ROBOTICS

Product manual

IRC5 Compact

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Product manual

IRC5 Compact

Design 14

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Original instructions.

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for:

- installing the controller, mechanically as well as electrically.
- maintenance of the controller.
- mechanical and electrical repair of the controller.

Usage

This manual should be used during:

- installation and preparation work.
- maintenance work.
- repair work.

Who should read this manual?

This manual is intended for:

- installation personnel.
- maintenance personnel.
- repair personnel.

Prerequisites

Maintenance/repair/installation personnel working with an ABB Robot must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.

References

Reference	Document ID
Product manual - IRC5	*3HAC047136-001*
Operating manual - Emergency safety information	*3HAC027098-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Operating manual - RobotStudio	*3HAC032104-001*
Operating manual - Getting started, IRC5 and RobotStudio	*3HAC027097-001*
Operating manual - Troubleshooting IRC5	*3HAC020738-001*
Application manual - MultiMove	*3HAC050961-001*
Application manual - Force Control	*3HAC050377-001*
Application manual - SafeMove1	*3HAC050974-001*
Application manual - Electronic Position Switches	*3HAC050996-001*
Application manual - Functional safety and SafeMove2	*3HAC052610-001*
Technical reference manual - RAPID Instructions, Functions and Data types	*3HAC050917-001*
Technical reference manual - System parameters	*3HAC050948-001*
Product specification - Controller IRC5	*3HAC047400-001*

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Reference	Document ID
See *Circuit diagrams on page 235*.	

Note

The document numbers that are listed for software documents are valid for RobotWare 6. Equivalent documents are available for RobotWare 5.

Revisions

Revision	Description
-	First edition. Released with the new computer unit, DSQC1000.
A	• New computer unit, DSQC1018, with two PCI slots and no knockout plates. No functional change, but affects illustrations. • Corrections on chapter *Repair on page 135*. • Corrected article number for line filter in *Replacement of line filter on page 206*. • Clarified the use of the WAN port in section *Connectors on the computer unit on page 62*.
B	• Added mounting kit as spare part in section *Mounting the controller in a 19" cabinet on page 51*. • Some changes on how the ports can be configured and used is described in section *Connectors on the computer unit on page 62*.
C	Release 15.2. • Minor corrections. • Added safety-related information related to mode switch keys, *Function tests on page 127*, and *Refurbish*. • Updates in section *Applicable standards on page 216*.
D	Release 16.1. • Updated cable info for IRB 1200 in section *Manipulator cables on page 231*. • Spare parts updated. • Section *Connecting cables to the controller* added. • New Remote service box introduced. • Safe Move 2 information added. • Circuit diagrams for Motors ON/OFF updated. • Minor corrections.
E	Release 16.2. • Added section *Installing the Safety module DSQC1015 for SafeMove on page 113*. • Added information that function tests should be performed after replacing a component. • Changes in the article names for some spare parts. • Removed section *Refurbish*.

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Revision	Description
F	Release 17.1. • Added sections *Function test of reduced speed control on page 134*, and *About emergency stop on page 28*. • Updated descriptions of stops in section *Protective stop and emergency stop on page 26*. • Added section *Safety data on page 18*. • Updated list of labels in section *Safety symbols on controller labels on page 23*. • New computer unit DSQC1024 is introduced, see *Computer unit parts on page 225*. • Spare parts updated, see *Manipulator cables on page 231*. • Added section *Grounding on page 80*. • Information regarding new safety board DSQC400E added. • Minor corrections.
G	Release 17.2. • Updated list of applicable standards. • Updated section *Connecting cables to the controller on page 68*. • Added section *Power supply system requirements on page 75*. • Spare parts updated, see *Manipulator cables on page 231*. • Removed all references to computer unit DSQC1024. • Minor corrections.
H	Release 18.1. • Added cautions about not using external power in section *Connecting the cables to the Safety module (hardware switch and 731-1) on page 116*. • Added information about DSQC 400E in section *Emergency stop output on page 96*. • Updated to correct and consistent naming convention: DSQC 400/DSQC 400E is called Safety board. DSQC1015 is called Safety module. • Updated information about DSQC 651 and DSQC 652. • Added section *FlexPendant parts on page 229*. • Safety section restructured. • Added information about disposal of storage media. • Clarified the limitations for Isolated Lan 3 in the section *Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later) on page 64*.
J	Release 18.2. • Updated spare parts for harnesses. • New computer unit DSQC1024 is added, see *Computer unit parts on page 225*. • Added note in section *Replacement of SD-card memory in computer unit on page 170*, that SD-card from DSQC1018 cannot be used in DSQC1024.

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Revision	Description
K	Published in release 19B. The following updates are made in this revision: • Updated spare parts numbers for manipulator cables. • New chapters added: *Conveyor tracking module on page 106* and *Installation of conveyor tracking module on page 111* • Updated the illustration for the dimension of the footprint. • Added information in *Connecting cables to the controller on page 68*. • Added information about delays on safety inputs in *Protective stop and emergency stop on page 26*. • Updated spare parts number for DSQC 668. • Updated spare parts and information for Connected Services box. Remote Service box is renamed to Connected Services box.
L	Published in release 19C. The following updates are made in this revision: • Added information about FlexPendant cables, see *Handling the FlexPendant cables on page 60*.
M	Published in release 20B. The following updates are made in this revision: • Information regarding power supply system requirements has been improved in sections *Isolation transformer on page 76* and *Mains line filter on page 77*.
N	Published in release 20D. The following updates are made in this revision: • SD card 3HAC061416-003 that is used with computer DSQC1024 added in spare part list for *Computer unit parts on page 225*. • Article numbers for signal cables updated in *Manipulator cables on page 231*.
P	Published in release 21A. The following updates are made in this revision: • Required space on the front updated in section *Required installation space on page 43*. • Note for the depth of the 19" cabinet added in section *Mounting the controller in a 19" cabinet on page 51*. • Minor corrections in section *Connectors on the computer unit on page 62*. • Information added about China RoHS, see *Environmental information on page 212*. • Spare part numbers corrected for manipulators IRB 1600 in section *Manipulator cables on page 231*. • Section *Installation of external enabling device* removed because external cabling is not possible with IRC5 Compact.
Q	Published in release 21B. The following updates are made in this revision: • Added a new section on Closing the Automatic Stop circuit, see *Closing the Automatic Stop circuit*.
R	Published in release 21C. The following updates are made in this revision: • The reference to the Euromap circuit diagram is updated to new article number. • Added information, see *AC current in CP/CS on page 69*.
S	Published in release 21D. The following updates are made in this revision: • Updated safety data.
T	Published in release 22A. The following updates are made in this revision: • Updated information about humidity, see *Operating conditions on page 41* and *Storage conditions on page 41*. • Added note about networks and Connected Services, see *Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later) on page 64*.

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Revision	Description
U	Published in release 22C. The following updates are made in this revision: • Added note that decommissioning shall be preceded by a risk assessment. • The rating label on the controller is changed to *full load current*.
V	Published in release 22D. The following updates are made in this revision: • Added information about a new version of the FlexPendant. • Added section *Open source and 3rd party components on page 221*.
W	Published in release 23A. The following updates are made in this revision: • Corrected spare part number for the FlexPendant holder.
X	Published in release 23B. The following updates are made in this revision: • Safety data updated.
Y	Published in release 23C. The following updates are made in this revision: • Added IRB 1510.
Z	Published in release 23D. The following updates are made in this revision: • Spart part for main computer DSQC1094 added in section *Computer unit parts on page 225*.
AA	Published in release 24A. The following updates are made in this revision: • Information about Ethernet Switch updated in *Controller system parts on page 223*. • Information about SD card updated in *Computer unit parts on page 225*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

Tip

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

Product manuals

Manipulators, controllers, DressPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.

Continues on next page

- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

Network security

Network security

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to provide, and continuously ensure, a secure connection between the product and to your network or any other network (as the case may be).

You shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its entities are not liable for damage and/or loss related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

The information does not cover how to design, install and operate a robot system, nor does it cover all peripheral equipment that can influence the safety of the robot system.

In particular, liability cannot be accepted if injury or damage has been caused for any of the following reasons:

- Use of the robot in other ways than intended.
- Incorrect operation or maintenance.
- Operation of the robot when the safety devices are defective, not in their intended location or in any other way not working.
- When instructions for operation and maintenance are not followed as intended.
- Non-authorized design modifications of the robot.
- Repairs on the robot and its spare parts carried out by in-experienced or non-qualified personnel.
- Foreign objects.
- Force majeure.

Spare parts and equipment

ABB supplies original spare parts and equipment which have been tested and approved for their intended use. The installation and/or use of non-original spare parts and equipment can negatively affect the safety, function, performance, and structural properties of the robot. ABB is not liable for damages caused by the use of non-original spare parts and equipment.

1.1.2 Safety data

About this section

This chapter describes the necessary safety data required by standard EN ISO 13849-1:2015.

Prevailing directives and standards

For the use of industrial robots and how to protect personnel from being injured, special regulations must be fulfilled as described in the following directives and standards:

- Machinery Directive 2006/42/EC
- EN ISO 10218-1:2011
- EN ISO 13849-1:2008 (when explicitly called forth by EN ISO 10218-1:2011 as ISO 13849-1:2006)
- EN ISO 13849-1:2015

Performance level and category

EN ISO 13849-1, which is a B-standard, describes the general concept of performance level (PL) and category. Each machine or machinery is potentially dangerous and can cause personal injury. Based on severity of injury and probability of accident, when using the machine, a certain level of safety performance, so called required performance level (PLr) can be defined, where *level a* represents the lowest risk and *level e* the highest. According to this, the machine must be equipped with safety related parts, meeting the required performance level, to reduce the risk to accepted low level. As specified in EN ISO 10218-1, normally *PL d* is required for robots, but depending on the applications a higher requirement could be needed if a risk analysis will result in *PL e*.

To comply with a certain PLr, in this case *d*, the safety related parts of the robots and controllers must be structurally designed according to specific structure categories and using reliable components.

In EN ISO 13849-1 it is in detail specified what category and components data, which must be met, to fulfill *PL d*. These are:

- Category 3, which is normally fulfilled using double channels
- $MTTF_D$ (Mean Time To dangerous Failure) – high
- DC (Diagnostic Coverage) – low or medium
- CCF (Common Cause Failures) – better than 65 scores according to Annex F

Performance level for ABB IRC5 controller

To verify that robots and controller comply with at least *PL d* a self assessment has been carried out and documented in a *Technical Report*. The essential conclusions are accounted for below.

The safety related parts of robot and controller are e.g. the following stop circuits:

- Enabling device
- Emergency stop on operator panel

Continues on next page

- Emergency stop on FlexPendant
- Limiting robot motion
- Protective stops
- SafeMove2

For the overall design and structure, the category 3 has been verified and meeting the requirements of CCF.

Each of the stop circuits includes different components like enabling switch, panel board, contactor board, relays etc. For each of these the $MTTF_D$ and DC have been calculated according to EN ISO 13849-1 Annex C, D and E resulting in the values as specified in the following table.

See the SISTEMA/ABB FSDT libraries for details of the safety functions.

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Safety function	Calculated $MTTF_D$ [years]	DC_{avg}
Emergency stop inputs (operator panel)	57	Medium
Automatic stop input	59	Medium
General stop input	59	Medium
Superior stop input	59	Medium
Limiting switch input (without customer connection)	59	Medium
Three-position enabling device inputs	51	Medium
Emergency stop status outputs	71	Medium
Emergency stop inputs (source external)	54	Medium
SafeMove2 functions (option)		
Protective stop	370	Low
Emergency stop	370	Low
Emergency stop safe fieldbus output	160	Low
Speed supervision	370	Low
Speed supervision safe fieldbus output	370	Low
Position supervision	370	Low
Position supervision safe fieldbus output	370	Low

Based on the values from the previous table of $MTTF_D$ values, the corresponding PFH_D can be calculated using the Annex K, table K1 of EN ISO 13849-1:2008. These are shown in the following table.

IRC5C Compact

Stop circuit	Calculated PFH_D	PL
Emergency stop inputs (operator panel)	1.03x10E-07	d
Automatic stop input	1.03x10E-07	d
General stop input	1.03x10E-07	d

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1.1.2 Safety data
Continued

Stop circuit	Calculated PFH_D	PL
Superior stop input	1.03x10E-07	d
Limiting switch input (without customer connection)	1.03x10E-07	d
Three-position enabling device inputs	1.19x10E-07	d
Emergency stop status outputs	7.68x10E-08	e
Emergency stop inputs (source external)	1.19x10E-07	d
SafeMove2 functions (option)		
Protective stop	1.01x10E-07	d
Emergency stop	1.01x10E-07	d
Emergency stop safe fieldbus output	1.01x10E-07	d
Speed supervision	1.01x10E-07	d
Speed supervision safe fieldbus output	1.01x10E-07	d
Position supervision	1.01x10E-07	d
Position supervision safe fieldbus output	1.01x10E-07	d

Conclusion according to EN ISO 13849-1:2015

The IRC5 controller safety system has a safety *category 3* with performance level *PL d* according to EN ISO 13849-1 using the simplified method of chapter 4.5.4 of EN ISO 13849-1 and thus fulfils the safety performance requirement of the robot safety standard EN ISO 10218-1.

The *Common Cause Failure* (CCF) is met according to the standard requirements.

1.1.3 Requirements on personnel

General

Only personnel with appropriate training are allowed to install, maintain, service, repair, and use the robot. This includes electrical, mechanical, hydraulics, pneumatics, and other hazards identified in the risk assessment.

Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, service, repair, or use the robot.

The plant liable must make sure that the personnel is trained on the robot, and on responding to emergency or abnormal situations.

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

This section specifies all safety signals used in the user manuals. Each signal consists of:

- A caption specifying the hazard level (DANGER, WARNING, or CAUTION) and the type of hazard.
- Instruction about how to reduce the hazard to an acceptable level.
- A brief description of remaining hazards, if not adequately reduced.

Hazard levels

The table below defines the captions specifying the hazard levels used throughout this manual.

Symbol	Designation	Significance
	DANGER	Signal word used to indicate an imminently hazardous situation which, if not avoided, will result in serious injury.
	WARNING	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in serious injury.
	ELECTRICAL SHOCK	Signal word used to indicate a potentially hazardous situation related to electrical hazards which, if not avoided, could result in serious injury.
	CAUTION	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in slight injury.
	ELECTROSTATIC DISCHARGE (ESD)	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in severe damage to the product.
	NOTE	Signal word used to indicate important facts and conditions.

1.2.2 Safety symbols on controller labels

Introduction to safety symbols

Both the manipulator and the controller are marked with labels containing safety symbols and important information about the product. The purpose of the labels is to ensure personal safety for all personnel handling the robot, for example during installation, service, or operation.

The safety symbols are language independent, they only use graphics. The information labels contain information in text. See *Symbols and information on labels on page 23*.

Note

The safety and information labels on the product must be observed.

Symbols and information on labels

Note

The descriptions in this section are generic, the labels can contain additional information such as values.

Label	Description
 xx1400001152	Read the user manual before use.
 xx1800000835	CE label
 xx1400002060	UR certified (component)

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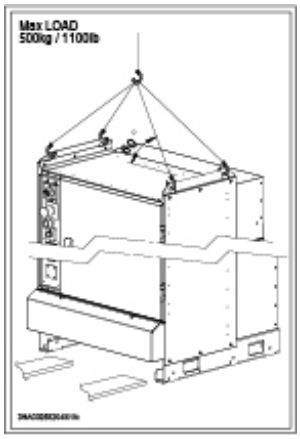
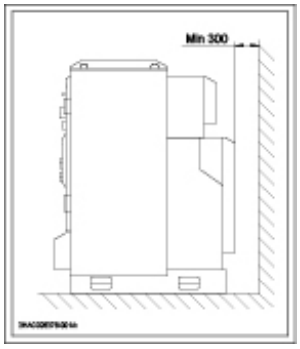
1.2.2 Safety symbols on controller labels

Continued

Label	Description
 xx1400002061	UL certified (robot with controller)
 xx1400001163	Rating label (example)
 xx1400001157	Lifting instruction for the IRC5 controller.
 xx1400001155	Required installation space.
 xx1400001151	Electrical shock

Continues on next page

Label	Description
 xx1400001161	Disconnect incoming mains before servicing the controller.
 xx1400001160	Disconnect incoming mains before servicing the controller (only for welding equipment).
 xx1700000354	Disconnect incoming mains before servicing the controller (for controllers without UL mains switch).
 xx1400001156	High voltage inside the module even if the main switch is in the OFF position.
 xx1400001162	ESD sensitive components inside the controller.

1.3 Robot stopping functions

1.3.1 Protective stop and emergency stop

Robot stopping functions

The robot has protective and emergency stop functions (stop category 0 or 1, in accordance with IEC 60204-1).

Stop category 0	As defined in IEC 60204-1, stopping by immediate removal of power to the machine actuators.
Stop category 1	As defined in IEC 60204-1, a controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved.

A stop function, protective or emergency stop, has a default setting for the stop category, see *Inputs to initiate a protective stop or an emergency stop on page 26*.

The default stop category for a protective or emergency stop can be re-configured.

Activation of external safety rated devices, connected to the robot controller through dedicated discrete safety inputs or safety protocols, will initiate these stop functions.

Inputs to initiate a protective stop or an emergency stop

Inputs to initiate a stop function	Description	Default stop category	Stop category reconfigurable
Emergency Stop (ES)	Input to initiate the emergency stop function. The *Emergency Stop* function is initiated in both automatic and manual mode.	Stop category 0 For deviations, see the product manual for the manipulator.	Yes
Automatic Stop (AS) (IRC5)	Input to initiate the protective stop function *Automatic Stop*. The *Automatic Stop* function is only initiated in automatic mode.	Stop category 1	Yes
General Stop (GS) (IRC5)	Input to initiate the protective stop function *General Stop*. The *General Stop* function is initiated in both manual mode and automatic mode.	Stop category 1	Yes
	Inputs to initiate the protective stop function. The protective stop function can be configured as *Automatic Stop* or *General Stop*. *Automatic Stop* is only initiated in automatic mode. *General Stop* is initiated in both manual mode and automatic mode. [i]	Stop category 1 For deviations, see the product manuals for the controller and the manipulator.	Yes

Continues on next page

Inputs to initiate a stop function	Description	Default stop category	Stop category reconfigurable
Superior Stop (SS) (IRC5)	Input to initiate the superior stop function. The *Superior Stop* function is initiated in both manual mode and automatic mode. (Superior stop is only available for IRC5.)	Stop category 1	Yes

i Depending on controller variant, there can be one or two inputs for the protective stop function. See the product manual for the robot controller.

For example, a safety rated output from a presence sensing device, connected to AS / GS, a dedicated discrete protective stop input on the robot controller, will when the protective stop function is configured as Automatic Stop (AS) initiate the protective stop function in automatic mode only.

The emergency stop function is a complementary protective measure and shall not be applied as a substitute for safeguarding measures or safety functions.

Note

For IRC5, a safety input on the panel board that is initiated, must remain active for at least 1.5 s.

Stop category configuration for IRC5

The stop category for the safety input can be configured, see *Technical reference manual - System parameters*.

Safety inputs	System parameter *Function*	Description
Emergency Stop	*SoftES*	*SoftES* is used to configure the emergency stop in automatic and manual mode. The default configuration is *FALSE* (stop category 0).
Automatic Stop	*SoftAS*	*SoftAS* can be used to configure the protective stop in automatic mode either as stop category 0 or category 1. The default configuration is *TRUE* (stop category 1).
General Stop	*SoftGS*	*SoftGS* can be used to configure the protective stop in automatic and manual mode, either as stop category 0 or category 1. The default configuration is *TRUE* (stop category 1).
Superior Stop	*SoftSS*	*SoftSS* can be used to configure the protective stop in automatic and manual mode, either as stop category 0 or category 1. The default configuration is *TRUE* (stop category 1).

1.3.2 About emergency stop

The emergency stop

The purpose of the emergency stop function is to avert actual or impending emergency situations arising from the behavior of persons or from an unexpected hazardous event.

The emergency stop function is to be initiated by a single human action.

The emergency stop function is a complementary protective measure and shall not be applied as a substitute for safeguarding measures and other functions or safety functions.

The effect of an activated emergency stop device is sustained until the actuator of the emergency stop device has been disengaged. This disengagement is only possible by an intentional human action on the device where the command has been initiated. The disengagement of the emergency stop device shall not restart the machinery but only permit restarting.

Note

The emergency stop device on the FlexPendant is operational when the robot is powered. Indicators to be used to verify that the robot is powered are the main switch on the cabinet or the LED indicator on the cabinet when robot is in Motors On Mode.

1.3.3 Enabling device and hold-to-run functionality

Three-position enabling device

CAUTION

The person using the three-position enabling device is responsible to observe the safeguarded space for hazards due to robot motion and any other hazards related to the robot.

The three-position enabling device is located on the FlexPendant. When continuously held in center-enabled position, the three-position enabling device will permit robot motion and any hazards controlled by the robot. Release of or compression past the center-enabled position will stop the robot motion.

CAUTION

For safe use of the three-position enabling device, the following must be implemented:

- The three-position enabling device must never be rendered inoperational in any way.
- If there is a need to enter safeguarded space, always bring the FlexPendant. This is to enforce single point of control.

Hold-to-run function in manual high speed mode

The hold-to-run function for manual high speed allows movement in conjunction with the three-position enabling device when the button connected to the function is actuated manually. This hold-to-run function can only be used in manual high speed mode. In case of hazard, release or compress the three-position enabling device.

How to use the hold-to-run function for manual high speed mode is described in the operating manual for the controller.

Deviations are listed in the product manual for the manipulator.

1.4 Robot operating modes

1.4.1 About the manual mode

The manual mode

Manual mode is a control state that allows for the direct control by an operator. The operator will through positioning the three-position enabling device to the center-position allow for movement of the manipulator.

There are two manual modes:

- Manual reduced speed
- Manual high speed (optional)

Safeguard mechanisms

Protective stop function initiated by

- Three-position enabling device (release of or compression past the center-enabled position)
- General Stop, GS (IRC5)

Deviations are listed in the product manual for the controller.

1.4.2 About the automatic mode

The automatic mode

Automatic mode is an operating mode in which the robot operates in accordance with the task program(s) and therefore not in manual control by an operator.

Safeguard mechanisms

Protective stop function initiated by

- Automatic Stop, AS (IRC5)
- General Stop, GS (IRC5)
- Superior Stop, SS (IRC5)

Note

Prior to allowing the robot to operate in automatic mode, ensure that any suspended safeguards, are returned to full functionality.

Deviations are listed in the product manual for the controller.

1.5 Safety during installation and commissioning

National or regional regulations

The integrator of the robot system is responsible for the safety of the robot system.

The integrator is responsible that the robot system is designed and installed in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

The integrator of the robot system is required to perform a risk assessment.

Layout

The robot integrated to a robot system shall be designed to allow safe access to all spaces during installation, operation, maintenance, and repair.

If robot movement can be initiated from an external control panel then an emergency stop must also be available.

If the manipulator is delivered with mechanical stops, these can be used for reducing the working space.

A perimeter safeguarding, for example a fence, shall be dimensioned to withstand the following:

- The force of the manipulator.
- The force of the load handled by the robot if dropped or released at maximum speed.
- The maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

The maximum TCP speed and the maximum velocity of the robot axes are detailed in the section *Robot motion* in the product specification for the respective manipulator.

Consider exposure to hazards, such as slipping, tripping, and falling.

Hazards due to the working position and posture for a person working with or near the robot shall be considered.

Hazards due to noise emission from the robot needs to be considered.

Consider hazards from other equipment in the robot system, for example, that guards remain active until identified hazards are reduced to an acceptable level.

Allergenic material

See the respective product manual for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

The robot must be properly fixed to its foundation/support, as described in the respective product manual.

When the robot is installed at a height, hanging, or other than mounted directly on the floor, there will be additional hazards.

Continues on next page

Using lifting accessories and other external equipment

Ensure that all equipment used during installation, service and all handling of the robot are in correct condition for the intended use.

Electrical safety

Incoming mains must be installed to fulfill national regulations.

The power supply wiring to the robot must be sufficiently fused and if necessary, it must be possible to disconnect it manually from the mains power.

The power to the robot must be turned off with the main switch and the mains power disconnected when performing work inside the controller cabinet. Lock and tag shall be considered.

Hazards due to stored electrical energy in the controller must be considered.

Harnesses between controller and manipulator shall be fixed and protected to avoid tripping and wear.

Wherever possible, power on/off or rebooting the robot controller shall be performed with all persons outside the safeguarded space.

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot.

Safety devices

The integrator is responsible for that the safety devices necessary to protect people working with the robot system are designed and installed correctly.

When integrating the robot with external devices to a robot system:

- The integrator of the robot system must ensure that emergency stop functions are interlocked in accordance with applicable standards.
- The integrator of the robot system must ensure that safety functions are interlocked in accordance with applicable standards.

Other hazards

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

The risk assessment should also consider other hazards arising from the application, such as, but not limited to:

- Water
- Compressed air
- Hydraulics

End-effector hazards require particular attention for applications which involve close human collaboration with the robot.

Continues on next page

1.5 Safety during installation and commissioning
Continued

Collaborative applications

If a robot is intended for a collaborative application, where occasional contact between the robot and the operator is expected, the safety aspects must still be addressed. See the product manual for the manipulator.

Verify the safety functions

Before the robot system is put into operation, verify that the safety functions are working as intended and that any remaining hazards identified in the risk assessment are mitigated to an acceptable level.

1.6 Safety during operation

Automatic operation

Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.

Lock and change of operating mode

To prevent hazard, it is the responsibility of the integrator to make sure that keys used to lock or change the operating mode are handled only by authorized personnel.

An IRC5 controller with a physical key for the mode selector, is designed so that the key fits on all IRC5 controllers, unless unique keys are ordered.

Safety devices not in use

Safety devices that are not connected to the robot or robot system cannot initiate a protective or emergency stop. These must be stored out of sight so that they cannot be mistaken for being in use.

1.7 Safety during maintenance and repair

General

Corrective maintenance must only be carried out by personnel trained on the robot.

Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

Never use the robot as a ladder, which means, do not climb on the controller, manipulator, including motors, or other parts. There are hazards of slipping and falling. The robot might be damaged.

Make sure that there are no tools, loose screws, turnings, or other unexpected parts remaining after maintenance or repair work.

When the work is completed, verify that the safety functions are working as intended.

Hot surfaces

Surfaces can be hot after running the robot, and touching these may result in burns. Allow the surfaces to cool down before maintenance or repair.

Hazards related to batteries

Under rated conditions, the electrode materials and liquid electrolyte in the batteries are sealed and not exposed to the outside.

There is a hazard in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. As a result under certain circumstances, electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow.

Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.

See safety instructions for the batteries in *Material/product safety data sheet - Battery pack* (*3HAC043118-001*).

Related information

See also the safety information related to installation and operation.

1.8 Safety during troubleshooting

General

When troubleshooting requires work with power switched on, special considerations must be taken:

- Safety circuits might be muted or disconnected.
- Electrical parts must be considered as *live*.
- The manipulator can move unexpectedly at any time.

DANGER

Troubleshooting on the controller while powered on must be performed by personnel trained by ABB or by ABB field engineers.

A risk assessment must be done to address both robot and robot system specific hazards.

Related information

See also the safety information related to installation, operation, maintenance, and repair.

1.9 Safety during decommissioning

General

See section *Decommissioning on page 211*.

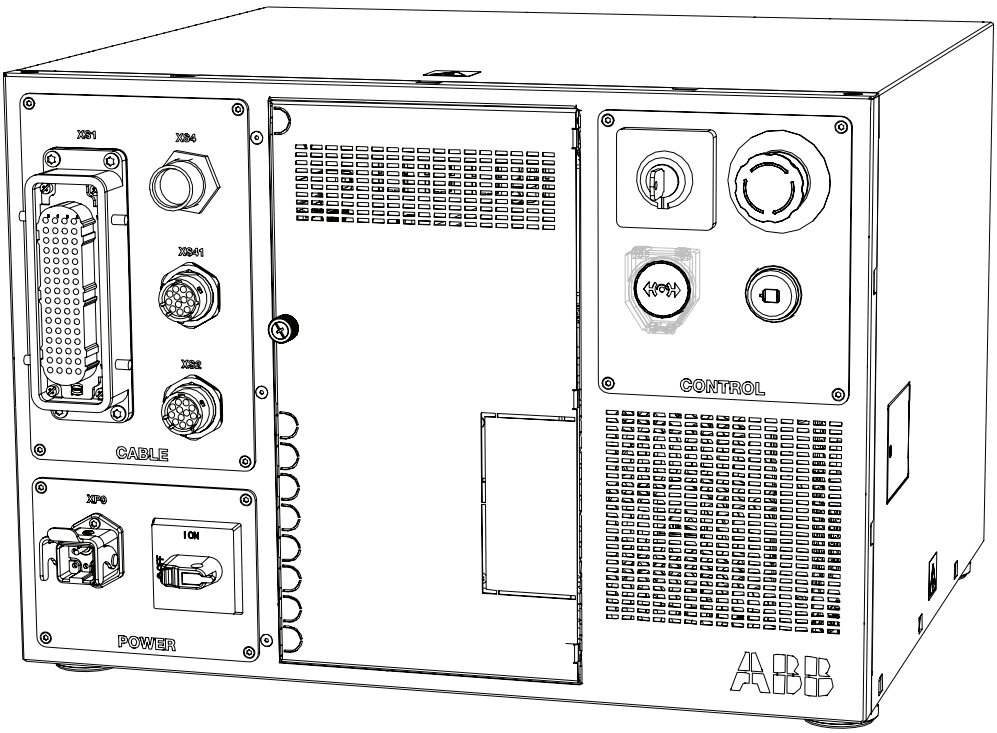
If the robot is decommissioned for storage, take extra precaution to reset safety devices to delivery status.

2 Installation and commissioning

2.1 Overview

General

The IRC5 Compact controller has all components in one small cabinet. Note that the appearance of the enclosure of the compact controller may vary depending on year model.



xx0900000316

Note

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

- the serial number
- article number
- revision

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

2.2 Installation activities

Prerequisites

The following section details the main steps on how to unload, transport, install and connect the IRC5 Compact controller.

Overview of the installation

	Action	Information
1	Unpack the delivered IRC5 Compact controller.	How to unpack, store and transport the IRC5 Compact controller is described in section *Unpacking the controller on page 41*.
2	Install the IRC5 Compact controller.	How to install the IRC5 Compact controller is described in section *On-site installation on page 43*.
3	Connect the manipulator to the IRC5 Compact controller.	How to connect the manipulator to the IRC5 Compact controller is described in section *Connecting cables to the controller on page 68*.
4	Connect power supply to the IRC5 Compact controller.	How to connect power supply is described in section *Connecting power supply on page 78*.
5	Connect the FlexPendant to the IRC5 Compact controller.	How to connect the FlexPendant is described in section *Connecting a FlexPendant on page 59*.
6	Install the safety functions, for example, the emergency stop.	*Connection of the MOTORS ON/MOTORS OFF circuit on page 88* *Closing the Automatic Stop circuit on page 87*
7	Miscellaneous connections.	How to connect buses, for example DeviceNet, is described in the Application manual for the respective bus. How to connect I/O units to the IRC5 Compact controller is described in the Application manual for the respective I/O unit. How to connect a PC to the controller is described in manual *Operating manual - RobotStudio* . How to connect to a network is detailed in section *Connectors on the computer unit on page 62*.
8	When the installation is complete, perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

2.3 Unpacking the controller

General

Read the safety regulations and other instructions before unpacking the controller, see *Safety on page 17*.

The installation must be done by qualified installation personnel and should conform to all national and local codes.

When unpacking the cabinet, inspect that it was not damaged during transport.

Note

If the controller is going to be stored before unpacking and installation, read the following information regarding storage conditions.

Storage conditions

The table below shows the recommended storage conditions for the IRC5 controller:

Parameter	Value
Min. ambient temperature	-25°C (-13°F)
Max. ambient temperature	+55°C (+131°F)
Max. ambient temperature (short periods, max 24 h)	+70°C (+158°F)

After storage, the operating conditions inside the controller must be met for at least 6 hours before switching on the controller (see *Operating conditions on page 41*).

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 conditions

The table below shows the allowed operating conditions for the IRC5 controller:

Parameter	Value
Min. ambient temperature	0°C (32°F)
Max. ambient temperature	+45°C (113°F)

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.

Continues on next page

Weight of controller

The table below shows the weight for the IRC5 controller:

Controller	Part	Weight
IRC5 Compact	Complete controller	max. 30 kg

Protection class

The table below shows the protection classes for the IRC5 controller and the FlexPendant:

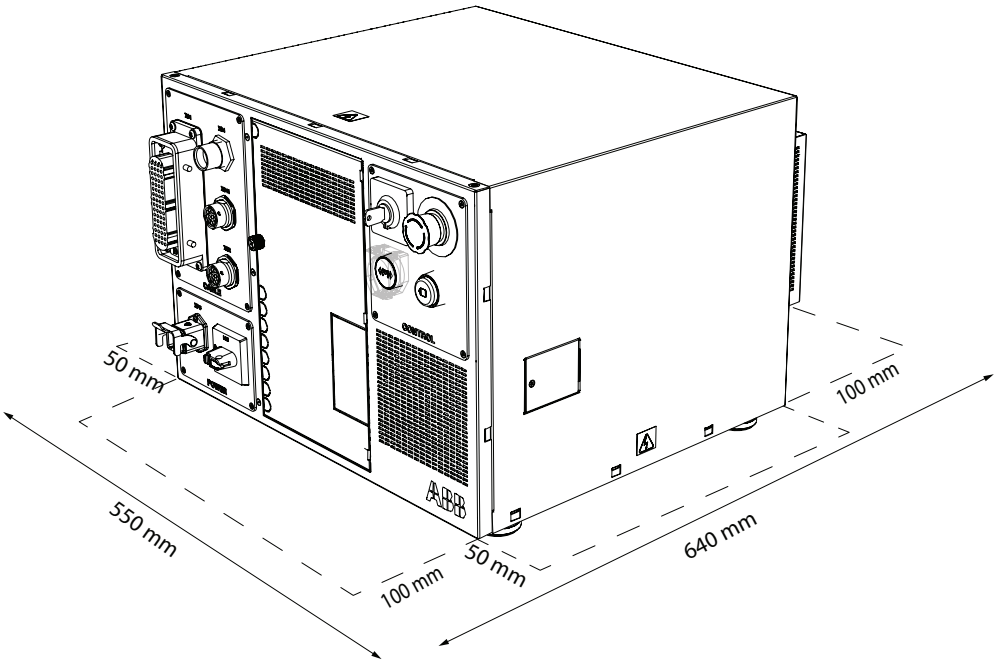
Equipment	Protection class
IRC5 Compact controller	IP20
FlexPendant	IP54

2.4 On-site installation

2.4.1 Required installation space

Dimensions

The following illustration shows the required installation space for the IRC5 Compact controller.



xx1400001367

a)	Not required if the controller is rack-mounted

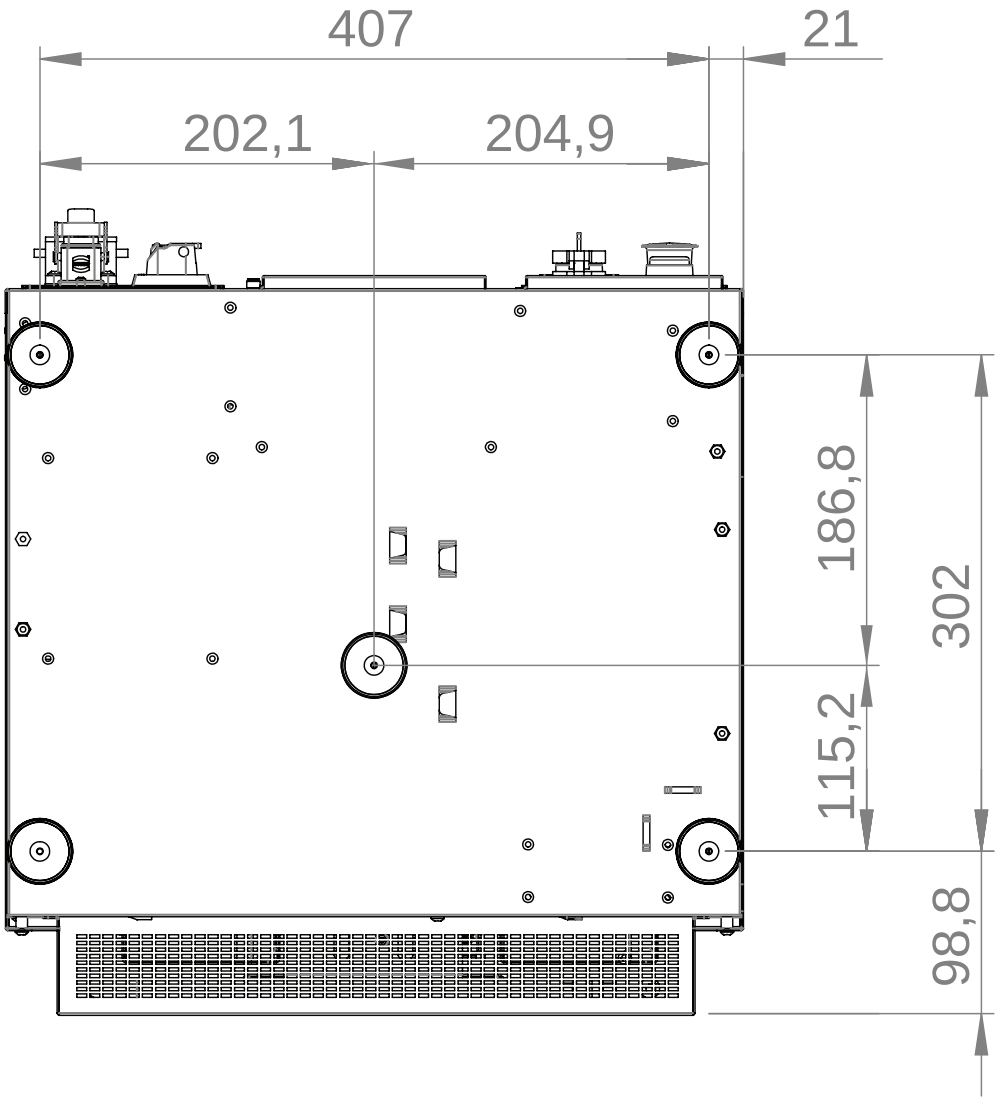
- A free space of 50 mm on both left and right side of the controller is required if the controller is mounted on desk (not rack-mounted).
- A free space of 100 mm on the back of the controller is required to ensure proper cooling. Do not place customer cables over the fan cover on the back of the controller (because this makes it difficult to inspect and it leads to inefficient cooling).
- A free space of 100 mm on the front of the controller is required to ensure enough space for connecting the harting connectors and FlexPendant cable.

Continues on next page

2.4.1 Required installation space

Continued

The following illustration shows the dimension of the footprint of the IRC5 Compact controller.



xx1400001366

- The feet should only be used for positioning, not for mounting or fastening.

Note

If the IRC5 Compact controller is to be installed in a rack, 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 cabinet.

2.4.2 Mounting the FlexPendant holder

Introduction

The FlexPendant holder is available in different versions, that fit different FlexPendant versions. The holder is compatible with the FlexPendant that it is delivered with.

The holder can be placed horizontally on a flat surface, for example, on top of the controller, or hanging, for example, on a door.

Note

To avoid dropping the FlexPendant from height, the holder should be placed in a comfortable working height.

Always use and store the FlexPendant in such a way that the cable does not become a tripping hazard.

When not using the device, place it so it does not accidentally fall.

Required equipment

Equipment	Note
Standard toolkit	See *Standard toolkit, IRC5 on page 219*
FlexPendant holder	For spare parts, see *FlexPendant parts on page 229*.

Note

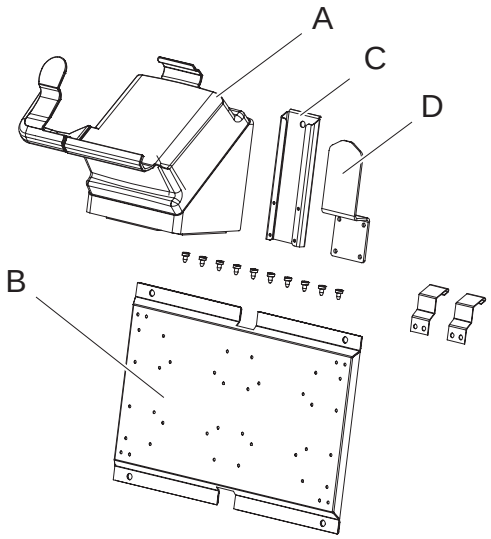
The FlexPendant should always be placed in the holder when it is not used and it is not allowed to use by unauthorized person.

