ROBOTICS

Product specification

OmniCore C line

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Product specification

OmniCore C30
OmniCore C90XT

OmniCore

Document ID: 3HAC065034-001

Revision: W

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Original instructions.

Table of contents

Overview of this specification

About this product specification

This product specification describes the properties of the OmniCore C line robot controller in terms of:

- Technical data and dimension
- The fulfilment of standards, safety and operating equipment
- RobotWare OS
- Controller system
- Variants and options

Usage

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

The specification is intended for:

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

References

Tip

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

Document name	Document ID
Product manual - OmniCore C30	*3HAC060860-001*
Circuit diagram - OmniCore C30, *Circuit diagram - OmniCore C30 for IRB 14050*, *Circuit diagram - CRB 15000*	*3HAC059896-009*, *3HAC063898-009*, *3HAC081041-003*
Product manual - OmniCore C90XT	*3HAC073706-001*
Circuit diagram - OmniCore C90XT	*3HAC065464-009*

Revisions

Revision	Description
A	First edition. Published in release 19B with RobotWare 7.
B	Published in release 19C with RobotWare 7. • Added IRB 1100

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Revision	Description
C	Published in release 19D with RobotWare 7.0.1. • Updated Independent Axis [3111-1] with a note • Updated the limitations of option Externally Guided Motion [3124-1] by adding IRB 14050 as a supported robot with Position Guidance • Updated Line fusing current for IRB 1100 • Updated Rated voltage and current • Added option *Force Control Interface* [3038-1] • Updated Operating requirements by remove IP40 from Dust and water protection
D	Published in release 20A with RobotWare 7.0.2. • Added *SafeMove2* options • Added description of *FlexPendant* applications and their respective options, see *FlexPendant applications on page 82* • Removed the limitations from option *Conv.Tracking unit Ext.* [3042-1] • Updated programming with Wizard, easy programming for IRB 14050 • Minor changes
E	Published in release 20B with RobotWare 7.0.4. • Added controller variant *OmniCore C90XT* and the related options • Updated available options regarding *Absolute Accuracy*
F	Published in release 20C with RobotWare 7.0.4. • Added a new product IRB 1300 • Updated Safety functions and added SafeMove to RobotWare chapter • Added option *FlexPendant 30m* [3016-3] • Added option *FlexPendant extension* [3017-x] • Updated the limitations for option *SafeMove Base* [3043-1] • Updated the limitations for option *SafeMove Pro* [3043-2] • Updated the description of FlexPendant Hardware options • Updated Safety functions/ Emergency Stop • Adjusted the naming of some options • Adjusted the requirement text for some options
G	Published in release 20C with RobotWare 7.0.4. • Updated graphics of the front panel

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Revision	Description
H	Published in release 20D with RobotWare 7.1. • Added a new product CRB 15000 • Added new variants CRB 1100 • Added option *PROFIsafe Device* [3023-2] • Added option *SICK laser scanner* [3051] • Added option *Collaborative package* [3063-1] • Added option *SafeMove Collaborative* [3043-3] • Updated Safety functions with additional functions for CRB 15000 • Updated the limitations of option *SoftMove* [3108-1] • Updated the limitations of option *Independent Axis* [3111-1] • Updated the limitations of option *Externally Guided Motion* [3124-1] • Updated Cooling for OmniCore C30 • Added FlexPendant holder • Added Warranty • Minor changes • Added information about new functionality in RobotWare 7.1
J	Published in release 21A with RobotWare 7.2. • Footnote added in section *FlexPendant applications on page 82* stating for what manipulators the lead-through functionality is applicable. • Verify Local Presence added in list of Digital inputs. • Added option *Robot Control Mate enabled* [3065-1] • Added option *IoT Data Gateway* [3154-1] • Added option Prepared for FlexLoader Vision [3134-1] • Changed the name Local IO to Scalable I/O • Added limitations to option *Base Dig. 16In/16Out* [3032-1] • Added PickMaster Twin options • Updated the requirements of option *Conv.Tracking unit int.* [3041-1] and option *Conv.Tracking unit ext.* [3042-1] • Added IRB 360 OmniCore • Added CRB 1100, CRB 15000
K	Published in release 21B with RobotWare 7.3. • AbsAcc All mounting pos [3101-4] added. • Limitations of SafeMove Base [3043-1] updated.
L	Published in release 21C with RobotWare 7.3. • Add limitation to option [3033-2] and [3015-1]. • Minor changes. • Description updated for option [3154-1].
M	Published in release 21D with RobotWare 7.5. • Description updated for option [3043-1]. • Description updated for option [3065-1]. • Added a new product IRB 920. • Added a new product IRB 910INV. • Added a new product IRB 1200 OmniCore. • Added option Safe base Dig. 6In/2Out [3037-x].

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Revision	Description
N	Published in release 22A with RobotWare 7.6. • Added option [3051-x]. • Added option [3063-x]. • Updated the description for Scalable safety I/O [3037-x]. • Updated the option name for Hot swappable FlexPendant [3018-1]. • Transportation and storage conditions added. • Added Force control Standard [3415-1]. • The option Externally Guided Motion [3124-1] is available for IRB 910INV. • Added CC-Link IE Field Basic Device [3066-2]. • Minor corrections to sections *Ethernet connections on page 53* and *Communication on page 54*.
P	Published in release 22B with RobotWare 7.7. • Added 24V customer power supply. • Added introduction of *Safety digital base device*. • *SoftMove* [3108-1] is available for CRB 15000. • Added Machining Standard [3418-1] and Machining Premium [3418-2].
Q	Published in release 22C with RobotWare 7.8. • Update descriptions for Collaborative Robot [3063-x].
R	Published in release 22D with RobotWare 7.8.1. • Minor changes. • Added new product CRB 1300 and IRB 365. • Added CAP and DAP [3125-1]. • Added Mains cable [3203-x].
S	Published in release 23A with RobotWare 7.10. • Added image for mains label in technical data section. • Updated requirements for option PROFISafe package [3063-1]. • Updated the list of *System signals on page 63*. • Added PROFIsafe Controller [3023-1]. • Added CAP Premium [3125-2].
T	Published in release 23B with RobotWare 7.10. • Added a new product IRB 930. • *Force Control Interface* [3038-1] phase out. • Added new option *Production Framework* [3404-1]. • Descriptions of *Mains voltage* [3007-x] updated. • Information about options for Integrated Vision cameras and lenses removed. For detailed descriptions of the options and related hardware, see *Product specification - Integrated Vision*.
U	Published in release 23C with RobotWare 7.12. • Updated the limitations for Mains cable [3203]. • Added new option *CC-Link IE Field Master* [3066-1].
V	Published in release 23D with RobotWare 7.13. • ABB Connect is the new name for ABB Ability Connected Services. • Updated requirements for option *PROFISafe Package* [3063-1]. • Updated requirements for option *Dual PROFISafe Package* [3063-3].

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Revision	Description
W	Published in release 24A with RobotWare 7.14. • Updated protection class of FlexPedant. • Updated requirements for option *PROFISafe Package* [3063-1]. • Updated requirements for option *I/O Package* [3063-2]. • Updated requirements for option *Dual PROFISafe Package* [3063-3]. • Updated requirements for option *Dual I/O Package* [3063-4]. • Updated the section *PROFINET Safety Network on page 132*.

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1 Description of OmniCore controller

1.1 OmniCore C30

General

OmniCore C30 is the most compact controller in OmniCore C line, optimized for a large selection of high performance applications such as material handling and small part assembly in light industry environment. OmniCore C30 is a compact controller in OmniCore C line family with protection class IP20.

OmniCore C30 supports the following manipulators:

- CRB 1100
- CRB 1300
- CRB 15000
- IRB 360 OmniCore
- IRB 365
- IRB 910INV
- IRB 920
- IRB 930
- IRB 1100
- IRB 1200 OmniCore
- IRB 1300
- IRB 14050

Operating environment

OmniCore C30 is intended to be used in industrial environment.

- Encapsulation is IP20
- Operational and storage according to IEC 61131-2
- Ambient temperature range is from 5-45°C
- Shock and vibration according to IEC60068

The controller maximizes floor space utilization by smallest possible size combined with an array of flexible integration possibilities including:

- Rack mounting kit for installation in standard 19" cabinet. Rack mount is very efficient way to save floor space and keep the controller protected from tough environments.
- Vertical installation kit to allow the controller to be installed standing vertically without compromising cooling. Also includes a hanging bracket for hanging the controller on its back.
- Elegant industrial designed desktop version optimized for easy access and elegant cable management routed from the back.

For more details, see *Technical data for OmniCore C30 controller on page 18*.

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1.1 OmniCore C30
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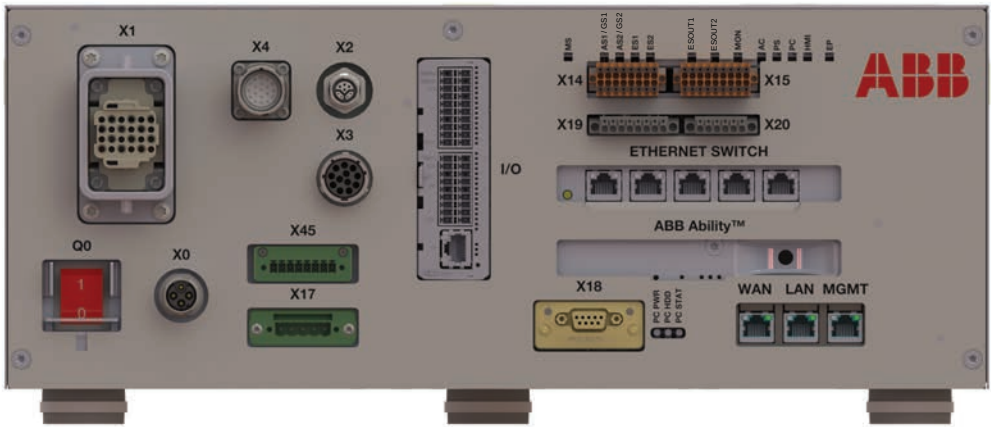
Different views of OmniCore C30



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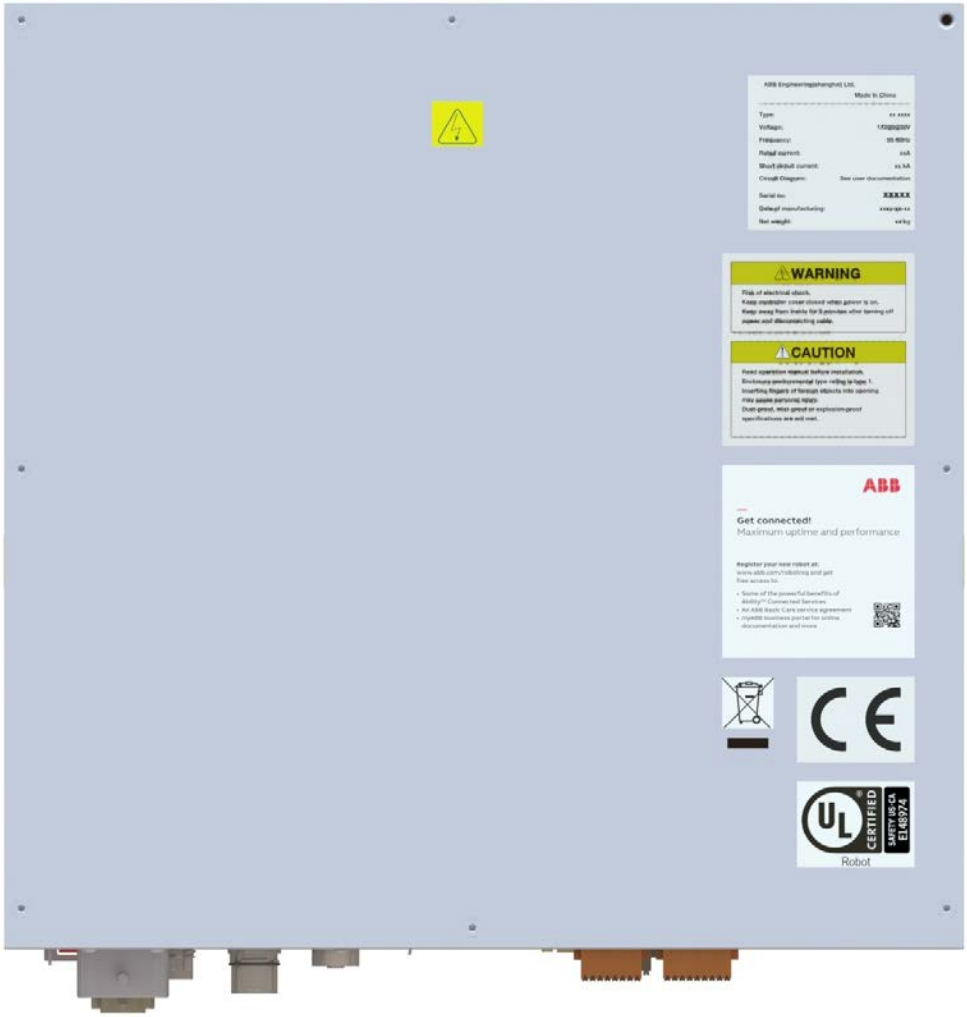

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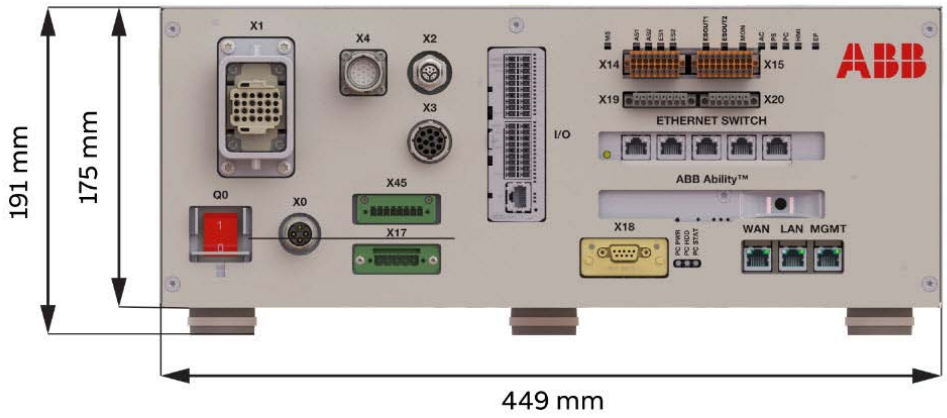
1.1.1 Technical data for OmniCore C30 controller

The dimensions of OmniCore C30



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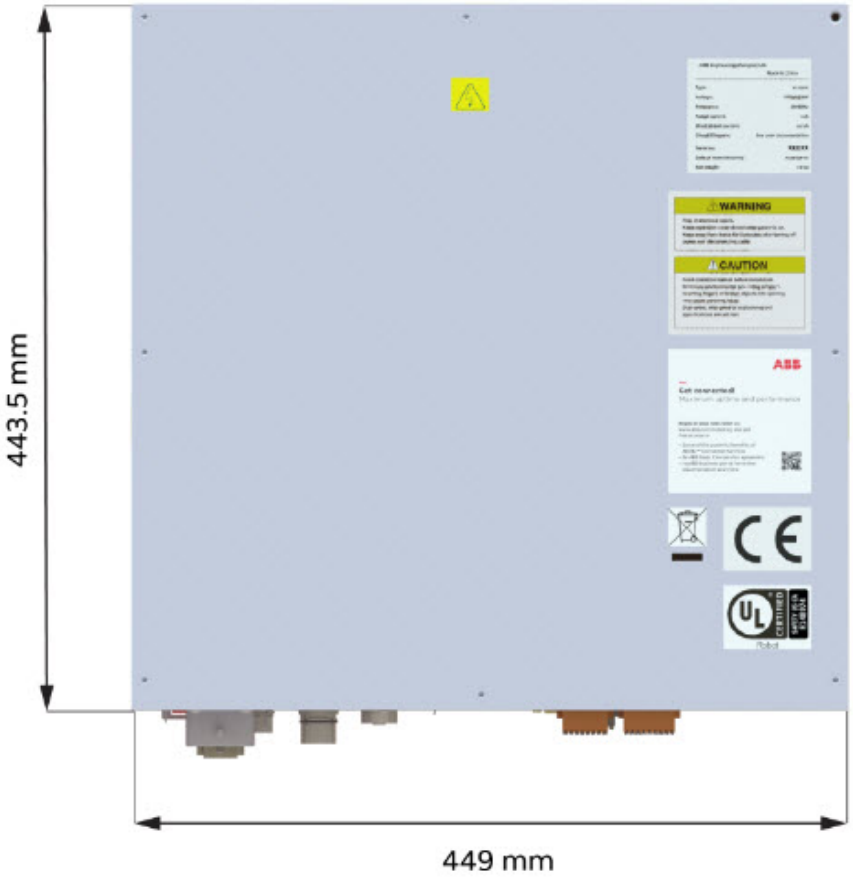

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Height	Base version: 191 mm (With foot) Base version: 175 mm (Without foot) Desktop version: 193 mm (With foot) Desktop version: 177 mm (Without foot)

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Width	Base version: 449 mm Desktop version: 509 mm
Depth	Base version: 443.5 mm Desktop version: 513.5 mm

Weight

OmniCore C30	25 kg 22 kg[i] 19 kg[ii]

i For IRB 14050 controller.
ii For CRB 15000 controller.

Protection classes for OmniCore C30

	Protection class
Controller cabinet, inner compartment for electronics	IP20
FlexPendant	IP65

Transportation and storage conditions

Parameter	Value
Minimum ambient temperature	-25°C (-13°F)
Maximum ambient temperature	+55°C (+131°F)
Maximum ambient temperature (less than 24 hrs)	+70°C (+158°F)
Vibration	Max. Grms = 4 m/s^2 (X & Y axis), Grms = 12.8 m/s^2 (Z axis)
Bumps	Max. 5 g = 50 m/s^2 (11 ms)

After storage, the operating conditions must be met for at least 4 hours before switching on the controller.

The robot controller shall only be stored indoors, in an environment that is dry and dust-free. In addition, wind, temperature fluctuations, and condensation shall be avoided.

Operating requirements

Requirements	Description
Dust and water protection according to IEC 60529	IP20
Explosive environments	The controller must not be located or operated in an explosive environment according to ATEX 94/9/EC.
Ambient temperature during operation	+5°C (+41°F) to +45°C (+113°F)
Ambient temperature during transportation and storage	-25°C (-13°F) to +55°C (+131°F) For short periods (not exceeding 24 hours): up to +70°C (+158°F)

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1.1.1 Technical data for OmniCore C30 controller
Continued

Requirements	Description
Bumps during transportation and operation	Max. 5 g = 50 m/s2 (11 ms)

Note

The humidity conditions shall apply with the environmental conditions EN 60721-3-3, climatic class 3K3. For temperatures 0-30 °C, the relative humidity must not exceed 85%. For temperatures exceeding 30 °C, the absolute humidity must not exceed 25g/m^3.

If the environmental conditions in EN 60721-3-3, climatic class 3K3, are not possible to meet at the installation site, desiccant bags can be placed inside the controller to achieve corresponding conditions. The desiccant bags must be replaced regularly to maintain approved operating conditions.

Power supply

Mains	Values
Voltage, IRB 1100, CRB 1100, IRB 1300, CRB 1300	220/230 VAC, 1 phase, voltage tolerance (+10%, -15%)
Voltage, IRB 360 OmniCore, IRB 365 OmniCore	220/230 VAC, 1 phase, voltage tolerance (+10%, -15%)
Voltage, IRB 910INV, IRB 920, IRB 930	220/230 VAC, 1 phase, voltage tolerance (+10%, -15%)
Voltage, IRB 14050, CRB 15000	100-230 VAC, 1 Phase, voltage tolerance (+10%, -10%)
Frequency	48.5 to 61.8 Hz
Short circuit current rating	5 kA

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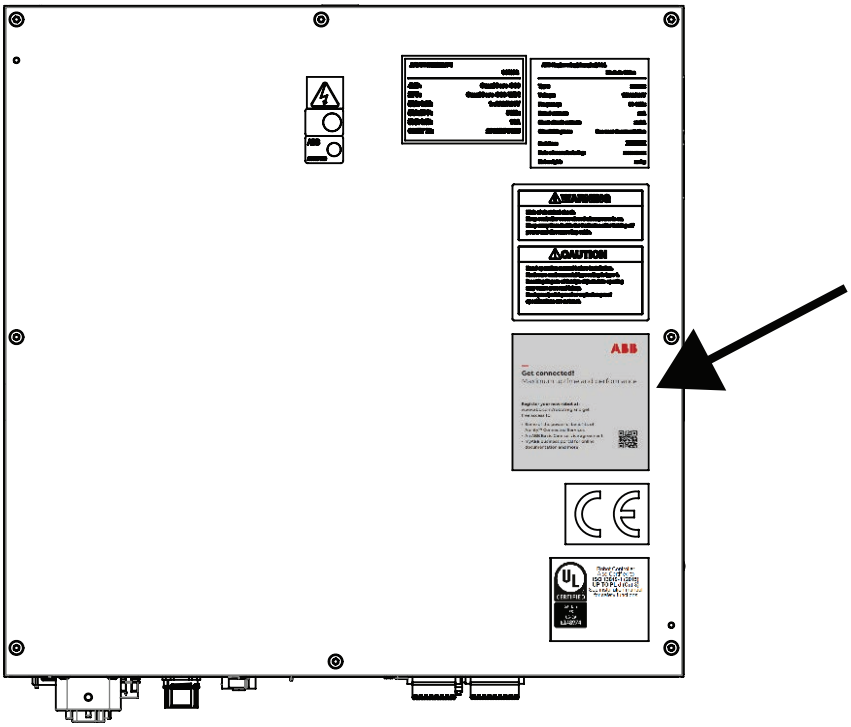
Rated voltage and current

To find the rated voltage and the full load current of the controller, see the name plate on the upper side of the cabinet.



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The rated current means maximum current in ISO Cube rapid when robot is running at rated voltage 230 VAC. It depends on application (manipulator size, options). See the following table.

Robot	Voltage (VAC)	Rated current (A), baseline options	Rated current (A), full options
CRB 15000	100, 230	5.5 at 100, 2.5 at 230	
IRB 365 OmniCore	230	4.5	6.5
IRB 910INV	230	4.5	6.5
IRB 920	230	4.5	6.5
IRB 930	230	4.5	6.5
IRB 1100, CRB 1100	230	4.5	6.5
IRB 1200	230	4.5	6.5
IRB 1300, CRB 1300	230	4.5	6.5
IRB 14050	100, 230	4.5 at 100, 2.25 at 230	

Line fusing

There is no integrated fuse inside OmniCore C30. Customer needs to add external fuse or circuit breaker itself according to current rating.

Robot	Current (A)
CRB 15000	1x6 in 230, 1x10 in 100

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1.1.1 Technical data for OmniCore C30 controller
Continued

Robot	Current (A)
IRB 360 OmniCore, IRB 365 OmniCore	1x10
IRB 910INV	1x10
IRB 920	1x10
IRB 930	1x10
IRB 1100, CRB 1100	1x10
IRB 1200	1x10
IRB 1300, CRB 1300	1x10
IRB 14050	1x6

Residual current

The OmniCore C line controller is designed to meet the following requirement of residual current. When connecting the robot controller to the power supply, an external earth fault protection (residual current device, RCD) is required based on the following data.

Robot	Residual Current in controller (mA)
IRB 1100	< 30 mA
IRB 1200 OmniCore	< 30 mA
IRB 1300	< 30 mA
IRB 910INV	< 30 mA
IRB 920	< 30 mA
IRB 930	< 30 mA
IRB 360 OmniCore	< 30 mA
IRB 365 OmniCore	< 30 mA
IRB 14050	< 3.5 mA
CRB 1100	< 30 mA
CRB 1300	< 30 mA
CRB 15000	< 3.5 mA

Note

The integrator is responsible to address local electrical requirements.

Power consumption

See the product specification for the respective manipulator.

24V customer power supply

Parameter	Value
Voltage	24V DC
Voltage tolerance	-3% ~ +10%
Max output current	3 A

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Cooling

The cooling fan on OmniCore C30 will work on reduced speed or shut off while the controller is in motors off state to lower the sound level. This is called fan control functionality. The fan will run with full cooling capacity when the controller is in motors on state. When changing to motors off, the fan will shut off if the temperature on the incoming air is low enough, or run in reduced speed if the temperature is too high. When the controller state is changed to motors off, the fan will shut off after 60 seconds if the temperature on the incoming air is low enough. If the temperature is too high, then the fan will continue at reduced capacity until the temperature is low enough and then turn off the fan.

The heat loss from the OmniCore C30 controller needs to be cooled when the OmniCore C30 controller is located in a closed cabinet, eg. 19” rack cabinet. The heat loss is highly depending on the use case and options installed. The temperature needs to be below max ambient temperature inside the closed cabinet. The heat loss data below shall be used as guiding.

Controller	Typical	Maximum	Recommended cooling capacity
OmniCore C30	80-100 W	120 W	>150 W

Configuration

The controller is very flexible and can, by using RobotStudio or the FlexPendant, easily be configured to suit the needs of each user.

For a detailed description of the installation procedure, see *Operating manual - OmniCore*.

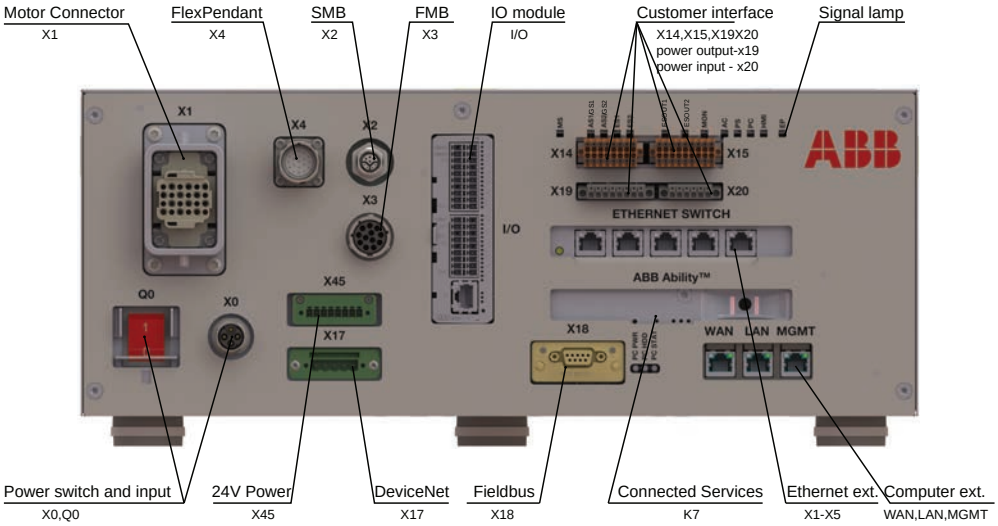
Airborne noise level

Data	Description	Note
Airborne noise level	The sound pressure level one meter away from each surface of the controller.	< 55 dB(A) Leq below +35 °C < 60 dB(A) Leq

1.1.2 Controller connectors

Connectors on OmniCore C30

The connection interface on OmniCore C30:



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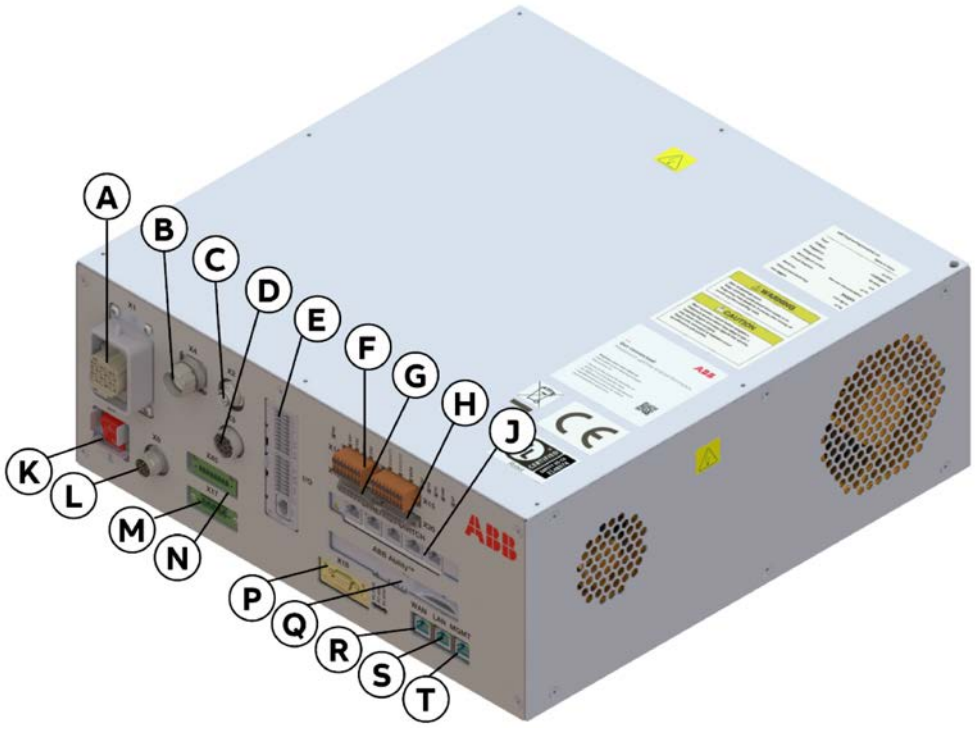

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	Description
A	Manipulator connector
B	FlexPendant connection
C	Manipulator signal connector (SMB connection), CFI with CRB 15000

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	Description
D	Manipulator signal connector (FMB connection)
E	I/O connection
F	Robot signal exchange proxy customer interface connection
G	24V 4A customer power
H	External 24V power input (can be connected here to keep the PC and system power available in case the cabinet is switched off)
J	Ethernet switch connection
K	Main switch (incoming main power input)
L	Power input connector (incoming main power input to the controller)
M	DeviceNet connector
N	Logic power output connector (additional 24V 8A)
P	Fieldbus adapter (Anybus)
Q	Connected Services Gateway to ABB Ability™ Cloud
R	WAN port (factory network)
S	LAN port (fieldbus)
T	Management port

1.2 OmniCore C90XT

General

OmniCore C90XT (Extra Tough) is the smallest high protection class robot controller in the industry. OmniCore C90XT is a compact controller in OmniCore C line family with protection class IP54.

The main objective for this controller is to meet the need for a compact solution for general industry paint, polishing, material handling, machine tending applications, and other applications with requirements for high IP protection class for small robots or relatively power intensive low voltage robots.

OmniCore C90XT controller also has the following features:

- Ideal for space-reduced production facilities with no compromise on protection or performance
- More space for discrete I/O, safety I/O (coming later), conveyor tracking unit inside the controller, for process control in a harsh environment IP54
- Provides 3 liters customer space inside the controller and 3 liters on the cabinet door with maximum power 40W
- An extension box is available for additional process equipment. The extension box provides 11 liters internal customer space.

OmniCore C90XT supports the following manipulators:

- CRB 1300
- IRB 910INV
- IRB 920
- IRB 930
- IRB 1100
- IRB 1200 OmniCore
- IRB 1300

Operating environment

OmniCore C90XT is intended to be used in industrial environment.

- Encapsulation is IP54
- Operational and storage according to IEC 61131-2
- Ambient temperature range is from 5-45°C
- Shock and vibration according to IEC60068

For more details, see *Technical data for OmniCore C90XT controller on page 32*.

