

# Maintenance & Operation Manual

## CSPS-6K Rectifier Shelf

**220VAC Input (1Phase 3Wire)**  
**-48VDC Output**  
**111A per Shelf**  
**37A per Rectifier Module**



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**Safety Tips**

**SAFETY FIRST... at ALL TIMES !**

- Before starting installation, operation, test. or repair work, carefully read and follow all directions specified in this manual for safe operation of the system and to minimize risk to the operator.
- This product has been manufactured under strict quality management. If any potentially hazardous procedure cannot be performed safely with regard to life or connected equipment, contact Dongah Elecomm immediately.
- Pay special attention to sections throughout this manual that are highlighted with the following **WARNING** or **CAUTION** symbols:

	<p>This <b>WARNING</b> symbol indicates a high risk that may cause death or critical injury to the operator if proper procedures and safety precautions are not used.</p>
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	<p>This <b>CAUTION</b> symbol indicates a serious risk that may cause injury to the operator or damage to connected equipment if proper procedures and safety precautions are not used. .</p>
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**《Check of Contained Materials》**

- Ensure that the product type and quantity received is the product type and quantity that you ordered. Use the enclosed shipping documents to verify all contents.
- Ensure that all parts and hardware are accounted for and with no deformation, damage, peeling or scratched paints, or cable damage.

**《Directions in Storage》**

- Secure and store this product package away from water, rain, direct sunlight, and any potentially harmful gas or liquid.
- Store this product within the specified temperature (-40°C to +85°C) and humidity (5% to 95%, non-condensing) conditions.

《Directions in Operation》

Injury, Electric Shock, Fire




- Do not run this system in a place with flammable or corrosive gases, dew or humidity. (It may cause an electric shock or fire.)
- Do not try to modify this product. (It may cause an electric shock, burn, or fire.)
- Operate this system under the environmental conditions specified in this manual.  
Take particular attention to voltage, frequency, temperature, humidity and vibrations. (Violating the environmental requirements may cause an electric shock or fire.)
- Before connecting the battery connections, load and grounding wires, pay attention not to reverse the polarity of them. (Polarity reversal may cause fire.)
- While the system is connected, do not touch any battery wire, load or grounding wire ports. It may cause an electric shock or death.
- Pay attention not to reverse the polarity of signaling cables and detection cables when connected. (It may cause a fire.)
- Do not leave excess or foreign materials (such as sheathes of electric wires or hardware) on top of or inside the product. It may cause an electric shock or fire.
- The DC outputs are connected to the battery before the system starts to be driven. Pay close attention not to cause an electric shock or short circuit.
- When the rectifier units are inserted into the shelf, be aware that the live AC input voltage is fed to the Connector in the rack side. (It may cause an electric shock.)
- When you insert or remove a rectifier unit from or into the shelf, be aware of the unit may be hot enough to cause a burn injury.
- Do not insert an object or finger into the rectifier unit fan. (It may cause an injury.)
- When handling rectifier units, pay close attention not to touch any open connector pins. (It may cause an electric shock.)




- When cables are connected, battery should be separated from the rectifier system except one point of the conductor at each cell.
- Start operation after all connections (battery, load, and grounding wires/cables) are made but Circuit Breakers are OFF.
- Connect the battery wire, load and grounding wire while the load side has been unloaded and Circuit Breakers are OFF.
- External transmission signal should be  $\leq 60V$  level and  $\leq 0.5A$ .
- Rectifier unit should be inserted and removed using the guide rail of the rectifier system, to engage connectors without damage.
- • Use caution during an AC failure event as the AC power may be restored at any time. Use special care to lockout/tagout the AC whenever necessary, check the presence of, and maintain the AC input to the power shelf, as needed.


《Test & Repair》

Electric Shock, Fire

	<ul style="list-style-type: none"> <li>• Trained and qualified personnel should perform test and repair work periodically with designated methods. (Violating this directive is a risk to life and limb and may cause an electric shock or fire.)</li> <li>• Only qualified labor with due knowledge and experience should repair this product. (Violating this directive is a risk to life and limb and may cause an electric shock or fire.)</li> <li>• Whenever the AC input, DC output, and/or Battery voltage(s) are applied or present, use precautions to avoid electric shock or short circuit when the system is tested or repaired.</li> </ul>
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	<ul style="list-style-type: none"> <li>• Even when the system is turned on while commercial power has failed, AC input may be fed to the system. Take particular attention of the live AC input voltages present during test and repair work.</li> </ul>
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《Disposal》