Continues on next page

2.4.2 Mounting the FlexPendant holder
Continued

Mounting kit

The FlexPendant holder is available in different versions, that fit different FlexPendant versions. The holder is compatible with the FlexPendant that it is delivered with.



xx2200001447

A	FlexPendant holder (the appearance depends on the version of the FlexPendant)
B	Mounting plate (mounting holes Ø 8.5 mm (2x), distance 340 mm)
C	Cable bracket holder
D	Cable bracket

Mounting the FlexPendant holder onto a flat surface (Horizontally)

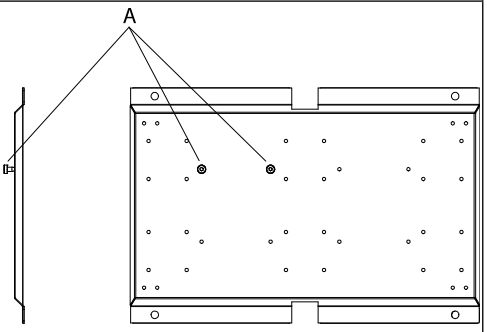
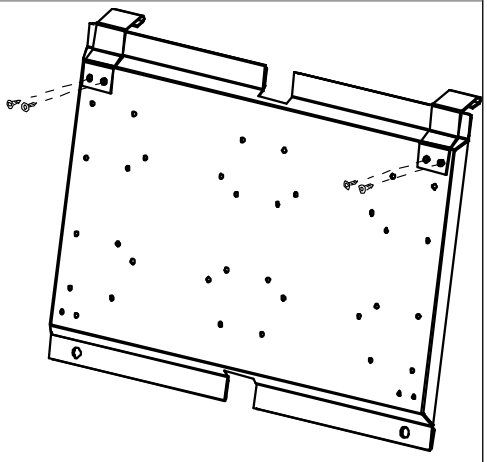
Use this procedure to mount the FlexPendant holder onto a flat surface, like the top of the controller.

	Action	Note/illustration
1	Clean the surface and make sure it is dry.	
2	Remove the protective liner from the tape, located underneath the holder.	
3	Press the holder onto the desired place.	
4	Mount the cable bracket holder in a suitable position, using one of the existing M8 screws.	
5	Mount the cable bracket on the cable bracket holder using enclosed Fastite screws (4 pcs).	

Continues on next page

Hanging the FlexPendant holder with the bracket

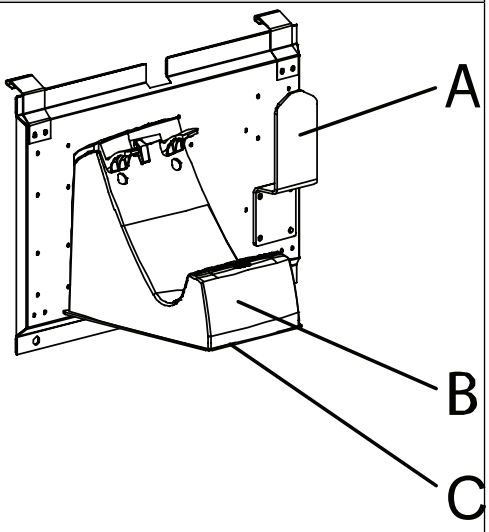
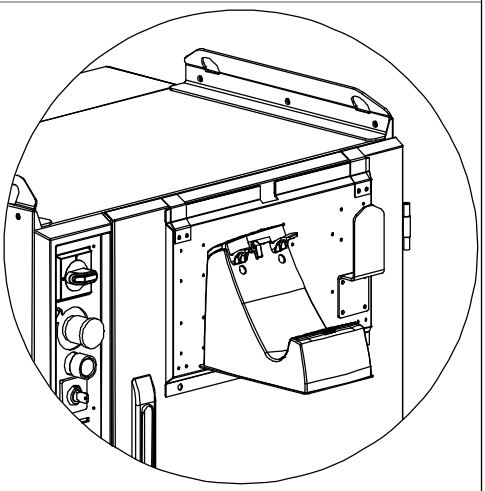
Use this procedure to hang the FlexPendant holder on any place that can hold the bracket, like a door or rack.

	Action	Note/Illustration
1	Secure the Fastite screws to the mounting plate.	 xx0800000048 • A: Fastite screw (2 pcs)
2	Secure the two hooks on the mounting plate with two Fastite screws for each hook.	 xx1100000052
3	On the FlexPendant holder for the Flex-Pendant with emergency stop located at the outer edge, remove the metal sheet plate from underneath the holder.	

Continues on next page

2.4.2 Mounting the FlexPendant holder

Continued

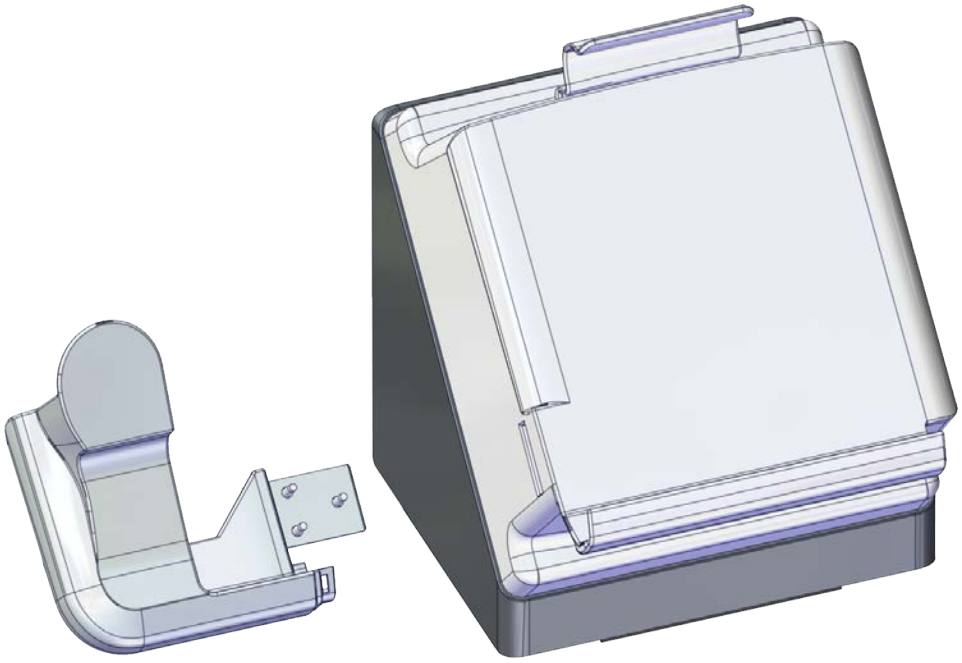
	Action	Note/Illustration
4	Place the FlexPendant holder and the cable bracket on the mounting plate and secure them with the enclosed Fastite screws (6 pcs).	 xx1700001453 • A: Cable bracket • B: FlexPendant holder • C: FlexPendant metal sheet plate (Not available on all versions)
5	Make sure the surface where the holder will hang is clean and dry. This applies to surfaces both for the hooks and the back of the holder (mounting plate).	
6	Remove the protective liner from the tape on the mounting plate.	
7	Hang the holder with the hooks in its location and then press the mounting plate against the surface.	 xx0700000243

Continues on next page

Mounting the bracket for the emergency stop on the FlexPendant holder

For the FlexPendant with emergency stop located at the connector, the holder includes a bracket to cover the emergency stop.

The FlexPendant holder is shipped without the bracket for the emergency stop assembled to the holder. They are separated as two parts.



xx2100000767

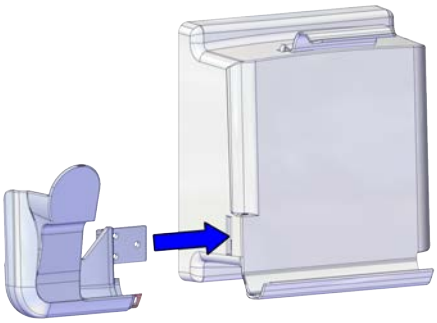
Use this procedure to mount the bracket for the emergency stop to the FlexPendant holder.

	Action	Note/illustration
1	Remove the four screws.	 xx2000002356
2	Separate the rear part from the FlexPendant holder.	

Continues on next page

2.4.2 Mounting the FlexPendant holder

Continued

	Action	Note/illustration
3	Insert the bracket into the FlexPendant holder.	 xx2100000765
4	Secure with the screws.	Screws: BN33 Phillips pan head tapping screw ST2.9x13 (3 pcs) Tightening torque: 6 Nm-7.8 Nm  xx2100000766
5	Refit the rear part and secure with the screws.	Screws: BN33 Phillips pan head tapping screw ST3.5x16 (4 pcs) Tightening torque: 9.4 Nm-12.2 Nm  xx2000002356

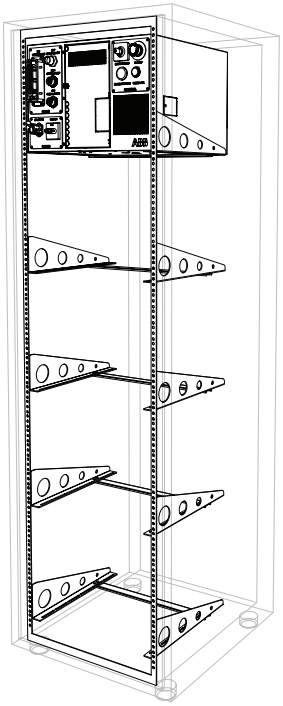
2.4.3 Mounting the controller in a 19" cabinet

General

The IRC5 Compact controller is designed to fit in a 19" cabinet.

Note

The depth of the 19" cabinet is suggested to be at least 650 mm. Or the 19" cabinet may have problem on closing the door when the IRC5 Compact controller is installed inside.



xx1400002112

Required equipment

Equipment	Information
Mounting kit	3HAC052262-001
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

Procedure

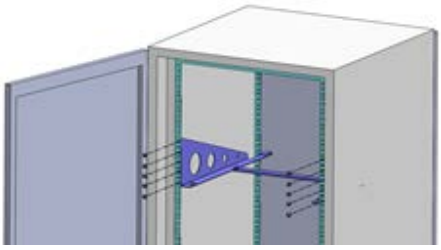
Use the following procedure to remove the axis computer.

	Action	Info/illustration
1	Remove the five feet from the cabinet.	

Continues on next page

2.4.3 Mounting the controller in a 19" cabinet

Continued

	Action	Info/illustration
2	Assemble the mounting brackets.	 xx1400002159
3	Fit the right, left and middle mounting brackets in the 19 inch cabinet.	 xx1500000232
4	Insert the IRC5 Compact in the 19 inch cabinet so that the latches fit in the recesses in the back of the mounting brackets. Fasten the IRC5 Compact to the mounting brackets with the attachment screws.	 xx1400002160

2.4.4 The unit is sensitive to ESD

Description

ESD (electrostatic discharge) is the transfer of electrical static charge between two bodies at different potentials, either through direct contact or through an induced electrical field. When handling parts or their containers, personnel not grounded may potentially transfer high static charges. This discharge may destroy sensitive electronics.

Safe handling

Use one of the following alternatives:

- Use a wrist strap. The wrist strap button is located inside the controller.

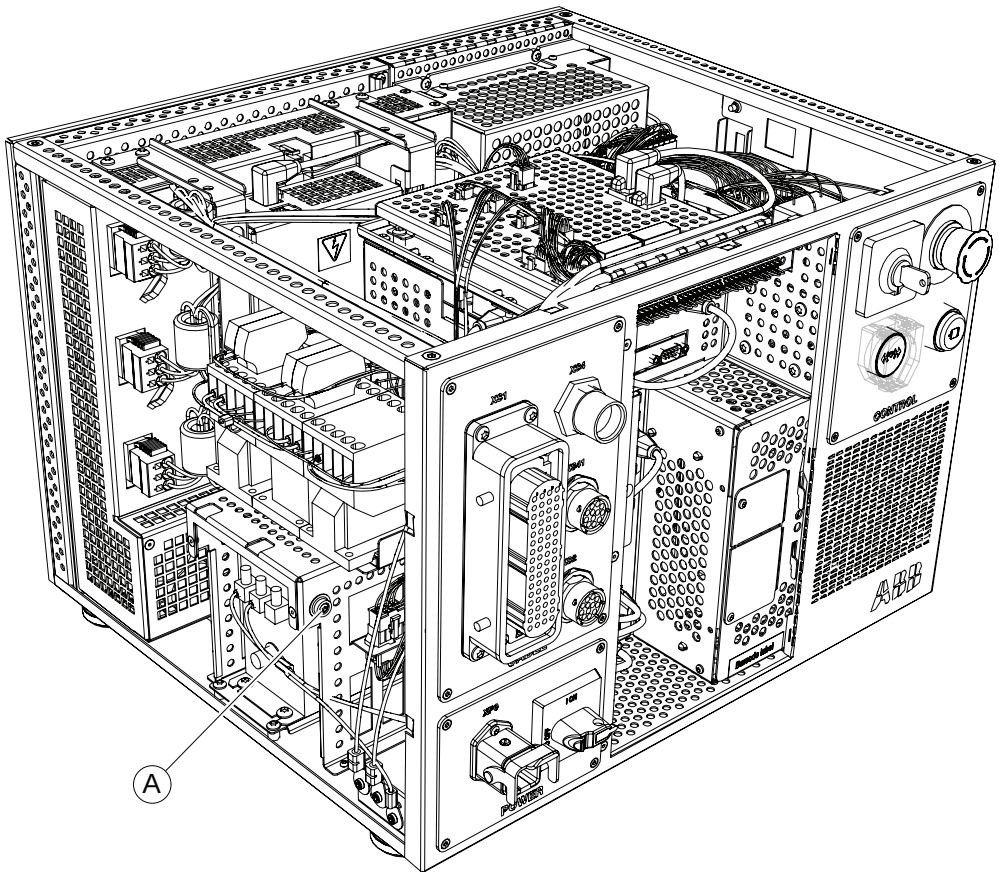
  Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
- Use an ESD protective floor mat.

  The mat must be grounded through a current-limiting resistor.
- Use a dissipative table mat.

  The mat should provide a controlled discharge of static voltages and must be grounded.

Wrist strap button

The location of the wrist strap button is shown in the following illustration.



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2.4.4 The unit is sensitive to ESD
Continued

A	Wrist strap button

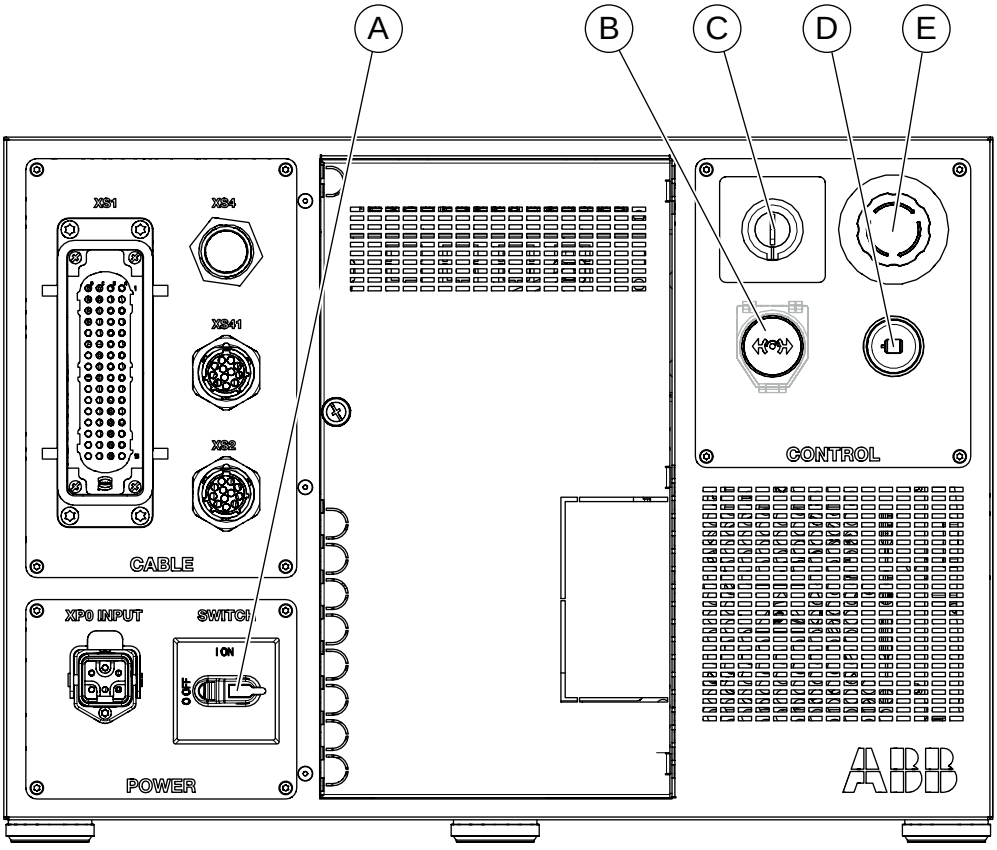
There is an additional wrist strap button on the main computer.

2.5 Buttons and switches

2.5.1 Buttons and switches on the front panel

Front panel controls

The following illustration describes the buttons and switches on the front panel of the IRC5 Compact controller.



xx1400001369

A	Main power switch
B	Brake release button (under the cover) for IRB 120. The IRC5 Compact used with other robots has no brake release button, only a blanking plug, since the robot has a brake release button.
C	Mode switch
D	Motors on
E	Emergency stop

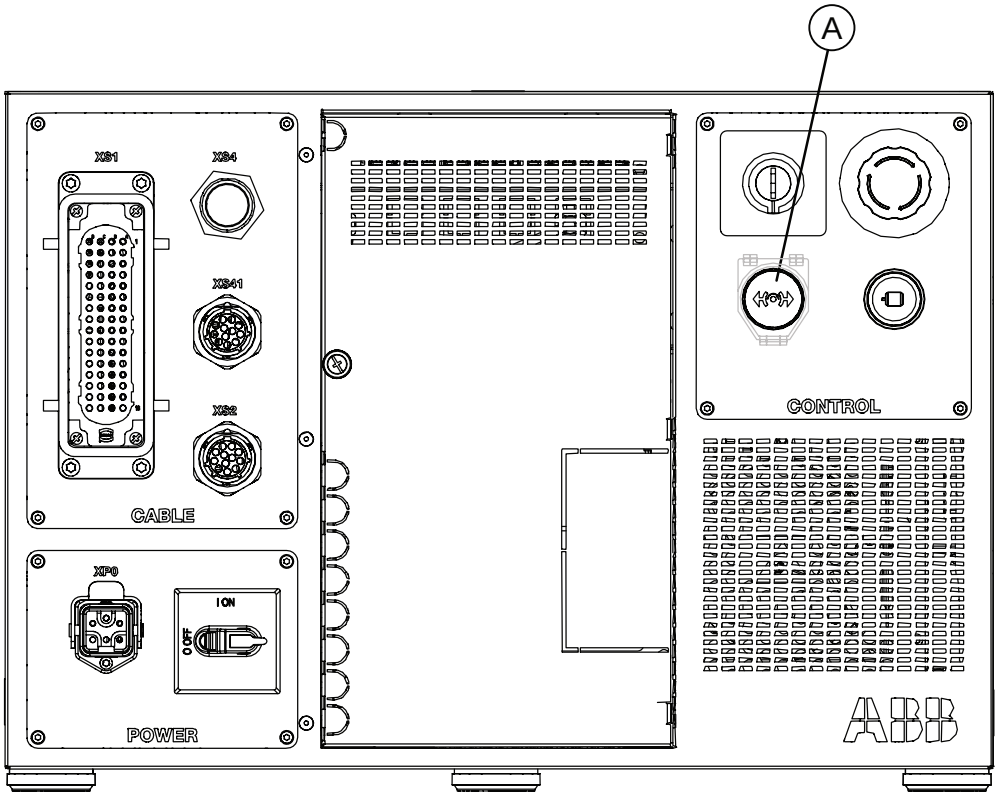
The brake release button is described in section *Brake release button on page 56*.

The other buttons and switches are described in *Operating manual - IRC5 with FlexPendant*.

Continues on next page

2.5.1.1 Brake release button

Location



xx1400001620

A	Brake release button (under the cover) for IRB 120.

IRB 120

An IRC5 Compact controller used with IRB 120 has a brake release button located under a plastic cover. At power on state, open the cover and press the brake release button to change the positions of the manipulator axes manually.

WARNING

Be very careful when releasing the brakes. The axes may fall immediately and can cause damage or injury.

Other robots

An IRC5 Compact controller used with other robots than IRB 120 has no brake release button, only a blanking plug. The brake release button is located on the robot.

2.6 Connections

2.6.1 Connectors on the IRC5 Compact controller

2.6.1.1 Connectors on the controller

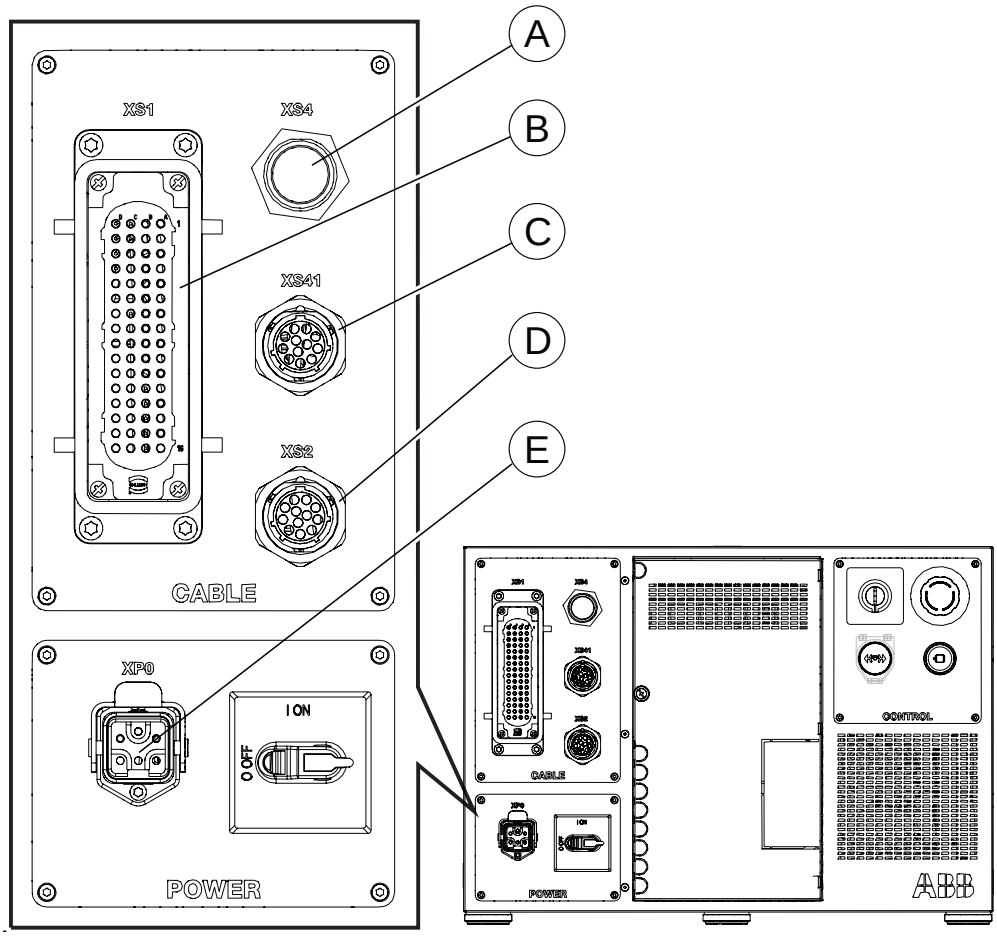
General

The following section describes the connectors on the front panel of the IRC5 Compact controller.

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

Connectors

The following details the connection interface on the IRC5 Compact.



xx1400001372

	Description
A	XS.4 FlexPendant connection

Continues on next page

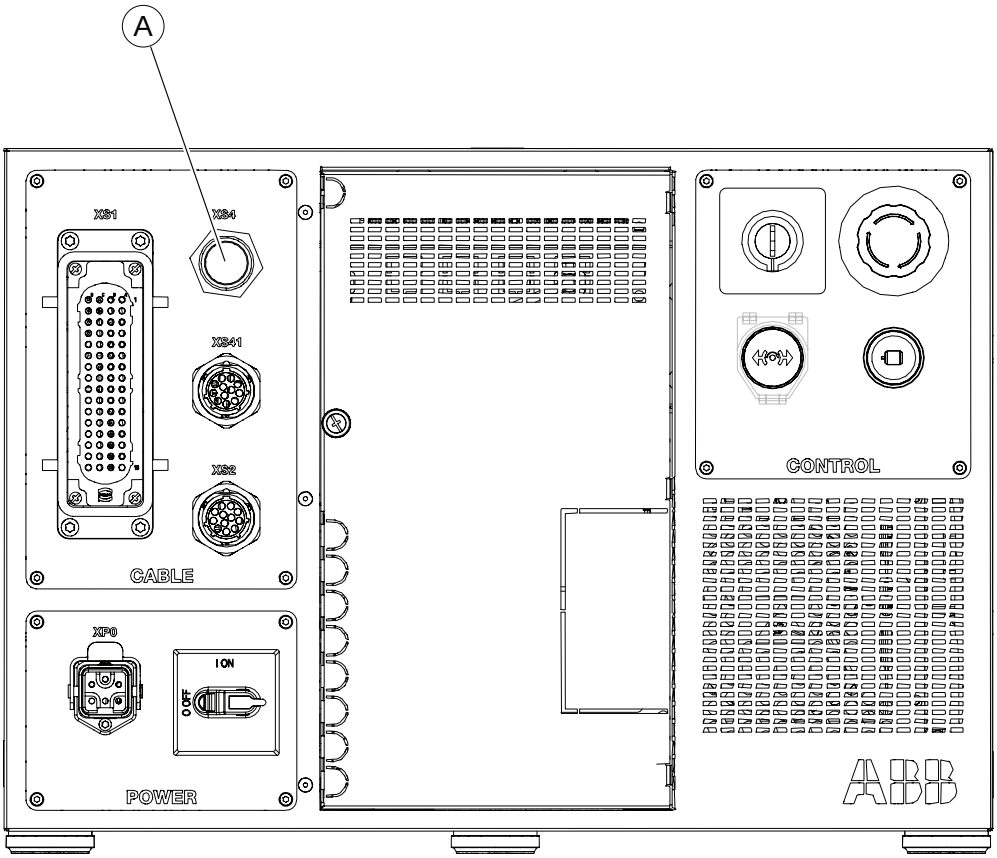
2.6.1.1 Connectors on the controller
Continued

	Description
B	XS.1 Robot power connection
C	XS.41 Additional axes SMB connection
D	XS.2 Robot SMB connection
E	XP.0 Mains connection

2.6.1.2 Connecting a FlexPendant

Location of FlexPendant connector

The FlexPendant connector on the Compact Controller is located on the front of the controller.



xx1400001371

A	FlexPendant connector

Connecting a FlexPendant

CAUTION

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

	Action	Information
1	Locate the FlexPendant socket connector on the controller or operator's panel.	The controller must be in manual mode.
2	Plug in the FlexPendant cable connector.	
3	Screw the connector lock ring firmly by turning it clockwise.	

Continues on next page

2.6.1.2 Connecting a FlexPendant
Continued

	Action	Information
4	The FlexPendant starts automatically when connected and verifies that it has the correct software installed. If an update is needed, this is shown.	*Updating the add-in FlexPendant SxTPU4 Software on page 60*

Updating the add-in FlexPendant SxTPU4 Software

Note

The add-in is only available for the FlexPendant with the emergency stop located at the connector. All other FlexPendant versions will automatically update their software via the controller (if needed).

The FlexPendant with the emergency stop located at the connector has an add-in that enables support for different RobotWare versions. This is the **FlexPendant SxTPU4 Software** add-in. The version of the add-in is shown during start-up.

When connecting the FlexPendant, the add-in verifies that it has support for the RobotWare version on the controller. If the RobotWare version is not supported by default, then the add-in requires an update. There are two method to update the FlexPendant add-in. The update is distributed as a software package.

- The update can be installed using a USB drive.
- If the update is available on the controller, then the FlexPendant will update itself when connecting it to the controller.

Once the add-in is updated, the FlexPendant can be connected to other IRC5 controllers with the same RobotWare version without requiring additional updates.

Update using a USB drive

Use the following procedure to update the add-in using a USB drive.

1. Download the update from RobotStudio, in the tab **Add-Ins**.
2. Save the software package (.rspak) on a USB drive in the folder `SxTPU4`, located in the root folder.
3. With the FlexPendant connected to the controller, reset the FlexPendant with the USB drive connected.
4. The update starts automatically and takes approximately 3-4 minutes.

Update from the controller

Use the following procedure to update the add-in from the controller.

1. In RobotStudio, use **Installation Manager 6** to create or update a system on your controller. Add the product *FlexPendantSxTPU4Software*.
2. Connect the FlexPendant to the controller.
3. The update starts automatically and takes approximately 3-4 minutes.

Handling the FlexPendant cables

FlexPendant cables are allowed to be rolled up by hand with a minimum bending radius of 10 times the cable diameter. This also applies to the extension cable. For example, if the cable is 9.5 mm then it is allowed to roll it with a radius of 95 mm.

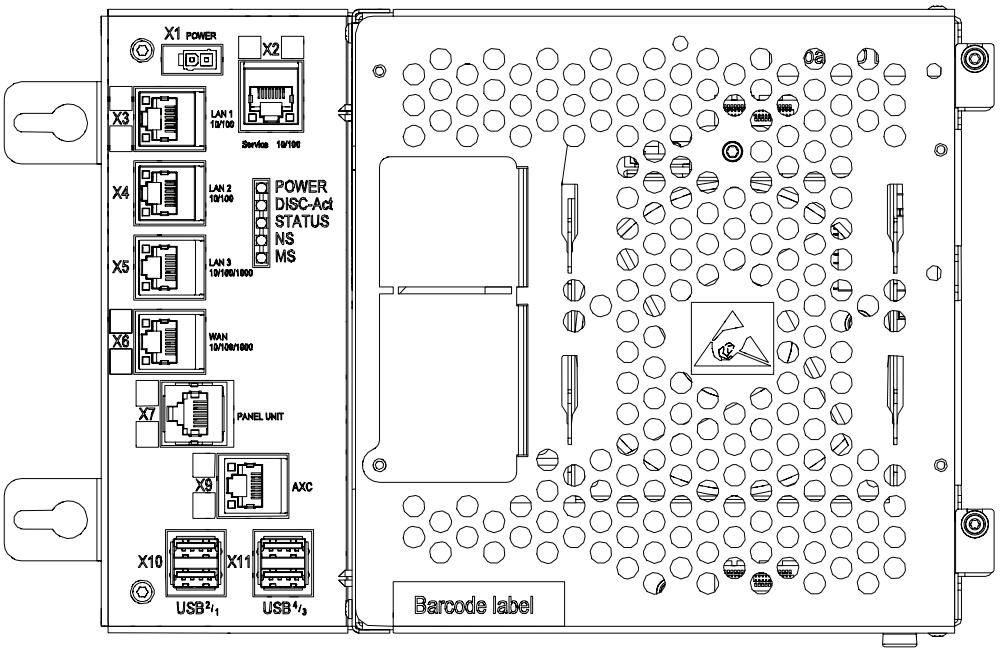
Continues on next page

Extension cables are not allowed to be used in chains.

2.6.1.3 Connectors on the computer unit

Overview of the computer unit

The following illustration shows an overview of the computer unit.



xx1300000608

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

Note

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

Service port test middle

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

Continues on next page

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

Note

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

WAN port

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

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

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

Note

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

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

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

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

Note

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

LAN ports

The LAN 1 port is dedicated for connecting the FlexPendant.

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

Continues on next page

2.6.1.3 Connectors on the computer unit
Continued

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

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

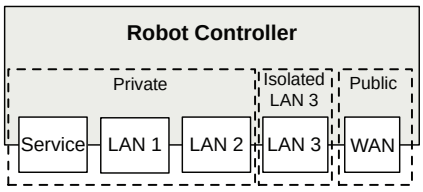
The default configuration is that LAN 3 is configured as an isolated network. This allows LAN 3 to be connected to an external network, including other robot controllers. The isolated LAN 3 network has the same address limitations as the WAN network.

Note

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

Note

If isolated LAN 3 network is selected, then it may not be possible to use *Connected Services* on LAN 3 port, depending on which fieldbus protocol is used (EtherNet/IP or PROFINET).

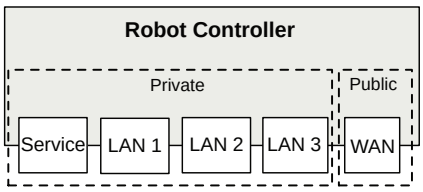


xx1500000393

An alternative configuration is that LAN 3 is part of the private network. The ports Service, LAN 1, LAN 2, and LAN 3 then belong to the same network and act just as different ports on the same switch. This is configured by changing the system parameter *Interface*, in topic *Communication* and type *Static VLAN*, from "LAN 3" to "LAN". See *Technical reference manual - System parameters*.

Note

With this alternate configuration it is possible to use *Connected Services* on LAN 3 as the network is not isolated to one fieldbus protocol.



xx1500000394

Note

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

Continues on next page

USB ports

The USB ports are intended for connecting USB memory devices.

Note

It is recommended to use the USB ports USB[1] and USB[2] on the X10 connector for connecting USB memory devices.

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

2.6.1.4 Connecting a serial channel to the controller

General

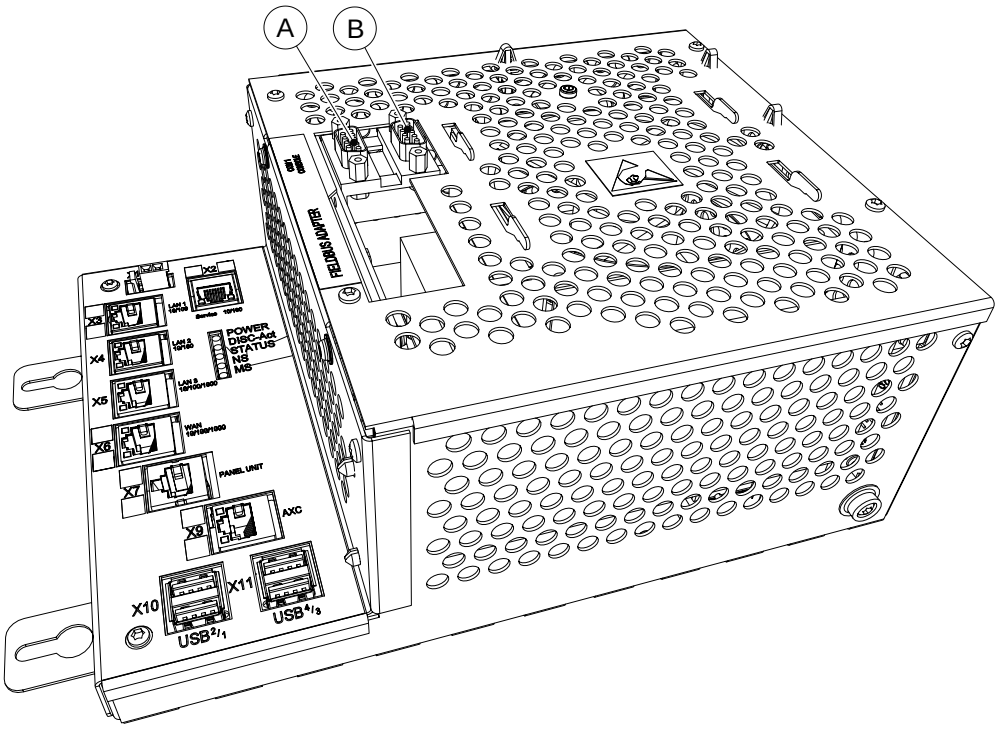
The serial channel is an option. To be able to connect a serial channel to the controller, the main computer needs to be equipped with the expansion board DSQC1003.

The expansion board has one RS232 serial channel, COM1, which can be used to communicate with process equipment.

The expansion board also enables the connection of a fieldbus adapter. For more information on how to connect a fieldbus adapter, see *Definition of fieldbuses, IRC5 on page 101*.

Location

The serial channel connector is located on the expansion board in the computer unit as shown below.



xx1300000610

A	COM1
B	CONSOLE

Note

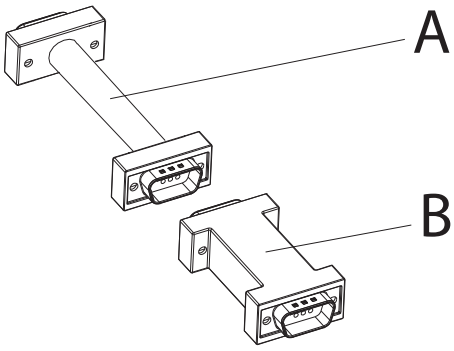
The CONSOLE connector is used for debugging purposes only.

Continues on next page

Conversion of the RS232 channel

The RS232 channel can be converted to RS422 full duplex with an optional adapter, DSQC 615.

The RS422 enables a more reliable point to point communication (differential) over longer distances, from RS232 = 15m to RS422 = 120m.

	Action	Info/Illustration
1	Connect the adapter to the serial channel connector.	A cable is needed between the serial channel connector and the adapter.  xx1300000854 A cable B adapter

2.6.2 Connecting cables to the controller

General

A good and proper electrical installation of the robot system is necessary to ensure the best performance and prolong the lifetime of the whole robot system.

This section includes important information on how to connect cables and signals to the controller.

Signal classes

Different rules apply to the different classes when selecting and laying cables. Signals from different classes must not be mixed.

Signal class	Description
Power signals Class 4 (noisy)	Supplies external motors and brakes. Applies to the cables associated with the power inputs and outputs of variable speed drives. Cables carrying strongly interfering signals such as motor cables, DC-link load sharing, unsuppressed inductive loads, DC motors, welding equipment, etc.
Control signals Class 3 (slightly noisy)	Digital operating and data signals (digital I/O, protective stop, etc.). Applies to cables carrying slightly interfering signals: AC power supply (<1 kV), DC power (24 V), power to equipment with RFI/EMI filters, control circuits with resistive or suppressed inductive loads (such as contactors and solenoids), direct-on-line induction motors, etc.
Measurement signals Class 2 (slightly sensitive)	Analog measurement and control signals (resolver and analog I/O). This class covers ordinary analogue signals such as analogue signals (4-20 mA, 0-10V, or signals below 1 MHz), low-speed digital signals (RS232, RS485), digital (on/off) signals, limit switches, encoders, etc.
Data communication signals Class 1 (sensitive)	Gateway (fieldbus) connection, computer link. Applies to cables carrying very sensitive signals. Signals with a full-scale range less than 1 V or 1 mA, and/or a source impedance >1 kOhm, and/or a signal frequency >1 Mhz. For example high-speed digital communication (Ethernet), thermocouples, thermistors, strain gauges and flowmeters.

Selecting cables

All cables laid in the control cabinet must be capable of withstanding 70 °C. In addition, the following rules apply to the cables of certain signal classes:

Signal class	Cable type
Power signals	Shielded cable with an area of at least 0.75 mm² or AWG 18.
Control signals	Shielded cable.
Measurement signals	Shielded cable with twisted pair conductors.
Data communication signals	Shielded cable with twisted pair conductors. A specific cable should be used for field bus connections and Ethernet, according to the standard specification of the respective bus.

Continues on next page

Note

Any local standards and regulations concerning insulation and area must always be complied with.

AC current in CP/CS

For specific applications where the correct cable dimensioning can depend on the relationship between the period of the duty cycle and the thermal time constant of the cable (for example, starting against high-inertia load, intermittent duty), the cable manufacturer can provide information.

Country specific norms have to be included.

The wire is not dimensioned to take care of starting motors or transformers.

The following table shows how much AC current can be supplied with a specific temperature, and the wire size.

Wire size (mm^2//AWG)	AC current			
	40°C//104F	45°C//113F	50°C//122F	52°C//125.6F
Single wire 0.2//24	4.5	4.1	3.7	3.2
Multi wire 2 pair 0.2//24	3.6	3.3	3.0	2.6
Multi wire 4 pair 0.2//24	2.9	2.7	2.4	2.1
Multi wire 6 pair 0.2//24	2.6	2.3	2.1	1.8
Multi wire 9 pair 0.2//24	2.3	2.0	1.8	1.6
Single wire 0.5//20	7.9	7.2	6.5	5.6
Multi wire 2 pair 0.5//20	6.3	5.8	5.2	4.5
Multi wire 4 pair 0.5//20	5.1	4.7	4.2	3.6
Multi wire 6 pair 0.5//20	4.5	4.1	3.7	3.2
Multi wire 9 pair 0.5//20	4.0	3.6	3.2	2.8
Single wire 0.75//18	9.5	8.6	7.8	6.7
Multi wire 2 pair 0.75//18	7.6	6.9	6.2	5.4
Multi wire 4 pair 0.75//18	6.2	5.6	5.1	4.4
Multi wire 6 pair 0.75//18	5.4	4.9	4.4	3.8
Multi wire 9 pair 0.75//18	4.8	4.3	3.9	3.4
Single wire 1.0//17	11.0	10.0	9.0	7.8
Multi wire 2 pair 1.0//17	8.8	8.0	7.2	6.2
Multi wire 4 pair 1.0//17	7.2	6.5	5.9	5.1
Multi wire 6 pair 1.0//17	6.3	5.7	5.1	4.5
Multi wire 9 pair 1.0//17	5.5	5.0	4.5	3.9
0.75//18 three phase	8.6	7.8	7.1	5.6
1.0//17 three phase	10.3	9.4	8.4	6.7

Continues on next page

2.6.2 Connecting cables to the controller
Continued

Route the cables

Routing of cables shall be done in a professional way.

- Cables of different classes, such as signal cables and power cables, must not be routed together as the power cables may introduce noise in the signal cables. The greater the separation distance, the lesser the risk for interference between the cables.
- Robot controller mains supply input cable and robot power cable should be separated even though they belong to the same class.
- If crossing cables from different classes, cables should cross at an angle close to 90 degrees.
- All external cables that are to be connected inside the controller must be shielded in the chassis before entering the cabinet.

Separation distances can be reduced if e.g. dividers are used between cables classes. Manufacturers of cable duct systems can provide information on how reduced separation distances can be achieved using their specific products.

