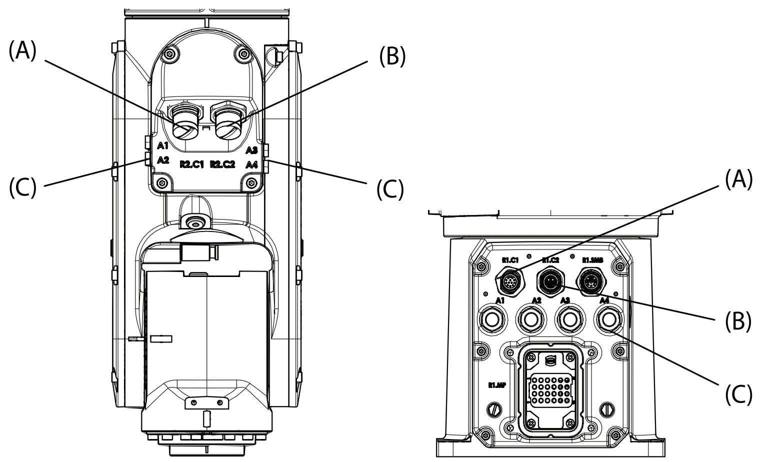
## 1.10 Customer connections

### Introduction to customer connections

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

There is also connections for Ethernet, one connector R2.C2 at the wrist and the corresponding connector R1.C2 located at the base.

Hose for compressed air is also integrated into the manipulator. There are 4 inlets at the base (R1/8”) and 4 outlets (M5) on the wrist.

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| Position | Connection | Description | Number | Value |
|---|---|---|---|---|
| A | (R1)R2.C1 | Customer power/signal | 8 wires[i] | 30 V, 1.5 A |
| B | (R1)R2.C2 | Customer power/signal or Ethernet | 8 wires | 30 V, 1 A or 1 Gbits/s |
| C | Air | Max. 6 bar | 4 | Outer diameter of air hose: 4 mm |

i The connector has 12 pins. Only pins 1 to 8 are available for use.

### Connector kits (optional)

Connector kits, base

R1.C1 and R1.C2 connectors on the base are parts of the CP/CS cable and Ethernet floor cable, respectively. For details about the robot cabling, see "Robot cabling and connection points" in robot product manual.

*Continues on next page*

## Connector kits, wrist

The table describes the CP/CS and Ethernet (if any) connector kits for wrist.

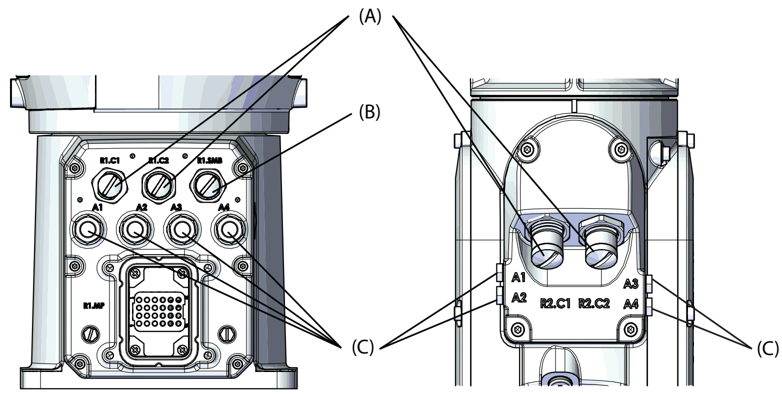
| Position | Description | | Art. no. |
|---|---|---|---|
| Connector kits | CP/CS | M12 CPCS Male straight connector kits | 3HAC066098-001 |
| | | M12 CPCS Male angled connector kits | 3HAC066099-001 |
| | Ethernet | M12 Ethernet Cat5e Male straight connector kits | 3HAC067413-001 |
| | | M12 Ethernet Cat5e Male angled connector kits | 3HAC067414-001 |

## 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 | CP/CS or Ethernet connector protection covers |
| B | SMB connector protection cover |
| C | Air hose connector protection covers |

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# 2 Specification of variants and options

## 2.1 Introduction to variants and options

### General

The different variants and options for the IRB 1090 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.

