ASG 8000i Thyristor CCR

Constant Current Regulator

User Manual

UM-6010, Rev. 0.9.6, 2026-02-13

ADB SAFEGATE

A.0 Disclaimer / Standard Warranty

CE certification

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

ETL certification

The equipment listed as ETL certified means that the product complies with the essential requirements concerning safety and C22.2 No.180:13 (R2018) regulations. The CSA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

All Products Guarantee

ADB SAFEGATE will correct by repair or replacement per the applicable guarantee below, at its option, equipment or parts which fail because of mechanical, electrical or physical defects, provided that the goods have been properly handled and stored prior to installation, properly installed and properly operated after installation, and provided further that Buyer gives ADB SAFEGATE written notice of such defects after delivery of the goods to Buyer. Refer to the Safety section for more information on Material Handling Precautions and Storage precautions that must be followed.

ADB SAFEGATE reserves the right to examine goods upon which a claim is made. Said goods must be presented in the same condition as when the defect therein was discovered. ADB SAFEGATE furthers reserves the right to require the return of such goods to establish any claim.

ADB SAFEGATE's obligation under this guarantee is limited to making repair or replacement within a reasonable time after receipt of such written notice and does not include any other costs such as the cost of removal of defective part, installation of repaired product, labor or consequential damages of any kind, the exclusive remedy being to require such new parts to be furnished.

ADB SAFEGATE's liability under no circumstances will exceed the contract price of goods claimed to be defective. Any returns under this guarantee are to be on a transportation charges prepaid basis. For products not manufactured by, but sold by ADB SAFEGATE, warranty is limited to that extended by the original manufacturer. This is ADB SAFEGATE's sole guarantee and warranty with respect to the goods; there are no express warranties or warranties of fitness for any particular purpose or any implied warranties of fitness for any particular purpose or any implied warranties other than those made expressly herein. All such warranties being expressly disclaimed.

Standard Products Guarantee

Products manufactured by ADB SAFEGATE are guaranteed against mechanical, electrical, and physical defects (excluding lamps) which may occur during proper and normal use for a period of two years from the date of ex-works delivery, and are guaranteed to be merchantable and fit for the ordinary purposes for which such products are made.

Note

See your applicable sales agreement for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

FAA Certified products manufactured by ADB SAFEGATE

ADB SAFEGATE L858 Airfield Guidance Signs are warranted against mechanical and physical defects in design or manufacture for a period of 2 years from date of installation, per FAA AC 150/5345-44 (applicable edition).

ADB SAFEGATE LED products (with the exception of obstruction lighting) are warranted against electrical defects in design or manufacture of the LED or LED specific circuitry for a period of 4 years from date of installation, per FAA EB67 (applicable edition). These FAA certified constant current (series) powered LED products must be installed, interfaced and powered with and through products certified under the FAA Airfield Lighting Equipment Program (ALECP) to be included in this 4 (four) year warranty. This includes, but is not limited to, interface with products such as Base Cans, Isolation Transformers, Connectors, Wiring, and Constant Current Regulators.

Note

See your sales order contract for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

Liability

WARNING

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

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

Unintended uses, includes the following actions:

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

Copyright Statement

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1.0 Safety

Introduction to Safety

This section contains general safety instructions for installing and using ADB SAFEGATE equipment. Some safety instructions may not apply to the equipment in this manual. Task- and equipment-specific warnings are included in other sections of this manual where appropriate.

1.1 Safety Messages

HAZARD Icons used in this manual

For all HAZARD symbols in use, see the Safety section. All symbols must comply with ISO and ANSI standards.

Carefully read and observe all safety instructions in this manual, which alert you to safety hazards and conditions that may result in personal injury, death or property and equipment damage and are accompanied by the symbols shown below.

	WARNING Failure to observe a warning may result in personal injury, death or equipment damage.
	DANGER – Risk of electrical shock or ARC FLASH Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage. ARC Flash may cause blindness, severe burns or death.
	WARNING – Wear personal protective equipment Failure to observe may result in serious injury.
	WARNING – Do not touch Failure to observe this warning may result in personal injury, death, or equipment damage.
	CAUTION Failure to observe a caution may result in equipment damage.
	ELECTROSTATIC SENSITIVE DEVICES This equipment may contain electrostatic devices.

Qualified Personnel

	**Important Information** The term **qualified personnel** is defined here as individuals 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 this equipment to ensure that its personnel meet these requirements. Always use required personal protective equipment (PPE) and follow safe electrical work practice.

1.1.1 Introduction to Safety

CAUTION

Unsafe Equipment Use
This equipment may contain electrostatic devices, hazardous voltages and sharp edges on components

- Read installation instructions in their entirety before starting installation.
- Become familiar with the general safety instructions in this section of the manual before installing, operating, maintaining or repairing this equipment.
- Read and carefully follow the instructions throughout this manual for performing specific tasks and working with specific equipment.
- Make this manual available to personnel installing, operating, maintaining or repairing this equipment.
- Follow all applicable safety procedures required by your company, industry standards and government or other regulatory agencies.
- Install all electrical connections to local code.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- 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 prior to returning power to the circuit.

Failure to follow these instructions can result in serious injury, death or equipment damage

Additional Reference Materials

Important Information

- IEC – International Standards and Conformity Assessment for all electrical, electronic and related technologies.
- IEC 60364 – Electrical Installations in Buildings.
- CSA – C22.2 No.180:13 (R2018), series isolating transformers for airport lighting.
- FAA Advisory: AC 150/5340-26 (current edition), Maintenance of Airport Visual Aid Facilities.
- Maintenance personnel must refer to the maintenance procedure described in the ICAO Airport Services Manual, Part 9.
- ANSI/NFPA 79, Electrical Standards for Metalworking Machine Tools.
- National and local electrical codes and standards.

1.1.2 Intended Use

CAUTION

Use this equipment as intended by the manufacturer
This equipment is designed to perform a specific function, do not use this equipment for other purposes

- Using this equipment in ways other than described in this manual may result in personal injury, death or property and equipment damage. Use this equipment only as described in this manual.

Failure to follow this instruction can result in serious injury or equipment damage

1.1.3 Material Handling Precautions : Storage

CAUTION

Improper Storage
Store this equipment properly

- If equipment is to be stored prior to installation, it must be protected from the weather and kept free of condensation and dust.

Failure to follow this instruction can result in equipment damage

1.1.4 Material Handling: Heavy Equipment

DANGER

UNSTABLE LOAD
USE CAUTION WHEN MOVING HEAVY EQUIPMENT

- USE EXTREME CARE WHEN MOVING HEAVY EQUIPMENT.
- VERIFY THAT THE MOVING EQUIPMENT IS RATED TO HANDLE THE WEIGHT.
- WHEN REMOVING EQUIPMENT FROM A SHIPPING PALLET, CAREFULLY BALANCE AND SECURE IT USING A SAFETY STRAP.

FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN DEATH, SERIOUS INJURY, OR EQUIPMENT DAMAGE

1.1.5 Operation Safety

CAUTION

Improper Operation
Do Not Operate this equipment other than as specified by the manufacturer

- 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 this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.
- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- 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.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this 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.

Failure to follow these instructions can result in serious injury, death or equipment damage.

1.1.6 Maintenance Safety

DANGER

ELECTRIC SHOCK HAZARD
THIS EQUIPMENT MAY CONTAIN ELECTROSTATIC DEVICES

- DO NOT OPERATE A SYSTEM THAT CONTAINS MALFUNCTIONING COMPONENTS. IF A COMPONENT MALFUNCTIONS, TURN THE SYSTEM OFF IMMEDIATELY.
- DISCONNECT AND LOCK OUT ELECTRICAL POWER.
- ALLOW ONLY QUALIFIED PERSONNEL TO MAKE REPAIRS OR REPLACE MALFUNCTIONING COMPONENTS ACCORDING TO INSTRUCTIONS PROVIDED IN MANUAL.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN DEATH OR EQUIPMENT DAMAGE

1.1.7 Material Handling Precautions, ESD

CAUTION

Electrostatic Sensitive Devices
This equipment may contain electrostatic devices

- Protect from electrostatic discharge.
- Electronic modules and components should be touched only when this is unavoidable e.g. soldering, replacement.
- Before touching any component of the cabinet you shall bring your body to the same potential as the cabinet by touching a conductive earthed part of the cabinet.
- Electronic modules or components must not be brought in contact with highly insulating materials such as plastic sheets, synthetic fiber clothing. They must be laid down on conductive surfaces.
- The tip of the soldering iron must be grounded.
- Electronic modules and components must be stored and transported in conductive packing.

Failure to follow this instruction can result in equipment damage

1.1.8 Arc Flash and Electric Shock Hazard

DANGER

SERIES CIRCUITS HAVE HAZARDOUS VOLTAGES
THIS EQUIPMENT PRODUCES HIGH VOLTAGES TO MAINTAIN THE SPECIFIED CURRENT - DO NOT DISCONNECT WHILE ENERGIZED.

- ALLOW ONLY QUALIFIED PERSONNEL TO PERFORM MAINTENANCE, TROUBLESHOOTING, AND REPAIR TASKS.
- ONLY PERSONS WHO ARE PROPERLY TRAINED AND FAMILIAR WITH ADB SAFEGATE EQUIPMENT ARE PERMITTED TO SERVICE THIS EQUIPMENT.
- AN OPEN AIRFIELD CURRENT CIRCUIT IS CAPABLE OF GENERATING >5000 VAC AND MAY APPEAR OFF TO A METER.
- NEVER UNPLUG A DEVICE FROM A CONSTANT CURRENT CIRCUIT WHILE IT IS OPERATING; ARC FLASH MAY RESULT.
- DISCONNECT AND LOCK OUT ELECTRICAL POWER.
- ALWAYS USE SAFETY DEVICES WHEN WORKING ON THIS EQUIPMENT.
- FOLLOW THE RECOMMENDED MAINTENANCE PROCEDURES IN THE PRODUCT MANUALS.
- DO NOT SERVICE OR ADJUST ANY EQUIPMENT UNLESS ANOTHER PERSON TRAINED IN FIRST AID AND CPR IS PRESENT.
- CONNECT ALL DISCONNECTED EQUIPMENT GROUND CABLES AND WIRES AFTER SERVICING EQUIPMENT. GROUND ALL CONDUCTIVE EQUIPMENT.
- USE ONLY APPROVED ADB SAFEGATE REPLACEMENT PARTS. USING UNAPPROVED PARTS OR MAKING UNAPPROVED MODIFICATIONS TO EQUIPMENT MAY VOID AGENCY APPROVALS AND CREATE SAFETY HAZARDS.
- CHECK THE 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 AIRFIELD ELECTRICAL EQUIPMENT.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN DEATH OR EQUIPMENT DAMAGE

1.1.9 Touch Current

WARNING

Touch current exceeds 3.5mA AC. The minimum size of the PE conductor shall comply with the local safety regulations for high PE conductor current equipment.

2.0 About this Manual

This document includes information with focus on safety, installation and maintenance procedures. Become familiar with the structure and content and carry out the actions completely and in the given sequence.

For more information, see www.adbsafegate.com.

Note

It is very important to read this document before any work is started.

3.0 Introduction

This manual includes installation, operation, maintenance and troubleshooting information for the ASG 8000i Constant Current Regulator (CCR).

3.1 General

3.1.1 ASG 8000i

ASG 8000i is a microprocessor based CCR designed specifically for supplying airfield lighting series circuits.

3.1.2 Airfield Lighting Series Circuit (AFL-circuit)

Series circuits are typically used at airports to transmit power from the CCR (Constant Current Regulator) to light fittings that are located far away and consume significant power. Light fittings are connected via isolation transformers to a series loop fed by the CCR. The output current of the CCR, which defines the brilliancy of the light fittings, is kept constant at each current step against supply, load and environmental changes. Current steps are provided in order to adjust the light output of the system to match with prevailing meteorological conditions.

The power of the circuits varies but can go up to 30 kVA, with a maximum output current of 6.6A. To achieve this, higher output voltages are required when using larger CCRs. Typically, all components (e.g. isolation transformers, connectors etc.) connected to series circuits are designed for 5 kV RMS voltage.

In summary, the use of series circuits and CCRs:

- ensures equal brightness for all lamps because of the constant current in the series loop, and
- reduces cabling costs and transmission losses due to the relatively low current level (6.6 A).

On the downside, due to the higher voltage of larger CCRs, extra precaution should be taken when working with circuits. Regular maintenance is also needed to maintain proper isolation levels.

3.1.3 Airfield Lighting Power Circuit (AFL-circuit) Design Guidelines

- Input power of the CCR is approx. 1.1 x rating of the CCR which should be considered when designing mains supply and supply cable sizes for the CCR.
- Output primary cable losses are approximately 160W/km (6.6A/6mm^2 Cu).
- Output secondary cable losses can be significant and should be calculated according the lengths, diameters and materials of the cables. Normally, isolation transformer can tolerate up to 10% losses without reducing its output current.
- Isolation transformers efficiencies are normally 0.9 or better which should be taken in account together with the two above points when defining CCR rating for a circuit.

3.1.4 Specifications

ASG 8000i is designed and manufactured in accordance with following specifications:

ICAO	Aerodrome design manual, Part 5
IEC	CCR-specific: 61822 – 61820-3-2 Electrical safety standard: 61204-7 – 62477-1 – 62477-2
EMC	IEC/EN 61000-6-2 & IEC/EN 61000-6-4
EASA	CS-ADR-DSN

ASG 8000i has also many unique new features not yet described in public specifications.

3.2 CCR Technical Data

3.2.1 Input Voltage (U1) and Frequency (F1)

Input Voltage U1

Version	Value (Un +-10%)
2.5, 4, 5, 10 or 15 kVA	230 V AC
5, 7.5, 10, 15, 20, 25 or 30 kVA	400 V AC

Input frequency F1

The input frequency F1 for all product versions is 50/60 Hz ±7.5%.

3.2.2 Efficiency and Power Factor

- Efficiency: better than 0.9 at full load / Load PF=1 / U1≤Un
- Power factor: better than 0.9 at full load / Load PF=1 / U1≤Un

3.2.3 Environmental

The CCR is designed for indoor use only, in an area with adequate ventilation for cooling the CCR.

Environmental Conditions	
Operation Temperature Range	0 °C – +50 °C[1]
Storage Temperature Range	−40 °C – +70 °C
Long-term Storage Temperature Range	15 °C – 30 °C
Humidity	Max. 95%
Long-term Storage Humidity	Max. 60%
Altitude	Below 2,000m
Degree of Pollution	Max. Pollution Degree 2
Degree of Protection	IP 20
Ultra-violet Light	No resistance (indoor use)

Mechanical Conditions	
Vibration	Operation: Class 3M2 according to IEC 60721-3-3:2019
	Transportation: Class 3M2 according to IEC 60721-3-3:2019
	Storage: Class 1M2 according to IEC 60721-3-1:2018
Shock/Drop/Topple	The unit shall be installed on concrete floors or other non-combustible surface only.

[1] This product is certified and guaranteed to operate within a temperature range of 0 °C to 50 °C, as defined by IEC61822:2009 and IEC6820-3-2-2023. The product is capable of functioning at temperatures outside the certified range, from −20 °C to +55 °C, and while its main functionalities and behavior are expected to remain, its performance is not guaranteed or certified for these extreme temperature conditions.

3.2.4 Output Current (I2)

All CCRs 6.6A RMS. Accuracy ±1% under the following conditions:

- Resistive load variation: 0 – 100%
- Max 30% open circuited isolation transformers of total load 50 – 100% of CCR rating
- Supply voltage: 0.90 – 1.10 Unom / Input Frequency needs to be 50/60 Hz ±7.5%e
- Environmental conditions within the above given values

3.2.5 CCR Standard Sizes and Output Voltages

CCR Size kVA	Nominal output U2n/V RMS	Max peak U2 u2p/V	Open circ ratio u2p/U2n
2.5	455	810	1.78
4	606	1081	1.78
5	757	1351	1.78
7.5	1136	2027	1.78
10	1515	2703	1.78
15	2272	4054	1.78
20	3030	5405	1.78
25	3788	6756	1.78
30	4545	8108	1.78

3.2.6 Protective Functions

- Input voltage: Delay and 2 levels, warning and alarm with tripping.
- Input frequency: Delay and 2 levels, warning and alarm with tripping.
- Temperature: Delay and 2 levels, warning and alarm with tripping.
- Open circuit: Delay and level with tripping. Incl. Capacitive current monitoring.
- Over current: 2 delays and levels with tripping.
- Earth fault: Selectable, tripping from level B if the maintenance switch is on.
- VA-drop: Selectable, tripping from level A.

3.2.7 Monitoring Functions

- Lamp fault: ±1 lamp up to 10 lamp faults and ±2 lamps up to 30 lamps at all steps from 25% load to 100% load. Max 30% of total lamp power. Delay and 2 levels.
- Earth fault value : 1kohm – 1Gohmm, delay and 2 levels.
- VA-drop: delay and 2 levels.
- Cumulative operating time monitoring for lamp life.

3.2.8 Display Functions

All above protective and monitoring functions, plus:

- Actual power display.
- Load power factor display.
- Consumed energy display with reset.
- Real time clock with time and date.
- Operating hours, all steps, total, cumulative hours and reset.
- 10 patch fault log with time and date labels.
- Info type displays e.g. CCR no, circuit name, control direction etc.

3.2.9 Remote Control Interfaces

- Parallel, selectable control voltage 24 – 60 VDC, signal mode and coding.
- Serial, major field bus interface cards available. Duplicated, redundant interface possible.

3.3 CCR Functional Components

3.3.1 General

The CCR consists of two functional units, each installed in its own compartment:

- The power and control circuits located at the top compartment of the CCR.
- The high voltage unit located at the lower compartment of the CCR.

