

# Product manual

## IRC5 Compact

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IRC5 Compact  
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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 - Trouble shooting IRC5</i>	3HAC020738-001
<i>Application manual - MultiMove</i>	3HAC050961-001
<i>Application manual - Force Control</i>	3HAC050377-001
See <a href="#">Circuit diagrams on page 197</a> .	



### Note

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

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## Overview of this manual

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### Revisions

Revision	Description
-	First edition. Released with the new computer unit, DSQC1000.
A	New computer unit, DSQC1018, with two PCI slots and no knockout plates. No functional change, but affects illustrations. Corrections on chapter <a href="#">Repair on page 111</a> . Corrected article number for line filter in <a href="#">Replacement of line filter on page 177</a> . Clarified the use of the WAN port in section <a href="#">Connectors on the computer unit on page 65</a> .
B	Added mounting kit as spare part in section <a href="#">Mounting the controller in a 19" cabinet on page 55</a> . Some changes on how the ports can be configured and used is described in section <a href="#">Connectors on the computer unit on page 65</a> .
C	<ul style="list-style-type: none"><li>Minor corrections.</li><li>Added safety-related information to sections <a href="#">CAUTION - Make sure that all mode switch keys are kept safe on page 45</a>, <a href="#">Function tests on page 102</a>, and <a href="#">Refurbish on page 109</a>.</li><li>Updates in section <a href="#">Applicable safety standards on page 184</a>.</li></ul>

# 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.

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## 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.

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## 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 trouble shooters.

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 - Introduction to RAPID*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5, for the controller and manipulator.*

# Network security

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## 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.

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# 1 Safety

## 1.1 Introduction to safety information

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### 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 32](#).
- 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 38](#).

# 1 Safety

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## 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, repair and maintenance work.

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#### Sections

The general safety information is divided into the following sections.

Contents	Examples of content
<b>General information</b>	<ul style="list-style-type: none"><li>• safety, service</li><li>• limitation of liability</li><li>• related information</li></ul>
<b>Safety risks</b> lists dangers relevant when working with the product. The dangers are split into different categories.	<ul style="list-style-type: none"><li>• safety risks during installation or service</li><li>• risks associated with live electrical parts</li></ul>
<b>Safety actions</b> describes actions which may be taken to remedy or avoid dangers.	<ul style="list-style-type: none"><li>• fire extinguishing</li><li>• safe use of the teach pendant or jogging device</li></ul>
<b>Safety stops</b> describes different types of stops.	<ul style="list-style-type: none"><li>• stopping functions</li><li>• description of emergency stop</li><li>• description of safety stop</li></ul>

## 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*<sup>1</sup>
- *Product manual*

<sup>1</sup> 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

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## 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

## 1.2.3 Safety risks

### 1.2.3.1 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, 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 mains supply/mains 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.

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# 1 Safety

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## 1.2.3.1 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.

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### Voltage related risks, robot

A danger of high 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).

See chapter *Installation* in the product manual.

---

### 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.

### 1.2.4 Safety actions

#### 1.2.4.1 Fire extinguishing



##### Note

Use a CARBON DIOXIDE (CO<sub>2</sub>) extinguisher in the event of a fire in the robot system (robot or controller)!

# 1 Safety

## 1.2.5.1 Overview of robot stopping functions

### 1.2.5 Safety stops

#### 1.2.5.1 Overview of robot stopping functions

##### Overview

Stops are categorized/classified by standards IEC 60204-1:2005 and ISO 10218-1:2011.

There are several robot stopping functions in the robot system.

- Hardware stops connected to the run chain.
- Manual stops.
- Stop with system input signals.
- Stop with RAPID instructions.
- System failure stops.

##### Stop modes

Stops can be in *category 0* or *category 1* mode. The stop mode is configured with system parameters, see [Soft stops on page 23](#).

Category 0 stop	This is related to stop category 0 as described in IEC 60204-1:2005, which means that power is removed immediately from the drive units, by releasing the run chain through the software enable signal, and the brakes are activated. Also the servo motors are used for the braking, by reversing to "generator" and ramping down the generated power in a controlled way. In this way, both the brakes and the motors are used to stop the robot, giving the shortest possible stop time and stop distance. However, it also means that the robot may leave the programmed path.
Category 1 stop	This is related to stop category 1 as described in IEC 60204-1:2005. It means that the power will be connected to the drive units for about 1 second, by a hardware delay, and the movement will be put to a full stop using the servo motors before the power is removed from the motors and the brakes are activated. This way the robot will stop on or very close to the programmed path. The category 1 stop is also called "soft" because it will be more soft for the mechanics, but note, it is the same as a <i>QuickStop</i> when initiated via a system input, see below.

##### Hardware stops connected to the run chain

There are several hardware stops available. All these stops are of safety category 3 as described in EN 13849-1, that is double channel initiated stop.

Stop connections:	Description:
Emergency stop	Disconnects drive power in all operating modes.
Automatic mode stop	Disconnects drive power in automatic operating mode. To be used as <i>Protective stop</i> in auto. Also called <i>Safety stop</i> . In manual mode this input connection will be inactive.

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Stop connections:	Description:
General stop	Disconnects drive power in all operating modes. To be used as <i>Protective stop</i> in all operating modes. Also called <i>Safety stop</i> .
Superior stop (not applicable for IRC5 Compact)	Disconnects drive power in all operating modes. To be used as <i>Protective stop</i> in all operating modes. Also called <i>Safety stop</i> . Intended for external equipment.

**Soft stops**

The stop mode for hardware stops is configured with system parameters, one parameter for each stop. Each of these parameters can have the value TRUE or FALSE (true or false). If TRUE the stop will be category 1 (or soft). If FALSE it will be category 0, (see exception below).

Default values are TRUE for SoftAS, SoftGS, and SoftSS, and FALSE for SoftES.

The parameters are of the type *Safety Run Chain* in the topic *Controller*. The following descriptions apply if the values are set to TRUE.

Soft Stop:	Description:
SoftES	Soft emergency stop is activated by pressing the emergency stop push button on the FlexPendant or on the industrial controller. SoftES is only used in auto. In manual mode, emergency stop will be a category 0 stop regardless if the value is TRUE or FALSE.
SoftAS	Soft automatic mode stop is intended for automatic mode during normal program execution. This stop is activated by safety devices such as light curtains, light beams, or sensitive mats.
SoftGS	Soft general stop is activated by safety devices such as light curtains, light beams, or sensitive mats.
SoftSS (not applicable for IRC5 Compact)	Soft superior stop has the same function as a general stop but is intended for externally connected safety devices.

**Manual stops**

A manual stop is initiated by a person. It can be a controlled or an uncontrolled stop depending on how the stop is initiated.

Stop mode:	Manual stop:	Description:
Category 1	Stop button on FlexPendant or release of hold-to-run function	This will stop program execution and cause an immediate stop of manipulator movements in all tasks. The manipulators will stop on the path with no deviation. This is called normal program stop.
Category 0	Release of enabling device or switching operating mode key	This will stop program execution and stop all program movements.

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# 1 Safety

## 1.2.5.1 Overview of robot stopping functions

*Continued*

### Stop with system input signals

In addition to the hardware stops as described above, it is also possible to define system input signals, which will give an immediate or delayed stop of different modes for all tasks and manipulators, when activated. Such signals are defined as system parameters of the type *System Input* in the topic I/O and for the following stop modes.

Stop mode:	Description:
Stop	Stops the RAPID program execution. All manipulator movements will be stopped on the path with no deviation. A program cannot be started when this signal is high. This stop is similar to a normal program stop using stop button on the FlexPendant.
QuickStop	Stops the RAPID program execution quickly, like a category 1 stop. This stop is performed by ramping down motion as fast as possible using optimum motor performance. The different axes are still coordinated to trying to keep the manipulator on path even if it may slide off by some millimeters. This kind of stop is more stressing for the mechanics than normal stop or SoftStop.
SoftStop	Stops the RAPID program execution much like an ordinary program stop, but slightly faster. The stop is performed by ramping down motion in a coordinated way, to keep the manipulator on the programmed path with minor deviation. This kind of stop is more soft to the mechanics than the QuickStop.
Stop at End of Cycle	Stops the RAPID program when the complete program is executed, that means when the last instruction in the main routine has been completed.
Stop at End of Instruction	Stops program execution after the current instruction is completed.

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



#### 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 manipulator.

Instruction:	Description:	Arguments:
SystemStopAction	Stops all manipulators 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 manipulator movements in all motion tasks. The Motors on button must be pressed before the program execution can be restarted.

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## 1.2.5.1 Overview of robot stopping functions

*Continued*

Instruction:	Description:	Arguments:
Stop	The current move instruction will be finished before the manipulator stops. A restart will continue the program execution.	\NoRegain - the manipulator will not return to the stop point when restarted, e.g. after having been jogged away. \AllMoveTasks - all manipulators 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 above for system input SoftStop, otherwise similar to a normal program stop. \AllMotionTasks - all manipulators 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.	
SearchX	Search instructions can be programmed with arguments to stop the manipulator movement close to the point where a search hit was noticed. The program execution will continue with the next instruction.	\Stop - the manipulator 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 manipulator may slide off path fairly much. This is also called StiffStop. \PStop - the manipulator will stop like after a normal program stop. \SStop - the manipulator will stop on path but quicker than a normal program stop. This is similar to a system input SoftStop. \Sup - the manipulator will continue to the ToPoint. If more than one search hit is found, an error will be reported.

RAPID instructions valid for IRC5 are described in *Technical reference manual - RAPID Instructions, Functions and Data types*.

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# 1 Safety

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## 1.2.5.1 Overview of robot stopping functions

*Continued*

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### System failure stops

Type of stop:	Description:
SysFail	In event of system failure raising a SysFail error the manipulator will stop immediately, with brakes being activated. This is a category 0 stop.
Power fail	In event of power failure the manipulator will stop immediately, with brakes being activated. This is a category 0 stop.
Stop at collision	When a collision is detected the manipulator will stop immediately, with power disconnected from the drive units and the brakes activated. After full stop the power is reconnected and the residual forces are relieved by moving the manipulator in the reversed direction a short distance back to its path. Then the program execution will stop with an error message. The manipulator remains in the state Motors on so that program execution can be resumed after the collision error message has been acknowledged. This is a category 0 stop.

## 1.2.5.2 What is an emergency stop?

### Definition of emergency stop

An emergency stop is a state that takes precedence over all other robot controls, causes all controlled hazards to stop, removes drive power from the robot actuators, remains active until it is reset, and can only be reset by manual action.

An emergency stop state means that all power is disconnected from the robot except for the manual brake release circuits. You must perform a recovery procedure, that is, resetting the emergency stop button and pressing the Motors On button, to return to normal operation.

The robot system can be configured so that the emergency stop results in either:

- A category 0 stop, immediately stopping the robot actions by disconnecting power from the motors.
- A category 1 stop, stopping the robot actions with power available to the motors so that the robot path can be maintained. When completed, power is disconnected from the motors.

The default setting is a category 0 stop. However, category 1 stops are preferred since they minimize unnecessary wear on the robot and the actions needed to return the system back to production. Consult your plant or cell documentation to see how your robot system is configured.



#### Note

The emergency stop function may only be used for the purpose and under the conditions for which it is intended.



#### Note

The emergency stop function is intended for immediately stopping equipment in the event of an emergency.



#### Note

Emergency stop should not be used for normal program stops as this causes extra, unnecessary wear on the robot.

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

### Classification of stops

The safety standards that regulate automation and robot equipment define categories in which each type of stop applies:

If the stop is...	... then it is classified as...
category 0 (zero)	uncontrolled
category 1	controlled

*Continues on next page*

## **1 Safety**

---

### **1.2.5.2 What is an emergency stop?**

*Continued*

---

#### **Emergency stop buttons**

In a robot system there are several emergency stop buttons that can be operated in order to achieve an emergency stop. There are emergency stop buttons available on the FlexPendant and on the controller cabinet. There can also be other types of emergency stops on your robot. Consult your plant or cell documentation to see how your robot system is configured.

## 1.2.5.3 What is a safety stop or protective stop?

### 1.2.5.3 What is a safety stop or protective stop?

#### Definition of safety stops

A safety stop is a state that stops all robot motion and removes power to the robot drive actuators. There is no recovery procedure. You need only to restore motor power to recover from a safety stop. Safety stop is also called protective stop.

The robot system can be configured so that the safety stop results in either:

- A category 0 stop, immediately stopping the manipulator actions by disconnecting power from the motors.
- A category 1 stop, stopping the manipulator actions with power available to the motors so that the manipulator path can be maintained. When completed, power is disconnected from the motors.

The default setting is a category 1 stop.

Category 1 stops are preferred since they minimize unnecessary wear on the manipulator and the actions needed to return the system back to production. Consult your plant or cell documentation to see how your robot system is configured.



#### Note

The safety stop function may only be used for the purpose and under the conditions for which it is intended.



#### Note

Safety stop should not be used for normal program stops as this causes extra, unnecessary wear on the manipulator.

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

#### Classification of stops

The safety standards that regulate automation and robot equipment define categories in which each type of stop applies:

If the stop is...	... then it is classified as...
category 0 (zero)	uncontrolled
category 1	controlled

*Continues on next page*

# 1 Safety

---

## 1.2.5.3 What is a safety stop or protective stop?

*Continued*

---

### Type of safety stops

Safety stops are activated through special signal inputs to the controller, see *Product manual - IRC5*.

The inputs are intended for safety devices such as cell doors, light curtains, or light beams.

Safety stop:	Description:
Automatic mode stop (AS)	Disconnects drive power in automatic mode. In manual mode this input is inactive.
General stop (GS)	Disconnects drive power in all operating modes.
Superior stop (SS) (not applicable for IRC5 Compact)	Disconnects drive power in all operating modes. Intended for external equipment.



#### Note

Use normal program stop for all other types of stop.

## 1.2.5.4 What is safeguarding?

### Definition

Safeguarding are safety measures consisting of the use of safeguards to protect persons from hazards which cannot reasonably be removed or sufficiently eliminated by design.

A safeguard prevents hazardous situations by stopping the robot when a safeguarding mechanism is activated. This is done by connecting the safeguard to any of the safety stop inputs in the robot controller.

The safety stops described in [What is a safety stop or protective stop? on page 29](#), should be used for safeguarding.



#### Note

The safeguarding function may only be used for the purpose and under the conditions for which it is intended.



#### Note

The safeguarding function should not be used for normal program stops as this causes extra, unnecessary wear on the manipulator.

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

### Safeguarded space

The safeguarded space is the space defined by the perimeter safeguarding. For example, a robot cell is safeguarded by the cell door and its interlocking device.

### Interlocking devices

Each present guard has an interlocking device which, when activated stops the manipulator. The manipulator cell door has an interlock that stops the manipulator when the door is opened. The only way to resume operation is to close the door.

### Safeguarding mechanisms

A safeguarding mechanism consists of a number of guards connected in series. When a guard is activated, the chain is broken and the machine operation is stopped regardless of the state of the guards in the rest of the chain.



#### Note

Use normal program stop for all other types of stop.

# 1 Safety

## 1.3.1 Safety signals in the manual

## 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

## 1.3.1 Safety signals in the manual

*Continued*

Symbol	Designation	Significance
 xx010000004	NOTE	Describes important facts and conditions.
 xx010000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

# 1 Safety

## 1.3.2 Safety symbols on controller labels

### 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 robot 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 system, for example during installation, service, or operation.

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

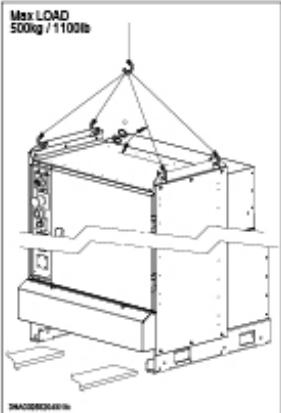
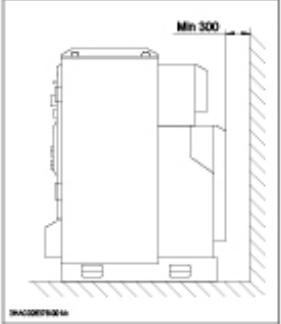
#### Symbols on safety labels

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).
 xx1400001156	High voltage inside the module even if the main switch is in the OFF position.

Continues on next page

## 1.3.2 Safety symbols on controller labels

*Continued*

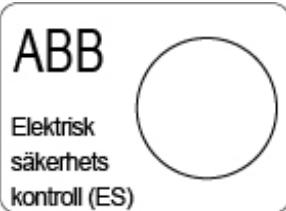
Label	Description
 xx1400001157	Lifting instruction for the IRC5 controller.
 xx1400001155	Installation space
 xx1400001153	Reminder to activate the service "Remote Service". (Can be removed after activation.)
 xx1400001154	The controller is equipped with Remote Service technology.

*Continues on next page*

# 1 Safety

## 1.3.2 Safety symbols on controller labels

*Continued*

Label	Description
 xx1400001152	Read the user manual before servicing.
 xx1400001158	Electrical safety check of the robot system (internal).
 xx1400001159	Functional test of the robot system (internal).
 xx1400001163	Rating label
 xx1400002060	UR certified (component)
 xx1400002061	UL certified (robot system) Sweden

*Continues on next page*

### 1.3.2 Safety symbols on controller labels

*Continued*

Label	Description
 C <b>UL</b> US LISTED  46EP                      Robot  xx1400002062	UL certified (robot system) China

# 1 Safety

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

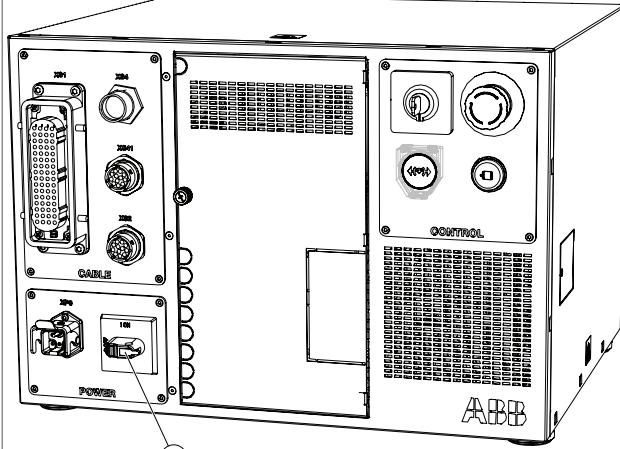
## 1.4 Safety related instructions

### 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.	

## 1.4.2 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*

# 1 Safety

## 1.4.2 WARNING - The unit is sensitive to ESD!

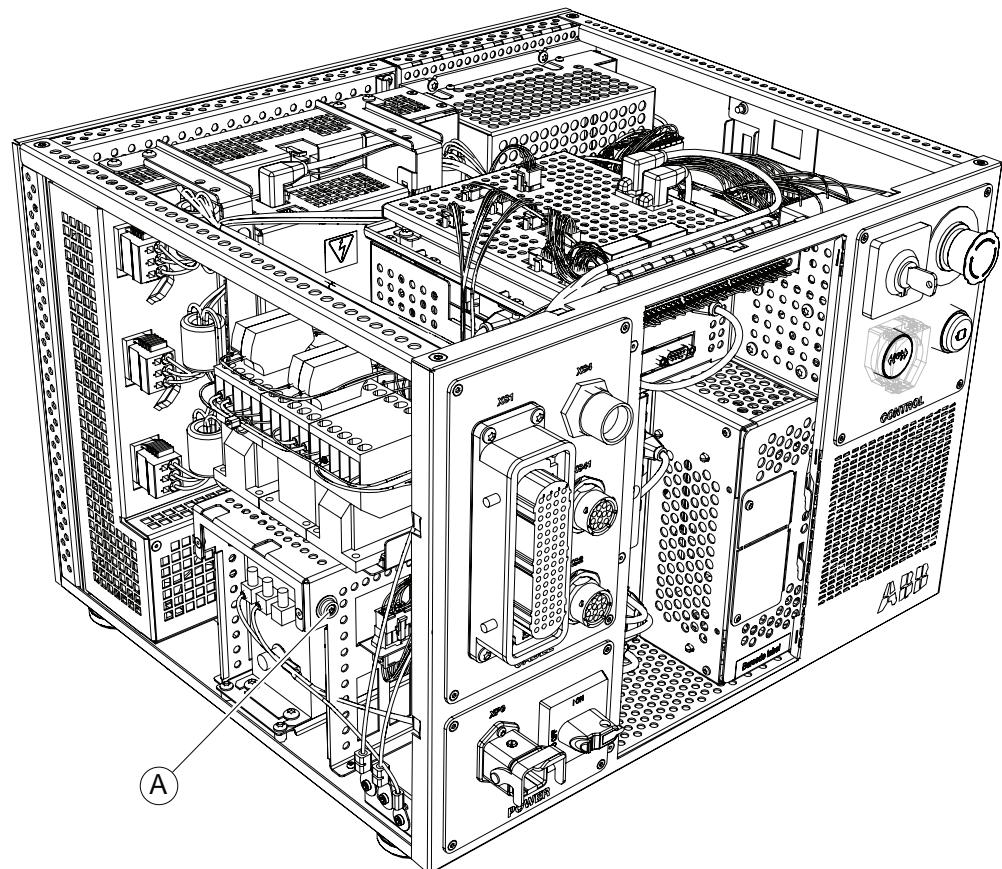
*Continued*

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### 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
---	--------------------

### 1.4.3 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 single cabinet or the modules of the dual cabinet. Nor is it allowed to use the single cabinet or the modules of the dual cabinet as a ladder.

## **1 Safety**

---

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

---

### **Description**

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

## 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 manipulator 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 Safety**

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### **1.4.6 CAUTION - Hot components in controller**

---

#### **Description**

Units and heat sinks are HOT after running the manipulator!

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.

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

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

---

#### Description

The key for the mode switch (CAM switch) on the IRC5 controller is 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.

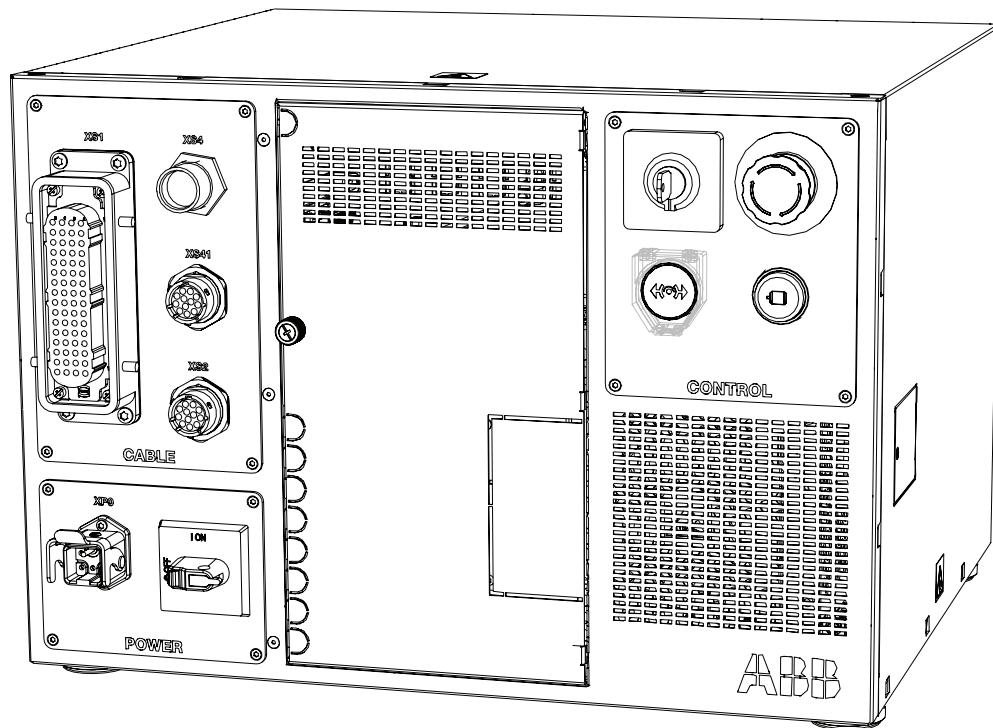
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## 2 Installation and commissioning

### 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 <a href="#">Unpacking the controller on page 49</a> .
2	Install the IRC5 Compact controller.	How to install the IRC5 Compact controller is described in section <a href="#">On-site installation on page 51</a> .
3	Connect the manipulator to the IRC5 Compact controller.	How to connect the manipulator to the IRC5 Compact controller is described in section <a href="#">Connecting cables to the controller on page 61</a> .
4	Connect power supply to the IRC5 Compact controller.	How to connect power supply is described in section <a href="#">Connecting power supply on page 70</a> .
5	Connect the FlexPendant to the IRC5 Compact controller.	How to connect the FlexPendant is described in section <a href="#">Connecting a FlexPendant on page 64</a> .
6	Miscellaneous connections.	How to connect MOTORS ON/MOTORS OFF circuits is described in section <a href="#">The MOTORS ON/MOTORS OFF circuit on page 74</a> . How to connect buses, for example DeviceNet, is described in the Application manual for the respective bus. How to connect I/O units to the IRC5 Compact controller is described in the Application manual for the respective I/O unit. How to connect a PC to the controller is described in manual <i>Operating manual - RobotStudio</i> . How to connect to a network is detailed in section <a href="#">Connectors on the computer unit on page 65</a> .

## 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 49](#) 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**

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### **2.3 Unpacking the controller**

*Continued*

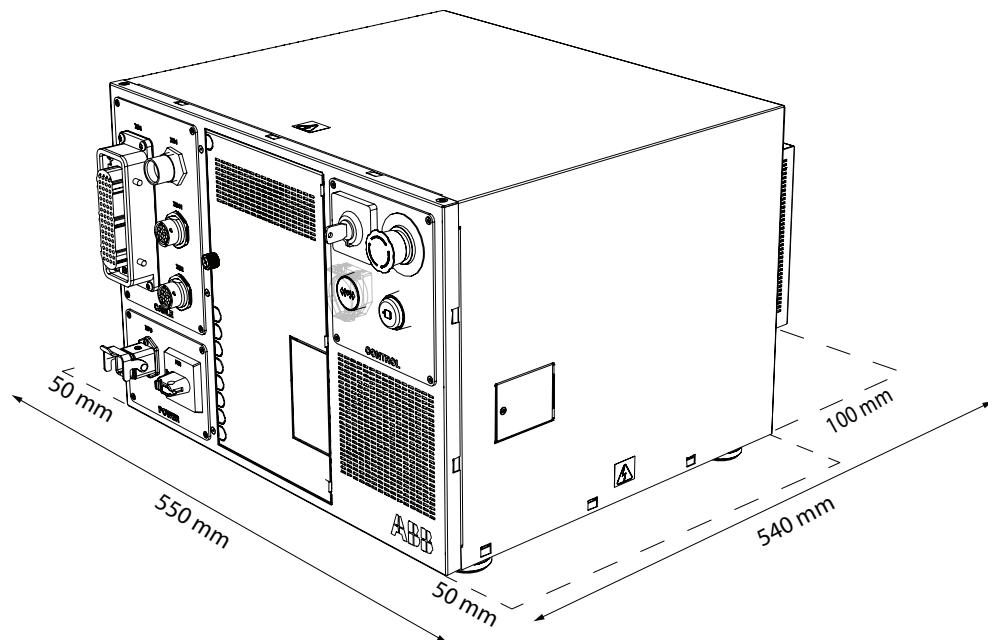
<b>Equipment</b>	<b>Protection class</b>
FlexPendant	IP54

## 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
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- 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).