Signal class	Cable type
Power signals	• These signals generate a lot of interference and must be laid separate from control, measurement, and communication signals. • The shielding must be connected to a paint-free part of the panel chassis of the cabinet at both ends of the cable. Any unshielded cable must be as short as possible. • The manipulator power cables are routed on the floor and along the left side of the controller cabinet. • Cables should not be wound up like coils. This could cause an magnetic field disturbing the signals. There will also be a risk of overheating depending on the load.
Control signals	• These signals are very sensitive to interference. To protect these signals they should not be laid along with the power signals. • In the cable, each signal must be twisted with a neutral wire. • The shielding must be connected directly to the chassis at both ends of the cable.
Measurement signals	
Data communication signals	

Shielding cables

When peripheral devices are connected to the robot system, a shielded cable is necessary to reduce coupling of the inner cable conductors to the environment they pass through.

Shielding cable requirements

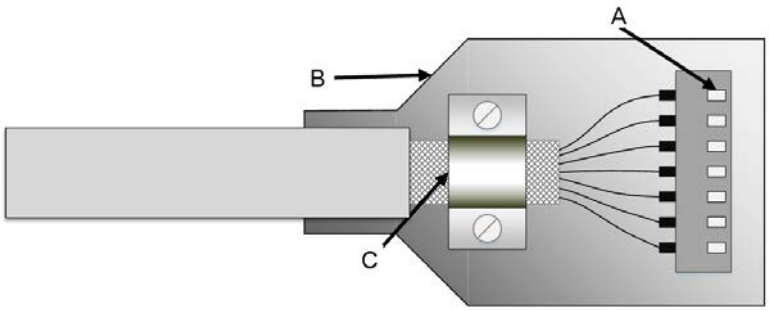
- The best method for shielding is to ground the shield at both ends of the cable, provided the ends grounding are at the same potential.
- If the grounding points have different electric potentials - grounding both ends will create a ground loop allowing unwanted current to flow in the shield. In such cases one end grounding may be used. The grounding point should then be at the robot controller side.
- Cables carrying analog low-level signals is another exception where the shield should be grounded at only one end.

Continues on next page

- Most data network and field bus types have defined grounding topologies. If such grounding schemes exist, they should be followed.
- In complex interference environments, two-layer shielding may be required. The inner shield should be grounded at the controller side only end and the outer shield should be grounded at both ends. The optimum shielding is a combination of foil and braid screens.
- The best connection is one in which the shielding is extended up to and makes a solid 360° connection (shown below) with the ground plane or chassis.

Shielding example

The below example shows the shielding of a d-type connector:



xx1700001320

A A dimpled connector body makes multiple bonds to the mating connector body all around its periphery, 360° bonding.

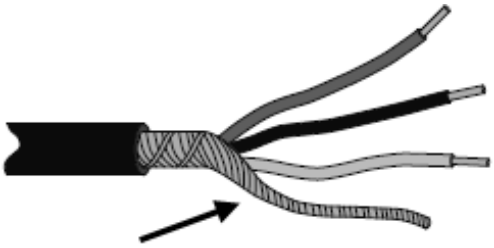
B Metal, or metallized, back shell makes 360° bond to the connector body.

C The cable shield is exposed and 360° clamped to the back shell. A tight fit is a must.

Many other 360° bonding methods and types of 360° shielded connectors are also acceptable.

Shield pigtail termination

Shield pigtail termination, as shown below, shall be avoided. If a pigtail connection cannot be avoided, make it as short as possible.



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2.6.2 Connecting cables to the controller
Continued

Ground and screen connections

The task of the grounding system is twofold - protective and functional. The primary task is to serve as protective earth (PE) for personal and equipment safety. The secondary task is to serve as a return path for common mode current.

For further information refer to EN 60204-1 and UL 1740.

Grounding requirements

The controller cabinet ground must come from the mains power supply PE.

- The cross-sectional area of each grounding (PE) conductor must be not less than 2 mm^2 copper (AWG14) in the IRC5 Compact controller, and not less than 10 mm^2 copper (AWG7) in the manipulator.
- The grounding cable color shall be green-yellow.
- The ground for the controller cabinet, robot manipulator and peripheral devices must be the same, preferably an equipotential ground grid (mesh).
- Ground connection points must have stable inter-metallic bonding, like screw fixation. Paint, dirt, rust, and other insulating material must be removed from the contacting surfaces.

For requirements on the marking of the supply ground connection inside the control cabinet refer to UL 508C. For further details on how grounding systems should be designed refer to IEC 61000-5-2. For details of cross-sectional area of PE refer to IEC 60204-1.

Grounding installation

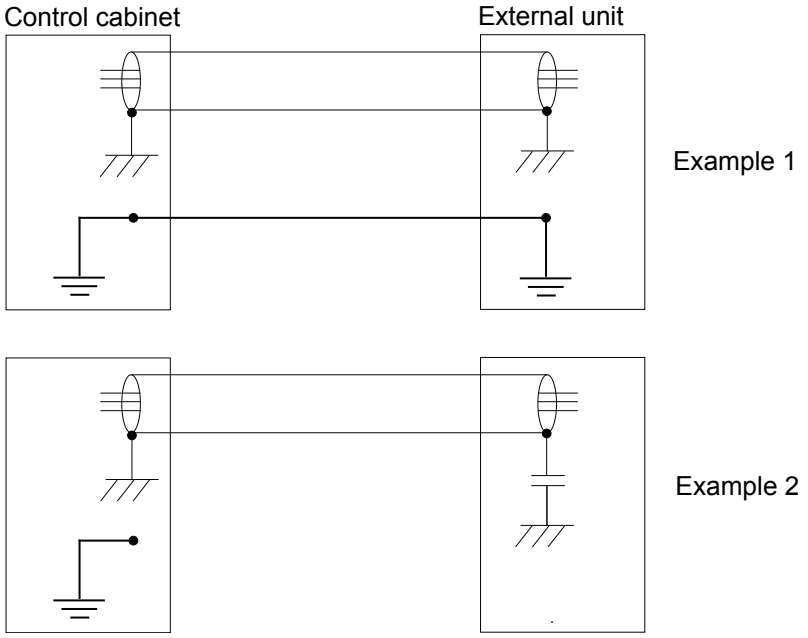
For information on how to install the ground for the IRC5 Compact controller cabinet, see *Grounding on page 80*.

For information on how to connect protective earth for the manipulator, see the corresponding product manual.

Continues on next page

Examples

The following figure shows 2 examples on how protective earth and the signal cable screens can be connected:



xx1200000960

Example 1:

- Where a good earth connection is available on all units, the best shielding is obtained by grounding all screens at both ends on all units.

Example 2:

- If the cable is terminated where a good earth connection is not available a noise suppression capacitor can be used. The screens of the 2 cables must be connected as shown in the figure, but not connected to the chassis of the unit.

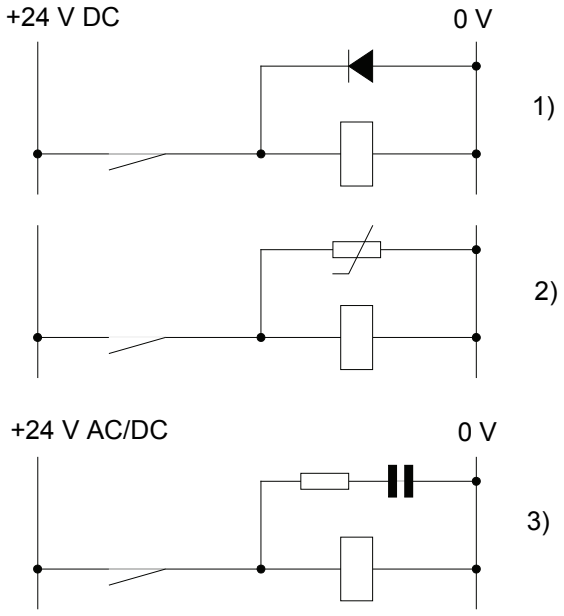
Continues on next page

2.6.2 Connecting cables to the controller
Continued

Interference elimination

Internal relay coils and other units that can generate interference inside the control cabinet are neutralized. External relay coils, solenoids and other units must be clamped in a similar way. The illustration below shows how this can be done.

Note that the turn-off time for DC relays increases after neutralization, especially if a diode is connected across the coil. Varistors give shorter turn-off times. Neutralizing the coils lengthens the life of the switches that control them.



xx1200000961

1 The diode should be dimensioned for the same current as the relay coil, and a voltage of twice the supply voltage.
2 The varistor should be dimensioned for the same energy as the relay coil, and a voltage of twice the supply voltage.
3 When AC voltage is used, the components needs to be dimensioned for >500 V max voltage and 125 V nominal voltage.

   The resistor should be 100 Ω, and the capacitor should be 1W 0.1 - 1 µF (typically 0.47 µF).

2.6.3 Power supply system requirements

Definition of the power supply system

IEC 60364 defines three different types of mains grounding using the two-letter codes. These are TN, TT, and IT.

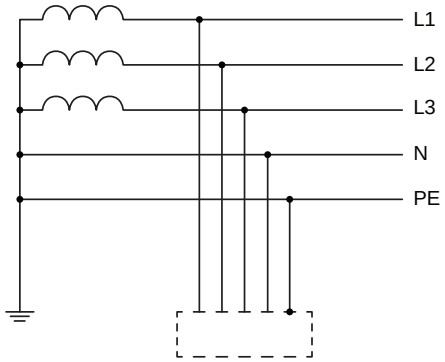
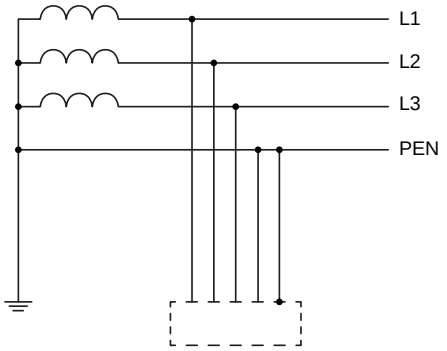
First letter	Type of ground connection
T	Direct connection of one point to ground.
I	Not connected to ground or connected to ground via a high impedance.

Second letter	Connection between ground and the device being supplied
T	Direct connection of one point to ground.
N	Direct connection to neutral at the origin of installation, which is connected to the ground

In the following section the transformer configuration refers to the transformer secondary side. Configuration of the transformer primary side is not discussed in this context.

Recommended power supply systems

The following systems are recommended by ABB:

TN–S system	TN–C system
PE and N are separate conductors that are connected together only near the transformer.	A combined PEN conductor is used as both a PE and an N conductor.
 xx1700001310	 xx1700001311

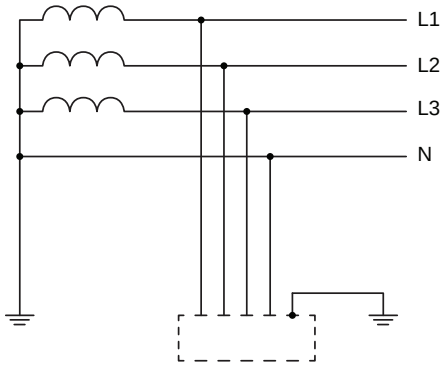
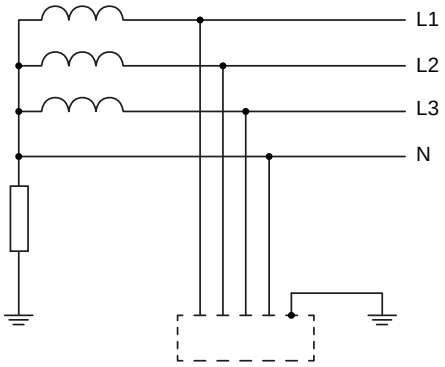
Not recommended power supply systems

The following systems are not recommended by ABB:

TT system (separate ground rods)	Resistance grounded secondary system
If this kind of system must be used, the grounding path resistance between ground 1 and 2 shall not exceed 0.1 Ohm, for more information refer to UL1740.	If this kind of system must be used, the voltage variations between any line and PE should not exceed ±10% of the nominal line voltage, for more information refer to EN 50160.

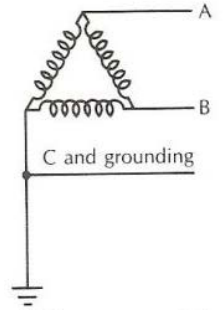
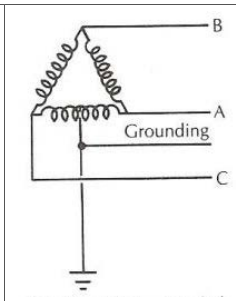
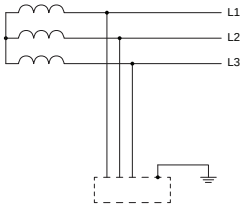
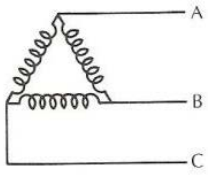
Continues on next page

2.6.3 Power supply system requirements
Continued

TT system (separate ground rods)	Resistance grounded secondary system
 xx1700001312	 xx1700001313

Not allowed power supply systems

The following systems are not allowed by ABB:

Un-symmetric system		IT system (ungrounded secondary)	
These transformers provide un-symmetric phase voltages with respect to ground. Inherent phase imbalances with respect to ground would put the drive system and mains line filter (if installed) under unacceptable stress.		The voltage between phases and ground is undefined and may cause damage to both drive system and mains line filter (if installed).	
 xx1700001314	 xx1700001315	 xx1700001316	 xx1700001317

Isolation transformer

A three-phase isolation transformer between the mains supply and the control cabinet is required for any of the below conditions:

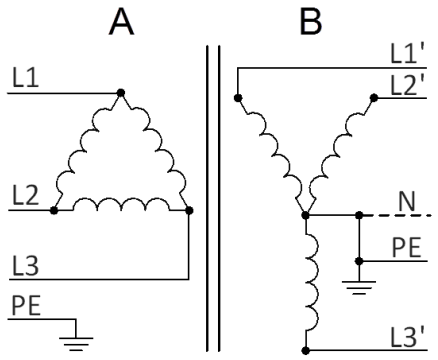
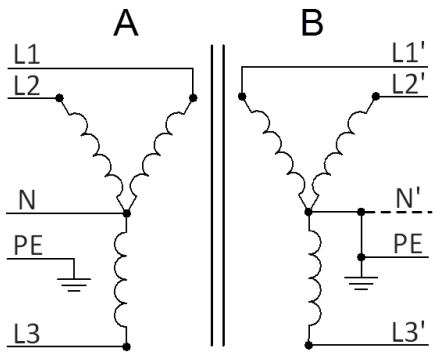
- Not allowed power supply system used, as mentioned in *Not allowed power supply systems on page 76*.
- When the mains supply is shared with a pressing machine, frequency converter, or other large industry equipment that may cause the power supply characteristics out of standard limits. To some extent, isolation transformers will filter out harmonics, spikes and surges.

Continues on next page

For further information refer to regional power supply standards.

Allowed isolation transformer types

The following isolation transformer types are allowed by ABB:

Delta-Wye isolation transformer (△/Y)	Wye-Wye isolation transformer (Y /Y)
 xx1700001318	 xx1700001319
A Primary/input B Secondary/output	

Mains line filter

A mains line filter is included in the IRC5 Compact controller, ensuring compliance with EN/IEC 61000-6-4.

Additional types of external filters may be used, provided they are approved by regional standards. For further information refer to regional power supply standards.

2.6.4 Connecting power supply

Note

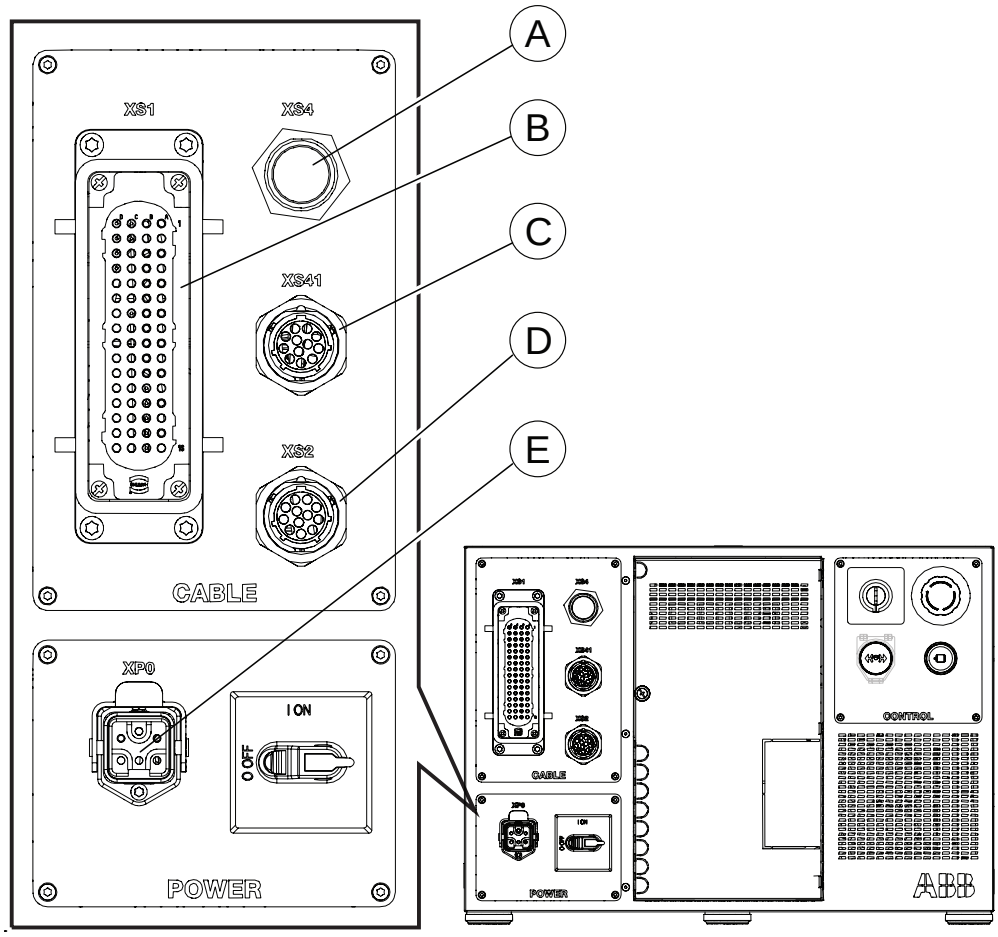
How to manufacture a cable with connector is described in section *Fitting the connector on page 81*.

CAUTION

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

Location

The following illustration shows the location of the power input connector on the front panel of the controller.



xx1400001372

	Description
A	XS.4 FlexPendant connection
B	XS.1 Robot power connection
C	XS.41 Additional axes SMB connection

Continues on next page

	Description
D	XS.2 Robot SMB connection
E	XP.0 Mains connection

Required equipment

Equipment	Note
Power supply cable (single phase)	
External circuit breaker	16A
External earth fault protection at control cables 3 -15m	30mA
External earth fault protection at control cables >15m	300mA
Circuit diagram	See *Circuit diagrams on page 235*.

Connecting power to the controller

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

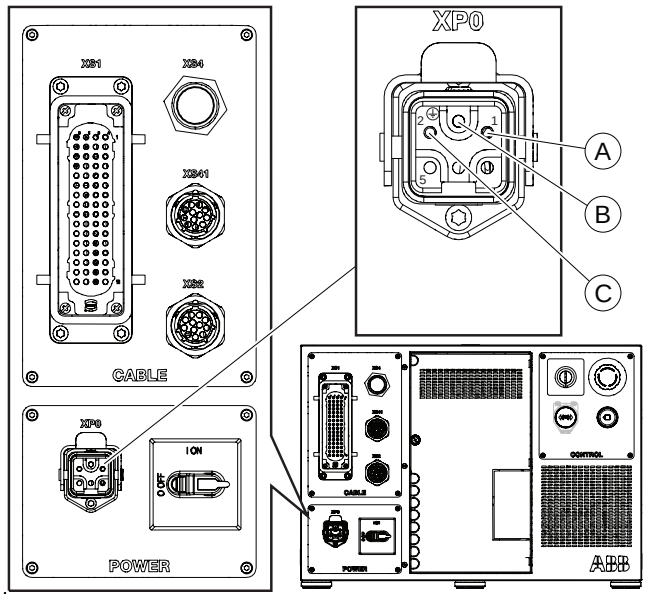
	Action
1	Connect the power cable from the power supply to connector XP0 on the front panel of the controller.

2.6.5 Grounding

Location

Note

The whole cabinet ground is connected to the XP0.PE point.



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	Description
A	XP0.1 Power lline
B	XP0.PE Grounding
C	XP0.2 Zero line

Required equipment

Equipment	Note
Mains connection cable (single phase)	
Circuit diagram	See *Circuit diagrams on page 235*.

Connecting ground controller

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

	Action
1	Connect single-phase power supply and PE wire to the XP0 connector.

2.6.6 Fitting the connector

General

This section describes how to manufacture a cable for connecting the mains power to the controller.

Specifications

The following describes the cable and fuse requirements for the mains power connection to the IRC5 Compact controller.

Component	Description
Cable type	Flexible oil resistant rubber
Cable area	3 x 2.5 mm^2
Fuse	Delay action fuse 16A

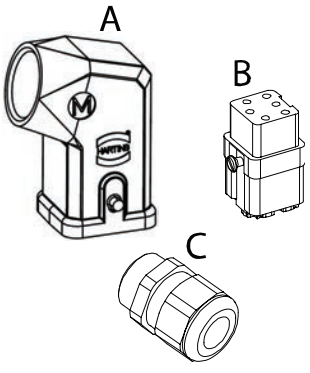
Included parts

The following parts are included in the delivery.

Part	Recommended supplier	Order number	Quantity
Hood	Harting, 19 20 003 1640	3HAC051426-001	1
Female insert	Harting, 09 12 005 2733	3HAC037697-001	1
Cable gland	Harting, 19 00 000 5184	3HAC034913-001	1

Procedure

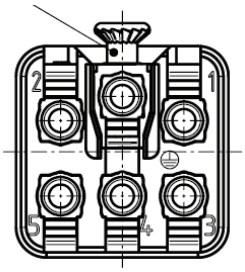
Use the following procedure to fit the connectors.

	Action	Note/illustration
1	Select a suitable single phase cable and earth cable, and cut it to desired length.	See previous specifications.
2	Fit the cable through the cable gland and hood.	 xx0900000365 • A: hood • B: female insert • C: cable gland

Continues on next page

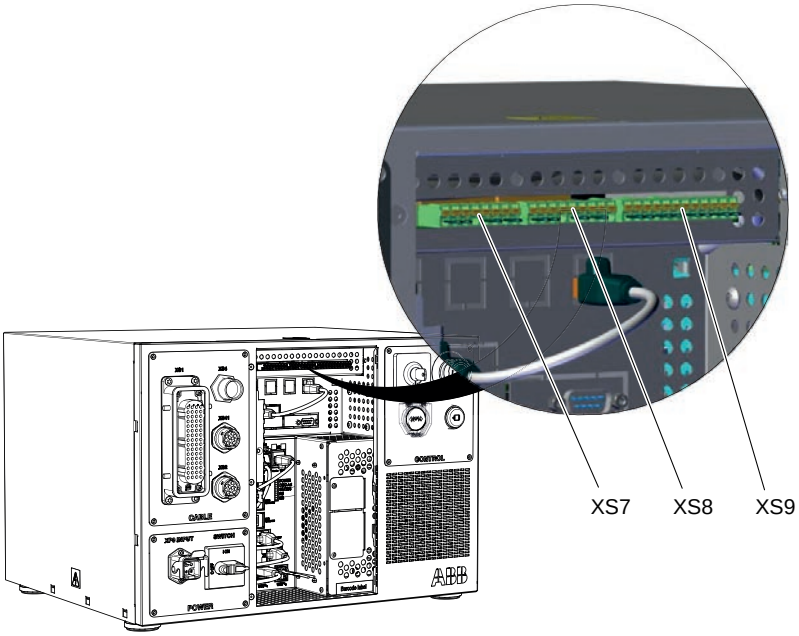
2.6.6 Fitting the connector

Continued

	Action	Note/illustration
3	Connect the wires according to the illustration. Use a screwdriver to make the contact tight.	 xx0900000366 For single phase: • X0.1 - power line • X0.2 - zero line • X0.PE - earth wire
4	Assemble the connector by fitting the hood and the female connector, and tighten the screws.	

2.6.7 Descriptions for connectors XS7 - XS17

XS7, XS8 and XS9 Safety



xx1500002927

These connectors is internally connected with safety board.

It contains the following signals:

- Auto stop
- General stop
- External emergency stop PB
- External supply
- External PTC

For connection details, see circuit diagram for IRC5 Compact, see *Circuit diagrams on page 235*.

Note

Safety male connectors are delivered with Compact controller. The bridge connector can be bought from ABB (3HAC051190-001). If it is bought from the manufacturer, see *Circuit diagrams on page 235* for connection details.

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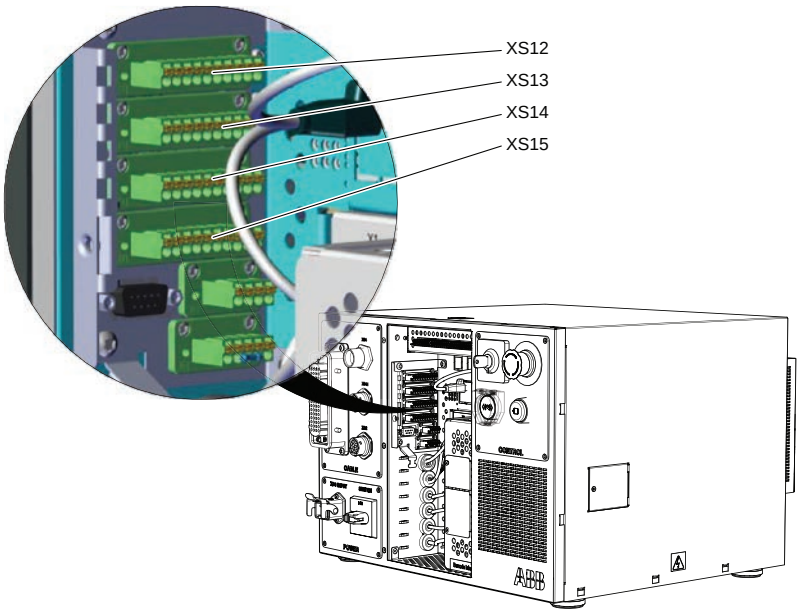
2.6.7 Descriptions for connectors XS7 - XS17
Continued

XS12, XS13, XS14 and XS15 I/O



xx1500002926

These connectors are internally connected with the I/O unit (DSQC 651 or DSQC 652).

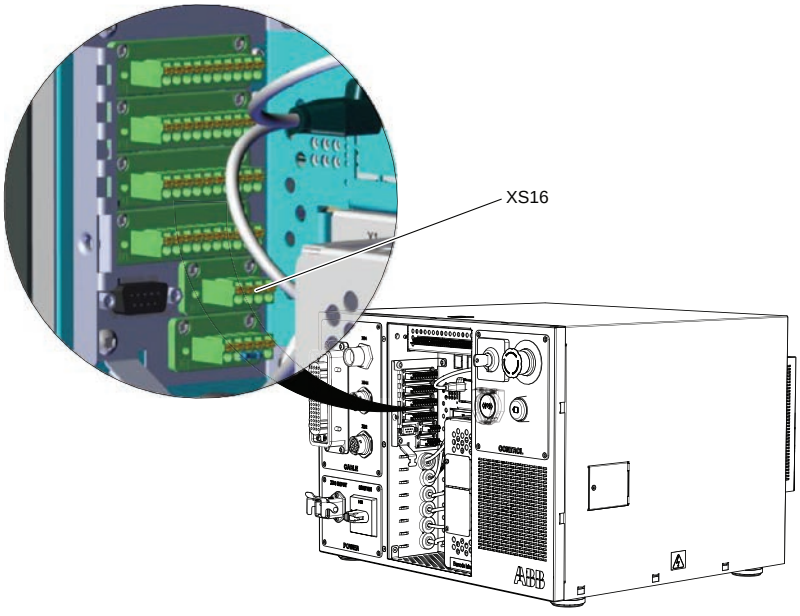
It contains 8 digital input and output signals, 8 analog output signals of DSQC 651.

It contains 16 digital input and output signals of DSQC 652.

It contains 24V, 0V for outputs and 0V for input of DSQC 651 or DSQC 652.

For connection details, see circuit diagram for IRC5 Compact, see *Circuit diagrams on page 235*.

XS16 Power Supply



xx1500002928

Continues on next page

This connector is internally connected with I/O unit (DSQC 652) and power distribution unit.

It contains the following signals:

- 24V power supply

Note

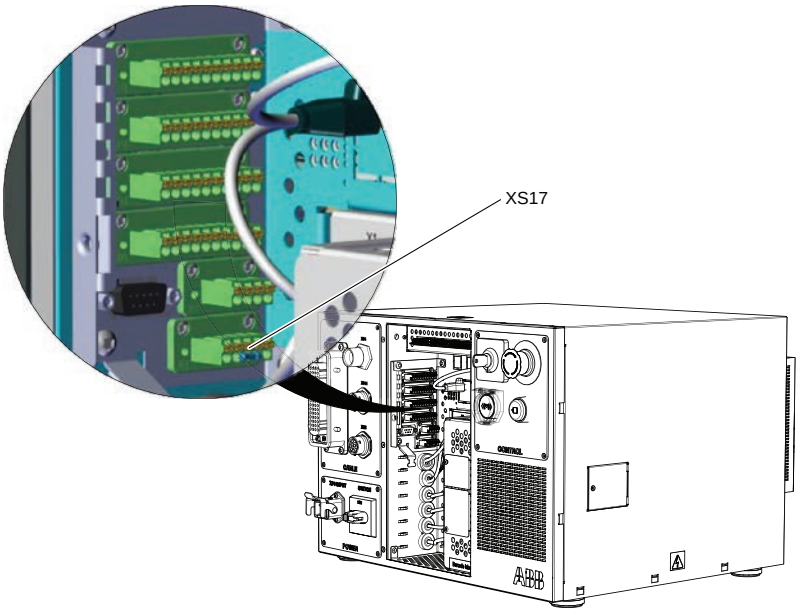
Total customer usage for 24V power supply from XS16 must not exceed 6A.

For connection details, see circuit diagram for IRC5 Compact controller.

Note

Power male connector are delivered with Compact controller. The power connector is included in the same cable as DeviceNet connector (3HAC054250-001). The bridge connector is a part of the cable 3HAC049564-001.

XS17 DeviceNet



xx1500002929

This connector is internally connected with DeviceNet - master bus.

It contains a DeviceNet signal.

For connection details, see circuit diagram for IRC5 Compact controller.

Note

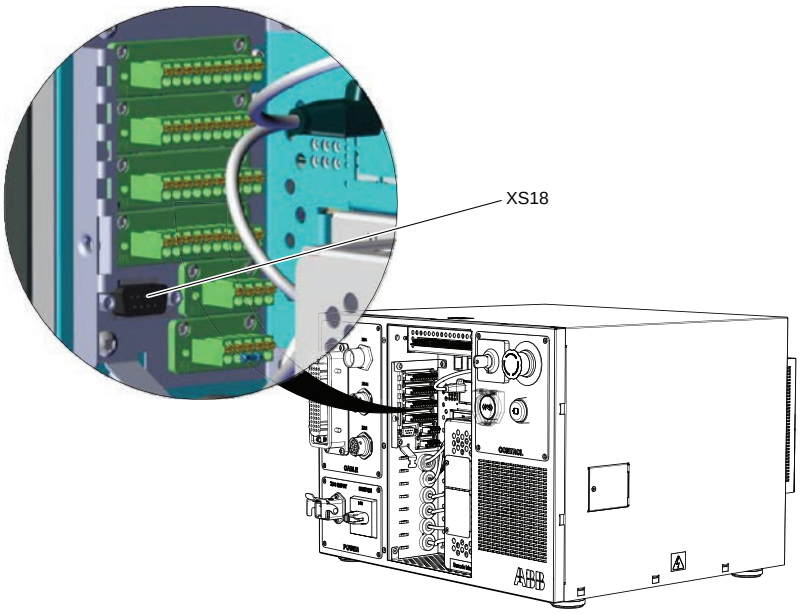
DeviceNet male connectors are delivered with Compact controller. The DeviceNet connector is included in the same cable as power connector (3HAC054250-001).

The bridge connector is a part of the cable 3HAC049564-001.

Continues on next page

2.6.7 Descriptions for connectors XS7 - XS17
Continued

XS18 Profibus



xx1500002972

This connector is internally connected with Profibus - master bus.

It contains a Profibus signal.

For connection details, see circuit diagram for IRC5 Compact controller.

2.6.8 Closing the Automatic Stop circuit

Closing the Automatic Stop circuit

The controller is shipped with a default configuration so that the automatic stop circuit is open and the general/superior stop circuit is bypassed (short-circuited). The system can only work in manual mode.

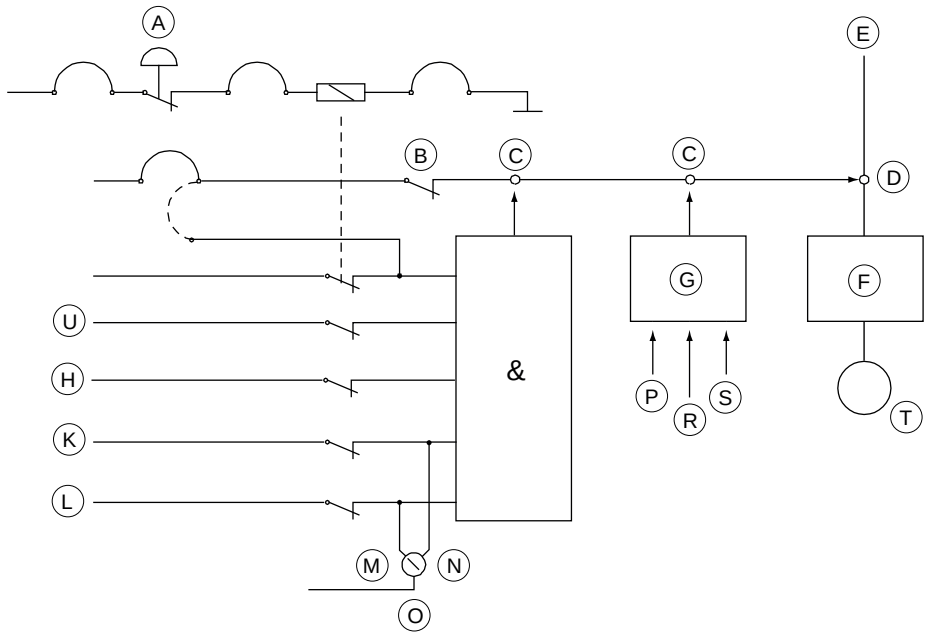
To enable the controller without any additional/external safety equipment, connect the safety circuit. To bypass Automatic stop circuit, 3-pole jumpers are enclosed in bag 3HAC078549-001 with corresponding instruction 3HAC078652-001. See the circuit diagram, *3HAC049406-003*.

2.6.9 Connection of the MOTORS ON/MOTORS OFF circuit

Outline diagram

The MOTORS ON/MOTORS OFF circuit is made up of two identical chains of switches.

The diagram shows one of the chains with the available customer connections, AS, GS, and ES.



xx1600000280

A	ES (emergency stop)
B	LS (Limit switch)
C	Solid state switches
D	Contactor
E	Mains
F	Drive unit
G	Second chain interlock
H	GS (general mode safeguarded space stop)
K	AS (Automatic mode safeguarded space stop)
L	ED (FlexPendant three-position enabling device)
M	Manual mode
N	Automatic mode
O	Operating mode selector
P	RUN
R	EN1
S	EN2

Continues on next page

T	Motor
U	SS (Input from, for example, SafeMove board)

Function of the MOTORS ON/MOTORS OFF circuit

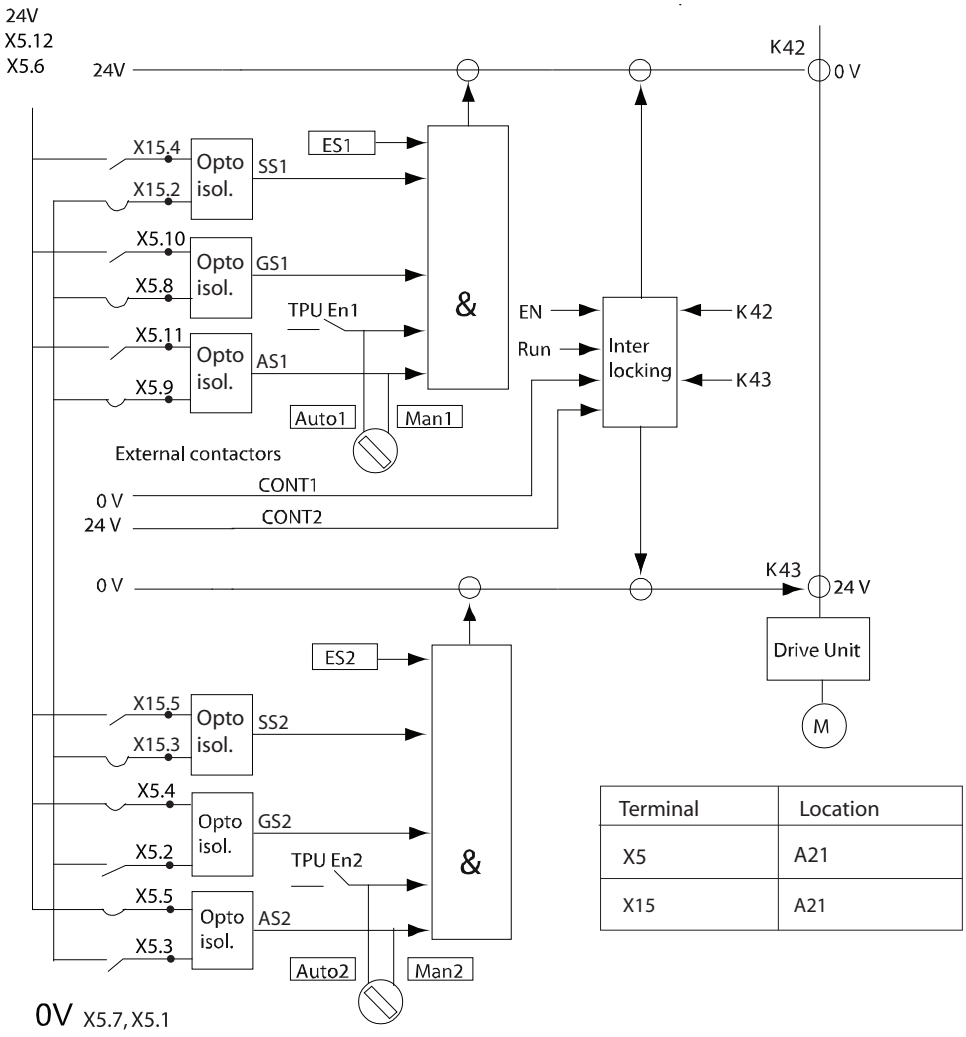
The circuit monitors all safety related equipment and switches. If any of the switches are opened, the MOTORS ON/MOTORS OFF circuit switches the power to Motors Off.

As long as the two chains not are in an identical state, the robot will remain in MOTORS OFF mode.

Connection of safety chains

The diagram below shows the dual channel safety chain.

The supply from internal 24V and 0 V is displayed. For external supply of GS and AS check the circuit diagram.



