

Product manual

IRC5 Panel Mounted Controller

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**Product manual
IRC5 Panel Mounted Controller
Design 14**

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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 Circuit diagrams on page 251 .	



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

Continued

Revisions

Revision	Description
-	<p>First edition.</p> <p>Released with the new computer unit, DSQC1000.</p>
A	<ul style="list-style-type: none">Added information on how to install an additional drive module, see Installation of additional Drive Module on page 108.
B	<ul style="list-style-type: none">Added the MultiMove switch to the spare parts list, see Controller parts on page 237.Added information on how to route the cables at installation.
C	<ul style="list-style-type: none">New computer unit, DSQC1018, with two PCI slots and no knockout plates. No functional change, but affects illustrations.Added new section, Additional cables on page 250, with drive module cables.Clarified the use of the WAN port in section Connectors on the computer unit on page 79.
D	<ul style="list-style-type: none">Some changes on how the ports can be configured and used is described in section Connectors on the computer unit on page 79.
E	<ul style="list-style-type: none">Minor corrections.Added safety-related information to sections CAUTION - Make sure that all mode switch keys are kept safe on page 47, Installation of external enabling device on page 113, Function tests on page 139, and Refurbish on page 148.Updates in section Applicable safety standards on page 230.Added section Safety data on page 32.

Product documentation, IRC5

Categories for user documentation from ABB Robotics

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

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

Product manuals

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

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

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

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

Continues on next page

Application manuals

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

An application manual generally contains information about:

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

Operating manuals

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

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

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 35](#).
- 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 41](#).

1 Safety

1.2.1 Introduction to general safety information

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

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

Sections

The general safety information is divided into the following sections.

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

1.2.2 Safety in the robot system

Validity and responsibility

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

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

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

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

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

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

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

Connection of external safety devices

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

Limitation of liability

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

Related information

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

Continues on next page

1 Safety

1.2.2 Safety in the robot system

Continued

Type of information	Detailed in document	Section
Restricting the working space	<i>Product manual for the robot</i>	Installation and commissioning

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.

Continues on next page

1 Safety

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.

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 and commissioning on page 49](#).

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 (CO₂) 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.

Continues on next page

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	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	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.

Continues on next page

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.

Continues on next page

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*.

Continues on next page

1 Safety

1.2.5.1 Overview of robot stopping functions

Continued

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)	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

1.2.6 Safety data

1.2.6 Safety data

About this section

This chapter describes the necessary safety data required by standard ISO 13849-1:2008.

Prevailing directives and standards

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

- Machinery Directive 2006/42/EC
- ISO 10218-1:2011
- ISO 13849-1:2008

In addition to these standards covering general machinery safety, a number of more specialized standards (referred to as normative), must also be fulfilled. See ISO 10218-1 chapter 2, "Normative references".

An alternative standard is:

- IEC 62061

See [IEC 62061 and PFH values on page 33](#).

Performance level and category

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

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

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

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

Continues on next page

IEC 62061 and PFH values

The standard IEC 62061 as well as ISO 13849-1 specifies the requirements for the design and implementation of safety related control systems of machinery. Either of these standards can be used for the verification of required safety. In IEC 62061 the Safety Integrity Level (SIL) as a measure of safety level is used, resembling the PL in ISO 13849. Connected to the SIL is the value of Probability of Dangerous Failure per Hour (PFHd), see IEC 62061 Table 3.

Performance level for ABB IRB robots and IRC5 controller

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

The safety related parts of robot and controller are, for example, the following stop circuits:

- Enabling device on FlexPendant and T10
- Emergency stop on operator panel
- Emergency stop on FlexPendant and T10
- Limiting switch on contactor board connector X21, X22
- Protective stops (AS, GS, SS)
- SafeMove
- Electronic position switches (EPS)

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

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

Stop circuit	Calculated MTTFd [years]	DCavg
Enabling device on FlexPendant and T10	80	Medium
Emergency stop on operator panel	126	Medium
Emergency stop on FlexPendant and T10	117	Medium
Limiting switch on contactor board connector X21, X22 ⁱ	180	Medium
Protective stops (AS, GS, SS) ⁱ	134	Medium
SafeMove (option) ⁱ	58	Medium
Electronic position switches (option)	105	Medium

ⁱ MTTFd is calculated without customer connections

Continues on next page

1 Safety

1.2.6 Safety data

Continued

Safety Integrity level for ABB IRB robots and IRC5 controller

Based on the values from the previous table of MTTFd values, the corresponding PFHd can be calculated using the Annex K, table K1 of ISO13849-1:2008. These are shown in the following table.

Stop circuit	Calculated PFHd
Enabling device on Flexpendant and T10	6.62x10E-08
Emergency stop on operator panel	4.29x10E-08 ⁱ
Emergency stop on FlexPendant and T10	4.29x10E-08 ⁱ
Limiting switch on contactor board connector X21, X22 ⁱⁱ	4.29x10E-08 ⁱ
Protective stops (AS, GS, SS) ⁱⁱ	4.29x10E-08 ⁱ
SafeMove (option) ⁱⁱ	1.03x10E-07
Electronic position switches (option)	4.29x10E-08 ⁱ

ⁱ The MTTFd values used for the calculations of the PFHd values are limited to max 100 years.

ⁱⁱ Calculated without customer connections



Note

The values in this table correspond to SIL 3 for all circuits.

Conclusion

According to ISO 13849-1:2008

The IRC5 controller safety system has a safety category 3 with performance level PL d according to ISO 13849-1:2008 using the simplified method of chapter 4.5.4 of ISO 13849-1:2008 and thus fulfils the safety performance requirement of the robot safety standard ISO 10218-1:2011.

The detailed analysis gives the following results:

- The enable switch circuit, Emergency stop and protective stop circuit conforms to the performance level PL e according to ISO 13849-1, Annex K, table K1.
- For the overall design and structure, the category 3 has been verified and meets the requirements.
- The Diagnostic Coverage is medium ($90\% < DCavg < 99\%$).
- The Common Cause Failure (CCF) is met according to the standard requirements.

According to IEC 62061

The PFHd values (shown in [Safety Integrity level for ABB IRB robots and IRC5 controller on page 34](#)) correspond to SIL 3 for the enable switch circuit, emergency stop and protective stop circuits according to table K1 of ISO 13849-1:2008.

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 <i>may</i> occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

Continues on next page

1 Safety

1.3.1 Safety signals in the manual

Continued

Symbol	Designation	Significance
 xx010000004	NOTE	Describes important facts and conditions.
 xx0100000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

1.3.2 Safety symbols on controller labels

Introduction to labels

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



Note

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

Types of labels

Both the 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

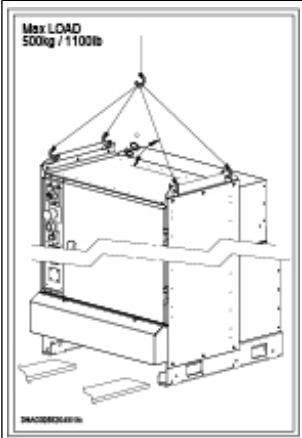
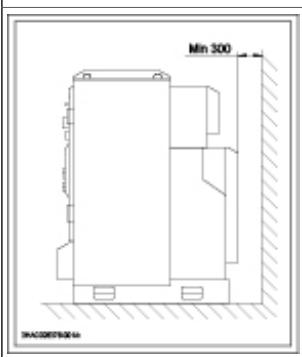
Label	Description
	Electrical shock
	ESD sensitive components inside the controller.
 xx1400001161	Disconnect power supply before servicing the controller.
 xx1400001160	Disconnect power supply before servicing the controller (only for welding equipment).
 xx1400001156	High voltage inside the module even if the main switch is in the OFF position.

Continues on next page

1 Safety

1.3.2 Safety symbols on controller labels

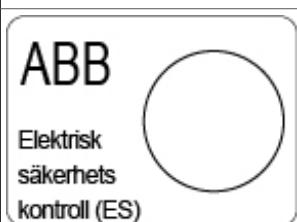
Continued

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

1.3.2 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).																						
<table border="1" data-bbox="446 1224 743 1538"> <tr> <td>ABB AB</td> <td>Made in Sweden</td> </tr> <tr> <td>721 65 Västerås</td> <td></td> </tr> <tr> <td>Type:</td> <td>IRC5 M2004</td> </tr> <tr> <td>Version:</td> <td>Control Module</td> </tr> <tr> <td>Voltage:</td> <td>1x230V</td> </tr> <tr> <td>Rated current:</td> <td>Frequency 50-60 Hz</td> </tr> <tr> <td>Circuit Diagram:</td> <td>9A</td> </tr> <tr> <td>Serial no:</td> <td>See user documentation</td> </tr> <tr> <td>04-50671</td> <td></td> </tr> <tr> <td>Date of manufacturing:</td> <td>2006-11-19</td> </tr> <tr> <td>Net weight:</td> <td>50 kg</td> </tr> </table> xx1400001163	ABB AB	Made in Sweden	721 65 Västerås		Type:	IRC5 M2004	Version:	Control Module	Voltage:	1x230V	Rated current:	Frequency 50-60 Hz	Circuit Diagram:	9A	Serial no:	See user documentation	04-50671		Date of manufacturing:	2006-11-19	Net weight:	50 kg	Rating label
ABB AB	Made in Sweden																						
721 65 Västerås																							
Type:	IRC5 M2004																						
Version:	Control Module																						
Voltage:	1x230V																						
Rated current:	Frequency 50-60 Hz																						
Circuit Diagram:	9A																						
Serial no:	See user documentation																						
04-50671																							
Date of manufacturing:	2006-11-19																						
Net weight:	50 kg																						
 xx1400002060	UR certified (component)																						
 29ZA Robot	UL certified (robot system) Sweden																						

Continues on next page

1 Safety

1.3.2 Safety symbols on controller labels

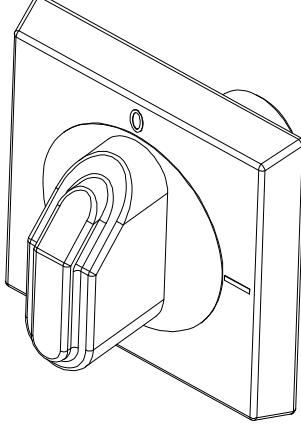
Continued

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

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, Panel Mounted Controller

	Action	Note/illustration
1	Switch off the main switch for the controller.	 xx0600003255

1 Safety

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.

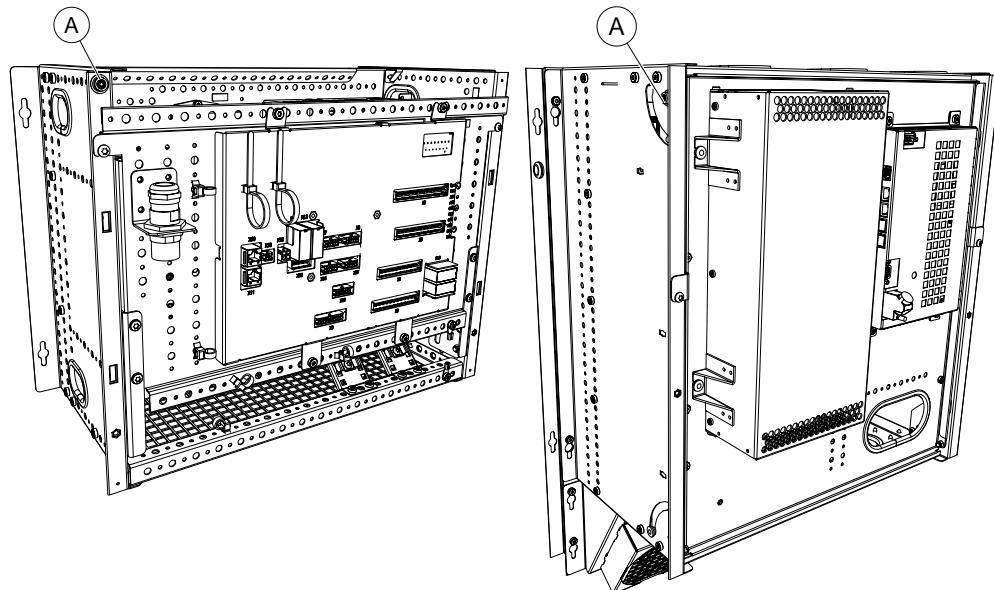
Elimination

	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.

Location of wrist strap button

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

Panel Mounted Controller



xx1300001960

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 . 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

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.

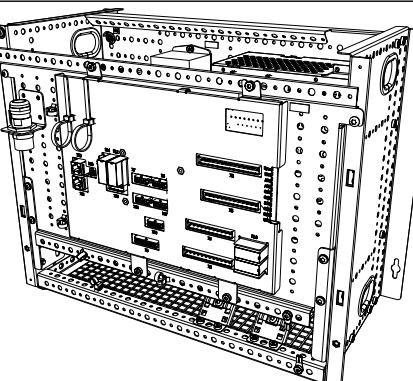
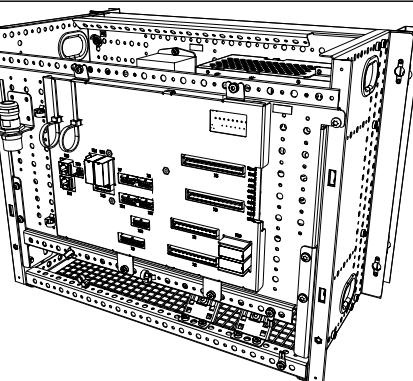
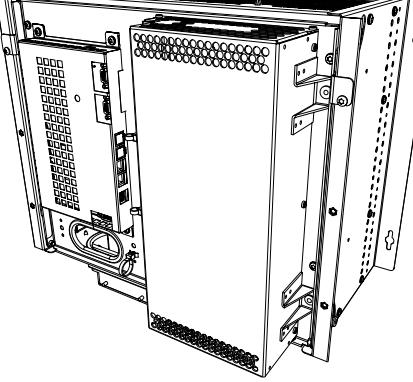
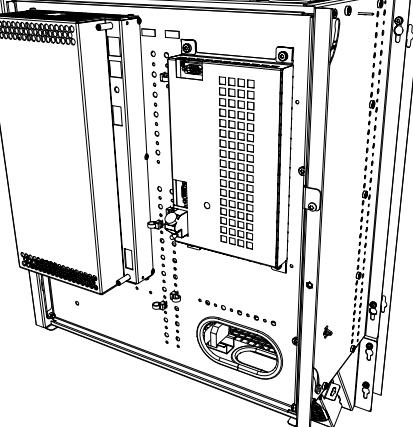
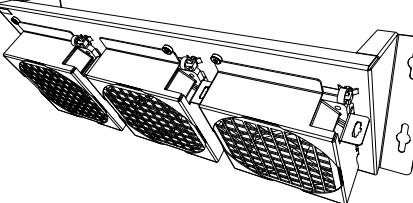
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2 Installation and commissioning

2.1 Overview

General

There are two versions of the IRC5 Panel Mounted Controller(PMC). PMC small is used for small robots and PMC large is used for large robots. The controller always consists of one control module and one drive module.

	PMC small	PMC large
A		
B		
C		
A Control module (with air channel for PMC large).		
B Drive module (different design for PMC small and PMC large).		
C Fan unit (for PMC large this is a part of the drive module).		

Continues on next page

2 Installation and commissioning

2.1 Overview

Continued

The control module contains the computer unit, communication interfaces, FlexPendant connection, service ports and also the system software which includes all basic functions for operation and programming.

The drive module contains the drive system.



Note

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.

Equipment

The following parts can be delivered with the IRC5 Panel Mounted Controller:

Part. no.	Description	Note
3HAC024244-005	Ethernet cable	Standard
3HAC027818-001	Connection Power supply	Standard
3HAC037824-001	Mains line filter (PMC small)	Standard for PMC small
3HAC024322-001	Mains line filter (PMC large)	Standard for PMC large
3HAC027201-001	Transformer unit	Standard
3HAC028357-001	GTPU 3, 10m cable	Option 701-1 and 701-3
3HAC031683-004	TPU cable, 30m	Option 701-3
3HAC021914-001	Harness - TPU jumper plug	Option 702-1
3HAC14178-1	Customer I/O power supply DSQC 609	Option 727-1
3HAC13398-2	Power supply	Option 728-1
3HAC025600-005	Harness - Drive/Control 4m	Option 761-1
3HAC038406-001	Fan unit	Standard for PMC large Option 882-1 for PMC small
3HAC026486-001	Additional module Digital 24V	Option 816-1
3HAC2588-2	Additional unit Que TRack unit	Option 826-1
3HAC038403-001	EPS board	Option 810-1
3HAC038402-001	SafeMove board	Option 810-2
3HAC024180-001	Multi volt transformer	Option 931-1

Continues on next page



Note

Because the parts of the IRC5 Panel Mounted Controller can be mounted with varying space apart, there is no guarantee that the standard cables are long enough. In some cases there may be a need to create your own customized cables.

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 Panel Mounted Controller modules.

Procedure

	Action	Detailed in
1	Unpack the delivered IRC5 Panel Mounted Controller.	Unpacking the controller on page 53
2	Install the IRC5 Panel Mounted Controller.	Installation, IRC5 Panel Mounted Controller on page 57
3	Connect the manipulator to IRC5 Panel Mounted Controller.	
4	Connect power supply to the IRC5 Panel Mounted Controller.	Connecting power supply to PMC small on page 65 Connecting power supply to PMC large on page 67
5	Connect the FlexPendant to the IRC5 Panel Mounted Controller.	Connecting a FlexPendant on page 78.
6	Miscellaneous connections.	How to connect MOTORS ON/MOTORS OFF circuits is detailed in section The MOTORS ON/MOTORS OFF circuit on page 84 . How to connect to an external safety relay is detailed in Connection of external safety relay on page 90 . How to connect buses, for example DeviceNet, is detailed in the respective application manual. How to connect to a network is detailed in section Connectors on the computer unit on page 79 .
7	If used, install add-ons.	How to install add-ons is detailed in section Installation of add-ons on page 108

2.3 Transporting and handling

2.3.1 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 53](#) 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
PMC small	Complete controller	max. 40 kg
	Control module	12 kg
	Drive module	22.5 kg

Continues on next page

2 Installation and commissioning

2.3.1 Unpacking the controller

Continued

Controller	Part	Weight
PMC large	Complete controller	max. 60 kg
	Control module	14 kg
	Drive module	40 kg

Weight of additional equipment

The table below shows the weight for equipment used with the IRC5 Panel Mounted Controller:

Equipment	Weight
Transformer	13 - 51 kg
Inductor	5.2 kg

Protection class

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

Equipment	Protection class
IRC5 Panel Mounted Controller	IP20
FlexPendant	IP54

The Panel Mounted Controller modules must be mounted in a water-proof and air-proof cabinet. Internal cooling is recommended but if that is not possible, a filter shall be used. When used in industrial environment, the cabinet should fulfill IP54. When used in foundry environment, the cabinet should fulfill IP67.

Cabinet cooling

If the cabinet where the IRC5 Panel Mounted Controller is mounted needs cooling depends on the power dissipation and the surface area of the cabinet. A heat test is necessary to get any exact answers. A rough estimation can be made using the following calculations.

The drive system efficiency is roughly 90%, so the power loss in the drive system is at least near 10%. Note that the power loss in the drive system will increase significantly if the motion cycle contains many frequent and sharp decelerations, which cause very high bleeder power loss. Other equipment in the PMC typically generates another 240W power loss.

For example, a customer RAPID program that creates 2000W output power may generate a power loss of 220W in the drive system. Total power loss is then approximately 460W.

The natural convection from a sheet metal cabinet is calculated as:

$$Q_s = A * k * T$$

Q_s = Heat emitted by the enclosure surface (W)

A = Enclosure area (m^2)

k = Heat transfer coefficient (W/m^2K), where k is approximately 5.5 for a metal sheet cabinet

Continues on next page

2 Installation and commissioning

2.3.1 Unpacking the controller

Continued

$\Delta T = T_i - T_u = \text{Temperature difference (K)}$

If the natural convection of the enclosure is too small, cooling equipment is needed with cooling capacity according to following formula:

$$Q_e = Q_v - Q_s$$

$Q_e = \text{Required cooling output from the cooling unit}$

$Q_v = \text{Installed heat loss}$

2 Installation and commissioning

2.4.1 Air channel for PMC large

2.4 On-site installation

2.4.1 Air channel for PMC large

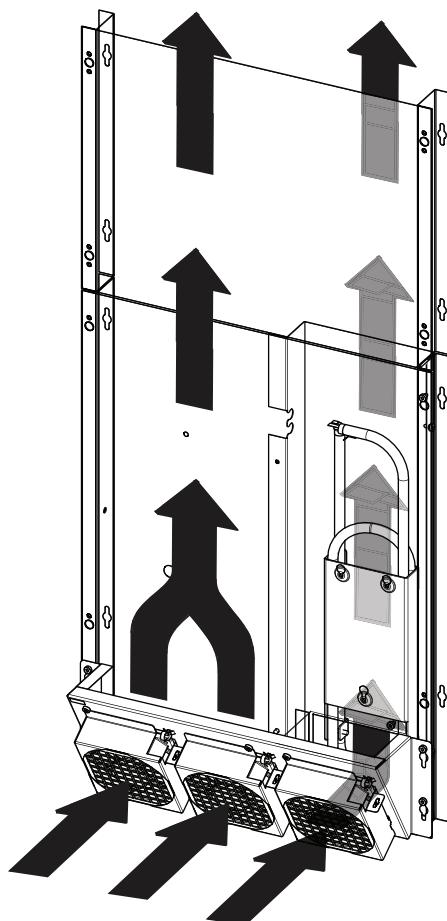
Mount PMC large on the air channel

For PMC large, there is an air channel that must be mounted behind the controller. Make sure that the air can flow freely in the air channel behind the controller as well as through the controller.

If the control module is mounted separately, it can be mounted without the air channel. If it is mounted on top of the drive module, it must be mounted on the air channel so it does not obstruct the air flow.

The air flow

The fan to the right creates an air flow through the air channel behind the controller, where the brake resistor bleeder is located. The two fans to the left creates an air flow through the controller modules.

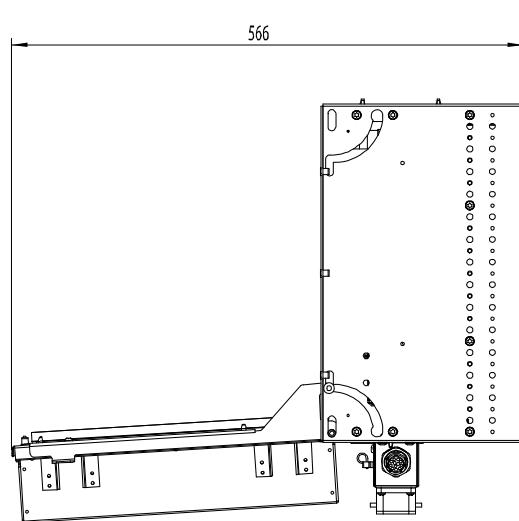
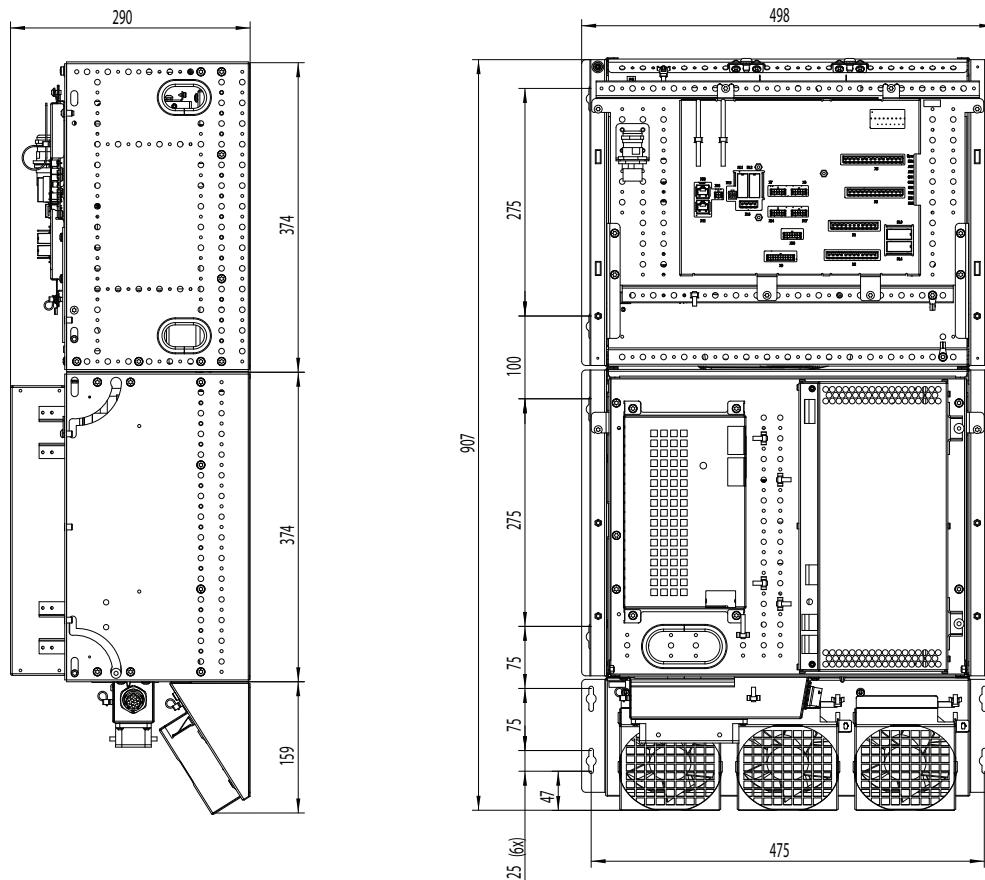


xx1100000537

2.4.2 Installation, IRC5 Panel Mounted Controller

Dimensions for PMC small

The illustration below shows the required installation space for the PMC small.



xx0700000031

Continues on next page

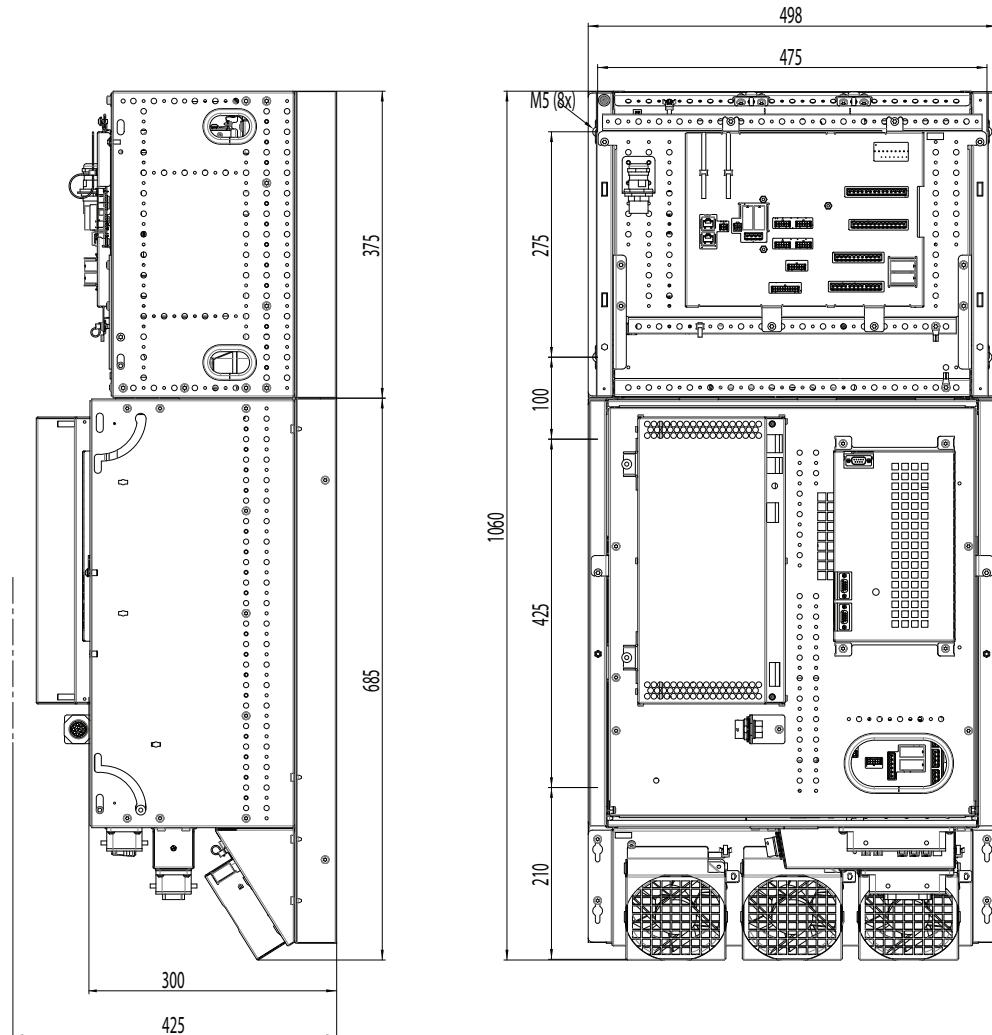
2 Installation and commissioning

2.4.2 Installation, IRC5 Panel Mounted Controller

Continued

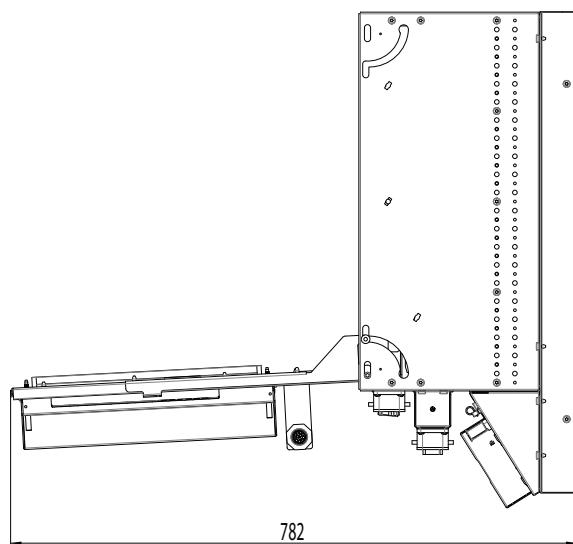
Dimensions for PMC large

The illustration below shows the required installation space for the PMC large.



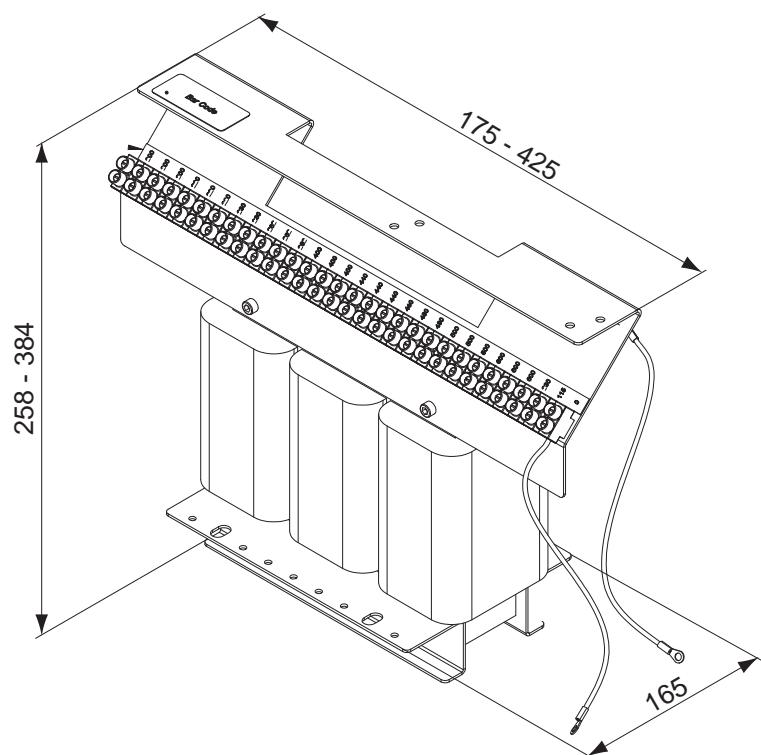
xx1100000533

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xx1100000534

Dimensions for transformers



xx0900000952

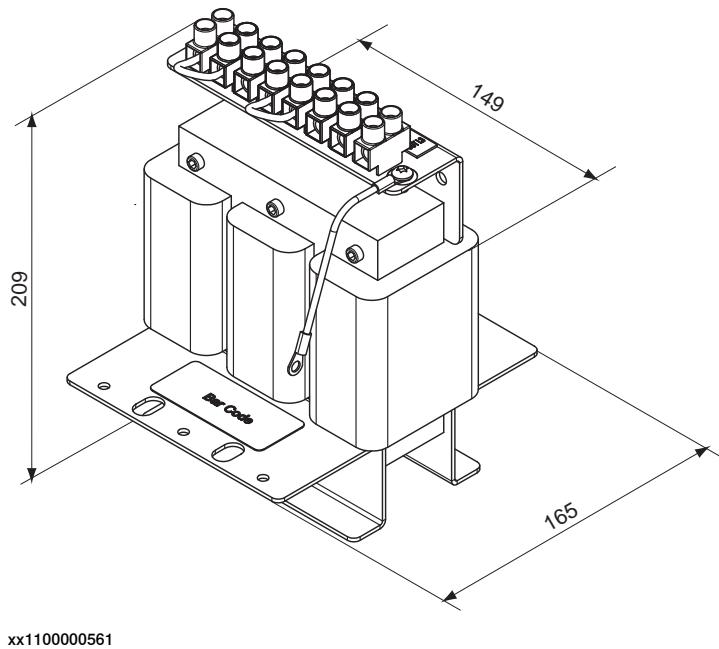
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2 Installation and commissioning

2.4.2 Installation, IRC5 Panel Mounted Controller

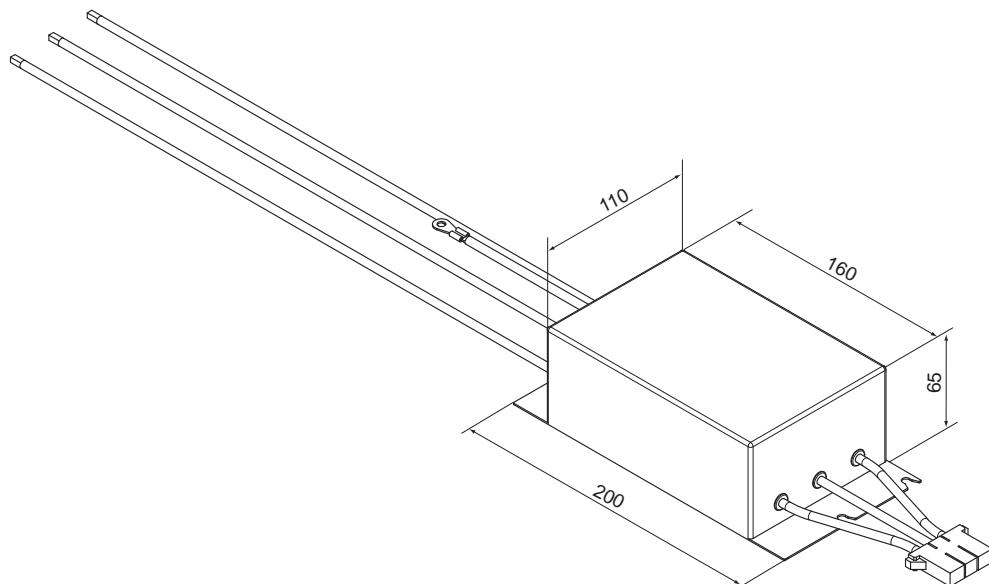
Continued

Dimensions for inductor



xx1100000561

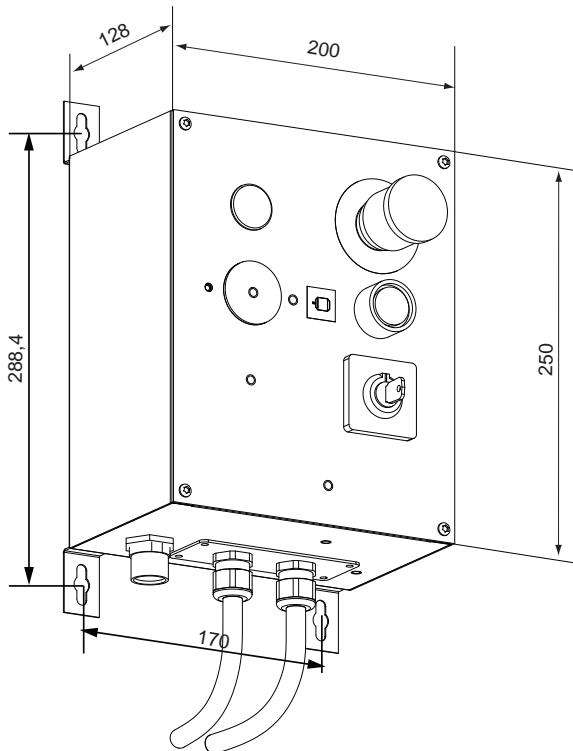
Dimensions for line filter



xx1100000563

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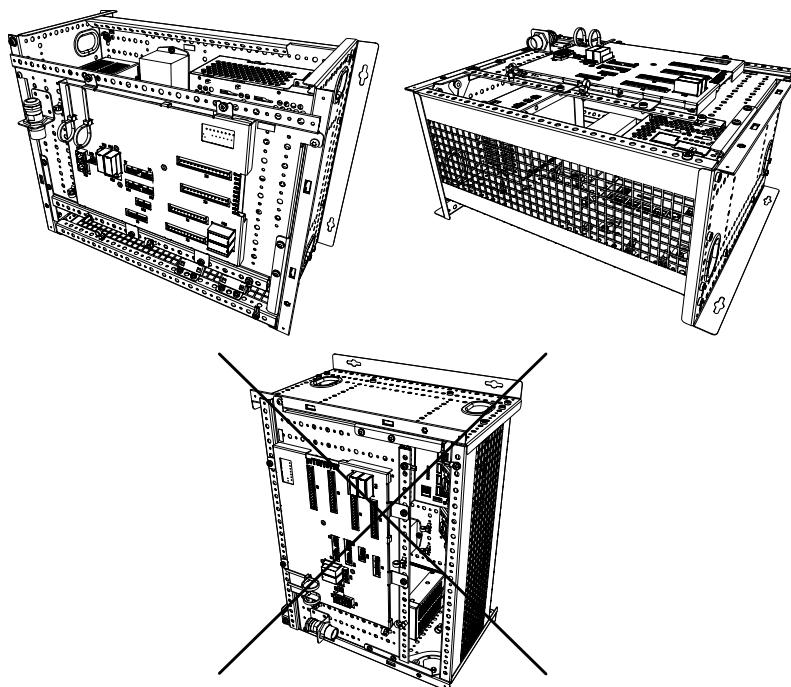
Dimensions for external operator's panel



xx1100000562

Installation conditions

For the air flow to function properly, the Control Module and the Drive Module of PMC small must be mounted according to following figure.



xx1300001944

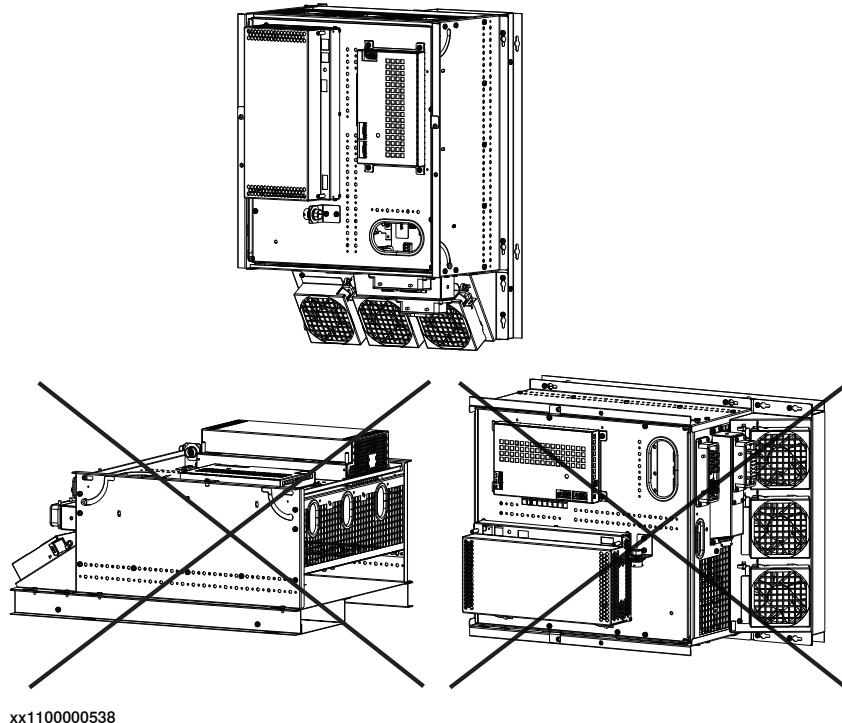
Continues on next page

2 Installation and commissioning

2.4.2 Installation, IRC5 Panel Mounted Controller

Continued

For the air flow to function properly, the Drive Module of PMC large must be mounted in an upright position according to following figure.



xx1100000538



Note

Do not mount the Control Module or Drive Module on a painted surface. The frame of the modules must be connected to earth.