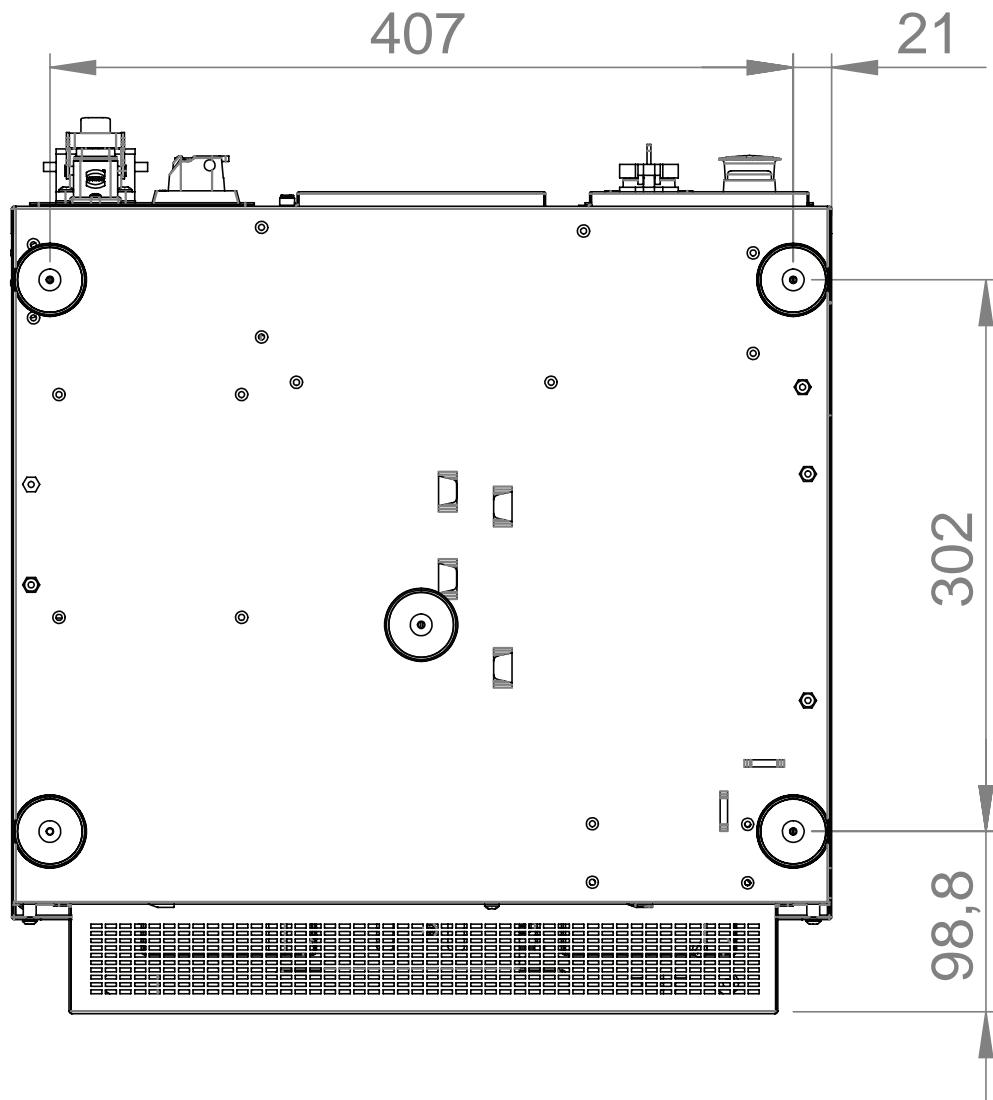
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## 2 Installation and commissioning

### 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.



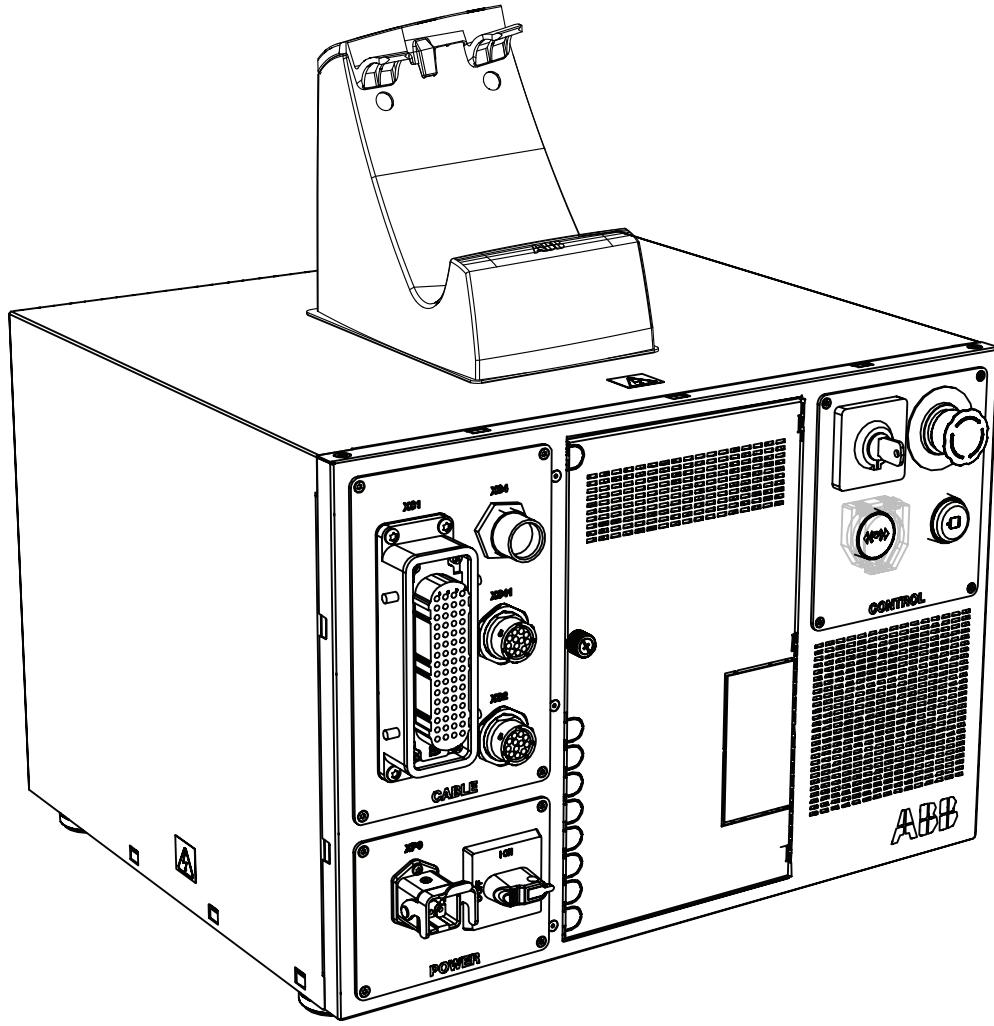
#### Note

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

##### Required equipment

Equipment	Art.no
FlexPendant holder	For spare parts, see <a href="#">Miscellaneous parts on page 192</a> .

*Continues on next page*

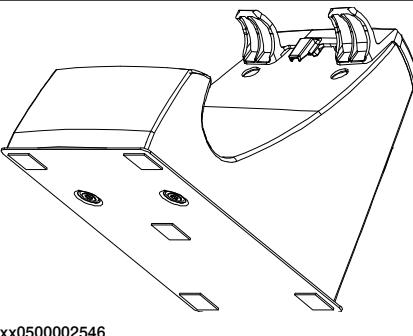
## 2 Installation and commissioning

### 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.   <b>Note</b> The surface must be clean and dry.	

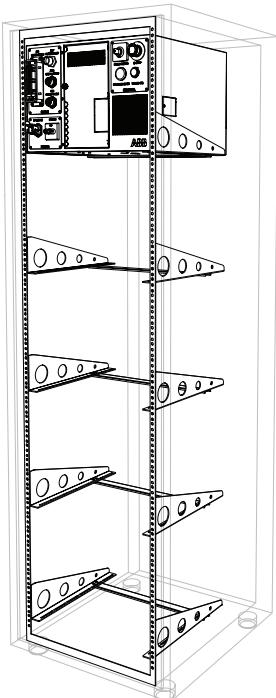
#### Note

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 <a href="#">Standard toolkit, IRC5 on page 187</a> .
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.

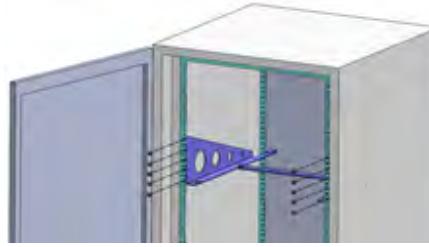
	Action	Info/illustration
1	Remove the five feet from the cabinet.	

*Continues on next page*

## 2 Installation and commissioning

### 2.4.3 Mounting the controller in a 19" cabinet

*Continued*

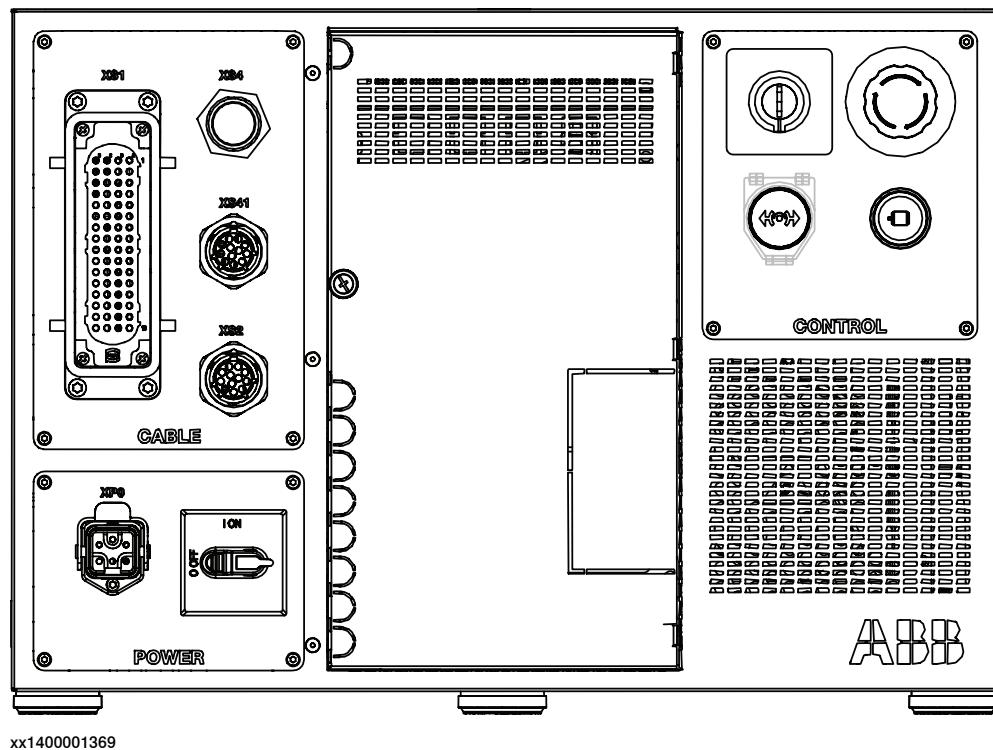
Action	Info/illustration
2 Assemble the mounting brackets.	 xx1400002159
3 Fit the right, left and middle mounting brackets in the 19 inch cabinet.	 xx1500000232
4 Insert the IRC5 Compact in the 19 inch cabinet so that the latches fit in the recesses in the back of the mounting brackets. Fasten the IRC5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

## 2.5 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.



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 58](#).

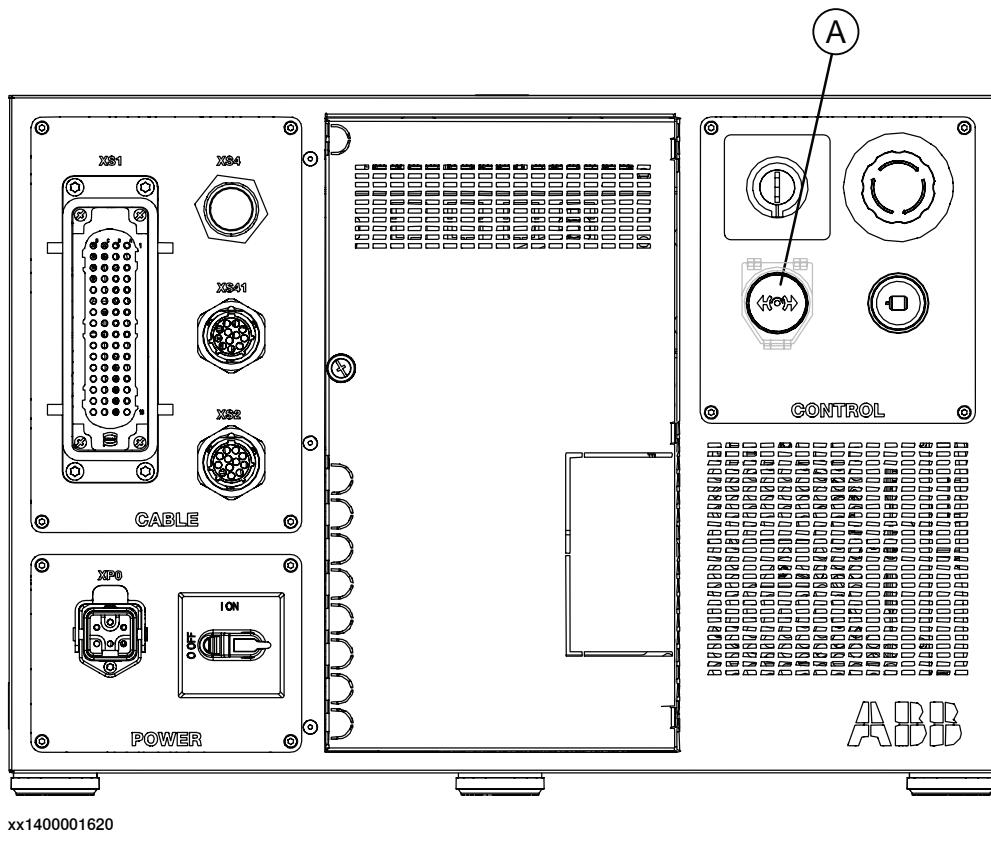
The other buttons and switches are described in *Operating manual - IRC5 with FlexPendant*.

*Continues on next page*

## 2 Installation and commissioning

### 2.5.1.1 Brake release button

#### Location



xx1400001620

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

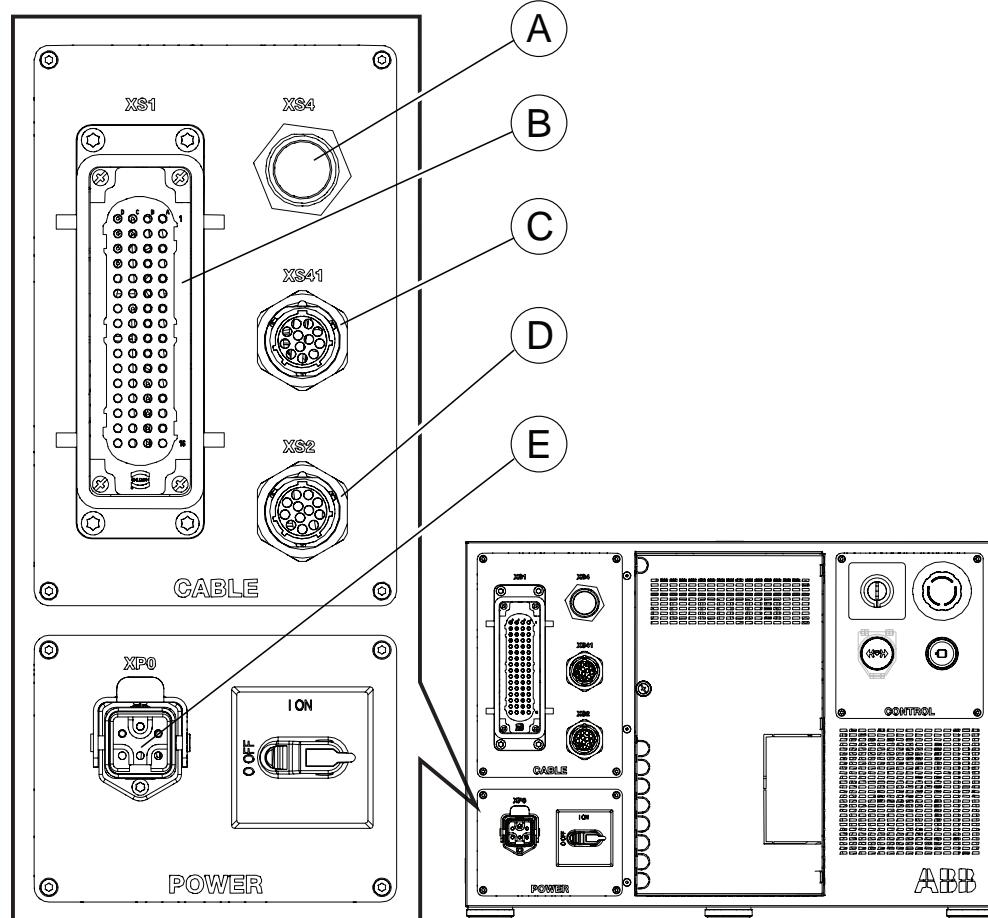


##### CAUTION

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**

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### **2.6.1.1 Connectors on the controller**

*Continued*

	<b>Description</b>
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 cables to the controller

##### General

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	Supplies external motors and brakes.
Control signals	Digital operating and data signals (digital I/O, safety stop, etc.).
Measuring signals	Analog measuring and control signals (resolver and analog I/O).
Data communication signals	Gateway (field bus) connection, computer link.

##### 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 <sup>2</sup> 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.



##### Note

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

*Continues on next page*

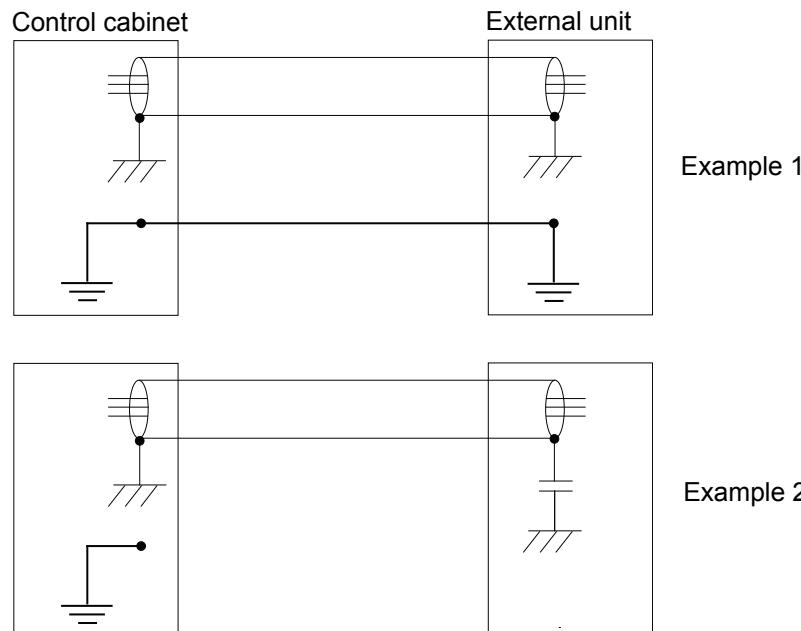
## 2 Installation and commissioning

### 2.6.1.2 Connecting cables to the controller

*Continued*

#### Ground and screen connections

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



xx1200000960

#### 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.

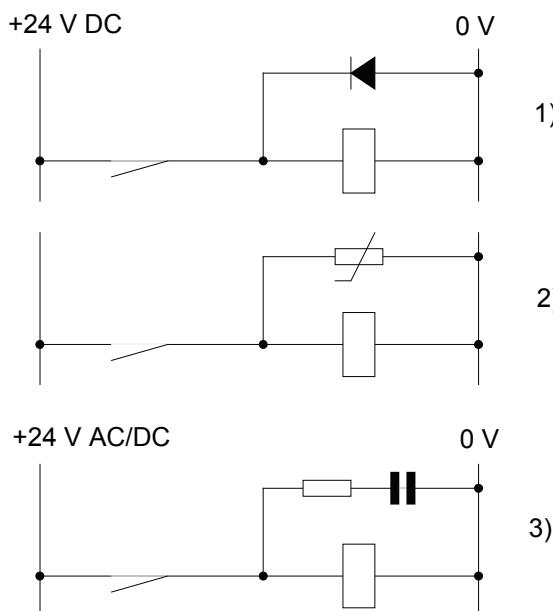
*Continues on next page*

#### Interference elimination

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

Note that the turn-off time for DC relays increases after neutralization, especially if a diode is connected across the coil. Varistors give shorter turn-off times.

Neutralizing the coils lengthens the life of the switches that control them.



xx1200000961

- 1 The diode should be dimensioned for the same current as the relay coil, and a voltage of twice the supply voltage.
- 2 The varistor should be dimensioned for the same energy as the relay coil, and a voltage of twice the supply voltage.
- 3 When AC voltage is used, the components needs to be dimensioned for >500 V max voltage and 125 V nominal voltage.  
The resistor should be 100 Ω, and the capacitor should be 1W 0.1 - 1 µF (typically 0.47 µF).

## 2 Installation and commissioning

### 2.6.1.3 Connecting a FlexPendant

#### 2.6.1.3 Connecting a FlexPendant

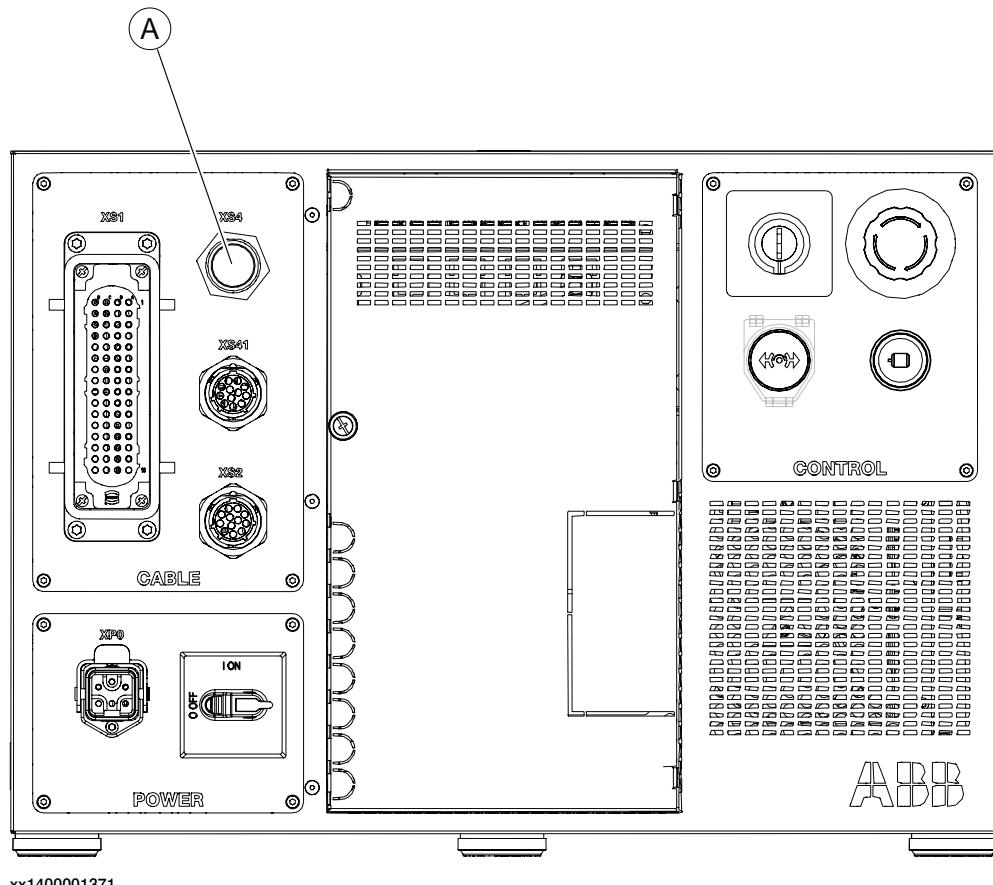
##### Location of FlexPendant connector

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.



A FlexPendant connector

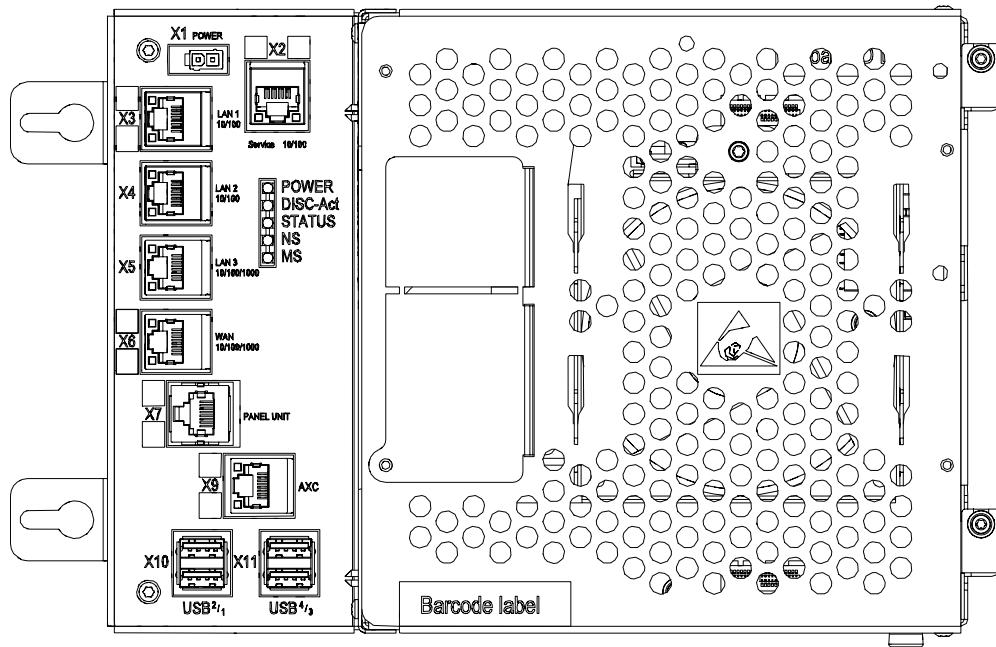
##### Connecting a FlexPendant

	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.	

## 2.6.1.4 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

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

*Continues on next page*

## 2 Installation and commissioning

---

### 2.6.1.4 Connectors on the computer unit

*Continued*

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



#### Note

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

---

### WAN port

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

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

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



#### Note

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

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

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

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



#### Note

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

---

### LAN ports

The LAN 1 port is dedicated for connecting the FlexPendant.

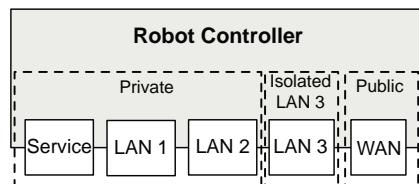
The LAN 2 and LAN 3 ports are intended for connecting network based process equipment to the controller. For example field buses, cameras, and welding equipment.

*Continues on next page*

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

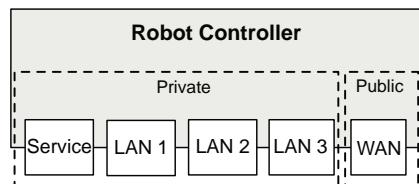
Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later)

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 USB<sup>1</sup> and USB<sup>2</sup> on the X10 connector for connecting USB memory devices.

