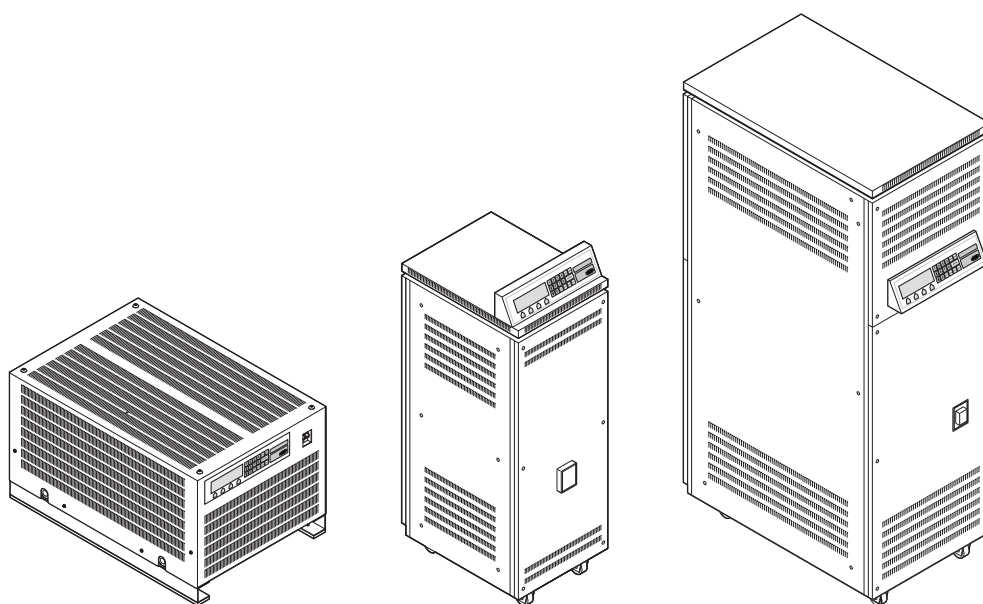


# Operation / Maintenance Manual

## Constant Current Regulator Type CRE



A.07.370e Edition 2.1

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# 1 About this manual

The manual shows the information necessary to:

- commission
- operate
- carry out maintenance on

the CRE 2.5 to 30 kVA.

- 2.5 kVA: stackable cabinet.
- 2.5 to 15 kVA: small cabinet.
- 20 to 30 kVA: big cabinet.

If in the manual the term equipment is used, this refers to the stackable cabinet, the small and the big cabinet.

## 1.1 How to work with the manual

1. Familiarize yourself with the structure and content.
2. Carry out the actions completely and in the given sequence.

## 1.2 Record of changes

Edition	Editor	Check	Date	Description
1.0	MR	AHU, MAW, VDV	09/2011	New
2.0	TWE		05/2017	Added information about stackable cabinet. Added information about new in- and output filters. Added CS. Added other mechanical improvements. Layout changes.
2.1	TWE		06/2017	Updated illustration for dongle to update the firmware. Small changes on preventive spare parts

## 1.3 Icons used in the manual

For all WARNING symbols, see chapter § 2.



### CAUTION

Can cause damage to the equipment.



### NOTE

Gives further information.

## 1.4 Abbreviations and terms

**Table: 1.1 Terms and abbreviations**

Term or abbreviation	Description
AC	Alternating Current
AGL	Airfield Ground Lighting
CENELEC	Comité Européen de Normalisation ELECTrotechnique (European Committee for Electrotechnical Standardization)
CS	Circuit Selector
CSM	Circuit Selector Module
DC	Direct Current
DSP	Digital Signal Processor
EFD	Earth Fault Detection
EMC	Electro Magnetic Compatibility
Equipment	The stackable, the small cabinet and big cabinet, if the information is the same
FAA	Federal Aviation Administration
FDT	Flash Development Toolkit
HMI	Human-Machine Interface
HV	High Voltage
ICAO	International Civil Aviation Organisation
IGBT	Insulated Gate Bipolar Transistor
LFD	Lamp Fault Detection
MW	Multiwire
PC	Personal Computer
PCB	Printed Circuit Board
PIC	A controller from Microchip.
PVC	PolyVinylChloride
PWM	Pulse Width Modulation
PE	Protective Earth
Remote control system	The remote control system in the airport to control the equipment on the field.
RMS	Root Mean Square
SCB	Series Connector Box
SCO	Series Cut Out
SHVS	Servo High Voltage Switch

## 2 Safety

Read all warnings carefully. Failure to do so may result in personal injury, death, or property damage.

### 2.1 Use

To use the equipment safely:

- Refer to the International Standard IEC 61820, *Electrical installation for lighting and beaconing of aerodromes - Constant current series circuits for aeronautical ground lighting - System design and installation requirements*, and to the International Standard IEC 61821, *Electrical installations for lighting and beaconing of aerodromes - Maintenance of aeronautical ground lighting circuits* for instructions on safety precautions.
- See FAA Advisory Circular AC 150/5340-26, *Maintenance of Airport Visual Aids Facilities*, for additional instructions on safety precautions.
- Observe all safety regulations. To avoid injuries, always remove power prior to making any wire connections and touching any live part. Refer to the International Standards IEC 61820 and IEC 61821.
- In addition for a parallel power supply also take into account the International Standard IEC 60598 (for class I equipment).
- Read and become familiar with the general safety instructions provided in this chapter before you install, operate, maintain or repair the equipment.
- Read and carefully follow the instructions given throughout this manual before installing, operating, maintaining, or repairing the equipment.
- Store this manual within easy reach of personnel installing, operating, maintaining or repairing the equipment.
- Follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies.
- Obtain and read Material Safety Data Sheets (MSDS) for all materials used.

### 2.2 Safety symbols

Become familiar with the safety symbols presented in this chapter. These symbols will alert you to safety hazards and conditions that may result in personal injury, death, or property and equipment damage.



**WARNING 1:** Failure to observe this warning may result in personal injury, death, or equipment damage.



**WARNING 2:** Risk of electrical shock. Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damages.

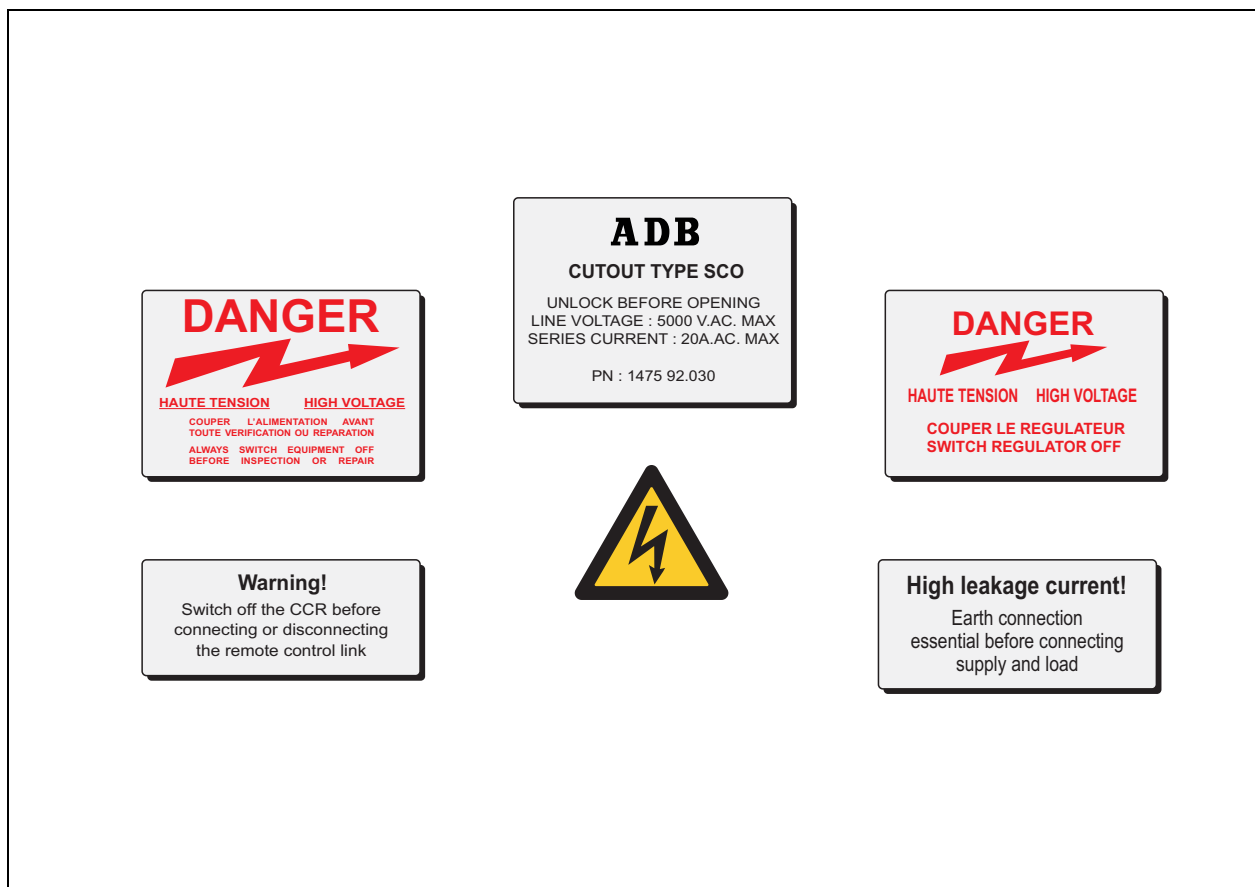


**WARNING 3:** Wear personal protective equipment. Failure to observe may result in serious injury.



**WARNING 4:** Do not touch. Failure to observe this warning may result in personal injury, death, or equipment damage.

## 2.3 Signs on the equipment



The signs on the equipment are part of the safety provisions. Do not cover or remove the signs. The signs must be present and legible during the entire life of the equipment.

## 2.4 Skilled personnel

The term skilled personnel is defined here as individual who thoroughly understand the equipment and its safe operation, maintenance, and repair. Skilled personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company operating the equipment to see that its personnel meet these requirements.



## 2.5 Liability



### **WARNING**

**Use of the equipment in ways other than described in the catalogue leaflet and the manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in the manual.**

ADB Safegate cannot be held responsible for injuries or damages resulting from non-standard, unintended uses of its equipment. The equipment is designed and intended only for the purpose described in the manual. Uses not described in the manual are considered unintended uses and may result in serious personal injury, death or property damage.

Unintended uses includes the following actions:

- Making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine ADB Safegate replacement parts or accessories.
- Failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards if not in contradiction with the general rules.
- Using materials or auxiliary equipment that are inappropriate or incompatible with your ADB Safegate equipment.
- Allowing unskilled personnel to perform any task on or with the equipment.

## 2.6 Installation

Read the installation section of all system component manuals before installing your equipment. A thorough understanding of system components and their requirements will help you install the equipment safely and efficiently.



### **WARNING**

**Failure to follow these safety procedures can result in personal injury or death.**

- Allow only skilled personnel to install ADB Safegate and auxiliary equipment. Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals and will void the warranty.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Install all electrical connections to local code provided they are not in contradiction with the general rules.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current and voltage demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment and animals (e.g. rodents).
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility (power products), and cover removal (power products).
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.

## 2.7 Operation

Only skilled personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, should operate this equipment.

Read all system component manuals before operating the equipment. A thorough understanding of system components and their operation will help you operate the equipment safely and efficiently.

- Before starting this equipment, check all safety interlocks and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the equipment if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use the equipment only in the environments for which it is rated. Do not operate the equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON. Make sure the exposed electrical connections are proven to be dead.

## 2.8 Use of the optional circuit selector cabinet

If the optional circuit selector cabinet is installed below the cabinet of the equipment, prevent situations where the equipment can tilt and fall. The circuit selector cabinet has an effect on the weight balance of the equipment. A falling equipment can result in personal injury or death.

## 2.9 Action in the event of an equipment malfunction

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

1. Disconnect and lock out electrical power.
2. Allow only skilled personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

## 2.10 Maintenance and repair

Allow only skilled personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with ADB Safegate equipment are permitted to service the equipment.

- Always use safety devices when working on the equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Do not service or adjust any equipment unless another person trained in first aid and Cardio Pulmonary Resuscitation (CPR) is present.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved ADB Safegate replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals, impair specified performance and create safety hazards.
- Check interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.

## **2.11 CE certification**

The equipment is CE certified. It means that the product complies with the essential requirements concerning health and safety. The directives that have been taken into consideration in the design are available on written request to ADB Safegate.

## **2.12 Guarantee**

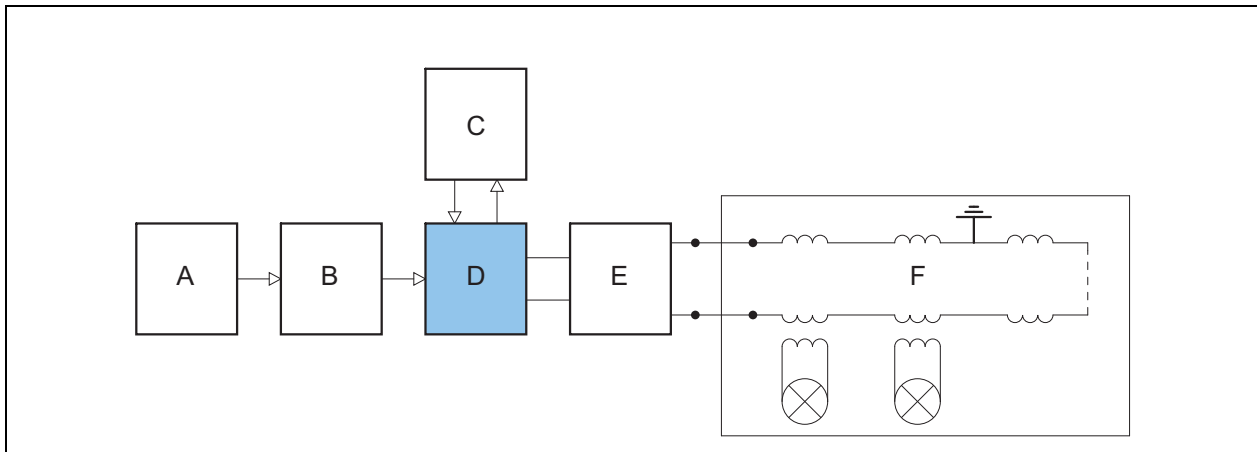
ADB Safegate guarantees that the performance of the equipment described in this manual, when sold by ADB or its licensed representatives, meets the corresponding requirements of FAA, ICAO and IEC.

Refer to the document 'General Conditions for Deliveries and Services by ADB Safegate.



## 3 Description

### 3.1 Series circuit system overview



A Input power supply

B Manual switch

C Remote control system

D Equipment

E Output disconnection device (optional)

F Series circuit

The equipment is a microprocessor-controlled constant current regulator with an optional output disconnection device (circuit selector).

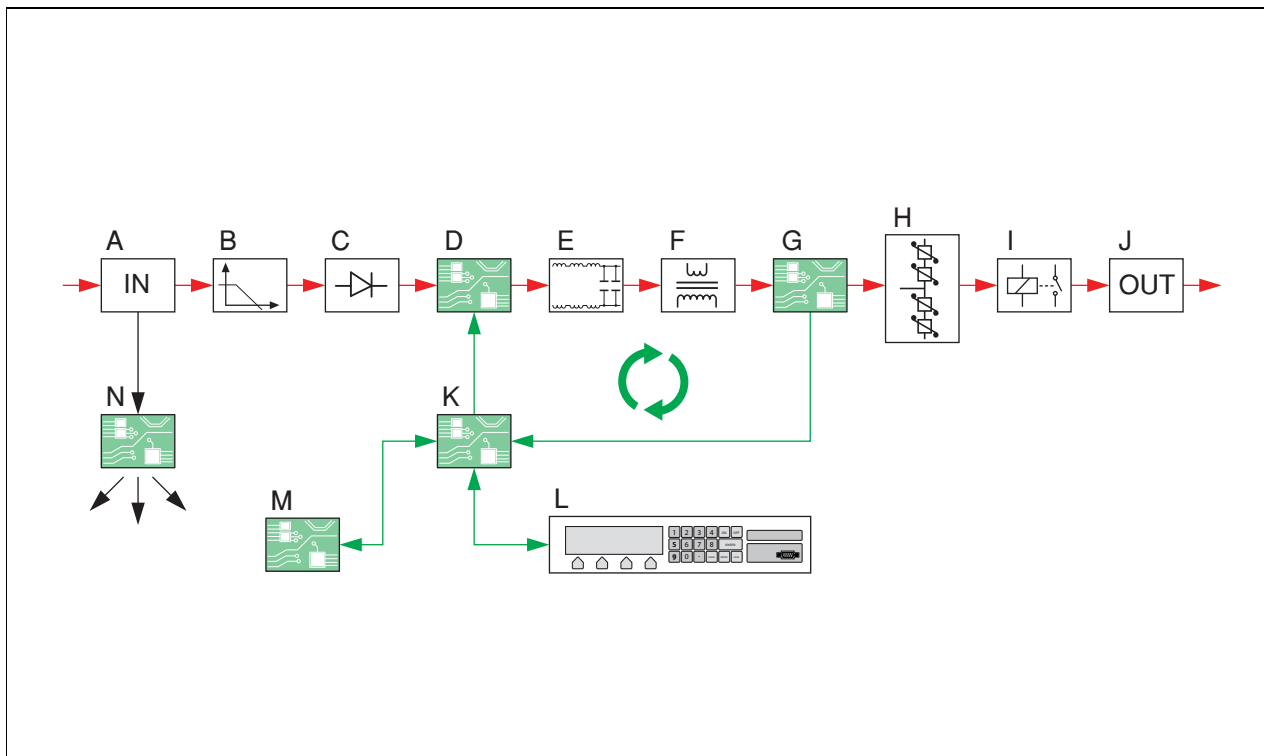
### 3.2 Intended use

The equipment is designed to convert an AC sine wave input voltage into an adjusted output current selected in brightness steps to supply a series AGL circuit.

Any other or additional use will be considered not to be in conformity with the purpose.

Do not operate the equipment outside the limits of the specifications or outside the specified ambient conditions.

### 3.3 Working principle



- A Line input.
- B Input filter. See § 3.5.1.
- C Diode bridge and sensing PCB, components of the IGBT power bridge. See § 3.5.3.
- D IGBT module and IGBT PCB, components of the IGBT power bridge. See § 3.5.3.
- E Output filter. See § 3.5.5.
- F Main transformer. See § 3.5.6.
- G Output measure PCB. See § 3.5.7.
- H Lightning arrestors. See § 3.5.8.
- I Circuit selector (optional). See § 3.6.3.
- J Series output connection. See § 3.6.
- K CPU PCB. See § 3.5.9.
- L HMI. See § 3.7.
- M Remote control PCB. See § 3.5.10.
- N Power supply PCB. See § 3.5.11.

#### Legend

- Red lines: current
- Green lines: signal wires connections
- Black lines: low voltage connections

#### Current regulation

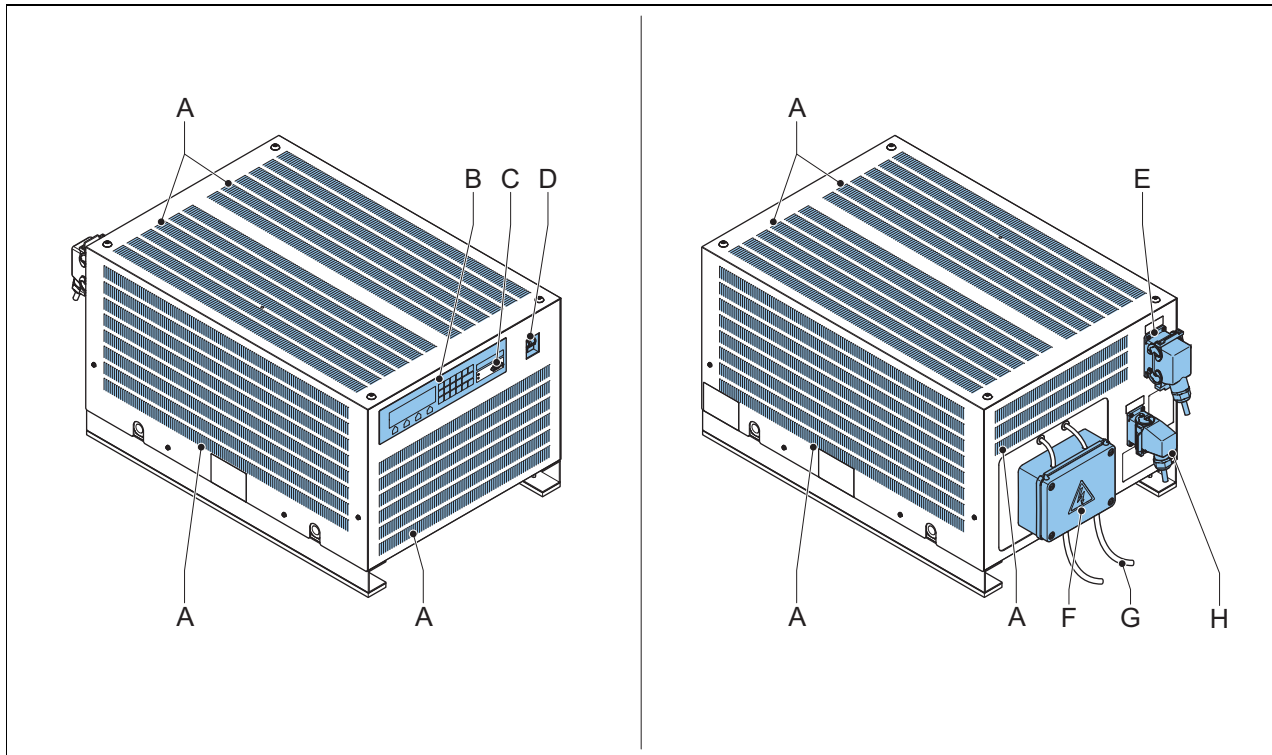
The equipment converts the single phase input voltage line into a rectified current and voltage. Then, the equipment converts this DC current and voltage into a pure sine wave with a defined power rating.

#### Main feedback loop

The output measure PCB sends the measured output to the CPU PCB. Depending on the output, the CPU PCB automatically generates a signal to adjust the regulation.

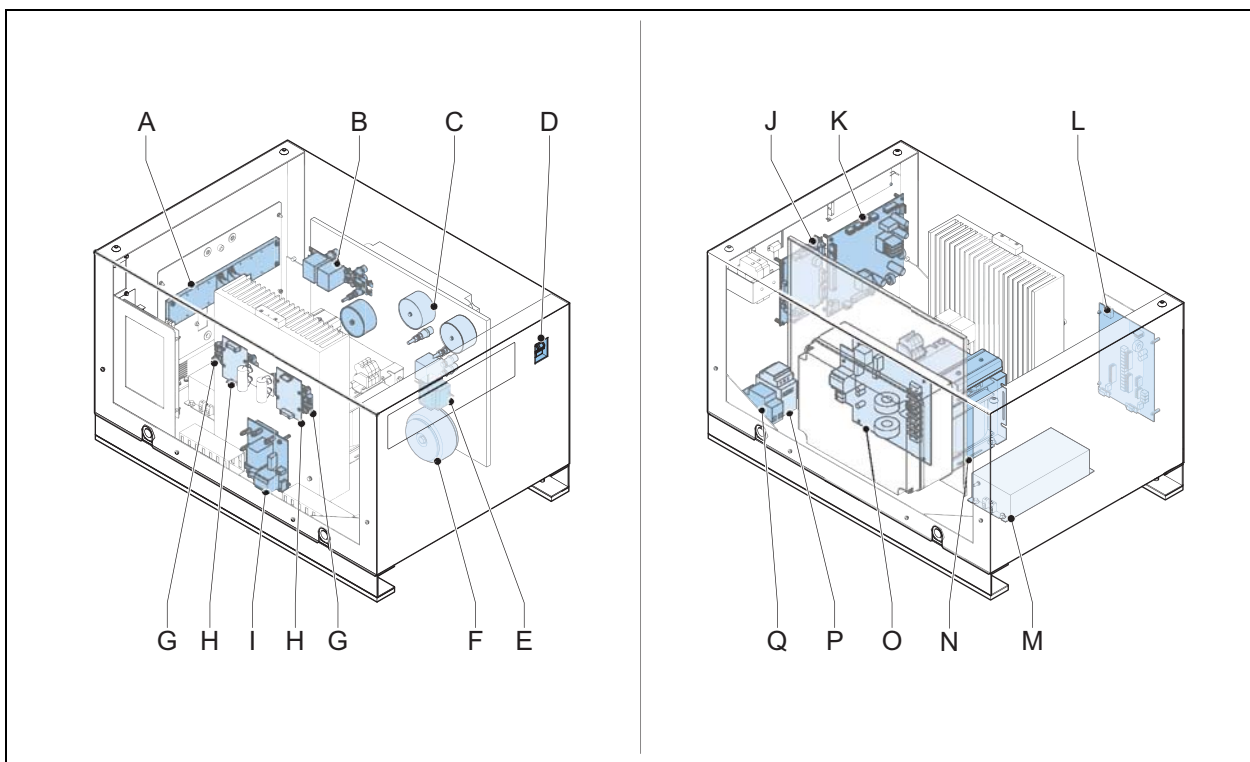
## 3.4 Lay-out of the equipment cabinet

### 3.4.1 Outside - stackable cabinet 2.5 kVA



- A Ventilation grids
- B HMI
- C Serial communication port
- D Manual switch
- E Remote control connector
- F Series output connection. The illustration shows the SCB.
- G Output to Series Circuit
- H Power supply connector

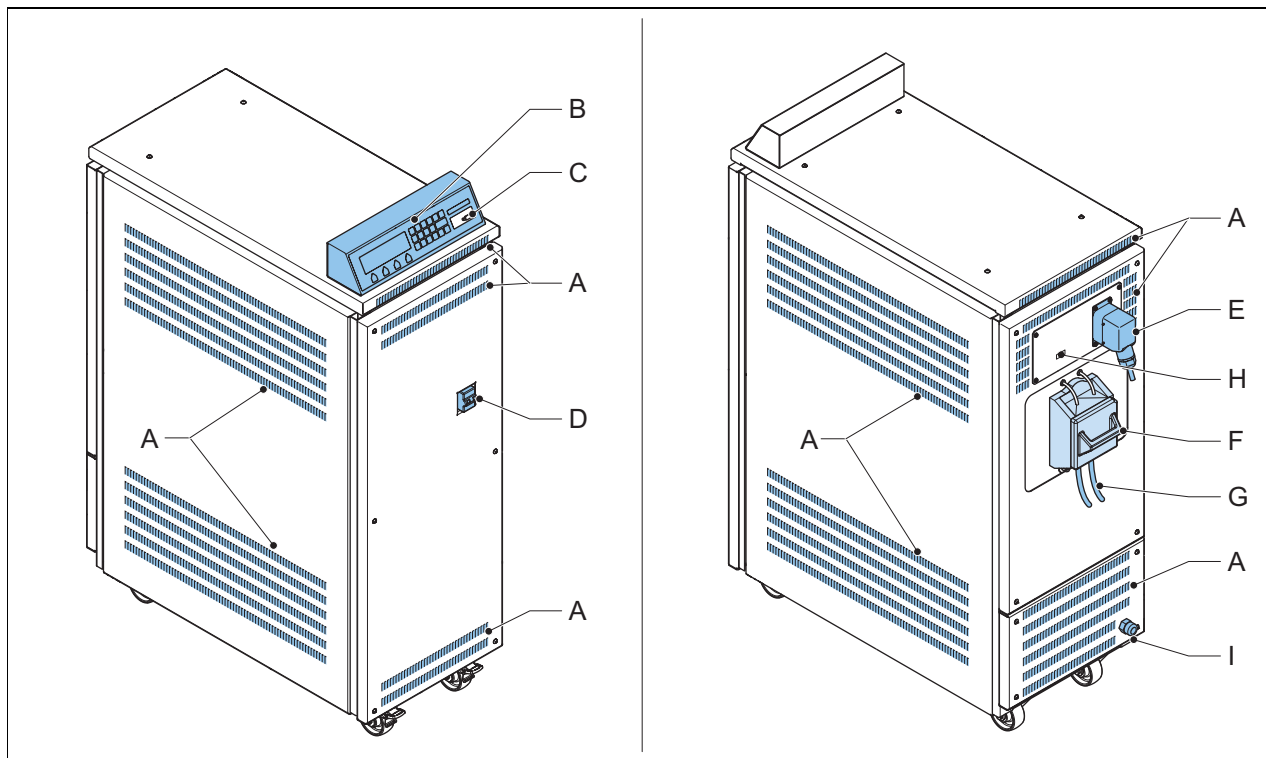
### 3.4.2 Inside - stackable cabinet 2.5 kVa



- A Lightning arrestors
- B Input filter
- C Output filter
- D Manual switch
- E Sensing transformer
- F Power supply transformer
- G IGBTs
- H IGBT-PCBs (EPS477)
- I Diode bridge + sensing PCB (EPS476)
- J CPU PCB (EPS479)
- K Power supply PCB (EPS480)
- L Remote control PCB (EPS495)
- M Line filter
- N Main transformer
- O Output measure PCB (EPS442)
- P Main contactor
- Q Main fuses



### 3.4.3 Outside - small cabinet: 2.5 to 15 kVA



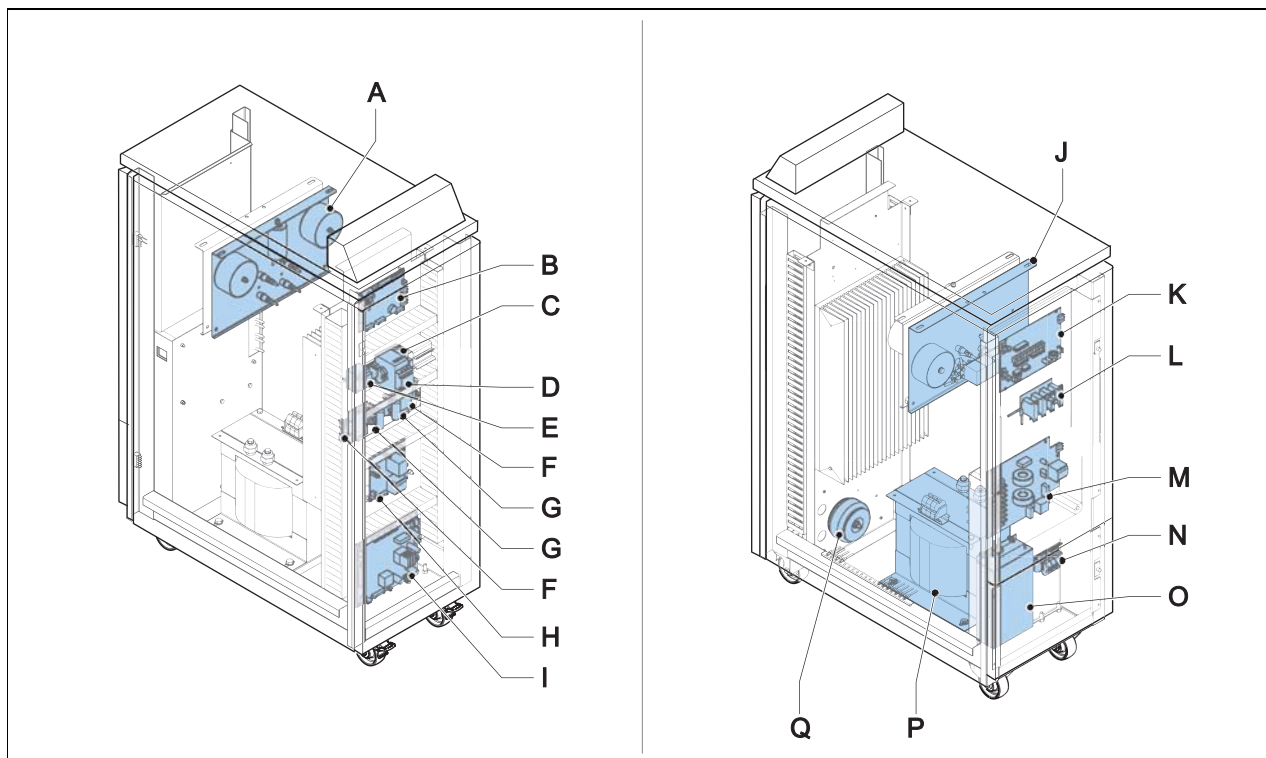
- A Ventilation grids
- B HMI
- C Serial communication port
- D Manual switch
- E Remote control connector
- F Series output connection. The illustration shows the SCO.
- G Output to Series Circuit
- H Ethernet connector
- I Power supply cable entry

### 3.4.4 Inside - small cabinet: 2.5 to 15 kVA



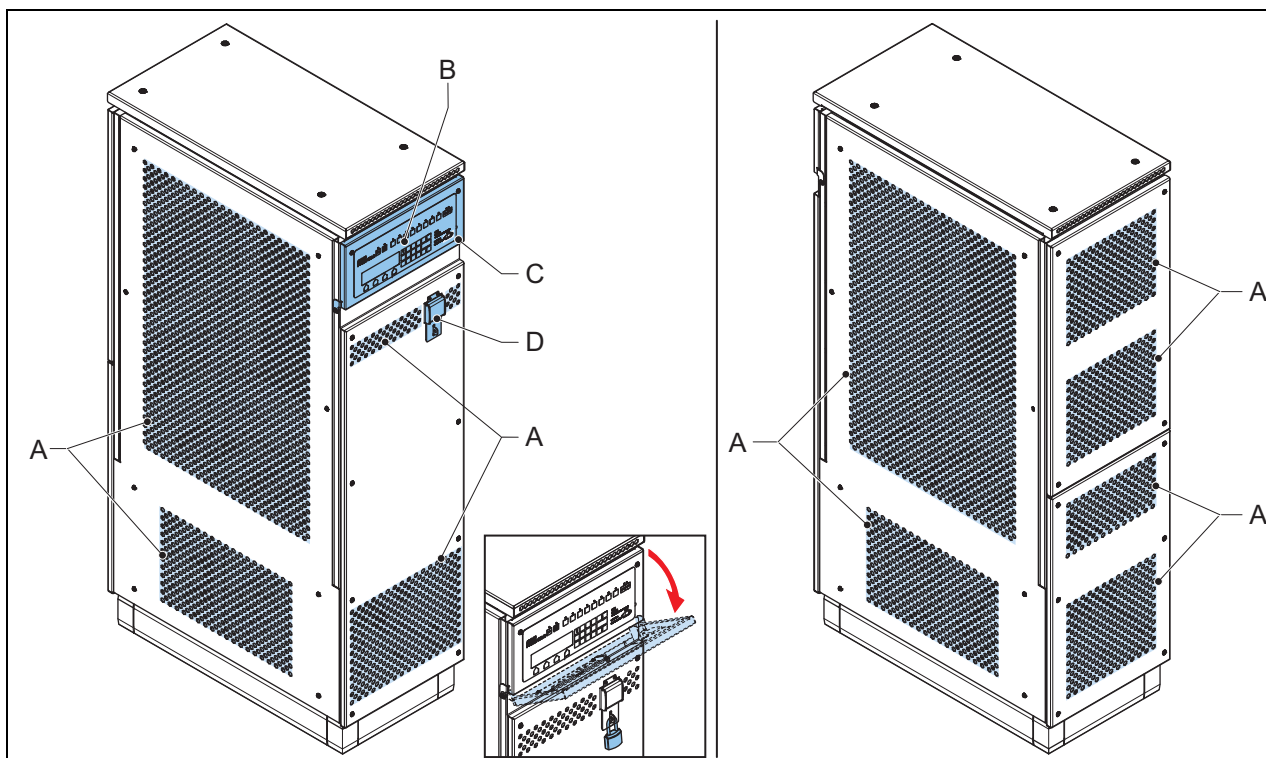
#### Note

The illustrations show the 10 kVA cabinet.



- A Output filter
- B CPU PCB
- C Main fuses
- D Main contactor
- E Sensing transformer
- F IGBT
- G IGBT PCB (EPS477)
- H Diode bridge and sensing PCB (EPS476 / EPS507)
- I Power supply PCB (EPS480)
- J Input filter
- K Remote control PCB (EPS495)
- L Lightning arrestors
- M Output measure PCB (EPS442)
- N Input terminals
- O Line filter
- P Main transformer
- Q Power supply transformer

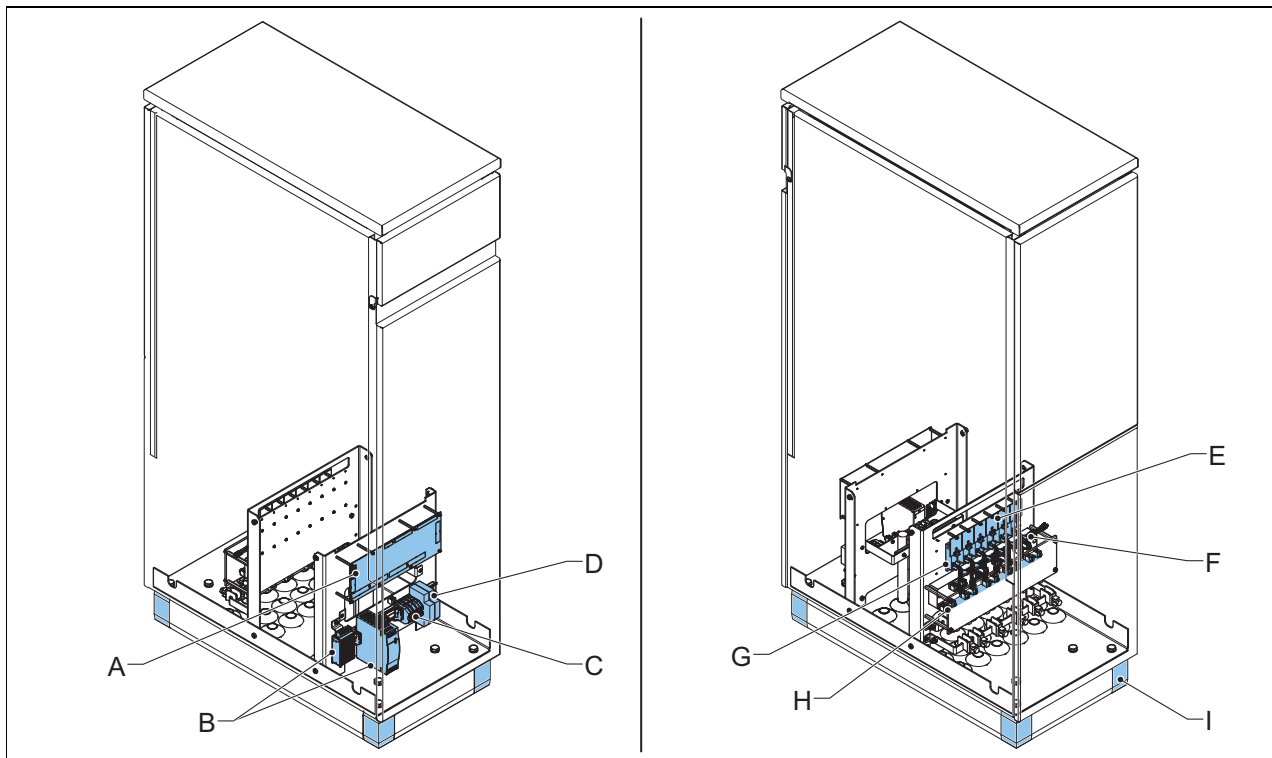
### 3.4.5 Outside - small cabinet: 2.5 to 15 kVA with CS (option CS)



- A Ventilation grids
- B HMI
- C Serial communication port
- D Manual switch with lockable cover

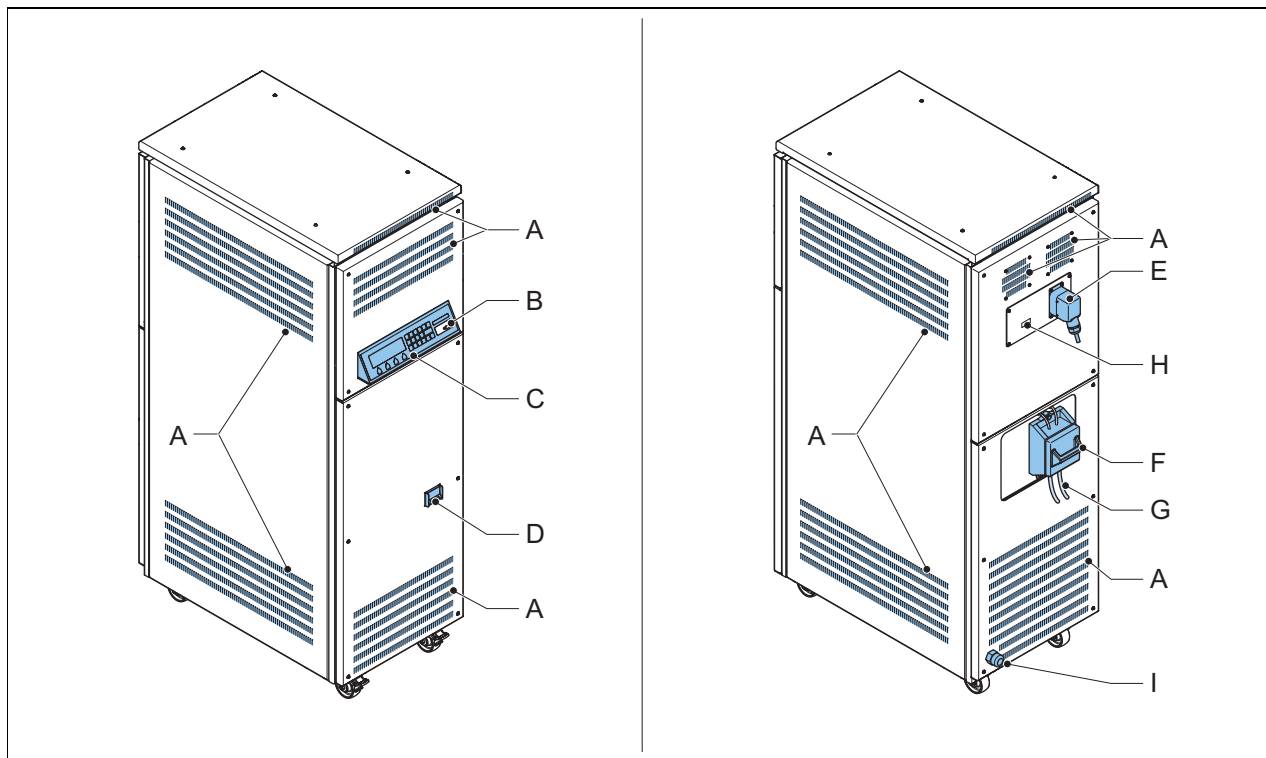
**3.4.6 Inside - small cabinet: 2.5 to 15 kVA with CS (option CS)****Note**

The illustration shows only the items of the CS. For all other items, see § 3.4.4.



