

Comau Robotics Instruction Handbook



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Control Unit C5G

Standard Version, Rel. 0/1/2

Maintenance

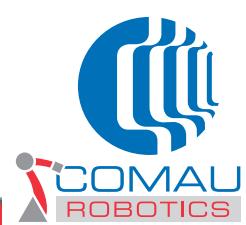
Help to problem-solving

Preventive maintenance plan to guarantee the C5G functionality over time

Preventive and special maintenance procedures

Spare part list

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SUMMARY

PREFACE	6
Reference documents	6
Contents of manuals of the Control Unit C5G	7
Documents storage	7
Limits on the Manual Content	7
Symbols used in the manual	8
1. GENERAL SAFETY PRECAUTIONS	9
Responsibilities	9
Safety Fundamental Requirements applied and respected	10
Safety precautions	10
Purpose	10
Definitions	10
Applicability	11
Operating modes	12
Performance	18
2. MAINTENANCE PRESCRIPTIONS.....	19
Precautions before starting	19
Precautions while carrying out maintenance activities.....	19
Precautions at the end of the maintenance activities.....	20
Maintenance staff.....	20
Equipment and tools necessary.....	20
Torque wrench settings	20
3. HELP IN TROUBLE SHOOTING.....	21
Precautions before starting	21
Methodology	21
Problem analysis	21
Diagnosis messages	22
Meaning of the format	22
Alarm quitting	23
Identification items and abbreviations for connectors, cables and modules	25
Traceability for replacement purposes.....	25
Replacing the components	26
Control Unit outline diagrams.....	26
Causes and remedy	29

Comau Customer Centre	30
4. HOW TO SWITCHING OFF THE POWER SUPPLY	31
Precautions and risks associated to the power supply off-switching	31
Switching off the power supply	32
5. HOW TO REACH THE MODULES.....	35
Precautions before starting	35
Risks associated with the module reaching procedures	35
Module location and reaching methods	36
Front door	38
Upper panel	39
Rear panel	40
6. HOW TO MOVE THE ROBOT WHEN THE CONTROL UNIT IS DAMAGED	41
Precautions before starting	41
Risks associated with the Robot handling with Control Unit disconnected	41
How to use the Brake Release module C5G-OBR	43
7. MAINTENANCE STRUCTURE.....	47
General information	47
Maintenance activities overview	47
8. PREVENTIVE MAINTENANCE	49
Precautions before starting	49
Equipment and tools required	49
Preventive maintenance plan	50
ACC: door closing and seal efficiency check	51
ACO: cleaning the condenser	52
ACO: emptying the condensate collecting can	54
E110: fan cleaning	56
E111..E113: fan cleaning	58
UPS: replacing the battery	60
9. SPECIAL MAINTENANCE	63
Precautions before starting	63

Equipment and tools required	63
Modules subject to special maintenance activities	64
ACO: replacement	65
ACO: limit switch replacement	70
AMS-APC820: module replacement with Compact Flash module recovery	74
AMS-ASM32: module replacement	83
AMS-IAM: module replacement	86
C5G-iTP or iTP2: replacement	92
Software loading in iTP or iTP2	95
AMS-PPS8: module replacement	96
Fuse replacement in the module AMS-PPS8	100
Symptoms and consequences for breaking of the fuse	100
HMK: hour-meter replacement	101
SDM: module replacement	103
UPS: replacing the module	107
Fuse replacement in the UPS module	109
10. SPARE PARTS	110
Precautions about the spare part usage	110
Where to procure the spare parts	111
Spare part list	111
Spare parts for the C5G basic model	112
Special configurations spare parts	122
11. SETTING OUT OF WORK AND DISMANTLING	124
Precautions before starting	124
Staff to set the plant out of work and dismantle it	124
Equipment and tools required	124
Setting out of work and dismantling procedure	124
Removing the cell and battery from the Control Unit	126

PREFACE

In this chapter are shown the following topics:

- Reference documents
- Contents of manuals of the Control Unit C5G
- Documents storage
- Limits on the Manual Content
- Symbols used in the manual.

Reference documents

This document refers to the Control Unit **C5G**.

The complete set of manuals **C5G** is composed of:

Comau	Control Unit C5G	<ul style="list-style-type: none"> - Technical Specification - Transport and installation - Maintenance - Use of Control Unit.
	Wiring diagram	<ul style="list-style-type: none"> - Circuit Diagram (ver. ACC1 and ACC3) - Circuit Diagram (ver. ACC5) - Circuit Diagram (ver. PAL)

These manuals must be integrated with the following documents:

Comau	Robot SMART5	<ul style="list-style-type: none"> - Technical specifications *1 - Transport and installation *1 - Maintenance *1
	Programming	<ul style="list-style-type: none"> - PDL2 Programming Language Manual - VP2 - Visual PDL2 - Motion Programming
	Application	<ul style="list-style-type: none"> - According to the type of application required.

*1 specific according to type of Robot installed



These manual mentioned above shall be undamaged as long as the Robotic System is installed and operates, they shall be always at available of those operating on the Robotic System

Contents of manuals of the Control Unit C5G

Device	Manual	Contents
Control Unit C5G	Technical Specification	<ul style="list-style-type: none"> – Description and general characteristics of the Control Unit – Guide to selecting the model of the Control Unit – General description upon expandability towards the I/O signals, communication networks, safeties – Description and purchase part numbers of the Control Unit and options.
	Transport and installation	<ul style="list-style-type: none"> – Information about the preparations and arrangements necessary to install the C5G – Dimension and weight, transport and lifting methods – Procedures for internal components adjustment and options to the power supply network – Procedure for connection to the plant energies and the electric power – Preliminary procedures for the Control Unit commissioning
	Maintenance	<ul style="list-style-type: none"> – Suggestions for problem shooting – Preliminary maintenance planning to ensure the functionality of C5G during the time – Preliminary and Special Maintenance procedures – Spare parts list
		– Wiring diagram

Documents storage

All documents provided shall be stored nearby the Robotic System and be at disposal of the operators that work with it, the documents shall be maintained intact for the entire Robotic System life.

Limits on the Manual Content

Figures inserted in the instructions handbook have the goal to represent the product and can differ from what actually visible on the Robotic System.

Symbols used in the manual

Below are listed the symbols that represent: WARNING, CAUTION and NOTES and their meaning



This symbol indicates operating procedures, technical information and precautions if are not observed and/or correctly performed could cause injuries to the personnel.



This symbol indicates operating procedures, technical information and precautions if are not observed and/or correctly performed could cause damage to the equipment.



This symbol indicates operating procedures, technical information and precautions that are to be underlined.



This symbol indicates the material disposal that is regulated by the WEEE Directive.



This symbol indicates to avoid environmental contamination, and to dismiss the materials on the appropriate collection facility.

1. GENERAL SAFETY PRECAUTIONS



It deals with a general specification that applies to the whole Robot System. Due to its significance, this document is referred to unreservedly in any system instructions handbook.

In this chapter are shown the following topics:

- [Responsibilities](#)
 - [Safety precautions](#).
-

1.1 Responsibilities

- The system integrator is responsible for ensuring that the [Robotic system \(Robot and Control Unit\)](#) are installed and handled in accordance with the Safety Standards in force in the country where the installation takes place. The application and use of the protection and safety devices necessary, the issuing of declarations of conformity and any EC markings of the system are the responsibility of the Integrator.
- COMAU Robotics shall in no way be held liable for any accidents caused by incorrect or improper use of the [Robotic system \(Robot and Control Unit\)](#), by tampering with circuits, components or software, or the use of spare parts that are not included in the spare parts list.
- The application of these Safety Precautions is the responsibility of the persons assigned to direct / supervise the activities indicated in the [Applicability](#) section are to make sure that the [Authorised Personnel](#) is aware of and scrupulously follow the precautions contained in this document as well as the Safety Standards in addition to the Safety Standards applicable to [Robotic system \(Robot and Control Unit\)](#) in force in the Country where the system is installed.
- The non-observance of the Safety Standards could cause to the operators permanent injuries or death and can damage the [Robotic system \(Robot and Control Unit\)](#).



The installation shall be made by qualified installation Personnel and should conform to all National and Local standards.

1.1.1 Safety Fundamental Requirements applied and respected

The robotic system is composed of C5G Control Unit and Robot series SMART 5 considers as applied and respected the following Safety Fundamental Requirements, Annex 1 of Directive on Machinery 2006/42/CE: 1.1.3 – 1.1.5 – 1.2.1 – 1.2.2 – 1.2.3 – 1.2.4.3 – 1.2.5 – 1.2.6 – 1.3.2 – 1.3.4 – 1.3.8.1 – 1.5.1 – 1.5.2 – 1.5.4 – 1.5.6 – 1.5.8 – 1.5.9 – 1.5.10 – 1.5.11 – 1.5.13 – 1.6.3 – 1.6.4 – 1.6.5 – 1.7.1 – 1.7.1.1 – 1.7.2 – 1.7.4. In case that is provided only the Robot SMART 5 series, are considered applicable the requirements: 1.1.3 – 1.1.5 – 1.3.2 – 1.3.4 – 1.3.8.1 – 1.5.1 – 1.5.2 – 1.5.4 – 1.5.6 – 1.5.8 – 1.5.9 – 1.5.10 – 1.5.11 – 1.5.13 – 1.6.4 – 1.6.5 – 1.7.1 – 1.7.1.1 – 1.7.2 – 1.7.4

1.2 Safety precautions

1.2.1 Purpose

These safety precautions define the behaviour and rules to be observed when performing the activities listed in the [Applicability](#) section.

1.2.2 Definitions

Robotic system (Robot and Control Unit)

Robotic system is the workable unit composed of: Robot, Control Unit, Teach Pendant and other options.

Protected Area

The protected area is the zone confined by the protection barriers and to be used for the installation and operation of the robot.

Authorised Personnel

Authorised personnel defines the group of persons who have been trained and assigned to carry out the activities listed in the [Applicability](#) section

Staff in charge

The staff in charge to direct or supervise the activities of the workers referred to in the paragraph above.

Installation and Putting into Service

The installation is intended as the mechanical, electrical and software integration of the Robot and Control System in any environment that requires controlled movement of robot axes, in compliance with the safety requirements of the country where the system is installed.

Operation in Programming Mode

Operating mode under the control of the operator, that excludes automatic operation and allows the following activities: manual handling of robot axes and programming of work cycles at low speed, programmed cycle testing at low speed and, when allowed, at the working speed.

Auto / Remote Automatic Mode

Operating mode in which the robot autonomously executes the programmed cycle at the work speed, with the operators outside the protected area, with the protection barriers closed and the safety circuit activated, with local (located outside the protected area) or remote start/stop.

Maintenance and Repairs

Maintenance and repairs are activities that involve periodical checking and / or replacement (mechanical, electrical, software) of Robot and Control System parts or components, and trouble shooting, that terminate when the Robot and Control System has been reset to its original project functional condition.

Putting Out of Service and Dismantling

Putting out of service defines the activities involved in the mechanical and electrical removal of the Robot and Control System from a production unit or from an environment in which it was under study.

Dismantling consists of the demolition and dismantling of the components that make up the Robot and Control System.

Integrator

The integrator is the professional expert responsible for the installation and putting into service of the Robot and Control System.

Misuse

Misuse is when the system is used in a manner other than that specified in the Technical Documentation.

Action area

The robot action area is the enveloping volume of the area occupied by the robot and its fixtures during movement in space.

1.2.3 Applicability

These Precautions are to be applied when carrying out the following activities:

- Installation and Putting into Service
- Operation in programming mode
- Auto / Remote Automatic Mode
- Robot axes brake
- Maintenance and Repair
- Putting Out of Service and Dismantling.

1.2.4 Operating modes

Installation and Putting into Service

- Putting into service is only possible when the Robot and Control System has been correctly and completely installed.
- The system installation and putting into service is exclusively the task of the authorised personnel.
- The system installation and putting into service is only permitted inside a protected area of an adequate size to house the robot and the fixtures it is outfitted with, without passing beyond the protection barriers. It is also necessary to check that under normal robot movement conditions there is no collision with parts inside the protected area (structural columns, power supply lines, etc.) or with the barriers. If necessary, limit the robot working areas with mechanical hard stop (see optional assemblies).
- Any fixed robot control protections are to be located outside the protected area and in a point where there is a full view of the robot movements.
- The robot installation area is to be as free as possible from materials that could impede or limit visibility.
- During installation the robot and the Control Unit are to be handled as described in the product Technical Documentation; if lifting is necessary, check that the eye-bolts are fixed securely and use only adequate slings and equipment.
- Secure the robot to the support, with all the bolts and pins necessary, tightened to the torque indicated in the product Technical Documentation.
- If present, remove the fastening brackets from the axes and check that the fixing of the robot fixture is secured correctly.
- Check that the robot guards are correctly secured and that there are no moving or loose parts. Check that the Control Unit components are intact.
- Install the Control Unit outside the protected area: the Control Unit is not to be used to form part of the fencing.
- Check that the voltage value of the mains is consistent with that indicated on the plate of the Control Unit.
- Before electrically connecting the Control Unit, check that the circuit breaker on the mains is locked in open position.
- Connection between the Control Unit and the three-phase supply mains at the works, is to be with a four-pole (3 phases + earth) armoured cable dimensioned appropriately for the power installed on the Control Unit. See the product Technical Documentation.
- The power supply cable is to enter the Control Unit through the specific cable entry and be properly clamped.
- Connect the earth conductor (PE) then connect the power conductors to the main switch.
- Connect the power supply cable, first connecting the earth conductor to the circuit breaker on the mains line, after checking with a tester that the circuit breaker terminals are not powered. Connect the cable armouring to the earth.
- Connect the signals and power cables between the Control Unit and the robot.

- Connect the robot to earth or to the Control Unit or to a nearby earth socket.
- Check that the Control Unit door (or doors) is/are locked with the key.
- A wrong connection of the connectors could cause permanent damage to the Control Unit components.
- The C5G Control Unit manages internally the main safety interlocks (gates, enabling push-buttons, etc.). Connect the C5G Control Unit safety interlocks to the line safety circuits, taking care to connect them as required by the Safety standards. The safety of the interlock signals coming from the transfer line (emergency stop, gates safety devices etc.) i.e. the realisation of correct and safe circuits, is the responsibility of the Robot and Control System integrator.



In the cell/line emergency stop circuit the contacts must be included of the control unit emergency stop buttons, which are on X30. The push-buttons are not interlocked in the emergency stop circuit of the Control Unit.

- The safety of the system cannot be guaranteed if these interlocks are wrongly executed, incomplete or missing.
- The safety circuit executes a controlled stop (IEC 60204-1 , class 1 stop) for the safety inputs Auto Stop/ General Stop and Emergency Stop. The controlled stop is only active under Automatic mode; under Programming mode the power is powered off immediately. The procedure for the selection of the controlled stop time (that can be set on SDM board) is contained in the Transport and Installation Manual of the Control Unit.
- When preparing protection barriers, especially light curtains and access doors, bear in mind that the robot stop times and distances are according to the stop category (0 or 1) and the weight of the robot.



Check that the controlled stop time is consistent with the type of Robot connected to the Control Unit. The stop time is selected using selector switches SW1 and SW2 on the SDM board.

- Check that the environment and working conditions are within the range specified in the specific product Technical Documentation.
- The calibration operations are to be carried out with great care, as indicated in the Technical Documentation of the specific product, and are to be concluded checking the correct position of the machine.

- To load or update the system software (for example after replacing boards), use only the original software handed over by COMAU Robotics. Scrupulously follow the system software uploading procedure described in the Technical Documentation supplied with the specific product. After uploading, always make some tests moving the robot at slow speed and remaining outside the protected area.
- Check that the barriers of the protected area are correctly positioned.

Operation in programming mode

- The robot is only to be programmed by the authorised personnel.
- Before starting to program, the operator must check the **Robotic system (Robot and Control Unit)** to make sure that there are no potentially hazardous irregular conditions, and that there is nobody inside the protected area.
- When possible the programming should be controlled from outside the protected area.
- Before operating inside the **Protected Area**, the operator must make sure from outside that all the necessary protections and safety devices are present and in working order, and especially that the hand-held programming unit functions correctly (slow speed, emergency stop, enabling device, etc.).
- During the programming session, only the operator with the Teach Pendant is allowed inside the **Protected Area**.
- If the presence of a second operator in the working area is necessary when checking the program, this person must have an enabling device interlocked with the safety devices.
- Activation of the motors (DRIVE ON) is always to be controlled from a position outside the range of the robot, after checking that there is nobody in the area involved. The Drive On operation is concluded when the relevant machine status indication is shown.
- When programming, the operator is to keep at a distance from the robot to be able to avoid any irregular machine movements, and in any case in a position to avoid the risk of being trapped between the robot and structural parts (columns, barriers, etc.), or between movable parts of the actual robot.
- When programming, the operator is to avoid remaining in a position where parts of the robot, pulled by gravity, could execute downward movements, or move upwards or sideways (when installed on a sloped plane).
- Testing a programmed cycle at working speed with the operator inside the protected area, in some situations where a close visual check is necessary, is only to be carried out after a complete test cycle at slow speed has been executed. The test is to be controlled from a safe distance.
- Special attention is to be paid when programming using the Teach Pendant: in this situation, although all the hardware and software safety devices are active, the robot movement depends on the operator.
- During the first running of a new program, the robot may move along a path that is not the one expected.
- The modification of program steps (such as moving by a step from one point to another of the flow, wrong recording of a step, modification of the robot position out of the path that links two steps of the program), could give rise to movements not expected by the operator when testing the program.

- In all cases operate cautiously, always remaining out of the robot's range of action and test the cycle at slow speed.

Auto / Remote Automatic Mode

- The activation of the automatic operation (AUTO and REMOTE states) is only to be executed with the **Robotic system (Robot and Control Unit)** integrated inside an area with protection barriers properly interlocked, as specified by Safety Standards currently in force in the Country where the installation takes place.
- Before starting the automatic mode the operator is to check the Robot and Control System and the protected area to make sure there are no potentially hazardous irregular conditions.
- The operator can only activate automatic operation after having checked:
 - that the Robot and Control System is not in maintenance or being repaired;
 - the protection barriers are correctly positioned;
 - that there is nobody inside the protected area;
 - that the Control Unit doors are closed and locked with the key;
 - that the safety devices (emergency stop, protection barrier devices) are functioning;
- Special attention is to be paid when selecting the automatic-remote mode, where the line PLC can perform automatic operations to switch on motors and start the program.

Robot axes brake

- In the absence of motive power, the robot axes movement is possible by means of optional release devices and suitable lifting devices. Such devices only enable the brake deactivation of each axis. In this case, all the system safety devices (including the emergency stop and the enable button) are powered off; also the robot axes can move upwards or downwards because of the force generated by the balancing system, or the force of gravity.



Before using the manual release devices, it is strongly recommended to sling the robot, or hook to an overhead travelling crane.

- Enabling the Brake releasing Module may cause the axes falling due to gravity as well as possible impacts due to an incorrect restoration, after applying the brake releasing module. The procedure for the correct usage of the Brake releasing Module (both for the integrated one and module one) is to be found in the maintenance manuals.

- When the motion is enabled again following the interruption of an unfinished MOVE, the track recovery typical function may generate unpredictable paths that may imply the risk of impact. This same condition arises at the next automatic cycle restarting. Avoid moving the Robot to positions that are far away from the ones provided for the motion restart; alternatively disable the outstanding MOVE programmes and/or instructions.

Maintenance and Repair

- At the COMAU works all robots are lubricated using products that do not contain any harmful substances. However, in some cases, repeated and prolonged exposure to such products may cause irritation of the skin and they may be harmful if swallowed.
First Aid Measures In case of contact with the eyes or skin: rinse the affected areas with copious amounts of water; should irritation persist, seek medical advice. If swallowed, do not induce vomiting or administer anything by mouth; see a doctor as soon as possible.
- Maintenance, trouble-shooting and repairs are only to be carried out by authorised personnel.
- When carrying out maintenance and repairs, the specific warning sign is to be placed on the control panel of the Control Unit, stating that maintenance is in progress and it is only to be removed after the operation has been completely finished - even if it should be temporarily suspended.
- Maintenance operations and replacement of components or the Control Unit are to be carried out with the main switch in open position and locked with a padlock.
- Even if the Control Unit is not powered (main switch open), there may be interconnected voltages coming from connections to peripheral units or external power sources (e.g. 24 Vdc inputs/outputs). Power off external sources when operating on parts of the system that are involved.
- Removal of panels, protection shields, grids, etc. is only allowed with the main switch open and padlocked.
- Faulty components are to be replaced with others having the same Part number, or equivalent components defined by COMAU Robotics.



After replacement of the SDM module, check on the new module that the setting of the stop time on selector switches SW1 and SW2 is consistent with the type of Robot connected to the Control Unit.

- Trouble-shooting and maintenance activities are to be executed, when possible, outside the protected area.
- Trouble-shooting executed on the control is to be carried out, when possible without power supply.
- Should it be necessary, during trouble-shooting, to intervene with the Control Unit powered, all the precautions specified by Safety Standards are to be observed when operating with hazardous voltages present.
- Trouble-shooting on the robot is to be carried out with the power supply powered off (DRIVE OFF).
- At the end of the maintenance and trouble-shooting operations, all deactivated safety devices are to be reset (panels, protection shields, interlocks, etc.).

- Maintenance, repairs and trouble-shooting operations are to be concluded checking the correct operation of the **Robotic system (Robot and Control Unit)** and all the safety devices, executed from outside the protected area.
- When loading the software (for example after replacing electronic boards) the original software handed over by COMAU Robotics is to be used. Scrupulously follow the system software loading procedure described in the specific product Technical Documentation; after loading always run a test cycle to make sure, remaining outside the protected area
- Disassembly of robot components (motors, balancing cylinders, etc.) may cause uncontrolled movements of the axes in any direction: before starting a disassembly procedure, consult the warning plates applied to the robot and the Technical Documentation supplied.
- It is strictly forbidden to remove the protective covering of the robot springs.

Putting Out of Service and Dismantling

- Putting out of service and dismantling the Robot and Control System is only to be carried out by **Authorised Personnel**.
- Move the robot to transport position and mount the axes locking items (if present), following the instructions on the plate posted on the robot and its Technical Documents.
- Before starting to put out of service, the mains voltage to the Control Unit must be powered off (switch off the circuit breaker on the mains distribution line and lock it in open position).
- After using the specific instrument to check there is no voltage on the terminals, disconnect the power supply cable from the circuit breaker on the distribution line, first disconnecting the power conductors, then the earth. Disconnect the power supply cable from the Control Unit and remove it.
- First disconnect the connection cables between the robot and the Control Unit, then the earth cable.
- If present, disconnect the robot pneumatic system from the air distribution mains.
- Check that the robot is properly balanced and if necessary sling it correctly, then remove the robot securing bolts from the support.
- Remove the robot and Control Unit from the working area, following all prescriptions in the product Technical Documents; in case of lifting, check the eyebolts fastening and use only suitable slinging devices and equipment.
- Before starting dismantling operations (disassembly, demolition and disposal) of the Robot and Control System components, contact COMAU Robotics & Service, or one of its branches, who will indicate, according to the type of robot and Control Unit, the operating methods in accordance with safety principles and safeguarding the environment.
- The waste disposal operations are to be carried out complying with the legislation of the country where the Robot and Control System is installed.

1.2.5 Performance

The performances below shall be considered before installing the robotic system:

- Stop spaces
- Mission time (typical value).

Stop spaces

- With Robot in programming mode (T1), if you press the stop push-button (red mushroom-shaped one on WiTP) in category 0 (According to Standard EN60204-1), you will obtain:

Tab. 1.1 - Stopping spaces in programming mode (T1)

Mode	Expected speed	Case	Stopping time	Stopping space
T1	250 mm/s	Nominal	120 ms	30 mm
		Limit	500 ms	125 mm

Tab. 1.2 - Safety electronics reaction time in programming mode (T1)

Mode	Expected speed	Case	Reaction time
T1	250 mm/s	For the safety inputs of the SDM module (e.g. stop push-button of TP in wired version)	150 ms
		For the stop and enabling device inputs from the TP in wireless version, when the safety wire transmission is active.	
		For the time-out of stop input and enabling device from TP in wireless version, when the safety wire transmission is lost or interrupted.	350 ms

- Considering the Robot in automatic mode, under full extension, full load and maximum speed conditions, if you press the stop push-button (red mushroom-shaped one on WiTP) in category 1 (according to standard EN60204-1) you will trigger the Robot complete stop with controlled deceleration ramp. Example: for Robot NJ 370-2.7 you will obtain the complete stop in about 85 ° motion, that correspond to about 3000 mm movement measured on TCP flange. Under the said conditions, the stopping time for Robot NJ 370-2.7 is equal to 1,5 seconds.
- For each Robot the limit stop distances can be required to COMAU Robotics.

Mission time (typical value)

- We remind you that the safety system efficiency covering is equal to 20 years (mission time of safety-related parts of control systems (SRP/CS), according to EN ISO 13849-1).

2. MAINTENANCE PRESCRIPTIONS

This chapter deals with the following topics:

- Precautions before starting
- Precautions while carrying out maintenance activities
- Precautions at the end of the maintenance activities
- Maintenance staff
- Equipment and tools necessary
- Torque wrench settings.



The maintenance activities that are not expressly specified in this manual are not allowed. If necessary, turn to the manufacturer.

2.1 Precautions before starting

- The majority of maintenance activities on the Control Unit are to be carried out with power off. In those cases the wording “[Main switch open \(OFF\)](#)” is specified in the maintenance sheet.
When the main switch is OFF, the X120 terminal board and the related cable up to the main switch are energized. In that case, the procedure to cut the power off completely requires the power disconnection from the mains.
- The maintenance activities to be carried out on the cabinet main powering section shall be performed only after disconnecting the power from the mains. In those cases the wording “[Incoming voltage off](#)” is specified in the maintenance sheet.
- Use original spare parts only. Spare parts are supplied by Comau. The bill of spare parts is to be found in [Cap.10. - Spare parts on page 110](#).

2.2 Precautions while carrying out maintenance activities

- If the fault type allows the robot re-positioning, we recommend to move it in resting position, before carrying out any maintenance activity.
- We remind you that in virtue of the Control Unit safety circuits inherent features, a warranty reduction may be possible in case of multiple faults (refer to norm EN ISO 13849-1).



In case of maintenance and/or troubleshooting activities on the safety circuits, do not stand nearby the Robot and carry out the motion in jog mode keeping at suitable distance.

2.3 Precautions at the end of the maintenance activities

- After completing the maintenance activities, check whether the Control Unit and matched Robot operate properly. Have the robot performing some working cycle and check the safety device functionality before leaving the station.



At the end of each maintenance session, the first machine start-up shall be regarded as a test for the whole plant. During such phase the operator shall stand outside the Robot range of action but in a position that allows to check its movements. Moreover, he/she shall have the Teach Pendant at disposal nearby.

2.4 Maintenance staff

The maintenance staff shall be suitably trained, in order to be able to use the lifting means properly (in case the whole Control Unit is to be replaced). Moreover, the staff shall be *warned or trained (in electrics)* and therefore aware of the risks associated with electric energy and of the measures to be taken to safely reach the Control Unit modules.

2.5 Equipment and tools necessary

The components fastening items (screws, nuts) have been standardized as much as possible.

The minimum equipment necessary to carry out maintenance activities on the C5G Control Unit is divided according to the maintenance typology:

- as for **preventive maintenance** refer to [par. 8.2 Equipment and tools required on page 49](#).
- as for **special maintenance** refer to [par. 9.2 Equipment and tools required on page 63](#).

2.6 Torque wrench settings

While disassembling and re-assembling the components comply with the screw torque wrench settings. If not otherwise specified, apply the torque corresponding to the screw typology.



Do not overtight, as you may damage the thread and therefore the item position in its seat.

Do not under tight, as it may cause the item falling and/or overheating (and consequent breaking) due to an incorrect adherence to the dissipating frame.

3. HELP IN TROUBLE SHOOTING

This chapter deals with the following topics:

- [Precautions before starting](#)
 - [Methodology](#)
 - [Control Unit outline diagrams](#)
 - [Causes and remedy](#)
 - [Comau Customer Centre](#)
-

3.1 Precautions before starting

- Read carefully the instructions in [Cap.2. - Maintenance prescriptions on page 19](#)
-

3.2 Methodology

- [Problem analysis](#)
 - [Diagnosis messages](#)
 - [Identification items and abbreviations for connectors, cables and modules](#)
 - [Traceability for replacement purposes](#)
 - [Replacing the components](#)
-

3.2.1 Problem analysis

The C5G Control Unit delivers information about the system status using:

- LEDs, located on the modules and cards
- diagnosis messages, displayed through the Teach Pendant.

Depending on the plant condition, one or both means (LEDs, messages) may be useful to detect possible faults:

- during the boot phase, the Teach Pendant is not active and it is necessary to rely on the LEDs on the modules
- when the Teach Pendant is active, the [Diagnosis messages](#) delivered are more efficient
- in all cases, in particular for the auxiliary circuit power supplies, LEDs represent the most immediate diagnostic procedure
- the pins in the tables in [Cap. Details about the C5G Control Unit on page 63](#) of the “Technical specifications” manual allow to check the availability of the expected corresponding signal
- for the connection among modules and further information about the circuits, refer to the Control Unit [Circuit Diagram \(ver. ACC1 and ACC3\)](#).

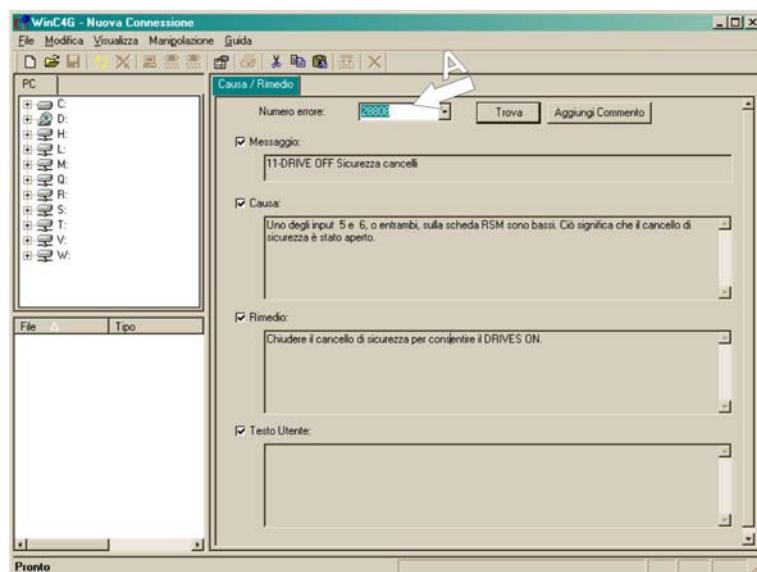
3.2.2 Diagnosis messages

The diagnosis messages are coded using numerical codes matched to a short description and are displayed through the Teach Pendant.

