ABB Robotics

Product specification
IRB 120

Power and productivity
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Trace back information:
Workspace R13-1 version a11
Checked in 2013-04-15
Skribenta version 4.0.006

Product specification

IRB 120-3/0.6
IRB 120T-3/0.6

Document ID: 3HAC035960-001
Revision: H

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ABB AB
Robotics Products
SE-721 68 Västerås
Sweden

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Overview

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 variants 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

Contents

Please see Table of Contents on page 3.

References

Reference	Document ID
Product specification - Controller software IRC5	*3HAC022349-001*
Product specification - Controller IRC5 with FlexPendant	*3HAC041344-001*
Product specification - Robot user documentation	*3HAC024534-001*
Product manual - IRB 120	*3HAC035728-001*

Revisions

Revision	Description
-	New product specification
A	Options 431-1 and 239-1 added
B	Standards updated, minor corrections
C	Size of washer for mounting the manipulator adjusted
D	Table for ambient temperature is adjusted
E	• Clean Room option added • Machinery directive updated
F	• New robot variant added • General corrections

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Continued

Revision	Description
G	• Added data for extended range of movement of axis 6. • Changed the illustration that shows the mounting surface of the tool flange.
H	• Minor corrections/update

1 Description

1.1 Structure

1.1.1 Introduction to structure

General

The IRB 120 is one of ABB Robotics latest generation of 6-axis industrial robot, with a payload of 3 kg, designed specifically for manufacturing industries that use flexible robot-based automation, e.g. 3C industriy. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems.

Clean room robots

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Particle emission from the robot fulfill Clean room class 5 standard according to DIN EN ISO 14644-1.

Clean room robots are specially designed to work in a clean room environment.

According to IPA test result:

The robot IRB120 is suitable for use in cleanrooms fulfilling the Air Cleanliness Class 5 according to ISO 14644-1, when operated at a capacity of 50%.

The robot IRB120 is suitable for use in cleanrooms fulfilling the Air Cleanliness Class 4 according to ISO 14644-1, when operated at a capacity of 100%.

Clean room robots are designed in order to prevent from particle emission from the robot. For example is, frequent maintenance work possible to perform without cracking the paint. The robot is painted with four layers of polyurethane paint. The last layer being a varnish over labels in order to simlify cleaning. 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)	Temp (°C)	Performed test	Total detected (ng)	Normed based on $1m^2$ and 1s(g)	Classification in accordance to 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.

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1.1.1 Introduction to structure

Continued

Operating system

The robot is equipped with the IRC5C or IRC5 (Single cabinet) 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 IRC5 with FlexPendant (IRC5C included).

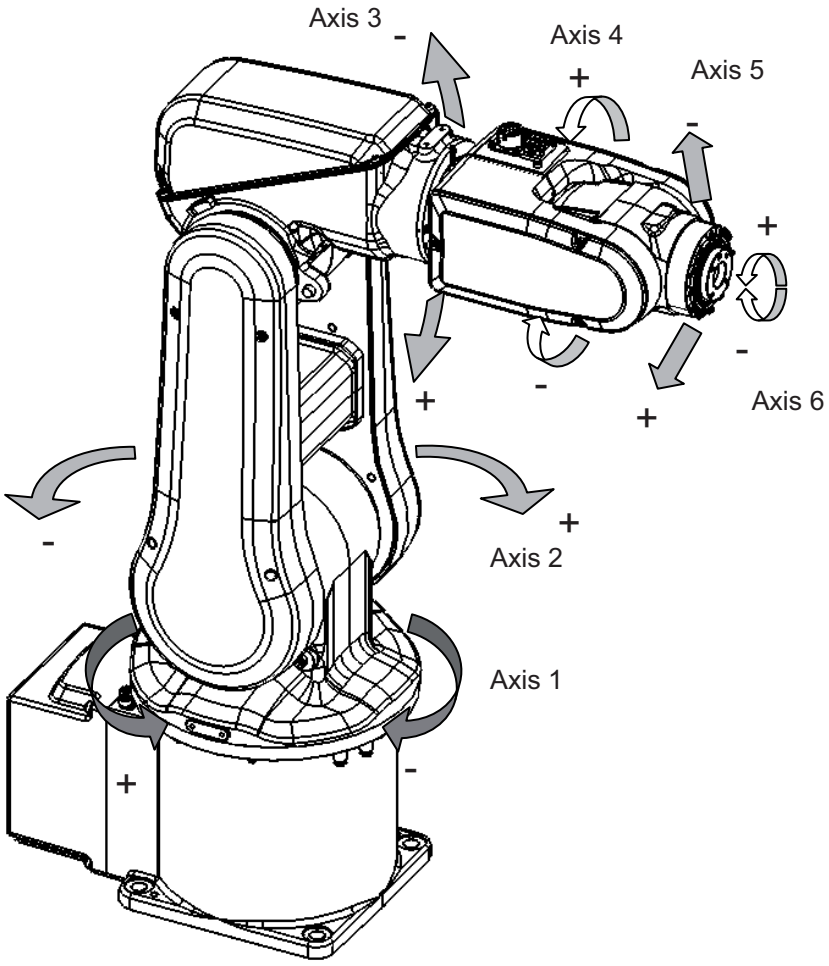
Safety

Safety standards valid for complete robot, manipulator and controller.

Additional functionality

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

Manipulator axes



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1.1.2 The Robot

General

The IRB 120-3/0.6 is available in two versions and both can be mounted on floor, inverted or on wall in any angle. The high speed variant, IRB 120T, provides further reduced cycle time.

Robot type	Handling capacity (kg)	Reach (m)
IRB 120	3 kg	0.58 m
IRB 120T	3 kg	0.58 m

Manipulator weight

Data	Weight
IRB 120(T)-3/0.6	25 kg

Other technical data

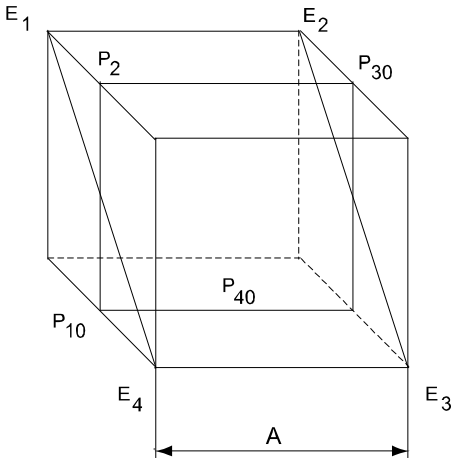
Data	Description	Note
Airborne noise level	The sound pressure level outside	< 70 dB (A) Leq (acc. to the working space Machinery directive 2006/42/EG)

Power consumption

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

Type of movement	Power consumption (kW)
ISO Cube Max. velocity	0.24 kW

Robot in 0 degree position	IRB 120
Brakes engaged	0.095 kW
Brakes disengaged	0.173 kW