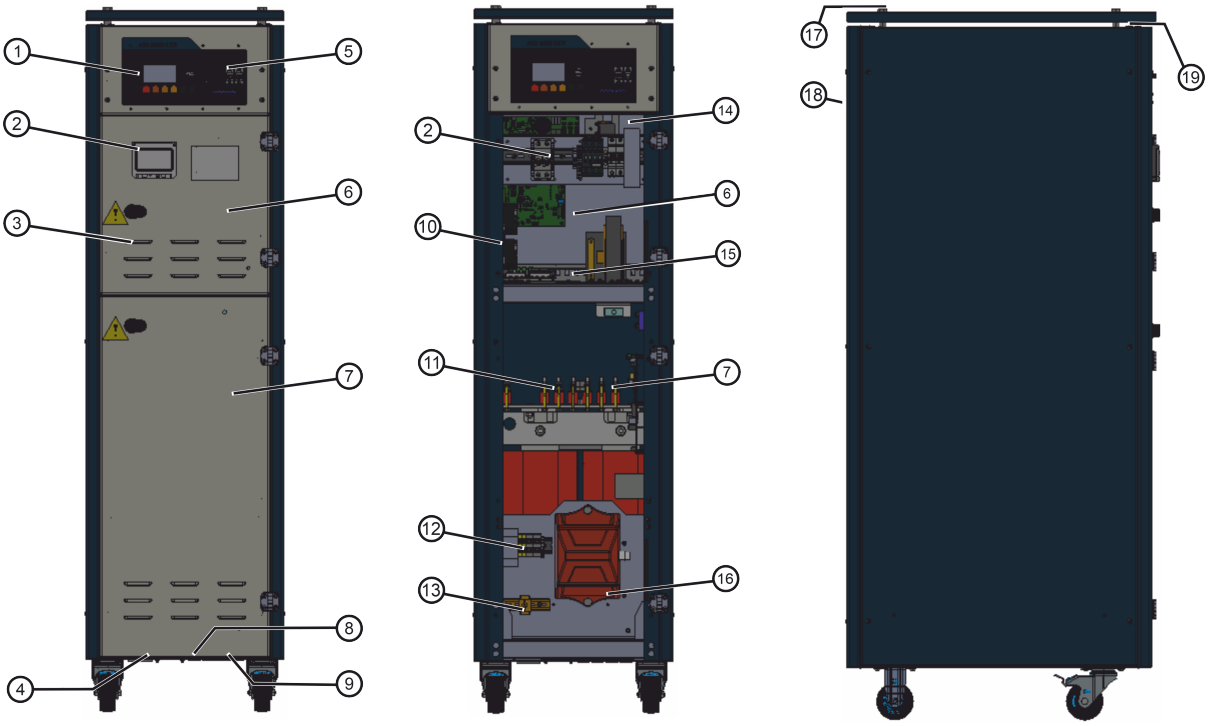
Natural cooling is provided for all compartments (no fans are used). All cable entries are through the bottom plate of the CCR. All components are accessible from the front.

Rating (kVA)/Dimensions (mm)	H	W	D
Up to 15kVA	1500	420	650
From 20 kVA	1500	510	650
With hooks	1540		

Note
All ASG 8000i models are shipped with wheels. For a different configuration, please contact ADB SAFEGATE.

Rating	Net weight (kg)	Gross weight (kg)
2.5 kVA / 230 V	125	175
4 kVA / 230 V	135	185
5 kVA / 230 V or 400 V	145	195
7.5 kVA / 400 V	162	212
10 kVA / 230 V or 400 V	190	240
15 kVA / 230 V or 400 V	200	250
20 kVA / 400 V	270	320
25 kVA / 400 V	295	345
30 kVA / 400 V	320	370

Figure 1: ASG 8000i location of components



Reference	Description
1	Human-Machine Interface
2	Circuit breaker
3	Low voltage compartment input vents
4	Mains cables entry
5	Remote control Front entry connectors
6	Low voltage compartment
7	High voltage compartment
8	Remote control cables bottom entry
9	Output cables entries (to AGL circuit)
10	Remote control connections for bottom entry cables
11	Main transformer output tapping settings
12	Mains input terminals connections and surge arrestors
13	Mains input cable strain reliefs
14	Thyristor element
15	Electrical components DIN rail
16	Output connections to AGL circuit (SCO on this picture)
17	Screws for hook fixation (*4)
18	Thyristor heatsink input and output vents
19	Low output

3.3.2 Power Circuit

The power circuit consists of components installed between the input terminals and the primary winding terminals of the main transformer:

Circuit Breaker	Protects the CCR from overload caused by potential component or regulator faults. It additionally serves as a main switch.
Input surge arresters	Protects the CCR from incoming voltage transients and is located next to the main switch.
Main fuse (option)	Optional supplementary protection measure, working alongside the circuit breaker to safeguard against potential component or regulator faults.
Passive filter	Suppresses EMC conductive emissions.
Thyristor unit	Forms the desired primary RMS voltages to produce correct output step currents (I2) by enabling only controlled parts of the sine waves to pass through in following way: ▪ Thyristor starts to conduct when ignition pulses are given to its gate ▪ Thyristor closes when ignition pulses are stopped and current passing through it goes to zero.

3.3.3 Main Transformer, Efficiency and Power Factor

The dry-type (not oil-cooled) main transformer defines the rating of the CCR. As the transformer has load tapping on the output, the rating of the transformer can be reduced in order to match with the connected load.

Optimal load matching provides the following benefits:

- Minimizes maximum output voltage in case of open circuit or thyristor failure.
- Optimizes efficiency of the CCR, since the input current that causes most of the CCR's power losses is decreased. Power losses generate heat which in turn causes aging of components. Therefore, load matching also improves the lifetime of the CCR.
- Optimizes the power factor.
- Minimizes the harmonic content of the input and output of the CCR.
- Optimizes the crest factor, which could cause an issue when connecting addressable light control and monitoring systems with the CCR.

Note
Load matching is provided, see section 5.4.

3.3.4 High Voltage Circuit

The high-voltage circuit consists of components connected between the output terminals and main transformer secondary winding terminals of the CCR and is assembled in a special high-voltage compartment. It consists of following components:

Output current measuring transformer	Measures the output current I2 and provides feedback information to the regulator function of the CCR. Secondary connected to control circuitry.
Output voltage measuring transformer	Measures the output voltage U2 of the CCR and provides information to various monitoring functions. The output voltage is always scaled to 25V with every CCR size.
Surge arresters	Protects the CCR from transients (e.g. lightning), coming from the AFL-circuit.
Earth fault module	The earth fault module measures isolation resistance of the AFL-circuit. It is connected to the circuit via high impedance / voltage resistor array and is completely isolated from the control electronics. With circuit selector function, earth fault is measured from all circuits simultaneously.
Output terminals	Special output terminals are used to ease maintenance tasks: ▪ Terminal taps, standards for all CCRs. ▪ Series cut-out (SCO) option. One pair of connectors is provided for each circuit of the CCR. Each pair is labeled with a capital and small character, e.g. **A** for output and **a** for return of the loop. For more information, see Appendix M – Input/Output Terminals.

3.3.5 Functional Blocks

ASG 8000i uses an internal CAN bus to provide robust and fast data sharing between the functional blocks. This allows the device to be customized with several options.

Control Unit (Part No EP00116)

The control unit is a custom designed electronic board containing a powerful 32-bit microprocessor with application program, and its peripheral circuits. The application program is stored on flash memory and can therefore be upgraded on-site if desired. All set-parameters are stored in a user flash memory, as well as on a SD card for backup options. The control unit manages the internal communication between all logical boards, as well as the equipped remote control interfaces.

Power Unit (URC5) (Part No EP00112)

The Power unit regulates the output current and adjusts the thyristor control according to the RMS actual current value (I2) provided by the RMS calculator (feedback) and the user-defined set value. RMS calculators define the actual output values by sampling the output waveforms and calculating effective (RMS) values from the sample data. In addition, it provides several monitor functions (e.g. open circuit detection) and signal processing blocks (e.g. output power calculation).

Human Machine Interface (Part No EP00113 and EP00169, optional)

With a backlit display, the HMI displays all necessary information to the user and allows configuration of the CCR parameters with a keypad (or touchscreen).

Earth Fault Detection (EFD) Measurement Unit (Part No EP00128)

The EFD unit is an Earth Fault Detection device, which uses a high impedance DC measurement technique. Equipped with a powerful 32bit microcontroller, it provides the isolation value of a series circuit, while keeping stressing of the high-voltage cables at a minimum.

Internal Power Supply (Part No EP00131)

The internal power supply provides 2x24VDC for the internal supply of the functional blocks in the CCR. The 2 24V rails provide a high electrical insulation between each other and the mains grid to provide maximum safety. One rail supplies the power electronics, the Power Unit, and the other provides power to control systems, such as EP00116 and EP00113.

EMC Filter Unit (Part No EP00133)

The EMC Filter unit is used for bringing the CCR to a very robust and reliable level of operation. It filters noise coming from or going towards the grid effectively.

Snubber Unit (Part No EP00134)

The snubber unit allows the reliable operation of the thyristor.

Circuit Selector Switch (Part No Unit EP00141, optional)

The optional Circuit Selector Switch unit provides the logic and signals to control the power relays/contactors and select different sections of the series circuit

3.3.6 Serial Control Interface

Serial control interface is used with computer based control and monitoring systems using latest fieldbus technologies for CCR communication.

This interface is standard for all CCRs of the ASG 8000i range and is designed under following criteria:

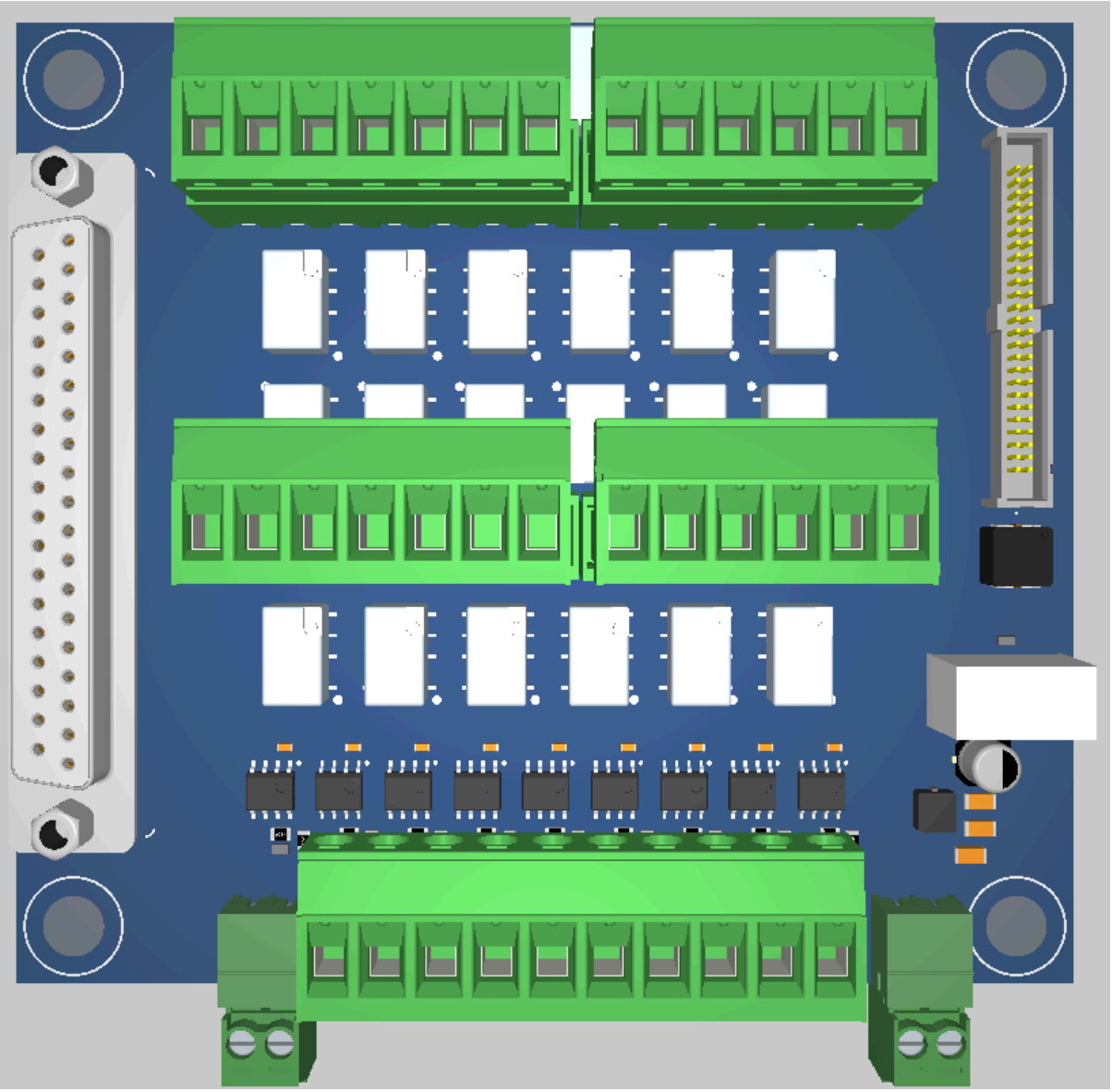
- To be compatible with most common fieldbus systems.
- Simple to interface: no data multiplexing, minimum "ripple" and round numbers (if possible no decimals) with data values.
- Possibility for redundant bus connection.

3.3.7 Multiwire Control Interface

The optional multiwire control interface can be used with traditional multiwire control systems. It is a remote control option, designed to match with most control system types.

Interface	Type	Data	
Input/controls	Relay coil	Ucont = 0.8 – 1.6xUdcnom / R=3840 ohm	
Output/indications	Relay contact	1 A / 30 VDC, 0.3 A / 60 VDC	
PARALLEL REMOTE CONTROL HARDWARE SETTINGS			
Setting	**Description**	**Factor setting**	**Allowed range**
Control voltage	Control DC-voltage selection	N/A	24 / 48 / 60 VDC

Figure 2: Multiwire Control Interface



3.4 Features

3.4.1 Earth Fault

The Earth Fault Detection (EFD) function measures the **insulation resistance** between the series circuit and earth, in compliance with IEC 61822:2009 and IEC 61820-3-2 standards.

The EFD module works when the equipment is connected to the mains supply, even if no output current is present. For the measured values, a warning level and an alarm level can be set. Both alarm and warning levels can be set to any value between 1 kOhm and 2 GOhm. However, the warning value should always be higher than the alarm value. The HMI shows the actual EFD value.

Working Principle

A current-limited DC voltage of up to 500VDC is applied between the series circuit and earth (or cable screen). The leakage current is then measured using a resistor. By combining the applied voltage value and the measured leakage current, the earth fault resistance value is calculated.

The HMI displays the current EFD value in real time. Additionally, this value is communicated via the serial remote communication interface for monitoring and integration into remote systems.

This functionality ensures effective monitoring of insulation resistance, enabling early detection of potential faults and ensuring system reliability.

Note

The EFD measurement is performed using a DC voltage, with the positive voltage applied to the series circuit and zero (ground) applied to earth.

3.4.2 Load Indicator

The Load Indicator, out of range and monitoring function provides comprehensive real-time data on the CCR's performance and operating conditions, ensuring precise control and effective diagnostics. Measurements and corresponding alarms are displayed on the Human-Machine Interface (HMI). They can also be communicated via the serial remote communication interface.

3.4.3 Lamp Fault Indicator

The Lamp Fault Monitoring function ensures precise detection and reporting of lamp failures within the airfield lighting series circuit, fully compliant with IEC 61822 and IEC 61820-3-2 standards. This feature enhances system reliability by providing real-time fault information and configurable alarms. Measurements and alarms are displayed on the Human-Machine Interface (HMI). Alarm can also be communicated via the serial remote communication interface.

The accuracy is ± 1 lamp with a range from 1 to 15 broken lamps.

3.4.4 Output Lighting Arrestor

The Output Lightning Arrestor feature provides robust protection for the CCR's output circuit, shielding it from voltage surges caused by lightning strikes or other transient events. It is connected directly across the AC output.

Fully compliant with IEC 61822 and IEC 61820-3-2 standards, this feature ensures the safety and reliability of the CCR and connected equipment, enhancing system performance and durability. When a cut-out option or circuit selector is installed in the CCR, the lightning arrestors are positioned between the CCR output and these optional components.

3.4.5 Field Circuit Isolator

The Series Cut-Out (SCO) functions as an output disconnection device between the CCR and the series circuit. It ensures safe isolation of the series circuit from the equipment during maintenance or testing operations, providing an additional layer of operational safety. To prevent unauthorized access, the SCO is equipped with a key-locked cover, ensuring secure and controlled operation at all times.

3.4.6 Non-Illumination Current Step

The Non-Illumination Step feature is available in compliance with IEC 61822 and IEC 61820-3-2 standards. This functionality allows the use of accessory devices on the series circuit by providing a non-illumination current step. Additionally, the CCR supports a current step as low as 1.6 A, offering enhanced flexibility for specific operational needs.

3.4.7 Out of Range Indicator

If the CCR is not able to stabilize the selected current of a B-step, it will indicate that the current is out of range by the blinking Output current LED. This information will also be transmitted to the remote control interface as feedback.

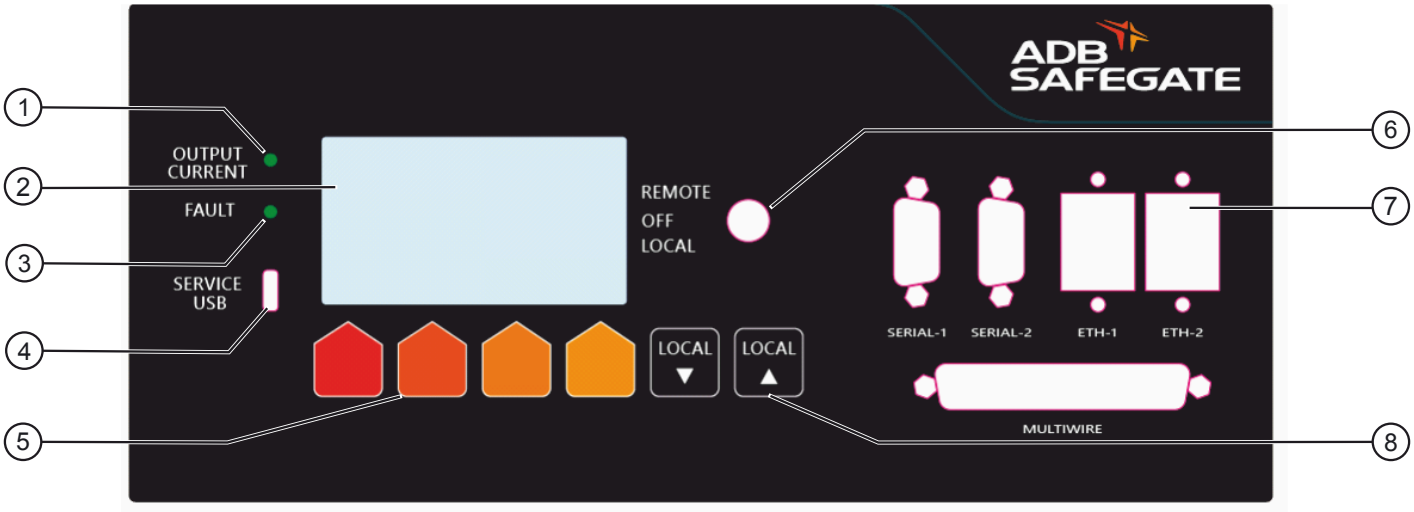
3.4.8 Input Surge Arrestor Monitoring

The input surge arrestors are equipped with a monitoring function that continuously assesses their ability to suppress voltage transients and surges. If the surge arrestors' capability to attenuate pulses is diminished, indicating degradation or approaching end-of-life, a corresponding alarm is automatically triggered. This alarm is clearly displayed on the Human-Machine Interface (HMI), allowing maintenance personnel to promptly identify and address the issue, thereby ensuring ongoing protection of the CCR and associated equipment.

