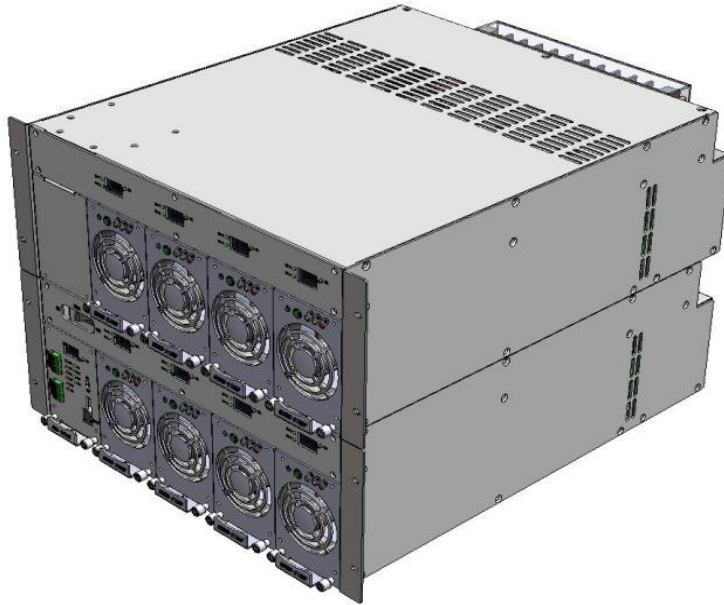


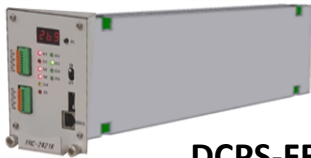
DCPS-FRS-2421K Operation Manual

DCPS-FRS-2421K Rectifier Shelf *and* DCPS-FRS-2421KE Expansion Shelf

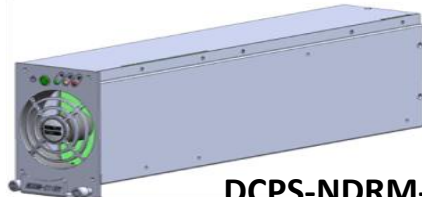


- **AC Input: 1Phase 3Wire (range: 93V~275V)**
- **DC Output: 27V @ 400A (up to 800A with stacked DCPS-FRS-2421KE Expansion Shelf)**
- **Hot-swappable 100A Rectifier Modules with individual Load Voltage and Current meters in Shelf**

Components of the DCPS-FRS-2421K Shelf



**DCPS-FRC-2421K
Control Module**



**DCPS-NDRM-2100F
Rectifier Module**

The **Appendix** within this User Manual contains supporting documents including datasheets for the DCPS-FRS-2421K Rectifier Shelf, modules, and other useful reference material

This Manual supports the DCPS-FRS-2421K Rectifier Shelf

Section 1. Shelf Overview

The DCPS-FRS-2421K Rectifier (Main) Shelf is a 19-inch wide, 4RU height, intelligently-controlled +27V DC Output Rectifier Shelf. The DCPS-FRC-2421K Control Module interfaces with up to 4 DCPS-NDRM-2100F Rectifier Modules in the Main Shelf and 4 in an optional DCPS-FRS-2421KE Expansion Shelf). The Expansion Shelf easily assembles on top of the Main Shelf and together they can provide a regulated +27Vdc, 800A output. Each Rectifier Module provides a regulated +27Vdc output with up to 100A current (see **Figure 1a** for derating below 176Vac input). The Rectifier Modules are hot-swappable, actively current-share with other NDRM-2100F modules, and support N+x Redundancy. Mid-load range efficiency is 91% and a flat efficiency curve maintains excellent efficient operation from light-to-full load conditions. The Main Shelf supports external battery back-up and provides a single 100A-rated battery breaker with battery Low Voltage Disconnect (LVD) protection.

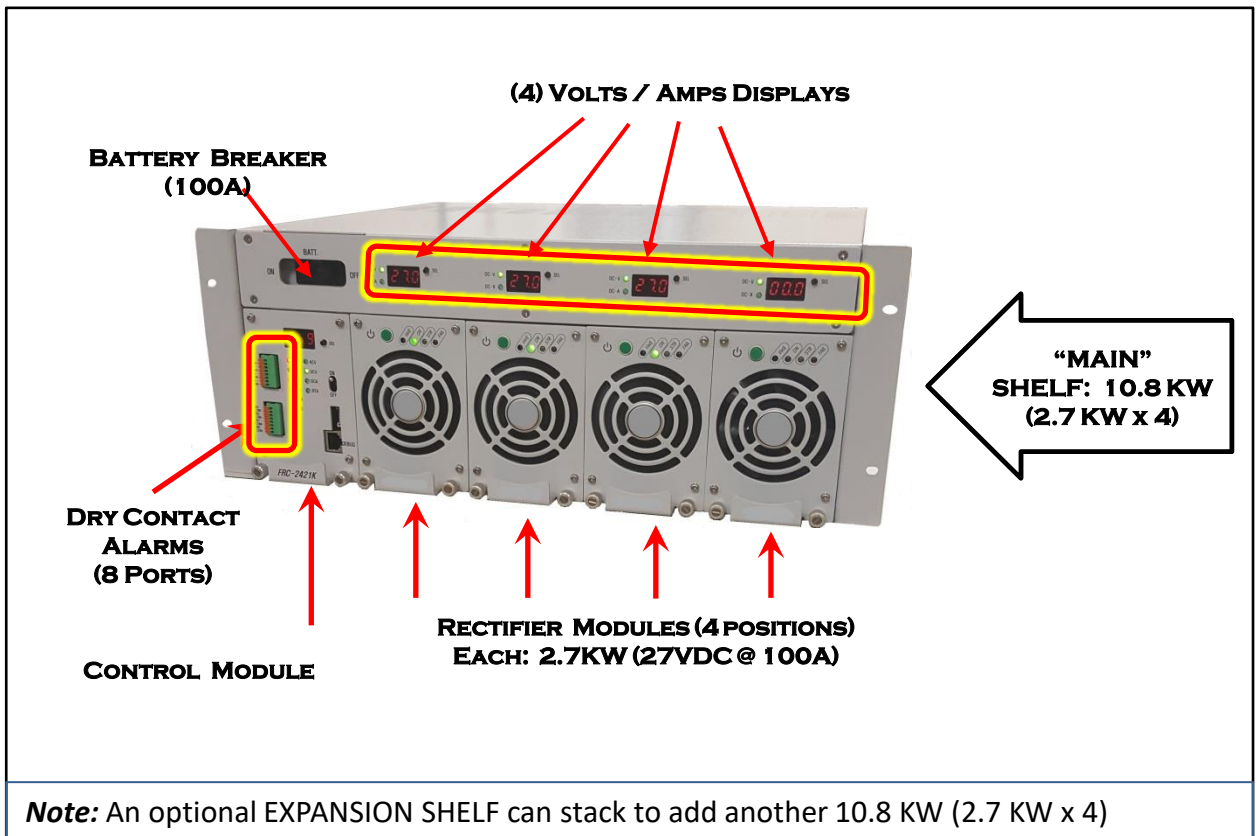


Figure 1. DCPS-FRS-2421K Rectifier Shelf

Section 1. DCPS-FRS-2421K Overview

Operating Ambient Temperature Derating: The DCPS-FRS-2421K Rectifier Shelf is designed to operate in ambient conditions with a temperature of -10°C to $+55^{\circ}\text{C}$ but power is derated above 50°C .

AC Input Voltage Derating: The DCPS-FRS-2421K Rectifier (Main) Shelf is designed to operate in conditions with the applied AC input voltage between 93Vac to 275Vac . Each DCPS-NDRM-2100F Rectifier Module is capable of providing full DC Output power when the AC input voltage is 176V or higher. However, each rectifier module's DC output power derates when the AC input voltage is below 176V , as shown below.

Figure 1a shows maximum available DC current the DCPS-FRS-2421K Rectifier Shelf depending on the AC input voltage and the number of Rectifier Modules in the Shelf.

		# of Rectifier Modules in Shelf				Operating in $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$ Environment with No temp derating
		RM #1	RM #2	RM #3	RM #4	
AC Input Range	93V to $\leq 100\text{V}$	35A	70A	105A	140A	AC "Low Line" Derating (35% of rated Load Current)
	100V to $\leq 176\text{V}$	40A	80A	120A	160A	AC "Low Line" Derating (40% of rated Load Current)
	176V to $\leq 275\text{V}$	100A	200A	300A	400A	AC "High Line" (No Derating)

Figure 1a. Available DC Output Current (with AC Deratings) and either 1,2,3, or 4 Rectifier Modules in the Main Shelf



CAUTION! RISK OF ELECTRIC SHOCK

Ensure AC Power is OFF before connections are made and anytime AC is accessible

Equipment is intended for installation in Restricted Access Location

and is intended to be installed and used by a Service Person with appropriate training and necessary experience for awareness of hazards and risks to person(s) associated to the operation of this system

! SAFETY FIRST !

Read and review all portions of this Operation Manual before attempting to touch, handle, connect-to or disconnect-from, configure, power up, power down, or make any measurements to or from this Rectifier Shelf.



Section 2. DCPS-FRS-2421K Shelf Specifications

2.1 Input Characteristics

- 1) Rated input voltage: 1 Phase 3Wire 220Vac
- 2) Input voltage range: 93Vac ~ 275Vac (Nominal:176VAC ~ 264VAC)
- 3) Input frequency: 45Hz ~ 65Hz
- 4) Efficiency: 88.0% max (100% load)
- 5) Power factor: ≥ 0.98 (100% load)

2.2 Output Characteristics

- 1) Rated output voltage : 27.0V $\pm 0.27V$
- 2) Operating voltage: 23.0V ~ 29.7V
- 3) Output current: **(Main Shelf only)** max. 400A (100A \times 4 Modules)
(Expansion shelf) adds 400A (100A \times 4 Modules) for Shelf max 800A
- 4) Output Distribution: **(Main Shelf only)** 4 common Load terminals,100A each; 1 Battery terminal, 100A (BLVD and 100A Circuit Breaker protected)
(Expansion shelf) adds 4 common Load terminals,100A each, for Shelf max 800A
- 5) Line Regulation over entire load range: $\pm 1.0\%$ ($\pm 0.27V$)
- 6) Load Regulation over entire line range: $\pm 1.0\%$ ($\pm 0.27V$)
- 7) Output current-limit inception at 105 % ~ 130% of full load
- 8) Output over voltage protection: Module OVP (shutdown) at $> 31.0Vdc$
- 9) Battery Low Voltage protection: LVD disconnects at 23.0V $\pm 0.5V$ (ends battery discharge)
- 10) Output Ripple / Noise: $\leq 250mVpeak$

Main Shelf only	# of Terminal Connections	Class	Capacity.	Voltage	Description
	4 (Common)	DC (Loads)	100A each	+27V	LOAD, 400A total
	1	DC (Battery +)	100A	+27V	Battery String
	6 (Common)	DC GND	100A each	GND	4-LOAD (-), 1-Battery(-), 1-F.G.
Main Shelf and Expansion Shelf	# of Terminal Connections	Class	Capacity.	Voltage	Description
	8 (Common)	DC (Loads)	100A each	+27V	LOAD
	1	DC (Battery +)	100A	+27V	Battery String
	10 (Common)	DC GND	100A each	GND	8-LOAD (-), 1-Battery(-), 1-F.G.

