ROBOTICS

Product specification

IRB 910INV

Trace back information:
Workspace 21A version a11
Checked in 2021-03-19
Skribenta version 5.4.005

Product specification

IRB 910INV-3/0.35
IRB 910INV-6/0.55

OmniCore

Document ID: 3HAC068057-001

Revision: E

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

Overview of this manual 7

1 Description 9

1.1 Structure 9
1.1.1 Introduction to structure 9
1.1.2 The robot 12
1.1.2.1 Technical data 13
1.2 Standards 18
1.2.1 Applicable standards 18
1.3 Installation 20
1.3.1 Introduction to installation 20
1.3.2 Operating requirements 21
1.3.3 Mounting the manipulator 22
1.4 Load diagrams 24
1.4.1 Introduction to load diagram 24
1.4.2 Load diagram 25
1.4.3 Maximum load and moment of inertia 27
1.4.4 Maximum TCP acceleration 28
1.5 Mounting of equipment 29
1.6 Calibration 34
1.6.1 Calibration methods 34
1.6.2 Fine calibration 36
1.6.3 Absolute Accuracy option 37
1.7 Maintenance and troubleshooting 39
1.7.1 Introduction to maintenance and trouble shooting 39
1.8 Robot motion 40
1.8.1 Working range and type of motion 41
1.8.2 Performance according to ISO 9283 43
1.8.3 Velocity 44
1.8.4 Robot stopping distances and times 45
1.9 Customer connections 46

2 Specification of variants and options 49

2.1 Introduction to variants and options 49
2.2 Manipulator 50
2.3 Floor cables 52
2.4 User documentation 54

3 Accessories 55

Index 57

This page is intentionally left blank

Overview of this manual

About this product specification

This product specification describes the performance of the manipulator or a complete family of manipulators in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety, and operating equipment
- The load diagrams, mounting or extra equipment, the motion, and the robot reach
- The specification of available variants and options

The specification covers the manipulator using the OmniCore controller.

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

The specification is intended for:

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

References

Document name	Document ID
Product manual, spare parts - IRB 910INV	*Document.ID-1*
Product manual - IRB 910INV	*3HAC068055-001*
Circuit diagram - IRB 910INV	*3HAC061899-011*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller [i]	*3HAC031045-001*
Product manual - OmniCore C30	*3HAC060860-001*
Product manual - OmniCore C90XT	*3HAC073706-001*
Operating manual - OmniCore	*3HAC065036-001*
Application manual - Controller software OmniCore	*3HAC066554-001*
Application manual - CalibWare Field	*3HAC030421-001*
Technical reference manual - Event logs for RobotWare 7	*3HAC066553-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*
Technical reference manual - System parameters	*3HAC065041-001*

[i] This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Revisions

Revision	Description
A	First edition.

Continues on next page

Continued

Revision	Description
B	Published in release R19D The following updates are done in this revision: • Protection option 3350-540 Base 54 and 3351-1 Cleanroom 1 added. 209-2 ABB white standard added. • Minor changes.
C	Published in release R20C. The following updates are done in this revision: • Minor Changes. • Absacc production data added.
D	Published in release R20D. The following updates are done in this revision: • Minor Changes. • Warranty section updated.
E	Published in release R21A. The following updates are done in this revision: • Maximum TCP acceleration added. • Connector types for CP/CS and Ethernet floor cable wiring are added.

1 Description

1.1 Structure

1.1.1 Introduction to structure

General

The IRB 910INV is ABB Robotics second generation SCARA robot, with 4 axes and a max payload of 3 kg and 6 kg in two different reach variants 0.35 m and 0.55 m, designed specifically for manufacturing industries that use flexible robot-based automation, e.g. 3C industry. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems.

Clean room robots

xx2000001471

Particle emission from the robot fulfill Clean room class 1 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 IRB 910INV is suitable for use in clean rooms fulfilling the Air Cleanliness Class 1 according to ISO 14644-1, when operated at a capacity of 50%.

The robot IRB 910INV is suitable for use in clean rooms fulfilling the Air Cleanliness Class 1 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 simplify cleaning. The paint has been tested regarding outgassing of Volatile Organic Compounds (VOC) and been classified in accordance with ISO 14644-8.

Continues on next page

1.1.1 Introduction to structure
Continued

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.

IP54 protection

The robot has IP54 as an option. The option will add sealing, machining parts and gaskets.

Operating system

The robot is equipped with the OmniCore C30 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 *Operating manual - OmniCore*.

Safety

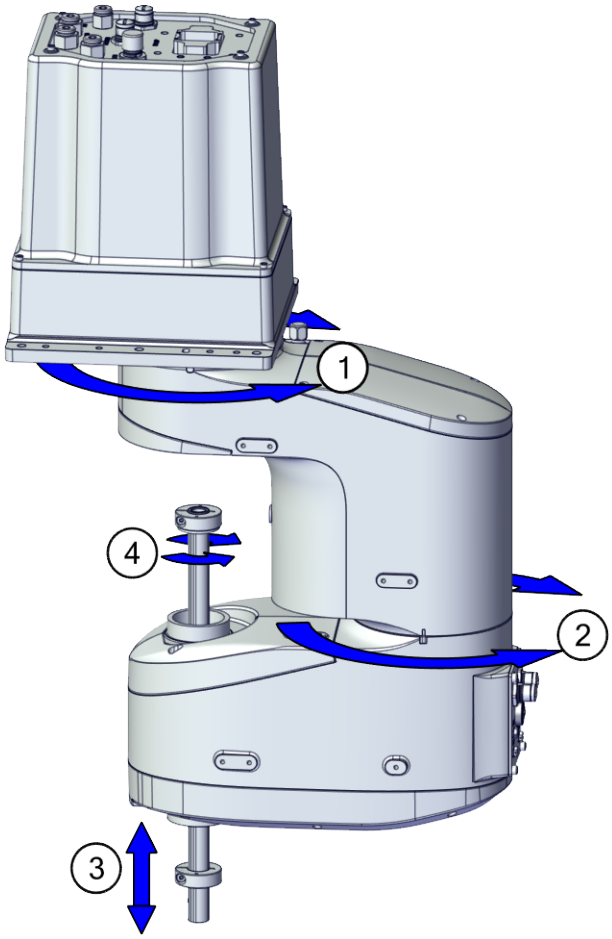
The safety standards are valid for the complete robot, manipulator and controller.

Additional functionality

For additional functionality, the robot can be equipped with optional software for application support - for example dispensing and cutting, communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see the *Product specification - OmniCore C line*.

Continues on next page

Manipulator axes



xx1900000084

Position	Description	Position	Description
1	Axis 1	2	Axis 2
3	Axis 3	4	Axis 4

1.1.2 The robot

General

The IRB 910INV is available in two variants and both can only be mounted on ceiling, no other mounting position is permitted.

Robot type	Maximum handling capacity (kg)	Reach (m)
IRB 910INV-3/0.35	3 kg	0.35 m
IRB 910INV-6/0.55	6 kg	0.55 m

Continues on next page

1.1.2.1 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
IRB 910INV	IRB 910INV-3/0.35: 19 kg IRB 910INV-6/0.55: 22 kg

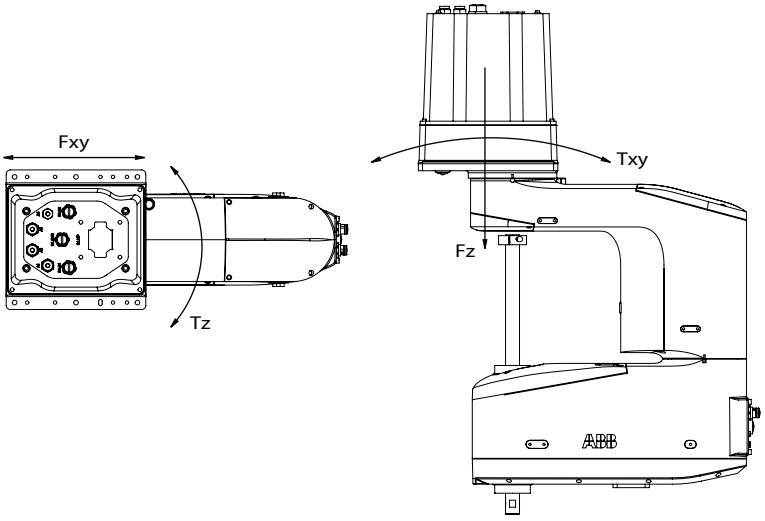
Note

The weight does not include tools and other equipment fitted on the robot!

