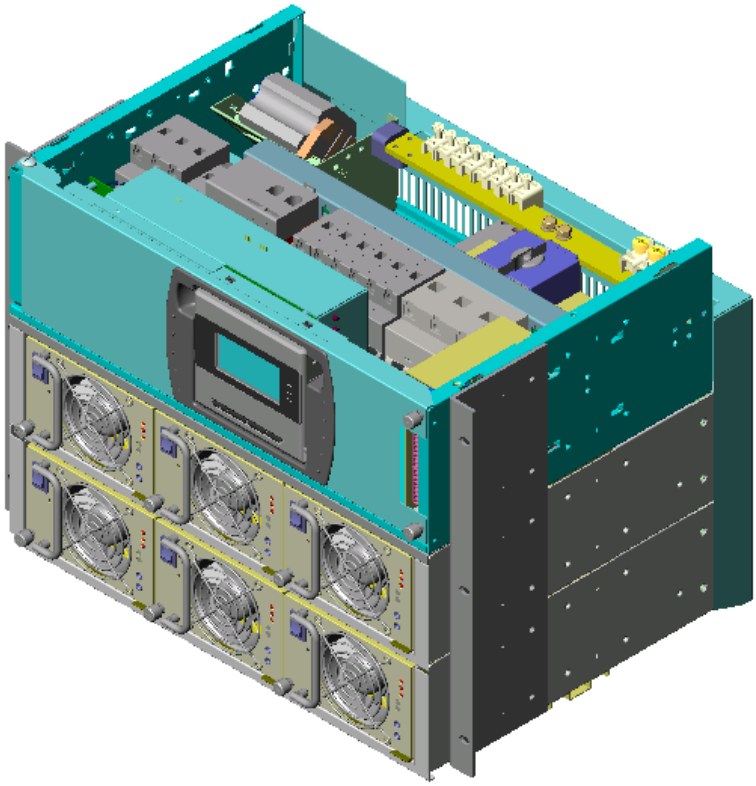
ES24/300-JKA01

System IOM



P/N: 5011220000

TABLE OF CONTENTS

1 GENERAL

1.1 Using This Manual

This manual contains specifications and instructions to properly install and maintain the MCS-1800 power system. Component specifications and drawings are contained in this manual.

Included in this manual is the operation and maintenance of the Control Supervisory Unit (CSU), MCS-1800 Switch Mode Rectifier (SMR), DC Distribution Shelf, Low Voltage Disconnect Switch (LVDS), system status and alarms, troubleshooting and system maintenance.

Step by step procedures required for installation and turn-up are detailed. All equipment parameter settings, adjustments and confirmation as well as system monitoring, operations and maintenance procedures are included.

Warnings are printed in bold lettering and alert the installation or maintenance craftsperson of a potential hazard to either or the craftsperson if the warning advisement is not followed.

1.2 Safety Notice

Products are not liable for any hazards incurred by not following proper safety procedures. Installation, Operation and maintenance personnel should always follow these safety rules:

1. Caution - Do not install or remove any SMR with the AC Breaker On. The AC Breakers must be switched to the off position prior to inserting a module into a shelf.
2. Before the shelf is operational, the AC input frequency and voltage must be verified, AC break rating and type is adequate, and other environmental conditions as noted in the specifications are met.
3. The shelf has passed stringent system testing prior to shipment. To avoid electrical shock, the MCS-1800 shelf requires a single ground point permanently connected to earth ground.
4. An AC Breaker must provide adequate isolation between the shelf input and Commercial AC Main.
5. The environment should be dust free and controlled by an HV AC system. The area must be free of any flammable vapors or fluids.
6. To avoid electrical hazard, the covers must not be removed on any component including the CSU and Rectifier.
7. Circuit breakers must be replaced with approved replacement circuit breakers meeting the original design specification.
8. All AC connections must be made per the latest issue of the National Electrical Code and must also conform to all local codes.

1.3 Environmental

1. Input Voltage: 380V /3L + N + PE

2. Input Frequency: 50/60 Hz ±5%
3. Operating Temperature: 0 ~ 50 °C
4. Humidity: 10 ~ 90% RH (non-Condensing)
5. Floor Load Density: 600 Kg/M^2
6. Installation Space Recommended:
   Front Clearance--- 4 inches minimum
   Rear Clearance--- 6 inches minimum

2 PRODUCT DESCRIPTION

2.1 Product Description

The MCS-1800 Power shelf consists of modular MCS-1800 rectifiers, a Control and Supervisory Unit (CSU) and a DC Distribution shelf. Up to 6 rectifiers can be equipped in 2 shelves, which can mount a CSU. The shelf requires a nominal input of 380 Vac (R-N;S-N;T-N for rectifier 220Vac) and provide an output of +24 VDC to power the load and also maintain fully charged batteries.

2.2 Product Main Features

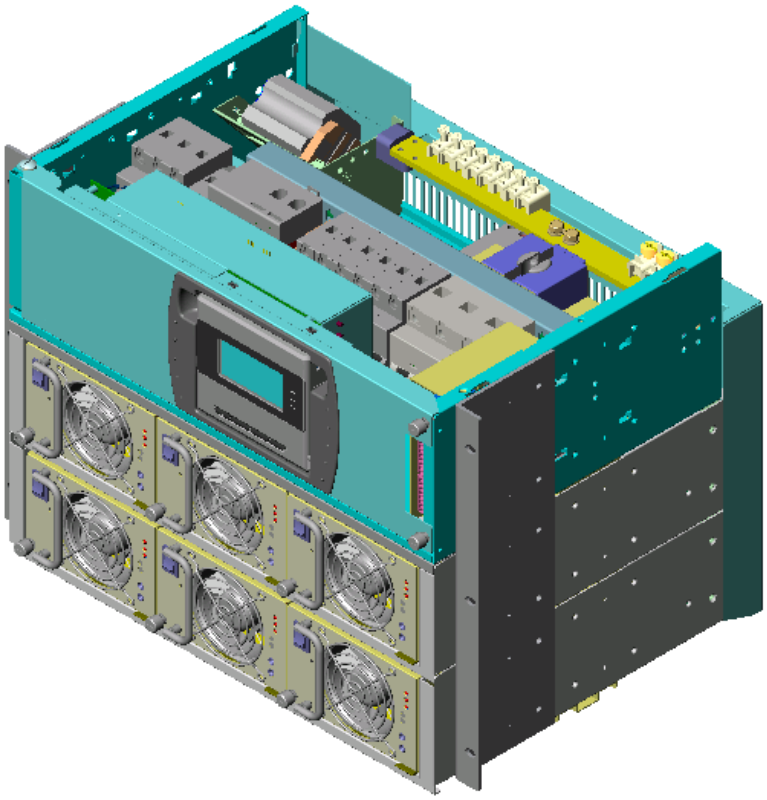
- +24 VDC/50A - 300A shelf (rectifiers 1-6 19" shelf).
- User Friendly LCD Interface (128*64 dots display)
- Hot Swappable 1800 Watts rectifiers, wide range PFC input (90~275Vac good for unstable utility environment)
- Light Weight Plug-in Modules for Simple Installation and Maintenance
- High Power Density Saves Valuable Floor space
- All rectifier modules are front accessible
- Active Power Factor Correction (> .99 PF)
- High Efficiency
- Temperature Compensation Float Voltage Control for VRLA Batteries
- Front Access for Simplified Operation and Maintenance
- Intelligent Remote Monitoring and Control (Remote Monitoring System) for Centralized Network Maintenance
- Battery temperature compensation voltage control
- Battery and Load breakers
- Equalize charge timer

2.3 Configuration

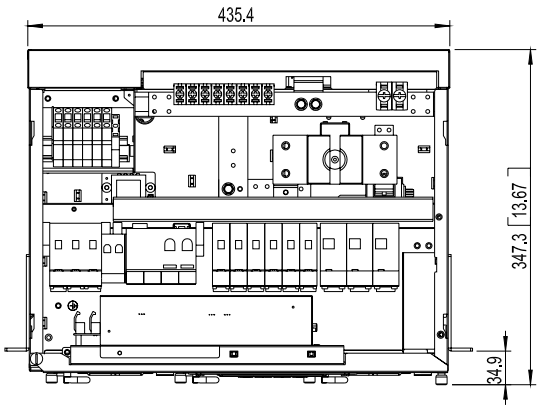
AC Input:	380V /3L + N + PE
System Capacity:	+24VDC/300A Max.
Rectifier:	+24/50A * 6 Max.

