

ROBOTICS

# Product specification

## IRB 1090



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Checked in 2024-12-20  
Skribenta version 5.6.018

## **Product specification**

**IRB 1090-3.5/0.58**

OmniCore

Document ID: 3HAC088057-001

Revision: D

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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
- Integrators and customers

## References

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

Document name	Document ID
<i>Product specification - OmniCore E line</i>	<i>3HAC079823-001</i>
<i>Product manual - OmniCore E10</i>	<i>3HAC079399-001</i>
<i>Product manual - IRB 1090</i>	<i>3HAC088056-001</i>

## Revisions

Revision	Description
A	First edition.
B	Published in release 23D. The following updates are done in this revision: <ul style="list-style-type: none"><li>• A label indicating that the robot is used only in educational applications is added.</li></ul>
C	Published in release 24B. The following updates are done in this revision: <ul style="list-style-type: none"><li>• Updated graphics for floor cables.</li></ul>
D	Published in release 24D. The following updates are done in this revision: <ul style="list-style-type: none"><li>• Added options [3203-X] Mains cable and options [3201-X] Parallel cable.</li></ul>

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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.

**Educational Application Only**

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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 Description

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## 1.1.1 Robot variants

### 1.1.1 Robot variants

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#### 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.

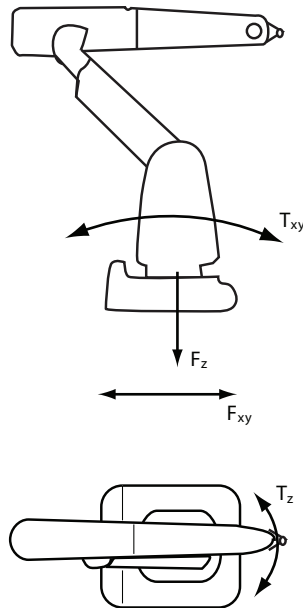
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# 1 Description

## 1.1.2 Technical data

Continued

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	$\pm 230$ N	$\pm 600$ N
Force z	$+210 \pm 380$ N	$+210 \pm 570$ N
Torque xy	$\pm 120$ Nm	$\pm 310$ Nm
Torque z	$\pm 40$ Nm	$\pm 110$ Nm


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## 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. 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  <b>Note</b> 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. <sup>i</sup> For information about compensating for foundation flexibility, see the description of <i>Motion Process Mode</i> in the manual that describes the controller software option, see <a href="#">References on page 7</a> .
Minimum foundation material yield strength	150 MPa	

<sup>i</sup> 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 possible 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

# 1 Description

## 1.1.2 Technical data

*Continued*

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 <sup>i</sup> (41 °F)
Maximum ambient temperature	+40 °C (104 °F)
Maximum ambient humidity	85% at constant temperature

<sup>i</sup> 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 <sup>i</sup>
Manipulator, protection type Standard	IP40

<sup>i</sup> 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

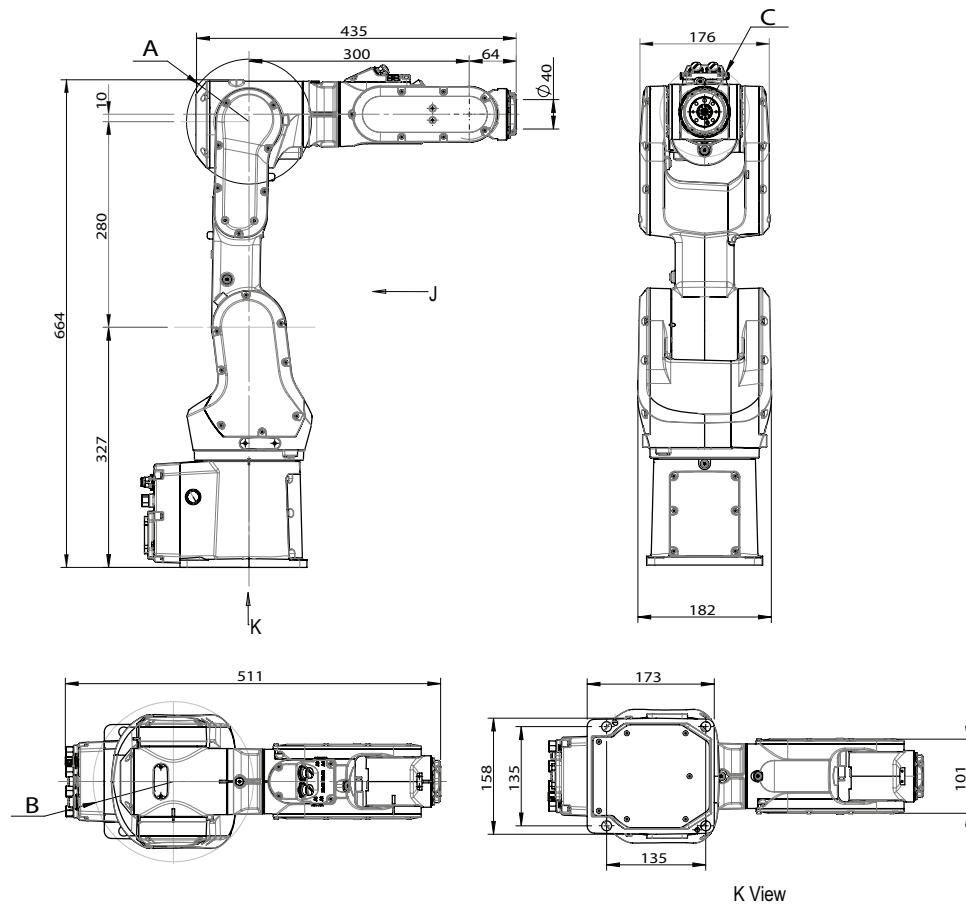
Data	Description	Note
Airborne noise level	The sound pressure level outside the working space.	< 70 dB(A) Leq (acc. to machinery directive 2006/42/EC)

### Power consumption at max load

Type of movement	IRB 1090-3.5/0.58
ISO Cube 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 Description

## 1.2.1 Applicable standards

## 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
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.



## 1.3 Installation

### 1.3.1 Introduction to installation

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#### 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](#).

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#### Extra loads

The upper arm can handle an additional load of 0.5 kg.  
See [Fitting equipment to the robot on page 37](#).

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#### Working range limitation

The working range of axes 1 can be limited by mechanical stops as option. See [Working range on page 41](#).

# 1 Description

## 1.3.2 Assembling the manipulator

### 1.3.2 Assembling the manipulator

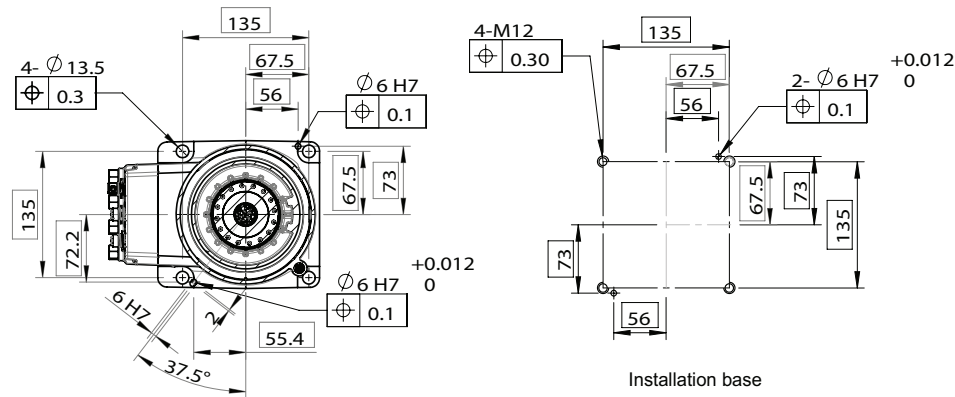
#### Attachment screws

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. 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: <ul style="list-style-type: none"> <li>Mechanical tolerances in the robot structure</li> <li>Deflection due to load</li> </ul> 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, 5 and 6.  <b>Note</b> For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction <code>WristOpt</code> , see <i>Technical reference manual - RAPID Instructions, Functions and Data types</i> . This instruction is only available for OmniCore robots.	Wrist Optimization

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# 1 Description

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## 1.4.1 Calibration methods

*Continued*

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### 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.

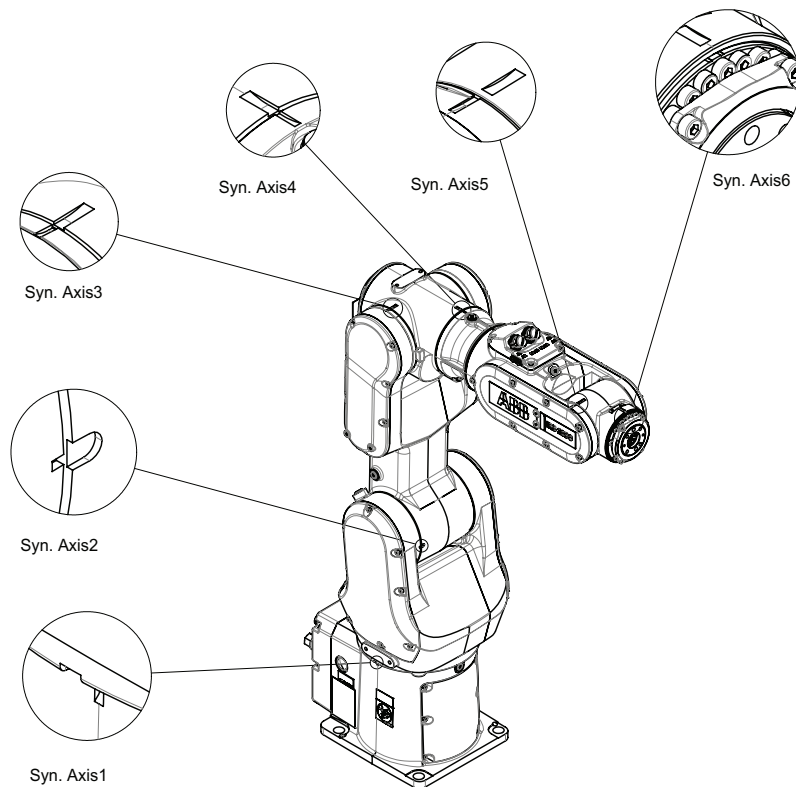
The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