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

The directions are valid for all inverted robots.



xx1900000059

F_{xy}	Force in any direction in the XY plane
F_z	Force in the Z plane
T_{xy}	Bending torque in any direction in the XY plane
T_z	Bending torque in the Z plane

The table shows the various forces and torques working on the robot during different kinds of operation.

Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!

Continues on next page

1.1.2.1 Technical data
Continued

WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Inverted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±420/440 N	±770/710 N
Force z	190 ±135/220 ±200 N	190 ±660/220 ±110 N
Torque xy	±220/170 Nm	±220/320 Nm
Torque z	±90/125 Nm	±160/190Nm

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.1/500 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy.
Maximum tilt	3°	
Minimum resonance frequency	22 Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. [i] For information about compensating for foundation flexibility, see *Application manual - Controller software OmniCore*, section *Motion Process Mode*.

i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25°C

Continues on next page

Parameter	Value
Maximum ambient temperature	55 °C
Maximum ambient temperature (less than 24 hrs)	70 °C
Maximum ambient humidity	95% at constant temperature (gaseous only)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	5 °C [i]
Maximum ambient temperature	45 °C
Maximum ambient humidity	95% at constant temperature

[i] At low environmental temperature < 10ºC 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.

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class
Manipulator, protection type Standard	IP30 [i] IP54 (option 3350-540)
Manipulator, protection type Clean Room	ISO Class 1

[i] The protection class of the ballscrew area is IP20. For more information, please contact ABB.

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/EC)

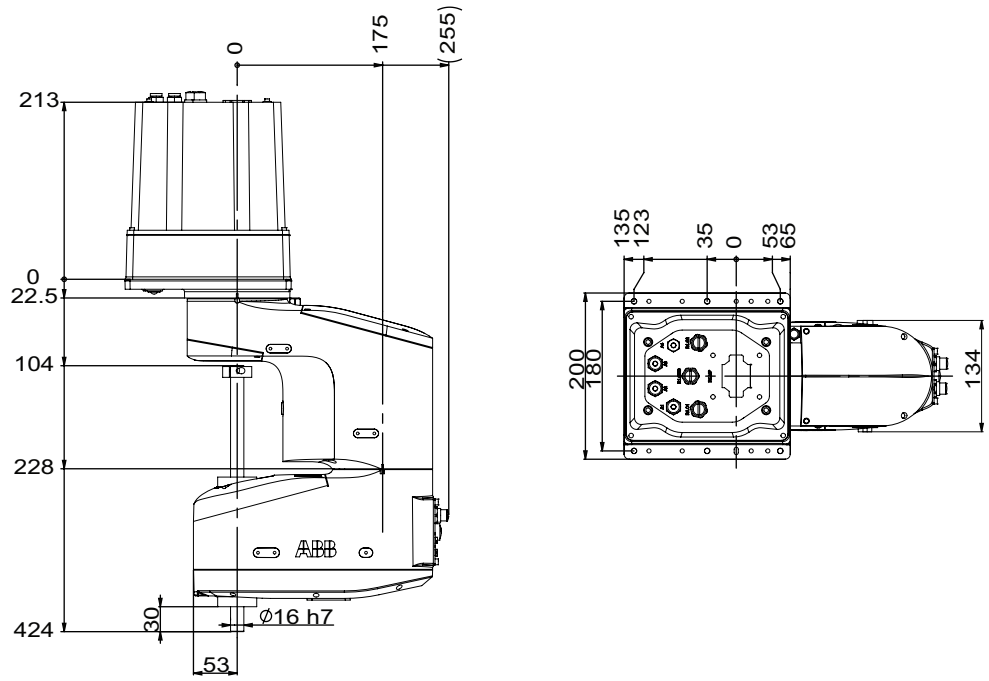
Power consumption

Robot in 0 degree position	IRB 910INV-3/0.35	IRB 910INV-6/0.55
Brakes engaged (W)	74	81
Brakes disengaged (W)	102	115

1.1.2.1 Technical data
Continued

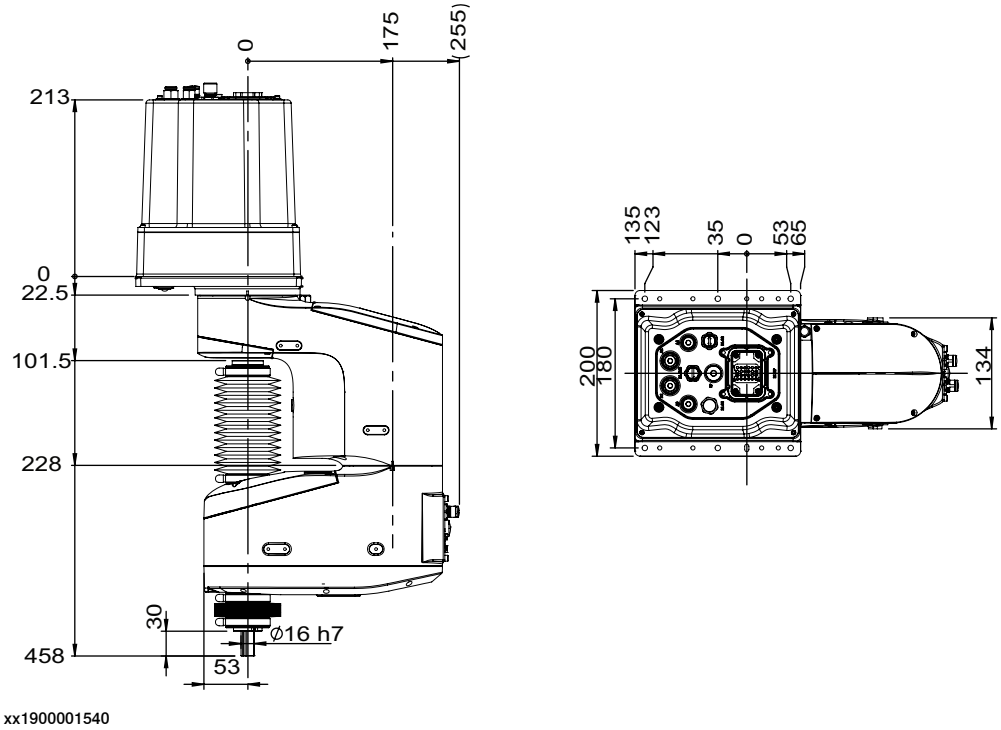
Dimensions of IRB 910INV-3/0.35

Robots with protection class IP30 (option 3350-300)



xx1800002818

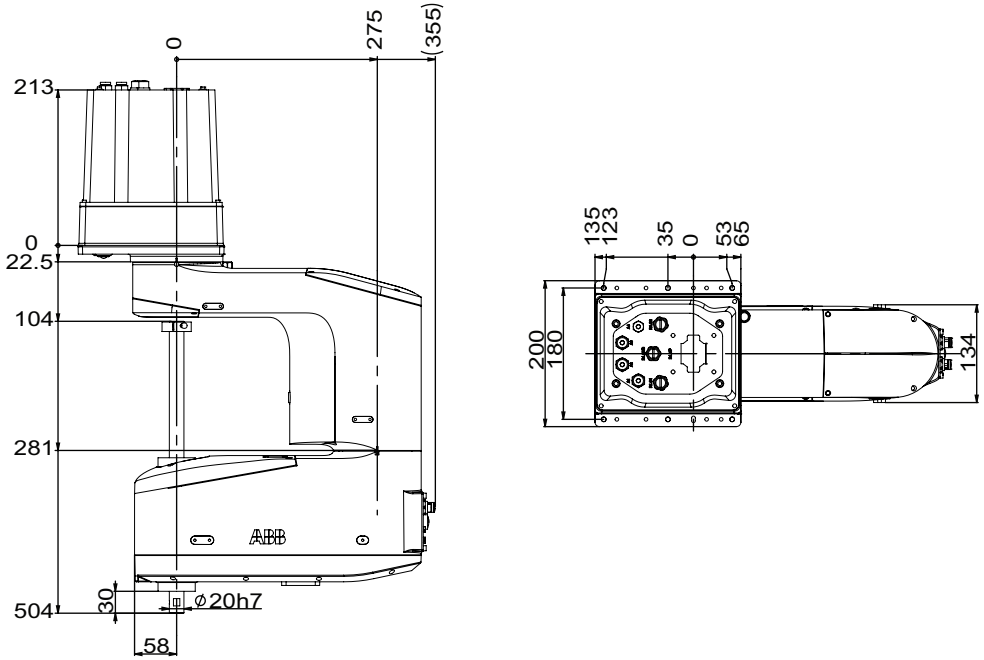
Robots with protection class IP54 (option 3350-540) or with protection type Clean Room (option 3351-1)