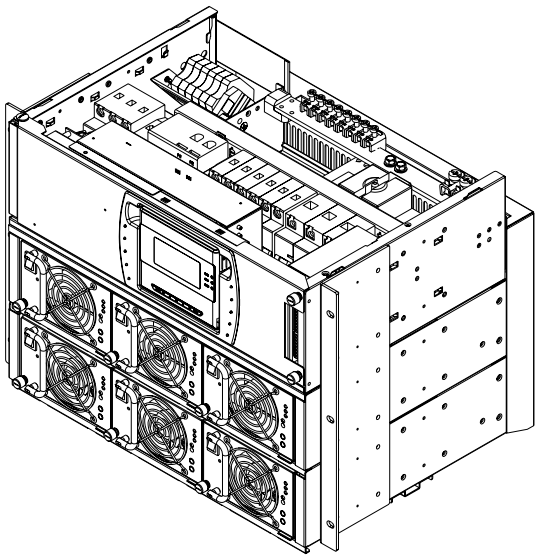
CSU (Control and Supervisory Unit)

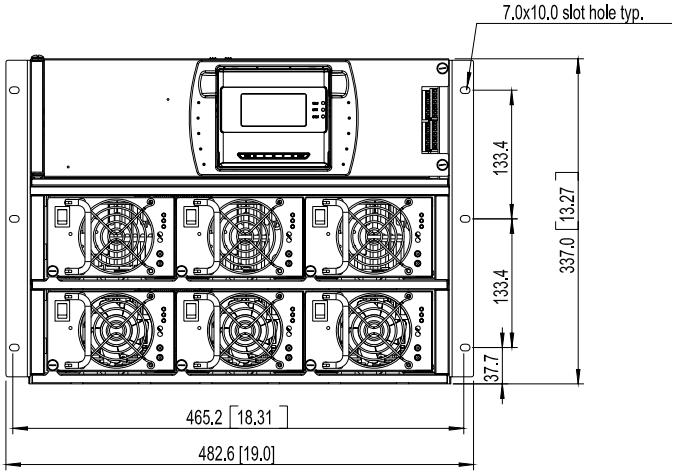
2.4 Shelf Outlook

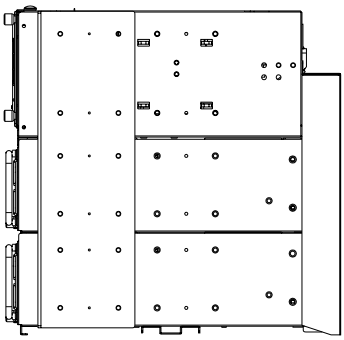


2.5 System Dimensions & Configuration









3 INSTALLATION

3.1 Tools Required

The following tools are recommended for the MCS-1800 installation:

- Phillips No. 3 screw driver
- Insulated slotted screw driver - blade size 1/4”
- Insulated slotted screw driver - blade size 1/8”
- Tweaker - Slotted screw driver blade size .09”×.02”
- Insulated side cutters
- Metric Socket Wrenches with Extensions

3.2 Preliminary Inspection

Prior to removing the system from the crate, note any damage to the crate. Remove the shelf from the crate and inspect the shelf for any dents or damage. If any damage is noted, contact the carrier immediately.

3.3 System Mounting

The shelf comes fully assembled with the DC Distribution Shelf, rectifiers mounted in a 19” shelf. The AC connections from the AC switch to the rectifier shelf are made at the factory. All CSU communication and signal leads are connected via the modular plugs and communicate with the rectifiers.

Mount the shelf with a distance no less than 4 inches from the rear of the rectifier shelf to a wall. This will provide adequate ventilation for the rectifiers. The front of the shelf should be clear of all obstruction and allow room for proper ventilation, installation and maintenance. The shelf should be mounted to the superstructure and floor per customer provided equipment engineering drawings.

3.4 Module Installation

In order to minimize the weight of system, all rectifier modules can be removed from the shelf and re-installed. Refer to Section 4 for module installation.

3.4.1 Rectifier Installation

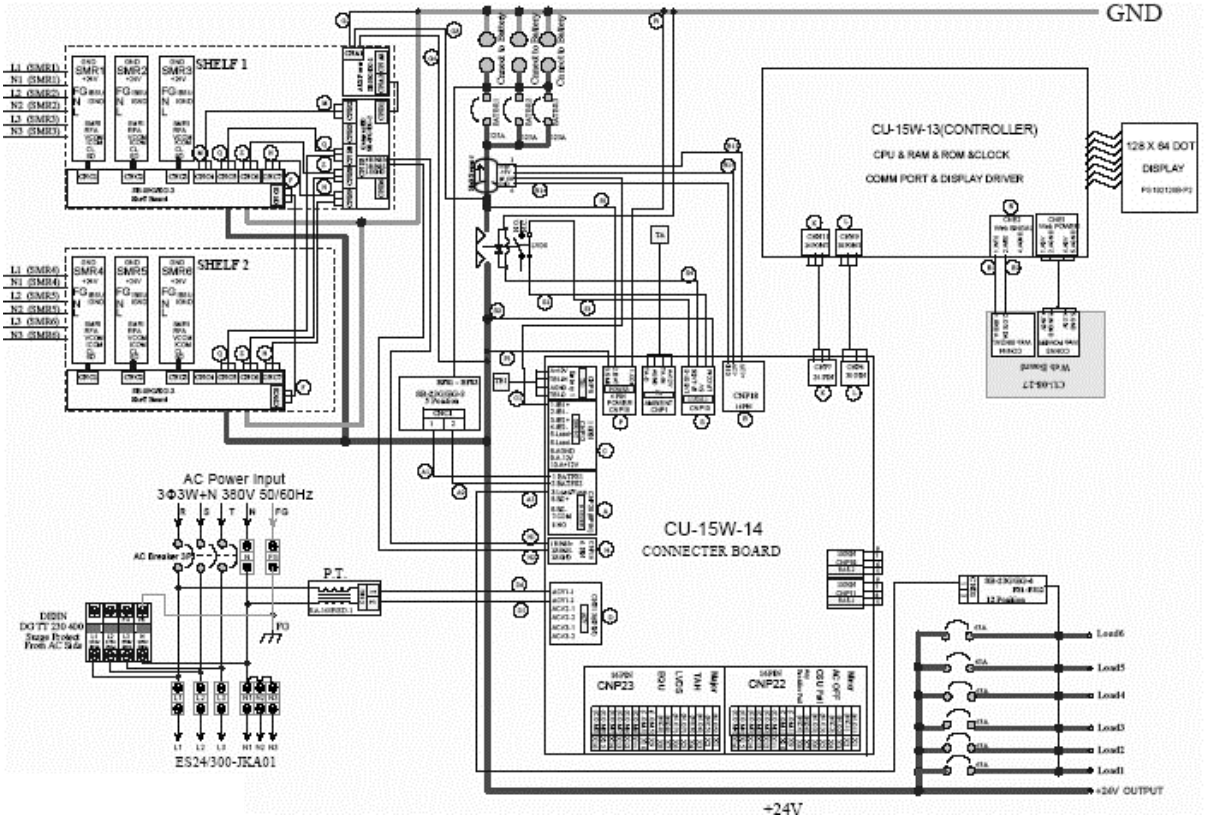
1) Install rectifier modules into the shelf

Do not force the module into the slot. If it does not slide in and connect easily, remove and re-seat the unit.

2) Push the handle in to lock the rectifier.

3.5 System Wiring

The shelf comes fully assembled and all the connections are made at the factory. There is no internal, shelf or module wiring required.



3.6 AC Input Connections

The connection of AC power distribution is from distribution box. All the AC cables can be connected to shelf main switch.

Breaker: 32A, 3P

Recommender wire: AWG #8

The shelf operates at AC voltages that can produce fatal electrical shock. Installation and maintenance personnel must observe all safety precautions.
Confirm the operating voltage before proceeding.
The input feeder circuit breaker at the AC panel must be in the Off position before attempting to wire the shelf.
Ensure all rectifier AC and DC breakers are in the off position.