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

## 2 Installation and commissioning

### 2.6.1.5 Connecting a serial channel to the controller

#### General

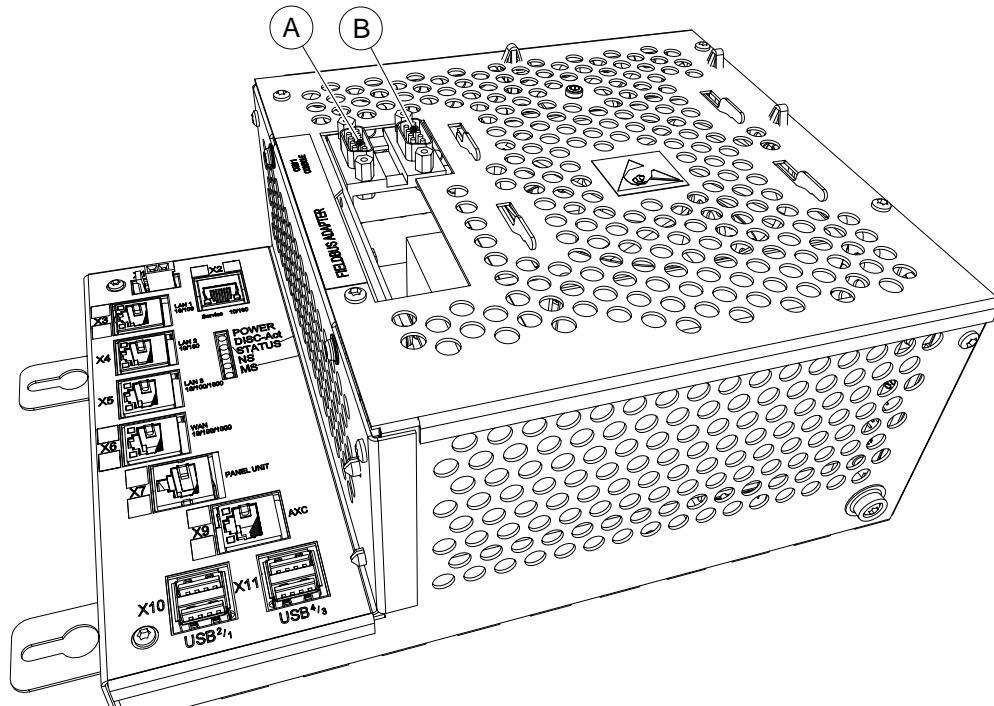
The serial channel is an option. To be able to connect a serial channel to the controller, the main computer needs to be equipped with the expansion board DSQC1003.

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 85](#).

#### Location

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



xx1300000610

A	COM1
B	CONSOLE



#### Note

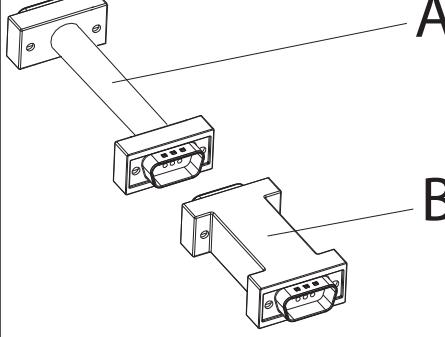
The CONSOLE connector is used for debugging purposes only.

*Continues on next page*

#### Conversion of the RS232 channel

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

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

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

## 2 Installation and commissioning

### 2.6.2 Connecting power supply

#### 2.6.2 Connecting power supply



##### Note

How to manufacture a cable with connector is described in section [Fitting the connector on page 72](#).

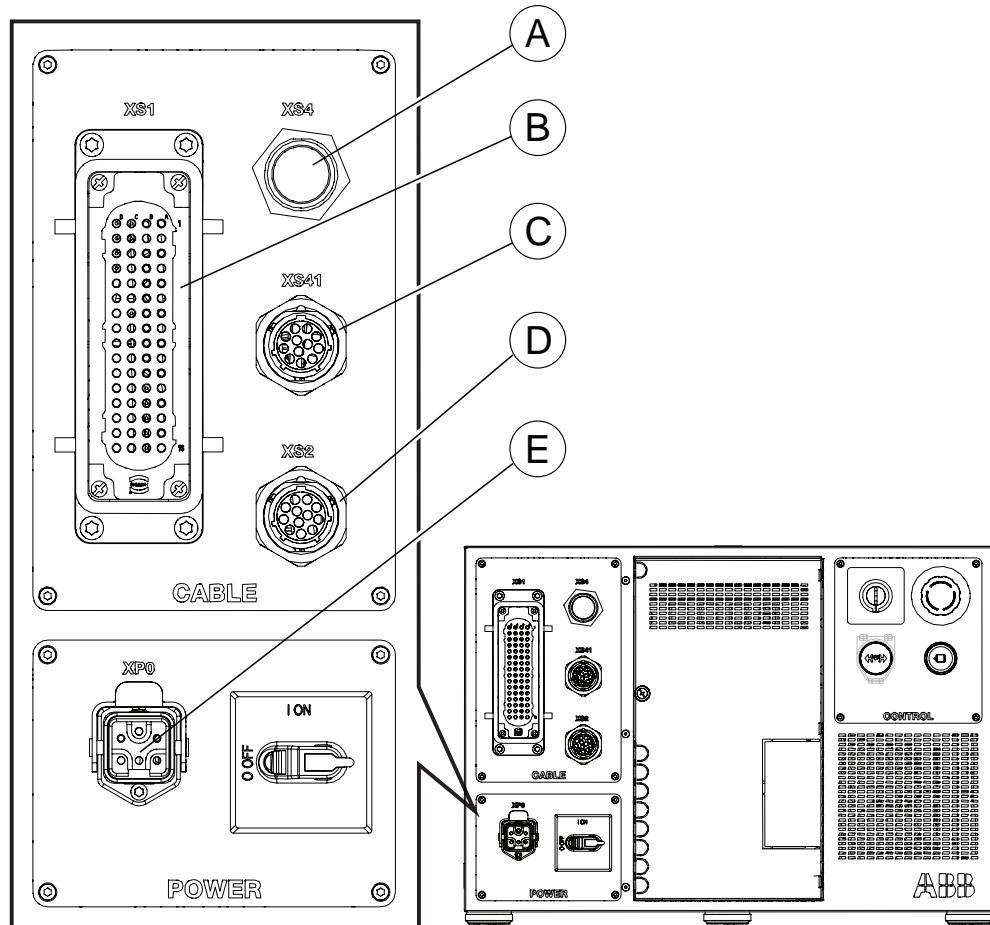


##### CAUTION

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

#### Location

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



xx1400001372

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

Continues on next page

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

#### Required equipment

Equipment	Note
Power supply cable (single phase)	
External circuit breaker	20A
External earth fault protection at control cables 3 -15m	30mA
External earth fault protection at control cables >15m	300mA
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

#### 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 Installation and commissioning

### 2.6.3 Fitting the connector

#### 2.6.3 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 <sup>2</sup>
Fuse	Delay action fuse 20A

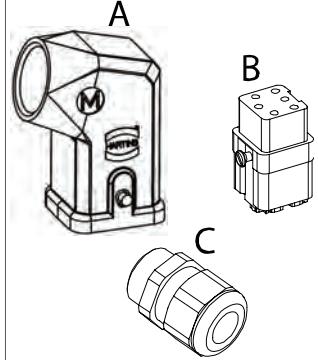
##### Included parts

The following parts are included in the delivery.

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

##### Procedure

Use the following procedure to fit the connectors.

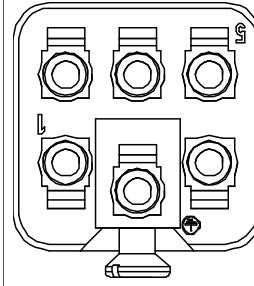
	Action	Note/illustration
1	Select a suitable single phase cable and earth cable, and cut it to desired length.	See previous specifications.
2	Fit the cable through the cable gland and hood.	 xx0900000365 <ul style="list-style-type: none"><li>A: hood</li><li>B: female insert</li><li>C: cable gland</li>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

*Continues on next page*

## 2 Installation and commissioning

### 2.6.3 Fitting the connector

*Continued*

	Action	Note/illustration
3	Connect the wires according to the illustration. Use a screwdriver to make the contact tight.	 <p>xx0900000366</p> <p><b>For single phase:</b></p> <ul style="list-style-type: none"><li>• X0.1 - power line</li><li>• X0.2 - zero line</li><li>• X0.PE - earth wire</li></ul>
4	Assemble the connector by fitting the hood and the female connector, and tighten the screws.	

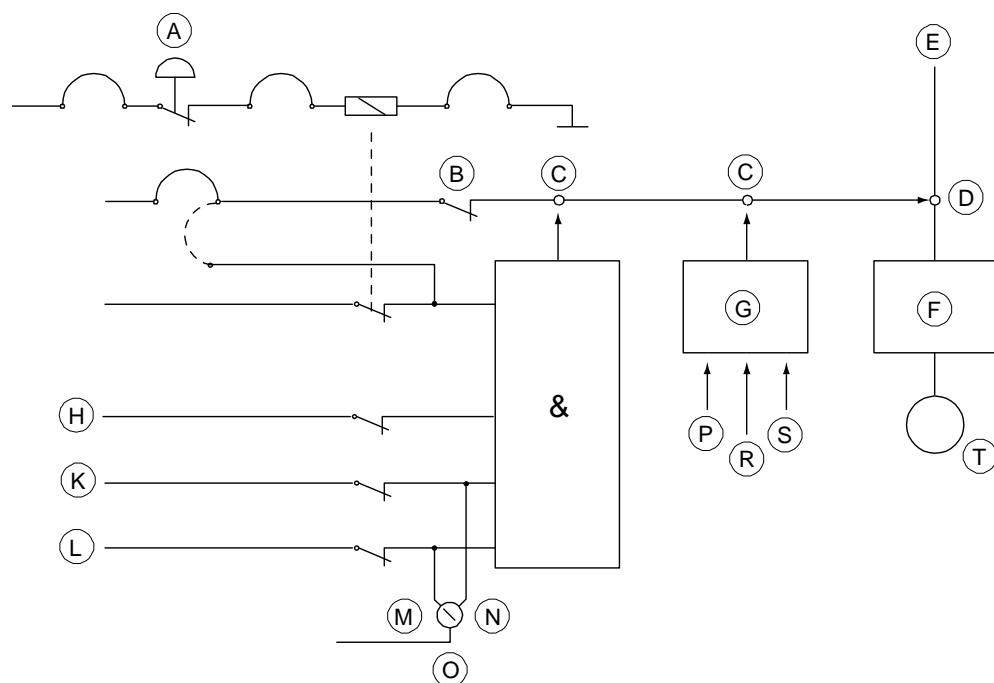
## 2 Installation and commissioning

### 2.6.4 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, SS and ES.



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 (TPU enabling device)
M	Manual mode
N	Automatic mode
O	Operating mode selector
P	RUN
R	EN1
S	EN2

Continues on next page

T	Motor
---	-------

#### Function of the MOTORS ON/MOTORS OFF circuit

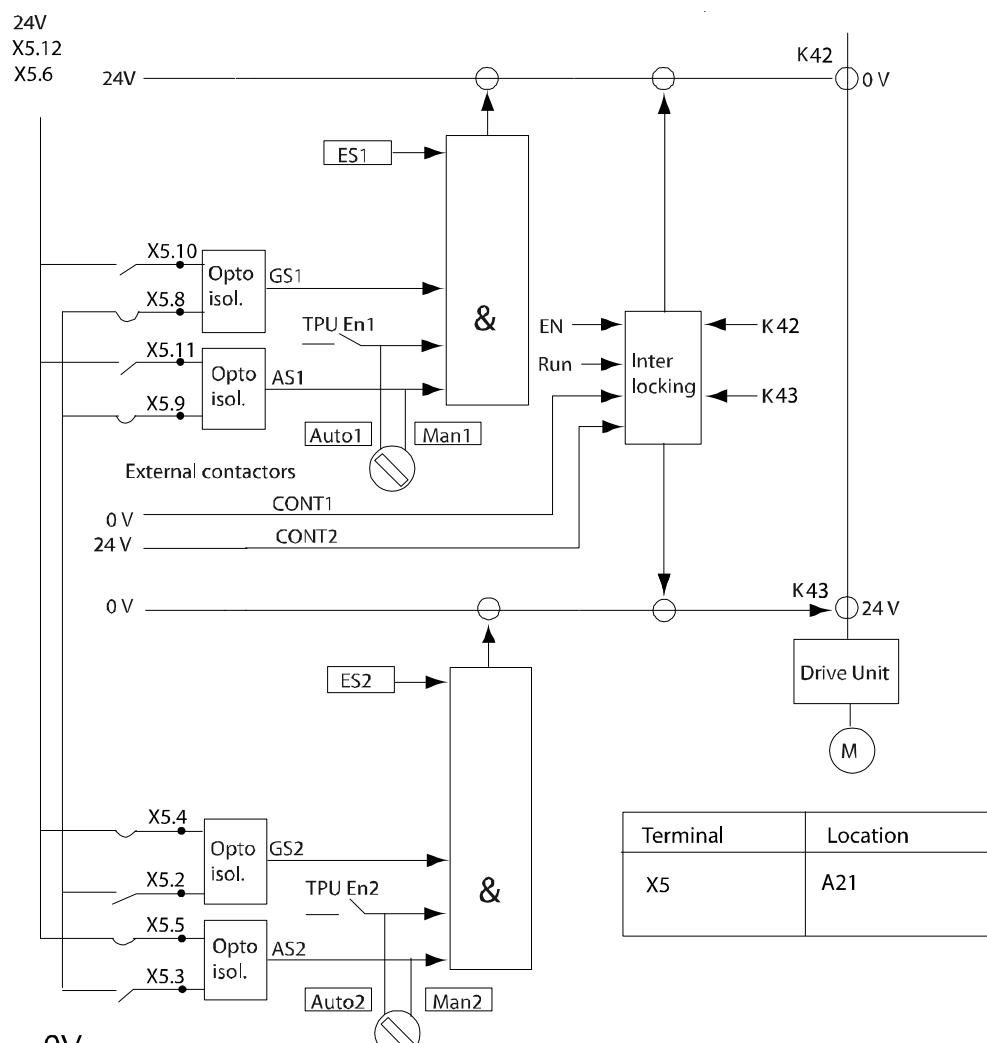
The circuit monitors all safety related equipment and switches. If any of the switches are opened, the MOTORS ON/MOTORS OFF circuit switches the power to Motors Off.

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.



en0900000483

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

*Continues on next page*

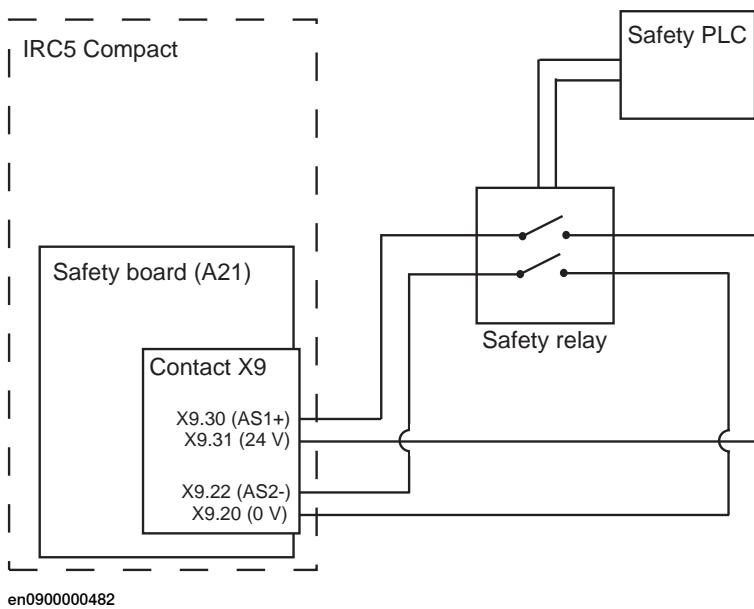
## 2 Installation and commissioning

### 2.6.4 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 <sup>1)</sup>
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

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



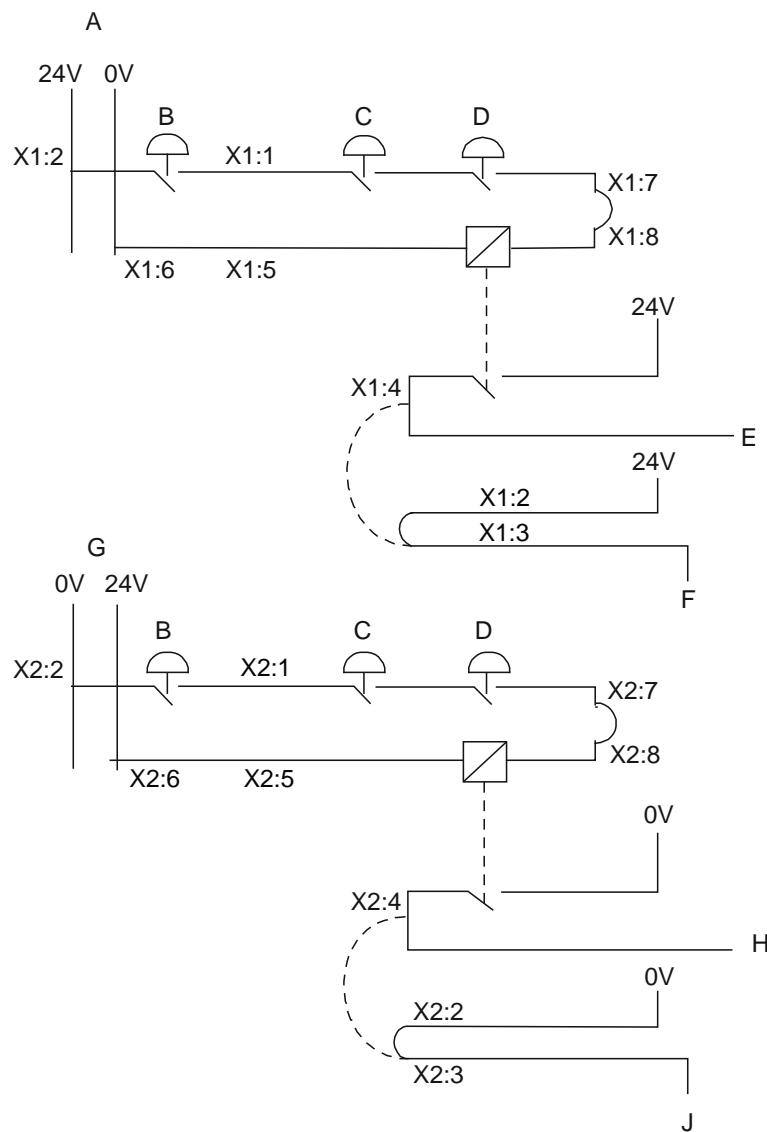
en0900000482

*Continues on next page*

#### 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

### 2.6.4 The MOTORS ON/MOTORS OFF circuit

*Continued*

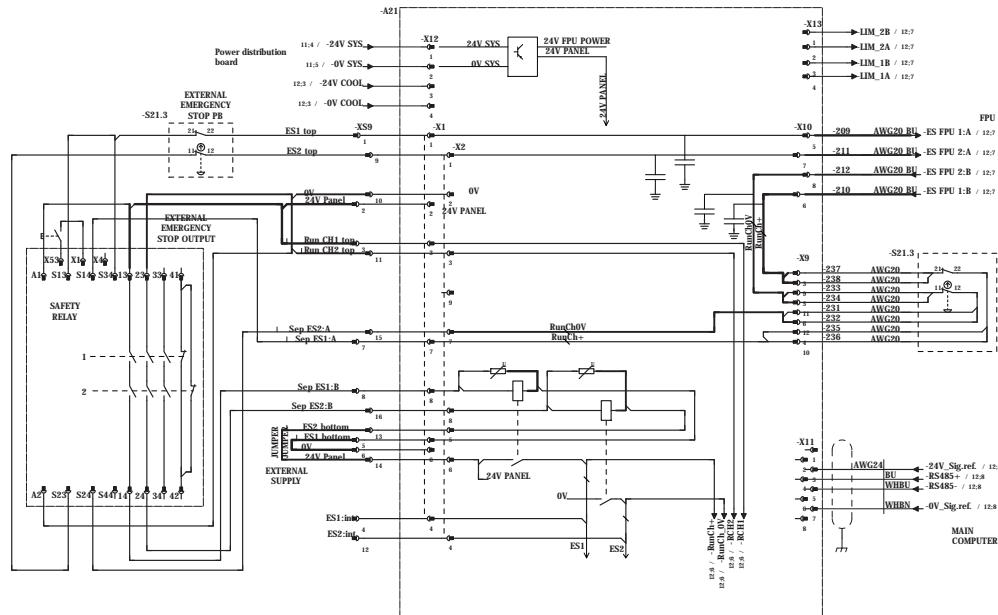
J	Run chain 2 top
<b>Technical data</b>	
External supply of ES relay	24 VDC $\pm$ 10% between terminals X1:3, 7 and X2:7, 3 respectively. <b>Note!</b> In case of interference, the external supply must be properly filtered.
Rated current per chain	40 mA
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

### 2.6.5 Emergency stop output

#### 2.6.5 Emergency stop output

##### Emergency stop output through safety relay

The IRC5 Compact does not have an emergency stop output from the safety board. 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.



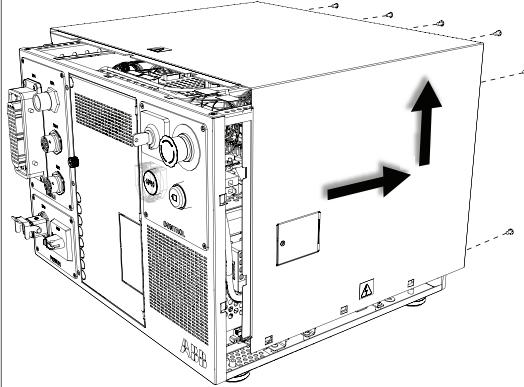
xx1100000556

## 2 Installation and commissioning

### 2.7 Opening the IRC5 Compact controller

#### 2.7 Opening the IRC5 Compact controller

##### Removing the controller cover

	Action	Info/illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38.</b>	
2	Remove the attachment screws on the cover.	 xx1400001364
3	Push the cover towards the back of controller to release it from the bend of the front panel, and then pull upwards to remove it.	

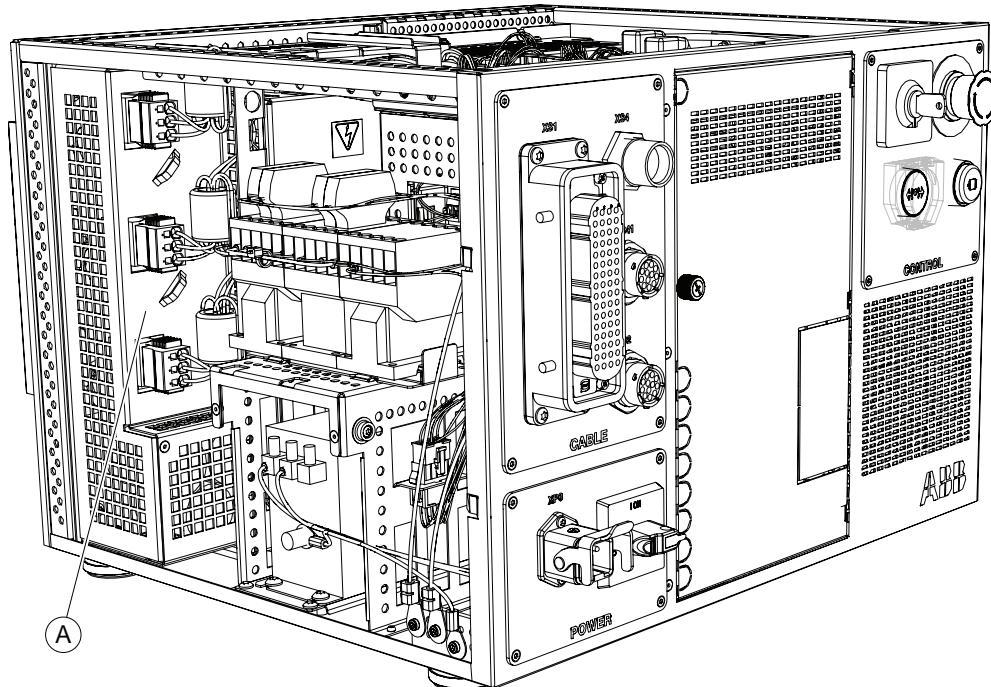
## 2.8 Drive system

### 2.8.1 Drive functions, general

#### General

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

#### Location of drive unit



xx1400001373

A	Main Drive Unit
---	-----------------

#### Replacing drive system parts

How to replace the drive unit is described in section [Replacement of drive unit on page 145](#).

## **2 Installation and commissioning**

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### **2.9.1 Memory functions**

## **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 142*.



#### **Note**

Only use SD-card memory supplied by ABB.