xx1900001540

Dimensions of IRB 910INV-6/0.55

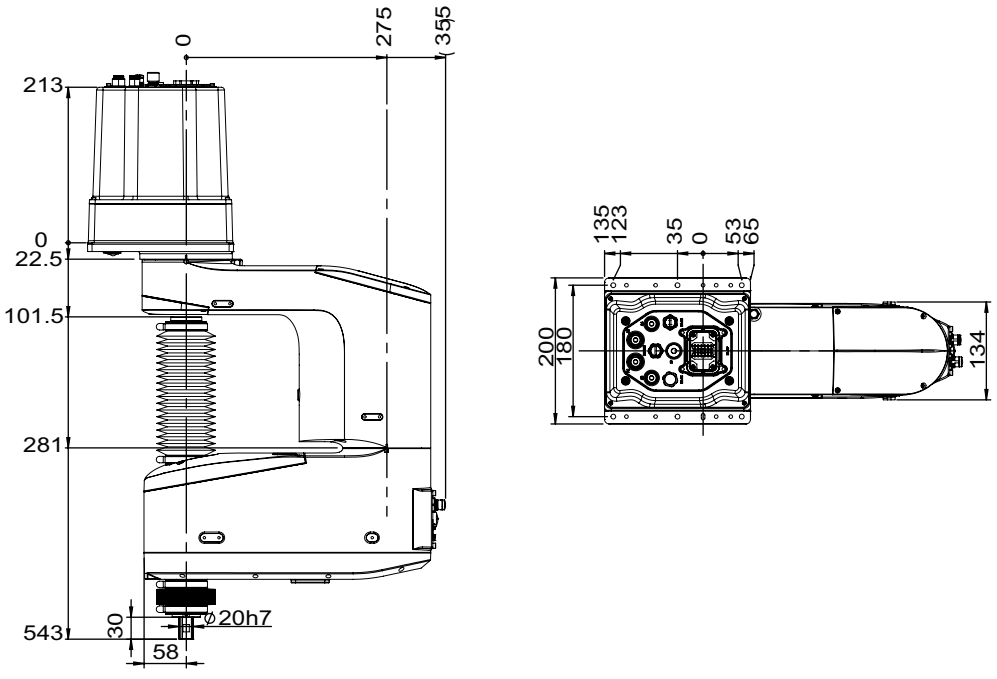
Robots with protection class IP30 (option 3350-300)



xx1900000217

Robots with protection class IP54 (option 3350-540) or with protection type Clean Room (option 3351-1)

The figure shows the dimension of the IRB 910INV-6/0.55 for Clean Room/IP54.



xx1900001541

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 ISO 10218-1:2011, Robots for industrial environments - Safety requirements -Part 1 Robots, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviations from ISO 10218-1:2011, these are listed in the declaration of incorporation which is part of the product delivery.

Normative standards, ISO

Standard	Description
ISO 9283:1998	Manipulating industrial robots - Performance criteria and related test methods
ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
ISO 13850	Safety of machinery - Emergency stop - Principles for design
IEC 60204-1:2005	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments

Continues on next page

Standard	Description
IEC 61000-6-4 (option 129-1)	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012[i]	Arc welding equipment - Part 1: Welding power sources
IEC 60974-10:2014[i]	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015[ii]	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

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

1.3 Installation

1.3.1 Introduction to installation

General

IRB 910INV is adapted for normal industrial environment. An end effector with max. weight of 3 kg or 6 kg, including payload, can be mounted on the lower end of the ball screw spline shaft (axis 3). For more information about mounting of extra equipment, see *Mounting of equipment on page 29*.

1.3.2 Operating requirements

Protection standard

Robot variant	Protection standard IEC529
All variants, manipulator	IP30
Option, all variants, manipulator	IP54
Option, all variants, manipulator	ISO Class 1

Explosive environments

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

Working range limitations

EPS will not be selectable and no mechanical limitations available.

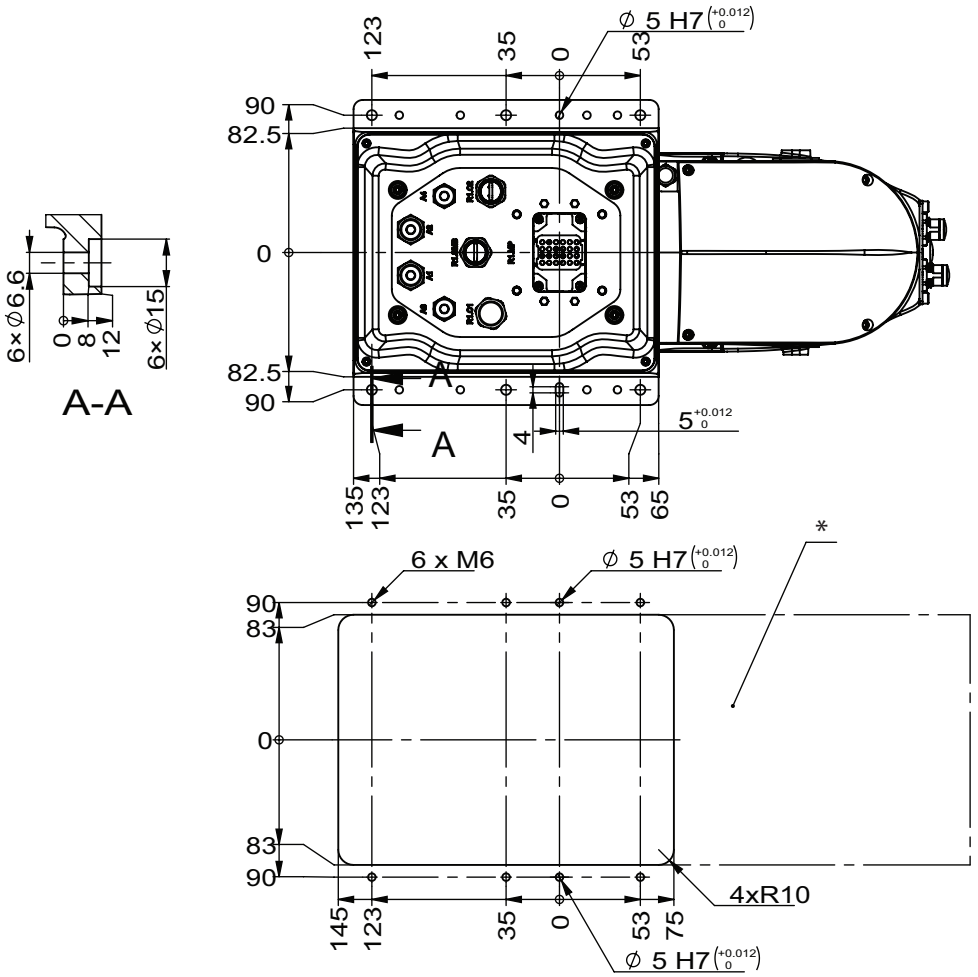
Relative humidity

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

1.3.3 Mounting the manipulator

Hole configuration, base

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



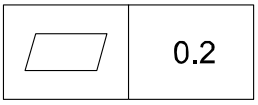
xx1800002817

* Maintenance window: Opening to access inner arm's cover is recommended.

