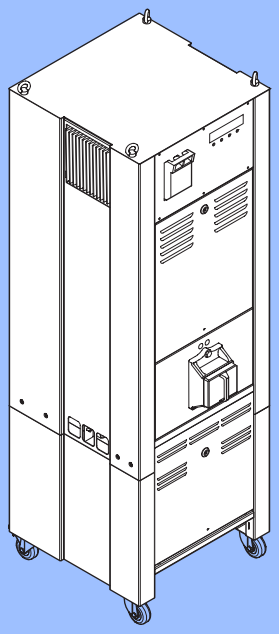

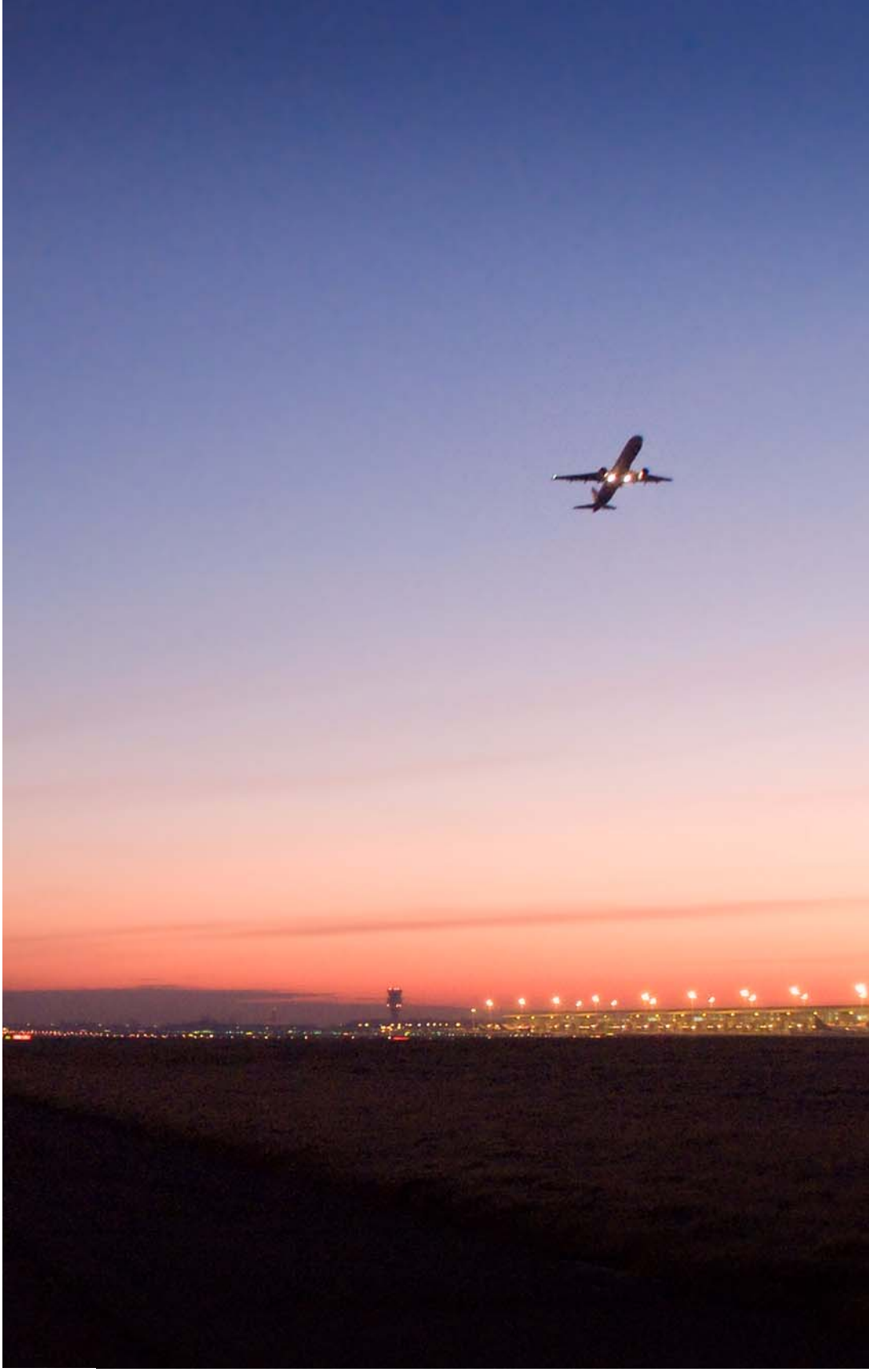

Operation and Maintenance manual

Microprocessor controlled constant current regulator
Type MCR³ 2.5 kVA to 30kVA

AM.07.360e Edition: Edition 2.0

ADB
Airfield Solutions

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ADB
Airfield Solutions

Table of contents

1 About this manual

The manual shows the information necessary to:
- commission
- operate
- carry out maintenance on

the MCR^3 2.5 to 30 kVA.
- 2.5 to 10 kVA: small cabinet;
- 15 to 30 kVA: big cabinet;

If in the manual the term equipment used, this refers to both 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

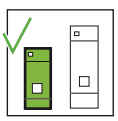
Edition	Editor	Check	Date	Description
1.0				New
2.0	MR	KBL, VHE, AHU, WEW	12/2010	Restructuring and adaptation after midlife update

1.3 Icons used in the manual

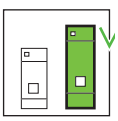
For all WARNING symbols, see the chapter 2.

CAUTION
Can cause damage to the equipment.

NOTE
Gives further information.



Small cabinet: represents applicability only to the 2.5 to 12.5 kVA version



Represents applicability only to the 15 to 30 kVA version.

1.4 Abbreviations and terms

Table: 1.1 Terms and abbreviations

Term or abbreviation	Description
AC	Alternating Current
AGLAS	Airfield Ground Lighting Automation System
AWG	American Wire Gauge
Binary notation	All data in the digital circuits is treated using “1” and “0”. Thus, all decimal notations are transcripted into binary notations.
CCL	Current Control Logic
CS	Circuit Selector
CSM	Circuit Selector Module
DC	Direct Current
EFD	Earth Fault Detection
EMC	Electro Magnetic Compatibility
Equipment	Both small cabinet and big cabinet, if the information is the same
FAA	Federal Aviation Administration
Hexadecimal notation	This is a way to write numbers in base 16 notation, instead of the standard base 10 notation. In the manual, it is used for bits and addresses, because it identifies better the active data address or data lines (16 or 8-bit large).
HV	High Voltage.
ICAO	International Civil Aviation Organisation
ILCMS	Individual Lamp Control and Monitoring System
LA	Lightning arrestor
LFD	Lamp Fault Detection
LMC	Local Master Controller
MCR^3	Microprocessor Controlled Constant Current Regulator, third generation
MW	Multiwire
PC	Personal Computer
PCB	Printed Circuit Board
PCMCIA	Personal Computer Memory Card International Association
PVO	A type of guidance sign with fluorescent lamps.
PE	Protective Earth

Term or abbreviation	Description
PSL	Power Supply Logic
RMS	Root Mean Square
SCO	Series CutOut
TBM	Thyristor Block Module
UI	User Interface

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.
- 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.

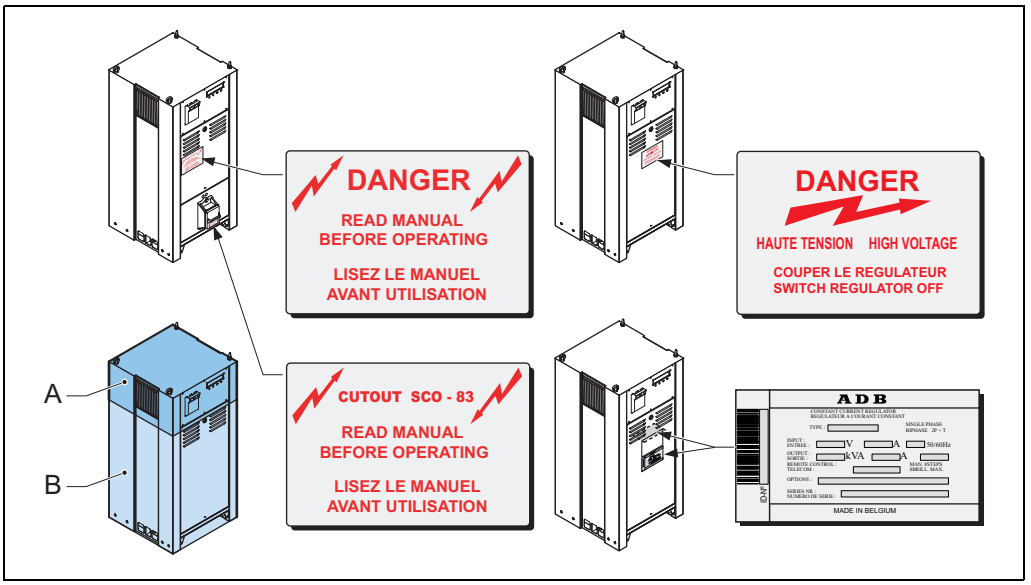
WARNING 2: Risk of electrical shock. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING 3: Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING 4: Wear personal protective equipment. Failure to observe may result in serious injury.

WARNING 5: Do not touch. Failure to observe this warning may result in personal injury, death, or equipment damage.

2.3 Signs on the equipment



A Low-voltage compartment B High-voltage compartment

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 Qualified personnel

The term qualified personnel is defined here as individual who thoroughly understand the equipment and its safe operation, maintenance, and repair. Qualified 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 cannot be held responsible for injuries or damages resulting from non-standard, unintended applications 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 an may result in serious personal injury, death or property damage.

Unintended uses may result from taking 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 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 equipment.
- Allowing unqualified personnel to perform any task.

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 qualified personnel to install ADB 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 qualified 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 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 qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

2.9 Maintenance and repair

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with ADB 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 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.

2.10 CE certification

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

2.11 Guarantee

ADB 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 and IEC.

The contractual warranty period applies for a period of 12 months after installation and at the latest for a period of 24 monts after ex-works delivery. Any defect in design, material or workmanship, which may occur during proper and normal use over this period will be repaired or replaced by ADB free of charge, ex. works.

The warranty does not cover consumables and/or operational failure resulting from improper maintenance or installation. Other damages caused by pavement maintenance equipment, snow ploughs or aircraft arresting gear hooks are not considered as a result of proper use and are beyond the scope of the warranty.

The warranty does not cover natural wear and tear or damage arising after delivery owing to faulty or negligent handling, excessive strain, unsuitable materials for operation, deficient civil engineering work, unsuitable soil conditions, and such chemical, electrochemical or electrical influences as were not assumed at the time of the conclusion of the contract.

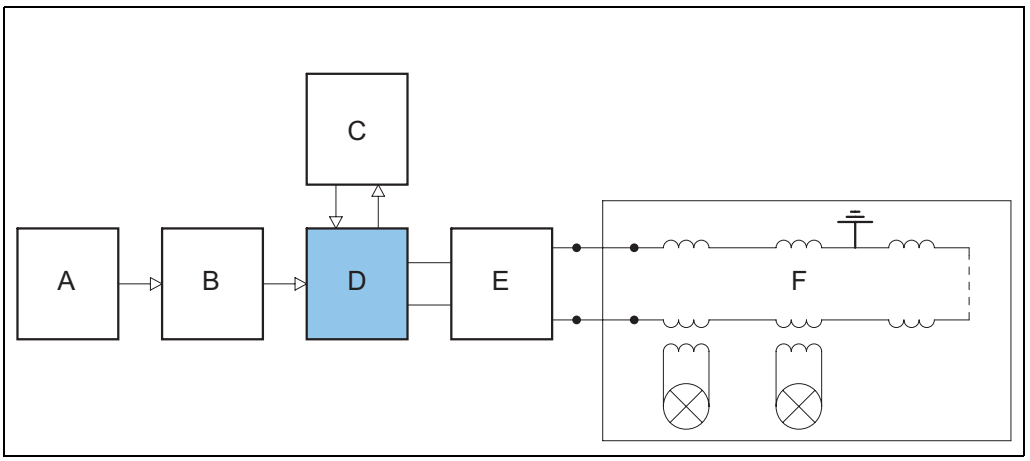
All liability for consequences of any inexpert alterations or repairs carried out by the purchaser or a third party shall be waived. ADB shall in no event be liable to the purchaser for any further claims, particularly claims for damages not affecting the goods themselves.

The above constitutes the limits of the liabilities of ADB in connection with the equipment covered by this manual.

Also refer to the document ‘General Conditions for Deliveries and Services by ADB’.

3 Description

3.1 Series circuit system overview



A	Input power supply	D	Equipment
B	Input disconnection device	E	Output disconnection device
C	Remote control system	F	Series circuit

The equipment is a microprocessor-controlled constant current regulator.

3.2 Intended use

The equipment is designed to supply airport lighting series circuits at different intensity levels. 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 Non linear loads

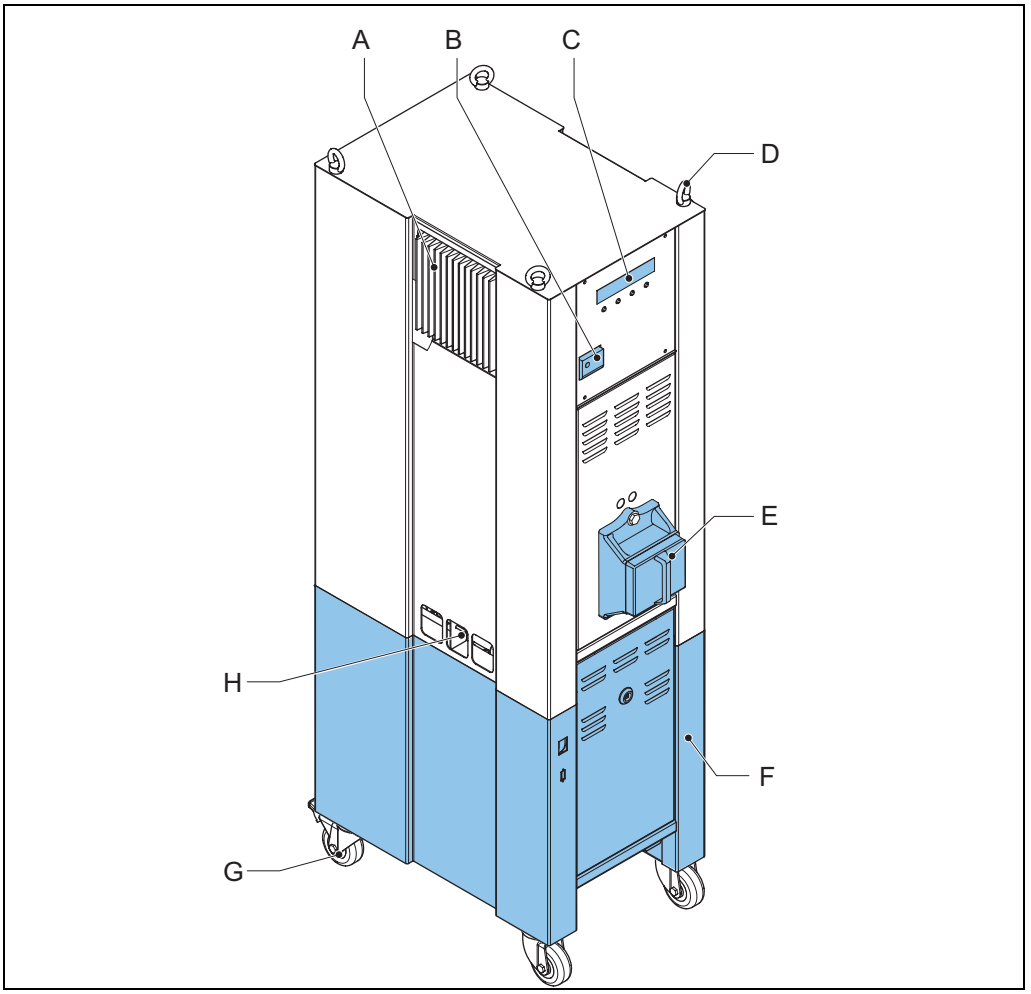
The equipment is fully compliant with several standards. See § 12.2.

Note
Non linear loads may negatively influence the correct operation of the equipment.

Examples:
- PVO loads are limited to 30 percent of the total load.
- It is recommended to switch blocks via ILCMS on a lower brightness step.

3.4 Lay-out of the equipment cabinets

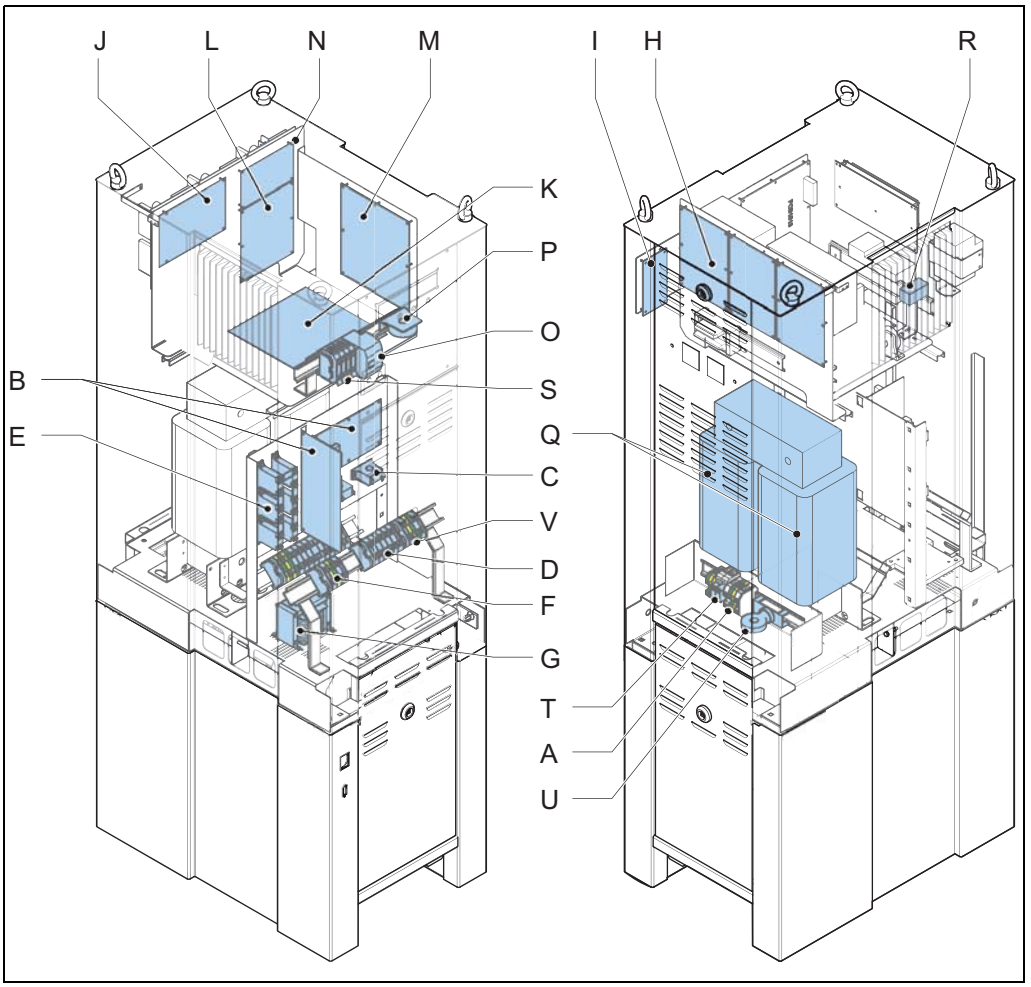
3.4.1 Outside - small cabinet: 2.5 to 10 kVa



Main items

A Thyristor heatsink
B Fused input switch
C User interface
D Lifting lugs (option)
E Series CutOut (SCO) (option)
F CS cabinet (option)
G Wheels (option)
H Ground stud M6

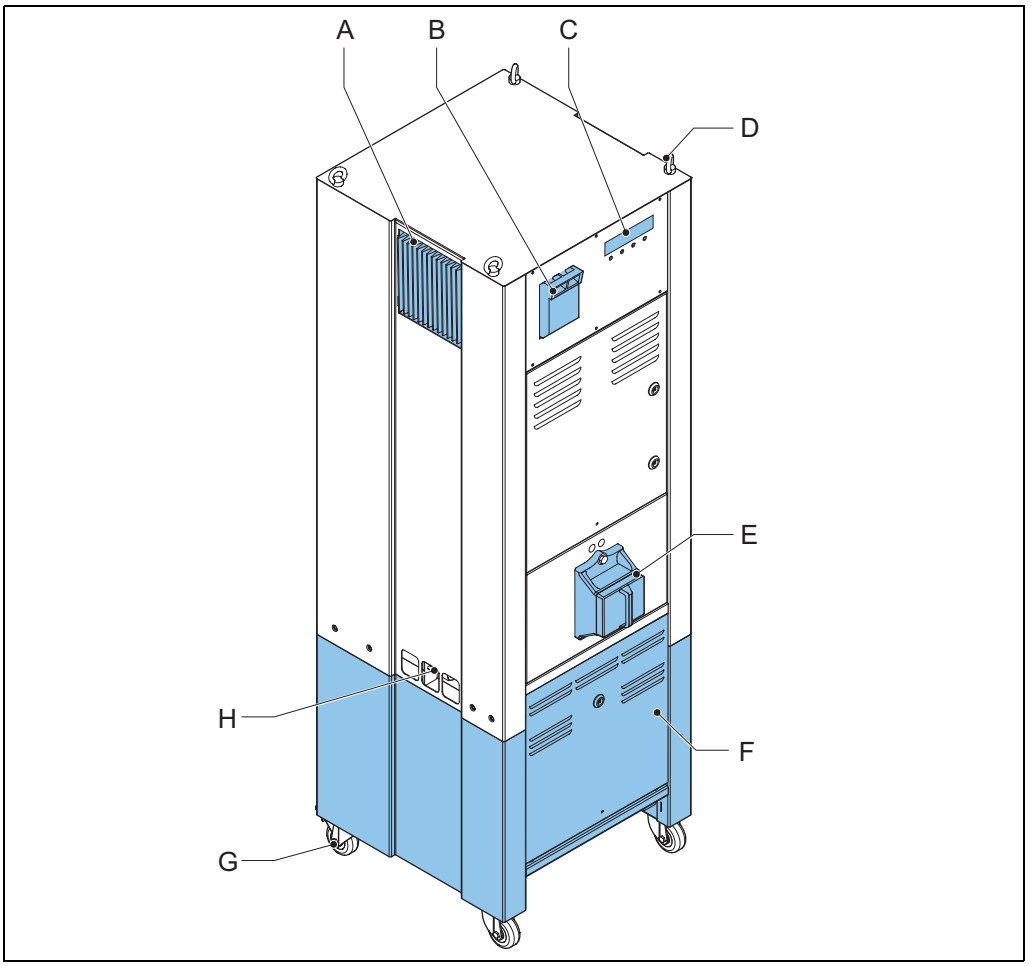
3.4.2 Inside - small cabinet: 2.5 to 10 kVa



Main items

A Input terminals (X1)
B Earth Fault Detection module (EFD) (option)
C Output measurement transformers (TI2, TI3)
D Tap (S6 to S1)
E Lightning arrestors (LA1, LA2)
F Output terminals (X2)
G Series choke (L1)
H Multiwire control (option)
I J-Bus logic (option)
J Thyristor Block Module (TBM)
K Power Supply Logic (PSL)
L Current Control Logic (CCL)
M Local Master Controller (LMC)
N Lamp Fault Detection (LFD) (option)
O Main contactor (K1)
P Input measurement transformer (TI1)
Q Output power transformer (T1)
R Thyristor (THP1)
S Fuses (F2, F3)
T Over Voltage Protection (OVP)
U Common mode choke
V Output terminals when you use a CSM

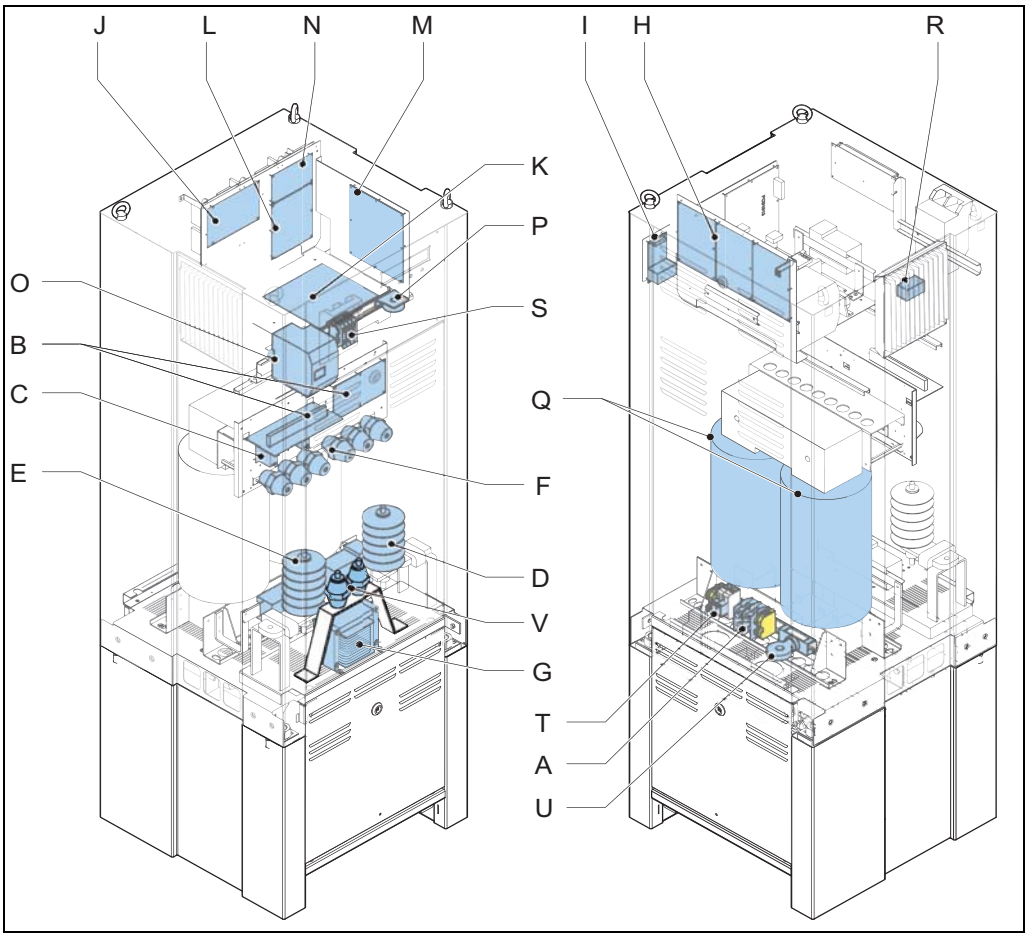
3.4.3 Outside - big cabinet 15 to 30 kVa



Main items

A Thyristor heatsink
B Fused input switch
C User interface
D Lifting lugs (option)
E Series CutOut (SCO) (option)
F CS cabinet (option)
G Wheels (option)
H Ground stud M6

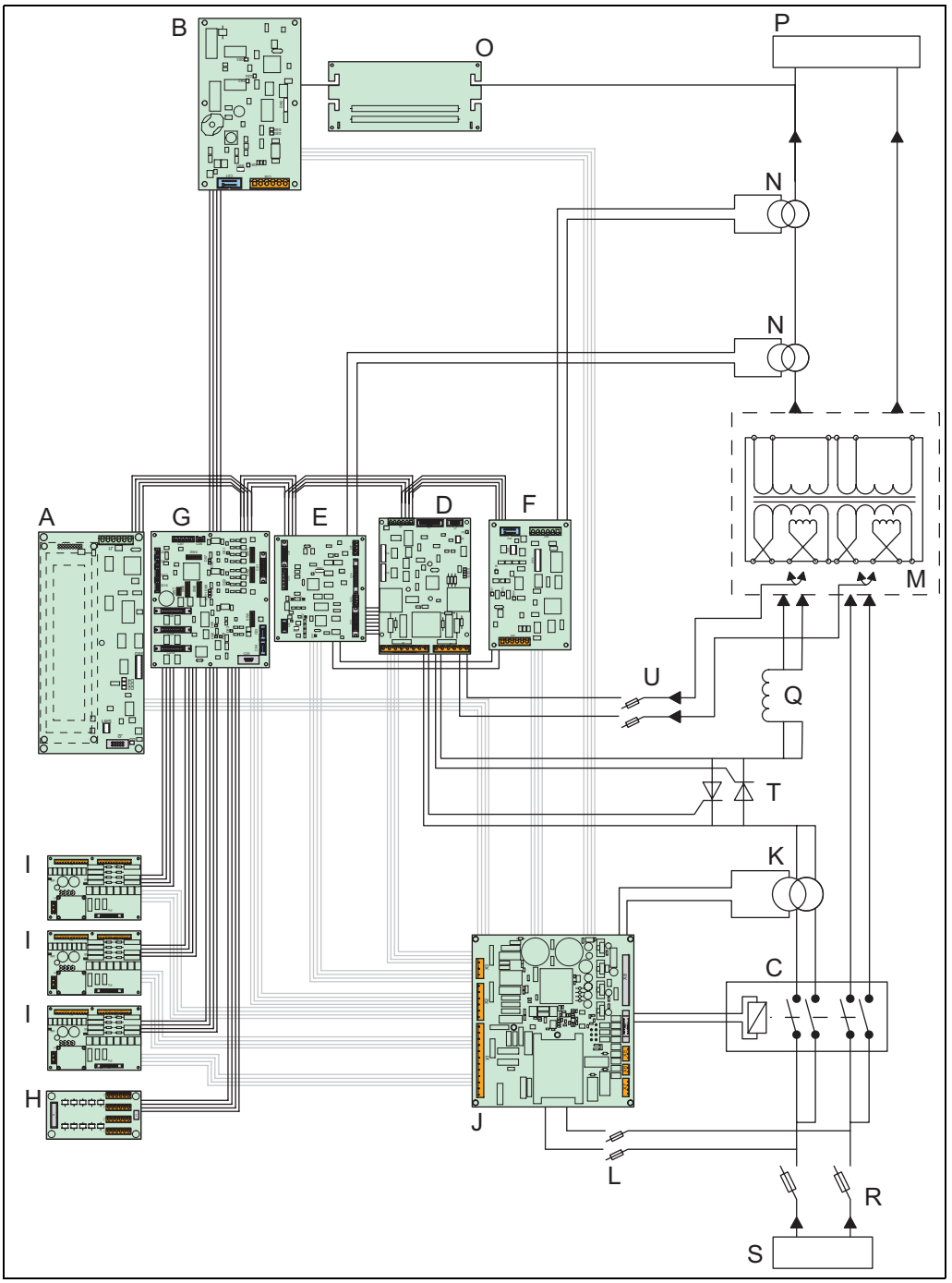
3.4.4 Inside - big cabinet 15 to 30 kVa



Main items

- A Input terminals (X1)
- B Earth Fault Detection module (EFD) (option)
- C Output measurement transformers (TI2, TI3)
- D Lightning arrestors (LA1, LA2)
- E Output terminals (X2)
- F Tap (S6 to S1)
- G Series choke (L1)
- H Multiwire control (option)
- I J-Bus logic (option)
- J Thyristor Block Module (TBM)
- K Power Supply Logic (PSL)
- L Current Control Logic (CCL)
- M Local Master Controller (LMC)
- N Lamp Fault Detection (LFD) (option)
- O Main contactor (K1)
- P Input measurement transformer (TI1)
- Q Output power transformer (T1)
- R Thyristor (THP1)
- S Fuses (F2, F3, F4)
- T Over Voltage Protection (OVP)
- U Common mode choke
- V Output terminals when you use a CSM

3.4.5 Overview of component connections



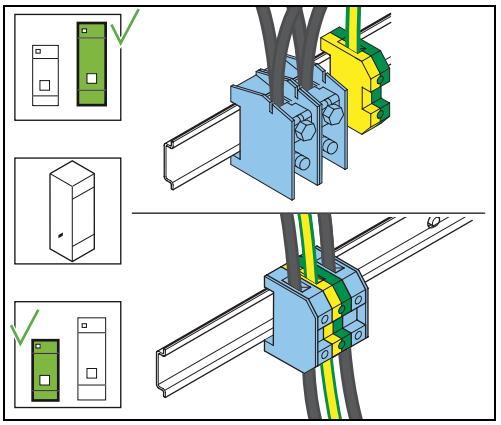
A	UI logic	L	Fuse (F2)
B	EFD (option)	M	Output power transformer (T1)
C	Main contactor (K1)	N	Output measurement transformer (TI2, TI3)
D	TBM	O	EFD resistors (option)
E	CCL	P	Output terminals (X2)
F	LFD (option)	Q	Series choke (L1)
G	LMC	R	Fused input switch (F1)
H	J-Bus interface (option)	S	Input terminals (X1)
I	Multiwire logic (option)	T	Thyristors (THP1)
J	PSL	U	Fuse (F3)
K	Input measurement transformer (TI1)		

3.5 Components

3.5.1 Power input

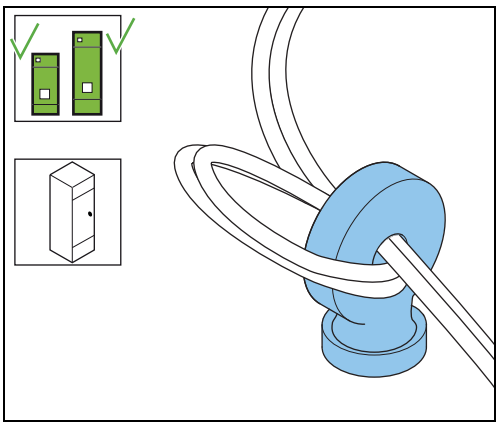
Input terminals (X1)

The input terminals connect the power input cables to the regulator. The size of these terminals depends on the input current rating of the regulator:



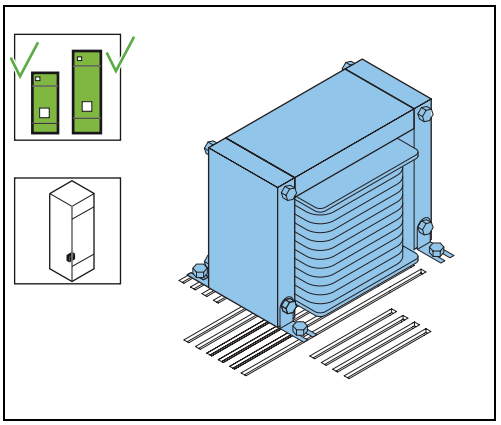
Common mode choke

The common mode choke blocks the high-frequency common-mode currents from the power circuitry.



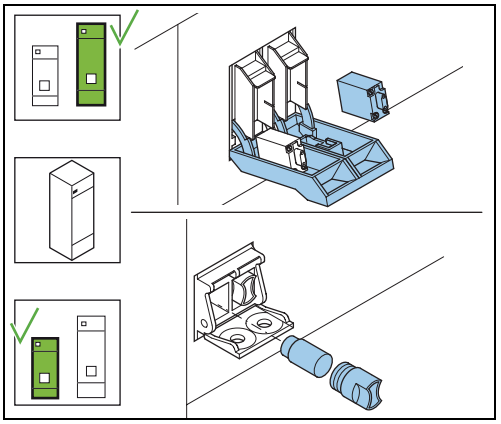
Series choke (L1)

The series choke limits the current rise time of the thyristors, the output transformer, and the current loop. The series choke also limits the harmonics on the current waveform.



Fused input switch (F1)

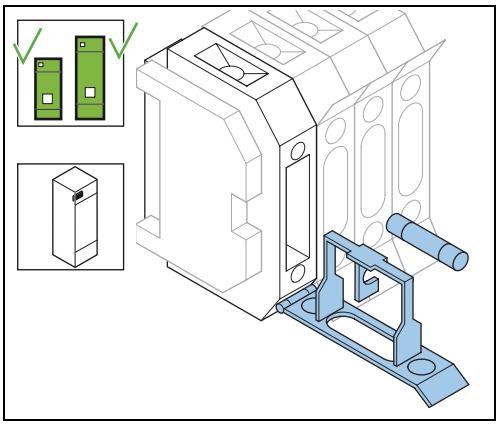
The fused input switch disconnects the equipment from the mains power supply.



Fuses (F2, F3)

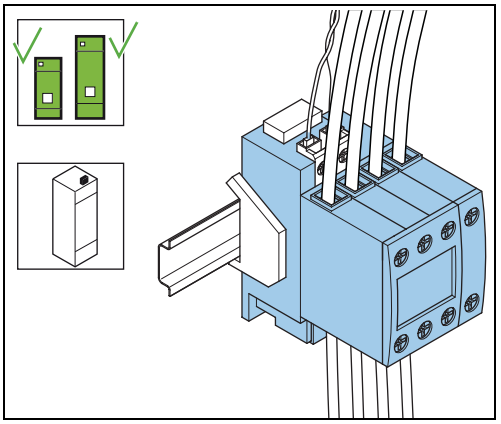
The fuses F2 and F3 protect the wiring of the equipment from overcurrent:

- F2 protects the low current mains wiring;
- F3 protects the wiring to measure the primary voltage of the power transformer;



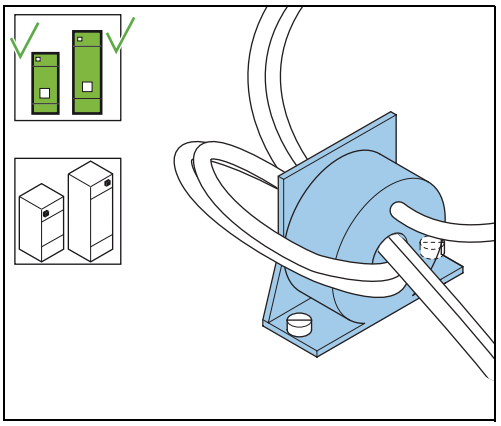
Main contactor (K1)

The main contactor interrupts the maximum input current. It also provides a positive interruption of the input power circuitry on both supply lines.



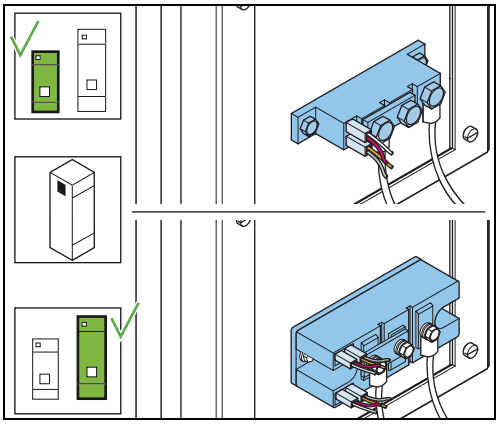
Input measurement transformer (TI1)

The input measurement transformer enables the equipment to measure the input current accurately.



Thyristors (THP1)

The thyristors use phase control as a closed loop regulation system to obtain the required output current.