#### 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:



xx0900000022

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

*Continues on next page*

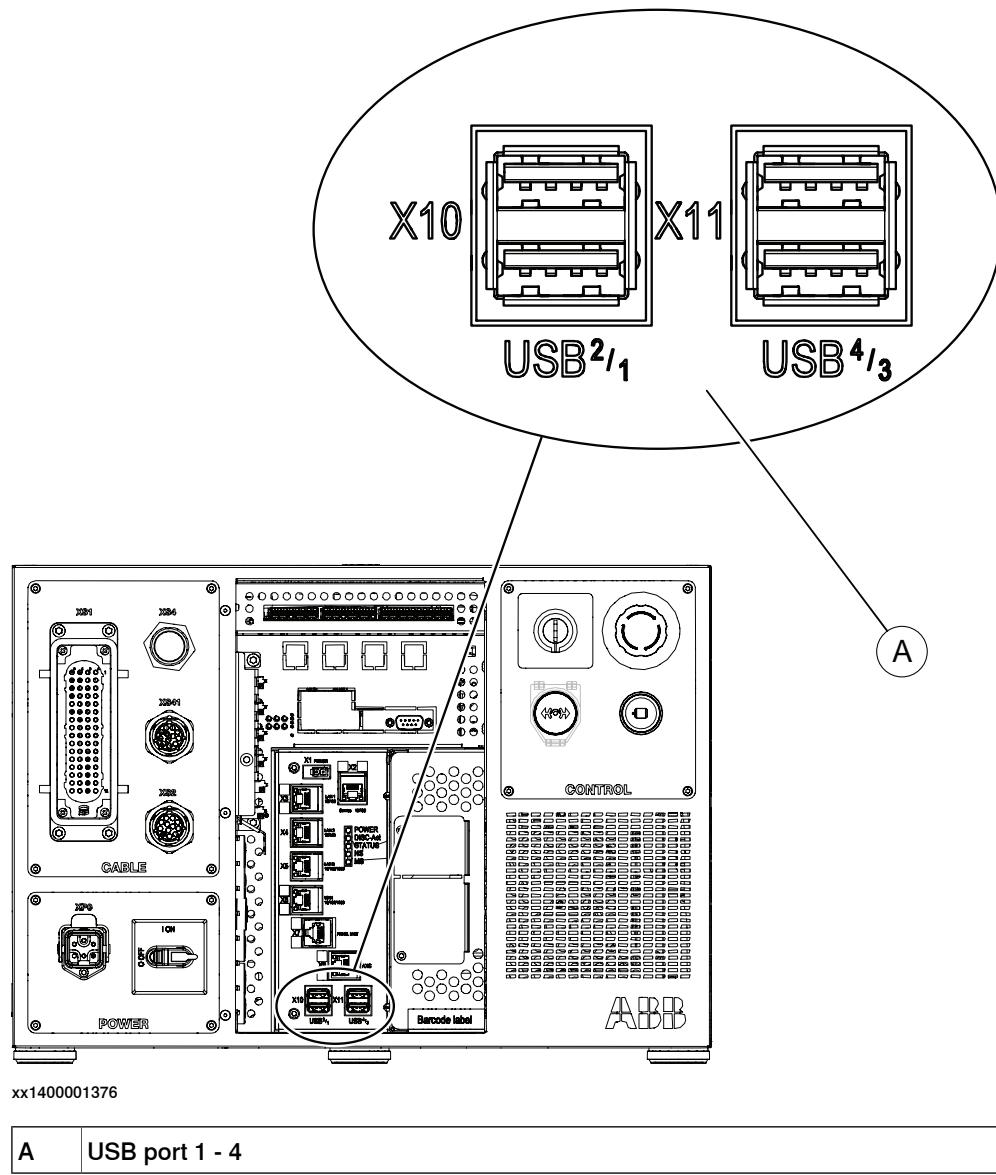
## 2 Installation and commissioning

### 2.9.2 Connecting a USB memory

*Continued*

#### Location on the controller

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



## 2.10 I/O system

### 2.10.1 Definition of fieldbuses, IRC5

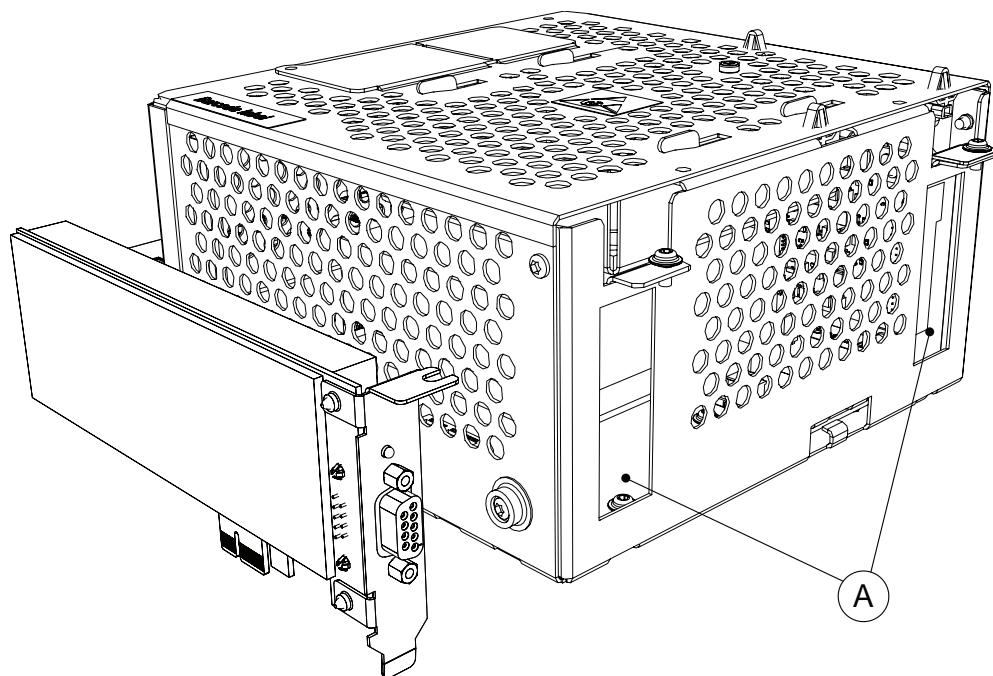
#### General

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.



xx1300000603

A	Slots for PClexpress boards
---	-----------------------------

Following master/slave boards are available:

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

*Continues on next page*

## 2 Installation and commissioning

### 2.10.1 Definition of fieldbuses, IRC5

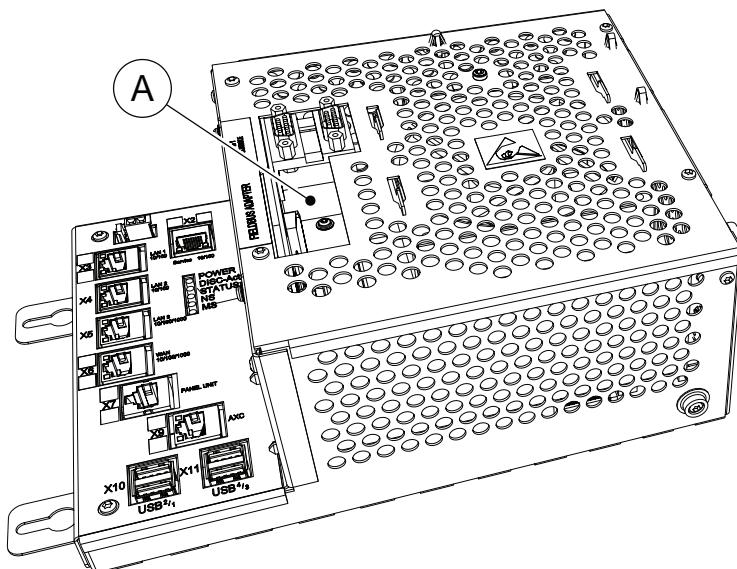
*Continued*

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#### 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 68](#).



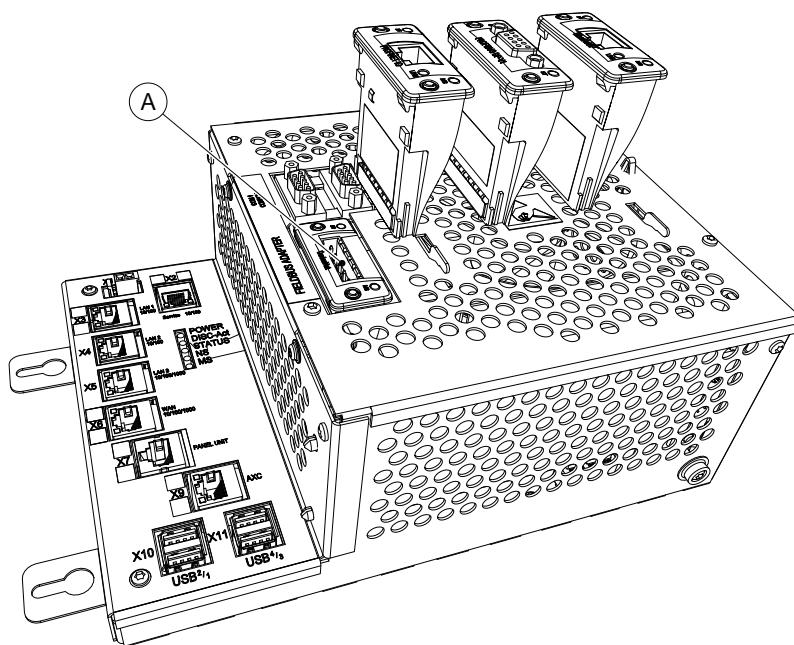
xx1300000605

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

*Continues on next page*

#### Fieldbus adapters

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



xx1300000604

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

Following fieldbus adapters are available:

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

#### References

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

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

*Continues on next page*

## **2 Installation and commissioning**

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### **2.10.1 Definition of fieldbuses, IRC5**

*Continued*

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

## 2.10.2 Definition of I/O units, IRC5

### General

The IRC5 controller may be fitted with 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.

### I/O units

The table below specifies the I/O units:

Description	Note
Digital I/O	DSQC 652

See [Spare parts on page 189](#) 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 I/O units mechanically and electrically.	Fit the expansion board and/or field bus adapter according to <a href="#">Replacement of expansion board in the computer unit on page 131</a> and/or <a href="#">Replacement of fieldbus adapter in the computer unit on page 134</a> .
Allowed configurations of I/O units and how to setup the configurations.	<i>Technical reference manual - System parameters</i>
How to install the I/O unit software related in a new system.	The application manual for the different I/O buses respectively, see listing in <a href="#">Definition of fieldbuses, IRC5 on page 85</a> .
Detailed descriptions of all available I/O units.	The application manual for the different I/O buses respectively, see listing in <a href="#">Definition of fieldbuses, IRC5 on page 85</a> .

## 2 Installation and commissioning

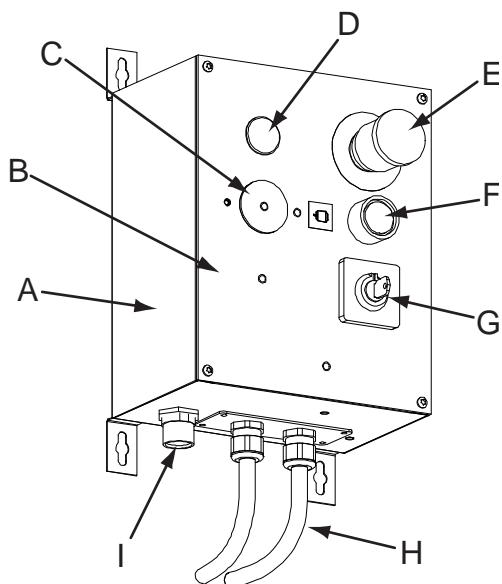
### 2.11.1 Installation of external operator's panel

## 2.11 Installation of add-ons

### 2.11.1 Installation of external operator's panel

#### Location

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



xx1000000954

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

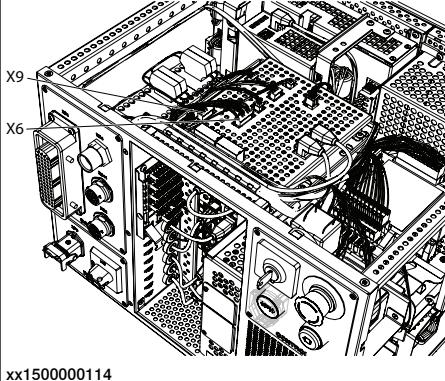
#### Required equipment

Equipment	Art. no.	Note
Wall cabinet IRC5	3HAC038671-001	
External Operator's panel cable	3HAC038672-001 3HAC038673-001 3HAC038674-001	7 m 15 m 30 m
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .	

Continues on next page

#### Procedure

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

	Action	Info/illustration
1	 <b>DANGER</b> <p>Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.</p>	
2	Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
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"> <li>• A21.X6</li> <li>• A21.X9</li> </ul>	
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.	 xx1000000956
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.	 • A: ground terminal xx1400002803
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 attachment screws for contactor unit and safety board unit.	
13 Fit the external operator's panel harness to the wall cabinet with four attachment screws.	
14 Connect the connectors and earth cable inside the wall cabinet.	
15 Mount the front panel of the external operator's panel on the wall cabinet with four attachment screws.	

## 2.11.2 Installation of external enabling device

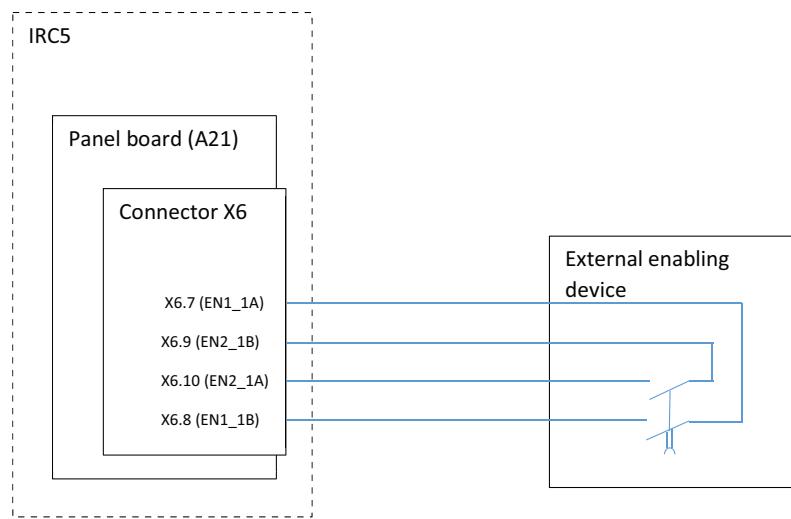
### Overview

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 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 Panel unit connector X6 pin 7-10 as shown in the figure below.



xx1500000534

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*

## **2 Installation and commissioning**

---

### **2.11.2 Installation of external enabling device**

*Continued*

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<sub>d</sub> for IRC5 enabling device chain is 80 years.
- IRC5's enabling device chain's calculated average probability of dangerous failure per hour (PFH<sub>d</sub>) is 6.62x10E-08.
- IRC5's enabling device chain's design and structure is category 3.
- IRC5's enabling device chain's Diagnostic Coverage is medium (90% < DCavg < 99%).
- The Common Cause Failure (CCF) is met according to the standard requirements.

# 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 <sup>i</sup>	<i>Inspecting the IRC5 Compact controller on page 96</i>
System fans	Inspection	6 months <sup>i</sup>	<i>Inspecting the IRC5 Compact controller on page 96</i>
FlexPendant	Cleaning	When needed	<i>Cleaning the FlexPendant on page 99</i>
Emergency stop (operating panel)	Function test	12 months	<i>Function test of emergency stop on page 102</i>
Emergency stop (FlexPendant)	Function test	12 months	<i>Function test of emergency stop on page 102</i>
Mode switch	Function test	12 months	<i>Function test of mode switch on page 103</i>
Enable device	Function test	12 months	<i>Function test of enabling device on page 104</i>
Motor contactors K42, K43	Function test	12 months	<i>Function test of motor contactors K42 and K43 on page 105</i>
Brake contactor K44	Function test	12 months	<i>Function test of brake contactor K44 on page 106</i>
Auto stop (tested if used)	Function test	12 months	<i>Function test of auto stop on page 107</i>
General stop (tested if used)	Function test	12 months	<i>Function test of general stop on page 108</i>
Safety parts	Refurbish	20 years	<i>Refurbish safety parts on page 109</i>

<sup>i</sup> The interval depends on the working environment of the equipment: a cleaner environment may extend the maintenance interval and vice versa.

### 3 Maintenance

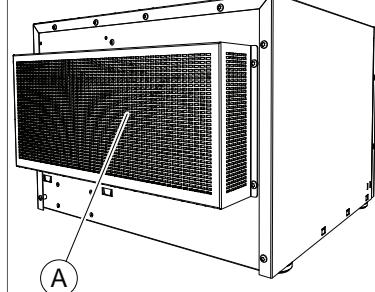
#### 3.2.1 Inspection of controller

### 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  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 39</b>	
3 Inspect connectors and cabling to make sure they are securely fastened and cabling not damaged.	
4 Inspect the system fans and ventilation holes on the surface of the cabinet to make sure they are clean.	 xx1400001377
5 After cleaning: Temporarily turn the power supply to the controller on. Inspect the fans to make sure they function correctly. Turn the power supply back off.	

## **3.3 Changing/replacing activities**

### **3.3.1 Activities**

---

#### **References**

Certain activities to be performed as specified in the maintenance schedule are not detailed in this chapter, but in the repair chapter. See *Repair on page 111*.

### **3 Maintenance**

---

#### **3.4.1 Cleaning of control cabinet**

### **3.4 Cleaning activities**

#### **3.4.1 Cleaning of control cabinet**

---

##### **Required equipment**

<b>Equipment, etc.</b>	<b>Note</b>
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.



xx0400000973

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.

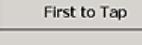
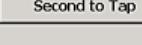
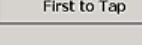
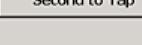
Action	Info/Illustration
1 Before cleaning the screen, tap <b>Lock Screen</b> on the ABB menu.	<p>The image shows the ABB menu interface. The 'Lock Screen' option is highlighted with a gray background. Other menu items include FlexPendant Explorer, Inputs and Outputs, Jogging, Production Window, Program Data, Program Editor, RobotWare Arc, Logout (Default User), and Restart. To the right of the menu, there is a legend for icons: a folder for Backup and Restore, a wrench for Calibration, a gear for Control Panel, a document for Event Log, a lock for Lock Screen, a person icon for Operator Window, and a system info icon for System Info.</p> <p>en0400001221</p>

*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.	 Manual System 7(GEVST-W-0000853) Guard Stop Stopped (Speed 100%)  In order to clean the touch screen you need to lock the screen.  Tap Lock to lock the screen.    
3 When the next window appears, it is safe to clean the screen.	To let you clean the touch screen all keystrokes are now disabled. Tap the two buttons below in sequence to unlock the screen.      en0400000658
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.	To let you clean the touch screen all keystrokes are now disabled. Tap the two buttons below in sequence to unlock the screen.      en0400000658

#### Do's and don'ts!

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

Always:

- use ESD Protection

*Continues on next page*

#### **3.4.2 Cleaning the FlexPendant** *Continued*

- 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 enabling device

##### 3.5.3 Function test of enabling device

###### Performing the function test

Action	Note
1 Start the robot system and turn the mode switch to manual mode.	
2 Press the enable device to the middle position and then hold the enable 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 enabling device pressed, press the enable device harder to the enable devices 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 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 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 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 are 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 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.	<p>The test is passed if the event message “20206 General stop open” appears in the FlexPendant log.</p> <p>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.</p>

## **3.6 Refurbish**

### **3.6.1 Refurbish safety parts**

---

#### **Time of the Proof Test Interval**

The Time of the Proof Test Interval for the safety parts of the system is 20 years. If this time interval is exceeded, the safety parts must be refurbished by the manufacturer.

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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.

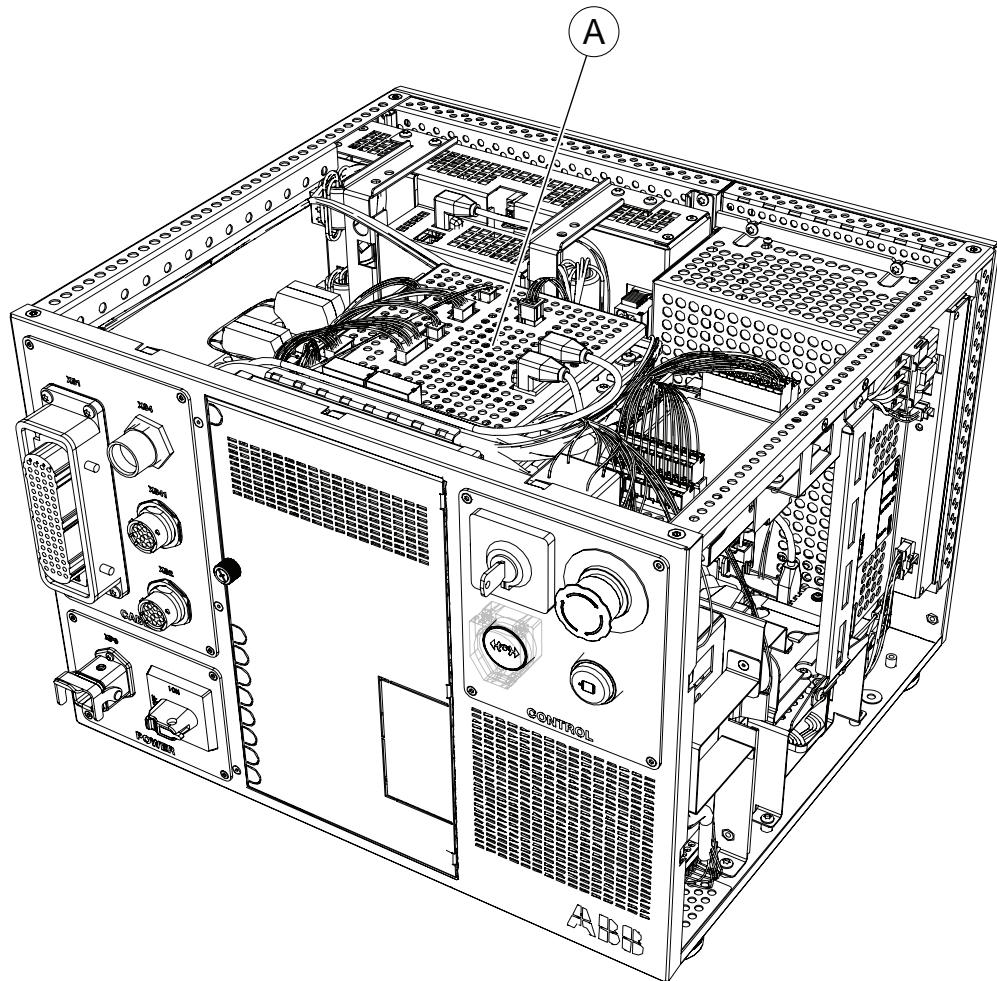
## 4 Repair

### 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
---	--------------

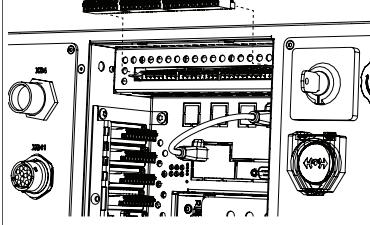
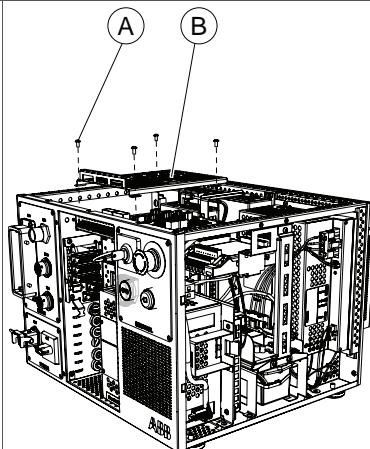
##### Required equipment

Equipment	Note
Safety board	DSQC 400 See <a href="#">Controller system parts on page 189</a> .
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

*Continues on next page*

**Removal**

Use the following procedure to remove the safety board.

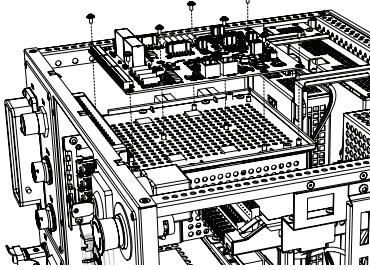
	Action	Note/illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 39</b>	
3	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller on page 80</i> .
4	Disconnect all connectors.	Make a note of all connections.
5	Remove the thumb screw and open the protective cover on the front of the cabinet.	
6	Disconnect three customer connectors.	 xx1400002007
7	Remove the four attachment screws to remove the protection cover.	 xx1400001379

*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  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <a href="#">WARNING - The unit is sensitive to ESD! on page 39</a>
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.

## 4.3 Replacement of I/O unit

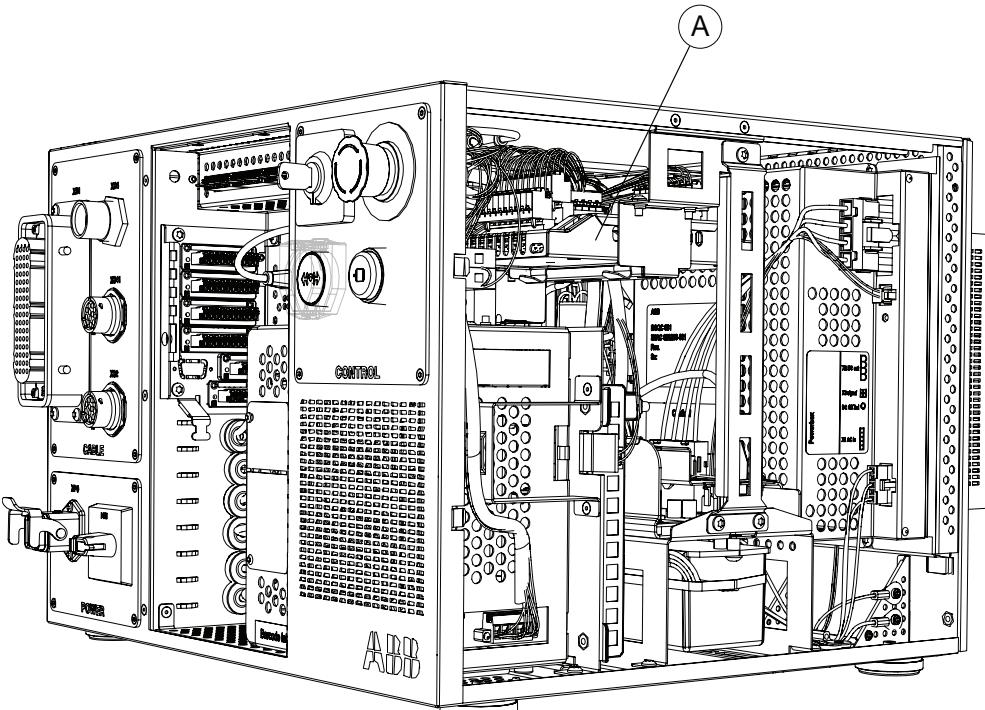
### General

An I/O unit may be installed in the IRC5 Compact controller. This is specified in [Definition of I/O units, IRC5 on page 89](#).

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

### Location

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



xx1400001381

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

### Required equipment

Equipment	Note
I/O unit	DSQC 652 See <a href="#">Controller system parts on page 189</a> .
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

*Continues on next page*

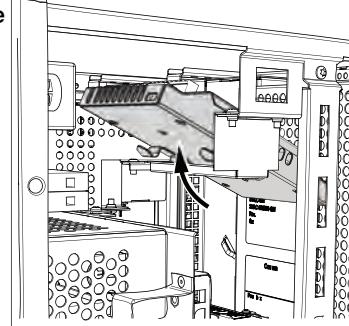
## 4 Repair

### 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  <b>DANGER</b> 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 38</i> .	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> 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 39</i>	
3 Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller on page 80</i> .
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  <b>DANGER</b> 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 38</i> .
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> 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 39</i>
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.