	<ul style="list-style-type: none"> <li>• This product should be disposed under the ordinary industrial wastes disposition procedure. Be aware that there may be industrial waste management policies that need to be followed at the local, state, and national levels.</li> </ul>
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# 1 - System Specifications

## 1.1 Electrical Characteristics

### 1.1.1 Input Characteristics

- 1) Rated input voltage : 1  $\Phi$  3W 220Vac
- 2) Input voltage range: 85Vac ~ 296Vac (Nominal:176VAC ~ 296VAC)
- 3) Input frequency : 47 ~ 63Hz
- 4) Efficiency : typical 96% (at 40% ~ 60% load)
- 5) Power factor :  $\geq 0.99$  (at 50% ~ 100% load)

### 1.1.2 Output Characteristics

- 1) Rated output voltage : -54.0V  $\pm 0.27$ V (at 50% load)
- 2) Operating voltage : -43.5V ~ -58.0V
- 3) Output current : 111A (37A  $\times$  3 Modules)
- 4) Output port : Single-point (Bus-bar)
- 5) Line Regulation :  $\pm 0.5\%$  ( $\pm 0.27$ V)
- 6) Load Regulation :  $\pm 0.5\%$  ( $\pm 0.27$ V)
- 7) Current Limit : at 101% ~ 120%
- 8) Over- Voltage Protection: -58.5V~-59.5V (Recycle to reset)
- 9) Output Ripple / Noise: 250mVp-p (max)

## 1.2 Safety Requirements

### 1.2.1 Electro Magnetic Interference (EMI)

- ✓ EN55022/EN61204-3 Class A

### 1.2.2 Input Surge Voltage

- ✓ Voltage → 6kV ( $1.2 \times 50 \mu\text{s}$ ), Current → 3kA ( $8 \times 20 \mu\text{s}$ )

### 1.2.3 Leakage Current

- ✓  $\leq 10\text{mA}$

### 1.2.4 Withstand Voltage

- 1) Input to Output: 3.0kVac (1 minute) or 4242Vdc (1 minute)
- 2) Input to Chassis : 1.5kVac (1 minute) or 2121Vdc (1 minute)

## 1.3 Environmental Characteristics

Operating Temperature:  $-10^{\circ}\text{C} \sim +75^{\circ}\text{C}$  (Derating above  $+55^{\circ}\text{C}$ )

Operating Humidity : 5% ~ 95%

## 1.4 Physical Specifications

### 1.4.1 Dimensions (W x D x H):

- ✓ 446mm x 408mm x 44.4mm

## 2 - Installation & Cabling



**CSPS-6K (SHELF)**

**Figure 2-1 Front View**

### 2.1 Preparation for Rack Installation

This rectifier is required to be installed using an indoor cabinet/rack in a clean, dry location, with at least 50cm spacing at the front and rear of the shelf to allow for unrestricted air flow.

### 2.2 Cabling



- Pay particular attention to safety procedures while installing rectifiers.
- Before cable installation, use a DVM to verify AC and DC voltages are not present. Use tagout/lockout, as needed.
- Before starting any operation, carefully read the following directions.

Input/output of the CSPS-6K rectifier is connected through terminals, connectors, and bus-bars. Pay attention to AC input Line/Load/GND and DC output connection polarities.

#### 2.2.1 AC Input Connection

The AC input includes a lightning surge arrestor (10kA). The AC input cables should be physically separated from DC output cables as much as possible to minimize EMI.

The AC 1Ø3W input cable may be connected after voltage of it is verified to be off and locked-out..

\* INPUT & FG cables should be as sized properly, at a minimum of:

- AC Line (ACL) and AC Neutral (CAN) terminals : min. 6SQ (10AWG)
- AC Ground (PE) : min. 8SQ (8AWG)
- Frame Ground (FG) : min. 8SQ (8AWG) / 1 or 2 HOLE LUG (5Øx15mm)

