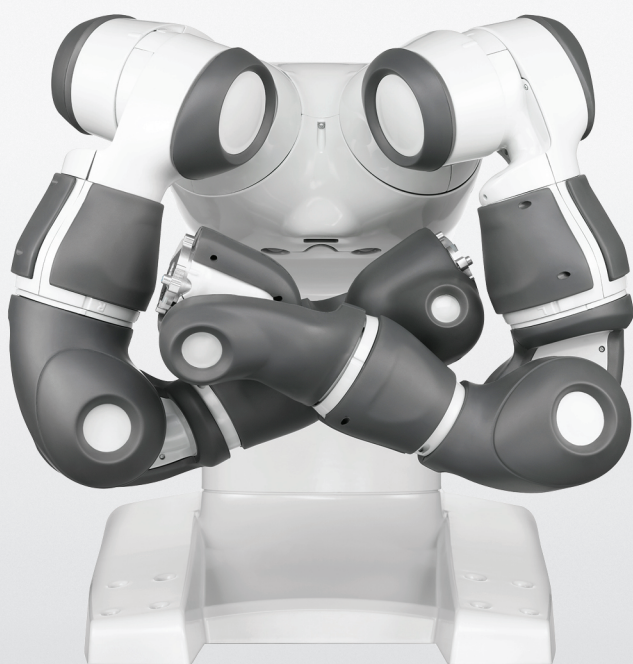


ROBOTICS

Product specification

IRB 14000



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Product specification

IRB 14000

Document ID: 3HAC052982-001

Revision: J

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Overview of this specification

About this product specification

[

It describes the performance of the manipulator or a complete family of manipulators in terms of:

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

The product specification also contains information for the 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.

Users

It is intended for:

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

References

Reference	Document ID
<i>Product manual - IRB 14000</i>	<i>3HAC052983-001</i>
<i>Product manual - Grippers for IRB 14000</i>	<i>3HAC054949-001</i>
<i>Product specification - Controller IRC5</i> IRC5 with main computer DSQC1000.	<i>3HAC047400-001</i>
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000.	<i>3HAC050945-001</i>
<i>Operating manual - IRC5 with FlexPendant</i>	<i>3HAC050941-001</i>

Revisions

Revision	Description
-	First edition.
A	<ul style="list-style-type: none"> • Minor corrections/update
B	<ul style="list-style-type: none"> • Changed torque y for endurance load and maximum load. • Main cable options added.
C	<ul style="list-style-type: none"> • Revised Tool I/O descriptions • Applicable ESD-standards added. • Modified maximum speed of IRB 14000 gripper from 20 mm/s to 25 mm/s.

Continues on next page

Overview of this specification

Continued

Revision	Description
D	Published in release R16.2. The following updates are done in this revision: <ul style="list-style-type: none">• Added part number for Mill-Max connector used on the tool flange. See Tool flange on page 31 and Tool flange on page 44.• Max current information added to tool flange, see Tool flange on page 44.• Max current added for pins A to D on the tool flange, when they are not used as Ethernet interfaces, see Tool flange on page 44.• Max current added for pin 9 on connector XS7 and XS8.• Added line fusing, rated power, and required equipment information for power connection to the controller. See Connecting power supply on page 76.
E	Published in release R17.1. The following updates are done in this revision: <ul style="list-style-type: none">• <i>SoftMove</i> is now supported since Robotware 6.04• Restriction of load diagram added.• Air input changed.
F	Published in release R17.2. The following updates are done in this revision: <ul style="list-style-type: none">• Updated list of applicable standards.• Minor corrections/update.• YuMi is available for clean room.
G	Published in release R18.1. The following updates are done in this revision: <ul style="list-style-type: none">• Minor changes.• The maximum motor power information added.
H	Published in release R18.1. The following updates are done in this revision: <ul style="list-style-type: none">• Minor changes.
J	Published in release R18.2. The following updates are done in this revision: <ul style="list-style-type: none">• Updated the figure of the hole configuration on base.• Editorial corrections.• Removed the phased out option GPRS/Internet (Remote Service) [890-1] from the unlisted option list.

1 Description

1.1 Structure

1.1.1 Introduction to structure

General

The IRB 14000 is ABB Robotics first generation dual arms robot with 7-axis each arm, industrial robot, 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 classification



xx1700001493

Particle emission from the robot (IRB 14000 YuMi including gripper and suction cup) fulfill Clean room class 5 standard according to DIN EN ISO 14644-1, -14.

According to IPA test result, the robot IRB 14000 YuMi is suitable for use in clean room environments.

Classification of airborne molecular contamination, see below:

Test environment parameters				
Cleanroom Air Cleanliness Class (According to ISO 14644-1)	Airflow velocity	Airflow pattern	Temperature	Relative humidity
ISO 1	0.45 m/s	vertical laminar flow	22 °C ± 0.5 °C	45% ± 0.5%
Test procedure parameters				
Capacity	Attached payload	Pressure of ultraclean air	Operation of each arm	Operation of each axis
50% and 100%	0 kg	6 bar	separately/together	separately

Test result/Classification:

Continues on next page

1 Description

1.1.1 Introduction to structure

Continued

When operated under the specified test conditions, the IRB 14000 YuMi including gripper and suction cup is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1.

Test parameter(s)	Air Cleanliness Class
Capacity=50%	5
Capacity=100%	5
Suction cup	5
Overall result	5

Protection

The robot has IP30 protection.

Operating system

The robot is equipped with the controller (located inside the body of the robot) 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*.

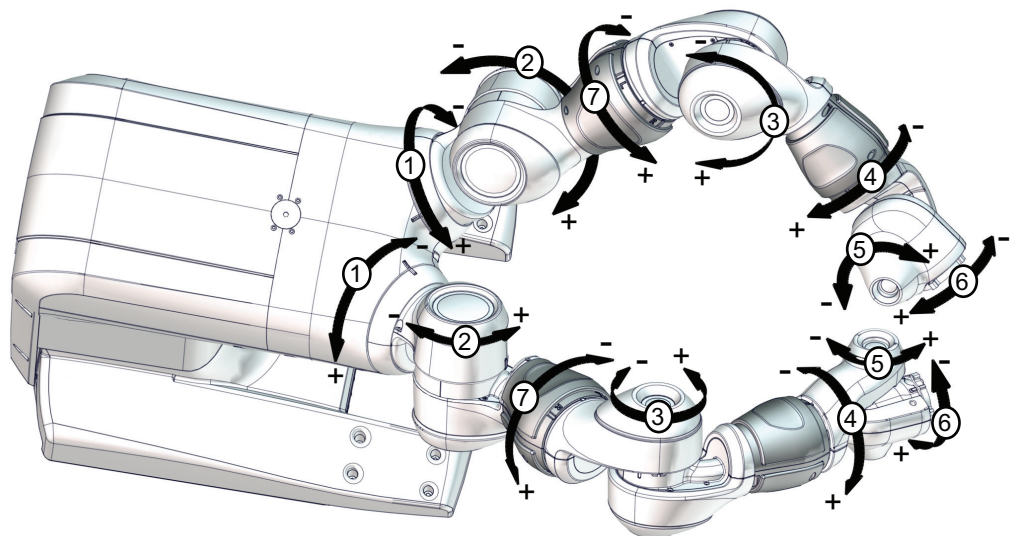
Safety

The safety standards are valid for the complete robot.

Additional functionality

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, sensor control etc. For a complete description on optional software, see *Product specification - Controller software IRC5*.

Arm axes



xx1500000254

1.1.2 The Robot

General

The IRB 14000 can only be mounted on table or other flat surface, no other mounting position is permitted.

Robot	Handling capacity (kg)	Reach (m)
IRB 14000	0.5 kg	0.559 m

Manipulator weight

Data	Weight
IRB 14000	38 kg

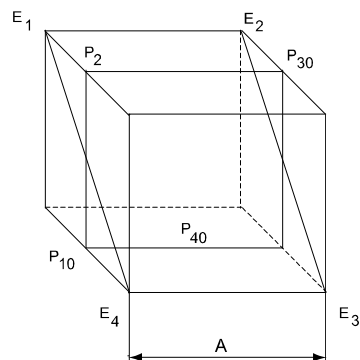
Other technical data

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

Power consumption

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

Type of movement	Power consumption (kW)
Average power consumption	< 0.17 kW
Robot in 0 degree position	IRB 14000
Brakes engaged	0.09 kW
Brakes disengaged	0.14 kW



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Position	Description
A	250 mm

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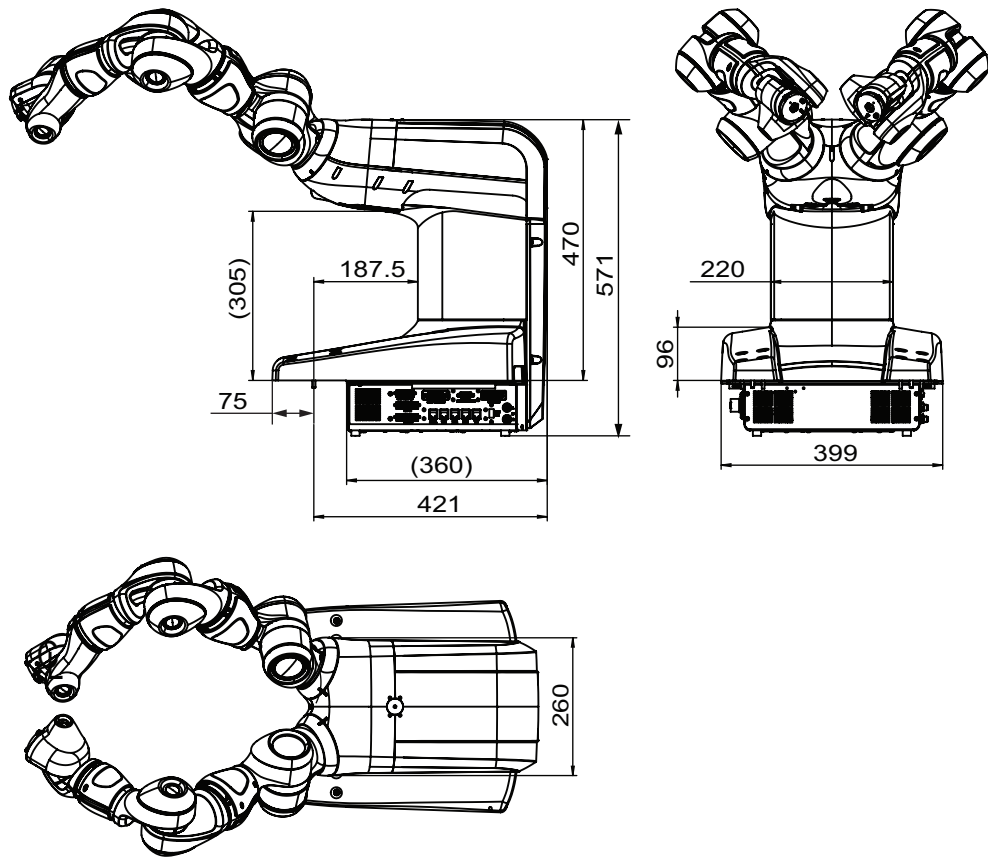
1 Description

1.1.2 The Robot

Continued

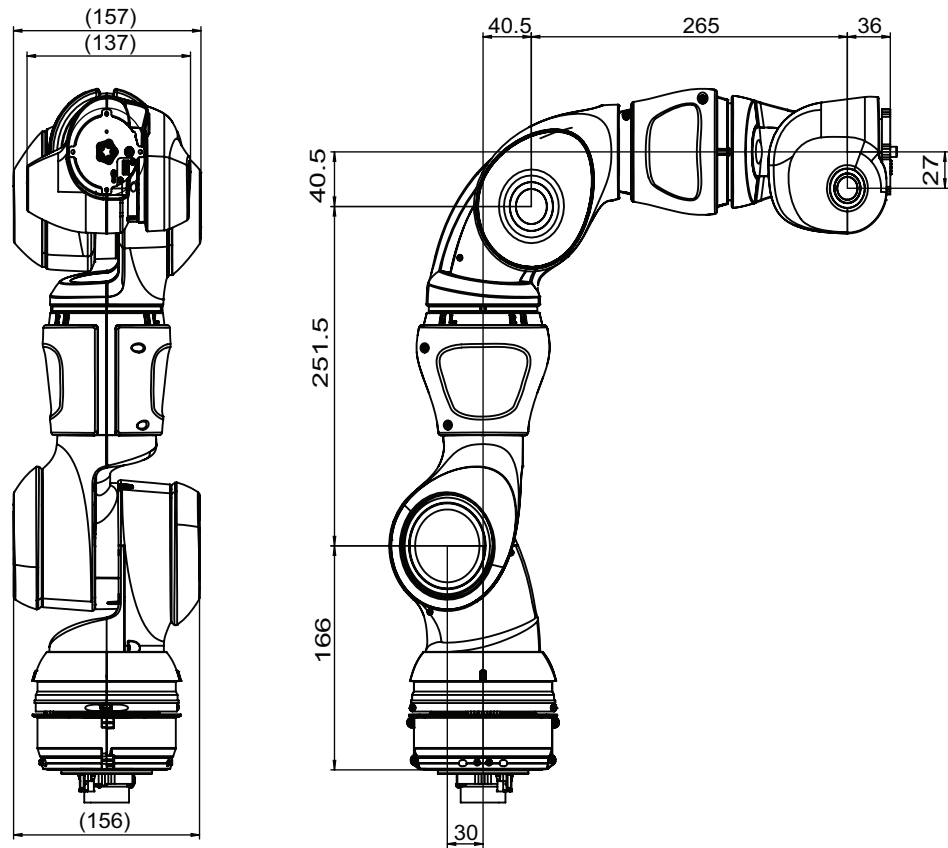
Dimensions

Robot



Continues on next page

Robot arms



xx150000434

1 Description

1.2.1 Applicable standards

1.2 Safety

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.

Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1:2011 ⁱ	Robots for industrial environments - Safety requirements -Part 1 Robot
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
ISO 9283:1998	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1:2015 ⁱⁱ	Classification of air cleanliness
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
EN 61000-6-4:2007 + A1:2011 IEC 61000-6-4:2006 + A1:2010	EMC, Generic emission
EN 61000-6-2:2005 IEC 61000-6-2:2005	EMC, Generic immunity
EN IEC 60974-1:2012 ⁱⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10:2014 ⁱⁱⁱ	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)
IEC 61340-5-1:2010	Protection of electronic devices from electrostatic phenomena - General requirements

ⁱ See [Deviations from ISO 10218-1:2011 on page 15](#).

ⁱⁱ Only robots with protection Clean Room.

ⁱⁱⁱ Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

Continues on next page

Deviations from ISO 10218-1:2011

ISO 10218-1:2011 was developed with conventional industrial robots in mind. Deviations from the standard are motivated for IRB 14000 in the table below. More information about ISO 10218-1 compliance is given in *technote_150918*.

Requirement	Deviation for IRB 14000	Motivation
§5.7.1 Mode selector which can be locked in each position.	The mode selector is implemented in software on FlexPendant.	Automatic and manual mode are usability features for IRB 14000, but not safety features. Locking the operating mode does not contribute to a necessary risk reduction. ⁱ
§5.12.1 Limiting the range of motion by adjustable stops (§5.12.2) or by safety functions (§5.12.3).	IRB 14000 does not have adjustable mechanical stops or provisions to install non-mechanical limiting devices.	The IRB 14000 robot is intended for collaborative applications where contact between robot and the operator is harmless. Limiting the working range is then not necessary for risk reduction. Note that PPE (Personal Protective Equipment) may be required.

ⁱ The selector is replaced by a selection through software and user authorities can be set to restrict the use of certain functions of the robot (e.g. access codes).

European standards

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

Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements
ANSI/ESD S20.20:2007	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

1 Description

1.2.2 Safety functions

1.2.2 Safety functions

Functional safety

The following safety functions are inherent design measures in the control system, contributing to power and force limiting. They are certified to category B, performance level b, according to EN ISO 13849-1.

Safety functions	Description
Cartesian speed supervision	The Cartesian speed of the elbow (arm check point, ACP) and the wrist (wrist center point, WCP) are supervised. If a limit is exceeded, the robot motion is stopped and a message displayed to the user. The default speed limit can be modified based on the risk assessment of the robot installation. The function is active in both manual and automatic mode. The speed limits are set by system parameters. See <i>Operating manual - IRB 14000</i> .
Protective stop (safety stop)	The controller has an electrical input which can be accessed in external devices mode to stop the robot, e.g. from a safety PLC. The protective stop function removes power from the actuators, and is a Category 0 stop, according to ISO 13850. In standalone mode, the FlexPendant emergency stop button is routed to this input, and utilizes the safety function to stop the robot.

Motor power safety

The maximum power of all the motors, integrated in IRB 14000, is less than 80W.

Additional safety features in the control system

Safety functions	Description
Three-position enabling device	The FlexPendant is always equipped with a three-position enabling device, but for the IRB 14000 system the enabling device is not used. Therefore the enabling device is disabled and inactive when the FlexPendant is connected to an IRB 14000 system, but it is enabled and active when connected to another robot.
Connecting external devices	External safety devices can be connected by removing the safety bridge connector on the controller. This also allows for stopping external machinery from the FlexPendant emergency stop button with retained dual channel safety.
Collision detection	In case of an unexpected mechanical disturbance, like a collision, the robot will stop and then slightly back off from its stop position.
Fire safety	The robot system complies with the requirements of UL (Underwriters Laboratories) for fire safety.
Electrical safety	The robot system complies with the requirements of UL for electrical safety.
Safety lamp	As an option, a safety lamp mounted on the manipulator can be connected. The lamp is activated when the controller is in the MOTORS ON state.

1.3 Installation

Introduction to installation

IRB 14000 is intended for use in industrial environment.

An arm can handle a maximum payload of 0.5 kg.

Continues on next page

1 Description

1.3.1 Operating requirements

1.3.1 Operating requirements

Protection standard

Robot variant	Protection standard IEC529
Manipulator + controller	IP30

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.