Continues on next page

Attachment screws

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

Suitable screws	M6x25 (robot installation directly on foundation)
Quantity	6 pcs
Quality	10.9
Suitable washer	12 x 6.4 x 1.6, steel hardness class 300HV
Guide pins	2 pcs, D5x20, ISO 2338 - 5m6x20 - A1
Tightening torque	11 Nm±1.1 Nm
Level surface requirements	 xx0900000643

1.4 Load diagrams

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:

- ball screw spline unit
- 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. For detailed information, see *Product manual - OmniCore C30*.

WARNING

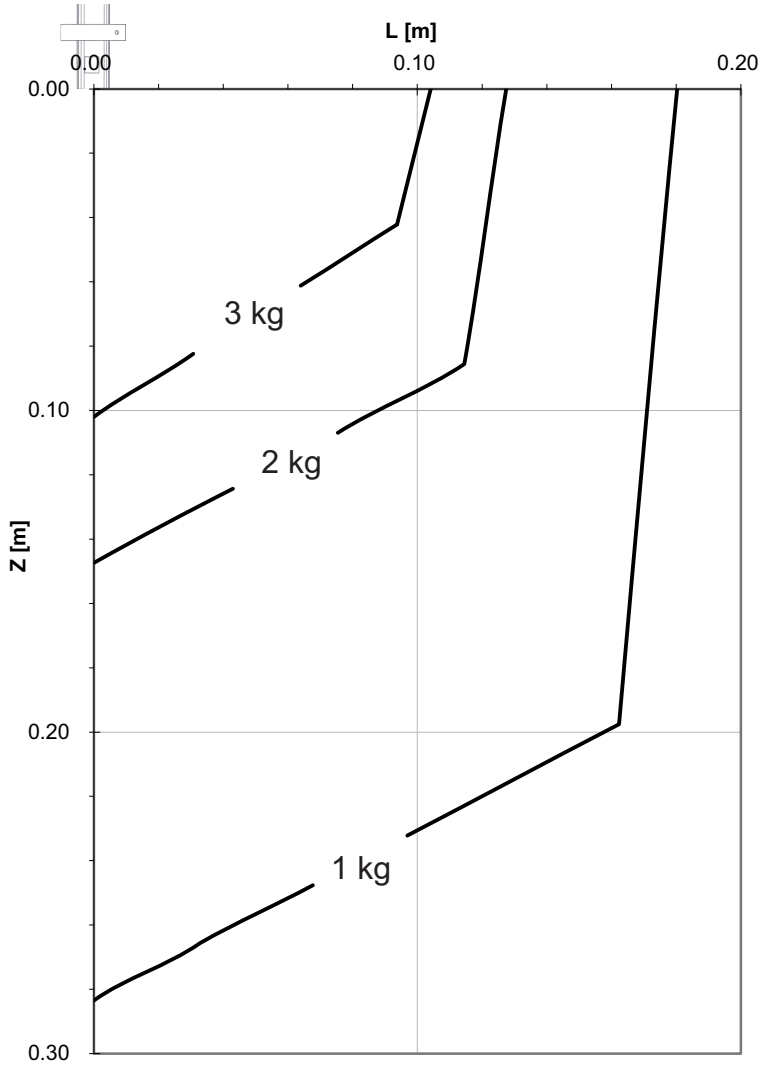
Robots running with incorrect load data and/or with loads outside diagram, will not be covered by robot warranty.

General

The load diagram includes a nominal pay load inertia, J_0 of 0.01 kgm^2. At different moment of inertia the load diagram will be changed. For robots that are inverted mounted, the load diagrams as given are valid and thus it is also possible to use RobotLoad within those tilt and axis limits.

1.4.2 Load diagram

IRB 910INV-3/0.35

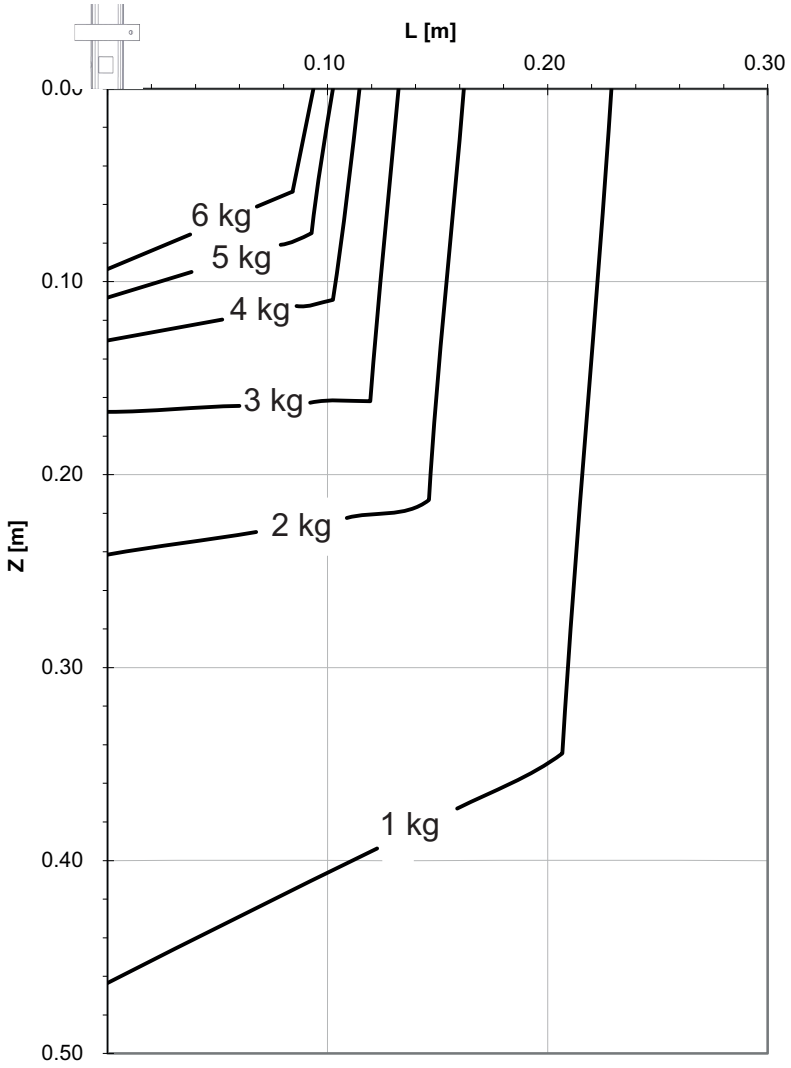


xx1800003275

Continues on next page

1.4.2 Load diagram
Continued

IRB 910INV-6/0.55



xx1800003276

1.4.3 Maximum load and moment of inertia

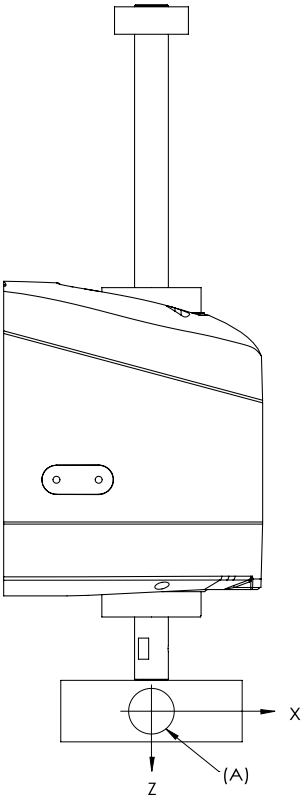
General

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. $L = \sqrt{(X^2 + Y^2)}$.

For IRB 910INV, L is 0 mm at the default rating and its maximum value changes with the payload. See *Load diagram on page 25*.

Full movement

Axis	Robot variant	Max. value
4	IRB 910INV-3/0.35	$J_4 = \text{Mass} \times L^2 + J_{0Z} \leq 0.05\ kgm^2$
	IRB 910INV-6/0.55	$J_4 = \text{Mass} \times L^2 + J_{0Z} \leq 0.12\ kgm^2$



xx1900001317

Position	Description
A	Center of gravity
J_{ox}, J_{oy}, J_{oz}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

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

Concerning SCARAs, as the movements types could be treated as combinations of horizontal movements alone and vertical movements alone, the detailed information of spacial acceleration values are listed. XYZ stands for 3-dimensional movements while XY stands for horizontal movements.