Note

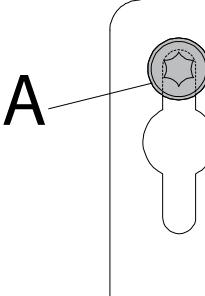
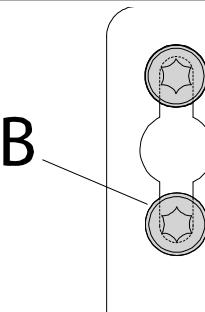
The Control Module and Drive Module must be mounted and connected to the same earth.

Continues on next page

Installing the modules in a cabinet

The IRC5 Panel Mounted Controller modules should be mounted on a rack system in a cabinet. The recommended minimum depth of the cabinet is 400 mm for PMC small and 500 mm for PMC large. The cabinet must fulfill the requirements specified in [Protection class on page 54](#).

The following procedure details how to install the IRC5 Panel Mounted modules.

	Action	Note/Illustration
1	Fit the module on pre-mounted M5 screws (4 pcs).	 xx0600003452 <ul style="list-style-type: none"> • A: M5 screws (4 pcs)
2	Secure the module with new M5 screws (4 pcs).	 xx0600003453 <ul style="list-style-type: none"> • B: M5 screws (4 pcs)
3	Fasten the module (M5 screw, 8 pcs)	Tightening torque 4,5 Nm.

2 Installation and commissioning

2.5.1 Route the cables

2.5 Connections

2.5.1 Route the cables

Route the cables

Cables of different types such as signal cables and power cables must not be routed together as the power cables may introduce noise in the signal cable. When crossing signals of different types it must be done at right angles.

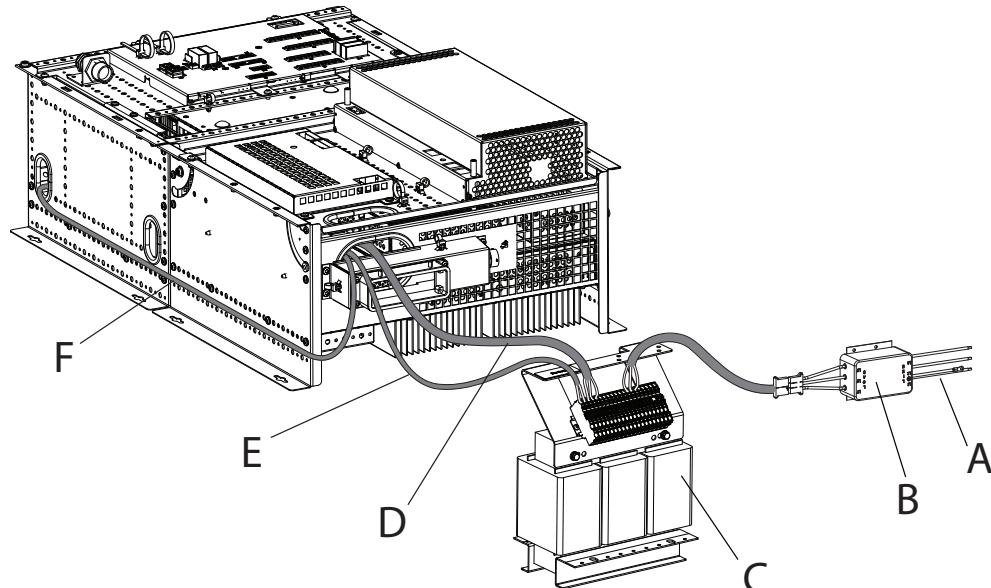
All external cables that are to be connected inside the controller must be shielded in the chassis before entering the cabinet.

All signals that are sensitive to interference should be routed and strapped along the right side of the controller cabinet according to the image.

Signal class	Cable type
Power signals	<ul style="list-style-type: none">These signals generate a lot of interference and must be laid separate from control, measuring, and communication signals.The shielding must be connected to a paint-free part of the panel chassis of the cabinet at both ends of the cable. Any unshielded cable must be as short as possible.The manipulator power cables are routed on the floor and along the side of the controller.Cables should not be wound up like coils. This could cause an eleclrical field disturbing the signals.
Control signals	<ul style="list-style-type: none">These signals are very sensitive to interference. To protect these signals they should NOT be laid along with the power signals.
Measuring signals	<ul style="list-style-type: none">In the cable, each signal must be twisted with a neutral wire.
Data communication signals	<ul style="list-style-type: none">The shielding must be connected directly to the chassis at both ends of the cable.

2.5.2 Connecting power supply to PMC small

Location



xx0600003295

A	Incoming power (3 phase)
B	Line filter
C	Transformer
D	Power supply 3x262V
E	Power supply 230V (2 phase)
F	Power supply 230V from the drive module to the control module

Required equipment

Equipment	Note
Incoming power cable	
Line filter	See Miscellaneous parts on page 240 .
Mini-Fit Jr Handcrimp tool	Recommendation: 16-24AWG Molex art. no. 063819090 (www.molex.com)
Standard toolkit	The contents are defined in section Standard toolkit, IRC5 on page 235 .
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

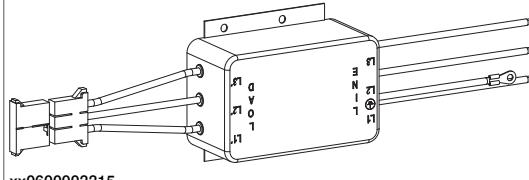
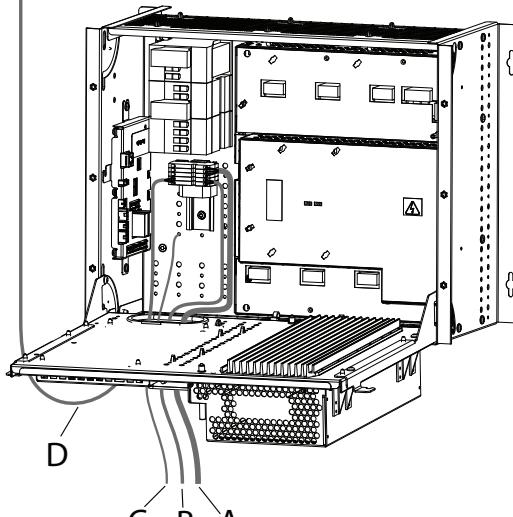
2 Installation and commissioning

2.5.2 Connecting power supply to PMC small

Continued

Connecting incoming power to the Drive Module

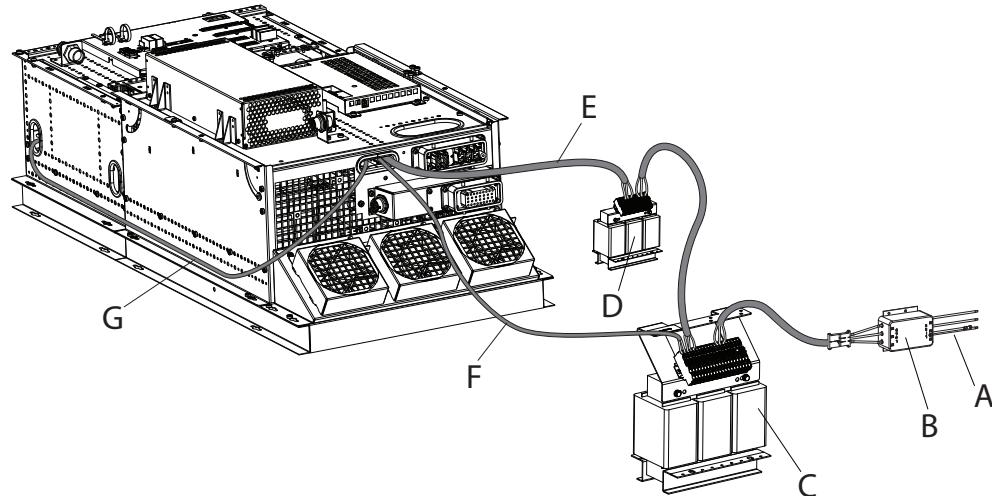
Use this procedure to connect power supply to the drive module.

Action	Note/illustration
1 Place the line filter and transformer near to the drive module and they must be on the same ground.	
2 Connect the incoming power to the Line filter (LINE).	 xx0600003315
3 Route, strap and connect the three phase wires to XT16:1, 2 and 3.	 xx0600003316 <ul style="list-style-type: none">A: incoming power 3x262V 10A wiresB: incoming 230V wiresC: incoming earth cableD: outgoing 230V to the Control Module
4 Route, strap and connect the two phase wires to XT16:4 and 5.	 CAUTION <p>Separate the power supply 2-phase wires from the 3-phase wires. These are disturbing on the Line filter LOAD side.</p>
5 Route, strap and connect the earth cable to PE.	

2.5.3 Connecting power supply to PMC large

Location

The controller is shown lying down in order to show the cables. Please note that the PMC large must be mounted in an upright position.



xx1100000506

A	Incoming power (3 phase)
B	Line filter
C	Transformer (can be left out for 3-phase if using incoming 3-phase of 400-480V) (can be left out for 2-phase if using incoming single phase of 230V)
D	Inductor
E	Power supply 3 x 400-480V
F	Power supply 230V (2 phase)
G	Power supply 230V from the Drive Module to the Control Module

Continues on next page

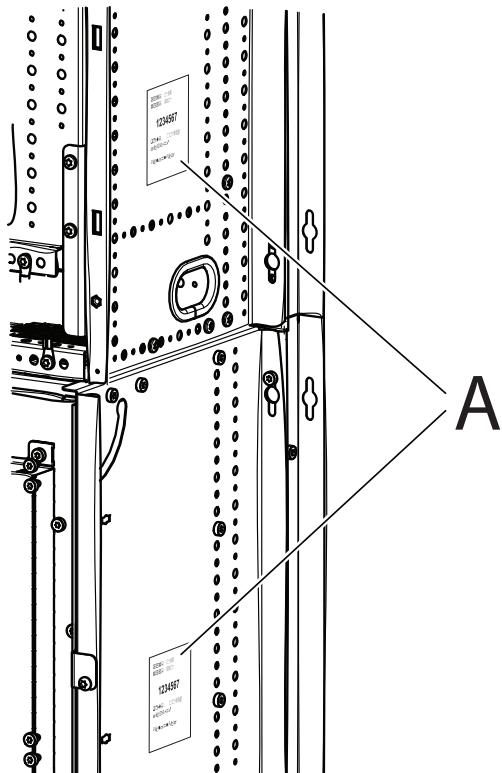
2 Installation and commissioning

2.5.3 Connecting power supply to PMC large

Continued

Rated voltage and current

To find the rated voltage, rated current and interrupting capacity of the IRC5 Panel Mounted Controller, see the name plates on the side of the control module and drive module.



xx1300001945

A	Controller name plates
---	------------------------

Required equipment

Equipment	Note
Incoming power cable	
Line filter	See Miscellaneous parts on page 240 .
Mini-Fit Jr Handcrimp tool	Recommendation: 16-24AWG Molex art. no. 063819090 www.molex.com
Standard toolkit	The contents are defined in section Standard toolkit, IRC5 on page 235 .
Circuit diagram	See Circuit diagrams on page 251 .

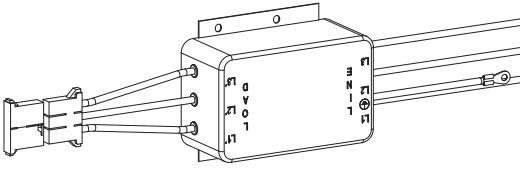
Recommended cables

Cable	Dimensions
230V	1.5-4 mm ² (AWG 16-12)
400-480V	4-10 mm ² (AWG 12-7)

Continues on next page

Connecting incoming power to the Drive Module

Use this procedure to connect power supply to the drive module.

	Action	Note/illustration
1	Place the line filter and transformer near to the drive module and they must be on the same ground.	
2	Connect the incoming power to the Line filter (LINE).	

Continues on next page

2 Installation and commissioning

2.5.3 Connecting power supply to PMC large

Continued

Action	Note/illustration
3 Route, strap and connect the three phase wires to the 3-phase automatic fuse (F1).	<p>xx1100000513</p> <p>xx1100000514</p> <ul style="list-style-type: none"> A: incoming power 3x400V 16A wires B: incoming 230V wires C: incoming earth cable D: outgoing 230V to the Control Module
4 Route, strap and connect the two phase wires to the 2-phase automatic fuse (F2).	CAUTION <p>Separate the power supply 2-phase wires from the 3-phase wires. These are disturbing on the Line filter LOAD side.</p>
5 Route, strap and connect the earth cable to PE.	

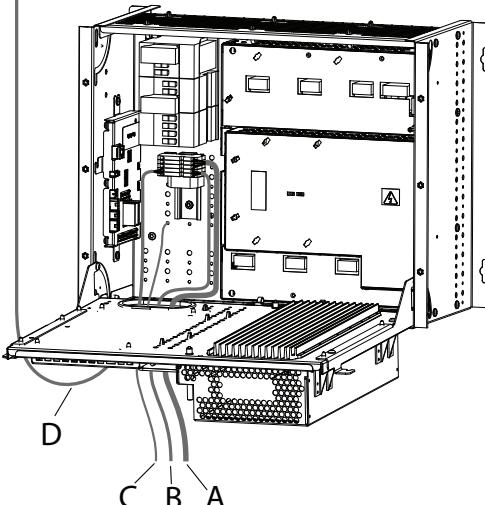
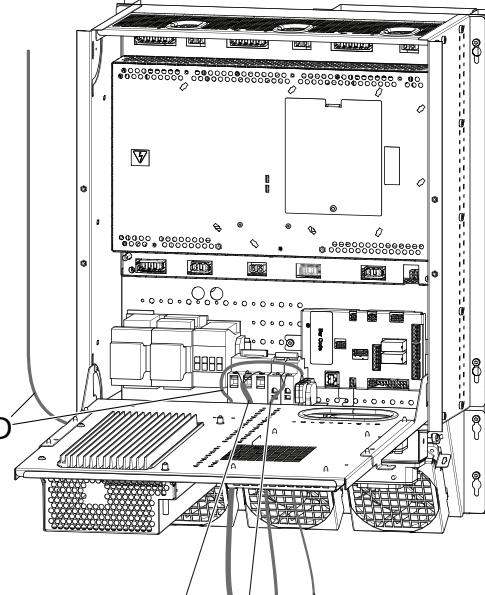
2.5.4 Connecting power supply to the control module

2.5.4 Connecting power supply to the control module

Connecting power supply 230V to the control module

The power to the control module can be provided from the drive module with cable 3HAC038835-001 (rolled up inside the drive module at delivery) or from an external source.

Use this procedure to connect power supply to the control module.

	Action	Note/illustration
1	If using the power supply from the drive module, roll out the power cable from the drive module.	<p>PMC small:</p>  <p>xx0600003316</p> <p>PMC large:</p>  <p>xx1100000513</p> <ul style="list-style-type: none"> D: 230V power supply from the drive module to the control module

Continues on next page

2 Installation and commissioning

2.5.4 Connecting power supply to the control module

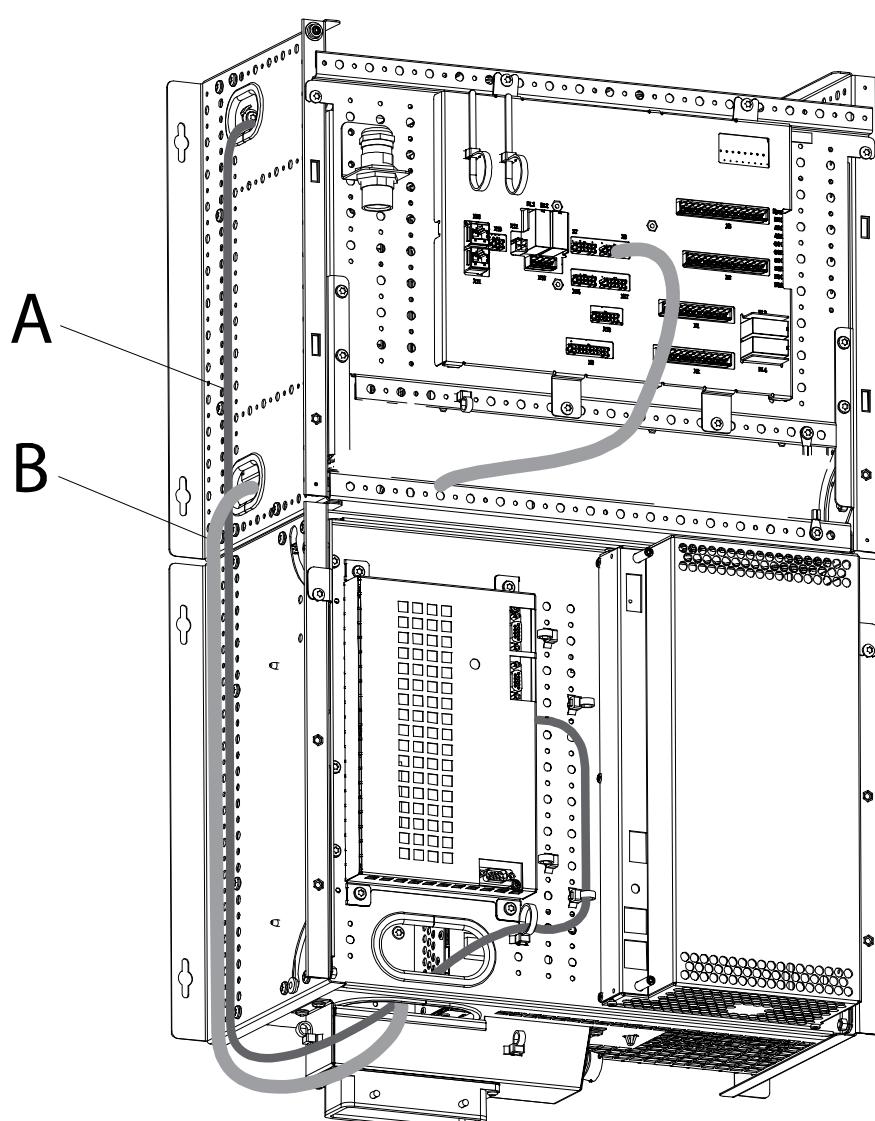
Continued

Action	Note/illustration
2 Route and strap the power supply 230V 10A cable as the illustration to the right shows.	Control module: xx1300001946 A Incoming earth B Power supply 230V 10A
3 Connect the power supply 230V 10A cable to the control power supply connector X1. <ul style="list-style-type: none">• phase 1 to G2.X1:1• earth to G2.X1:3• phase 2 (N) to G2.X1:5	
4 Connect incoming earth to PE.	

2.5.5 Connecting communication cables between IRC5 Panel Mounted Drive Module and control module

Location

PMC small:



xx0600003294

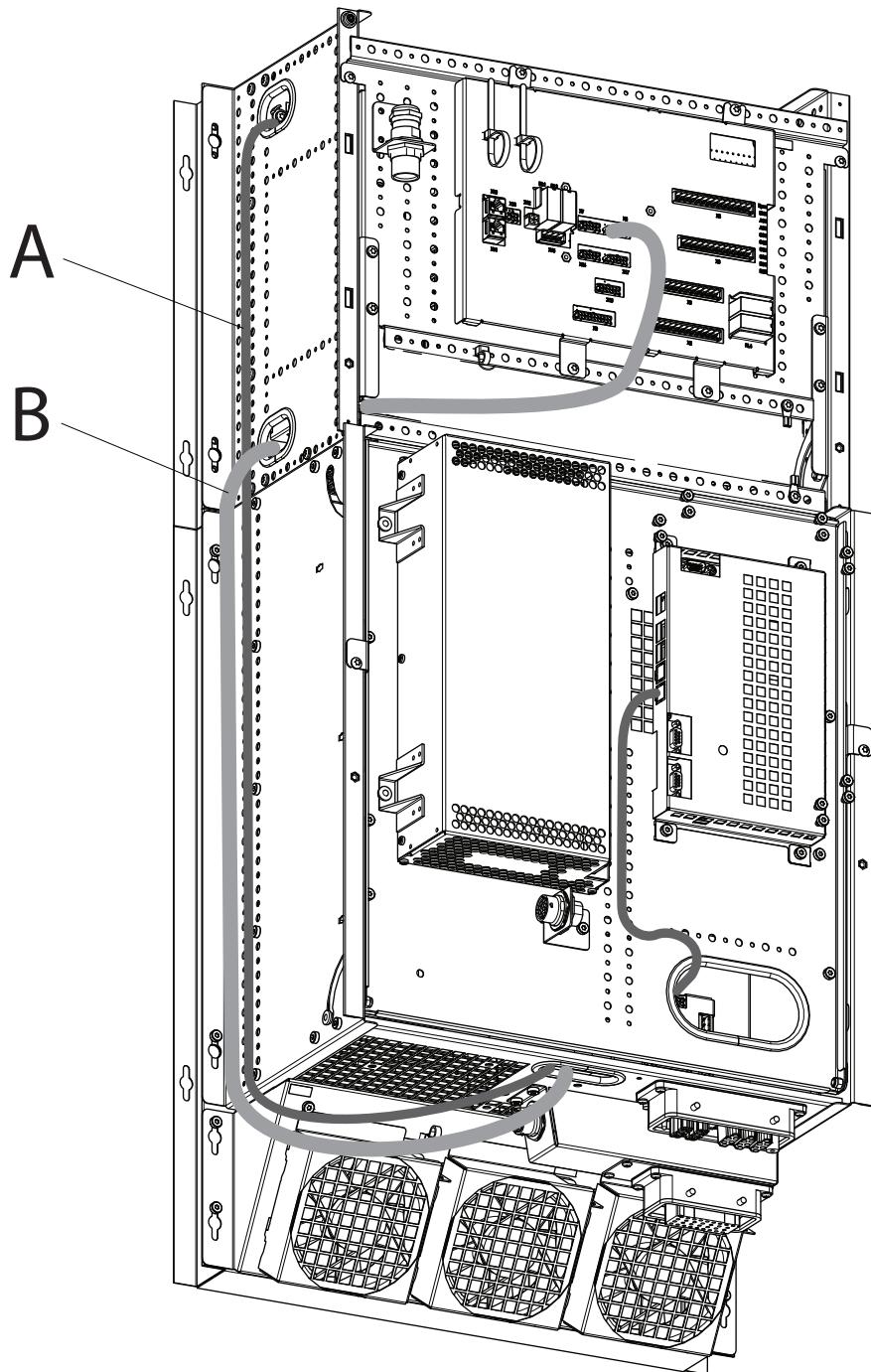
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2 Installation and commissioning

2.5.5 Connecting communication cables between IRC5 Panel Mounted Drive Module and control module

Continued

PMC large:



xx1100000486

A	Ethernet cable
B	Panel board/Contactor interface board cable

Required equipment

Equipment	Art. no.	Note
Ethernet cable	3HAC024244-005	

Continues on next page

2 Installation and commissioning

2.5.5 Connecting communication cables between IRC5 Panel Mounted Drive Module and control module

Continued

Equipment	Art. no.	Note
Panel board/Contactor interface board cable	3HAC024201-001	
Standard toolkit		Described in section Standard toolkit.
Circuit diagram		See Circuit diagrams on page 251 .

Connecting the Ethernet cable

Use this procedure details connect the Ethernet cable between the drive module and control module.

	Action	Note/Illustration
1	Connect the cable to the Axis computer board connector A42.X2, route and strap the cable as shown in the illustration above.	
2	Connect the cable to the Main computer connector A32.A9.	

Connecting the Panel board/Contactor interface board cable

Use this procedure to connect the panel board/contactor interface board cable between the drive module and control module.

	Action	Note/Illustration
1	Connect the cable to the Contactor interface board connector A43.X1, route and strap the cable as shown in the illustration above.	
2	Connect the cable to the Panel board connector A21.X7.	

2 Installation and commissioning

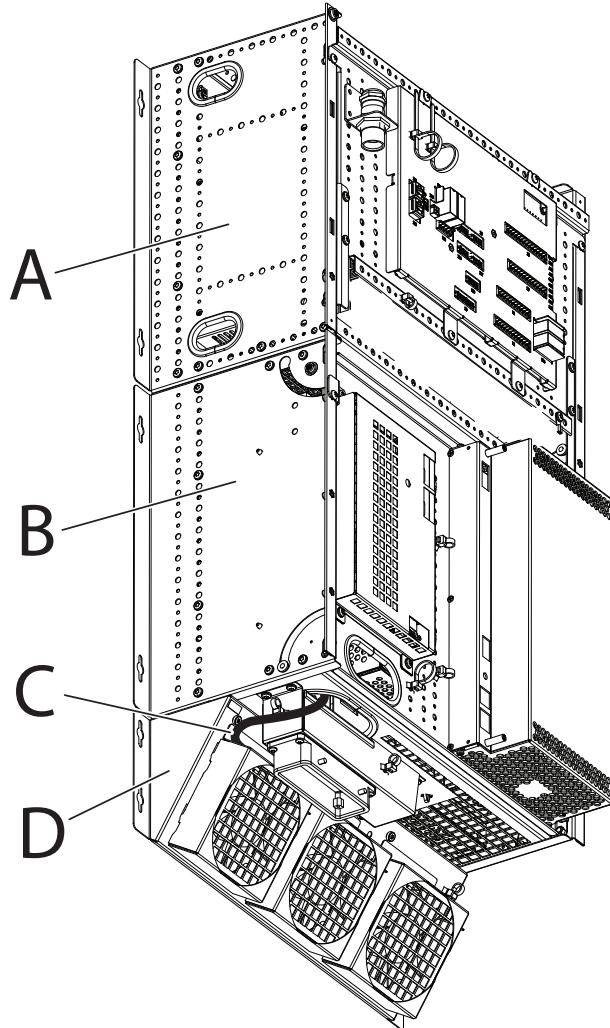
2.5.6 Connecting fan unit to IRC5 Panel Mounted Drive Module



Note

For PMC large, the fan unit is already connected at delivery.

Location



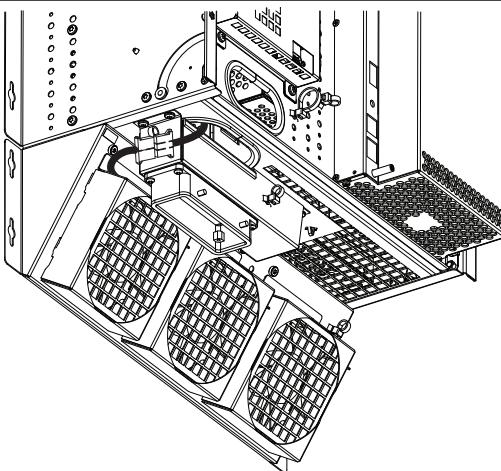
xx0600003323

A	Control module
B	Drive module
C	Fan cable
D	Fan unit

Continues on next page

Connecting fan unit to drive module

Use this procedure to connect the fan unit to the drive module.

Action	Note/Illustration
1 Connect fan unit to drive module E1.XP1	 xx0600003324
2  WARNING The fan unit must not be covered. Check that nothing covers or blocks the fan unit.	
3 Temporarily turn the power supply to the modules on. Inspect all fans to make sure they function correctly. Turn the power supply back off.	

2 Installation and commissioning

2.5.7 Connecting a FlexPendant

2.5.7 Connecting a FlexPendant

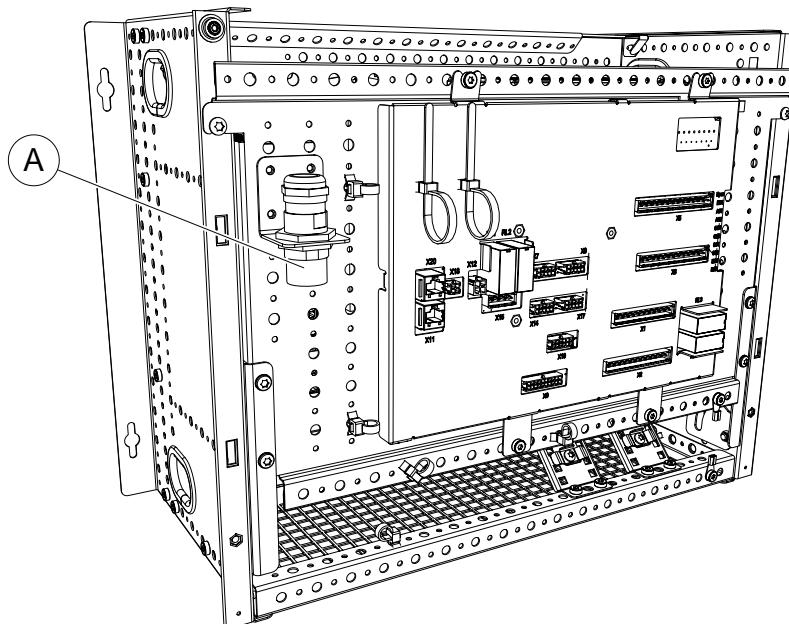
Location of FlexPendant connector

The FlexPendant connector on the Panel Mounted 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.



xx1300001947

A

FlexPendant connector

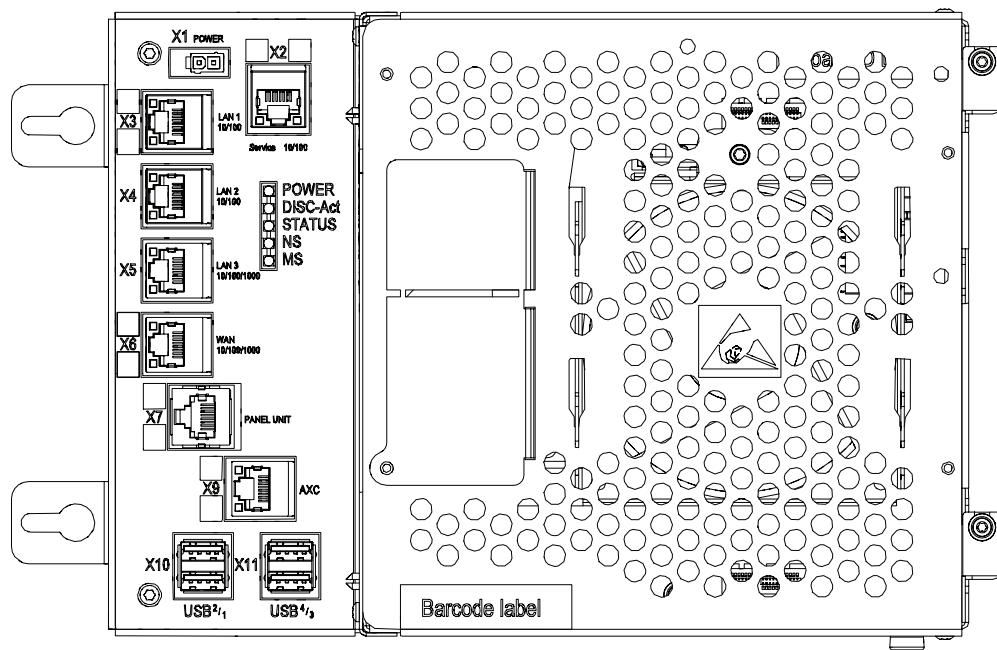
Connecting a FlexPendant

	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.	

2.5.8 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

2.5.8 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.

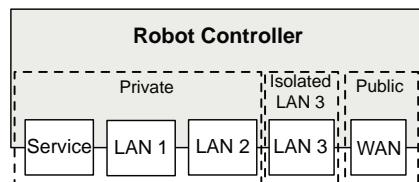
The LAN 2 and LAN 3 ports are intended for connecting network based process equipment to the controller. For example field buses, cameras, and welding equipment.

Continues on next page

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

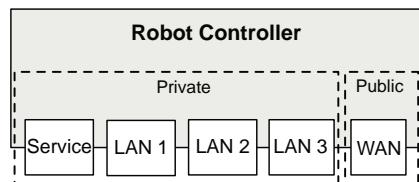
Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later)

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 USB¹ and USB² on the X10 connector for connecting USB memory devices.