3.7 Frame Grounding

The frame ground must be connected to a permanent earth ground connection. Feed the frame ground lead through the knock out at the rear of the right hand side of the DC distribution and connect to the frame ground lug.

Do not connect this terminal to AC power system neutral.

3.8 DC Distribution Connections

Load Breaker: 6 Breaker positions --Breaker Rate: 63A * 6.

Battery Breaker: 3 Breaker positions –Breaker Rate: 125A * 3.

3.9 Battery String Connections

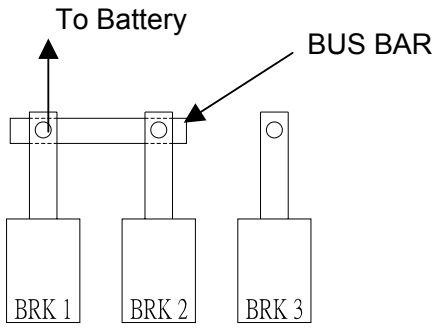
Verify the polarity of the battery leads prior to connecting the battery cables to the system. Failure to connect the battery cables correctly to the system can cause damage to batteries and the shelf.

WARNING: Battery Breaker connecting notice.

The battery switch in the system is assembly with three 125A breakers. To avoid the current over the breaker rating, the manufacturer recommended:

Normally, the system has several battery breaker positions, each position for one battery string, please notice that, the total rating of battery breaker shall not less than the maximum O/P power of the system. But, if there is only one (1) battery string had connect to the system and the rating of the breaker is less than the O/P power of the system. Please consider

1. Switch on the exact quantity of SMR to control the SMR's O/P equal to the battery capacity to extent the life of SMR and to avoid breaker trip when charge (or discharge)
2. Parallel two (2) breakers to the battery with two copper wires (2 wires must be in same condition, Ex. Length, Diameter, Material…)
3. Parallel the breaker with copper bus (Refer to the figure)



3.10 Battery And Ambient Temperature Sensors

One battery sensor cable is provided with each shelf. The cable is labeled TB-1 terminate on connectors TB-1 on the Detection Module. The positive bus on the inter-cell connections of the battery strings for +24 VDC, or in between the battery cells depending on whether the batteries are exiting or being installed with the power shelf.

The Ambient Temperature Sensor is labeled TA and can be placed anywhere clear of the rectifier fan flow. The Ambient Temperature Sensor TA is terminate to the back of the CSU to the connector labeled Ambient Temp.

4 START - UP PROCEDURE

4.1 Initial Startup Preparation

Verify all connections prior to starting this section.

Ensure the input AC circuit breaker located at the AC service panel is switched to the “Off” position.
Confirm the operating voltage before proceeding.
Ensure the frame ground is properly connected to a permanent earth ground connection.
Ensure the AC Circuit breakers located on the front of each rectifier are switched to the “Off” position
Ensure all the Load DC Circuit breakers located in the DC Distribution Cabinet are switched to the “Off” position.
The correct rectifier power-up sequence is as follows:
1. Switch the AC circuit breaker located on the front of the rectifier to the “On” position
2. Switch the DC circuit breaker after “FLO LED” become light, located directly below the AC Circuit breaker on the front of the rectifier, to the “On” position.
Failure to follow this sequence may damage the rectifier.

4.2 No Load Start-up

The shelf can be turned up without a load. The start-up procedure is as follows:
1. Switch all DC circuit breakers (load) to the “Off” position.
2. Make sure battery is not connected to the system Battery Bus.
3. For Rectifier startup refer to section 7.3.2.
4. Check the CSU for alarm status. The “Load Less than 1 Amps” alarm should appear.

4.3 Basic Functional Verification

After shelf start-up, basic functional verification should proceed as follows:

1. Check the monitor of CSU display.
2. Compare the SMR DC voltage readings at the CSU with the output voltage of each rectifier by using multi-meter (measure at the + and - V points located at the front of each rectifier.
3. The FUSE LEDs on the panel will light because the DC load circuit breakers are switched “Off”.

4.4 Parameter Settings

Most parameters are pre-set at the factory and are listed on the shelf Test Report included with each shelf. This section provides a general explanation for some parameter may need changing.

4.4.1 Float/Equalize Voltage

Both Float and Equalize voltages are preset at factory and listed on the shelf Test Report, also reference attachment 5-1. The CSU controls the system settings and overrides the settings made on each rectifier. If a different value is required, both

SMR and CSU settings must be identical. Refer to section 5.4.3.8 Float/Equalize Voltage Settings.

4.4.2 Current Limit

The CSU controls the system current limit threshold by monitoring the total load, the number of rectifiers in-service and the battery current. A parameter sets current limit in the event of a DC overload condition for the system and overrides the current limit set at each rectifier, reference 7.3.5 Current Limit Setting.

If the CSU fails, the system will change current limit at the rectifier setting.

4.4.3 Total Number of SMRs

The CSU uses this parameter to scan for rectifier status and alarms. Refer to section 5.3.4 for detailed parameter setting procedures.

4.4.4 SMR Slot Assignment

This parameter is used with the parameter “Total Number of SMRs” and directs the CSU to scan the assigned slots for rectifier status and alarms. Refer to section 5.3.4 for detailed parameter setting procedures.

4.4.5 Maximum Battery Capacity

Battery capacity must reflect the rating of the installed battery. Refer the battery manufacture specification for the rated capacity.

4.5 DC Load Connections

Basic Functional Testing should be completed prior to the load being applied. Switch all DC circuit breakers to the “OFF” position.

A. Connect the positive load cable to the Ground Bus.
B. Connect the negative load cable to the DC breaker lug.
C. Switch the DC circuit breakers or Load Fuse to the “ON” position.

Tighten the DC Circuit Breaker lugs to ensure proper contact is made with the load cable and the trip sense wire. Failure to properly torque the DC circuit breaker lugs may cause heat damage.

4.6 Functionality Check

Control and supervisory functional testing can be performed at the CSU after the Basic Functional Testing is completed and the DC Load is connected.

Check the status of the equipment by viewing the Main Page and by pressing button. Verify voltages, current and temperature for normal operation. Compare the rectifier voltages by using a multi-meter and taking the measurements at the front of each rectifier.

Verify the Alarm display at the CSU to ensure that all alarm conditions are resolved.

5 CONTROL & PARAMETER ADJUSTMENT

5.1 Description

CSU Display

5.2 Display

A 192*64 characters LCD Display is on the CSU for display shelf status as the following:

Main page: DCV, DCI, shelf status, Alarm

Button A BACK; B ↑; C ↓; D ENTER

5.3 Function

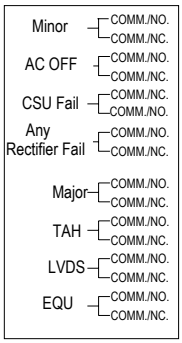
5.3.1 Relay output

5.3.1.1 Relay Specifications

Settings	Description
Arrangement	1 Form C (SPDT)
Contact rating	1A at 24VDC / 1A at 120V AC
Resistance	100mΩ
Condition	Normal Open

5.3.1.2 Relay Definition

Relay	Alarm Event	ALARM EVENT DESCRIPTION
1	Minor	MINOR ALARM
2	AC OFF	AC Fail Alarm
3	CSU Fail	CSU Fail alarm
4	Any Rec. Fail	Any Rectifiers Fail
5	Major	MAJOR ALARM
6	TAH	System Over Temperature
7	LVDS	LVDS Trip Alarm
8	EQU	EQU Alarm



Relay Label

Beware of the CSU Fail connector's NC and NO connection.

