ROBOTICS

Product specification

IRB 140

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Checked in 2020-12-16
Skribenta version 5.3.075

Product specification

IRB 140-6/0.8
IRB 140T-6/0.8

Document ID: 3HAC041346-001
Revision: Q

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Original instructions.

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Overview of this product specification

About this product specification

It 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 requirements
- The load diagrams, mounting of extra equipment, the motion and the robot reach
- The specification of variant and options available

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.

Users

It is intended for:

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

References

Reference	Document ID
Product specification - Controller IRC5 IRC5 with main computer DSQC1000.	*3HAC047400-001*
Product specification - Controller software IRC5 IRC5 with main computer DSQC1000 and RobotWare 5.6x.	*3HAC050945-001*
Product specification - Controller software IRC5 IRC5 with main computer DSQC1000 and RobotWare 6.	*3HAC050945-001*
Product manual - IRB 140	*3HAC027400-001*
Product specification - Robot user documentation, IRC5 with RobotWare 6	*3HAC052355-001*

Revisions

Revision	Description
-	• Replaces article numbers 3HAC9041-1, 3HAC9885-1, 3HAC10320-1, 3HAC10319-1, 3HAC10323-1, and 3HAC9041-012.
A	• Machinery directive updated • Figure of the base is updated, see *Illustration on page 19*.
B	• Info regarding attachment bolts added
C	• Minor corrections/update
D	• Values for stop distance/time IRB 140 Std. added

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Revision	Description
E	• Text for ISO test adjusted • Robot stopping distances and times for category 0 and category 1 stops are moved to a separate document, *Product specification - Robot stopping distances according to ISO 10218-1*
F	• Text for Foundry Plus updated.
G	• Minor corrections/update
H	• Minor corrections/update
J	• Illustration in section *"Robot motion/Introduction"* is change.
K	Published in release R17.1. The following updates are done in this revision: • Restriction of load diagram added.
L	Published in release R17.2. The following updates are done in this revision: • Updated list of applicable standards. • Updated inaccuracy in drawings of fastening
M	Published in release R18.1. The following updates are done in this revision: • TCP acceleration should be presented by RobotStudio.
N	Published in release R18.2. The following updates are done in this revision: • Corrected option number to 435-88 for variant IRB 140T-6/0.8.
P	Published in release 19C. The following updates are done in this revision: • Updated information about *Absolute Accuracy*. • Note added about need to calibrate if the robot is other than floor mounted.
Q	Published in release 20D. The following updates are done in this revision: • Warranty section updated.

1 Description

1.1 Structure

1.1.1 Introduction

General

IRB 140 is a 6-axis industrial robot, with a payload of 6 kg, designed specifically for manufacturing industries that use flexible robot-based automation. The robot has an open structure that is specially adapted for flexible use, and can communicate extensively with external systems.

Protection type Foundry Plus 2

Robots with the option Foundry Plus 2 are designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications.

Typical applications are spraying insertion and part extraction of die-casting machines, handling in sand casting and gravity casting, etc. (Please refer to Foundry Prime robots for washing applications or other similar applications). Special care must be taken in regard to operational and maintenance requirements for applications in foundry are as well as in other applications areas. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility for the Foundry Plus 2 protected robot.

The robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the corrosion protection additional rust preventive are applied to exposed and crucial areas, e.g. has the tool flange a special preventive coating. Although, continuous splashing of water or other similar rust formation fluids may cause rust attach on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on the mentioned.

The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against water and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus 2 features:

- Improved sealing to prevent penetration into cavities to secure IP67
- Additional protection of cabling and electronics
- Special covers that protect cavities
- Well-proven connectors
- Nickel coated tool flange
- Rust preventives on screws, washers and unpainted/machined surfaces
- Extended service and maintenance program

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1.1.1 Introduction
Continued

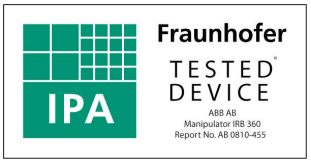
The Foundry Plus 2 robot can be cleaned with appropriate washing equipment according to the robot product manual. Appropriate cleaning and maintenance is required to maintain the protection, for example can rust preventive be washed off with wrong cleaning method.

Available robot versions

The option Foundry Plus 2 might not be available for all robot versions.

See *Specification of variants and options on page 41* for robot versions and other options not selectable together with Foundry Plus 2.

Protection type Clean Room



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The illustration above is a sample of an IPA certified lable.

Robots with the option Clean Room are classified for clean room class 6 according to ISO 14644-1.

The Clean Room robots are protected with a paint appropriate for clean room applications. The paint has been tested regarding outgassing of Volatile Organic Compounds (VOC) and been classified in accordance with ISO 14644-8.

Classification of airborne molecular contamination, see below:

Parameter				Outgassing amount		
Area (m^2)	Test duration (s)	Temperature (°C)	Performed test	Total detected (ng)	Normed based on 1 m^2 and 1s (g)	Classification in accordance with ISO 14644-8
4.5E-03	3600	23	TVOC	2848	1.7E-07	-6.8
4.5E-03	60	90	TVOC	46524	1.7E-04	-3.8

Classification results in accordance with ISO 14644-8 at different test temperatures. See *Specification of variants and options on page 41* for options that are not selectable together with the option Clean Room.

Operating system

The robot is equipped with the IRC5 controller and robot control software, RobotWare. RobotWare supports every aspect of the robot system, such as motion control, development and execution of application programs, communication etc. See *Product specification - Controller software IRC5*, and *Product specification - Controller IRC5 with FlexPendant*.

Safety

Safety standards valid for complete robot, manipulator and controller.