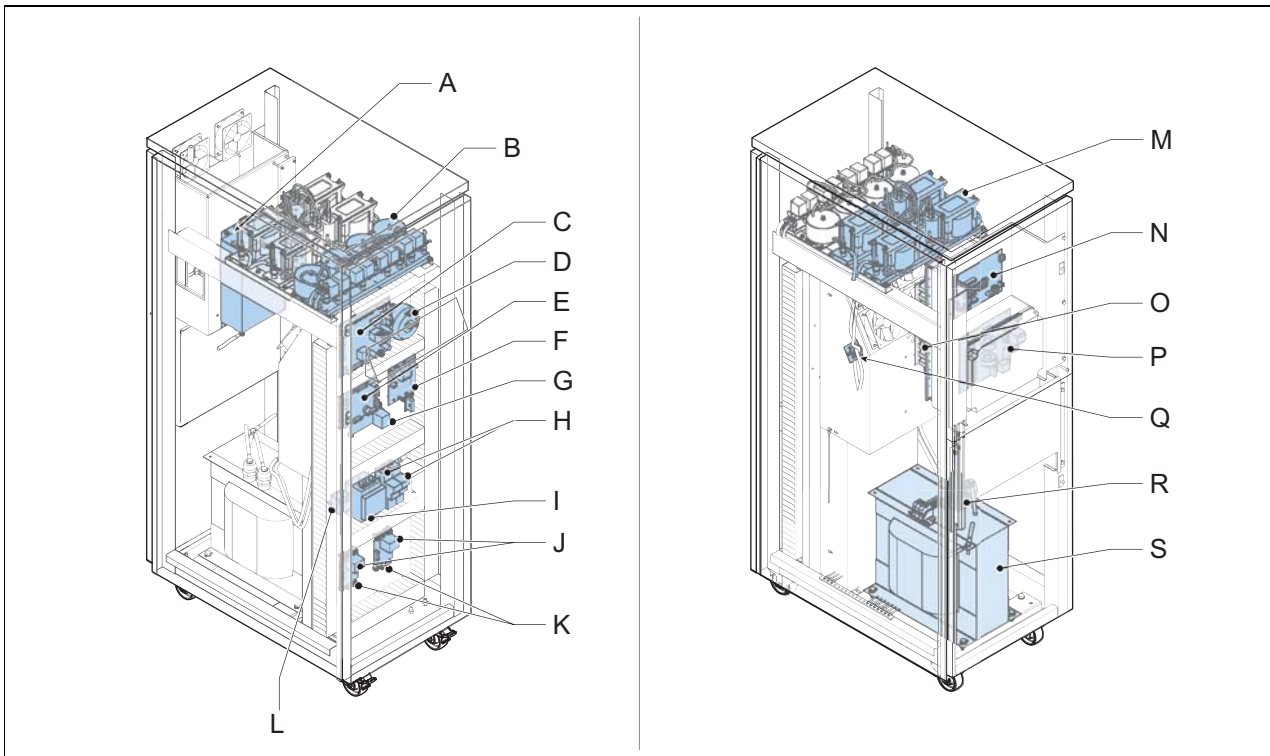
- A Interface PCB (PCB1702)
- B Power supply converters for multiwire remote control
- C Input terminals
- D Lightning arrestors
- E CS PCB (PCB1619)
- F Current sensors
- G CS relays
- H Connection terminals for the primary circuit
- I Supports

### 3.4.7 Outside - big cabinet 20 to 30 kVA



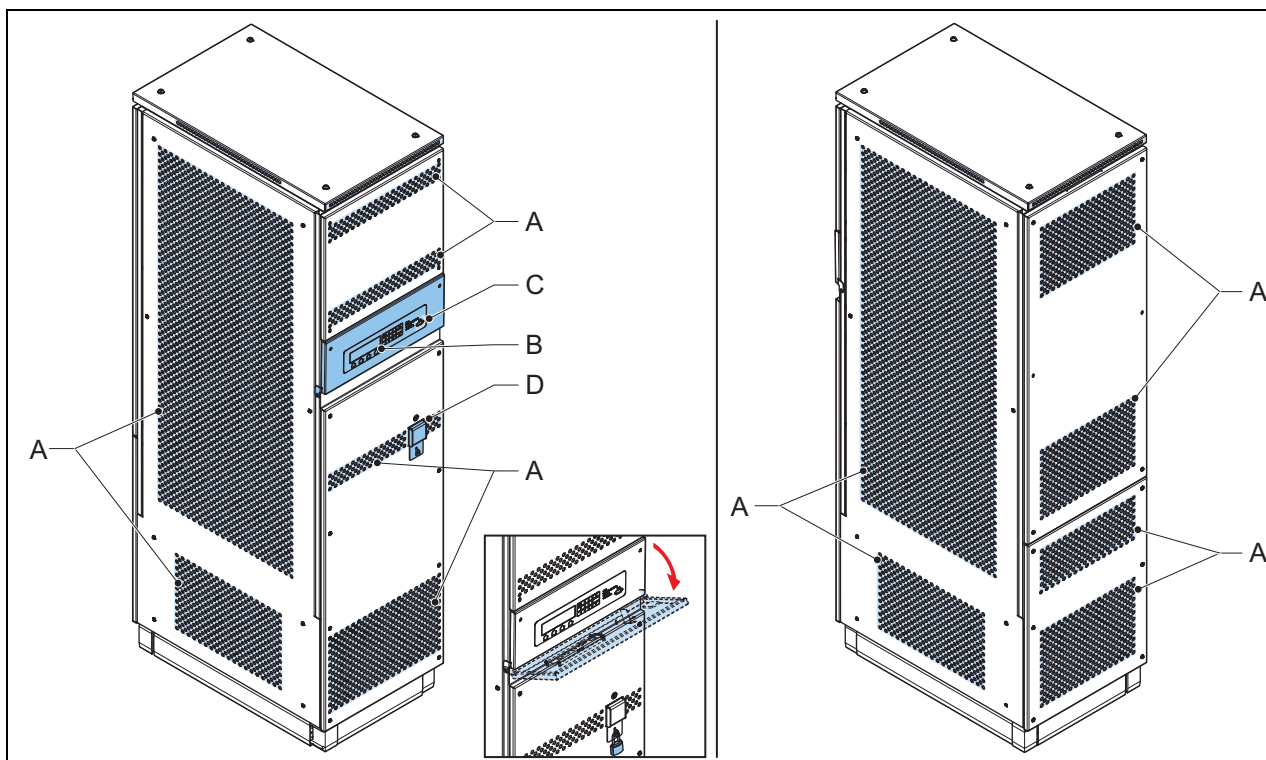
- A Ventilation grids
- B HMI
- C Serial communication port
- D Manual switch
- E Remote control connector
- F Series output connection. The illustration shows the SCO.
- G Output to Series Circuit
- H Ethernet connector
- I Power supply cable entry

### 3.4.8 Inside - big cabinet 20 to 30 kVa



- A Line filter
- B Input filter
- C Power supply PCB (EPS480)
- D Power supply transformer
- E CPU PCB (EPS479)
- F Sensing PCB (EPS476)
- G Diode Bridge
- H Main fuses
- I Main contactor
- J IGBT-PCBs (EPS496)
- K IGBTs
- L Sensing transformer
- M Output filter
- N Remote control PCB (EPS495)
- O Lightning arrestors
- P Output measure PCB (EPS442)
- Q Hall sensor
- R Input terminals
- S Main transformer

### 3.4.9 Outside - big cabinet: 20 to 30 kVA with CS (option CS)



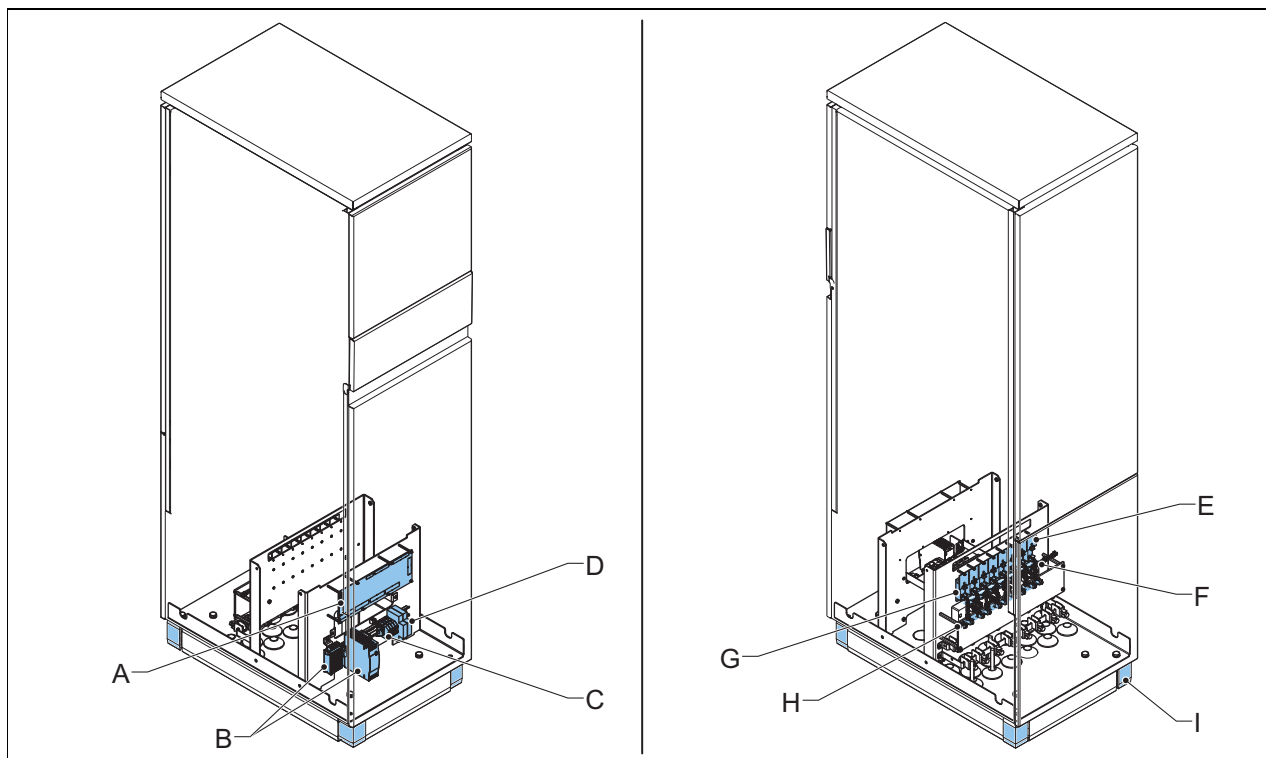
- A Ventilation grids
- B HMI
- C Serial communication port
- D Manual switch

### 3.4.10 Inside - big cabinet: 20 to 30 kVA with CS (option CS)



#### Note

The illustration shows only the items of the CS. For all other items, see § 3.4.4.



- A Interface PCB (PCB1702)
- B Power supply convertors for multiwire remote control
- C Input terminals
- D Lightning arrestors
- E CS PCB (PCB1619)
- F Current sensors
- G CS relays
- H Connection terminals for the primary circuit
- I Supports

## 3.5 Components

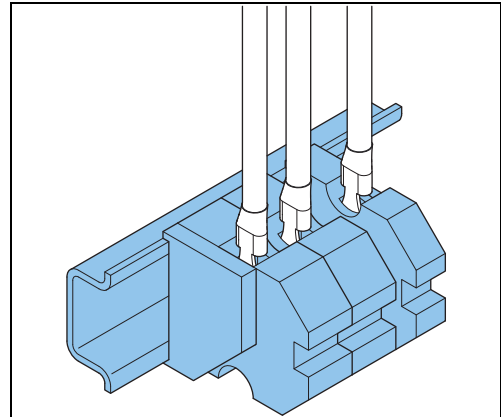
For the exact location and connectors see § 3.4 and the electrical scheme. You can find the electrical scheme attached on the outside of the equipment.



### 3.5.1 Line input

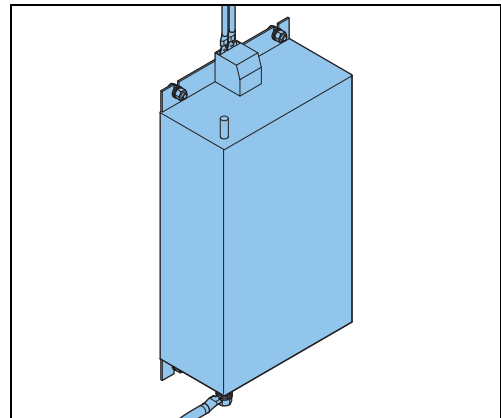
#### *Input terminal, all cabinets*

The input terminal connects the power input cables to the equipment.



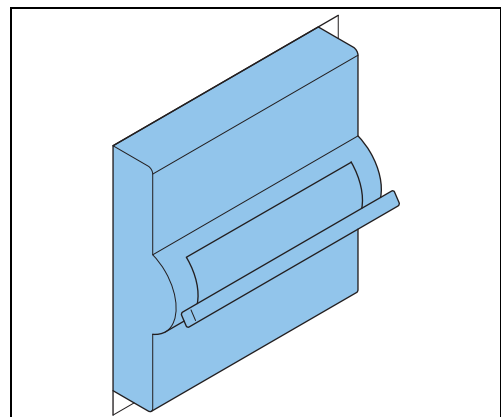
#### *Line filter, all cabinets*

The line filter blocks the noise the equipment generates to the line input and filters out voltage pulses from the input voltage.



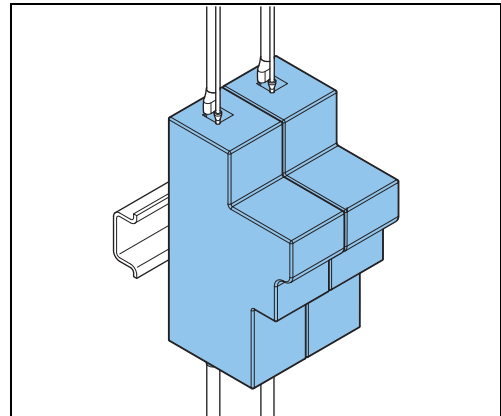
#### *Manual switch, all cabinets*

The manual switch is a magneto-thermal switch that connects the mains power supply to the equipment. You can manually set the switch to the ON or OFF position.

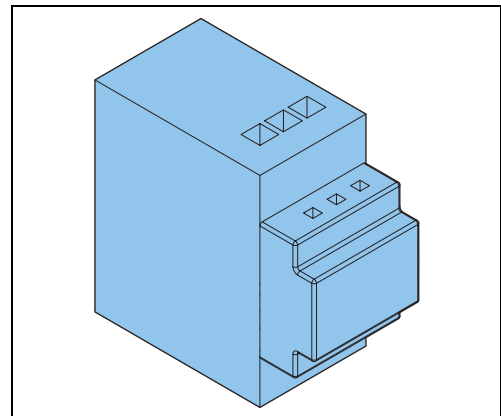


*Main fuses, all cabinets*

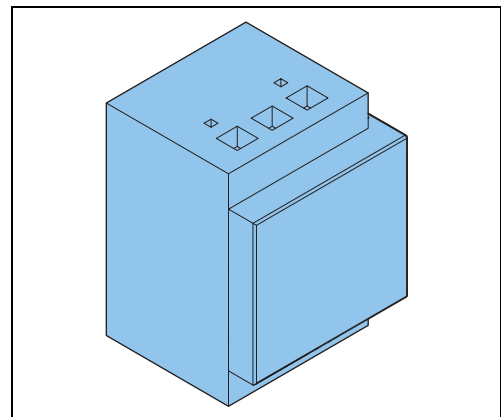
The main fuses disconnect the equipment from the mains power supply if the input current is above a given value.

*Main contactor, stackable cabinet and small cabinet*

The main contactor allows the power supply PCB to automatically interrupt the power.

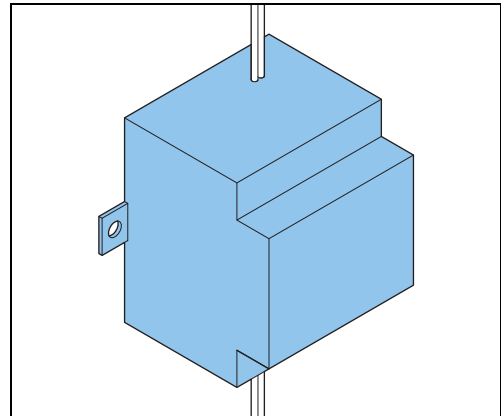
*Main contactor, big cabinet*

The main contactor allows the power supply PCB to automatically interrupt the power.



*Sensing transformer, all cabinets*

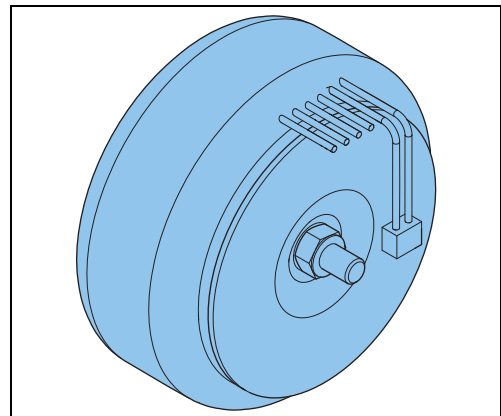
The sensing transformer measures the input voltage level of the line input.



*Power supply transformer, all cabinets*

The power supply transformer:

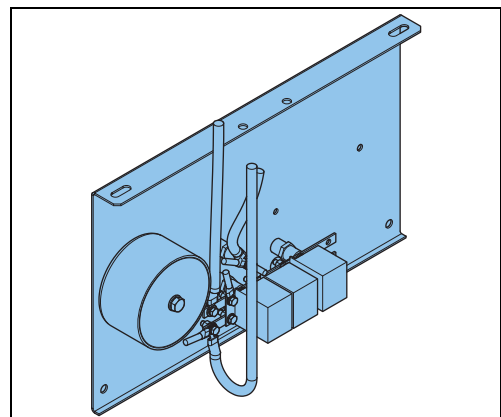
- Supplies the zero crossing signal determined from the input voltage.
- Provides the correct current and voltage to power all the electronic components such as PCBs and to power the fans (for 15 to 30kVA equipment).



### 3.5.2 Input filter

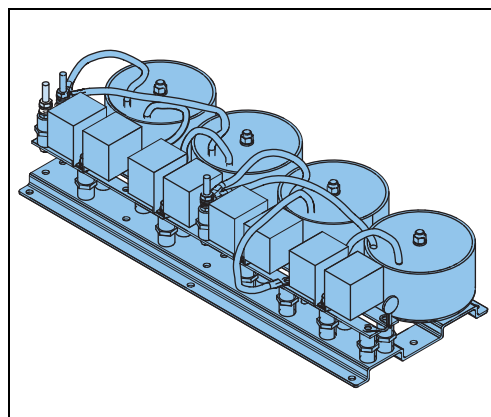
*Input filter, stackable cabinet and small cabinet (except 15 kVA)*

The input filter is a 12.5 kHz filter that blocks the noise the equipment produces from the line input at a different frequency than the line filter.



### *Input filter, 15 kVA small cabinet and big cabinet*

The input filter is a 12.5 kHz filter that blocks the noise the equipment produces from the line input at a different frequency than the line filter.



### 3.5.3 IGBT power bridge

The IGBT power bridge has the components that follow:

- Diode bridge + sensing PCB
- IGBT PCB
- IGBT



#### **WARNING**

**If one of these three components breaks, you must replace the entire IGBT power bridge.**

### *Diode bridge + sensing PCB (EPS476 / EPS507), stackable cabinet and small cabinet*

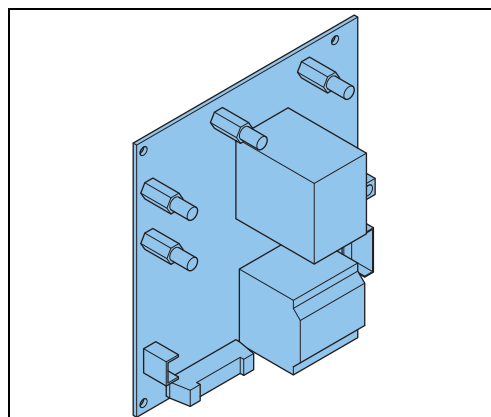
The diode bridge converts the AC line input to a rectified current and voltage.

The sensing PCB measures the AC input line.



#### **Note**

**In the stackable cabinet and the small cabinet, the sensing PCB and the diode bridge are combined into one part.**



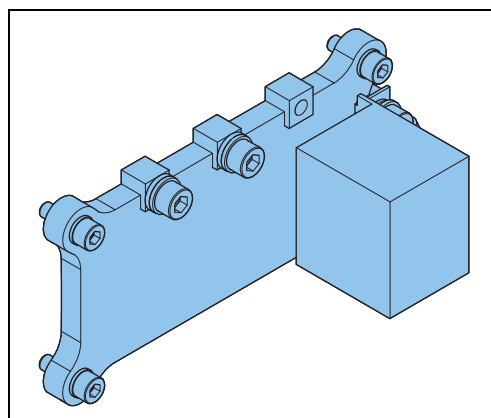
### *Diode bridge, big cabinet*

The diode bridge converts the AC line input to a rectified current and voltage.



#### **Note**

**In the big cabinet, the sensing PCB and the diode bridge are separate parts.**

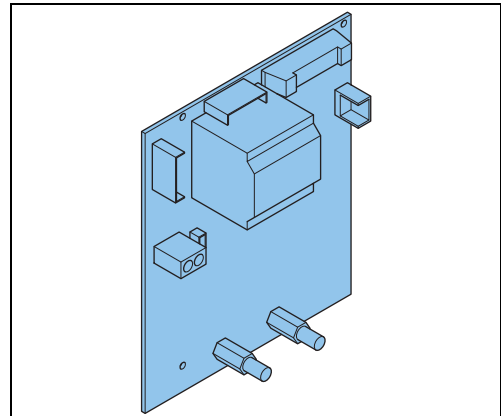


*Sensing PCB (EPS476), big cabinet*

The sensing PCB measures the AC input line and controls the diode bridge.

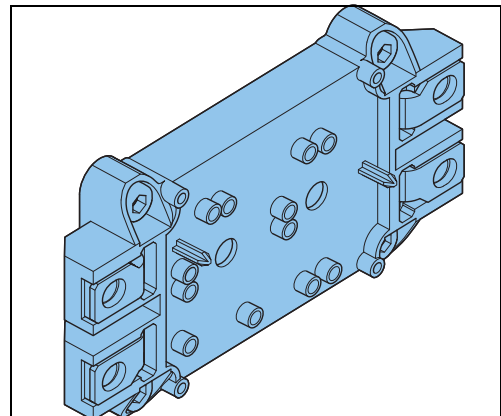


**Note**  
In the big cabinet, the sensing PCB and the diode bridge are separate parts.



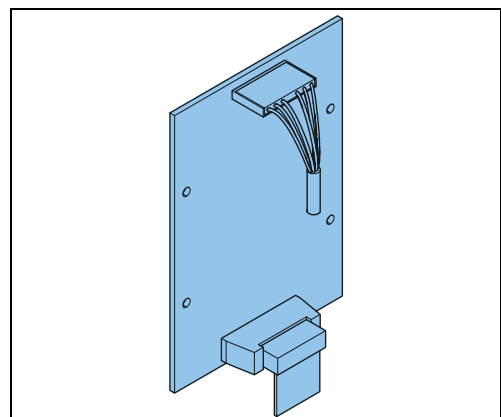
*IGBT, all cabinets*

An IGBT controls a high power via a low power electronic signal. The IGBT can switch at high frequency. Two IGBTs are installed together in one housing. The system uses four IGBTs connected as an H-bridge to make an AC-signal.



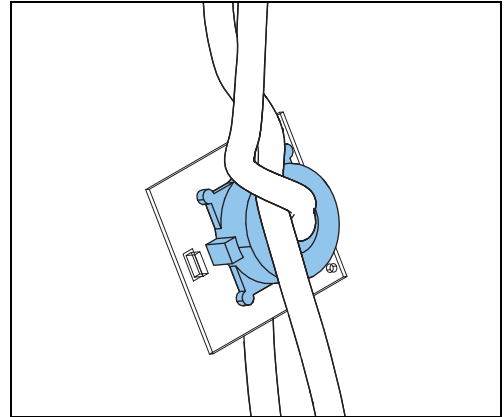
*IGBT PCB (EPS477 / EPS496 / EPS 478), all cabinets*

The IGBT PCB measures the output signal from the IGBT H-bridge.



### 3.5.4 Hall sensor, big cabinet

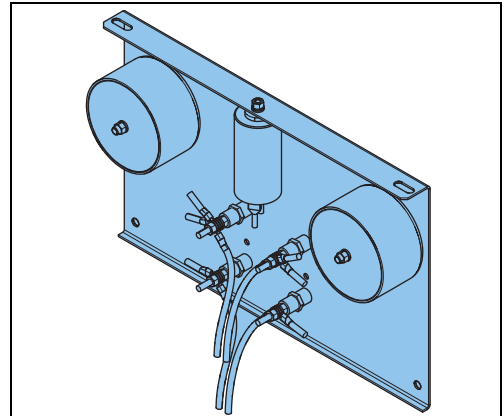
The Hall sensor measures the current between the IGBT and the output filter.



### 3.5.5 Output filter

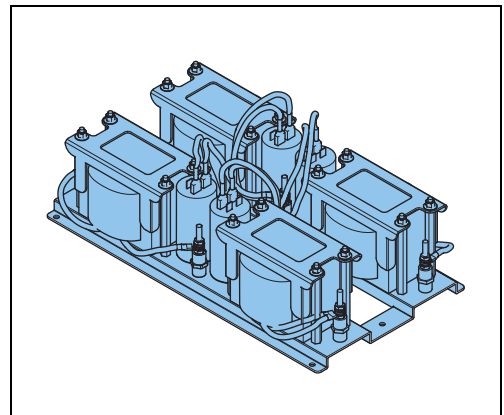
*Output filter, stackable cabinets and small cabinet (except 15 kVA)*

The output filter is a Pulse Width Modulation (PWM) filter that builds the pure sine wave signal that comes from the H-bridge.



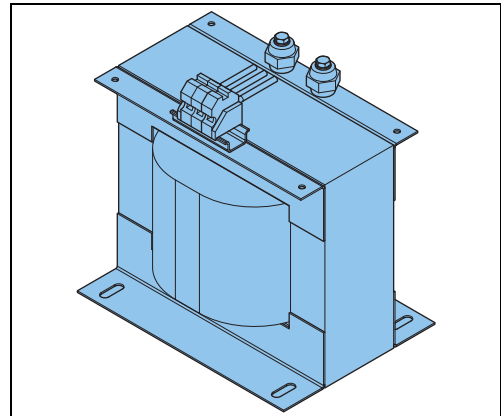
*Output filter, 15 kVA small cabinet and big cabinet*

The output filter is a Pulse Width Modulation (PWM) filter that builds the pure sine wave signal that comes from the H-bridge.



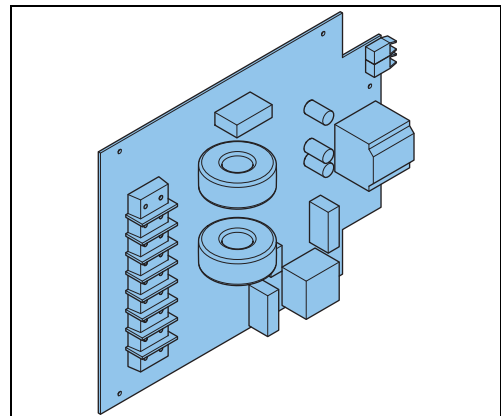
### 3.5.6 Main transformer, all cabinets

The main transformer converts the pure sine wave to the correct output voltage and current.



### 3.5.7 Output measure PCB (EPS422), all cabinets

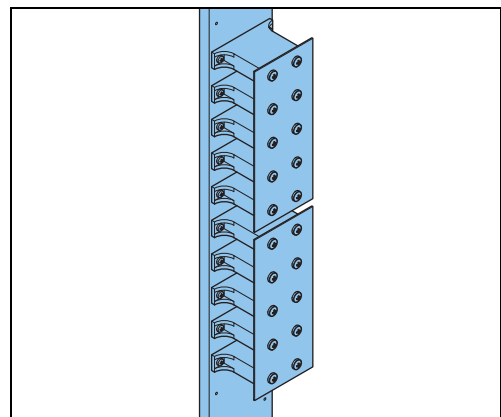
The output measure PCB measures the output voltage and current and sends these measurements to the CPU PCB. The EFD (See § 3.5.13) and LFD (See § 3.5.12) logic is also located on the output measure PCB.



### 3.5.8 Power output

#### *Lightning arrestors, all cabinets*

The lightning arrestors are installed on the power output. The lightning arrestors are varistors. A varistor is a surge protection device that is connected directly across the AC output.



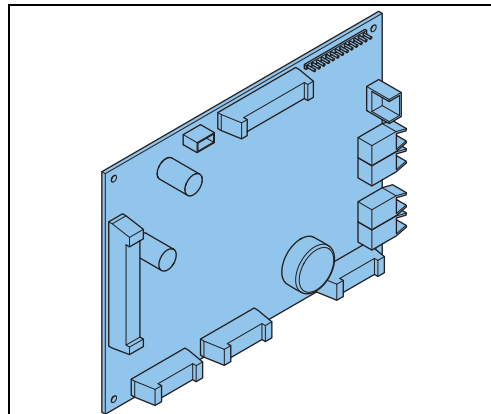
### Connection to the series circuit

There are mutual exclusive options possible. See §3.6.

#### 3.5.9 CPU PCB (EPS479), all cabinets

The CPU PCB

- Receives the measurement data of the output current and voltage from the output measure PCB via an optical fibre and compares these values with the required values. A software algorithm processes this data to adjust the signals from the output filters.
- Receives and processes input signals from the HMI and the remote control PCB.

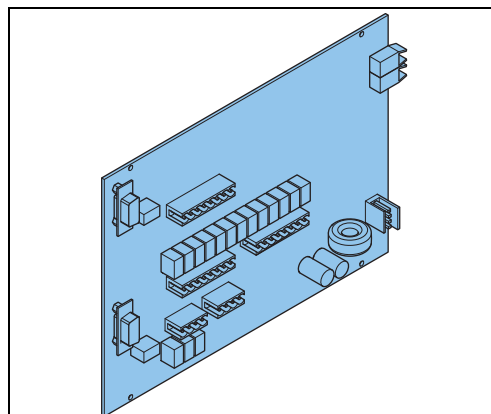


#### 3.5.10 Remote control PCB (EPS495), all cabinets

The equipment can be monitored or controlled remotely with J-Bus (2-wire RS485), multiwire or ethernet (option). This remote control allows the remote control system to:

- Receive information about the equipment.
- Configure the brightness steps.
- Test the equipment.

The remote control PCB connects the equipment to the remote control system. The internal connection between the remote control PCB and the CPU PCB goes through an optical fibre.



#### Note

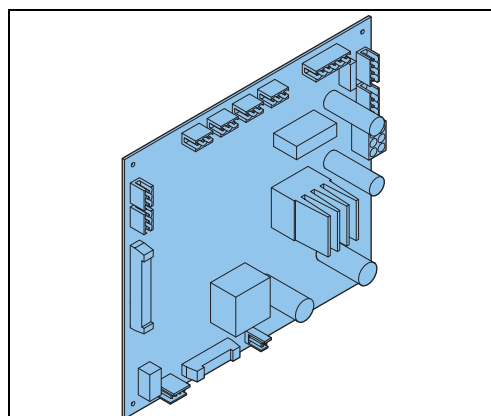
**For remote control through an ethernet connection, an additional ethernet PCB is required. See § 3.6.2.**

#### 3.5.11 Power supply PCB (EPS480), all cabinets

The power supply PCB provides the power supply for:

- All electronic components such as PCBs of the equipment.
- The fans (for 15 to 30 kVA equipments).
- The control for the main contactor.

The power supply PCB also manages the safety switches on the panels.





### 3.5.12 Lamp Fault Detection (LFD)

The equipment analyses the output current and the voltage pattern to calculate, on a linear load, the number of open circuited lamps, in compliance with IEC 61822.

The accuracy is  $\pm 1$  lamp with a range from 1 to 15 broken lamps.

The HMI shows the actual LFD value.

### 3.5.13 Earth Fault Detection (EFD)

The EFD measures the insulation resistance between the series circuit and the earth in compliance with IEC 61822.

The EFD module works when the equipment is connected to the mains supply, even if no output current is present.

You can set two alarm levels, Level 1 and Level 2, for the measured values. Both alarm levels can be set to any value between 5 kOhm and 500 MOhm. However, Level 1 must always be higher than Level 2.

Working principle: A high-voltage resistor applies a stable, current-limited voltage of 450 VDC between the series circuit and the earth or cable screen.

The HMI shows the actual EFD value.

## 3.6 Options

### 3.6.1 Remote control

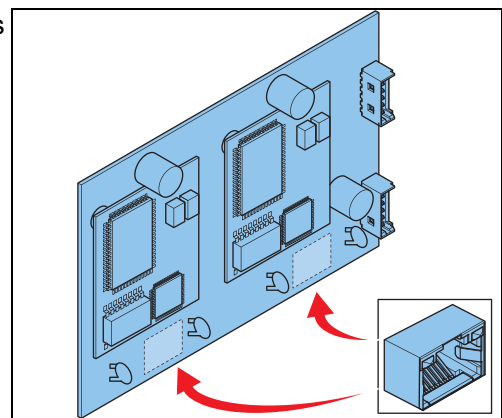
These remote control connections are possible:

- Ethernet (Ethernet PCB required)
  - Single
  - Double
- J-Bus
  - Single
  - Double
- Multiwire with 8 input signals and 17 output signals, always possible to monitor via single J-Bus

### 3.6.2 Ethernet PCB (EPS542), all cabinets

The ethernet PCB converts the ethernet to an RS-485 signal. This PCB is required if you need to remotely operate the equipment through an ethernet connection.

The illustration shows a double ethernet connection.



### 3.6.3 Circuit selector (CS)

With a CS you can connect several (up to eight) series circuits to a single equipment.

The CS has two modes:

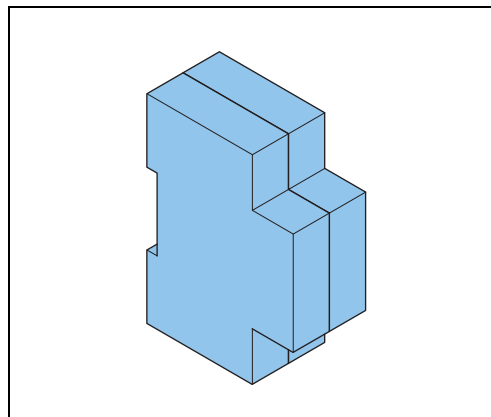
- Simultaneous: the equipment can connect to a number of the available circuits at the same time;
- Alternate: the equipment can connect to only one circuit at a time.

### 3.6.4 Lightning arrestors (option CS)

**Note**

**This item is installed on the CS when the CS option is chosen.**

The additional lightning arrestors for the CS are installed on the power output. The lightning arrestors are varistors. A varistor is a surge protection device that is connected directly across the AC output.

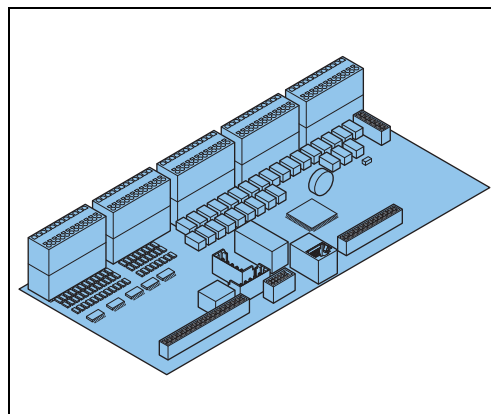


### 3.6.5 Interface PCB (PCB1702) (option CS)

**Note**

**This item is installed on the CS when the CS option is chosen.**

The interface PCB is the remote control interface PCB of the equipment, if the equipment has a CS.

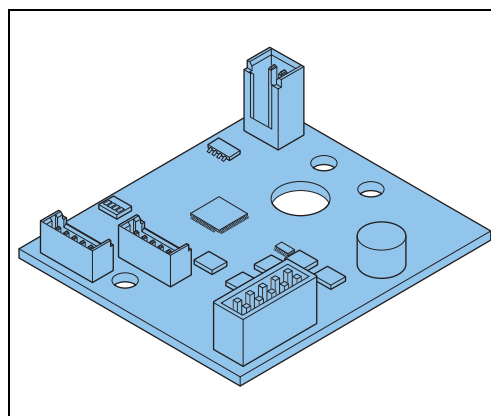


### 3.6.6 CS PCB (PCB1619) (option CS)

**Note**

**This item is installed on the CS when the CS option is chosen.**

The CS PCBs drive the CS relays through CANbus and measure the current after the relay with a current sensor. (see § 3.6.10).

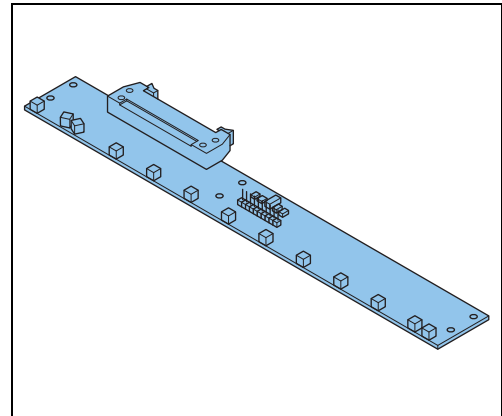


### 3.6.7 HMI SIN PCB (PCB1703) (option CS)



**Note**  
This item is installed on the CS when the CS option is chosen.

The HMI SIN BCB provides the indication of the state of the different series circuits (selected or not selected).

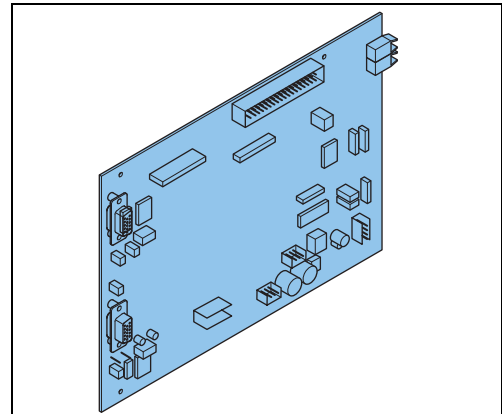


### 3.6.8 Remote control SIN PCB (PCB1694) (option CS)



**Note**  
This item is installed on the CS when the CS option is chosen.

The remote control SIN PCB is the interface between the CPU PCB and the interface PCB.

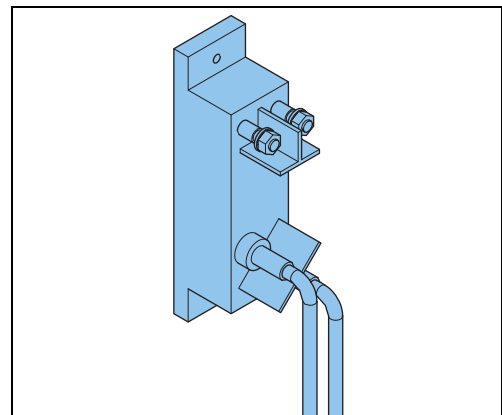


### 3.6.9 CS relay (option CS)



**Note**  
This item is installed on the CS when the CS option is chosen.

The CS relays switch on or off its designated series circuit.

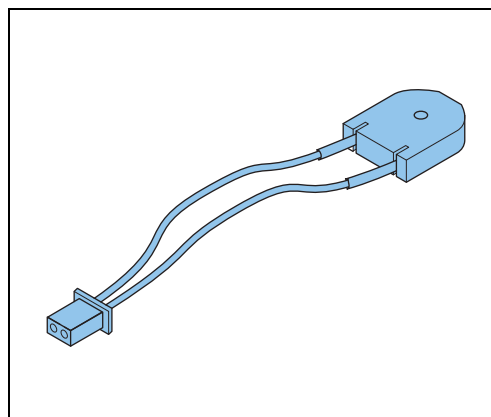


### 3.6.10 Current sensor (option CS)

**Note**

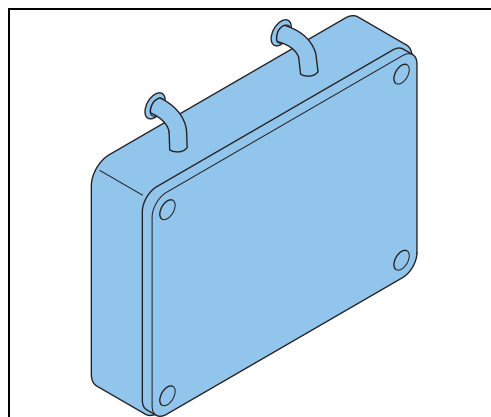
This item is installed on the CS when the CS option is chosen.

The current sensors sense if there runs current through the series circuits.



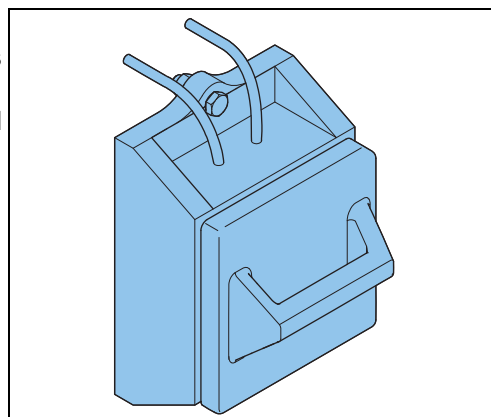
### 3.6.11 Series Connector Box (SCB), all cabinets

The SCB connects the equipment to the series circuit with two medium voltage cables of the primary circuit. The SCB does not allow the short circuit connection.



### 3.6.12 Series CutOut (SCO), all cabinets

The SCO acts as an output disconnection device between the equipment and the series circuit. The SCO also isolates the series circuit from the equipment during maintenance or testing operations. The cover is locked with a key to prevent unauthorized access.

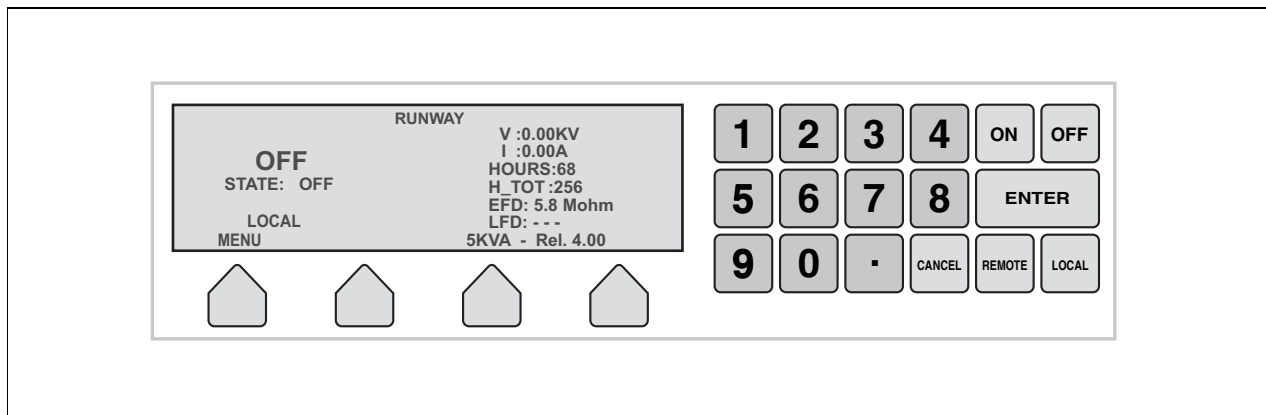


### 3.6.13 Rolling castors

The equipment can be supplied with two fixed and two pivoting rolling castors to facilitate the movement of the equipment. The option is not available for stackable equipments or for an equipment with a CS.

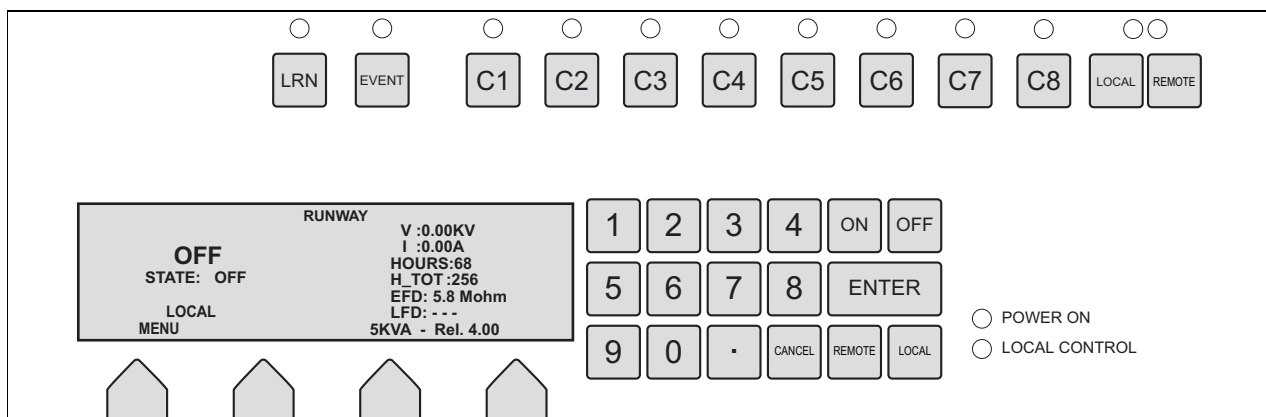
## 3.7 HMI

You can operate the equipment with the HMI.



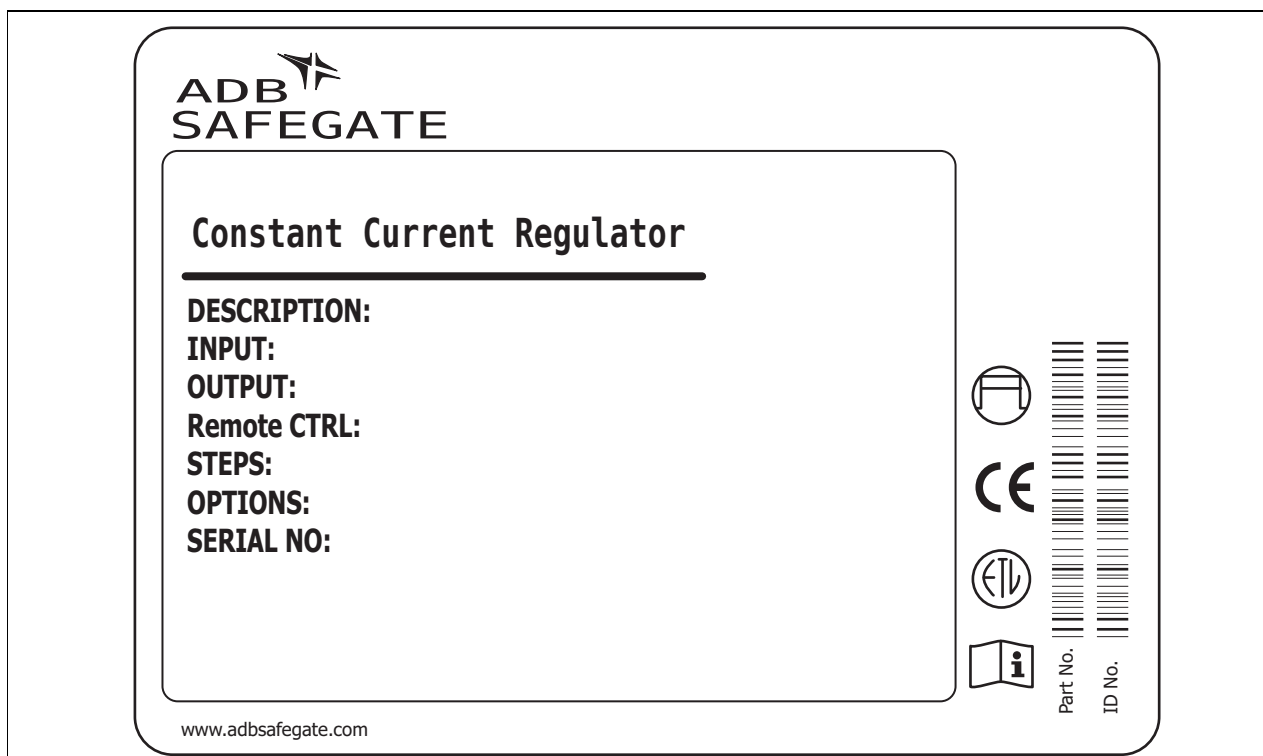
### 3.8 HMI of an equipment with CS (option CS)

You can operate the equipment with the HMI.