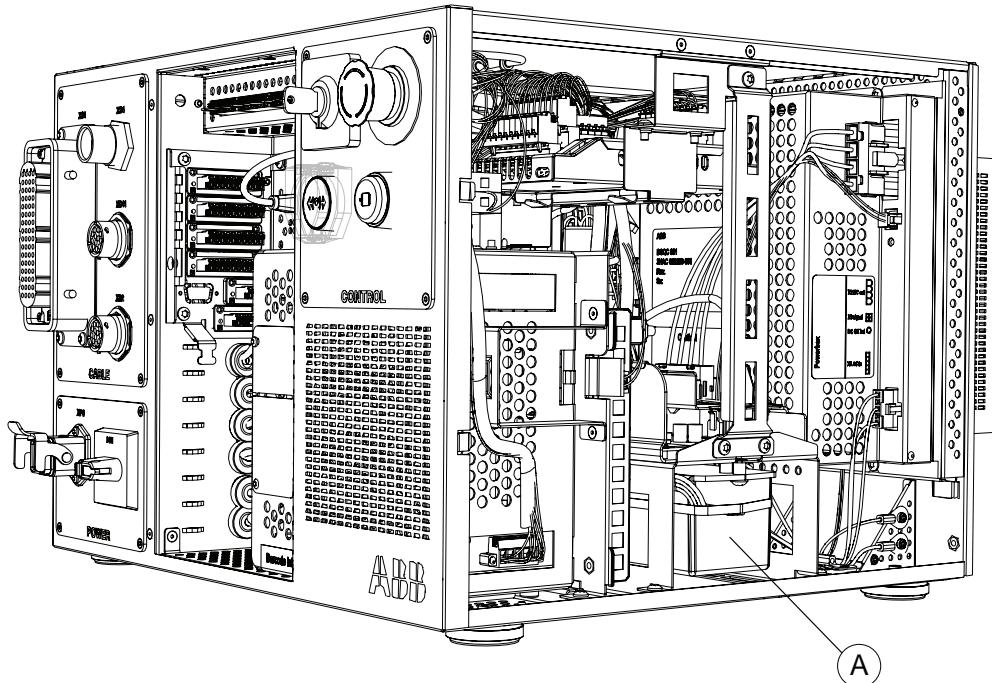
## 4 Repair

### 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 <a href="#">Controller system parts on page 189</a> .
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

##### Removal

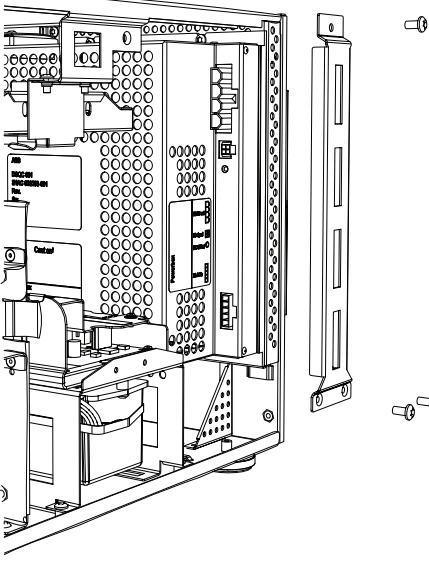
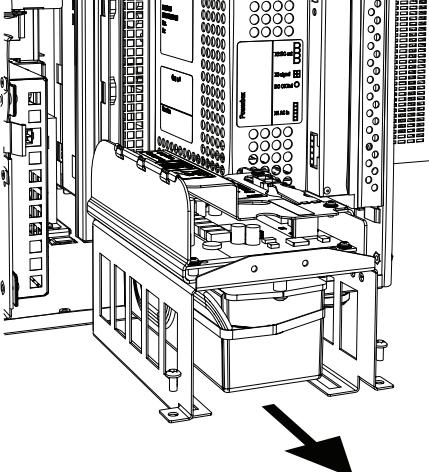
The following procedure describes how to remove the backup energy bank.

Action	Note/illustration
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	
2 Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .

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## 4.4 Replacement of backup energy bank

*Continued*

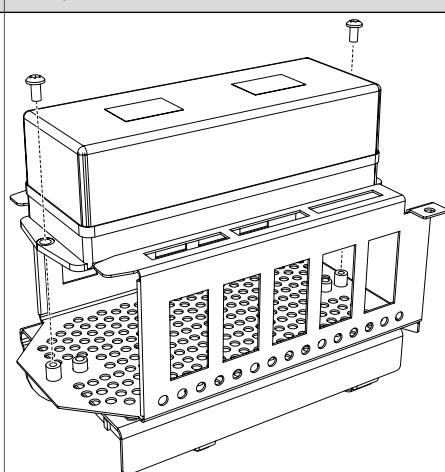
Action	Note/illustration
3 Remove the three attachment screws, and remove the support bar.	 xx1400001384
4 Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 xx1400001385
5 Disconnect all connectors from the power distribution board.	
6 Pull the backup energy bank unit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

*Continues on next page*

## 4 Repair

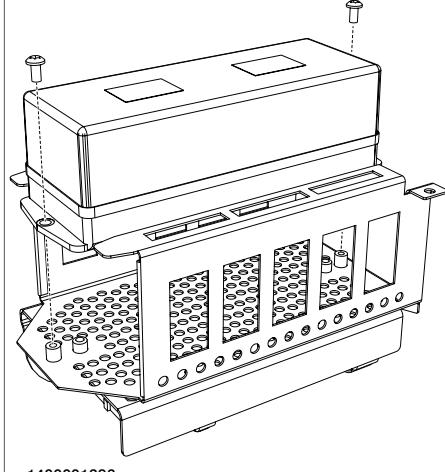
### 4.4 Replacement of backup energy bank

*Continued*

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

### Refitting

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

Action	Note/illustration
1  <b>DANGER</b>  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 38.	
2 Refit the new backup energy bank.	
3 Refit the attachment screws, and tighten them.	 xx1400001386
4 Slide the backup energy bank unit half way in.	
5 Reconnect all the connectors to the power distribution board.	

*Continues on next page*

## 4.4 Replacement of backup energy bank

*Continued*

	Action	Note/illustration
6	Refit the backup energy bank unit.	 xx1400001387  <b>Note</b> Ensure to fit in the latches properly.
7	Refit the support bar with the three attachment screws.	
8	Refit the cabinet cover.	

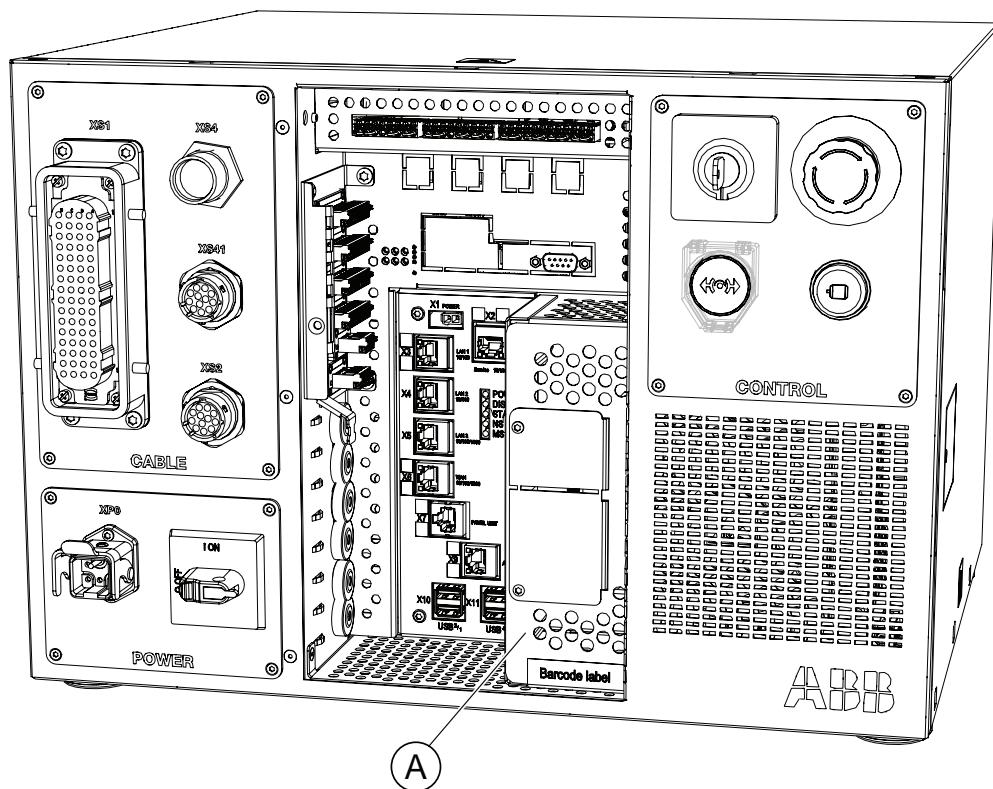
## 4 Repair

### 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
---	---------------

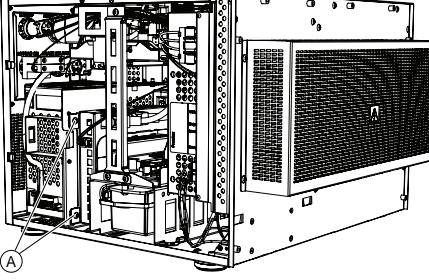
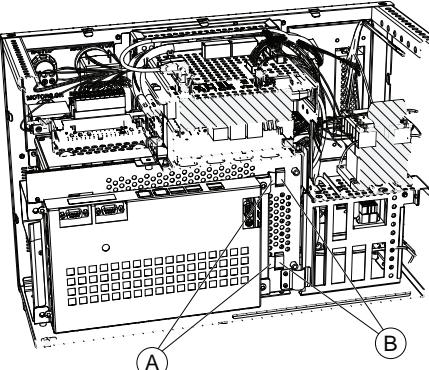
##### Required equipment

Equipment	Note
Computer unit	DSQC1018 (or DSQC1000) See <a href="#">Spare parts on page 189</a> .
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 <a href="#">Circuit diagrams on page 197</a> .

Continues on next page

**Removal**

The procedure below details how to remove the computer unit.

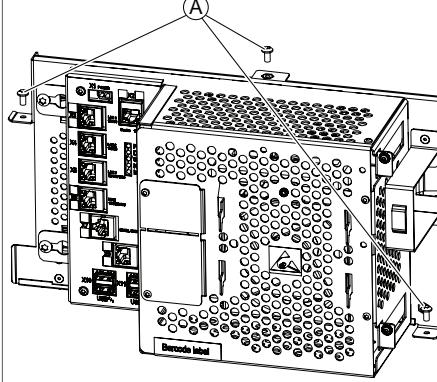
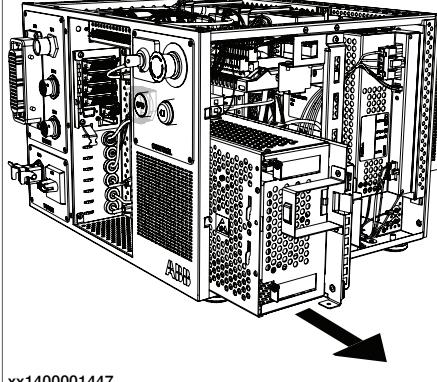
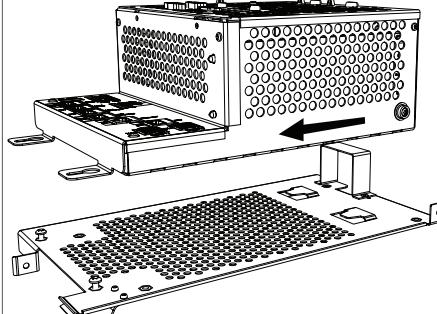
Action	Note/illustration
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
2  <b>WARNING</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD!</b> on page 39	
3 Open the door in the front and disconnect all connectors from the computer unit.	
4 Remove the cover of the cabinet.	See <a href="#">Removing the controller cover on page 80</a> .
5 Disconnect all connectors from the computer unit.	
6 Remove the attachment screws for the axis computer.	 xx1500000234 A Axis computer attachment screws
7 Pull the axis computer slightly to release the latches on the axis computer from the recesses on the assembly plate. Push the axis computer slightly away from the assembly plate.	 xx1500000235 A Latches B Recesses

*Continues on next page*

## 4 Repair

### 4.5 Replacement of computer unit

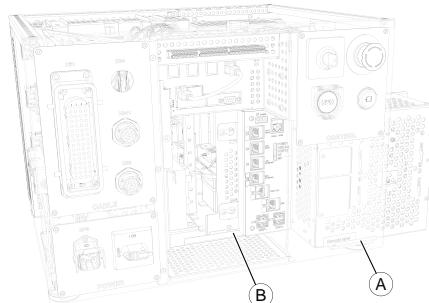
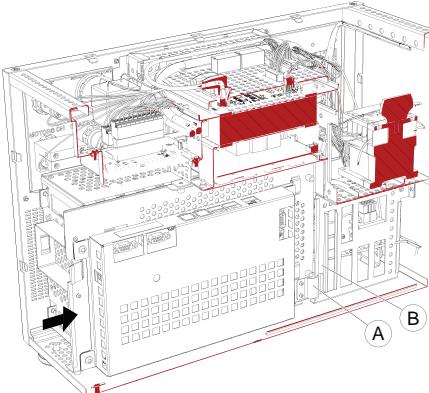
*Continued*

	Action	Note/illustration
8	Remove the three attachment screws on the assembly plate.	 xx1400001388 <b>A</b> attachment screws
9	Slide the assembly plate with computer unit out of the controller cabinet. Lift the computer unit slightly to get the wrist band button on the bottom over the edge of the cabinet.	 xx1400001447
10	Loosen the attachment screws, and pull the computer unit in the direction of the arrow. The computer unit is suspended by latches and attachment screws.	 xx1400001448 <b>WARNING</b> Prevent the computer unit from falling down due to gravity by supporting the computer unit from beneath by hand.

*Continues on next page*

## Refitting

The procedure below details how to refit the computer unit.

Action	Note/illustration
<p>1</p>  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
<p>2</p>  <b>WARNING</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD!</b> on page 39	
<p>3</p> Fit the computer unit in position on the assembly plate.	
<p>4</p> Tighten the attachment screws.	
<p>5</p> Slide the assembly plate with the computer unit into the cabinet. The computer unit should rest on guide structure 1. Guide structure 2 should fit between the assembly plate and the computer unit.	 xx1500000236 A Guide structure 1 B Guide structure 2
<p>6</p> Make sure the computer unit spring is clipped on to the structure wall inside the cabinet.	 xx1500000233 A Computer unit spring B Structure wall

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## 4 Repair

### 4.5 Replacement of computer unit

*Continued*

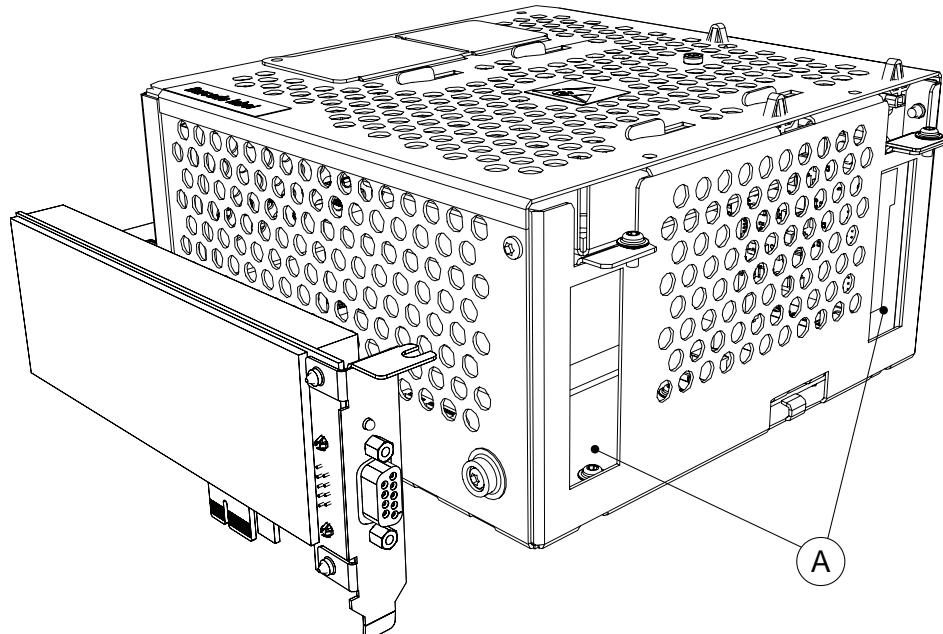
	Action	Note/illustration
7	Tighten the assembly plate attachment screws.	
8	Fit the axis computer unit so that its latches fit into the recesses of the assembly plate.	
9	Tighten the axis computer unit attachment screws.	
10	Reconnect all connectors to the computer unit.	
11	Refit the cabinet cover.	

## 4.6 Replacement of PClexpress boards in the computer unit

**4.6 Replacement of PClexpress boards in the computer unit****Location**

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

- DeviceNet Master/Slave
- PROFIBUS-DP Master



xx1300000603

A	Slots for PClexpress cards
---	----------------------------

**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> .
Standard toolkit		The contents are described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
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.

*Continues on next page*

## 4 Repair

### 4.6 Replacement of PClexpress boards in the computer unit

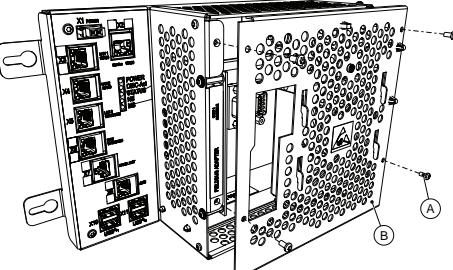
Continued

#### 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 <i>Circuit diagrams on page 197</i> .	

#### Removal

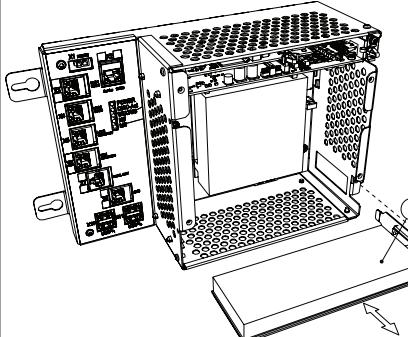
The procedure below details how to remove a PClexpress board.

	Action	Note/Illustration
1	 <b>DANGER</b>  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 38</i> .	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b>  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 39</i>	
3	Remove the cover of the cabinet.	See <i>Removing the controller cover on page 80</i> .
4	Remove the computer unit.	See <i>Replacement of computer unit on page 122</i> .
5	Disconnect any cables to/from the PClexpress board.	 <b>Tip</b>  Make a note of which cables are disconnected.
6	 <b>CAUTION</b>  Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 <b>A</b> Attachment screws (4 pcs.) <b>B</b> Upper cover

Continues on next page

## 4.6 Replacement of PClexpress boards in the computer unit

Continued

Action	Note/Illustration
7 Remove the attachment screw on top of the PClexpress board bracket.	 xx1300000685 <p>A Attachment screw B PClexpress board</p>
8 Gently pull the board straight out.	<p><b>!</b> CAUTION Always grip the board around the edges to avoid damage to the board or its components.</p> <p><b>!</b> CAUTION Immediately put the board in an ESD safe bag or similar.</p>

**Refitting**

The procedure below details how to refit a PClexpress board.

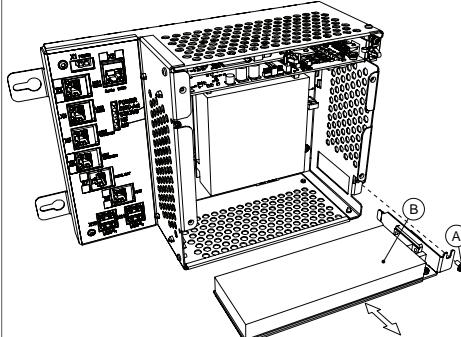
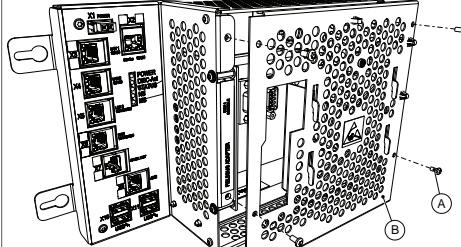
Action	Note/Illustration
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <b>WARNING - The unit is sensitive to ESD! on page 39</b>	

*Continues on next page*

## 4 Repair

### 4.6 Replacement of PClexpress boards in the computer unit

*Continued*

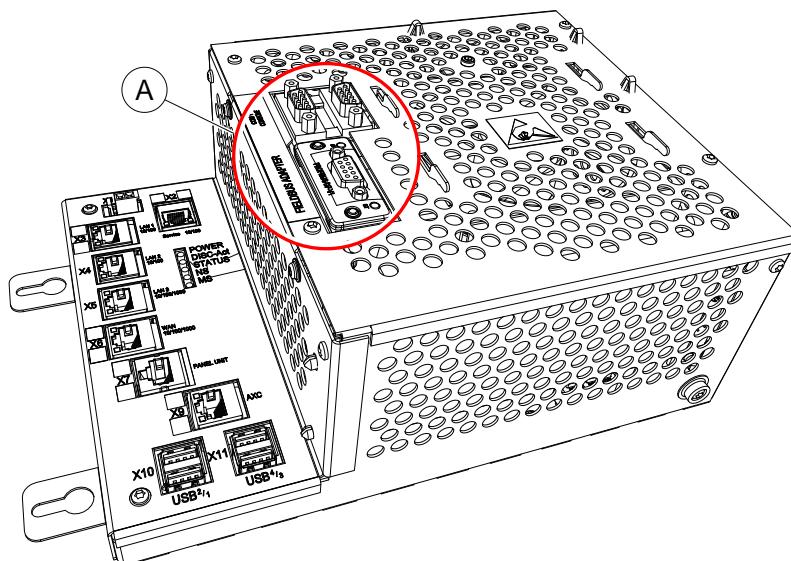
	Action	Note/Illustration
3	Fit the PClexpress board in position by pushing the PClexpress board into the socket on the motherboard.	 <p>xx1300000685</p> <p>A Attachment screw B PClexpress board</p> <p><b>! CAUTION</b></p> <p>Always grip the board around the edges to avoid damage to the board or its components.</p>
4	Refit the attachment screw on top of the PClexpress board bracket.	
5	Reconnect any additional cables to the PClexpress board.	
6	Refit the fan connector and close the computer unit.  <b>! CAUTION</b> Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
7	Refit the computer unit.	See <a href="#">Replacement of computer unit on page 122</a> .
8	Refit the controller cover.	
9	Make sure the robot system is configured to support the installed PClexpress board.	

## 4.7 Replacement of expansion board in the computer unit

**4.7 Replacement of expansion board in the computer unit****Location**

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

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



xx1300000860

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

**Required equipment**

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

**Removal**

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

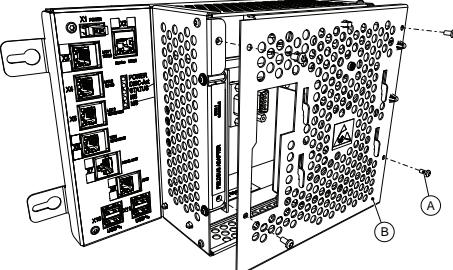
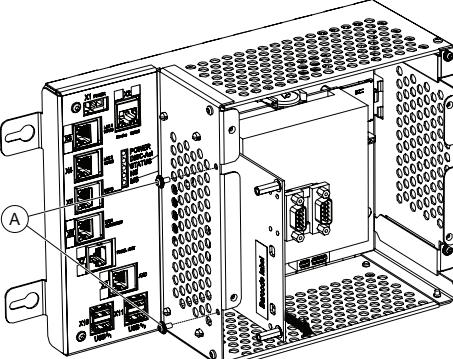
	Action	Note/Illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	

*Continues on next page*

## 4 Repair

### 4.7 Replacement of expansion board in the computer unit

*Continued*

Action	Note/Illustration
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <a href="#">WARNING - The unit is sensitive to ESD! on page 39</a>	
3 Remove the cover of the cabinet.	See <a href="#">Removing the controller cover on page 80</a> .
4 Remove the computer unit.	See <a href="#">Replacement of computer unit on page 122</a> .
5 Disconnect any cables to/from the fieldbus adapter.	
6 Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector.   <b>CAUTION</b>  Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Upper cover
7 If there is a fieldbus adapter, remove it.	See <a href="#">Replacement of fieldbus adapter in the computer unit on page 134</a> .
8 Remove the attachment screws on the computer unit.	 xx1300000859 A Attachment screws (2 pcs)
9 Grip the expansion board and gently pull it straight out.	 <b>CAUTION</b>  Always grip the expansion board around the edges to avoid damage to the board or its components.

*Continues on next page*

**Refitting**

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

Action	Note/Illustrator
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <b>WARNING - The unit is sensitive to ESD!</b> on page 39	
3  <b>CAUTION</b>  Push carefully so no pins are damaged. Make sure that the expansion board is pushed straight into the connector.	 <b>CAUTION</b>  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.   <b>CAUTION</b>  Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.	
6 Refit the computer unit.	See <b>Replacement of computer unit</b> on page 122.
7 Refit the controller cover.	
8 Reconnect any cable to the fieldbus adapter.	

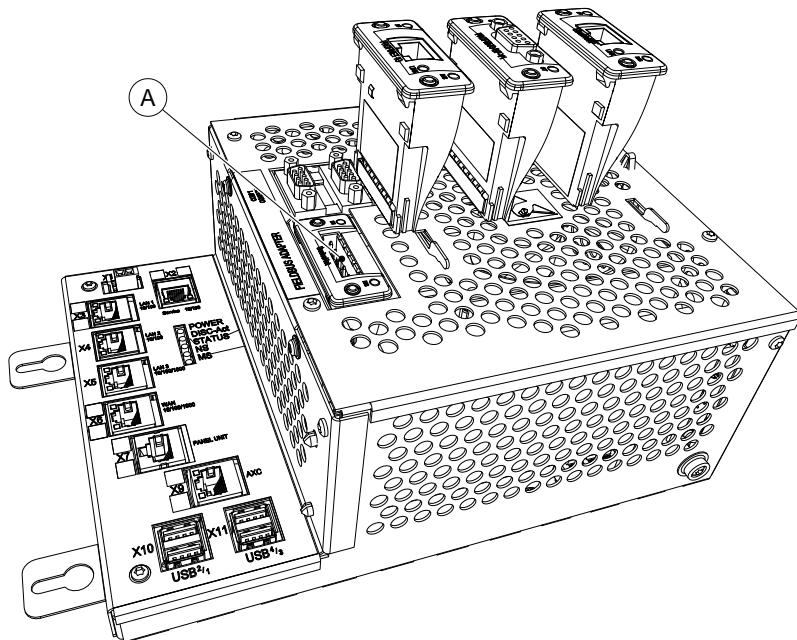
## 4 Repair

### 4.8 Replacement of fieldbus adapter in the computer unit

#### Location

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

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



xx1300000604

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

#### Required equipment

Equipment	Art. no.	Note
AnybusCC EtherNet/IP slave fieldbus adapter	3HAC027652-001	DSQC 669 Ethernet/IP communication is described in <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>

Continues on next page

## 4.8 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 <a href="#">Standard toolkit, IRC5 on page 187</a> .

## 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 <a href="#">Circuit diagrams on page 197</a> .	

## Removal

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

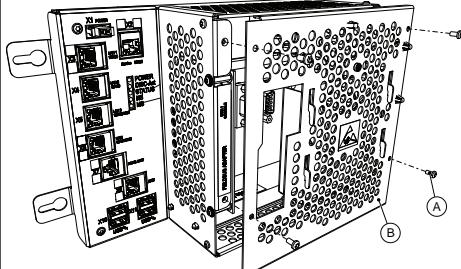
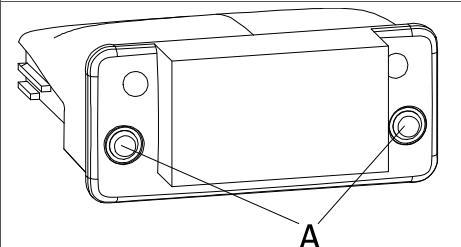
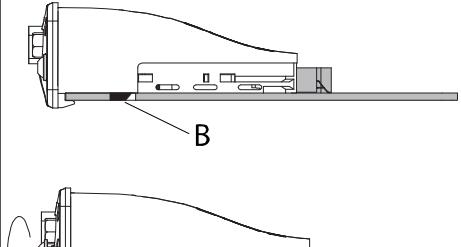
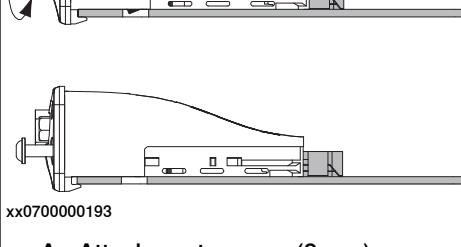
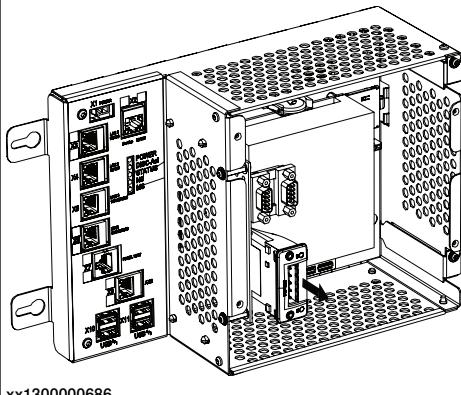
	Action	Note/Illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <a href="#">WARNING - The unit is sensitive to ESD! on page 39</a>	
3	Remove the cover of the cabinet.	See <a href="#">Removing the controller cover on page 80</a> .
4	Remove the computer unit.	See <a href="#">Replacement of computer unit on page 122</a> .

