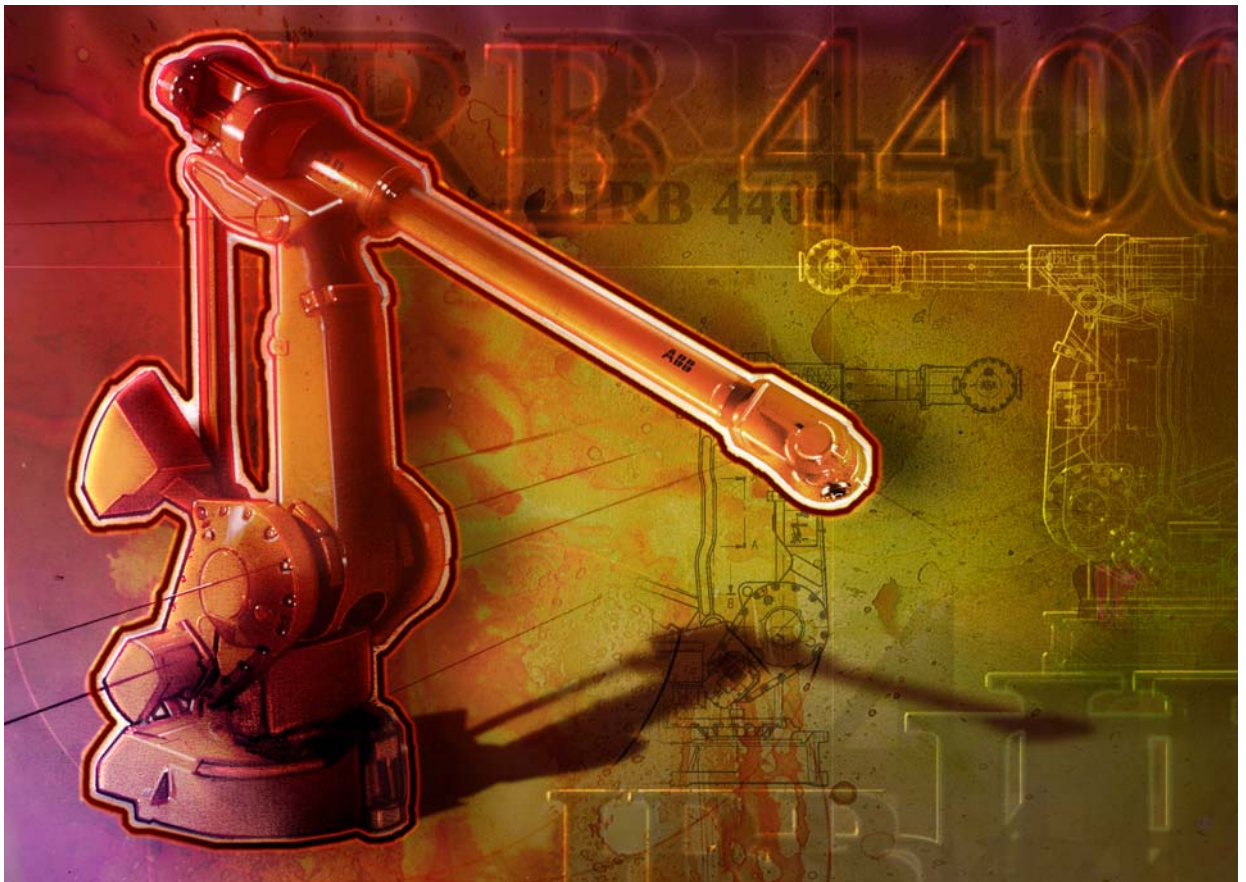


## Product specification

### Articulated robot

IRB 4400/60  
M2004





# **Product specification**

Articulated robot

3HAC9117-1

Rev.R

IRB 4400/60

M2004

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# Overview

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## 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
Revision 8	- New values for Performance Acc. to ISO 9283 added - M2000 cancelled.
Revision J	- Foundry Prime added - Option 287-5 Wash removed
Revision K	- Text added to "Clean room robots" - Footnote added to "Pose accuracy"
Revision L	- Changes in chapter Standards - Directions of forces - Warranty information for load diagrams
Revision M	- Maximum load and moment of inertia for full axis 5 movement - Wrist torque
Revision N	- Changes for Calibration data - Work range - Explanation of ISO values (new figure and table) - Stopping distance - User documentation on DVD
Revision P	- General update for 9.1 release
Revision Q	- All variants except IRB 4400/60 removed
Revision R	- Foundry Plus 2 - Foundry Prime 2

---

### Complementary Product specifications

Product specification	Description
Controller	IRC5 with FlexPendant, 3HAC021785-001
Controller Software IRC5	RobotWare 5.12, 3HAC022349-001
Robot User Documentation	IRC5 and M2004, 3HAC024534-001



# 1 Description

## 1.1 Structure

### 1.1.1 Introduction

---

**General**

The IRB 4400 is a 6-axis industrial robot, designed specifically for manufacturing industries that use flexible robot-based automation. The robot has built-in process ware, an open structure that is specially adapted for flexible use, and can communicate extensively with external systems.

---

**Foundry Plus robots**

The Foundry Plus option is designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications. Typical applications are spraying insertion and part extraction of die-casting machines, cast cleaning, handling in sand casting and gravity casting, etc. Special care must be taken in regard to operational and maintenance requirements for applications in foundry as well as in other applications areas. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility for the Foundry Plus protected robot. The Foundry Plus robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the corrosion protection additional rust preventive are applied to exposed and crucial areas, e.g. has the tool flange a special preventive coating. Although, continuous splashing of water or other similar rust formation fluids may cause rust attach on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on the mentioned. The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against liquid and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus/Foundry Plus 2 features:

- Improved sealing to prevent penetration into cavities to secure IP67
- Additional protection of cabling and electronics
- Special covers protecting cavities
- Well-proven connectors
- Nickel coated tool flange (Foundry Plus 2)
- Rust preventives on screws, washers and unpainted/machined surfaces

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

# 1 Description

---

## 1.1.1 Introduction

---

### Foundry Prime 2

The robot version Foundry Prime is designed for water jet cleaning of casts and machined parts, and similar very harsh, but proven robotic application environments. Applicability in other applications cannot be guaranteed without prior testing, previous experience or professional judgment by ABB. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility.

The manipulator can withstand surrounding solvent based detergent (max. pH 9.0 and must contain rust inhibitor). The detergent must be approved by ABB. In addition, the manipulator can withstand indirect spray from jet pressure (max. 600 bar) and 100% humidity (gaseous mixture only). The manipulator can work in an environment with a cleaning bath temperature < 60° C, typically used in a water jet cleaning application with moderate speed. If fluids that may cause rust formation, for example water, are continuously splashing the robot or are used in the vicinity of the robot it is strongly recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on robots unpainted areas, joints, or other unprotected, surfaces.

The robot is protected by well-proven sealings for gears and bearings, pressurized motors and electronic compartment and detergent resistant painting system in three layers. Non painted surfaces have rust preventive coating, and motors on IRB 4400 are sealed with a sealing compound.

As the robot is designed for very harsh environments, an extended service and maintenance program is required. Special care must be taken when replacing parts or performing other maintenance and service that breaks the paint surface as the paint surface acts as a protective barrier. For detailed information of the maintenance program, see chapter Maintenance in the Product Manual. It is highly recommended to sign a Service Agreement with ABB due to difficult and severe environmental conditions.

The Foundry Prime robot can be cleaned with appropriate washing equipment according to product manual. Appropriate cleaning and maintenance are required to

maintain the Foundry Prime protection, for example can the rust preventive be washed off with wrong cleaning method.

The protection, Foundry Prime is only available for robot versions: IRB 4400/60

Please contact your local ABB organization for an updated list of approved washing detergents.