Terminal	Location
X5	A21
X15	A21

xx1600000281

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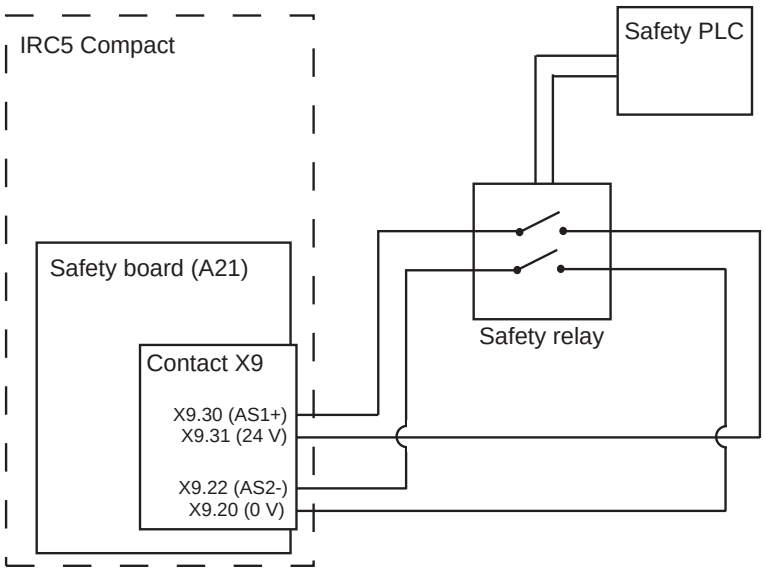
2.6.9 Connection of the MOTORS ON/MOTORS OFF circuit
Continued

Technical data per chain	
Limit switch	Load: 300 mV Max. voltage drop: 1 V
External connectors	Load: 10 mA Max. voltage drop: 4 V
GS/AS load at 24 V	25 mA
GS/AS closed "1"	>18 V
GS/AS open "0"	< 5 V
External supply of GS/AS/SS	Max. + 35 VDC Min. - 35 VDC
GS/AS Filter time	2.0 ms [1)]
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

1) When connecting e.g. a Safety PLC to a safety stop, make sure that the safety check pulses do not exceed 2.0 ms, otherwise a safety relay must be connected in between. See illustration below.



en0900000482

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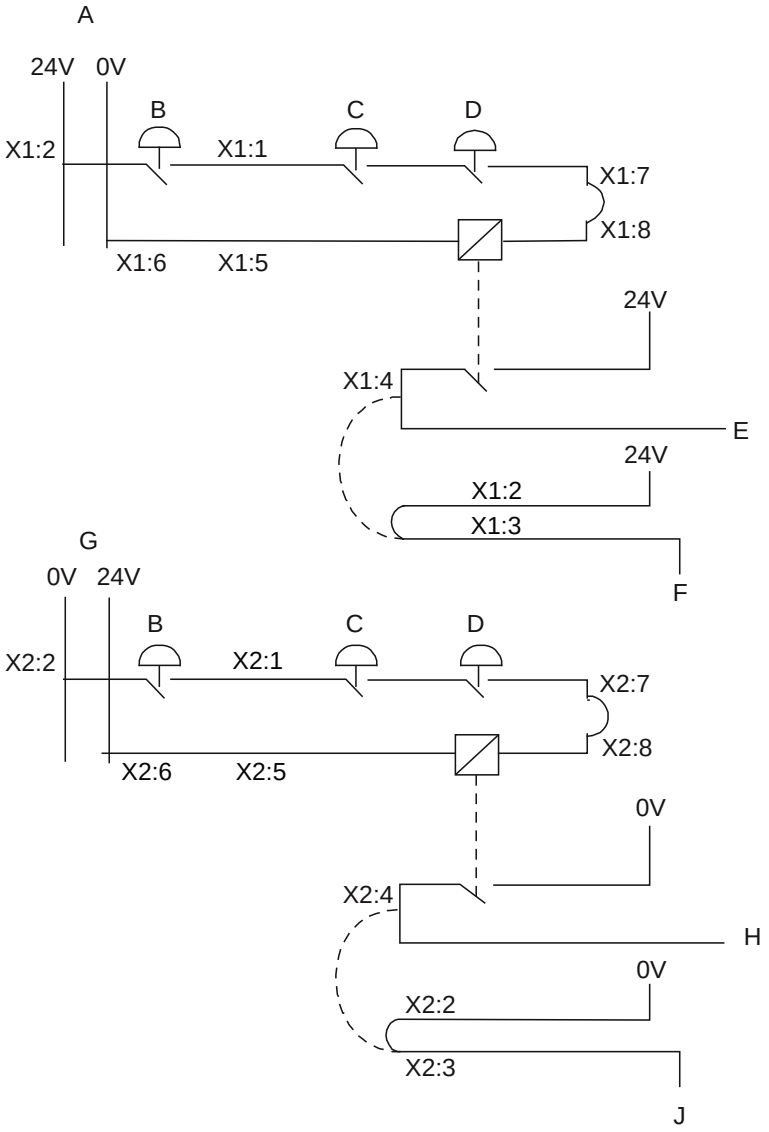
Connection of ES1/ES2 on panel unit

The diagram below shows the terminals for the emergency circuits.

The supply from internal 24V (X1:2/X2:6) and 0V (X1:6/X2:2) is displayed. For an ext. supply, X1:1 / X2:5 is connected to ext. 24V, and X1:5 / X2:1 is connected to ext. 0V.



xx1000001009

A	Internal
B	Ext stop
C	FlexPendant
D	Cabinet
E	ES1 internal
F	Run chain 1 top
G	Internal
H	ES2 internal

Continues on next page

2.6.9 Connection of the MOTORS ON/MOTORS OFF circuit

Continued

J	Run chain 2 top

Technical data	
External supply of ES relay	24 VDC ± 10% between terminals X1:3, 7 and X2:7, 3 respectively. **Note!** In case of interference, the external supply must be properly filtered.
Rated current per chain	40 mA
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

2.6.10 Programmable stop functions

Stopping functions

There are different methods to stop the robot, in addition to manually initiated stops.

- Stop with system input signals
- Stop with RAPID instructions
- Other stops

Stop with system input signals

In the control system, it is possible to define system input signals to be set/reset through different interactions, for example, through I/O signals. See *Application manual - Controller software IRC5*.

The RAPID program cannot be started when any of the system input signals is high.

Pre-defined system input	Description
Stop	The RAPID program execution is stopped, and the manipulator is stopped on path with no deviation. This stop is similar to a normal program stop using stop button on the FlexPendant.
SoftStop	This is a faster stop of the manipulator than *Stop*. This stop is more stressing for the mechanics than normal stop, therefore there might be a minor deviation on path.
QuickStop	This is a faster stop of the manipulator than *Stop* and *SoftStop*. This stop is more stressing for the mechanics than normal stop or *SoftStop*, therefore there might be a deviation on path.
Stop at End of Cycle	Stops the RAPID program when the complete program is executed, that means when the last instruction in the main routine has been completed.
Stop at End of Instruction	Stops program execution after the current instruction is completed.

All of these stops are performed without using the brakes, and the power is never disconnected. The program execution can be continued directly, for example by activating a start signal if the stop signal is set low.

Note

Only safety rated input signals are allowed to be used for safety.

Continues on next page

2.6.10 Programmable stop functions
Continued

Stop with RAPID instructions

There are several RAPID instructions available that stops the robot.

Instruction	Description	Arguments
SystemStopAction	Stops all robots in all tasks immediately.	\Stop: similar to a normal program stop with stop button. \StopBlock: as above, but to restart the PP has to be moved. \Halt: this is like a category 0 stop, i.e. it will result in motors off state, stop of program execution and robot movements in all motion tasks. The Motors on button must be pressed before the program execution can be restarted.
Stop	The current move instruction will be finished before the robot stops. A restart will continue the program execution.	\NoRegain: the robot will not return to the stop point when restarted, e.g. after having been jogged away. \AllMoveTasks: all robots will be stopped.
StopMove	The current move instruction will be stopped immediately as a normal program stop but the program execution will continue with the next instruction. StartMove must be executed to get the robot moving again.	\Quick: the stop will be a soft stop on path, as described for system input *SoftStop*, otherwise similar to a normal program stop. \AllMotionTasks: all robots will be stopped.
DebugBreak	The current move instruction and the program execution will be stopped immediately as a normal program stop. A restart of the program will continue the program execution.	
EXIT	The current move instruction and the program execution will be stopped immediately as a normal program stop. After stop the Program Pointer is lost and has to be reset to Main.	
EXITCYCLE	The current move instruction and program execution will be stopped immediately. The Program Pointer will be moved to Main and if running mode is continuous, the program will be restarted.	

Continues on next page

Instruction	Description	Arguments
`SearchX`	Search instructions can be programmed with arguments to stop the robot movement close to the point where a search hit was noticed. The program execution will continue with the next instruction.	`\Stop`: the robot will stop as fast as possible. This stop is performed by ramping down motion in each motor separate from each other, and as fast as possible. Since it will be without any coordination, the robot may slide off path fairly much. `\PStop`: the robot will stop like after a normal program stop. `\SStop`: the robot will stop on path but quicker than a normal program stop. This is similar to a system input *SoftStop*. `\Sup`: the robot will continue to the `ToPoint`. If more than one search hit is found, an error will be reported.

RAPID instructions are described in *Technical reference manual - RAPID Instructions, Functions and Data types*.

Other unexpected stops

Type of stop	Description
SysFail	In the control system there is a surveillance and monitoring function that can detect abnormal situations. In such cases a stop will be initiated. The robot controller must be restarted.
Power fail	In the control system there is a monitoring function that can detect power failure. In such cases a stop will be initiated.
Stop at collision	In the control system there is a monitoring function that can detect collisions. In such cases a stop will be initiated.  **WARNING** Special care must be taken when restarting a machine that is stopped due to a collision. The robot might make a limited move when restarted.  **WARNING** The revolution counters might need to be updated after a collision to ensure path accuracy.

2.6.11 Emergency stop output

Emergency stop output through safety relay

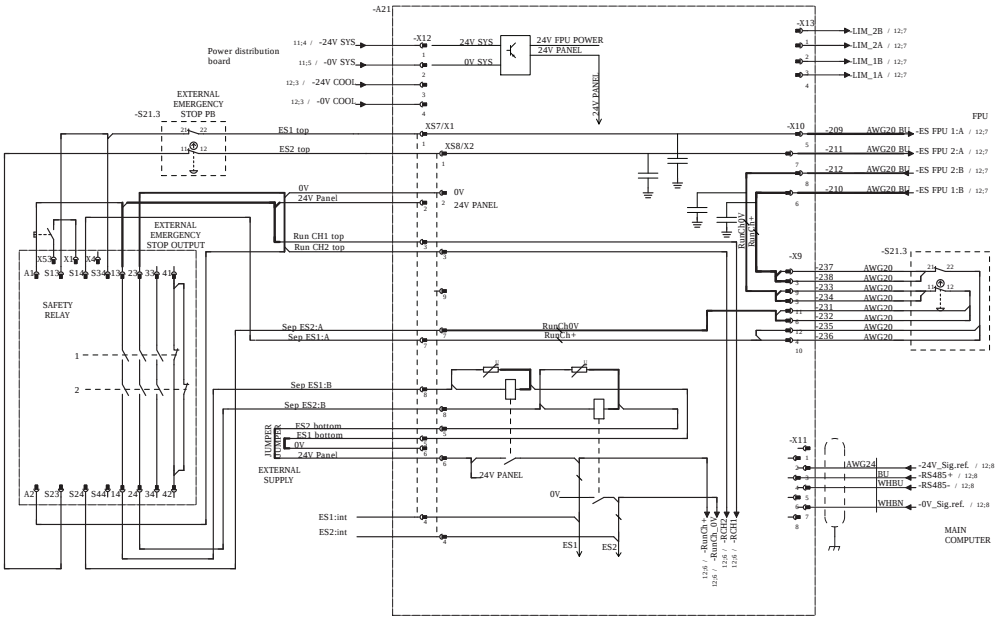
The safety board DSQC 400 does not have an emergency stop output. The emergency stop output can be extended by adding one safety relay. The diagram below shows the connection of a safety relay, type RT6 from Jokab Safety. ABB Robotics does not offer the safety relay option. The safety relay can be purchased from Jokab Safety or Pilz.

Note

The safety board DSQC 400E has an integrated emergency output connector (X14), but this is only intended for functional safety module DSQC1015. It is not recommended to connect external equipment to this connector inside the controller. Therefore, it is recommended to use the same solution for DSQC 400E as for DSQC 400.

For more information on the safety board, see *Replacement of safety board on page 136* and *Controller system parts on page 223*.

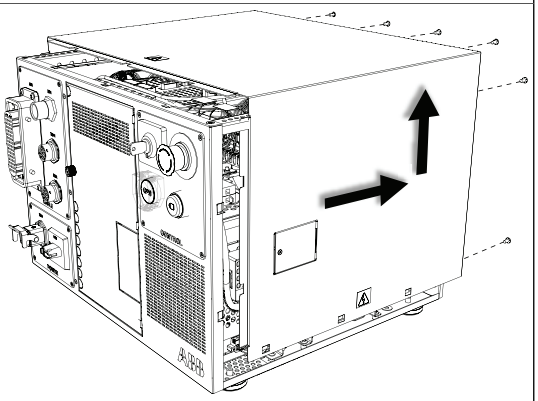
Safety relay on safety board DSQC 400



xx1100000556

2.7 Opening the IRC5 Compact controller

Removing the controller cover

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the attachment screws on the cover.	 xx1400001364
3	Push the cover towards the back of controller to release it from the bend of the front panel, and then pull upwards to remove it.	

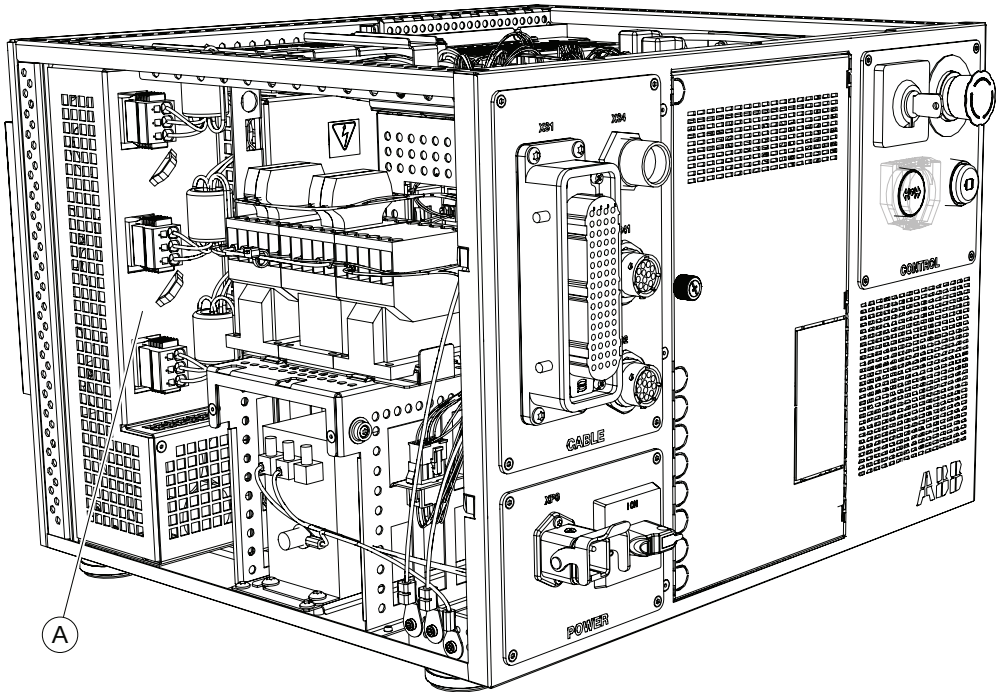
2.8 Drive system

2.8.1 Drive functions, general

General

The robot is powered by power electronics found in the IRC5 Compact controller.

Location of drive unit



xx1400001373

A	Main Drive Unit

Replacing drive system parts

How to replace the drive unit is described in section *Replacement of drive unit on page 173*.

2.9 Memory functions

2.9.1 Memory functions

General

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

For more information on how to replace the SD-card memory, see *Replacement of SD-card memory in computer unit on page 170*.

Note

Only use SD-card memory supplied by ABB.

CAUTION

Reformatting the SD-card or modifying the disk partition can cause irreparable boot-up problems.

2.9.2 Connecting a USB memory

Handling USB

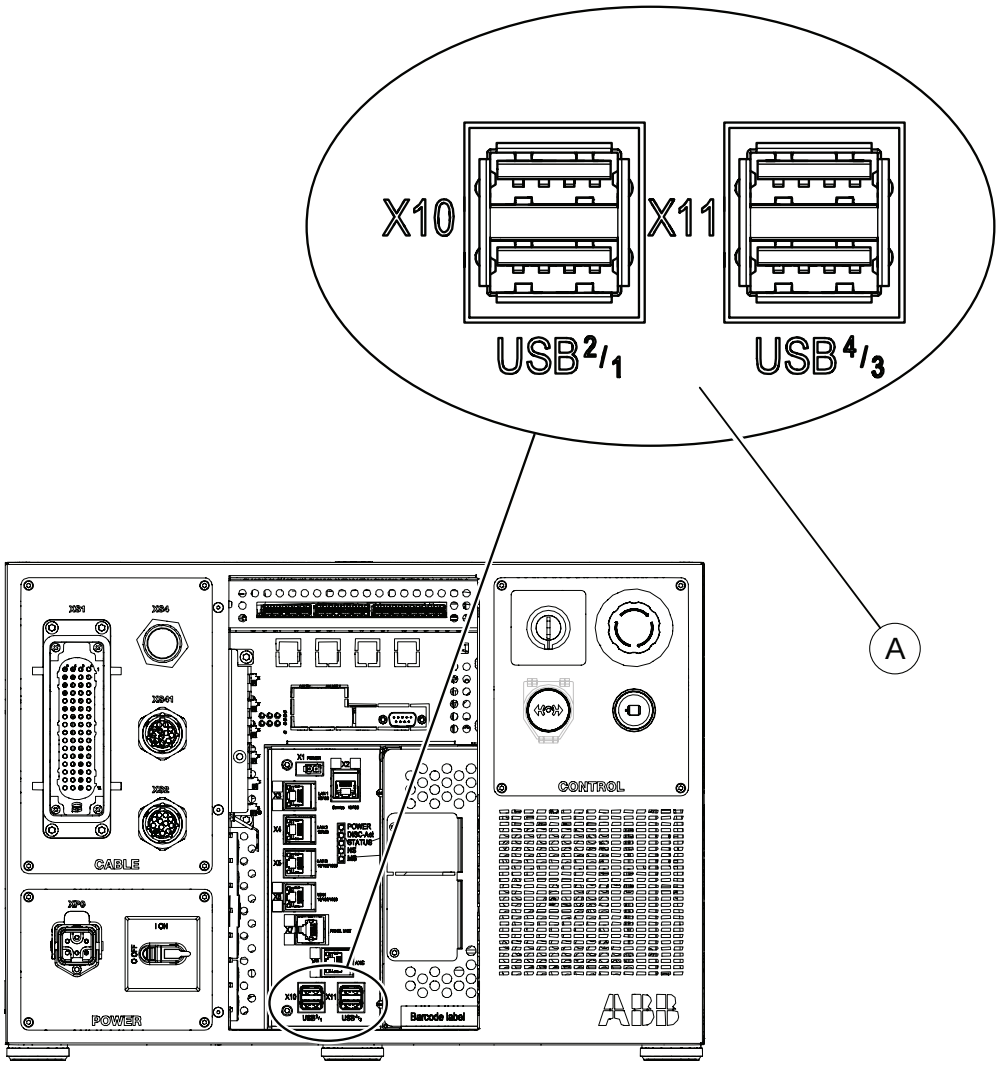
Handling of USB memory is described in *Operating manual - IRC5 with FlexPendant*.

Location on FlexPendant

The USB port on the FlexPendant is located behind a rubber cover.

Location on the controller

The location of the USB ports on the IRC5 Compact controller is shown by the following illustration:



xx1400001376

A	USB port 1 - 4

2.10 I/O system

2.10.1 Definition of fieldbuses, IRC5

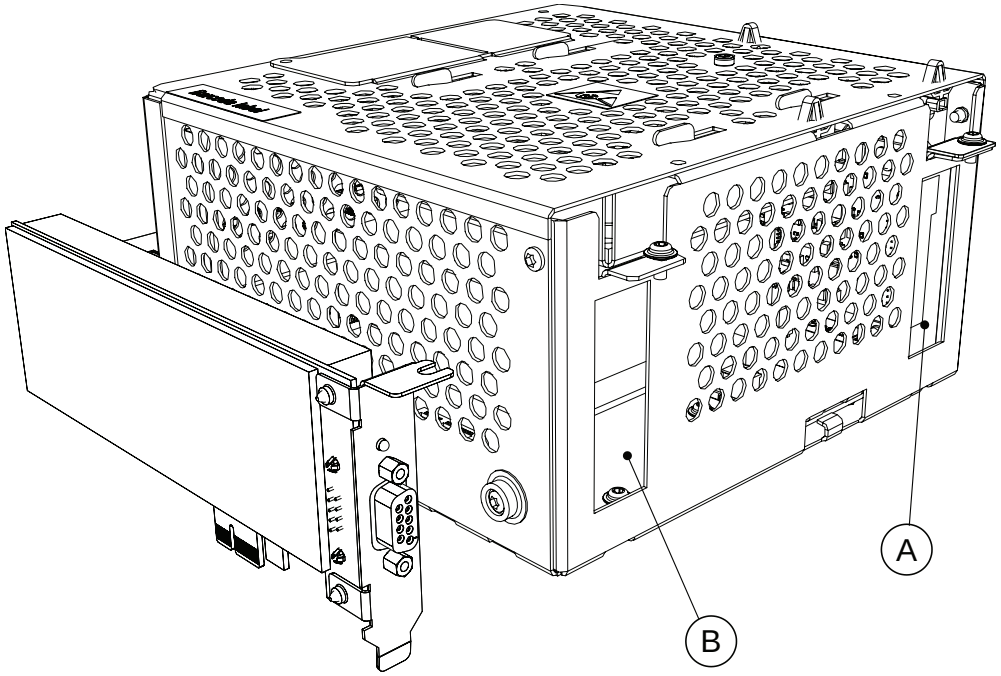
General

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

In the standard form, no fieldbus is mounted to the controller.

Fieldbus master/slave boards

On the main computer unit there are slots available for installing a master/slave board.



xx1600000536

A	Slot for PCIexpress boards
B	Slot for safety module (option SafeMove Pro or SafeMove Basic)

The following master/slave boards are available:

Description	Art. no.	Type designation
PROFIBUS Master PCIexpress	3HAC044872-001	DSQC1005
DeviceNet Master/Slave PCIexpress	3HAC043383-001	DSQC1006

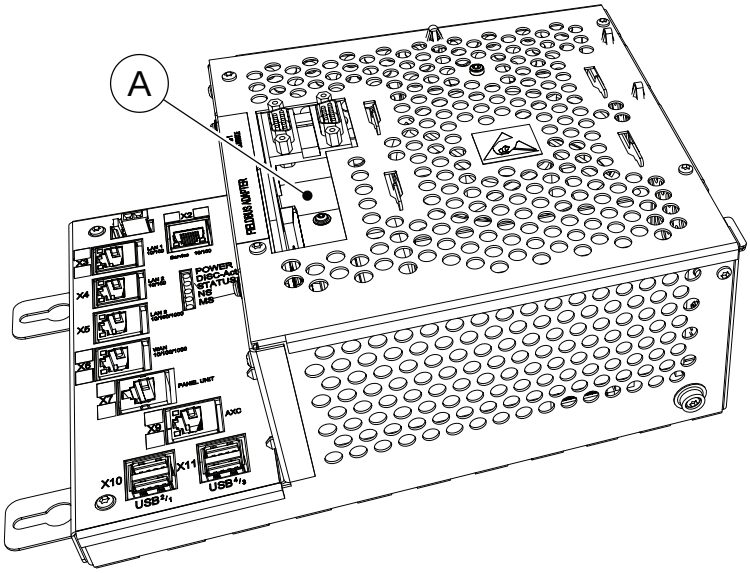
Continues on next page

2.10.1 Definition of fieldbuses, IRC5
Continued

Expansion board for fieldbus adapters

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

The expansion board is also equipped with a serial channel. For more information on how to connect to the serial channel, see *Connecting a serial channel to the controller on page 66*.



xx1300000605

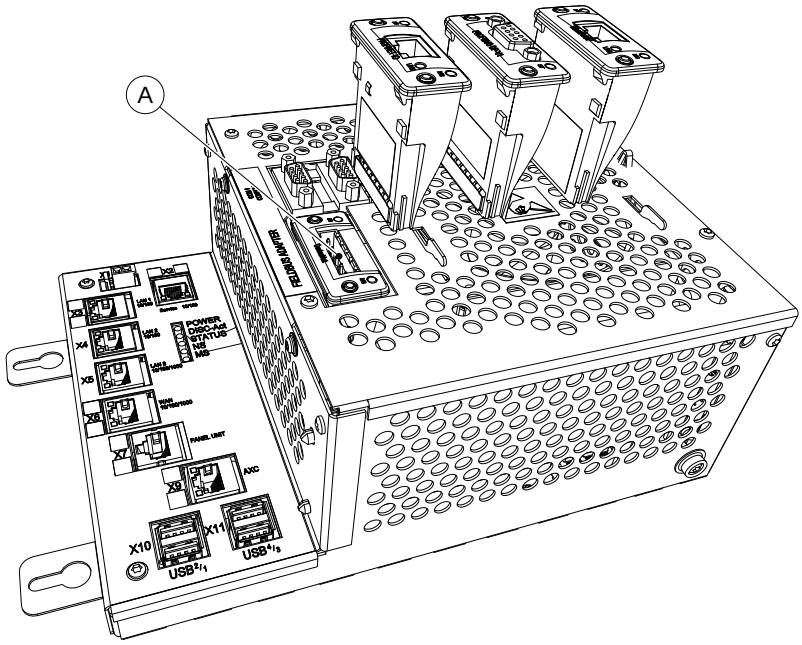
A	Assembled expansion board for fieldbus adapters, without adapter.

Description	Art. no.	Type designation
AnybusCC / RS232 expansion board	3HAC046408-001	DSQC1003

Continues on next page

Fieldbus adapters

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



xx1300000604

A	Slot for AnybusCC fieldbus adapters

Following fieldbus adapters are available:

Description	Art. no.	Type designation
AnybusCC DeviceNet slave	3HAC045973-001	DSQC1004
AnybusCC PROFIBUS slave	3HAC026840-001	DSQC 667
AnybusCC Ethernet/IP slave	3HAC027652-014	DSQC 669
AnybusCC PROFINET slave	3HAC031670-001	DSQC 688

References

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

Manual title	Art. no.
Application manual - DeviceNet Master/Slave	*3HAC050992-001*
Application manual - DeviceNet Anybus Slave	*3HAC050993-001*
Application manual - EtherNet/IP Anybus Adapter	*3HAC050997-001*
Application manual - EtherNet/IP Scanner/Adapter	*3HAC050998-001*
Application manual - PROFIBUS Anybus Device	*3HAC050965-001*
Application manual - PROFIBUS Controller	*3HAC050966-001*
Application manual - PROFIenergy Device	*3HAC050967-001*

Continues on next page

2.10.1 Definition of fieldbuses, IRC5
Continued

Manual title	Art. no.
Application manual - PROFINET Anybus Device	*3HAC050968-001*
Application manual - PROFINET Controller/Device	*3HAC065546-001*

2.10.2 DeviceNet I/O units

General

The IRC5 controller may be fitted with DeviceNet I/O or encoder units. These are configured in an identical way.

Standard configuration

In the standard form, no fieldbus is mounted to the controller.

It is possible to connect any type of DeviceNet compliant I/O unit on the DeviceNet - master bus. All I/O units should comply with the DeviceNet standard and be conformance tested by ODVA.

DeviceNet I/O units and parts

The table below specifies the DeviceNet I/O units:

Description	Note
Digital I/O	DSQC 652

See *Spare parts on page 223* for the spare part numbers.

Encoder interface units

The table below specifies the encoder interface units:

Description	Art. no.	Note
Encoder interface unit for conveyor tracking	3HNE 01586-1	DSQC 377B

Further information

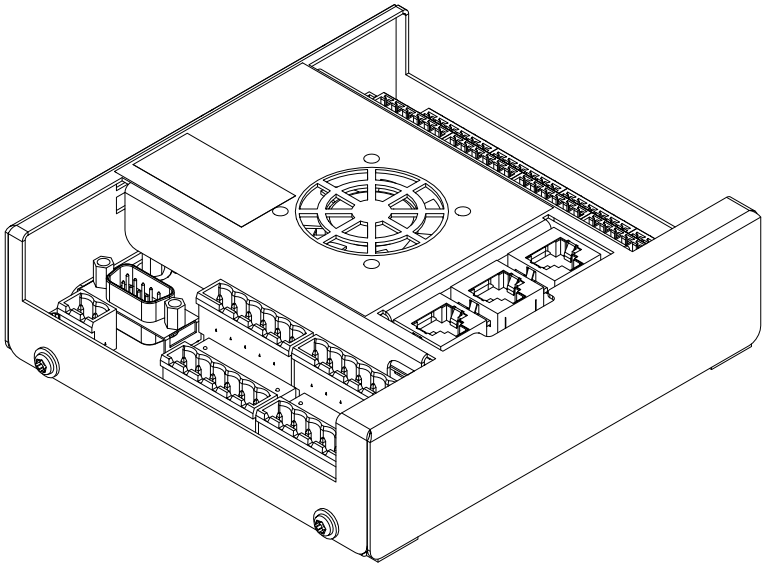
The table below gives references to additional information:

Information:	Found in:
How to install the DeviceNet I/O units mechanically and electrically.	Fit the expansion board and/or field bus adapter according to *Replacement of expansion board in the computer unit on page 159* and/or *Replacement of fieldbus adapter in the computer unit on page 162*.
Allowed configurations of DeviceNet I/O units and how to setup the configurations.	*Technical reference manual - System parameters*
How to install the DeviceNet I/O unit software related in a new system.	The application manual for the different I/O buses respectively, see listing in *Definition of fieldbuses, IRC5 on page 101*.
Detailed descriptions of all available DeviceNet I/O units.	The application manual for the different I/O buses respectively, see listing in *Definition of fieldbuses, IRC5 on page 101*.

2.10.3 Conveyor tracking module

General

The conveyor tracking module, DSQC 2000 CTM-01, is a network based conveyor interface that provides connections for 4 encoders and 8 cameras. The camera connections can also be used for other sensor types, for example photocells. The module uses network communication to share conveyor speed and position data with one or more robot controllers.



xx1800000941

Encoder interface units

The table below specifies the encoder interface units:

Description	Art. no.	Note
DSQC2000 CTM-01	3HNA027579-001	Conveyor tracking module
CONNECTOR KIT - DSQC2000	3HNA029345-001	Connector kit **Note** The connector kit includes contacts for 2 encoders and 4 cameras. Two connector kits are needed to handle additional encoders and cameras.

Continues on next page

Further information

The table below gives references to additional information:

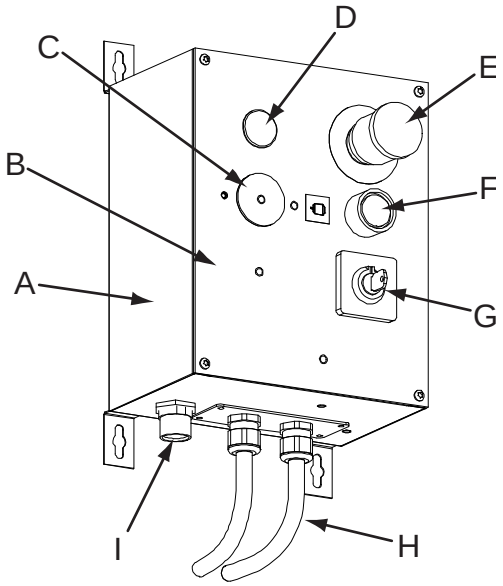
Information:	Found in:
How to install and configure Conveyor Tracking.	*Application manual - Conveyor tracking*, *3HAC050991-001*

2.11 Installation of add-ons

2.11.1 Installation of external operator's panel

Location

An external operator's panel may be fitted in a separate wall cabinet as shown in the illustration below.



xx1000000954

A	Wall cabinet
B	Front panel
C	Blanking plug for FlexPendant
D	Blanking plug for actuator red
E	Emergency stop button
F	Motor ON button
G	Mode switch
H	External Operator's panel harness
I	FlexPendant connector

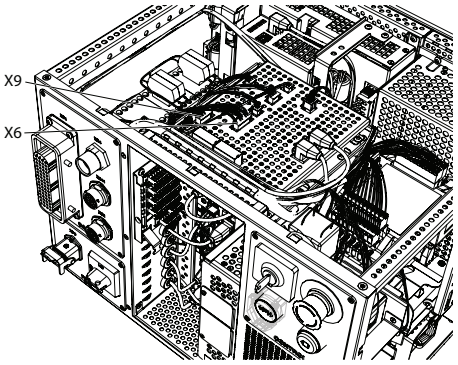
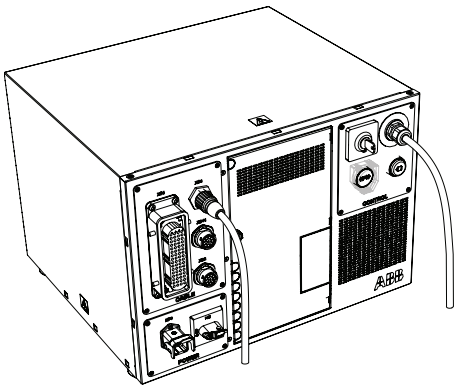
Required equipment

Equipment	Art. no.	Note
Wall cabinet IRC5	3HAC038671-001	
External Operator's panel cable	3HAC065947-001 3HAC065947-004 3HAC065947-005	7 m 15 m 30 m
Circuit diagram	See *Circuit diagrams on page 235*.	

Continues on next page

Procedure

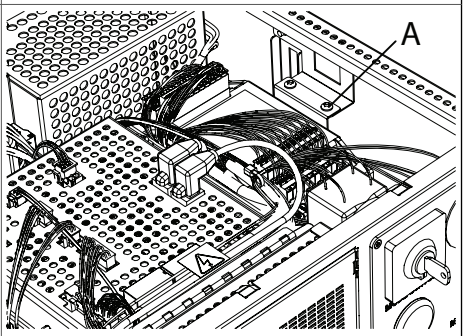
The procedure below details how to install the external control panel.

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
3	Remove the two attachment screws for the safety board unit and gently pull it out a little bit.	
4	Remove the contactor unit (contactors attached with plate) attachment screws and move the unit leftwards a little bit.	
5	Disconnect signal cabling from the safety board. Connectors: • A21.X6 • A21.X9	 xx1500000114
6	Detach the Emergency stop button, Motor on button and Mode switch together with their cabling on the controller. Mount these buttons and switch on the external operator's panel and strap the cabling to the existing cable strapping behind the front panel.	
7	Connect the round connector from the external operator's panel harness to XS4 on the controller.	
8	Fit the cable from the external operator's panel harness to the controller through the hole for Emergency stop button and tighten the cable gland.	 xx1000000956

Continues on next page

2.11.1 Installation of external operator's panel

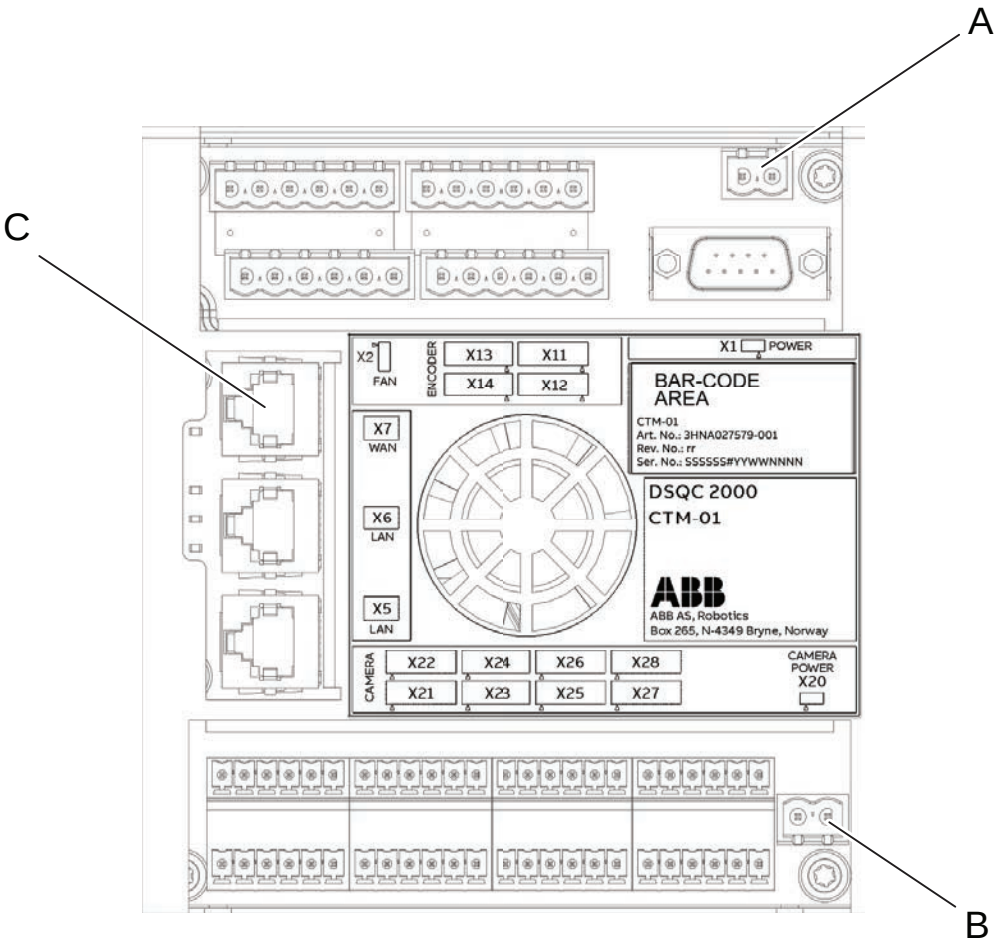
Continued

	Action	Info/illustration
9	Cover the holes for Motor on button and Mode switch on the controller with a blanking plug.	
10	Connect the earth cable to the ground terminal inside the cabinet.	 xx1400002803 • A: ground terminal
11	Connect the signal connectors Ext.A21.X6 and Ext.A21.X9 to the connector X6 and X9 on the safety board.	
12	Strap the cables and secure the attachments screws for contactor unit and safety board unit.	
13	Fit the external operator's panel harness to the wall cabinet with four attachment screws.	
14	Connect the connectors and earth cable inside the wall cabinet.	
15	Mount the front panel of the external operator's panel on the wall cabinet with four attachment screws.	

2.11.2 Installation of conveyor tracking module

Location

The conveyor tracking module must be powered by a 24V power supply and connected to the Ethernet.



xx1800002638

A	X1, Power inlet 24VDC
B	X20, Optional camera power inlet 24VDC
C	X7 WAN, Ethernet connection

Required equipment

Equipment	Article number	Note
DSQC 2000 CTM-01	3HNA027579-001	
CONNECTOR KIT - DSQC 2000	3HNA029345-001	
Application manual - Conveyor tracking	*3HAC050991-001*	
Standard toolkit		See *Standard toolkit, IRC5 on page 219*.

Continues on next page

2.11.2 Installation of conveyor tracking module

RobotWare - OS

Continued

Equipment	Article number	Note
Circuit diagram - IRC5 Compact	*3HAC049406-003*	

Note

The connector kit includes contacts for 2 encoders and 4 cameras. Two connector kits are needed to handle additional encoders and cameras.

Fitting

The procedure below details how to fit the units.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Connect 24VDC power supply to X1 (power inlet, main functions) and X20 (optional camera power inlet) on the conveyor tracking module.	External 24VDC power supply is needed for option 1551-1.
4	Connect the Ethernet cable to the connector X7 WAN on the conveyor tracking module.	The WAN port of the CTM must be connected to the same Ethernet network as the robot controllers.
5	Connect wires to the encoder and camera connectors as required.	Described in the *Application manual - Conveyor tracking*.

2.11.3 Installing the Safety module DSQC1015 for SafeMove

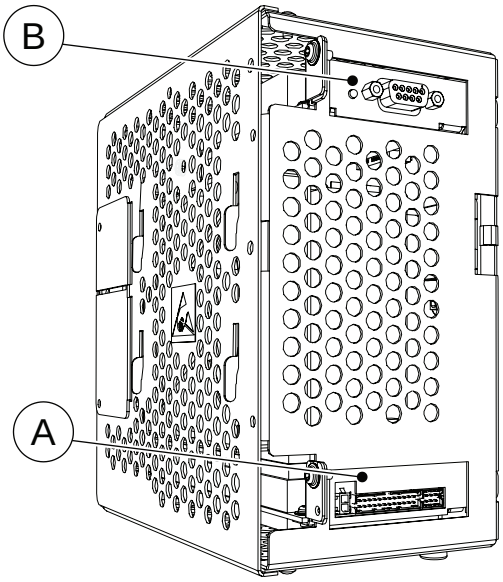
General

To use the options SafeMove Basic and SafeMove Pro you need to install the Safety module DSQC1015 in the robot controller.

The procedure below describes how to install the Safety module and how to connect the cables.

Location

The Safety module DSQC1015 is a PCIexpress board that is located inside the IRC5 main computer unit.



xx1500001760

A	Safety module DSQC1015
B	PCIexpress slot for other devices.

Required equipment

Illustration of the cable harnesses are found in section:

- *Connecting the cables to the Safety module (hardware switch and 731-1) on page 116*

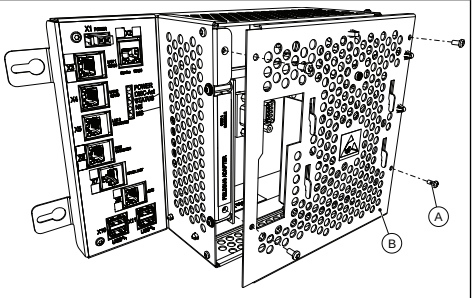
Item	Equipment	Note
	DSQC1015 Safety module	3HAC048858-001
A2	Harness safety hard Key switch	3HAC057074-001
D	Harness 24 V I/O DSQC1015	3HAC057073-001
B	Harness auxiliary contact	3HAC057076-001
E	Harness Emergency stop	3HAC032324-001
F	Harness Control (Motor on, Key switch)	3HAC049563-001

Continues on next page

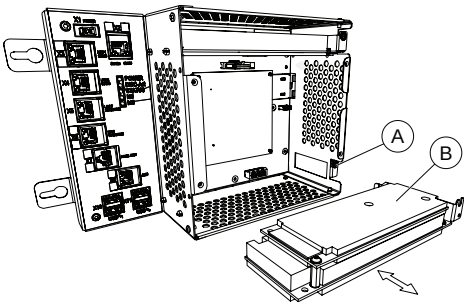
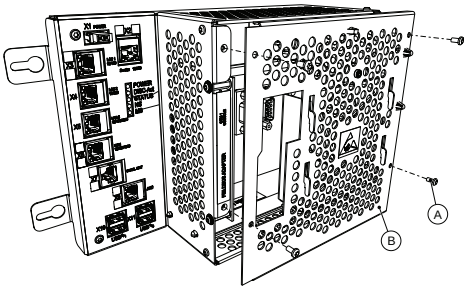
2.11.3 Installing the Safety module DSQC1015 for SafeMove
Continued

Item	Equipment	Note
G	Harness extended Key switch	3HAC057075-001 Used when the controller has the option 735-3 or 735-4 *Additional contacts*.
	Standard toolkit	The contents are defined in section *Standard toolkit, IRC5 on page 219*.
	Circuit diagram	See *Circuit diagrams on page 235*.