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## 4 Repair

### 4.8 Replacement of fieldbus adapter in the computer unit

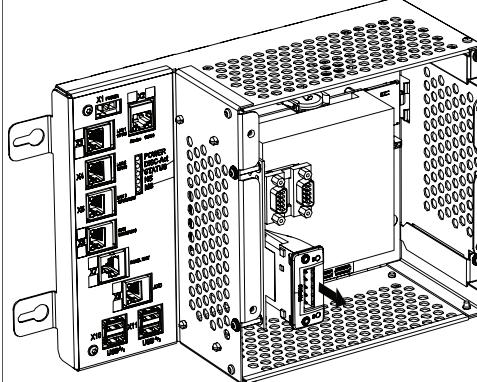
*Continued*

Action	Note/Illustration
5 Disconnect any cables to/from the fieldbus adapter.	
6 Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector.  ! CAUTION  Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.	 xx1300000684 A Attachment screws (4 pcs.) B Upper cover
7 Loosen the attachment screws (2 pcs) on front of the fieldbus adapter to release the fastening mechanism.  i Note  Only loosen the attachment screws. Do not remove them.	   xx0700000193 A Attachment screws (2 pcs) B Fastening mechanism
8 Grip the loosened attachment screws and gently pull the fieldbus adapter straight out.	 xx1300000686

*Continues on next page*

**Refitting**

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

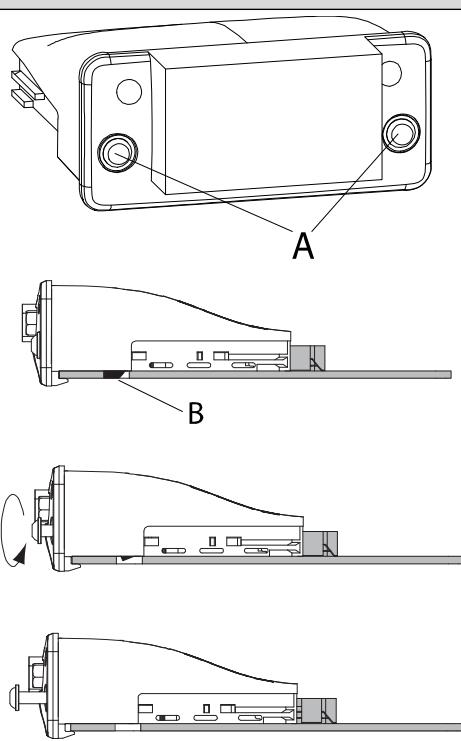
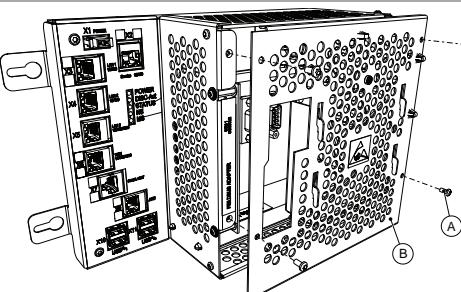
Action	Note/Illustrator
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <b>WARNING - The unit is sensitive to ESD!</b> on page 39	
3  <b>CAUTION</b>  Push carefully so no pins are damaged. Make sure that the adapter is pushed straight onto the rails.   xx1300000686	  <b>CAUTION</b>  Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.

Continues on next page

## 4 Repair

### 4.8 Replacement of fieldbus adapter in the computer unit

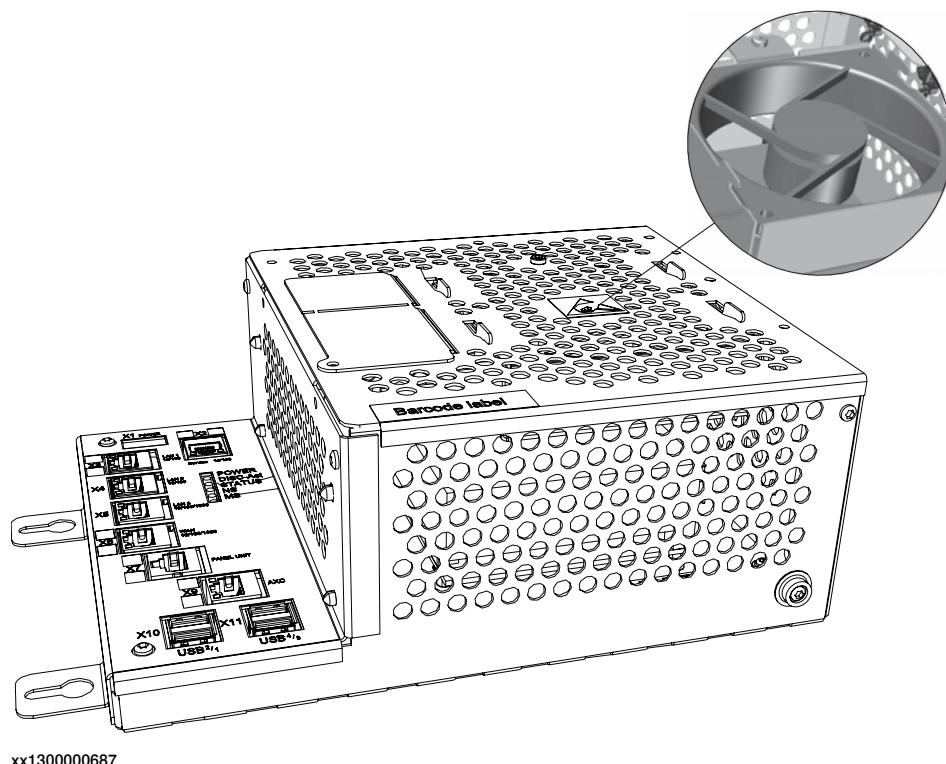
*Continued*

Action	Note/Illustrator
<p>4 Secure the fieldbus adapter with its attachment screws (2 pcs).</p>	 <p>A Attachment screws (2 pcs) B Fastening mechanism</p>
<p>5 Refit the fan connector and close the computer unit.</p> <p><b>CAUTION</b> Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.</p>	 <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
6 Refit the computer unit.	See <a href="#">Replacement of computer unit on page 122</a> .
7 Refit the controller cover.	
8 Reconnect the cable to the fieldbus adapter.	
9 Make sure the robot system is configured to reflect the fieldbus adapter installed.	

## 4.9 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 <a href="#">Spare parts on page 189</a> .
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 <a href="#">Circuit diagrams on page 197</a> .

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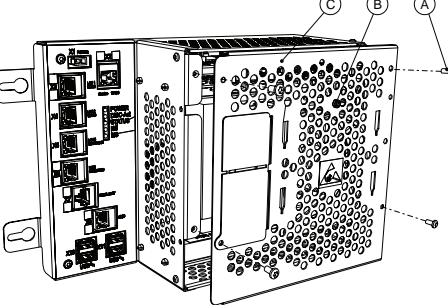
## 4 Repair

### 4.9 Replacement of fan in computer unit

*Continued*

#### Removal

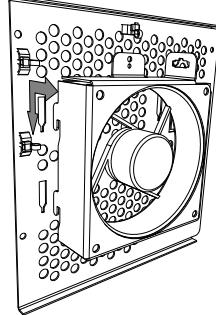
The procedure below details how to remove the fan in the computer unit.

Action	Note/Illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <b>WARNING - The unit is sensitive to ESD! on page 39</b>
3	Remove the cover of the cabinet. See <a href="#">Removing the controller cover on page 80</a> .
4	Remove the computer unit. See <a href="#">Replacement of computer unit on page 122</a> .
5	Open the computer unit by removing the upper cover attachment screws and lift off the upper cover.  xx1300000688 A Upper cover attachment screws (4 pcs.) B Fan attachment screw C Upper cover
6	Disconnect the fan connector and remove the cable straps.  <b>CAUTION</b> 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*

## 4.9 Replacement of fan in computer unit

Continued

Action	Note/Illustration
8 Remove the fan from the upper cover.	 xx1300000806

**Refitting**

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

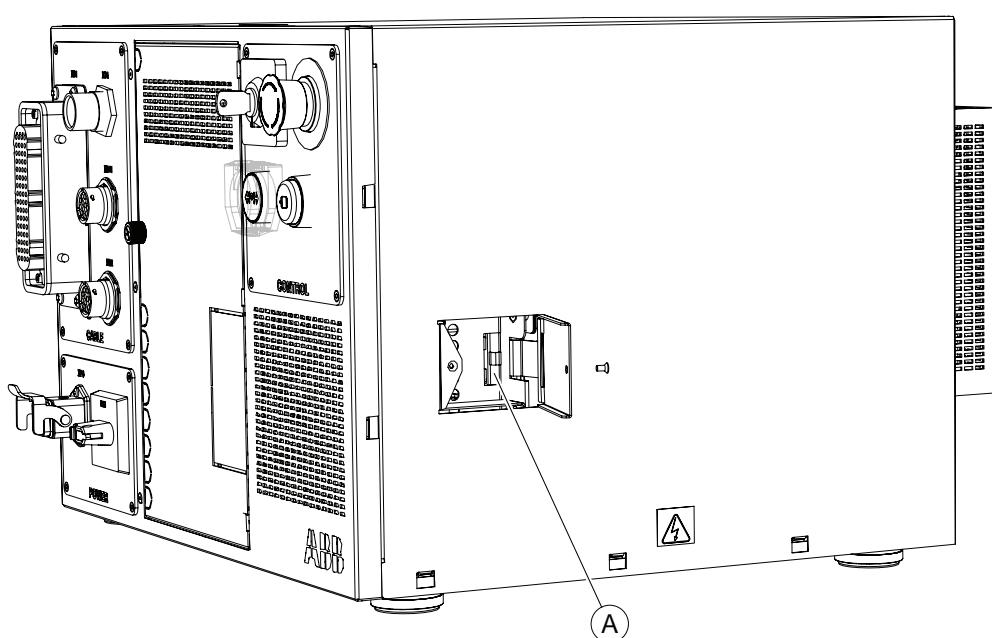
Action	Note/Illustration
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <b>WARNING - The unit is sensitive to ESD!</b> on page 39	
3 Refit the fan on the upper cover.	
4 Refit the attachment screw.	
5 Strap the fan cable to the upper cover.	 <b>CAUTION</b>  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 <b>Replacement of computer unit</b> on page 122.
7 Refitt the controller cover.	
8 Refit the fan connector and close the computer unit.	 <b>CAUTION</b>  Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.

## 4 Repair

### 4.10 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>Note</b>	
Only use SD-card memory supplied by ABB.	

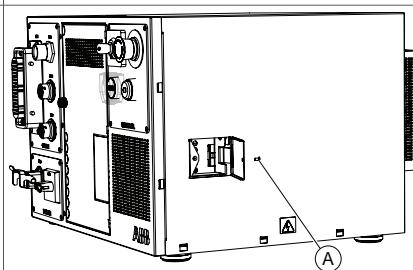
#### Required equipment

Equipment	Note
SD-card 2GB	DSQC1008 2GB See <a href="#">Spare parts on page 189</a> .  <b>Note</b> Only use SD-card memory supplied by ABB. Includes <i>ABB boot application</i> software to correctly reboot the robot controller.
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

Continues on next page

**Removal**

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

Action	Note/illustration
1  <b>DANGER</b>  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 38</i> .	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  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 39</i>	
3 Remove the attachment screw and open the hatch on the right hand side of the controller.	 xx1400001375 • A: attachment screw
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	Note/illustration
1  <b>DANGER</b>  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 38</i> .	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  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 39</i>	

*Continues on next page*

## 4 Repair

### 4.10 Replacement of SD-card memory in computer unit

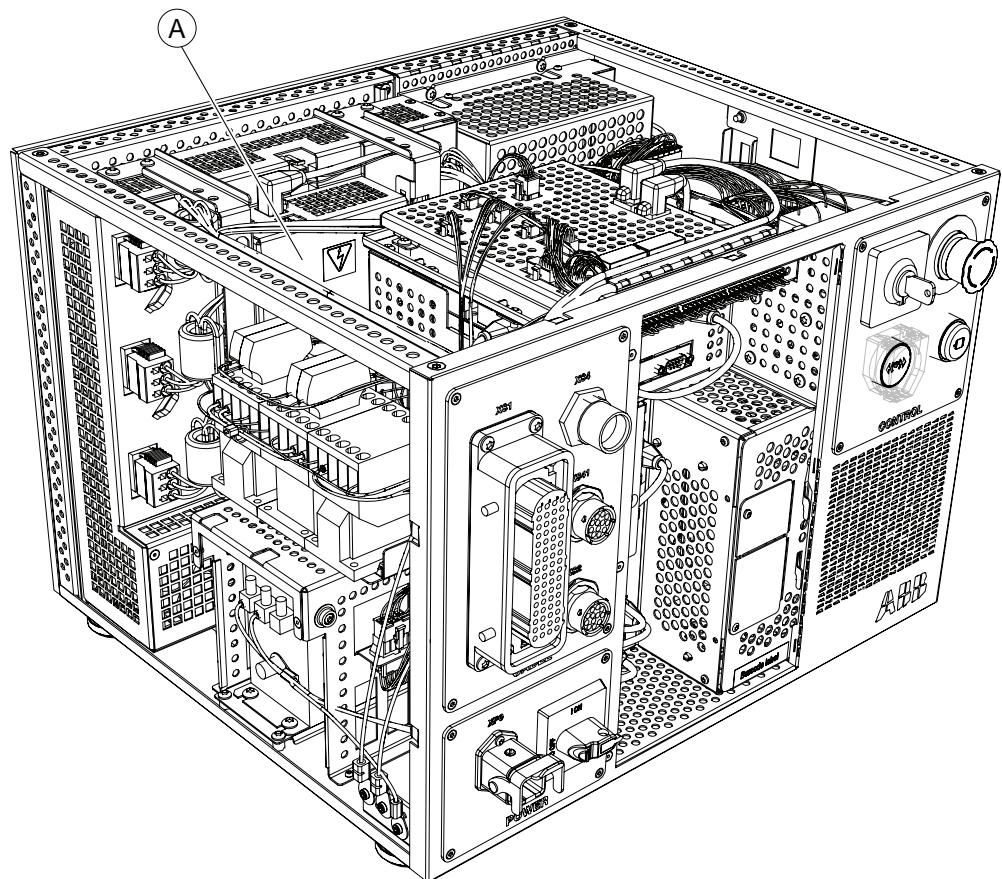
*Continued*

	Action	Note/Illustration
3	 <b>CAUTION</b> 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.	

## 4.11 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 <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

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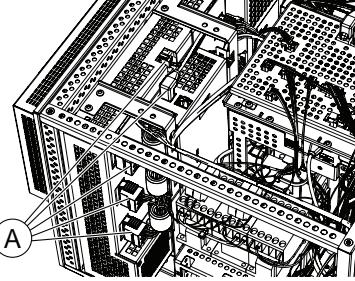
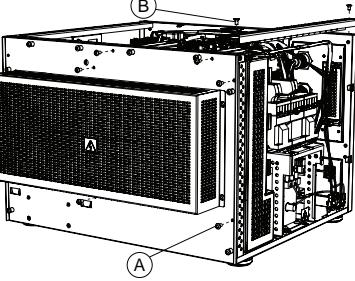
## 4 Repair

### 4.11 Replacement of drive unit

*Continued*

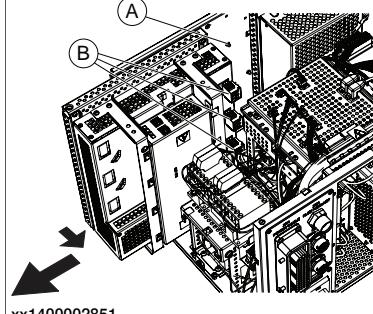
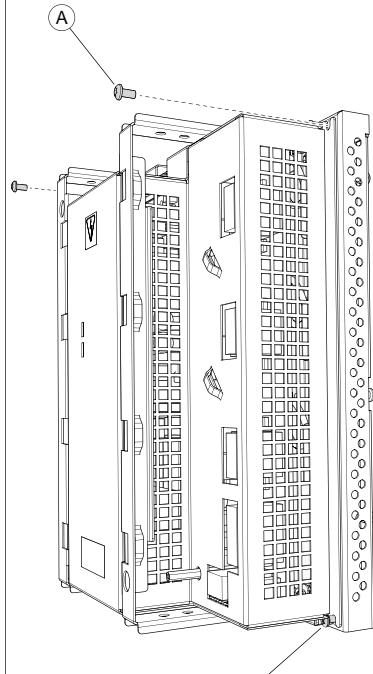
#### Removal

Use the following procedure to remove the Main Drive Unit.

	Action	Information
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38.</b>	
2	Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
3	Disconnect the connectors on the top and on the left on the Main Drive Unit.	 xx1400002850 <b>A</b> Connectors on the Main Drive Unit
4	Remove the six attachment screws in the back of the controller.	 xx1400001619 <b>A</b> Attachment screws for Main Drive Unit <b>B</b> Attachment screws for support bar
5	Remove the support bar by removing the two attachment screws.	

*Continues on next page*

4.11 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>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>A Upper attachment (2 pcs.)  B Lower attachment (2 pcs.)</p>

*Continues on next page*

## 4 Repair

### 4.11 Replacement of drive unit

*Continued*

#### Refitting

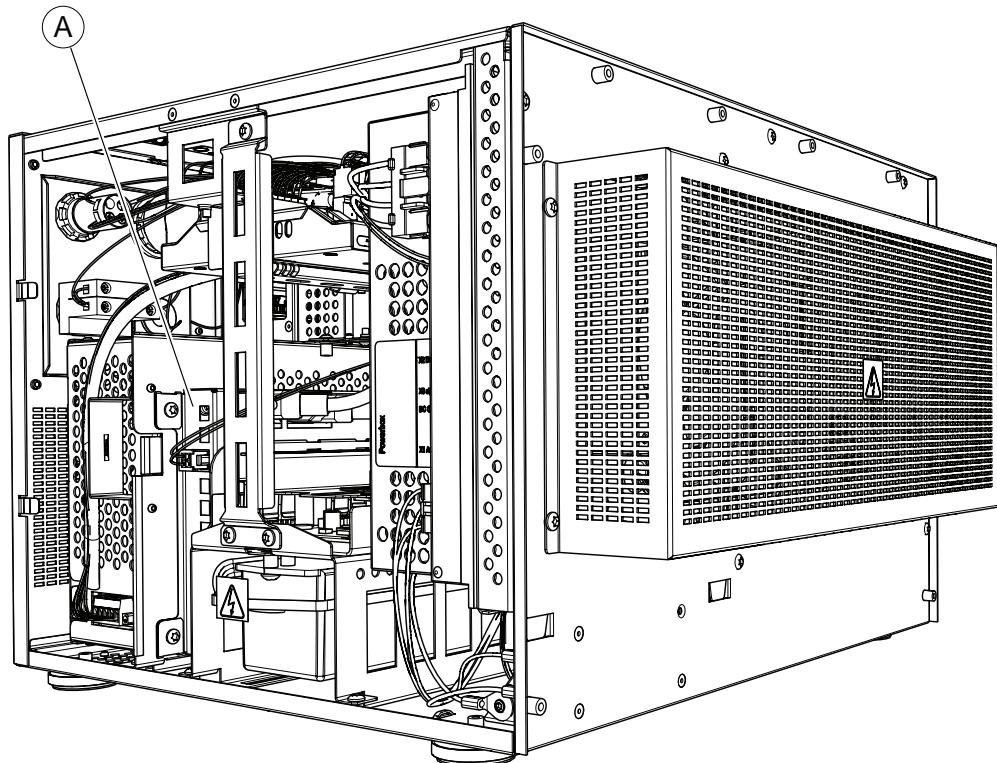
Use the following procedure to refit the Main Drive Unit.

	Action
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38.</b>
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.

## 4.12 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 <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

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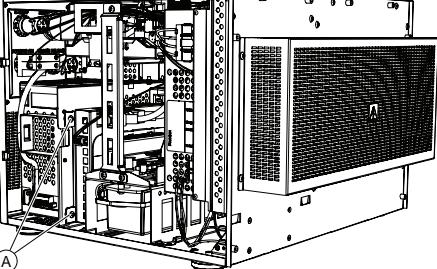
## 4 Repair

### 4.12 Replacement of axis computer

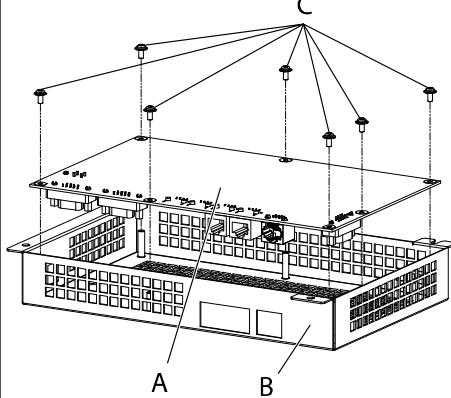
*Continued*

#### Removal

Use the following procedure to remove the axis computer.

	Action	Info/illustration
1	 <b>DANGER</b> 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 38</i> .	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> 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 39</i>	
3	Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller on page 80</i> .
4	Disconnect all connectors from the axis computer unit.	 <b>Note</b> Make a note of any connections.
5	Remove the attachment screws.	 xx1500000234 <b>A Attachment screws</b>
6	Slide the axis computer unit out of the controller.	

*Continues on next page*

Action	Info/illustration
7 Remove the seven attachment screws and gently lift the axis computer board straight up.	 <p>xx1000000953</p> <p>A Axis computer board B Axis computer cover C Attachment screws</p>

**Refitting**

Use this procedure to refit the axis computer.

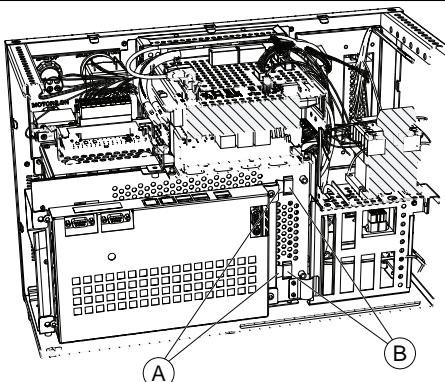
Action	Info/illustration
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 38.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 39	
3 Gently fit the axis computer board into the cover and refit the attachment screws.	

*Continues on next page*

## 4 Repair

### 4.12 Replacement of axis computer

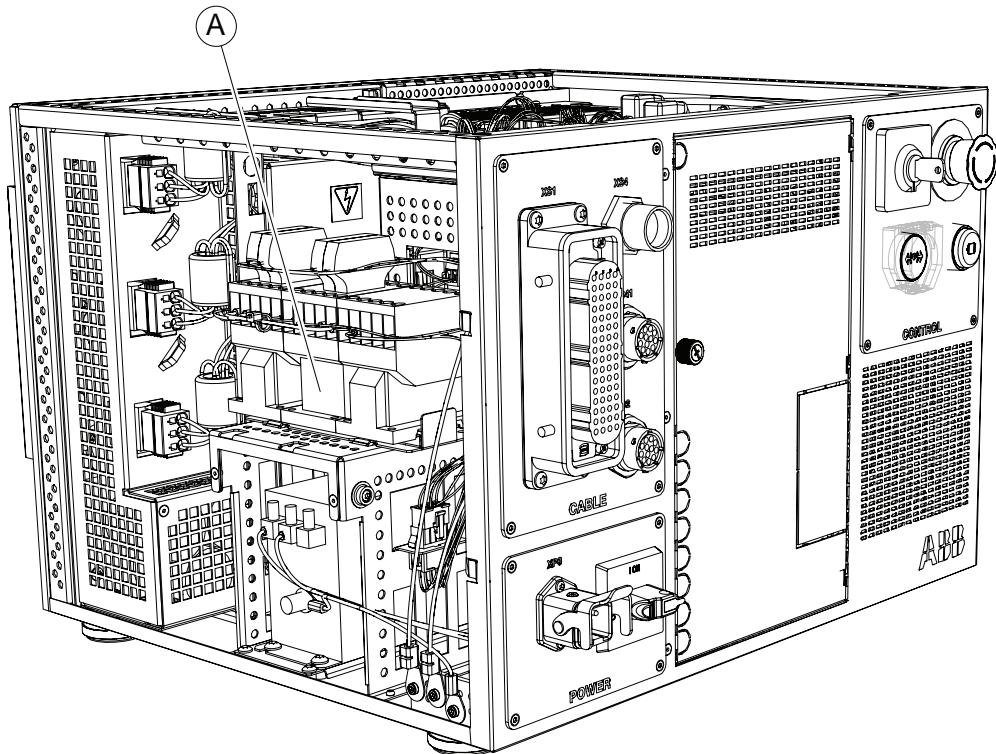
*Continued*

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.	

## 4.13 Replacement of contactor unit

### Location

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



xx1400002008

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

### Required equipment

Equipment	Note
Contactor unit	Contactor ASL16-30-10 DC24V See <a href="#">Miscellaneous parts on page 192</a> .
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

### Removal

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

Action	Note/illustration
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	

*Continues on next page*

## 4 Repair

### 4.13 Replacement of contactor unit

Continued

Action	Note/illustration
2 Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
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

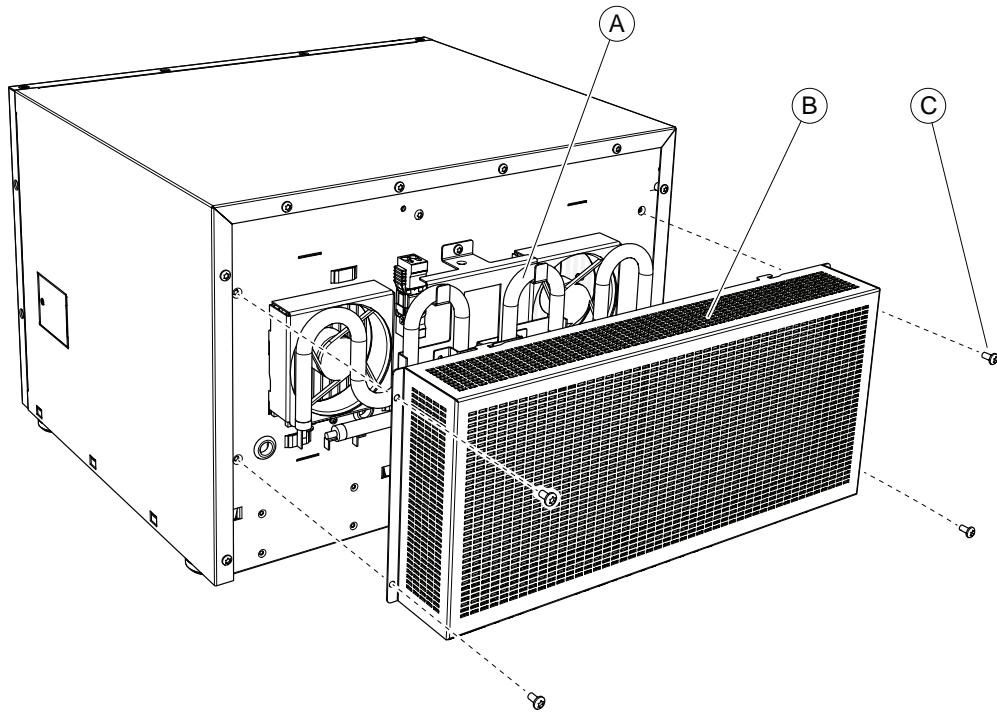
The procedure below details how to refit the backup energy bank.