See chapter Specification of Variants and Options for options not selectable together with Foundry Prime.

---

**Operating system**

The robot is equipped with the IRC5 controller and robot control software, RobotWare.

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

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 gluing and arc 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/RobotWare.

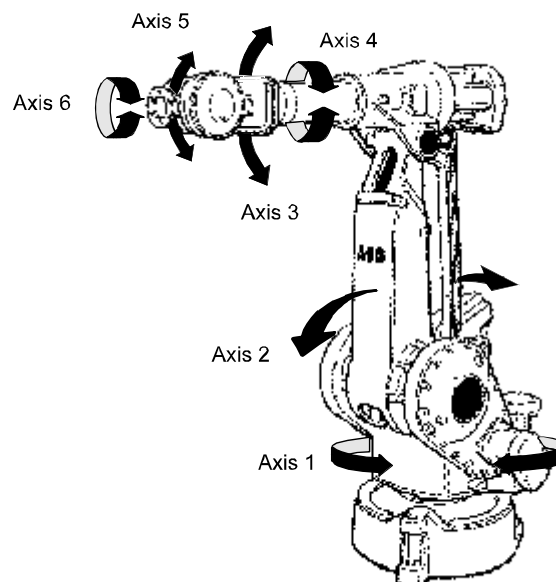


Figure 1 The IRB 4400 manipulator has 6 axes.

## 1 Description

---

### 1.1.2 Different robot versions

### 1.1.2 Different robot versions

---

#### General

The IRB 4400 is available in one version.

Robot type	Handling capacity (kg)	Reach (m)
IRB 4400/60	60 kg	1.96 m

### 1.1.3 Definition of version designation

IRB 4400 Version Handling capacity:

Prefix description	Robot type	Description
Version	L	Long arm
	S	Shelf mounted manipulator
Handling capacity		Indicates the maximum handling capacity (kg)

---

#### Manipulator weight

Robot type	Weight
IRB 4400/60	1040 kg

---

#### Other technical data

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

**Power consumption**

Path E1-E2-E3-E4 in the ISO Cube, maximum load.

IRB 4400/60 (Cube side = 630 mm)

Speed [mm/s]	Power consumption [kW]
Max.	1.33
1000	0.99
500	0.78
100	0.66

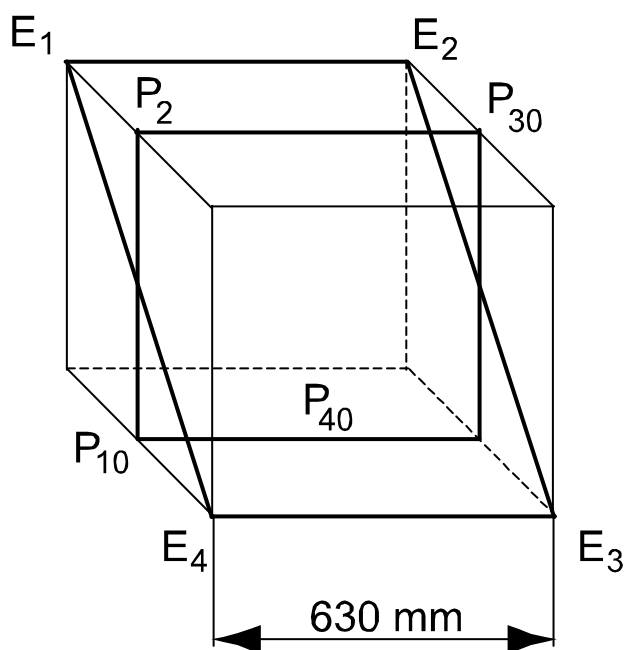


Figure 2 Path E1-E2-E3-E4 in the ISO Cube, maximum load.

# 1 Description

## 1.1.3 Definition of version designation

### Dimensions

IRB 4400/60

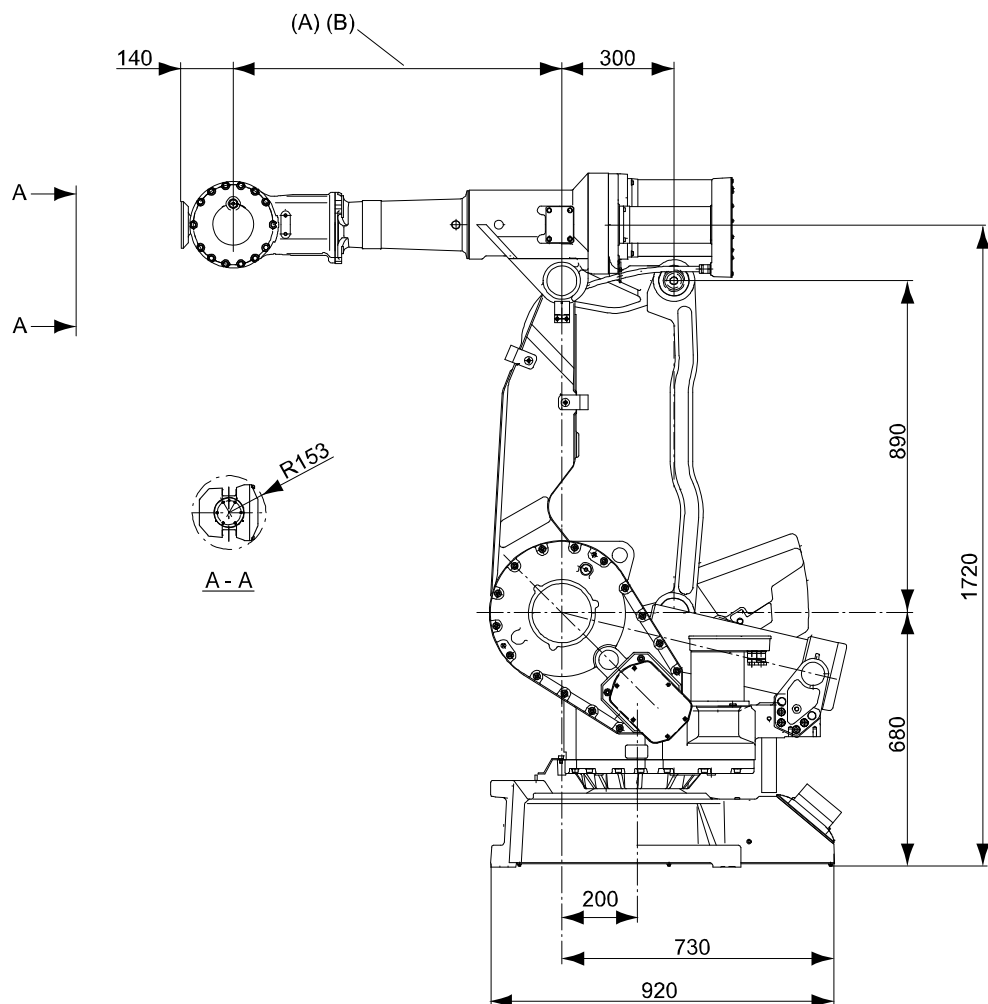


Figure 3 View of the manipulator from the side (dimensions in mm).