To better understand the message, identify the cause that led to it as well as the suitable method to remove it, use the WinC4G software.

The software main window ([Fig. 3.1](#)) displays the above mentioned information. To call the information enter the error code in field (A).

Fig. 3.1 - WinC4G main window related to the error codes



3.2.2.1 Meaning of the format

The error messages are displayed on the Teach Pendant and WinC4G software and also stored in a file named ERROR.LOG. It deals with a Control Unit memory resident file that can be recalled if a message is erased or the user wishes to check which alarms occurred.

The message format is the following:

xxxx.yyyyy-zz: Text

Tab. 3.1 - Message format

Position	Description
xxxx	Stored event progressive number. The messages identified by ---- are not stored.
yyyyy	Error code
zz	Seriousness level (see details in Tab. 3.2)
Text	Message text

ex. ----.28808-10: Gate safety

The error message meaning is the following:

- ----- (the message is not stored)
- 28808 (error numerical code)
- 10 (seriousness level)
- Gate safety (message text featuring the fault detected on the plant).

3.2.2.2 Alarm quitting

Find below the quitting procedures as a function of the alarm seriousness level:

Tab. 3.2 - Seriousness level and corresponding quitting procedure

Seriousness level	Meaning	Impact on the system	Quitting procedure
00	Informative message	None	None
01	Informative message	None	None
02	Warning	No impact on the Control Unit status.	None
03	Not used		
04	PDL2 programme error	Programme in PAUSE or HOLD mode, if it deals with a holdable programme.	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the fault in the programme. - Restart the programme.
05	Not used		
06	PDL2 programme error	All programmes in PAUSE or HOLD mode, if it deals with holdable programmes.	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the fault in the programme. - Restart all programmes.
07	Not used		
08	Hold	HOLD	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the cause that gave rise to the alarm - Restore the programme pressing the START key
09	Not used		
10	Driving devices off	HOLD and following DRIVE OFF (stop according to category 1, in compliance with norm EN 60204-1)	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the cause that gave rise to the alarm - DRIVE ON - Restore the programme pressing the START key

Tab. 3.2 - Seriousness level and corresponding quitting procedure

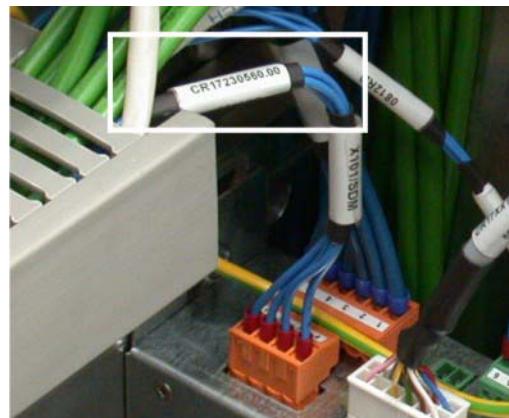
Seriousness level	Meaning	Impact on the system	Quitting procedure
11	Driving devices off	DRIVE OFF (stop according to category 0, in compliance with norm EN 60204-1)	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the cause that gave rise to the alarm - DRIVE ON - Restore the programme pressing the START key
12	Driving devices off	HOLD, DRIVE OFF and DEACTIVATE (stop according to category 1, in compliance with norm EN 60204-1 and programme deactivation)	<ul style="list-style-type: none"> - Quit the fault pressing the RESET (Ctrl + HOME keys on WinC4G) key - Remove the cause that gave rise to the alarm - DRIVE ON - Restore the programme pressing the START key
13	Fatal error	Stops the Robot according to category 0 (in compliance with norm EN 60204-1) and deactivate all PDL2 programs (DEACTIVATE) and leaves the system in minimum configuration.	<ul style="list-style-type: none"> - Remove the cause that gave rise to the alarm - Switch the Control Unit off and allow at least 30 seconds for the UPS module deactivation - Switch the Control Unit back on
14	Fatal error	Stops the Robot according to category 0 (in compliance with norm EN 60204-1) and deactivate all PDL2 programs (DEACTIVATE) and leaves the system in minimum configuration.	<ul style="list-style-type: none"> - Remove the cause that gave rise to the alarm - Switch the Control Unit off and allow at least 30 seconds for the UPS module deactivation - Switch the Control Unit back on
15	Fatal error	Stops the Robot according to category 0 (in compliance with norm EN 60204-1) and deactivate all PDL2 programs (DEACTIVATE) and leaves the system in minimum configuration.	<ul style="list-style-type: none"> - Remove the cause that gave rise to the alarm - Switch the Control Unit off and allow at least 30 seconds for the UPS module deactivation - Switch the Control Unit back on.

3.2.3 Identification items and abbreviations for connectors, cables and modules

All connectors and cables in the Control Unit are supplied with clear abbreviations and characterized univocally, to allow a rapid identification of the connection as well as the [Traceability for replacement purposes \(see par. 3.2.4 on page 25\)](#).

The abbreviations are posted both on the movable and the fixed connector. In the case of the latter, the abbreviation is silk-screen-printed nearby the component.

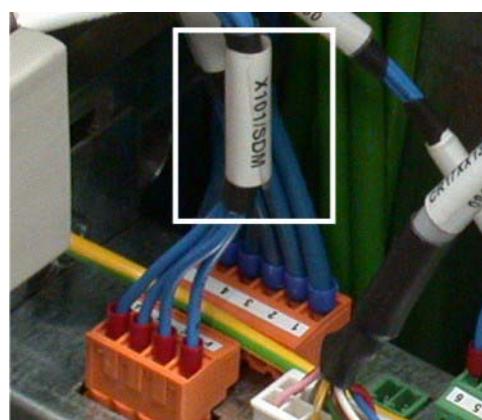
Fig. 3.2 - Example of abbreviation on connector and cable



Each connector ending on the modules is identified by the letter "X" followed by a progressive number and the abbreviation of the corresponding component (example X9 / CPU, X100 / FIA, etc.).

The connector abbreviation is clearly silk-screen-printed on the component.

Fig. 3.3 - Example of abbreviation on connector



3.2.4 Traceability for replacement purposes

Each cable / component is identified by a label featuring the Serial Number S/N and the purchase code, Part Number, P/N.

The codes are defined as follows:

- S/N followed by 4 figures (year and month of manufacturing) e 2 letters
- P/N followed by 8 figures (purchase code), a separating dot and 2 figures identifying the review status.

3.2.5 Replacing the components

To replace the components, we recommend to identify the damaged ones through the [Identification items and abbreviations for connectors, cables and modules](#), such as to be able to replace them with an identical spare part.

Find in [Cap.10. - Spare parts on page 110](#) the codes and descriptions of the components available as spare parts.

The spare parts can be purchased directly from Comau at the addresses listed in [par. 3.5 Comau Customer Centre on page 30](#) where it is also possible to have the damaged components repaired.



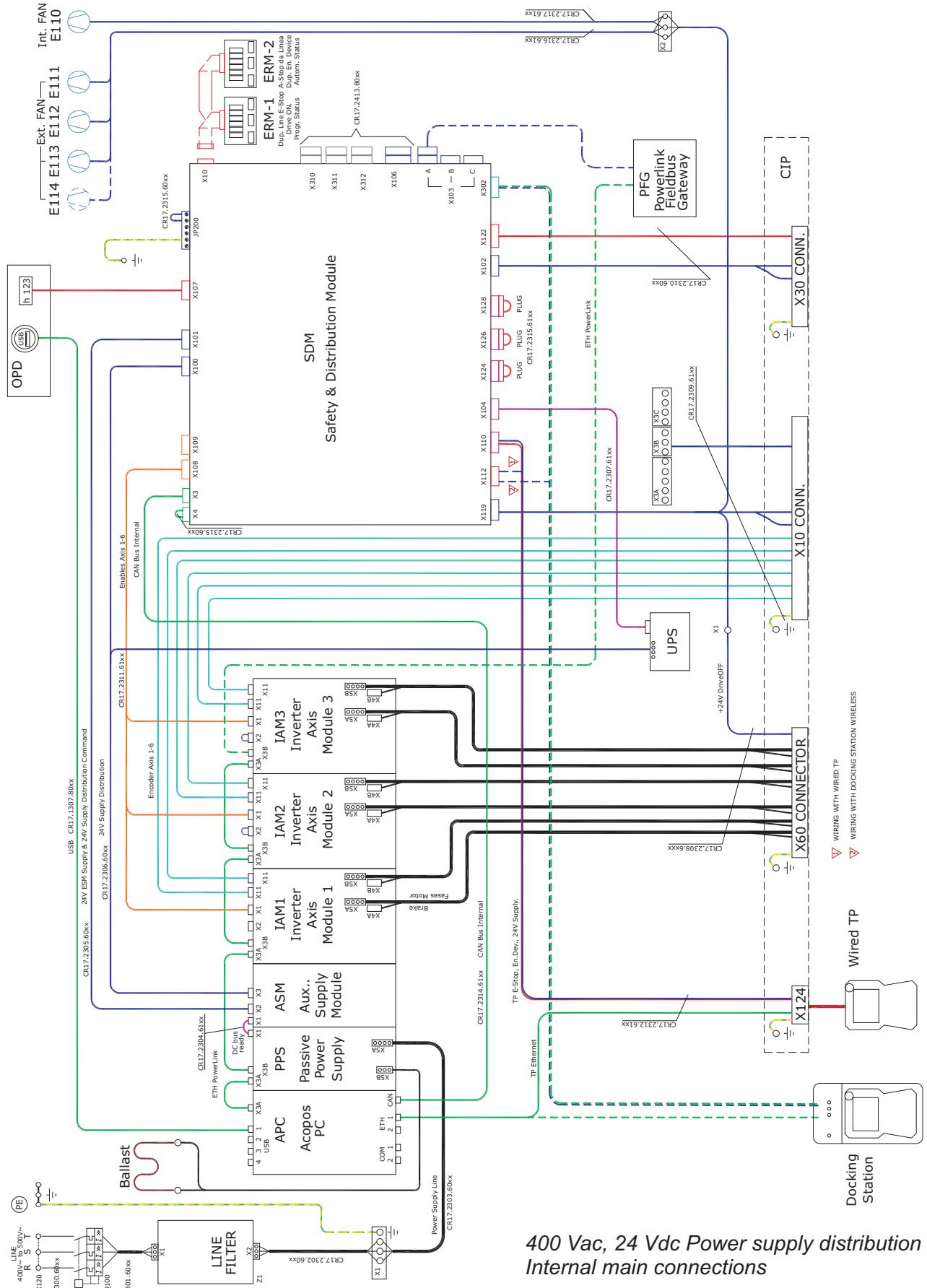
Do not carry out independent or not authorized repairing activities on the damaged modules. The repairing activities shall be carried out by Comau only.

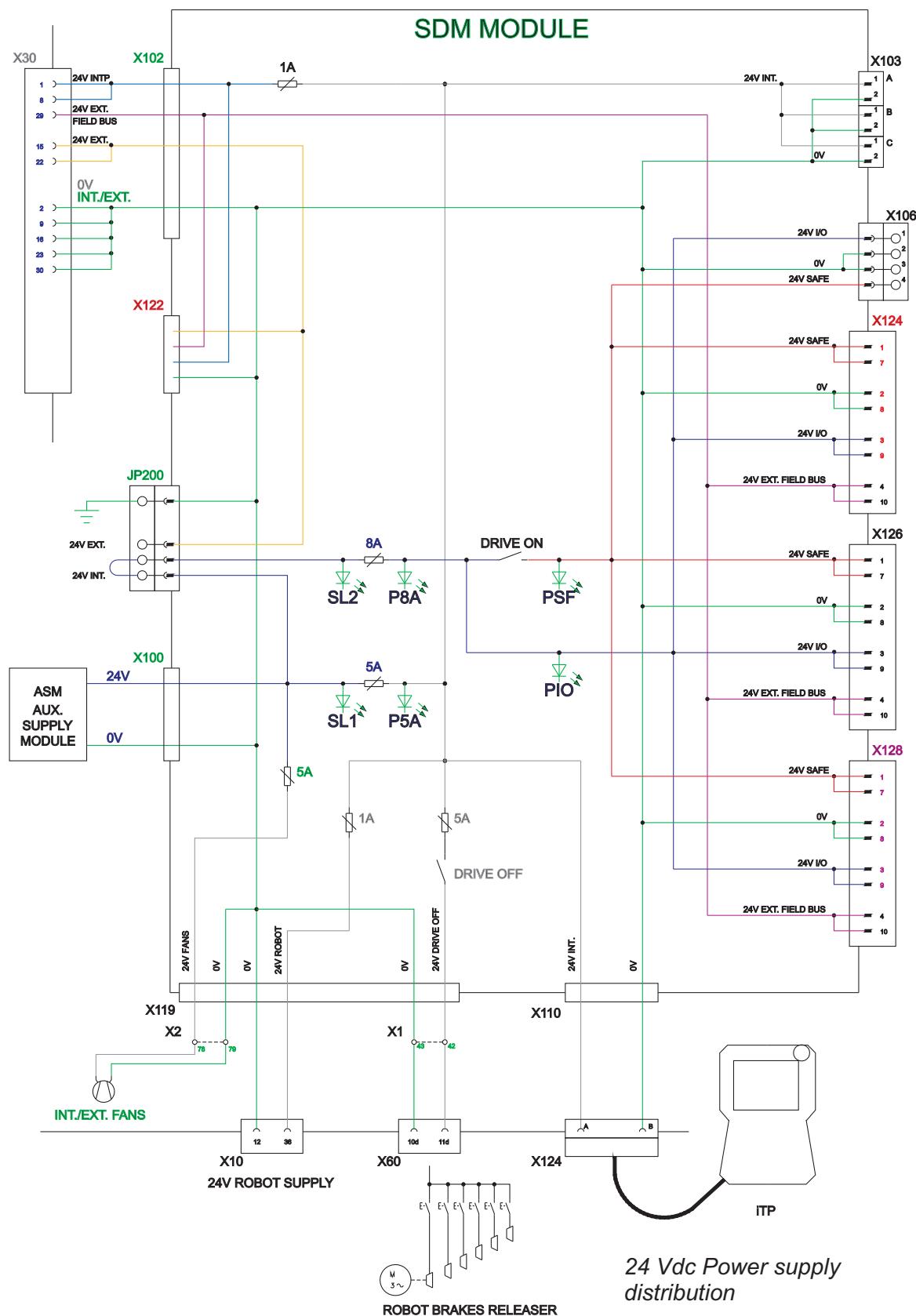
3.3 Control Unit outline diagrams

In the following pages are shown the outline wiring diagrams of the system main interconnections.



For all necessary connection information and details, refer to the Control Unit and Robot wiring diagrams.


 400 Vac, 24 Vdc Power supply distribution
Internal main connections



3.4 Causes and remedy

Tab. 3.3 - System conditions and the method of detection the fault

Functional phase	The cause	Information for resolution of the fault
The fault		
Power supply		
Some leds switched on the AMS-PPS module, all the remaining modules with the leds switched off	<p>The temperature probe on the transformer intervened, interrupting precautionary the power supply of BUS-DC</p> <p>If the main switch remained closed with the following intervention of the probe, the state of the leds on the module AMS-PPS is:</p> <ul style="list-style-type: none"> - [24V] Acceso fisso Verde; - [RDY] Lampeggiante Verde; - [R/E] Lampeggiante Verde/Rosso <p>If the main switch has been closed and the probe was already active, the state of the leds on the module AMS-PPS is:</p> <ul style="list-style-type: none"> - [24V] Steady on Green; - [ERR] Slow flashing Red; - [R/E] Slow flashing Red 	<p>Detect the cause for the overheating of the transformer compartment, which consequently makes it difficult to the dissipation of heat generated by the transformer.</p> <p>Clean the inlet mouths / air outlet of the transformer compartment, clean / check the efficiency of the fan installed inside the transformer compartment.</p> <p>Verify the environmental conditions (temperature outside the limits indicated in the technical features, conditioner option C5G-ACO inefficient).</p>
Absence of 24 Vdc supplied by module AMS-ASM32 and Leds [ERR] + [RDY] flashing every 3 seconds	The module AMS-ASM32 is disconnected or damaged.	Replace the module AMS-ASM32 (see par. 9.5 AMS-ASM32: sostituzione modulo on page 71).
Absence of the power supply – BUS DC and/or 24 Vdc on the axis expansion C5G-ACPWx or – 24 Vdc on the axis expansion C5G-ABSL (only for applications with Robot Laser)	<p>Failure of one or more fuses on the C5G-EXU modules</p> <p>The condition of complete efficiency is highlighted by the state of the leds, as shown below:</p> <ul style="list-style-type: none"> - [24V] green, steady on - [OLDC] red off - [OL24] red off - [OLD] red, off - [HLD] orange, off - [NLD], bright green 	Replace the fuses.

3.5 Comau Customer Centre

The Comau Customer Centre will be at your disposal at the following addresses:

Section	Address	Service available
Cause and solution	service.robotics@comau.com	To get help for troubleshooting and request software options
Spare parts	spares.robotics@comau.com	To request spare parts
Repair	repairs.robotics@comau.com	To request intervention for repairing activities

Alternatively, please turn to the manufacturer following the instructions in [par. 2.5.4 Manufacturer's details on page 30](#) of the “Technical specifications” manual.

4. HOW TO SWITCHING OFF THE POWER SUPPLY

This section deals with the following topics:

- Precautions and risks associated to the power supply off-switching
 - Switching off the power supply.
-

4.1 Precautions and risks associated to the power supply off-switching

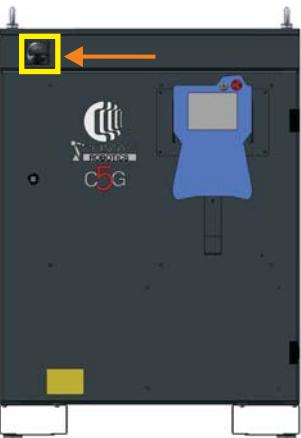
- After **switching off** the Control Unit wait for **at least 30 seconds** before **switching it back on**.
- Before removing any connector **wait for at least 30 seconds** and make sure that all LEDs are off.
Failure to comply with those warnings may result in:
 - in the jamming of one or more modules
 - in the damaging of one or more modules functionality.
- In case one or more module stop, switch off the system and wait for at least 30 seconds before switching the power supply back on.
- If installed, connector **X120 shall not be used for the power supply sectioning** (C5G-MCK option).
- To **increase the battery life** do not switch off the Control Unit before carrying out the **software shutdown**.
- The **software shutdown** procedure enables the files and applications closing without requiring the buffer battery.



If the Control Unit is switched off when the Robot is in motion, the system and therefore the Robot are compelled to perform an immediate stop without deceleration ramps with consequent stress for the kinematic chain, drift of the trajectory direction (unpredictable also due to the force of gravity) and risk of impacts. If this stop modality is performed repeatedly, the Robot System and/or equipment connected to the Robot may suffer damages.

Pay attention to any possible interconnected voltages, usually identified with orange conductor wires.

4.2 Switching off the power supply

	<p>Status:</p> <ul style="list-style-type: none"> – Before powering off the electrical power, it is advised to disable the Robotic system by means of the software shutdown procedure. <p>Material:</p> <ul style="list-style-type: none"> – Not required <p>Equipment:</p> <ul style="list-style-type: none"> – Padlock diameter min. 5 mm / max 8 mm (<i>min. 0.19 in / max 0.31 in</i>), (not supplied)
---	---

Preliminary procedures / notes

- The majority of maintenance activities for the Control Unit are to be carried out with power supply off. In those cases the maintenance card feature the wording “**Main switch open (OFF)**”.
- Some activities, especially those related to the box main power supply section, are to be carried out only after switching off the mains power supply. In those cases the maintenance card features the wording “**Incoming power supply off**”.



The main switch located on the Control Unit disconnects the power to the robot (or robots) connected to it only and occasionally to the application.
 – To verify the area or devices powered by a specific Control Unit it may be necessary to refer also to the Usage Instruction Manual related to the machine where the robot system is integrated.

Operating procedure

Main switch control in OFF position



Operating procedure (Continued)**Main switch open (OFF)**

- a. Carry out the software shutdown. Act on the specific control on the Teach Pendant.
- b. Wait for the shutdown procedure to end.
- c. With box door closed, move lever (A) of the Q100 main switch to 0 (OFF) position.
- d. Press lever (B) to access the slot.
- e. Fit the padlock in the slot available on the switch control.
- f. Remove the padlock only after completing the maintenance activities.
- g. The padlock is not supplied together with the electric box.



With main switch open, the connector X120 and the cable up the main switch are energized.

Operating procedure (Continued)

Incoming voltage off

(if the optional connector X120 is not installed)

- a. Perform the power supply off-switching as specified in [Main switch open \(OFF\)](#).
- b. Open and padlock the main switch up the Control Unit. The padlock is not supplied together with the Control Unit.

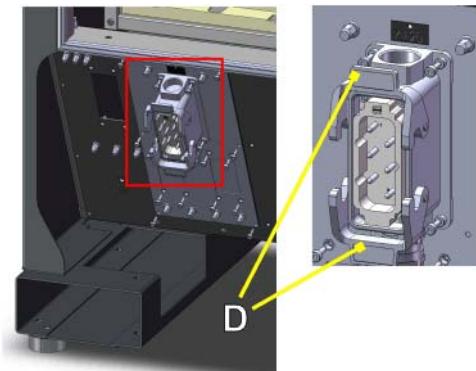
Incoming voltage off

(if the optional connector X120 is installed)



If available, connector X120 shall not be removed with Q100 main switch closed.

- a. Perform the power supply off-switching as specified in the previous steps.
- b. This activity requires the removal of connector X120, located in the box lower area.
- c. Release the levers (D).
- d. Remove the movable X120 connector.



Follow-up procedure

- Not necessary
 -

5. HOW TO REACH THE MODULES

This chapter deals with the following topics:

- [Precautions before starting](#)
 - [Risks associated with the module reaching procedures](#)
 - [Module location and reaching methods](#)
-

5.1 Precautions before starting

- Read carefully the instructions in [Cap.2. - Maintenance prescriptions on page 19](#)
 - Reach for the internal modules only after disconnecting the power.
-

5.2 Risks associated with the module reaching procedures

- **Reaching the modules from the rear door** does not endanger the operator. The protection category for the internal electric components is IP2x.
- **Reaching the modules after removing the rear panel**, implies the following risks:
 - [burn](#), due to the high temperature of the recovery resistance and the [CPU, power supplies and power modules](#) heat sink rear panel
 - [cut / abrasion](#), due to rotating fans, (only if the powering has not been turned off as required).

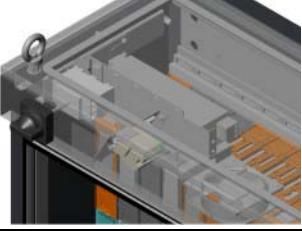
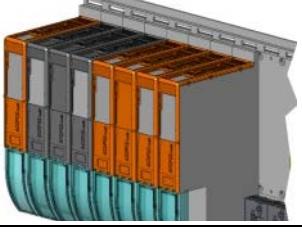
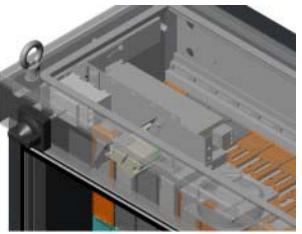
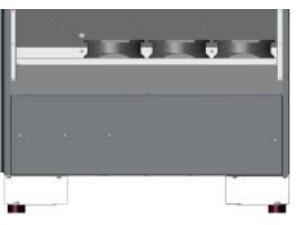
5.3 Module location and reaching methods

The modules can be reached through:

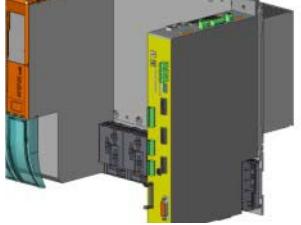
- Front door
- Upper panel
- Rear panel.

Find in [Tab. 5.1](#) (in alphabetical order) the modules and components that are included in the maintenance plan and the related access point.

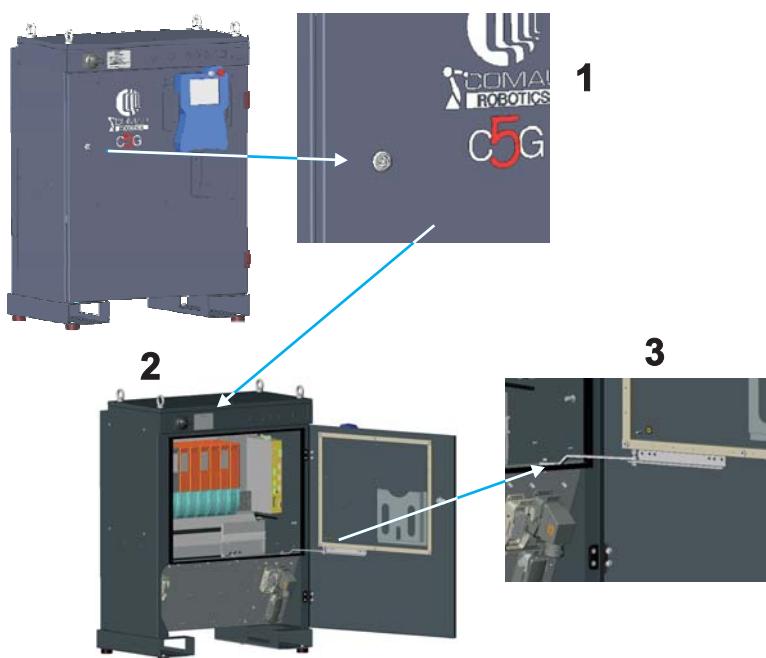
Tab. 5.1 - Module / component list and access point

Module / component	Access point
	ACE - Arm Controller Electromechanical (ACE) Upper panel
	ACC - CPU, power supplies and power modules Front door (see par. 5.3.1 on page 38)
	CIP - Connector Interface Panel (CIP) Front door (see par. 5.3.1 on page 38)
	ERR - Energy Recovery Resistance Rear panel (see par. 5.3.3 on page 40) and Upper panel (see par. 5.3.2 on page 39)
	FAN - Internal ventilation system - E110 Upper panel (see par. 5.3.2 on page 39)
	FAN - Internal ventilation system - E111.E114 Rear panel (see par. 5.3.3 on page 40)

Tab. 5.1 - Module / component list and access point (Continued)

Module / component	Access point
	Front door (see par. 5.3.1 on page 38)
	Front door (see par. 5.3.1 on page 38)
	Front door (see par. 5.3.1 on page 38)  It can be necessary to remove a panel C5G-OPK: Options Plate Kit

5.3.1 Front door



Equipment

Supplied FIST key
(Spare part Comau 19920154)

Fastening screws

Not required

Be careful

- Terminals are in protection category IP2x



Precautions

- if possible, turn the power off before starting to work inside the cabinet.

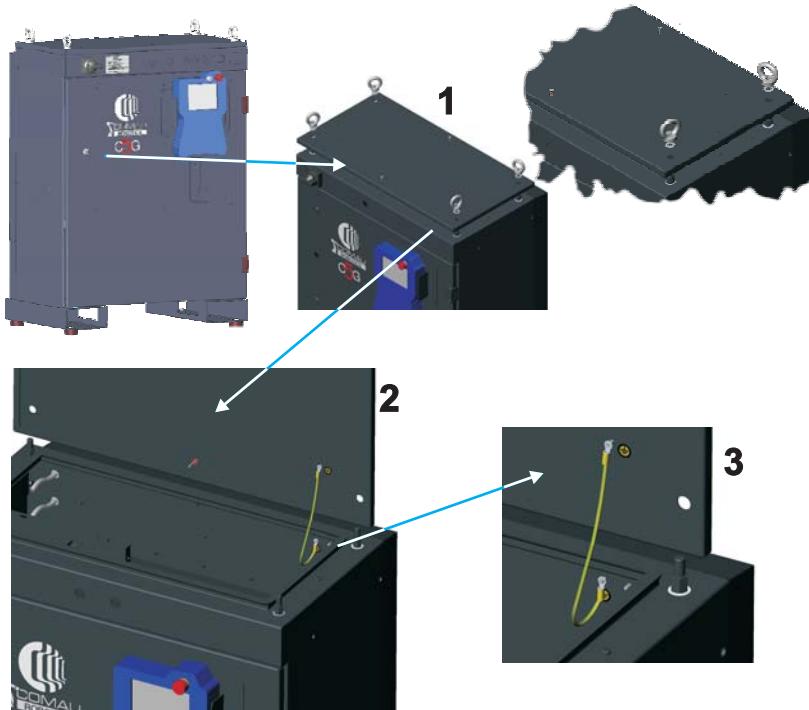
Front door opening procedure

- a. Turn the supplied key by 90° clockwise (1).
- b. Open the door (2)
- c. The door is supplied with a special item that locks it in open position (3).

Front door closing procedure

- a. Make sure the lock inside lever is vertical and pointing upwards.
- b. Unlock the door acting on the lower locking item (3).
- c. Close the door.
- d. Lock the door using the supplied key, turning it by 90° counterclockwise.
- e. Do not leave the key in the lock.

5.3.2 Upper panel



Equipment

Allen spanner 3 mm

Fastening screws

TSEI M5 no. 2

Be careful

- Terminals are in protection category IP2x 
- The X120 terminal board is energized also when the main switch is off

Precautions

- Always disconnect the power from the mains before reaching the upper panel.
- Disconnect and padlock at the power source.