5.4 System Alarm Message / Setting

5.4.1 Alarm Message/Setting:

Item	Description	Default	Setting Range	Tolerance
HVSD	DC High Voltage shutdown	29.5 VDC	29~30VDC	±0.5V
	HVSD Recovery Voltage	28.5 VDC		
HV	DC High Voltage Alarm	29 VDC	28~29VDC	±0.5V
	HV Recovery Voltage	28.5 VDC		
LV	DC Low Voltage Alarm	23 VDC	22~25VDC	±0.5V
	LV Recovery Voltage	24 VDC		
ACH	AC High Voltage Alarm	264 VAC	230~500VAC	±2V
	ACH Recovery Voltage	261 VAC		
ACL	AC Low Voltage Alarm	176 VAC	90~500VAC	±2V
	ACL Recovery Voltage	179 VAC		
BTA	Battery Over Temperature Alarm	40℃	30~50℃	±1°C
	BTA Recovery	35℃		
	Bat. Temp. Sensor Disconnect			

TA	Ambient Over Temperature Alarm	45℃	35~75℃	±1°C
	TA Recovery	40℃		
	Ambient Temp Sensor Disconnect			
System Time	System Date and Time	Now-24Hour		
System Language	System Language Selection	English		
Fuse Blown	Fuse Blown			
Breaker Fail	Breaker fail or trip			

5.4.2 Rectifier Setting

Function	Description	Default				Setting Range
CL	Manual Current Limited	AUTO	50			5~62.5
	Volt Compensation/Limit	ON	1.3			-1.3~1.3
EQU ON/OFF	Equalize charging voltage Function on/off	ON	AUTO	1 Month	Now+1 Month	1~12Month
				1 hr		1~24hr
				28.2VDC		27.5~28.5VDC
FL/EQU status	System Charge State	FL				
	Set FL/EQU Voltage	FL	27VDC			25~28VDC
		EQU	28.2VDC			27.5~28.5VDC

5.4.3 Battery setting:

Function	Description	Default				Setting Range
	Temp Comp/Coefficient	ON	4mv/℃			0.1~4mv/℃
	Battery Load Test	ON	AUTO	1 Month	Now+1 Month	1~12Month
				23.5VDC		21~26VDC
				1hr		1~24hr
	Battery Total AMP HOUR	300AH				0~6000 AH
	End Battery Test Voltage	23.5V				21~26 VDC

5.5 Real Time Operation Status

The shelf status is displayed on the front of the CSU. The Main page is always displayed during normal operation.

Main page:

```
DCV                    27.0V
DCI                      0A
Sys  Sta.                FL
Alarm Existing
```

DCV: System output DC Voltage
DCI: Total system output current

Sys Sta: System status
Alarm Existing: “Alarm Existing” will display if alarm had occurred

5.5.1 System Information

Sys Info ↑
Sys setting ┘
Curr. Alarm ↓

Press ENTER;

Rectifier
Battery
Event Log
Curr. Setting
AC & Temp
Date & Version

Press ENTER;

5.5.1.1 Rectifier Information

Rectifier Info		
01	0.0A	OK
02	0.0A	OK
03	0.0A	OK
-		
-		
-		
24	0.0A	OK

Total 24 rectifiers can be display

5.5.1.2 Battery Information

Rectifier
Battery
Event Log
Curr. Setting
AC & Temp
Date & Version

Press ENTER

Batt. 1	
Charging…	
Current	0.0A
Temp.	32℃
Batt. 2	
Charging…	
Current	0.0A
Temp.	30℃

5.5.1.3 Event Information

Rectifier Battery Event Log Curr. Setting
AC & Temp Date & Version

Press ENTER

00 XXXX Alarm YYYY-MM-DD HH: MM: SS 01 XXXX Alarm YYYY-MM-DD HH: MM: SS
- - 99 XXXX Alarm YYYY-MM-DD HH: MM: SS

Total 100 events can be display

5.5.1.4 Current Setting Information

Rectifier Battery Event Log Curr. Setting
AC & Temp Date & Version

Press ENTER

5.5.1.4.1 DC Setting

DC Setting ↑ Alarm setting ┘ Batt. setting ↓ Other setting

Press ENTER

DC Setting EQU VLT 28.2V FL VLT 27V

5.5.1.4.2 Alarm Setting

DC Setting ↑ Alarm setting ┘ Batt. setting ↓ Other setting

Press ENTER

Alarm Setting HV 29V LV 23V HVSD 29.5V
ACH 264V ACL 176V HT 45℃ LT
HTSD 50℃ LTSD EQU ALM ON TST ALM ON
BATT OTP 40℃ LVDS1 LVDS2 BATT Unb ON

5.5.1.4.3 Batt. Setting

DC Setting ↑ Alarm setting ┘ Batt. setting ↓ Other setting

Press ENTER

B- Parameter T- COMP BDT Setting B-EQU Setting

a. B- Parameter

B- Parameter T- COMP BDT Setting B-EQU Setting

Press ENTER

Batt. Capacity 300AH
Stop EQU… Max. Time 1Hr Min. Curr. 0.1C Extra Time 1Hr

b. T- COMP

B- Parameter T- COMP BDT Setting B-EQU Setting

Press ENTER

Linear Non Linear

b-1. Linear

Linear Non Linear

Press ENTER

ENABLE in EQU Coef 4.0mV/℃ RANGE ±1.3V T- START 25℃

b-2. Non Linear

Linear Non Linear

Press ENTER

T0, V0 : T1, V1: T2, V2: T3, V3 :

c. BDT Setting

B- Parameter T- COMP BDT Setting B-EQU Setting

Press ENTER

Periodic BDT Status ON Next Batt Test 05/06/02 00:00
BDT I 0.1C End VLT V BDT Time 1Hr
Periodic Test Period 1M Date 1D Time 0Hr

d. B- EQU Setting

B- Parameter T- COMP BDT Setting B-EQU Setting

Press ENTER

Periodic B-EQU Status ON Next EQU 05/07/02 00:00
Periodic B-EQU Period 1M Date 1D Time 0Hr

5.5.1.4.4 Other Setting

DC Setting ↑ Alarm setting ┘ Batt. setting ↓ Other setting

Press ENTER

Eficnt Func. ON

5.5.1.5 AC & Temperature Information

Rectifier Battery Event Log Curr. Setting
AC & Temp Date & Version

Press ENTER

ACV ACV1 217V Ambient Temp 25℃

5.5.1.6 Date & Version

Rectifier Battery Event Log Curr. Setting
AC & Temp Date & Version

Press ENTER

Current Date YYYY/MM/DD Current Time HH: MM: SS
HW Version SW Version

5.5.2 System Setting

Sys Info ↑ Sys setting ┘ Curr. Alarm ↓

Press ENTER;

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

5.5.2.1 DC Setting

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

DC Setting EQU VLT 28.2V FL VLT 27.0V

5.5.2.2 Alarm Setting

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

Alarm Setting HV ON LV ON HVSD ON
ACH ON ACL ON HT ON LT ON

HTSD ON Batt. OTP ON LVDS1 LVDS2
EQU ON Batt. Tst ON Batt. Unb ON

5.5.2.2.1 HV Alarm

HV Alarm *Enable Disable SETPOINT 29V

5.5.2.2.2 LV Alarm

LV Alarm *Enable Disable SETPOINT 23V

5.5.2.2.3 HVSD Alarm

HVSD Alarm SETPOINT 29.5V

5.5.2.2.4 ACH Alarm

ACH Alarm *Enable Disable SETPOINT 264V

5.5.2.2.5 ACL Alarm

ACL Alarm *Enable Disable SETPOINT 176V

5.5.2.2.6 HT Alarm

HT Alarm *Enable Disable SETPOINT 45℃

5.5.2.2.7 LT Alarm

LT Alarm *Enable Disable SETPOINT ℃

5.5.2.2.8 HTSD Alarm

HTSD Alarm SETPOINT 50℃

5.5.2.2.9 Batt OTP Alarm

Batt OTP Alarm *Enable Disable SETPOINT 40℃

5.5.2.2.10 LVDS1 Alarm

LVDS1 Alarm SETPOINT V

5.5.2.2.11 LVDS2 Alarm

LVDS2 Alarm SETPOINT V

NEVER** set the default voltage of LVDS2 **over** the default voltage of LVDS1, otherwise, the function of LVDS1 will **DISABLE.