Pos	Description
A	800

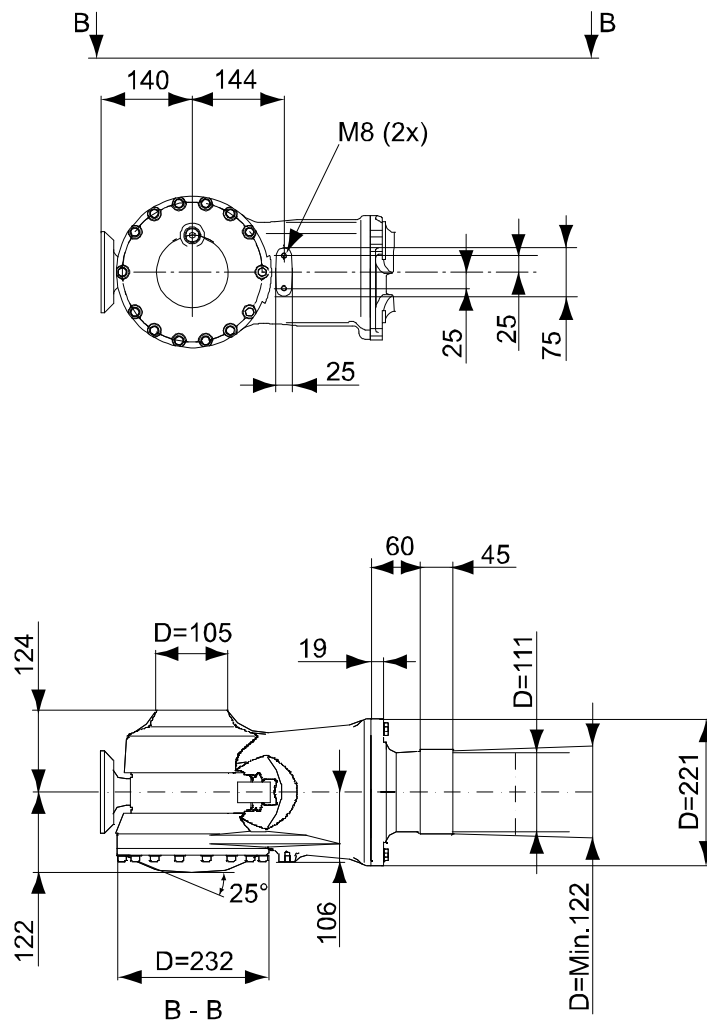


Figure 4 View of the manipulator from the side (dimensions in mm).

IRB 4400/60

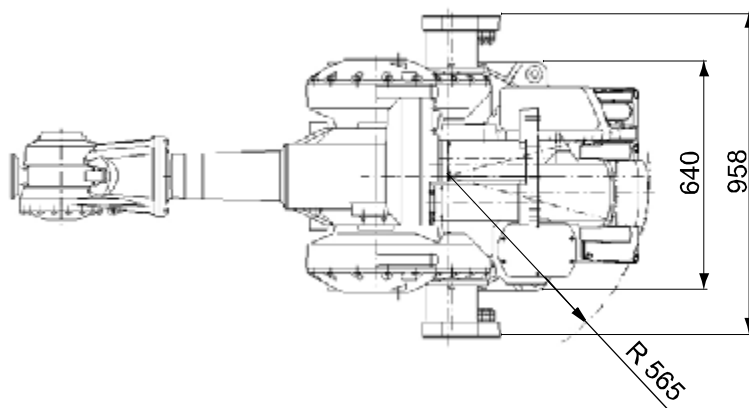


Figure 5 View of the manipulator from above (dimensions in mm).

## 1 Description

---

### 1.2.1 Standards

## 1.2 Safety/Standards

### 1.2.1 Standards

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 60204-1:2006	Safety of machinery - Electrical equipment of machines
EN ISO 10218-1:2006 <sup>a</sup>	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
IEC 60529	Degrees of protection provided by enclosures

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

Standard	Description
ANSI/RIA 15.06/1999	Safety Requirements for Industrial Robots and Robot Systems
ANSI/UL 1740-1998 (option)	Safety Standard for Robots and Robotic Equipment
CAN/CSA Z 434-03 (option)	Industrial Robots and Robot Systems - General Safety Requirements

The robot complies fully with the health and safety standards specified in the EEC's Machinery Directives.



## 1.2.2 Safety

The robot is designed with absolute safety in mind. It has a dedicated safety system based on a two-channel circuit which 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.

---

### Over-speed protection

The speed of the robot is monitored by two independent computers.

---

### 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.

# 1 Description

---

## 1.2.2 Safety

---

### **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 in 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 shuts off.

---

### **Collision detection (option)**

In case of an unexpected mechanical disturbance like a collision, electrode sticking etc., the robot will stop and slightly back off from its stop position.

---

### **Restricting the working space**

The movement of each axis can be restricted using software limits.

Axes 1-2 can also be restricted by means of mechanical stops and axis 3 by an electrical switch (option).

---

### **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.

---

### **Fire safety**

Both the manipulator and control system comply with UL's (Underwriters Laboratories) tough requirements for fire safety.

---

### **Safety lamp (option)**

The robot can be equipped with a safety lamp mounted on the manipulator. This is activated when the motors are in the MOTORS ON state.

## 1.3 Installation

### 1.3.1 Introduction

---

**General**

All the versions of IRB 4400 are designed for floor mounting except one version for shelf-mounting. Depending on the robot version an end effector of max. weight 60 kg, including payload, can be mounted on the mounting flange (axis 6). See section Load diagrams .

---

**Other equipment**

Extra loads can be mounted on the upper arm and on the base.  
There are holes for mounting extra equipment, see section Mounting equipment , Figure 13 and Figure 20.

---

**Working range**

The working range of axes 1-2 can be limited by mechanical stops and axis 3 by limit switches. Electronic Position Switches can be used on all axes for indicating the position of the manipulator.

## 1 Description

### 1.3.2 Operating requirements

### 1.3.2 Operating requirements

#### Protection standards

Description	Protection standard IEC 60529
Standard Manipulator	IP54
Foundry Plus Manipulator	IP67, steam washable

#### Explosive environments

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

#### Ambient temperature

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

#### Relative humidity

Description	Relative humidity
Complete robot during transportation and storage	Max. 95% at constant temperature
Complete robot during operation	Max. 95% at constant temperature
Complete robot during operation, option 287-6 Foundry Prime	Max. 100%

### 1.3.3 Mounting the manipulator

Maximum load in relation to the base coordinate system.

	<b>Endurance load in operation all IRB 4400</b>	<b>Max. load at emergency stop all IRB 4400</b>
Force xy	$\pm 7500 \text{ N}$	$\pm 9000 \text{ N}$
Force z	$+ 9500 \pm 2000 \text{ N}$	$+ 9500 \pm 3000 \text{ N}$
Torque xy	$\pm 14000 \text{ Nm}$	$\pm 16000 \text{ Nm}$
Torque z	$\pm 2000 \text{ Nm}$	$\pm 4000 \text{ Nm}$

## 1 Description

### 1.3.3 Mounting the manipulator

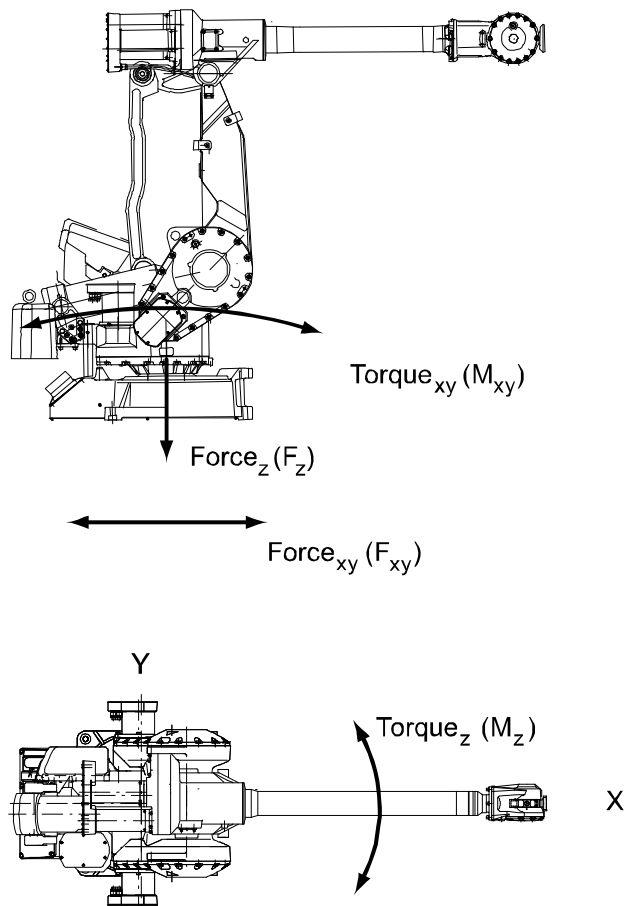


Figure 6 Direction of forces.