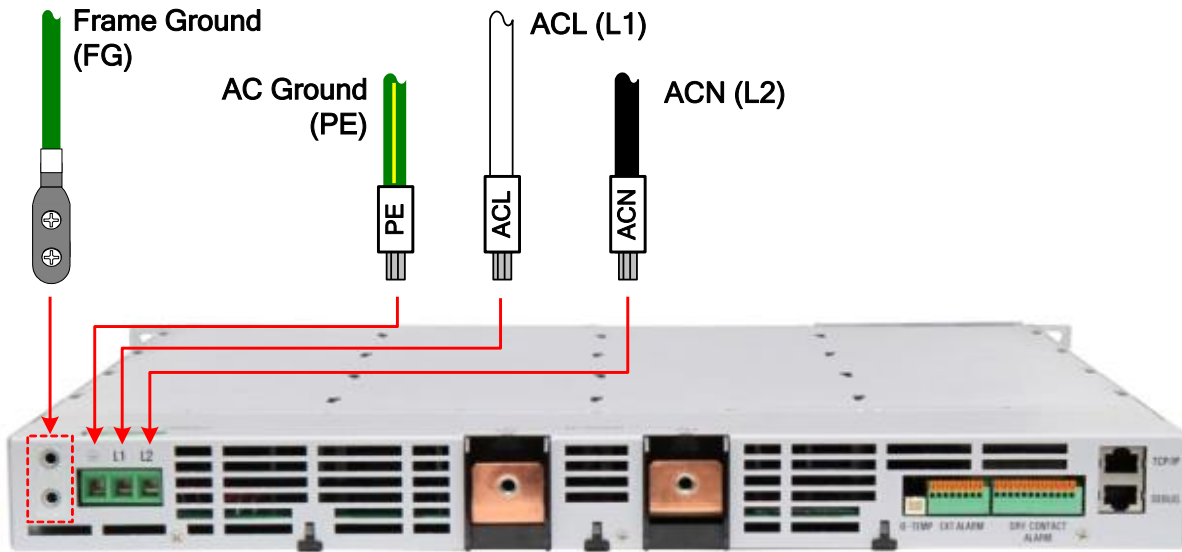


Figure 2-2. AC Input & FG Cable Connection

2.2.2 DC Output Connection

DC output cable should be connected referring to Table 2-1 and Figure 2-3. Connect each of the output cables to corresponding port.

Table 2-1 Output Cable & LUG

LOAD (-48V)	RTN (RETURN GROUND)
55A: 1HOLE LUG → 25SQ or greater	55A: 1HOLE LUG → 25SQ or greater
110A: 1HOLE LUG → 50SQ or greater	110A: 1HOLE LUG → 50SQ or greater

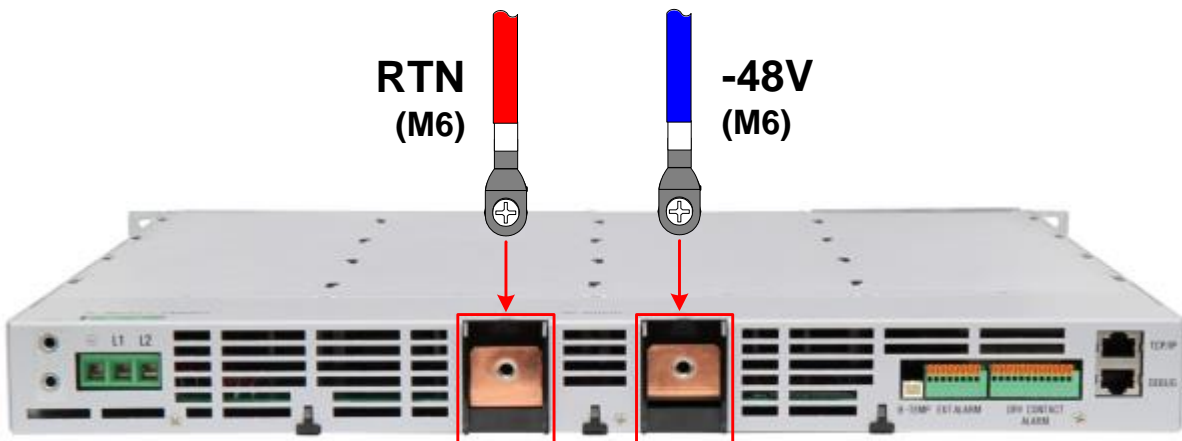
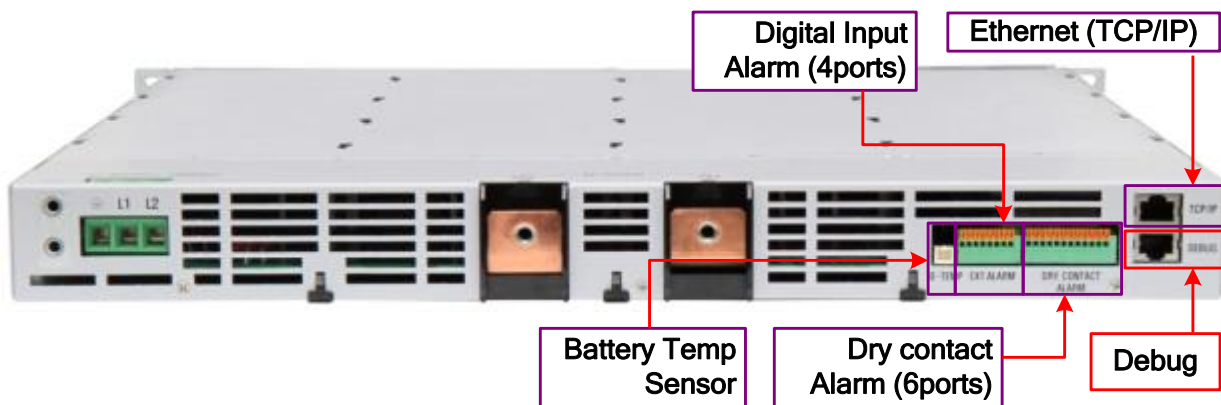