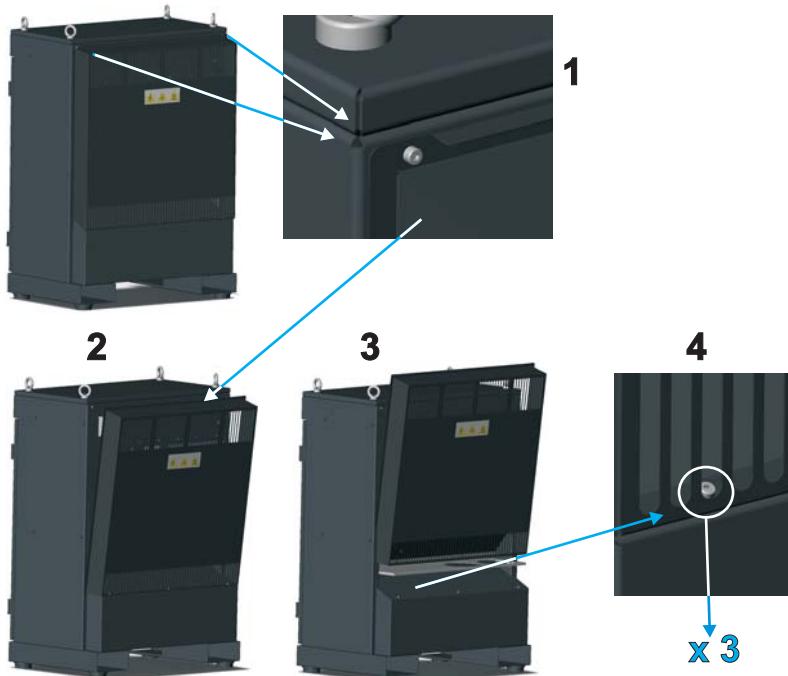
Cabinet upper panel opening procedure

- a. Unscrew the 2 TSEI screws and the 4 eyebolts located on the panel (1).
- b. Lift and move the panel (2) slightly away; be very careful to the earth connection on the panel (3).
- c. Disconnect the earth wire (3) from the movable panel side.

Cabinet upper panel closing procedure

- a. Connect the earth wire (3).
- b. Lay the panel and tighten the 2 TSEI screws without applying an excessive torque.
- c. Tighten the 4 eyebolts, making sure the 4 O-Rings in teflon are present.

5.3.3 Rear panel



Equipment

Allen spanner 3 mm

Fastening screws

TCEI M4 no. 2

Be careful

- Rotating fan
- Hot surfaces



Precautions

- Always disconnect the power before reaching the rear panel.
- Be careful to hot surfaces: recovery resistance and heat sink.

Cabinet rear panel opening procedure

- a. Unscrew the 2 TCEI screws located on the panel (1) top.
- b. Remove the panel (2) and lift it (3) to release it from the 3 lower pins.

Cabinet rear panel closing procedure

- a. Place the panel on the cabinet lower part and have the 3 pins fitting together with the holes in the panel (4) base.
- b. Bring the panel near the cabinet.
- c. Tighten the 2 TCEI screws without applying an excessive torque.

6. HOW TO MOVE THE ROBOT WHEN THE CONTROL UNIT IS DAMAGED

This chapter deals with the following topics:

- Precautions before starting
 - Risks associated with the Robot handling with Control Unit disconnected
 - How to use the Brake Release module C5G-OBR
-

6.1 Precautions before starting

- Read carefully the instructions in [Cap.2. - Maintenance prescriptions on page 19](#)
- The “integrated brake releasing device” located on the Robot may be disabled if the Control Unit is damaged. In that case, it is possible to use the brake releasing Module C5G-OBR (optional). The brake release Module C5G-OBR is to be regarded as an alternative solution in case the Teach Pendant cannot be used.
- The brake releasing Module C5G-OBR powers the engine brakes with a 24Vdc current from an outside source. This command may therefore give rise to possible dropping risks (refer to [par. 6.2 Risks associated with the Robot handling with Control Unit disconnected on page 41](#)).
- The “integrated brake releasing device” usage procedures are to be found in each specific Robot maintenance manual.

6.2 Risks associated with the Robot handling with Control Unit disconnected

- The axes releasing procedure may result in the axes dropping.
- The brake release module C5G-OBR cuts off all system safety devices: emergency stop, enabling device push-button, general stop and fence.
- Depending on the load applied to the Robot wrist and position, the axes may move unpredictably and induce a dropping path that is not perpendicular to the floor.
- While carrying out those activities, the operators shall never stand in the operating area and in particular under the Robot axes.
- Suitable lifting means may be required to lift the axes and equipment installed on the Robot wrist, due to their weight (e.g. crane, bridge crane).
- In case of person trapping, enable the brake releasing control only if you are sure that the involved person will not have to experience a pressure increase caused by the released axes weight.
- If not differently indicated, the contemporaneous use of 2 or more connectors can generate additional risks.
- At the end of the operation carry out the Turn-Set procedure on each axis.

- Respect the couplings between the Robots, the connector to be used, the selection on the selector switch on the brake releasing device module and the related axis, described in [Tab. 6.1](#).



The selected axis on the selector switch could not correspond to the axis number defined in the robotic system. Before driving the axis release check the proper selection on the selector switch and the corresponding coupled axis: neglected coupling can cause accidental fall due to gravity of an axis / arm / satellite.

Tab. 6.1 - Matching robot / table, connector and released axes

	Connector on the Robot base / table or other	Loose connector to be used on the module C5G-OBR	Selected axis on the module selector switch C5G-OBR								
			1	2	3	4	5	6	7/8/9/10		
Released axis on Robot / Positioner / Table											
Robot											
SiX / NS / NM / NJ / NJ4	X2	X2	1	2	3	4	5	6	--		
PAL	X2	X2	1	2	3	--	--	6	--		
PAL 470	X2	X2	1	2	3	--	5	6	--		
PRESS 100	X2	X2	1	2	3	4	5	6	--		
PRESS 130 SH	X2	X2	1	2	3	4	5	6	--		
	Directly on axis 1 slave motor	MTR7	1	--	--	--	--	--	--		
Laser	X2	X2	1	2	3	4	--	--	--		
Sledges											
TR		AUX	--	--	--	--	--	--	Axis x		
Positioners											
MP	XMTRx	MTR7	Axis x	--	--	--	--	--	--		
PTDV	X2	X2	10	9 *1	8 *1	--	--	--	--		
PTDO	X2	X2	10 (No)	9 *1	8 *1	--	--	--	--		
Tables											
TR	XMTRx	MTR7	Axis x	--	--	--	--	--	--		
Additional axis											
Additional axis	XMTRx	MTR7	Axis x	--	--	--	--	--	--		

-- = Non influential because of axis absence on Control Unit

*1 = auxiliary axes on positioners (satellites)

Axis x = it depends on the assignment of the axis number on the system

No = axis present on the Control Unit but the break release function is not available

XMTRx = from XMTR7 to XMTR10, according to the configuration of the table installed.

6.3 How to use the Brake Release module C5G-OBR

 Example Robot figure	<p>Status:</p> <ul style="list-style-type: none"> - Power off <p>Material:</p> <ul style="list-style-type: none"> - Powering cable supplied with plug suitable for the power connection source (not included in the brake releasing device module option C5G-OBR) <p>Equipment:</p> <ul style="list-style-type: none"> - Brake releasing module C5G-OBR - Suitable lifting means to support the Robot axes subject to gravity
--	--

Preliminary procedures / notes



The axes releasing procedure may result in the axes dropping due to gravity. Please refer to [par. 6.2 Risks associated with the Robot handling with Control Unit disconnected on page 41](#).

- The brake release Module C5G-OBR option includes a movable plug suitable for the panel socket located on the module rear side. Before the first usage, prepare a powering cable with plug suitable for the power supply source available in the operating area.
- Power the module (from 100 to 230 Vac, 1.5 A @ 120 Vac / 0.7 A @ 230 Vac). The cable section shall be at least 0.5 mm² / 20 AWG. Adjust the section according to the cable length and guard up the system.



Make sure the powering supply voltage is suitable for the brake releasing device.



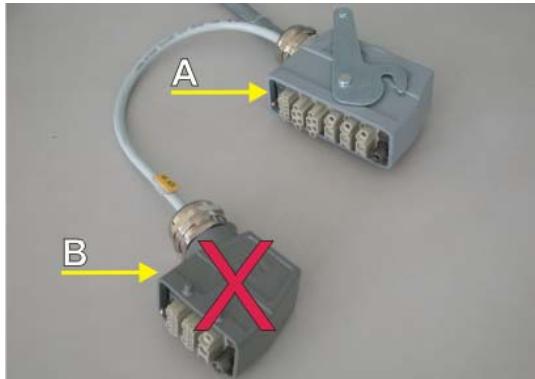
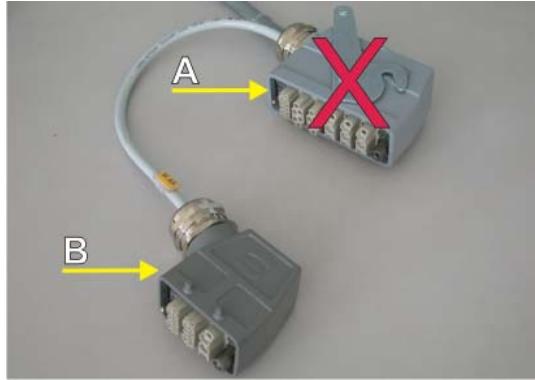
This procedure describes the typical operations useful for the majority of Robots and Positioners.

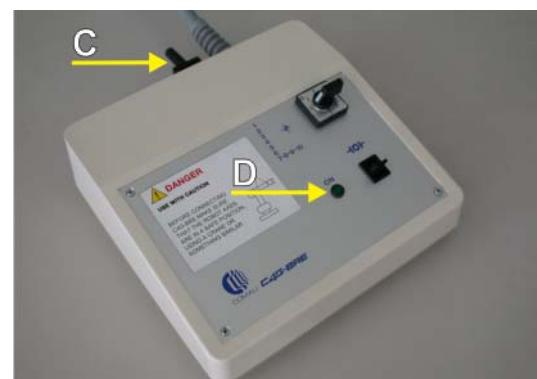
See the related manuals of the Robot to obtain specific details.

Operating procedure

- a. Support the robot axes subject to gravity by means of a crane or bridge crane. Use ropes or bands, but do not use chains. Refer to the Robot manual to identify the most suitable point to sling the Robot.

Operating procedure (Continued)

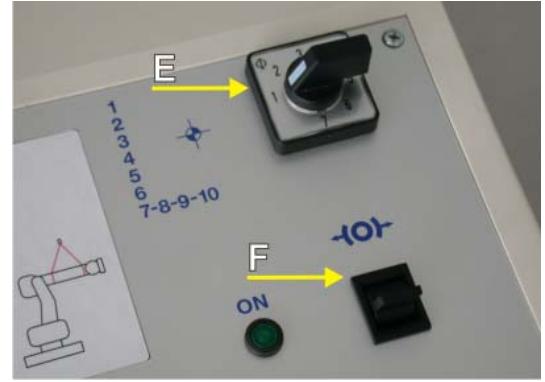
- b. To release the Robot axes:
- Disconnect the power connector X2 by the Robot base. The connector position is different depending on the Robot type (if necessary, refer to the Robot manual).
 - Connect the movable connector (A) to the connector X2 by the Robot base. The movable connector (B) is not to be used and can be left on the floor.
- 
- c. To release axes from 7 to 10:
- Disconnect the power connector from the involved axis. The connector position is different depending on the installation type.
 - Connect the movable connector (B) to the connector of the corresponding axis to be released. The movable connector (A) is not to be used and can be left on the floor.
- 
- d. Supply input power (C) to the releasing module.
- e. The powering is signalled through the green LED (D) lighting up.



Illustrative picture

Operating procedure (Continued)

- f. Select the axis to be released on the selector switch (E).
- g. Keep tight the ropes that are used the support the axes subject to gravity.
- h. To release Robot axes 1 to 6:
 - Axes from 1 to 6 can be selected singularly together with the related position.
- i. To release axes from 7 to 10:
 - Axes from 7 to 10 are connected through a dedicated connector, that can be connected to one axis at a time and activated only with selector switch in position "7-8-9-10".
- j. Use the lever push-button (F) to release the involved axis. Operate the push-button by pressing shortly and check the movement produced by the released axis. At the same time, release gradually the rope used to support the axes subject to gravity.
- k. The motion stops when the push-button is released, as the brake is applied (control enabled by the user action).



Follow-up procedure

- Restore the power connector connections on the Robot and /or involved axes.

Recover the Robot function after break release C5G-OBR

The motion through break release module C5G-OBR leads to axes Turn-set lost; **therefore it is very important to restore properly the function** before the first use:

**-Before issuing the Drive On instruction do not stand under the Robot and be sure that nothing is near by the axes subject to gravity.
-in turn-set condition, it is possible a Drive On axes falling that, in case of big Robots with long arms, can reach some centimetres**

To restore the Turn-set condition following the procedure described below**:

- a. position the Robot axes nearby the calibration notches. In order to carry out properly the calibration "by sight" use the parallel pin with a suitable diameter
- b. carry out the CAT command. Wait for the Turn-set adjustment, at the end of this procedure the transducer "timing" can be obtained and then the positions are stored.
- c. restart the unit, make some test cycles at low speed to check the proper operation.



** The complete and detailed procedure to carry out the Turn-set is described in the Robot maintenance manual.

7. MAINTENANCE STRUCTURE

7.1 General information

The Control Unit maintenance includes:

- Maintenance activities overview
- Preventive maintenance
- Special maintenance



We recommend the user performs regular and accurate preventive maintenance activities to preserve the Control Unit functional features for long.

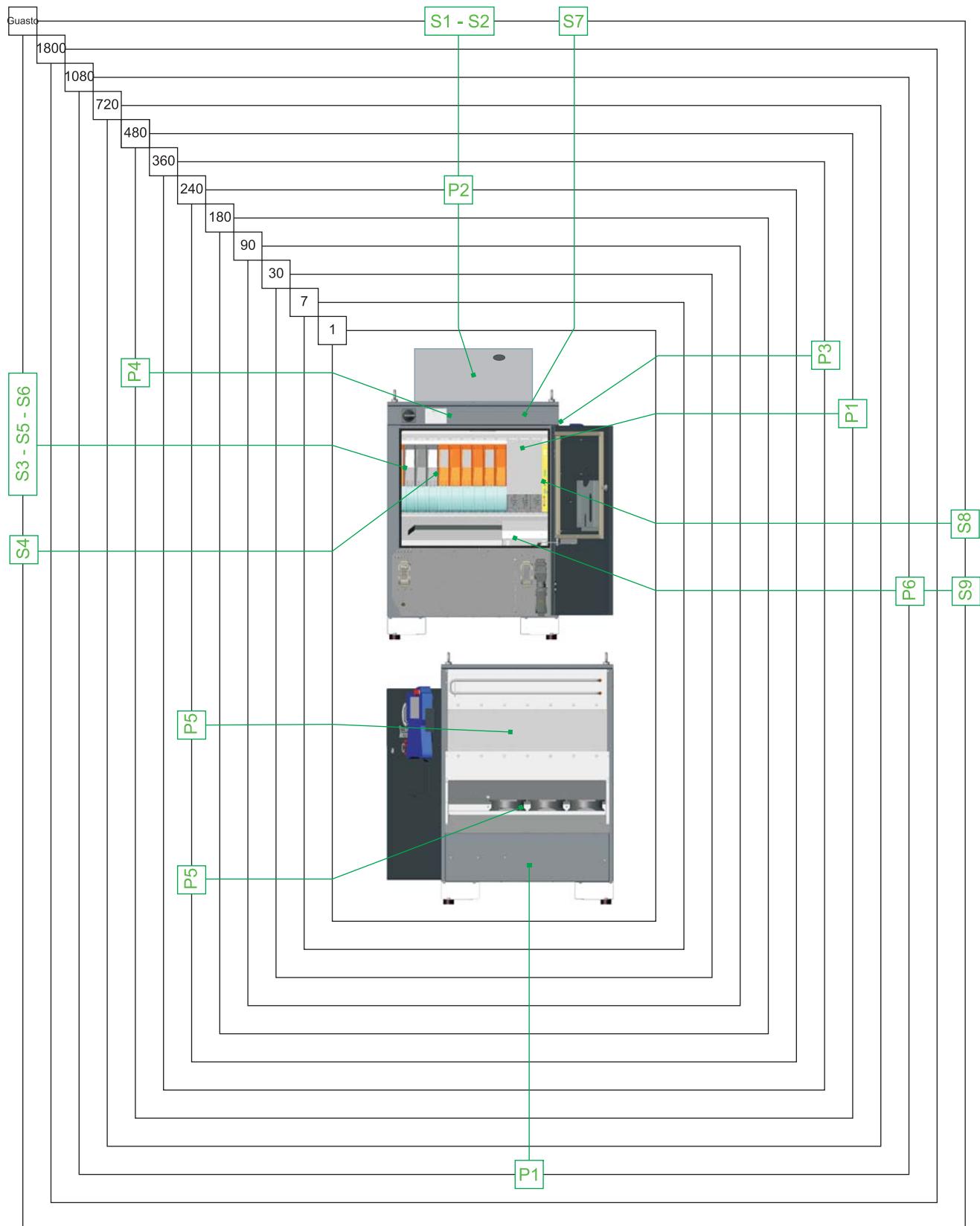
In case of poor or missing maintenance during the warrant period, the warrant itself shall become void.

7.2 Maintenance activities overview

[Fig. 7.1](#) shows an overview of the complete maintenance plan, where the maintenance positions and frequencies.

In the very internal rectangle are listed the daily frequencies; while in the concentric ones (always more external) are listed the following frequencies in increasing order.

The figure shows the intervention positions with the references listed in the summaries in [Tab. 8.2 - Preventive maintenance plan on page 50](#) e [Tab. 9.2 - Special maintenance activities on page 64](#)

Fig. 7.1 - Maintenance activities overview


8. PREVENTIVE MAINTENANCE

This chapter deals with the following topics:

- [Precautions before starting](#)
 - [Equipment and tools required](#)
 - [Preventive maintenance plan](#)
-

8.1 Precautions before starting

- Read carefully the instructions in [Cap.2. - Maintenance prescriptions on page 19](#)
- To guarantee the Control Unit proper operating, it is necessary to carry out preventive maintenance activities periodically, to reduce the amount of faults caused by the ordinary deterioration over time and preserve its functional features longer.



In case of poor or missing preventive maintenance activities during the warranty period, this will be regarded as prejudicial to the warranty itself.

8.2 Equipment and tools required

The minimum equipment to carry out **preventive maintenance activities** on the C5G Control Unit is:

Tab. 8.1 - Equipment and tools required

Vacuum-cleaner
Soft bristle brush
Crossheaded and bladeheaded screwdrivers set
Allen spanner set (sizes in mm)
Ecological solvent
Cases
Gloves

8.3 Preventive maintenance plan

Find in [Tab. 8.2](#) the preventive maintenance plan based on the frequency.

The maintenance sheets are ordered by abbreviation and listed in alphabetical order.

Tab. 8.2 - Preventive maintenance plan

Frequency	Activity / Sheet	Ref. ¹
When carrying out other activities	ACC: door closing and seal efficiency check (see par. 8.4 on page 51)	P1
	Check the efficiency of the system of signs	
Depending on the installation environment	ACO: emptying the condensate collecting can	P3
8 months	E111..E113: fan cleaning (see par. 8.8 on page 58)	P5
8 months	<p>Check the safety circuits and devices. Check the functionality of the following devices at least every 8 months:</p> <ul style="list-style-type: none"> – emergency push-button, checking the actual functionality of the two channels – enabling push-button (enabling device) checking the actual functionality of the two channels. The C5G diagnosis system checks the efficiency of the related safety circuit and, in case of fault, displays a corresponding message on the Teach Pendant. – inputs of the emergency stop, Auto Stop (Gates) and General Stop checking the actual functionality of the two channels. The C5G diagnosis system checks the efficiency of the related safety circuits and, in case of fault, displays a corresponding message on the Teach Pendant. – Pilz safety relay available for the C5G-IEAK options (if installed). <p> Please, refer also to the manual related to the cell where the C5G will be installed.</p>	
8 months	ACO: cleaning the condenser (if installed).	P2
16 month	E110: fan cleaning (see par. 8.7 on page 56)	P4
3 years (2 years *1)	<p>UPS: replacing the battery (see par. 8.9 on page 60)</p> <p>*1 We recommend the battery preventive replacement in case the installation area is subject to repeated power supply interruptions or stops without performing the software shutdown procedure. This advanced replacement guarantees optimum performances in any situation.</p> <p>Note: if the Control Unit operates in an environment with temperature continuously higher than 35 °C, the battery duration can be strongly reduced.</p>	P6

¹ The reference is to be found in [Fig. 7.1 - Maintenance activities overview on page 48](#).

8.4 ACC: door closing and seal efficiency check

Arm Controller Cabinet

 Front view	<table border="1"> <tr> <td>Status:</td><td>– Irrelevant</td></tr> <tr> <td>Material:</td><td>– Not required</td></tr> <tr> <td>Equipment:</td><td>– Not required</td></tr> </table>	Status:	– Irrelevant	Material:	– Not required	Equipment:	– Not required
Status:	– Irrelevant						
Material:	– Not required						
Equipment:	– Not required						

Preliminary procedures / notes

- The cabinet door shall remain closed to guarantee the efficiency of the cooling system and prevent contamination from entering in the cabinet. Thanks to the structure, the IP 54 protection category of the cabinet guarantees such efficiency level.
- The deterioration of the seal performances may have a detrimental impact on this situation.

Operating procedure

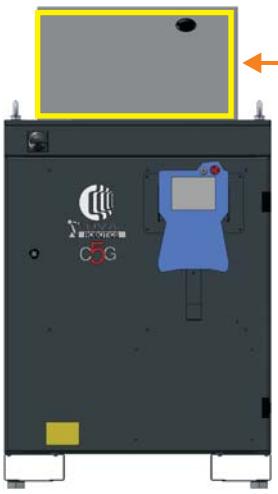
- a. Check the seals efficiency and the correct positioning in their seat along the entire door perimeter.
- b. If necessary, replace the seals.

Follow-up procedure

- Not required

8.5 ACO: cleaning the condenser

Air Conditioner Option

 Front view	Status: – Main switch open (OFF)
	Material: – Not required
	Equipment: – Crossheaded screwdriver – Soft bristle brush – Vacuum cleaner – Ecological solvent

Preliminary procedures / notes

- The conditioner does not require any maintenance activities. Possible traces of oil are symptom of leakages from the cooling circuit and replacement is necessary (see card [ACO: replacement](#)).
- The amount of dirt inside the conditioner depends on the quality of the installation environment air. The schedule in the maintenance plan refers to a typical condition.



Before removing the conditioner cover, make sure the powers supply is off and the inside fan is still.

We advise against using compressed air, due to the impossibility to check the amount of dirt removed, with the risk to direct it towards the operators face.

Operating procedure

- a. The cleaning includes the fan, condenser and environment air inlet and outlet openings.
- b. Unscrew the screws securing the conditioner cover.
- c. Lift the cover and remove the earth wire connection.
- d. Using a brush, remove the dirt while contemporaneously sucking with the vacuum cleaner to collect the it. Possible persistent dirt may be removed using an ecological solvent.
- e. Make sure the condensate drainage opening and related pipe are not obstructed.

Operating procedure

- f. In case the thermostat setting gets accidentally modified, reset the default value of 45 °C.



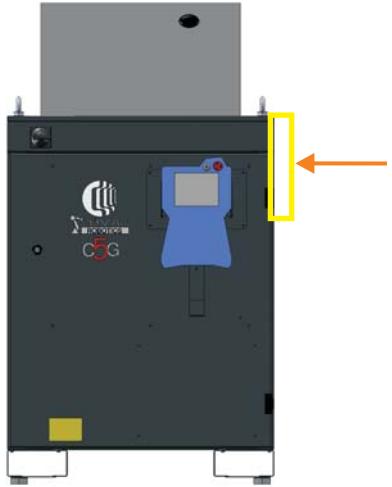
- g. Replace the cover restoring the earth wire connection.
- h. Screw back in place the cover fastening screws.

Follow-up procedure

- Not required

8.6 ACO: emptying the condensate collecting can

Air Conditioner Option

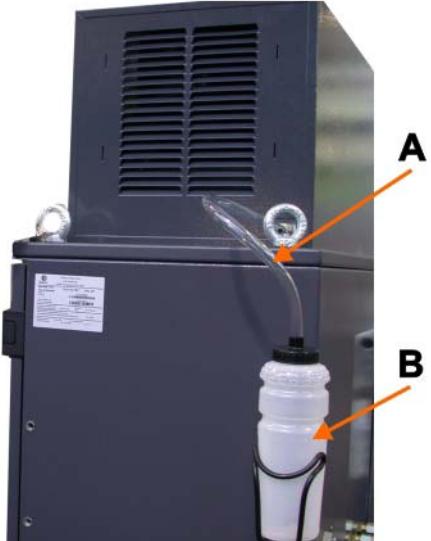
 Front view	Status: – Unimportant Material: – Not required Equipment: – Not required
--	---

Preliminary procedures / notes

- The emptying frequency depend on the environment humidity, therefore shall be adjusted accordingly.

Operating procedure

- a. Remove the pipe (**A**) from the can (**B**).
- b. Remove the can (**B**) from the supporting item.
- c. Open the plug and empty the can in any water drain well.

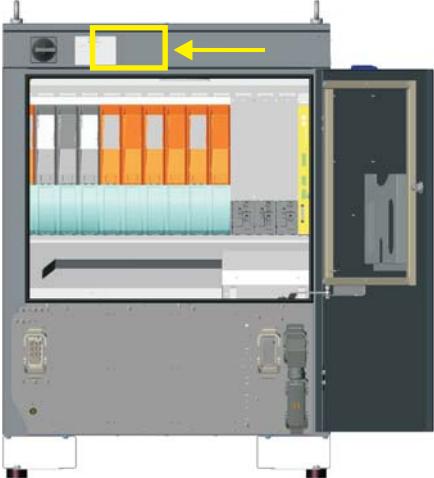


- d. Close the plug and replace the tank (**B**) in the supporting item.
- e. Fit the pipe back in place.

Follow-up procedure
– Not required

8.7 E110: fan cleaning

Fan

 Front view	<p>Status: – Main switch open (OFF)</p> <p>Material: – Not required</p> <p>Equipment:</p> <ul style="list-style-type: none"> – 3-mm allen spanner – Soft bristle brush – Vacuum-cleaner – Gloves
---	---

Preliminary procedure/ notes

- To ensure the control unit smooth operating, it is necessary to guarantee the efficiency of the cooling system.
- The amount of dirt on the cooling fan depends on the quality of the air circulating in the installation area. The times specified in the maintenance plan apply to a typical situation.



Before removing the panel, make sure the power is disconnected and the fan is still.

We do not advise using compressed air, as it does not allow to control the dirt removed, that could hit the operator face.

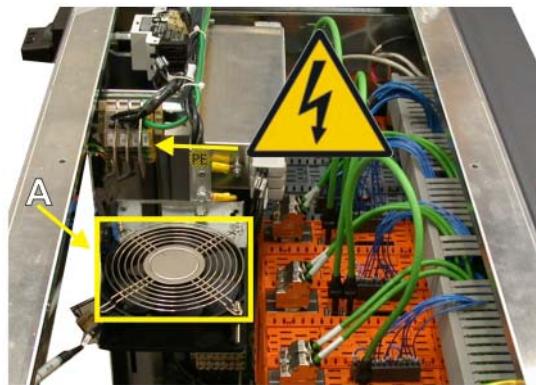
Operating procedure

- a. The cleaning procedure involves the fan and adjacent area.
- b. Remove the [Upper panel \(see par. 5.3.2 on page 39\)](#) to reach the upper area.
- c. Remove the dirt using a brush and contemporaneously suck the dirt with the vacuum-cleaner.

Operating procedure

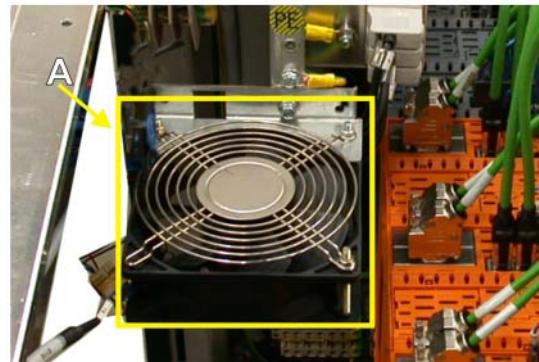
- d. The area to be cleaned is the fan (A) one.

Be careful and make sure the X120 terminal board is not powered.



- e. Remove the dirt using the brush, in particular on the fan (A) blade inside area.

- f. Mount the [Upper panel \(see par. 5.3.2 on page 39\)](#) back.

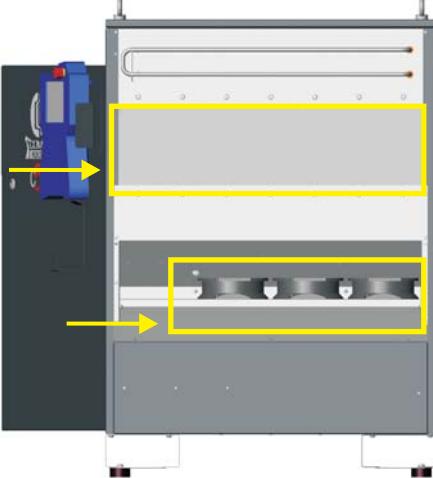


- g. If dirt is detected inside the cabinet, check the seal status. Refer to [par. 8.4 ACC: door closing and seal efficiency check on page 51](#).

Follow-up procedure

- Not required

8.8 E111..E113: fan cleaning

 Rear view	<p>Status: – Main switch open (OFF)</p> <p>Material: – Not required</p> <p>Equipment: – 3-mm allen spanner – Soft bristle brush – Vacuum-cleaner – Gloves</p>
--	--

Preliminary procedures / notes

- To ensure the control unit smooth operating, it is necessary to guarantee the efficiency of the cooling system.
- The amount of dirt on the cooling fans and channel depends on the quality of the air circulating in the installation area. The times specified in the maintenance plan apply to a typical situation.
- The control Unit in rel. 0 can be provided with fans from E111 toE114.



