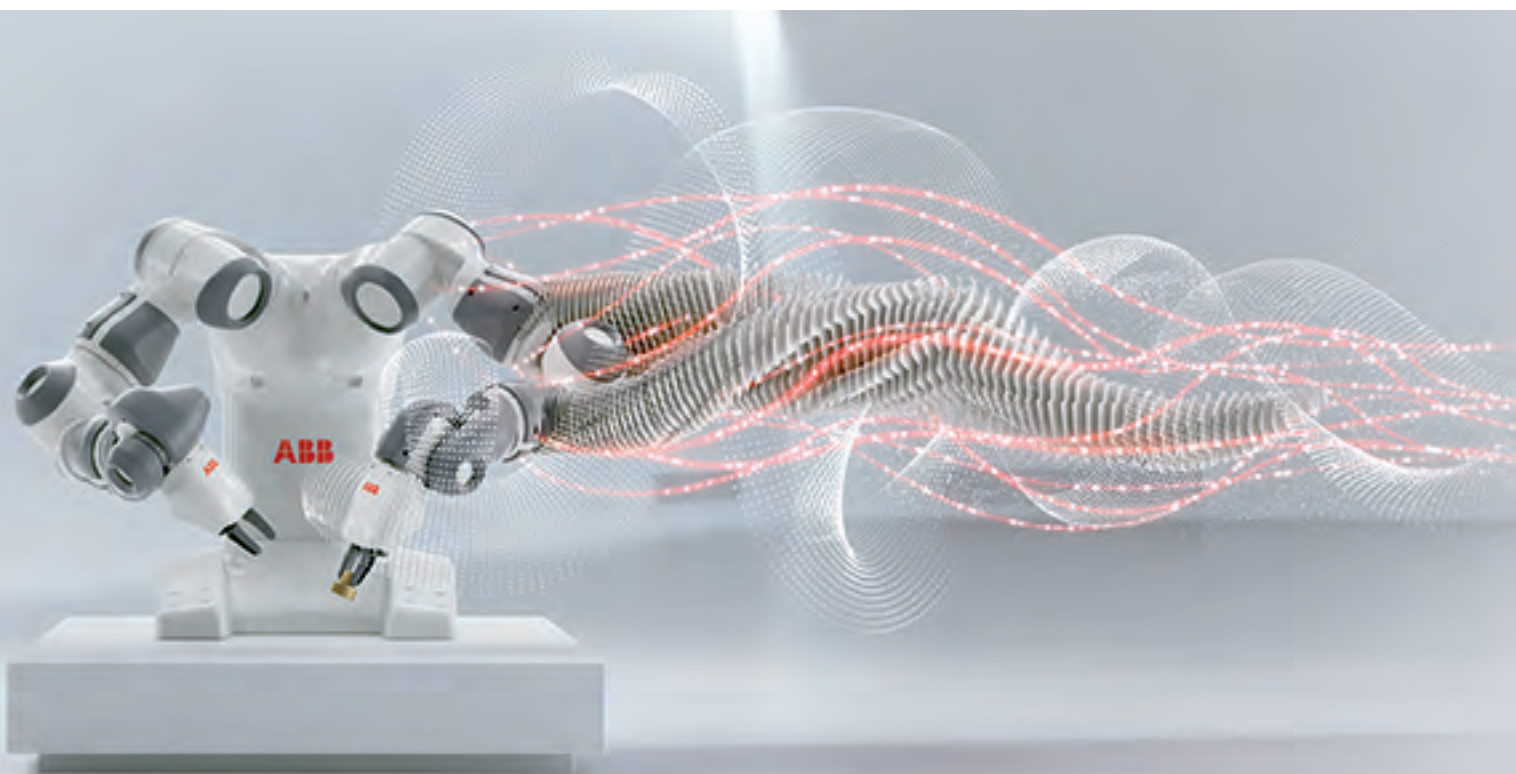

ROBOTICS

Product manual

IRC5 Compact



Trace back information:
Workspace R17-2 version a11
Checked in 2017-09-20
Skribenta version 5.1.011

Product manual
IRC5 Compact

Release 17.2

Document ID: 3HAC047138-001

Revision: G

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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
<i>Product manual - IRC5</i>	3HAC047136-001
<i>Operating manual - Emergency safety information</i>	3HAC027098-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC050941-001
<i>Operating manual - RobotStudio</i>	3HAC032104-001
<i>Operating manual - Getting started, IRC5 and RobotStudio</i>	3HAC027097-001
<i>Operating manual - Troubleshooting IRC5</i>	3HAC020738-001
<i>Application manual - MultiMove</i>	3HAC050961-001
<i>Application manual - Force Control</i>	3HAC050377-001
<i>Application manual - SafeMove</i>	3HAC050974-001
<i>Application manual - Electronic Position Switches</i>	3HAC050996-001
<i>Application manual - Functional safety and SafeMove</i>	3HAC052610-001
<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>	3HAC050917-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001
See Circuit diagrams on page 217 .	

Continues on next page



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	<ul style="list-style-type: none">• New computer unit, DSQC1018, with two PCI slots and no knockout plates. No functional change, but affects illustrations.• Corrections on chapter Repair on page 127.• Corrected article number for line filter in Replacement of line filter on page 197.• Clarified the use of the WAN port in section Connectors on the computer unit on page 58.
B	<ul style="list-style-type: none">• 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 58.
C	Release 15.2. <ul style="list-style-type: none">• Minor corrections.• Added safety-related information to sections CAUTION - Make sure that all mode selector keys are kept safe on page 40, Function tests on page 118, and Refurbish.• Updates in section Applicable standards on page 204.
D	Release 16.1. <ul style="list-style-type: none">• Updated cable info for IRB 1200 in section Manipulator cables on page 213.• 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. <ul style="list-style-type: none">• Added section Installing the Safety module DSQC1015 for SafeMove on page 104.• Added information that function tests should be performed after replacing a component.• Changes in the article names for some spare parts.• Removed section Refurbish.

Revision	Description
F	<p>Release 17.1.</p> <ul style="list-style-type: none">• Added sections Function test of reduced speed control on page 125, and Recover from emergency stops on page 41.• Updated descriptions of stops in section Protective stop and emergency stop on page 19.• Added section Safety data on page 24.• Updated list of labels in section Safety symbols on controller labels on page 29.• New computer unit DSQC1024 is introduced, see Computer unit parts on page 210.• Spare parts updated, see Manipulator cables on page 213.• Added section Grounding on page 73.• Information regarding new safety board DSQC400E added.• Minor corrections.
G	<p>Release 17.2.</p> <ul style="list-style-type: none">• Updated list of applicable standards.• Updated section Connecting cables to the controller on page 63.• Added section Power supply system requirements on page 68.• Spare parts updated, see Manipulator cables on page 213.• Removed all references to computer unit DSQC1024.• Minor corrections.

Product documentation, IRC5

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.

All documents listed can be ordered from ABB on a DVD. The documents listed are valid for IRC5 robot systems.

Product manuals

Manipulators, controllers, DressPack/SpotPack, 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.
 - Decommissioning.
 - Reference information (safety standards, unit conversions, screw joints, lists of tools).
 - Spare parts list with exploded views (or references to separate spare parts lists).
 - Circuit diagrams (or references to circuit diagrams).
-

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

- *Technical reference manual - Lubrication in gearboxes*: Description of types and volumes of lubrication for the manipulator gearboxes.
- *Technical reference manual - RAPID overview*: An overview of the RAPID programming language.
- *Technical reference manual - RAPID Instructions, Functions and Data types*: Description and syntax for all RAPID instructions, functions, and data types.
- *Technical reference manual - RAPID kernel*: A formal description of the RAPID programming language.
- *Technical reference manual - System parameters*: Description of system parameters and configuration workflows.

Continues on next page

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, DVD with PC software).
- How to install included or required hardware.
- How to use the application.
- 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.

The group of manuals includes (among others):

- *Operating manual - Emergency safety information*
- *Operating manual - General safety information*
- *Operating manual - Getting started, IRC5 and RobotStudio*
- *Operating manual - IRC5 Integrator's guide*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Troubleshooting IRC5*

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 damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

1 Safety

1.1 Introduction to safety information

Overview

The safety information in this manual is divided into the following categories:

- General safety aspects, important to attend to before performing any service or installation work on the controller. These are applicable for all service work and are found in section [General safety information on page 16](#).
- Safety signals and symbols shown in the manual and on the controller, warning for different types of dangers, are found in [Safety signals and symbols on page 27](#).
- Specific safety information, pointed out in the procedure at the moment of the danger. How to avoid and eliminate the danger is either detailed directly in the procedure, or further detailed in separate instructions, found in section [Safety related instructions on page 33](#).

1 Safety

1.2.1 Introduction to general safety information

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

This section details general safety information for personnel performing installation, maintenance and repair work.

Sections

The general safety information is divided into the following sections.

Section	Examples of content
Safety in the robot system on page 17	This section describes the following: <ul style="list-style-type: none">• safety, service• limitation of liability• related information
Protective stop and emergency stop on page 19	This section describes protective stop and emergency stop.
Safety risks on page 21	This section lists dangers relevant when working with the product. The dangers are split into different categories. <ul style="list-style-type: none">• safety risks during installation or service• risks associated with live electrical parts
Safety actions on page 23	This section describes actions which may be taken to remedy or avoid dangers. <ul style="list-style-type: none">• fire extinguishing• safe use of the teach pendant or jogging device

1.2.2 Safety in the robot system

Validity and responsibility

The information does not cover how to design, install and operate a complete system, nor does it cover all peripheral equipment that can influence the safety of the entire system. To protect personnel, the complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

The users of ABB industrial robots are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that the safety devices necessary to protect people working with the robot system are designed and installed correctly. Personnel working with robot must be familiar with the operation and handling of the industrial robot as described in the applicable documents, for example:

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - General safety information*¹
- *Product manual*

¹ This manual contains all safety instructions from the product manuals for the robots and the controllers.

The robot system shall be designed and constructed in such a way as to allow safe access to all areas where intervention is necessary during operation, adjustment, and maintenance.

Where it is necessary to perform tasks within the safeguarded space there shall be safe and adequate access to the task locations.

Users shall not be exposed to hazards, including slipping, tripping, and falling hazards.

Connection of external safety devices

Apart from the built-in safety functions, the robot is also supplied with an interface for the connection of external safety devices. An external safety function can interact with other machines and peripheral equipment via this interface. This means that control signals can act on safety signals received from the peripheral equipment as well as from the robot.

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.

Related information

Type of information	Detailed in document	Section
Installation of safety devices	<i>Product manual for the robot</i>	Installation and commissioning
Changing operating modes	<i>Operating manual - IRC5 with FlexPendant</i>	Operating modes

Continues on next page

1 Safety

1.2.2 Safety in the robot system

Continued

Type of information	Detailed in document	Section
Restricting the working space	<i>Product manual for the robot</i>	Installation and commissioning
Load limits for tools and workpieces	<i>Product specification for the robot</i>	Load diagrams
Configuration of safety module (requires Functional safety options)	<i>Application manual - Functional safety and SafeMove</i>	

1.2.3 Protective stop and emergency stop

Overview

Protective stops and emergency stops are defined by standards IEC 60204-1:2005 and EN ISO 10218-1:2011.

Stops can be in *category 0* or *category 1*.

Stop category 0	As defined in IEC 60204, stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop. In IRC5 this is implemented by removing power immediately in the drive units.
Stop category 1	As defined in IEC 60204, a controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved. In IRC5 this is implemented by removing power in the drive units after about 1 second using the servos to stop the machine.

Inputs to initiate a protective stop or an emergency stop

There are several safety inputs available to initiate a protective stop or an emergency stop. All these safety inputs are of structure category 3 as described in EN ISO 13849-1.

These safety inputs will initiate a stop of category 0 or category 1.

Safety inputs to initiate a stop	Description
Protective stop in automatic mode	The safety input <i>Automatic Stop</i> is only operational in automatic mode. The default configuration is stop category 1.
Protective stop in automatic and manual mode	There are two safety inputs to initiate a protective stop in both automatic and manual mode. It is the safety input <i>General Stop</i> and the safety input <i>Superior Stop</i> . The default configuration is stop category 1.
Emergency stop	The <i>Emergency Stop</i> is operational in both automatic and manual mode. The default configuration is stop category 0.

To modify the configuration of the stop category, see *Technical reference manual - System parameters*.

Protective stop

Protective stops are activated through the dedicated safety inputs *Automatic Stop*, *General Stop*, and *Superior Stop*, on the controller. For example, the protective inputs are connected to safety outputs of presence sensing devices. This is to provide safeguarding.

See *Installation and commissioning in Product manual - IRC5*.

Continues on next page

1 Safety

1.2.3 Protective stop and emergency stop

Continued

Emergency stop

The emergency stop function shall not be applied as a substitute for safeguarding measures and other safety functions but should be designed for use as a complementary protective measure. (See ISO 13850.)



Note

Emergency stop must not be used for protective stop or program stop as this causes extra, unnecessary wear on the robot.

For how to perform program stops, see section *Stopping programs* in *Operating manual - IRC5 with FlexPendant*.

Depending on selected options for the robot, the number of emergency stops can vary. See documentation for the robot and the complete machine.

Other methods to stop the robot

There are also other methods to stop the robot. See:

- *Installation and commissioning* in *Product manual - IRC5*
- *Technical reference manual - System parameters*
- *Technical reference manual - RAPID Instructions, Functions and Data types*.

1.2.4 Safety risks

1.2.4.1 Risks associated with live electric parts

Voltage related risks, general

Work on the electrical equipment of the robot must be performed by a qualified electrician in accordance with electrical regulations.

- Although troubleshooting may, on occasion, need to be carried out while the power supply is turned on, the robot must be turned off (by setting the main switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The main supply to the robot must be connected in such a way that it can be turned off from outside the working space of the robot.
- Make sure that no one else can turn on the power to the controller and robot while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.

The necessary protection for the electrical equipment and robot system during construction, commissioning, and maintenance is guaranteed if the valid regulations are followed.

All work must be performed:

- by qualified personnel
- on machine/robot system in deadlock
- in an isolated state, disconnected from power supply, and protected against reconnection.

Voltage related risks, IRC5 controller

A danger of high voltage is associated with, for example, the following parts:

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The main supply/main switch
- The transformers
- The power unit
- The control power supply (230 VAC)
- The rectifier unit (262/400-480 VAC and 400/700 VDC. Note: capacitors!)
- The drive unit (400/700 VDC)
- The drive system power supply (230 VAC)
- The service outlets (115/230 VAC)
- The customer power supply (230 VAC)
- The power supply unit for additional tools, or special power supply units for the machining process.

Continues on next page

1 Safety

1.2.4.1 Risks associated with live electric parts

Continued

- The external voltage connected to the controller remains live even when the robot is disconnected from the mains.
- Additional connections.

Voltage related risks, robot

A danger of low voltage is associated with the robot in:

- The power supply for the motors (up to 800 VDC).
- The user connections for tools or other parts of the installation (max. 230 VAC).

Voltage related risks, tools, material handling devices, etc.

Tools, material handling devices, etc., may be live even if the robot system is in the OFF position. Power supply cables which are in motion during the working process may be damaged.

1.2.5 Safety actions

1.2.5.1 Fire extinguishing



Note

Use a CARBON DIOXIDE (CO₂) extinguisher in the event of a fire in the robot or controller!

1 Safety

1.2.6 Safety data

1.2.6 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

In addition to these standards covering general machinery safety, a number of more specialized standards referred to as normative, must also be fulfilled. See EN ISO 10218-1 chapter *Normative references*.

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.

Continues on next page

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

- Enabling device
- Emergency stop on operator panel
- 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.

IRC5C Compact

Safety function	Calculated $MTTF_D$ [years]	DC_{avg}
Emergency stop inputs	56	Medium
Automatic stop input	59	Medium
General stop input	59	Medium
Superior stop input	59	Medium
Limiting switch input (without customer connection)	176	Medium
Three-position enabling device inputs	46	Medium
Emergency stop status outputs	263	Medium
SafeMove2 functions (option)		
Protective stop category 0	52	Medium
Protective stop category 1	370	Low
Emergency stop category 0	52	Medium
Emergency stop category 1	370	Low
Emergency stop safe fieldbus output	160	Low
Speed supervision category 0	52	Medium
Speed supervision category 1	370	Low
Speed supervision safe fieldbus output	370	Low
Position supervision category 0	52	Medium
Position supervision category 1	370	Low
Position supervision safe fieldbus output	370	Low

Continues on next page

1 Safety

1.2.6 Safety data

Continued

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	1.19x10E-07	d
Automatic stop input	1.03x10E-07	d
General stop input	1.03x10E-07	d
Superior stop input	1.03x10E-07	d
Limiting switch input (without customer connection)	4.29x10E-08	e
Three-position enabling device inputs	1.54x10E-07	d
Emergency stop status outputs	4.29x10E-08	e
SafeMove2 functions (option)		
Protective stop category 0	1.19x10E-07	d
Protective stop category 1	1.01x10E-07	d
Emergency stop category 0	1.19x10E-07	d
Emergency stop category 1	1.01x10E-07	d
Emergency stop safe fieldbus output	1.01x10E-07	d
Speed supervision category 0	1.19x10E-07	d
Speed supervision category 1	1.01x10E-07	d
Speed supervision safe fieldbus output	1.01x10E-07	d
Position supervision category 0	1.19x10E-07	d
Position supervision category 1	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.

1.3 Safety signals and symbols

1.3.1 Safety signals in the manual






Introduction to safety signals

This section specifies all dangers that can arise when doing the work described in the user manuals. Each danger consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel do not eliminate the danger.
- Instruction about how to eliminate danger to simplify doing the work.

Danger levels

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



Symbol	Designation	Significance
 xx0200000022	DANGER	Warns that an accident <i>will</i> occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on.
 xx0100000002	WARNING	Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0200000024	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
 xx0100000003	CAUTION	Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

Continues on next page

1 Safety

1.3.1 Safety signals in the manual

Continued

Symbol	Designation	Significance
 xx0100000004	NOTE	Describes important facts and conditions.
 xx0100000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

1.3.2 Safety symbols on controller labels

Introduction to labels

This section describes safety symbols used on labels (stickers) on the controller. Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.



Note






The safety and health symbols on the labels on the product must be observed. Additional safety information given by the system builder or integrator must also be observed.

Types of labels

Both the manipulator and the controller are marked with several safety and information labels, containing important information about the product. The information is useful for all personnel handling the robot, for example during installation, service, or operation.

The information labels can contain information in text (English, German, and French).

Symbols on safety labels


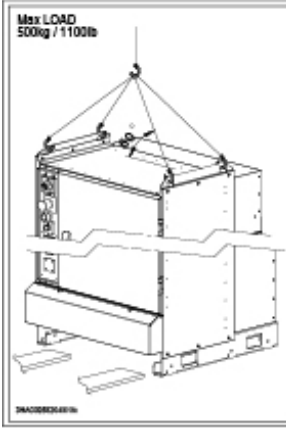
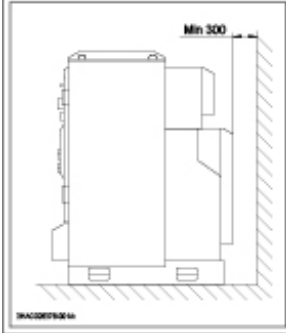

Label	Description
 xx1400001151	Electrical shock
 xx1400001162	ESD sensitive components inside the controller.
 xx1400001161	Disconnect power supply before servicing the controller.
 xx1400001160	Disconnect power supply before servicing the controller (only for welding equipment).
 xx1700000354	Disconnect power supply before servicing the controller (for controllers without UL mains switch).

Continues on next page


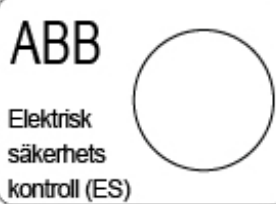



1 Safety

1.3.2 Safety symbols on controller labels

Continued

Label	Description
 <p>xx1400001156</p>	<p>High voltage inside the module even if the main switch is in the OFF position.</p>
 <p>xx1400001157</p>	<p>Lifting instruction for the IRC5 controller.</p>
 <p>xx1400001155</p>	<p>Required installation space.</p>
 <p>xx1400001154</p>	<p>QR code for <i>ABB Basic Care</i> service agreement.</p>




Continues on next page

Label	Description
 <p>xx1400001152</p>	<p>Read the user manual before servicing.</p>
 <p>xx1400001158</p>	<p>Electrical safety check of the robot system (internal).</p>
 <p>xx1400001159</p>	<p>Functional test of the robot system (internal).</p>
 <p>xx1400001163</p>	<p>Rating label</p>
 <p>xx1400002060</p>	<p>UR certified (component)</p>

1 Safety

1.3.2 Safety symbols on controller labels

Continued

Label	Description
 <p>xx1400002061</p>	UL certified (robot with controller)
 <p>xx1700000355</p>	SafeMove label (for <i>SafeMove Basic</i> and <i>SafeMove Advanced</i> software).
 <p>xx1700000353</p>	Safety UL label (for the <i>Functional Safety</i> solution together with UL mark).

1.4.1 DANGER - Make sure that the main power has been switched off!

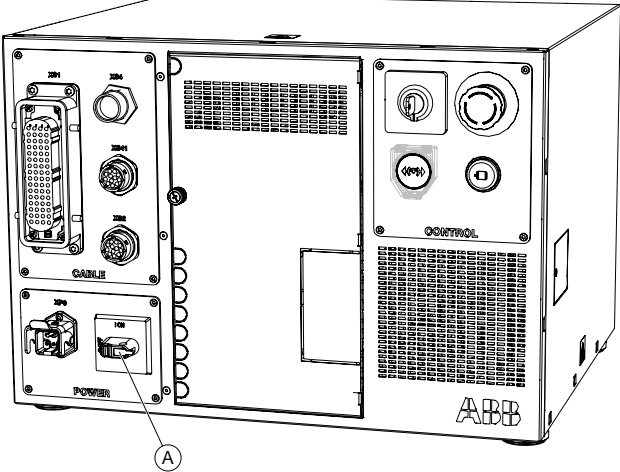
1.4 Safety related instructions

1.4.1 DANGER - Make sure that the main power has been switched off!

Description

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid these dangers, do not proceed working before eliminating the danger as detailed below.

Elimination, IRC5 Compact Controller

	Action	Note/illustration
1	Switch off the main power switch on the controller cabinet.	<p>Note that the position of the main switch can vary depending on the year model.</p>  <p>xx0900000313</p> <p>A: Main power switch</p>
2	Disconnect the input power cable from the wall socket.	

1 Safety

1.4.2 WARNING - The unit is sensitive to ESD!

1.4.2 WARNING - 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.

Elimination

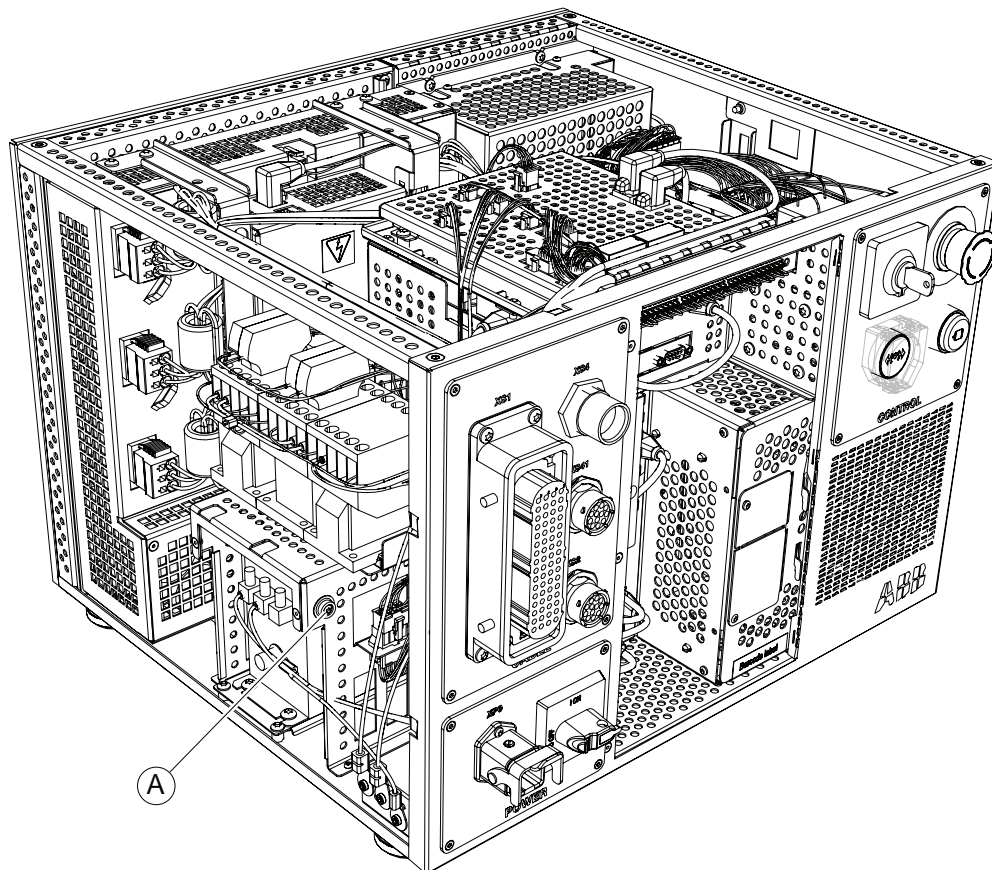
	Action	Note
1	Use a wrist strap.	Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
2	Use an ESD protective floor mat.	The mat must be grounded through a current-limiting resistor.
3	Use a dissipative table mat.	The mat should provide a controlled discharge of static voltages and must be grounded.

Continues on next page

Location of wrist strap button

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

IRC5 Compact Controller



xx1400001622

A	Wrist strap button
---	--------------------

1 Safety

1.4.3 CAUTION - Never stand on or use the cabinet as a ladder

1.4.3 CAUTION - Never stand on or use the cabinet as a ladder

Description

To avoid personal injury or damaging the product, it is never allowed to stand on the cabinet. Nor is it allowed to use the cabinet as a ladder.

1.4.4 CAUTION - Make sure that there are no loose screws or turnings

1.4.4 CAUTION - Make sure that there are no loose screws or turnings

Description

To avoid damaging the product, make sure that there are no loose screws, turnings or other parts inside the cabinet after work has been performed.

1 Safety

1.4.5 CAUTION - Close the cabinet door

1.4.5 CAUTION - Close the cabinet door

Description

The cabinet door must be closed properly when the robot system is in production. If a door is not properly closed, the cabinet does not comply with the protection class IP54 or IP20. The shield for Electro Magnetic Compatibility is also affected if the door is not properly closed.



Note

To comply with IP54 all openings to the controller cabinet must be covered. This includes unconnected connectors which must be fitted with covers.

1.4.6 CAUTION - Hot components in controller

Description

Units and heat sinks are HOT after running the robot!

Touching the units and heat sinks may result in burns!

With higher environment temperature more surfaces on the controller get HOT and may result in burns.

1 Safety

1.4.7 CAUTION - Make sure that all mode selector keys are kept safe

1.4.7 CAUTION - Make sure that all mode selector keys are kept safe

Description

The key for the mode selector on the IRC5 controller is in standard designed to work with all mode switches on all IRC5 controllers. It is the responsibility of the robot system owner to make sure that all keys only are accessible to authorized personnel, to prevent misuse.

1.4.8 Recover from emergency stops

Overview

Recovering from an emergency stop is a simple but important procedure. This procedure ensures that the robot system is not returned to production while maintaining a hazardous condition.

Reset the latch of emergency stop buttons

All push-button style emergency stop devices have a latching feature that must be released in order to remove the emergency stop condition of the device.

In many cases this is done by twisting the push-button as marked, but there are also devices where you pull the button to release the latch.

Reset automatic emergency stop devices

All automatic emergency stop devices also have some kind of latching feature that must be released. Consult your plant or cell documentation to see how your robot system is configured.

Recover from emergency stops

	Action
1	Make sure the hazardous situation that resulted in the emergency stop condition no longer exists.
2	Locate and reset the device or devices that gave the emergency stop condition.
3	Press the Motors On button to recover from the emergency stop condition.

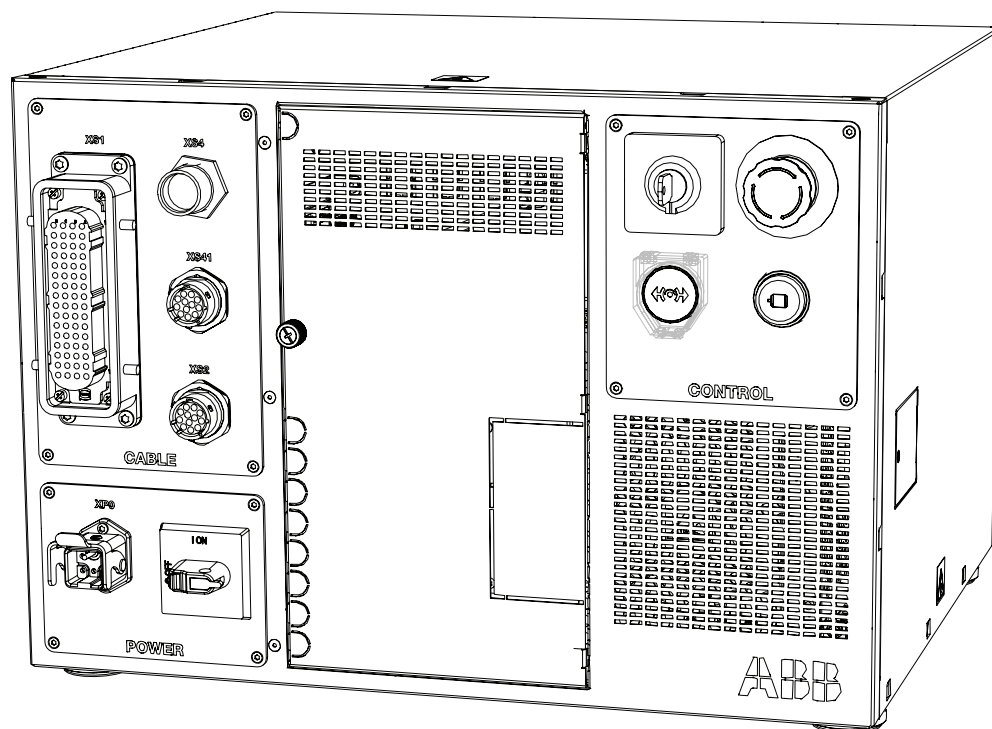
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2 Installation and commissioning

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 Installation and commissioning

2.2 Installation activities

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 45 .
2	Install the IRC5 Compact controller.	How to install the IRC5 Compact controller is described in section On-site installation on page 47 .
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 63 .
4	Connect power supply to the IRC5 Compact controller.	How to connect power supply is described in section Connecting power supply on page 71 .
5	Connect the FlexPendant to the IRC5 Compact controller.	How to connect the FlexPendant is described in section Connecting a FlexPendant on page 57 .
6	Miscellaneous connections.	<p>How to connect MOTORS ON/MOTORS OFF circuits is described in section The MOTORS ON/MOTORS OFF circuit on page 80.</p> <p>How to connect buses, for example DeviceNet, is described in the Application manual for the respective bus.</p> <p>How to connect I/O units to the IRC5 Compact controller is described in the Application manual for the respective I/O unit.</p> <p>How to connect a PC to the controller is described in manual <i>Operating manual - RobotStudio</i> .</p> <p>How to connect to a network is detailed in section Connectors on the computer unit on page 58.</p>

2.3 Unpacking the controller

General

Before unpacking and installing the robot system, read the safety regulations and other instructions very carefully. These are found in Chapter [Safety on page 15](#).

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

When unpacking the controller, check 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)
Max. ambient humidity	Maximum 95% at constant temperature.

After storage, the operating conditions must be met for at least 4 hours before switching on the controller (see [Operating conditions on page 45](#) below).

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)
Max. ambient humidity	Maximum 95% at constant temperature.