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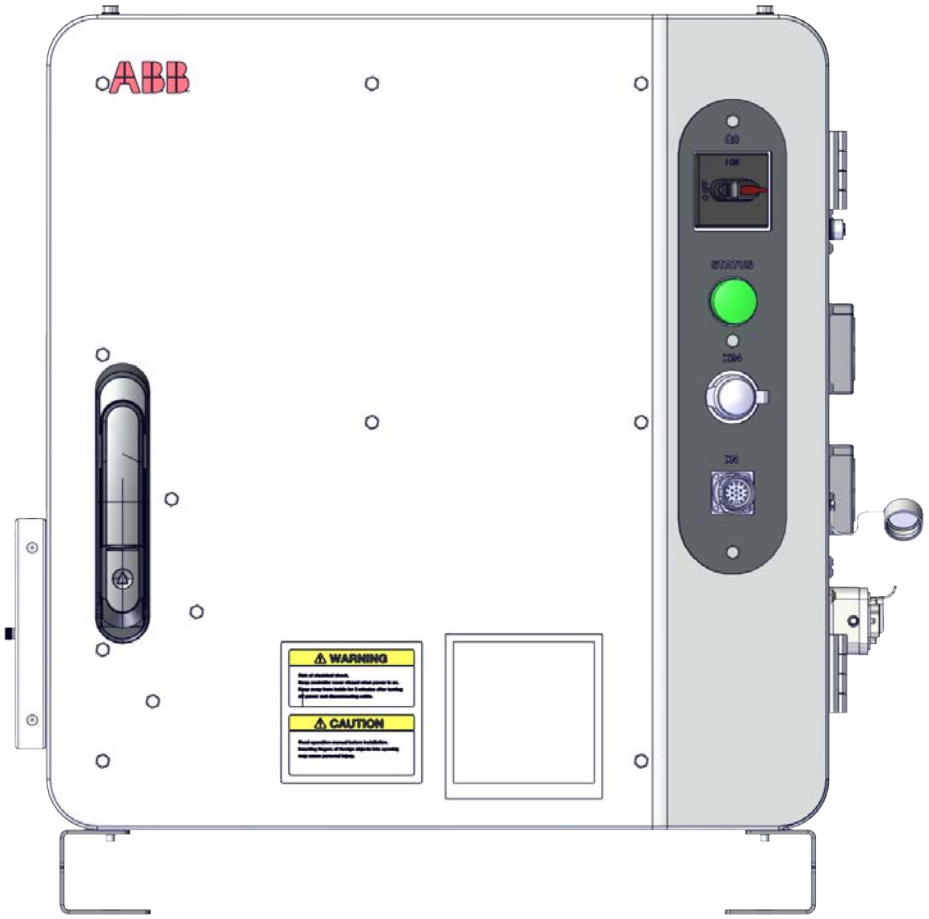
Different views of OmniCore C90XT



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1.2 OmniCore C90XT
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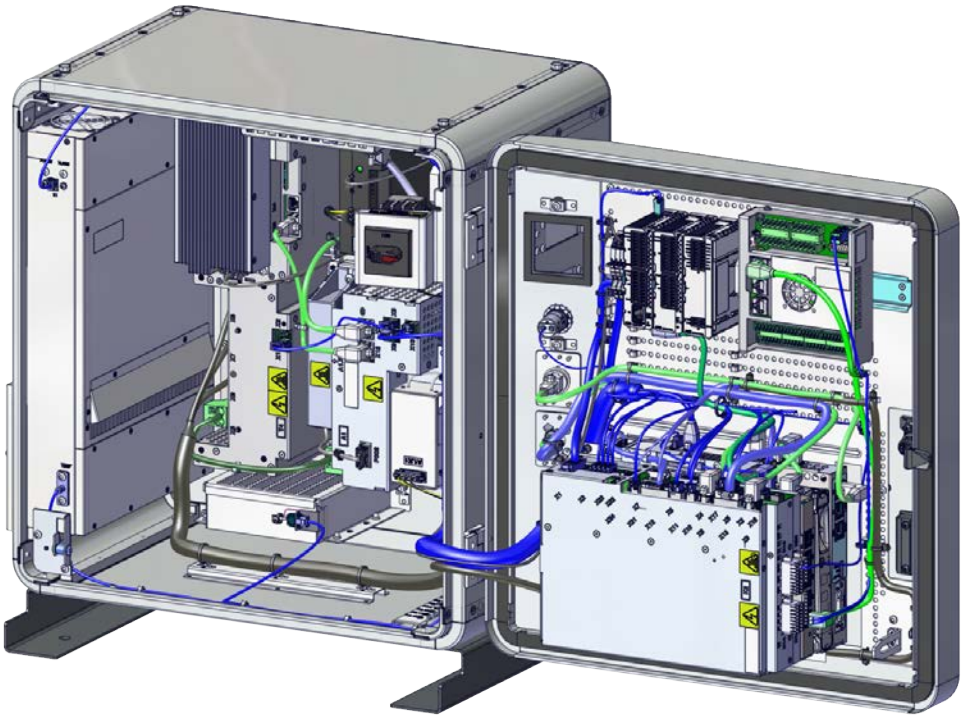

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1.2 OmniCore C90XT
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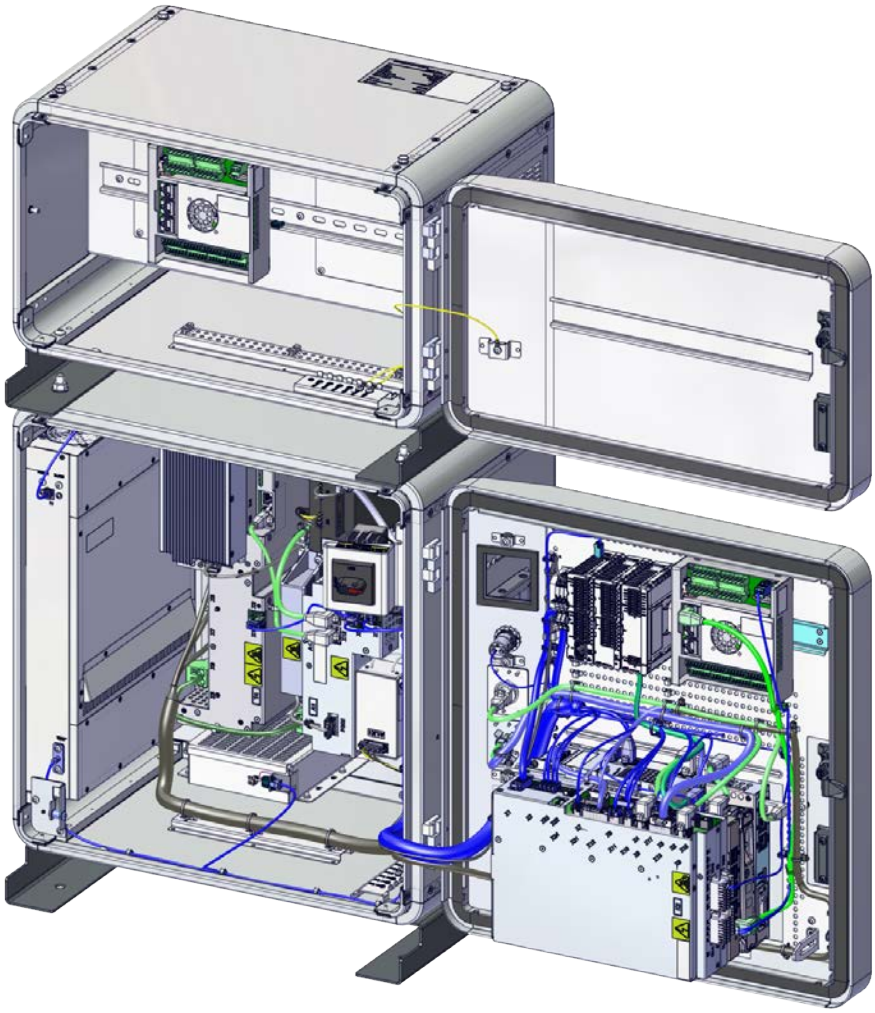

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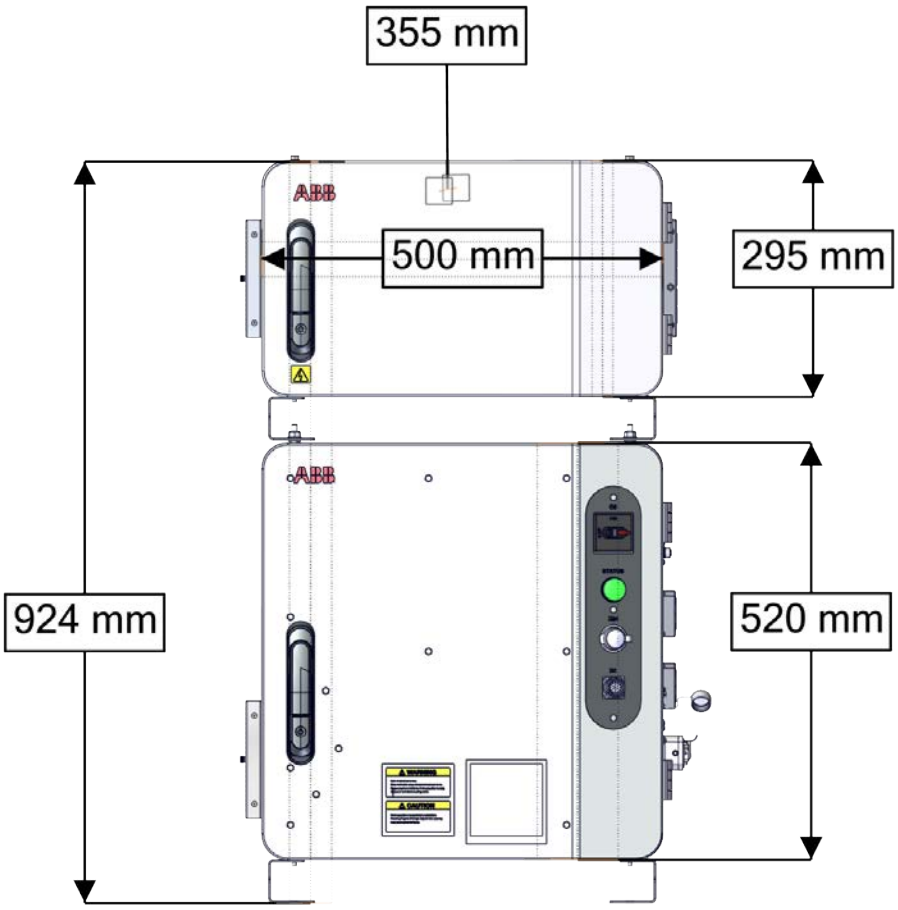
1.2.1 Technical data for OmniCore C90XT controller

The dimensions of OmniCore C90XT

Height	520 mm
Width	500 mm
Depth	355 mm

The dimension of the extension box

Height	295 mm
Width	500 mm
Depth	355 mm



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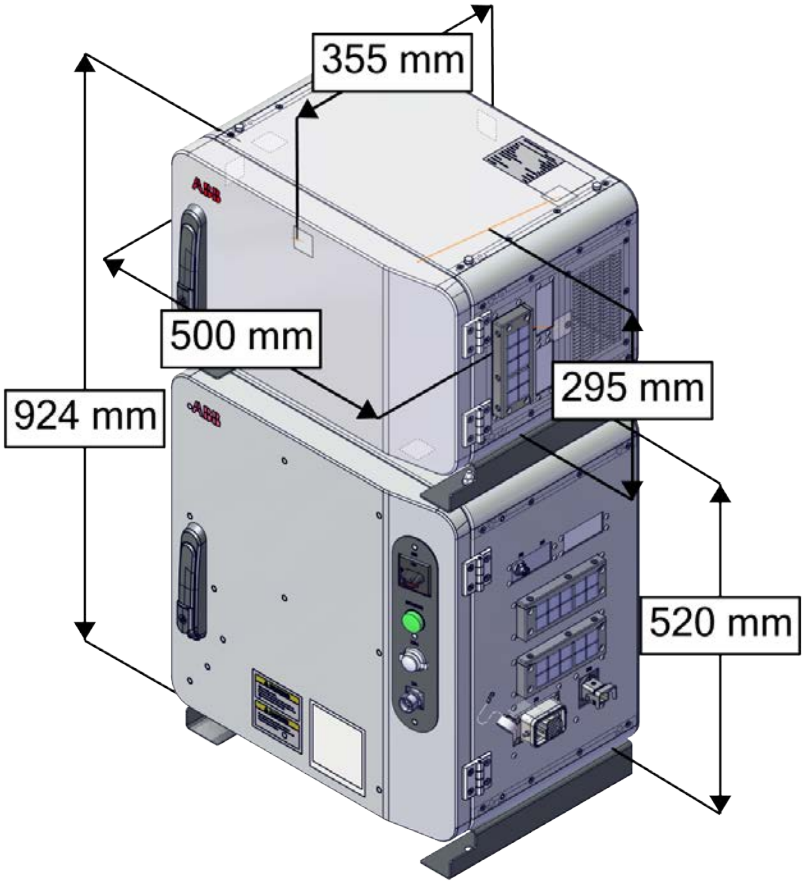

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Weight

OmniCore C90XT	46 kg (not including the extension box)
Extension box	25 kg

Protection classes for OmniCore C90XT

Controller cabinet	IP54
Extension box	IP54
Controller electronics	IP54
FlexPendant	IP65

Transportation and storage conditions

Parameter	Value
Minimum ambient temperature	-25°C (-13°F)
Maximum ambient temperature	+55°C (+131°F)

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1.2.1 Technical data for OmniCore C90XT controller
Continued

Parameter	Value
Maximum ambient temperature (less than 24 hrs)	+70°C (+158°F)
Vibration	Max. Grms = 4 m/s^2 (X & Y axis), Grms = 12.8 m/s^2 (Z axis)
Bumps	Max. 5 g = 50 m/s^2 (11 ms)

After storage, the operating conditions must be met for at least 4 hours before switching on the controller.

The robot controller shall only be stored indoors, in an environment that is dry and dust-free. In addition, wind, temperature fluctuations, and condensation shall be avoided.

Operating requirements

Requirements	Description
Dust and water protection according to IEC 60529	IP54
Ambient temperature during operation	+5°C (+41°F) to +45°C (+113°F)
Ambient temperature during transportation and storage	-25°C (-13°F) to +55°C (+131°F) For short periods (not exceeding 24 hours): up to +70°C (+158°F)
Bumps during transportation and operation	Max. 5 g = 50 m/s2 (11 ms)

Note

The humidity conditions shall apply with the environmental conditions EN 60721-3-3, climatic class 3K3. For temperatures 0-30°C, the relative humidity must not exceed 85%. For temperatures exceeding 30°C, the absolute humidity must not exceed 25g/m^3.

If the environmental conditions in EN 60721-3-3, climatic class 3K3, are not possible to meet at the installation site, desiccant bags can be placed inside the controller to achieve corresponding conditions. The desiccant bags must be replaced regularly to maintain approved operating conditions.

Power supply

Mains	Values
Voltage	220/230 VAC, 1 phase, voltage tolerance (+10%, -15%)
Frequency	48.5 to 61.8 Hz
Power	Max 2.5 KVA
Short circuit current rating	5 kA

24V customer power supply

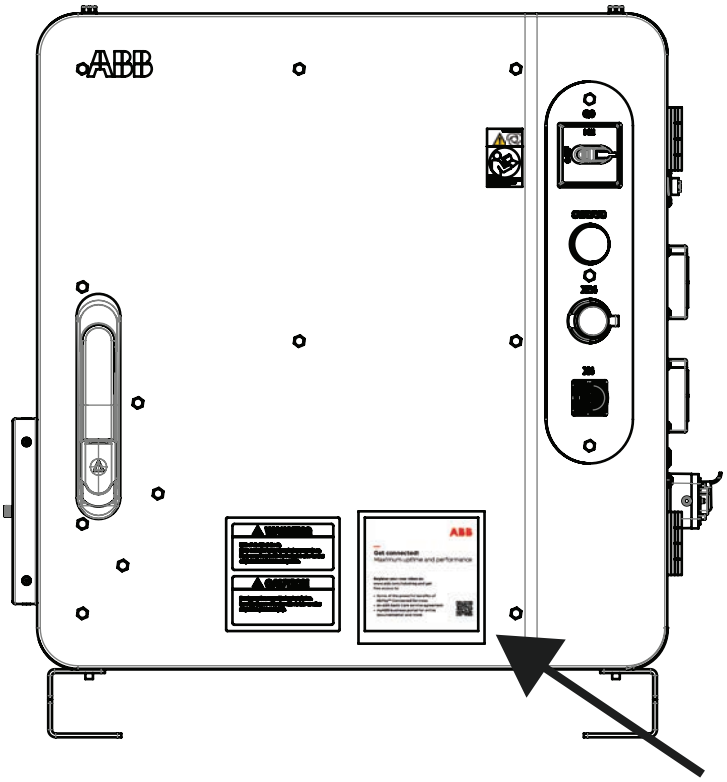
Parameter	Value
Voltage	24V DC

Continues on next page

Parameter	Value
Voltage tolerance	-3% ~ +10%
Max output current	3 A

Rated voltage and current

To find the rated voltage and the full load current of the controller, see the name plate on the upper side of the cabinet.



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The rated current means maximum current in ISO Cube rapid when the robot is running at rated voltage 230 VAC. It depends on application (manipulator size, options). See the following table.

Robot	Voltage (VAC)	Rated current (A), baseline options	Rated current (A), full options
CRB 1300	230	4.5	6.5
IRB 910INV	230	4.5	6.5
IRB 920	230	4.5	6.5
IRB 930	230	4.5	6.5
IRB 1100	230	4.5	6.5
IRB 1200	230	4.5	6.5
IRB 1300	230	4.5	6.5

Continues on next page

1.2.1 Technical data for OmniCore C90XT controller
Continued

Line fusing

There is no integrated fuse in side OmniCore C90XT. Customer needs to add external fuse or circuit breaker itself according to current rating. The following table shows the recommended rating for an external fuse or circuit breaker.

Robot	Current (A)
CRB 1300	10
IRB 910INV	10
IRB 920	10
IRB 930	10
IRB 1100	10
IRB 1200	10
IRB 1300	10

Power consumption

See the product specification for the respective manipulator.

Cooling

The cooling fan will work on reduced speed or shut off while the controller is in motors off state to lower the sound level. The fan will run with full cooling capacity when the controller is in motors on state. When changing to motors off, the fan will shut off if the temperature on the incoming air is low enough, or run in reduced speed if the temperature is too high. When the controller state is changed to motors off, the fan will shut off after 60 seconds if the temperature on the incoming air is low enough. If the temperature is too high, then the fan will continue at reduced capacity until the temperature is low enough and then turn off the fan.

Configuration

The controller is very flexible and can, by using RobotStudio or the FlexPendant, easily be configured to suit the needs of each user.

For a detailed description of the installation procedure, see *Operating manual - OmniCore*.

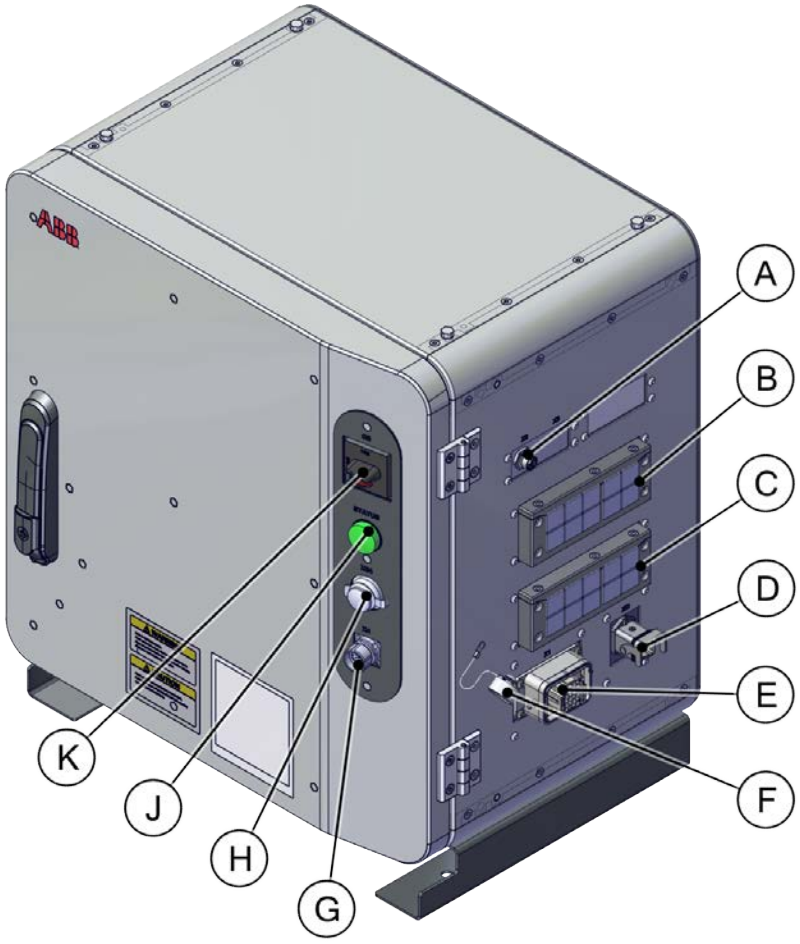
Airborne noise level

Data	Description	Note
Airborne noise level	The sound pressure level one meter away from each surface of the controller.	Controller in Motors On Mode: < 64 dB(A) Leq Controller in Standby Mode: < 61 dB(A) Leq

1.2.2 Controller connectors

Connectors on OmniCore C90XT

The connection interface on OmniCore C90XT:



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	Description
A	Manipulator signal connector (SMB connection)
B	Cable grommet, option
C	Cable grommet, baseline
D	Main Power input connection
E	Manipulator connection
F	FlexPendant connector cover
G	FlexPendant connection
H	Management port connection
J	Motors on lamp
K	Main switch (incoming mains power input)

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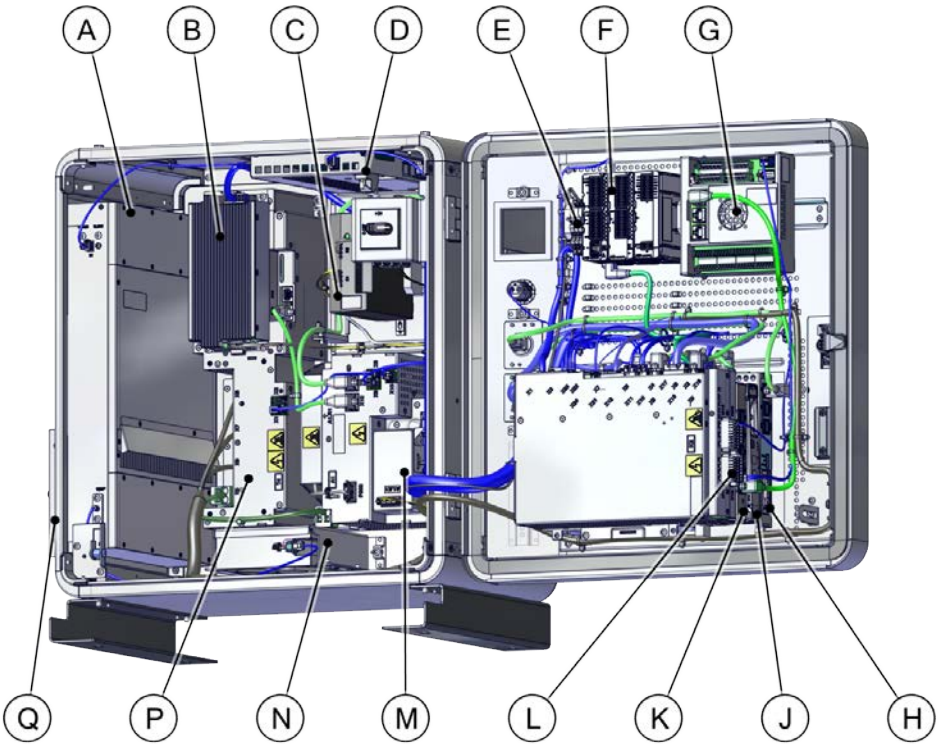
1.2.2 Controller connectors

Continued



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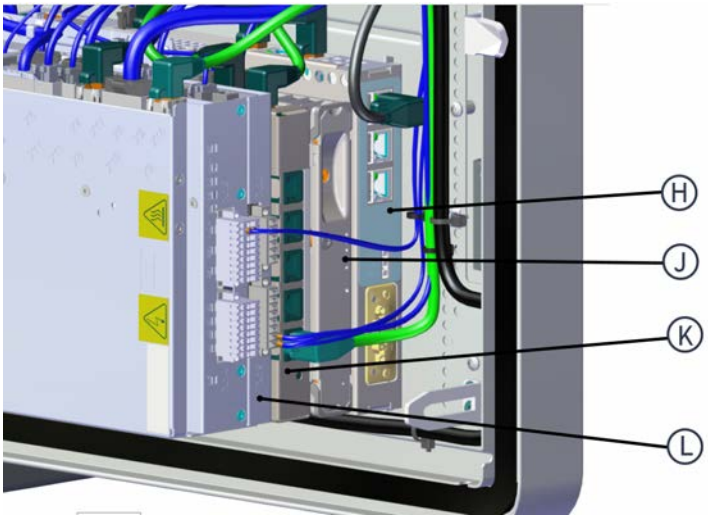

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	Description
A	Heat exchanger
B	Power supply device (baseline)
C	Additional power supply device (option)
D	Axis computer
E	24V power output terminal
F	Scalable I/O Internal devices
G	Conveyor tracking unit

Continues on next page

	Description
H	Fieldbus adapter slave devices
J	Connected Services Gateway to ABB Ability™ Cloud
K	Ethernet switch connection
L	Robot signal exchange proxy, customer interface connection
M	Power unit
N	Standard fan
P	Drive unit
Q	Air filter

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2 Safety

2.1 Applicable standards

General

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

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1

Region specific standards and regulations

Standard	Description
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

2.2 Safety functions

Safety

The safety design of the controller is state of the art. 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 is cut off and the brakes engage.

Safety functions	Description
Category 0 Stop	Stop function that immediately removes the power to the motors and applies the brakes.
Category 1 Stop	Stop function that stops the robot using the motors instead of the brakes which leads to a controlled stop where the robot is stopping on the programmed path. This stop is more effective especially on large robots. A category 0 stop will be applied with a 1 second delay after a category 1 stop is triggered.
Protective Stop	The integrator of the cell can connect sensors/equipment which triggers the safety controller to issue a stop the robot using category 0 stop or category 1 stop. The sensor could be placed on the cell door, stopping the robot when the door is opened.
Emergency Stop	If something happens either with the robot system or in a machine near the robot system and the operator presses the emergency stop, then all machines/systems in sight shall be stopped. Emergency Stop status output is available in the basic delivery of OmniCore controller family including all variants. The emergency stop button is integrated in the FlexPendant.
Manual Operation Supervision	In manual reduced speed the robot can be moved using the FlexPendant and the enabling device. The enabling switch must be pressed to maintain safety.
Start / Restart Function	The start / restart function ensures that all safety conditions are met before enabling movement after a stop.
Service Mode	During service of the robot, it must be possible to move the robot without the safety monitoring, for example move the robot without being disturbed by forbidden zones/ranges stopping the robot. When the Service Mode is activated, all safety monitoring is deactivated (muted). The safety is maintained by not allowing service mode to be active in automatic mode. For safety, the enabling device needs to be pressed for moving the robot. The enabling device is integrated in the FlexPendant.
Parameterization	The parameterization consists the following functions. • Configuration of a Safety System • Safety Configuration Integrity Check • Configuration of Zones • Signal Configuration
Hot Swappable FlexPendant	It is possible to remove the FlexPendant while the robot is in automatic mode. This makes it possible to use only one FlexPendant for several robots, where the FlexPendant is only connected occasionally and used for recovering from stops. In manual mode, there is no use of the functionality since it is not possible to do anything with the system without the FlexPendant. The functionality is in therefore deactivated in manual mode.

Continues on next page

Safety functions	Description
Monitored Category 1 Stop	The category 1 stop stops the robot using the motors. The safety controller monitors that the stop is performed, that the retardation is above the limit. If the retardation is less than the limit a category 0 stop is triggered. When the robot has stopped, the power to the motors is removed and the brakes are applied.
Fire safety	The control system complies with the requirement of UL (Underwriters Laboratories) for fire safety.

OmniCore C30 for IRB 14050

In OmniCore C30 for IRB14050, the safety functions are as follows.

Safety functions	Description
Category 0 Stop	Stop function that immediately removes the power to the motors and applies the brakes.
Category 1 Stop	Stop function that stops the robot using the motors instead of the brakes which leads to a controlled stop where the robot is stopping on the programmed path. This stop is more effective especially on large robots. A category 0 stop will be applied with a 1 second delay after a category 1 stop is triggered.
Protective Stop	The integrator of the cell can connect sensors/equipment which triggers the safety controller to issue a stop the robot using category 0 stop or category 1 stop. The sensor could be placed on the cell door, stopping the robot when the door is opened.
Emergency Stop	If something happens either with the robot system or in a machine near the robot system and the operator presses the emergency stop, then all machines/systems in sight shall be stopped. For OmniCore C30, the emergency stop button is integrated in the FlexPendant.
Manual Operation Supervision	In manual reduced speed the robot can be moved using the FlexPendant and the enabling device. The enabling switch must be pressed to maintain safety.
Start / Restart Function	The start / restart function ensures that all safety conditions are met before enabling movement after a stop.
Service Mode	During service of the robot, it must be possible to move the robot without the safety monitoring, for example move the robot without being disturbed by forbidden zones/ranges stopping the robot. When the Service Mode is activated, all safety monitoring is deactivated (muted). The safety is maintained by not allowing service mode to be active in automatic mode. For safety, the enabling device needs to be pressed for moving the robot. The enabling device is integrated in the FlexPendant.
Axis Speed Supervision	The axis speed supervision function can monitor if the axis speed is too high or too low. If an axis in the supervised system moves over a configured limit then the robot is stopped. If an axis moves too slowly then a signal is set, for example, to indicate that there is a risk for overheating if the axis controls a band going through an oven.
Tool Speed Supervision	The tool speed supervision function can monitor if the tool speed is too high or too low. If a point on the supervised tool system moves over a configured limit then the robot is stopped. If the tool moves too slowly then a signal is set, for example, to indicate that there is a risk for overheating if a laser is mounted on the tool.

Continues on next page

Safety functions	Description
Axis Position Supervision	If the robot moves outside the given axis range then the robot is stopped.
Tool Position Supervision	If the tool on the robot is moved outside a given zone or inside a protected zone then the robot is stopped.
Tool Orientation Supervision	If the tool points in an unsafe direction then a signal is set, for example, if a laser cutter is mounted on the tool.
Stand Still Supervision	If the robot is moving when the function is active then the robot stops or the opposite, when the robot is standing still a signal is set.
Contact Application Tolerance	The Contact Application Tolerance function relaxes the diagnostic function *Control Error Supervision* for making it possible for the robot to be in contact with the work piece. All safety functions are still active but the safety is decreased when the diagnostic tolerance is increased. The Operational Safety Area is only possible to activate in a limited area (zone or range).
Parameterization	The parameterization consists the following functions. • Configuration of a Safety System • Safety Configuration Integrity Check • Configuration of Zones • Signal Configuration
Hot Swappable FlexPendant	It is possible to remove the FlexPendant while the robot is in automatic mode. This makes it possible to use only one FlexPendant for several robots, where the FlexPendant is only connected occasionally and used for recovering from stops. In manual mode, there is no use of the functionality since it is not possible to do anything with the system without the FlexPendant. The functionality is in therefore deactivated in manual mode.
Monitored Category 1 Stop	The category 1 stop stops the robot using the motors. The safety controller monitors that the stop is performed, that the retardation is above the limit. If the retardation is less than the limit a category 0 stop is triggered. When the robot has stopped, the power to the motors is removed and the brakes are applied.
Fire safety	The control system complies with the requirement of UL (Underwriters Laboratories) for fire safety.

OmniCore C30 for CRB 15000

Additional safety functions in OmniCore C30 for CRB 15000 as follows.

Safety functions	Description
Axis Torque Supervision	The axis torque supervision function can monitor the torque applied on each axis. If an axis in the supervised system applies torques exceeding the configured limit, it indicates that the arm is squeezing something and the robot is stopped.
Tool Force Supervision	The tool force supervision function can monitor the applied external force on the tool. If the external additional force on the tool in the supervised system exceeds the configured limit, it indicates that the tool is squeezing something and the robot is stopped.

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Operating cycles for safety parts

The expected cycles for safety parts are listed below.

Safety part	Cycles
Enabling device	750 000
Emergency stop (FlexPendant)	750 000
Contactors	10 000 000
Safety relay (actuator in OmniCore C30 for IRB 14050)	2 250 000

2.3 Safety data

Prevailing standards and directives

For the use of industrial robots, regulations must be fulfilled as described in the following standards and directives:

- EN ISO 10218-1:2011
- Machinery Directive 2006/42/EC

Related information

For more detailed information, see the product manual for the robot controller.

3 Installation and maintenance

3.1 Installation

General

The controller is delivered with a standard configuration for the corresponding manipulator, and can be operated immediately after installation. Its configuration is displayed in plain language and can easily be changed using the RobotStudio or the FlexPendant.

3.2 Mounting the controller with 19" rack mounting kit

General

The OmniCore C line controller is designed to fit in a 19" cabinet.

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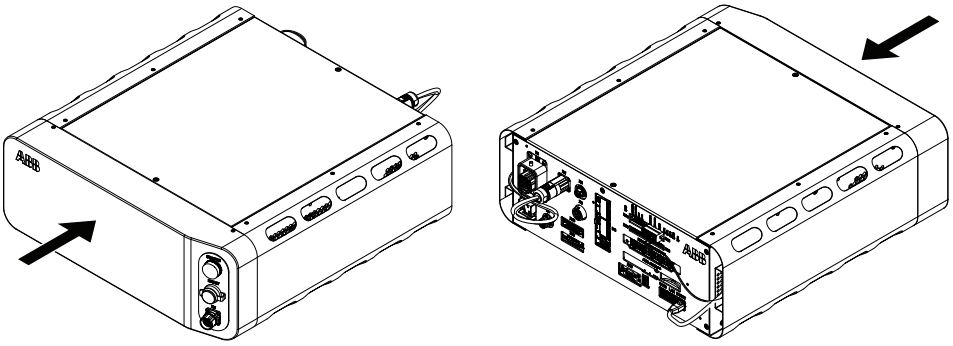
Note

If the controller is installed in a rack (cabinet), it must be fastened in a way that prevents distortion of the controller cabinet. Preferably with angle bars along the entire side edges of the controller.

3.3 Mounting the controller with desktop mounting kit

General

The OmniCore C30 controller is designed to fit as a desk version, that can have a desktop mounting kit.



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Note

If the desktop mounting kit is mounted to the controller, do not hold the TPU connector (X4) during any moving or transporting of the controller.

3.4 Maintenance

General

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

The OmniCore C30 controller is enclosed, which means that the electronic circuitry is protected when operating in a workshop environment. The only maintenance parts are cooling fans.

For OmniCore C90XT controller there are also air filters that may require maintenance.

See the product manual for the controller for maintenance activities and intervals.

Functions

The robot has several functions to provide efficient diagnostics and error reports.

Function	Detail
Online supervision	CPU temperature
	AC and DC voltage levels
	Power Supply functions
	UPS capacitor status
	All internal communication channels (cables)
	CMOS battery
	Safety chains (two channel supervision)
	Safety chains (function test)
	Safety switches
	Motor temperatures
	Drive system: communication cable, voltage levels, temperatures, motor current and cable, reference quality
	Measurement system: communication cable, resolver function including cables
	Fieldbus cable (communication and power)
	Fieldbus units (connection, status)
	Program execution and resource handling
Power on	Built-in self-test
Fault tracing support	Computer status LEDs
Error message	Displayed in selected language The message includes the reason for the fault and suggests recovery action
Faults and major events are logged and time-stamped.	This makes it possible to detect error chains and provides the background for any downtime. The log can be saved to file or viewed from PC tools like RobotStudio, Robot Web Services or any OPC client application
Manual test	Commands and service programs in RAPID to test units and functions

Continues on next page

Function	Detail
Properties	Detailed properties of hardware and software in the controller are available for viewing from FlexPendant or RobotStudio

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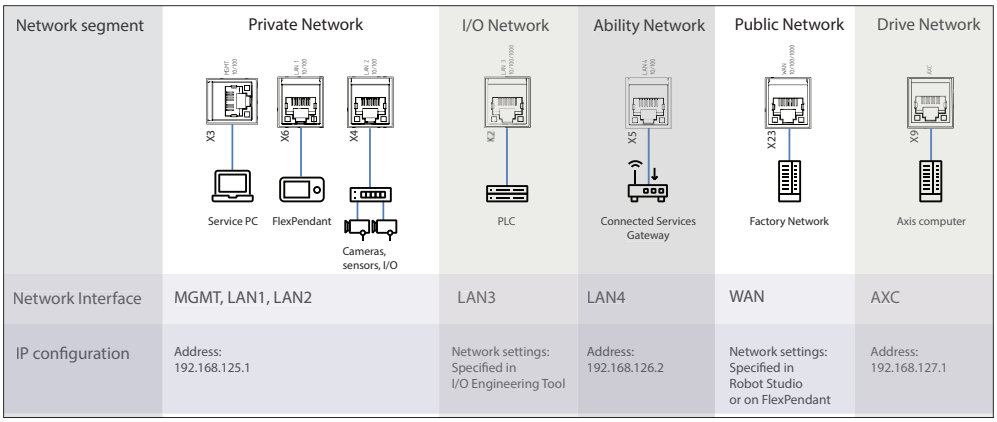
4 Controller system

4.1 Ethernet connections

Ethernet connections, Baseline

LAN	Fieldbus or customer options. Connection to the controller's I/O Network. Intended for connecting the robot controller to a factory wide industrial network isolated from WAN.
WAN	Connection to factory WAN
MGMT	Local Management Port

Ethernet ports vs. options



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Baseline/ Option	LAN1	LAN2	LAN3	LAN4	MGMT	WAN	AXC
Base Dig. 16In/16Out [3032-1]		x					
FlexPendant [3017-x]	x						
Connected Services [3013-x]				x			
Fieldbus options			*			x	
Baseline for connection to PC					x		
Connection to factory WAN						x	
Internal connection to drive system							x

With OmniCore C90XT and in addition to the table above:

Medium res. Camera [3128-1], High res. Camera [3129-1]		x					
Conv.Tracking unit int. [3041-1], Conv.Tracking unit ext. [3042-1]		x	*			Or x	
Base Dig. 16In/16Out [3032-2]		x					
Ethernet cable - Length [3202-x]		x					

* Connection to LAN3 is possible for PROFINET Controller/Device/EtherNet/IP Scanner/Adapter and CC-Link Device.