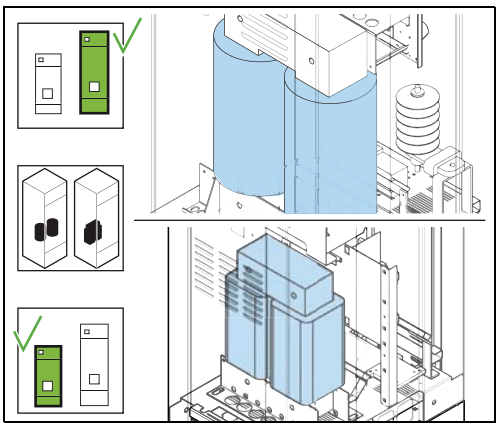


3.5.2 Power output

Output power transformer (T1)

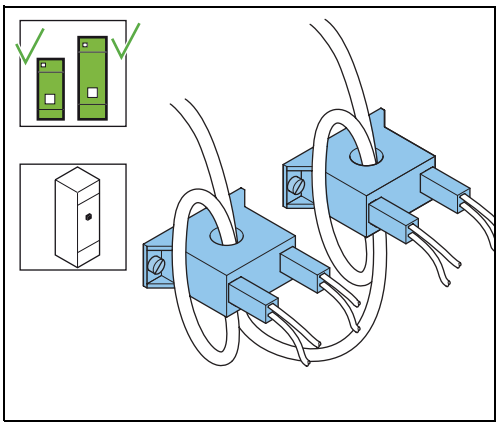
The transformer has a set of primary and secondary taps. The primary taps can adapt to the typical input voltages of 220, 240, 380, 400 or 416 V - 50 or 60 Hz. The secondary taps allow the equpment to adapt to the actual load with a set of steps: 2/8, 4/8, 6/8, 7/8, and 8/8.
The following exceptions apply:

- 25 and 30 kVA: only the primary taps 380, 400 or 416 V - 50 or 60 Hz.
- 25 and 30 kVA: 6.6 and 20 A power transformers.
- 2.5 kVA: only the secondary taps 8/8 and 4/8.



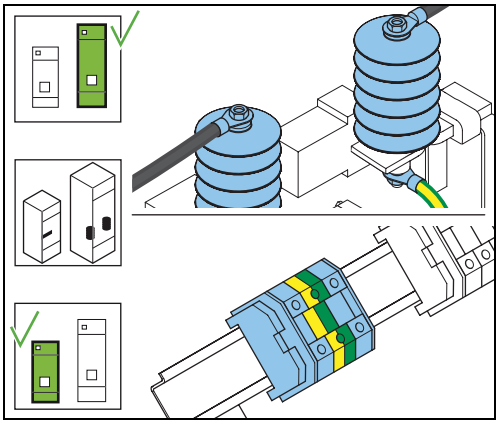
Output measurement transformer (TI2, TI3)

The output measurement transformer enables the equipment to measure the output current accurately.



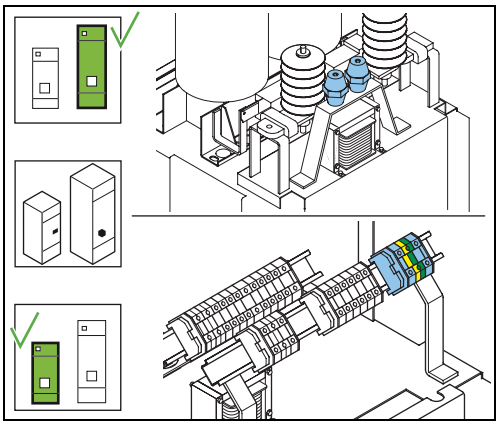
Output terminals (X2)

The output terminals connect the equipment to the series circuit.



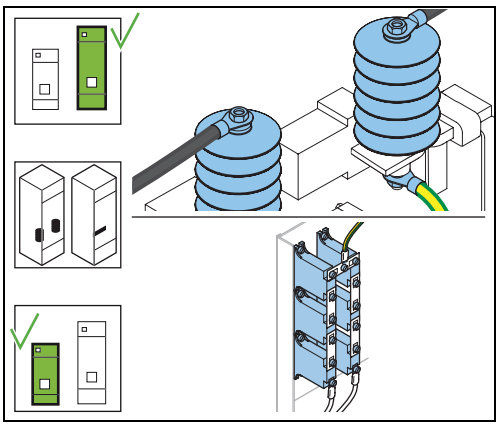
Output terminals when you use a CSM

The output terminals connect the equipment to the series circuit.



Lightning arrestors (LA1, LA2)

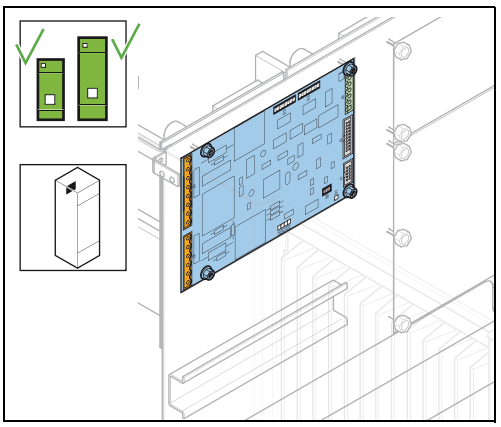
The output terminals connect the equipment to the series circuit. The output terminals are also used as lighting arrestors.



3.5.3 Printed Circuit Boards (PCBs)

Thyristor Block Module (TBM)

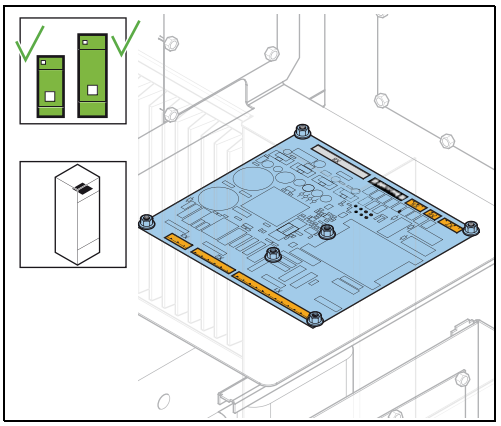
The TBM is the interface between the CCL and the thyristor gates. The TBM PCB controls the thyristor gates to obtain the required conduction angle. The TBM also provides fast overcurrent protection and asymmetric output voltage monitoring.



Power supply Logic (PSL)

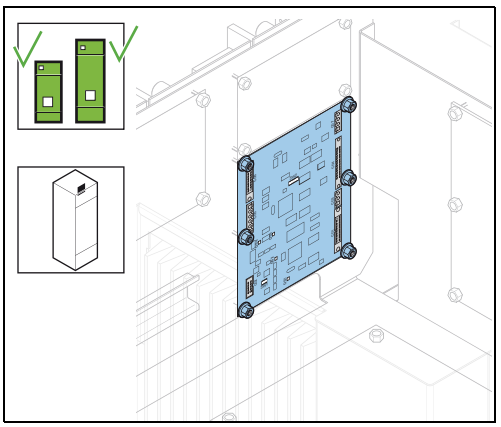
The PSL supplies power to the other modules in +12 / +5 / -12 V.
If the power supply to the PSL is interrupted, its signal (Power Good) goes low in less than 20 ms. The PSL maintains the DC voltages for about two seconds after a power failure, which leaves sufficient time for the CCL to prepare a fast restart without the loss of control data.

The PSL also provides 230 V AC for the internal 230 V AC components of the equipment. The input lines have supplementary filters to reduce the conducted emission of the equipment.



Current Control Logic (CCL)

The CCL compares the actual output current and the received brightness step request. The CCL calculates the optimal conduction angle. The CCL checks the tolerance of the output current, the overcurrent, or open circuit condition and produces the back-indication signals. In addition, the CCL also monitors the output circuit and the input parameters.
The CCL module also controls the back-indication signals ON and REG.ERR.



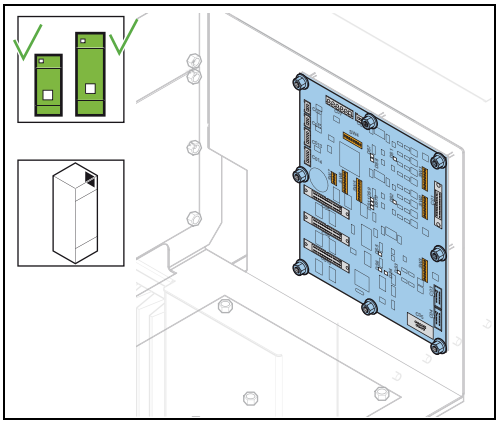
Back-indication signals ON and REG.ERR

The equipment can send basic back-indication signals to a monitoring system. These signals indicate to the monitoring system if the equipment is ON or OFF.
These signals must have simple, potential free contacts. The maximum contact load is:

- AC - 110 V - 2 A - 220 VA;
- DC - 110 V - 2 A - 60 VA.

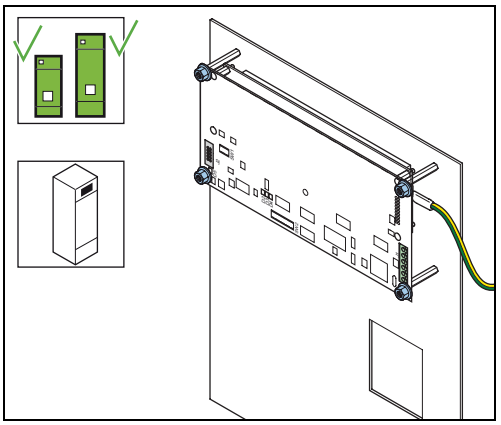
Local Master Controller (LMC)

The LMC communicates with the other modules as a master via a local bus. The LMC processes and distributes the messages it receives from the other modules. Each slave has a control line to request transmission of data to the LMC.
The local bus connection uses the RS485 protocol to send isolated signals over two wires.



User Interface (UI)

The user interface allows you to operate the equipment, view the status and the parameters. You can change some in Local Mode.



3.6 Working principle

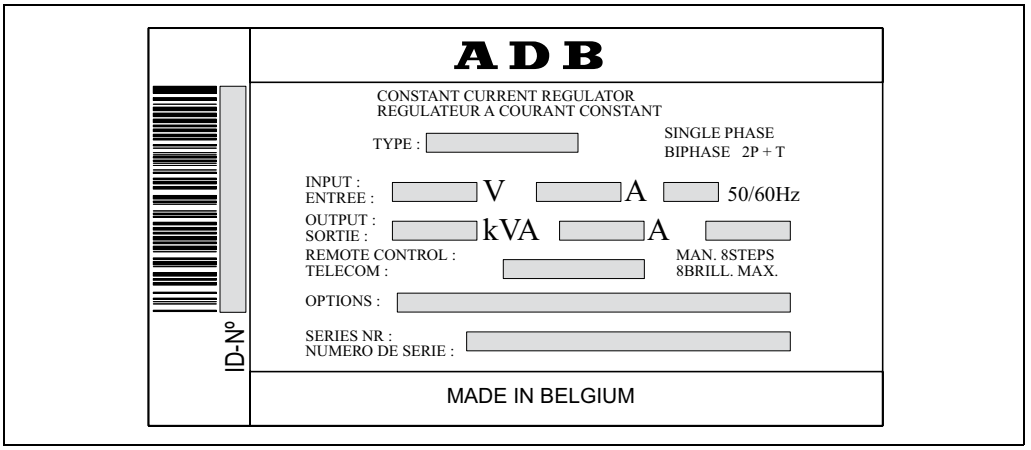
The equipment varies the output voltage to the series circuit to keep the output current constant. The conduction angle of the thyristor changes to vary the output voltage.

The sequence:
- The equipment receives a step request from a local or remote control.
- The CCL requests the contactor to close.
- The contactor closes.
- The CCL sends a request to the TBM to start firing the thyristors.
- The TBM fires the thyristor gates.
- The CCL compares the request with the actual output and adjusts the firing request to the TBM, if necessary.
- The produced RMS voltage is fed into a power transformer.
- The power transformer transforms the voltage to the required output voltage.

This process will be maintained until no output is anymore demanded or if any of the safety features are triggered. The equipment stops immediately when triggered by a safety feature. The safety can only be reset at the TBM.

3.7 Nameplate

Each equipment has a standard nameplate:



3.8 Options

Remote control

The equipment can be controlled remotely with Multiwire, J-Bus, or a combination of the above. The system automatically detects which communication method is available.

Multiwire

Each equipment has a maximum of three multiwire PCBs connected to the LMC:
- MW1;
- MW2;
- MW3 (for CS only)

A multiwire PCB has 8 input and 8 output signals. The terminals handle the incoming and outgoing signals between the equipment and the remote control system.

The multiwire interface provides control and back-indication signals for basic remote control functions between the equipment and a remote control system.
The number of multiwire PCBs in the equipment determines the maximum number of available terminals.

Note
It is necessary to configure a specific signal only to one terminal.

J-Bus

J-Bus can be either a single or a dual databus:
- With a single databus, the equipment has only one communication channel.
- With a dual databus, the equipment has two redundant separate communications channels: Bus A and Bus B. They should take different routes to avoid a communication failure if one cable is interrupted.

Series CutOut (SCO)

The optional 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 can be locked with a key to prevent unauthorized access.

Earth Fault Detection (EFD)

The EFD shows the insulation resistance of the series circuit on the user interface. This value is only an indication. To find out a more accurate value, use a specific measurement tool (Megger).The EFD measures the insulation resistance between the series circuit and the earth. 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 20 kOhm and 250 MOhm. However, Level 1 must always be higher than Level 2.
Working principle: A high-voltage resistor applies a stable, current-limited voltage of 500 V DC between the series circuit and the ground or cable screen.

Lamp Fault Detection (LFD)

The LFD shows the number of defective light fittings on the UI.
The operation of the LFD is based on the change in the output waveforms when a series transformer saturates as a consequence of the lamp having blown at the secondary side.
The LFD can be used together with a CS. It is then possible to calibrate the LFD module for two or more different circuit combinations.
The accuracy for a calibrated LFD level is one light fitting with a margin of +/- 3 light fittings.

The LFD provides correct measurements only if these conditions apply:
- All lamp transformers are of the same type and rating;
- Reactive and capacitive loads are low;
- The cable capacitance towards ground is less than 1µF and is equally distributed in the series loop.
- No non-linear lights, such as guidance signs, BRITE, serial-to-parallel adapts or poor contacts at primary or secondary lamp transformers.

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.

The interface board converts the logic control signals (12 V DC) that come from the CCL PCB into coil control voltages. If the equipment has a multiwire interface, the multiwire PCB MW3 serves as the remote control and back-indication interface for circuit selection.
The fuses F4 protect the power supply to the auxiliary transformer that feeds the CS logic. These fuses are located close to the main fuse F1 and are accessible after removing the user interface panel.

An auxiliary transformer T1 is used to adapt the input voltage to the contactor coil voltage level.

The type of high-voltage contactors (K1-K8) depends on the cabinet size. The number of contactors depends on the number of circuits and can be from two to eight.
For the big cabinet the HV-circuit connects directly to the HV contactor terminals. For the small cabinet there are separate connection terminals for the circuit connection.
The coil voltage of the HV contactors is standardized to 230 V 50/60 Hz.

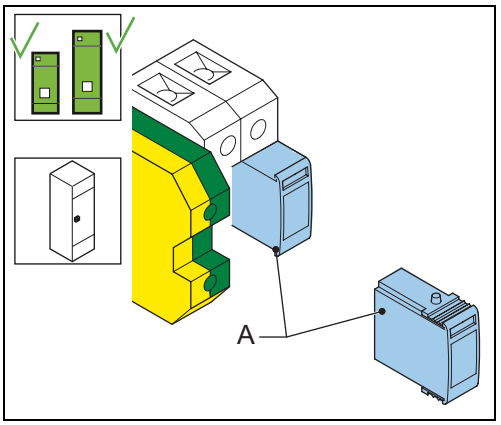
Hour counters

Measure the number of hours the equipment is ON, or the number of hours the equipment is ON and produces output current that is higher than a set value.
If the equipment has a CS, each circuit has its own hour counter.

Overvoltage protection (MOV1A and MOV1B)

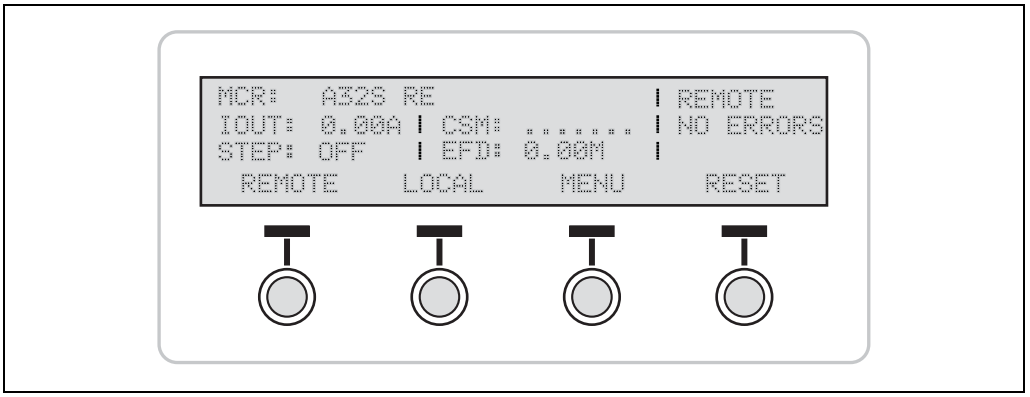
The overvoltage protection module protects the input circuit from incoming voltage transients or peaks. The status of the modules is monitored.

The overvoltage protection modules have indicators. These indicators become red when the protection is activated.



3.9 User interface (UI)

You can operate the equipment with the UI.



4 Commissioning

4.1 Main commissioning procedure

1. Do the first start-up. See § 4.2.
2. Adjust the tap setting. See § 4.3.
3. Calibrate the Lamp Fault Detection (LFD) module (option). See § 4.4.
4. Calibrate the Earth Fault Detection EFD) module (option). See § 4.5.
5. Adjust the number of available brightness steps. See § 5.4.
6. Configure the remote control interface: Multiwire (option). See § 4.6.
7. Configure the remote control interface: J-bus (option). See § 4.7.

4.2 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.

4.2.1 Measure input voltage

Prepare

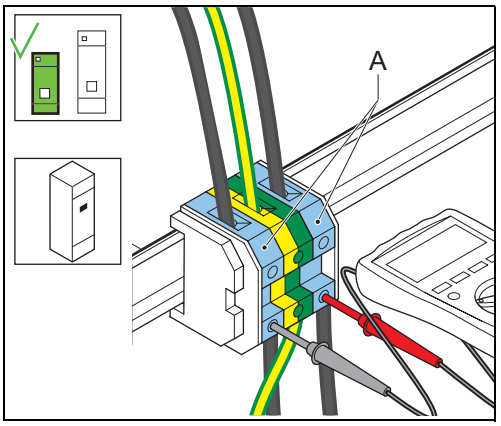
1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Remove the lower rear panel. See § 7.3.
3. Switch ON the disconnection device. *Do not switch ON the equipment.*

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 voltage stated on the nameplate of the equipment and with local regulations.

CAUTION
An excessive input voltage can damage the equipment.

3. If this is not the case, do not switch ON the equipment. Otherwise, switch on the equipment and set it to LOCAL mode. See § 5.1



Finish

1. Install the lower rear panel.
2. Wait for approximately 30 minutes and make sure the equipment works correctly.
3. Make sure that all power to the equipment is OFF. See § 5.3.

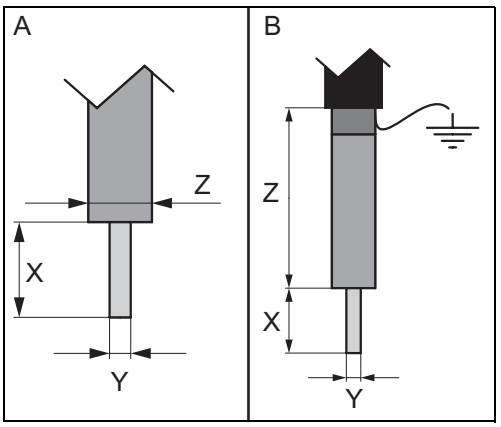
4.2.2 Measure output current in short-circuit

Prepare

1. Make sure that the tap setting is set to 8/8. See § 12.7.
2. Make sure that all power to the equipment is OFF. See § 5.3.
3. Open the front panel. See § 7.3.
4. Remove the output cable.
5. Short-circuit the output terminal. Choose between:
   - Short-circuit with separate piece of output cable;
   - Short-circuit with SCO (option).

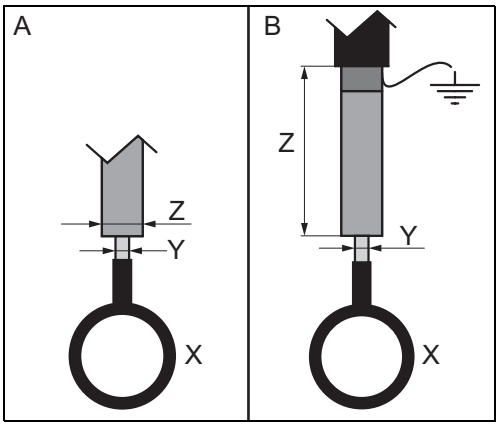
Strip cable (small cabinet)

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



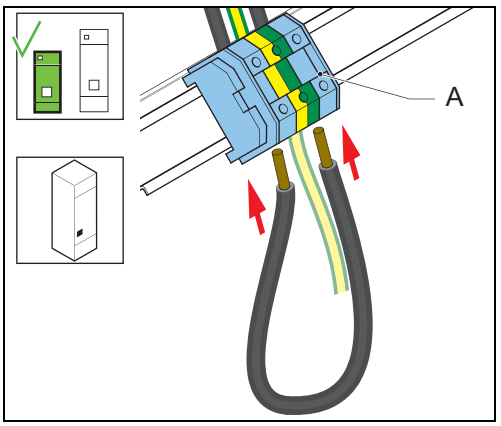
Strip cable (big cabinet)

1. Strip a separatie piece of output cable:
   - A: unscreened cables
     - X: M10;
     - ∅ Y: less than or equal to 7 mm;
     - ∅ Z: less than or equal to 12 mm.
   - B: screened cables
     - X: M10;
     - ∅ Y: less than or equal to 7 mm;
     - Z: 100 mm.



Short circuit with separate piece of output cable

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

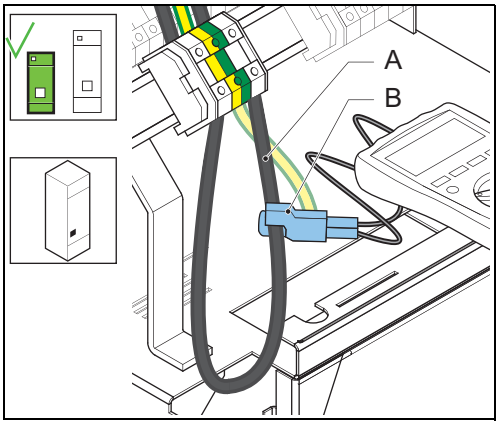


Short circuit with SCO (option)

1. Set the SCO to mode C. See § 5.12.
2. With the separate piece of output cable, short-circuit the output terminals.

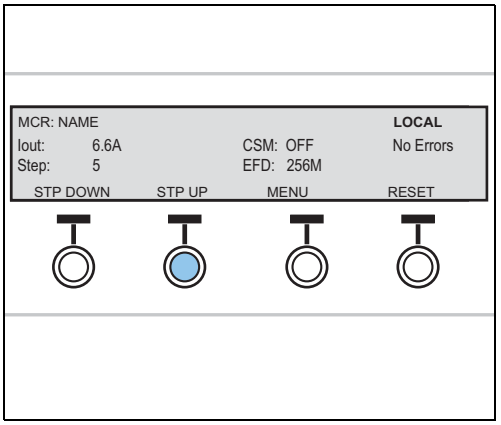
Connect AC True RMS multimeter

1. Connect an AC True RMS multimeter (B) to the short-circuited cable (A) or the output power cable in the case of an SCO.



Measure output current

1. Switch ON the equipment and set it to LOCAL mode. See § 5.1.
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 step. *Check each brightness step separately from the highest to the lowest level.*



Finish

1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Close the front panel.

4.2.3 Measure resistance of series circuit

Prepare

1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Remove the lower rear panel. See § 7.3.
3. Discharge the output terminals. Either set the SCO to earthed mode or connect an earthing point to the output terminal.
4. Remove the output cable.

Measure resitances of equipment without SCO

1. Remove the output cables from the connection terminals.
2. Measure the insulation resistance: measure on the ends of the series cable. *Use the insulation tester Megger 500 V or 1000 V*.
3. Measure the resistance of the series circuit: join the ends of the series cables and then measure.

Short circuit with SCO (option)

1. Remove the SCO. See § 7.2.14.
2. Measure the resistance of the series circuit: measure on the ends of the series circuit.
3. Install the SCO. See § 7.2.14.
4. Measure the insulation resistance: set the SCO to mode C (short circuit position). See § 5.12.

Calculate

1. Calculate:
   - the minimum insulation resistance of the series circuit. See § 8.4;
   - the resistance of the series circuit. See § 8.5.

2. *Make sure that the measured and the calculated values match and that all the values are in accordance with all local safety regulations.*

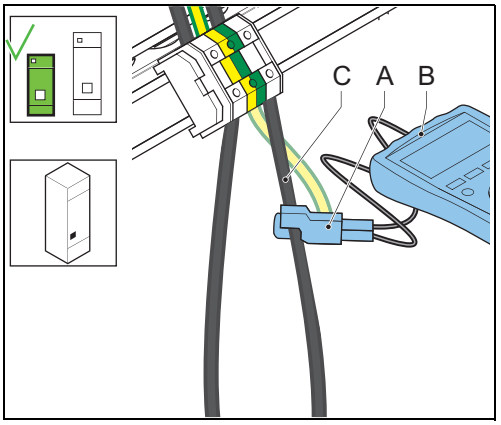
Finish

1. In case the equipment has a CS (option), test each circuit separately.
2. Make sure that all power to the equipment is OFF. See § 5.3.

4.2.4 Measure output current to the series circuit

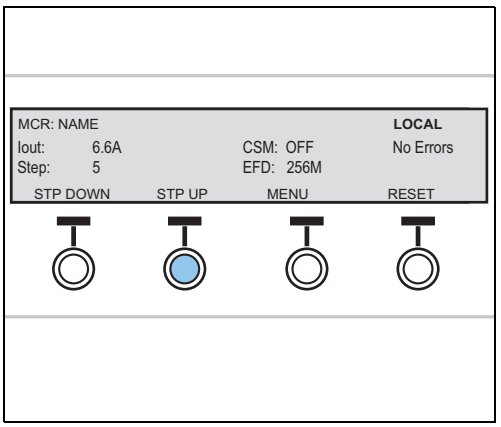
Prepare

1. Make sure that the series circuit has been measured and approved. See § 4.2.3.
2. Make sure that all power to the equipment is OFF. See § 5.3.
3. Make sure that the series circuit is connected.
4. Connect an AC current clamp (A) and a True RMS Multimeter (B) to the series circuit cable (C).



Measure

1. Switch ON the equipment and set it to LOCAL mode. See § 5.1.
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 tap setting is too low or that the equipment is too small for the load.*
4. Compare the output current reading on the UI with the reading on the True RMS Multimeter.
5. Examine if the output current readings are in accordance with local regulations.
6. If the output current readings are not in accordance with the local regulations, 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. Check all brightness steps separately. *Go through the whole procedure for each brightness step.*

Finish

1. Wait for approximately 30 minutes and make sure that he equipment works correctly.
2. Make sure that all power to the equipment is OFF. See § 5.3.

4.2.5 Test Circuit Selector (CS) in short-circuit (option)

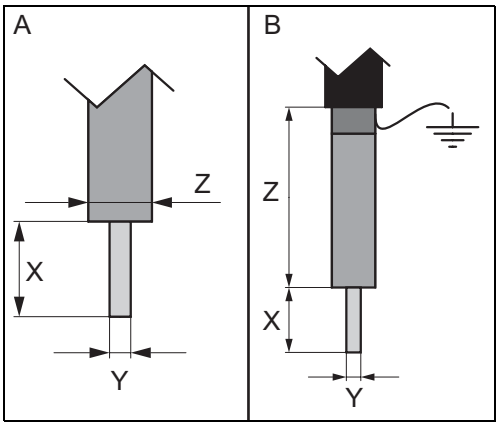
Test the CS to make sure that the equipment produces the correct output current.

Prepare

1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Remove the front panel and the CS cabinet panel. See § 7.3.
3. Remove the output cable.

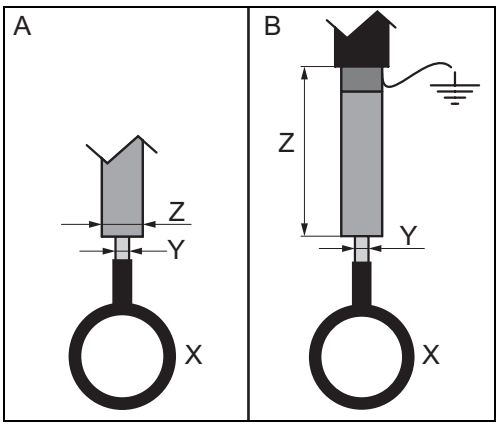
Strip cable (small cabinet)

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



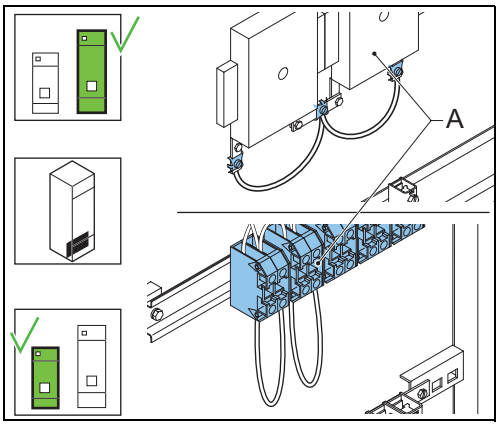
Strip cable (big cabinet)

1. Strip a separatie piece of output cable:
   - A: unscreened cables
     - X: M10;
     - ∅ Y: less than or equal to 7 mm;
     - ∅ Z: less than or equal to 12 mm.
   - B: screened cables
     - X: M10;
     - ∅ Y: less than or equal to 7 mm;
     - Z: 100 mm.



Short-circuit

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



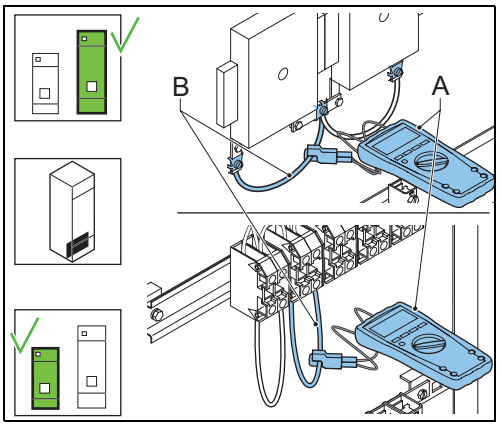
Short circuit with SCO (option)

1. Set the SCO to mode C. See § 5.12.

Note
The SCO makes sure that excessive output current does not damage the series circuit.

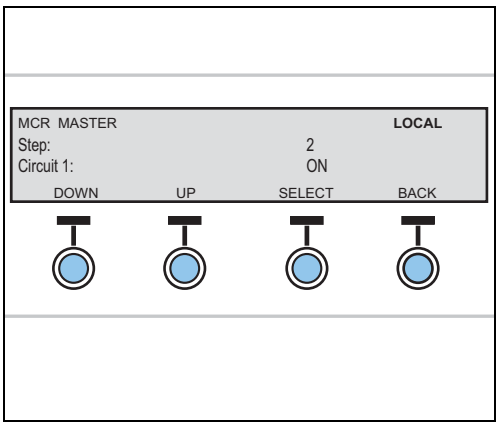
Connect AC True RMS multimeter

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



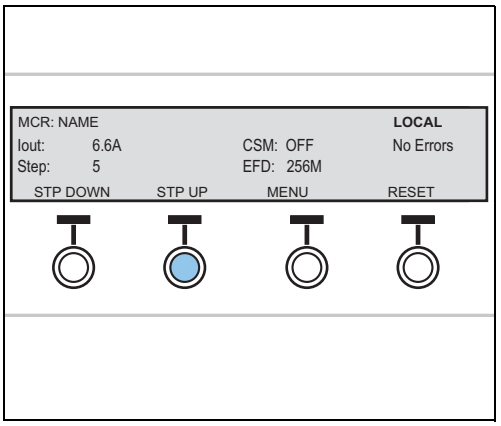
Activate Circuit 1

1. Switch ON the equipment and set it to LOCAL mode. See § 5.1.
2. In the UI start page, push the **Menu** button twice. *You can now scroll through the available menus with the Down and Up buttons.*
3. Push the **Down** button until the asterisk (*) is adjacent to **MCR Control**.
4. Push the **Select** button to go to the **MCR Control** menu.
5. Push the **Down** button until an asterisk (*) is adjacent to **Circuit 1**.
6. Push the **Select** button to select **Circuit 1**.
7. Push the **Toggle** button to set the Circuit 1 to ON.



Measure

1. Select the step 6.6 A. See § 5.1.
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 § 5.3.
2. Install the AC True RMS multimeter on the next circuit.
3. Set the equipment to LOCAL mode. See § 5.1.
4. Select the step 6.6 A.
5. Measure the output current.
6. Repeat the previous steps for all circuits.

Repeat

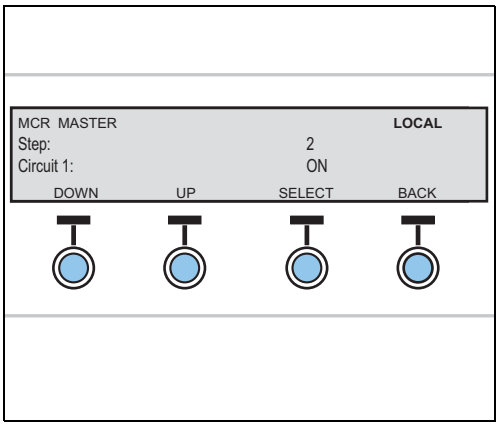
1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Install the front panel and the CS cabinet panel.

4.2.6 Measure output current series circuit with CS (option)

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

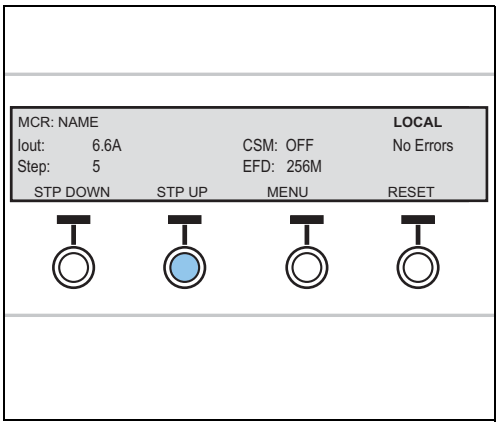
Prepare

1. Make sure that all the output circuits are connected to the equipment.
2. In the UI start page, push the **Menu** button twice. *You can now scroll through the available menus with the Down and Up buttons.*
3. Push the **Down** button until the asterisk (*) is adjacent to **MCR Control**.
4. Push the **Select** button to go to the **MCR Control** menu.
5. Push the **Down** button until the asterisk (*) is adjacent to **Circuit 1**.
6. Push the **Select** button to select **Circuit 1**.
7. Push the **Toggle** button to set the Circuit 1 to ON.
8. Repeat steps 4 to 6 and witch ON all circuits.



Measure

1. Push the **Back** button. The UI now shows the menu selection page.
2. Push the **Select** button to go to the **Setup** menu.
3. Push the **STP up** button until the **Step** field changes to 6.6 A.
4. If the output current does not reach 6.6 A, change the series circuit configuration before you proceed.
5. 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 in the **MCR Control** menu. *After you disable a circuit, check that the lights in that circuit go OFF.*
2. Set the equipment to OFF. See § 5.3.

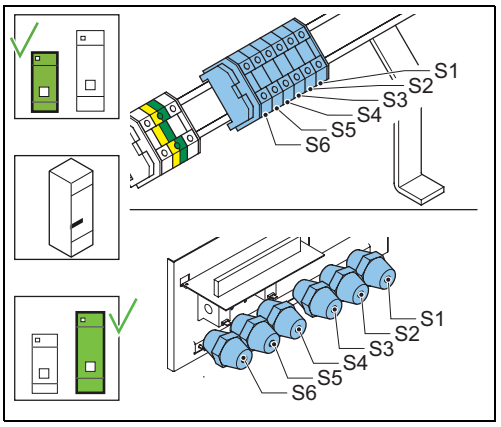
4.3 Adjust tap setting

The adjustment of the tap setting adjusts the equipment to the actual load and optimizes the use of the equipment concerning efficiency and power factor.

Note
Use the configuration software tool. See chapter 10. The procedure can also be carried out with the UI if firmware version 2.00 or higher is installed.

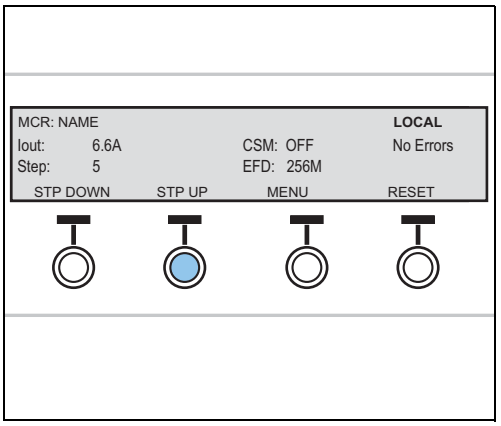
Prepare

1. Push the **Menu** button to go to the **Setup** menu.
2. Push the **STP Down** button until the UI shows OFF.
3. Make sure that all power to the equipment is OFF. See § 5.3.
4. Open the front panel. See § 7.3.
5. Make sure that the taps are wired to tap 8/8. See § 12.7.
6. Close the front panel.



Switch equipment ON

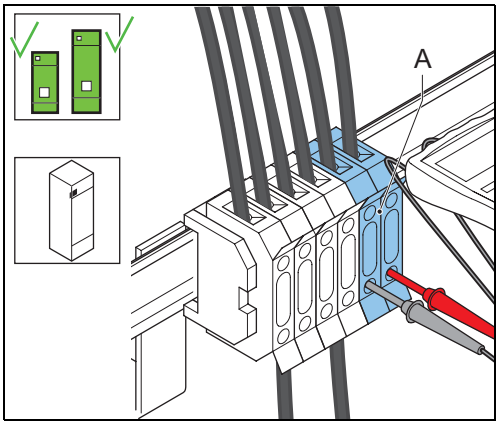
1. Set the equipment to LOCAL mode. See § 5.1.
2. Select the step 6.6 A.
3. If the output current does not reach 6.6 A, change the series circuit configuration before you proceed.
4. Examine if all light fittings have the same brilliancy level. *Go to the runway area to make a visual inspection.*
5. Wait for approximately 30 minutes and make sure the equipment works correctly.
6. Record the input and output measurements on the UI. *This allows you to compare the values after you changed the tap.*



Measure voltage at input of power transformer

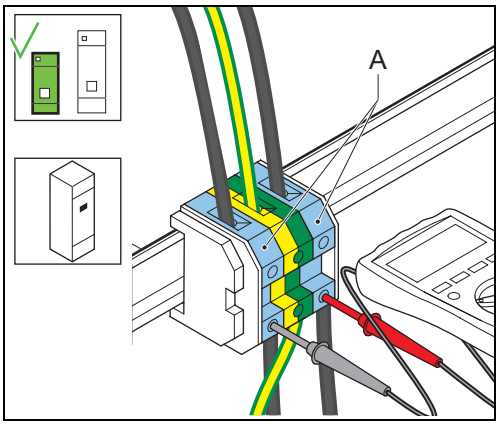
1. Measure the voltage on the terminals of fuse holder F3 (A). *Use a True RMS Multimeter.*
2. Find the tap setting that matches the voltage reading. See § 12.7.
3. Make sure that all power to the equipment is OFF. See § 5.3.
4. Discharge the series circuit. Either set the SCO to earthed mode or connect an earthing wire to the output terminal.