## 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.

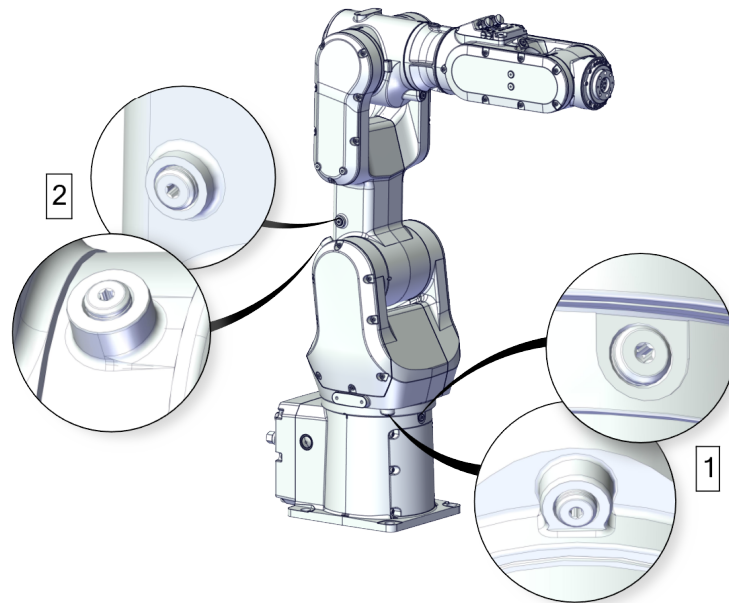
## 1 Description

### 1.4.3 Fine calibration

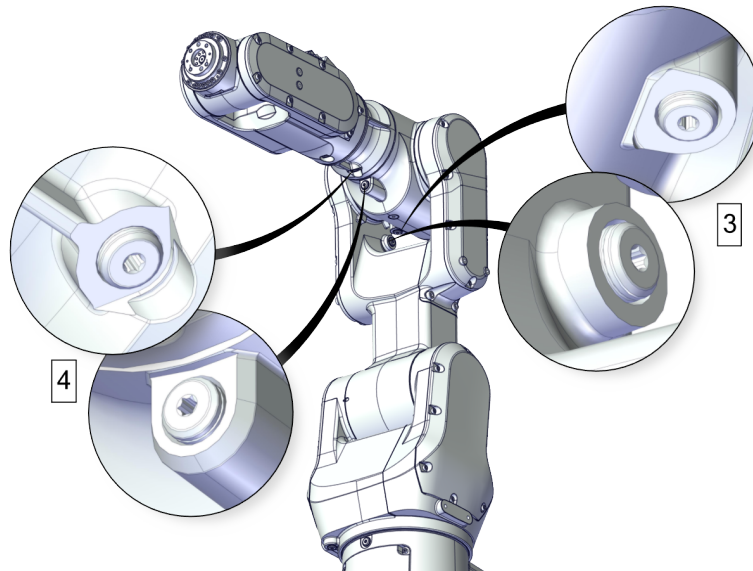
### 1.4.3 Fine calibration

#### General

The fine calibration is done with the Axis calibration method.

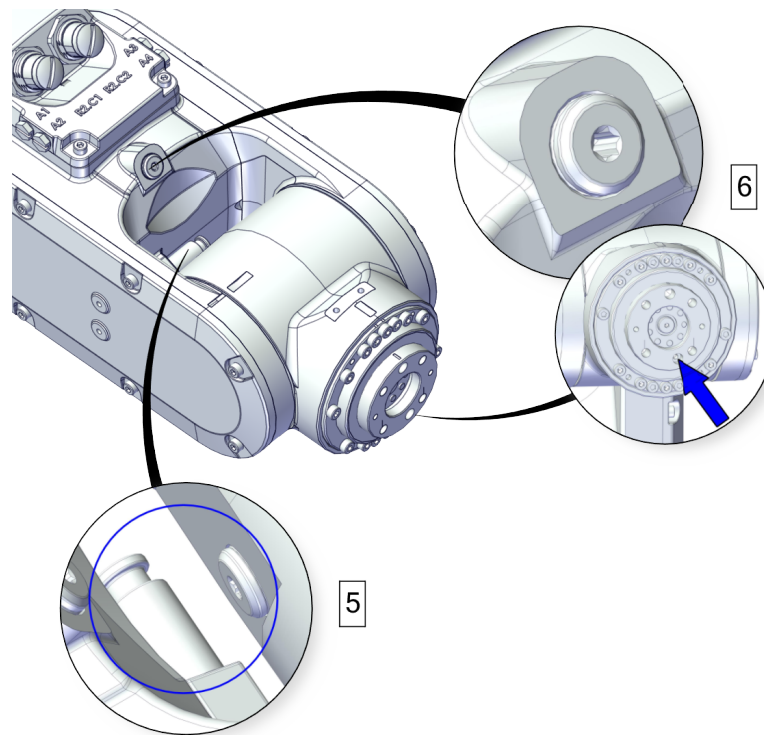


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### Axes

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

# 1 Description

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## 1.4.4 Absolute Accuracy calibration

### 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.



#### Note

Singularities might appear in slightly different positions on a real robot compared to RobotStudio, where *Absolute Accuracy* is off compared to the real controller.

#### 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.

*Continues on next page*



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
- 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

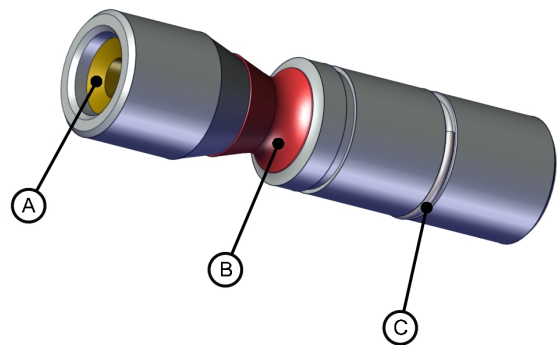
If any part is missing or damaged, the tool must be replaced immediately.

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# 1 Description

## 1.4.4 Absolute Accuracy calibration

Continued



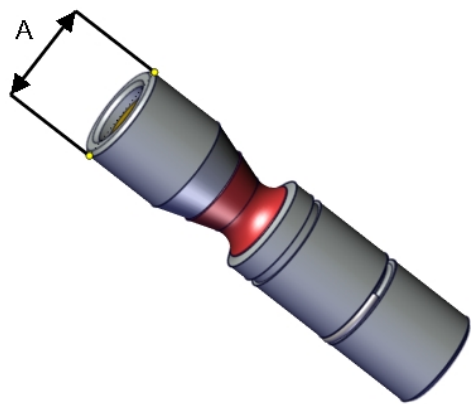
xx1500001914

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.



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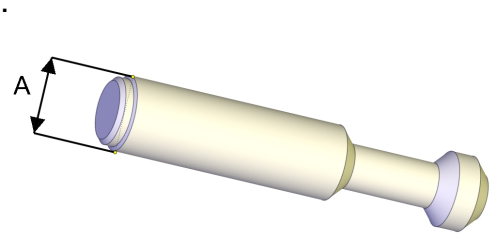
A	Outer diameter
---	----------------

### 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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A	Outer diameter
---	----------------

# 1 Description

## 1.4.5.1 Synchronization marks and synchronization position for axes

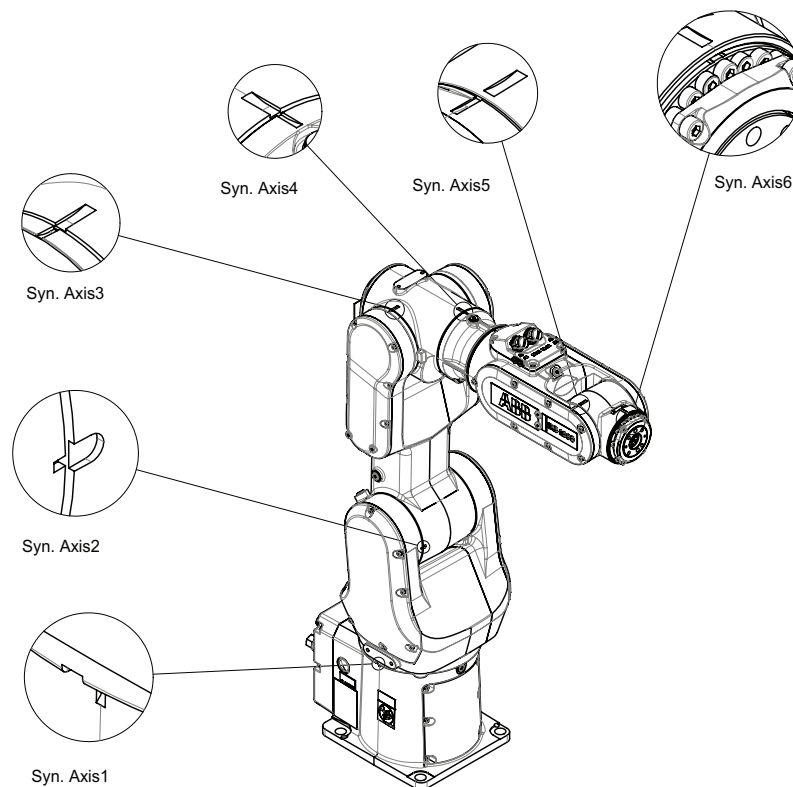
### 1.4.5 Synchronization marks and axis movement directions