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

2 Installation and commissioning

2.5.9 Connecting a serial channel to the controller

General

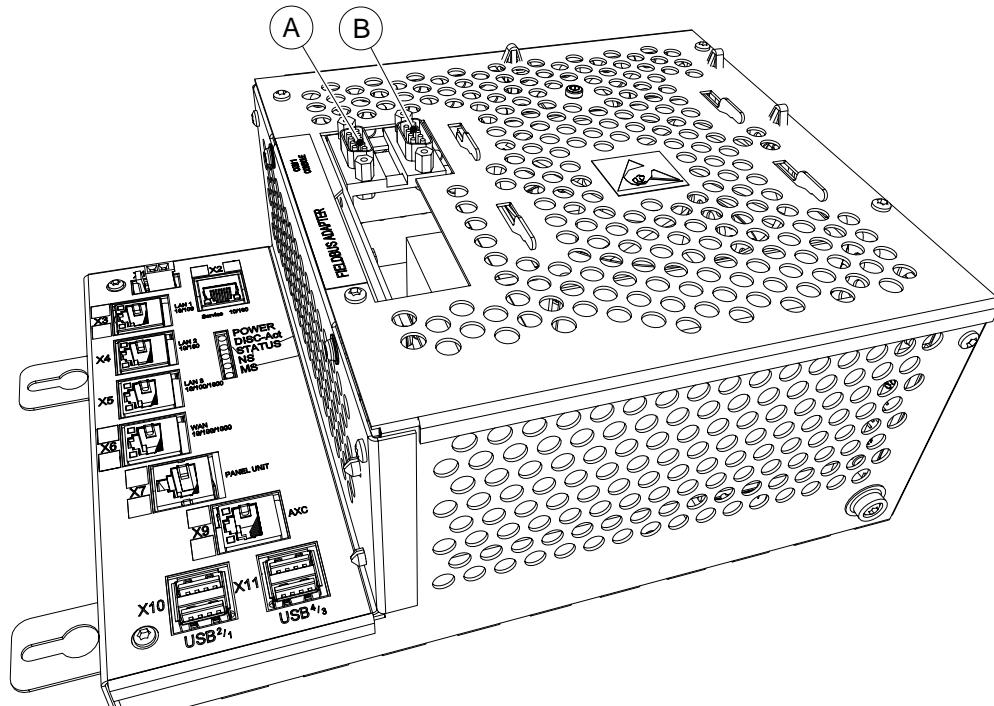
The serial channel is an option. To be able to connect a serial channel to the controller, the main computer needs to be equipped with the expansion board DSQC1003.

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 102](#).

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>

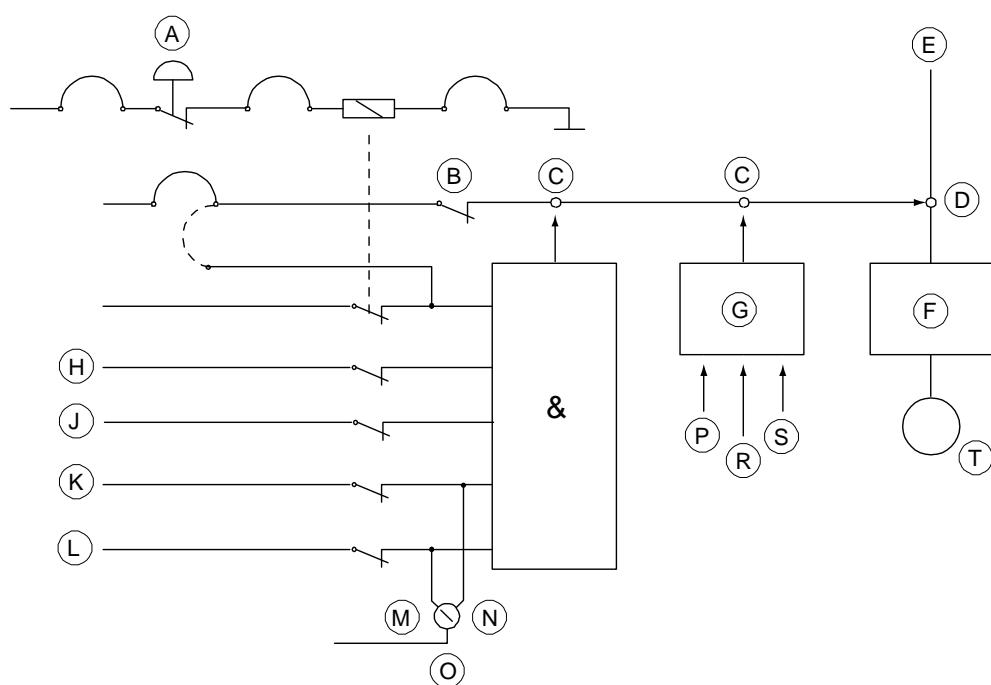
2 Installation and commissioning

2.5.10 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.



xx0100000174

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)
J	SS (superior stop, same function as GS)
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

Continues on next page

S	EN2
T	Motor



Note

Make sure the polarity is correct and that the voltage is not more than 24 V.

Function of the MOTORS ON/MOTORS OFF circuit

The circuit monitors all safety related equipment and switches. If any of the switches is opened, the MOTORS ON/MOTORS OFF circuit switches the power to the motors off.

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

Continues on next page

2 Installation and commissioning

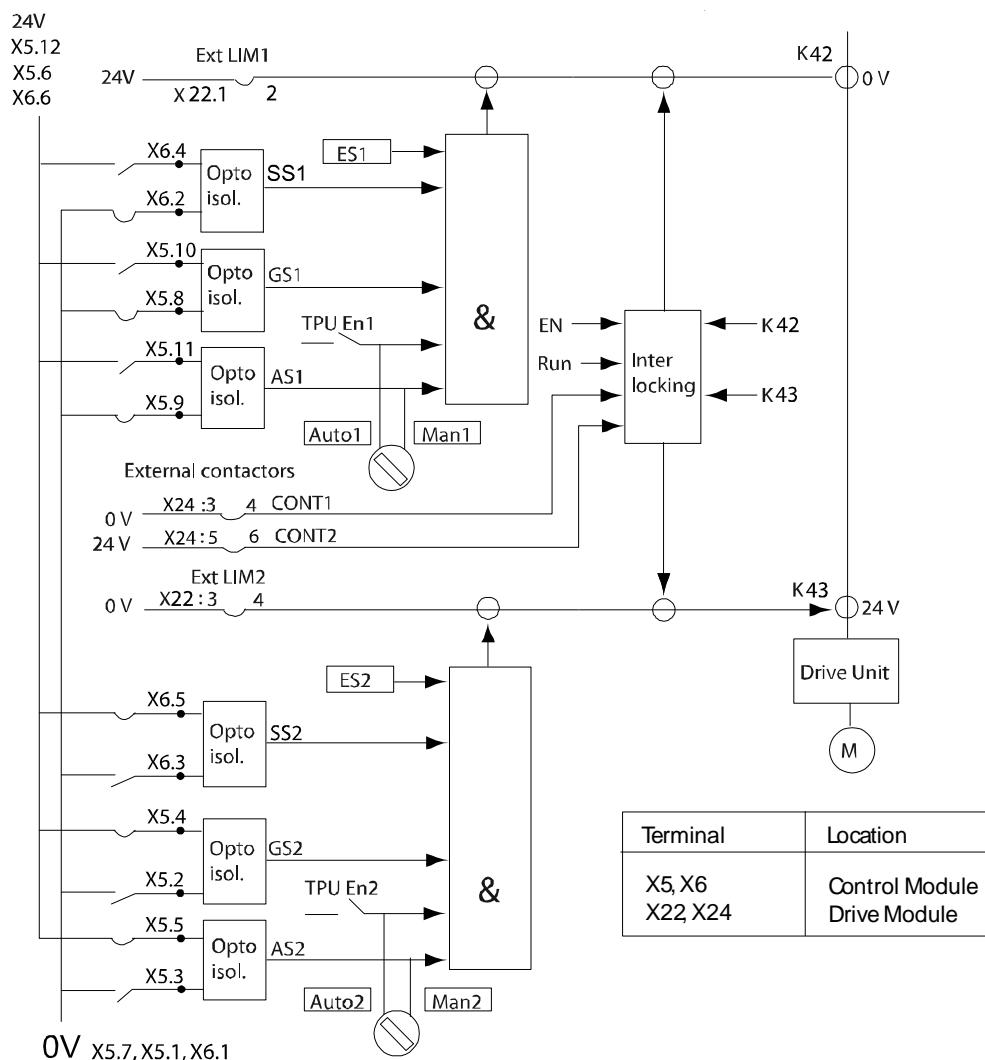
2.5.10 The MOTORS ON/MOTORS OFF circuit

Continued

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.



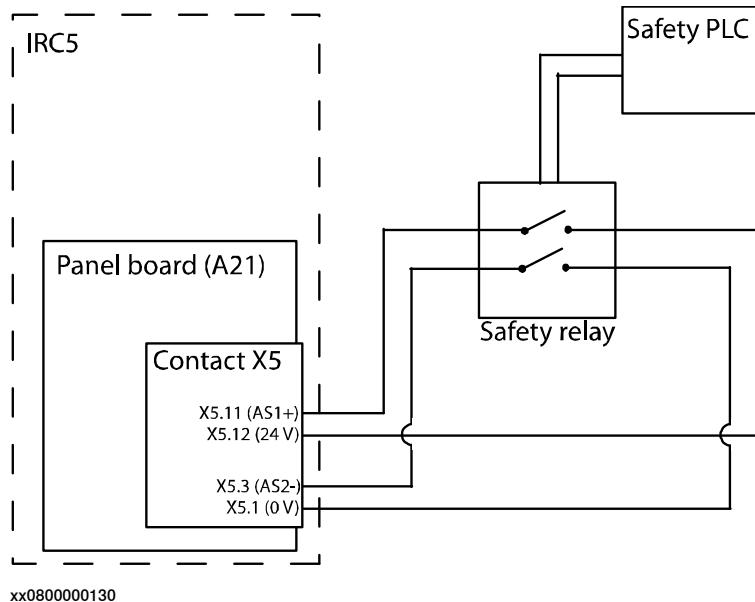
xx0100000166

Technical data per chain	
Limit switch	Load: 300 mV Max. voltage drop: 1 V
External connectors	Load: 10 mA Max. voltage drop: 4 V
GS/AS/SS load at 24 V	25 mA
GS/AS/SS closed "1"	>18 V
GS/AS/SS open "0"	< 5 V
External supply of GS/AS/SS	Max. + 35 VDC Min. - 35 VDC
GS/AS/SS Filter time	2.0 ms ⁱ

Continues on next page

Technical data per chain	
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

- i When connecting for example a safety PLC to a safety stop, make sure that the safety check pulses not exceeds 2.0 ms, otherwise a safety relay must be connected in between. See the following illustration.



xx0800000130

Continues on next page

2 Installation and commissioning

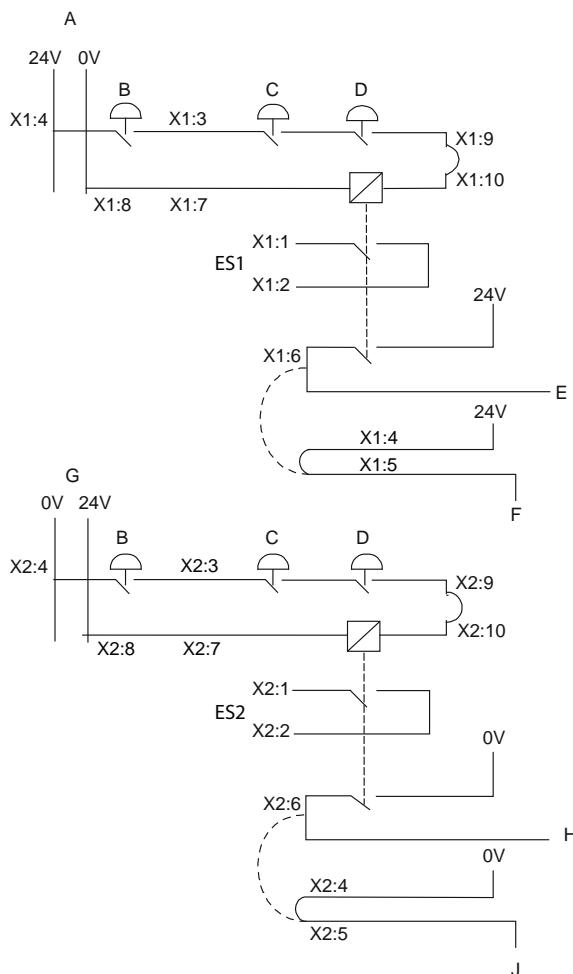
2.5.10 The MOTORS ON/MOTORS OFF circuit

Continued

Connection of ES1/ES2 on panel unit

The diagram below shows the terminals for the emergency circuits.

The supply from internal 24V (X1:4/X2:8) and 0V (X1:8/X2:4) is displayed. For an ext. supply, X1:3 / X2:7 is connected to ext. 24V, and X1:7 / X2:3 is connected to ext. 0V.



xx0100000191

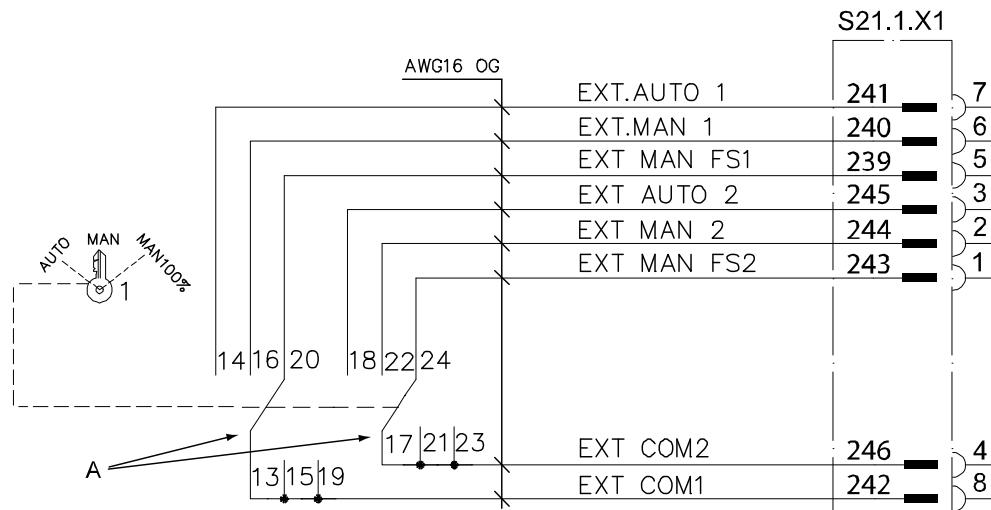
A	Internal
B	Ext stop
C	FlexPendant
D	Cabinet
E	ES1 internal
F	Run chain 1 top
G	Internal
H	ES2 internal
J	Run chain 2 top
ES1	Emergency stop output 1
ES2	Emergency stop output 2

Continues on next page

Technical data	
ES1 and ES2 max output voltage	120 VAC or 48 VDC
ES1 and ES2 max output current	120 VAC: 4 A 48 VDC L/R: 50 mA 24 VDC L/R: 2 A 24 VDC R load: 8 A
External supply of ES relay	24 VDC ± 10% between terminals X1:3, 7 and X2:7, 3 respectively.
	 Note
	In case of interference, the external supply must be properly filtered.
Rated current per chain	40 mA
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

Connection to operating mode selector

The illustration below shows the connection of terminals for customer use.



A	Mode selector
Technical data	
Max. voltage	48 VDC
Max. current	4 A
Max. potential in relation to the cabinet earthing and other signal groups.	300 V
Signal class	Control signals

2 Installation and commissioning

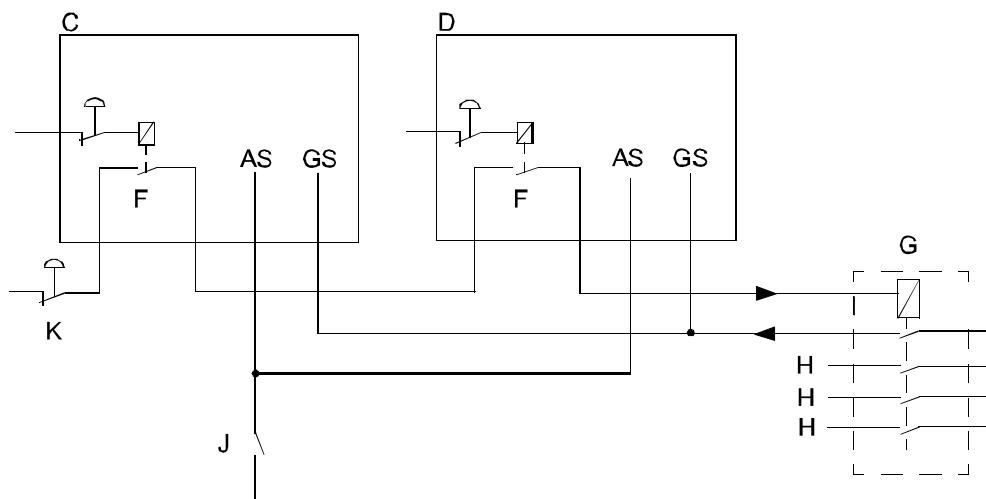
2.5.11 Connection of external safety relay

Description

The motor contactors K42 and K43 in the controller can operate with external equipment if external relays are used.

Connection example

The following figure shows an example of how to connect an external safety relay.



xx0100000246

C	Robot 1
D	Robot 2
F	ES (emergency stop) relay
G	External Safety relay
H	To other equipment
J	Safety gate
K	Cell ES (emergency stop)

2.5.12 Connection of Drive Module Disconnect, by limit switch

2.5.12 Connection of Drive Module Disconnect, by limit switch

General

This function enables you to temporarily disconnect a drive module and deactivate any robot or additional mechanical units connected to this module. The procedures are detailed below.

It is also possible to connect a remote switch to enable a Drive Module Disconnect. The required equipment and procedure for connection of a switch are specified below.



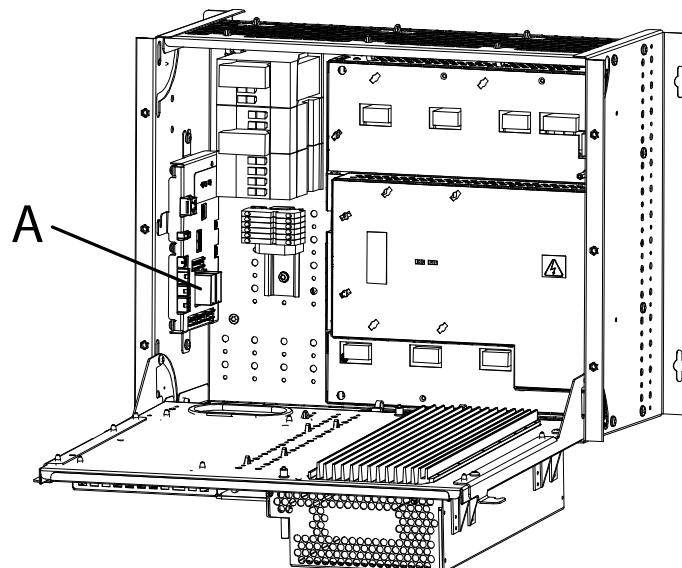
Note

The system diagnostics monitors the connection and disconnection of drive modules, and event log messages regarding these events will be stored in the event log when required. These messages are accessible using the FlexPendant or RobotStudio.

Location

The contactor interface board unit is located in the Panel Mounted Drive Module as shown below.

PMC small:



xx0600003241

A	Contactor interface board
---	---------------------------

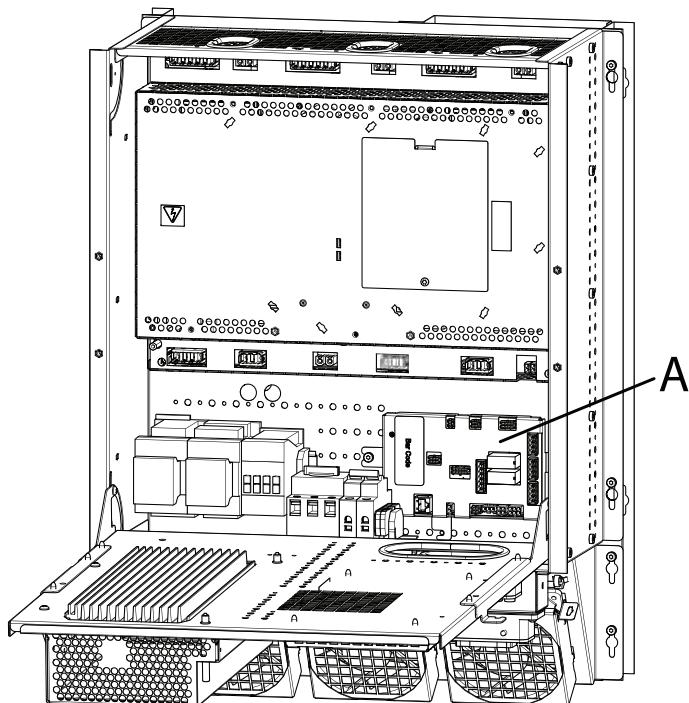
Continues on next page

2 Installation and commissioning

2.5.12 Connection of Drive Module Disconnect, by limit switch

Continued

PMC large:



xx1100000481

A	Contactor interface board
---	---------------------------

Required equipment

The table below details the required equipment.

Equipment	Note
Wire	AWG20
Switch	24V 0.5A
<i>Operating manual - RobotStudio</i>	
<i>Operating manual - IRC5 with FlexPendant</i>	
Standard toolkit	
Circuit diagram	See Circuit diagrams on page 251 .

Enabling Drive Module Disconnect in RobotStudio

The following procedures details how to enable the system for Drive Module Disconnect.

	Action
1	In the Configuration editor in RobotStudio, select the topic <i>Motion</i> .
2	Select the type <i>Drive Module User Data</i> .
3	Set the parameter for selected drive module to YES.
4	Restart the system.

Continues on next page

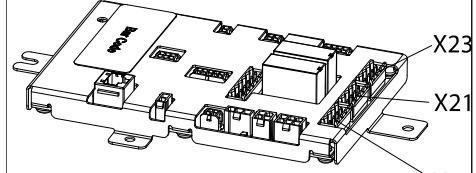
Enabling Drive Module Disconnect with the FlexPendant

The following procedures details how to enable the system for Drive Module Disconnect.

Action	
1	In the Control panel on the FlexPendant, tap Topics , and select Motion .
2	Tap the type <i>Drive Module User Data</i> , and then tap to select the drive module.
3	Set the parameter for selected drive module to YES .
4	Restart the system.

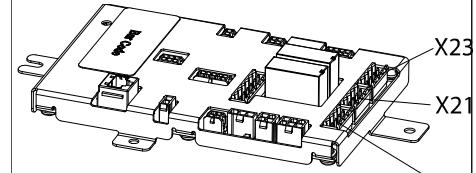
Disconnecting the drive module

Use this procedure to disconnect a drive module.

	Action	Note/illustration
1	Make sure that the system is in the MO-TORS_OFF state.	
2	Disconnect the connector X22.	<p>It is also possible to use connector X21, but this is typically used for limit switches on the robot.</p>  <p>xx0600003250</p>

Reconnecting the drive module

Use this procedure to reconnect the drive module.

	Action	Note/illustration
1	Make sure that the system is in the MO-TORS_OFF state.	
2	Reconnect the X22 connector.	 <p>xx0600003250</p>
3	Move the program pointer to main in the RAPID-program where the disconnected mechanical units are active.	

Connect a remote switch

The following procedures details how to connect a remote switch.

	Action	Note/illustration
1	Make sure that the system is in the MO-TORS_OFF state.	

Continues on next page

2 Installation and commissioning

2.5.12 Connection of Drive Module Disconnect, by limit switch

Continued

	Action	Note/illustration
2	Disconnect the jumpers from the connector X22.	
3	Connect the wires to the connector X22 according to the diagram on the right.	<p>LIMIT SWITCH 2 EXTERNAL AXIS</p> <p>LIMIT SWITCH 1 CONTROL CABLE</p> <p>xx0500002091</p>

2.5.13 Connecting a Limit switch override push button



DANGER

The Limit switch override is used to disconnect safety limitations. Make sure the Limit switch override function is not active longer than absolutely necessary.

If the option SafeMove is implemented, Limit switch override must never be used at all. The SafeMove safety controller has its own override function.

General

The override circuit enables the possibility to jog an axis out of a forbidden (limited) zone.

Limitations

The switch has to be placed inside the controller to eliminate the risk of electrical noise.

Required equipment

Equipment	Art. no	Note
Contact block	1SFA 610 605 R1001	ABB CW Control
Contact blocks with holder	1SFA 611 605 R1201	ABB CW Control
Push button	1SFA 611 102 R1105	ABB CW Control
Connector X23	1SSA 245 204 R0100	ABB CW Control
Wire		Cable AWG 20 Blue
Standard toolkit		This is detailed in section Standard toolkit, IRC5 on page 235 .
Circuit diagram		See Circuit diagrams on page 251 .

Procedure

The following procedure details how to connect a Limit switch override circuit in the controller.

	Action	Note/illustration
1	DANGER Before any work inside the IRC5 controller please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	

Continues on next page

2 Installation and commissioning

2.5.13 Connecting a Limit switch override push button

Continued

Action	Note/illustration
2 Attach two additional contact blocks on the existing push button (Motors on).	<p>xx0500002553</p> <ul style="list-style-type: none"> • A: Additional contact blocks • B: Existing contact, lamp blocks • C: Holder • D: Push button
3 Connect wires from the contact blocks to the connector according to the diagram to the right.	<p>xx0500002556</p>
4 Fit the connector to the X23 connector on the contactor interface board.	<p>xx0600003250</p>

2.6 Drive system

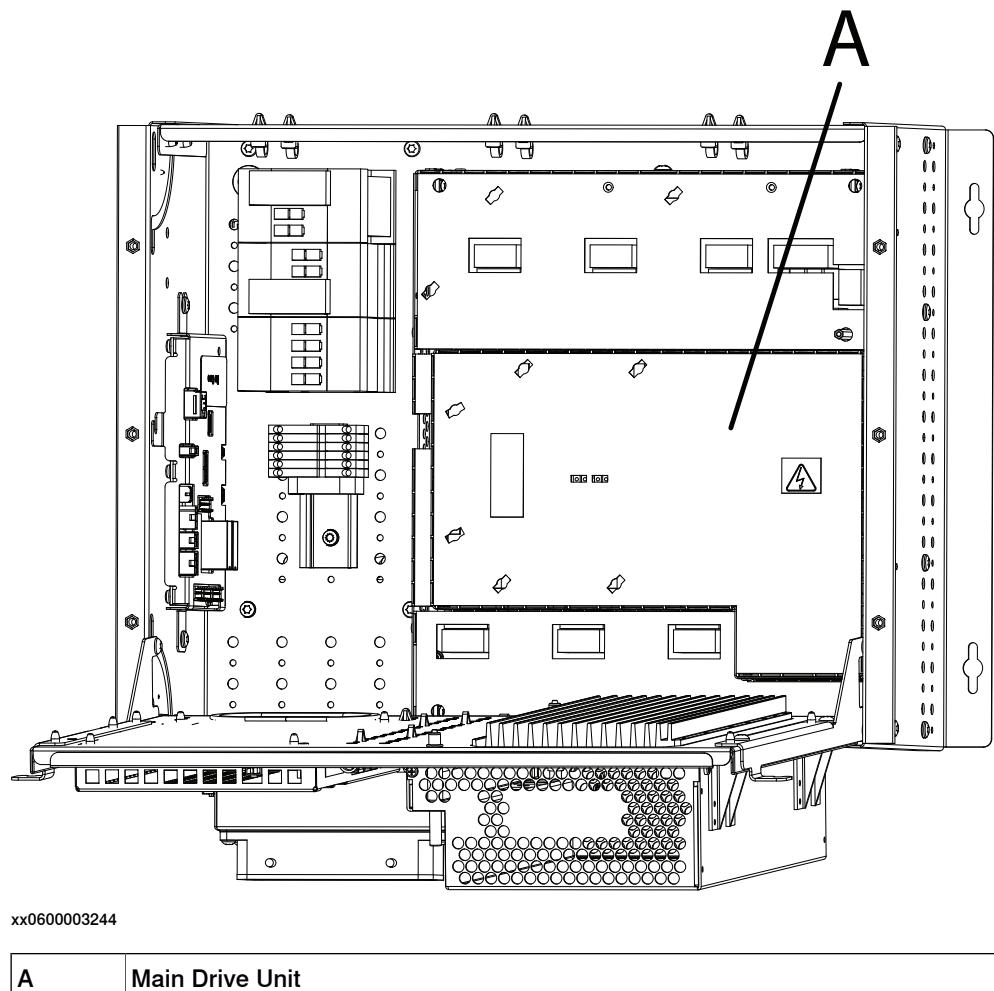
2.6.1 Drive functions, general

General

The robot is powered by power electronics found in the IRC5 Panel Mounted Controller.

Location of drive unit

PMC small:



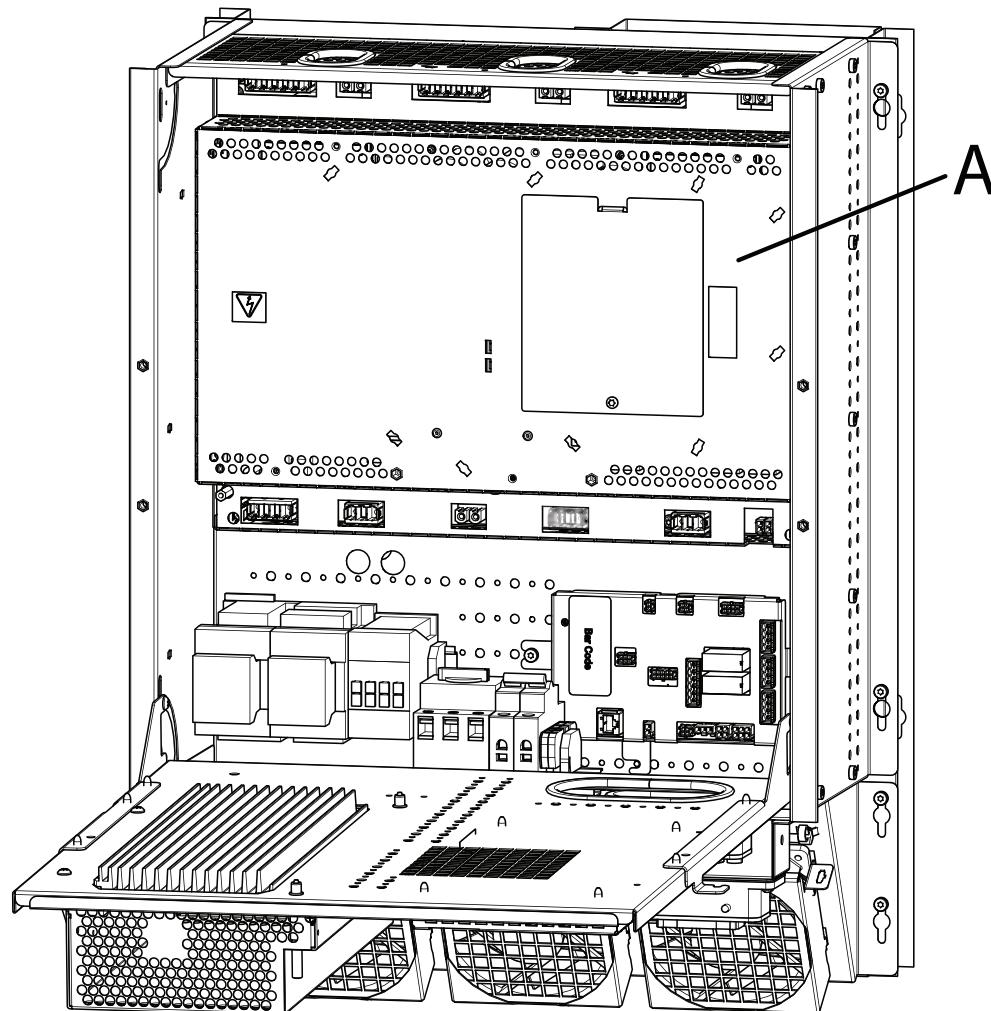
Continues on next page

2 Installation and commissioning

2.6.1 Drive functions, general

Continued

PMC large:



xx1100000482

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

Replacing drive system parts

How to replace the drive unit for PMC small is described in section [Replacement of drive unit for PMC small on page 179](#).

How to replace the drive unit for PMC large is described in section [Replacement of Main Drive Unit for PMC large on page 182](#).

2.7 Memory functions

2.7.1 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 177*](#).



Note

Only use SD-card memory supplied by ABB.

2 Installation and commissioning

2.7.2 Connecting a USB memory

2.7.2 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:

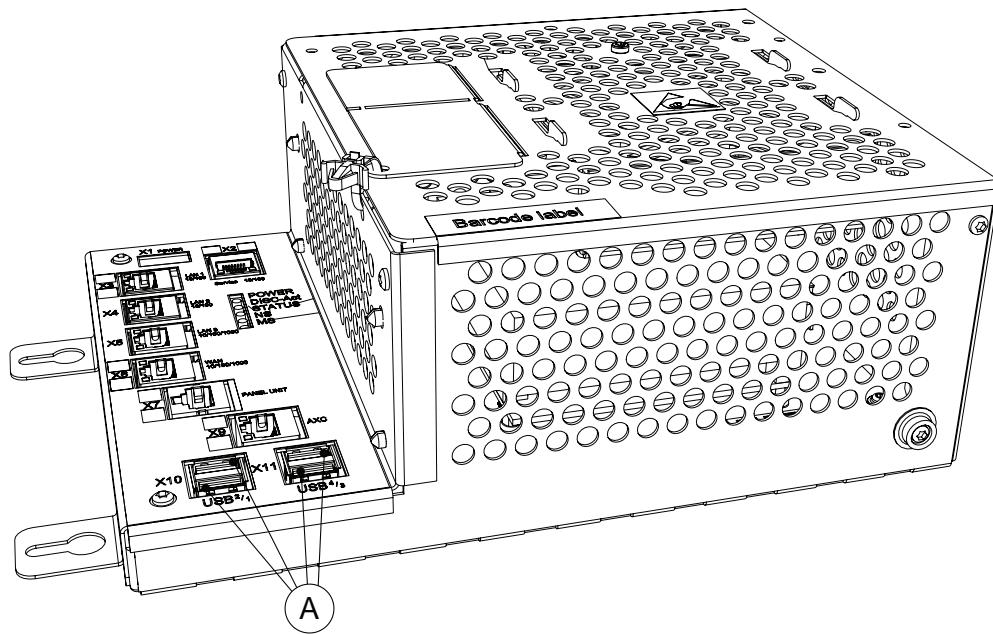


xx0900000022

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

Location on main computer

The location of the USB ports on the main computer is shown by the following illustration:



xx1300000602

A	USB ports
---	-----------

Continues on next page



Note

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

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

2 Installation and commissioning

2.8.1 Definition of fieldbuses, IRC5

2.8 I/O system

2.8.1 Definition of fieldbuses, IRC5

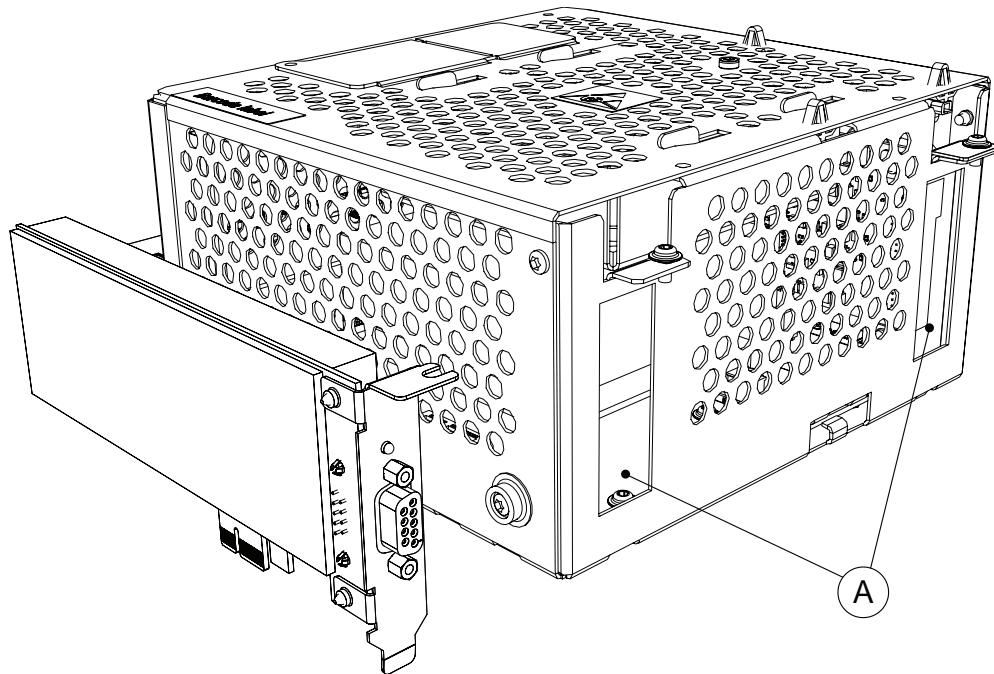
General

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:

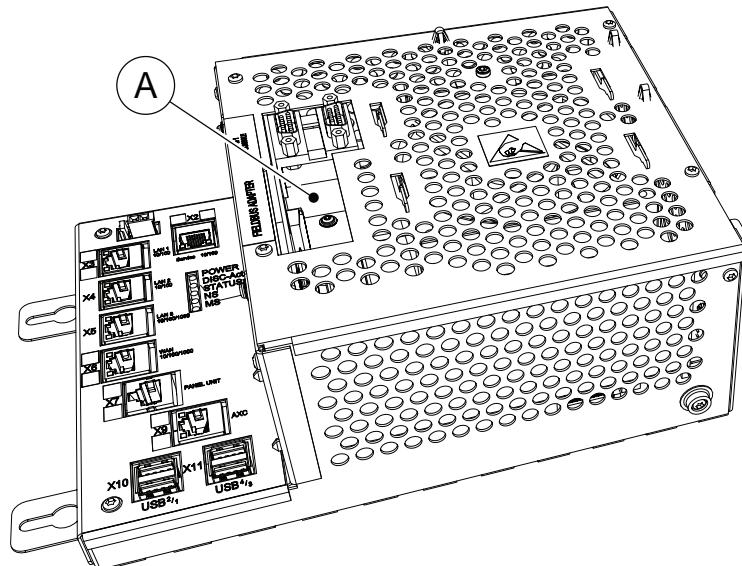
Description	Art. no.	Type designation
PROFIBUS Master PClexpress	3HAC044872-001	DSQC1005
DeviceNet Master/Slave PClexpress	3HAC043383-001	DSQC1006

Continues on next page

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 82](#).