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

Continues on next page

2 Installation and commissioning

2.3 Unpacking the controller

Continued

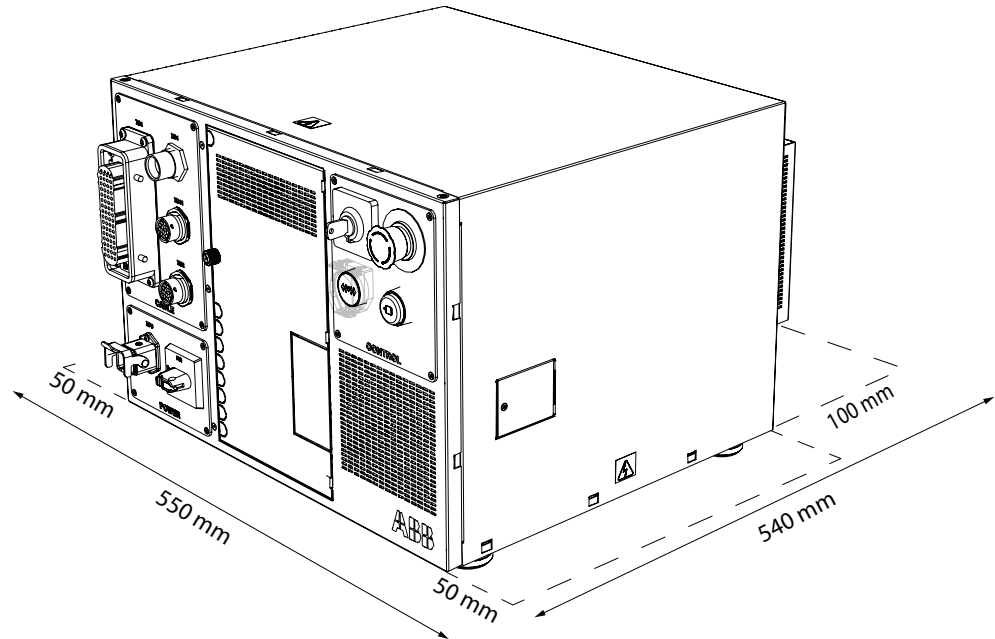
Equipment	Protection class
FlexPendant	IP54

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).

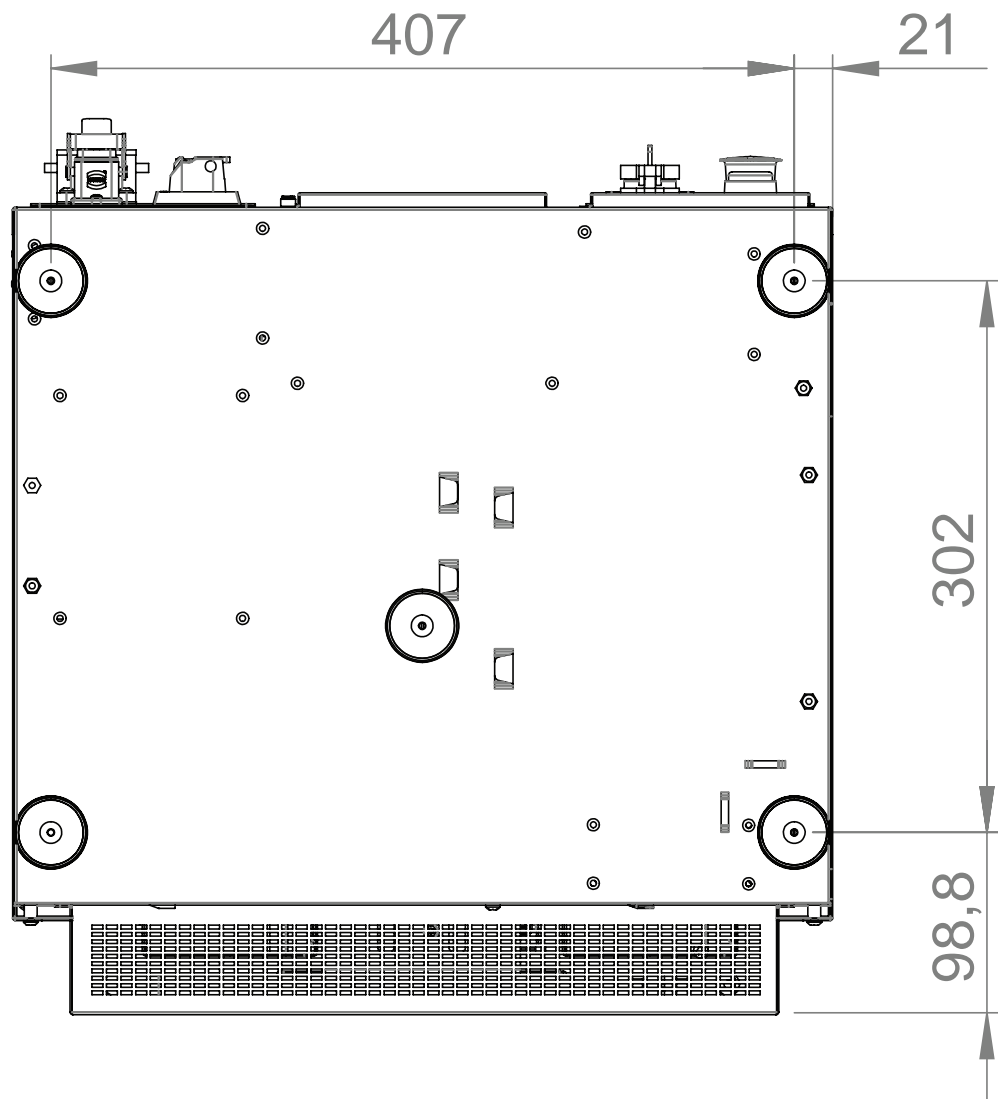
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2 Installation and commissioning

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.



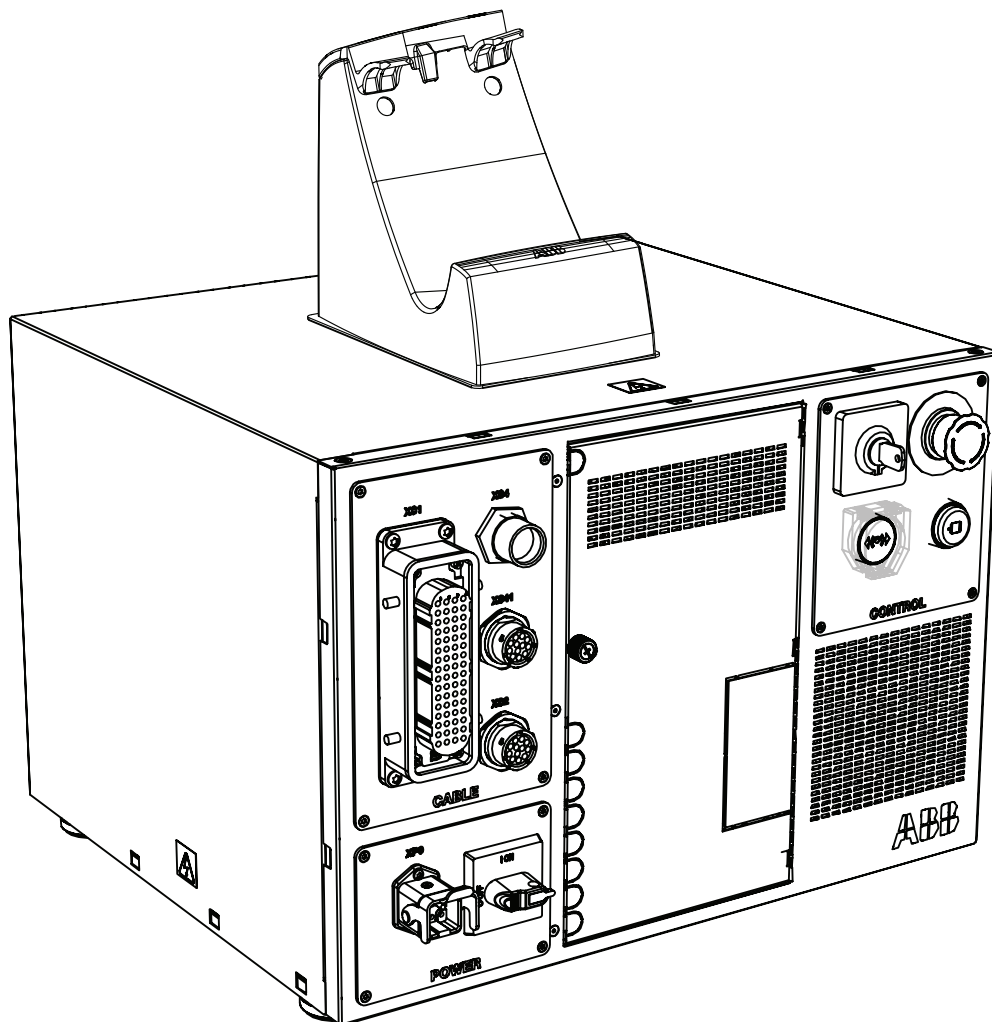
Note

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

Location

One possible placement of the FlexPendant holder is shown in the illustration below, but it can also be placed at another location.



xx1400001368



Note

Do not position the FlexPendant holder so that it is an obstacle in the place of work.

Required equipment

Equipment	Art.no
FlexPendant holder	For spare parts, see Miscellaneous parts on page 212 .

Continues on next page

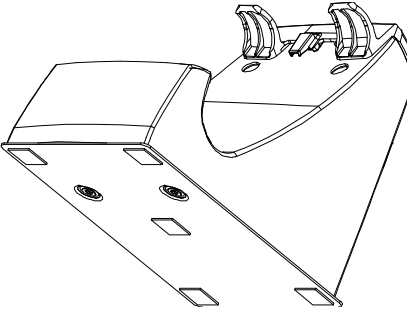

2 Installation and commissioning

2.4.2 Mounting the FlexPendant holder

Continued

Mounting the FlexPendant holder

Use this procedure to mount the FlexPendant holder.

	Action	Note/illustration
1	Remove the protective liner from the tape.	 xx0500002546
2	Press the mounting plate with FlexPendant holder against the surface where it should be mounted.  Note The surface must be clean and dry.	

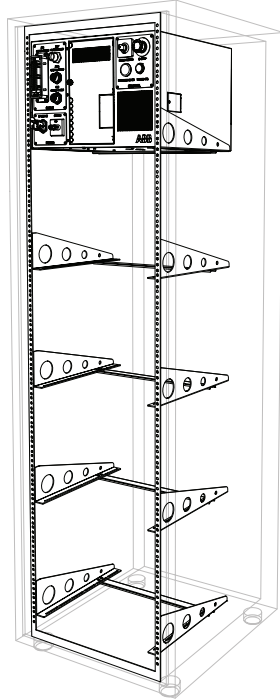
 **Note**

For rack mounted IRC5 Compact, do not place the FlexPendant holder on top of the rack. Find a solution where the FlexPendant is placed so that it cannot fall to the floor from a high position.

2.4.3 Mounting the controller in a 19" cabinet

General

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



xx1400002112

Required equipment

Equipment	Information
Mounting kit	3HAC052262-001
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
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.


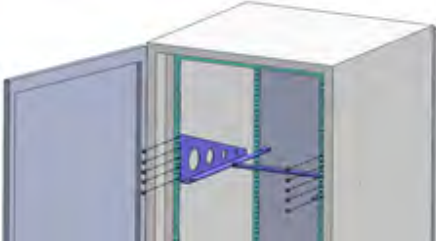

	Action	Info/illustration
1	Remove the five feet from the cabinet.	

Continues on next page

2 Installation and commissioning

2.4.3 Mounting the controller in a 19" cabinet

Continued

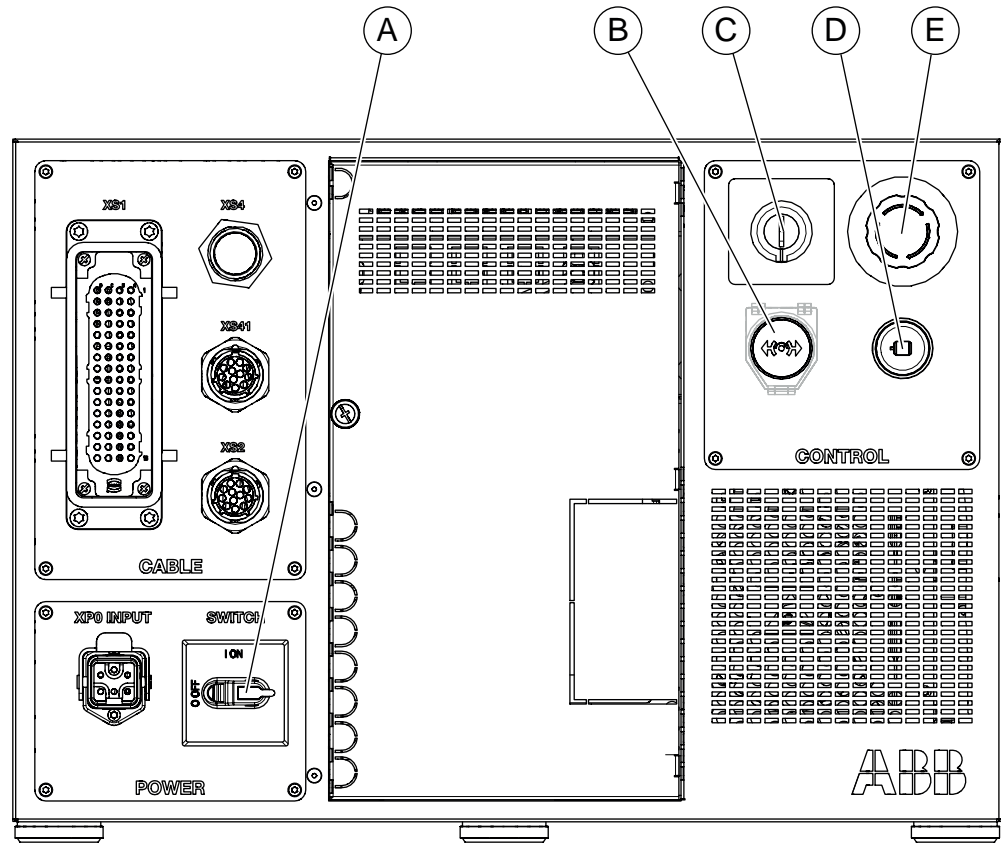
	Action	Info/illustration
2	Assemble the mounting brackets.	 <p data-bbox="959 907 1066 925">xx1400002159</p>
3	Fit the right, left and middle mounting brackets in the 19 inch cabinet.	 <p data-bbox="959 1211 1066 1229">xx150000232</p>
4	Insert the IRC5 Compact in the 19 inch cabinet so that the latches fit in the recesses in the back of the mounting brackets. Fasten the IRC5 Compact to the mounting brackets with the attachment screws.	 <p data-bbox="959 1615 1066 1632">xx1400002160</p>

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 54](#). The other buttons and switches are described in *Operating manual - IRC5 with FlexPendant*.

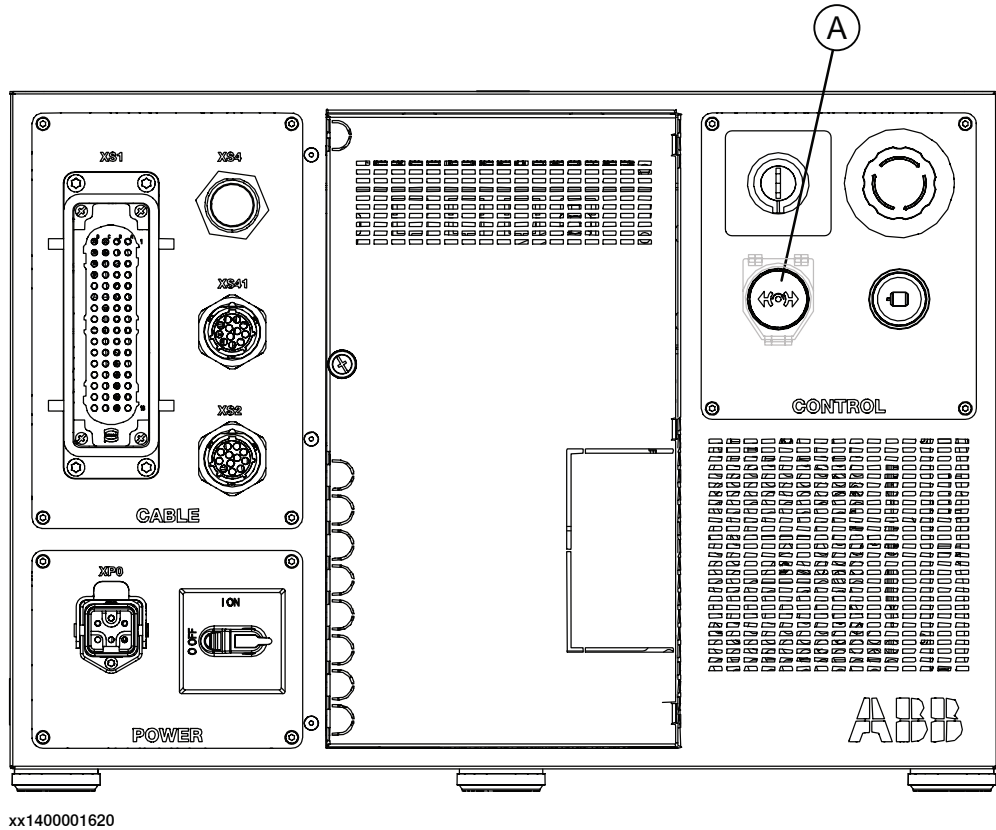
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2 Installation and commissioning

2.5.1.1 Brake release button

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.

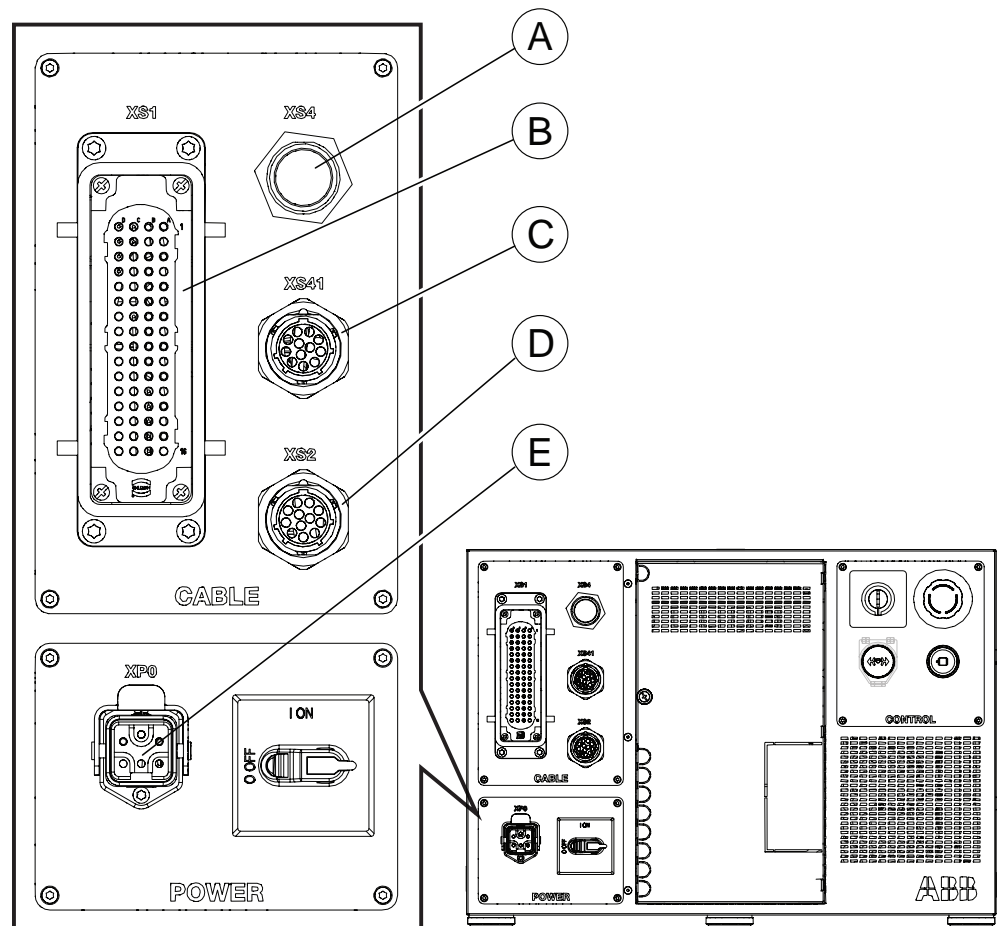


CAUTION

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 Installation and commissioning

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

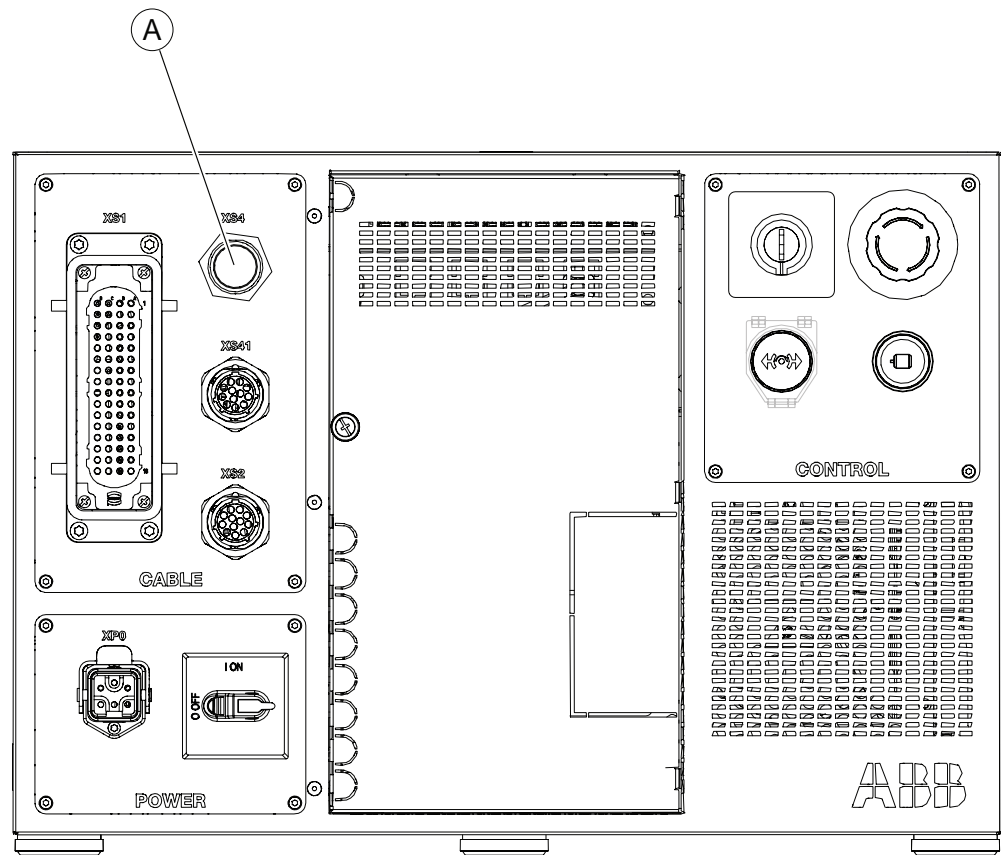
Location of FlexPendant connector

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



CAUTION

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



xx1400001371

A	FlexPendant connector
---	-----------------------

Connecting a FlexPendant

	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.	

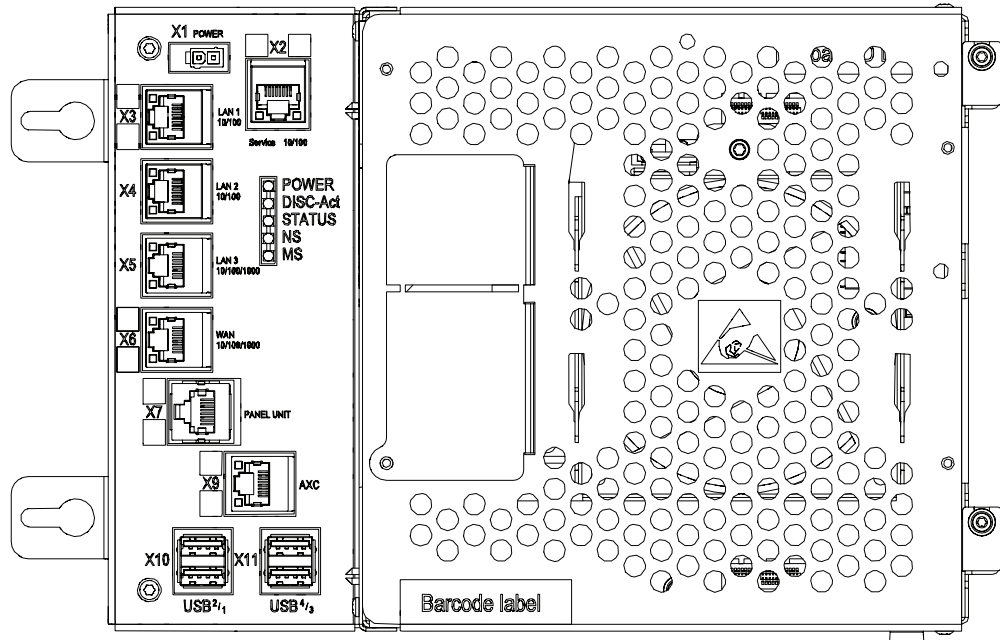
2 Installation and commissioning

2.6.1.3 Connectors on the computer unit

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 *Working online in Operating manual - RobotStudio*.

WAN port

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

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

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



Note

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

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

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

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



Note

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

LAN ports

The LAN 1 port is dedicated for connecting the FlexPendant.

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 Installation and commissioning

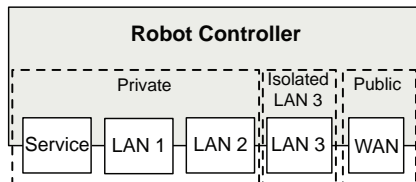
2.6.1.3 Connectors on the computer unit

Continued

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

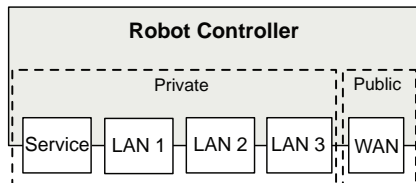
Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later)

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.



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*.



xx1500000394



Note

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

USB ports

The USB ports are intended for connecting USB memory devices.



Note

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

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

2.6.1.4 Connecting a serial channel to the controller

General

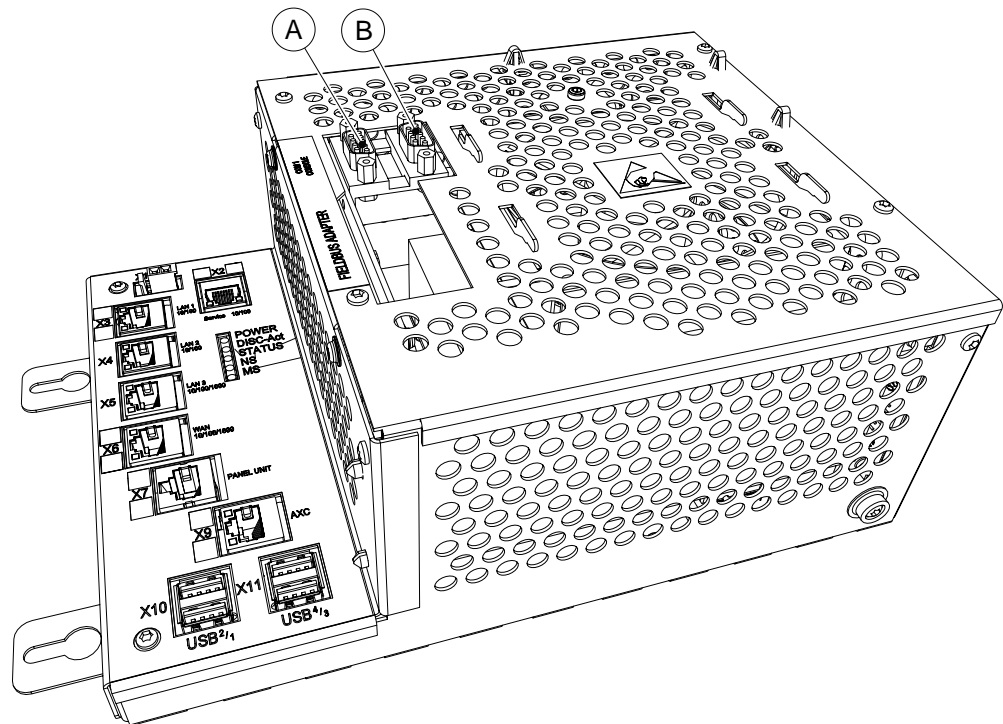
The serial channel is an option. To be able to connect a serial channel to the controller, the main computer needs to be equipped with the expansion board DSQC1003.

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 94](#).

Location

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



xx130000610

A	COM1
B	CONSOLE



Note

The CONSOLE connector is used for debugging purposes only.

Continues on next page

2 Installation and commissioning

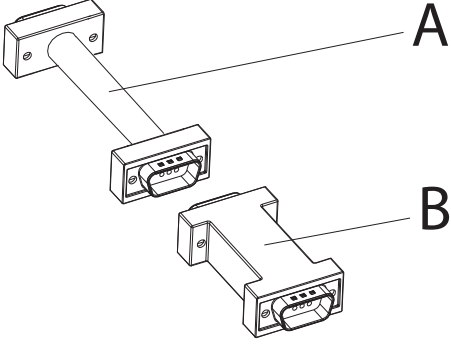
2.6.1.4 Connecting a serial channel to the controller

Continued

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.	<p>A cable is needed between the serial channel connector and the adapter.</p>  <p>xx130000854</p> <p>A cable B adapter</p>

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.
Measuring signals Class 2 (slightly sensitive)	Analog measuring 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 mm ² or AWG 18.
Control signals	Shielded cable.
Measuring 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

2 Installation and commissioning

2.6.2 Connecting cables to the controller

Continued



Note

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

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	<ul style="list-style-type: none">• These signals generate a lot of interference and must be laid separate from control, measuring, 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 would also be a risk of overheating depending on the load.
Control signals	<ul style="list-style-type: none">• 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.
Measuring 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

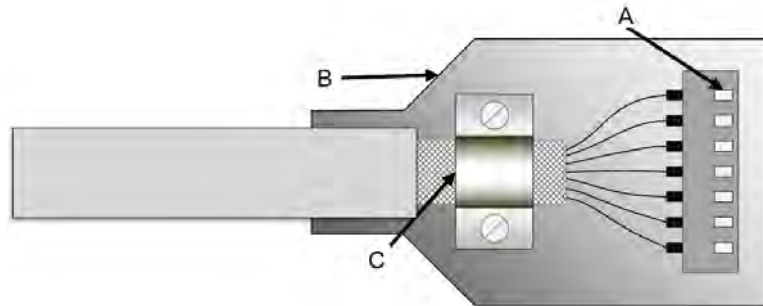
- The best method for shielding is to ground the shield at both ends of the cable, provided the ends grounding are at the same potential.
- The optimum shielding is a combination of foil and braid screens.

Continues on next page

- 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:



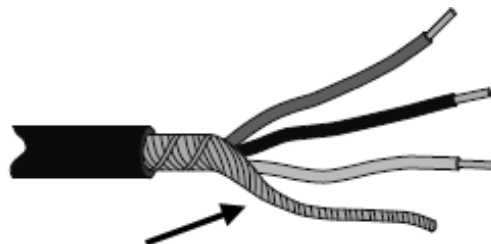
xx1700001320

- 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.



xx1700001321

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.

Continues on next page

2 Installation and commissioning

2.6.2 Connecting cables to the controller

Continued

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 mm² copper (AWG14) in the IRC5 Compact controller, and not less than 10 mm² 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.

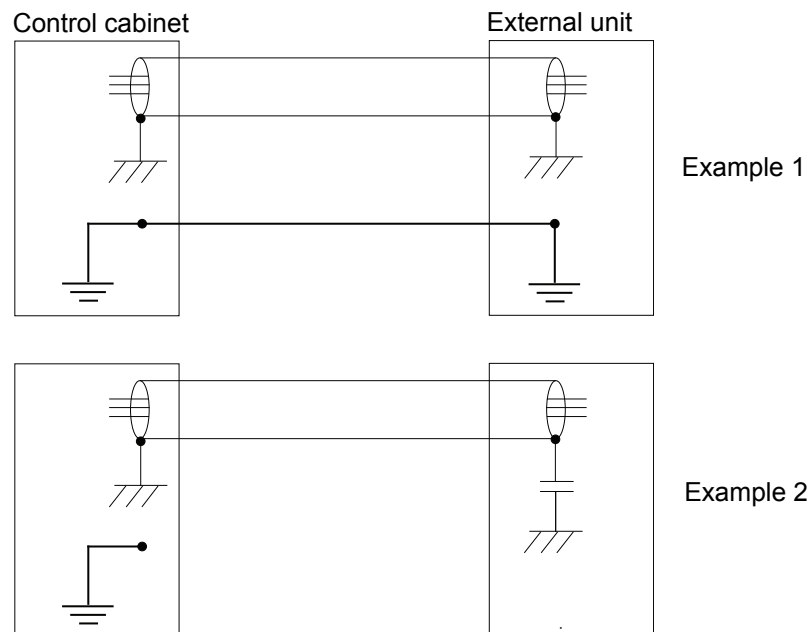
Grounding installation

For information on how to install the ground for the IRC5 Compact controller cabinet, see [Grounding on page 73](#).