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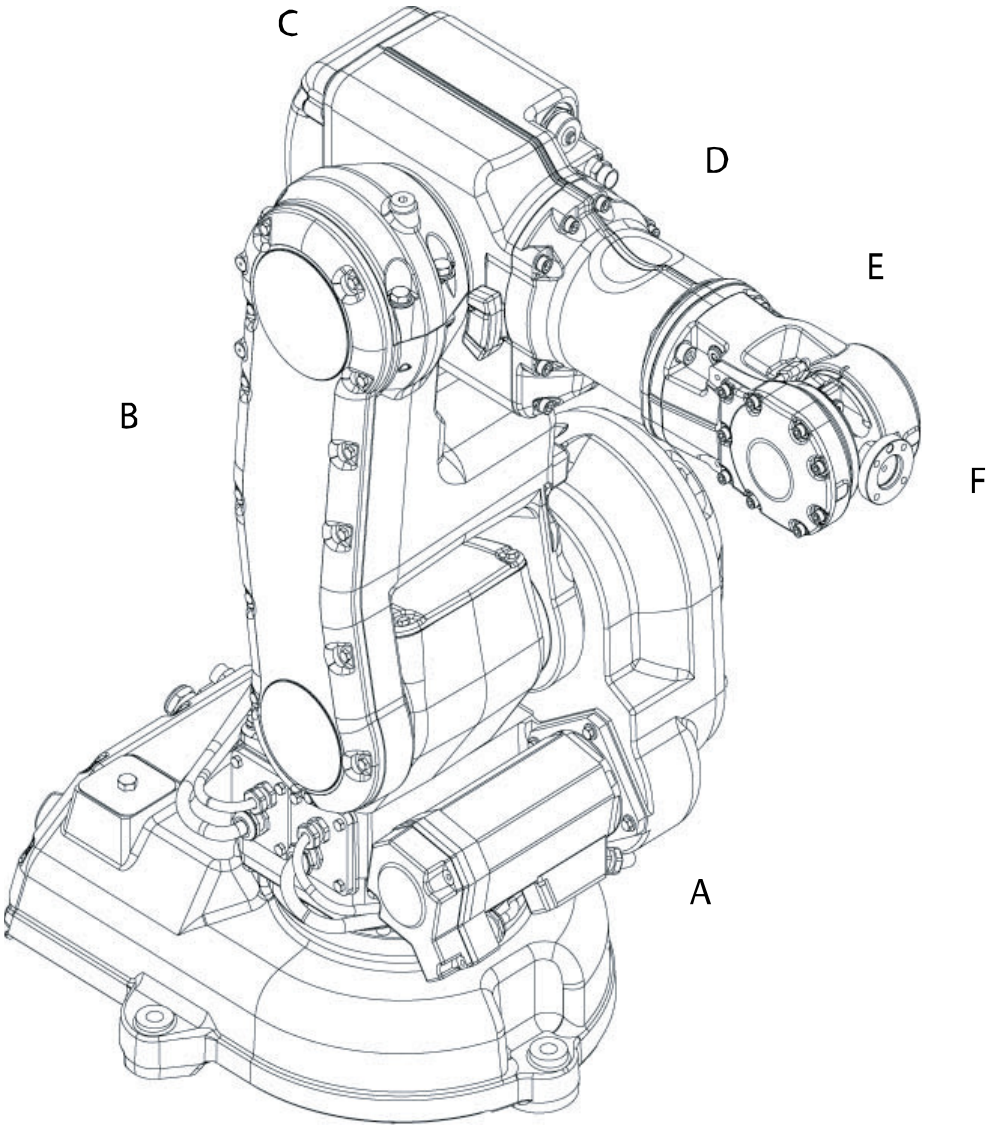
Additional functionality

For additional functionality, the robot can be equipped with optional software for application support - for example gluing and welding, communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software. See *Product specification - Controller software IRC5*.

Manipulator axes



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Position	Description	Position	Description
A	Axis 1	B	Axis 2
C	Axis 3	D	Axis 4
E	Axis 5	F	Axis 6

1.1.2 Different robot versions

General

The IRB 140-6/0.8 is available in two versions and all can be mounted on floor, inverted or on wall in any angle (tilted around X or Y axis). The high speed variant, IRB 140T, provides further reduced cycle time:

Robot type	Handling capacity (kg)	Reach (m)
IRB 140	6 kg	0.8 m
IRB 140T	6 kg	0.8 m

Manipulator weight

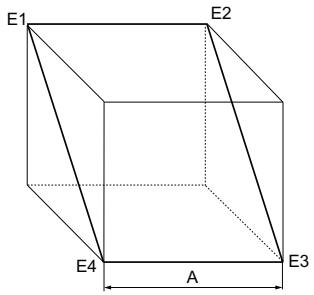
Data	Description
Manipulator	98 kg (excluding the cables to the controller)

Other technical data

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

Power consumption

Speed (mm/s)	Power consumption (kW)
Max.	0.44
1000	0.39
500	0.36
100	0.34



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Position	Description
A	250 mm

Path E-E2-E3-E4 in the ISO Cube, maximum load.

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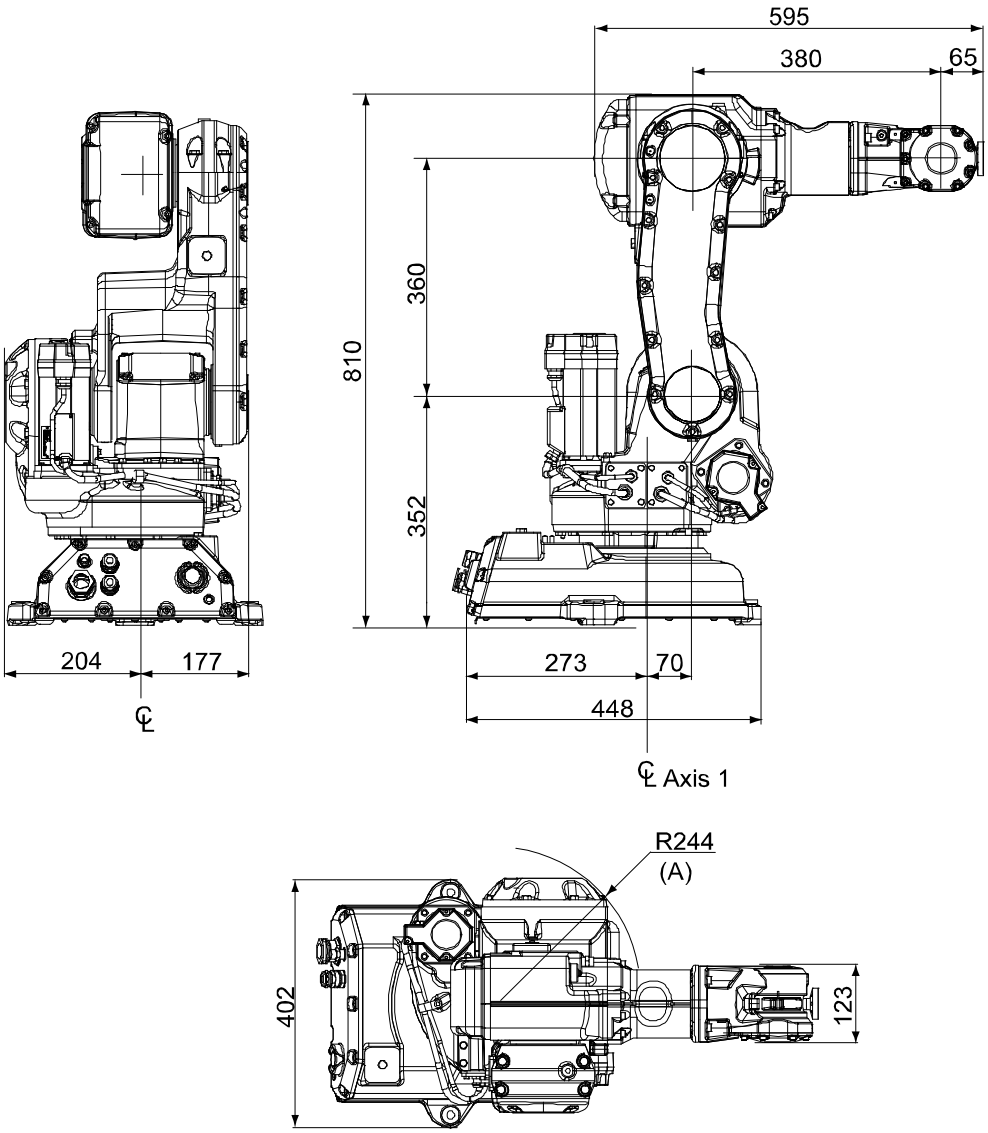
Dimensions IRB 140



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Pos	Description
A	Minimum turning radius

1.2 Standards

1.2.1 Applicable standards

Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

The product is designed in accordance with EN ISO 10218-1, Robots for industrial environments - Safety requirements -Part 1 Robot. If there are deviations, these are listed in the declaration of incorporation which is included on delivery.