Before removing the panel, make sure the power is disconnected and the fans are still.

Be careful, as the recovery resistance may be very hot.

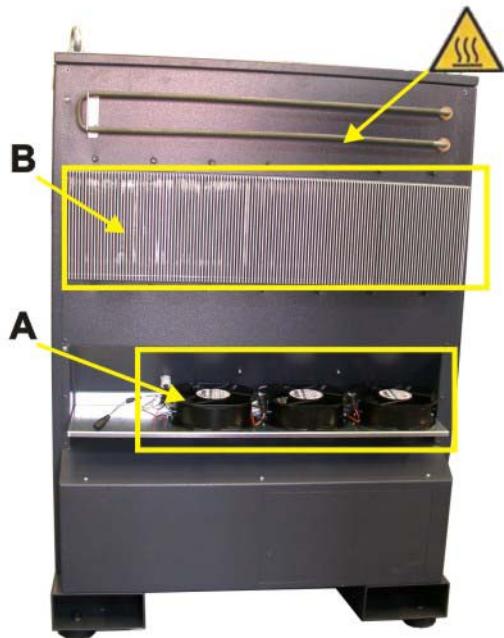
We do not advise using compressed air, as it does not allow to control the dirt removed, that could hit the operator face.

Operating procedure

- a. The cleaning procedure shall include fans, heat sink, air passage channel and panel grids.
- b. Remove the [Rear panel \(see par. 5.3.3 on page 40\)](#) to reach the cabinet rear area.
- c. Remove the dirt using a brush and contemporaneously suck the dirt with the vacuum-cleaner.

Operating procedure

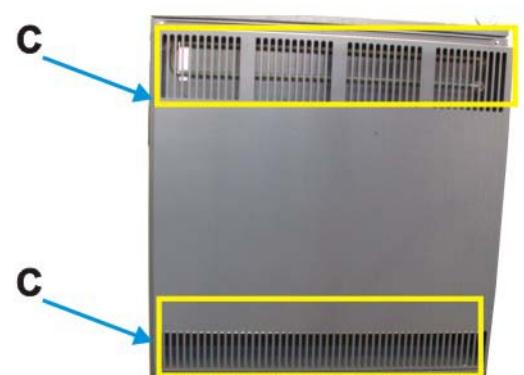
- d. The area to be cleaned is the fan (**A**) and heat sink (**B**) one.
 Be careful, as the recovery resistance may be very hot.



- e. Remove the dirt using the brush, in particular on the fan (**A**) blade inside area.



- f. Remove the dirt from the panel grids (**C**).
 g. Mount the [Rear panel](#) (see par. 5.3.3 on page 40) back.

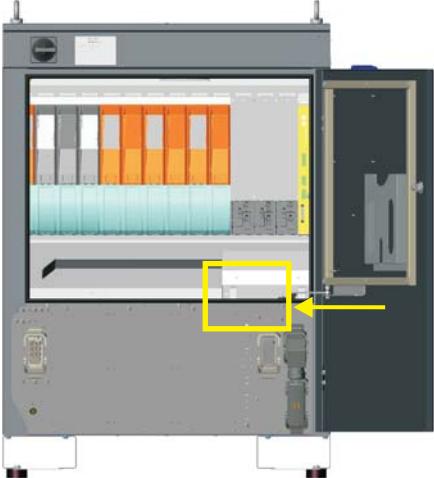


Follow-up procedure

- Not required

8.9 UPS: replacing the battery

Uninterruptible Power Supply

 Front view	Status: – Irrelevant * ¹ Material: – Battery (see Tab. 10.3 - Uninterruptible Power Supply (UPS) on page 113) Equipment: – Cross-headed screwdriver
---	---

Preliminary procedures / notes



Handle the battery with care. Use only batteries supplied as spare parts.
 Do no damage the casing to prevent corrosive fluid leakages.



The flat battery pack shall be disposed of in compliance with the environmental protection laws in force.

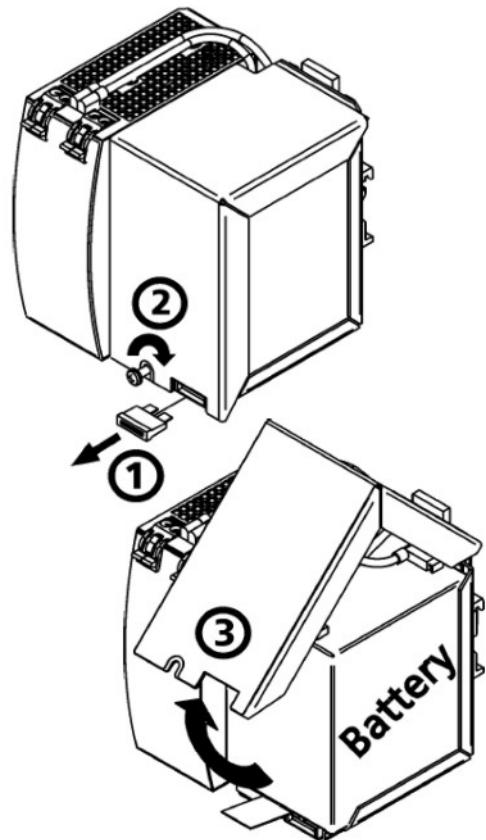
*¹ If optional modules are installed that do not allow to reach the UPS module, we recommend turning the Control Unit off before carrying out the procedure (refer to the topic [Main switch open \(OFF\)](#)).

Operating procedure

- The UPS module is usually reachable and there is no need to remove other components. If this is the case go to step d.
- If there are optional modules on the option plate C5G-OPK that inhibits the access, it is advisable to operate in the following way:
 - switch off the Control Unit.
 - if it is possible, release the UPS module from the omega guide (detaching lever in the upper part) passing behind the components / C5G-OPK options plate and rest the UPS module on the pavement inside of the electric cabinet (**with care** to **avoid abrasions** caused by crashes and creeps with the C5G-OPK plate).
 - or, remove the optional module installed more on the right to enter by the front side the UPS module. Usually it is not necessary to disconnect the cables of the option and it can be moved on the side, allowing to enter the module.

Operating procedure (Continued)

- c.
- d. Remove the fuse before acting on the module C5G-UPS (1).
- e. Loosen the cover fastening screw by 4-5 turns (2). If it is not removed completely, it will be easier to mount it back.
- f. Lift and remove the battery cover (3).
- g. Disconnect (4) the cables from the battery terminals.
- h. Remove the battery by pulling the tag (5).



- i. Fit in the new battery and carry out the steps above in reverse order.
- j. Connect the cable according to the polarity.
- k. Fasten the cover and fit the slot in the screw pressing slightly.
- l. Tighten the screw without overdoing.
- m. Fit in the fuse.

Operating procedure (Continued)

n. If one or more modules have been removed:

n.1 Fasten the UPS module on the omega guide.

n.2 Mount back the removed option panel.



Transfer the flat batteries to the suitable waste collection sites.

For further details, please refer to [Cap. Setting out of work and dismantling procedure on page 124](#)

Follow-up procedure

- The battery needs about **3 hours** for a complete charge and therefore to be able to operate again.
- During the charging period, the Control Unit may not be able to guarantee controlled shutdowns in case of powering interruption. Always perform the suitable shutdown software procedure.

9. SPECIAL MAINTENANCE

This chapter deals with the following topics:

- [Precautions before starting](#)
- [Equipment and tools required](#)
- [Modules subject to special maintenance activities](#)

9.1 Precautions before starting

- Read carefully the instructions in [Cap.2. - Maintenance prescriptions on page 19](#)



The maintenance activities that are not described in the sheets below shall be performed by Comau qualified staff.

9.2 Equipment and tools required

The minimum equipment necessary to carry out **special maintenance activities** on the **C5G** Control Unit is:

Tab. 9.1 - Equipment and tools required

Flat blade screwdriver set
Cross-headed screwdriver set
Allen spanner set (sizes in mm), including extension rods
Socket wrench set (sizes in mm)
Racket torque wrench (or screwdriver) with inserts and extension rod up to 260 mm, adjustment field about 1 to 6 Nm.
Anti Static Wrist Strap Discharge band grounding
Personal Computer supporting the WinC5G software properly installed.
Disk On Key or other storage support, connection via USB
If the whole Control Unit has to be replaced, lifting mean suitable for the installation area (crane or lift truck)
In case of activities on multipolar connectors, contacts gripper Harting Part no. 09 99 000 0001, contacts puller Harting Part no. 009 99 000 0012 and Harting contacts.

9.3 Modules subject to special maintenance activities

To replace possible damaged items, follow the procedures described in the maintenance sheets below.

The sheets, in alphabetical order following the abbreviations, are to be found in [Tab. 9.2](#).

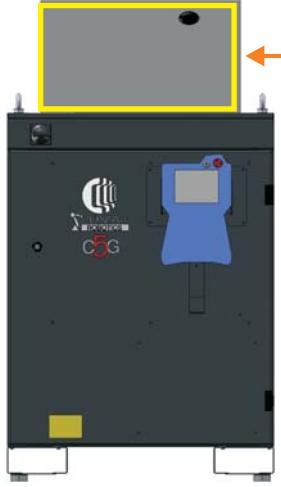
Tab. 9.2 - Special maintenance activities

Activity / Sheet	Ref. ¹
ACO: replacement (see par. 9.4 on page 65)	S1
ACO: limit switch replacement (see par. 9.5 on page 70)	S2
AMS-APC820: module replacement with Compact Flash module recovery (see par. 9.6 on page 74)	S3
AMS-ASM32: module replacement (see par. 9.7 on page 83)	S4
AMS-IAM: module replacement (see par. 9.8 on page 86)	S5
C5G-iTP or iTP2: replacement (see par. 9.9 on page 92)	S10
AMS-PPS8: module replacement (see par. 9.10 on page 96)	S6
HMK: hour-meter replacement (see par. 9.11 on page 101)	S7
SDM: module replacement (see par. 9.12 on page 103)	S8
UPS: replacing the module (see par. 9.13 on page 107)	S9

¹ The reference is to be found in [Fig. 7.1 - Maintenance activities overview on page 48](#).

9.4 ACO: replacement

Air Conditioner Option

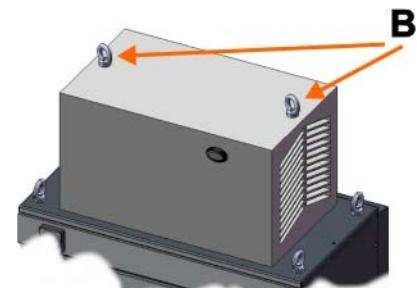
 Front view	Status: <ul style="list-style-type: none"> – Main switch open (OFF) Material: <ul style="list-style-type: none"> – Conditioner complete with box roof (see Tab. 10.10 - Conditioning on page 121) Equipment: <ul style="list-style-type: none"> – M8 male eyebolts, supplied with the conditioner – Lifting system with 40 kg capacity (ex. crane), with 2 1-m long ropes with hook / shackle (Note: inside diameter of conditioner eyebolt is equal to 20 mm) – Crossheaded screwdriver – Bladeheaded medium screwdriver – 3 mm Allen wrench
---	---

Preliminary procedures / notes

- The compressor lubrication oil needs to stabilize. For this reason allow at least **8 hours** before setting the conditioner at work.
- The procedure may be applied both in case of replacement of the conditioning device on the Control Unit roof and on the Application Box roof, adapting the references to the Control Unit to the Application Box.

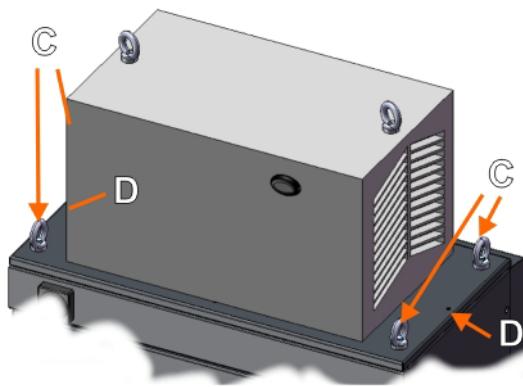
Operating procedure

- a. On the conditioner, remove the 2 upper bombé-headed screws (**A**) that cover the eyebolt holes.
- b. On the conditioner, screw in the 2 M8 eyebolt (**B**) in the screws place. The eyebolts are usually supplied with the Control Unit (if equipped with the option). In case they are no longer available, use the ones supplied with the new conditioner.

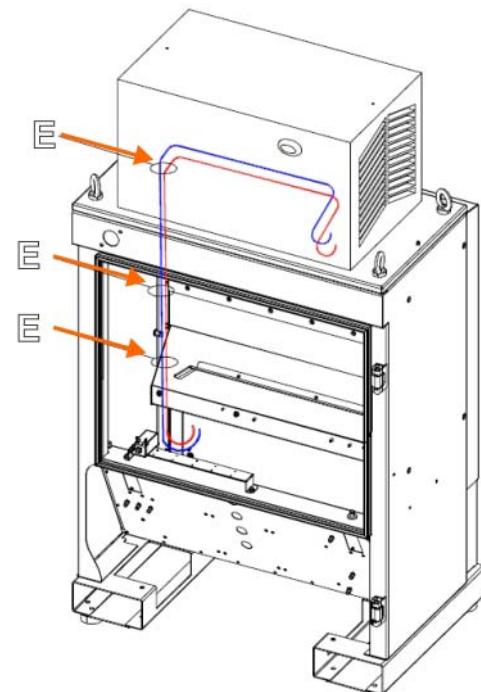


Operating procedure

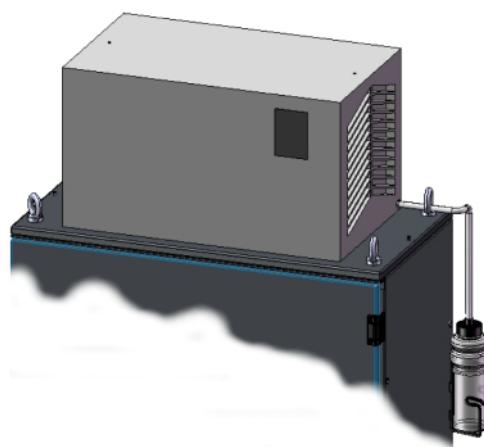
- c. On the C5G, unscrew and remove the 4 M12 female eyebolts (**C**) on the roof.
- d. On the C5G, unscrew the 2 TSEI M4 untightening screws (**D**).



- e. Disconnect the conditioner connection cable inside the box. It may be necessary to remove 2 or more plastic clamps (**E**). The cable is connected on the terminal board by the box base.
- f. From inside the box disconnect the earth wire connected to the roof. The wire on the box remains connected.

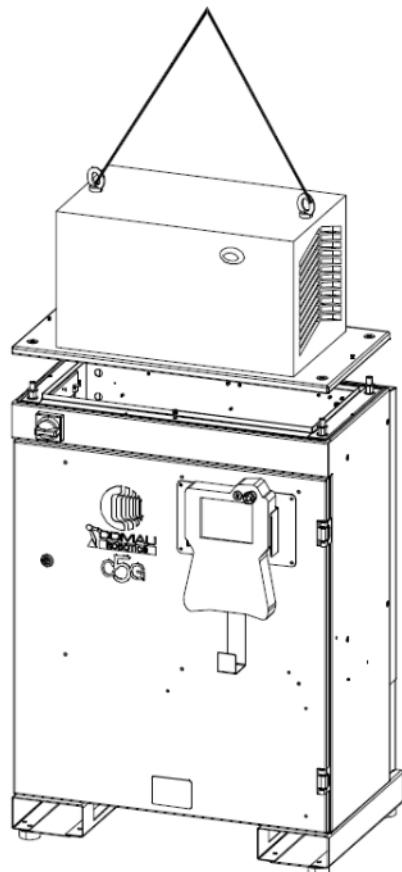


- g. Remove the condensate drainage pipe from the collecting can and the eyebolt.

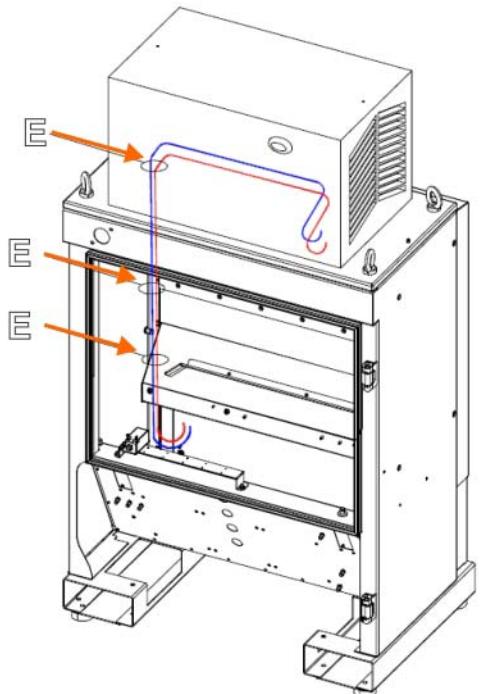


Operating procedure

- h. By means of 2 ropes and a suitable lifting system, anchor to the 2 eyebolts on the conditioner. Lift perfectly vertical, such as not to damage the threaded bars that come out the Control Unit, seat of the removed eyebolts. **Note: the conditioner weighs 35 kg.**
- i. Place the conditioner removed on the floor, remove the anchoring system and lift and place the new conditioner on the Control Unit. Be careful with the powering cable coming out the conditioner and the earth wire for the metallic roof connection. Keep the conditioner in front position (the blind panel is located frontally).

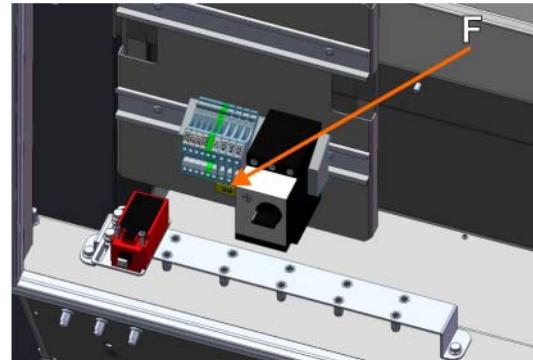


- j. Place the connection cable tidily inside the Control Unit.
- k. Fasten the cable using plastic clamps (E).



Operating procedure

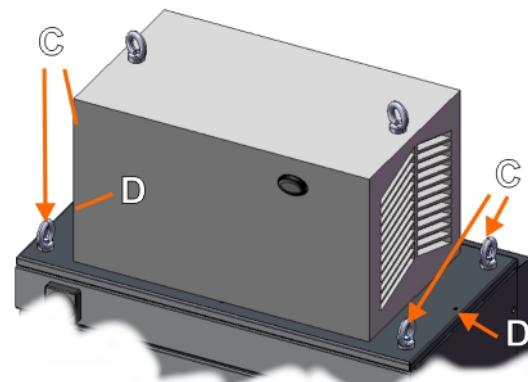
- I. Connect the cable end on the terminal board (**F**) by the box base according to the numbering on the wires. The connection is on the lower side.



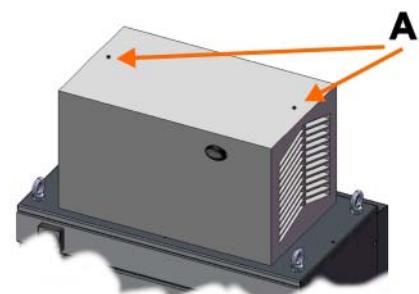
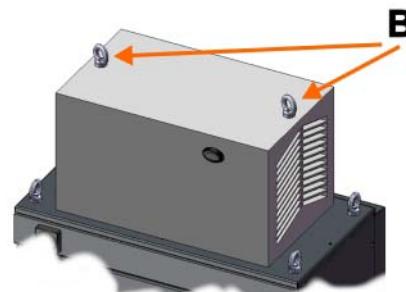
- m. Restore the connection of the roof earth wire.

- n. On the C5G, crew in the 4 M12 female eyebolts (**C**) on the roof, that are supplied with plastic washers.

- o. On the C5G, screw in the 2 TSEI M4 untightable screws (**D**).

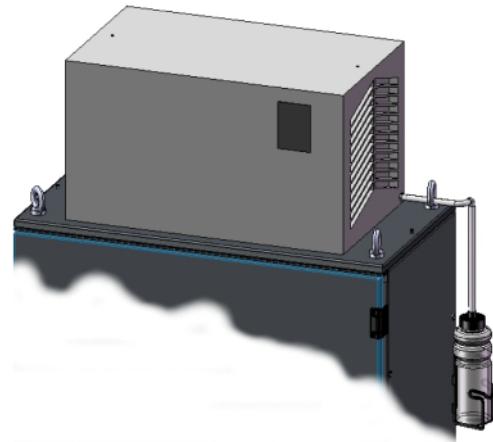


- p. On the conditioner, remove the 2 M8 eyebolts (**B**) and screw in their place the 2 bombè-headed screws (**A**). Put the eyebolts in the Control Unit pocket, not to lose them.



Operating procedure

- q. Fit the new condensate drainage pipe in the eyebolt and then in the collecting can. Be careful to the pipe path, that shall go downwards. Cut the pipe access length.



- r. Lift the conditioner front blind panel and make sure the value is set at 45 °C (default value).
- s. Close the front panel.

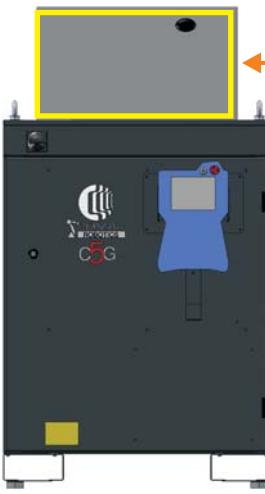


Follow-up procedure

- Make sure at least **8 hours** have elapsed for the stabilisation (without conditioner capsizing) before setting the conditioner at work.
- The conditioner start-up is performed only when the box door/s are in the closed position controlled by limit switch/es.

9.5 ACO: limit switch replacement

Air Conditioner Option

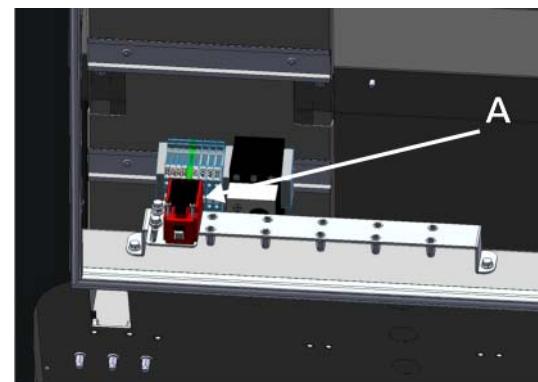
 Front view	<table border="1"> <tbody> <tr> <td>Status:</td><td>– Main switch open (OFF)</td></tr> <tr> <td>Material:</td><td>– Limit switch (see Tab. 10.10 - Conditioning on page 121)</td></tr> <tr> <td>Equipment:</td><td>– Cross cut screwdriver – Blade cut medium screwdriver – 3-mm Allen wrench</td></tr> </tbody> </table>	Status:	– Main switch open (OFF)	Material:	– Limit switch (see Tab. 10.10 - Conditioning on page 121)	Equipment:	– Cross cut screwdriver – Blade cut medium screwdriver – 3-mm Allen wrench
Status:	– Main switch open (OFF)						
Material:	– Limit switch (see Tab. 10.10 - Conditioning on page 121)						
Equipment:	– Cross cut screwdriver – Blade cut medium screwdriver – 3-mm Allen wrench						

Preliminary procedures / notes

- This procedure can be applied in case of limit switch replacement both in the Control Unit and in the Application Box, adapting the Control Unit references to the Application Box.

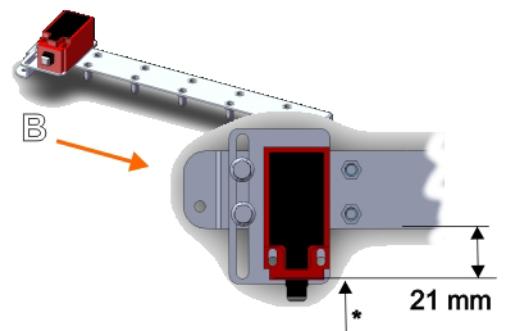
Operating procedure

- Remove the limit switch (A) unscrewing the fastening screws.
- Disconnect the wires directly from the limit switch terminals.
- Dismount the cable fastener from the damaged limit switch and mount it on the new one.
- Place the cable in the cable fastener.
- Connect the wires according to the original position. In Fig. 9.1 and Fig. 9.2 show the limit switch wiring diagrams.
- Tighten the cable fastener.

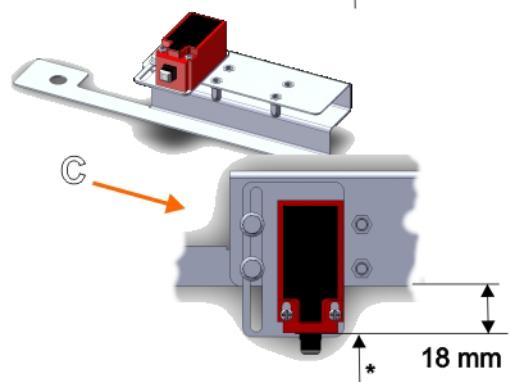


Operating procedure (Continua)

- g. Depending on the installation position, fasten the limit switch according to the data in the drawing on the side.
- (B): installation bracket inside the Control Unit
- (C): installation bracket inside the Application Box.
- *: corresponds to the limit switch face profile



- h. Tighten the screws and make sure the height is the same.

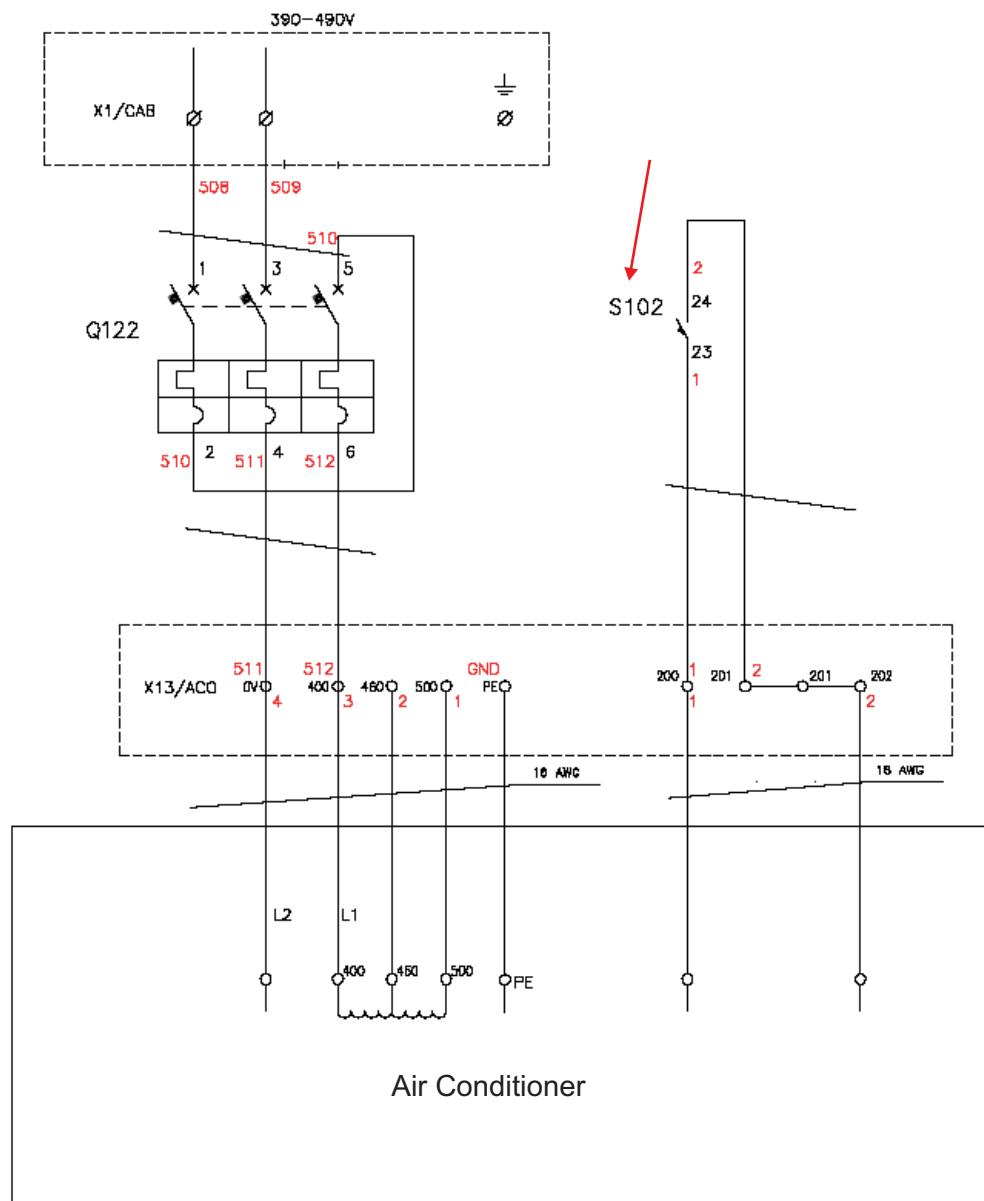


- i. Close the door without overdoing and make sure the limit switch actuator stroke is not too long.

Following procedure

- The conditioner is activated subject to the position of closed cabinet door(s), that are controlled by the limit switch(es).