Figure 2-3 Output Cable Connection

2.2.3 Communication Cable Connection

Rectifier alarm and operation status are sent out over Debug and Ethernet ports.

Pins are assigned as follows:



**Figure 2-4. Communication Connection Ports**

**Table 2-2. Communication Pinout Table**

> Ethernet (TCP/IP)

Pin NO	Name	Description	Comments
1	TX+	Transmit Data+	CONNECTOR: RJ45
2	TX-	Transmit Data-	
3	RX+	Receive Data+	
4	Not Used		
5	Not Used		
6	RX-	Receive Data-	
7	Not Used		
8	Not Used		

## 3 - Initialization & Check Points

*Once all of the cabling and installation procedures are finished, initialize the system and perform the functional test in the following order. Check carefully if there are any service failures or alarms during the test.*

- 1) Check that all of the power switches have been turned off, and check polarity and cable connection status using DVM.
- 2) Check that the input power has been correctly connected using DVM.
- 3) Check that the DC Output cables have been correctly connected, and check polarity.
- 4) Turn on the AC main Circuit Breaker.
- 5) Check that each installed Rectifier Module front panel LED is green, and verify that the DC output voltage is correct.

### 3.1 Installation Check List

To check installation of the system, use the following procedure:

- 1) Check that the equipment rack has been properly and firmly mounted to the floor.
- 2) Check that the dry contact alarms cable (optional) of the Control unit is connected.
- 3) Check if CIRCUIT BREAKER has been installed in the distribution frame of the system.
- 4) Check if audible alarm switch of the control panel is ON.
- 5) Verify that the rack Frame Ground has been connected to the main ground busbar.
- 6) Check if the AC power ground is connected to the surge protector ground.
- 7) Check if the I/O cable has been correctly connected.
- 8) Verify that all installed rectifier modules have been fully inserted.

### 3.2 Rectifier Module Insertion & Removal

#### 3.2.1 Rectifier Module Installation

Each Rectifier Module should be inserted into the shelf from the front. Insert each module until it reaches the mating connector then push in the ejector to fully seat the connectors. The ejector will easily lock into place when inserted and seated.



**Figure 3-1. Rectifier Unit Front View**

### 3.2.2 Rectifier Module Removal

Remove the Rectifier Module by pushing in on the top front portion of the ejector then pull the ejector handle to slide the module out from the shelf assembly.

### 3.3 Normal Operation

Status data is displayed on the LCD window of the Control unit. Use the push button switches on the front panel to edit or display setup values.

#### 3.3.1 Initial Operation Status Check

##### 1) Rectifier Module (NESPACE-48/2K)

- ➔ Check that the ON LED is illuminated.
- ➔ Check that ALARM LED is turned off.

If the FAIL LED is ON, the Rectifier Module is not operating normally. In that case, check the unit status on the LCD window of the Control unit.

- ➔ Check that the Rectifier Module fan operates normally (pulls air in from front to rear).

##### 2) Controller (NESPACE-KA)

- ➔ Check that the status indicator “ FAIL ” LED (red) is off.
- ➔ Check that the audible alarm is not activated (it should remain quiet).
- ➔ Check that alarms are not shown (as activated) on the LCD display and that the LCD displays the present status correctly.



