

**CONSTANT CURRENT
REGULATORS**

YKCCR-L10 series

5 KW to 30 KVA

INTRODUCTION MANUAL

*Published by YKLIGHT
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Date: April 2010

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INDEX

1. INTRODUCTION.....	4
2. BRIEF TECHNICAL SPECIFICATIONS.....	5
3. MODES OF OPERATION.....	6
4. MAIN FEATURES.....	7
5. CCR-L10 WORKING PRINCIPLE AND ELECTRONIC CARDS	9
6. POWER EFFICIENT.....	11
7. PRINCIPLE OF OPERATION.....	13
8. CCR-L10 TOWER CONTROL (OPTIONAL).....	15
9. CCR-L10 CONTROL + MONITOR PART LIST(FRONT).....	16
10. CCR-L10 CONTROL + MONITOR PART LIST(INSIDE).....	17
11. CCR-L10 INSIDE	18
12. MATERIAL GUIDE	20
13. CCR-L10 ERROR MESSAGES.....	21
14. SCHEMATICS.....	22

SAFETY PRECAUTIONS

Safety procedures shall be observed on all conditions.

Constant current regulators do produce high voltages, which is dangerous to the unauthorized and un-trained personnel. Therefore, strict measures must be observed for safety.

All possible ways and protection measures to prevent such accidents has been considered in the design and production of those regulators.

In case, if no regulatory procedures exists. Always as a guide the FAA Advisory Circular AC 150/5340-26 "Maintenance of Airport Visual Aid Facilities" for instructions on safety precautions is reachable. This document is available free of charge via Internet www.faa.gov.

1. INTRODUCTION

CCR-L10 belongs to the family of Airfield lighting systems of company produced as state-of-art instruments and years of experience are integrated to the system. Designed and manufactured for maximum reliability and safety in all operating conditions and most challenging environments.

All our Constant current regulators are designed to meet, superseded the requirements of related international and military standards, and are compliant to ICAO, FAA and NATO standards and regulations.

ICAO: Aerodrome Design Manual, Part 5 paragraphs 3.2.1.4/5/6.

FAA : AC 150/5345-10E and L829.

Here in with this booklet, operation and basic servicing is described.

Our regulators are micro-controller controlled state of the art systems with User-friendly menu driven software, which allows easy but secure operation.

All the system has incorporated with automatic and continuous BIT (built in testing). If any system failure detected user is warned and operation is ceased.

All the setups parameters for the operation can be carried out more easily via RS232 serial link with an ordinary PC(Optional).

All the electronics are in modular form and state of the art technology has been applied. Modular structure of the system mechanics and electronics brings easy and fast maintenance and servicing with low MTTR (Mean Time To Repair).

All the electronic boards have conformal coating to protect against the harsh environment conditions.

Status of the regulator can be checked any time via serial link for current intensity, any existing failure and any other failure(Optional).

Five, Eight(Optional) and Ten(Optional) light intensity levels are freely user selectable within the limits of AC 150/5345-10E.

As optional, a radio control module is available to control the lights from the airplanes and helicopters . System can be manual controlled or remote controlled either with remote control unit (RCU) or by any air band radio wireless. If command is received by a radio, lights will be governed accordingly until the 15 minutes elapsed. During this 15 minutes radio can initiate a new cycle with different light level.

2. BRIEF TECHNICAL SPECIFICATIONS

Output power	4/ 5/ 7.5/ 10/ 12.5/ 15/ 20/ 25/ 30 kVA.
Output current	6.6 A <20kVA and above 20 A
Frequency	50/ 60 Hz (± 10%).
Input voltages	220/ 230/ 240/ 380/ 400/ 415 V (±10%) Monophase/duophase/threephase
Control	a) Classical b) Via serial link RS232/RS485 c) Radio controlled (optional)

OUTPUT CURRENT LEVELS

Brightness Levels	6,6 Amp regulators (A)			20 Amp regulators (A)			
	5 step	8 Step	10 Step		5 Step	8 Step	10 Step
1	2,8	2,8	2,8		8,5	8,5	8,5
2	3,4	3,1	3		10,3	9,4	9,1
3	4,1	3,4	3,2		12,4	10,3	10,3
4	5,2	3,9	3,4		15,8	11,8	12,4
5	6,6	4,6	4,1		20	13,9	13,5
6		5,5	4,8			16,7	14,2
7		6,4	5,2			19,4	15,8
8		6,6	5,8			20	17
9			6,4				18,2
10			6,6				20

Power Factor: At nominal resistive load and maximum brightness:
Up to 10 kVA power factor is minimum 0.90
Above 10 kVA power factor is minimum 0.95

Efficiency: At nominal resistive load and max. Brightness greater than **90%**.