WARNING
Any remaining power in the series circuit can be lethal.



Reconnect tap wires

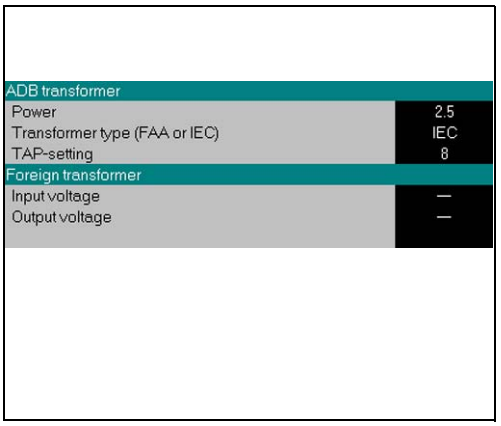
1. Reconnect the tap wires according to the tap you selected.
2. Install the disconnection device.
3. Push the **Menu** button once.
4. Push the **STP UP** button until the **Iout** field shows 6.6 A.
5. Measure the output current on the output terminals (A). *Use an AC current clamp and a True RMS Voltmeter.*
6. If the output current does not reach 6.6 A:
   - Change the tap wires to the closest higher setting;
   - Measure the output current value. See § 4.2.4 or 4.2.6.



7. Switch ON the equipment. *Use the fused input switch.*
8. Wait for approximately 30 minutes and make sure the equipment works correctly.

Adjust configuration

1. Open the configuration software tool.
2. Go to menu **Installation**.
3. Click the field adjacent to the **TAP-setting** parameter. *A window opens.*
4. Select the appropriate TAP setting.
5. On the UI, push the **Menu** button once.
6. Push the **STP UP** button until the **Iout** field shows 6.6 A.
7. Make sure that the output voltage that the UI shows does not exceed the maximum value. See § 12.7.3.
8. If the output voltage is higher than the maximum value:
   - Change the tap wires to the closest higher setting;
   - Measure the output current value. See § 4.2.4 or 4.2.6.



4.4 Calibrate Lamp Fault Detection (LFD) (option)

If the equipment has an LFD, you must carry out this procedure. Also consider de accuracy of the LFD. See § 3.8.

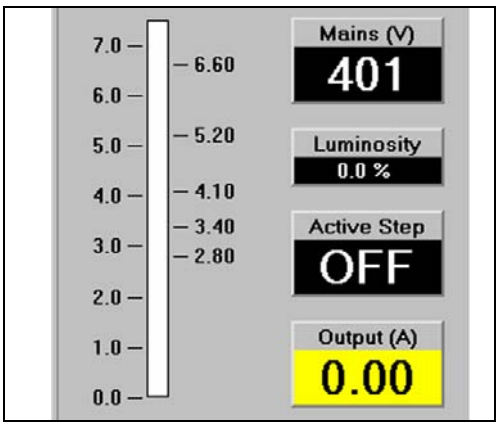
CAUTION
The LFD module does not work if the series circuit includes these types of lights:
- **LED lights;**
- **PVO lights (guidance lights);**
- **WIGWAG (runway guard lights).**

Note
Use the configuration software tool. See chapter 10.

Note
The procedure below shows the configuration software tool. It is also possible to carry out the procedure on the UI. In this case, switch the equipment to OFF and back to ON after each change in the setting. For more information on the UI, see chapter 9.

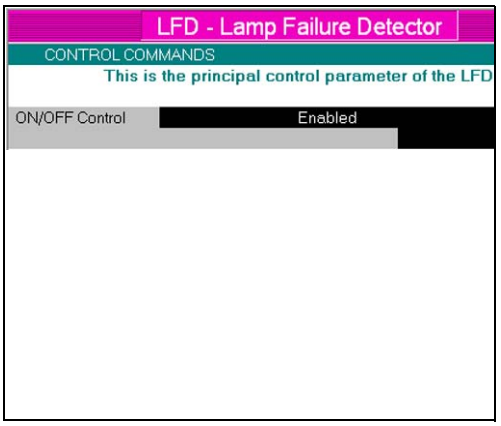
Prepare

1. Open the configuration software tool.
2. Make sure that the equipment is connected to the series circuit.
3. Make sure that the tap setting is correct.
4. Switch ON the equipment. *Use the fused input switch.*
5. Push the Active Step button and set the equipment to 6.6 A.
6. Examine if all light fittings all light up. *Go to the runway area to make a visual inspection.*
7. Push the Active Step button and set the equipment to OFF.



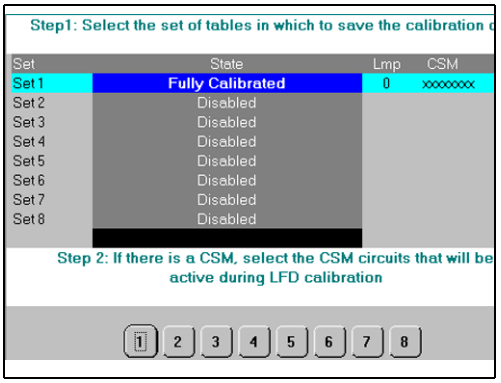
Enable the LFD function

1. Select the menu **LFD > Control commands**.
2. Set the parameter **ON/OFF control** to 'Enabled'.



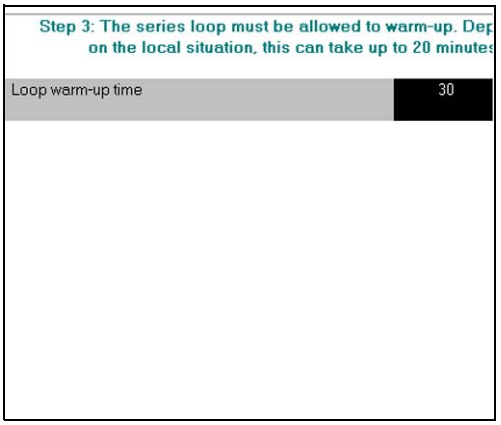
Select LFD calibration

1. Erase the calibration tables of all sets..
2. Select the menu **LFD > LFD calibration.**
3. Select the set to calibrate..
4. If the equipment has a CS, define the combination of circuits that will be active for that set. *A set is a combination of circuits.*



Set Loop warm-up time for the selected set

1. Select **Loop warm-up time.**
2. Adjust the time for the series circuit (10 to 1275 s).
   - Short series circuit (below 1000 m): 30 s;
   - Medium series circuit (up to 3000 m): 120 s;
   - Long series circuit (more than 3000 m): 240 s.



Carry out reference calibration

1. Select **Do the 'Reference' measurement**.

Note
The equipment starts automatically.

2. Wait until the equipment finished the calibration procedure.

Remove lamps

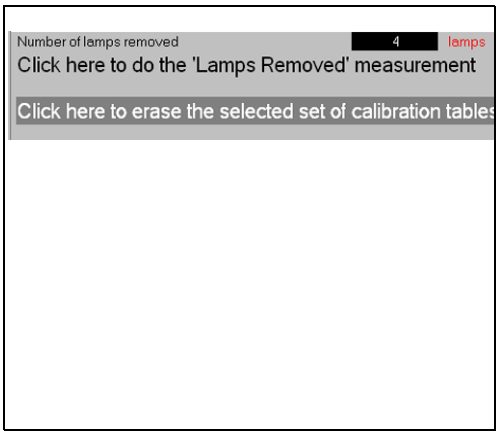
1. Make sure that all power to the equipment is OFF. See § 5.3.
2. Earth the series circuit with an earthing wire or with the SCO (See § 5.12).
3. Remove a number of light fittings in the field.

Note
Choose the number of lamps in function of the alarm level you use.

4. Switch ON the equipment and set it to LOCAL mode. See § 5.1.

Set number of removed lamps

1. In the LFD menu, enter the number of light fittings you removed.
2. Select **Do the 'Lamps Removed' measurement**.
3. Wait until the equipment finished the procedure.
4. Make sure that all power to the equipment is OFF. See § 5.3.
5. Leave the equipment OFF for 10 seconds.
6. Switch ON the equipment. *Use the fused input switch.*



Set alarm level

1. In the LFD menu, select the parameters **Lamp failure levels** 1 and 2.
2. Enter the alarm levels you want to use.
3. Make sure that all power to the equipment is OFF. See § 5.3.
4. Leave the equipment OFF for 10 seconds.

Reconnect the light fittings in the field circuit

1. Connect the first light fitting you disconnected.
2. Switch ON the equipment. *Use the fused input switch.*
3. Make sure that the number of lamps removed corresponds to the LFD reading on the main menu.
4. Make sure that all power to the equipment is OFF. See § 5.3.
5. Leave the equipment OFF for 10 seconds.
6. Repeat the previous steps and connect the rest of the light fittings one by one.

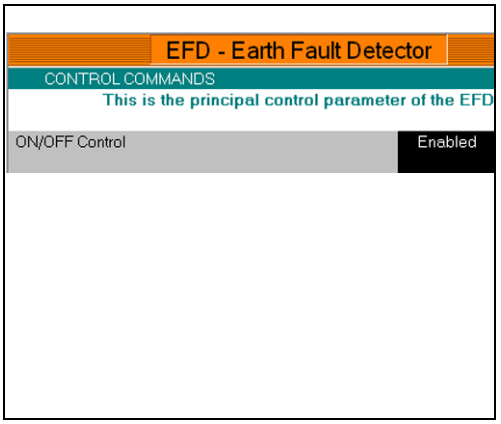
4.5 Calibrate Earth Fault Detection (EFD) (option)

If the equipment has an EFD, you must carry out this procedure.

Note
Use the configuration software tool. See chapter 10.

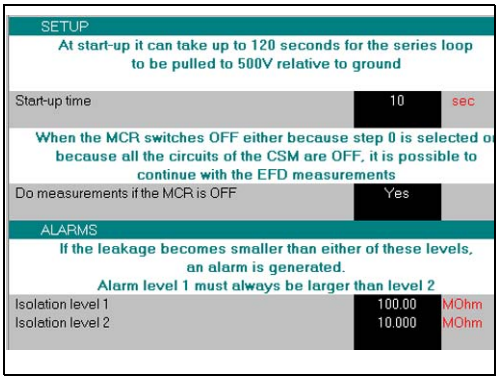
Note
The procedure below shows the configuration software tool. It is also possible to carry out the procedure on the UI. In this case, switch the equipment to OFF and back to ON after each change in the setting. For more information on the UI, see chapter 9.

1. Open the configuration software tool.
2. Switch ON the equipment. *Use the fused input switch.*
3. Select the menu **EFD**.
4. Go to section **Control commands > ON/ OFF control**. *Set the parameter to enabled. See the graphic*.



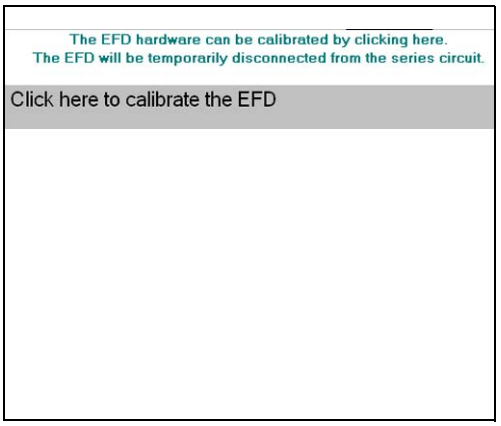
Enter Startup time and Isolation level

1. Go to the section **Setup > Startup time**.
2. Enter the correct time for the series circuit. *Calculate at least 4 s per km of cable if the capacitance is less than 0.2 µF/km*.
3. Select the parameters **Isolation level** 1 and 2.
4. Enter the alarm levels you want to use:
   - Level 1: 2 times the minimum insulation value of the respective series circuit. See § 8.4.
   - Level 2: 0.5 times the minimum insulation value of the respective series circuit. See § 8.4.



Calibrate

1. Select **Calibrate the EFD**.
2. Wait until the equipment finished the calibration procedure.

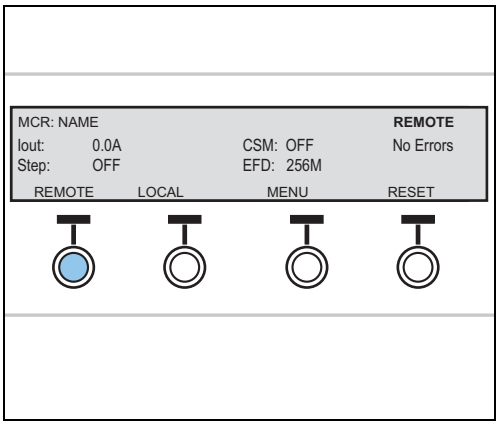


4.6 Remote control configuration: multiwire (option)

Note
Use the configuration software tool. See chapter 10.

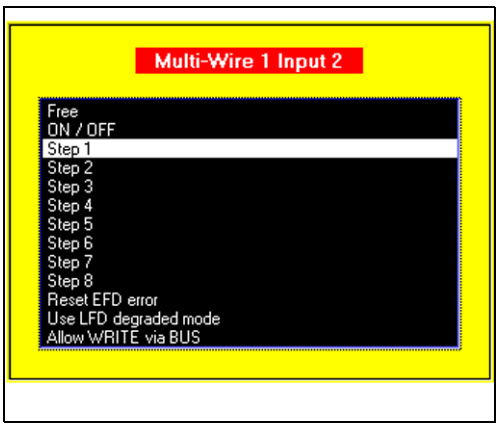
Enable and test remote control

1. Push the **Remote** button. You can see the status **REMOTE** on the UI.
2. Test all remote control functions with the remote control system that is connected to the equipment. For the factory settings, see § 11.3.
3. Examine if the remote control receives the signals.
4. Simulate errors with the **Error simulation** tab in the **Setup menu**.
5. Examine if the the errors return to the control system.



Change input and output signals function assigned to terminals, if required

1. In the configuration software tool open menu **IO**.
2. To change the input and output signals of the multiwire PCBs 1 to 3, click the respective terminal fields *to change the function assigned to it. A pop-up window appears.* See also § 11.3.
3. Carry out the error simulation again, if applicable.



4.7 Remote control configuration: J-Bus (option)

4.7.1 General procedure

1. Set the binary address of the LMC.
2. Set the slave address.
3. Choose and set a two or four wire communication type.
4. Check the connection.

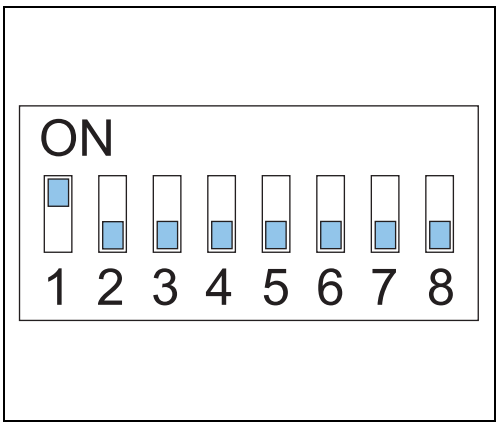
4.7.2 Set binary address of LMC PCB 1513

1. Set the dip-switches according to the databus connection of the equipment. For details see § 11.5.

4.7.3 Set binary address

The slave on the databus must have a unique binary address.

1. Change the settings of the dip-switches of dip-switch bank SW4 on the LMC PCB.



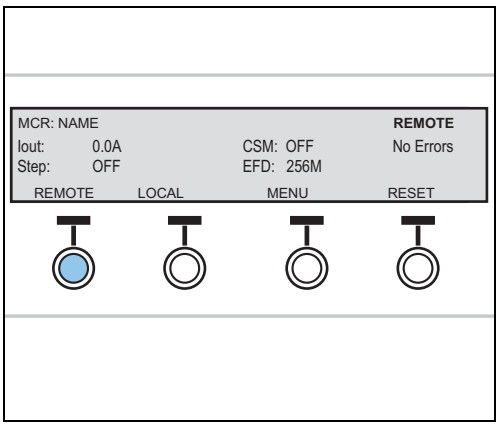
4.7.4 Set two/four wire communication

1. Set the straps on the LMC PCB. See § 11.5.

4.7.5 Check connection

Connect from a place where the remote control connection already works.

1. Push the **Remote** button. You can see the status **REMOTE** on the UI.
2. Check all remote control functions.
3. In the configuration software tool open menu **IO**.
4. Start the error simulation.
5. Examine if the remote control receives the signals.



5 Operation

Note
The manual shows who to change paramaters with the UI. You can also use the configuration software tool. See chapter 10.

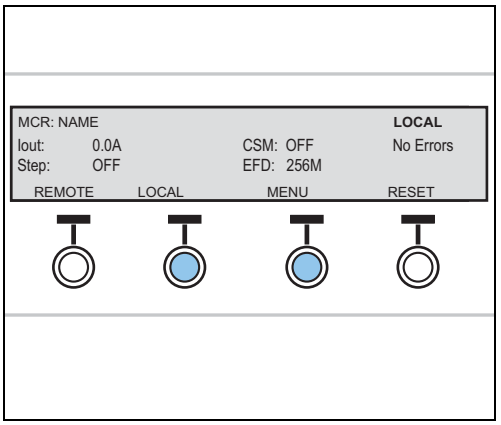
5.1 Switch ON in local mode

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 § 5.4. For more information on the produced output currents, see § 12.4.

1. Switch ON the disconnection device.
2. Switch ON the equipment. *Use the fused input switch. The UI lights up.*

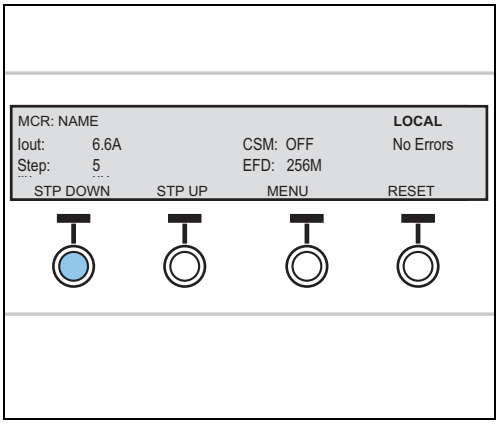
WARNING
High voltage can be present on the system.

3. Push the **Local** button on the UI to set the equipment to Local mode. *The upper right corner of the screen now shows the mode LOCAL*.
4. In the UI start page, push the **Menu** button once.
5. Push the **STP UP** button until the **Iout** field shows the expected output current.



5.2 Switch OFF in local mode

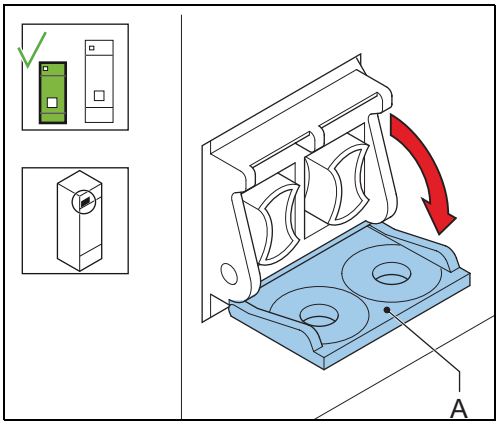
1. Push the **Local** button on the user interface. *The screen now shows the mode LOCAL.*
2. Push the **Menu** button once to go to the **Setup** menu.
3. Push the **STP Dow**n button until the **Step** field changes to OFF.
4. Switch OFF the power supply. See § 5.3.



5.3 Switch OFF power supply

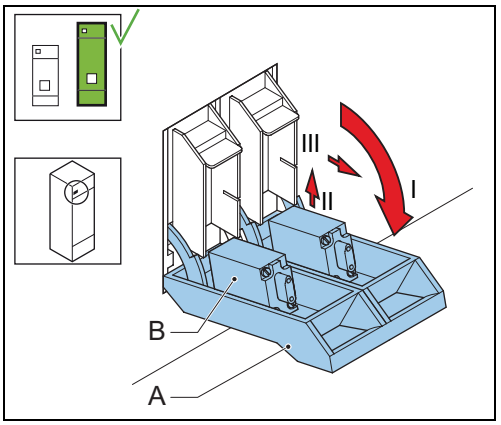
Small cabinet

1. Switch OFF the fused input switch (A).
2. Switch OFF the main power supply at the disconnection device.
3. Open the main switch on the main distribution board.
4. Disconnect the equipment from the series circuit.



Big cabinet

1. Switch OFF the fused input switch (A).
2. Switch OFF the main power supply at the disconnection device.
3. Open the main switch on the main distribution board.
4. Disconnect the equipment from the series circuit.



5.4 Adjust number of used brightness steps

5.4.1 Used brightness steps

All equipments are programmed with five steps by default. You can change the number of required steps.
Table 5.1 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 brithness steps. Tthe default current value set for step 3 is 4.1 A.

Table: 5.1 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	**2.8**	2.7	2.2	2.8
2	5.5	4.4	**3.4**	3.4	2.8	3.1
3	6.6	5.5	**4.1**	3.9	3.4	3.4
4		6.6	**5.2**	4.5	4.1	3.9
5			**6.6**	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.

5.4.2 Adjust number of used brightness steps

1. On the UI, go to menu **MCR Setup > Stepdata**.
2. Set the number of required steps and the values for the individual steps. See § 9.6.2.

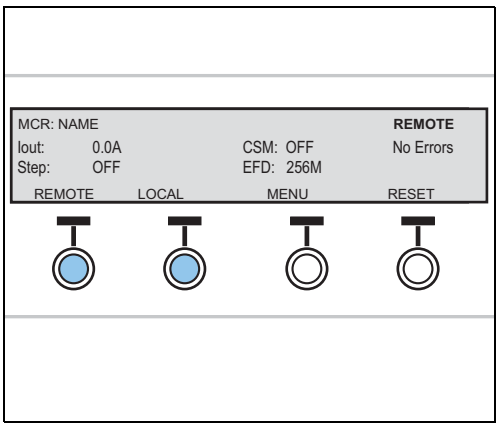
Note
If you add a step, the steps automatically use the values in the table above. Change each step individually if required.

3. Test all brightness steps one by one. Make sure that all the lamps have the same brightness level.
4. Examine all brightness steps one by one. *Examine if all light fittings have the same brilliancy level. Go to the runway area to make a visual inspection.*

5.5 Switch between local and remote mode

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

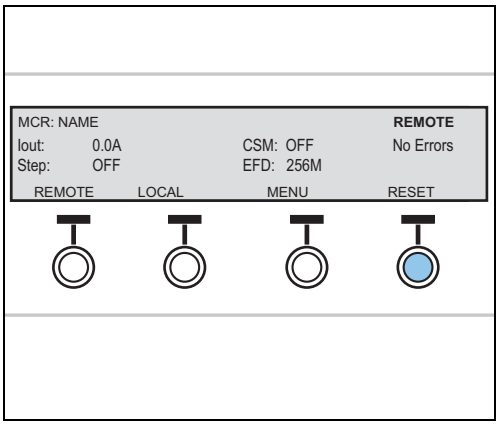
1. Push the **LOCAL** or **REMOTE** button on the user interface. *The screen now shows the new mode.*



5.6 Reset

Reset the equipment when the equipment:
- Does not respond;
- Does not produce the requested output;
- Was switched OFF.

1. Press **Reset**. *The equipment now tries to restart.*
2. If the equipment does not restart, see chapter 6.



5.7 View and clear errors

The UI only displays 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.

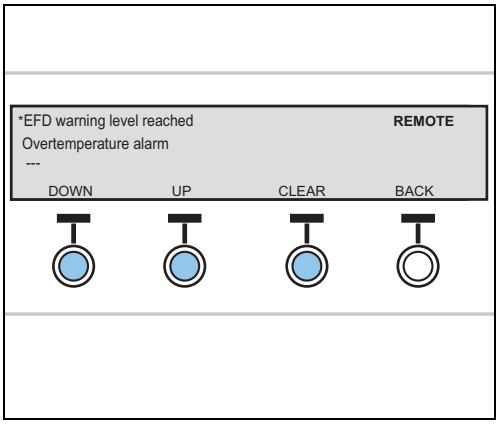
When a critical error occurs, the equipment stops automatically.

The equipment does not store error messages and shows only the latest 15 error messages. You can view and clear these error messages with the UI.

If you clear the error list, the errors disappear. The errors but are not solved.

View

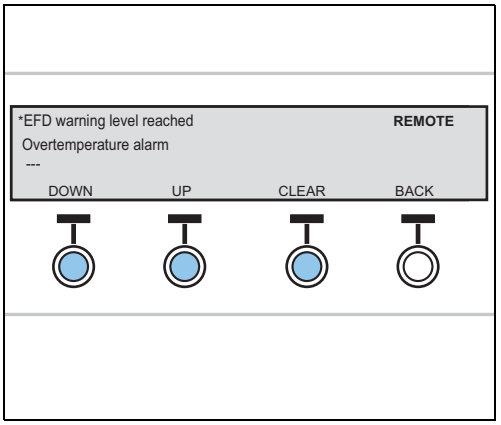
1. On the start page, press **Menu** twice.
2. Press **Start**. *You can now see the available menus.*
3. Press **Down** until the asterisk is next to **MCR: View errors**.
4. Press **Select** to view the error list.
5. Press **Down** or **Up** to scroll trough the error list.



Clear

1. On the start page, press **Menu** twice.
2. Press **Start**. *You can now see the available menus.*
3. Press **Down** until the asterisk is next to **MCR: View errors**.
4. Press **Select** to view the error list.
5. Press **Clear**.

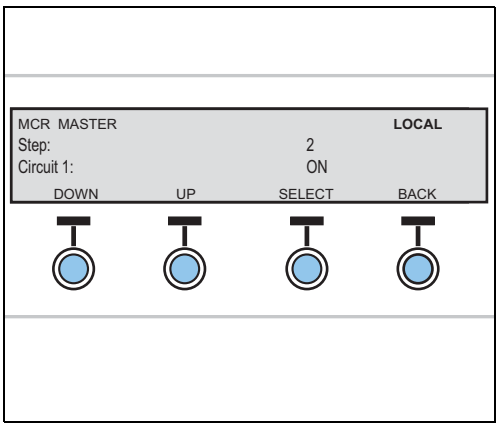
Note
To clear EFD errors, see § 9.8.
When errors are cleared, they are permanently erased.



5.8 Activate with CS (option) in Local mode

If your system has a CS, you must activate separately all circuits that are in use. You can also deactivate circuits to stop the equipment from producing output current to them.

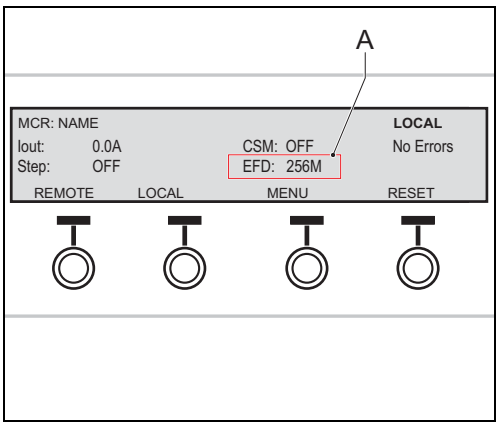
1. On the start page, press **Menu** twice.
2. Push the **Down** button until the asterisk (*) is next to **MCR Control**.
3. Push the **Select** button.
4. Push the **Down** button until the asterisk (*) is next to **Circuit 1**.
5. Push the **Select** button.
6. Push the **Toggle** button to set the circuit ON or OFF.
7. Repeat steps 4 to 6 if necessary for other circuits.



5.9 Examine Earth Fault Detection (EFD) levels

To examine the insulation resistance of the connected circuits, check the EFD value.

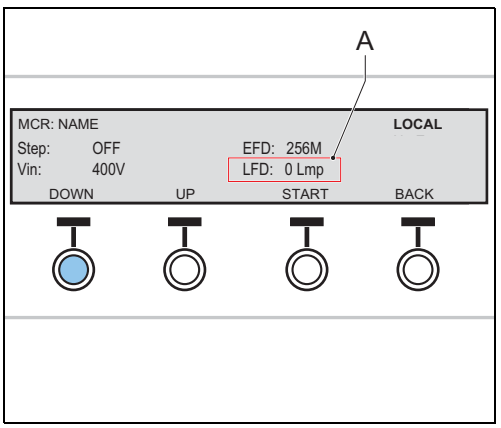
1. Read the **EFD** value (A) on the UI.
2. Make sure that the value is in accordance with local and IEC standards.



5.10 Examine Lamp Fault Detection (LFD) levels

To check the number of burnt lamps in the series circuit, check the LFD value.

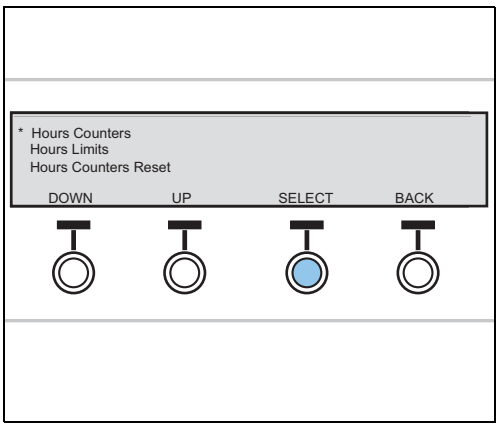
1. On the start page, press **Menu** twice.
2. Press **Down** to scroll down the menu until the screen shows the **LFD** field.
3. Make sure that the value is in accordance with local and IEC standards.



5.11 Examine hour counter levels

To check the amount of hours the equipment is ON or produces output current that is higher than a set value, check the hour counter levels.

1. On the start page, press **Menu** twice.
2. Press **Start**.
3. Press **Down** until the asterisk is next to **Hour Counters**. Then press **Select** to show the menu.
4. Press **Select** to view the Hour Counters.

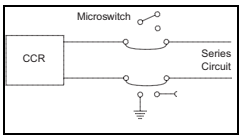
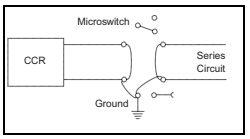
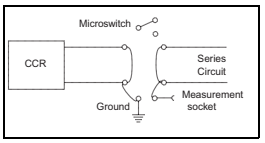
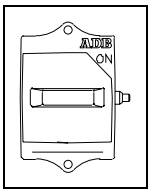
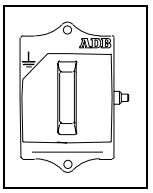
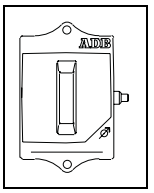


5.12 Use Series CutOut (SCO)

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

5.12.1 Operation mode

The SCO has three operation modes:

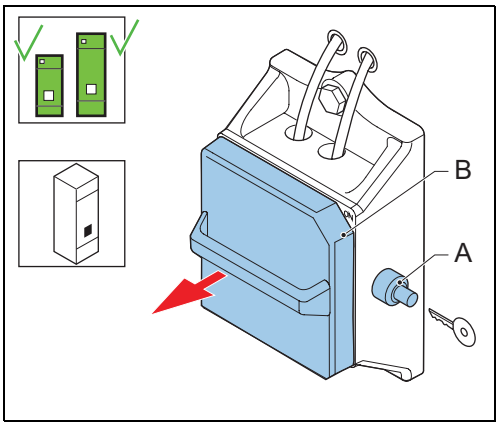
Description	Mode A	Mode B	Mode C
Purpose	Normal operation. Equipment delivers current to the connected series circuit.	Maintenance operation. Equipment or series circuit can be serviced safely.	Measurement possible. The series circuit insulation relative to ground can be measured.
Diagram			
Cover placement[1]			
Handle position	Horizontal.	Turned 90 degrees counter clockwise from position A.	Turned 90 degrees clockwise from position A.
Series circuit	Connected to the equipment.	Shorted and grounded	Disconnected from equipment, shorted and connected to measurement terminal.
Equipment	Delivers current to the series circuit.	Shorted and grounded.	Shorted and grounded.
Microswitch[2]	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.

5.12.2 Adjust operation mode

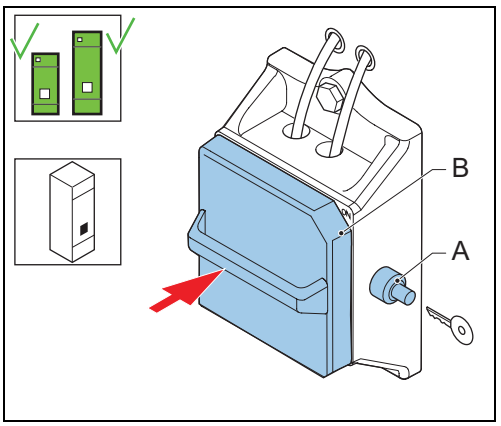
Remove cover

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 § 5.12.1.
2. Close the lock (A).



6 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 control;**
- **Set the equipment to the brightness step OFF before you examine the series circuit.**
- **Switch OFF the main switch of the equipment;**

6.1 Preliminary checks

Before you do any adjustments on the equipment, examine if:
- the communication between the equipment and the remote control works;
- the power supply to the equipment is within the acceptance limits;
- the fused input switches and auxiliary fuses are operational;
- input fuses and auxiliary fuses work normally;
- all connectors are correctly in place;
- no components show burned marks;
- wires are not interrupted or damaged.

6.2 Troubleshooting guide

6.2.1 Fault: Equipment does not turn ON

Table: 6.1 Equipment does not turn ON

Problem	Possible cause	Possible solution
No local indications on boards.	Damaged fuse on fused switch.	Replace the fuse. See § 7.2.12.
	Damaged auxiliary power fuses (F3/F4) in the top cabinet.	Replace the fuse. See § 7.2.12.
	Defective PSL PCB.	Replace the PSL PCB. See § 7.2.6.
	Damaged internal fuses on PCBs.	Replace the fuse. See § 7.2.12.
Alarm “Error” and the main contactor (K) in the power module is not energized.	Power supply level is lower than the pre-set value.	Examine the power supply and correct the voltage level.
		Examine the calibration of the input voltage measurement.
	Damaged fuse on the PSL board (PSL/F1).	Examine the wires and the main contactor coil.
		Replace the fuse. See § 7.2.12.
	Failure in the CCL or PSL PCB wires.	Examine the wires.
		Replace the defective PCB. See § 7.2.4 or 7.2.6.
Main contactor (K) in the power module is energized but the equipment does not generate any output current.	Failure in the CCL or TBM PCB.	Examine the wires.
		Replace the defective PCB. See § 7.2.4 or 7.2.5.

6.2.2 Fault: Equipment turns ON but suddenly de-energizes

Table: 6.2 Equipment turns ON but suddenly de-energizes

Problem	Possible cause	Solution (See)
Protection of the power supply to the equipment became operational.	Power supply, fuses or the protection is not correctly dimensioned.	Adjust the circuit breakers and/or the mains protection to comply with the equipment specifications. See the installation manual.
	Failure in power supply wires or equipment components.	Examine the wires to and inside the equipment. Check the installation manual for the specifications
		Examine the fused switch and the terminals.
Noise coming from the equipment unit and the fuses of the Fused switch have blown.	One of the thyristors is not operational or is short-circuited.	Examine the wires to the thyristor gates.
		Examine the TBM PCB.
	Failure in thyristor control pulses.	Replace the TBM PCB. See § 7.2.5.
	One of the thyristors is interrupted.	Replace the TBM PCB. See § 7.2.5.

Problem	Possible cause	Solution (See)
Alarm “Overcurrent error”.	Overcurrent.	Examine the maximum output current and adjust if necessary.
		Examine the overcurrent alarm level and adjust if necessary. See § 10.3.3.
	Defective circuit connections.	Improve or restore the connections.
	Defective components.	Replace the defective components.
	Blocks of load are switched on the circuit without adjustment the equipment output.	Adjust the block switch approach..
Alarm “Open circuit error”.	Open circuit in the circuit loop.	Examine the series loop for interruptions.
	Equipment malfunction.	Examine the thyristors, the wires of the transformer and the choke, the main contactor, the output measurement transformer, and the TBM PCB.
	The equipment goes below the minimum output current.	- Examine the quality of the input voltage. - Examine the load of the circuit. - Adjust the tap setting. See § 4.3.
Alarm “Overload condition”.	Equipment malfunction.	- Adjust the tap setting. See § 4.3. - Examine the load of the circuit.

6.2.3 Fault: equipment does not produce requested output current

Table: 6.3 Equipment does not produce the requested output current

Problem	Possible cause	Solution (See)
Equipment produces the maximum output current at all times.	Maximum brightness step is always chosen.	Disconnect the remote control line for the max. brightness step and then examine the remote control signals.
		Operate the equipment in LOCAL mode. See § 5.1..
	The parameters of the brightness steps are not set correctly.	Examine and adjust the parameter settings in the MCR Setup and stepdata user menu..
You can select all brightness steps up to a certain step, but no steps above that step.	One brightness step is always set.	Examine the remote control signals and examine if the equpment operates in local mode..
		Examine if the equipment operates in LOCAL mode. See § 5.1.
	Failure of the multiwire logic.	Examine the multiwire.
You can select only the minimum brightness step.	Failure of the remote control line.	Examine if the module works correctly in local control on the remote control line.
	Failure of the logic.	Examine the multiwire and the CCL.
The equipment does not reach the output current.	Equipment is overloaded.	Examine the output transformer tap, the power supply voltage and the load.
No output current.	Input voltage is too low.	Examine the input voltage and the equipment parameter settings.
	Failure of the logic.	Examine the local control, Local Bus, MW, LMC, CCL, and TBM PCBs.
No display on the user interface. The LED lights on the boards are not lit.	Power supply failure.	Examine the mains power supply, fuses, wires, and PSL PCB.

7 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 tot the local operation procedures and procedures regarding HV equipment.**

7.1 Preventive maintenance schedule

Table: 7.1 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.	Check 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, calibratie the output current again.
	Visually: - if the wiring of the equipment and the circuit is not damaged; - for rust spots and general damage; - the housing for dust accumulation; - all signs on the equipment for legibility and damage	- Repair damaged or loose wires - Replace damaged components. - Clean and repair rust spots. - Clean the inside of the equipment wit an dry air blower.
	The electrical connections (e.g. input connections, output connections, tap setttings) for correct electrical tighntness:	Tighten all the connections to make sure that all connections are tightened.

7.2 Part replacement

WARNING
Make sure you have read and understood all safety procedures and standards related to this equipment. See chapter 2.

WARNING
Make sure you switch OFF the power to the equipment. See § 5.3.

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.**
- **You have saved the equipment settings as a profile. To do this in the configuration software tool, see § 10.3.7.**
- **You put in the new parts exactly the same way as the parts you removed.**

CAUTION
After you preplaced a part, test the equipment to make sure it is replaced correctly.

Note
See the CD labeled '????' for connection schemes.

The procedures show how to replace these parts:
- UI PCB. See § 7.2.2.
- LMC PCB. See § 7.2.3.
- CCL PCB. See § 7.2.4.
- TBM PCB. See § 7.2.5.
- PSL PCB. See § 7.2.6.
- Multiwire MW1, MW2, MW3 PCBs (option). See § 7.2.7.
- J-Bus PCB (option). See § 7.2.8.
- EFD PCB and resistor (option). See § 7.2.9.
- LFD PCB (option). See § 7.2.10.
- CS PCB. See § 7.2.11.
- Power components, input. See § 7.2.12.
- Power components, output. See § 7.2.13.
- SCO (option). See § 7.2.14.
- CSM (option). See § 7.2.15.

7.2.1 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 more than 0.5% for the adjusted value.