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1.1.2 The Robot

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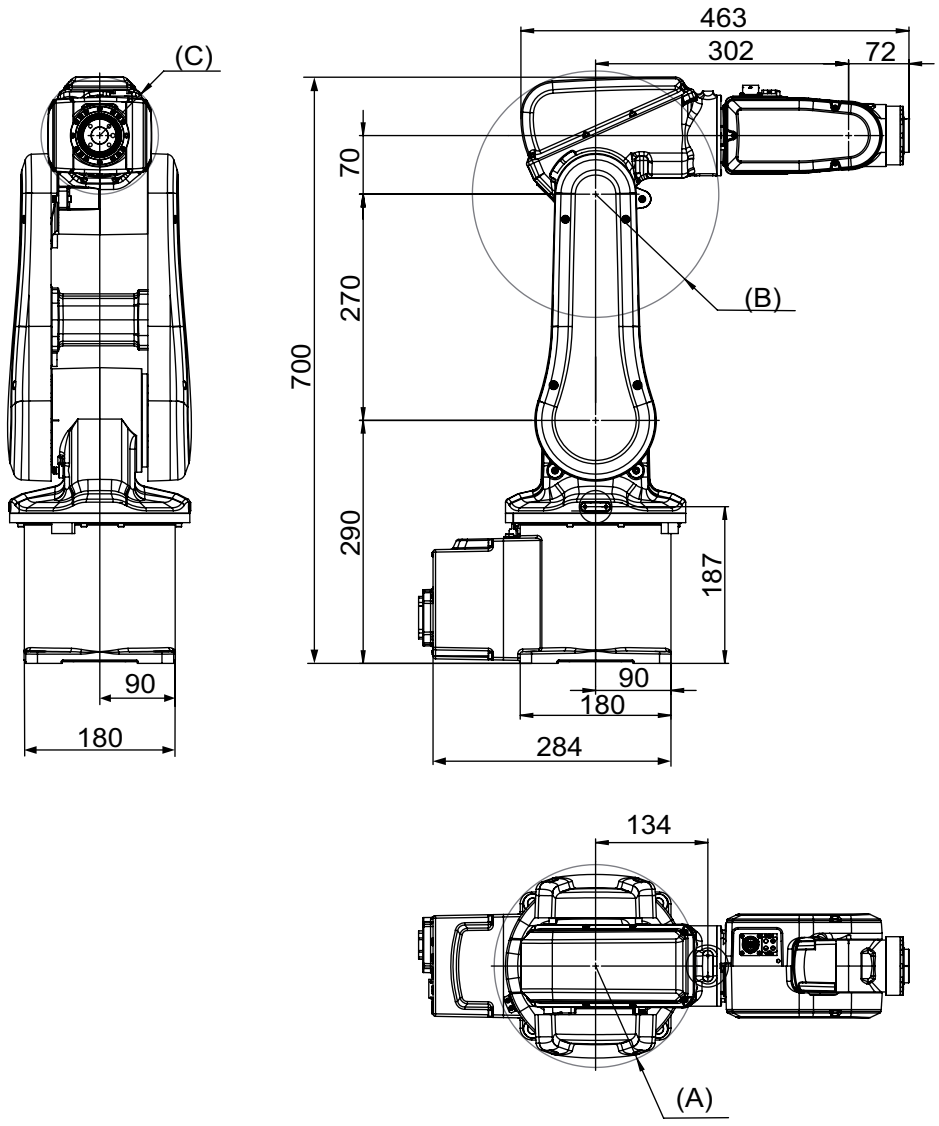
Pos	Description
A	250 mm

Dimensions IRB 120-3/0.6



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Pos	Description
A	Minimum turning radius axis 1 R=121 mm
B	Minimum turning radius axis 3 R=147 mm
C	Minimum turning radius axis 4 R=70 mm

1.2 Standards

1.2.1 Applicable safety standards

Standards, EN ISO

The manipulator system is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100 -1	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
EN ISO 12100 -2	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1 [i]	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Manipulating industrial robots, coordinate systems, and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 [ii]	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 [iii]	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 [iii]	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

[i] There is a deviation from paragraph 6.2 in that only worst case stop distances and stop times are documented.
[ii] Only robots with protection Clean Room.
[iii] Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards

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1.2.1 Applicable safety standards

Continued

Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740 (option 429-1)	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03 (option 429-1)	Industrial robots and robot Systems - General safety requirements

1.3 Installation

1.3.1 Introduction to installation

General

IRB 120 is adapted for normal industrial environment. An end effector, weighing a maximum of 3 kg, including payload, can be mounted on the robot's mounting flange (axis 6). Other equipment, weighing a maximum of 0.3 kg, can be mounted on the upper arm. For more information about mounting of extra equipment, see Figure on next page.

1.3.2 Operating requirements

Protection standard

Protection standard	IEC529
All variants, manipulator	IP30

Explosive environments

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

Working Range Limitations

EPS will not be selectable together with IRC5C. No mechanical limitation.

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(C) 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 operation, transportation and storage	Max. 95% at constant temperature

Mounting the manipulator

Maximum load in relation to the base coordination system. See Figure below.

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±265 N	±515 N
Force z	-265 ±200 N	-265 ±365 N
Torque xy	±195 Nm	±400 Nm
Torque z	±85 Nm	±155 Nm

Wall Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±470 N	±735 N
Force z	0 ±200 N	0 ±630 N

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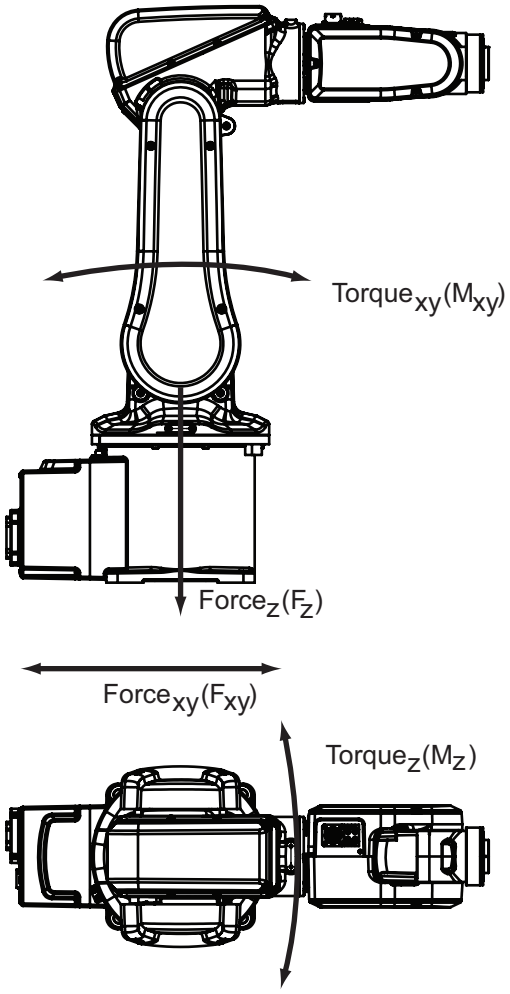
Continued

Force	Endurance load (in operation)	Max. load (emergency stop)
Torque xy	±240 Nm	±450 Nm
Torque z	±90 Nm	±175 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±265 N	±515 N
Force z	265 ±200 N	265 ±365 N
Torque xy	±195 Nm	±400 Nm
Torque z	±85 Nm	±155 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}).