4.0 User Interface

4.1 Overview of the HMI

Figure 3: ASG 8000i Human-Machine Interface



Reference	Description
1	Output Current Presence Indicator LED
2	Backlit Monochrome LCD Screen
3	Fault Presence Indicator LED
4	Maintenance USB Port
5	Navigation/Selection Buttons for On-Screen Menus
6	Mode Selection Rotary Knob (OFF, Local Control, Remote Control)
7	Remote Control Front Entry Connectors
8	Local Current Step Adjustment Buttons (Increase/Decrease)

4.2 Display Interface

Home Screen

The home screen of the ASG 8000i CCR has the following indications:

Figure 4: ASG 8000i Home Screen Example

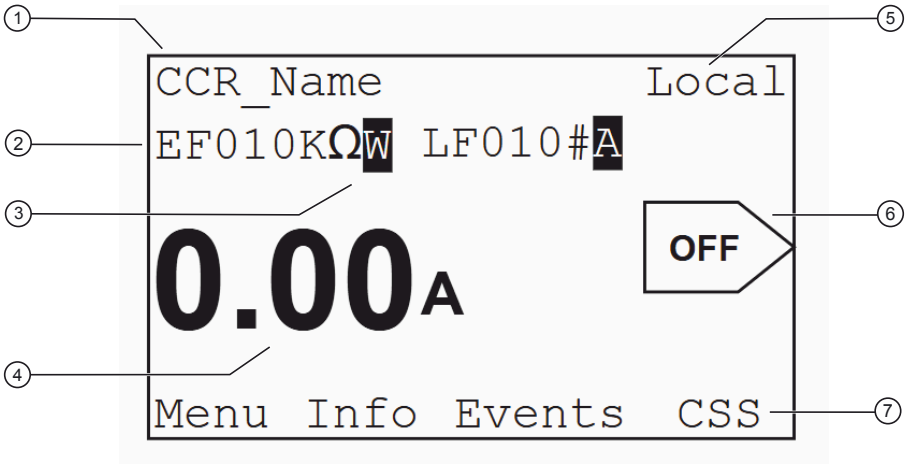


Table 1: Home Screen Indications

Reference	Description	Remarks
1	CCR Name	Can be edited from **Menu**>**Circuit Parameters**>**CCR Name**
2	Current EFD/LFD values	If present
3	Warning/Alarm presence	For more information on these indications, open the **Events** screen
4	Real-time output current value	
5	Operation mode (LOCAL/REMOTE)	Changed with the rotary knob
6	Operation status (OFF/Current step)	
7	Navigation to menu screens (Menu/Info/Events/CSS)	Selected with the four physical buttons

Menu Navigation

Depending on the state of the display, the four physical buttons under the HMI are assigned to different commands, allowing menu and submenu navigation, as well as parameterization of the CCR.

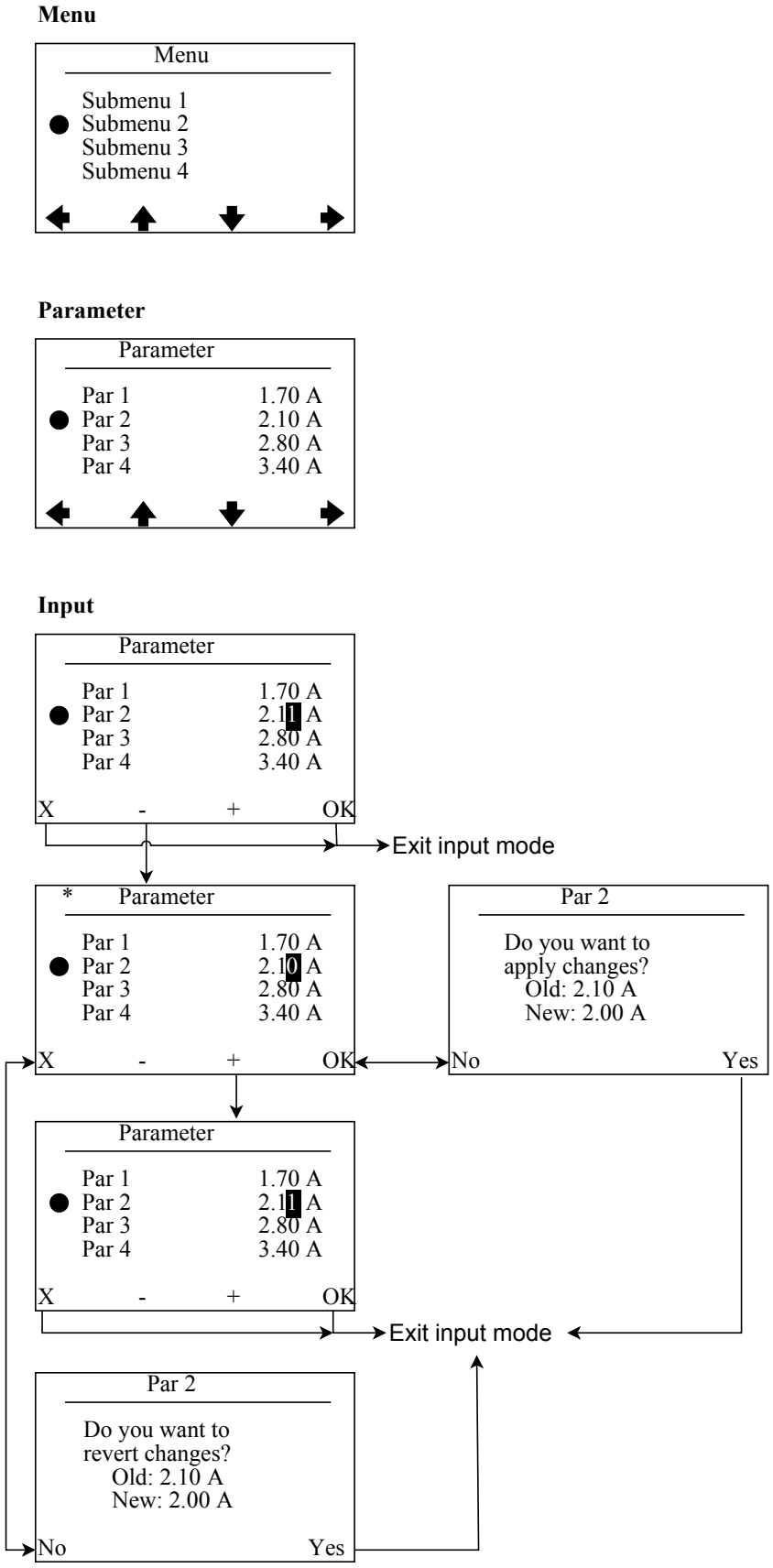
From the Home Screen, access to the following screens:

- **Menu** (Configuration Menu)
- **Info** (Information)
- **Events** (Information about current alarms and warnings)
- **CSS** (Circuit Selection Screen, if a CSS module is present)

From one of the Menu/Info/Events/CSS screen:

- The two central buttons allow navigation to all menu or submenu items of the same level (up and down arrows), as well as increasing and decreasing a parameter value (minus and plus signs).
- The two side buttons allow selection of a highlighted submenu or parameter (right arrow) and return to the previous menu level (left arrow). When a parameter has been selected and then configured, the same buttons are assigned to commands that reject or confirm the new value (X/OK or "No"/"Yes").

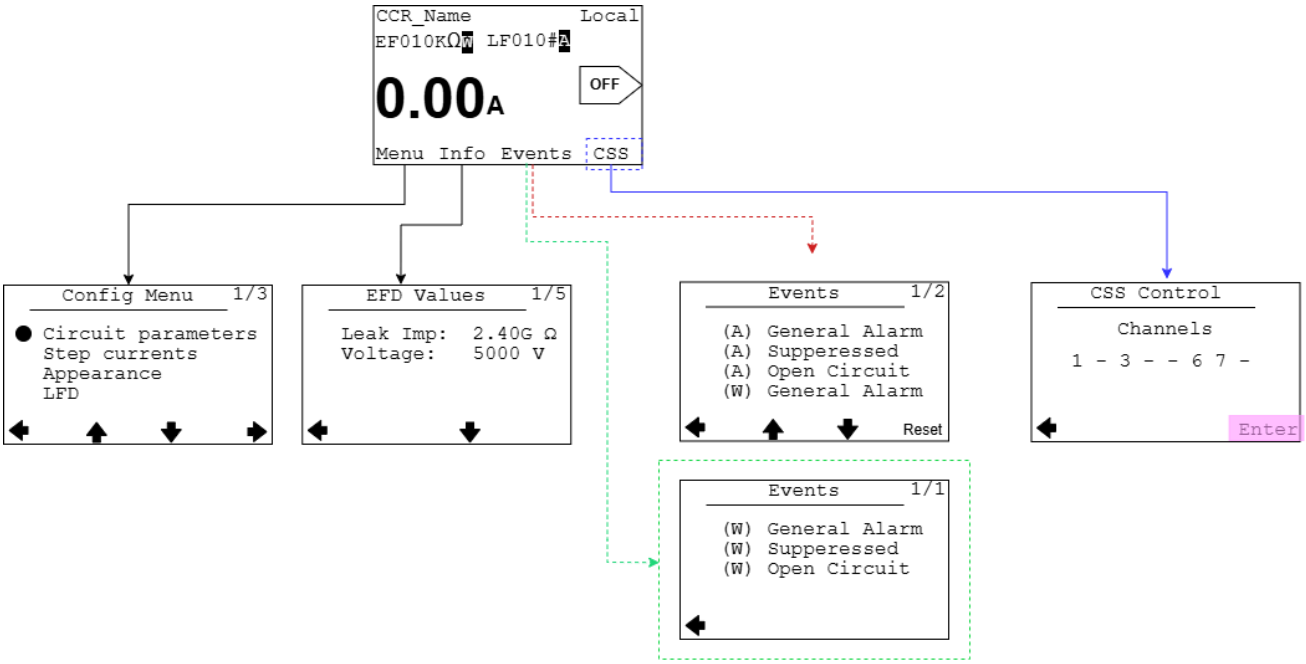
Figure 5: Menu Navigation Example



Menu Screens

By using the physical navigation buttons on the home screen, the user can access the following screens:

Figure 6: First Menu Screens



The **Config Menu** allows:

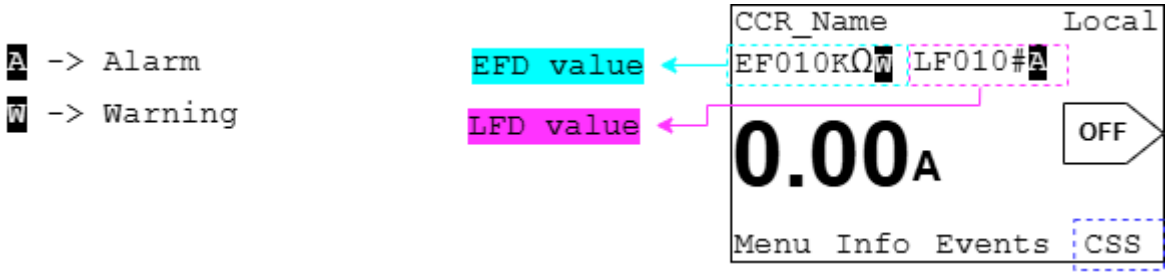
- assigning a name to the device from the **Circuit Parameters** submenu,
- accessing the **Step Currents** submenu to modify number of steps and the current value for each step,
- accessing the **Appearance** submenu to modify display and language settings,
- enabling/disabling **LFD** and **EFD** and setting alarm and warning thresholds,
- accessing **VA Drop** settings
- enabling/disabling remote control options and modifying **Communication** settings for each option,
- modifying **CSS** settings,
- enabling/disabling **Failsafe** options,
- modifying **Cap Load** settings,
- modifying **Ramping** settings,
- modifying **Compatibility** settings,
- accessing **Input Voltage**, **Input Frequency**, **Temperature**, **Over Curren**t and **Over Circuit alarm** settings, and
- accessing the **Service Menu** to perform calibration procedures and firmware updates.

Info allows access to status information screens about the CCR:

- **EFD Values**,
- **Output Values**,
- **Input Values**,
- **CCR Type**,
- **Versions of boards**,
- **CSM version** (if present) and SCR ontime, and
- **Phase detection**

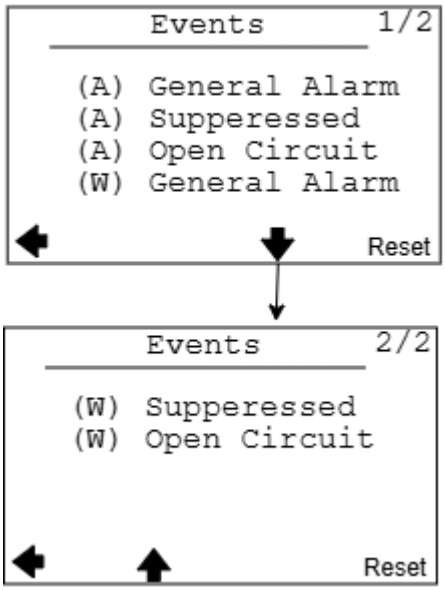
Events allows access to information about present alarms and warnings. When this option flashes, there is a locking alarm in place that prevents the CCR from operation. When the background of the option is white (transparent) there are only active warnings. When the background and the font are shown with inverted contrast, there is at least one active alarm, and potentially more alarms and warnings. As a rule, alarms have higher priority than warnings. The presence of alarms and warnings related to EFD/LFD values is also indicated by an A or a W next to the Home Screen values.

Figure 7: Home Screen with Alarms and Warnings



When there are alarms in place, the user has the option to **Reset** the alarms to verify that a successful action has taken place to avoid triggering the alarm(s), as shows the Figure below:

Figure 8: Events Screen Example



The **CSS** option in the Home Screen is only shown if a CSS module is present and enabled. It allows access to circuit selection options.

4.3 Calibration Procedures

Most calibration procedures can be accessed from the **Service Menu** under the **Config Menu**.

Table 2: Service Menu Tree

Submenu Item/Parameter		Default	Min	Max
Provision mode		0	-	-
Firmware update	Running FW	000.000	-	-
	Avail FW	000.000	-	-
	Update	0	-	-
LFD calibration	# lights	1	1	999

Table 2: Service Menu Tree

Submenu Item/Parameter		Default	Min	Max
	# disc.lights1	1	1	999
	Warm up time	60	-	-
	Stab time	5	-	-
	Detecting time	10	-	-
	Channels	-	-	-
	Calibrate Reference circuit	-	-	-
	Calibrate N disconnected circuit	-	-	-
	Save all calib data	-	-	-
O/P current SP cal	Current	-	-	-
	Calibration	-	-	-
I/P current SP cal	Current	-	-	-
	Calibration	-	-	-
O/P voltage SP cal	Current	-	-	-
	Calibration	-	-	-
I/P voltage SP cal	Current	-	-	-
	Calibration	-	-	-
O/P current DP cal	Current	-	-	-
	Calibration	-	-	-
I/P current DP cal	Current	-	-	-
	Calibration	-	-	-
O/P voltage DP cal	Current	-	-	-
	Calibration	-	-	-
I/P voltage DP cal	Current	-	-	-
	Calibration	-	-	-
Backup/Restore	Item	N/A	-	-
	Backup	N/A	-	-
	Restore	N/A	-	-
Type	Core size	15000	-	30000
	Tapped size	15000	-	30000
	Nominal Input Voltage	400	230	400
	Nominal Frequency	50	50	60
Sequencer	Sequence ID	-	-	-

Table 2: Service Menu Tree

Submenu Item/Parameter	Default	Min	Max
Start	-	-	-
Abort	N/A	-	-

4.3.1 Output Current and Voltage Calibration

SP (Single Point) and DP (Double Point) calibration procedures for output current and output voltage can be accessed from the **Table 2**.

Output Current SP and DP Calibration
1. Connect external calibrated RMS A-meter (10A, accuracy better than 1%) in series with the load circuit. Use at least 10% load of the CCR capacity.
WARNING High voltage circuit – De-energize CCR before connecting!
Note For more information on easy meter connection, see Series Cut Out (SCO) option in Appendix M – Output Terminals. Clamp meter accuracy is normally not adequate for 1% accuracy. For periodic maintenance checks, clamp type meter is still recommended for safety reasons.
2. Navigate to **Config Menu** > **Service Menu** > **O/P Current SP Cal** or **O/P Current DP Cal**. The first line under the name of the calibration procedure turns into a status bar of inverted contrast that highlights a required step.
3. Set the CCR's step to B1.
4. Set the **Current** parameter equal to the external meter's reading value. and select **OK** to save changes. If performing DP calibration, a second phase will be triggered, where the user will be prompted to set the CCR's step to B5 and then set the **Current** value with the new meter reading.
5. Select **Go** to start the calibration.
WARNING Make sure that there is max 20% deviation between the two readings. Selecting set with bigger difference between the readings may result to over current on the output circuit!

When the calibration is completed, the display shows a "Calibration Finished" message and returns to the first screen of the procedure.

Output Voltage SP and DP Calibration
1. Connect external calibrated RMS V-meter (Min 30V, accuracy better than 1%) to the voltage transformer test outputs located on the right side of the power unit of the control rack.
2. Navigate to **Config Menu** > **Service Menu** > **O/P Voltage SP Cal** or **O/P Voltage DP Cal**. The first line under the name of the calibration procedure turns into a status bar of inverted contrast that highlights a required step.
3. Set the CCR's step to B1.
4. Set the **Voltage** parameter equal to the external meter's reading value and select **OK** to save changes. If performing DP calibration, a second phase will be triggered, where the user will be prompted to set the CCR's step to B5 and then set the **Voltage** value with the new meter reading.
5. Select **Go** to start the calibration.
Note Calibration of more than ±10% from factory defaults is not allowed and an error indication will appear on the display before returning to the first screen of the procedure.

When the calibration is completed, the display shows a "Calibration Finished" message and returns to the first screen of the procedure.

Note

- Output Current calibration affects also the VA-drop function.
- Calibration with short circuit load (U2 = 0) is not allowed.
- Calibration of more than ±20% from factory defaults is not allowed and an error indication will appear on the display before returning to the first screen of the procedure.

4.3.2 Input Current and Voltage Calibration

SP (Single Point) and DP (Double Point) Calibration procedures for input current and input voltage can be accessed from the **Table 2**.

Input Current SP and DP Calibration
1. Connect external calibrated RMS A-meter (100A, accuracy better than 1%) in series between grid and CCR (or use Current clamp). Use at least 10% load of the CCR capacity.
WARNING High voltage circuit – De-energize CCR before connecting!
2. Navigate to **Config Menu** > **Service Menu** > **I/P Current SP Cal** or **I/P Current DP Cal**. The first line under the name of the calibration procedure turns into a status bar of inverted contrast that highlights a required step.
3. Set the CCR's step to B1.
4. Set the **Current** parameter equal to the external meter's reading value. and select **OK** to save changes. If performing DP calibration, a second phase will be triggered, where the user will be prompted to set the CCR's step to B5 and then set the **Current** value with the new meter reading.
5. Select **Go** to start the calibration.
WARNING Make sure that there is max 20% deviation between the two readings. Selecting set with bigger difference between the readings may result to over current on the output circuit!

Input Voltage Calibration
1. Connect an external calibrated RMS V-meter (Min 30V, accuracy better than 1%) to the voltage transformer test outputs located on the right side of the power unit of the control rack.
WARNING High voltage circuit – De-energize CCR before connecting!
2. Navigate to **Config Menu** > **Service Menu** > **I/P Voltage Cal**. The first line under the name of the calibration procedure turns into a status bar of inverted contrast that highlights the status of calibration.
3. Set the **Voltage** parameter equal to the external meter's reading value and select **OK** to save changes.
4. Select **Go** to start the calibration

When the calibration is completed, the display shows a "Calibration Finished" message and returns to the first screen of the procedure.

