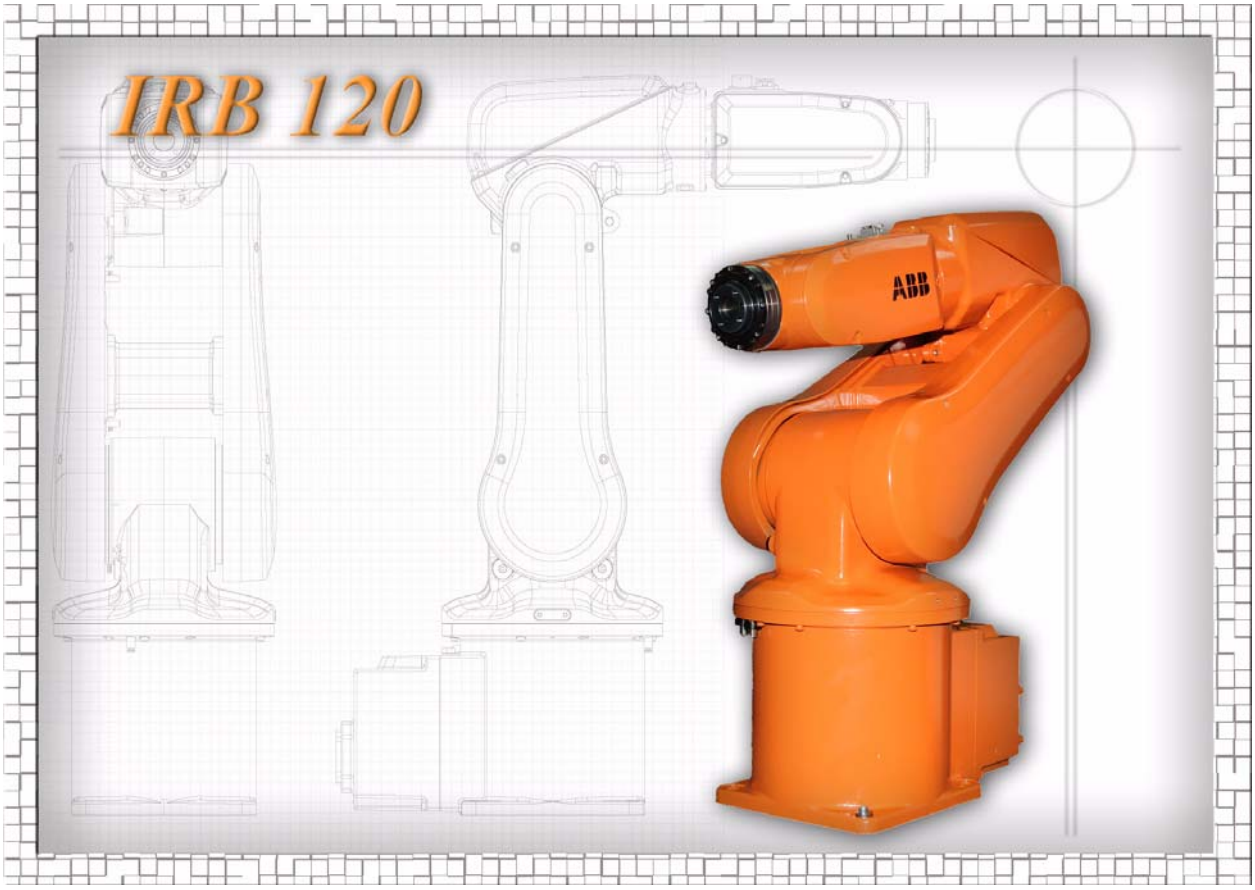
Product specification

Articulated robot

IRB 120 - 3/0.6



Product specification

IRB 120-3/0.6

Document ID: 3HAC035960-001

Revision: A

ABB AB
Robotics Products
SE-721 68 Västerås
Sweden

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 variant and options available

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.

Revisions

Revision	Description
-	- New Product Specification
A	- Option 431-1 and 239-1 added

Complementary documentation

Product specification	Description
Controller	IRC5C and IRC5 with FlexPendant, 3HAC021785-001
Controller Software IRC5	RobotWare 5.13, 3HAC022349-001
Robot User Documentation	IRC5C/IRC5 and M2004, 3HAC024534-001

Product Manual	Description
Manipulator	IRB 120, 3HAC035728-001

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.

Operating system

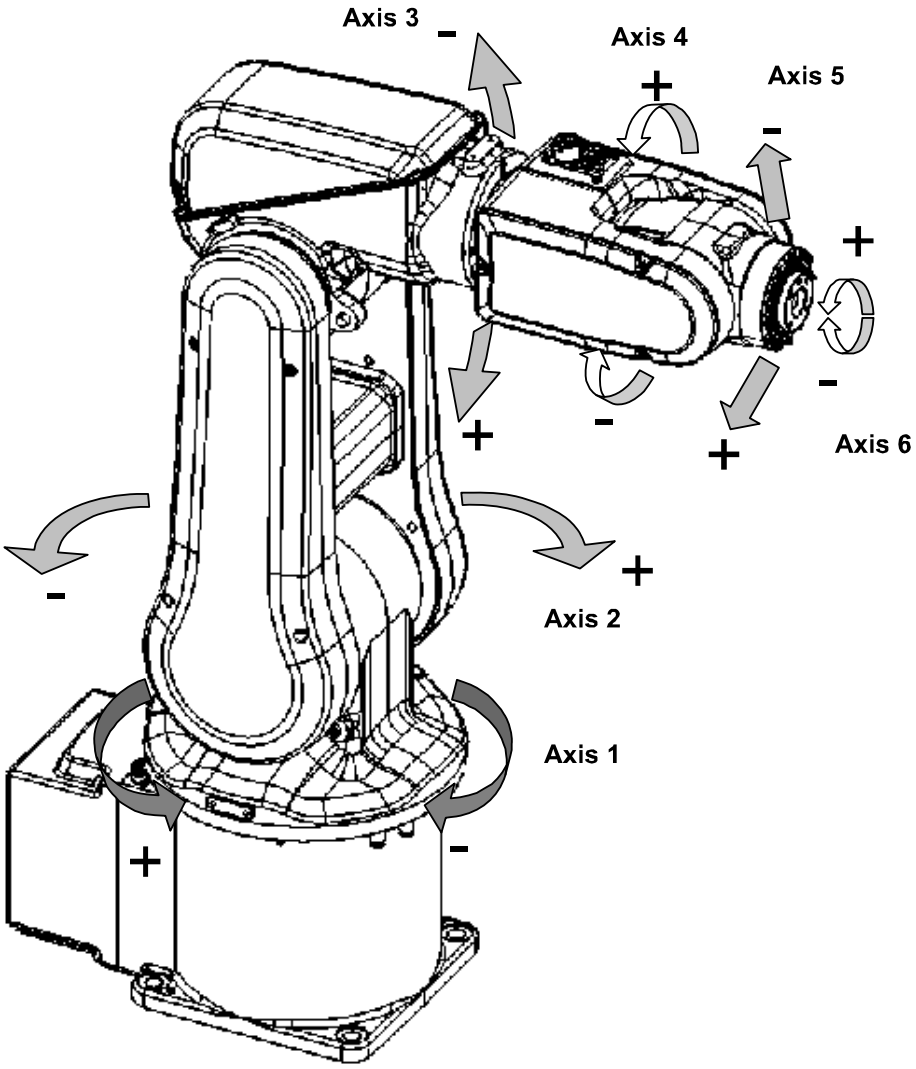
The robot is equipped with the IRC5C or IRC5 (Single cabinet) controller and robot control software, RobotWare for M2004. RobotWare supports every aspect of the robot system, such as motion control, development and execution of application programs, communication etc. See Product specification - Controller IRC5 with FlexPendant (IRC5C included). Safety standards require a controller to be connected to the robot.For additional functionality, the robot can be equipped with optional software for application support - for example communication features - network communication - and advanced functions such as multitasking etc. For a complete description on optional software, see the Product specification - RobotWare Options.