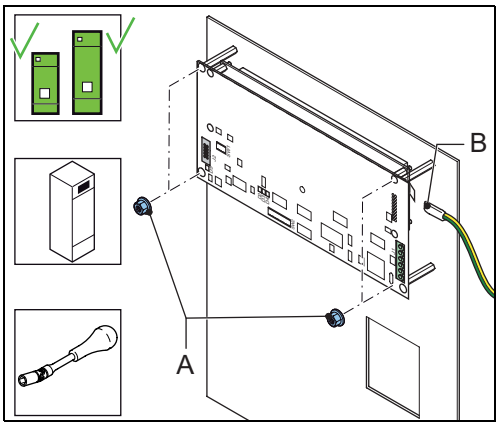
Tools

- Standard electrical and mechanical tool kit;·
- Screwdrivers with protection up to 1000 V;
- Spanner set (ring or socket spanners);·
- Allen key 8 mm;
- Torque screwdrivers and adaptors for sockets:
  - Torque between 2.25 and 2.75 Nm (average 2.5)
  - Torque between 2.5 and 4 Nm (average 3.25);
  - Torque between 4.5 and 5.5 Nm (average 5).
- Short, slotted screwdriver;
- Magnet rod for collecting loose items;
- Angle socket wrench.

7.2.2 UI PCB

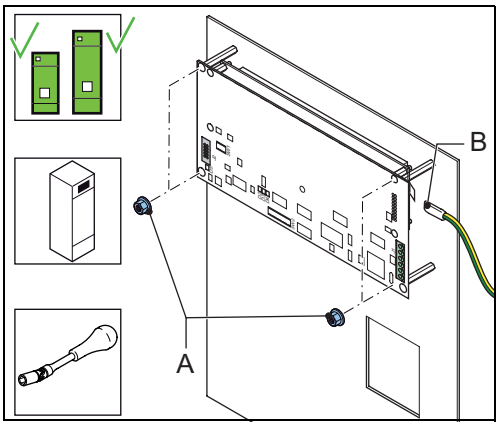
Remove

1. Examine if the firmware version on identification the new UI PCB is correct.
2. Switch OFF the power supply. See § 5.3.
3. Remove the UI panel. See § 7.3.
4. Disconnect the cables from the PCB.
5. Disconnect the earthing wire from the earthing terminal (B).
6. Remove the nuts (A). *Use a number 5.5 socket wrench.*
7. Remove the earthing terminal (B).
8. Remove the UI PCB.



Install

1. Install the new UI PCB.
2. Set the dip-switch settings of the new PCB to the same settings as the removed PCB.
3. Install the earthing terminal (B).
4. Install the nuts (A). *Use a number 5.5 socket wrench.*
5. Install the UI panel and connect the wires.



Examine the firmware version

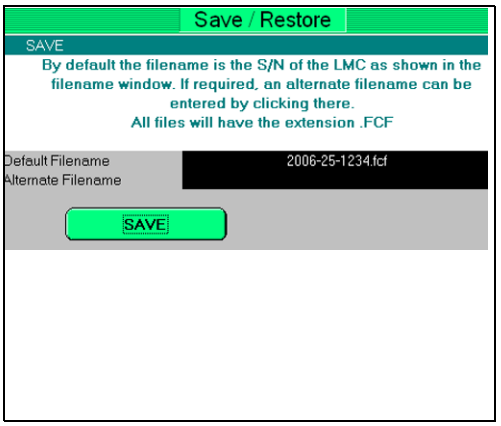
1. Compare the firmware version on the identification of the new UI PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.

7.2.3 Local Master Controller (LMC) PCB

Note
Use the configuration software tool. See chapter 10.

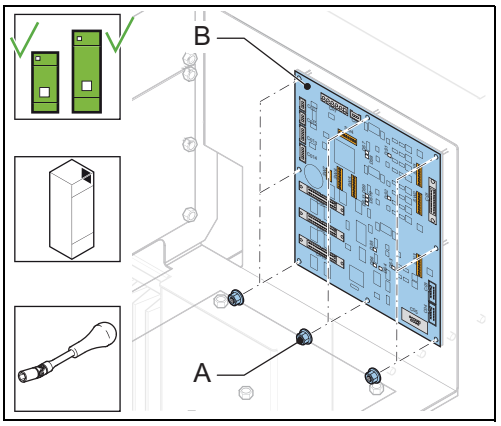
Prepare

1. Examine if the firmware version on the identification of the new LMC PCB is correct.
2. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
3. Open the configuration software tool.
4. Go to menu **SAVE**.
5. Select **Save**. *The used IO profile is now saved on your PC*.
6. Switch OFF the power supply. See § 5.3.



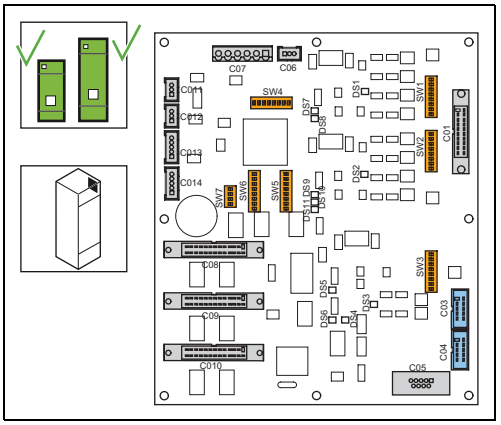
Replace

1. Remove the top panel. See § 7.3.
2. Loosen the screws of the connector C05.
3. Disconnect the serial connection from the connector C05.
4. Disconnect the cables from the CCL PCB (B).
5. Remove the nuts (A). *Use an angle socket wrench.*
6. Replace the LMC PCB (B).
7. Set the dip-switch settings of the new PCB to the same settings as the removed PCB.
8. Install the nuts (A).



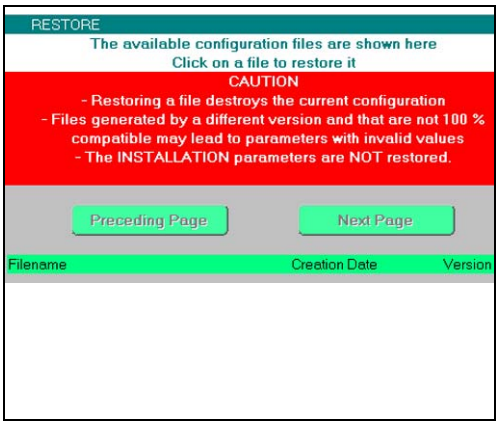
Connect

1. Connect the serial connection to the connector C05.
2. Tighten the screws of the connector C05.
3. Connect the cables to the connectors:
   - Local bus to C03;
   - EFD to C04;
   - J-Bus to C01;
   - DC Power supply to C07;
   - MW1 to C09, MW2 to C010, and MW3 to C08.
4. Install the top panel.



Restore IO profile

1. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
2. Open the configuration software tool.
3. Go to menu **SAVE**.
4. Restore the IO profile. Select **Restore** and browse to the saved profile on your PC.
5. Switch OFF the power supply. See § 5.3.



Examine the firmware version

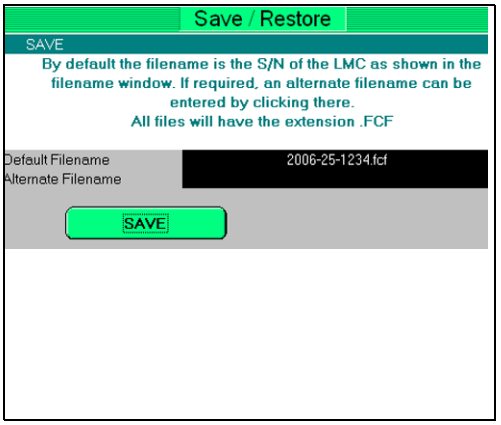
1. Compare the firmware version on the identification of the new LMC PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.
3. Switch OFF the power supply. See § 5.3.

7.2.4 Current Control Logic (CCL) PCB

Note
Use the configuration software tool. See chapter 10.

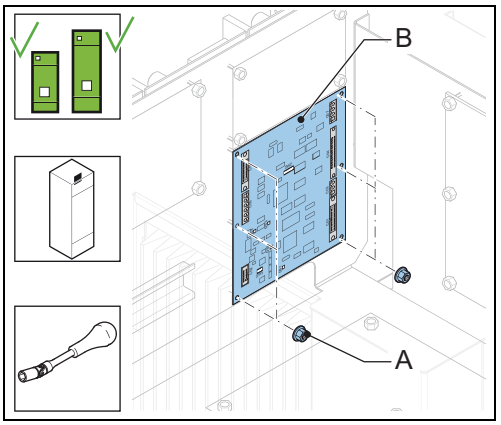
Prepare

1. Examine if the firmware version on the identification of the new CCL PCB is correct.
2. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
3. Open the configuration software tool.
4. Go to menu **SAVE**.
5. Select **Save**. The used IO profile is now saved on your PC.
6. Switch OFF the power supply. See § 5.3.



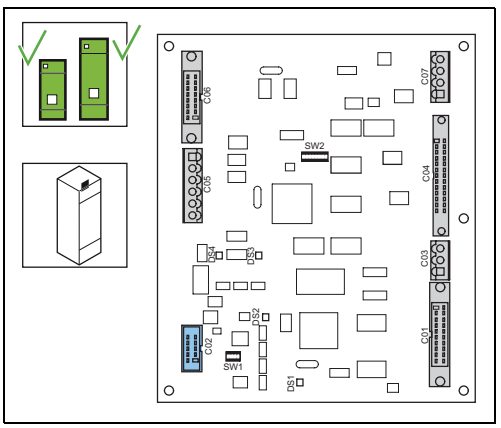
Replace

1. Remove the top panel. See § 7.3.
2. Disconnect the cables from the CCL PCB (B).
3. Remove the nuts (A). *Use a number 5.5 socket wrench.*
4. Replace the CCL PCB (B).
5. Set the dip-switch settings of the new PCB to the same settings as the removed PCB.
6. Install the nuts (A).



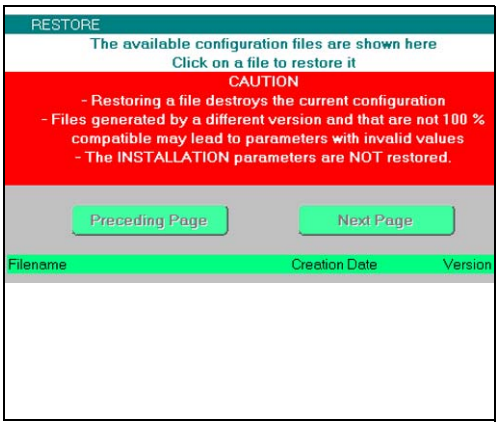
Connect

1. Connect the cables to the connectors:
   - Logic flat cable connection from PCB1521 to C06;
   - DC Power supply to C05;
   - Local bus to C02;
   - TBM module to C01;
   - LFD module to C03;
   - CS module to C04;
   - Current transformer TI2 to C07.
2. Install the top panel.



Restore IO profile

1. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
2. Open the configuration software tool.
3. Go to menu **SAVE**.
4. Restore the IO profile. Select **Restore** and browse to the saved profile on your PC.
5. Compare the readings in the software with the the parameters of your equipment.
6. If the firmware version of the new CCL PCM is 2.00 or higher, calibrate the LFD. See § 4.4. Contact ADB if you need more information.



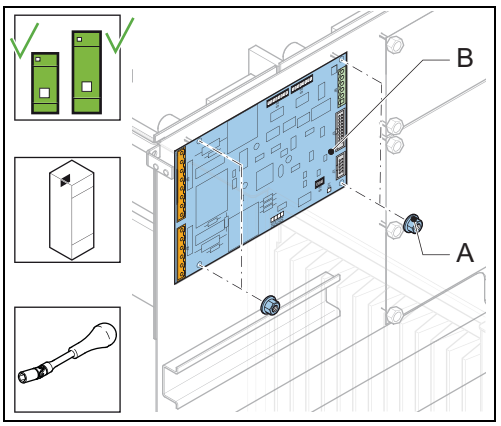
Examine the firmware version

1. Compare the firmware version on the identification of the new CCL PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.
3. Switch OFF the power supply. See § 5.3.

7.2.5 Thyristor Block Module (TBM) PCB

Replace

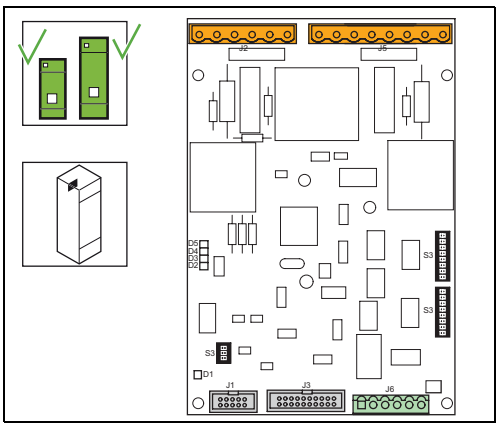
1. Examine if the firmware version on the identification of the new TBM PCB is correct.
2. Switch OFF the power supply. See § 5.3.
3. Remove the top panel. See § 7.3.
4. Disconnect the cables from the TBM PCB (B).
5. Remove the nuts (A). *Use a number 5.5 socket wrench.*
6. Replace the TBM PCB (B).
7. Set the dip-switch settings of the new PCB to the same settings as the removed PCB.
8. Install the nuts (A).



Connect

1. Connect the cables to the connectors:
   - Thyristor bank connection to J5;
   - DC Power supply to J6;
   - CCL module to J3;
   - Local bus to J1.

2. Install the top panel.



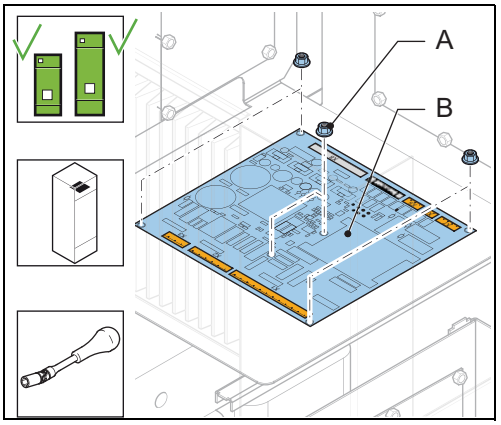
Examine the firmware version

1. Compare the firmware version on the identification of the new TBM PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.

7.2.6 Power Supply Logic (PSL) PCB

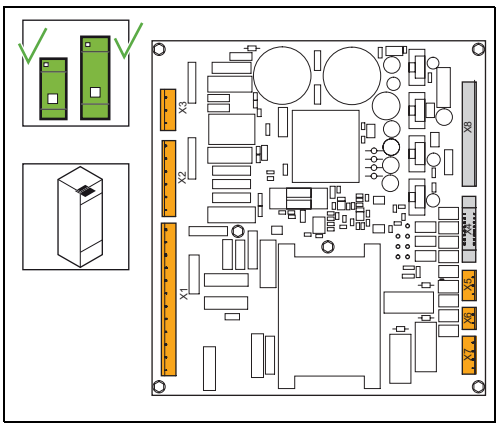
Replace

1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel. See § 7.3.
3. Disconnect the cables from the PSL PCB (B).
4. Remove the nuts (A). *Use a number 5.5 socket wrench.*
5. Replace the PSL PCB (B).
6. Install the nuts (A).



Connect

1. Connect the cables to the connectors:
   - DC Power input supply to X1;
   - SCO to X2 (option). If the equipment does not have an SCO, the connection you need to replace has a jumper.
   - Power output to the MW boards to X3;
   - DC power distribution to X8;
   - CCL to X4;
   - Current transformer to X5;
   - Overvoltage protection (MOV1) to X6;
   - Back-indication signals ON and REG.ERR (optional) to X7.
2. Install the top panel.

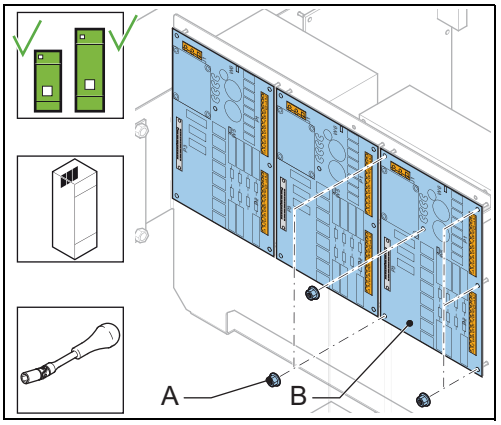


7.2.7 Multiwire MW1, MW2 or MW3 PCB (option)

The procedure applies to both the 24 V DC and the 48 V DC multiwire PCB.

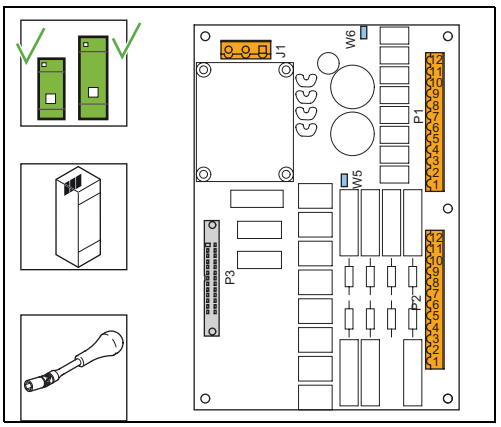
Replace

1. Switch OFF the power supply. See § 5.3.
2. Record the position of dip switches SW5 and SW6.
3. Remove the rear panel. See § 7.3.
4. Disconnect the cables from the Multiwire PCB (B).
5. Remove the nuts (A). *Use a number 5.5 socket wrench.*
6. Replace the Multiwire PCB (B).
7. Install the nuts (A).
8. Set the dip switches SW5 and SW6 to the position you recorded in step 2.



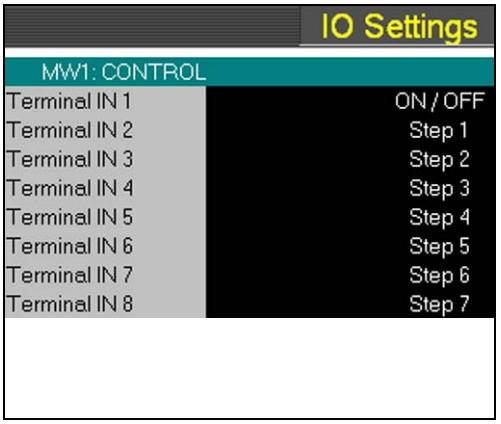
Connect

1. Connect the cables to the connectors:
   - Power supply to J1;
   - LMC to P3;
   - Input and output signal connectors to P1 and P2.



Examine

1. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
2. Install the rear panel.
3. Switch OFF the power supply. See § 5.3.
4. Examine the functionality of the replaced Multiwire PCB.

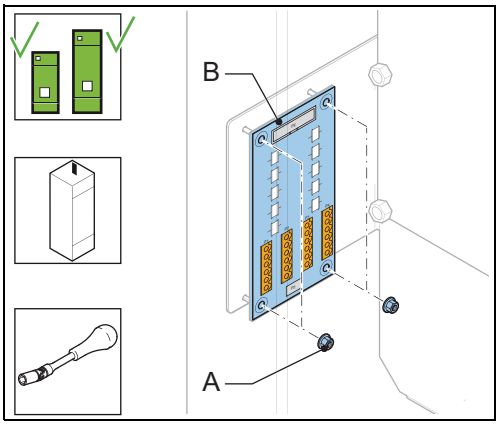


7.2.8 J-Bus PCB (option)

CAUTION
When one equipment on the databus chain is disconnected, the other equipments on that databus are also disconnected at the same time.

Replace

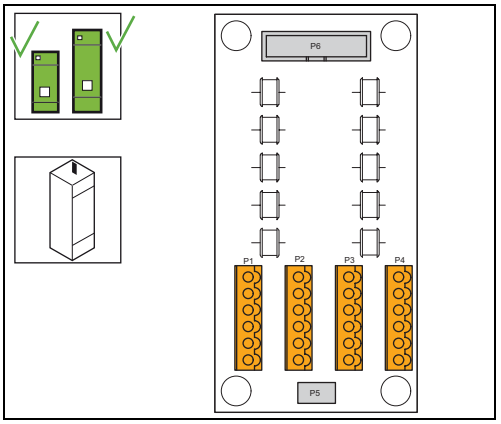
1. Switch OFF the power supply. See § 5.3.
2. Remove the rear panel. See § 7.3.
3. Disconnect the cables and the earthing wire from the J-Bus PCB (B).
4. Remove the screws (A). *Use a number 5.5 socket wrench.*
5. Replace the J-Bus PCB (B).
6. Install the screws (A).



Connect

1. Connect the cables to the connectors:
   - LMC to P6;
   - J-Bus control for Bus A to P1 and P2;
   - J-Bus control for Bus B to P3 and P4;
   - Earth wire to the ground terminal.

2. Install the rear panel.



7.2.9 Earth Fault Detection (EFD) PCB and resistor (option)

EFD PCB

The procedure applies to both the big and the small cabinet. The procedure shows the small cabinet.

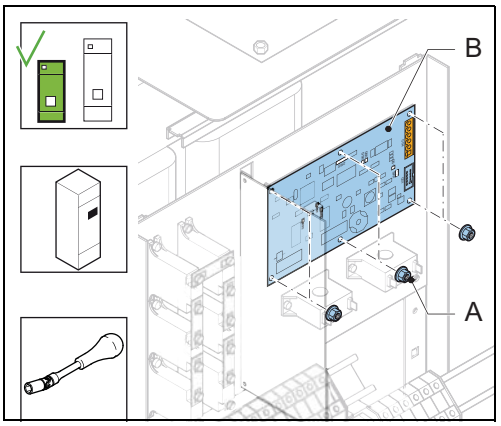
WARNING
Be careful when you handle the EFD PCB.
The EFD produces a voltage of 500 V DC. This voltage is connected to the output circuit of the equipment, thus all high-voltage components have this voltage level relative to ground.

Prepare

1. Examine if the firmware version on the identification of the new EFD PCB is correct.
2. Switch OFF the power supply. See § 5.3.

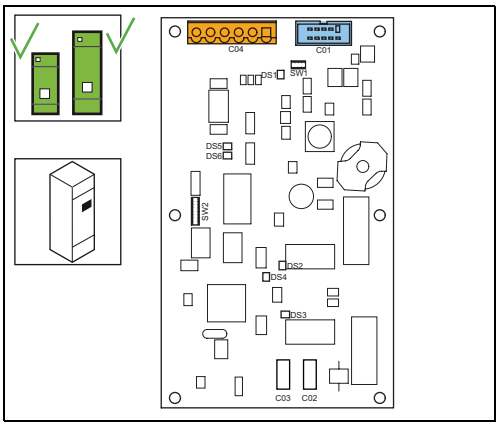
WARNING
Earth the circuit and isolate it from the equipment to avoid exposure to lethal voltages.

3. Open the front panel. See § 7.3.
4. Disconnect the cables and the earthing wire from the EFD PCB.
5. Remove the nuts (A). *Use a number 5.5 socket wrench.*
6. Replace the EFD PCB.
7. Install the nuts (A).



Connect

1. Connect the cables to the connectors:
   - Power supply to C04;
   - Local bus to C01;
   - High-voltage connection from the resistor to C02;
   - Earth wire to the ground terminal C03.
2. Close the front panel.
3. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
4. Calibrate the EFD. See § 4.5.
5. Examine the functionality of the EFD PCB.



Examine the firmware version

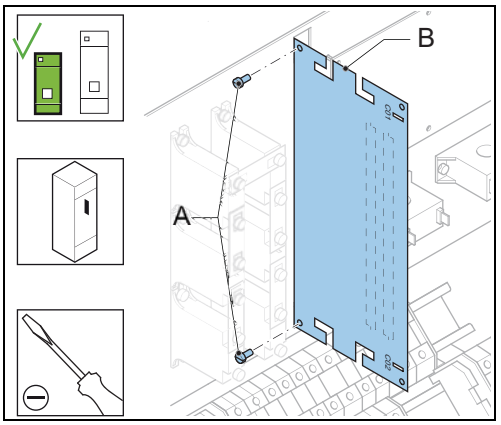
1. Compare the firmware version on the identification of the new EFD PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.

EFD resistor

The procedure applies to both the small and the big cabinet. In the small cabinets the EFD resistor is placed horizontally. In the big cabinets the EFD resistor is placed vertically.

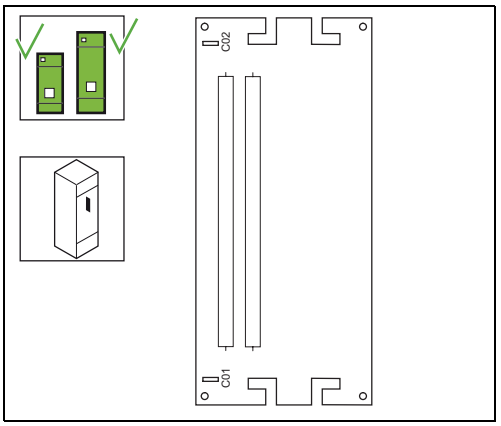
Replace

1. Switch OFF the power supply. See § 5.3.
2. Open the front panel. See § 7.3.
3. Disconnect the wires from the EFD resistor (B).
4. Remove the slotted screws (A). *Use a short slotted-screwdriver.*
5. Replace the EFD resistor (B).
6. Install the slotted screws (A).



Connect

1. Connect the cables to the connectors:
   - EFD connection to C01;
   - Output terminal connection to C02.
2. Close the front panel.
3. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
4. Calibrate the EFD. See § 4.5.
5. Examine the functionality of the EFD PCB.

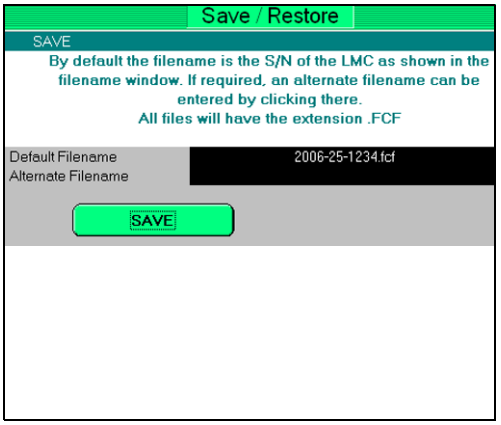


7.2.10 Lamp Fault Detection (LFD) PCB (option)

Note
Use the configuration software tool. See chapter 10.

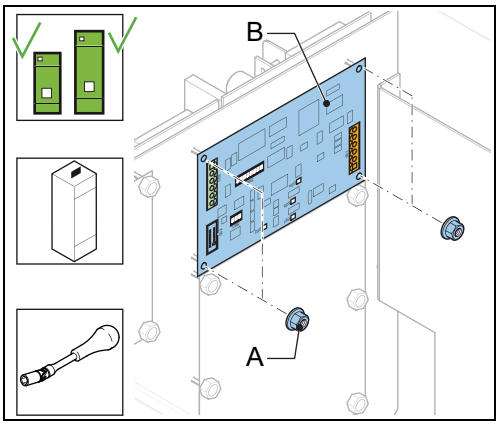
Prepare

1. Examine if the firmware version on the identification of the new LFD PCB is correct.
2. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
3. Open the configuration software tool.
4. Go to menu **SAVE**.
5. Select **Save**. The used IO profile is now saved on your PC.
6. Switch OFF the power supply. See § 5.3.



Replace

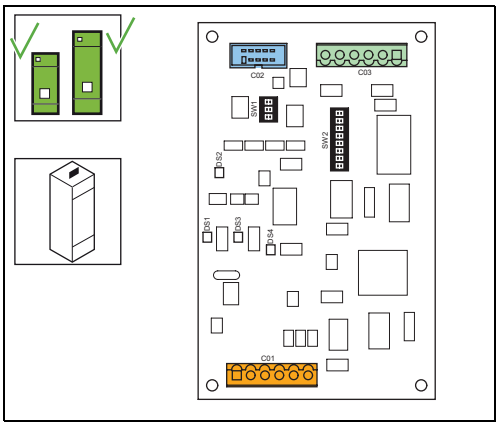
1. Remove the top panel. See § 7.3.
2. Disconnect the cables from the LFD PCB (B).
3. Remove the nuts (A). *Use a number 5.5 socket wrench.*
4. Replace the LFD PCB (B).
5. Install the nuts (A).



Connect

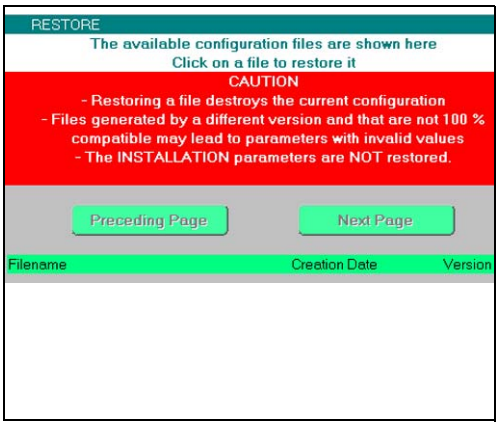
1. Connect the cables to the connectors:.
   - CCL connection to C03;
   - Local bus to C02;
   - DC Power supply to C03.

2. Install the top panel.



Restore IO profile

1. Switch ON the equipment. *Use the fused input switch and the disconnection device.*
2. Open the configuration software tool.
3. Go to menu **SAVE**.
4. Restore the IO profile. Select **Restore** and browse to the saved profile on your PC.
5. Examine if all the parameters are correctly restored.
6. Switch OFF the power supply. See § 5.3.
7. Calibrate the LFD. See § 4.4.



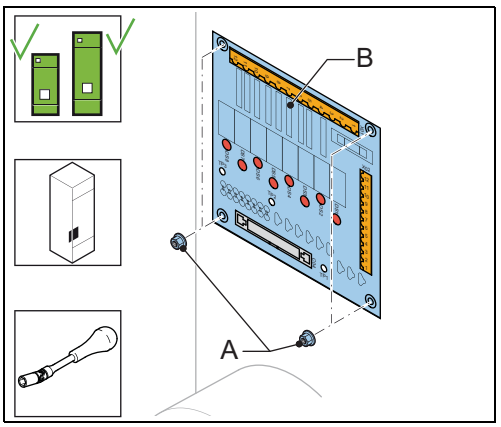
Examine the firmware version

1. Compare the firmware version on the identification of the new EFD PCB with the version on the MCR Setup menu. See § 9.6.
2. If the firmware version is not the same, contact ADB.

7.2.11 Circuit Selector (CS) PCB

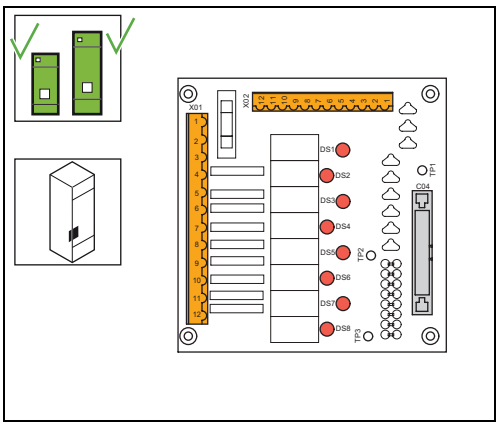
Replace

1. Switch OFF the power supply. See § 5.3.
2. Remove the front panel of the CS cabinet. See § 7.3.
3. Disconnect the cables from the CS PCB (B).
4. Remove the nuts (A). *Use a number 5.5 socket wrench.*
5. Replace the CS PCB.
6. Install the nuts (A).



Connect

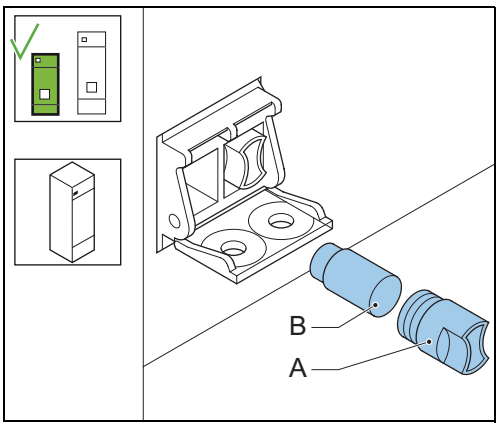
1. Connect the cables to the connectors:
   - LMC connection to C04;
   - Control and power connection to X01;
   - Feedback connection from the contactors to X02;
2. Install the front panel of the CS cabinet.



7.2.12 Power components, input

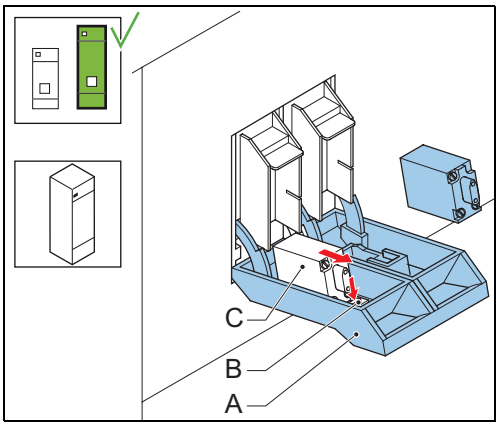
Fused input switch, small cabinet

1. Switch OFF the power supply. See § 5.3.
2. Turn the fuse holder (A) counter clockwise. *Use the turning handle tool.*
3. Remove the fuse holder.
4. Remove the fuse (B) from the fuse holder.
5. Install the new fuse in the fuse holder. *The fuse must click into the holder.*
6. Turn the fuse holder clockwise until it is tightened.
7. Close the fused input switch. *Use the turning handle tool.*



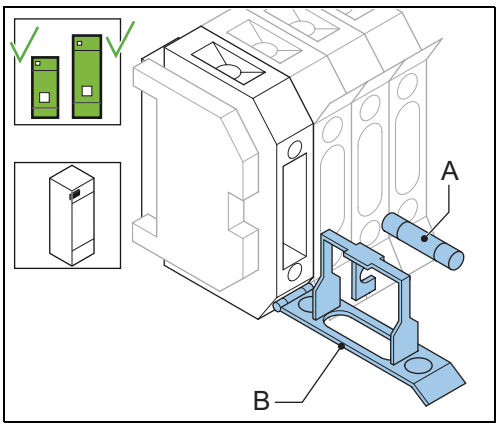
Fused input switch, big cabinet

1. Switch OFF the power supply. See § 5.3.
2. Open the hatch (A).
3. Push down the clip (B) and remove the fuse (C).
4. Install the new fuse.
5. Close the hatch.



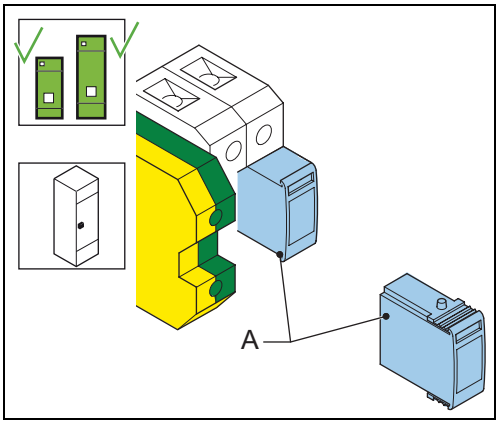
Fuses F2 and F3

1. Switch OFF the power supply. See § 5.3.
2. Open the front panel. See § 7.3.
3. Open the fuse holder (B).
4. Replace the fuse (A).
5. Close the fuse holder (B).
6. Close the front panel.



MOV1/A, MOV1/B (option)

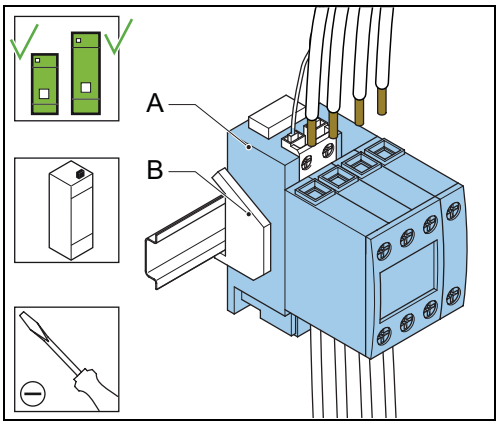
1. Switch OFF the power supply. See § 5.3.
2. Open the front panel. See § 7.3.
3. Replace the over-voltage protection plug-in module (A).
4. Close the front panel.



Main contactor (K1)

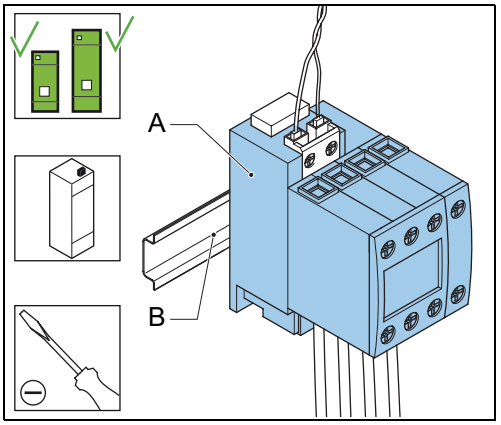
Prepare

1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel and the UI panel. See § 7.3.
3. Disconnect the cables 1 L1, 3 L2, 5 L3 and 7 L4 on top of the main contactor (A). *Each cable is connected with a screw.*
4. Loosen the screws of the rail stopper (B).
5. Remove the UI panel (see § 7.3) and the rail stopper (B).



Remove

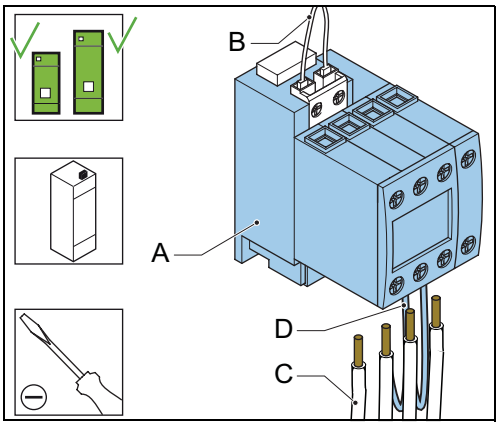
1. Remove the main contactor (A).
   Use a screwdriver as a lever to release the main contactor from the rail (B).



Disconnect

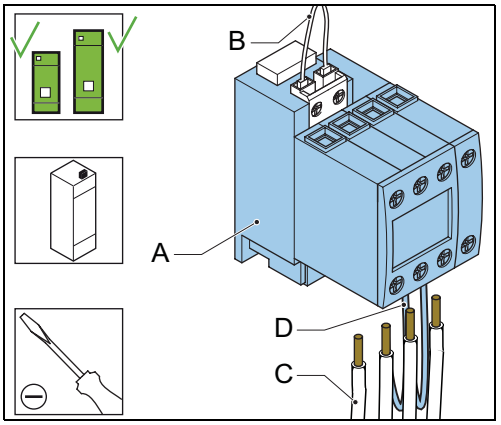
1. Loosen the screws of the cables (C) at the bottom of the main contactor.
2. Disconnect the connectors A1 and A2 (B) on top of the main contactor (A).
3. Disconnect the cables (C).

Note
When you disconnect the cables (C), also the connectors (D) become loose.



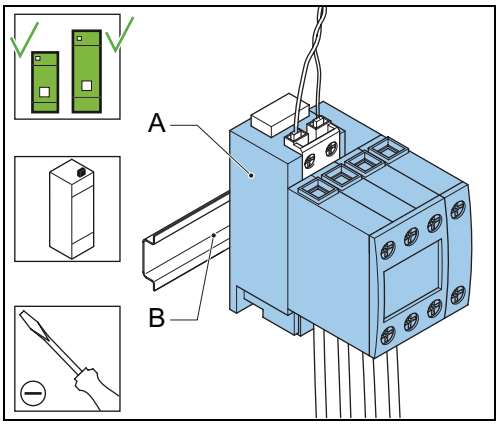
Connect

1. Connect the cables (C) and (D) to the new main contactor (A).
2. Connect the cables (D).
3. Tighten the screws of the cables.
4. Connect the connectors (B).