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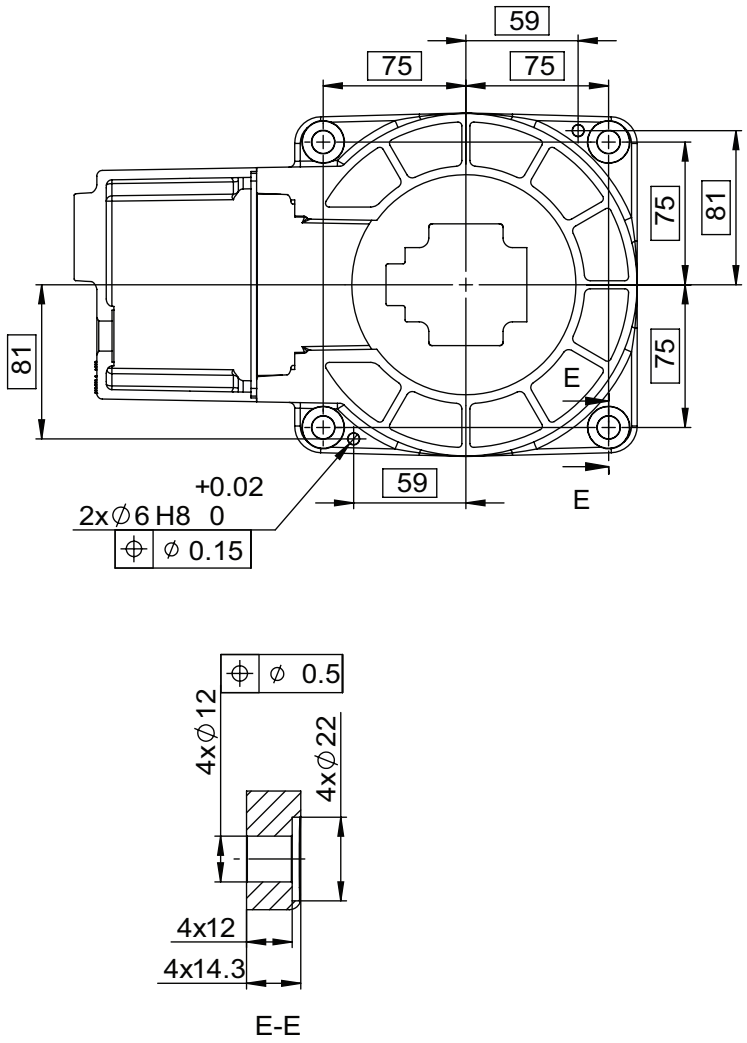
1.3.2 Operating requirements

Continued

Fastening holes robot base



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Attachment bolts, specification

The table below specifies required bolts and washers for securing the robot at installation site.

Specification	Description
Attacment bolts, 4 pcs	M10 x 25 (installation directly on foundation)
Guide pins, 2 pcs	D=6x20
Washers, 4 pcs	10.5 x 20 x 2
Quality	Quality 8.8
Tightening torque	47 Nm

1.4 Load diagram

1.4.1 Introduction to Load diagram

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 is the service routine LoadIdentify available, which allows the user to make an automatic definition of the tool and load, to determine correct load parameters. Please see *Operating Manual - IRC5 with FlexPendant*, art. No. 3HAC16590-1, for detailed information.

WARNING

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

General

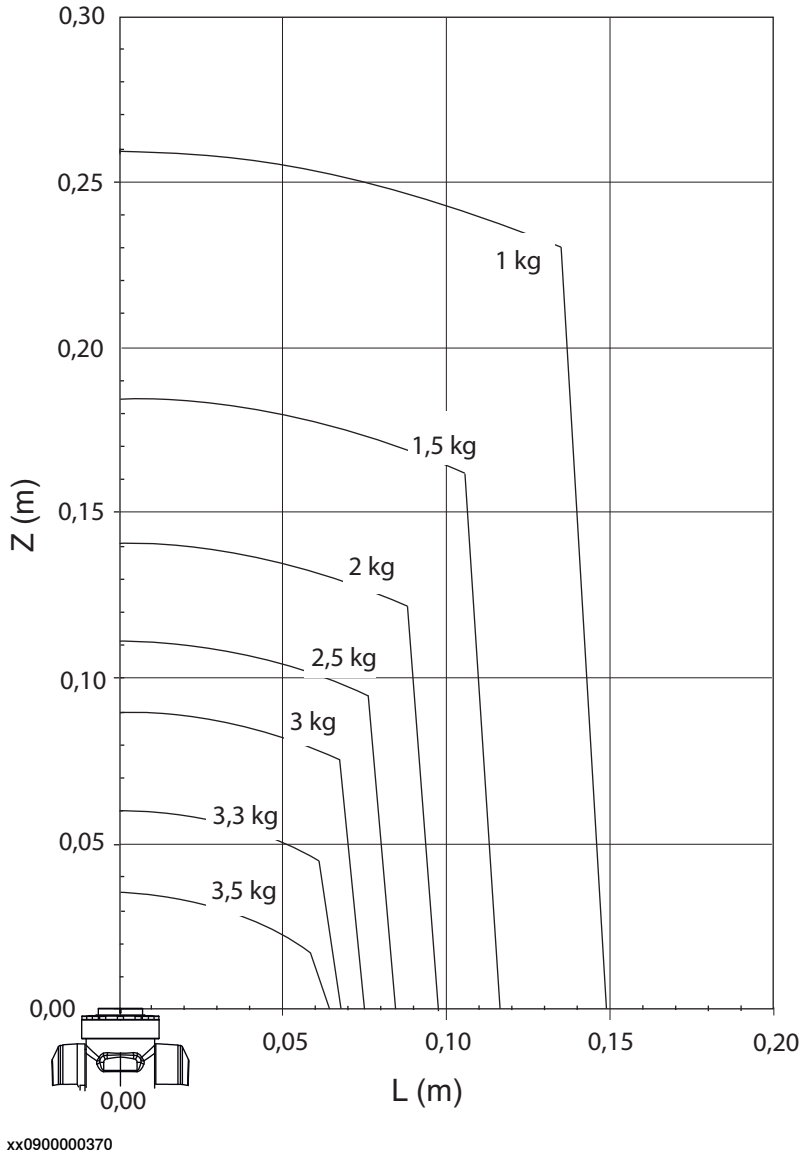
The load diagram includes a nominal pay load inertia, J_0 of 0.012 kgm^2 and an extra load of 0.3 kg at the upper arm housing. At different moment of inertia the load diagram will be changed.

Control of load case by "RobotLoad"

For an easy check of a specific load case, use the calculation program ABB RobotLoad. Please contact your local ABB organization.