#### 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.

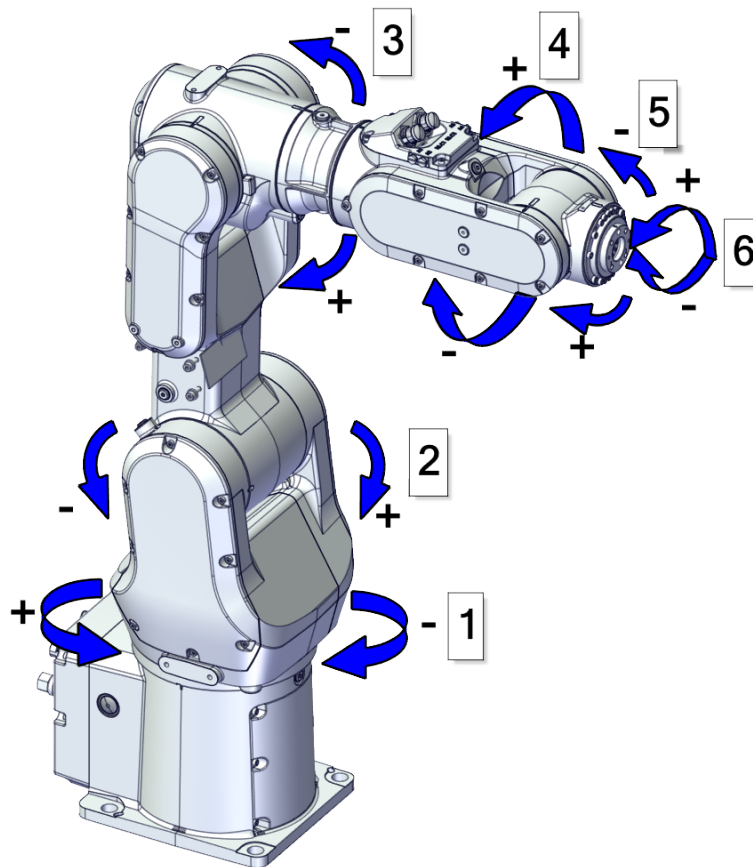
### 1.4.5.2 Calibration movement directions for all axes

#### 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 Description

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## 1.5.1 Introduction

## 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,  $J_0$  of  $0.012 \text{ kgm}^2$ , 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.

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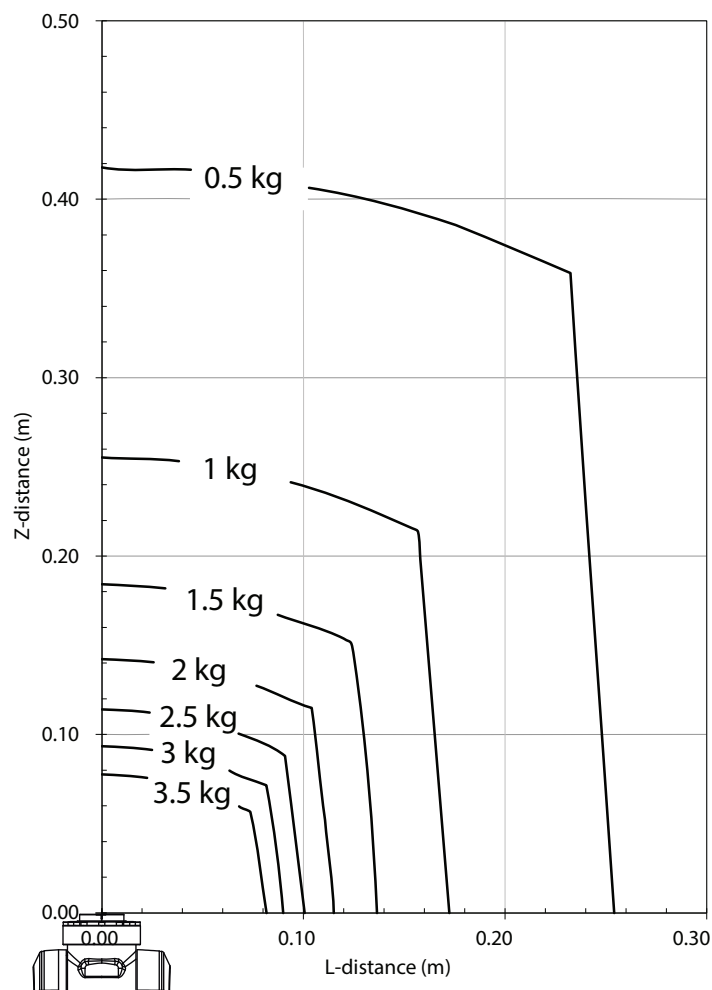
### Control of load case with RobotLoad

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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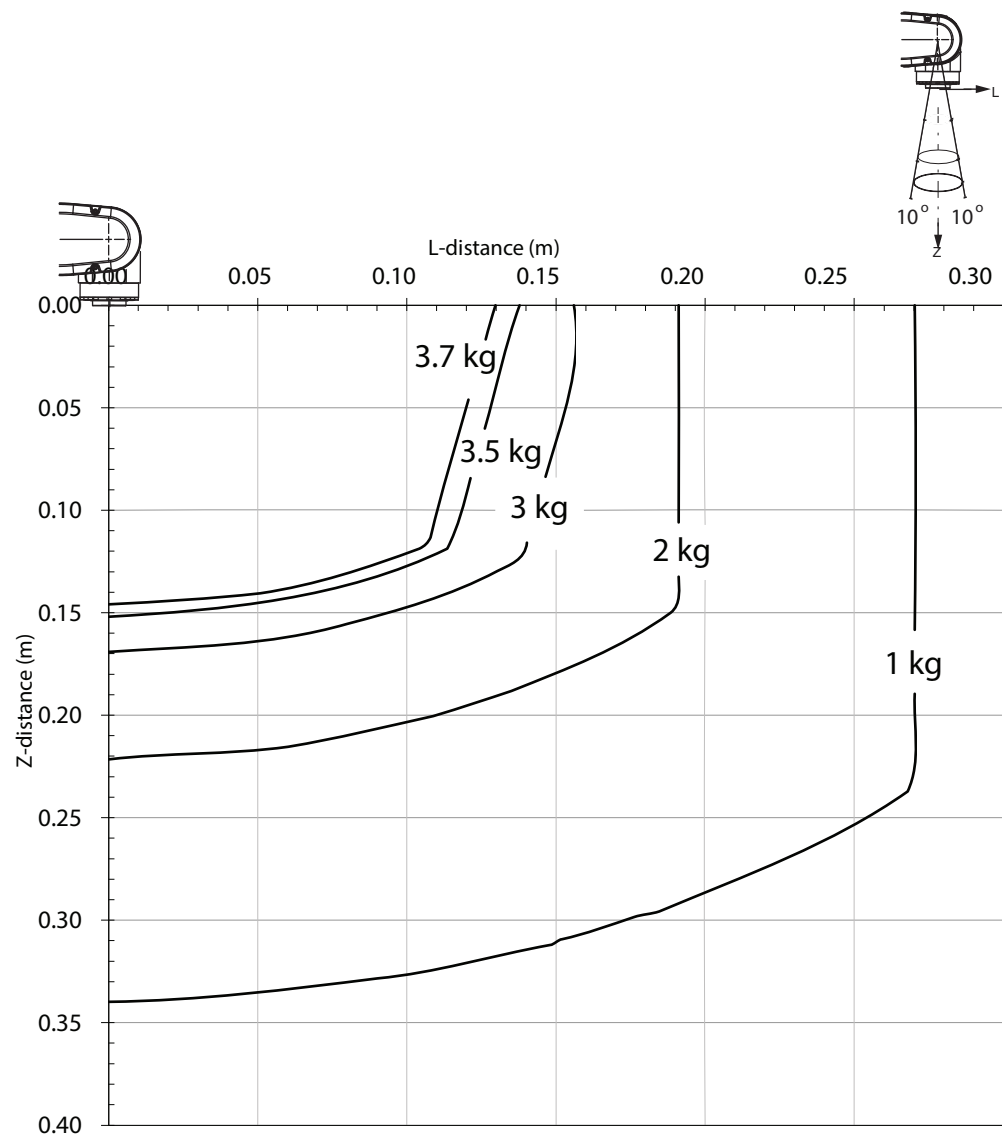
Figure 1.1:

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1 Description

1.5.2 Diagrams  
Continued

Diagrams of IRB 1090-3.5/0.58 "Vertical Wrist" ( $\pm 10^\circ$ )



xx2300000828

For wrist down ( $0^\circ$  deviation from the vertical line).

	Description
Max load	3.5 kg
Z <sub>max</sub>	0.078 m
L <sub>max</sub>	0.082 m



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

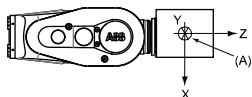
## 1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

**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  $\text{kgm}^2$ .  $L = \text{sqr}(X^2 + Y^2)$ , 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	$Ja_5 = \text{Load} \times ((Z + 0.064)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 0.175 \text{ kgm}^2$
6	IRB 1090-3.5/0.58	$Ja_6 = \text{Load} \times L^2 + J_{oz} \leq 0.085 \text{ kgm}^2$



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.

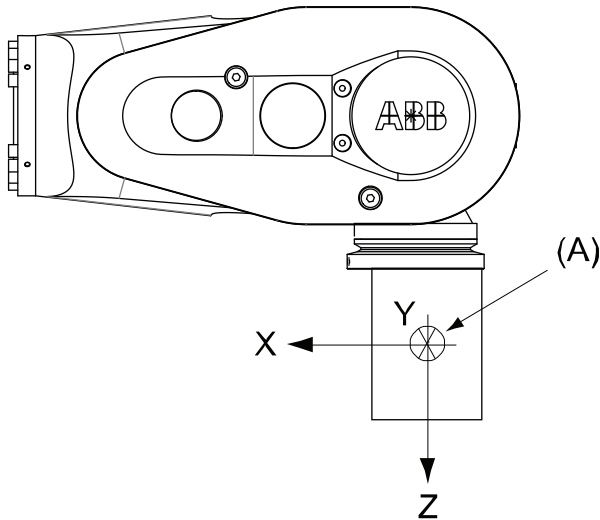
*Continues on next page*

# 1 Description

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

### Limited axis 5, center line down

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



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 Description

## 1.5.5 Maximum TCP acceleration

### 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 Max acceleration at nominal load COG [m/s <sup>2</sup> ]	Controlled Motion Max acceleration at nominal load COG [m/s <sup>2</sup> ]
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