Table 1. DC Output Terminal Block assignments

Section 2. DCPS-FRS-2421K Shelf Specifications (continued)

2.3 Safety Requirements

2.3.1 Electro Magnetic Interference (EMI)

- EN55022/CISPR22 Class A/FCC Part 15

2.3.2 Surge Voltage of Power Cable

- Voltage → 6kV (1.2 × 50μs), Current → 3kA (8 × 20μs)

2.3.3 Leakage Current

- ≤ 30mA

2.3.4 Withstand Voltage

- 1) between input port and output port : 1.5kVac, 1 min. or 2121Vdc, 1 min.
- 2) between input port and chassis : 1.0kVac, 1 min. or 1414Vdc, 1 min.

2.4 Environmental Characteristics

- Operating Temperature: -10°C ~ +55°C (max); de-rates above 50 °C
- Operating Humidity: 10% ~ 95%, non-condensing

2.5 Mechanical Dimensions

- DCPS-FRS-2421K (Main) Shelf ⇒ 177mm **(H)** X 482.6mm **(W)** X 555mm **(D)**
⇒ 6.97in. **(H)** X 19.0in. **(W)** X 21.85in. **(D)**
- DCPS-FRS-2421KE (Expansion) Shelf ⇒ 177mm **(H)** X 482.6mm **(W)** X 555mm **(D)**
⇒ 6.97in. **(H)** X 19.0in. **(W)** X 21.85in. **(D)**
- **[Main and Expansion] Shelf Assembly** ⇒ 354.8mm **(H)** X 482.6mm **(W)** X 555mm **(D)**
⇒ 13.97in. **(H)** X 19.0in. **(W)** X 21.85in. **(D)**
- DCPS-NDRM-2100F Rectifier Module ⇒ 122.5mm **(H)** X 85mm **(W)** X 405.5mm **(D)**
⇒ 4.82in. **(H)** X 3.34in. **(W)** X 15.97in. **(D)**
- DCPS-FRC-2421K Control Module ⇒ 122.5mm **(H)** X 83mm **(W)** X 405.5 **(D)**
⇒ 4.82in. **(H)** X 3.27in. **(W)** X 15.97in. **(D)**



ATTENTION

USE ESD GROUND PROTECTION DURING ANY CLOSE CONTACT WITH THIS POWER SHELF INCLUDING INSTALLATION, REMOVAL, AND REPLACEMENT OF ANY SHELF COMPONENT INCLUDING RECTIFIER MODULE(S), CONTROL MODULE, ALARM BOARD, AND CIRCUIT BREAKERS

Section 3. Installation & Cabling

Exterior View of DCPS-FRS-2421K (Main) Rectifier Shelf

The maximum # of Rectifier Modules per 4RU Main Shelf is 4. If an Expansion shelf is used then 4 additional Rectifier Modules. For details on the Expansion shelf, see Section 3.3.



Preparation for Rack Installation

The installation location should be clean and dry. The Rectifier Shelf requires a minimum of at least 50cm clearance at the front and sides. The Rectifier Modules pull air in from the front so the front of the Shelf should be clear of any obstructions or other items to allow for adequate airflow.

Note: All Shelf components except Rectifier Modules, Rack Temp cable, and Batt Temp cable have been factory-installed.

AC Input Protection

The end-customer shall ensure that the appropriately sized and rated AC input protection devices (such as fuses or circuit breakers) and properly sized cables are installed by trained personnel.

DC Output Terminal Block Protective Cover

The Main Shelf and the Expansion Shelf each have a clear protective cover mounted over the DC Output terminal block (see **Figure 2**). The cover is held in place by 2 mounting screws for easy access for cable installation and other maintenance. When work is completed or the shelf will be left unattended, always replace the protective covers over the terminal blocks.

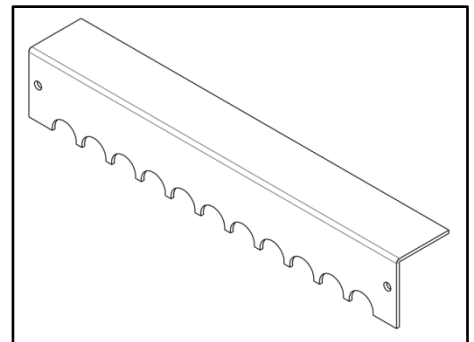


Figure 2. Output Terminal Block Cover



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Section 3. Installation & Cabling (continued)

3.1 Minimum Size for AC Input Cables:

- ❖ ACL1 ~ ACL8 (AC-Line1): 3.5mm² (AWG 12) *Use M4 lug
- ❖ ACN1 ~ ACN8 (AC-Line2): 3.5mm² (AWG 12) *Use M4 lug
- ❖ P.E. (Protective Earth Ground) : 3.5mm² (AWG 12) *Use M4 lug
- ❖ Communication Ground min. 8mm² (AWG 3/0) *Use M6 lug

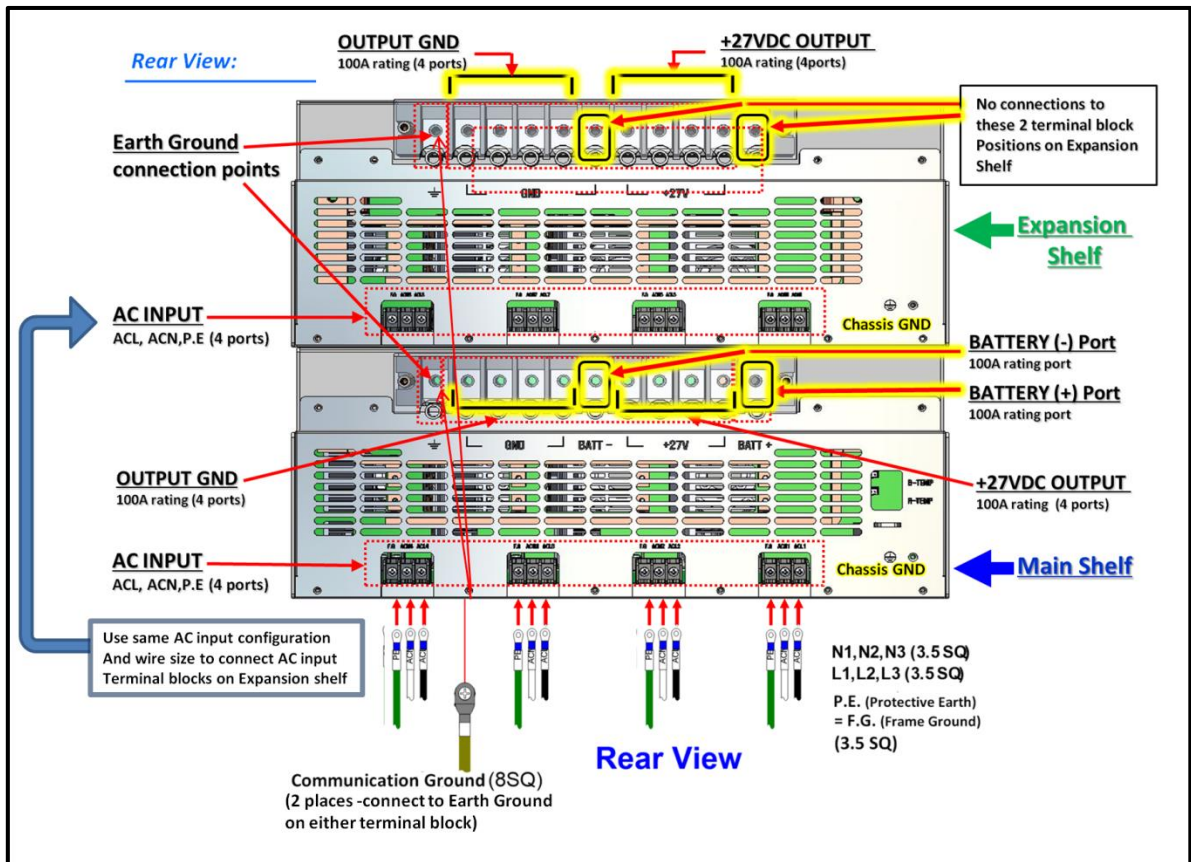


Figure 3. AC Input, Output, & Ground connections for Main and Expansion Shelf



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Section 3. Installation & Cabling (continued)

3.2 Minimum Size for DC Output Cables:

❖ DC Outputs, DC GND, BATT+, BATT-: 25mm² (AWG 4)

Connect output cables to corresponding terminal block positions shown in **Figure 4**.

Use lugs no wider than 17mm with hole size M6 (or ¼-inch, US).

Recommended lug for the DC Output terminals is a one-hole, short barrel with window lug, #2 AWG wire, 1/4 stud hole, 90 ° angle tongue (Panduit part# LCAS2-14F-Q, or equivalent).



The Shelf includes 2 cables (**R-TEMP** and **B-TEMP**) for temperature monitoring; connections are on the rear of the Main Shelf. They each contain a thermistor circuit at the loose end of the cable.

- **R-TEMP**: Rack Temperature probe that measures the ambient temperature near the Main Shelf. The **R-TEMP** probe should be mounted in front-central portion of the Main Shelf.
- **B-TEMP**: Battery Temperature probe that measures the ambient temperature near the external Battery String. The **B-TEMP** probe and should be mounted on the top-central portion of the Battery String.

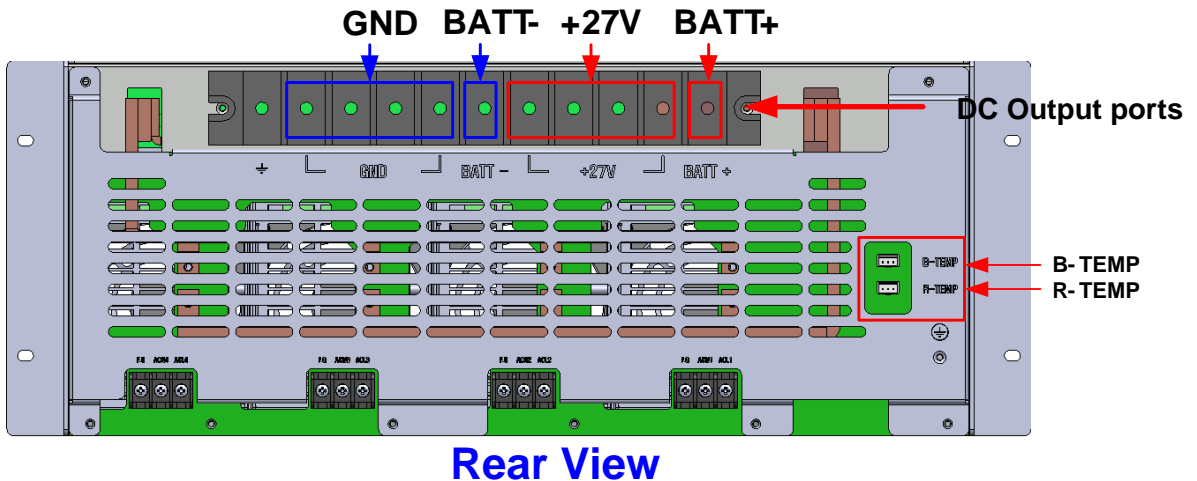


Figure 4. Output Cable Connection – Rectifier (Main) shelf



ATTENTION

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Section 3. Installation & Cabling (continued)

3.3 Expansion Shelf (optional):

The DCPS-FRS-2421KE Expansion Shelf is an optional add-on that stacks with the Main Shelf and allows up to 4 additional Rectifier Modules to be added (for higher power than just the Main shelf). The following notes apply specifically to the Expansion Shelf:

1. The AC Power Deratings in **Figure 2** applies equally to the Expansion Shelf and the Main Shelf.
2. The Expansion Shelf looks and functions similar to the Main Shelf, as each accepts up to 4 Rectifier Modules with Volt/Amp displays above each rectifier position. However, only the Main Shelf portion includes a Battery Circuit Breaker and LVD protection.
3. Any empty Rectifier Module position requires a Blank Panel (see **Figure 4b** on next page) in that position for best thermal performance, to keep debris out, and for safety purposes.
4. Most of the Shelf monitoring and control is performed by the components of the Main Shelf; the Expansion Shelf includes a Blank Panel to fill the empty Control Module position.
5. All Rectifier Modules actively current-share with all other working modules in both shelves.