---

#### 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 ( $F_{xy}$ ).

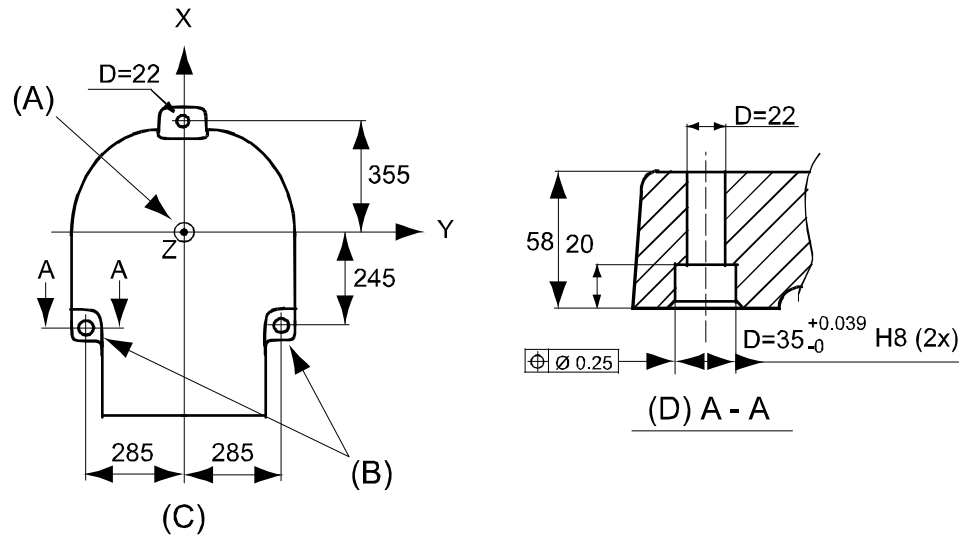


Figure 7 Hole configuration (dimensions in mm).

Pos	Description
A	Z = center line axis 1
B	The same dimensions
C	View from the bottom of the base
D	Section

# 1 Description

## 1.3.3 Mounting the manipulator

### Mounting surface and bushings

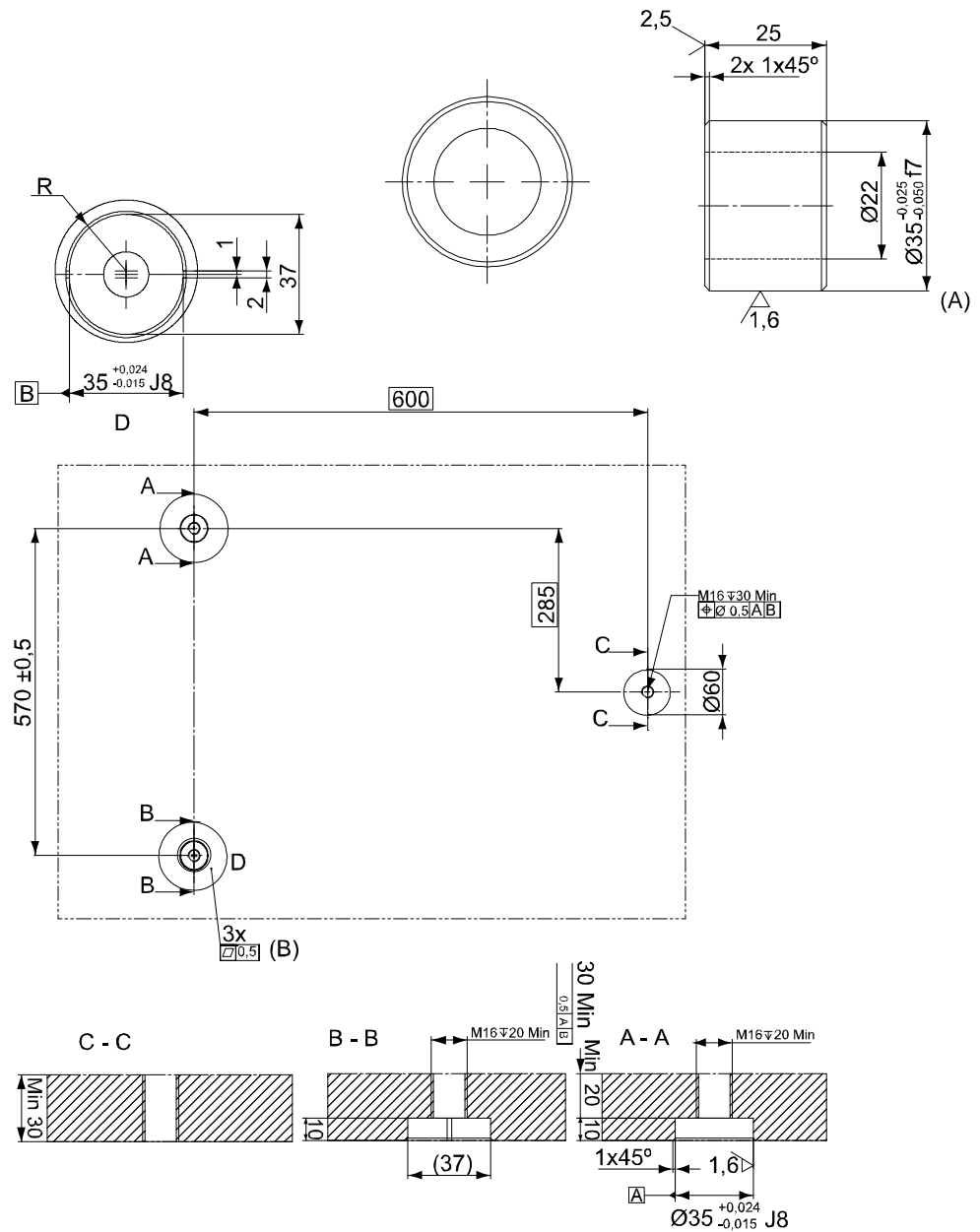


Figure 8 Mounting surface and bushings.

Pos	Description
A	Surface treatment, ISO 2081 Fe/Zn 8 c2 Guide Bushings
B	Common zone



## 1.4 Calibration and References

### 1.4.1 Fine calibration

#### General

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

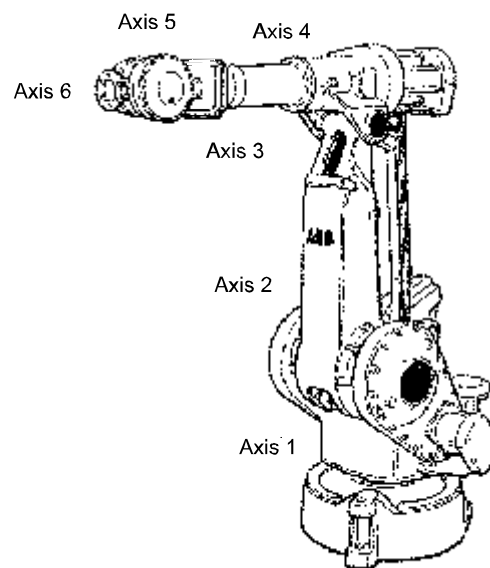


Figure 9 All axes in zero position.

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

# 1 Description

---

## 1.4.2 Absolute Accuracy calibration

### 1.4.2 Absolute Accuracy calibration

---

#### General

Requires RobotWare option Absolute Accuracy, please see Product specification - Controller software IRC5/RobotWare for more details.