5.5.2.2.12 EQU Alarm

EQU Alarm *Enable Disable

5.5.2.2.13 Batt. Tst Alarm

Batt. Tst Alarm *Enable Disable

5.5.2.2.14 Batt. Unb Alarm

Batt. Unb Alarm *Enable Disable SETPOINT --V

5.5.2.3 Batt. Setting

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

```
B-Parameter
T-COMP
BDT Setting
B-EQU Setting
```

5.5.2.3.1 B-Parameter Setting

```
B-Parameter
Capacity   300AH
EQU Stop
EQU Enable
```

a. EQU Stop Setting

```
Stop  EQU
Max. Time   1Hr
Min. Curr   0.01C
Extra Time   1Hr
```

```
EQU CL
Stage1
Stage2
Stage3
```

b. EQU Enable Setting

```
EQU Enable
Batt. Cap   ON
BO Time   ON
Batt. VLT   ON
```

b-1. Batt. Cap Setting

```
Battery Remain Cap
  ON
  OFF
SETPOINT    80%
```

b-2. BO Time Setting

```
AC Break Time
  ON
  OFF
SETPOINT    1Hr
```

b-3. Batt. VLT Setting

```
Batt. Volt
  ON
  OFF
SETPOINT    23.5V
```

5.5.2.3.2 T-COMP Setting

```
T-COMP
     *Enable
      Disable
```

T-COMP Enable Choose T-COMP Linear Non Linear

a. Linear

Coef 4mV/℃ RANGE ±1.3V T- START 25℃

b. Non Linear

T0, V0 T1, V1 T2, V2 T3, V3

5.5.2.3.3 BDT Setting

Manual BDT Periodic BDT Next BDT 00: 00 YYYY/MM/DD

Manual BDT Setting

Manual BDT Status: OFF Setting Start MBDT
BDTI 0.10C End VLT 23.5V BDT Time 1Hr

5.5.2.3.4 B-EQU Setting

Manual B-EQU Periodic B-EQU Next B-EQU 00: 00 YYYY/MM/DD

5.5.2.4 Date Setting

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

Date Setting YYYY/MM/DD HH: MM

5.5.2.5 Efficiency Mgt.

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

Efficiency Mgt. Status ON * Enable Disable

5.5.2.6 Alarm Reset

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

Alarm Reset Reset HVSD Reset Com-Fail

a. Reset HVSD

- High voltage shutdown reset-

b. Reset Com-Fail

-Communication fail reset-

5.5.2.7 Temp. Unit

DC Setting Alarm Setting Batt. Setting Date Setting
Efficiency Mgt. Alarm Reset Temp. Unit

Press ENTER;

Temp. Unit Fahrenheit * Celsius

5.5.3 Curr. Alarm

Sys Info	↑
Sys setting	┘
Curr. Alarm	↓

Press ENTER;

L Bkr0-06A BDT C Alarm TASF Alarm

6 WEB BROWSER

6.1 Feature

- Applied in TCP/IP Internet/Intranet Environment
- Monitoring and control to Power System
- User-friendly Graphic Interface
- Dynamic information presentation
- Password function
- Microsoft Explorer and Netscape Support

Setup IP, subnet mask and gateway address of WEB Server

User can set address through two different methods. One is through RMS (Remote monitoring system) software provided by Delta and another is through LCD display on controller.

Move your mouse to the field of IP address, for example (172.16.20.253), Subnet Mask (255.255.255.0) and Gateway IP address (172.16.20.254) and input your setting on these three fields.

6.2 Use LCD display of controller

6.2.1 Home page, Index.htm

This page, Fig1, displays the information about this site such as name, location, product modal and system description. In additions, list the last updated date to make user know current SW version.

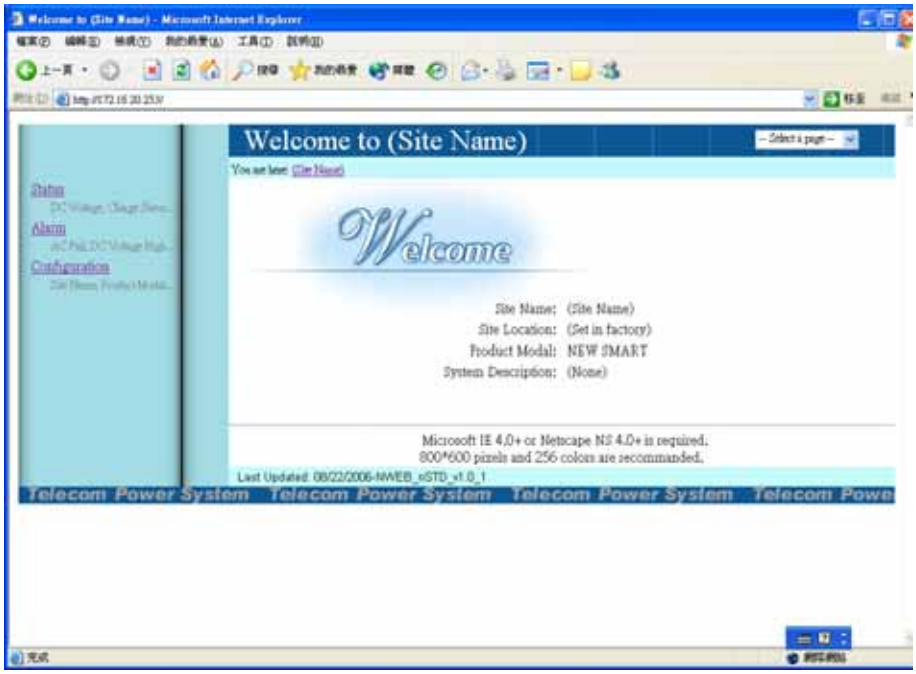


Fig1. Index.htm

6.2.2 Config.htm

(a) Choose on “Configure” of “-Select a page-“ to configure your system.
(b) This page, Fig2, supports users for configuring site’s basic information, and password. After finishing configuration, please click on “Submit” icon to start making changes after inputting correct “administrator” and “password”.

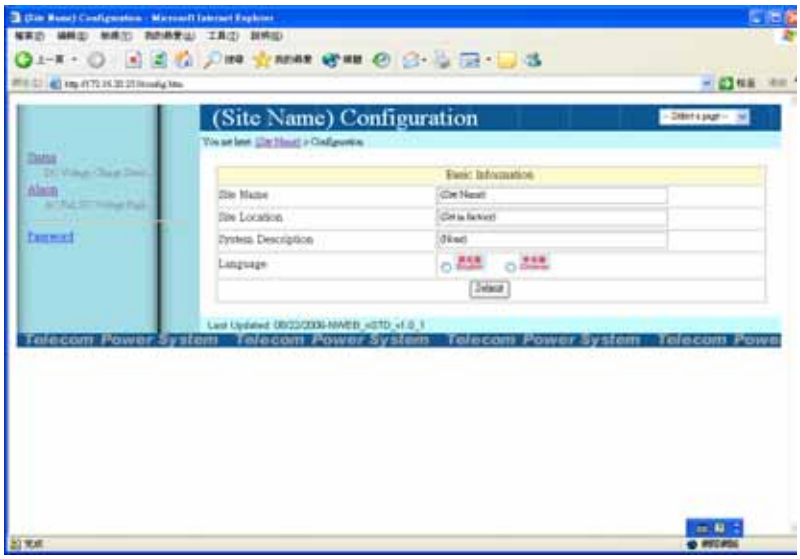


Fig2. Config.htm

6.2.3 Passwd.htm

Default password: 67890
Default Administrator name: admin

Fig3. passwd.htm

6.2.4 Status.htm

(a) Choose on “Status” of “-Select a page-“ to read current data of your system.
(b) This page, Fig4, displays current data such as ACV, DCV, DCI, charge state for this site and allows users with password to have the ability to change current charge state from FL to EQU and vice versa after clicking on “SET” image.

Fig4. Display current data of system such as ACV, DCV and DCI.

6.2.5 Alarm.htm

(a) Choose on “Alarm” of “-Select a page-“ to read current alarm of your system.
(b) This page, Fig5, displays current alarm message. If system occurs alarm, then color of “ball image” will change into red to warn users.

Fig5. Blink “red” ball if occurring alarm message.

6.2.6 Dcbrk.htm

Fig6. Show information about Break.

6.2.7 Smr.htm

(a) Choose on “Smr” of “-Select a page-“ to read current status, current and alarm information of every rectifier.

(b) This page, Fig6, displays current data about rectifiers such as current, status (ON/OFF/Vacant) and alarm message (Normal/CL/Failure). In addition, allow users with password to change ON/OFF mode of rectifiers and do shutdown recovery.