1.4.2 Load diagrams

IRB 120 - 3/0.6



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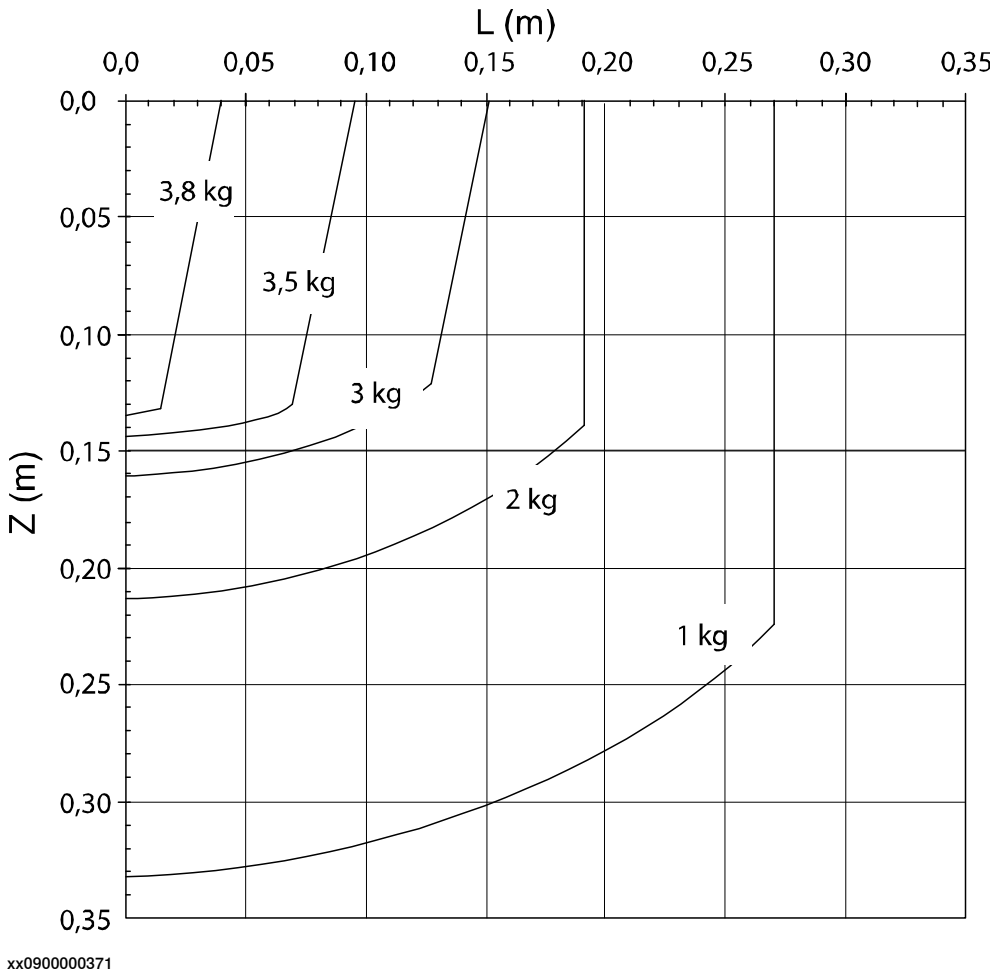
IRB 120 - 3/0.6 "Vertical wrist" (± 10°)



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	Description
Max load	4.2 kg
Z_{max}	0.119 m
L_{max}	0.022 m

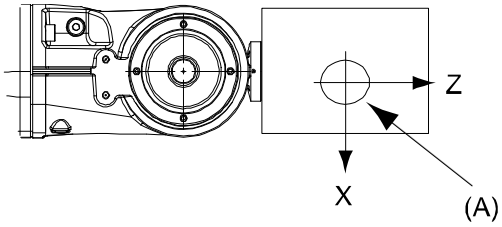
1.4.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

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. $L = \sqrt{(X2 + Y2)}$, see Figure 8.

Full movement of Axis 5 (±115º)

Axis	Robot Type	Max. value
5	IRB 120(T)-3/0.6	J_5 = Mass x $((Z + 0.072^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 0.175\ kgm^2$
6	IRB 120(T)-3/0.6	J_6= Mass x $L^2 + J_{0Z} \leq 0.085\ kgm^2$



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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.

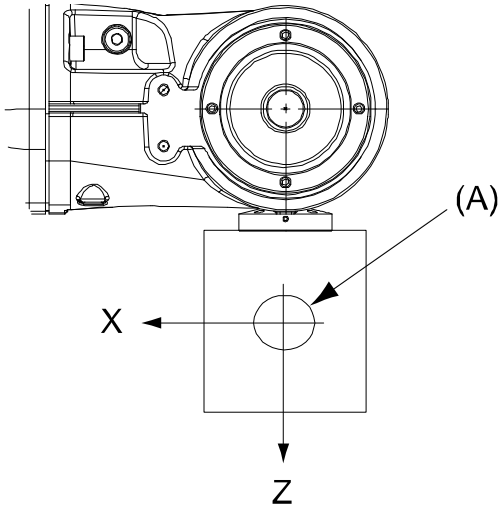
Continues on next page

1.4.3 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	Max. value
5	IRB 120(T)-3/0.6	J_5 = Mass x (($Z + 0.072^2 + L^2$) + max (J_{ox}, J_{oy}) ≤ 0.175 kgm^2
6	IRB 120(T)-3/0.6	J6= Mass x L^2 + J_{0Z} ≤ 0.085 kgm^2



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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.

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, please contact your local ABB organization.

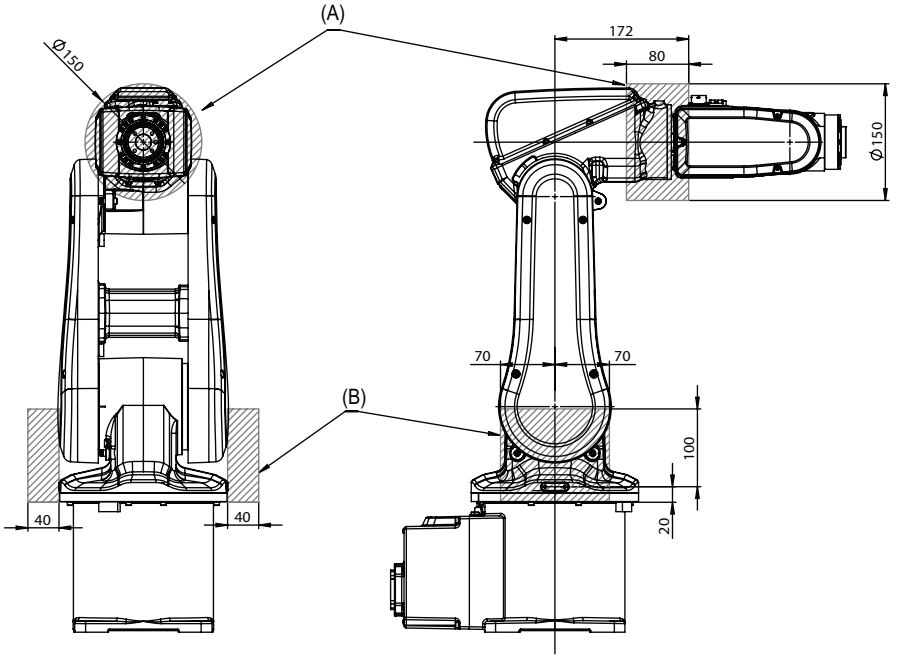
Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 120(T)-3/0.6	4.8 Nm	2.2 Nm	3 kg

1.5 Mounting of equipment

1.5.1 Introduction to Mounting of equipment

General

Extra loads can be mounted on to the upper arm and frame. Definitions of load areas and permitted load are shown in Figure 10. 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. (See figures in capter Holes for mounting of extre equipment).