---

#### The calibration concept

Absolute Accuracy (AbsAcc) is a calibration concept, which ensures a TCP absolute accuracy of better than  $\pm 1$  mm in the entire working range.

Absolute accuracy 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. It also includes load compensation for deflection caused by the tool and equipment. Tool data from robot program is used for this purpose. The positioning will be within specified performance regardless of load.

---

#### Calibration data

The user is supplied with robot calibration data (compensation parameters saved on the manipulator SMB) and a certificate that shows the performance (Birth certificate). The difference between an ideal robot and a real robot without AbsAcc can typically be 8 mm, resulting from mechanical tolerances and deflection in the robot structure.

If there is a difference, at first start-up, between calibration data in controller and the robot SMB, correct by copying data from SMB to controller.

---

**Absolute Accuracy option**

Absolute Accuracy option is integrated in the controller algorithms for compensation of this difference and does not need external equipment or calculation.

Absolute Accuracy is a RobotWare option and includes an individual calibration of the robot (mechanical arm).

Absolute Accuracy is a TCP calibration in order to Reach (m) a good positioning in the Cartesian coordinate system.

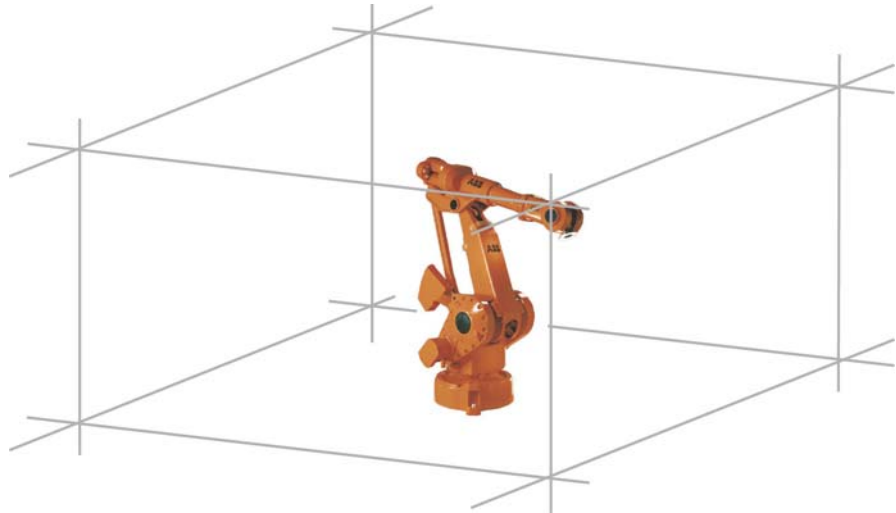


Figure 10 The Cartesian coordinate system.

---

**Production data**

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 4400/60,	0.30	0.75	100

## 1.5 Load diagrams

### 1.5.1 Introduction



**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 outside load diagram is used the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure



**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.**



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

## 1.5.2 Diagrams

IRB 4400/60

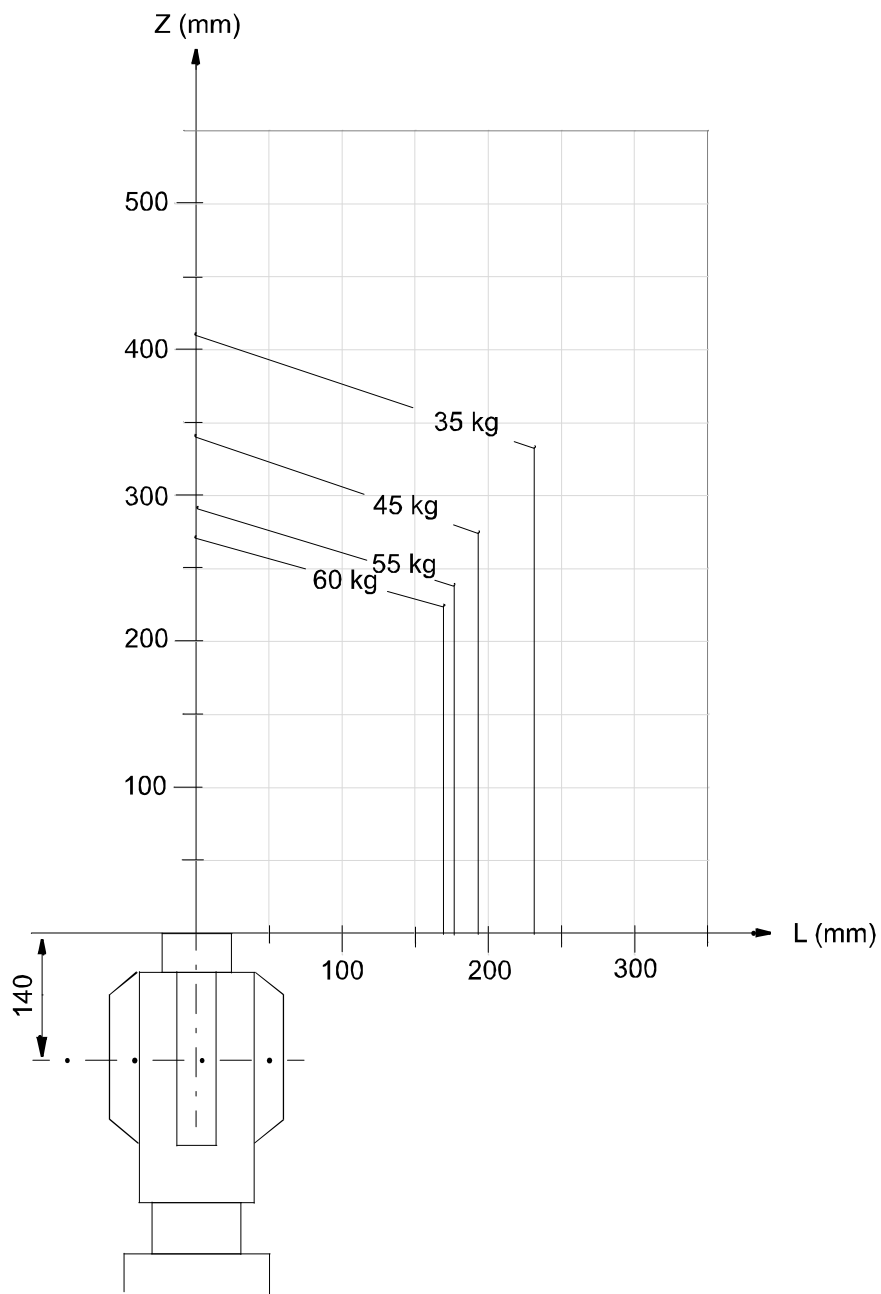


Figure 11 Maximum weight permitted for load mounted on the mounting flange at different positions (center of gravity).

	Description
Z	See the above diagram and the coordinate system in the Product specification - IRC5 with FlexPendant.
L	Distance in X-Y plane from Z-axis to the center of gravity.

## 1 Description

---

### 1.5.2 Diagrams

	Description
J	Maximum own moment of inertia on the total handle weight = max. 2.5 kgm <sup>2</sup> .

### 1.5.3 Maximum load and moment of inertia for full axis 5 movement

#### General

Total load given as: Mass in kg, center of gravity (Z and L) in meter and moment of inertia ( $J_{ox}$ ,  $J_{oy}$ ,  $J_{oz}$ ) in  $\text{kgm}^2$ .  $L = \sqrt{(X^2 + Y^2)}$ , see Figure 12.