Fig7. Show information about rectifiers.

6.2.8 Parm.htm

(a) Click on “Parameter” of “-Select a page-“ to read current parameter of your system.
(b) This page, Fig7, shows the parameter setting value and allow user with password to change parameters after clicking on “SET” image.

Fig8. Show value about parameter and click on “SET” icon to change its data.

6.2.9 Asetup.htm

(a) Click on “Alarm” of “-Select a page-“ and click on “Alarm Setting” to read current parameter about alarm limit.
(b) This page, Fig8, displays alarm parameter setting value and allow user with password to change parameters after clicking on “SET” image.

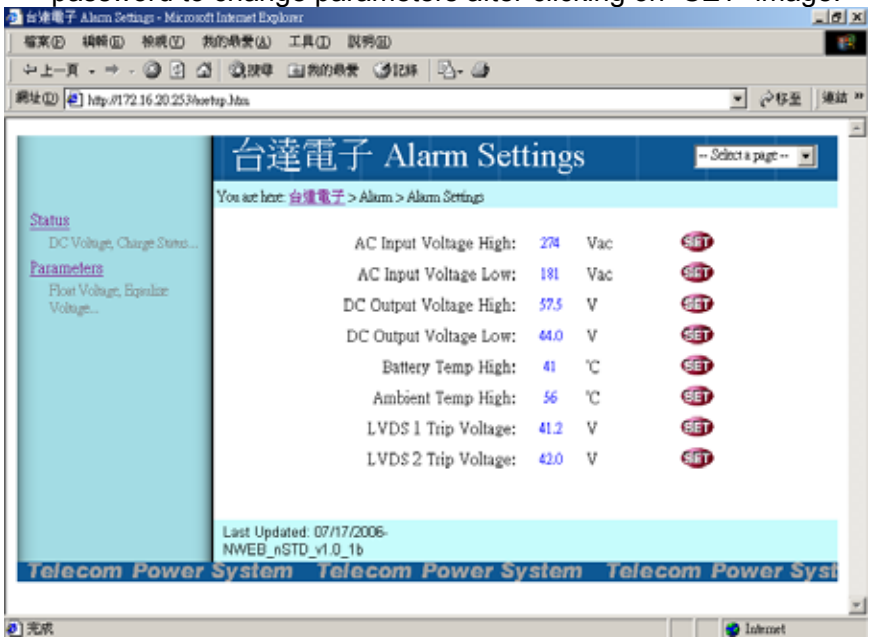


Fig9. Show parameters about alarm limit.

6.2.10 Sitemap.htm

Click on “Site map” of “-Select a page-“ to give an introduction of WEB.

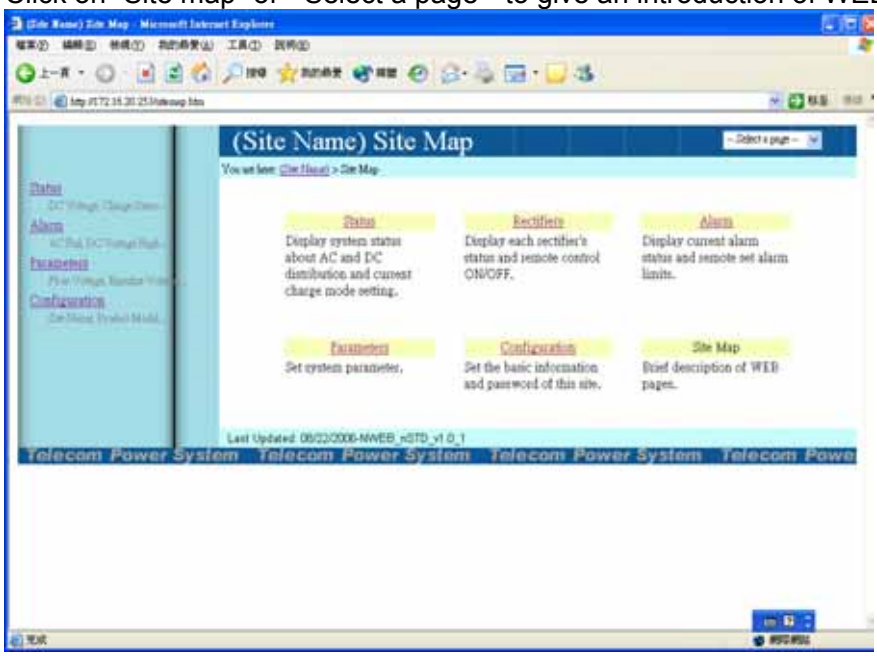


Fig10. Show an introduction to every page.

7 SWITCH MODE RECTIFIERS

7.1 Description

The Switch Mode Rectifiers (SMR) modules are rated at 50 Amps at +24 VDC. The modular design provides the flexibility to configure and expand the system as the load demand increases. Each MCS-1800 module is hot swappable with front access for ease of maintenance without system shutdown providing uninterrupted service.

The MCS-1800 series module is active power factor corrected to great than 0.99 PF (THD<5%) for maximum AC utilization. Each module is equipped with AC breakers located at the front of he module to allow for easy identification when maintenance is required.

7.2 Specifications

7.2.1 Input

Specification	Value
Input Voltage	90VAC to 275VAC, Single Phase or three phases, (during 90 to 175 VAC de-rated to 50% Load)
Input Current	12 Amps (at 176 VAC, Full Load or at 90VAC, Half Load)
Line Frequency	45 to 65 Hz
Power Factor	>0.99, at 220 VAC Input, Full Load
THD	<5%, at 220 VAC Input, Full Load
Efficiency	>90%, Full Load
Inrush Current	<12 Amps (peak), 220 VAC, Full Load, Cold Start
Start Time Delay (Walk-In)	3 to 10 seconds
Protection	Fuse

7.2.2 Output

Specification	Value
DC Output Voltage	24 to 29 VDC (factory preset at 27 VDC)
Output Power	1500 W Maximum
Regulation:	

Load Line	<0.5% (Load 0 to 100%) <0.1%
Current Limit	110% Max. of Rated Output Current
Noise: Audio Band Wide Band Acoustic	 <2mV <20 mVrms (10 KHz to 100 MHz) <55 dBA @ 1M
Current Sharing	<5% of Rated Output Current
Dynamic Response	10% to 90% Load Change Overshoot ≤5% Rated Output Voltage Recovery Time <1 ms to ≤1% Rated Output Voltage
Protection	Fuse

7.2.3 Protection

Condition	Response	Specification
High Output Voltage	Automatic Shutdown and Latch	29.5Vdc ± 0.5Vdc
Over Current/Output Short	Automatic Shutdown and Recovery	120%~135% of rated current
Over Temperature	Automatic Shutdown and Recovery	85 °C ± 5 °C
Brownout	No Damage	
AC Input Voltage High	Automatic Shutdown and Recovery	310Vac ± 10Vac
AC Input Voltage Low	Automatic Shutdown and Recovery	70Vac ~ 85Vac

7.2.4 Display LED Indicators

Indicator	Color	Function	Description
LED	Red	MAJ.	Major
LED	Yellow	MIN	Minor
LED	Yellow	EQU	Equalize Charge

7.2.5 Status/Alarm indicators

Indicator	Color	Function	Description
LED	Amber	CL	Current Limit
LED	Green	AC	AC ON
LED	Red	RFA	Rectifier Failure Alarm

7.2.6 Environmental

Specification	Description
Operating temperature	32°F to +122°F (0℃ to +50℃)
Storage temperature	-40 to +185°F(-40℃ to +85℃)
Humidity	0% to 95% Relative Humidity Noncondensing
Altitude	-500 ~ 10,000ft
Weight	3.3 Kg (7.26 lbs.)
EMI/FRI suppression	Conforms to EN 55022, BS 6527 FCC Part 15 Subpart J, and CISPR 22 Class A
Current harmonic	Conforms to EN 61000-3-2/A12, EN 60555-2, IEC 1000-3-2 Class A
Voltage fluctuation	Conforms to EN 61000-3-3M, EN 60555-3
Electrostatic discharge	Conforms to EN 61000-4-2, IEC 1000-4-2, IEC 801-2 Level 4
Radiated susceptibility	Conforms to IEC 1000-4-3, IEC 801-3 Level 3
Electrical fast transients	Conforms to EN 61000-4-4, IEC 1000-4-4, IEC 801-4 Level 4
Conducted susceptibility	Conforms to IEC 1000-4-6 Level 3
Lightning/surge	Conforms to ANS/IEEE C62.41.-1, 1991 B3, IEC 1000-4-5 Level Special (6KV)
Safety	Meets IEC 950, EN60950, UL/C^{UL}/CE Approval
MTBF	>150 K hours
Cooling	Fan cooling

7.2.7 Physical

Physical Dimensions (W x H x D)	3.3 in. x 5.2 in. x 10.35 in. / 83.6x 132 x 263mm
Weight	7.26lbs / 3.3Kg

7.3 Adjustments

7.3.1 Description

SMR adjustments for SMR Current Limit, Float Voltage and Equalize Voltage can adjustment from CSU Float and Equalize voltage setting current limit, float and equalize voltage settings are pre-set at the factory.