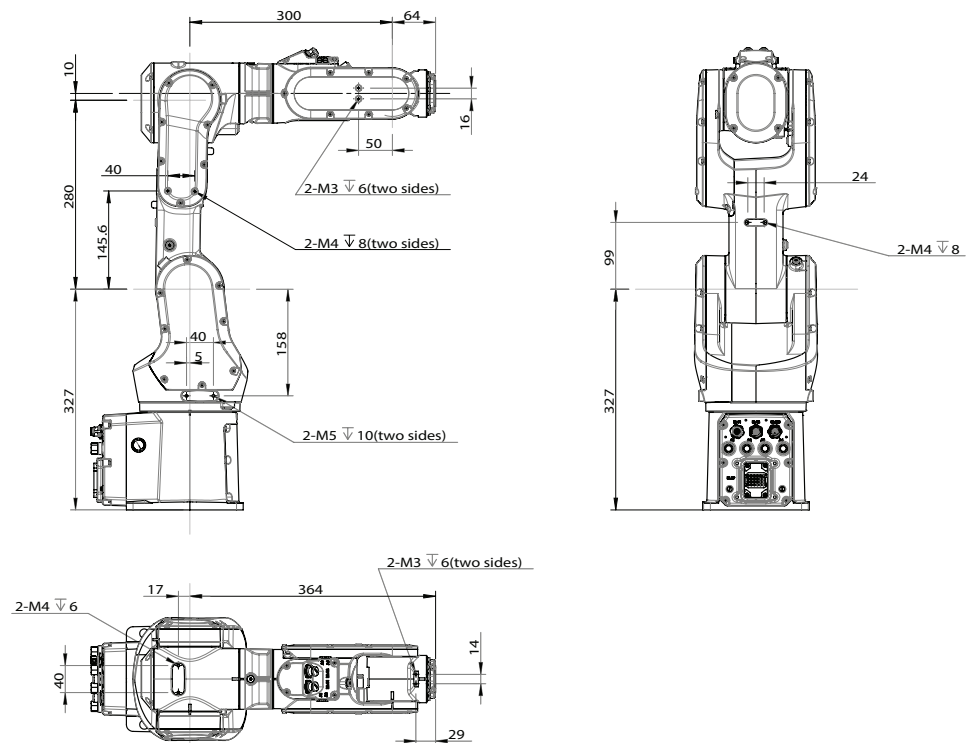
### Attachment holes and dimensions

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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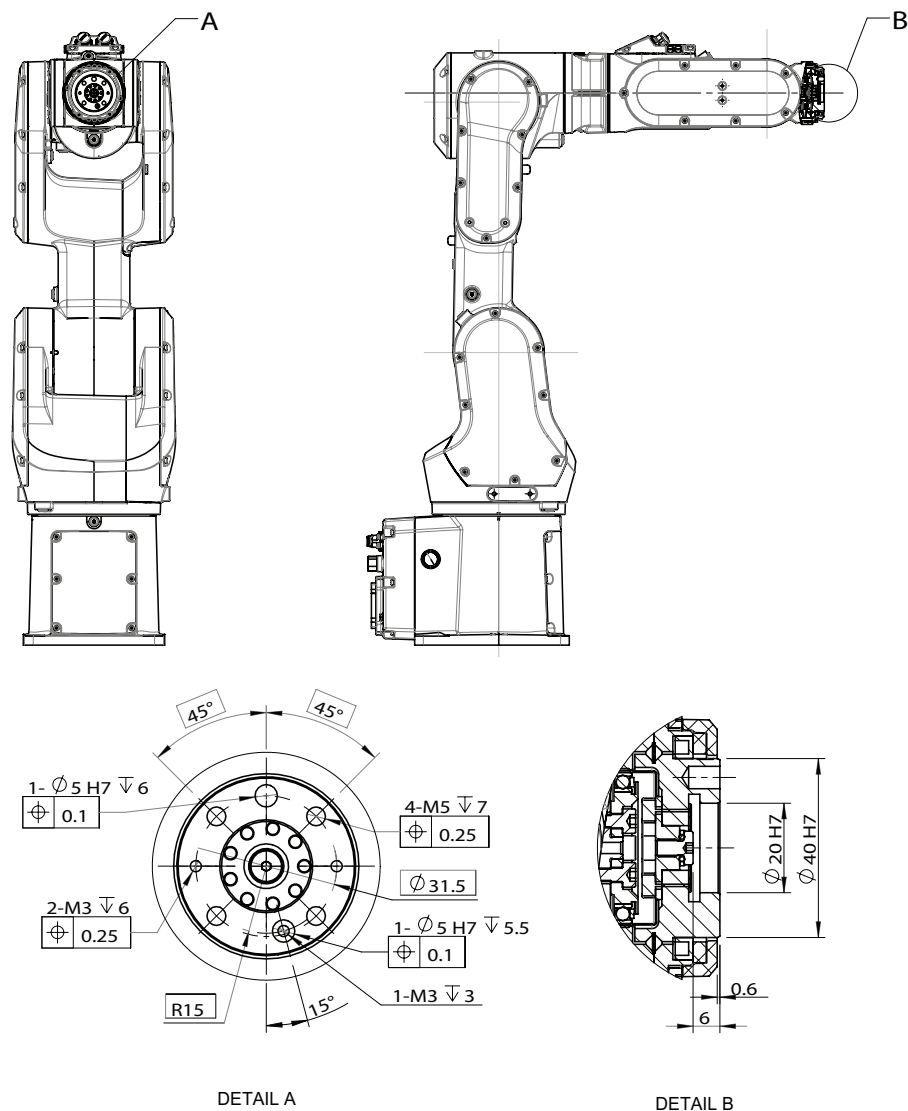
*Continues on next page*

# 1 Description

## 1.6 Fitting equipment to the robot

*Continued*

### Tool flange standard



xx2300001052



### 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 Description

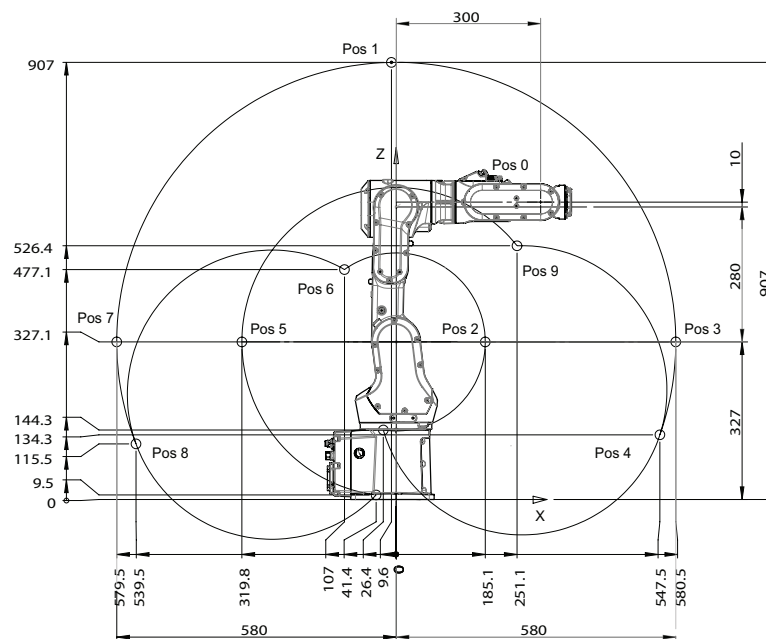
## 1.8.1 Working range

## 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.



xx2300001049

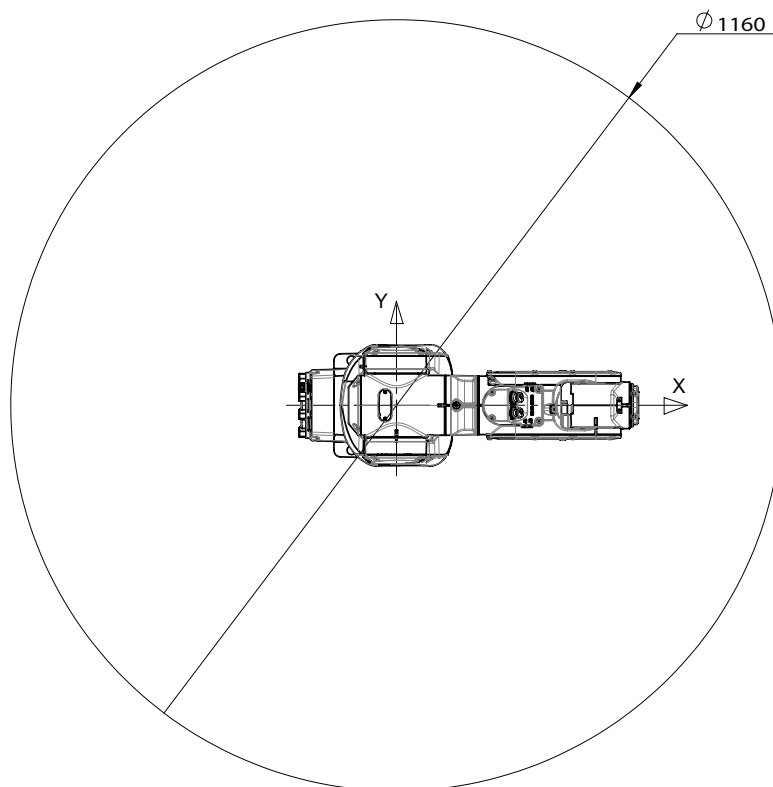
#### Positions at wrist center and angle of axes 2 and 3

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



xx2300001050

## Working range

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

# 1 Description

## 1.8.2.1 Adjusting the working range

## 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 <sup>i</sup>	Movable mechanical stop <sup>ii</sup>
Axis 1	yes	no
Axis 2	yes	no
Axis 3	yes	no
Axis 4	no	no
Axis 5	yes	no
Axis 6	no	no

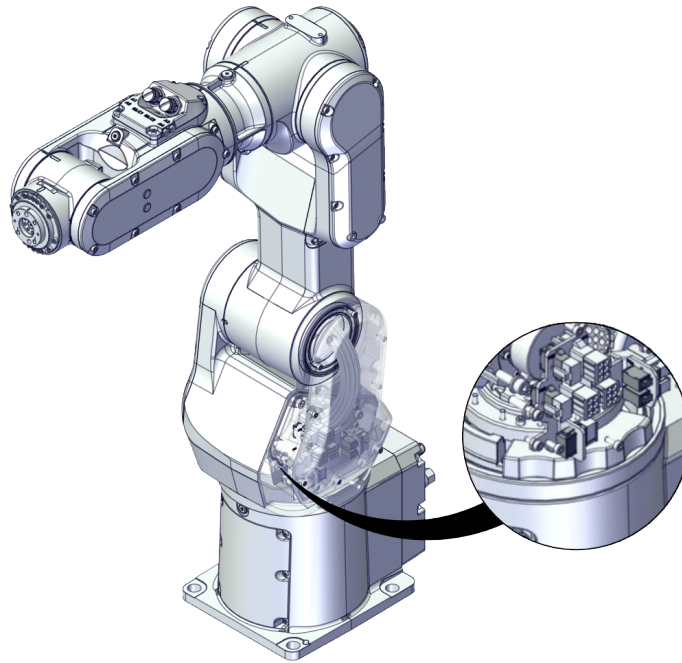
<sup>i</sup> Part of the casting or fixed on the casting and can not /should not be removed.