Installing the Safety module

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Open the computer unit by removing the attachment screws and lift off the cover. Disconnect the fan connector. **CAUTION** Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Cover
6	Remove the attachment screw on top of the slot bracket.	

Continues on next page

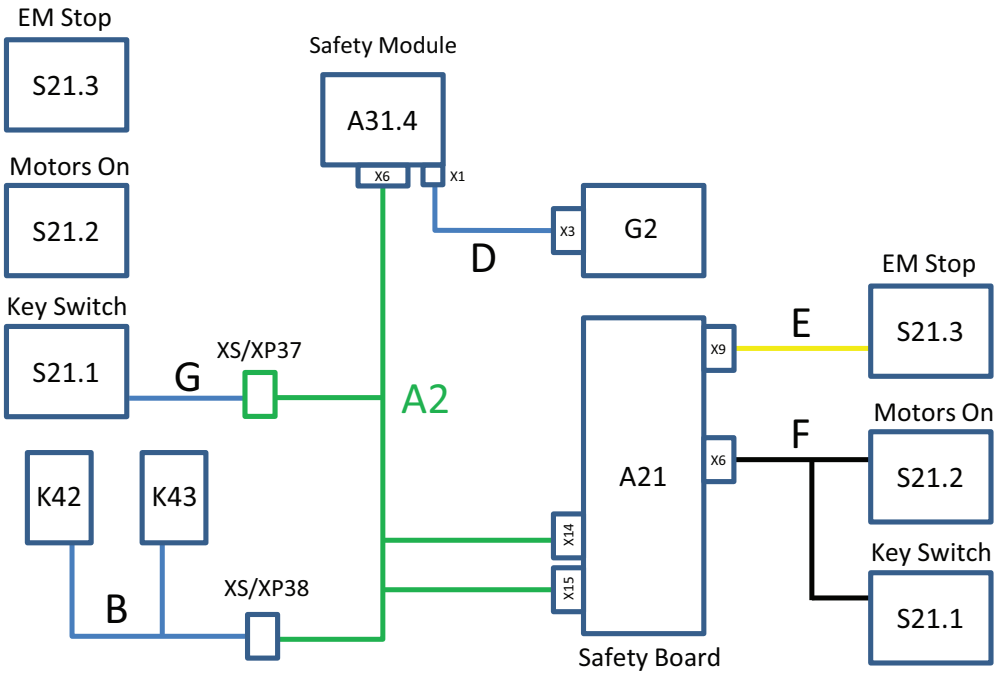
	Action	Note/Illustration
7	Fit the Safety module in position by pushing it into the socket on the motherboard.	 xx1500001761 A Attachment screw B Safety module **CAUTION** Always grip the board around the edges to avoid damage to the board or its components.
8	Refit the attachment screw on top of the Safety module bracket.	
9	Refit the fan connector and close the computer unit. **CAUTION** Be careful with the fan cable when closing the cover. The fan cable must not be squeezed.	 xx1300000684 A Attachment screws (4 pcs.) B Cover
10	Connect all cables according to the procedures described below.	

Continues on next page

2.11.3 Installing the Safety module DSQC1015 for SafeMove
Continued

Connecting the cables to the Safety module (hardware switch and 731-1)

This procedure describes how to connect the cables for a robot controller equipped with the options *Hardware switch* and 731-1 *Safety internal connection*.



xx1600000252

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.
3	Mount auxiliary contact harness contact blocks (B) on contactors K42 and K43.
4	Connect auxiliary contact harness (B) to safety hard Key switch harness (A2) at connector XS/XP38.
5	Connect safety hard Key switch harness (A2) connector A31.4.X6 to Safety module DSQC1015.
6	Connect connector A31.4.X1 on 24 V I/O harness (D) to safety module DSQC1015. **CAUTION** Do **not** connect an external power source.
7	Connect connector G2.X3 on 24 V I/O harness (D) to power distribution unit (G2).
8	Connect safety hard Key switch harness (A2) connectors X14 and X15 to the safety board (A21).

Continues on next page

	Action
9	Connect extended Key switch harness (G) to safety hard Key switch harness (A2) at connector XS/XP37.
10	Connect emergency stop harness (E) connector A21.X9 to the safety board.
11	Connect emergency stop harness (E) connector S21.3 to Emergency Stop on the control panel.
12	Connect the control harness (F) connector A21.X6 to the safety board.
13	Connect the control harness (F) connector S21.2 to Motors On on the control panel.
14	Connect the control harness (F) connector S21.1 to Key Switch on the control panel.
15	Route cables properly in existing cable holders.

Continues on next page

2.11.4 Installing the Connected Services box

Introduction

If the controller is not equipped with a Connected Services box at delivery, the box can be installed later.

For controllers produced before August 2019, contact ABB for assistance. For controllers produced after August 2019, use the refitting procedure in *Replacement of Connected Services box on page 187*.

2.12 Testing

Function tests

When the installation is complete, perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

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3 Maintenance

3.1 Maintenance schedule, IRC5 Compact controller

General

The IRC5 Compact robot controller must be maintained at regular intervals to ensure its function. The maintenance activities and their respective intervals are specified below.

Intervals

Equipment	Maintenance activity	Interval	Detailed in section:
Complete controller	Inspection	12 months [i]	*Inspecting the IRC5 Compact controller on page 122*
System fans	Inspection	6 months [i]	*Inspecting the IRC5 Compact controller on page 122*
FlexPendant	Cleaning	When needed	*Cleaning the FlexPendant on page 125*
Emergency stop (operating panel)	Function test	12 months	*Function test of emergency stop on page 127*
Emergency stop (FlexPendant)	Function test	12 months	*Function test of emergency stop on page 127*
Mode switch	Function test	12 months	*Function test of mode switch on page 128*
Enable device	Function test	12 months	*Function test of three-position enabling device on page 129*
Motor contactors K42, K43	Function test	12 months	*Function test of motor contactors K42 and K43 on page 130*
Brake contactor K44	Function test	12 months	*Function test of brake contactor K44 on page 131*
Auto stop (tested if used)	Function test	12 months	*Function test of Automatic Stop on page 132*
General stop (tested if used)	Function test	12 months	*Function test of General Stop on page 133*
Reduced speed control	Function test	During commissioning	*Function test of reduced speed control on page 134*.

[i] The interval depends on the working environment of the equipment: a cleaner environment may extend the maintenance interval and vice versa.

Function test after replacement of component

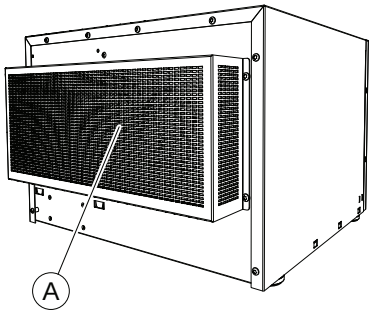
In addition to performing the function tests according to the intervals, function tests should be performed after replacing a component in the controller.

3.2 Inspection activities

3.2.1 Inspection of controller

Inspecting the IRC5 Compact controller

Use this procedure to inspect the IRC5 Compact controller.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	Inspect connectors and cabling to make sure they are securely fastened and cabling not damaged.	
4	Inspect the system fans and ventilation holes on the surface of the cabinet to make sure they are clean.	 xx1400001377
5	After cleaning: Temporarily turn the power supply to the controller on. Inspect the fans to make sure they function correctly. Turn the power supply back off.	

3.3 Changing/replacing activities

3.3.1 Activities

References

Certain activities to be performed as specified in the maintenance schedule are not detailed in this chapter, but in the repair chapter. See *Repair on page 135*.

3.4 Cleaning activities

3.4.1 Cleaning of the controller cabinet

Required equipment

Equipment, etc.	Note
Vacuum cleaner	ESD protected

Internal cleaning

Clean the cabinet interior with an ESD protected vacuum cleaner, if necessary.

Cleaning considerations

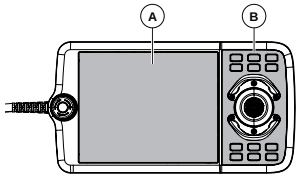
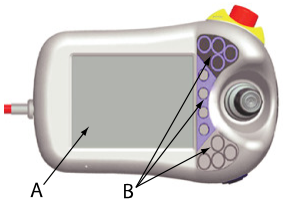
This section specifies some special considerations when cleaning the controller.

- Always use ESD protection.
- Always use cleaning equipment as specified above. Any other cleaning equipment may shorten the life of paint work, rust inhibitors, signs, or labels.
- Always make sure that all protective covers are fitted to the controller before cleaning.
- Never remove any covers or other protective devices when cleaning the outside of the controller.
- Never use compressed air or spray with a high pressure cleaner.
- Never leave the door open when cleaning the exterior.

3.4.2 Cleaning the FlexPendant

Location

The surfaces to clean are shown in the illustration below.

FlexPendant with emergency stop button at the connector	FlexPendant with emergency stop button at the outer edge
 xx1800000128	 xx0400000973

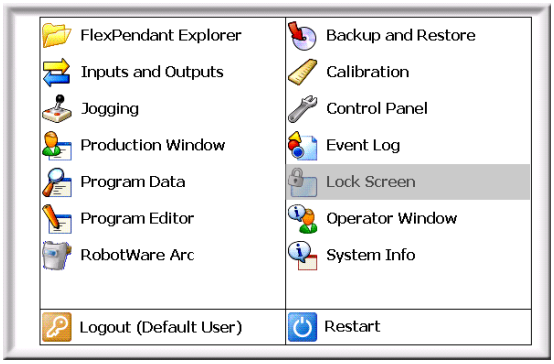
A	Touchscreen
B	Hard buttons

Required equipment

Equipment, etc.	Note
Soft cloth	ESD protected
Water/Mild cleaning agent	

Clean the touch screen

This section describes how to clean the touch screen.

	Action	Info/Illustration
1	Lock the screen.	 en0400001221

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3.4.2 Cleaning the FlexPendant
Continued

	Action	Info/Illustration
2	It is safe to clean the FlexPendant when the Lock screen appears.	 en0400000658
3	Clean the touch screen and hardware buttons using a soft cloth and water or a mild cleaning agent.	
4	Unlock the screen, by tapping the buttons.	 en0400000658

Cleaning considerations

The section below specifies some special considerations when cleaning the FlexPendant:

- Use ESD Protection
- Use cleaning equipment as specified above. Any other cleaning equipment may shorten the life time of the touch screen.
- Check that all protective covers are fitted to the device before cleaning.
- Make sure that no foreign objects or liquids can penetrate into the device.
- Do not remove any covers before cleaning the FlexPendant.
- Do not spray with a high pressure cleaner.
- Do not clean the device, operating panel and operating elements with compressed air, solvents, scouring agent or scrubbing sponges.

3.5 Function tests

3.5.1 Function test of emergency stop

Overview

Perform this test on the emergency stop button both on the operating panel and on the FlexPendant.

Performing the function test

	Action	Note
1	Make a visual inspection of the emergency stop button to make sure it is not physically damaged.	If any damage is found on the emergency stop button, it must be replaced.
2	Start the robot system.	
3	Press the emergency stop button.	The test is passed if the event message **10013 Emergency stop state** appears in the event log. If either of the following happens, then the test is failed and the root cause must be found: • if the event message **10013 Emergency stop state** does not appear • if the event message **90223 Emergency stop conflict** appears
4	After the test, release the emergency stop button and press the motors on button to reset the emergency stop state.	

3.5.2 Function test of mode switch

2-position mode switch

	Action	Note
1	Start the robot system.	
2	Start with the mode switch in manual mode and then switch the mode switch to auto mode. Run the robot in auto mode.	This test is passed if it is possible to run the robot in auto mode. If it is not possible to run the robot in auto mode, this test is failed and the root cause of the failure must be found.
3	Switch the mode switch to manual mode.	This test is passed if the event message **10015 Manual mode selected** appears in the event log. If the event message **10015 Manual mode selected** is not shown, the test failed and the root cause of the failure must be found.

3-position mode switch

	Action	Note
1	Start the robot system.	
2	Start with the mode switch in manual mode and then switch the mode switch to auto mode. Run the robot in auto mode.	This test is passed if it is possible to run the robot in auto mode. If it is not possible to run the robot in auto mode, this test is failed and the root cause of the failure must be found.
3	Switch the mode switch to manual full speed mode. Run the program in manual full speed mode.	This test is passed if it is possible to run the program in manual full speed mode. If it is not possible to run the program in manual full speed mode, this test is failed and the root cause of the failure must be found.
4	Switch the mode switch to manual mode.	This test is passed if the event message **10015 Manual mode selected** appears in the event log. If the event message **10015 Manual mode selected** is not shown, the test failed and the root cause of the failure must be found.

3.5.3 Function test of three-position enabling device

Performing the function test

	Action	Note
1	Start the robot system and turn the mode switch to manual mode.	
2	Press the three-position enabling device to the middle position and then hold the enabling device in this position.	This test is passed if the event message **10011 Motors ON state** appears in the event log. If either of the following happens, then the test is failed and the root cause must be found: • if the event message **10011 Motors ON state** does not appear • if the event message **90224 Enabling Device conflict** appears
3	While still holding the three-position enabling device pressed, press the enabling device harder to the enable the device's third position.	This test is passed if the event message **10012 Safety guard stop state** appears in the event log. If either of the following happens, then the test is failed and the root cause must be found: • if the event message **10012 Safety guard stop state** does not appear • if the event message **90224 Enabling Device conflict** appears

3.5.4 Function test of motor contactors K42 and K43

Performing the function test

	Action	Note
1	Start the robot system and turn the mode switch to manual mode.	
2	Press the three-position enabling device to the middle position and then hold the enabling device in this position.	This test is passed if the event message **10011 Motors ON state** appears in the event log. If the event message **37001 Motor on activation error** appears, the test is failed and the root cause of the failure must be found.
3	Release the three-position enabling device.	This test is passed if the event message **10012 safety guard stop state** appears in the event log. If the event message **90227 Motor contactor conflict** appears, the test is failed and the root cause of the failure must be found.

3.5.5 Function test of brake contactor K44

Performing the function test

	Action	Note
1	Start the robot system and turn the mode switch to manual mode.	
2	Press the three-position enabling device to the middle position and then hold the enabling device in this position. While having eye contact with the manipulator, move the joystick slightly in any direction to disengage the brakes.	This test is passed if the brakes is disengaged and the manipulator can be moved. If the event message **50056 Joint collision** appears in the event log, the test is failed and the root cause of the failure must be found.
3	Release the three-position enabling device to engage the brakes.	This test is passed if the event message **10012 safety guard stop state** appears in the event log. If the event message **37101 Brake failure** appears, the test is failed and the root cause of the failure must be found.

3.5.6 Function test of Automatic Stop

Performing the function test

	Action	Note
1	Start the robot system and change the operating mode to auto mode.	
2	Activate the Automatic Stop, for example by opening the connected robot cell door, which has interlock connection with Automatic Stop.	The test is passed if the event message **90205 Auto Stop open** appears in the event log. If the event message **90205 Auto Stop open** does not appear or if the event message **90225 Auto Stop conflict** appears in the event log, then the test has failed and the root cause of the failure must be found.

3.5.7 Function test of General Stop

Performing the function test

	Action	Note
1	Start the robot system.	
2	Activate the General Stop.	The test is passed if the event message **90206 General Stop open** appears in the event log. If either of the following happens, then the test is failed and the root cause must be found: • if the event message **90206 General Stop open** does not appear • if the event message **90226 General Stop conflict** appears

3.5.8 Function test of reduced speed control

Performing the function test

	Action	Note
1	Start the robot system and change the operating mode to manual.	
2	Create a test program where the robot moves along a known distance with a programmed speed higher than 250 mm/s.	The distance and speed must be adapted to the current installation and robot model.
3	Start the program in manual mode and measure the time it takes for the robot to travel the distance.  **Tip** To get accurate results, use sensors or I/O signals to measure the time.	This test is passed if the speed of the robot does not exceed 250 mm/s, otherwise the test is failed and the root cause of the failure must be found.

4 Repair

4.1 Overview

Structure of this chapter

This chapter describes all repair activities recommended for the IRC5C Compact and any external unit.

It is made up of separate procedures, each describing a specific repair activity. Each procedure contains all the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

All procedures assume that the controller is easy to access from all sides and that no additional covers or equipment are fitted.

WARNING

Repair activities not described in this chapter must only be carried out by ABB. Otherwise damage to the mechanics and electronics may occur.

Required equipment

The details of the equipment required to perform a specific repair activity are listed in the respective procedures.

Safety information

There are general safety information and specific safety information. The specific safety information describes the danger and safety risks while performing specific steps in a procedure. Make sure to read through the chapter *Safety on page 17* before commencing any service work.

Note

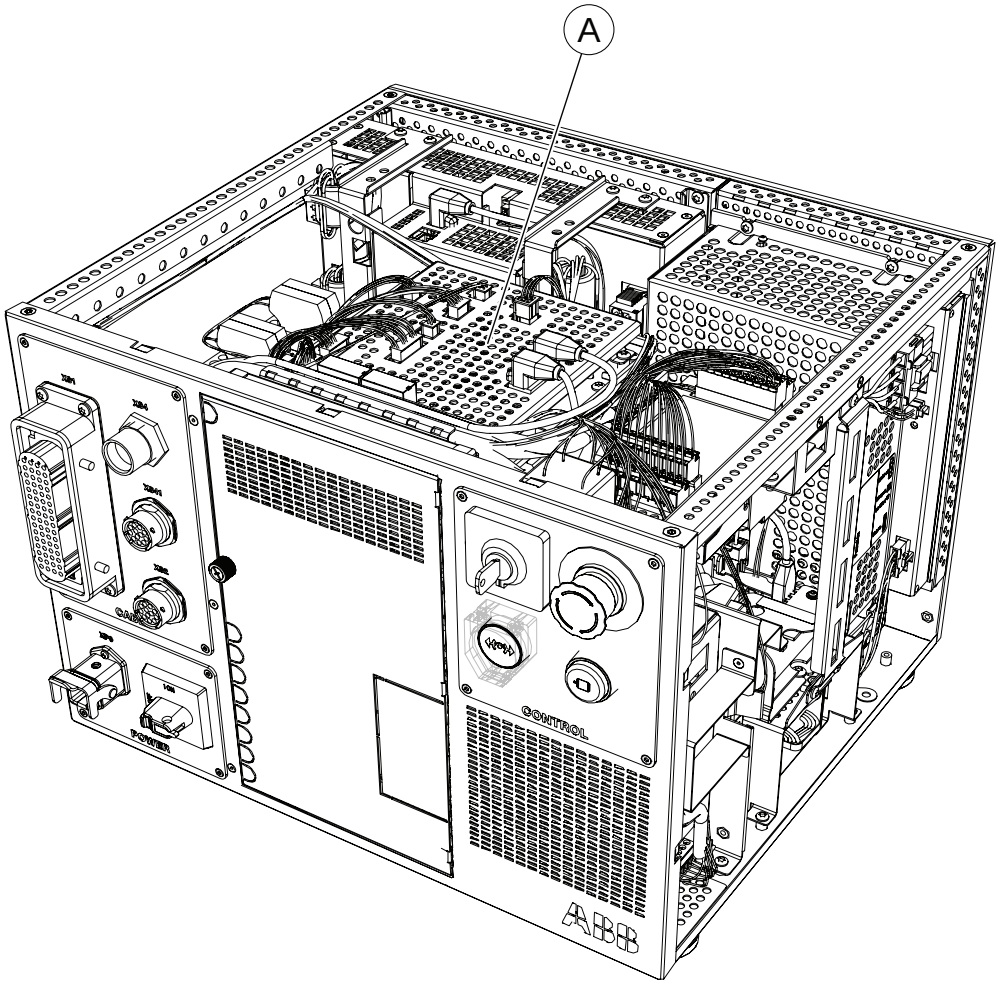
When replacing a part on the IRC5C Compact, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

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

4.2 Replacement of safety board

Location

The safety board is located as shown in the following illustration.



xx1400001378

A	Safety board

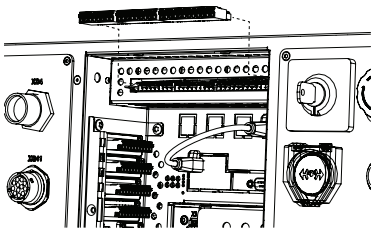
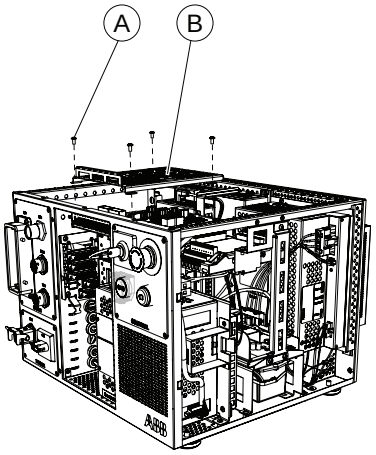
Required equipment

Equipment	Note
Safety board	DSQC 400 or DSQC 400E See *Controller system parts on page 223*
Circuit diagram	See *Circuit diagrams on page 235*.

Continues on next page

Removal

Use the following procedure to remove the safety board.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
4	Disconnect all connectors.	Make a note of all connections.
5	Remove the thumb screw and open the protective cover on the front of the cabinet.	
6	Disconnect three customer connectors.	 xx1400002007
7	Remove the four attachment screws to remove the protection cover.	 xx1400001379

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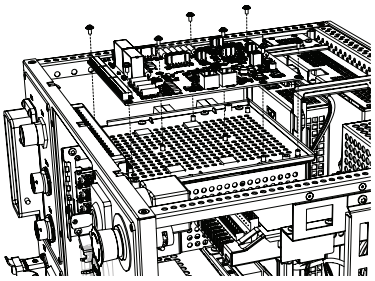
	Action	Note/illustration
8	Remove the eight attachment screws.	 xx1400001380
9	Gently lift the safety board out.	

Refitting

Use the following procedure to refit the safety board.

Note

Always grip the board around the edges to avoid damage to the board or its components.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.
3	Gently lift the safety board out of the ESD safe bag and fit it into position on the safety board plate.
4	Secure the safety board with its attachment screws.
5	Refit the safety board unit protection cover.
6	Reconnect all connectors.
7	Refit the cabinet cover.
8	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.3 Replacement of I/O unit

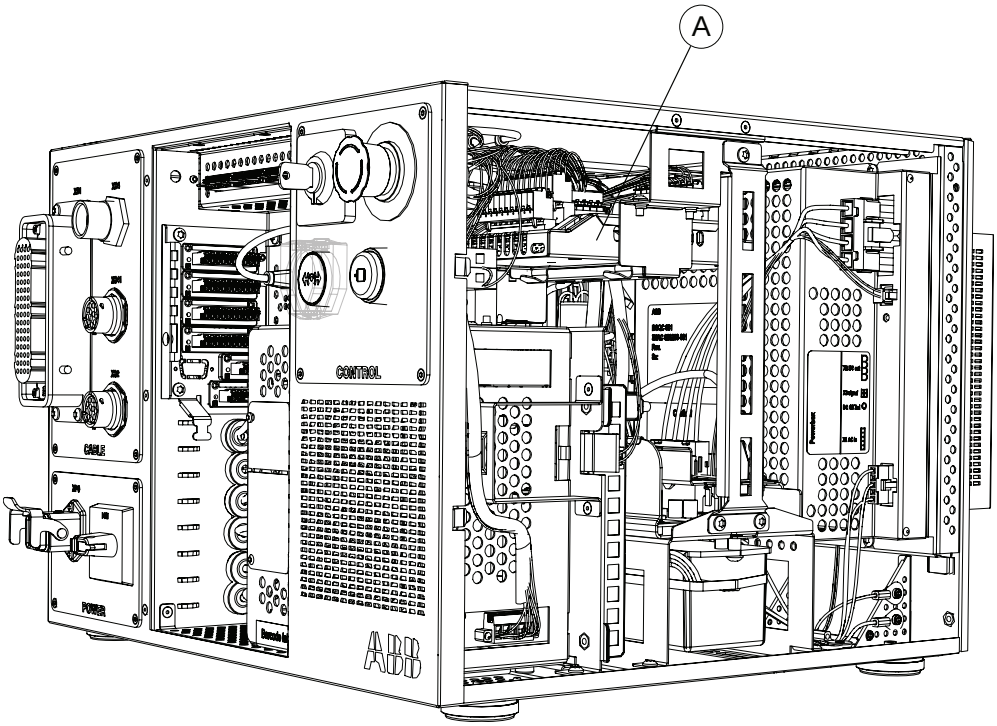
General

An I/O unit may be installed in the IRC5 Compact controller. This is specified in *DeviceNet I/O units on page 105*.

How to configure the I/O unit is detailed in *Operating manual - RobotStudio*.

Location

The location of I/O unit is shown in the following illustration.



xx1400001381

A	I/O unit

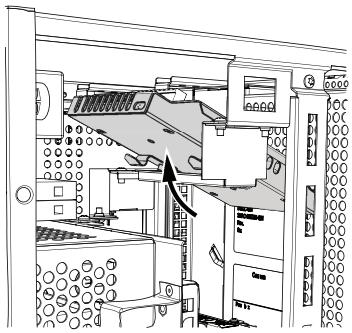
Required equipment

Equipment	Note
I/O unit	DSQC 652 See *Controller system parts on page 223*.
Circuit diagram	See *Circuit diagrams on page 235*.

Continues on next page

Removal

The procedure below details how to remove the I/O units or Gateways.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
4	Disconnect the connectors from the unit.	Note which connector goes where, to facilitate reassembly.
5	Tip the unit away from the mounting rail and remove it.	 xx1400001382

Refitting

The procedure below describes how to refit the I/O unit.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.
3	Hook the unit back onto the mounting rail and snap it gently in position.
4	Reconnect all connectors disconnected during removal.
5	Refit the cabinet cover.

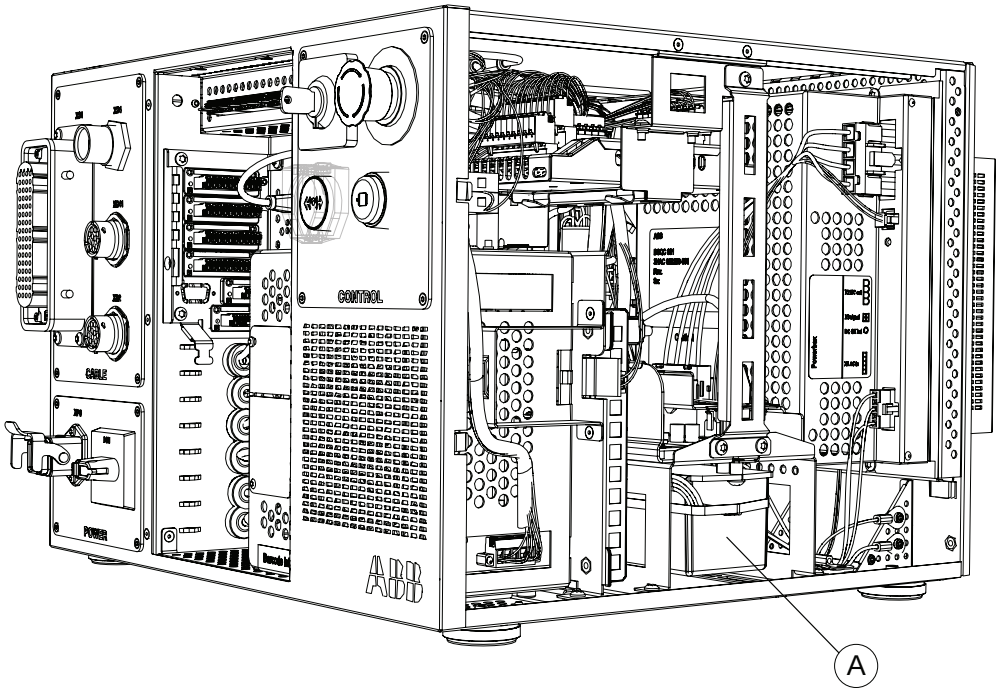
Continues on next page

	Action
6	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.4 Replacement of backup energy bank

Location

The following illustration shows the location of the backup energy bank in IRC5 Compact.



xx1400001383

A	Backup energy bank

Required equipment

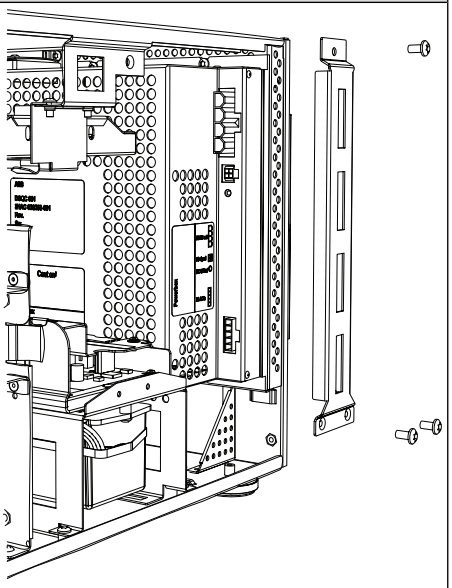
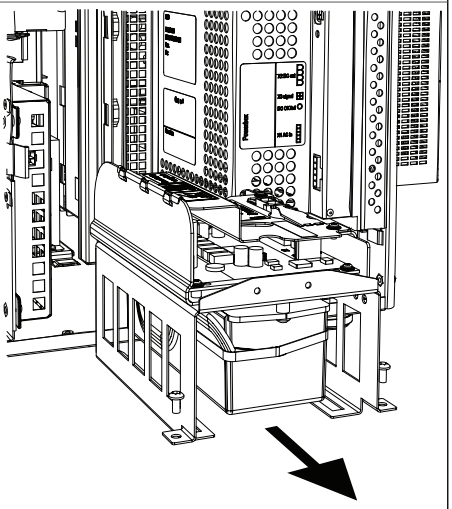
Equipment	Note
Backup energy bank	DSQC 655 See *Controller system parts on page 223*.
Circuit diagram	See *Circuit diagrams on page 235*.

Removal

The following procedure describes how to remove the backup energy bank.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.

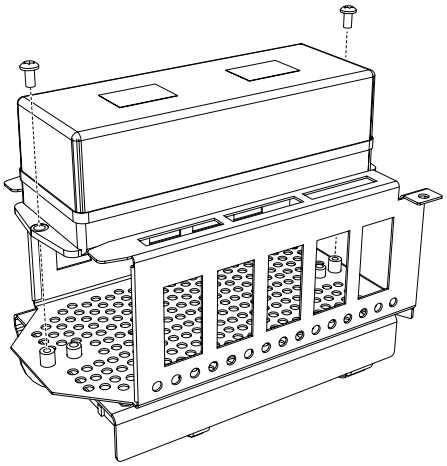
Continues on next page

	Action	Note/illustration
3	Remove the three attachment screws, and remove the support bar.	 xx1400001384
4	Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 xx1400001385
5	Disconnect all connectors from the power distribution unit.	
6	Pull the backup energy bank unit out completely.	

Continues on next page

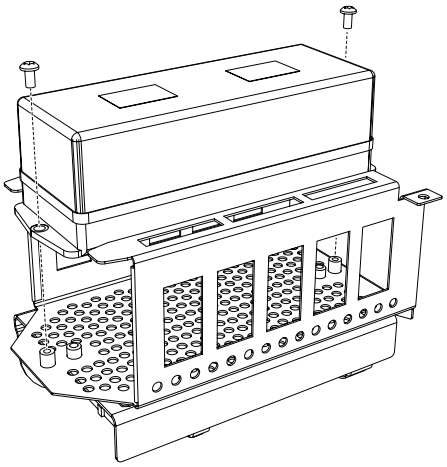
4.4 Replacement of backup energy bank

Continued

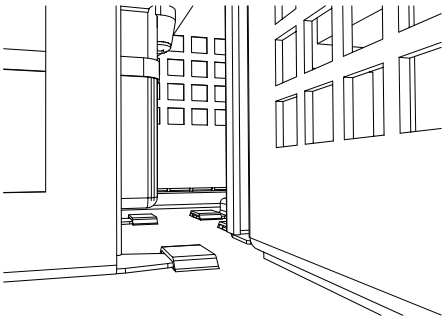
	Action	Note/illustration
7	Remove the two attachment screws.	 xx1400001386
8	Remove backup energy bank.	

Refitting

The procedure below details how to refit the backup energy bank.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Refit the new backup energy bank.	
3	Refit the attachment screws, and tighten them.	 xx1400001386
4	Slide the backup energy bank unit half way in.	
5	Reconnect all the connectors to the power distribution unit.	

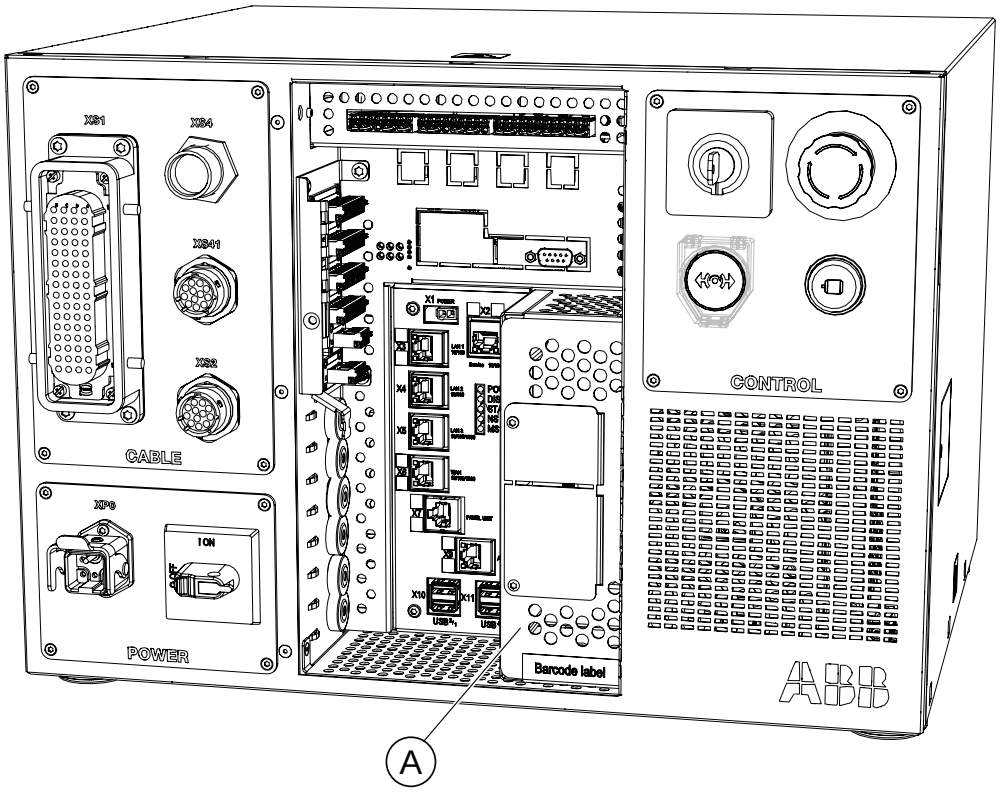
Continues on next page

	Action	Note/illustration
6	Refit the backup energy bank unit.	 xx1400001387 **Note** Ensure to fit in the latches properly.
7	Refit the support bar with the three attachment screws.	
8	Refit the cabinet cover.	
9	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.5 Replacement of computer unit

Location

The computer unit is located as shown in the illustration below.



xx1400001363

A	Computer unit

Required equipment

Equipment	Note
Computer unit	See *Spare parts on page 223*.
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See *Circuit diagrams on page 235*.

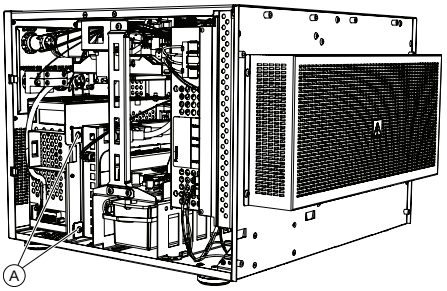
Continues on next page

Removal

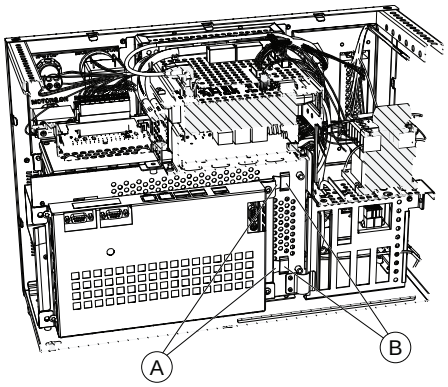
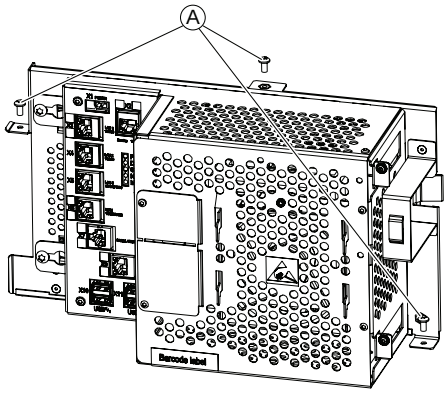
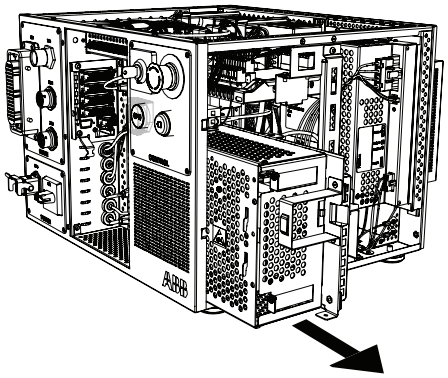
The procedure below details how to remove the computer unit.

Note

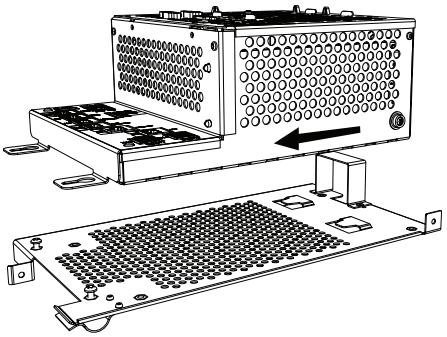
If possible, do a backup of the system before removing the computer unit. For information on how to do a backup see *Operating manual - IRC5 with FlexPendant*.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Open the door in the front and disconnect all connectors from the computer unit.	
4	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
5	Disconnect all connectors from the computer unit.	
6	Remove the attachment screws for the axis computer.	 xx1500000234 A Axis computer attachment screws

Continues on next page

	Action	Note/illustration
7	Pull the axis computer slightly to release the latches on the axis computer from the recesses on the assembly plate. Push the axis computer slightly away from the assembly plate.	 xx1500000235 A Latches B Recesses
8	Remove the three attachment screws on the assembly plate.	 xx1400001388 A attachment screws
9	Slide the assembly plate with computer unit out of the controller cabinet. Lift the computer unit slightly to get the wrist band button on the bottom over the edge of the cabinet.	 xx1400001447

Continues on next page

	Action	Note/illustration
10	Loosen the attachment screws, and pull the computer unit in the direction of the arrow. The computer unit is suspended by latches and attachment screws.	 xx1400001448 **WARNING** Prevent the computer unit from falling down due to gravity by supporting the computer unit from beneath by hand.

Refitting

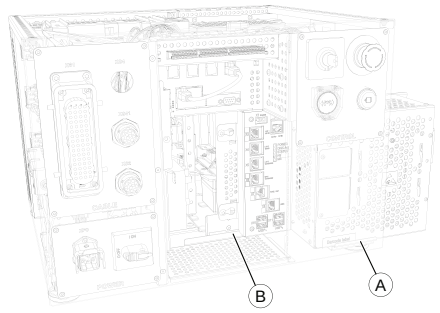
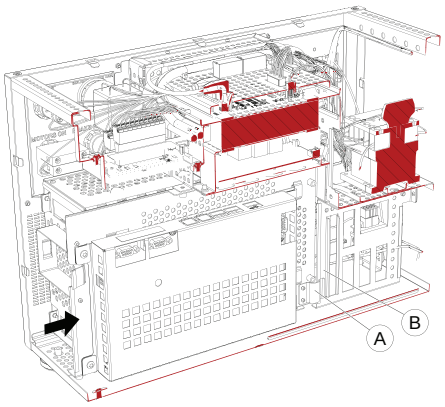
The procedure below describes how to refit the computer unit.

Note

After replacing the main computer, the RobotWare system can be reset. It is then necessary to restore a backup. For information on how to restore a backup see *Operating manual - IRC5 with FlexPendant*.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Fit the computer unit in position on the assembly plate.	
4	Tighten the attachment screws.	