#### Full movement of Axis 5 ( $\pm 120^\circ$ )

Axis	Robot Type	Max. value
5	IRB 4400/60	$J_5 = \text{Mass} \times ((Z + 0.14)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 30.0 \text{ kgm}^2$
6	IRB 4400/60	$J_6 = \text{Mass} \times L^2 + J_{oz} \leq 17.5 \text{ kgm}^2$

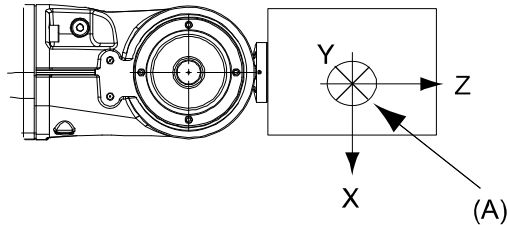


Figure 12 Moment of inertia when full movement of axis 5.

Pos	Description
A	Center of gravity

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

## 1 Description

---

### 1.5.4 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 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 4400/60	242.0 Nm	98.9 Nm	60 kg



## 1.6 Mounting equipment

### 1.6.1 Introduction

IRB 4400/60

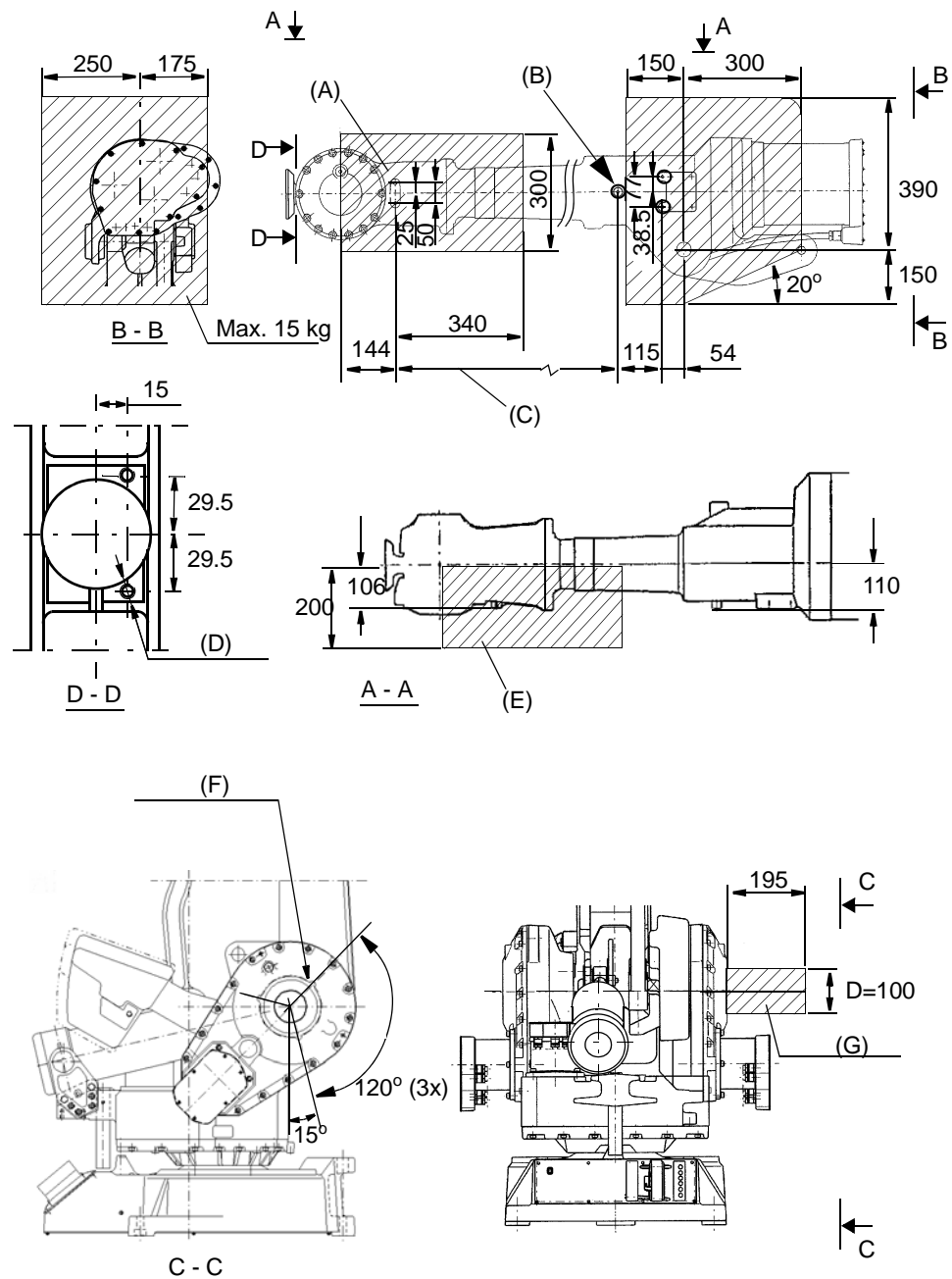


Figure 13 The shaded area indicates the permitted positions (center of gravity) for any extra equipment mounted in the holes (dimensions in mm).

Pos	Description
A	M8 (2x) Used if option 218-6 is chosen, Depth of thread 9
B	M8 (3x) Depth of thread 14

# 1 Description

---

## 1.6.1 Introduction

Pos	Description
C	571 for 4400/60
D	M6 (2x) tapped depth 12
E	Max. 5 kg for 4400/60 at max. handling weight
F	M8 (3x), R = 92, Depth 16 (If option 34-1 is chosen these holes are occupied.)
G	Max. 35 kg

## 1.6.2 Robot tool flange

IRB 4400/60

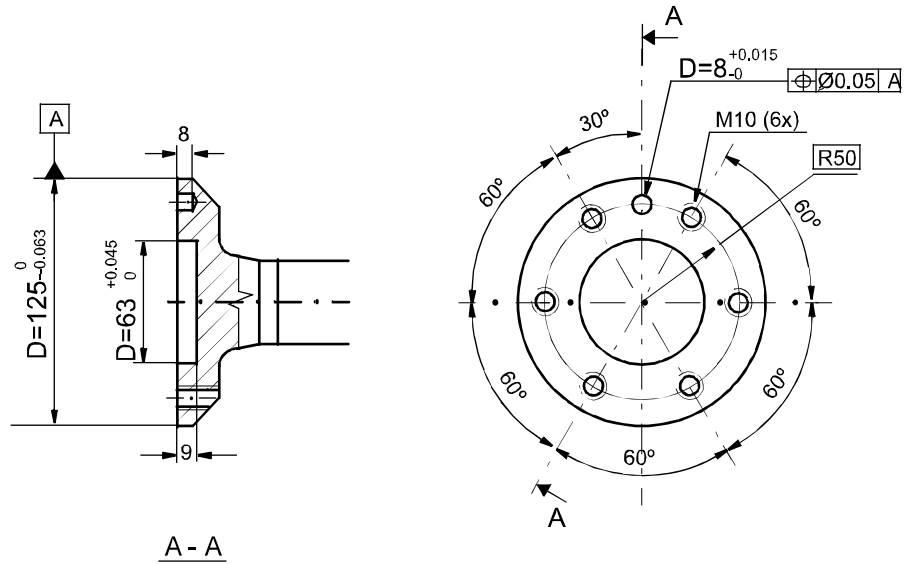


Figure 14 The mechanical interface, mounting flange (dimensions in mm).

## 1 Description

---

### 1.7.1 Introduction

## 1.7 Maintenance and Troubleshooting

### 1.7.1 Introduction

---

#### General

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

- Maintenance-free AC motors are used
- Oil is used for the gear boxes
- 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 depend on selected options. For detailed information on maintenance procedures, see Maintenance section in the Product Manual.