Output voltage surge protection: Outputs are equipped with lighting arrestors.

3. MODES OF OPERATION



4. MAIN FEATURES

- The CCR can be operated in either Manual or serial link commanded either by Tower control or a PC. By using the Global, commands all CCR connected on this serial link shall follow the commands and respond back when commanded depending on their individual addressing.
- It uses tested thyristor technology combined with the latest generation of micro-controller electronics.
- The essential electrical parameters are clearly displayed on the front face of the regulator (currents, Alarms, etc.).
- The display of this data as well as the possibility to manage and control by remote control is possible by a computer serial link type **Mod-Bus serial communication**.
- The up to date auto diagnostic contributes towards preventative maintenance of the regulator.
- The regulator is provided, as standard, with the number and brightness values of the load specifications, as well as the pre-programmed alarms to 2% & 10% for the burnt out lamps (option), and 100kohm and 1Mohm for the insulation faults (option).
- It is possible and easy to change **the configuration parameters of the regulator** with the help of a portable PC or portable console:
 - Number of brightness, values of current orders by brightness
 - Values of alarm controls (OPTION: lamp failure detectors and earth fault detector)
 - Reading of the electronic parameters
 - Reading of operating time
 - Testing
 - Servicing.
- All regulators are capable of responding properly to the Control tower commands.
- Extremely easy programming and parameters set-up, no need for long training.
- Lamp Fault detection is optionally available.
- Output circuit isolation detection is optionally available.
- The stand-alone regulators have standard lifting lugs and optional rolling castors.
- The System includes full manual and automatic test functions and can be remotely interrogated from the Control Unit
- In case of severe failure, all units have automatic power shutdown facility.
- Up to 255 CCR can be connected and governed on a serial link of RS485.
- All modules have BIT (Built in Test) function.
- Optionally CCR can be controlled via Radio (transceiver).
- All materials and production components are warranted against defective workmanship for 24 months from date off purchase.

Standard Accessories:

Operation and service manual

5. CCR-L10 WORKING PRINCIPLE AND ELECTRONIC CARDS

CCR-L10 is made for processing with both one and two phases. Connections must be made for the specific phase selection. CCR controls the current either with Thyristors or Triyac.

CCR-L10 uses two Thyristors to control the phase firing angles. By this method it regulates the power and output current.

CCR-L10 uses 48VDC voltage to activate the remote control. Remote voltage can be generated from CCR-L10 and also from Tower.

CCR-L10 ELECTRONIC CARDS

BASE (PCB 130410):

BASE card contains Power Units, Rectifiers, and Relays. It also contains a Connector for the Pid Card (CON1, CON 2, CON 3).