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

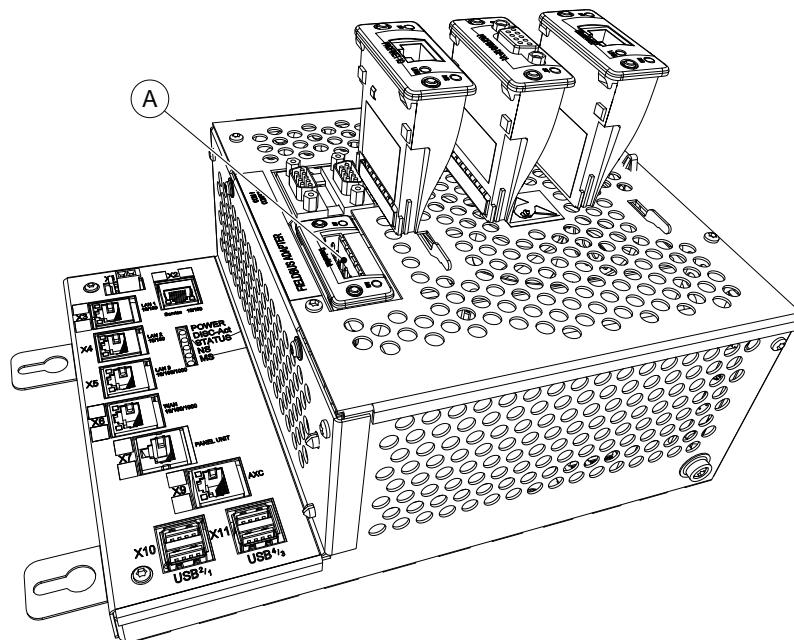
2 Installation and commissioning

2.8.1 Definition of fieldbuses, IRC5

Continued

Fieldbus adapters

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



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

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2 Installation and commissioning

2.8.1 Definition of fieldbuses, IRC5

Continued

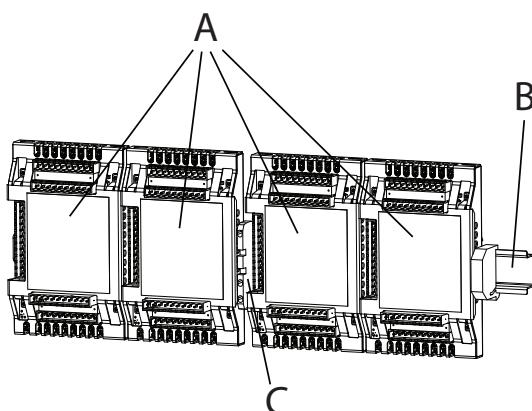
Manual title	Art. no.
<i>Application manual - PROFINET Anybus Device</i>	<i>3HAC050968-001</i>
<i>Application manual - PROFINET Controller/Device</i>	<i>3HAC050969-001</i>

2 Installation and commissioning

2.8.2 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.



xx0600003256

A	I/O or encoder units
B	Mounting rail
C	Connection terminal XT31

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:

See [Spare parts on page 237](#) 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 Replacement of expansion board in the computer unit on page 166 and/or Replacement of fieldbus adapter in the computer unit on page 169 .

Continues on next page

Information:	Found in:
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 <i>Definition of fieldbuses, IRC5 on page 102</i> .
Detailed descriptions of all available I/O units.	The application manual for the different I/O buses respectively, see listing in <i>Definition of fieldbuses, IRC5 on page 102</i> .

2 Installation and commissioning

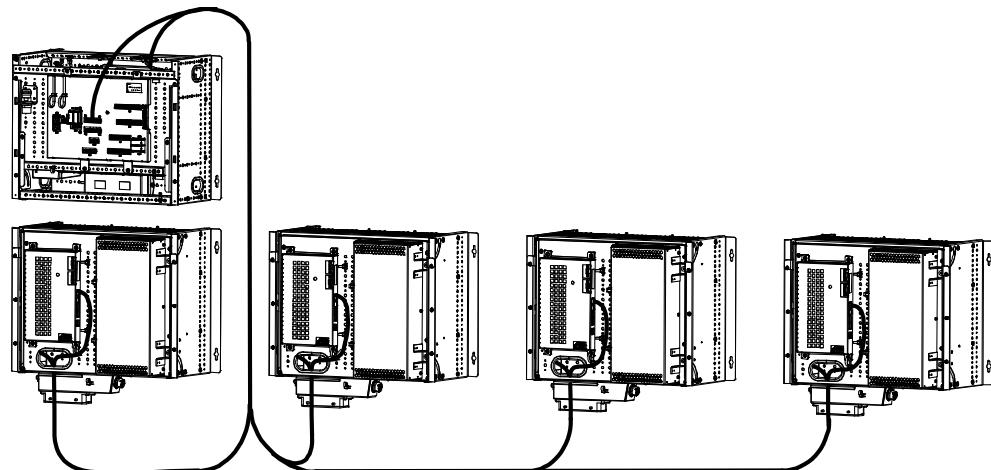
2.9.1 Installation of additional Drive Module

2.9 Installation of add-ons

2.9.1 Installation of additional Drive Module

General

To be able to use a MultiMove system or to control more than 3 additional axes, an additional Drive Module is needed. The IRC5 Controller is prepared for up to three additional Drive Modules.



For more information about installing additional Drive Modules, see *Application manual - MultiMove*.

2.9.2 Installation of external operator's panel, IRC5

Overview

External operator's panels can be either simply a panel or a panel box. See illustrations below.



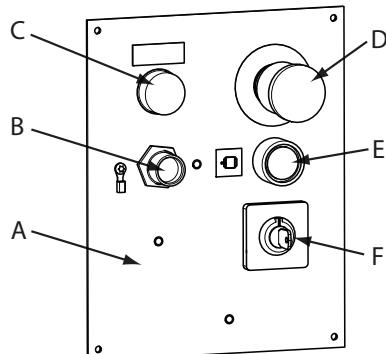
Note

When ordering the external operator's panel as an add-on, the external operator's panel is delivered empty together with labels and blanking plugs.

When installing, the following components must be moved from the controller to the external operator's panel:

- Mode switch
- Motor ON button
- Emergency stop button

External operator's panel (option 733-3)



xx1100000522

A	Front panel
B	FlexPendant connector
C	Blanking plug for actuator red
D	Emergency stop button
E	Motor ON button
F	Mode switch

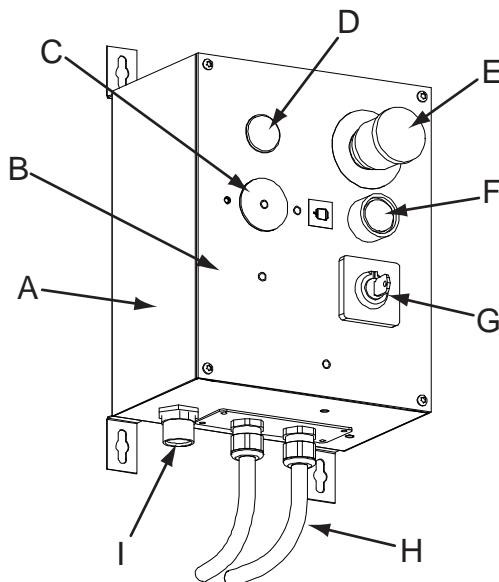
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2 Installation and commissioning

2.9.2 Installation of external operator's panel, IRC5

Continued

External operator's panel box (option 733-4)



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

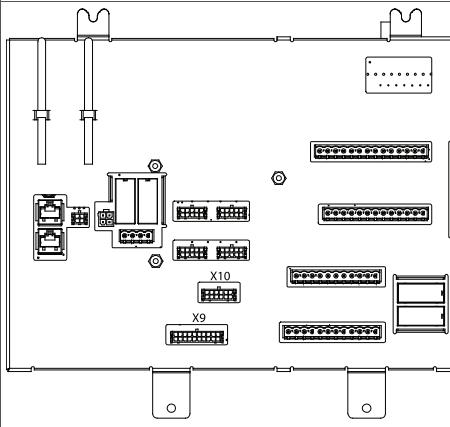
Required equipment

Equipment	Art. no.	Note
External operator's panel (733-3)	3HAC040643-003	
External operator's panel box (733-4)	3HAC040644-003	
External operator's panel cable	3HAC038767-001 3HAC038768-001 3HAC038769-001	7 m 15 m 30 m
Standard toolkit		The contents are defined in section, Standard toolkit, IRC5 on page 235
Circuit diagram		See Circuit diagrams on page 251 .

Continues on next page

Procedure

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

	Action	Info/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	Disconnect the cable from the ethernet connector for FlexPendant on the computer unit.	
3	Disconnect signal cabling from the panel board unit. Connectors: <ul style="list-style-type: none"> • A21.X9 • A21.X10 	
4	Connect the ethernet connector A31.X3 for the FlexPendant to the computer unit.	
5	Connect the signal connectors A21.X9 and A21.X10 to the connector X9 and X10 on the panel board unit.	
6	Strap the cabling to the existing cable strapping inside the controller.	
7	Fit the following components to the correct positions on the external operator's panel: <ul style="list-style-type: none"> • S21.1, Mode switch • S21.2, Motor ON button • S21.3, Emergency stop button 	
8	Fit the cabling to the panel box with the four attachment screws.	
9	Attach the XS4 connector to the external operator's panel, and connect the free ends of the harness to the components on the external operator's panel.	See Circuit diagrams on page 251 .
10	Connect the earth cable.	
11	Strap the cabling on the external operator's panel.	

Continues on next page

2 Installation and commissioning

2.9.2 Installation of external operator's panel, IRC5

Continued

	Action	Info/Illustration
12	Power on the controller and test the functionality of the Mode switch, Motor ON button, and the Emergency stop button.	

2.9.3 Installation of external enabling device

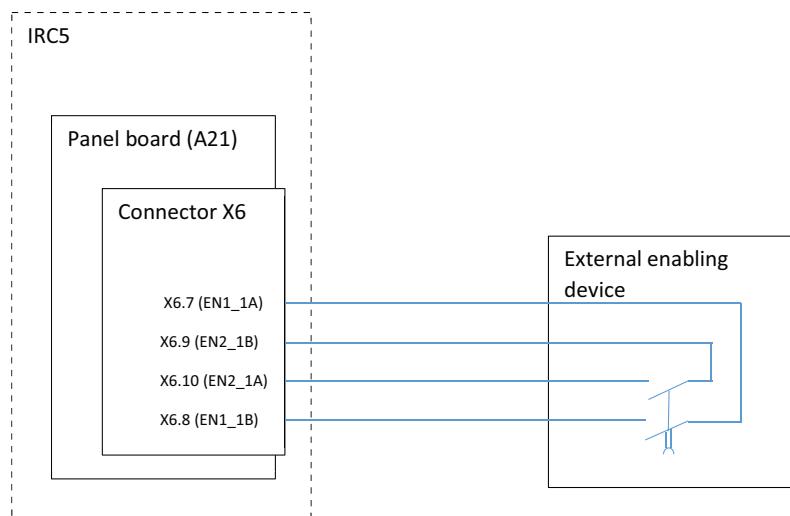
Overview

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

2.9.3 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

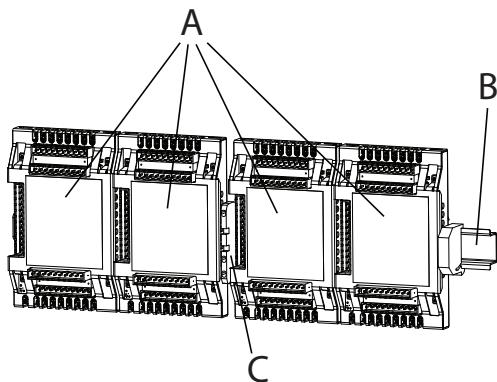
The safety-related performance of the enabling device chain, without the external enabling device, is as follows:

- MTTF_d for IRC5 enabling device chain is 80 years.
- IRC5's enabling device chain's calculated average probability of dangerous failure per hour (PFH_d) is 6.62x10E-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.

2.9.4 Installation of I/O, Gateways and encoder interface units, IRC5

Location

The I/O units, Gateway or encoder interface units to be installed are shown in the illustration below.



xx0600003256

A	I/O units, Gateways or Encoder interface units
B	Mounting rail
C	Connection terminal XT31

Required equipment

Equipment	Art. no.	Note
I/O units, Gateways or encoder interface units		
<i>Application manual - DeviceNet Master/Slave</i>	3HAC050992-001	
Circuit diagram	See Circuit diagrams on page 251 .	

Fitting

The procedure below details how to fit the units.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2	Fit the I/O unit by snapping it onto the mounting rail.	
3	Connect the DC supply to the board.	
4	Connect wires to the inputs and output connectors as required.	Described in the Application manual for the respective busses.

2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

General

To use the option Electronic Position Switches you need to install an EPS board in the robot controller. The procedure below will show how to install this board.



Note

It is not possible to have the options EPS and SafeMove installed at the same time - that is, only one of these two options can be installed and used.



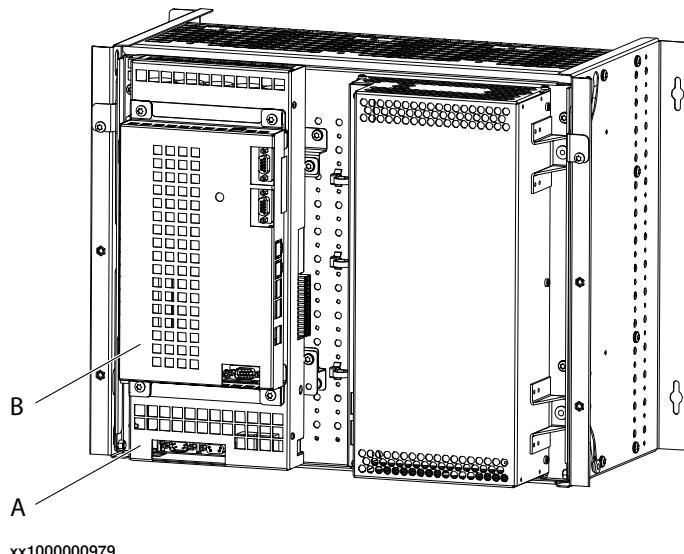
WARNING

The safety controller has passive monitoring, i.e. it does not stop the robot. If an axis is outside its configured range, an output signal goes low. It is the responsibility of the installation personnel to connect the output signals in such a way that the robot is stopped if there is a risk of a dangerous situation.

Illustration

The EPS board should be mounted behind the axis computer.

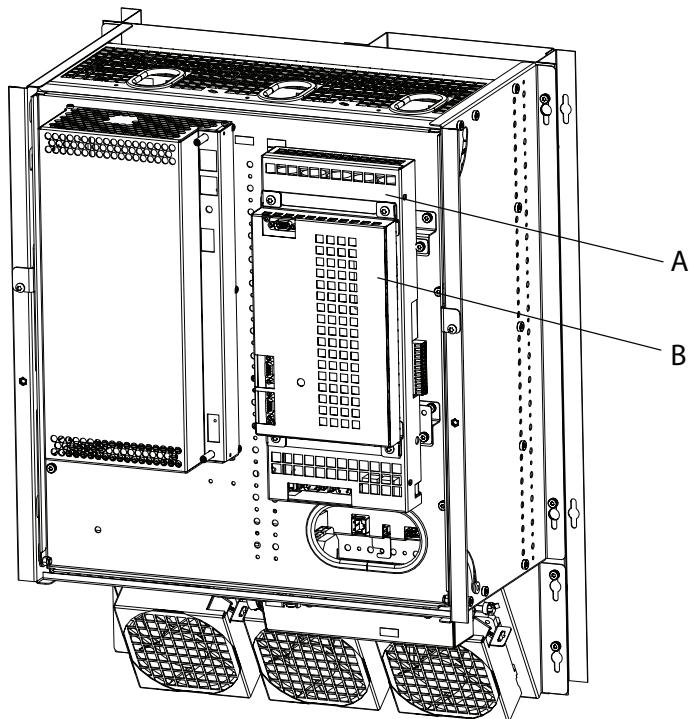
PMC small:



A	EPS board
B	Axis computer

Continues on next page

PMC large:



xx1100000483

A	EPS board
B	Axis computer

Procedure

The procedure below details how to install an EPS board.

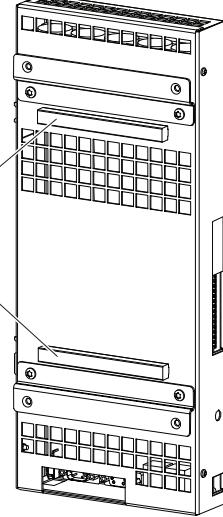
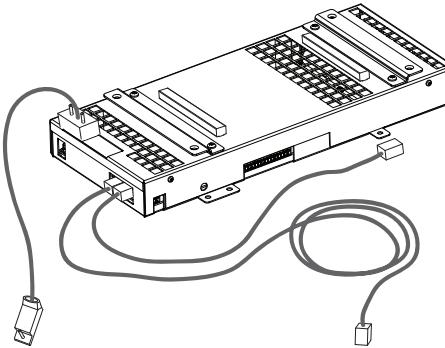
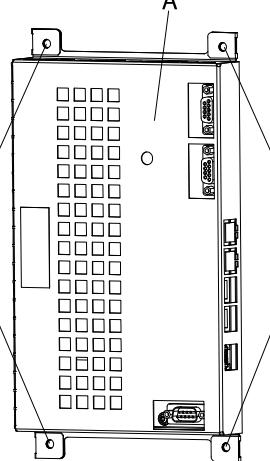
	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2	 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	

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2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

Continued

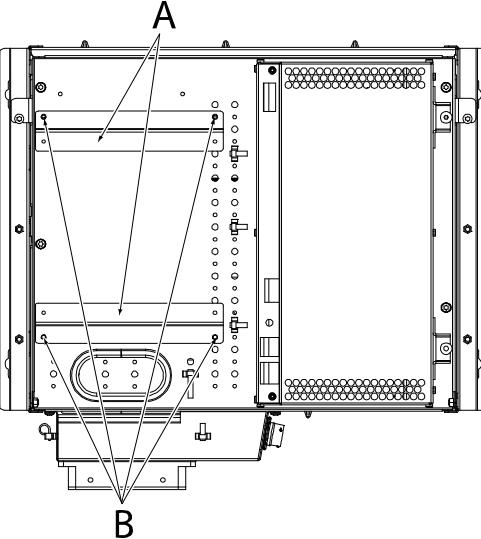
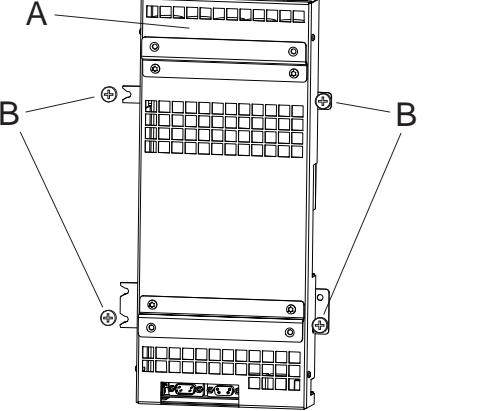
Action	Note/illustration
3 If not already in place, fit the EMC strips on the EPS board.	 xx0700000087
4 Connect the short SMB cable and both Ethernet cables to the EPS board before mounting the board. These connections may be difficult to reach once the board is mounted. The two Ethernet connectors on the EPS board are interchangeable (it does not matter which is connected to the main computer and which is connected to the axis computer).	 xx0600003303
5 Remove the attachment screws of the axis computer. Lift out the axis computer so that the EPS board can be fitted behind the axis computer.	 xx0900000030 <ul style="list-style-type: none"> • A: axis computer • B: attachment screws

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2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

Continued

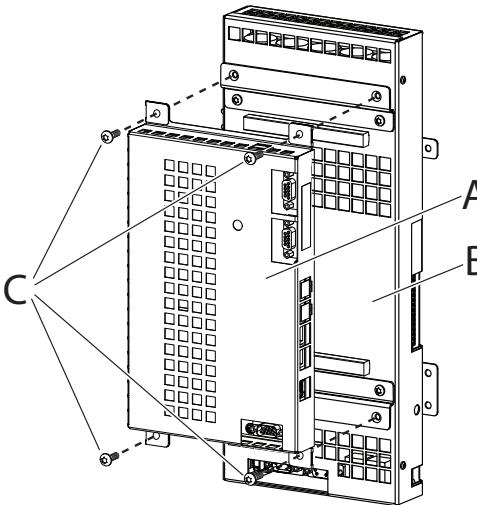
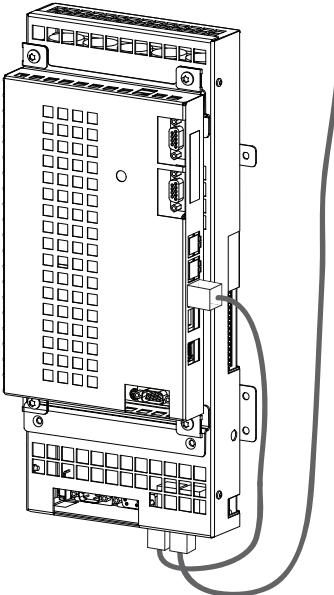
	Action	Note/illustration
6	<p>Only for PMC small: Attach two mounting brackets on the drive module, so that the EPS board can be mounted on these brackets.</p>	 <p>A B xx1000000981</p> <ul style="list-style-type: none"> • A: mounting brackets • B: attachment screws
7	<p>Fit the EPS board in the same place as the axis computer was before.</p>	 <p>A B xx0600003204</p> <ul style="list-style-type: none"> • A: EPS board • B: attachment screws

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2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

Continued

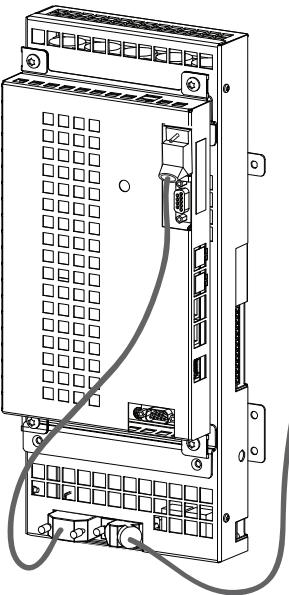
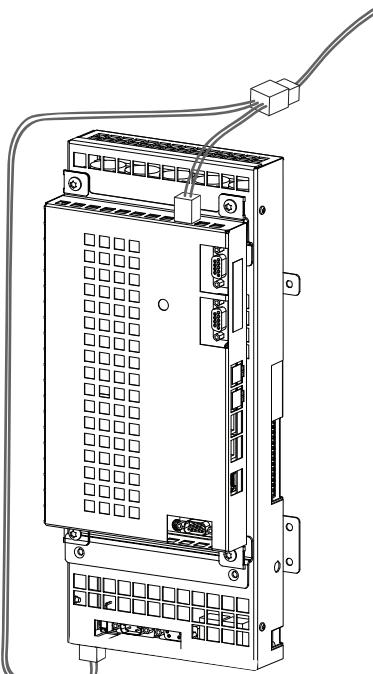
	Action	Note/illustration
8	Fit the axis computer on the EPS board.	 <p>xx0900000438</p> <ul style="list-style-type: none">• A: axis computer• B: EPS board• C: attachment screws
9	Remove the existing Ethernet cable from the axis computer and connect it to the EPS board. Connect the short Ethernet cable between the EPS board and the axis computer.	 <p>xx0600003218</p>

Continues on next page

2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

Continued

	Action	Note/illustration
10	<p>Remove the SMB cable from the axis computer and connect it to the EPS board.</p> <p>Connect the SMB cable from the EPS board to the axis computer.</p>	 xx0600003207
11	<p>Remove the power cable from the axis computer and connect it to the split cable.</p> <p>Connect the split cable to the EPS board and the axis computer.</p>	 xx0600003208

Continues on next page

2 Installation and commissioning

2.9.5 Installing the EPS board DSQC 646 for Electronic Position Switches

Continued

Action	Note/illustration
12 Connect signal cables to the plug contact, which is then connected to the I/O connector of the EPS board. <ul style="list-style-type: none"> • Connect a power supply, 24 V to pin 1 and 0 V to pin 2. Check with a voltmeter that the voltage is 24 V between pin 1 and 2 on the Phoenix connector. • Connect the output signals from the EPS board (pin 3-12). • Connect the sync switch signals to pin 13 and 14. If dual channel wiring is not used, connect only pin 14. 	<p>xx0600003209</p> <ul style="list-style-type: none"> • A: I/O Connector • B: Plug contact • C: Power supply • D: 5 safe outputs (10 signals) • E: Sync switch (dual signal)

2.9.6 Installing the SafeMove board DSQC 647

General

To use the option SafeMove you need to install an SafeMove board DSQC 647 in the robot controller. The procedure below will show how to install this board.



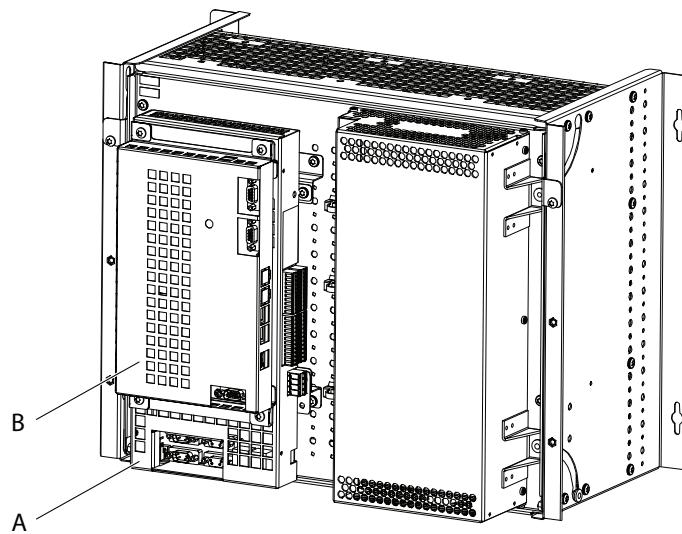
Note

It is not possible to have the options SafeMove and EPS installed at the same time - that is, only one of these two options can be installed and used.

Location

The SafeMove board should be mounted behind the axis computer.

PMC small:



xx1000000980

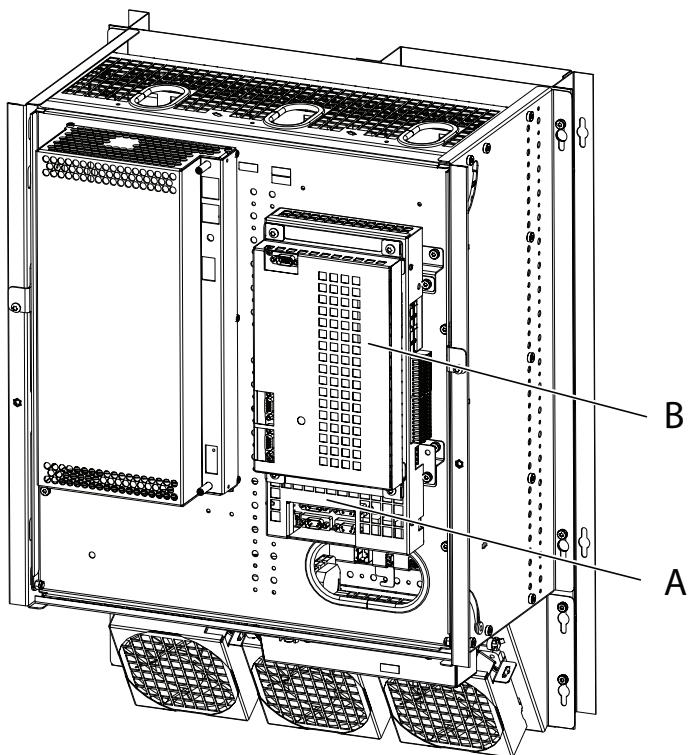
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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

PMC large:



xx1100000499

A	SafeMove board
B	Axis computer

Procedure

The procedure below details how to install the SafeMove board.

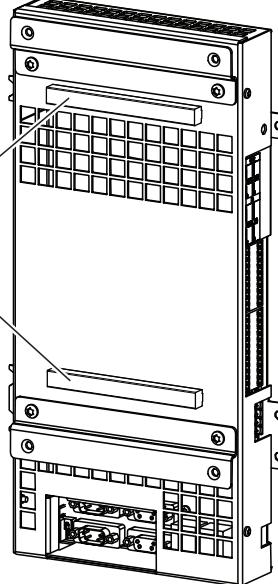
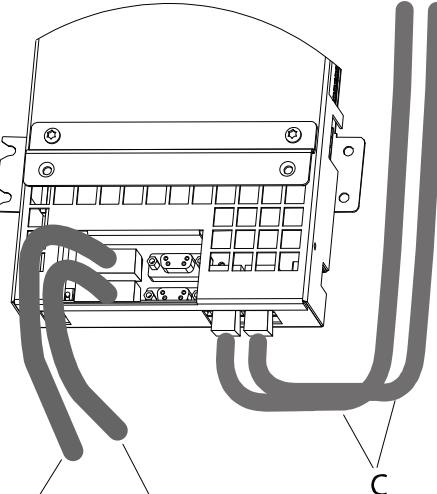
	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	

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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

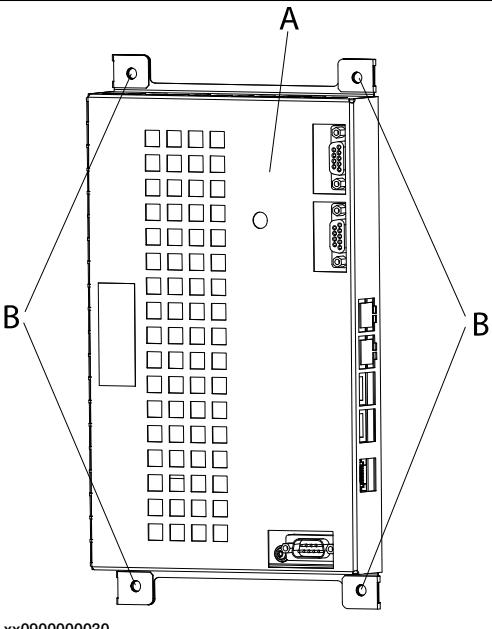
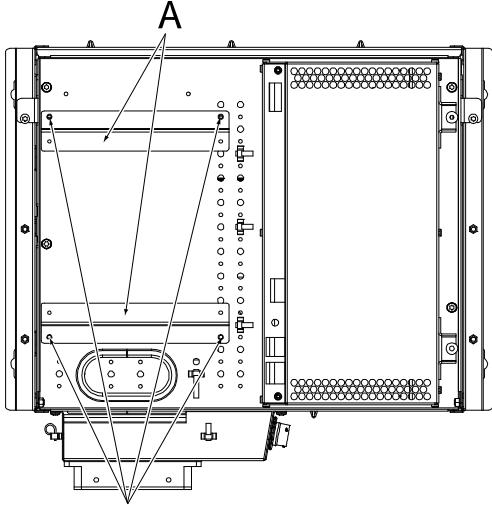
Action	Note/illustration
3 If not already in place, fit the EMC strips on the SafeMove board.	 <p>xx0800000204</p> <ul style="list-style-type: none"> A: EMC strips
4 Connect both SMB cables and both Ethernet cables to the SafeMove board before mounting the board. These connections may be difficult to reach once the board is mounted. The two Ethernet connectors on the SafeMove board are interchangeable (it does not matter which is connected to the main computer and which is connected to the axis computer).	 <p>xx0800000103</p> <ul style="list-style-type: none"> A: SMB1 cable B: SMB2 cable C: Ethernet cables

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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

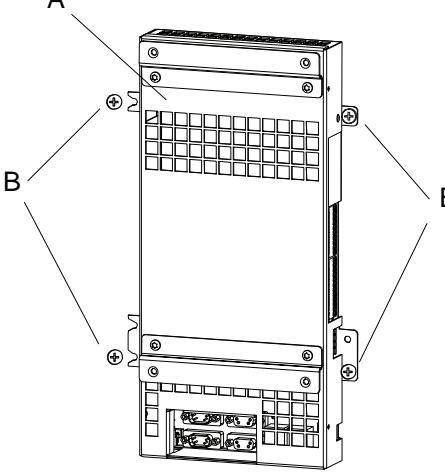
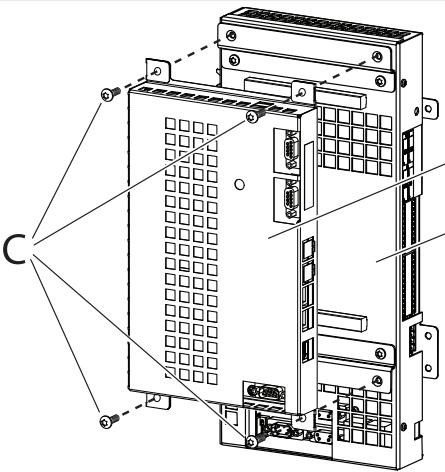
Action	Note/illustration
5 Remove the attachment screws of the axis computer. Lift out the axis computer so that the SafeMove board can be fitted behind the axis computer.	 <p>xx0900000030</p> <ul style="list-style-type: none"> • A: axis computer • B: attachment screws (4 pcs)
6 Only for PMC small: Attach two mounting brackets on the drive module, so that the SafeMove board can be mounted on these brackets.	 <p>xx1000000981</p> <ul style="list-style-type: none"> • A: mounting brackets • B: attachment screws

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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

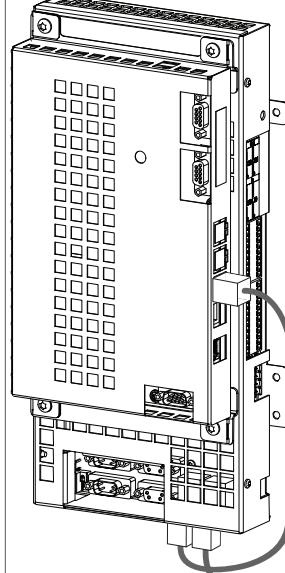
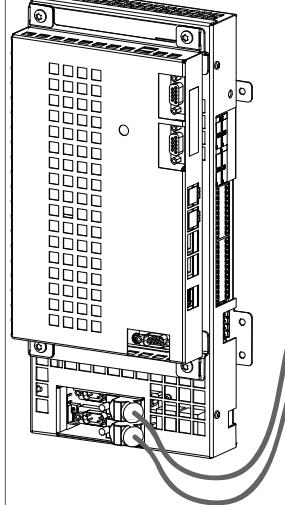
Action	Note/illustration
7 Fit the SafeMove board in the same place as the axis computer was before.	 <p>xx0800000104</p> <ul style="list-style-type: none"> • A: SafeMove board • B: attachments screws (4 pcs)
8 Fit the axis computer on the SafeMove board.	 <p>xx0900000441</p> <ul style="list-style-type: none"> • A: Axis computer • B: SafeMove board • C: attachment screws (4 pcs)

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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

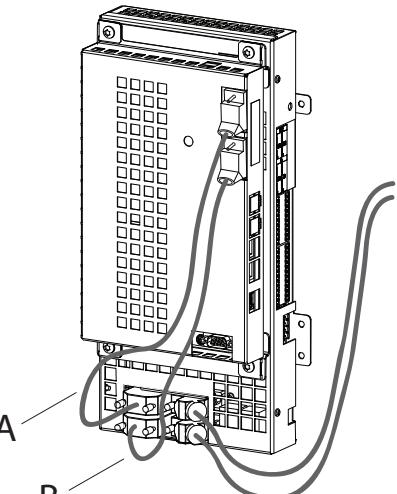
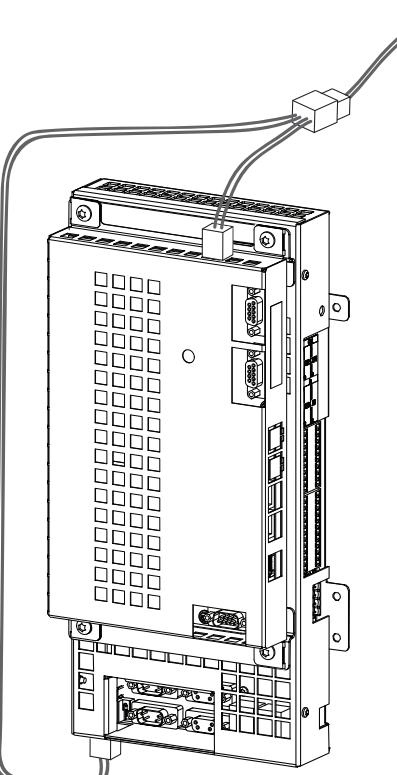
Action	Note/illustration
9 Remove the existing Ethernet cable from the axis computer and connect it to the EPS board. Connect the short Ethernet cable between the SafeMove board and the axis computer.	 xx0800000018
10 Disconnect the SMB cables from the axis computer and connect them to the SafeMove board.	 xx0800000031 <ul style="list-style-type: none">• A: SMB1 cable (robot)• B: SMB2 cable (external axes)

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2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

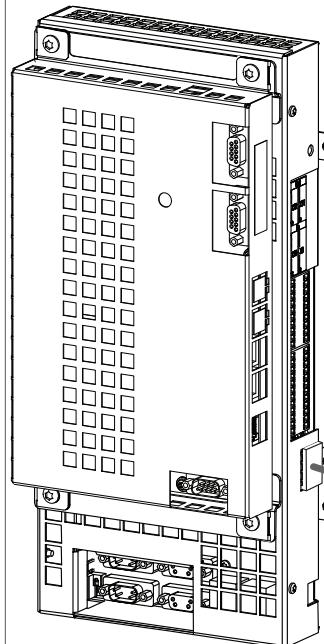
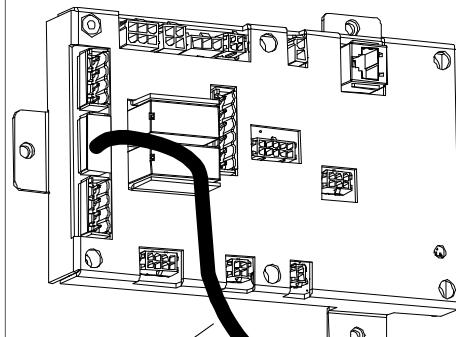
Action	Note/illustration
11	<p>Connect the SMB cables from the SafeMove board to the axis computer.</p>  <p>xx0800000032</p> <ul style="list-style-type: none">• A: SMB1 cable• B: SMB2 cable
12	<p>Disconnect the power cable from the axis computer and connect it to the split cable. Connect the split cable to the SafeMove board and the axis computer.</p>  <p>xx0800000028</p>

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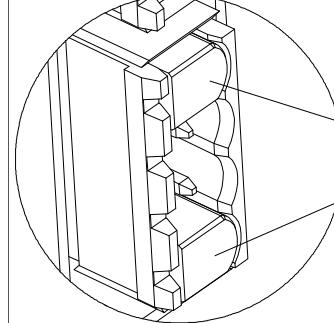
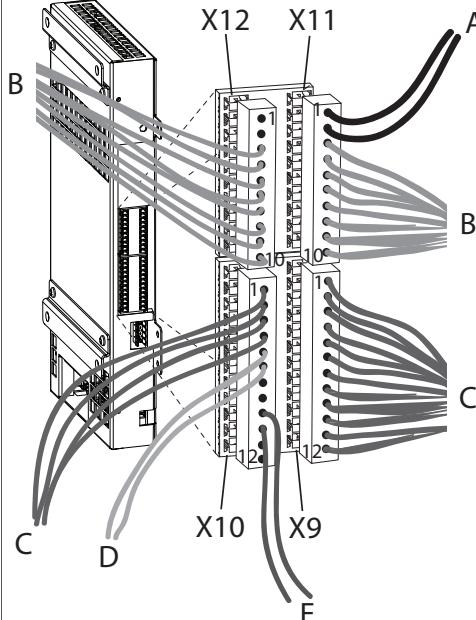
2 Installation and commissioning

2.9.6 Installing the SafeMove board DSQC 647

Continued

	Action	Note/illustration
13	Connect the limit switch cable between the SafeMove board (X13) and the contactor interface board (X21)	<p>SafeMove board:  xx0800000033</p> <p>Contactor interface board:  xx0800000105</p> <ul style="list-style-type: none">A: limit switch cable

Continues on next page

Action	Note/illustration
14 Mount the plugs in the limit switch override contact (X23) at pin 1 and 4 on the contactor interface board.	<p>The limit switch override contact must be plugged and not used when using SafeMove.</p>  <p>xx0800000035</p> <ul style="list-style-type: none"> A: plug (2pcs)
15 Connect signal cables to the plug contacts, which is then connected to the I/O connector of the SafeMove board.	 <p>xx0700000640</p> <ul style="list-style-type: none"> A: Power supply B: 8 safe outputs (16 signals) C: 8 safe inputs (16 signals) D: Sync switch (dual signal) E: Override operation input (dual signal)

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3 Maintenance

3.1 Maintenance schedule, controller IRC5

General

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

Certain activities to be performed as specified in the Maintenance Schedule are not all detailed in this chapter, but in the Repair chapter.