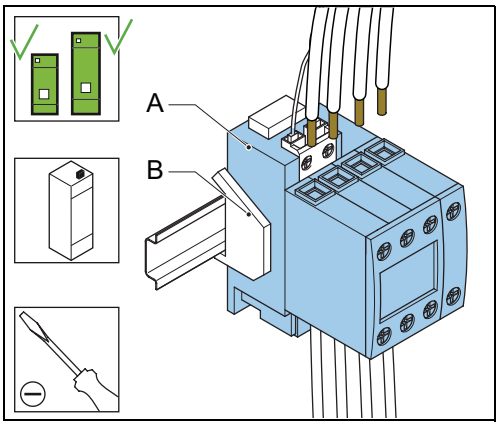
Install - 1

1. Push the main contactor (A) to the rail (B).



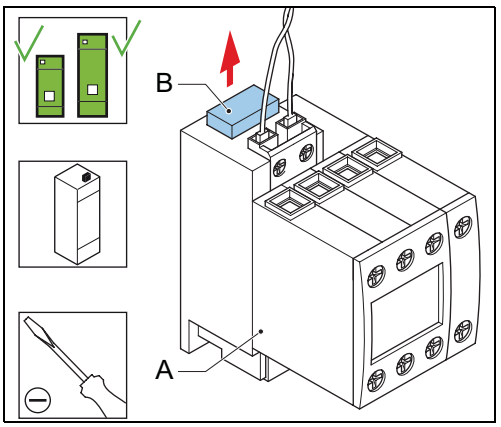
Install - 2

1. Install the rail stopper (B).
2. Tighten the screws of the rail stopper.
3. Connect the cables 1 L1, 3 L2, 5 L3 and 7 L4 on top of the main contactor (A).
4. Tighten the screws of the cables.
5. Install the top panel and the UI panel.



Main contactor K1, RC coil protection

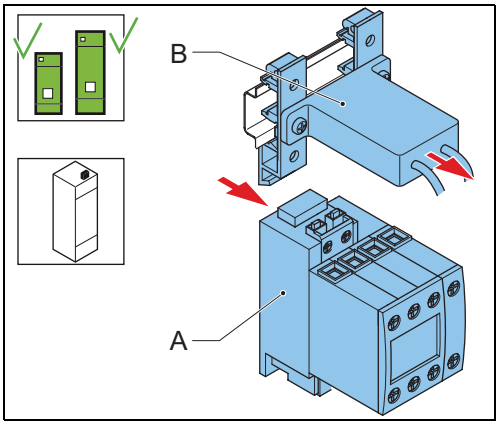
1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel. See § 7.3.
3. Remove the main contactor (A). See the procedure for the main contactor (K1) above.
4. Replace the RC coil protection (B). *The RC coil protection fits into a clip.*
5. Install the main contactor (A). See the procedure for the main contactor (K1) above.
6. Install the top panel.



Main contactor K1, mains filter

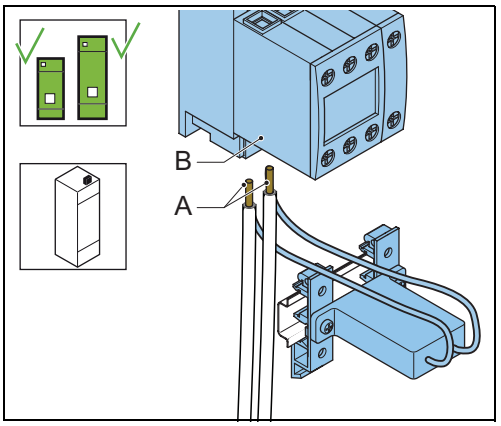
Remove - 1

1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel. See § 7.3.
3. Remove the main contactor (A). See the procedure for the main contactor (K1) above.
4. Remove the mains filter module (B).
5. Loosen the screws for the terminals 4 T2 and 6T3.
6. Disconnect the mains filter cables A1 and A2 from the mains contactor.



Remove - 2

1. Remove the crimp (A) that connects the mains filter cables and the cables 4 T2 and 6 T3.



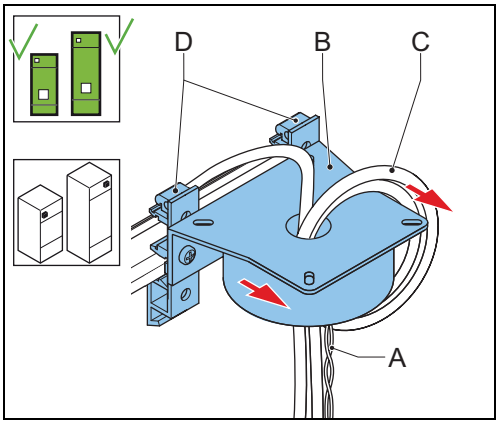
Install

1. Install in the new mains filter.
2. Install the crimp that connects the mains filter cables and the cables 4 T2 and 6 T3.
3. Install the main contactor (A). See the procedure for the main contactor (K1) above.
4. Connect the mains filter cables A1 and A2 to the mains contactor together with the cables 4 T2 and 6 T3.
5. Install the top panel.

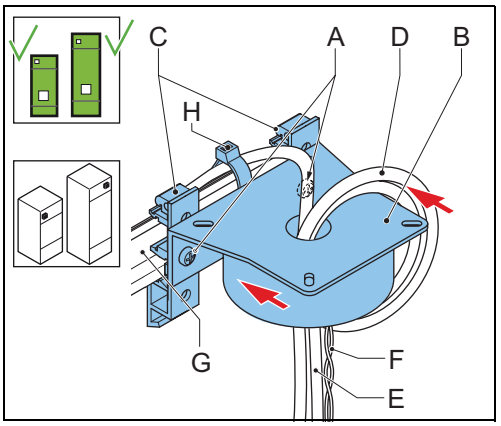
Input measurement transformer (TI1)

Remove

1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel and the UI panel. See § 7.3.
3. Disconnect the cable (A) from connector X5 on the PSL. See § 11.7. *The cable is labeled F00.*
4. Disconnect the cables (C) at the bottom of the main contactor. See the procedure for the main contactor (K1) above. *The cables are labeled A05.*
5. Pull the cables (C) through the input measurement transformer (B).
6. Pull the clamps (D) and remove the input measurement transformer.



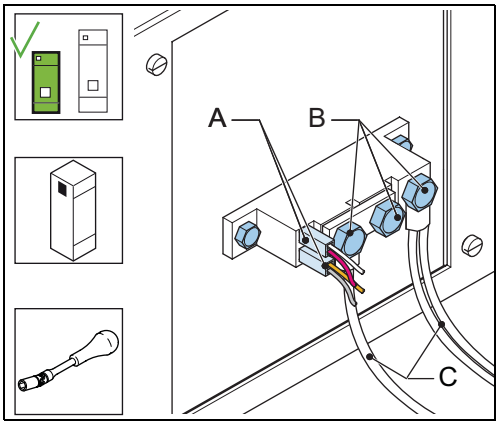
Install



1. Install the screws (A) and connect the new input measurement transformer (B) to the clamps (C).
2. Install the cable (D) through the input measurement transformer. *The cable is labeled A05.*
   - For an equipment with a current less than 63 A, make two loops through the input measurement transformer.
   - For an equipment with a current more than 63 A, make one loop through the input measurement transformer.
3. Connect the cables (E) to 2 T1 and 4 T2 at the bottom of the main contactor. See the procedure for the main contactor (K1) above. *The cable is labeled A05.*
4. Connect the cable (F) to connector X5 on the PSL. See § 11.7. *The cable is labeled F00.*
5. Install the input measurement transformer on the rail (G).
6. Connect the cable (D) to the rear of the rail (H).

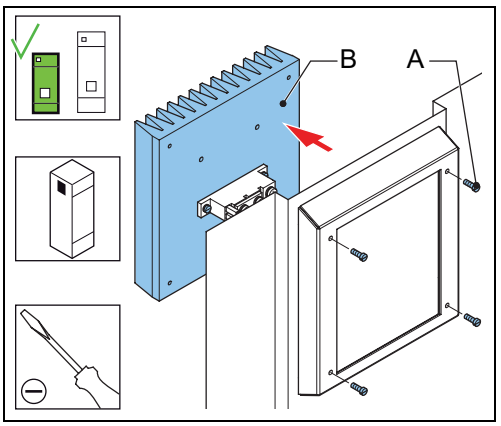
Thyristor pack (THP-1,THP-2)

Disconnect



1. Switch OFF the power supply. See § 5.3.
2. Remove the top panel. See § 7.3.
3. Disconnect the control cable pairs (A).
4. Remove the screws (B) and the copper plate. *Use a torque screwdriver.*
5. Disconnect the cables (C).

Remove heat sink

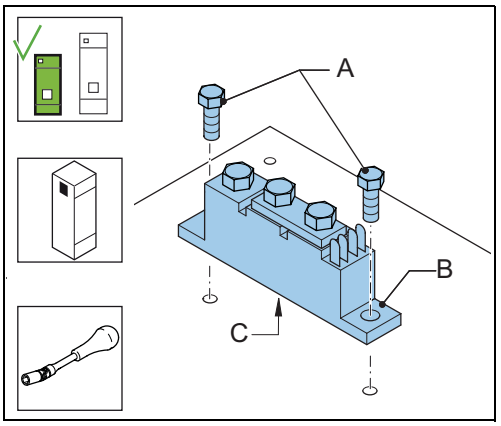


1. Remove the screws (A).
2. Remove the heat sink (B).

WARNING
The heat sink becomes hot when the equipment is in operation.

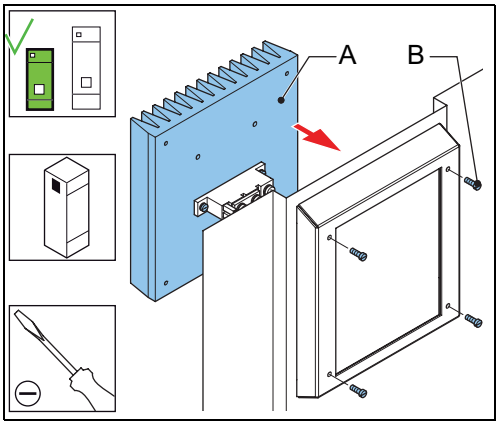
Replace

1. Remove the bolts (A).
2. Remove the thyristor pack (B).
3. Wipe clean the heat sink below the thyristor pack (C).
4. Apply an even layer of conductive paste on the rear of the new thyristor pack.
5. Install the new thyristor pack (B).
6. Install the screws (A) and apply these torque values (*Use a torque screwdriver*.):
   - Type CTT90GK (M5): Between 2.5 and 4 Nm (average 3.25);
   - Type CTT165GK (M6): Between 4.5 and 5.5 Nm (average 5).



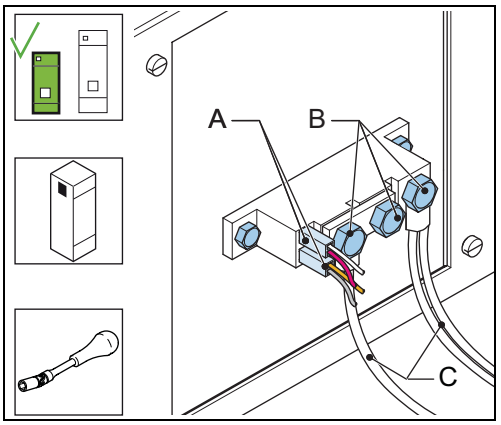
Install heat sink

1. Install the heat sink (A).
2. Install the screws (B). *Use a torque screwdriver*.



Connect

1. Connect the cables (C) and the copper plate with the three screws (B) and apply these torque values *(Use a torque screwdriver.*):
   - Type CTT90GK (M5): Between 2.5 and 4 Nm (average 3.25);
   - Type CTT165GK (M6): Between 2.25 and 2.75 Nm (average 2.5).
2. Connect the control cable pairs (A).
3. Install the top panel.



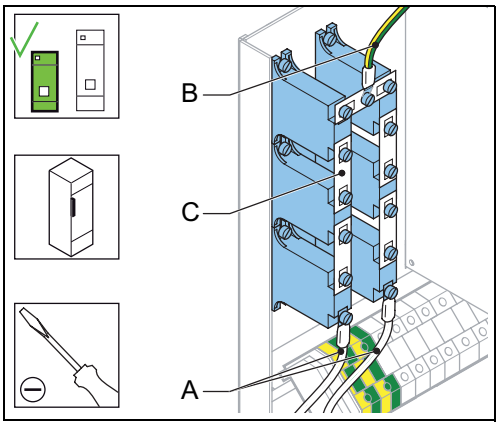
7.2.13 Power components, output

Lightning arrestors (LA1 - LA2), small cabinet

The procedure shows the replacement of three lightning arrestor modules as an example. The procedure for all six lightning arrestors is identical.

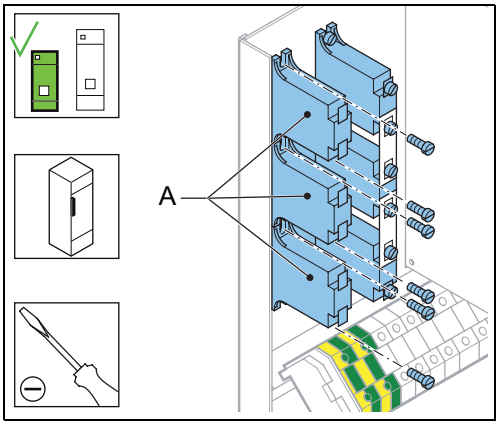
Prepare

1. Switch OFF the power supply. See § 5.3.
2. Open the front panel. See § 7.3.
3. Disconnect the wires (A) that come from the output terminals.
4. Disconnect the earthing wire (B).
5. Remove the screws of the copper plates (C).
6. Remove the copper plates (C).



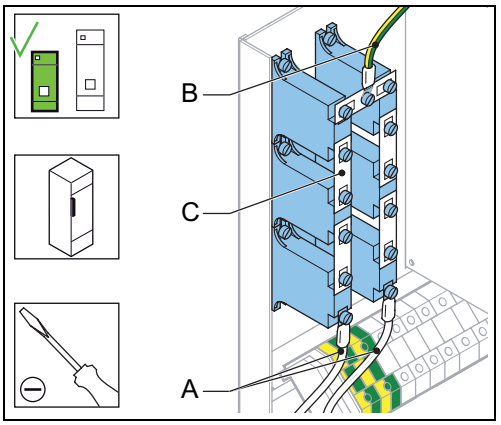
Replace

1. Remove the screws of the lightning arrestors (A)
2. Replace the lightning arrestors.
3. Install the screws of the lighting arrestors.



Install

1. Install the copper plates (C).
2. Install the screws of the copper plates.
3. Connect the earthing wire (B).
4. Connect the wires (A) that come from the output terminals.
5. Close the front panel.



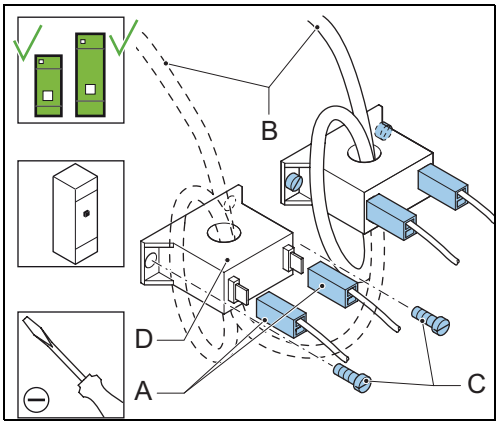
Output current measurement transformer (TI2, TI3)

Prepare

1. Switch OFF the power supply. See § 5.3.
2. Open the front panel. See § 7.3.

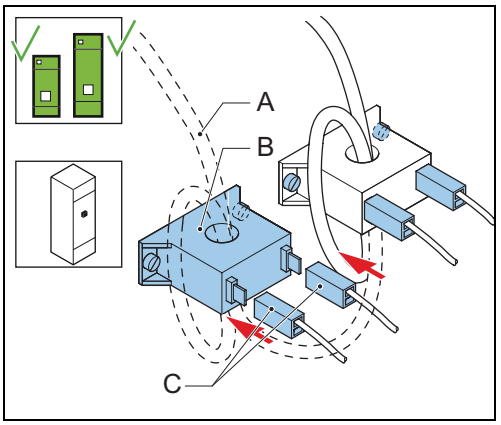
Replace

1. Disconnect the connectors (A). *Use a pair of pliers if necessary.*
2. Disconnect the cable (B) at the output terminal 2.
3. Disconnect the cable (B) that goes through the transformer.
4. Push the cable (B) trough the transformer.
5. Remove the screws (C).
6. Replace the output current transformer (D).
7. Install the screws (C).



Install

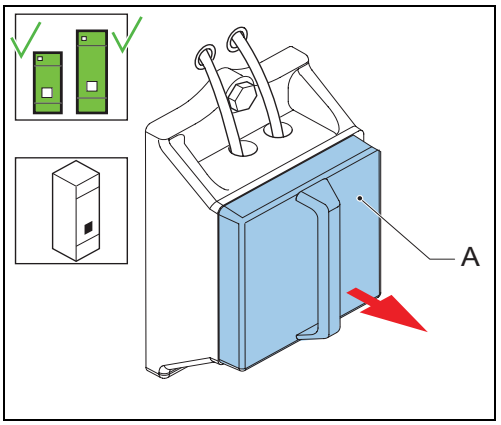
1. Put the cable (A) through the transformer (B) in a loop. The cable must pass the hole twice.
2. Connect the cable (A) at the output terminal 2.
3. Connect the connectors (C).
4. Close the front panel.



7.2.14 Series CutOut (SCO) (option)

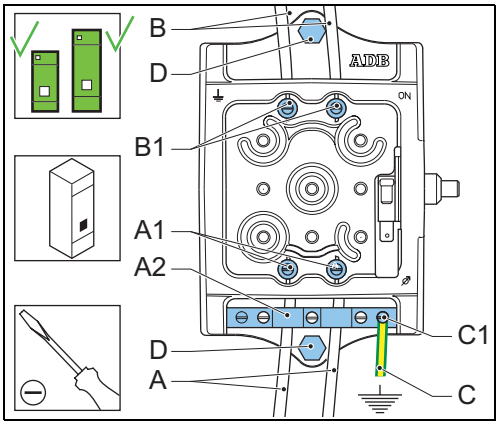
Prepare

1. Switch OFF the power supply. See § 5.3.
2. Make sure that the circuit is earthed.
3. Remove the cover of the SCO (A).



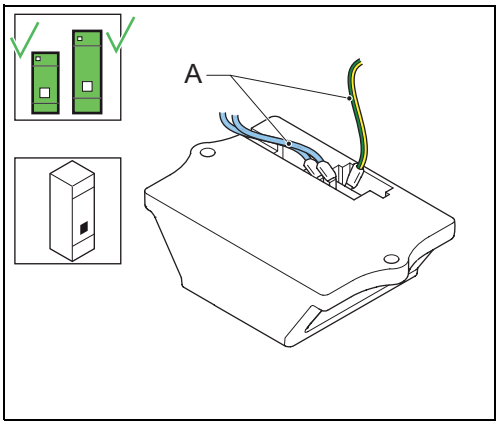
Remove

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.



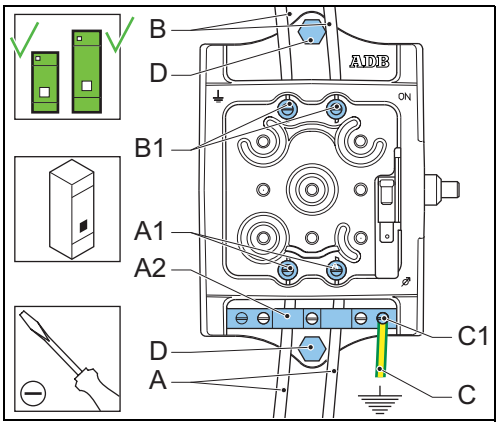
Connect micro switch

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



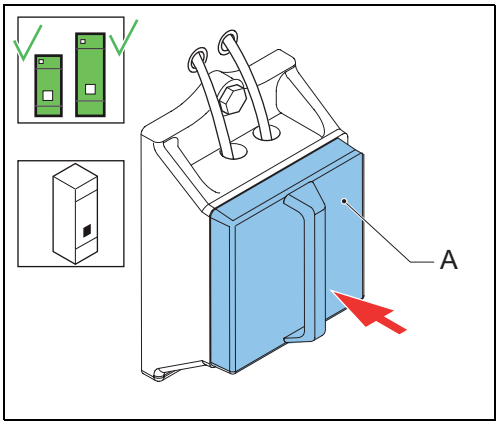
Install

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).



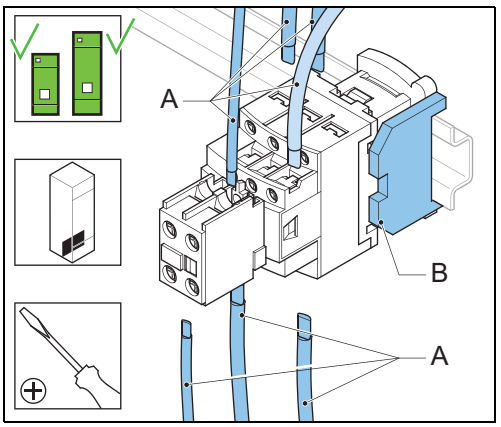
7.2.15 Circuit Selector Module (CSM) (option)

High-voltage contactor (CS - K1 - K8)

The procedure shows the replacement of a contactor for voltages up to 1515 V. The procedure for a contactor for voltages up to 4545 V is similar.

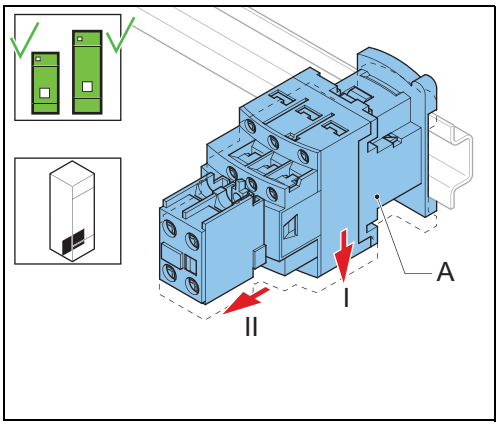
Remove - 1

1. Switch OFF the power supply. See § 5.3.
2. Remove the rear panel of the CS cabinet. See § 7.3.
3. Loosen the screws of the cables (A).
4. Disconnect the cables (A).
5. Remove the rail stopper (B).



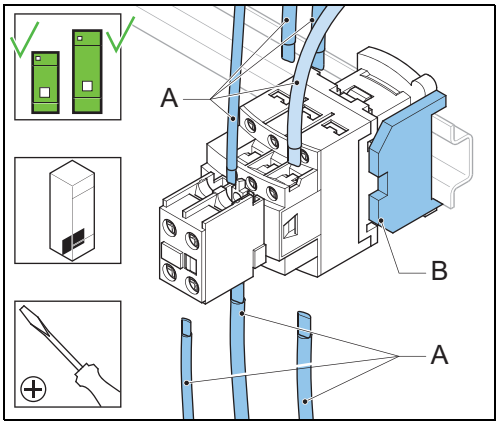
Remove - 2

1. Remove the high-voltage contactor (A). *Push down (I) and pull (II) the high-voltage contactor.*



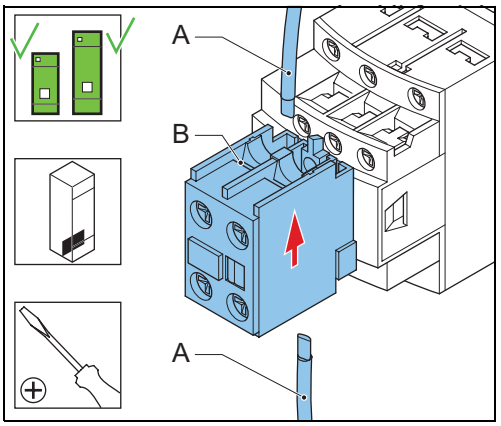
Install

1. Install the new high-voltage contactor. *Push the HV-contactor on the rail (C).*
2. Install the rail stopper (B).
3. Connect the cables (A).
4. Tighten the screws of the cables.
5. Install the rear panel of the CS cabinet.



Auxiliary contact (CS - K1 - K8)

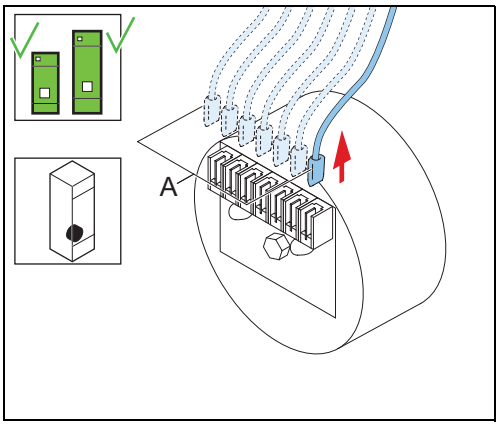
1. Switch OFF the power supply. See § 5.3.
2. Remove the rear panel of the CS. See § 7.3.
3. Remove the cables (A).
4. Replace the auxiliary contact (B). *The auxiliary contact fits into a clip.*
5. Install the rear panel of the CS cabinet.



CSM voltage transformer (CS - K1 - K8)

Prepare

1. Switch OFF the power supply. See § 5.3.
2. Remove the rear panel of the CS cabinet. See § 7.3.
3. Pull out the cables from the input supply terminals (A).

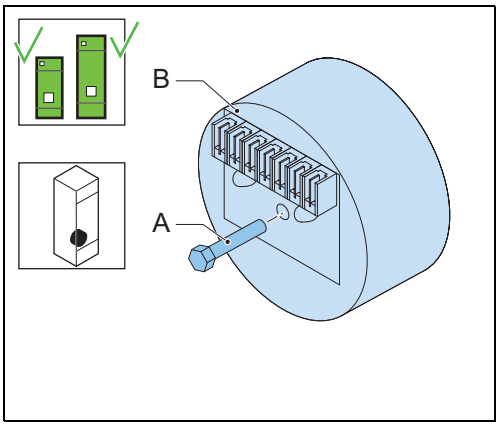


Replace

1. Remove the bolt (A).
2. Replace the CSM voltage transformer (B).
3. Install the bolt (A).
4. Connect the cables to the input supply terminals.

Note
See the CD labeled '????' for connection schemes.

5. Install the rear panel of the CS cabinet.



7.3 Remove panels

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

CAUTION

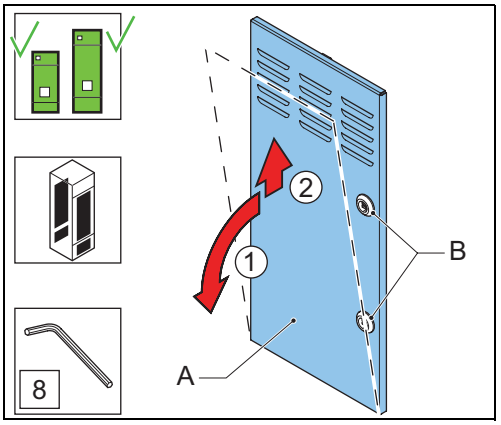
- **Do not operate the equipment with any of the panels removed.**
- **Do not mix panels from different equipments.**
- **Always connect the earthing wires before you install the panels.**

7.3.1 Front and rear panel

Remove panel

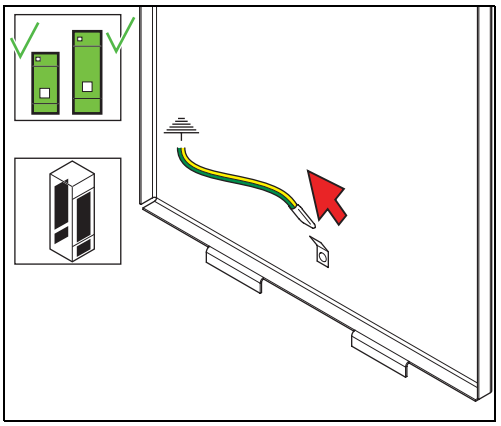
1. Open the locks (B). *Use an Allen key 8 mm*.
2. Remove the panel (A).

Note
The front panel is a hinged panel. The front panel stays attached to the equipment.



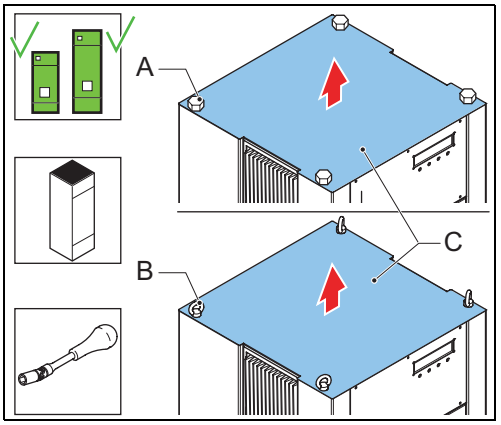
Disconnect wires

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



7.3.2 Top panel

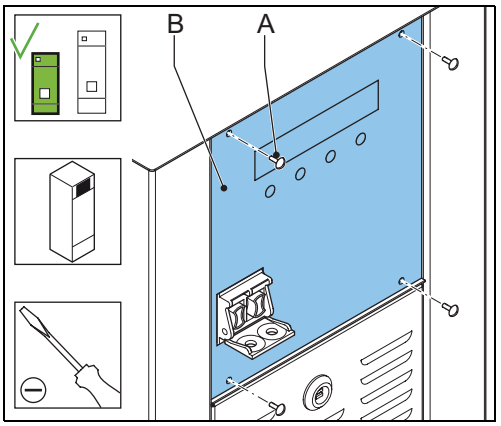
1. Remove the bolts (A) or the optional lifting lugs (B).
2. Remove the panel (C).



7.3.3 UI panel: small cabinet

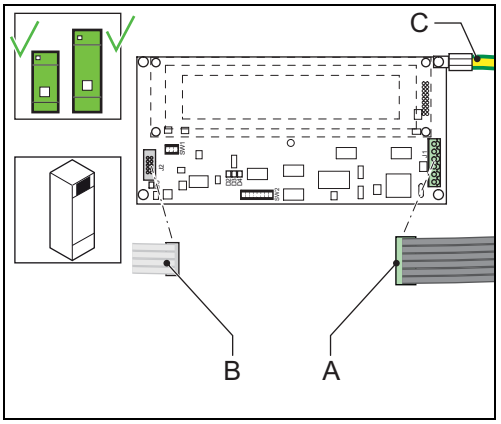
Remove panel

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



Disconnect wires

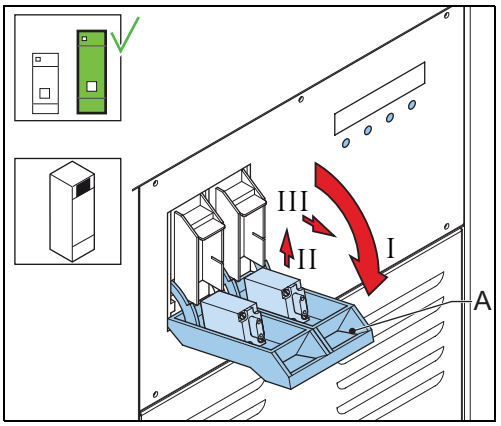
1. Disconnect the power cable from connector J1 (A).
2. Disconnect the local bus cable from connector J2 (B)
3. Disconnect the earthing wire (C).



7.3.4 UI panel: big cabinet

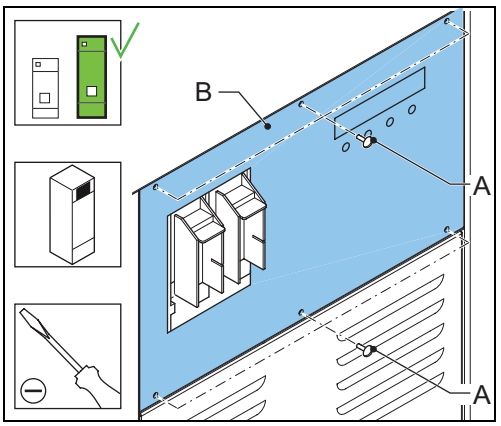
Remove fused input switch and complete handle (A)

1. Open the handle (I).
2. Move up the handle (II).
3. Pull and remove the handle (III).



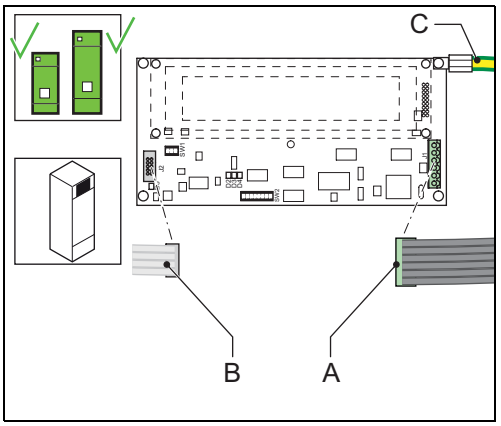
Remove panel

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



Disconnect wires

1. Disconnect the power cable from connector J1 (A).
2. Disconnect the local bus cable from connector J2 (B)
3. Disconnect the earthing wire (C).



8 Checks and measurements

8.1 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 anly connecte 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.

8.2 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 brighness step. See § 5.1.
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.

8.3 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.*

8.4 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) [µA]
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 x 2 = 266 µA
- Allowed insulation resistance current the cable is 80 x 1 = 80 µA
- Total allowed insulation resistance current for this circuit is 266 µA + 80 µA = 346 µA
- When you test with 5000 V, according to Ohms law, the minimum resistance is 14 MOhm.

8.5 Calculate resistance of series circuit

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

Where:

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

Example:
circuit length is 8000 m
cable section is 6 mm^2
number of series transformers is 122
Then $R_{prim} = (18 \times 10^{-3}) \times 8000/6 + 122 \times 0.1212 = 36.7$ Ohm

8.6 Measure cable capacitance

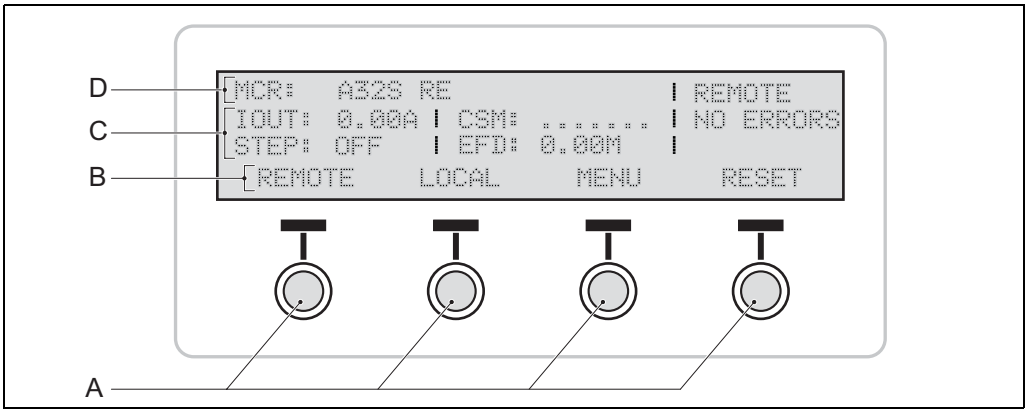
Measure the cable capacitance towards the ground as follows:

1. Make sure that the main switch is OFF.
2. Make sure that the LFD PCB (option) is connected to the equipment.
3. Connect a multimeter to the regulator output cable. *Use a Multimeter that has an internal resistance of 10 MOhm.*
4. Disconnect the 500 V DC power cable to the LFD 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 µF, the measured voltage decreases from 400 V DC to 147 V DC (=0.37x400) 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 µF.

9 User Interface (UI)

9.1 User Interface (UI) Overview



A Push-buttons
B Push-button functions
C Menu rows
D Title row

9.2 Navigate the User Interface (UI)

Use the push-buttons to navigate through the menus.

The UI shows the selected function of each push-button above the push-button. The table shows the available functions for the push-buttons:

Table: 9.1 Push-button functions

Function	Action
ABORT	To stop the selected action and to return to the previous menu.
BACK	To go back to the previous menu.
CLEAR	To clear the error list.
CONTINUE	To confirm an action and go to the next step.
DOWN	To scroll down in a menu that has more lines that the screen can show.
MENU	On the start page, to browse the available menus.
RESET	To clear the error after you have resolved the error.
SELECT	To confirm a selection.
START	To open the menu that is selected on the screen.
TOGGLE	To switch between options in a list.
UP	To scroll up in a menu that has more lines that the screen can show.

9.3 Control modes

The UI shows the selected control mode on the title row. See table 9.2 below.

Table: 9.2 Control modes

Mode	Description
LOCAL	To control the equipment with the UI. All the parameters are accessible to read and to modify.
REMOTE	To control the equipment with a remote control system. All the parameters can be read but nothing can be modified.
DONGLE	To control the equipment with a dongle and a configuration software tool. The display is locked and nothing can be visualized or modified.

9.4 MCR Control menu

Table: 9.3 MCR Control menu

Item	Range
MCR master	To change between local and remote mode.
Step	To change the selected brightness step.
Circuit 1-8	To set the enabled circuits ON or OFF if the equipment has a CS.

9.5 MCR View menu

The menu shows a list of latest error messages.

CAUTION
The error messages are not stored. The clear button does not solve the errors.

Table: 9.4 MCR View menu

Item	Range
Error	Shows only the latest error messages.

9.6 MCR Setup menu

9.6.1 Output current

To change the settings for the output current.

Table: 9.5 MCR output current menu

Item	Range
Nominal output current [A]	6.6 or 8.3 or 12 or 20
Overcurrent level 1 [%]	2.0 - 7.5
Overcurrent delay 1 [s]	1.0 - 12.0
Overcurrent level 2 [%]	4.5 - 25
Overcurrent delay 2 [s]	0.0 - 10.0
Step settling speed [s]	0.0 - 2.5
Regulation error value [%]	1.5 – 25
Regulation error delay [s]	1.0 - 12
Switch ON delay [s]	0.0 - 1.0 s
Switch OFF if overload	NO / YES
Shut-down current value [A]	0.00 - 2.40
Remote reset allowed	YES / NO
MCR in STOPBAR mode	NORMAL / STOPBAR
LOW speed regulation	ON / OFF

9.6.2 Step data

To set the number of available brightness steps.

Table: 9.6 Step data menu

Item	Description
Number of steps	Range: 3 to 8.
Step 1 [0.01 A]	Range: 1.8 up to the value of the next step.
Step 2 - 8	To set a value from the previous step to the next step. For a 6.6 A equipment, set a difference of at least 0.1 A between two steps. For a 20 A equipment, set a difference of at least 0.3 A between two steps.

9.6.3 Default mode

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.

Table: 9.7 Default mode menu

Item	Description
Default mode	*Use default* or *Use actual*. You can only set default time, step and CSM values when you selected *Use default*.
Default time [s]	The time after which the equipment starts to use the default settings.
Default step	OFF or from 1 to 8.
Default CSM	To set each circuit to ON / OFF.

9.6.4 Supply voltage

CAUTION
First contact ADB if you want to change any of these parameters. Wrongly set parameters can damage the equipment.