Note

- Calibration of more than ±20% from factory defaults is not allowed and an error indication will appear on the display before returning to the first screen of the procedure.
- Calibration of the input voltage is independent of the output current; it may be performed with the output current at 0 A. As step 5 indicates no significant change in input voltage under load, only single-point calibration is required.

4.3.3 Lamp Fault Detection Calibration

The Lamp Fault Detection calibration procedure can be accessed from the **Table 2**.

Lamp Fault
1. The LFD calibration can only be performed when LFD has been enabled from **Config Menu** > **LFD** > **On**.
2. Navigate to Lamp Fault Calibration, by selecting **Config Menu** > **Service Menu** >**LFD Calibration**.
3. Set the LFD calib value options of the first screen: **total number of lights**, **number of disconnected lights** and **warm up time**. **Save** changes.
4. Set the LFD calib value options of the second screen: **stabilizing time** and **detecting time**.
5. If calibration should be done for different circuit combinations, turn on the CSM module and set the active circuit. In the LFD calib value options of the second screen, under the Channels option, choose the circuit combination to be calibrated.

From this point, there are two types of LFD Calibration that should be performed in the following order:

Step A: Calibrate the reference circuit
1. To start the calibration with reference circuit navigate to **Config Menu** -> **Service Menu** -> **LFD calibration** -> **Calibrate Ref**.
2. The **Start** calibration button will appear only when the LFD module is enabled.
3. Press the **Start** button to start the reference calibration for the circuit combination if CSM is enabled.
4. When the calbration process is completed, the display shows the message "Calibration with all connected lights successful" and returns to the last screen accessed before starting the procedure.

Step B: Calibrate the circuit with N disconnected lights
1. To start the calibration with reference circuit navigate to **Config Menu** -> **Service Menu** -> **LFD calibration** -> **Calibrate N Disc**.
2. Disconnect the lights from the circuit shown on the screen.
3. The **Start** calibration button will appear only when the LFD module is enabled.
4. Press the **Start** button to start the calibration with some disconnected lighs for the circuit combination if CSM is enabled.
5. When the calibration process is completed, the display shows the message "Calibration with N disconnected lights successful" and returns to the last screen accessed before starting the procedure.
6. After both processes are successfully performed, select Save All Calib Data from this menu to save the calibration. The display briefly shows the message "Saving LFD Calibration Data" before returning to the previous screen.

Note

The procedure can be aborted at all times, by selecting the **Abort** option at the left.

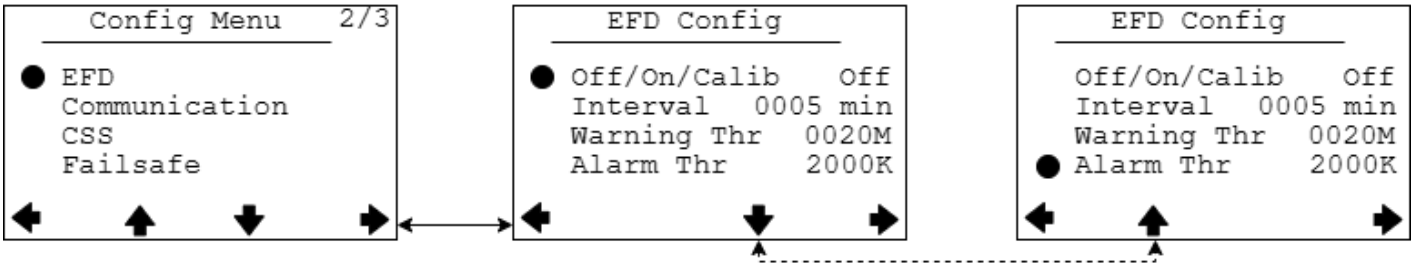
When the calibration is completed, the display shows a "Calibration Successful" message and returns to the first screen of the procedure.

4.3.4 Earth Fault Detection Configuration and Calibration

EFD Configuration

Earth Fault Detection can be configured from the **EFD Config** submenu, within the **Config Menu**.

Figure 9: EFD Config Screen



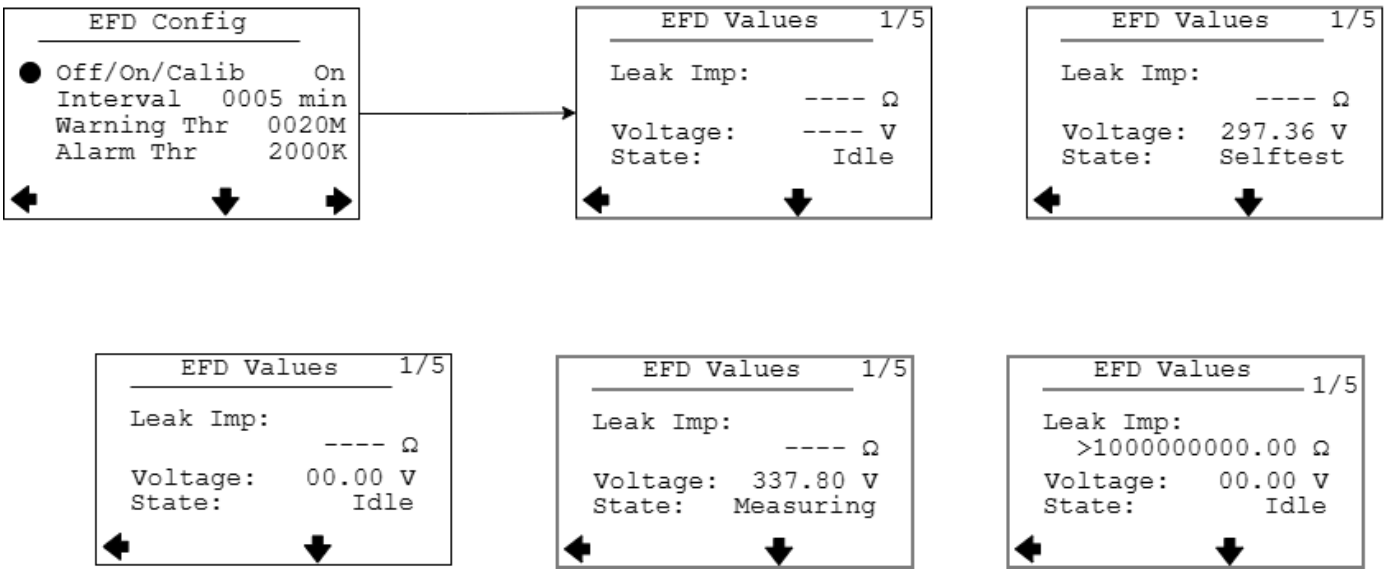
WARNING

Extra precaution must be used when working with high-voltage circuits! Always de-energize the CCR before making connections.

- The **Interval** parameter defines the time in minutes that the EFD selftest is performed.
- The **Warning Thr** parameter defines an impedance value in Ohm/kOhm/MOhm/GOhms. If the EFD is measured as lower than this value, a warning is triggered.
- The **Alarm Thr** parameter defines an impedance value in Ohm/kOhm/MOhm/GOhms. If the EFD is measured as lower than this value, an alarm is triggered.

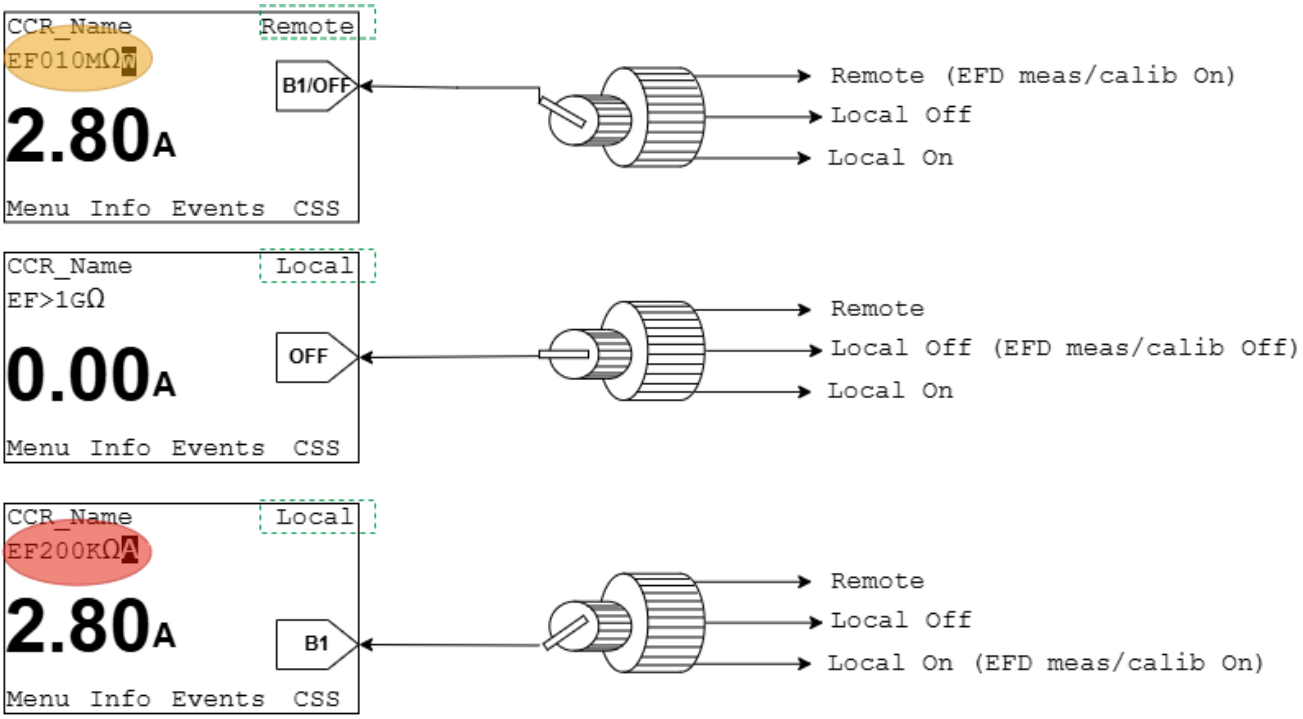
If EFD is enabled, at board startup and every time a selftest is performed, the **EFD Values** page of the **Info** screen shows the measurement process:

Figure 10: EFD Startup and Selftest - Info Screen View



When the CCR is in Local On or Remote Control modes and the impedance value is measured at lower than the warning and/or alarm values, the Home Screen displays the respective indication next to the EFD value, as shown in the following figure.

Figure 11: EFD Alarm/Warning Triggered



Note
More details about the W and A indications can be found in the **Events** screen.

EFD Calibration

EFD Calibration can be accessed from the **Service** menu.

EFD Calibration
1. Disconnect the series circuit on both nodes.
2. Turn the mode selection rotary knob to Remote position or Local On.
3. Navigate to **Config Menu** -> **Service Menu** -> **EFD calibration** screen. The first line under the name of the EFD calibration procedure turns into a status bar of inverted contrast that highlights the status of EFD.
4. The **Start** button to start the calibration will only appear when the EFD status is ready. If the EFD is busy with measuring the leakage value, performing a self-test, or EFD is disconnected, the **Start** button will not be available.
5. Once the EFD is in ready state and the **Start** button appears, press it to start the EFD calibration.
6. Once the Calibration is started, the screen will navigate automatically to the **EFD values** page in the **Info** screen. The set megging input voltage and state of EFD can be observed from this page.
7. Once the calibration is finished, the state of the EFD will be changed to ready, and it will start measuring the leakage value for the configured interval of time.

4.3.5 Firmware Update

Firmware Update can be accessed from the **Service** menu.

Firmware Update
1. Switch off the CCR.
2. Insert the microSD card into the dedicated slot on the Control Unit PCB Ensure the correct firmware file **fw_update.tar** is saved in the **root directory** of the card.
3. Switch on the CCR.
4. Navigate to **Service** menu -> **Backup/Restore** and create a backup of the existing configurations before starting the FW update.

Firmware Update
2. Navigate to **Config Menu** -> **Service Menu** -> **FW Update** screen. The first line under the name of the **FW Update** procedure is the status bar that informs the user whether a new firmware is available.
5. If a new firmware is available, the status bar prompts the user to turn Provisioning Mode before proceeding with the update.
6. If the Provisioning Mode has been turned on and the user selects **Update** -> **OK** there will be a confirmation screen with a **No**/**Yes** option before proceeding. Press **Yes** to update.
7. The next screen informs the user about the **Update Process**.
8. After successfully installing updates, the HMI will display "Firmware Update Successful" message. Press **OK** to go to the main screen/.
9. Navigate to **Service** menu -> **Backup/Restore** and restore the configurations from the last backup created and resume regular operation.

4.4 Protective Functions

4.4.1 Open Circuit Protection

This function protects the maintenance personnel in case of open circuit by tripping the CCR after a delay time if the output current stays below a predefined threshold level. The output current must exceed the threshold level to enable CCR normal operation. The capacitive current monitor may be selected to monitor the power factor of the load. With an open circuit on long shielded cables, there may be enough capacitance in the cable to hold the output current above the open circuit threshold level. If the load power factor is highly capacitive, capacitive load detection will switch off the CCR when selected and display an open circuit locking alarm. Detection time for capacitive output current is one second.

4.4.2 Over Current Protection

This function protects the lamps in the AFL circuit and also the CCR from long term over current caused by possible regulation/component fault of the CCR. If the output current exceeds the threshold level for a predefined time period (delay time), the CCR trips. Two levels A (normally higher threshold and shorter delay) and B are provided.

4.4.3 Over Current Protection, Fast Reset

The function protects the lamps in the AFL circuit and also the CCR for fast over currents, caused by load changes. If the output current exceeds 125% of nominal maximum intensity, the CCR will limit the output current below 2.0 Arms within 10ms for up to 80 ms, and will restore operation to normal.

4.4.4 Input Voltage Protection

This function protects the lamps in the AFL circuit and also the CCR from possible regulation/component fault of the CCR caused by long term over/under input voltage.

If the input voltage is out of acceptable limits for a predefined delay time the CCR trips. CCR starts automatically after the input voltage returns to acceptable limits.

B-levels are used as warning indication and can be set by the user. Reset mode is always A (resets automatically when actual value returns within acceptable limits).

4.4.5 Input Frequency and Temperature Protection

Frequency protection function protects the lamps in the AFL circuit and also the CCR from possible regulation/component fault of the CCR, caused by long term input frequency fault.

If the input frequency is out of acceptable limits (+/- 5% deviation results to a warning, +/- 10% to an alarm), the CCR trips. It will resume operation automatically when the input frequency returns within acceptable limits.

Temperature function protects the CCR from overheating caused by too high environmental temperature, for instance. The CCR monitors heat sink and main transformer temperature levels and raises a warning or an alarm if the values are outside the acceptable range. Once the temperature levels return within acceptable range, the CCR resumes operation.

4.5 ASG 8000i Events List

The following table is a complete list of alarms (A) and warnings (W) for ASG 8000i.

Note
Alarms in bold are locking alarms. Locking alarms turn the display red and are also indicated in the home screen with a message.

Events		
A/W	**Name**	**Set Condition**
(A)	General Alarm	When alarm bitmask matches the configured set mask.
(A)	Suppressed	When the output current is suppressed due to another alarm.
(A)	Locked	When the output current is suppressed and locked due to another alarm.
(A)	**Open Circuit**[1]	**When the CCR is unable to make current flow because of a cable break.** (See Troubleshooting section.)
(A)	**Over Current**[1]	**When the CCR saw a current spike due to a sudden load reduction.**(See Troubleshooting section.)
(A)	Overload	When the CCR is not able to reach the requested output current.
(A)	Regulation: Set-current not reached	When the CCR is not able to reach the requested output current (but is stable.
(A)	Unstable	When the CCR detects oscillations in the output current.
(A)	I/p Voltage Low	When the input voltage is below the alarm threshold.
(A)	I/p Voltage High	When the input voltage is above the alarm threshold.
(A)	I/p Freq Low	When the input frequency is below the alarm threshold.
(A)	I/p Freq High	When the input frequency is above the alarm threshold.
(A)	Temperature	When the CCR core temperature is above the alarm threshold.
(A)	Comm Channel A	When communication channel A is not read-only, and is not communicating.
(A)	Comm Channel B	When communication channel B is not read-only, and is not communicating.
(A)	Failsafe Active	When all non read-only communication channels are down, and when configured to go to failsafe.
(A)	HMI Disconn	When the HMI board is disconnected from the internal bus.
(A)	URC5 Disconn	When the URC5 board is disconnected from the internal bus.
(A)	CSM Disconn	When the CSM board is disconnected from the internal bus.
(A)	Mains off[2]	When the URC5 board does not detect input voltage.
(A)	EFD Disconn	When the EFD board is disconnected from the internal bus.
(A)	Mains Con Fail (Contactor)	When the mains contactor actual state does not match the commanded state.
(A)	SCR Failure	When the thyristor is broken.
(A)	**Cutout Open**[3]	**When the SCO microswitch is open.**
(A)	**Open door**[3]	**When the CCR door is opened.**
(A)	Contactor error C1	When the CSM contactor of channel 1 is not in the correct state

A/W	Events Name	Set Condition
(A)	Contactor error C2	When the CSM contactor of channel 2 is not in the correct state.
(A)	Contactor error C3	When the CSM contactor of channel 3 is not in the correct state.
(A)	Contactor error C4	When the CSM contactor of channel 4 is not in the correct state
(A)	Contactor error C5	When the CSM contactor of channel 5 is not in the correct state.
(A)	Contactor error C6	When the CSM contactor of channel 6 is not in the correct state.
(A)	Contactor error C7	When the CSM contactor of channel 7 is not in the correct state.
(A)	Contactor error C8	When the CSM contactor of channel 8 is not in the correct state.
(A)	EFD: Value	When the earth leakage resistance is lower then the alarm threshold.
(A)	EFD: Measurement time out	When the earth leakage resistance measurement timed out.
(A)	EFD: Open circuit	When the EFD board detects a cabling issue. (open circuit)
(A)	EFD: Short circuit	When the EFD board detects a cabling issue (short circuit).
(A)	EFD:Meg enable	When the EFD board detects flyback transformer issue.
(A)	EFD: Selftest	When the EFD board selftest failed.
(A)	EFD: Open load calibration	When the EFD board Open load calibration failed.
(A)	LFD: VA Drop	When the measured VA drop is higher then the alarm threshold.
(A)	LFD: Lamps Out	When the LFD number/percentage of failed lamps exceeds the alarm threshold.
(A)	LFD: Calibration data load failed	When the LFD calibration data could not be loaded.
(A)	LFD: Calibration incomplete	When the LFD calibration data has not been completed for the current commanded state.
(A)	HMI menu data	When the control board fails, push the menu config data to HMI.
(A)	Temperature Sensor	When the temperature sensor fails to respond.
(W)	General Warning	When warning bitmask matches the configured set mask.
(W)	Provisioning mode	When the CCR output is suppressed because it is in provisioning mode.
(W)	Misconfigured	When inconsistensies in the configuration are detected.
(W)	System log message lost	When the syslog log tracking has lost a message.
(W)	System log connection down A	When the syslog connection on channel A Ethernet interface is disconnected.
(W)	System log connection down B	When the syslog connection on channel B Ethernet interface is disconnected.
(W)	I/p Voltage Low	When the input voltage is below the warning threshold.
(W)	I/p Voltage High	When the input voltage is above the warning threshold.
(W)	I/p Freq Low	When the input frequency is below the warning threshold.
(W)	I/p Freq High	When the input frequency is above the warning threshold.
(W)	Temperature	When the CCR core temperature is above the warning threshold.
(W)	SDLOG msg lost	When the sdlog log tracking has lost a message.
(W)	CSM: EEPROM Init	When the EEPROM is not initialized properly.
(W)	CSM: EEPROM Write	When the EEPROM write operation is not done properly.