Standards, EN ISO

The product is designed in accordance with selected parts of:

Standard	Description
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
ISO 9283:1998	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1:2015 [i]	Classification of air cleanliness
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
EN 61000-6-4:2007 + A1:2011 IEC 61000-6-4:2006 + A1:2010 (option 129-1)	EMC, Generic emission
EN 61000-6-2:2005 IEC 61000-6-2:2005	EMC, Generic immunity
EN IEC 60974-1:2012 [ii]	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10:2014 [ii]	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1:2016	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

i Only robots with protection Clean Room.
ii Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

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European standards

The product is designed in accordance with selected parts of:

Standard	Description
EN 614-1:2006 + A1:2009	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574:1996 + A1:2008	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

UL, ANSI, and other standards

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 434-14	Industrial robots and robot Systems - General safety requirements

1.3 Installation

1.3.1 Introduction

General

IRB 140 is available in four different environmental adapted variants, one for normal industrial environment, one for foundry, one for other harsh environments, and one for clean room environments. An end effector, weighing a maximum of 6 kg, including payload, can be mounted on the robot's mounting flange (axis 6). Other equipment, weighing a maximum of 1.5 kg, can be mounted on the upper arm.

For more information about mounting of extra equipment, see Figure in *Holes for mounting of extra equipment on page 26*.

1.3.2 Operating requirements

General

Robot version/ Protection standard	IEC60529
All variants, manipulator	IP67

Steam washable

The Foundry Plus and SteamWash versions are steam washable.

Clean room standards

Clean room manipulator ISO 14644-1 class 6.

Explosive environments

The robot must not be located or operated in an explosive environment.

Ambient temperature

Description	Standard/Option	Temperature
Manipulator during operation	Standard	+ 5°C [i] (41°F) to + 45°C (113°F)
For the controller	Standard/Option	See Product specification - Controller IRC5 with FlexPendant
Complete robot during transportation and storage	Standard	- 25°C (-13°F) to + 55°C (131°F)
For short periods (not exceeding 24 hours)	Standard	up to + 70°C (158°F)

[i] At low environmental temperature < 10° C is, as with any other machine, a warm-up phase recommended to be run with the robot. Otherwise there is a risk that the robot stops or run with lower performance due to temperature dependent oil and grease viscosity.

Relative humidity

Description	Relative humidity
Complete robot during transportation and storage	Max. 95% at constant temperature
Complete robot during operation	Max. 95% at constant temperature

Mounting the manipulator

Maximum load in relation to the base coordinate system. See figures below:

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1020 N	± 2000 N
Force z	- 1000 ± 620 N	- 1000 ± 1250 N
Torque xy	± 700 Nm	± 1500 Nm
Torque z	± 250 Nm	± 470 Nm

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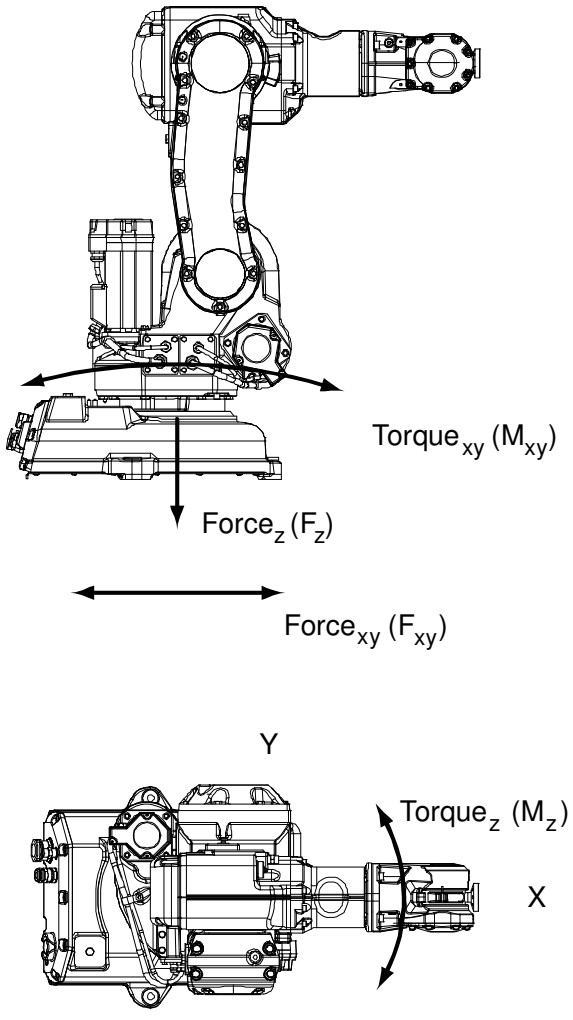
1.3.2 Operating requirements
Continued

Wall Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1750 N	± 2800 N
Force z	± 850 N	± 1600 N
Torque xy	± 1020 Nm	± 1710 Nm
Torque z	± 250 Nm	± 485 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1020 N	± 2000 N
Force z	+ 1000 ± 620 N	+ 1000 ± 1250 N
Torque xy	± 700 Nm	± 1500 Nm
Torque z	± 250 Nm	± 470 Nm



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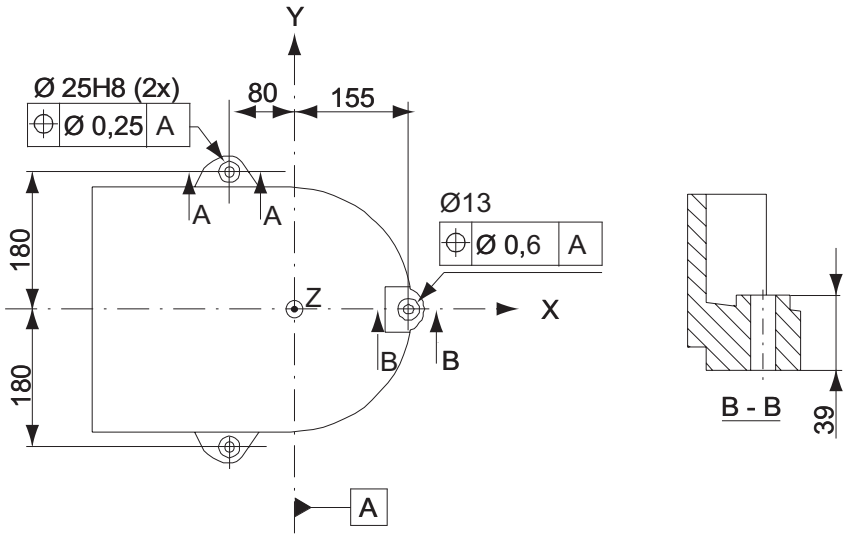
Note regarding M_{xy} and F_{xy}

The bending torque (M_{xy}) can occur in any direction in the XY-plane of the base coordinate system.