Table: 9.8 Supply voltage menu

Item	Range
Nominal supply voltage [V]	220, 230, 240, 380, 400 or 415
Mains frequency [Hz]	50 or 60 (measured)
Fuse range	63 or 125
Mains switch OFF level [%]	70 - 80
Mains switch ON level [%]	80 - 90
Mains warning level [%]	110 - 130
TAP setting	2/8 to 8/8

9.6.5 IO

Table: 9.9 IO menu

Item	Range
Multiwire 1	The system detects the available multiwire modules. Multiwire 3 is reserved for the CS. You cannot change the input / output functions wit the UI. To change these functions, use the configuration software tool, see § 10.3.6.
Multiwire 2	
Multiwire 3	
Bus A	To monitor the slave number for Bus A and to change the J-Bus baudrate and parity settings separately for Bus A and B. The J-Bus(ses) must be enabled before you can use them.
Bus B	
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.
Local kill	To disable local control.
Temperature limit	To set an upper temperature limit between 20 ^{O}C and 70 ^{O}C. The setting gives only a warning, it does not shut down the equipment.
Mains protection	Option.
Door open	Option.

9.6.6 Versions

To show the present software version of each module. If the local bus does not detect a module, the UI shows the marking -.-- instead of the software version. You can update these software versions only with the configuration software tool. See chapter 10.

9.6.7 Serial numbers

To show the serial number of each module. If the local bus does not detect a module, the UI shows the marking -.-- instead of the module serial number. You can not change these numbers.

9.7 Circuit Selector Module (CSM) or AGLAS menu (options)

The CSM and AGLAS menus are mutually exclusive.

Table: 9.10 CSM menu

Item	Description
AGLAS installed	Enables the feedback of the AGLAS on the UI.
CSM installed	Must be active when a CSM or a CSR is connected and installed.
CSM mode	To define the operational modes of the CSM: - 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.
Circuit 1 - 8	To enable and disable circuits in the selector.

9.8 Earth Fault Detection (EFD) menu (option)

Table: 9.11 Earth Fault Detection menu

Item	Range
EFD Control	Disabled / enabled
EFD Reset error	YES / NO
EFD ON if MCR is OFF	YES / NO If the parameter is set to YES, the EFD works even if the equipment is switched OFF.
EFD Startup [s]	4 - 120
EFD Level 1 [MOhm]	1 - 255 You can set a warning level even if you do not specify a value.
EFD Level 2 [MOhm]	0.06 - 9.99 You can set an error level even if you do not specify a value.
EFD Calibration	To start the calibration.

9.9 Lamp Fault Detection (LFD) menu (option)

- Level 1 and level 2 both have a range of up to 31, but level 2 must always be larger than level 1.
- LFD VA-drop levels: the VA drop alarm can be enabled or disabled.
- The accuracy for a calibrated LFD level is one light fitting with a margin of +/- 3 light fittings.

9.10 Lamp Fault Detection (LFD) calibration menu (option)

Table: 9.12 LFD Calibration menu

Item	Description
LFD View sets	To display the different circuit combinations (sets) for the LFD calibration. There are 1, 2, 4, or 8 sets available, depending on the installed options.
LFD Active set	To select the circuit combination (set) to be calibrated. If no sets are selected, the display shows *Invalid*.
LFD Select CSM circuits	To select the circuit combination set for which the LFD calibration is performed.
LFD Warm-up time [s]	Range: 10 - 1200 seconds. The time depends on the length of the circuit and the number of transformers.
LFD Do REFERENCE Calibration	To start the reference calibration.
LFD No. of lamps removed	Range: 1 to 31. To define the number of light fittings you removed during the calibration.
LFD LAMPS REMOVED Calibration	To start the calibration with the number of light fittings removed.
LFD Erase calibration	To erase LFD calibrations for the active set. It is recommended that you erase all sets befor an LFD calibration.

9.11 Hour counters menu (option)

The hour counters are set to disabled by default. If a CSM is installed, you can enable hour counters for different circuits.

Table: 9.13 Hour Counters menu

Item	Description
Hour counters (h)	There are two types of hour counters: - Counters that measure the number of hours the equipment is ON. - Counters that measure the number of hours the equipment is ON and produces output current that is higher than a predifined value. If the equipment has a CS, each circuit has its own hour counter.
Hour Limits	Set the values that the hour counters use to monitor the output current.
Hour Counters Reset	To reset the hour counters.

9.12 Display menu

Table: 9.14 Display menu

Item	Description
Display Contrast [%]	Locked to 100 %.
Display time-out [s]	Range: 5.0 to 124.5 seconds. 124.5 seconds locks the display, that is, the back light always remains ON and the display shows LOCK.
Embedded language	To shows the main language of the UI.
Extra language	To choose an alternative language if it is available.

9.13 Alarm texts and messages on User Interface (UI)

Table: 9.15 Equipment faults

Alarm text / message	Alarm status: error (E) / warning (W)	Description
MCR switched OFF for OVERCURRENT	E	The output current is higher than one of the two preset levels and after the corresponding delay of each level. - The equipment switches OFF; - Restart the equipment only after you have found the cause of the alarm.
MCR switched OFF for open circuit	E	The output current drops below the minimum output current. - The equipment switches OFF; - Restart the equipment only after you have found the cause of the alarm.
Output current DEVIATES	W	The output current is different from the set value.
MCR in OVERLOAD	W	In case of overload, the output current may be lower than required. You can configure the equipment to consider this as an open circuit condition and to switch OFF. By default, the equipment does not switch OFF.
OPEN DOOR error	E	One of the panels of the equipment is open.
AGLAS is disconnected	W	The system cannot detect the AGL system.

Alarm text / message	Alarm status: error (E) / warning (W)	Description
OVERTEMPERATURE	W	The equipment is too hot.
Mains supply is LOW	W	The mains supply voltage drops below a preset level, the equipment switches OFF. - The equipment switches OFF; - When the mains supply voltage has reached a higher (user-adjustable) level again, the equipment restarts automatically.
POWER LOSS!!	W	The equipment is about to have a power loss.
Mains frequency out of range	W	The mains frequency is out of range.
CSM is disconnected	W	The system cannot detect the CS unit.

Table: 9.16 Earth Fault Detection (EFD) faults

Alarm text (message)	Alarm status: error (E) / warning (W)	Description
EFD warning level reached	E	The EFD unit is above the value set for level 1.
EFD alarm level reached	E	The EFD unit is above the value set for level 2.
EFD calibration running	W	The system performs the EFD calibration.

Table: 9.17 Lamp Fault Detection (LFD) faults

Alarm text (message)	Alarm status: error (E) / warning (W)	Description
LFD warning level reached	E	The LFD unit has reached the set number of burnt lamps for level 1.
LFD alarm level reached	E	The LFD unit has reached the set number of burnt lamps for level 2.
LFD VA warning level reached	E	The LFD unit has detected a VA-drop (load loss), which is above the set value for level 1.
LFD VA alarm level reached	E	The LFD unit has detected a VA-drop (load loss), which is above the set value for level 2.

Table: 9.18 Hour counter faults

Alarm text (message)	Alarm status: error (E) / warning (W)	Description
Hour counter exceeds limit	W	The total hour counter is above the set limit for any selected hours counter.
Hour counter exceeds limit	W	The hour counter for the threshold output current is above the set limit.
Hour counter exceeds limit	W	The hour counter for the CS circuit 1-8 is above the set limit

Table: 9.19 J-Bus faults

Alarm text (message)	Alarm status: error (E) / warning (W)	Description
Bus A down	E	BUS A does not function correctly.
Bus B down	E	BUS B does not function correctly.

10 Configuration software tool

With the configuration software tool, you can operate the equipment from a PC.

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.

10.1 Install configuration software tool on a PC

10.1.1 Requirements

System requirements:
- PC with Microsoft Windows 2000 or XP operation system;
- 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.

Configuration tool package:
- 1 dongle with embedded software;
- 1 installation CD-Rom with a flasher program;
- 2 cables:
  - Extension cable (DB9M/DB9M-1,5 m;
  - Cable null modem (DB9F/DB9F-1,8 m.

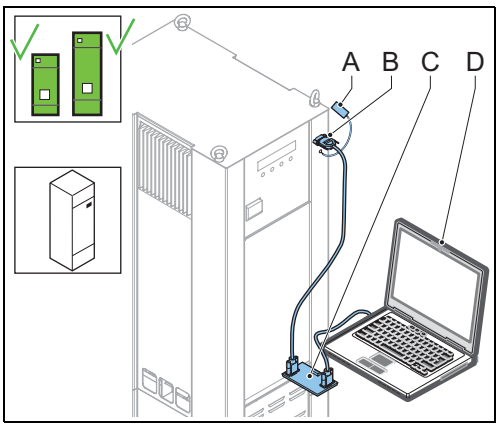
10.1.2 Install software

1. Open Windows Explorer.
2. In Windows Explorer, open the main folder of the installation CD-ROM.
3. Run the setup application file. *Follow the instructions of the installation program. The software is now installed.*
4. Copy the system upgrade files (.upl) from the installation CD to the directory where you installed the software.

10.2 Start configuration software tool

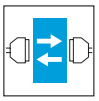
10.2.1 Connect cables

1. Make sure that the equipment is switched OFF. See § 5.3.
2. Remove the protection cover (A).
3. Connect the extension cable to the dongle (B) and to the PC connector of the equipment (C).
4. Connect the cable null modem to the dongle (B) and to the serial communication port of your PC (D).



Start software

1. Switch the equipment ON. The equipment also supplies power to the dongle.
2. Click the MCR_WIN.exe file in the directory where you installed the software. *The configuration tool opens.*
3. Select the menu **Configuration**.
4. Select the applicable serial communication port (COM) to which you connected the dongle.



Note
The baud rate and parity settings for the communication between the PC, dongle and the equipment must be the same. For the dongle, the default baud rate is 38400 and the default parity setting is EVEN.

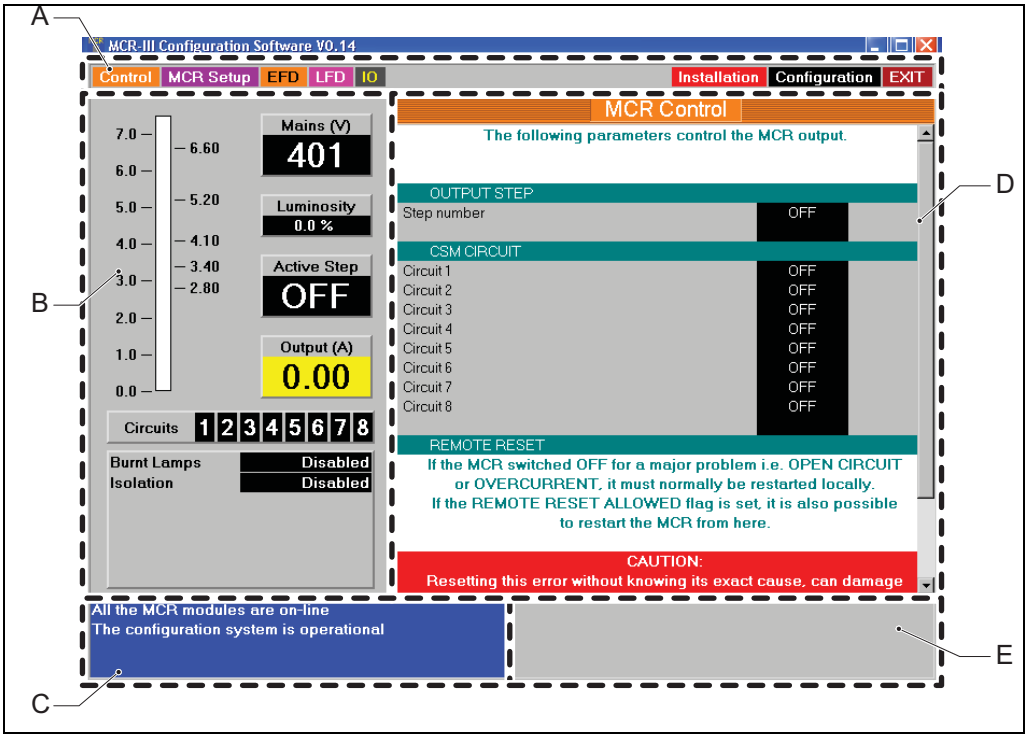
5. The dongle automatically makes the connection to the equipment.

Finish

1. Disconnect the extension cable from the dongle and the PC connector of the equipment.
2. Install the protection cover.

10.3 Description of screens and menus

10.3.1 Configuration software tool screen



A Menu bar
B Status view
C Communication connection status view
D Active menu view
E Error message

Table: 10.1 Screen structure

Screen item	Description
Menu bar	The screen item shows the available menu items and the Exit button.
Status view	The screen item shows: - The present status of the input and the output current; - Error messages; - The status of burnt light fittings. The screen item allows you to: - Change the selected brightness step; - Select the active circuits. The screen item is always visible.
Communication connection status view	The screen item shows possible communication errors between the dongle and the equipment.
Active menu view	The screen item changes when you select a menu item from the menu bar. You can scroll this view up or down.

10.3.2 Control menu

Table: 10.2 Control menu

Item	Range
Step	To change the selected brightness step.
Circuit 1 - 8	To set the enabled circuits ON or OFF if the equipment has a CS.
Remote reset	To reset the equipment.

10.3.3 MCR Setup menu

Identification and software versions

The menu shows the software versions and serial numbers of all the PCBs installed in the equipment. If a mode is not detected, the screen shows a marking -.-- instead of the software version.

Note
The corresponding software is required to upload to change the software version.

Output current

Table: 10.3 Output current menu

Item	Description
Output current	Shows the maximum and minimum output current of the equipment. You can change this value in the **Installation** menu.
Steps	Set the number of available brightness steps. For each step, you can set a step value. For a 6.6 A equipment, set a difference of at least 0.1 A between two steps. For a 20 A equipment, set a difference of at least 0.3 A between two steps.
Shut-down	To set a Shut-down current value if the equipment has a CS. When you switch OFF a circuit, the equipment lowers temporarily the output current of the circuit to this value.
Overcurrent alarm levels	To set alarm levels for overcurrent situations.
Mode of operation	To set parameters that define the operation mode for the output current.
Remote reset	To reset the equipment. The **Remote reset allowed** parameter shows if a reset is possible.
Default operation	To set parameters for default mode operation. These parameters are used during a communication failure between the equipment and remote control or LMC/CCL modules.

Mains supply

Table: 10.4 Mains supply menu

Item	Range
Mains supply & frequency	Shows information about the mains supply. You can change these values in the **Installation** menu.
Alarm levels	To define alarm levels for the mains supply.

CS (option)

Table: 10.5 CS menu (option)

Item	Range
Mode of operation	Range: alternate or simultaneous.
Circuits	To enable or disable circuits.

The menu is only visible when a CS is installed.

Error simulation

Table: 10.6 Error simulation menu

Item	Range
Output current	To simulate output current errors. Available options: - Overcurrent; - Open circuit; - Overload; - Output current deviates; - Output current unstable.
Mains voltage	To simulate mains voltage errors. Available options: - Mains voltage too low; - Mains voltage too high; - Mains voltage unstable.

You can use the simulated errors to test the connection between the equipment and the remote control system.

Input/output measurements

Table: 10.7 Input/output measurements menu

Item	Range
Measurements	Shows the different input and output values.
Calibration	To calibrate input and output measurements for the CCL module.

WARNING
Any calibration is potentially harmful because high voltages and currents are involved.

Note
When the equipment is in short-circuit, you can calibrate the equipment only roughly. For fine-tuning, the equipment must be in full load.
For most values, when you start a calibration, there is first an offset adjustment. This means that the equipment switches OFF. Then it switches to the maximum output current and requests you to enter the correct reading.

Hour counters

Hour counters are set to disabled by default. If a CSM is installed, you can enable hour counters for different circuits.

Table: 10.8 Hour counter menu (option)

Item	Description
Hour counters [hour]	There are two types of hour counters: - Counters that measure the number of hours the equipment is ON. - Counters that measure the number of hours the equipment is ON and produces an output current that is higher than a user-defined value. If the equipment has a CS, each circuit has its own hour counter.
Hour Limits	To set the upper limit of hour counters. When this limit is exceeded the configuration software shows a warning.

10.3.4 Earth Fault Detection (EFD) menu (option)

Table: 10.9 EFD menu

Item	Range
Control commands	To enable or disable the EFD module.
EFD Calibration	To start the calibration. After a successful calibration, the module can correctly measure the leakage current of the field circuit. The EFD module then translates this to a corresponding leakage resistance.
Setup	To set a start-up time for the series loop. Count 4 seconds for each km of cable, if the cable capacitance is less than 0.2 µF/km.
Alarms	To set alarm levels to warn about leakages and simulate EFD errors.

10.3.5 Lamp Fault Detection (LFD) menu (option)

Table: 10.10 LFD menu

Item	Range
Control commands	To enable or disable the LFD module.
Alarms	To set alarm levels to warn about leakages and simulate an LFD errors.
LFD Calibration	To start the calibration.

10.3.6 IO menu

Table: 10.11 IO menu

Item	Description
Hardware present	Shows the detected hardware modules.
IO Arbiter	To set: - the signal source for remote control; - a priority for different systems. If IO Arbiter is set to disabled, remote control is not possible.
Local Kill	To disable local control.
Warning messages	Shows the UI and J-Bus warnings detected by the system.
Temperature	To set an upper temperature limit between 20 ^{O}C and 70 ^{O}C to protect the equipment from overheating.
Bus	- To change the J-Bus baudrate and parity settings separately for Bus A and Bus B; - To monitor the slave number values. Only if J-Bus is enabled.
Multiwire	To change the back-indication/control functions of each signal for MW 1, MW 2, and MW 3. MW 3 is reserved for the CS.

10.3.7 Save menu

Table: 10.12 Save menu

Item	Description
Save	To save the IO settings parameters as a profile on your PC.
Restore	To upload a previously saved IO settings profile to the unit.

10.3.8 Installation menu

CAUTION
First contact ADB if you want to change any of these parameters. Wrongly set parameters can damage the equipment.

Table: 10.13 Installation menu

Item	Range
Nominal supply voltage [V]	220, 230, 240, 380, 400 or 415
Maximum output current [A]	6.6 or 8.3 or 12 or 20.
Mains supply fuse [A]	63 or 125
Power transformer specifications	Shows the different power transformers of the equipment.
CS or AGLAS	Shows the presence and operational mode of the CS or AGLAS.
Fast start-up	Do not use this option!

10.3.9 Configuration menu

Table: 10.14 Configuration menu

Item	Range
Communication port	To select the serial communication port your PC uses to connect to the dongle.
COM port configuration	To change the baudrate and parity parameters for the serial communication port.
Buzzer control	To enable or disable a sound notification for the PC.
Upload software	To upload a new software version for a module. Each module has its own software version that can be changed when a new release becomes available.
Language selection	Shows the available languages for the configuration tool. The default language is English.

Upload a software file

1. Save the file to the installation menu of the configuration software tool. *The screen shows the available software versions.*
2. Click a file. *The upload starts.*

11 PCB drawings and settings

11.1 LED RUN

Each PCB has LED lights that have specific functions related to that PCB. The general function is given in the table below.

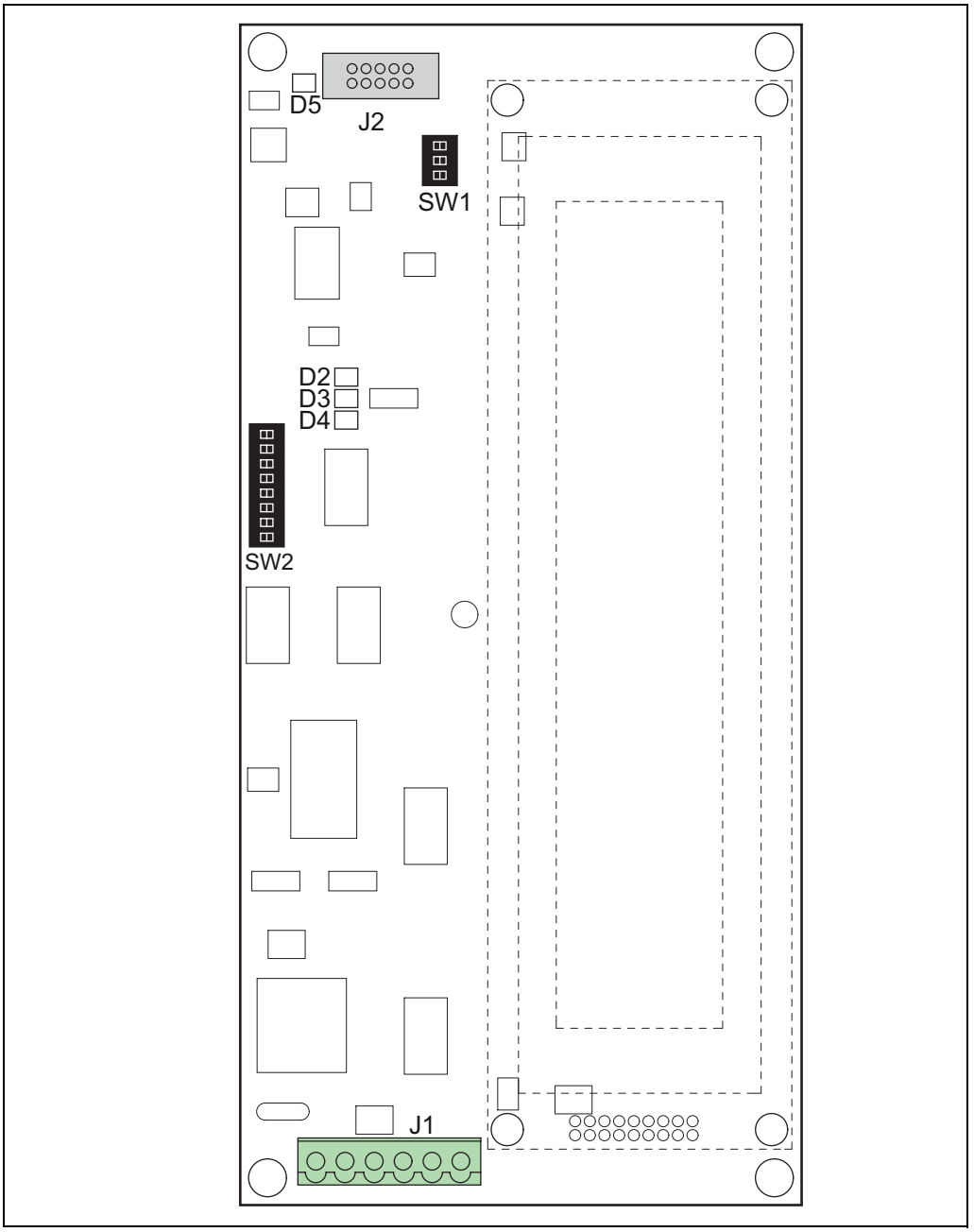
Table: 11.1 General LED RUN light functions

LED RUN	Description
Blinks once per second	The micro controller is operational.
Blinks at a much higher rate	The micro controller is in boot-loader mode and a software upload is required.

For the specific functions and locations, see the description of the specific PCB.

11.2 UI - PCB1507

11.2.1 Printed Circuit Board (PCB)



11.2.2 Connectors

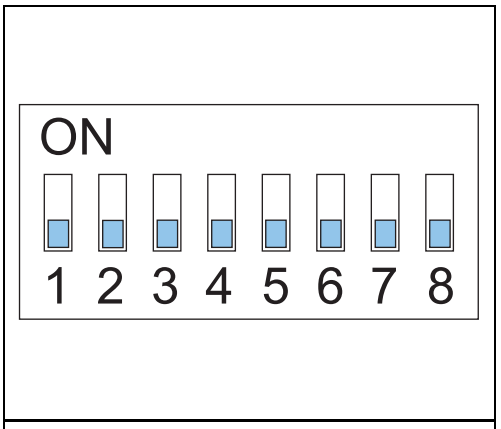
Table: 11.2 UI connectors

Connector	Connection to
J1	Power supply
J2	Local bus

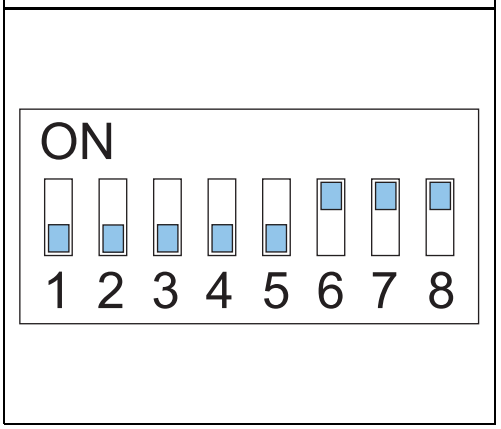
11.2.3 Dip-switches

Factory setting of the dip-switch banks:

SW:



SW2:



SW1: Local Bus - Line termination

Table: 11.3 Dip-switch bank SW1: local bus line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm
4	Not used

SW2: Various functions

Table: 11.4 Dip-switch bank SW2: various functions

Dip-switch	Function								
1	Not used								
2	Not used								
3	ON: Lock in boot-loading mode								
4	Not used								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

11.2.4 LEDs

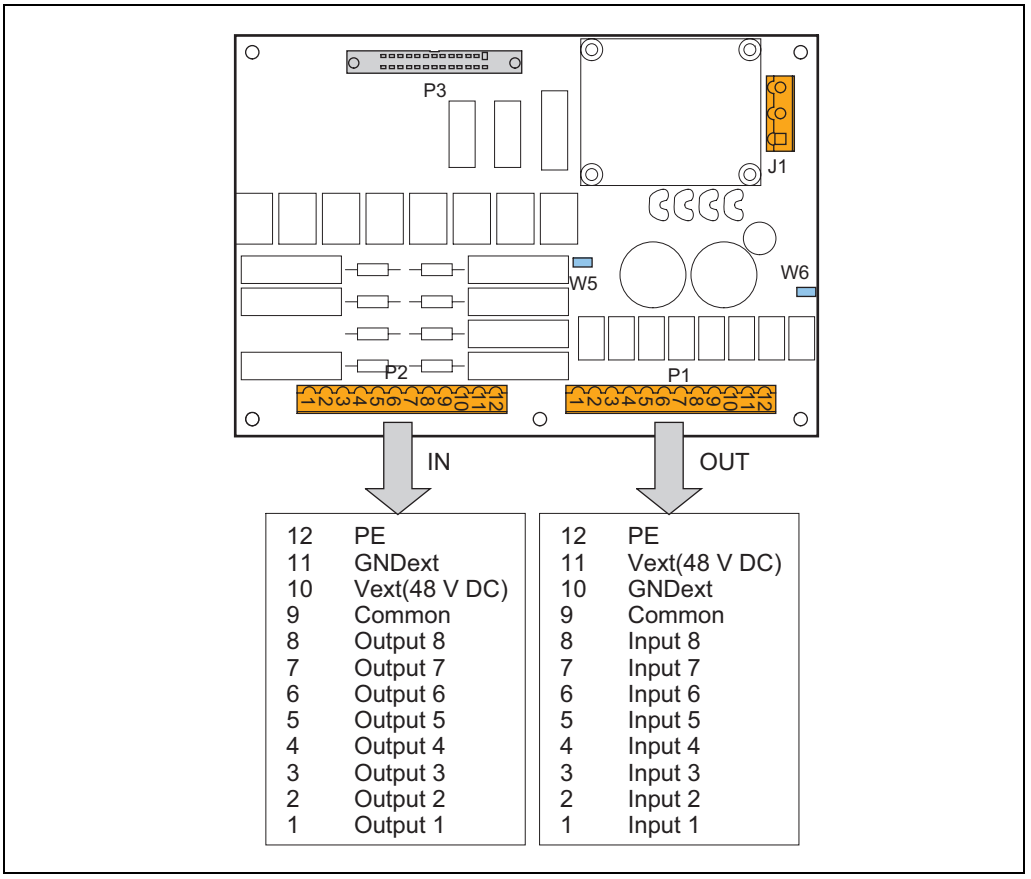
Table: 11.5 UI LED RUN light functions

LED	Function
D2	Local Bus – RXD
D3	Local Bus – TXD
D4	Micro controller – RUN
D5	Local Bus – isolated 5 V present

11.3 Multiwire - PCB1486 (option)

Note
It is impossible to attribute the same function to more than one terminal.

11.3.1 Layout of the Printed Circuit Board (PCB)



11.3.2 Straps

Table: 11.6 Multiwire PCB straps

Strap	Description
W5	Internal voltage for remote control.
W6	Internal voltage for back indication signals.

11.3.3 Connectors

Table: 11.7 Multiwire PCB connectors

Connector	Connection to
P1	Back-indication/output signals The connector type is WAGO 231-312/026-000 cage-clamp connector. This connector can accept wires of 0.08 to 2.5 mm^2 (28 - 12 AWG).
P2	Control/input signals The connector type is WAGO 231-312/026-000 cage-clamp connector. This connector can accept wires of 0.08 to 2.5 mm^2 (28 - 12 AWG).
P3	Flat cable connection to the LMC.
J1	Power supply to the multiwire interface PCB

11.3.4 Factory settings

Table: 11.8 Factory settings for the MW back-indication signals

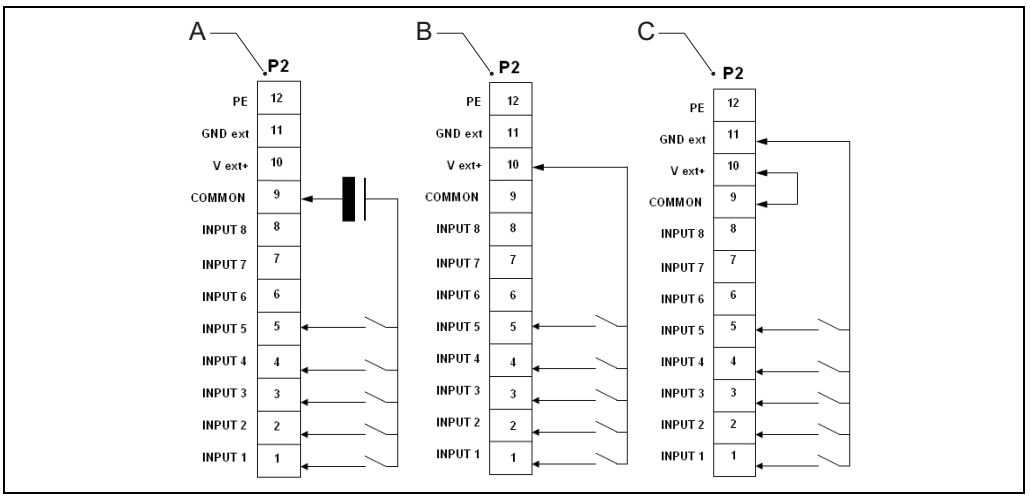
MW1 input		MW2 input		MW3 input	
1	Step 1	1	Reset EFD error	1	Circuit 1
2	Step 2	2	Use LFD degraded mode	2	Circuit 2
3	Step 3	3	Allow write via Bus	3	Free
4	Step 4	4	Free	4	Free
5	Step 5	5	Free	5	Free
6	Free	6	Free	6	Free
7	Free	7	Free	7	Free
8	Free	8	Free	8	Free

Table: 11.9 Factory settings for the MW control signals

MW1 output		MW2 output		MW3output	
1	Step 1 obtained	1	Over current alarm	1	Circuit 1 active
2	Step 2 obtained	2	Open circuit alarm	2	Circuit 2 active
3	Step 3 obtained	3	EFD warning level	3	Free
4	Step 4 obtained	4	EFD alarm level	4	Free
5	Step 5 obtained	5	LFD warning level	5	Free
6	MCR is ON	6	LFD alarm level	6	Free
7	Regulation error	7	LFD VA drop warning level	7	Free
8	Over temperature alarm	8	LFD VA drop alarm level	8	Free

11.3.5 Input terminals

The tables show examples of functions you can configure to the input connector P2 of PCB MW1 or MW2. Each signal must have its own wire. In addition, each board must have a separate wire for a common earthing.



A With external power supply
B With internal power supply (polarized contacts positive)
C With internal power supply (polarized contacts negative)

Table: 11.10 Functions for connector P2 in MW1 and MW2.

Function	Description
Free	This terminal is not in use.
ON / OFF	A separate ON / OFF signal.

Function	Description
Step 1	Selection for brightness steps.
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	
Step 7	
Step 8	
Reset EFD error	Reset EFD alarms, levels 1 and 2.
Use LFD degraded mode	Cancel the back-indication of LFD alarm, level 1.
Allow WRITE via bus	An external signal that allows the bus to change parameters in multiwire control. This works only if you set the arbiter to *Multiwire control, Bus A monitoring* or *Multiwire control, Bus B monitoring*.

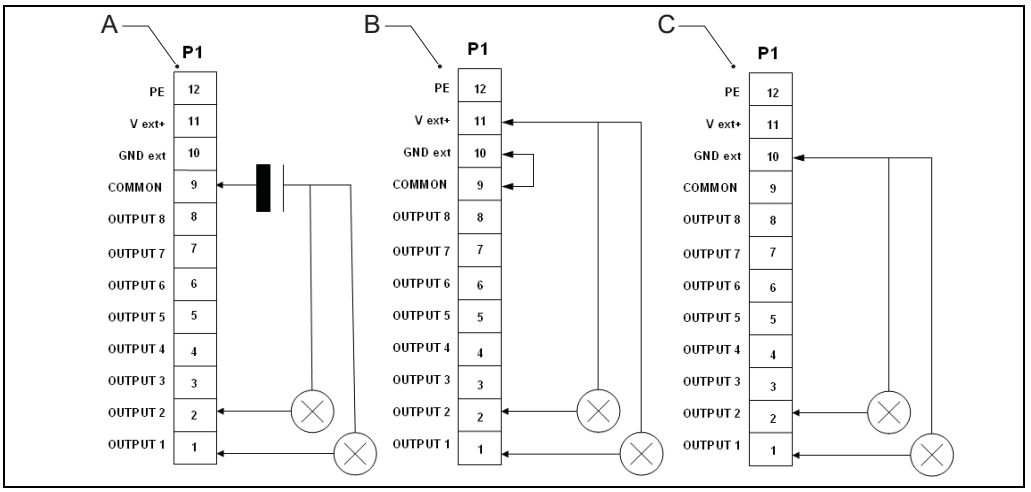
Table: 11.11 Functions for connector P2 in MW3

Function	Description
Free	This terminal is not in use.
Circuit 1	Selection for circuits.
Circuit 2	
Circuit 3	
Circuit 4	
Circuit 5	
Circuit 6	
Circuit 7	
Circuit 8	

Table: 11.12 Connect P2 wires, per power supply type

Back indication	External power supply (A)	Internal power supply (polarized contacts positive) (B)	Internal power supply (polarized contacts negative) (C)
Remarks	Remove strap W5, 24 V DC (PCB 1593.13.510) 48 V DC (PCB 1593.13.520)	Install strap W5	Remove strap W5

11.3.6 Output terminals



A With external power supply
B With internal power supply (polarized contacts positive)
C With internal power supply (polarized contacts negative)

The table shows an example of functions you can configure to the output connector P1 of PCBs MW1 or MW2. Each signal must have its own wire. In addition, each board must have a separate wire for a common earthing.

Note
Warnings are only available if you activated that option through the user interface. Otherwise, only errors are available.

Table: 11.13 Functions for connector P1 in MW1 and MW2

Function	Description
Free	This terminal is not in use.
Step 1 obtained	Back-indication for actual brightness steps.
Step 2 obtained	
Step 3 obtained	
Step 4 obtained	
Step 5 obtained	
Step 6 obtained	
Step 7 obtained	
Step 8 obtained	
Overcurrent alarm	There is overcurrent in the loop. The equipment switched itself OFF.
Open circuit alarm	There is an open circuit in the loop. The equipment switched itself OFF.
EFD warning level	Level 1 is exceeded. The actual fault condition may not be present any more.
EFD alarm level	Level 2 is exceeded. The actual fault condition may not be present any more.

Function	Description
LFD warning level	Level 1, preset quantity of burnt lamps, is reached. The warning disappears after the condition is no longer detected.
LFD alarm level	Level 2, preset quantity of burnt lamps, is reached. The warning disappears after the condition is no longer detected.
LFD VA warning level	Level 1, the preset value for VA drop is exceeded.
LFD VA error level	Level 2, the preset value for VA drop is exceeded.
Lamp life warning	Preset time for the lamp is exceeded.
Local bus error	One or more modules on the local bus do not communicate.
Bus A down	Bus A does not receive messages.
Bus B down	Bus B does not receive messages.
Overtemperature	This terminal becomes activated when the inside temperature of the equipment (measured on the LMV) becomes more than the set maximum temperature. As soon as the temperature is below the set maximum temperature, the terminal becomes inactive.
MOV blown alarm	The system cannot detect the optional lightning arrestor protection of the input voltage or it must be replaced.
MCR is ON	The equipment is ON.
MCR is in local	The equipment in is in the local mode.
MCR is in MW remote	The equipment in is in the remote mode.
Regulation error	
Door OPEN alarm	
CSM fault	

Table: 11.14 Functions for connector P1 in MW3

Function	Description
Free	This terminal is not in use.
Circuit 1	Selection for circuits.
Circuit 2	
Circuit 3	
Circuit 4	
Circuit 5	
Circuit 6	
Circuit 7	
Circuit 8	
CS fault	The requested circuits are different than the actual circuits detected.

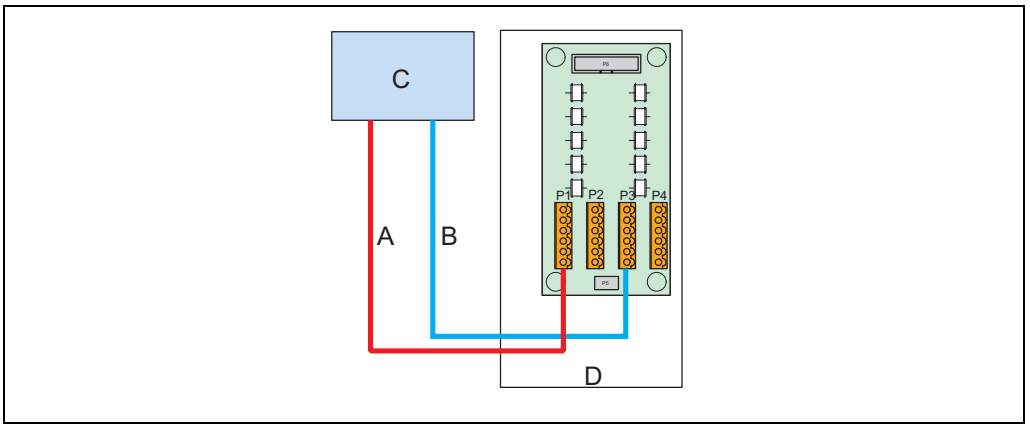
Table: 11.15 Connect P1 wires, depending on the power supply

Back indication	External power supply (A)	Internal power supply (polarized contacts positive) (B)	Internal power supply (polarized contacts negative) (C)
Remarks	Remove strap W6, Max. 110 V DC, polarity is not important	Remove strap W6	Install strap W6

11.4 J-Bus - PCB1502 (option)

The PCB provides the connection between the user J-Bus(ses) and the LMC.
The J-Bus interface uses a single or dual databus(es) to allow remote monitoring of a bigger quantity of parameters.