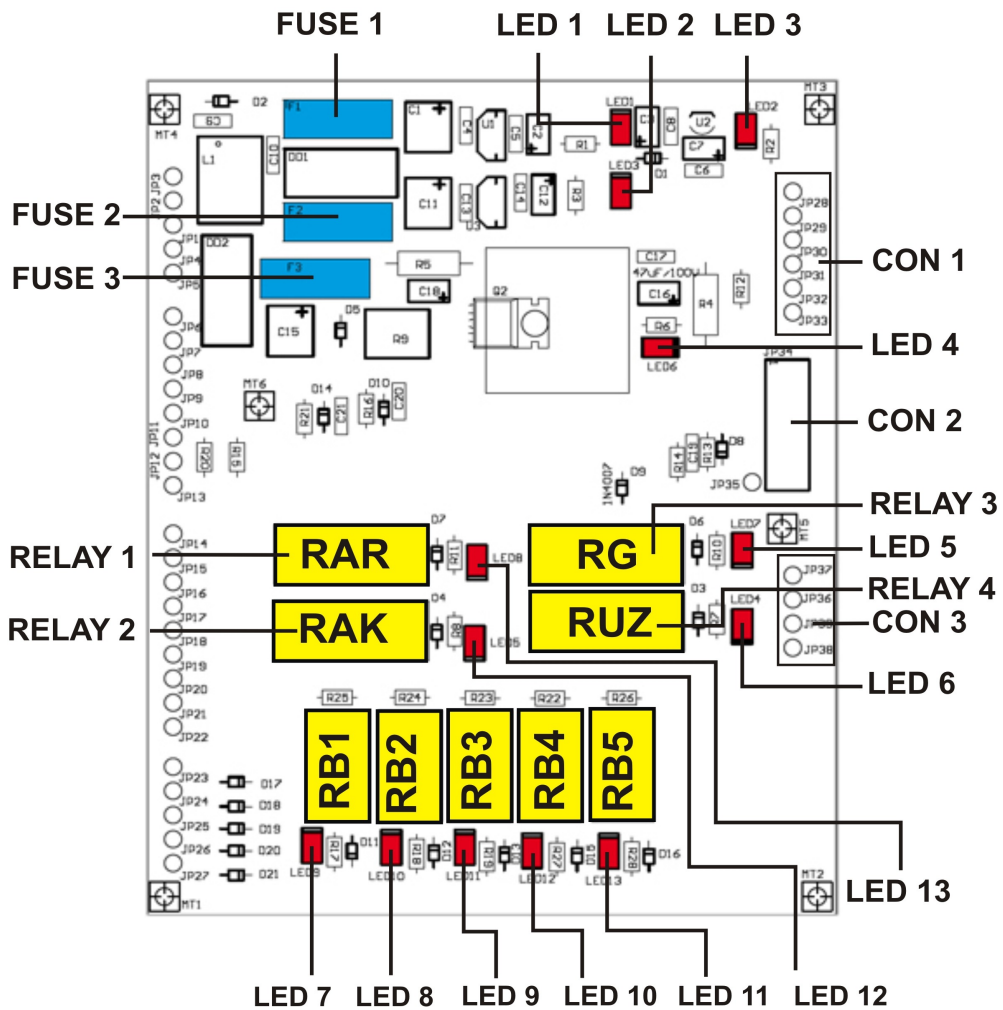


Figure: base card

LED lamps on the BASE card:

- LED 1: - 12 volt power source.
- LED 2: + 12 volt power source.
- LED 4: + 48 volt power source.
- LED 3: + 5 reference voltage for Remote control.
- LED 7 to L11: Light intensity level For Remote Control Roles (From 1 to 5 levels).
- LED 5: on, when RG relay be pulled
- LED 6: on, when CCR is switched to remote control then RUZ relays pulled in
- LED 12: on, when CCR is delivering current to the output then RAK relays
Pulled in
- LED 13: on, when there is fault in the system then RAR relay pulled in
- CON 1, CON 2, CON3 : Connector for PID CARD.
- FUSE 1, FUSE2, FUSE 3 are Fuses for +12V,-12V and 48V
- RB1 to RB5 are remote control level selector relays

PID CONTROL (PCB 120410):

Pid card contains Micro-controller and Amplifiers to sense and regulate the current. It is connected to CCRBASE card from JP1 connector.

This card also contains visual components. Via these components operator is able to see errors from the combination of leds and LCD screen. This card is plugged to the front panel.

LED lamps on the PANEL card:

- LED 1: on, when CCR is open.
- LED 2: on, when the output circuit is open.
- LED 3: on, when an error occurs.

THYRISTOR FIRING(PCB 100410):

Thyristor firing card fires thyristors and changes firing angles to provide specific current. It is connected to CCRBASE from jp12 and jp13 connectors.

EARTH(PCB 040812)(OPTIONAL):

Earth card detects the short circuits in the serial link of lamps. It is connected to CCRBASE from jp10 and jp11 connectors.

THYRISTOR PROTECTION(PCB 0410):

Thyristor Pro Card protects the thyristor from negative pulses. It contains several varistors and capacitors.

6. POWER EFFICIENT

To use CCR more efficiently correct connections have to be made for specific loads.

THEORY :

FOR LAMP NUMBER AND CABLE LENGTH:

Lamp power	: P
Lamp number	: n
Transformer and Cable losses	: Pk
Cable length	: l
Cable loss	: 130W/km

a) Power delivered to Transformer and Lamps = $n*(P + Pk)$

$$\text{b) Power Taken} = \frac{n(P+Pk)}{\text{Cosf}}$$

$$\text{c) Cable Loss} = l*130$$

$$\text{d) All Power for the serial circuit. } P_s = \frac{n(P+Pk)}{\text{Cosf}} + l*130$$

$$\text{e) Serial circuit voltage } V_s' = \frac{P_s}{I}$$

f) Extra voltage requirements and Serial voltage increase for broken lamps. $V_s = V_s' + V_s' * 0.1$