The same applies to the transverse force (F_{xy}).

Illustration



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1.3.2 Operating requirements
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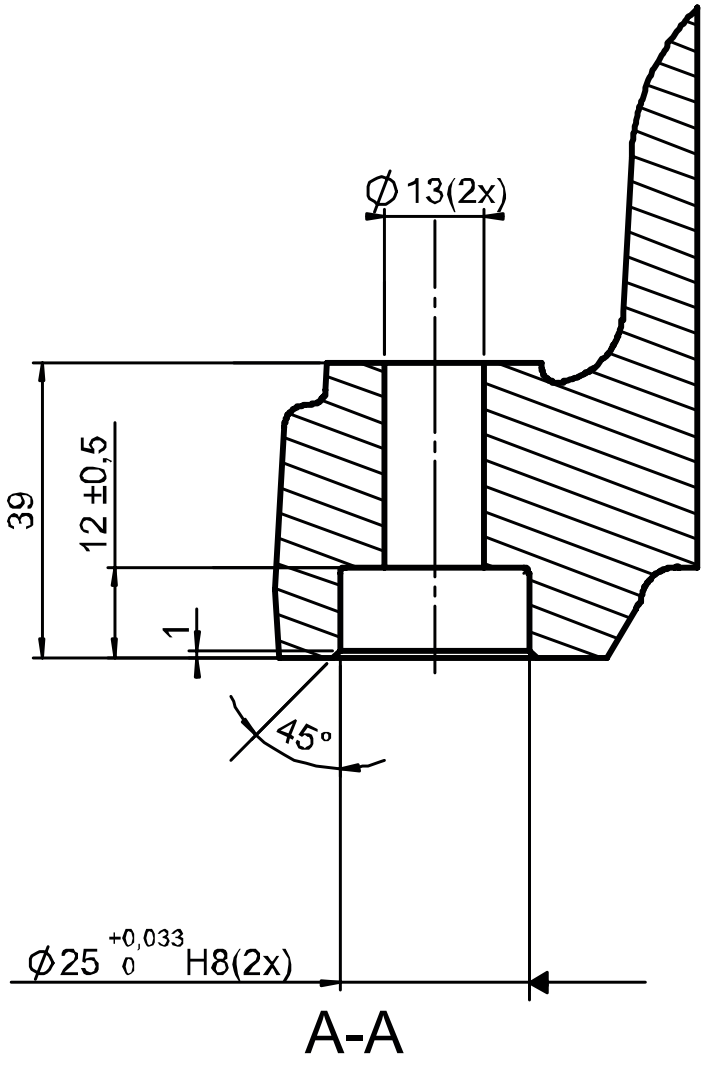

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Attachment bolts, specification

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

Specification	Description
Suitable screws, lightly lubricated:	M12
Quality	8.8
Suitable washers:	Thickness: 2.5 mm Outer diameter: 24 mm Inner diameter: 13.4 mm
Tightening torque:	85 Nm

Note

When the robot is to be mounted in a tilted or a suspended position, the guide sleeves must be used to secure the bolted joint.

1.4 Load diagram

1.4.1 Introduction

Information

WARNING

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

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

- motors
- gearboxes
- mechanical structure

WARNING

In the robot system there is a service routine called *LoadIdentify* available, which allows the user to make an automatic definition of the tool and load, to determine correct load parameters. See *Operating manual - IRC5 with FlexPendant*.

WARNING

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

General

The load diagram includes a nominal pay load inertia, J_0 of 0.012 kgm^2. 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 by "RobotLoad"

To easily control a specific load case, use the calculation program ABB RobotLoad. Contact your local ABB organization for more information.

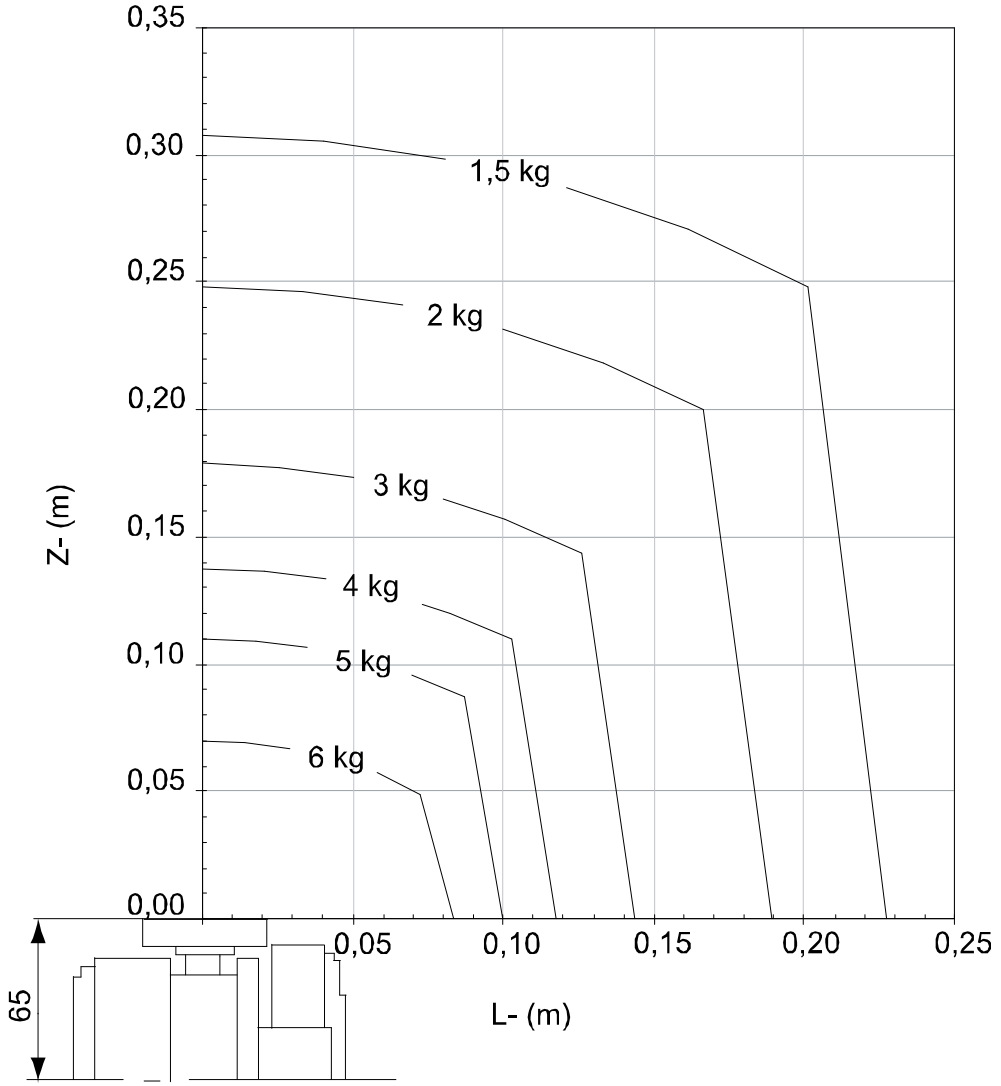
The result from RobotLoad is only valid within the maximum loads and tilt angles. There is no warning if the maximum permitted armload is exceeded. For over load cases and special applications, contact ABB for further analysis.