See Section 3.2.1 for Assembly Instructions for Expansion Shelf

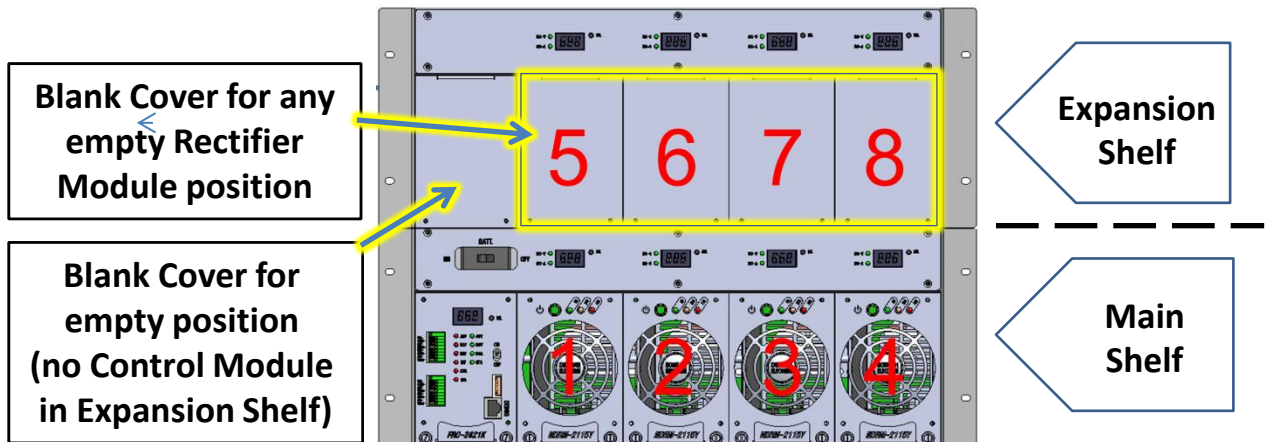


Figure 4a. Expansion Shelf mated with Main Shelf

Section 3. Installation & Cabling (continued)

3.3 Expansion Shelf (optional)

3.3.1 Assembly Instructions for Expansion Shelf -

The DCPS-FRS-2421KE Expansion Shelf mounts with Main Shelf, as follows:

1. Ensure that all AC and DC power is removed from the Shelf before this assembly process is started. This includes any external battery bank connected to the Shelf.
2. Remove each Rectifier Module and the Control Module from both shelves.
3. To stack and interconnect the Expansion Shelf, a communication cable and 2 bus bars are provided from the shelf supplier (see **Figure 4c**). The cable and bus bars will connect the 2 shelves together through the Access Cover openings, As shown in **Figure 4d**.



Figure 4c. Bus Bars and Communication Cable

Instructions continued on next page

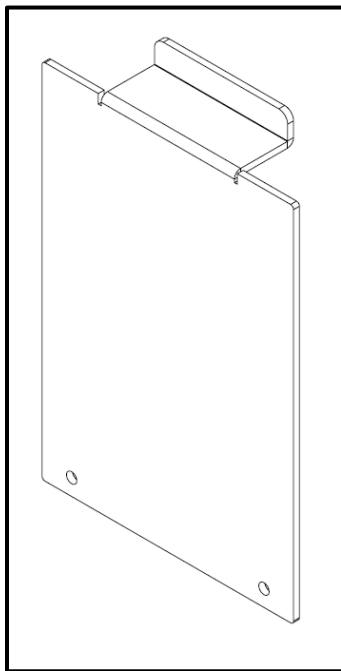


Figure 4b. Blank Panel

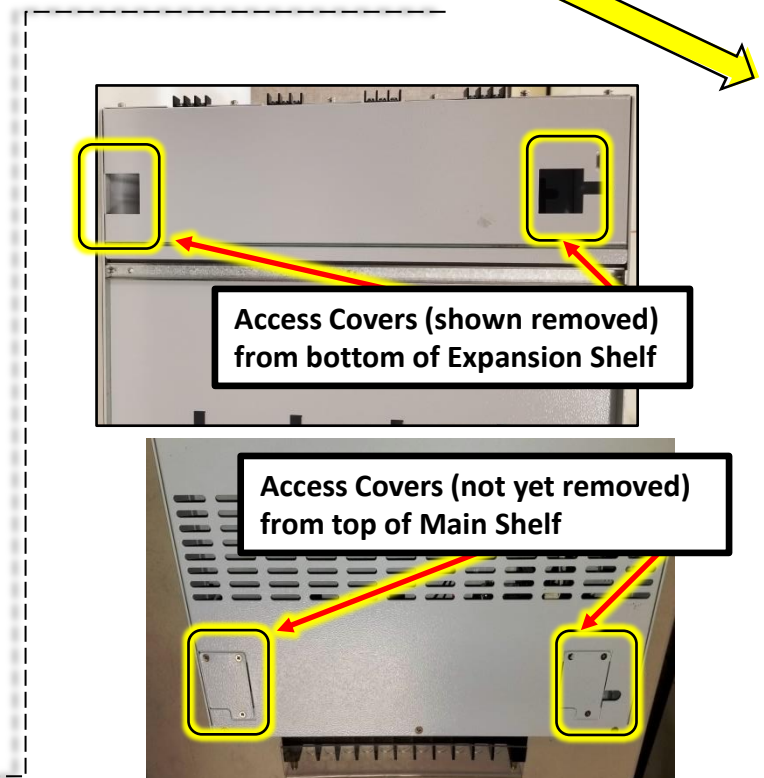


Figure 4d. Access Covers for Cable and Bus Bars

3.3.1 Assembly Instructions for Expansion Shelf *(continued)*

See Figures 4e and Figure 4f below

- 4) Remove the 10 pan-head screws that hold each of the rear covers then remove both rear covers.
- 5) Using the existing hardware on each shelf's bus bar, connect the 2 additional bus bars between the Main Shelf and the Expansion Shelf (through the Access Cover openings) to the existing DC output bus bars. This connects the DC outputs together between the upper Expansion shelf to the lower Main shelf. Ensure that each bus bar (Red or Blue) insulated sleeve is positioned where the bus bar comes near the chassis (Access Cover openings).
- 6) Plug in the communication cable into connectors located into the upper Expansion Shelf connector and the lower Main Shelf connector. The Shelf connector locations are shown in **Figure 4f**.
- 7) Re-attach the rear covers to each shelf to complete the assembly.
- 8) Prepare to mount the Rectifier Shelf assembly in an Equipment Rack by installing the 2 **Side Support Brackets** shelf supports into left-side and right-side Rack positions. See **Appendix A9** for the **Side Support Bracket** mechanical drawing.
- 9) Position the Main+Expansion Rectifier Shelf assembly into the Equipment Rack onto both shelf supports then attach the Rectifier Shelf front-mount brackets to the Rack.
- 10) Reinstall the Control Module and desired number of Rectifier Modules into the Main and/or Expansion shelf, ensuring the power switch is OFF to each module before installing. Finger-tighten the thumb screws to secure each module. Use a Module Filler for each module position that will not be filled with a Rectifier Module.

Shelf Assembly is complete and ready for Shelf Power-up Procedure. Proceed to Section 3.4.

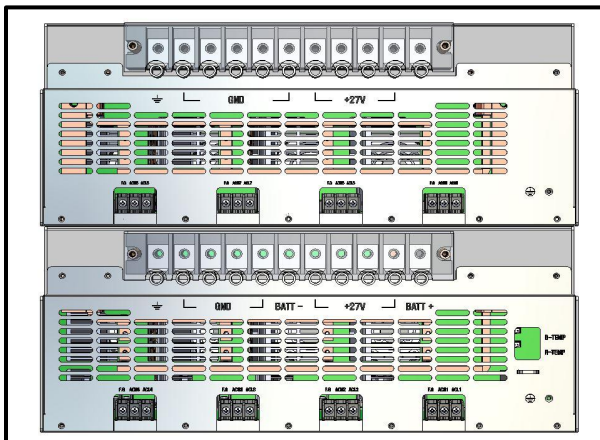


Figure 4e. Rear Covers

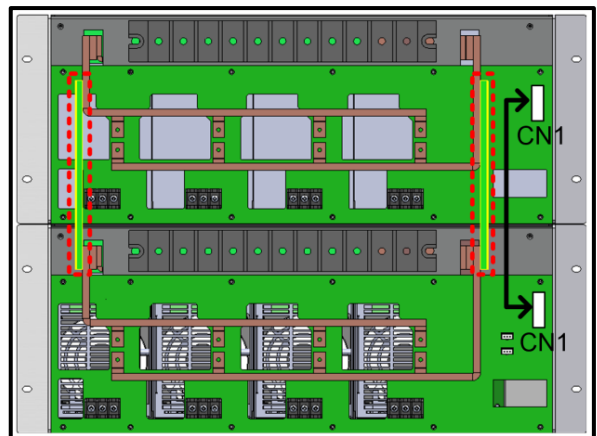


Figure 4f. Shelf Locations for Bus Bars and Cable

3.4. Shelf Power-up Procedure

Using all guidance, instructions and safety precautions from previous sections within this document, proceed with the following steps to power up the Rectifier Shelf.

- 1) Install the Control Module and desired number of Rectifier Modules into the Main and/or Expansion shelf, ensuring the power switch is OFF (green pushbutton switch OUT) to each module before installing. Finger-tighten the thumb screws to secure each module in the Shelf. Use a Blank Panel for each module position that will not be filled with a Rectifier Module.
- 2) Make all necessary cable connections for the Main Shelf and/or Expansion Shelf then apply AC input(s) to the Shelf AC Input terminal blocks, with all modules power switches off. Confirm the STB LED is lit for each installed Rectifier Module (indicating Standby status: Ready to Power ON)
- 3) Turn one Rectifier Module ON (green pushbutton switch IN). Confirm the module's STB LED turns off and the green 'ON' LED is now lit. The Shelf DC-V/DC-A displays should be active with all 4 LEDs lit green. Using the 'SEL' switch, confirm that the Shelf display located above the active Rectifier Module is actively displaying values for DC output voltage and DC output current.