Continues on next page

1.1.1. Introduction to structure

Continued

Manipulator axes



1.1.2. The Robot

General

The IRB 120-3/0.6 can be mounted on floor, inverted or on wall in any angle.

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

Manipulator Weight

Data	Weight
IRB 120-3/0.6	25 kg

Other technical data

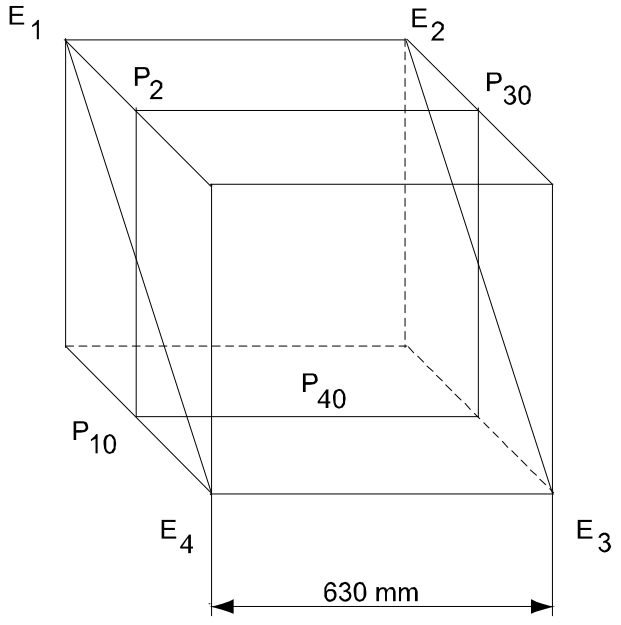
Data	Description	Note
Airborne noise level	The sound pressure level outside	< 70 dB (A) Leq (acc. to the working space Machinery directive 89/392 EEC)

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 calibration position	IRB 120
Brakes engaged	0.173 kW
Brakes disengaged	0.095 kW



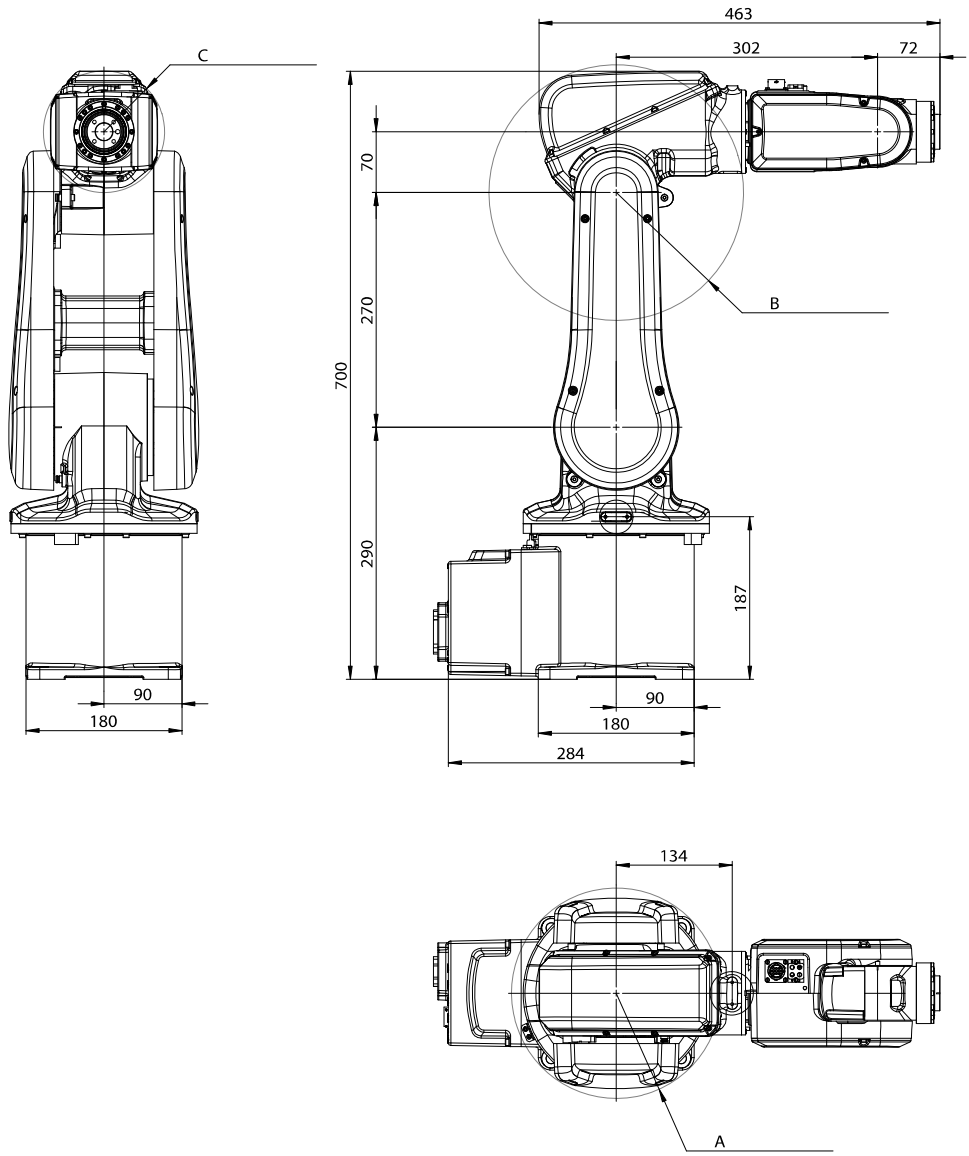
xx0900000265

Continues on next page

1.1.2. The Robot

Continued

Dimensions IRB 120-3/0.6



xx0900000256

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 Safety/Standards

1.2.1. Standards

General

The robot conforms to the following standards:

Standard	Description
EN ISO 12100-1	Safety of machinery, terminology
EN ISO 12100-2	Safety of machinery, technical specifications
EN 954-1	Safety of machinery, safety related parts of control systems
EN 60204	Electrical equipment of industrial machines
EN ISO 60204-1:2005	Safety of machinery - Electrical equipment of machines
EN ISO 10218-1:2006[a]	Robots for industrial environments - Safety requirements
EN 61000-6-4 (option)	EMC, Generic emission
EN 61000-6-2	EMC, Generic immunity

a. There is a deviation from paragraph 6.2 in that only worst case stop distances and stop times are documented

Standard	Description
ISO 9787	Manipulating industrial robots, coordinate Systems and motions

Standard	Description
ISO 9787	Manipulating industrial robots, coordinate systems and motions
ISO 9409-1	Manipulating industrial robots, mechanical interface

Standard	Description
ANSI/RIA R15.06/1999 (option)	Safety Requirements for Industrial Robots and Robot Systems

1.2.2. Safety

General

Safety function	Description
The Service Information System (SIS)	The service information system gathers information about the robot's usage and determines how hard the robot is used. The usage is characterized by the speed, the rotation angles and the load of every axis. With this data collection, the service interval of every individual robot of this generation can be predicted, optimized and service activities planned ahead. The collection data is available via the FlexPendant or the network link to the robot. The Process Robot Generation is designed with absolute safety in mind. It is dedicated to actively or passively avoid collisions and offers the highest level of safety to the operators and the machines as well as the surrounding and attached equipment. These features are presented in the active and passive safety system. The time the robot is in operation (brakes released) is indicated on the FlexPendant. Data can also be monitored over network, using for example WebWare.

The Active Safety System	Description
General	The active safety system includes those software features that maintain the accuracy of the robot's path and those that actively avoid collisions which can occur if the robot leaves the programmed path accidentally or if an obstacle is put into the robot's path.
The Active Brake System (ABS)	All robots are delivered with an active brake system that supports the robots to maintain the programmed path in General Stop (GS), Auto Stop (AS) and Superior Stop (SS). The ABS is active during all stop modes, braking the robot to a stop with the power of the servo drive system along the programmed path. After a specific time the mechanical brakes are activated ensuring a safe stop. The stopping process is in accordance with a class 1 stop. The maximum applicable torque on the most loaded axis determines the stopping distance. In case of a failure of the drive system or a power interruption, a class 0 stop turns out. Emergency Stop (ES) is a class 0 stop. All stops (GS, AS, SS and ES) are reconfigurable. While programming the robot in manual mode, the enabling device has a class 0 stop.

Continues on next page

Continued

The Active Safety System	Description
The Self Tuning Performance (STP)	The Process Robot Generation is designed to run at different load configurations, many of which occur within the same program and cycle. The robot's installed electrical power can thus be exploited to lift heavy loads, create a high axis force or accelerate quickly without changing the configuration of the robot. Consequently the robot can run in a "power mode" or a "speed mode" which can be measured in the respective cycle time of one and the same program but with different tool loads. This feature is based on QuickMove™. The respective change in cycle time can be measured by running the robot in NoMotionExecution with different loads or with simulation tools like RobotStudio.
The Electronically Stabilised Path (ESP)	The load and inertia of the tool have a significant effect on the path performance of a robot. The Process Robot Generation is equipped with a system to electronically stabilize the robot's path in order to achieve the best path performance. This has an influence while accelerating and braking and consequently stabilizes the path during all motion operations with a compromise of the best cycle time. This feature is secured through TrueMove™.
Over-speed protection	The speed of the robot is monitored by two independent computers.
Restricting the working space	The movement of each axis can be restricted using software limits. As options there are safeguarded space stops for connection of position switches to restrict the working space for the axes 1-3.Axes 1-3 can also be restricted by means of mechanical stops.
Collision detection (option)	In case of an unexpected mechanical disturbance, such as a collision, electrode sticking, etc., the robot will detect the collision, stop on the path and slightly back off from its stop position, releasing tension in the tool.

The Passive Safety System	Description
General	The Process Robot Generation has a dedicated passive safety system that by hardware construction and dedicated solutions is designed to avoid collisions with surrounding equipment. It integrates the robot system into the surrounding equipment safely.
Compact robot arm design	The shape of the lower and upper arm system is compact, avoiding interference into the working envelope of the robot.The lower arm is shaped inward, giving more space under the upper arm to re-orientate large parts and leaving more working space while reaching over equipment in front of the robot.The rear side of the upper arm is compact, with no components projecting over the edge of the robot base even when the robot is moved into the home position.

Continues on next page

1.2.2. Safety

Continued

The Passive Safety System	Description
Electronic Position Switches (EPS) on up to 7 axes (option) Not valid for IRC5C	EPS offers axes position status signals, fulfilling applicable regulations for personnel safety. Five outputs can each be configured to reflect the position of a single axis or a combination of axes. For each output, the range for each included axis can be set arbitrarily.

The Internal Safety Concept	Description
General	The internal safety concept of the Process Robot Generation is based on a two-channel circuit that is monitored continuously. If any component fails, the electrical power supplied to the motors shuts off and the brakes engage.
Safety category 3	Malfunction of a single component, such as a sticking relay, will be detected at the next MOTOR OFF/MOTOR ON operation. MOTOR ON is then prevented and the faulty section is indicated. This complies with category 3 of EN 954-1, Safety of machinery - safety related parts of control Systems - Part 1.
Selecting the operating mode	The robot can be operated either manually or automatically. In manual mode, the robot can only be operated via the FlexPendant, that is not by any external equipment.
Reduced speed	In manual mode, the speed is limited to a maximum of 250 mm/s (600 inch/min.). The speed limitation applies not only to the TCP (Tool Center Point), but to all parts of the robot. It is also possible to monitor the speed of equipment mounted on the robot.
Three position enabling device	The enabling device on the FlexPendant must be used to move the robot when in manual mode. The enabling device consists of a switch with three positions, meaning that all robot movements stop when either the enabling device is pushed fully in, or when it is released completely. This makes the robot safer to operate.
Safe manual movement	The robot is moved using a joystick instead of the operator having to look at the FlexPendant to find the right key.
Emergency stop	There is one emergency stop push button on the controller and another on the FlexPendant. Additional emergency stop buttons can be connected to the robot's safety chain circuit.
Safeguarded space stop	The robot has a number of electrical inputs which can be used to connect external safety equipment, such as safety gates and light curtains. This allows the robot's safety functions to be activated both by peripheral equipment and by the robot itself.
Delayed safeguarded space stop	A delayed stop gives a smooth stop. The robot stops the same way as at a normal program stop with no deviation from the programmed path. After approx. 1 second the power supplied to the motors is shut off.
Hold-to-run control	"Hold-to-run" means that you must depress the start button in order to move the robot. When the button is released the robot will stop. The hold-to-run function makes program testing safer.