Please refer to the Repair chapter of the equipment in question.

Intervals

Equipment	Maintenance activity	Interval	Note
Complete controller modules	Inspection	12 months *	Inspection of the controller on page 134 .
FlexPendant	Cleaning	When needed	Cleaning the FlexPendant on page 136 .
Emergency stop (operating panel)	Function test	12 months	Function test of emergency stop on page 139
Emergency stop (FlexPendant)	Function test	12 months	Function test of emergency stop on page 139
Mode switch	Function test	12 months	Function test of mode switch on page 140
Enable device	Function test	12 months	Function test of enabling device on page 141
Motor contactors K42, K43	Function test	12 months	Function test of motor contactors K42 and K43 on page 142
Brake contactor K44	Function test	12 months	Function test of brake contactor K44 on page 143
Auto stop (tested if used)	Function test	12 months	Function test of auto stop on page 144
General stop (tested if used)	Function test	12 months	Function test of general stop on page 145
Superior stop (tested if used)	Function test	12 months	Function test of superior stop on page 146
Limit switch (tested if used)	Function test	12 months	Function test of limit switch on page 147
Safety parts	Refurbish	20 years	Refurbish safety parts on page 148

*) The time 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 the controller

3.2 Inspection activities

3.2.1 Inspection of the controller

Inspection

The procedure below describes how to inspect the IRC5 controller.



WARNING

Please observe the following before commencing any repair work on the IRC5 controller, or units connected to the controller:

- Switch off all electric power supplies with the power switch!
- Before handling, make sure you are grounded through a special ESD wrist bracelet or similar. Many components inside the module are sensitive to ESD (ElectroStatic Discharge) and can be destroyed if exposed to discharge.

See the Safety chapter, [WARNING - The unit is sensitive to ESD! on page 42](#)

	Action	Note/Illustration
1	Inspect all sealing joints and cable glands to make sure they are airtight in order to prevent dust and dirt from penetrating into the controller cabinet.	
2	Inspect connectors and cabling to make sure they are securely fastened and cabling not damaged.	
3	Inspect the drive system fans and air channels in the controller to make sure they are clean.	
4	 WARNING The fan unit must not be covered. Check that nothing covers or block the fan unit.	
5	After cleaning: <ul style="list-style-type: none">• Temporarily turn the power supply to the modules on.• Inspect all fans to make sure they function correctly.• Turn the power supply back off.	
6	Replace any malfunctioning fans as described in Replacement of drive system fans on page 203 .	

3.3 Cleaning activities

3.3.1 Cleaning of the controller cabinet

Required equipment

Equipment, etc.	Note
Vacuum cleaner	ESD protected

Internal cleaning

The procedure below details how to clean the interior of the controller.

	Action	Note/Illustration
1	Clean the cabinet interior with a vacuum cleaner if necessary.	

Do's and don'ts!

Always!

- Always use ESD protection.
- Always use cleaning equipment as specified above! Any other cleaning equipment may shorten the life of paint work, rust inhibitors, signs, or labels!
- Always make sure that all protective covers are fitted to the controller before cleaning!

Never!

- Never use compressed air or spray with a high pressure cleaner.
- Never leave the door open when cleaning the exterior.

3 Maintenance

3.3.2 Cleaning the FlexPendant

3.3.2 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 Lock Screen on the ABB menu.	The image shows the ABB menu interface. The "Lock Screen" option is highlighted with a grey background and a white border. 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 vertical list of icons corresponding to the menu items: FlexPendant Explorer (yellow folder), Inputs and Outputs (blue arrow), Jogging (orange play button), Production Window (green person icon), Program Data (blue document icon), Program Editor (red pencil icon), RobotWare Arc (purple wrench icon), Logout (Default User) (orange key icon), and Restart (blue power button). en0400001221

Continues on next page

3.3.2 Cleaning the FlexPendant Continued

Action	Info/Illustration
2 Tap the Lock button in the following window.	 <p>In order to clean the touch screen you need to lock the screen.</p> <p><u>Tap Lock to lock the screen.</u></p> <p style="text-align: center;">Lock</p>  <p>en0400000657</p>
3 When the next window appears, it is safe to clean the screen.	<p>To let you clean the touch screen all keystrokes are now disabled.</p> <p>Tap the two buttons below in sequence to unlock the screen.</p> <p style="text-align: center;">First to Tap</p> <p style="text-align: center;">Second to Tap</p>  <p>en0400000658</p>
4 Clean the touch screen and hardware buttons using a soft cloth and water or a mild cleaning agent.	
5 To unlock the screen, follow the instructions on the screen.	<p>To let you clean the touch screen all keystrokes are now disabled.</p> <p>Tap the two buttons below in sequence to unlock the screen.</p> <p style="text-align: center;">First to Tap</p> <p style="text-align: center;">Second to Tap</p>  <p>en0400000658</p>

Do's and don'ts!

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

Always:

- use ESD Protection

Continues on next page

3 Maintenance

3.3.2 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.

3.4 Function tests

3.4.1 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 Maintenance

3.4.2 Function test of mode switch

3.4.2 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.

3.4.3 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 Maintenance

3.4.4 Function test of motor contactors K42 and K43

3.4.4 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.

3.4.5 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 is disengaged and the manipulator can be moved. If the Event message "50056 Joint collision" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.
3	Release the 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 Maintenance

3.4.6 Function test of auto stop

3.4.6 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.

3.4.7 Function test of general stop**Performing the function test**

	Action	Note
1	Start the robot system.	
2	Activate the general stop.	The test is passed if the event message “20206 General stop open” appears in the FlexPendant log. If the event message “20206 General stop open” does not appear or if the event message “20226 General stop conflict” appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.

3 Maintenance

3.4.8 Function test of superior stop

3.4.8 Function test of superior stop

Performing the function test

	Action	Note
1	Start the robot system.	
2	Activate the superior stop.	<p>The test is passed if the event message “20215 Superior stop open” appears in the FlexPendant log.</p> <p>If the event message “20215 Superior stop open” does not appear or if the event message “20220 Superior stop conflict” appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.</p>

3.4.9 Function test of limit switch

Testing limit switches on manipulator

This must be tested on all the axes that has mounted limit switches.

	Action	Note
1	Start the robot system.	
2	Jog the axis under test to the limit switch activation position.	The test is passed if the event message "20214 Limit switch open" appears in the FlexPendant log when the axis reaches the limit switch activation position. If the event message "20214 Limit switch open" does not appear or if the event message "20222 Limit switch conflict" appears in the FlexPendant log, the test is failed and the root cause of the failure must be found.
3	After the test the robot must be jogged out of the limit switch activation position again. This is done by jogging the robot after pressing the limit switch override push button. See Connecting a Limit switch override push button on page 95 .	

Testing limit switches for a SafeMove system

Perform validation of the function Safe Axis Speed. See *Application manual - SafeMove*. If this test is passed the limit switch works as intended.

3 Maintenance

3.5.1 Refurbish safety parts

3.5 Refurbish

3.5.1 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.

4 Repair

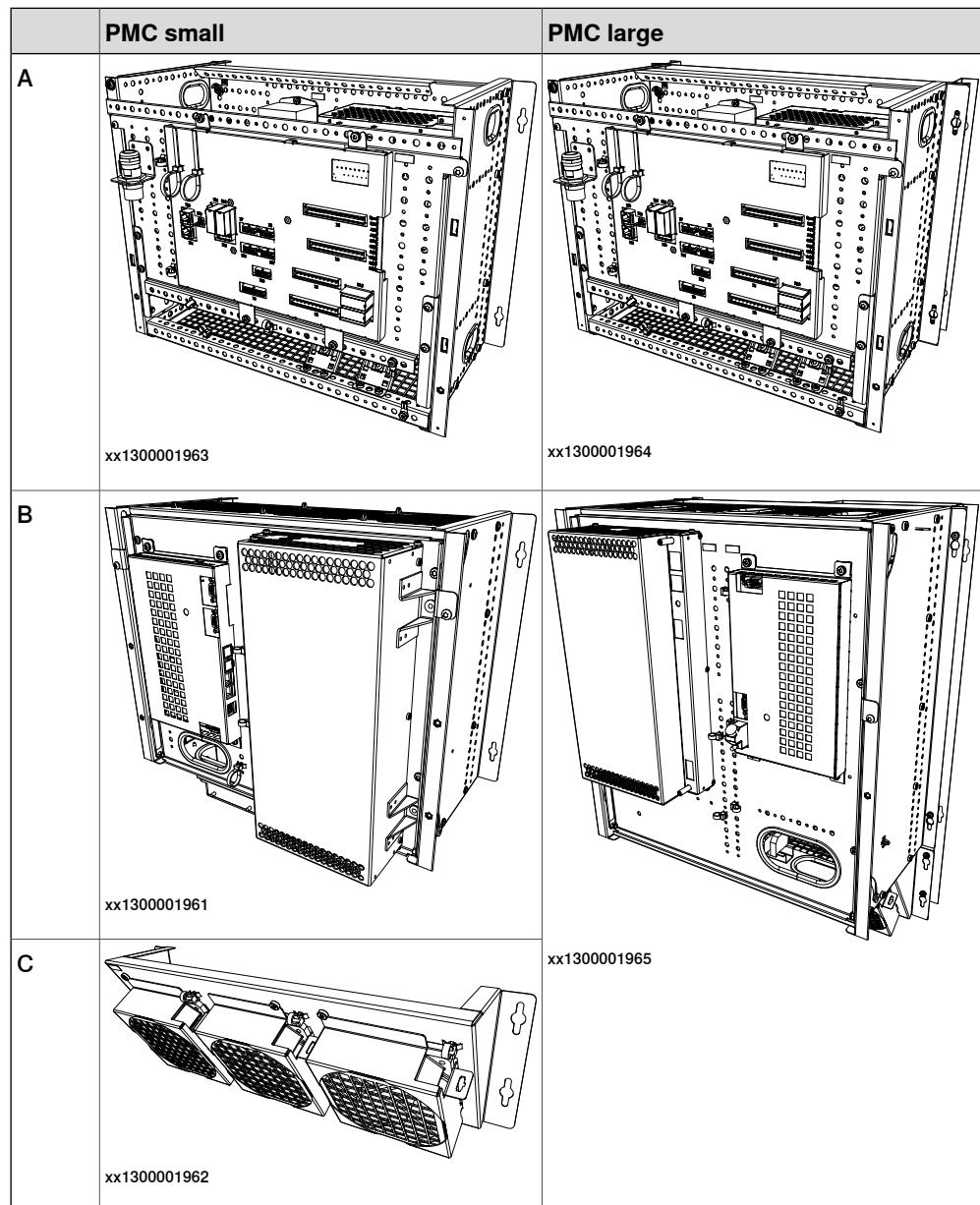
4.1 Overview

General

There are two versions of the IRC5 Panel Mounted Controller. PMC small is used for small robots and PMC large is used for large robots. The controller always consists of one control module and one drive module.

The control module contains the computer unit, communication interfaces, FlexPendant connection, service ports and also the system software which includes all basic functions for operation and programming.

The drive module contains the drive system.



Continues on next page

4 Repair

4.1 Overview

Continued

A	Control module (with air channel for PMC large).
B	Drive module (different design for PMC small and PMC large).
C	Fan unit (for PMC large this is a part of the drive module).



Note

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

- the serial number
- article number
- revision

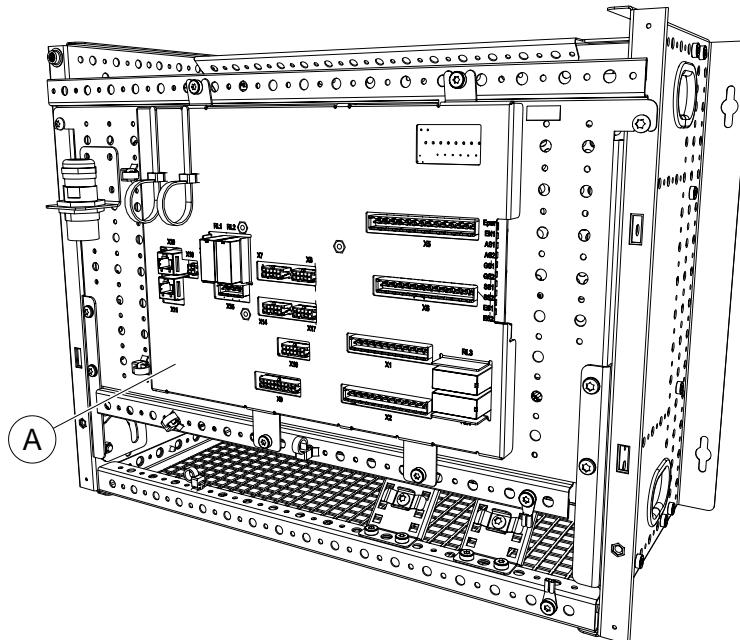
of both the replaced unit and the replacement unit.

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

4.2 Replacement of panel board

Location

The panel board unit, DSQC 643, is located as shown in the illustration below.



xx1300001948

A	Panel board unit
---	------------------

Required equipment

Equipment	Note
Panel board unit	DSQC 643 See Spare parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit!
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Removal

The procedure below details how to remove the panel board unit.

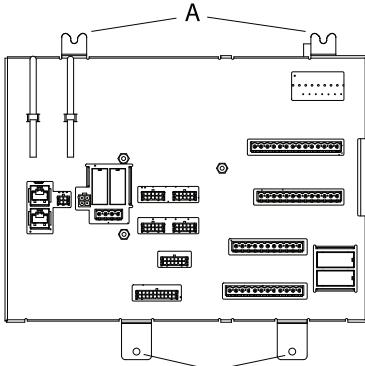
	Action	Note/Illustration
1	DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	

Continues on next page

4 Repair

4.2 Replacement of panel board

Continued

Action	Note/Illustration
<p>2</p>  xx0200000023  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	
<p>3</p> Disconnect all connectors.	 Note Make a note of any connections.
<p>4</p> Remove the lower attachment screws, and remove the Panel Unit.	 xx0600003227 <ul style="list-style-type: none"> • A: fixed attachments • B: hole for attachment screw

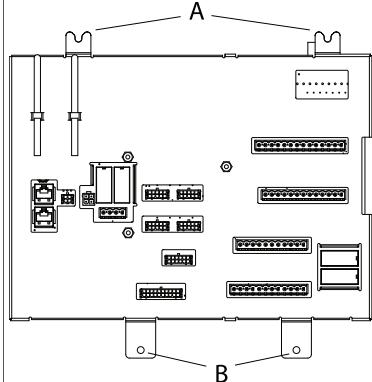
Refitting

The procedure below details how to refit the panel board unit.

Action	Note/Illustration
<p>1</p>  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
<p>2</p>  xx0200000023  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	

Continues on next page

4.2 Replacement of panel board*Continued*

	Action	Note/Illustration
3	Refit the panel board unit.	
4	Refit the lower attachment screws.	 xx0600003227 <ul style="list-style-type: none">• A: fixed attachments• B: hole for attachment screw
5	Reconnect all connectors.	

4 Repair

4.3 Replacement of I/O units and Gateways

4.3 Replacement of I/O units and Gateways

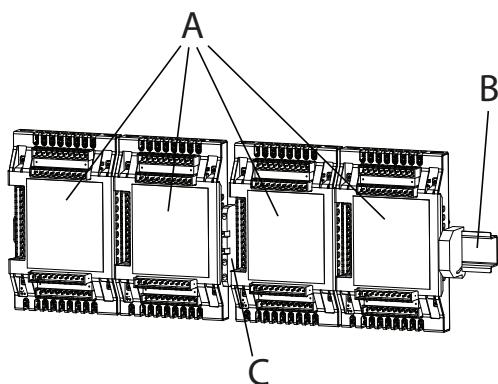
General

A number of I/O units and gateway units may be installed in the controller. These are specified in [Definition of I/O units, IRC5 on page 106](#).

How to configure the I/O units is detailed in [Operating manual - RobotStudio](#).

Location

The location of the I/O units, gateway units, or encoder interface units are shown in the illustration below.



xx0600003256

A	I/O units, Gateways or Encoder interface units
B	Mounting rail
C	Connection terminal XT31

Required equipment

Equipment	Note
A number of units are available.	Specified in section Definition of I/O units, IRC5 on page 106 .
Standard toolkit	The contents are defined in section Standard toolkit!
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

Removal

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

Action	Note/illustration
 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3 Identify the I/O unit or gateway unit to be replaced.	
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.	

Refitting

The procedure below details how to refit the I/O units or gateway units.

Action
 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .
 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 42</i>
3 Hook the unit back onto the mounting rail and snap it gently in position.
4 Reconnect all connectors disconnected during removal.

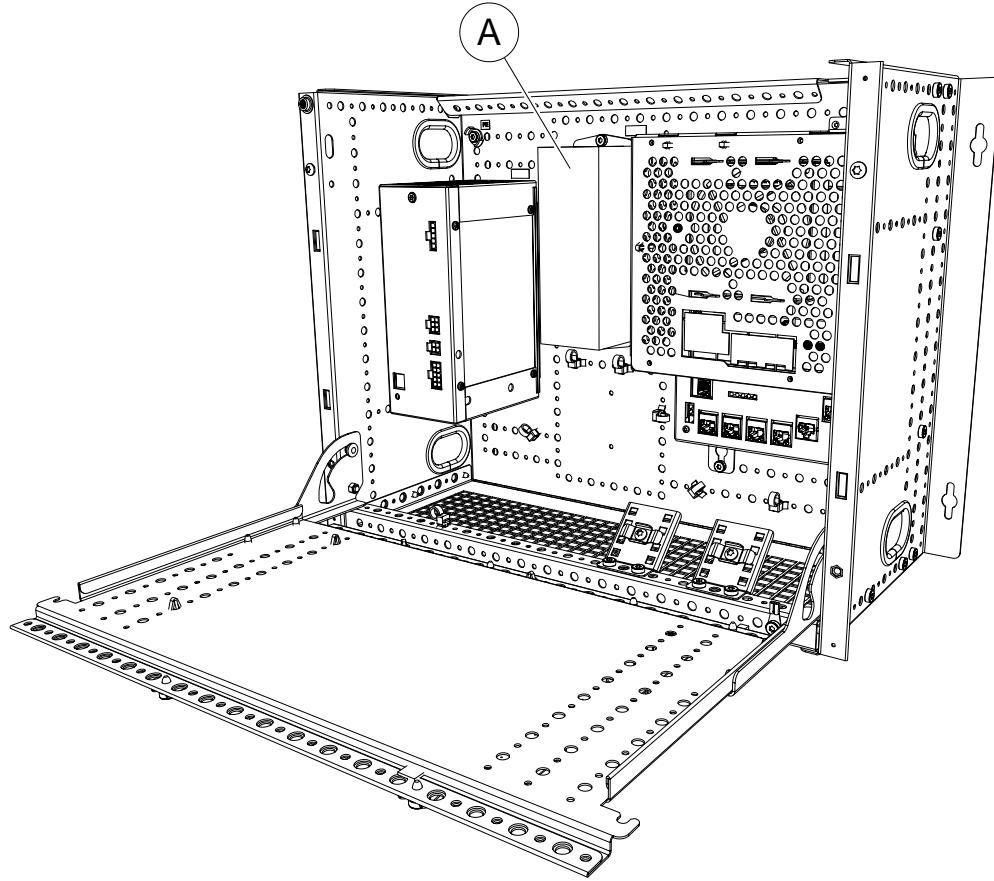
4 Repair

4.4 Replacement of backup energy bank

4.4 Replacement of backup energy bank

Location

The illustration below shows the location of the backup energy bank in the IRC5 controller.



xx1300001949

A	Backup energy bank
---	--------------------

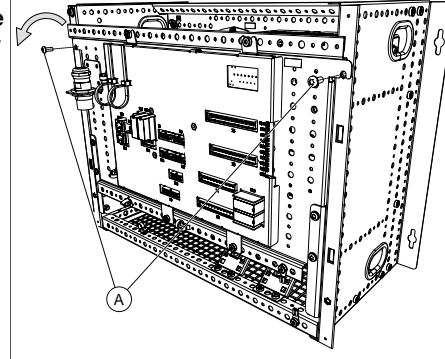
Required equipment

Equipment	Note
Backup energy bank	DSQC 655 See Control module parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

Removal

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

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 41.	
2 Remove the attachment screws and pull the front with the Panel Board Unit in the arrow direction.	 xx1300001950 A attachment screws
3 Disconnect the connector X4 from the distribution board.	
4 Remove the <i>attachment screw</i> .	
5 Pull the <i>backup energy bank</i> out.	

Refitting

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

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 41.	
2 Refit the new backup energy bank.	
3 Refit and tighten the <i>attachment screw</i> .	
4 Reconnect the connector to the <i>control power supply</i> connector X4.	
5 Refit the front with the Panel Board Unit.	

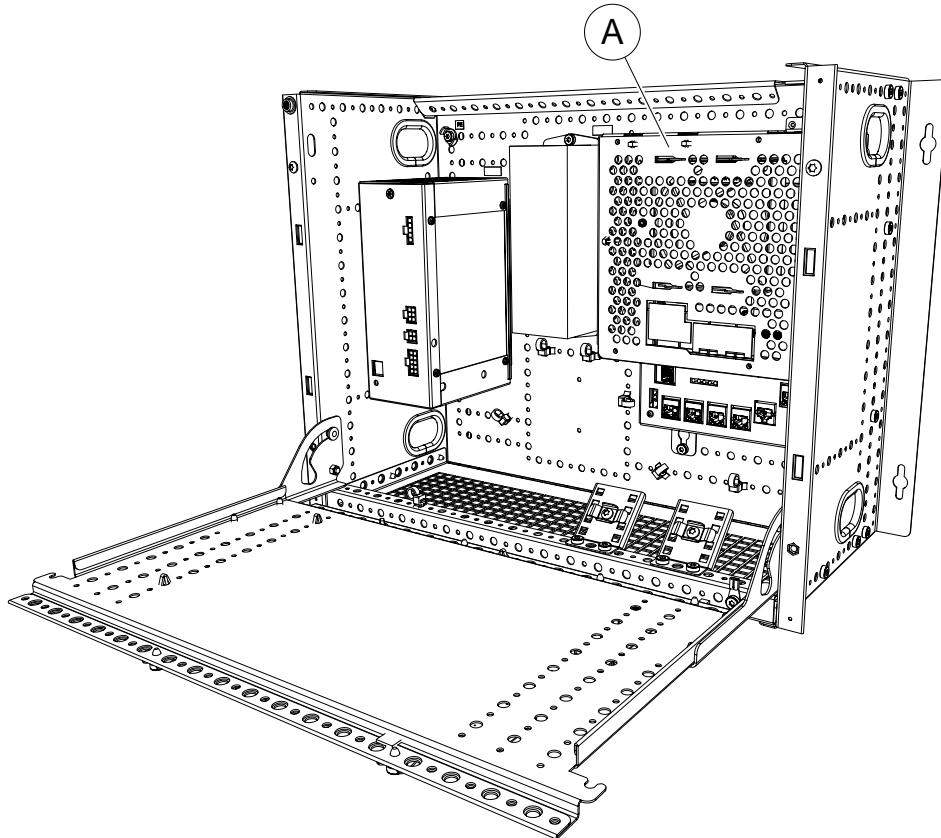
4 Repair

4.5 Replacement of computer unit

4.5 Replacement of computer unit

Location

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



xx1300001951

A	Computer unit
---	---------------

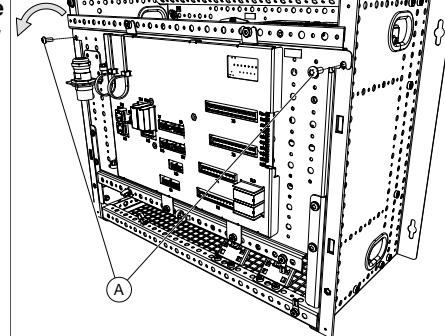
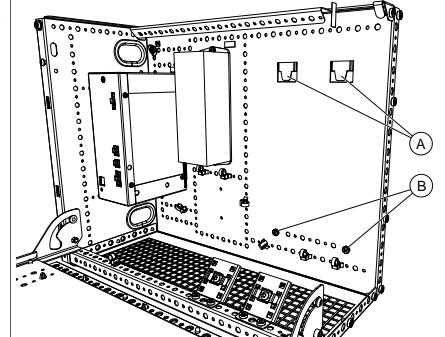
Required equipment

Equipment	Note
Computer unit	DSQC1018 (or DSQC1000) See Spare parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

Removal

The procedure below details how to remove the computer unit.

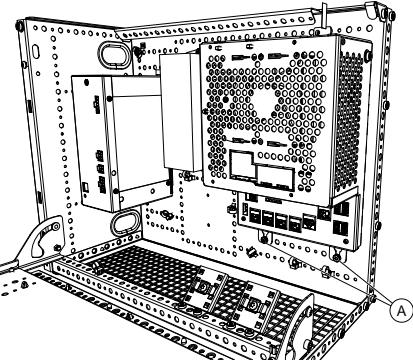
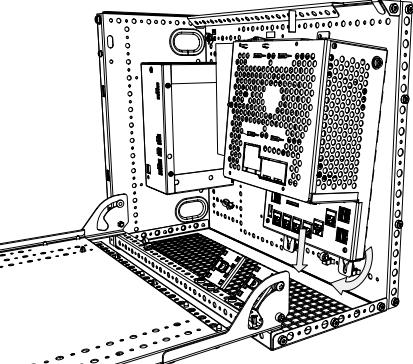
Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	
3 Disconnect all connectors from the computer unit.	
4 Remove the attachment screws and pull the front with the Panel Board Unit in the arrow direction.	 xx1300001950 A attachment screws
5 The computer unit is suspended by latches and attachment screws.	 xx1300001952 A Latches B Attachment screws

Continues on next page

4 Repair

4.5 Replacement of computer unit

Continued

Action	Note/illustration
6 Support the computer unit beneath by hand and loosen the attachment screws.	 xx1300001953 <p style="text-align: center;">A Attachment screws</p>
7 Pull the computer unit in the arrow direction.	 xx1300001954 <p style="text-align: center;"> WARNING Prevent the computer unit from falling down due to gravity by supporting the computer unit from beneath by hand. </p>

Refitting

The procedure below details how to refit the computer unit.

Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	

Continues on next page

	Action	Note/illustration
3	Fit the computer unit in position	
4	Tighten the attachment screws.	
5	Reconnect all connectors to the computer unit.	
6	Refit the front with the Panel Board Unit.	

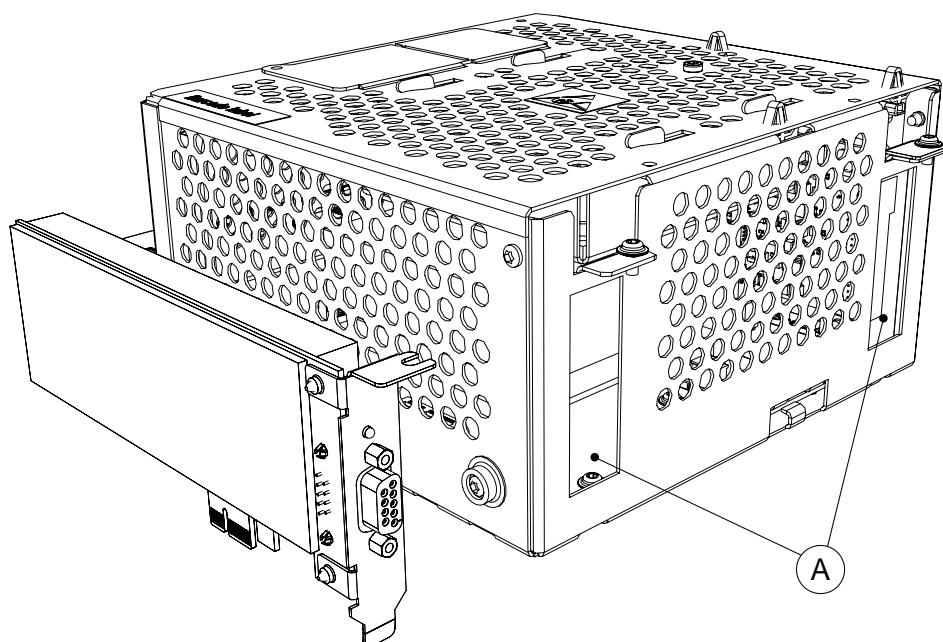
4 Repair

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 Standard toolkit, IRC5 on page 235 .
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.

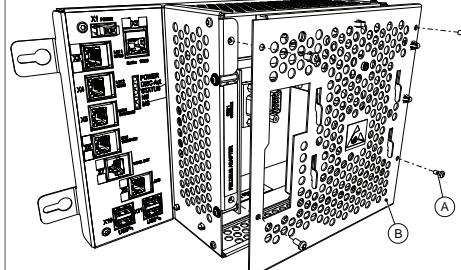
Continues on next page

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 251</i> .	

Removal

The procedure below details how to remove a PClexpress board.

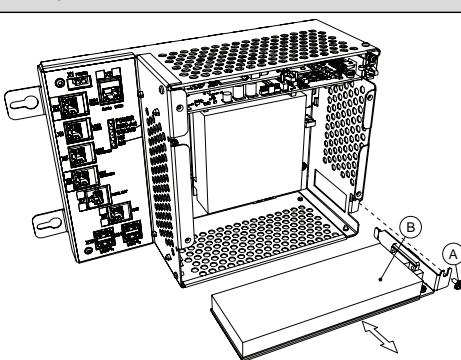
	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	
3	Disconnect any cables to/from the PClexpress board.	 Tip Make a note of which cables are disconnected.
4	CAUTION Open the computer unit by removing the attachment screws and lift off the upper cover. Disconnect the fan connector. 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

Continues on next page

4 Repair

4.6 Replacement of PClexpress boards in the computer unit

Continued

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

Refitting

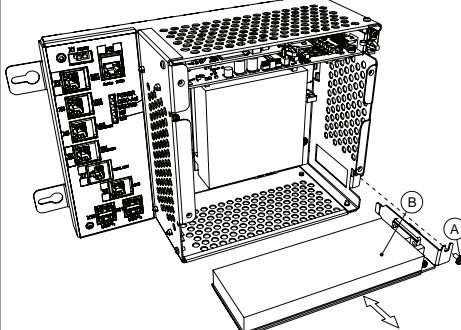
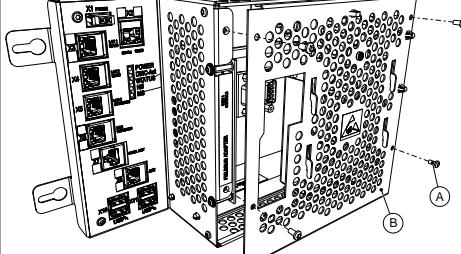
The procedure below details how to refit a PClexpress board.

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	

Continues on next page

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>! CAUTION 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. ! CAUTION 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 Make sure the robot system is configured to support the installed PClexpress board.	

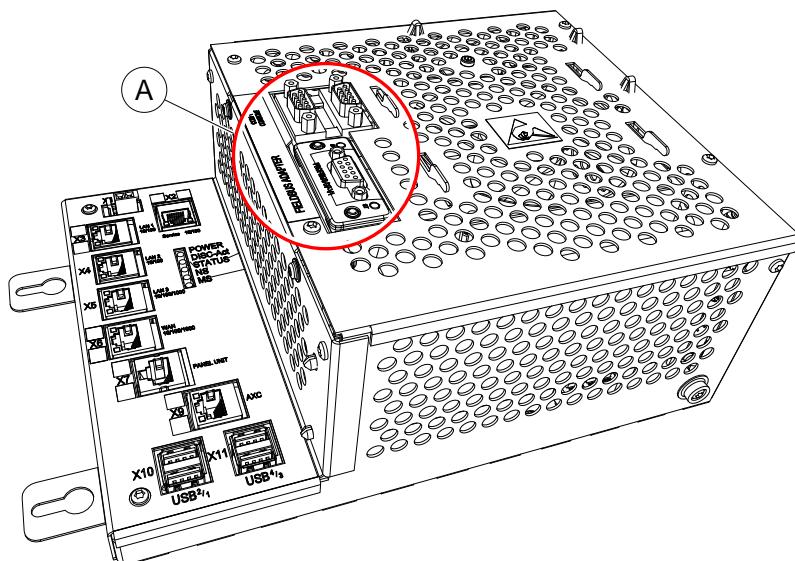
4 Repair

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

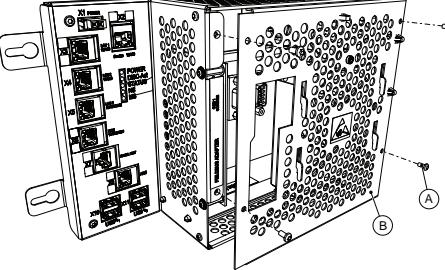
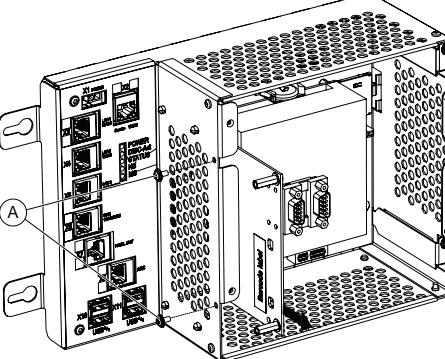
Equipment	Art. no.	Note
Expansion Board complete	3HAC046408-001	DSQC1003
Standard toolkit		The contents are described in section Standard toolkit, IRC5 on page 235 .