Action	Note/illustration
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	
2 Refit the contactor unit.	
3 Refit the attachment screws, and tighten them.	
4 Reconnect all wires.	
5 Refit the cabinet cover.	

## 4.14 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 <a href="#">Miscellaneous parts on page 192</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .

### Removal

Use the following procedure to remove the line filter.

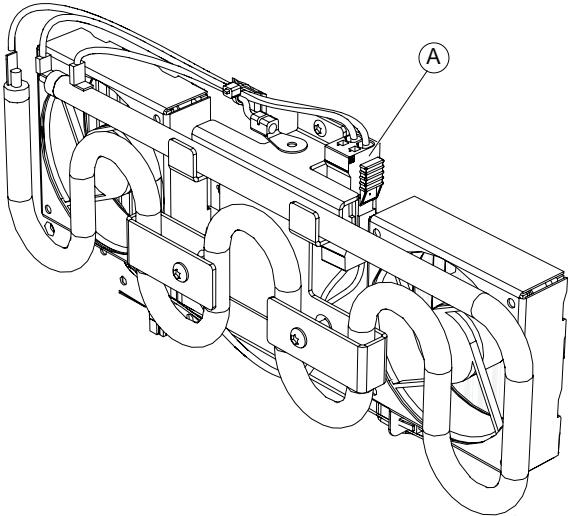
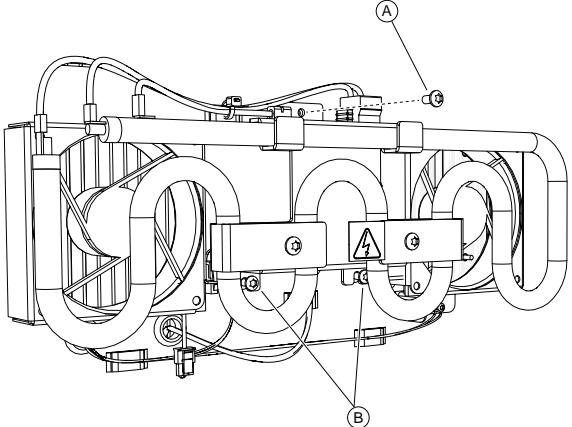
	Action	Note/illustration
1	<b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	

*Continues on next page*

## 4 Repair

### 4.14 Replacement of brake resistor bleeder

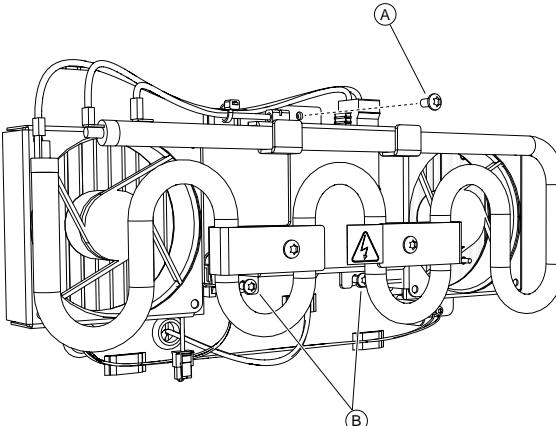
*Continued*

Action	Note/illustration
2  <b>CAUTION</b> Hot surface on top of the bleeder. Risk of burns. Be careful when removing the unit.	
3 Remove the fan cover.	
4 Disconnect the bleeder connector.	 <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  <b>DANGER</b>  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 38.	
2 Refit the brake resistor bleeder by sliding the recesses in beneath the lower attachment screw heads, and push it inwards and then downwards.	 xx1400001458 A Upper attachment screw B Lower attachment screws
3 Refit the upper attachment screw.	
4 Tighten all the attachment screws for the bleeder.	
5 Reconnect the bleeder connector.	
6 Refit the fan cover, push it left towards the grooves.	
7 Refit the attachment screws for the fan cover, and tighten them.	

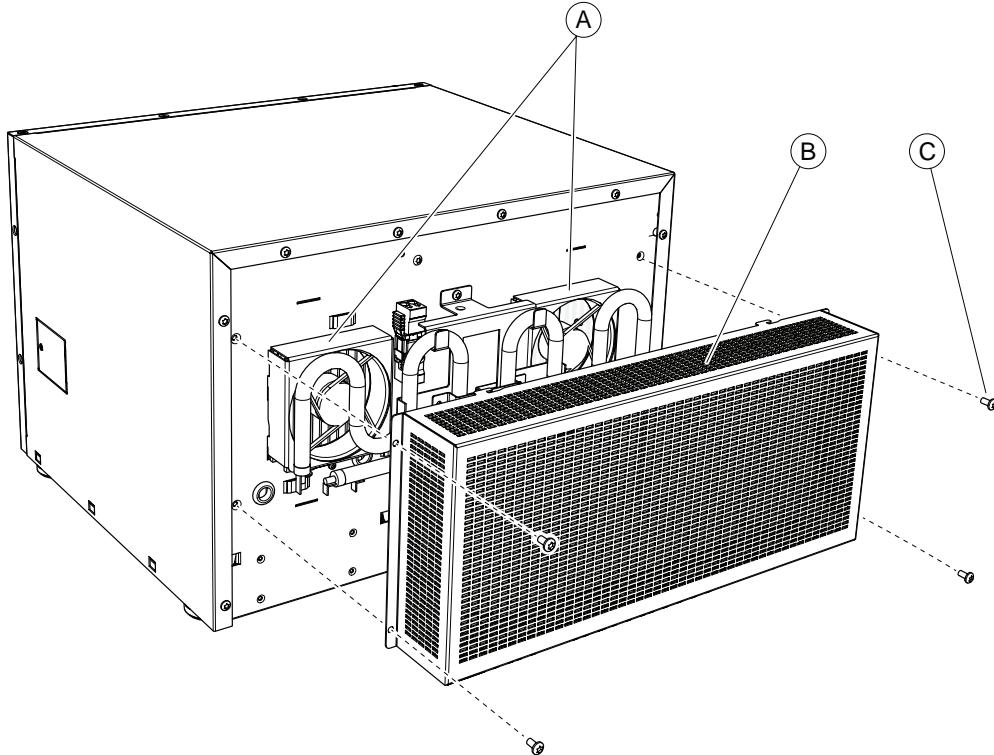
## 4 Repair

### 4.15 Replacement of system fans

#### 4.15 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

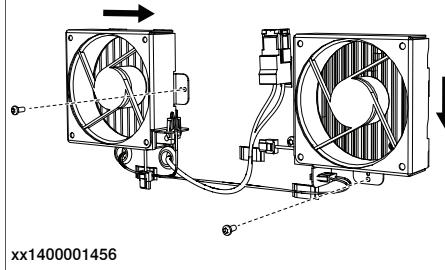
##### Required equipment

Equipment	Note
Fan with receptacle	See <a href="#">Miscellaneous parts on page 192</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .

*Continues on next page*

**Removal**

Use this procedure to remove one of the system fans.

Action	Info/illustration
1  <b>DANGER</b>  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 38</i> .	
2  <b>CAUTION</b>  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 on page 155</i> .
6 Disconnect the connectors to the fan.	
7 Loosen the attachment screw on the fan receptacle.	
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  <b>DANGER</b>  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 38</i> .	
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

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### 4.15 Replacement of system fans

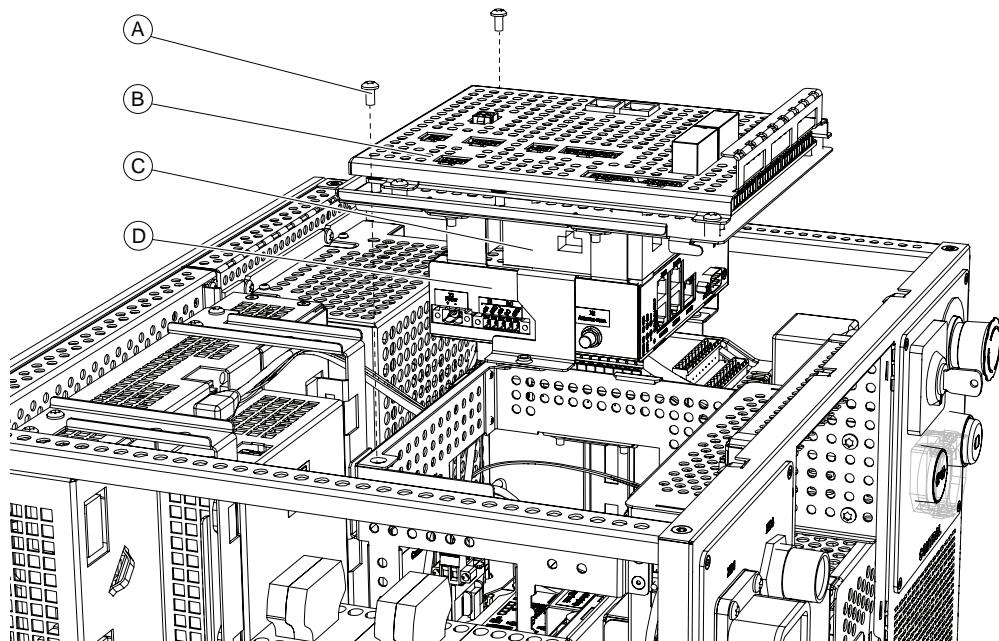
*Continued*

	Action	Info/illustration
5	Refit and connect the brake resistor bleeder.	See <a href="#">Replacement of brake resistor bleeder on page 155</a> .
6	Put the fan cover in place and push it to the right.	
7	Fasten the four attachment screws on the fan cover.	

## 4.16 Replacement of Remote Service box

### Location

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



xx1500000230

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

### Required equipment

Equipment	Information
Remote Service box	DSQC 680 See <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

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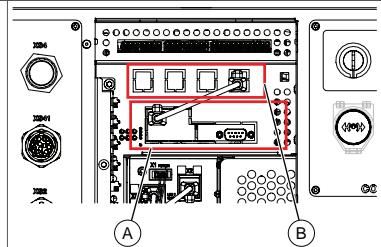
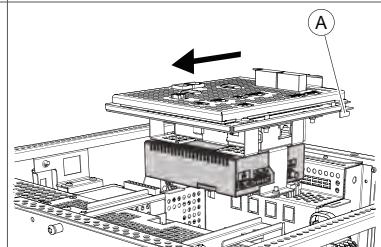
## 4 Repair

### 4.16 Replacement of Remote Service box

*Continued*

#### Removal

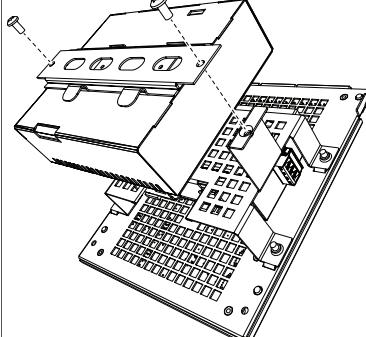
Use this procedure to remove the Remote Service box.

	Action	Information
1	 <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 39</b>	
3	On the cabinet front, disconnect the connectors from the Remote Service contacts.  If you have an Ethernet switch, disconnect the connectors from this as well.	 xx1400002787  A Remote Service contacts B Ethernet switch contacts
4	Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
5	Disconnect all connectors from the safety board, Remote Service box, and Ethernet switch.	
6	Remove the two attachment screws, and push the safety board unit backwards to release the latches.	 xx1400001462

*Continues on next page*

## 4.16 Replacement of Remote Service box

Continued

Action	Information
7 Turn the unit around, and remove the two attachment screws from the mounting rail.	 xx1400001460
8 Tip the unit away from the mounting rail.	

**Refitting**

Use this procedure to refit the Remote Service box.

Action
1  <b>DANGER</b> 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 38</i> .
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> 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 39</i>
3 Fit the Remote Service box in position on the mounting rail.
4 Refit the mounting rail and secure with attachment screws.
5 Refit the safety board unit and secure it with attachment screws.
6 Reconnect all connectors to the Remote Service box, Ethernet switch and safety board.
7 Refit the cabinet cover.

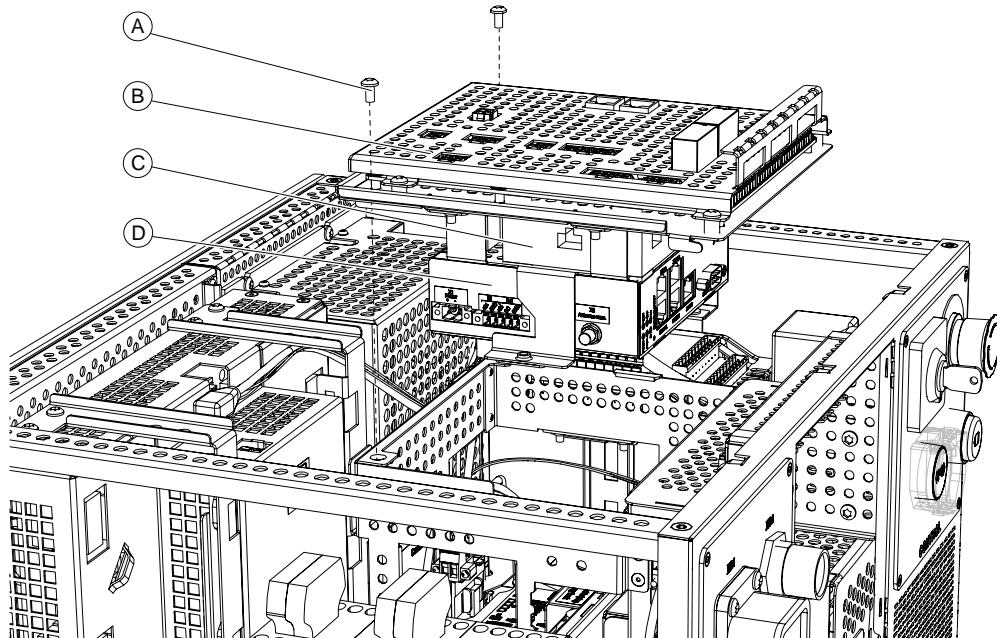
## 4 Repair

### 4.17 Replacement of Ethernet switch

#### 4.17 Replacement of Ethernet switch

##### Location

The following illustration shows the location of the Ethernet switch.



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

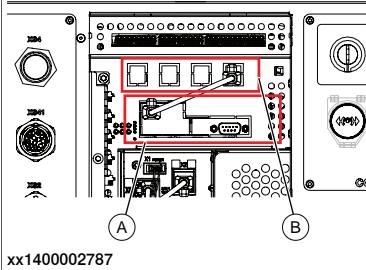
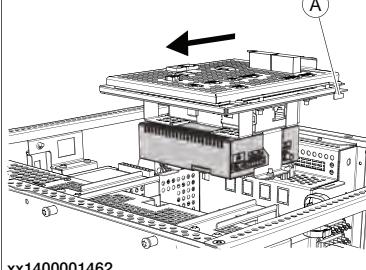
##### Required equipment

Equipment	Information
Ethernet switch	3HAC034884-001
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See <a href="#">Circuit diagrams on page 197</a> .

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**Removal**

Use this procedure to remove the Ethernet switch.

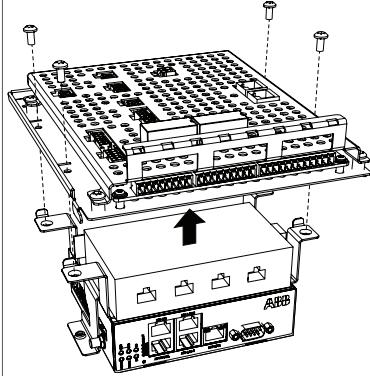
Action	Information
 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38</b> .	
 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 39</b>	
3 On the cabinet front, disconnect the connectors from the Ethernet switch contacts. If you have a Remote Service box, disconnect the connectors from this as well.	 xx1400002787 A Remote Service contacts B Ethernet switch contacts
4 Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
5 Disconnect all connectors from the safety board, Ethernet switch, and Remote Service box.	
6 Remove the two attachment screws, and push the safety board unit backwards to release the latches.	 xx1400001462

*Continues on next page*

## 4 Repair

### 4.17 Replacement of Ethernet switch

*Continued*

Action	Information
7 Remove the attachment screws, and lift off the safety board.	 xx1500000231
8 Remove the Ethernet switch.	

#### Refitting

Use this procedure to refit the Ethernet switch.

Action
1  <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 39</a>
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.

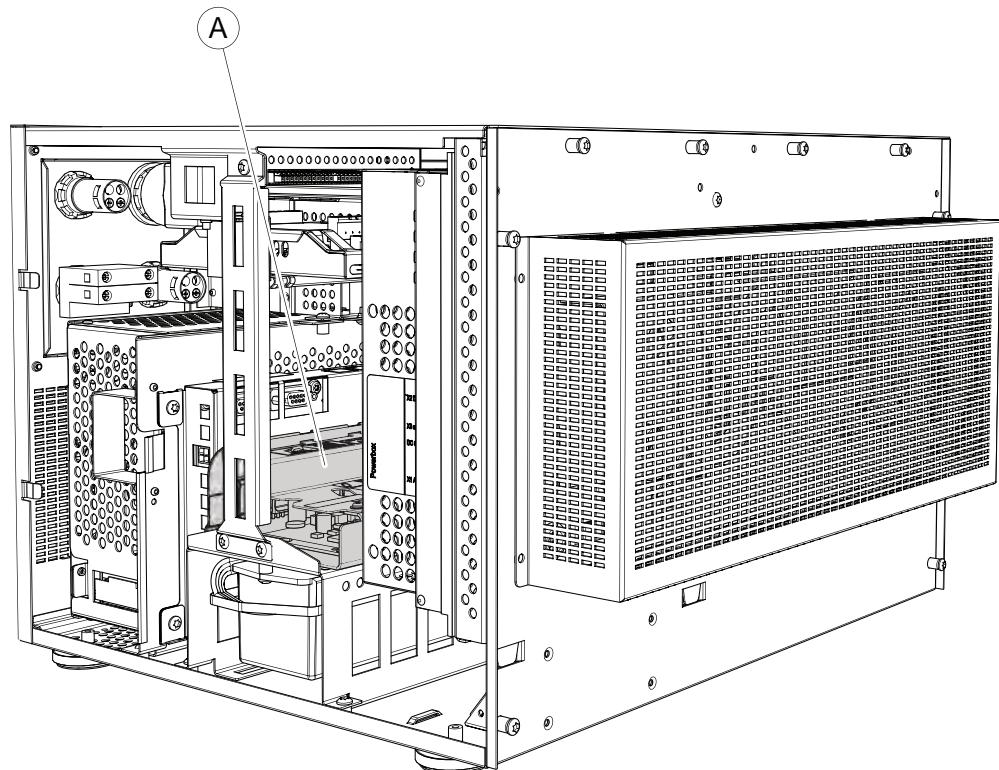
## 4.18.1 Replacement of power distribution board

## 4.18 Replacement of power supply

## 4.18.1 Replacement of power distribution board

## Location

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



xx1400001463

A	Power distribution board
<b>CAUTION</b>	
<p>Hot surface on top of the power distribution board unit. Risk of burns. Be careful when removing the unit. Do not route or place cables on top of the power distribution board.</p>	

## Required equipment

Equipment	Note
Power distribution board	DSQC 662 See <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .

*Continues on next page*

## 4 Repair

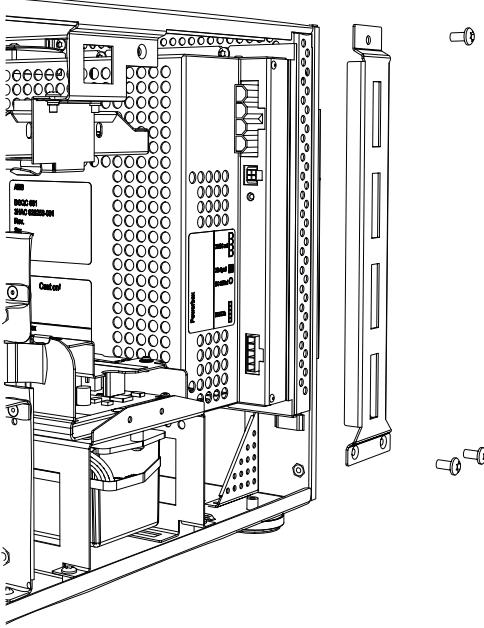
### 4.18.1 Replacement of power distribution board

*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 <a href="#">Circuit diagrams on page 197</a> .

#### Removal

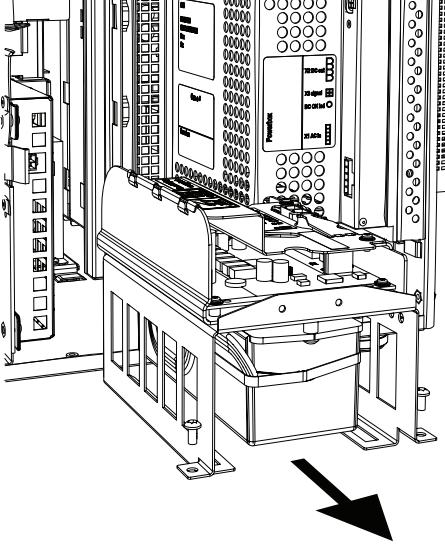
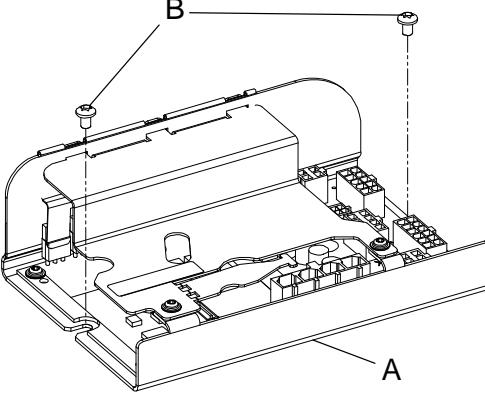
Use this procedure to remove the power distribution board.

	Action	Note/illustration
1	 <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	
2	 <b>CAUTION</b>  Hot surface on top of the power distribution board unit. Risk of burns. Be careful when removing the unit.	
3	Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
4	Remove the three attachment screws, and remove the support bar.	 xx1400001384

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## 4.18.1 Replacement of power distribution board

*Continued*

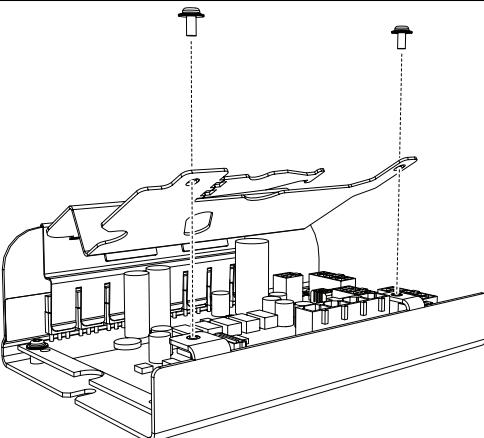
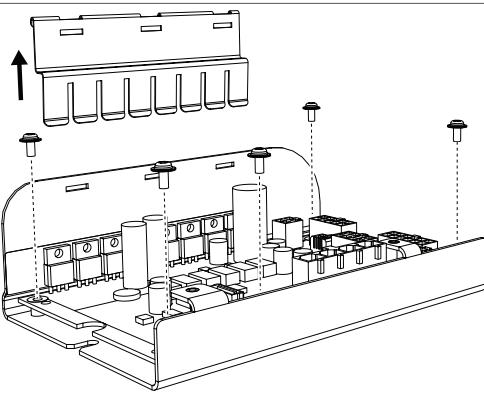
Action	Note/illustration
5 Remove the two attachment screws, and pull the backup energy bank unit slightly out.	 xx1400001385
6 Disconnect all connectors from the power distribution board.	
7 Pull the backup energy bank unit out completely.	
8 Remove the attachment screws and lift the board out.	 xx0900000549 <ul style="list-style-type: none"> <li>• A: power distribution board</li> <li>• B: attachment screws</li> </ul>

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## 4 Repair

### 4.18.1 Replacement of power distribution board

*Continued*

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

### Refitting

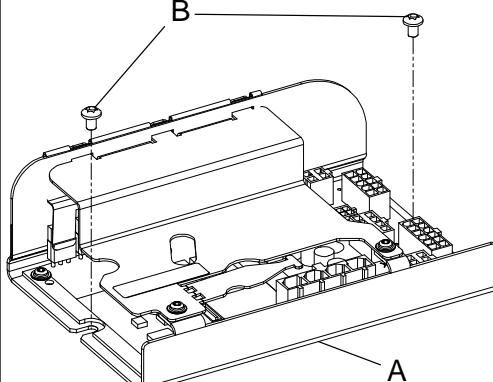
Use this procedure to refit the power distribution board.

Action	Note/illustration
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	

*Continues on next page*

## 4.18.1 Replacement of power distribution board

*Continued*

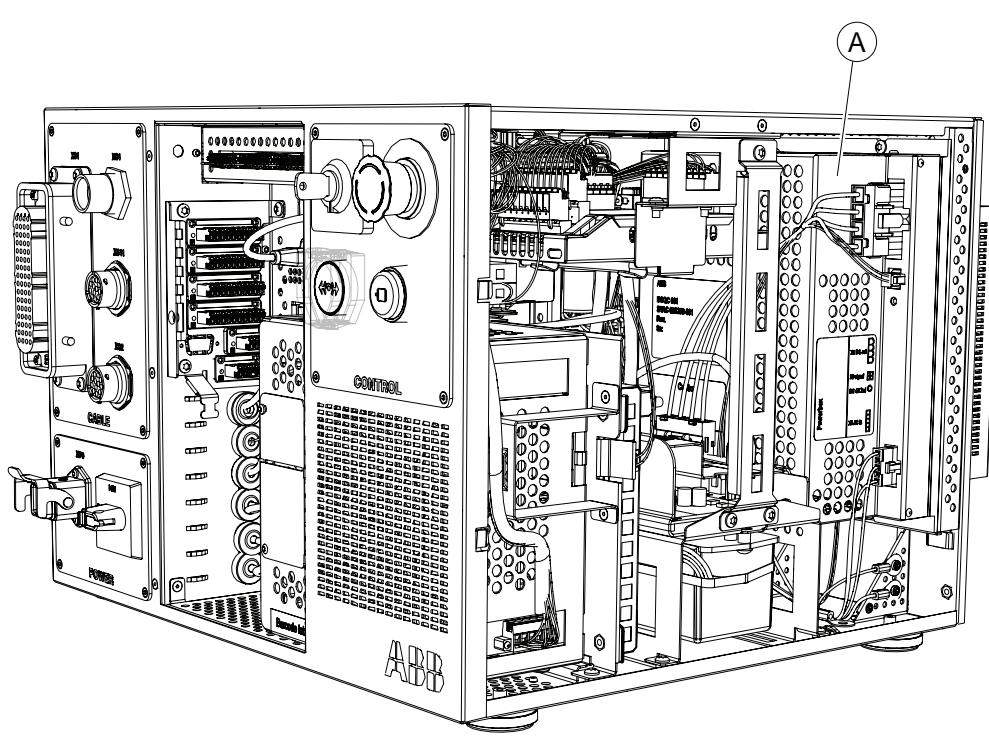
Action	Note/illustration
2 Put the new power distribution board in place and refit the attachment screws.	 <p>xx0900000549</p> <ul style="list-style-type: none"> <li>• A: power distribution board</li> <li>• B: attachment screws</li> </ul>
3 Refit the spring and cover plate. Secure with attachment screws.	
4 Refit the power distribution board and secure with attachment screws.	
5 Slide the backup energy bank unit half way in.	
6 Reconnect the connectors X1 - X9.   <b>CAUTION</b> Hot surface on top of the power distribution board unit. Do not route or place cables on top of the power distribution board.	
7 Refit the backup energy bank unit.	
8 Refit the support bar with the three attachment screws.	
9 Refit the cabinet cover.	