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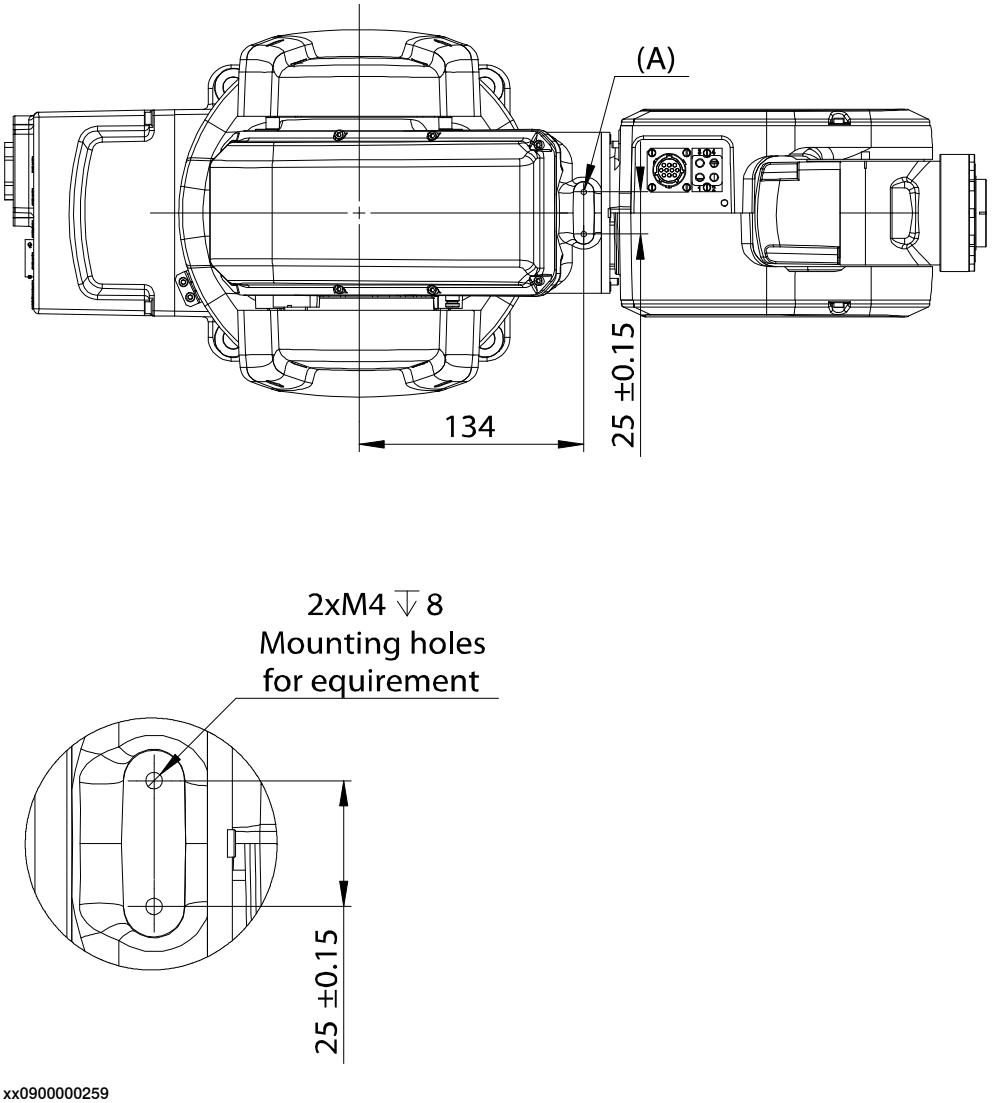
Load area	Max load	
	A	B
IRB 120-3/0.6	0.3 kg	0.5 (x2) kg

1.5.2 Holes for mounting extra equipment

Upper arm



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1.5.2 Holes for mounting extra equipment

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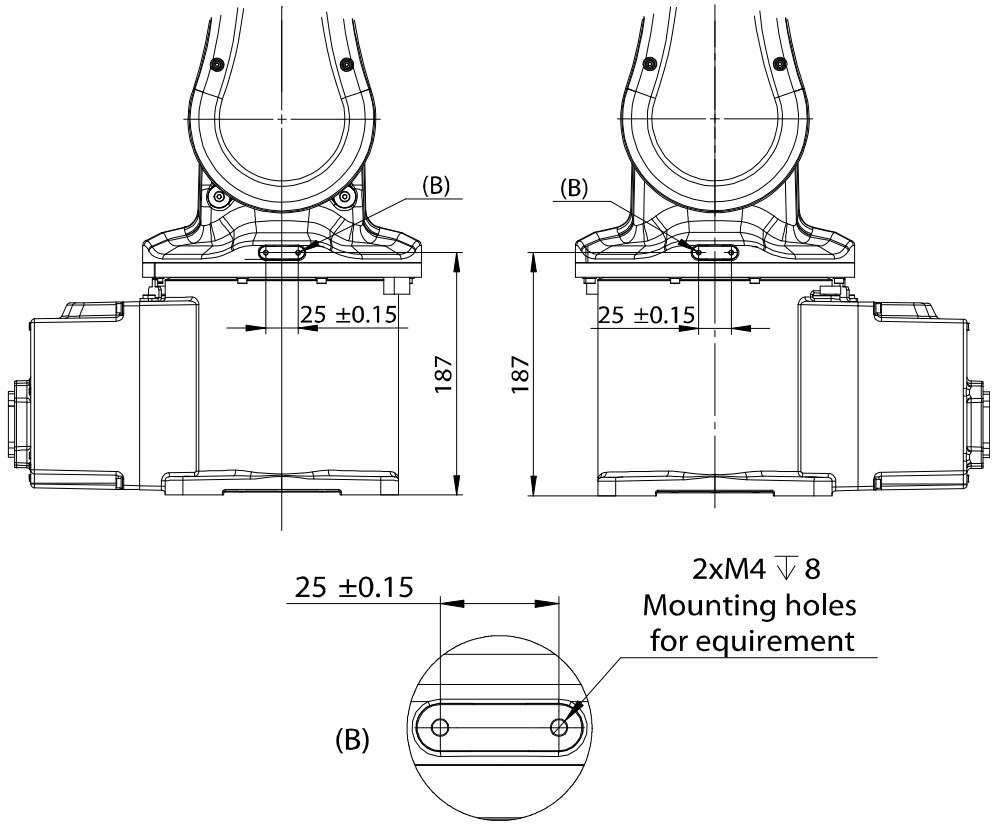
Frame