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
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 (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)

Relative humidity

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

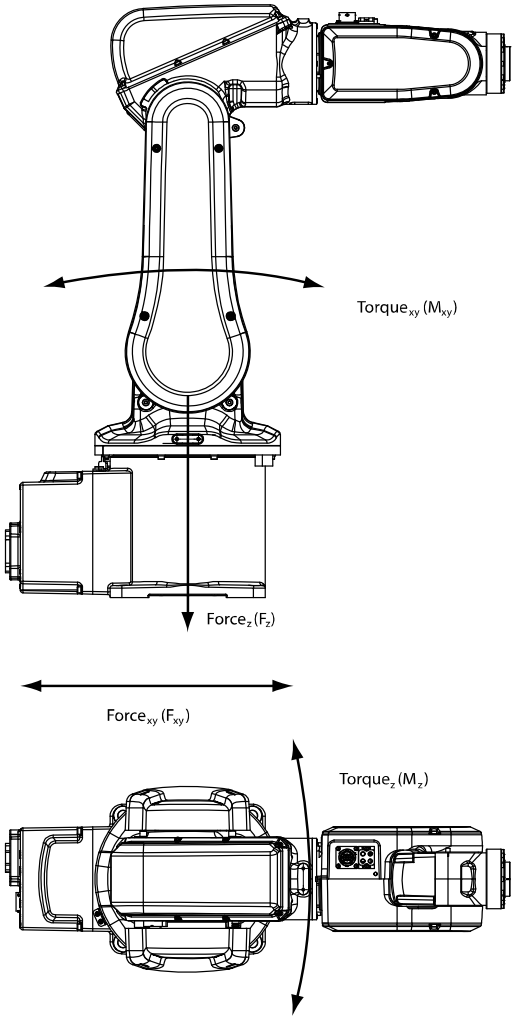
Mounting the manipulator

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

	Data	Endurance load in operation	Max. load at emergency stop
Force xy	Floor, suspended Wall	±265 N ±470 N	±515 N ±735 N
Force z	Floor Suspended Wall	-265 ±200 N +265 ±200 N 0 ±200 N	-265 ±365 N +265 ±365 N 0 ±630 N
Torque Mxy	Floor, suspended	±195 Nm	±400 Nm
Torque Mz	Floor, suspended	±85 Nm	±155 Nm
Torque Mxy	Wall mounted	±240 Nm	±450 Nm
Torque Mz	Wall mounted	±90 Nm	±175 Nm

Continues on next page

Continued



xx0900000257

Note regarding M_{xy} and F_{xy}

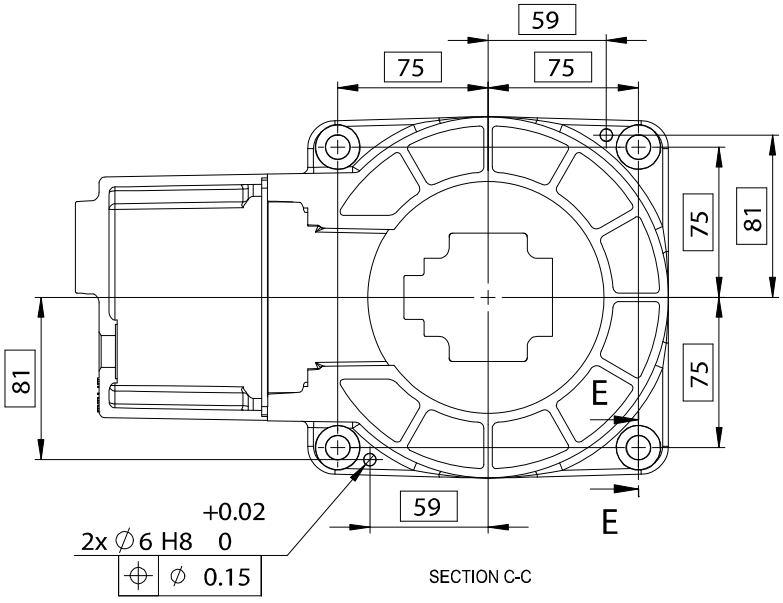
The bending torque (M_{xy}) can occur in any direction in the XY-plane of the base coordinate system.The same applies to the transverse force (F_{xy}).

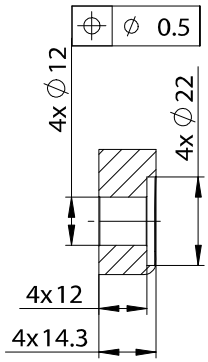
Continues on next page

1.3.2. Operating requirements

Continued

Fastening holes robot base





xx0900000258

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 23 x 3.2
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

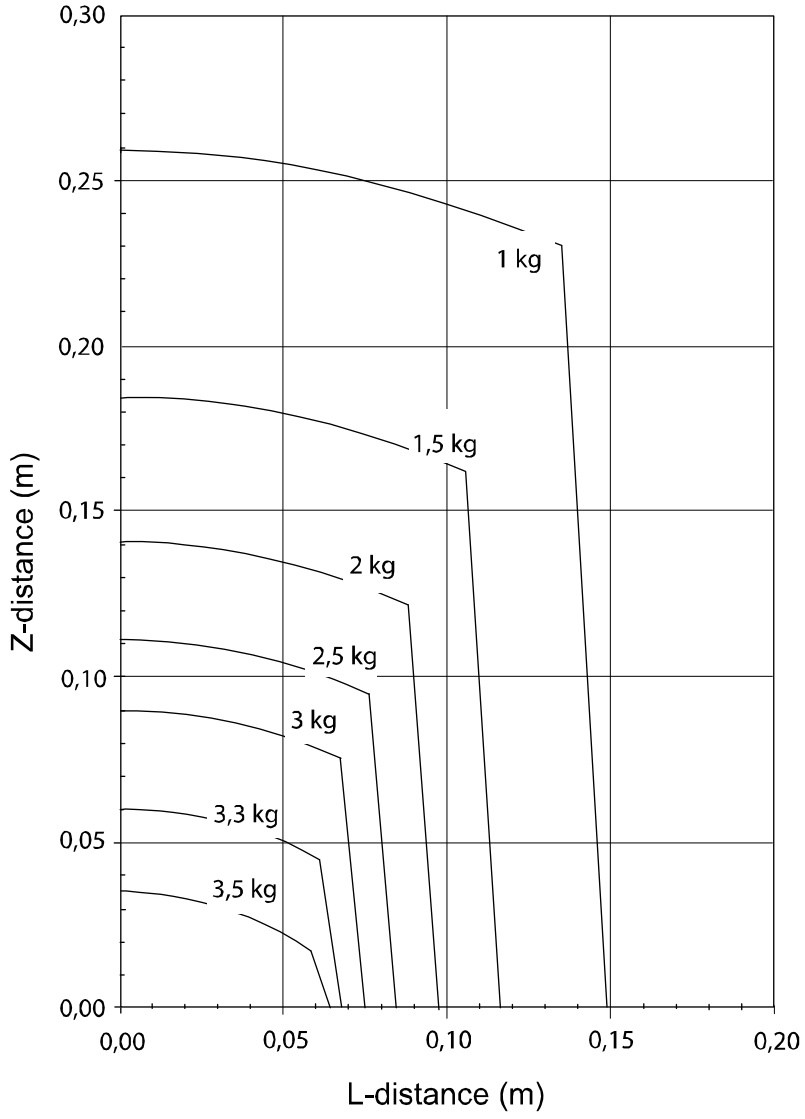
The load diagram includes a nominal pay load inertia, J_0 of 0.012 kgm^2 and an extra load of 0.3 kg at the upper arm housing. At different moment of inertia the load diagram will be changed.