4.2 Communication

Ethernet

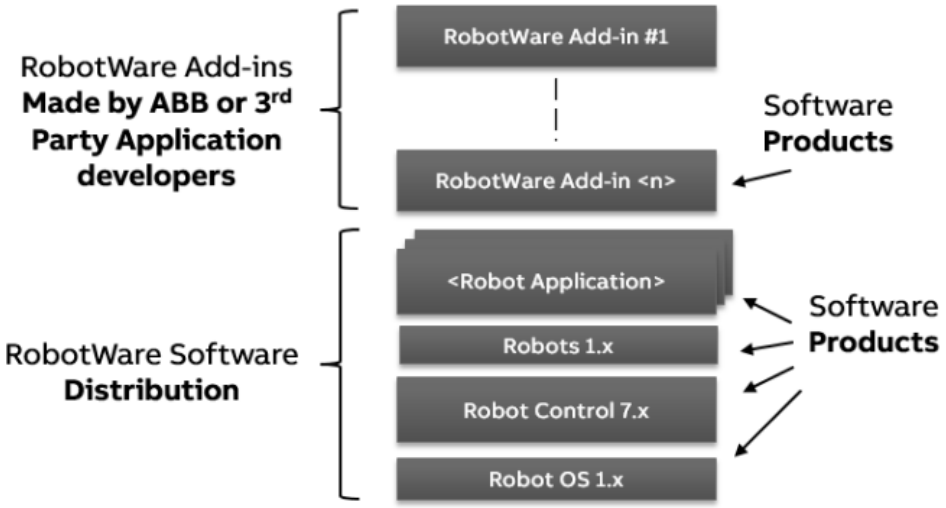
The communication includes TCP/IP with network configuration possibilities like:

- DNS, DHCP etc.
- Network file system access using SFTP server
- Control and/or monitoring of controllers by Windows applications built with PC SDK
- Boot/upgrading of controller software via the network or a portable PC
- Communication with RobotStudio
- Connected Services

4.3 RobotWare

RobotWare 7

RobotWare 7 is the control software platform that runs on the OmniCore controllers. The distribution consists of several software products.



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Standard features of RobotWare

The RobotWare software distribution contains the standard features for robot control, and selected additional software products. The unique motion control in RobotWare together with the built-in high-level programming language RAPID offers a reliable and flexible performance.

See also *Robot motion on page 59*, *I/O system on page 63*, and *Programming on page 69*.

Motion technology

QuickMove 2nd generation	A unique self-optimizing motion control feature that keeps cycle times to a minimum by ensuring maximum acceleration at every moment. ABB robots cycle times are up to 25% shorter than competitors. See *QuickMove™ on page 59*.
TrueMove 2nd generation	TrueMove ensures that the motion path followed by the robot is the same as the programmed path regardless of the robot speed. See *TrueMove™ on page 59*.
Additional axes	Up to 36 axes can be run from the control system. The robot main axes can be coordinated with external mechanical structures such as work-piece positioners and track-motion devices or gantries. This requires that the controller has additional drive units.
Electronically linked motors	Create robot control master/slave motor configurations to replace mechanical driving shafts in gantries or positioners.
Motion Process modes	Optimize robot behavior based on specific needs, i.e. optimize the performance of the robot for a specific application.
Motion Error Handler	Maintain RAPID execution when motion errors such as collision and singularities occur.

Continues on next page

Programming technology

Error handling	Exceptional robot behavior is ensured through customized error handlers which can be set up to take a certain action depending on error type.

Communications technology

Robot web services	Programming interface based on HTML5 to communicate with robot from any device, regardless of operating system.
Socket messaging	Allows for the exchange TCP/IP messages over a network for machine-to-machine communication.

Service technology

Remote Service enabled	A robot in need of maintenance will, through wireless technology, alert ABB so we can offer quick support. see *Connected Services Gateway on page 120*.
Service Information System	Predicts robot service needs. It includes operating time, calendar time and advanced algorithms for calculation of gearbox services.

General technology

User-authorization system (UAS)	The data, functionality, and commands of a controller are protected by the UAS, which defines the access rights for the individual users of the robot controller.
Power failure support	If the power supply is cut off during operation, the robot restarts at the exact same position and system status as before the power failure.
Modify Installation	Managing RobotWare installation and adding new options has never been as hassle free and easy.
Improved jogging response	Manual robot movement, also known as jogging, is more responsive.
Snapshots	Snapshots are used to create a backup of the current system state. The backup also includes all installed software products, user data, and system internal data. This is a useful tool before making changes to or updating the RobotWare system, which makes it easy to restore old systems and enables fast switching between different systems in a flexible production environment.

RobotWare options and application support

RobotWare comes with various application specific support.

Note

OmniCore C30 offers a limited scope of application options, see *Specification of controller & RobotWare options on page 93*.

Motion performance

Advanced Robot Motion	Functionality for optimizing the robot's motion control and for minimizing path deviation. See *Advanced robot motion [3100-1] on page 157*.
Absolute Accuracy	Makes your robot even more precise. Perfect for off-line programming and fast replacements of robots. See *Absolute Accuracy [3101] on page 164*.

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Motion coordination

Conveyor tracking	Coordinates the robot motion with a conveyor line. See *Conveyor on page 208*.

Motion functions

World Zones	Defines actions when a robot enters a defined area of the working space.The zones can be used to stop the robot from entering a zone, either permanently or only when another robot is working in the zone. See *World Zones [3106-1] on page 167*.
Independent Axis	Makes an additional axis (linear or rotating) run independently of the other axes in the robot system. See *Independent Axis [3111-1] on page 174*.
Path Recovery	Stores all system data, when an interrupt occurs (fault message or other) and restores them after necessary actions have been taken. Useful for service interrupts. See *Path Recovery [3113-1] on page 177*.
SoftMove	In applications where materials or tools cannot be precisely positioned, the robot can be set to Soft Servo mode, allowing the robot to act like a mechanical spring when encountering resistance from the environment. See *SoftMove [3108-1] on page 172*.
Collision Detection	Protects equipment and robot from severe damage. It stops the robot if the motion torque values are exceeded. See *Collision detection [3107-1] on page 169*.
Collision Avoidance	Collision Avoidance is a software option that enables the possibility to stop the robot before colliding with fixed objects. See *Collision avoidance [3150-1] on page 170*.

Communications

SFTP/FTP and NFS Client	SFTP/FTP/NFS Client makes it possible to read information on a remote hard disk directly from the controller. See *Communication on page 180*.

Engineering tools

Multi-tasking dialog	Run up to 14 RAPID programs simultaneously. Use them for supervision of external equipment, operator or advanced calculations.
Continuous Application Platform	Used for designing continuous path process applications, such as arc welding applications. By using CAP, the development work is much faster and results in robust high performance applications.
Discrete Application Platform	Used for designing discrete point process applications, such as spot-welding applications. By using DAP, the development work is much faster and results in robust high performance applications.
Externally Guided Motion (EGM)	Enables external sensors and controllers to control the robot motion with very fast robot response.

Vision

Integrated Vision interface	Makes the most advanced vision tools an integral part of ABB robots. Enables a variety of applications with minimum experience and programming time. See *Vision interface [3127-1] on page 199*.

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Application options

> **Note**
>
> OmniCore C30 offers a limited scope of application options, see *Specification of controller & RobotWare options on page 93*.

ArcWare	Optimizes the robot for arc welding. The positioning of the robot and the process control and monitoring are handled in one and the same instruction as well as process equipment supervision, error recovery, etc
SpotWare	This option provides dedicated spot weld instructions for fast and accurate positioning combined with gun manipulation, process start and supervision of the weld equipment.
DispenseWare	This option provides support for different types of dispensing processes such as gluing and sealing.
Prepared for PickMaster	PickMaster application are configurable integration of robots, vision systems and conveyors.
RobotWare Force Control	Allows the robot to be contact force controlled. Typically this is useful in assembly and machining. The option requires dedicated hardware sensors.
RobotWare Machining	This is a set of instructions, which facilitate the use of robots for machining applications.

SafeMove

SafeMove includes a set of easy-to-use tools for fast setup, validation, and commissioning.

Features

Safety fieldbuses	Built-in safety fieldbuses eliminating the need for dedicated hardware for communication with safety equipment such as safety PLCs & light curtains.
Tool position supervision	Protects the operator and enhances machine and equipment safety by supervising the position of the tool.
Tool speed supervision	Protects the operator and enhances machine and equipment safety by supervising the speed of the tool.
Tool orientation supervision	Protects the operator and enhances machine and equipment safety by supervising the orientation of the tool.
Axis position supervision	Protects the surroundings and operators by supervising the axis position.
Axis speed supervision	Protects the surroundings and operators by supervising the axis speed.
Standstill supervision	Supervises the stand-still of robot axes without having to switch the robot to Motors Off. It enables operators to perform tasks in the immediate vicinity of the robot.
Contact application tolerance	Allows the robot to be in contact with work-piece in limited areas. This can for example be used in applications where the robot is used for grinding or during tool change.
Stop functions	Triggers stop of the robot using fieldbus inputs from the safety PLC.
Configuration	Performed in RobotStudio using Visual SafeMove configurator.

4.4 Robot motion

QuickMove™

The QuickMove™ concept means that a self-optimizing motion control is used. The robot automatically optimizes the motion parameters to achieve the best possible performance throughout the cycle - based on load properties, location in working area, velocity, and direction of movement.

- No parameters have to be adjusted to achieve correct path, orientation, and velocity
- Maximum acceleration is always obtained (acceleration can be reduced, for example when handling fragile parts)
- The number of adjustments that have to be made to achieve the shortest possible cycle time is minimized

TrueMove™

The TrueMove™ concept means that the programmed path is followed - regardless of the speed or operating mode - even after a safeguarded stop, a process stop, a program stop, or a power failure.

The very accurate path and speed are based on advanced dynamic modelling.

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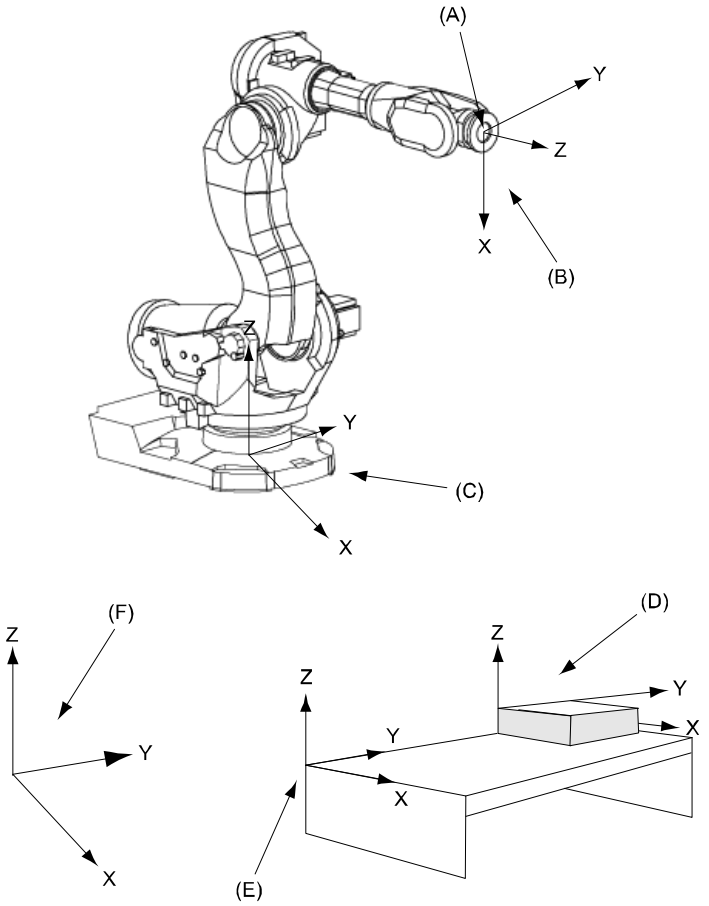
Coordinate systems



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Pos	Description
A	Tool Center Point (TCP)
B	Tool coordinates
C	Base coordinates
D	Object coordinates
E	User coordinates
F	World coordinates

System	Description
Coordinate systems	RobotWare includes a very powerful concept of multiple co-ordinate systems that facilitates jogging, program adjustment, copying between robots, off-line programming, sensor based applications, additional axes co-ordination etc. Full support for TCP (Tool Center Point) attached to the robot or fixed in the cell ("Stationary TCP").
World coordinate system	The world coordinate system defines a reference to the floor, which is the starting point for the other coordinate systems. Using this coordinate system, it is possible to relate the robot position to a fixed point in the workshop. The world coordinate system is also very useful when two robots work together or when using a robot carrier.

Continues on next page

System	Description
Base coordinate system	The base coordinate system is attached to the base mounting surface of the robot.
Tool coordinate system	The tool coordinate system specifies the tool's center point and orientation.
User coordinate system	The user coordinate system specifies the position of a fixture or workpiece manipulator.
Object coordinate system	The object coordinate system specifies how a workpiece is positioned in a fixture or workpiece manipulator. The coordinate systems can be programmed by specifying numeric values or jogging the robot through a number of positions (the tool does not have to be removed). Each position is specified in object coordinates with respect to the tool's position and orientation. This means that even if a tool is changed because it is damaged, the old program can still be used, unchanged, by making a new definition of the tool. If a fixture or workpiece is moved, only the user or object coordinate system has to be redefined.
Stationary TCP	When the robot is holding a work object and working on a stationary tool, it is possible to define a TCP for that tool. When that tool is active, the programmed path and speed are related to the work object.
Program displacement	If the location of a workpiece varies from time to time, the robot can find its position by means of a digital sensor. The robot program can then be modified in order to adjust the motion to the location of the part.

Additional features

System	Description
Program execution	The robot can move in any of the following ways: • Joint motion (all axes move individually and reach the programmed position at the same time). • Linear motion (the TCP moves in a linear path). • Circle motion (the TCP moves in a circular path).
Soft servo	Soft servo - allowing external forces to cause deviation from programmed position - can be used as an alternative to mechanical compliance in grippers, where imperfection in processed objects can occur. Any motors (also additional) can be switched to soft servo mode, which means that it will adopt a spring-like behavior.
Jogging	The robot can be manually operated in any one of the following ways: • Axis-by-axis, that is one axis at a time. • Linearly, that is the TCP moves in a linear path (relative to one of the coordinate systems mentioned above). • Reoriented around the TCP. It is possible to select the step size for incremental jogging. Incremental jogging can be used to position the robot with high precision, since the robot moves a short distance each time the joystick is moved. During manual operation, the current position of the robot and the additional axes can be displayed on the FlexPendant.

Continues on next page

System	Description
Singularity handling	The robot can pass through singular points in a controlled way, that is points where two axes coincide.
Motion supervision	The behavior of the motion system is continuously monitored in regards to position and speed level to detect abnormal conditions and quickly stop the robot if something is not OK. A further monitoring function, Collision Detection, is optional, see option *Collision detection [3107-1] on page 169*.
Big inertia	One side effect of the dynamic model concept is that the system can handle very big load inertias by automatically adapting the performance to a suitable level. For big, flexible objects it is possible to optimize the servo tuning to minimize load oscillation.
Load identification	The robot can automatically identify the load properties and thus ensures a correct dynamic model of the total arm system. This leads to optimum performance and life time, without need for cumbersome manual calculations or measurements. Load identification is available for most robots, and positioners (IRP). For more information, see *Operating manual - OmniCore*. It is also possible to tune the parameters in the mounting stiffness to compensate for a non rigid mounting frame.

4.5 I/O system

Fieldbus master/slave

There are options available for different fieldbus types and there are separated options for master and slave.

Option	Description	Master/Slave	Number of I/O devices
DeviceNet™	PCIe card certified by ABB included	Yes/Yes	20
PROFINET IO	Software based	Yes/Yes	50
EtherNet/IP	Software based	Yes/Yes	20 (4,049 signals/device)
CC-Link IE Field Basic	Software based	Yes/Yes	N/A

Multiple fieldbuses can be installed and configured on both LAN and WAN in parallel with both master and slave. Limitation: Only one software based master can be used. Maximum total number of I/O devices is 50.

For all bus types commercially available third party I/O devices can be used.

For more information, see *Industrial networks & fieldbuses on page 130*.

System signals

Signals can be assigned to special system functions such as program start, so as to be able to control the robot from an additional panel or PLC. Several signals can be given the same functionality.

Note

For more information on system signals, see *Technical reference manual - System parameters*.

Digital inputs

- Backup
- Collision Avoidance
- Disable backup
- Interrupt
- Limit Speed
- Load
- Load and Start
- Motors Off
- Motors On
- Motors On and Start
- PP to Main
- ProfiSafeOpAck
- Quick Stop
- Reset Execution Error Signal

Continues on next page

4.5 I/O system
Continued

- SimMode
- Start
- Start at Main
- Stop
- Stop at End of Cycle
- Stop at End of Instruction
- System Restart
- Trust Revolution Counter
- Verify Local Presence
- Verify Move Robot in Auto
- Write Access

Digital outputs

- Absolute Accuracy Active
- Auto On
- Backup Error
- Backup in Progress
- Collision Avoidance
- Cycle On
- Emergency Stop
- Execution Error
- Limit Speed
- Mechanical Unit Active
- Mechanical Unit Not Moving
- Motion Supervision On
- Motion Supervision Triggered
- Motors Off
- Motors Off State
- Motors On
- Motors On State
- Path Return Region Error
- Power Fail Error
- PP Moved
- Production Execution Error
- Revolution Counter Lost
- Robot In Trusted Position
- Run Chain OK
- SimMode
- Simulated I/O
- SMB Battery Charge Low
- Speed Override

Continues on next page

- System Input Busy
- TaskExecuting
- TCP Speed
- TCP Speed Reference
- Temperature Warning
- Write Access

Analog outputs

- TCP Speed
- TCP Speed Reference

General I/O

The inputs and outputs can be configured to suit your installation.

- Each signal and unit can be given a name, for example *Gripper*, or *Feeder*
- I/O mapping (that is a physical connection for each signal)
- Polarity (active high or low)
- Cross connections
- Up to 32 digital signals can be grouped together and used as a single signal when, for example, entering a bar code
- Sophisticated error handling
- Selectable trust level (that is what action to take when a unit is "lost")
- Program controlled enabling/disabling of I/O units
- Scaling of analog signals
- Filtering
- Pulsing
- TCP-proportional analog signal
- Programmable delays
- Virtual I/O (for forming cross connections or logical conditions without need for the physical hardware)
- Accurate coordination with motion

Manual functions

Manual functions are available to:

- List all the signal values
- Create your own list of your most important signals
- Manually change the status of an output signal

Continues on next page

Scalable I/O

Introduction

Scalable I/O is a modular, compact, and scalable I/O system that consists of a base unit, which is the minimum configuration, and add-on units. Up to four add-on units can be controlled by a base unit with maintained performance (it may be reduced depending on controller variant), and any combination of add-on units are supported.

When using the standard Plug & Produce interface no additional RobotWare options or hardware options are required to connect to the robot controller.

The add-on devices have an optical interface and must be attached to the base device. The additional Ethernet port on the base device can be used to daisy chain any Ethernet based equipment on the same network, for example additional base devices.

The following I/O devices are available:

- Base module with industrial network connectivity, 16 digital inputs, and 16 digital outputs.
- Add-on module with 16 digital inputs and 16 digital outputs.
- Add-on module with 4 analog inputs and 4 analog outputs.
- Add-on module with 8 digital inputs and 8 relay outputs.

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See *Scalable I/O on page 140*.

Features

- Easy to install.
- Easy to configure in RobotWare with support of the new Plug & Produce interface.
- Compact and scalable.
- Can be mounted inside the controller and/or distributed outside.
- Supports standard DIN-rail mounting.

Continues on next page

- Galvanically isolated add-on devices.
- Dual port switch for Daisy chaining.

Digital I/O electrical data

Supply voltage	21-28 V DC
Output current, nominal	500 mA per output, short circuit protected
Input voltage levels	0-5 V digital low 15-30 V digital high
Input current	<0.5 mA

Analog I/O electrical data

Input voltage	0 - +10 V
Output voltage	0 - +10 V
Resolution	12 bit

Relay I/O electrical data

Max voltage	230 V AC per contact
Max current	2 A per contact

Safety digital base device

The safety I/O unit *DSQC1042 Safety Digital Base* is a device that can be used to control and monitor machine safety equipment in a system. The device can be used together with the add-on devices. It uses dual channels, meaning that no undetected single fault can lead to loss of safety functions.

For more information, see *Application manual - Scalable I/O*.

4.6 Memory

DRAM memory

The DRAM memory is used for runtime storage of the system software, volatile data and power fail protected data.

The size and the free space of the DRAM memory can be seen in the window *System Info* on the FlexPendant.

Mass memory

The mass memory is used for permanent storage of firmware, products, system internal data and user data.

The total size and the free space of the mass memory can be seen in the window *System Info* on the FlexPendant.

RAPID memory

The RAPID memory consists of an internal representation of the RAPID programs and data. The memory also contains runtime stacks and data that are needed for the RAPID interpreter.

The RAPID memory is power fail protected and therefore the programs and data do not need to be reloaded after system powered off/on.

The total available memory for user programs can vary depending on the number of installed RobotWare options. The total size of the RAPID memory is statically allocated and will not vary during runtime.

The total size and the free space of the RAPID memory can be seen in the window *System Info* the FlexPendant.

The storage allocated for the programs depends on the type of data and instructions that are used and not on the size of the program files on disk, see *Example of RAPID memory consumption on page 68*.

Example of RAPID memory consumption

For details on RAPID memory consumption, see *Technical reference manual - RAPID kernel*.

Introduction	Robtarget marked (*)	Robtarget named
MoveL or MoveJ	312 bytes	552 bytes

4.7 Programming

4.7.1 Overview of programming

General

Programming the robot can be done by RAPID programming language and both from the FlexPendant or RobotStudio. Instructions and arguments are picked from lists of appropriate alternatives.

Wizard is a programming application available on the FlexPendant for the small and collaborative robots, see *Wizard programming on page 75*.

Programming environment

The programming environment can be easily customized:

- Shop floor language can be used to name programs, signals, counters, etc
- New instructions with suitable names can be created
- The most common instructions can be collected in easy-to-use pick lists
- Positions, registers, tool data, or other data, can be created

Programs, parts of programs, and any modifications can be tested immediately without having to translate (compile) the program.

Movements

A sequence of movements is programmed as a number of partial movements between the positions to which you want the robot to move.

End position

The end position of a movement is selected either by manually jogging the robot to the desired position, by referring to a previously defined position or by defining numeric values.

Position types

A position can be defined either as:

- a stop point, that is the robot reaches the programmed position.
- or a fly-by point, that is the robot passes close to the programmed position. The size of the deviation is defined independently for the TCP, the tool orientation and the additional axes.

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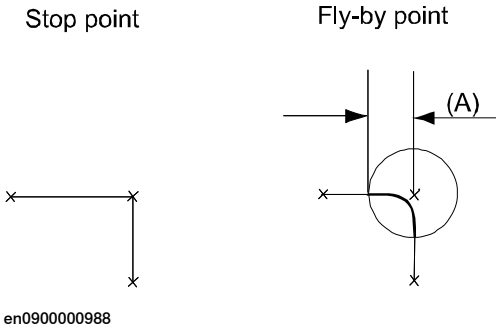
4.7.1 Overview of programming
Continued



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A	User definable distance (in mm).

Velocity

The velocity may be specified in the following units:

- mm/s
- seconds (time it takes to reach the next programmed position)
- degrees/s (for reorientation of the tool or for rotation of an additional axis)

Program management

When saving a program to disk, the program is a folder containing the program file, and the files that contain the modules. All these files are loaded when loading a program. If needed, other modules can be loaded when executing.

The modules are stored as normal PC text files, which means they can be edited using a standard PC.

Editing programs

Programs can be edited using standard editing commands, that is, cut-and-paste, copy, delete, etc. Individual arguments in an instruction can also be edited using these commands.

A robot position can easily be changed either by:

- jogging the robot to a new position and then pressing *Modify Position* (this registers the new position)
- entering or modifying numeric values

To prevent unauthorized personnel from making program changes, user authorization system can be used.

Testing programs

Several helpful functions can be used when testing programs. For example, it is possible to:

- start from any instruction
- execute an incomplete program
- run a single cycle
- execute forwards/backwards step-by-step
- simulate wait conditions
- temporarily reduce the speed

Continues on next page

- change a position

For more information, see *Operating manual - OmniCore* and *Operating manual - RobotStudio*.

4.7.2 Automatic operation

General

A dedicated production window with commands and information required by the operator is displayed during automatic operation.

The operation procedure can be customized to suit the robot installation by means of user-defined displays and dialogs.

The robot can be ordered to go to a service position when a specific signal is set. After service, the robot is ordered to return to the programmed path and continue program execution.

Special routines

You can also create special routines that will be automatically executed when the power is switched on, at program start and on other occasions. This allows you to customize each installation and to make sure that the robot is started up in a controlled way.

Automatic restore of parameters and I/O at power on

The robot is equipped with absolute measurement, making it possible to operate the robot directly when the power is switched on. For your convenience, the robot saves the used path, program data and configuration parameters so that the program can be easily restarted from where you left off. Digital outputs are also set automatically to the value prior to a power failure if this behavior has been selected.

4.7.3 RAPID language and programming environment

General

The RAPID language is a well balanced combination of simplicity, flexibility and power. It contains the following concepts:

- Hierarchical and modular program structure to support structured programming and reuse
- Routines can be *Functions* or *Procedures*
- Local or global data and routines
- Data typing, including structured and array data types
- User defined names on variables, routines, and I/O
- Extensive program flow control
- Arithmetic and logical expressions
- Interrupt handling
- Error handling (for exception handling in general, see *Error handling on page 74*)
- User defined instructions (appear as an inherent part of the system)
- Backward handler (user definition of how a procedure should behave when stepping backwards)
- Many powerful built-in functions, for example mathematics and robot specific
- Unlimited language (no maximum number of variables etc., only memory limited). Built-in RAPID support in user interfaces, for example user defined pick lists, facilitate working with RAPID.
- Support for Unicode symbols in strings and comments

4.7.4 Error handling

General

Many advanced features are available to make fast error recovery possible. The error recovery features easily adapt to a specific installation in order to minimize downtime.

Examples

- Error Handlers (automatic recovery often possible without stopping production)
- Restart on path
- Power failure restart
- Service routines
- Error messages: plain text with remedy suggestions, user defined messages
- Diagnostic tests
- Event logging

4.7.5 Wizard programming

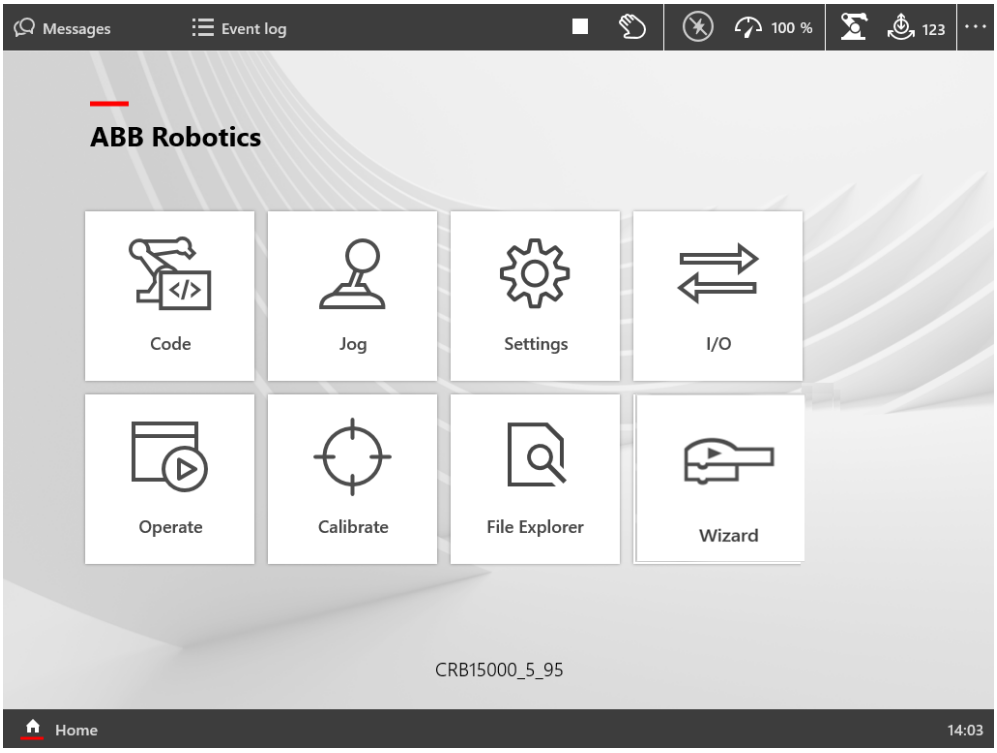
General

The Wizard is an easy programming application on the FlexPendant for GoFa, SWIFTI, and YuMi robots. Wizard provides an easy and interactive programming means, enabling users to program by simply combining visible instruction blocks and setting pre-defined parameters.

It is easy to use by dragging blocky instructions and organizing it, RAPID instructions are generated and downloaded to the controller automatically without need to edit RAPID codes.

The Wizard programming contains the following functions:

- Moving the fingers
- Controlling the fingers and suction cups
- Performing picking and placing
- Working with I/O signals



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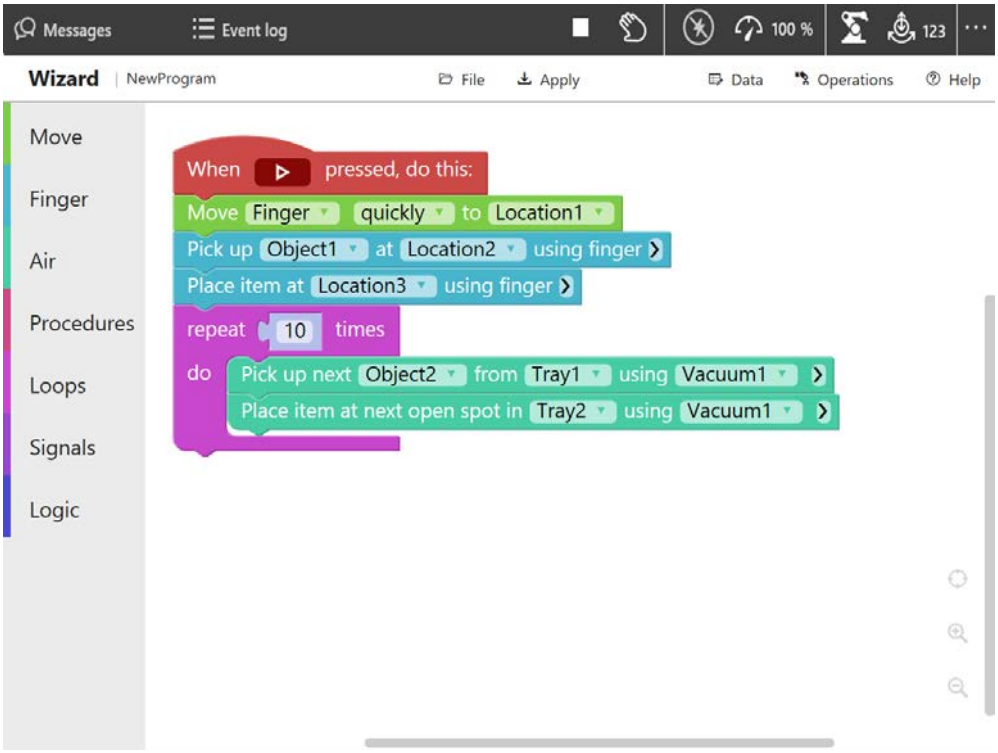
4.7.5 Wizard programming
Continued



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The Wizard programming requires the following options for IRB 14050:

- *Collision Detection* [3107-1]
- *Multitasking* [3114-1]

5 Operator interface

5.1 FlexPendant

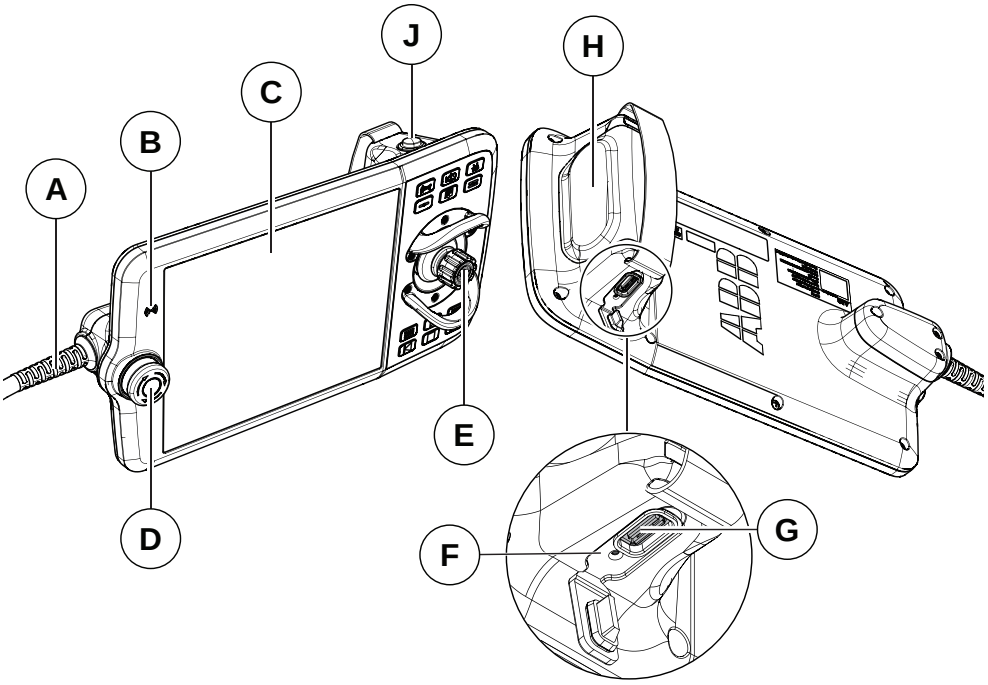
General

The FlexPendant is a handheld operator unit that is used to perform many of the tasks involved when operating a robot system, such as running programs, jogging the manipulator, programming and modifying robot programs, and so on.

The FlexPendant is designed for continuous operation in harsh industrial environment. The touch screen is easy to clean and resistant to water, oil, and accidental welding splashes. The FlexPendant hardware is IP54 rated.

The capabilities of the FlexPendant is dependent on which FlexPendant software options are available.

Main parts of the FlexPendant



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A	Connector
B	RFID reader (functionality not yet implemented)
C	Touchscreen
D	Emergency stop device
E	Joystick
F	Reset button
G	USB port
H	Three-position enabling device

Continues on next page

5.1 FlexPendant
Continued

J	Thumb button. Manual hold to run full speed button [i]

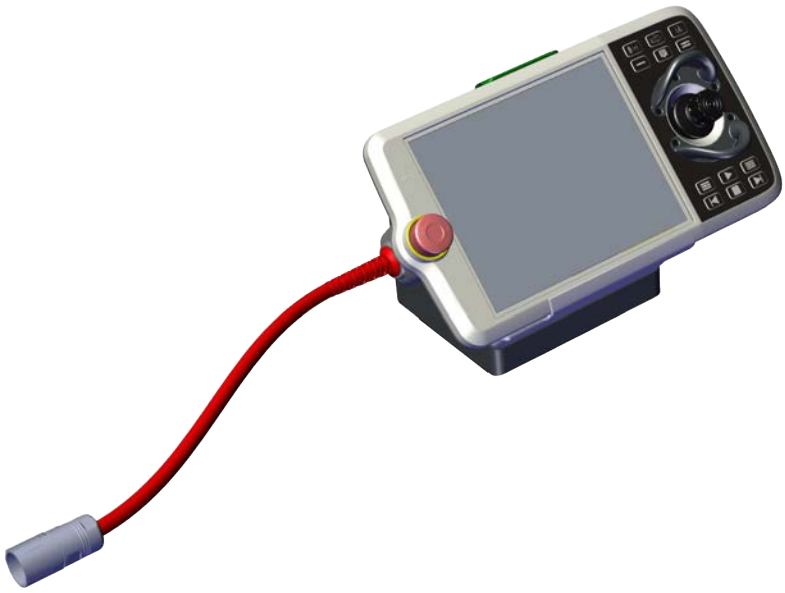
[i] Functionality not available in all markets.