1.4.2 Diagrams

Introduction

The robot is optimized for the rated load according to the load diagram and rated moment of inertia. These have been used in the performance tests. The maximum allowed load and moment of inertia are received from the formulas in the table below Figure below.

IRB 140-6/0.8



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	Description
Z	See the above diagram and the coordinate system in the Product specification - IRC5 with FlexPendant
L	Distance in X-Y plane from Z-axis to the center of gravity
J_0	Rated own moment of inertia on the total handle weight = 0.012 kgm^2

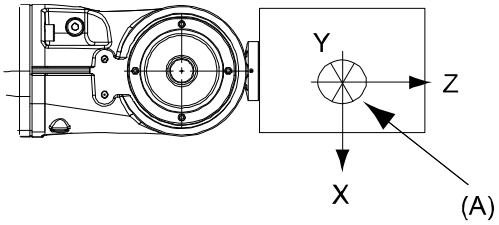
1.4.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

General

Total load given as: Mass in kg, center of gravity (Z and L) in m and moment of inertia (J_{ox}, J_{oy}, J_{ox}) in kgm^2. L= ÷(X2 + Y2), see Figure below.

Full movement of Axis 5 (±115º)

Axis	Robot Type	Max. value
5	IRB 140(T)-6/0.8	J_5 = Mass x $((Z + 0.065)^2 + L^2)$ + max (J_{ox}, J_{oy}) ≤ 0.42 kgm^2
6	IRB 140(T)-6/0.8	J_6= Mass x L2 + J_{0Z} ≤ 0.30 kgm^2



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Pos	Description
A	Center of gravity

	Description
Jox, Joy, Joz	Max. moment of inertia around the X, Y and Z axes at center of gravity.

Wrist torque

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

Note

The 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. Also arm loads will influence the permitted load diagram. For finding the absolute limits of the load diagram, please use the ABB RobotLoad. Please contact your local ABB organization.

Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 140(T)-6/0.8	8.58 Nm	4.91 Nm	5 kg

1.4.4 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 then to use RobotStudio.

Maximum Cartesian design acceleration for nominal loads

Robot type	E-stop Max acceleration at nominal load COG [m/s^2]	Controlled Motion Max acceleration at nominal load COG [m/s^2]
IRB 140T	110	57

Note

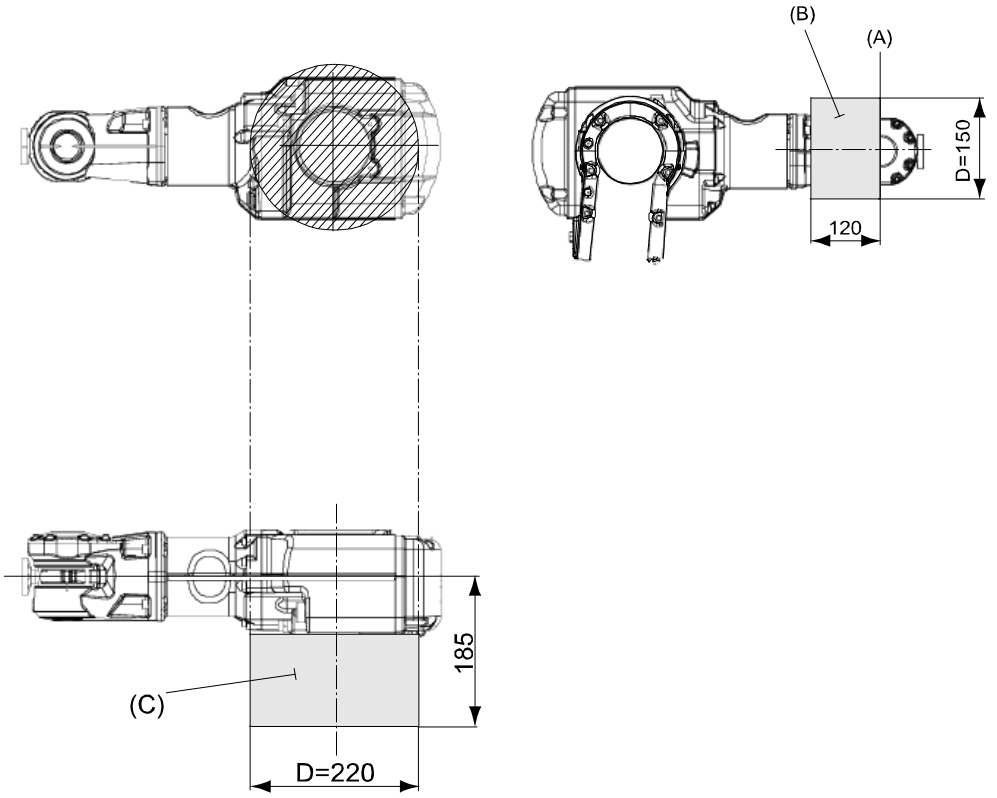
Acceleration levels for E-stop and controlled motion includes acceleration due to gravitational forces. Nominal load is define with nominal mass and cog with max offset in Z and L (see load diagram).

1.5 Mounting of equipment

1.5.1 Introduction

General

Extra loads can be mounted on to the wrist and on to the upper arm housing. Definitions of load areas and permitted load are shown in Figure below. The center of gravity of the extra load shall be within the marked load areas. The robot is supplied with holes for mounting of extra equipment.