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

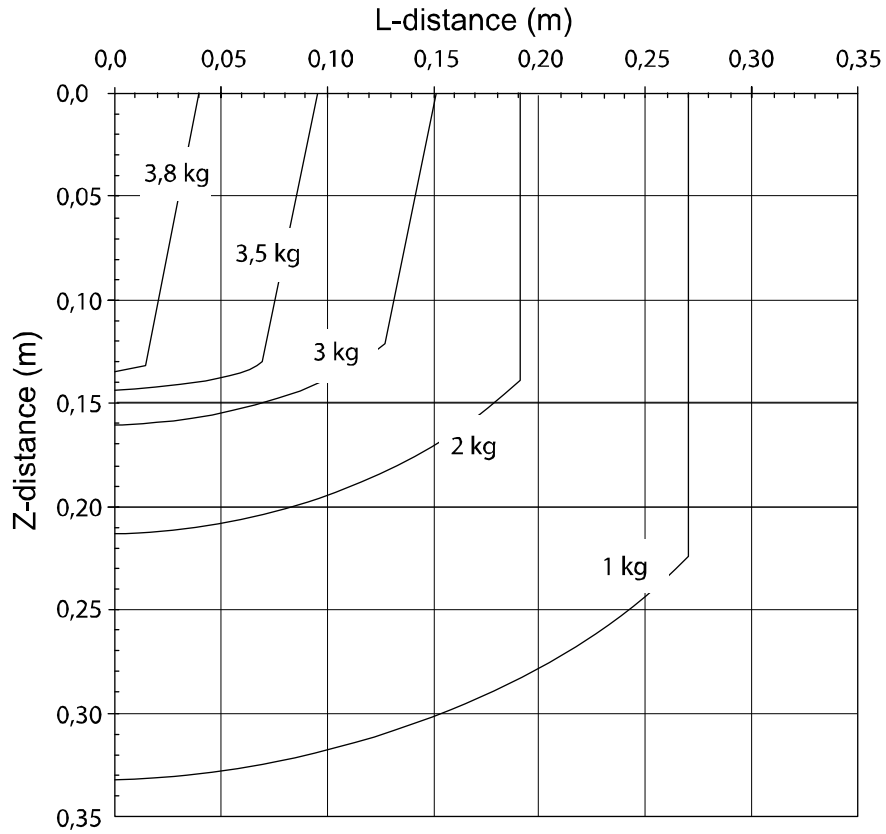
IRB 120 - 3/0.6



xx0900000370

Continues on next page

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



xx0900000371

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

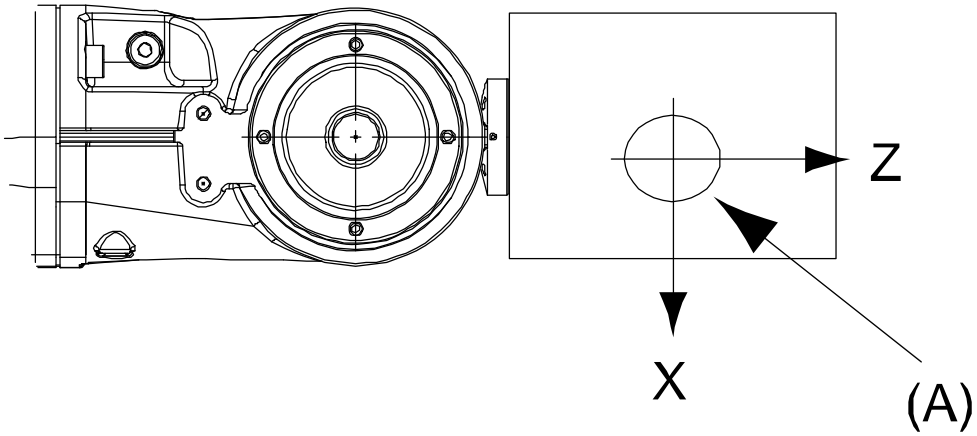
1.4.3. Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

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 below.

Full movement of Axis 5 (±115º)

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



xx0800000458

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.

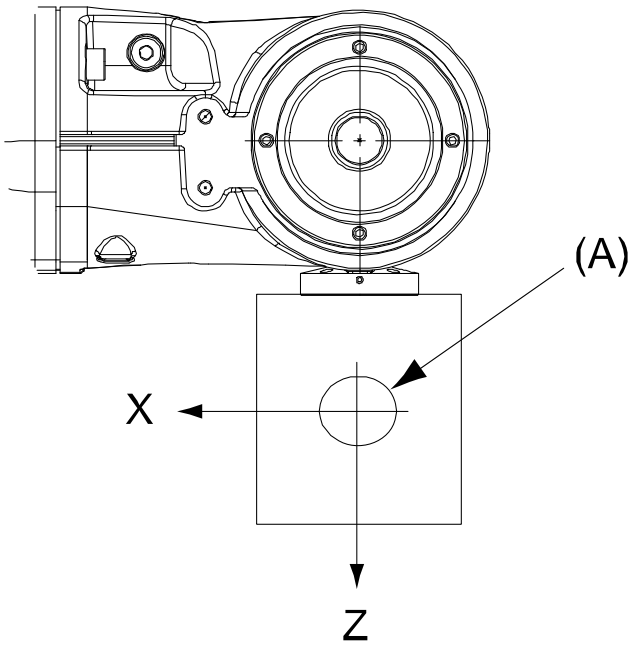
Continues on next page

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 120-3/0.6	J_5 = Mass x (($Z + 0.072^2 + L^2$) + max (J_{ox}, J_{oy}) ≤ 0.175 kgm^2
6	IRB 120-3/0.6	J_6= Mass x L^2 + J_{0Z} ≤ 0.085 kgm^2



xx0800000459

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. For finding the absolute limits of the load diagram, please use the ABB RobotLoad. Please contact your local ABB organization.