EXAMPLE : Operation for 50 Lamps of 100W and 8 km Cable length.

$$\text{a) } 50 (100+20) = 6000W$$

$$\text{b) } \frac{6000}{0,85} = 7058 \text{ VA}$$

$$\text{c) } 8 \times 130 = 1040 \text{ VA}$$

$$\text{d) } 7058 + 1040 = 8098 \text{ VA CCR Needed.}$$

$$\text{e) } \frac{8098}{6.6A} = 1227 \text{ V}$$

$$\text{f) } 1227 + 123 = 1350 \text{ V This is the voltage that Regulator needed for 6.6A.}$$

To use CCR more efficiently please watch these steps.

1- The Number of lamps is an important factor for power management. Suited connections must be selected for the Transformers' secondary inputs.

$$\text{Power} = (\text{Number of lamps(NL)}) * (\text{Single Lamp Power(SLP)})$$

Power=NL* SLP	CRC 5 KW	CRC 7.5 KW	CRC 10 KW	CRC 15 KW	CRC 20 KW
1000W	300 V	600 V	950 V	1200 V	1650 V
2000W	500 V	600 V	950 V	1200 V	1650 V
3000W	600 V	600 V	950 V	1200 V	1650 V
4000W	700 V	800 V	950 V	1200 V	1650 V
5000W	750 V	1000 V	950 V	1200 V	1650 V
6000W		1300 V	1125 V	1200 V	1650 V
7000W		1300 V	1350 V	1600 V	1650 V
8000W		1300 V	1550 V	1600 V	1650 V
9000W			1550 V	1600 V	1650 V
10000W			1550 V	2000 V	2075 V
11000W				2000 V	2075 V
12000W				2500 V	2875 V
13000W				2500 V	2875 V
14000W				2600 V	2875 V
15000W				2600 V	2875 V
16000W					2875 V
17000W					2875 V
18000W					3350 V
19000W					3350 V
20000W					3350 V

Example: 40 LAMPS X 45 W = 1800W We find from table (second line);

- For 5KW CCR 500 V secondary input,
- For 7.5KW CCR 600 V secondary input,
- For 10KW CCR 750 V secondary input
- For 15KW CCR 1200 V secondary input,
- For 20KW CCR 1650 V secondary input.

2- Do not forget to connect the Systems ground cables.

7. PRINCIPLE OF OPERATION

Constant Current Regulators provide a constant current throughout airfield lighting systems. Airfield lighting system requires a network of cables extending over several kilometers, which causes; serious voltage drops therefore constant current method is employed to avoid dimming of farther lamps. CCR are such electronic equipments that continuously produce a fixed current as independently of loads that are connected to their outputs.

The CCR regulates voltage fluctuations and prevents intensity variation, which often occur in lamps located at the end of power lines.

Either CCR output current levels can be selected by the front panel switch or from a remote position which is controlled by remote unit.

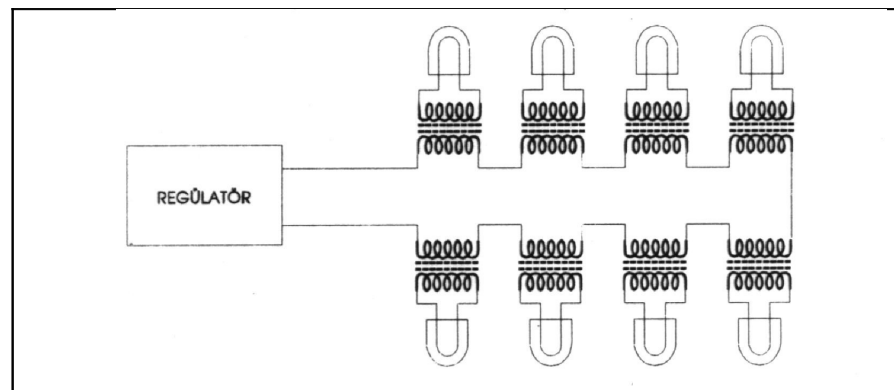


Figure 1. Serial powered circuits

By changing the levels, the brightness levels can be altered. Regulator has five brightness levels and controlled by locally or remotely with classical connection or digitally by a serial link.

The entire electronic circuit is supported with led lights in order to allow easy fault detection. The function list of these LED's is given in the following table. Physical location is shown in related schematics.