<sup>ii</sup> 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 Description

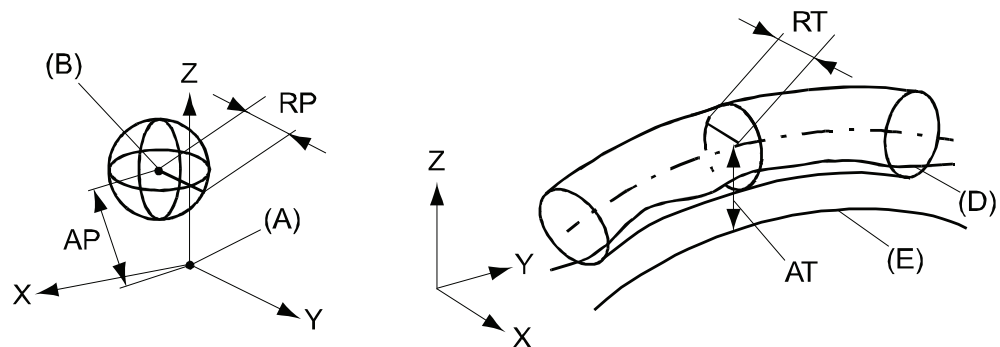
## 1.8.3 Performance according to ISO 9283

### 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

<b>IRB 1090</b>	<b>3.5/0.58</b>
Pose accuracy, AP <sup>i</sup> (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

<sup>i</sup> AP according to the ISO test above, is the difference between the taught 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 Description

---

## 1.9.1 Robot stopping distances according to ISO 10218-1

## 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 or shorter. The movement of the axes does not necessarily represent the actual application. Therefore, the braking distance must be validated for each application.

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.

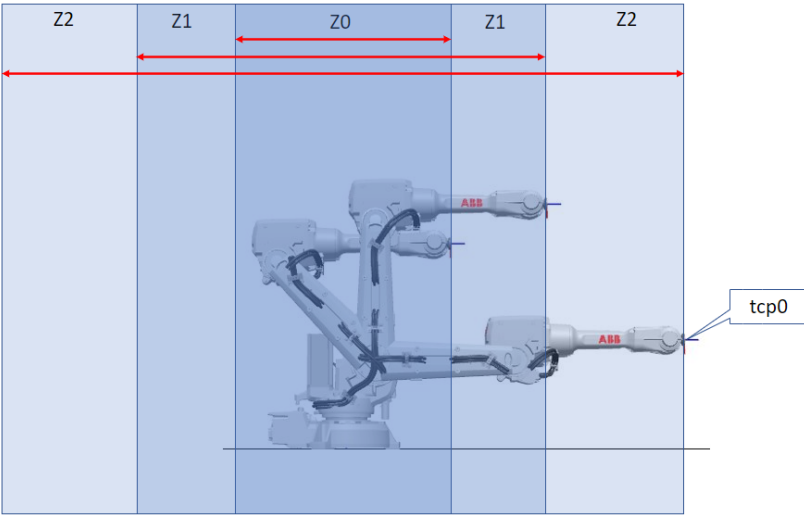
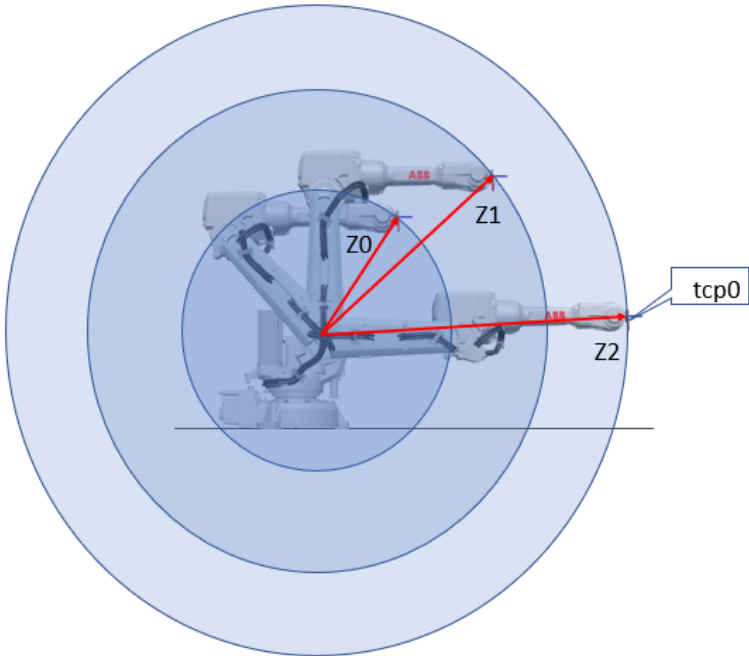
The used loads represent the rated load. No arm load is used. See the [Load diagrams on page 30](#).

*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.

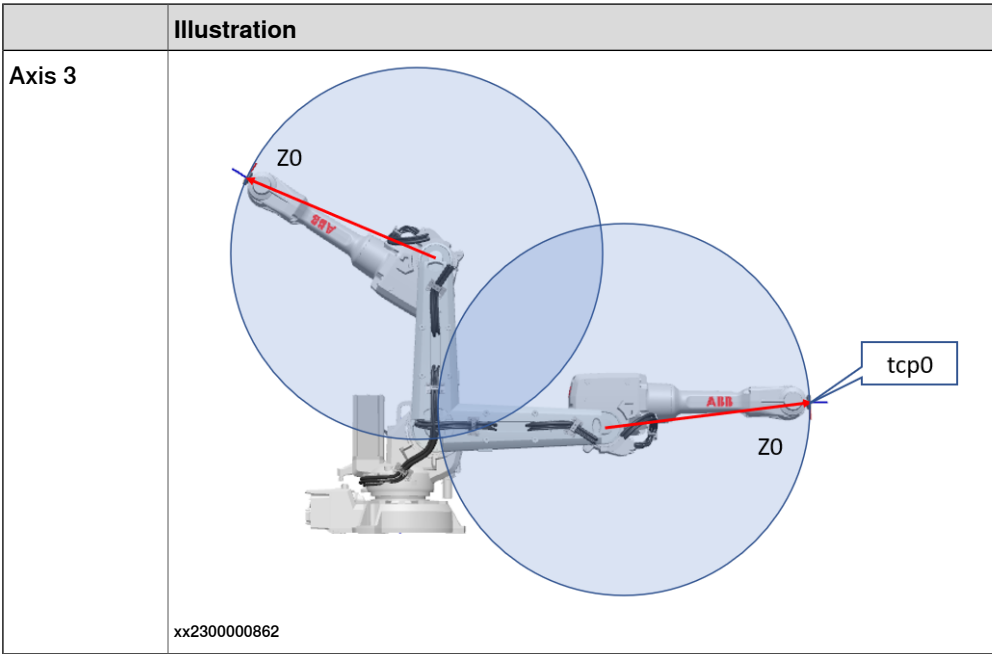
	Illustration
Axis 1	 <p data-bbox="619 1084 724 1102">xx2300000860</p>
Axis 2	 <p data-bbox="619 1827 724 1845">xx2300000861</p>

Continues on next page

# 1 Description

## 1.9.1 Robot stopping distances according to ISO 10218-1

Continued



### 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.

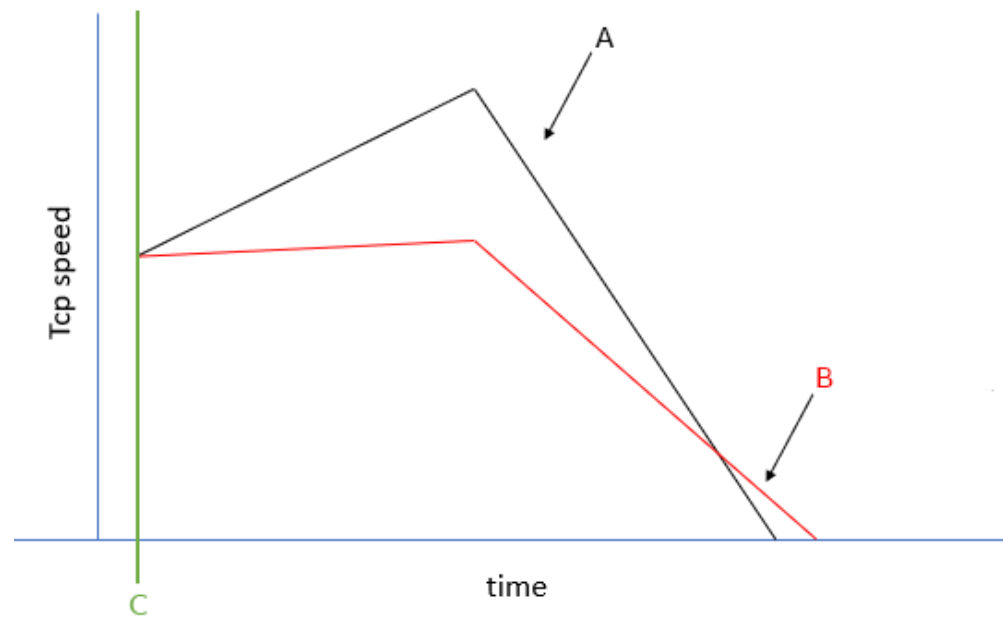
### Reading the data

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.