Features	Description
Touchscreen display	An 8" color display which displays text as well as graphical information. User input is entered by pressing menu commands, push buttons etc. with the finger or with the supplied stylus on the display. **Note** If protective gloves are used, these must be compatible with touchscreens when using the FlexPendant.
Manual hold to run full speed button	One of the program execution keys must be pressed continuously when running the program in manual mode with full speed.
Joystick	The 3D joystick is used to jog (move) the robot manually, for example when programming the robot. Large deflections of the joystick will move the robot quickly, smaller deflections will move it more slowly.
Emergency stop button	The robot stops immediately when the button is pressed in.
Left handed users	The display will adapt to left handed users by automatically rotating the display and invert the joystick directions.
IP 54 classification	Protected to dust and splashing of water.

FlexPendant holder

The FlexPendant should always be placed in the holder when it is not used and it is not allowed to use by unauthorized person.

The FlexPendant holder can be split in 2 parts which enables to mount the holder horizontally or vertically. It is possible to hang the FlexPendant holder with the bracket.



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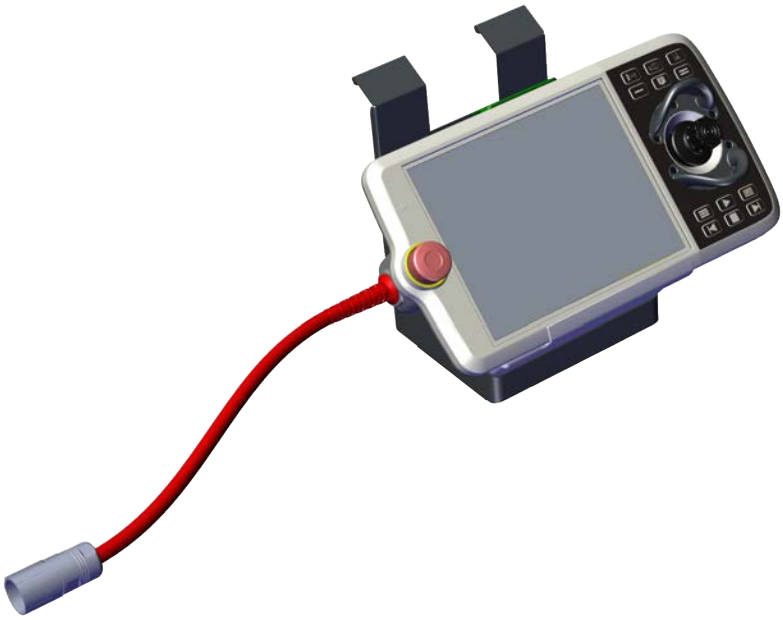

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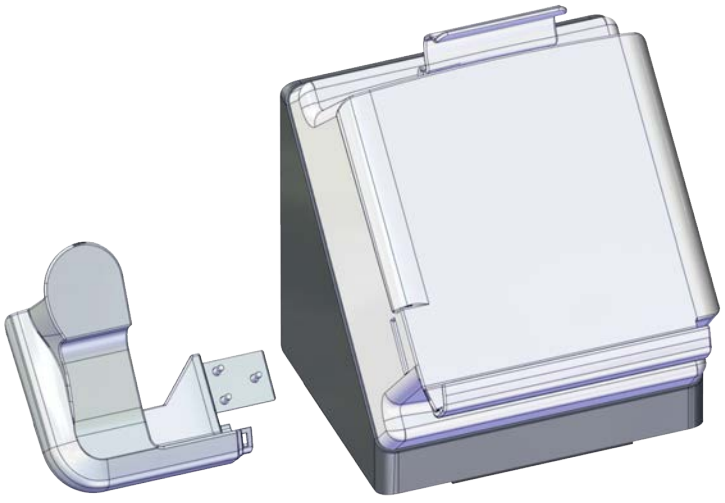
E-stop cover

The E-stop cover can be mounted by users after risk analysis of the finished production cell. See OmniCore product manual - *Mounting the bracket for the emergency stop on the FlexPendant holder* for more details.



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5.1 FlexPendant
Continued

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FlexPendant options

FlexPendant hardware options are separated from the software options/apps.

Hardware options

Hardware options	Description
3016-x FlexPendant	The FlexPendant hardware device. Available with 3, 10, or 30 meters cable length. Requires option FlexPendant base apps [3120-x].
3017-x FlexPend ext cable	Extension cables. Available with 15, 22, or 30 meters cable length.
3018-1 Hot swappable FlexP.	The possibility to remove and attach the FlexPendant during operation. Used to share FlexPendant between several robots. Requires option FlexPendant base apps [3120-x].

See *Human machine interface on page 126*.

Software options

Software options	
3120-1 Limited App Package	Software to be able to jog, calibrate, operate, and work with basic settings.
3120-2 Essential App Package	Additional features making it easy and efficient working with the robot system. Includes 3120-1 Limited App Package.
3151-1 Program Package	The tools needed for creating new programs and configurations on the FlexPendant.

See *FlexPendant base apps on page 184* and *FlexPendant independent apps on page 189*.

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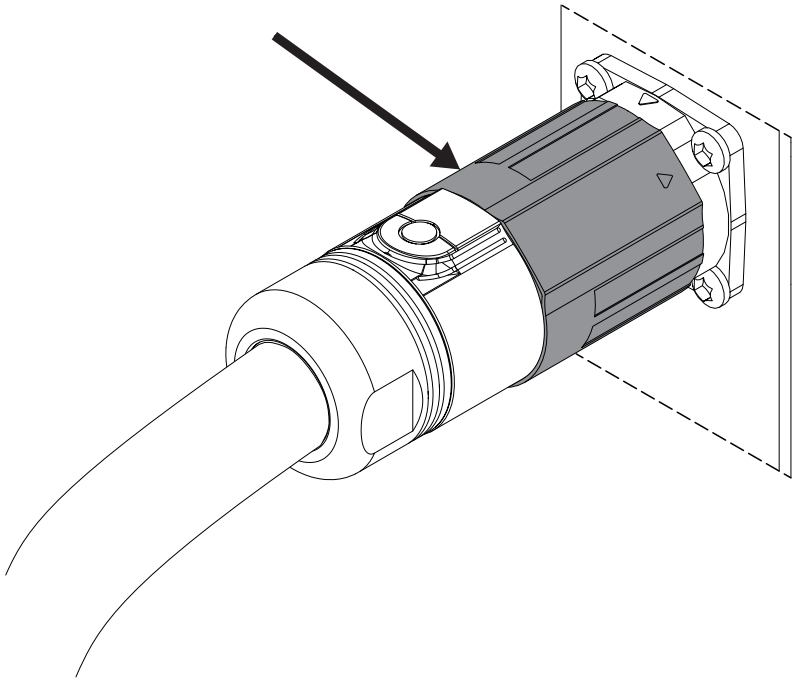
For more information about what functionality is available in the different options, see *FlexPendant applications on page 82*.

Connecting the FlexPendant

The controller must be in manual mode when connecting the FlexPendant.

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

Plug in the connector on the controller and tighten the locking ring.



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> **CAUTION**
>
> Make sure that the emergency stop button is not pressed in when connecting the FlexPendant.

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5.1.1 FlexPendant applications

The FlexPendant applications

The FlexPendant contains applications for controlling the robot. There are different application packages depending on the options selected for the robot. The *Limited App Package* is always included, unless another app package is selected.

There are more applications available than those listed below. These can be specific for the selected products and options, for example, application software, or applications for controlling grippers and tools.

Code

The **Code** application is used to create new programs, modify existing programs, and so on.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Create new programs, edit existing programs			✓
View and edit RAPID modules and RAPID routines			✓
Debug Options PP to main, cursor to program pointer, goto position, call routine, cancel routine, check program, view system data, next move instruction			✓
Teach position (ModPos)			✓
Check for syntactic and semantic error			✓

If the option *Program Package* is not selected then programs must be created and edited using RobotStudio.

Program Data

The **Program Data** application is used to view and edit RAPID data.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
View and edit RAPID data (program data)			✓
Manage payload data	✓	✓	
Manage tool data	✓	✓	
Manage work object data	✓	✓	

Jog

The **Jog** application is used to jog the ABB industrial robot using an intuitive touch based user interface or using a joystick.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Joystick jog	✓	✓	

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Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Touch jog		✓	
Align tool		✓	
Lead-through	✓[1]	✓[1]	
Jog supervision	✓	✓	
GoTo (jog to target)		✓	
3D visualization	✓	✓	

Settings

The **Settings** application is used to configure the general settings of OmniCore controller and FlexPendant. Controller configuration includes Network, ABB Connected Services, Time and Language, Backup, Restore, System diagnostics and so on. FlexPendant configuration includes background settings and programmable keys.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
System About, hardware devices, software resources	✓	✓	
Network Status, WAN settings, DNS Client	✓	✓	
ABB Connected Services Status, Connected Services status, configure 3G/WiFi/wired Status, Connected Services status, configure 4G/3G/Wi-Fi/wired	✓	✓	
Configure Connected Services	✓	✓	
Backup and Recovery Backup, restore, system diagnostics, restart, reset user data, RobotWare Installation Utilities	✓	✓	
Date & time	✓	✓	
Region & language	✓	✓	
Programmable keys	✓	✓	

I/O

The **I/O** application is used to manage the I/O signals. Signals are configured with system parameters.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Show industrial networks	✓	✓	
View all I/O signals	✓	✓	

1 Only applicable for compatible manipulators, currently IRB 14050 and CRB 15000.

Continues on next page

5.1.1 FlexPendant applications
Continued

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Display I/O signals with respect to category	✓	✓	
Filter signals	✓	✓	
Sort signals	✓	✓	
Set signals	✓	✓	
Bit values	✓	✓	
Navigate to device specific signals	✓	✓	
Identify device	✓	✓	
Scan EDS	✓	✓	
Activate and deactivate devices	✓	✓	
Start	✓	✓	
Scan	✓	✓	
Firmware upgrade	✓	✓	

Operate

The **Operate** application is used to view the program code while the program is running. Controller data can be configured for viewing the data in the form of dashboards. Updates during production are shown here.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
View dashboards		✓	
Configure dashboards		✓	
Load and execute RAPID programs	✓	✓	
View loaded RAPID programs	✓	✓	
Teach position (ModPos) of robtargets in loaded RAPID programs	✓	✓	
Reset program pointer to Main	✓	✓	
Show program pointer position	✓	✓	
Show motion pointer position	✓	✓	
Execute service routines	✓	✓	

Calibrate

The **Calibrate** application is used for calibration and definition of frames for ABB robots.

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Mechanical unit calibration	✓	✓	
Update revolution counters	✓	✓	
Edit motor offset values	✓	✓	
Load motor offset values	✓	✓	

Continues on next page

Feature	*Limited App Package* [3120-1]	*Essential App Package* [3120-2]	*Program Package* [3151-1]
Fine calibration	✓	✓	
Robot memory	✓	✓	
Base frame calibration	✓	✓	
Execute calibration specific service routines	✓	✓	

File Explorer

The File Explorer is a file manager, similar to Windows Explorer, with which you can view, rename, delete, or move files and folders on the controller or on a connected external USB drive.

Note

The file explorer supports operations on the following file formats: TXT, CFG, PNG, XML, ZIP, JPG, MOD, PGF, LOG, and MODX.

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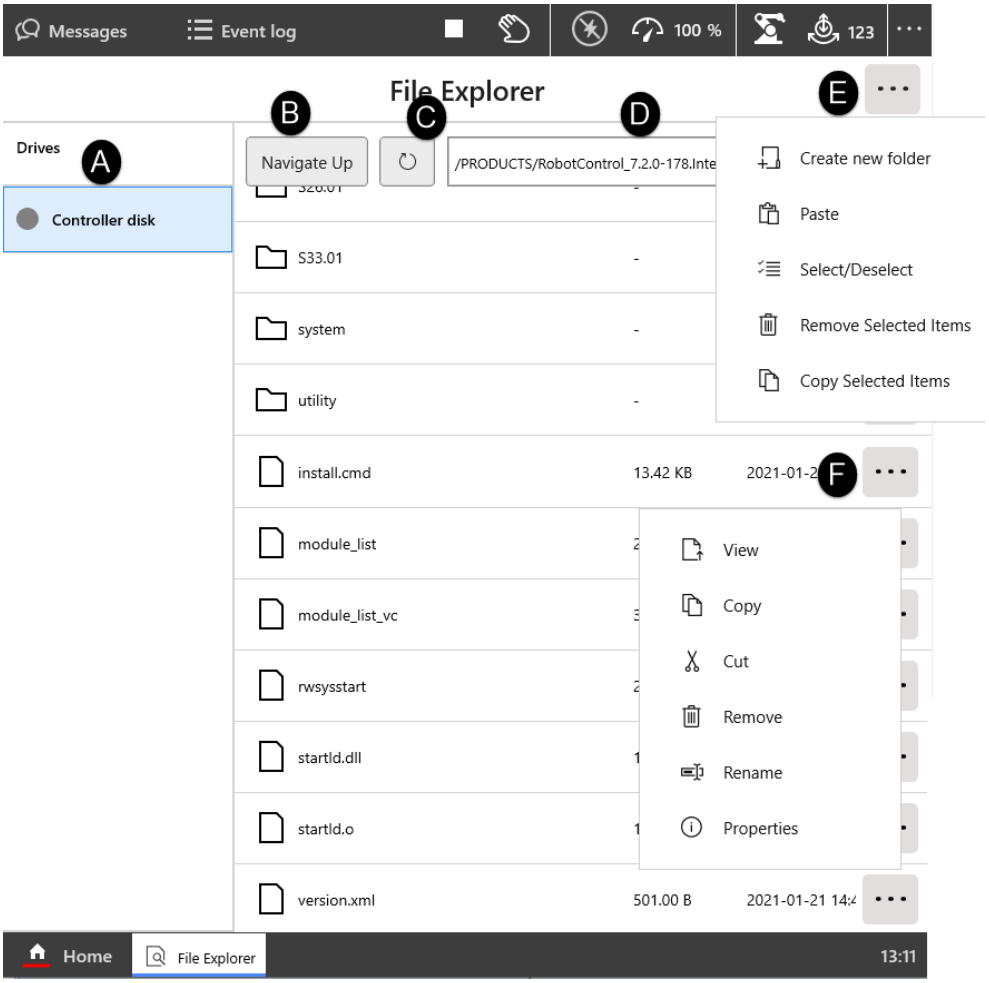
5.1.1 FlexPendant applications
Continued

To manage files and folders, from the Home screen, open **File Explorer**. The file explorer window is displayed. The following image and table provides information regarding the functions available in the file explorer window.



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Label	Description
A	Displays the available drives. If a USB drive is connected to the FlexPendant that is also displayed here.
B	Navigates to the folder up by one level.
C	Refreshes the files and folders.
D	Displays the path of the selected folder.
E	Displays the options available for a selected folder. • **Create new folder**: Creates a new folder in the selected folder. • **Paste**: Pastes the copied files or folders in the selected folder. • **Select/Deselect**: Selects or clear the selection for a set of files and folders. • **Remove Selected Items**: Removes the selected items. • **Copy Selected Items**: Copies the selected items.

Continues on next page

Label	Description
F	Displays the options available for a selected item. • **View**: Allows you to view the selected text or picture files. • **Copy**: Copies the selected item. • **Cut**: Cuts the selected item. • **Remove**: Deletes the selected item. • **Rename**: Changes the name of the selected item. • **Properties**: Displays the properties of the selected item.

Note

The following grants are required for full access to controller disk:

- **Read access to controller disks**
- **Write access to controller disks**

Without the **Read and Write access to controller disks** grant you may get access to some folders in controller disk like `/TEMP` but not all of them.

While moving the file and folders following are the possible scenarios:

- Moving files and folders within the controller disk.
- Moving files and folders from controller to USB drive and vice versa.

Note

It is not possible to move or copy files and folders within a USB drive.

SafeMove

The application **SafeMove** is used to configure some parts of SafeMove. See *Application manual - Functional safety and SafeMove*. For full SafeMove configuration, see *Visual SafeMove* in RobotStudio.

5.2 RobotStudio

Overview

RobotStudio is a PC application for working efficiently with controller data. RobotStudio can be seen as a companion to the FlexPendant, where the two complement each other and each is optimized for its specific tasks. By exploiting the benefits of this powerful combination, an efficient way of working can be achieved.

The FlexPendant is primarily intended for jogging, teach-in, operation, and touch-up, whereas RobotStudio is ideal for dealing with configuration data, program management, online documentation, and remote access.

RobotStudio acts directly on the active data in the controller. Connection to the controller can be made locally through the service PC connection and, if the controller is equipped with the RobotWare option *RobotStudio Connect [3119-1]*, over a network connection.

The mastership handling system ensures that RobotStudio can only take control of a robot if this is acknowledged from the FlexPendant in manual mode.

The main entry to the functionality of RobotStudio is a robot view explorer. From this you select which robot to work with, in case you have several robots installed, and what parts of the system you want to work with.

RobotStudio basic delivery contains:

- The **Modify Installation** function for creating, installing, and maintaining systems
- A *Configuration Editor* for editing the system parameters of the running system
- A *Program Editor* for online programming
- An *Event Recorder* for recording and monitoring robot events
- Tools for backing up and restoring systems
- An administration tool for user authorization (UAS)
- Other tools for viewing and handling controller and system properties

Access to the full scope of RobotStudio as a powerful off-line programming and simulating tool is ordered separately.

See *Operating manual - RobotStudio* for detailed information.

Configuration Editor

Use the Configuration Editor to make easy and controlled changes of system parameters on a running system.

From the configuration editor you view and edit the system parameters of a specific topic in a controller. The Configuration Editor has direct communication with the controller. This means that changes apply as soon as you complete the command.

For some parameters, however, a restart is required in order for the change to take effect, in which case you will be notified of this.

Continues on next page

Program Editor

With the Program Editor you view and edit programs loaded into the controller's program memory. The Program Editor has built in functionality for making it easier to write the RAPID code when programming a robot.

Event Recorder

With the Event Recorder you can view and save events from controllers in your robot view. You can start one Event Recorder for each controller.

Miscellaneous

RobotStudio has a number of other useful tools, for example:

- Backing up and restoring systems
- Administration tool for User Authorization
- Other tools for viewing and handling controller and system properties, for example monitoring of I/O signals

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6 ABB Connect (ABB Ability Connected Services)

General

ABB Connect is a suite of solutions that provide advanced analytics and proactive, actionable data to optimize and fine-tune performance, to ensure reliability from single robots to entire fleets of robots deployed across several factories.

Note

ABB Connected Services is the new name for the functionality previously known as ABB Ability. During a period of time, both names will appear in and on our products.

All new ABB robots come with a secure and encrypted connection via Ethernet, WiFi, or 3G/4G, between robots controller and ABB Connect cloud to ensure optimal customer data and network security.

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7 Specification of controller & RobotWare options

General

The available options for the controller and for the RobotWare are described in this section.

For details about manipulator options, see the product specification for the respective manipulator.

Continues on next page

7.1 Controller

7.1.1 Controller variant

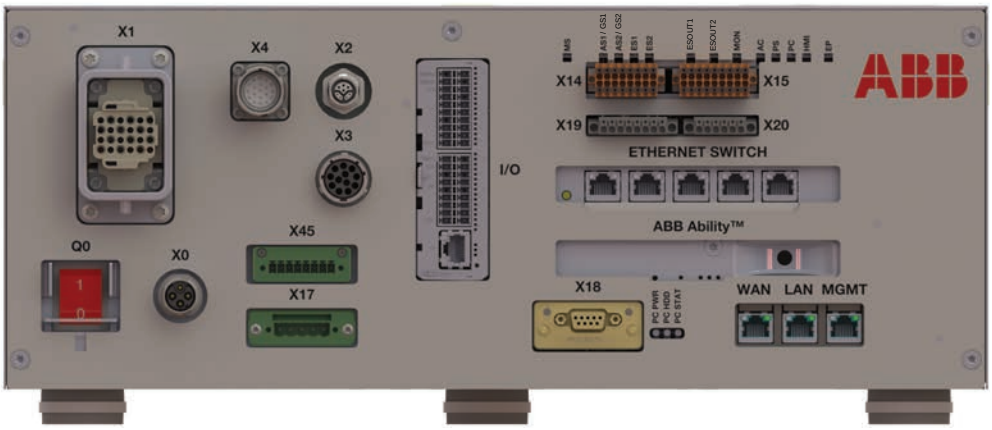
7.1.1.1 OmniCore C30 [3000-130]

General

OmniCore C30 is the first controller of the OmniCore controller family, C line compact controllers. OmniCore C30 controller offers a compact solution suitable for most applications where there is less need for additional equipment inside.

It is used to control an ABB manipulator used in an industrial application such as material handling and machine tending.

The controller contains all needed hardware to run a robot.



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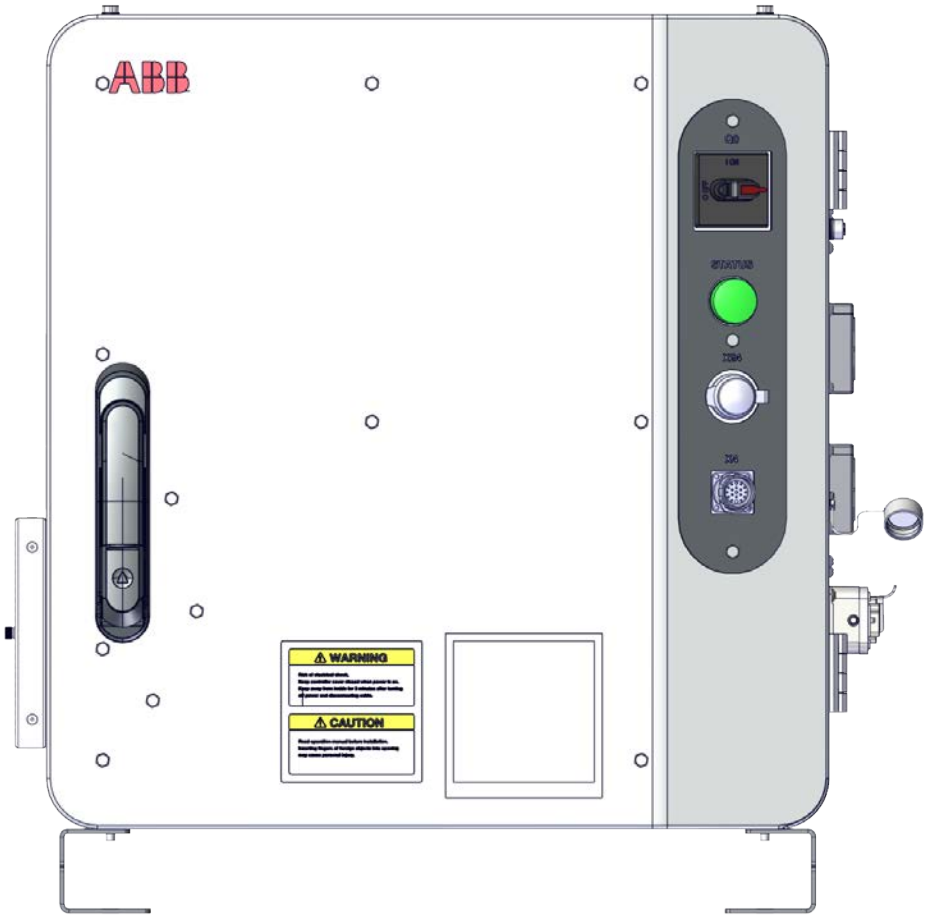
See *OmniCore C30 on page 15*.

7.1.1.2 OmniCore C90XT [3000-210]

General

OmniCore C90XT is a compact controller in OmniCore C line with protection class IP54.

The main objective for this controller is to meet the need for a compact solution for general industry paint, polishing, material handling, machine tending applications, and other applications with requirements for high IP protection class for small robots or relatively power intensive low voltage robots.



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See *OmniCore C90XT on page 26*.

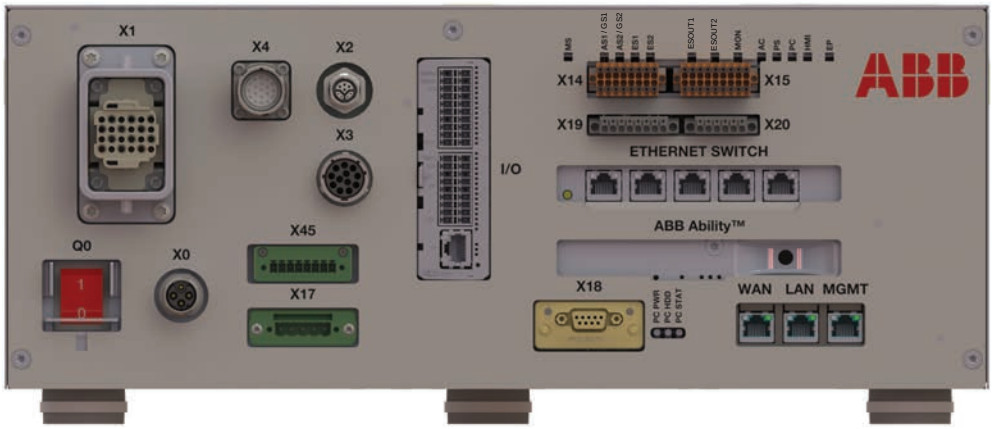
7.2 Controller encapsulation

7.2.1 Base [3001-1]

General

The Base encapsulation option is the basic encapsulation for OmniCore C30 and it is a built-in encapsulation available in two variants:

- 19" rack mounting kit
- Vertical mounting kit



xx1800003670

Limitations

This option is only possible to order with controller variant *OmniCore C30* [3000-130].

7.2.2 Desktop [3001-2]

General

The encapsulation option Desktop is optimized for open visible placement with clear intuitive HMI.

This option can be chosen when the controller is put on the table. The option is an additional industrial design cover for the basic cabinet encapsulation.

xx1800003674

Limitations

This option is only possible to order with controller variant *OmniCore C30* [3000-130].

7.3 Built-in mounting kit

7.3.1 19" rack mounting kit [3002-1]

General

This option can be chosen when the controller is put into the 19" cabinet, this option is an additional fitting structure for 19" cabinet.

Rack mounted is very efficient way to save floor space and keep the controller protected from tough environments.

xx1800003675

Requirements

The option *19" rack mounting kit* requires option *Base* [3001-1].

Limitations

This option is only possible to order with controller variant *OmniCore C30* [3000-130].

7.3.2 Vertical mounting kit [3002-2]

General

This option can be chosen when the controller is installed vertically, this option is an additional supporting structure for vertical installation.

It is also included a hanging bracket for hanging the controller on its back.

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Continues on next page

7.3.2 Vertical mounting kit [3002-2]
Continued

xx1800003677

Requirements

The option *Vertical mounting kit* requires option *Base* [3001-1].

Limitations

This option is only possible to order with controller variant *OmniCore C30* [3000-130].

7.4 Extension box

7.4.1 Extension box [3047-1]

General

The option *Extension box* provides IP54 compartment for additional process equipment such as conveyor tracker, vision for picker, external axes.

The *Extension box* provides the following features:

- A customer space of 11 liters encapsulation with dimensions 190*400*150 mm
- The empty *Extension box* supports maximum 65W power for customer equipment
- The box can be placed remotely from OmniCore C90XT controller, for example together with a conveyor tracking unit, PLC etc.

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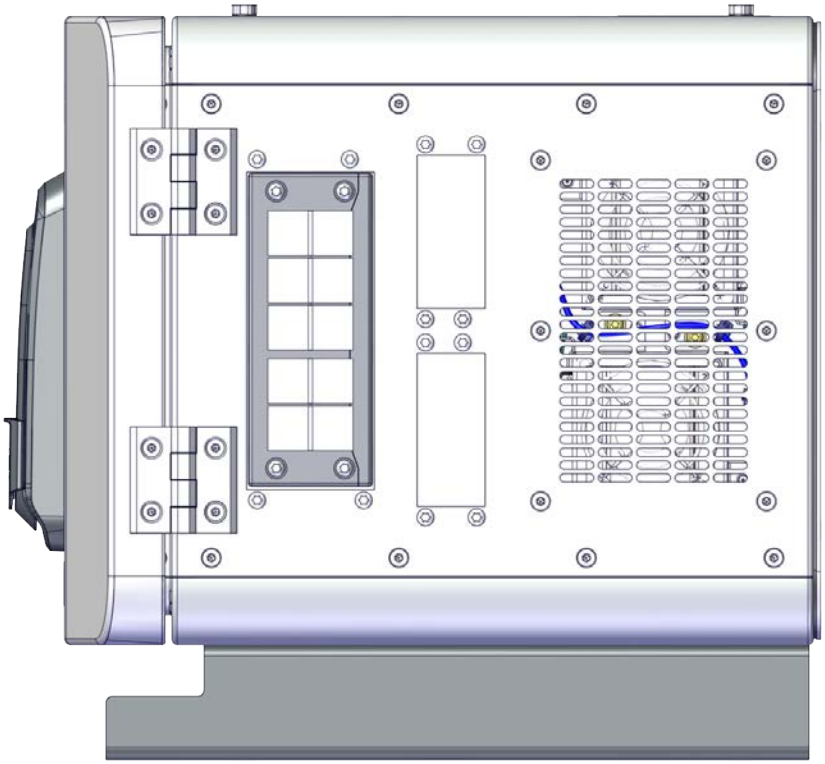
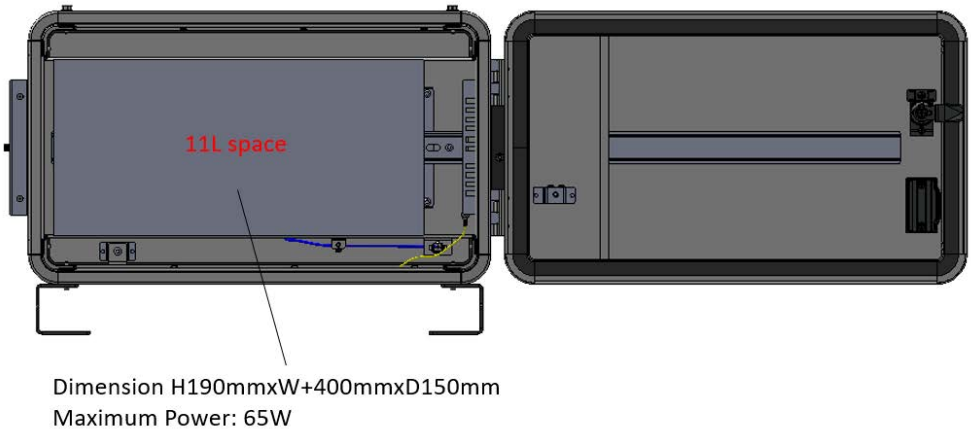
7.4.1 Extension box [3047-1]

Continued



xx2000000347



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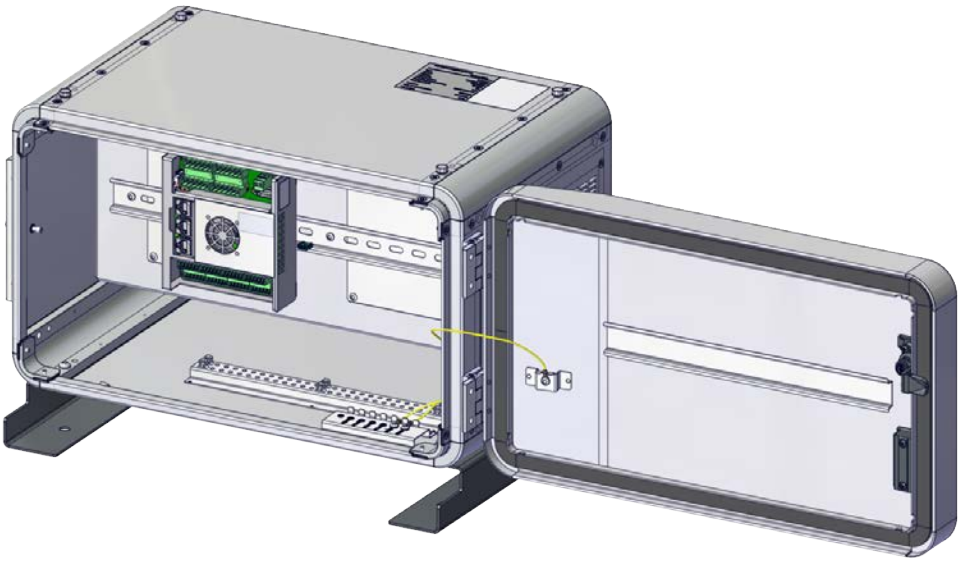

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7.4.1 Extension box [3047-1]
Continued

Stacking the controller with the extension box

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Limitations

The option *Extension box* is only possible to order with controller variant *OmniCore C90XT* [3000-210].

7.5 Controller specification for the collaborative robot

7.5.1 Collaborative robot

7.5.1.1 PROFISafe package [3063-1]

General

This bundle package includes the mandatory options to use the PROFISafe laser scanner with CRB 1100 and CRB 1300.

Requirements

The option *Profisafe package* includes the options listed below:

- *Base Dig. 16In/16Out* [3032-1]
- *SafeMove Collaborative* [3043-3]
- *PROFIsafe scanner* [3051-1]
- *RobotStudio Connect* [3119-1]
- *Multitasking* [3114-1]
- *RW Add-In prepared* [3121-1]
- *Ethernet, Parallel, Air* [3303-2]
- *Parallel cable - Length* [3201-x]
- *PROFINET Controller* [3020-1]
- *PROFINET Device* [3020-2]
- *PROFIsafe Controller* [3023-1]
- *PROFIsafe Device* [3023-2]

Limitations

The option *PROFISafe package* is currently only available for CRB 1100 and CRB 1300 variants.

For CRB 1100, it is only possible to order with controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to order with controller variant *OmniCore C30* [3000-130] and *OmniCore C90XT* [3000-210].

7.5.1.2 IO Package [3063-2]

General

This bundle package includes the mandatory options to use the OSSD based laser scanner with CRB 1100 and CRB 1300.

Requirements

The option *IO Package* includes the options listed below:

- *SafeMove Collaborative* [3043-3]
- *I/O scanner* [3051-2]
- *Multitasking* [3114-1]
- *RW Add-In prepared* [3121-1]
- *Ethernet, Parallel, Air* [3303-2]
- *Parallel cable - Length* [3201-x]
- *Base Dig. 16In/16Out* [3032-1]
- *Safe base Dig. 6In/2Out* [3037-2]
- *RobotStudio Connect* [3119-1]

Limitations

The option *IO Package* is currently only available for CRB 1100 and CRB 1300 variants.