Ambient temperature

Description	Standard/Option	Temperature
Manipulator + controller during operation	Standard	+ 5 °C ⁱ (41 °F) to + 40 °C (104 °F)
Complete robot during transportation and storage	Standard	- 10 °C (14 °F) to + 55 °C (131 °F)

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

Relative humidity

Description	Relative humidity
Complete robot during operation, transportation and storage	Max. 85% at constant temperature

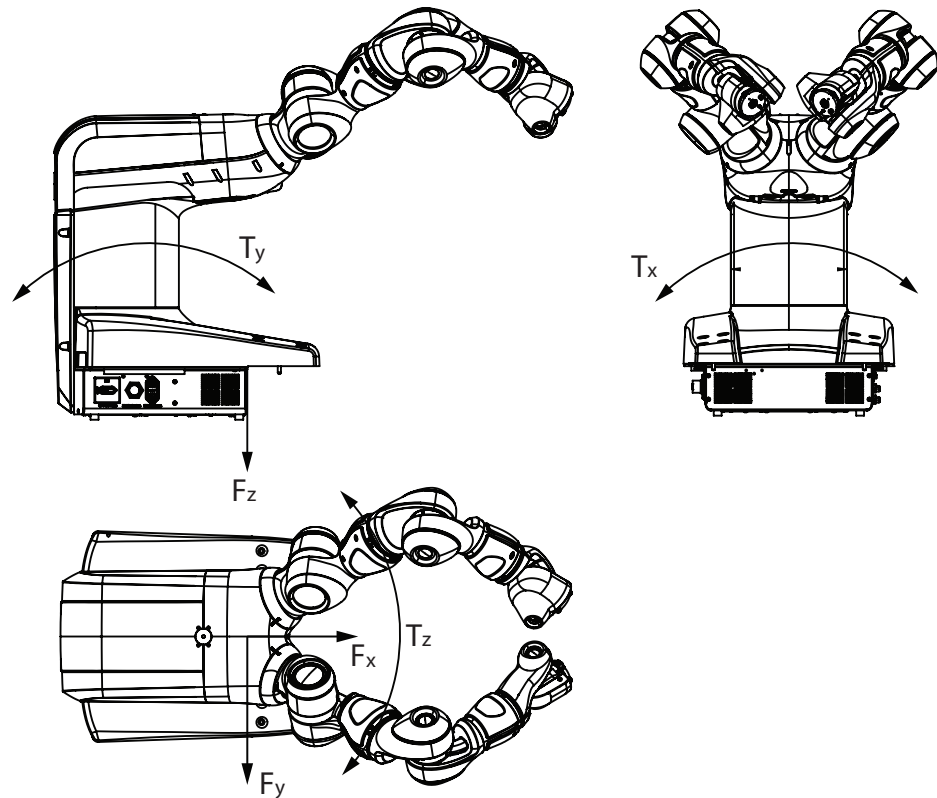
1.3.2 Mounting the manipulator

Maximum load

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

Table mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force x	±89 N	±178 N
Force y	±147 N	±294 N
Force z	+380 ±140 N	+380 ±280 N
Torque x	±101 Nm	±202 Nm
Torque y	+14 ±98 Nm	+14 ±172 Nm
Torque z	±61 Nm	±122 Nm



xx1500000104

F_x	Force in the X plane
F_y	Force in the Y plane
F_z	Force in the Z plane
T_x	Bending torque in the X plane
T_y	Bending torque in the Y plane
T_z	Bending torque in the Z plane

Continues on next page

1 Description

1.3.2 Mounting the manipulator

Continued

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



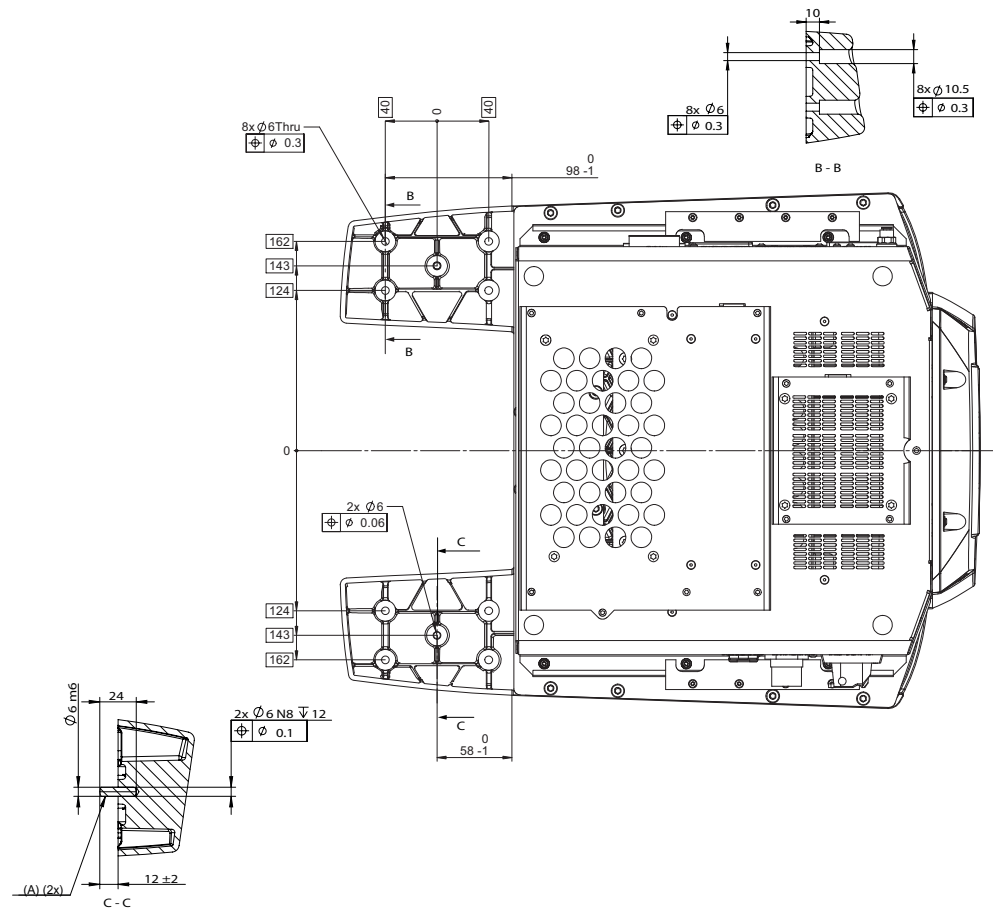
Note

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

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Fastening holes robot base

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



xx1400002124

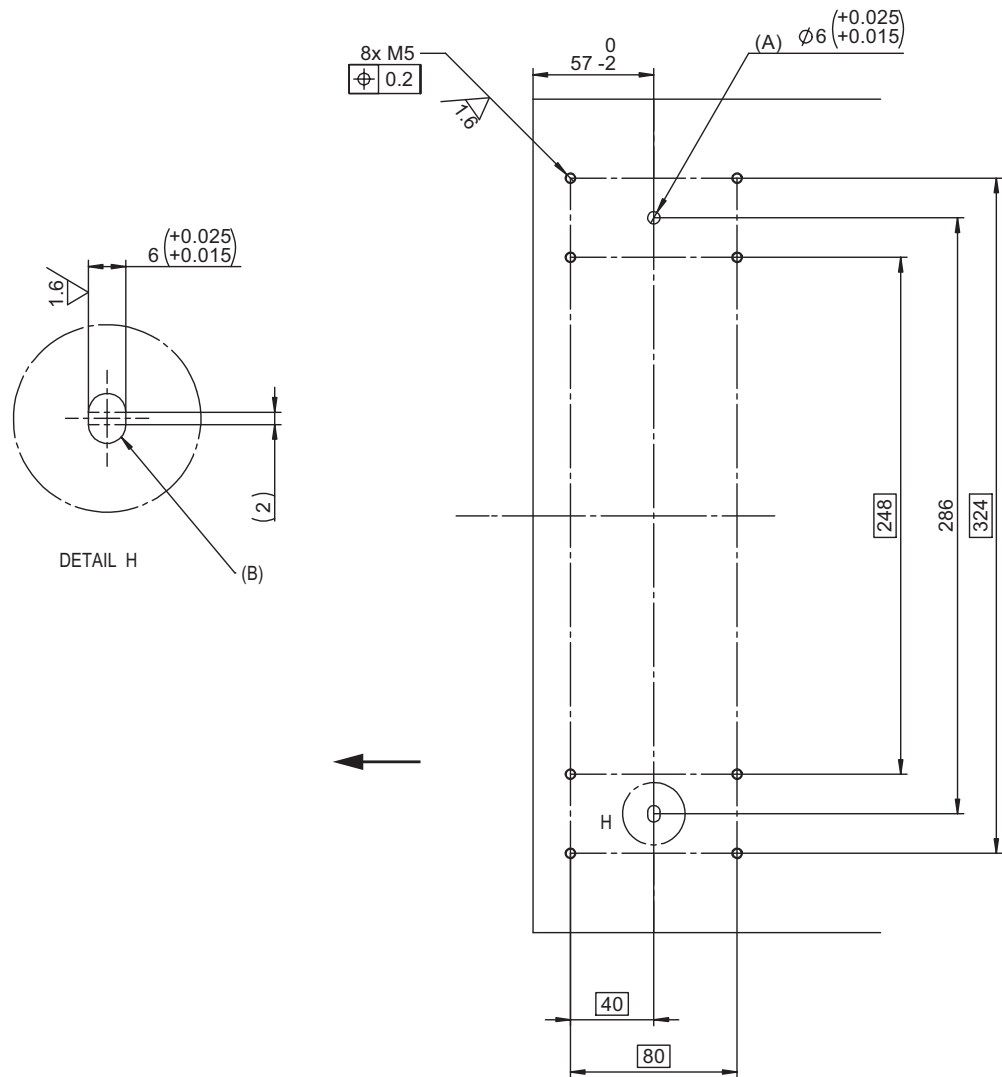
A	Guide pins, 3HNP00449-1, one is to fit round hole, the other is to fit slot hole.
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1 Description

1.3.2 Mounting the manipulator

Continued



xx1400002121

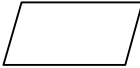
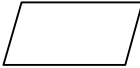
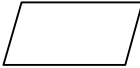
A	Master hole (round)
B	Alignment hole (slot)

Attachment bolts, specification

The table specifies the type of securing screws and washers to be used to secure the robot directly to the foundation. It also specifies the type of pins to be used.

Suitable screws	M5x25
Suitable washers	5.3x10x1
Quantity	8 pcs
Quality	8.8
Guide pins	2 pcs, article number 3HNP00449-1
Tightening torque	3.8 Nm ± 0.38 Nm

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Level surface requirement	<table border="1"><tr><td data-bbox="991 286 1203 443"></td><td data-bbox="1209 286 1422 443">0.1</td></tr></table> <p data-bbox="976 465 1086 488">xx1500000627</p>		0.1
	0.1		

1 Description

1.4.1 Introduction to load diagram

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. For detailed information, see *Operating manual - IRC5 with FlexPendant*.



WARNING

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

General

The load diagram includes a nominal pay load inertia, J_0 of 0.001 kgm^2 . At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, wall or inverted mounted, the load diagrams as given are valid and thus it is also possible to use RobotLoad within those tilt and axis limits.

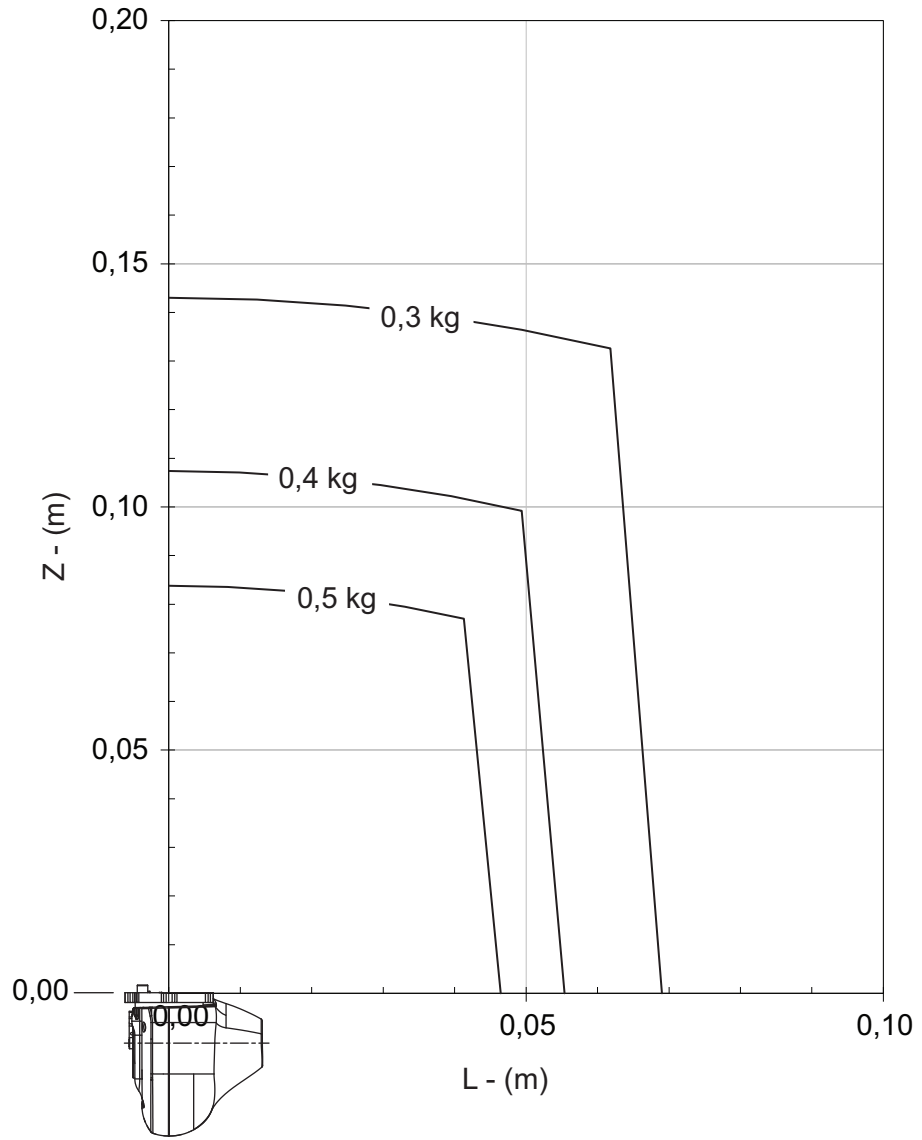
Control of load case by "RobotLoad"

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

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

1.4.2 Load diagram

IRB 14000 - 0.5/0.5 (without gripper)



xx150000097

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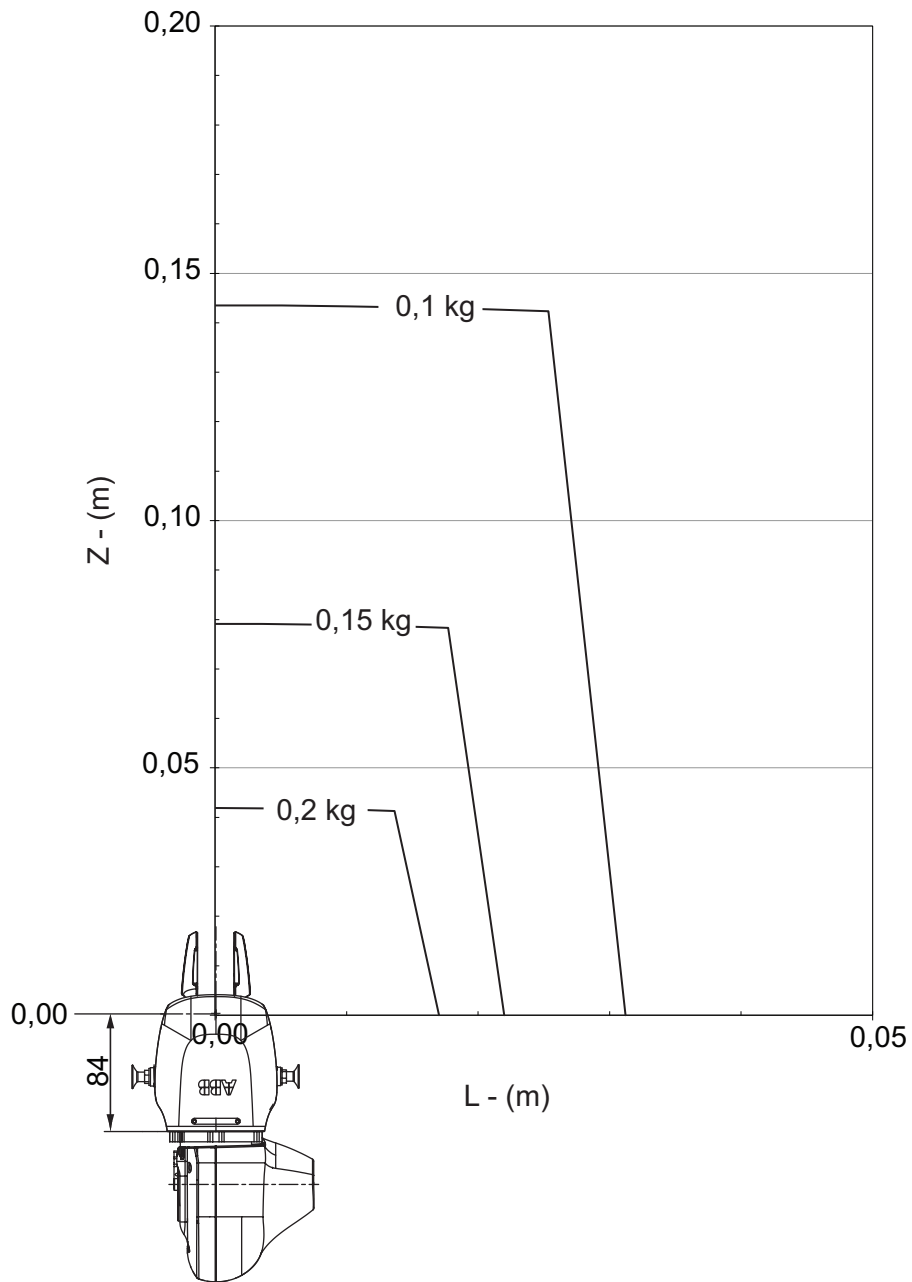
1 Description

1.4.2 Load diagram

Continued

IRB 14000 - 0.5/0.5(with gripper)

Hand CoG, see table below.



xx1500000501

Mass	Z	L
280 g	47.3 mm	13.9 mm

The load diagram with gripper is an example, given for the heaviest combination of IRB 14000 Gripper options (servo + 2 vacuum modules), including fingers and suction tools. Actual load capacity should be determined from the robot load diagram and the mass data of the actual gripper and end effectors.

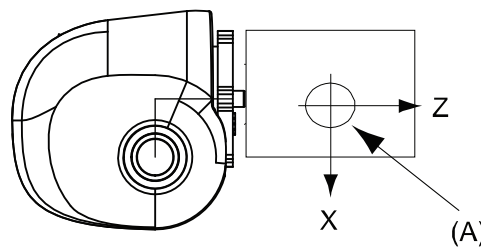
1.4.3 Maximum load and moment of inertia

General

Total load given as: Mass in kg, center of gravity (Z and L) in m and moment of inertia (J_{0x} , J_{0y} , J_{0z}) in kgm^2 . $L = \sqrt{X^2 + Y^2}$.

Full movement

Axis	Robot variant	Max. value
5	IRB 14000 - 0.5/0.5	$J_5 = \text{Mass} \times ((Z + 0.045)^2 + L^2) + \max(J_{0x}, J_{0y}) \leq 0.012 \text{ kgm}^2$
6	IRB 14000 - 0.5/0.5	$J_6 = \text{Mass} \times L^2 + J_{0z} \leq 0.009 \text{ kgm}^2$



xx1500000774

Position	Description
A	Center of gravity
J_{0x}, J_{0y}, J_{0z}	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, contact your local ABB organization.

Robot variant	Max wrist torque axes 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 14000	0.64 Nm	0.23 Nm	0.5 kg

1 Description

1.5.1 General

1.5 Mounting of equipment

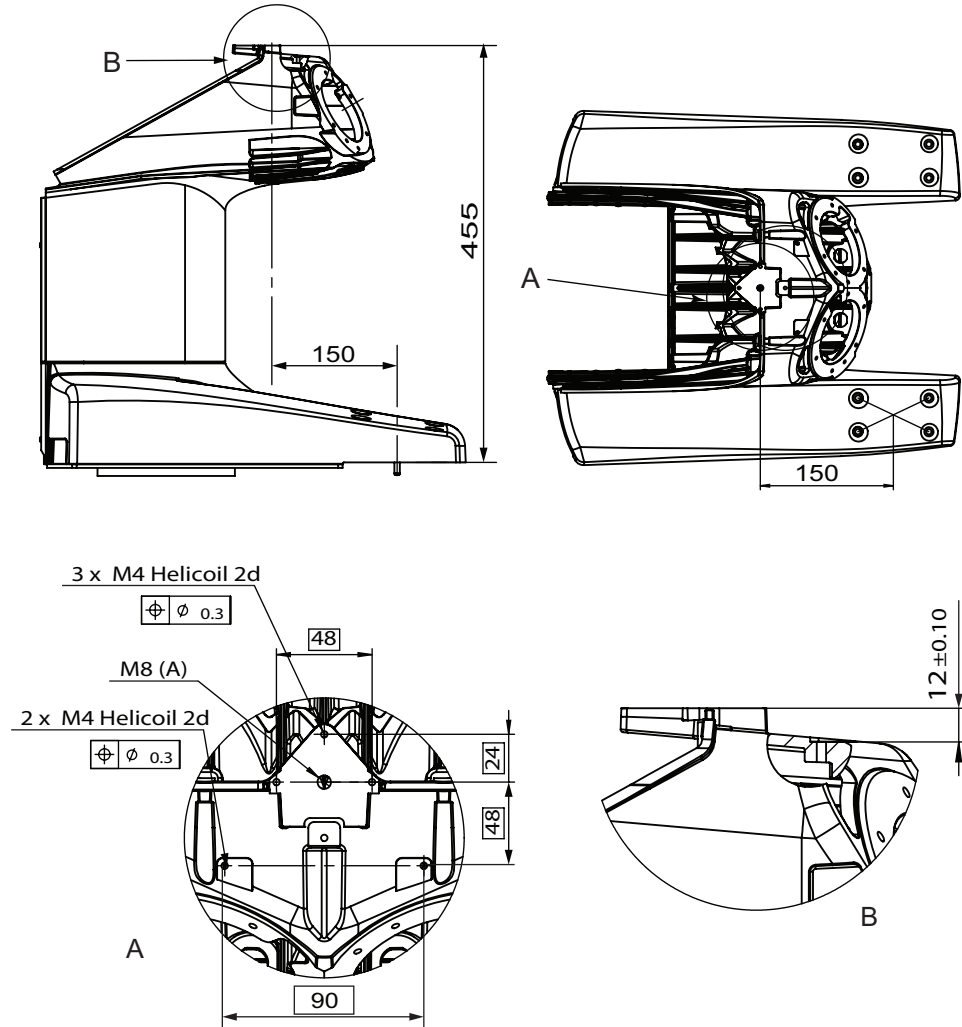
1.5.1 General

Each arm ends with a tool flange, for mounting of available grippers, see [Grippers on page 45](#) or for customer specific equipment and on robot.

Below is an overview of the robot and tool flange, see [Tool flange on page 31](#) for details.