Continues on next page

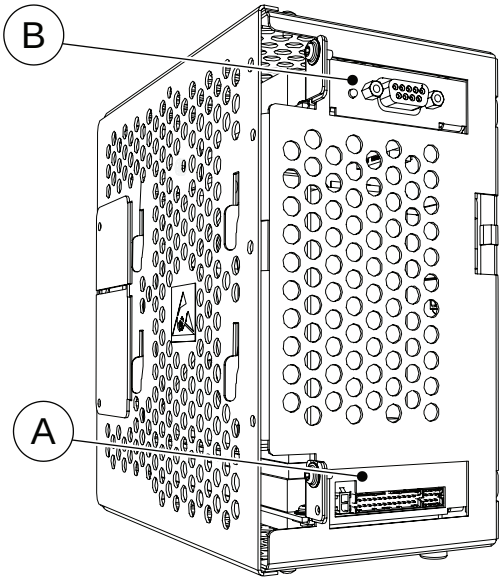
	Action	Note/illustration
5	Slide the assembly plate with the computer unit into the cabinet. The computer unit should rest on guide structure 1. Guide structure 2 should fit between the assembly plate and the computer unit.	 xx1500000236 A Guide structure 1 B Guide structure 2
6	Make sure the computer unit spring is clipped on to the structure wall inside the cabinet.	 xx1500000233 A Computer unit spring B Structure wall
7	Tighten the assembly plate attachment screws.	
8	Fit the axis computer unit so that its latches fit into the recesses of the assembly plate.	
9	Tighten the axis computer unit attachment screws.	
10	Reconnect all connectors to the computer unit.	
11	Refit the cabinet cover.	
12	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.6 Replacement of PCIexpress boards in the computer unit

Location

The following PCIexpress boards may be fitted in the slots in the computer unit as shown in the figure below:

- DeviceNet Master/Slave
- PROFIBUS-DP Master
- Safety module (second generation SafeMove safety controller)



xx1500001760

A	Safety module DSQC1015
B	PCIexpress slot for other devices.

Required equipment

Equipment	Art. no.	Note
Profibus-DP Master	3HAC044872-001	DSQC1005 Profibus communication is described in *Application manual - PROFIBUS Controller*.
DeviceNet Master/Slave	3HAC043383-001	DSQC1006 DeviceNet communication is described in *Application manual - DeviceNet Master/Slave*.
Safety module	3HAC048858-001	DSQC1015 SafeMove (2nd generation) is described in *Application manual - Functional safety and SafeMove2*.
Standard toolkit		The contents are described in section *Standard toolkit, IRC5 on page 219*.

Continues on next page

4.6 Replacement of PCIexpress boards in the computer unit

Continued

Equipment	Art. no.	Note
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to tools required.

References

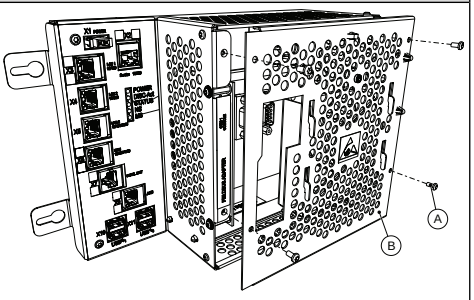
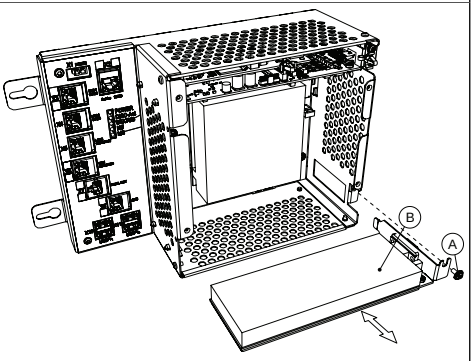
Equipment	Art. no.	Note
Application manual - PROFIBUS Controller	*3HAC050966-001*	Contains information on how to configure the system for PROFIBUS devices.
Application manual - DeviceNet Master/Slave	*3HAC050992-001*	Contains information on how to configure the system for DeviceNet devices.
Circuit diagram	See *Circuit diagrams on page 235*.	

Removal

The procedure below details how to remove a PCIexpress board.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Disconnect any cables to/from the PCIexpress board.	**Tip** Make a note of which cables are disconnected.

Continues on next page

	Action	Note/Illustration
6	Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector. **CAUTION** Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Upper cover
7	Remove the attachment screw on top of the PCIexpress board bracket.	 xx1300000685 A Attachment screw B PCIexpress board
8	Gently pull the board straight out.	**CAUTION** Always grip the board around the edges to avoid damage to the board or its components. **CAUTION** Immediately put the board in an ESD safe bag or similar.

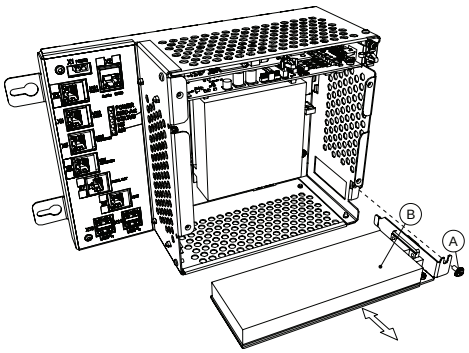
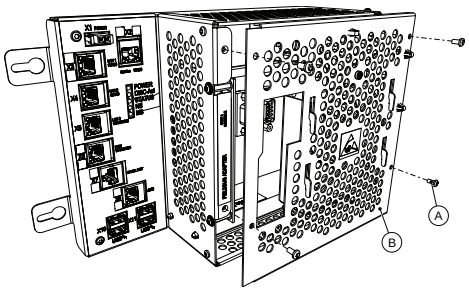
Refitting

The procedure below details how to refit a PCIexpress board.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

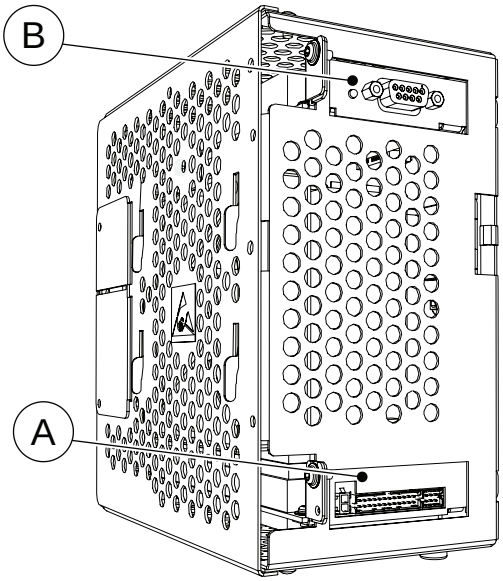
4.6 Replacement of PCIexpress boards in the computer unit
Continued

	Action	Note/Illustration
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Fit the PCIexpress board in position by pushing the PCIexpress board into the socket on the motherboard.	 xx1300000685 A Attachment screw B PCIexpress board **CAUTION** Always grip the board around the edges to avoid damage to the board or its components.
4	Refit the attachment screw on top of the PCIexpress board bracket.	
5	Reconnect any additional cables to the PCIexpress board.	
6	Refit the fan connector and close the computer unit. **CAUTION** Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.	 xx1300000684 A Attachment screws (4 pcs.) B Upper cover
7	Refit the computer unit.	See *Replacement of computer unit on page 146*.
8	Refit the controller cover.	
9	Make sure the robot system is configured to support the installed PCIexpress board.	
10	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.7 Replacement of Safety module DSQC1015 for SafeMove

Location

The Safety module DSQC1015 is a PCIexpress board that is located inside the IRC5 main computer unit.



xx1500001760

A	Safety module DSQC1015
B	PCIexpress slot for other devices.

Required equipment

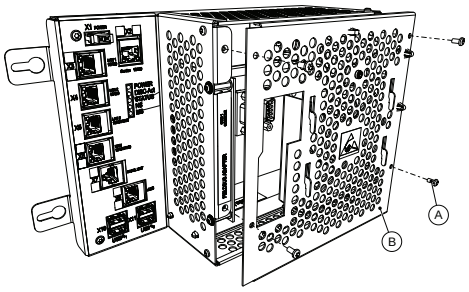
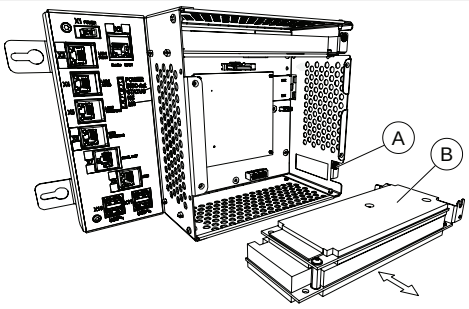
Equipment	Note
DSQC1015 Safety module	3HAC048858-001
Standard toolkit	The contents are defined in section *Standard toolkit, IRC5 on page 219*.
Circuit diagram	See *Circuit diagrams on page 235*.

Removing the Safety module

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

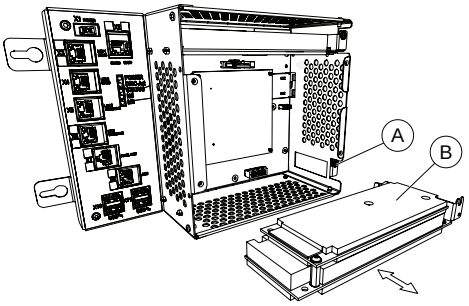
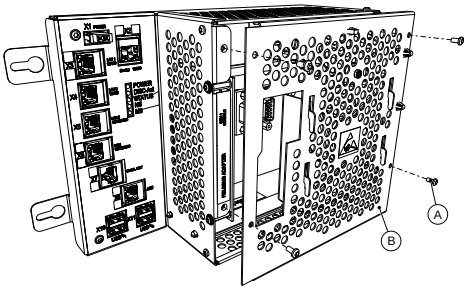
Continues on next page

4.7 Replacement of Safety module DSQC1015 for SafeMove
Continued

	Action	Note/Illustration
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Open the computer unit by removing the attachment screws and lift off the cover. Disconnect the fan connector. **CAUTION** Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Cover
6	Remove the attachment screw on top of the slot bracket.	
7	Remove the Safety module by pulling it out of the socket on the motherboard.	 xx1500001761 A Attachment screw B Safety module **CAUTION** Always grip the board around the edges to avoid damage to the board or its components.

Continues on next page

Refitting the Safety module

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Fit the Safety module in position by pushing it into the socket on the motherboard.	 xx1500001761 A Attachment screw B Safety module **CAUTION** Always grip the board around the edges to avoid damage to the board or its components.
4	Refit the attachment screw on top of the Safety module bracket.	
5	Refit the fan connector and close the computer unit. **CAUTION** Be careful with the fan cable when closing the cover. The fan cable must not be squeezed.	 xx1300000684 A Attachment screws (4 pcs.) B Cover
6	Refit the computer unit.	See *Replacement of computer unit on page 146*.
7	Refit the cover of the cabinet.	

Continues on next page

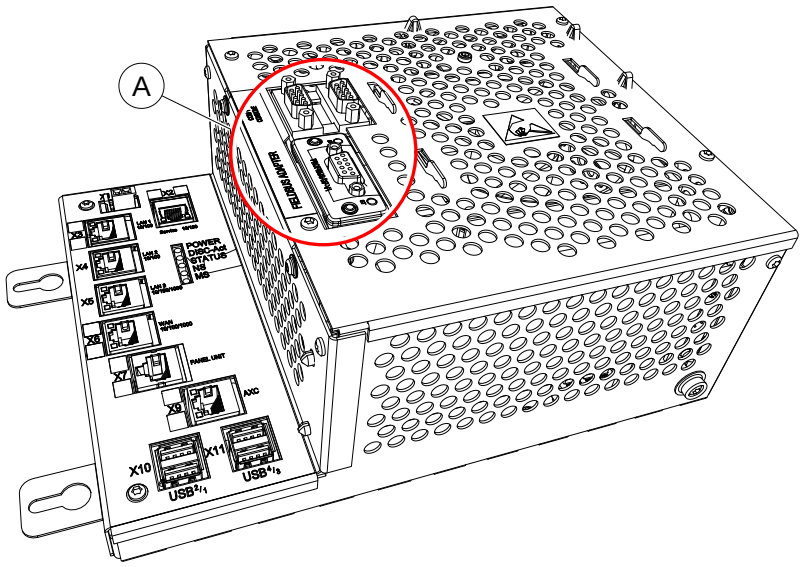
	Action	Note/Illustration
8	Perform the function tests in section *Function tests on page 127* to verify that the basic safety features (e.g. emergency stop) work properly.	
9	Perform a synchronization.	See *Application manual - Functional safety and SafeMove2*.
10	Perform a Cyclic Brake Check.	See *Application manual - Functional safety and SafeMove2*.
11	Lock the SafeMove configuration file.	See *Application manual - Functional safety and SafeMove2*.

4.8 Replacement of expansion board in the computer unit

Location

To connect a serial channel or a fieldbus adapter to the controller, the main computer must be equipped with the expansion board DSQC1003.

The expansion board is located in the computer unit as shown below.



xx1300000860

A	Expansion board with serial channel and one slot for AnybusCC fieldbus adapter.

Required equipment

Equipment	Art. no.	Note
Expansion Board	3HAC046408-001	DSQC1003

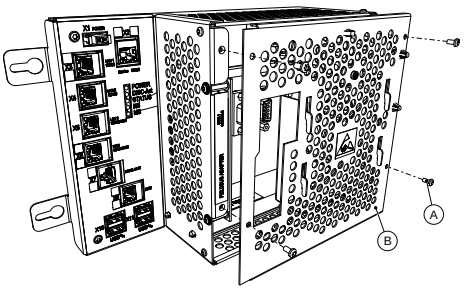
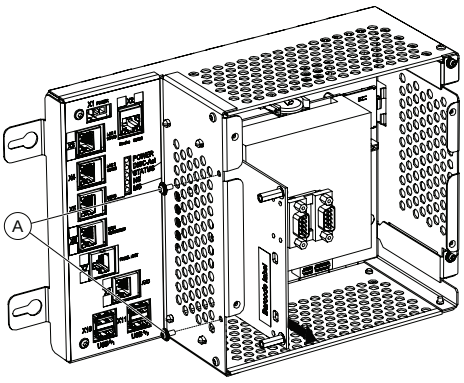
Removal

The following procedure describes how to remove the expansion board from the computer unit.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

4.8 Replacement of expansion board in the computer unit
Continued

	Action	Note/Illustration
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Disconnect any cables to/from the fieldbus adapter.	
6	Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector. **CAUTION** Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Upper cover
7	If there is a fieldbus adapter, remove it.	See *Replacement of fieldbus adapter in the computer unit on page 162*.
8	Remove the attachment screws on the computer unit.	 xx1300000859 A Attachment screws (2 pcs)
9	Grip the expansion board and gently pull it straight out.	**CAUTION** Always grip the expansion board around the edges to avoid damage to the board or its components.

Continues on next page

Refitting

The following procedure describes how to refit the expansion board in the computer unit.

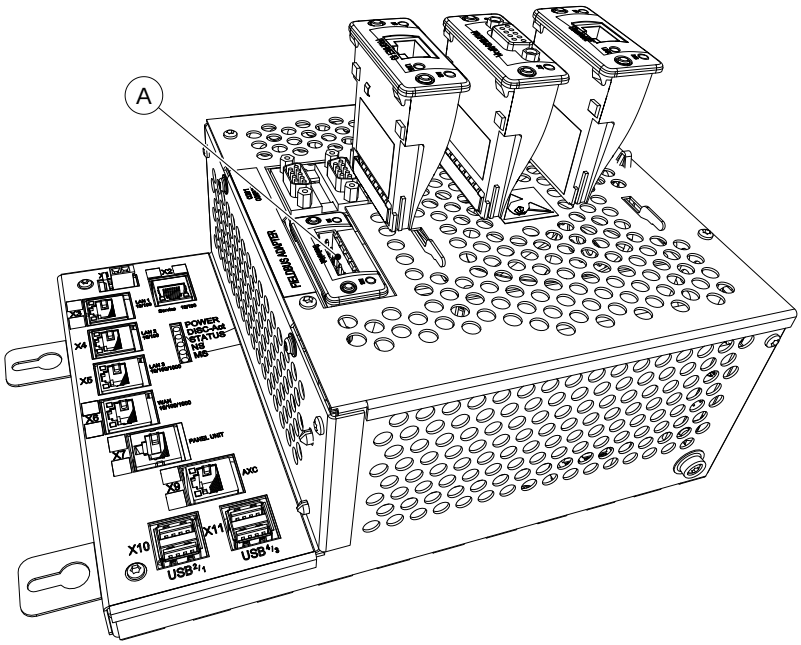
	Action	Note/Illustrator
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Fit the expansion board in position by pushing the expansion board into the connector on the motherboard. **CAUTION** Push carefully so no pins are damaged. Make sure that the expansion board is pushed straight into the connector.	**CAUTION** Always grip the expansion board around the edges to avoid damage to the board or its components.
4	Secure the expansion board in the computer unit with the attachment screws.	
5	Refit the fan connector and close the computer unit. **CAUTION** Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.	
6	Refit the computer unit.	See *Replacement of computer unit on page 146*.
7	Refit the controller cover.	
8	Reconnect any cable to the fieldbus adapter.	
9	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.9 Replacement of fieldbus adapter in the computer unit

Location

One of the following fieldbus adapters may be fitted in the slot in the computer unit as shown in the figure below:

- AnybusCC EtherNet/IP slave
- AnybusCC PROFIBUS slave
- AnybusCC PROFINET slave
- AnybusCC DeviceNet slave



xx1300000604

A	Slot for AnybusCC fieldbus adapters

Required equipment

Equipment	Art. no.	Note
AnybusCC EtherNet/IP slave fieldbus adapter	3HAC027652-001	DSQC 669 Ethernet/IP communication is described in *Application manual - EtherNet/IP Anybus Adapter*
AnybusCC PROFIBUS slave fieldbus adapter	3HAC026840-001	DSQC 667 PROFIBUS communication is described in *Application manual - PROFIBUS Anybus Device*
AnybusCC PROFINET slave fieldbus adapter	3HAC031670-001	DSQC 688 PROFINET communication is described in *Application manual - PROFINET Anybus Device*

Continues on next page

Equipment	Art. no.	Note
AnybusCC DeviceNet slave fieldbus adapter	3HAC045973-001	DSQC1004 DeviceNet communication is described in *Application manual - DeviceNet Anybus Slave*.
Standard toolkit		The contents are described in section *Standard toolkit, IRC5 on page 219*.

References

Equipment	Art. no.	Note
Application manual - EtherNet/IP Anybus Adapter	*3HAC050997-001*	Contains information on how to configure the system for EtherNet/IP Fieldbus Adapter DSQC 669.
Application manual - PROFIBUS Anybus Device	*3HAC050965-001*	Contains information on how to configure the system for PROFIBUS Fieldbus Adapter DSQC 667.
Application manual - PROFINET Anybus Device	*3HAC050968-001*	Contains information on how to configure the system for PROFINET Fieldbus Adapter DSQC 688.
Application manual - DeviceNet Anybus Slave	*3HAC050993-001*	Contains information on how to configure the system for DeviceNet Fieldbus Adapter DSQC1004.
Circuit diagram	See *Circuit diagrams on page 235*.	

Removal

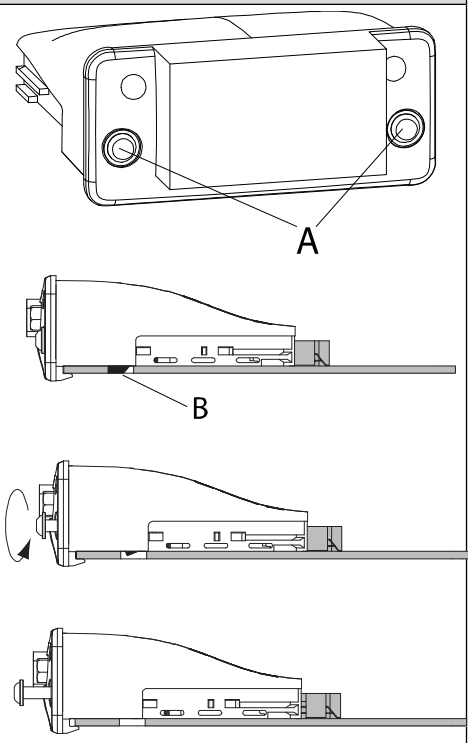
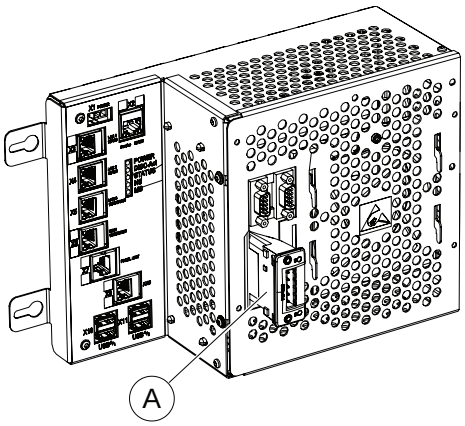
The following procedure details how to remove the fieldbus adapter from the computer unit.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Disconnect any cables to/from the fieldbus adapter.	

Continues on next page

4.9 Replacement of fieldbus adapter in the computer unit

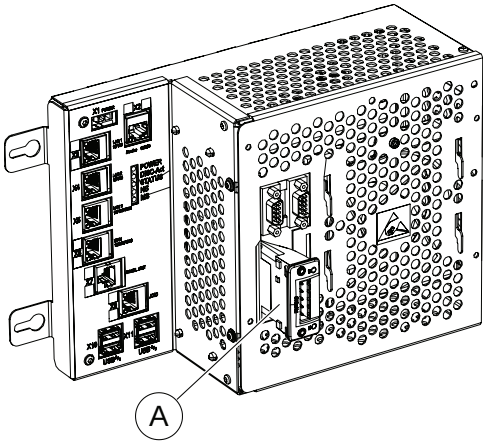
Continued

	Action	Note/Illustration
6	Loosen the attachment screws (2 pcs) on front of the fieldbus adapter to release the fastening mechanism. **Note** Only loosen the attachment screws. Do not remove them.	 xx0700000193 A Attachment screws (2 pcs) B Fastening mechanism
7	Grip the loosened attachment screws and gently pull the fieldbus adapter straight out.	 xx1500001755 A Fieldbus adapter

Continues on next page

Refitting

The following procedure details how to refit the fieldbus adapter in the computer unit.

	Action	Note/Illustrator
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Fit the fieldbus adapter in position by pushing the fieldbus adapter along the rails on the motherboard. **CAUTION** Push carefully so no pins are damaged. Make sure that the adapter is pushed straight onto the rails.	 xx1500001755 A Fieldbus adapter **CAUTION** Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.

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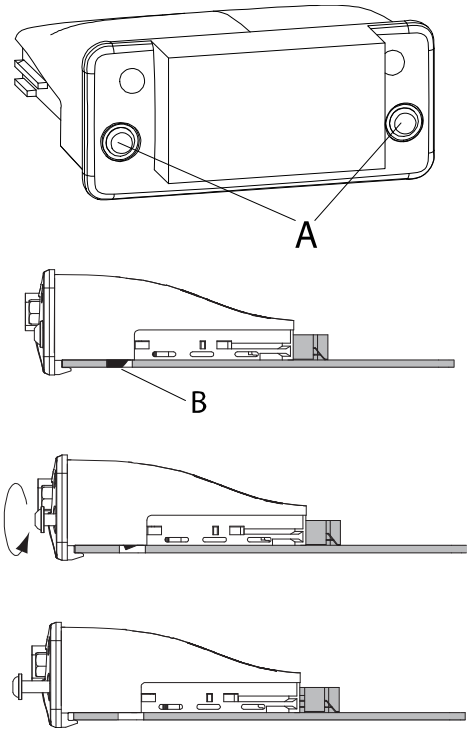
4.9 Replacement of fieldbus adapter in the computer unit

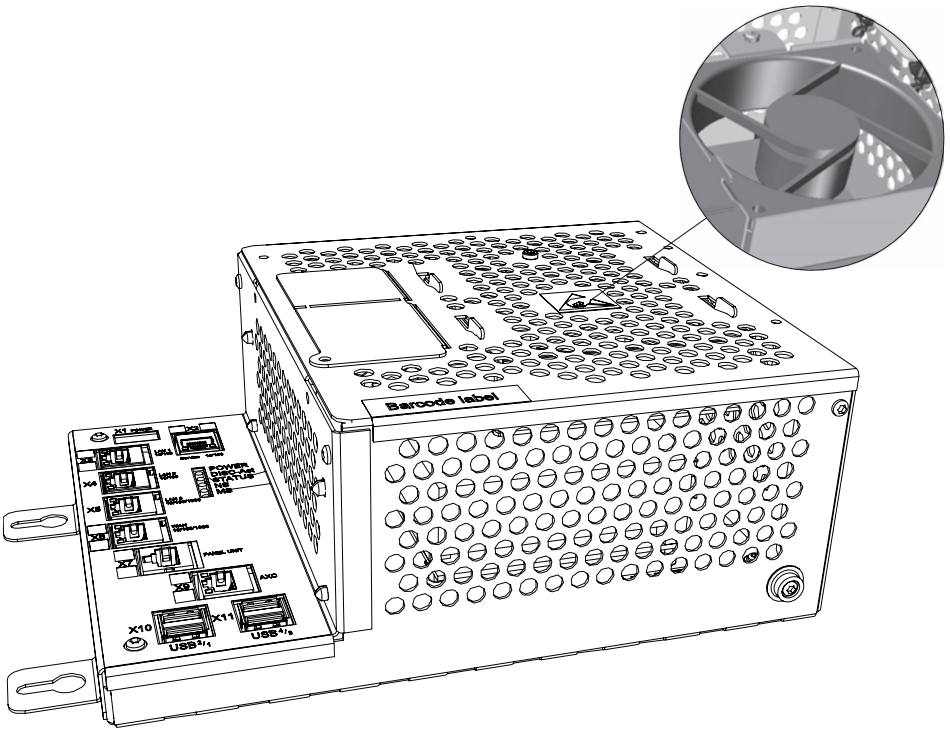
Continued

	Action	Note/Illustrator
4	Secure the fieldbus adapter with its attachment screws (2 pcs).	 xx0700000193 A Attachment screws (2 pcs) B Fastening mechanism
5	Refit the computer unit.	See *Replacement of computer unit on page 146*.
6	Refit the controller cover.	
7	Reconnect the cable to the fieldbus adapter.	
8	Make sure the robot system is configured to reflect the fieldbus adapter installed.	
9	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.10 Replacement of fan in computer unit

Location

The computer fan is located under the upper cover as shown in the figure below.



xx1300000687

Required equipment

Equipment	Note
Fan	See *Spare parts on page 223*.
Cable straps	
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See *Circuit diagrams on page 235*.

Removal

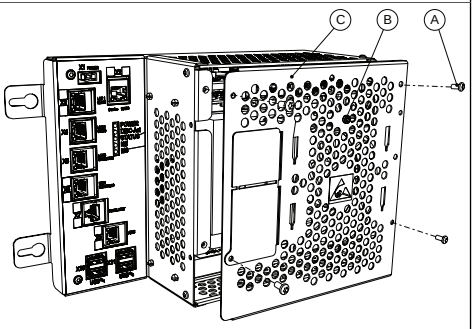
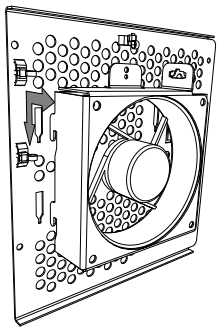
The procedure below details how to remove the fan in the computer unit.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

4.10 Replacement of fan in computer unit

Continued

	Action	Note/Illustration
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Removing the controller cover on page 97*.
4	Remove the computer unit.	See *Replacement of computer unit on page 146*.
5	Open the computer unit by removing the upper cover attachment screws and lift off the upper cover.	 xx1300000688 A Upper cover attachment screws (4 pcs.) B Fan attachment screw C Upper cover
6	Disconnect the fan connector and remove the cable straps.	**CAUTION** Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.
7	Remove the fan attachment screw.	
8	Remove the fan from the upper cover.	 xx1300000806

Continues on next page

Refitting

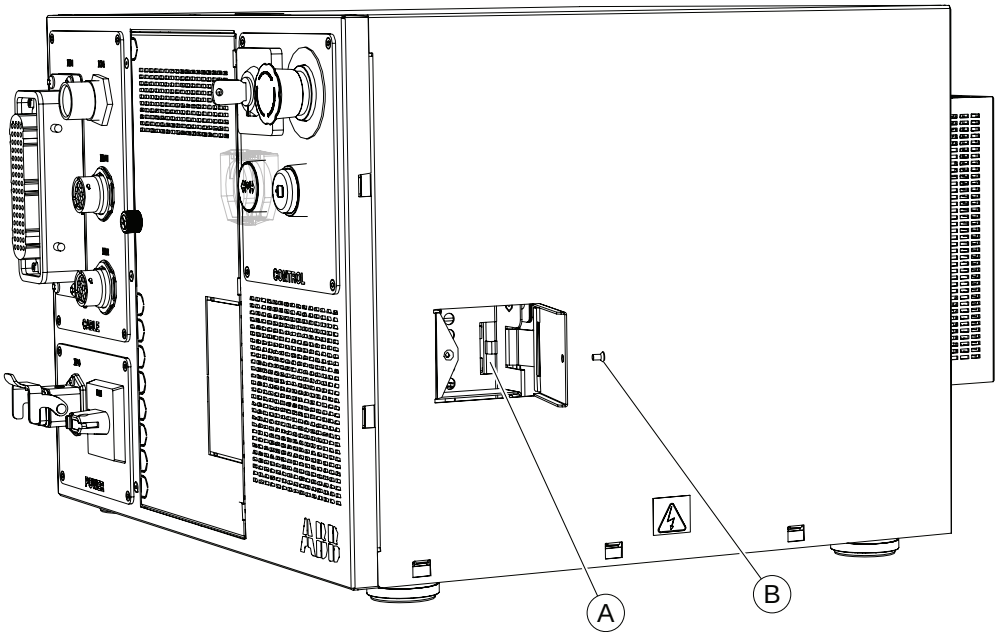
The procedure below details how to refit the fan in the computer unit.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Refit the fan on the upper cover.	
4	Refit the attachment screw.	
5	Strap the fan cable to the upper cover.	**CAUTION** When strapping the cable make sure that the cable is not stretched or squeezed, and that the cable does not get caught in the fan.
6	Refit the computer unit.	See *Replacement of computer unit on page 146*.
7	Refit the controller cover.	
8	Refit the fan connector and close the computer unit.	**CAUTION** Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.
9	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.11 Replacement of SD-card memory in computer unit

Location

The location and orientation of the SD-card memory is shown by the following illustration.



xx1400001374

A	Slot for SD-card memory
B	Attachment screw

Note

Only use SD-card memory supplied by ABB.

Note

The SD-card from the computer unit DSQC1018 cannot be used in the computer unit DSQC1024/DSQC1094. Use the backup and restore function to move data from DSQC1018 to DSQC1024/DSQC1094.

CAUTION

Reformatting the SD-card or modifying the disk partition can cause irreparable boot-up problems.

Continues on next page

Required equipment

Equipment	Note
SD-card 2GB	See *Spare parts on page 223*. **Note** Only use SD-card memory supplied by ABB. Includes *ABB Boot Application* software to correctly reboot the robot controller.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.

Removal

Use the following procedure to remove the SD-card memory.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.
3	Remove the attachment screw and open the hatch on the right hand side of the controller.
4	Gently push the SD-card memory with your finger until it clicks, and then pull it straight out.

Refitting

Use the following procedure to refit the SD-card memory.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.

Continues on next page

4.11 Replacement of SD-card memory in computer unit

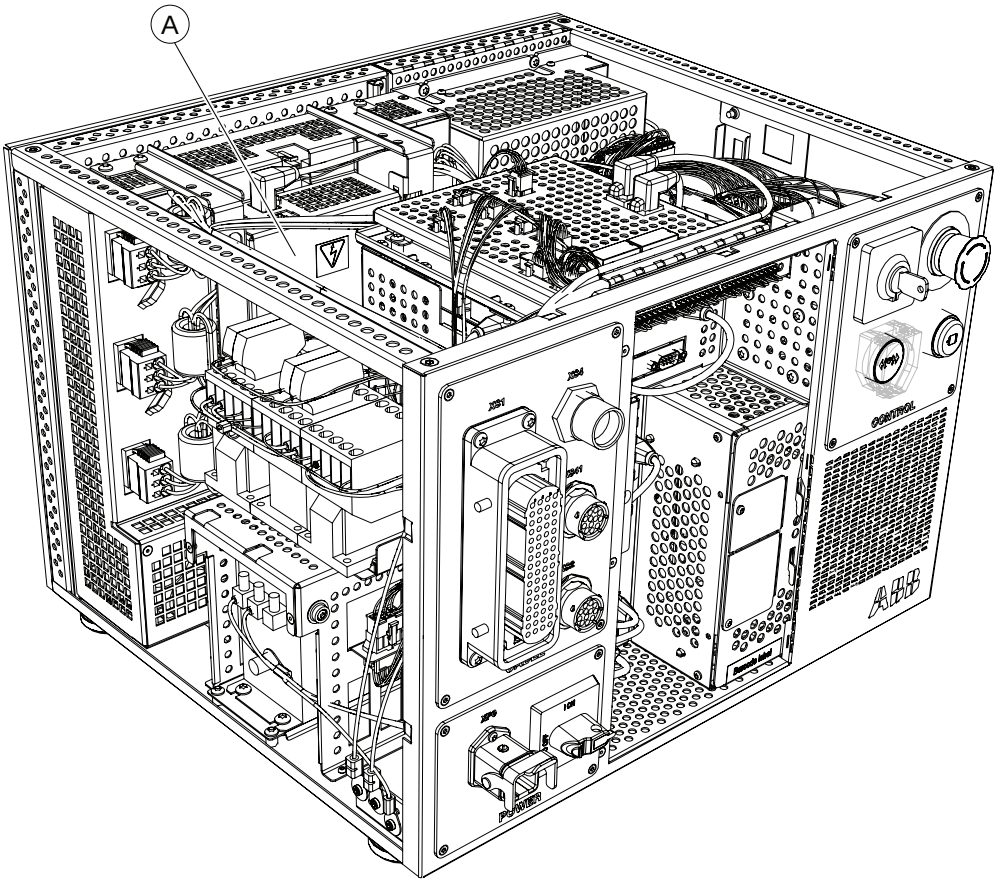
Continued

	Action
3	**CAUTION** Make sure that the SD-card memory is correctly oriented before inserting it. Otherwise the SD-card memory or the SD-card memory slot may be damaged.
4	Gently push the SD-card memory with your finger until it clicks into place.
5	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.12 Replacement of drive unit

Location

The following illustration shows the location of the Main Drive Unit.



xx1400001449

A	Main Drive Unit

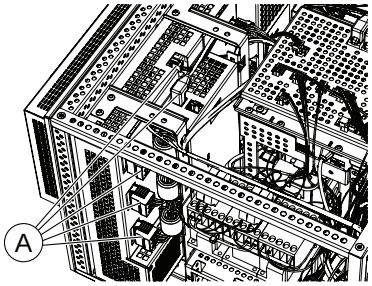
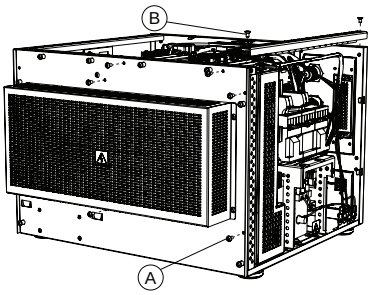
Required equipment

Equipment	Note
Main Drive Unit	See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

Continues on next page

Removal

Use the following procedure to remove the Main Drive Unit.

	Action	Information
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
3	Disconnect the connectors on the top and on the left on the Main Drive Unit.	 xx1400002850 A Connectors on the Main Drive Unit
4	Remove the six attachment screws in the back of the controller.	 xx1400001619 A Attachment screws for Main Drive Unit B Attachment screws for support bar
5	Remove the support bar by removing the two attachment screws.	

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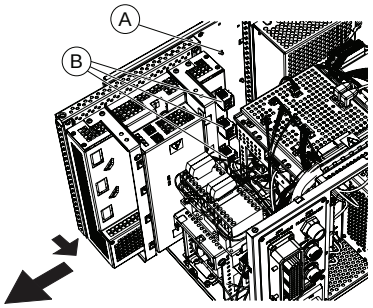
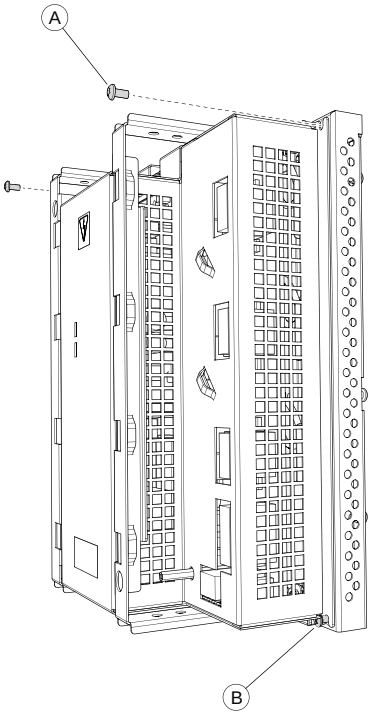
	Action	Information
6	Push the Main Drive Unit out from the back of the controller to get free from the screws in the back plane. Then slide the Main Drive Module half way out.	 xx1400002851 **A** Screws sticking out of the back plane of the controller **B** Connectors on the Main Drive Unit
7	Disconnect the connectors from the right side of the Main Drive Unit.	
8	Remove the Main Drive Unit from the controller.	
9	Loosen the two lower attachment screws, and remove the two upper screws, to remove the drive unit from mounting frame.	 xx1400001450 **A** Upper attachment (2 pcs.) **B** Lower attachment (2 pcs.)

Continues on next page

Refitting

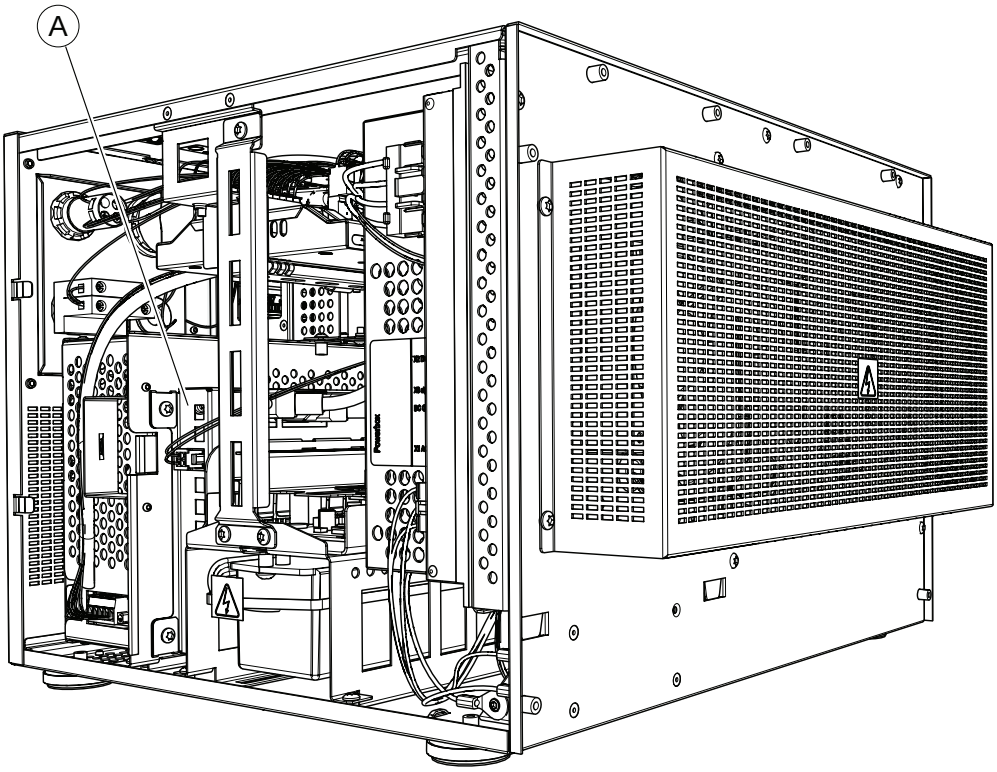
Use the following procedure to refit the Main Drive Unit.

	Action
1	 **DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	Fit the unit in its intended position and orientation on the mounting frame. Secure it with its attachment screws.
3	Slide the Main Drive Unit half way into the controller.
4	Reconnect the connectors on the right side of the Main Drive Unit.
5	Refit the Main Drive Unit in the controller and secure it with its attachment screws.
6	Refit support bar with its attachment screws.
7	Reconnect the connectors on the top and left on the Main Drive Unit.
8	Refit the cabinet cover.
9	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.13 Replacement of axis computer

Location

The location of the axis computer is shown by the following illustration.



xx1400001451

A	Axis computer unit

Required equipment

Equipment	Information
Axis computer	DSQC 668 See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

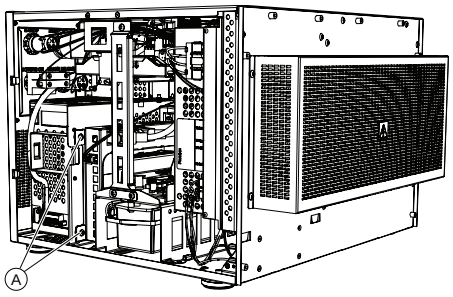
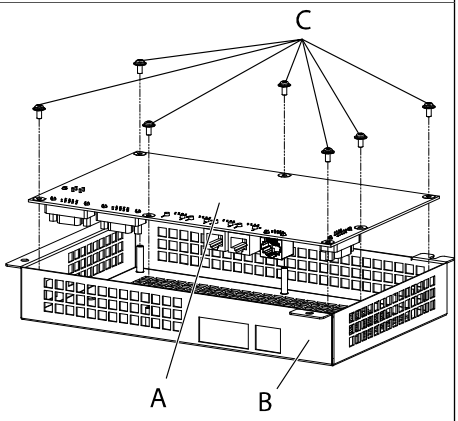
Continues on next page

4.13 Replacement of axis computer

Continued

Removal

Use the following procedure to remove the axis computer.