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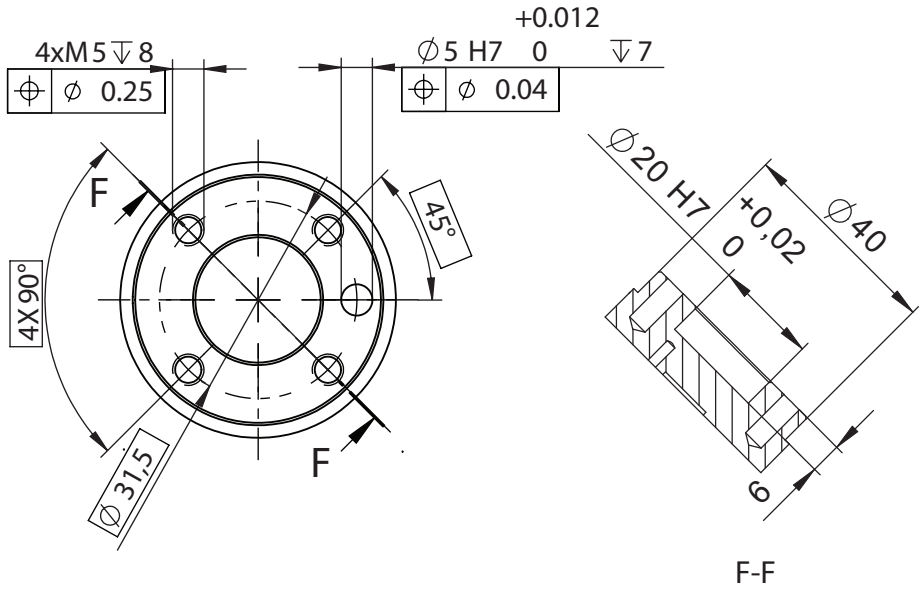
Robot tool flange



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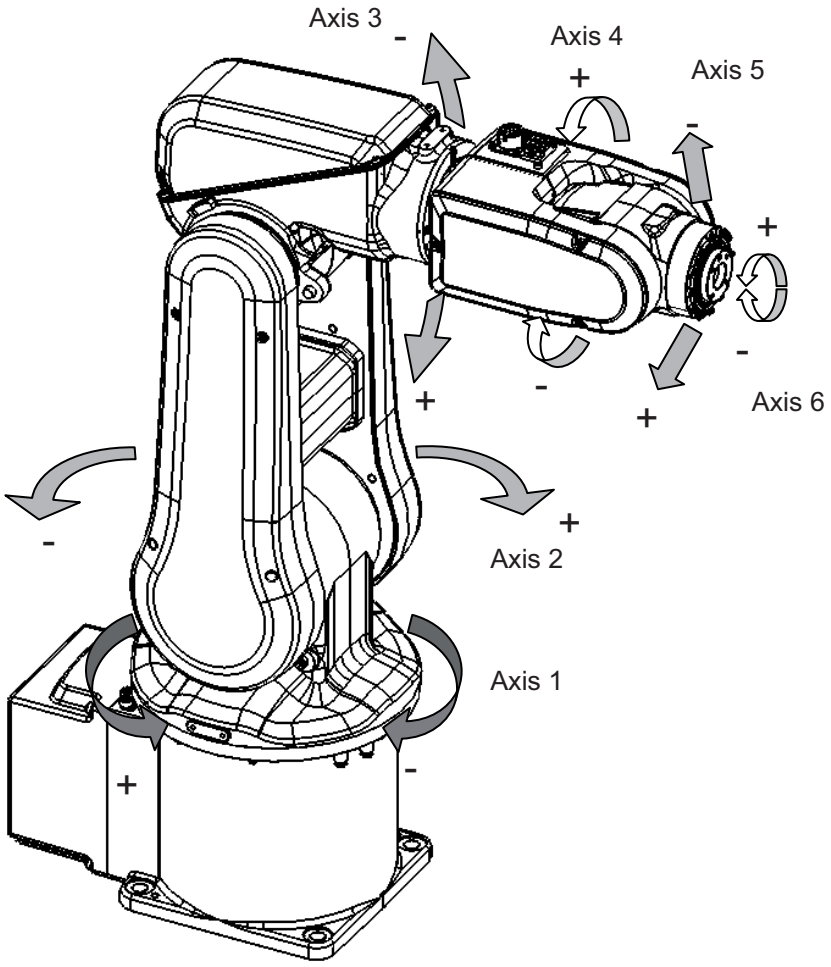
1.6 Calibration

1.6.1 Fine calibration

General

Fine calibration is made by moving the axes against hard stops. For detailed information on calibration of the robot see *Product manual - IRB 120*.



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Calibration	Position
Calibration of all axes	All axes 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

1.7 Maintenance and Troubleshooting

1.7.1 Introduction to Maintenance and Toubleshooting

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.
- Grease 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 Working range and type of motion

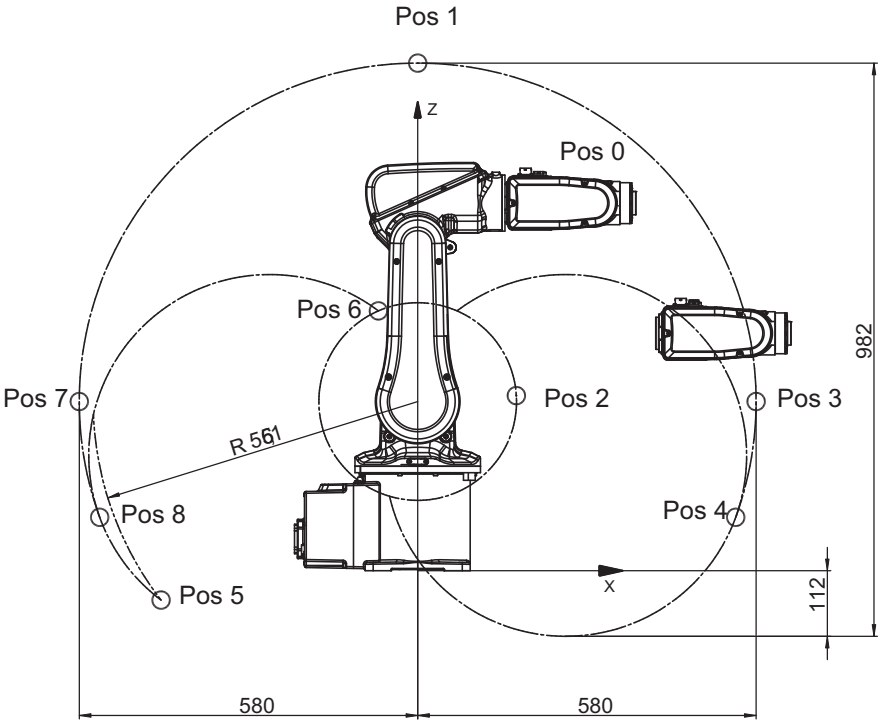
Working range

The figures show the working ranges of the robot.

The extreme positions of the robot arm are specified at the wrist center (dimensions in mm).

Working range

The illustration shows the unrestricted working range of the robot.