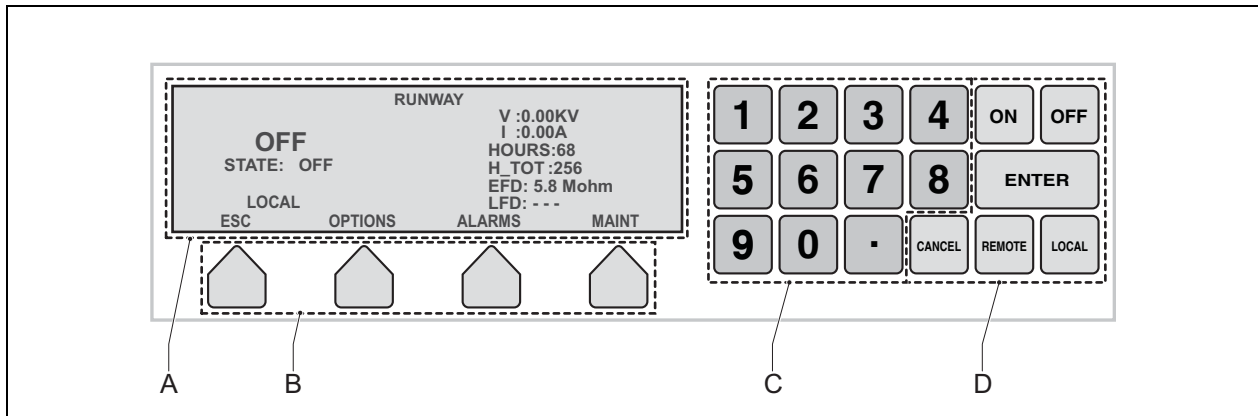
### 3.9 Nameplate

Each equipment has a standard nameplate:



## 4 Description of the HMI

### 4.1 HMI overview



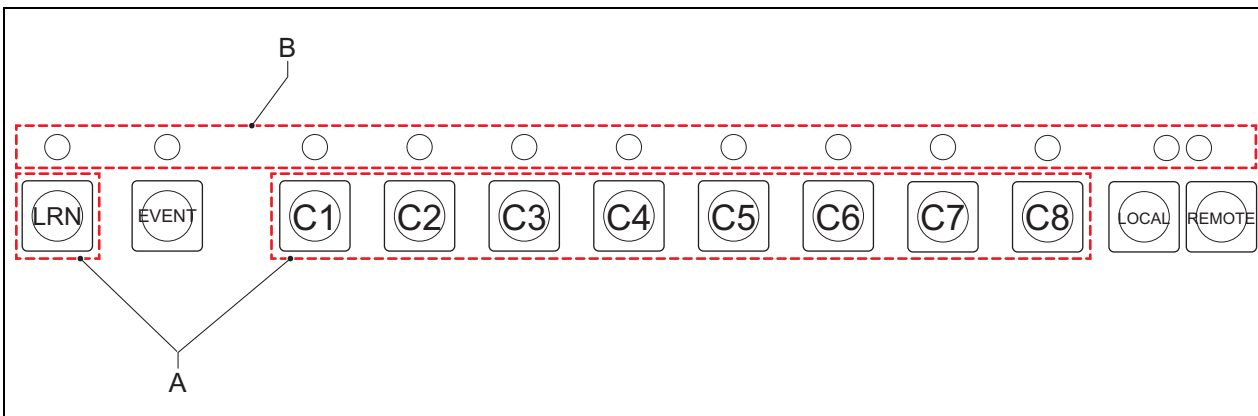
- A Display
- B Function buttons
- C Keypad
- D ON, OFF, ENTER, CANCEL REMOTE and LOCAL buttons

### 4.2 HMI overview for an equipment with a CS (option CS)



**Note**

The HMI of an equipment has the standard HMI (see § 4.1), with an extra set of buttons and indicators.



- A Function buttons
- B Function indicator LEDs

The LED's for the function buttons C1 to C8 are ON is the circuit is selected. The LEDs are OFF when the circuit is not selected.

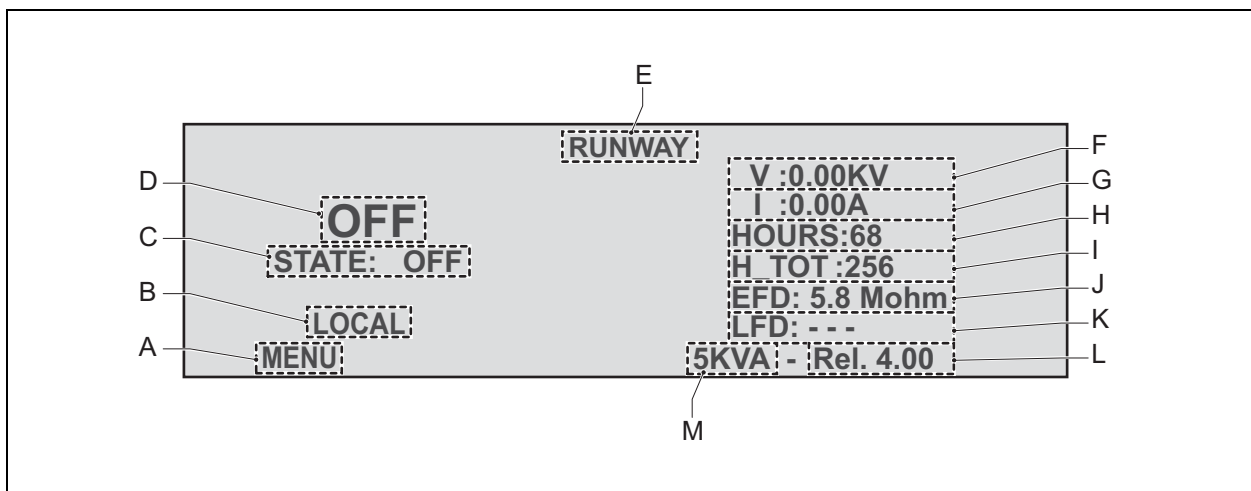
The LRN function button is not used.

LED	LED colour	Description
CS ON	Green	The equipment and the CS are active.
EVENT	Red	An alarm is active.
LOCAL	Red	The equipment and the CS are in local mode <sup>1</sup>
REMOTE	Green	The equipment and the CS are in local mode <sup>1</sup>

1) You can only select local or remote control on the equipment



### 4.3 Display overview: Main screen



**Table: 4.1 Display description: Main screen**

	Name	Description
A	Menu	Push the corresponding function button to go to the Main menu.
B	Mode indication	Shows the state, LOCAL or REMOTE.
C	State	The state can be OFF or ON.
D	Brightness level	OFF, or BRIGHTNESS 0 to 5. Optionally, more levels are possible. If the display shows BRIGHTNESS 0, this means that the equipment has a pre-defined current as output, due to a remote control loss.
E	Field circuit	Shows the name of the field circuit that the equipment delivers power to.
F	True RMS output voltage	Shows the true RMS output voltage in kV.
G	True RMS output current	Shows the true RMS output current in A.
H	Highest brightness step counter	Shows the time that the equipment operates at the maximum brightness step in h.
I	Total brightness counter	Shows the total time that the equipment is set to 'on' in h.
J	EFD indicator	Shows the measurement of the resistance to earth. The equipment continuously measures the value, also when the equipment is in the OFF state, when the equipment has power.
K	LFD indicator	In normal mode (linear load): Shows the number of broken lamps if the LFD is calibrated. In inductive mode (non-linear load): Shows the text 'inductive'
L	Software version	Shows the current software version.
M	Power rating	Shows the power rating of the equipment.

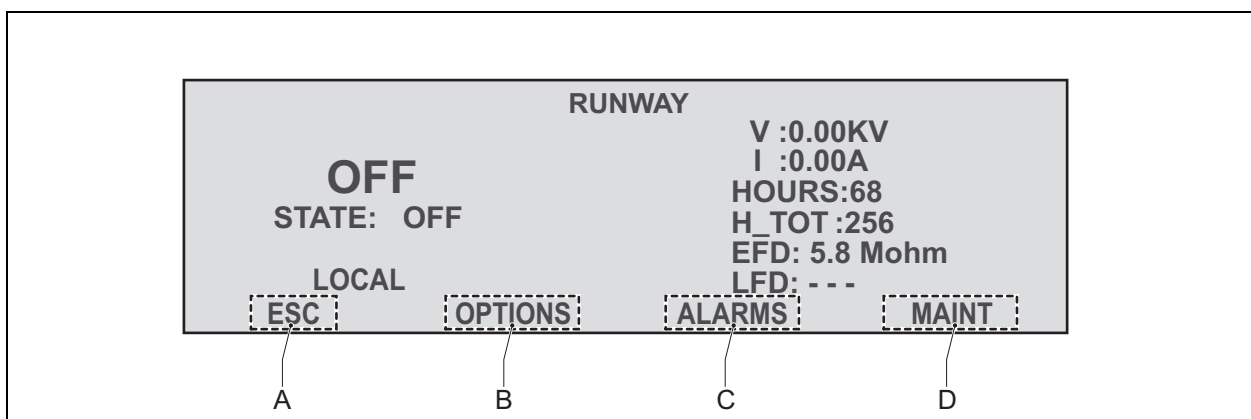
## 4.4 Description of general functions

The function buttons can have different functions. The display description show the dedicated functions. This section shows the general functions, which are available in several menus.

**Table: 4.2 General function buttons**

Button	Description
→	To go to the next submenu.
←	To go to the previous submenu.
ESC	To go to the higher level menu.
-	To decrease the value.
+	To increase the value.
YES	To confirm the selection.
NO	To decline the selection.
SAVE	To save an alphanumeric or numeric string.
UP, DOWN, LEFT, RIGHT	To move the cursor in the display.

## 4.5 Main menu



**Table: 4.3 Display description: Menu screen**

	Name	Description
A	ESC	To return to the Main menu. See § 4.5.
B	OPTIONS	To go to the Options menu. See § 4.6.
C	ALARMS	To go to the Alarms menu. See § 4.7.
D	MAINT	To go to the Maintenance menu. See § 4.8.

## 4.6 Options menu

**Table: 4.4 Buttons**

Button	Description
RS232/485	To activate or deactivate the RS232 or RS485 port.
MODE	To select the correct equipment work mode (see § 9.9): - NORMAL (for linear loads) - INDUCTIVE (for non-linear loads (e.g. LED loads))
ID	To change the name of the field circuit that the equipment powers. See § 4.10 how to enter an alphanumeric string with the HMI.
SLVNUM	To change the address number of the equipment in the RS485 network.
LANG	To change the language of the display.
CONTR	To change the display contrast.
LFD	To calibrate the LFD.
HCOUNT	To reset the HOURS indicator.

## 4.7 Alarms menu

**Table: 4.5 Buttons**

Button	Description
RESET	To reset the alarm: See also § 9.7.
FORWARD	To show the previous alarm in the list: See also § 4.11.

For an overview of alarm texts and messages, see § 4.11.

## 4.8 Maintenance menu

Before you can access the maintenance menu, you must fill in a password.

**Table: 4.6 General function buttons**

Button	Description
TEST	Shows the DSP microcontroller operating parameters. These parameters show the state of the software process that controls the equipment. These parameters are only for an advanced user.
MORE	<p>To go to more submenus:</p> <ul style="list-style-type: none"> <li>- IGBT TEST A verification test of the IGBT.</li> <li>- INPUT FREQ Do not change this parameter.</li> <li>- REMOTE CONTROL MODE Multiwire or J-Bus</li> <li>- JBUS PROTOCOL MCR2 protocol or MCR3 protocol</li> <li>- CSE/MODE Activate circuit selector. Yes or No.</li> <li>- JBUS mode 485 or Ethernet mode</li> <li>- MULTIWIRE CONFIGURATION To configure the output pins of the multiwire connector. You can change the connector function with the <b>ON</b> and <b>OFF</b> buttons. To save the configuration, push the <b>ENTER</b> button.</li> <li>- V/I CALIBRATION Do not use this parameter.</li> <li>- ETHERNET CONFIGURATION Only for an equipment with the Ethernet Remote Control PCB. To configure the 2 IP addresses.</li> </ul>

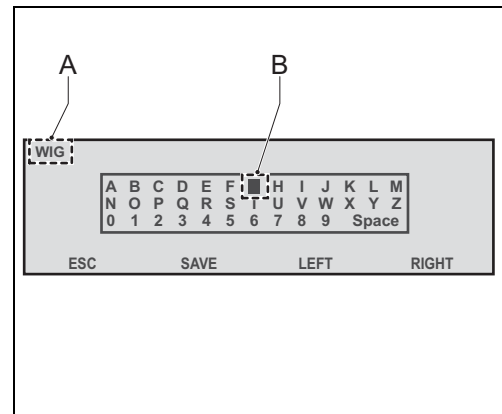
## 4.9 Mode menu

**Table: 4.7 General function buttons**

Button	Description
RAMP TIME	The time that the equipment takes to change from one brightness step to another, in seconds (0 to 125 s).
HALFWAVE WIDTH	To enhance the current peak. You can decrease the half wave width and so reshape the sinusoidal waveform (50 to 100%). The default value is 100% (no enhancement).
MAX PWM WIDTH	To smoothen the maximum current the equipment can supply to prevent a too high current to run on the lamps. You can reduce maximum power threshold on the PWM cycle (1 to 100%). The default value is 100% (no threshold on the current output).
CURRENT LIMIT	Maximum peak current.
PID TYPE	Do not change this parameter.

## 4.10 How to enter an alphanumeric string

1. The display shows an alphanumeric matrix (B).
2. Push the LEFT and RIGHT buttons to select the character.
3. Push the ENTER button. The HMI adds the character to the string (A).
4. Push the CANCEL button to delete the last character.
5. Push the SAVE button to confirm the string.



## 4.11 Alarm texts and messages on the HMI

There are four types of alarms:

- Equipment alarms
  - The equipment automatically switches OFF. Restart the equipment only after you have found the cause of the alarm.
  - The red light goes on but the equipment still operates. Find the cause of the alarm.
- Field alarms
  - The equipment automatically switches OFF. Restart the equipment only after you have found the cause of the alarm.
  - The red light goes on but the equipment still operates. Find the cause of the alarm.

Alarm text / message	Possible cause	Equipment alarm	Field alarm	Only red light goes on	Equipment switches off automatically
450V EFD MISSING	The 450 V EFD test voltage is missing.	x		x	
560VDC BUS OVERCURRENT	The current on the primary power transformer is too high.	x			x
ALARM!!!	Several alarms have occurred at the same time.	x			x
BAD REGULATION	The current did not reach the selected level within the ramp up time.	x		x	
DSP ERROR OR WRONG FIRMWARE	The CPU DSP has failed or the DSP firmware is corrupted.	x			x
EFD LEVEL 1 FAULT	The resistance to earth is less than level 1 (20 MOhm default value).		x	x	
EFD LEVEL 2 FAULT	The resistance to earth is less than level 2 (2 MOhm default value).		x	x	
GATE H FAULT	There is a problem with the H-bridge (IGBT). On the HMI, a message shows "IGBT KO: xxx x".	x			x
IGBT KO: ...	Both IGBTs are broken.	x		x	
IGBT KO: BTM A	The IGBT A is broken.	x		x	
IGBT KO: TOP A	The IGBT A is broken.	x		x	
IGBT KO: BTM B	The IGBT B is broken.	x		x	
IGBT KO: TOP B	The IGBT B is broken.	x		x	
IGBT KO: TOP BTM A	The IGBT A is broken.	x		x	
IGBT KO: TOP BTM B	The IGBT B is broken.	x		x	
INPUT VOLTAGE TOO HIGH	The input voltage is too high.	x		x	
INPUT VOLTAGE TOO LOW	The input voltage is too low. This can lead to an over current situation.	x			x

Alarm text / message	Possible cause	Equipment alarm	Field alarm	Only red light goes on	Equipment switches off automatically
LFD LEVEL 1 FAULT	Minimum 3 broken lamps.		x	x	
LFD LEVEL level 2 fault	Minimum 5 broken lamps.		x	x	
MAIN CONTACTOR FAILED (OFF)	The main contactor is broken.	x			x
MAIN CONTACTOR FAILED (ON)	The main contactor is broken.	x			x
MAIN DC <95%	The rectified 560 V DC voltage is too low. (Only applies to 3 phase input).	x			x
MAIN REMOTE CTRL SWITCH OFF	The main remote control switch does not go on when the microprocessor gives an 'on' command.	x			x
MAIN REMOTE CTRL SWITCH ON	The main remote control switch goes on before the microprocessor gives an 'off' command.	x			x
MANY ERRORS HAVE HAPPENED, DURING CONTROL	Different alarms are generated in the same alarm time interval after the equipment startup phase.	x			x
MANY ERRORS HAVE HAPPENED, DURING ON	Different alarms are generated in the same alarm time interval during the equipment startup phase.	x			x
NO FAN	One or more fans do not operate correctly.	x		x	
ONE PHASE MISSING	One phase is missing. The display shows which phase is missing.	x			x
OPEN CIRCUIT	The output circuit is interrupted. Link the cable correctly before you restart the equipment.		x		x
OVERCURRENT	<ul style="list-style-type: none"> <li>- The output current is more than <math>I_{max} + 5\%</math> for minimum 4s.</li> <li>- The output current is more than <math>I_{max} + 20\%</math> for minimum 0.4 s.</li> </ul>		x		x
OVERLOAD	The load of the equipment is too high.		x	x	
OVERVOLTAGE FROM FIELD	The "IGBT OVP" has stopped the equipment when it could not find a suitable operation mode after several retries.		x		x
PHASE ERROR	There is a problem with the mains frequency detection.	x		x	
PIC COMMUNICATION ERROR	A faulty communication with the measurement PCB.	x			x

Alarm text / message	Possible cause	Equipment alarm	Field alarm	Only red light goes on	Equipment switches off automatically
PRE-CHARGE CONTACTOR ON	The pre-charge contactor is broken (VIS only).	x			x
PRE-CHARGE CONTACTOR OFF	The pre-charge contactor is broken (VIS only).	x			x
SCO / DOOR OPENED	A front, rear and or field connection panel is open.	x			x
TEMPERATURE SENSOR FAULT	There is a fault in the temperature measurement circuit.	x		x	
TLC ERROR	There is an error on the remote control PCB.	x		x	
TOO HIGH TEMPERATURE	The temperature of the heat sink is too high.	x		x	
V IN UNSTABLE	The input voltage is not stable.	x		x	
VA DROP LEVEL EXCEEDED	The output power goes below a preset level.	x		x	



## 5 Description of the configuration software tool

With the configuration software tool, you can:

- Read the state of the equipment (alarms, output current, input current, ...).
- Read the configuration of the equipment.
- Adjust the configuration of the equipment.
- Test the equipment.
- Send writing and reading commands to the equipment.



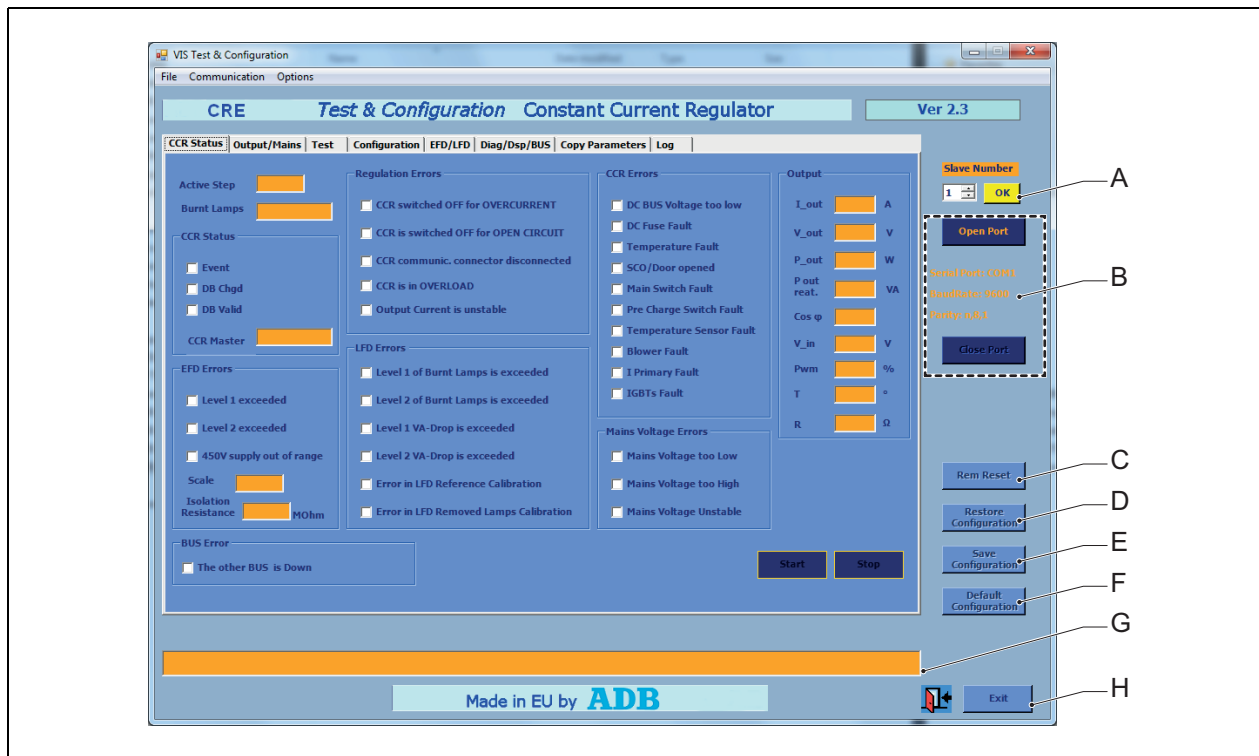
### WARNING

When you activate the configuration tool, you transfer all control of the equipment to the configuration software tool. In this situation, remote or local control of the equipment is not possible.

To update the software version, contact ADB Safegate.

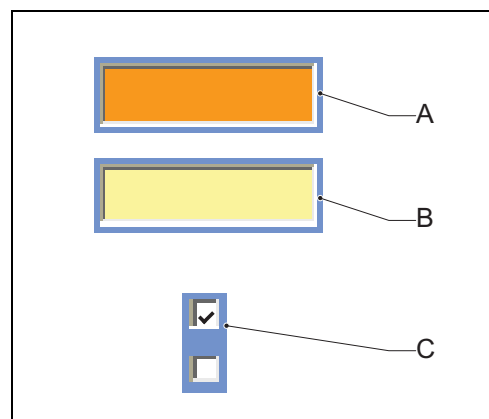
### 5.1 Description of screens and menus

#### 5.1.1 General



		Description
A	Slave	To select the slave number of the equipment you want to connect to.
B	Connection	To open and close the port to the selected slave number.
C	Rem Reset	To reset the alarm. See also § 9.7.
D	Restore configuration	To restore a saved configuration from the PC to the equipment.
E	Save configuration	To make the values sent to the equipment active on eeprom. The values you send to the equipment are not active on the eeprom.
F	Default configuration	To return to the factory default configuration.
G	Message bar	Shows communication messages and error messages about the software configuration tool.
H	Exit	To exit the configuration software tool.

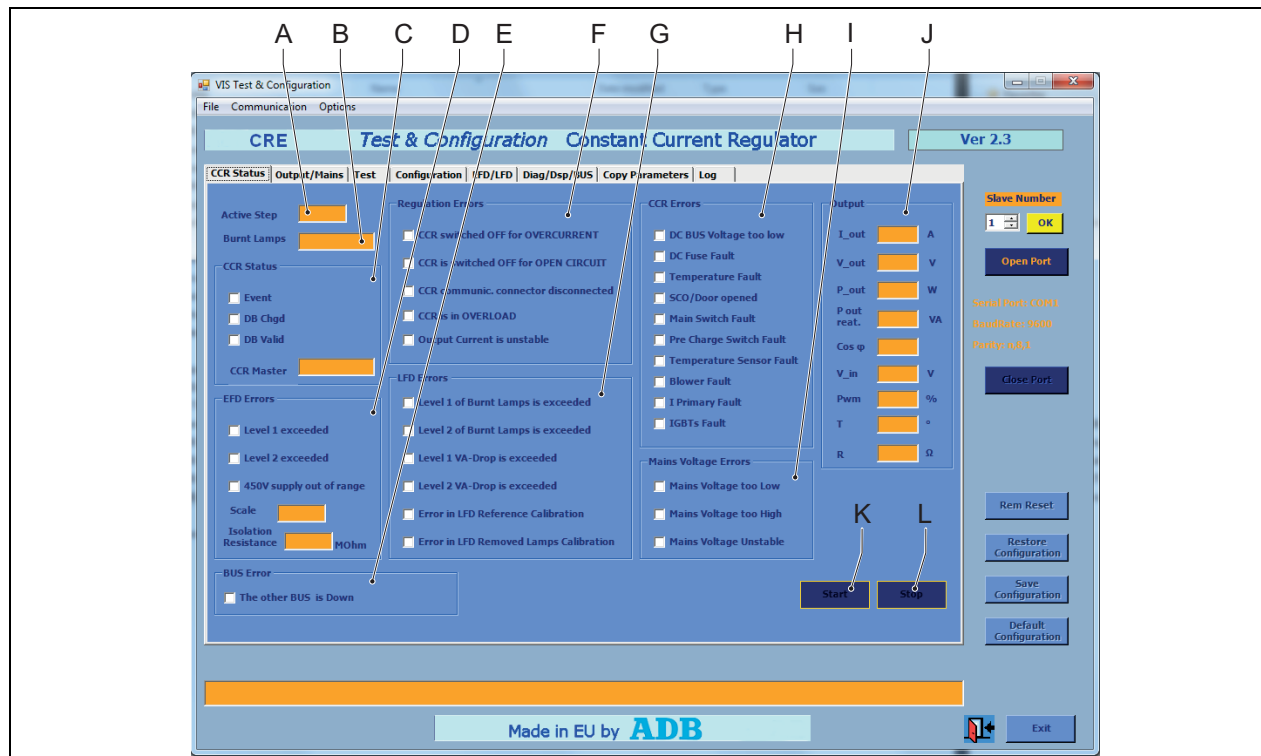
You can adjust the values in the yellow areas (A).  
 You can not adjust values in the orange areas (B).  
 White selection boxes: if the box is marked, the item applies (C).



### 5.1.2 Screens

- CCR Status screen. See § 5.2.
- Output/Mains screen. See § 5.3.
- Test screen. See § 5.4.
- Configuration screen. See § 5.5.
- EFD/LFD screen. See § 5.6.
- Diag/Dsp/BUS screen. See § 5.7.
- Copy Parameters screen. See § 5.8.
- Log screen. See § 5.9.
- Test JBus screen. See § 5.10.

## 5.2 CCR status screen



		Description
A	Active step	Shows the active brightness step of the selected equipment.
B	Burnt lamps	Shows the number of burnt lamps in the series circuit.
C	CCR Status	See § 5.2.1.
D	EFD Errors	See § 5.2.2.
E	Bus Error	Only applies to a double J-Bus or Ethernet connection.
F	LFD Errors	See § 5.2.3.
G	Regulation Errors	See § 5.2.4.
H	CCR Errors	See § 5.2.5.
I	Mains Voltage Errors	See § 5.2.6.
J	Output	See § 5.2.7.
K	Start	To show the parameters of the selected slave equipment.
L	Stop	To stop to show the parameters of the slave equipment.

### 5.2.1 CCR Status

Item	Description
Event	An error event occurred.
DB Chgd	A change was made to the database.
DB Valid	The data in the database is up to date.
CCR Master	LOCAL SELECTOR: the master is in LOCAL mode PC: the RS232 port of the master is active. BUS A. The J-BUS is active and the master is in REMOTE mode.

### 5.2.2 EFD Errors

	Possible cause	Alarm type
Level 1 exceeded	The resistance to earth is less than level 1 (20 MOhm default value).	The red light on the equipment goes on.
Level 2 exceeded	The resistance to earth is less than level 2 (2 MOhm default value).	
450V supply out of range	The 450 V EFD test voltage is missing.	
Scale	Shows 0 for a 20 µA EFD scale and 1 for a 200 µA EFD scale.	
Isolation resistance	Shows the isolation resistance value (0 to 500 MOhm).	

### 5.2.3 LFD Errors

	Possible cause	Alarm type
Level 1 of Burnt Lamps is exceeded	Minimum 3 broken lamps.	The red light on the equipment goes on.
Level 2 of Burnt Lamps is exceeded	Minimum 5 broken lamps.	
Level 1 VA-Drop is exceeded	The output power goes below a preset level.	
Level 2 VA-Drop is exceeded	The output power goes below a preset level.	
Error in LFD Reference Calibration	The LFD reference calibration is not done or is not successful.	
Error in LFD Removed Lamps Calibration	The LFD removed lamps calibration is not done or is not successful.	

#### 5.2.4 Regulation Errors

	Possible cause	Alarm type
CCR switched OFF for OVERCURRENT	<ul style="list-style-type: none"> <li>- The output current is more than <math>I_{max} + 5\%</math> for minimum 4s.</li> <li>- The output current is more than <math>I_{max} + 20\%</math> for minimum 0.4s.</li> </ul>	<ul style="list-style-type: none"> <li>- The equipment automatically switches OFF.</li> <li>- Restart the equipment only after you have found the cause of the alarm.</li> </ul>
CCR switched OFF for OPEN CIRCUIT	The output circuit is interrupted. Connect the cable correctly before you restart the equipment.	
Measure board connector disconnected	<p>There is no communication between the CPU PCB and the measure PCB.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- The optical cable is disconnected.</li> <li>- The power supply cable is disconnected.</li> <li>- Malfunction of the measure PCB.</li> </ul>	
CCR is in OVERLOAD	The load of the equipment is too high.	
Output current is unstable	<p>The output current fluctuates or could not reach the requested value.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- Load switching (E.g. Aglas, Brite).</li> <li>- Too much load on the series circuit.</li> </ul>	

### 5.2.5 CCR Errors

	Possible cause	Alarm type
DC BUS Voltage too low	<p>Only for a three-phase equipment. The voltage on the DC bus does not reach the nominal value.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- Malfunction of the IGBT.</li> <li>- The wiring is not connected properly.</li> </ul>	<ul style="list-style-type: none"> <li>- The equipment automatically switches OFF.</li> <li>- Restart the equipment only after you have found the cause of the alarm.</li> </ul>
Temperature Fault	The temperature of the heat sink is too high.	
SCO/Door opened	A front, rear and/or field connection panel is open.	The red light on the equipment goes on.
Main Contactor Fault	<p>The main contactor does not switch on when the microprocessor gives an 'on' command.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- Malfunction of the main contactor.</li> <li>- Malfunction of the feedback of the contactor.</li> <li>- A faulty connection on the power supply PCB.</li> </ul>	
Pre-Charge Contactor Fault	<p>The precharge contactor does not go on when the microprocessor gives an 'on' command.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- Malfunction of the main contactor.</li> <li>- Malfunction of the feedback of the contactor.</li> <li>- A faulty connection on the power supply PCB.</li> </ul>	
Temperature Sensor Fault	There is fault in the temperature measurement circuit.	<ul style="list-style-type: none"> <li>- The equipment automatically switches OFF.</li> <li>- Restart the equipment only after you have found the cause of the alarm.</li> </ul>
Blower Fault	One or more fans do not operate correctly.	
I Primary Fault	There is a problem with the current after the IGBT.	
IGBT Fault	<p>The IGBT test did not succeed after the 'ON step request'.</p> <p>Possible root causes:</p> <ul style="list-style-type: none"> <li>- Malfunction of the IGBT.</li> <li>- A faulty wiring between the CPU PCB and the IGBT PCB.</li> <li>- Malfunction of the IGBT PCB.</li> </ul>	

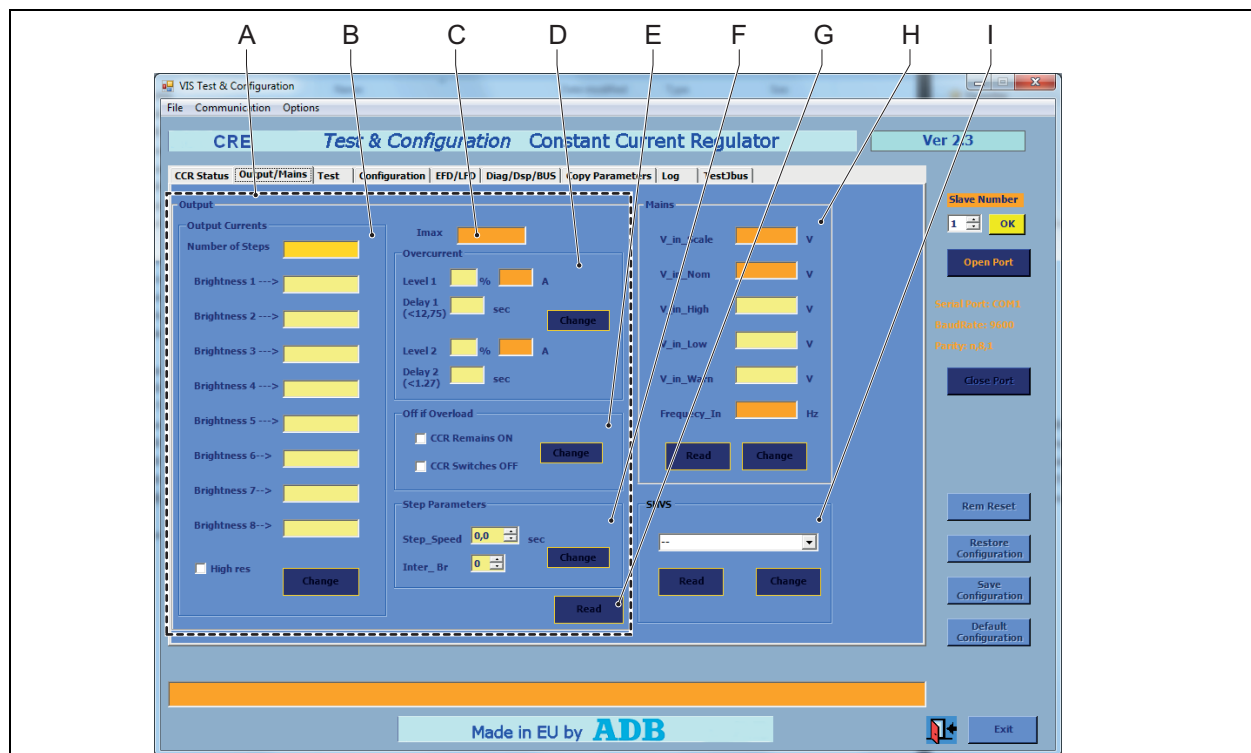
### 5.2.6 Mains Voltage Errors

	Possible cause	Alarm type
Mains Voltage too Low	The input voltage is too low. This can lead to an over current situation.	<ul style="list-style-type: none"> <li>- The equipment automatically switches OFF.</li> <li>- Restart the equipment only after you have found the cause of the alarm.</li> </ul>
Mains Voltage too high	The input voltage is too high.	
Mains Voltage unstable	The input voltage is not stable.	The red light on the equipment goes on.

### 5.2.7 Output

Item	Description
I_out	Shows the output current.
V_out	Shows the output voltage.
P_out	Shows the output power.
V_in	Shows the input voltage.
Pwm	Shows the PWM.

### 5.3 Output/Mains screen



		Description
A	Output screen part	See items B to F.
B	Output currents	See § 5.3.1.
C	Imax	Shows the maximum output current.
D	Overcurrent	See § 5.3.3.
E	Off if overload	See § 5.3.2.
F	Step parameters	See § 5.3.4.
G	Read	To read the actual Output parameters from the selected equipment.
H	Mains	See § 5.3.5.
I	SHVS	Not used



### 5.3.1 Output currents

Item	Description
Number of Steps	To select the number of brightness steps.
Brightness 1 to 8	To adjust the current for each brightness step, accurate up to 25 mA.
Change	To activate the values and to send them to the equipment.



#### Note

**When you select less than 8 brightness steps, the steps higher than the highest step automatically get the current of the highest brightness step.**

Example:

When you select 4 brightness steps and you select 4.750 A for brightness step 4, brightness steps 5 to 8 are disabled and get 4.750 A current assigned automatically.

### 5.3.2 Off if overload

Item	Description
CCR Remains ON	To make sure that the equipment remains ON when the equipment is in overload state and the alarm comes up.
CCR Switches OFF	To make sure that the equipment switches OFF when the equipment is in overload state and the alarm comes on.
Change	To activate the values and to send them to the equipment.

### 5.3.3 Overcurrent

Item	Description
Level 1 and Level 2	To set the percentage of the maximum of the two thresholds for overcurrent. The screen part also shows the actual current threshold values.
Delay 1 and 2	To set the delay before the overcurrent alarm comes on, in s.
Change	To activate the values and to send them to the equipment.

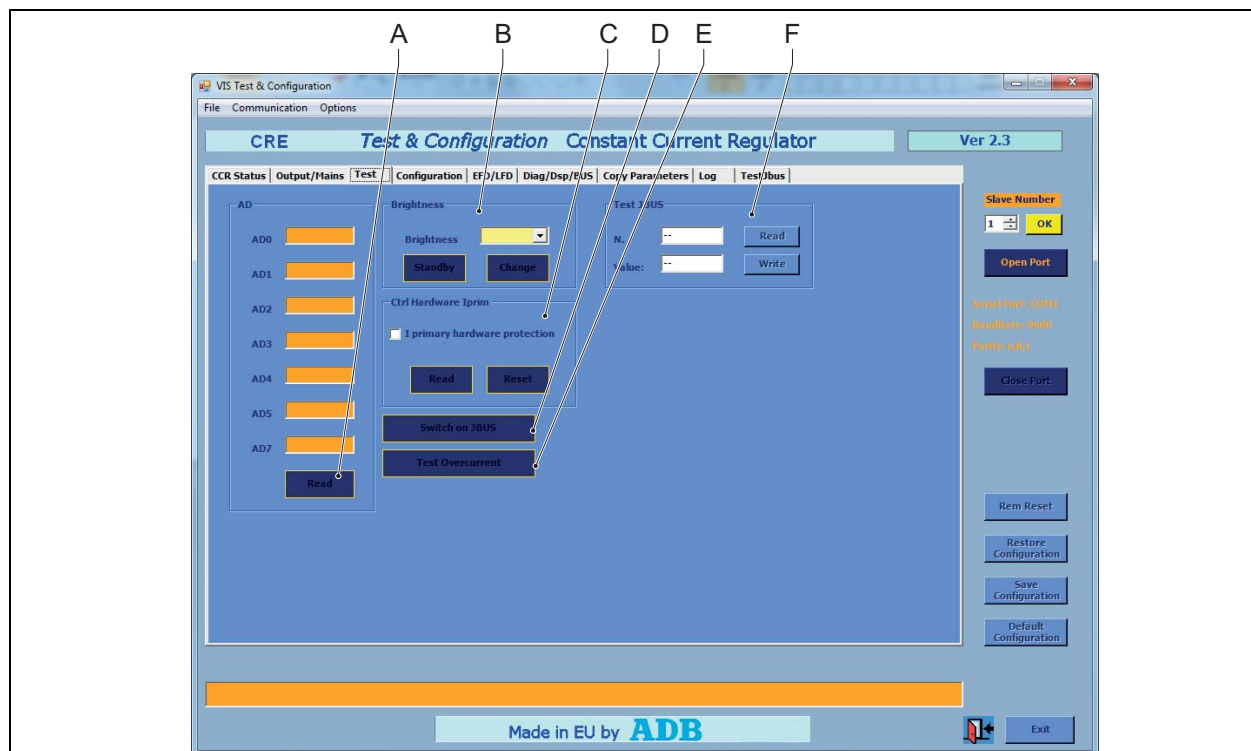
### 5.3.4 Step Parameters

Item	Description
Step_Speed	To set the time that the equipment takes to change from one brightness step to another, in seconds (0 to 125 s).
Inter_Br	To define an intermediate brightness between steps.
Change	To activate the values and to send them to the equipment.

### 5.3.5 Mains

Item	Description
V_in_Scale	Shows the scale used to calculate the nominal voltage.
V_in_Nom	Shows the nominal supply voltage.
V_in_High	To adjust the supply voltage threshold above which the equipment restarts when it switched OFF due to a too low supply voltage.
V_in_Low	To adjust the supply voltage threshold below which the equipment gives an alarms and switches OFF.
V_in_Warn	To adjust the voltage threshold above which the equipment gives an alarm.
Frequency_In	Shows the supply voltage frequency.
Change	To activate the values and to send them to the equipment.
Read	To read the actual Mains parameters from the selected equipment.

## 5.4 Test screen



		Description
A	Read	To read the actual Analogue Data parameters (AD0 to AD7) from the selected equipment.
B	Brightness	See § 5.4.1.
C	Ctrl Hardware Iprim	See § 5.4.2.
D	Switch on JBUS	To enable the J-Bus serial port an to disable the RS232 serial port.
E	Test Overcurrent	To start the overcurrent alarm test.
F	Test JBUS	See § 5.4.3.

### 5.4.1 Brightness

Item	Description
Brightness	To select the step.
Standby	To set the selected equipment to stand-by.
Change	To activate the values and to send them to the equipment.

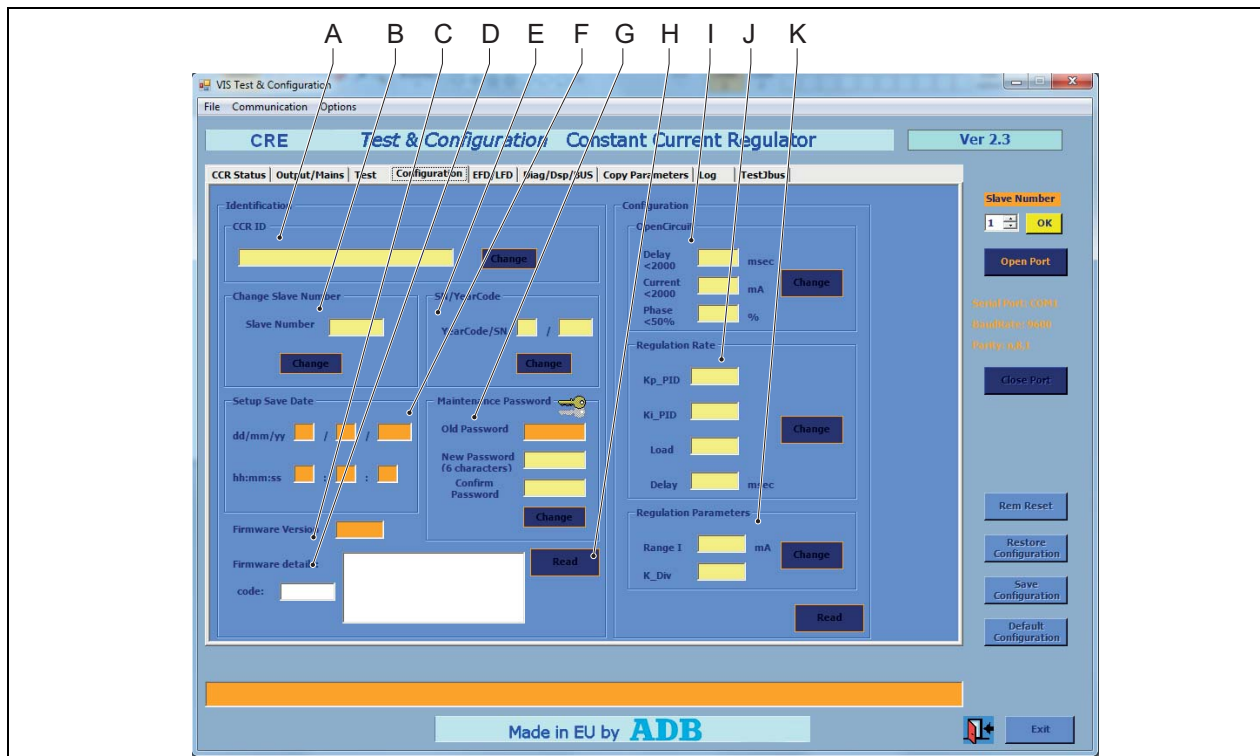
#### 5.4.2 Ctrl Hardware Iprim

Item	Description
I primary hardware protection	Shows if the primary current hardware protection is released. This is a read-only parameter.
Reset	To reset the primary current hardware protection.
Read	To read the actual primary current protection parameter from the selected equipment.

#### 5.4.3 Test JBUS

Item	Description
N.	To select the data line.
Value	To select the test data value.
Read	To read the actual JBUS parameters from the selected data line.
Write	To send the selected test data to the selected data line.

## 5.5 Configuration screen



		Description
A	CCR ID	See § 5.5.1.
B	Change Slave Number	See § 5.5.2.
C	Firmware version	Shows the firmware version of the selected equipment.
D	Firmware details	Shows a description on the firmware version of the selected equipment.
E	SN/YearCode	See § 5.5.3.
F	Setup Save Date	Shows the date and time of the latest save of the data of the selected equipment. The date and time are generated from the PC that is connected to the equipment.
G	Maintenance Password	See § 5.5.4.
H	Read	To read the actual configuration parameters from the selected data line.
I	Open Circuit	Do not use these parameters. There is a risk of damage to the equipment. Only ADB Safegate service engineers are allowed to use these parameters.
J	Regulation Rate	
K	Regulation Parameters	

### 5.5.1 CCR ID

Item	Description
Blank field	To change the name of the field circuit that the equipment delivers power to. This name shows in the HMI.
Change	To activate the value and to send it to the equipment.

### 5.5.2 Change Slave Number

Item	Description
Slave Number	To adjust the slave number of the selected equipment.
Change	To activate the value and to send it to the equipment.

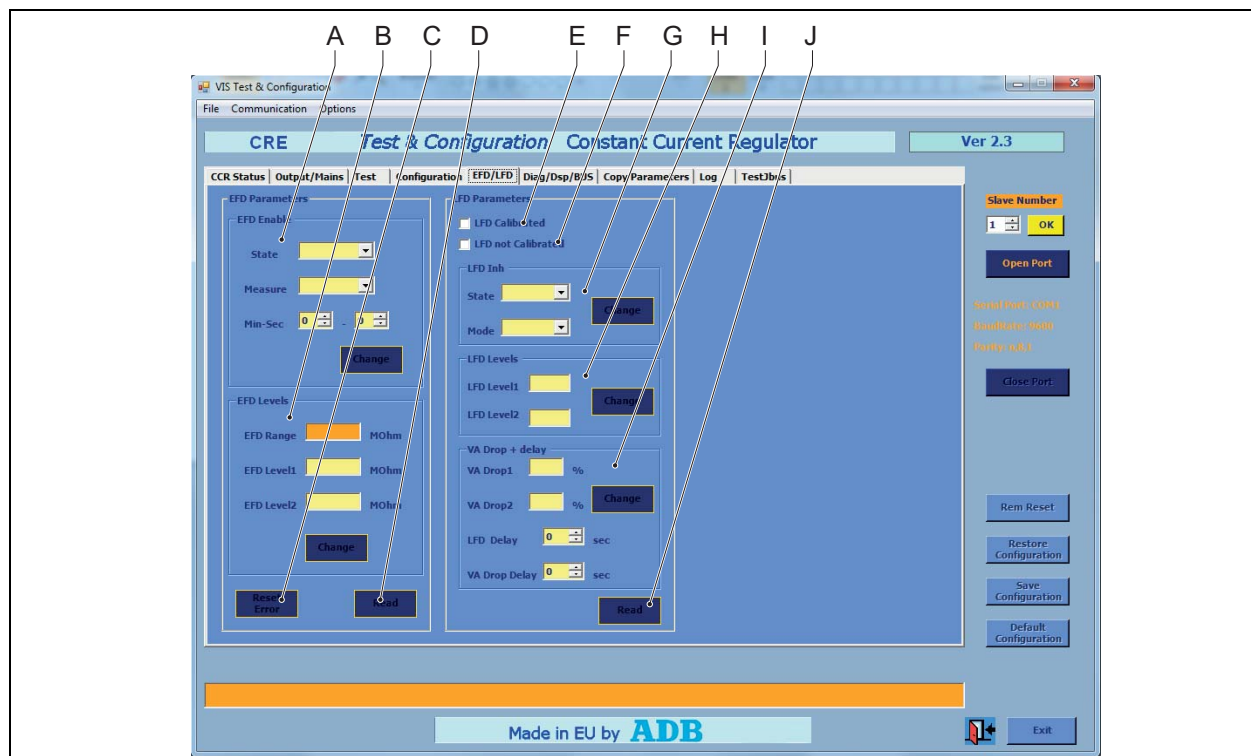
### 5.5.3 SN/YearCode

Item	Description
YearCode/SN	To change the production year and the serial number.
Change	To activate the value and to send it to the equipment.