7.3.2 Start up

The following procedure must be followed for the installation and start up of each SMR:

1) Ensure the AC switch located on the front of the SMR is in the “OFF” position.

2) Switch the rectifier AC switch to the “ON” position.

The correct rectified power-up sequence is as follows:

Switch the AC switch, located on the front of the rectifier, to the on position.

7.3.3 Float Voltage Adjustment

Verify the required float voltage setting per the battery manufacturer specification. If the factory setting differs from the battery manufacturer recommended setting, all the rectifiers and the CSU Float Voltage parameter must be adjusted to the new setting. Use CSU to adjust the FLO voltage.

7.3.4 Equalize Voltage Adjustment

Verify the required equalize charge voltage setting per the battery manufacturer specification. If the factory setting differs from the battery manufacturer recommended setting, all the rectifiers and the CSU Equalize Voltage parameter must be adjusted to the new setting. Use CSU to adjust the EQU voltage.

7.3.5 Current limit setting

The maximum current limit is 110% of the rectifier rating. Can use CSU to adjust current limit.

7.4 Status/Alarm Indicators

The operating condition of SMR can fully display by the LED on front panel. (Refer to the FIG. 8)

7.5 System Alarm and Trouble Shooting

During an alarm condition, the faulty SMR will have its RFA and/or FF indicator light on the front panel. The alarm signal will be sent to CSU, which will process the alarm, create the alarm display.

7.6 SMR Operating Principle

After applying single phase 220 VAC to the SMR, current is applied to the EMI filter and circulates through protection components such as the AC circuit breaker and the fuse. The major functions of the protection devices are to prevent the SMR from being damaged by surge current and to efficiently reduce the interruption signal of differential mode and common mode, to eliminate the high frequency interruption signal from input current and to prevent the feedback of interruption signal reverse current to the circuit.

After the single phase AC current been converted to DC current through bridge rectifier, PFC boost converter, and reaches the requirement of True Power Factor (PF>0.99) (THD<5%) through PFC controller. It generates a 400V DC voltage that is applied to the DC/DC converter. Besides supplying power to all the control circuitry of the SMR, a back current source is established.

Through a DC/DC converter, the 400 VDC voltage produces a stable output voltage. The circuitry uses the Full Bridge series resonant converter technique.

Using a switching frequency higher than 100 KHz, the 400 VDC is converted to an AC pulse, then through the high frequency transformer, step down, the voltage becomes an appropriate AC pulse width.

The stable DC current is yielded by the Secondary AC pulse after flowing through a diode and output filter and is fed back through a DC/DC controller.

Before the stable voltage and DC current is delivered by the output of the rectifier, it has been converted by a DC/DC converter, the common mode EMI noise is eliminated by a filter circuit, through an output circuit fuse, to the system in parallel.

8 CONTROL & SUPERVISORY UNIT

8.1 Control and Supervisory Unit (CSU)

8.1.1 Software Interface

Power system controller	Delta New Smart CSU
Display	LCD 128 x 64 dots display LED (Major, Minor, EQU)
Push button	4 push buttons on the CSU LCD display. They are used to control the power system.
Language	English / Chinese

8.1.2 System Management

Monitoring:	AC input information
	DC information
	Rectifier information
	Battery Information
	DC load information
	Environment detection
Parameter Setting:	System output parameter setting
	Alarm threhold setting
	Alarm configuration setting
	System relay setting
Others:	Remote management
	Event log

Efficiency management
Battery discharge test function

8.1.3 Remote Management

Method:	RS-232 cable (9 pin), Internet/Intranet
SW Interface: (Optional)	Delta Remote Management Software
	Network Management Software
	Internet Browser, SNMP
Hardware Interface: (Optional)	RS-232/RJ 45

Remote management function is optional. The function depends on customer site hardware/software support. Please consult Delta representative for details.

9 DC DISTRIBUTION CABINET

9.1 Distribution

Maximum capacity of the system: +24V/300A

Battery breaker: 3 Breaker positions (125A * 3)

Output: Max. 300A, Load breaker 6 positions (63A * 6)

9.2 LVDS (low voltage disconnect switch)

LVDS – Battery Disconnect Arrangement (300A * 1, Battery side)

The contact is installed in front of battery. When LVDS open, it will disconnect the batteries from the system. Because the system avoids over discharge for batteries, the CSU controls LVDS open or close.

9.3 Battery Connections

Verify the polarity of the battery leads prior to connecting the battery cables to the system. Fail to connect the battery cables to the system can cause damage to batteries and system.

The system voltage (rectifier output voltage) is 24 VDC, connect the positive battery cable(s) to the +24V bus and connect the negative battery cable(s) to the ground bus.

9.4 Battery and Ambient Temperature Sensors

One battery sensor cable are provided with each system. The labeled TB-1 cable terminate on the connectors TB-1 on the detection module. The battery temperature sensor should be fixed to positive bus on the inter-cell connections of the battery strings for +24 VDC, or between the battery cells depending on whether the batteries are exiting or being installed with the power system.

The ambient temperature sensor is labeled TA and placed anywhere clear of the rectifier fan flow. The ambient temperature sensor TA is terminated on the detection module.

10 ALARMS AND TROUBLE SHOOTING

10.1 AC Fail/AC High Voltage / AC Low Voltage Alarm Description

There are three (3) AC alarm conditions that are monitored by the system: AC Fail, AC High Voltage and AC Low Voltage. AC fail occurs when AC current is not present at the AC Distribution box. AC high Voltage (ACH) is a factory set parameter and can be adjusted by setting parameter 23. High Voltage Alarm (ACH) to the desired voltage. All three alarms result in the system shutting down rectifiers until either AC is restored (AC is restored (AD Fail condition), or the AC voltage returns to levels within the parameter threshold settings (AC High Voltage and AC Low Voltage).

10.1.1 AC Fail, AC Input High(ACH) and AC Input Low (ACL) Alarm Conditions

AC Fail: Major Alarm

When the CSU senses the absence of AC current at the AC Distribution box located in the rear of the DC Distribution Shelf, the CSU will initiate a major alarm and 'AC DN' will be displayed on the main page. ACL and AC DN Alarm is indicated on the CSU D6 page. Battery is in discharge status. The alarm will be re-set to normal condition when AC is restored. During an AC Fail condition, the CSU is power by the reserve batteries.

AC Input High (ACH):

When the CSU senses the input AC Voltage exceeding parameter alarm, the CSU will initiate an AC High Alarm, displayed on the CSU D6 page. The system will shut down the rectifiers, however the CSU and the DC-DC Converters will operate off the reserve batteries. The CSU will continue to monitor the AC input voltage. The ACH alarm will re-set to the normal operation when AC input voltage decreases within the threshold parameter setting.

AC Voltage Low (ACL):

The AC Voltage Low Alarm occurs when the AC input voltage falls below the threshold set in parameter alarm. When the ACL condition is sensed, an ACL alarm is displayed on the CSU alarm page. The CSU will shut down the rectifiers, however the CSU and the DC-DC Converters will continue to operate off the reserve batteries. The CSU will continue to monitor the AC input voltage. The ACL alarm will re-set to the normal operation when AC input voltage increases within the threshold parameter setting.