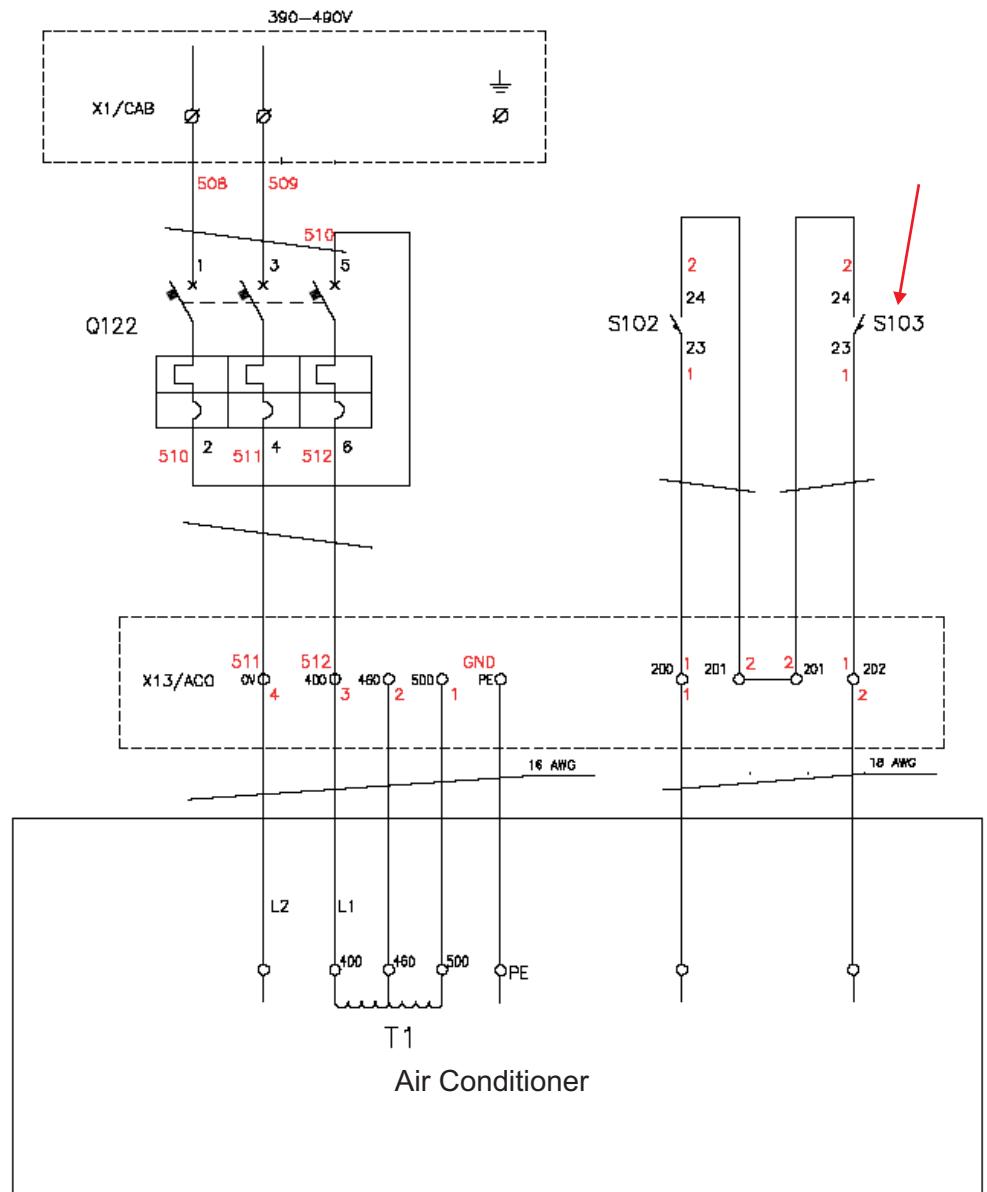
Fig. 9.1 - Limit switch on Control Unit: connection diagram



Q122: magneto-thermal automatic switch inside Control Unit

S102: limit switch inside Control Unit

Fig. 9.2 - Limit switch on Application Box: connection diagram



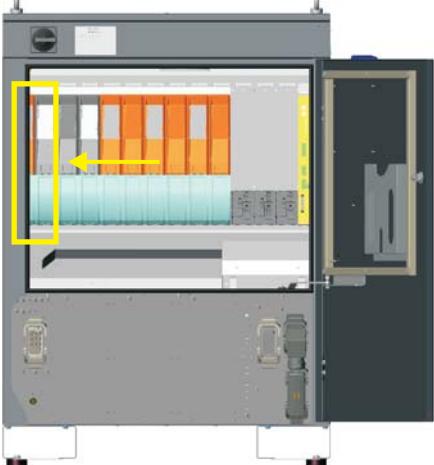
Q122: magneto-thermal automatic switch inside Control Unit

S102: limit switch inside Control Unit

S103: limit switch inside Application Box

9.6 AMS-APC820: module replacement with Compact Flash module recovery

Acopos PC

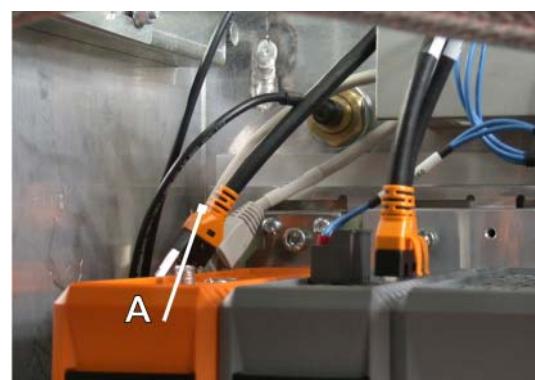
 Front view	<p>Status: – Main switch open (OFF)</p> <p>Material: – Module AMS-APC820 (see Tab. 10.4 - CPU, power supplies and power modules on page 114)</p> <p>Equipment</p> <ul style="list-style-type: none"> – Slot headed screwdriver (3,5 x 0,6) – Racket torque wrench (or screwdriver), socket head wrench insert 5 mm, extension rod up to 260 mm – Rag
---	--

Preliminary procedures/ notes

- Unnecessary

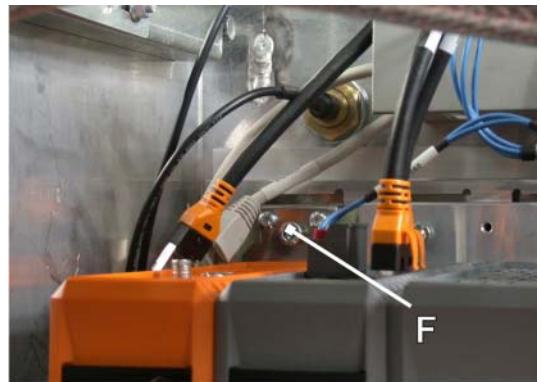
Operating procedure

- a. Disconnect the connectors on the module upper side.
Depending on the connector type, it may be necessary:
 - to unscrew the screws before removing the connector
 - (A): press the flap and keep it pressed during the removal procedure
- b. Remove other possible connectors and/or USB flash disk in the USB ports of the AMS-APC820, included the port XD: under the module, under the transparent lexan door.

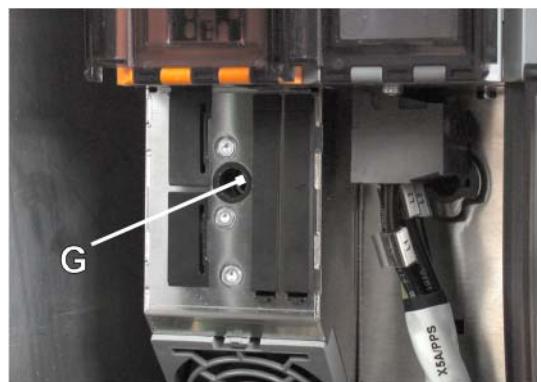


Operating procedure

- c. Unscrew the Allen screw (**F**) and remove it.



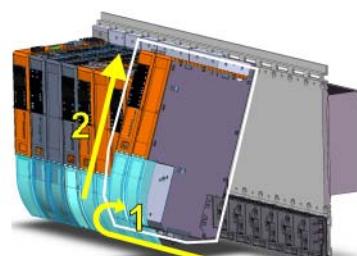
- d. Unscrew the Allen screw (**G**) until it idles. The screw is of unusable type and shall not be removed.



- e. Remove the module by slightly moving away the lower part, then lift it.

- f. In case of resistance due to the friction with the adjoining modules:

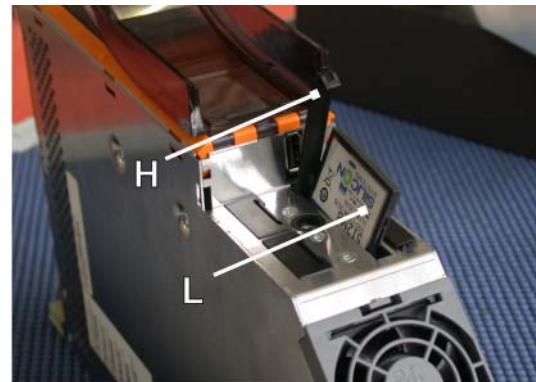
- loosen all Allen screws of the adjoining module.
- If that is not sufficient, keep on loosening all screws of all installed modules.



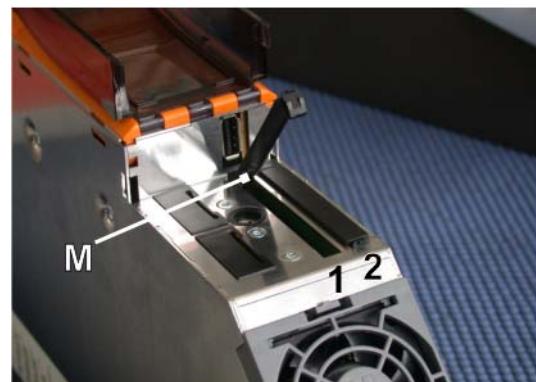
Illustrative picture with AMS-IAM module highlighted

Operating procedure

- g. Remove the Compact Flash fitted in slot 1.
- h. To carry out the removal procedure you shall open door (H), that contemporaneously lifts the Compact Flash (L).



- i. On the new AMS-APC820 module:
- i.1 fit the removed Compact Flash back in slot 1 (M).



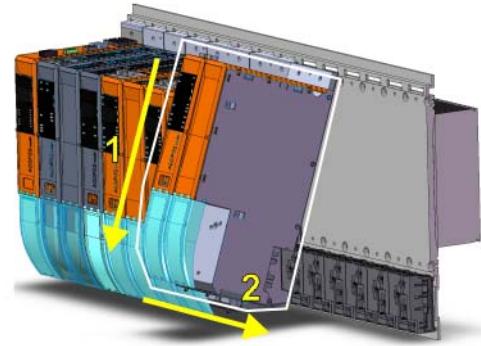
- i.2 Lift the front door and check that the four rotating selector switches are configured with the number 0 (zero)
- i.3 Check that the rotating selector switch is configured with number 3.



- j. Make sure the module bottom wall and the supporting area on the heat sink are both perfectly clean.

Operating procedure

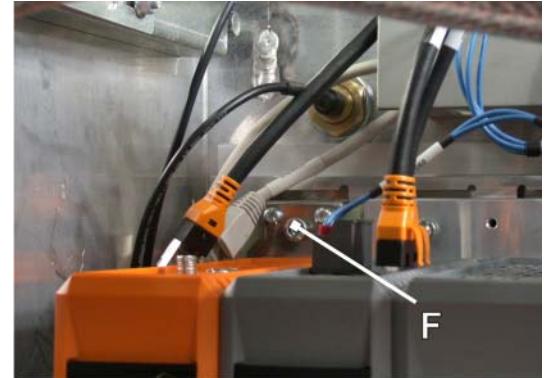
- k. Mount the new module in the slot hooking it first from the upper part, then lower it while pushing it against the heat sink.



- l. Tighten the Allen screw (**G**) at 5 Nm.



- m. Tighten the Allen screw (**F**) at 5 Nm.



Operating procedure

- n. Set back all connectors (**A**), making sure the fitting is followed by a sharp click indicating the fitting has been completely accomplished. Pay attention to the connectors orientation if necessary refer to the position on the module AMS-APC820 removed.
- o. Place back any other connectors and USB Flash Disk that may have been removed previously.
- p. If necessary, refer to the connectors and modules table included in the diagram posted inside the Control Unit door.
- q. Lower the lexan lower cover on the module.
- r. **Note:** On the first start after the replacement of AMS-APC820:
 - the Control Unit restarts in minimal configuration and many commands will not be available until the update procedure of configuration has been completed (the parameters are resident only on the Compact Flash);
 - may take a few minutes before the system is ready and the teach pendant ready to be used. The cause is the need to update the firmware inside of the module. In this case, with the system started and at the end of the steps listed below, will need the switch off and the following restart (still signaled in the messages on the teach pendant).
- s. Then switch on the Control Unit and wait that the Teach pendant is operational and functional. If you are using a wireless Teach Pendant, it may be necessary to carry out the Pairing procedure, possibly advanced by the emergency Unpairing one (the Pairing and Unpairing procedure are described in the Control Unit Usage Modalities manual).
- t. On the mode selector of the Control Unit, select the mode **PROG**. The selector can be found on the Teach Pendant (TP wired) or on the docking station (TP wireless).

Enter the Control Unit with maintenance operator's profile rights

- u. Log in with the maintenance operator profile rights:

- u.1 From the menu Home, press the softkey "Login" (key **F2**)
- u.2 Use the numerical keyboard to fill in the user name value "MU" and confirm with the key **Enter**.
- u.3 Use the numerical keyboard to fill in the password value "MU" and press the softkey "OK" (key **F5**).



Operating procedure

Loading the system parameters

- v. Loading the system parameters:
- v.1 Enter the Setup menu (key **L3**). If necessary use the key **MORE**.
- v.2 If necessary press the softkey "Config" (key **F1**)
- v.3 With arrows select the item 2 "Load the configuration file (Load)" and confirm with the key **Enter**
- v.4 Choose it pressing again the key **Enter** e choosing it with the "browse" (key **F1**) the suitable configuration file, that is usually defined:
UD:\sys\cfg\CNTRLC5G_xxx.C5G (xxx = serial number of C5G).
- v.5 Confirm the file choice with the softkey **OK** (key **F5**). Confirm the loading accomplishment with the softkey **OK** (key **F5**). To confirm the operation accomplishment it is shown for a while the message "Operation in progress".
- v.6 The system loses the coordinates absolute reference and requires to carry out the procedure Turn Set. On this purpose enter the page "Setup", "Arm", "Calib" and then press the softkey "Turn Set" (key **F1**). If necessary, see the procedure in the manual "Use of the Control Unit".



Operating procedure

Storing of the new configuration

- w. **Save the system configuration**
 (this operation aligns the contents of all areas stored in the Control Unit):

- w.1 Enter the Menu Setup (key **L3**).
- w.2 Press the softkey “Config” (key **F1**)
- w.3 With the arrows select the item 1 “Save the configuration file (Save)” and confirm with the key **Enter**
- w.4 The field “File” remarks automatically the configuration file name and the related path previously given (e.g. UD:\sys\cnfg\CNTRL C5G_xxx. **C5G**).



- w.5 Confirm storing with the softkey OK (key **F5**). To confirm loading, To confirm the operation accomplishment it is shown for a while the message “Operation in progress”.
- w.6 Reset any alarms “64584 new restart sequence” and “64569 restart of a new system software detected”. On this purpose enter the specific page “Alarm”, “Latched”.

System restart

- x. **Restart the system**
- x.1 Deactivate the active menu to enter the Home screen
 - x.2 in the Home screen, press the softkey “Restart” (key **F4**)
 - x.3 With the arrows select the item 1 “Complete (Cold)” and confirm with the key **Enter**

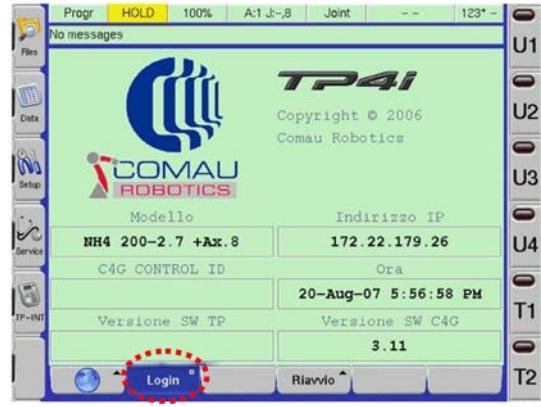


Operating procedure

Load the machine description parameters, calibration constant, hour meter value

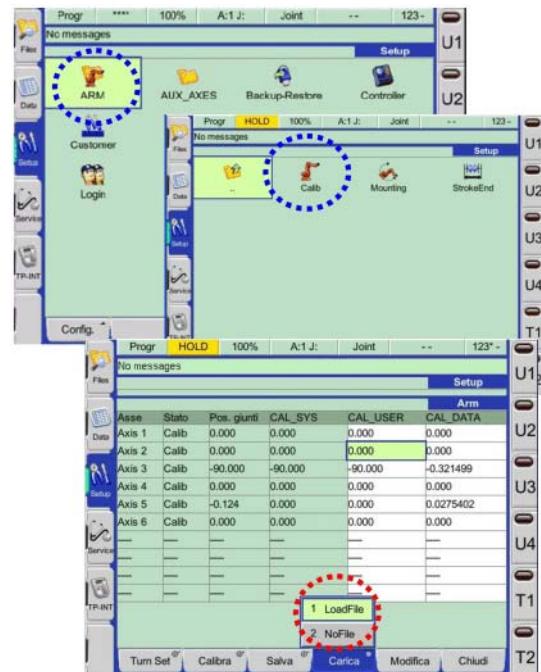
- y. Log in with the maintenance operator profile rights:

- y.1 From Home Menu, press the softkey “Login” (key **F2**)
- y.2 Use the numerical keyboard to fill in the user name value “MU” and confirm with the key **Enter**.
- y.3 Use the numerical keyboard to fill in the password value “MU” and press the softkey “OK” (key **F5**).



- z. Load the machine description, the calibration constants the hour meter values:

- z.1 Enter the Setup menu (key **L3**). If necessary use the key **MORE**.
- z.2 Select “ARM” and confirm with the key **Enter**, then “Calib” and confirm with the key **Enter**.
- z.3 Press and keep pressed the softkey “Load” (key **F4**) to display the menu items.
- z.4 With the arrows select the item 1 “LoadFile” and confirm with the key **Enter**



- z.5 Confirm loading with the softkey “YES” (key **F5**). To confirm the operation accomplishment it is shown for a while the message “Operation in progress”.
- z.6 Exit opening the softkey “Close” (key **F6**), then select the icon “Folder backward” and confirm with the key **Enter**.

Operating procedure

Save the new configuration

- aa. Save the system configuration
 (this operation aligns the contents of all the stored areas of the Control Unit):

aa.1 Enter the Menu Setup (key L3).

aa.2 Press the softkey “Config” (key F1)

aa.3 With the arrows, select the item 1 “Save configuration file (Save)” and confirm with the key **Enter**

aa.4 The item “File” shows automatically the name of the configuration file and the related path previously set (e.g. UD:\sys\cnfg\CNTRL C5G_xxx.C5G).

aa.5 Confirm the storing with the softkey OK (key F5). To confirm the operation accomplishment it is shown for a while the message “Operation in progress”.

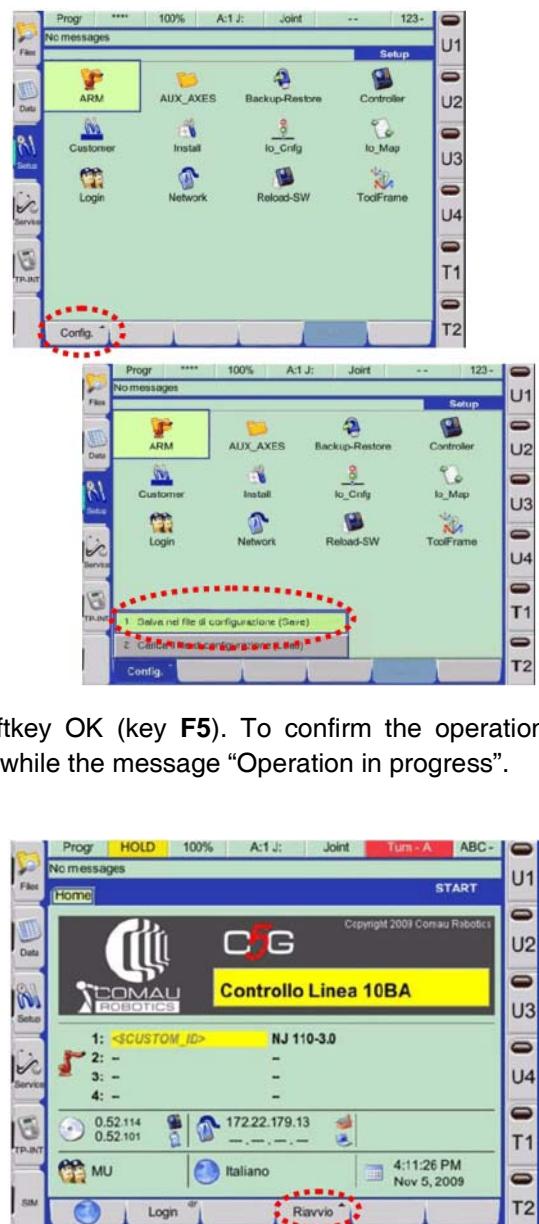
System restart

- ab. Reset the system:

ab.1 Deactivate the active Menu to enter the Home screen page (key L3)

ab.2 In the Home screen, press the softkey “Restart” (key F4)

ab.3 With the arrows select the item 1 “Complete (Cold)” and confirm with key **Enter**

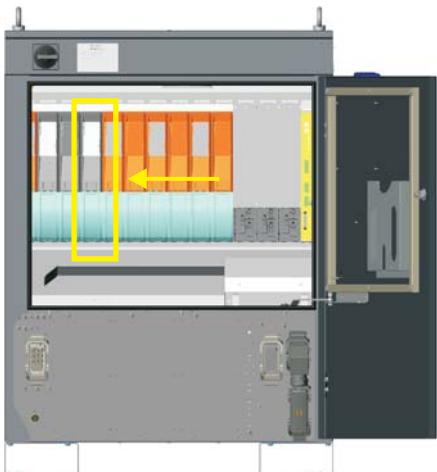


Following procedure

- Maintenance user access (login and password) is restored with the one previously stored in the users database and the access with the preset “MU” login and password could not be possible.
- Do not stand under and nearby the Robot.
- Carry out some motion cycles in low speed to check the proper functioning.
- Select the AUTO mode, and with low speed, check the program proper functioning.

9.7 AMS-ASM32: module replacement

Auxiliary Supply Module

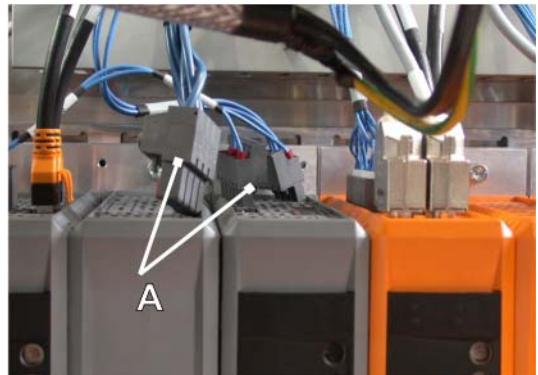
 Front view	Status: – Main switch open (OFF)
	Material: – Module AMS-ASM32 (see Tab. 10.4 - CPU, power supplies and power modules on page 114)
	Equipment: – Racket torque wrench (or screwdriver) socket head wrench insert 5 mm, extension rod up to 260 mm

Preliminary procedures / notes

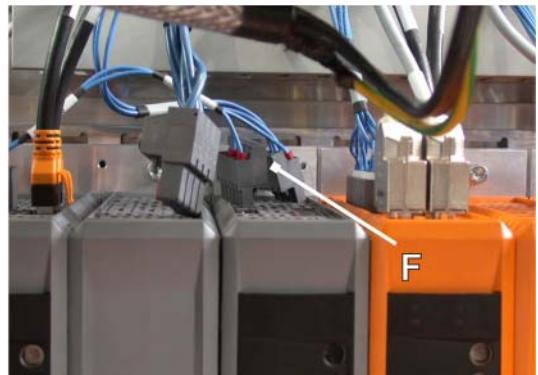
- Not required.

Operating procedures

- a. Disconnect the connectors on the module upper side.
Depending on the connector type, it may be necessary:
– (A): to carry out a direct removal (connector without fastening systems)

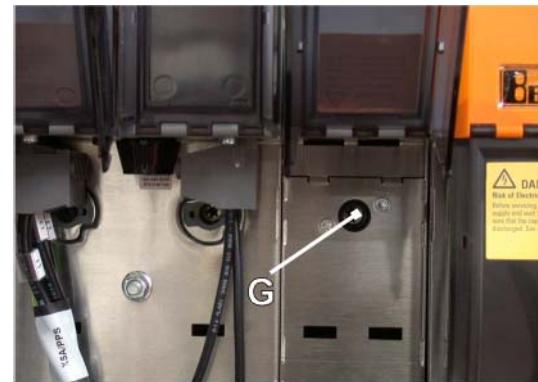


- b. Unscrew the Allen screw (F) and remove it.

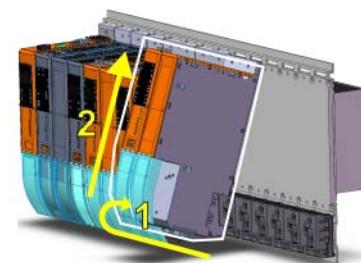
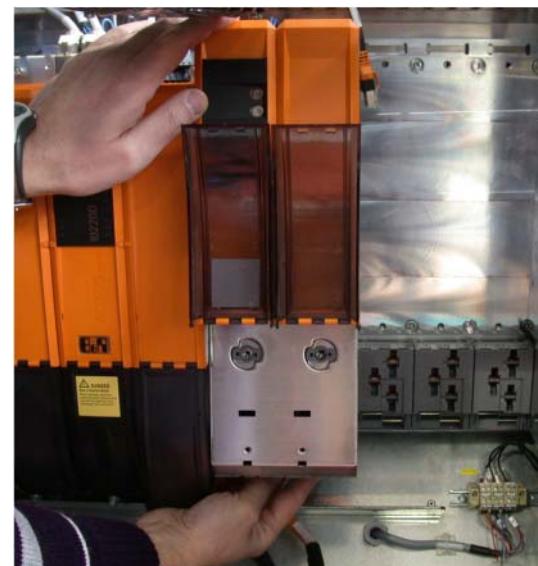


Operating procedures (Continua)

- c. Unscrew the Allen screw (**G**) until it idles. The screw is of unloseable type and shall not be removed.



- d. Remove the module by slightly moving the lower part, then lift it.
- e. In case of resistance due to the friction with the adjoining modules:
- loosen all Allen screws of the adjoining module.
 - If that is not sufficient, keep on loosening all screws of all installed modules.

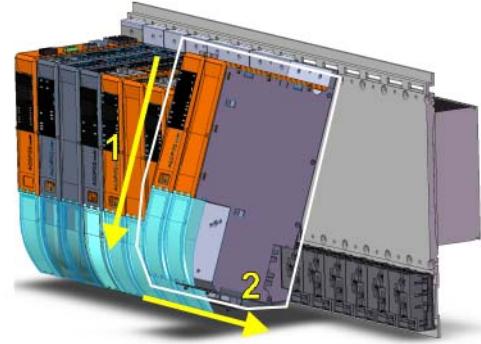


Illustrative picture with AMS-IAM module highlighted

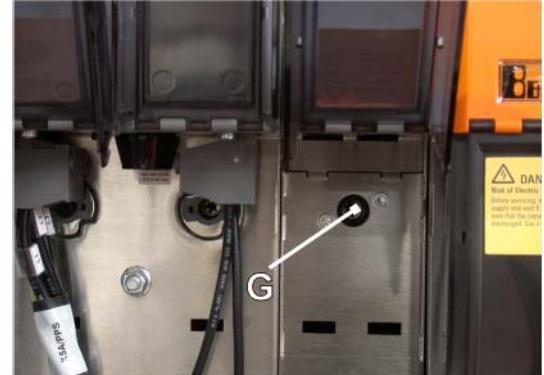
- f. Make sure the module bottom wall and the supporting area on the heat sink are both perfectly clean.

Operating procedures (Continua)

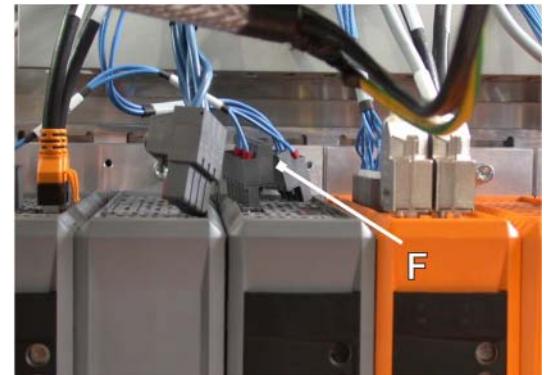
- g. Mount the new module in the slot hooking it first from the upper part, then lower it while pushing it against the heat sink.



- h. Tighten the Allen screw (**G**) by 5 Nm.



- i. Tighten the Allen screw (**F**) by 5 Nm.



- j. Place back all connectors (**A**).

- k. If necessary, refer to the connectors and modules table included in the diagram posted inside the Control Unit door.

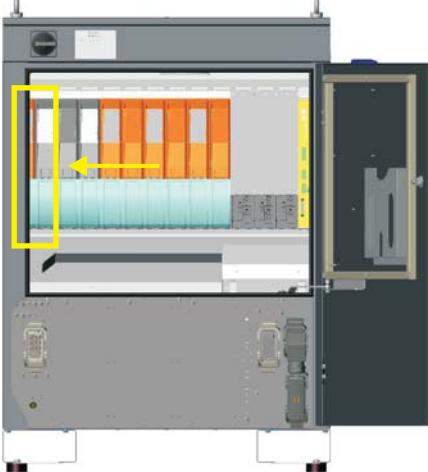
- l. Lower the lexan lower cover on the module.

Follow-up procedure

- Not required.