For information on how to install the ground for the manipulator, see the corresponding product manual.

Examples

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



xx1200000960

Continues on next page

Example 1:

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

Example 2:

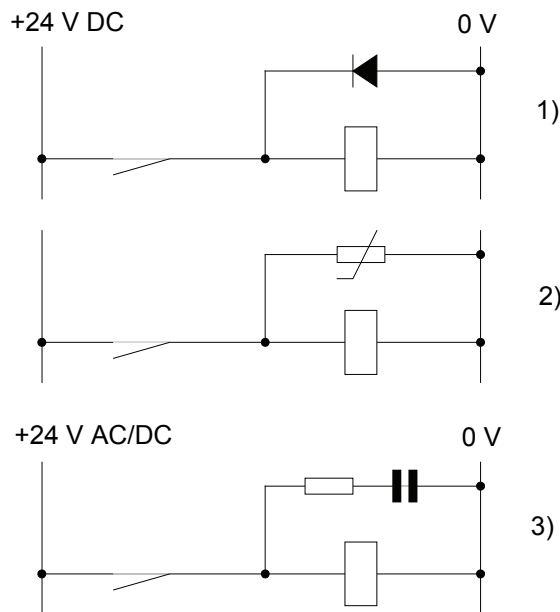
- If the cable is terminated where a good ground is not available a noise suppression capacitor can be used. The screens of the 2 cables must be connected as shown in the figure, but not connected to the chassis of the unit.

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.



xx120000961

- 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 Installation and commissioning

2.6.3 Power supply system requirements

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.

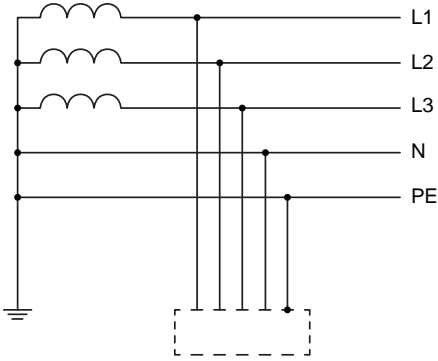
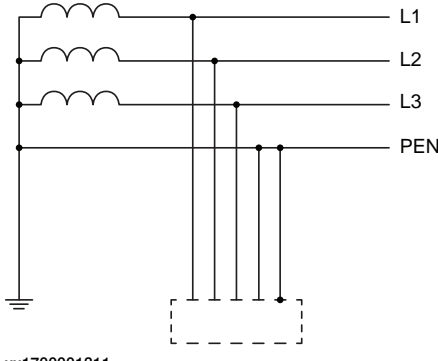
First letter	Type of ground connection
T	Direct connection of one point to ground.
I	Not connected to ground or connected to ground via a high impedance.

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:

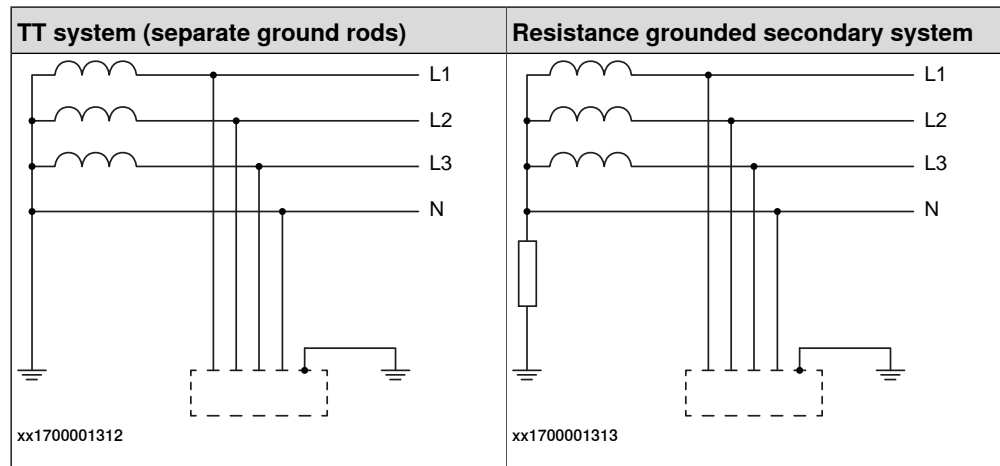
TN-S system	TN-C system
PE and N are separate conductors that are connected together only near the transformer.	A combined PEN conductor is used as both a PE and an N conductor.
 <p>xx1700001310</p>	 <p>xx1700001311</p>

Not recommended power supply systems

The following systems are not recommended by ABB:

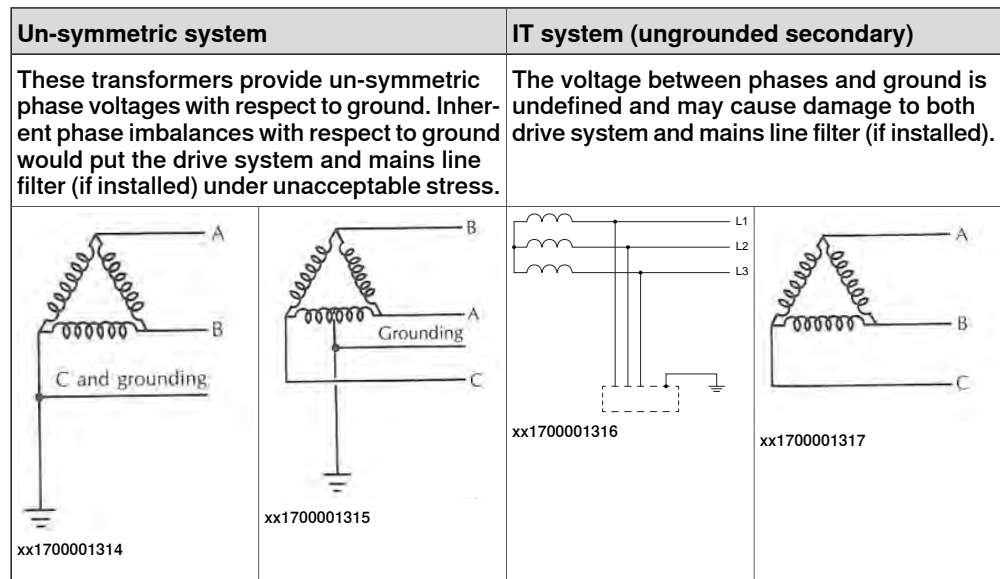
TT system (separate ground rods)	Resistance grounded secondary system
If this kind of system must be used, the grounding path resistance between ground 1 and 2 shall not exceed 0.1 Ohm, for more information refer to UL1740.	If this kind of system must be used, the voltage variations between any line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

Continues on next page



Not allowed power supply systems

The following systems are not allowed by ABB:



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 69](#).
- 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, see below.
- Mains power supply is out of standard limits, like voltage variations (+10% to -15%), frequency variations (48.5 Hz to 61.8 Hz), harmonic (5%), voltage unbalance (2%), voltage surge, voltage dips/swells, and so on.

Continues on next page

2 Installation and commissioning

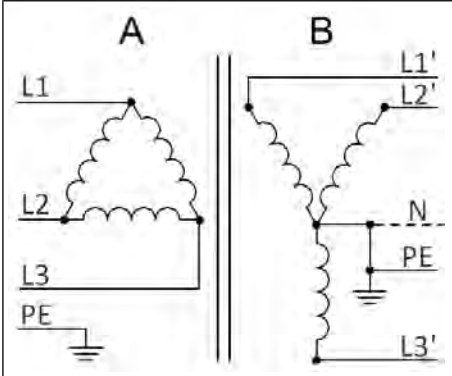
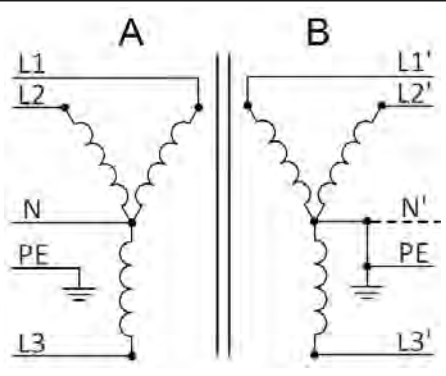
2.6.3 Power supply system requirements

Continued

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 (Δ/Y)	Wye-Wye isolation transformer (Y/Y)
 <p>xx1700001318</p>	 <p>xx1700001319</p>
A Primary/input B Secondary/output	

Mains line filter

A mains line filter is included in the IRC5 Compact controller.

A mains line filter in each robot cabinet is required for any of the below conditions:

- Robot system CE-labelling is required.
- Robot system will be installed in an EU country.
- 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, see below.
- Mains power supply is out of standard limits, like voltage variations (+10% to -15%), frequency variations (48.5 Hz to 61.8 Hz), harmonic (5%), voltage unbalance (2%), voltage surge, voltage dips/swells, and so on.

Other 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 74](#).

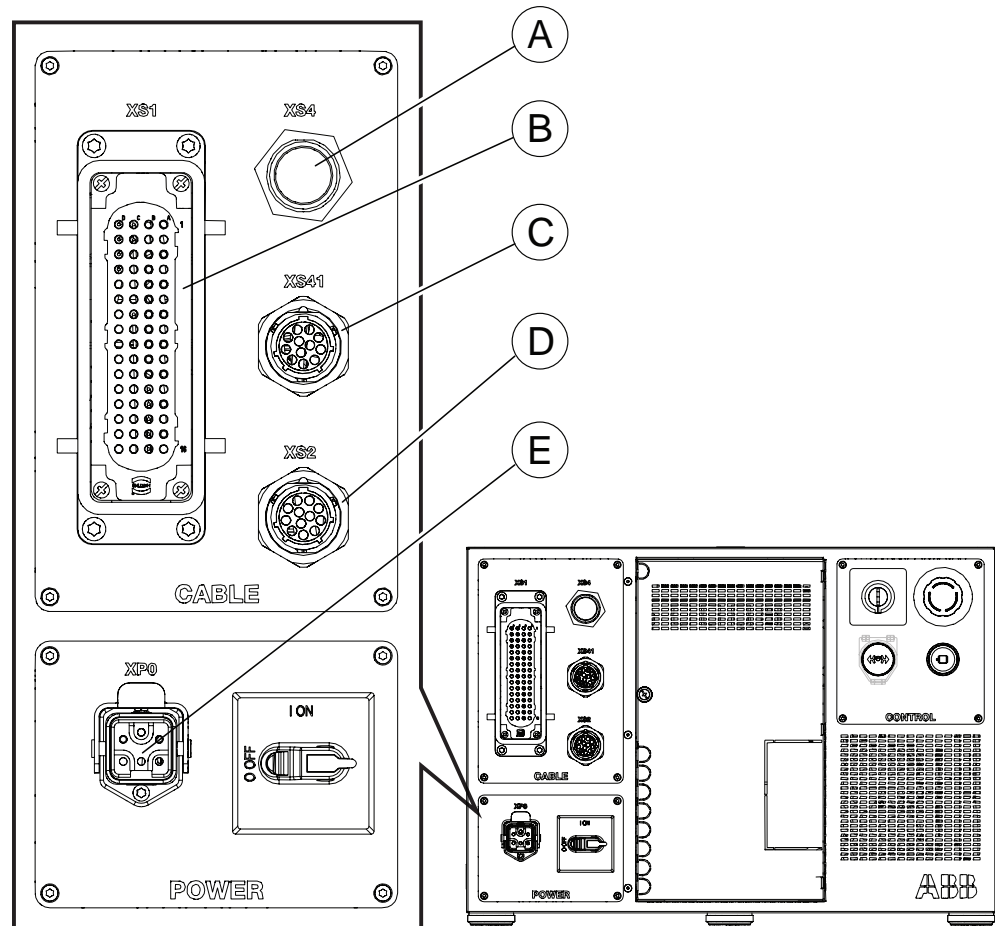


CAUTION

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

2 Installation and commissioning

2.6.4 Connecting power supply

Continued

	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 217 .

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.

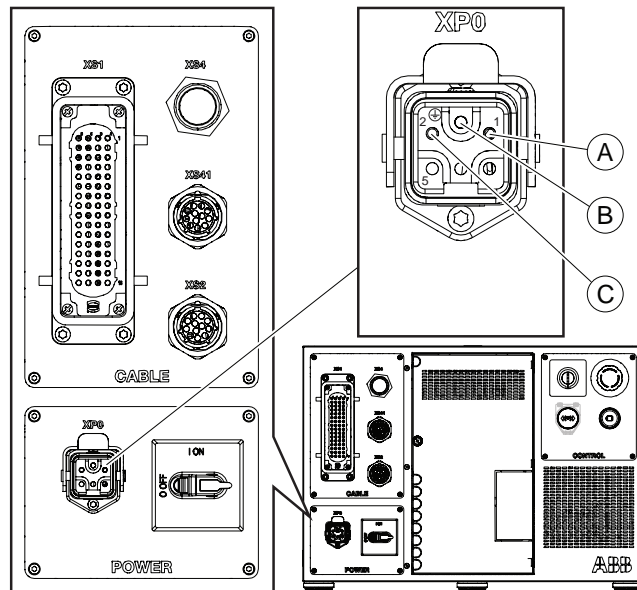
2.6.5 Grounding

Location



Note

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



xx170000507

	Description
A	XP0.1 Power line
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 217 .

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 Installation and commissioning

2.6.6 Fitting the 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

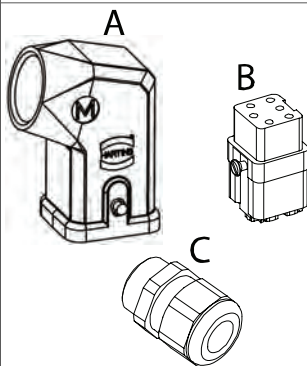
Included parts

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.

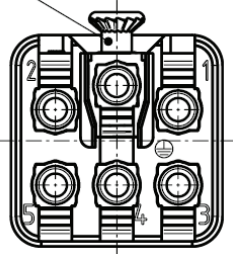
	Action	Note/illustration
1	Select a suitable single phase cable and earth cable, and cut it to desired length.	See previous specifications.
2	Fit the cable through the cable gland and hood.	 <p>xx0900000365</p> <ul style="list-style-type: none">• A: hood• B: female insert• C: cable gland

Continues on next page

2 Installation and commissioning

2.6.6 Fitting the connector

Continued

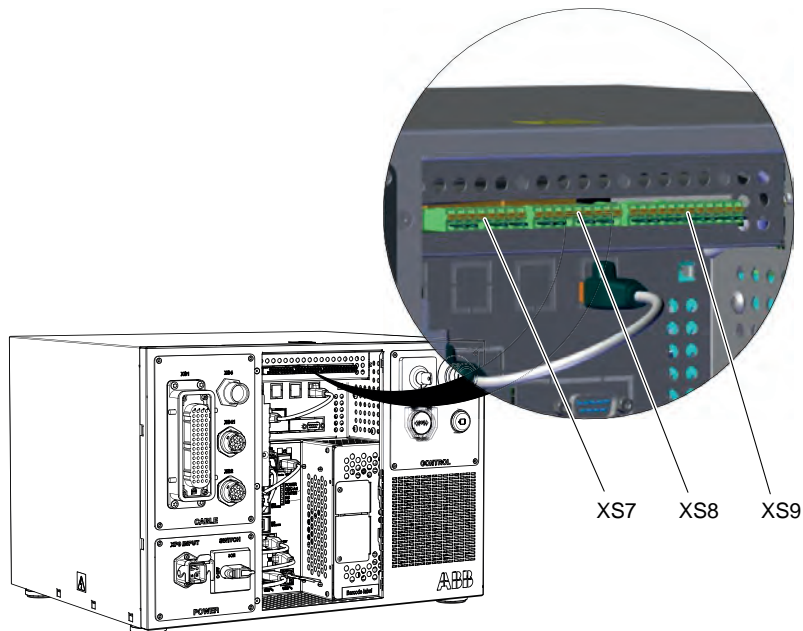
	Action	Note/illustration
3	Connect the wires according to the illustration. Use a screwdriver to make the contact tight.	 <p data-bbox="1117 584 1225 600">xx0900000366</p> <p data-bbox="1117 622 1310 651">For single phase:</p> <ul data-bbox="1150 651 1390 741" style="list-style-type: none">• X0.1 - power 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 Installation and commissioning

2.6.7 Descriptions for connectors XS7 - XS17

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 217](#).

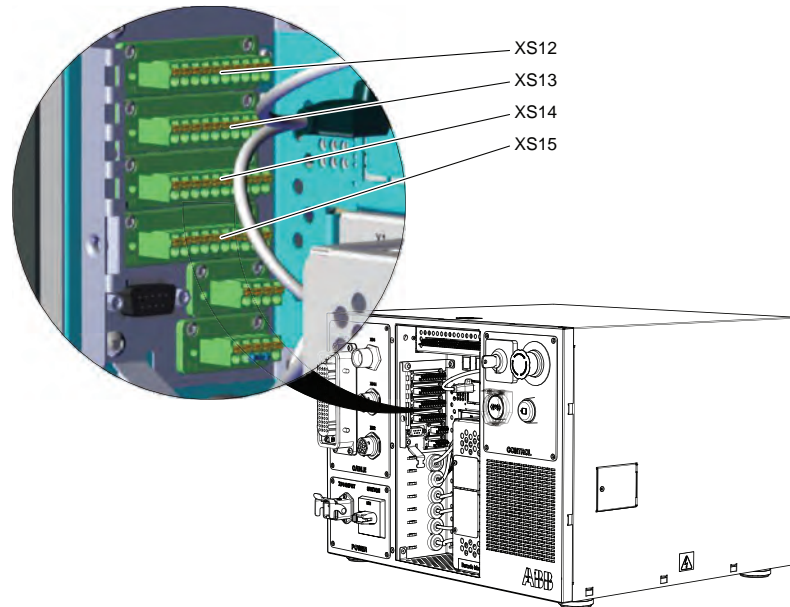


Note

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 217](#) for connection details.

Continues on next page

XS12, XS13, XS14 and XS15 I/O



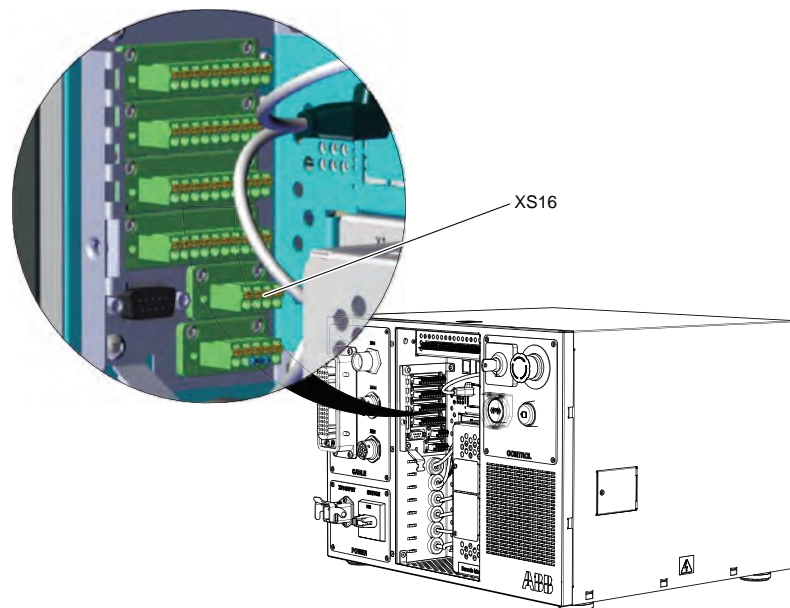
xx1500002926

The connectors are internally connected with the I/O unit (DSQC 652).

The connectors contain 16 digital input signals, 16 digital output signals, 24V and 0V for the outputs, and 0V for the inputs. Note that 24V and 0V needs external power supply.

For connection details, see circuit diagram for IRC5 Compact, see [Circuit diagrams on page 217](#).

XS16 Power Supply



xx1500002928

Continues on next page

2 Installation and commissioning

2.6.7 Descriptions for connectors XS7 - XS17

Continued

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.

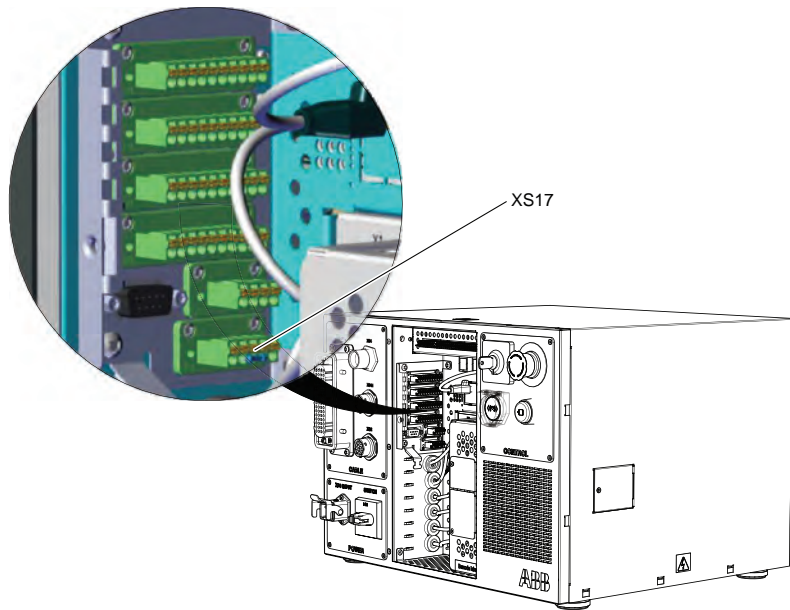
For connection details, see circuit diagram for IRC5 Compact controller.



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.

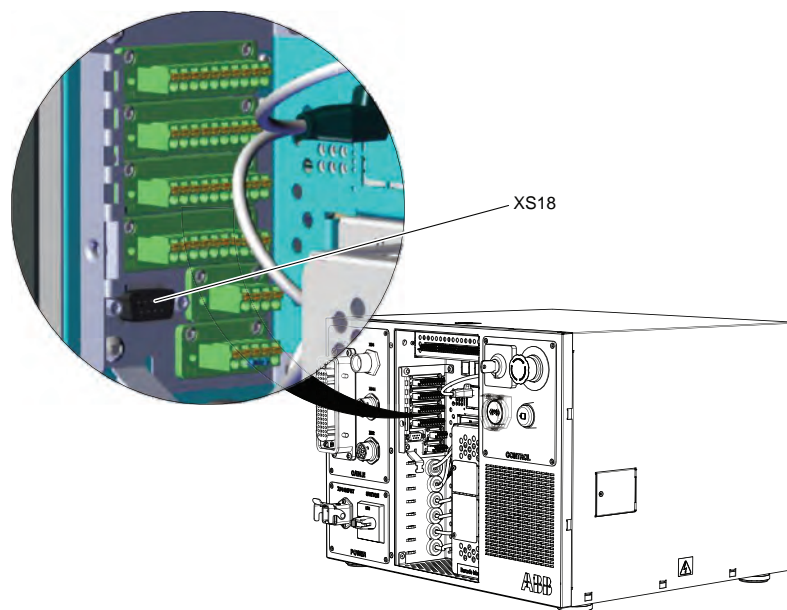


Note

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

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 Installation and commissioning

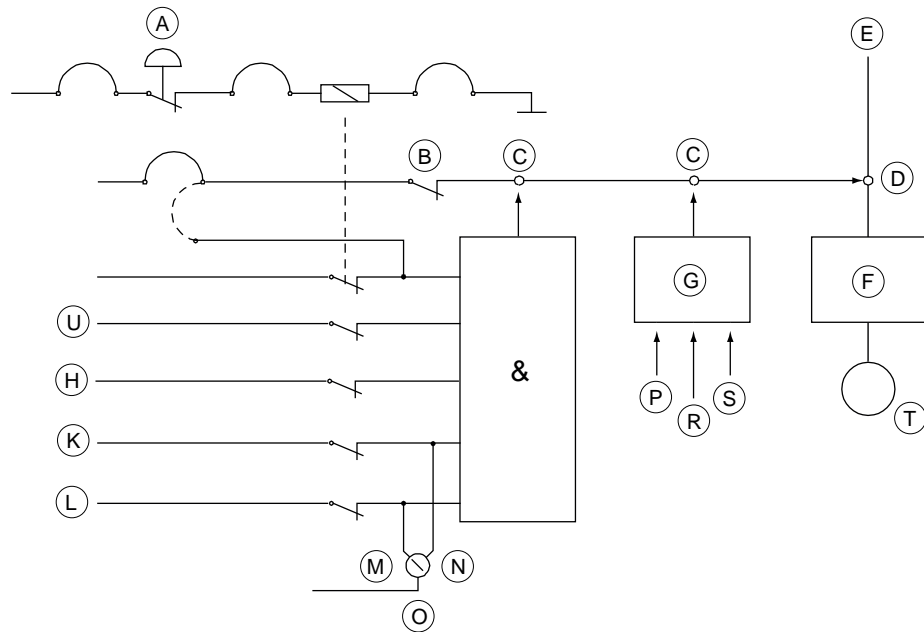
2.6.8 The MOTORS ON/MOTORS OFF circuit

2.6.8 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 the available customer connections, AS, GS, and ES.



xx160000280

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
T	Motor

Continues on next page

U	SS (Input from, for example, SafeMove board)
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Function of the MOTORS ON/MOTORS OFF circuit

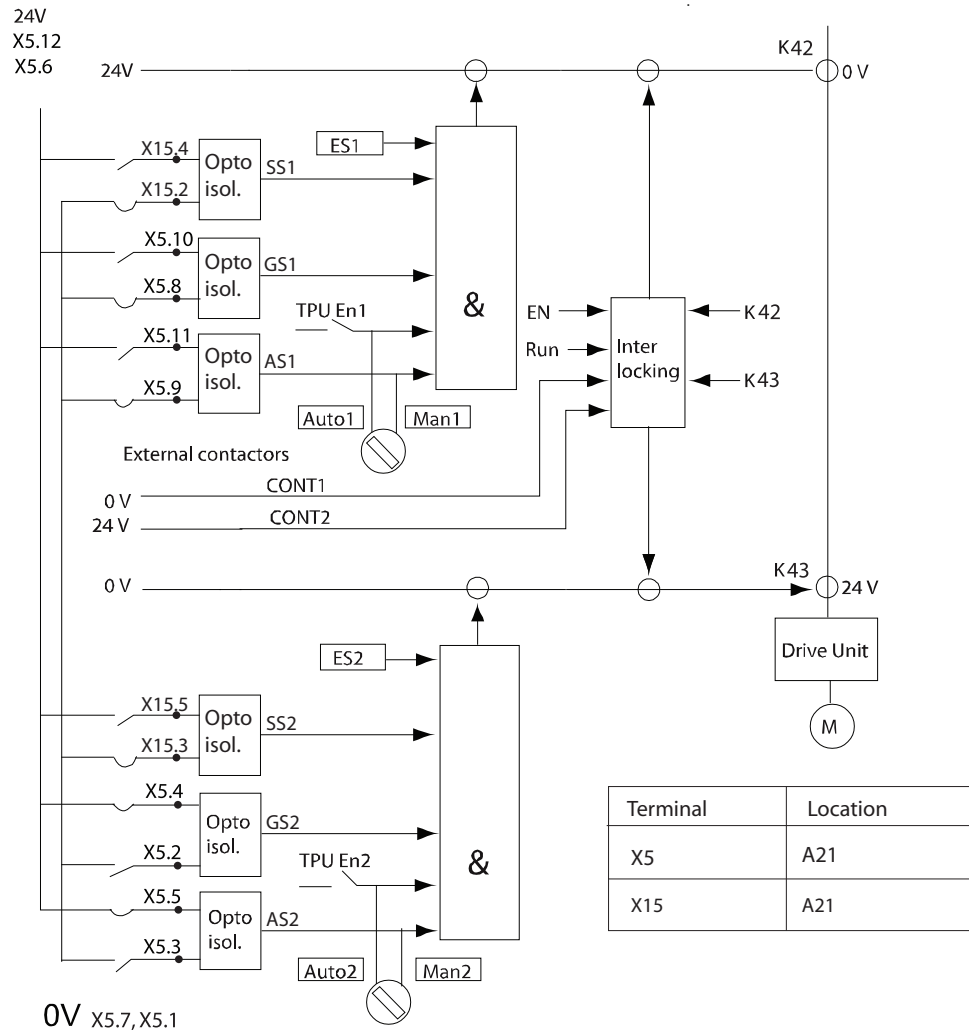
The circuit monitors all safety related equipment and switches. If any of the switches are opened, the MOTORS ON/MOTORS OFF circuit switches the power to Motors Off.

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.



xx1600000281

Technical data per chain	
Limit switch	Load: 300 mV Max. voltage drop: 1 V

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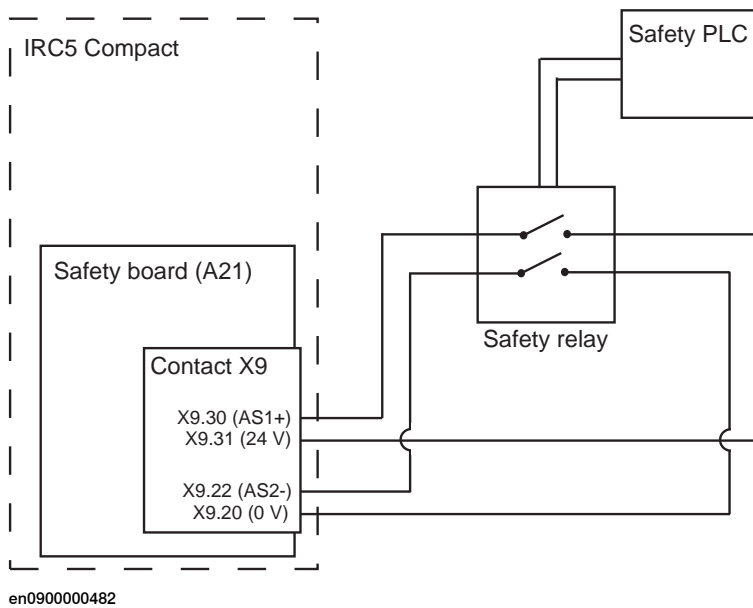
2 Installation and commissioning

2.6.8 The MOTORS ON/MOTORS OFF circuit

Continued

Technical data per chain	
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.

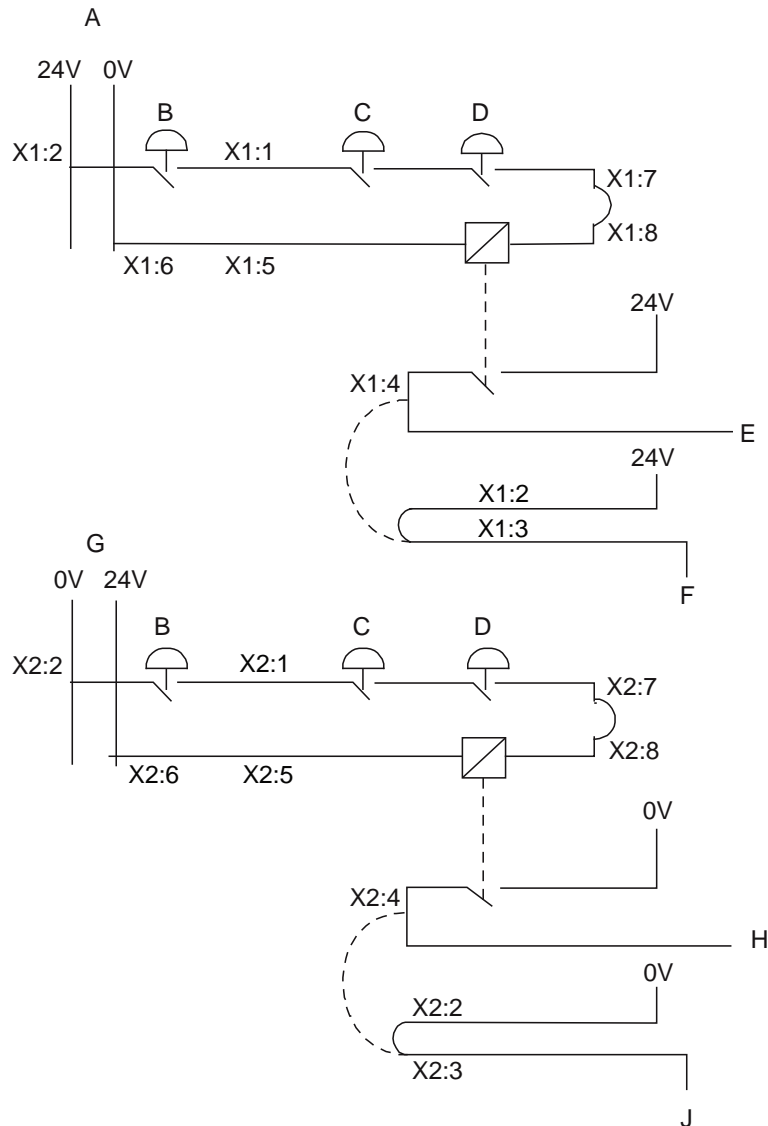


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Connection of ES1/ES2 on panel unit

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 Installation and commissioning

2.6.8 The MOTORS ON/MOTORS OFF circuit

Continued

J	Run chain 2 top
Technical data	
External supply of ES relay	24 VDC \pm 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

2.6.9 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 category configuration

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

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

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 networks, I/O blocks, RobAPI, etc. See *Application manual - Controller software IRC5*.