Events		
A/W	**Name**	**Set Condition**
(W)	CSM: EEPROM Read	When the EEPROM read operation is not done properly.
(W)	EFD: Value	When the earth leakage resistance is lower then the warning threshold.
(W)	EFD: CAN lost during self test	When the self test is interrupted becasues of CAN communication lost.
(W)	EFD: Auto mode timeout	When the EFD board measuring in auto mode but do not have measurement value with in the timeout.
(W)	EFD: Megging Input voltage stable	When the measurement started the megging voltage is does not reach stablize with in timeout.
(W)	LFD: VA Drop	When the measured VA drop is higher then the warning threshold.
(W)	LFD: Lamps Out	When the LFD number/percentage of failed lamps exceeds the warning threshold.
(W)	Input SPD Fault	When the input surge arrestor has lost its capacity to reduce voltage surges

Events List Notes

1. When an Open Circuit or an Over Current locking alarm is triggered, ASG 8000i switches off within IEC limits.
2. Although technically not a locking alarm, Mains Off is also a main screen alarm displayed in red.
3. When a Cutout Open or an Open Door locking alarm is triggered, ASG 8000i switches off.

5.0 Installation

5.1 General

This section deals with the installation of the CCR. Please refer to specific wiring diagrams and mechanical drawings for detailed information.

5.1.1 Transportation, Unpacking and Storage

Transportation

Make sure to do the following regarding transportation:

- Keep the CCR always in upright position during transportation and storage.
- Protect the CCR from adverse weather conditions.

Unpacking

Make sure to do the following upon receipt:

- Unpack and inspect the equipment immediately.
- Check the packing and equipment itself for damage.
- Notify the carrier of any damages.

Storage

Make sure to do the following regarding storage:

- Do not store the equipment for a prolonged period in its packaging.
- Store the equipment in an environment that complies with the environmental conditions defined for its use in the Environmental section.
- Inspect the equipment regularly.

Do the following after a long storage period:

- Clean the equipment, if necessary.
- Remove the oxidation layer from the electrical contact before connection, if necessary.

NOTICE

For long term storage, it is recommended to keep the equipment in a dry (<60% humidity) and moderate temperature area (15−30°C ambient temperature).

5.1.2 Moving and Handling the CCR at Site

10 cm elevation of the bottom plate is provided to enable use of forklifts. Ensure that the ends of the forklift arms reach the entire length or width of the product to securely lift the CCR. With the optional top hooks, a crane can also be used for moving the CCR.

Keep the CCR always in upright position as it contains heavy components and fixing is designed for upright position only.

5.1.3 Installation Requirements

Note

- The CCR is designed for indoor use only, in an area with adequate ventilation for cooling the CCR.
- Make sure you use air conditioning to reduce the risk of equipment damage.
- Make sure that you install the CCR in a well-ventilated environment with sufficient clearances to walls and other objects. This way you ensure proper ventilation and smooth workflows in case of operation/maintenance tasks.
- The installation environment shall be rated at maximum Pollution Degree 2 and free of vibrations.
- The unit shall be installed on concrete floors or other non-combustible surface only.

The table below lists the heat dissipation values of the CCR:

Table 3: Heat dissipation for air conditioning calculation

Version	Value (W)
2.5 kVA	300 W
4 kVA	400 W
5 kVA	500 W
7.5 kVA	600 W
10 kVA	700 w
15 kVA	900 W
20 kVA	1100 W
25 kVA	1400 W
30 kVA	1700 W

5.2 Mechanical Installation

- All cable entries are through the bottom plate of the CCR or from the front panel, for remote control.
- Leave 20 cm clearance from wall and 50 cm between CCR rows (back to back installation) for proper ventilation space.
- Reserve sufficient clearance in the front of the CCR for maintenance and operation purposes.

5.3 Electrical Installation

5.3.1 Mains Connection

- Connect the mains supply cable into the CCR's main switch terminals L, N (or L2), PE.
- Make sure that the cable size is sufficient for the CCR rating.
- Make sure that a proper earth for the CCR is provided. Although the earth copper wire is provided with the supply, additional safety grounding of the CCR is recommended.
- Make sure that the fuse bank in the supplying low voltage switchboard is correct for the supply cable and the CCR rating. See table below.
- It is recommended that the CCRs should be balanced evenly on the supply phases in order to provide as equal load for the 3 phases as possible, in all operational situations.
- OVC input voltage rating: OVC III
- OVC output voltage rating:
  - without circuit selector or cut-out and without output surge arrestor: OVC II
  - without circuit selector or cut-out with output surge arrestor: OVC III
  - with circuit selector or cut-out: Maximum impulse voltage is 17.5 kV
- Protective class of the equipment: Class I
- Number of phases: single-phase CCR

WARNING

The recommendations below should be considered as guidelines. Always follow national requirements for LV-boards and supply cables, which deviate from the values below.

Table 4: Recommended values for mains supply cabling

CCR size	Supply (V)	Main circuit breaker in CCR	Recommended size of circuit breaker for supply power in LV-board	Recommended minimum cross section of supply copper wire from LV-board to CCR	Recommended minimum cross section of earth copper wire from LV-board to CCR	Inom (Arms) (roundup)
2.5 kVA	230 VAC	2 pole 20 A, C-curve	2 pole 25 A, C-curve	6 mm^2	6 mm^2	13
4 kVA	230 VAC	2 pole 25 A, C-curve	2 pole 32 A, C-curve	10 mm^2	10 mm^2	21
5 kVA	230 VAC	2 pole 32 A, C-curve	2 pole 40 A, C-curve	10 mm^2	10 mm^2	26
	400 VAC	2 pole 20 A, C-curve	2 pole 25 A, C-curve	6mm^2	6 mm^2	15
7.5 kVA	400 VAC	2 pole 25 A, C-curve	2 pole 32 A, C-curve	10 mm^2	10 mm^2	23
10 kVA	230 VAC	2 pole 63 A, C-curve	2 pole 80 A, C-curve	25 mm^2	16 mm^2	52
	400 VAC	2 pole 32 A, C-curve	2 pole 40 A, C-curve	10 mm^2	10 mm^2	30
15 kVA	230 VAC	2 pole 100 A, C-curve	2 pole 125 A, C-curve	35 mm^2	25 mm^2	78
	400 VAC	2 pole 50 A, C-curve	2 pole 63 A, C-curve	16 mm^2	16 mm^2	45
20 kVA	400 VAC	2 pole 80 A, C-curve	2 pole 100 A, C-curve	35 mm^2	25 mm^2	60
25 kVA	400 VAC	2 pole 80 A, C-curve	2 pole 100 A, C-curve	35 mm^2	25 mm^2	75
30 kVA	400 VAC	2 pole 100 A, C-curve	2 pole 125 A, C-curve	50 mm^2	25 mm^2	90

CAUTION

The minimum size of the PE conductor shall comply with the local safety regulations for high PE conductor current equipment.

Table 5: Supply earthing systems and system voltage (V)

Supply earthing systems	System voltage
TN-S, TN-C, TN-CS, TT (not corner earthed)	≤ 230 V
TN-S, TT (corner earthed)	≤ 400 V
TN-C (middle point earthed)	≤ 200 V
IT (corner or not corner referenced)	≤ 230 V (TOV: 400 V)

Table 6: Prospective short-circuit current (PSCC) and residual current device (RCD)

	All power ratings
Max. PSCC	Small frame (2.5 - 15 kVA) 6 kA (ABB S202 series)
	Large frame (20 - 30 kVA) 40 kA (ABB S802P series)
RCD type	A, AC, F, B

Power Rating (kVA)	Input Voltage (V)	ABB Circuit Breaker	C-Curve
			Min. PSCC (A)
Small Cabinet			
3	230	S202-C20	200
4	230	S202-C25	250

Power Rating (kVA)	Input Voltage (V)	ABB Circuit Breaker	C-Curve
			Min. PSCC (A)
5	230	S202-C32	320
5	400	S202-C20	200
7.5	400	S202-C25	250
10	230	S202-C63	320
10	400	S202-C32	1000
15	230	S202-C100	1000
15	400	S202-C50	500
Large Cabinet			
20	400	S802P-C80	800
25	400	S802P-C80	800
30	400	S802P-C100	1000

CAUTION
This product can cause a DC current in the PE conductor. Where a residual current-operated protective device (RCD) is used for protection against electrical shock, only an RCD of Type B is allowed on the supply side of this product.

5.3.2 AFL-Circuit Connection

- Connect each circuit to pair of terminals marked with capital and small characters (e.g. A, a)
- If more circuits than one is used the connectors are in alphabetical order i.e. circuit 1 = A, a, circuit 2 = B, b etc.
- If grounding is used connect the cable shields to the grounding terminals on the cable fixing rail of the high voltage compartment.

5.3.3 Serial Remote Control Connection

- Connect the bus cable with with one of the two D9 connectors directly on the front of the CCR or internally on the control board

Note
Make sure that the connector is designed for that specific bus type (e.g. Profibus). For more information, see Appendix A . If the connectors have termination switches, make sure their settings conform to bus configuration (normally first and last physical units are terminated. Remember that there are termination switches on the serial control cards too!). It is recommended to use the termination in the cable connector to be able to replace any unit without affecting the bus operation. Make sure that the node address setting conforms to the bus configuration.

5.3.4 Parallel Remote Control Connection

- Connect the parallel control cable directly on one of the D37 connectors located on the front of the CCR. For more information, see Appendix E.
- Optionally, ASG 8000i can be delivered with terminal block-connections inside the low voltage compartment. The signal connection details are equal to the D37 connector.

Note
Before connecting, check that the remote control voltage setting conforms to the control voltage used.

5.4 Load Matching

Load matching is provided by using the taps on the Main Transformer. Benefits of load matching are described in Main Transformer, Efficiency and Power Factor.

5.5 Load Matching

Load matching is provided by using the taps on the Main Transformer. Benefits of load matching are described in Main Transformer, Efficiency and Power Factor.

Output Tap Setting (general advised procedure)

Several methods exist to select the transformer output tap, depending on the installation, the available information, the load, and any site-specific procedures. The procedure below follows the recommended method:

Output Tap Setting
1. Connect the CCR to the AGL series circuit using the factory-set output tap (default transformer connections) and switch on the CCR.
2. On the HMI, read and note the CCR output voltage (V_meas).
3. Calculate the required voltage: V_req = V_meas × 1.1.
4. Calculate the nominal CCR output voltage: V_nom = (Rated kVA × 1000) / 6.6 A.
5. Calculate the required tap percentage: Tap% = V_req / V_nom (limit to max. 100%). If Tap% > 100%, use 100%.
6. Switch off the CCR and follow all recommended safety steps before accessing the high-voltage compartment: isolate the supply, secure against re-energization, and verify the absence of voltage.
7. Adjust the transformer output connections to the tap equal to, or the next higher value than, your calculated Tap%. Tap connections are defined by two terminals (e.g., B1–B2, B1–B3, etc.). The selected tap percentage is the difference between the two tap values (e.g., for B2–B4: Tap% = %_B4 − %_B2).
8. Switch the CCR back on and check operation (start-up, current steps, output power/voltage stability).
9. If the CCR does not start or reach its rated output, increase the tap step-by-step until all functions operate correctly.

Note

1. If the output voltage or tap percentages are indicated on the transformer nameplate or label, always use those values. If this information is not available, refer to the tap table provided in this manual.
2. The additional −5% tap is intended for a 380 V nominal supply voltage and may be used if the required performance cannot be achieved with the other tap settings.

Tap Terminal	-5%	0%	15%	20%	35%	60%	80%	100%
	B0	B1	B2	B3	B4	B5	B6	B7

5.6 Commissioning Procedure

This section includes the necessary procedure that needs to be followed before operating a new CCR unit for the first time.

CT No.		Task	Manual Reference
1	1.1	Check if packaging is intact and the tilt indicator is okay.	5.1
	1.2	Review the CCR for any shipping damage, assessing both internal and external components.	5.1
	1.3	Record the CCR and circuit information in the Commissioning Test Report. Fill up the report while following along the commissioning procedure.	
2	2.1	Open the CCR doors, then either short circuit the output terminal taps or set the cutout (SCO) in "shorted" mode. Verify this step by measuring continuity on the output terminal.	Appendix F
	2.2	Check the supply cable and supply circuit breaker coming to the CCR. Measure the supply voltage, it should match the input voltage rating of the CCR.	
	2.3	Check that the CCR rotary switch is in "Off" position and the CCR circuit breaker is off as well.	
	2.4	Connect the supply cable to the CCR following the steps in the Electrical Installation.	5.3
	2.5	Measure the input voltage again and verify that it matches the CCR rating.	

CT No.		Task	Manual Reference
3	3.1	Engage the circuit breaker of the CCR, the display should light up.	
	3.2	Change the HMI language if necessary (**Menu-> Appearance-> Language**).	
	3.3	Adjust the LCD contrast if necessary (**Menu-> Appearance -> Display -> Contrast**).	
	3.4	Optional: Assign a CCR name (**Menu -> Circuit Parameters -> CCR name**).	
	3.5	Optional: Set a password to secure the CCR settings, which will be required for any future modifications.	
	3.6	Check in the **Info** screen that the CCR power rating and input supply voltage rating fit to the CCR label on the top door.	
	3.7	Check in the **Info** screen the firmware version and update the firmware if necessary.	
	3.8	Configure applicable remote control interfaces:	
		Serial Interface	5.3.3
	3.8a	Modbus TCP: 1. Go to **Menu -> Communication -> General** and set the **Slave number**, **Control timeout**, and **Modbus** protocol. 2. Use the **Control** setting to choose which interface(s) should be in control. 3. Set the **Ethernet A/B** settings based on the local infrastructure. a) Select **Active** to enable the corresponding ethernet interface. b) Enter the **ip address**, **port**, and preferred **framing**. c) After saving, peform a power cycle for the CCR to apply the changes.	
	3.8b	Modbus RTU (RS-485): 1. Go to **Menu -> Communication -> General** and set the **Slave number**, **Control timeout**, and **Modbus** protocol. 2. Use the **Control** setting to choose which interface(s) should be in control. 3. Set the **RS485 A/B** settings based on the local infrastructure. a) Select **Active** to enable the corresponding RS485 interface. b) Enter the **baud rate**, **stop bits**, and preferred **parity**. c) After saving, peform a power cycle for the CCR to apply the changes.	
	3.8c	Profibus: 1. Go to **Menu -> Communication -> General** and set the **Slave number, Control timeout**, and **Modbus** protocol. 2. Use the **Control** setting to choose which interface(s) should be in control. 3. Set **Expansion Slot 1/2** to Profibus depending on the setup. 4. After saving, perform a power cycle for the CCR to apply the changes.	
		Parallel Interface	5.3.4
	3.8d	1. Go to **Menu -> Communication -> General** and use the **Control** setting to choose which interfaces should be in control. 2. Set **Expansion Slot 1/2** to Multiwire depending on the setup. 3. Set the **Multiwire** settings based on the local infrastructure. a) Select **input style**, **output style**, and **input format** for the interface. b) After saving, peform a power cycle for the CCR to apply the changes.	
	3.9	Configure Circuit Selector Module if applicable: 1. Select the Circuit Selector type and activate it (**Menu -> CSS**). 2. Select the **Active circuits**. 3. On the main screen, the **CSS** option should now be available to control the live channels. At least one of the channels should be activated to see output current flow.	
4	4.1a	Check all current steps and adjust them if needed (**Menu -> Step Currents**).	
	4.1b	Turn on the CCR output by moving the rotary switch to the "Local" position.	
	4.1c	Check the output current in all steps by measuring the current with a TRMS current clamp to be compliant with the step current settings.	
	4.2a	Disengage the circuit breaker and follow all safety rules. Then connect the series circuit to the CCR and (if applicable) set the cutout (SCO) to "Operational" mode.	5.3.2
	4.2b	Engage the circuit breaker, turn the CCR in local control mode, and measure the output current in all steps with a TRMS current clamp.	
	4.3	Use an TRMS ammeter with an accuracy of 1% or better to calibrate the output current.	4.3

CT No.		Task	Manual Reference
	4.4	Check and perform output voltage (SP/DP) calibration if necessary.	4.3
	4.5	Check and perform input current (SP/DP) calibration if necessary.	4.3
	4.6	Check and perform input voltage calibration if necessary.	4.3
	4.7	Check the tapping and adjust it if needed.	5.4
	4.8	Run all intensity steps and check that the input voltage is sufficient.	
5	5.1	Optional: Check the supply voltage protection.	
	5.2	Optional: Check the input frequency protection.	
	5.3	Optional: Check the temperature protection.	
	5.4	Optional: Check the open circuit protection.	
	5.5	Optional: Check the over current protection.	
	5.6	Optional: Check and adjust/test the capacitve load protection.	
	5.7	Check current and fault leds on the HMI overlay.	
6	6.1	Optional: Check and configure the earth fault detection feature. 1. Enable EFD by selecting "On" as EFD mode in **Menu -> EFD**. 2. Configure the measurement **interval**. 3. Adjust the **warning** and alarm **thresholds**. 4. Choose the **hold off time**, if required. 5. If desired, activate **Suppress on alarm**.	
7	7.1	Optional: Check and configure the lamp fault detection feature. 1. Enable LFD by selecting "On" in **Menu -> LFD**. 2. Adjust the **warning** and **alarm thresholds**. 3. Choose the **hold off time**, if required. 4. Select the **Units** to "%" or "#" to display the LFD value on the main screen as percentage or number. 5. Perform the LFD calibration process (**Menu -> Service Menu -> LFD Calibration**).	
8	8.1	Optional: Check and adjust the VA drop feature.	
	8.2	Optional: Check and adjust the failsafe feature.	
	8.3	Optional: Check and adjust the ramping feature.	
	8.4	Optional: Check the remote control function according to the remote control manual.	
9	9.1	Sign all sheets of the commissioning test report. Store the diary and all documents inside the CCR.	

6.0 Maintenance

CAUTION

When the CCR is in maintenance, authorized skilled personnel may open the top door of the CCR to make a visual check of the components (i.e., LED status on PCB). Any operation other than a visual check, which involves inserting any body part or tool into the equipment, is not authorized. Opening the top door, which is part of the enclosure that provides protection against hazardous voltages in operation, gives potential access to live parts of hazardous voltage if a body part or tool is inserted. During the visual check with the door open, it is recommended to use appropriate Individual Protection Equipment (such as safety glasses) as defined by local regulations.