For CRB 1100, it is only possible to order with controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to order with controller variant *OmniCore C30* [3000-130] and *OmniCore C90XT* [3000-210].

7.5.1.3 Dual PROFISafe package [3063-3]

General

This bundle package includes the mandatory options to use the PROFISafe laser scanners with CRB 1100 and CRB 1300.

Requirements

The option *Dual Profisafe package* includes the options listed below:

- *Base Dig. 16In/16Out* [3032-1]
- *SafeMove Collaborative* [3043-3]
- *Multitasking* [3114-1]
- *RW Add-In prepared* [3121-1]
- *Ethernet, Parallel, Air* [3303-2]
- *Parallel cable - Length* [3201-x]
- *Dual PROFIsafe scanner* [3051-3]
- *RobotStudio Connect* [3119-1]
- *PROFINET Controller* [3020-1]
- *PROFINET Device* [3020-2]
- *PROFIsafe Controller* [3023-1]
- *PROFIsafe Device* [3023-2]

Limitations

The option *Dual PROFISafe package* is currently only available for CRB 1100 and CRB 1300 variants.

For CRB 1100, it is only possible to order with controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to order with controller variant *OmniCore C30* [3000-130] and *OmniCore C90XT* [3000-210].

7.5.1.4 Dual IO Package [3063-4]

General

This bundle package includes the mandatory options to use the OSSD based laser scanners with CRB 1100 and CRB 1300.

Requirements

The option *Dual IO Package* includes the options listed below:

- *SafeMove Collaborative* [3043-3]
- *Dual I/O scanner* [3051-4]
- *Multitasking* [3114-1]
- *RW Add-In prepared* [3121-1]
- *Ethernet, Parallel, Air* [3303-2]
- *Parallel cable - Length* [3201-x]
- *RobotStudio Connect* [3119-1]
- *Base Dig. 16In/16Out* [3032-1]
- *Safe base Dig. 6In/2Out* [3037-2]

Limitations

The option *Dual IO Package* is currently only available for CRB 1100 and CRB 1300 variants.

For CRB 1100, it is only possible to order with controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to order with controller variant *OmniCore C30* [3000-130] and *OmniCore C90XT* [3000-210].

7.6 Floor cables

7.6.1 Mains cable

Mains cable [3203]

A mains cable will come pre-assembled for connecting the controller to a power outlet or wall connection box.

Note

The requirement for the power can be found in the the product specification for the respective manipulator, in the section for technical data (voltage, current, residual current etc.).

Option	Lengths	Description
3203-1	EU mains cable, 3 m	Cable assembly with CEE7/VII line-side plug  xx2200001743
3203-2	UK mains cable, 3 m	Cable assembly with BS1363 line-side plug, 5A fused  xx2200001744
3203-3	US mains cable, 3 m	Cable assembly with NEMA5-15 line-side plug  xx2200001745
3203-4	JP mains cable, 3 m	Cable assembly with JIS8303 line-side plug  xx2200001746

Continues on next page

Option	Lengths	Description
3203-5	CN mains cable, 3 m	Cable assembly with CPCS-CCC line-side plug  xx2200001747
3203-6	AU mains cable, 3 m	Cable assembly with AS/NZS 3112 line-side  xx2200001748
3203-7	All regions cable, 5 m	Cable assembly without line-side plug  xx2200001749

Limitations

The option Mains cable [3203-x] is only available for OmniCore C30.

The options [3203-2, -3, -4] are only available for IRB 14050.

7.7 Environment

7.7.1 Operating temperature

7.7.1.1 Max 45deg [3004-1]

General

The option *Max 45deg* [3004-1] allows room temperature up to 45°C.

7.7.2 Cooling air filter

General

The air filter module prevents particles from entering air ducts thereby protecting fans and preventing build-up of debris on the drive and power supply heat exchangers, which could reduce the cooling efficiency.

A course or fine filter may be fitted depending on the level of ambient dust.

The air filter module is a serviceable item and should at such come in few variants that are easily replaced by a service technician. The design of the air filter makes it easy to maintain.

The air filter module is available in the two variants: *Moist particle filter* and *Moist dust filter*.

Air filter

xx1900002147

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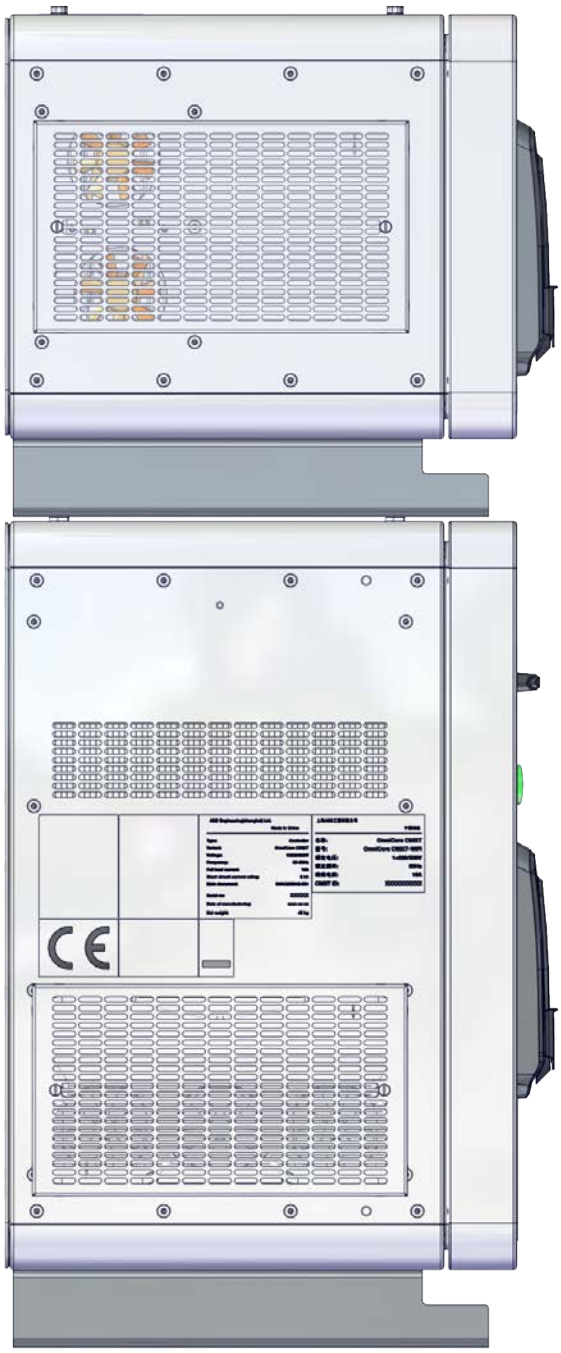
7.7.2 Cooling air filter
Continued



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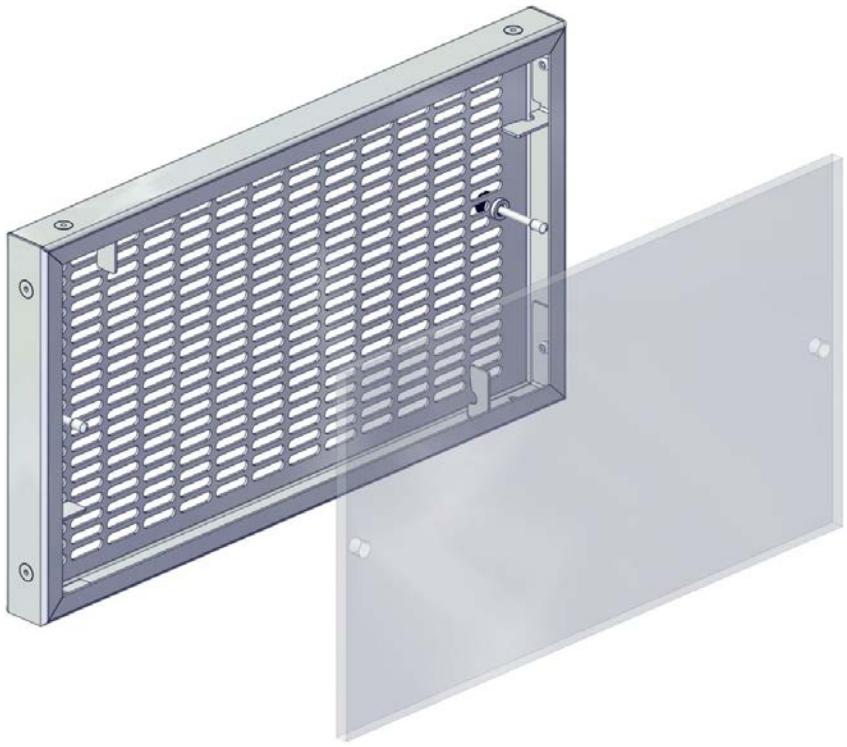
7.7.2.1 Moist particle filter [3005-1]

General

Moist particles are prevented from entering the air ducts and fans by metal mesh filter. Select when cooling air contains moist particles > 0.5 mm.



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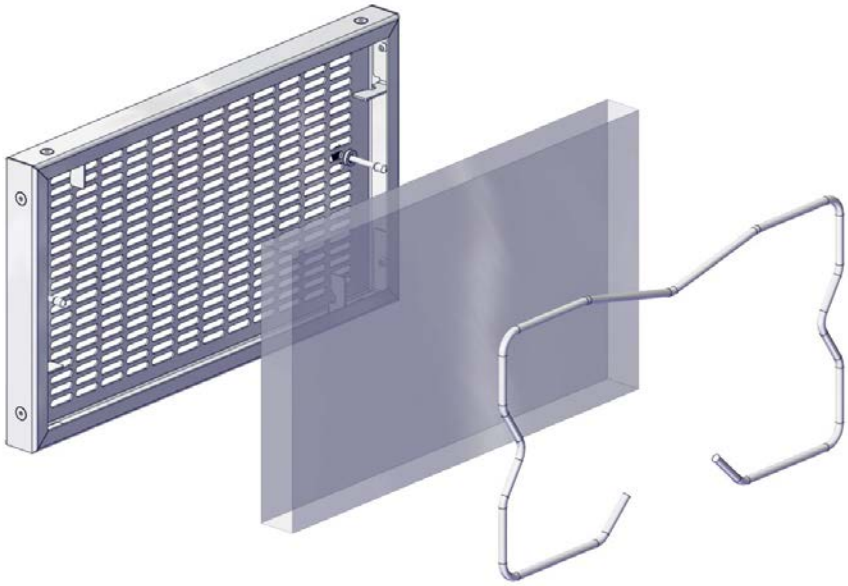
Limitations

The option *Moist particle filter* is not possible to order with controller variant *OmniCore C30* [3000-130].

7.7.2.2 Moist dust filter [3005-2]

General

Moist particles are prevented from entering the air ducts and fans by polymeric filter. Select when cooling air contains moist dust.



xx2000000267

Limitations

The option *Moist dust filter* is not possible to order with controller variant *OmniCore C30* [3000-130].

7.8 Regional & installation options

7.8.1 Standards

7.8.1.1 UL/CSA [3006-1]

General

The robot and the control system are certified by Underwriters Laboratories to comply with the Safety Standard ANSI/UL 1740-1998 Industrial Robots and Robotic Equipment and CAN/CSA Z 434-94. Law for UL/CSA certification is required in some US states and Canada.

UL (UL listed) means certification of the complete robot product. The option is visualized by a "UL" label attached to the cabinet.

7.8.2.1 220-230 V AC (+10%-15%) [3007-1]

7.8.2 Mains voltage

7.8.2.1 220-230 V AC (+10%-15%) [3007-1]

General

The controller can be connected to a rated voltage of between 220 V and 230 V.

7.8.2.2 100-230 V AC (±10 %) [3007-2]

General

OmniCore C30 controller in IRB 14050 and in CRB 15000 can be connected to a rated voltage between 100 V and 230 V.

This option is the default value for IRB 14050 and for CRB 15000.

7.9 Connectivity & logical power

7.9.1 Connected Services Gateway

General

ABB Ability™ Connected Services provide communication capabilities between robots controller and ABB. The connectivity can be directed securely through an embedded Connected Services Gateway module 3G, WiFi or Wired.

The connectivity can be directed securely through an embedded, wired, Connected Services.

Wired LAN [3013-1]

The option *Wired LAN* for Connected Services uses a wired connection for transferring data.

WiFi [3013-2]

The option *WiFi* for Connected Services uses a WiFi connection for transferring data.

Mobile network [3013-3]

The option *Mobile network* for Connected Services uses a 3G mobile network connection for transferring data. ABB sim card is included but can be replaced by a customer sim card for advanced features.

This option is the default selection.

7.9.2 Ethernet switch

7.9.2.1 5 port Ethernet switch [3014-1]

General

The option *5 port Ethernet switch* can be used to connect for example *Conveyor Tracking* modules, *Integrated Vision* cameras, *Scalable I/O* units or other devices from the ABB EcoSystem, such as Grippers.

The Ethernet switch cannot be used for fieldbus options like PROFINET, and does not have a PROFINET certification.

7.9.3 Additional logic 24V power

7.9.3.1 24V 8Amps [3015-1]

General

Additional 24V 8Amps power supply for customer use.

Limitations

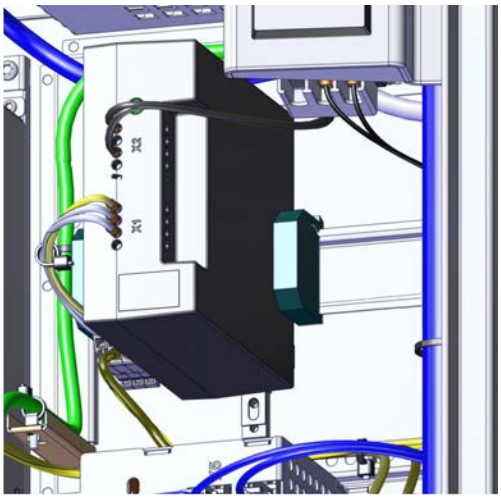
The option *Additional logic 24V 8Amps* is only possible to order with controller variant *OmniCore C30* [3000-130] and is not possible to order with CRB 14050.

7.9.3.2 24V 4Amps [3015-2]

General

4A selected due to application/process.

xx1900002151



xx2000000358

Limitations

The option Additional logic *24V 4Amps* is not possible to order with controller variant *OmniCore C30* [3000-130].

7.9.4.1 24V 4Amps [3049-1]

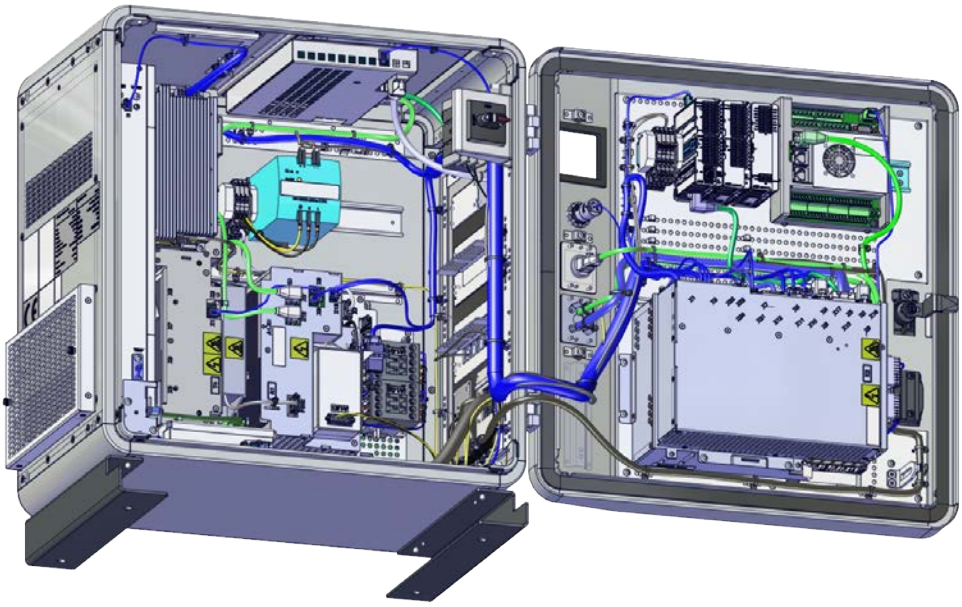
7.9.4 DeviceNet logic 24V power

7.9.4.1 24V 4Amps [3049-1]

General

24V power supply for customer use. One 4Amp unit certified for ODVA (DeviceNet). It is only needed for supply of external DeviceNet devices.

xx2000000350



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Limitations

The option *DiveceNet logic 24V 4Amps* is not possible to order with:

- Controller variant *OmniCore C30* [3000-130]
- Option *Additional logic 24V Power* [3015-x]

7.10 Human machine interface

7.10.1 FlexPendant

FlexPendant [3016]

Color graphic teach pendant with touch screen of resolution 1024 x 768 px.

For more information, see *FlexPendant on page 77*.

Option	Description
3016-1	FlexPendant 3m
3016-2	FlexPendant 10m
3016-3	FlexPendant 30m

Requirements

The option *FlexPendant* requires option *FlexPendant base apps* [3120-x]

For more information, see *FlexPendant base apps on page 184*.

Limitations

The option *FlexPendant 30m* is not possible to order with IRB 14050 and CRB 15000.

7.10.2 FlexPendant extension

FlexPend ext cable [3017]

Option	Description
3017-1	FlexPend ext cable 15m
3017-2	FlexPend ext cable 22m
3017-3	FlexPend ext cable 30m

Limitations

FlexPendant extension is not possible to order with IRB 14050 and CRB 15000.

The total cable length when order *FlexPendant* [3016-x] together with *FlexPendant extension* [3017-x] is less than or equal to 50m.

7.10.3 Hot swappable FlexPendant [3018-1]

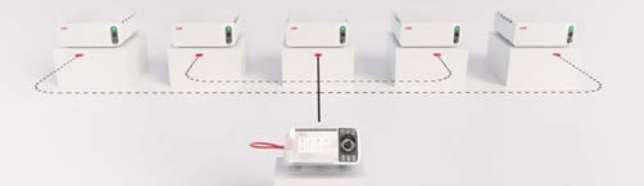
General

With the option *Hot swappable FlexPendant [3018-1]* it is possible to detach and attach the FlexPendant from an OmniCore controller in automatic mode, without interrupting the ongoing process.

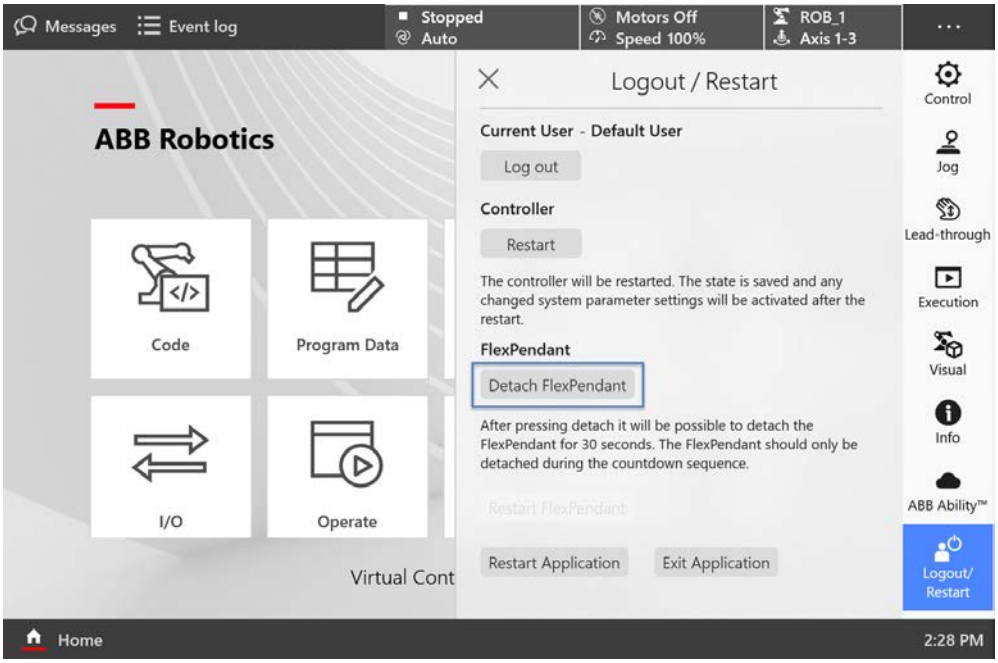
This option is required if the option *FlexPendant [3016-x]* is not selected.

This allows for the following, but not limited to, use cases:

- Avoid damage due to accidental wear (tripping, falling to the ground), when the FlexPendant is not used.
- Avoid damage to the FlexPendant in harsh environment.
- Avoid unintentional user interaction in automatic mode.
- Reusing one FlexPendant on several robots.



xx1800003666



xx1800003667

Requirements

The option *Hot swappable FlexP.* requires option *FlexPendant base apps* [3120-x]

For more information, see *FlexPendant base apps on page 184*.

7.10.4 Robot Control Mate enabled [3065-1]

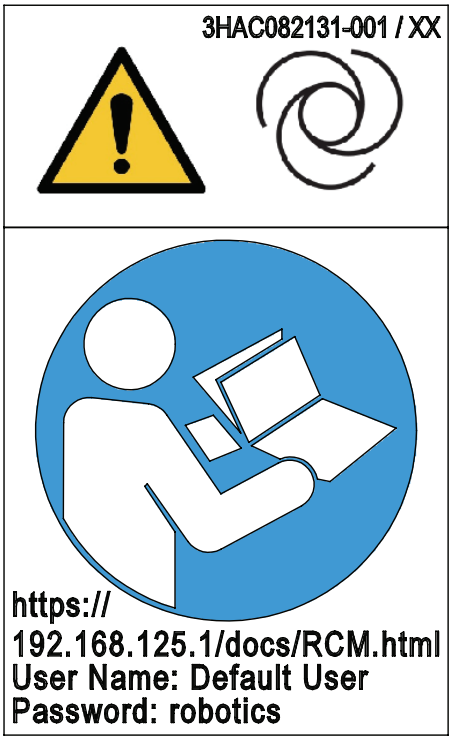
General

With the option *Robot Control Mate enabled* the robot controller will be delivered with automatic mode active from the factory.

Robot Control Mate is a control function to move the robot in automatic mode using a RobotStudio add-in. The *Robot Control Mate* can be downloaded from the add-in section in RobotStudio.

The *Robot Control Mate* can be used without the option *Robot Control Mate enabled* but will require the user to manually activate automatic mode using a FlexPendant and install the option *Hot swappable FlexP.* [3018-1].

With automatic mode active the robot may move unexpectedly once all safety circuit requirements are fulfilled. The risk is highlighted by the warning label attached to the controller.



xx2100000357

The option is available for IRB 1010, IRB 1100, IRB 1300, IRB 910INV, IRB 14050, IRB 360, IRB 920, IRB 930, IRB 1200, CRB 1100, CRB 1300, CRB 15000.

For more information, see *Robot Control Mate* manual (3HAC073107-010), available in the RobotStudio Help section.

Requirements

The option *Robot Control Mate* requires the option *Hot swappable FlexP.* [3018-1].

7.11 Industrial networks & fieldbuses

7.11.1 PROFINET

7.11.1.1 PROFINET Controller [3020-1]

General

PROFINET is an open standard for Industrial Ethernet. PROFINET satisfies requirements for automation technology. PROFINET solutions can be implemented for factory and process automation, for safety applications, and for the entire range of drive technology right up to clock-synchronized motion control.

PROFINET has a modular design and different PROFINET communication profiles are all combinations of modular elements from the groups transmission technology, communication protocol, and application profiles.

With this option the robot controller can only act as a PROFINET controller on the PROFINET network.

7.11.1.2 PROFINET Device [3020-2]

General

With this option *PROFINET Device* the robot controller can only act as a PROFINET device with 256 byte inputs and 256 byte outputs on the PROFINET network.

7.11.1.3 PROFINET Safety Network

7.11.1.3.1 PROFIsafe Controller [3023-1]

General

The robot controller acts as a PROFIsafe controller and host safe I/O devices (F-Devices) directly. The devices are connected to the Public network or I/O network on the main computer.

A RobotWare license with the options *PROFINET SW* [3020-x] and *PROFIsafe Controller* are required to run PROFIsafe on the controller.

Network segment	C30	C90XT	Description
Public Network	WAN	WAN	Wide Area Network that can host a public industrial network.
I/O Network	LAN	LAN 3	Secondary public/factory network. Isolated from WAN.

Requirements

The option *PROFIsafe Controller* requires option *PROFINET Controller* [3020-1].

7.11.1.3.2 PROFIsafe Device [3023-2]

General

All I/O communication for the SafeMove functionality is done via a safety PLC using PROFIsafe (safe PROFINET). The safety PLC will act as a PROFIsafe controller (F-Host) and the robot controller will act as a PROFIsafe device (F-Device). The PROFIsafe I/O is connected to one of the the Ethernet ports WAN or LAN (C30) / LAN 3 (C90XT) on the main computer.

A RobotWare license with the options *PROFINET SW* [3020-x] and *PROFIsafe Device* are required to to run PROFIsafe on the controller.

Requirements

The option *PROFIsafe Device* requires option *PROFINET Device* [3020-2].

7.11.2 EtherNet/IP

7.11.2.1 EtherNet/IP Scanner [3024-1]

General

EtherNet/IP is a communications link to connect industrial devices. The EtherNet/IP (EtherNet Industrial Protocol) is managed by ODVA (Open DeviceNet Vendors Association). It is a well established industrial EtherNet communication system with good real-time capabilities. EtherNet/IP extends commercial off-the-shelf Ethernet to the CIP (Common Industrial Protocol); the same upper-layer protocol and object model found in DeviceNet and ControlNet.

CIP allows EtherNet/IP and DeviceNet system integrators and users to apply the same objects and profiles for plug-and-play interoperability among devices from multiple vendors and in multiple sub-nets. Combined, DeviceNet, ControlNet, and EtherNet/IP promote transparency from sensors to the enterprise software.

With this option the robot controller can only act as an EtherNet/IP scanner on the EtherNet/IP network.

7.11.2.2 EtherNet/IP Adapter [3024-2]

General

With the option *EtherNet/IP Adapter* the robot controller can only act as a EtherNet/IP Adapter with 509 byte inputs and 505 byte outputs on the EtherNet/IP network.

7.11.3 CC Link IE Field Basic

7.11.3.1 CC-Link IE FB Master [3066-1]

General

CC-Link IE Field Basic is a communications link for industrial devices. CC-Link IE communication using general-purpose Ethernet technology which can be easily applied to small-scale equipment not requiring high-speed control and is easy to use and develop. Realizing cyclic communication on the CC-Link IE field network by software. The communication can be done simultaneously with standard Ethernet TCP/IP communication (HTTP, FTP, etc.)

CC-Link standard is monitored by CLPA (CC-Link Partner Association).

Features

With this option the robot controller can act as an CC-Link IE Field Basic Master on the Industrial Ethernet network.

7.11.3.2 CC-Link IE Field Basic Device [3066-2]

General

CC-Link IE Field Basic is a communications link for industrial devices. CC-Link IE communication using general-purpose Ethernet technology which can be easily applied to small-scale equipment not requiring high-speed control and is easy to use and develop. Realizing cyclic communication on the CC-Link IE field network by software. The communication can be done simultaneously with standard Ethernet TCP/IP communication (HTTP, FTP, etc.)

CC-Link standard is monitored by CLPA (CC-Link Partner Association).

Features

With this option the robot controller can act as an CC-Link IE Field Basic Device on the Industrial Ethernet network.

7.11.4 DeviceNet

7.11.4.1 DeviceNet m/s IO

7.11.4.1.1 DeviceNet single ch. [3029-1]

General

The DeviceNet is a communications link to connect industrial devices. It is a simple networking solution that reduces both cost and time to wire and install industrial automation devices, and the direct connectivity provides improved communication between devices. DeviceNet is an open network standard.

- Peer-to-peer data exchange where a DeviceNet product can produce and consume messages
- Master/slave operation defined as a proper subset of peer-to-peer
- A DeviceNet product can function as a master or server, or both

Requirements

The option *DeviceNet single ch.* occupies 1 PCIe slot.

7.12 Ethernet & signal interfaces

7.12.1 Cable grommet [3050-1]

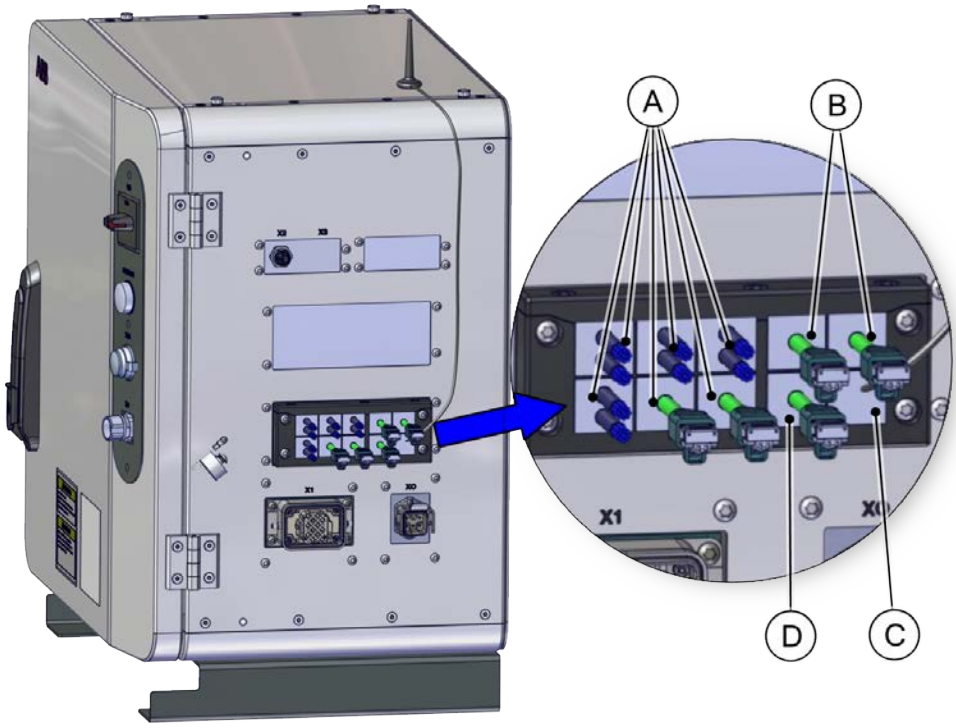
General

The option *Cable grommet* provides for connections of Ethernet-based communication links to external ABB selected devices such as cameras, conveyor tracker, etc.

The technical solutions in this module vary with the number of Ethernet ports that should be available for communication, IP class, and requirements on the Ethernet connector itself (RJ45 or M12).

The option *Cable grommet* provides extended capability for connectivity.

The module also contains 24VDC for external usage and WAN.



xx2000000490

A	For I/O signal cable from I/O unit and CSI cable from robot signal exchange proxy
B	For Ethernet cable from main computer
C	For antenna cable from Connected Services Gateway
D	Reserved for customer connection

Limitations

The option *Cable grommet* is not possible to order with controller variant *OmniCore C30* [3000-130].

7.13 Scalable I/O

7.13.1 Scalable I/O Internal

7.13.1.1 Add-on Analog 4In/4Out [3034-1]

General

DSQC1032

4 Analog Inputs 4 Analog Outputs

For more information, see *Scalable I/O on page 66*.

xx1800003685

Requirements

The option *Add-on Analog 4In/4Out* requires option *Base Dig. 16In/16Out* [3032-1].

Limitations

The option *Add-on Analog 4In/4Out* is not possible to order with controller variant *OmniCore C30* [3000-130].

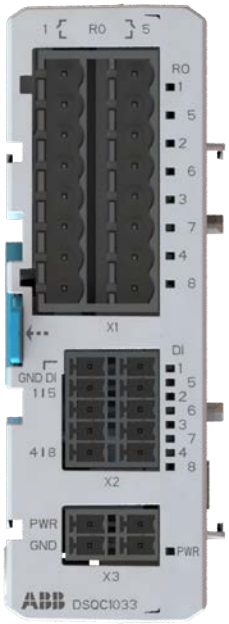
7.13.1.2 Add-on Relay 8In/8Out [3035-1]

General

DSQC1033

8 Digital inputs 8 Relay outputs

For more information, see *Scalable I/O on page 66*.



xx2200000420

Requirements

The option *Add-on Relay 8In/8Out* requires option *Base Dig. 16In/16Out* [3032-1].

Limitations

The option *Add-on Relay 8In/8Out* is not possible to order with controller variant *OmniCore C30* [3000-130].

7.13.2 Scalable I/O External

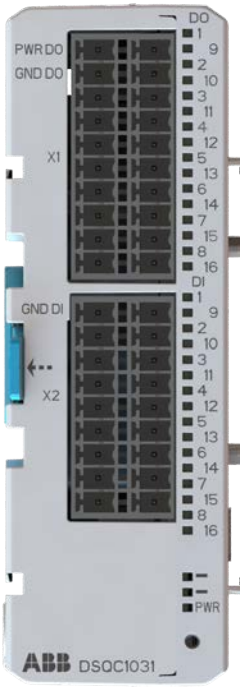
7.13.2.1 Add-on Dig. 16In/16Out [3033-2]

General

DSQC1031

24 V Digital with 16 Inputs, 16 Outputs

For more information, see *Scalable I/O on page 66*.



xx2200000419

Requirements

The option *Add-on Dig. 16In/16Out* requires option *Base Dig. 16In/16Out* [3032-2].

Limitations

The option *Add-on Dig. 16In/16Out* is not possible to order with CRB 15000.

7.13.2.2 Add-on Analog 4In/4Out [3034-2]

General

DSQC1032

4 Analog Inputs 4 Analog Outputs

For more information, see *Scalable I/O on page 66*.

xx1800003685

Requirements

The option *Add-on Analog 4In/4Out* requires option *Base Dig. 16In/16Out* [3032-2].

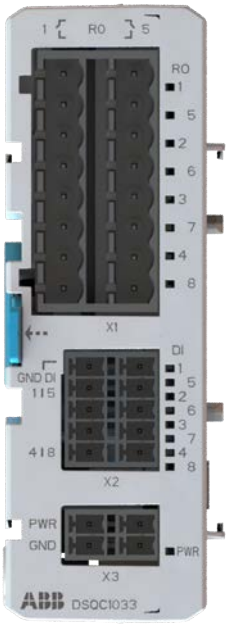
7.13.2.3 Add-on Relay 8In/8Out [3035-2]

General

DSQC1033

8 Digital inputs 8 Relay outputs

For more information, see *Scalable I/O on page 66*.



xx2200000420

Requirements

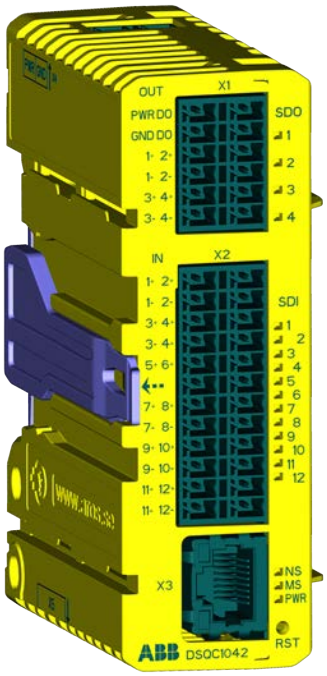
The option *Add-on Relay 8In/8Out* requires option *Base Dig. 16In/16Out* [3032-2].