1.5.2 Robot

Top mounting interface body



xx150000495

Pos	Description
A	M8 hole for lifting eye, thru hole

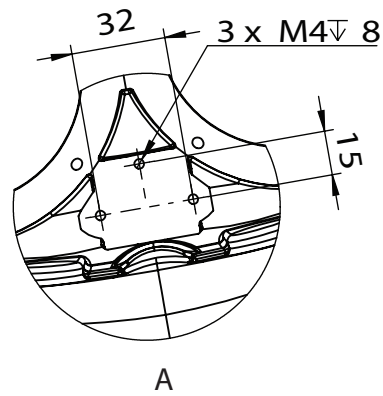
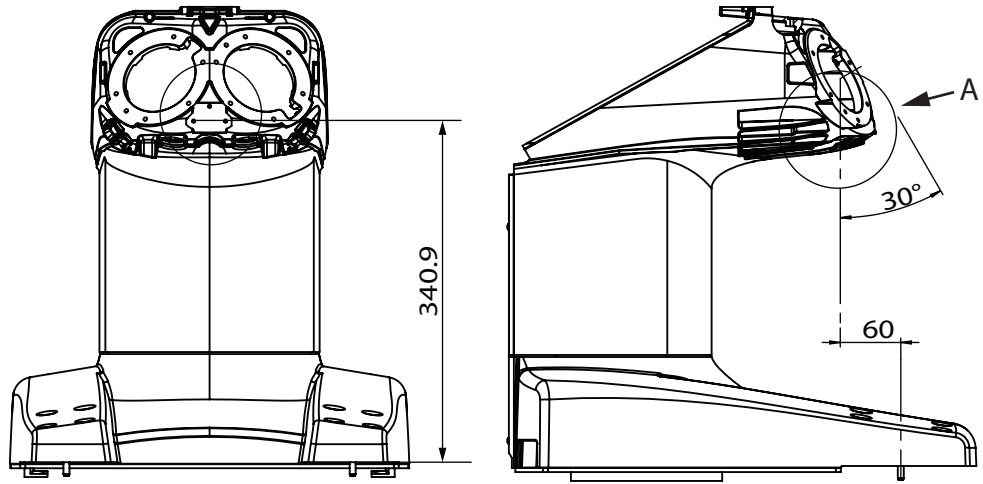
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1 Description

1.5.2 Robot

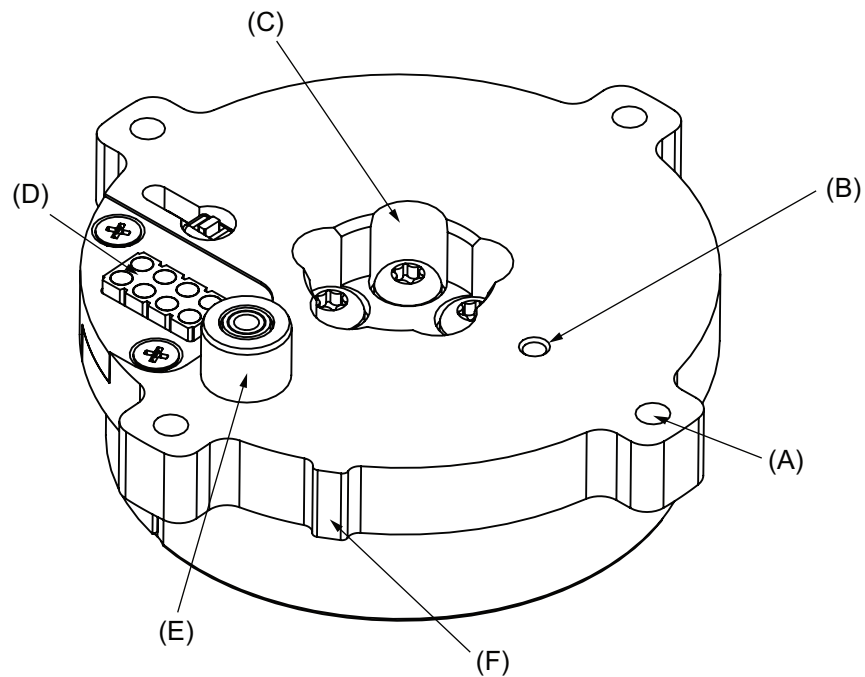
Continued

Chest mounting interface



xx150000494

1.5.3 Tool flange



xx150000099

Pos	Description
A	4 x 2.9 thru holes for M2.5 screws
B	2E8 pin hole for alignment
C	15H7 for alignment, max depth 5 mm
D	Mill-Max (430-10-208-00-240000), spring-loaded header, double row 8 pad connector for 24V and Ethernet or IO
E	Outer diam. 7.5e8 and inner diam. 4.4F10 for air hose
F	Calibration mark for axis 6

Continues on next page

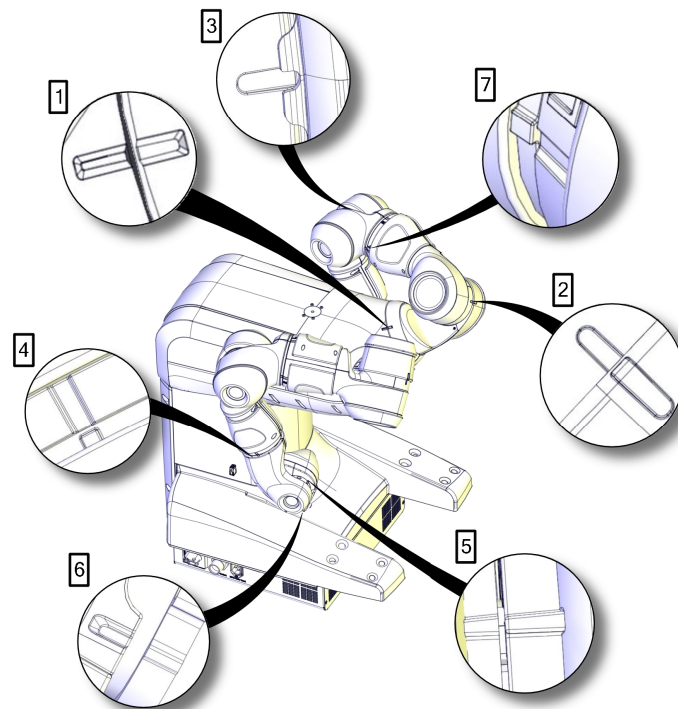
1.6 Calibration

1.6.1 Fine calibration

General

Fine calibration is made by moving the axes so that the synchronization mark on each joint is aligned, and running the CalHall routine.

For detailed information on calibration of the robot see *Product manual - IRB 14000*.



xx150000526

1 Description

1.6.2 Absolute accuracy calibration

1.6.2 Absolute accuracy calibration

Prerequisites

Requires RobotWare option Absolute Accuracy, see *Product specification - Controller software IRC5*.

The calibration concept

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

Absolute Accuracy compensates for:

- Mechanical tolerances in the robot structure
- Deflection due to load

Absolute Accuracy calibration is focusing 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.

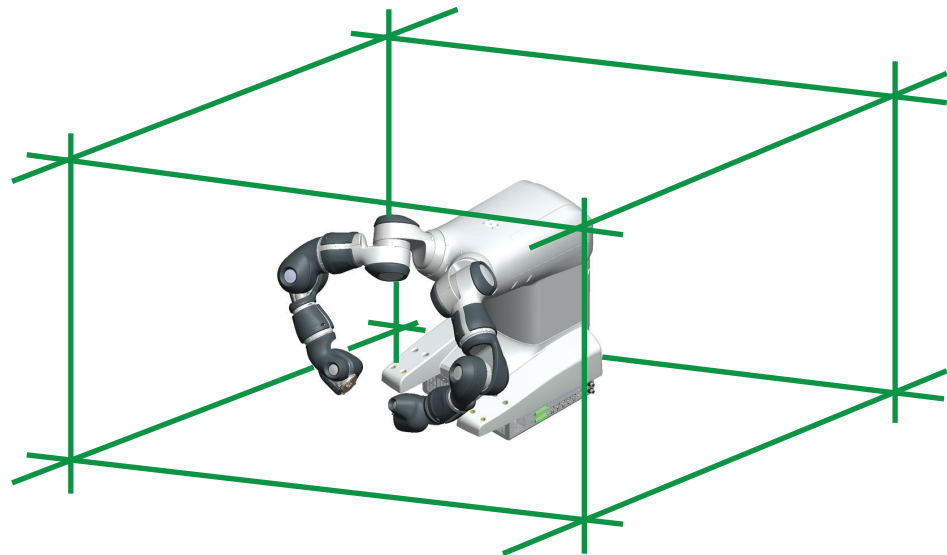
Calibration data

The user is supplied with robot calibration data (compensation parameter file, absacc.cfg) and a certificate that shows the performance ("birth certificate"). The difference between an ideal robot and a real robot without Absolute Accuracy may reach up to 10 mm, resulting from mechanical tolerances and deflection in the robot structure.

Continues on next page

Absolute Accuracy option

The Absolute Accuracy option is integrated in the controller algorithms for compensation of the difference between the ideal and the real robot, 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 to reach a good positioning in the Cartesian coordinate system.



xx150000761

Product data

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 14000 - 0.5/0.5	0.3	0.6	100

1 Description

1.7.1 Introduction to maintenance and trouble shooting

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 gear boxes.
- The cabling is routed for longevity.
- It has a program memory “battery low” alarm.

Maintenance

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

1.8 Robot motion

1.8.1 Working range and type of motion

Robot motion

Axis	Type of motion	Degree of motion
Axis 1	Arm - Rotation motion	-168.5° to +168.5°
Axis 2	Arm - Bend motion	-143.5° to +43.5°
Axis 7	Arm - Rotation motion	-168.5° to +168.5°
Axis 3	Arm - Bend motion	-123.5° to +80°
Axis 4	Wrist - Rotation motion	-290° to +290°
Axis 5	Wrist - Bend motion	-88° to +138°
Axis 6	Flange - Rotation motion	-229° to +229°

Continues on next page

1 Description

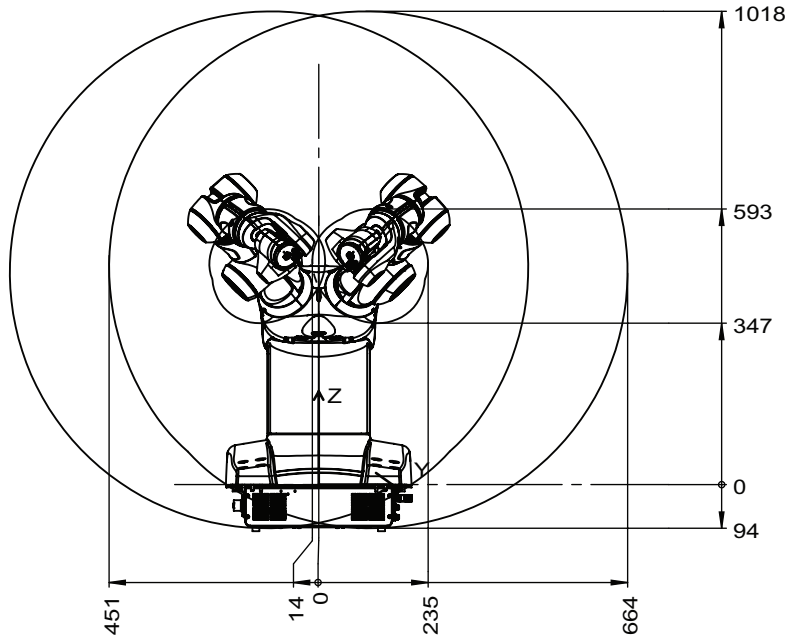
1.8.1 Working range and type of motion

Continued

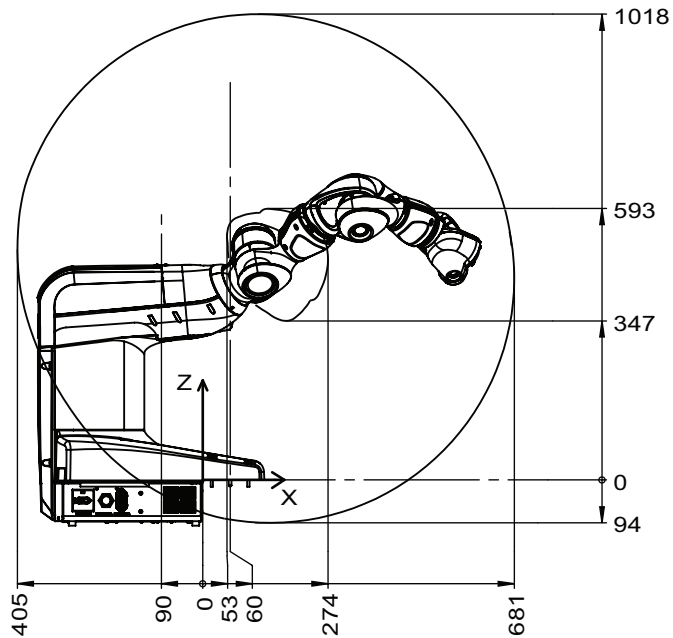
Illustration, working range IRB 14000

The illustrations show the unrestricted working range of the robot.

Front view

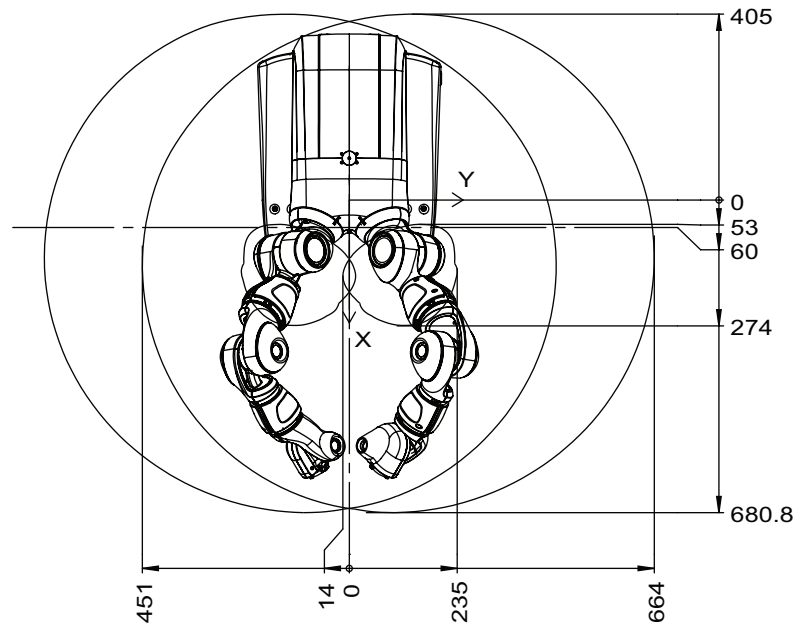


Side view



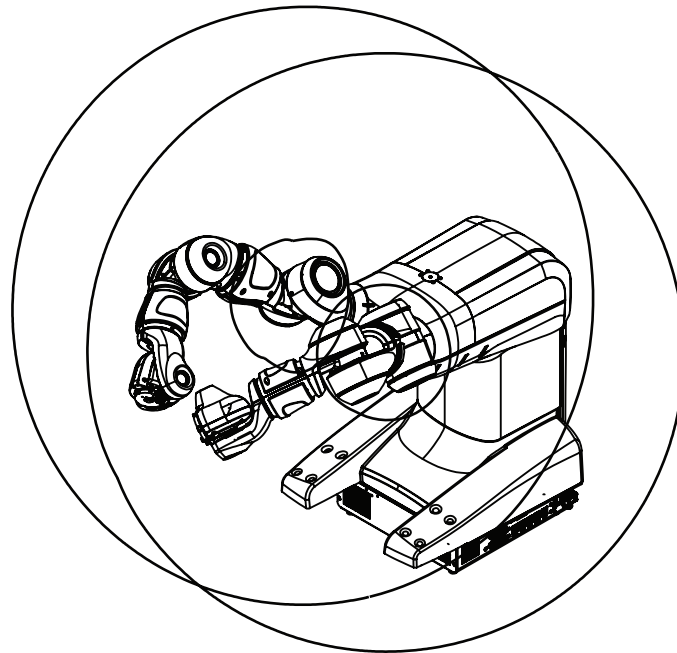
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Top view



xx150000336

Isometric view



xx150000661

1 Description

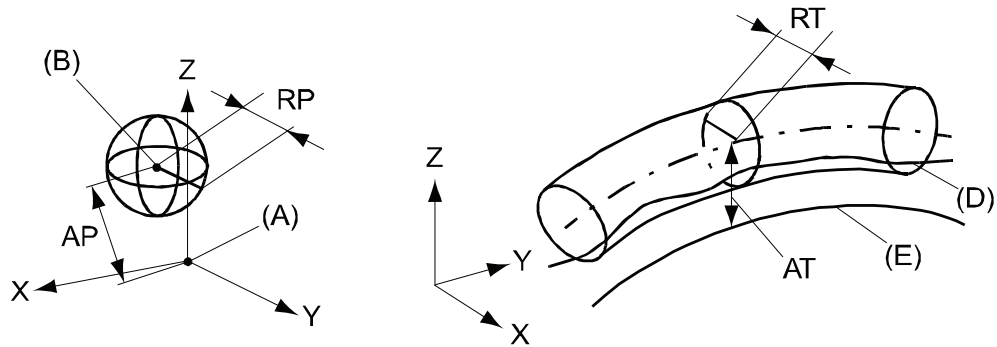
1.8.2 Performance according to ISO 9283

1.8.2 Performance according to ISO 9283

General

At rated maximum load, maximum offset and 1.5 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

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

Description	Values
	IRB 14000
Pose repeatability, RP (mm)	0.02
Pose accuracy, AP (mm)	0.02
Linear path repeatability, RT (mm)	0.10
Linear path accuracy, AT (mm)	1.36
Pose stabilization time, Pst (s) within 0.1 mm of the position	0.37

1.8.3 Velocity**General**

Robot variant	Axis 1	Axis 2	Axis 7	Axis 3	Axis 4	Axis 5	Axis 6
IRB 14000	180 °/s	180 °/s	180 °/s	180 °/s	400 °/s	400 °/s	400 °/s

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

Resolution

Approximately 0.01° on each axis.

1 Description

1.8.4 Stopping distance / time

1.8.4 Stopping distance / time

General

Stopping distance/time for emergency stop (category 0) 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 variant	Axis	Category 0	
		A	B
IRB 14000	1	23	0.37
	2	23	0.37
	7	26	0.40
	3	26	0.40

	Description
A	Stopping distance in degrees
B	Stop time (s)

1.9 Customer connections

Introduction to customer connections

Customer connection, the cables are integrated in the robot and the connectors are placed on the left side at the base and in the tool flange.

The tool flange is equipped with an 8-pole pad-type connector for signal and power. Positions E-H are for power (24V) and PE. Positions A-D are for signal, and can be either Ethernet or IO signals.

Upon delivery, the robot has Ethernet on the flange positions A-D. The Ethernet connection from each arm is routed to the LAN2 port on the main computer via an internal Ethernet switch in the controller. The user can reconnect inside the controller to instead get IO signals on the flanges. There is a female Ethernet connector waiting next to the Ethernet switch inside of the controller, by which flange positions A-D can instead be routed to XP12 on the left side panel of the controller. There, cross connections to DI and DO connectors XS8 and XS7 can easily be made.

On each flange, only one of Ethernet and IO signals can be used at the same time. When selecting the IRB 14000 SmartGrippers, Ethernet will be used, and the Tool IO signals on XP12 are not available on the flange. The Tool IO signals, on the other hand, can be used when integrating a basic pneumatic or electric gripper that is controlled by a small number of IO signals, and that is not Ethernet-based.

Robot base

For customer connections robot base, see [Controller on page 73](#).

Continues on next page

1 Description

1.9 Customer connections

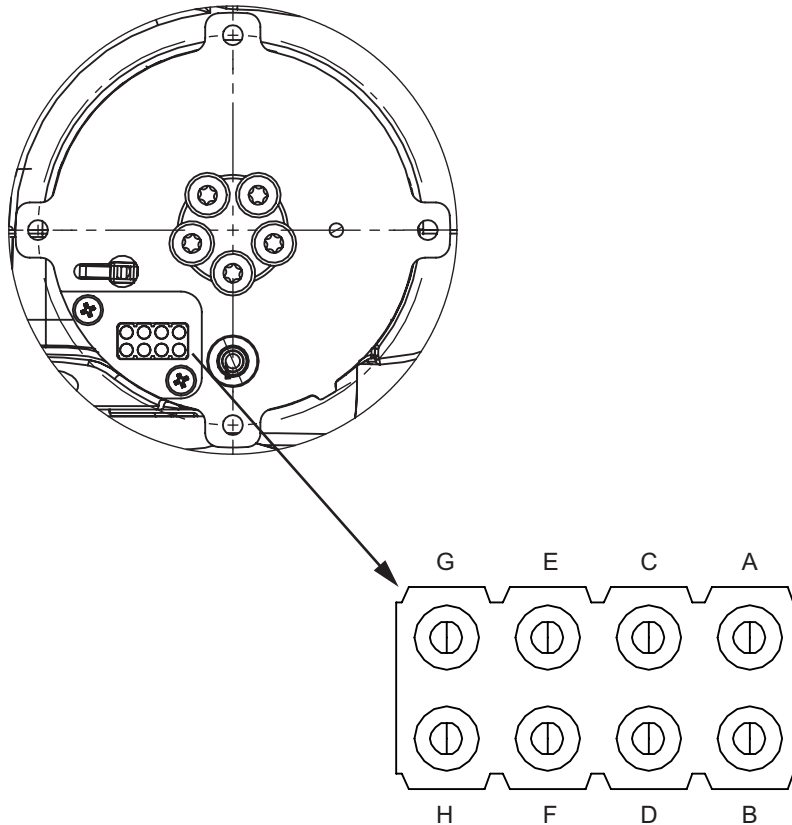
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Tool flange



Note

Customer signals (each arm) at tool flange is only available when no grippers are selected. Tool connector type, Spring-loaded Header Double row, Mill-Max (430-10-208-00-240000).