Continues on next page

4.7 Replacement of expansion board in the computer unit

*Continued***Removal**

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

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	
3 Disconnect any cables to/from the fieldbus adapter.	
4 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
5 If there is a fieldbus adapter, remove it.	See Replacement of fieldbus adapter in the computer unit on page 169 .
6 Remove the attachment screws on the computer unit.	 xx1300000859 A Attachment screws (2 pcs)

Continues on next page

4 Repair

4.7 Replacement of expansion board in the computer unit

Continued

Action	Note/Illustration
7 Grip the expansion board and gently pull it straight out.	 CAUTION Always grip the expansion board around the edges to avoid damage to the board or its components.

Refitting

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

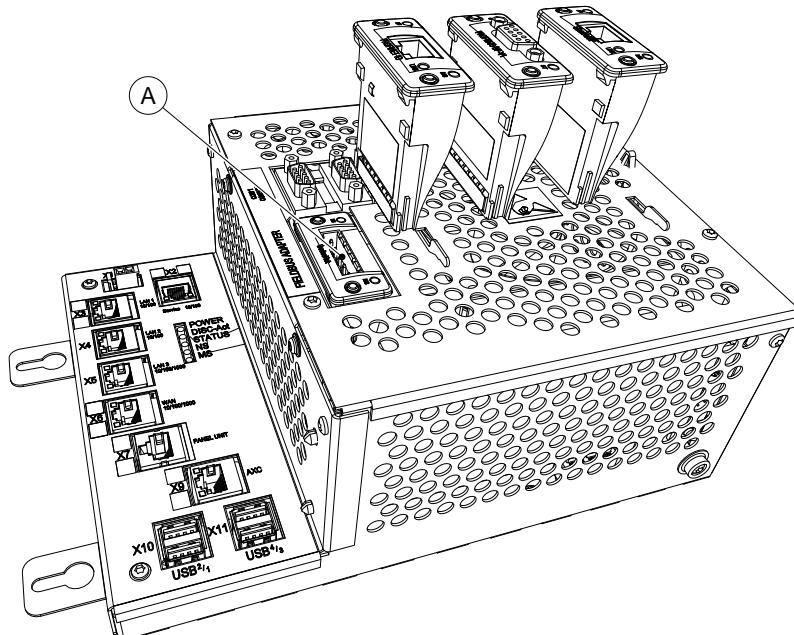
Action	Note/Illustrator
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	
3 Fit the expansion board in position by pushing the expansion board into the connector on the motherboard.  CAUTION Push carefully so no pins are damaged. Make sure that the expansion board is pushed straight into the connector.	 CAUTION Always grip the expansion board around the edges to avoid damage to the board or its components.
4 Secure the expansion board in the computer unit with the attachment screws.	
5 Refit the fan connector and close the computer unit.  CAUTION Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.	
6 Reconnect any cable to the fieldbus adapter.	

4.8 Replacement of fieldbus adapter in the computer unit

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 Repair

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 Standard toolkit, IRC5 on page 235 .

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 Circuit diagrams on page 251 .	

Removal

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

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	
3	Disconnect any cables to/from the fieldbus adapter.	

Continues on next page

4.8 Replacement of fieldbus adapter in the computer unit

Continued

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

Continues on next page

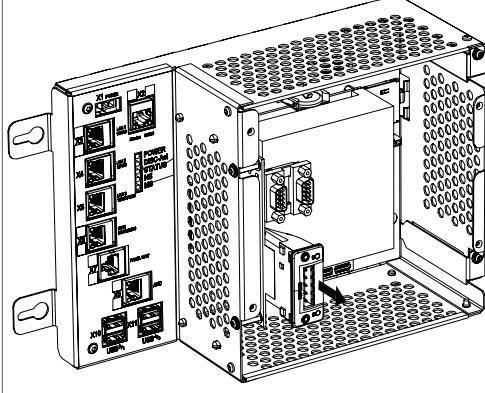
4 Repair

4.8 Replacement of fieldbus adapter in the computer unit

Continued

Refitting

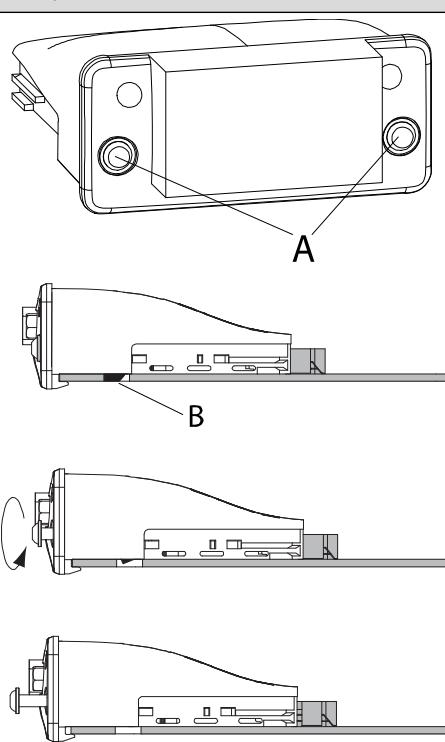
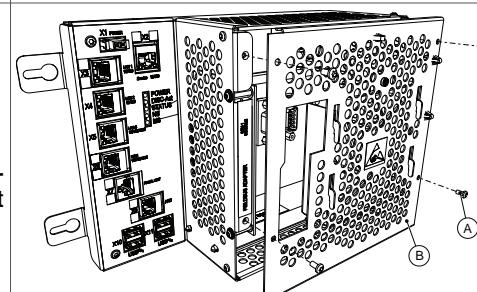
The following procedure details how to refit the fieldbus adapter in the computer unit.

Action	Note/Illustrator
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3  CAUTION Push carefully so no pins are damaged. Make sure that the adapter is pushed straight onto the rails.	 xx1300000686  CAUTION Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.

Continues on next page

4.8 Replacement of fieldbus adapter in the computer unit

Continued

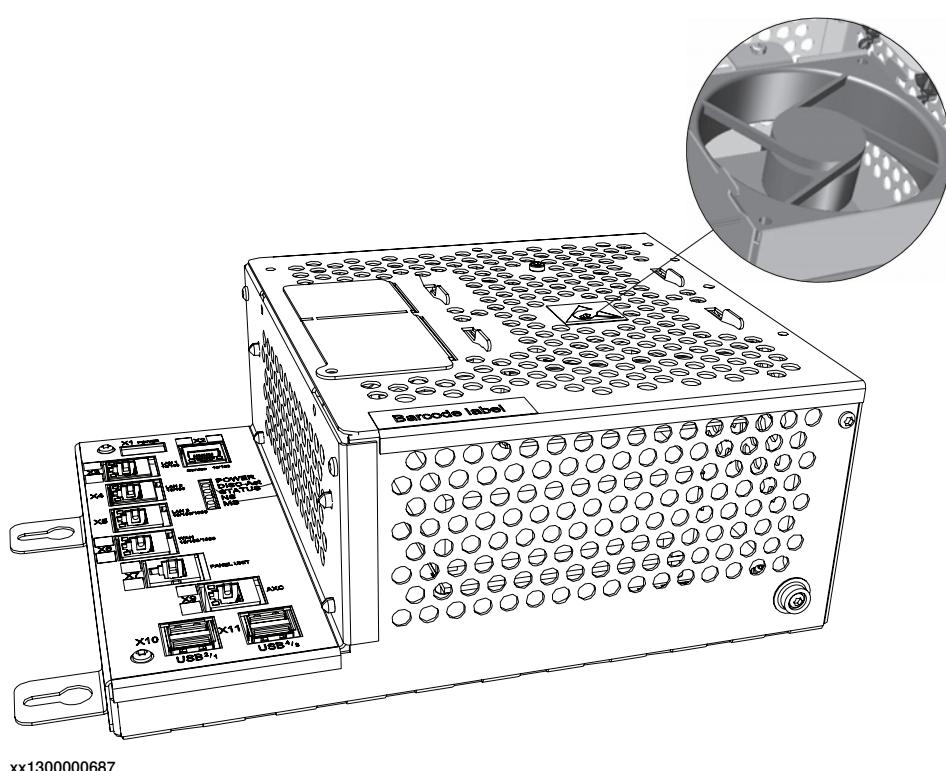
Action	Note/Illustrator
4 Secure the fieldbus adapter with its attachment screws (2 pcs).	 <p>xx0700000193</p> <p>A Attachment screws (2 pcs) B Fastening mechanism</p>
5 Refit the fan connector and close the computer unit.	<p>! CAUTION</p> <p>Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.</p>  <p>xx1300000684</p> <p>A Attachment screws (4 pcs.) B Upper cover</p>
6 Reconnect the cable to the fieldbus adapter.	
7 Make sure the robot system is configured to reflect the fieldbus adapter installed.	

4 Repair

4.9 Replacement of fan in computer unit

Location

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



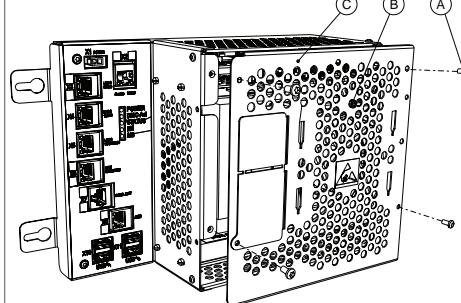
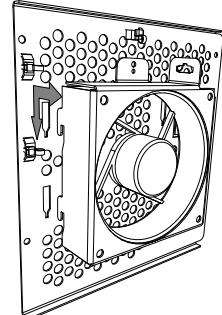
Required equipment

Equipment	Note
Fan	See Spare parts on page 237 .
Cable straps	
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

Removal

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

	Action	Note/Illustration
1	 DANGER <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.</p>	
2	 ELECTROSTATIC DISCHARGE (ESD) <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42</p>	
3	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
4	Disconnect the fan connector and remove the cable straps.	 CAUTION <p>Be careful with the fan cable when opening and removing the upper cover. The fan cable must not be stretched.</p>
5	Remove the fan attachment screw.	
6	Remove the fan from the upper cover.	 xx1300000806

Continues on next page

4 Repair

4.9 Replacement of fan in computer unit

Continued

Refitting

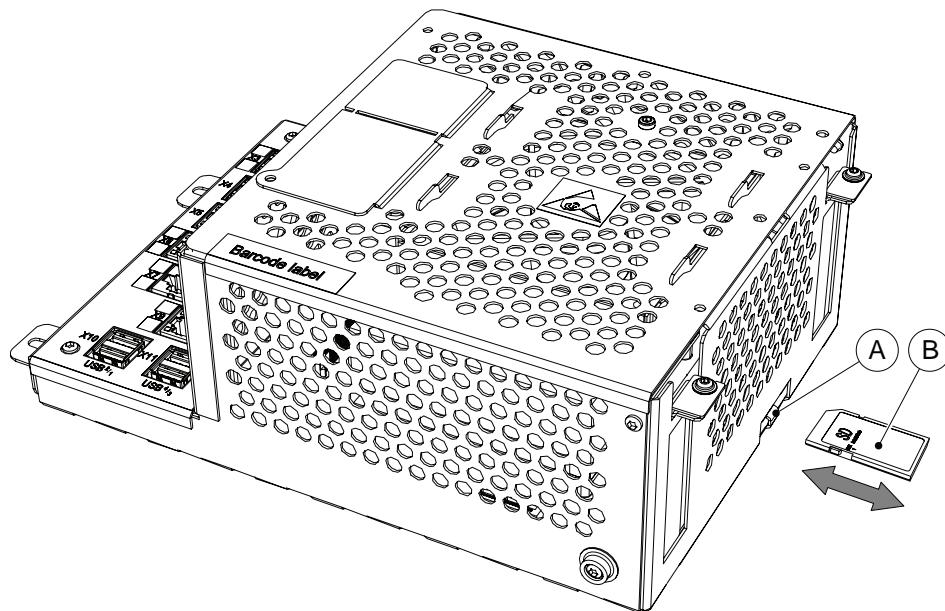
The procedure below details how to refit the fan in the computer unit.

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3 Refit the fan on the upper cover.	
4 Refit the attachment screw.	
5 Strap the fan cable to the upper cover.	 CAUTION When strapping the cable make sure that the cable is not stretched or squeezed, and that the cable does not get caught in the fan.
6 Refit the fan connector and close the computer unit.	 CAUTION Be careful with the fan cable when closing the upper cover. The fan cable must not be squeezed.

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.



xx1300000807

A	Slot for SD-card memory
B	SD-card memory



Note

Only use SD-card memory supplied by ABB.

Required equipment

Equipment	Note
SD-card 2GB	DSQC1008 2GB See Spare parts on page 237 . 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 Standard toolkit, IRC5 on page 235 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

4 Repair

4.10 Replacement of SD-card memory in computer unit

Continued

Removal

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

Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3 Gently push the SD-card memory with your finger until it clicks, and then pull it straight out.	

Refitting

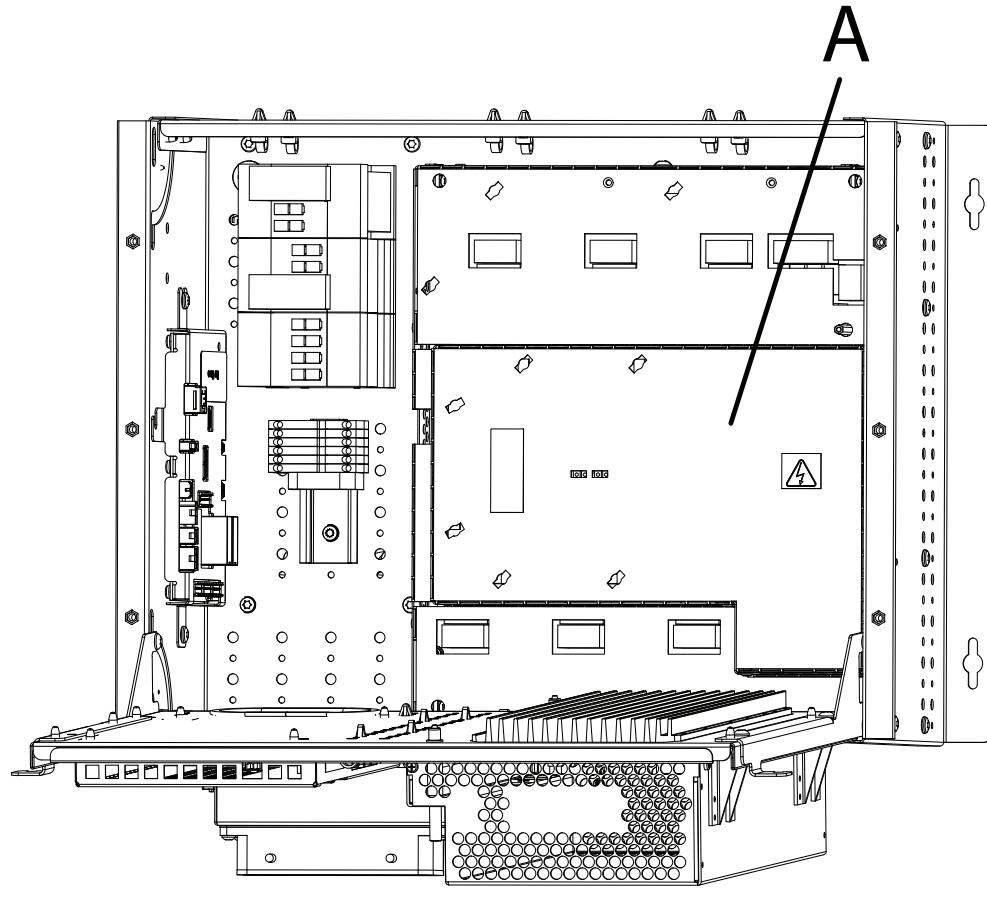
Use the following procedure to refit the SD-card memory.

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please observe the safety information in section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3  CAUTION Make sure that the SD-card memory is correctly oriented before inserting it. Otherwise the SD-card memory or the SD-card memory slot may be damaged.	
4 Gently push the SD-card memory with your finger until it clicks into place.	

4.11 Replacement of drive unit for PMC small

Location

The illustration below shows the location of the drive unit in PMC small.



Required equipment

Equipment	Note
Main Drive Unit	See Drive module parts for PMC small on page 238 .
Standard toolkit	The contents are defined in section Standard toolkit, IRC5 on page 235 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

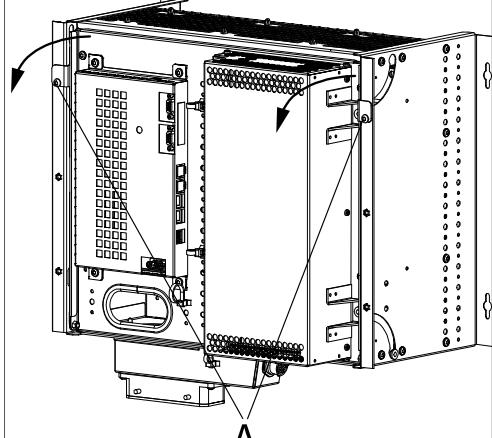
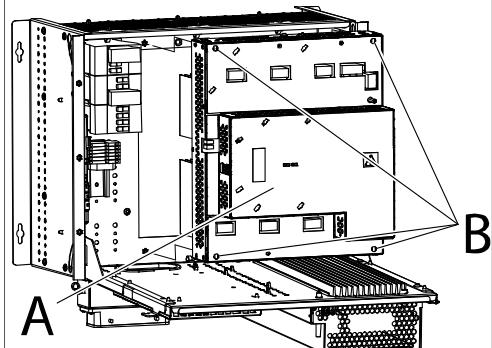
4 Repair

4.11 Replacement of drive unit for PMC small

Continued

Removal

The procedure below details how to remove the drive unit from PMC small.

Action	Note/illustration
1	<p> DANGER</p> <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.</p>
2	<p>Loosen the attachment screws and pull the front (axis computer/drive system power supply unit) in the arrow direction.</p>  <p>xx0600003242</p> <ul style="list-style-type: none">A: attachment screws
3	<p>Disconnect all connectors from the unit to be replaced.</p>
4	<p>Remove the drive unit after unscrewing its <i>attachment screws</i> .</p>  <p>xx0600003248</p> <p>Parts:</p> <ul style="list-style-type: none">A: drive unitB: attachment screws

Continues on next page

Refitting

The procedure below details how to refit the drive unit to PMC small.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2	Fit the unit in its intended position and orientation. Secure it with its <i>attachment screws</i> .	
3	Reconnect any connectors disconnected at removal.	
4	Refit the front (axis computer/drive system power supply unit)	

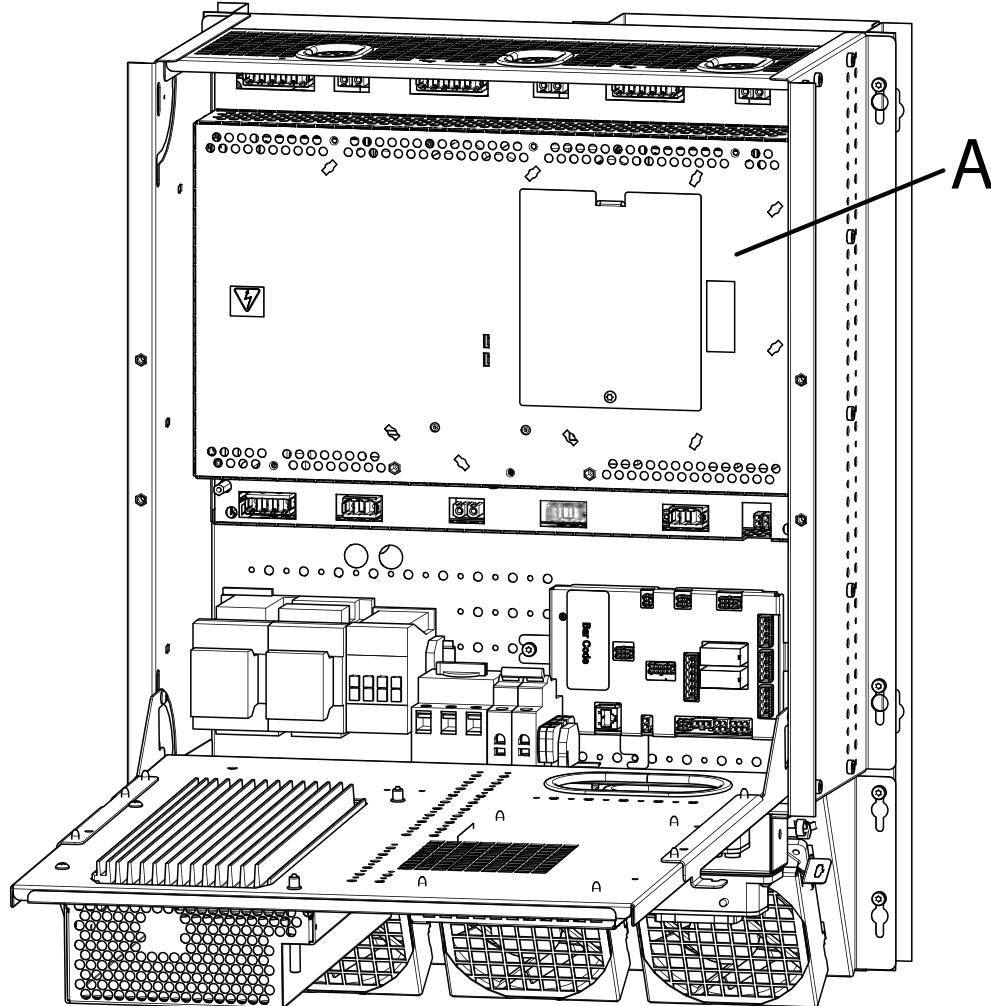
4 Repair

4.12 Replacement of Main Drive Unit for PMC large

4.12 Replacement of Main Drive Unit for PMC large

Location

The illustration below shows the location of the Main Drive Unit in PMC large.



A Main Drive Unit

Required equipment

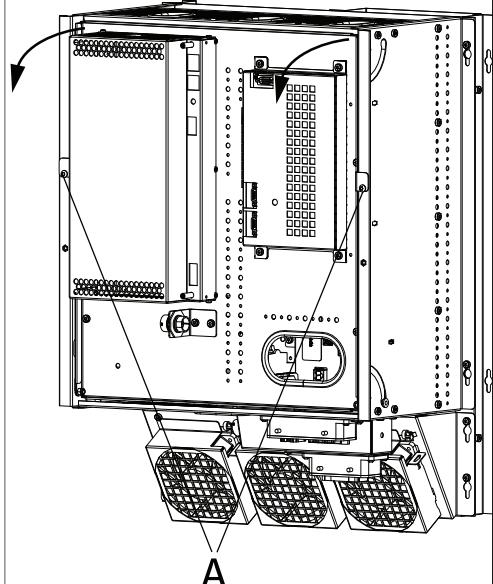
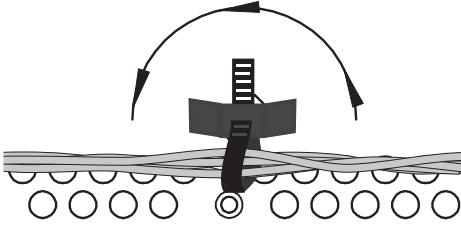
Equipment	Note
Main Drive Unit	See Drive module parts for PMC large on page 239 .
Standard toolkit	The contents are defined in section Standard toolkit, IRC5 on page 235 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

4.12 Replacement of Main Drive Unit for PMC large *Continued*

Removal

The procedure below details how to remove the Main Drive Unit from PMC large.

	Action	Note/illustration
1	 DANGER <p>Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.</p>	
2	<p>Loosen the attachment screws and pull the front (axis computer/drive system power supply unit) in the arrow direction.</p>	 xx1100000488 <ul style="list-style-type: none"> A: attachment screws
3	<p>Disconnect all connectors and remove all cables from the unit to be replaced.</p>	 Tip <p>Loosen the cable from the Main Drive Unit by turning the cable straps in the arrows direction.</p>  xx1100000560

Continues on next page

4 Repair

4.12 Replacement of Main Drive Unit for PMC large

Continued

Action	Note/illustration
4 Remove the drive unit after unscrewing its <i>attachment screws</i> .	<p>xx1100000489</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: drive unit • B: attachment screws

Refitting

The procedure below details how to refit the Main Drive Unit to PMC large.

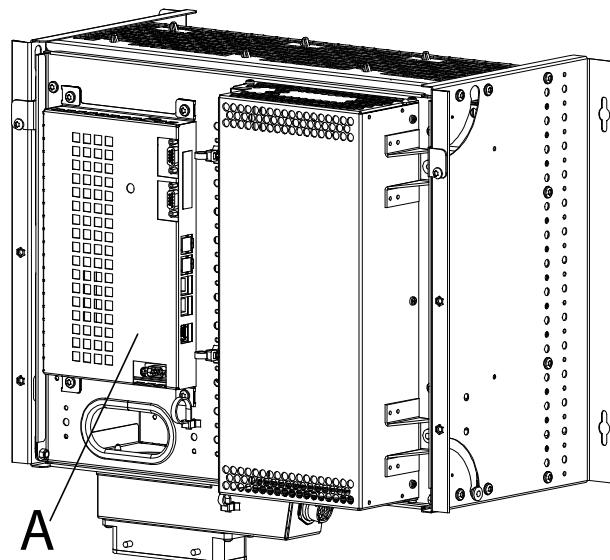
Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2 Fit the unit in its intended position and orientation. Secure it with its <i>attachment screws</i> .	
3 Reconnect any connectors disconnected at removal.	
4 Refit the front (axis computer/drive system power supply unit)	

4.13 Replacement of Axis computer

Location

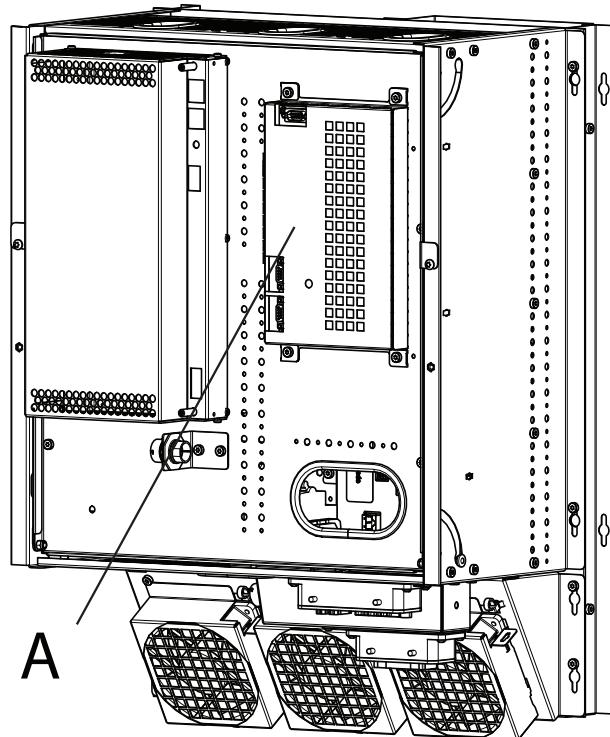
The illustration below shows the location of the axis computer in the controller.

PMC small:



xx0600003240

PMC large:



xx1100000492

Continues on next page

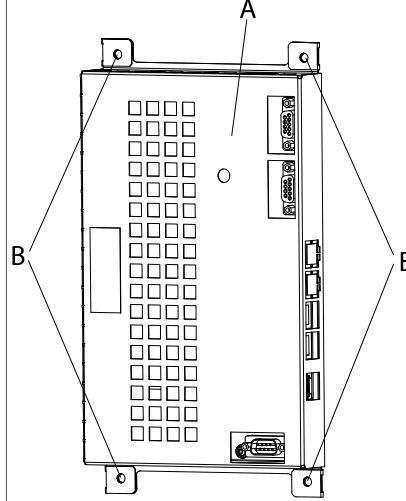
4 Repair

4.13 Replacement of Axis computer

Continued

Removal

The procedure below details how to remove the axis computer.

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	
3 Disconnect all connectors from the axis computer.	 Tip Make a note of the connections.
4 Remove the attachment screws.	 <ul style="list-style-type: none">• A: axis computer• B: attachment screws
5 Remove the axis computer.	

Continues on next page

Refitting

The procedure below details how to refit the axis computer.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41.</i>	
2	Fit the new axis computer.	
3	Refit the attachment screws.	
4	Reconnect all the connectors.	

4 Repair

4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches

4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches

General

An Electronic Position Switches safety controller, EPS board, is mounted if the option Electronic Position Switches is used.



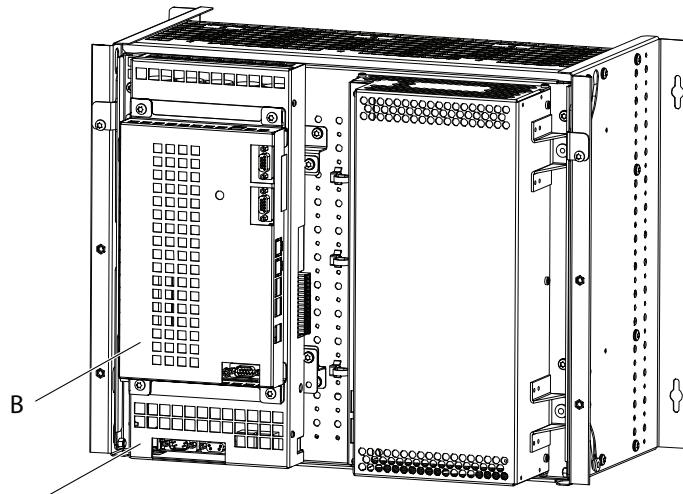
Note

After replacement of the safety controller, the Electronic Position Switches configuration must be downloaded to the new safety controller and then validated. For more information, see *Application manual - Electronic Position Switches*.

Location

The EPS board is mounted behind the axis computer.

PMC small:



xx1000000979

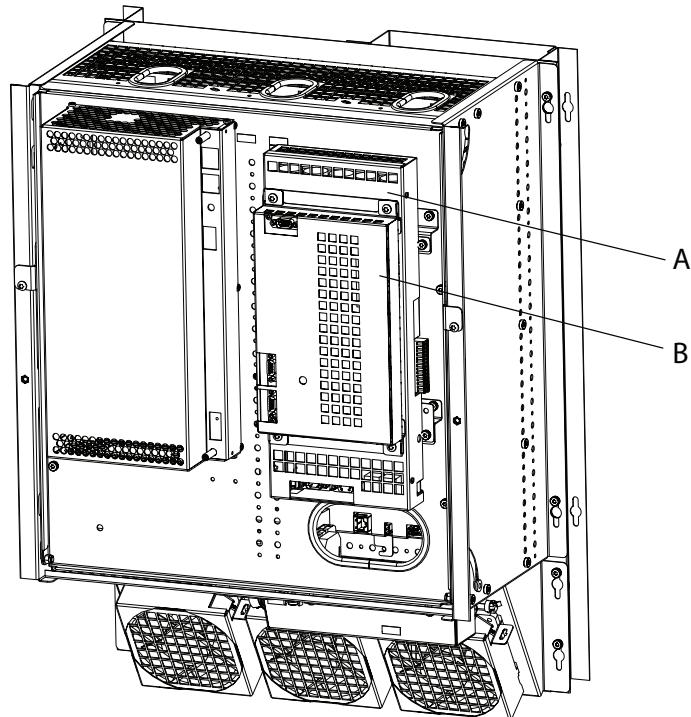
A	EPS board
B	Axis computer

Continues on next page

4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches

Continued

PMC large:



xx1100000483

A	EPS board
B	Axis computer

Removal

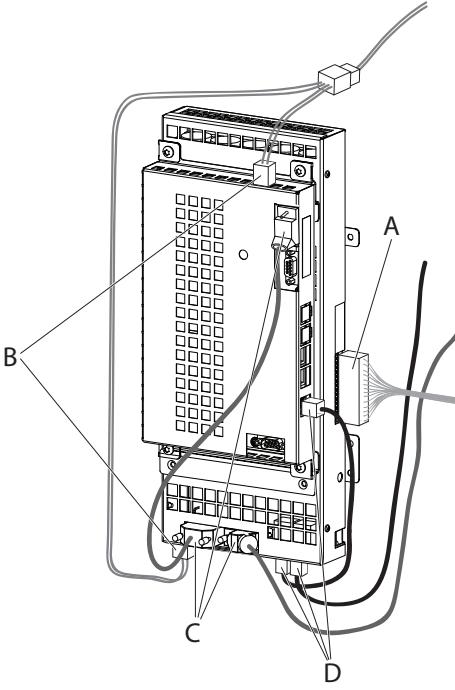
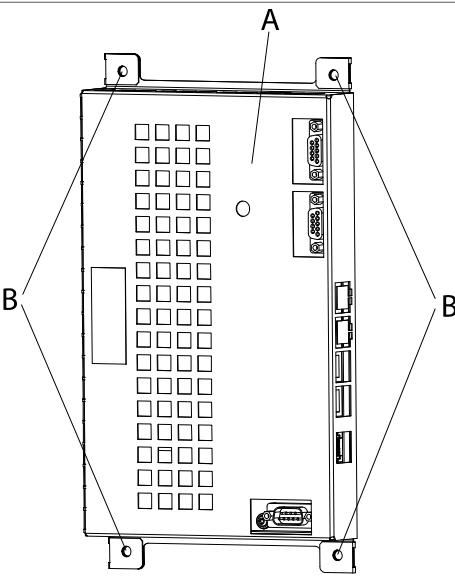
	Action	Note/illustration
1	 DANGER Before any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2	 WARNING The unit is sensitive to ESD, before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42	

Continues on next page

4 Repair

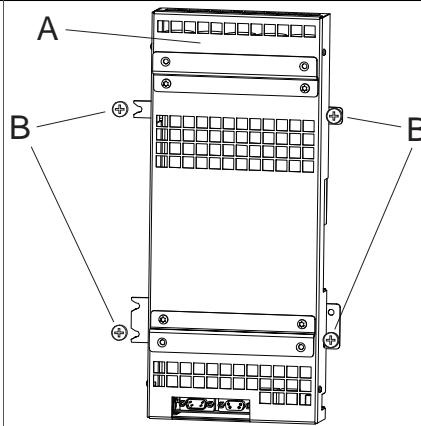
4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches

Continued

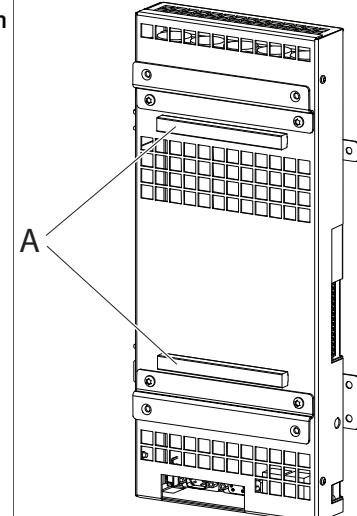
Action	Note/illustration
3 Disconnect the following cables connected to the EPS board and axis computer: <ul style="list-style-type: none"> • Plug contact in I/O connector • Power cables • SMB cables • Ethernet cables 	 <p>xx0700000101</p> <p>A: Plug contact in I/O connector B: Power cables C: SMB cables D: Ethernet cables</p>
4 Remove the attachment screws of the axis computer and remove the axis computer.	 <p>xx0900000030</p> <ul style="list-style-type: none"> • A: axis computer • B: attachment screws

Continues on next page

4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches
Continued

Action	Note/illustration
5 Remove the attachment screws of the EPS board and remove the EPS board.	 <p>xx0600003204</p> <ul style="list-style-type: none"> • A: EPS board • B: attachment screws

Refitting

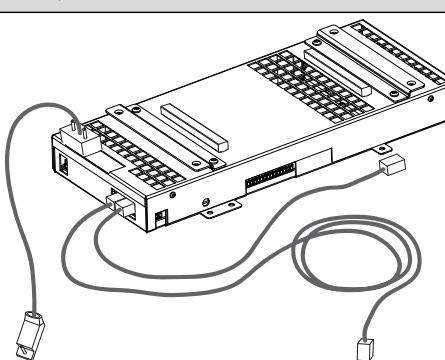
Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2  WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	
3 If not already in place, fit the EMC strips on the EPS board.	 <p>xx0700000087</p>

Continues on next page

4 Repair

4.14 Replacement of EPS board DSQC 646 for Electronic Position Switches

Continued

Action	Note/illustration
<p>4 Connect the short SMB cable and both Ethernet cables to the EPS board before mounting the board. These connections may be difficult to reach once the board is mounted.</p> <p>The two Ethernet connectors on the EPS board are interchangeable (it does not matter which is connected to the main computer and which is connected to the axis computer).</p>	 <p>xx0600003303</p>
5 Refit the EPS board and the axis computer.	
6 Refit all the cables.	