Basic CCR has five main parts:

- Adjustment Control Unit
- Operation and Control Unit
- Power Transformer
- Electronic firing and Switching Unit



Local and Remote control parameters

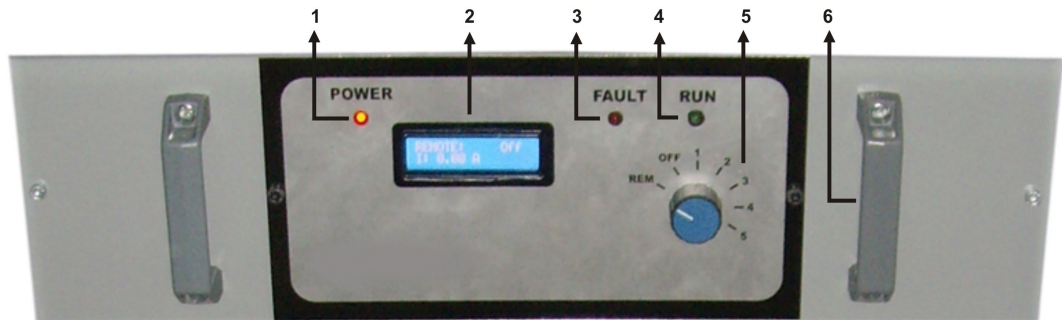


Figure2: Control Panel



Figure3: Local Control LCD screen

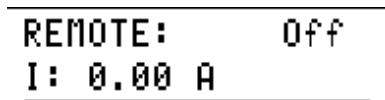


Figure4: Remote Control LCD screen

Power Led:

On, when main power is turned on. (Figure 2 No:1)

Run Led:

On, when CCR is delivering current to the output. (Figure 2 No:4)

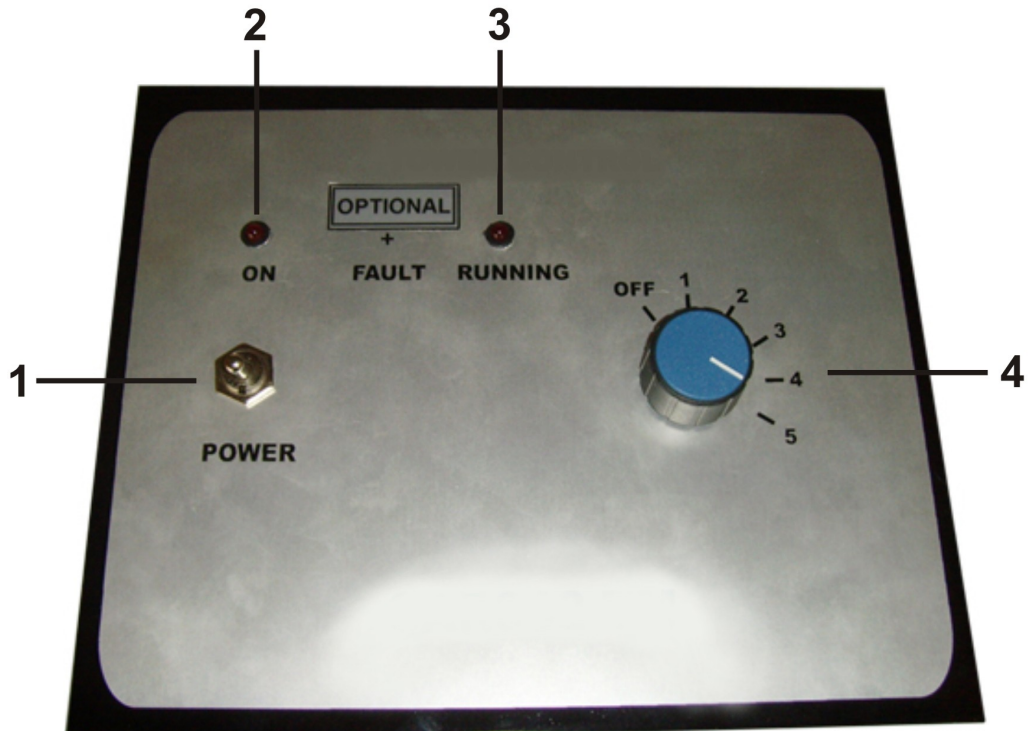
Fault Led:

On, when CCR is has fault messages. (Figure 2 No:3) (See part 13.CCR-L10 ERROR MESSAGES)