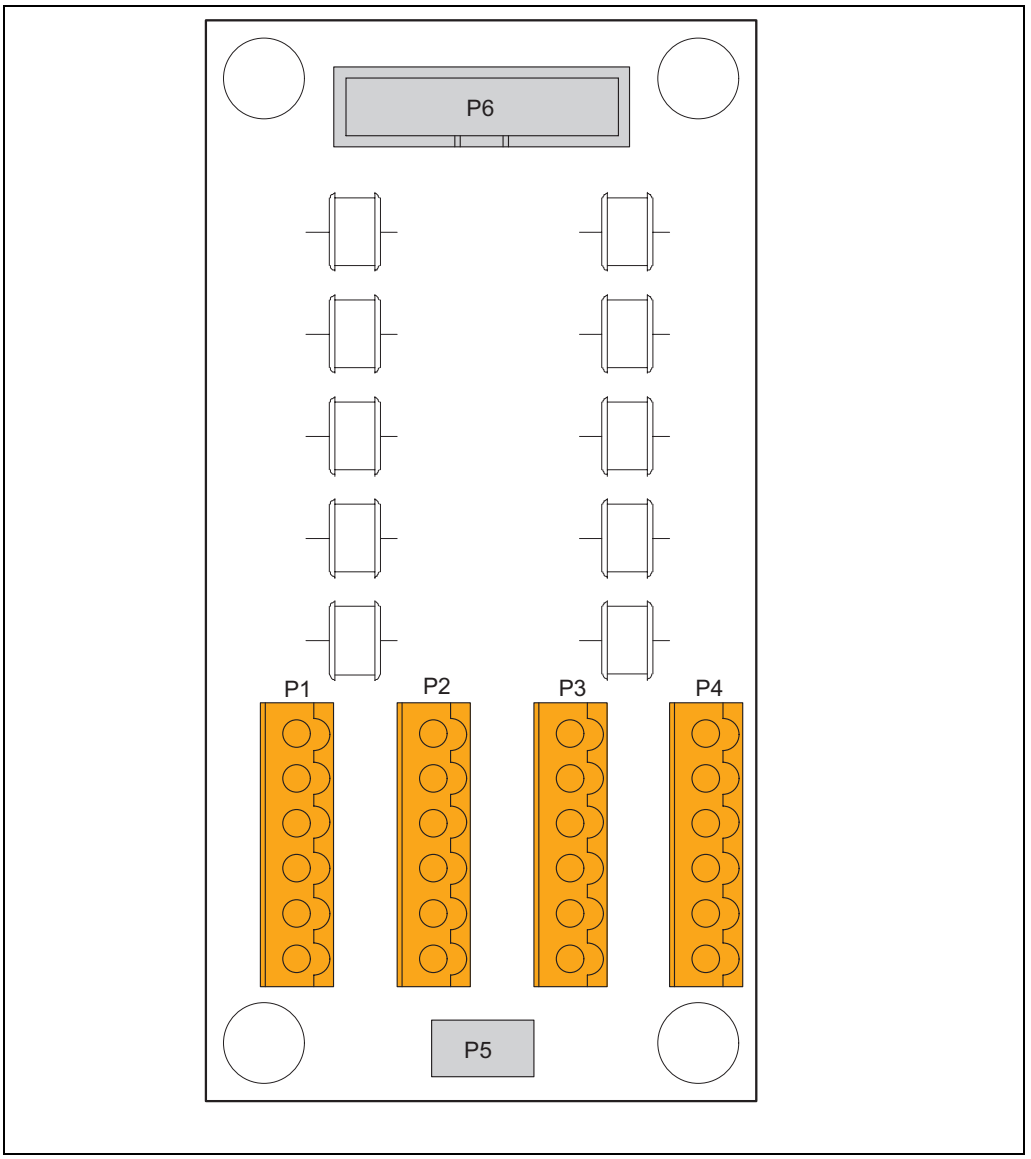
An equipment is always a slave on the J-Bus. There can be a maximum of 31 equipments on one bus section with one common bus master.



A Bus A
B Bus B
C Master (in the substation)
D Slave 000001(value set on the dipswitch bank SW1 of the LMC PCB)

11.4.1 Layout of the Printed Circuit Board (PCB)

The PCB provides the interconnection of the user J-Bus(ses) with the LMC. The PCB has gas arrestors for overvoltage protection.



Description:

- P1: Bus A connection to the substation on the master;
- P3: Bus B connection to the substation on the master;
- P5: PE.

11.4.2 Connectors

Table: 11.16 J-Bus connectors

Connector	Connection to
P1	J-Bus control for Bus A
P2	J-Bus control for Bus A
P3	J-Bus control for Bus B
P4	J-Bus control for Bus B
P5	PE
P6	LMC

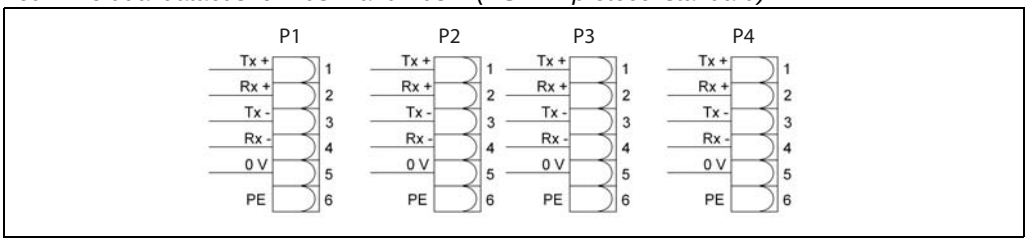
Table: 11.17 Wiring for connectors P1-P4

Wire	Description
1	Tx +
2	Rx +
3	Tx -
4	Rx -
5	0V
6	PE

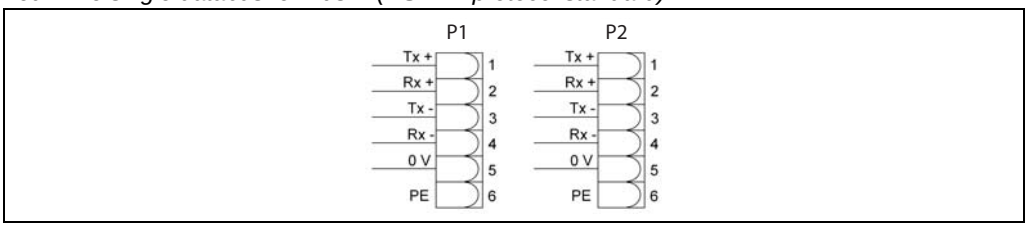
11.4.3 Slave connections on J-Bus PCB (1502)

The figures show the wire connections for the slave side. The connections for the master side depend on the used hardware.

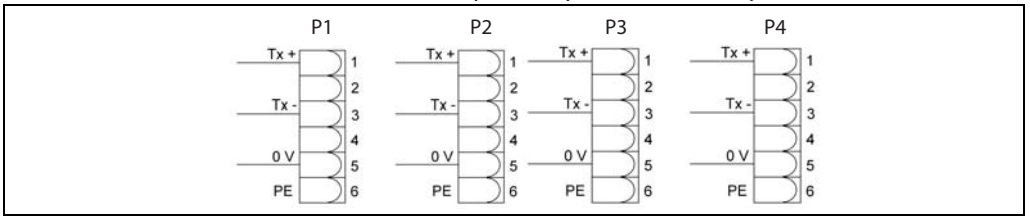
Four-wire dual databus for Bus A and Bus B (RS-422 protocol standard)



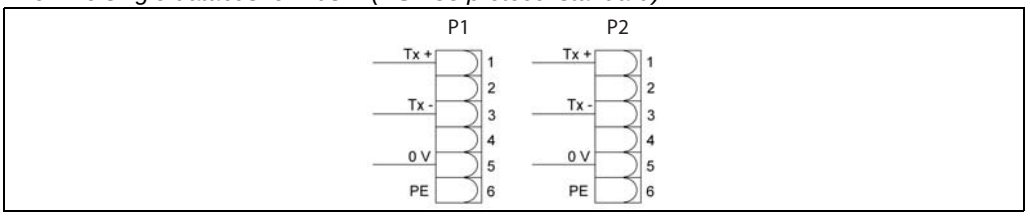
Four-wire single databus for Bus A (RS-422 protocol standard)



Two-wire dual databus for Bus A and Bus B (RS-485 protocol standard):

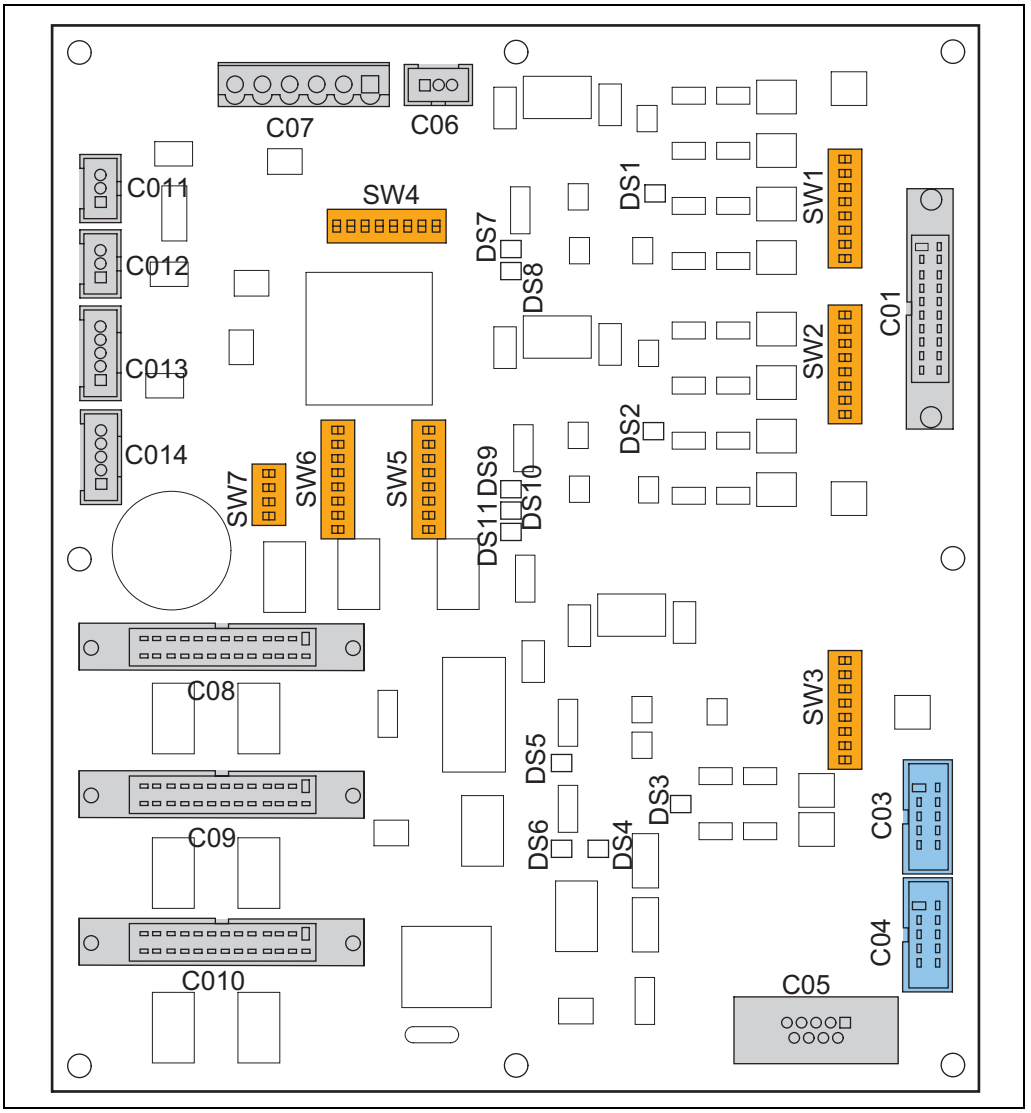


Two-wire single databus for Bus A (RS-485 protocol standard):



11.5 Local Master Controller (LMC) - PCB1513

11.5.1 Printed Circuit Board (PCB)



11.5.2 Connectors

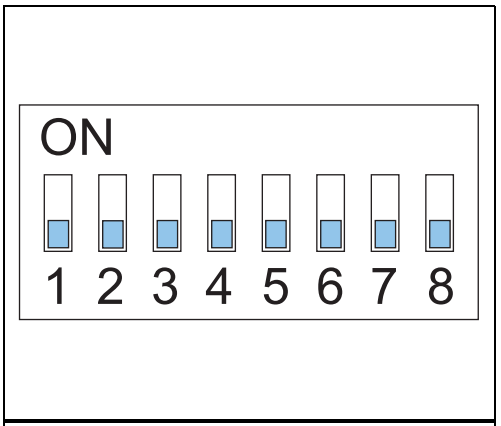
Table: 11.18 LMC connectors

Connector	Type	Connection to
C01	20-pin, flat connector, grey	Xre
C03	10-pin, flat connector, blue	Local bus
C04	20-pin, flat connector, blue	EFD PCB
C05	9-pole, Sub-D female	Dongle
C07	6-pin Phoenix, grey	Power supply
C08	26-pin, flat connector, grey	MW3
C09	26-pin, flat connector, grey	MW1
C10	26-pin, flat connector, grey	MW2
C11	3-pin stocko	Not in use
C12	3-pin stocko	Not in use

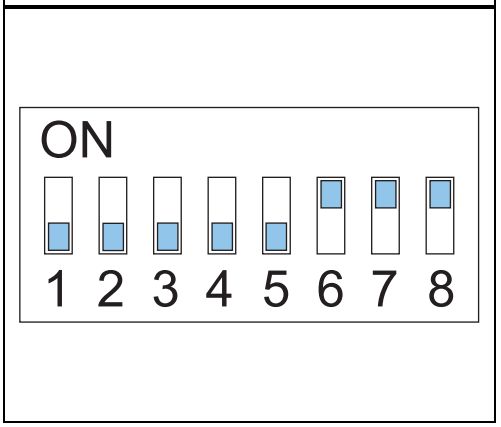
11.5.3 Dip-switches

Factory setting of the dip-switches:
SW4 - J-Bus slave number
SW5 - Depends on the presence of the modules

SW1 and SW2:



SW6:



Line termination SW1 (J-Bus A) and SW 2 (J-Bus B)

This dip-switch bank handles line termination for J-Bus A. The dip-switch bank also determines the use of two- or four-wire transmission.

Table: 11.19 Dip-switch bank SW1 J-Bus A line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm
4	OFF = 2 wire / ON = 4 wire
5	ON: Receive / R – pull up 680 Ohm
6	ON: Receive / R – Line termination 150 Ohm
7	ON: Receive / R – pull down 680 Ohm
8	Not used

SW3 Local Bus and Sync line - Line termination

Table: 11.20 Dip-switch bank SW3 local bus and sync line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm
4	Not used
5	ON: Receive / R – pull up 680 Ohm
6	ON: Receive / R – line termination 150 Ohm
7	ON: Receive / R – pull down 680 Ohm
8	Not used

SW4 J-Bus slave number

The J-Bus slave number, composed by the dip-switches in the position OFF:

Table: 11.21 SW4 J-Bus slave number

Dip-switch	Hexadecimal value	Decimal value
1	01 hex	1
2	03 hex	2
3	04 hex	4
4	08 hex	8
5	10 hex	16
6	20 hex	32
7	40 hex	64
8	80 hex	128

SW5 Local Bus - modules

This dip-switch bank allows you to enable or disable Local Bus modules. The dip-switch bank setting on the LMC allows to disable the detection of the optional units. This means that the Local Bus to these units is deactivated.

Table: 11.22 Dip-switch bank SW5 local bus modules

Dip-switch	Function
1	ON: UI enabled
2	ON: EFD enabled
3	ON: LFD enabled
4	Not used
5	Not used
6	Not used
7	Not used
8	ON: dongle enabled

SW6 Various functions

Table: 11.23 Dip-switch bank SW6 various functions

Dip-switch	Function								
1	ON: Local Kill								
2	ON: E2P init								
3	ON: Lock in boot-loader								
4	Not used								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

SW7

Not used.

11.5.4 LEDs

Table: 11.24 LMC LED RUN light functions

LED	Function
DS1	J-Bus A – isolated 5 V present
DS2	J-Bus B – isolated 5 V present
DS3	Local Bus – isolated 5 V present
DS4	Local Bus – TXD
DS5	Sync line signal
DS6	Local Bus – RXD
DS7	J-Bus A – RXD
DS8	J-Bus A – TXD
DS9	J-Bus B – RXD
DS10	J-Bus B – TXD
DS11	Micro controller - RUN

11.5.5 Two/four wire communication

Table: 11.25 Two-wire communication

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Line termination 150 Ohm. Set this ON only for the last equipment on the databus.
3	ON: Transmit / E – pull down 680 Ohm
4	OFF = 2 wire

Table: 11.26 Four-wire communication

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm. Set this ON only for the last equipment on Bus A.
3	ON: Transmit / E – pull down 680 Ohm
4	ON = 4 wire
5	ON: Receive / R – pull up 680 Ohm
6	ON: Receive / R – Line termination 150 Ohm. Set this ON only for the last equipment on Bus A.
7	ON: Receive / R – pull down 680 Ohm

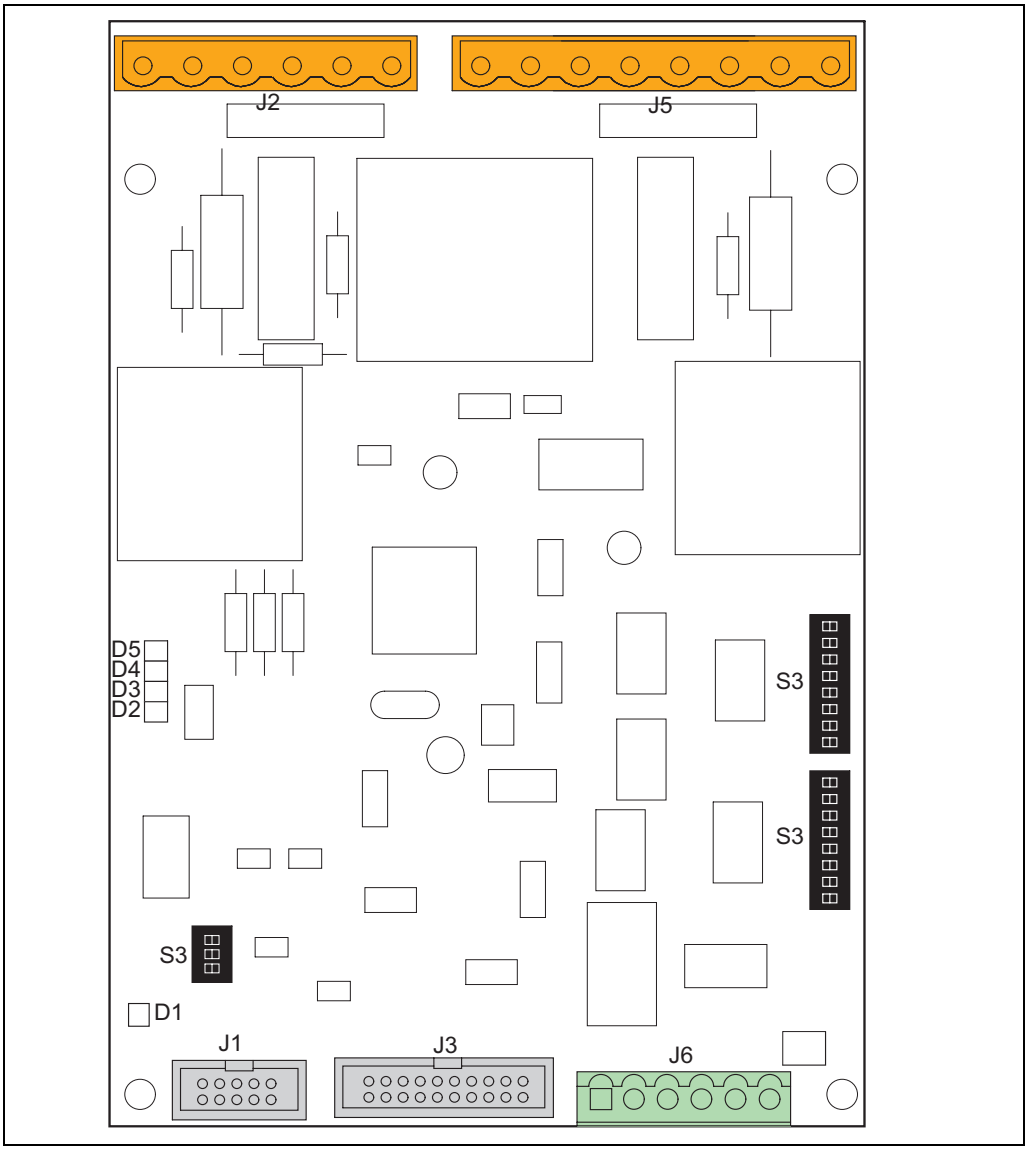
11.5.6 Line termination

J-Bus communication for Bus A and Bus B must be separately closed at the last equipment of a set of many equipments. With a dual databus, Bus A and Bus B must be closed separately.

Note
With a dual databus, the physical route of Bus A and Bus B must go in opposite directions. This means that first equipment for Bus A is the last equipment for Bus B.

11.6 Thyristor Block Module (TBM) - PCB1517

11.6.1 Printed Circuit Board (PCB)



11.6.2 Connectors

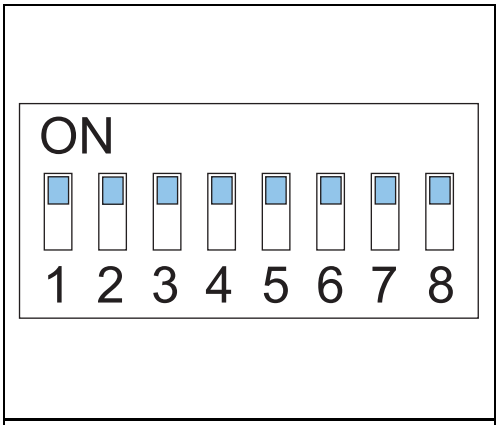
Table: 11.27 TBM connectors

Connector	Type	Connection to
J1	10-pin, flat connector, grey	Local bus
J2	6-pin WAGO, orange	Not in use
J3	6-pin Phoenix contact, green	CCL PCB
J5	20-pin, flat connector, grey	Thyristor bank
J6	8-pin WAGO, orange	Power supply

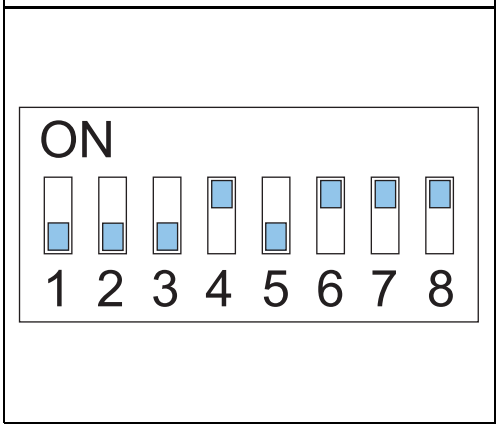
11.6.3 Dip-switches

Factory setting of the dip- switches:S1 - all ONS2 - 1:OFF 2:OFF 3:OFF 4:ON 5:OFF 6:ON 7:ON 8:ON

SW1:



SW2:



S1 Local Bus - Line termination

Table: 11.28 Dip-switch bank S1 local bus line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm

S2 Various functions

Table: 11.29 Dip-switch bank S2 various functions

Dip- switch	Function								
1	Recall default parameters								
2	CCL-TBM communication, parity: For 115200 Bd: 0 = even / 1 = odd For 38400 Bd: 0 = even / 1 = no parity								
3	ON: Lock in boot-loading mode								
4	CCL-TBM communication, baudrate: 0 = 115200 Bd / 1 = 38400 Bd								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

S3 Various functions

Not in use.

11.6.4 LEDs

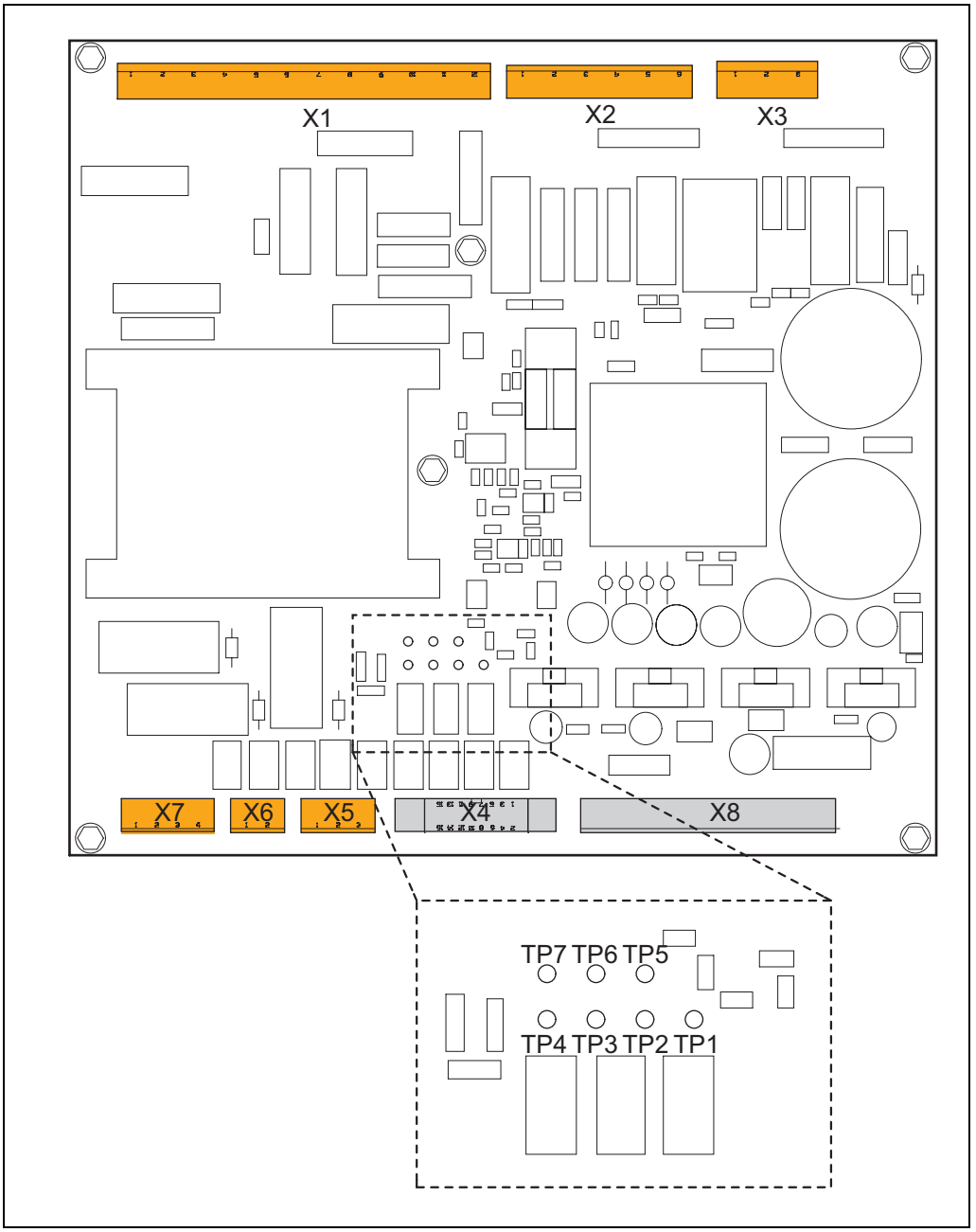
Table: 11.30 TBM LED RUN light functions

LED	Function
D1	Local Bus – isolated 5 V present
D2	Micro controller – RUN
D3	Local Bus – TXD
D4	Local Bus – TXD
D5	Local Bus – enabled

11.7 Power Supply Logic (PSL) - PCB1521

11.7.1 Printed Circuit Board (PCB)

CAUTION
To prevent any damage or electrical shock on the Capacitor, discharge the Capacitor with the power resistor. The capacitor remains charged at about 70 V DC a long time after the equipment is disconnected from the power supply. The remaining energy in the capacitor is approximately 2 Joule. Use a resistor of about 1000 Ohm / 3 W across the capacitor terminals to discharge the capacitor to below 24 V.



11.7.2 Connectors

Table: 11.31 PSL connectors

Connector	Connection to
X1	Power input supply
X2	SCO to X2 (option). If the equipment does not have a SCO, make the connector jumpered.
X3	Power output to the MW boards
X4	CCL
X5	Current transformer
X6	Overvoltage protection (MOV1)
X7	Back-indication signals ON and REG.ERR (optional)
X8	DC power distribution

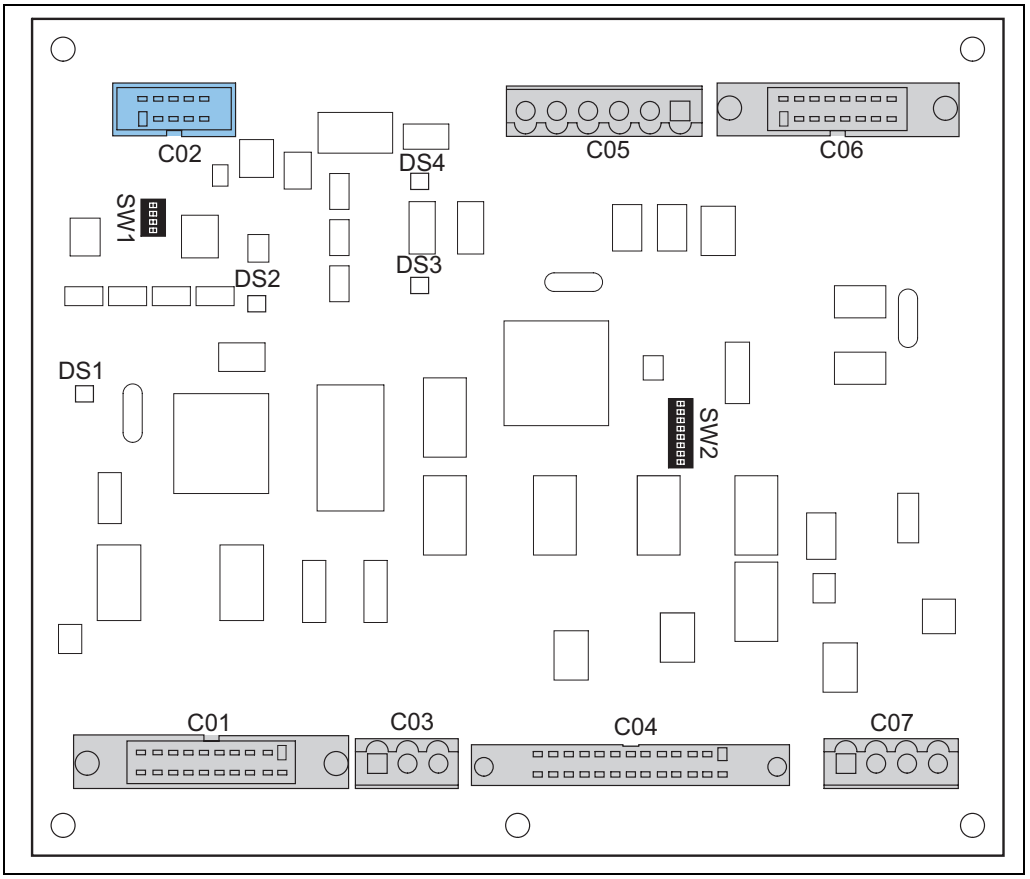
11.7.3 Test points

Table: 11.32 PSL test points

Test point	Function
TP1	+12 V DC - Relay control common
TP2	Ground, relative to +12 V DC signal
TP3	Relay control signal - K1 (main contactor)
TP4	Relay control signal - K2 (regulation error)
TP5	Relay control signal - K3 (SCO locking)
TP6	5 V AC1 - input voltage reference, AC signal
TP7	5 V AC2 - input voltage reference, AC signal

11.8 Current Control Logic (CCL) - PCB1516

11.8.1 Printed Circuit Board (PCB)



11.8.2 Connectors

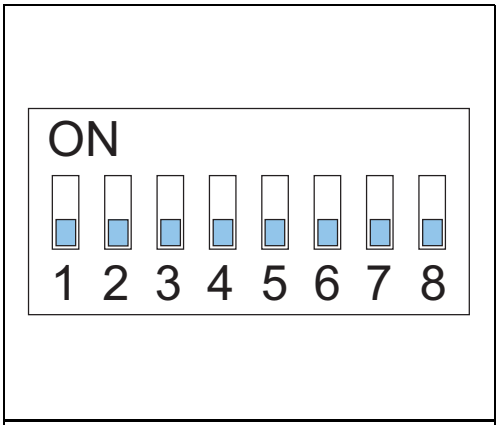
Table: 11.33 CCL connectors

Connector	Type	Connection to
C01	20-pin, flat connector, grey	TBM PCB
C02	10-pin, flat connector, blue	Local bus
C03	3-pin WAGO, grey	LFD PCB
C04	26-pin, flat connector, grey	CS PCB
C05	4-pin WAGO, grey	Power supply
C06	16-pin, flat connector, grey	Power supply
C07	6-pin WAGO, grey	Current transformer

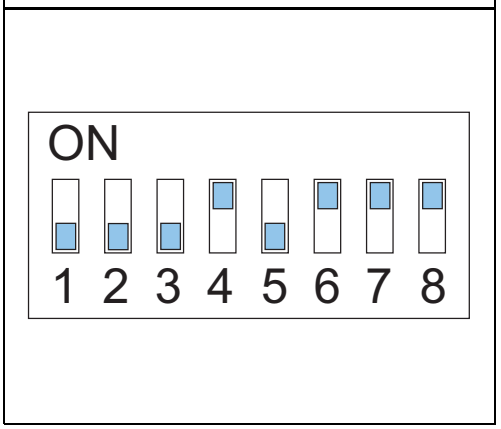
11.8.3 Dip-switches

Factory setting of the switches:

SW1:



SW2 (00010111)



SW1 Local Bus - Line termination

Table: 11.34 Dip-switch bank SW1 local bus line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm

SW2 Various functions

Table: 11.35 Dip-switch bank SW2 various functions

Dip-switch	Function								
1	Recall default parameters								
2	CCL-TBM communication, parity: For 115200 Bd: 0 = even / 1 = odd For 38400 Bd: 0 = even / 1 = no parity								
3	ON: Lock in boot-loading mode								
4	CCL-TBM communication, baudrate: 0 = 115200 Bd / 1 = 38400 Bd								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

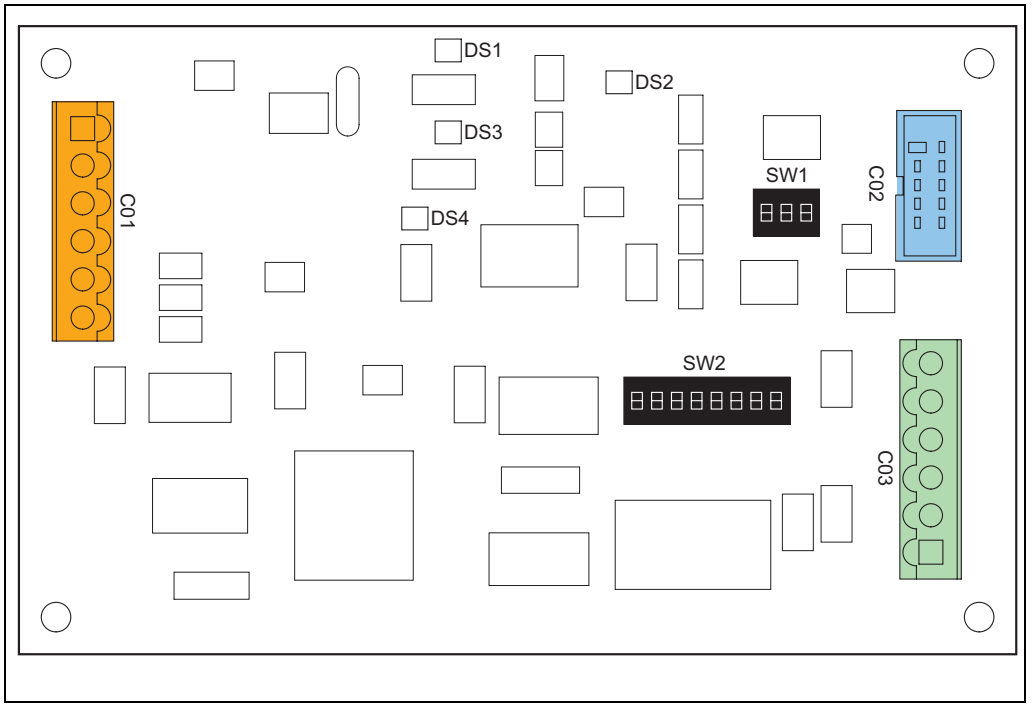
11.8.4 LEDs

Table: 11.36 CCL LED RUN light functions

LED	Function
D1	Micro controller – RUN
D2	Local Bus – isolated 5 V present
D3	Local Bus – TXD
D4	Local Bus – TXD

11.9 Lamp Fault Detection (LFD) - PCB1519 (option)

11.9.1 Printed Circuit Board (PCB)



11.9.2 Connectors

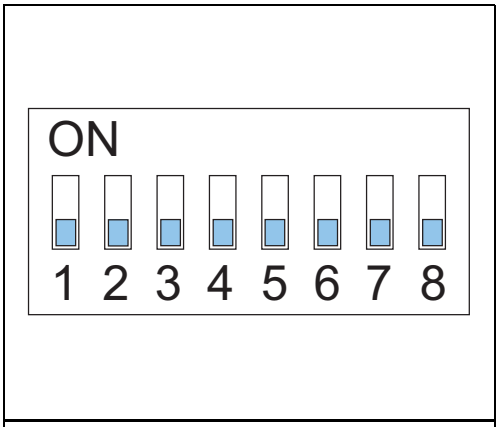
Table: 11.37 LFD connectors

Connector	Connection to
C01	Output measurement transformer
C02	Local bus
C03	Power supply

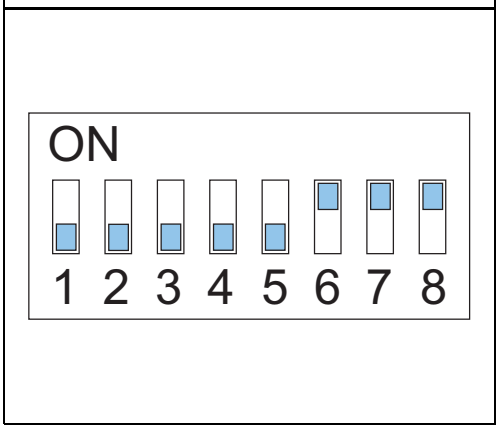
11.9.3 Dip-switches

Factory setting of the switches:

SW1: (all OFF)



SW2:



SW1 Local Bus - Line termination

Table: 11.38 Dip-switch bank SW1 local bus line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm
4	Not used

SW2 Various functions

Table: 11.39 Dip-switch SW2 various functions

Dip-switch	Function								
1	Not used								
2	Not used								
3	ON: Lock in boot-loading mode								
4	Not used								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

11.9.4 LEDs

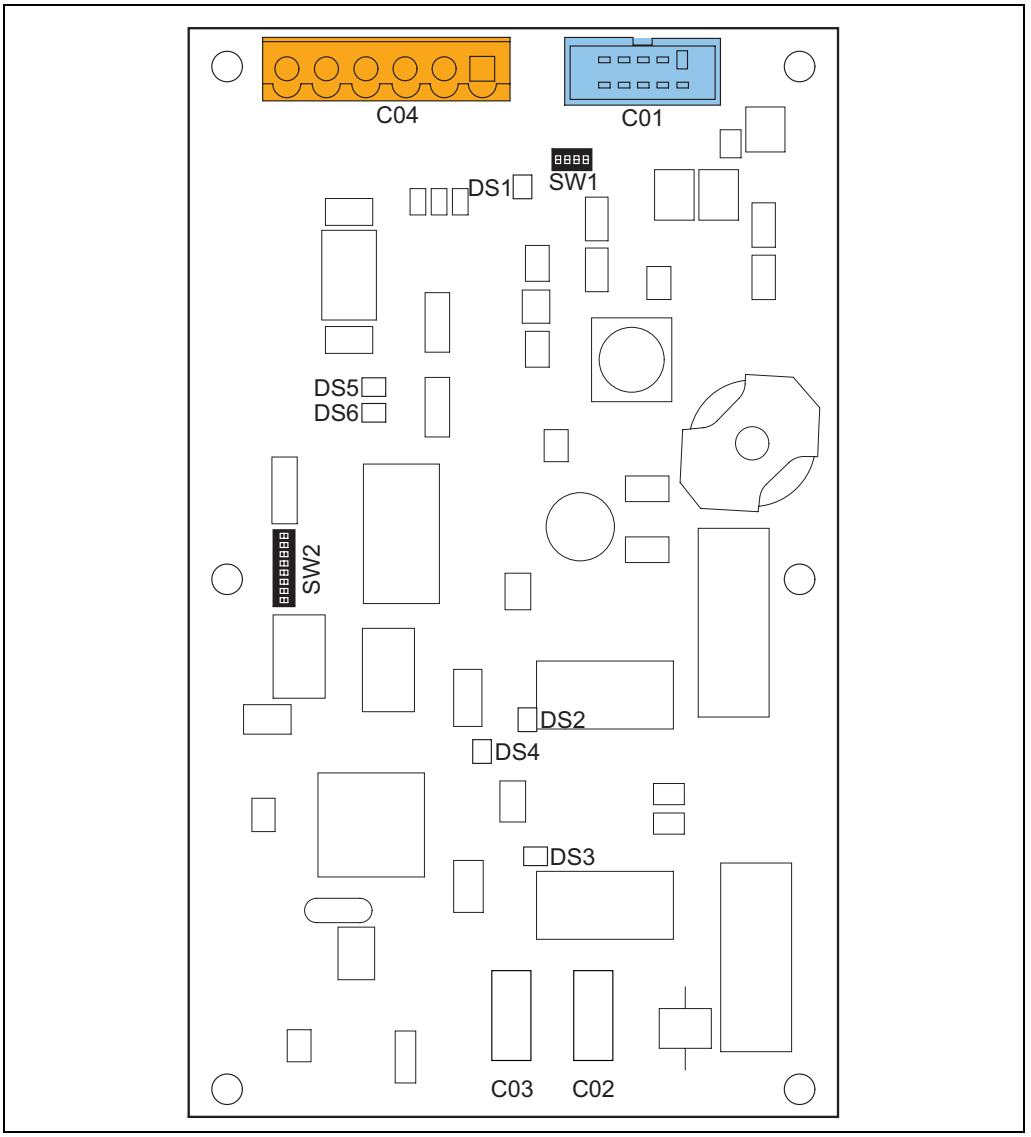
Table: 11.40 LFD LED RUN light functions

LED	Function
DS1	Micro controller – RUN
DS2	Local Bus – isolated 5 V present
DS3	Local Bus –TXD
DS4	Local Bus – RXD

11.10 Earth Fault Detection (EFD) - PCB1514 (option)

WARNING
Be careful when you handle the EFD PCB.
The EFD produces a voltage of 500 V DC. This voltage is connected to the output circuit of the equipment, thus all high-voltage components have this voltage level relative to ground.