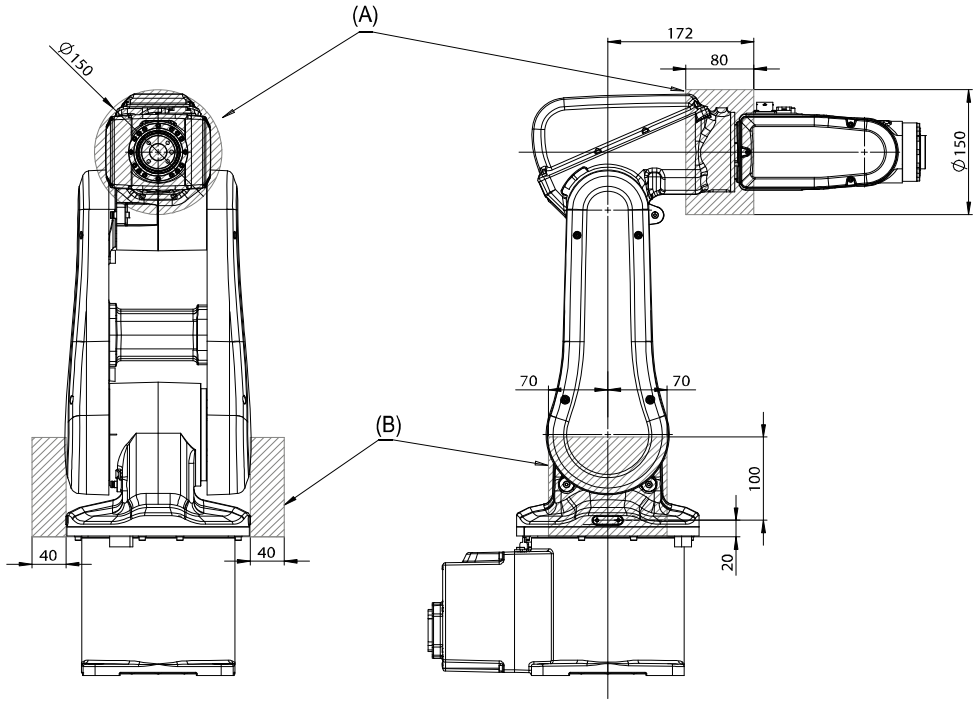
Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 120- 3/0.6	4.8 Nm	2.2 Nm	3 kg

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 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. (See figures in capter Holes for mounting of extre equipment).