4.15 Replacement of SafeMove board DSQC 647

General

A SafeMove safety controller, SafeMove board, is mounted if the option SafeMove is used.



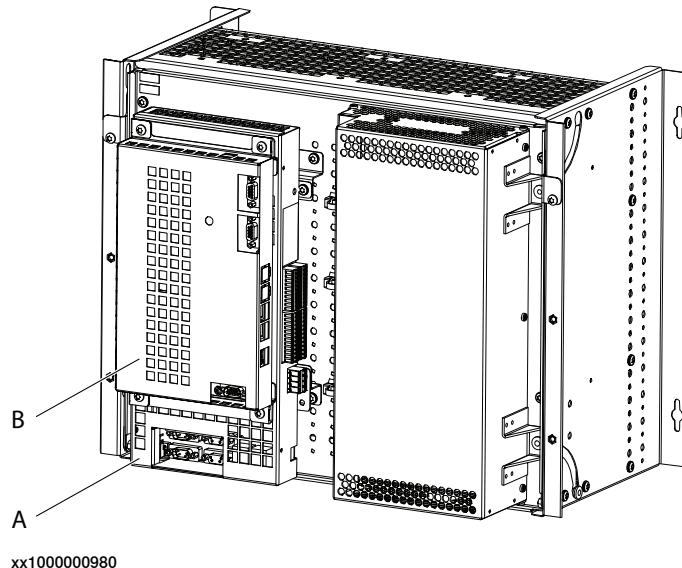
Note

After replacement of the safety controller, the SafeMove configuration must be downloaded to the new safety controller and then validated. For more information, see *Application manual - SafeMove*.

Location

The SafeMove board is mounted behind the axis computer.

PMC small:



A	SafeMove board
B	Axis computer

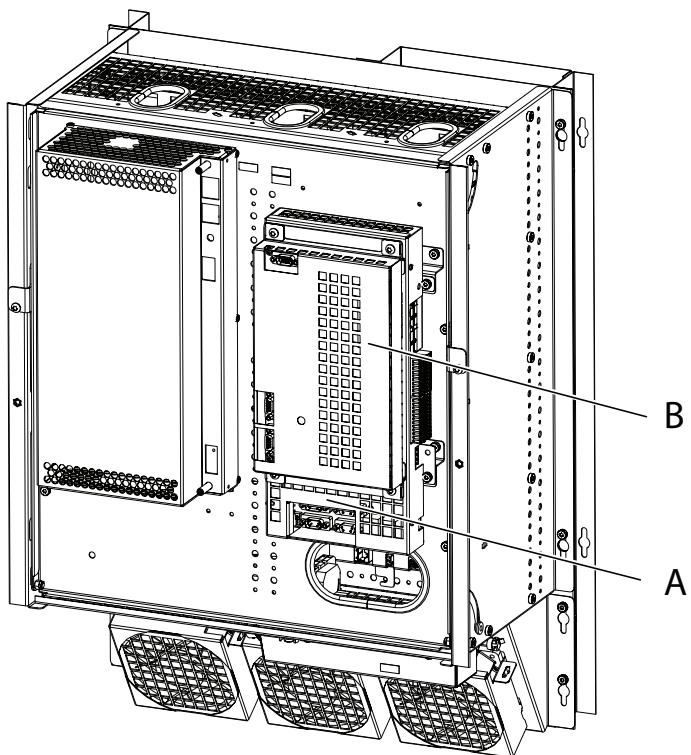
Continues on next page

4 Repair

4.15 Replacement of SafeMove board DSQC 647

Continued

PMC large:



xx1100000499

A	SafeMove board
B	Axis computer

Removal

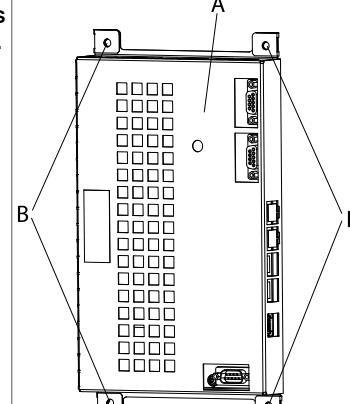
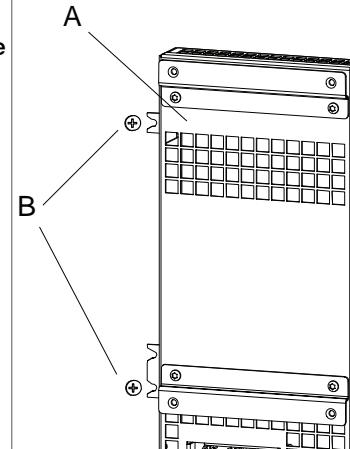
The procedure below details how to remove the SafeMove board.

Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2  WARNING The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42 .	
3 Disconnect the cables connected to the SafeMove board and the cables between the SafeMove board and the axis computer.	

Continues on next page

4.15 Replacement of SafeMove board DSQC 647

Continued

Action	Note/illustration
4 Remove the attachment screws of the axis computer and remove the axis computer.	 <p>xx0900000030</p> <ul style="list-style-type: none"> • A: axis computer • B: attachment screws (4 pcs)
5 Remove the attachment screws of the SafeMove board and remove the SafeMove board.	 <p>xx0800000104</p> <ul style="list-style-type: none"> • A: SafeMove board • B: attachment screws (4 pcs)

Refitting

The procedure below details how to refit the SafeMove board.

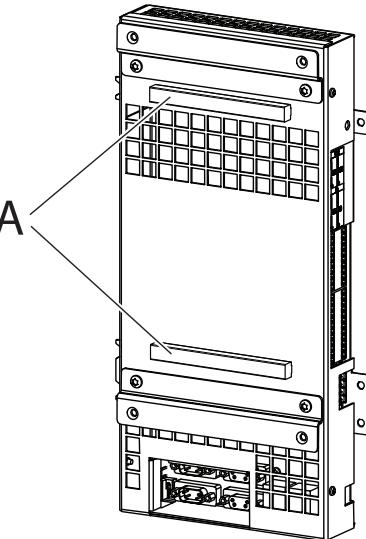
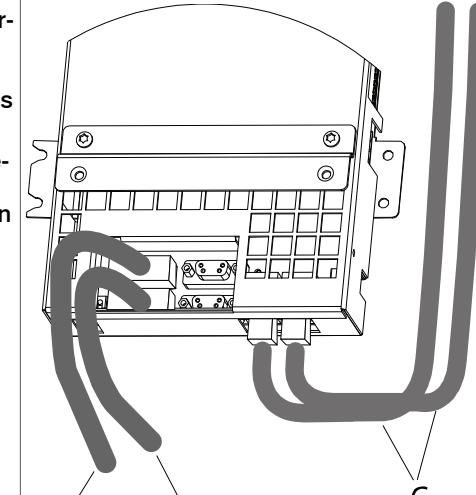
Action	Note/illustration
 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	

Continues on next page

4 Repair

4.15 Replacement of SafeMove board DSQC 647

Continued

Action	Note/illustration
2 <p> WARNING</p> <p>The unit is sensitive to ESD. Before handling the unit please observe the safety information in section WARNING - The unit is sensitive to ESD! on page 42.</p>	
3 <p>If not already in place, fit the EMC strips on the SafeMove board.</p>	 <p>xx0800000204</p> <ul style="list-style-type: none"> A: EMC strips
4 <p>Connect both SMB cables and both Ethernet cables to the SafeMove board before mounting the board. These connections may be difficult to reach once the board is mounted.</p> <p>The two Ethernet connectors on the SafeMove board are interchangeable (it does not matter which is connected to the main computer and which is connected to the axis computer).</p>	 <p>xx0800000103</p> <ul style="list-style-type: none"> A: SMB1 cable B: SMB2 cable C: Ethernet cables
5 <p>Refit the SafeMove board and the axis computer.</p>	
6 <p>Refit all cables.</p>	

Continues on next page

	Action	Note/illustration
7	After replacement of the safety controller, the SafeMove configuration must be downloaded to the new safety controller and then validated. For more information, see <i>Application manual - SafeMove</i>	

4 Repair

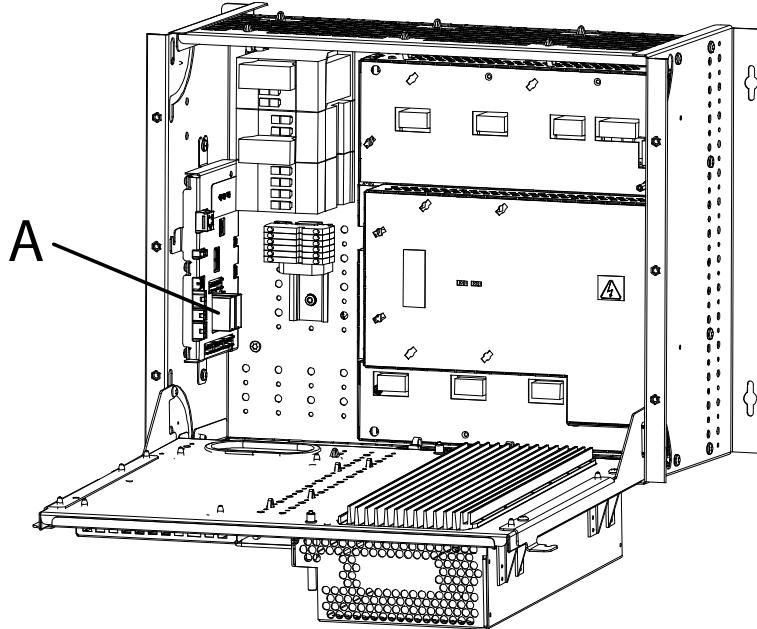
4.16 Replacement of Contactor Interface Board

4.16 Replacement of Contactor Interface Board

Location

The illustration below shows the location of the contactor interface board in the controller.

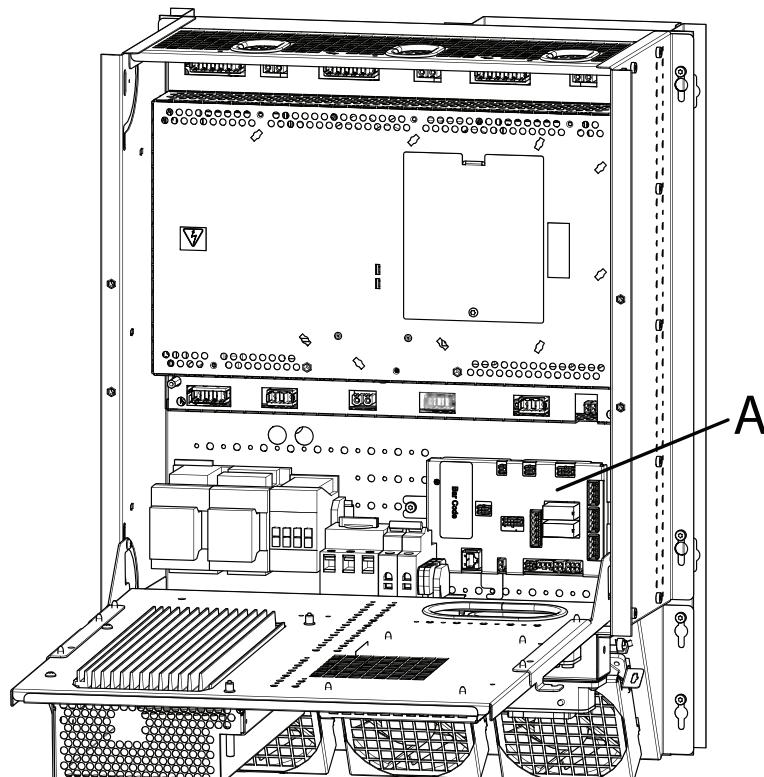
PMC small:



xx0600003241

Continues on next page

PMC large:



xx1100000481

A	Contactor interface board
---	---------------------------

Required equipment

Equipment	Note
Contactor Interface board	DSQC 611 See Spare parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

4 Repair

4.16 Replacement of Contactor Interface Board

Continued

Removal

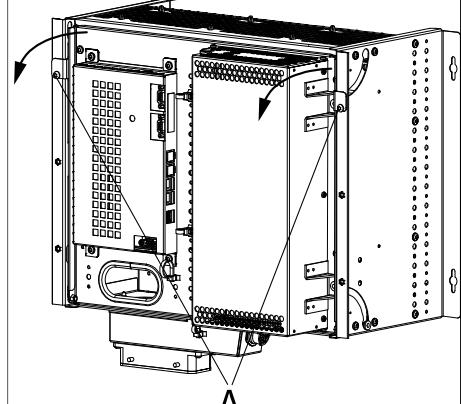
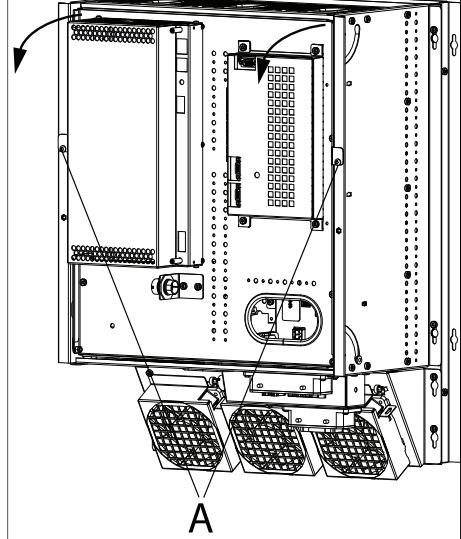
The procedure below details how to remove the contactor board.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2	 WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 42</i>	

Continues on next page

4.16 Replacement of Contactor Interface Board

Continued

Action	Note/Illustration
3 Loosen the attachment screws and pull the front (axis computer/drive system power supply unit) in the arrow direction.	<p>PMC small:</p>  <p>xx0600003242</p> <p>PMC large:</p>  <p>xx1100000488</p> <ul style="list-style-type: none"> A: attachment screws
4 Disconnect all connectors.	 <p>Tip</p> <p>Make a note of any connections.</p>

Continues on next page

4 Repair

4.16 Replacement of Contactor Interface Board

Continued

	Action	Note/Illustration
5	Remove the attachment screws.	 xx0600003243 <ul style="list-style-type: none">A: contactor interface boardB: attachment screws
6	Remove the contactor interface board.	

Refitting

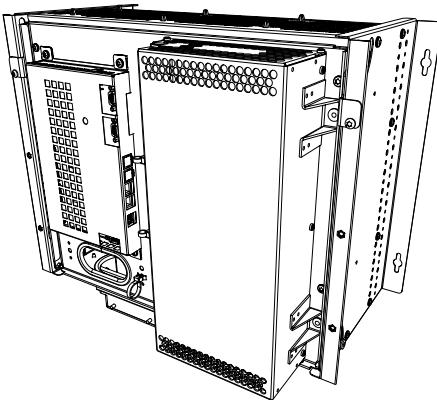
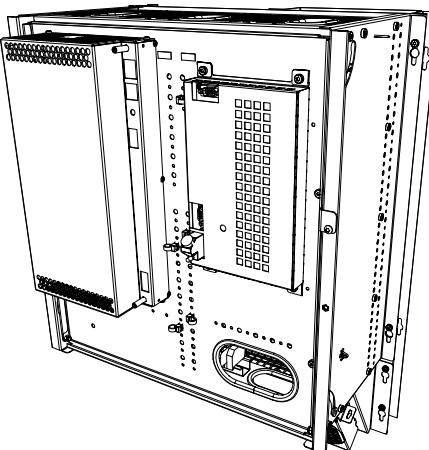
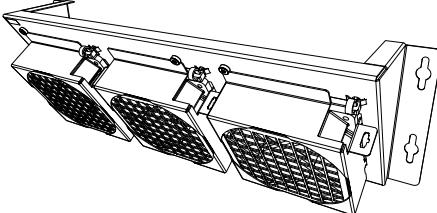
The procedure below details how to refit the contactor board.

	Action	Note/Illustration
1	DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2	WARNING The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 42	
3	Refit the contactor interface board.	
4	Refit the attachment screws.	
5	Reconnect all connectors.	
6	Refit the front (with axis computer/drive system power supply unit).	

4.17 Replacement of drive system fans

Location

The illustration below shows the location of the fan unit in the controller.

	PMC small	PMC large	
A	 xx1300001961	 xx1300001965	
B	 xx1300001962		
A	Drive Module (different design for PMC small and PMC large).		
B	Fan unit (for PMC large this is a part of the Drive Module).		

Required equipment

Equipment	Note
Fan with receptacle	See Spare parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit.
Other tools and procedures may be required. see references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Removal

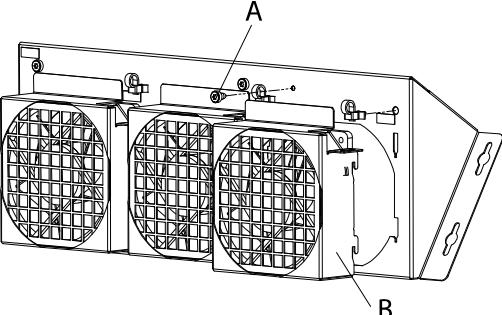
	Action	Note/illustration
1	Disconnect the fan cable.	

Continues on next page

4 Repair

4.17 Replacement of drive system fans

Continued

	Action	Note/illustration
2	Remove the attachment screw.	 xx0600003328 <ul style="list-style-type: none">• A: attachment screw• B: fan with receptacle
3	Push the fan unit upwards and remove it.	
4	Remove attachment screws and remove the cover from the fan.	

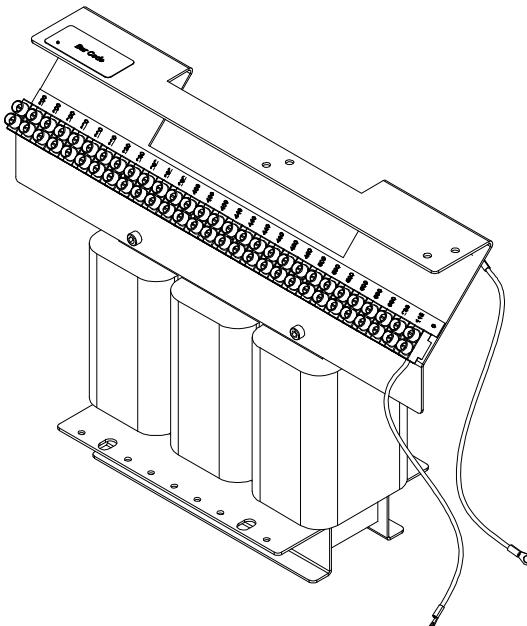
Refitting

	Action	Note/Illustration
1	Refit the fan to the cover.	
2	Refit the fan unit.	
3	Reconnect the fan cable.	

4.18 Replacement of transformer unit

Location

The illustration below shows the transformer unit.



xx0600003259

Required equipment

Equipment	Note
Transformer unit	13kVA, 6kVA, 4.2kVA, 1.2kVA See Spare parts on page 237 .
Standard toolkit	The contents are defined in section Standard toolkit
Circuit diagram	See Circuit diagrams on page 251 .

Removal

The following procedures details how to remove the transformer unit.

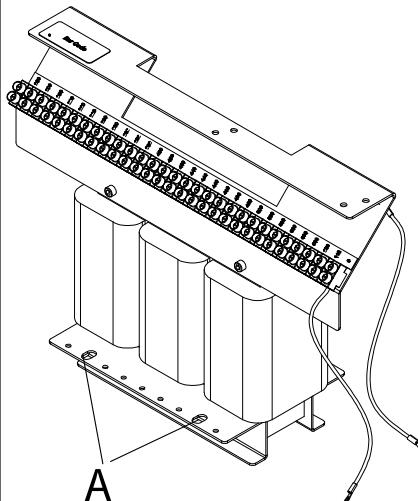
	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	 WARNING The transformer weighs between 15 and 40 kg, use a hoist and lifting slings.	

Continues on next page

4 Repair

4.18 Replacement of transformer unit

Continued

Action	Note/illustration
3 Disconnect the two grounding wires (gnye, blue).	
4 Disconnect the mains power supply wires.	 Note Make a note of the terminal to which each of the wires are connected. This will facilitate reconnection to the same terminal.
5 Remove the two transformer attachment screws.	 xx0600003260 <ul style="list-style-type: none"> A: attachment screw (2pcs)
6 Lift the transformer unit out with lifting slings and a hoist.	

Refitting

The following procedure details how to refit the transformer unit.

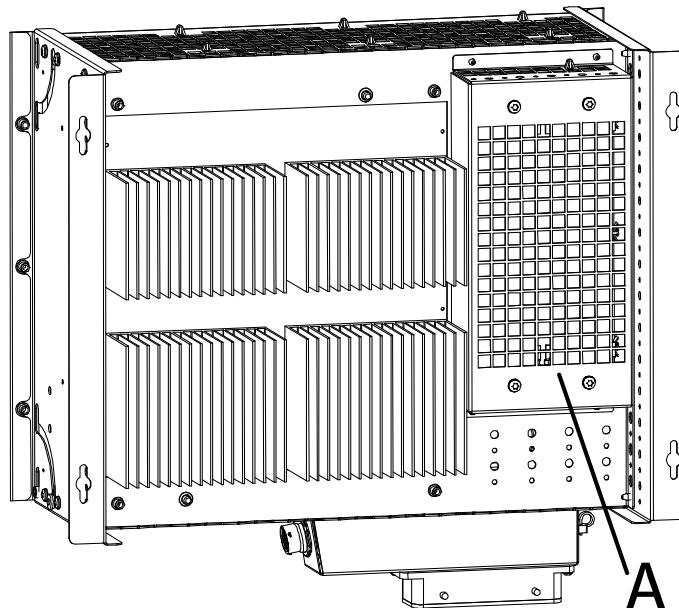
Action	Note/illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2  WARNING The transformer weighs between 15 and 40 kg, use a hoist and lifting slings.	
3 Fit the new transformer in place with a hoist and lifting slings.	
4 Refit the attachment screws.	
5 Reconnect the mains power supply wires and grounding wires.	

4.19 Replacement of brake resistor bleeder for PMC small

4.19 Replacement of brake resistor bleeder for PMC small

Location

The illustration below shows the location of the brake resistor bleeder in the PMC small. Note! The brake resistor bleeder is placed on the back of the drive module.



xx0600003251

A	Brake resistor bleeder
---	------------------------

Required equipment

Equipment	Note
Brake resistor bleeder	See Drive module parts for PMC large on page 239 .
Standard toolkit	The contents are defined in section Standard toolkit
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Removal

The following procedure details how to remove the brake resistor bleeder.

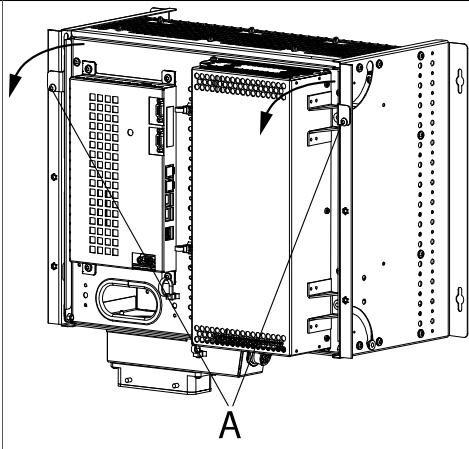
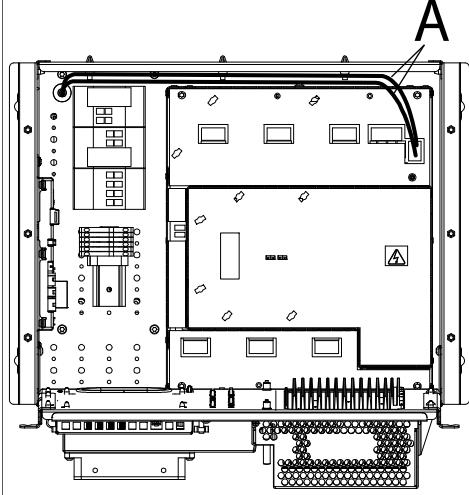
	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	

Continues on next page

4 Repair

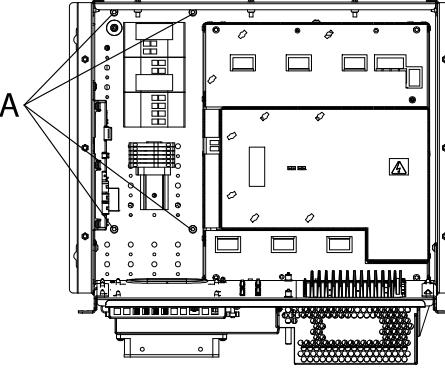
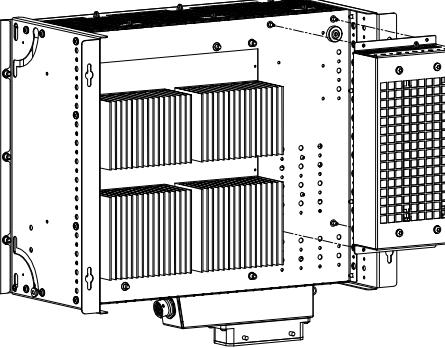
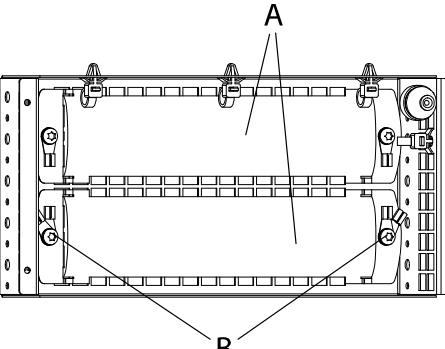
4.19 Replacement of brake resistor bleeder for PMC small

Continued

Action	Note/illustration
2 Remove the attachment screws and pull the front (axis computer/drive system power supply unit) in the arrow direction.	 <p>xx0600003242</p> <ul style="list-style-type: none"> • A: attachment screws
3 Disconnect all the cables from the drive module.	NOTE! Make a note of any connections.
4 Remove the drive module.	
5 Remove the Contactor interface board.	See Replacement of Contactor Interface Board on page 198 .
6 Disconnect the brake resistor bleeder cables.	 <p>xx0600003291</p> <ul style="list-style-type: none"> • A: brake resistor bleeder cable

Continues on next page

4.19 Replacement of brake resistor bleeder for PMC small
Continued

Action	Note/illustration
7 Remove the attachment screws for the brake resistor bleeder unit and remove the unit.	 xx0600003252 <ul style="list-style-type: none"> A: attachment screws  xx0600003329
8 Remove the attachment nuts.	 xx0600003330 <ul style="list-style-type: none"> A: bleeder B: attachment nut (2 pcs)
9 Remove the bleeder.	

Refitting

The following procedure details how to refit the brake resistor bleeder

Action
1 Refit the bleeder and attachment nuts.
2 Refit the brake resistor bleeder unit to the drive module.
3 Refit the attachment screws (10 pcs)
4 Reconnect the brake resistor bleeder cables.

Continues on next page

4 Repair

4.19 Replacement of brake resistor bleeder for PMC small

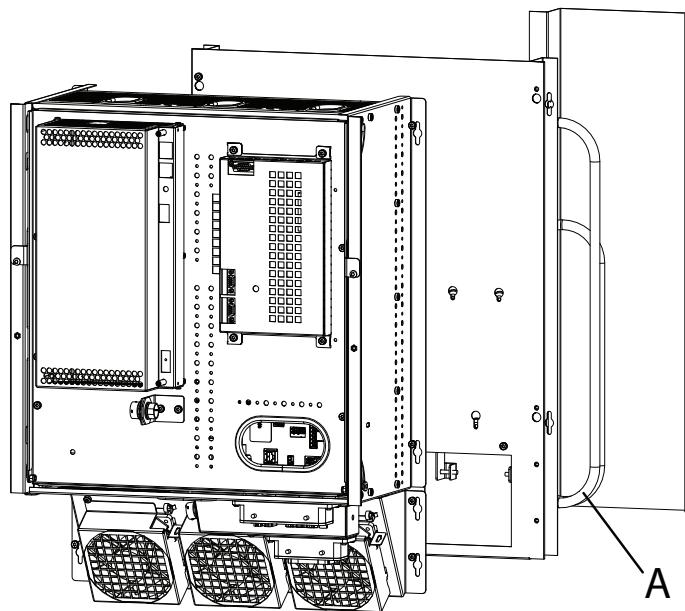
Continued

	Action
5	Refit the Contactor interface board.
6	Refit the drive module.
7	Reconnect all connectors and cables to the drive module.
8	Refit the front (axis computer/drive system power supply).

4.20 Replacement of brake resistor bleeder for PMC large

4.20 Replacement of brake resistor bleeder for PMC large**Location**

The illustration below shows the location of the brake resistor bleeder in the PMC large. The brake resistor bleeder is located in the air channel behind the drive module.



xx1100000523

A	Brake resistor bleeder
---	------------------------

Required equipment

Equipment	Note
Brake resistor bleeder	See Drive module parts for PMC large on page 239 .
Standard toolkit	The contents are defined in section Standard toolkit
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .

Continues on next page

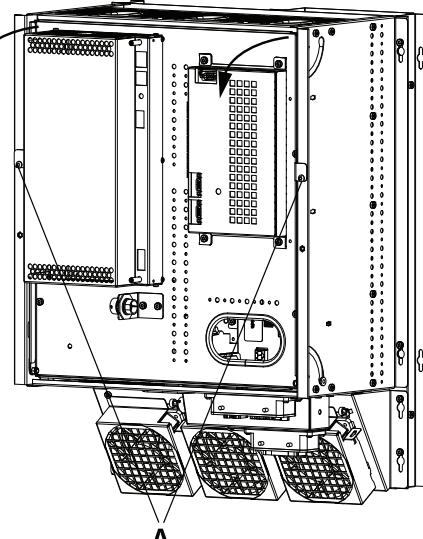
4 Repair

4.20 Replacement of brake resistor bleeder for PMC large

Continued

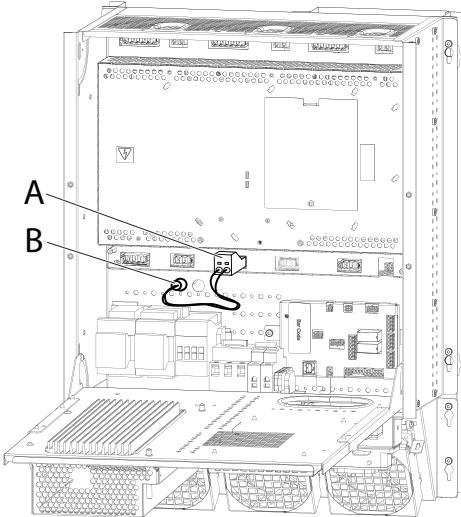
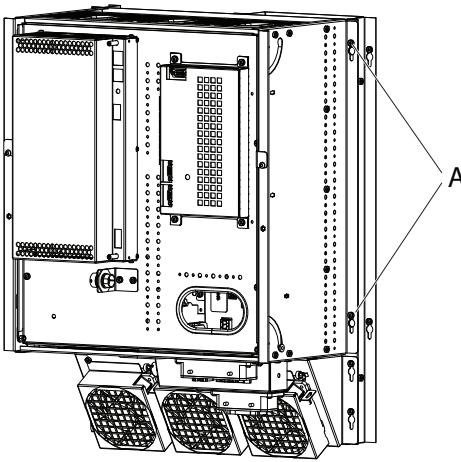
Removal

The following procedure details how to remove the brake resistor bleeder.

	Action	Note/illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2	Remove the attachment screws and pull the front (axis computer/drive system power supply unit) in the arrow direction.	 xx1100000488 • A: attachment screws
3	Disconnect all the cables from the drive module.	 Note Make a note of any connections.

Continues on next page

4.20 Replacement of brake resistor bleeder for PMC large
Continued

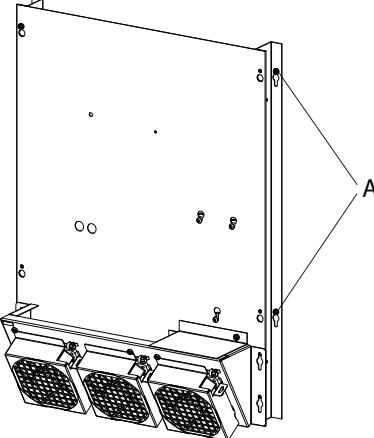
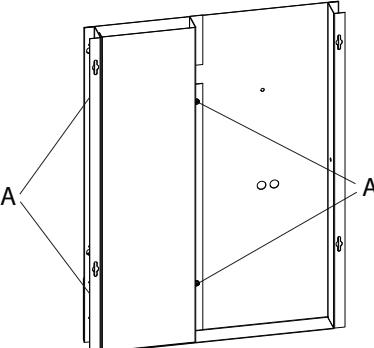
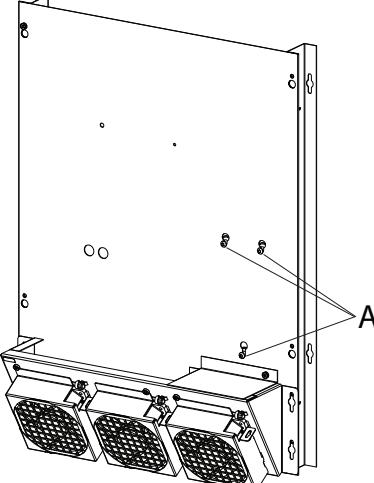
	Action	Note/illustration
4	Disconnect the brake resistor bleeder cables from the connector to let the cables through the cable gland.	 <p>xx1100000524</p> <ul style="list-style-type: none"> A: brake resistor bleeder cable connector B: cable gland
5	Remove the drive module from the air channel.	 <p>xx1100000525</p> <ul style="list-style-type: none"> A: attachment screws (4 pcs)

Continues on next page

4 Repair

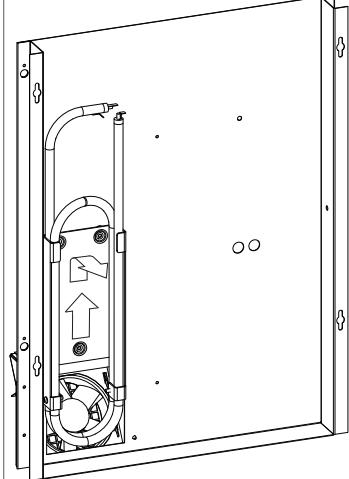
4.20 Replacement of brake resistor bleeder for PMC large

Continued

Action	Note/illustration
6 Remove the air channel.	 <p>xx1100000526</p> <ul style="list-style-type: none"> • A: attachment screws (4 pcs)
7 Remove the plate on the back of the air channel.	 <p>xx1100000527</p> <ul style="list-style-type: none"> • A: attachment screws
8 Loosen the attachment screws for the brake resistor bleeder.	 <p>xx1100000529</p> <ul style="list-style-type: none"> • A: attachment screws

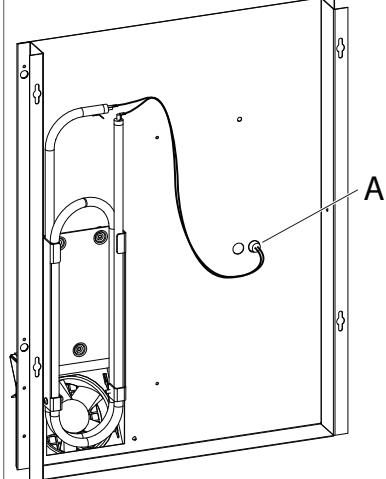
Continues on next page

**4.20 Replacement of brake resistor bleeder for PMC large
Continued**

	Action	Note/illustration
9	Lift and remove the brake resistor bleeder.	 <p style="text-align: center;">xx1100000530</p>

Refitting

The following procedure details how to refit the brake resistor bleeder

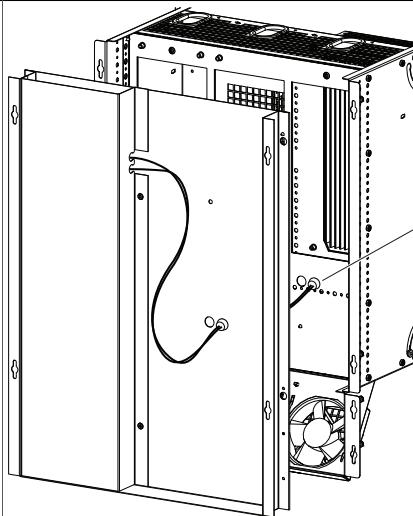
	Action	Note/illustration
1	Refit the bleeder to the air channel plate.	
2	Tighten the attachment screws for the brake resistor bleeder.	
3	Guide the brake resistor cables through the cable gland of the air channel.	 <p style="text-align: center;">xx1100000531</p> <p style="text-align: center;">Cable gland</p>
4	Refit the plate on the back of the air channel.	
5	Refit the air channel.	