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Pin	Description
A	EtherNet RD-
B	EtherNet TD-
C	EtherNet RD+ (Max current = 2A, when not used as Ethernet signals)
D	EtherNet TD+ (Max current = 2A, when not used as Ethernet signals)
E	PE
F	Spare
G	0V, IO
H	24V, IO (Max current = 1 A/arm)

2 Grippers

2.1 Structure

2.1.1 Introduction

General

The IRB 14000 gripper is a smart, multifunctional gripper for part handling and assembly. The gripper has one basic servo module and two optional functional modules, vacuum and vision. The three modules can be combined to provide five different combinations for users in different applications.

A pair of getting-started fingers are provided together with the gripper for demo and test purposes. These fingers should be replaced with fingers designed for the actual application by the system integrator.

If the vacuum module option is selected, a first set of suction cups and filters are provided together with the gripper.

Protection

The IRB 14000 gripper has IP30 protection.

Communication

The IRB 14000 gripper communicates with the IRB 14000 controller over an Ethernet IP fieldbus. A RobotWare add-in, SmartGripper, is provided to facilitate the operation and programming of the gripper. The add-in contains RAPID driver, FlexPendant interface and configuration files.

Left and right

The IRB 14000 gripper can be mounted on left or right arm without restrictions. It can also be moved between arms and between robots. After a gripper is installed to the robot, the setup of Left or Right identity (chirality) of the gripper is done from the FlexPendant interface.

Safety

The IRB 14000 gripper has a patented floating shell structure that helps absorb impacts during collisions. End effectors such as fingers and suction tools need to be designed for the actual application and included in the risk assessment by the system integrator.

2 Grippers

2.1.2 Function modules

2.1.2 Function modules

General

The functions of the three gripper modules are described as follows.

	Function module	Description
1	Servo	The servo module is the basic part of the gripper. It gives the function of gripping objects. Fingers are installed on the base of the servo module, and finger movement and force can be controlled and supervised.
2	Vacuum	The vacuum module contains the vacuum generator, vacuum pressure sensor and blow-off actuator. When the suction tools are mounted, the gripper can pick up objects by the suction function and place the objects by the blow-off function.
3	Vision	The vision module contains a Cognex AE3 In-Sight camera, supporting all functions of ABB Integrated Vision.

The three function modules can be combined into five different possibilities as listed in the following table.

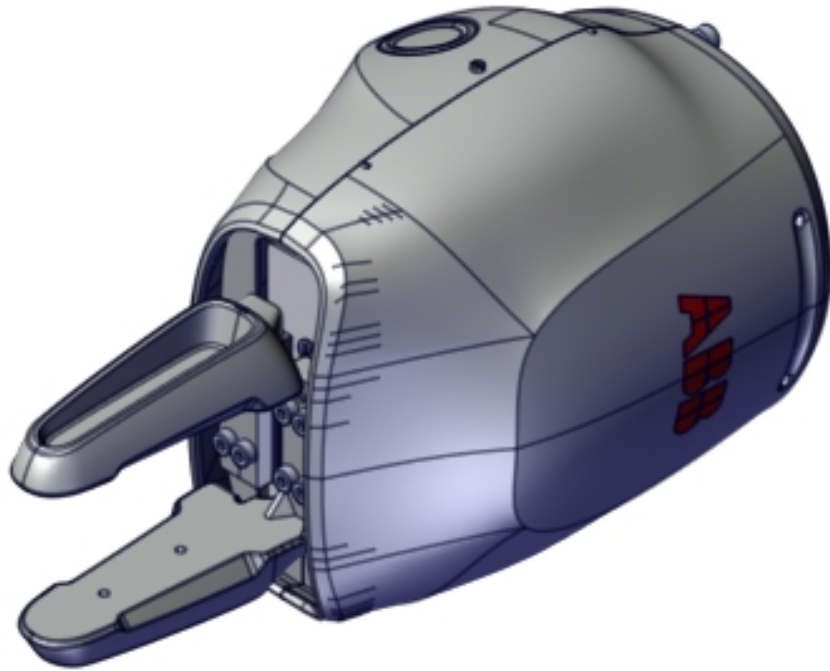
	Combination	Includes...
1	Servo	One servo module
2	Servo + Vacuum	One servo module and one vacuum module
3	Servo + Vacuum 1 + Vacuum 2	One servo module and two vacuum modules
4	Servo + Vision	One servo module and one vision module
5	Servo + Vision + Vacuum	One servo module, one vision module, and one vacuum module

Continues on next page

Combination views

Servo

The following figure illustrates the gripper with one servo module.



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Continues on next page

2 Grippers

2.1.2 Function modules

Continued

Servo + Vacuum

The following figure illustrates the gripper with one servo module and one vacuum module.



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Continues on next page

Servo + Vacuum 1 + Vacuum 2

The following figure illustrates the gripper with one servo module and two vacuum modules.



xx1400002139

Continues on next page

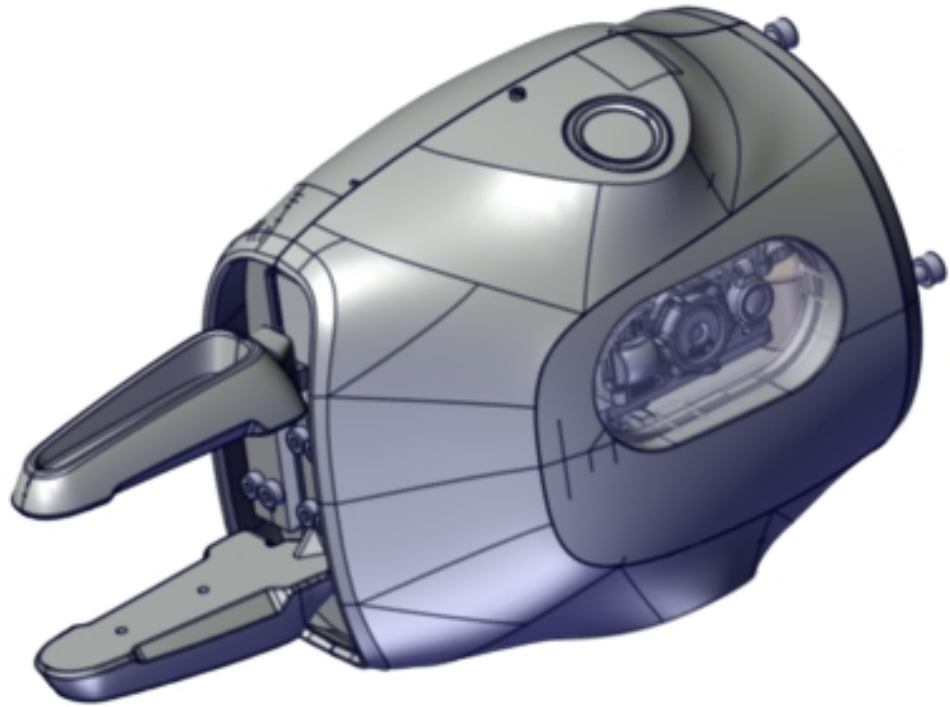
2 Grippers

2.1.2 Function modules

Continued

Servo + Vision

The following figure illustrates the gripper with one servo module and one vision module.

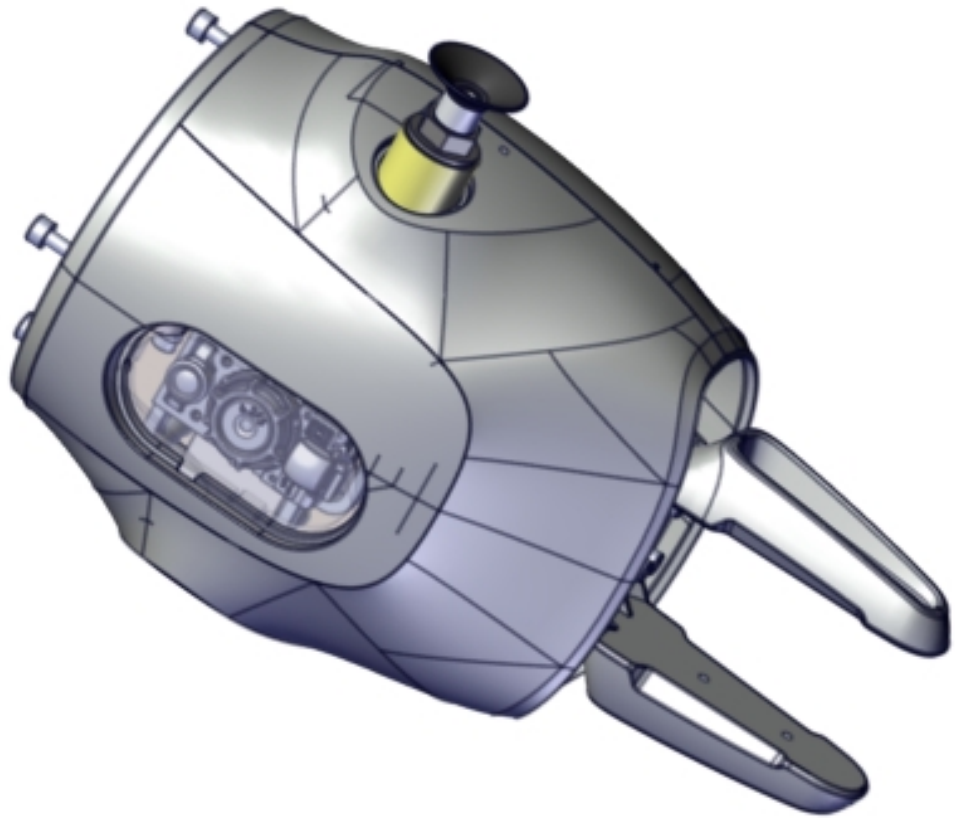


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Continues on next page

Servo + Vision + Vacuum

The following figure illustrates the gripper with one servo module, one vacuum module and one vision module.



xx140002141

2 Grippers

2.2.1 General

2.2 Technical data

2.2.1 General

Weight and load capacity

Combination	Weight (g) without fingers, suction cup(s), and filter(s) ⁱ	Weight (g) of the whole gripper	Max. load capacity (g) without fingers, suction cup(s), and filter(s) ⁱⁱ	Max. load capacity (g) of the whole gripper ⁱⁱ
Servo	215	230	285	270
Servo + Vacuum 1	225.5	248	274.5	252
Servo + Vacuum 1 + Vacuum 2	250	280	250	220
Servo + Vision	229	244	271	256
Servo + Vision + Vacuum 1	239.5	262	260.5	238

ⁱ The getting-started fingers weights 15 g, and the standard suction cups and filters weight 7.5 g per set.

ⁱⁱ Load capacity = 500 - Weight
Center of gravity (CoG) limitations applied. See the robot load diagram.

Detailed mass data - Center of Gravity

Combination	CoG (mm) without fingers, suction cup(s), and filter(s)			CoG (mm) of the whole gripper		
	x	y	z	x	y	z
Servo	8.7	12.3	49.2	8.2	11.7	52
Servo + Vacuum 1	8.9	12.3	48.7	8.6	11.7	52.7
Servo + Vacuum 1 + Vacuum 2	7.4	12.4	44.8	7.1	11.9	47.3
Servo + Vision	7.9	12.4	48.7	7.5	11.8	52.7
Servo + Vision + Vacuum 1	8.2	12.5	48.1	7.8	11.9	50.7

Detailed mass data - Inertia

Combination	Inertia (kgm ²) without fingers, suction cup(s), and filter(s)			Inertia (kgm ²) of the whole gripper		
	Ixx	Iyy	Izz	Ixx	Iyy	Izz
Servo	0.00017	0.00020	0.00008	0.00021	0.00024	0.00009
Servo + Vacuum	0.00017	0.00020	0.00008	0.00021	0.00024	0.00009
Servo + Vacuum 1 + Vacuum 2	0.00020	0.00024	0.00011	0.00025	0.00029	0.00012
Servo + Vision	0.00017	0.00019	0.00008	0.00021	0.00023	0.00008

Continues on next page

2 Grippers

2.2.1 General Continued

Combination	Inertia (kgm ²) without fingers, suction cup(s), and filter(s)			Inertia (kgm ²) of the whole gripper		
	lxx	lyy	lzz	lxx	lyy	lzz
Servo + Vision + Vacuum	0.00018	0.00020	0.00009	0.00022	0.00024	0.00009

Tooldata definitions without fingers, suction cup(s), and filter(s)

Combination	Tooldata
Servo	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.215, [8.7, 12.3, 49.2], [1, 0, 0, 0], 0.00017, 0.00020, 0.00008]]
Servo + Vacuum	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.226, [8.9, 12.3, 48.7], [1, 0, 0, 0], 0.00017, 0.00020, 0.00008]]
Servo + Vacuum 1 + Vacuum 2	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.250, [7.4, 12.4, 44.8], [1, 0, 0, 0], 0.00020, 0.00024, 0.00011]]
Servo + Vision	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.229, [7.9, 12.4, 48.7], [1, 0, 0, 0], 0.00017, 0.00019, 0.00008]]
Servo + Vision + Vacuum	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.240, [8.2, 12.5, 48.1], [1, 0, 0, 0], 0.00018, 0.00020, 0.00009]]

Tooldata definitions with fingers, suction cup(s), and filter(s)

Combination	Tooldata
Servo	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.230, [8.2, 11.7, 52.0], [1, 0, 0, 0], 0.00021, 0.00024, 0.00009]]
Servo + Vacuum	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.248, [8.6, 11.7, 52.7], [1, 0, 0, 0], 0.00021, 0.00024, 0.00009]]
Servo + Vacuum 1 + Vacuum 2	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.280, [7.1, 11.9, 47.3], [1, 0, 0, 0], 0.00025, 0.00029, 0.00012]]
Servo + Vision	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.244, [7.5, 11.8, 52.7], [1, 0, 0, 0], 0.00021, 0.00023, 0.00008]]
Servo + Vision + Vacuum	[TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.262, [7.8, 11.9, 50.7], [1, 0, 0, 0], 0.00022, 0.00024, 0.00009]]

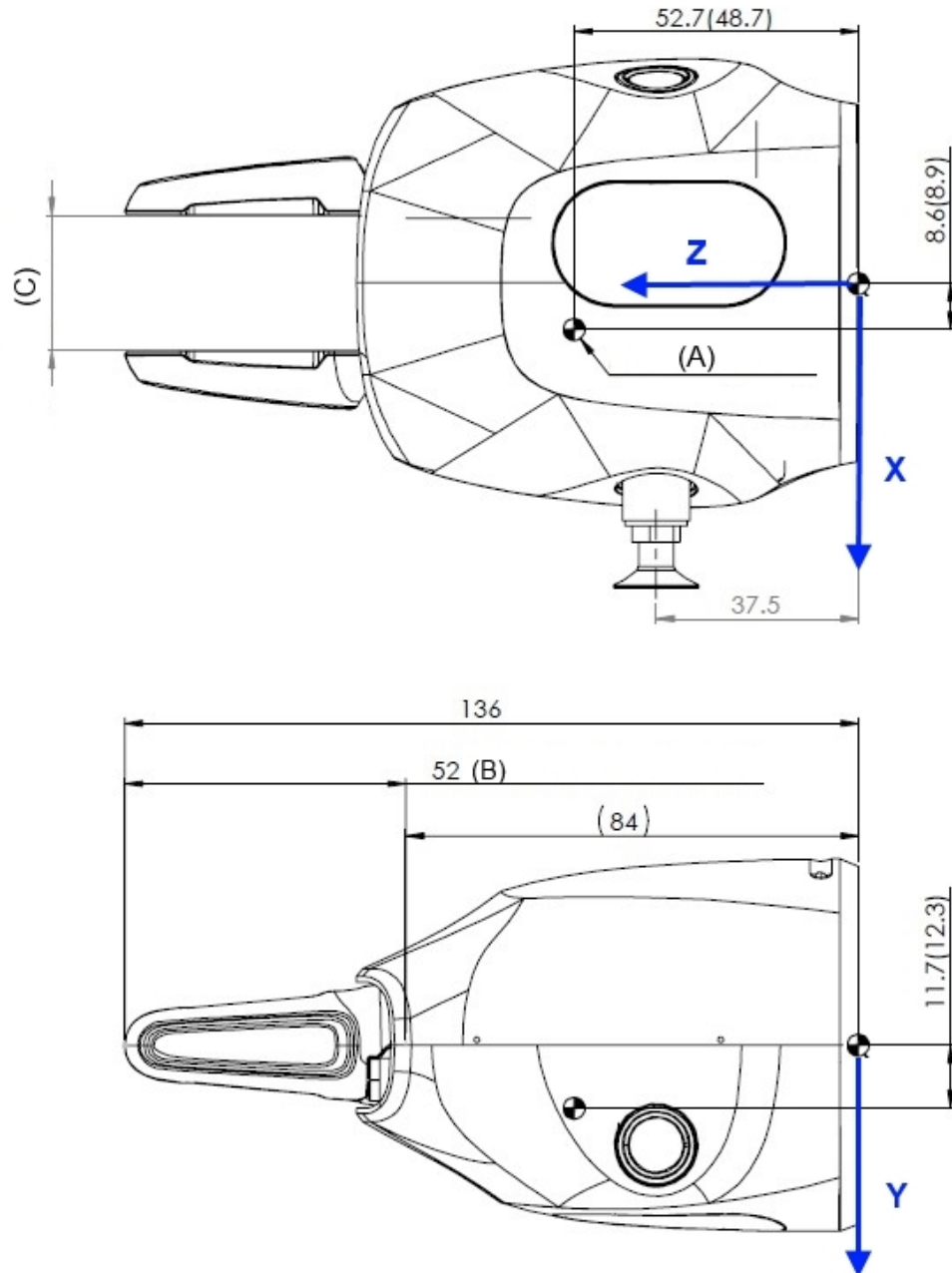
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2 Grippers

2.2.1 General Continued

Mass data, illustration

The following figure shows the mass data of the gripper with one servo module and one vacuum module as an example.



xx150000826

A	CoG Note: Dimensions of CoG in the brackets are without the fingers and suction tools
B	Getting-started finger length
C	Travel length: 0-50 mm

Continues on next page

Airborne noise level

Description	Note
The sound pressure level outside	< 55 dB, measured at a location 0.5 m away from the gripper.

Power consumption

The gripper is powered by 24 V DC and the maximum power consumption of the whole gripper is 9 W.

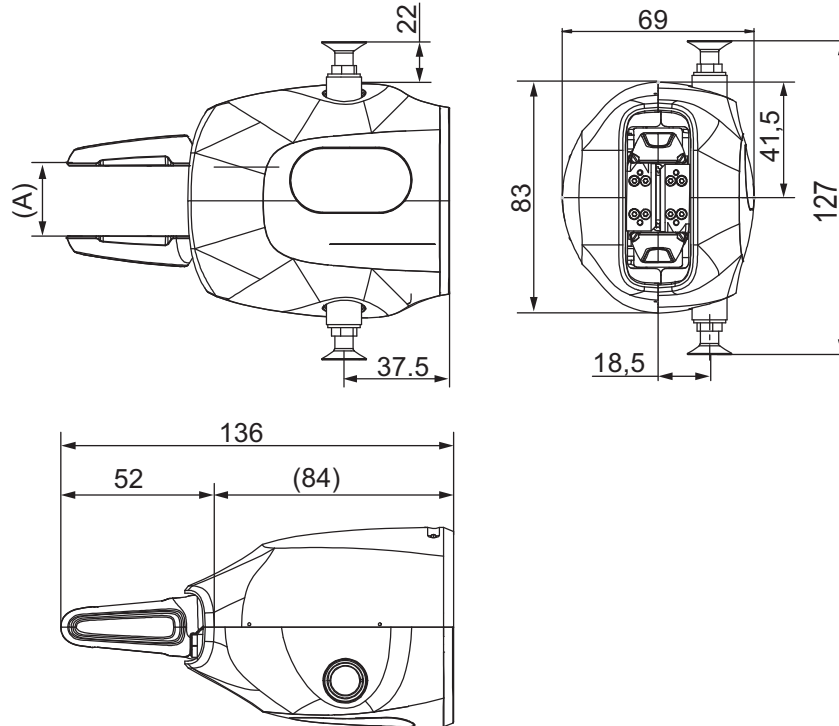
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2 Grippers

2.2.1 General Continued

Dimensions

The following figure shows the dimension of the gripper with one servo module and two vacuum modules. The dimensions of other gripper options can be obtained by simply removing the dimension data of the suction cups and filters. For the specific dimension of the camera used in the gripper with a vision module, see [Camera, dimensions on page 61](#).