For Step 4, refer to Section 8.1 and Figure 33 for Control Module front panel functions and features.

- 4) Next, turn the Control Module ON (switch UP) then wait 2~3 seconds to confirm Normal operation of the Control Module (actively displaying valid readings on the display). While alarms will likely be activated on the Control Module's front panel, this is considered normal until the next section ("Mastering the GUI") is completed, as the GUI allows re-configurations of most of the system settings that may either set or clear alarms.
- 5) When the Shelf, Control Module, and Rectifier Modules are running solidly and without any 'FAIL' LEDs or other serious indicators,, consider the Power-Up procedure completed. Proceed to Section 4 to begin working with the Graphical User Interface (GUI).

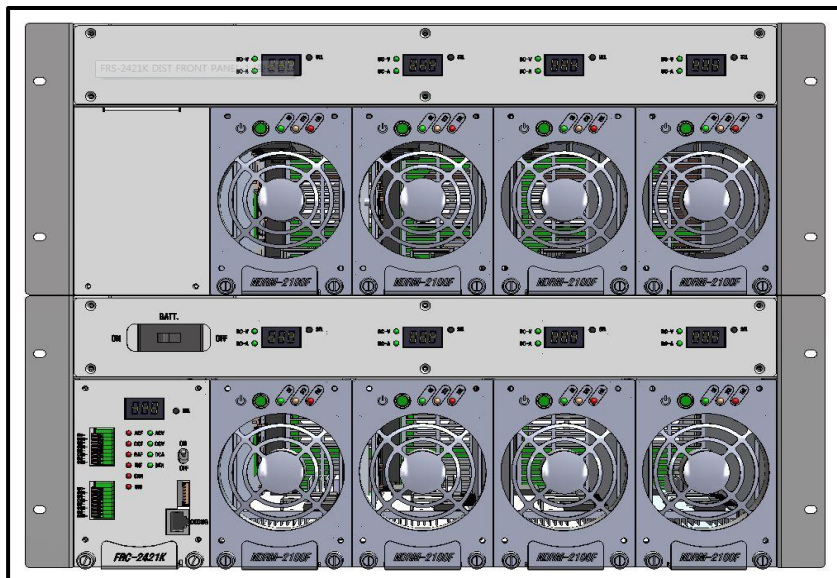


Figure 4g. Fully configured DCPS-FRS-2421K (Main) & DCPS-FRS-2421KE (Expansion)

Section 4

Mastering the GUI

- Login/Access to the Rectifier Shelf using the Graphical User Interface (GUI)
- GUI (Main Page) elements
- Alarm Manager
- Rectifier Manager
- System Operation
- Controller Manager
- System Configuration
- Measurement Set
- Date/Time Set
- Controller Set
- Factory Initialization
- Alarm Log, Data Log, and Event Log
- Exiting the GUI

GUI Log-In using the DEBUG port

1. With the Control Module switched ON, connect the DEBUG cable's USB connector into the PC/laptop's USB port and the DEBUG cable's other end (RJ45 plug) into the Shelf's DEBUG port located on the front panel of the Control Module. Note that the DEBUG cable assembly has a built-in RS232-to-USB adapter with a DB9 connector that mates with the DB9 connector on the RJ45 cable assembly

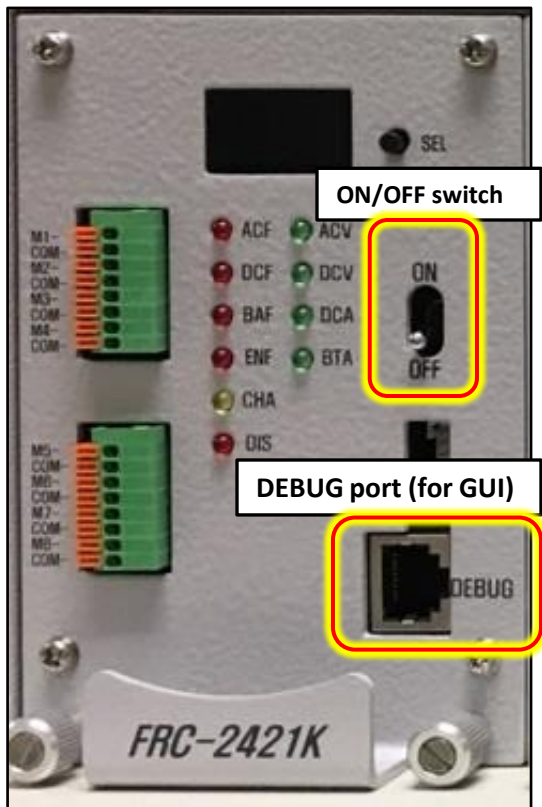


Figure 5a. Access, Log-in, Connect

Note: If GUI fails to connect or load properly during the GUI Login process, ensure that the DEBUG cable is wired as shown in **Figure 5b**.

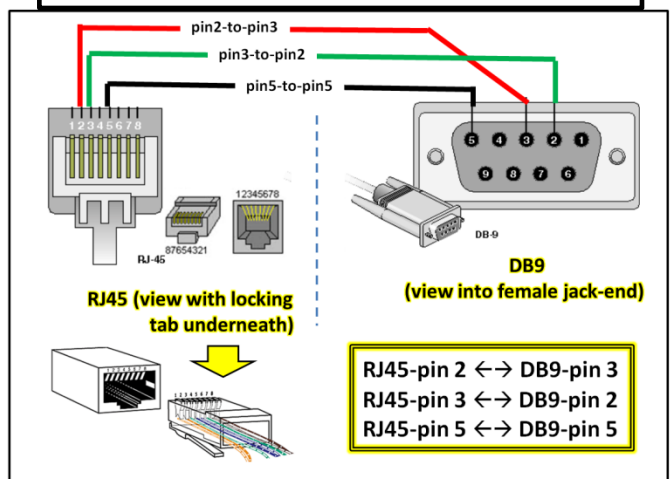


Figure 5b. DEBUG cable pinmap

GUI Log-In using the DEBUG port (continued)

2. Run the “FRS_2421K.exe” (GUI) program.
3. Click ‘Access’ then ‘Login’.
4. In the Login pop-up window, enter the **ID** and **Password** then click the **Log-in** button (or Enter).
5. Click ‘Access’ then ‘Connect’.
6. Select “**Serial Port**” then enter the **COM Port #** of the adapter-connected USB port. (To confirm the correct port, go the “Ports” list in Device Manager). The “**Port Refind**” may also be clicked to quickly snap into the correct COM Port.
7. If shown, select “**Read from Rectifier**” then “**Connect**” (otherwise just click “**Connect**”).

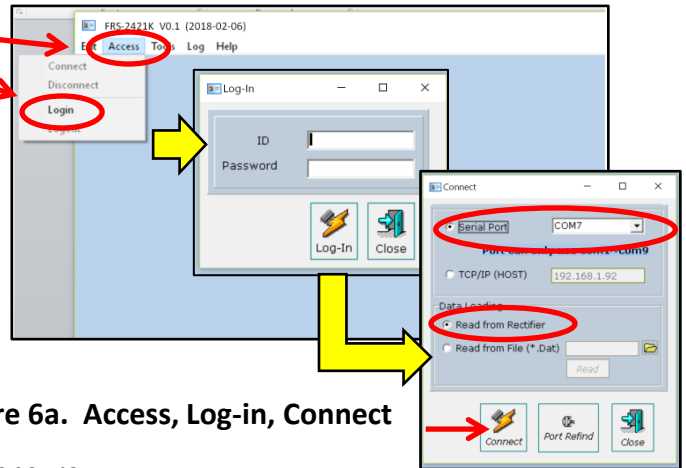


Figure 6a. Access, Log-in, Connect

Note: *If GUI fails to connect or load properly, ensure **DEBUG** cable is wired as shown in **Figure 5b**.*

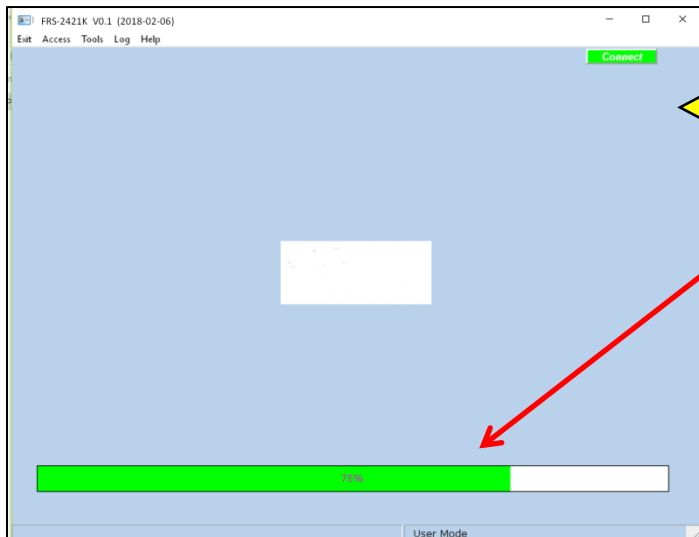


Figure 6b. GUI Loading (Progress bar)

8. A **Progress Bar** is shown while connecting and the **DEBUG (RS232)** connection completes within just a few seconds. When 100% complete, the Shelf is connected to the PC/laptop and the **FRS-2421K GUI (Main Page)** is active, as shown in **Figure 7**.

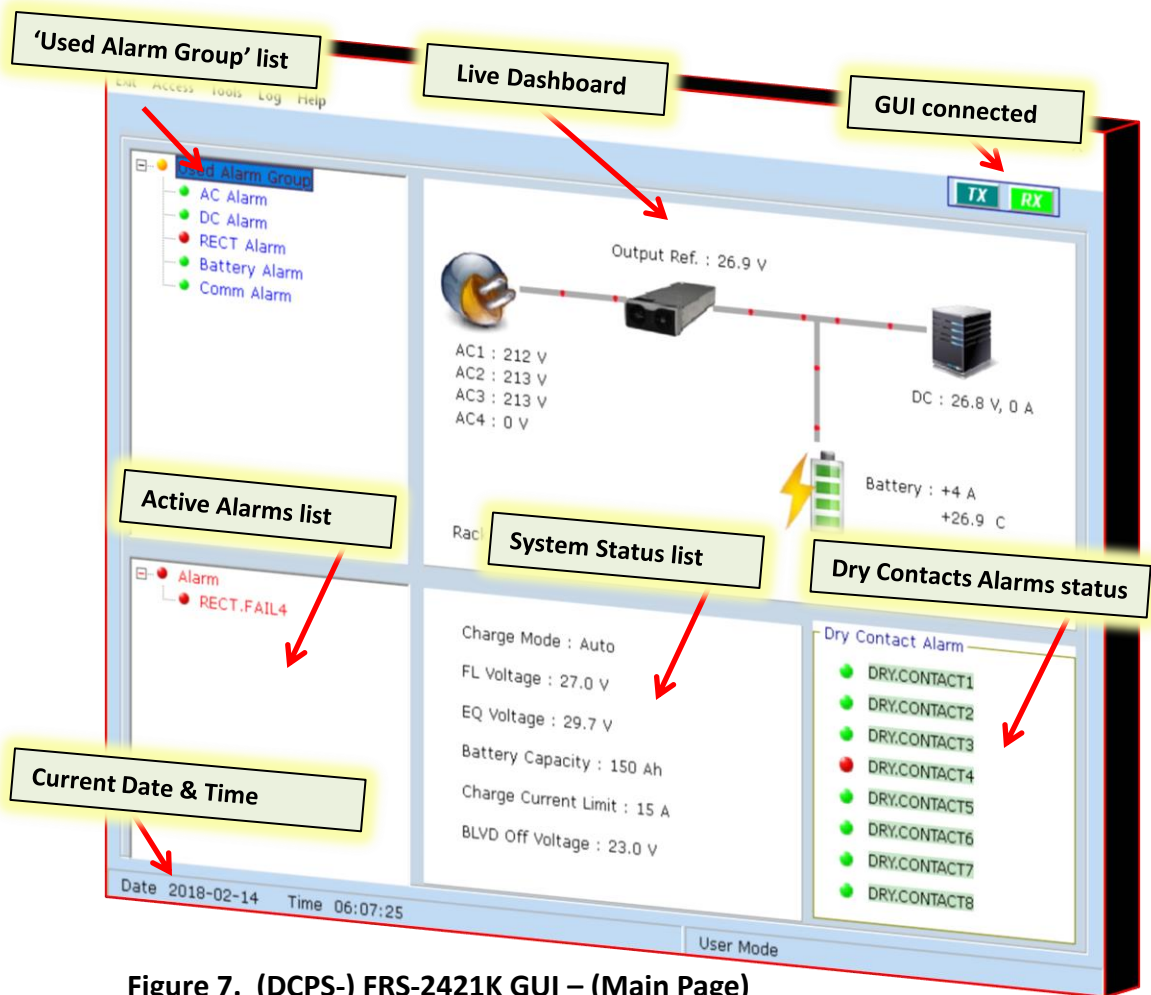
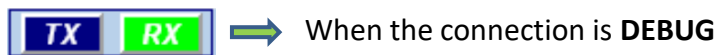