10.1.2 AC Fail Trouble Shooting

During an AC Fail condition, the CSU is powered by reserve batteries ad the rectifiers and the rectifiers are shut down. When AC is restored, observe the battery charge current. It may be necessary to decrease the current limit to the charge current range during equalize if a deep discharge situation has occurred.

10.1.3 AC High Voltage (ACH) Trouble shooting

Verify the AC input voltage at the AC service pane. If the AC input voltage is higher than the threshold setting, the CSU will take the rectifiers of line. The AC circuit

breaker at the AC service panel should be tripped until the AC utility is repaired and the AC input is within input specifications.

Verify the AC distribution voltage is higher than the setting value. If not, the system will continue to operate and the CSU may be faulty. The CSU should be swapped with a spare. the High Voltage (ACH) parameter set to the desired high voltage threshold setting, and verified that the ACH alarm is cleared. Follow established repair/return policy to have the faulty CSU repaired by Delta Products.

Do not increase the threshold setting past normal operating input voltages. Operating rectifiers in a High Input Voltage condition can result in seriously damaging the rectifier modules.

10.2 DC Output Voltage High/Low (HV/LV)

10.2.1 DC Output Voltage High Alarm-HV Minor Alarm.

This alarm condition exists when the DC output voltage is higher than the parameter alarm setting. The alarm will re-set to the normal condition when the voltage is decreased below the threshold parameter setting. The output voltage can be adjusted via the CSU and at the rectifier. Reference the CSU float voltage parameter rectifier setting and the rectifier equalize Voltage rectifier Setting

10.2.2 DC Output Low Alarm-LV Minor Alarm

This alarm condition exists when the DC output voltage is lower than the parameter alarm setting. The alarm will clear when the DC output voltage increases. The output voltage can be adjusted via the CSU and at the rectifier.

10.2.3 DC Voltage High/Low Trouble Shooting

Verify the output of each rectifier. If the rectifier output is not within tolerance, swap the rectifier with a spare module, and return the faulty unit to Delta Products for repair. If the output of each rectifier is within tolerance, check the parameters to ensure the correct settings.

10.3 DC Circuit Breaker Tripped Alarm

10.3.1 DC Circuit Breaker Tripped Alarm

When a DC load circuit breaker is tripped, the CSU will go into alarm.

Press the alarm button and the CSU will display “Breaker Fail”.

Open the DC Distribution Cabinet Door.

Re-set the tripped circuit breaker.

The CSU alarm should clear.

10.3.2 Circuit Breaker Fail Condition Trouble Shooting

If the circuit breaker continues to fail:

Check the DC Branch load (fed by the DC circuit breaker) to ensure the circuit breaker is the correct size.

If the branch load exceeds the circuit breaker rating, the circuit breaker must be changed to a higher rating.

Swap with a spare circuit breaker with a higher rating.

10.4 Over-Temperature Alarm

10.4.1 mperature-Ambient

This alarm is generated when the threshold temperature set in parameter alarm setting TA is exceeded and also controls the Temperature Compensation Voltage Control. The CSU senses the temperature via sensor TA and generates an Ambient Over Temperature Alarm setting – TA.

10.4.2 Over Temperature - Ambient Troubleshooting

Verify that the ambient temperature has exceeded the parameter setting by checking the thermostat reading in the hut or equipment room and comparing the reading to the CSU Reading.

The CSU will decrease the float voltage for every degree over the 25 C or 77 degrees F threshold.

The CSU will decrease the equalize voltage for every degree below the 25 C or 77 degrees F threshold.

If the TA parameter setting has been exceeded, increase the air conditioning.

If the TA threshold is exceeded, it is recommended to turn off the AC Main feeding the Rectifiers until the ambient temperature has decreased below the threshold temperature.

If the sensor is defective, turn the Temperature Compensation Feature off.

Contact Delta Products for a replacement sensor

Operating the system at excessive temperatures can damage the rectifier.

10.4.3 Over Temperature - Battery Alarm

This alarm is generated when the threshold temperature set in parameter TB-1 or TB-2 (if equipped with 2 battery strings) is exceeded. The CSU senses the temperature via sensor TB-1 or TB-2 and generates a Battery Over Temperature Alarm-TB-1 or TB-2.

10.4.4 Over Temperature-Battery Troubleshooting

Check the ambient temperature and verify it is within the TA parameter threshold.

If the TA and TB-1 & 2 thresholds are not exceeded, check the thermostat reading in the hut or equipment room and comparing the reading to the CSU reading. If the TB-1 or TB-2 sensor is defective, contact Delta Products for a replacement sensor.

It is recommended that if the system is in the equalize mode, switch the status to float to reduce the battery temperature.

10.5 Rectifier Fail Alarm

When a rectifier fails, the alarm information is sent to the CSU and the rectifier is shut down. The rectifier should be swapped out with a spare unit and the faulty unit returned to Delta Products for repair.

Do not open the rectifier module. There are no serviceable parts. Call Delta Customer Service for an RMA number for repair and return.

11 MAINTENANCE

11.1 Cleaning and Maintenance

11.1.1 General

Special maintenance is not necessary for this shelf, unless the shelf is being operated in a severely harsh environment (dusty environment). The front panels and the cover of the shelf were treated with a special coating, do not use organic cleanser or volatile solvent or corrosion damage may occur. For daily cleaning, brush the dust from the cover and panel. If necessary, use a gentle cleanser or a lightly dampened lint free cloth to remove any dirt or smudges.

11.1.2 Periodic Maintenance

Periodic maintenance is not required for normal operation. If necessary, wipe remove dust from the front of the MCS-1800 shelf using a lint free, soft cloth an gently wipe the front of the shelf, the CSU and rectifiers. Use a gentle detergent to clean is acceptable.

Do not use spray cleanser to clean the equipment. Using a spray cleanser directly on the equipment can result in serious equipment damage.

Check the DC Bus for heat discoloration. If the bus has any heat discoloration, notify Delta Customer Service.

11.2 Removing and Replacing a Rectifier Module

11.2.1 Removing a Rectifier

Do not touch the DC output Bus when pulling out the SMR module.

Switch the AC input breaker at the front of the SMR from the “ON “ to “OFF” position.

1. The rectifiers are equipped with a handle switch safety lock.

2. If the rectifier pulled out from the shelf without switching the AC circuit breaker to the “Off” position. It will cause the rectifier damage.

Push down and then pull out the handle to un-lock the rectifier.

Pull out the SMR module slowly from the shelf, using one hand to support the rear half of the SMR and remove the rectifier from the shelf.

11.2.2 Replacing a Rectifier

1. Switch the AC input breaker to the “OFF” position.

Failure to have the AC input switch in the “OFF” position can damage the rectifier.

2. Install the rectifier module, holding the handle with one hand and using the other to support the rear half of the rectifier module. Place the rectifier in the shelf make sure that the rail is on the tack.

Do not force the module into the slot. If it does not slide in and connect easily, remove and re-set the unit.

Lock the rectifier by push the handle into the front panel.

Switch the rectifier AC input circuit breaker to the “ON” position.

Float Voltage Adjusting:

Verify the required float voltage setting per the battery manufacturer specification. If the factory setting differs from the battery manufacturer recommended setting, all the rectifiers and the CSU Float Voltage parameter must be adjusted to the new setting. Use CSU to adjust the FLO voltage.

Equalize Voltage Adjusting:

Verify the required equalize charge voltage setting per the battery manufacturer specification. If the factory setting differs from the battery manufacturer recommended setting, all the rectifiers and the CSU Equalize Voltage parameter must be adjusted to the new setting. Use CSU to adjust the EQU voltage

11.2.3 Adding a Rectifier

Refer to the procedures in section 11.2.2.

11.3 Replacing a Rectifier Cooling Fan

Under a fan fail condition, the rectifier will automatically go into alarm and shut down. It is recommended that a maintenance craftsperson change the fans on-site.

- Follow Rectifier Removal procedure.
- Remove the front panel.
- Loosen 4 screws on the fan.
- Remove the faulty fan from the rectifier.
- Position the new fan on the rectifier.
- Tighten the fan by mounting screws.
- Assemble the front panel.
- Replacing a Rectifier to complete the fan replacement procedure.