7.13.3 Scalable safety I/O Internal

7.13.3.1 Safe base Dig. 6In/2Out (1-2) [3037-1]

General

The DSQC1042 safety digital base device has 12 inputs and 4 outputs working in dual channel pairs. Due to the dual channel configuration, the device has 6 safe digital inputs and 2 safe digital outputs. The safety digital base device can be combined with up to four additional add-on devices.



xx2100001681

Connector	Description
X1	Digital outputs, process power
X2[i]	Digital inputs
X3	EtherNet
X4	Logic power
X5	EtherNet

i The numbers (printings) on the module only show the I/O numbers (digital input/output). It is not the pin position number for connector X1 or X2 (only I/O number).

For more information see *Application manual - Scalable I/O*.

Limitations

The option *Safe base Dig. 6In/2Out* is not possible to order with option *Base Dig. 16In/16Out* [3032-1].

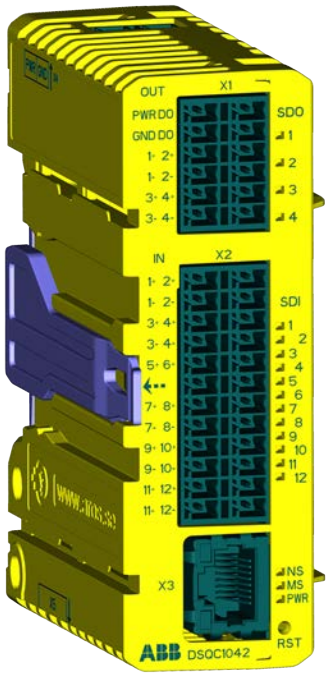
For V400XT, a second row of I/O units can be added. This option is not applicable for V250XT.

7.13.4 Scalable safety I/O External

7.13.4.1 Safe base Dig. 6In/2Out [3037-2]

General

The DSQC1042 safety digital base device has 12 inputs and 4 outputs working in dual channel pairs. Due to the dual channel configuration, the device has 6 safe digital inputs and 2 safe digital outputs. The safety digital base device can be combined with up to four additional add-on devices.



xx2100001681

Connector	Description
X1	Digital outputs, process power
X2[i]	Digital inputs
X3	EtherNet
X4	Logic power
X5	EtherNet

i The numbers (printings) on the module only show the I/O numbers (digital input/output). It is not the pin position number for connector X1 or X2 (only I/O number).

For more information see *Application manual - Scalable I/O*.

7.14 Functional Safety

General

OmniCore controller is prepared with the hardware to run keyless mode switch and SafeMove.

Continues on next page

7.14.1 Robot safety supervision

7.14.1.1 SafeMove Basic [3043-1]

General

The option *SafeMove Basic* gives you access to the configurator **Visual SafeMove** in RobotStudio. With **Visual SafeMove** you can:

- configure and visualize supervision functions in a 3D environment
- configure stop functions, such as automatic stop
- configure *Cyclic Brake Check*
- configure safe signals (safe EtherNet communication and I/O)
- configure signal logics
- configure system status outputs

For more information, see *Application manual - Functional safety and SafeMove*.

Included functions	
Supported number of axes	9
Safe ranges	8
Safe zones	1
Axis position supervision	Yes
Contact application support	Yes

Limitations

SafeMove supports the articulated, palletizing, and collaborative robots. For SCARA robots, only the function *Axis Position Supervision* is supported.

7.14.1.2 SafeMove Pro [3043-2]

General

The option *SafeMove Pro* gives you access to the configurator **Visual SafeMove** in RobotStudio. With **Visual SafeMove** you can:

- configure and visualize supervision functions in a 3D environment
- configure stop functions, such as automatic stop
- configure *Cyclic Brake Check*
- configure safe signals (safe EtherNet communication and I/O)
- configure signal logics
- configure system status outputs

For more information, see *Application manual - Functional safety and SafeMove*.

Included functions	
Supported number of axes	9
Safe ranges	8
Safe zones	16
Tool changer support	Yes (16 tools)
Axis position supervision	Yes
Axis speed supervision	Yes
Tool orientation supervision	Yes
Tool position supervision	Yes
Tool speed supervision	Yes
Stand still supervision	Yes
Contact application support	Yes

Limitations

SafeMove supports the articulated, palletizing, and collaborative robots. For SCARA robots, only the function *Axis Position Supervision* is supported.

7.14.1.3 SafeMove Collaborative [3043-3]

General

The option *SafeMove Collaborative* gives you access to the configurator **Visual SafeMove** in RobotStudio. With **Visual SafeMove** you can:

- configure and visualize supervision functions in a 3D environment
- configure stop functions, such as automatic stop
- configure *Cyclic Brake Check*
- configure safe signals (safe EtherNet communication and I/O)
- configure signal logics
- configure system status outputs

For more information, see *Application manual - Functional safety and SafeMove*.

Included functions	
Supported number of axes	9
Safe ranges	8
Safe zones	16
Tool changer support	Yes (16 tools)
Axis position supervision	Yes
Axis speed supervision	Yes
Tool orientation supervision	Yes
Tool position supervision	Yes
Tool speed supervision	Yes
Stand still supervision	Yes
Contact application support	Yes

Limitations

The option *SafeMove Collaborative* is only available for CRB 15000, CRB 1100, CRB 1300.

7.14.2 Operation mode selector

7.14.2.1 3 modes Keyless [3044-1]

General

Operator mode selection from the FlexPendant without key switch.

The operational modes to switch between is:

- Auto mode
- Manual mode (reduced speed)
- Manual mode (full speed)

7.14.2.2 2 modes Keyless [3044-2]

General

Operator mode selection from the FlexPendant without key switch.

The operational modes to switch between is:

- Auto mode
- Manual mode (reduced speed)

7.14.3 Safety laser scanner

7.14.3.1 PROFIsafe scanner [3051-1]

General

The *PROFIsafe scanner* is an option bundles hardware and software, including:

- The laser scanner SICK Microscan3 core model MIC3-ABAZ40PZ1P01 AB
- The connecting cables between the scanner and robot controller
- The mounting plate for the scanner
- The PC software to easily set up the safety configuration of the scanner

The laser scanner device provides a timely and continuous monitoring of the activities within its scanning area by detecting if a human or other objects enter its protective field. If the option PROFISafe scanner is available and purchased, the scanner can be directly connected to the robot controller; If the option PROFISafe device is purchased, it must connect to the PLC and then to the OmniCore controller via the PROFINET safe (PROFIsafe) network. Through the configuration software it's possible to easy set up the safety areas of the scanner.

Requirements

The option PROFIsafe scanner requires option *Collab. speed control* [3143-1].

Limitations

The option *PROFIsafe scanner* is only available for CRB 1100, CRB 1300 and CRB 15000.

For CRB 1100 and CRB 15000, the option is only possible to order with the controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to oder with controller variant *OmniCore C30* [3000-130] and OmniCore C90XT [3000-210].

7.14.3.2 I/O scanner [3051-2]

General

The *I/O scanner* is an option bundles hardware and software, including:

- The laser scanner SICK Microscan3 Pro IO model MICS3-CCAZ40AA1P01 AB detailed scanner model can be obtained on the scanner nameplate
- The connecting cables between the scanner and robot controller
- The mounting plate for the scanner
- The PC software to easily set up the safety configuration of the scanner

The laser scanner device provides a timely and continuous monitor on the activities within its scanning area and forms a protective field. The scanner must be connected through OSSD I/O to the DSQC1042 board in the OmniCore controller. Through the configuration software it's possible to easy set up the safety areas of the scanner.

Requirements

The option *I/O scanner* requires option *Collab. speed control* [3143-1].

Limitations

The option *I/O scanner* is only available for CRB 1100, CRB 1300 and CRB 15000.

For CRB 1100 and CRB 15000, the option is only possible to order with the controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to oder with controller variant *OmniCore C30* [3000-130] and OmniCore C90XT [3000-210].

7.14.3.3 Dual PROFIsafe scanner [3051-3]

General

The *Dual PROFIsafe scanner* is an option bundles hardware and software, including:

- Two SICK Microscan3 core laser scanners model MIC3-ABAZ40PZ1P01 AB
- The connecting cables between scanners and from the scanners to robot controller
- The mounting plate for the scanner
- The PC software to easily set up the safety configuration of the scanner

The laser scanner devices provide a timely and continuous monitoring of the activities within their scanning area by detecting if a human or other objects enter their protective fields. If the option PROFIsafe scanner is available and purchased, the scanners can be directly connected to the robot controller; If the option PROFISafe device is purchased they must connect to the PLC and then to the OmniCore controller via the PROFINET safe (PROFIsafe) network. Through the configuration software it's possible to easy set up the safety areas of the scanners.

Requirements

The option Dual PROFIsafe scanner requires option *Collab. speed control* [3143-1].

Limitations

The option *Dual PROFIsafe scanner* is only available for CRB 1100, CRB 1300 and CRB 15000.

For CRB 1100 and CRB 15000, the option is only possible to order with the controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to oder with controller variant *OmniCore C30* [3000-130] and OmniCore C90XT [3000-210].

7.14.3.4 Dual I/O scanner [3051-4]

General

The *Dual I/O scanner* is an option bundles hardware and software, including:

- Two laser scanners SICK Microscan 3 Pro IO model MICS3-CCAZ40AA1P01 AB detailed scanner model can be obtained on the scanner nameplate
- The connecting cables between scanners and from the scanners to robot controller
- The mounting plate for the scanner
- The PC software to easily set up the safety configuration of the scanner

The laser scanner devices provide a timely and continuous monitor on the activities within its scanning area and forms a protective field. The scanners must be connected through OSSD I/Os to the DSQC1042 board in controller. Through the configuration software it's possible to easy set up the safety areas of the scanner.

Limitations

The option *Dual I/O scanner* is only available for CRB 1100, CRB 1300 and CRB 15000.

For CRB 1100 and CRB 15000, the option is only possible to order with the controller variant *OmniCore C30* [3000-130].

For CRB 1300, it is possible to oder with controller variant *OmniCore C30* [3000-130] and OmniCore C90XT [3000-210].

7.15 Motion Performance

7.15.1 Advanced robot motion

7.15.1.1 Advanced robot motion [3100-1]

About Advanced robot motion

The option *Advanced robot motion* gives you access to:

- *Advanced Shape Tuning*, see *Advanced Shape Tuning on page 158*.
- *Wrist Move*, see *WristMove on page 162*.
- Changing *Motion Process Mode* from RAPID, see *Motion Process Mode on page 160*.

Continues on next page

7.15.1.1.1 Advanced Shape Tuning

General

> **Note**
>
> This functionality is included in the option *Advanced robot motion*, see *Advanced robot motion [3100-1] on page 157*.

Advanced Shape Tuning offers the possibility to compensate for frictional effects that might appear at low speed cutting robot motion (10-100 mm/s). This is especially useful when cutting advanced shapes, for example, small circles, or other similar applications when path accuracy is crucial. Friction tuning can be used to improve path accuracy of the robot in cutting applications.

The option gives the user access to tuning parameters and the possibility to change the tuning parameters for each axis during program execution with RAPID commands in the robot program. The option also includes RAPID instructions for automatic fine tuning of friction level for each specific shape. The software automatically repeats the movement until the best friction level for each axis has been found. After the tuning has been completed each robot axis has a unique set of tuning values for each shape. The tuning is performed by the user and for each specific shape.

Features

- Very accurate path performance for advanced motion at low speed, e.g. shape cutting
- Automatic tuning of the friction level using RAPID
- Access to tuning parameters
- Tuning axis by axis
- Change tuning from RAPID program

Application

Friction effects typically arise when cutting small, advanced shapes like for example circles. The major source of friction effects comes changing direction of axis movement. The effects appear in the form of up to 0.5 mm path deviations.

Typical applications are cutting of small shapes, such as holes, slots, rectangles. Other applications may be high precision gluing or dispense of small geometries.

Performance

Using *Advanced Shape Tuning*, typically a 0.5 mm path deviation can be reduced to about 0.1 mm. This however, requires careful tuning of the friction level (see *Operating manual - OmniCore* for tuning procedure, and the instruction `TuneServo` described in *Technical reference manual - RAPID Instructions, Functions and Data types*). Note that even with careful tuning, there is no guarantee that "perfect" paths will always be generated.

Continues on next page

Requirements

There are no hardware or software requirements for this option.

RAPID instructions

RAPID instructions included in this option:

Instruction	Description
FricIdInit	Instruction to start the friction level identification
FricIdEvaluate	Function that will return the friction level that produced the best results
FricIdSetFricLevels	Instruction to set friction levels

Change of tuning from RAPID is done with standard parameters.

Instruction	Description
TuneServo	*Technical reference manual - RAPID Instructions, Functions and Data types*

Limitations

- The movement sequence for which friction tuning is done must begin and end with a fine point.
- The tuning process requires about 15 iterations of the movement per axis.
- The movement sequence between `FricIdInit` and `FricIdEvaluate` cannot be longer than 4 seconds.

7.15.1.1.2 Motion Process Mode

Purpose

The purpose of Motion Process Mode is to simplify application specific tuning, i.e. to optimize the performance of the robot for a specific application.

For most applications the default mode is the best choice.

Tip

If the default mode does not give sufficient accuracy, first test to use *Accuracy mode*, and if that is not sufficient, use *Low speed accuracy*.

Available motion process modes

A motion process mode consists of a specific set of tuning parameters for a robot. Each tuning parameter set, that is each mode, optimizes the robot tuning for a specific class of applications.

There following modes are predefined:

- *Optimal cycle time mode* – this mode gives the shortest possible cycle time and is normally the default mode.
- *Accuracy mode* – this mode improves path accuracy. The cycle time will be slightly increased compared to *Optimal cycle time mode*.
- *Low speed accuracy mode* – this mode improves path accuracy. The cycle time will be slightly increased compared to *Accuracy mode*.
- *Low speed stiff mode* - this mode is recommended for contact applications where maximum servo stiffness is important. Could also be used in some low speed applications, where a minimum of path vibrations is desired. The cycle time will be increased compared to *Low speed accuracy mode*.
- *Press tending mode* – Changes the *Kv Factor*, *Kp Factor* and *Ti Factor* in order to mitigate tool vibrations. This mode is primarily intended for use in press tending applications where flexible grippers with a large extension in the y-direction are used.
- *Collaborative mode* – This mode is recommended for collaborative applications where robot should run smoothly. The cycle time will be increased compared to optimal cycle time mode. This will only have any effect on GoFa CRB 15000.

There are also four modes available for application specific user tuning:

- *MPM User mode 1 – 4*

Selection of mode

The default mode is automatically selected and can be changed by changing the system parameter *Use Motion Process Mode* for type *Robot*.

Changing the *Motion Process Mode* from RAPID is only possible if the option *Advanced Robot Motion* is installed. The mode can only be changed when the robot is standing still, otherwise a fine point is enforced.

Continues on next page

The following example shows a typical use of the RAPID instruction `MotionProcessModeSet`.

```
MotionProcessModeSet OPTIMAL_CYCLE_TIME_MODE;
! Do cycle-time critical movement
MoveL *, vmax, ...;
...

MotionProcessModeSet ACCURACY_MODE;
! Do cutting with high accuracy
MoveL *, v50, ...;
...
```

Limitations

- The *Motion Process Mode* concept is currently available for all six- and seven-axes robots except paint robots with TrueMove1.
- The *Mounting Stiffness Factor* parameters are only available for the following robots:

  IRB 120, IRB 140, IRB 1200, IRB 1520, IRB 1600, IRB 2600, IRB 4600, IRB 6620 (not LX), IRB 6640, IRB 6700.
- For IRB 1410, only the *Accset* and the geometric accuracy parameters are available.
- The following robot models do not support the use of *World Acc Factor* (i.e. only *World Acc Factor = -1* is allowed):

  IRB 340, IRB 360, IRB 540, IRB 1400, IRB 1410

7.15.1.1.3 WristMove

General

Note

This functionality is included in the option *Advanced robot motion*, see *Advanced robot motion [3100-1] on page 157*.

WristMove is an interpolation method that only uses two axes to perform the movement. It is favorable to use in applications where one need to improve the accuracy for small shapes, for example in cutting applications. For shapes like small holes, the friction effects from the main axes (axes 1-3) of the robot may cause path deviations. *WristMove* is a method to limit the axes movement to only use two wrist axes, and thereby minimizing the friction effects on the path. In addition, a movement with *WristMove* interpolation is faster than corresponding movement without *WristMove* as less robot weight needs to be moved. The user can define which axis pair to be used for the specific movement.

Features

- Interpolation method to only use a pair of two axes. Allowable combinations, Axis5/Axis6, Axis4/Axis5 or Axis4/Axis6
- Support for any shape consisting of circular arc and straight lines, e.g. holes, slots, rectangles, etc.
- Lead in - Lead out -> any shape
- Activate interpolation mode prior to shape generation
- Used together with RAPID instruction `CirPathMode` and movement instructions for circular arcs, that is, `MoveC`, `TrigC`, `CapC`, etc
- Straight line segments can be achieved using `MoveC` with collinear targets.

Application

WristMove is an option that can be used in cutting applications, like laser cutting, water jet cutting, routing, etc, to improve the accuracy for small shapes. The solution is a flexible, easy-to-use software feature that can be applied in any application where the robot needs to perform small shape movements.

The option can help to reduce path deviations up to or above 50% in favorable circumstances.

Continues on next page

Performance

WristMove is especially useful in cutting small holes, or other similar movements, with radius up to 25 mm. For these kinds of movements one can expect an accuracy of about ±0.1 mm when using *WristMove* at normal cutting speeds. This accuracy is the radial deviation between the actual movement and the programmed circle. This however, requires careful usage of the *WristMove* option (see *Operating manual - OmniCore* for details, and the instruction `CirPathMode` described in *Technical reference manual - RAPID Instructions, Functions and Data types*). Note that even with careful usage, there is no guarantee that "perfect" paths will always be generated.

WristMove can potentially improve cycle time as a movement with *WristMove* is faster than a corresponding movement without *WristMove* interpolation. The reason is that less robot weight needs to be moved in order to achieve the movement.

Requirements

There are no additional hardware or software requirements for this option.

RAPID instructions

There are no RAPID instructions included in this option.

Change of interpolation mode is done by setting parameters in RAPID instruction `CirPathMode`.

Limitations

- *WristMove* cannot be used if the work object is moving
- *WristMove* cannot be used if the robot is mounted on a track that is moving
- Can only use movement instructions for circular arcs, that is, `MoveC`, `TrigC`, `CapC` etc
- When cutting holes, or other shapes, the edges will be conical depending on the robot movement and the distance between tool and workobject
- The tool's height above the surface and the distance to the cutting point will vary during the cut due to the movement of only two axes
- *WristMove* cannot be used on robots with non-spherical wrist, for example, GoFa or YuMi

7.15.2 Absolute Accuracy [3101]

Purpose

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

Here are some examples of when this accuracy is important:

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

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

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

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved in the robot memory
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

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

Absolute Accuracy supports floor mounted, wall mounted, and ceiling mounted installations. The compensation parameters that are saved in the robot memory differ depending on which Absolute Accuracy option is selected.

When is *Absolute Accuracy* being used

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

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

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

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

Continues on next page

- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

Absolute Accuracy not active

The following are examples of when Absolute Accuracy is not active:

- Any motion function based on a jointtarget (`MoveAbsJ`)
- Independent joint
- Joint based jogging
- Additional axes
- Track motion

> **Note**
>
> In a robot system with, for example, an additional axis or track motion, the Absolute Accuracy is active for the manipulator but not for the additional axis or track motion.

RAPID instructions

There are no RAPID instructions included in this option.

Available options

The following options are available for *Absolute Accuracy*:

- *AbsAcc Floor mounted* [3101-1]
- *AbsAcc Ceiling mounted* [3101-2]
- *AbsAcc Wall mounted* [3101-3]
- AbsAcc All mounting pos [3101-4]

Absolute Accuracy is mandatory to select for IRB 14050.

Performance data

The performance data is described in the product specification for the respective manipulator.

Limitations

Absolute Accuracy [3101-x] is not available for IRB 360 with OmniCore.

[3101-3] and [3101-4] are not possible to select for IRB 1100 and IRB 1300.

Absolute Accuracy cannot be selected for robots with the option *Inverted*.

7.16 Motion Supervision

7.16.1 Motion supervision bundle

7.16.1.1 Motion supervision bundle [3105-1]

About Motion supervision bundle

The option *Motion supervision bundle* gives you access to the included options:

- *World Zones*, see *World Zones [3106-1] on page 167*
- *Collision detection*, see *Collision detection [3107-1] on page 169*
- *Collision avoidance*, see *Collision avoidance [3150-1] on page 170*

7.16.2 World Zones

7.16.2.1 World Zones [3106-1]

General

The option *World Zones* is used to define in which area in space the TCP is operating, or the current joint configuration.

Features

- Set input/output signal, when TCP or joint within or outside zone
- Stop robot when reaching a zone border
- Cubical, Cylindrical, Spherical and Joint zones
- Set I/O when the robot is in home position and configuration
- Automatic activation at start-up or activated/deactivated from RAPID program
- Active in automatic and manual mode

Application

Application	Description
Home position	When the robot is started from a PLC, the PLC will check that the robot is inside the volume of the home configuration. In this way other equipment may move safely in the cell.
Protection of equipment	A zone may enclose other cell equipment, and thus prevent the robot from moving into that area.
Robots working in the same area	Handshaking between robots ensures that only one robot at a time is working within a zone. This functionality also ensures efficiency in these operations, since robots can be put waiting for another robot to finish its work within the zone and immediately enter the zone, when the first is finished.

Performance

For safety reasons, this software function shall not be used for protection of personnel. Use hardware protection equipment.

Requirements

There are no software or hardware requirements for this option.

RAPID instructions

RAPID instructions included in this option:

Instruction	Description
WZBoxDef	Define a cubical world zone
WZCylDef	Define a cylindrical world zone
WZLimSup	Activate world zone limit supervision
WZSphDef	Define a sphere-shaped world zone
WZDOSet	Activate world zone digital output
WZDisable	Deactivate world zone supervision

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7.16.2.1 World Zones [3106-1]
Continued

Instruction	Description
WZEnable	Activate world zone supervision
WZFree	Erase world zone supervision
WZHomeJointDef	Define a global zone in joint coordinates
WZLimJointDef	Define a global zone in joint coordinates, for limitation of work area

7.16.3 Collision detection

7.16.3.1 Collision detection [3107-1]

General

Collision detection is a software option, which reduces collision impact forces on the robot. In this way, the robot and external equipment can be protected from severe damage.

Features

- Protection of robot and equipment
- Protection from collisions from any direction
- Robot movement stops and the robot moves back, along the programmed path
- Can reduce the collision force to 30%

Application

Abnormal torque levels on any robot axis (for additional axes, only positioners listed below are covered) are detected and will cause the robot to stop quickly and thereafter back off to relieve forces between the robot and environment.

Performance

The sensitivity (with default tuning) is comparable to the mechanical alternative (mechanical clutch) and it is in most cases much better. In addition, *Collision detection* has the advantages of no added stick-out and weight, no need for connection to the e-stop circuit, no wear, the automatic backing off after collision and, finally, the adjustable tuning.

Tuning is normally not required, but the sensitivity can be changed from RAPID or manually. *Collision detection* can also be switched off completely for part of a program. This may be necessary when strong process forces are acting on the robot.

RAPID instructions

RAPID instruction included in this option:

Instruction	Description
MotionSup	Changing the sensitivity of the collision detection or activating/deactivating the function.

7.16.4 Collision avoidance

7.16.4.1 Collision avoidance [3150-1]

General

Collision avoidance is a software option that enables the possibility to stop the robot before colliding with fixed objects, such as fences, the floor or equipment in the cell. A collision model for the objects need to be built and downloaded to the controller using RobotStudio.

Features

The *Collision avoidance* feature monitors the geometries of the robot and its work envelope and stops the robot before a possible collision. The static geometry surrounding the robot can also be included in the configuration. This is useful where object positions are dynamically created during runtime by cameras or sensors. The predicted collision can be visualized in the RobotStudio Online Monitor.

Collision avoidance is active during jogging and program execution. The Collision Prediction supports convex geometries such as points, line segments, and convex polygons. Non-convex objects must be split into smaller parts that can be approximated.

Application

This feature can be activated in RobotStudio where it is also possible to define the objects that should be supervised.

For more information, see *Application manual - Controller software OmniCore* and *Operating manual - RobotStudio*.

Performance

The *Collision avoidance* is optimized for and runs on the controller in the motion planner to be able to stop the robot before colliding with monitored objects.

Limitations

CAUTION

Collision Avoidance shall not be used for safety of personnel.

- Paint robots are not supported.
- *Collision Avoidance* cannot be used in manual mode together with responsive jogging. The system parameter *Jog Mode* must be changed to *Standard*.
- Only stationary/non-moving objects can be configured with a trigger signal. A trigger signal must correspond to a group signal. Furthermore, each collision object must have its own trigger signal.
- There is no support for applications that do corrections to the path, such as conveyor tracking, WeldGuide, Force Control, SoftMove, SoftAct etc.

Continues on next page

RAPID instructions

There are no RAPID instructions related to this option but it is possible to enable and disable the function using the digital output signal *Collision_Avoidance*. By setting *Collision_Avoidance* to 0 the function is disabled. It is recommended to enable it (set *Collision_Avoidance* to 1) as soon as the work is done that required Collision Avoidance to be disabled.

7.17 Motion Functions

7.17.1 SoftMove

7.17.1.1 SoftMove [3108-1]

General

SoftMove is a cartesian soft servo option that allows the robot to be compliant or floating in order to adjust to external forces or variations in work objects. *SoftMove* can lower the stiffness of the robot in one or several pre-defined cartesian direction(s) (in relation to either the tool or the work object) while keeping the original behavior in the other directions. The behavior of the softness is controlled by two parameters *Stiffness* and *Damping*. With *SoftMove*, the robot is compliant in the specified direction(s) only which facilitates high accuracy and reliability. The option reduces robot programming time and enables effective interaction between robot and machine, which reduces cycle time.

Features

SoftMove is used to set up softness in one of the following directions:

- one of the Cartesian directions (x, y or z)
- one of the Cartesian planes (xy, xz or yz)
- all directions (xyz)
- the plane xy and rotational around the z axis

Applications

Machine tending of different machines, for example die casting machines, injection moulding machines, machine tools, etc. Extraction of parts from machine

- Insertion of parts into the machine – robot holds or pushes
- Extraction of parts from machine
- Placing/picking a work object in a tool
- Placing a molded or cast part in a fixture
- Tool exchanging on peripheral machines
- Absorbing of shocks and vibrations

Assembly functions

- Framing - a robot holds and presses a part towards the rest of the car body while another process attaches the part to the body
- Simple assembly functions not requiring searching or fitting

Welding

- Hold-and-Weld
- Hotplate welding

Press tending

- Follow movement of press

Continues on next page

Polishing/Grinding

- Simple polishing and grinding applications with low process forces not requiring process feedback

RAPID instructions

See *Application manual - SoftMove*.

Limitations

Collision Detection is deactivated when *SoftMove* is activated.

Activation and deactivation of *SoftMove* can only be done in fine points.

SoftMove does not work for 4-axis robots, for example IRB 910INV, IRB 920 and IRB 360 OmniCore.

SoftMove does not work together with:

- Tracking functionality such as, `CorrWrite`, *Conveyor Tracking*, seam tracking and *WeldGuide*.
- Force control options

`CSSAct` does not activate motion control. A movement instruction is required to activate the motion control.

7.18 Motor Control

7.18.1 Independent Axis

7.18.1.1 Independent Axis [3111-1]

General

The option *Independent Axis* is used to make an external axis (linear or rotating) run independently of the other axes in the robot system.

The option also includes the function *Axis Reset*, which can reset the axis position counter from RAPID. *Axis Reset* is useful for repeated maneuvers, where mechanical reset of the axis (mechanically turning back the axis) would mean loss of cycle time in the process.

Note

In the current version, additional axis is not supported.

Features

- Movement of an axis, independent of the robot motion
- Independent movements, programmed with absolute or relative positions
- Continuous rotational/linear movement of an axis
- Speed regulation of the independent axis
- Reset of Axis position counter (axes 4, 6 and additional (rotating) axes)

Application

Application	Description
Axis Reset	When polishing, a large work area is sometimes needed on the robot axis 6 in order to be able to carry out final polishing without stopping. Assume that the axis has rotated 3 turns, for example. It can now be reset using this function, without having to physically rotate it back again, this will reduce cycle times. Pick and place - In a pick and place operation using, the rotation angle of axis 4 can increase and move towards the limit. Instead of moving axis 4 back to zero angle it can be reset saving cycle time in the application.

Performance

The movements will be made with the same performance as additional axes without *Independent Axis*.

Requirements

There are no software or hardware requirements for this option.

Continues on next page

Limitations

If an axis has a gear ratio which is not an integer number, fine calibration is required after resetting the revolution counter on the serial measurement board, if a precise axis position is needed in the application.

Internal and customer cabling and equipment may limit the ability to use independent axis functionality on axis 4 and 6.

The option is not possible to use together:

- 4 axis robots, for example IRB 910INV
- *Robot safety supervision* options [3043-x]

For information about what capability a specific robot's axis 4/6 has, contact ABB.

RAPID instructions and functions

RAPID instructions included in this option:

Instructions	Description
IndCMove	Running an axis continuously
IndDMove	Running an axis independently a specified distance
IndRMove	Running an axis Independently to a position within one revolution, without taking into consideration the number of turns the axis had rotated earlier
IndAMove	Running an axis Independently to an absolute position
IndReset	Change an axis to dependent mode and/or reset the working area

RAPID functions included in this option:

Instructions	Description
IndInpos	Checking whether or not an independent axis has reached the programmed position
IndSpeed	Checking whether or not an independent axis has reached the programmed speed

7.19 RAPID Program Features

7.19.1 Program feature bundle

7.19.1.1 Program feature bundle [3112-1]

About Program feature bundle

The option *Program feature bundle* gives you access to the included options:

- *Path Recovery*, see *Path Recovery [3113-1] on page 177*
- *Multitasking*, see *Multitasking [3114-1] on page 178*

7.19.2 Path Recovery

7.19.2.1 Path Recovery [3113-1]

General

The option *Path Recovery* is used to store all system data, when an interrupt occurs (fault message or other) and restore them after necessary actions have been taken.

Features

- Store path data (all current system information)
- Restore path data (all system information, as was before interrupt/fault)

Application

Application	Description
Service of process equipment	When an error message occurs, the position/path data can be stored and the robot moves automatically to a service area. After service, the robot moves back to the exact same position, including all system data and continues welding.

Performance

There is no performance data available for this option.

Requirements

There are no software or hardware requirements for this option.

RAPID instructions

RAPID instructions included in this option:

Instruction	Description
StorePath	Stores the path when an interrupt occurs
RestorePath	Restores the path after an interrupt
PathRecStart	Start the path recorder
PathRecStop	Stop the path recorder
PathRecMoveBwd	Move path recorder backwards
PathRecMoveFwd	Move path recorder forward

7.19.3 Multitasking

7.19.3.1 Multitasking [3114-1]

General

The option *Multitasking* gives the possibility of executing up to 20 programs (tasks) in parallel, including the main program. *Multitasking* can be used to control peripheral equipment or other processes concurrently with robot motion.

Features

- Automatic start at power on
- START/STOP commands for task execution
- Tasks are programmed using standard RAPID instructions
- Priorities can be set between tasks
- Communications between tasks using signal presistent data or Rapid Message Queue

Application

Application	Description
Supervision	A task can be used to continuously monitor certain signals even when the main program has stopped, thus taking over the job traditionally allocated to a PLC.
Operator dialogue	An operator dialogue might be required at the same time as the robot is performing, for example welding. By putting this operator dialogue into a parallel task, the operator can specify input data for the next work cycle without having to stop the robot.
Control of external equipment	The robot can control a piece of external equipment in parallel with the normal program execution.

Performance

It is possible to configure if the task shall react on START/STOP requests or if it shall start automatically. In the later case it will not stop at emergency stops, which can be useful for some applications.

Note

The response time of *Multitasking* does not match that of a PLC. *Multitasking* is primary intended for less demanding tasks.

The longer time is for cases when heavy calculation of movement is performed.

Requirements

There are no software or hardware requirements for this option.

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RAPID instructions

RAPID instructions included in this option:

Instruction	Description
WaitSyncTask	Synchronize several program tasks at a special point in each program.
IRMQMessage	Orders RMQ interrupts for a data type
RMQFindSlot	Find a slot identity from the slot name
RMQGetMessage	Get an RMQ message
RMQGetMsgData	Get the data part from an RMQ message
RMQGetMsgHeader	Get header information from an RMQ message
RMQSendMessage	Send an RMQ data message
RMQSendWait	Send an RMQ data message and wait for a response
RMQGetSlotName	Get the name of an RMQ client

7.20 Communication

7.20.1 File Transfer Protocol

7.20.1.1 FTP & SFTP Client [3116-1]

General

The option *FTP & SFTP Client* makes it possible to read information from a remote computer, directly from the controller.

Once the application protocol is configured, the remote computer can be accessed in the same way as the controller's internal hard disk.

Performance

There is no performance data available for this option.

Requirements

The external computer must have an FTP or an SFTP server.

The FTP client has been validated against the following FTP servers:

- FileZilla
- ServU
- MS IIS
- Linux Ubuntu

The SFTP client has been validated against the following SFTP servers:

- Rebex
- Complete
- Cerberus

RAPID instructions

There are no RAPID instructions included in this option.

7.20.2 Network File System

7.20.2.1 NFS Client [3117-1]

General

The option *NFS client* (Network File System) makes it possible to read information from a remote computer, directly from the controller.

Once the application protocol is configured, the remote computer can be accessed in the same way as the controller's internal hard disk.

Performance

There is no specific performance data available for this option.

Requirements

The external computer must have an NFS server.

RAPID instructions

There are no RAPID instructions included in this option.

7.20.3 IoT Gateway

7.20.3.1 IoT Data Gateway [3154-1]

General

The option *IoT Data Gateway* [3154-1] is needed to enable IoT Gateway to communicate with RobotWare.

IoT Gateway is an application that share information from the robot controller with other parts of the process/production unit. The information can be configured according to the OPC UA standard format or MQTT with a customer defined format.

The IoT Gateway application software is deployed/installed on a customer Windows PC or Server, connected to the same network as the robot controller(s) and can access data from multiple robot controllers at the same time (each robot controller require to have the option *IoT Data Gateway*).

The application software package is available for download at the ABB Developer Center (robotstudio.com), *https://developercenter.robotstudio.com*

In the download package, an Application manual (3HAC078375-001) and video tutorial are available illustrating the configuration and usage of the IoT Gateway.

7.21 User Interaction Application

7.21.1 RobotStudio Connect

7.21.1.1 RobotStudio Connect [3119-1]

General

RobotStudio is the programming, configuration and commissioning tool for OmniCore controllers. RobotStudio acts directly on the active data in the controller and enables activities like RAPID programming, update/booting of the systems software and system configuration. Connecting RobotStudio directly to the local management port is enabled by default, but connecting RobotStudio over a public network requires option *RobotStudio Connect* [3119-1].