Figure 7. (DCPS-) FRS-2421K GUI – (Main Page)

Figure 7 shows the FRS-2421 GUI main page, which opens when Shelf is actively connected to the PC/laptop. The current date & time is actively updating and the following is highlighted:



- Click '**Access**'. Note that **Connect** & **Login** are greyed-out (inactive) and **Disconnect** & **Logout** are highlighted (active).
- **Disconnect** disables the network connection between the laptop and the GUI.
- **Logout** fully logs out the user from the GUI program.
- To close out the GUI program, click **Exit**.

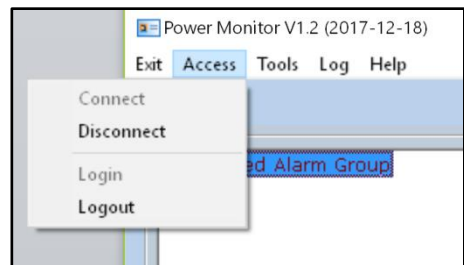
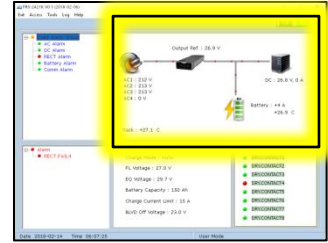


Figure 8. Disconnect and Logout

Section 4. GUI (Main Page) Elements

4.1 Live Dashboard



The **Live Dashboard** is a real-time visual indicator of critical configured Shelf items including “Used” alarms for AC inputs, DC output, Battery and Rack temperatures, Battery State (charge or discharge), and measured values. Some of the items in the Live Dashboard include:

- **AC Input Voltage (V)** applied to the Rectifier Shelf.
- **DC Output Bus Voltage (V)** from either the AC-powered Rectifier Shelf (or external Batteries, if populated) during an AC fault condition.
- **DC Load:**
 - **Capacity (0% ~ 100%)** is calculated value based on # of Rectifier Modules in Shelf
 - **Measured DC Load Voltage (V)**
 - **Measured DC Load Current (A)**
- **Battery current (A):** a “+” value indicates battery is charging; a “-” value indicated battery is discharging.
- “Rack” and “Battery” measured temperatures are shown, in °C.

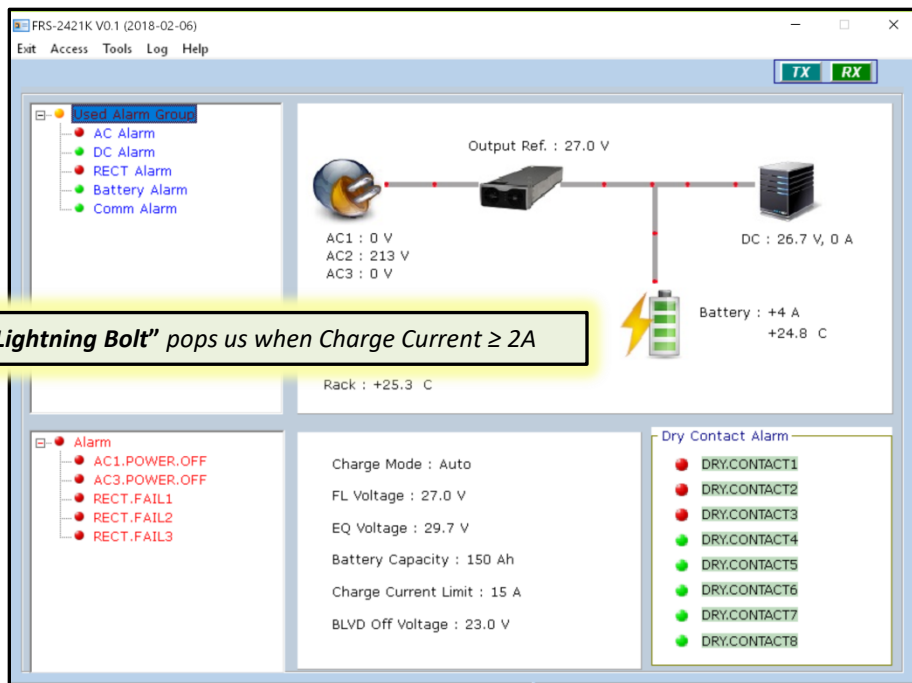



Figure 9. Live Dashboard

Section 4. GUI (Main Page) Elements

4.2 Used Alarm Group

The **Used Alarm Group** is a drop-down list of configured alarms. Double-click the **Used Alarm Group** header (or click the “+”  icon to expand the list).

The expanded list shows the 5 Alarm Groups:

- **AC Group**
- **DC Group**
- **Rectifier Group**
- **Battery Group**
- **Comm alarm**

Each group has an Alarm Status Indicator that shows Alarm(s) Clear (green) or Alarm(s) Active (red) within that specific group.

Double-click any of the 5 Alarm Group headers to open the “**Alarm Define**” page. In the **Alarm Define** page, click any alarm item in the list to edit any of the parameters specific to each Alarm Item.

All Alarms Names can be edited. “**Used**” Alarms can alarm; “**Unused**” alarms cannot alarm.

See next page for details on Alarm Define settings

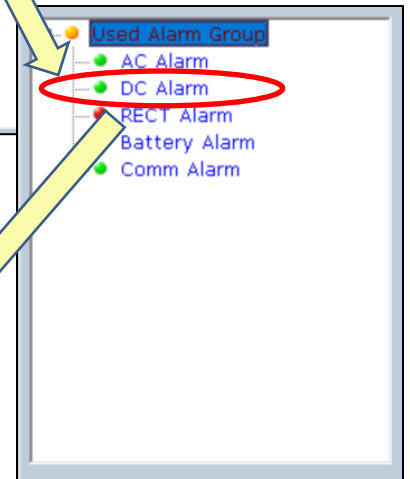
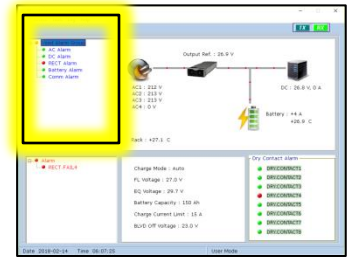


Figure 10.
Used Alarm Group expanded

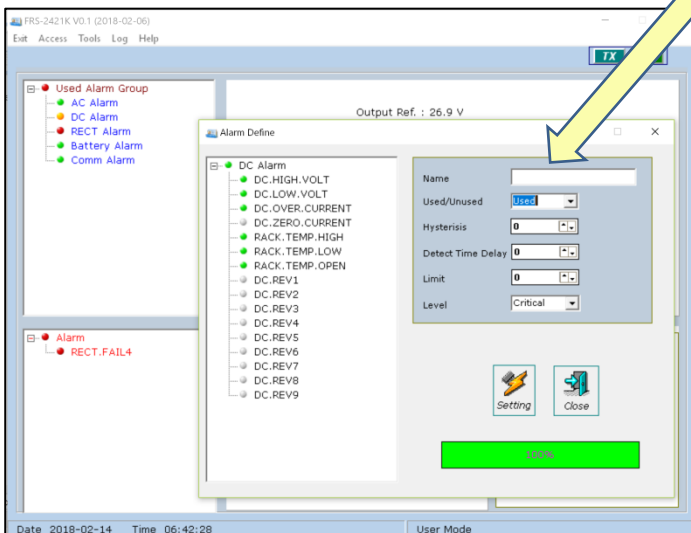


Figure 11. Used Alarm Group- Alarm Define page

Section 4. GUI (Main Page) Elements

4.3 Alarms

All active alarms (red) that are listed in the **Used Alarm Group** are shown in the **Alarms** drop-down list. The Alarm Name and the red alarm status indicator will be listed for each active alarm unless the drop-down menu is closed. Only alarms that have been configured as “Used” (in the **User Alarm Group>Alarm Define** page) can alarm. Figure 17 shows the **Tools>Alarm Manager>Alarm Items Setting** page. Alarm Manager details are found in **Section 5 – Tools** of this User Manual.

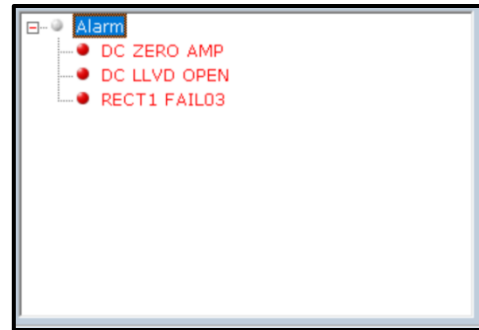
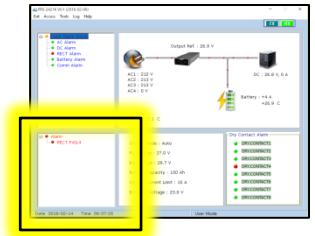
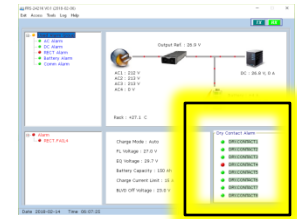


Figure 12. Alarm dropdown list

4.4 Dry Contact Alarm

Only Dry Relay Alarms that have been assigned to any Dry Contact can alarm. Alarms are assigned to Dry Contacts in the “Mapping” section in the Alarm Manager-Output Relay Mapping page (see **Section 5.1.1** for details). To view mapped (assigned) alarms, click on any **Dry Contact** in the list to open the **Dry Contact Alarm** page (see **Figure 14**). All alarms that are check-marked are mapped to the chosen Dry Contact. Any alarms listed on this page may be assigned to any of the Dry Contacts. Note that it is allowed to map the same alarm to more than one Dry Contact.