Pre-defined system input	Description
<i>Stop</i>	The RAPID program execution is stopped, and the manipulator is stopped on path with no deviation. The RAPID program cannot be started when this system input signal is high. This stop is similar to a normal program stop using stop button on the FlexPendant.
<i>SoftStop</i>	This is a faster stop of the manipulator than <i>Stop</i> . This stop is more stressing for the mechanics than normal stop, therefore there might be a minor deviation on path.
<i>QuickStop</i>	This is a faster stop of the manipulator than <i>Stop</i> and <i>SoftStop</i> . This stop is more stressing for the mechanics than normal stop or <i>SoftStop</i> , therefore there might be a deviation on path.
<i>Stop at End of Cycle</i>	Stops the RAPID program when the complete program is executed, that means when the last instruction in the main routine has been completed.

Continues on next page

2 Installation and commissioning

2.6.9 Programmable stop functions

Continued

Pre-defined system input	Description
<i>Stop at End of Instruction</i>	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.



Note

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

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. This is often used in for example trap routines.	\Quick: the stop will be a soft stop on path, as described for system input <i>SoftStop</i> , otherwise similar to a normal program stop. \AllMotionTasks: all robots will be stopped.
BREAK	The current move instruction and the program execution will be stopped immediately as a normal program stop. A restart 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 has to be reset to Main.	
EXITCYCLE	The current move instruction and program execution will be stopped immediately. The Program Pointer will be reset 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.	<p><code>\Stop</code>: 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.</p> <p><code>\PStop</code>: the robot will stop like after a normal program stop.</p> <p><code>\SStop</code>: the robot will stop on path but quicker than a normal program stop. This is similar to a system input <i>SoftStop</i>.</p> <p><code>\Sup</code>: the robot will continue to the <code>ToPoint</code>. If more than one search hit is found, an error will be reported.</p>

RAPID instructions valid for IRC5 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	<p>In the control system there is a monitoring function that can detect collisions. In such cases a stop will be initiated.</p> <p> WARNING</p> <p>Special care must be taken when restarting a machine that is stopped due to a collision. The robot might make a limited movement when restarted.</p> <p> WARNING</p> <p>The revolution counters might need to be updated after a collision to ensure path accuracy.</p>

2 Installation and commissioning

2.6.10 Emergency stop output

2.6.10 Emergency stop output

Emergency stop output through safety relay

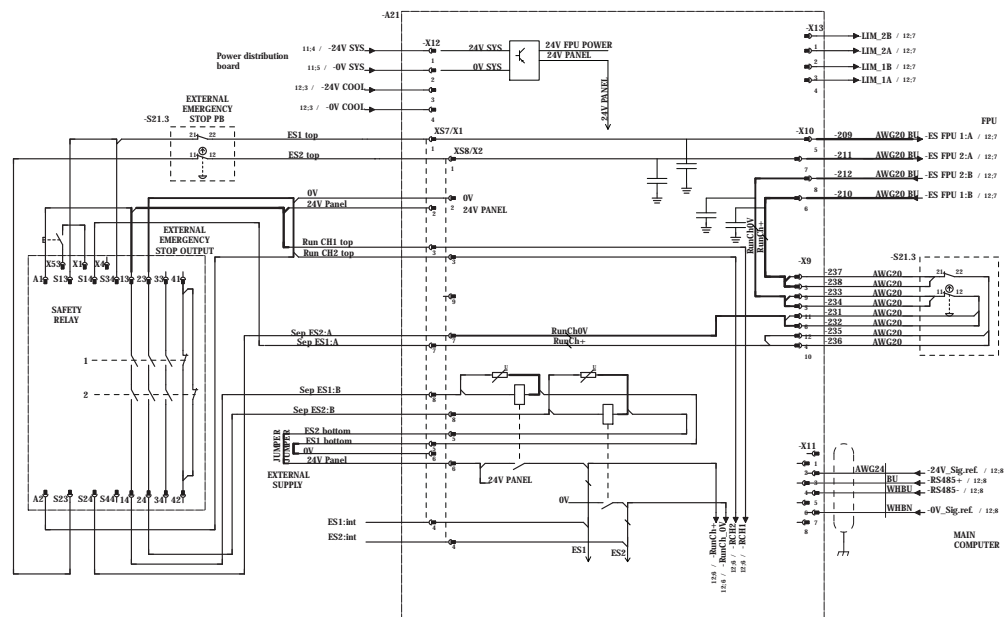
The safety board DSQC 400 does not have an emergency stop output. The emergency stop output can be extended by adding one safety relay. The diagram below shows the connection of a safety relay, type RT6 from Jokab Safety. ABB Robotics does not offer the safety relay option. The safety relay can be purchased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



Note

The safety board DSQC 400E has an integrated emergency output connector (X14). Therefore there is no need to use an external safety relay with this board. For more information on the safety board, see [Replacement of safety board on page 128](#) and [Controller system parts on page 209](#).


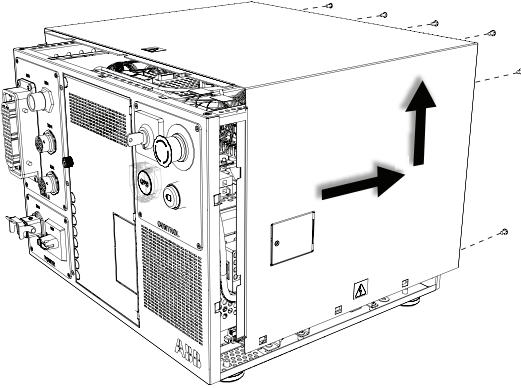
Safety relay on safety board DSQC 400



xx110000556

2.7 Opening the IRC5 Compact controller

Removing the controller cover

	Action	Info/illustration
1	<p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	<p>Remove the attachment screws on the cover.</p>	 <p>xx1400001364</p>
3	<p>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.</p>	

2 Installation and commissioning

2.8.1 Drive functions, general

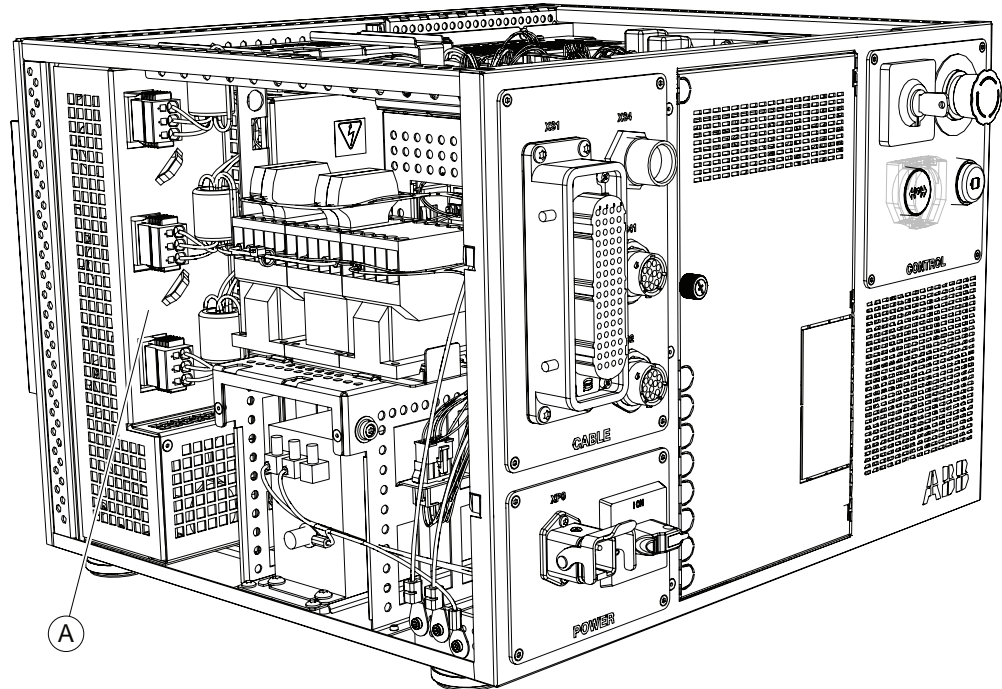
2.8 Drive system

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 165](#).

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 163](#).



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 Installation and commissioning

2.9.2 Connecting a USB memory

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



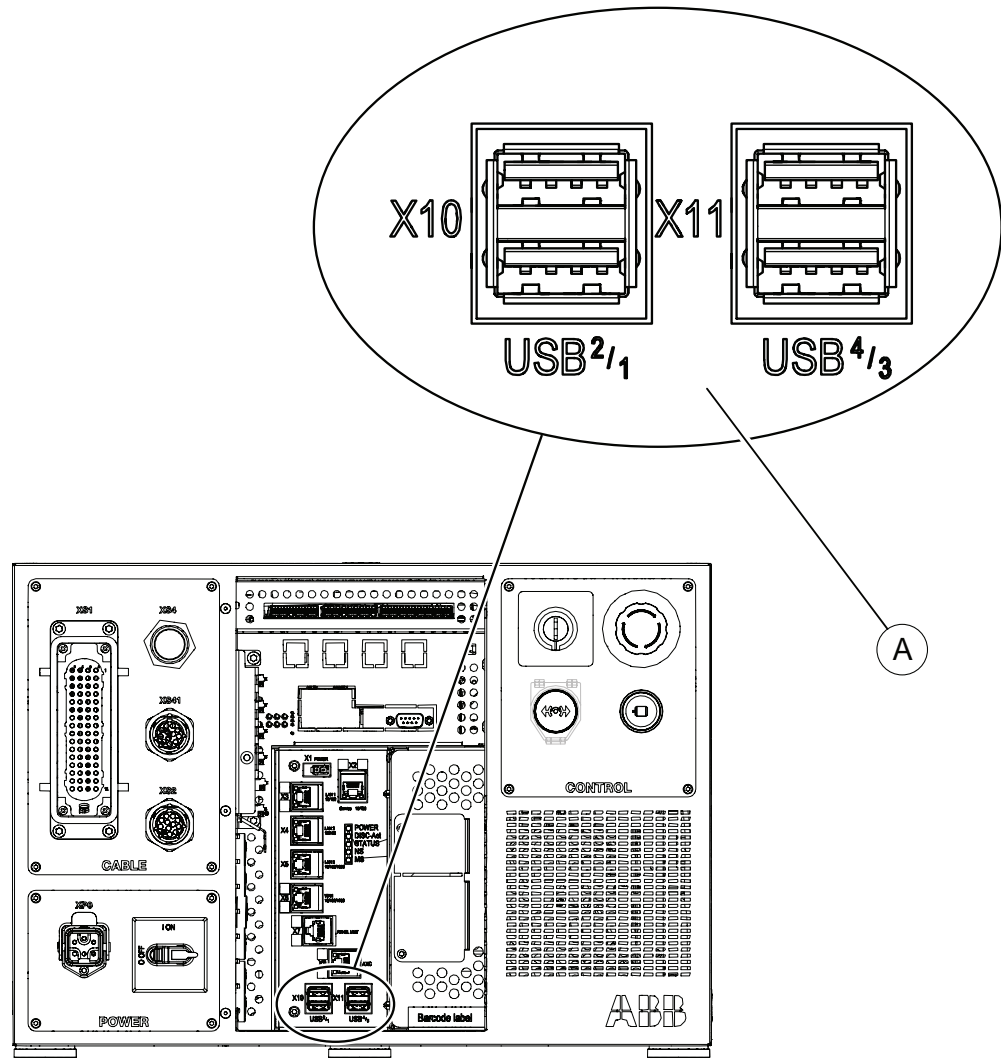
xx090000022

A	USB port (located behind rubber cover)
---	--

Continues on next page

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 Installation and commissioning

2.10.1 Definition of fieldbuses, IRC5

2.10 I/O system

2.10.1 Definition of fieldbuses, IRC5

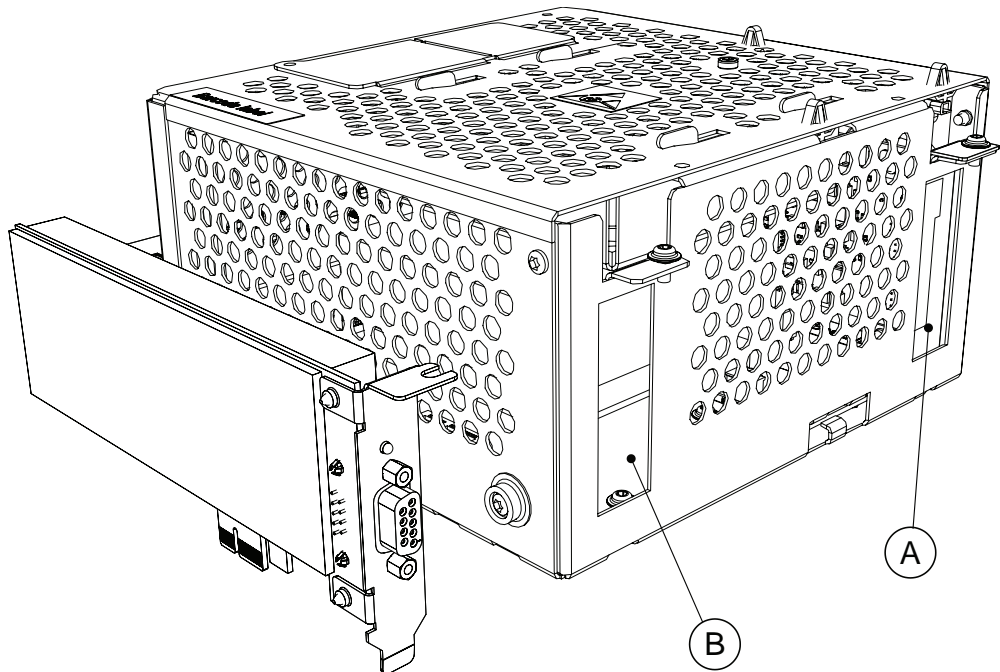
General

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.



xx160000536

A	Slot for PCIeexpress boards
B	Slot for safety board (option SafeMove Pro or SafeMove Basic)

Following master/slave boards are available:

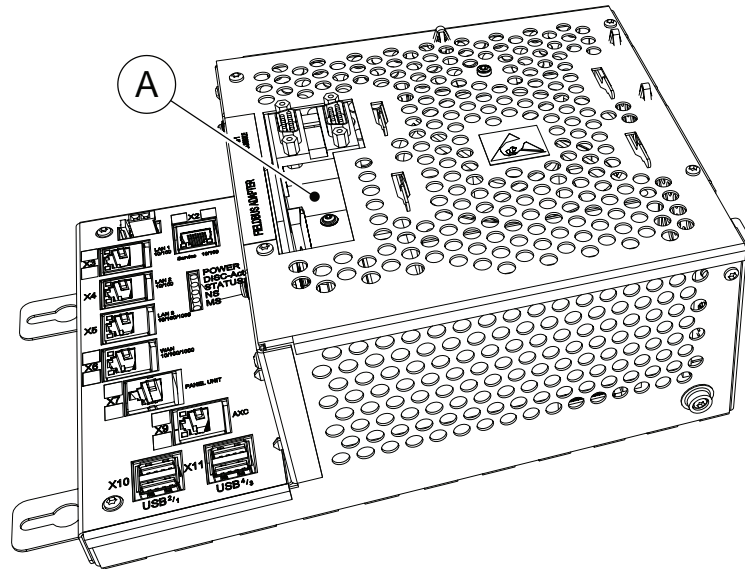
Description	Art. no.	Type designation
PROFIBUS Master PCIeexpress	3HAC044872-001	DSQC1005
DeviceNet Master/Slave PCIeexpress	3HAC043383-001	DSQC1006

Continues on next page

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 61](#).



xx130000605

A	Assembled expansion board for fieldbus adapters, without adapter.	
Description	Art. no.	Type designation
AnybusCC / RS232 expansion board	3HAC046408-001	DSQC1003

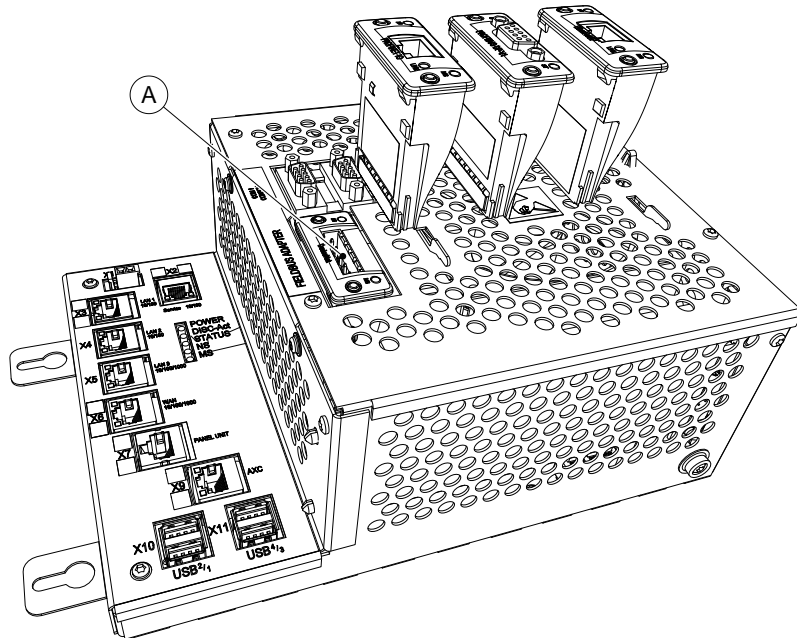
2 Installation and commissioning

2.10.1 Definition of fieldbuses, IRC5

Continued

Fieldbus adapters

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



xx130000604

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.
<i>Application manual - DeviceNet Master/Slave</i>	<i>3HAC050992-001</i>
<i>Application manual - DeviceNet Anybus Slave</i>	<i>3HAC050993-001</i>
<i>Application manual - EtherNet/IP Anybus Adapter</i>	<i>3HAC050997-001</i>
<i>Application manual - EtherNet/IP Scanner/Adapter</i>	<i>3HAC050998-001</i>
<i>Application manual - PROFIBUS Anybus Device</i>	<i>3HAC050965-001</i>
<i>Application manual - PROFIBUS Controller</i>	<i>3HAC050966-001</i>
<i>Application manual - PROFinergy Device</i>	<i>3HAC050967-001</i>

Continues on next page

2 Installation and commissioning

2.10.1 Definition of fieldbuses, IRC5

Continued

Manual title	Art. no.
<i>Application manual - PROFINET Anybus Device</i>	<i>3HAC050968-001</i>
<i>Application manual - PROFINET Controller/Device</i>	<i>3HAC050969-001</i>

2 Installation and commissioning

2.10.2 DeviceNet I/O units

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 209](#) 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:

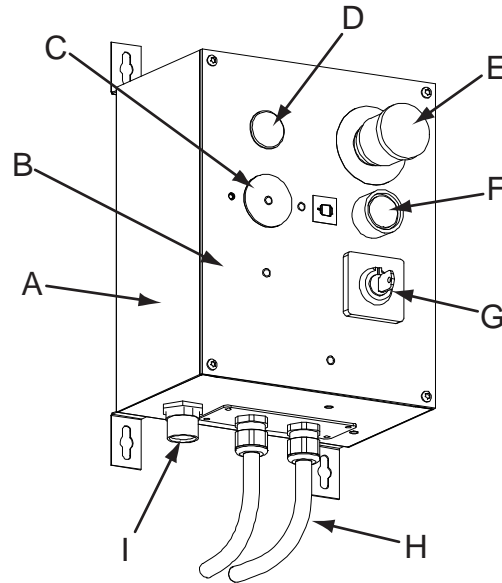
Information:	Found in:
How to install the DeviceNet I/O units mechanically and electrically.	Fit the expansion board and/or field bus adapter according to Replacement of expansion board in the computer unit on page 151 and/or Replacement of fieldbus adapter in the computer unit on page 154 .
Allowed configurations of DeviceNet I/O units and how to setup the configurations.	<i>Technical reference manual - System parameters</i>
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 94 .
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 94 .

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.



xx100000954

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	3HAC038672-001	7 m
	3HAC038673-001	15 m
	3HAC038674-001	30 m
Circuit diagram	See Circuit diagrams on page 217 .	

Continues on next page


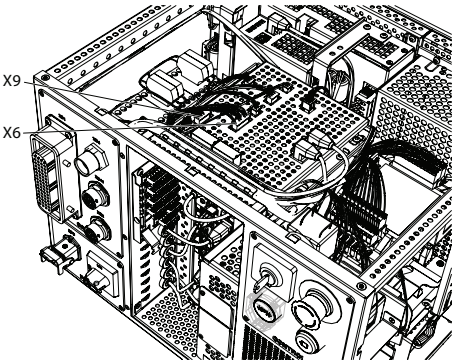
2 Installation and commissioning

2.11.1 Installation of external operator's panel

Continued

Procedure

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

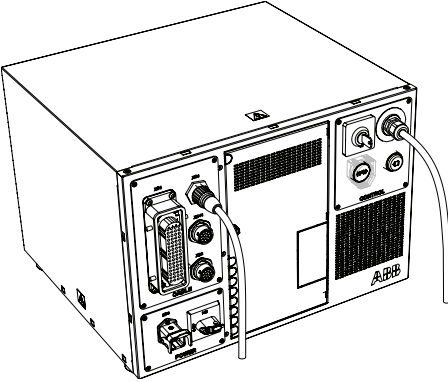
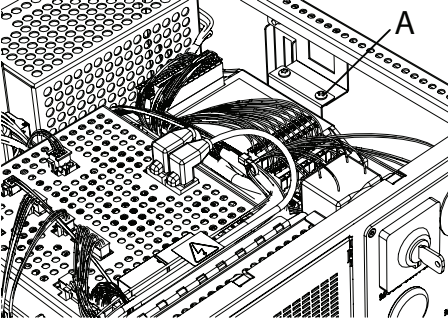
	Action	Info/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller</i> on page 89.
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	<p>Disconnect signal cabling from the safety board.</p> <p>Connectors:</p> <ul style="list-style-type: none"> • A21.X6 • A21.X9 	 <p>xx150000114</p>
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.	

Continues on next page

2 Installation and commissioning

2.11.1 Installation of external operator's panel

Continued

	Action	Info/illustration
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.	 <p>xx100000956</p>
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.	 <p>xx1400002803</p> <ul style="list-style-type: none"> • 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 Installation and commissioning

2.11.2 Installation of external enabling device

2.11.2 Installation of external enabling device

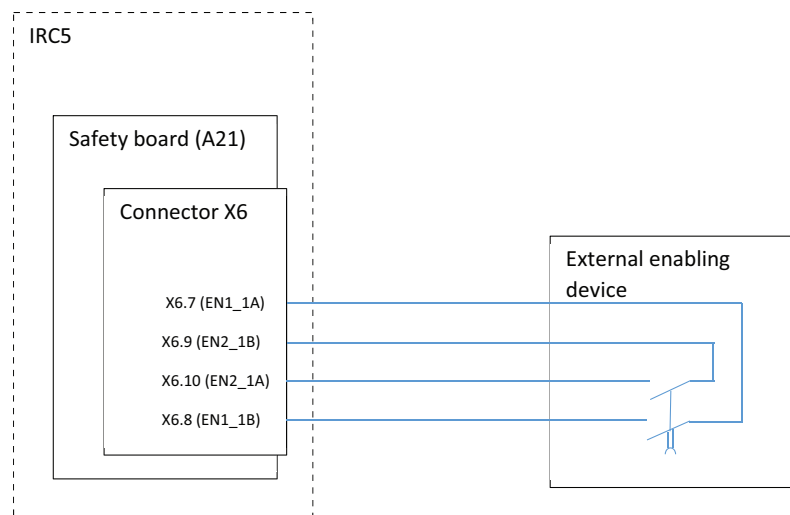
Overview

IRC5 is delivered with one enabling device but have the possibility to connect one additional external enabling device (cannot be ordered from ABB Robotics).

When an external enabling device is used together with the three-position enabling device on the teach pendant, both enabling devices must be enabled to be able to operate the manipulator in manual mode.

Connecting the external enabling device

The external enabling device must be connected to the safety board connector X6 pin 7-10 as shown in the figure below.



xx1600000181

The enabling device chain is enabled if X6 pin 7 is short circuited with X6 pin 8 at the same time as X6 pin 9 is short circuited with X6 pin 10.

Requirement on the external enabling device

The external enabling device connected to IRC5 must have the following characteristics:

- Redundant channels.
- Three-position enabling device. When the enabling device is pressed to the center position the enabling device chain must be enabled. When the enabling device is released or pressed to third position, the enabling device chain must be disabled.
- The enabling device must have a B10 value of at least 100000 cycles (less than 10% chance of failure before 100000 cycles).
- The mean time to dangerous failure (MTTF_d) of the external enabling device must be high enough to ensure that the external enabling device together

Continues on next page

with IRC5's enabling device chain is above 55 years. See safety related performance for the enabling device chain below.

Performance of IRC5 original enabling device chain

The safety-related performance of the enabling device chain, without the external enabling device, is as follows:

- $MTTF_d$ for IRC5 enabling device chain is 80 years.
- IRC5's enabling device chain's calculated average probability of dangerous failure per hour (PFH_d) is 6.62×10^{-8} .
- IRC5's enabling device chain's design and structure is category 3.
- IRC5's enabling device chain's Diagnostic Coverage is medium ($90\% < DC_{avg} < 99\%$).
- The Common Cause Failure (CCF) is met according to the standard requirements.

2 Installation and commissioning

2.11.3 Installing the Safety module DSQC1015 for SafeMove

2.11.3 Installing the Safety module DSQC1015 for SafeMove

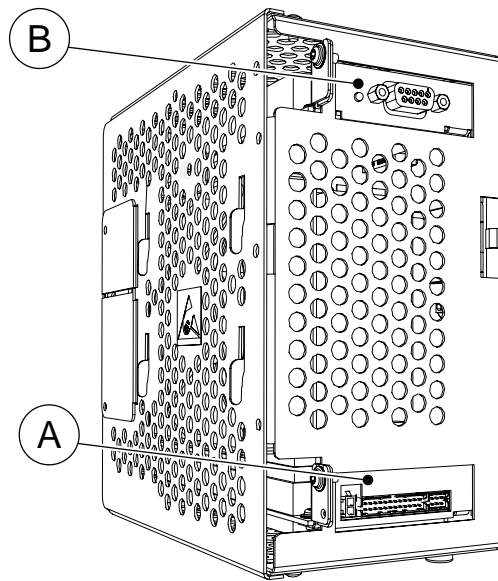
General

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 PCIeexpress 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 107](#)

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




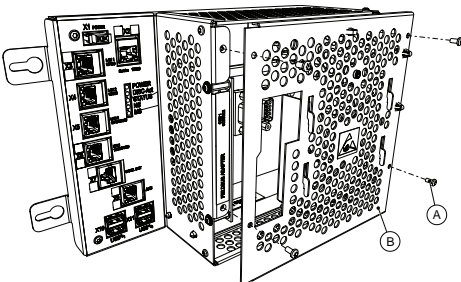
2 Installation and commissioning

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 <i>Additional contacts</i> .
	Standard toolkit	The contents are defined in section Standard toolkit, IRC5 on page 207 .
	Circuit diagram	See Circuit diagrams on page 217 .

Installing the Safety module

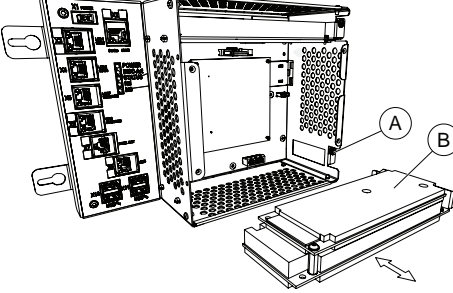
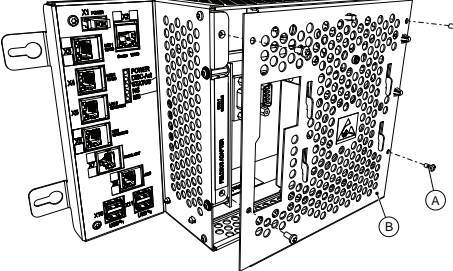
	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34	
3	Remove the cover of the cabinet.	See Removing the controller cover on page 89 .
4	Remove the computer unit.	See Replacement of computer unit on page 138 .
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.	 xx130000684 A Attachment screws (4 pcs.) B Cover
6	Remove the attachment screw on top of the slot bracket.	

Continues on next page

2 Installation and commissioning

2.11.3 Installing the Safety module DSQC1015 for SafeMove

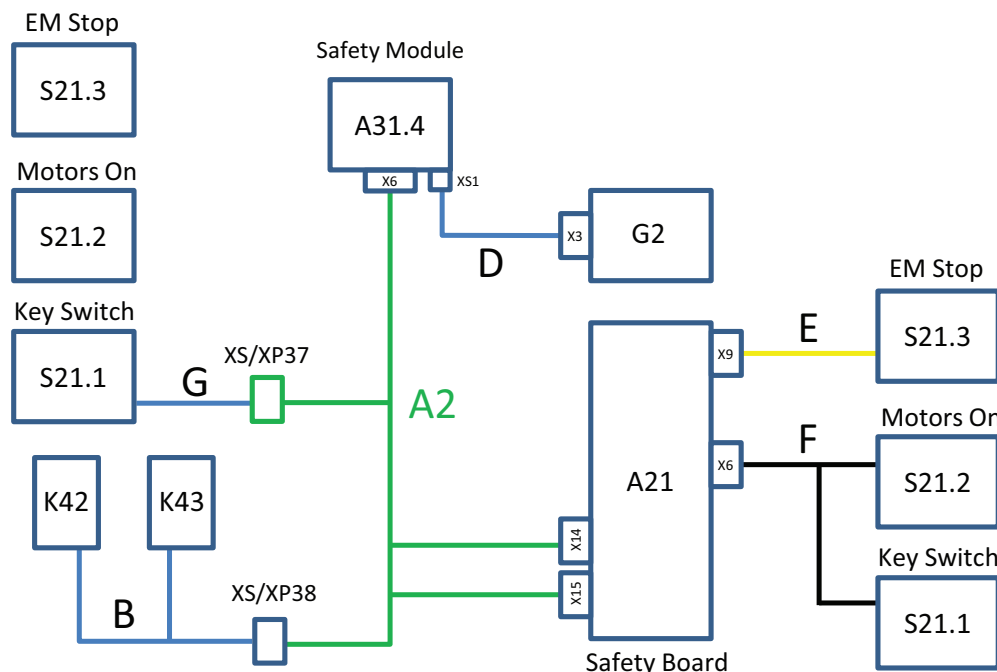
Continued

	Action	Note/Illustration
7	Fit the Safety module in position by pushing it into the socket on the motherboard.	 <p>xx1500001761</p> <p>A Attachment screw B Safety module</p> <p>! CAUTION</p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p>
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.	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Cover</p>
10	Connect all cables according to the procedures described below.	



Continues on next page

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*.



xx160000252

	Action
1	 DANGER Before commencing any work inside the cabinet, read the safety information in section DANGER - Make sure that the main power has been switched off! on page 33
2	 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 34
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 board DSQC1015.
6	Connect connector A31.4.X1 on 24 V I/O harness (D) to safety board DSQC1015.
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 panel board (A21).
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 panel board.

Continues on next page

2 Installation and commissioning

2.11.3 Installing the Safety module DSQC1015 for SafeMove

Continued

	Action
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 panel 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

2.12 Testing

Function tests

When the installation is complete, perform the function tests in section [Function tests on page 118](#) 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 112
System fans	Inspection	6 months ⁱ	Inspecting the IRC5 Compact controller on page 112
FlexPendant	Cleaning	When needed	Cleaning the FlexPendant on page 115
Emergency stop (operating panel)	Function test	12 months	Function test of emergency stop on page 118
Emergency stop (FlexPendant)	Function test	12 months	Function test of emergency stop on page 118
Mode switch	Function test	12 months	Function test of mode switch on page 119
Enable device	Function test	12 months	Function test of three-position enabling device on page 120
Motor contactors K42, K43	Function test	12 months	Function test of motor contactors K42 and K43 on page 121
Brake contactor K44	Function test	12 months	Function test of brake contactor K44 on page 122
Auto stop (tested if used)	Function test	12 months	Function test of auto stop on page 123
General stop (tested if used)	Function test	12 months	Function test of general stop on page 124
Reduced speed control	Function test	During commissioning	Function test of reduced speed control on page 125.