WARNING

Only qualified personnel should perform maintenance tasks!

CAUTION

De-energize the CCR before making changes to connection interfaces. With circuit selector all circuits are connected in series and short circuited. Circuits are not disconnected from the high voltage output. Selection of any combination of circuits is made within the circuit selector by removing the shorts. Always check for high voltage before any work with the AFL-circuit.

6.1 Content of Maintenance Work

The CCRs are designed using proven technology to reduce the maintenance requirements to minimum.

The maintenance tasks are securing the optimal performance of the constant current regulator and minimizing service interruptions.

Preventive maintenance program is recommended to be applied whenever possible. It can be divided in the following categories:

Type of check	Action
Visual	▪ Remove dust and dirt if necessary. ▪ Check wiring, especially earth wires. ▪ Check for loosened terminal screws. ▪ Check for damaged or loosened components.
Functional	▪ Run all current steps. ▪ Check remote controls and indications. ▪ Check protections (at least open circuit).
Calibration	Output current calibration check.
	Other calibration check, if desired

The main compartment can be opened via the door latch locks. The doors can be temporarily removed by unscrewing them from their hinges and disconnecting the earth connections.. A door switch in the high-voltage unit turns off the power when the door is opened.

Note

Remember to reconnect earth wires when reinstalling the doors and covers of the CCR.

6.2 Standard of Maintenance Work

Personnel responsible of the maintenance tasks should be familiar with all applicable airfield maintenance standards, e.g. IEC 61821, as well as with all relevant national and local safety regulations and requirements.

6.3 Cycle of Maintenance Work

The recommended maintenance period for CCRs installed in a substation environment, where the CCR is not exposed to excessive dirt or humidity, is one year.

In environments where dust or dirt is very severe, cleaning and verification of air circulation inside the CCR can require shorter maintenance periods.

Preventive maintenance program is recommended to be applied whenever possible.

6.4 Tools

There are no special tools required for maintenance or troubleshooting.

Below are listed some basic tools that are needed:

- Screwdriver set, including at least:
  - Slotted 3x0.5, connectors for wires.
  - Slotted 5.5x1.0, for contactors and circuit breakers.
  - Torx T25, for connections for frame
  - Torx T30, for connections for 15kva 230V, 20-30kva thyristor
  - Torx T20, for connections for core grounding
  - Torx T10, for connections for HMI
  - No. 1 Phillips, for connections for High Voltage board
- Hexagon socket drivers:
  - 5.5mm socket, for boards
  - 8mm socket, for grounding hardware
- Miscellaneous:
  - Hex Key set, metric, for supply and main transformer in larger CCRs
  - Box Cutter or Knife for cutting grommets
  - Torque wrench
  - Clean compressed air for cleaning dust or dirt
  - CCR manual for correct operation procedures.

In addition to the maintenance tools:

- Spare parts for component replacement.

7.0 Troubleshooting

WARNING

High voltage present! Only qualified personnel should do troubleshooting! If the CCR has tripped because of input voltage, frequency or temperature failure it is possible that it starts automatically when the mains returns to accepted values! Remember to check the fault indication and the fault log before troubleshooting.

7.1 CCR Does Not Start

Check/Observe	Probable cause / corrective action
LCD display shows error "Access to config failed".	1. Check that the control board firmware version matches the HMI firmware version by navigation to the **Versions** page from the **Info** menu. version. 2. Upgrade or downgrade versions accordingly by accessing the **Service** menu. **Note** Firmware versions prior to 1.0 allow no access to the Service menu. Contact ADB SAFEGATE for further assistance.
LCD display shows no main menu and displays error “CB COMM LOST”. Fault LED is on.	1. Check/replace the RJ45 CAN cables. 2. Ensure that the CAN terminations are set properly. 3. Ensure that the control board is powered up.
LCD displays error "URC5 Disconnected". Fault LED is on.	1. Check/replace the RJ45 CAN cables. 2. Ensure that the CAN terminations are set properly. 3. Ensure that the URC5 board is powered up.
LCD display is blank and the backlight is off after start-up.	1. Check the 24V DC power supply to HMI. 2. If required, replace HMI unit.
LCD display shows nothing and display backlight is on after start-up.	1. Check the display contrast. 2. Adjust the display contrast in **Menu** > **Appearance** > **Display** > **Contrast**. 3. If required, replace HMI unit.
Input frequency alarm in **Events** page	1. Check mains frequency level. 2. Check the Nominal Frequency configuration parameter in the **Service menu** -> **Type** -> **Nominal Input Frequency** parameter value. 3. Check the config parameter in **Menu** -> **Input Frequency Alarms** -> **Prevent Startup Threshold** low and high parameter value. 4. Check sync transformer. 5. Check the input frequency value in **Info** page.
Input voltage alarm in **Events** page	1. Check mains voltage level. 2. Check the Nominal voltage configuration parameter in the **Service menu** -> **Type** -> **Nominal Input Voltage** parameter value. 3. Check the config parameter in **Menu** -> **Input Voltage Alarms** -> **Prevent Startup Threshold** low and high parameter value. 4. Check the **Input voltage calibration**. 5. Check sync transformer. 6. Check the input voltage value in **Info** page.
Temperature alarm in **Events** page	1. Check the temperature value from **Info** screen. 2. Check that ventilation is not blocked. 3. Check the temperature sensor on the heatsink (or core as optional). 4. Check the sensor type in **Menu** -> **Temperature Alarms**.

Check/Observe	Probable cause / corrective action
Circuit Breaker	Check if the circuit breaker is on or off.
EFD value alarm in **Events** page	1. Check the EFD config parameter in **Menu** -> **EFD** -> **Suppress on Alarm**. 2. Check the EFD config parameter in **Menu** -> **EFD** -> **Alarm and Warning threshold** values.

7.2 CCR Trips

Check/Observe	Probable cause/Corrective action
Input voltage alarm in **Events** page	1. Check mains voltage level. 2. Check the Nominal voltage configuration parameter in the **Service menu** -> **Type** -> **Nominal Input Voltage** parameter value. 3. Check the config parameter in **Menu** -> **Input Voltage Alarms** -> **Trip Threshold** low and high parameter values. 4. Check the **Input voltage calibration**. 5. Check sync transformer. 6. Check the input voltage value in **Info** page.
Input Frequency alarm in **Events** page	1. Check mains frequency level. 2. Check the **Nominal Frequency** configuration parameter in the **Service menu** -> **Type** -> **Nominal Input Frequency** parameter value. 3. Check the config parameter in **Menu** -> **Input Frequency Alarms** -> **Trip Threshold** low and high parameter values. 4. Check sync transformer. 5. Check the input frequency value in **Info** page.
LCD displays error "Open Circuit". Fault LED is on.	1. Check if the load matches the power rating (transformer voltage tapping) of the CCR. 2. Check the config parameters in **Menu** -> **Open circuit Alarms** -> **Current** and **Shutdown time**.
LCD displays error "Open Circuit (CAP Load)". Fault LED is on.	Check the config parameters in **Menu** -> **Capacitive Load** -> **Zero crossing limit**, **Alarm time**, and **SCR ontime**.
LCD displays error "Cutout Open". Fault LED is on.	1. Check the cutout for being in the correct position. 2. Check the CUT-OUT OPEN LED status on the URC5 board. 3. Check the wiring and function of the micro-switch in the cutout to URC5 board.
LCD displays error "Open Door". Fault LED is on.	1. Ensure that the bottom door is closed. 2. Ensure that the door switch is working correctly. 3. Check the wiring between door switch and URC5 board.
LCD displays error "Mains Off". Fault LED is on.	1. Check all circuit breakers inside of the CCR. 2. Error should disappear when the main power is back.
Temperature alarm in **Events** page	1. Check the temperature value from **Info** screen. 2. Check that ventilation is not blocked. 3. Check the temperature sensor on the heatsink and core. 4. Check the sensor type in **Menu** -> **Temperature Alarms**. 5. Check the config parameter in **Menu** -> **Temperature Alarms** -> **Threshold** low and high and suppress in alarm parameter value.
LCD displays error "Over current". Fault LED is on.	Check the config parameters in **Menu** -> **Over current Alarms** ->**Low and High Current** and **Low and High time**.
VA Drop alarm in "Events" page	1. Check the VA drop config parameter in **Menu** -> **VA drop** ->**Suppress on Alarm**. 2. Check the VA drop parameter in **Menu** -> **VA drop** -> **Alarm and Warning threshold values** and **On** or **Off**.

7.3 Incorrect Performance of the CCR

Check/Observe	Probable cause/Corrective action
Max output current not provided (I out max < 6.6 A)	Load too big for the CCR. Check main transformer tapping. Check if input voltage is above 90% of the nominal value.
Current step differs from the control system step request. Current LED flashes with 500 ms interval	Make sure the output current is not oscillating. This could be done with the help of a current probe, connected to an oscilloscope.
CCR emits excessive noise	1. Check fixing of the choke of the passive filter. 2. Check thyristor controller and module. 3. Check with an oscilloscope and current clamp if both positive and negative half cycles are present on the output current.

Appendix A: Serial Communication Interface – Profibus DP Connection

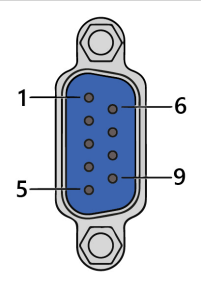
Bus cabling

The bus cabling is made in daisy chain form (from the first unit to second ... to last) Special Profibus DP cable must be used. Two wires (+ and -) are connected in each fieldbus connector.

WARNING

Make sure that the polarity is not mixed anywhere on the bus.

Figure 12: D9 Female Connector



Bus connectors

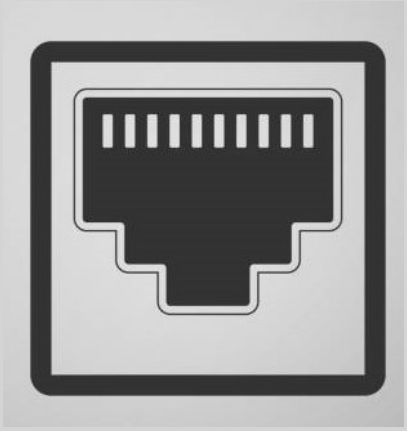
D9 female connector provided on the card front plate. Special Profibus DP fieldbus connectors must be used. The connectors normally include 2 screw terminals for incoming and outgoing cable connection and may include also bus termination switches.

Table 7: Fieldbus Hardware Signal Connection/Profibus DP

D9 Pin No	Signal/Profibus DP	Remarks
Housing	Shield	Bus cable shield, connected to PE
1	Not Connected	-
2	Not Connected	-
3	B-line	Positive RxD / TxD according to RS 485 specification
4	RTS	Request to send
5	GND BUS	Isolated GND for the BUS termination
6	+5 V BUS	Isolated +5 V for the bus termination
7	Not Connected	-
8	A-line	Negative RxD / TxD according to RS 485 specification
9	Not Connected	-

Appendix B: Serial Communication Interface – Modbus TCP Connection

Figure 13: RJ45 Female Ethernet Connector



Cabling

Each communication interface has its own standard Ethernet connection cable which is connected (plug in) between the control system Ethernet switch (hub) and the CCR.

Connector

RJ45 female connector is provided on the HMI front plate.

Addressing

Each communication interface must have unique address on the Ethernet local area network where it is connected (including control system devices and CCR communication interfaces).

- IP address #1 = 192.168.0.n (default)
- IP address #2 = 172.162.0.n (default)

The last field n is binary coded with 8 dip-switches on the front plate of the communication interface.

Note
Addresses 0 and 127 cannot be used.

- Subnet mask = 255.255.255.0 (default)
- Default gateway = 0.0.0.0 (default, no gateway set)
- It is possible to change the default IP address 192.168.0 (IAONA standard for private networks), the subnet mask and default gateway address if necessary by performing the following steps.
- Connect a PC directly to the RJ45 female connector on the CCR.
- Open the Network Adapter settings and use the following values:
  - IP address: 192.168.0.12
  - Subnet mask: 255.255.255.0
  - Gateway address: 0.0.0.0
  - DNS1 address: 0.0.0.0
  - DNS2 address: 0.0.0.0
- Type the new network information in the relevant fields.
- Store the configuration.
- Turn off the power to the CCR.
- Set the dip-switch on the CCR to address 0.
- Turn on the power to the CCR.
- Test that the new IP address is valid.
- ***Note:****Only the last digit of the default IP address 192.168.0.n can be set using the dip-switch. If the default IP address has been changed the dip-switch must remain set to address 0.*

Power breaks

ASG 8000i equipped with single modbus TCP serial interface can manage 1 second power breaks without any break on the control status. When returning from longer power breaks the failsafe setting will be used until the serial interface is in online mode and starts following the control system commands. The start-up time varies depending on the network status from 1 to 3 seconds.

Appendix C: Serial Control Interface Signal List Profibus DP/ Modbus TCP

The ASG8000i reuses the same signal list for Profibus DP/ Modbus TCP as the MCR3 and the IDM8000. The preferred preset can be chosen from **Config Menu**->**Communication**->**General**->**Modbus Type**. Table 8 and Table 9 list the signals for MCR3 compatibility. Table 10 and Table 11 show the Control and Indication Bits for IDM8000 preset.

For MCR3

Table 8: MCR3: Control Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
0x0030	48	1	0-7	Current steps	Remote requested current steps
		2	8-15	Circuits	Remote requested circuits

Table 9: MCR3: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
0x60	96	1	0	rev	Reserved
			1	rev	Reserved
			2	Remote / Local	Remote = 1
			3	rev	Reserved
			4	rev	Reserved
			5	Failsafe	Failsafe (default) mode
			6	rev	Reserved
			7	Lamp limit reached	TODO: Implement when hour counters are implemented.
		2	8	rev	Reserved
			9	Od (A) Alarm (Open door)	Open door Alarm
			10	MOV blown	TODO: Not implemented, we don't monitor the MOV, if there even is one
			11	Temp (A) Alarm	Temperature alarm
			12	System log server	0 = Dis/Remote logging not mode running, 1 = En/Remote logging mode running
			13	Other bus status	0 = Other bus up (RS485_A, ETH_A, RS485_B, ETH_B), 1 = Other bus down (RS485_A, ETH_A, RS485_B, ETH_B)
			14	Dual bus operation status	Only supported arbiter is A and B, in which case there is no concept of a primary bus, keep these at 0.
			15		
0x61	97	1,2	0 - 15	Local bus status	The local bus no longer exists, there is no dongle, return 0 here.
0x62	98	1	0	Reported Step Bit 0	Repoerted steps in BCD formate
			1	Reported Step Bit 1	
			2	Reported Step Bit 2	
			3	Reported Step Bit 3	

Table 9: MCR3: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
			4	rev	Reserved
			5	rev	Reserved
			6	rev	Reserved
			7	rev	Reserved
		2	8	Circ 1	Reported Circuit 1
			9	Circ 2	Reported Circuit 2
			10	Circ 3	Reported Circuit 3
			11	Circ 4	Reported Circuit 4
			12	Circ 5	Reported Circuit 5
			13	Circ 6	Reported Circuit 6
			14	Circ 7	Reported Circuit 7
			15	Circ 8	Reported Circuit 8
0x63	99	1	0	Has CB	LMC (we will consider the control board as LMC)
			1	Has HMI	UI (we will consider the HMI(s) as UI).
			2	Has URC5	CCL (we will consider the URC5 as CCL).
			3	Has EFD	EFD available or not.
			4	Has LFD	LFD is implemented in CB (not implemented yet, always 0.)
			5	Has URC5 (Why same bit repeated ???)	TBM (we will consider the URC5 as TBM).
			6	rev	Reserved
			7	rev	Reserved
		2	8	Has CB	MSB mirrors LSB.
			9	Has HMI	
			10	Has URC5	
			11	Has EFD	
			12	Has LFD	
			13	Has URC5 (Why same bit repeated ???)	
			14	rev	
			15	rev	
0x64	100	1	0	Has CB	LMC (we will consider the control board as LMC)
			1	Has HMI	UI (we will consider the HMI(s) as UI).
			2	Has URC5	CCL (we will consider the URC5 as CCL).
			3	Has EFD	EFD available or not.

Table 9: MCR3: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
			4	Has LFD	LFD is implemented in CB (not implemented yet, always 0.)
			5	Has URC5 (Why same bit repeated ???)	TBM (we will consider the URC5 as TBM).
			6	rev	Reserved
			7	rev	
		2	8	rev	Reserved
			9	rev	
			10	rev	
			11	rev	
			12	rev	
			13	rev	
			14	rev	
			15	rev	
0x65	101	1,2	0 - 15	EFD leak value	EFD leak impedance measurement
0x66	102	1,2	0 - 15	LFD value	LFC measurement value
0x67	103	1,2	0 - 15	I1	Output current in mA
0x68	104	1,2	0 - 15	U2	Output voltage in 0.1V
0x69	105	1,2	0 - 15	P2	Output power in W.
0x6a	106	1,2	0 - 15	step and circuits (commanded)	Current request for step and circuits (commanded)
0x6b	107	1,2	0 - 15	step and circuits (remote resquested)	Pending request for step and circuits (remote resquested)
0x6c	108	1,2	0 - 15	I1	Input current in 0.1A
0x6d	109	1,2	0 - 15	U1	Input voltage in 0.1V
0x6e	110	1,2	0 - 15	P1	Input power in W
0x6f	111	1,2	0 - 15	Conduction angle	Conduction angle in degrees (assumed range 0-180)
0x70	112	1,2	0 - 15	Temp	temperature in 0.5C
0x71	113	1	0	Oc A	Over Current A Alarm
			1	crest factor	crest factor too high //Not implemented
			2	Zero crossing A	Zero crossing detection Alarm //Not implemented
			3	Up A	Open Circuit A Alarm
			4	ccl measurement connector disconnected	ccl measurement connector disconnected //Not implemented
			5	Regulation (Output current deviates) A	Regulation (Output current deviates) A Alarm

Table 9: MCR3: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
			6	Over load A Alarm	Over load A Alarm
			7	Unstable A	Unstable A alarm (Output current unstable)
		2	8	Asymmetry error on output //Not implemented	Asymmetry error on output //Not implemented
			9	Open door A	Open door A (Alarm)
			10	mov Blown alert	mov Blown alert //Not implemented
			11	rev	Reserved
			12	Temp Sensor is missing	Temp Sensor is missing //Not implemented
			13	rev	Reserved
			14	Temparature A Alarm	Temparature A Alarm
			15	rev	Reserved
0x72	114	1	0	U1 low A	Input Voltage low Alarm
			1	U1 high A	Input Voltage high Alarm
			2	U1 unstable A	Input voltage unstable Alarm //Not implemented
			3	P1 loss (Brownout)	Input power loss (Brownout)
			4	Mains frequency out of limit A	Mains frequency out of limit Alarm
			5	CSM disconnected A	CSM disconnected Alarm
			6	Error during ccl calibration	Error during ccl calibration // Not implemented
			7	rev	Reserved
		2	8 - 15	Circuit error	Commanded is not equal to actual
0x73	115	1,2	0 - 15	Hour Counter A	Hour Counter Error // Not implemented
0x74	116	1	0	EFD B	EFD Value Warning
			1	EFD A	EFD Value Alarm
			2	EFD calib	EFD calibrating
0x75	117	1,2	0 - 15	LFD Error	LFD Errors // not implemented
0x76	118	1	0	Bus A down	Bus A down
			1	Bus B down	Bus B down
0x77	119	1,2	0 - 15	// Not implemented	??
0x281	641	1,2	0 - 15	EFD B level	EFD Warning level
0x282	642	1,2	0 - 15	EFD A level	EFD Alarm level
0x283	643	1,2	0 - 15	EFD Interval	EFD Interval
0x2C0	704	1,2	0 - 15	LFDA	LFD //Not implemented
0x2C1	705	1,2	0 - 15	LFD B	LFD //Not implemented