9.8 AMS-IAM: module replacement

Inverter Axis Module

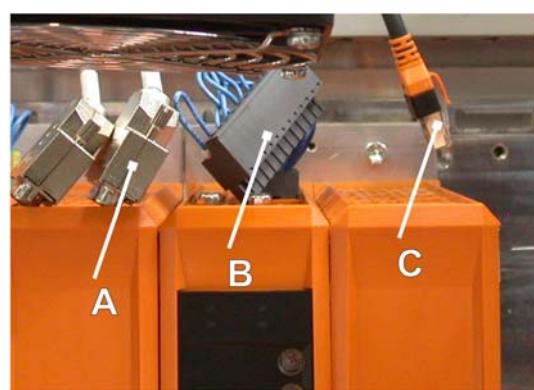
 Front view	<table border="1"> <tbody> <tr> <td>Status:</td><td>– Main switch open (OFF)</td></tr> <tr> <td>Material:</td><td>– Module AMS-IAMI (see Tab. 10.4 - CPU, power supplies and power modules on page 114)</td></tr> <tr> <td>Equipment:</td><td> <ul style="list-style-type: none"> – Blade-headed flat screwdriver, short (4 x 25) – Blade-headed screwdriver (3 x 15 and 6 x 15) – Racket torque wrench (or screwdriver) socket head wrench insert 5 mm, extension rod up to 260 mm – Antistatic arm band </td></tr> </tbody> </table>	Status:	– Main switch open (OFF)	Material:	– Module AMS-IAMI (see Tab. 10.4 - CPU, power supplies and power modules on page 114)	Equipment:	<ul style="list-style-type: none"> – Blade-headed flat screwdriver, short (4 x 25) – Blade-headed screwdriver (3 x 15 and 6 x 15) – Racket torque wrench (or screwdriver) socket head wrench insert 5 mm, extension rod up to 260 mm – Antistatic arm band
Status:	– Main switch open (OFF)						
Material:	– Module AMS-IAMI (see Tab. 10.4 - CPU, power supplies and power modules on page 114)						
Equipment:	<ul style="list-style-type: none"> – Blade-headed flat screwdriver, short (4 x 25) – Blade-headed screwdriver (3 x 15 and 6 x 15) – Racket torque wrench (or screwdriver) socket head wrench insert 5 mm, extension rod up to 260 mm – Antistatic arm band 						

Preliminary procedures / notes

- The antistatic arm band can be connected on one of the pins available inside the galvanized connector panel (CIP). The connection efficiency is guaranteed only if the Control Unit is earthed.
- The antistatic band shall be worn during the transducer modules mounting and dismounting procedure. During the other activities the arm band is not required.
- The images and explanations in the procedure refer to a AMS-IAM double module. In case of single module, the no. of connectors and fastening screws is to halved.

Operating procedure

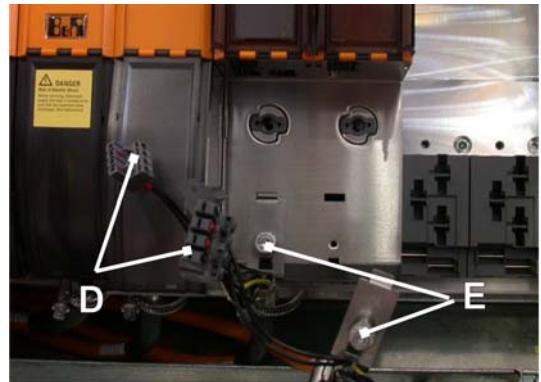
- a. Disconnect the connectors on the module upper side.
Depending on the connector type, it may be necessary:
 - (A): to unscrew the screws before removing the connector
 - (B): to carry out a direct removal (connector without fastening systems)
 - (C): to press the tongue and keep it pressed during the removal



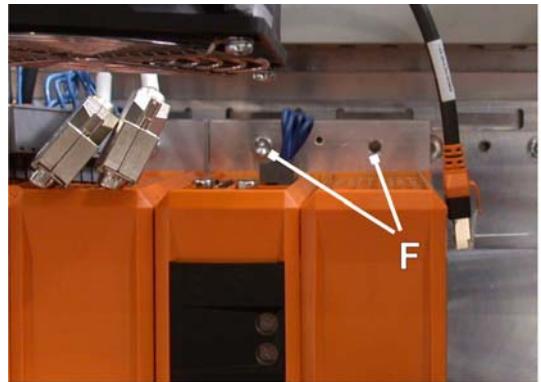
Operating procedure (Continued)

b. Disconnect the connectors on the module lower side by removing the connectors (**D**).

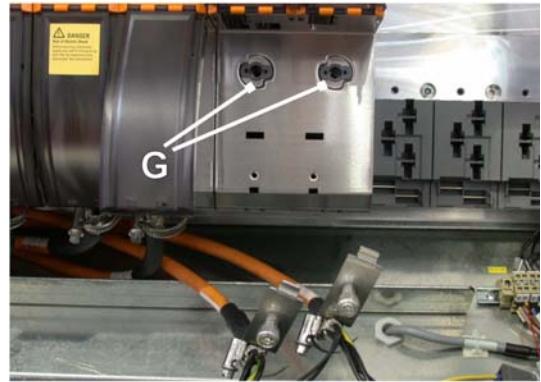
c. Unscrew the screws (**E**), lift the terminal and move it away from the module.



d. Unscrew the Allen screws (**F**) and remove them.

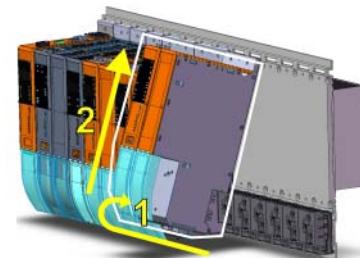
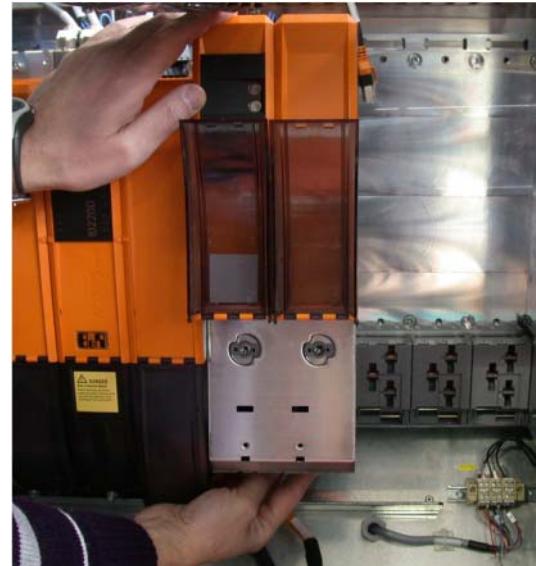


e. Unscrew the Allen screws (**G**) until they idle. The screws are of unsalable type and shall not be removed.

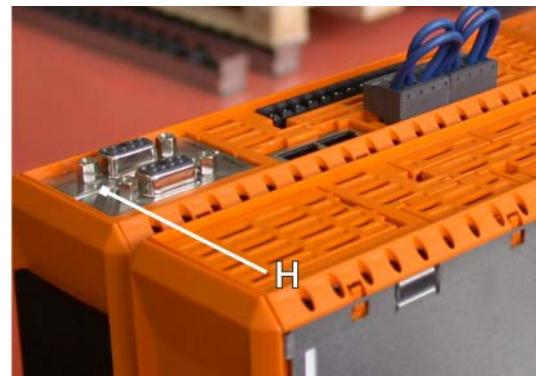


Operating procedure (Continued)

- f. Remove the module by slightly moving away the lower part, then lift it.
- g. In case of resistance due to the friction with the adjoining modules:
 - loosen all Allen screws of the adjoining module.
 - If that is not sufficient, keep on loosening all screws of all installed modules.

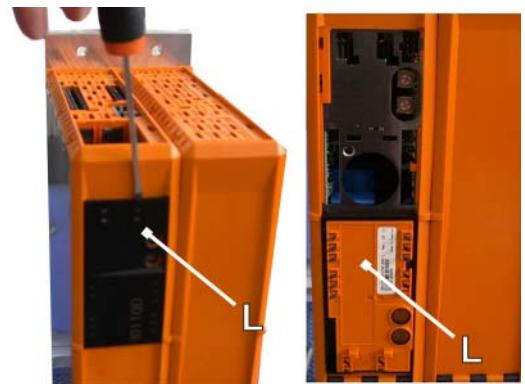


- h. Wear the antistatic arm band.
- i. Check the transducer (**H**) module type. The abbreviation is printed on the metallic front area:
 - Interface module
Encoder AMS-ETI22:
ENDAT 2.2 / AC0120-2
 - Interface module
Resolver AMS-RTI:
Resolver / AC0122
- j. Prepare a new axes module with interface module/s consistent with the removed items.
- k. The transducer interface module (e.g. module AMS-ETI22) may vary depending on the module. We recommend to use new replacement items both for the AMS-IAM module and the interface one, being very carefully not to change the model.



Operating procedure (Continued)

- I. Open the front door (L) by prizing on the upper area using a screwdriver.

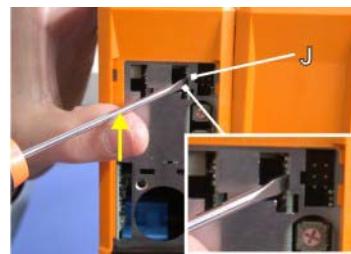


- m. Record the IP address of module AMS-IAM available on the rotating selector switches (M) to be able to set it in the new module.



- n. If necessary, remove the interface module:

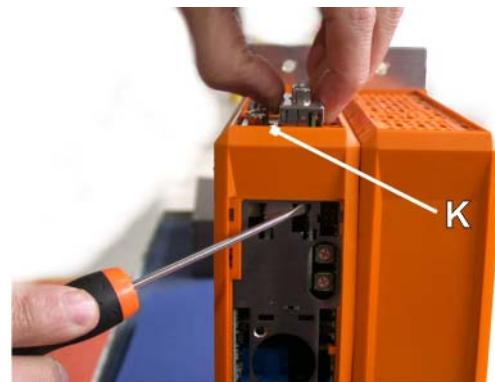
- n.1 Using a screwdriver, push gently upwards, prizing on the inside tooth (J) available on the interface module.



Operating procedure (Continued)

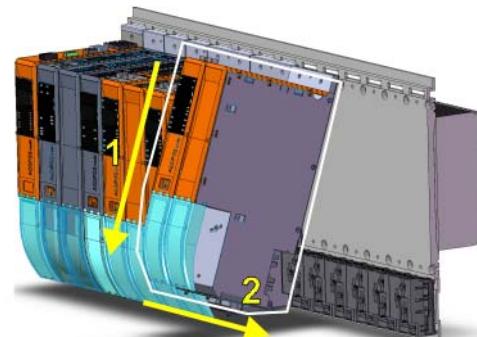
n.2 Remove the module (**K**) while keeping on pushing gently.

n.3 Repeat the procedure for the second module.



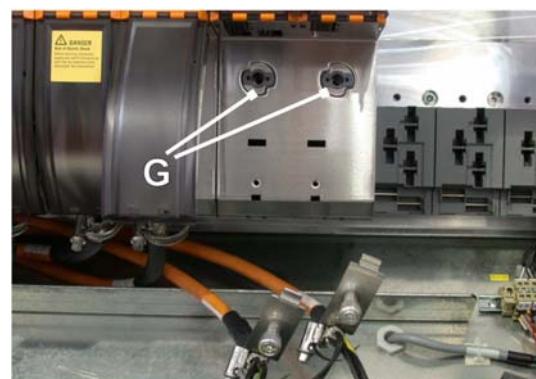
o. Make sure the module bottom wall and the supporting area on the heat sink are both perfectly clean.

p. Mount the new module in the slot hooking it first from the upper part, then lower it while pushing it against the heat sink.

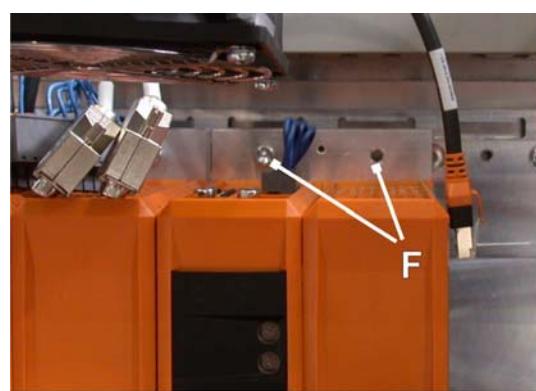


q. Set the address.

r. Tighten the Allen screws (**G**) by 5 Nm.

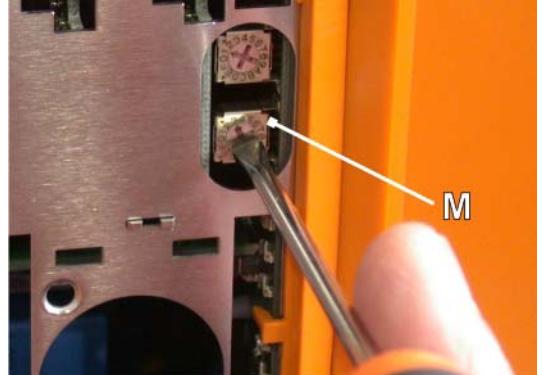


s. Tighten the Allen screws (**F**) by 5 Nm.



Operating procedure (Continued)

- t. Place back all connectors (**C**), making sure the fitting is followed by a sharp “click” indicating the fitting has been completely accomplished.
- u. Place back the connectors (**B**).
- v. Place the connectors (**A**) back and the corresponding screws (tighten the screws without overdoing).
- w. Place the terminal back and tighten the screw (**E**).
- x. Place the connectors back (**D**).
- y. Place the connectors (**A**) back and tighten the corresponding screws (tighten the screws without overdoing).
- z. If necessary, refer to the connectors and modules table included in the diagram posted inside the Control Unit door.
- aa. Lower the lexan lower cover on the module.
- ab. Set the IP address on the rotating selector switches (**M**) of module AMS-IAM according to the values in the removed module.
- ac. Close back the door (**L**).
- ad. At the first start after the AMS-IAM, replacement, the Control Unit checks and automatically updates if necessary the internal firmware of the module. The current updating procedure and the updating confirmation rare shown in the TPInt page. Do not interrupt the procedure. During updating it is not possible to carry out any motion instruction.

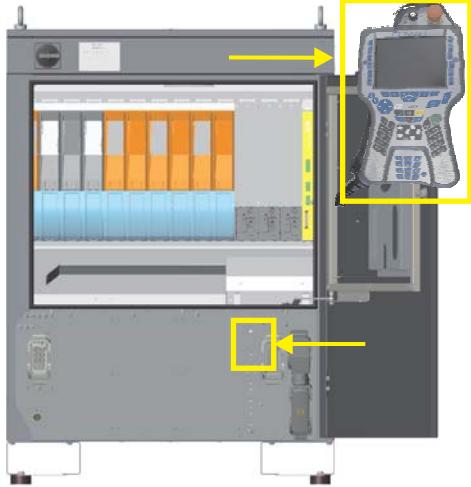


Follow-up procedure

- Do not stand under the Robot or in the areas nearby.
- Carry out some motion cycles at reduced speed to check the proper operating.
- Select the AUTO mode and check the proper operating at reduced speed.

9.9 C5G-iTP or iTP2: replacement

Teach Pendant for Internet

 Front view	<p>Status:</p> <ul style="list-style-type: none"> – Main switch open (OFF) <p>Material:</p> <p>According to requirements:</p> <ul style="list-style-type: none"> – C5G-iTP or iTP2 without cable, or – cable for C5G-iTP or iTP2 <p>(see Tab. 10.10 - Conditioning on page 121)</p> <p>Equipment</p> <ul style="list-style-type: none"> – Medium cross-tip screwdriver – Hex wrench 24 mm
---	--

Preliminary procedures/ notes

- The procedure describes the cable replacement, the same can be used also to replace the Teach Pendant.

 The teach pendants C5G-iTP and C5G-iTP2 do not have similar functions and can not be interchanged.
- To enter the Teach pendant connector open the front door.

 Limit the tightening torque of the nut and screws to avoid damages on the plastics parts.

Operating procedure

- a. Unscrew the ring nut (A)
- b. Remove the connector (B).
- c. By moving the cable (C), pay attention to the cable path which could be winding because of installation needs avoid to pull the cable, prefer to recover it by pushing.

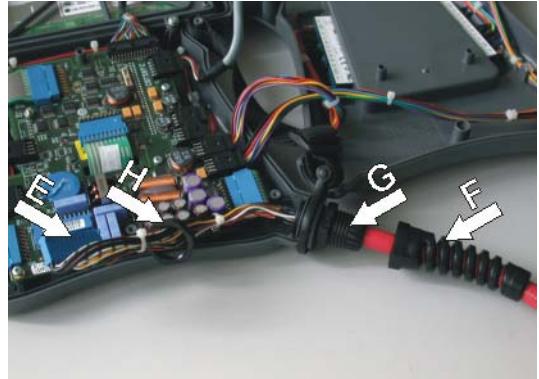
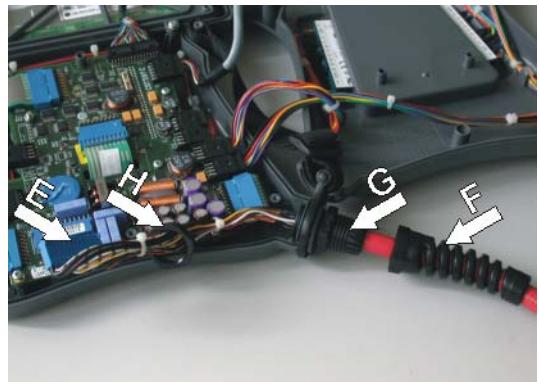


Operating procedure (Continued)

- d. Lean the Teach Pendant on the work bench.
- e. Remove the 8 cross head screws (D).

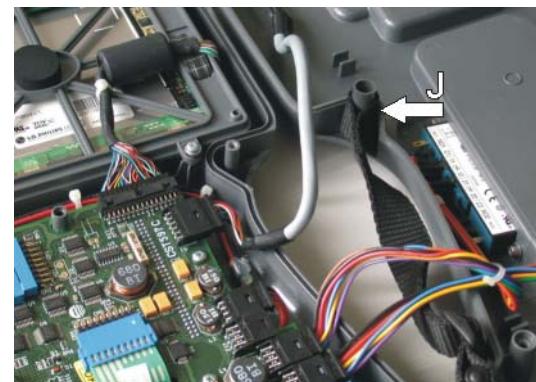


- f. Disconnect the connector (E).
- g. Unscrew the wire pulled (F).
- h. Unscrew the fitting (G) maintain the cable steadily. The inside nut (H) is locked in its seat.
- i. After complete unscrewing of the fitting (G), unscrew the nut (H).
- j. Unscrew the nut from its seat.
- k. If the cable or teach pendant are damaged, replace them with new ones.
- l. When reassembling, continue in reverse order.
- m. The wire puller (F) shall be separated from the fitting (G). If necessary unscrew the wire puller (F).
- n. Insert the cable in the seat of the teach pendant.
- o. Insert the nut (H) through the connector.
- p. Clamp the connector (E). If necessary feed the cable inside the fitting (G). It is unnecessary to have too much cable inside the teach pendant.
- q. Set the nut (H) in its seat.
- r. Maintain steady the cable and screw completely the fitting (G).
- s. Screw completely the wire puller (F).



Operating procedure (Continued)

- t. Close the teach pendant sheath.
- u. Pay particularly attention to the eyelet of the flap that is to be inserted in the seat (J).



- v. Screw again the 8 cross head screws (D).
- w. By tightening the screws do not apply the excessive forces, which can damage the sheath.



- x. Reset the cable (C) in the original path.
- y. Insert the connector (B).
- z. Screw completely the ring nut (A).



Following procedure



Check of the proper updating is made automatically with the following restart. When the message identifying the checking process is displayed, do no interrupt the updating process.

Then the system is reset automatically with Restart Cold.

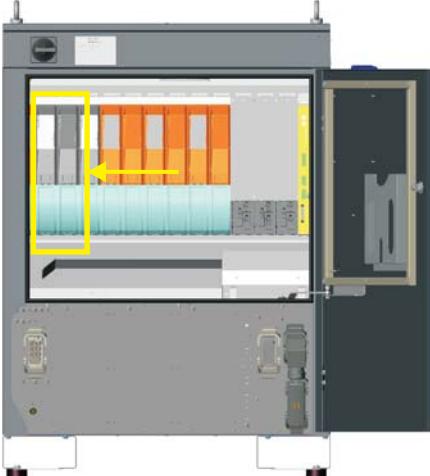
9.9.1 Software loading in iTP or iTP2

Preliminary procedures / notes

- After a teach pendant replacement any kind of software updating is not required.
- If it is necessary, when restarting the Control Unit a dedicated procedure carries out the required updating drawing the software from the system software. A message indicates that the operation is in progress. Do not shut off the Control Unit and wait for the procedure completion.

9.10 AMS-PPS8: module replacement

Passive Power Supply

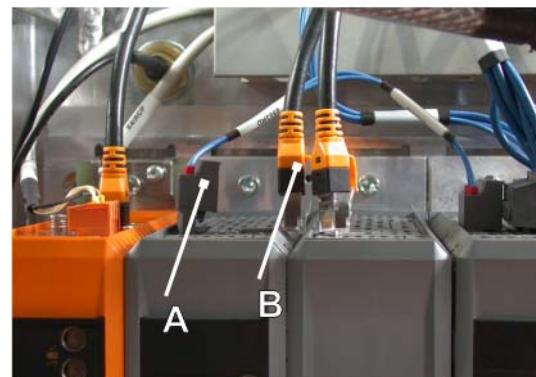
 Front view	Status: <ul style="list-style-type: none"> - Main switch open (OFF) Material: <ul style="list-style-type: none"> - Module AMS-PPS8I (see Tab. 10.4 - CPU, power supplies and power modules on page 114) Equipment: <ul style="list-style-type: none"> - Racket torque wrench (or screwdriver) socket head wrench insert 5 mm, extension rod up to 260 mm
---	--

Preliminary procedures / notes

- Before replacing the module after diagnosing a non-functioning, we recommend to check the efficiency status of the fuse (see [Fuse replacement in the module AMS-PPS8 \(see par. 9.10.1 on page 100\)](#) and [Symptoms and consequences for breaking of the fuse \(see par. 9.10.2 on page 100\)](#))

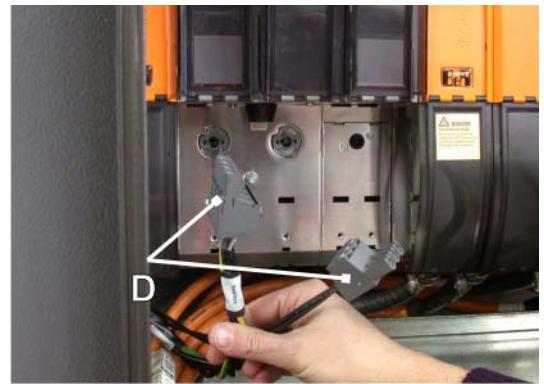
Operating procedure

- a. Disconnect the connectors on the module upper side.
Depending on the connector type, it may be necessary:
 - (A): to carry out the direct removal (connector without fastening systems)
 - (B): to press the tongue and keep it pressed during the removal

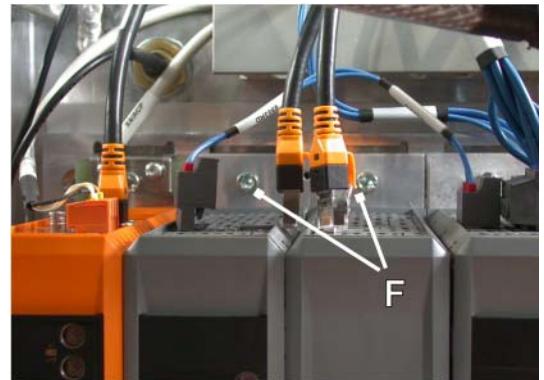


Operating procedure (Continued)

- b. Disconnect the connectors on the module lower side by removing the connectors (D).



- c. Unscrew the Allen screws (F) and remove them.

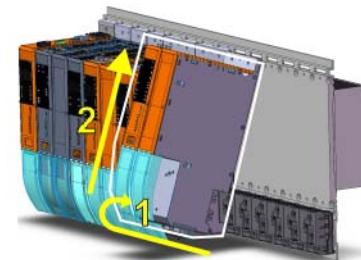
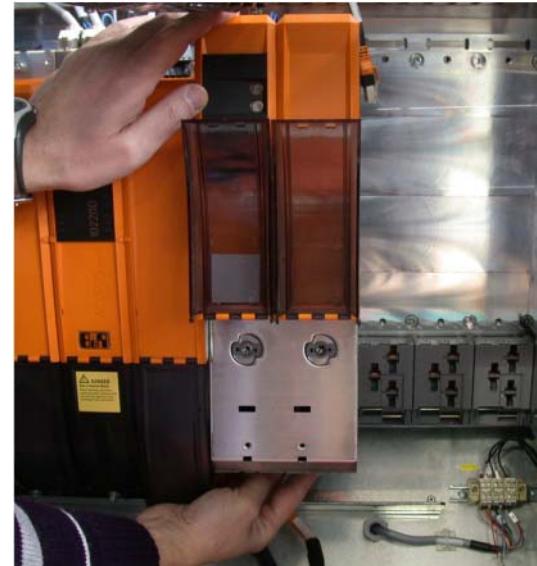


- d. Unscrew the Allen screws (G) until they idle. The screws are of unloseable type and shall not be removed.



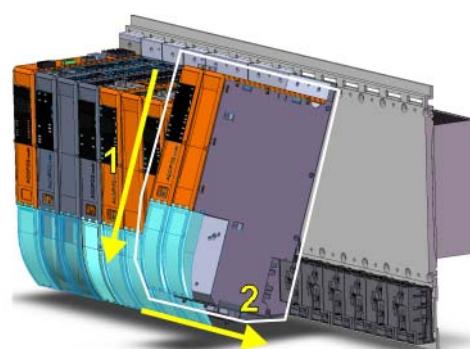
Operating procedure (Continued)

- e. Remove the module by slightly moving away the lower part, then lift it.
- f. In case of resistance due to the friction with the adjoining modules:
 - loosen all Allen screws of the adjoining module.
 - If that is not sufficient, keep on loosening all screws of all installed modules.



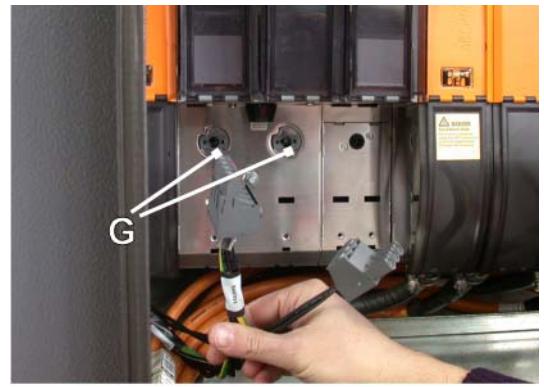
Illustrating picture with AMS-IAM module highlighted

- g. Make sure the module bottom wall and the supporting area on the heat sink are both perfectly clean.
- h. Mount the new module in the slot hooking it first from the upper part, then lower it while pushing it against the heat sink.

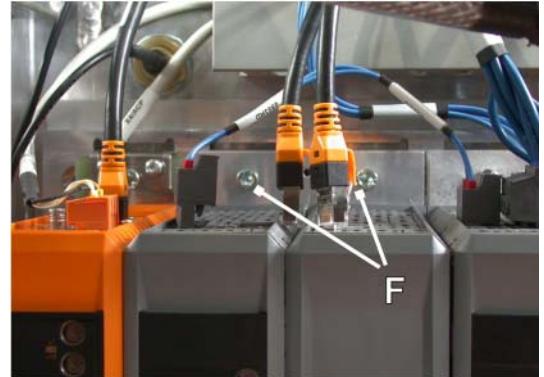


Operating procedure (Continued)

- i. Tighten the Allen screws (**G**) by 5 Nm.



- j. Tighten the Allen screws (**F**) by 5 Nm.



- k. Place back all connectors (**B**), making sure the fitting is followed by a sharp "click" indicating the fitting has been completely accomplished.
- l. Place back all connectors (**A**) and (**D**).
- m. If necessary, refer to the connectors and modules table included in the diagram posted inside the Control Unit door.
- n. Lower the lexan lower cover on the module.
- o. At the first start after the AMS-PPS8 replacement, the Control Unit checks and automatically updates if necessary the internal firmware of the module. The current updating procedure and the updating confirmation rare shown in the TPInt page. Do not interrupt the procedure. During updating it is not possible to carry out any motion instruction.

Follow-up procedure

- At the first startup after the AMS-PPS8 replacement may take a few minutes before the system is ready and the programming terminal ready to be used. The cause is the need to update the firmware inside of the module. In this case, a system started, you may need to switch off and following restart (still signaled in the messages on the programming terminal).

9.10.1 Fuse replacement in the module AMS-PPS8

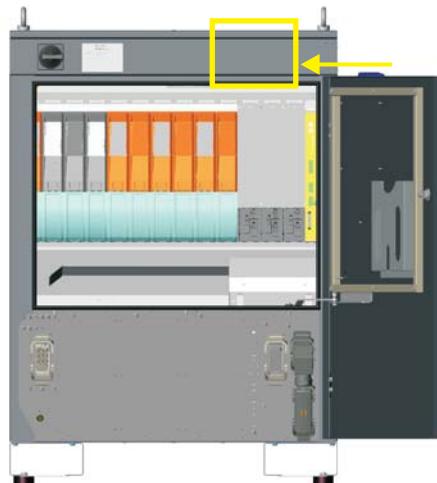
Operative procedure
<p>a. Raise the lower door to cover the cables and unscrew the fuse holder plug.</p> <p>b. Verify the fuse efficiency by testing continuity.</p> <p>c. If necessary, replace the fuse (F30):</p> <ul style="list-style-type: none"> - quick type, 10.3 x 38 mm, 30A, 600V 

9.10.2 Symptoms and consequences for breaking of the fuse

Operative procedure
<p>a. The intervention of the fuse (F30) excludes the recovery resistance from Bus-DC with the following overvoltage on the bus and the error appearance:</p> <ul style="list-style-type: none"> - 60948 11-DRIVE OFF Axis <axis_num> Arm <arm_num> <axisType> - 7200:DC bus - Overvoltage - 60950 11-DRIVE OFF Axis <axis_num> Arm <arm_num> <axisType> - 7225:DC bus - Overvoltage <p>b. This error can also be generated by the interruption of the connection of the resistance or the breaking of the resistance itself (value 14.96 ohms)</p>

9.11 HMK: hour-meter replacement

Hour Meter Kit

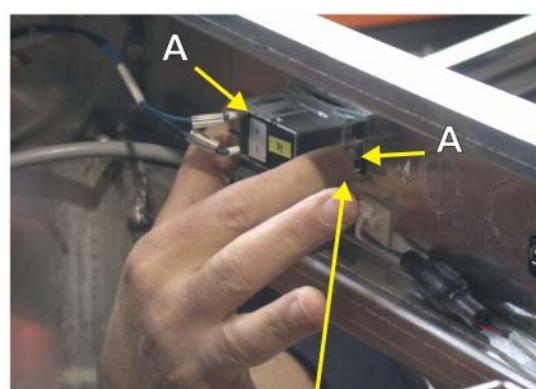
 Front view	<p>Status: – Main switch open (OFF)</p> <p>Material: – Hour-meter (see Tab. 10.2 - Operator Panel Devices (OPD) on page 112)</p> <p>Equipment: – Flat blade screwdriver</p>
---	--

Preliminary procedures / notes

- The hour-meter module records the Robot working hours. Record the value displayed by the removed hour-counter and take it into account in the future Robot periodic maintenance sessions.