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 Maintenance



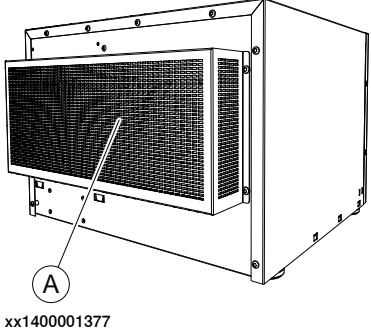
3.2.1 Inspection of controller

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 commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 33.</i>	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 34</i>	
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.	
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 127](#).

3 Maintenance

3.4.1 Cleaning of control cabinet

3.4 Cleaning activities

3.4.1 Cleaning of control cabinet

Required equipment

Equipment, etc.	Note
Vacuum cleaner	ESD protected

Internal cleaning

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

Do's and don'ts!

The section below specifies some special considerations when cleaning the controller.

Always:

- use ESD Protection
- use cleaning equipment as specified above! Any other cleaning equipment may shorten the life of paintwork, rust inhibitors, signs, or labels!
- check that all protective covers are fitted to the controller before cleaning!

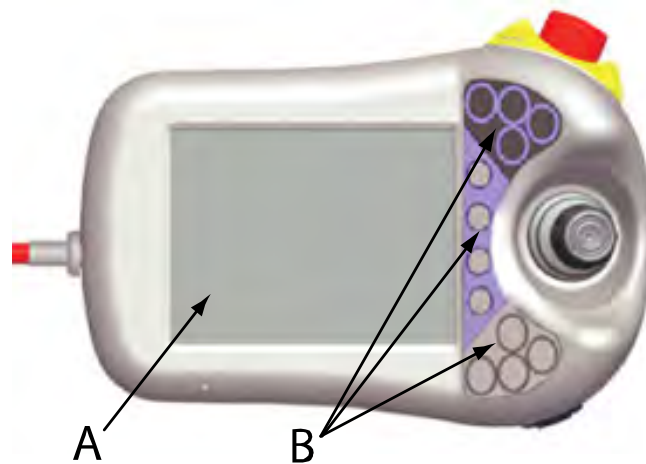
Never:

- remove any covers or other protective devices when cleaning the outside of the controller!
- use compressed air or spray with a high pressure cleaner!

3.4.2 Cleaning the FlexPendant

Location

The surfaces to clean are shown in the illustration below.



xx040000973

A	Touch screen
B	Hard buttons

Required equipment

Equipment, etc.	Note
Soft cloth	ESD Protected
Warm water/Mild cleaning agent	

Clean the touch screen

This section details how to clean the touch screen.

Action	Info/Illustration
1 Before cleaning the screen, tap Lock Screen on the ABB menu.	<p>The screenshot shows the ABB menu with various options. The 'Lock Screen' option is highlighted in grey. Other options include FlexPendant Explorer, Inputs and Outputs, Jogging, Production Window, Program Data, Program Editor, RobotWare Arc, Backup and Restore, Calibration, Control Panel, Event Log, Operator Window, System Info, Logout (Default User), and Restart.</p>

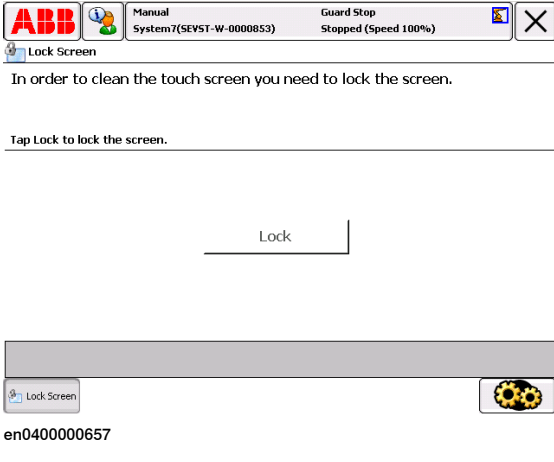
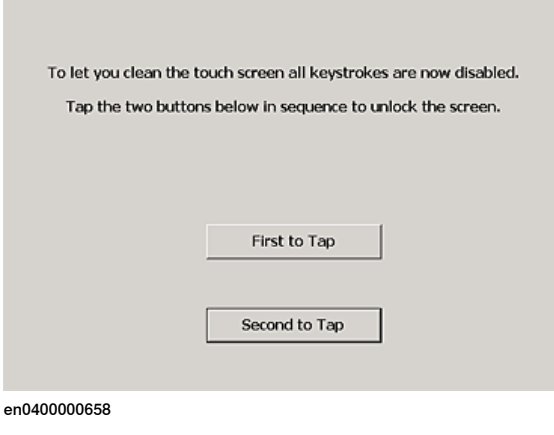

en0400001221

Continues on next page

3 Maintenance

3.4.2 Cleaning the FlexPendant

Continued

	Action	Info/Illustration
2	Tap the Lock button in the following window.	 <p>en040000657</p>
3	When the next window appears, it is safe to clean the screen.	 <p>en040000658</p>
4	Clean the touch screen and hardware buttons using a soft cloth and water or a mild cleaning agent.	
5	To unlock the screen, follow the instructions on the screen.	 <p>en040000658</p>

Do's and don'ts!

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

Always:

- use ESD Protection

Continues on next page

- 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.

Never:

- remove any covers before cleaning the FlexPendant.
- spray with a high pressure cleaner.
- clean the device, operating panel and operating elements with compressed air, solvents, scouring agent or scrubbing sponges.

3 Maintenance

3.5.1 Function test of emergency stop

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 FlexPendant log. If the event message "10013 emergency stop state" does not appear or if the event message "20223 Emergency stop conflict" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.
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 FlexPendant log. If the event message "10015 Manual mode selected" is not shown in the FlexPendant log, 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 FlexPendant log. If the event message "10015 Manual mode selected" is not shown in the FlexPendant log, the test failed and the root cause of the failure must be found.

3 Maintenance

3.5.3 Function test of three-position enabling device

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 FlexPendant log. If the event message "10011 Motors ON state" does not appear or if the event message "20224 Enabling device conflict" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.
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 FlexPendant log. If the event message "10012 safety guard stop state" does not appear or if the event message "20224 Enabling device conflict" appears in the Flexpendant log, the test is failed and the root cause of the failure must be found.

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 FlexPendant log. If the event message "37001 Motor on activation error" appears on the FlexPendant log, 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 FlexPendant log. If the event message "20227 Motor contactor conflict" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.

3 Maintenance

3.5.5 Function test of brake contactor K44

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 FlexPendant 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 FlexPendant log. If the event message "37101 Brake failure" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.

3.5.6 Function test of auto stop

Performing the function test

	Action	Note
1	Start the robot system and turn the mode switch to auto mode.	
2	Activate the auto stop, e.g. by opening the connected robot cell door.	The test is passed if the event message "20205 Auto stop open" appears in the FlexPendant log. If the event message "20205 Auto stop open" does not appear or if the event message "20225 Auto stop conflict" appears in the Flexpendant log, the test is failed and the root cause of the failure must be found.

3 Maintenance

3.5.7 Function test of general stop


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 "20206 General stop open" appears in the FlexPendant log. If the event message "20206 General stop open" does not appear or if the event message "20226 General stop conflict" appears in the Flexpendant log, the test is failed and the root cause of the failure must be found.

3.5.8 Function test of reduced speed control

Performing the function test

	Action	Note
1	Start the robot system and turn the mode switch to manual mode.	
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	<p>Start the program in manual mode and measure the time it takes for the robot to travel the distance.</p> <p> Tip</p> <p>To get accurate results, use sensors or I/O signals to measure the time.</p>	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.

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4 Repair

4.1 Overview

Report replacements

When replacing a unit in the controller, report to ABB:

- the serial number
- article number
- revision

of both the replaced unit and the replacement unit.

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

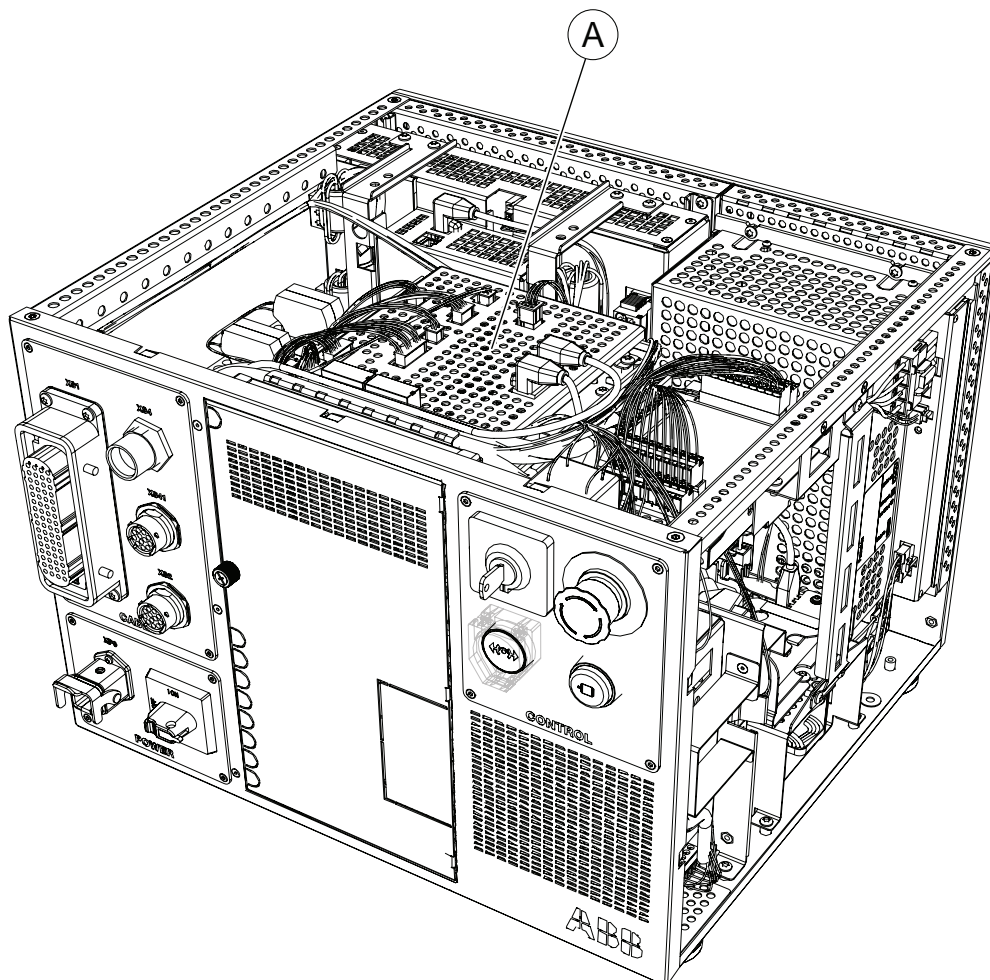
4 Repair

4.2 Replacement of safety board

4.2 Replacement of safety board

Location

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



xx1400001378

A	Safety board
---	--------------



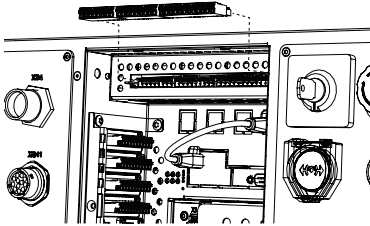
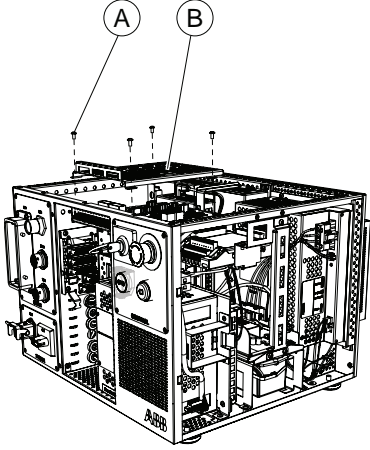
Required equipment

Equipment	Note
Safety board	DSQC 400 See Controller system parts on page 209
Circuit diagram	See Circuit diagrams on page 217 .

Continues on next page

Removal

Use the following procedure to remove the safety board.

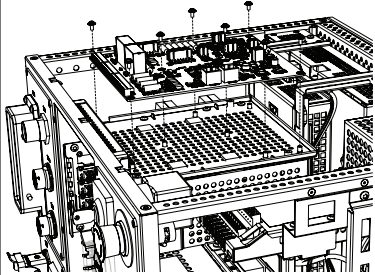
	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller</i> on page 89.
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.	 <p>xx1400002007</p>
7	Remove the four attachment screws to remove the protection cover.	 <p>xx1400001379</p>

Continues on next page

4 Repair

4.2 Replacement of safety board

Continued

	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 commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34
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 118 to verify that the safety features work properly.

4.3 Replacement of I/O unit

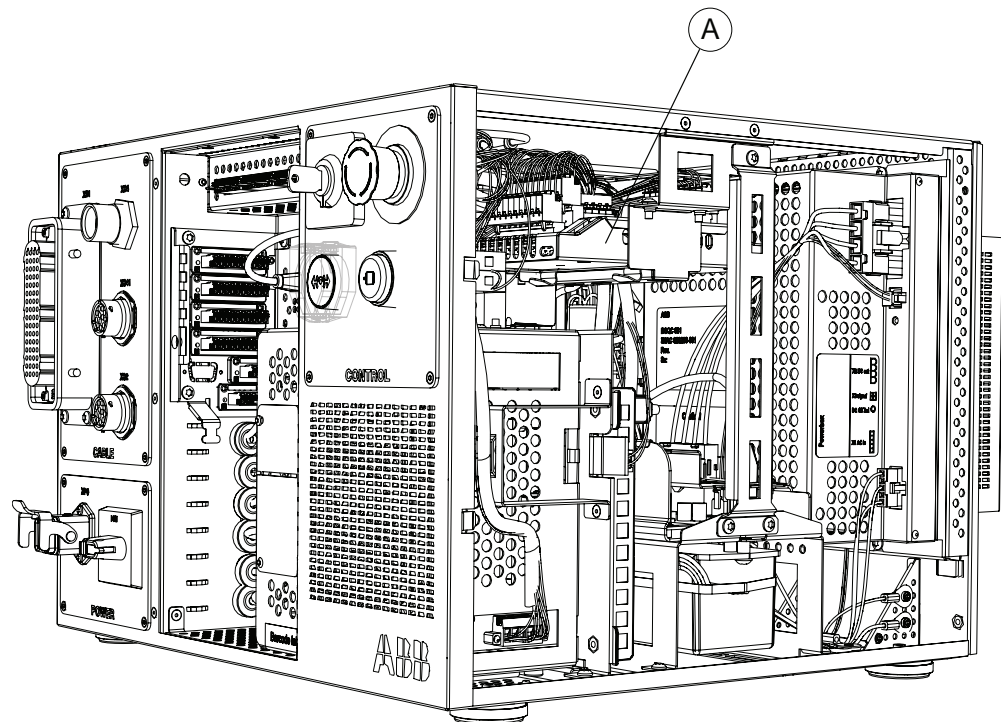
General

An I/O unit may be installed in the IRC5 Compact controller. This is specified in [DeviceNet I/O units on page 98](#).

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.



xx140001381

A	I/O unit
---	----------

Required equipment

Equipment	Note
I/O unit	DSQC 652 See Controller system parts on page 209 .
Circuit diagram	See Circuit diagrams on page 217 .

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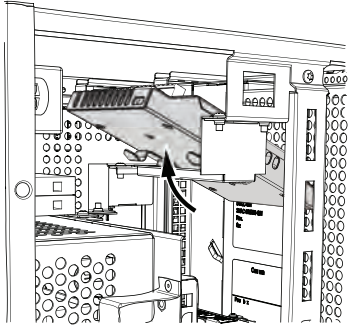
4 Repair

4.3 Replacement of I/O unit

Continued



Removal

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

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34	
3	Remove the cover of the cabinet.	See Opening the IRC5 Compact controller on page 89 .
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 commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34
3	Hook the unit back onto the mounting rail and snap it gently in position.
4	Reconnect all connectors disconnected during removal.

Continues on next page

	Action
5	Refit the cabinet cover.
6	Perform the function tests in section Function tests on page 118 to verify that the safety features work properly.

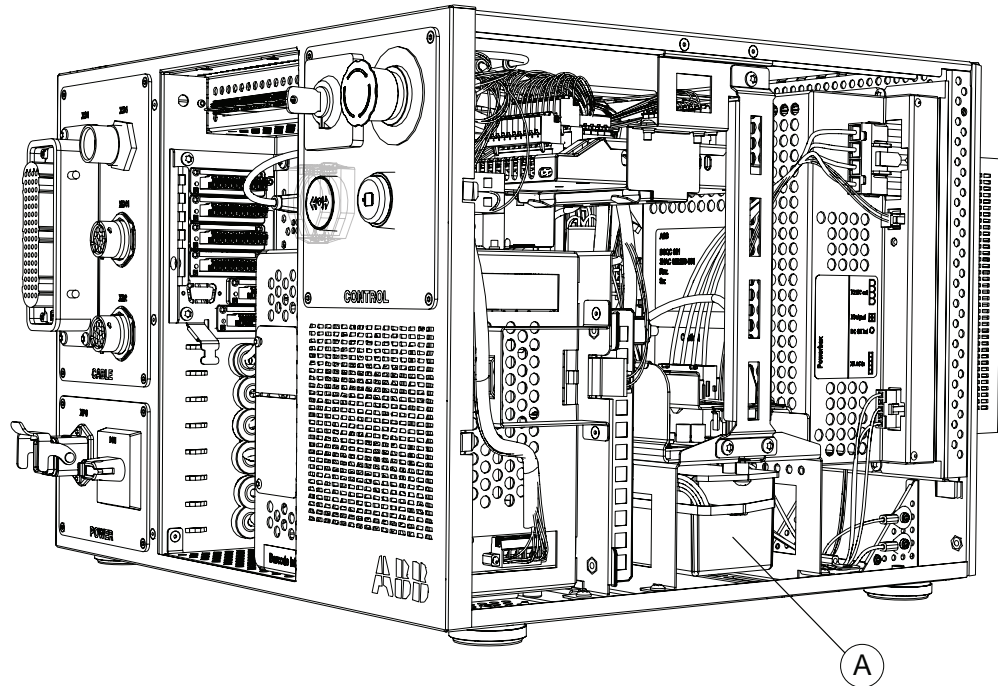
4 Repair

4.4 Replacement of backup energy bank

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

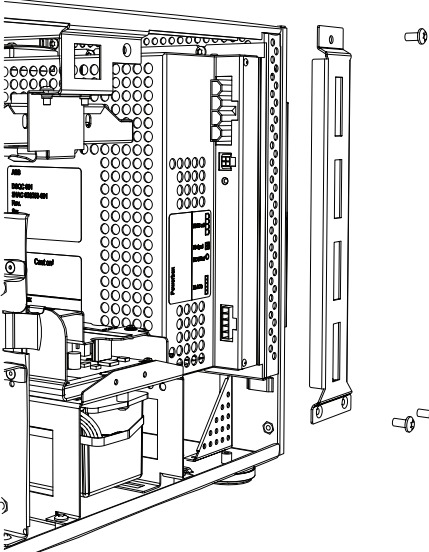
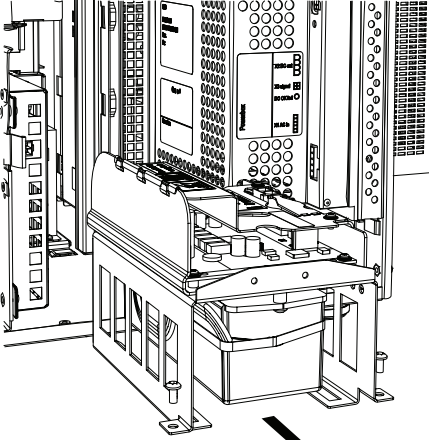
Equipment	Note
Backup energy bank	DSQC 655 See Controller system parts on page 209 .
Circuit diagram	See Circuit diagrams on page 217 .

Removal

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

Action	Note/illustration
<p>1</p> <p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	
<p>2</p> <p>Remove the cover of the cabinet.</p>	See Opening the IRC5 Compact controller on page 89 .

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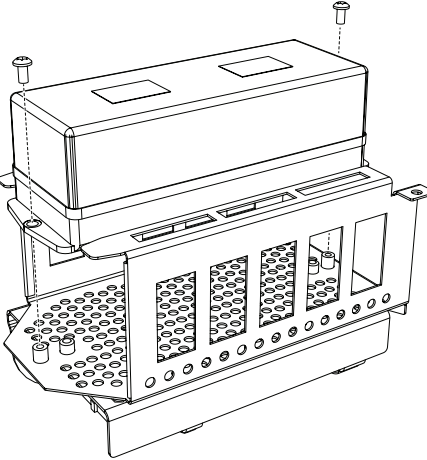
	Action	Note/illustration
3	Remove the three attachment screws, and remove the support bar.	 <p>xx1400001384</p>
4	Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 <p>xx1400001385</p>
5	Disconnect all connectors from the power distribution unit.	
6	Pull the backup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

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4 Repair


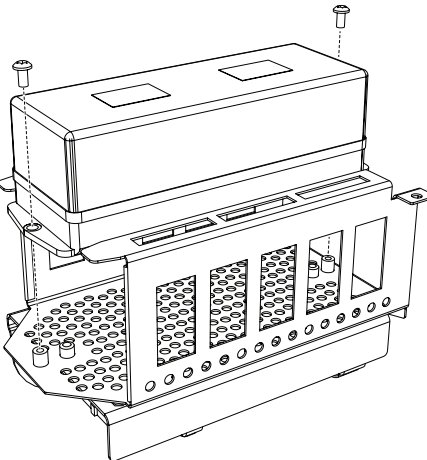
4.4 Replacement of backup energy bank

Continued

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

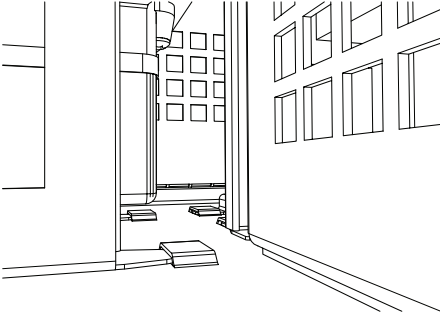

Refitting

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

	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	Refit the new backup energy bank.	
3	Refit the attachment screws, and tighten them.	 <p>xx1400001386</p>
4	Slide the backup energy bank unit half way in.	
5	Reconnect all the connectors to the power distribution unit.	

Continues on next page

4.4 Replacement of backup energy bank
Continued

	Action	Note/illustration
6	Refit the backup energy bank unit.	 <p data-bbox="995 629 1102 651">xx1400001387</p> <p data-bbox="995 674 1054 730"> Note</p> <p data-bbox="995 741 1390 775">Ensure to fit in the latches properly.</p>
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 118 to verify that the safety features work properly.	

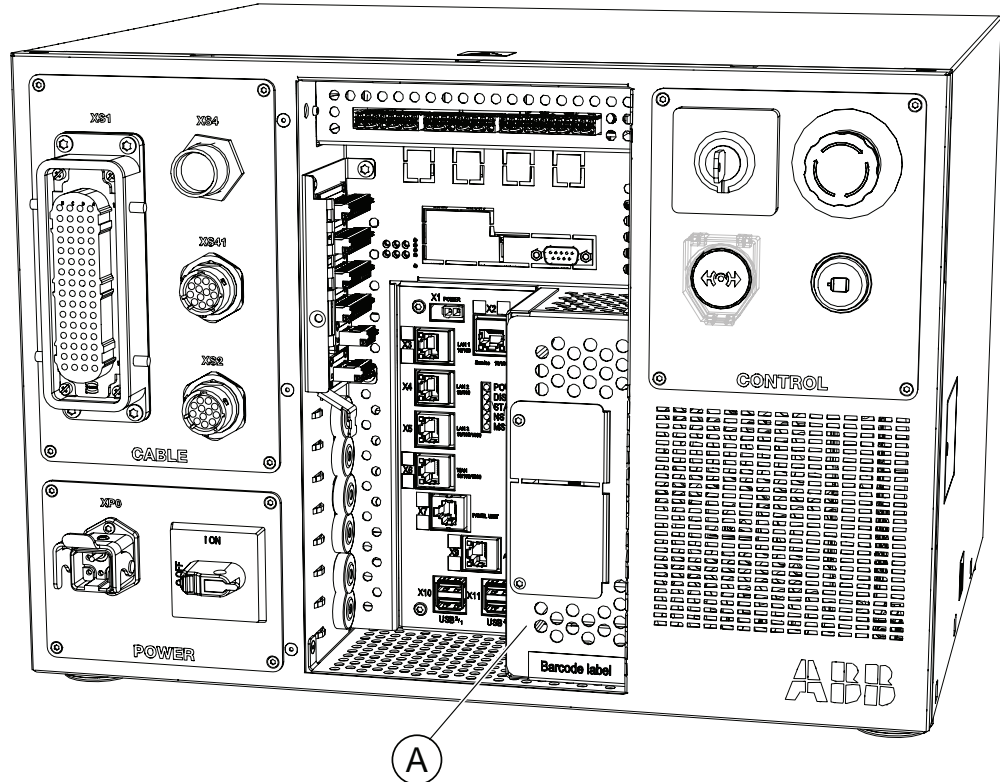
4 Repair

4.5 Replacement of computer unit

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 209 .
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 217 .

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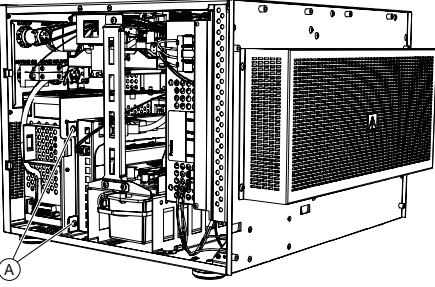
Removal

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*.

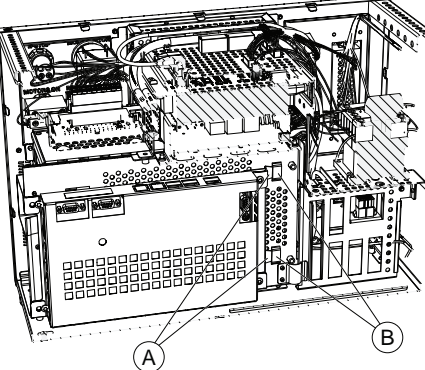
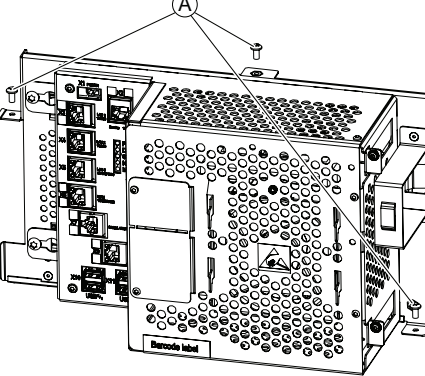
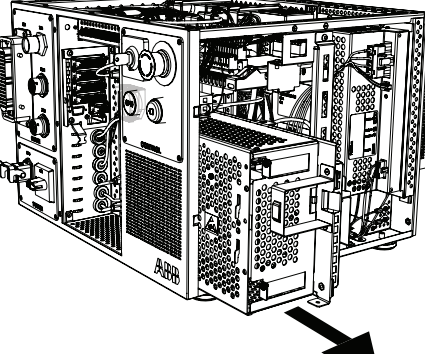
	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.	
2	 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 34	
3	Open the door in the front and disconnect all connectors from the computer unit.	
4	Remove the cover of the cabinet.	See <i>Removing the controller cover</i> on page 89.
5	Disconnect all connectors from the computer unit.	
6	Remove the attachment screws for the axis computer.	 <p data-bbox="999 1630 1102 1644">xx1500000234</p> <p data-bbox="1031 1664 1436 1693">A Axis computer attachment screws</p>

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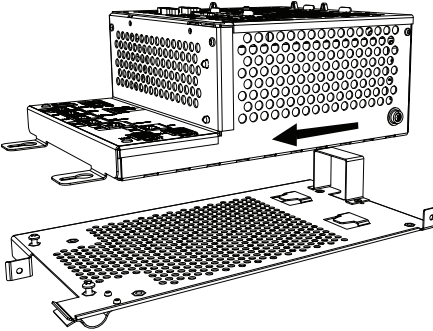

4 Repair

4.5 Replacement of computer unit

Continued

	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.	 <p>xx150000235</p> <p>A Latches B Recesses</p>
8	Remove the three attachment screws on the assembly plate.	 <p>xx1400001388</p> <p>A attachment screws</p>
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.	 <p>xx1400001447</p>

Continues on next page

	Action	Note/illustration
10	<p>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.</p>	 <p>xx1400001448</p> <p> WARNING</p> <p>Prevent the computer unit from falling down due to gravity by supporting the computer unit from beneath by hand.</p>



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*.

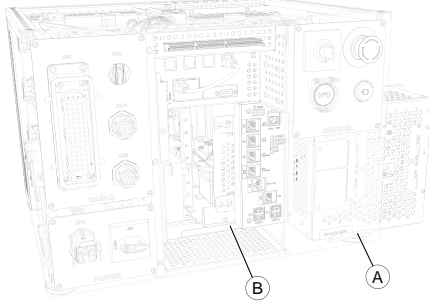
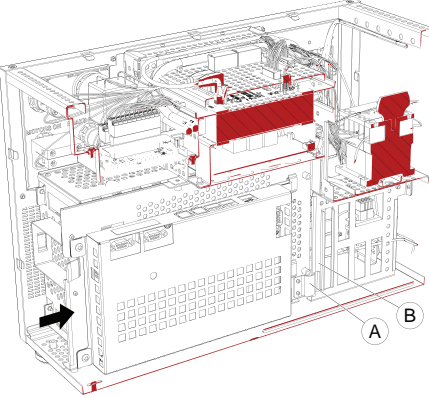
	Action	Note/illustration
1	<p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	<p> WARNING</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	<p>Fit the computer unit in position on the assembly plate.</p>	
4	<p>Tighten the attachment screws.</p>	

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4 Repair

4.5 Replacement of computer unit

Continued

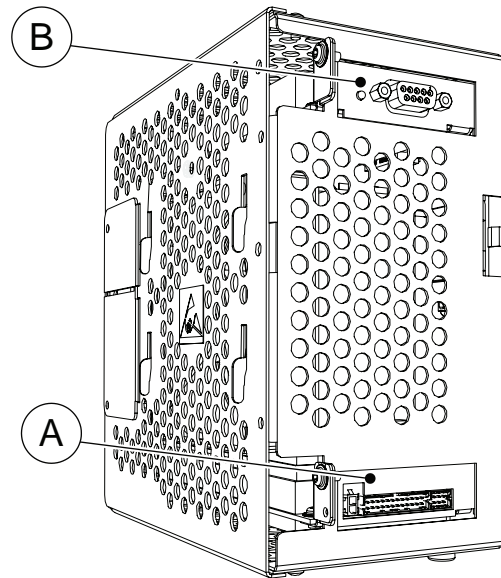
	Action	Note/illustration
5	Slide the assembly plate with the computer unit into the cabinet. The computer unit should rest on guide structure 1. Guide structure 2 should fit between the assembly plate and the computer unit.	 <p data-bbox="970 629 1070 645">xx150000236</p> <p data-bbox="999 663 1230 719"> A Guide structure 1 B Guide structure 2 </p>
6	Make sure the computer unit spring is clipped on to the structure wall inside the cabinet.	 <p data-bbox="970 1167 1070 1182">xx150000233</p> <p data-bbox="999 1200 1273 1256"> A Computer unit spring B Structure wall </p>
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 118 to verify that the safety features work properly.	

4.6 Replacement of PCIe boards in the computer unit

Location

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

- DeviceNet Master/Slave
- PROFIBUS-DP Master
- Safety board (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 <i>Application manual - PROFIBUS Controller</i> .
DeviceNet Master/Slave	3HAC043383-001	DSQC1006 DeviceNet communication is described in <i>Application manual - DeviceNet Master/Slave</i> .
Safety board	3HAC048858-001	DSQC1015 SafeMove (2nd generation) is described in <i>Application manual - Functional safety and SafeMove</i> .
Standard toolkit		The contents are described in section Standard toolkit, IRC5 on page 207 .

Continues on next page

4 Repair

4.6 Replacement of PCIe 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
<i>Application manual - PROFIBUS Controller</i>	3HAC050966-001	Contains information on how to configure the system for PROFIBUS devices.
<i>Application manual - DeviceNet Master/Slave</i>	3HAC050992-001	Contains information on how to configure the system for DeviceNet devices.
Circuit diagram	See Circuit diagrams on page 217 .	