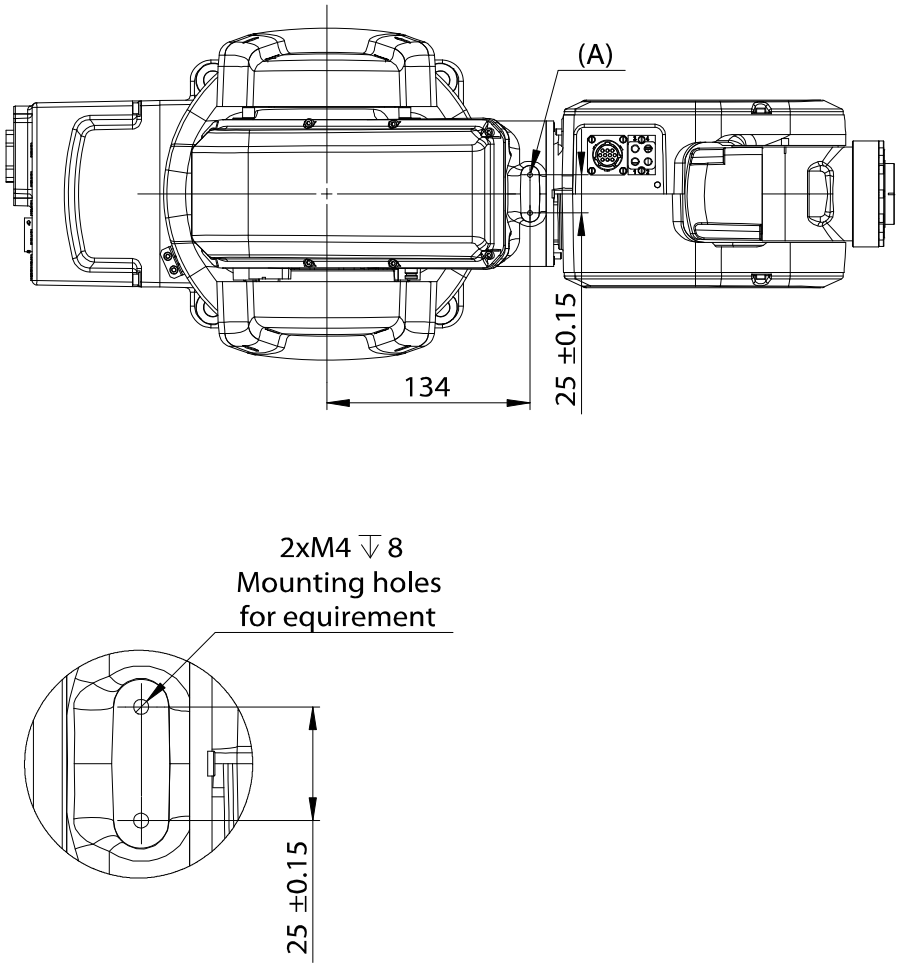


xx0900000369

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

1.5.2. Holes for mounting of extra equipment

Upper arm



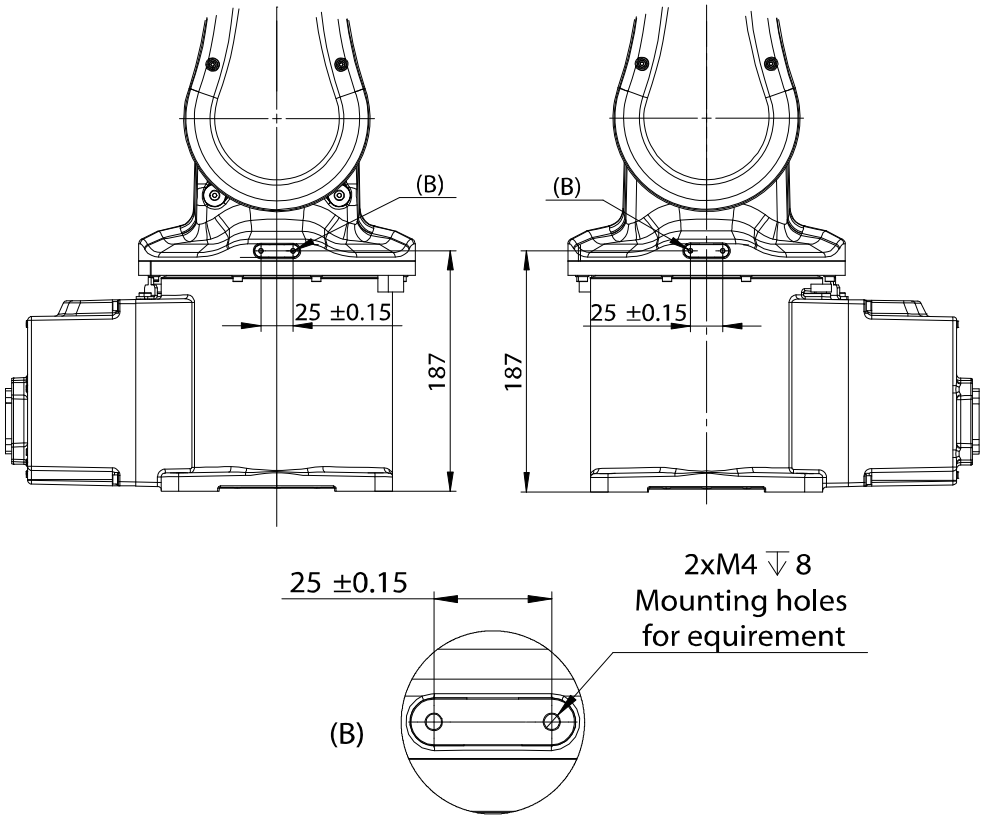
xx0900000259

Continues on next page

1.5.2. Holes for mounting of extra equipment

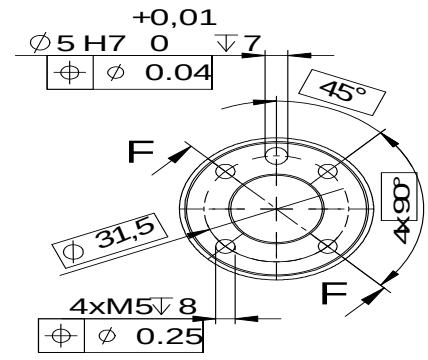
Continued

Frame

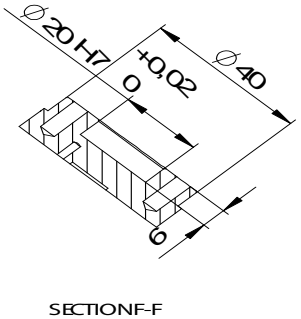


xx0900000260

Robot tool flange



xx0900000261



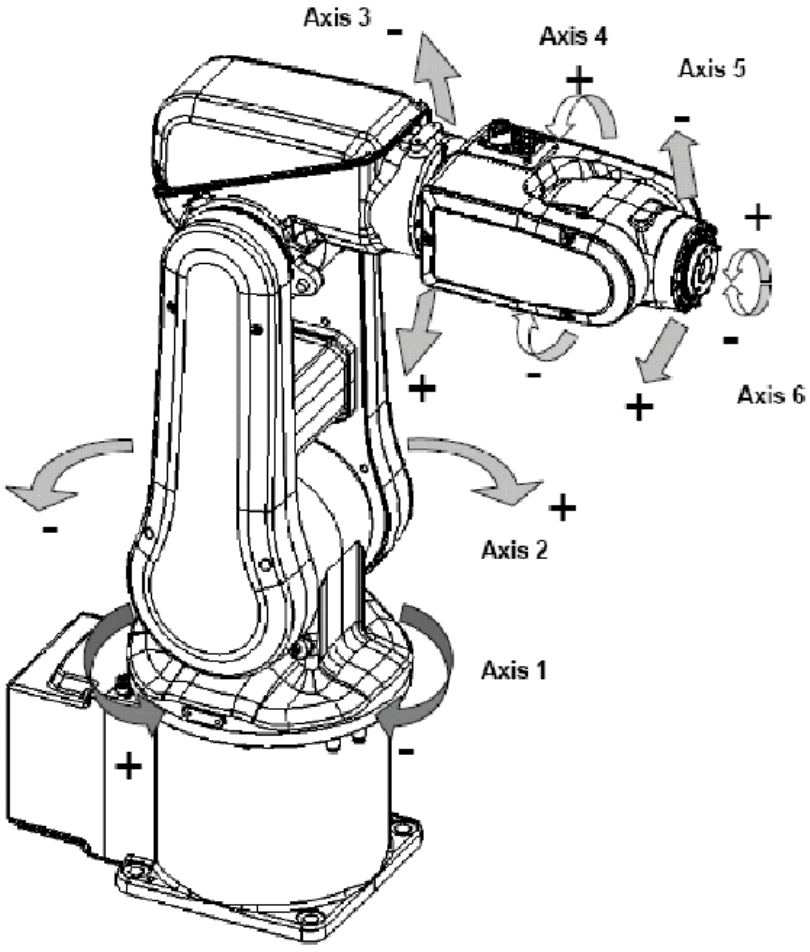
SECTION F-F

1.6 Calibration

1.6.1. Fine calibration

General

Fine calibration is made by moving the axes against hard stops. Detailed information on performing calibration of the robot see Product Manual, art. No. 3HAC035728-001.



xx0900000262

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

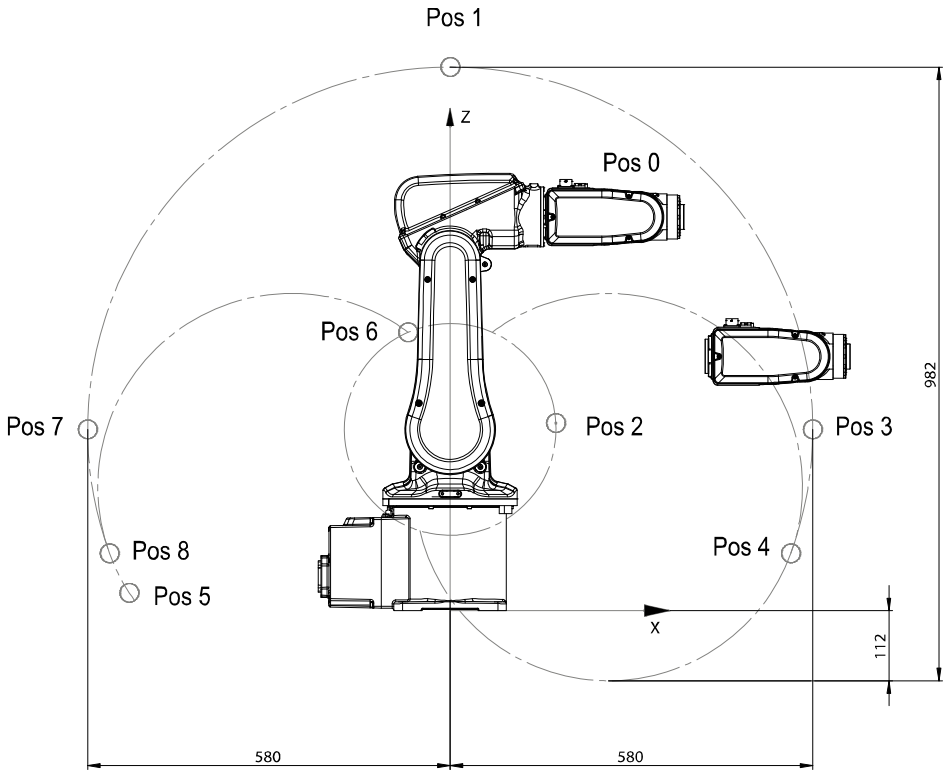
The maintenance intervals depend on the use of the robot, the required maintenance activities also depends on selected options. For detailed information on maintenance procedures, see Maintenance section in the Product Manual.