See **Section 5 – Tools>Alarm Manager** of this User Manual for more details..



Figure 13. Dry Contact Alarms

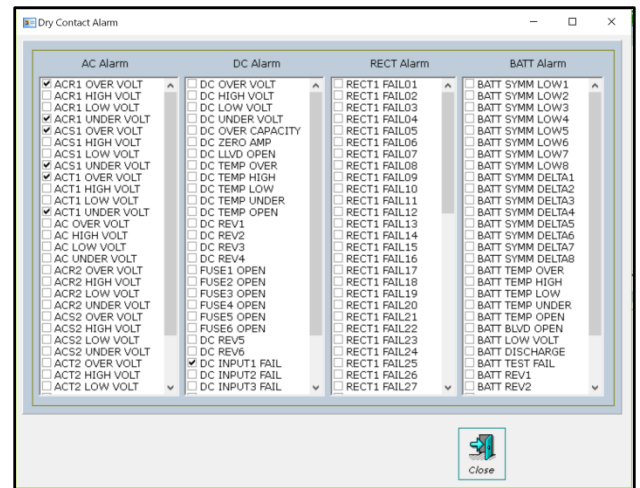


Figure 14. Alarm Manager- Dry Contact Alarm page

Section 5. Tools

5.1 Alarm Manager -allows the user to assign and configure all Shelf input/output alarms.

5.1.1 Output Relay Mapping

Click **Tools>Alarm Manager>** to enter the **Alarm Manager** page. Click **Output Relay Mapping** to open the **Mapping** list. This page allows the user to define alarms to any of the Dry Relay outputs. Click on each **“Mapping # x”** links to open the Alarm Define page, which allows the user to checkmark any alarm item and save it to the specific Output Relay Contact alarm group. All mapped alarm items are listed in the GUI’s **Used Alarm Items** page in this Alarm Manager section.

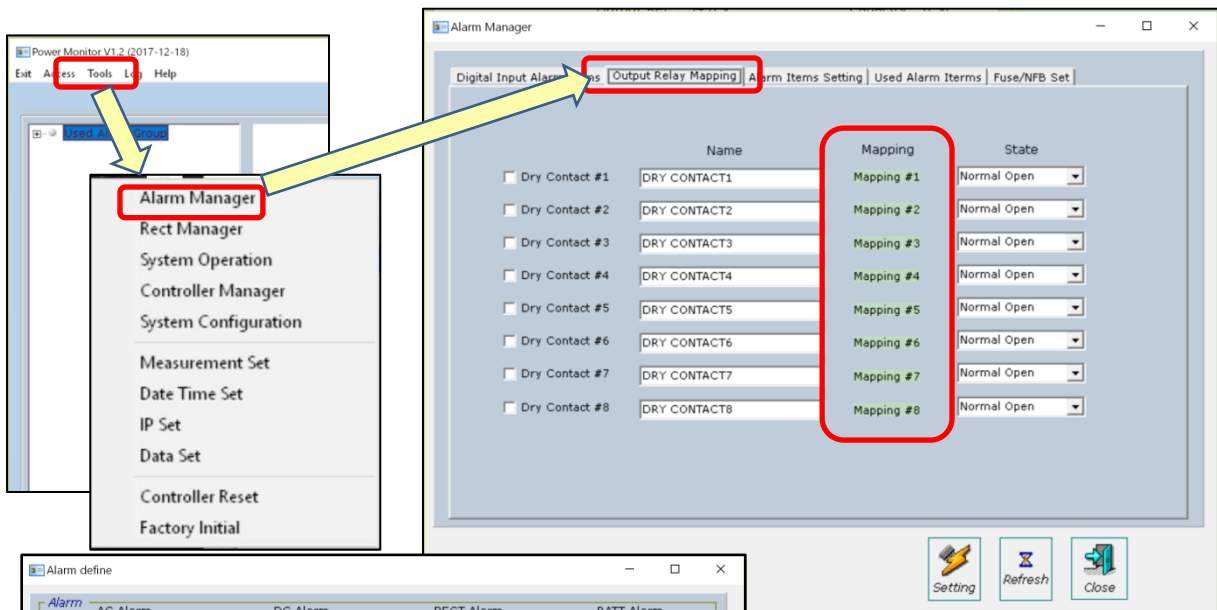


Figure 16. Alarm Manager page

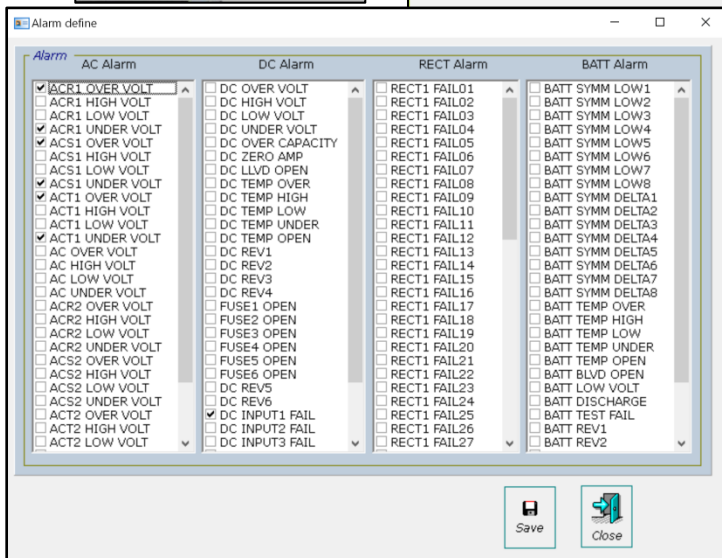


Figure 15. Alarm Define page (Mapping Output Relays)

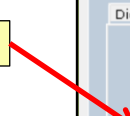
Section 5. Tools

5.1 Alarm Manager -allows the user to assign and configure all Shelf input/output alarms.

5.1.2 Alarm Items Setting

Click **Tools>Alarm Manager>Alarm Items Setting** to open the **Alarm Items Setting page**, which allows each alarm item to be edited within each of the 4 Alarm Groups. To edit any alarm, choose the specific alarm from the 'Items' (drop-down list) then edit any of the 6 fields for that alarm. To save the new settings, first click on the check-box for the matched Alarm Group then click the **Setting** button. A **Setting Success** window pops up when the edits are complete. Click on the **Refresh** button to refresh the page with new settings.

Alarm Items (drop-down menu)



6 Fields that may be edited:

- Change mapped alarm ('Used' or 'Unused')
- Edit Hysteresis parameter
- Edit Time Delay (seconds)
- Edit Upper Limit or Lower Limit
- Change Alarm Level
- * Critical (Major), Minor, Information Only
- Edit the Alarm Item name

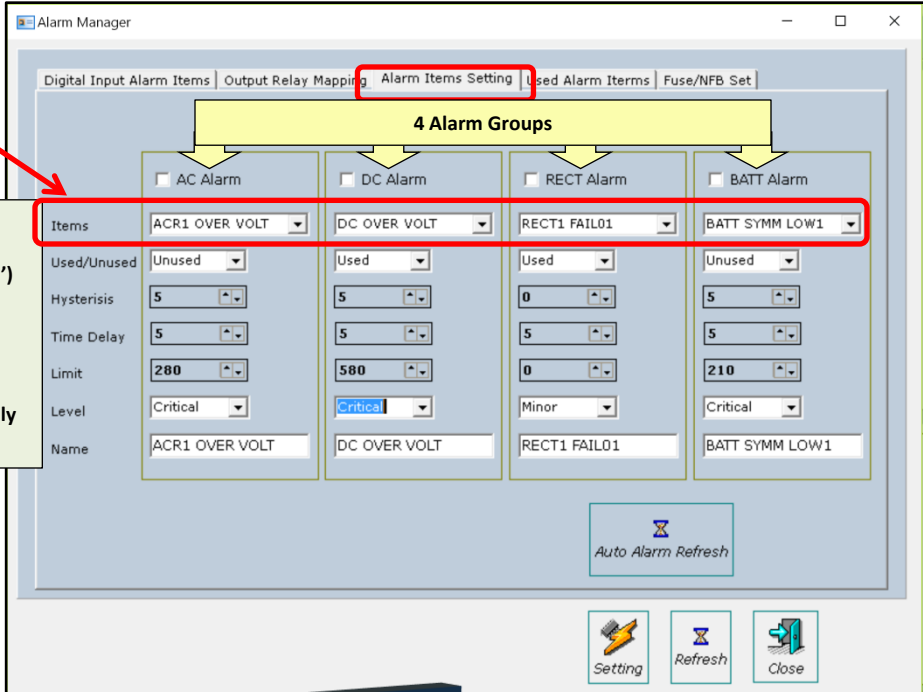
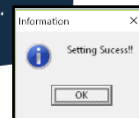


Figure 17. Alarm Items Setting

- To edit settings for any Alarm Item:
- ✓ *Choose the alarm* in one of the 4 Alarm Group 'Items' drop-down lists.
 - ✓ *Edit the fields* for that specific alarm item.
 - ✓ *Click the Alarm Group check-box* that is matched to the edited alarm.
 - ✓ *Click the Setting button* (at page bottom) to Save new settings.
 - ✓ When edits are accepted, a "Setting Success" window pops up.
 - ✓ *Click the Refresh button* to refresh the page.



Section 5. Tools

5.1 Alarm Manager -allows the user to assign and configure all Shelf input/output alarms.

5.1.3 Fuse/NFB Set

Click **Tools>Alarm Manager>Fuse/NFB Set** to open the **Fuse/NFB Set page**, which allows each Fuse Alarm and/or NFB (Circuit Breaker) Alarm information to be edited. For each Fuse/NFB listed, the specific alarm **Name** can be edited and the alarm contact **State** is configurable using the drop-down menu choices (Not Used, Normally Closed, or Normally Open). To save new settings, first click on the check-box for the matched **Fuse/NFBx** then click the **Setting** button. A **Setting Success** window pops up when the edits are complete. Click on the **Refresh** button to refresh the page with new settings.