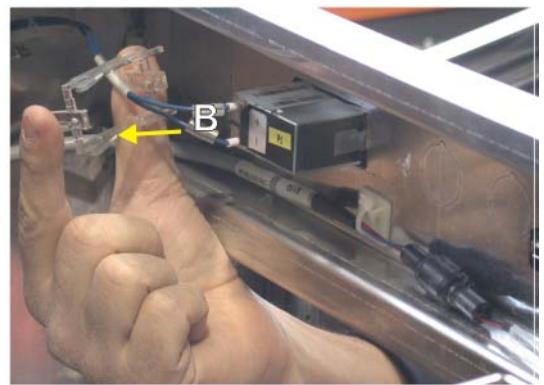
Operating procedure

- a. Press both side levers (**A**) on the inside plastic frame.
- b. Slip off the frame (**B**), while acting on the levers.



Operating procedure (Continued)

- c. Slip off the frame (B) while acting on the levers.



- d. Push the hour-meter outwards.
 e. Connect the wires to the new hour-meter.



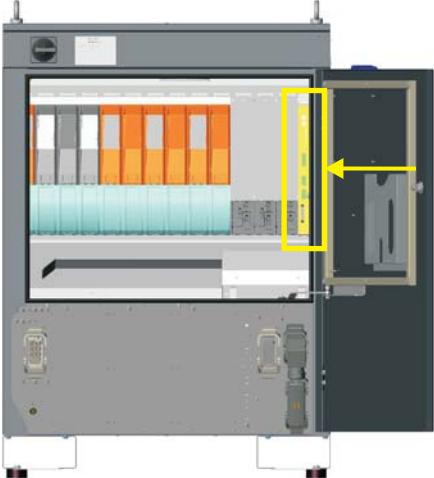
- f. Place the new hour-counter in its seat and orient it properly.
 g. Place the plastic frame back, while keeping the hour-meter in its seat, and push it firmly in position.

Follow-up procedure

- Not necessary.

9.12 SDM: module replacement

Safety Distribution Module

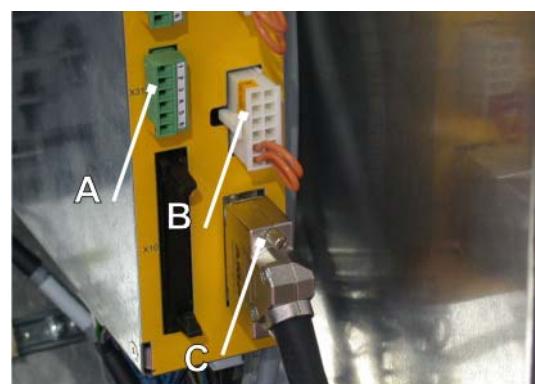
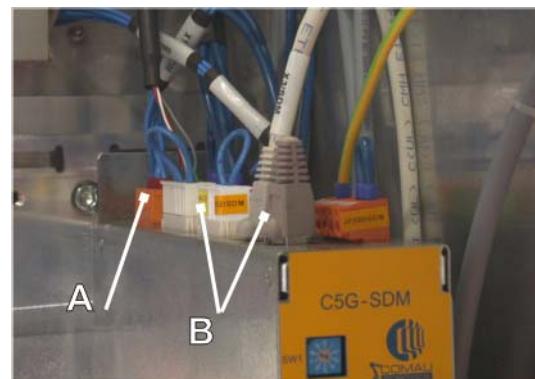
 Front view	Status: <ul style="list-style-type: none"> - Main switch open (OFF) Material: <ul style="list-style-type: none"> - Module SDM (see Tab. 10.5 - Safety Distribution Module (SDM) on page 116) Equipment: <ul style="list-style-type: none"> - Flat blade-headed screwdriver, short (4 x 25) - Flat blade-headed screwdriver (3 x 15 e 6 x 15) - Racket torque wrench (or screwdriver), socket head insert 5 mm, extension rod up to 260 mm
---	---

Preliminary procedures / notes

- Not required.

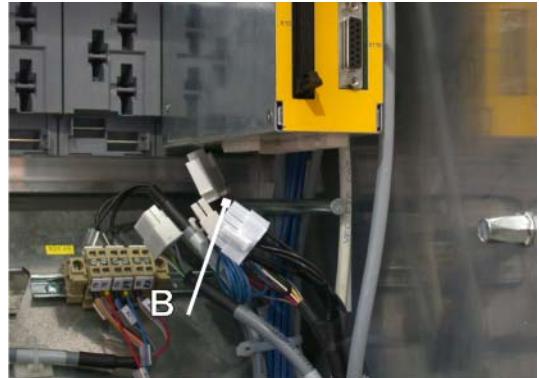
Operating procedure

- a. Disconnect the connectors on the module upper area.
Depending on the connector it may be necessary:
 - to unscrew the screws before removing the connector
 - **(A):** to carry out a direct removal (connector without fastening systems)
 - **(B):** to press the tang and keep it pressed during the removal
- b. Disconnect the connectors on the module front side.
Depending on the connector it may be necessary:
 - **(A):** to carry out a direct removal (connector without fastening systems)
 - **(B):** to press the tang and keep it pressed during the removal
 - **(C):** to unscrew the screws before removing the connector



Operating procedure (Continue)

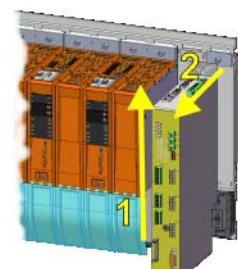
- **Note:** if options are installed, the connectors **(A)** and **(B)** may differ, as cabled wires replace the standard version typical bridges.
- c. Disconnect the connectors on the module lower side:
- **(B):** press the tang and keep it pressed during the removal.



- d. Unscrew by 2-3 turn the Allen screw **(F)**, but do not remove it.

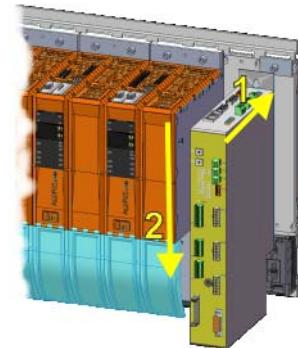


- e. Remove the module by slightly lifting the lower part, then move it away. The module is not locked below.



Operating procedure (Continue)

- f. At the stand, remove possible connectors still available on the module and serving as plugs or without connections, such as to guarantee the same functions and performances for the new module as well (in particular connectors with bridges). Fit them on the new module complying with the original position.
- g. Make sure the module bottom wall and the supporting area on the heat sink are both perfectly clean.
- h. Mount the new module in the slot by fitting it through the upper screw, then lower it pushing it against the heat sink.



- i. Tighten the Allen screw (**F**) by 5 Nm.



- j. Set the time selected on the stop circuit timer in the SDM module rotating selector switches (**SW1** and **SW2**) consistently with the values in the module removed. Refer also to [Tab. 9.3 - Time to be set depending on the Robot family on page 106](#) and [Tab. 9.4 - Time and position for the rotating selector switches on SDM module on page 106](#).



Usage restrictions

- Take into account that **the controlled time zeroing or reduction may result in:**
 - departures from the expected trajectory, due to the untimely triggering of the motors waiting brakes.
 - possible Robot stress, due to the motors waiting brake triggering, and impacts caused by the departures from the expected trajectory.

Operating procedure (Continue)

- k. Place back connectors (**A**).
- l. Place back all connectors (**B**), making sure the fitting is followed by a sharp "click" indicating the fitting has been completely accomplished.
- m. Place back all connectors (**C**) and screw the corresponding screws (tighten the screws without overdoing).
- n. If necessary, refer to the connectors and modules table included in the diagram posted inside the Control Unit door.

Follow-up procedure

- Do not stand under the Robot or in the areas nearby.
- Carry out some motion cycles at reduced speed to check the proper operating.
- Select the AUTO mode and check the proper operating at reduced speed.

Tab. 9.3 - Time to be set depending on the Robot family

Robot family	Time to be set on SDM module (preferential depending on the Robot family and typical applications)
SMART 5 Six / NS	
SMART 5 NM	1.5 seconds *1
SMART 5 NJ / NJ4	
SMART NX1-600	2 seconds
SMART NX1-800	6 seconds

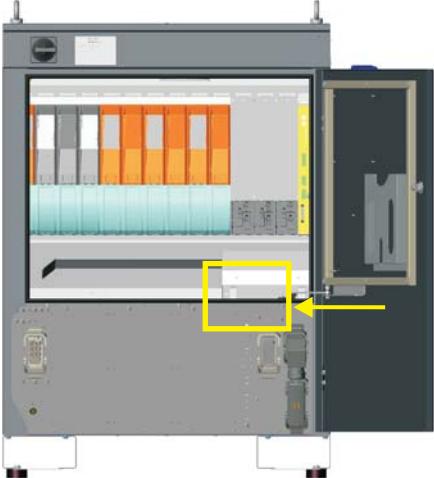
Tab. 9.4 - Time and position for the rotating selector switches on SDM module

Time (seconds) 	0	0,5	1	1,5 *1	2	2,5	3	4	5	6
SW1 / SW2 selector switch position	0	1	2	3 *1	4	5	6	7	8	9

*1 Manufacturer's default value.

9.13 UPS: replacing the module

Uninterruptible Power Supply

 Front view	Status: <ul style="list-style-type: none"> – Main switch open (OFF) Material: <ul style="list-style-type: none"> – Complete Module C5G-UPS (refer to Tab. 10.3 - Uninterruptible Power Supply (UPS) on page 113) – Fuse, if necessary (refer to Tab. 10.3 - Uninterruptible Power Supply (UPS) on page 113) Equipment: <ul style="list-style-type: none"> – Cross-headed screwdriver
---	---

Preliminary procedures / notes



Handle the module with care as it hosts a battery.



This module hosts a battery and shall be disposed of in compliance with the environmental protection principles and laws in force. For further details about the battery removal, refer to [par. 11.5 Removing the cell and battery from the Control Unit on page 126](#).

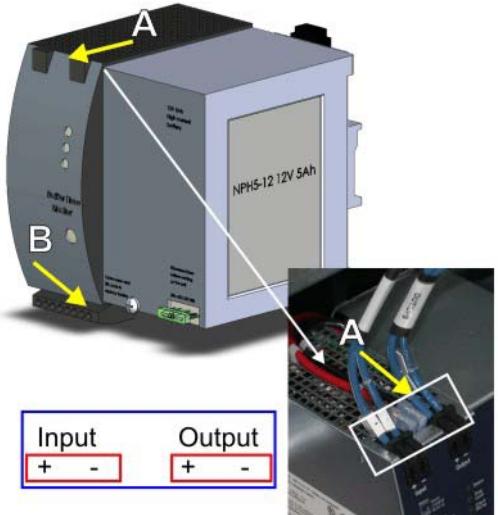
- Before replacing the UPS module due to an alleged fault, make sure it cannot be ascribed to the battery protection fuse installed on the module (refer to [par. 9.13.1 Fuse replacement in the UPS module on page 109](#)).

Operating procedure

- a. The UPS module is usually reachable and there is no need to remove other components. If this is the case go to step c.
- b. If there are optional modules on the option plate C5G-OPK that inhibits the access, it is advisable to operate in the following way:
 - b.1 if it is possible, release the UPS module from the omega guide (detaching lever in the upper part) passing behind the components / C5G-OPK options plate and rest the UPS module on the pavement inside of the electric cabinet (**with care** to **avoid abrasions** caused by crashes and creeps with the C5G-OPK plate).
 - b.2 or, remove the optional module installed more on the right to enter by the front side the UPS module. Usually it is not necessary to disconnect the cables of the option and it can be moved on the side, allowing to enter the module.

Operating procedure (Continued)

- c. Draw out the 4 upper conductors (**A**), held in position by spring block clamp.
- d. Draw out the lower connector (**B**).
- e. Replace the UPS module.
- f. Re-connect the 4 connectors respecting the original position, following the numeration.
- g. Insert the lower connector.



- h. Fasten the UPS module on the omega guide.
- i. If one or more modules have been removed:

- i.1 Mount back the removed option panel.



Transfer the UPS module and battery to the suitable waste collecting sites.
For further details refer to [Cap. Setting out of work and dismantling procedure on page 124](#)

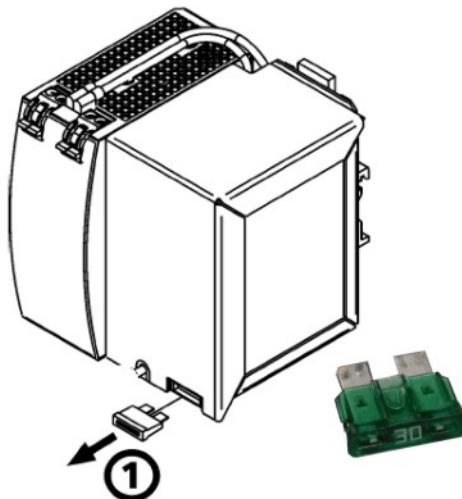
Follow-up procedure

- The battery needs about **3 hours** for a complete charge and therefore to be able to operate again.
- During the charging period, the Control Unit may not be able to guarantee controlled shutdowns in case of powering interruption. Always perform the suitable shutdown software procedure.

9.13.1 Fuse replacement in the UPS module

Operating procedure

- a. The UPS module is usually reachable and there is no need to remove other components. If this is the case go to step **c**.
- b. If there are optional modules on the option plate C5G-OPK that inhibits the access, it is advisable to operate in the following way:
 - b.1 if it is possible, release the UPS module from the omega guide (detaching lever in the upper part) passing behind the components / C5G-OPK options plate and rest the UPS module on the pavement inside of the electric cabinet (**with care** to **avoid abrasions** caused by crashes and creeps with the C5G-OPK plate).
 - b.2 or, remove the optional module installed more on the right to enter by the front side the UPS module. Usually it is not necessary to disconnect the cables of the option and it can be moved on the side, allowing to enter the module.
- c. Draw out the fuse **(1)**.
- d. Replace with a new fuse, inserting it steadily in the seat.
- e. If the module was removed hook the UPS module on the omega guide.
- f. Power on the Control Unit and check the UPS module functioning.



10. SPARE PARTS

This chapter deals with the following topics:

- Precautions about the spare part usage
 - Where to procure the spare parts
 - Spare part list
 - Spare parts for the C5G basic model
 - Special configurations spare parts.
-

10.1 Precautions about the spare part usage

Find in this chapter the spare part list divided per module.

If not clearly specified, the spare part suits all Unit Control sizes.



Use only original spare parts for the C5G Control Unit, in particular for the devices installed in the status and safety circuits.

Do not carry out independent or unauthorized activities on damaged modules.

Repairs shall be performed by Comau staff only.

Do not use the spare parts for purposes other than the ones specified.



The spare part features and performances are to be regarded as valid only if the spare part is used according to the specifications in the Instruction Manuals related to the C5G Control Unit.

The Control Unit Compliance Statements apply also to the single spare parts, if the latter are used according to the specifications in the Instruction Manuals related to the C5G Control Unit.

10.2 Where to procure the spare parts

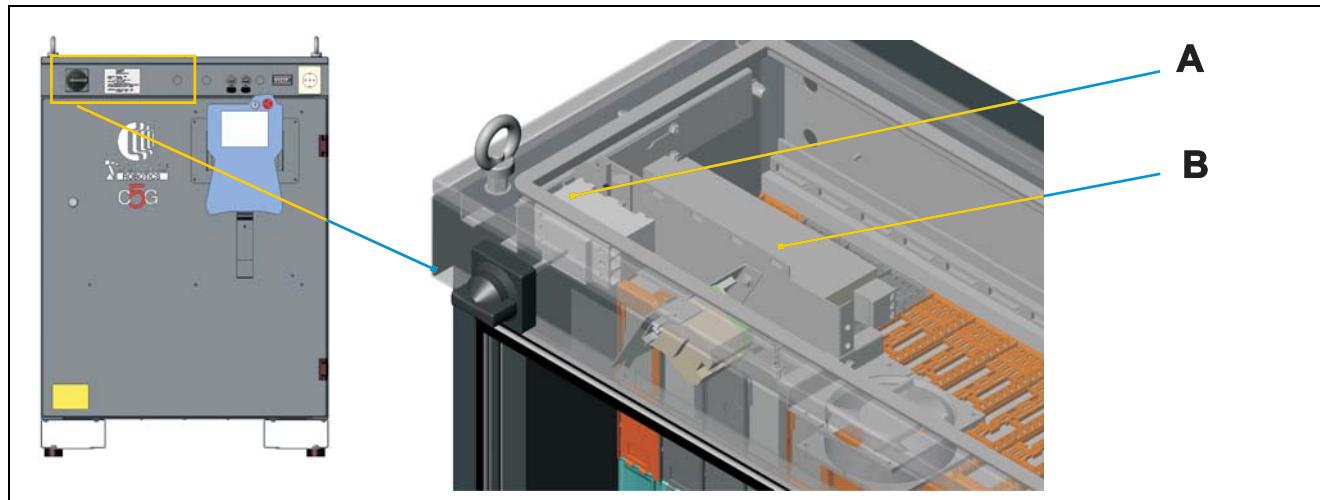
The original spare parts can be purchased through the [Comau Customer Centre](#).

10.3 Spare part list

- Spare parts for the C5G basic model
 - Arm Controller Electromechanical (ACE)
 - Operator Panel Devices (OPD)
 - Uninterruptible Power Supply (UPS)
 - CPU, power supplies and power modules
 - Safety Distribution Module (SDM)
 - Internal ventilation system
 - C5G-iTP Teach Pendant, wired
 - C5G-WiTP Teach Pendant, wireless
 - Teach pendant C5G-TP5, with cable
 - Conditioning
- Special configurations spare parts
 - Expansion unit Multi Machine C5G-ACPWx
 - C5G-ACSK Arm Controller Safety kit

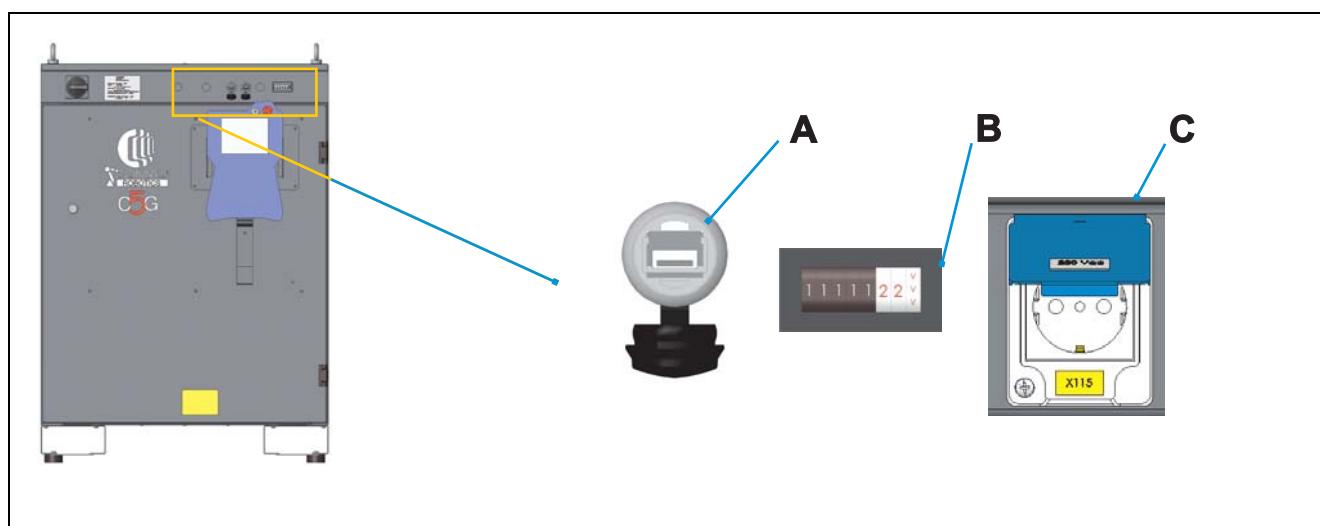
10.4 Spare parts for the C5G basic model

Tab. 10.1 - Arm Controller Electromechanical (ACE)



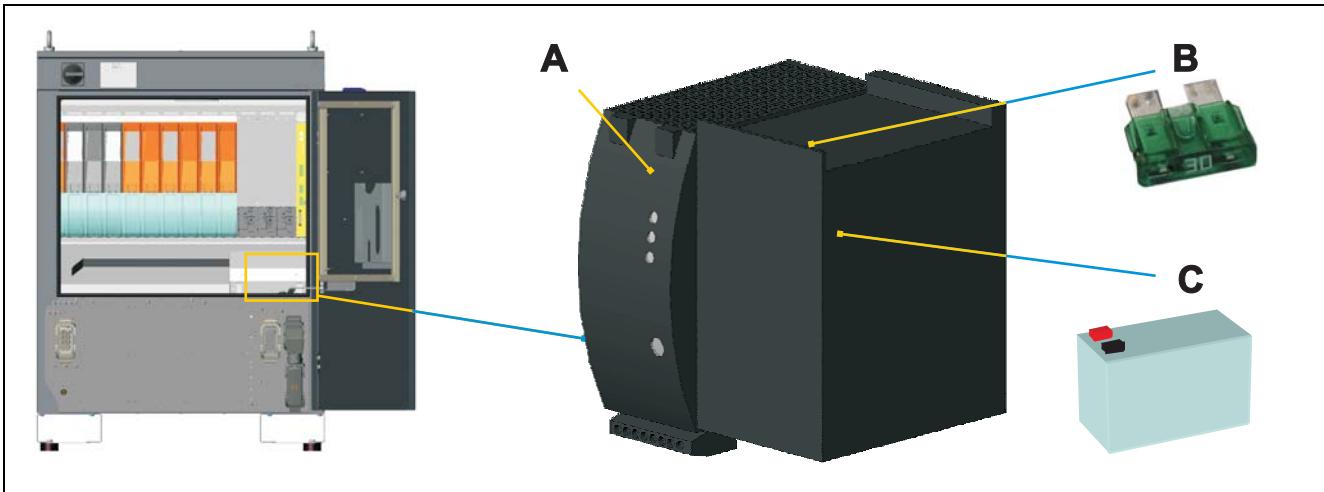
Item	Comau Part no.	Description
A	CR19191126	PKZMO-25 main circuit breaker 25 A (Q100)
	CR19191127	PKZO-XH-MCC black handle, 90° turned switch and extension (Q100)
B	CR10140283	EMI filter 8kW 30 A 520 Vac (Z1)

Tab. 10.2 - Operator Panel Devices (OPD)



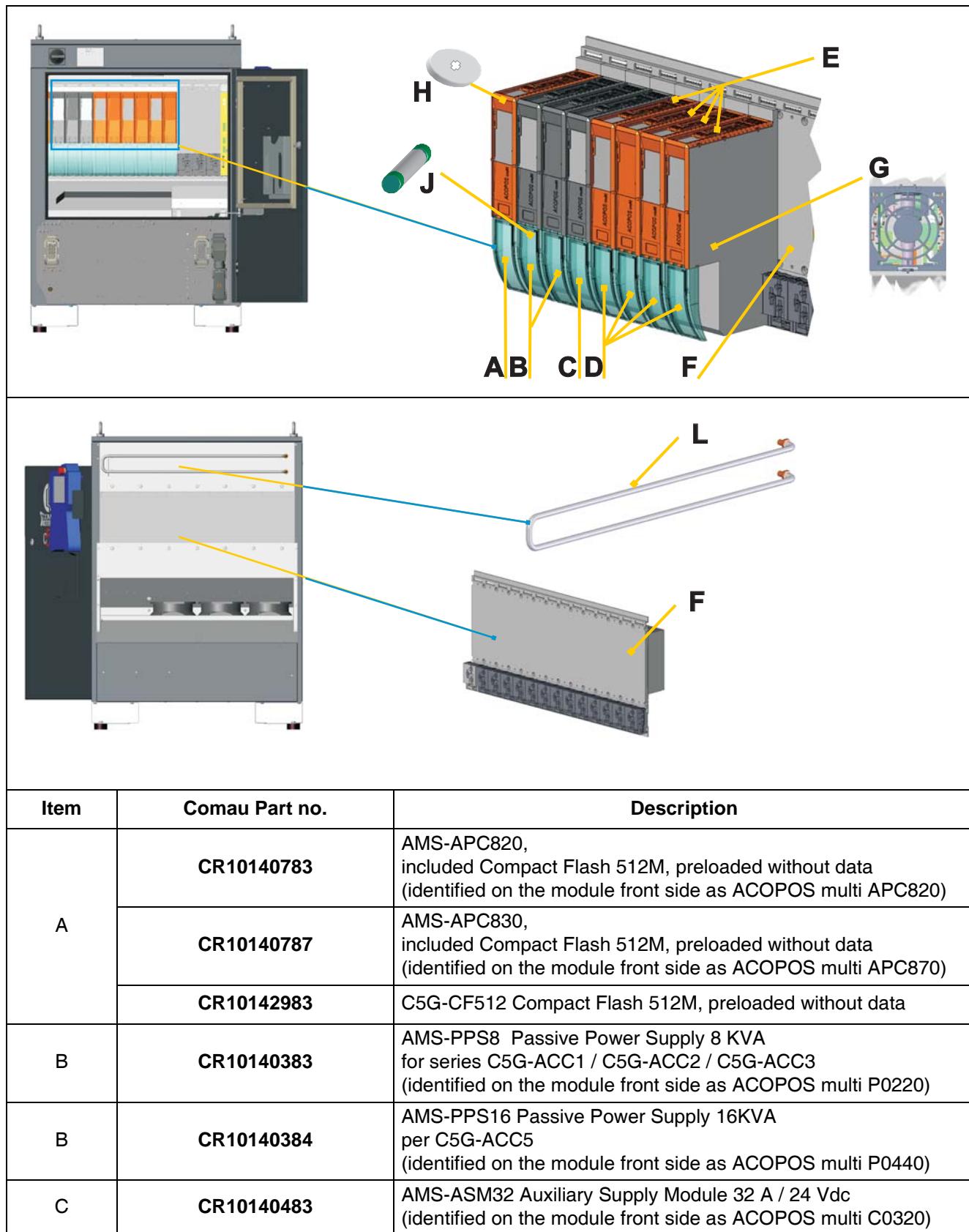
Item	Comau Part no.	Description
A	CR17130780	USB kit
B	CR17132480	Hour meter kit
C	CR17033580	Service Socket spare parts

Tab. 10.3 - Uninterruptible Power Supply (UPS)



Item	Comau Part no.	Description
A	CR10140583	C5G-UPS complete
B	CR10142483	C5G-UPS blade fuse 30 A (green)
C	CR10142283	C5G-UPS battery 12 V 5 Ah, 70 x 106 x 90 mm (W x H x D)

Tab. 10.4 - CPU, power supplies and power modules



Tab. 10.4 - CPU, power supplies and power modules (Continued)

Item	Comau Part no.	Description
D *1	CR10141183	AMS-IAM 2,8+2,8 Inverter Axis Module 2,8/10 + 2,8/10 (identified on the module front side as ACOPOS multi I0028D)
	CR10141283	AMS-IAM5,5+5,5 Inverter Axis Module 5.5/20 + 5.5/20 (identified on the module front side as ACOPOS multi I0055D)
D *1	CR10141483	AMS-IAM11+11 Inverter Axis Module 11/43 + 11/43 (identified on the module front side as ACOPOS multi I0110D)
	CR10141583	AMS-IAM22+22 Inverter Axis Module 22/85 + 22/85 (identified on the module front side as ACOPOS multi I0220D)
	CR10141683	AMS-IAM 44 Inverter Axis Module (identified on the module front side as ACOPOS multi I0440D)
E *2	CR10140883	AMS-ETI22 ETI Encoder Trasducer Interface ENDAT2.2 (identified on the module front side as Endat 2.2 AC0120-2)
E *2	CR10141683	AMS-RTI Resolver Trasducer Interface (identified on the module front side as Resolver / AC0122)
F	CR10140183	AMS-FMP14 Feed-through Mounting Plate 14 slots
G *3	CR10141983	AMS-AFU ACOPOS Fan Unit
H	CR10142383	C5G-APC Lithium Battery 3V 950 mAh
J	CR19190057	Fuse 30A, 600V, fast, 10.3 x 38 mm
L	CR19191128	C5G-ERR Energy Recovery Resistance 15 ohm 2 kW