### 5.5.4 Maintenance Password

Item	Description
Old Password	Shows the current maintenance password.
New Password	To adjust the maintenance password.
Confirm Password	Copy the adjusted maintenance password for confirmation.
Change	To activate the value and to send it to the equipment.

## 5.6 EFD/LFD screen



		Description
A	EFD Enable	See § 5.6.1.
B	EFD Levels	See § 5.6.2.
C	Reset error	To reset the EFD error.
D	Read	To read the actual EFD parameters from the selected equipment.
E	LFD Calibrated	Shows if the LFD is calibrated.
F	LFD not Calibrated	Shows if the LFD is not calibrated.
G	LFD Inh	See § 5.6.3.
H	LFD Levels	See § 5.6.4.
I	VA Drop + delay	See § 5.6.5.
J	Read	To read the actual LFD and VA Drop parameters from the selected equipment.

### 5.6.1 EFD Enable

Item	Description
State	To select if the EFD measurement is enabled or disabled.
Measure	If the EFD measurement is enabled, you can choose between these values: <ul style="list-style-type: none"> <li>- Interval: the interval between measurements is indicated in the Min-Sec field.</li> <li>- Continuous: the equipment measure continuously. The Min-Sec field is not active.</li> </ul>
Min-Sec	To set the time between measurement if the measurement is set as interval.
Change	To activate the value and to send it to the equipment.

### 5.6.2 EFD Levels

Item	Description
EFD Range	Shows the maximum earth leakage value the equipment can measure.
EFD Level1	To adjust the insulation resistance below which the equipment gives the EFD Level 1 alarm.
EFD Level2	To adjust the insulation resistance below which the equipment gives the EFD Level 2 alarm.
Change	To activate the value and to send it to the equipment.

### 5.6.3 LFD Inh

Item	Description
State	To select if the LFD is enabled or not.
Mode	To choose between different LFD modes: <ul style="list-style-type: none"> <li>- Normal: both the LFD 1 and 2 Levels are active.</li> <li>- Degraded: only LFD 2 Level is active.</li> </ul>
Change	To activate the value and to send it to the equipment.

### 5.6.4 LFD Levels

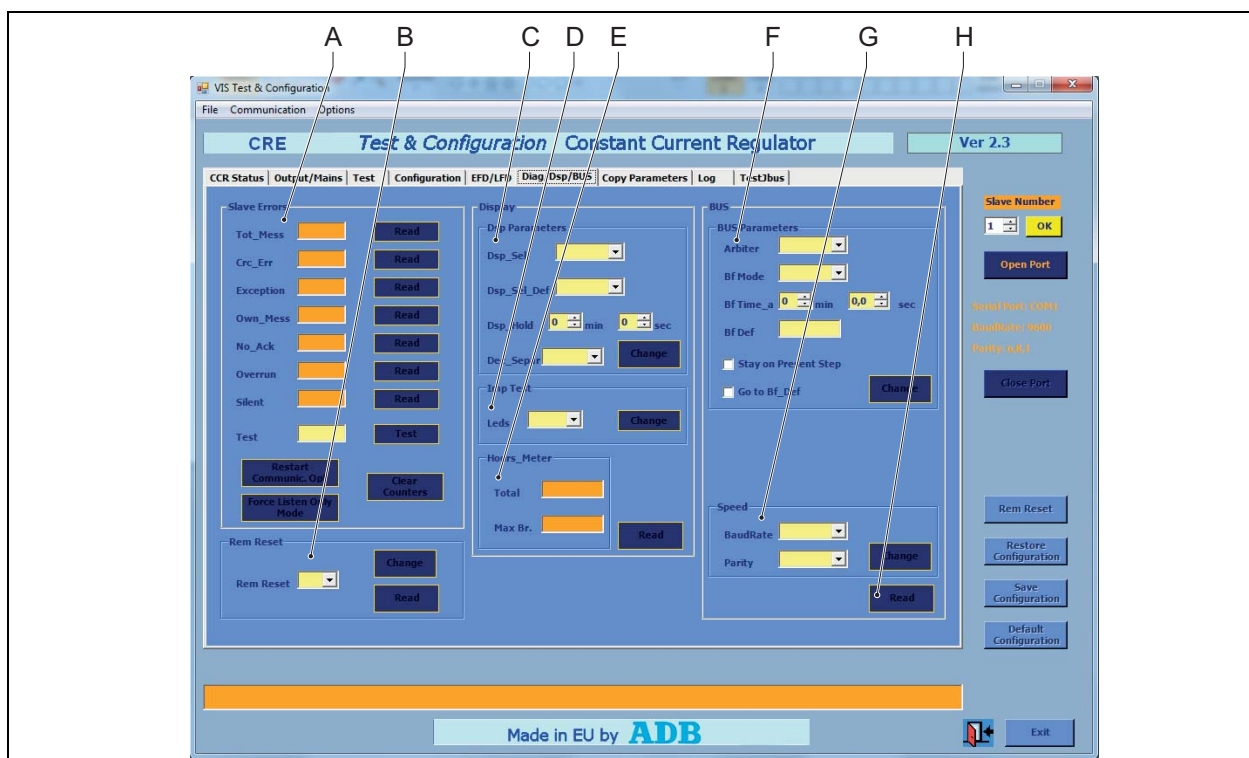
Item	Description
LFD Level1 and Level2	To adjust the threshold above which the equipment gives the LFD Level 1 and Level 2 alarm.
Change	To activate the value and to send it to the equipment.



### 5.6.5 VA Drop + delay

Item	Description
VA Drop1 and Drop2	To adjust the threshold above which the equipment gives the VA Drop 1 and Drop 2 alarm.
LFD Delay	To adjust the minimum time span after the error before the equipment gives the LFD Level 1 or Level 2 alarm.
VA Drop Delay	To adjust the minimum time span after the error before the equipment gives the VA Drop 1 or Drop 2 alarm.
Change	To activate the value and to send it to the equipment.

## 5.7 Diag/Dsp/BUS screen



		Description
A	Slave errors	See § 5.7.1.
B	Rem Reset	See § 5.7.2.
C	Dsp parameters	See § 5.7.3.

		Description
D	Imp Test	See § 5.7.4.
E	Hours_Meter	See § 5.7.5.
F	Bus Parameters	<ul style="list-style-type: none"> <li>- Arbiter: To set the signal source for remote control. To set a priority for different systems. If you set this parameter to disabled, remote control is not possible.</li> <li>- BF Mode: Use <i>normal</i> or <i>stop bar</i>.</li> <li>- BF Time: The time after which the equipment starts to use the default settings.</li> <li>- BF Def: To set default values that the equipment uses when the remote control (J-Bus) connection is down for longer than the time set in the menu. Leave this field blank or set a value from 1 to 8.</li> <li>- Select either <i>Stay on Prevent</i> step or <i>Go to Bf-Def</i>.</li> </ul>
G	Speed	See § 5.7.7.
H	Read	To read the actual J-Bus parameter of the equipments.

**Note**

To show the screen part with the bus parameters, select **Options>Advanced**.

**5.7.1 Slave Errors**

Item	Description
Read buttons	To read the actual slave error from the selected equipment.
Tot_Mess	Shows the number of messages that the equipment received.
Crc_Err	Shows the number of messages with checksum that the equipment received.
Exception	Shows the number of messages with wrong commands that the equipment received.
Own_Mess	Shows the number of messages that belong to the selected equipment.
No_Ack	Shows the number of messages for which the equipment did not receive a reply.
Overrun	Shows the number of messages with overrun that the equipment received.
Silent	Shows the if the equipment replies to messages: <ul style="list-style-type: none"> <li>- 0: the equipment replies to messages.</li> <li>- 1: the equipment goes not reply to messages.</li> </ul>
Test field	To test the communication. You can enter a number in the field to test.
Test button	To test the communication with the value in the test field.
Restart Communic.Opt	To set all counters to 0 and the silent value to 0.
Force Listen Only Mode	To set the silent field to 1 and to force the equipment to reply to messages.
Clear Counters	To set all counters to 0 but not to change the silent value.

### 5.7.2 Rem Reset

Item	Description
Rem Reset	To enable or disable the Rem Reset button. - 1: the Rem Reset button is enabled. - 0: the Rem Reset button is disabled.
Change	To activate the value and to send it to the equipment.
Read	To read the actual Rem Reset parameter from the selected equipment.

### 5.7.3 Dsp Parameters

Item	Description
Dsp_Sel	To select what the HMI shows optionally. You can choose from four parameters. The HMI only shows the selected parameter. - LAMP: the number of broken lamps. - VA_Out: the VA output. - VA_Out%: the percentage of the VA output. - LMP_Test: to carry out a display test.
Dsp_Sel_Def	To select what the HMI shows optionally. You can choose from four parameters. The HMI shows the selected parameter, but only for the time indicated in the DSP_Hold field. - LAMP: the number of broken lamps. - VA_Out: the VA output. - VA_Out%: the percentage of the VA output. - LMP_Test: to carry out a display test.
Dsp_Hold	To adjust the time the HMI shows the optional parameter.
Dec_Separ	To adjust the decimal separator for the UI (, or .).
Change	To activate the value and to send it to the equipment.

### 5.7.4 Imp Test

Item	Description
Leds	To carry out a test on the LEDs of the keyboard on the HMI. The LED adjacent to the DB9 connector comes on.
Change	To activate the value and to send it to the equipment.

### 5.7.5 Hours\_Meter

Item	Description
Total	Shows the total time that the equipment is set to 'on' in h.
Max Br.	Shows the time that the equipment operates at the maximum brightness step in h.
Read	To read the actual hours parameters from the selected equipment.

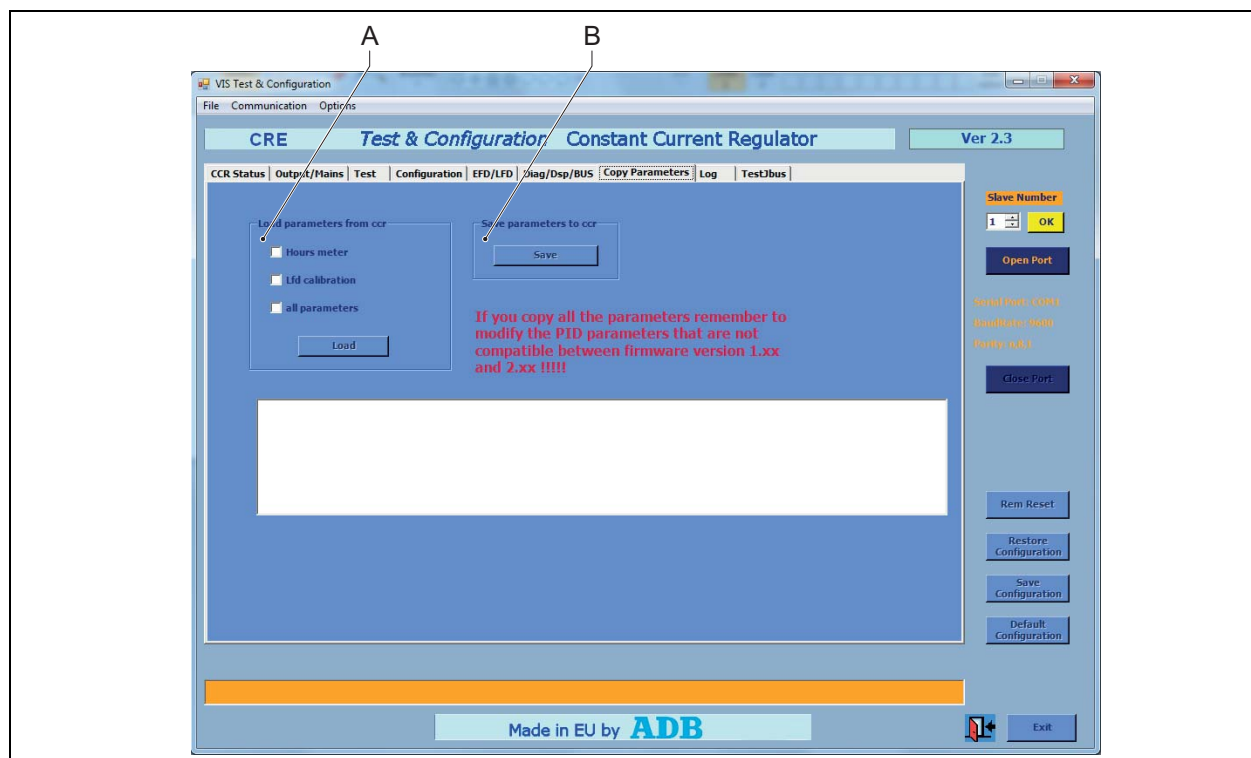
### 5.7.6 Rem Reset Circuit selector

Item	Description
Circuit selector	When the boxed is checked, the circuit selector will be reset.
Change	To activate the value and to send it to the equipment.
Read	To read the actual Circuit selector parameter from the selected equipment.

### 5.7.7 Speed

Item	Description
BaudRate	To adjust BaudRate of the J-Bus connection between the equipments.
Parity	To adjust the parity of the J-Bus connection between the equipments.
Change	To activate the value and to send it to the equipment. Do not change the speed parameters when you connect the equipment with the ethernet line.

## 5.8 Copy Parameters screen

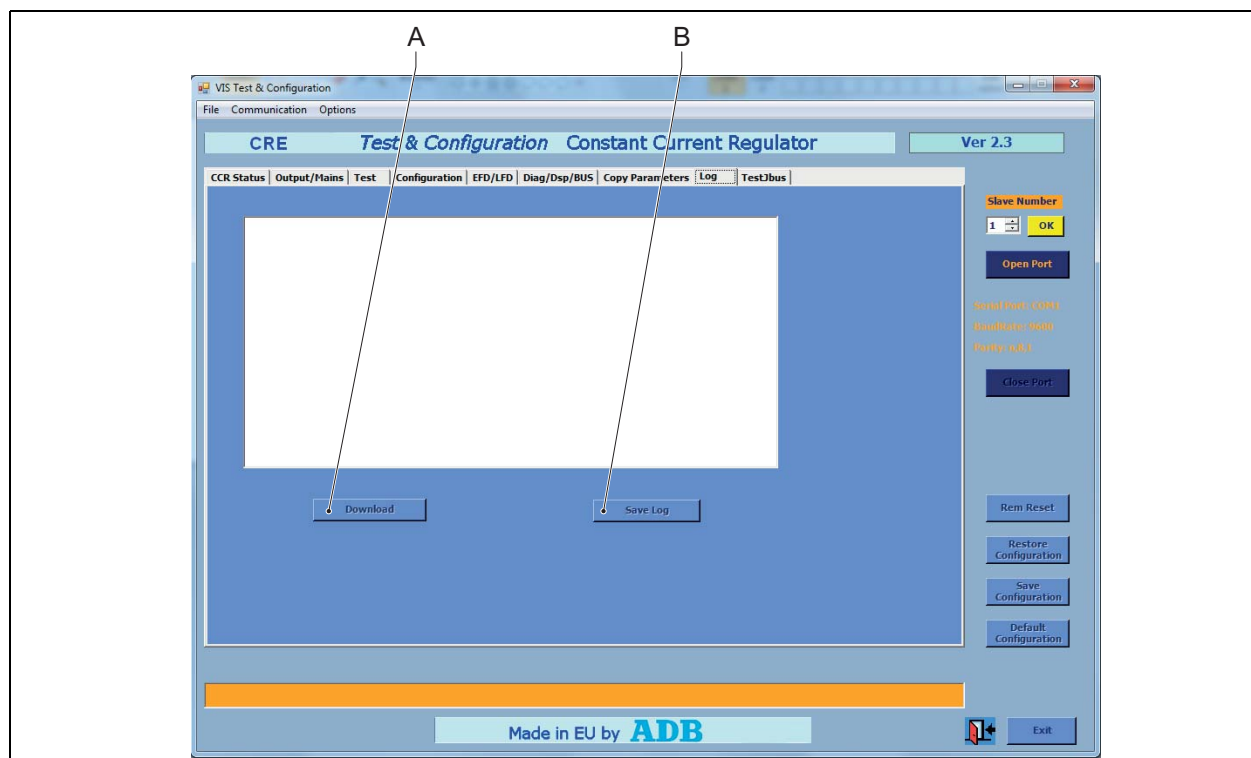


		Description
A	Load parameters from ccr	See § 5.8.1.
B	Save	To save the parameters from the PC to the selected equipment.

### 5.8.1 Load parameters from ccr

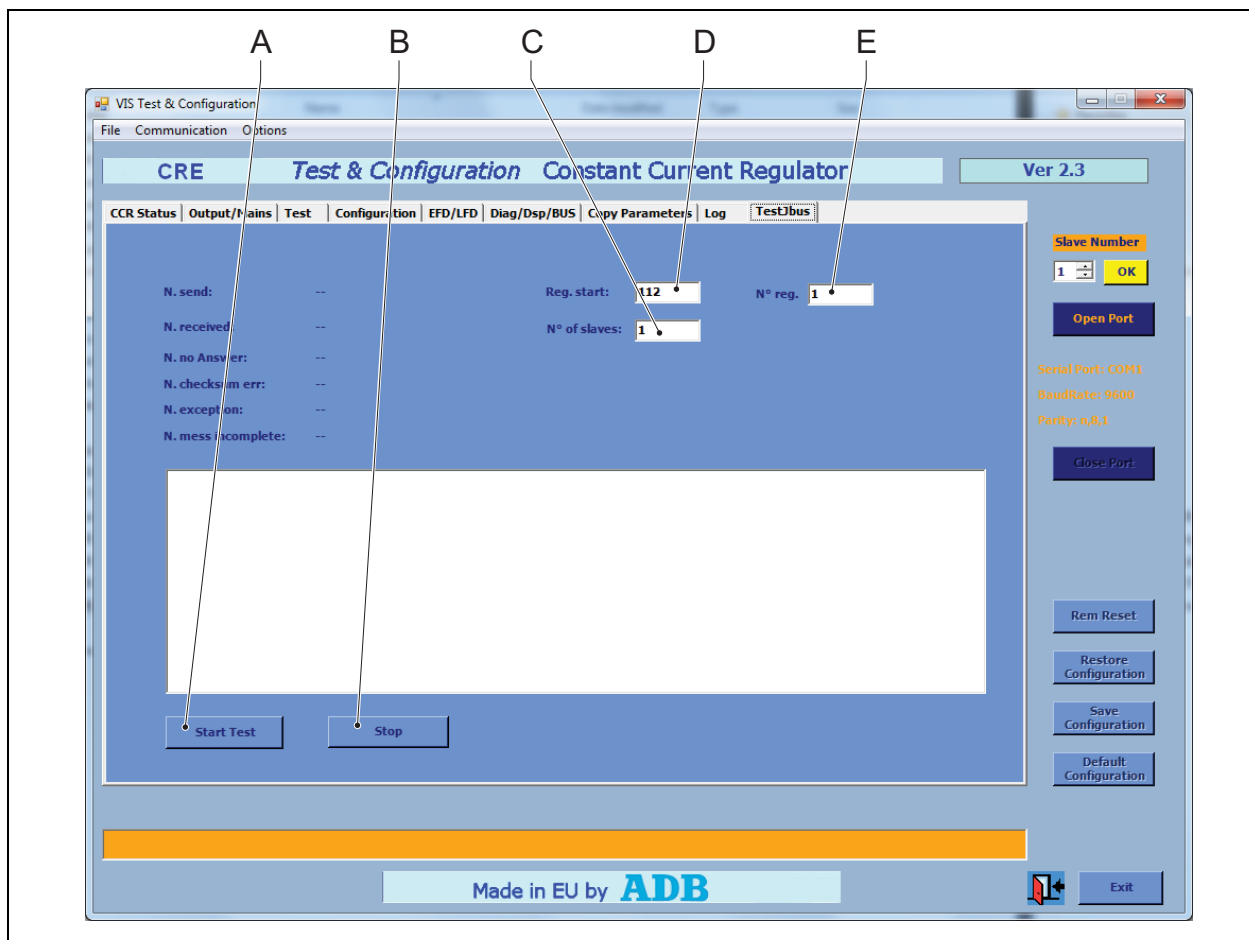
Item	Description
Hours meter	To select if you want to load/save the hours meter values of the equipment.
Lfd calibration	To select if you want to load/save the LFD calibration parameters of the equipment.
all parameters	To select if you want to load/save the all parameters of the equipment.
Load	To load the selected parameters to the PC.

## 5.9 Log screen



		Description
A	Download	To show the history file of the selected equipment in the Log screen.
B	Save Log	To save the log file to the PC.

## 5.10 Test JBus screen



		Description
A	Start Test	To start the test.
B	Stop	To stop the test.
C	No. of slaves	Shows the number of slaves.
D	Reg. start	
E	No. of reg	

## 6 Circuit selector web interface (option CS)

### 6.1 Description of settings

The screenshot displays the Circuit selector web interface. It features a table of series circuits data (labeled B) and a configuration settings panel (labeled A).

**Table B: Series Circuits Data**

	Presence	Status Relay	Current	24V	3.3V	frm.rel	
RELC 0	Yes	open	19	24	ok	242	RELAY ON RELAY OFF
RELC 1	Yes	open	18	24	ok	242	RELAY ON RELAY OFF
RELC 2	Yes	open	18	23	ok	241	RELAY ON RELAY OFF
RELC 3	Yes	open	20	23	ok	242	RELAY ON RELAY OFF
RELC 4	Yes	open	19	23	ok	242	RELAY ON RELAY OFF
RELC 5	Yes	open	17	23	ok	242	RELAY ON RELAY OFF
RELC 6	no	open	0	0	ko	0	RELAY ON RELAY OFF
RELC 7	no	open	0	0	ko	0	RELAY ON RELAY OFF

**WARNING: switch ON/OFF the relays with the CCR ON can be very dangerous!**

**Configuration**

Mode: ☐ ALTERNATE ☒ ALTERNATE ☐ SIMULTANEOUS

Key Local/remote enabled:

Power supply:  Firmware rev.:

Relay type:

Alarms:

Circuits number:

Current threshold:

C1-C8 inputs inverted:

C1-C8 outputs inverted:

LRN:

A Configuration settings

B Series circuits data

**Table: 6.1 Configuration settings**

Setting	Description
Mode	Simultaneous: free circuit selection Alternate: only 1 circuit selection is possible (only for 2 way CS)
Key local/remote enabled	Set to: DISABLE
Circuits number	The number of used series circuits
Current threshold	Set to: 1500
C1-C8 inputs inverted	Set to: NORMAL
C1-C8 outputs inverted	Set to: NORMAL
LRN	Set to: LRN - disabled - REST = long press

**Table: 6.2 Series circuits data**

Item	Description
Presence	YES for detected relays NO for undetected relays
3.3V	OK for all connected CS PCBs KO for all not connected CS PCBs
24V	Input voltage measured by the CS PCB
Status relay	To check the correction functioning of the relay, push the buttons RELAY ON and RELAY OFF
Current	The output current that the CS PCB measures
frm.rel	Firmware version on the interface PCB



## 7 Install and operate the configuration software tool

### 7.1 Install the configuration tool software

#### *Requirements*

System requirements:

- PC with Microsoft Windows 2000, XP operation system, or later;
- At least 50 Mbytes free disk space;
- 1 free serial communication (COM) port, or a virtual serial communication port over a USB bridge or a PCMCIA card;
- PC user account with either administrator or power user rights.

1. Move the WINCCR.exe file from the CD-ROM to the harddrive of the PC.

### 7.2 Start the configuration software tool

#### *Activate the serial port, if applicable*

1. On the HMI, push the **MENU** button to go to the Main menu.
2. Push the **SER/JBUS** button to go to the SER/JBUS screen.
3. Push the **SERIAL** button to activate the serial port.

#### *Configure the ethernet port, if applicable*

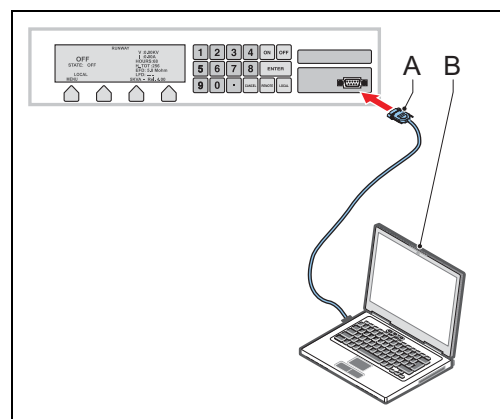
1. On the HMI, push the **MENU** button to go to the Main menu.
2. Push the **MORE** button to go to the Mode screen.
3. Push the **ETHERNET CONFIGURATION** button to configure the ethernet port.

#### *Find the slave number of the equipment*

1. On the HMI, push the **ESC** button to go to the Main menu.
2. Push the **OPTIONS** button to go to the Options menu.
3. Push the **SLVNUM** button to show the slave number.
4. Take a note of the slave number. You will need it for reference later.

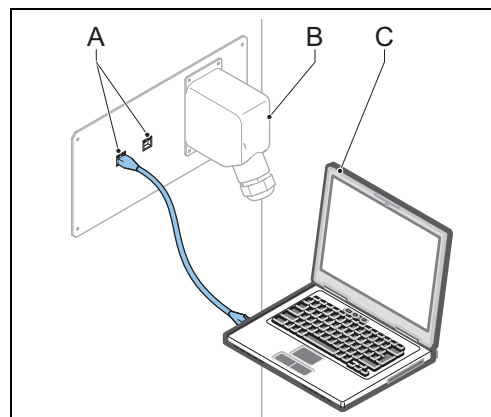
#### *Connect the serial cable, if applicable*

1. Switch OFF the equipment. See § 9.2.
2. Connect the extension cable to the dongle (A) and to the serial communication port of the PC (B).



*Connect ethernet cable, if applicable*

1. Switch OFF the equipment. See § 9.2.
2. Connect the ethernet cable (B) to the equipment (A) and to the PC (C).



*Configure the remote control ethernet connection*

1. Make sure that the IP range of the PC is in the same range as the device.
2. Access the web control interface of the device.
3. From the **Network Settings** control panel, set the IP address, Netmask, and IP configuration to the values of the network that the Ethernet board uses.
4. From the **Serial Settings** control panel, make sure that the serial parameters have the values that follow:
  - Baud Rate: 9600
  - Data Bits: 8
  - Stop Bits: 1
  - Parity: None
5. From the **Operating Settings** control panel, make sure that the Port=01 parameters have the values that follow:
  - Operation mode: TCP Server Mode
  - TCP alive check time: 0
  - Inactivity time: 5000
  - Max connection: 1
6. Make sure the **Data Packing** parameters have the values that follow:
  - Delimiter 1: 0. Do not select Enable.
  - Delimiter 2: 0. Do not select Enable.
  - Force transmit: 10
7. Make sure the **TCP Server Mode** parameters have the values that follow:
  - Local TCP port: 502
  - Do not select Apply the above settings to all serial ports.
8. From the **Serial Command Mode** control panel, make sure the serial parameters have the values that follow:
  - Trigger Setting: HW Trigger
  - SW Trigger Character: 2B 2B 2B

*Start software*

1. Switch the equipment ON.
2. Click the WINCCR.exe file in the directory where you installed the software. *The configuration tool opens on the CCR Status screen.*

*Setup the serial port, if applicable*

1. Select the menu **Communication**.
2. Select the applicable serial communication port (COM).



**Note**

**The baud rate and parity settings for the communication between the PC and the equipment must be the same. For the dongle, the default baud rate is 9600 and the default parity setting is None.**

3. Push the **OK** button to confirm the settings.
4. Push the **Open Port** button to open the selected serial port.
  - *If the settings are correct, the yellow OK button is enabled and the message bar shows the message 'Port opened'.*
  - *If the settings are not correct, the bottom bar shows an error message.*

*Setup the ethernet port, if applicable*

1. Select the menu **Communication>Ethernet**.
2. Select the applicable IP address and Port.
3. Push the **OK** button to confirm the settings.
4. Push the **Open Port** button to open the selected serial port.
  - *If the settings are correct, the yellow OK button is enabled and the bottom bar shows the message 'Port opened'.*
  - *If the settings are not correct, the bottom bar shows an error message.*

## 7.3 Monitor the data of an equipment

*Select the equipment*

1. Select the slave number of the equipment you want to monitor.
2. Push the **OK** button.

*Start to monitor*

1. Select the CCR status screen. See § 5.2.
2. Push the **Start** button. *The screen shows the data of the selected equipment.*

*Stop to monitor*

1. Push the **Stop** button. *The screen does no longer show the data of the selected equipment.*

## 7.4 Stop the configuration software tool

1. Serial connection: Disconnect the extension cable from the dongle and the PC connector of the equipment.
2. Ethernet connection: Disconnect the ethernet cable from the PC and the equipment.



## 8 Commissioning

### 8.1 Main commissioning procedure

1. Do the first start-up. See § 8.2.
2. Calibrate the Lamp Fault Detection (LFD) module. See § 8.3.
3. Adjust the number of available brightness steps. See § 9.6.
4. Configure the remote control interface (option). See § 8.4, § 8.5 and/or § 8.6 dependent upon the hardware.

### 8.2 First start-up

The equipment stores the last request after a power cycle. This means that when the equipment is switched ON, it starts to produce the same output current that was valid before the equipment was switched OFF.

When you start up the equipment for the first time, the powering-down status is unknown. This procedure allows to prevent the equipment to produce output current at the first start-up.

#### 8.2.1 Procedure

1. Measure the input voltage. See § 8.2.2 or § 8.2.3.
2. Measure the output current in short circuit. See § 8.2.4.
3. Measure the resistance and the insulation resistance of the series circuit. See § 8.2.10.
4. Measure the output current to the series circuit. See § 8.2.18.

#### 8.2.2 Measure input voltage on big and small cabinets

##### *Prepare*

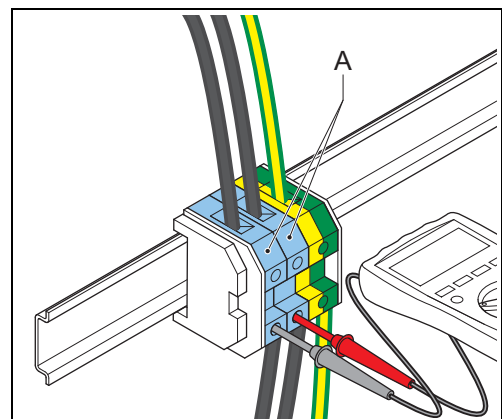
1. Make sure that the manual switch is in the OFF position. See § 9.3.
2. Remove the lower rear panel. See § 11.3.
3. Set the manual switch to the ON position.
4. On the HMI, push the **Local** button. *The screen now shows the state LOCAL.*
5. Push the **OFF** button. The equipment goes to the mode OFF.

##### *Measure*

1. Measure the input voltage on the input terminals (A). *Use a True RMS Multimeter.*
2. Examine if the voltage is in accordance with:
  - The nameplate of the equipment.
  - Local regulations.



**CAUTION**  
An excessive input voltage can damage the equipment.



##### *Finish*

1. Switch off the power supply. See § 9.3.
2. Install the lower rear panel.

### 8.2.3 Measure input voltage on stackable cabinet

#### Prepare

1. Set the manual switch to the ON position.
2. On the HMI, push the **Local** button. *The screen now shows the state LOCAL.*
3. Push the **OFF** button. The equipment goes to the mode OFF.

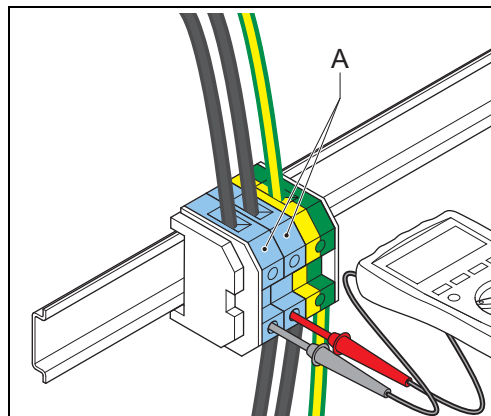
#### Measure

1. Measure the input voltage on the pins 1 and 3 (A). *Use a True RMS Multimeter.*
2. Examine if the voltage is in accordance with:
  - The nameplate of the equipment.
  - Local regulations.



#### CAUTION

An excessive input voltage can damage the equipment.



#### Finish

1. Switch off the power supply. See § 9.3.
2. Install the lower rear panel.

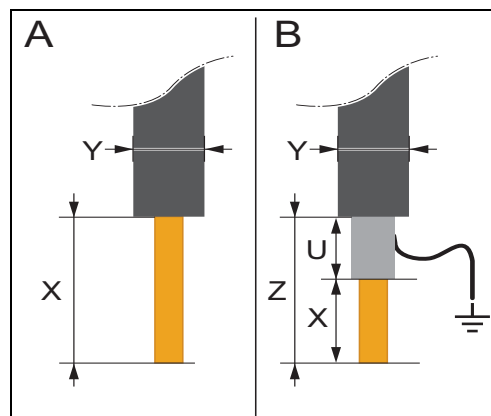
### 8.2.4 Measure output current in short-circuit

1. Make sure that all power to the equipment is OFF. See § 9.3.
2. Put the output in short-circuit. For SCB, see § 8.2.5. For SCO, see § 8.2.6.
3. Measure the output current in short-circuit. See § 8.2.7.
4. Make sure that all power to the equipment is OFF. See § 9.3.
5. If you use an SCB: Remove the separate piece of cable and connect the series circuit cables. See § 8.2.5.
6. If you use an SCO: set the SCO to mode A. See § 9.8.

### 8.2.5 Put SCB in short-circuit

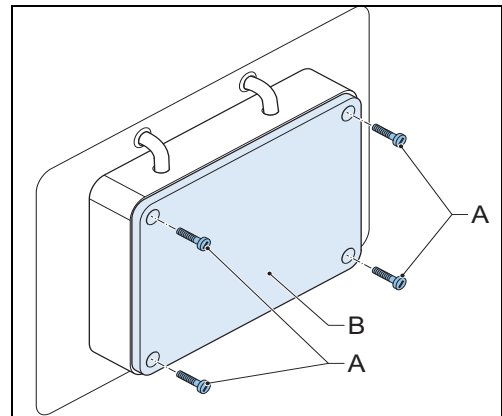
#### Strip cables

1. Strip a separate piece of series circuit cable at both ends.
  - A: unscreened cables
    - X: 16 mm
    - Ø Y: less than or equal to 18 mm
  - B: screened cables
    - X: 16 mm
    - Ø Y: less than or equal to 18 mm
    - U: 11 mm
    - Z: 77 mm



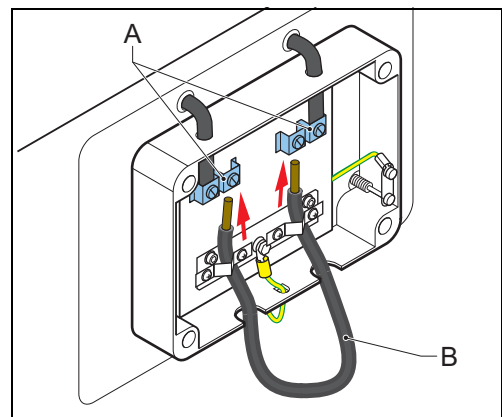
*Remove the box panel of the SCB*

1. Loosen the screws (A).
2. Remove the box panel (B).



*Short circuit SCB with separate piece of output cable*

1. Disconnect the series circuit cables.
2. With the separate piece of output cable (B), short-circuit the output terminals (A).
3. Install the box panel.



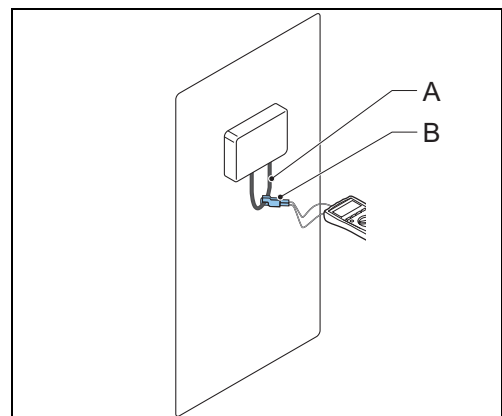
#### **8.2.6 Put SCO in short circuit**

1. Set the SCO to mode C. See § 9.8.

#### **8.2.7 Measure the output current in short circuit**

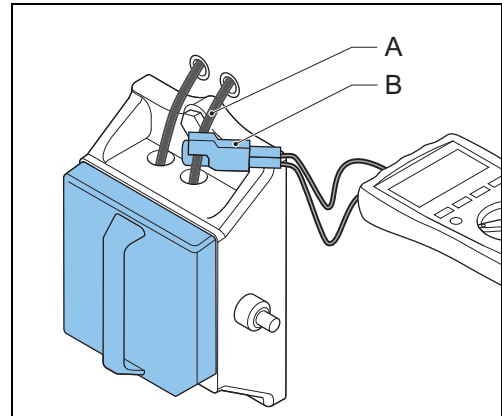
*Connect AC True RMS multimeter (SCB)*

1. Connect the current clamp of an AC True RMS multimeter (B) to the short-circuited cable (A).



### Connect AC True RMS multimeter (SCO)

1. Connect the current clamp of an AC True RMS multimeter (B) to the output cable (A).



### Measure output current

1. Switch ON the equipment and set it to LOCAL mode. See § 9.1.
2. Select the step 6.6 A.
3. Read the output current value from the AC True RMS Multimeter.
4. Repeat the previous steps and examine the output current value for each brightness step. *Check each brightness step separately from the highest to the lowest level.*

### 8.2.8 Test CS in short-circuit (option CS)

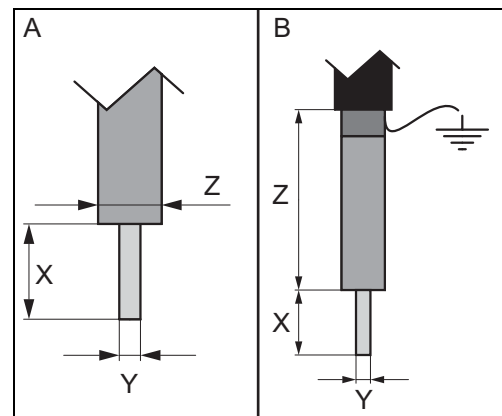
Test the CS to make sure that the equipment produces the correct output current.

#### Prepare

1. Make sure that all power to the equipment is OFF. See § 9.2.
2. Remove the front panel and the CS cabinet panel. See § 11.3.
3. Remove the output cable.

#### Strip cable

1. Strip a separate piece of output cable:
  - A: unscreened cables
    - X: 16 mm;
    - $\varnothing$  Y: less than or equal to 7 mm;
    - $\varnothing$  Z: less than or equal to 12 mm.
  - B: screened cables
    - X: 14 mm;
    - $\varnothing$  Y: less than or equal to 14 mm;
    - Z: less than or equal to 50 mm.





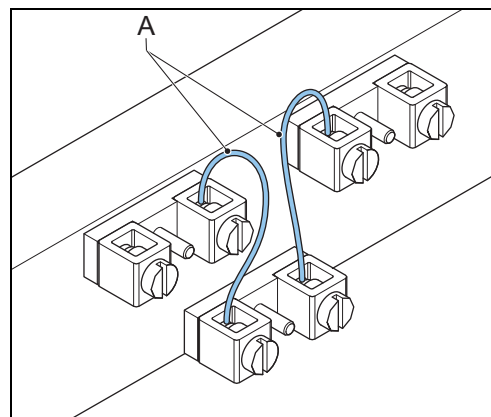
### Short-circuit

1. With the separate piece of output cable, short-circuit the series circuit terminals (A).



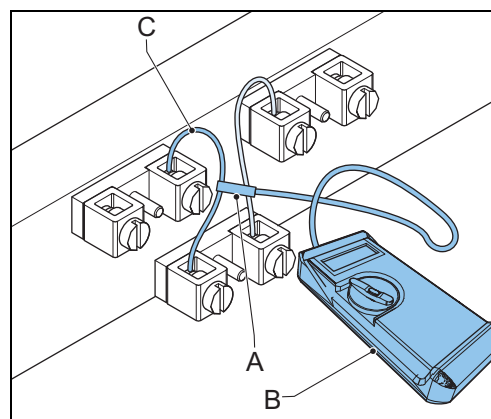
#### Note

The illustration shows an equipment with connections to two series circuits, both in short-circuit. The procedure for more or less series circuits is similar.



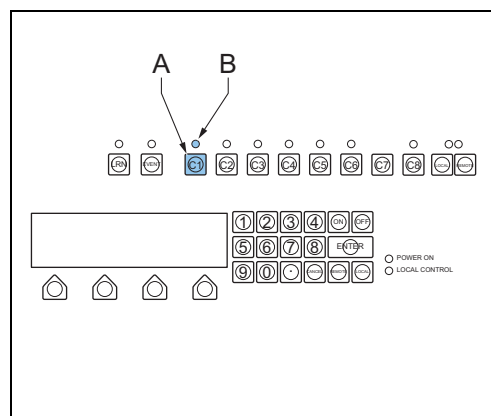
### Connect AC True RMS multimeter

1. Connect an AC current clamp (A) and a True RMS multimeter (B) to the first short-circuited cable (C).



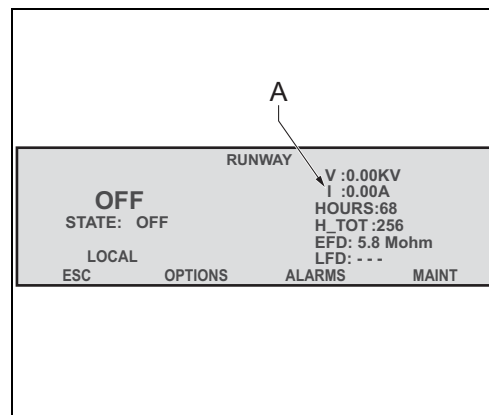
### Activate Circuit 1

1. Switch ON the equipment. See § 9.1.
2. Push the **C1** button (A) to select **Circuit 1**. The indicator for circuit 1 (B) goes on.



### Measure

1. Adjust the brightness step until the HMI shows 6.6 A for True RMS output current (A). See § 9.5.
2. If the output current on the AC True RMS multimeter does not reach 6.6 A, change the series circuit configuration before you proceed.
3. Repeat the previous steps and examine the output current value for each step. *Go through all steps separately from the highest to the lowest level.*



### Repeat

1. Make sure that all power to the equipment is OFF. See § 9.2.
2. Install the AC True RMS multimeter on the next circuit.
3. Activate the next circuit.
4. Measure the output current for the next circuit.
5. Repeat the previous steps for all circuits.

### Repeat

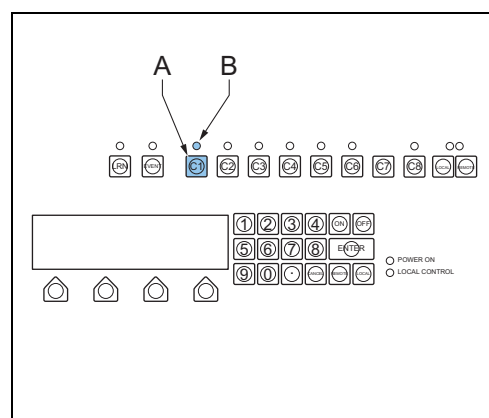
1. Make sure that all power to the equipment is OFF. See § 9.2.
2. Install the front panel and the CS cabinet panel.

### 8.2.9 Measure output current series circuit (option CS)

The procedure applies to simultaneous circuit selectors. For alternate circuit selectors, measure each circuit separately.

### Prepare

1. Switch ON the equipment. See § 9.1.
2. Push the **C1** button (A) to select **Circuit 1**. *The indicator for circuit 1 (B) goes on.*
3. Do the previous step again and select all circuits.



### Measure

1. Adjust the brightness step until the HMI shows 6.6 A for True RMS output current (A). See § 9.5.
2. If the output current does not reach 6.6 A, change the series circuit configuration before you proceed.
3. Examine if all lights to the respective circuits have a similar current level. *Go to the runway area to make a visual inspection.*

*Finish*

1. Disable each circuit one by one menu (the indicators must be OFF). *After you disable a circuit, check that the lights in that circuit go OFF.*
2. Set the equipment to OFF. See § 9.2.

**8.2.10 Measure resistance and the insulation resistance of series circuit**

1. Prepare the series circuit. For SCB, see § 8.2.11. For SCO, see § 8.2.12.
2. Measure the resistance of the series circuit. See § 8.2.13.
3. Measure the insulation resistance of the series circuit. See § 8.2.14.
4. Calculate minimum insulation resistance of series circuit. See § 8.2.15.
5. Calculate resistance of series circuit See § 8.2.16.
6. Complete the activities. See § 8.2.17.