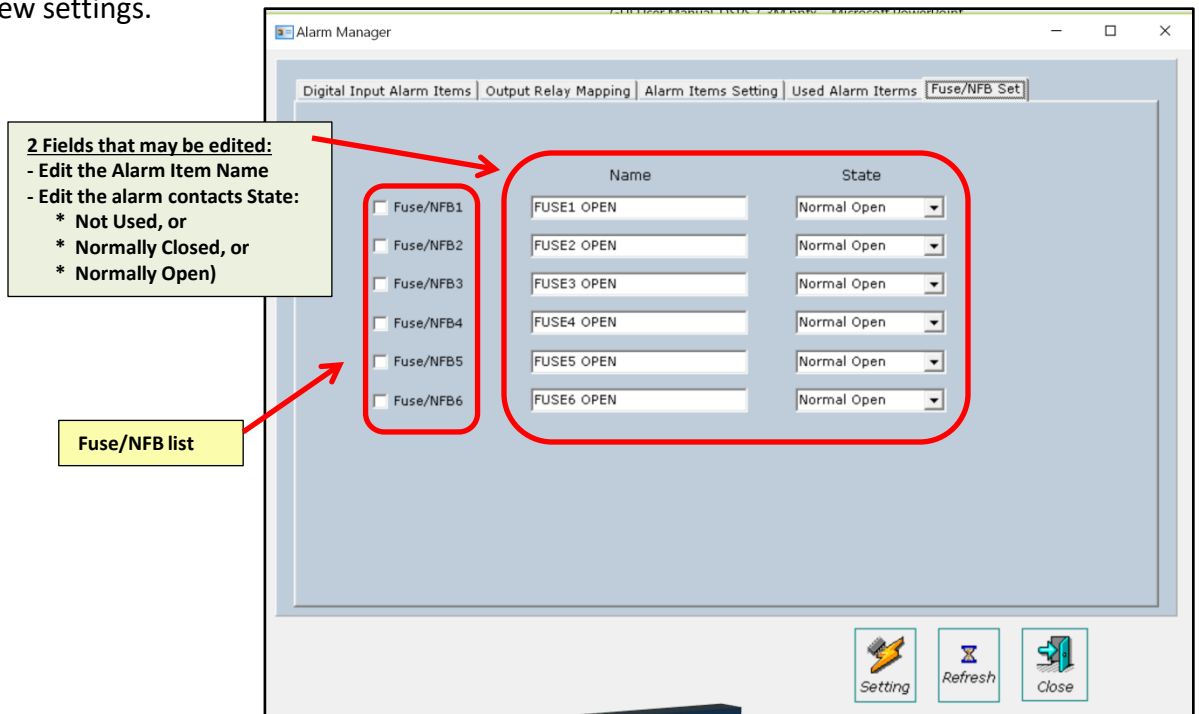
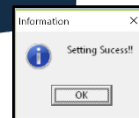


Figure 18. Fuse/NFB Set page

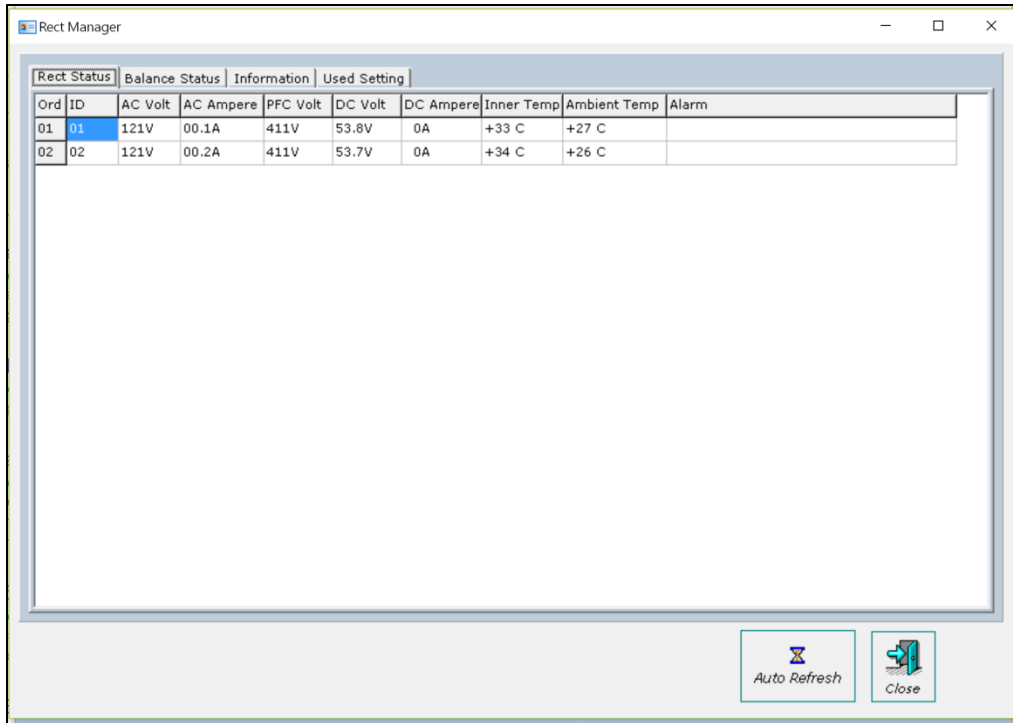
- To edit settings for any Fuse/NFB alarm:
- ✓ Click the Fuse/NFB check-box for the alarm that will be edited.
 - ✓ Edit the fields (Name and/or State) for that specific alarm.
 - ✓ Click the Setting button (at page bottom) to Save new settings.
 - ✓ When edits are accepted, a "Setting Success" window pops up.
 - ✓ Click the Refresh button to refresh the page.



Section 5. Tools

5.2 Rect Manager –shows active measured values and individual module information for all Used (assigned) Rectifier Modules in the Shelf.

Click **Tools>Rect Manager** to open the **Rect Manager** page



The screenshot shows a window titled "Rect Manager" with a table of data. The table has columns for Ord, ID, AC Volt, AC Ampere, PFC Volt, DC Volt, DC Ampere, Inner Temp, Ambient Temp, and Alarm. Two rows are visible, with the first row (ID 01) highlighted in blue.

Ord	ID	AC Volt	AC Ampere	PFC Volt	DC Volt	DC Ampere	Inner Temp	Ambient Temp	Alarm
01	01	121V	00.1A	411V	53.8V	0A	+33 C	+27 C	
02	02	121V	00.2A	411V	53.7V	0A	+34 C	+26 C	

At the bottom right of the window, there are two buttons: "Auto Refresh" (with an hourglass icon) and "Close" (with a window icon).

Figure 19. Rect Manager page

Section 5. Tools

5.3 System Operation –shows active measured values and individual module information for all Used (assigned) Rectifier Modules in the Shelf.

Click **Tools>System Operation** to open the **System Operation page**, which includes Shelf- and external Battery Back-up (BBU) user-configurable settings. It includes a plot of the Battery-specific Temperature-Compensated Charge Profile and has several parameters that can be edited.

Figure 20 shows the System Operation page with settings that include a traditional VRLA battery back-up configuration. However, all settings on this System Operation page should be reviewed for proper configurations that meet end-user system and battery requirements.

System Operation user-configurable settings are defined in detail on the following pages.

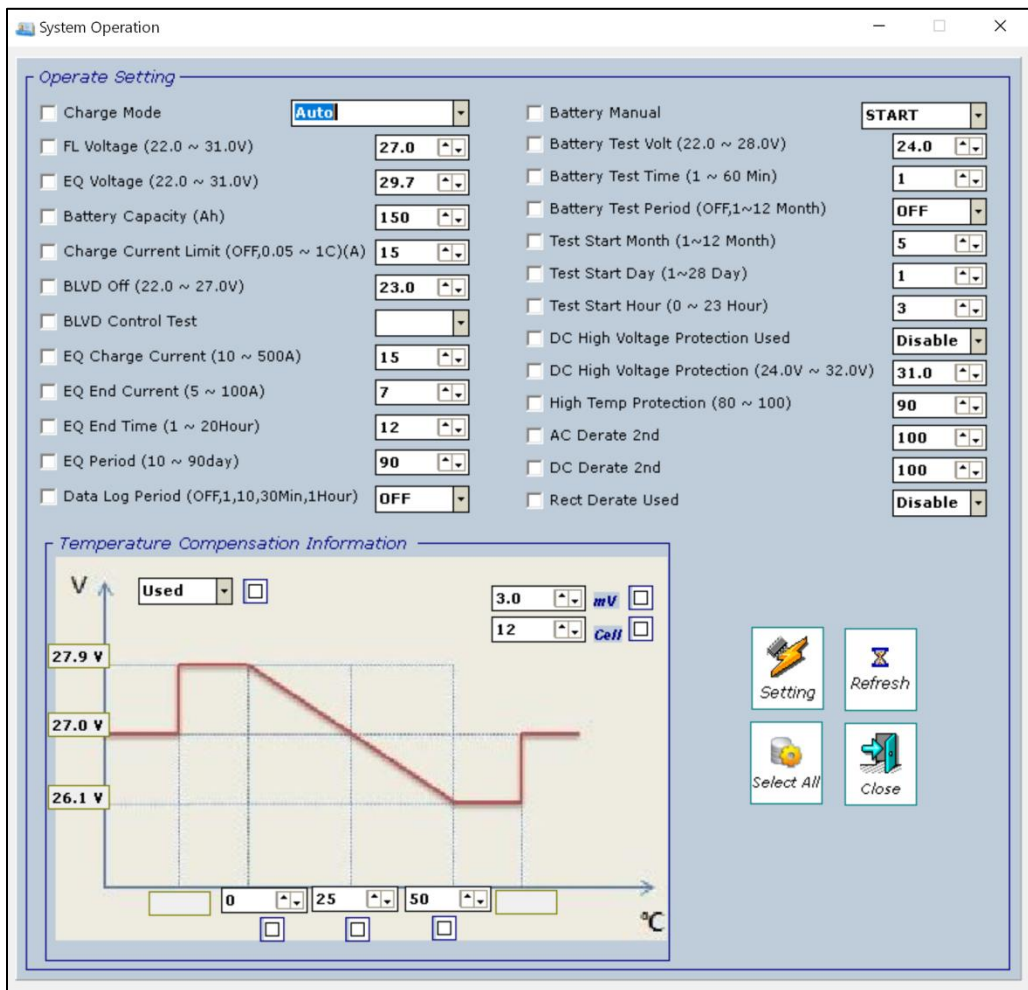
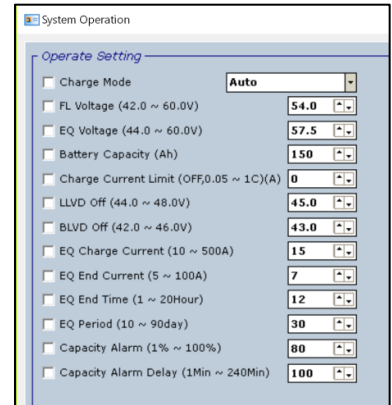


Figure 20. System Operation page

Section 5. Tools

5.3 System Operation (continued)

--User-Configurable Settings-- (Page Left)



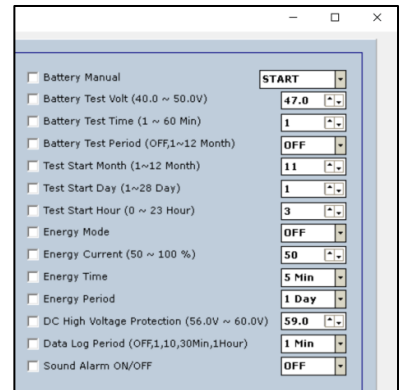
- **Charge Mode** has 3 settings:
 - **Auto** -Automatic Charge mode driven by an algorithm with critical user-configurable setpoints that are within this System Operation page, including EQ Voltage, EQ Charge current, EQ End current, EQ End Time, and FL Voltage.
 - **Manual FL** –this setting forces the Shelf into **Float Charge** mode; DC Bus will stay at the **FL Voltage** setpoint until taken out of this mode of operation.
 - **Manual EQ** - –this setting forces the Shelf into **EQ Charge** mode; DC Bus will stay at the **EQ Voltage** setpoint until taken out of this mode of operation.
- **FL Voltage** –set to the battery manufacturer’s recommended Float voltage, which is a value also stated as Volts-Per-Cell (VPC) recommendations. The 27.0V factory setting is based on a 24V VRLA battery string (12-cell) 2.25 VPC charge-rate. **This FL Voltage setting must always be at least 0.5V lower than the DC High Voltage Protection setting.**
- **EQ Voltage** –this is the EQ (Boost) Charge voltage setpoint best determined by the battery manufacturer datasheet Volts-Per-Cell (VPC) recommendations. The 29.7V factory setting is based on a 24V VRLA battery string (12-cell) 2.475 VPC charge-rate. **This EQ Voltage setting must always be at least 0.5V lower than the DC High Voltage Protection setting.**
- **Battery Capacity (Ah)** –setpoint is based on the rated Ah capacity of a single 24V battery string.
- **Charge Current Limit**- any charge current up to the maximum safe limit, based on battery manufacturer maximum charge current recommendations.
- **BLVD Off** -Voltage (V) setpoint that will turn off the Battery LVD (contactor)
- **BLVD Control Test** –allows user to toggle the ON/OFF state of the LVD, for test purposes.
- **EQ Charge Current** –In **Auto** Charge mode, this value is the minimum current that will force boost charge by entering **EQ Charge** (Bus Voltage = EQ Voltage, with Charge Current Limit)
- **EQ End Current** –In **Auto** Charge mode, this value is the charge current setting that allows a transition from Boost Charge back to Float Charge but only after the **EQ End Time** setpoint.
- **EQ End Time** - In **Auto** Charge mode, this value is the time period that the battery charge current must stay ≤ EQ Charge to allow a transition from Boost Charge back to Float Charge.
- **EQ Period** –time period between the start of each automatic **EQ Charge** process.