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Pos	Position at wrist center (mm)		Angle (degrees)	
	X	Z	Axis 2	Axis 3
A	302 mm	630 mm	0°	0°
B	0 mm	870 mm	0°	-77°
C	169 mm	300 mm	0°	+70°
D	580 mm	270 mm	+90°	-77°
E	545 mm	91 mm	+110°	-77°
F	-440 mm	-50 mm	-110°	-110°
G	-67 mm	445 mm	-110°	+70°
H	-580 mm	270 mm	-90°	-77°
J	-545 mm	91 mm	-110°	-77°

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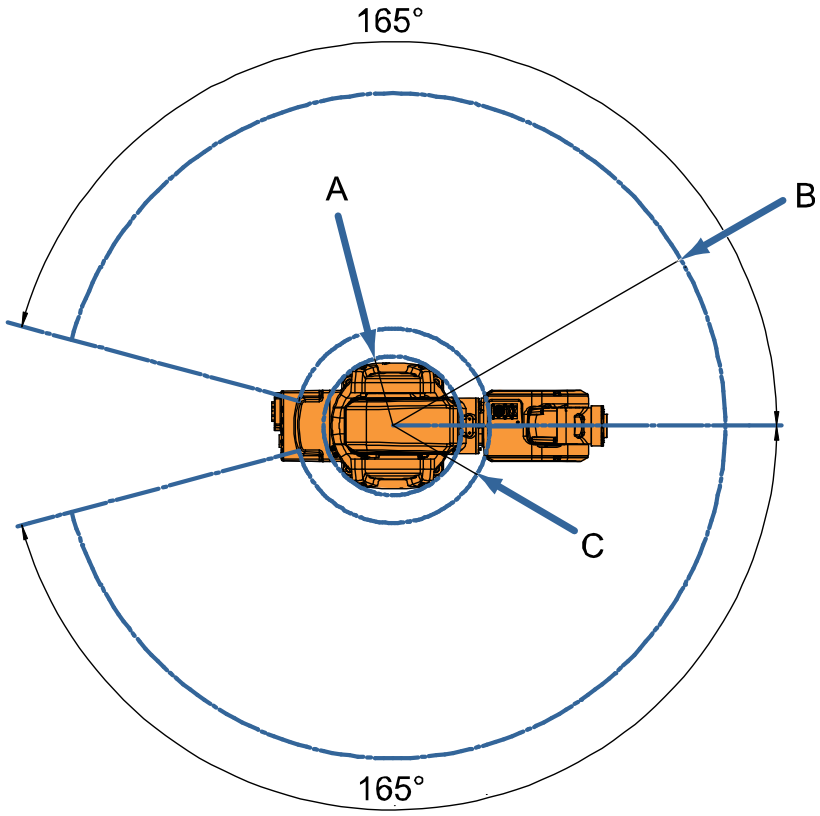
1.8.1 Working range and type of motion

Continued

Turning radius

The turning radius of robot is shown in the figure.



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Robot variant	Pos. A	Pos. B	Pos. C
IRB 120-3/0.6	R121 [1]	R580	R169.4

[1] Minimum turning radius axis 1.

Robot motion

The table specifies the types and ranges of motion in every axes.

Location of motion	Type of motion	Range of movement
Axis 1	Rotation motion	+165° to -165°
Axis 2	Arm motion	+110° to -110°
Axis 3	Arm motion	+70° to -110°
Axis 4	Wrist motion	+160° to -160°
Axis 5	Bend motion	+120° to -120°
Axis 6	Turn motion	+400° to -400° (default) +242 revolutions to -242 revolutions maximum [i]

i The default working range for 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).

1.8.2 Introduction to Robot motion

General

Axis	Type of motion	Range of movement
Axis 1	Rotation motion	+ 165° to - 165°
Axis 2	Arm motion	+ 110° to - 110°
Axis 3	Arm motion	+ 70° to - 110°
Axis 4	Rotation motion	+ 160° to - 160°
Axis 5	Bend motion	+ 120° to - 120°
Axis 6	Turn motion	+ 400° to - 400°

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1.8.2 Introduction to Robot motion

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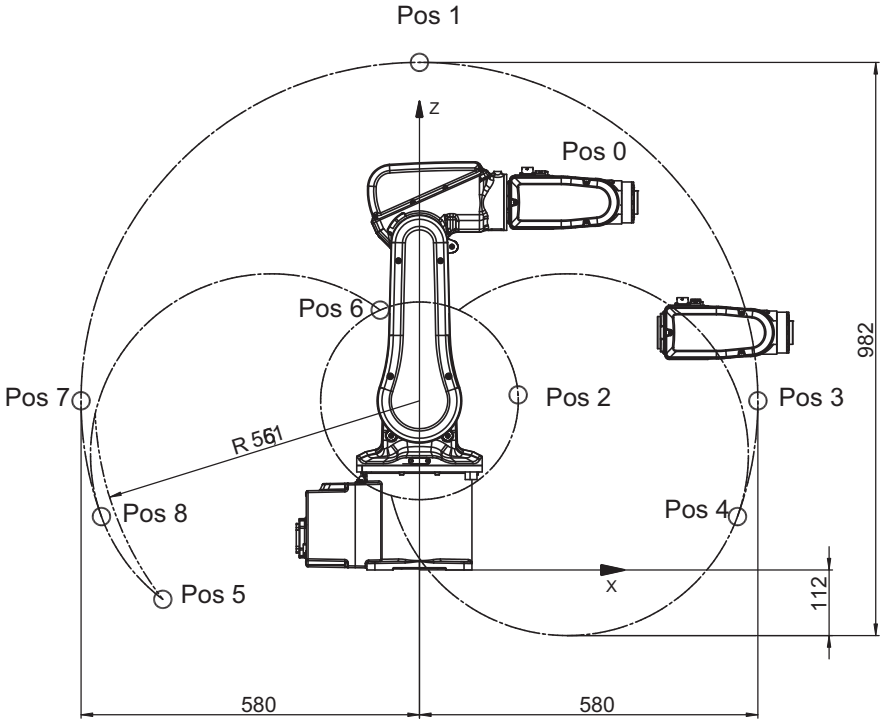

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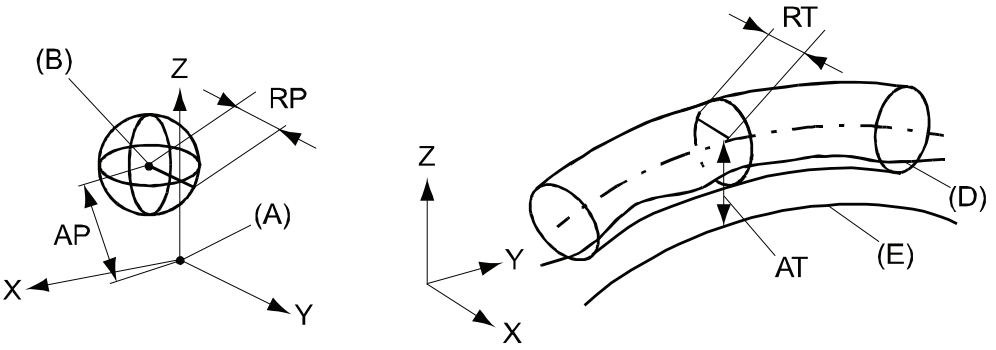
Position No. (see Figure 15)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
0	302	630	0	0
1	0	870	0	-77
2	169	300	0	70
3	580	270	90	-77
4	545	91	110	-77
5	-440	-50	-110	-110
6	-67	445	-110	70
7	-580	270	-90	-77
8	-545	91	-110	-77

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

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



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

Description	Values
IRB	**120 - 3/0.6 and 120T-3/0.6**
Pose repeatability, RP (mm)	0.01
Pose accuracy, AP[a] (mm)	0.02
Linear path repeatability, RT (mm)	0.07-0.16
Linear path accuracy, AT (mm)	0.21-0.38
Pose stabilization time, Pst (s) within 0.2 mm of the position	0.03

a. 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 prgram execution.