Table 9: MCR3: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
0x2C2	706	1,2	0 - 15	LFD //Not implemented	LFD //Not implemented
0x2C3	707	1,2	0 - 15	LFD //Not implemented	LFD //Not implemented
0x800	2048	1,2	0 - 15	Total hours MSW	Total hours MSW
0x801	2049	1,2	0 - 15	Total hours LSW	Total hours LSW
0x802	2050	1,2	0 - 15	Total hours max intensity. MSW	Total hours max intensity. MSW
0x803	2051	1,2	0 - 15	Total hours max intensity. LSW	Total hours max intensity. LSW
0x804	2052	1,2	0 - 15	Total ON time of the circuit in minutes.	
0x805	2053	1,2	0 - 15		
0x806	2054	1,2	0 - 15		
0x807	2055	1,2	0 - 15		
0x808	2056	1,2	0 - 15		
0x809	2057	1,2	0 - 15		
0x80a	2058	1,2	0 - 15		
0x80b	2059	1,2	0 - 15		
0x80c	2060	1,2	0 - 15		
0x80d	2061	1,2	0 - 15		
0x80e	2062	1,2	0 - 15		
0x80f	2063	1,2	0 - 15		
0x810	2064	1,2	0 - 15		
0x811	2065	1,2	0 - 15		
0x812	2066	1,2	0 - 15		
0x813	2067	1,2	0 - 15		
0x890	2192	1,2	0 - 15	CCR ID Block	ASCII text of CCR name
0x891	2193	1,2	0 - 15		
0x892	2194	1,2	0 - 15		
0x893	2195	1,2	0 - 15		
0x894	2196	1,2	0 - 15		
0x895	2197	1,2	0 - 15		
0x896	2198	1,2	0 - 15		
0x897	2199	1,2	0 - 15		
0x898	2200	1,2	0 - 15		
0x899	2201	1,2	0 - 15		

For IDM80000

Table 10: IDM80000: Control Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
0x400	1024	1	0	On ind a	Off + 7 steps * binary coding * static 1= on
			1	On ind b	
			2	On ind c	
			3	Dir 2/Circ 1	Acc. The CCR type
			4	Circ 2	Circuit 2
			5	Circ 3	Circuit 3
			6	Circ 4	Circuit 4
			7	Hb	Heartbeat bit

Table 11: IDM8000: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
0x0	0	1	0	On ind a	Off + 7 steps * binary coding * static 1= on
			1	On ind b	
			2	On ind c	
			3	Dir 2/ Circ1	0=dir 1, 1=dir 2 / Circ 1 on
			4	Circ 2	
			5	Circ 3	
			6	Circ 4	
			7	Remote / Local	Remote = 1
		2	8	Pwr on or On bit	Reported step > 0
			9	Over Current (Oc)	Over current alarm
			10	Open Circuit (Uc)	Open circuit alarm
			11	U1 (A) Alarm	Input voltage High + Low alarm
			12	U1 (B) Warning	Input voltage High + Low warning
			13	Freq (A) Alarm	Input frequency High + Low alarm
			14	Freq (B) Warning	Input frequency High + Low warning
			15	Temp (A) Alarm	Temperature alarm
0x1	1	3	16	Temp (B) Warning	Temperature warning
			17	VA (A) Alarm	VA-drop alarm
			18	VA (B) Warning	VA-drop warning
			19	Cf	Current fault (Regulation, Unstable, Overload) alarm
			20	LF (A) Alarm	Lamp fault / Lamps out alarm
			21	LF (B) Warning	Lamp fault / Lamps out warning

Table 11: IDM8000: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
			22	EF (A) Alarm	Earth fault alarm
			23	EF (B) Warning	Earth fault warning
		4	24	rev	Reserved
			25	EF / 0	EF / Earth fault value * value 0-100 * 127=off * Max 50M or 1G * Lsb= EF / 0
			26	EF / 1	
			27	EF / 2	
			28	EF / 3	
			29	EF / 4	
			30	EF / 5	
			31	EF / 6	
0x2	2	5	32	EF scale 0	Earth fault value scale 0=1K and 100K, 1=10K and 1M, 2=100k scale, 10M range | 10M scale, 1G scale.
			33	EF scale 1	
			34	LF / 0	LF / Qty of lamp faults * 0-62 lamp faults * 63= monitoring off * Lsb = LF / 0
			35	LF / 1	
			36	LF / 2	
			37	LF / 3	
			38	LF / 4	
			39	LF / 5	
		6	40	rev	Reserved
			41	rev	
			42	rev	
			43	rev	
			44	rev	
			45	rev	
			46	rev	
			47	rev	
0x3	3	7	48	I2 / 0	I2 / Output current * 8A = 160 * digit = 0,05A *resol = 0,6% * Lsb= I2 / 0 I2 / Output current * ???A = 160 * digit = ???A *resol = ???? * Lsb= I2 / 0
			49	I2 / 1	
			50	I2 / 2	
			51	I2 / 3	
			52	I2 / 4	
			53	I2 / 5	
			54	I2 / 6	
			55	I2 / 7	

Table 11: IDM8000: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
		8	56	U2 / 0	U2 / Output voltage *resol = 0,8% *125=U2n (acc CCR size) * U2n = Pn / 6,6A * digit = U2n / 125 * eg 3,63V / 3kVA CCR * Lsb= U2 / 0
			57	U2 / 1	
			58	U2 / 2	
			59	U2 / 3	
			60	U2 / 4	
			61	U2 / 5	
			62	U2 / 6	
			63	U2 / 7	
0x4	4	9	64	P2 / 0	P2 / Output actual power * 125 = Pn (acc CCR size) * digit = Pn / 125 * eg 24W / 3kVA CCR * resol = 0,8% * Lsb= P2 / 0
			65	P2 / 1	
			66	P2 / 2	
			67	P2 / 3	
			68	P2 / 4	
			69	P2 / 5	
			70	P2 / 6	
			71	P2 / 7	
		10	72	Circ 5	Circuit 5 selected
			73	Circ 6	Circuit 6 selected
			74	SCO	Series Cutout Open
			75	rev	Reserved
			76	rev	
			77	rev	
			78	rev	
			79	rev	
0x5	5	11	80	Type	0=Norm,1=Dir,2-4=Cs2-4
			81		
			82		
			83	rev	Reserved
			84	Size	1=2,5kVA, 2=3kVA, 3=4kVA...12=30kVA
			85		
			86		
			87		
		12	88	On ind a	Feedback of the other serial interface control bits when redundant duplicate interface is used
			89	On ind b	

Table 11: IDM8000: Indication Bits

Bus Address		Byte	Bit	Signal	Remarks
Hex	Decimal				
			90	On ind c	
			91	Dir 2/ Circ1	
			92	Circ 2	
			93	Circ 3	
			94	Circ 4	
			95	Hb	
0x6	6	13	96-104	rev	Reserved
		14	105-112	rev	Reserved
0x7	7	15	113-120	rev	Reserved
		16	121-128	rev	Reserved

Appendix D: Multiwire Control Interface Signal List

The ASG8000i supports multiple presets for the Multiwire Control Interface. The corresponding preset can be selected from **Config Menu**->**Communication**->**Multiwire**. The following table shows the Input and Output pin assignments for the different presets. The presets are based on existing ADB SAFEGATE CCR models.

Input Pins						
Pins	CRE	MCR3	IDM8000			
			Normal		Circuit Selector	
			Decimal	Binary	Decimal	Binary
1	Step 1	Step 1	Step 1	B0	Step 1	B0
2	Step 2	Step 2	Step 2	B1	Step 2	B1
3	Step 3	Step 3	Step 3	B2	Step 3	B2
4	Step 4	Step 4	Step 4	N/A	Circuit 1	-
5	Step 5	Step 5	Step 5	N/A	Circuit 2	-
6	On	Disabled	Step 6	N/A	Circuit 3	-
7	Disabled	Disabled	Step 7	N/A	Circuit 4	-
8	Disabled	Disabled	Disabled	-	Circuit 5	-
9	Disabled	Disabled	Disabled	-	Circuit 6	-

Output Pins						
Pins	CRE	MCR3	IDM8000			
			Normal		Circuit Selector	
			Decimal	Binary	Decimal	Binary
1	Disabled	Step 1	On	On	On	On
2	Disabled	Step 2	Disabled	Disabled	Disabled	Disabled
3	Step 1	Step 3	Step 1	B0: Step bit 0 indication	Step 1	B0: Step bit 0 indication
4	Step 2	Step 4	Step 2	B1: Step bit 1 indication	Step 2	B1: Step bit 1 indication
5	Step 3	Step 5	Step 3	B2: Step bit 2 indication	Step 3	B2: Step bit 2 indication
6	Step 4	On	Step 4	Disabled	Circuit 1	Circuit 1
7	Step 5	Regulation error	Step 5	Disabled	Circuit 2	Circuit 2
8	Disabled	Over temperature alarm	Step 6	Disabled	Circuit 3	Circuit 3
9	Disabled	Over current alarm	Step 7	Disabled	Circuit 4	Circuit 4
10	Open circuit	Open circuit alarm	Disabled	Disabled	N/A	N/A
11	Disabled	EFD warning	Disabled	Disabled	Circuit 5	Circuit 5
12	Disabled	EFD alarm	Disabled	Disabled	Circuit 6	Circuit 6
13	On / Off	LFD warning	Disabled	Disabled	Disabled	Disabled
14	Over current	LFD alarm	Disabled	Disabled	Disabled	Disabled

Output Pins						
Pins	CRE	MCR3	IDM8000			
			Normal		Circuit Selector	
			Decimal	Binary	Decimal	Binary
15	Lamp fault warning - FB	LFD VA drop warning	Disabled	Disabled	Disabled	Disabled
16	Bad regulation	LFD VA drop alarm	Open circuit alarm.	Open circuit alarm.	Open circuit alarm.	Open circuit alarm.
17	LFD alarm (Relay 11)	Circuit 1 active	Over current alarm.	Over current alarm.	Over current alarm.	Over current alarm.
18	EFD warning - FB	Circuit 2 active	Disabled	Disabled	Disabled	Disabled
19	EFD error - FB	Disabled	Lamp fault alarm A	Lamp fault alarm A	Lamp fault alarm A	Lamp fault alarm A
20	Disabled	Disabled	Lamp fault warning B	Lamp fault warning B	Lamp fault warning B	Lamp fault warning B
21	High temperature alarm	Disabled	VA-drop alarm	VA-drop alarm	VA-drop alarm	VA-drop alarm
22	Disabled	Disabled	Earth fault alarm A	Earth fault alarm A	Earth fault alarm A	Earth fault alarm A
23	Disabled	Disabled	Earth fault warning B	Earth fault warning B	Earth fault warning B	Earth fault warning B
24	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

Appendix E: Spare Parts List

Critical Parts are essential for uninterrupted operation and should be kept in stock (Table 12).

Recommended Parts is advised to be kept available for uninterrupted operation and should be kept in stock (Table 13).

Corrective Parts are those required only for rare and unexpected failures, and can be ordered when needed (Table 14).

Table 12: Critical Spare Parts

Description & Component No	Part No	230 V					400 V						
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA
Earth Fault Detection board EP00128-001-01	SP00065-000-01	1	1	1	1	1	1	1	1	1	1	1	1
URC5 control board EP00112-ICO-01	SP00038-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Auxiliary Power supply 230/400 to 24VDC EP00101-001-01	SP00039-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Control board EP00116-001-01	SP00040-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Thyristor RC protection EP00134-002-01	SP00041-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Thyristor 2.5kVA to 10KVA 6351.85.120	SP.011378	1	1	1	1		1	1	1	1			
Thyristor 20kVA to 30kVA EB00483-002-01	SP00043-002-01					1					1	1	1
Profibus expansion board EP00144-001-01	SP00050-001-01	1	1	1	1	1	1	1	1	1	1	1	1
Multiwire expansion board and interface board EP00145-001-01*	SP00051-001-01	1	1	1	1	1	1	1	1	1	1	1	1
*Also include EP00150-001-01		1	1	1	1	1	1	1	1	1	1	1	1
HMI with IO for slim frame NN.AS00310-210-02	SP00055-210-02	1	1	1	1	1	1	1	1	1			
HMI with IO for wide frame NN.AS00310-220-02	SP00055-220-02										1	1	1

Note

Component numbers EB00526-000-01 (Profibus expansion board), EP00145-001-01 and EB00526-000-01 (Multiwire expansion and interface boards) are for CCRs with those options.

Note

Regarding the suitable HMI between NN.AS00310-210-02 and NN.AS00310-220-02, please consider that the presence of Circuit Selector may change the frame size. Contact ADB SAFEGATE for details.

Table 13: Recommended Spare Parts

Description & Component No	Part No	230 V					400 V						
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA
EMI filter 230V EP00133-002-01	SP00045-002-01	1	1	1	1	1							
EMI filter 400V EP00133-001-01	SP00045-001-01						1	1	1	1	1	1	1
Main circuit breaker 230V 2.5-3kVA & 400V 5kVA 6150.90.600	SP00046-001-01	1					1						
Main circuit breaker 230V 4kVA & 400V 7.5kVA 6150.90.560	SP00046-002-01		1					1					
Main circuit breaker 230V 5kVA & 400V 10kVA EZ00014-032-01	SP00046-003-01			1					1				
Main circuit breaker 230V 10kVA EZ00014-063-01	SP00046-005-01				1								
Main circuit breaker 230V 15kVA EZ00014-100-01	SP00046-007-01					1							
Main circuit breaker 230V 20kVA EZ00016-125-01	SP00046-009-01												
Main circuit breaker 400V 15kVA 6150.90.580	SP00046-004-01									1			
Main circuit breaker 400V 20kVA & 25kVA EZ00016-080-01	SP00046-006-01										1	1	
Main circuit breaker 400V 30kVA EZ00016-100-01*	SP00046-008-01												1
*also include EP00150-001-01		1	1	1	1	1	1	1	1	1	1	1	1
Contactor 230 VAC 2.5KVA & 400 VAC 5KVA EB00514-009-01	SP00053-009-01	1					1						
Contactor 230 VAC 4KVA EB00514-016-01	SP00053-016-01		1					1					

Table 13: Recommended Spare Parts

Description & Component No	Part No	230 V					400 V						
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA
Contactor 230 VAC 5KVA EB00514-030-01	SP00053-030-01			1					1				
Contactor 230 VAC 10KVA & 400 VAC 7.5KVA_15KVA EB00514-016-01 duplicate	SP00053-016-01				2					2			
Contactor 230 VAC 15KVA & 400 VAC 20 KVA _ 25KVA EB00514-080-01*	SP00053-080-01					2					2	2	
*Also include EB00526-000-01													
Contactor 230 VAC 20KVA & 400 VAC 10KVA_30KVA EB00514-030-01*	SP00053-030-01												2
*Also include EB00526-000-01													
Input surge arrester EZ00011-001-01	SP00056-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Control circuit breaker EZ00014-0D2-01	SP00057-000-01	1	1	1	1	1	1	1	1	1	1	1	1
Cutout 1475.92.030	SP.011932	1	1	1	1	1	1	1	1	1	1	1	1
Lightning arrester 6314.32.750	SP.011369	1	1	1	1	1	1	1	1	1	1	1	1
3-Pole Connecting Strip 230 VAC 10 KVA & 400 VAC 15 KVA A3812 A3812	SP00058-000-01				4					4			
Connecting Strip 230 VAC 15 KVA_20KVA & 400 VAC 20 KVA to 30KVA A3820	SP00059-000-01					4					4	4	4
24 VDC external Power supply EB00568-001-01	SP00060-001-01	1	1	1	1	1	1	1	1	1	1	1	1

Table 13: Recommended Spare Parts

Description & Component No	Part No	230 V					400 V						
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA
48 VDC external Power supply EB00568-002-01	SP00060-002-01	1	1	1	1	1	1	1	1	1	1	1	1
Current measurement transformer ET00020-001-01	SP00061-000-01	1	1	1	1	1	1	1	1	1	1	1	1

Note
Cutout 1475.92.03 and spare part are for CCRs that were ordered with that option.

Note
Selecting between external power supply SP00060-001-01 and SP00060-002-01 depends on the CCR's Internal Power Supply option, 24VDC or 48VDC respectively.