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Pos	Description
A	Travel length = 0 - 50 mm

2.2.2 Servo module

Travel length

Description	Data
Travel length	0-50 mm (max. 25 mm per finger)

Maximum speed

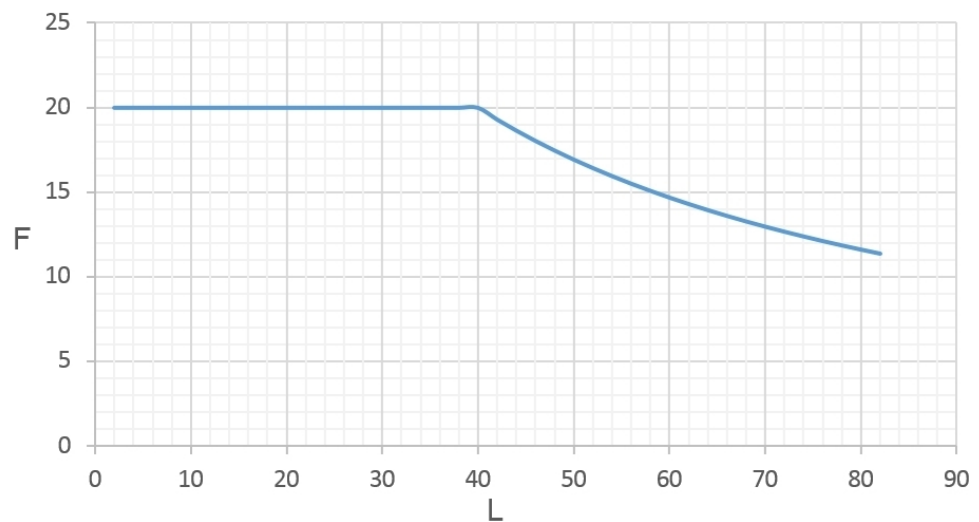
Description	Data
Speed	25 mm/s
Repeatability	±0.05 mm

Gripping force

Description	Data
Gripping direction	Inward or outward
Maximum gripping force	20 N (at the gripping point of 40 mm)
External force (not in gripping directions)	15 N (at the gripping point of 40 mm)
Force control accuracy	±3 N

Load diagram

The following figures show the relationship between the maximum allowed gripping force and gripping point to the finger flange.



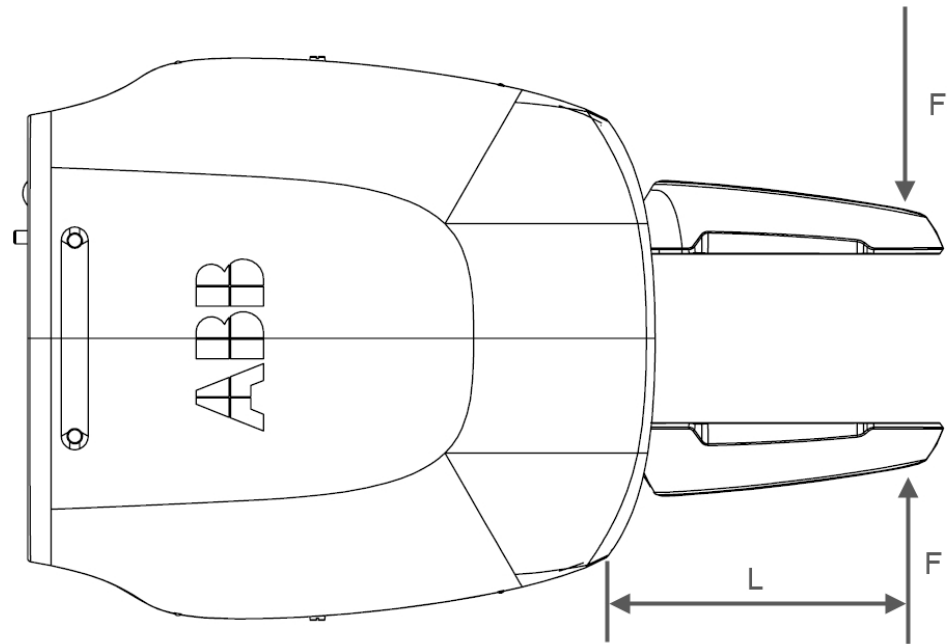
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2 Grippers

2.2.2 Servo module

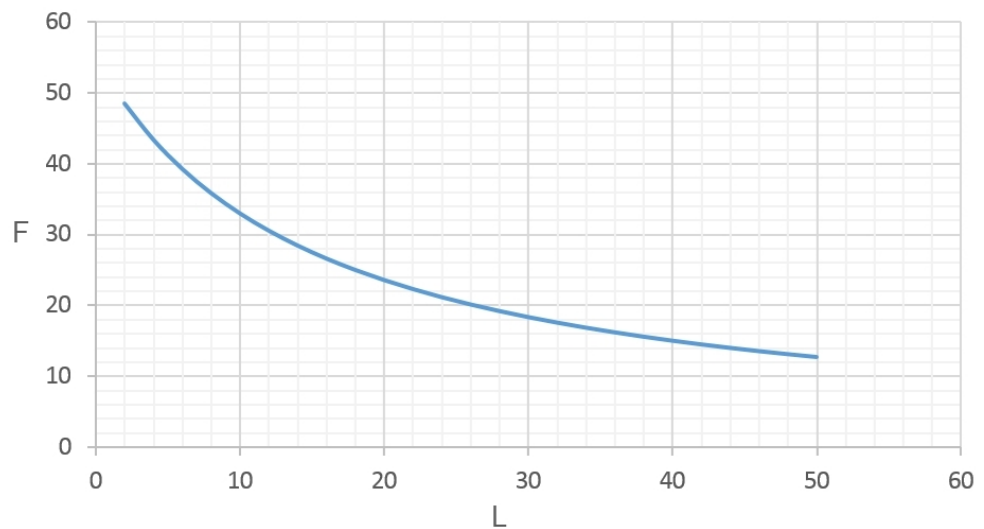
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xx150000797

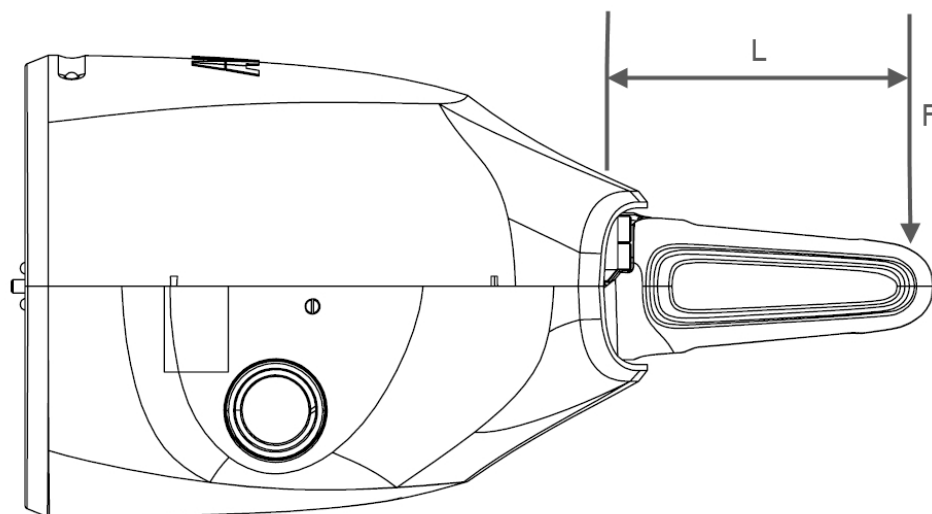
Pos	Description
F	Gripping force, in unit of N
L	Length from the gripping point to the finger flange, in unit of mm

The following figures show the relationship between the maximum allowed external force and gripping point to the finger flange.



xx150000798

Continues on next page



xx150000799

Pos	Description
F	External force, in unit of N
L	Length from the gripping point to the finger flange, in unit of mm

Position control and calibration

The servo module has integrated position control with the repeatability of ± 0.05 mm. The servo module is calibrated by RAPID instructions or using the FlexPendant interface.

For details, see the section *IRB 14000 gripper FlexPendant application* and chapter *RAPID references in Product manual - Grippers for IRB 14000*.

2 Grippers

2.2.3 Vacuum module

2.2.3 Vacuum module

Vacuum generator

The vacuum module has an integrated vacuum generator that is designed with a maximum payload of 150 g. The actual payload capacity depends on the following factors:

- Suction tool design and the choice of suction cups
- The surface structure of the object being picked
- The pickup point and the CoG of the object being picked
- Robot motion while the object is picked
- Air pressure input to the robot

Vacuum pressure sensor

The air pressure of the vacuum module can be monitored in real time using an in-built vacuum sensor. This makes it possible to detect whether the object is correctly picked up by the suction tool.

Blow-off actuator

To minimize cycle time and ensure accurate drop-off of the picked objects, a blow-off actuator is integrated in the vacuum module.

2.2.4 Vision module

General

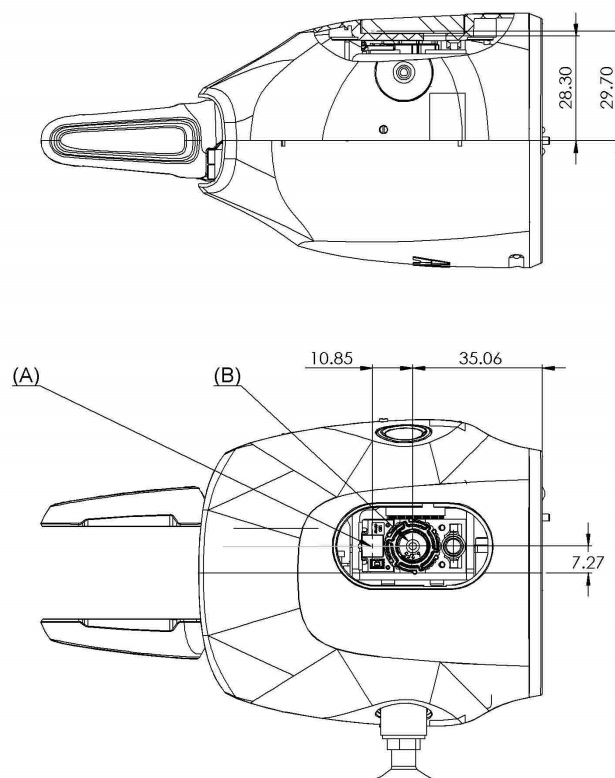
The vision module includes a Cognex AE3 camera and provides powerful and reliable vision and identification tools.

Camera, specification

Description	Data
Resolution	1.3 Megapixel
Lens	6.2mm f/5
Illumination	Integrated LED with programmable intensity
Software engine	Powered by Cognex In-Sight
Application programming software	ABB Integrated vision or Cognex In-Sight Explorer

Camera, dimensions

The following figure shows the dimension of the Cognex AE3 camera.



xx1500001395

Pos	Description
A	Internal illumination

Continues on next page

2 Grippers

2.2.4 Vision module

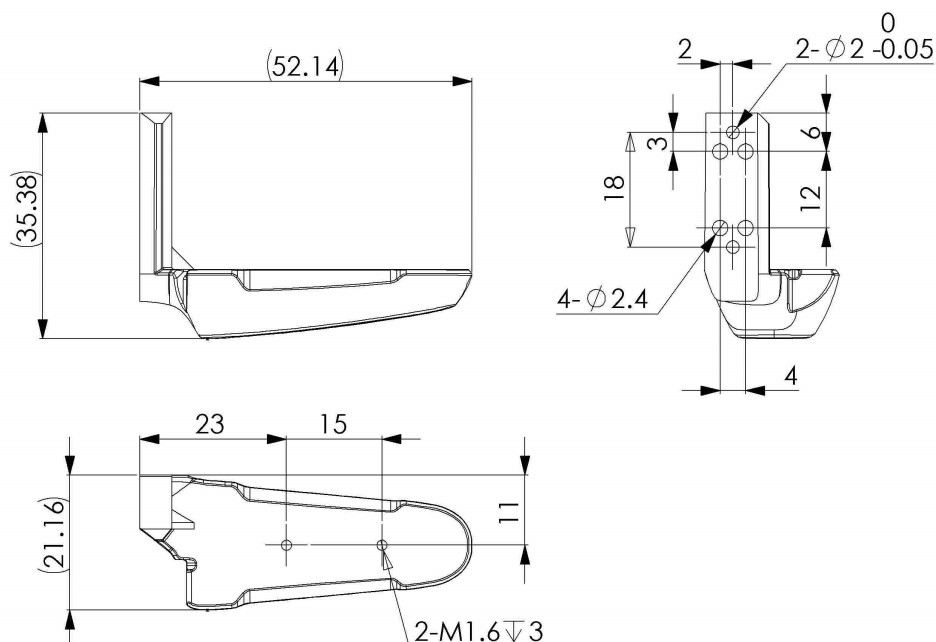
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Pos	Description
B	Lens

2.2.5 Fingers

Getting-started finger, dimensions

The following figure shows the dimension of the getting-started finger.



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Design requirements for customized fingers

Except for the two getting-started fingers delivered together with the IRB 14000 gripper, it is also possible for users to customize fingers based on actual requirements. When designing fingers, the following requirements should be met:

- To enhance the stiffness for gripping and extend lifetime of the fingers, it is recommended metal be used as the finger materials.
- The finger size must be designed properly to prevent any collision with the gripper shell during the finger movement or gripping.
- The length of the screws that are used for fastening the fingers to the finger flange must be proper and less than the maximum hole depth on the flange. For details about the maximum hole depth, see [Hole configuration, finger flange on page 69](#).
- Installation direction and position of the fingers should follow those of the getting-started fingers. For details, see [Getting-started finger, dimensions on page 63](#).

2 Grippers

2.3.1 Operating requirements

2.3 Installation

2.3.1 Operating requirements

Protection standard

Option combination	Protection standard IEC529
All gripper combinations	IP30

Ambient temperature

Description	Standard/Option	Temperature
Gripper during operation	Standard	+ 5 °C (41 °F) to + 40 °C (104 °F)
Gripper during transportation and storage	Standard	- 10 °C (14 °F) to + 55 °C (131 °F)

Air input

The nominal operating pressure is 6 bar. Considering the working pressure of air tube in arm, in normal operation the gripper is recommended to be supplied with 5-6 bar air input. Before the air input, ensure that the input air is filtered and clean.

Relative humidity

Description	Relative humidity
Complete gripper during operation, transportation and storage	85% at constant temperature (gaseous only)

2.3.2 Recommended standard tightening torque

Standard tightening torque

The table below specifies the recommended standard tightening torque for the screws.

Screw type	Tightening torque (Nm) on metal	Tightening torque (Nm) on plastic
M1.2	N/A	0.05
M1.6 (12.9 class carbon steel screw)	0.25	N/A
M1.6 (stainless steel screw)	N/A	0.05
M2	0.25	0.1
M2.5	0.45	0.45

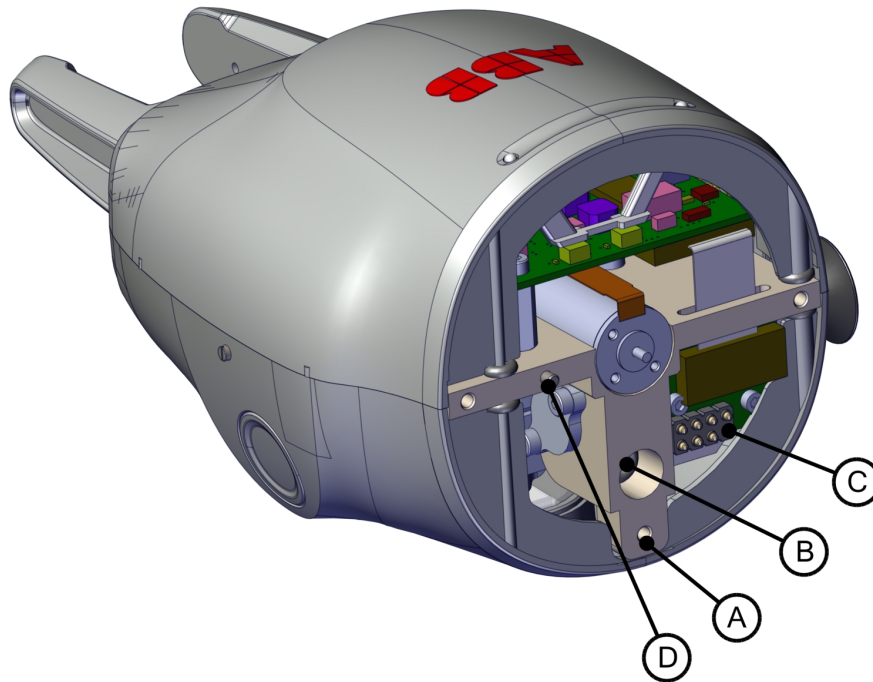
2 Grippers

2.3.3 Mounting the gripper

2.3.3 Mounting the gripper

Mounting flange

Three M2.5 holes and one guide pin are used to assemble the gripper to the arm tool flange.

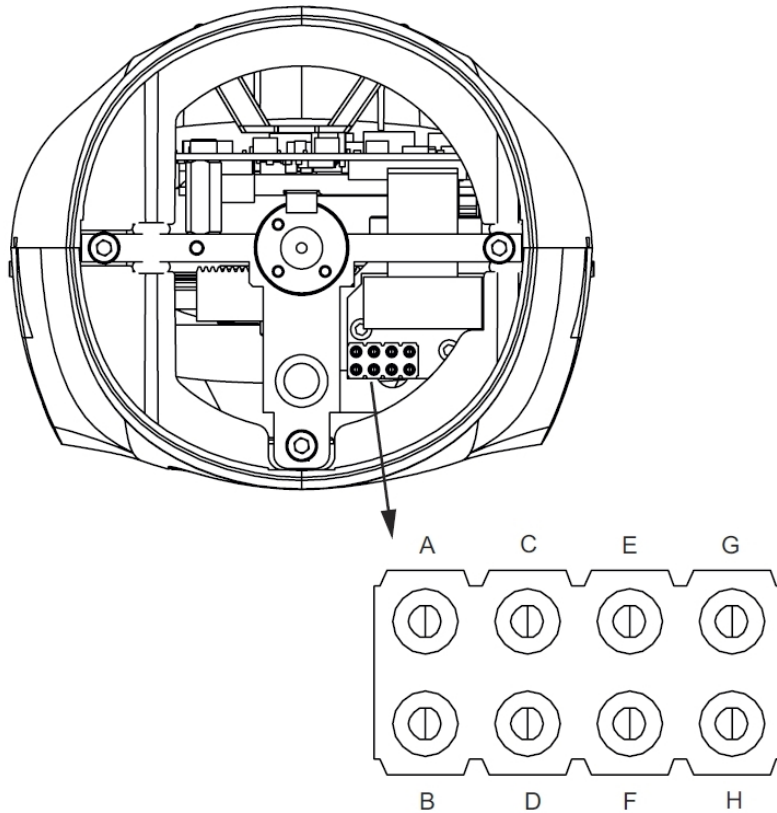


xx1500000126

Pos	Description
A	Recommended screws, three M2.5 x 8
B	Air hose
C	8-pin connector (spring-loaded)
D	Guide pin

Continues on next page

The pins of the connector (shown as C in the preceding figure) are defined as follows.



xx150000796

Pin	Description
A	EtherNet RD-
B	EtherNet TD-
C	EtherNet RD+
D	EtherNet TD+
E	PE
F	Spare
G	0V, IO
H	24V, IO