1.8 Robot Motion

1.8.1. 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 - 90°
Axis 4	Rotation motion	+ 160° to - 160°
Axis 5	Bend motion	+ 120° to - 120°
Axis 6	Turn motion	+ 400° to - 400°



xx0900000263

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	-513	28	-110	-90
6	-67	445	-110	70

Continues on next page

1.8.1. Introduction to Robot motion

Continued

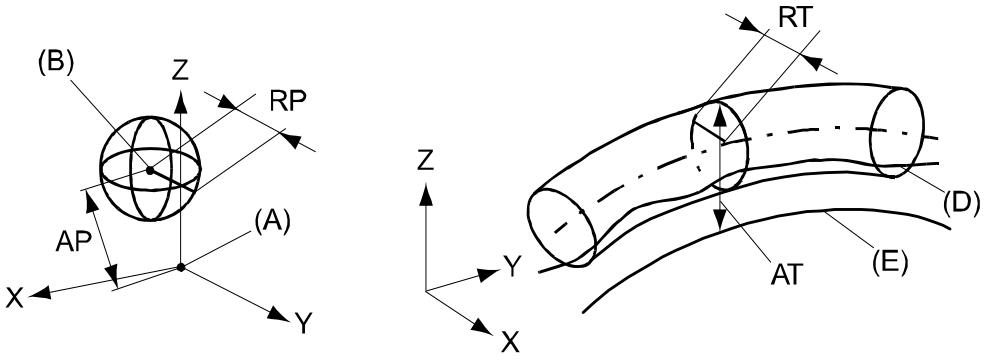
Position No. (see Figure 15)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
7	-580	270	-90	-77
8	-545	91	-110	-77

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, 1m cube with all six axes in motion

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
RP	Tolerance of position B at repeated positioning	RT	Tolerance of the path at repeated program execution

Description	Values
IRB	**120 - 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

1.8.3. 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

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

Resolution

Approx. 0.01° on each axis.

1.8.4. Stopping distance/time

General

Stopping distance/time for emergency stop (category 0), program stop (category 1) 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 120-3/0.6	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.

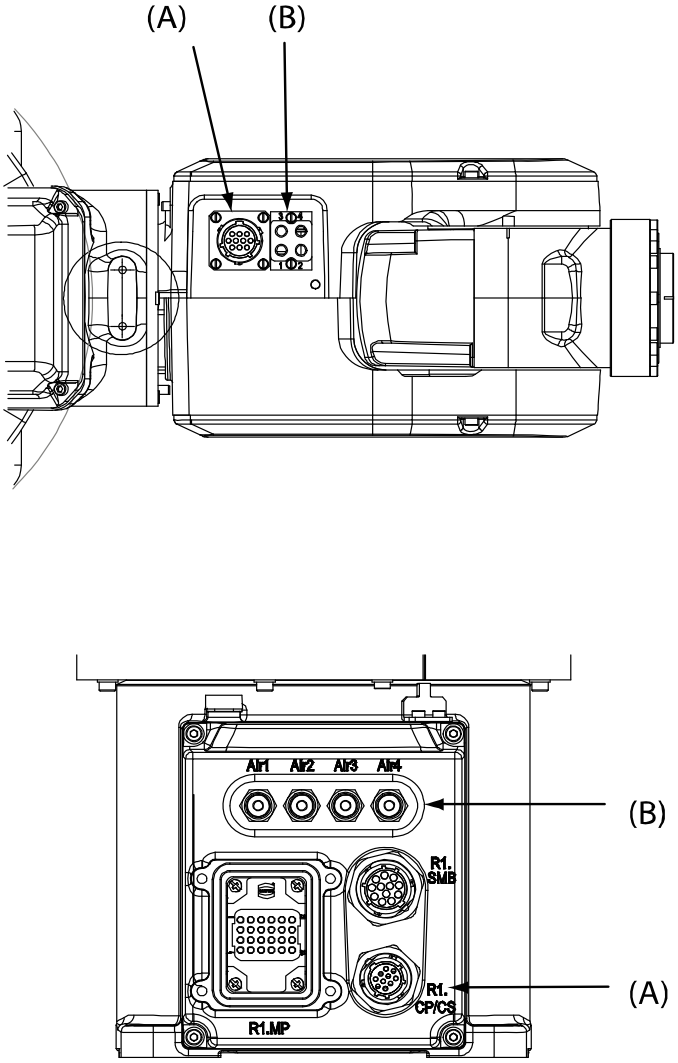
	Description
A	Distance in degrees
B	Stop time (s)

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.



xx0900000264

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

2.1.1. Introduction to Variants and Options

General

The different variants and options for the IRB 120 are described below.The same numbers are used here as in the Specification form.For controller options, see Product specification - Controller IRC5 with FlexPendant, and for software options, see Product specification - RobotWare Options.

2.1.2. Manipulator

Variants

Option	IRB Type	Handling capacity (kg) / Reach (m)
435-100	IRB 120	3/0.6

Manipulator color

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

Protection

Option	Description
287-4	Standard

Connector kit

The kit consists of connectors, pins and sockets.

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

Warranty

Option	Type	Description
438-1	Standard Warranty	Standard warranty is 18 months (1 1/2 years)
438-2	Standard + 12 months	18 + 12 months (2 1/2 years)
438-4	Standard + 18 months	18 + 18 months (3 years)
438-5	Standard + 24 months	18 + 24 months (3 1/2 years)
438-6	Standard + 6 months	18 + 6 months (2 years)
438-8	Stock Warranty	Maximum 6 months postponed warranty starting from shipment date ABB Robotics Production unit (PRU) + Option 438-1. Warranty commences automatically after 6 months or from activation date of standard warranty. (See ABB Robotics BA Warranty Rules).

2.1.3. Floor cables

Manipulator cable length

Option	Lengths
210-1	3 m
210-2	7 m
210-3	15 m

Connection of Parallel communication

Option	Lengths	Description
94-1	7 m	Not together with IRC5 Compact
94-2	15 m	Not together with IRC5 Compact

2.1.4. 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.

2.1.5. Documentation

DVD User Documentation

Option	Type	Description
808-1	Documentation on DVD	See Product specification Robot User Documentation

2.1.5. Documentation

3 Accessories

3.1 Introduction to Accessories

3.1.1. General

Basic software and software options for robot and PC

For more information, see Product specification - Controller IRC5C with FlexPendant, and Product specification - RobotWare Options.

Robot Peripherals

- Motor Units

3HAC035960-001, Revision A, en

ABB AB
Robotics Products
S-721 68 VÄSTERÅS
SWEDEN
Telephone: +46 (0) 21 344000
Telefax: +46 (0) 21 132592