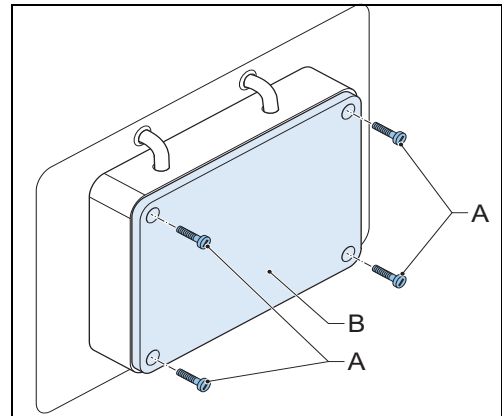
**8.2.11 Prepare with SCB**

*Set power to OFF*

1. Make sure that all power to the equipment is OFF. See § 9.3.

*Remove the box panel*

1. Loosen the screws (A).
2. Remove the box panel (B).



*Discharge the output terminals*

1. Discharge the output terminals.
2. Completely remove the series circuit cables, also the shielding, if applicable.

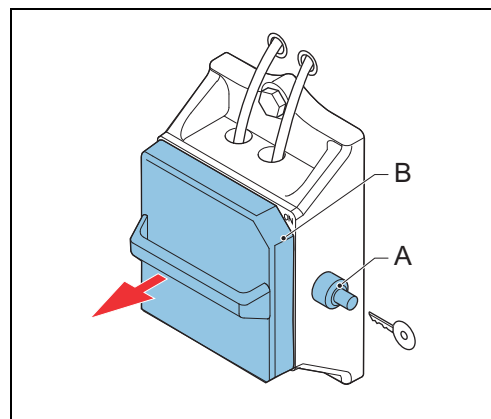
### 8.2.12 Prepare with SCO

Set power to OFF

1. Make sure that all power to the equipment is OFF. See § 9.3.
2. Set the SCO to mode C. See § 9.8. *The output terminals are now discharged.*

Remove cover

1. Open the lock (A).
2. Remove the cover (B). *Use the handle.*

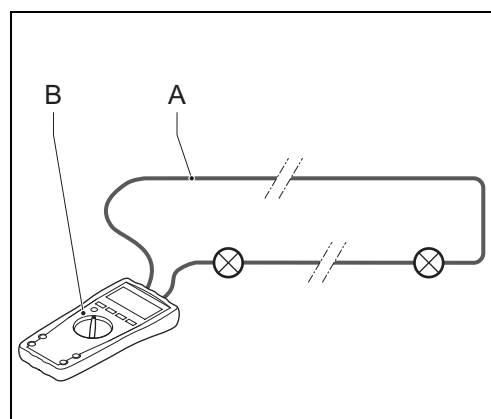


Remove series circuit cables

1. Completely remove the series circuit cables, also the shielding, if applicable.

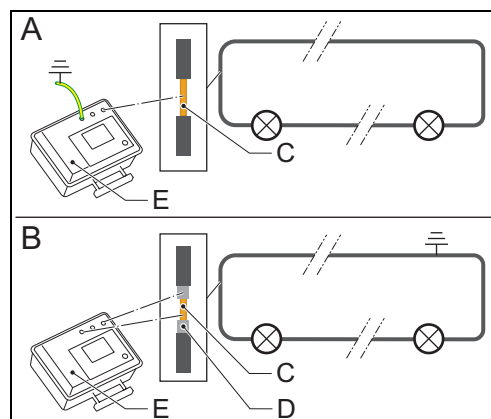
### 8.2.13 Measure resistance of series circuit

1. Measure the resistance: measure on the ends of the series cable (A). *Use a multimeter (B), in accordance with local regulations.*



### 8.2.14 Measure insulation resistance of series circuit

1. Join the ends of the series circuit cables (C).
2. Measure the insulation resistance of the series circuit. *Use the insulation tester (E). Megger 5000 V or 10000 V, in accordance with local regulations.*
  - A: when the series circuit cable is not shielded
  - B: when the series circuit cable is shielded. Measure the earth on the shield (D).



### 8.2.15 Calculate minimum insulation resistance of series circuit

**Table: 8.1 Theoretical insulation resistance for the series circuit**

Item	Maximum insulation resistance current (standard: ICAO, part 5, § 3.9.4.7) [ $\mu$ A]
Series transformer	2
100 m of cable with standard number of connectors	1

Example: a runway centre-line circuit with 133 light fixtures with a total length of the series circuit of 8 km.

- Allowed insulation resistance current for the transformers is  $133 \times 2 = 266 \mu\text{A}$
- Allowed insulation resistance current the cable is  $80 \times 1 = 80 \mu\text{A}$
- Total allowed insulation resistance current for this circuit is  $266 \mu\text{A} + 80 \mu\text{A} = 346 \mu\text{A}$
- When you test with 5000 V, according to Ohms law, the minimum resistance is 14 MOhm.

### 8.2.16 Calculate resistance of series circuit

$$R_{\text{prim}} = \rho \times L/A + y \times 0.1212$$

Where:

- $R_{\text{prim}}$  = resistance of the series circuit in Ohm
- $\rho = 18 \times 10^{-3}$  (Ohm  $\times$  mm<sup>2</sup>)/m
- L = length of the circuit in m
- A = section of the cable in mm<sup>2</sup>
- y = number of series transformers in the circuit

Example:

circuit length is 8000 m

cable section is 6 mm<sup>2</sup>

number of series transformers is 122

Then  $R_{\text{prim}} = (18 \times 10^{-3}) \times 8000/6 + 122 \times 0.1212 = 36.7 \text{ Ohm}$

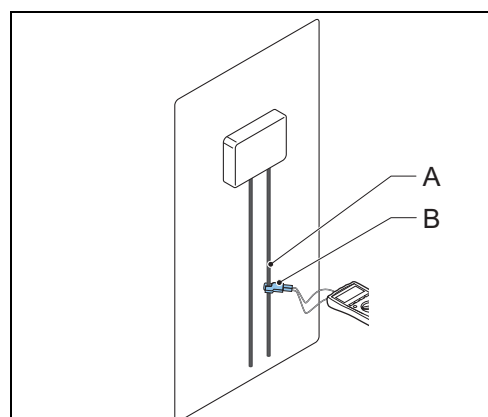
### 8.2.17 Complete the measurement

1. Make sure that the measured and the calculated values match and that all the values are in accordance with all local safety regulations.
2. Connect the series circuit cables to the equipment.
3. Install the cover or the box panel.

### 8.2.18 Measure the output current to the series circuit

Prepare

1. Make sure that the series circuit is measured and approved. See § 8.2.10.
2. Make sure that all power to the equipment is OFF. See § 9.3.
3. Make sure that the series circuit is connected.
4. Connect an AC current clamp (B) to the series circuit cable (A).



#### Measure

1. Switch ON the equipment and set it to LOCAL mode. See § 9.1.
2. Select the step 6.6 A.
3. If the output current does not reach 6.6 A, change the series circuit configuration before you proceed.  
*This indicates that the equipment is too small for the load.*
4. Compare the output current reading on the HMI with the reading on the True RMS Multimeter.
5. Examine if the output current readings are in accordance with local regulations.
6. If not, do not continue.

#### Check brilliancy level

1. Examine if all light fittings have the same brilliancy level. *Go to the runway area to make a visual inspection.*
2. Examine all the brightness steps separately. *Go through the whole procedure for each brightness step.*

#### Finish

1. Wait for approximately 30 minutes and make sure that the equipment works correctly.
2. Make sure that all power to the equipment is OFF. See § 9.3.

## 8.3 Calibrate Lamp Fault Detection (LFD)

Do this procedure to make sure that the equipment indicates the correct number of broken lamps. See § 3.5.12 for the accuracy of the LFD.



#### CAUTION

The LFD module does not work if the series circuit includes these types of lights:

- LED lights without the monitoring option;
- PVO/PVL lights (guidance signs);
- WIGWAG (runway guard lights).

#### Make sure that all lamps in the series circuit operate

1. Make sure that the equipment is connected to the series circuit.
2. Switch ON the equipment and set it to LOCAL mode. See § 9.1.
3. Set the equipment to the highest brightness step. See § 9.5.
4. Examine if all light fittings light up. *Go to the runway area to make a visual inspection.*
5. Push the **OFF** button on the UI.

#### Select LFD calibration

1. On the HMI, push the **OPTIONS** button to go to the Options menu.
2. Push the **LFD** button. *The HMI asks if you want to do the calibration.*
3. Push the **Yes** button. *The HMI asks the number of burnt lamps (0 - 99).*
4. Select '0', no broken lamps.
5. Wait until the equipment shows the Main screen. See § 4.3.

#### *Remove lamps*

1. Make sure that all power to the equipment is OFF. See § 9.3.
2. Earth the series circuit.
  - With the SCO. See § 9.8.
  - With an earthing wire on the SCB.
3. Remove a number of lamps in the field.



#### **Note**

**Choose the number of lamps in function of the alarm level you use. By default, 8 to 10 lamps.**

4. Switch ON the equipment and set it to LOCAL mode. See § 9.1.

#### *Set number of removed lamps*

1. On the HMI, push the **OPTIONS** button to go to the Options menu.
2. Push the **LFD** button. *The HMI asks if you want to do the calibration.*
3. Push the **Yes** button. *The HMI asks the number of burn lamps (0 - 99).*
4. Enter the number of removed lamps.
5. Wait until the equipment shows the Main screen. See § 4.3.

#### *Examine the LFD measurement*

1. Make sure that all power to the equipment is OFF. See § 9.3.
2. Connect a number of lamps, but not all.
3. Switch ON the equipment and set it to LOCAL mode. See § 9.1.
4. Make sure that the number of lamps removed corresponds to the LFD reading on the main menu.
5. Make sure that all power to the equipment is OFF. See § 9.3.
6. Leave the equipment OFF for 10 seconds.
7. Repeat the previous steps and connect the rest of the lamps.

#### *Set alarm level*

1. With the configuration software tool, set the LFD Level1 and LFD Level2 alarm levels. See § 5.6.

## **8.4 Remote control configuration: multiwire (option)**

#### *Examine if the equipment is set to multiwire remote control*

1. On the HMI, push the **MENU** button to go to the Main menu.
2. Push the **MAINT** button to go to the Maintenance menu. See § 4.8.
3. Push the **MORE** button.
4. Push the → or ← buttons until the HMI shows the remote control mode.
5. Make sure that the remote control mode is 'MULTIWIRE'.
6. If necessary, adjust the remote control mode.

#### *Examine or adjust the input and output signals function assigned to terminals*

1. Push the → or ← buttons until the HMI shows the multiwire configuration.
2. Check and adjust the signals if necessary. See § 4.8.



#### **Note**

**For the standard multiwire configuration, see § 12.3. You can only adjust the signals 6 to 15. The other signals are fixed.**

## 8.5 Remote control configuration: J-Bus (option)

*Configure the slave number*

1. On the HMI, push the **MENU** button to go to the Main menu.
2. Push the **OPTIONS** button to go to the Options menu.
3. Push the **SLVNUM** button to set the slave number of the equipment.
4. Push the **SAVE** button to save the slave number to the equipment.

*Examine and adjust the configuration, if necessary*

1. On the HMI, push the **ESC** button a number of times until the UI shows the Main menu.
2. Push the **MAINT** button to go to the Maintenance menu. See § 4.8.
3. Push the **MORE** button.
4. Push the → or ← buttons until the HMI shows the remote control mode.
5. Set the remote control mode to 'JBUS'.
6. Set the applicable J-Bus protocol. The default value is 'MCR2'.
7. Set the J-Bus mode to '485'.

## 8.6 Remote control configuration: ethernet (option)

*Examine the remote control mode and adjust if necessary*

1. On the HMI, push the **MENU** button to show the Main menu. See § 4.3.
2. Push the **MAINT** button to go to the Maintenance menu. See § 4.8.
3. Push the **MORE** button.
4. Push the → or ← buttons until the HMI shows the remote control mode.
5. Set the remote control mode to 'JBUS'.
6. Set the applicable J-Bus protocol. The default value is 'MCR2'.
7. Set the J-Bus mode to 'Ethernet'.

*Examine the ethernet configuration and adjust if necessary*

1. Push the → or ← buttons until the HMI shows the ethernet configuration.
2. Examine the parameters and adjust if necessary.
3. If you use a double ethernet connection, push the **DOWN** button until the HMI shows the ethernet configuration of the second ethernet connection.
4. Examine the parameters and adjust if necessary.

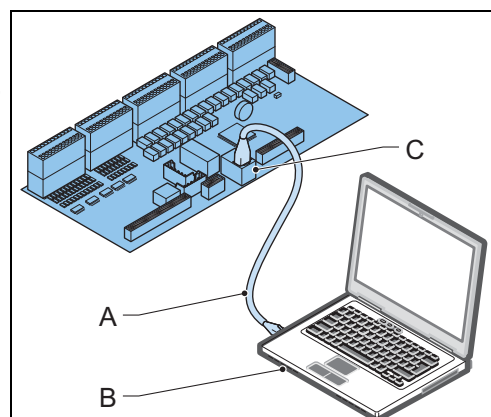
## 8.7 CS configuration (option CS)

Tools:

- PC with ethernet connector
- RJ45 cable (ethernet cable)

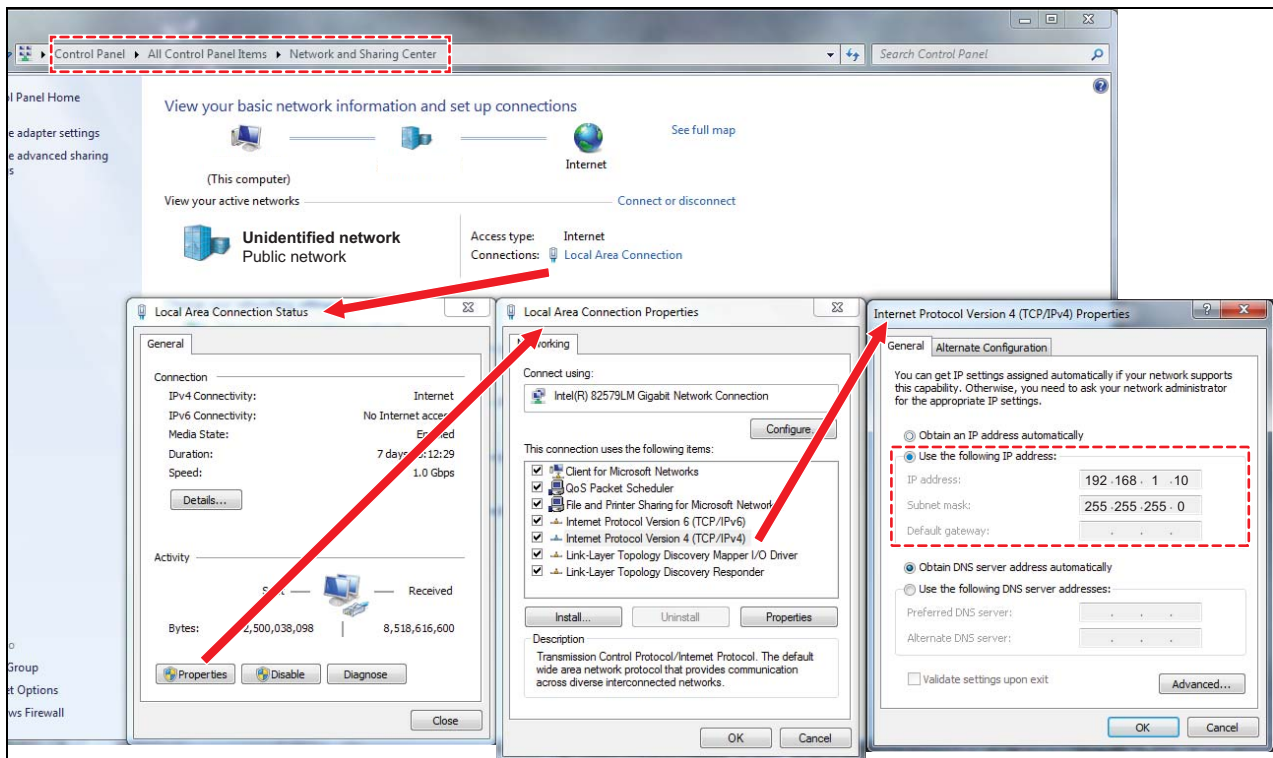
*Connect the PC to the interface PCB (PCB1702)*

1. Switch OFF the equipment. See § 9.2.
2. Remove the front panel. See § 11.3.
3. Connect the ethernet cable (A) to the PC (B) and the interface PCB (C).





Select a 'useable IP address'



1. Select a 'useable' IP address. Refer to the screenshots above.

*Examine the ethernet configuration and adjust if necessary*

1. Simultaneously press button C2 on the HMI and switch ON the equipment. See § 9.1.
2. Wait until the LEDs on the HMI for local and remote will flash simultaneously. Now, you can configure the CS.
3. Release the button C2 on the HMI. Now, you can configure the CS.
4. On the PC, go to web address 192.168.1.22 to connect to the Circuit selector web-interface.
5. Change parameters where necessary.



**Note**

**Press the 'Update' button after a change.**

6. Switch OFF the equipment. See § 9.2.
7. Disconnect the ethernet cable.
8. Install the front panel. See § 11.3.

*Configure the HMI*

1. Switch ON the equipment. See § 9.1.
2. On the HMI, go to the maintenance menu.
3. Push the **MORE** button.
4. Push the → or ← buttons until the HMI shows the CSE mode screen.
5. Push the **ON** button.
6. Push the → or ← buttons until the HMI shows the multiwire configuration.
7. Set the values to the list below:
  - J6.1: Circuit selector CCRON
  - J6.2: OVER CURRENT
  - J6.3: OPEN CIRCUIT
  - J6.5: Circuit selector 2
  - J6.7: EFD WARNING
  - J6.8: EFD ERROR
  - J7.1: HIGH TEMPERATURE ALARM
  - J7.2: Circuit selector 6

**Note**

The alarms **OVER CURRENT** and **OPEN CIRCUIT** are also used on the interface PCB to generate the error signal 'CCR FAULT'

## 9 Operation

### 9.1 Switch ON the equipment

When you switch ON the equipment, it starts to produce the same output current that was valid before the equipment was switched OFF.

To set a different output current, select another brightness step. See § 9.5. For more information on the produced output currents, see § 13.6.

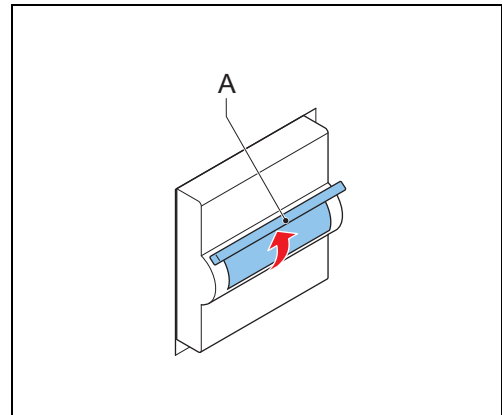
Prerequisite of this procedure is that the equipment is switched off.

1. Set the manual switch (A) to the ON position.
  - *The equipment starts to produce the same output current that was valid before the equipment was switched OFF.*
  - *The HMI lights up.*
  - *The equipment starts in the same mode as it was stopped: Local or Remote mode.*



**WARNING**  
High voltage can be  
present on the system.

2. If the UI shows that the equipment is in the state OFF, push the **ON** button. The *HMI shows the state ON.*
3. To switch between Local and Remote mode, see § 9.4.

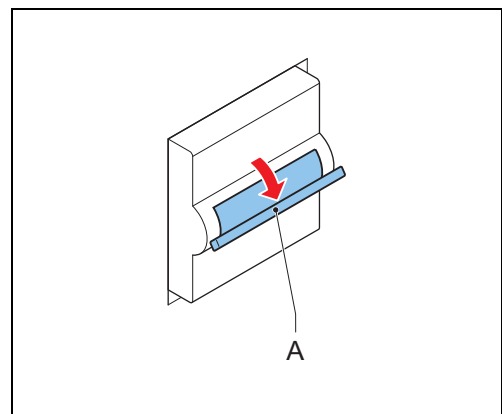


### 9.2 Switch OFF the equipment

1. On the HMI, push the **Local** button. *The screen now shows the state LOCAL.*
2. Push the **OFF** button. The equipment goes to the mode OFF.
3. Switch OFF the power supply. See § 9.3.

### 9.3 Switch OFF the power supply

1. Set the manual switch (A) to the OFF position.
2. Open the main switch on the main distribution board.
3. Disconnect the equipment from the series circuit.



## 9.4 Switch between local and remote mode

To control the equipment through the HMI switch to the local mode. To control the equipment with the remote control system, switch to the remote mode.

1. For Local mode, push the **LOCAL** button on the HMI. *The HMI now shows the mode LOCAL.*



### Note

The keypad keys on the HMI only operate when the equipment is in Local mode.

2. For Remote mode, push the **REMOTE** button on the HMI. *The UI now shows the mode REMOTE. You can now change the brightness step with the remote control device.*

## 9.5 Select brightness step

1. Make sure that the equipment is powered ON, in the ON state and in Local mode. See § 9.1.
2. To select a brightness step, push the corresponding number on the keypad. *The equipment immediately starts to produce the chosen brightness.*

## 9.6 Adjust number of used brightness steps

1. Use the configuration software tool. See § 5.3. For information on the used brightness steps, see § 13.6.
2. Examine all brightness steps one by one. See § 9.5. *Examine if all light fittings have the same brilliancy level. Go to the runway area to make a visual inspection.*

## 9.7 Alarms

The HMI only shows information about errors that the equipment can detect. The equipment does not detect all possible errors. You have to observe if the equipment operates correctly.

*LOCAL mode: an alarm occurs, the equipment switches OFF automatically*

- If you need to switch off the power supply to remove the cause of the alarm: The equipment starts to produce the same output current that was valid before the equipment was switched OFF.
- If you do not need to switch off the power supply to remove the cause of the alarm: The equipment remains in the state OFF. Only after you reset the alarm and push the **ON** button, the equipment starts to produce the same output current that was valid before the equipment was switched OFF.

*REMOTE mode: an alarm occurs, the equipment switches OFF automatically*

- If you need to switch off the power supply to remove the cause of the alarm: The equipment starts at the actual multiwire/J-Bus command.
- If you do not need to switch off the power supply to remove the cause of the alarm: After you reset the alarm, the equipment automatically goes to the actual multiwire command.

*Reset an alarm*

1. If the HMI does not show the alarm, push the **Menu** button to go to the Main Menu.
2. Push the **ALARMS** button to go to the Alarms menu.
3. Push the **RESET** button to reset the alarm.

*Clear the error list*

1. On the HMI, push the **Menu** button to go to the Main Menu.
2. Push the **ALARMS** button to go to the Alarms menu.
3. Push the **CLEAR ALARMS** button. *The equipment clears the error list.*

## 9.8 Use Series CutOut (SCO)

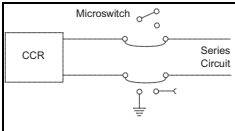
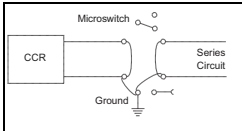
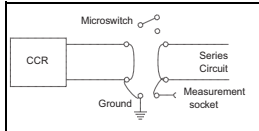
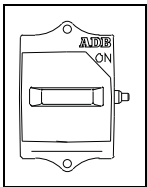
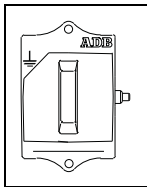
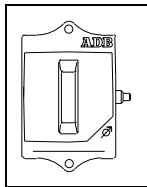
### 9.8.1 Operation mode



**WARNING**

Always wear protective gloves and shoes when working with the equipment or series circuit.

The SCO has three operation modes:

Description	Mode A	Mode B	Mode C
<b>Purpose</b>	Normal operation. Equipment delivers current to the connected series circuit.	Maintenance operation. Equipment or series circuit can be serviced safely.	Measurement possible. The series circuit insulation relative to ground can be measured.
<b>Diagram</b>			
<b>Cover placement<sup>1</sup></b>			
<b>Handle position</b>	Horizontal.	Turned 90 degrees counter clockwise from position A.	Turned 90 degrees clockwise from position A.
<b>Series circuit</b>	Connected to the equipment.	Shorted and grounded	Disconnected from equipment, shorted and connected to measurement terminal.
<b>Equipment</b>	Delivers current to the series circuit.	Shorted and grounded.	Shorted and grounded.
<b>Microswitch<sup>2</sup></b>	Activated. Equipment is ON.	Not activated. Equipment is OFF.	Activated. Equipment is ON.

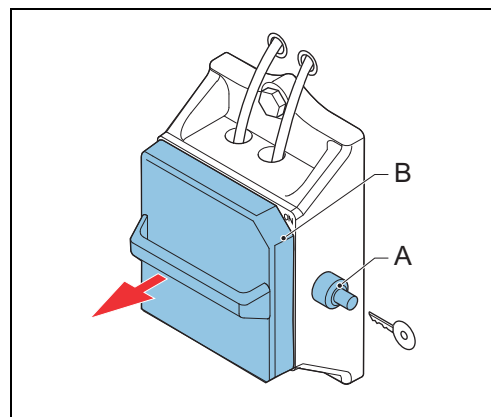
1) Only the three positions shown can be used. In another position, the cover does fit correctly.

2) When the cover is closed, the micro switch is activated. When the cover is open, the microcircuit is deactivated and the equipment shuts down.

### 9.8.2 Adjust operation mode

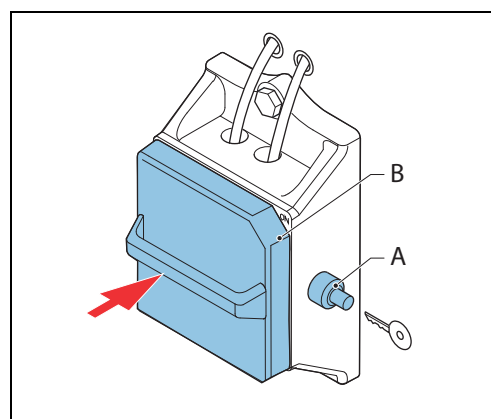
#### *Remove cover*

1. Open the lock (A).
2. Remove the cover (B). *Use the handle.*



#### *Set operation mode*

1. Install the cover (B). See the cover placement in § 9.8.1.
2. Close the lock (A).



## 9.9 Operation mode

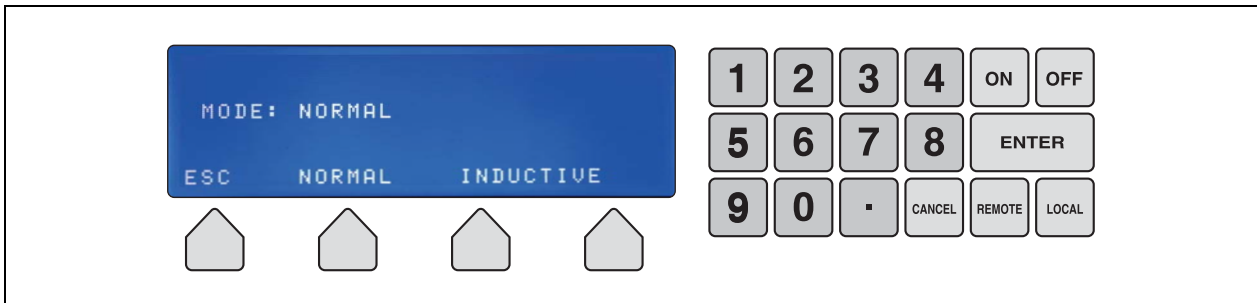
A series circuit with non-linear loads can be unstable. If the system is unstable, do the procedure below.



### Note

The equipment automatically detects if the inductive mode is required. The alarm message 'DC BUS VOLTAGE TOO HIGH' means that the series circuit is unstable.

1. On the HMI, push the **MENU** button go to the Main menu.
2. Push the **OPTIONS** button to go to the Options menu.
3. Push the **MODE** button to go to the Mode menu.
4. Select the applicable mode: **Normal** is the factory default. **Inductive** is for cases where the current regulation is under the influence of inductive load and becomes unstable. *The HMI now shows the Main screen.*



### Note

The equipment has these limitations in inductive mode:

- The power is limited to 85%.
- The LFD measurement is not active.
- In normal mode the equipment limits all current peaks higher than 7 A in less than 10 ms, in inductive mode the current peak can reach 9 A.
- The output waveform is not a perfect sinusoidal wave.





## 10 Troubleshooting



### **WARNING**

Do not troubleshoot unless you have read and understood all the information in chapter 2 and you are qualified to work on high-voltage systems.

- Set the equipment to Local mode.
- Set the equipment to the brightness step OFF before you examine the series circuit.
- Switch OFF the main switch of the equipment;

If you do not obey the steps above, an increase of the power input can start an on cycling and restart the equipment. This results in a possible lethal output voltage.

### 10.1 Preliminary checks

Before you do any adjustments on the equipment, examine:

- the alarm and back-indication signals on the display and/or remote control.
- if the power supply to the equipment is within the acceptance limits.
- if the fused input switches and auxiliary fuses are operational.
- if the input fuses and auxiliary fuses work normally.
- if all connectors are correctly in place.
- if no components show burned marks.
- if the input circuit breaker is in the 'open' position.
- wires are not interrupted or damaged.

## 10.2 Troubleshooting guide



**Note**  
For a list of errors, see § 5.2.

### 10.2.1 Fault: Equipment does not turn ON

**Table: 10.1 Equipment does not turn ON**

Problem	Possible cause	Possible solution
No display indications.	A problem with the power supply on the diode bridge PCB.	- Examine the transformer on the diode bridge.
		- If necessary, replace the IGBT power bridge that contains the diode bridge PCB. See § 11.2.5.
	The main switch is damaged.	- Examine the external 400 VAC/24VAC transformer.
		- Replace the external transformer, if necessary.
	The input line filter is damaged.	Replace the line filter. See § 11.2.19.
	The main contactor is damaged.	Replace the main contactor. See § 11.2.20 or § 11.2.21
		Replace the power supply PCB. See § 11.2.28.
		Replace the CPU PCB. See § 11.2.2.

## 10.2.2 Fault: Equipment does not go to the ON state

**Table: 10.2 Equipment does not turn ON**

Problem	Possible cause	Possible solution
Local mode: - The display shows an alarm. - The red lamp on top of the equipment goes on.	One of the panels is opened.	Close the panel.
		- Examine the fuses on power supply PCB. - Replace the fuses if necessary. See § 11.2.8.
Remote mode: - The red lamp on top of the equipment goes on.	The main contactor is enabled when the equipment is in the OFF state when there is no command from the CPU PCB. Or The main contactor is not enabled when there is a command from the CPU PCB.	- Examine the CPU PCB. - Replace the CPU PCB if necessary. See § 11.2.2.
		- Examine the main contactor. - Replace the main contactor if necessary. See § 11.2.20 or § 11.2.21
	One or more phases are not present.	Examine the wiring connections.
		- Examine the CPU PCB. - Replace the CPU PCB if necessary. See § 11.2.2.
		- Examine the fuses on power supply PCB. - Replace the fuses if necessary. See § 11.2.8.
		- Examine the external 400 VAC/24VAC transformer. - Replace the external transformer, if necessary.
	One of the fuses for the phases is broken.	- Examine the main fuses. - Replace the broken fuse. See § 11.2.22.

### 10.2.3 Fault: Equipment turns ON but suddenly de-energizes

**Table: 10.3 Equipment turns ON but suddenly de-energizes**

Problem	Possible cause	Solution (See)
<p>After you pressed the ON button you record these problems:</p> <p>Local mode:</p> <ul style="list-style-type: none"> <li>- The display shows an alarm.</li> <li>- The red lamp on top of the equipment goes on.</li> </ul> <p>Remote mode:</p> <ul style="list-style-type: none"> <li>- The red lamp on top of the equipment goes on.</li> </ul>	The input AC line is delivers less than 360 VAC.	<p>Examine the input VAC line.</p> <ul style="list-style-type: none"> <li>- Examine the external 400 VAC/24VAC transformer.</li> <li>- Replace the external transformer, if necessary.</li> </ul>
	Open circuit.	<p>Examine the connection of the high voltage cable to the field connection unit and to the power supply transformer</p> <ul style="list-style-type: none"> <li>- Examine the output measure PCB.</li> <li>- Replace the output measure PCB, if necessary. See § 11.2.27.</li> </ul>
	Overcurrent.	<ul style="list-style-type: none"> <li>- Examine the output measure PCB.</li> <li>- Replace the output measure PCB, if necessary. See § 11.2.27.</li> </ul>
	A malfunction of the communication of the output measurement PCB.	<ul style="list-style-type: none"> <li>- Examine the output measure PCB.</li> <li>- Replace the output measure PCB, if necessary. See § 11.2.27.</li> </ul>
	The current on the primary winding of the power supply transformer is too high.	<ul style="list-style-type: none"> <li>- Examine the IGBTs.</li> <li>- If necessary, replace the IGBT power bridge that contains the IGBT. See § 11.2.10 or § 11.2.11.</li> </ul>
		<ul style="list-style-type: none"> <li>- Examine the CPU PCB.</li> <li>- Replace the CPU PCB if necessary. See § 11.2.2.</li> </ul>
		<ul style="list-style-type: none"> <li>- Examine the IGBT PCB.</li> <li>- If necessary, replace the IGBT power bridge that contains the IGBT PCB. See § 11.2.10 or § 11.2.11.</li> </ul>

### 10.2.4 Fault: equipment does not produce requested output current

**Table: 10.4 Equipment does not produce the requested output current**

Problem	Possible cause	Solution (See)
The red lamp on top of the equipment goes on.	The equipment does not operate correctly.	<ul style="list-style-type: none"> <li>- Examine the IGBT modules.</li> <li>- If necessary, replace the IGBT power bridge that contains the IGBT module. See § 11.2.10 or § 11.2.11.</li> </ul>
		<ul style="list-style-type: none"> <li>- Examine the output measure PCB.</li> <li>- Replace the output measure PCB, if necessary. See § 11.2.27.</li> </ul>
		<ul style="list-style-type: none"> <li>- Examine the IGBT PCB.</li> <li>- If necessary, replace the IGBT power bridge that contains the IGBT PCB. See § 11.2.10 or § 11.2.11.</li> </ul>

## 10.3 Checks and measurements

### 10.3.1 Measure input voltage

1. Make sure that the main switch is OFF.
2. Make sure that the input supply cables that come from the mains distribution panel are only connected to the equipment you want to measure.
3. Switch on the mains distribution to feed the equipment you want to measure.
4. Make sure that all connectors are securely tightened.
5. Measure the input voltage (V) to the equipment. *Use a True RMS Multimeter.*
6. Check the nameplate of the equipment and make sure that the input voltage is compatible with the equipment.

### 10.3.2 Measure output current

1. Make sure that main switch is OFF.
2. Install a calibrated True RMS multimeter with a current clamp in the output circuit.
3. Switch on the equipment and set the equipment to the highest brightness step. See § 9.5.
4. Read the output current from the True RMS multimeter.
5. Make sure that the measurement is accurate. Calibrate the output current again if necessary.

### 10.3.3 Check fuse breaker and voltage of switch board

1. Make sure that the main switch is OFF.
2. Check the nameplate of the equipment to make sure that the fuse breaker voltage and the current rating of the switchboard is compatible with the equipment. Allowed variance by standards:
  - IEC: +10 %
  - FAA: ±10 %
3. Set the main switch to ON.
4. Measure the voltage (V) of the switchboard. *Use a calibrated True RMS multimeter.*

### 10.3.4 Calculate minimum insulation resistance of series circuit

1. Calculate the minimum insulation resistance of the series circuit. See § 8.2.15.
2. Make sure that the calculated values are higher than the values measured during commissioning.

### 10.3.5 Calculate resistance of series circuit

1. Calculate the resistance of the series circuit. See § 8.2.16.
2. Make sure that the calculated values are higher than the values measured during commissioning.

### 10.3.6 Measure cable capacitance

Measure the cable capacitance towards the ground as follows:

1. Make sure that the main switch is OFF.
2. Connect a multimeter to the regulator output cable. *Use a Multimeter that has an internal resistance of 10 MOhm.*
3. Disconnect the 500 V DC power cable to the EFD module. *The Multimeter now measures the discharge time of the cable capacitance from 400 V DC to 147 V DC.*

If the cable capacitance is 1  $\mu\text{F}$ , the measured voltage decreases from 400 V DC to 147 V DC ( $=0.37 \times 400$ ) in approximately 10 seconds.

If the voltage you measure with the LFD module connected is already 330 V DC, the cable leakage resistance is approximately 10 MOhm. In this case, the discharge time is approximately 5 seconds for a cable capacitance of 1  $\mu\text{F}$ .

## 11 Maintenance



### WARNING

- Only personnel authorized to work on high-voltage equipment can do maintenance work on the equipment.
- Operate the equipment under local control when you do maintenance work on the equipment to prevent the equipment from being accidentally switched ON.
- Obey all local safety procedures.
- Make sure that you have obtained the necessary permissions according to the local operation procedures and procedures regarding HV equipment.

### 11.1 Preventive maintenance schedule

**Table: 11.1 Preventive maintenance schedule**

Frequency	Check	Action
In accordance with ICAO Aerodrome Design Manual Part 9 Airport Maintenance practices or in accordance with local maintenance regulations. Adapt the maintenance frequency to the local conditions.	Examine the operation of the equipment on all brightness steps on all readings.	Use a PC to log the data, if required.
	Input voltage.	If the input voltage is not within the limits, tell the power company to adjust the voltage. Make sure that you do the necessary actions to align the input voltage with the input limitations.
	Output current. Use a calibrated True RMS multimeter and/or a current clamp.	If the output current is not within tolerance, calibrate the output current again.
	Visually: <ul style="list-style-type: none"> <li>- if the wiring of the equipment and the circuit is not damaged.</li> <li>- for rust spots and general damage.</li> <li>- the housing for dust accumulation.</li> <li>- all signs on the equipment for legibility and damage.</li> </ul>	<ul style="list-style-type: none"> <li>- Repair damaged or loose wires</li> <li>- Replace damaged components.</li> <li>- Clean and repair rust spots.</li> <li>- Clean the inside of the equipment with a dry air blower.</li> </ul>
	If the electrical connections (e.g. input connections, output connections) are tightened correctly.	Tighten all the connections to make sure that all connections are tightened.

## 11.2 Part replacement



### WARNING

- Make sure you have read and understood all safety procedures and standards related to this equipment. See chapter 2.
- Make sure you switch OFF the power to the equipment. See § 9.3.
- Make sure you switch OFF the manual switch to remove all power to the equipment.



### CAUTION

While you carry out maintenance, make sure that:

- You do not drop any screws or nuts inside the equipment cabinet. Collect all loose nuts and screws immediately.
- You can identify all cables you disconnect. Label the cables.
- If you need to change a PCB, you change the correct PCB.
- You have saved the equipment settings as a profile. To do this in the configuration software tool, see chapter 7.
- You put in the new parts exactly the same way as the parts you removed.
- After you replaced a part, test the equipment to make sure it is replaced correctly.



### Note

See the electrical schemes inside the equipment cabinet for the connection schemes.

### 11.2.1 Required tools

#### Measurement tools

- True RMS Multimeter



### CAUTION

The output voltage of the 30 kVA / 6.6 A equipment can reach approximately 4600 V at full load. An isolating measurement transformer for use on the 5000 V AC line is recommended.

- Multimeter
- Insulation tester "Megger" 500 V or 1000 V
- Clamp or A-meter true RMS scale 10 and 30 A



### CAUTION

The current regulation is +/- 1%. To make an acceptable readjustment of the output current, the accuracy of the meter must be better than 0.5% for the adjusted value.

#### Tools

- Standard electrical and mechanical tool kit
- Screwdrivers with protection up to 1000 V
- Spanner set (ring or socket spanners)
- Allen keys 4 and 6 mm
- Torque screwdrivers (2 - 10 Nm and adaptors)
- Short, slotted screwdriver
- Magnet rod for collecting loose items
- Angle socket wrench



### 11.2.2 CPU PCB (EPS479) replacement



#### CAUTION

- If you install an OVP version of the CPU PCB, make sure that the diode bridge PCB is also an OVP version.
- If you install an non-OVP version of the CPU PCB, make sure that the diode bridge PCB is also an non-OVP version.
- Make sure that you update the correct firmware. The firmware code for an OVP version of the PCB ends with an 'e'.

Parts: see § 13.8.

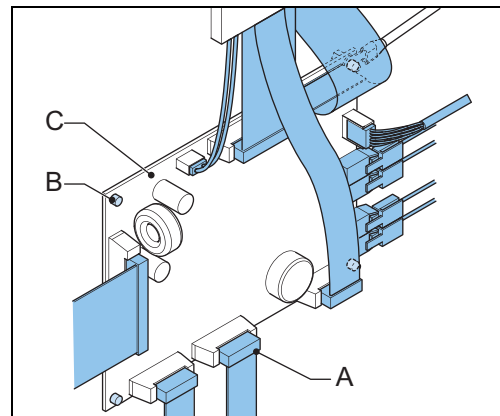
- CPU PCB
- Firmware

#### *Remove panel*

1. Remove the front panel. See § 11.3.

#### *Disconnect*

1. Disconnect the connectors and the wires (A).
2. Remove the fasteners (B).
3. Remove the CPU PCB (C).



#### *Install*

1. Install the new CPU PCB.
2. Install the fasteners.
3. Connect all the wires.



#### CAUTION

**Connect the keyboard cable with the green side down.**

#### *Update the firmware*

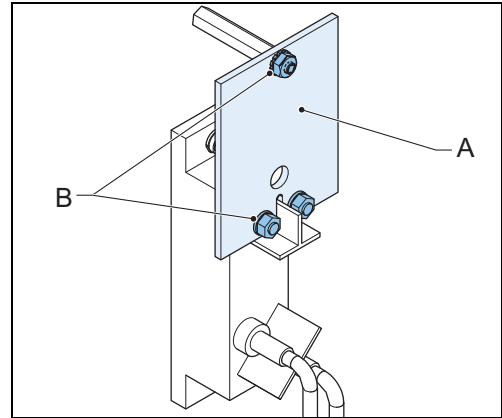
1. Update the firmware. See § 11.4.
2. Install the front panel. See § 11.3.

### 11.2.3 CS PCB (PCB1619) replacement (option CS)

Parts: see § 13.8.

- CS PCB

1. Switch OFF the power supply. See § 9.2.
2. Remove the rear panel. See § 11.3.
3. Disconnect the cables from the CS PCB that you need to replace (A).
4. Remove the fasteners (B).
5. Replace the CS PCB.
6. Install the fasteners (A).
7. Connect the cables to the connectors.
8. Install the rear panel.

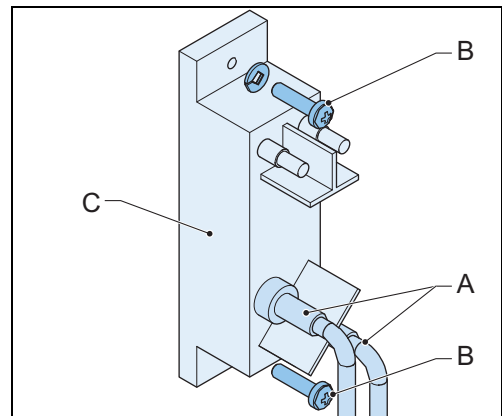


### 11.2.4 CS Relay replacement (option CS)

Parts: see § 13.8.

- CS relay

1. Switch OFF the power supply. See § 9.2.
2. Remove the rear panel. See § 11.3.
3. Remove the CS PCB. See § 11.2.3.
4. Disconnect the cables (A) from the output terminals.
5. Remove the fasteners (B).
6. Replace the CS relay (C).
7. Install the fasteners.
8. Connect the cables to the output terminals.
9. Install the CS PCB. See § 11.2.3.



### 11.2.5 Diode bridge + sensing PCB (EPS476 / EPS507) replacement, small and stackable cabinet



#### CAUTION

- If you install an OVP version of the CPU PCB, make sure that the diode bridge + sensing PCB is also an OVP version.
- If you install an non-OVP version of the CPU PCB, make sure that the diode bridge + sensing PCB is also an non-OVP version.
- Make sure that you update the correct firmware. The firmware code for an OVP version of the PCB ends with an 'e'.

Parts: see § 13.8.

- Diode bridge + sensing PCB



#### Note

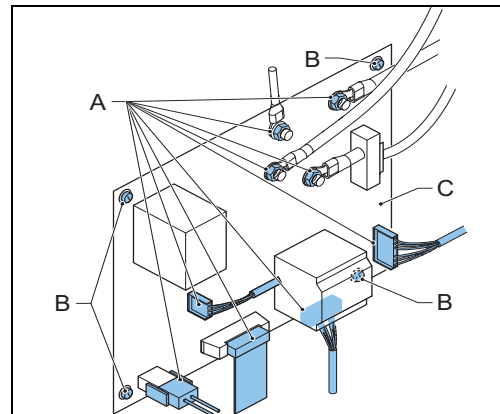
The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.

#### Prepare

1. Remove the front panel. See § 11.3.

#### Remove

1. Disconnect the wires and connectors (A).
2. Remove the fasteners (B).
3. Remove the diode bridge + sensing PCB (C).



### Install

1. Wipe clean the copper plate (A).
2. Apply an even layer of conductive paste on the copper plate.
3. Install the new diode bridge on the new sensing PCB.
4. Make sure that the diode bridge makes good contact with the heatsink.



#### CAUTION

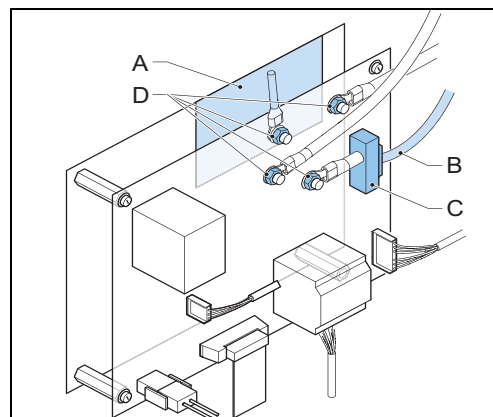
If there is a washer or a screw between the diode bridge and the heatsink, the heat dissipation is not sufficient.

5. Connect all the wires.



#### CAUTION

Carefully put the wire (B) through the sensing transformer (C). The sensing transformer is easily damaged.



6. Tighten the fasteners (D). *Apply a torque of 2 Nm.*
7. Install the front panel. See § 11.3.
8. On the HMI, do a check on the firmware version. *The firmware code for an OVP version of the PCB ends with an 'e'.*
9. If the firmware version is not correct, update the firmware version. See § 11.4.

### 11.2.6 Diode bridge and sensing PCB (EPS476) replacement, big cabinet



#### CAUTION

- If you install an OVP version of the CPU PCB, make sure that the diode bridge and sensing PCB is also an OVP version.
- If you install a non-OVP version of the CPU PCB, make sure that the diode bridge and sensing PCB is also a non-OVP version.
- Make sure that you update the correct firmware. The firmware code for an OVP version of the PCB ends with an 'e'.

Parts: see § 13.8.

- Diode bridge and sensing PCB



#### Note

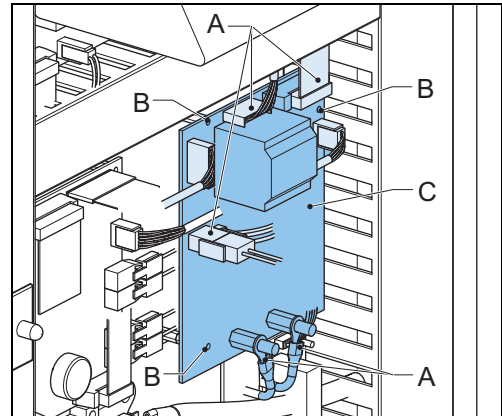
The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.