Continues on next page

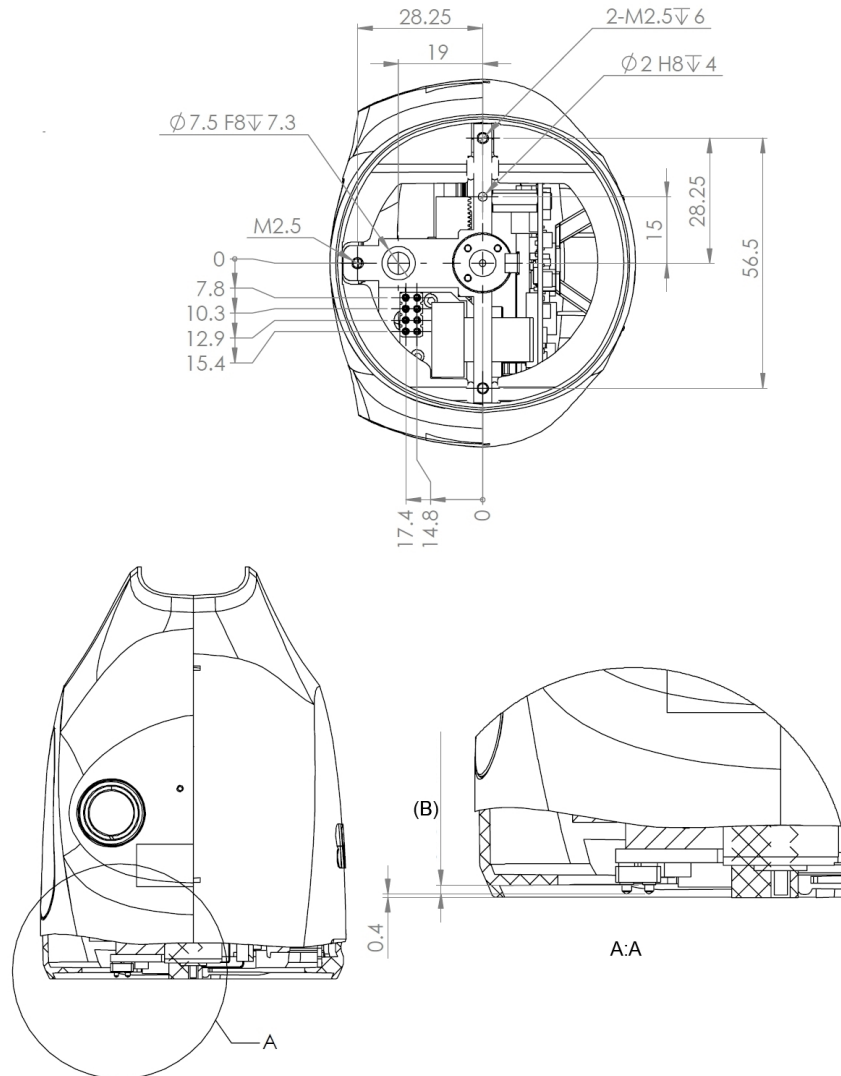
2 Grippers

2.3.3 Mounting the gripper

Continued

Hole configuration, mounting base

The following figure shows the hole configuration when assembling the gripper to the arm tool flange.



xx150000793

Pos	Description
B	Stroke = 1 mm

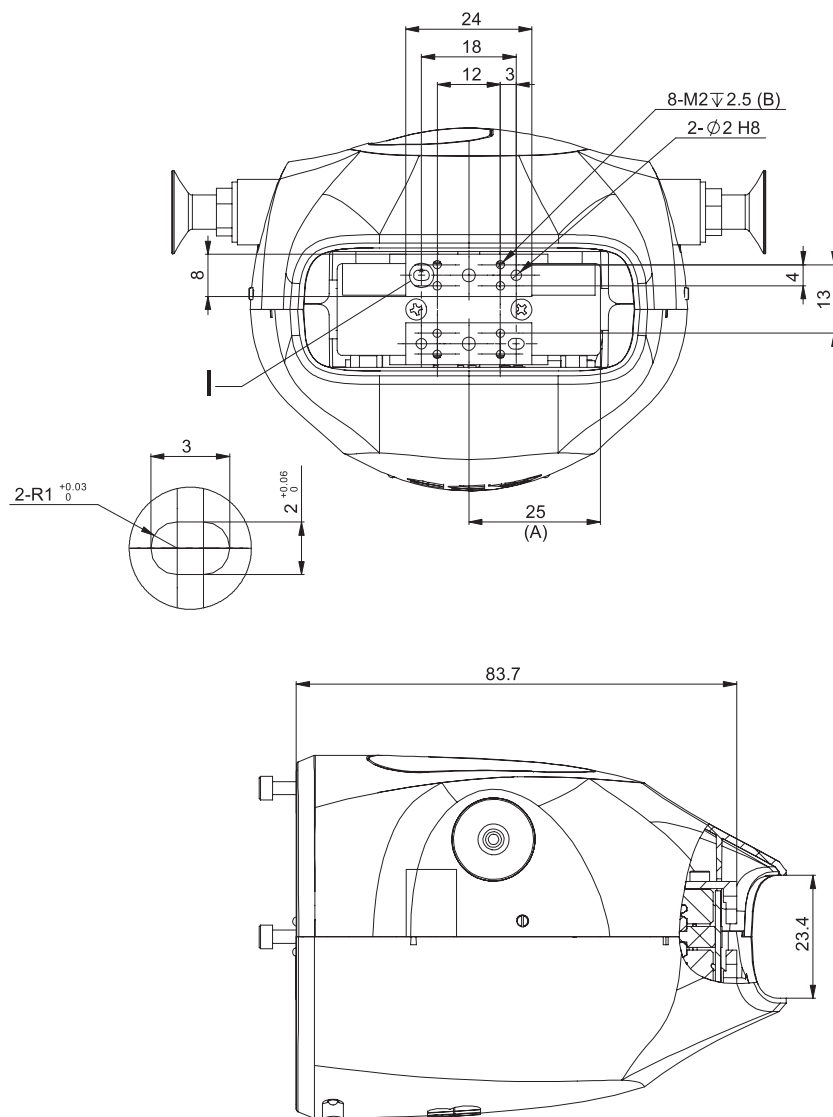
2.3.4 Mounting the fingers

General

A pair of getting-started fingers are provided together with the gripper for demo and test purposes. These fingers should be replaced with fingers designed for the actual application by the system integrator and must be included in the final risk assessment done by the system integrator.

Hole configuration, finger flange

The following figures show the hole configuration and main dimensions of the finger flanges.



xx150000794

Pos	Description
A	Position of the maximum displacement
B	Maximum hole depth

2 Grippers

2.3.5 Mounting tools to the vacuum module

2.3.5 Mounting tools to the vacuum module

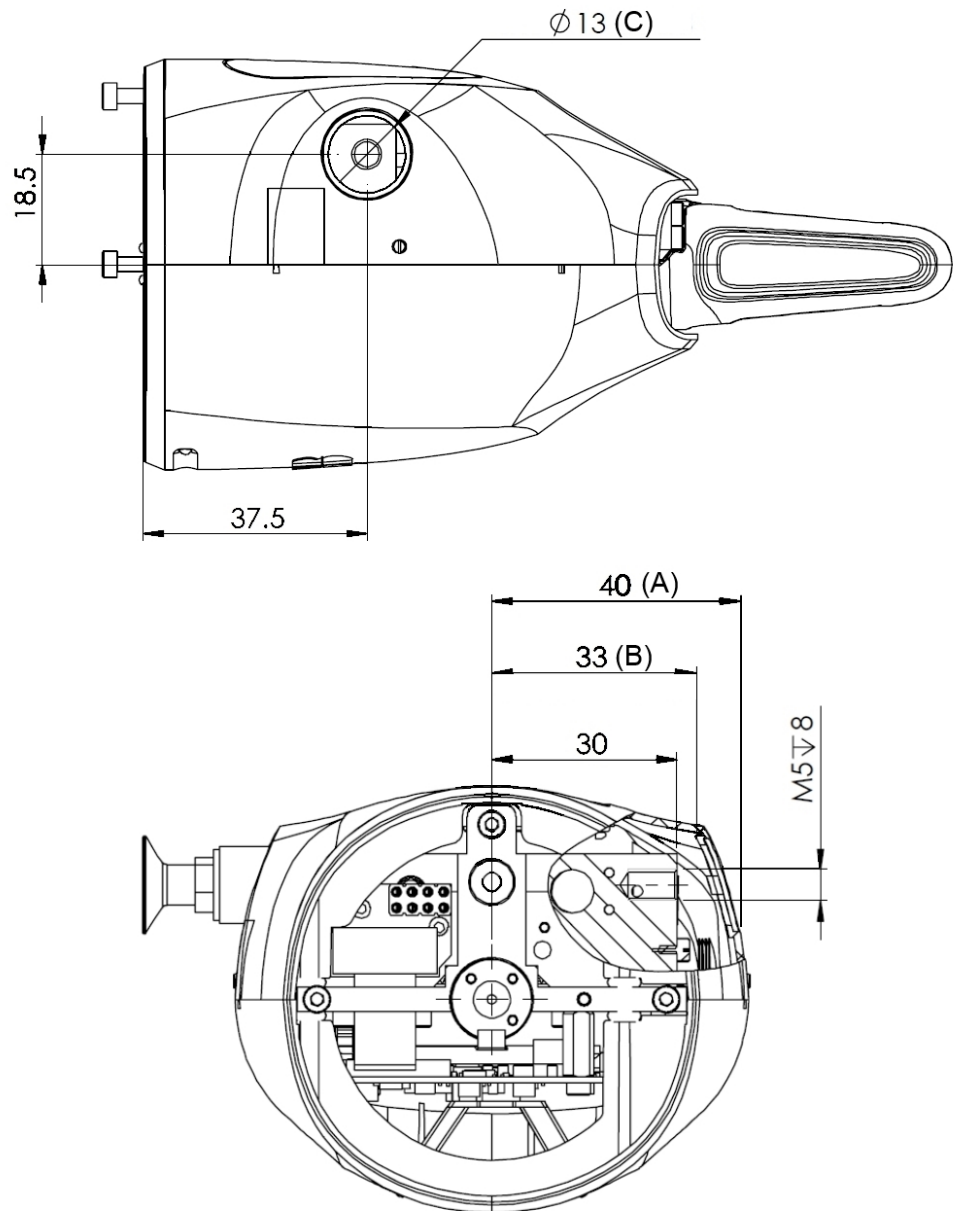
General

The vacuum module is delivered with a first set of suction cups and filters for demo and test purposes. Application-specific suction tools should be designed and chosen by the system integrator. Air filters are required in the suction tools to ensure the long-term performance of the vacuum module. If the vacuum function is not required, passive assembly tools, such as press tools, can also be mounted to the suction tool interface. Any tools mounted to the gripper must be included in the final risk assessment by the system integrator.

Continues on next page

Hole configuration, vacuum tools

The following figure shows the hole configuration and tool interface of the vacuum module.



xx150000795

Pos	Description
A	Length from the center to the outer shell surface
B	Length from the center to the inner shell surface
C	Shell hole depth

2 Grippers

2.4.1 Introduction

2.4 Maintenance and trouble shooting

2.4.1 Introduction

General

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

Maintenance

The maintenance intervals depend on the use of the gripper, and the required maintenance activities also depend on the selected options.

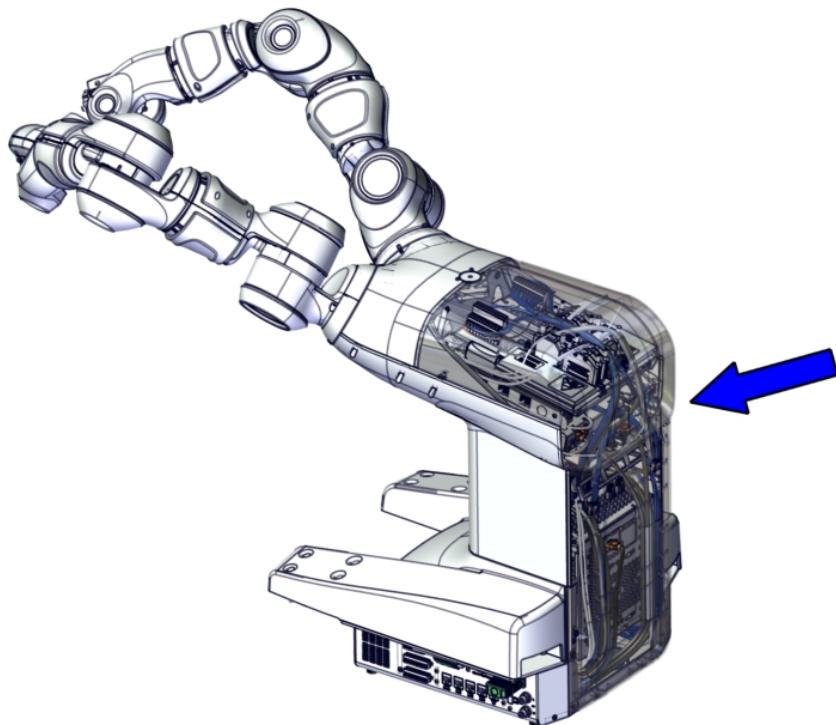
For detailed about the maintenance procedures, see the *Maintenance* chapter in the *Product manual - Grippers for IRB 14000*.

3 Controller

3.1 Overview

Overview

The IRB 14000 integrated controller is based on the standard IRC5 controller, and contains all functions needed to move and control the robot.



xx1400002127



Note

When replacing a unit in the controller, report the following data to ABB, for both the replaced unit and the replacement unit:

- the serial number
- article number
- revision

This is particularly important for the safety equipment to maintain the safety integrity of the installation.

Continues on next page

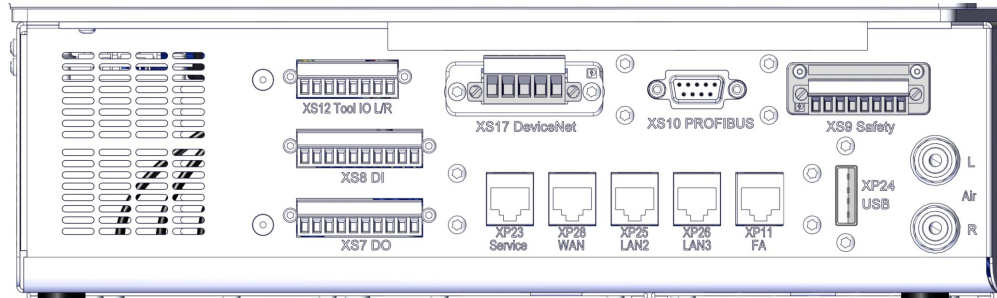
3 Controller

3.1 Overview

Continued

Controller interface, left side

The following illustration describes the interface on the left side panel of the controller.



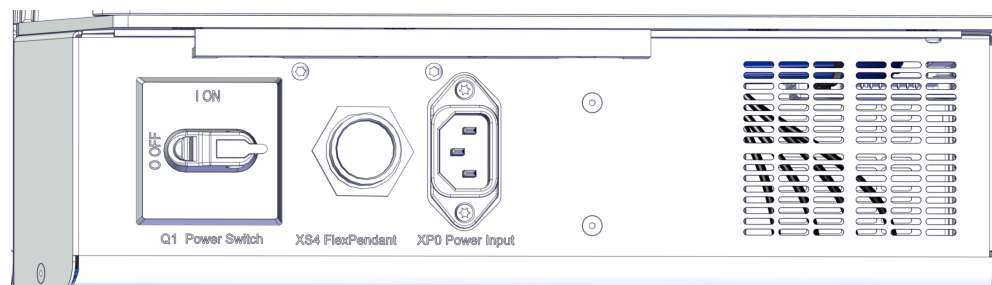
xx1400002129

XS12	Tool I/O, left and right arm 4x4 digital I/O signals to the tool flanges, to be cross connected with XS8 and/or XS9. This is alternative to Ethernet on the tool flange.
XS17	DeviceNet Master/Slave
XS10	Fieldbus adapter PROFIBUS Anybus device (fieldbus adapter option)
XS9	Safety signals
XS8	Digital inputs 8 digital input signals (approx. 5 mA) to the internal I/O board (DSQC 652) Pin number 9 (24 V = max current 3A)
XS7	Digital outputs 8 digital output signals (150 mA/channel) from the internal I/O board (DSQC 652) Pin number 9 (24 V = max current 3A)
XP23	Service
XP28	WAN (connection to factory WAN).
XP25	LAN2 (connection of Ethernet based options).
XP26	LAN3 (connection of Ethernet based options).
XP11	FA = Fieldbus adapter PROFINET or EtherNet/IP (fieldbus adapter option)
XP24	USB port to main computer
Air L	Air supply, left arm O.D. 4 mm air hose, 0.6 MPa air pressure
Air R	Air supply, right arm O.D. 4 mm air hose, 0.6 MPa air pressure

Continues on next page

Controller interface, right side

The following illustration describes the interface on the right side panel of the controller.



xx1400002125

Q1	Power switch
XS4	FlexPendant
XP0	Power input Main AC power connector, IEC 60320-1 C14, 100-240 VAC, 50-60 Hz

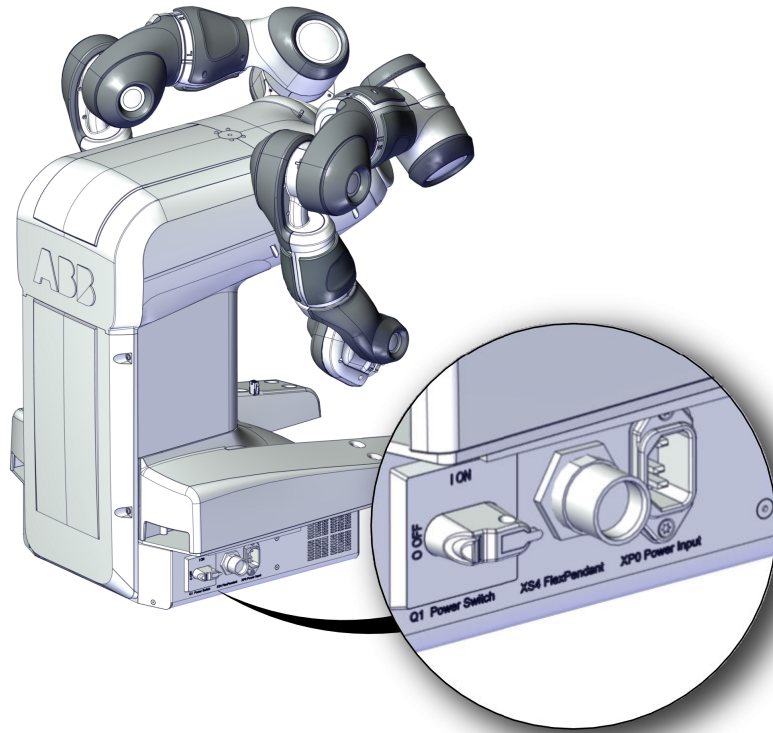
3 Controller

3.2 Connecting power and the FlexPendant

3.2 Connecting power and the FlexPendant

Overview

The following illustration shows the connectors on the right side of the controller.



xx150000503

Q1	Power switch
XS4	FlexPendant
XPO	Power input Main AC power connector, IEC 60320-1 C14, 100-240 VAC, 50-60 Hz

Connecting power supply

Line fusing

Line fusing of the IRB 14000 is 5A at 100-240 V.

Rated power

Rated power of the IRB 14000 is 360 W.

Required equipment

Equipment	Note
Power supply cable (single phase)	
External circuit breaker	8A
External earth fault protection at control cables 3 -15m	30mA
External earth fault protection at control cables >15m	300mA

Continues on next page

Equipment	Note
Circuit diagram	See <i>Circuit diagram - Product.ProductName</i> .

Connecting power to the controller

The following procedure describes how to connect the main power to the controller.



CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.



Note

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

	Action	Information
1	Locate the main AC power connector on the right side of the controller.	The power switch must be turned off.
2	Connect the power cable	

Connecting a FlexPendant

The following procedure describes how to connect a FlexPendant to the controller.



CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.

	Action	Information
1	Locate the FlexPendant socket connector on the right side of the controller.	The controller must be in manual mode.
2	Plug in the FlexPendant cable connector.	
3	Screw the connector lock ring firmly by turning it clockwise.	

3 Controller

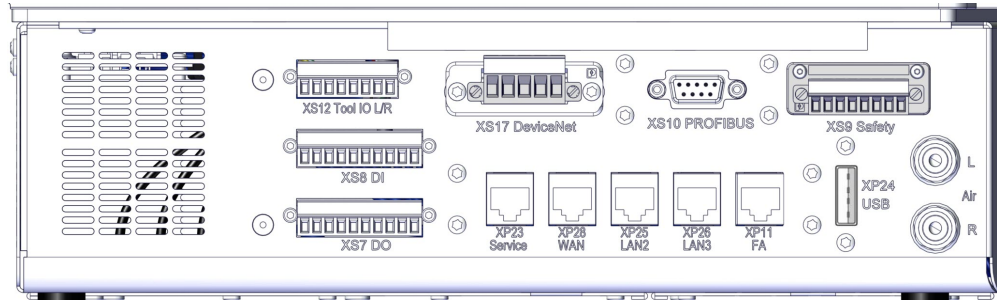
3.3 Connecting a PC and Ethernet based options

3.3 Connecting a PC and Ethernet based options

Introduction

The following connectors on the interface on the left side panel of the controller are directly connected to the Ethernet ports of the IRC5 main computer.