## 1.8 Robot Motion

### 1.8.1 Introduction

---

**IRB 4400/60**

Type of motion	Range of movement
Axis 1 Rotation motion	+ 165° to - 165°
Axis 2 Arm motion	+ 95° to - 70°
Axis 3 Arm motion	+ 65° to - 60°
Axis 4 Wrist motion	+ 200° to - 200°
Axis 5 Bend motion	+ 120° to - 120°
Axis 6 Turn motion	+ 400° to - 400° +200 rev. <sup>a</sup> to -200 rev. Max. <sup>b</sup>

a. rev. = Revolutions

b. 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 Description

## 1.8.1 Introduction

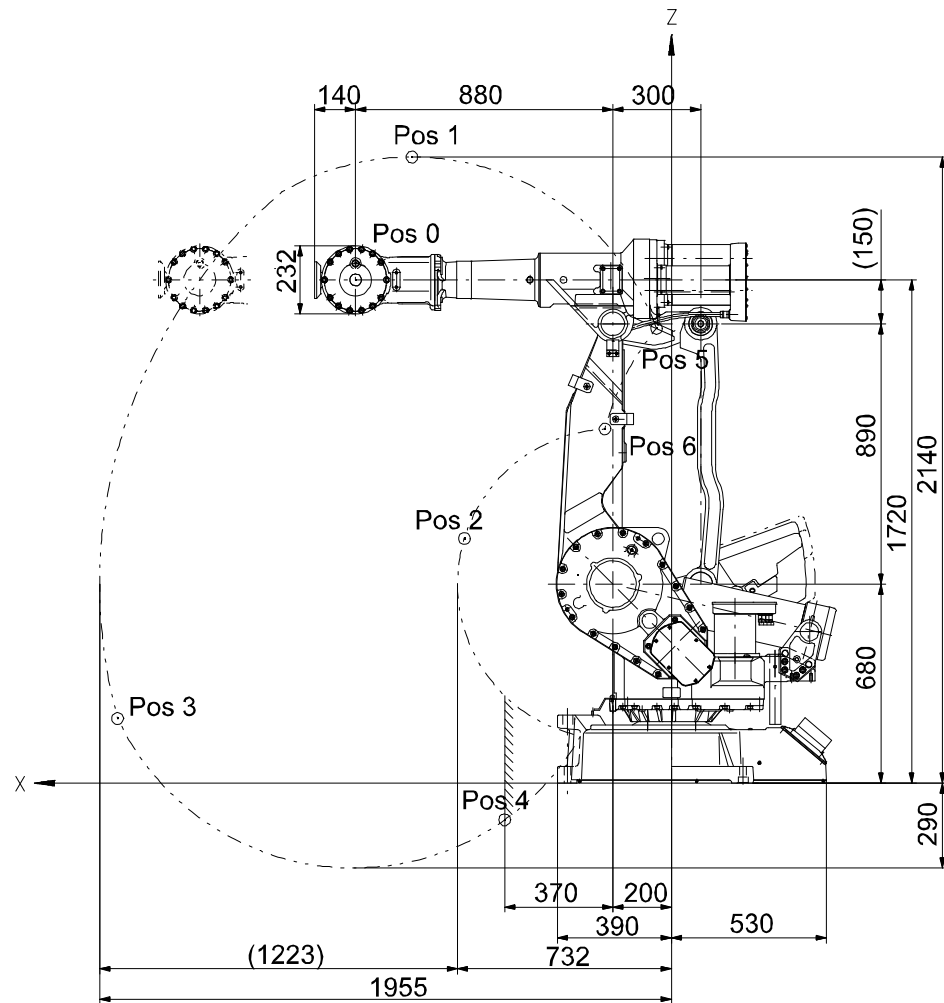


Figure 15 The extreme positions of the robot arm IRB 4400/45 and /60 (dimensions in mm).

Positions (mm) and Angles (degrees) for IRB 4400/60:

Position No. (see Figure 15)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
0	1080	1720	0	0
1	887	2140	0	-30
2	708	836	0	65
3	1894	221	95	-60
4	570	-126	95	40
5	51	1554	-70	40
6	227	1210	-70	65

## 1.8.2 Performance according to ISO 9283

### General

At rated load and 1,6 m/s velocity on the inclined ISO test plane with all six robot axes in motion.

The figures for AP, RP, AT and RT are measured according to Figure 16.

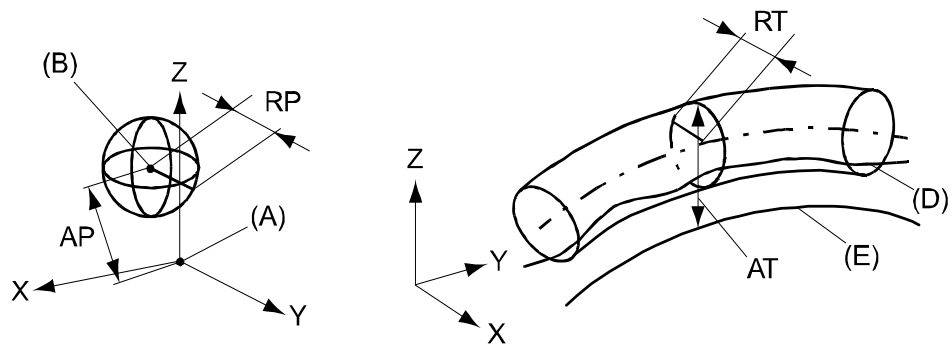


Figure 16 Explanation of ISO values.

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
<b>IRB</b>	<b>4400/60</b>
Pose accuracy, AP <sup>a</sup> (mm)	0.12
Pose repeatability, RP (mm)	0.19
Pose stabilization time, PSt (s) within 0.2 mm of the position	0.27
Path accuracy, AT (mm)	0.56
Path repeatability, RT(mm)	0.56

a. AP according to the ISO test above, is the difference between the taught position (position manually modified in the cell) and the average position obtained during program execution.

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

## 1 Description

---

### 1.8.3 Velocity

#### 1.8.3 Velocity

Axis no.	IRB 4400/60
1	150°/s
2	120°/s
3	120°/s
4	225°/s
5	250°/s
6	330°/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

Stopping distance/time for emergency stop (category 0), program stop (category 1) and at mains power supply failure at max speed, max stretched 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 4400/60	1	65	0.9	84	1.0	76	0.9
	2	16	0.3	24	0.4	22	0.3
	3	15	0.3	25	0.4	23	0.3

	Description
A	Distance in degrees
B	Stop time (s)

## 1 Description

---

### 1.8.5 Signals

### 1.8.5 Signals

---

#### Signal connections on robot arm

To connect extra equipment on the manipulator, there are cables integrated into the manipulator's cabling, one FCI UT07 14 12SH44N connector and one FCI UT07 18 23SH44N connector on the rear part of the upper arm.

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

	Number	Value
Signals	23	50 V, 250 mA
Power	10	250 V, 2 A
Air	1	Max. 8 bar, inner hose diameter 8 mm

## 2 Specification of Variants and Options

### 2.1 Introduction

#### 2.1.1 General

The different variants and options for the IRB 4400 are described below.

The same numbers are used here as in the Specification form. For controller, see Product specification - Controller IRC5 with FlexPendant and for software options, see Product specification - Controller software IRC5/RobotWare.

#### 2.1.2 Manipulator

---

##### Variants

Option	IRB Type	Handling capacity (kg) / Reach (m)
435-38	IRB 4400/60	60/1.96

---

##### Manipulator color

Option	Description
209-1	Protection Standard and Foundry have color ABB Orange
209-4--192	The manipulator is painted with the chosen RAL-color.