Removal


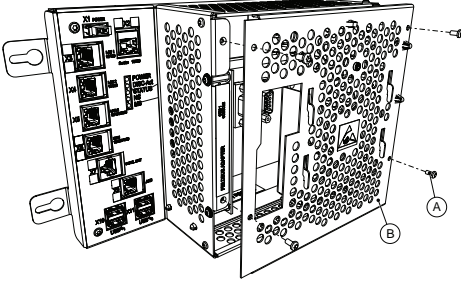
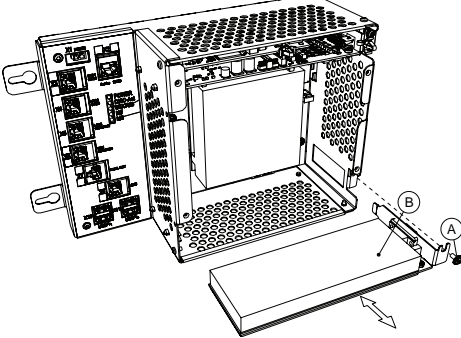


The procedure below details how to remove a PCIe board.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34	
3	Remove the cover of the cabinet.	See Removing the controller cover on page 89 .
4	Remove the computer unit.	See Replacement of computer unit on page 138 .
5	Disconnect any cables to/from the PCIe board.	 Tip Make a note of which cables are disconnected.

Continues on next page


4.6 Replacement of PCIeexpress boards in the computer unit

Continued

	Action	Note/Illustration
6	<p>Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector.</p> <p> CAUTION</p> <p>Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.</p>	 <p>xx130000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
7	<p>Remove the attachment screw on top of the PCIeexpress board bracket.</p>	 <p>xx130000685</p> <p>A Attachment screw B PCIeexpress board</p>
8	<p>Gently pull the board straight out.</p>	<p> CAUTION</p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p> <p> CAUTION</p> <p>Immediately put the board in an ESD safe bag or similar.</p>

Refitting

The procedure below details how to refit a PCIeexpress board.


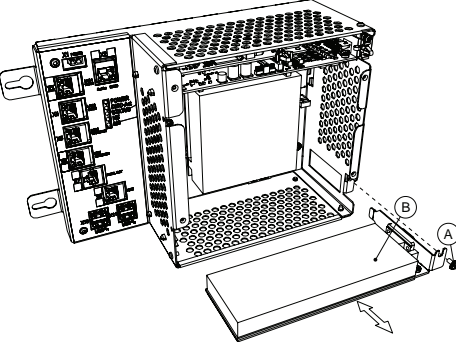


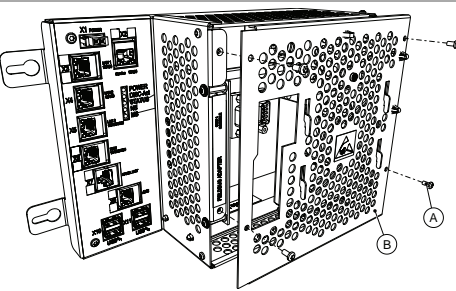
	Action	Note/Illustration
1	<p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	

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4 Repair

4.6 Replacement of PCIe boards in the computer unit

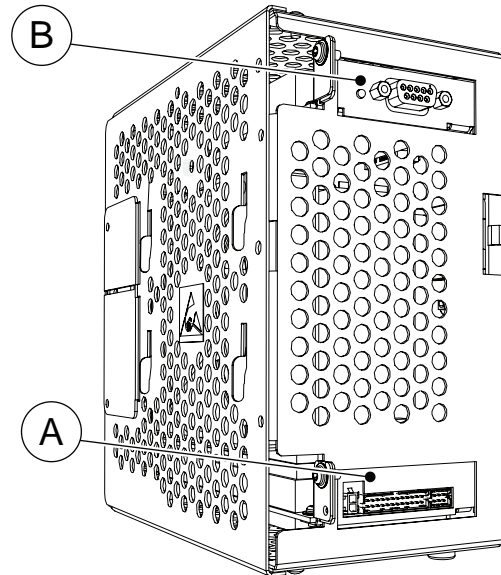
Continued

	Action	Note/Illustration
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34</p>	
3	<p>Fit the PCIe board in position by pushing the PCIe board into the socket on the motherboard.</p>	 <p>xx130000685</p> <p>A Attachment screw B PCIe board</p> <p> CAUTION</p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p>
4	<p>Refit the attachment screw on top of the PCIe board bracket.</p>	
5	<p>Reconnect any additional cables to the PCIe board.</p>	
6	<p>Refit the fan connector and close the computer unit.</p> <p> CAUTION</p> <p>Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.</p>	 <p>xx130000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
7	<p>Refit the computer unit.</p>	<p>See Replacement of computer unit on page 138.</p>
8	<p>Refit the controller cover.</p>	
9	<p>Make sure the robot system is configured to support the installed PCIe board.</p>	
10	<p>Perform the function tests in section Function tests on page 118 to verify that the safety features work properly.</p>	

4.7 Replacement of Safety module DSQC1015 for SafeMove

Location

The Safety module DSQC1015 is a PCIeexpress 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 207 .
Circuit diagram	See Circuit diagrams on page 217 .

Removing the Safety module



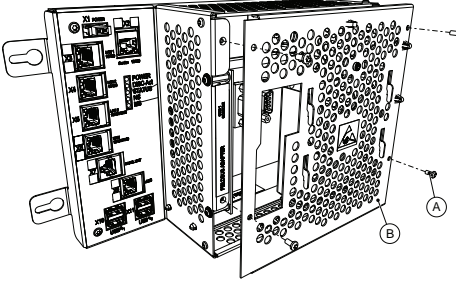
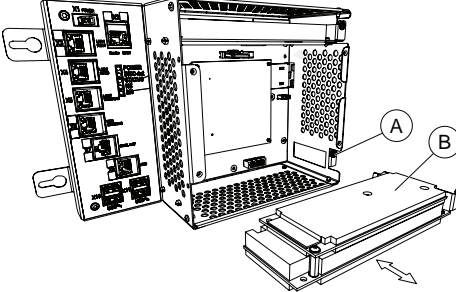

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .	

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4 Repair



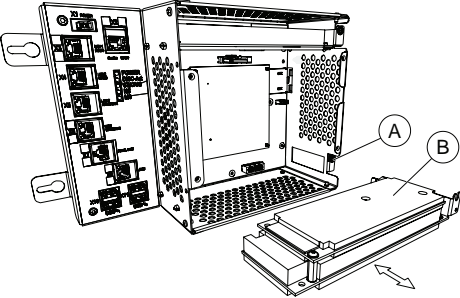


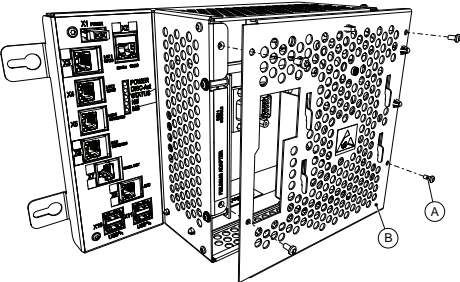
4.7 Replacement of Safety module DSQC1015 for SafeMove

Continued

	Action	Note/Illustration
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	Remove the cover of the cabinet.	See <i>Removing the controller cover</i> on page 89.
4	Remove the computer unit.	See <i>Replacement of computer unit</i> on page 138.
5	<p>Open the computer unit by removing the attachment screws and lift off the cover. Disconnect the fan connector.</p> <p> CAUTION</p> <p>Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.</p>	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Cover</p>
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.	 <p>xx1500001761</p> <p>A Attachment screw B Safety module</p> <p> CAUTION</p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p>

Continues on next page

Refitting the Safety module

	Action	Note/Illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	<p>Fit the Safety module in position by pushing it into the socket on the motherboard.</p>	 <p>xx1500001761</p> <p>A Attachment screw B Safety module</p>  <p>CAUTION</p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p>
4	<p>Refit the attachment screw on top of the Safety module bracket.</p>	
5	<p>Refit the fan connector and close the computer unit.</p>  <p>CAUTION</p> <p>Be careful with the fan cable when closing the cover. The fan cable must not be squeezed.</p>	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Cover</p>
6	<p>Refit the computer unit.</p>	<p>See <i>Replacement of computer unit</i> on page 138.</p>

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4 Repair

4.7 Replacement of Safety module DSQC1015 for SafeMove

Continued

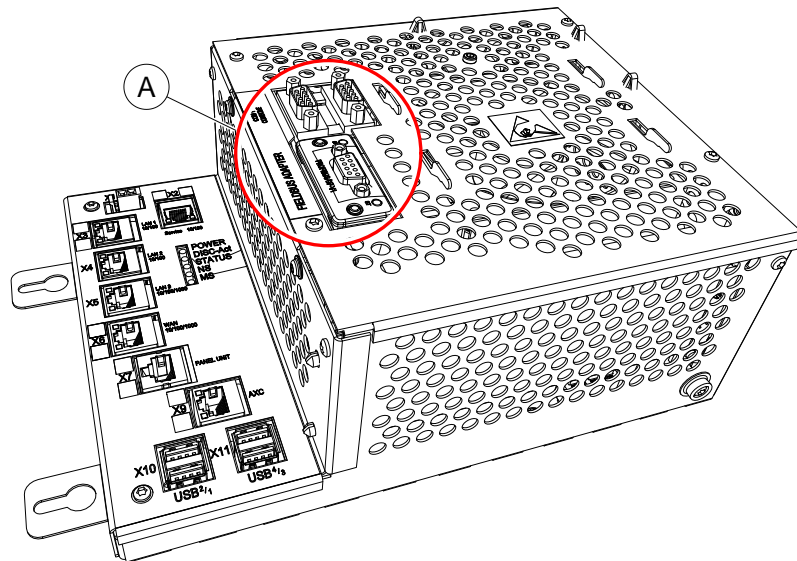
	Action	Note/Illustration
7	Refit the cover of the cabinet.	
8	Perform the function tests in section Function tests on page 118 to verify that the basic safety features (e.g. emergency stop) work properly.	
9	Perform a synchronization.	See <i>Application manual - Functional safety and SafeMove</i> .
10	Perform a Cyclic Brake Check.	See <i>Application manual - Functional safety and SafeMove</i> .
11	Lock the SafeMove configuration file.	See <i>Application manual - Functional safety and SafeMove</i> .

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.



xx130000860


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.



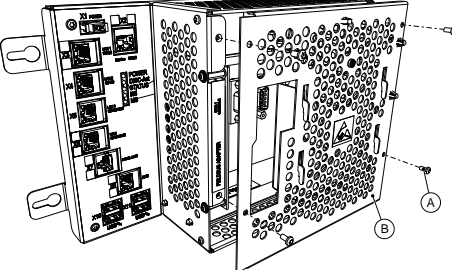
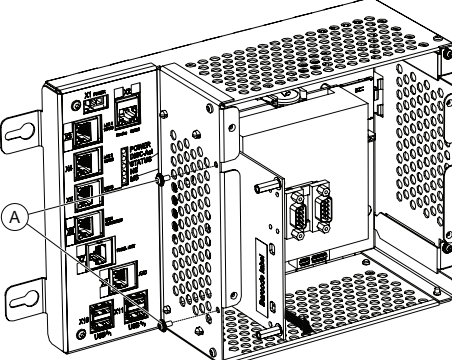

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.	

Continues on next page

4 Repair

4.8 Replacement of expansion board in the computer unit






Continued

	Action	Note/Illustration
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	Remove the cover of the cabinet.	See <i>Removing the controller cover on page 89.</i>
4	Remove the computer unit.	See <i>Replacement of computer unit on page 138.</i>
5	Disconnect any cables to/from the fieldbus adapter.	
6	<p>Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector.</p> <p> CAUTION</p> <p>Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.</p>	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
7	If there is a fieldbus adapter, remove it.	See <i>Replacement of fieldbus adapter in the computer unit on page 154.</i>
8	Remove the attachment screws on the computer unit.	 <p>xx1300000859</p> <p>A Attachment screws (2 pcs)</p>
9	Grip the expansion board and gently pull it straight out.	<p> CAUTION</p> <p>Always grip the expansion board around the edges to avoid damage to the board or its components.</p>

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 commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34	
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 138.
7	Refit the controller cover.	
8	Reconnect any cable to the fieldbus adapter.	
9	Perform the function tests in section Function tests on page 118 to verify that the safety features work properly.	

4 Repair

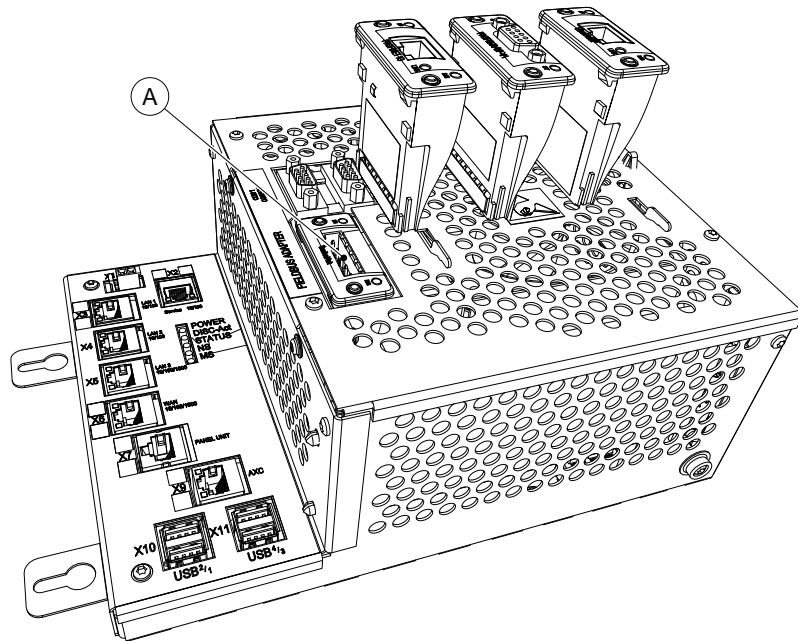
4.9 Replacement of fieldbus adapter in the computer unit

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



xx130000604

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 <i>Application manual - EtherNet/IP Anybus Adapter</i>
AnybusCC PROFIBUS slave fieldbus adapter	3HAC026840-001	DSQC 667 PROFIBUS communication is described in <i>Application manual - PROFIBUS Anybus Device</i>
AnybusCC PROFINET slave fieldbus adapter	3HAC031670-001	DSQC 688 PROFINET communication is described in <i>Application manual - PROFINET Anybus Device</i>

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4.9 Replacement of fieldbus adapter in the computer unit

Continued



Equipment	Art. no.	Note
AnybusCC DeviceNet slave fieldbus adapter	3HAC045973-001	DSQC1004 DeviceNet communication is described in <i>Application manual - DeviceNet Anybus Slave</i> .
Standard toolkit		The contents are described in section <i>Standard toolkit, IRC5 on page 207</i> .

References

Equipment	Art. no.	Note
<i>Application manual - EtherNet/IP Anybus Adapter</i>	3HAC050997-001	Contains information on how to configure the system for EtherNet/IP Fieldbus Adapter DSQC 669.
<i>Application manual - PROFIBUS Anybus Device</i>	3HAC050965-001	Contains information on how to configure the system for PROFIBUS Fieldbus Adapter DSQC 667.
<i>Application manual - PROFINET Anybus Device</i>	3HAC050968-001	Contains information on how to configure the system for PROFINET Fieldbus Adapter DSQC 688.
<i>Application manual - DeviceNet Anybus Slave</i>	3HAC050993-001	Contains information on how to configure the system for DeviceNet Fieldbus Adapter DSQC1004.
Circuit diagram	See <i>Circuit diagrams on page 217</i> .	

Removal

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


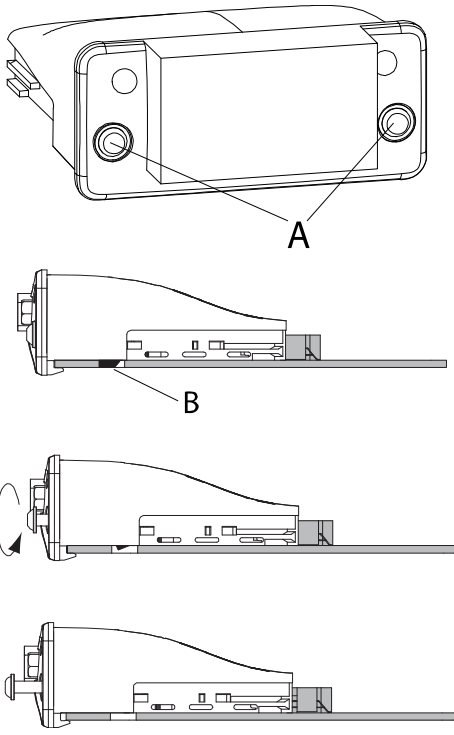
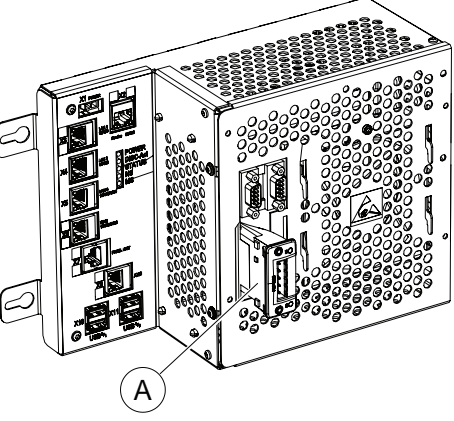
	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 33</i> .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD! on page 34</i>	
3	Remove the cover of the cabinet.	See <i>Removing the controller cover on page 89</i> .
4	Remove the computer unit.	See <i>Replacement of computer unit on page 138</i> .

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4 Repair

4.9 Replacement of fieldbus adapter in the computer unit




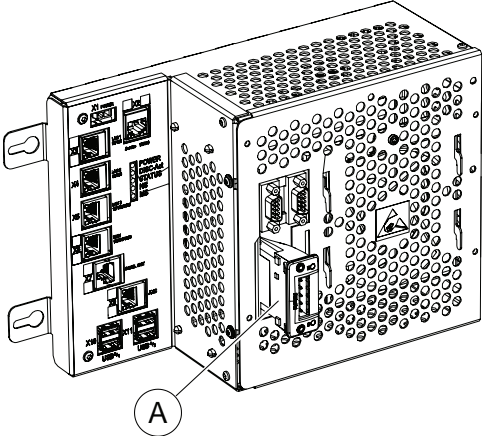

Continued

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

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Refitting

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

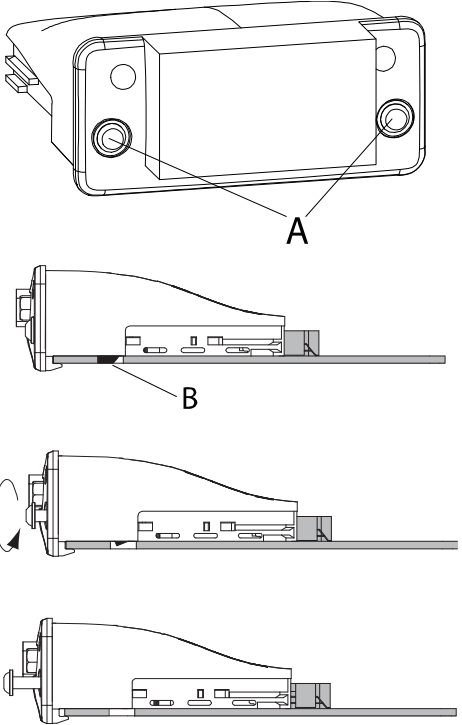
	Action	Note/Illustrator
1	<p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	<p> ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	<p>Fit the fieldbus adapter in position by pushing the fieldbus adapter along the rails on the motherboard.</p> <p> CAUTION</p> <p>Push carefully so no pins are damaged. Make sure that the adapter is pushed straight onto the rails.</p>	 <p>xx1500001755</p> <p>A Fieldbus adapter</p> <p> CAUTION</p> <p>Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.</p>

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4 Repair

4.9 Replacement of fieldbus adapter in the computer unit

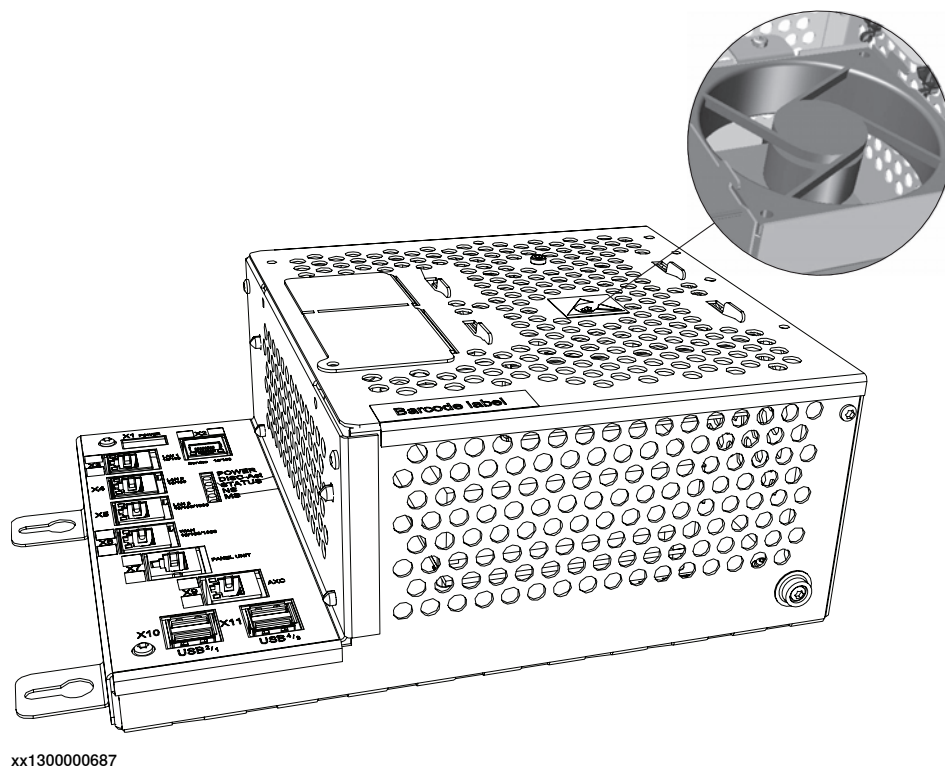
Continued

	Action	Note/Illustrator
4	Secure the fieldbus adapter with its attachment screws (2 pcs).	 <p data-bbox="925 1041 1029 1064">xx0700000193</p> <p data-bbox="957 1075 1292 1131"> A Attachment screws (2 pcs) B Fastening mechanism </p>
5	Refit the computer unit.	See Replacement of computer unit on page 138 .
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 118 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.



Required equipment

Equipment	Note
Fan	See Spare parts on page 209 .
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 217 .

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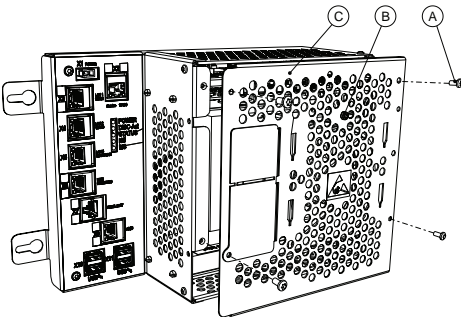

4 Repair

4.10 Replacement of fan in computer unit

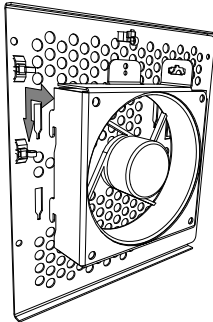
Continued

Removal

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





	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34	
3	Remove the cover of the cabinet.	See <i>Removing the controller cover</i> on page 89.
4	Remove the computer unit.	See <i>Replacement of computer unit</i> on page 138.
5	Open the computer unit by removing the upper cover attachment screws and lift off the upper cover.	 <p>xx130000688</p> <p>A Upper cover attachment screws (4 pcs.) B Fan attachment screw C Upper cover</p>
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.	

Continues on next page

	Action	Note/Illustration
8	Remove the fan from the upper cover.	 <p>xx130000806</p>

Refitting

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

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34	
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	Refitt the computer unit.	See <i>Replacement of computer unit</i> on page 138.
7	Refitt 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.

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4 Repair

4.10 Replacement of fan in computer unit

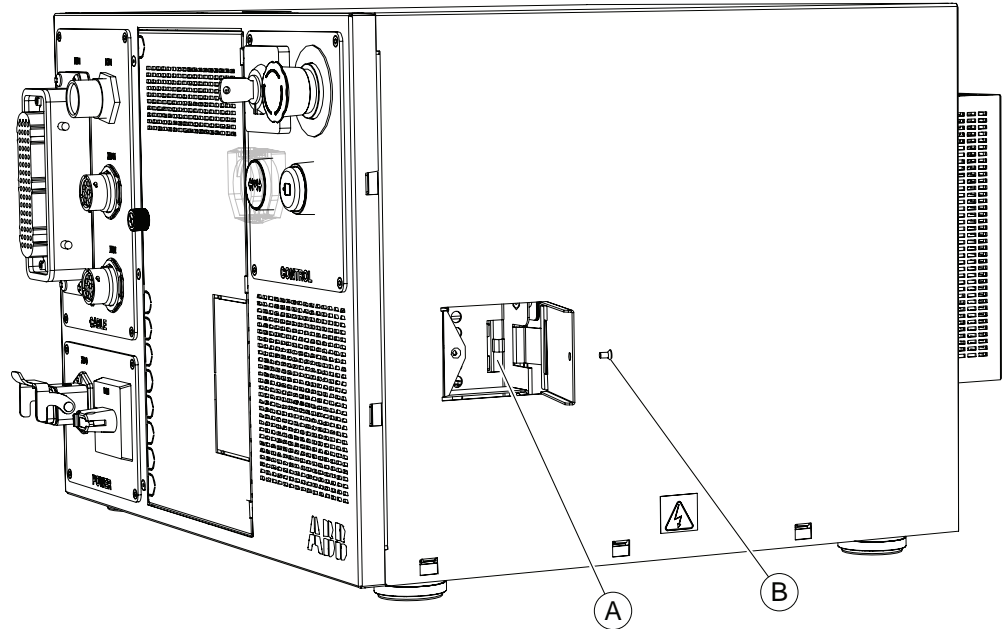
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	Action	Note/Illustration
9	Perform the function tests in section Function tests on page 118 to verify that the safety features work properly.	

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.



CAUTION

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

Required equipment

Equipment	Note
SD-card 2GB	See Spare parts on page 209 . Note Only use SD-card memory supplied by ABB. Includes <i>ABB Boot Application</i> software to correctly reboot the robot controller.

Continues on next page

4 Repair



4.11 Replacement of SD-card memory in computer unit

Continued

Equipment	Note
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .




Removal

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

	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34
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

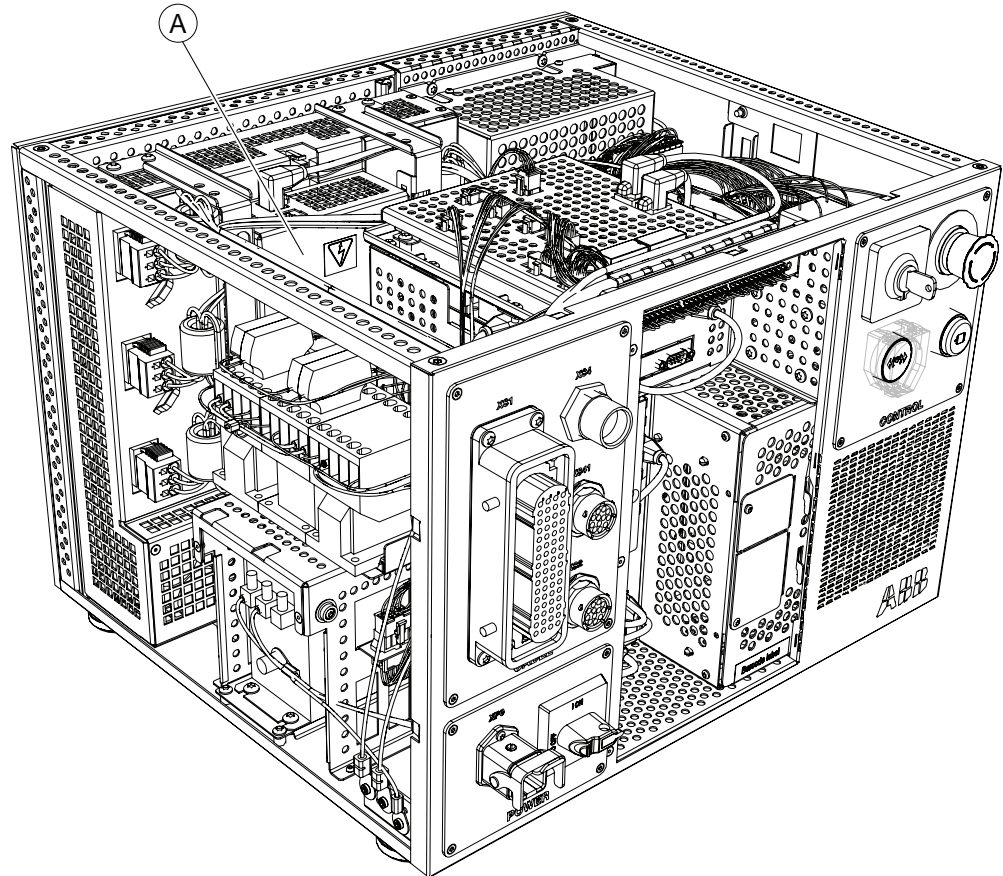
Use the following procedure to refit the SD-card memory.

	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 34
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 118 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 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

Continues on next page


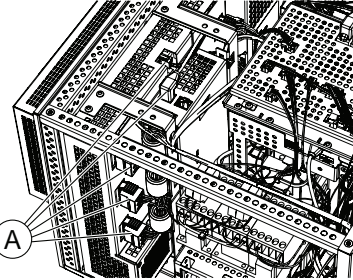
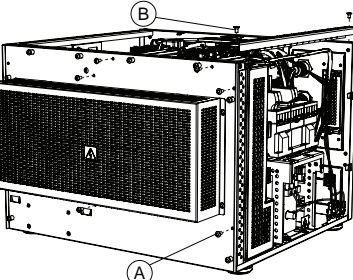
4 Repair

4.12 Replacement of drive unit

Continued

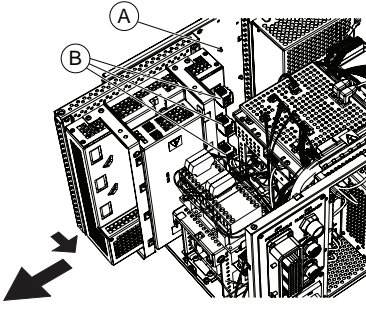
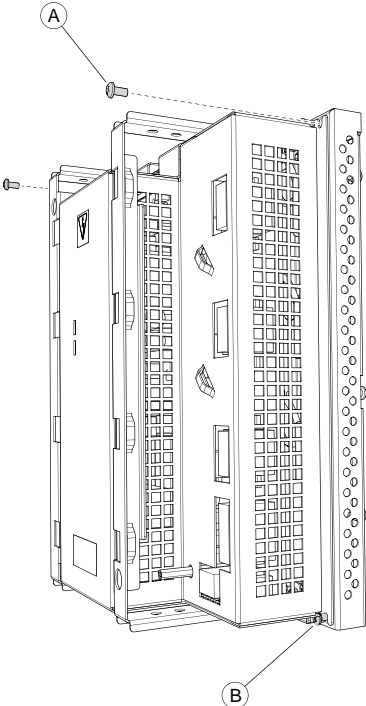
Removal

Use the following procedure to remove the Main Drive Unit.

	Action	Information
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller</i> on page 89.
3	Disconnect the connectors on the top and on the left on the Main Drive Unit.	 <p>xx1400002850</p> <p>A Connectors on the Main Drive Unit</p>
4	Remove the six attachment screws in the back of the controller.	 <p>xx1400001619</p> <p>A Attachment screws for Main Drive Unit</p> <p>B Attachment screws for support bar</p>
5	Remove the support bar by removing the two attachment screws.	