### Prepare

1. Remove the lower front panel. See § 11.3.

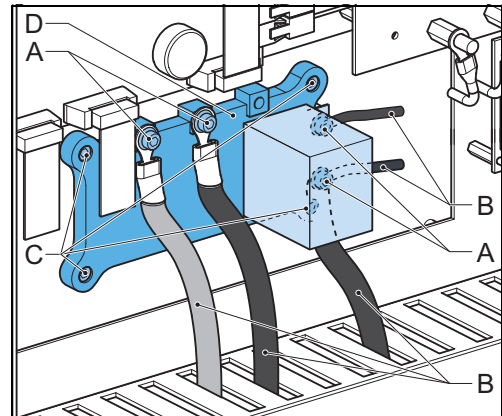
#### Remove sensing PCB

1. Disconnect the wires and connectors (A).
2. Remove the fasteners (B).
3. Remove the sensing PCB (C).



#### Remove diode bridge

1. Remove the fasteners (A).
2. Disconnect the wires (B).
3. Remove the fasteners (C).
4. Remove the diode bridge (D).



#### Install

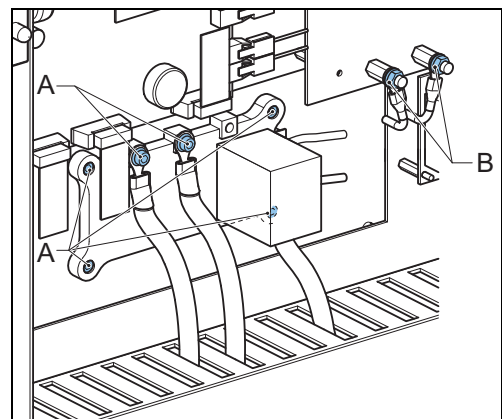
1. Wipe clean the heat sink where you install the new diode bridge.
2. Apply an even layer of conductive paste on the back side of the new diode bridge.
3. Install the new diode bridge.
4. Make sure that the diode bridge makes good contact with the heatsink.



#### CAUTION

**If there is a washer or a screw between the diode bridge and the heatsink, the heat dissipation is not sufficient.**

5. Tighten the fasteners (A). *Apply a torque of 4 Nm.*
6. Install the new sensing PCB.
7. Connect all the wires to the sensing PCB.
8. Tighten the fasteners (B). *Apply a torque of 2 Nm.*



#### Finish

1. Install the lower front panel. See § 11.3.1.
2. On the HMI, do a check on the firmware version. *The firmware code for an OVP version of the PCB ends with an 'e'.*
3. If the firmware version is not correct, update the firmware version. See § 11.4.

### 11.2.7 Display and keyboard replacement

Parts: see § 13.8.

- Display/keyboard panel

1. Remove the display/keyboard panel. See § 11.3.
2. Install the new display/keyboard panel. See § 11.3.

### 11.2.8 Fuses on the power supply PCB (EPS480) replacement

Parts: see § 13.8.

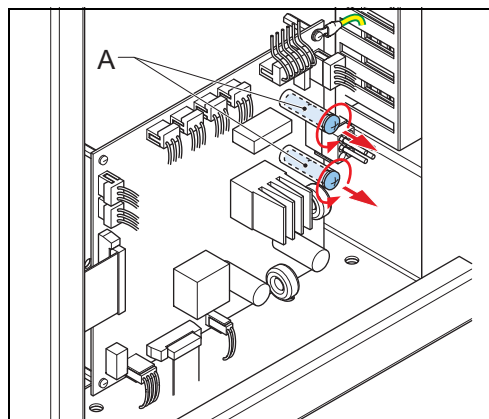
- Fuses. See also § 13.5.

#### *Remove panel*

1. Remove the lower front panel. See § 11.3.

#### *Replace*

1. Push, turn counterclockwise and remove the fuse (A). *It is possible that only one fuse is broken. Only replace the broken fuse.*
2. Install the new fuse.



#### *Install*

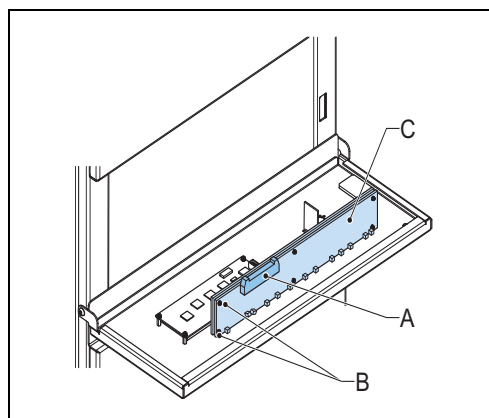
1. Install the lower front panel. See § 11.3.

### 11.2.9 HMI SIN PCB (PCB1694) replacement (option CS)

Parts: see § 13.8.

- HMI SIN PCB

1. Remove the display/keyboard panel. See § 11.3.
2. Disconnect the connectors and the wires (A).
3. Remove the fasteners (B).
4. Remove the HMI SIN PCB (C).
5. Install the new remote control PCB.
6. Connect all the wires.
7. Install the display / keyboard panel. See § 11.3.



### 11.2.10 IGBT replacement, stackable and small cabinet

Parts: see § 13.8.

- IGBT



**Note**

The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.

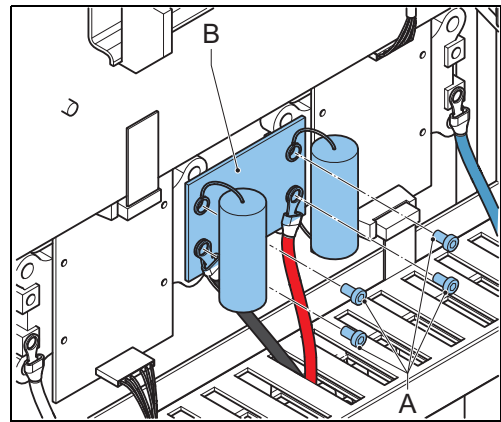
The illustrations for this procedure show the situation for the 2.5 kVA and 10 kVA cabinets.

*Remove panel*

1. Remove the front panel. See § 11.3.

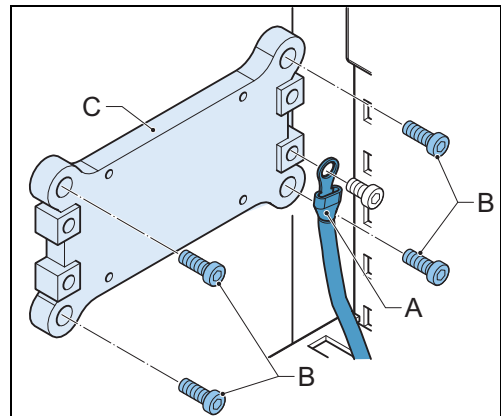
*Remove - 1*

1. Remove the fasteners (A).
2. Remove the capacitor plate (B).
3. Remove the IGBT PCB. See § 11.2.12.



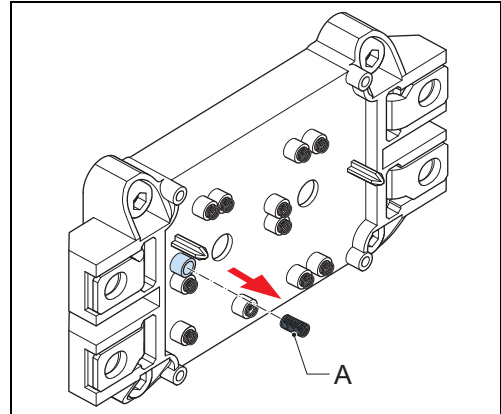
*Remove - 2*

1. Disconnect the wire (A).
2. Remove the fasteners (B).
3. Remove the IGBT (C).

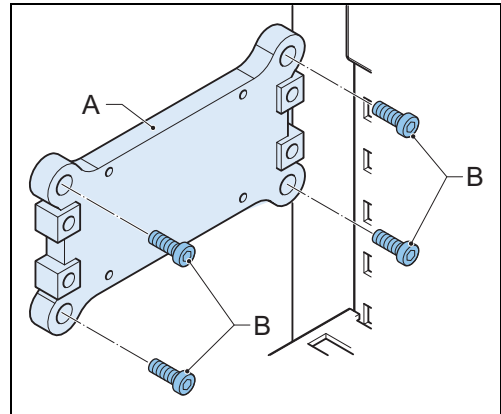


*Prepare the IGBT*

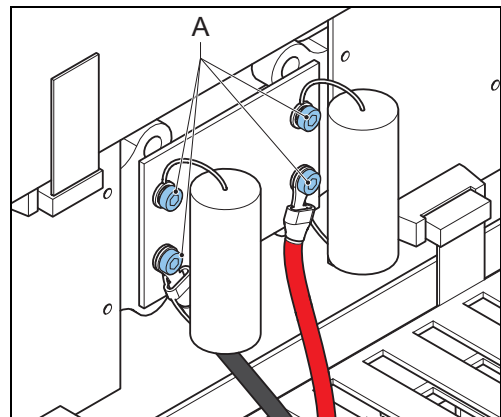
1. Make sure that spring number 7 (A) of the IGBT is removed.  
*Once a spring has been removed, it cannot be installed back.*

*Install - 1*

1. Wipe clean the heat sink below the IGBT (A).
2. Apply an even layer of conductive paste on the rear of the IGBT (the side that touches the heat sink).
3. Tighten the fasteners (B) crosswise. *Apply a torque of 4 Nm.*

*Install - 2*

1. Install the IGBT PCB. See § 11.2.12.
2. Install the capacitor plate.
3. Connect the wires.
4. Install the fasteners (A). *Apply a torque of 4 Nm.*
5. Install the front panel. See § 11.3.





### 11.2.11 IGBT replacement, big cabinet

Parts: see § 13.8.

- IGBT

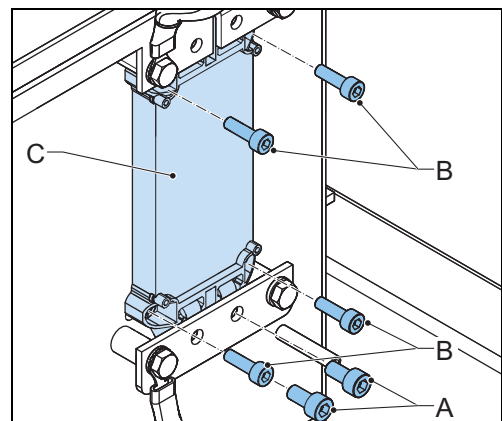


#### Note

- The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.
- The procedure shows the IGBT at the right-hand side. The procedure for the IGBT at the left-hand side is similar.

#### Remove

1. Remove the IGBT PCB. See § 11.2.13.
2. Remove the fasteners (A).
3. Remove the fasteners (B).
4. Remove the IGBT (C).



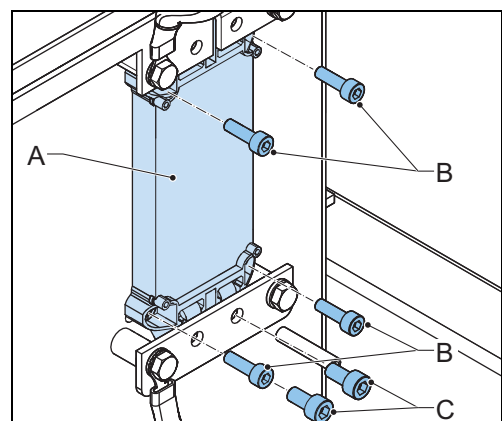
#### Install



#### CAUTION

when you tighten the fasteners, only apply force vertically. Use an allen key screwdriver or an allen key handle instead of a socket wrench or a ratchet. Sideways force can cause the components to get damaged.

1. Wipe clean the heat sink below the new IGBT (A).
2. Apply an even layer of conductive paste on the rear of the IGBT (the side that touches the heat sink).
3. Install the IGBT.
4. Install the fasteners (B). *Apply a torque of 4 Nm.*
5. Install the fasteners (C). *Apply a torque of 4 Nm.*
6. Install the IGBT PCB. See § 11.2.13.



### 11.2.12 IGBT PCB (EPS477 / EPS 478) replacement, small cabinet

Parts: see § 13.8.

- IGBT PCB



#### Note

The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.

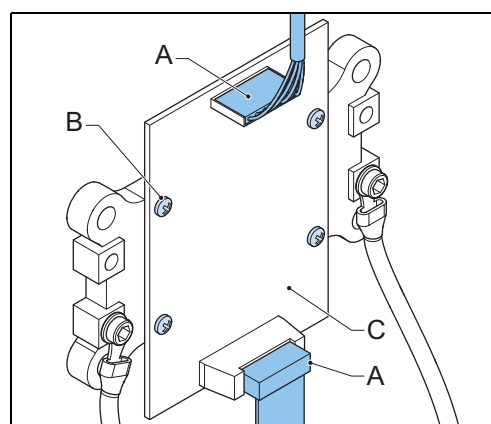
The illustrations for this procedure show the situation for the 2.5 kVA and 10 kVA cabinets.

#### Remove panel

1. Remove the front panel. See § 11.3.

#### Disconnect

1. Disconnect the connectors and the wires (A).
2. Remove the fasteners (B).
3. Remove the IGBT PCB (C).



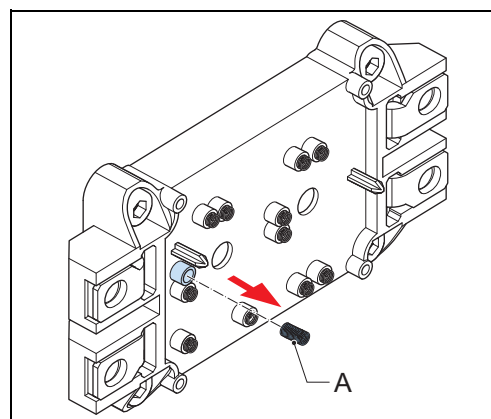
#### Install



#### CAUTION

when you tighten the fasteners, only apply force vertically. Use an allen key screwdriver or an allen key handle instead of a socket wrench or a ratchet. Sideways force can cause the components to get damaged.

1. Make sure that spring number 7 (A) of the IGBT is removed.  
*Once a spring has been removed, it cannot be installed back.*
2. Install the new IGBT PCB.
3. Connect all the wires.
4. Install the front panel. See § 11.3.



### 11.2.13 IGBT PCB (EPS496) replacement, big cabinet

Parts: see § 13.8.

- IGBT PCB



#### Note

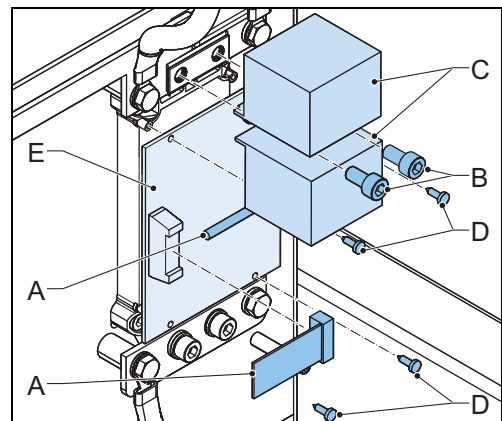
- The IGBT PCB, IGBT module, and the diode bridge and sensing PCB together are the IGBT power bridge. If one component breaks, replace the entire IGBT power bridge.
- The procedure shows the IGBT PCB at the right-hand side. The procedure for the IGBT PCB at the left-hand side is similar.

#### Remove panel

1. Remove the lower front panel. See § 11.3.

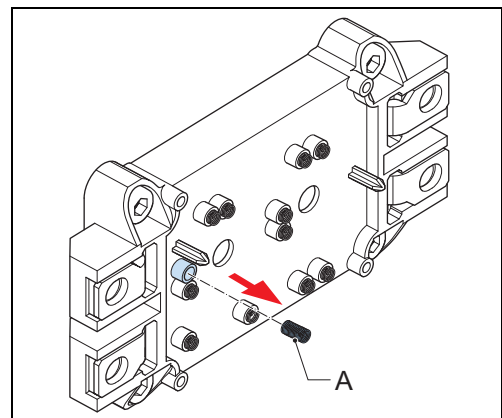
#### Remove

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the capacitors (C).
4. Remove the fasteners (D).
5. Remove the IGBT PCB.



#### Remove the spring from the IGBT

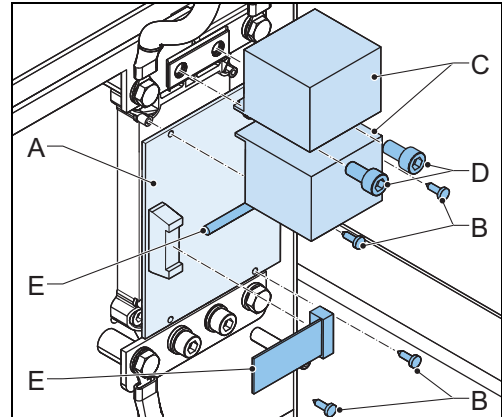
1. Make sure that spring number 7 (A) of the IGBT is removed.  
*Once a spring has been removed, it cannot be installed back.*



*Install***CAUTION**

when you tighten the fasteners, only apply force vertically. Use an allen key screwdriver or an allen key handle instead of a socket wrench or a ratchet. Sideways force can cause the components to get damaged.

1. Install the new IGBT PCB (A) on the IGBT.
2. Install the fasteners (B) crosswise. *Apply a torque of 4 Nm.*
3. Install the capacitors (C).
4. Install the fasteners (D). *Apply a torque of 4 Nm.*
5. Connect the wires (E).

**11.2.14 Input filter replacement, stackable cabinet**

Parts: see § 13.8.

- Input filter
- Output filter

**Note**

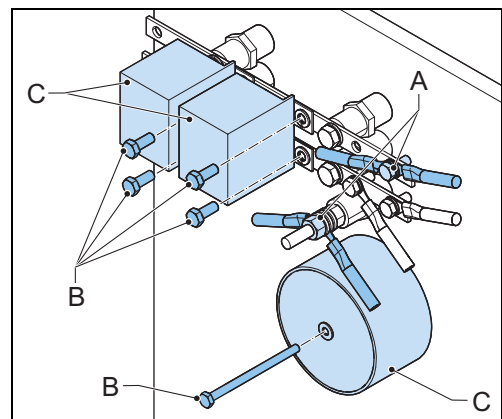
- Always replace the input filter and the output filter together.
- The number of filters and capacities can be different from the illustrations, depending on the output power.

*Remove panel*

1. Remove the top panel. See § 11.3.

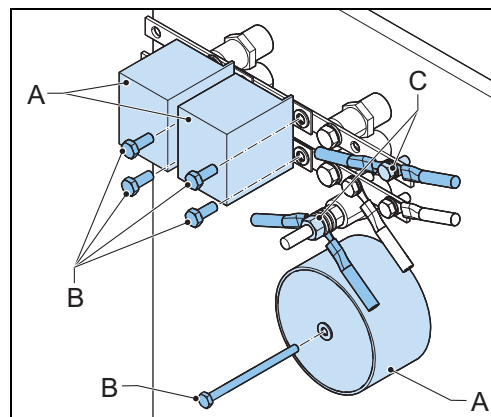
*Remove*

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the parts of the input filter (C).



### Install

1. Install the new parts of the input filter (A).
2. Tighten the fasteners (B). *Apply a torque of 3 Nm.*
3. Connect the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the top panel. See § 11.3.



### 11.2.15 Input filter replacement, small (up to 10 kVA) cabinet

Parts: see § 13.8.

- Input filter
- Output filter



### Note

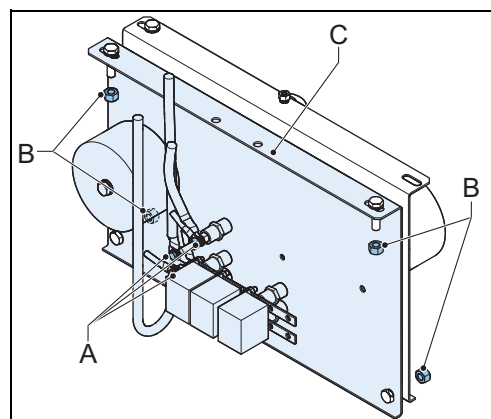
- **Always replace the input filter and the output filter together.**
- **The number of filters and capacities can be different from the illustrations, depending on the output power.**

### Remove panel

1. Remove the side panels. See § 11.3.

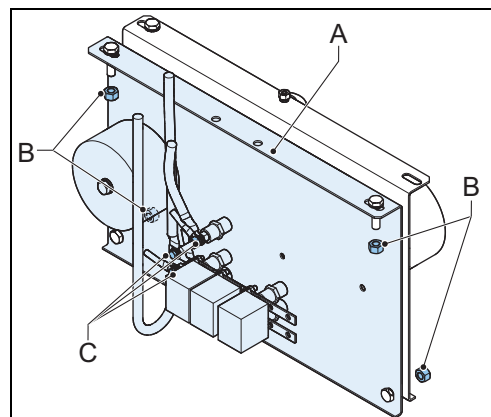
### Remove

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the input filter plate (C).



*Install*

1. Install the new input filter plate (A).
2. Tighten the fasteners (B).
3. Install the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the side panels. See § 11.3.

**11.2.16 Input filter replacement, small cabinet (15 kVA) and big cabinet**

Parts: see § 13.8.

- Input filter
- Output filter

**Note**

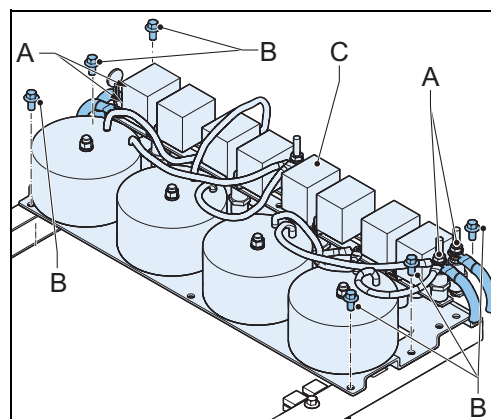
- **Always replace the input filter and the output filter together.**
- **The number of filters and capacities can be different from the illustrations, depending on the output power.**

*Remove panel*

1. Remove the side panels. See § 11.3.

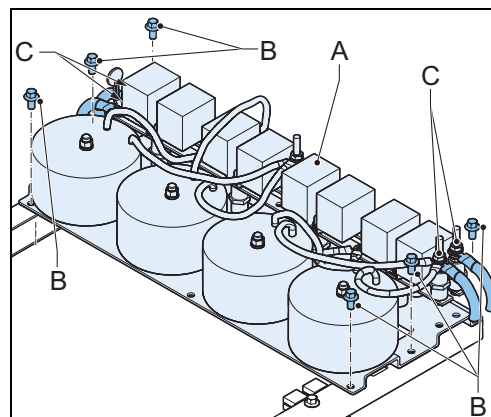
*Remove*

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the complete input filter (C).



*Install*

1. Install the new complete input filter (A).
2. Tighten the fasteners (B).
3. Install the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the side panels. See § 11.3.

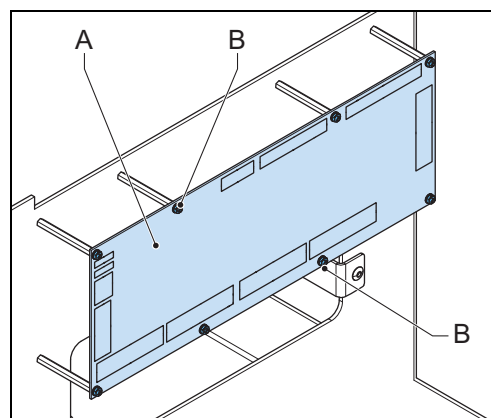


**11.2.17 Interface PCB (PCB1702) replacement (option CS)**

Parts: see § 13.8.

- Interface PCB

1. Switch OFF the power supply. See § 9.2.
2. Remove the front panel. See § 11.3.
3. Disconnect the cables from the CS PCB (A).
4. Remove the fasteners (B).
5. Replace the CS PCB.
6. Install the fasteners (A).
7. Connect the cables to the connectors.
8. Install the front panel of the CS cabinet.



### 11.2.18 Lightning arrestors replacement, equipment with SCO or SCB

**Note**

The number of lightning arrestors can be different from the illustrations, depending on the output power.

Parts: see § 13.8.

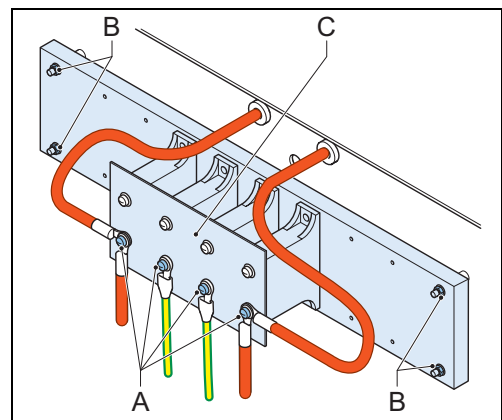
- Lightning arrestors

*Remove panel*

1. Remove the side panels. See § 11.3.

*Remove*

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the lightning arrestors assembly (C).

*Install*

1. Install the new lightning arrestors assembly.
2. Instal the wires.
3. Install the side panels. See § 11.3.



### 11.2.19 Line filter replacement

Parts: see § 13.8.

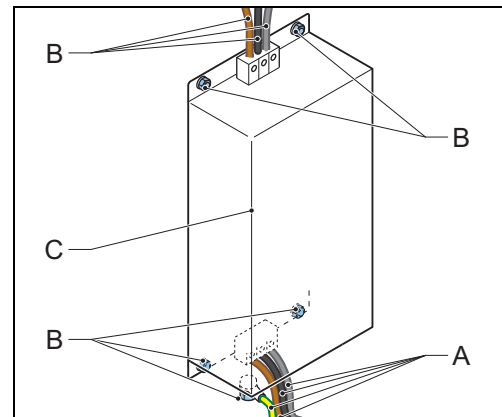
- Line filter

#### *Remove panel*

1. Remove the side panels. See § 11.3.
2. Remove the lower rear panel. See § 11.3.

#### *Remove*

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the line filter (C).



#### *Install*

1. Install the new line filter.
2. Install the wires.
3. Install the lower rear panel. See § 11.3.
4. Install the side panels. See § 11.3.

### 11.2.20 Main contactor replacement, small cabinet

**WARNING**

Make sure that you switched OFF the power to the equipment. See § 9.3.

Parts: see § 13.8.

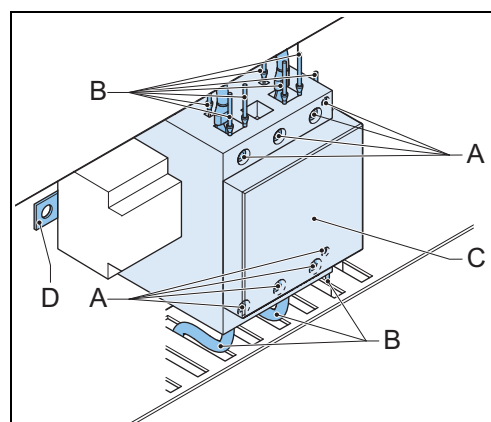
- Main contactor

*Remove panel*

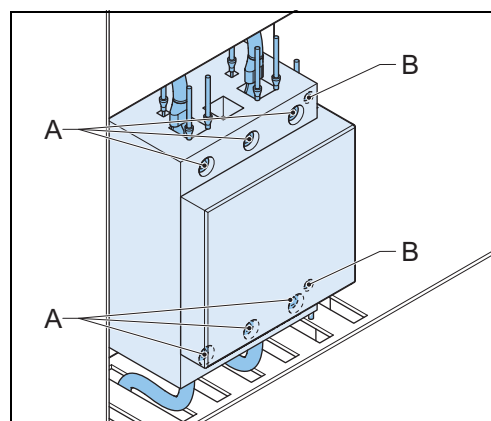
1. Remove the lower front panel. See § 11.3.

*Disconnect*

1. Loosen the screws (A).
2. Disconnect the wires (B).
3. Remove the main contactor (C). *Use a screwdriver as a lever to release the manual switch from the rail (D).*

*Install*

1. Install the new main contactor.
2. Connect all the wires.
3. Tighten the screws of the main power cables (A). *Apply a torque of 5 Nm.*
4. Tighten the screws of the auxiliary power cables (B). *Apply a torque of 1.7 Nm.*
5. Install the lower front panel. See § 11.3.



### 11.2.21 Main contactor replacement, big cabinet



**WARNING**

Make sure that you switched OFF the power to the equipment. See § 9.3.

Parts: see § 13.8.

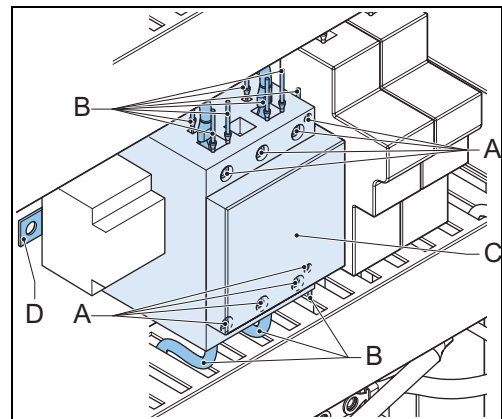
- Main contactor

*Remove panel*

1. Remove the lower front panel. See § 11.3.

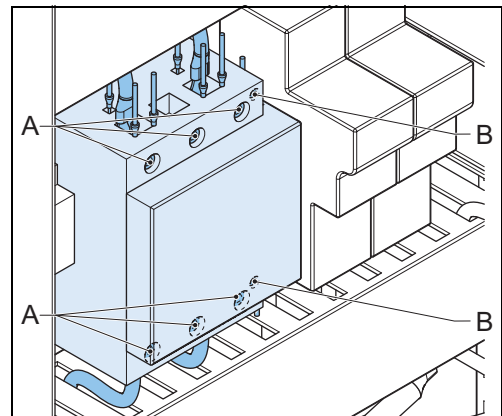
*Disconnect*

1. Loosen the screws (A).
2. Disconnect the wires (B).
3. Remove the main contactor (C). *Use a screwdriver as a lever to release the manual switch from the rail (D).*



*Install*

1. Install the new main contactor.
2. Connect all the wires.
3. Tighten the screws of the main power cables (A). *Apply a torque of 4 Nm.*
4. Tighten the screws of the auxiliary power cables (B). *Apply a torque of 1.7 Nm.*
5. Install the lower front panel. See § 11.3.



### 11.2.22 Main fuses replacement

Parts: see § 13.8.

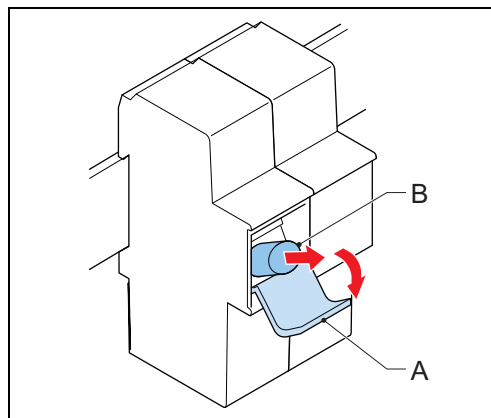
- Fuses. See also § 13.5.

#### *Remove panel*

1. Remove the lower front panel. See § 11.3.

#### *Replace*

1. Open the fuse holder (A).
2. Replace the fuse (B).
3. Close the fuse holder.



#### *Install*

1. Install the lower front panel. See § 11.3.

### 11.2.23 Manual switch replacement



#### **WARNING**

**Make sure that you switched OFF the power to the equipment. See § 11.3.**

Parts: see § 13.8.

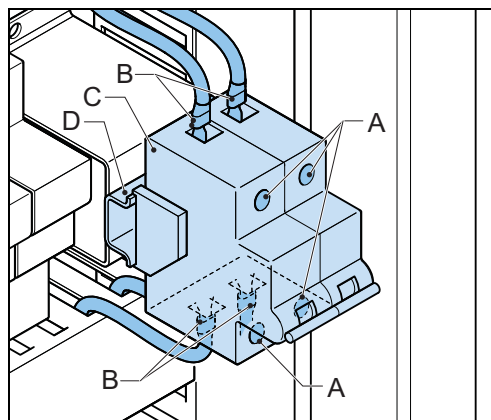
- Manual switch

#### *Remove panel*

1. Remove the lower front panel. See § 11.3.

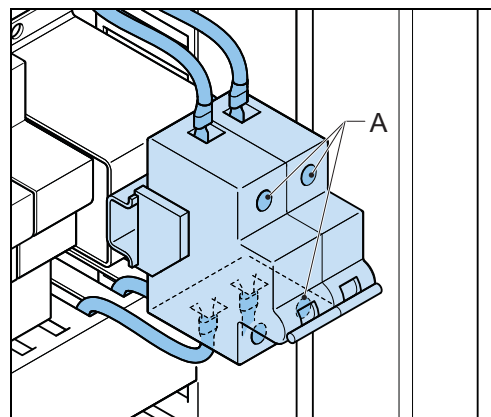
#### *Disconnect*

1. Loosen the screws (A).
2. Disconnect the wires (B).
3. Remove the manual switch (C). *Use a screwdriver as a lever to release the manual switch from the rail (D).*



### Install

1. Install the new manual switch.
2. Connect all the wires.
3. Tighten the screws (A). *Apply a torque of 4 Nm.*
4. Install the lower front panel. See § 11.3.



### 11.2.24 Output filter replacement, stackable cabinet

Parts: see § 13.8.

- Input filter
- Output filter



### Note

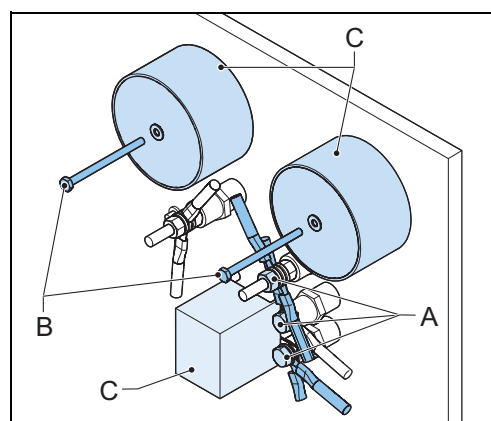
- **Always replace the input filter and the output filter together.**
- **The number of filters and capacities can be different from the illustrations, depending on the output power.**

### Remove panel

1. Remove the top panel. See § 11.3.

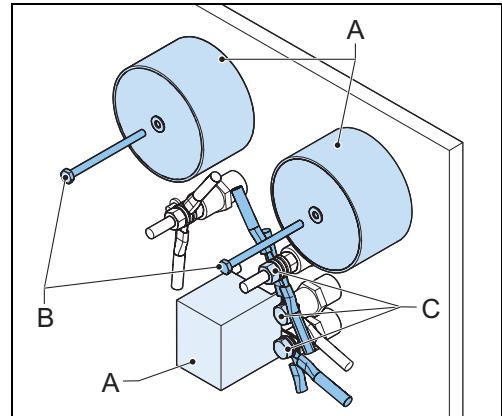
### Remove

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the parts of the output filter (C).



*Install*

1. Install the new parts of the output filter (A).
2. Tighten the fasteners (B). *Apply a torque of 3 Nm.*
3. Connect the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the top panel. See § 11.3.

**11.2.25 Output filter replacement, small (up to 10 kVA) cabinet**

Parts: see § 13.8.

- Input filter
- Output filter

**Note**

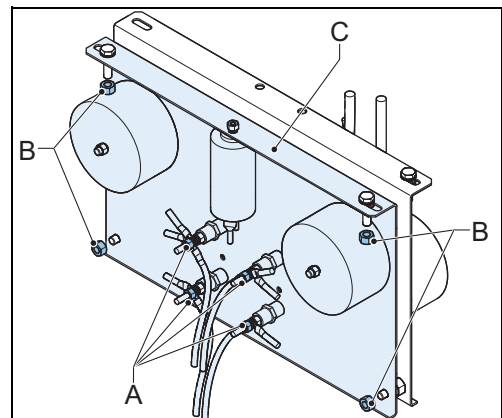
- **Always replace the input filter and the output filter together.**
- **The number of filters and capacities can be different from the illustrations, depending on the output power.**

*Remove panel*

1. Remove the side panels. See § 11.3.

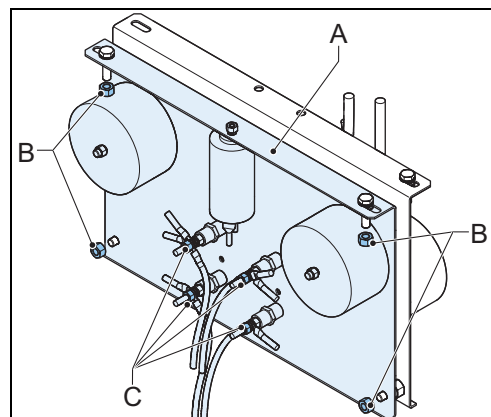
*Remove*

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the output filter plate (C).



### Install

1. Install the new output filter plate (A).
2. Tighten the fasteners (B).
3. Install the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the side panels. See § 11.3.



### 11.2.26 Output filter replacement, small cabinet 15 kVA and big cabinet

Parts: see § 13.8.

- Input filter
- Output filter



#### Note

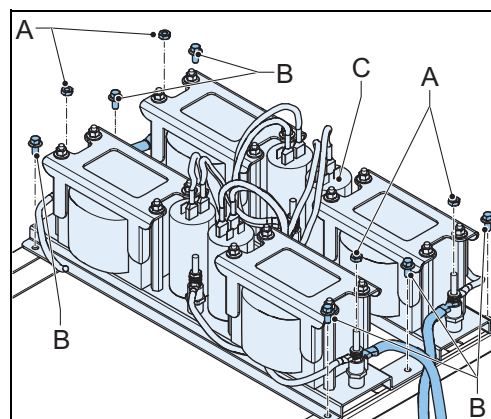
- **Always replace the input filter and the output filter together.**
- **The number of filters and capacities can be different from the illustrations, depending on the output power.**

### Remove panel

1. Remove the side panels. See § 11.3.

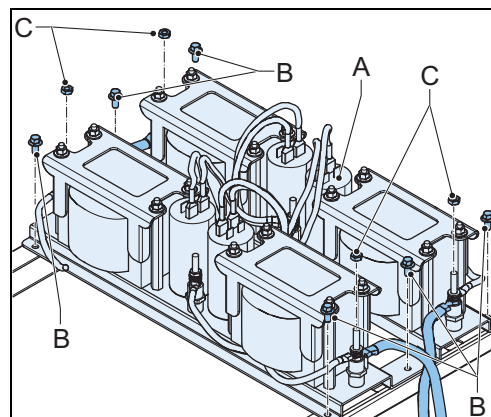
### Remove

1. Disconnect the wires (A).
2. Remove the fasteners (B).
3. Remove the complete output filter (C).



*Install*

1. Install the new complete output filter (A).
2. Tighten the fasteners (B).
3. Install the wires.
4. Tighten the fasteners (C). *Apply a torque of 6 Nm.*
5. Install the side panels. See § 11.3.

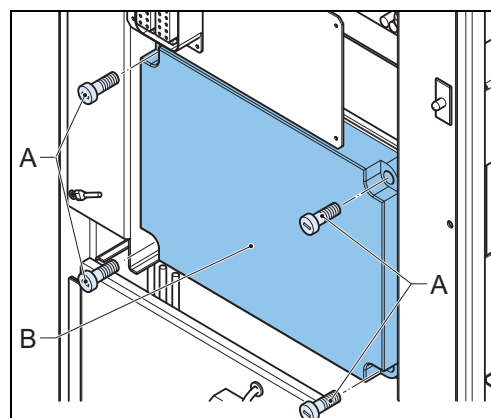
**11.2.27 Output measure PCB (EPS442) replacement**

Parts: see § 13.8.

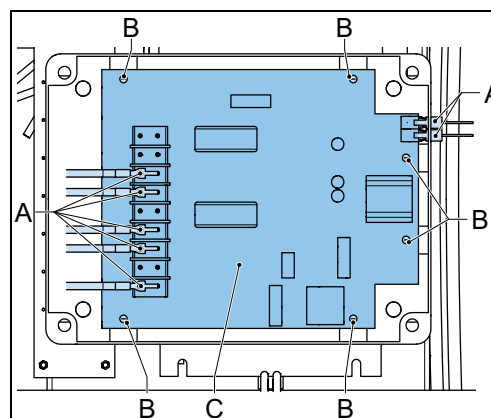
- Output measure PCB

*Remove panels*

1. Remove the upper rear panel. See § 11.3.
2. Remove the screws (A).
3. Remove the box panel (B).

*Disconnect*

1. Disconnect the wires and connectors (A).
2. Remove the fasteners (B).
3. Remove the output measure PCB (C).

*Install*

1. Install the new output measure PCB.
2. Install the wires and connectors.
3. Install the box panel.
4. Install the upper rear panel. See § 11.3.



### 11.2.28 Power supply PCB (EPS480) replacement

Parts: see § 13.8.

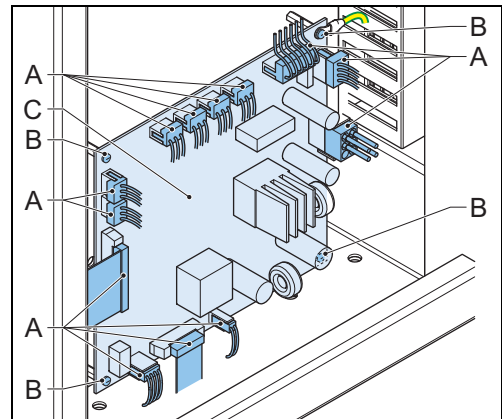
- Power supply PCB

#### *Remove panel*

1. Remove the front panel. See § 11.3.

#### *Disconnect*

1. Disconnect the connectors and the wires (A).
2. Remove the fasteners (B).
3. Remove the power supply PCB (C).



#### *Install*

1. Install the new power supply PCB.
2. Connect all the wires.
3. Install the front panel. See § 11.3.

### 11.2.29 Remote control PCB (EPS495) replacement



#### **Note**

The procedure is similar for the replacement of the remote control PCB SIN.

Parts: see § 13.8.

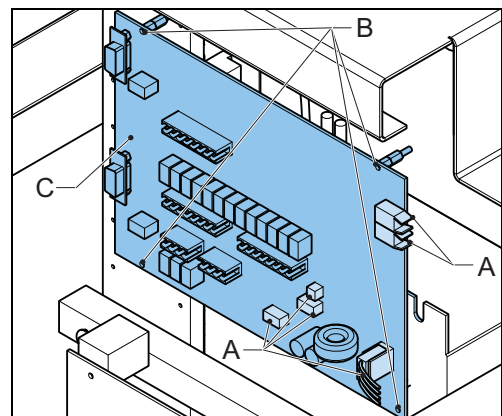
- Remote control PCB or remote control PCB SIN

#### *Remove panel*

1. Remove the upper rear panel. See § 11.3.

#### *Disconnect*

1. Disconnect the connectors and the wires (A).
2. Remove the fasteners (B).
3. Remove the remote control PCB (C).



*Install*

1. Set the dip-switches of the new remote control PCB. See § 12.3.
2. Install the new remote control PCB.
3. Connect all the wires.

**CAUTION**

Depending on the configuration of the equipment, other wires need to be connected. These can be different from the illustration above.

4. Install the upper rear panel. See § 11.3.

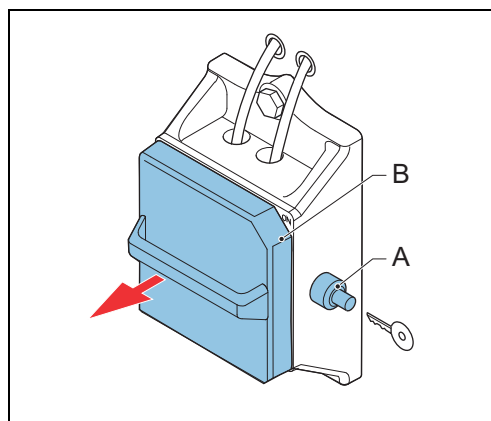
**11.2.30Series CutOut (SCO) replacement (option)**

Parts: see § 13.8.

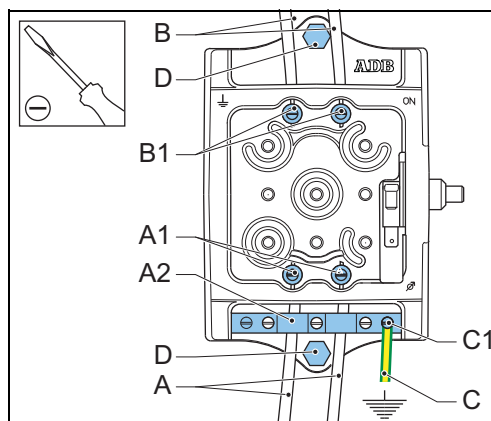
- Series CutOut (SCO)

*Prepare*

1. Switch OFF the power supply. See § 9.3.
2. Make sure that the circuit is earthed.
3. Open the lock (A).
4. Remove the cover (B). *Use the handle.*

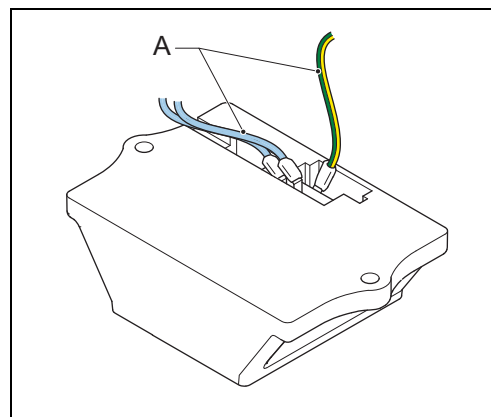
*Remove*

1. Loosen the screws (A1).
2. Remove the series circuit cables from the earthing bar (A2).
3. Disconnect the series circuit cables (A).
4. Loosen the screws (B1).
5. Disconnect the output cables (B).
6. Loosen the screw (C1)
7. Disconnect the earthing wire (C).
8. Remove the bolts (D).
9. Remove the SCO.