# 1 Description

---

## 1.9.2 Measuring stopping distance and time

### 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](http://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.



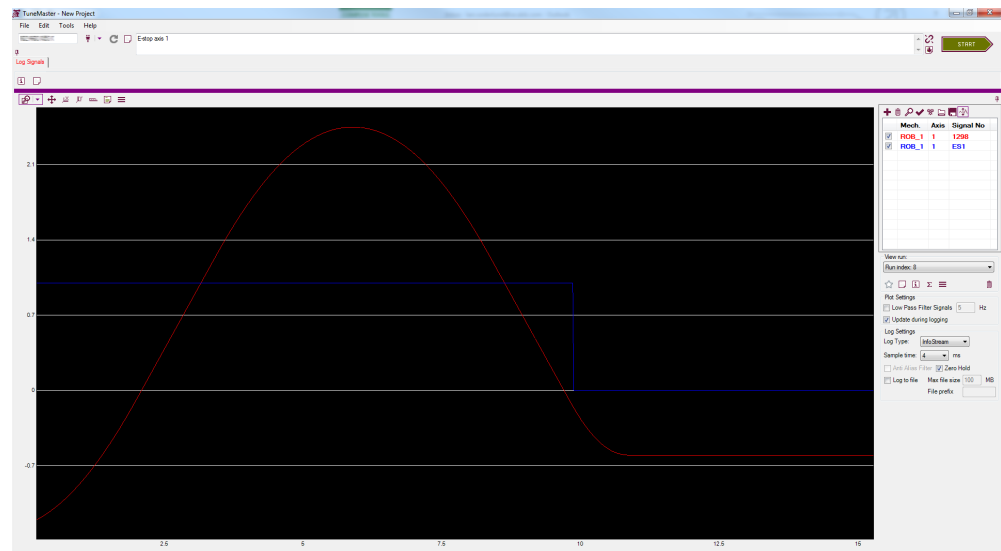
#### Tip

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



xx1600000386

## 1 Description

### 1.9.3 IRB 1090-3/0.58

### 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

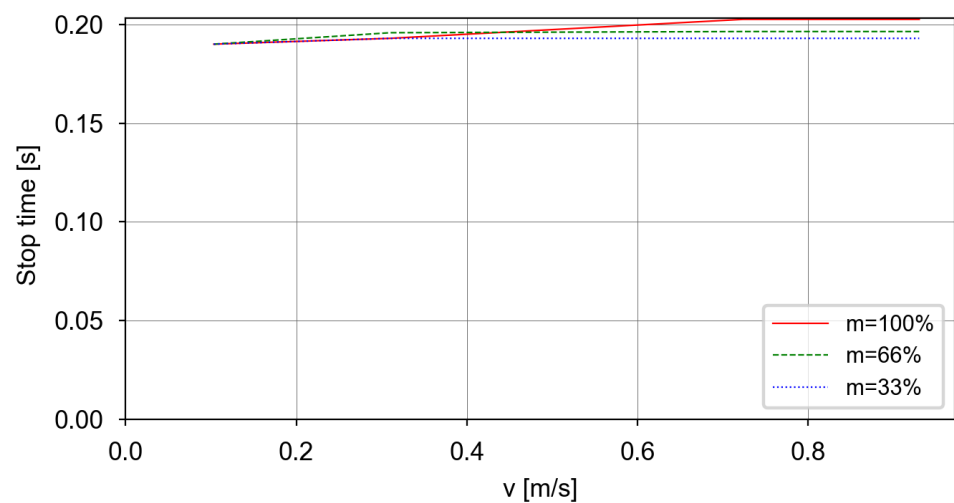
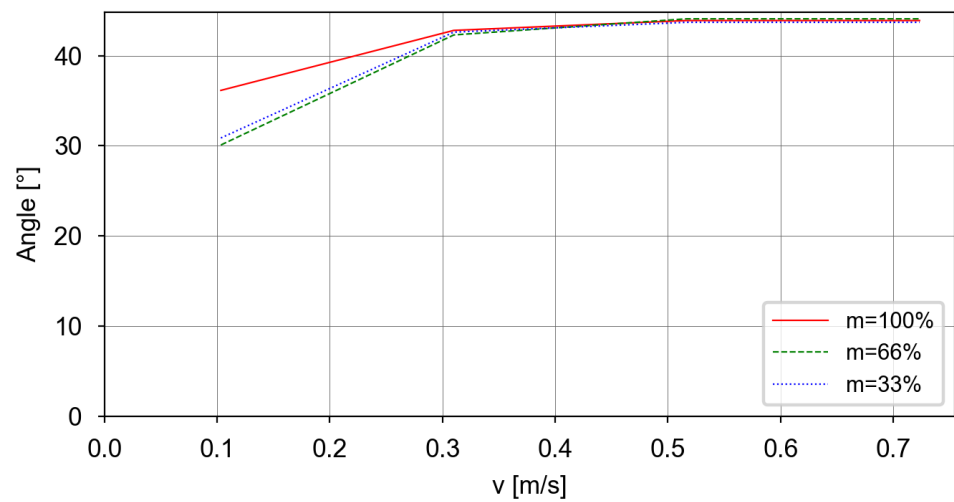
Zone border	Axis 2	Axis 3
z0-z1	48°	30°
z1-z2	90°	-30°

##### Axis 3

Only one zone exists.

*Continues on next page*

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

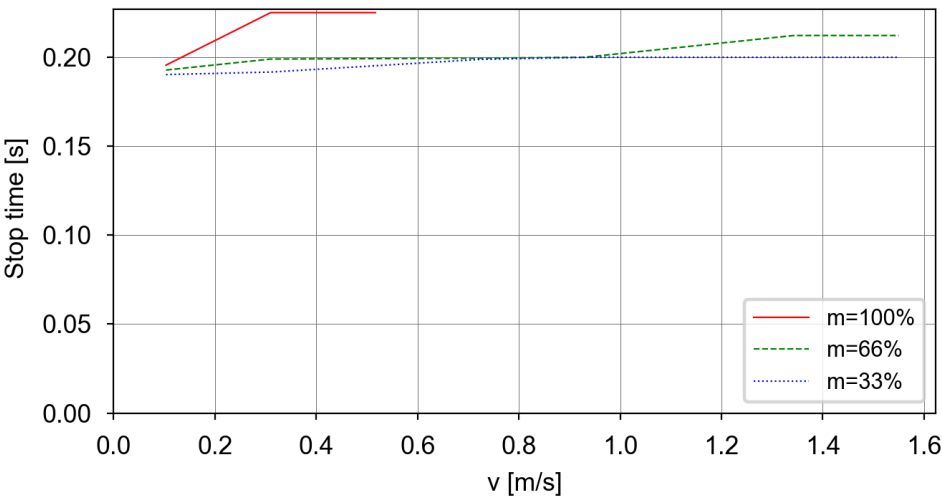
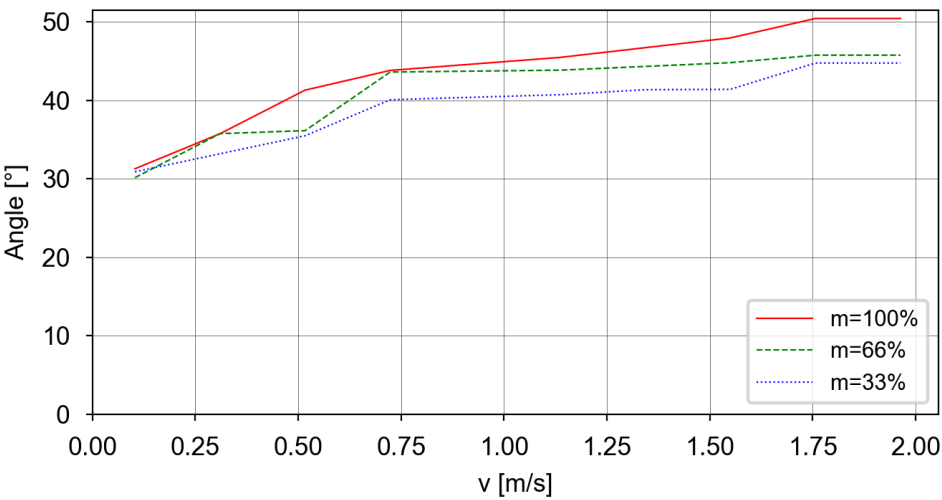


Continues on next page

1 Description

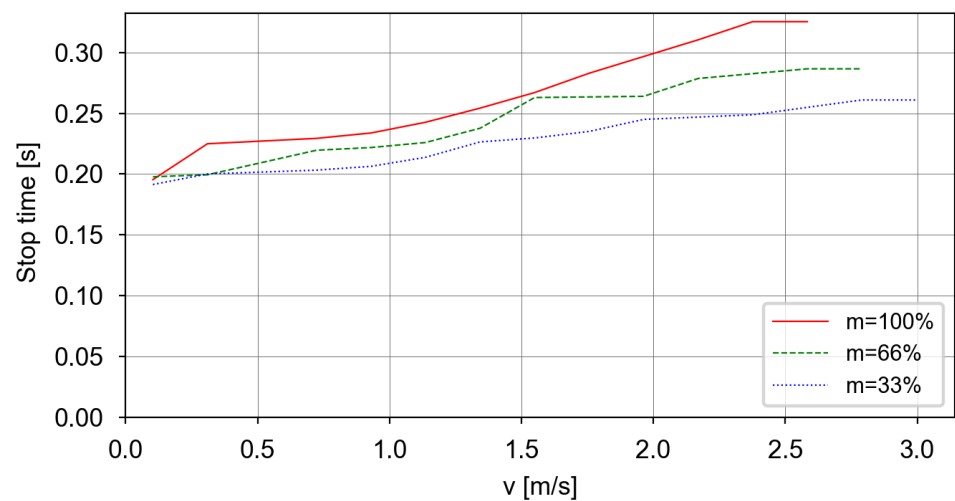
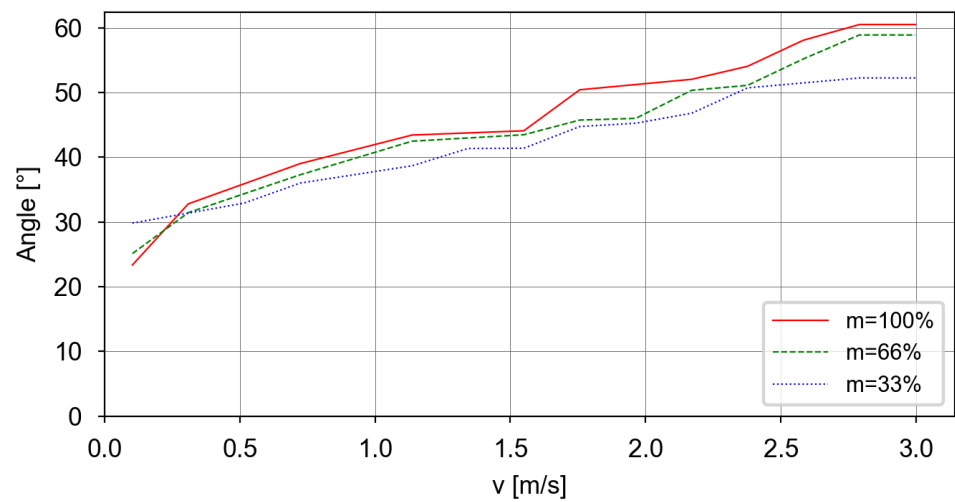
1.9.3 IRB 1090-3/0.58  
Continued