When Level Selector Switch is set to a brightness level, level number and specified current is showed on the Lcd screen. (Figure 3)

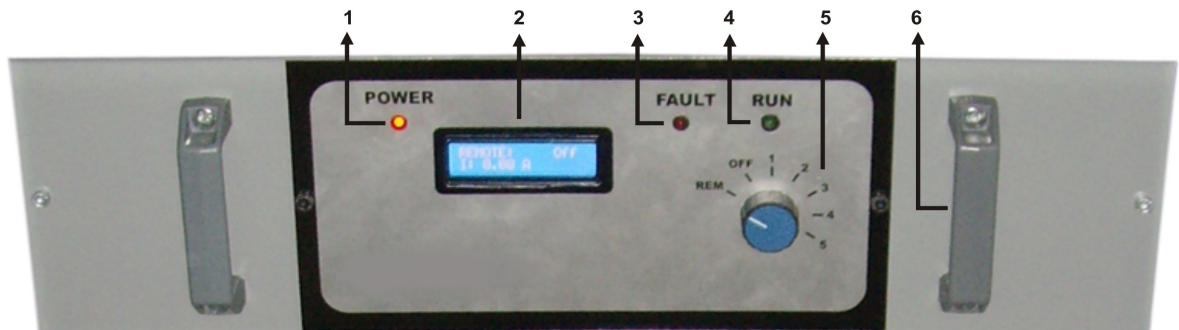
For remote control Level Selector Switch is set to REM position (Figure 4)

8. CCR-L10 TOWER CONTROL (Optional)



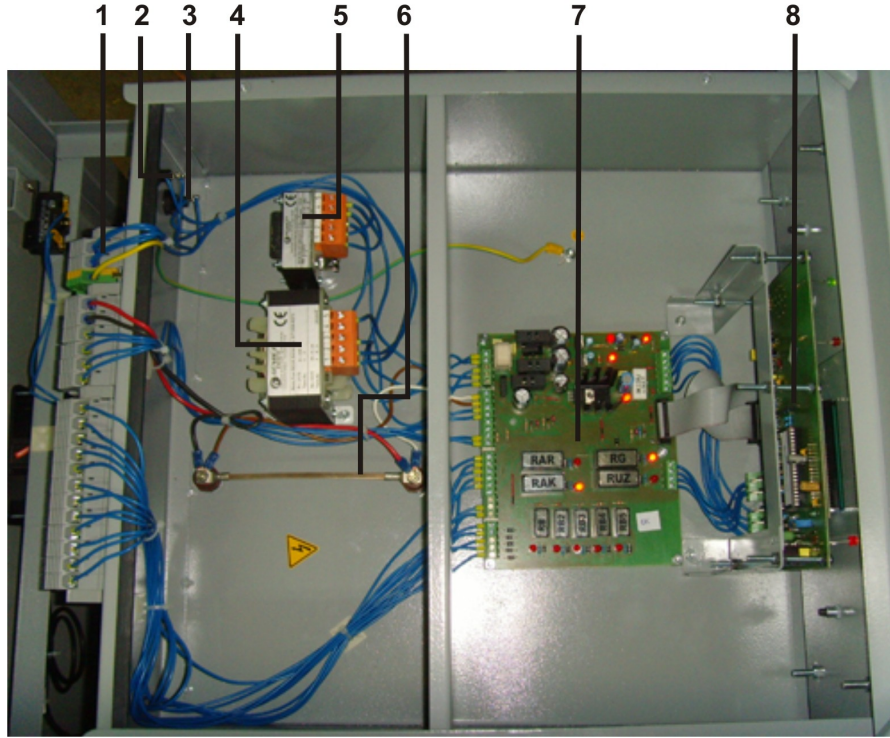
Item No	CRC code no	Nomenclature
1	CRC.150.E.05	On LED
2	CRC.150.E.05	Run LED
3	CRC.150.DM.21	On/Off Switch
4	CRC.150.DM.20	Level Selector Switch (SW3)

9. CCR-L10 CONTROL + MONITOR PART LIST(FRONT)



Item No	CRC code no	Nomenclature
1	CRC.150.E.05	CCR On LED
2	CRC.150.DM.07	LCD Display
3	CRC.150.E.05	Fault Indicator LED
4	CRC.150.E.05	CCR Run LED
5	CRC.150.DM.20	Level Selector Switch (SW3)
6	CRC.150.M.02	Carrying Handle