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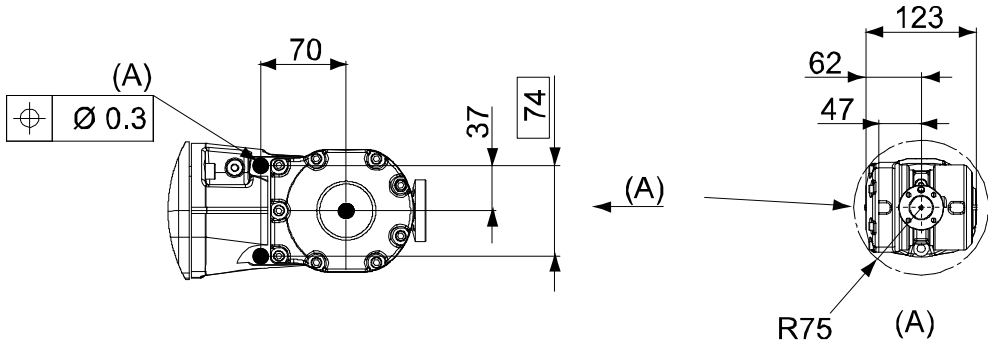
Position	Description
A	Center line of Axis 5
B	Maximum 0.5 kg when 1.0 kg on to the upper arm house 0 kg when 1.5 kg on to the upper arm house
C	Maximum 1 kg when 0.5 kg on to the wrist 1.5 kg when 0 kg on to the wrist

1.5.2 Holes for mounting of extra equipment

Wrist design IRB 140 IRC5



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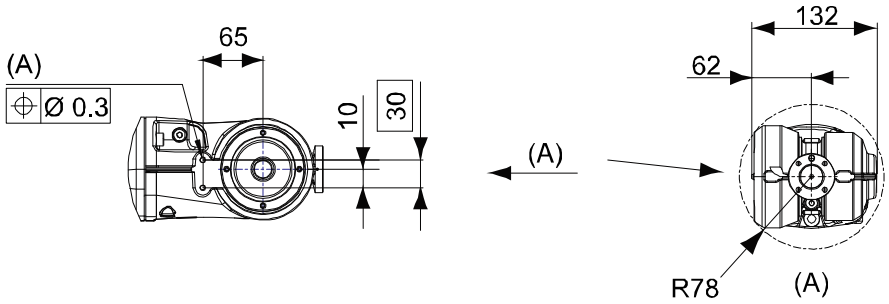
Wrist design IRB 140 IRC5, Type C



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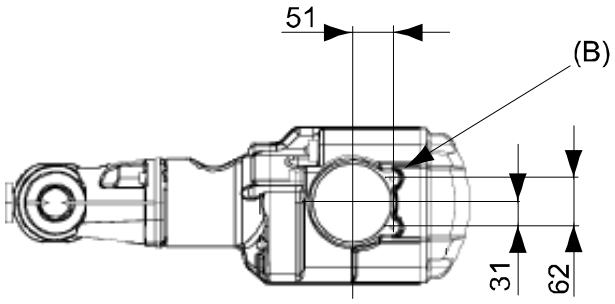
Upper arm housing



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Position	Description
A	Design until September 2006: 2x M5 depth 7.5, Mounting holes for equipment. Design after September 2006, Type C: 2x M6 depth 10, Mounting holes for equipment.
B	2x M5 depth 7.5, Mounting holes for equipment.

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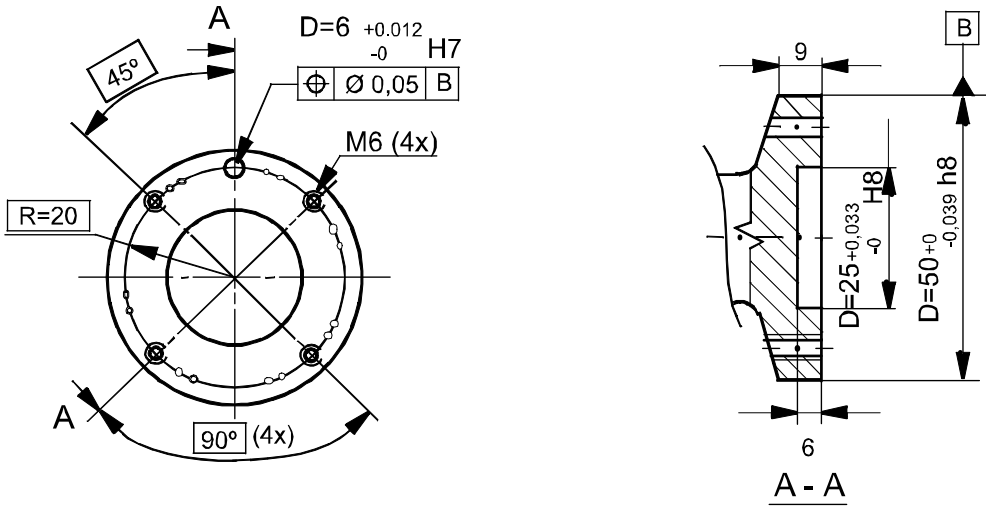
Robot tool flange



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1.6 Calibration and references

1.6.1 Calibration methods

Overview

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

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

More information is available in the product manual.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot. For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.	Calibration Pendulum Levelmeter calibration (alternative method)
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the SMB (serial measurement board) in the robot. For robots with RobotWare 5.05 or older, the absolute accuracy calibration data is delivered in a file, absacc.cfg, supplied with the robot at delivery. The file replaces the calib.cfg file and identifies motor positions as well as absolute accuracy compensation parameters. A robot calibrated with Absolute accuracy has a sticker next to the identification plate of the robot. To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.  xx0400001197	CalibWare

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Type of calibration	Description	Calibration method
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.	Wrist Optimization

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of all ABB robots (except IRB 6400R, IRB 640, IRB 1400H, and IRB 4400S).

Two different routines are available for the Calibration Pendulum method:

- Calibration Pendulum II
- Reference calibration

The calibration equipment for Calibration Pendulum is delivered as a complete toolkit, including the *Operating manual - Calibration Pendulum*, which describes the method and the different routines further.

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 following routines are available for the Wrist Optimization method:

- Wrist Optimization

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.

CalibWare - Absolute Accuracy calibration

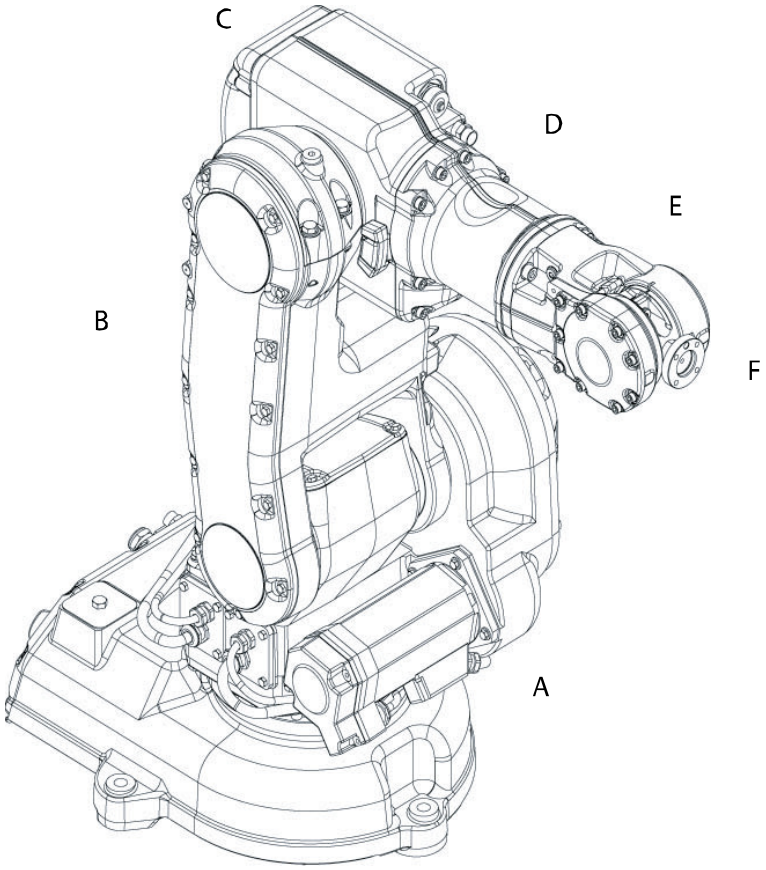
The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

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.