11.10.1 PCB board



11.10.2 Connectors

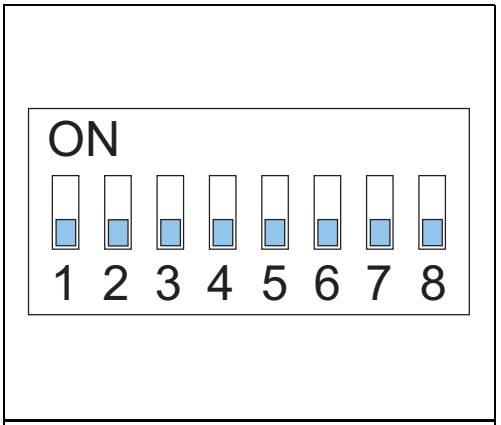
Table: 11.41 EFD connectors

Connector	Connection to
C01	Power supply
C02	High-voltage connection from the resistor to C02
C03	PE
C04	Local bus

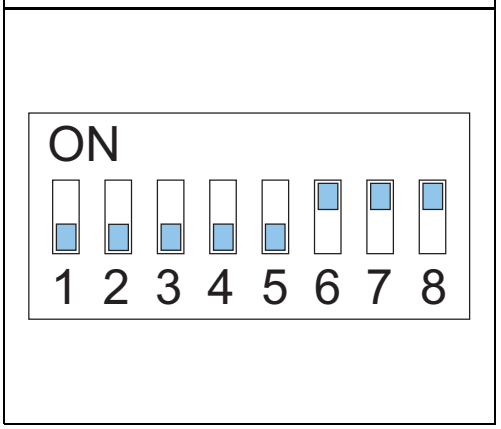
11.10.3 Dip-switches

Factory setting of the dip-switches:

SW1 (all OFF):



SW2:



SW1 Local Bus - Line termination

Table: 11.42 Dip-switch bank SW1 local bus line termination

Dip-switch	Function
1	ON: Transmit / E – pull up 680 Ohm
2	ON: Transmit / E – line termination 150 Ohm
3	ON: Transmit / E – pull down 680 Ohm
4	Not used

SW2 Various functions

Table: 11.43 Dip-switch bank SW2 various functions

Dip-switch	Function								
1	Not used								
2	Not used								
3	ON: Lock in boot-loading mode								
4	Not used								
5	Local Bus - baudrate:	0	9600 Bd	1	19200 Bd	0	38400 Bd	1	9600 Bd
6		0		0		1		1	
7	Local Bus - parity:	0	NO parity	1	NO parity	0	ODD parity	1	EVEN parity
8		0		0		1		1	

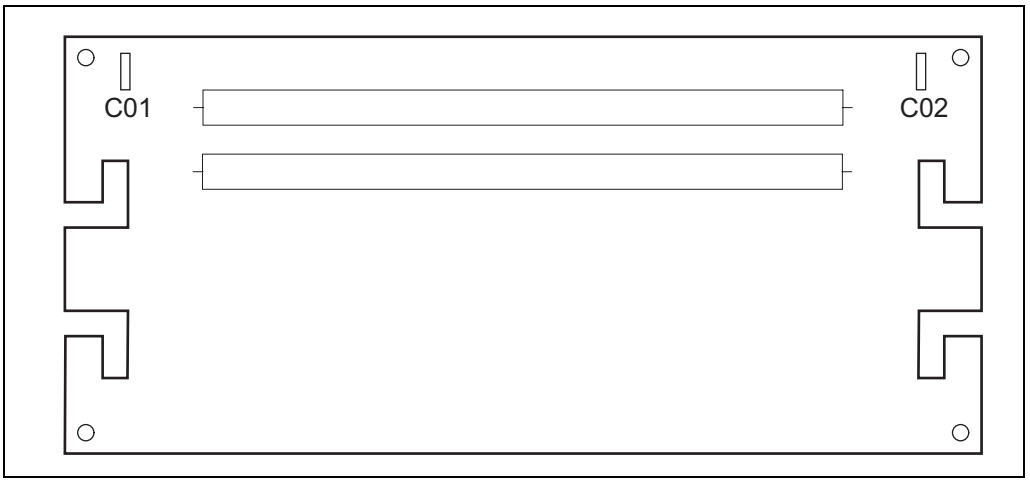
11.10.4 LEDs

Table: 11.44 EFD LED RUN light functions

LED	Function
DS1	Local Bus – isolated 5 V present
DS2	Ohm-test activated
DS3	Output disconnected
DS4	Micro controller – RUN
DS5	Local Bus –TXD
DS6	Local Bus – RXD

11.11 Earth Fault Detection (EFD)-Resistor - PCB1515 (option)

11.11.1 Printed Circuit Board (PCB)



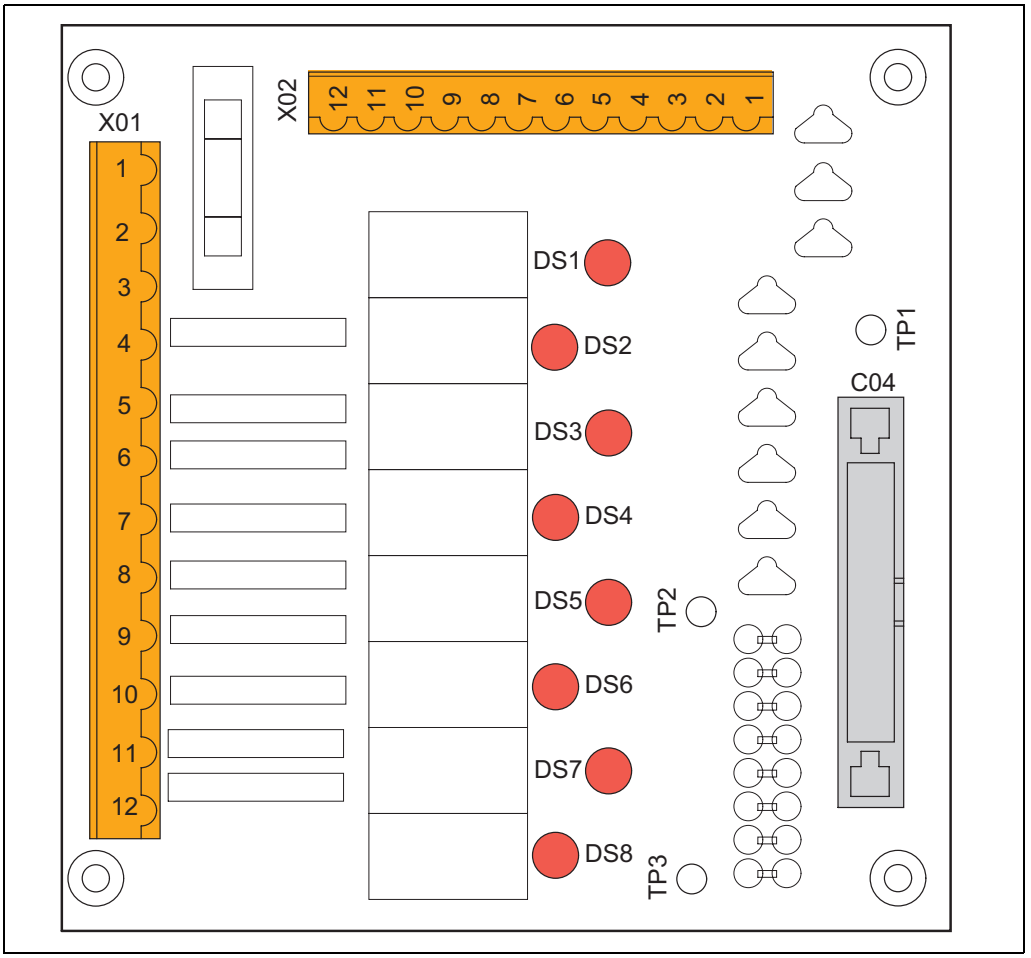
11.11.2 Connectors

Table: 11.45 EFD-Res connectors

Connector	Connection to
C01	EFD
C02	Output terminal

11.12 Circuit Selector – PCB1523 (option)

11.12.1 Printed Circuit Board (PCB)



11.12.2 Connectors

Table: 11.46 CS connectors

Connector	Connection to
X01	Control and power
X02	Feedback connection from the contactors
C04	CCL

11.12.3 Test points

Table: 11.47 CS test points

Test point	Function
TP1	Ground, relative to +12 V DC signal
TP2	+12 V DC signal for relay control – K1 to K4
TP3	+12 V DC signal for relay control – K5 to K8

11.12.4 LEDs

Table: 11.48 CS LED RUN light functions

LED	Function
DS1	Relay K1 energized / Circuit 1 short-circuited
DS2	Relay K2 energized / Circuit 2 short-circuited
DS3	Relay K3 energized / Circuit 3 short-circuited
DS4	Relay K4 energized / Circuit 4 short-circuited
DS5	Relay K5 energized / Circuit 5 short-circuited
DS6	Relay K6 energized / Circuit 6 short-circuited
DS7	Relay K7 energized / Circuit 7 short-circuited
DS8	Relay K8 energized / Circuit 8 short-circuited

12 Technical data

12.1 Technical characteristics

Table: 12.1 Technical characteristics

Item	2.5 to 10 kVa	15 to 30 kVA
Rated powers [kVA]	2.5 / 4 / 5 / 7.5 / 10	15 / 20 / 25 / 30
Rated input voltage [V] [1] [2]	FAA: 220 / 230 / 240 / 380 / 400 (± 15%) IEC: 230/ 400 (± 15%)	
Rated frequencies [Hz]	50 / 60 (± 7.5%)	

Current regulation limits	Current regulation is guaranteed under the following conditions (±1.5%):
	- A minimum of 30% of lamp transformers with an open circuit in their secondary side. This is for a range from half-load to full-load.
	- For nominal input voltage:
	  - IEC: ± 10%
	  - FAA: + 10% / -5%
	
	Operation from -5% to -15% (FAA) or from -10% to -15% (IEC) of nominal input voltage with full load can cause output current to be too low at the maximum brightness step.
	
	Operation at +15% of the nominal input voltage is restricted to a maximum period of 1 hour. This helps to prevent that components become overheated or overstressed.	

Output current [A]	6.6	
Remote control and monitoring	Multiwire, single or dual wire industrial field bus (J-Bus), or the two combined	
Net weight [kg][3]		
Maximum	380	380
2.5 kVA	57	
4 kVA	103	
5 kVA	120	
7.5 kVA	123	
10 kVA	155	
15 kVA		220
20 kVA		235
25 kVA		250
30 kVA		303
crate	40	50
CS cabinet (option)	50	15

1) 25 and 30 kVA, only for 380/ 400/ 415 V.
2) Some readjustments are possible in the ranges 220 - 240 V and 380 - 415 (420 V). For readjustments, contact ADB.
3) The net weights depend on the chosen configuration.

12.2 Applicable standards

The equipment is in accordance with these standards:

Table: 12.2 Applicable standards

Standard	Description
ICAO	Aerodrome Design Manual, Part 5 paragraphs 3.2.1.4/5/6
FAA	AC 150/5345-10F and L829
IEC	IEC 61822

12.3 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).

12.4 Output circuit values

Rated power [kVA]	Output current [A]	Max. RMS output voltage [V]	Dielectric test on output circuit [V][1]	Max. open circuit RMS output [V][2]	Max. open circuit peak voltage [V][3]
2.5	6.6	378	1895	530	750
4	6.6	606	3030	850	1200
5	6.6	757	3790	1060	1500
7.5	6.6	1136	5680	1590	2250
10	6.6	1515	7575	2120	3000
15	6.6	2272	11360	3180	4490
20	6.6	3030	15150	4240	5990
25	6.6	3788	18940	5300	7490
30	6.6	4545	22730	6360	8990
25	20	1250	6250	1750	2470
30	20	1500	7500	2100	2970

1) 50 Hz RMS voltage during 1 minute.
2) Under worst condition, considered 1.4 times maximum RMS output voltage.
3) Under worst condition, considered 1.4 times maximum RMS output voltage.

12.5 Dimensions

The small cabinet (A) and the big cabinet (B):

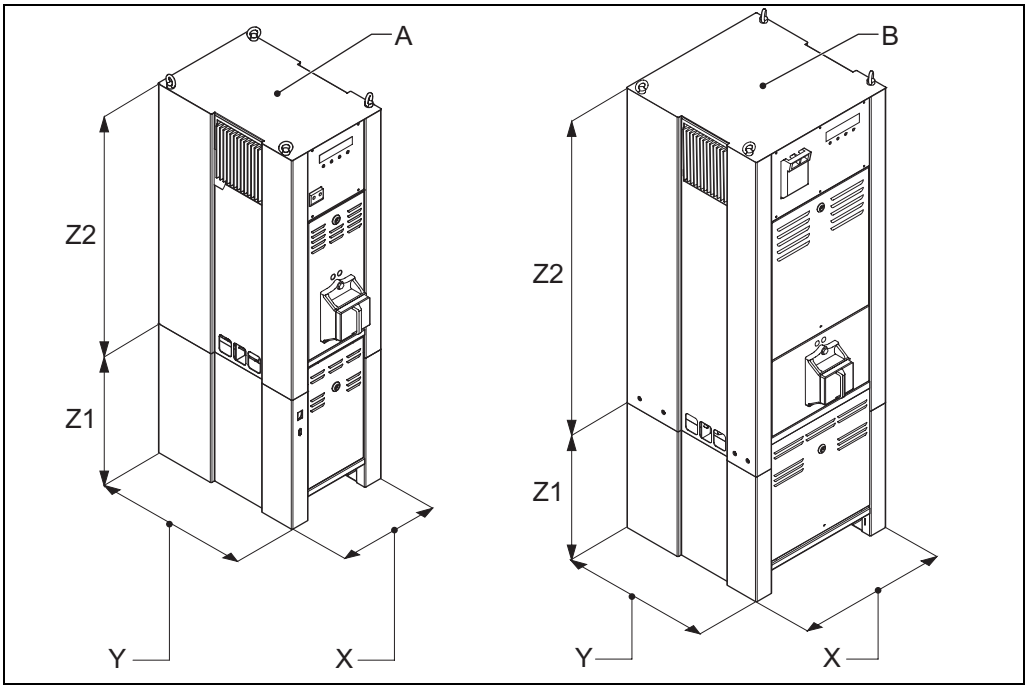


Table: 12.3 Dimensions

Item	A - 2.5 to 10 kVa	B - 15 to 30 kVA
X [mm]	400	600
Y [mm]	600	600
Z1 [mm]	500	500
Z2 [mm]	930	1280
Dimensions with options [mm] Wheels Lifting lugs CS Bolts M12	 Height + 100 Height + 50 Height + 500 Height + 15	

12.6 Ambient conditions

The equipment is air-cooled without fans. Thus, the equipment must have a good airflow, especially if they operate near the maximum temperature.

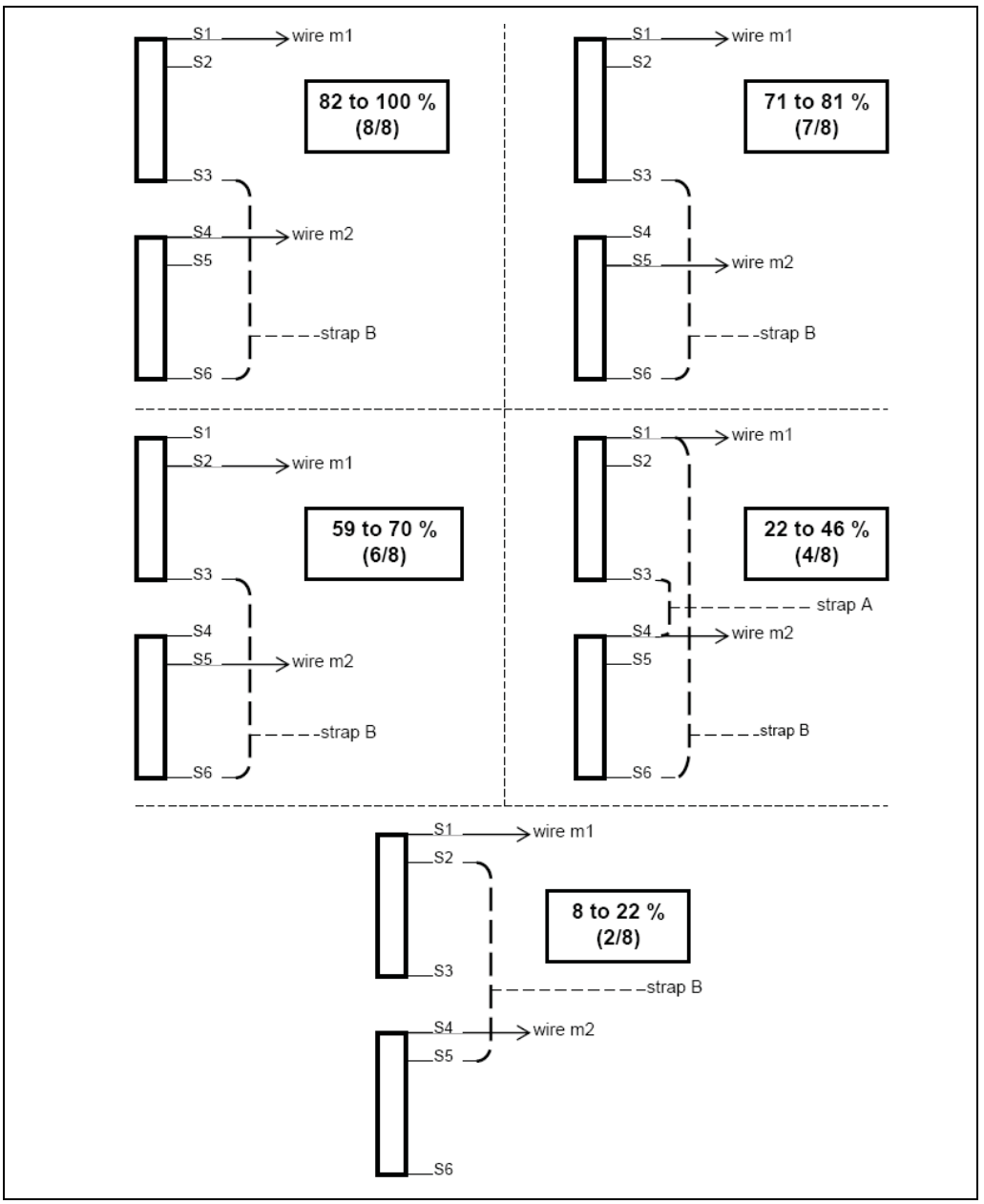
Table: 12.4 Ambient conditions

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

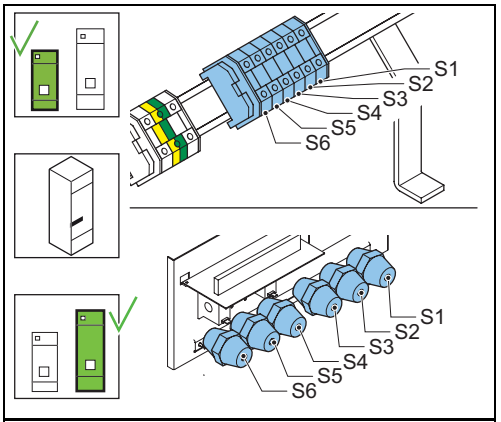
12.7 Taps

12.7.1 Tap setting connections

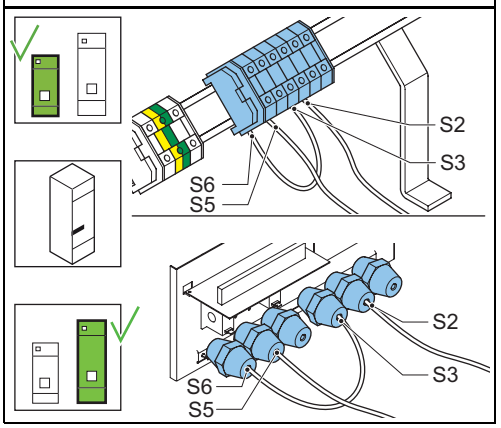
The figure shows the wire connections for different taps.



Overview of the taps:



Example: correct tap 6/8 setting for:
- 7.5 kVA equipment;
- Supply voltage: 380 V;
- Measured voltage reading on the terminals of fuse holder F3: 210 V.



12.7.2 Tap selection tables

Table: 12.5 Tap settings for 2.5 kVA equipment

2.5 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	199-175	208-183	217-191	343-301	360-316	378-332	8/8
	100-51	104-53	108-55	171-87	180-91	189-96	4/8

Table: 12.6 Tap settings for 4 kVA equipment

4 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	199-175	208-183	217-191	343-301	360-316	378-332	8/8
	174-150	182-157	190-164	300-258	315-271	331-285	7/8
	149-101	156-105	163-109	257-172	270-181	284-190	6/8
	100-51	104-53	108-55	171-87	180-91	189-96	4/8
	50-0	52-0	54-0	86-0	90-0	95-0	2/8

Table: 12.7 Tap settings for 5 kVA equipment

5 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	199-176	208-184	217-192	343-302	360-318	378-334	8/8
	174-151	182-158	191-164	301-259	317-273	333-287	7/8
	150-101	157-105	163-110	258-173	272-182	286-191	6/8
	100-51	104-53	109-55	172-87	181-91	190-96	4/8
	50-0	52-0	54-0	86-0	90-0	95-0	2/8

Table: 12.8 Tap settings for 7.5 kVA equipment

7.5 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	201-177	210-185	219-193	347-304	365-320	383-336	8/8
	176-152	184-159	192-165	303-261	319-275	335-289	7/8
	151-101	158-106	164-111	260-174	274-184	288-193	6/8
	100-51	105-53	110-56	173-88	183-92	192-97	4/8
	50-0	53-0	55-0	87-0	91-0	96-0	2/8

Table: 12.9 Tap settings for10 kVA equipment

10 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	200-176	210-185	220-193	346-303	366-321	386-339	8/8
	175-151	184-158	192-166	302-260	320-275	338-290	7/8
	150-101	157-106	165-111	259-174	274-184	289-194	6/8
	100-51	105-53	110-56	173-87	183-92	193-97	4/8
	50-0	52-0	55-0	86-0	91-0	96-0	2/8

Table: 12.10 Tap settings for 15 kVA equipment

15 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	121-186	221-194	230-202	364-320	383-336	401-352	8/8
	185-160	193-167	201-173	319-274	335-288	351-302	7/8
	159-104	166-111	172-116	273-183	287-192	301-201	6/8
	106-54	110-56	115-58	182-92	191-97	200-101	4/8
	51-0	55-0	57-0	91-0	96-0	100-0	2/8

Table: 12.11 Tap settings for 20 kVA equipment

20 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	211-185	221-195	223-204	368-323	384-337	405-355	8/8
	184-156	194-167	203-175	322-277	336-289	354-305	7/8
	158-106	166-112	174-117	276-185	288-193	304-204	6/8
	105-54	111-56	116-59	184-93	192-97	203-102	4/8
	51-0	55-0	58-0	92-0	96-0	101-0	2/8

Table: 12.12 Tap settings for 25 kVA equipment

25 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	-	-	-	364-320	382-335	399-350	8/8
	-	-	-	319-274	334-287	349-300	7/8
	-	-	-	273-183	286-192	299-200	6/8
	-	-	-	182-92	191-96	199-101	4/8
	-	-	-	91-0	95-0	100-0	2/8

Table: 12.13 Tap settings for 30 kVA equipment

30 kVA	Supply voltage [V]						Tap setting
	220	230	240	380	400	415	
Measured voltage [V]	-	-	-	370-324	388-341	407-357	8/8
	-	-	-	323-278	340-292	356-306	7/8
	-	-	-	277-186	291-195	305-205	6/8
	-	-	-	185-93	194-98	204-103	4/8
	-	-	-	92-0	97-0	102-0	2/8

12.7.3 Tap maximum output voltages

Table: 12.14 Maximum output voltages with the corresponding tap setting

Equipment type [kVA] / Iout [A]	Tap setting				
	8/8	7/8	6/8	4/8	2/8
2.5 / 6.6	378	-	-	190	-
4 / 6.6	606	530	450	300	150
5 / 6.6	757	660	565	375	185
7.5 / 6.6	1136	990	850	565	280
10 / 6.6	1515	1320	1130	755	375
15 / 6.6	2272	1980	1695	1130	560
20 / 6.6	3030	2645	2260	1505	745
25 / 6.6	3788	3305	2825	1880	935
30 / 6.6	4545	3965	3390	2255	1120
25 / 20	1250	1090	930	620	310
30 / 20	1500	1310	1120	745	370

12.8 Parts list

12.8.1 General

WARNING
Use only original ADB 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.

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 or our local representative.

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 or equipments.
Keep spare parts always in stock. For example:
- Fuses;
- Lightning arrestors;
- PCBs;
- Terminals;
- Connectors;
- Fused switches.

12.8.2 Standard Printed Circuit Boards (PCBs)

Table: 12.15 Standard PCBs

Item	Description	Part number	Quantity per order
UI	PCB1507 - User Interface	1593.14.000	1
LMC	PCB1513 - Local Master Circuit	1593.14.113	1
CCL	PCB1516 - Current Control Logic	1590.03.541	1
TBM	PCB1517 - Thyristor Block Module	1593.14.213	1
PSL	PCB1521 - Power Supply Logic	1593.14.402	1

Note
The PCBs must be loaded with customised firmware.

12.8.3 Optional Printed Circuit Boards (PCBs)

Table: 12.16 Optional PCBs

Item	Description	Part number	Quantity per order
MW1, MW2, MW3	PCB1486.1 - LMC Multiwire 24V remote control interface	1593.13.510	1
MW1, MW2, MW3	PCB1486.2 - LMC Multiwire 48V remote control interface	1593.13.520	1
JB	PCB1502 - J-Bus Interface	1590.03.490	1
EFD	PCB1514 - Earth Fault Detector, logic board	1590.03.521	1
EFD Res.	PCB1515 - Earth Fault Detector, resistor board	1590.03.530	1
LFD	PCB1519 - Lamp Fault Detector, logic board	1590.03.551	1
CS	PCB1523 - CS PCB	1590.03.561	1
Dongle	Dongle with MCR3 Calibration Software	1444.00.030	1

Note
The PCBs must be loaded with customised firmware.

12.8.4 Firmware versions of PCBs

Table: 12.17 Official firmware version of PCBs

Item	Latest firmware version
Dongle	2.00
LMC	2.01
CCL	2.01
TBM	2.00
LFD	2.00

Note
The firmware versions show the latest version available at the time of writing of this manual.

12.8.5 Power components, input

Parts

Table: 12.18 Power input components

Item	Description	Part number	Quantity per order
Fused switch F1	5SG7 fused switch - fuse interrupter for Neozed fuses (small cabinet)	6132.00.212	10
Fused switch F1	Input fuse 20 A - Neozed for 5SG7 fused switch	6130.54.460	2
Fused switch F1	Input fuse 25 A - Neozed for 5SG7 fused switch	6130.57.360	2
Fused switch F1	Input fuse 35 A - Neozed for 5SG7 fused switch	6130.61.363	2
Fused switch F1	Input fuse 50 A - Neozed for 5SG7 fused switch	6130.63.363	2
Fused switch F1	Input fuse 63 A - Neozed for 5SG7 fused switch	6130.66.270	2
Fused switch F1	NH00 fused switch - fuse interrupter (big cabinet)	6132.00.220	2
Fused switch F1	Input fuse 63 A NH00, for NH00 fused switch	6130.66.280	2
Fused switch F1	Input fuse 80 A NH00, for NH00 fused switch	6130.68.330	2
Fused switch F1	Input fuse 100 A NH00, for NH00 fused switch	6130.71.280	2
Fused switch F1	Input fuse 125,A NH00, for NH00 fused switch	6130.75.330	2
Fused switch F2, F3	Fuse holder for symmetric rail 35 mm, fuses DIA 6.3 L 32	6112.45.203	2
Wiring bridge	Bridge to connect F2 and F4 (option)	6112.30.040	2

Item	Description	Part number	Quantity per order
Fused switch F2, F3	Fuse M1.6 A HBC DIA 6.3 L 32 (medium)	6130.27.005	10
Fused switch F4 (option)	Fuse T4 A HBC DIA 6.3 L 32 (slow-blow)	6130.37.180	10
PSL / F1 PSL / F2	Fuse T1A HBC DIA 5 L20 (slow-blow)	6130.26.134	10
CS - F1(option)	Fuse T4 A HBC DIA 5 L20 (slow-blow)	6130.37.132	10
MOV1/A, MOV1/B (option)	Lightning arrestor for mains input	6134.03.080	2
CS - T1(option)	Autotransformer 250 VA for CS	6300.03.160	1
K1	Main contactor up to 50 A	6148.45.580	1
K1	Main contactor for 63 A and 80 A	6148.45.630	1
K1	Main contactor for 100 A and 125 A	6148.45.600	1
For K1	Main contactor, RC coil protection - up to 80 A	6148.45.590	1
For K1	Main contactor, RC coil protection - 100 A and 125 A	6148.45.610	1
For K1	Mains filtering at contactor contacts, all power ratings	1481.02.640	1
T.I.1	Input current measurement transformer 200/0.2 A	1481.02.650	1
THP-1, THP-2	Thyristor pack CRPTT90GK (up to 50 A)	6351.85.320	1
THP-1, THP-2	Thyristor pack CRPTT165GK (above 50 A)	6351.85.330	1
Common mode choke	Common mode choke, ferrite core OC/2	1481.02.660	1

Fuse types

Table: 12.19 Internal and external fuses for 220 to 240 V (230 V IEC) equipments

Input supply voltage 220 to 240 V (230 V IEC)			
Output power [kVA]	**Fuse in fused switch**		**External fuse [A]**
	Rating [A]	**Type**	
2.5	20	Neozed	25
4	25	Neozed	35
5	35	Neozed	50
7.5	50	Neozed	63
10	63	Neozed	80
15	100	NH00	100
20	125	NH00	125

Table: 12.20 Internal and external fuses for 380 to 416 V (400 V IEC) equipments

Input supply voltage 380 to 416 V (400 V IEC)			
Output power [kVA]	**Fuse in fused switch**		**External fuse [A]**
	Rating [A]	**Type**	
2.5	20	Neozed	25
4	20	Neozed	25
5	20	Neozed	25
7.5	25	Neozed	35
10	35	Neozed	50
15	50	NH00	63
20	80	NH00	80
25	80	NH00	100
30	100	NH00	125

Thyristors and main contactor types

Table: 12.21 Thyristors and main contactors for 220 to 240 V (230 V IEC) equipments

Input supply voltage 220 to 240 V (230 V IEC)			
Output power (kVA)	**Current rating**	**Thyristor**	**Main contactor**
2.5	/01	CTT90GK12	3RT1326+3RT1926-1CD00
4	/01	CTT90GK12	3RT1326+3RT1926-1CD00
5	/01	CTT90GK12	3RT1326+3RT1926-1CD00
7.5	/01	CTT90GK12	3RT1326+3RT1926-1CD00
10	/02	CTT165GK12	3RT1336+3RT1936-1CD00
15	/03	CTT165GK12	3RT1344+3RT1936-1CD00
20	/03	CTT165GK12	3RT1344+3RT1936-1CD00

Table: 12.22 Thyristors and main contactors for 380 to 416 V (400 V IEC) equipments

Input supply voltage 380 to 416 V (400 V IEC)			
Output power (kVA)	**Current rating**	**Thyristor**	**Main contactor**
2.5	/01	CTT90GK12	3RT1326+3RT1926-1CD00
4	/01	CTT90GK12	3RT1326+3RT1926-1CD00
5	/01	CTT90GK12	3RT1326+3RT1926-1CD00
7.5	/01	CTT90GK12	3RT1326+3RT1926-1CD00

Input supply voltage 380 to 416 V (400 V IEC)			
Output power (kVA)	**Current rating**	**Thyristor**	**Main contactor**
10	/02	CTT90GK12	3RT1326+3RT1926-1CD00
15	/03	CTT90GK12	3RT1326+3RT1926-1CD00
20	/03	CTT165GK12	3RT1336+3RT1936-1CD00
25	/03	CTT165GK12	3RT1336+3RT1936-1CD00
30	/03	CTT165GK12	3RT1344+3RT1936-1CD00

12.8.6 Power components, output

Table: 12.23 Power output components

Item	Description	Part number	Quantity per order
LA1-LA2	Lightning arrestor type Siemens B32K750 for 2.5 kVA to 10 kVA - 6.6 A units	6314.32.750	2
LA1-LA2	Lightning arrestor type G.E. 3kV-XEP for 15 kVA - 6.6 A. units Qty 2x1 -	6134.03.322	2
LA1-LA2	Lightning arrestor type G.E. 6kV-XEP for 20 to 30 kVA-6.6 A. units Qty 2x1	6134.03.622	2
T.I.2, T.I.3	Output current measurement transformer for 6.6 A. 50 / 0.05 A	6302.03.180	1

12.8.7 Power components, transformers

Set the wires according to the input voltage of the equipment.

Table: 12.24 Power transformer components

Item	Description	Part number	Quantity per order
T1	Power transformer, 2.5 kVA, 6.6 A	1476.03.198	1
T1	Power transformer, 4 kVA, 6.6 A	1476.03.742	1
T1	Power transformer, 5 kVA, 6.6 A	1476.03.752	1
T1	Power transformer, 7.5 kVA, 6.6 A	1476.03.762	1
T1	Power transformer, 10 kVA, 6.6 A	1476.03.772	1
T1	Power transformer, 15 kVA, 6.6 A	1476.03.783	1
T1	Power transformer, 20 kVA, 6.6 A	1476.03.793	1
T1	Power transformer, 25 kVA, 6.6 A	1476.03.813	1
T1	Power transformer, 30 kVA, 6.6 A	1476.03.803	1
T1	Power transformer, 25 kVA, 20 A	1476.03.843	1
T1	Power transformer, 30 kVA, 20 A	1476.03.833	1

12.8.8 Power components, choke

Table: 12.25 Power choke components

Item	Description	Part number	Quantity per order
L1	Series choke, 2.5 kVA	1476.02.500	1
L1	Series choke, 4 kVA	1476.02.504	1
L1	Series choke, 5 kVA	1476.02.505	1
L1	Series choke, 7.5 kVA	1476.02.507	1
L1	Series choke, 10 kVA	1476.02.510	1
L1	Series choke, 15 kVA	1476.02.515	1
L1	Series choke, 20 kVA	1476.02.520	1
L1	Series choke, 25 kVA	1476.02.525	1
L1	Series choke, 30 kVA	1476.02.530	1

12.8.9 Circuit Selector (CS)

Table: 12.26 CS components

Item	Description	Part number	Quantity per order
SCO	Plug-in high voltage Cut-Out type SCO	1475.92.030	1
CS - K1…K8	High-voltage contactor, up to 1515 V / 6.6 A RMS	6148.47.510	1
CS - K1…K8	High-voltage contactor, up to 4545 V / 6.6 A or 1515 V / 20A RMS	6148.45.229	1
CS - K1…K8, RC coil protection	RC coil protection, for contactors up to 1515 V RMS	6148.98.250	1
CS - K1…K8, RC coil protection	RC coil protection, for contactors up to 4545 V / 6.6 A or 1515 V / 20A RMS	6148.45.238	1
CS - K1…K8, Auxiliary contact	Auxiliary contact, for contactors up to 1515 V RMS	6148.45.484	1
CS - K1…K8, Auxiliary contact	Auxiliary contact, for contactors up to 4545 V / 6.6 A or 1515 V / 20 A RMS	6148.45.236	1

12.8.10 Hardware

Table: 12.27 Hardware components

Item	Description	Part number	Quantity per order
Wheels (optional)	Fixed Wheel	7015.35.241	2
Wheels (optional)	Wheel with lock	7015.35.251	2
Lifting lugs (optional)	Lifting lugs M12	7015.20.120	4
PCB	Standoffs for PCBs M3 L10	7510.08.300	10
PCB	Nut Hex M3 for PCB mounting	7154.04.010	100
Wiring	Cable clamp, for cable diameter up to 8 mm	6126.83.810	10
Wiring	Cable clamp, for cable diameter from 7 up to 16 mm	6126.83.820	10

12.8.11 Connectors

Table: 12.28 Connectors

Item	Description	Part number	Quantity per order
PSL/X7	Spring clamp terminal box 4-pole	6112.32.517	1
MW1-2 or 3 / P1 or P2	Spring clamp terminal box 12-pole	6112.33.112	1
JB / P1, P2, P3 or P4	Spring clamp terminal box 6-pole	6112.32.518	1
Cage-clamp	Connector accessory, operating lever, 231-131	6112.32.500	10

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