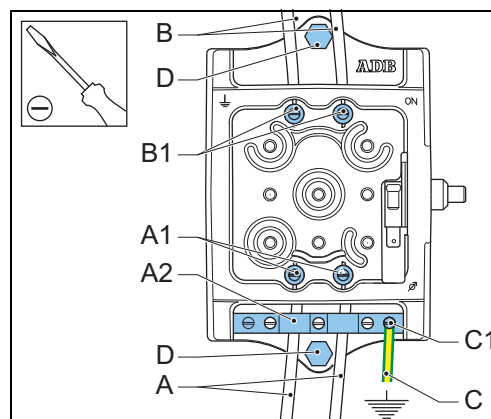
### Connect micro switch

1. Disconnect the cables to the micro switch (A).
2. Connect the cables to the micro switch (A) in the new SCO.



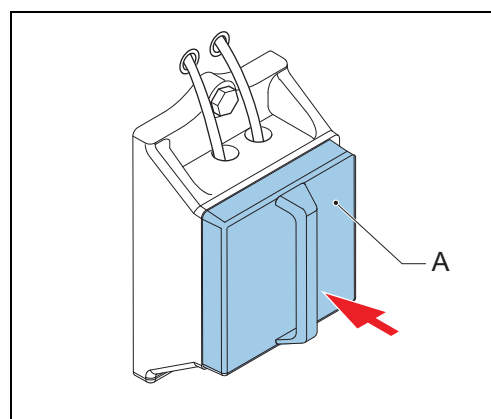
### Install

1. Install the new SCO.
2. Install the bolts (D).
3. Connect the earthing wire (C). *Use the screw connection (C1).*
4. Connect the output cables (B).
5. Tighten the screws B1.
6. Connect the series circuit cables (A).
7. Tighten the screws (A1).
8. Connect the wires to the earthing bar (A2).
  - Make the connection of the shield of the cable to the earthing bar.
  - If there is no shield on the cable, connect a clamp to the outside of the cable.



### Finish

1. Install the cover of the SCO (A).



### 11.2.31 Series Connection Box (SCB) replacement (option)

Parts: see § 13.8.

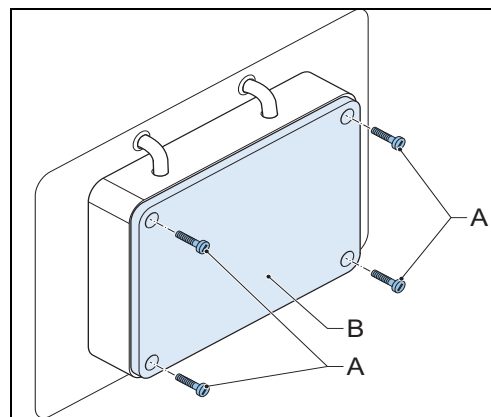
- Series Connection Box (SCB)

#### *Prepare*

1. Switch OFF the power supply. See § 9.3.
2. Make sure that the circuit is earthed.

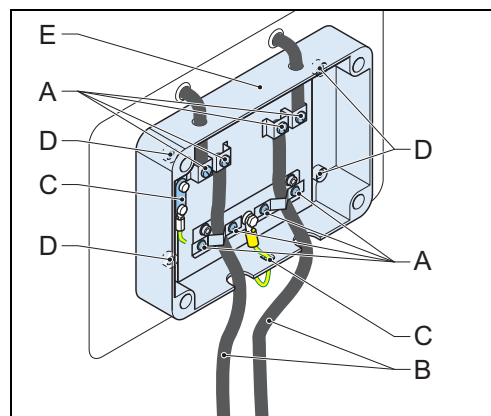
#### *Remove panel*

1. Loosen the fasteners (A).
2. Remove the box panel (B).



#### *Remove*

1. Loosen the screws (A).
2. Disconnect the series circuit cables (B).
3. Disconnect the wires and connectors (C).
4. Loosen the screws (D).
5. Carefully remove the SCB (E).



#### *Install*

1. Install the new SCB.
2. Put the series circuit cables through the stress-relief clamps.
3. Tighten the screws of the stress-relief clamps.
4. Install all the wires and connectors.
5. Install the box panel.

## 11.3 Remove panels

The panels of the equipment can be removed for installation or maintenance procedures.



### WARNING

- Do not operate the equipment with any of the panels removed.
- Do not mix panels from different equipments.
- Always connect the earthing wires before you install the panels.
- The panels can be heavy, especially the side panels.
- Do not change or lock the panel switches. A Panel switch sees if a panel is installed or not.



### Note

The panels differ in size and number of screws. The illustrations below show the principle.

### 11.3.1 Generic panels

#### *Remove panel*

1. Set the manual switch to the 'OFF' position.
2. Remove the screws (A) from the bottom to the top.



### WARNING

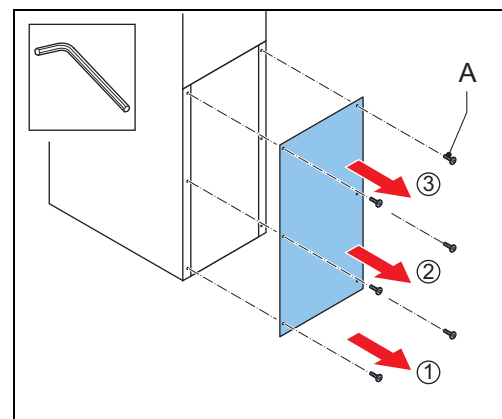
The panels are heavy. Also, the momentum of the panel can cause damage to the panel and the screws if you remove the top screws first.

3. Carefully remove the panel (B).



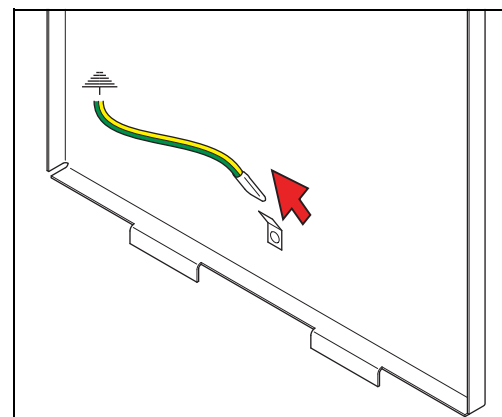
### CAUTION

Do not damage cables and/or connectors.



#### *Disconnect wires*

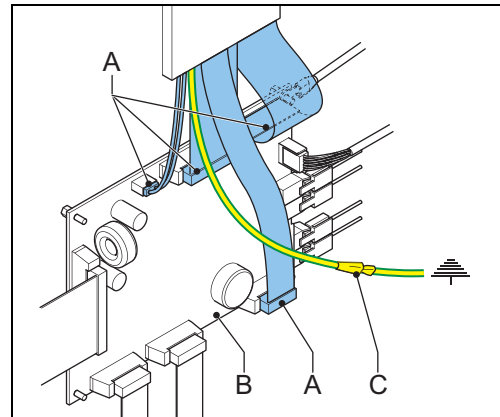
1. Disconnect the green/yellow earthing wires. *The wires have a fast-on connector.*



### 11.3.2 Remove the display / keyboard panel of the small cabinet

#### *Disconnect HMI*

1. Remove the front panel. See § 11.3.1.
2. Disconnect the wires (A) to the HMI from the CPU PCB (B).
3. Disconnect the earthing wire (C).

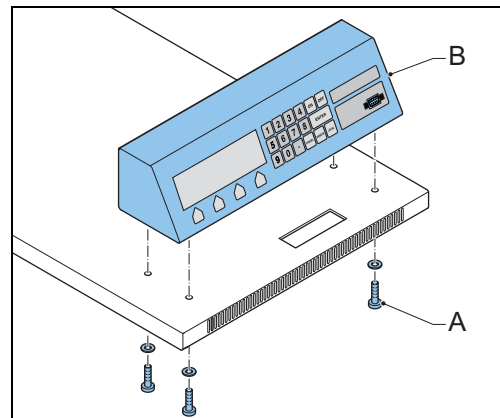


#### *Remove panel*

1. Remove the top panel. See § 11.3.5.
2. Remove the screws (A).
3. Carefully remove the panel (B).



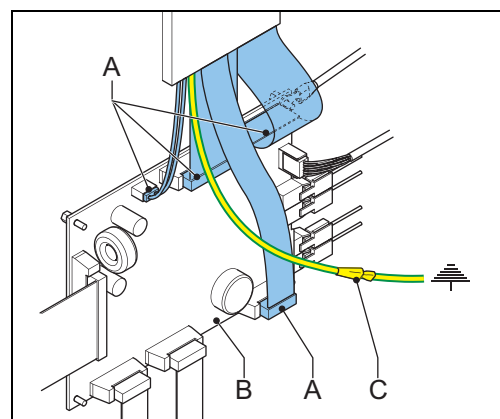
**CAUTION**  
Do not damage cables and/or connectors.



### 11.3.3 Remove the display / keyboard panel of the big cabinet

#### *Disconnect HMI*

1. Remove the lower front panel. See § 11.3.1.
2. Disconnect the wires (A) to the HMI from the CPU PCB (B).
3. Disconnect the earthing wire (C).

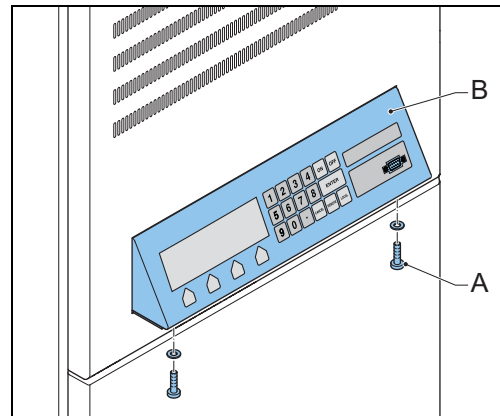


*Remove panel*

1. Remove the screws (A).
2. Carefully remove the panel (B).



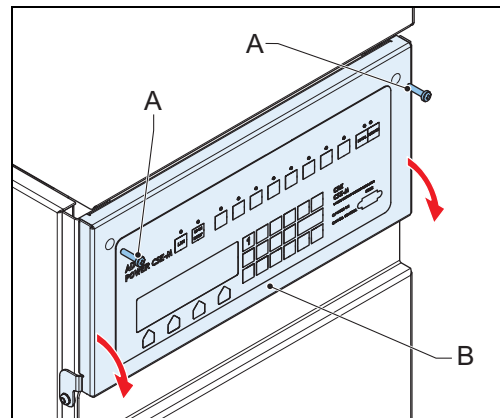
**CAUTION**  
Do not damage cables and/or connectors.



**11.3.4 Remove the display / keyboard panel of a cabinet with a CS (option CS)**

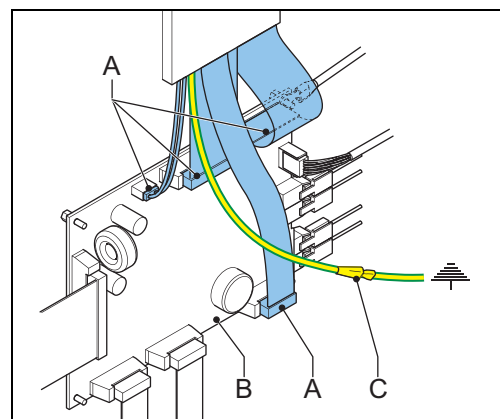
*Open panel*

1. Remove the screws (A).
2. Open the panel (B) downwards.



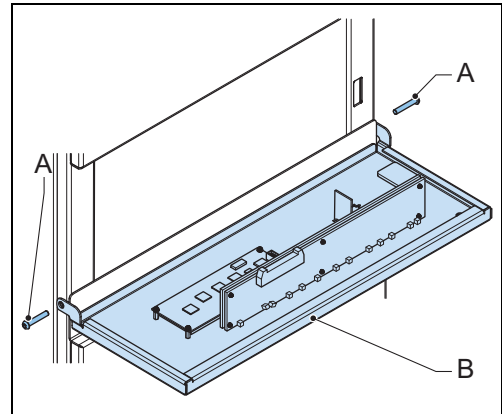
*Disconnect HMI*

1. Disconnect the wires (A) to the HMI from the CPU PCB (B).
2. Disconnect the earthing wire (C).

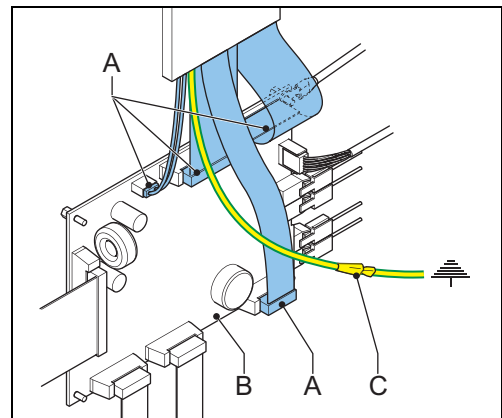


*Remove panel*

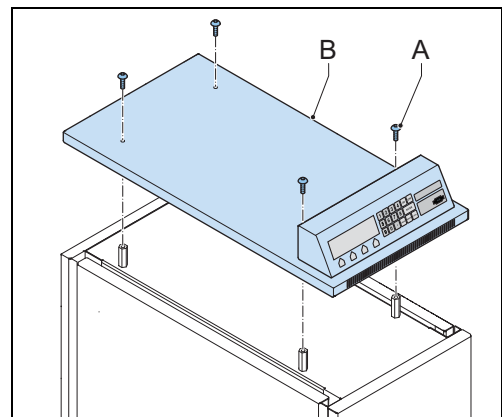
1. Remove the screws (A).
2. Remove the panel (B).

**11.3.5 Top panel (small cabinet)***Disconnect HMI*

1. Remove the front panel. See § 11.3.1.
2. Disconnect the wires (A) to the HMI from the CPU PCB (B).
3. Disconnect the earthing wire (C).

*Remove*

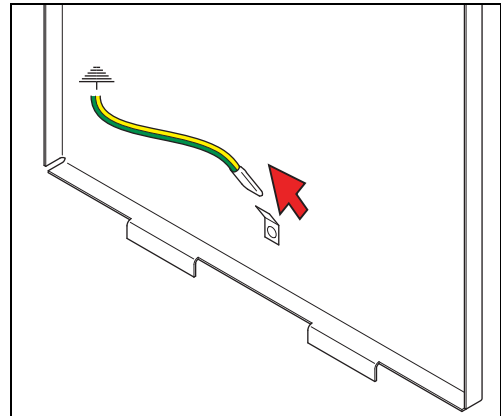
1. Remove the screws (A).
2. Remove the top panel (B).





*Disconnect wires*

1. Disconnect the green/yellow earthing wires. *The wires have a fast-on connector.*



## 11.4 Firmware update

### 11.4.1 Firmware update procedure

*Tools:*

- PC with serial port connection
- Firmware update dongle: 'Pin to Pin DB9P & DB9S cable'
- Correct firmware upload file

1. Install the software to upload the firmware. See § 11.4.2.
2. Change the SD flash file paths, if necessary. See § 11.4.3.
3. Do a check on the equipment parameters. See § 11.4.4.
4. Update the firmware. See § 11.4.5.
5. Start the equipment after a firmware update. See § 11.4.6.

### 11.4.2 Install the software to upload the firmware

*Install the software*

1. Unzip the file 'sdfash.zip' to the default path of D:\sdfash.



**Note**

**If you extract the zip file to a different location, see § 11.4.3.**

2. Run the program SDFlash.exe.
3. Select *File>Open Project*.
4. Select the 'F2812SerialFlash.sdp' project from the 'sdfash' directory.
5. If you opened the program for the first time, select the correct Emulator Address/ID.



**Note**

**This is the same process as selecting the correct COM-port address, where C4 would equal COM 4. Refer to the device manager of the PC to find the correct address. You can change this setting later from the *Project >Settings >Target tab>Emulator Address/ID* drop down list.**

6. Go to *File>Exit*.
7. Click *Save*.

*Do a check on the port settings*

1. Go to *Start>Control Panel>System>Hardware tab>Device Manager>Ports>USB Serial Port*.
2. Right-click on *USB Serial Port*.
3. Select *Properties*.
4. Select the tab *Port Settings*.
5. In the *Advanced Settings for COM* window, do these steps:
  - Make sure that the COM Port Number is correct. Select the correct Emulator Address/ID (see earlier in this procedure).
  - Change Receive (Bytes) to 4096.
  - Change Transmit (Bytes) to 4096.
  - Change Latency Timer (msec) to 16.

### 11.4.3 Change the SD Flash file paths



**Note**

Do this procedure if you extracted the zip file 'sdflash.zip' to a different location than D:\sdflash.

1. Go to *Project>Settings*.
2. In the indicated tabs, change the indicated fields to the correct file path.

Tab	Field
Target	Driver
	Board File
Erase	Algorithm
Programming	Algorithm
Verify	Algorithm

3. Click OK.

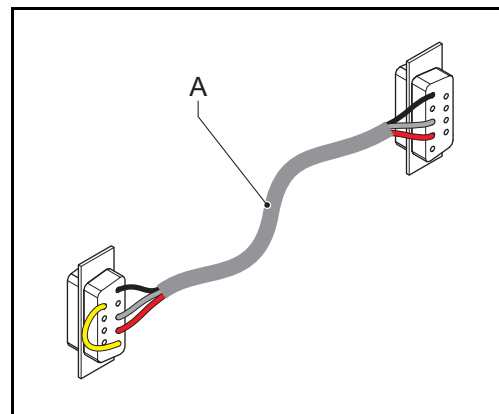
### 11.4.4 Do a check of the equipment parameters

1. Start the configuration software tool. See § 7.2.
2. Go to the *Configuration* screen.
3. Go to the *Identification* tab.
4. Push the *Read* button to show the firmware details.
5. Make sure that the equipment parameters below match these of the filename of the required firmware version:
  - Single Phase (CRE) or Tri-phase (VIS)
  - Input Voltage: 230V range or 400V range
  - CCR Power Rating in kVA
  - SHVS installed or SHVS not installed.
  - The type of control system. This is PPT unless specified.
6. Stop the configuration software tool. See § 7.4.
7. Switch OFF the equipment. See § 9.2.
8. Make sure that the manual switch is in the OFF position. See § 9.3.

### 11.4.5 Update the firmware

#### *Prepare the equipment*

1. Remove the lower front panel. See § 11.3.1.
2. Remove the watch-dog jumper from the CPU PCB (EPS479). See § 12.1.
3. Connect the firmware update dongle (A) between the PC and the equipment.
4. Click on SDFlash.exe.
5. Do a check if F2812SerialFlash.sdp loads.
6. If not, see § 11.4.2 and load the correct project.
7. Switch ON the equipment. See § 9.1. *When the equipment is ready for the firmware upload, the HMI is blank.*
8. If the HMI is not blank, see § 11.4.2 and load the correct project.



#### *Upload the firmware*

1. Go to *Project>Settings>Programming tab>Flash Data File field*.
2. Select the correct firmware version file from the files with a \*.out extension.
3. Go to *Device>Flash*. If asked to save changes, click *yes*.
4. Make sure that the *Erase, Program and Verify* checkboxes are checked.
5. Click *Start*.
6. Wait until the upload is complete.
7. Close the SDFlash program.

#### **11.4.6 Start the equipment after a firmware update**

##### *Start the equipment again*

1. Switch OFF the equipment. See § 9.2.
2. Make sure that the manual switch is in the OFF position. See § 9.3.
3. Install the watch-dog jumper on the CPU PCB.
4. Switch ON the equipment. See § 9.1.

##### *Do a check if the firmware is correctly updated*

1. Make sure that the firmware data on the lower line of the main menu on the HMI is correct.
2. Start the configuration software tool. See § 7.2.
3. Go to the *Configuration* screen.
4. Go to the *Identification* tab.
5. Push the *Read* button to show the firmware details.

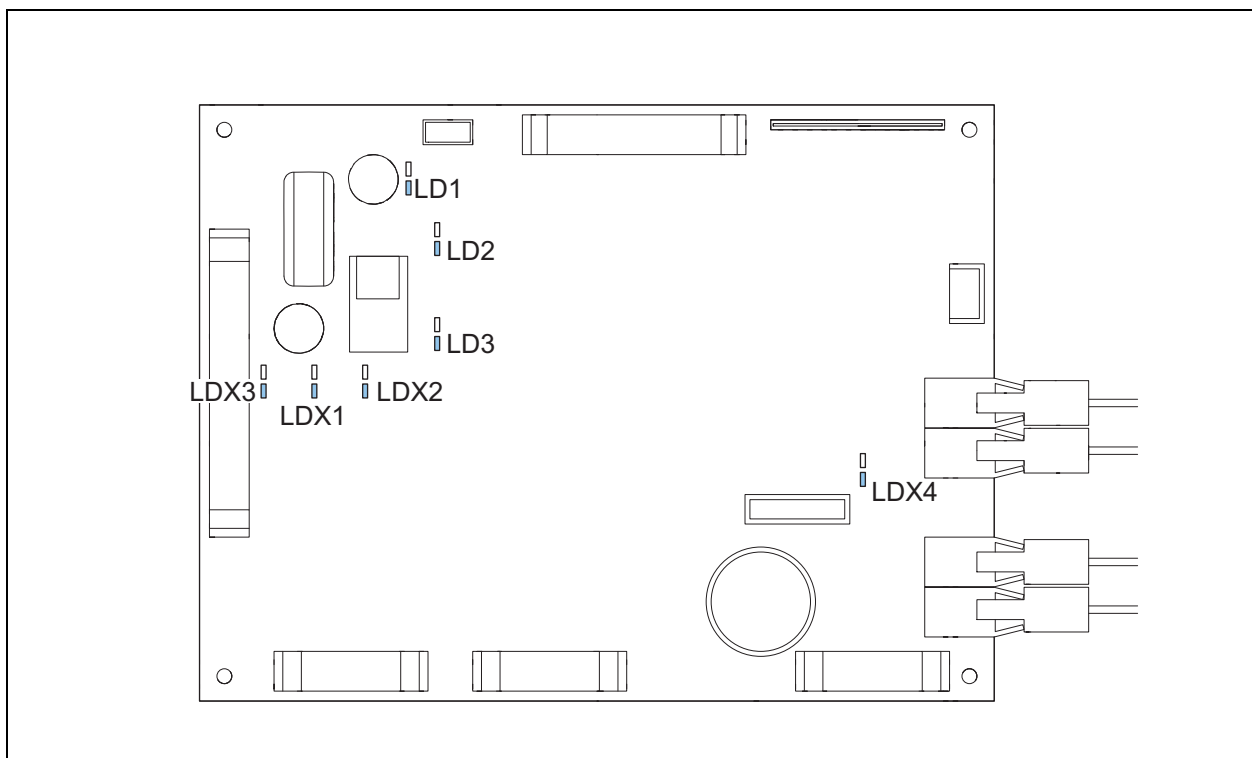
##### *Disconnect the cable and install the front panel*

1. Switch OFF the equipment. See § 9.2.
2. Make sure that the manual switch is in the OFF position. See § 9.3.
3. Disconnect the firmware update dongle.
4. Install the lower front panel. See § 11.3.1.
5. Switch ON the equipment. See § 9.1.

## 12 PCB drawings and settings

### 12.1 CPU PCB (EPS479)

#### 12.1.1 Printed Circuit Board (PCB)



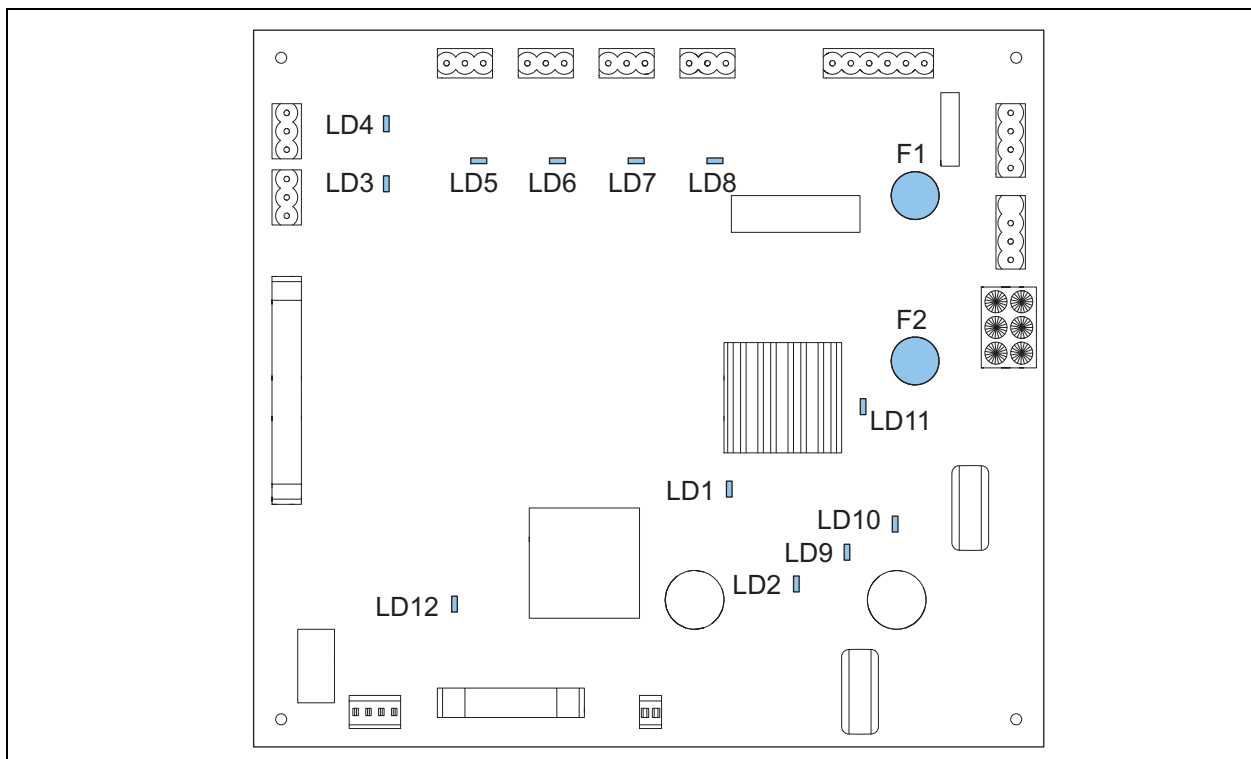
#### 12.1.2 LEDs

**Table: 12.1 CPU PCB LED functions**

LED	Color	Function
LDX1	Red	The LED is red when the voltage for the power supply is +5V DC (generated on the PCB).
LDX2	Red	The LED is red when the voltage is +5V DC.
LDX3	Red	The LED is red when the voltage from the power supply PCB is +12 V DC.
LDX4	Red	The LED is red when the CPU operates.
LD1	Green	The LED is green when the voltage for the power supply on the PCB is +5 V DC (generated on the PCB).
LD2	Green	The LED is green when the voltage for the power supply on the PCB is +3.3 V DC (generated on the PCB).
LD3	Green	The LED is green when the voltage for the powers supply on the PCB is +1.8 V DC (generated on the PCB).

## 12.2 Power supply PCB (EPS480)

### 12.2.1 Printed Circuit Board (PCB)



### 12.2.2 LEDs

**Table: 12.2 Power supply PCB LED functions**

LED	Color	Function
LD1	Green	The LED is green when the voltage for the fans, if applicable is +24 V DC (generated on the PCB)
LD2	Red	The LED is red when the voltage of the power supply on the PCB is 12 V DC.
LD3	Red	The LED is red when the fan connected to J8 is active.
LD4	Red	The LED is red when the fan connected to J10 is active.
LD5	Red	The LED is red when the fan connected to J12 is active.
LD6	Red	The LED is red when the fan connected to J14 is active.
LD7	Red	The LED is red when the fan connected to J16 is active.
LD8	Red	The LED is red when the fan connected to J18 is active.
LD9	Red	The LED is red when the input voltage after the diode bridge PT is 24 V DC (nominal).
LD10	Red	The LED is red when the voltage of the power supply on the PCB is 20 V DC.
LD11	Red	The LED is red when the sense input line voltage is 24 V AC (nominal).
LD12	Green	The LED is green when the voltage from the 50 kHz power supply on the PCB is 48 V DC.

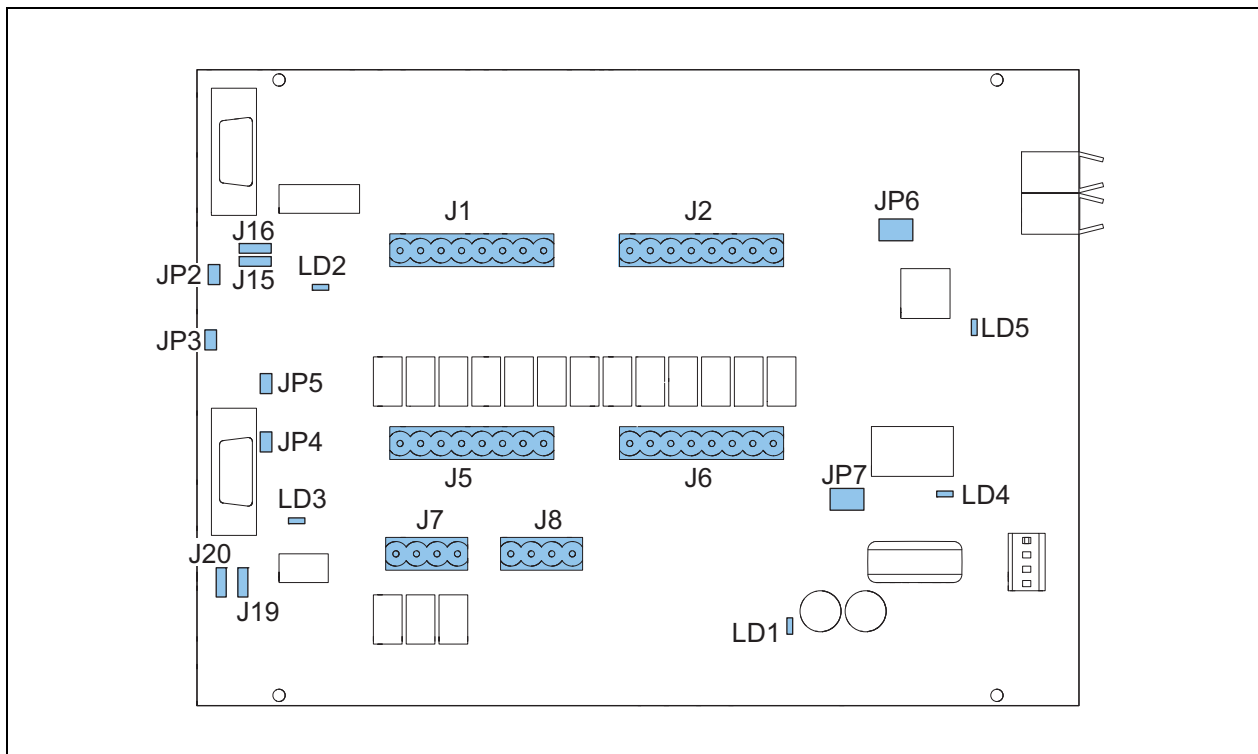
### 12.2.3 Fuses

**Table: 12.3 Power supply PCB Fuses**

<b>F1</b>	<b>1.6 A</b>
<b>F2</b>	<b>2.5 A</b>

## 12.3 Remote control PCB (EPS495)

### 12.3.1 Printed Circuit Board (PCB)









### 12.3.2 LEDs

**Table: 12.4 Remote control PCB LED functions**







<b>LED</b>	<b>Color</b>	<b>Function</b>
LD1	Green	The LED is green when the voltage of the power supply on the PCB is 12 V DC.
LD2	Green	The LED is green when the voltage from the DCDC1, generated on the PCB, is + 5 V DC insulated.
LD3	Green	The LED is green when the voltage from the DCDC2, generated on the PCB, is + 5 V DC insulated.
LD4	Red	The LED flashes red when the U5 CPU is active.
LD5	Red	The LED flashes red when the U6 CPU is active.

### 12.3.3 Jumper settings

**Table: 12.5 Remote control PCB jumper settings**

Jumper	Position	Function
JP2	insert	enable TX serial channel 1 termination resistance
JP3	insert	enable RX serial channel 1 termination resistance
JP4	insert	enable TX serial channel 2 termination resistance
JP5	insert	enable RX serial channel 2 termination resistance
JP6	position 1-3 and position 2-4 	ethernet channel 1: enable
	position 3-5 and position 4-6 	serial channel 1: enable
JP7	position 1-3 and position 2-4 	ethernet channel 2: enable
	position 3-5 and position 4-6 	serial channel 2: enable
J15	position 2-3 	serial channel 1: RS485 configuration
	position 1-2 	serial channel 1: RS422 configuration (not used)



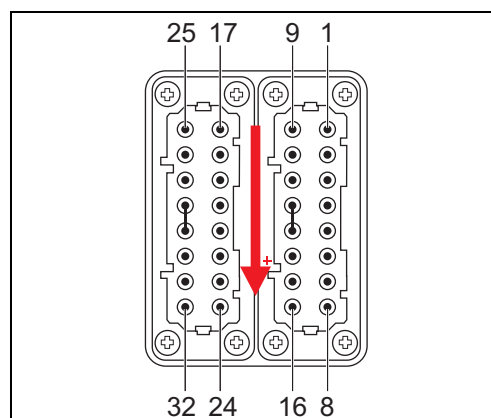
Jumper	Position	Function
J16	position 2-3 	serial channel 1: RS485 configuration
	position 1-2 	serial channel 1: RS422 configuration (not used)
J19	position 2-3 	serial channel 2: RS485 configuration
	position 1-2 	serial channel 2: RS422 configuration (not used)
J20	position 2-3 	serial channel 2: RS485 configuration
	position 1-2 	serial channel 2: RS422 configuration (not used)

#### 12.3.4 Multiwire / J-Bus connection scheme



##### Note

The table below shows the standard remote control configuration for the signals. If you want another configuration, contact ADB Safegate.



**Table: 12.6 Factory set terminal assignments for remote control connections with multiwire and single J-Bus**

Function	Terminal number on 32-pole connector	Relay number on Remote Control PCB (unless indicated otherwise)
<b>Control signals (fixed)</b>		
Step 1	1	J1.1
Step 2	2	J1.2
Step 3	3	J1.3
Step 4	4	J1.4
Step 5	5	J1.5
ON	6	J1.6
CCR OFF from HVCS	8	J1.7
<b>Feedback signals (fixed)</b>		
Step 1	9	J5.1
Step 2	10	J5.2
Step 3	11	J5.3
Step 4	12	J5.4
Step 5	13	J5.5
ON (step1,2...5) / OFF (OFF or Standby Step0)	19	J5.6
<b>Feedback signals (configurable):</b> the values below are default values, for configuration options (for the options, see the table that follows)		
Disable local/remote	14	J5.7 (NC) <sup>1</sup>
	28	J5.8
Open circuit	16	J6.1 <sup>1</sup>
Overcurrent	20	J6.2 <sup>1</sup>
Bad regulation	22	J6.3 <sup>1</sup>
	15	J6.4 (CM)
Lamp fault	23	J6.5 <sup>1</sup>
EFD warning	24	J6.7 <sup>1</sup>
EFD error	25	J6.8 <sup>1</sup>
High temperature alarm	27	J7.1 <sup>1</sup>
Short circuit	29	J7.2 <sup>1</sup>
Lamp fault warning	21	J7.3 <sup>1</sup>
<b>External signals (fixed)</b>		
	24	CRE doormswitch (power input door)
	26	CRE doormswitch (power input door)
	7	

Function	Terminal number on 32-pole connector	Relay number on Remote Control PCB (unless indicated otherwise)
	17	
	18	
<b>J-Bus interface (fixed)</b>		
RS485 BusA GND	30	DB9.3
RS485 Data -	32	DB9.2
RS485 Data +	31	DB9.1

1) Configurable with HMI

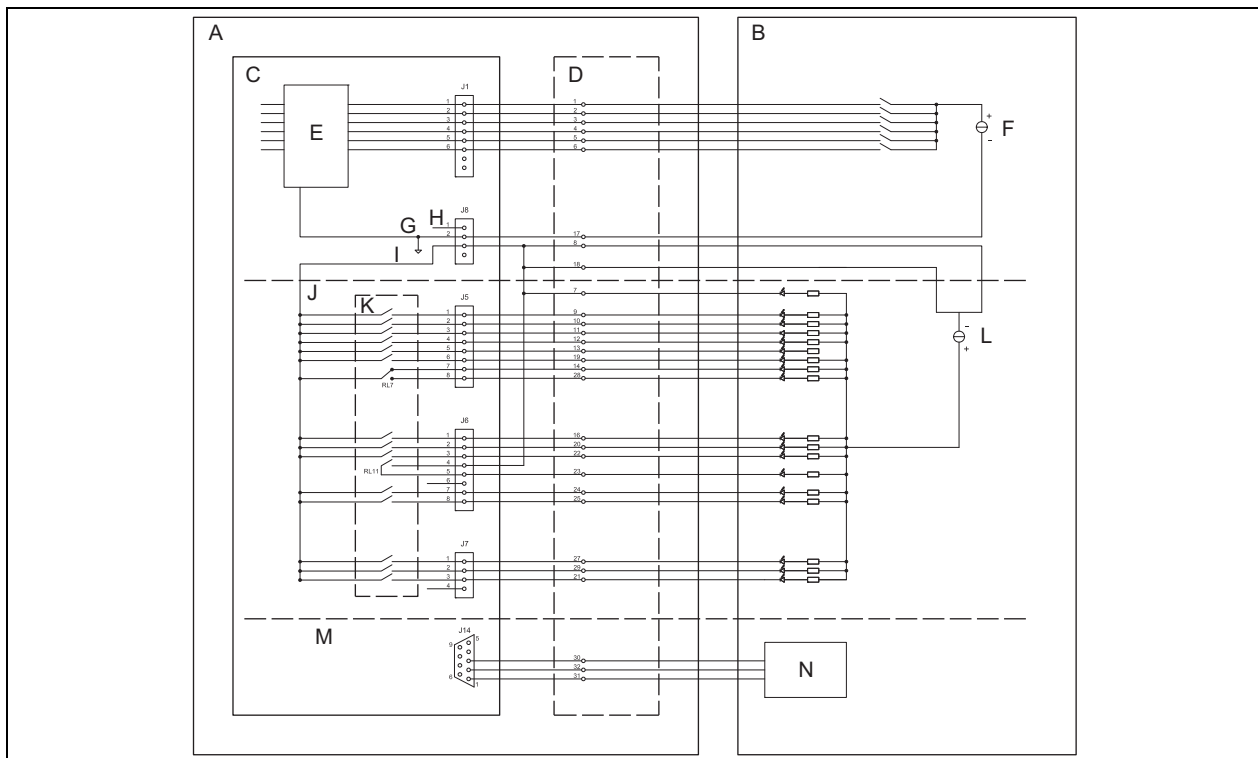
**Table: 12.7 Factory set terminal assignments for remote control connections with multiwire dual J-Bus**

Function	Terminal number on 32-pole connector	Relay number on Remote Control PCB (unless indicated otherwise)
<b>Control signals (fixed)</b>		
Step 1	1	J1.1
Step 2	2	J1.2
Step 3	3	J1.3
Step 4	4	J1.4
Step 5	5	J1.5
ON	6	J1.6
CCR OFF from HVCS	8	J1.7
<b>Feedback signals (fixed)</b>		
Step 1	9	J5.1
Step 2	10	J5.2
Step 3	11	J5.3
Step 4	12	J5.4
Step 5	13	J5.5
ON (step1,2...5) / OFF (OFF or Standby Step0)	19	J5.6
<b>Feedback signals (configurable):</b>		
Disable local/remote	14	J5.7 (NC) <sup>1</sup>
Open circuit	16	J6.1 <sup>1</sup>
Overcurrent	20	J6.2 <sup>1</sup>
Bad regulation	15	J6.4 (CM)
EFD error	25	J6.8 <sup>1</sup>
Lamp fault warning	21	J7.3 <sup>1</sup>

Function	Terminal number on 32-pole connector	Relay number on Remote Control PCB (unless indicated otherwise)
<b>External signals</b> (fixed)		
	7	
	17	
	18	
<b>J-Bus interface</b> (fixed)		
RS485 BusA GND	30	DB9.3
RS485 Data -	32	DB9.2
RS485 Data +	31	DB9.1
RS485 BusB GND	27	DB92.3
RS485 Data +	28	DB92.1
RS485 Data -	29	DB92.2

1) Configurable with HMI

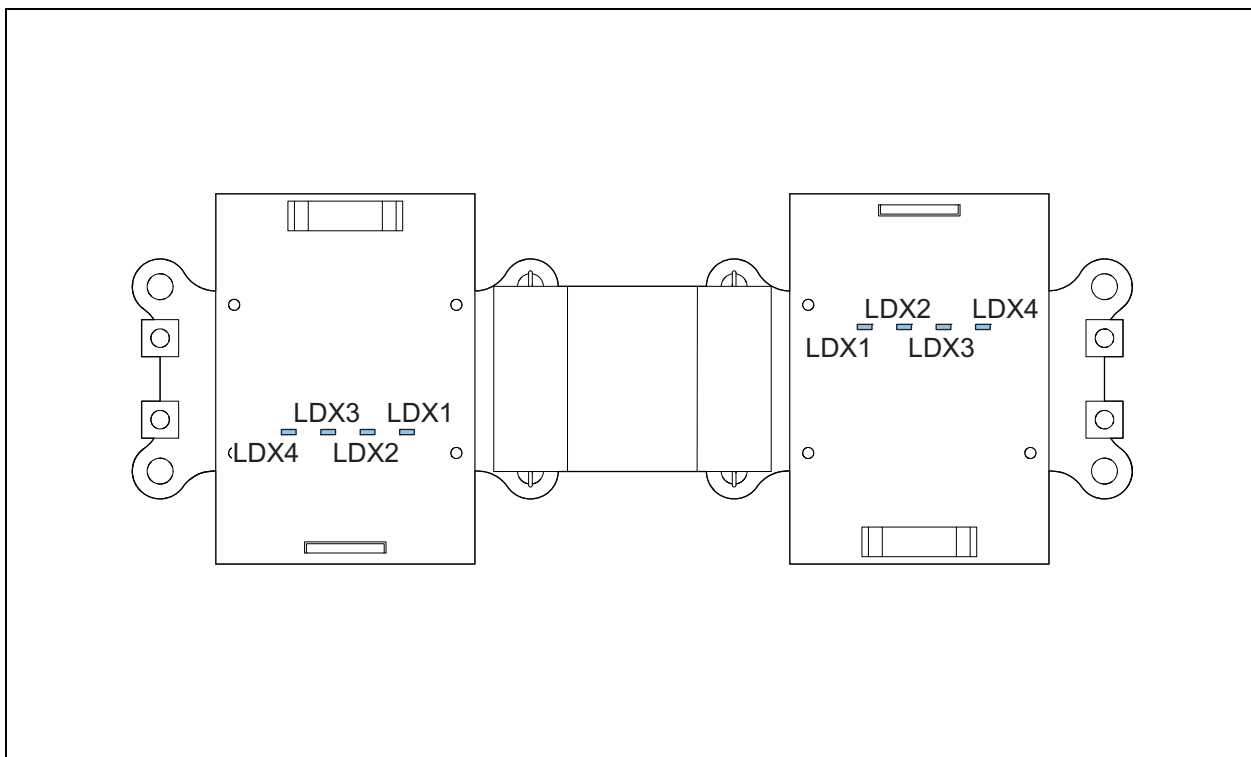
*Multiwire and J-Bus connection*



- A Equipment
- B Remote control equipment
- C Remote control PCB - input signals
- D Remote control connector on the equipment
- E Opto coupler
- F 48 V DC power supply
- G Isoground
- H +48 V DC
- I Rel com
- J Remote control PCB - feedback signals
- K Relais
- L 24 V DC power supply
- M J-Bus RS485 connection
- N J-Bus RS485 interface

## 12.4 IGBT PCB (EPS477 / EPS 496)

### 12.4.1 Printed Circuit Board (PCB) EPS477 for 2s Semix

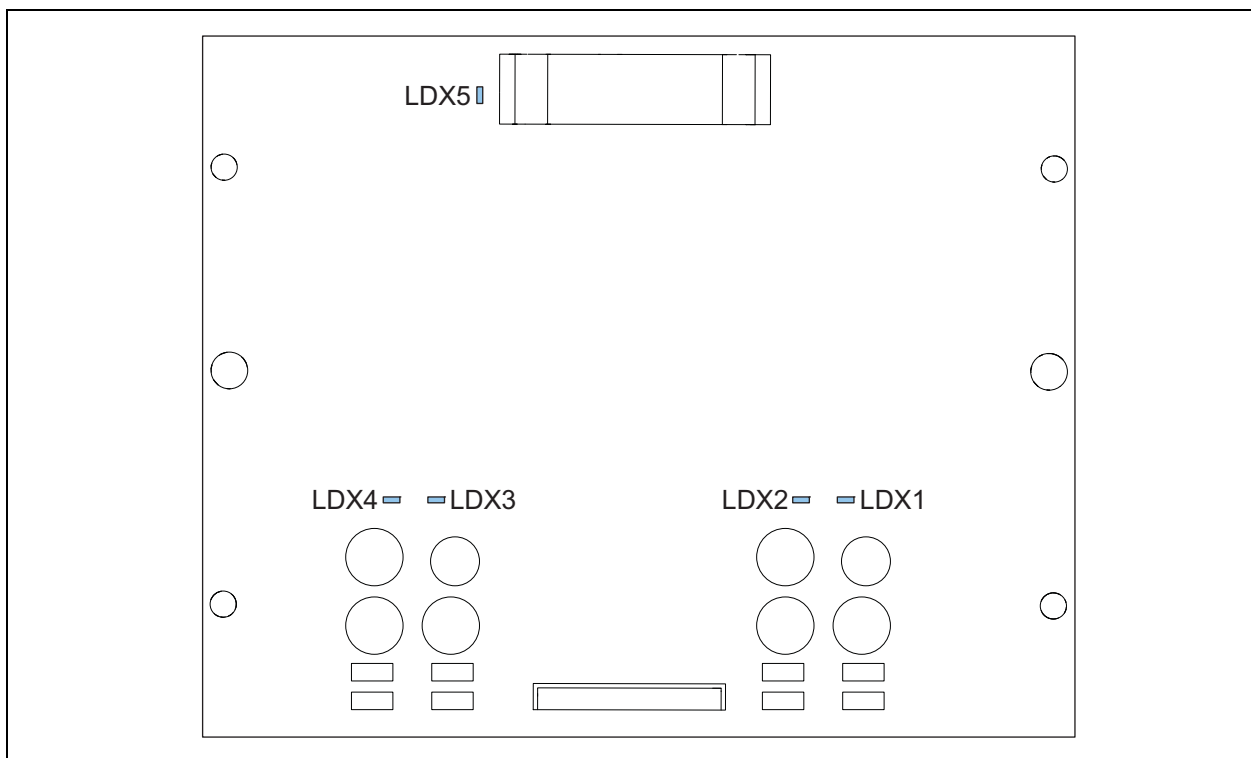


### 12.4.2 LEDs EPS477 for 2s Semix

**Table: 12.8 IGBT PCB LED functions**

LED	Color	Function
LDX1	Red	The LED is red when the voltage for the high side IGBT, generated on the PCB, is +18 V DC.
LDX2	Red	The LED is red when the voltage for the high side IGBT, generated on the PCB, is -5 V DC.
LDX3	Red	The LED is red when the voltage for the low side IGBT, generated on the PCB, is +18 V DC.
LDX4	Red	The LED is red when the voltage for the low side IGBT, generated on the PCB, is -5 V DC.