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
4	Disconnect all connectors from the axis computer unit.	**Note** Make a note of any connections.
5	Remove the attachment screws.	 xx1500000234 A Attachment screws
6	Slide the axis computer unit out of the controller.	
7	Remove the seven attachment screws and gently lift the axis computer board straight up.	 xx1000000953 A Axis computer board B Axis computer cover C Attachment screws

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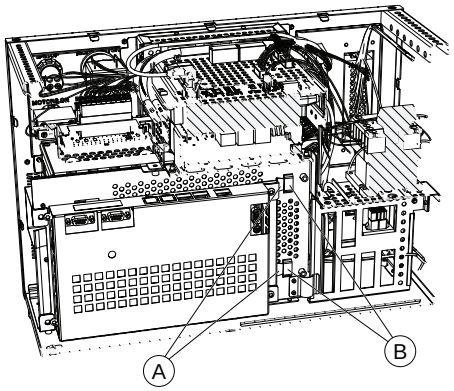
Refitting

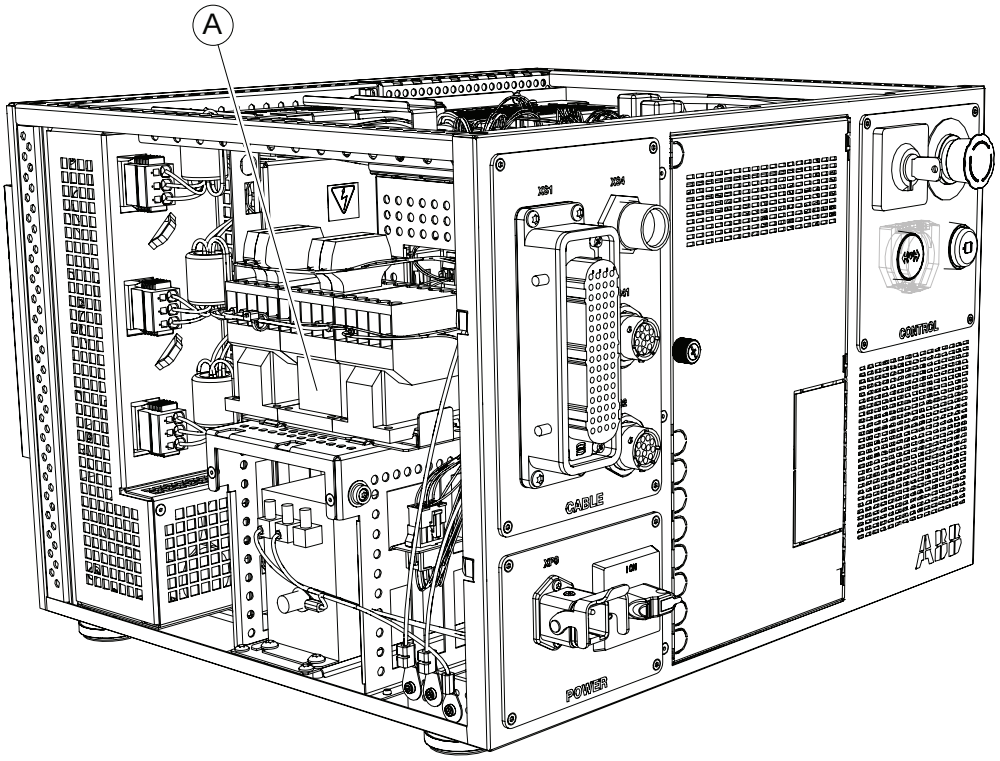
Use this procedure to refit the axis computer.

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	Gently fit the axis computer board into the cover and refit the attachment screws.	
4	Slide the axis computer unit into the controller, ensuring that the latches fit into the recesses.	 xx1500000235 A Latches B Recesses
5	Tighten the axis computer unit attachment screws.	
6	Reconnect all the connectors.	
7	Refit the cabinet cover.	
8	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.14 Replacement of contactor unit

Location

The following illustration shows the location of the contactor unit in IRC5 Compact.



xx1400002008

A	Contactor unit

Required equipment

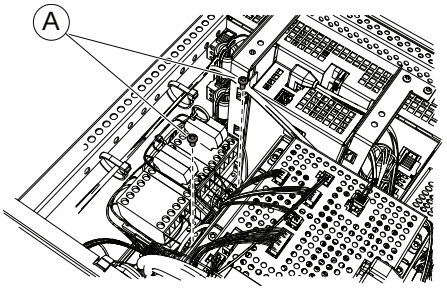
Equipment	Note
Contactor unit	Contactor ASL16-30-10 DC24V See *Miscellaneous parts on page 227*.
Circuit diagram	See *Circuit diagrams on page 235*.

Removal

The following procedure describes how to remove the backup energy bank.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.

Continues on next page

	Action	Note/illustration
3	Disconnect all wires from the contactor unit.	Make a note of all connections.
4	Remove the two attachment screws.	 xx1400002030
5	Remove contactor unit, and replace each defective component.	

Refitting

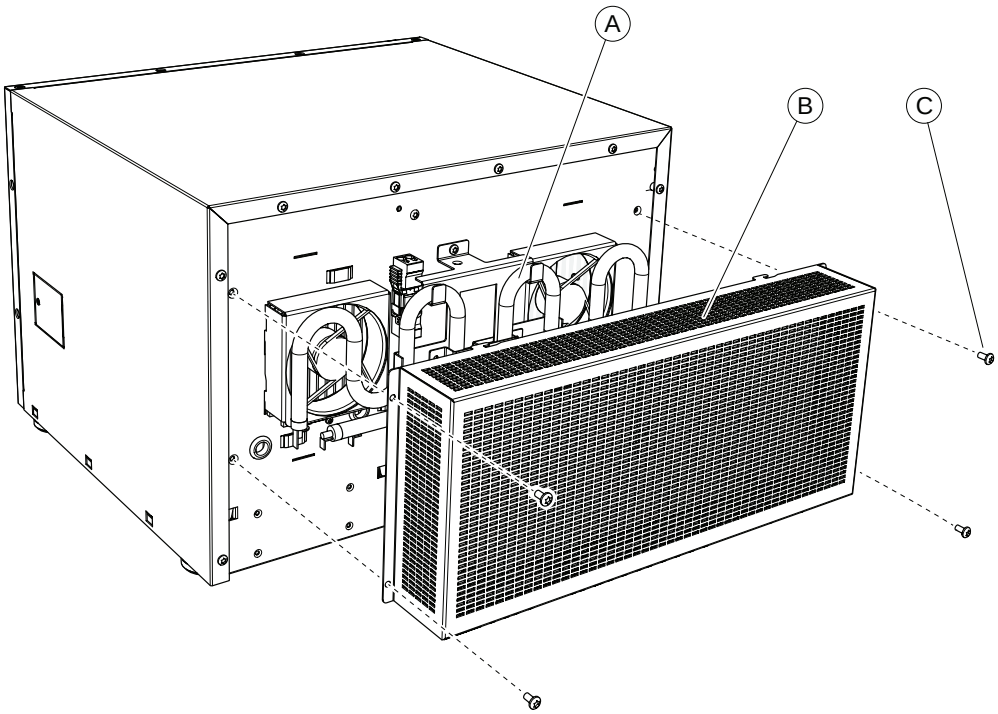
The procedure below details how to refit the backup energy bank.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	Refit the contactor unit.
3	Refit the attachment screws, and tighten them.
4	Reconnect all wires.
5	Refit the cabinet cover.
6	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.15 Replacement of brake resistor bleeder

Location

The following illustration shows the location of the brake resistor bleeder.



xx1400001457

A	Bleeder
B	Fan cover
C	Attachment screws

Required equipment

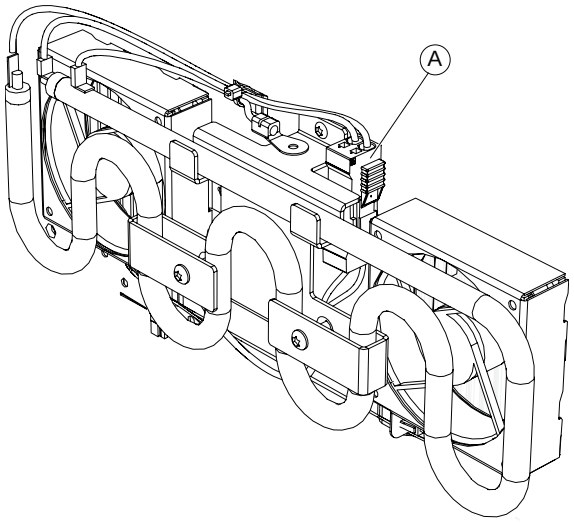
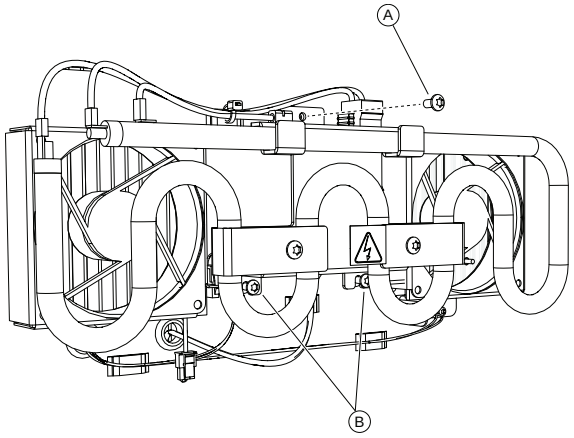
Equipment	Note
Brake resistor bleeder	See *Miscellaneous parts on page 227*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.

Removal

Use the following procedure to remove the line filter.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

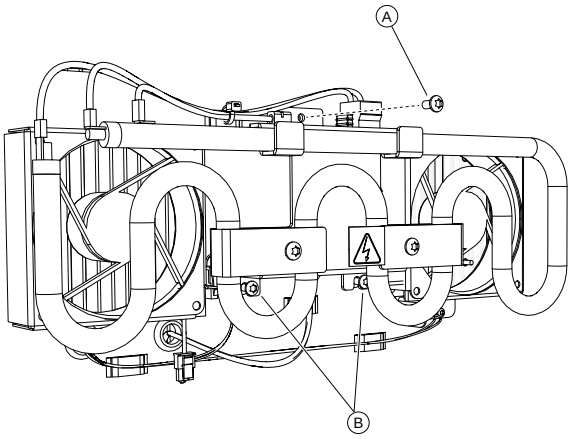
	Action	Note/illustration
2	**CAUTION** Hot surface on top of the bleeder. Risk of burns. Be careful when removing the unit.	
3	Remove the fan cover.	
4	Disconnect the bleeder connector.	 xx1500000119 A Bleeder connector
5	Loosen the two lower attachment screws on the bleeder bracket.	 xx1400001458 A Upper attachment screw B Lower attachment screws
6	Remove the upper attachment screw.	
7	Pull the brake resistor bleeder upwards and then outwards, to release it from the lower screw heads, and remove it.	

Continues on next page

4.15 Replacement of brake resistor bleeder
Continued

Refitting

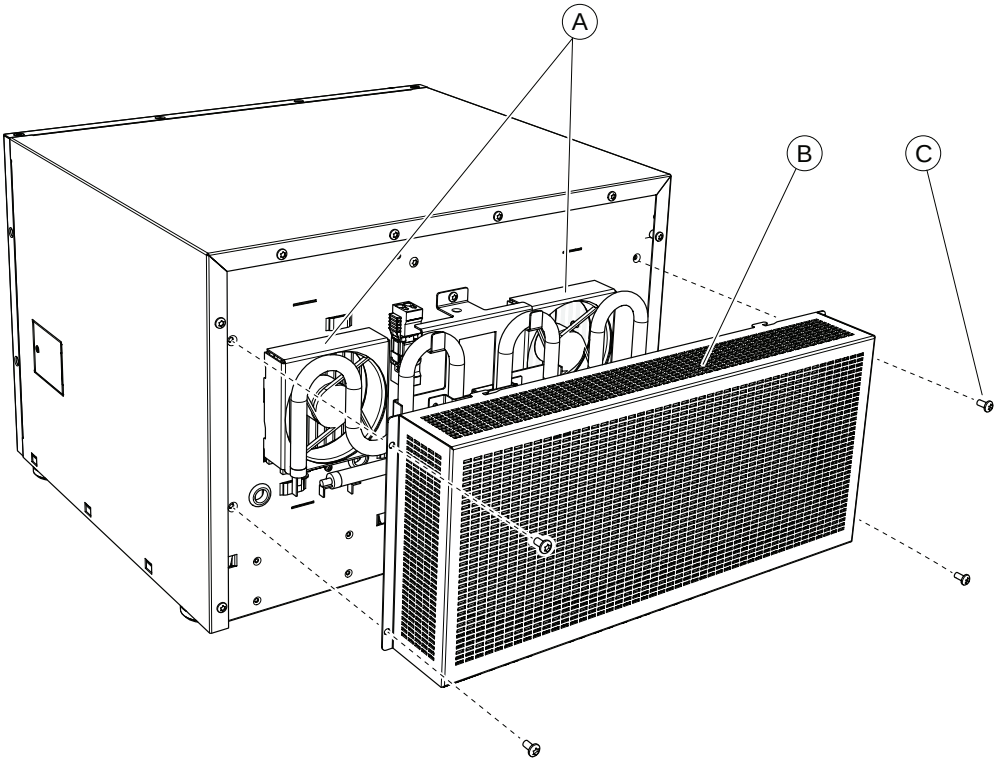
Use the following procedure to refit the line filter.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Refit the brake resistor bleeder by sliding the recesses in beneath the lower attachment screw heads, and push it inwards and then downwards.	 xx1400001458 A Upper attachment screw B Lower attachment screws
3	Refit the upper attachment screw.	
4	Tighten all the attachment screws for the bleeder.	
5	Reconnect the bleeder connector.	
6	Refit the fan cover, push it left towards the grooves.	
7	Refit the attachment screws for the fan cover, and tighten them.	
8	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.16 Replacement of system fans

Location

The following illustration shows the location of the system fans.



xx1400001454

A	System fan
B	Fan cover
C	Attachment screws

Required equipment

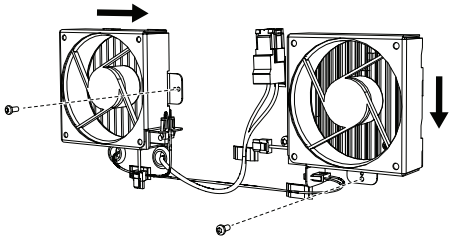
Equipment	Note
Fan with receptacle	See *Miscellaneous parts on page 227*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.

Removal

Use this procedure to remove one of the system fans.

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

	Action	Info/illustration
2	**CAUTION** Hot surface on top of the bleeder. Risk of burns. Be careful when removing the unit.	
3	Remove four attachment screws on the fan cover.	
4	Push the fan cover to the left and remove it.	
5	Remove brake resistor bleeder.	See *Replacement of brake resistor bleeder on page 182*.
6	Disconnect the connectors to the fan.	
7	Loosen the attachment screw on the fan receptacle.	 xx1400001456
8	Push the fan according to illustration, to release and remove it.	

Refitting

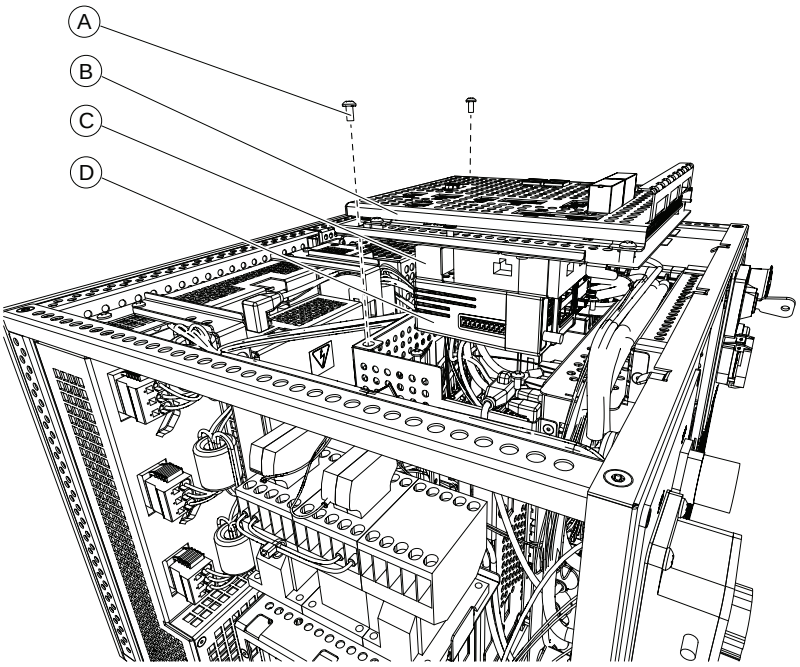
Use this procedure to refit one of the system fans.

	Action	Info/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Put the fan in place and push it upwards.	
3	Fasten the attachment screw on the fan receptacle.	
4	Connect the connectors to the fan.	
5	Refit and connect the brake resistor bleeder.	See *Replacement of brake resistor bleeder on page 182*.
6	Put the fan cover in place and push it to the right.	
7	Fasten the four attachment screws on the fan cover.	
8	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.17 Replacement of Connected Services box

Location

The following illustration shows the location of the Connected Services box.



xx1500000230

A	Attachment screws
B	Safety board
C	Ethernet switch
D	Connected Services box

Note

The Connected Services box DSQC 680 is deprecated as of August 2019. The new box is available in the following variants:

- 3G connection (DSQC1016)
- WiFi connection (DSQC1023)

Required equipment

Note

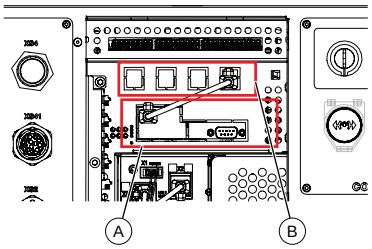
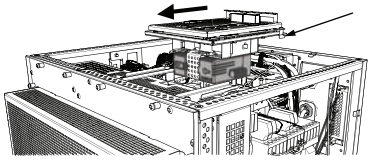
The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRC5C Compact via myABB Business Portal, *www.abb.com/myABB*.

Continues on next page

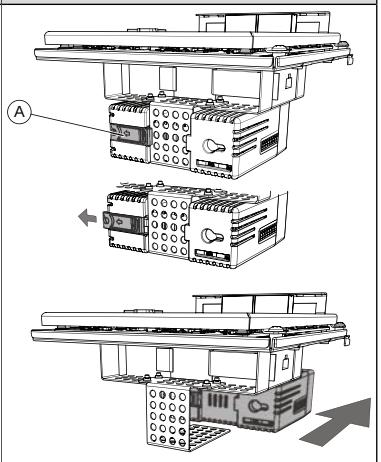
Equipment	Information
Connected Services box	DSQC 680 or DSQC1016/1023 See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See *Circuit diagrams on page 235*.

Removing DSQC 680

Use this procedure to remove the Connected Services box, version DSQC 680.

	Action	Information
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	On the cabinet front, disconnect the connectors from the Connected Services contacts. If you have an Ethernet switch, disconnect the connectors from this as well.	 xx1400002787 A Connected Services contacts B Ethernet switch contacts
4	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
5	Disconnect all connectors from the safety board, Connected Services box, and Ethernet switch.	
6	Remove the two attachment screws, and push the safety board unit backwards to release the latches.	 xx1400001462

Continues on next page

	Action	Information
7	Pull the latch (A) to the left, and push the Connected Services box out.	 xx1400001460

Refitting DSQC 680

Use this procedure to refit the Connected Services box, version DSQC 680.

Note

For controllers produced before August 2019 with DSQC 680 to be replaced by DSQC1016/1023, contact your local ABB for assistance.

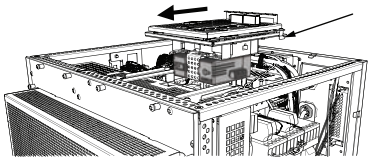
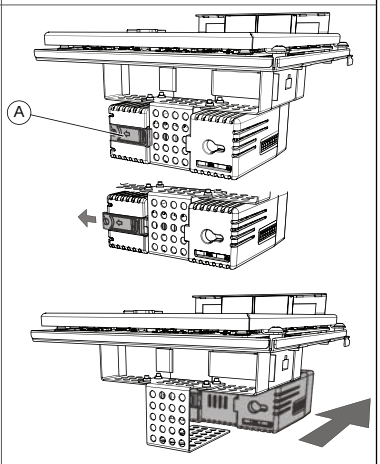
For controllers produced after August 2019, use the following procedure.

	Action
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.
3	Pull the latch to the left and push the Connected Services box in position on the mounting bracket.
4	Refit the safety board unit and secure it with attachment screws.
5	Reconnect all connectors to the Connected Services box, Ethernet switch and safety board.
6	Refit the cabinet cover.
7	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

Continues on next page

Removing DSQC1016/1023

Use this procedure to remove the Connected Services box, version DSQC1016/1023.

	Action	Information
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	Remove the top and front covers.	See *Opening the IRC5 Compact controller on page 97*.
4	Disconnect the antenna.	
5	Remove the cable and connectors connected to: • Safety board • Ethernet switch (if installed) • Connected Services Box	
6	Remove the two attachment screws, and push the safety board unit backwards to release the latches.	 xx1400001462
7	Pull the latch (A) to the left, and push the Connected Services box out.	 xx1400001460
8	If installed, remove the Ethernet switch.	
9	Remove the safety board from the assembly.	
10	Remove the connector in the Connected Services box.	

Continues on next page

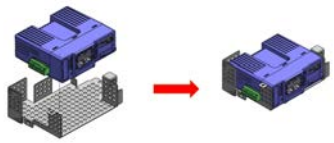
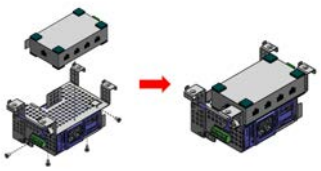
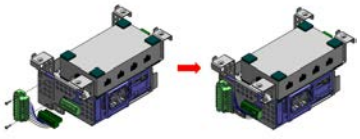
Refitting DSQC1016/1023

Use this procedure to refit the Connected Services box, version DSQC1016/1023.

Note

For controllers produced before August 2019 with DSQC 680 to be replaced by DSQC1016/1023, contact your local ABB for assistance.

For controllers produced after August 2019, use the following procedure.

	Action	Information
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 53*.	
3	For 3G variant (DSQC1016), insert the sim card in the Connected Services box.	
4	Place the Connected Services box in the bracket.	 xx1800003183
5	If an Ethernet switch is used, place the Ethernet switch on top of the Connected Services box and secure the screws.	 xx1800003184
6	Assemble the adapter cable.	 xx1800003185

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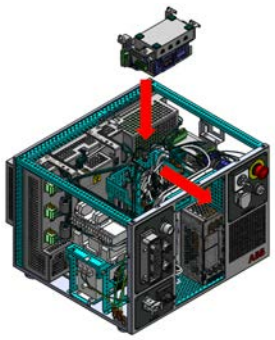
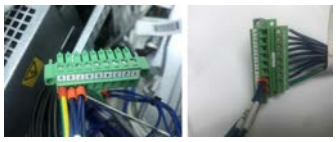
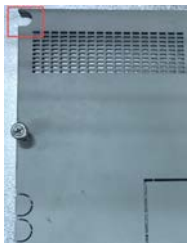
4.17 Replacement of Connected Services box

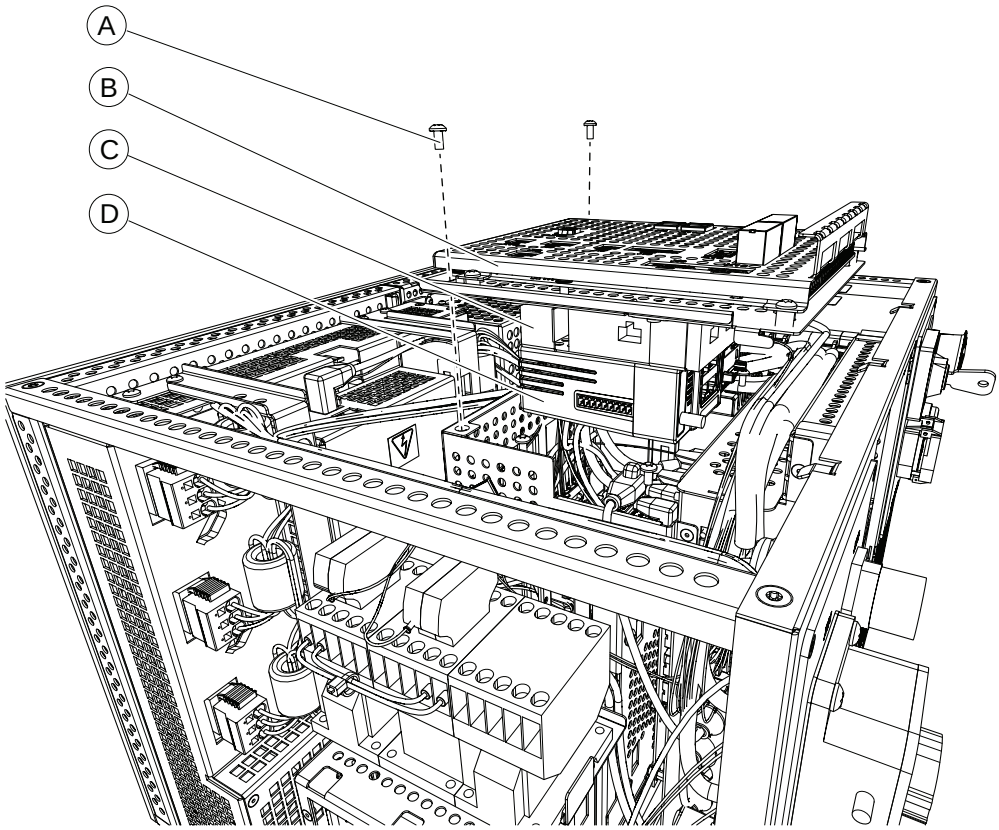
Continued

	Action	Information
7	Pull the latch to the left and push the Connected Services box in position on the mounting bracket.	 xx1800003186
8	Connect the cable 3HAC068451-002 to the cable 3HAC068464-002 using the 9-pin connector. Tighten the screws on both sides. Pin 9 is connected to PE.	 xx1800003651
9	Connect the other side of PE to ground.	 xx1800003377
10	Refit the safety board unit and secure it with attachment screws.	
11	Reconnect all connectors to the Connected Services box, Ethernet switch, and safety board.	 xx1900000462
12	Connect the antenna to the Connected Services box.	
13	If needed, remove the sheet metal in the door's upper left corner.	 xx1800003372
14	Refit the cabinet covers.	
15	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.18 Replacement of Ethernet switch

Location

The following illustration shows the location of the Ethernet switch.



xx1500000230

A	Attachment screws
B	Safety board
C	Ethernet switch
D	Connected Services box

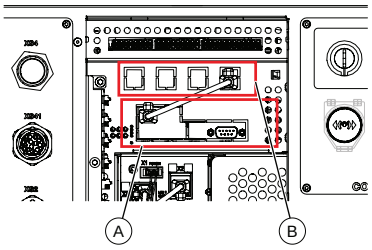
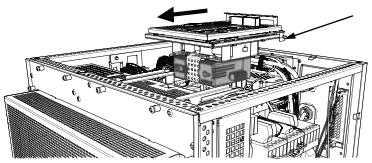
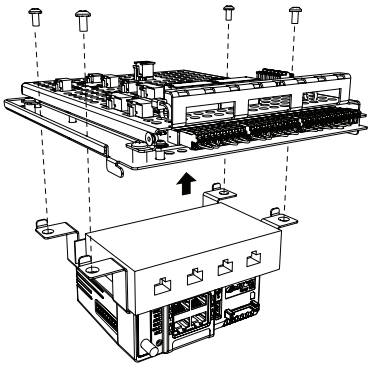
Required equipment

Equipment	Information
Ethernet switch	3HAC034884-001
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See *Circuit diagrams on page 235*.

Continues on next page

Removal

Use this procedure to remove the Ethernet switch.

	Action	Information
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.	
3	On the cabinet front, disconnect the connectors from the Ethernet switch contacts. If a Connected Services box is installed, disconnect the connectors from this as well.	 xx1400002787 A Connected Services contacts B Ethernet switch contacts
4	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
5	Disconnect all connectors from the safety board, Ethernet switch, and Connected Services box.	
6	Remove the two attachment screws, and push the safety board unit backwards to release the latches.	 xx1400001462
7	Remove the attachment screws, and lift off the safety board.	 xx1500000231
8	Remove the Ethernet switch.	

Continues on next page

Refitting

Use this procedure to refit the Ethernet switch.

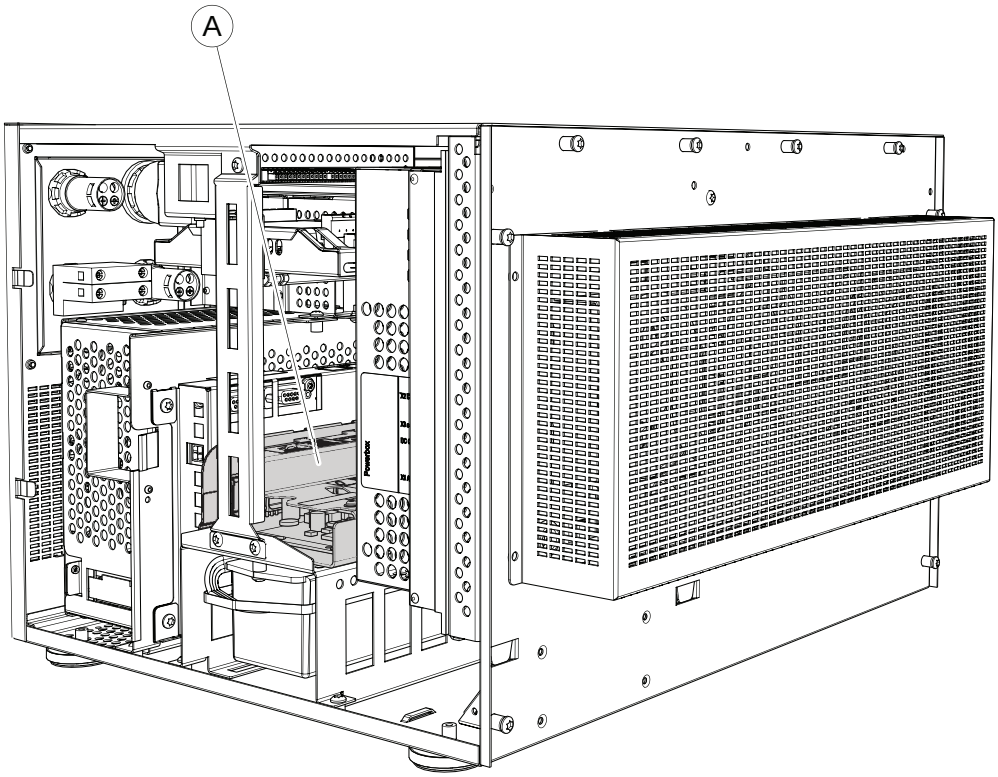
	Action
1	 **DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.
2	 **WARNING** The unit is sensitive to ESD. Before handling the unit, see *The unit is sensitive to ESD on page 53*.
3	Refit the Ethernet switch.
4	Refit the safety board and secure it with the attachment screws.
5	Refit the safety board unit and secure it with the attachment screws.
6	Reconnect all connectors to the Ethernet switch, Connected Services box, and safety board.
7	Refit the cabinet cover.
8	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.

4.19 Replacement of power supply

4.19.1 Replacement of power distribution unit

Location

The location of the power distribution unit is shown by the following illustration.



xx1400001463

A	Power distribution unit

CAUTION

Hot surface on top of the power distribution unit.

Risk of burns. Be careful when removing the unit.

Do not route or place cables on top of the power distribution unit.

Required equipment

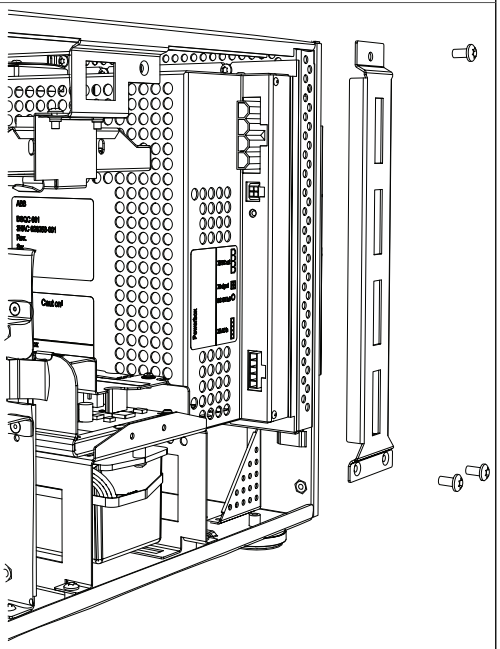
Equipment	Note
Power distribution unit	DSQC 662 See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.

Continues on next page

Equipment	Note
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See *Circuit diagrams on page 235*.

Removal

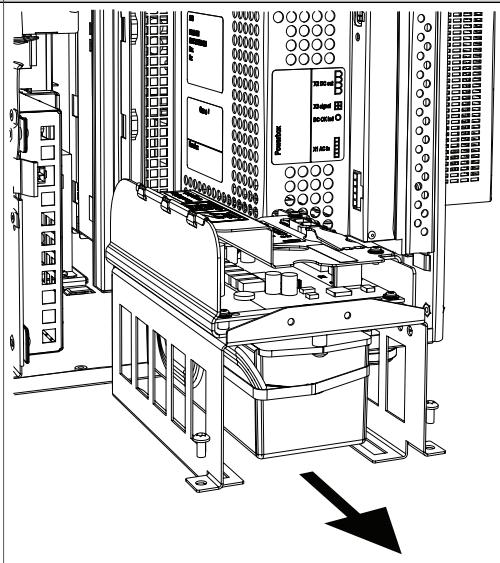
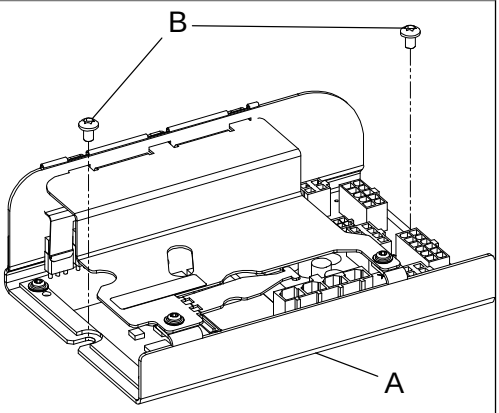
Use this procedure to remove the power distribution unit.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	**CAUTION** Hot surface on top of the power distribution unit. Risk of burns. Be careful when removing the unit.	
3	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
4	Remove the three attachment screws, and remove the support bar.	 xx1400001384

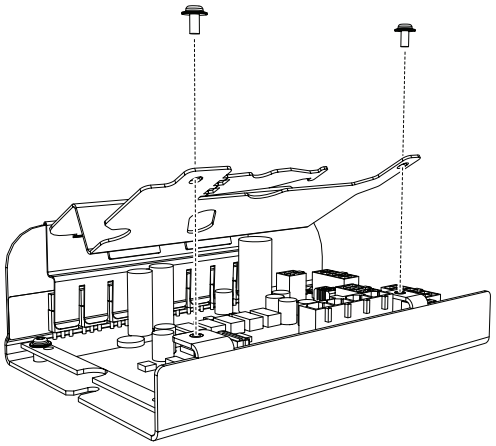
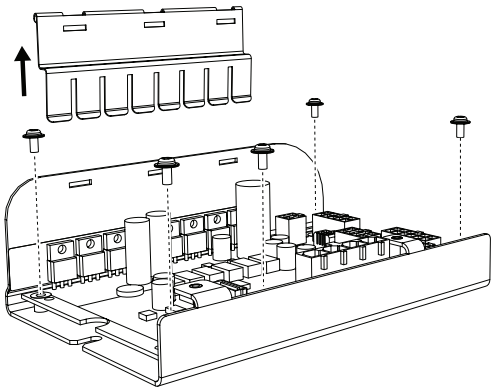
Continues on next page

4.19.1 Replacement of power distribution unit

Continued

	Action	Note/illustration
5	Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 xx1400001385
6	Disconnect all connectors from the power distribution unit.	
7	Pull the backup energy bank unit out completely.	
8	Remove the attachment screws and lift the board out.	 xx0900000549 • A: power distribution unit • B: attachment screws

Continues on next page

	Action	Note/illustration
9	Remove the two attachment screws and cover plate.	 xx1400001464
10	Remove the five attachment screws and spring.	 xx1400001465

Refitting

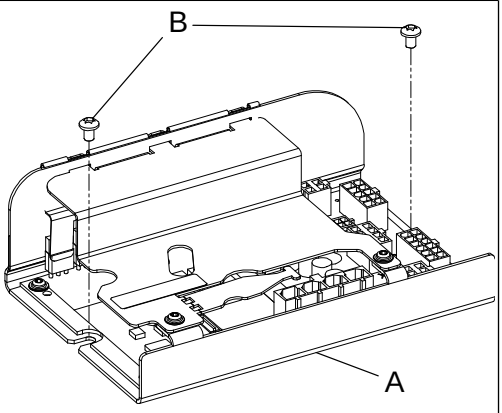
Use this procedure to refit the power distribution unit.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

4.19.1 Replacement of power distribution unit

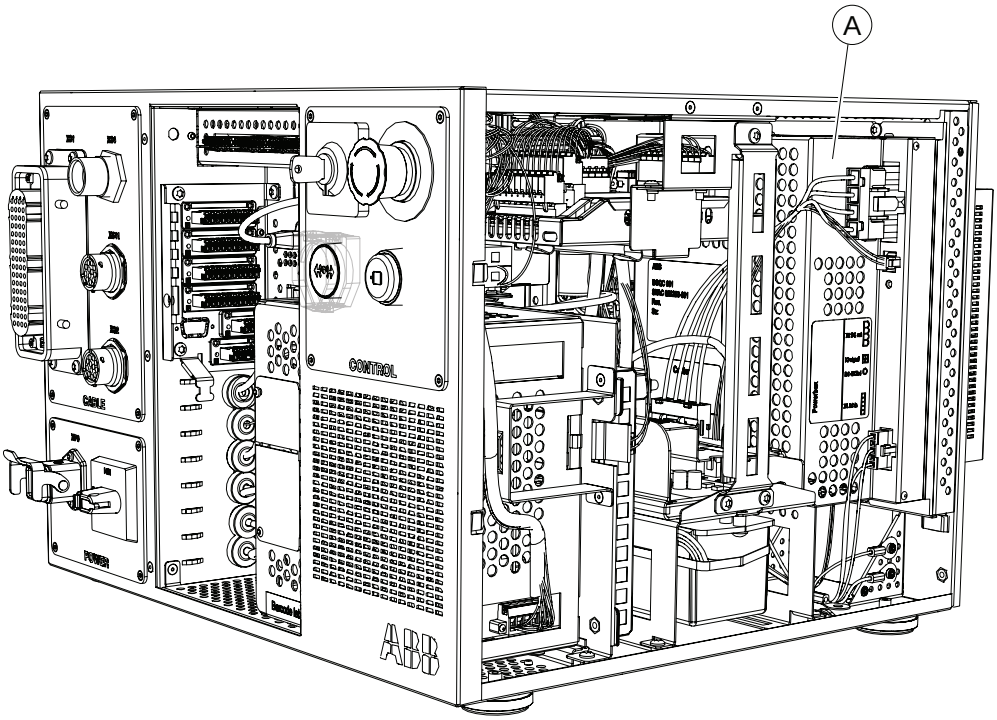
Continued

	Action	Note/illustration
2	Put the new power distribution unit in place and refit the attachment screws.	 xx0900000549 • A: power distribution unit • B: attachment screws
3	Refit the spring and cover plate. Secure with attachment screws.	
4	Refit the power distribution unit and secure with attachment screws.	
5	Slide the backup energy bank unit half way in.	
6	Reconnect the connectors X1 - X9. **CAUTION** Hot surface on top of the power distribution unit. Do not route or place cables on top of the power distribution unit.	
7	Refit the backup energy bank unit.	
8	Refit the support bar with the three attachment screws.	
9	Refit the cabinet cover.	
10	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.19.2 Replacement of system power supply

Location

The following illustration shows the location of the system power supply.



xx1400001466

A	System power supply

Required equipment

Equipment	Note
System power supply	DSQC 661 See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

Removal

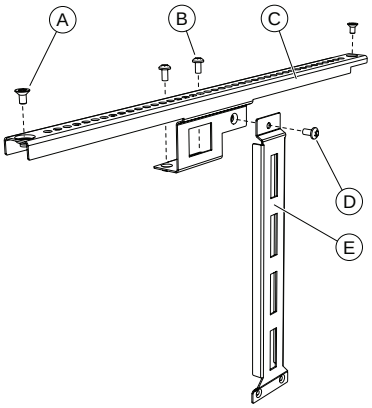
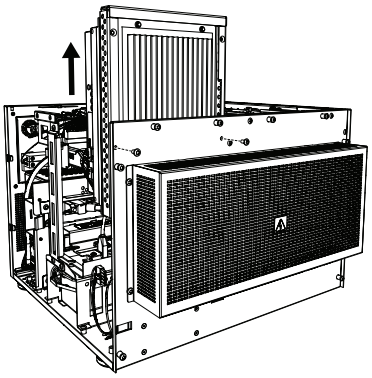
Use the following procedure to remove the system power supply.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

4.19.2 Replacement of system power supply

Continued

	Action	Note/Illustration
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
3	Disconnect all connectors from the unit.	
4	Remove the right side beam, according to illustration.	 xx1400001468 • A: torx counters head screw (2 pcs) • B: torx pan head screw (2 pcs) • C: beam • D: torx pan head screw (support) • E: support
5	Remove two attachment screws in the back of the controller, to loosen support bracket.	 xx1400001467
6	Pull the system power supply with support bracket straight up.	