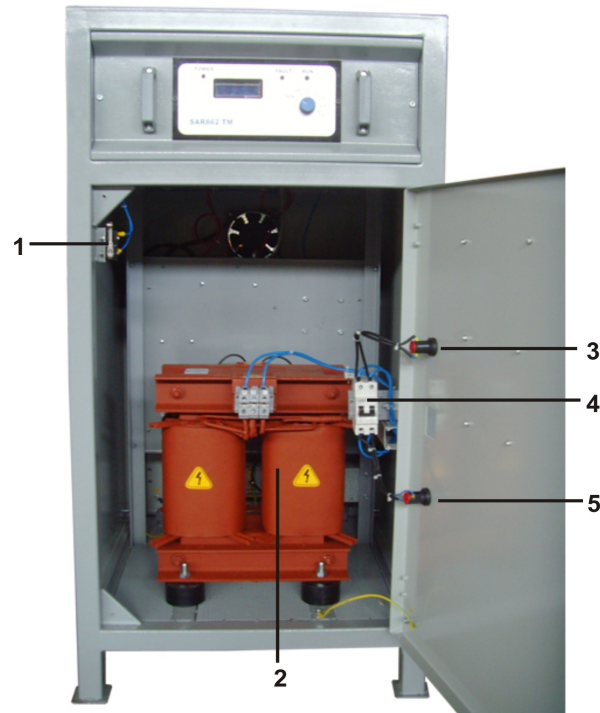
10. CCR-L10 CONTROL + MONITOR PART LIST(INSIDE)



Item No	CRC code no	Nomenclature
1	CRC.150.DM.12	Terminal Group
2	CRC.150.D.11	Fuse 1 (1A)
3	CRC.150.D.11	Fuse 2 (1A)
4	CRC.150.D.13	Transformer TR3
5	CRC.150.D.14	Transformer TR4
6	CRC.150.D.03	Current Sensor
7	CRC.150.E.01.003	Base Board (PCB130410)
8	CRC.150.E.01.002	PID Control Board (PCB120410)

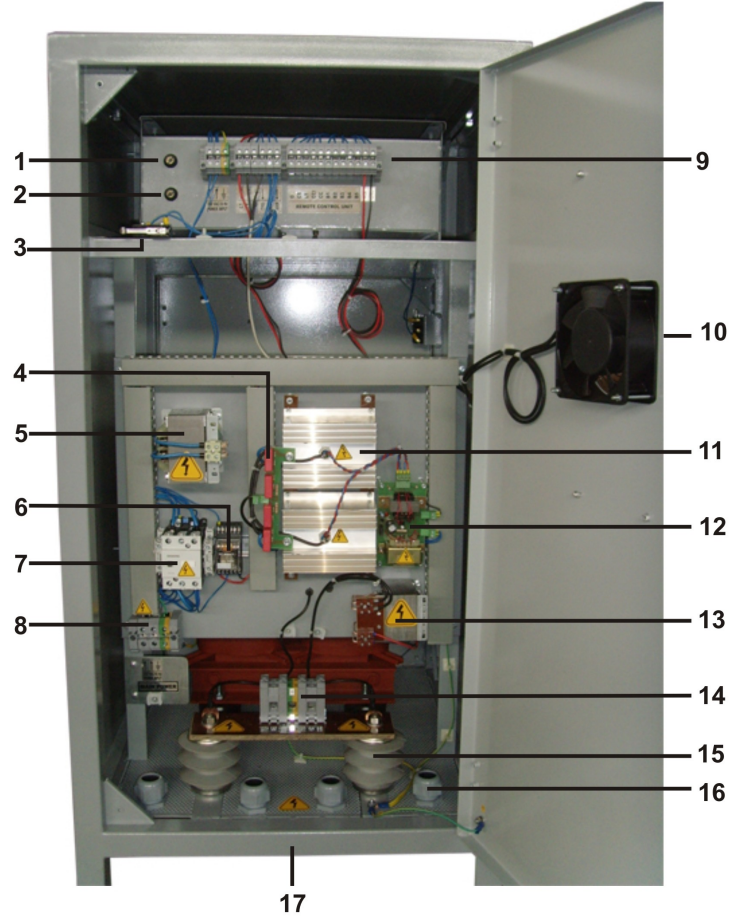
11. CCR-L10 INSIDE

1. Front inside view



Item No	CRC code no	Nomenclature
1	CRC.150.DM.22	Door Switch (SW1)
2	CRC.150.D.25	Main transformer (T1)
3	CRC.150.D.08	Power OUTPUT Indicator (H2)
4	CRC.150.DM.09	Automatic Fuse Switch (E1)
5	CRC.150.D.08	Power INPUT Indicator (H1)