Robot type	E-stop Max acceleration at nominal load COG [m/s^2]		Controlled Motion Max acceleration at nominal load COG [m/s^2]	
	XYZ	XY	XYZ	XY
IRB 910INV-3/0.35	99	99	40	34
IRB 910INV-6/0.55	66	65	29	27

Note

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

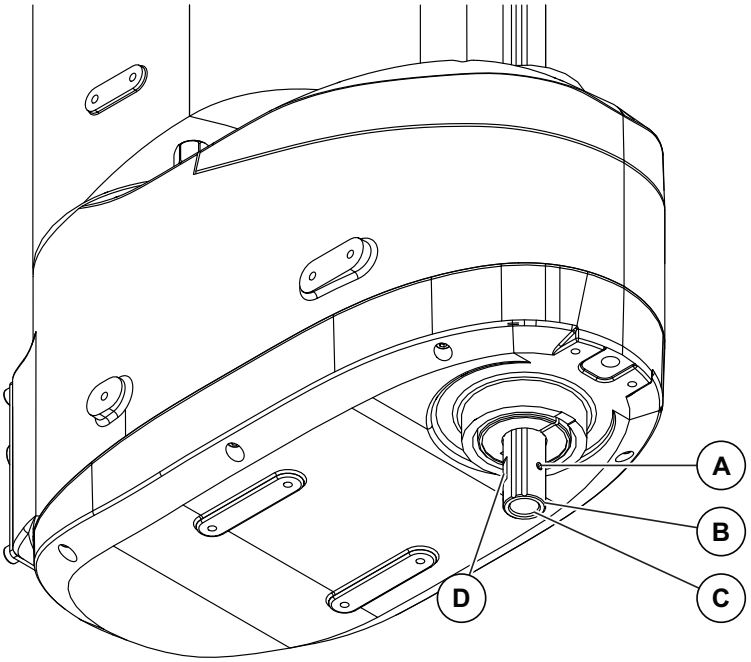
1.5 Mounting of equipment

Fitting of end effector to the ball screw spline shaft

An end effector can be attached to the lower end of the shaft of the ball screw spline unit. The dimensions for fitting the end effector is shown in the following figure.

Note

Mounting of other equipment on the IRB 910INV may damage the gearboxes.



xx1800002819

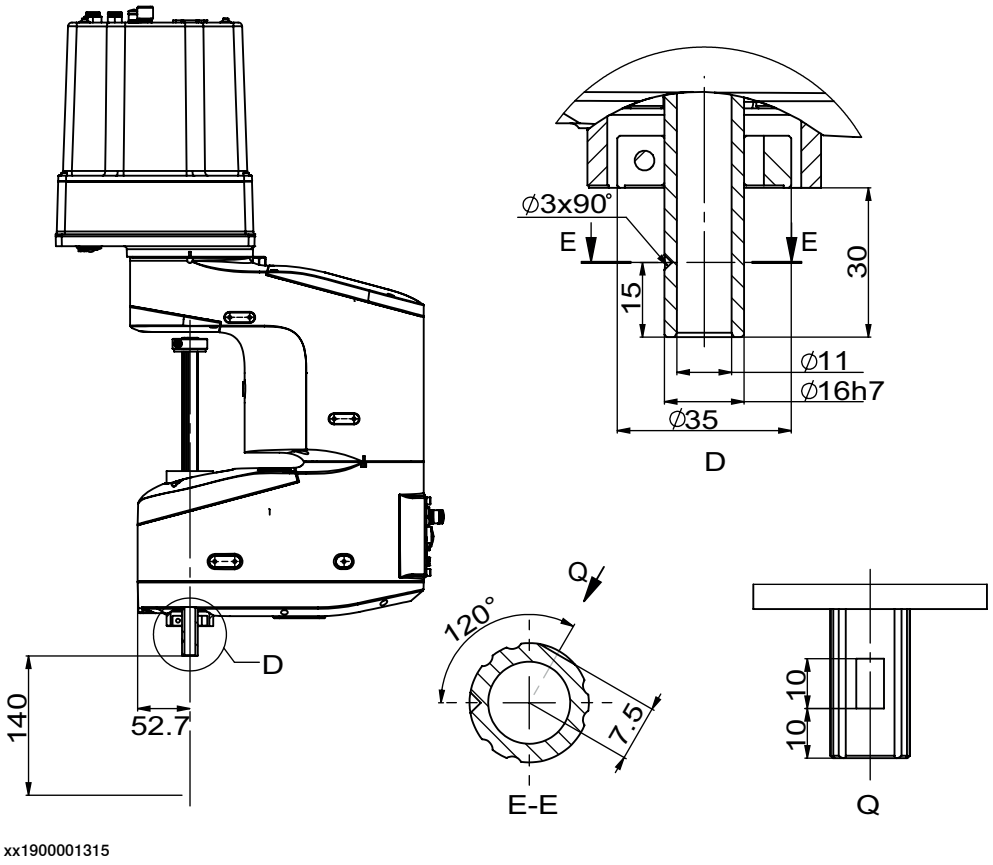
A	Conical hole
B	Shaft diameter
C	Through hole
D	Flat cut