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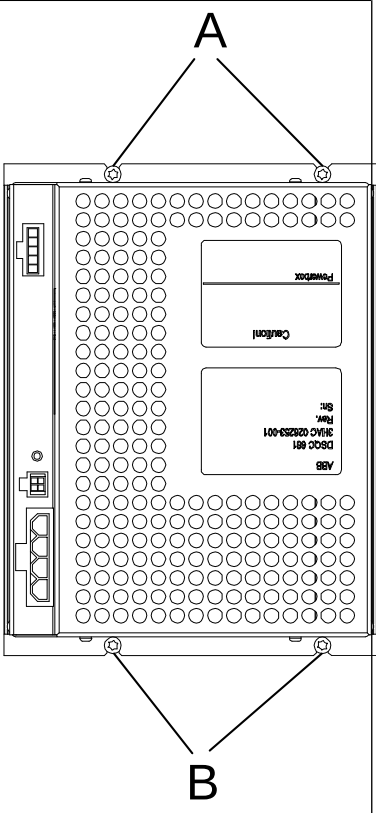
	Action	Note/Illustration
7	Loosen the two lower attachment screws.	 xx0900000570 • A: upper attachment screws • B: lower attachment screws
8	Remove the two upper attachment screws.	
9	Pull the power supply unit upwards to release it from the lower screw heads, and remove it.	

Refitting

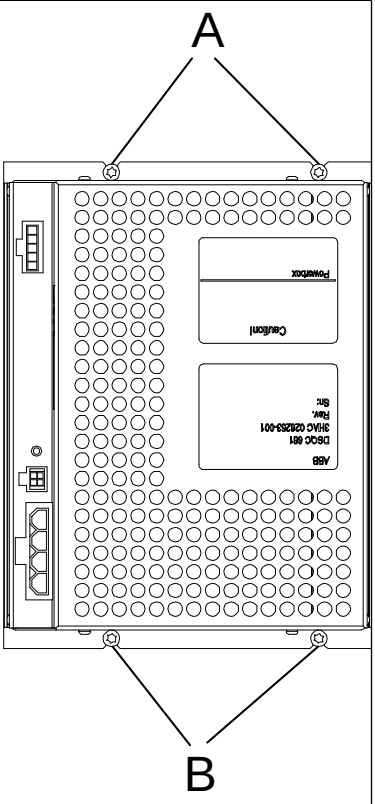
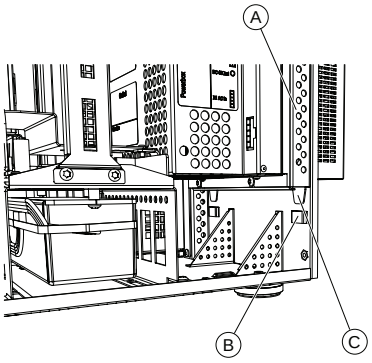
Use the following procedure to refit the system power supply.

	Action	Note/Illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

4.19.2 Replacement of system power supply

Continued

	Action	Note/Illustration
2	Refit the power supply by sliding the recesses in beneath the lower screw heads.	 xx0900000570 • A: upper attachment screws • B: lower attachment screws
3	Refit the two upper attachment screws.	
4	Tighten the attachment screws (4 pcs).	
5	Refit system power supply with support bracket by fitting the latches into the recesses.	 xx1400001469 • A: support bracket • B: recess • C: latch
6	Refit the two attachment screws to the support bracket in the back of the controller	
7	Refit right side beam and secure with attachment screws.	
8	Reconnect all connectors to the unit.	

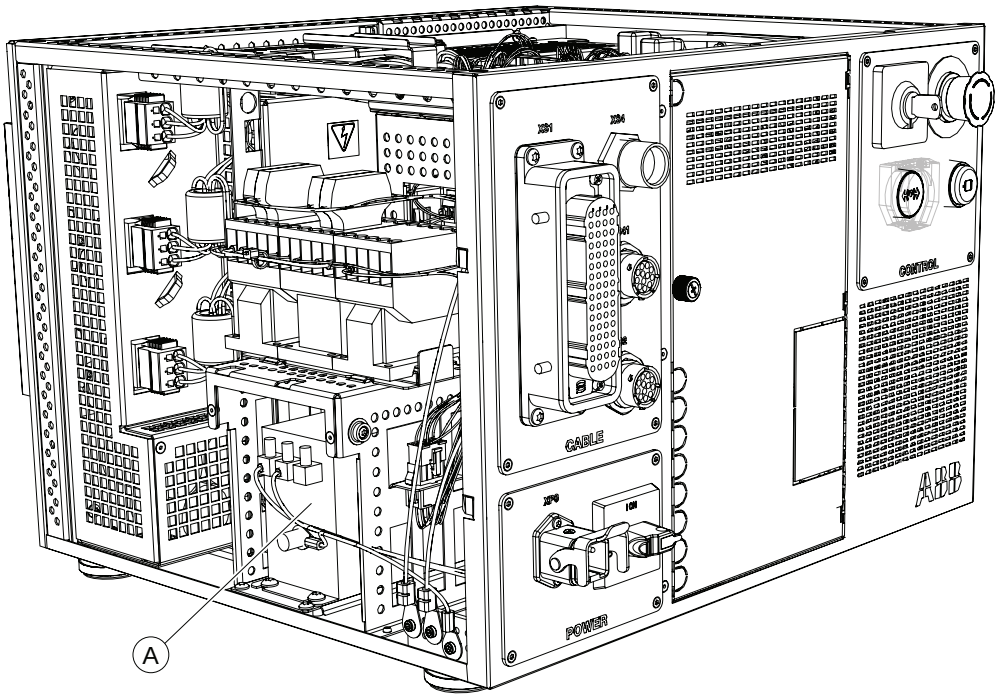
Continues on next page

	Action	Note/Illustration
9	Refit the cabinet cover.	
10	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

4.19.3 Replacement of line filter

Location

The following illustration shows the location of the line filter.



xx1400001470

A	Filter

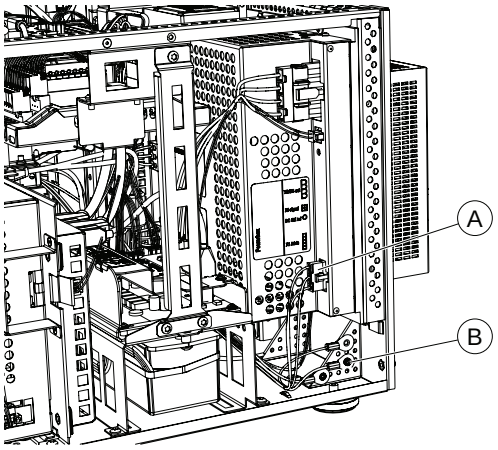
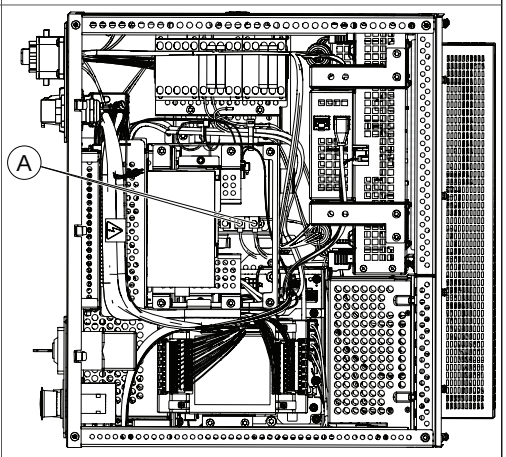
Required equipment

Equipment	Spare part no.	Note
Line filter	3HAC037698-001	See *Controller system parts on page 223*.
Standard toolkit	The content is described in section *Standard toolkit, IRC5 on page 219*.	
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		

Continues on next page

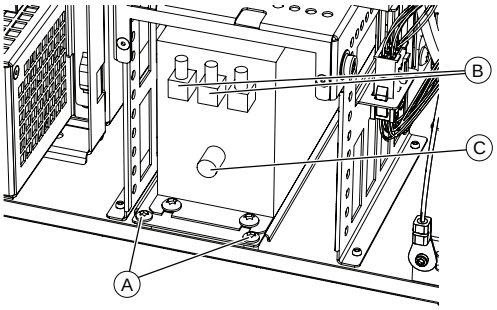
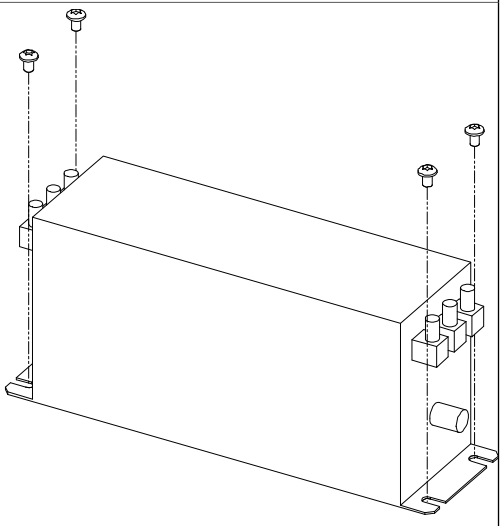
Removal

Use the following procedure to remove the line filter.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	
2	Remove the cover of the cabinet.	See *Opening the IRC5 Compact controller on page 97*.
3	Disconnect connector X1 from the system power supply.	 xx1400002853 A Connector X1 B Ground connection
4	Disconnect the ground connection.	
5	Disconnect and remove the safety board unit to be able to access the secondary side of the line filter.	See *Replacement of Connected Services box on page 187*.
6	Disconnect the cables from L1', L2' on the secondary side of the line filter.	 xx1400002854 A Line filter connections

Continues on next page

4.19.3 Replacement of line filter
Continued

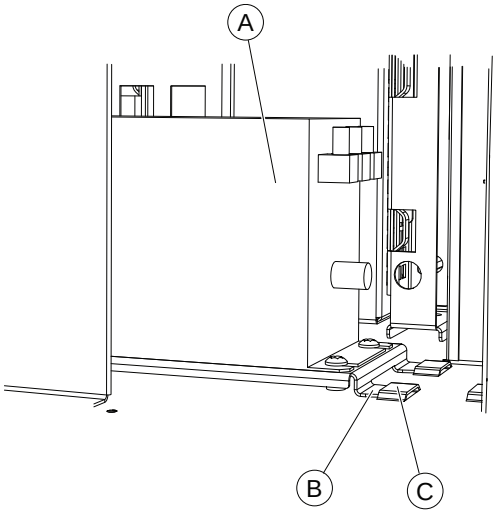
	Action	Note/illustration
7	Remove the two support bracket attachment screws and pull the line filter out slightly.	 xx1400002849 A Attachment screws for the support bracket B L1 and L2 connections C Ground connection
8	Disconnect the cables from L1, L2 and ground connection on the primary side of the line filter.	
9	Pull the line filter unit out.	
10	Disconnect the ground cable cable from the secondary side of the line filter.	
11	Remove the four attachment screws of the line filter and remove it from the support bracket.	 xx0900000572 A Attachment screws for the line filter

Refitting

Use the following procedure to refit the line filter.

	Action	Note/illustration
1	**DANGER** Before doing any work inside the cabinet, disconnect the mains power. For more information, see *Electrical safety on page 33*.	

Continues on next page

	Action	Note/illustration
2	Fit the line filter in position on the support bracket and secure the four attachment screws.	
3	Reconnect the ground cable to the secondary side of the line filter.	
4	Slide the line filter into the controller.	
5	Reconnect the cables to L1, L2 and ground connection on the primary side of the line filter.	
6	Refit the line filter unit by fitting the latches into the recesses.	 xx140000XXXX A Line filter B Latches C Recess
7	Secure the line filter unit with two attachment screws.	
8	Reconnect the cables to L1' and L2' connections on the secondary side of the line filter.	
9	Refit the safety board unit with its two attachment screws.	
10	Reconnect all connectors to the safety board unit.	
11	Reconnect connector X1 to the system power supply.	
12	Reconnect the ground connection under the system power supply.	
13	Refit the cabinet cover.	
14	Perform the function tests in section *Function tests on page 127* to verify that the safety features work properly.	

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5 Decommissioning

5.1 Introduction to decommissioning

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

> **Note**
>
> The decommissioning process shall be preceded by a risk assessment.

Disposal of materials used in the robot

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

See also *Environmental information on page 212*.

Disposal of storage media

Before disposal of any storage equipment (anything from an SD card to a complete controller), make sure that all sensitive information has been deleted.

> **Tip**
>
> To remove all data from the SD card, use the **Clean Disk** function (part of **Recovery Disk** function) in RobotStudio. See *Operating manual - RobotStudio*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

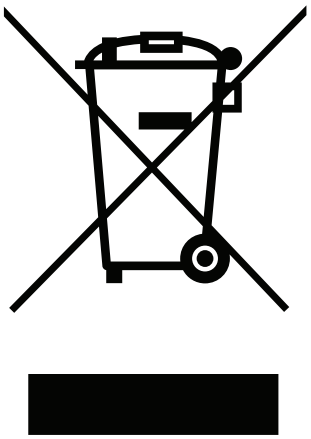
5.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials should be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

Materials used in the product

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Heat sinks on power supplies and drive units
Batteries, Lithium	Main computer
Brominated flame retardants	Electronics
Copper	Cables
Lead	Electronics
Plastic/rubber	Cables, connectors, etc.
Steel	Cabinet structure, plates, screws, etc.

Continues on next page

China RoHS symbol

The following symbol shows the information to hazardous substances and the environmental protection use period of IRC5C Compact according to "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products (SJ/T 11364-2014) ".

xx1900000803

Green symbol with "e" in it: The product does not contain any hazardous substances exceeding concentration limits and is a green environmentally friendly product which can be recycled.

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6 Reference information

6.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

6.2 Applicable standards

Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

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

Normative standards as referred to from ISO 10218-1

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

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13732-1:2006	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012[i]	Arc welding equipment - Part 1: Welding power sources

Continues on next page

Standard	Description
IEC 60974-10:2014[i]	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015[ii]	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

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

6.3 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

6.4 Standard toolkit, IRC5

General

All service (repair, maintenance and installation) instructions contain lists of tools required to perform the specified activity. All special tools, that is, all tools that are not considered as standard tools as defined below, are listed in their instructions respectively.

This way, the tools required are the sum of the Standard Toolkit and any tools listed in the instructions.

Contents, standard toolkit, IRC5

Tool	Remark
Screw driver, Torx	Tx10
Screw driver, Torx	Tx20
Screw driver, Torx	Tx25
Ball tipped screw driver, Torx	Tx25
Screw driver, flat blade	4 mm
Screw driver, flat blade	8 mm
Screw driver, flat blade	12 mm
Screw driver	Phillips-1
Box spanner	8 mm

6.5 Screw joints

General

This section details how to tighten the various types of screw joints on the controller.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

Tightening torque

Before tightening any screw, note the following:

- Determine whether a standard tightening torque or special torque is to be applied. The standard torques are specified in the tables below. Any special torques are specified in the Repair, Maintenance or Installation procedure description. Any special torque specified overrides the standard value.
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatical tools.
- Use the *correct tightening technique*, i.e. *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

The table below specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess heads.*

Dimension	Tightening torque (Nm) Class 4.8, oil-lubricated
M2.5	0.25
M3	0.5
M4	1.2
M5	2.5
M6	5.0

6.6 Open source and 3rd party components

Open source and 3rd party components

ABB products use software provided by third parties, including open source software. The following copyright statements and licenses apply to various components that are distributed inside the ABB software. Each ABB product does not necessarily use all of the listed third party software components. Licensee must fully agree and comply with these license terms or the user is not entitled to use the product. Start using the ABB software means accepting also referred license terms. The third party license terms apply only to the respective software to which the license pertains, and the third party license terms do not apply to ABB products. With regard to programs provided under the GNU general public license and the GNU lesser general public license licensor will provide licensee on demand, a machine-readable copy of the corresponding source code. This offer is valid for a period of three years after delivery of the product.

ABB software is licensed under the ABB end user license agreement, which is provided separately.

RobotWare

For RobotWare, there is license information in the folder **licenses** in the RobotWare distribution package.

OpenSSL

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/)

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

This product includes software written by Tim Hudson (tjh@cryptsoft.com).

CTM

For OIeOS, the Linux based operating system used on the conveyor tracking module (CTM), a list of copyright statements and licenses is available in the file /**etc**/**licenses.txt** located on the CTM board and accessible via the console port or by downloading the file over SFTP.

For the CTM application, a list of copyright statements and licenses is available in the file /**opt**/**ABB.com**/**ctm**/**licenses.txt** located on the CTM board and accessible via the console port or by downloading the file over SFTP.

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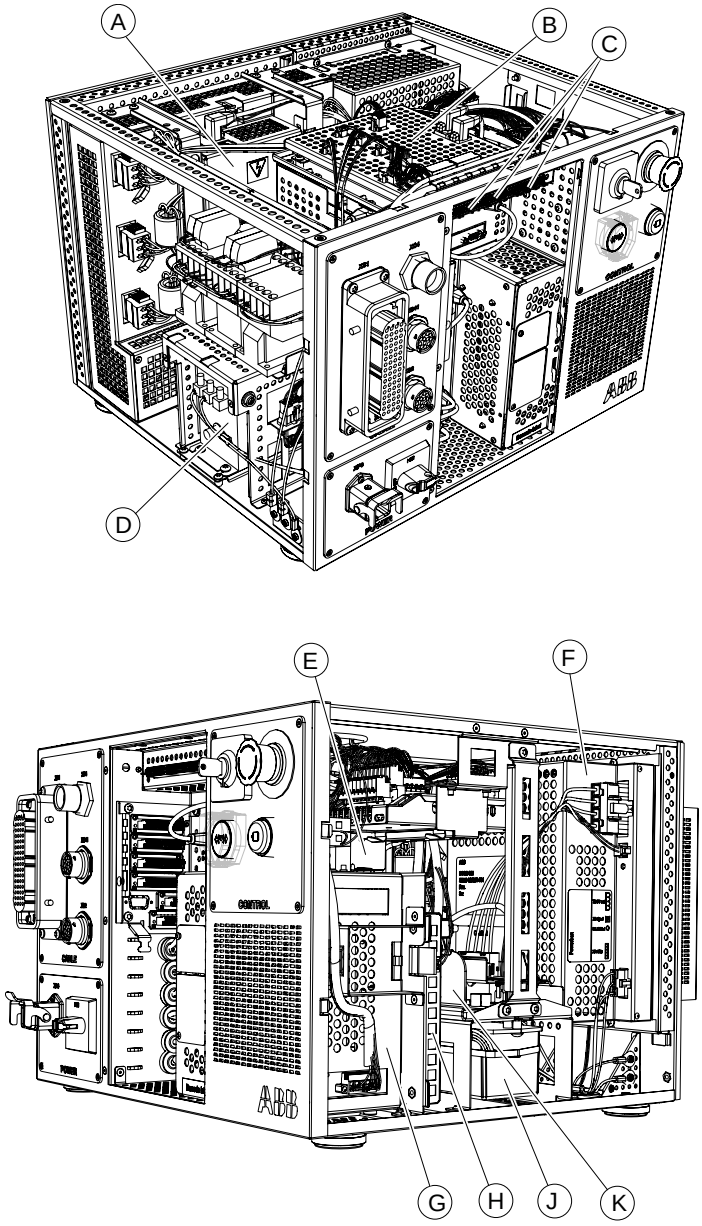
7 Spare parts

7.1 IRC5 Compact controller

Controller system parts



xx1400001621

	Spare part no.	Description	Note
A	3HAC036260-001	Main Drive Unit, MDU-430C	DSQC 431
B	3HAC037310-001	Safety board	DSQC 400
	3HAC059163-001		DSQC 400E
C	3HAC051190-001	Multipole con. XS7, XS8, XS9	

Continues on next page

	Spare part no.	Description	Note
D	3HAC037698-001	Line filter	
E	3HAC043053-001	Connected Services box	DSQC 680 For controllers produced earlier than August 2019.
E	3HAC049807-001	DSQC 1016 3G Connected Services box	DSQC 1016
	3HAC028459-001	Magnetic roof antenna	
	3HAC042958-001	Sim card	
E	3HAC058038-001	DSQC 1023 WiFi Connected Services box	DSQC 1023
	3HAC059424-001		
E	3HAC069612-001	Retrofit kit	For Connected Services box
F	3HAC026253-001	System Power Supply	DSQC 661
G	See *Computer unit parts on page 225*.		
H	3HAC029157-001	Axis computer	DSQC 668
J	3HAC025562-001	Backup energy bank	DSQC 655
K	3HAC026254-001	Power distribution unit	DSQC 662
-	3HAC034884-001	Ethernet switch	

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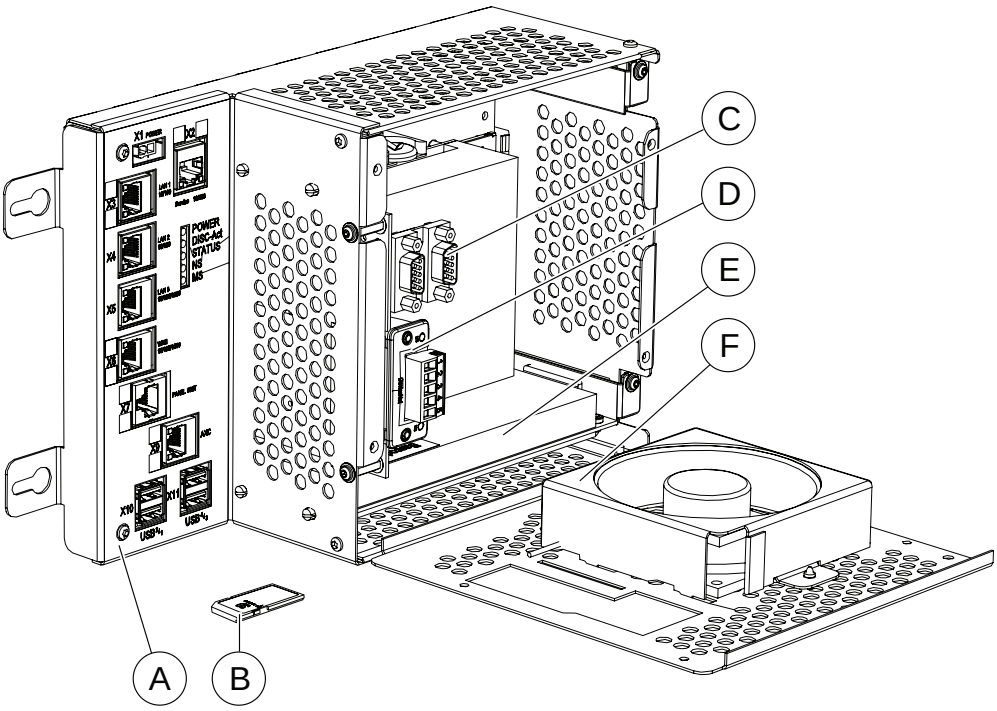
Computer unit parts

The illustration below shows the placement of the computer unit parts in the recommended spare part list.



xx1300000851

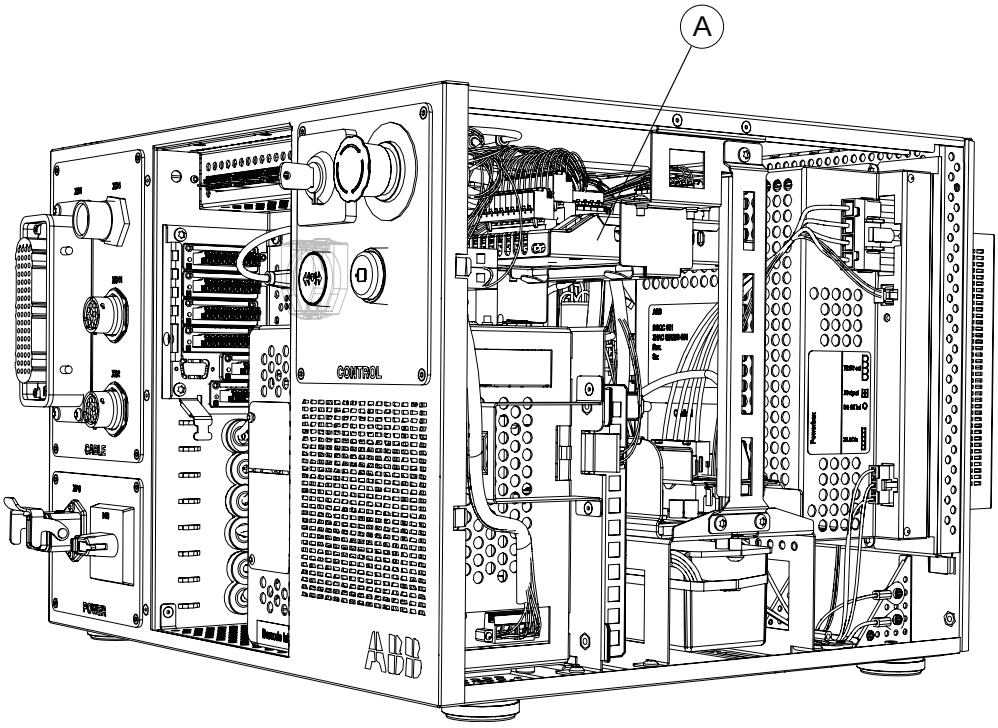
	Spare part no.	Description	Type
A	3HAC042766-001	Computer unit (1 PCI slot)	DSQC1000
A	3HAC050363-001	Computer unit (2 PCI slots)	DSQC1018
A	3HAC058366-001	Computer unit (2 PCI slots) Recommended for RobotWare 6.08 and later versions.	DSQC1024
A	3HAC087348-001	Computer unit (2 PCI slots) Recommended for RobotWare 6.15 and later versions. **Note** Previous revisions might be supported. Contact you local ABB office for information.	DSQC1094
B	3HAC061416-003	SD card	Used with computer DSQC1000, DSQC1018, DSQC1024, DSQC1094
C	3HAC046408-001	Expansion Board complete	DSQC1003
D	3HAC031670-001	PROFINET Slave Fieldbus Adapter	DSQC 688
D	3HAC026840-001	PROFIBUS Slave Fieldbus Adapter	DSQC 667
D	3HAC027652-001	Ethernet/IP Slave Fieldbus Adapter	DSQC 669

Continues on next page

7.1 IRC5 Compact controller
Continued

	Spare part no.	Description	Type
D	3HAC045973-001	DeviceNet Slave Fieldbus Adapter	DSQC1004
E	3HAC043383-001	DeviceNet Master/Slave PCIexpress	DSQC1006
E	3HAC044872-001	PROFIBUS-DP Master PCIexpress	DSQC1005
F	3HAC026525-001	Fan	-
-	3HAC14944-1	RS-232/422 Converter	DSQC 615

I/O System parts



xx1400001381

A	I/O unit

	Spare part no.	Description	Note
A	3HAC025784-001	ADCombi I/O unit	DSQC 651
A	3HAC025917-001	Digital 24V I/O unit	DSQC 652
*	3HAC025918-001	Digital I/O with relay outputs	DSQC 653

* Mounted outside controller cabinet

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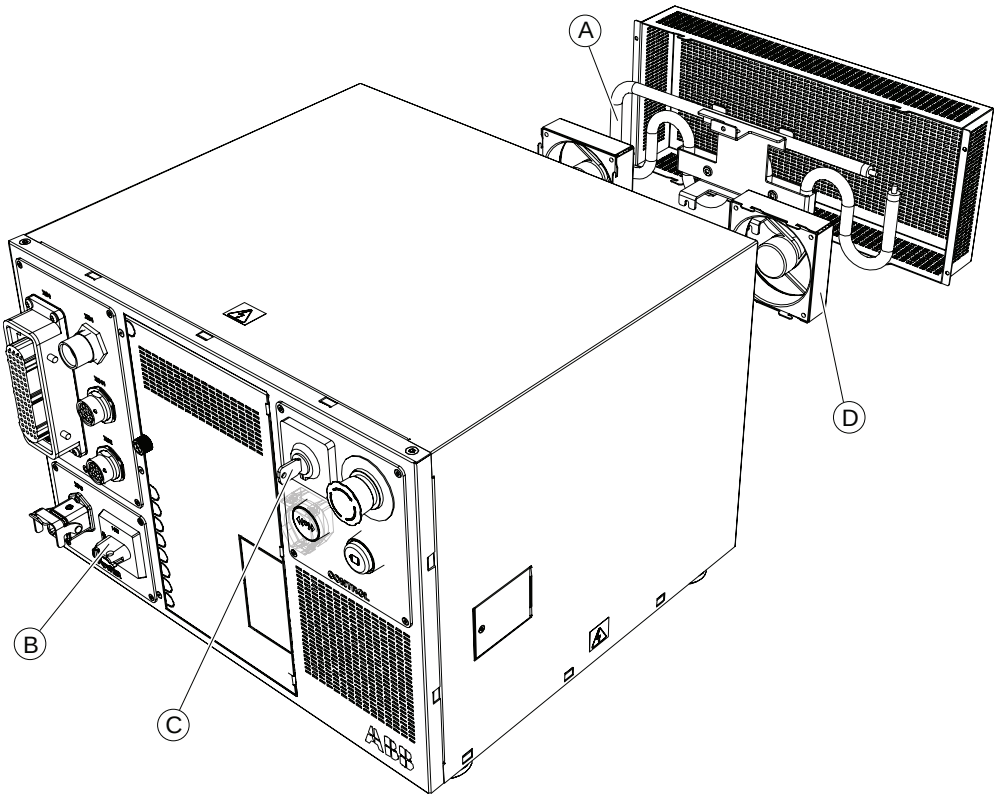
Miscellaneous parts



xx1400002002

	Spare part no.	Description
A	3HAC051187-001	Brake resistor bleeder asm
B	3HAC037699-001	Handle for 6 mm switch
C	3HAC052287-003	Mode selector
C	3HAC052287-001	Mode selector 2 pos
D	3HAC051135-001	Fan with receptacle
	3HAB2997-1	Wrist band
	3HAC037700-001	Contactor ASL16-30-10 DC24V
	3HAC031561-001	Auxiliary contact CA3-10
	3HAC031562-001	Auxiliary contact CA3-01
	3HAC052262-001	Mounting kit, 19" cabinet
	3HNE 01586-1	Conveyor Tracking Unit, DSQC 377B
	3HNA027579-001	CTM-01 Conveyor Tracking Module, DSQC 2000

External operator's panel

	Spare part no.	Description	Note
-	3HAC038671-001	External control panel box	Option 733-4
-	3HAC065947-001	External Operator's panel cable 7 m	Option 734-5
-	3HAC065947-004	External Operator's panel cable 15 m	Option 734-1

Continues on next page

7.1 IRC5 Compact controller
Continued

	Spare part no.	Description	Note
-	3HAC065947-005	External Operator's panel cable 30 m	Option 734-3

7.2 FlexPendant parts

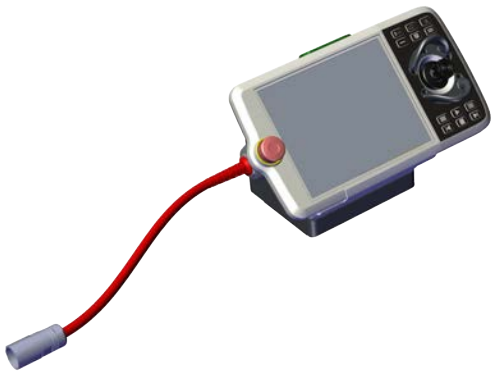
FlexPendant versions

The FlexPendant is available in different versions, as the hardware has been updated over the years. The exact appearance on the graphics might therefore differ slightly from reality.

> **Note**
>
> The different versions support many, but not all, versions of the IRC5 controllers/RobotWare versions. Contact your local ABB office for more information about compatibility.

The FlexPendant holder is available in different versions, that fit different FlexPendant versions. The holder is compatible with the FlexPendant that it is delivered with.

FlexPendant with emergency stop at the connector



xx2100001802

Article number	Description
3HAC085598-001	FlexPendant 10 m
3HAC085598-002	FlexPendant 30 m
3HAC084673-001	10 m cable for FlexPendant
3HAC084673-002	30 m cable for FlexPendant
3HAC055665-002	FlexPendant extension cable 15 m
3HAC055665-003	FlexPendant extension cable 22 m
3HAC055665-004	FlexPendant extension cable 30 m
3HAC079391-001	TPU Holder asm (assembly)

The extension cables cannot be used together with an external operator panel (option 733-3 or 733-4).

Continues on next page

FlexPendant with emergency stop at the outer edge

xx0300000449

Article number	Description
3HAC028357-001	FlexPendant with cable 10 m
3HAC031683-001	Cable 10 m for FlexPendant
3HAC031683-004	Cable 30 m for FlexPendant
3HAC055665-002	FlexPendant extension cable 15 m
3HAC055665-003	FlexPendant extension cable 22 m
3HAC055665-004	FlexPendant extension cable 30 m
3HAC033498-001	FlexPendant holder
3HAC033596-002	FlexPendant holder upper part
3HAC025042-001	Cable holder bracket
3HAC026357-001	Cable bracket
3HAC035075-001	Set of stylus
3HAC028357-050	TPU hand strap

The extension cables cannot be used together with an external operator panel (option 733-3 or 733-4).

7.3 Manipulator cables

Signal cables, IRB 120

Spare part no.	Description
3HAC035320-001	Control cable signal 3 m
3HAC2493-1	Control cable signal 7 m
3HAC2530-1	Control cable signal 15 m

Signal cables, IRB 1510

Art. no.	Description	Option no.
3HAC068917-001	Robot cable, signal 7 m	210-2
3HAC068918-001	Robot cable, signal 15 m	210-3

Power cables, IRB 120

Spare part no.	Description
3HAC032694-001	Control cable power 3 m
3HAC032695-001	Control cable power 7 m
3HAC032696-001	Control cable power 15 m

CP/CS cables IRB 120, IRB 1200, IRB 910SC

Art. no.	Description	Option no.
3HAC049186-001	Customer cable signal 3 m	94-6
3HAC049186-004	Customer cable signal 7 m	94-1
3HAC049186-005	Customer cable signal 15 m	94-2
3HAC049186-006	Customer cable signal 22 m	94-3
3HAC049186-007	Customer cable signal 30 m	94-4

Cable packages for IRB 140 (including signal, power and customer cables)

Art. no.	Description
3HAC7996-1	Control cable power 3 m
3HAC7996-5	Control cable power 7 m
3HAC7996-6	Control cable power 15 m
3HAC7996-7	Control cable power 22 m
3HAC7996-8	Control cable power 30 m

Signal cables, IRB 260

Art. no.	Description
3HAC7998-1	Control cable signal 7 m
3HAC7998-2	Control cable signal 15 m

Continues on next page

7.3 Manipulator cables
Continued

Art. no.	Description
3HAC7998-3	Control cable signal 22 m
3HAC7998-4	Control cable signal 30 m

Power cables, IRB 260, 1600 (version B) [1]

Art. no.	Description	Option no. [i]
3HAC9038-1	Control cable power 7 m	Foundry: 210-2 and 287-3 Wash: 210-5 and 287-5
3HAC9038-2	Control cable power 15 m	Foundry: 210-3 and 287-3 Wash: 210-5 and 287-5
3HAC9038-3	Control cable power 22 m	Foundry: 210-4 and 287-3 Wash: 210-5 and 287-5
3HAC9038-4	Control cable power 30 m	Foundry: 210-5 and 287-3 Wash: 210-5 and 287-5

i The option number depends on the protection type of the manipulator.

Cable packages for IRB 360 (including signal, power and customer cables)

Art. no.	Description
3HAC029903-001	Control cable, power and signal 3 m
3HAC029903-002	Control cable, power and signal 7 m
3HAC029903-003	Control cable, power and signal 15 m
3HAC029903-004	Control cable, power and signal 22 m
3HAC029903-005	Control cable, power and signal 30 m
3HAC038411-001	Control cable, power and signal, stainless contact screws, 3 m
3HAC038411-002	Control cable, power and signal, stainless contact screws, 7 m
3HAC038411-003	Control cable, power and signal, stainless contact screws, 15 m
3HAC038411-004	Control cable, power and signal, stainless contact screws, 22 m
3HAC038411-005	Control cable, power and signal, stainless contact screws, 30 m

Signal cables, IRB 910SC

Spare part no.	Description
3HAC057787-001	Control cable signal 3 m
3HAC057788-001	Control cable signal 7 m
3HAC057789-001	Control cable signal 15 m

Power cables, IRB 910SC

Art. no.	Description
3HAC057784-001	Control cable power 3 m
3HAC057785-001	Control cable power 7 m

1 **IRB 1600/1660ID in standard protection has two versions, A and B. For details about the robot version, see product manual for the robot.**

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Art. no.	Description
3HAC057786-001	Control cable power 15 m

Signal cables, IRB 1200

Spare part no.	Description
3HAC035320-001	Control cable signal 3 m
3HAC2493-1	Control cable signal 7 m
3HAC2530-1	Control cable signal 15 m
3HAC2540-1	Control cable signal 22 m
3HAC2566-1	Control cable signal 30 m

Power cables, IRB 1200, 1510

Art. no.	Description	Option no.
3HAC040503-007	Control cable power 3 m	210-1 (only for IRB 1200)
3HAC040503-001	Control cable power 7 m	210-2
3HAC040503-002	Control cable power 15 m	210-3
3HAC040503-003	Control cable power 22 m	210-4 (only for IRB 1200)
3HAC040503-004	Control cable power 30 m	210-5 (only for IRB 1200)

Ethernet cables, IRB 1200

Art. no.	Description	Option no.
3HAC055518-001	Ethernet cable 3 m	859-9
3HAC055518-002	Ethernet cable 7 m	859-1
3HAC055518-003	Ethernet cable 15 m	859-2
3HAC055518-004	Ethernet cable 22 m	859-3
3HAC055518-005	Ethernet cable 30 m	859-4

Signal cables, IRB 1410, 1600

Art. no.	Description
3HAC2493-1	Control cable signal 7 m
3HAC2530-1	Control cable signal 15 m
3HAC2540-1	Control cable signal 22 m
3HAC2566-1	Control cable signal 30 m

Power cables, IRB 1410, 1600 (version A)[2]

Art. no.	Description	Option no.[i]
3HAC2492-1	Control cable power 7 m	Standard: 210-2 and 287-4
3HAC2529-1	Control cable power 15 m	Standard: 210-3 and 287-4

2 **IRB 1600/1660ID in standard protection has two versions, A and B. For details about the robot version, see product manual for the robot.**

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7.3 Manipulator cables
Continued

Art. no.	Description	Option no.[i]
3HAC2539-1	Control cable power 22 m	Standard: 210-4 and 287-4
3HAC2564-1	Control cable power 30 m	Standard: 210-5 and 287-4
3HAC9038-1	Control cable power 7 m	Foundry: 210-2 and 287-3 Wash: 210-2 and 287-5
3HAC9038-2	Control cable power 15 m	Foundry: 210-3 and 287-3 Wash: 210-3 and 287-5
3HAC9038-3	Control cable power 22 m	Foundry: 210-4 and 287-3 Wash: 210-4 and 287-5
3HAC9038-4	Control cable power 30 m	Foundry: 210-5 and 287-3 Wash: 210-5 and 287-5

i The option number depends on the protection type of the manipulator.

CP/CS cables IRB 1600

Art. no.	Description	Option no.
3HAC061420-001	Cable CP/CS 7 m	94-1, 16-1 and 17-5
3HAC061420-002	Cable CP/CS 15 m	94-2, 16-1 and 17-5
3HAC061420-003	Cable CP/CS 22 m	94-3, 16-1 and 17-5
3HAC061420-004	Cable CP/CS 30 m	94-4, 16-1 and 17-5

8 Circuit diagrams

8.1 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but are available for registered users on myABB Business Portal, *www.abb.com/myABB*.

See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
Circuit diagram - IRC5 Compact	*3HAC049406-003*

Manipulators

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 120	*3HAC031408-003*
Circuit diagram - IRB 140 type C	*3HAC6816-3*
Circuit diagram - IRB 260	*3HAC025611-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Circuit diagram - IRB 390	*3HAC060545-009*
Circuit diagram - IRB 460	*3HAC036446-005*
Circuit diagram - IRB 660	*3HAC025691-001*
Circuit diagram - IRB 760	*3HAC025691-001*
Circuit diagram - IRB 1200	*3HAC046307-003*
Circuit diagram - IRB 1410	*3HAC2800-3*
Circuit diagram - IRB 1600/1660 (with IRC5)	*3HAC021351-003*
Circuit diagram - IRB 1510	*3HAC087368-003*
Circuit diagram - IRB 1520	*3HAC039498-007*
Circuit diagram - IRB 2400	*3HAC6670-3*
Circuit diagram - IRB 2600	*3HAC029570-007*
Circuit diagram - IRB 4400/4450S	*3HAC9821-1*
Circuit diagram - IRB 4600	*3HAC029038-003*
Circuit diagram - IRB 6620	*3HAC025090-001*
Circuit diagram - IRB 6620 / IRB 6620LX	*3HAC025090-001*
Circuit diagram - IRB 6640	*3HAC025744-001*
Circuit diagram - IRB 6650S	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 6660	*3HAC025744-001* *3HAC029940-001*
Circuit diagram - IRB 6700 / IRB 6790	*3HAC043446-005*

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8.1 Circuit diagrams
Continued

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 7600	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 14000	*3HAC050778-003*
Circuit diagram - IRB 910SC	*3HAC056159-002*

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