For more information about the functionality of each connector, see [Connectors on the computer unit on page 79](#).



xx1400002129

XP23	Service
XP28	WAN (connection to factory WAN).
XP25	LAN2 (connection of Ethernet based options).
XP26	LAN3 (connection of Ethernet based options).
XP24	USB port to main computer

Multiple Ethernet based options

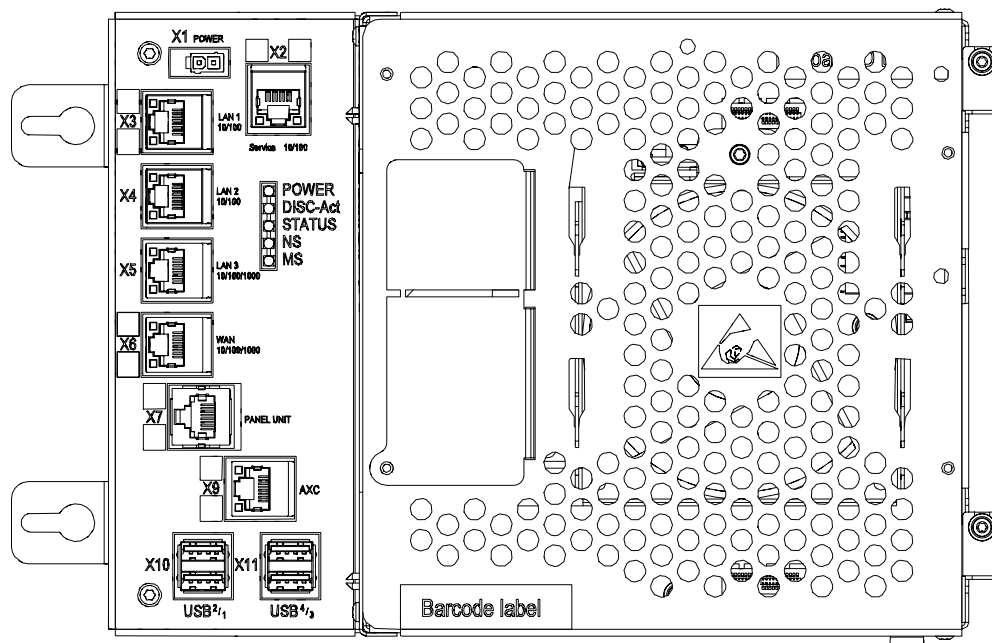
For IRB 14000 it is possible to use both the options *PROFINET Controller/Device* (888-2) and *EtherNet/IP Scanner/Adapter* (841-1) at the same time.

Continues on next page

3.3.1 Connectors on the computer unit

Overview of the computer unit

The following illustration shows an overview of the computer unit.



xx130000608

X1	Power supply
X2 (yellow)	Service (connection of PC).
X3 (green)	LAN1 (connection of FlexPendant).
X4	LAN2 (connection of Ethernet based options).
X5	LAN3 (connection of Ethernet based options).
X6	WAN (connection to factory WAN).
X7 (blue)	Panel unit
X9 (red)	Axis computer
X10, X11	USB ports (4 ports)



Note

It is not supported to connect multiple ports of the main computer (X2 - X6) to the same external switch, unless static VLAN isolation is applied on the external switch.

Service port test middle

The service port is intended for service engineers and programmers connecting directly to the controller with a PC.

Continues on next page

3 Controller

3.3.1 Connectors on the computer unit

Continued

The service port is configured with a fixed IP-address, which is the same for all controllers and cannot be changed, and has a DHCP server that automatically assigns an IP-address to the connected PC.



Note

For more information about connecting a PC to the service port, see section *Working online in Operating manual - RobotStudio*.

WAN port

The WAN port is a public network interface to the controller, typically connected to the factory network with a public IP address provided by the network administrator.

The WAN port can be configured with fixed IP-address, or DHCP, from the **Boot application** on the FlexPendant. By default the IP-address is blank.

Some network services, like FTP and RobotStudio, are enabled by default. Other services are enabled by the respective RobotWare application.



Note

The WAN port cannot use any of the following IP-addresses which are allocated for other functions on the IRC5 controller:

- 192.168.125.0 - 255
- 192.168.126.0 - 255
- 192.168.127.0 - 255
- 192.168.128.0 - 255
- 192.168.129.0 - 255
- 192.168.130.0 - 255

The WAN port cannot be on a subnet which overlaps with any of the above reserved IP-addresses. If a subnet mask in the class B range has to be used, then a private address of class B must be used to avoid any overlapping. Please contact your local network administrator regarding network overlapping.

See the section about topic *Communication in Technical reference manual - System parameters*.



Note

For more information about connecting a PC to the WAN port, see section *Working online in Operating manual - RobotStudio*.

LAN ports

The LAN 1 port is dedicated for connecting the FlexPendant.

Continues on next page

The LAN 2 and LAN 3 ports are intended for connecting network based process equipment to the controller. For example field buses, cameras, and welding equipment.

**Note**

When using IRB 14000 grippers, the following restrictions apply to the usage of LAN2:

- Any external units connected to LAN2 need to have IP addresses on the same subnet as the grippers, network *192.168.125.0/24*.
- If option *841-1 EtherNet/IP Scanner/Adapter* is used for external units (EtherNet/IP scanners or adapters), these units must be connected to LAN2, network *192.168.125.0/24*. These units will share EtherNet/IP network with the IRB 14000 grippers.

Note that option *840-1 EtherNet/IP Anybus Adapter* can be used without restrictions.

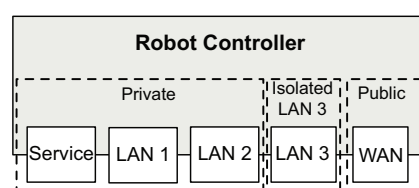
LAN 2 can only be used as private network to the IRC5 controller.

Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later)

The default configuration is that LAN 3 is configured as an isolated network. This allows LAN 3 to be connected to an external network, including other robot controllers. The isolated LAN 3 network has the same address limitations as the WAN network.

**Note**

The isolated LAN 3 cannot be used to connect to any HMI device (RobotStudio, Robot Web Services, or PC SDK client) since it does not support the protocol needed for communication.



xx1500000393

An alternative configuration is that LAN 3 is part of the private network. The ports Service, LAN 1, LAN 2, and LAN 3 then belong to the same network and act just as different ports on the same switch. This is configured by changing the system

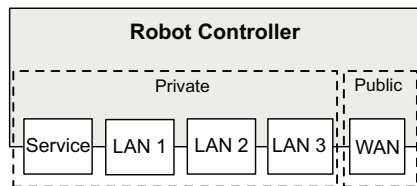
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3 Controller

3.3.1 Connectors on the computer unit

Continued

parameter *Interface*, in topic *Communication* and type *Static VLAN*, from "LAN 3" to "LAN". See *Technical reference manual - System parameters*.



xx1500000394



Note

For more information and examples of connecting to different networks, see *Application manual - EtherNet/IP Scanner/Adapter* or *Application manual - PROFINET Controller/Device*.

USB ports

The USB ports are intended for connecting USB memory devices.



Note

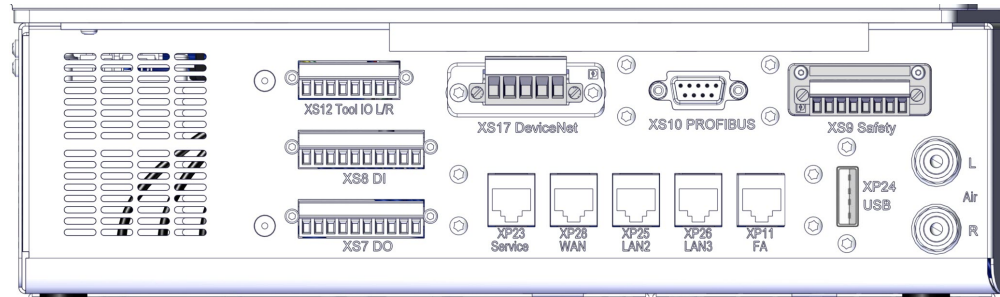
It is recommended to use the USB ports USB¹ and USB² on the X10 connector for connecting USB memory devices.

The USB ports on the X11 connector are intended for internal use.

3.4 Connecting I/O signals

Introduction

It is possible to connect digital I/O signals to the IRB 14000 through the connectors on the interface on the left side panel of the controller.



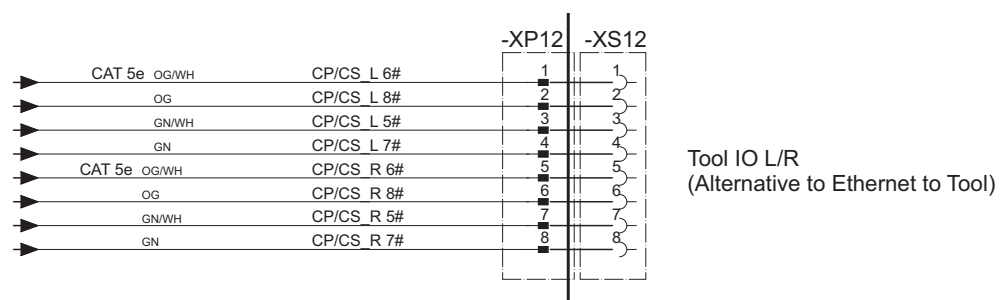
xx1400002129

XS12	Tool I/O, left and right arm 4x4 digital I/O signals to the tool flanges, to be cross connected with XS8 and/or XS9. This is alternative to Ethernet on the tool flange.
XS8	Digital inputs 8 digital input signals to the internal I/O board (DSQC 652) Pin number 9 (24 V = max current 3A)
XS7	Digital outputs 8 digital output signals from the internal I/O board (DSQC 652) Pin number 9 (24 V = max current 3A)

Tool I/O

Tool I/O is an alternative to Ethernet on the tool flange.

When not using Ethernet to the tool flanges it is possible to use the XS12 connector for connecting digital I/O signals instead.



xx1500000012

For more information about connecting the tool I/O, see *Circuit diagram - Product.ProductName*.

Continues on next page

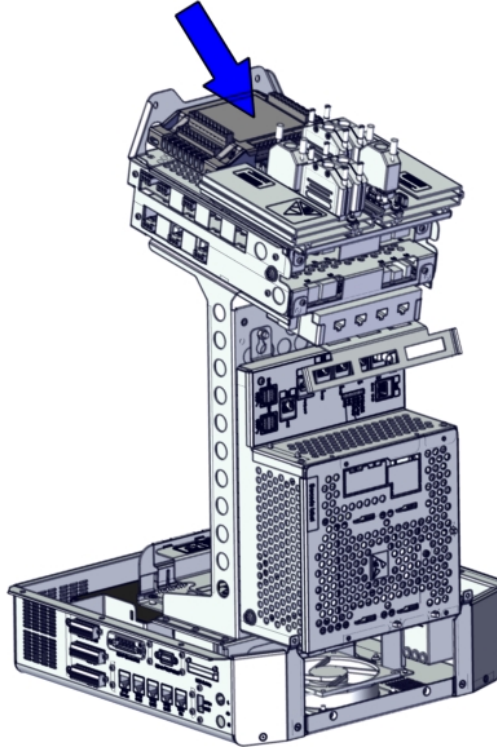
3 Controller

3.4 Connecting I/O signals

Continued

Digital inputs and outputs

The connectors for digital inputs and outputs on the controller interface are connected to the internal DeviceNet I/O unit in the controller.



xx150000429

The signals are predefined in the system parameters in topic *I/O System*, with the names `custom_DI_x` and `custom_DO_x`. The customer should change the names to fit the current application.

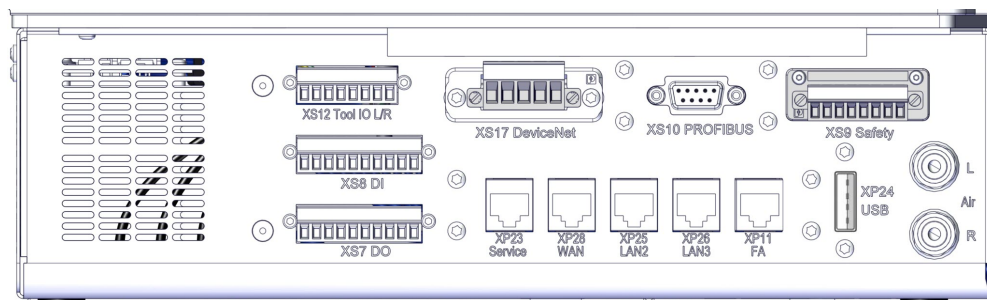
For more information about configuring I/O, see *Application manual - DeviceNet Master/Slave* and *Technical reference manual - System parameters*

3.5 Connecting fieldbuses

Introduction

The IRC5 Controller may be fitted with a number of different fieldbus adapters and fieldbus master/slave boards.

The following connectors on the interface on the left side panel of the controller are directly connected to the fieldbus connectors on the integrated IRC5 main computer.



xx1400002129

XS17	DeviceNet
XS10	Fieldbus adapter PROFIBUS (fieldbus adapter option)
XP11	Fieldbus adapter PROFINET or EtherNet/IP (fieldbus adapter option)



Note

DeviceNet m/s (option 709-1) is provided at XS17 as default.

The DeviceNet fieldbus adapter (option 840-4) is not supported by IRB 14000.

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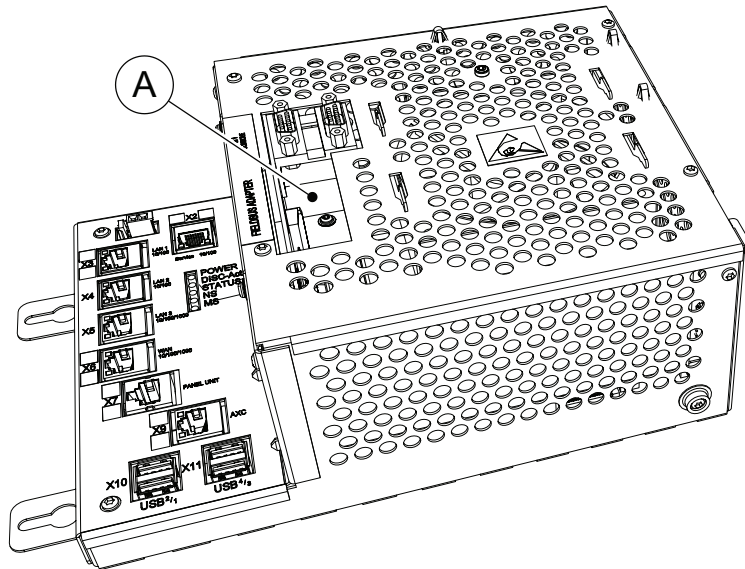
3 Controller

3.5 Connecting fieldbuses

Continued

Expansion board for fieldbus adapters

An expansion board needs to be installed to be able to fit a fieldbus adapter. On top of the main computer unit, there is one slot available for installing the expansion board.

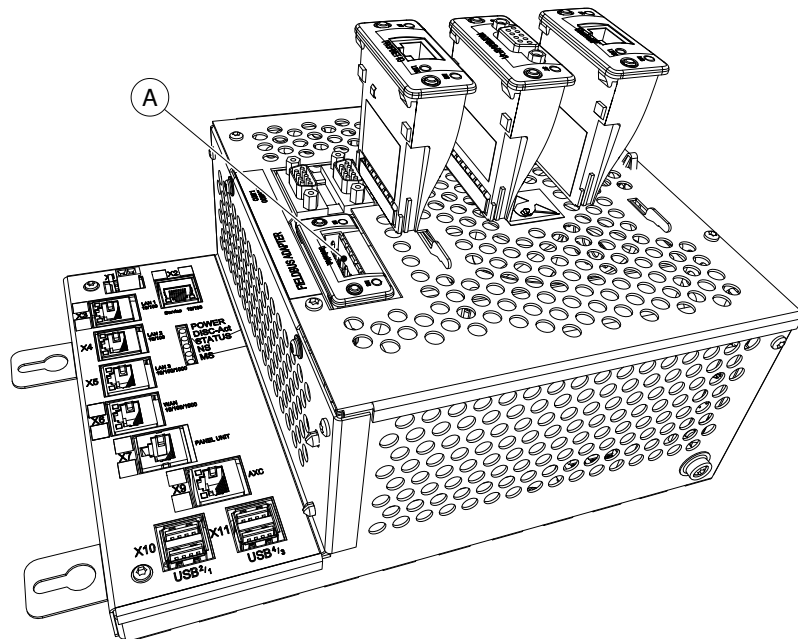


xx130000605

A	Assembled expansion board for fieldbus adapters, without adapter.
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Fieldbus adapters

The fieldbus adapters are inserted into the expansion board on top of the main computer unit. There is one slot available for installing a fieldbus adapter.



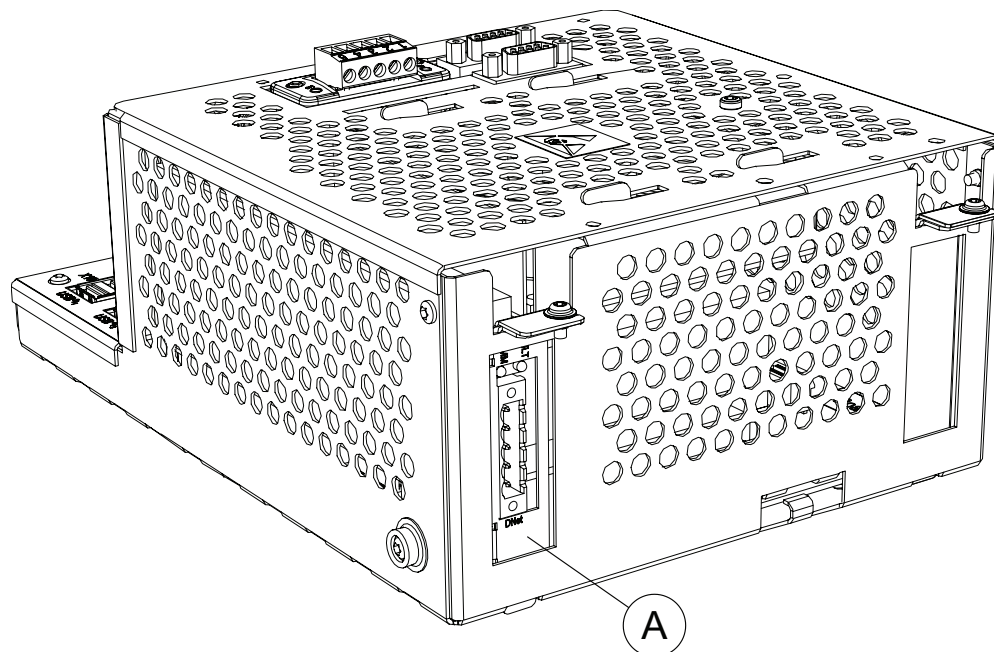
xx130000604

Continues on next page

A	Slot for AnybusCC fieldbus adapters
---	-------------------------------------

DeviceNet master/slave board

The DeviceNet m/s board is installed the right side of the main computer.



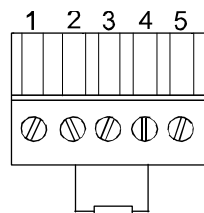
xx1300001968

A	Slot for DeviceNet m/s board
---	------------------------------

Termination resistors in the DeviceNet bus

Each end of the DeviceNet bus must be terminated with a 121 ohm resistor. The two terminating resistors should be as far apart as possible.

The termination resistor is placed in the cable connector. There is no internal termination on the DeviceNet PCI board. The termination resistor is connected between CANL and CANH - that is, between pin 2 and pin 4 according to the illustration below.



xx0400000674

References

For more information on how to install and configure the fieldbuses, see the respective fieldbus application manual.

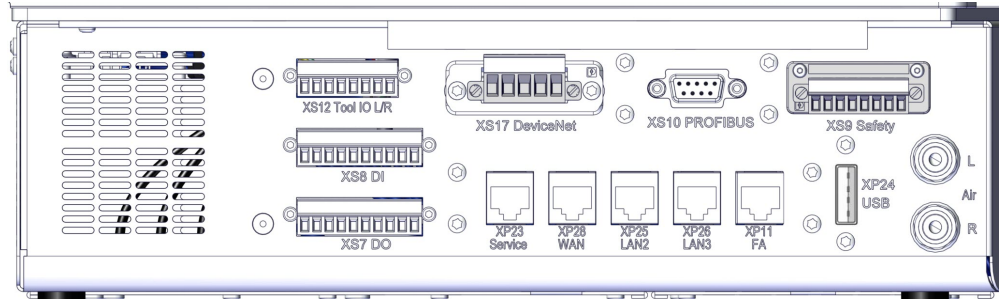
3 Controller

3.6 Connecting safety signals

3.6 Connecting safety signals

Introduction

The IRB 14000 safety stop signals (SS) are accessed through the safety connector on the interface on the left side panel of the controller. This is covered by a safety bridge connector by default in standalone mode. If the bridge connector is removed, it is external device mode.