Continues on next page

4.12 Replacement of drive unit Continued

	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.	 <p>xx1400002851</p> <p>A Screws sticking out of the back plane of the controller B Connectors on the Main Drive Unit</p>
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.	 <p>xx1400001450</p> <p>A Upper attachment (2 pcs.) B Lower attachment (2 pcs.)</p>

Continues on next page


4 Repair

4.12 Replacement of drive unit

Continued

Refitting

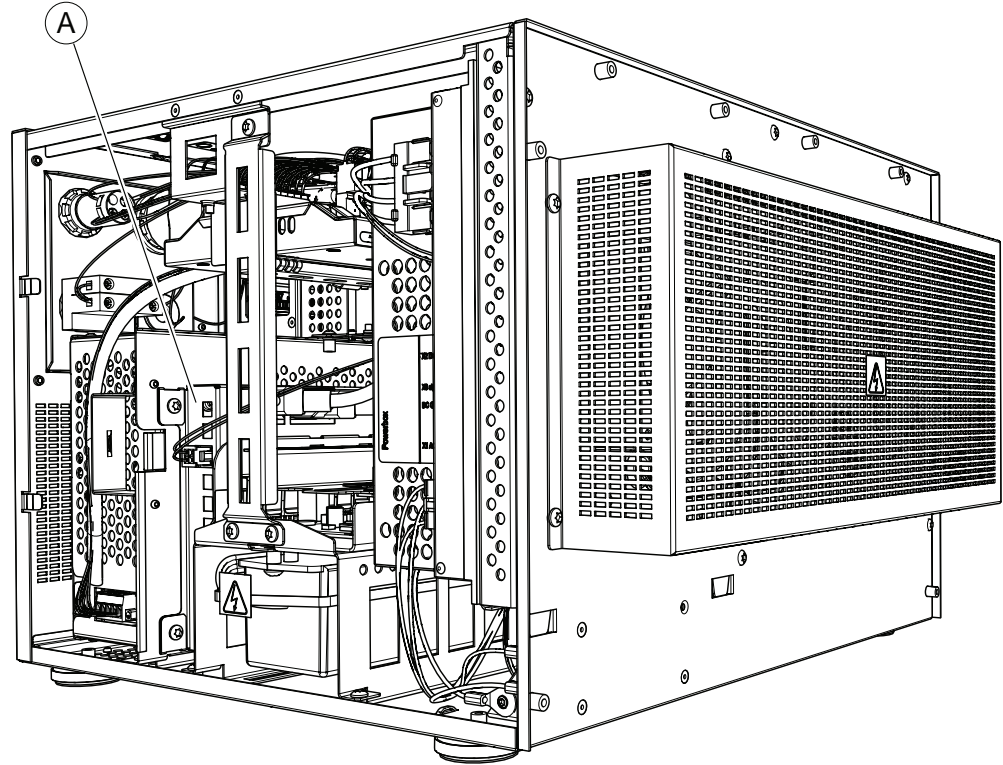
Use the following procedure to refit the Main Drive Unit.

	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on <i>page 33</i> .
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 <i>Function tests on page 118</i> 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 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

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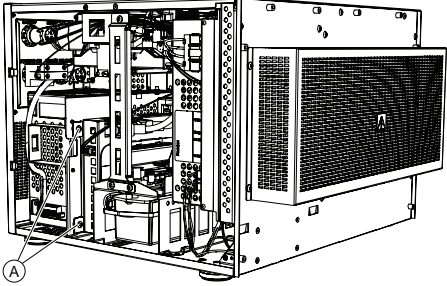
4 Repair

4.13 Replacement of axis computer

Continued

Removal

Use the following procedure to remove the axis computer.

	Action	Info/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller</i> on page 89.
4	Disconnect all connectors from the axis computer unit.	 <p>Note</p> <p>Make a note of any connections.</p>
5	Remove the attachment screws.	 <p>xx150000234</p> <p>A Attachment screws</p>
6	Slide the axis computer unit out of the controller.	



Continues on next page

4.13 Replacement of axis computer
Continued

	Action	Info/illustration
7	Remove the seven attachment screws and gently lift the axis computer board straight up.	<p>xx100000953</p> <p>A Axis computer board B Axis computer cover C Attachment screws</p>

Refitting

Use this procedure to refit the axis computer.

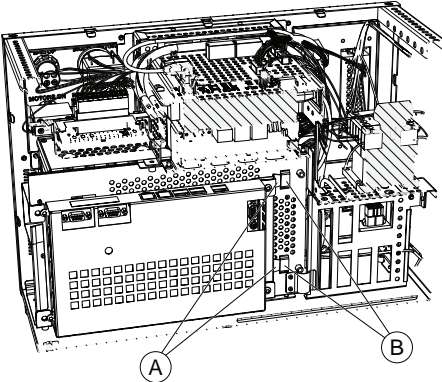
	Action	Info/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 34</p>	
3	Gently fit the axis computer board into the cover and refit the attachment screws.	

Continues on next page

4 Repair

4.13 Replacement of axis computer

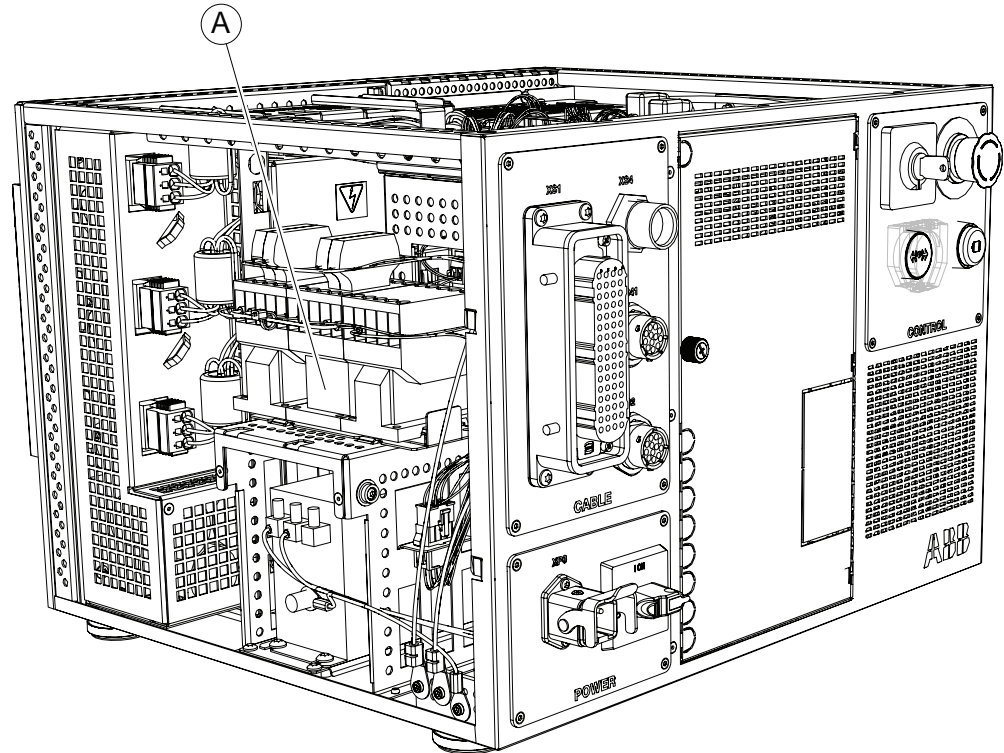
Continued

	Action	Info/illustration
4	Slide the axis computer unit into the controller, ensuring that the latches fit into the recesses.	 <p>xx1500000235</p> <p>A Latches B Recesses</p>
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 118 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.



xx140002008


A	Contactor unit
---	----------------

Required equipment

Equipment	Note
Contactor unit	Contactor ASL16-30-10 DC24V See Miscellaneous parts on page 212 .
Circuit diagram	See Circuit diagrams on page 217 .

Removal

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

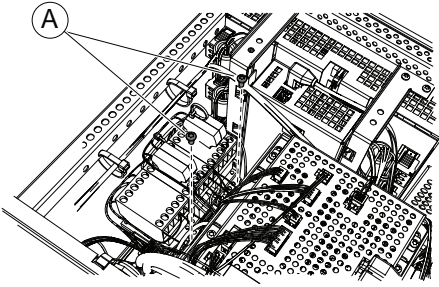
Action	Note/illustration
<p>1</p> <p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	

Continues on next page

4 Repair


4.14 Replacement of contactor unit

Continued

	Action	Note/illustration
2	Remove the cover of the cabinet.	See Opening the IRC5 Compact controller on page 89 .
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

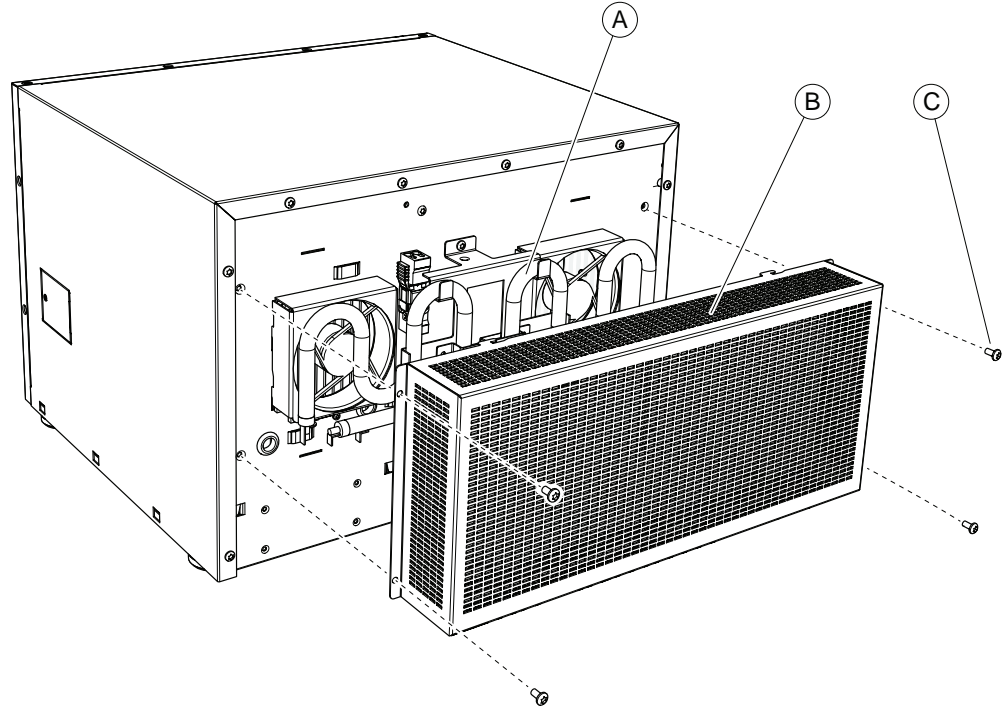
The procedure below details how to refit the backup energy bank.

	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! 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 118 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 <i>Miscellaneous parts on page 212</i> .
Standard toolkit	The content is described in section <i>Standard toolkit, IRC5 on page 207</i> .

Removal

Use the following procedure to remove the line filter.


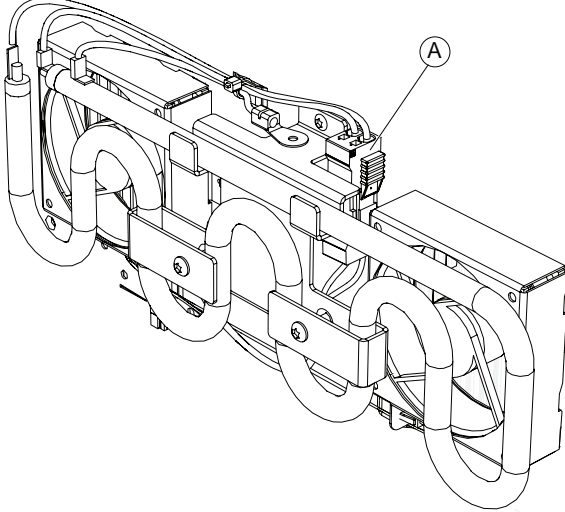
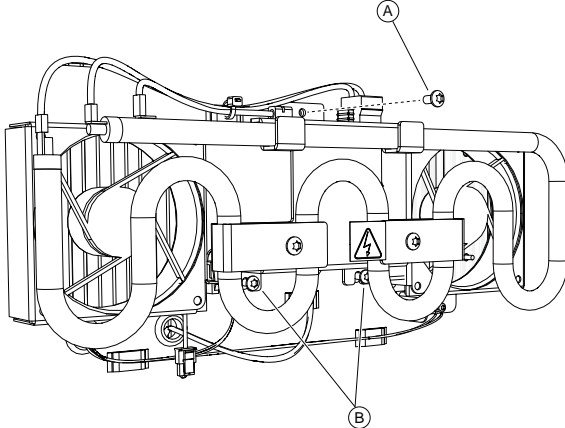
	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 33</i>.</p>	

Continues on next page

4 Repair

4.15 Replacement of brake resistor bleeder


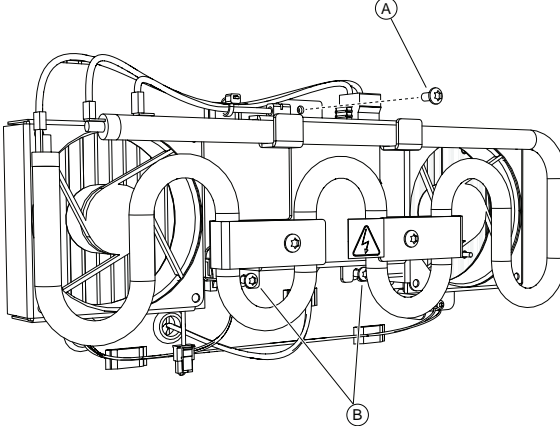
Continued

	Action	Note/illustration
2	<p> CAUTION</p> <p>Hot surface on top of the bleeder. Risk of burns. Be careful when removing the unit.</p>	
3	Remove the fan cover.	
4	Disconnect the bleeder connector.	 <p>xx1500000119</p> <p>A Bleeder connector</p>
5	Loosen the two lower attachment screws on the bleeder bracket.	 <p>xx1400001458</p> <p>A Upper attachment screw B Lower attachment screws</p>
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

Refitting

Use the following procedure to refit the line filter.

	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	<p>Refit the brake resistor bleeder by sliding the recesses in beneath the lower attachment screw heads, and push it inwards and then downwards.</p>	 <p>xx1400001458</p> <p>A Upper attachment screw B Lower attachment screws</p>
3	<p>Refit the upper attachment screw.</p>	
4	<p>Tighten all the attachment screws for the bleeder.</p>	
5	<p>Reconnect the bleeder connector.</p>	
6	<p>Refit the fan cover, push it left towards the grooves.</p>	
7	<p>Refit the attachment screws for the fan cover, and tighten them.</p>	
8	<p>Perform the function tests in section <i>Function tests on page 118</i> to verify that the safety features work properly.</p>	

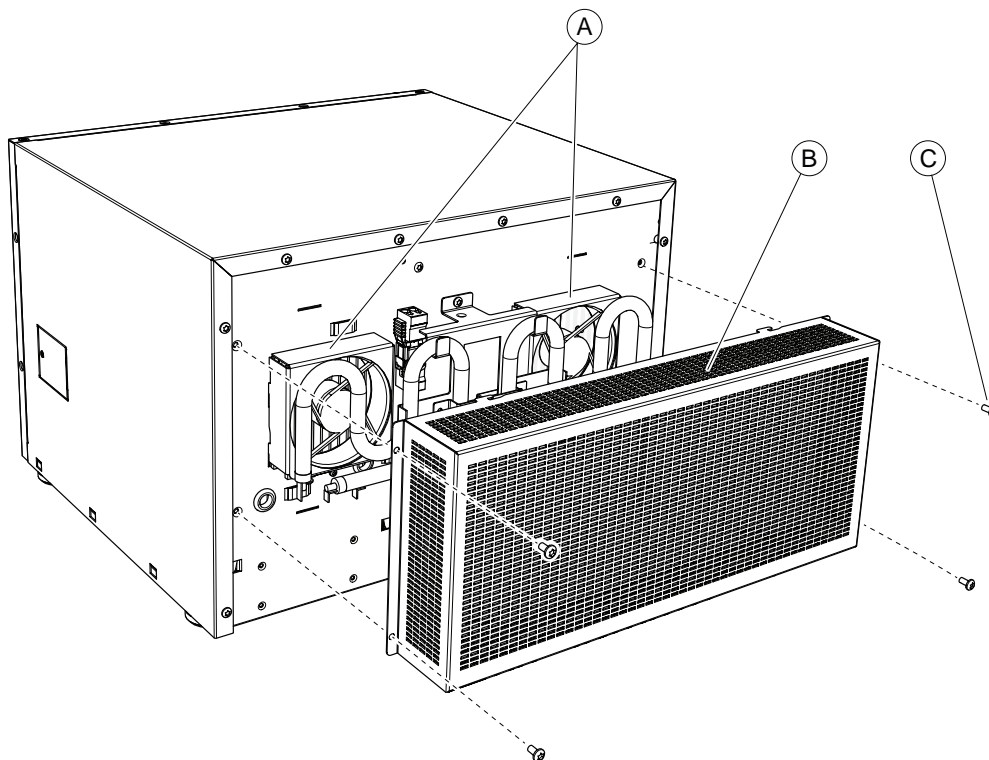
4 Repair

4.16 Replacement of system fans

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



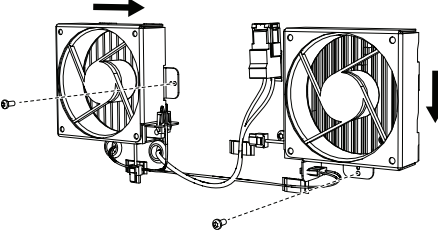
Required equipment

Equipment	Note
Fan with receptacle	See Miscellaneous parts on page 212 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .

Continues on next page


Removal

Use this procedure to remove one of the system fans.

	Action	Info/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.	
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 <i>Replacement of brake resistor bleeder</i> on page 175.
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 commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> 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.	

Continues on next page

4 Repair

4.16 Replacement of system fans

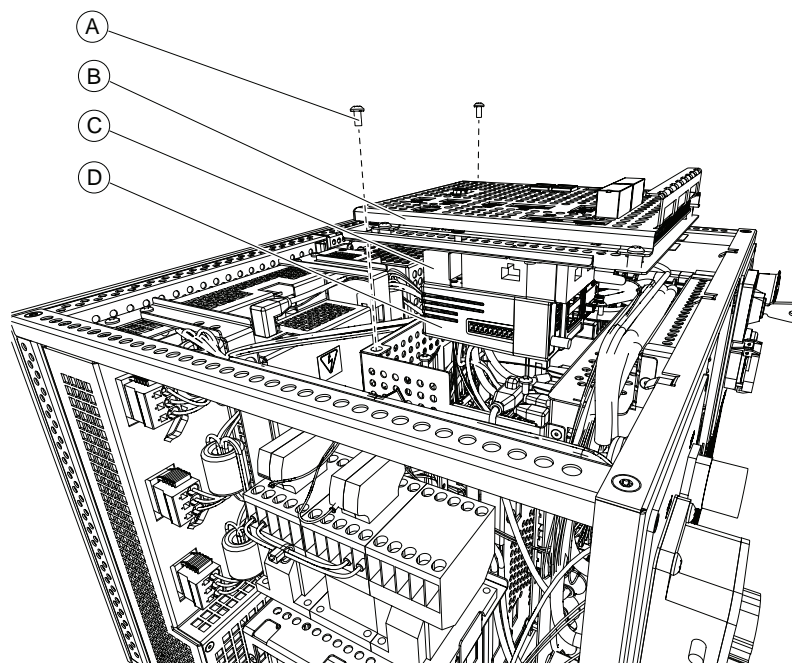
Continued

	Action	Info/illustration
5	Refit and connect the brake resistor bleeder.	See Replacement of brake resistor bleeder on page 175 .
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 118 to verify that the safety features work properly.	

4.17 Replacement of Remote Service box

Location

The following illustration shows the location of the Remote Service box.



xx150000230

A	Attachment screws
B	Safety board
C	Ethernet switch
D	Remote Service box

Required equipment

Equipment	Information
Remote Service box	DSQC 680 See Controller system parts on page 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
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 217 .

Continues on next page



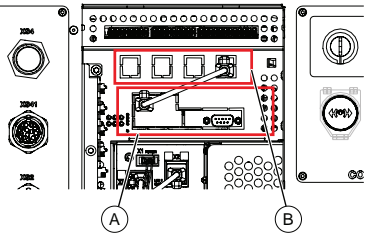
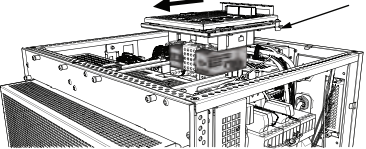
4 Repair

4.17 Replacement of Remote Service box

Continued

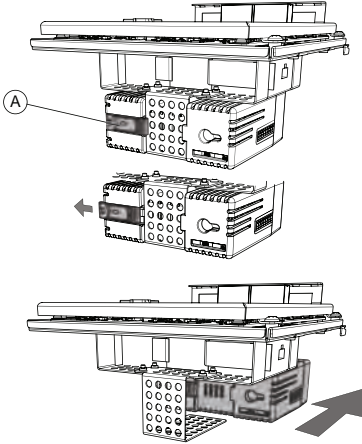
Removal

Use this procedure to remove the Remote Service box.

	Action	Information
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 34</p>	
3	<p>On the cabinet front, disconnect the connectors from the Remote Service contacts.</p> <p>If you have an Ethernet switch, disconnect the connectors from this as well.</p>	 <p>xx1400002787</p> <p>A Remote Service contacts B Ethernet switch contacts</p>
4	<p>Remove the cover of the cabinet.</p>	<p>See Opening the IRC5 Compact controller on page 89.</p>
5	<p>Disconnect all connectors from the safety board, Remote Service box, and Ethernet switch.</p>	
6	<p>Remove the two attachment screws, and push the safety board unit backwards to release the latches.</p>	 <p>xx1400001462</p>



Continues on next page

4.17 Replacement of Remote Service box
Continued

	Action	Information
7	Pull the latch (A) to the left, and push the Remote Service box out.	 <p>xx1400001460</p>

Refitting

Use this procedure to refit the Remote Service box.

	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 34
3	Pull the latch to the left and push the Remote Service 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 Remote Service box, Ethernet switch and safety board.
6	Refit the cabinet cover.
7	Perform the function tests in section <i>Function tests on page 118</i> to verify that the safety features work properly.

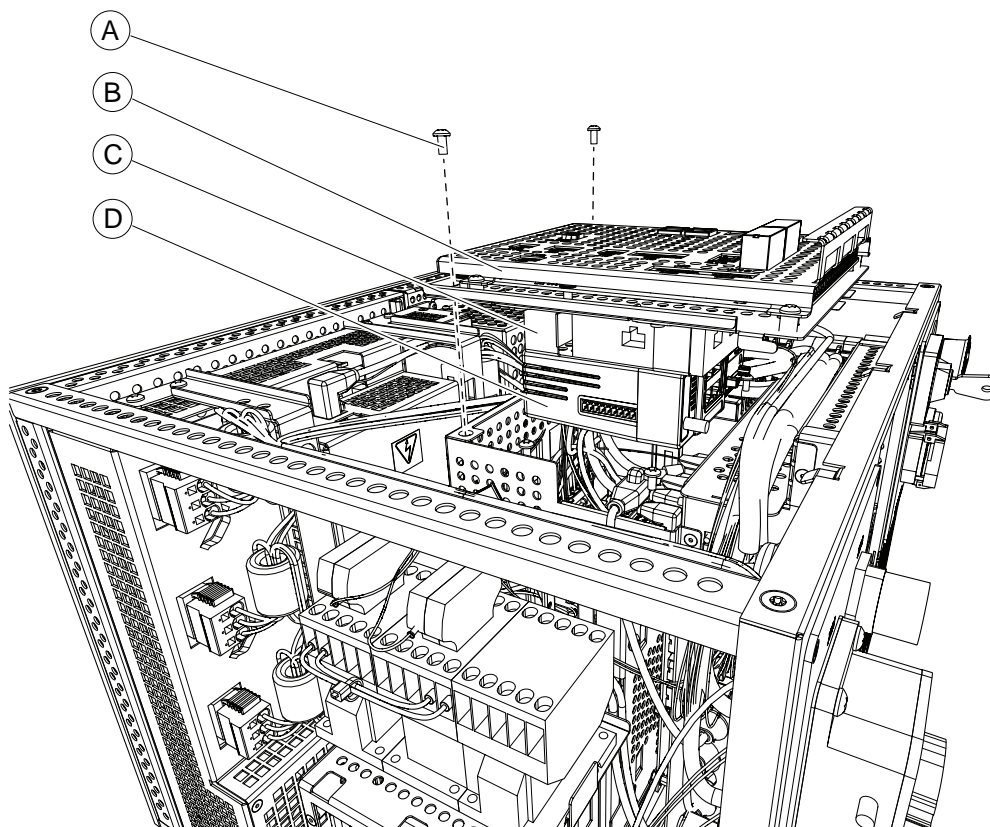
4 Repair

4.18 Replacement of Ethernet switch

4.18 Replacement of Ethernet switch

Location

The following illustration shows the location of the Ethernet switch.



xx150000230

A	Attachment screws
B	Safety board
C	Ethernet switch
D	Remote Service box



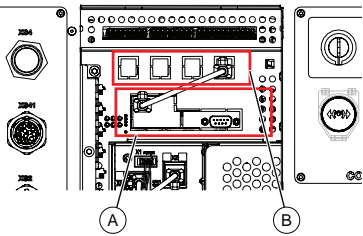
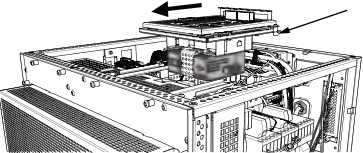
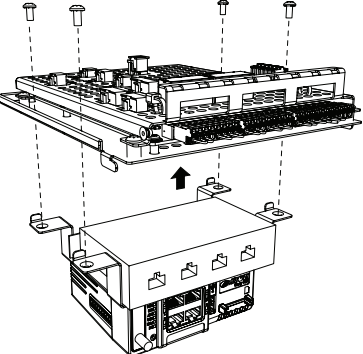
Required equipment

Equipment	Information
Ethernet switch	3HAC034884-001
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
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 217 .

Continues on next page

Removal

Use this procedure to remove the Ethernet switch.

	Action	Information
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	
2	 <p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 34</p>	
3	<p>On the cabinet front, disconnect the connectors from the Ethernet switch contacts.</p> <p>If you have a Remote Service box, disconnect the connectors from this as well.</p>	 <p>xx1400002787</p> <p>A Remote Service contacts B Ethernet switch contacts</p>
4	<p>Remove the cover of the cabinet.</p>	<p>See Opening the IRC5 Compact controller on page 89.</p>
5	<p>Disconnect all connectors from the safety board, Ethernet switch, and Remote Service box.</p>	
6	<p>Remove the two attachment screws, and push the safety board unit backwards to release the latches.</p>	 <p>xx1400001462</p>
7	<p>Remove the attachment screws, and lift off the safety board.</p>	 <p>xx1500000231</p>
8	<p>Remove the Ethernet switch.</p>	

Continues on next page



4 Repair

4.18 Replacement of Ethernet switch

Continued

Refitting

Use this procedure to refit the Ethernet switch.

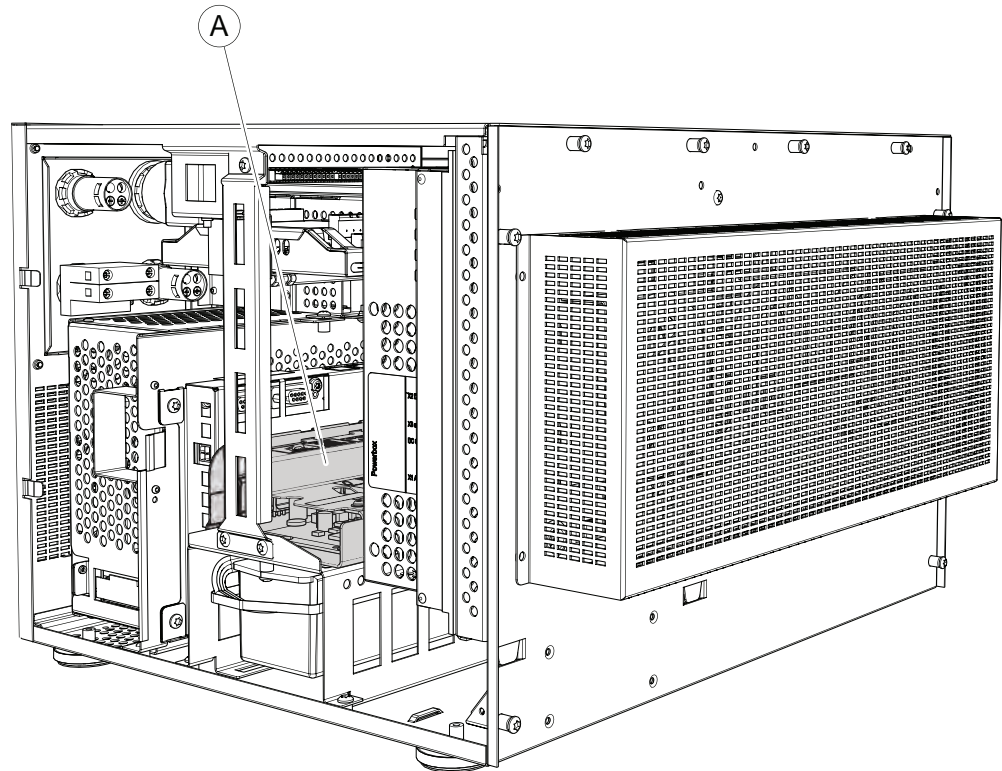
	Action
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 34
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, Remote Service box, and safety board.
7	Refit the cabinet cover.
8	Perform the function tests in section Function tests on page 118 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 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .

Continues on next page

4 Repair



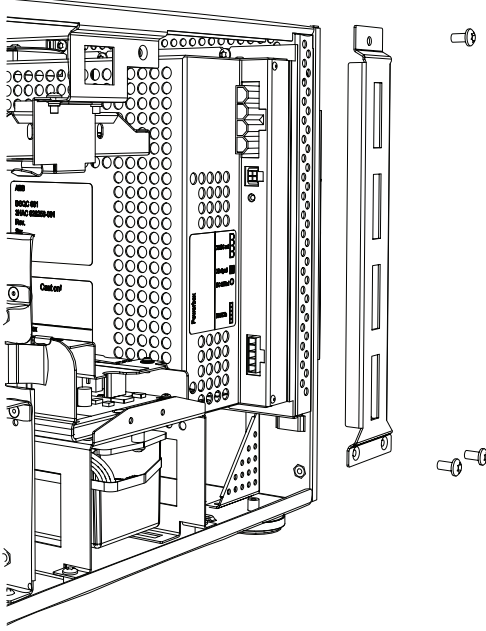
4.19.1 Replacement of power distribution unit

Continued

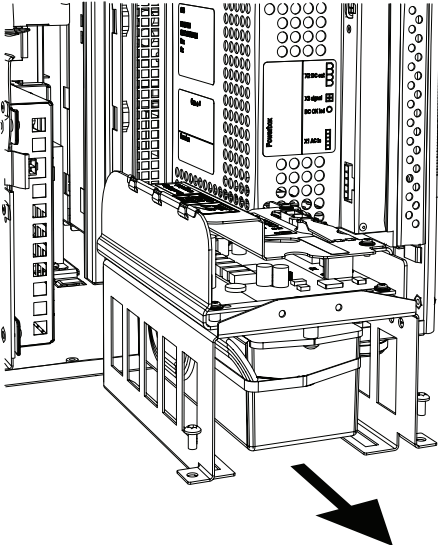
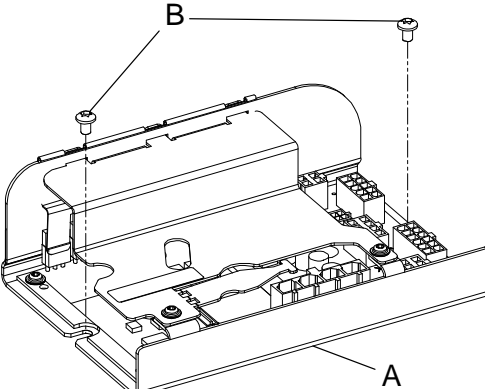
Equipment	Note
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See Circuit diagrams on page 217 .

Removal

Use this procedure to remove the power distribution unit.