**Figure 3-2. Control Unit Front View**

### 3.4 Abnormal Actions / Corrective Measures

If the FAIL LED (red) is on while the Rectifier System is powered ON, the alarm status will be displayed on the LCD window of the control panel and the audible alarm will sound. Check the alarm status and take corrective measures.

**Table 3-1 Corrective Actions per Alarm (optional, user defined)**

No	ALARM	CORRECTIVE MEASURES	Default (List)
Port1	AC input	AC High & Low voltage Measure actual input voltage using the digital volt meter. Verify input voltage UV, OV alarm settings.	AC UV : Under 174Vac AC OV : Over 276Vac
Port2	Output voltage	Verify default setting of output voltage. Verify output voltage UV,OV alarm settings. Verify individual current of unit and check if load sharing is working correctly (only for the case of Under voltage fail).	DC OV : Over 58Vdc DC UV : Under 47.5Vdc
Port3	Rectifier module	If an inserted rectifier module inserted has any problem, remove and reinsert it. If it fails again, replace the module.	UNIT FAIL (Default.#1~#2, Max #3)
Port4	Environment (Etc)	Check details using a PC and the Debug port to check the actual status of the alarm.	Rack. High Temp (80℃) Rack. Sensor fail (open)
Port5	Ext Alarm	Check details using a PC and the Debug port to check the actual status of the alarm. Check the	Digital input Alarm fail (Default: Normally open)



		Digital input (Ext) Alarm cable	
Port6	Control	If Control Unit has any problems, power the AC off to the Shelf then remove and reinsert it. If it fails again, replace the Control Unit.	

\* Type can be set arbitrarily (Normal open / Normal closed)

## 4 - Rectifier Module (NESPAC\_48/2K) Configuration

### 4.1 ON LED (GREEN)

The ON LED is lit (GREEN) when the Rectifier Module is in normal operation.

If internal communication with the Control Unit fails, the ON LED slowly blinks.

### 4.2 FAIL LED (RED)

The FAIL LED is lit (RED) under one of the following conditions:

- \* When system is shut down due to the DC OV (OverVoltage) protection circuit.
- \* When system is shut down due to the OT (OverTemperature) protection circuit.
- \* When system is in a DC UV (UnderVoltage) due to an over- current limit condition.
- \* When the internal FAN has failed – FanFail (FF).
- \* When system shuts down due to the AC OV or AC UV exceeding rated spec limit.
- \* When output is not functioning or voltage falls below DC UV limit (for any reason).

## 5 - Rectifier System (RM) Operation

### 5.1 Rectifier System Operation

- ① Check that each RM ON LED is illuminated (GREEN) for normal operation.

If the RM FAIL LED is on (RED), check module error status then remove and reinsert the RM to check the status again.

- ② Verify that the RM ON LED is illuminated (GREEN) for normal operation.

If the FAIL LED is still on (RED), check the alarm displayed on the Control Unit LCD.

*If any error on the rectifier system is not solved under the direction of above Table 3-1, contact a Sales Representative or the headquarters of Dongahelecomm.*

## 5.2 Rectifier Removal / Replacement

- ① The Rectifier Modules are hot-swappable so can be replaced with AC power applied. (Note that if any external battery has been connected, the Control Unit still operates.)
- ② The Control Unit is not hot-swappable so replacement requires that the AC input voltage be turned off and all external batteries be disconnected (BATT circuit breakers OFF). Then the Control Unit can be replaced and the system power restored.

## 5.3 Rectifier Module Restart

If a Rectifier Module output voltage is suspended due to a DC OverVoltage (OV) or Fan Failure (FF), manually turn off the main AC Circuit Breaker. Then, when the module is fully discharged (LED off), turn on the AC Circuit Breaker to see if the event was isolated or recurring. If the OV/FF is still indicating the failure, replace the Rectifier Module and repeat this restart process to check that the replacement module clears the alarm.

# 6 - Rectifier Maintenance

## 6.1 Overview

The purpose of this document is to provide guidelines to test the rectifier and setup measures to restore the rectifier to normal operation within a shortest possible time when any fault occurs to the system. Enough field-replaceable spare parts must be maintained on-hand to prepare for replacement of units or components that may fail in the field. Even though the fault location and reason are detected under the guidelines of this Manual, if field repair work is not possible, or a long period of time is needed for repair, the faulty units should be replaced with a spare one held in reserve. This allows the system alarm to be cleared quickly and efficiently to minimize technician time and maximize system up-time.