## 2 Specification of Variants and Options

### 2.1.2 Manipulator

#### Protection

Option	Description
287-4	Standard
287-3	<p>The Foundry Plus option is designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications. Typical applications are spraying insertion and part extraction of die-casting machines, cast cleaning, handling in sand casting and gravity casting, etc. Special care must be taken in regard to operational and maintenance requirements for applications in foundry as well as in other applications areas. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility for the Foundry Plus robot. The Foundry Plus robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the corrosion protection additional rust preventive are applied to exposed and crucial areas, e.g. has the tool flange a special preventive coating. Although, continuous splashing of water or other similar rust formation fluids may cause rust attach on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on the mentioned. The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against liquid and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.</p> <p>Selected Foundry Plus/Foundry Plus 2 features:</p> <ul style="list-style-type: none"><li>- Improved sealing to prevent penetration into cavities to secure IP67</li><li>- Additional protection of cabling and electronics</li><li>- Special covers protecting cavities</li><li>- Well-proven connectors</li><li>- Rust preventives on screws, washers and unpainted/machined surfaces</li><li>- Extended service and maintenance program</li></ul> <p>The Foundry Plus 2 robot can be cleaned with appropriate washing equipment.</p>

Option	Description
287-6 <sup>a</sup>	<p>Robots adapted for water jet cleaning of casts and machined parts, and similar very harsh, but proven robotic application environments. Applicability in other applications cannot be guaranteed without prior testing, previous experience or professional judgment by ABB. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility.</p> <p>The manipulator can withstand surrounding solvent based detergent (max. pH 9.0 and must contain rust inhibitor). The detergent must be approved by ABB. In addition, the manipulator can withstand indirect spray from jet pressure (max. 600 bar) and 100% humidity (gaseous mixture only). The manipulator can work in an environment with a cleaning bath temperature &lt; 60°C, typically used in a water jet cleaning application with moderate speed. If fluids that may cause rust formation, for example water, are continuously splashing the robot or are used in the vicinity of the robot it is strongly recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on robots unpainted areas, joints, or other unprotected surfaces. As the robot is designed for very harsh environments, an extended service and maintenance program is required. For detailed information of the maintenance program, see chapter Maintenance in the Product Manual. It is highly recommended to sign a Service Agreement with ABB due to difficult and severe environmental conditions.</p> <p>The robot is labeled "Foundry Prime".</p> <p>Only available for IRB 6640-235/2.55 and IRB 6640-180/2.55.</p> <p>Please contact your local ABB organization for an updated list of approved washing detergents.</p> <p>The following options are NOT selectable together with option 287-6:</p> <ul style="list-style-type: none"> <li>• 209-2 ABB White standard</li> <li>• 209 RAL code</li> <li>• 213-1 Safety lamp</li> <li>• 37-1 Base plate</li> <li>• 87-1 Cooling fan for axis 1 motor</li> <li>• 88-1 Cooling fan for axis 2 motor</li> <li>• 184-1 Insulated Tool Flange</li> <li>• 536-1 Chip protection</li> </ul>

a. Only available for IRB 4400/60

## 2 Specification of Variants and Options

### 2.1.2 Manipulator

#### Application interface

Air supply and signals for extra equipment to upper arm:

Option	Description
218-8	Integrated hose and cables for connection of extra equipment on the manipulator to the rear end of the upper arm.

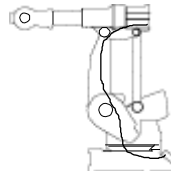


Figure 17 Integrated hose and cables.

Option	Description
218-6	Hose and cables for connection of extra equipment are continuing to the wrist on the outside of the upper arm. Not available for options 287-3 and 287-5.

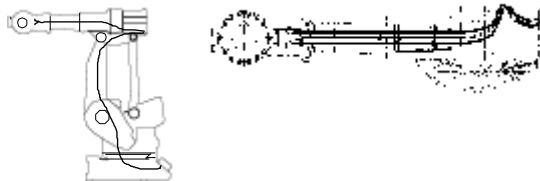


Figure 18 Hose and cables.

#### Application interface Connection to

Option	Description
16-1 <sup>a</sup>	Cabinet The signals are connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, to the the controller.

a. Note! In a M2004 MultiMove application additional robots have no Control Module. The screw terminals with internal cabling are then delivered separately to be mounted in the main robot Control Module or in another encapsulation, for example a PLC cabinet.

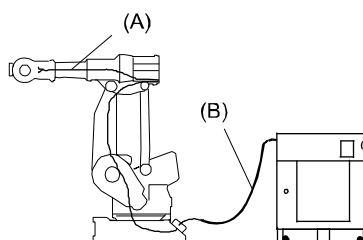


Figure 19 Connection to cabinet.

Pos	Description
A	If 218-6
B	If 16-1

#### Application equipment cable lengths

If connection to Cabinet:

Option	Lengths
94-1	7 m
94-2	15 m
94-3	22 m
94-4	30 m

#### Safety lamp

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

## 2 Specification of Variants and Options

---

### 2.1.2 Manipulator

---

#### Electronic Position Switches (EPS)

The mechanical position switches indicating the position of the three main axes are replaced with electronic position switches for up to 7 axes, for increased flexibility and robustness.

For more detailed information, see Product specification - Controller IRC5 with FlexPendant and Application Manual Electronic Position Switches, art. No. 3HAC0277709-001.

---

#### Connector kit

Detached connectors, suitable to the connectors for the application interface and position switches.

The kit consists of connectors, pins and sockets.

Option	Description
431-1	For the connectors on the upper arm.
239-1	For the connectors on the foot if connection to manipulator, option 16-2.
426-1	For connection to position switches and connection to manipulator, option 271-2 and position switch(es).



#### Working range limit

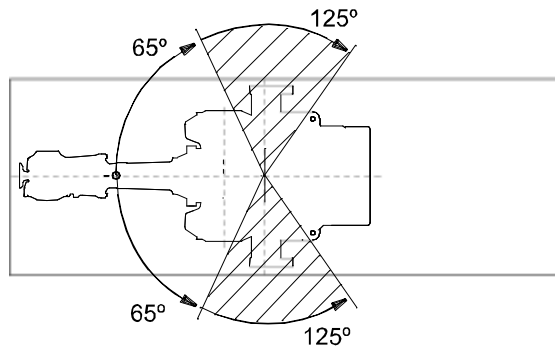


Figure 20 Mounting area of the stops, axis 1

Option	Description
28-1 Axis 1	Two extra stops for restricting the working range. The stops can be mounted within the area from 65° to 125°. See Figure 20.

#### IRB 4400/60

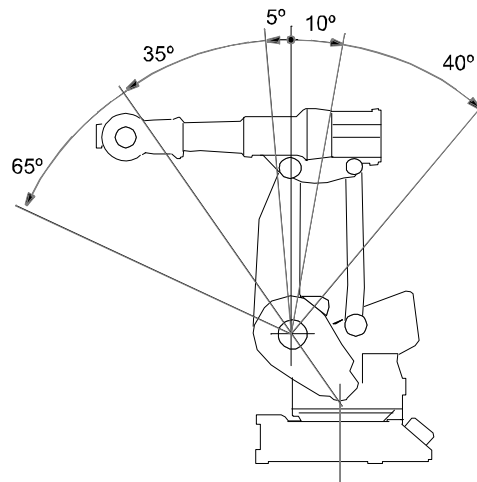


Figure 21 Mounting positions of the stops, axis 2.

Option	Description
32-1 Axis 2	Stop lugs for restricting the working range. Figure 6 illustrates the mounting positions of the stops.

#### 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)

## 2 Specification of Variants and Options

---

### 2.1.2 Manipulator

Option	Type	Description
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

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#### Manipulator cable length

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

---

#### Connection of parallel communication

Option	Lengths
94-1	7 m
94-2	15 m
94-3	22 m
94-4	30 m

### 2.1.4 Documentation

---

#### DVD User Documentation

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

## 2 Specification of Variants and Options

---

### 2.1.4 Documentation

## **3 Accessories**

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

For more information, see Product specification - Controller IRC5 with Flex-Pendant and Product specification - Controller software IRC5/RobotWare.

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### **Robot Peripherals**

- Track Motion
- Motor Units



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