	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! 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 89 .
4	Remove the three attachment screws, and remove the support bar.	 xx1400001384

Continues on next page

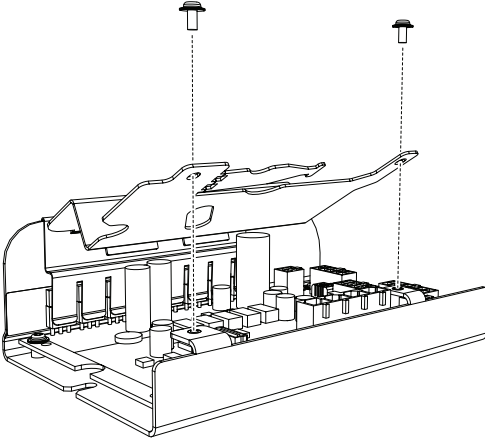
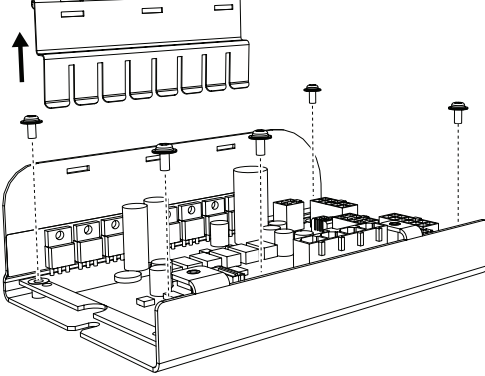
	Action	Note/illustration
5	Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 <p data-bbox="949 862 1053 884">xx1400001385</p>
6	Disconnect all connectors from the power distribution unit.	
7	Pull the backup energy bank unit out completely.	
8	Remove the attachment screws and lift the board out.	 <p data-bbox="949 1456 1053 1478">xx0900000549</p> <ul data-bbox="981 1500 1300 1556" style="list-style-type: none"> • A: power distribution unit • B: attachment screws

Continues on next page

4 Repair


4.19.1 Replacement of power distribution unit

Continued

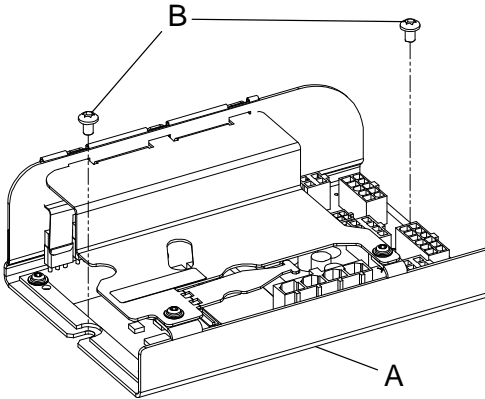

	Action	Note/illustration
9	Remove the two attachment screws and cover plate.	 <p>xx1400001464</p>
10	Remove the five attachment screws and spring.	 <p>xx1400001465</p>

Refitting

Use this procedure to refit the power distribution unit.

	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	

Continues on next page

	Action	Note/illustration
2	Put the new power distribution unit in place and refit the attachment screws.	 <p>xx0900000549</p> <ul style="list-style-type: none"> • 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	<p>Reconnect the connectors X1 - X9.</p> <p> CAUTION</p> <p>Hot surface on top of the power distribution unit.</p> <p>Do not route or place cables on top of the power distribution unit.</p>	
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 118 to verify that the safety features work properly.	

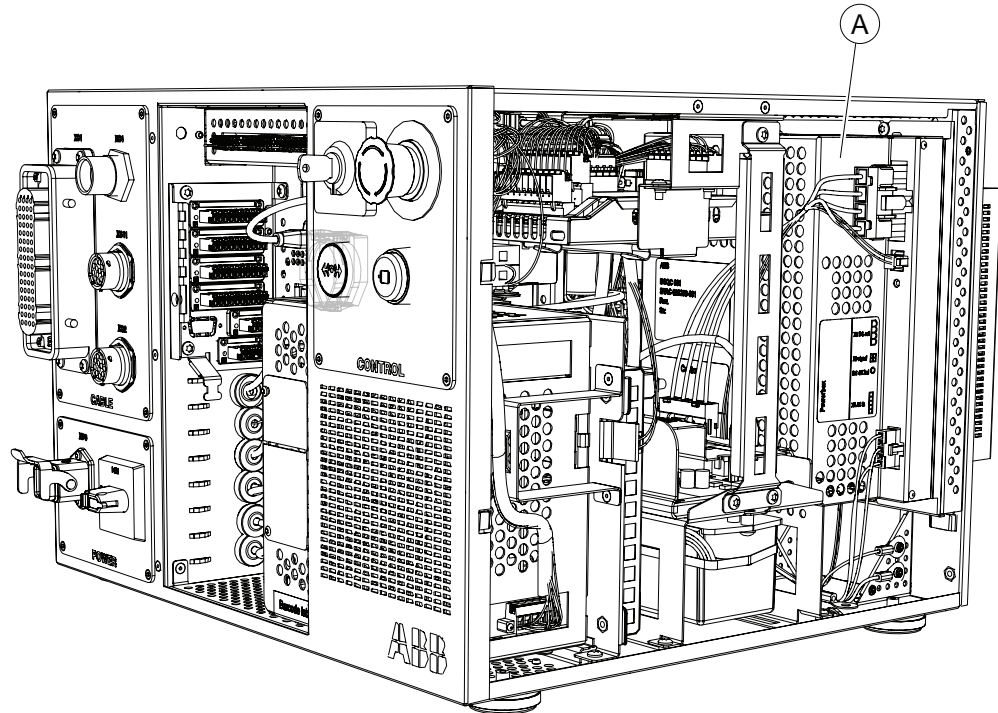
4 Repair

4.19.2 Replacement of system power supply

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 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

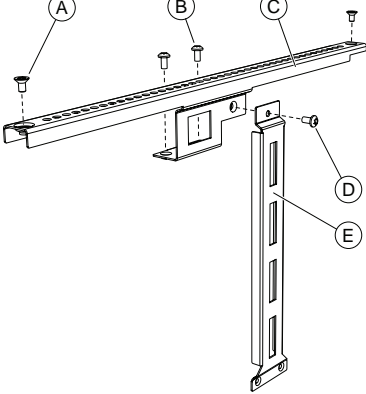
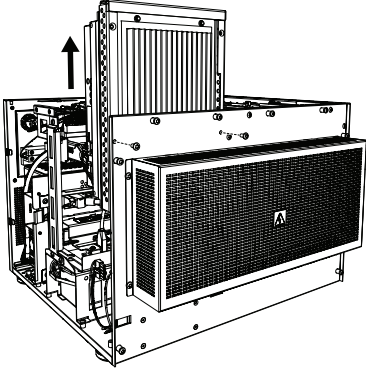
Removal

Use the following procedure to remove the system power supply.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33 .	

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4.19.2 Replacement of system power supply Continued

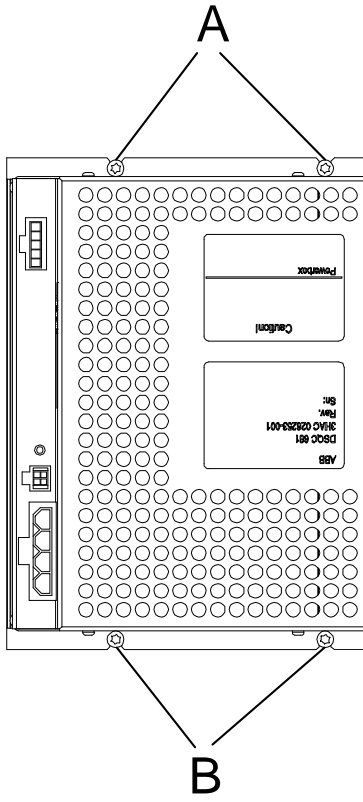
	Action	Note/Illustration
2	Remove the cover of the cabinet.	See Opening the IRC5 Compact controller on page 89 .
3	Disconnect all connectors from the unit.	
4	Remove the right side beam, according to illustration.	 <p data-bbox="1070 840 1181 862">xx1400001468</p> <ul data-bbox="1102 873 1433 1115" style="list-style-type: none"> • 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.	 <p data-bbox="1070 1507 1181 1529">xx1400001467</p>
6	Pull the system power supply with support bracket straight up.	

Continues on next page

4 Repair


4.19.2 Replacement of system power supply

Continued

	Action	Note/Illustration
7	Loosen the two lower attachment screws.	 <p data-bbox="1038 1122 1145 1144">xx0900000570</p> <ul data-bbox="1074 1160 1406 1249" style="list-style-type: none"> • 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.	

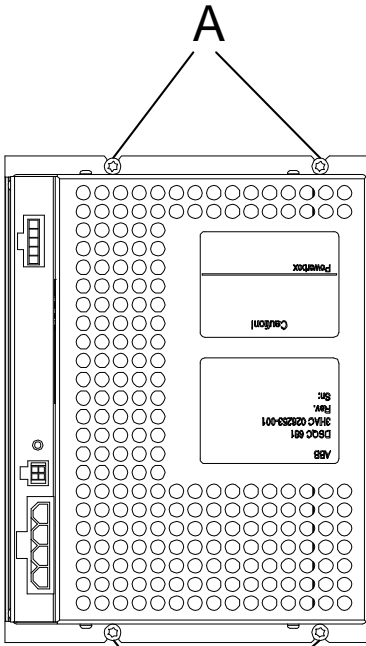
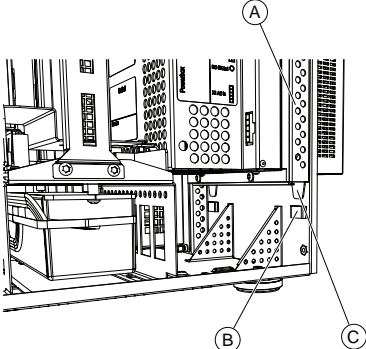
Refitting

Use the following procedure to refit the system power supply.

	Action	Note/Illustration
1	 <p data-bbox="563 1581 671 1608">DANGER</p> <p data-bbox="472 1641 1034 1749">Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 33.</p>	

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.	 <p>The diagram shows a power supply unit with a grid of holes. Two screws at the top are labeled 'A' and two at the bottom are labeled 'B'. The unit has labels: 'PowerBox', 'Control', 'ABB', 'D50C 801', '3HAC 02823-001', 'Rev. 1', and '81C'.</p> <p>xx0900000570</p> <ul style="list-style-type: none"> • 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.	 <p>The diagram shows the power supply unit being inserted into a rack. A support bracket is being attached to the back of the unit. Labels A, B, and C point to the support bracket, a recess, and a latch respectively.</p> <p>xx1400001469</p> <ul style="list-style-type: none"> • 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

4 Repair

4.19.2 Replacement of system power supply

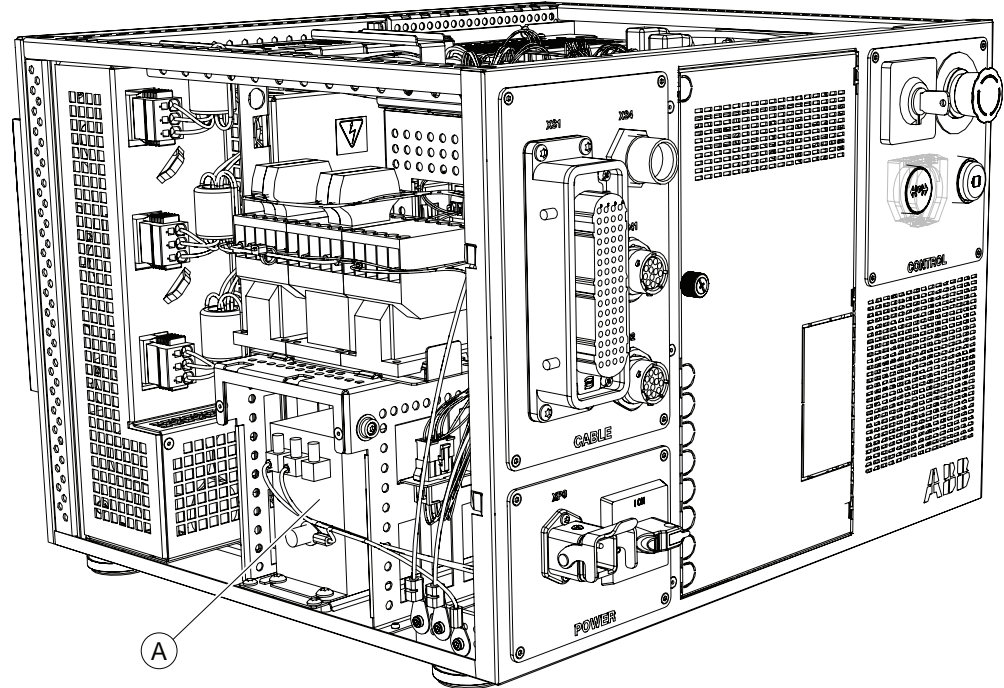
Continued

	Action	Note/Illustration
9	Refit the cabinet cover.	
10	Perform the function tests in section Function tests on page 118 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 209 .
Standard toolkit	The content is described in section Standard toolkit, IRC5 on page 207 .	
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		

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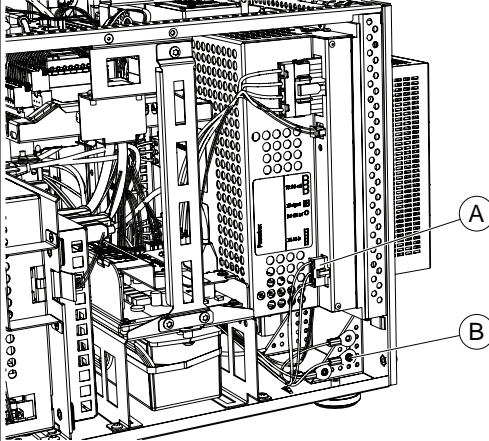
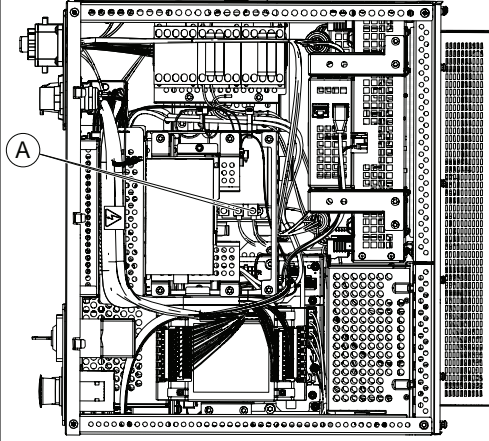
4 Repair

4.19.3 Replacement of line filter

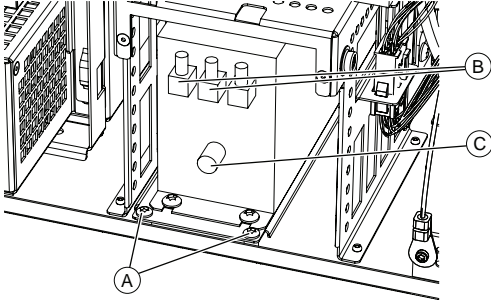
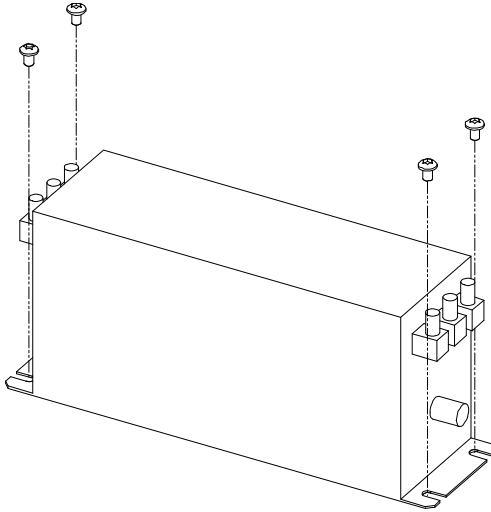
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Removal

Use the following procedure to remove the line filter.


	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	
2	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller</i> on page 89.
3	Disconnect connector X1 from the system power supply.	 <p>xx1400002853</p> <p>A Connector X1 B Ground connection</p>
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 <i>Replacement of Remote Service box</i> on page 181.
6	Disconnect the cables from L1', L2' on the secondary side of the line filter.	 <p>xx1400002854</p> <p>A Line filter connections</p>

Continues on next page

	Action	Note/illustration
7	Remove the two support bracket attachment screws and pull the line filter out slightly.	 <p>xx1400002849</p> <p>A Attachment screws for the support bracket B L1 and L2 connections C Ground connection</p>
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.	 <p>xx0900000572</p> <p>A Attachment screws for the line filter</p>

Refitting

Use the following procedure to refit the line filter.

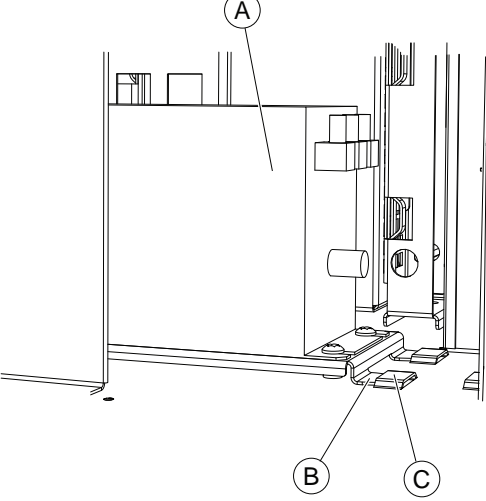
	Action	Note/illustration
1	 <p>DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 33.</p>	

Continues on next page

4 Repair

4.19.3 Replacement of line filter

Continued

	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.	 <p data-bbox="916 1137 1029 1160">xx140000XXXX</p> <ul data-bbox="948 1173 1091 1272" style="list-style-type: none"> 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 118 to verify that the safety features work properly.	

5 Decommissioning

5.1 Introduction

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.

General

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.

5 Decommissioning

5.2 Environmental information

5.2 Environmental information

Hazardous material

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

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 Reference information

6.2 Applicable standards

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.

Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1:2011	Robots for industrial environments - Safety requirements -Part 1 Robot
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
ISO 9283:1998	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1:2015 ⁱ	Classification of air cleanliness
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
EN 61000-6-4:2007 + A1:2011 IEC 61000-6-4:2006 + A1:2010 (option 129-1)	EMC, Generic emission
EN 61000-6-2:2005 IEC 61000-6-2:2005	EMC, Generic immunity
EN IEC 60974-1:2012 ⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10:2014 ⁱⁱ	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

ⁱ Only robots with protection Clean Room.

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

European standards

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

Continues on next page

Other standards

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

6 Reference information

6.3 Unit conversion

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 Reference information

6.5 Screw joints

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%**!

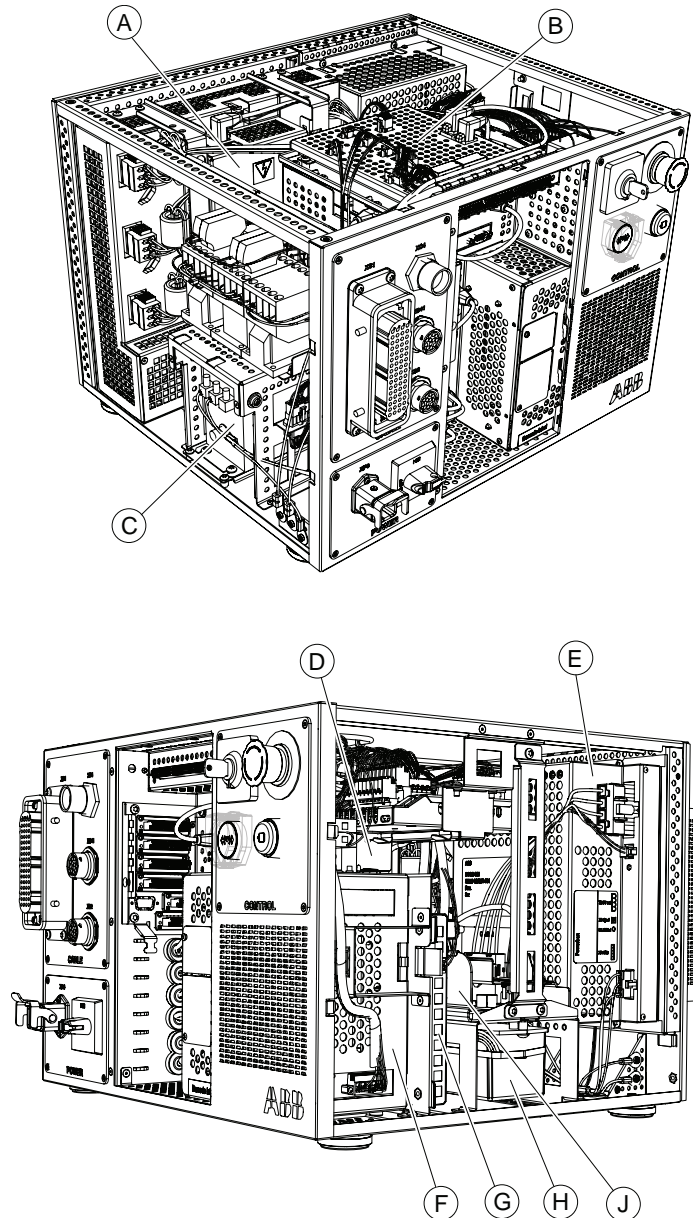
The table below specifies the recommended standard tightening torque for *oil-lubricated screws with slotted or cross-recess heads*.

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

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	3HAC037698-001	Line filter	

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7 Spare parts

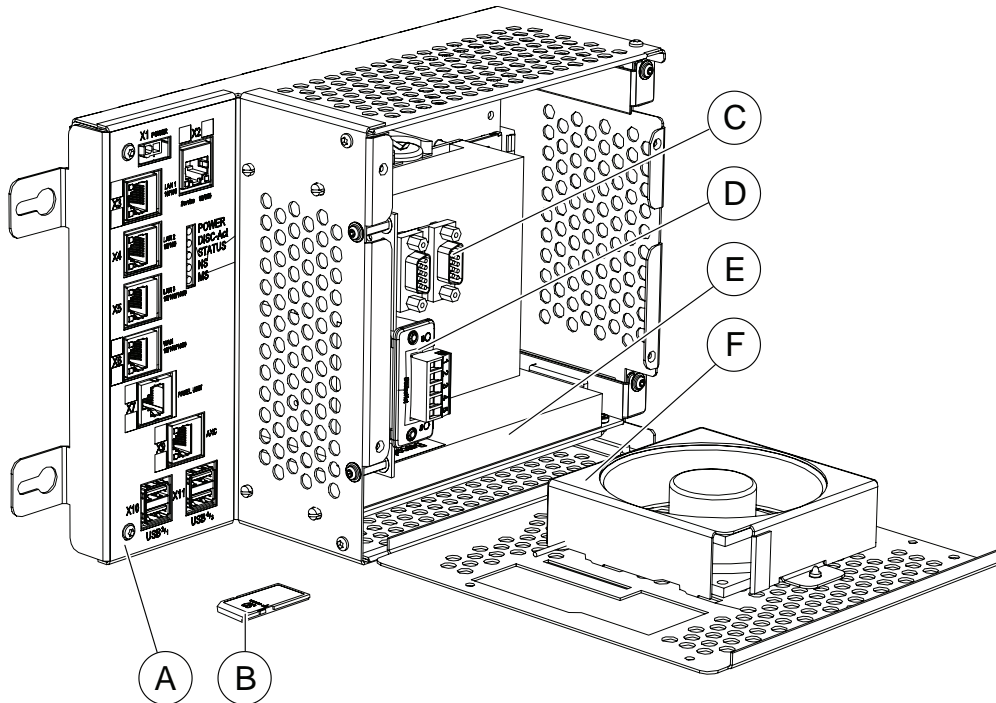
7.1 IRC5 Compact controller

Continued

	Spare part no.	Description	Note
D	3HAC043053-001	Remote Service box	DSQC 680
E	3HAC026253-001	System Power Supply	DSQC 661
F	See Computer unit parts on page 210 .		
G	3HAC028179-001	Axis computer	DSQC 668
H	3HAC025562-001	Backup energy bank	DSQC 655
J	3HAC026254-001	Power distribution unit	DSQC 662
	3HAC051190-001	Multipole con. XS7, XS8, XS9	

Computer unit parts

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



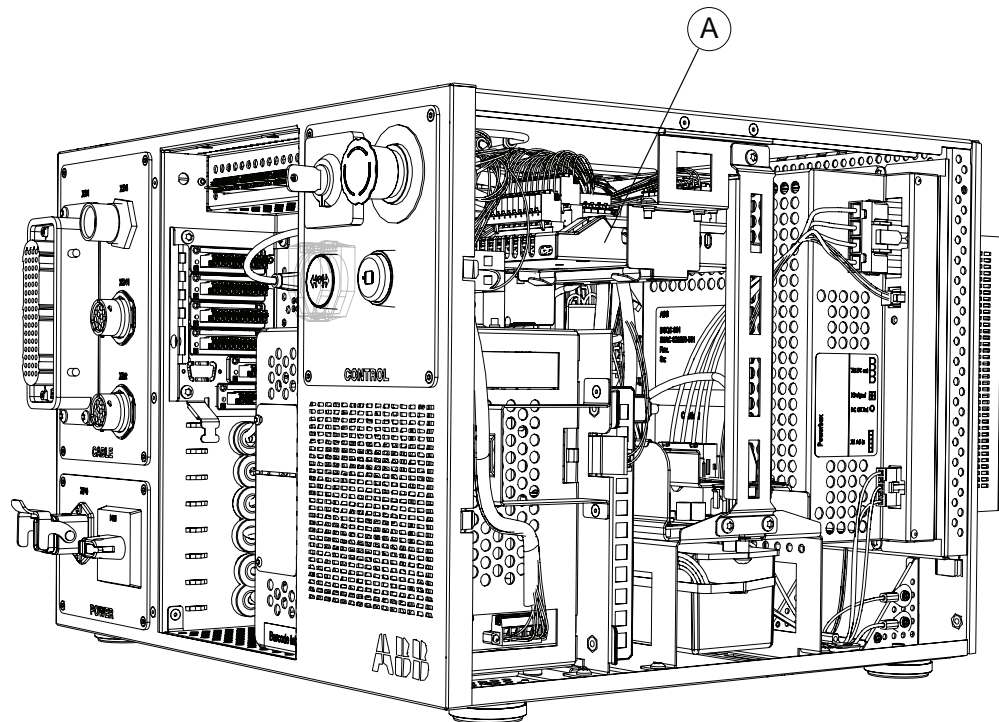
xx130000851

	Spare part no.	Description	Type
A	3HAC042766-001	Computer unit (1 PCI slot)	DSQC1000
A	3HAC050363-001	Computer unit (2 PCI slots)	DSQC1018
B	3HAC047184-003	Mass Memory with boot loader 2GB	- (previously called DSQC1008)
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
D	3HAC045973-001	DeviceNet Slave Fieldbus Adapter	DSQC1004

Continues on next page

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

I/O System parts



xx140001381

	Spare part no.	Description	Note
A		I/O unit	
*	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

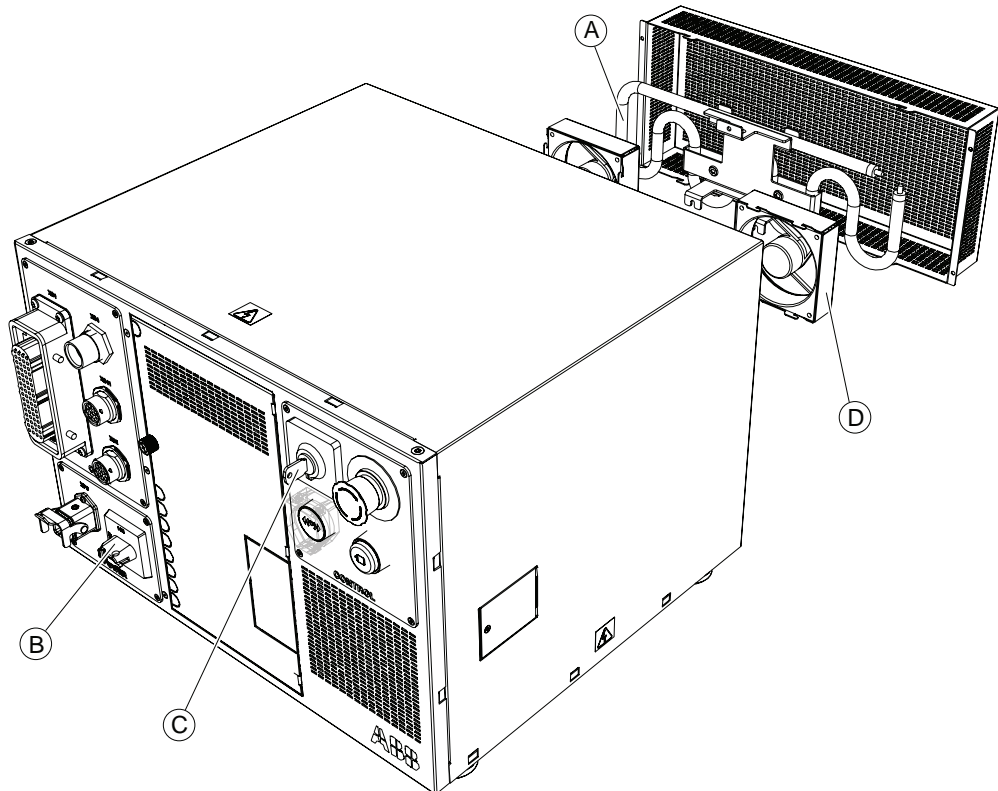
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7 Spare parts

7.1 IRC5 Compact controller

Continued

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
D	3HAC051135-001	Fan with receptacle
	3HAB2997-1	Wrist band
	3HAC037700-001	Contactors ASL16-30-10 DC24V
	3HAC031562-001	Auxiliary contact CA3-01
	3HAC033498-001	FlexPendant holder
	3HAC033596-002	FlexPendant holder upper part
	3HAC052262-001	Mounting kit, 19" cabinet

External operator's panel

	Spare part no.	Description	Note
-	3HAC038671-001	External control panel box	Option 733-4
-	3HAC038672-001	External Operator's panel cable 7m	Option 734-5
-	3HAC038673-001	External Operator's panel cable 15m	Option 734-1
-	3HAC038674-001	External Operator's panel cable 30m	Option 734-3

7.2 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

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
3HAC7998-3	Control cable signal 22 m
3HAC7998-4	Control cable signal 30 m

Continues on next page

7 Spare parts

7.2 Manipulator cables

Continued

Power cables, IRB 260

Art. no.	Description
3HAC9038-1	Control cable power 7 m
3HAC9038-2	Control cable power 15 m
3HAC9038-3	Control cable power 22 m
3HAC9038-4	Control cable power 30 m

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
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

Continues on next page

Power cables, IRB 1200

Spare part no.	Description
3HAC040503-007	Control cable power 3 m
3HAC040503-001	Control cable power 7 m
3HAC040503-002	Control cable power 15 m
3HAC040503-003	Control cable power 22 m
3HAC040503-004	Control cable power 30 m

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

Art. no.	Description
3HAC2492-1	Control cable power 7 m
3HAC2529-1	Control cable power 15 m
3HAC2539-1	Control cable power 22 m
3HAC2564-1	Control cable power 30 m
3HAC9038-1	Control cable power 7 m
3HAC9038-2	Control cable power 15 m
3HAC9038-3	Control cable power 22 m
3HAC9038-4	Control cable power 30 m

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

Continues on next page

7 Spare parts

7.2 Manipulator cables

Continued

Art. no.	Description	Option no.
3HAC061420-003	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 delivered as separate documents on the documentation DVD. See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRC5</i>	<i>3HAC024480-011</i>
<i>Circuit diagram - IRC5 Compact</i>	<i>3HAC049406-003</i>
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	<i>3HAC026871-020</i>
<i>Circuit diagram - Euromap</i>	<i>3HAC024120-004</i>
<i>Circuit diagram - Spot welding cabinet</i>	<i>3HAC057185-001</i>

Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	<i>3HAC031408-003</i>
<i>Circuit diagram - IRB 140 type C</i>	<i>3HAC6816-3</i>
<i>Circuit diagram - IRB 260</i>	<i>3HAC025611-001</i>
<i>Circuit diagram - IRB 360</i>	<i>3HAC028647-009</i>
<i>Circuit diagram - IRB 460</i>	<i>3HAC036446-005</i>
<i>Circuit diagram - IRB 660</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 760</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 1200</i>	<i>3HAC046307-003</i>
<i>Circuit diagram - IRB 1410</i>	<i>3HAC2800-3</i>
<i>Circuit diagram - IRB 1600/1660</i>	<i>3HAC021351-003</i>
<i>Circuit diagram - IRB 1520</i>	<i>3HAC039498-007</i>
<i>Circuit diagram - IRB 2400</i>	<i>3HAC6670-3</i>
<i>Circuit diagram - IRB 2600</i>	<i>3HAC029570-007</i>
<i>Circuit diagram - IRB 4400/4450S</i>	<i>3HAC9821-1</i>
<i>Circuit diagram - IRB 4600</i>	<i>3HAC029038-003</i>
<i>Circuit diagram - IRB 6400RF</i>	<i>3HAC8935-1</i>
<i>Circuit diagram - IRB 6600 type A</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6600 type B</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6620</i>	<i>3HAC025090-001</i>

Continues on next page

8 Circuit diagrams

8.1 Circuit diagrams

Continued

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	<i>3HAC025090-001</i>
<i>Circuit diagram - IRB 6640</i>	<i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6650S</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6660</i>	<i>3HAC025744-001</i> <i>3HAC029940-001</i>
<i>Circuit diagram - IRB 6700</i>	<i>3HAC043446-005</i>
<i>Circuit diagram - IRB 7600</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 14000</i>	<i>3HAC050778-003</i>
<i>Circuit diagram - IRB 910SC</i>	<i>3HAC056159-002</i>

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