Continues on next page

1.5 Mounting of equipment
Continued

End effector flange of IRB 910INV-3/0.35

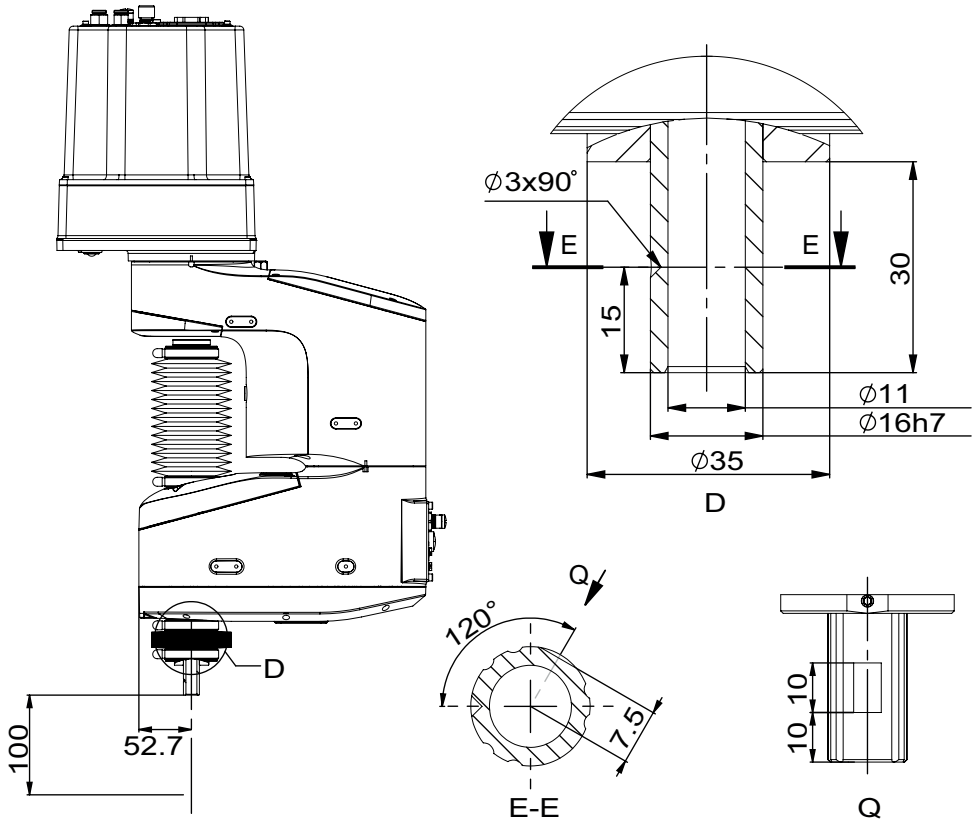
IP30



xx1900001315

Continues on next page

Clean Room/ IP54



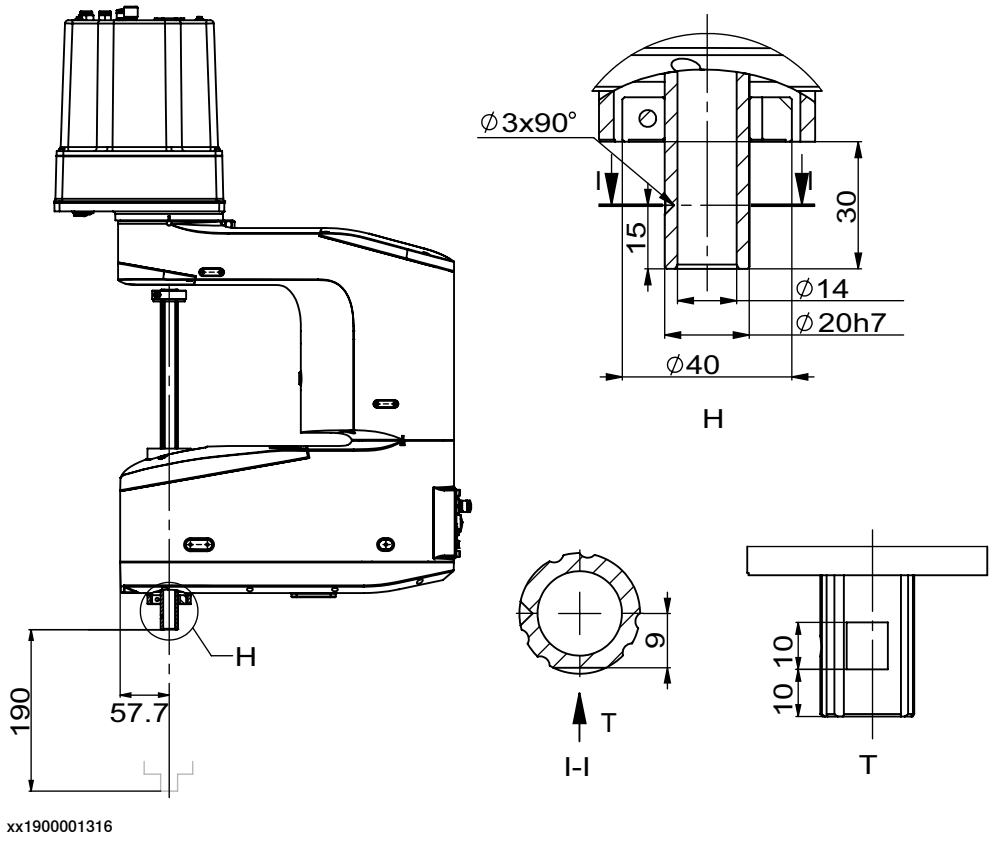
xx1900001544

Continues on next page

1.5 Mounting of equipment
Continued

End effector flange of IRB 910INV-6/0.55

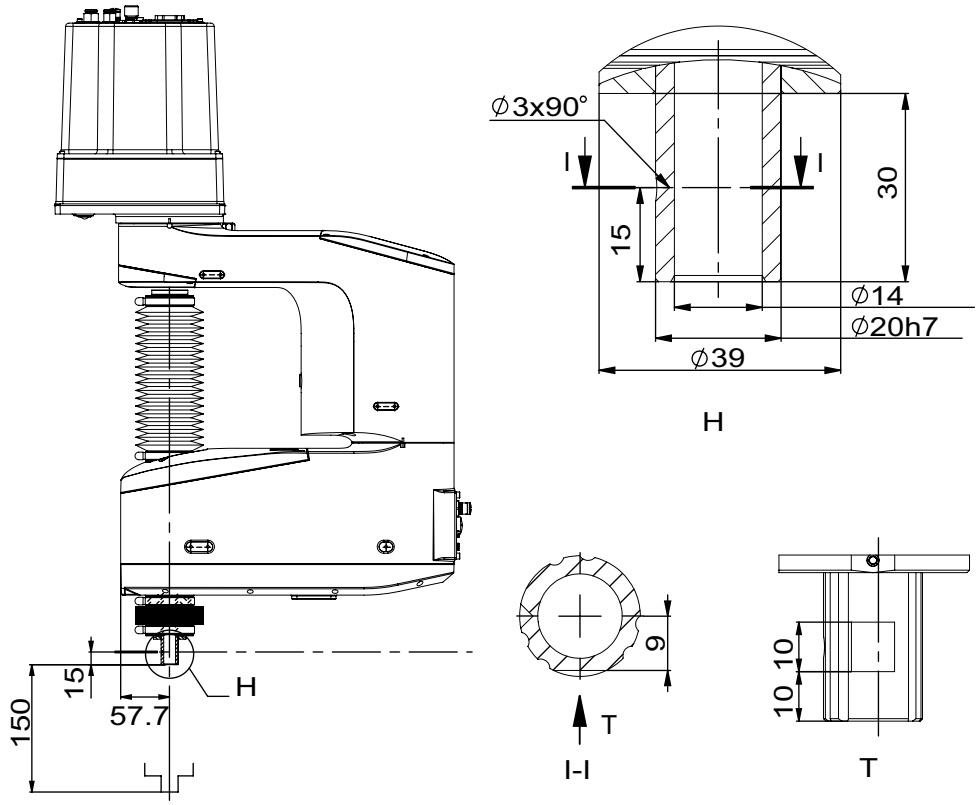
IP30



xx1900001316

Continues on next page

Clean Room/ IP54



xx1900001545

1.6 Calibration

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.	Axis Calibration [i]
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. A robot calibrated with Absolute accuracy has the option information printed on its name plate. To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare

[i] Only axes 1 and 2 can be calibrated using Axis Calibration method.

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 910INV and is the most accurate method for the standard calibration. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

Continues on next page

The calibration equipment for Axis Calibration is delivered as a toolkit.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

CalibWare - Absolute Accuracy calibration

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

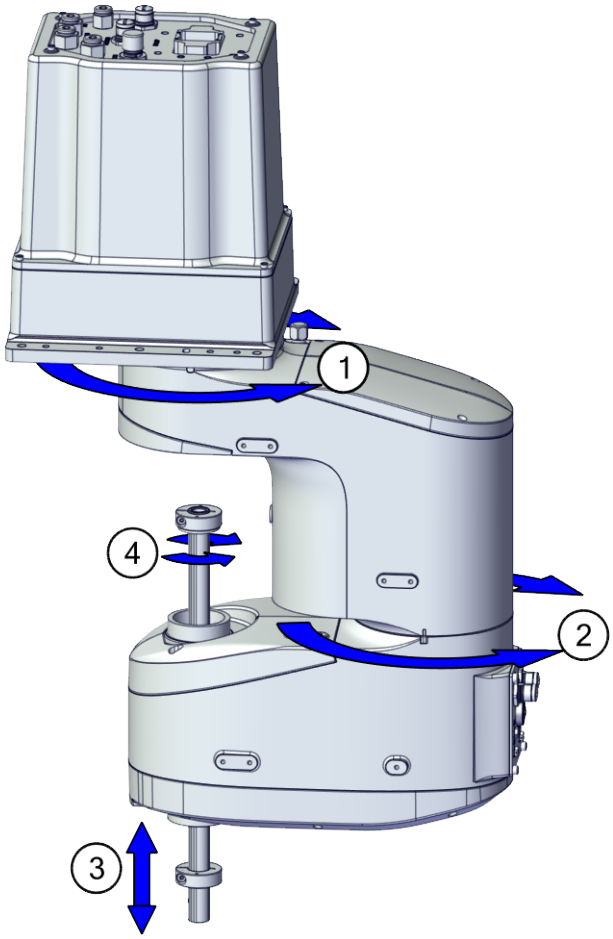
If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

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

1.6.2 Fine calibration

General

Fine calibration is made by moving the axes so that the synchronization mark on each joint is aligned. For detailed information on calibration of the robot see *Product manual - IRB 910INV*.



xx1900000084

Position	Description	Position	Description
1	Axis 1	2	Axis 2
3	Axis 3	4	Axis 4

1.6.3 Absolute Accuracy option

Purpose

Absolute Accuracy is a calibration concept that improves TCP accuracy. The difference between an ideal robot and a real robot can be several millimeters, resulting from mechanical tolerances and deflection in the robot structure. *Absolute Accuracy* compensates for these differences.

Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to eg. vision system or offset programming
- Re-use of programs between applications

The option *Absolute Accuracy* is integrated in the controller algorithms and does not need external equipment or calculation.

Note

The performance data is applicable to the corresponding RobotWare version of the individual robot.

What is included

Every *Absolute Accuracy* robot is delivered with:

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

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

Absolute Accuracy supports floor mounted, wall mounted and ceiling mounted installations. Compensation parameters saved on the robot's serial measurement board differ depending on which Absolute Accuracy option is selected.

When is *Absolute Accuracy* being used

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

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

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

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

Continues on next page

1.6.3 Absolute Accuracy option
Continued

- 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 910INV-3/0.35	0.5	1	100
IRB 910INV-6/0.55	0.5	1	100

1.7 Maintenance and troubleshooting

1.7.1 Introduction to maintenance and trouble shooting

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 gearboxes.
- The cabling is routed for longevity, and in the unlikely event of a failure, its modular design makes it easy to change.

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 - IRB 910INV*.

1.8 Robot motion

General

Note

Robot moves faster when axis 3 is at a higher position. If the axis 3 is at a relatively low position, the acceleration and deceleration of axes 1, 2 and 4 may be reduced based on the actual position and speed of the axes, and the stabilization time for final positioning may also be longer when moving the robot horizontally.

Continues on next page

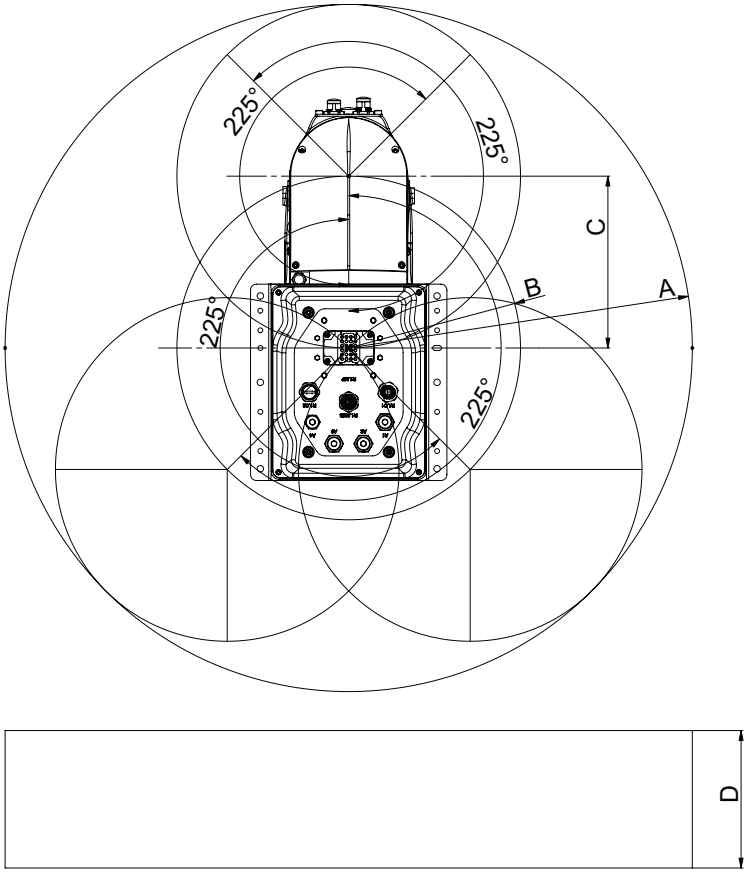
1.8.1 Working range and type of motion

Robot motion

Axis	Type of motion	Working range	
		IRB 910INV-3/0.35	IRB 910INV-6/0.55
Axis 1	Rotation motion	±225°	±225°
Axis 2	Rotation motion	±225°	±225°
Axis 3	Linear motion	-140 mm to 0 mm	-190 mm to 0 mm
Axis 3 (IP54 and Clean Room)	Linear motion	-100 mm to 0 mm	-150 mm to 0 mm
Axis 4	Rotation motion	±720°	±720°

Illustration, working range and turning radius

This illustration shows the unrestricted working range and turning radius.



xx1800002809

	IRB 910INV-3/0.35		IRB 910INV-6/0.55	
	IP30	Clean Room/IP54	IP30	Clean Room/IP54
A	R350	R350	R550	R550
B	R175	R175	R275	R275

Continues on next page

1.8.1 Working range and type of motion
Continued

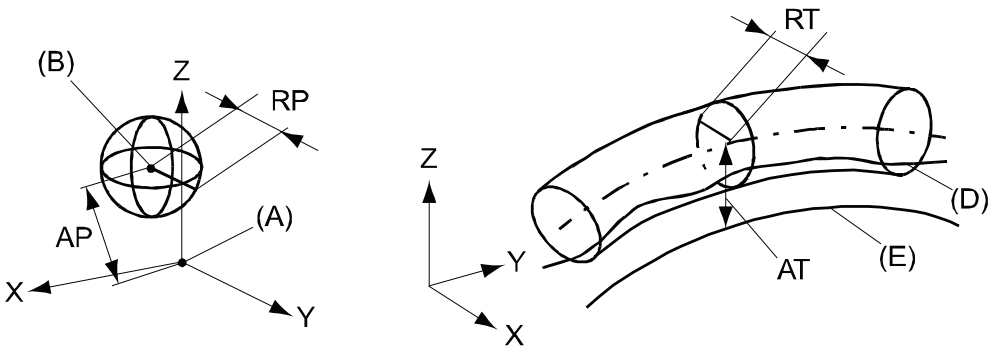
	IRB 910INV-3/0.35		IRB 910INV-6/0.55	
	IP30	**Clean Room/IP54**	**IP30**	**Clean Room/IP54**
C	175	175	275	275
D	140	100	190	150

1.8.2 Performance according to ISO 9283

General

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

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



xx0800000424

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

Description	Values[i]	
	IRB 910INV-3/0.35	IRB 910INV-6/0.55
Pose repeatability, RP (mm)	0.01	0.01
Linear path repeatability, RT (mm)	0.06	0.05
Pose stabilization time, PSt (s) within 0.1 mm of the position	0.61	1.05

[i] The values are based on the zero position of axis 3.

1.8.3 Velocity

General

Robot variant	Axis 1	Axis 2	Axis 3	Axis 4
IRB 910INV-3/0.35	672 °/s	780 °/s	1.1m/s	3,000 °/s
IRB 910INV-6/0.55	420 °/s	780 °/s	1.1 m/s	3,000 °/s

The velocities of axes 1, 2, and 4 are measured with 1 kg payload and axis 3 at position of 0 mm.

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

Resolution

Approximately 0.01° on each axis.

1.8.4 Robot stopping distances and times

Introduction

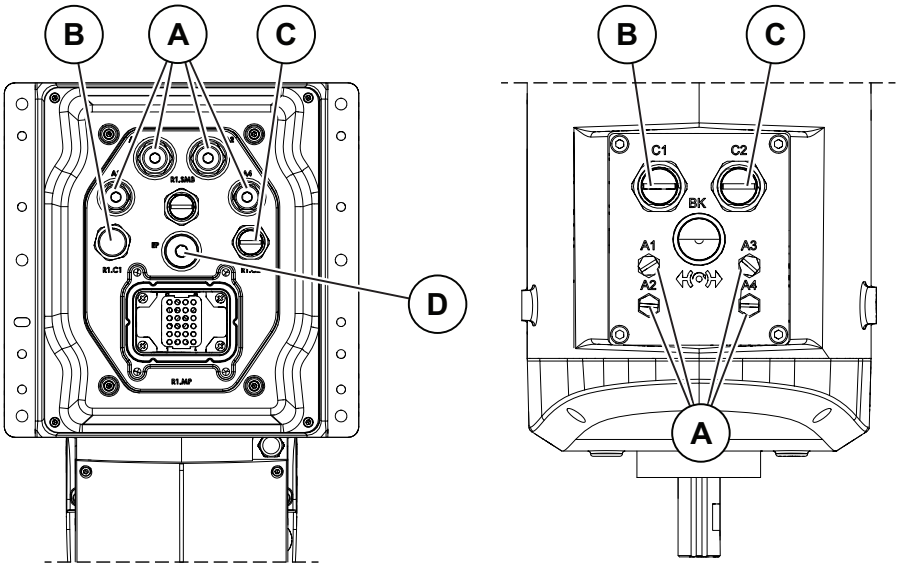
The stopping distances and times for category 0 and category 1 stops, as required by EN ISO 10218-1 Annex B, are listed in *Product specification - Robot stopping distances according to ISO 10218-1* (*3HAC048645-001*).