2. Back inside view



Item No	CRC code no	Nomenclature
1	CRC.150.D.11	Fuse 1 (1A)
2	CRC.150.D.11	Fuse 2 (1A)
3	CRC.150.DM.22	Door Switch (SW1)
4	CRC.150.E.01.005	Thyristor Protection Card (PCB0410)
5	CRC.150.D.15	Shock Transformer (T5)
6	CRC.150.DM.17	Main Control Relay (48V/DC)(K2)
7	CRC.150.DM.16	Main Contactor (K1)
8	CRC.150.DM.12	Main Power Input Terminal
9	CRC.150.DM.12	Terminal Group
10	CRC.150.DM.24	Fan (220v 50hz)
11	CRC.150.D.10	Thyristor (Q1,Q2)
12	CRC.150.E.01.004	Thyristor Firing card(PCB100410)
13	CRC.150.D.21	Current Transformer (T2)
14	CRC.150.DM.13	Circuit Output Terminal
15	CRC.150.D.26	Surge protector (PA1,PA2)
16	CRC.150.M.13	Cable duct
17	CRC.150.M.23.001	Main Case

12. Material guide

E1	Automatic Fuse Switch 32A
T1	Main transformer 775V - 5 kW
T2	10/10 current transformer
T3	Power transformer 2x24V 40W
T4	Power transformer 2x16V 15W
T5	Shock Transformer
	Base Card Components (Relays)
RUZ	Remote control relay 48V
RG	General relay 48V
RAK	Current relay 48V
RAR	Faulty relay 48V
RB1	First level brightness relay 48V
RB2	Second level brightness relay 48V
RB3	Third level brightness relay 48V
RB4	Forth level brightness relay 48V
RB5	Fifth level brightness relay 48V
	Electronic Cards
PCB 130410	Base card
PCB 120410	PID card
PCB 040812	Earth Protection card (optional)
PCB 100410	Thyristor Firing card
PCB 0410	Thyristor protection card
SW1	Front door switch
SW2	Back door switch
SW3	Level Selector Switch
K1	Main Contactor
Q1	Thyristor 69A 1200V
Q2	Thyristor 69A 1200V
PA1	Surge protector
PA2	Surge protector
H1	Main input lamp 220V/50hz
H2	Main output lamp 220V/50hz
K2	Main Control Relay (48V/DC)
F1	Fuse 1 (1A)
F2	Fuse 2 (1A)
FA1	Fan (220v 50hz)

13. CCR-L10 ERROR MESSAGES

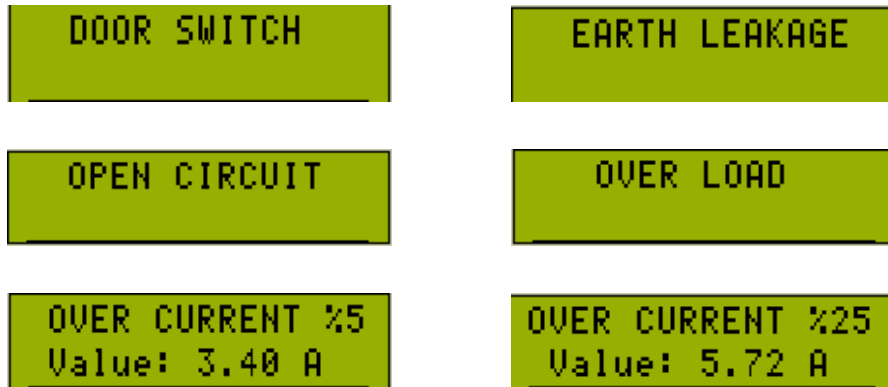


Figure 5: Error Messages

CCR has six error messages. When an error occurs fault led turns on and the fault message appears on the LCD screen. To restart the CCR set the Level Selector Switch to off position and reselect the current level.

FAULTS Messages:

Over Load:

When CCR is over capacity or too much lamps are connected.

Earth Leakage: (Optional)

On, when circuit has a shortcut to ground (Earth).

Over Current %5 or %25:

On, when over current limit condition is reached.

Open Circuit:

On, when the output circuit is open.

14. SCHEMATICS