## 2.2 Manipulator

### Manipulator color

| Option | Description | RAL code[i] |
|---|---|---|
| 209-202 | ABB Graphite White std<br>Standard color | RAL 7035 |

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

### Media & Communication

When 3303-1 Parallel & Air is selected then 3304-1 and 3305-1 options are activated for selecting.

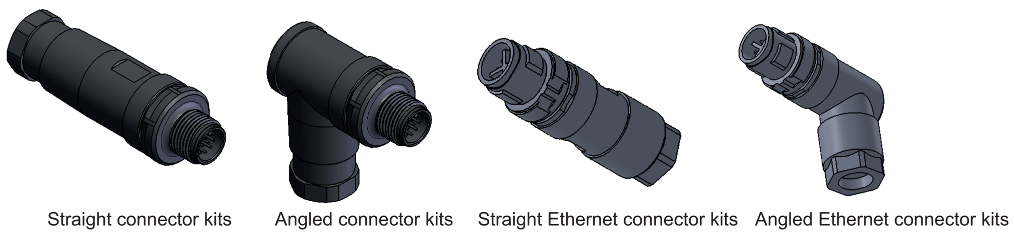
When 3303-2 Ethernet, Parallel, Air is selected then 3304-1,3305-1,3306-1 and 3307-1 options are activated for selecting.

| Option | Type | Description |
|---|---|---|
| 3303-1 | Parallel & Air | Includes customer power CP and customer signals CS + air. |
| 3303-2 | Ethernet, Parallel, Air | Includes CP, CS + air + Ethernet (PROFINET). |

### Connector kits manipulator

The kit consists of connectors, pins and sockets.

| Option | Description |
|---|---|
| 3304-1 | Male-type, Straight arm connector kits |
| 3305-1 | Male-type, Angled arm connector kits |
| 3306-1 | Male-type, Straight arm Ethernet connector kits |
| 3307-1 | Male-type, Angled arm Ethernet 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.

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### 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. |
| 438-6 | Standard warranty + 6 months | Standard warranty extended with 6 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.<br>**Note**<br>Special conditions are applicable, see *Robotics Warranty Directives*. |

## 2.3 Floor cables

### Manipulator cable - Straight

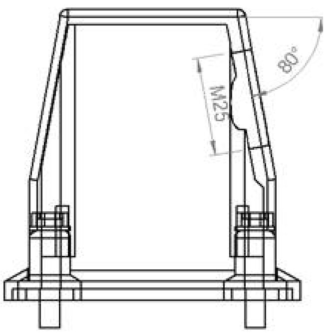
| Option | Lengths |
|---|---|
| 3200-1 | 3 m |
| 3200-2 | 7 m |
| 3200-3 | 15 m |

xx2100001122

### Manipulator cable - Angled

| Option | Lengths |
|---|---|
| 3209-1 | Angled type connector, requires option *Manipulator cable* - Length [3200-X] |

xx2100001123

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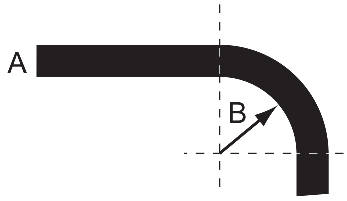
### Bending radius for static floor cables

The minimum bending radius is 10 times the cable diameter for static floor cables.




xx1600002016

| | |
|---|---|
| A | Diameter |
| B | Diameter x10 |

### Connection of Ethernet

Required 3303-2 Ethernet, Parallel, Air and occupies 1 Ethernet port.

| Option | Lengths |
|---|---|
| 3202-2 | 7 m |

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# 3 Accessories

## General

There is a range of tools and equipment available.

## Basic software and software options for robot and PC

For more information, see *Product specification - OmniCore E line*.

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