Note : As this rectifier uses AC voltage, it may cause electric shock. As battery voltage is fed to the system, safety measures should be taken to repair and maintain the rectifier.

## 6.2 Periodic Inspection

To guarantee effective operation of the system, periodic inspection is required.

Periodic inspection should be carried out one time per 6 months.

- 1) Take care not to block the air ventilation holes with dust, dirt, or other debris.
- 2) Check the cable connections and tighten as necessary.
- 3) Check if internal temperature of the site is maintained at the rated levels.
- 4) Visually check all rectifier operation states and alarm states.
- 5) Check the equipment rack floor mount is maintained and ensure there is not water leakage at or near the installation site for the rectifier system.

## 6.3 Adding Rectifier Module

To expand the system capacity, rectifier modules are hot-swappable so may be inserted to vacant slots while the Rectifier Shelf is powered up normally.

- 1) Insert a rectifier module to the vacant slot until it reaches the mating connector then push in the ejector to fully seat the connectors. The ejector will easily lock into place when inserted and seated.
- 2) Confirm the Rectifier Module ON LED is illuminated GREEN.
- 3) On the Control Unit, check operation status of the newly inserted module for no active alarms.

## 7– Problem Solving & Fault Fixing

***Repairing or problem fixing of the rectifier should be necessarily carried out by experienced workers observing safety directions.***

- \* Jobs should be carried out in due order.
- \* Workers should not wear rings, watches or metallic accessories.
- \* If non-insulated conductors are used, check using a power meter if voltage is fed to them.

***- Circuits and boards should be protected from EMI.***

## 7.1 Problem Solving

This rectifier has been designed for users to solve problems easily. The meter window of the control panel displays details of faults.

## 7.2 Replacing Parts

If a fault is suspected on a particular point, circuit board of that point should be replaced. Replacing or replacement of individual circuits should not be made in fields.

## 7.3 Order of Replacement

### 7.3.1 Replacement of Rectifier Module

- 1) When a rectifier module is replaced, an alarm will be activated. Turn off the rectifier module from the control panel, or notify this fact to the person in charge.
- 2) Push in on a the ejector on the Rectifier Module, and then pull the ejector handle to remove the module.
- 3) Slide in a new Rectifier Module along the mechanical guides until it reaches the backplane connector.
  - 4) Carefully push in the ejector handle to lock the mating connectors. The ejector handle easily should snap in place and lock into the Rectifier Module front panel.
- 5) Check that the module operates normally and that no alarms are activated.

## Definitions

**C/B** : **C**ircuit **B**reaker

**S/W** : **S**Witch

**RMS** : **R**oot **M**ean **S**quare

**LVD** : **L**ow **V**oltage **D**isconnect

**ACF** : **A**C **F**ail(power failure)

**ACV** : **A**C **V**oltage

**ALM** : **A**Lar**M**

**AMP** : **A**MPere

**AUTO-FL MODE** : **A**UTO-**F**loating charging **M**ODE

**AUTO-EQ MODE** : **A**UTO-**E**qualize charging **M**ODE

**DCV** : **D**C **V**oltage

**Comm. Fail** : **C**ommunication **F**ail

**Comp.** : **C**ompensation

**Curr.** : **C**urrent

**DC** : **D**irect **C**urrent

**DCF** : **D**C **F**ail

**DCOV** : **D**C **O**ver **V**oltage

**DCUV** : **D**C **U**nder **V**oltage

**DCH** : **D**is**C**harge

**FF** : **F**an **F**ail

**LCD** : **L**iquid **C**rystal **D**isplay

**LED** : **L**ight **E**mitting **D**iode

**LDA** : output **L**oa**D** **A**mpere

**MF** : **M**odule **F**ail

**OV** : **O**ver **V**oltage

**OCA** : **O**ver **C**urrent **A**mpare

**OT** : **O**ver **T**emperature

**REC** : **R**ECtifier

**RX** : **R**eceipt channel

**TX** : Transmit channel

**Temp** : Temperature

**UV** : Under Voltage

**V1.0** : Version 1.0

**ERR** : ERRor

**ENT** : ENTer

**LCA** : Load Current Ampere

**CSPS-6K RECTIFIER SHELF  
Maintenance & Operation  
MANUAL**

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