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



Continues on next page

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

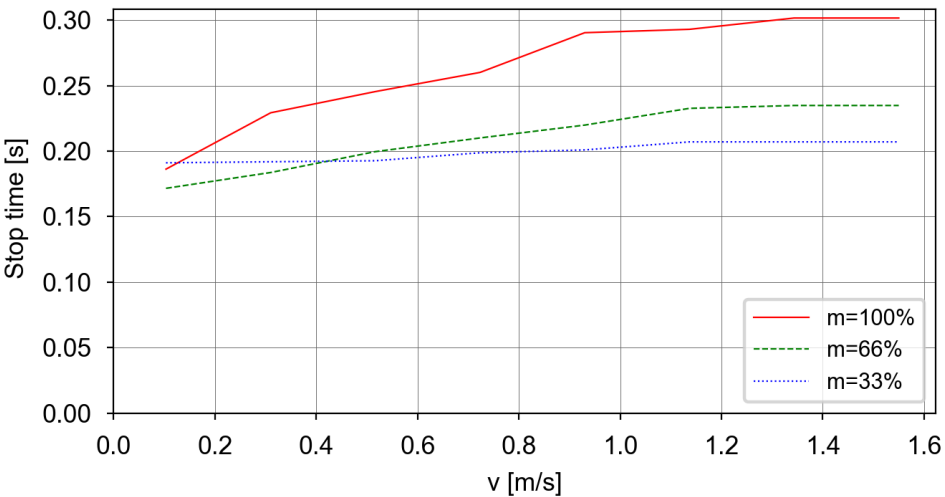
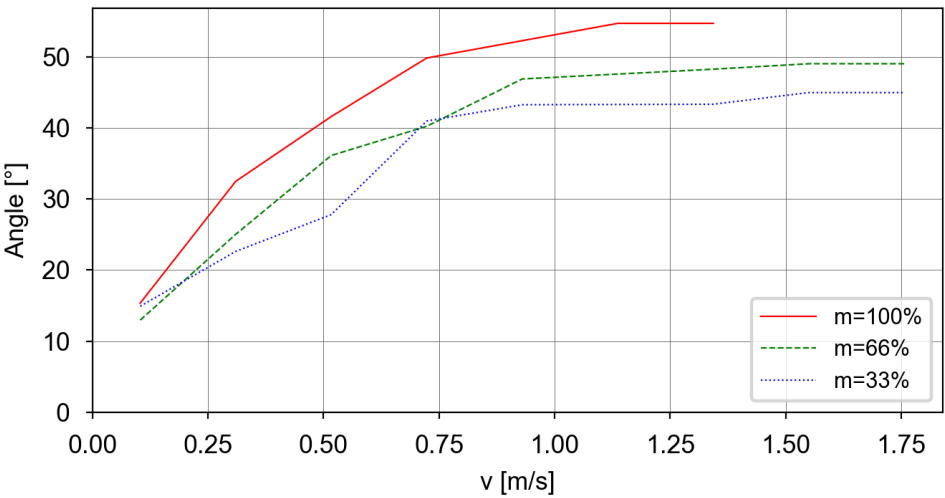


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1 Description

1.9.3 IRB 1090-3/0.58  
Continued

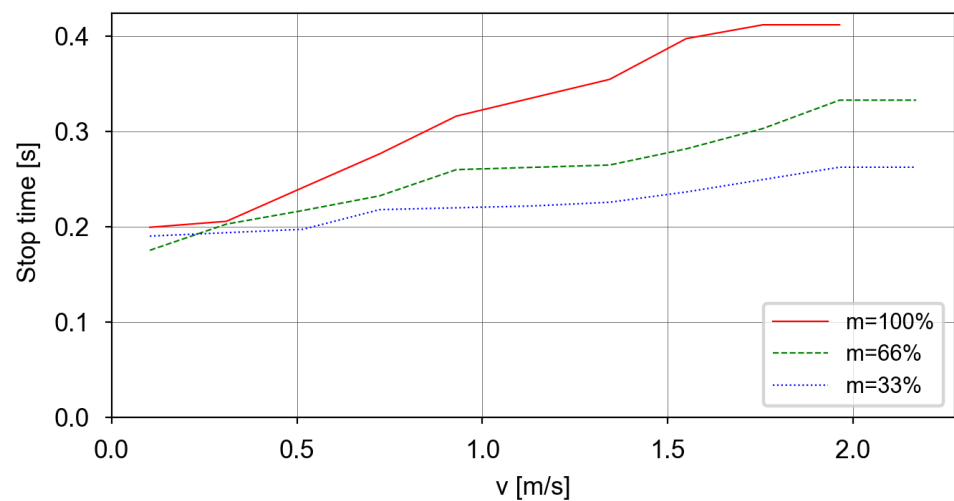
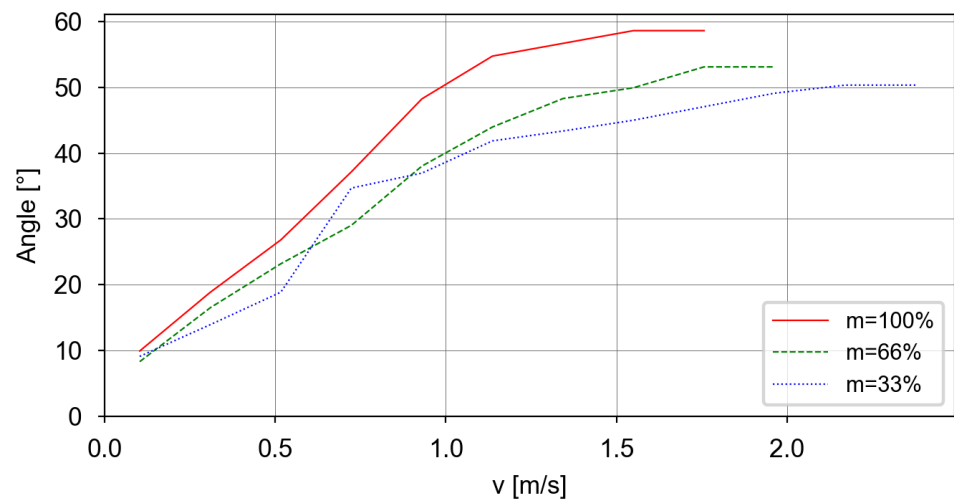
Category 1, Axis 2, Extension zone 0, stopping distance and stopping time