Continues on next page

4 Repair

4.20 Replacement of brake resistor bleeder for PMC large

Continued

Action	Note/illustration
6 Guide the brake resistor bleeder cable through the cable gland into the drive module.	 <p>xx1100000532</p> <p>Cable gland into drive module</p>
7 Refit the drive module on the air channel.	
8 Reconnect all connectors and cables to the drive module.	

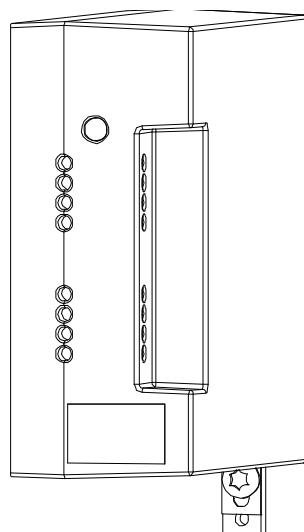
4.21.1 Replacement of customer I/O power supply

4.21 Replacement of power supply

4.21.1 Replacement of customer I/O power supply

Location

The customer I/O power supply is shown in the following illustration.



xx0600003258

Required equipment

Equipment	Article number	Note
Customer I/O power supply	3HAC14178-1	DSQC 609
Standard toolkit		The contents are defined in section Standard toolkit.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram	See Circuit diagrams on page 251 .	

Removal

The procedure below details how to remove the customer I/O power supply.

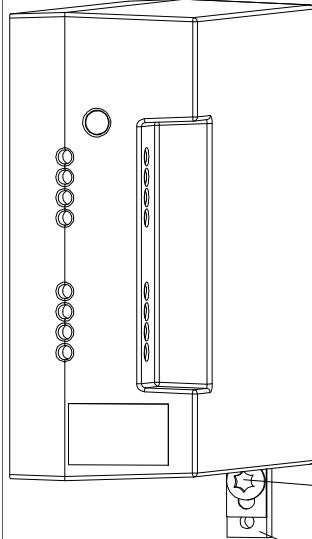
	Action	Note/Illustration
1	DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	

Continues on next page

4 Repair

4.21.1 Replacement of customer I/O power supply

Continued

Action	Note/Illustration
2 Loosen the terminal screws for each connected wire. Remove wires from the terminals.	
3 Loosen the DIN-lock fixing screw.	 xx0700000124 <ul style="list-style-type: none"> • A: DIN-lock fixing screw • B: DIN-lock lever
4 Pull the DIN-lock lever downwards to release the power supply unit.	
5 Remove the power supply unit.	

Refitting

The procedure below details how to refit the customer I/O power supply.

Action	Note/Illustration
1  DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2 Refit the new power supply unit on the DIN-rail.	

Continues on next page

4.21.1 Replacement of customer I/O power supply
Continued

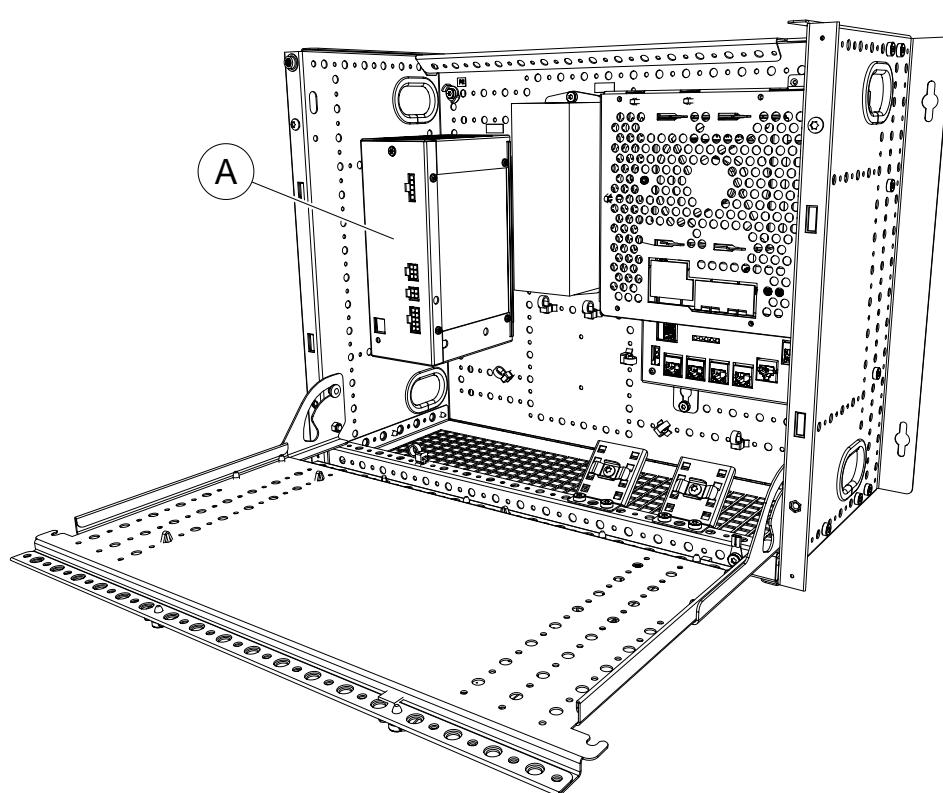
Action	Note/Illustration
3 Fasten the DIN-lock fixing screw.	<p>xx0700000124</p> <ul style="list-style-type: none"> • A: DIN-lock fixing screw • B: DIN-lock lever
4 Refit all wires in the screw terminals.	
5 Fasten the screw terminal screws with correct torque.	

4 Repair

4.21.2 Replacement of control power supply

Location

The control power supply is located as shown the illustration below.



xx1300001958

A	Control power supply
---	----------------------

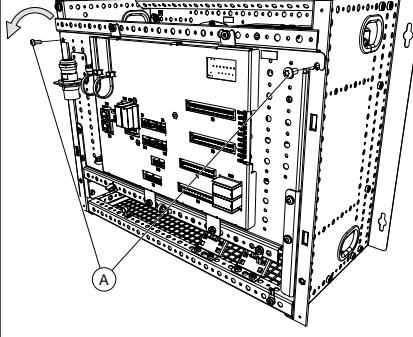
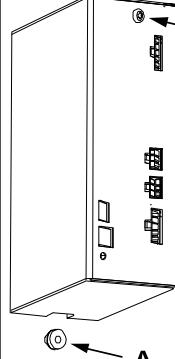
Required equipment

Equipment	Spare part no.	Note
Control Power Supply	3HAC12928-1	DSQC 604
Standard toolkit		The contents are defined in section Standard toolkit!
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram		See Circuit diagrams on page 251 .

Continues on next page

Removal

The procedures below details how to remove the control power supply.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off!</i> on page 41.	
2	Remove the attachment screws and pull the front with the Panel Board Unit in the arrow direction.	 xx1300001950 A attachment screws
3	Disconnect the connectors X1 - X4 on the control power supply.	
4	Loosen the attachment screw and push the power supply up to release it from the cap nut.	 xx0600003229 A cap nut B attachment screw
5	Remove the power supply unit.	

Continues on next page

4 Repair

4.21.2 Replacement of control power supply

Continued

Refitting

The procedures below details how to refit the control power supply.

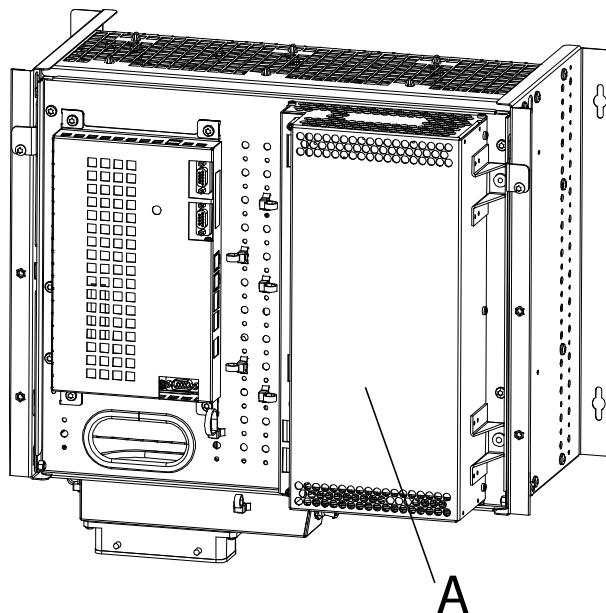
	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41.	
2	Refit the control power supply.	
3	Lock the unit in place by tighten the attachment screw.	
4	Reconnect the connectors X1 - X4.	
5	Refit the front with the Panel Board Unit.	

4.21.3 Replacement of drive system power supply

4.21.3 Replacement of drive system power supply**Location**

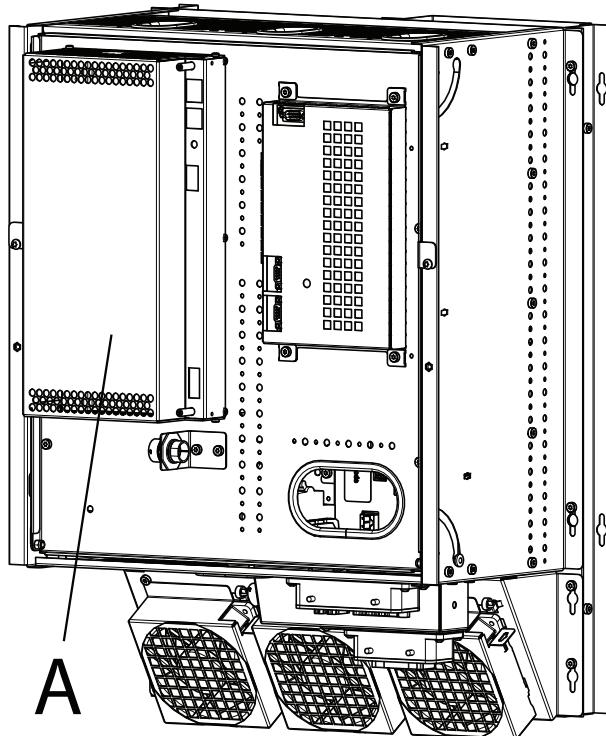
The illustration below shows the location of the drive system power supply in the IRC5 controller.

PMC small:



xx0600003239

PMC large:



xx1100000496

Continues on next page

4 Repair

4.21.3 Replacement of drive system power supply

Continued

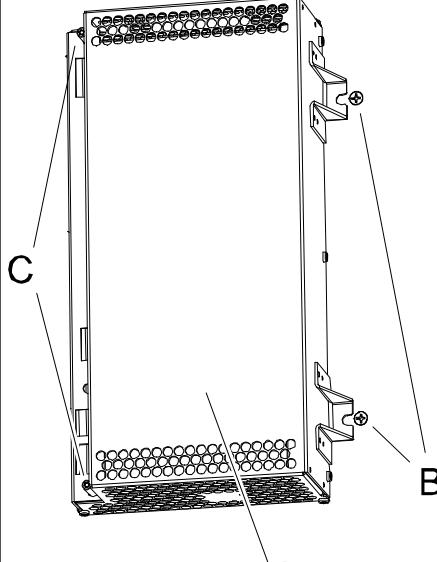
A	Drive system power supply
---	---------------------------

Required equipment

Equipment	Spare part no.	Note
Drive system power supply	3HAC026289-001	DSQC 626A Only for PMC small.
Drive system power supply	3HAC020466-001	DSQC 627
Standard toolkit		The contents are defined in section Standard toolkit!
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram		See Circuit diagrams on page 251 .

Removal

The procedure below details how to remove the drive system power supply.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section DANGER - Make sure that the main power has been switched off! on page 41 .	
2	Disconnect all connectors from the unit.	 xx1000000960 A drive system power supply B cup nut (2 pcs) C attachment screw (2 pcs)

Continues on next page

4.21.3 Replacement of drive system power supply

Continued

	Action	Note/Illustration
3	Loosen the attachment screws.	
4	Pull the power supply unit to the right to release it from the cap nuts, and remove it.	

Refitting

The procedure below details how to refit the drive system power supply.

	Action	Note/Illustration
1	 DANGER Before commencing any work inside the cabinet, please observe the safety information in section <i>DANGER - Make sure that the main power has been switched off! on page 41</i> .	
2	Refit the power supply by sliding the recesses in beneath the cap nuts, and push it to the left.	
3	Tighten the attachment screws.	
4	Reconnect all connectors to the unit.	

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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.

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

6 Reference information

6.1 Introduction

General

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

6 Reference information

6.2 Applicable 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 ⁱ	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 ⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 ⁱⁱ	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)

ⁱ Only robots with protection Clean Room.

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

European standards

Standard	Description
EN 614-1	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

Standard	Description
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.

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

6.4 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

6 Reference information

6.5 Weight specifications

6.5 Weight specifications

Definition

In all repair and maintenance instructions, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are high-lighted in this way.

To avoid injury, ABB recommends the use of lifting equipment when handling components with a weight exceeding 22 kg.

Example

Below is an example of how a weight specification is presented:



CAUTION

The transformer weighs 55 kg! All lifting equipment used must be sized accordingly!

6.6 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

6.7 Lifting accessories and lifting instructions

General

Many repair and maintenance activities require different pieces of lifting accessories, which are specified in each procedure.

The use of each piece of lifting accessories is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting accessories.

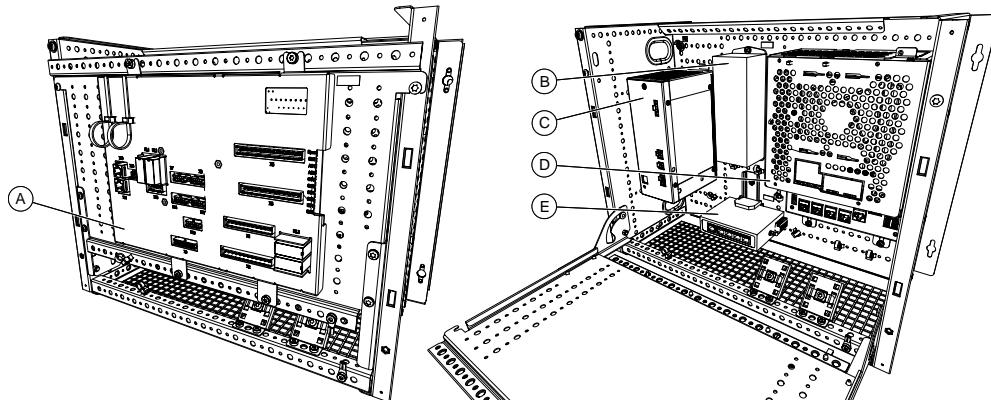
This implies that the instructions delivered with the lifting accessories should be stored for later reference.

7 Spare parts

7.1 Controller parts

Control module parts

The illustration below shows the placement of the control module parts in the recommended spare part list.



xx1300001959

	Spare part no.	Description	Note
A	3HAC024488-001	Panel board unit	DSQC 643
B	3HAC025562-001	Backup energy bank	DSQC 655
C	3HAC12928-1	Control power supply	DSQC 604
D	See Computer unit parts on page 240 .		
E	3HAC045976-001	DSQC1007 Eth. switch (MultiMove)	DSQC1007
	3HAC024244-001	Ethernet cable cross conn	
	3HAC021377-001	Bridge connector for panel board	
	3HAC024000-001	Bridge connector for panel board X1	
	3HAC024000-002	Bridge connector for panel board X2	
	3HAC024000-003	Bridge connector for panel board X6	
	3HAC024000-004	Bridge connector for panel board X5	

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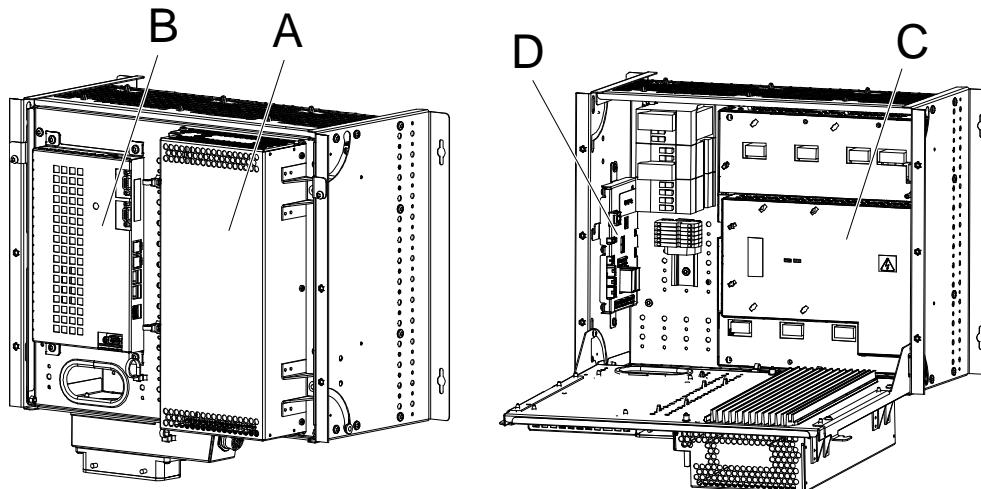
7 Spare parts

7.1 Controller parts

Continued

Drive module parts for PMC small

The illustration below shows the placement of the drive module parts in the recommended spare part list.



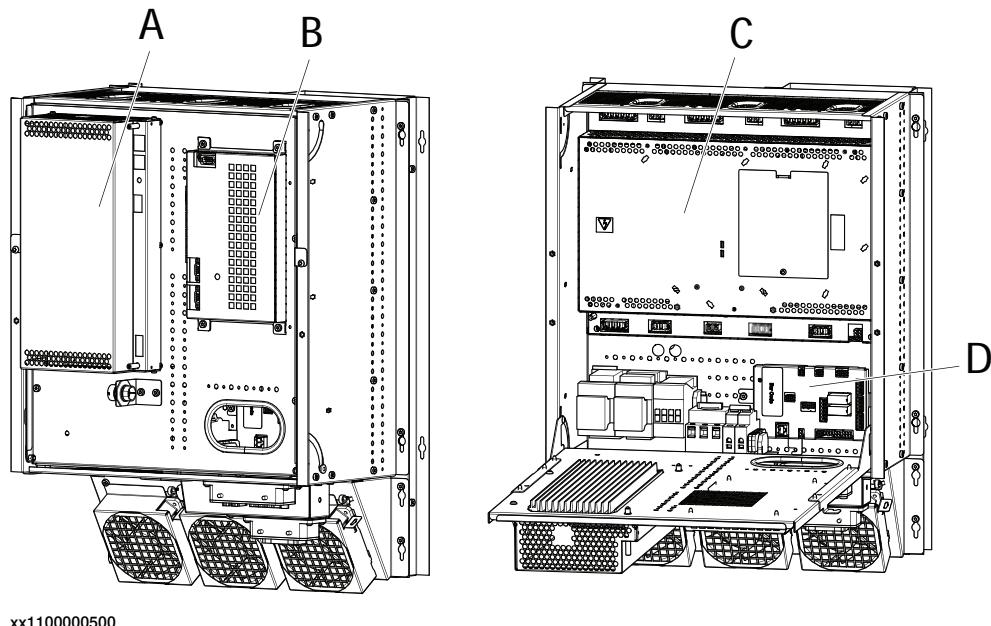
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	Spare part no.	Description	Note
A	3HAC026289-001	Drive system power supply	DSQC 626A
	3HAC020466-001	Drive system power supply ext.	DSQC 627
B	3HAC029157-001	Axis computer unit	DSQC 668
C	3HAC035301-001	Main Drive Unit	DSQC 618
D	3HAC13389-2	Contactor interface board	DSQC 611
	3HAC038808-001	Brake resistor bleeder	IRB 140, 340, 360
	3HAC037753-001	Brake resistor bleeder	IRB 260
	3HAC038440-001	Harness-Power supply/Drive	
	3HAC024254-005	Ethernet cable strait con	

Continues on next page

Drive module parts for PMC large

The illustration below shows the placement of the drive module parts in the recommended spare part list.



xx1100000500

	Spare part no.	Description	Note
A	3HAC020466-001	Drive system power supply ext.	DSQC 627
B	3HAC029157-001	Axis computer unit	DSQC 668
C	3HAC029818-001	Main Drive Unit	DSQC 663
D	3HAC13389-2	Contactor interface board	DSQC 611
	3HAC032586-001	Brake resistor bleeder	
	3HAC038440-001	Harness-Power supply/Drive	
	3HAC024254-007	Ethernet cable strait con	

I/O System parts

The table below details parts in the recommended spare part list.

	Spare part no.	Description	Type
A	3HAC025784-001	ADCombi I/O	DSQC 651
A	3HAC025917-001	Digital I/O	DSQC 652

Ext I/O parts

The table below details parts in the recommended spare part list.

	Spare part no.	Description	Note
	3HAC026486-001	Additional Module Dig 24V	
	3HAC026486-002	Additional Module AD Combi	

Continues on next page

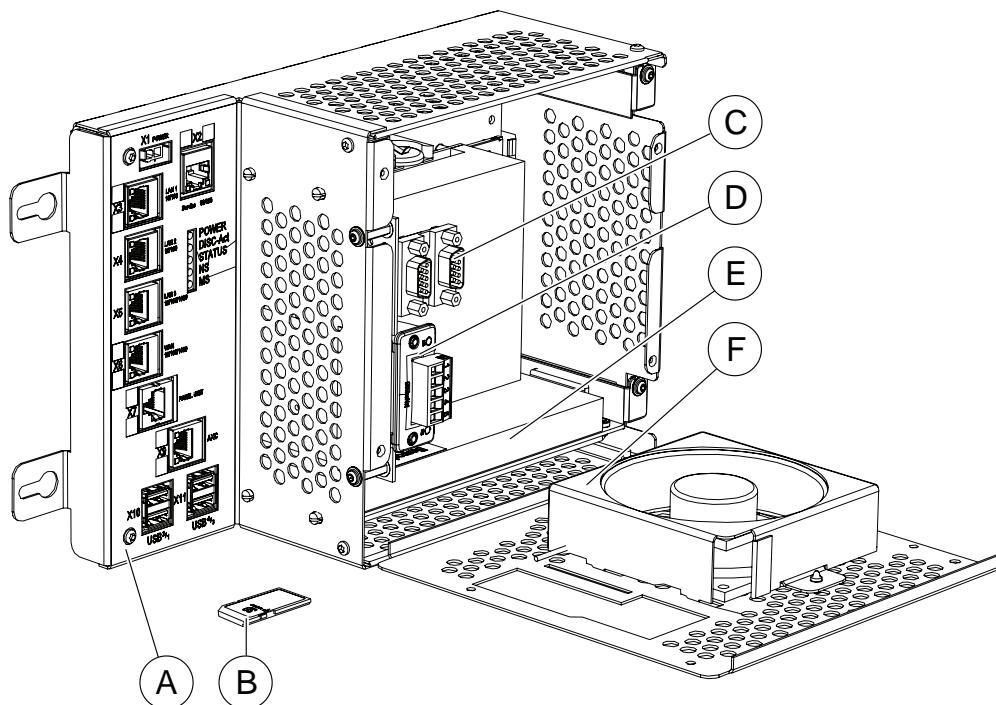
7 Spare parts

7.1 Controller parts

Continued

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
F	3HAC026525-001	Fan with receptacle	
-	3HAC14944-1	RS-232/422 Converter	DSQC 615

Miscellaneous parts

The table below shows parts in the recommended spare part list.

	Spare part no.	Description	Note
	3HAC029105-001	Fans with receptacle	
	3HAC037824-001	Line filter for PMC small	

Continues on next page

7 Spare parts

7.1 Controller parts *Continued*

	Spare part no.	Description	Note
	3HAC024322-001	Line filter for PMC large	
	3HAC037015-001	Transformer unit 400-480V	1.2 kVA
	3HAC037016-001	Transformer unit 200-220V	4.2 kVA
	3HAC037017-001	Transformer unit 400V	4.2 kVA
	3HAC037018-001	Transformer unit 440-600V	4.2 kVA
	3HAC024180-001	Transformer unit 200-600V	6 kVA
	3HAC024138-001	Transformer unit 200-600V	13 kVA
	3HAC024144-001	Inductor (Reactor unit)	
	3HAC024125-001	Harness-XP10/T1	
	2CDS253001R0104	3-pol automatic fuse	
	1SCA02235R6610	Switch	
	3HAC15326-3	Main switch	
	3HAC028357-001	GTPU 2, 10 M Cable	
	3HAC031683-001	TPU Cable, 30m	
	3HAC021914-001	Harness-TPU Jumper plug	
	3HAC14178-1	Customer I/O Power supply	DSQC 609

7 Spare parts

7.2.1 Manipulator cables

7.2 Manipulator cables

7.2.1 Manipulator cables

Signal cables, IRB 120

Cable	Art. no.	Option no.
3HAC035320-001	Robot cable, signal: L=3 m	210-1
3HAC2493-1	Robot cable, signal: L=7 m	210-2
3HAC2530-1	Robot cable, signal: L=15 m	210-3

Signal cables, IRB 460, 1410, 1520, 1600, 2600, 4600, 6700

Art. no.	Description	Option no.
3HAC2493-1	Control cable signal L=7m	210-2
3HAC2530-1	Control cable signal L=15m	210-3
3HAC2540-1	Control cable signal L=22m	210-4
3HAC2566-1	Control cable signal L=30m	210-5

Signal cables, IRB 260, 660, 760, 2400, 4400, 6600, 6650, 6620, 6640, 6660, 6650S, 7600

Art. no.	Description	Option no.
3HAC7998-1	Control cable signal L=7m	210-2
3HAC7998-2	Control cable signal L=15m	210-3
3HAC7998-3	Control cable signal L=22m	210-4
3HAC7998-4	Control cable signal L=30m	210-5

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

Art. no.	Description	Option no.
3HAC7996-1	Control cable power L=3m	210-1
3HAC7996-5	Control cable power L=7m	210-2
3HAC7996-6	Control cable power L=15m	210-3
3HAC7996-7	Control cable power L=22m	210-4
3HAC7996-8	Control cable power L=30m	210-5

Power cables, IRB 1410, 1600, 2400

Art. no.	Description	Option no. ⁱ
3HAC2492-1	Control cable power L=7m	Standard: 210-2 and 287-4
3HAC2529-1	Control cable power L=15m	Standard: 210-3 and 287-4
3HAC2539-1	Control cable power L=22m	Standard: 210-4 and 287-4
3HAC2564-1	Control cable power L=30m	Standard: 210-5 and 287-4

Continues on next page

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

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

Power cables, IRB 1520

Art. no.	Description	Option no.
3HAC040503-001	Control cable power L=7m	210-2
3HAC040503-002	Control cable power L=15m	210-3

Power cables, IRB 120

Cable	Art. no.	Option no.
3HAC032694-001	Robot cable, power: L=3 m	210-1
3HAC032695-001	Robot cable, power: L=7 m	210-2
3HAC032696-001	Robot cable, power: L=15 m	210-3

Power cables, IRB 260

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

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

Power cables, IRB 360

Art. no.	Description	Option no.
3HAC029903-001	Control cable, power and signal L=3m	(435-80 or 435-81 or 435-82)
3HAC029903-002	Control cable, power and signal L=7m	(435-80 or 435-81 or 435-82)
3HAC029903-003	Control cable, power and signal L=15m	(435-80 or 435-81 or 435-82)
3HAC029903-004	Control cable, power and signal L=22m	(435-80 or 435-81 or 435-82)

Continues on next page

7 Spare parts

7.2.1 Manipulator cables

Continued

Art. no.	Description	Option no.
3HAC029903-005	Control cable, power and signal L=30m	(435-80 or 435-81 or 435-82)
3HAC038411-001	Control cable, power and signal, stainless contact screws, L=3m	(435-80 or 435-81 or 435-82)
3HAC038411-002	Control cable, power and signal, stainless contact screws, L=7m	(435-80 or 435-81 or 435-82)
3HAC038411-003	Control cable, power and signal, stainless contact screws, L=15m	(435-80 or 435-81 or 435-82)
3HAC038411-004	Control cable, power and signal, stainless contact screws, L=22m	(435-80 or 435-81 or 435-82)
3HAC038411-005	Control cable, power and signal, stainless contact screws, L=30m	(435-80 or 435-81 or 435-82)

Power cables, IRB 4400

Art. no.	Description	Option no. ⁱ
3HAC2512-1	Control cable power L=7m	Standard: 210-2 and 287-4 Clean room: 210-2 and 287-1
3HAC2535-1	Control cable power L=15m	Standard: 210-3 and 287-4 Clean room: 210-3 and 287-1
3HAC2560-1	Control cable power L=22m	Standard: 210-4 and 287-4 Clean room: 210-4 and 287-1
3HAC2572-1	Control cable power L=30m	Standard: 210-5 and 287-4 Clean room: 210-5 and 287-1
3HAC8182-1	Control cable power L=7m	Foundry: 210-2 and 287-3 Wash: 210-2 and 287-5
3HAC8182-2	Control cable power L=15m	Foundry: 210-3 and 287-3 Wash: 210-3 and 287-5
3HAC8182-3	Control cable power L=22m	Foundry: 210-4 and 287-3 Wash: 210-4 and 287-5
3HAC8182-4	Control cable power L=30m	Foundry: 210-5 and 287-3 Wash: 210-5 and 287-5

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

Power cable, IRB 460, 660, 760, 2600, 4600, 6600, 6620, 6640, 6650, 6650S, 6660, 6700, 7600

Art. no.	Description	Option no.
3HAC026787-001	Control cable power L=7m	(435-6 or 435-18 or 435-24 or 435-36) and 210-2
3HAC026787-002	Control cable power L=15m	(435-6 or 435-18 or 435-24 or 435-36) and 210-3
3HAC026787-003	Control cable power L=22m	(435-6 or 435-18 or 435-24 or 435-36) and 210-4
3HAC026787-004	Control cable power L=30m	(435-6 or 435-18 or 435-24 or 435-36) and 210-5

7.2.2 Fan cables

IRB 6600 and IRB 7600

Art. no.	Description	Option no.
3HAC022723-001	Harness - Axis 1&2 cooling	(87-1 or 88-1 or 89-1) and 210-2
3HAC022723-004	Harness - Axis 1&2 cooling	(87-1 or 88-1 or 89-1) and 210-3
3HAC022723-005	Harness - Axis 1&2 cooling	(87-1 or 88-1 or 89-1) and 210-4
3HAC022723-006	Harness - Axis 1&2 cooling	(87-1 or 88-1 or 89-1) and 210-5
3HAC022708-001	Harness - axis 1/2/3 cooling	(87-1 or 88-1 or 89-1) and 274-1 or 274-2 or 274-3 or 274-4

7 Spare parts

7.2.3 CP/CS Harness IRB 2600, 4600, 6600, 7600, 660, 6620, 6640, 6700, 460 and 760

7.2.3 CP/CS Harness IRB 2600, 4600, 6600, 7600, 660, 6620, 6640, 6700, 460 and 760

CP/CS

Art. no.	Description	Option no.
3HAC022957-001	Harness CP/CS L=7m	94-1
3HAC022957-002	Harness CP/CS L=15m	94-2
3HAC022957-006	Harness CP/CS L=22m	94-3
3HAC022957-003	Harness CP/CS L=30m	94-4

CP/CS/Profibus

Art. no.	Description	Option no.
3HAC022988-001	Harness CP/CS, PROFIB L=7m	92-2
3HAC022988-002	Harness CP/CS, PROFIB L=15m	92-3
3HAC022988-006	Harness CP/CS, PROFIB L=22m	92-4
3HAC022988-003	Harness CP/CS, PROFIB L=30m	92-5

CP/CS DeviceNet

Art. no.	Description	Option no.
3HAC022978-001	Harness CP/CS, DeviceNet L=7m	90-2
3HAC022978-002	Harness CP/CS, DeviceNet L=15m	90-3
3HAC022978-006	Harness CP/CS, DeviceNet L=22m	90-4
3HAC022978-003	Harness CP/CS, DeviceNet L=30m	90-5

Ethernet/PROFINET cable

Art. no.	Description	Option no.
3HAC031924-001	Connection of Ethernet, L=7m	859-1
3HAC031924-002	Connection of Ethernet, L=15m	859-2
3HAC031924-003	Connection of Ethernet, L=22m	859-3
3HAC031924-004	Connection of Ethernet, L=30m	859-4

7.2.4 Customer signal, CP/CS and CS

IRB 1400

Art. no.	Description	Option no.
3HAC3346-1	Customer cable sign. L=7m	16-1 and 17-5 and 94-1
3HAC3347-1	Customer cable sign. L=15m	16-1 and 17-5 and 94-2
3HAC3348-1	Customer cable sign. L=22m	16-1 and 17-5 and 94-3
3HAC3349-1	Customer cable sign. L=30m	16-1 and 17-5 and 94-4

IRB 1600, 2400

Art. no.	Description	Option no. ⁱ
3HAC3353-1	Customer cable sign. L=7m	Standard: 94-1 and 287-4
3HAC3354-1	Customer cable sign. L=15m	Standard: 94-2 and 287-4
3HAC3355-1	Customer cable sign. L=22m	Standard: 94-3 and 287-4
3HAC3356-14	Customer cable sign. L=30m	Standard: 94-4 and 287-4
3HAC8183-1	Customer cable sign. L=7m	Foundry: 94-1 and 287-3 Wash: 94-1 and 287-5
3HAC8183-2	Customer cable sign. L=15m	Foundry: 94-2 and 287-3 Wash: 94-2 and 287-5
3HAC8183-3	Customer cable sign. L=22m	Foundry: 94-3 and 287-3 Wash: 94-3 and 287-5
3HAC8183-4	Customer cable sign. L=30m	Foundry: 94-4 and 287-3 Wash: 94-4 and 287-5

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

IRB 260

Art. no.	Description	Option no. ⁱ
3HAC8183-1	Customer cable signal, L=7m	Foundry: 94-1 and 287-3 Wash: 94-1 and 287-5
3HAC8183-2	Customer cable signal, L=15m	Foundry: 94-2 and 287-3 Wash: 94-2 and 287-5
3HAC8183-3	Customer cable signal, L=22m	Foundry: 94-3 and 287-3 Wash: 94-3 and 287-5
3HAC8183-4	Customer cable signal, L=30m	Foundry: 94-4 and 287-3 Wash: 94-4 and 287-5

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

IRB 360

Art. no.	Description	Option no. ⁱ
3HAC14860-1	Customer cable sign. L=7m	218-9 and 94-1
3HAC14860-2	Customer cable sign. L=15m	218-9 and 94-2

Continues on next page

7 Spare parts

7.2.4 Customer signal, CP/CS and CS

Continued

Art. no.	Description	Option no.ⁱ
3HAC14860-3	Customer cable sign. L=22m	218-9 and 94-3
3HAC14860-4	Customer cable sign. L=30m	218-9 and 94-4

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

7.2.5 Customer power-signal

IRB 1600, 260, 2400 and 4400

Art. no.	Description	Option no. ⁱ
3HAC8183-1	Customer pow.-sign. L=7m	94-1 and 16-1 and 17-5 and (287-3 or 243-5)
3HAC8183-2	Customer pow.-sign. L=15m	94-2 and 16-1 and 17-5 and (287-3 or 243-5)
3HAC8183-3	Customer pow.-sign. L=22m	94-3 and 16-1 and 17-5 and (287-3 or 243-5)
3HAC8183-4	Customer pow.-sign. L=30m	94-4 and 16-1 and 17-5 and (287-3 or 243-5)
3HAC3353-1	Customer pow.-sign. L=7m	94-1 and 16-1 and 17-5 and (287-4 or 243-1)
3HAC3354-1	Customer power-sign. L=15m	94-2 and 16-1 and 17-5 and (287-4 or 243-1)
3HAC3355-1	Customer power-sign. L=22m	94-3 and 16-1 and 17-5 and (287-4 or 243-1)
3HAC3356-1	Customer power-sign. L=30m	94-4 and 16-1 and 17-5 and (287-4 or 243-1)

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

IRB 360

Art. no.	Description	Option no. ⁱ
3HAC030198-001	Internal Customer cable L=3m	218-5 and 94-6
3HAC030198-002	Internal Customer cable L=7m	218-5 and 94-1
3HAC030198-003	Internal Customer cable L=15m	218-5 and 94-2
3HAC030198-004	Internal Customer cable L=22m	218-5 and 94-3
3HAC030198-005	Internal Customer cable L=30m	218-5 and 94-4

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

7 Spare parts

7.2.6 Additional cables

7.2.6 Additional cables

Drive module cables

Cable	Art. no.	Option no.
3HAC025600-001	Cable between control module and drive module: L=1.7 m	
3HAC025600-005	Cable between control module and drive module: L=4 m	761-1
3HAC025600-006	Cable between control module and drive module: L=30 m	761-3

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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