1.9 Customer connections

Introduction to customer connections

The cables for customer connection are integrated in the robot and the connectors are placed at the outer arm and base. There are two connectors C1/C2 at the outer arm. Corresponding connector R1.C1/R1.C2 are located at the base.

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



xx1800002821

Position	Connection	Description	Number	Value
A	Air	Max. 6 bar	4	Air hose OD 4 mm x2, air hose OD 6 mm x2
B	C1	Customer power/signal	8 wires[i]	30 V, 1.5 A
C	C2	Customer power/signal or ethernet	8 wires	30 V, 1 A or 1 Gbits/s
D	EP	Exhaust port[ii]	1	Φ10 , 7~9L/min[iii]

i The connector has 12 pins. Only pins 1 to 8 are available for use.
ii Only available for protection type Clean Room.
iii To avoid the deformation of bellows, reduce the air flow if necessary.

Continues on next page

Connector kits

The tables describes the CP/CS and Ethernet (if any) connector kits for the outer arm.

Connector kits, outer arm

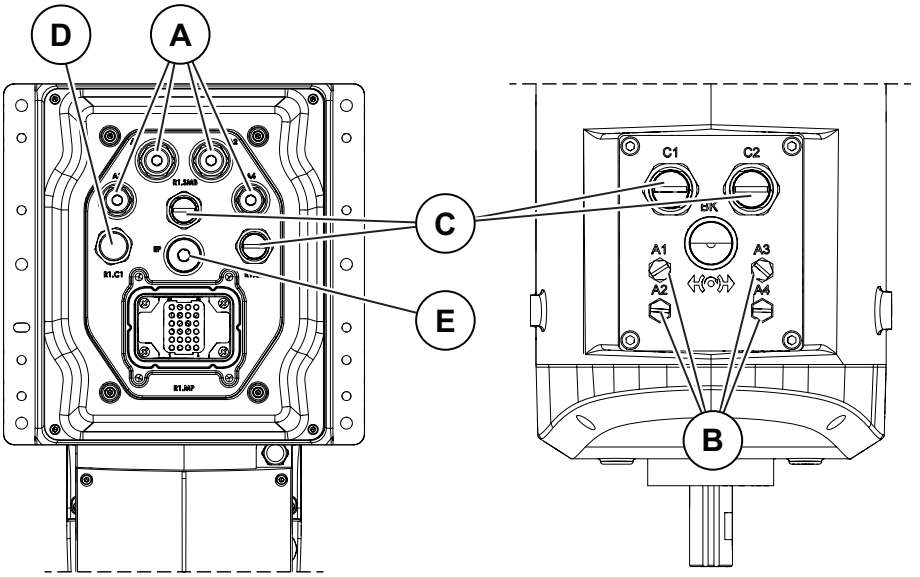
Position	Description		Art. no.
Connector kits	CP/CS	M12 CP/CS Male straight connector kits	3HAC066098-001
		M12 CP/CS Male angled connector kits	3HAC066099-001
	Ethernet	M12 Ethernet Cat5e Male straight connector kits	3HAC067413-001
		M12 Ethernet Cat5e Male angled connector kits	3HAC067414-001

Protection covers

Protection covers for water and dust proofing

Protection covers are delivered together with the robot and must be well fitted to the connectors in any application requiring water and dust proofing.

Always remember to refit the protection covers after removing them.



xx1900000149

A	Protection covers for air hose connector on the base
B	Protection covers for air hose connector on the process hub
C	Protection covers for C2/SMB connector on the base and C1/C2 connector on the process hub
D	Protection cover for C1 connector on the base
E	Protection cover for exhaust port connector on the base

This page is intentionally left blank

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 910INV are described in the following sections. The same option numbers are used here as in the specification form.

The variants and options related to the robot controller are described in the product specification for the controller.

2.2 Manipulator

Manipulator variants

Option	IRB Type	Max handling capacity (kg)	Reach (m)
3300-3	IRB 910INV	3	0.35
3300-4	IRB 910INV	6	0.55

Manipulator color

Option	Description
209-2	ABB White standard, required 3351-1 Cleanroom 1
209-202	ABB Graphite White std

Note

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

Manipulator protection

Option	Description
3350-300	Base 30, IP30
3350-540	Base 54, IP54
3351-1	Cleanroom 1, ISO Class 1

Media & Communication

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

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

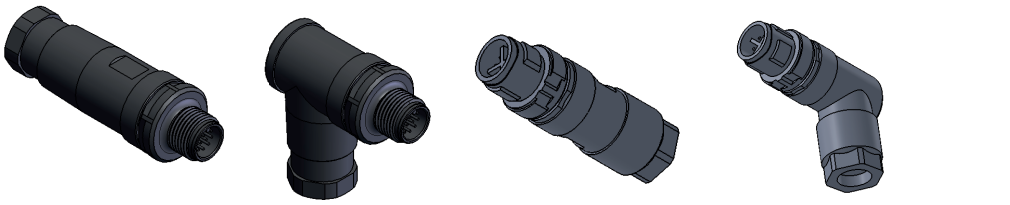
Option	Type	Description
3303-1	Parallel & Air	Includes customer power CP and customer signals CS + air.
3303-2	Ethernet, Parallel, Air	Includes CP, CS + air + Ethernet (PROFINET).

Connector kits manipulator

The kit consists of connectors, pins and sockets.

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

Continues on next page



Straight connector kits | Angled connector kits | Straight Ethernet connector kits | Angled Ethernet connector kits

xx1900000140

Note

The kits are designed and used for connectors on upper arm.

2.3 Floor cables

Manipulator cable length

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

Connection of parallell communication

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

Option	Lengths
3201-1	3 m
3201-2	7 m
3201-3	15 m

Connection of Ethernet

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

Option	Lengths
3202-2	7 m
3202-3	15 m

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.

Continues on next page

Option	Type	Description
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.
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*.

2.4 User documentation

User documentation

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

Tip

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

3 Accessories

General

There is a range of tools and equipment available.

Basic software and software options for robot and PC

For more information, see *Product specification - OmniCore C line* and *Product specification - Controller software OmniCore*.

This page is intentionally left blank

Index

A
Absolute Accuracy, 37
Absolute Accuracy, calibration, 35
ambient humidity
  operation, 15
  storage, 14
ambient temperature
  operation, 15
  storage, 14

C
calibration
  Absolute Accuracy type, 34
  standard type, 34
calibration, Absolute Accuracy, 35
CalibWare, 34
category 0 stop, 45
category 1 stop, 45
compensation parameters, 37

D
documentation, 54

F
foundation
  requirements, 14

H
humidity
  operation, 15
  storage, 14

I
instructions, 54

L
loads on foundation, 13

M
manuals, 54

O
operating conditions, 15
options, 49

P
product standards, 18
protection classes, 15
protection type, 15

R
requirements on foundation, 14
robot
  protection class, 15
  protection types, 15
  technical data, 13

S
safety standards, 18
securing the robot to foundation, attachment screws, 23
service instructions, 54
standards, 18
  ANSI, 18
  CAN, 18
  EN IEC, 18
  EN ISO, 18
standard warranty, 52
stock warranty, 52
stopping distances, 45
stopping times, 45
storage conditions, 14

T
technical data
  robot, 13
temperatures
  operation, 15
  storage, 14
torques on foundation, 13

U
user documentation, 54

V
variants, 49

W
warranty, 52
weight, 13

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

ABB AS
Robotics & Discrete Automation
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

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

abb.com/robotics

3HAC068057-001, Rev E, en