Continues on next page



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

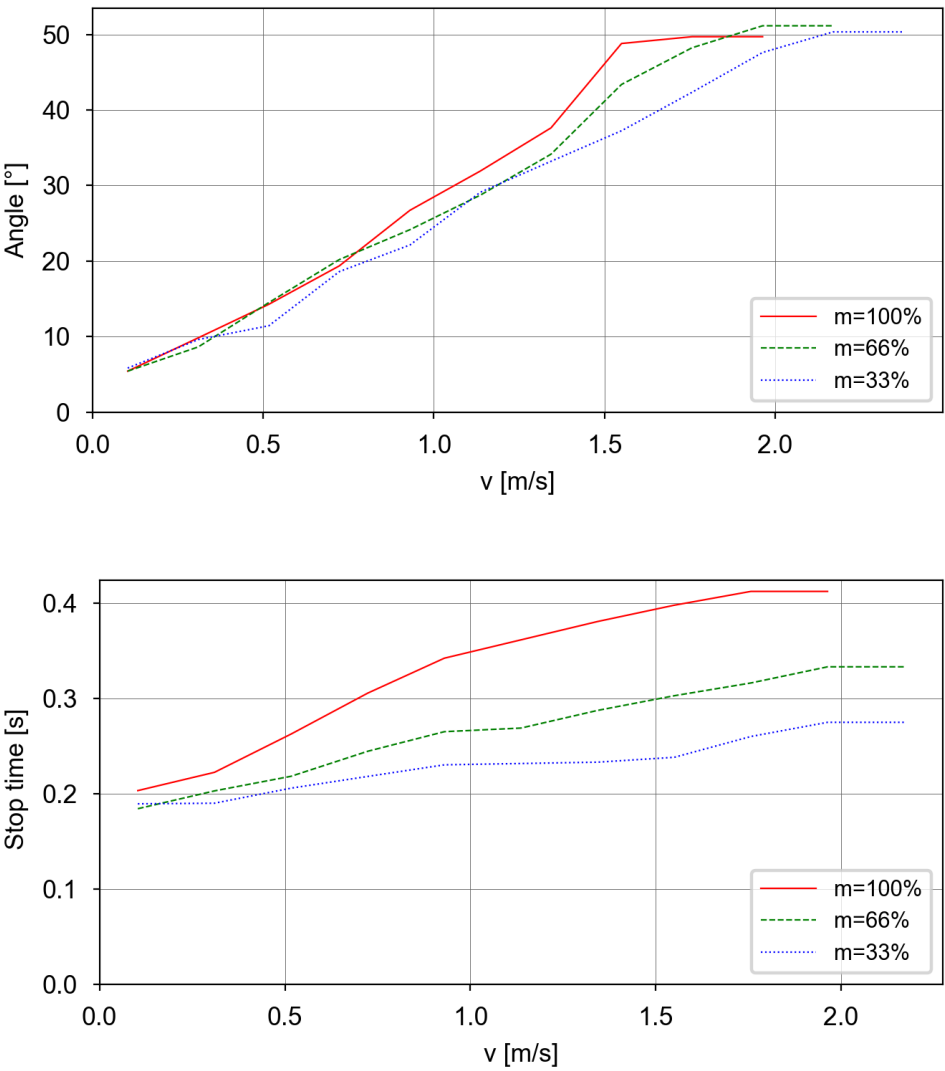


*Continues on next page*

1 Description

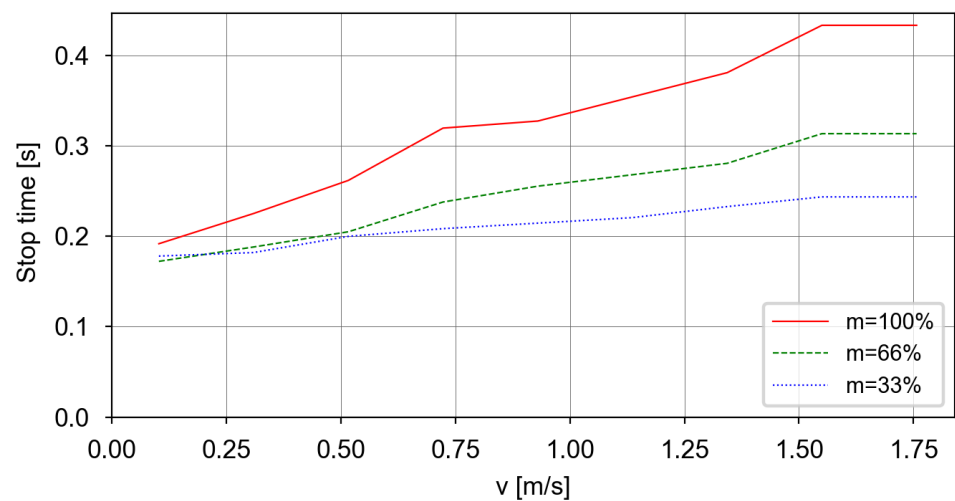
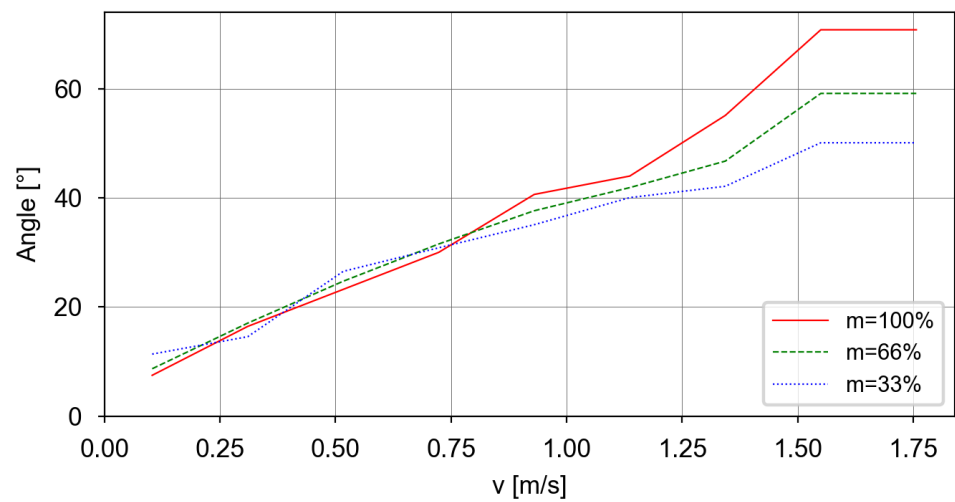
1.9.3 IRB 1090-3/0.58  
Continued

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



Continues on next page

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



# 1 Description

## 1.10 Customer connections

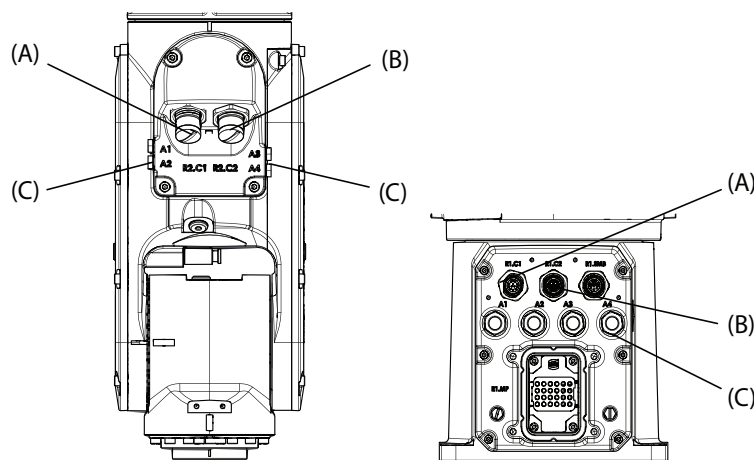
### 1.10 Customer connections

#### 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.



xx2300001047

Position	Connection	Description	Number	Value
A	(R1)R2.C1	Customer power/signal	8 wires <sup>i</sup>	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

<sup>i</sup> 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.

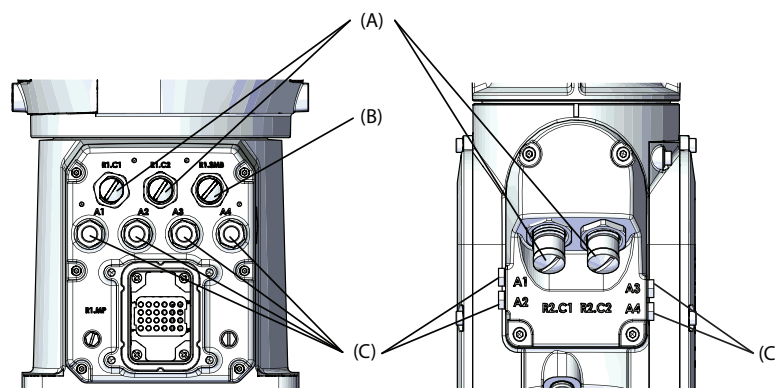
Position	Description		Art. no.
Connector kits	CP/CS	M12 CPCS Male straight connector kits	3HAC066098-001
		M12 CPCS Male angled connector kits	3HAC066099-001
	Ethernet	M12 Ethernet Cat5e Male straight connector kits	3HAC067413-001
		M12 Ethernet Cat5e Male angled connector kits	3HAC067414-001

### 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.



xx1900000132

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 Specification of variants and options

### 2.2 Manipulator

### 2.2 Manipulator

#### Manipulator color

Option	Description	RAL code <sup>i</sup>
209-202	ABB Graphite White std Standard color	RAL 7035

<sup>i</sup> 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).

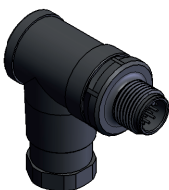
#### Connector kits manipulator

The kit consists of connectors, pins and sockets.

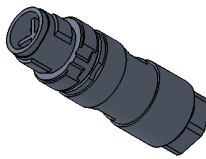
Option	Description
3304-1	Male-type, Straight arm connector kits
3305-1	Male-type, Angled arm connector kits
3306-1	Male-type, Straight arm Ethernet connector kits
3307-1	Male-type, Angled arm Ethernet connector kits



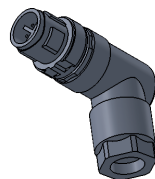
Straight connector kits



Angled connector kits



Straight Ethernet connector kits



Angled Ethernet connector kits

xx1900000140



#### 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.

*Continues on next page*



**Warranty**

For the selected period of time, ABB will provide spare parts and labor 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 with ABB Connected Services 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 <i>Customer Delivery Date</i> or latest 18 months after <i>Factory Shipment Date</i> , 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	<p>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 <i>Factory Shipment Date</i> or from activation date of standard warranty in WebConfig.</p> <div> <b>Note</b> </div> <p>Special conditions are applicable, see <i>Robotics Warranty Directives</i>.</p>

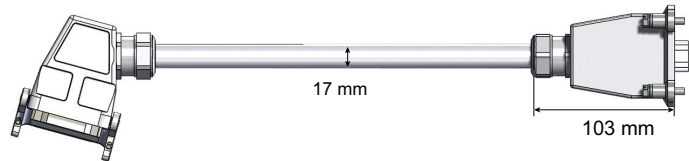
## 2 Specification of variants and options

### 2.3 Floor cables

### 2.3 Floor cables

#### Manipulator cable - Straight

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



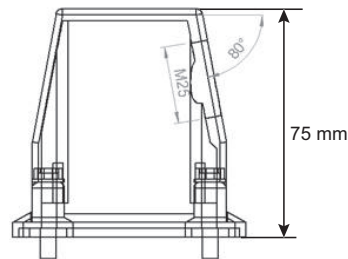
xx2100001122

#### Manipulator cable - Angled

Option	Lengths
3209-1	Angled type connector, requires option <i>Manipulator cable</i> - Length [3200-X]



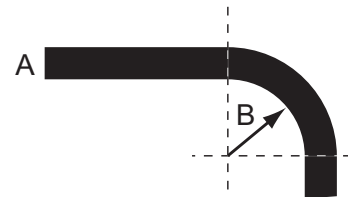
xx2100001123



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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

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A	Diameter
B	Diameter x10

**Mains cable**

Option	Lengths	Description
3203-1	EU mains cable, 3 m	Cable assembly with CEE7/VII line-side plug
3203-2	UK mains cable, 3 m	Cable assembly with BS1363 line-side plug, 5A fused
3203-5	CN mains cable, 3 m	Cable assembly with CPCS-CCC line-side plug
3203-6	AU mains cable, 3 m	Cable assembly with AS/NZS 3112 line-side
3203-7	All regions cable, 5 m	Cable assembly without line-side plug

**Tip**

The option *Mains cable* requires option *3000-105 OmniCore E10* or *3000-130 OmniCore C30*.

**Connection of parallel communication**

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

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

**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

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### General

There is a range of tools and equipment available.

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### Basic software and software options for robot and PC

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

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