Features

This option allows RobotStudio to connect to the robot using the public network interface (WAN)

Application

This feature is applicable for the RobotStudio PC product.

Performance

There is no performance data available for this feature

Requirements

There are no additional software or hardware requirements for this feature

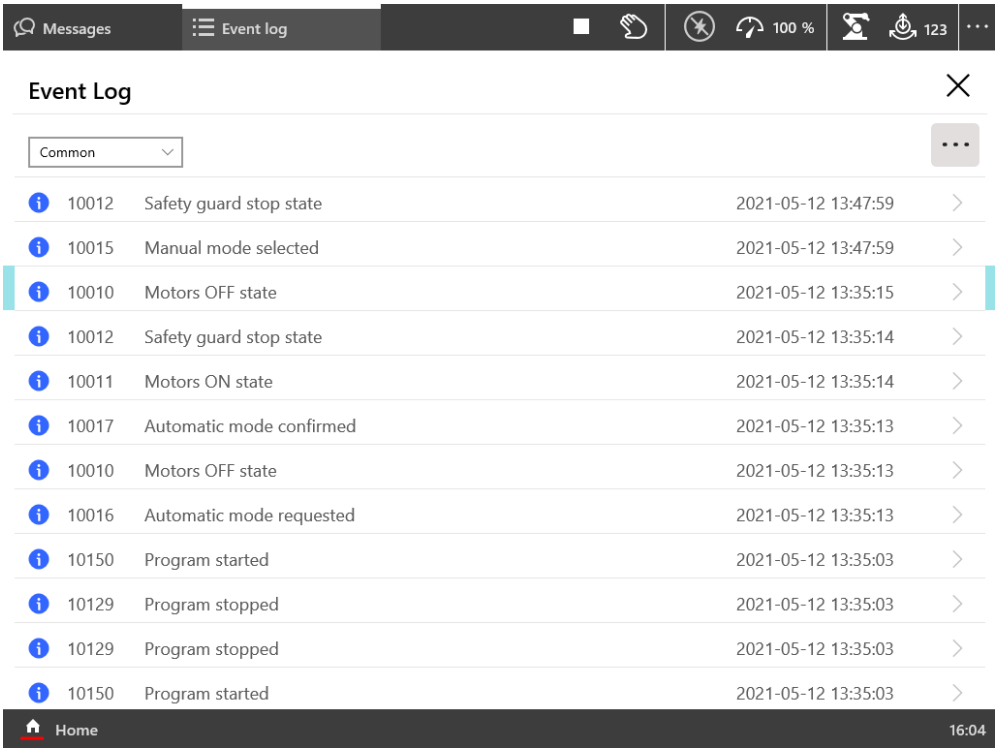
7.21.2 FlexPendant base apps

7.21.2.1 Limited app package [3120-1]

General

The option *Limited app package* contains base functionality to operate the robot system. This base version of software for the FlexPendant allows for the most crucial functionality, like jogging the robot, calibration of the robot, basic operation (start, stop, loading programs), read and write I/O signals, event log and operator messages.

For more information about what functionality is available in this option, see *FlexPendant applications on page 82*.



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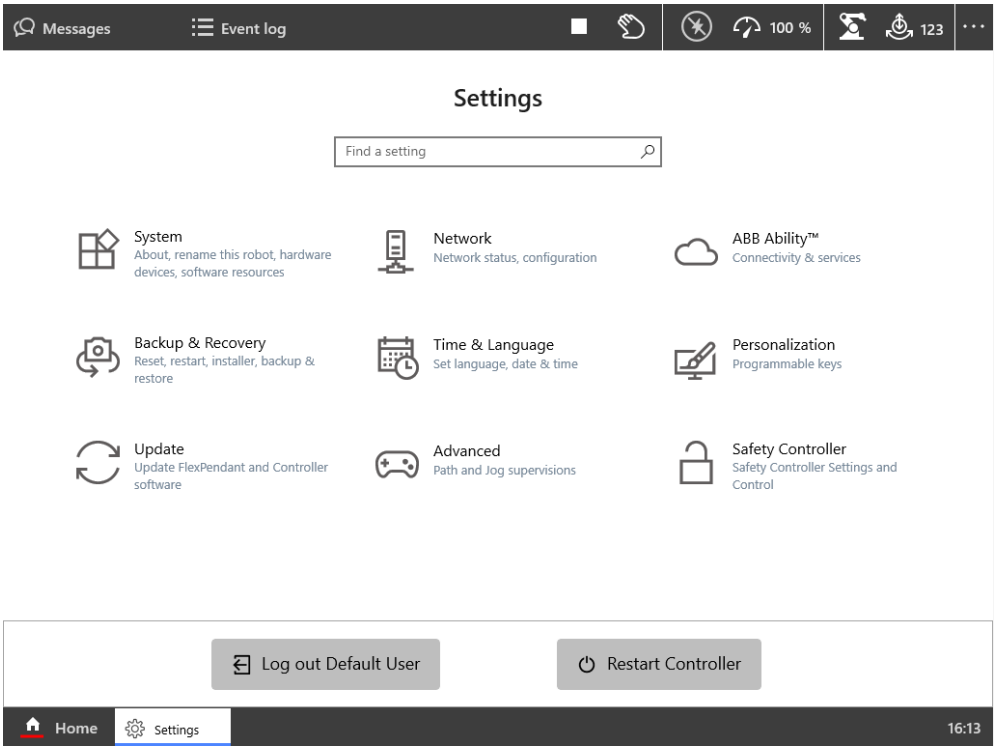

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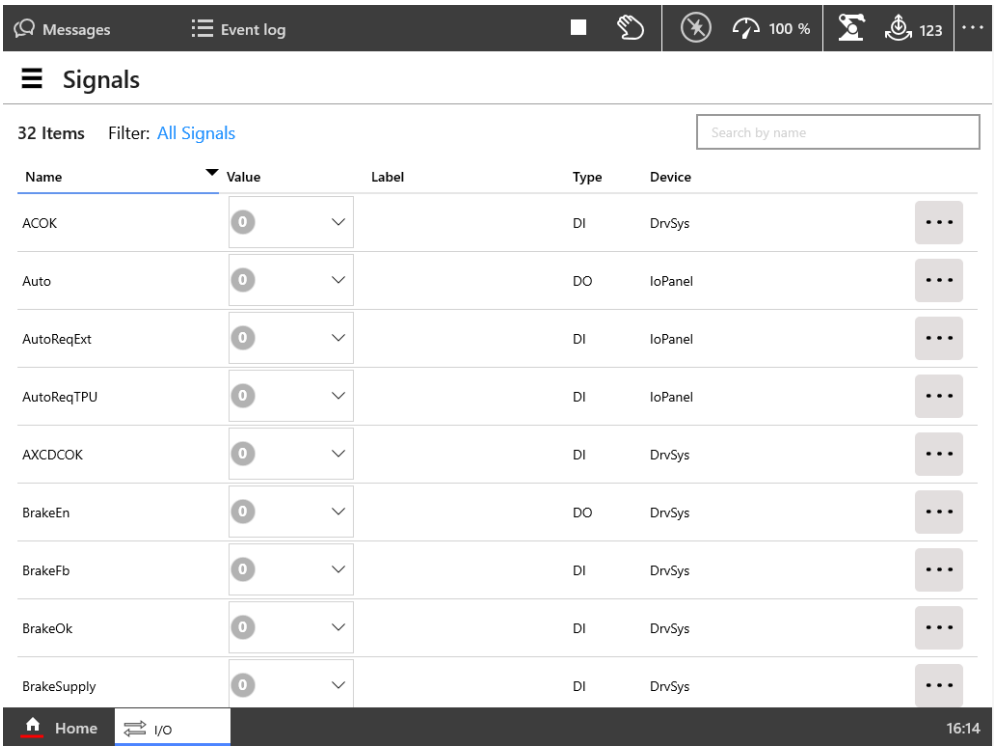

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7.21.2.1 Limited app package [3120-1]

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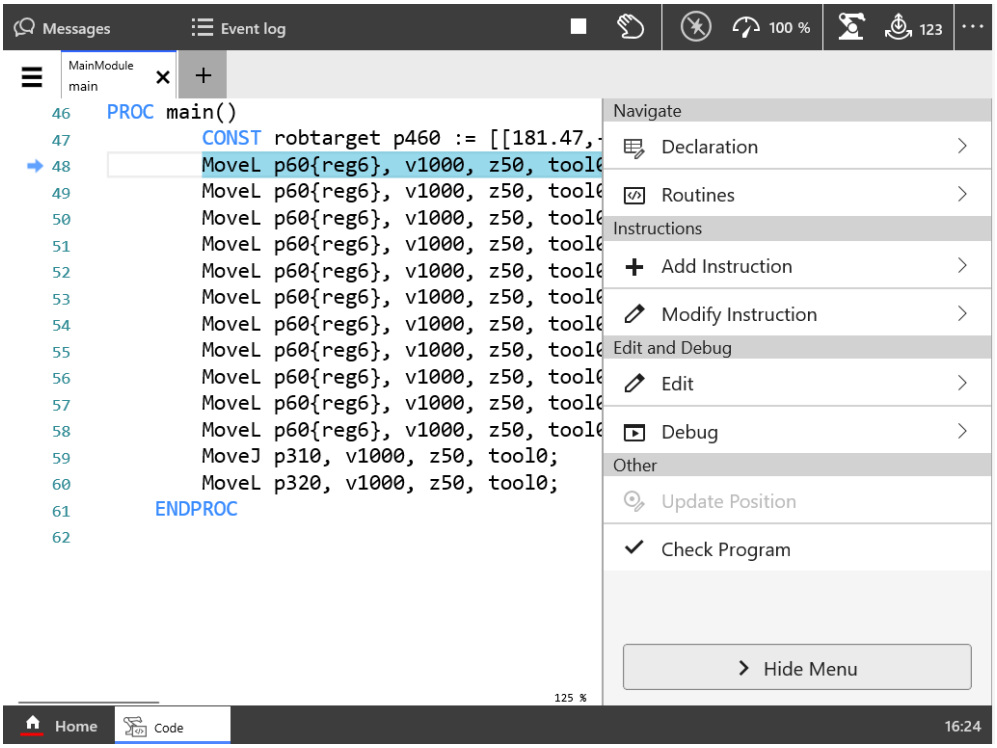

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7.21.2.2 Essential app package [3120-2]

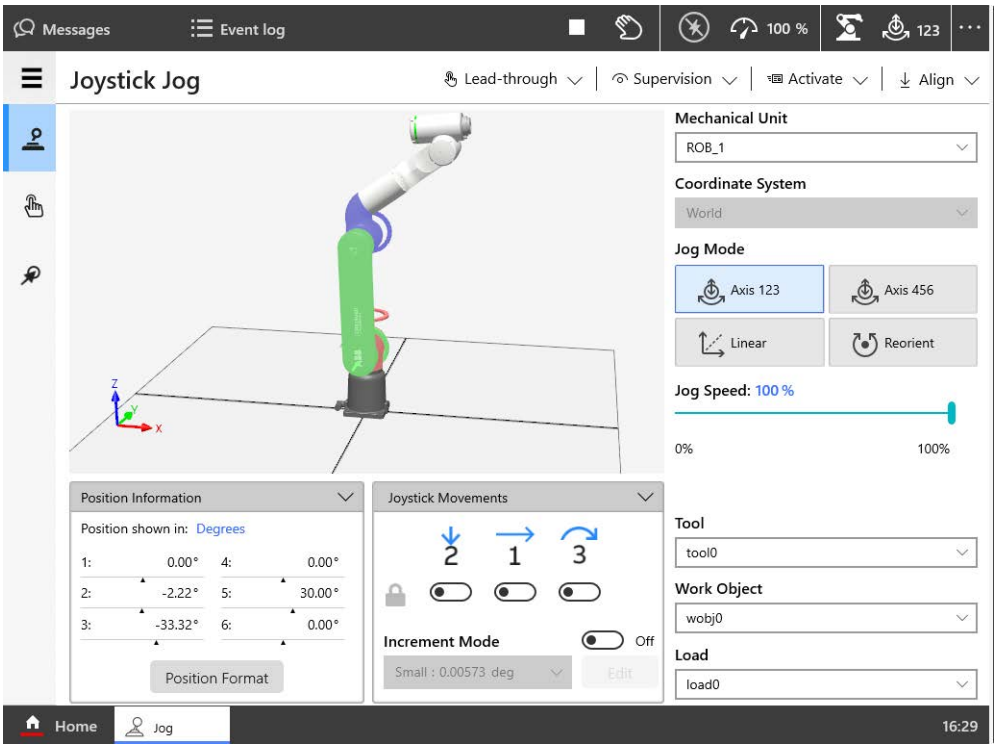
General

The option *Essential app package* includes features that will make it easy and efficient to work with the robot system.

Jog functionality is improved with 3D illustrations, and dashboards makes it easy to view the system status at a glance.

The option *Essential app package* includes option *Limited app package* [3120-1].

For more information about what functionality is available in this option, see *FlexPendant applications on page 82*.



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7.21.2.2 Essential app package [3120-2]

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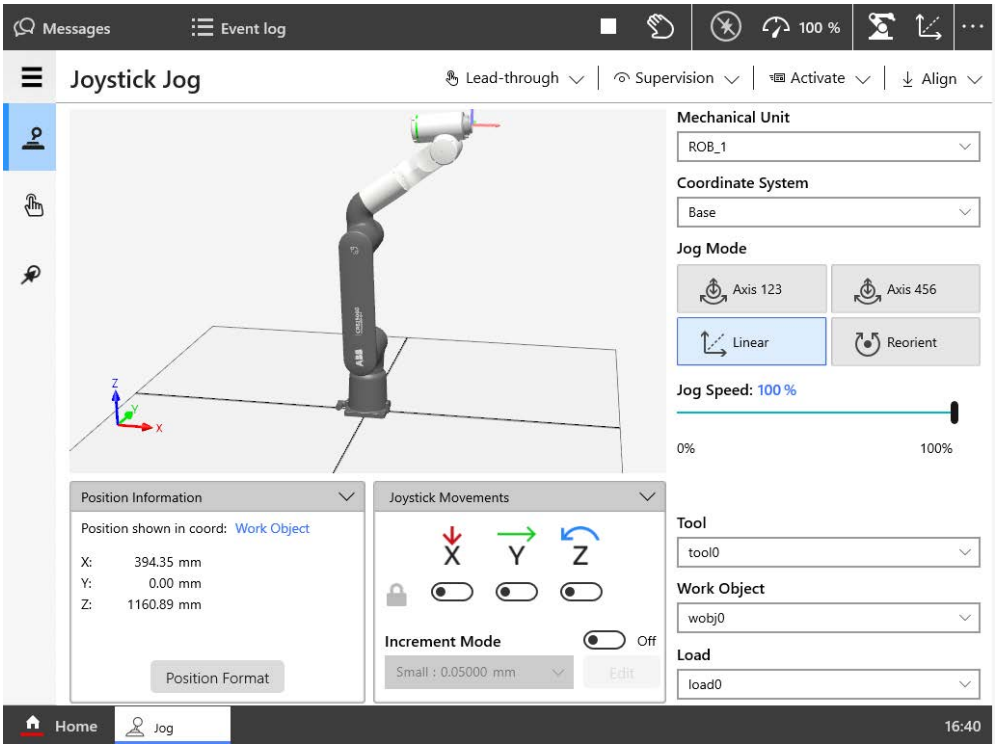

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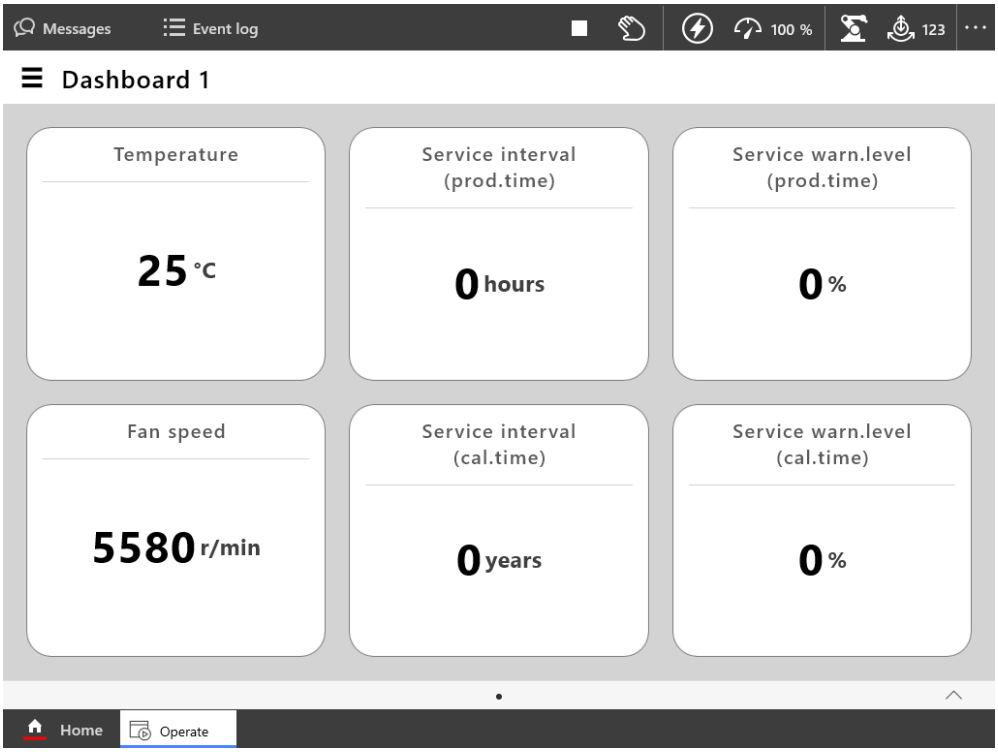

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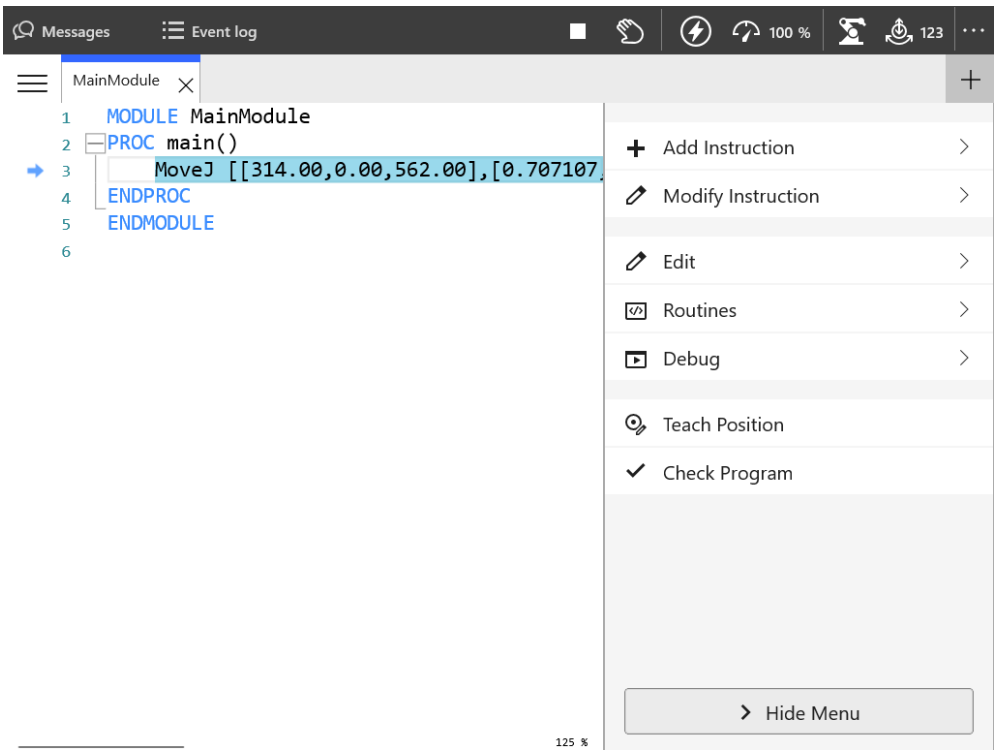
7.21.3 FlexPendant independent apps

7.21.3.1 Program package [3151-1]

General

The option *Program package* is required in order to create new and edit existing RAPID programs on the FlexPendant. If the program package is not selected with the FlexPendant, RobotStudio must instead be used on a separate PC to create and edit RAPID programs.

For more information about what functionality is available in this option, see *FlexPendant applications on page 82*.



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7.21.3.1 Program package [3151-1]

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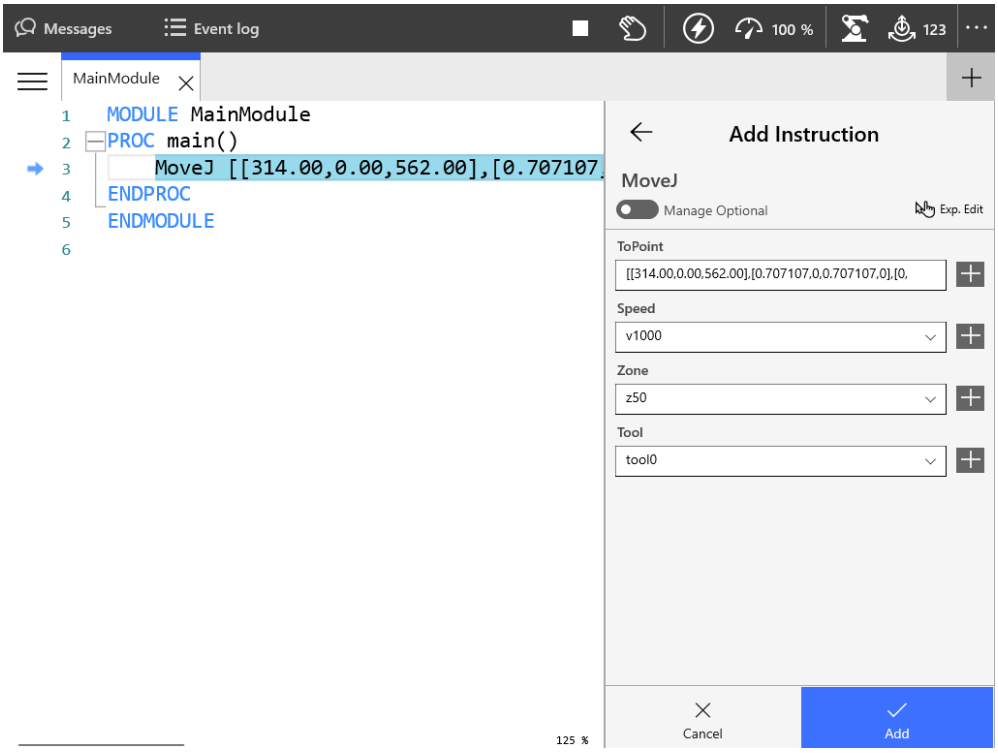

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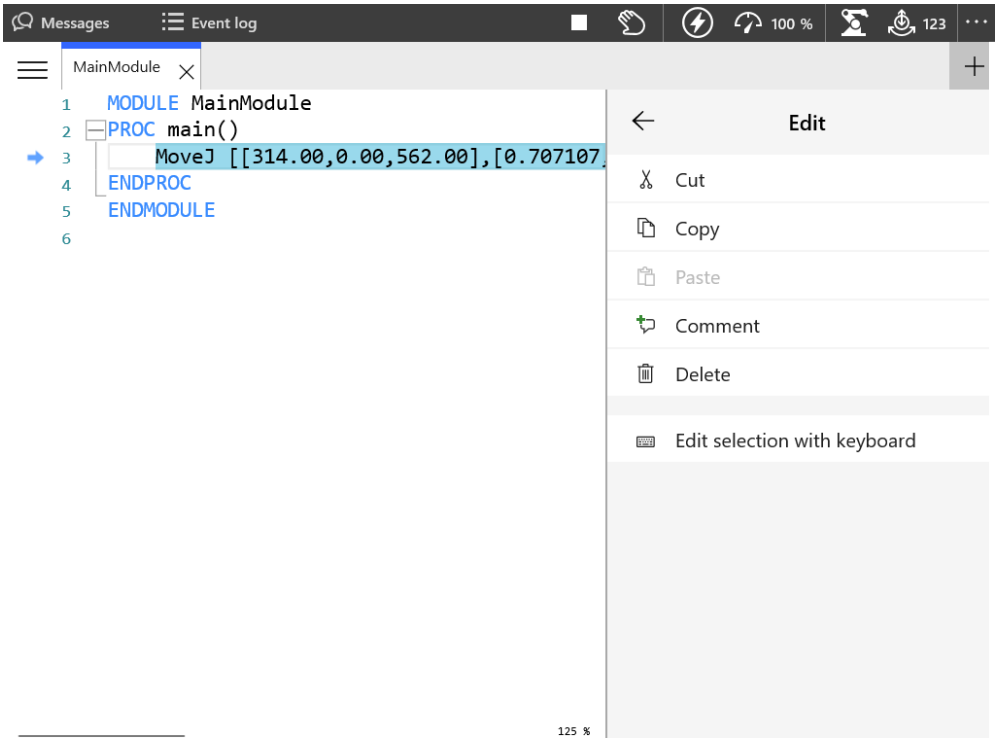

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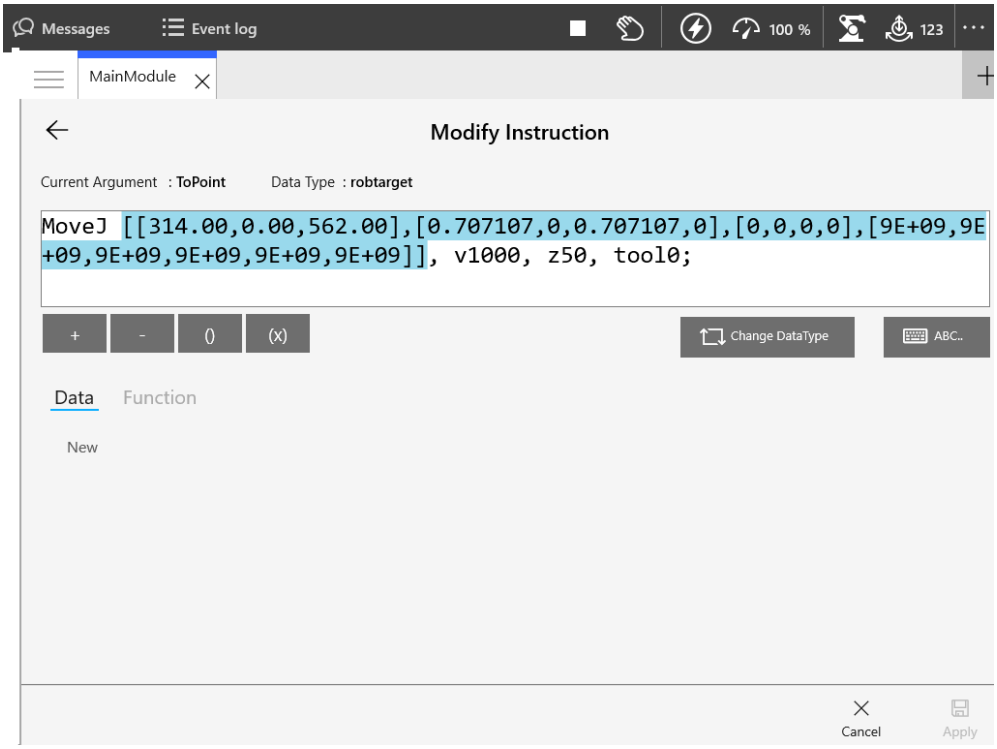

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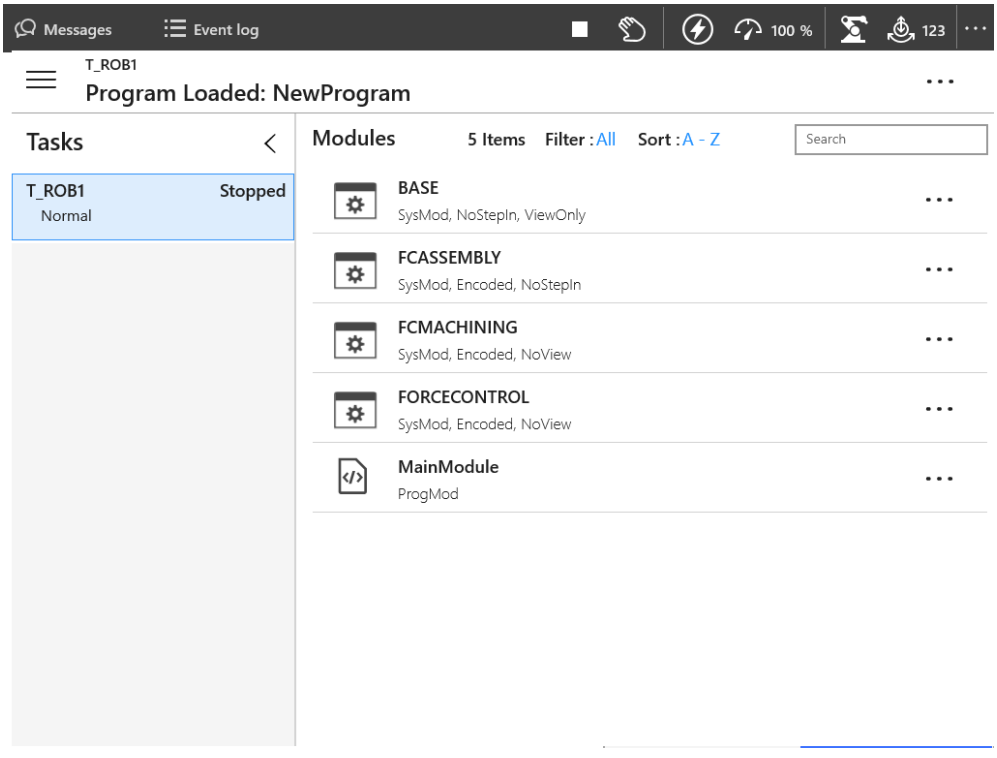

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Requirements

The option *Program package* requires option *FlexPendant base apps* [3120-x].

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7.21.3.1 Program package [3151-1]
Continued

Limitations

The FlexPendant options are not tied to the FlexPendant hardware, but instead to OmniCore controller. This means a FlexPendant runs the apps licensed to the controller its connected to.

The same shared FlexPendant can accordingly have different apps on different robots.

7.22 Engineering Tools

7.22.1 RobotWare Add-in

7.22.1.1 RobotWare Add-In prepared [3121-1]

General

The option *RobotWare Add-In prepared* makes it possible to run licensed Add-Ins from 3rd party developers on the robot controller.

Features

Add-Ins allow to create installable additional software packages that extend the capabilities offered by RobotWare, making ABB's robot controllers even smarter and even more user-friendly. Creating RobotWare Add-Ins is also the recommended way for 3rd party developers to add new features into RobotWare.

An Add-In can include a number of RAPID modules, system modules, or program modules which hold the basic code for the Add-In. The Add-In also includes some files for loading and configuration at start up. The Add-In may also include .xml files with event log messages in different languages.

An Add-In can also consist of more advanced coding, such as *C#* code, for FlexPendant applications. For more advanced coding, use RobotStudio SDK applications.

Note

The RobotWare option *RobotWare Add-In prepared* is only needed for licensed Add-Ins. It is not needed for open Add-Ins or Add-Ins delivered together with RobotWare, for example track motion and positioners.

For more information, see *Application manual - RobotWare add-ins*.

Application

Add-Ins can be used for any application, equipment, or functionality that extends the capabilities offered by RobotWare.

Performance

There is no performance data available for this option.

Requirements

Unlicensed, open, Add-Ins

What you need from ABB to package and run your own open Add-In is:

- RobotWare Add-In Packaging tool

Licensed Add-Ins

What you need from ABB to package and run your own licensed Add-In is:

- RobotWare Add-In Packaging tool

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7.22.1.1 RobotWare Add-In prepared [3121-1]
Continued

- a licence certificate for the RobotWare Add-In Packaging tool for your Add-In name
- RobotWare option *RobotWare Add-In prepared*

To license the Add-In, you will also need:

- License Generator
- a publisher certificate
- a licensing certificate for the License Generator

RAPID instructions

There are no RAPID instructions included in this option.

7.22.2 Path Corrections

7.22.2.1 Path Corrections [3123-1]

General

The option *Path Correction* changes the robot path according to the user input. The robot can thus follow/track a contour, such as an edge or a seam.

The performance is limited by RAPID, which provides the corrections. When the correction is written with `CorrWrite`, it is taken into account immediately. The path corrections are entered from the RAPID program. *Path Corrrection* have to be made in the path coordinate system.

Path correction can be used with CAP, RobotWare Arc, linear move instructions, `Trigg` instructions, and `Search` instructions.

Features

- Adjust a robot path at a user set offset
- Read current path offset
- Change path on the fly

Application

Application	Description
Path offset	Mainly used in arc welding, to adjust a welding path.

Performance

Minimum offset: 0.1 mm.

Requirements

There are no additional software or hardware requirements for this option.

RAPID instructions

RAPID instructions included in this option:

Instruction	Description
CorrCon	Activating path correction
CorrDisCon	Deactivating path correction
CorrRead	Read current path correction
CorrWrite	Changing path correction
CorrClear	Removes all correction generators

7.22.3 Externally Guided Motion

7.22.3.1 Externally Guided Motion [3124-1]

General

The option *Externally Guided Motion* (EGM) offers three different features:

- EGM Position Stream is available for input via UDP sockets only. It provides the possibility to periodically send planned and actual mechanical unit (e.g. robot, positioner, track motion …) position data from the robot controller to an external device. The message contents is specified by the Google Protobuf definition file egm.proto. The cyclic communication channel (UDP) can be executed in the high-priority network environment of the robot controller which ensures a stable data exchange up to 250 Hz.
- EGM Position Guidance is designed for advanced users and provides a low level interface to the robot controller, by by-passing the path planning that can be used when high responsiveness to robot movements are needed. EGM can be used to read positions from and write positions to the motion system at a high rate, every 4 ms with a control lag of 10–20 ms depending on the robot type. The references can either be specified using joint values or cartesian values. The cartesian data can be relative to any work object for robots.
- EGM Path Correction gives the user the possibility to correct a programmed robot path. The device or sensor that is used to measure the actual path has to be mounted on the tool flange of the robot and it must be possible to calibrate the sensor frame.

  The corrections are performed in the path coordinate system, which gets its x-axis from the tangent of the path, the y-axis is the cross product of the path tangent, and the z-direction of the active tool frame and the z-axis is the cross product of x-axis and y-axis.

  EGM Path correction has to start and end in a fine point. The sensor measurements can be provided at multiples of about 48 ms.

Features

The RobotWare option *Externally Guided Motion* gives you access to:

- Instructions to start and stop EGM Position Stream.
- Instructions to set up, activate, and reset EGM Position Guidance.
- Instructions to set up, activate, and reset EGM Path Correction.
- Instructions to initiate EGM Position Guidance movements, synchronized with RAPID execution or not, and to stop them.
- Instructions to perform EGM Path Correction movements.
- A function to retrieve the current EGM state.
- System parameters to configure EGM and set default values.
- Support of *Absolute Accuracy*.

Continues on next page

Application

The purpose of EGM Position Stream is to provide external equipment with the current and planned positions of mechanical units that are controlled by the robot controller.