### 12.4.3 Printed Circuit Board (PCB) EPS496 for 3s Semix



- A LDX1 - red
- B LDX2 - red
- C LDX3 - red
- D LDX4 - red
- E LDX4 - red

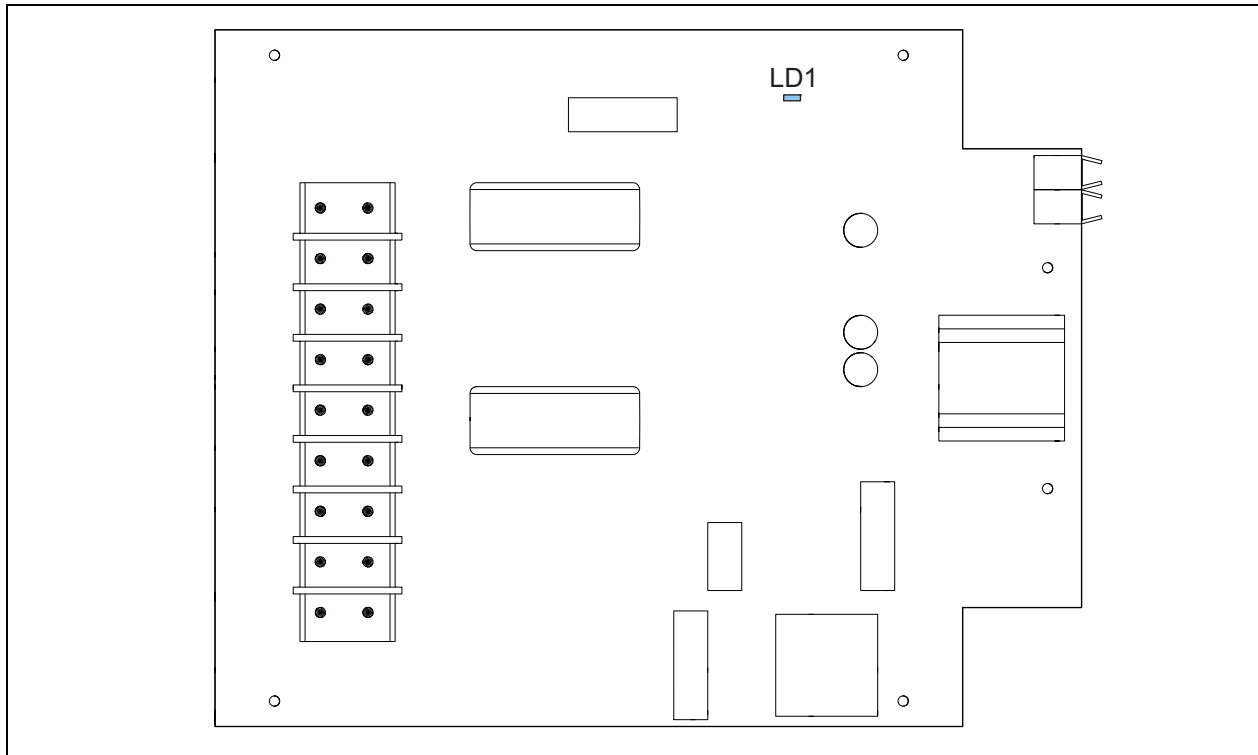
### 12.4.4 LEDs EPS477 for 1s and 2s Semix

**Table: 12.9 IGBT PCB LED functions**

LED	Function
LDX1	The LED is red when the voltage for the high side IGBT, generated on the PCB, is +18 V DC.
LDX2	The LED is red when the voltage for the high side IGBT, generated on the PCB, is -5 V DC.
LDX3	The LED is red when the voltage for the low side IGBT, generated on the PCB, is +18 V DC.
LDX4	The LED is red when the voltage for the low side IGBT, generated on the PCB, is -5 V DC.
LDX5	The LED is red when the voltage for logic IC power supply is + 5 V DC.

## 12.5 Output measure PCB (EPS442)

### 12.5.1 Printed Circuit Board (PCB)



### 12.5.2 LEDs

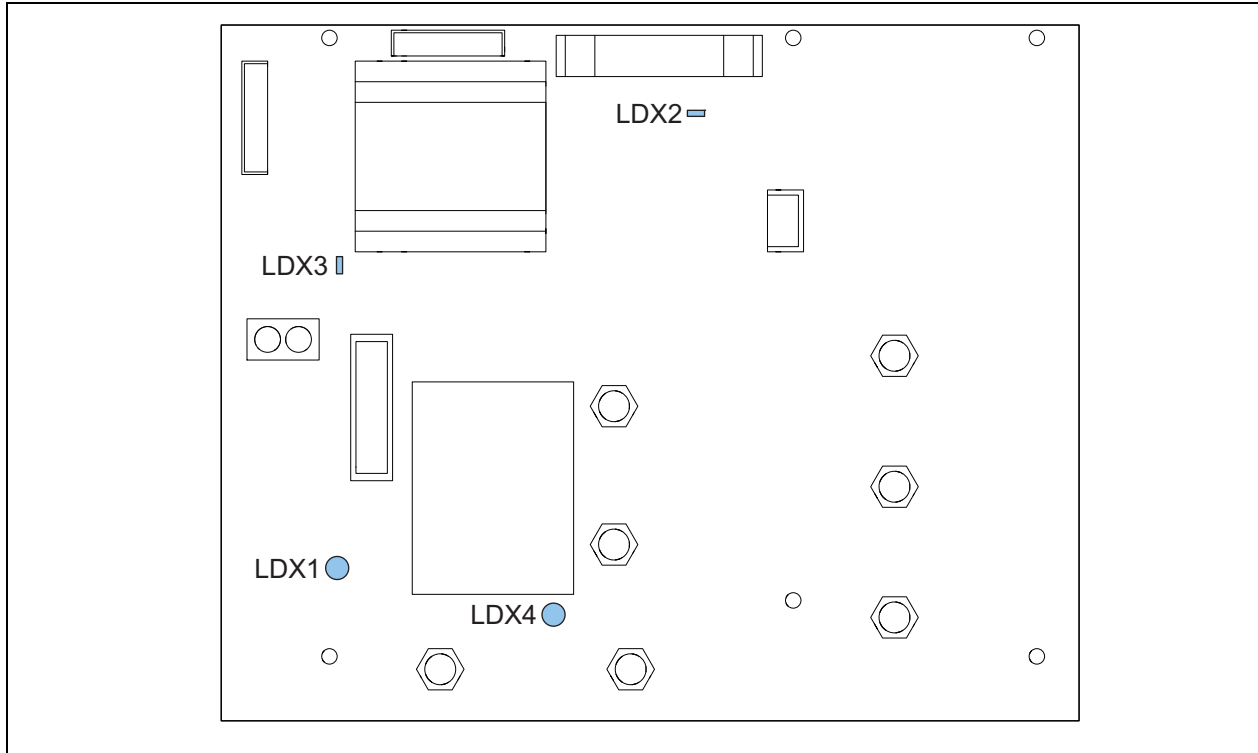
**Table: 12.103 Phase bridge PCB LED RUN light functions**

LED	Color	Function
LD1	Red	The LED flashes red is the CPU on the PCB is active.



## 12.6 Diode bridge and sensing PCB (EPS476 / EPS 507)

### 12.6.1 Printed Circuit Board (PCB)



### 12.6.2 LEDs

**Table: 12.11 Diode bridge and sensing PCB LED functions**

LED	Color	Function
LDX1	Red	The LED is red when the nominal voltage for the IGBT test is 24 V DC.
LDX2	Red	The LED is red when the voltage from the power supply PCB is +5 V DC.
LDX3	Red	The LED is red when the voltage from the 50 kHz power supply on the PCB is +18 V DC.
LDX4	Red	The LED is red when the nominal voltage for the IGTBT bridge bus is 560 V DC.



Connector	Connection to	Connection point	Description
X5	Remote control multiwire connection	CS1RC	Remote control input circuit 1
		CS2RC	Remote control input circuit 2
		CS3RC	Remote control input circuit 3
		CS5RC	Remote control input circuit 4
		CS5RC	Remote control input circuit 5
		CS6RC	Remote control input circuit 6
		CS7RC	Remote control input circuit 7
		CS8RC	Remote control input circuit 8
		CSSP0	Remote control input CS spare 0
		CSSP1	Remote control input CS spare 1
		SPMW3	Remote control input equipment spare 3
		SPMW4	Remote control input equipment spare 4
X4	Remote control multiwire connection	B1RC	Remote control input brightness step 1
		B2RC	Remote control input brightness step 2
		B3RC	Remote control input brightness step 3
		B4RC	Remote control input brightness step 4
		B5RC	Remote control input brightness step 5
		ONRC	Remote control equipment ON <sup>1</sup>
		SPMW1	Remote control input equipment spare 2
		SPMW2	Remote control input equipment spare 1
		CC	Common for remote control signals
		CC	Common for remote control signals
		VISO+	Voltage source 24 VDC, positive pole <sup>2</sup>
		VISO-	Voltage source 24 VDC, negative pole <sup>2</sup>

Connector	Connection to	Connection point	Description
X3	Remote control multiwire connection	CS1FB	Feedback circuit 1
		CS2FB	Feedback circuit 2
		CS3FB	Feedback circuit 3
		CS4FB	Feedback circuit 4
		CS5FB	Feedback circuit 5
		CS6FB	Feedback circuit 6
		CS7FB	Feedback circuit 7
		CS8FB	Feedback circuit 8
		CSE-FLT	Feedback CS fault
		CSESP1CS6FB	Feedback CS, spare 1
		CSESP2CS5FB	Feedback CS, spare 2
		CSESP3CS4FB	Feedback CS, spare 3
X2	Remote control multiwire connection	J6.2	Feedback equipment, configured for 'Over current'
		J6.3	Feedback equipment, configured for 'Open circuit'
		J6.6	Feedback equipment, configured for 'EFD ERROR L1'
		J6.7	Feedback equipment, configured for 'EFD ERROR L2'
		J6.8	Feedback equipment, configurable spare J6.8
		J7.1	Feedback equipment, configured for 'HI TEMP'
		J7.2NC	Feedback equipment, configurable spare J7.2 NC
		J7.2NO	Feedback equipment, configurable spare J7.2 NO
		J7.3NC	Feedback equipment, configurable spare J7.3 NC
		J7.3NO	Feedback equipment, configurable spare J7.3 NO
		CROFF	Feedback equipment OFF
		CRFLT	Feedback equipment fault

Connector	Connection to	Connection point	Description
X1	Remote control multiwire connection	B1FB	Feedback equipment, configurable spare J5.1
		B2FB	Feedback equipment, configurable spare J5.2
		B3FB	Feedback equipment, configurable spare J5.3
		B4FB	Feedback equipment, configurable spare J5.4
		B5FB	Feedback equipment, configurable spare J5.5
		ON_FB	Feedback equipment ON
		J5.7NC	Feedback equipment in local mode
		J5.7NO	Feedback equipment in remote mode
		CF	Common for feedback signals
		CF	Common for feedback signals
		VISO+	Voltage source 24 VDC, positive pole <sup>3</sup>
		VISO-	Voltage source 24 VDC, negative pole <sup>3</sup>

- 1) Equipment ON control can happen only happen through an external signal (no jumper J10 and no resistor R116 wired) or by a brightness selection (if jumper J10 is installed or resistor R116 is wired)
- 2) The voltage source (floating in regard to earth in this equipment) can be used as a source for the remote control signals if the positive or negative pole is connected to CC.
- 3) The voltage source (floating in regard to earth in this equipment) can be used to give a voltage feedback signal if the positive or negative pole is connected to CF.

#### 12.7.4 LEDs

**Table: 12.13 LEDs that indicate the logic functionality**

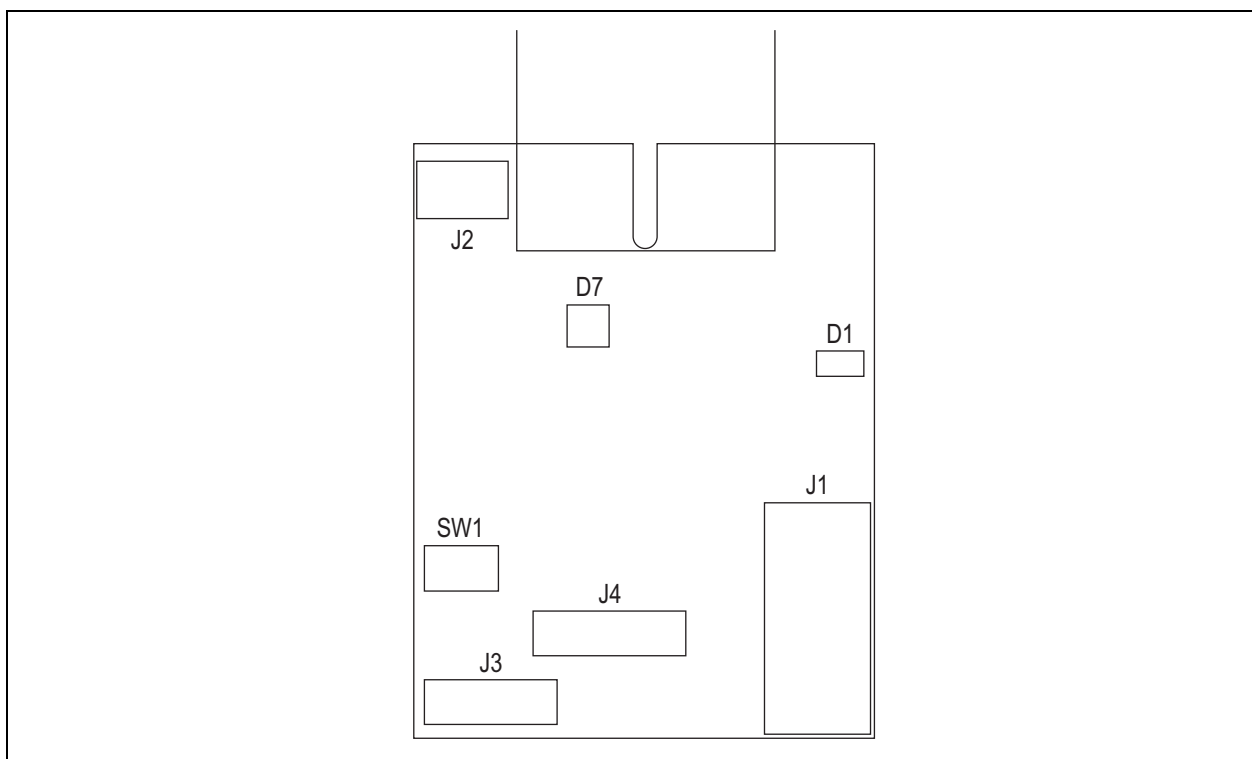
LED	Function
D7	RV3. The LED is ON if the CPU power supply is OK.
D9	The LED is ON during normal operation.
D10	The LED is ON if the equipment is in configuration mode. The LED flashes during normal operation.
D11	The LED is ON if there is no CAN-bus activity. The LED flashes if the CAN-bus is operational.
D12	The LED is ON during normal operation.
D13	The LED is ON during normal operation.
D25	The LED is ON if the CAN-bus voltage (isolated 5V) is OK.

**Table: 12.14 LEDs that indicate the interface functionality**

LED	Function
D59	LED 'CRE_ON_IN'. The LED is ON if the equipment is operational and supplies power to the output circuit.
D61	LED J5.7 IN. The LED is ON if the equipment is in remote mode.
D63	LED J7.1 IN. Spare LED.
D64	LED to CRE LOCREM. The LED is ON if there the equipment is in local mode.
D65	LED to CRE REQCON. The LED is ON if the CS requests to switch on the equipment.
D66	LED CSEFLT. The LED is ON if the circuit selector is faulty (CSE-FAULT)
D67	LED SP_UC1. Spare LED.
D68	LED SP_UC2. Spare LED.
D69	LED SP_UC3. Spare LED.
D73	LED J7.2_IN, SP IN1. Spare LED.
D75	LED J7.2_IN, SP IN2. Spare LED.
D81	LED 5VEPS

## 12.8 CS PCB (PCB1619) (option CS)

### 12.8.1 Printed Circuit Board (PCB)



### 12.8.2 Connectors

**Table: 12.15CS connectors**


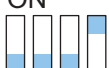






Connector	Connection to
J1	Flat cable to piggy with 24VDC power supply, earthing and CAN-bus
J2	Connection for the current sensor.
J3	Not used.
J4	Not used.

### 12.8.3 LEDs

LED	Function
D7	The LED flashes BLUE if the relay coil is not energized. The LED flashes GREEN if the relay coil is energized. The LED flashes RED or alternating BLUE/GREEN if there is a failure. The LED is OFF if the PCB is not operational.
D1	The LED is ON if the PCB is operational. The LED is OFF if the PCB is not operational.

### 12.8.4 Dip switch

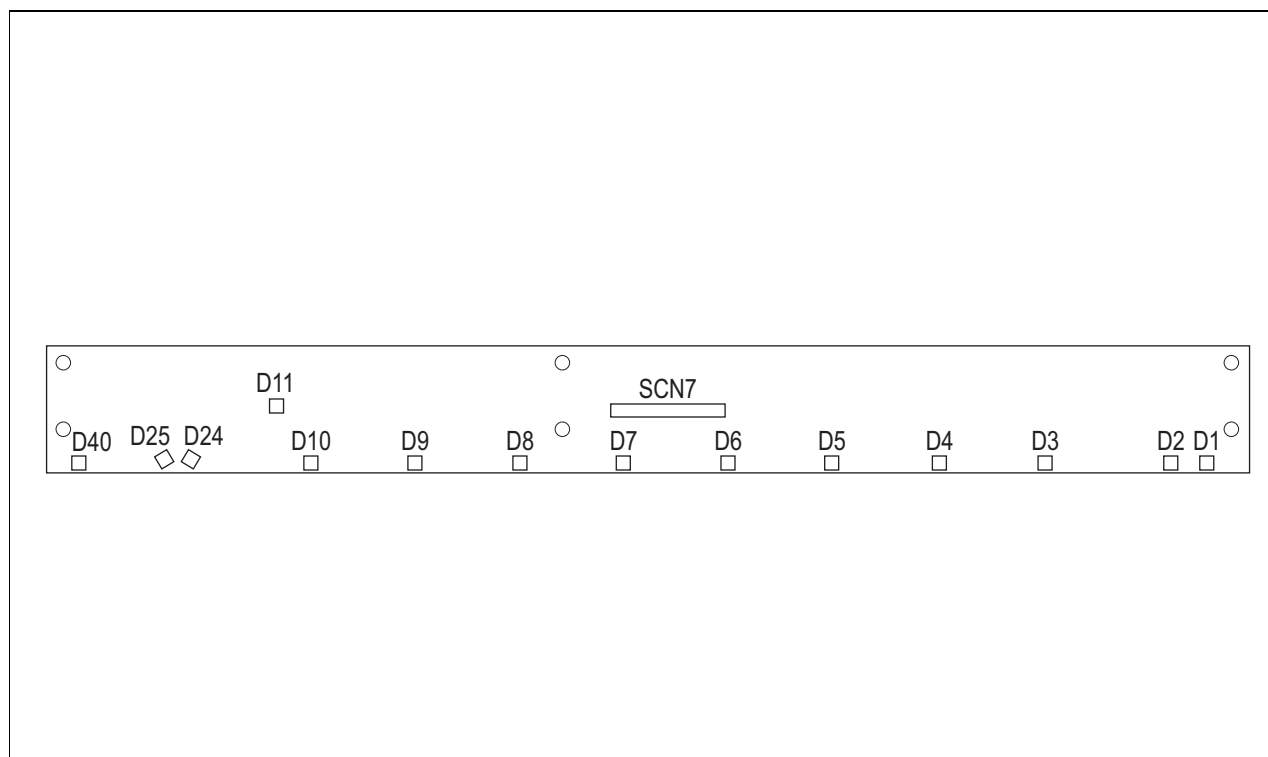
**Table: 12.16**Dip switch SW1

Dip switch setting	Function
ON 	Circuit 1 (Address 0)
ON 	Circuit 2 (Address 1)
ON 	Circuit 3 (Address 2)
ON 	Circuit 4 (Address 3)
ON 	Circuit 5 (Address 4)
ON 	Circuit 6 (Address 5)
ON 	Circuit 7 (Address 6)
ON 	Circuit 8 (Address 7)



## 12.9 HMI SIN PCB (PCB1703) (option CS)

### 12.9.1 Printed Circuit Board (PCB)



### 12.9.2 Connectors

Connector	Connection to
CSN 7	KEY_LED1 flat cable connection to the interface PCB (1702).

### 12.9.3 LEDs

LED	Colour	LED status	Description
D1	Green	ON	The CS is in remote mode.
D2	Red	ON	The CS is in local mode.
D3	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D4	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.

LED	Colour	LED status	Description
D5	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D6	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D7	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D8	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D9	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D10	Green	ON	Circuit 1 is selected and the equipment supplies output current.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF or in stand-by.
		Flashing (interval 1 s)	The CS PCB is faulty.
D24	Green	ON	The CS and the equipment are ON.
		Flashing: 0.5 s ON, 2.5 s OFF	The equipment is OFF.
D25	Red	Flashing	The CS generates and alarm signal.
D40	Green	Flashing	LRN - function

## 12.10 Test parameters

### 12.10.1 Analog channels

**Table: 12.17** Analog channels

Channel	Description	Value range
0	Temperature	17000 - 32000
1	Temperature	27000 - 32000
2	I bridge	100 - 2000
3	V bridge	0 - 30000
4	V in	± 31000
5	Aux 1	x = 0
6	Aux 2	x = 0
Ref1	V reference 1	± 54000
Ref2	V reference 2	± 2800

### 12.10.2 Input

**Table: 12.18** Test input parameters

Connector	Function
PB0	Fan 1
PB1	If 1, the Precharge control switch is enabled
PB2	If 1, the Main control switch is enabled
PB3	Fan 2
PB4	If 0, SCO/panel is open
PB5	If 1, BUS fuse is not damaged
PF0	If 0, the overcurrent protection is ON
PF1	If 0, the overcurrent protection is ON

### 12.10.3 Outputs

**Table: 12.19 Test output parameters**

Connector	Function
PE0	0 = Main control switch enabled
PE1	0 = Precharge control switch enabled
PE2	0 = Gate H activation
PE3	1 = Fan enabled
PE4	Display font
PE5	1 = Display back lighting ON
PE6	1 = Red fault LED ON
PE7	1 = Green power LED ON

### 12.10.4 External inputs

I0 to I15: Inputs from multiwire PCB.

### 12.10.5 External outputs

O0 to O15: Outputs from multiwire PCB.

### 12.10.6 PIC analog channels

**Table: 12.20 PIC analog channels test**

Channel	Description
Div_I	Number of divisions of output current
Div_V	Number of divisions of output voltage
EFD	Number of divisions of EFD
Phase	Phase displacement between V and I (x 1000)

## 13 Technical data

### 13.1 Specifications

**Table: 13.1 Technical specifications**

Item	Description
Rated input voltage [V]	400 V AC ( $\pm 10\%$ ) single phase 230 V AC ( $\pm 10\%$ ) single phase
Rated frequencies [Hz]	50 or 60
Current regulation limits	Current regulation is guaranteed under the following conditions ( $\pm 0.1$ A): <ul style="list-style-type: none"> <li>- Under IEC 61822 environmental conditions</li> <li>- For nominal input voltage under IEC or FAA standard conditions</li> <li>- From full load to short circuit</li> </ul>
Current regulation modes	Two preset regulation modes: <ul style="list-style-type: none"> <li>- normal mode (for linear loads)</li> <li>- inductive mode (for non-linear loads (e.g. LED loads))</li> </ul>
Average efficiency at full load	92 to 94% depending on the size of the equipment, under nominal resistive load, nominal output current and nominal input voltage
Power factor at output	The power factor exceeds the IEC and FAA requirements. The power factor at rated load is close to 1 and is kept at high level for any possible operational conditions.
Brightness steps	5 standard, 8 maximum, fully adjustable in 65k levels (1mA resolution)
Output current [A]	6.6
Remote control and monitoring	<ul style="list-style-type: none"> <li>- Multiwire: 24 VDC and 48 VDC to 60 VDC</li> <li>- Single or dual J-Bus protocol over 2-wire RS485.</li> <li>- Single or dual J-Bus protocol over Ethernet IEEE 802.3</li> </ul>
Regulation response time	<ul style="list-style-type: none"> <li>- Less than 0.3 seconds</li> <li>- Exceeds the requirements of IEC 61822</li> </ul>
Open circuit output voltage	Less than 1.2 times the nominal output voltage (RMS)
Ingress protection	IP 21

**Table: 13.2 Output specifications**

Type	Rated output power [kW]	RMS output voltage at 6.6 A RMS output current [kV]	Insulated test on output <sup>1</sup> [kV]	Output overvoltage protection 25kApk
CRE 2.5	2.5	0.38	3	0.75 kV <sub>RMS</sub> , 1.4 kJ
CRE 4.0	4.0	0.60	5	1.5 kV <sub>RMS</sub> , 2.8 kJ
CRE 5.0	5.0	0.75	5	1.5 kV <sub>RMS</sub> , 2.8 kJ
CRE 7.5	7.5	1.13	6	2.2 kV <sub>RMS</sub> , 4.2 kJ

Type	Rated output power [kW]	RMS output voltage at 6.6 A RMS output current [kV]	Insulated test on output <sup>1</sup> [kV]	Output overvoltage protection 25kApk
CRE 10	10.0	1.50	10	2.2 kV <sub>RMS</sub> , 4.2 kJ
CRE 15	15	2.30	12	3.0 kV <sub>RMS</sub> , 5.6 kJ
CRE 20	20	3.03	15	4.5 kV <sub>RMS</sub> , 8.4 kJ
CRE 25	25	3.80	19	5.2 kV <sub>RMS</sub> , 9.8 kJ
CRE 30	30	4.54	23	6.0 kV <sub>RMS</sub> , 11.2 kJ

1) Test condition: 50 Hz sinusoidal wave for 1 minute. The test is done without output overvoltage protections.

## 13.2 Applicable standards

The equipment is in accordance with these standards:

**Table: 13.3 Applicable standards**

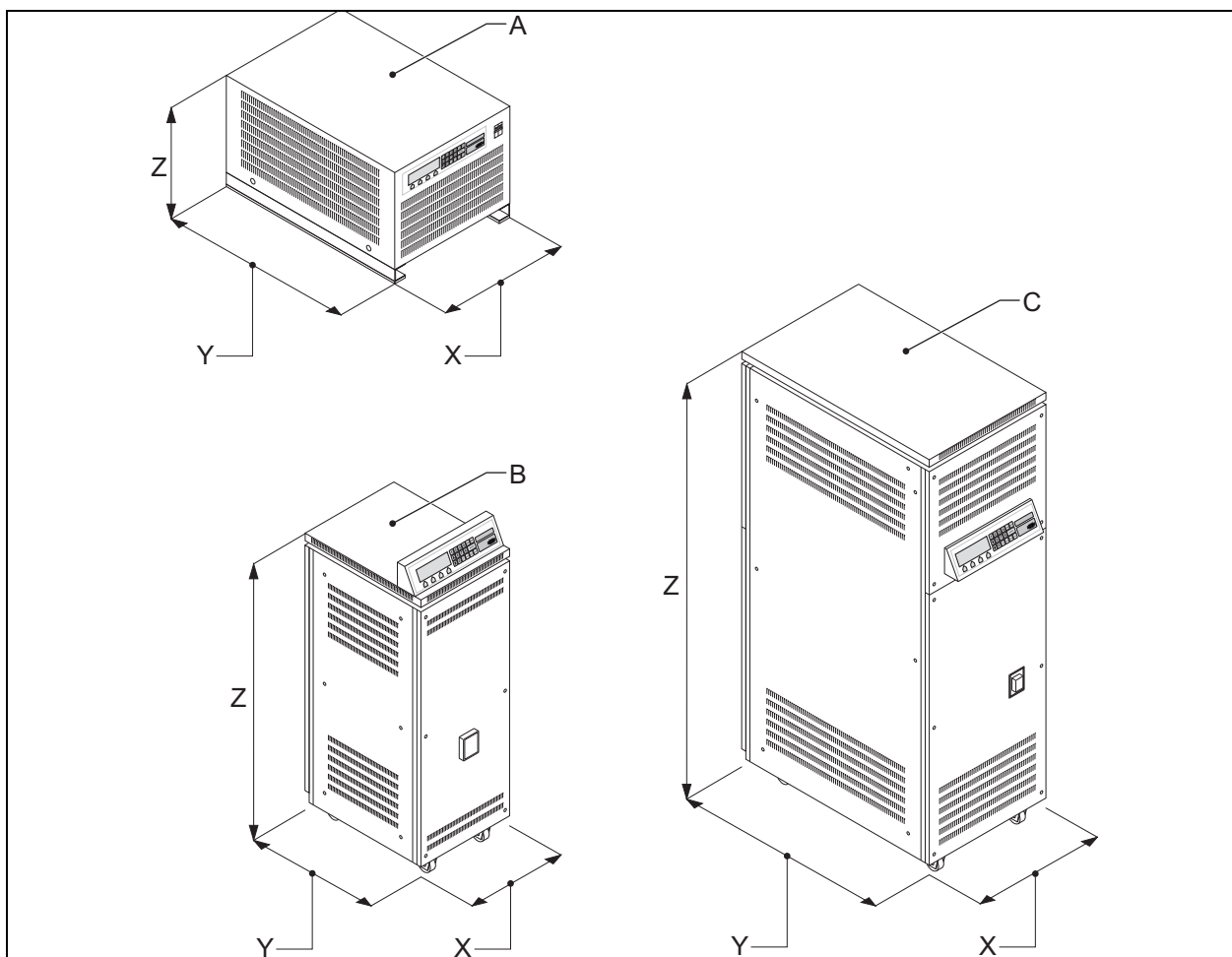
Standard	Description
ICAO	Aerodrome Design Manual, Part 5 paragraphs 3.2. (current edition)
FAA	AC 150/5345-10 (current edition), L-828 and L829 except for input voltage
IEC	IEC 61822
CENELEC	EN 61822
CE certified	

## 13.3 ElectroMagnetic Compatibility (EMC)

The equipment is designed to operate in an industrial electro-magnetic environment. The regulator complies with IEC 61822, in accordance with IEC 61000-6-4 and IEC 6-6-2 (generic standard for industrial environment). The equipment is, with adapted test levels, in accordance with IEC/TS61000-6-5, G (substation environment, location G).

## 13.4 Dimensions and mass

The stackable cabinet (A), the small cabinet (B) and the big cabinet (C):



**Table: 13.4 Dimensions**

Item	A - 2.5 kVA (stackable)	B - 2.5 kVA	B - 4 to 15 kVA	C - 20 to 30 kVA
X [mm]	420	420	420	520
Y [mm] <sup>1</sup>	800	550	840	840
Z [mm]	460	1300	1300	1600

1) Depending on the type of series output connection (options)

**Table: 13.5 Mass**

Type	Net mass	Crate mass	Crate dimensions width x depth x height [mm]
2.5 (rack)	95	20	600 x 1000 x 650
2.5	130	23	1200 x 800 x 1500
4	160	23	1200 x 800 x 1500
5	165	23	1200 x 800 x 1500
7.5	190	23	1200 x 800 x 1500
10	230	23	1200 x 800 x 1500
15	260	23	1200 x 800 x 1500
20	330	40	1200 x 800 x 1850
25	380	40	1200 x 800 x 1850
30	410	40	1200 x 800 x 1850

## 13.5 Protection devices

**Table: 13.6 Protection devices specifications**

Equipment type [kVA]	Equipment voltage [V]	Main fuse rating [A]	Manual switch type C rating [A]	Maximum line input current [A]
2.5	208 to 230	16	16	14.7
	380 to 400	16	10	8.0
4	208 to 230	32	25	23.4
	380 to 400	20	16	12.8
5	208 to 230	50	40	29.3
	380 to 400	32	20	16.0
7.5	208 to 230	50	50	44.0
	380 to 400	32	25	24.1
10	380 to 400	50	40	32.1
15	380 to 400	50	50	48.1
20	380 to 400	80	80	64.2
25	380 to 400	100	100	80.2
30	380 to 400	125	100	96.2



## 13.6 Used brightness steps

All equipments are programmed with five steps by default. You can change the number of required steps. Table 13.7 shows the current values that the equipment produces at each step, depending on how many steps are programmed.

Example:

The equipment is set to five brightness steps. The default current value set for step 3 is 4.1 A.

**Table: 13.7 Current values produced at each brightness step**

Brightness step	Default current value [A]					
	No. of steps used					
	3	4	5 (default)	6	7	8
1	4.8	3.3	<b>2.8</b>	2.7	2.2	2.8
2	5.5	4.4	<b>3.4</b>	3.4	2.8	3.1
3	6.6	5.5	<b>4.1</b>	3.9	3.4	3.4
4		6.6	<b>5.2</b>	4.5	4.1	3.9
5			<b>6.6</b>	5.4	5.2	4.6
6				6.6	6.4	5.5
7					6.6	6.4
8						6.6

These values apply when the minimum current is 2.8 A and the maximum current is 6.6 A.

## 13.7 Ambient conditions

The equipment is air-cooled with fans. Thus, the equipment must have a good airflow, especially if they operate near the maximum temperature.

**Table: 13.8 Ambient conditions**

Item	Description
Temperature	From -20 up to +55 °C <sup>1</sup>
Altitude	From 0 (sea level) up to 1000 meter
Relative humidity	From 10% up to 95% RH without condensation

1) For IEC conformity to -40 °C an optional modification is required.

## 13.8 Parts list

### 13.8.1 Part orders



#### WARNING

Use only original ADB Safegate spare parts.

If you use other spare parts, the specific module or the equipment may be damaged. This can also put the personnel in danger.



#### Note

The parts list may be subject to change without prior notice. Contact ADB Safegate to obtain the latest version.

#### *Part orders*

Each part of the equipment has a part number. When you order parts:

- Always mention the part number of the ordered part;
- Always mention serial number and type of the equipment. These are indicated on the nameplate of the equipment.

For all spare part orders, contact ADB Safegate or the local representative of ADB Safegate.

#### *Recommendations*

To reduce downtime during maintenance, have one or more extra equipment cabinets in stand-by at the substation. This is especially important at major airports, which have a large amount of equipments.

Keep spare parts always in stock. For example:

- Fuses;
- Lightning arrestors;
- PCBs.

### 13.8.2 Preventive spare parts

Item	Table
Main fuse	13.9 Preventive spare parts - Main fuse
Main contactor	13.10 Preventive spare parts - Main contactor
Lightning arrestors	13.11 Preventive spare parts - Lightning arrestors
Overvoltage protection	13.12 Preventive spare parts - Overvoltage protection
Capacitors	13.13 Preventive spare parts - Capacitors
Safety switches	13.14 Preventive spare parts - Safety switches
Fans	13.15 Preventive spare parts - Fans
IGBT bridge	13.17 Preventive spare parts - IGBT bridge
CPU PCB	13.16 Preventive spare parts - CPU PCB and CPU PCB with OVP
Output measure PCB	13.18 Preventive spare parts - Output measure PCB
Power supply PCB	13.19 Preventive spare parts - Power supply PCB
Remote control PCB	13.20 Preventive spare parts - Remote control PCB
Diode bridge PCB	13.21 Preventive spare parts - Diode bridge PCB and diode bridge PCB with OVP
IGBT PCB	13.22 Preventive spare parts- IGBT PCB
Ethernet adapter	13.23 Preventive spare parts- Ethernet adapter
Display and keyboard	13.24 Preventive spare parts- Display and keyboard

**Table: 13.9 Preventive spare parts - Main fuse**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Fuse 16A 10X38 aM	6130.20.150	2									2	2			
Fuse 20A 10X38 aM	6130.20.160		2												
Fuse 32A 10x38 aM	6130.20.200			2	2								2		
Fuse 50A 14x51 aM	6130.20.210					2	2							2	2
Fuse 80A 22x58 aM	6130.20.280							2							
Fuse 100A 22x58 aM	6130.20.300								2						
Fuse 125A 22x58 aM	6130.20.220									2					

**Table: 13.10 Preventive spare parts - Main contactor**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Contacteur LC1D12B7	6148.46.030	1	1								1	1			
Contacteur LC1D32B7	6148.46.000			1	1	1							1	1	
Contacteur LC1D40B7	6148.46.010						1								1
Contacteur LC1D80B7	6148.46.020							1	1	1					

**Table: 13.11 Preventive spare parts - Lightning arrestors**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Lightning arrestor SIOV B72232-B751-K1	6314.32.750	2	4	4	4	6	8	10	12	14	2	2	4	4	4

**Table: 13.12 Preventive spare parts - Overvoltage protection**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Overvoltage protection V480LA80BP	6314.12.286					1	1								

**Table: 13.13 Preventive spare parts - Capacitors**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
CAP. PPA1854100KN polypropylene film +	6322.60.240	2	2	2	2	2					2	2	2	2	2
CAP. RMB2104250KVR 2.5uF/1000V	6322.60.270						2	3	3	3					

**Table: 13.14 Preventive spare parts - Safety switches**

Description	Part number	Quantity per order													
		400 V									230 V				
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Doorswitch EPS: 684	6150.49.060	3	3	3	3	3	3	4	4	4		3	3	3	3

**Table: 13.15 Preventive spare parts - Fans**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
CCR FAN 120x120x38 24vdc ball bearing	7074.10.100						2	6	6	6					

**Table: 13.16 Preventive spare parts - CPU PCB and CPU PCB with OVP**

Description	Part number	Quantity per order													
		400 V									230 V				
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS479/5 CRE/VIS CPU pcb:CS00179 rev.1.1	1597.00.000	1	1	1	1						1	1	1	1	1
EPS479e/5 CRE/VIS CPU & OVP pcb:CS00179 rev.1.1	1597.00.030	1	1	1	1										
EPS479/15 CRE/VIS CPU pcb:CS00179 rev1.1	1597.00.010					1	1								
EPS479/15 CRE/VIS CPU & OVP pcb:CS00179 rev1.1	1597.00.040					1	1								
EPS479/30 CRE/VIS CPU pcb:CS00179 rev1.1	1597.00.020							1	1	1					
EPS479/30 CRE/VIS CPU & OVP pcb:CS00179 rev1.1	1597.00.050							1	1	1					

**Table: 13.17 Preventive spare parts - IGBT bridge**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Semix 202 GB 12E4s (IGBT)	6351.88.040	2	2	2	2	2	2				2	2	2	2	2
Semix 453 GB 12E4s (IGBT)	6351.88.060							2	2	2					
ISOLAT.M6 0.6kV	6126.12.485							2	2	2					
Semix 341D16s (Bridge Rectifier)	6351.88.030							1	1	1					

**Table: 13.18 Preventive spare parts - Output measure PCB**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS442/2.5 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.100	1									1	1			
EPS442/5 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.110		1	1									1	1	
EPS442/7.5 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.120				1										1
EPS442/10 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.130					1									
EPS442/15 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.140						1								
EPS442/20 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.150							1							
EPS442/30 CRE/VIS out.meas.board CS0039 rev.2.2	1597.00.160								1	1					

**Table: 13.19 Preventive spare parts - Power supply PCB**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS480/30 CRE pow.sup.board PCB CS00180 rev.1.2(6 fans, with SHVS)	1597.00.210	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Table: 13.20 Preventive spare parts - Remote control PCB**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Communicaton Board: EPS495 CRE/VIS communication board PCB CS00190 rev.1.2	1597.00.300	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PCB1694 CRE EPS495 SIN (option CS)	1593.27.500	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Table: 13.21 Preventive spare parts - Diode bridge PCB and diode bridge PCB with OVP**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS476/5 CRE2.5/ 7.5KVA PCB CS00176 rev.2.0 (diode bridge & sensing)	1597.00.401	1	1	1	1										
EPS476e/5 CRE2.5/ 7.5KVA PCB CS00176 rev.2.0 (diode bridge & sensing + OVP)	1597.00.402	1	1	1	1										
EPS476/5 CRE2.5KVA PCB CS00176 230V+ rev.V2.0 (diode bridge & sensing)	1597.00.460										1	1			
EPS507e CRE10/15KVA PCB CS00202 rev.1.2 (diode bridge & sensing + OVP)	1597.00.412					1	1								
EPS476/30 CRE/VIS 20/ 30KVA PCB CS00176 rev.2.0 (sensing, without diode bridge)	1597.00.421							1	1	1					
EPS476e/30 CRE/VIS 20/30KVA PCB CS00176 rev.2.0 (sensing, without diode bridge + OVP)	1597.00.422							1	1	1					
EPS476e/5/230 CRE2.5KVA PCB CS00176 230V+ rev.V2.0 (diode bridge & sensing + OVP)	1597.00.462										1	1			
EPS507 CRE4/7,5KVA PCB CS00202 230V+ rev,V1,2	1597.00.470												1	1	1
EPS507e/230 CRE4/ 7,5KVA PCB CS00202 230V+ rev.V1.2 (diode bridge & sensing + OVP)	1597.00.472												1	1	1



**Table: 13.22 Preventive spare parts- IGBT PCB**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS477 CRE/VIS 2.5/15KVA PCB CS00177 rev.1.1 (IGBT driver)	1597.00.510	2	2	2	2	2	2				2	2	2	2	2
EPS496 CRE/VIS 20/30KVA PCB CS00191 rev. 1.0 (IGBT driver)	1597.00.530							2	2	2					
EPS478 CRE/VIS 2.5/15KVA PCB CS00178 rev.1.0 (connection board)	1597.00.520	1	1	1	1	1	1				1	1	1	1	1

**Table: 13.23 Preventive spare parts- Ethernet adapter**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
EPS542 CRE/VIS single ethernet adapter PCB CS00230 rev.1.0	1597.00.600	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EPS542 CRE/VIS double ethernet adapter PCB CS00230 rev.1.0	1597.00.610	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Table: 13.24 Preventive spare parts- Display and keyboard**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
CCR KEYBOARD BOX ASSY. MONOPHASE	4072.30.620	1	1	1	1	1	1	1	1	1		1	1	1	1

### 13.8.3 Corrective spare parts

Item	Table
Manual switch	13.25 Corrective spare parts - Manual switch
Main fuse housing	13.26 Corrective spare parts - Main fuse housing
Line filter	13.27 Corrective spare parts - Line filter
Input filter	13.28 Corrective spare parts - Input filter
Output filter	13.29 Corrective spare parts - Output filter
Main transformer	13.30 Corrective spare parts - Main transformer

**Table: 13.25 Corrective spare parts - Manual switch**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
S202-C10	6150.90.750	1													
S202-C16	6150.90.530		1								1	1			
S202-C20	6150.90.600			1											
S202-C25	6150.90.560				1								1		
S202-C40	6150.90.610					1								1	
S202-C50	6150.90.580						1								1
S292-C80	6150.90.630							1							
S292-C100	6150.90.640								1	1					

**Table: 13.26 Corrective spare parts - Main fuse housing**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Fuse housing 32	6150.90.700	1	1	1	1						1	1	1	1	
Fuse housing 50	6150.90.710					1	1								1
Fuse housing 125	6150.90.720							1	1	1					

**Table: 13.27 Corrective spare parts - Line filter**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Line filter 284.003(1Ph 10A/400V)	6115.18.090	1													
MK1015 (1Ph 230V)	6115.18.120										1	1			
Line filter 284.001(1Ph 20A/400V)	6115.18.050		1	1											
Line filter 284.002(2Ph 40A/400V)	6115.18.060				1	1	1						1	1	
EMK1065 (1Ph 230V)	6115.18.130														1
Line filter 284.004(2Ph 90A/400V)	6115.18.070							1	1	1					

**Table: 13.28 Corrective spare parts - Input filter**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Toroidal inductor 750uH/ 15A	6166.50.350	1	1	1							1	1	1	1	
Inductance 285uH/40A	6166.50.310				2	2	2	4	4	4					2
CAP. PMC1704500KVR 5uF/700V step 20-25+	6322.60.220	2	3	3	3	3					2	3	3	3	3
CAP. RMB2104250KVR 2,5uF/1000V	6322.60.270						8	8	8	8					

**Table: 13.29 Corrective spare parts - Output filter**

Description	Part number	Quantity per order													
		400 V									230 V				
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Toroidal inductor 750uH/ 15A	6166.50.350	2									2				
Inductance 285uH/40A	6166.50.310		2	2	2	2						2	2	2	2
CAP. PMC1704500KVR 5uF/700V step 20-25+	6322.60.220	2	3	3	3	3	2	4	4	4	1				
Induct 150uH 100A - 20-25-30 kVA	6166.50.360							4	4	4					
Induct 300uH 50A - 15 kVA	6166.50.370						2								

**Table: 13.30 Corrective spare parts - Main transformer**

Description	Part number	Quantity per order													
		400 V										230 V			
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5
Transf.400Vac out:24V	6300.03.430	1	1	1	1	1	1	1	1	1					
Transf.100VA 400V/24V-	6300.03.400	1	1	1	1	1	1								
Transf.200VA 400V/24V-6VA/24V-194VA	6300.03.410							1	1	1					
Transf.100VA 230V/24V-94VA/24V-6VA	6300.03.420										1	1	1	1	1
Transf. 6VA 230V/24V	6300.03.440										1	1	1	1	1

**Table: 13.31 Corrective spare parts - Hall sensor**

Description	Part number	Quantity per order														
		400 V										230 V				
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5	
Hall sensor old version <sup>1</sup>	1597.00.500							1	1	1						
Hall sensor new version <sup>2</sup> : PCB1628 CRE current sensor 200A	1593.21.000							1	1	1						

1) Shape: square. Location: connected to the sensing PCB.

2) Shape and location: see § 3.4.8. Use from firmware version rel4.27e.

**Table: 13.32 Corrective spare parts - CS parts**

Description	Part number	Quantity per order														
		400 V										230 V				
		2.5	4	5	7.5	10	15	20	25	30	2.5 ST	2.5	4	5	7.5	
PCB1702 CSE-M SIN Logic MW	1593.28.300	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DC-DC CONV. 18-36V/ 24VDC 15W SD-15B-24	6341.82.024	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PSU 180-550VAC 24VDC 5A WDR-120-24	6341.80.240	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surge arrestor cartridge L1-PE 230V IT	6134.03.080	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Relay Gigavac G81AB47 code Epsilon 7784	6169.07.100	Depends on the number of series circuits.														
RELC CSE-M	1593.20.200	Depends on the number of series circuits.														
PCB1703 CSE-M HMI SIN	1593.28.400	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