1.6.2 Fine calibration

General

Fine calibration is made using the Calibration Pendulum, see *Operating manual - Calibration Pendulum*.



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Pos	Description	Pos	Description
A	Axis 1	B	Axis 2
C	Axis 3	D	Axis 4
E	Axis 5	F	Axis 6

Calibration

Calibration	Position
Calibration of all axes	All axes are in zero position
Calibration of axis 1 and 2	Axis 1 and 2 in zero position
	Axis 3 to 6 in any position
Calibration of axis 1	Axis 1 in zero position
	Axis 2 to 6 in any position

1.6.3 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.

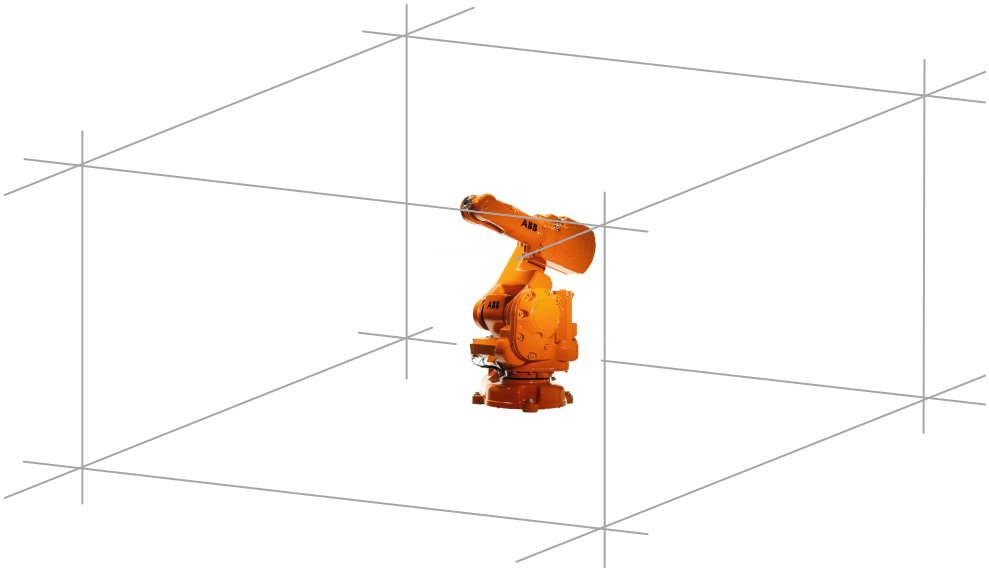
Here are some examples of when this accuracy is important:

- 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.



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What is included

Every *Absolute Accuracy* robot is delivered with:

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

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1.6.3 Absolute Accuracy calibration
Continued

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

Absolute Accuracy supports both floor mounted and inverted installations. The compensation parameters differ depending on if the robot is floor mounted or inverted.

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
- 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 140(T)-6/0.8	0.35	0.75	100

1.7 Maintenance and troubleshooting

1.7.1 Introduction

General

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

- Maintenance-free AC motors are used.
- Oil is used for all gear boxes.
- The cabling is routed for longevity, and in the unlikely event of a failure, its modular design makes it easy to change.
- It has a program memory “battery low” alarm.

Maintenance

The maintenance intervals depend on the use of the robot, the required maintenance activities also depends on selected options. For detailed information on maintenance procedures, see Maintenance section in the Product Manual.

1.8 Robot motion

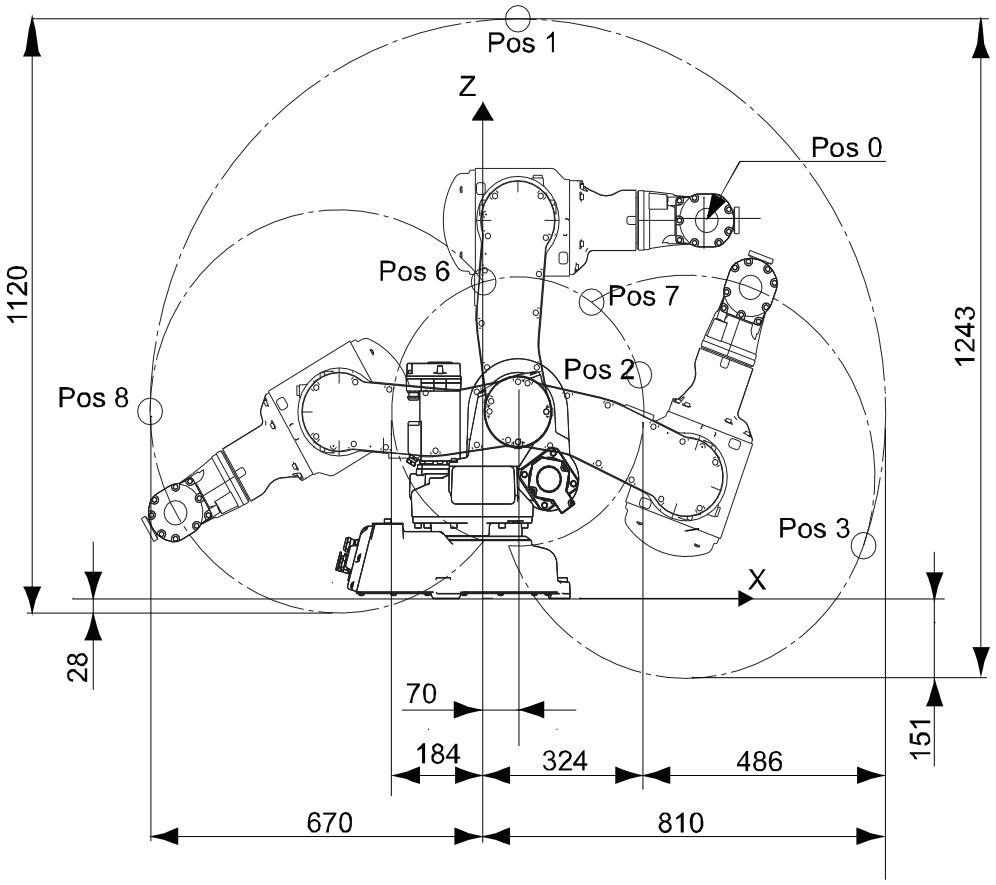
1.8.1 Introduction

General

Type of motion	Range of movement
Axis 1: Rotation motion	+ 180° to - 180°
Axis 2: Arm motion	+ 110° to - 90°
Axis 3: Arm motion	+ 50° to - 230°
Axis 4: Wrist motion	+ 200° to - 200° Default + 165 revolutions to - 165 revolutions Max. i
Axis 5: Bend motion	+ 115° to - 115°
Axis 6: Turn motion	+ 400° to - 400° Default + 163 revolutions to -163 revolutions Max. *i*

i The default working range for axis 4 and axis 6 can be extended by changing parameter values in the software.