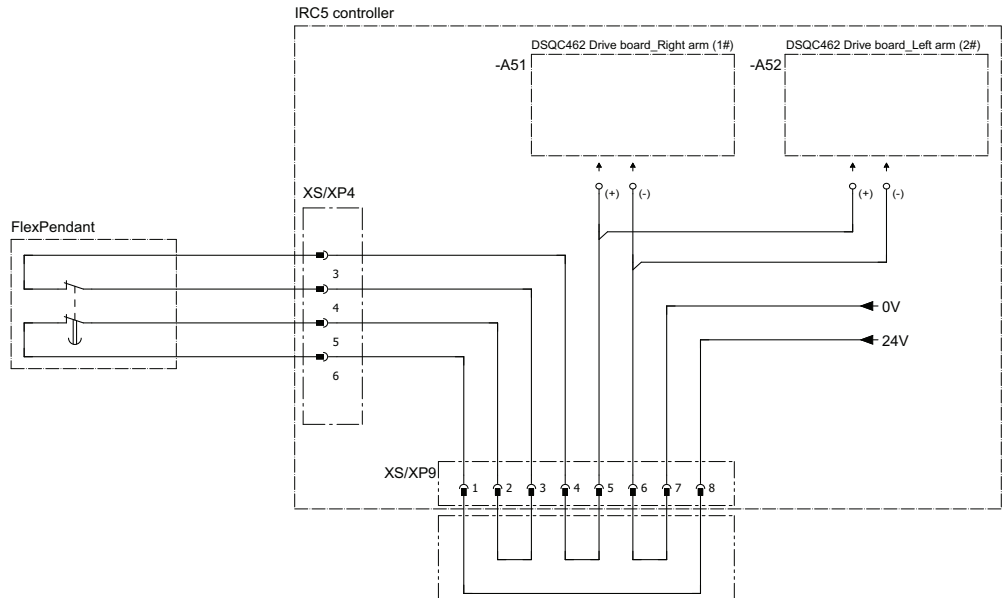
xx1400002129

XS9	Safety signals
-----	----------------

Standalone safety

IRB 14000 standalone is not connected to any external safety devices. The safety connector on the foot interface is plugged with a safety bridge connector, that closes both emergency stop channels of the FlexPendant.

The safety stop input on each drive monitors this channel, and triggers a safety stop if the circuit is open or not powered.



xx1500000013

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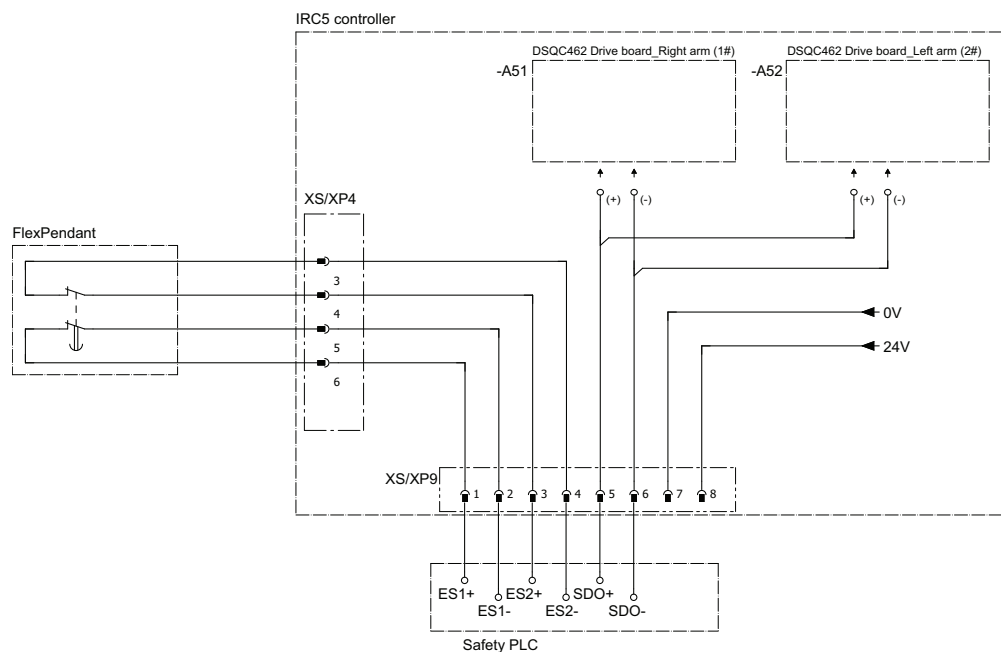
Safety when connected to external devices

To connect to external safety devices, the safety bridge connector must be removed. The system integrator shall then use a safety PLC or safety relay to feed and monitor the dual channel emergency stop of the IRB 14000 FlexPendant.

Safety PLC

The safety PLC shall process the input from the IRB 14000 emergency stop, as well as inputs from other safety devices in the cell, and set the necessary outputs to stop machinery in the cell.

Dual channel safety performance can be maintained where such is required. IRB 14000 can be stopped from the safety PLC by routing back a single channel stop signal to the safety connector XS9.



xx150000014

For more information about connecting the safety signals, see *Circuit diagram - Product.ProductName*.

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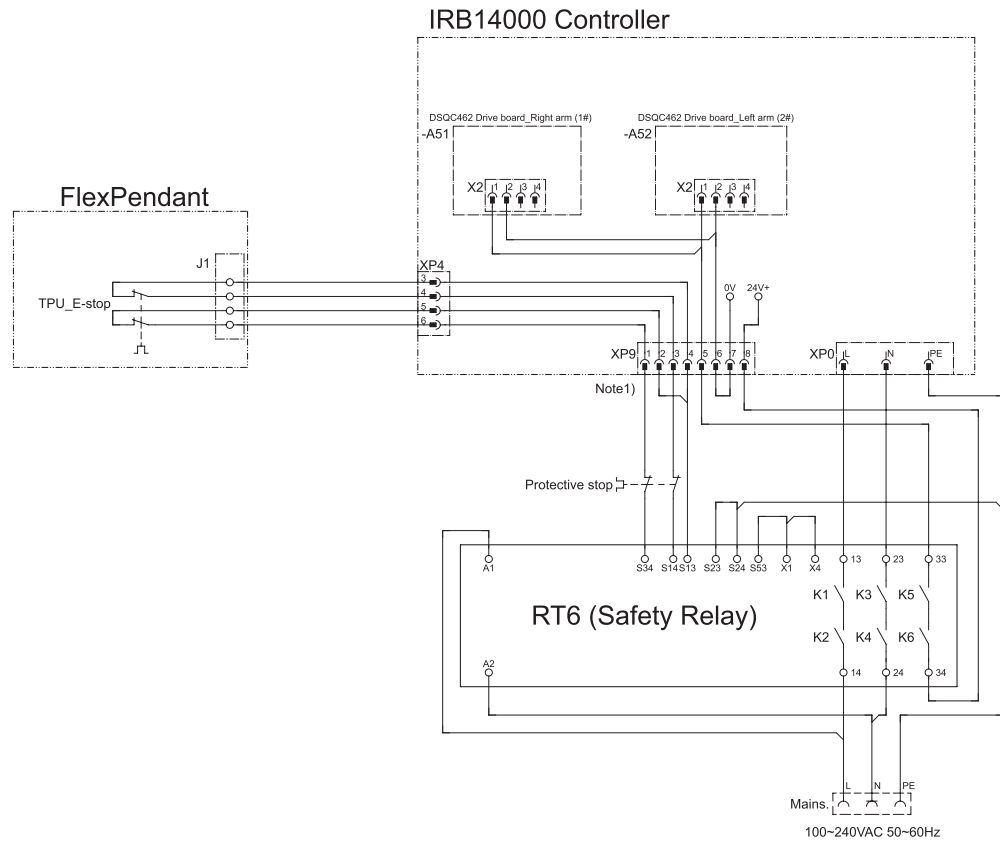
3 Controller

3.6 Connecting safety signals

Continued

RT6 safety relay (option 1526-X)

Both the external protective stop and IRB 14000 internal emergency stop are daisy-chained and connected directly to the RT6 safety relay (option 1526-X) through the safety connector XS9. The safety relay also receives main power inputs and then feeds the inputs to the robot power inlet. Contact ABB for further information.



xx1600001076

For more information about connecting the safety signals, see *Circuit diagram - Product.ProductName*.

3.7 Memory functions

3.7.1 SD-card memory

General

The controller is fitted with an SD-card memory containing ABB Boot Application software. The SD-card memory is located inside the computer unit.



Note

Only use SD-card memory supplied by ABB.

3 Controller

3.7.2 Connecting an USB memory

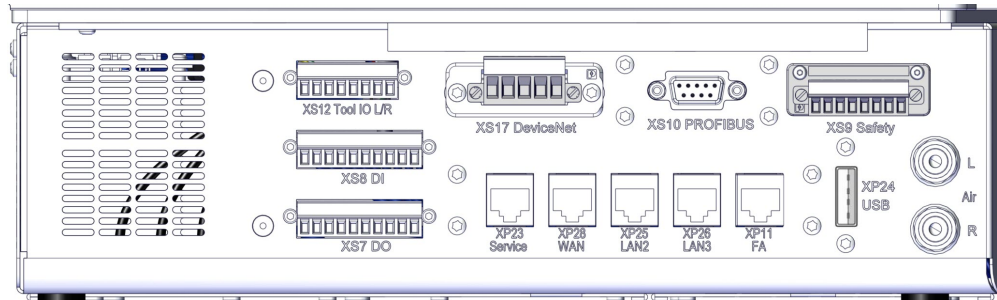
3.7.2 Connecting an USB memory

General

Handling of USB memory is described in *Operating manual - IRC5 with FlexPendant*.

Location on the controller

The location of the USB port on the controller is shown by the following illustration:



xx1400002129

XP24	USB ¹ port to main computer
------	--

Location on the FlexPendant

The location of the USB port on the FlexPendant is shown by the following illustration:



xx150000701

3.8 What is Cartesian speed supervision?

Definition of Cartesian speed supervision

The Cartesian speed supervision is a safety function that supervises the Cartesian speed of the elbow (arm check point, ACP) and the wrist (wrist center point, WCP). The default speed limit can be modified if needed, based on the risk assessment for the robot installation. If any of the configured speed limits are exceeded, then the robot motion is stopped and a message is displayed.

The Cartesian speed supervision is active in both manual and automatic mode. The setting is defined by system parameters.

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4 Specification of variants and options

4.1 Introduction to variants and options

General

The different variants and options for the IRB 14000 are described in the following sections. The same option numbers are used here as in the specification form.

Related information

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

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

4 Specification of variants and options


4.2 Manipulator

4.2 Manipulator

Variants

Option	IRB Type	Handling capacity (kg)	Reach (m)
435-131	IRB 14000	0.5	0.559

Warranty

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from <i>Customer Delivery Date</i> or latest 18 months after <i>Factory Shipment Date</i> , whichever occurs first. 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 <i>Factory Shipment Date</i> or from activation date of standard warranty in WebConfig.  Note Special conditions are applicable, see <i>Robotics Warranty Directives</i> .

4.3 Grippers

Below are the gripper options.




First gripper

Option	Type	Description
1512-1	Servo	
1513-1	Vacuum 1	Requires: Servo [1512-1]
1514-1	Vacuum 2	Requires: Servo [1512-1] and Vacuum 1 [1513-1], Not together with: Vision [1515-1]
1515-1	Vision	Requires: Servo [1512-1], Integrated Vision support [1520-1]

Second gripper

Option	Type	Description
1516-1	Servo	
1517-1	Vacuum 1	Requires: Servo [1516-1]
1518-1	Vacuum 2	Requires: Servo [1516-1] and Vacuum 1 [1517-1], Not together with: Vision [1519-1]
1519-1	Vision	Requires: Servo [1516-1], Integrated Vision support [1520-1]

Grippers

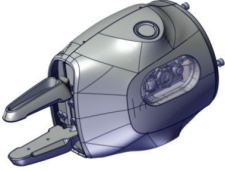

Option	Type	Description
1512(6)-1		Servo
1512(6)-1 + 1513(7)-1		Vacuum 1 Servo + one vacuum unit
1512(6)-1+1513(7)-1+1514(8)-1		Vacuum 2 Servo + two vacuum units

Continues on next page

4 Specification of variants and options

4.3 Grippers

Continued

Option	Type	Description
1512(6)-1+1515(9)-1		Vision Servo + integrated vision camera
1512(6)-1+1513(7)-1+1515(9)-1		Vision Servo + integrated vision camera + one vacuum unit

4.4 Basic

Mains cable

Option	Type	Description
1525-1	EU mains cable, 2 m	IEC C14 cable assembly with locking system and CEE7/VII line-side plug.
1525-2	UK mains cable, 2 m	IEC C14 cable assembly with locking system and BS1363 line-side plug, 5A fused.
1525-3	US mains cable, 6 ft	IEC C14 cable assembly with locking system and NEMA5-15 line-side plug.
1525-4	JP mains cable, 2 m	IEC C14 cable assembly with locking system and J18303 line-side plug.
1525-5	CN mains cable, 2 m	IEC C14 cable assembly with locking system and CPCS-CCC line-side plug.
1525-6	AU mains cable, 2 m	IEC C14 cable assembly with locking system and AS/NZS 3112 line-side plug.

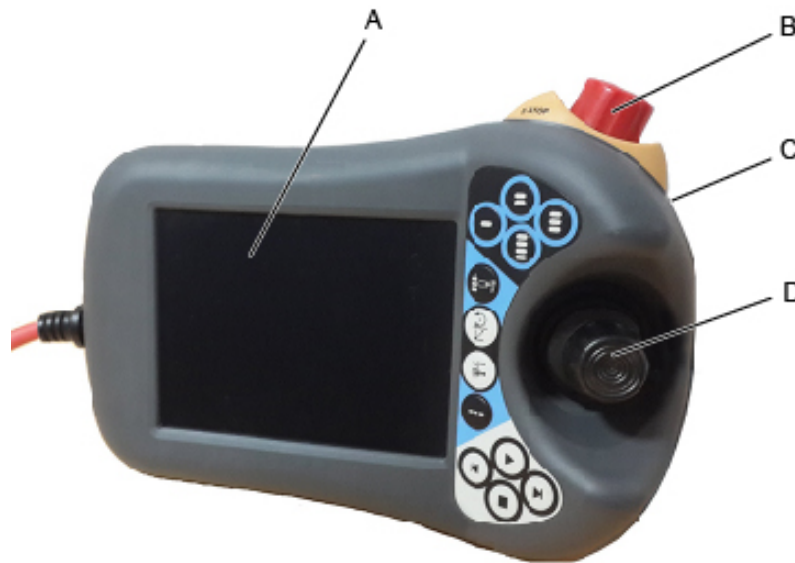
Safety relay

Option	Type	Description
1526-1	RT6 relay, 230VAC	ABB RT6 safety relay for 230VAC.
1526-2	RT6 relay, 115VAC	ABB RT6 safety relay for 115VAC.

FlexPendant

Color graphic pendant with touch screen.

Option	Description
701-1	FlexPendant 10 m



xx1400002067

Continues on next page

4 Specification of variants and options

4.4 Basic Continued

Pos	Description
A	Display
B	Emergency stop button
C	Enabling control device (no function)
D	Joystick

FlexPendant removal

Option	Description
702-1	Connector plug The option consists of a jumper connector to close the safety chains. This is mandatory if a FlexPendant is not connected.

RS232 serial port

Option	Description
970-1	RS232 Serial Channel One RS232 serial channel for permanent use which can be used for communication point to point with printers, terminals, computers, and other equipment.

The fieldbus adapter and the RS232 serial channel is located on the fieldbus adapter expansion board. Therefore the option 970-1 is required when using a fieldbus adapter, see [Fieldbus adapters on page 100](#).

DeviceNet™ m/s

Option	Description
709-1	Single channel. Occupies 1 PCI slot.

PROFIBUS DP

Option	Description
969-1	PROFIBUS DP Master NOT TOGETHER WITH:PROFIBUS DP [840-2]

PROFINET IO

Option	Description
888-2	PROFINET IO m/s SW Occupies one Ethernet port.
888-3	PROFINET IO slave SW Occupies one Ethernet port.

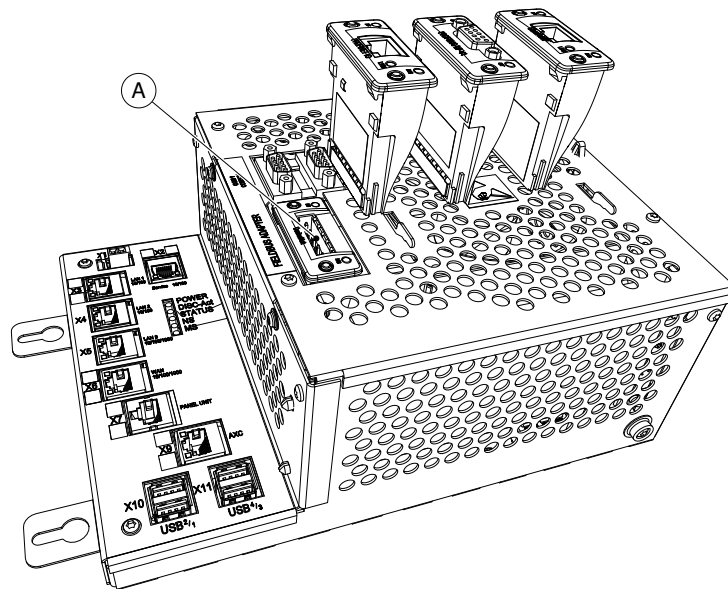
Fieldbus adapters

Option	Description
840-1	EtherNet/IP™ Up to 1024 digital inputs and 1024 digital outputs can be transferred serially to a master equipped with an EtherNet/IP™ interface. The bus cable is connected directly to the adapter RJ45 connector.

Continues on next page

Option	Description
840-2	PROFIBUS DP Up to 512 digital inputs and 512 digital outputs can be transferred serially to a master equipped with a PROFIBUS DP interface. The bus cable is connected to the adapter D-sub connector.
840-3	PROFINET IO Up to 1024 digital inputs and 1024 digital outputs can be transferred serially to a master equipped with a PROFINET IO interface. The bus cable is connected to the adapter RJ45 connector.

The fieldbus adapter and the RS232 serial channel is located on the fieldbus adapter expansion board. Therefore the option 970-1 is required when using a fieldbus adapter, see [RS232 serial port on page 100](#).



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A	Slot for AnybusCC fieldbus adapters
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Enc. interface unit-Exte

Option	Description
826-1	Encoder interface unit- Exte REQUIRES: DeviceNet™ m/s [709-X] or DeviceNet™ Lean [748-1]

Conveyor Tracking

Option	Description
606-1	Conveyor Tracking NOT TOGETHER WITH: Prep. for PickMaster 3 [642-1] REQUIRES: Encoder interface unit [826-1]

Continues on next page

4 Specification of variants and options

4.4 Basic *Continued*

High resolution PoE camera

Integrated Vison interface

Option	Description
1521-1	(1-2) Choose quantity Only for IRB 14000.

4.5 Unlisted options

Included by default, not listed in the specification form

Option	Name	Option	Name
604-1	Multimove, coordinated	613-1	Collision detection
988-1	RW Add-In prepared	841-1	EtherNet/IP™ m/s
608-1	World Zones	611-1	Path Recovery
612-1	Path Offset	616-1	PC Interface
688-1	RobotStudio App Connect	617-1	FlexPendant Interface
1341-1	Vision Interface	213-1	Safety Lamp
1520-1	Integrated Vision SW	129-1	Prep. for CE labelling
429-1	UL/CSA		

Not currently supported, not listed in the specification form

Option	Name	Option	Name
602-1	Advanced shape tuning	607-1	Sensor Sync
607-2	Analog Sync	610-1	Independent Axis
624-1	Cont. Appl. Platform	625-1	Discrete Appl. Platform
628-1	Sensor Interface	634-1	MultiProcess
641-1	Dispense	1167-1	Machine Tending
642-2	PickMaster 5	661-2	Force Control base
687-1	Advanced robot motion	702-2	Hot plug
813-1	Optical Tracking	840-4	DeviceNet IO (Fieldbus adapter)
897-1	RRI	900-1	WristMove
951-1	RW Cutting	976-1	T10 Jogging device
983-1	Enabling	812-1	Production Manager
	Additional axes and drive module options		

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5 Accessories

Introduction to accessories

General

There is a range of tools and equipment available.

Basic software and software options for robot and PC

For more information, see *Product specification - Controller IRC5* and *Product specification - Controller software IRC5*.

Robot peripherals

- Grippers
- Signal lamp
- Stationary camera



Note

Cognex In-Sight Micro 1402 is a stationary camera specific to IRB 14000. See *Product specification - Integrated Vision*.

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