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

1.8.4 Velocity

General

Robot Type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
IRB 120 - 3/0.6	250 °/s	250 °/s	250 °/s	320 °/s	320 °/s	420 °/s
IRB 120T - 3/0.6	250 °/s	250 °/s	250 °/s	420 °/s	590 °/s	600 °/s

Supervision is required to prevent overheating in applications with intensive and frequent movements.

Resolution

Approx. 0.01° on each axis.

1.8.5 Stopping distance/time

General

Stopping distance/time for emergency stop (category 0), program stop (category1) and at mains power supply failure at max speed, max streched out and max load, categories according to EN 60204-1. All results are from tests on one moving axis. All stop distances are valid for floor mounted robot, without any tilting.

Robot Type		Category 0		Category 1		Main power failure	
	Axis	A	B	A	B	A	B
IRB 120(T)-3/0.6	1	23	0.18	31	0.25	43	a
	2	28	0.22	74	0.63	36	a
	3	15	0.12	48	0.36	19	a

a. Not yet available.

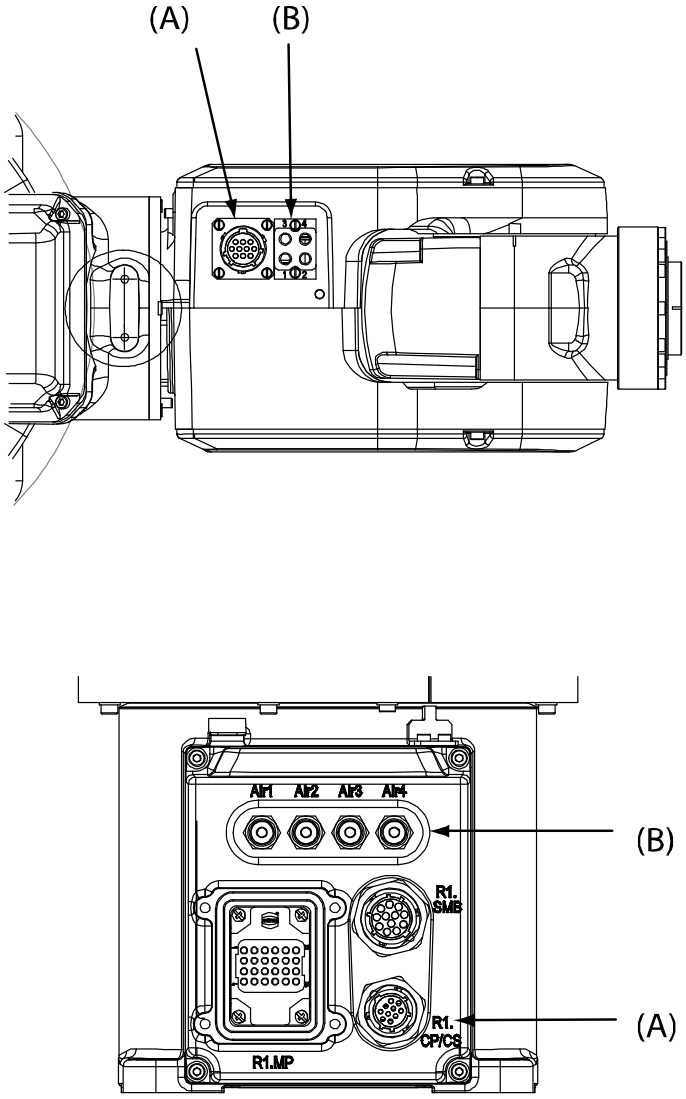
	Description
A	Distance in degrees
B	Stop time (s)

1.9 Customer connections

1.9.1 Introduction to Customer connections

General

Customer connection, the cables are integrated in the robot and the connectors is placed on the upper arm housing and one at the base.One UTOW01210SH05 connector (R2.CP/CS) the upper arm housing. Corresponding connector UTOW71210PH06 (R1.CP/CS) is located at the base. Hose for compressed air is also integrated into the manipulator. There is 4 inlets at the base (R 1/8”) and 4 outlets (M5) on the upper arm housing.



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Pos	Connection	Description	Number	Value
A	(R1)R2.CP/CS	Customer power/signal	10	49 V, 500 mA
B	Air	Max. 5 bar	4	Inner hose diameter 4 mm

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 120 are described in the following sections. The same option numbers are used here as in the specification form.

Related information

For the controller see *Product specification - Controller IRC5 with FlexPendant*.

For the software options see *Product specification - Controller software IRC5*.

2.2 Manipulator

Variants

Option	Variant	Handling capacity (kg) / Reach (m)
435-100	Standard performance variant	IRB 120-3/0.6
435-109	High speed variant	IRB 120T-3/.06

Manipulator color

Option	Description
209-	The robot is painted in color ABB Orange.
209-2	The robot is painted in white color.

Note

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

Protection

Option	Description
287-4	Standard
287-1	Clean Room The robot is labelled with "Clean Room"

Connector kit

Option	Description
431-1	For the connectors on the upper arm, customer connection.
239-1	For the connectors on the foot.

Warranty

Option	Type	Description
438-1	Standard warranty	Standard warranty is 18 months from *Customer Delivery Date* or latest 24 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 sarranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.

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Option	Type	Description
438-5	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.
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

2.4 Process

Process module

Option	Type	Description
768-1	Empty cabinet small	See Product specification - Controller IRC5 with FlexPendant, chapter 2.2.1.
768-2	Empty cabinet large	See Product specification - Controller IRC5 with FlexPendant, chapter 2.2.1.
715-1	Installation kit	See Product specification - Controller IRC5 with FlexPendant, chapter 2.2.1.

2.5 Documentation

DVD User Documentation

The user documentation describe the manipulator system in detail, including service and safety instructions. All documents are available on the documentation DVD, 3HAC032875-001.

Option	Type	Description
808-1	Documentation on DVD	See *Product specification - Robot user documentation*

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 with FlexPendant* and *Product specification - Controller software IRC5*.

Robot peripherals

- Motor Units

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Contact us

ABB AB
Discrete Automation and Motion
Robotics
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

ABB AS, Robotics
Discrete Automation and Motion
Box 265
N-4349 BRYNE, Norway
Telephone: +47 51489000

ABB Engineering (Shanghai) Ltd.
5 Lane 369, ChuangYe Road
KangQiao Town, PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Discrete Automation and Motion
Robotics
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

www.abb.com/robotics

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