Some example of applications are:

- Laser Welding, where the Laser head is controlling the Laser beam dynamically.
- Any robot mounted equipment that controls the "robot"-TCP with an external controller.

The purpose of EGM Position Guidance is to use external devices to generate position data for one or several robots. The robots will be moved to that given position.

Some examples of applications are:

- Place an object (e.g. car door or window) at a location (e.g. car body) that was given by an external sensor.
- Bin picking. Pick objects from a bin using an external sensor to identify the object and its position.

The purpose of EGM Path Correction is to use external robot mounted devices to generate path correction data for one or several robots. The robots will be moved along the corrected path, which is the programmed path with added measured corrections.

Some examples of applications are:

- Seam tracking.
- Tracking of objects moving near a known path.

Performance

EGM Position Stream can be used to read positions from and write positions to the motion system at a high rate, every 4 ms.

EGM Position Guidance can be used to read positions from and write positions to the motion system at a high rate, every 4 ms with a control lag of 10–20 ms depending on the robot type.

EGM Path Correction can handle sensor measurements at a rate of about 48 ms.

Requirements

External devices communicating with the controller via Analog Signals, Group signals or an Ethernet link (UDP). For the Ethernet link, the application protocol (UdpUc – UDP UniCast) is used.

Limitations

Limitations for EGM Position Stream

- EGM Position Stream is available with UdpUc communication only.
- Tool data and load data cannot be changed dynamically during an active position stream.

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7.22.3.1 Externally Guided Motion [3124-1]
Continued

- Absolute Accuracy is not supported if streaming is started using `EGMStreamStart`, but it is supported if it started using `EGMActXXX\StreamStart`.
- EGM Position Stream is not compatible with EGM Path Correction.
- It is not allowed to activate or deactivate mechanical units if EGM Position Stream is active.

Limitations for EGM Position Guidance

- Has to start and to end in a fine point.
- The first movement that is performed after a controller restart cannot be an EGM movement.
- Pose mode supports 6-axis robots, 4-axis palletizer robots, YuMi robots, and SCARA robots.
- It is not possible to perform linear movements using EGM Position Guidance, since EGM Position Guidance does not contain interpolator functionality. The actual path of the robot will depend on the robot configuration, the start position, and the generated position data.
- There is a limitation of one mechanical unit per motion task.
- It is not possible to use EGM Position Guidance to guide a mechanical unit in a moving work object.
- If the robot ends up near a singularity, i.e. when two robot axes are nearly parallel, the robot movement will be stopped with an error message. In that situation the only way is to jog the robot out of the singularity.
- When EGM is active, Motion Supervision can behave differently than during normal movements. The recommended action after a collision is to disable EGM and start the EGM sequence from the beginning.

Limitations for EGM Path Correction

- Supports only 6-axis robots.
- Has to start and to end in a fine point.
- The external device has to be robot mounted.
- Corrections can only be applied in the path coordinate system.
- Only position correction in y and z can be performed. It is not possible to perform orientation corrections, nor corrections in x (which is the path direction/tangent).
- When EGM is active, Motion Supervision can behave differently than during normal movements. The recommended action after a collision is to disable EGM and start the EGM sequence from the beginning.

RAPID instructions

For information about the included RAPID instructions, functions, and data types see *Application manual - Controller software OmniCore*.

7.23 Vision and sensor

7.23.1 Vision

7.23.1.1 Vision interface [3127-1]

General

ABB's Integrated Vision system provides a robust and easy-to-use vision system for general purpose Vision Guided Robotics (VGR) applications.

The system includes a complete software and hardware solution that is fully integrated with the robot controller and the RobotStudio programming environment. The vision capability is based on the Cognex In-Sight® smart camera family, with embedded image processing and an Ethernet communication interface.

RobotStudio is equipped with a vision programming environment that exposes the full palette of Cognex EasyBuilder® functionality with robust tools for 2D part location, part inspection, and identification. The RAPID programming language is extended with dedicated instructions and error tracing for camera operation and vision guidance.

For more information about the option *Integrated Vision*, see *Product specification - Integrated Vision*.

7.23.1.2 Prep. For FL Vision [3134-1]

General

The option Prepared for FlexLoader Vision enables the use of the PC-based FlexLoader Vision function package with one OmniCore controller. The option is used as licensing mechanism for the application software. The FlexLoader function packages themselves are ordered separately, typically from the Global Solution Center for Machine Tending or your local ABB sales contact.

For further information see product specification *FlexLoader Vision (3HAC064614-001)*.

This option applicable to IRB 1100, IRB 1300.

Features

- PC-based architecture, scalable up to 4 cameras
- Pre-pick collision avoidance
- Supports user-defined grippers
- Out of reach prevention
- Choice of moving and rolling part avoidance
- User defined parameter to robot or external PLC
- Supports both 2D and 3D sensors
- Simple and intuitive user interface designed for machine tool tending
- Handles an unlimited number of components without mechanical fixtures
- Teach-in time of new work pieces is less than 10 minutes
- Faster changeover time between components
- Parameterized teach-in interface for lathe applications provides a quick and easy user experience
- Pre-programmed robot code provides short installation time
- Single point of operating control

Application

FlexLoader Vision is a robot guiding vision system for machine tending applications. It identifies the work piece location and orientation from the picking area and guides the robot with precision in the robot cell. It allows a complete teach-in that is very simple and intuitive from beginning to end. It is well-proven with high speed, short teach-in times and reliable production in a user friendly way.

The FlexLoader Vision can be used for both 2D and semi-oriented 3D applications.

The system reverts complex 3D images to well-known 2D images in order to increase the usability for the operator. No CAD files are required to teach-in new components.

FlexLoader Vision is part of most function packages in the FlexLoader product family, offering a wide range of machine tool tending solutions.

Performance

See product specification *FlexLoader Vision (3HAC064614-001)*.

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Requirements

The option *Prep. For FL Vision* requires option *Multitasking [3114-1]*.

7.23.1.3 Prepared for Visual servoing

7.23.1.3.1 Prep. Visual Servoing [3135-1]

General

Visual Servoing is a PC-based software which allows to increase the robot accuracy for high precision assembly and alignment applications.

Visual servoing involves the use of one or more cameras and a computer vision system to control the position of the robot's end-effector relative to the work piece as required by the task.

Features

- Enabling 6-axis robots for high precision assembly
- Improved alignment speed compared to traditional look-then-move approach.
- Reduced variance of alignment speed compared to look-then-move approach.
- Easy commissioning with auto calibration and tuning for servoing purpose.
- Compatible with a wide number of vision sensors.

Application

Assembly for high accuracy needed applications, especially in Electronics.

- Assembly applications
- Alignment of components
- Picking/placing a work object in a tool
- Placing a part in a fixture

Requirements

The option *Prepared for Visual Servoing* requires option *EGM [3124-1]*.

Limitations

High Accuracy assembly only verified for IRB 1100.

7.23.2 Force Control

7.23.2.1 Force Control Standard [3415-1]

General

Force control Standard is an option that contains the RAPID instructions required to run force control.

Force control Standard is available for CRB 15000 (GoFa) and is using the built-in torque sensors in combination with the RAPID instructions to support different application/solutions based on making the robot compliant with external forces/process forces.

Assembly FC

Assembly FC (Force Control) is a set of functions, which will highly facilitate the use of robots for assembly tasks. Assembly is a very demanding application where parts with very small tolerances shall fit together, e.g shafts into gear wheels. Since tolerances are in the magnitude of robot repeatability, this normally requires high accuracy fixtures and robots with very high precision and still the risk for position failure, where parts are stuck or damaged, is very high. In many cases also parts are not fixed but can have random positions, and thus traditional position-controlled robots are not possible to use.

With *Assembly FC* and Force/Torque sensor the robot is equipped with "tactile" sense and thus can handle the parts like a human worker, that is search along a predefined pattern and try pushing until parts slip into position with only small contact forces used. If measured force gets larger than desired the robot would move back to decrease the force. This will save both installation cost and programming time but also reduce the process cycle time.

Other areas where *Assembly FC* is useful are:

- Product testing - apply the same amount of force to a product repetitive
- Part mating
- Automated fastening

Assembly FC includes functions to use different predefined assembly patterns, designed for different tasks, but also possibility to combine some of them to create new patterns for more complex assembly tasks.

Machining FC

Machining FC is a set of functions, which will highly facilitate the use of robots for machining applications. *Machining FC* includes solutions for using force control in different machining applications where the robot needs to be sensitive to process forces. *Machining FC* offers two kinds of process control, optimized for different kinds of machining, namely *FC Pressure* and *FC Speed Change*.

FC Pressure functionality

With the FC Pressure functionality, the robot will always keep a constant force against a surface, resulting in that the robot will follow the curvature of the surface.

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7.23.2.1 Force Control Standard [3415-1]
Continued

The FC Pressure functionality is for example advantageous to use in machining processes like grinding and polishing where the robot needs to obtain a defined pressure (force) between the tool and part for proper result. With FC Pressure functionality, the programmed path roughly needs to follow the surface as the robot position will be adjusted to achieve the defined contact force between tool and part. This will save programming time as well as improve the product quality.

FC Speed Change functionality

FC Speed Change will allow programming at the maximum process speed and automatically slow down the robot when the machining forces are too high.

The FC Speed Change functionality can for example be favorable to use in a machining process like deburring, where the robot needs to slow down when hitting excessive burr, or even retract for sequential machining. The robot is position controlled, that is it will follow the programmed path, in this functionality. With the FC Speed Change functionality the robot will vary the processing speed. This will save programming time but also reduce the process cycle time.

Functional description

Normally robots are position controlled, which means that the robot is forced to move to a certain ordered position. If the robot is prevented to reach the target, the servo will increase power until max torque or collision is detected.

With *Assembly FC* it will be possible to let the robot search along a surface while keeping a predefined contact force. Once the mounting hole is found, the part will “fall” into place and the robot will push the part in to the opening until correct position is reached.

A typical assembly task will for example be the mounting of axis and gear wheels in a clutch. Such a task will include several different movements to find the correct location and insert the axis. For any assembly task it will be possible to tailor the best optimum search pattern/movement and choose between a number of criteria for accepting/ending the operation.

With *Force Control for Machining*, it will be possible to either let the robot maintain a constant force perpendicular to the path while following the surface curvature (FC Pressure) or let the robot slow down on the pre-defined path to reduce the force acting on the robot (FC Speed Change).

About FC Pressure

The purpose of FC Pressure is to make the robot sensitive to contact forces perpendicular to the move direction. The robot can “feel” its surroundings and follow the surface of the processed part to obtain a certain pressure against an object. This means that the robot will change its position in order to apply a constant force/pressure on a surface, even if the exact position of the surface is not known. Since pressure is obtained by moving the robot path, this function is more suited for polishing, grinding and cleaning, where a surface should be made even and smooth. The material that is removed and the changes of the surface topology / dimensions depend on the process parameters like tooling, applied pressure, robot speed etc.

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See below some examples from foundry and metal fabrication where FC Pressure is useful:

- Grinding of faucets
- Polishing of kitchen sinks
- Deflashing and cleaning of castings
- Deburring of castings

About FC Speed Change

In processes where path accuracy is important and where the finished result shall comply with specific dimensions, FC Speed Change is recommended. This function will be useful combined with force sensor or other input indicating excessive forces, which can negatively affect the finished result. When speed change is active and if machining forces exceed a certain value, then the path speed will automatically be reduced, thus decreasing forces, minimizing changed dimensions due to deflections of the robot arm and most probably avoid damaging the part/tool due to stress and heat. This will guarantee path accuracy even if much material shall be removed. Some examples where FC Speed Change may be used:

- (Wheel) Grinding unevenly distributed material on casted surfaces
- Milling along the edge of a work piece
- Deburring along contour of a work piece
- Deflashing unevenly distributed burr along a part line on castings
- Deburring of castings

Assembly FC features

- Sensor calibration and load identification, which will calibrate the force sensor to remove offsets such as the gravity force. RAPID instructions: `FCCalib`, `FCLoadId`
- Activation and deactivation of Force Control. When activating Force Control for instance, the following can be set up.
- Force control coordinate system
- Damping, that is how the robot speed depends on the contact force. RAPID instructions: `FCAct`, `FCDeact`, `FCRefStart`
- Definition of reference values (desired force, torque and/or search pattern). When activating a force/torque reference, the robot will move in order to achieve the specified reference level. When activating a search reference, the robot will attempt to move according to the specified pattern, like circular, spiral or linear movement. RAPID instructions: `FCRefForce`, `FCRefLine`, `FCRefCircle`, `FCRefSpiral`, `FCRefSpringForce` etc.
- End conditions (how long to apply the force, torque and search pattern). The reference force, torque and movement are used to search for a fit. The end conditions are used to determine when this search has been successful. All conditions have a time-out that allows execution to continue even if the end condition is not met. RAPID instructions: `FCCondPos`, `FCCondForce`, `FCCondTime`, `FCCondWaitWhile` etc.

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7.23.2.1 Force Control Standard [3415-1]
Continued

- Supervision, that is Force Control data can be supervised and limits set that must be met. Any data outside supervision conditions will result in an emergency stop. This can be used as a safety measurement by limiting the work area, robot speed, etc. RAPID instructions: `FCSupvForce, FCSupvPos` etc.
- Functions providing feedback from the process, which will give a snapshot of some process data like contact forces, actual load, speed, or if the condition was met or if timed out. RAPID functions: `FCGetForce, FCGetProcessData, FCIsForceMode`
- Data types supporting the instructions and functions

Machining FC feature

- Instructions for programming FC Pressure start, movements and stop.
- Instructions for activating/deactivating FC Speed Change.
- Instruction to setup gravity compensation and sensor offset calibration.
- Instructions for defining reference values (desired force, speed change parameters or movement).
- Instructions for defining recover function for Speed Change
- Instructions for supervision.
- Functions returning data about load, detected forces or process status.
- Data types supporting the instructions and functions

Example of setting up an assembly application

The following steps will illustrate how to set up a new assembly task:

1. Calibrate force sensor
2. Calibrate work piece weight and center of gravity
3. Done once for one type of work piece by executing a RAPID program
4. Determine start point to activate force control, that is where contact is possible
5. Determine nominal contact for magnitude and direction period during which assembly take place
6. Driving force to make two parts fit together

   No motion command necessary during this sequence
7. Determine the search pattern magnitude, frequency and direction
8. Determine supervision criteria

   Optional, may be used to prevent robot to move into fragile areas
9. Determine end point to deactivate force control

   Typical point for the completion of assembly
10. Activate Force Control and references and wait until criteria are fulfilled

    Robot will move until assembly end condition or time out is reached

Product

The option *Force Control Base* will include following:

- Advanced software for the force control

Continues on next page

- A specific set of RAPID instructions for assembly
- A specific set of RAPID instructions for machining
- Manual

Force sensor

Force Control Standard uses built-in torque sensors in the CRB 15000 robot arm. No other sensor is required.

Limitations for Force control Standard

- *Force control Standard* is only available for CRB 15000.
- *Force control Standard* requires OmniCore C30 Controller.
- The total load, that is the sum of gravitational forces and external contact forces, must not exceed limits as specified in the load diagrams for a specific robot.
- If Force control Standard is used together with SafeMove or Electronic Position Switches, the function Operational Safety Range must be used. See the respective manual for these options.

When the robot is force controlled, the following functionality is *not* accessible:

- *Arc*
- *Collision Detection*
- *Conveyor tracking*
- *Independent axes*
- Joint soft servo (instruction `SoftAct`)
- *Path Offset*
- *PickMaster*
- RAPID instructions such as `FCAct`, `FCDeact`, `FCConditionWaitWhile`, and `FCRefStop` can only be called from normal level in a motion task.
- *Sensor* or *Analog synchronization*
- *Sensor interface*
- *SoftMove*
- Tracking functionality like *Conveyor Tracking*, *Optical Tracking*, and *Weld Guide*.
- Force controlled pressure applications (FCPressL etc) and Force controlled speed change applications (FCSpdChgAct etc) cannot be combined with EGM instructions.
- *World Zones*

7.23.3 Conveyor

7.23.3.1 Conveyor Tracking

7.23.3.1.1 Conveyor Tracking [3103-1]

General

The option *Conveyor Tracking* (also known as line tracking) contains functionality which makes the robot follow a work object on a moving conveyor. While tracking the conveyor, the programmed TCP path and speed, relative to the work object, will be maintained even when the conveyor speed is changing slowly.

Features

- Linear and circular conveyors
- Up to 4 conveyors simultaneously. Switch between tracking the one or the other
- Up to 254 objects can be organized in an object queue that can be manipulated by RAPID instructions
- Possibility to define a start window on the conveyor where an object must be enter before tracking of the object can start
- A maximum tracking distance may be specified
- If the robot is mounted on a parallel track motion, the system can be configured such that the track will follow the conveyor and maintain the relative position to the conveyor
- Tracking of a conveyor can be activated *on the fly*, that is it is not necessary to stop in a fine point

Application

Any application where conveyors are used for example painting, arc welding, picking and other applications.

Performance

In automatic mode, at 150 mm/s constant conveyor speed, the tool center point (TCP) of the robot will stay within +/- 2 mm of the path as seen with no conveyor motion. This is valid as long as the robot is within its dynamic limits with the added conveyor motion. This figure depends on the calibration of the robot and conveyor and is applicable for linear conveyor tracking only.

RAPID instructions

RAPID instructions included in this option:

Instruction	Description
WaitWObj	Connects to a work object in the start window
DropWObj	Disconnects from the current object

7.23.3.2 Conv.Tracking unit int. [3041-1]

General

Encoder interface unit for conveyor tracking (DSQC2000). The network based conveyor interface provides connections for 4 encoders and 8 cameras. Network communication is used to share conveyor speed and position data with one or more robot controllers. It can be located inside a robot controller. Each of the encoder inputs supports one 2 phase encoder. Each of the camera connections consists of one digital sync input, one 24V digital trigger output and a camera power output. The camera connection may also be used for other kind of sync input sources, for example, photocells.

The option *Conv.Tracking unit int.* requires:

- *Conveyor Tracking* [3103-1] (the RobotWare option) which makes the robot follow a work object on a moving conveyor.

General	
Power supply input	24 VDC (-15/+20%), typically 200 mA (current not including power outputs)
Operating temperature	+5 °C - +65 °C
Ethernet LAN	2 switched LAN ports, 100Mbit
Ethernet WAN	1 WAN port, 100Mbit

Encoders	4 pcs (X11-X14)
Power output	24 VDC, max 120 mA With connection discovery and overload protection/diagnostic (floating pins will stay at discovery voltage of 10V at off state)
Frequency	0-20 kHz
Input current	5.2 mA at 24 VDC
Voltage levels	15 VDC < '1' < 30 VDC, -3 VDC< '0' < 5 VDC
Supported Encoder types	PNP, NPN, and Push-Pull

The following encoder is verified: Lenord & Bauer GEL 262.

Cameras	8 pcs (X21-X28)
Camera power output	Supplied from X20 camera power inlet. Normally 24VDC With overload protection

Sync input signal	
Power output	24 VDC, 120 mA With overload protection
Frequency	0-20 kHz
Input Current	5.2 mA at 24 VDC
Voltage levels	15 VDC < '1' < 30 VDC, -3 VDC< '0' < 5 VDC
Supported input types	PNP and Push-Pull

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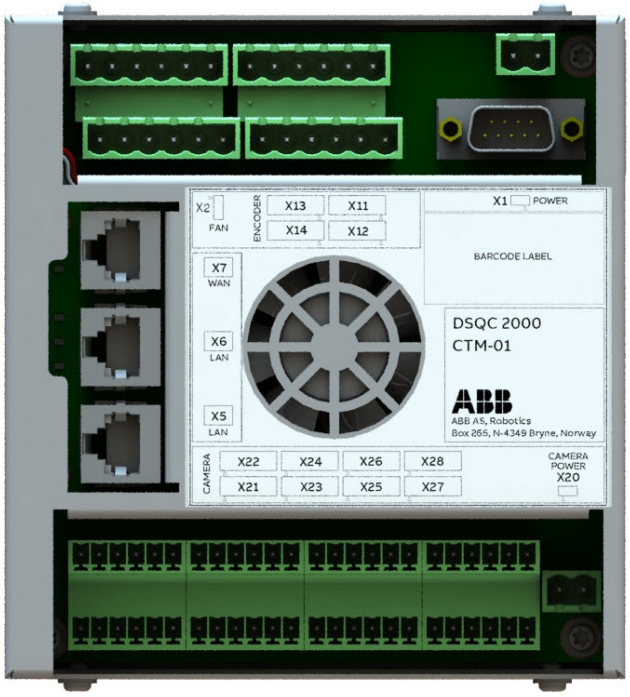
7.23.3.2 Conv.Tracking unit int. [3041-1]
Continued

Trigger output	
Digital output	24 VDC , max 120 mA With connection discovery and overload protection/diagnostic. (Floating pins will stay at discovery voltage of 10V at off state)
Minimum load	0.1 mA



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Requirements

The option Conv.Tracking unit int. requires:

- Option *Conveyor Tracking* [3103-1] or *PickMaster Ready* [3152-x]
- Occupies 1 Ethernet port

Limitations

- The option *Conv.Tracking unit int.* is not possible to order with controller variant *OmniCore C30* [3000-130]
- The possible order combinations of option *Conv.Tracking unit int.* and option *Conv.Tracking unit ext.* is up to two units

7.23.3.3 Conv.Tracking unit ext. [3042-1]

General

Encoder interface unit for conveyor tracking (DSQC2000). It is provided as a separate unit from the controller and needs to be installed in a separate, customized cabinet.

The network based conveyor interface provides connections for 4 encoders and 8 cameras. Network communication is used to share conveyor speed and position data with one or more robot controllers. Each of the encoder inputs supports one 2 phase encoder. Each of the camera connections consists of one digital sync input, one 24V digital trigger output and a camera power output. The camera connection may also be used for other kind of sync input sources, for example, photocells.

The option *Conv.Tracking unit Ext.* requires:

- *Conveyor Tracking* [3103-1] (the RobotWare option) which makes the robot follow a work object on a moving conveyor.

General	
Power supply input	24 VDC (-15/+20%), typically 200 mA (current not including power outputs)
Operating temperature	+5 °C - +65 °C
Ethernet LAN	2 switched LAN ports, 100Mbit
Ethernet WAN	1 WAN port, 100Mbit

Encoders	**4 pcs (X11-X14)**
Power output	24 VDC, max 120 mA With connection discovery and overload protection/diagnostic (floating pins will stay at discovery voltage of 10V at off state)
Frequency	0-20 kHz
Input current	5.2 mA at 24 VDC
Voltage levels	15 VDC < '1' < 30 VDC, -3 VDC< '0' < 5 VDC
Supported Encoder types	PNP, NPN, and Push-Pull

The following encoder is verified: Lenord & Bauer GEL 262.

Cameras	**8 pcs (X21-X28)**
Camera power output	Supplied from X20 camera power inlet. Normally 24VDC With overload protection

Sync input signal	
Power output	24 VDC, 120 mA With overload protection
Frequency	0-20 kHz
Input Current	5.2 mA at 24 VDC
Voltage levels	15 VDC < '1' < 30 VDC, -3 VDC< '0' < 5 VDC

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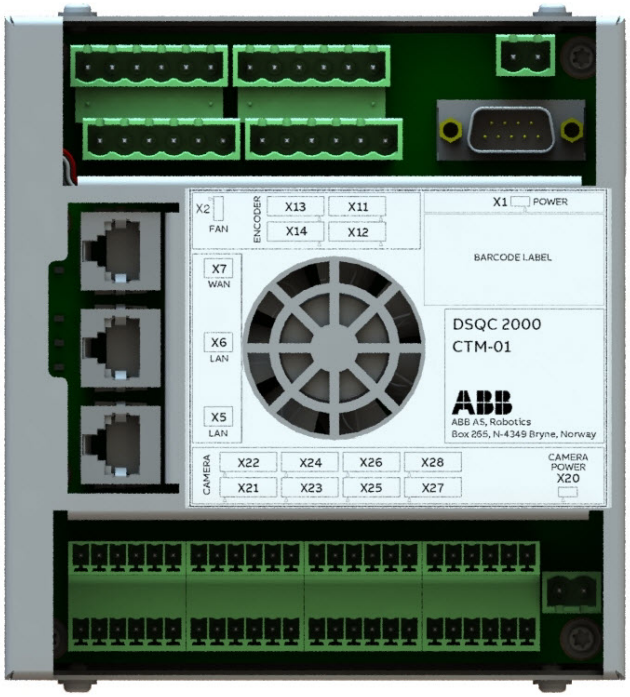
7.23.3.3 Conv.Tracking unit ext. [3042-1]
Continued

Sync input signal	
Supported input types	PNP and Push-Pull

Trigger output	
Digital output	24 VDC , max 120 mA With connection discovery and overload protection/diagnostic. (Floating pins will stay at discovery voltage of 10V at off state)
Minimum load	0.1 mA



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Requirements

The option *Conv.Tracking unit ext.* requires:

- Option *Conveyor Tracking* [3103-1] or *PickMaster Ready* [3152-x]
- Occupies 1-2 Ethernet port(s)

Limitations

The possible order combinations of option *Conv.Tracking unit int.* and option *Conv.Tracking unit ext.* is up to two units.

7.24 Packaging

7.24.1 PickMaster Twin

7.24.1.1 PickMaster Ready

7.24.1.1.1 PickMaster Cell Ready [3152-1]

General

The option *PickMaster Cell Ready*

- Checked by PickMaster Runtime when connecting to a robot, during commissioning when configuring position source and when starting a recipe
- The license is needed to enable PickMaster Runtime with vision for one robot
- Digital I/O is needed for PickMaster functions
- The option is used with Conveyor Tracking options: *Conv. Tracking unit ent.* [3041-1], *Conv. Tracking unit ext.* [3042-1]

Includes RobotWare options

- *Conveyor Tracking* [3103-1]
- *PickMaster Vision Ready* [3153-1]

7.24.1.1.2 PickMaster Robot Ready [3152-2]

General

The option *PickMaster Robot Ready*

- Checked by PickMaster Runtime when connecting to one robot without vision and when starting a recipe
- The license is needed for a robot to be included in PickMaster Runtime
- Digital I/O is needed for PickMaster functions
- The option is used with Conveyor Tracking options: *Conv. Tracking unit ent.* [3041-1], *Conv. Tracking unit ext.* [3042-1]

Includes RobotWare option

- *Conveyor Tracking* [3103-1]

7.24.1.2 PickMaster Vision

7.24.1.2.1 PickMaster Vision Ready [3153-1]

General

The option *PickMaster Vision Ready*

- Checked by PickMaster Runtime during commissioning when configuring position source and when starting a recipe
- The License is needed to receive positions generated by a sensor, either the standard vision or External Sensor
- Valid for multiple sensor driven position sources
- The option is included in *PickMaster Cell Ready* [3152-1]

Requirements

The option *PickMaster Vision Ready* requires option *PickMaster Robot Ready* [3152-2]

7.25 Application Spot welding

7.25.1 Servo Tool Change [3110-1]

General

Servo Tool Change enables an on-line change of tools (external axes), for a certain drive- and measurement system. The control is switched between the axes by switching the motor cables from one servomotor to another. The switch is performed on-line during production.

Main advantages:

- Flexibility in the production process. One robot handles several tools.
- Minimized equipment. A single drive-measurement system shared by many tools.

Features

- On-line change of tools
- Up to 8 different tools

Application

Application	Description
Servo gun changing	Robot held servo guns, designed for different reach and weld forces, equipped with different brands and sizes of servo motors, may be held and operated by a robot, switching from one servo gun to another.
Servo Tool Change	Can be used as an independent option, or as an addition to the RobotWare Spot Servo options.

Performance

When switching tools, the following steps are performed (switching from Axis 1 to Axis 2):

- Axis 1 is deactivated using the RAPID instruction `DeactUnit`
- Axis 1 is disconnected from the motor cables
- Axis 2 is connected to the motor cables
- Axis 2 is activated using RAPID instruction `ActUnit`
- After activation, axis 2 is ready to run

The motor position at the moment of deactivation of one axis is saved and restored next time the axis is activated.

Note

The motor position must not change more than half a motor revolution, when the axis is disconnected. In RobotWare Spot Servo, there is a calibration routine, which handles larger position changes.

Continues on next page

Requirements

Servo Tool Change requires a mechanical wrist interface, a tool changer.

A MOC service parameter, *Disconnect deactive* (type *Measurement channel*), must be defined as *YES* for each tool (external axis) used with this function.

Limitations

- *Servo Tool Change* can be used up to 8 different tools but is limited by 14 axes in total for the drive module. For example, if the robot is on a track motion or if another additional axis is connected to a drive module it reduces the number of allowed tools that can be used with servo disconnect.

RAPID instructions

There are no RAPID instructions included in this option.

7.26 Application Engineering

7.26.1 CAP and DAP Standard [3125-1]

General

Continuous Application Platform Standard (CAP) and Discrete Application Platform Standard (DAP) is a software platform for time-critical applications where a continuous process, for example, arc welding must be synchronized with the TCP movement of the robot, or where a discrete process shall be performed at specific robot positions, for example, spot welding.

Target users are advanced application software engineers and system integrators, for example for arc welding, laser welding, laser cutting, spot welding, drilling, measuring, quality control, etc.

The main advantages are achieved in the following areas:

- Development time
- Program execution time
- Similar look and feel between applications
- Stable software kernel

Features

- Special RAPID instructions and data types
- A single instruction for motion and process execution
- Combination of fine point positioning with the execution of up to 4 parallel processes
- Specialized process for monitoring of external process device, like spot welding controllers
- Supports encapsulation of the process and motion, in shell-routines provided to the end-user
- Flying start/flying end support

Application

Creation of advanced application software with a continuous or discrete process, for example, arc welding, laser cutting, laser welding, spot welding, drilling, measuring, quality control, etc.

Performance

The platform is designed to have an internal kernel, administrating the fast and quality secured application demands. The kernel calls RAPID routines, which are prepared by the application developer to fulfill the specific tasks. The application developer regulates the degree of flexibility of the end-user, by hiding process complexity.

Requirements

The option *Multitasking* is required for Discrete Application Platform (DAP) functionality if more than 1 DAP process is used.

Continues on next page

RAPID instructions

See *Application manual - Continuous Application Platform* and *Application manual - Discrete Application Protocol*.

Limitations

It is not possible to use CAP and DAP together.

CAP and DAP can only be used on 6-axis robots and CRB 15000.

7.26.2 CAP and DAP Premium [3125-2]

General

The Premium level includes all functionality from the Standard level, in addition to the premium functionality.

For a description of the Standard level, see *CAP and DAP Standard [3125-1] on page 218*.

Features: Tracking Interface

The *Tracking Interface* feature for CAP makes it possible to use external equipment as source of robot path corrections. The interface is easy to access: either by using analog input or output signals, or simply RAPID persistent data to provide corrections. The interface is set up simply using a RAPID instruction. Some areas of use are e.g. height control for Plasma welding or TIP TIG welding.

- At-Point-Tracking controlled by analog input signals.
- At-Point-Tracking controlled by analog output signals.
- At-Point-Tracking controlled by persistent variables.

The *Tracking Interface* can be used together with CAP.

Limitations

It is not possible to use CAP and DAP together.

CAP and DAP can only be used on 6-axis robots and CRB 15000.

7.26.3 Production Framework [3404-1]

General

Production Framework is a customizable modular platform for order based external control of an ABB robot system.

It shares some features with the older product *Production Manager* but is generally more focused on providing a flexible and customizable platform rather than a provided-as-is fixed solution.

The main purpose of the framework is to handle orders from an external source, typically a PLC in charge of managing the various equipment in the cell. These orders are then executed by the framework by running user-specified RAPID routines.

Features

- Safely transferring orders from the TRAP execution level to normal execution level
- A state-based production loop
- Events, which can be used by the programmer to run code at various times in the production loop, or when certain system events occur
- Multi-tasking and MultiMove abstraction layer for easier (compared to using the basic RAPID API) synchronization of orders and events that are running on several RAPID tasks
- Aborting orders
- Enqueueing orders
- Customizable order constraints
- General logging
- Traceability
- Running independently on any RAPID task, including background tasks
- Flexible architecture with customizable features

Add-In distributed

This option requires an Add-In (Production Framework), available through the RobotStudio Add-In repository.

Requirements

- Multitasking [3114-1]

Limitations

Not together with product: CRB 1100, CRB 1300

7.27 Application Machining

7.27.1 Machining Standard [3418-1]

General

Machining Software provides the auto-calibration function that allows users to define calibration toolkits (eg. probe), cutters, external axis and work objects. The calibrated data can be copied to and reused in RAPID for other projects, which simplifies the calibration process.

> **Note**
>
> The Machining Software application on FlexPendant is only supported by OmniCore controllers operating in RobotWare 7.*X*.

Key features

Machining Standard provides the following main features:

- Web-based access to machining projects (using PC)
- Dedicated Machining application for working with machining projects (using FlexPendant)
- Auto-calibration on calibration toolkit, cutters, external axis and work objects

7.27.2 Machining Premium [3418-2]

General

Machining Software complements the Machining PowerPac - Machining Functionality (hereinafter referred as Machining PowerPac) add-in in RobotStudio. After creating programs in Machining PowerPac, users can synchronize or load the programs to Machining Software and then perform program tuning in web browser on PC or in the dedicated Machining application on FlexPendant. Different from Machining PowerPac that provides offline programming functions, Machining Software can load the tuned programs to the connected controller (virtual or real) directly. This improves programming efficiency and reduce the onsite commissioning time.

Note

The Machining Software application on FlexPendant is only supported by OmniCore controllers operating in RobotWare 7.*X*.

Key features

Machining Premium provides the following main features:

- Web-based access to machining projects (using PC)
- Dedicated Machining application for working with machining projects (using FlexPendant)
- Tunning programs created by either Machining PowerPac or Machining Software itself including path smoothing and instruction editing
- Auto-calibration on calibration toolkit, cutters, external axis and work objects

Versions

Machining Software provides two versions, Machining Standard (option 3418-1) and Machining Premium (option 3418-2), with different user access to functions. The following table lists the main functions to which the two options can access.

Function		Standard	Premium
File operations	File loading	X	X
	File export	X	X
Program tuning	Path smoothing		X
	Wave path setting		X
	Instruction editing		X
Auto-calibration	Toolkit calibration	X	X
	Cutter calibration	X	X
	Work object calibration	X	X

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7.27.2 Machining Premium [3418-2]
Continued

Note

Only one version can be installed on a controller at a time.

For the web-based Machining Software, if the version is changed, clean the browser cache and restart the browser to make the new version take effect. Otherwise, a version incompatibility message will be displayed.

7.28 Warranty

Warranty

For the selected period of time, ABB will provide spare parts and labor to repair or replace the non-conforming portion of the equipment without additional charges. During that period, it is required to have a yearly *Preventative Maintenance* according to ABB manuals to be performed by ABB. If due to customer restrains no data can be analyzed with ABB Connected Services for robots with OmniCore controllers, and ABB has to travel to site, travel expenses are not covered. The *Extended Warranty* period always starts on the day of warranty expiration. Warranty Conditions apply as defined in the *Terms & Conditions*.

Note

This description above is not applicable for option *Stock warranty* [438-8]

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from *Factory Shipment Date* or from activation date of standard warranty in WebConfig. **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

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Index

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