## 4 Repair

### 4.18.2 Replacement of system power supply

#### Location

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



A System power supply

#### Required equipment

Equipment	Note
System power supply	DSQC 661 See <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	

#### Removal

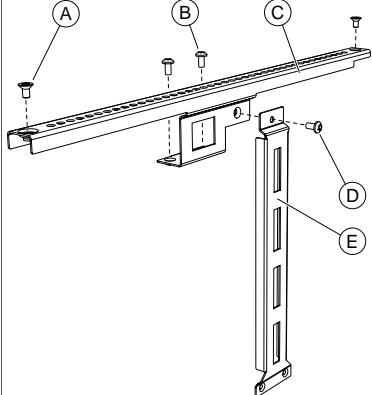
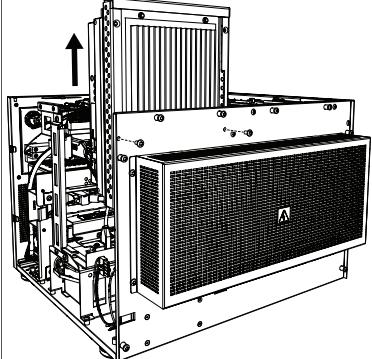
Use the following procedure to remove the system power supply.

Action	Note/Illustration
1  <b>DANGER</b>  Before commencing any work inside the cabinet, please observe the safety information in section <a href="#">DANGER - Make sure that the main power has been switched off! on page 38</a> .	

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## 4.18.2 Replacement of system power supply

*Continued*

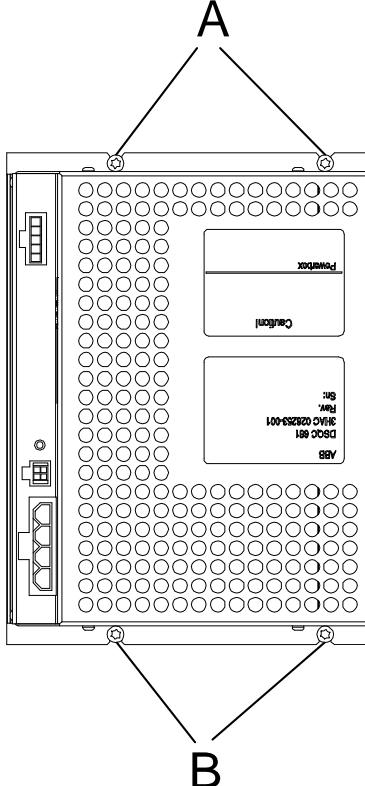
Action	Note/Illustration
2 Remove the cover of the cabinet.	See <i>Opening the IRC5 Compact controller on page 80</i> .
3 Disconnect all connectors from the unit.	
4 Remove the right side beam, according to illustration.	 <p>xx1400001468</p> <ul style="list-style-type: none"> <li>• A: torx counters head screw (2 pcs)</li> <li>• B: torx pan head screw (2 pcs)</li> <li>• C: beam</li> <li>• D: torx pan head screw (support)</li> <li>• E: support</li> </ul>
5 Remove two attachment screws in the back of the controller, to loosen support bracket.	 <p>xx1400001467</p>
6 Pull the system power supply with support bracket straight up.	

*Continues on next page*

## 4 Repair

### 4.18.2 Replacement of system power supply

*Continued*

Action	Note/Illustration
7 Loosen the two lower attachment screws.	 <p>A B</p> <p>xx0900000570</p> <ul style="list-style-type: none"> <li>• A: upper attachment screws</li> <li>• B: lower attachment screws</li> </ul>
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

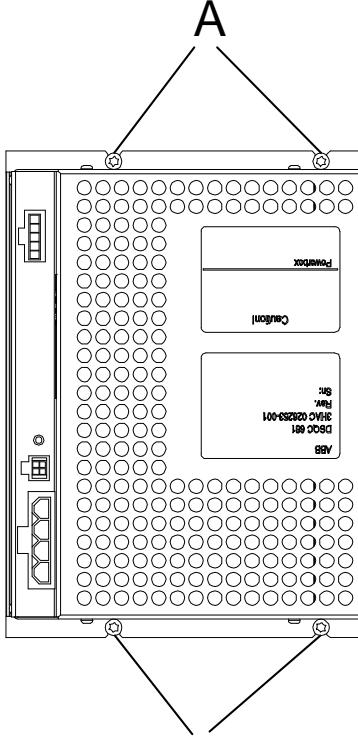
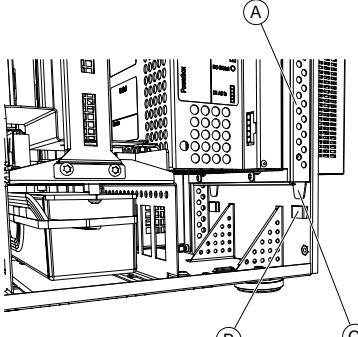
Use the following procedure to refit the system power supply.

Action	Note/Illustration
<p>1  <b>DANGER</b></p> <p>Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off! on page 38.</b></p>	

*Continues on next page*

## 4.18.2 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>xx0900000570</p> <ul style="list-style-type: none"> <li>A: upper attachment screws</li> <li>B: lower attachment screws</li> </ul>
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>xx1400001469</p> <ul style="list-style-type: none"> <li>A: support bracket</li> <li>B: recess</li> <li>C: latch</li> </ul>
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.	

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## **4 Repair**

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### **4.18.2 Replacement of system power supply**

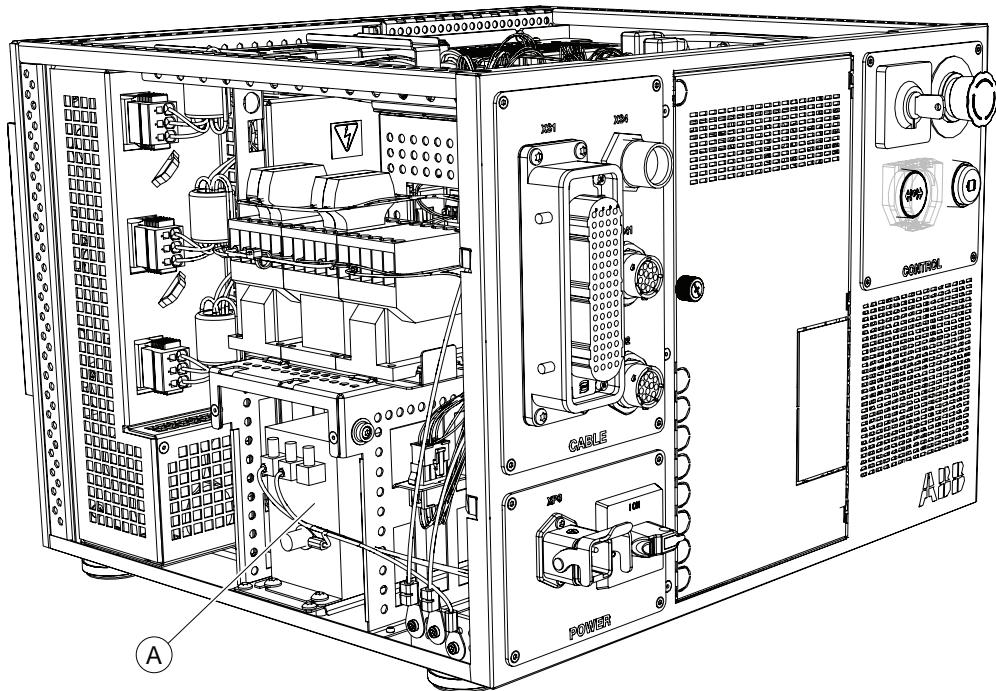
*Continued*

	<b>Action</b>	<b>Note/Illustration</b>
9	Refit the cabinet cover.	

### 4.18.3 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 <a href="#">Controller system parts on page 189</a> .
Standard toolkit	The content is described in section <a href="#">Standard toolkit, IRC5 on page 187</a> .	
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		

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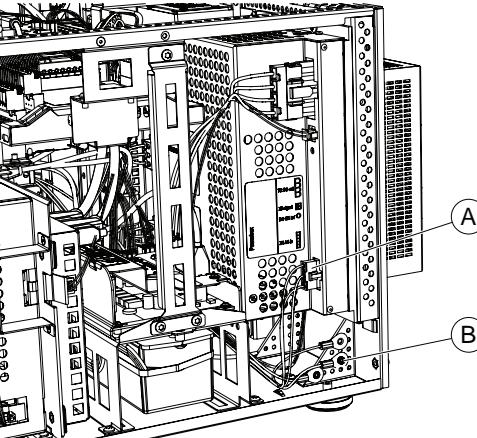
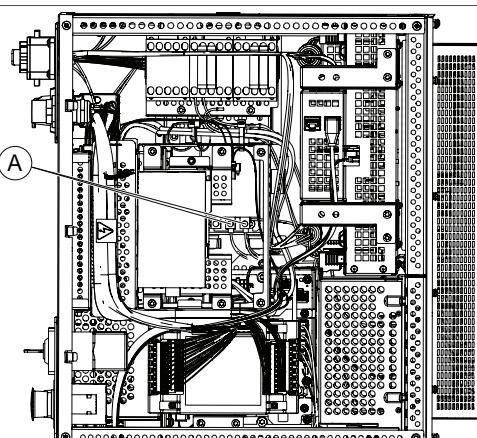
## 4 Repair

### 4.18.3 Replacement of line filter

*Continued*

#### Removal

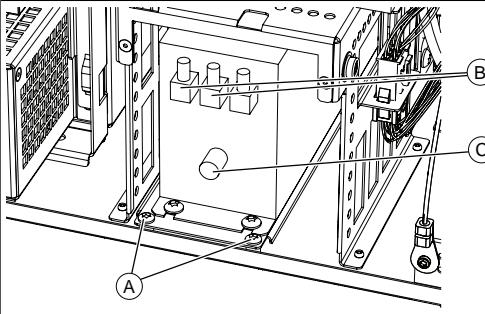
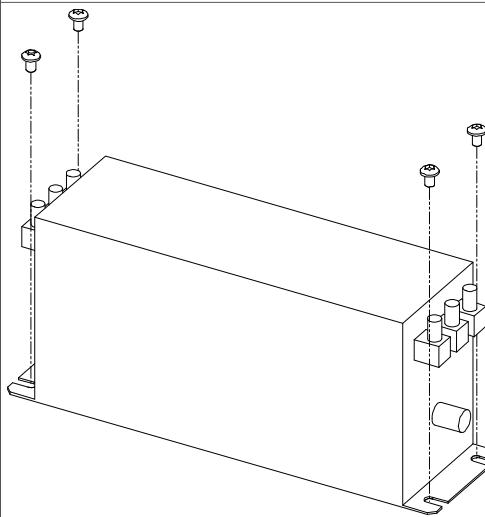
Use the following procedure to remove the line filter.

	Action	Note/illustration
1	 <b>DANGER</b> Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.	
2	Remove the cover of the cabinet.	See <a href="#">Opening the IRC5 Compact controller on page 80</a> .
3	Disconnect connector X1 from the system power supply.	 xx1400002853 A Connector X1 B Ground connection
4	Disconnect the ground connection.	
5	Disconnect and remove the safety board unit to be able to access the secondary side of the line filter.	See <a href="#">Replacement of Remote Service box on page 161</a> .
6	Disconnect the cables from L1', L2' on the secondary side of the line filter.	 xx1400002854 A Line filter connections

*Continues on next page*

## 4.18.3 Replacement of line filter

Continued

	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.

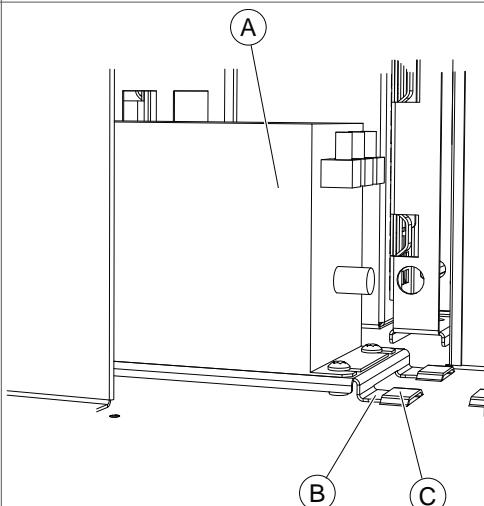
	Action	Note/illustration
1	 <b>DANGER</b> <p>Before commencing any work inside the cabinet, please observe the safety information in section <b>DANGER - Make sure that the main power has been switched off!</b> on page 38.</p>	

Continues on next page

## 4 Repair

### 4.18.3 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>xx140000XXXX</p> <p>A Line filter B Latches C Recess</p>
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.	

# 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 to prevent health or environmental hazards.

<b>Material</b>	<b>Example application</b>
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 safety standards

#### 6.2 Applicable safety standards

##### Standards, EN ISO

The robot system is designed in accordance with the requirements of:

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

<sup>i</sup> Only robots with protection Clean Room.

<sup>ii</sup> Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

##### European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards

##### Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740 (option 429-1)	Safety standard for robots and robotic equipment

*Continues on next page*

## **6 Reference information**

### **6.2 Applicable safety standards**

*Continued*

<b>Standard</b>	<b>Description</b>
CAN/CSA Z 434-03 (option 429-1)	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.

<b>Quantity</b>	<b>Units</b>		
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 pneumatic 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%!

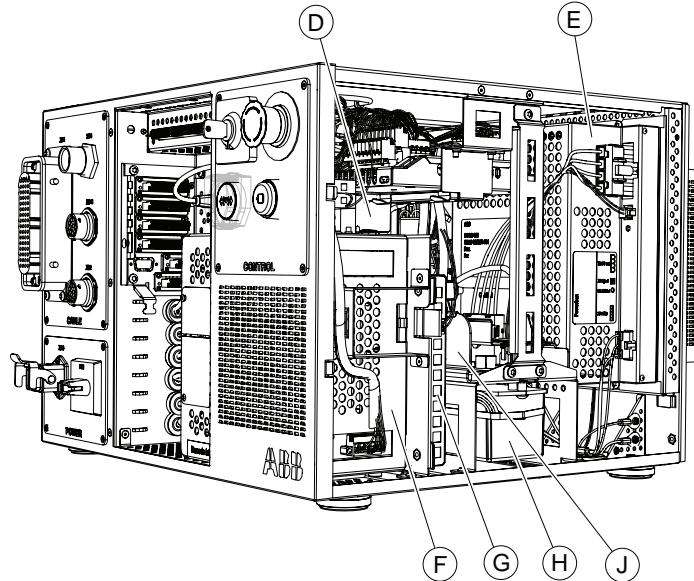
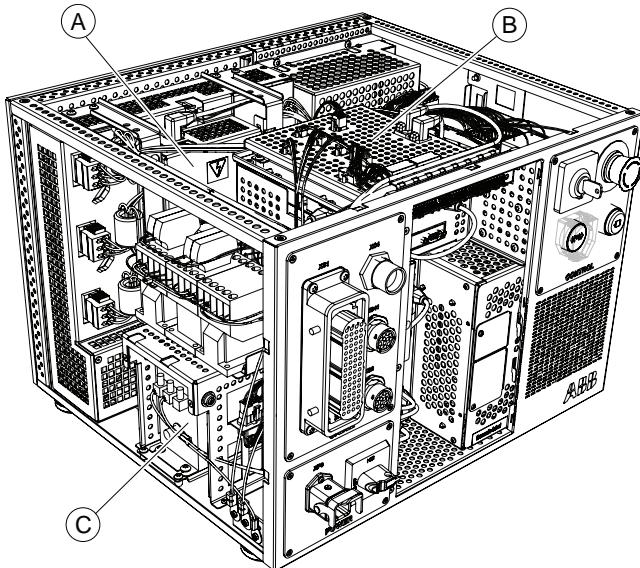
The table below specifies the recommended standard tightening torque for *oil-lubricated screws with slotted or cross-recess heads*.

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 IRC 5 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
C	3HAC037698-001	Line filter	
D	3HAC043053-001	Remote Service box	DSQC 680

Continues on next page

## 7 Spare parts

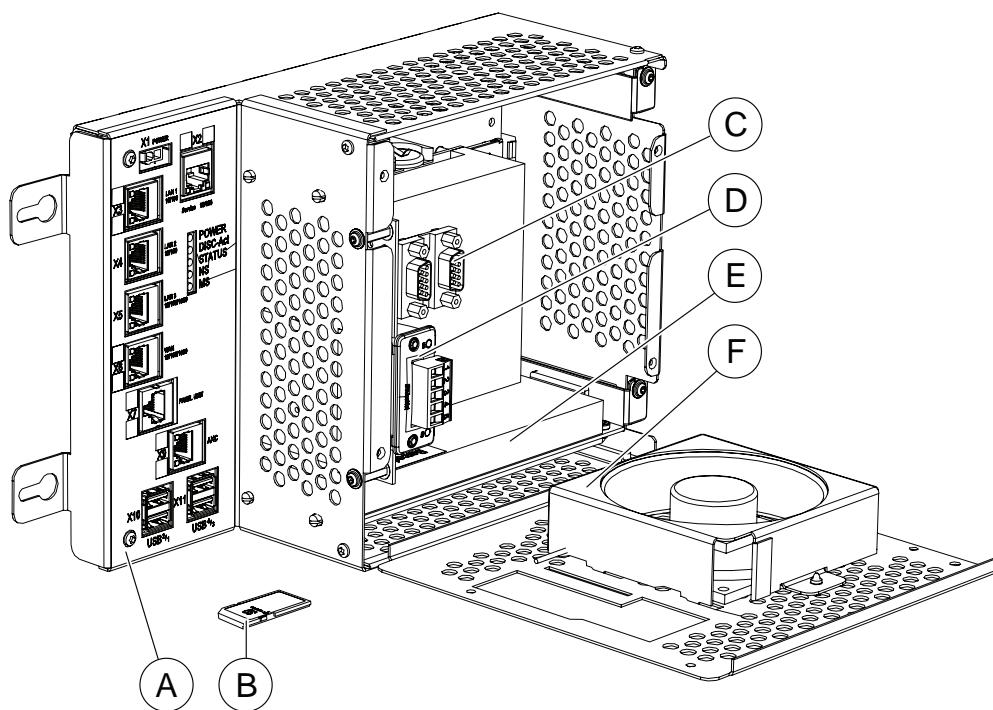
### 7.1 IRC 5 Compact controller

*Continued*

	Spare part no.	Description	Note
E	3HAC026253-001	System Power Supply	DSQC 661
F	3HAC042766-001	Computer unit (1 PCI slot)	DSQC1000
F	3HAC050363-001	Computer unit (2 PCI slots)	DSQC1018
G	3HAC028179-001	Axis computer	DSQC 668
H	3HAC025562-001	Backup energy bank	DSQC 655
J	3HAC026254-001	Power distribution board	DSQC 662

#### Computer unit parts

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

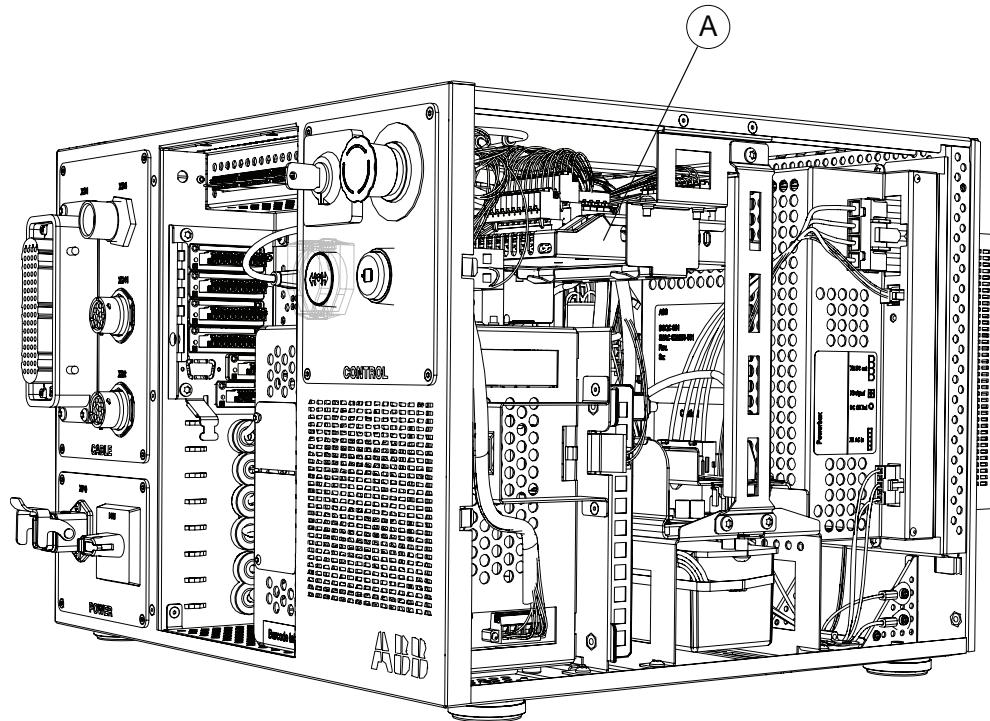


xx1300000851

	Spare part no.	Description	Type
A	3HAC042766-001	Computer unit (1 PCI slot)	DSQC1000
A	3HAC050363-001	Computer unit (2 PCI slots)	DSQC1018
B	3HAC047184-003	Mass Memory with boot loader 2GB	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
E	3HAC043383-001	DeviceNet Master/Slave PClexpress	DSQC1006
E	3HAC044872-001	PROFIBUS-DP Master PClexpress	DSQC1005

*Continues on next page*

	Spare part no.	Description	Type
F	3HAC026525-001	Fan with receptacle	
-	3HAC14944-1	RS-232/422 Converter	DSQC 615

**I/O System parts**

xx1400001381

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

\* Mounted outside controller cabinet

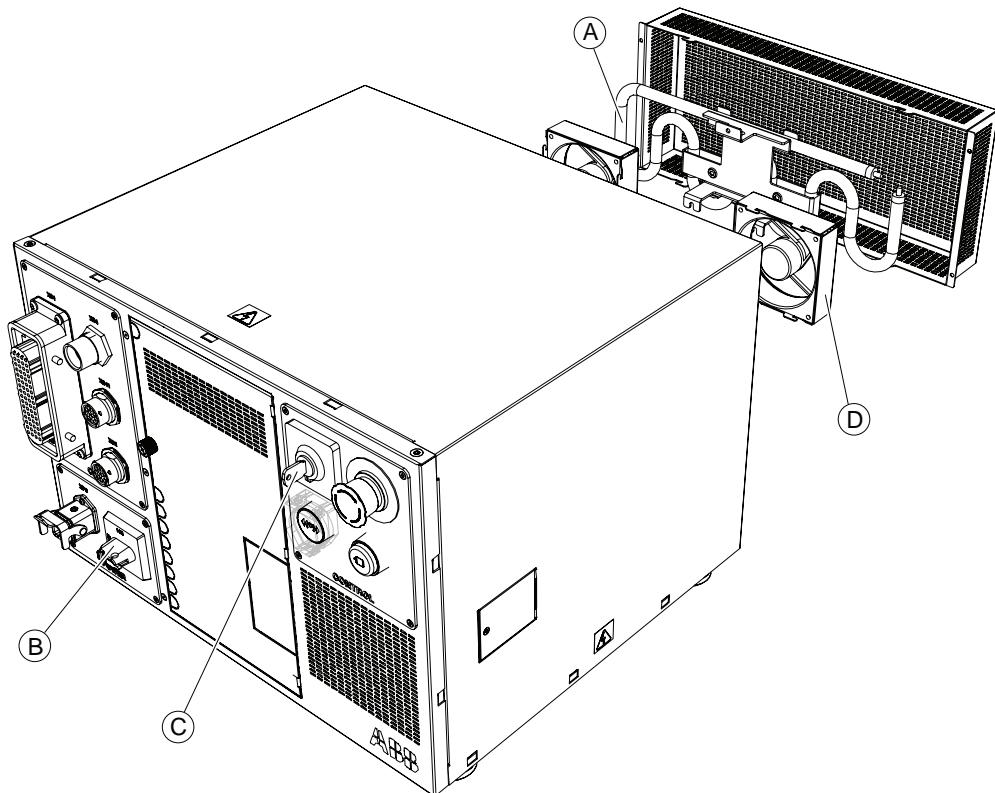
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## 7 Spare parts

### 7.1 IRC 5 Compact controller

*Continued*

#### Miscellaneous parts



xx1400002002

	Spare part no.	Description
A	3HAC037682-001	Brake resistor bleeder asm
B	3HAC037699-001	Handle for 6 mm switch
C	3HAC052287-001	Cam Switch
D	3HAC029105-001	Fan with receptacle
	3HAB2997-1	Wrist band
	3HAC037700-001	Contactor ASL16-30-10 DC24V
	3HAC031561-001	Auxiliary contact CA3-10
	3HAC031562-001	Auxiliary contact CA3-01
	3HAC033498-001	FlexPendant holder
	3HAC033596-002	FlexPendant holder upper part

## 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 L=3m
3HAC032695-001	Control cable power L=7m
3HAC032696-001	Control cable power L=15m

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

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

### Signal cables, IRB 260

Art. no.	Description
3HAC7998-1	Control cable signal L=7m
3HAC7998-2	Control cable signal L=15m
3HAC7998-3	Control cable signal L=22m
3HAC7998-4	Control cable signal L=30m

### Power cables, IRB 260

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

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

Art. no.	Description
3HAC029903-001	Control cable, power and signal L=3m

*Continues on next page*

## 7 Spare parts

### 7.2 Manipulator cables

*Continued*

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

#### Signal cables, IRB 1200

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

#### Power 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

#### Signal cables, IRB 1410, 1600

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

#### Power cables, IRB 1410, 1600

Art. no.	Description
3HAC2492-1	Control cable power L=7m
3HAC2529-1	Control cable power L=15m
3HAC2539-1	Control cable power L=22m

*Continues on next page*

Art. no.	Description
3HAC2564-1	Control cable power L=30m
3HAC9038-1	Control cable power L=7m
3HAC9038-2	Control cable power L=15m
3HAC9038-3	Control cable power L=22m
3HAC9038-4	Control cable power L=30m

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# 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
Circuit diagram - IRC5	3HAC024480-011
Circuit diagram - IRC5 Compact	3HAC049406-003
Circuit diagram - IRC5 Panel Mounted Controller	3HAC026871-020
Circuit diagram - Euromap	3HAC024120-004

### Robots

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

Continues on next page

## 8 Circuit diagrams

### 8.1 Circuit diagrams

*Continued*

Product	Article numbers for circuit diagrams
<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>

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