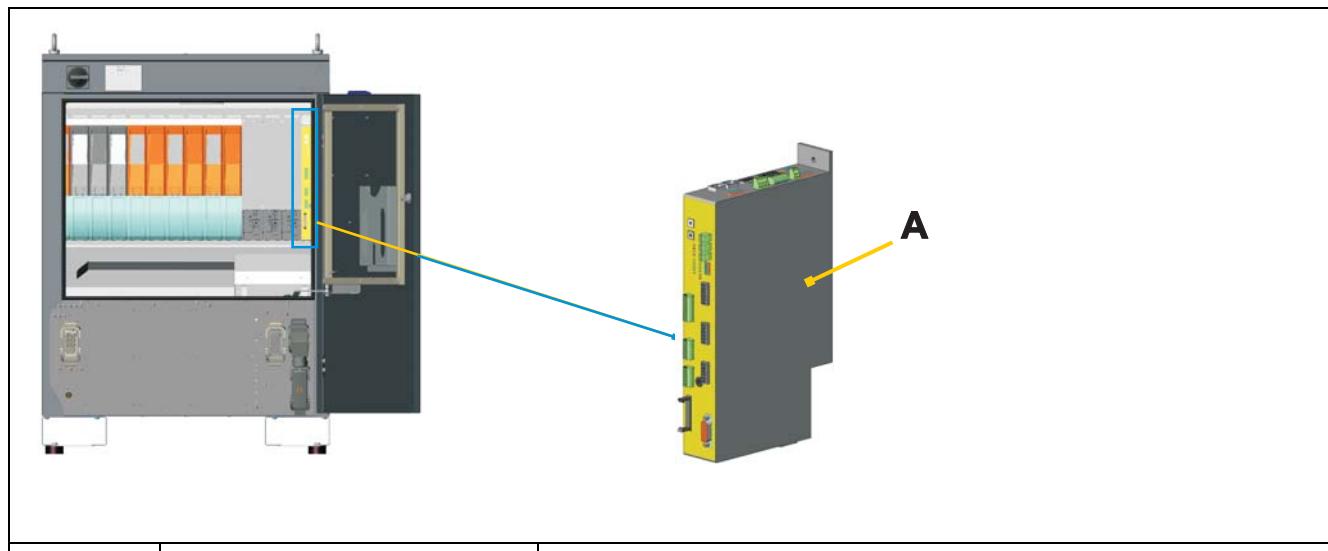
*1 Position and no. depending on the installed axes power

*2 Alternative, depending on the type of transducer on the motor

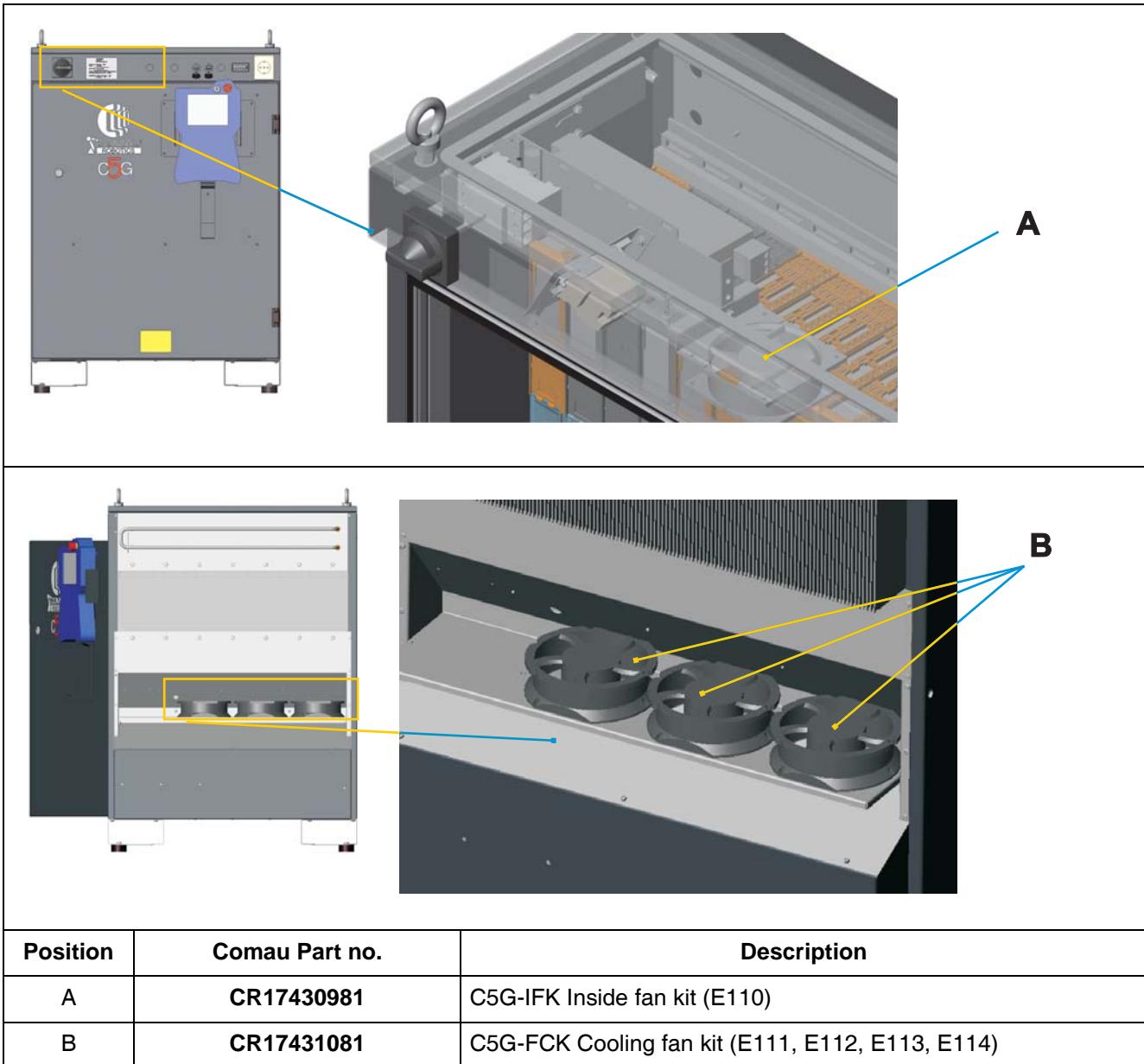
*3 Fan standardized for all modules:

- no. 2 installed in the module AMS-APC820
- no. 1 installed in each module AMS-PPS8, AMS-ASM 32
- no. 1 or 2 installed in each module AMS-IAM xx, depending on the no. of slot taken by the module.

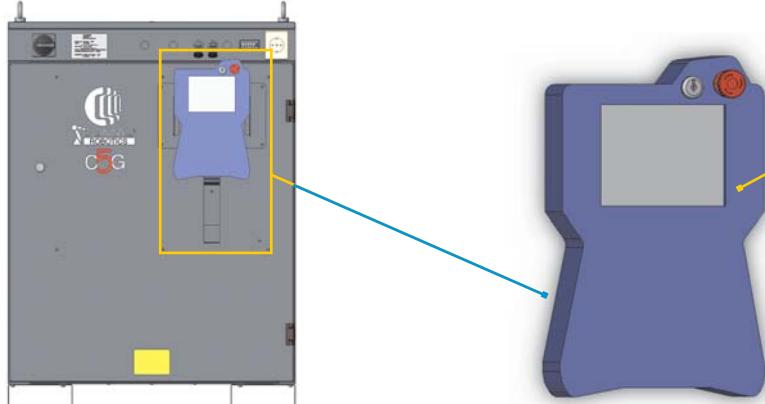
Tab. 10.5 - Safety Distribution Module (SDM)



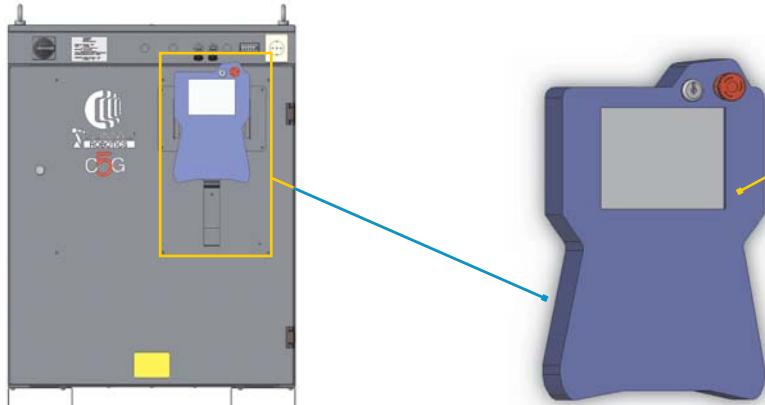
Item	Comau Part no.	Description
A	CR17430080	C5G-SDM Safety & Distribution Module

Tab. 10.6 - Internal ventilation system


Tab. 10.7 - C5G-iTP Teach Pendant, wired

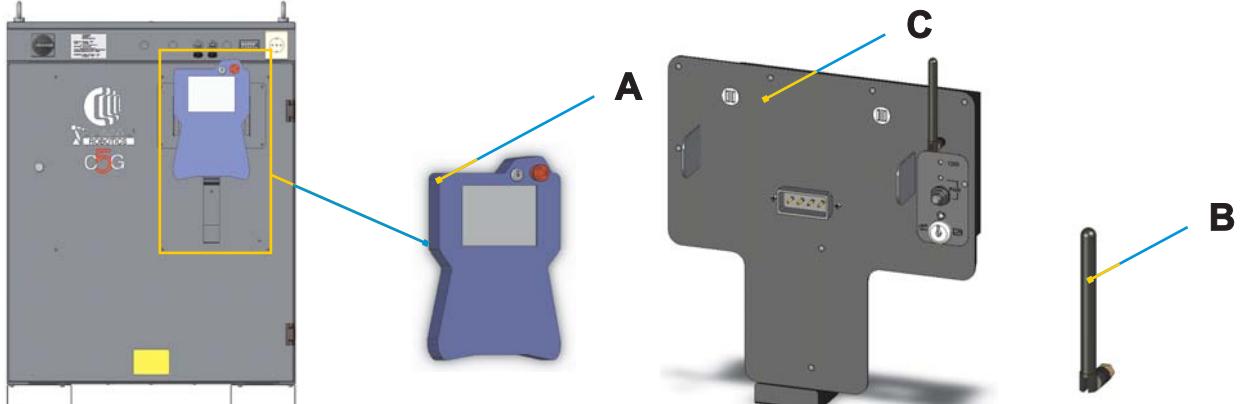
Part no.: COMAU CR17910381, CR17910382, CR17910383		
		C5G-iTP (wired)

Position	Comau Part no.	Description
A	CR17910380	Teach pendant C5G-iTP without cable
-	CR17910381	Teach pendant C5G-iTP10, with cable length 10 m
-	CR17910382	Teach pendant C5G-iTP20, with cable lunata 20 m
-	CR17910383	Teach pendant C5G-iTP30, with cable length 30 m

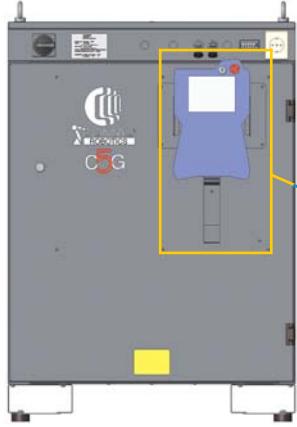
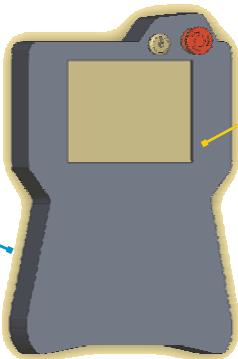
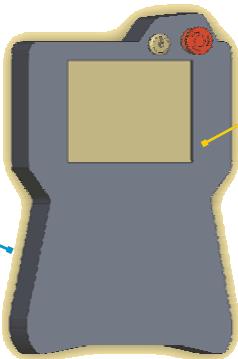
Part no.: COMAU CR17910581, CR17910582, CR17910583		
		C5G-iTP2 (wired)

Position	Comau Part no.	Description
A	CR17910580	Teach pendant C5G-iTP2 without cable
-	CR17910581	Teach pendant C5G-iTP210, with cable length 10 m
-	CR17910582	Teach pendant C5G-iTP220, with cable length 20 m
-	CR17910583	Teach pendant C5G-iTP230, with cable length 30 m

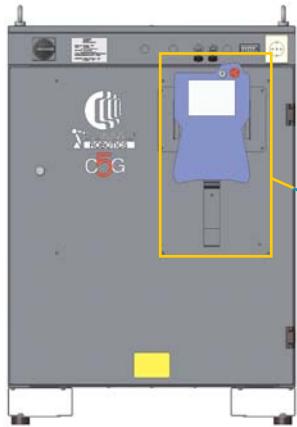
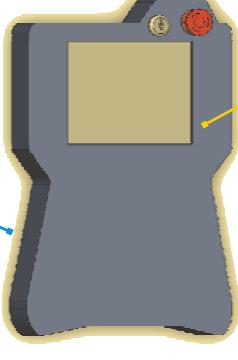
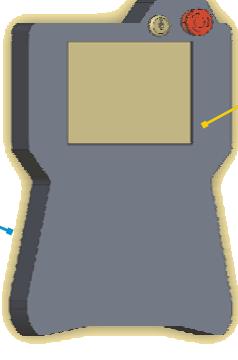
Tab. 10.8 - C5G-WiTP Teach Pendant, wireless

Part no.: COMAU CR17911380		
 <p>C5G-WiTP (wireless)</p>		
Position	Comau Part no.	Description
A	CR17911380	Teach pendant C5G-WiTP
B	CR10152981	Antenna with connector SMA
C	CR17910480	Docking station C5G-WiDS5 per Terminal C5G-WiTP

Tab. 10.9 - Teach pendant C5G-TP5, with cable

Part no.: COMAU CR17431985, CR17432085		
		 C5G-TP5 (wired), 3 key positions
A		

Position	Comau Part no.	Description
A	CR17910085	Teach pendant C5G-TP5WC, without cable (key selector switch with 3 positions)
	CR17910185	Teach pendant C5G-TP510, with cable length 10 m (key selector switch with 3 positions)
-	CR17240065	Cable with connectors C5G-TP5C10, length 10 m

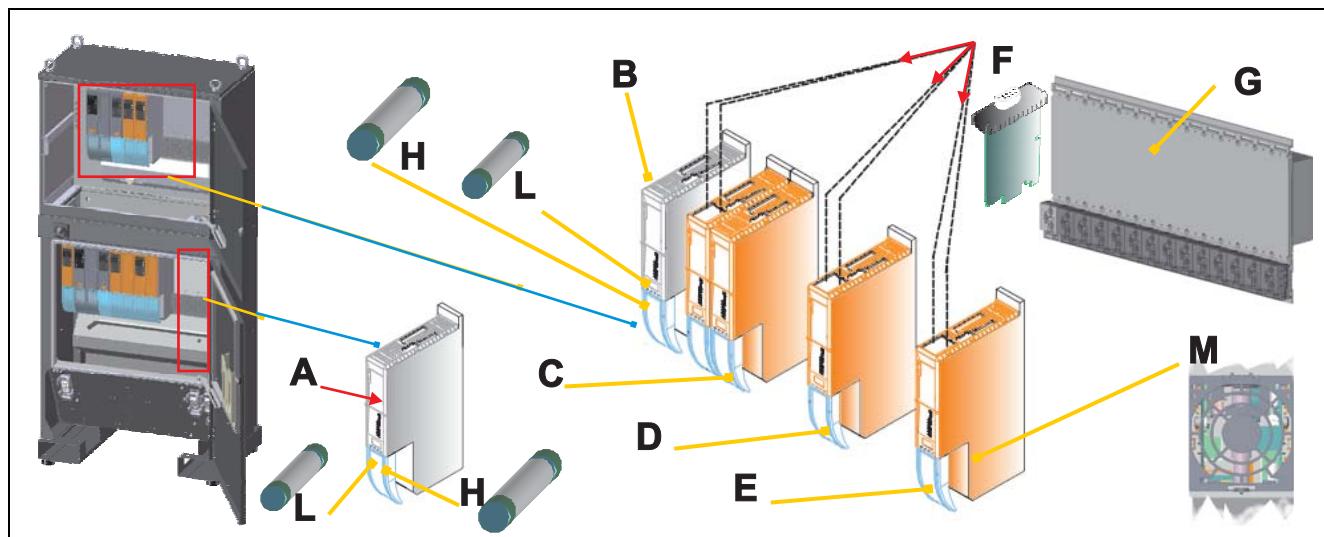
Part number: COMAU CR17432185		
		 C5G-TP5 (wired), 2 positions
A		

Tab. 10.10- Conditioning

Part no.: COMAU CR17133680		
Position	Comau Part no.	Description
A	CR17431880	C5G-ACG Conditioner Unit complete with conditioner, metallic roof and powering cable for conditioner.
B	--	Bipolar limit switch 1NO+ 1NC, NEW ELFIN 50F11 Note: the limit switch model is identical also when installed in the Application Box
C	--	IMagneto.thermal switch curve D 2,5-4A, SQUARE D - GV2-P08
D	CR19900028	Condensate collecting flask

10.5 Special configurations spare parts

Tab. 10.11- Expansion unit Multi Machine C5G-ACPWx

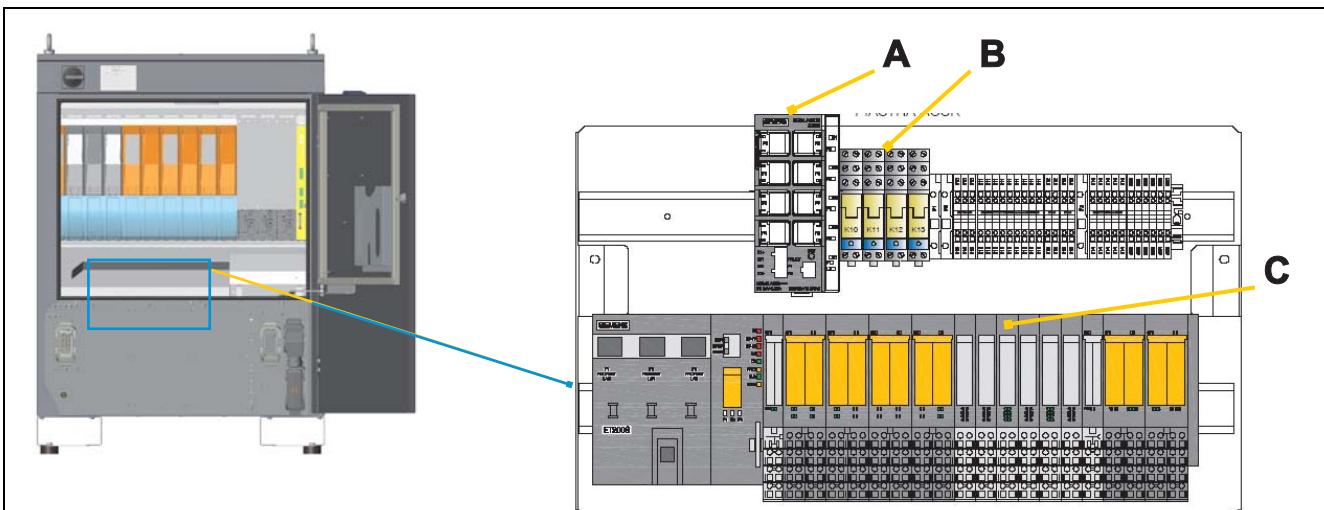


Position	Comau Part no.	Description
A / B	CR10142783	Expansion module from 50A - AMS-EXU
C / D / E * ¹	CR10141183	AMS-IAM 2,8+2,8 Inverter Axis Module 2,8/10 + 2,8/10 (identified on the front module as ACOPOS multi I0028D)
	CR10141283	AMS-IAM5,5+5,5 Inverter Axis Module 5,5/20 + 5,5/20 (identified on the front module as ACOPOS multi I0055D)
	CR10141483	AMS-IAM11+11 Inverter Axis Module 11/43 + 11/43 (identified on the front module as ACOPOS multi I0110D)
	CR10141583	AMS-IAM22+22 Inverter Axis Module 22/85 + 22/85 (identified on the front module as ACOPOS multi I0220D)
	CR10140883	AMS-ETI22 ETI Encoder Trasducer Interface ENDAT2.2 (identified on the front module as Endat 2.2 AC0120-2)
F	CR10140184	AMS-FMP10 Feed-through Mounting Plate 10 slots
G	CR19190060	Fuse 14X51 700V/20A Ultra Fast-Acting (per Bus DC)
L	CR19190061	Fuse 10X38 600V/12A Fast-Acting (per 24V DC)
M * ²	CR10141983	AMS-AFU ACOPOS Fan Unit

*¹ Position and quantity according to the power of the axes installed

*² Fan unified for all modules:

- q.ty 1 or 2 installed in each module AMS-IAM xx, according to number of slot occupied by the module.

Tab. 10.12- C5G-ACSK Arm Controller Safety kit


Position	Comau Part no.	Description
A	CR19023005	8 DOOR PROFINET SWITCH SIEMENS 6GK5208-0BA10-2AA3
B	--	SAFETY RELAIS Finder 50.12.9.024.5000
	--	MODULO LED + DIODO + A1 6-24VDC Finder 99.02.9.024.99
C	CR19023006	IM 151-8 F-CPU PROFINET CONTROLLER Siemens 6ES7151-8FB01-0AB0
	CR19020003	Module Power PM-E DC 24V for electronic modules with diagnosis Siemens 6ES7138-4CB11-0AB0
	CR19020006	Module 4/8F-DI, DC 24V, PROFIsafe V2 Siemens 6ES7138-4FA04-0AB0
	CR19020007	Module 4F-DO, DC 24V/2A, PROFIsafe V2 Siemens 6ES7138-4FB03-0AB0
	CR19023007	Electronic module, 8DI, DC 24V, Standard Siemens 6ES7131-4BF00-0AA0
	CR19023008	Electronic module, 8DO, DC 24V/0,5A, Standard Siemens 6ES7132-4BF00-0AA0
	CR19023010	Memory Card 512kB Siemens 6ES7953-8LJ30-0AA0

11. SETTING OUT OF WORK AND DISMANTLING

This chapter deals with the following topics:

- Precautions before starting
 - Staff to set the plant out of work and dismantle it
 - Equipment and tools required
 - Setting out of work and dismantling procedure
 - Removing the cell and battery from the Control Unit
-

11.1 Precautions before starting

The robot system (consisting of Robot and Control Unit) shall be dismantled in compliance with the environmental prescriptions and according to the methodologies in force in the land where it is installed.

Prepare different containers to collect the different materials separately.

11.2 Staff to set the plant out of work and dismantle it

The staff that shall perform the dismantling shall be suitably trained, in order to be able to use the lifting means properly.

Moreover, the staff shall be *warned or trained (in electrics)* and therefore be aware of the dangers associated with electric energy and of the measures to be taken when working on electric connections.

11.3 Equipment and tools required

- Ordinary mechanical and electric equipment.
 - Containers.
-

11.4 Setting out of work and dismantling procedure

In this section are described the main steps to perform the robot system dismantling at the end of its operating life.

The activities below are to be carried out by the [Staff to set the plant out of work and dismantle it](#) only:

- a. create around the robot system sufficient space to perform all movements without endangering the staff
- b. move the robot to transport position and mount the axes locking items (if present), following the instructions on the plate posted on the robot and its Technical Documents.

- c. open the Control Unit main switch and lock it in open position
- d. disconnect the electric power at the distribution source and lock the switch in open position.
- e. disconnect the powering cable from the Control Unit; disconnect the power wires first and then the earth one
- f. disconnect the multipolar connectors by the Control Unit and Robot sides
- g. if installed, disconnect the pneumatic system from the distribution network and blow off the residual air
- h. before moving the Robot and Control Unit, we recommend to remove possible batteries, oils and other chemicals (found procedure and location in the next sections)
- i. read carefully and follow the instructions in the chemicals safety sheets not to endanger the operator and to avoid polluting the environment



The disposing activities shall be carried out in compliance with the laws in force in the land where the machine is installed: dispose of batteries, oils and chemicals according to the environmental laws and transfer them to the suitable waste collecting sites.

- j. Remove the robot and Control Unit from the working area, following all prescriptions in the product Technical Documents; in case of lifting, check the eyebolts fastening and use only suitable slinging devices and equipment
- k. Move the Robot and Control Unit to the area intended for the dismantling and disposing procedures.
- l. If the procedure is to be carried out independently, disassemble the components from up downwards and act with particular care when handling machine units/parts that may fall due to gravity



Act carefully, to avoid possible parts or components falling during the removal phase, as this could severely endanger the operators.

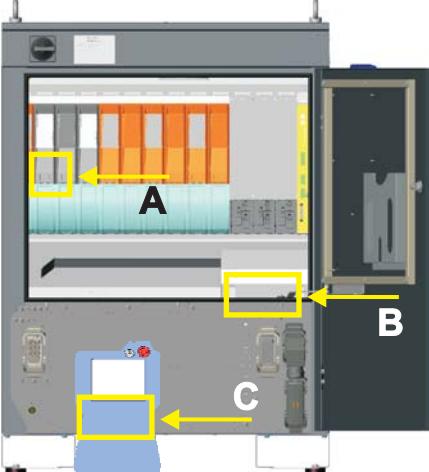
- m. remove the parts and separate, as much as possible, the different components based on the materials (plastic, metal, electronic modules, cells, batteries, etc.) that shall be disposed of applying the waste separation principle. Transfer the materials resulting from the dismantling to duly authorized company



The disposing activities shall be performed in compliance with the laws in force in the land where the machine is installed: dispose of electronic cards and ferrous/plastic materials according to the law prescriptions and transfer them to the suitable waste collecting sites.

In case of problems while carrying out the component disassembling, dismantling and disposing procedures, turn to the manufacturer's design technical depth, which will specify the operating modalities in compliance with the safety and environmental protection principles.

11.5 Removing the cell and battery from the Control Unit

	Status: – Power off
	Material: – Not necessary
	Equipment: – Blade screwdriver – Star-shaped blade screwdriver – Container

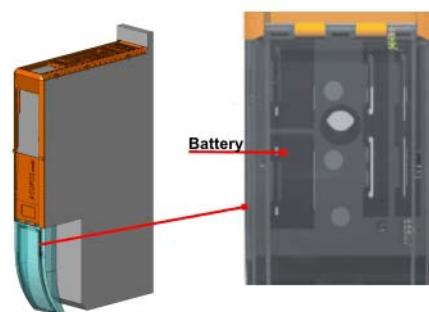
Preliminary procedures / notes

- The disposing activities shall be carried out in compliance with the laws in force in the land where the machine is installed: dispose of batteries and cells according to the environmental protection prescriptions and transfer them to the suitable waste collecting sites
- The Control Unit features the following cells /batteries:
 - Button-shaped cell in the module AMS-APC820 (reference A)
 - Battery in the module C5G-UPS (reference B)
 - Battery in the WiTP Teach Pendant (reference C).

Operating procedure

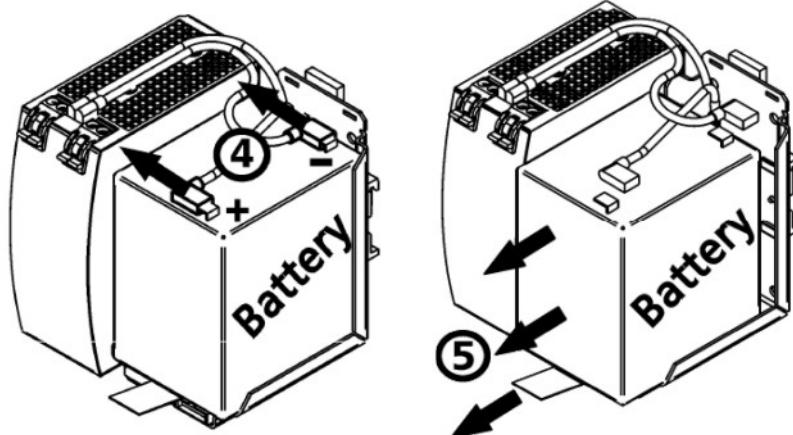
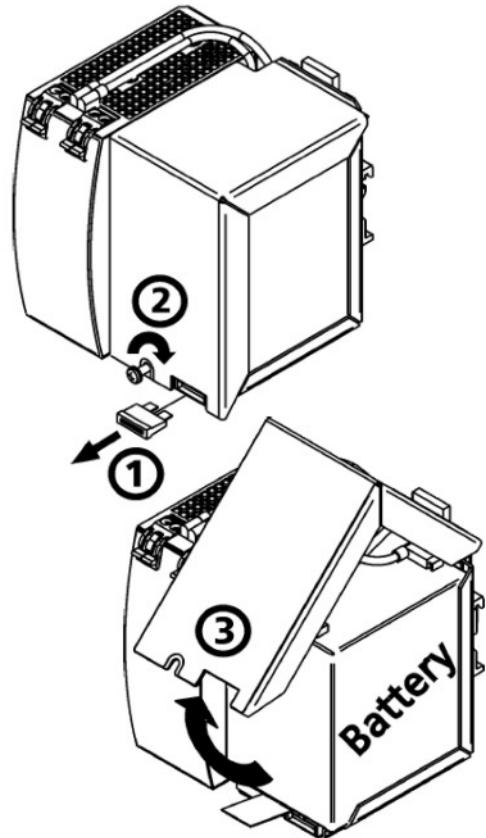
Button-shaped cell in the module AMS-APC820 (reference A)

- a. Lift the front item of module AMS-APC820.
- b. Open the lower door.
- c. Remove the button-shaped cell pulling the tag.



Operating procedure (Continued)
**Battery in the module C5G-UPS
(reference B)**

- a. Remove the fuse before acting on module C5G-UPS.
- b. Remove the cover fastening screw.
- c. Remove the battery cover.
- d. Disconnect the cables from the battery terminals.
- e. Remove the battery pulling the tag.



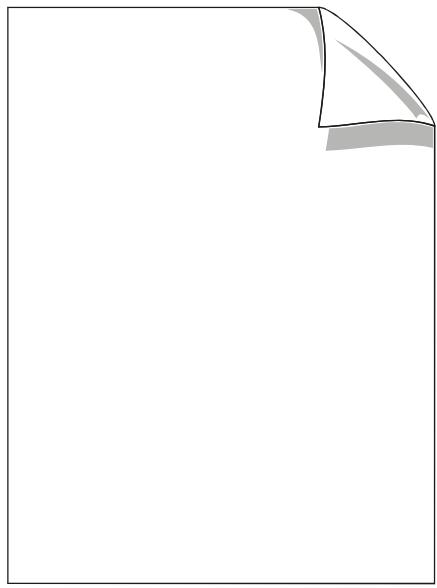
Operating procedure (Continued)**Battery in the WiTP Teach Pendant (reference C)**

- a. Open the Teach Pendant removing the fastening screws.
- b. Remove the screws and items that lock the battery.
- c. Lift the battery and disconnect the side connector.

**Follow-up procedure**

Transfer cells and batteries to the suitable waste collecting sites.







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Original instructions