Table 14: Corrective Spare Parts

Description	Part No	230 V					400 V							
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA	
Synchronizing transformer 230VAC ET00019-002-01	SP00042-002-01	1	1	1	1	1								
Synchronizing transformer 400VAC ET00019-001-01	SP00042-001-01						1	1	1	1	1	1	1	
2,02mH 16A Choke EL00003-001-01	SP00044-001-01	1												
Choke 1,5mH 25A EL00003-012-01	SP00044-012-01		1	1										
Choke 3,67mH 16A EL00003-003-01	SP00044-003-01						1							
Choke 2.45mH 23A EL00003-004-01	SP00044-004-01							1						
Choke 0,75mH, 50A EL00003-014-01	SP00044-014-01				1									
Choke 1,83mH 31A EL00003-005-01	SP00044-005-01								1					
Choke 0,5mH, 75A EL00003-015-01	SP00044-015-01					1								
Choke 1,22mH 46A EL00003-007-01	SP00044-007-01									1				
Choke 0,35mH, 100A EL00003-016-01	SP00044-016-01													
Choke0,92mH 61A EL00003-009-01	SP00044-009-01										1			
Choke 0,73mH 76A EL00003-010-01	SP00044-010-01											1		
Choke 0,61mH 91A EL00003-011-01	SP00044-011-01												1	
Main transformer 230V 2.5kVA ET00021-016-01	SP00049-016-01	1												
Main transformer 230V 4kVA ET00021-002-01	SP00049-002-01		1											

Table 14: Corrective Spare Parts

Description	Part No	230 V					400 V							
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA	
Main transformer 230V 5kVA ET00021-012-01	SP00049-012-01			1										
Main transformer 230V 10kVA ET00021-013-01	SP00049-013-01				1									
Main transformer 230V 15kVA ET00021-014-01	SP00049-014-01					1								
Main transformer 230V 20kVA ET00021-015-01	SP00049-015-01													
Main transformer 400V 5kVA ET00021-003-01	SP00049-003-01						1							
Main transformer 400V 7.5kVA ET00021-004-01	SP00049-004-01							1						
Main transformer 400V 10kVA ET00021-005-01	SP00049-005-01								1					
Main transformer 400V 15kVA ET00021-007-01	SP00049-007-01									1				
Main transformer 400V 20kVA ET00021-009-01	SP00049-009-01										1			
Main transformer 400V 25kVA ET00021-010-01	SP00049-010-01											1		
Main transformer 400V 30kVA ET00021-011-01	SP00049-011-01												1	
Voltage transformer 230 VAC 2.5KVA ET00024-016-01	SP00052-016-01	1												
Voltage transformer 230 VAC 4KVA ET00024-002-01	SP00052-002-01		1											

Table 14: Corrective Spare Parts

Description	Part No	230 V					400 V							
		2.5kVA	4kVA	5kVA	10kVA	15kVA	5kVA	7.5kVA	10kVA	15kVA	20kVA	25kVA	30kVA	
Voltage transformer 230 VAC 5KVA & Voltage transformer 400VAC 5KVA ET00024-003-01	SP00052-003-01			1			1							
Voltage transformer 230 VAC 10KVA & Voltage transformer 400VAC 10KVA ET00024-005-01	SP00052-005-01				1				1					
Voltage transformer 230 VAC 15KVA & Voltage transformer 400VAC 15KVA ET00024-007-01	SP00052-007-01					1				1				
Voltage transformer 230 VAC 20KVA & Voltage transformer 400VAC 20KVA ET00024-009-01	SP00052-009-01										1			
Voltage transformer 400VAC 7.5KVA ET00024-004-01	SP00052-004-01							1						
Voltage transformer 400VAC 25KVA ET00024-010-01	SP00052-010-01											1		
Voltage transformer 400VAC 30KVA ET00024-011-01	SP00052-011-01												1	
Door switch 6150.49.060	SP.011297	1	1	1	1	1	1	1	1	1	1	1	1	

Appendix F: Input/Output Terminals

F.1 Input Terminal

The input connection can be done with standard terminal block, the green/yellow being reserved for the earth (example: WDU35 from Weidmuller). Standard industrial cables can be used with the following characteristics:

- Connection cross-section, stranded, min-max: 2.5-50 mm^2
- Wire connection cross-section, solid core,min- max.: 2,5-50mm^2
- Wire connection cross-section, finely stranded with wire-end ferrules min-max: 2.5-35 mm^2
- Twin wire-end ferrules, min-max.: 1.5-16 mm^2
- Max. number of connector in parallel per terminal : 1
- Stripping length: 18mm
- Tightening torque, min-max.: 4-5Nm
- Insulation temperature Cable: 90°C

The CCR is equipped with strain reliefs for the input power cable that shall be used to prevent tension on the cables, ensuring secure and stable connections.

F.2 Output Terminal with Terminal Taps

The output cable needs to be connected on "spacer column insulator" (example of possible insulator: SA621000 (Vemer)).

Figure 14: Example of insulator SA621000

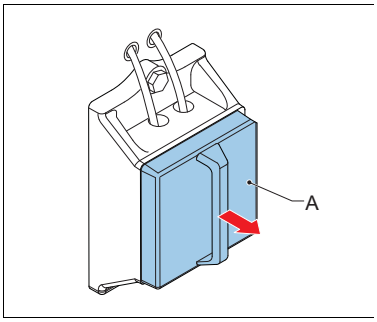
The connectors bolds of the insulator are M6 so the customer should add an M6 ringterminal to his wire to connect it to this output

The CCR is equipped with strain reliefs for the output power cable that shall be used to prevent tension on the cables, ensuring secure and stable connections.

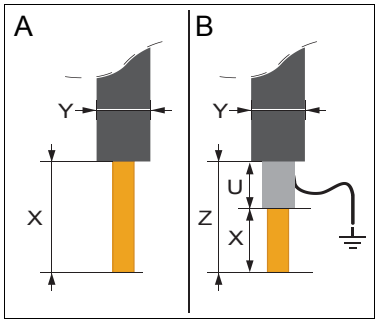
F.3 Output Terminal with Cutout (SCO) Option

Remove cover

Remove the cover (A) of the SCO.

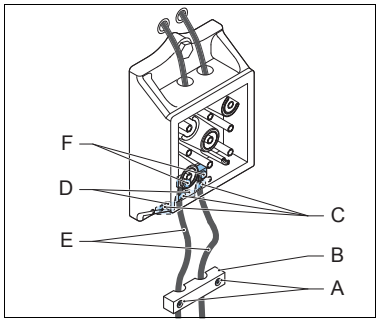


Strip cables



1. Strip the series circuit cables at the end.
   - A: unscreened cables
     - Strip the series circuit cables at the end.
       - X: 14 mm
       - ø Y: less than or equal to 12 mm
   - B: screened cables
     - X: 16 mm
     - U: 10 mm
     - Z: 43 mm

Installation - Connect



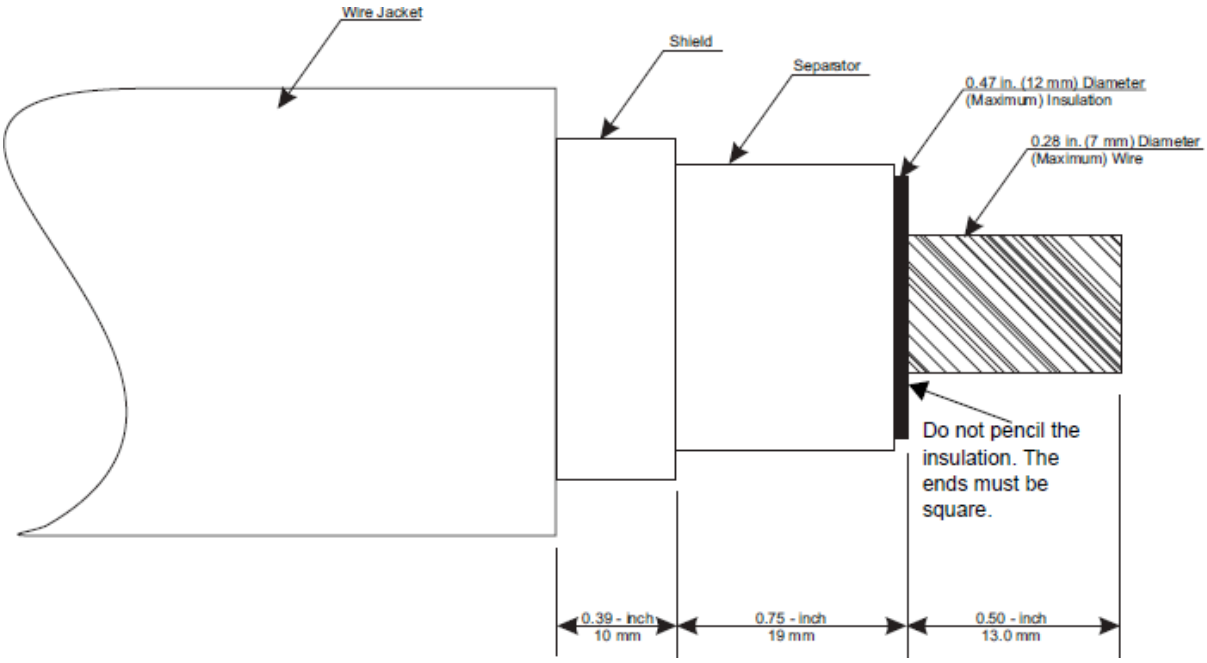
1. Loosen the screws (A) of the cable guide (B).
2. Loosen the screws (C) of the stress-relief clamps (D).
3. Lead the series circuit cables (E) through the cable guide and through the stress-relief clamps.
4. Loosen the screws (F).
5. Install the series circuit cables.

6. Tighten the screws (A), (C) and (E).

F.4 Output Terminal with Series Cutout

Strip the input and output cable wires to ½ inch (13 mm) from the end of the wire. Make sure that any plastic coating on the wire is cut off.

Figure 15: Stripping Shielded L-824 Wire



Connect the input L-824 wire to the SCO cutout.

The SCO is equipped with strain reliefs for the output power cable that shall be used to prevent tension on the cables, ensuring secure and stable connections.

Appendix G: Principle Wiring Diagram

Figure 16: ASG 8000i CCR Thyristor 15 kVA 230 VAC (Rev. D)

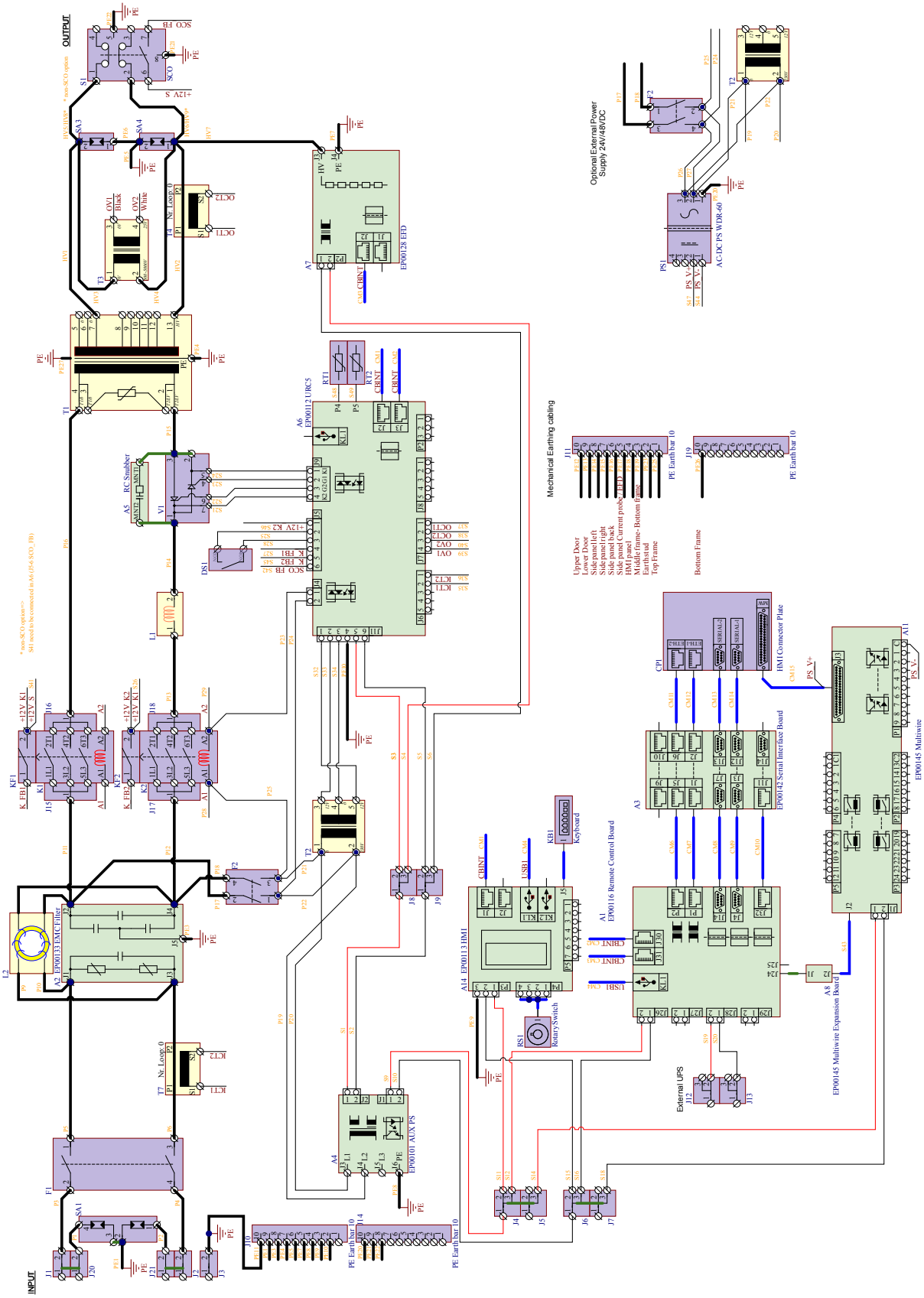
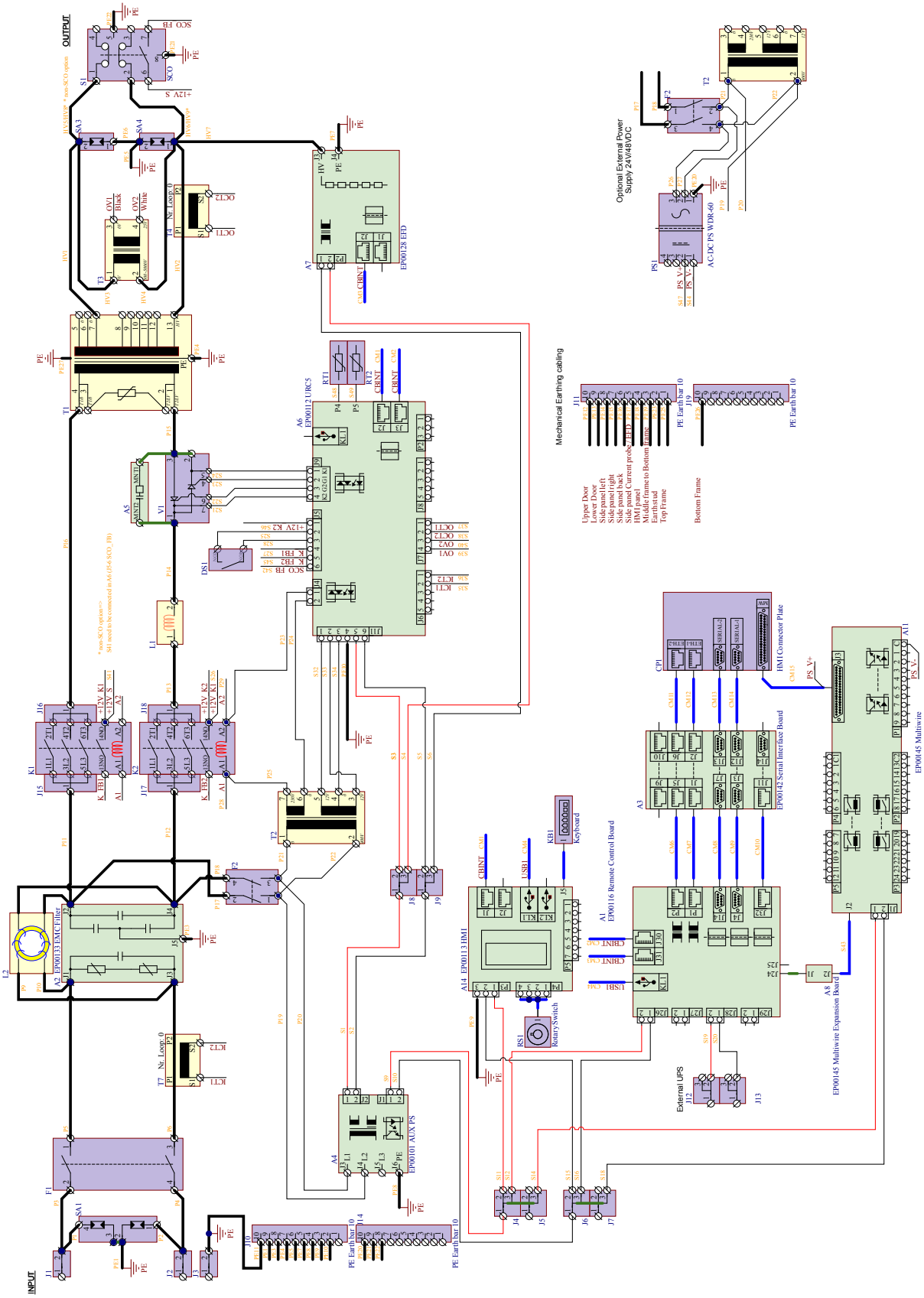


Figure 17: ASG 8000i CCR Thyristor 15 kVA 400 VAC (Rev. D)



Appendix H: Support

Our experienced engineers are available for support and service at all times, 24 hour/7 days a week. They are part of a dynamic organization making sure the entire ADB SAFEGATE is committed to minimal disturbance for airport operations.

ADB SAFEGATE Support

Technical Support – Global

Customers in Europe, the Middle East, Africa and Asia Pacific are more than welcome to our portal for technical support. Trained in all areas of system issues, troubleshooting, quality control and technical assistance, our highly experienced Technical support specialists are available 24 hours a day, seven days a week to provide assistance over the phone.

Europe: **+32-2-722-17-11**

China: **+86-10-8476-0106**

Middle East and Africa: **+971-4-452-7575**

In the Americas, we also offer live technical support.

Live Technical Support – Americas

If at any time you have a question or concern about your product, contact ADB SAFEGATE's US-based technical support specialists, available 24 hours a day, seven days a week, to assist you via phone.

ADB SAFEGATE Americas Technical Service & Support (US & Canada) :**+1-800-545-4157**

ADB SAFEGATE Americas Technical Service & Support (Canada): **+1-905-631-1597**

ADB SAFEGATE Americas Technical Service & Support (International): **+1-614-861-1304**. For technical service press 3 and for sales support press 4.

We can also be reached via email during regular business hours.

Airfield and Gate: **techservice.us@adbsafegate.com**

Gate: **gateservice.us@adbsafegate.com**

We look forward to working with you!

Before You Call

When you have an airfield lighting or control system problem, prior to calling, please ensure the following:

- Review the product's manual and troubleshooting guide.
- Be located with the product ready to troubleshoot.
- Have all necessary information available: airport code/company name, customer id number, contact phone number/email address, product/part number.
- Have all necessary tools that may be needed at hand.

When calling about an issue with Safedock A-VDGS, we can serve you better if you collect the following information before you call:

- Relevant information regarding the issue you are calling about, such as gate number, flight number, aircraft type and time of the event.
- What, if any, actions have been taken to resolve the issue prior to the call.
- If available, provide a CCTV recording of the incident to aid in aligning the information from the Safedock log file.

For more information, see www.adbsafegate.com, contact ADB SAFEGATE Support via email at **support@adbsafegate.com**.

H.1 ADB SAFEGATE Website

The ADB SAFEGATE website, www.adbsafegate.com, offers information regarding our airport solutions, products, company, news, links, downloads, references, contacts and more.

H.2 Recycling

H.2.1 Local Authority Recycling

The disposal of ADB SAFEGATE products is to be made at an applicable collection point for the recycling of electrical and electronic equipment. The correct disposal of equipment prevents any potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling. The recycling of materials helps to conserve natural resources. For more detailed information about recycling of products, contact your local authority city office.

H.2.2 ADB SAFEGATE Recycling

ADB SAFEGATE is fully committed to environmentally-conscious manufacturing with strict monitoring of our own processes as well as supplier components and sub-contractor operations. ADB SAFEGATE offers a recycling program for our products to all customers worldwide, whether or not the products were sold within the European Union (EU).

ADB SAFEGATE products and/or specific electrical and electronic component parts which are fully removed/separated from any customer equipment and returned will be accepted for our recycling program.

All items returned must be clearly labeled as follows:

- For Restriction of Hazardous Substances (RoHS)/Waste Electrical and Electronic Equipment (WEEE) Recycling
- Sender contact information (Name, Business Address, Phone number).
- Main Unit Serial Number.

ADB SAFEGATE will continue to monitor and update according for any future requirements for EU directives as and when EU member states implement new regulations and or amendments. It is our aim to maintain our compliance plan and assist our customers.

Empowering the Airside Evolution

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