Option 610-1 *Independent axis* can be used for resetting the revolution counter after the axis has been rotated (no need for “rewinding” the axis).



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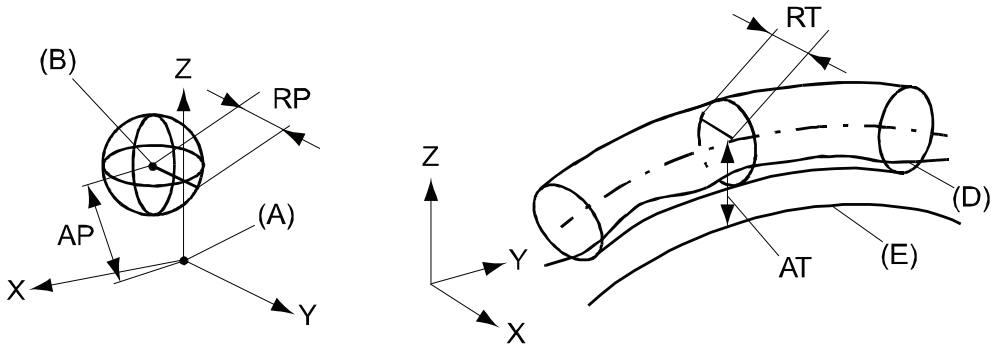
Position (see Figure 12)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
0	450	712	0	0
1	70	1092	0	-90
2	314	421	0	+50
3	765	99	110	-90
6	1	596	-90	+50
7	218	558	110	-230
8	-670	352	-90	-90

1.8.2 Performance according to ISO 9283

General

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

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



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Position	Description	Position	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

Description	Values
IRB	**140-6/0.8 and 140T-6/0.8**
Pose repeatability, RP (mm)	0.03
Pose accuracy, AP[i] (mm)	0.02
Linear path repeatability, RT (mm)	0.08
Linear path accuracy, AT (mm)	0.67
Pose stabilization time, Pst (s) within 0.2 mm of the position	0.08

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.

The above values are the range of average test-results from a number of robots.

Continues on next page

Typical values for conveyor tracking

All values measured with PickMaster and IRC5.

Constant conveyor speed (mm/s)	Repeatability (mm)
100	0.4
300	0.7

Start/stop conveyor (mm/s)	Repeatability (mm)
300 (start/stop in 0.5 sec.)	0.7

1.8.3 Velocity

3-phase power supply

Axis No.	IRB 140-6/0.8	IRB 140T-6/0.8
1	200°/s	250°/s
2	200°/s	250°/s
3	260°/s	260°/s
4	360°/s	360°/s
5	360°/s	360°/s
6	450°/s	450°/s

1-phase power supply

When the robot uses a single phase power supply, like with IRC5 Compact controller, the performance regarding max axis speed is reduced, see table below. The reduced top speed can be increased if the power supply minimum voltage is higher than the default setting 187 V (220x0.85). See the system parameter *Mains tolerance min*, in *Technical reference manual - System parameters*.

Note that the robot acceleration is not affected by the single phase power supply. Thus the cycle time may not be affected at all. RobotStudio can be used to test the cycle. The parameter *Mains tolerance min* can also be modified in RobotStudio.

Axis No.	IRB 140-6/0.8	IRB 140T-6/0.8
1	200°/s	229°/s
2	200°/s	228°/s
3	245°/s	245°/s
4	348°/s	348°/s
5	360°/s	360°/s
6	450°/s	450°/s

Resolution

Approximately 0.01° on each axis.

1.8.4 Robot stopping distances and times

Introduction

The stopping distances and times for category 0 and category 1 stops, as required by EN ISO 10218-1 Annex B, are listed in *Product specification - Robot stopping distances according to ISO 10218-1* (*3HAC048645-001*).

1.8.5 Signals

Signal connections on robot arm

To connect extra equipment on the manipulator, there are cables integrated into the manipulator's cabling from the controller to the upper arm housing.

In the controller, the signals are connected to 12-pole terminals, Phoenix MSTB 2.5/12-ST-5.08, and on the upper arm housing to FCI UT07 14 12SH44N.

Hose for compressed air is also integrated into the manipulator. There is an inlet (R1/4") at the base and an outlet (R1/4") on the upper arm housing.

Description	Number	Values
Signals	12	49 V, 500 mA
Air	1	Max. 8 bar, inner hose diameter 6.5 mm

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 140 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

Variants

Option	Variant	Robots
435-87	Standard performance variant	IRB 140-6/0.8
435-88	High speed variant	IRB 140T-6/0.8

Manipulator color

Option	Description	Note
209-1	ABB Orange standard	
209-2	ABB White standard	
209-202	ABB Graphite White standard	Standard color
209-4--192	The manipulator is painted with the chosen RAL-color	

Note

Notice that delivery time for painted spare parts will increase for none standard colors.

Protection types

Option	Protection type	Note
287-4	Standard	IP 67
287-3	Foundry Plus 2	See *Protection type Foundry Plus 2 on page 9* for a complete description of protection type Foundry Plus 2.
287-1	Clean Room	Robot with protection type Clean Room fulfil class 6 according to ISO 14644-1. See *Protection type Clean Room on page 10* for a complete description of protection type Clean Room. The robot is labeled with "Clean Room".
287-5	SteamWash	Robot with the same protection as in option 287-3 Foundry Plus 2.

Connector kit

Option	Description
431-1	Detached connectors, suitable to the connectors on the upper arm. The kit consists of connectors, pins and sockets.

Continues on next page

Safety lamp

Option	Description
213-1	Safety lamp A safety lamp with an orange fixed light can be mounted on the manipulator. The lamp is active in MOTORS ON mode. The safety lamp is required on a UL/UR approved robot.

Warranty

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

Note

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

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.

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

2.3 Floor cables

Manipulator cable length

Option	Lengths
210-1	3 m
210-2	7 m
210-3	15 m
210-4	22 m
210-5	30 m

2.4 Process

Process module

Option	Type	Description
768-1	Empty cabinet small	*Product specification - Controller IRC5*
768-2	Empty cabinet large	*Product specification - Controller IRC5*
715-1	Installation kit	*Product specification - Controller IRC5*

2.5 User documentation

User documentation

The user documentation describes the robot in detail, including service and safety instructions.

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

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3 Accessories

3.1 Introduction to 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 - Controller IRC5* and *Application manual - Controller software IRC5*.

Robot peripherals

- Motor Units[1]

[1] Not applicable for IRC5 Compact controller.

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