Section 5 Tools

5.3 System Operation (continued)

--User-Configurable Settings—(Page Right)

- **Battery Manual** –**START & STOP** for manual Battery tests.
- **Battery Test Volt** –sets a voltage level for the automated Battery test, for comparison to battery manufacturer datasheet discharge characteristics to determine Battery Health.
- **Battery Test Time** –sets how long the automated Battery Test will run.
- **Battery Test Period** –sets how often the automated Battery Test is performed; **OFF** will disable the Battery Test process.
- **Test Start Month** –sets the specific month that the automated Battery Test will start.
- **Test Start Day** –sets the specific day (of the month) that the automated Battery Test will start.
- **Test Start Hour** –sets the specific hour (of the day) that the automated Battery Test will start.
- **DC High Voltage Protection Used** –select to Disable or Enable the DC high voltage protection.
- **DC High Voltage Protection** –(from 24.0V ~ 32.0V) for overvoltage protection on the DC Bus.
This setting must always be at least 0.5V higher than the FL Voltage and EQ Voltage settings.
- **High Temp Protection** –select the Rectifier Module shutdown temperature (+80°C to 100°C).
- **AC Derate Used** –sets a per-module AC voltage derating inception point for 35A/module during extreme low AC voltage conditions. Default is 100V; values are configurable from 80V ~ 120V.
- **DC Derate Used** –sets a per-module DC derated current for conditions when the AC derating is active (see **AC Derate Used**)and the **Rect Derate Used** is set to **ON**. Setting is in % of the derated Load current of the Rectifier Module.
- **Rect Derate Used** –sets a per-module **DC Derate Used** setting either ON or OFF.



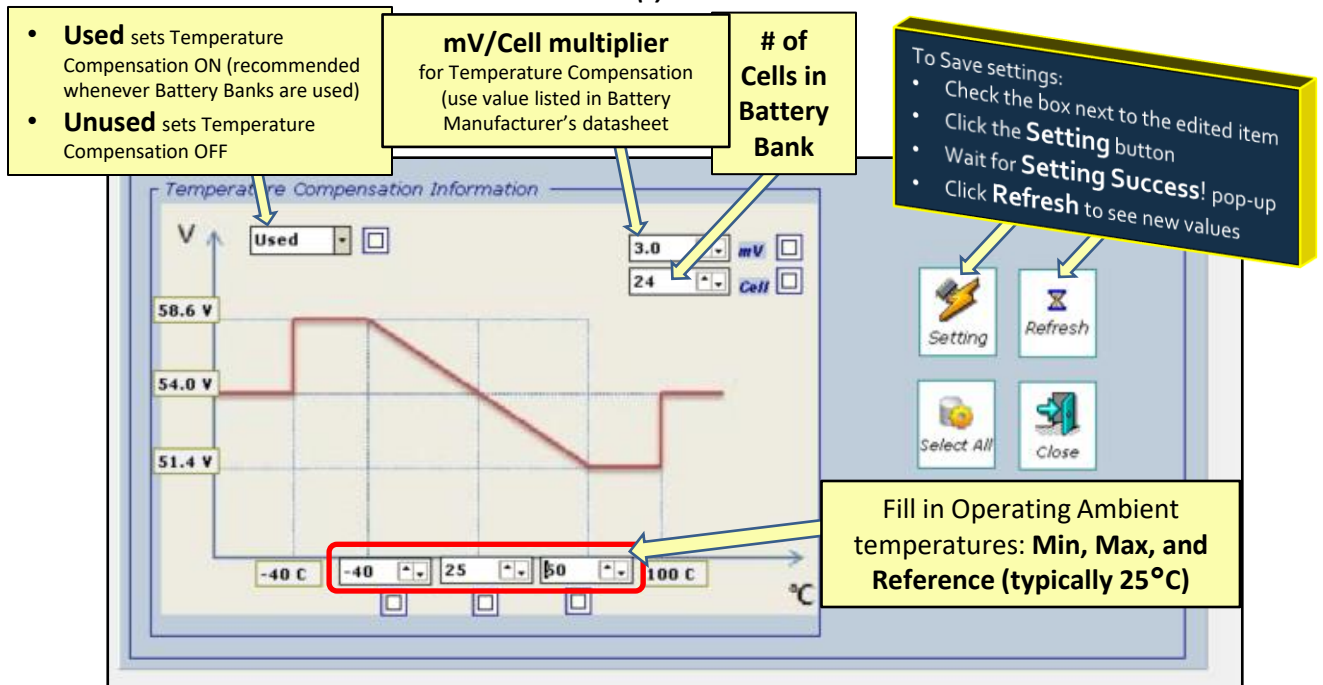
Section 5. Tools

5.3 System Operation (continued)

--User-Configurable Settings—Temperature Compensation (Tcomp)

- **Battery Charge Profile** –This page includes a temperature-compensated Battery Charge Profile that actively graphs the values and slope of the battery charge voltage versus ambient temperature. A check-box is next to each user-configurable parameter, as shown in **Figure 27**.
- **Temperature Compensation (Tcomp) assumptions:**
 - Temperature Compensation equation uses $T_{ref} = +25^{\circ}\text{C}$ for the reference temperature
 - T_{comp} formula includes a negative multiplier for the **mV/Cell multiplier** so the slope is negative. As battery temperature decreases, charging voltage is increased and as battery temperature increases, charging voltage decreases.
- **Tcomp formula:** $[-(\text{mV/Cell multiplier}) \times (^{\circ}\text{C away from } T_{ref}) \times (\# \text{ of Cells in Battery Bank})]$
- Example (using a typical 24V lead-acid battery, parameters in Figure 25, and $+10^{\circ}\text{C}$ Ambient):
 At $+10^{\circ}\text{C}$ Ambient \rightarrow $[-(0.003) \times (-15) \times (12)] = 0.54\text{V}$
 (In this example, temperature compensation increases the Battery Charge voltage by 0.54V at $+10^{\circ}\text{C}$).

If supplied, ensure Battery Temperature cables are connected properly between Shelf and Battery Bank(s)



The screenshot shows the 'Temperature Compensation Information' interface. It features a graph of Voltage (V) vs. Temperature (°C) with a red line showing a negative slope. The graph has three horizontal segments at 58.6 V, 54.0 V, and 51.4 V. Below the graph are input fields for Min, Max, and Reference temperatures, with values -40, 25, and 50 respectively. To the right of the graph are controls for 'mV/Cell multiplier' (3.0) and '# of Cells in Battery Bank' (24). A 'Used' checkbox is checked. A 'Setting' button is highlighted with a yellow box, and a 'Refresh' button is also highlighted. A yellow callout box provides instructions on how to save settings. A yellow callout box at the bottom right points to the temperature input fields, instructing the user to fill in operating ambient temperatures: Min, Max, and Reference (typically 25°C).

- **Used** sets Temperature Compensation ON (recommended whenever Battery Banks are used)
- **Unused** sets Temperature Compensation OFF

mV/Cell multiplier
for Temperature Compensation (use value listed in Battery Manufacturer's datasheet)

of Cells in Battery Bank

To Save settings:

- Check the box next to the edited item
- Click the **Setting** button
- Wait for **Setting Success!** pop-up
- Click **Refresh** to see new values

Fill in Operating Ambient temperatures: **Min, Max, and Reference (typically 25°C)**

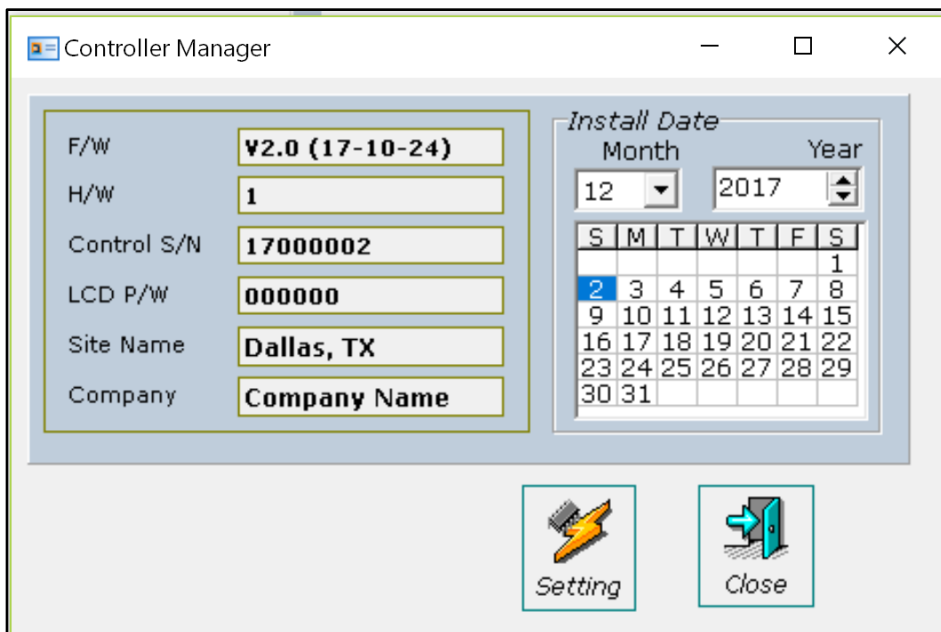
Figure 21. Temperature Compensation Information for Battery Charging Profile

Section 5. Tools

5.4 Controller Manager

➤ **Controller Manager page** contains:

- **F/W** –Firmware version for the Control Module. Do not edit this field unless required.
- **H/W** –Hardware version for the Control Module. Do not edit this field unless required.
- **Control S/N** –Serial Number for the Control Module. Do not edit this field unless required.
- **LCD P/W** –This is the Password for TCP/IP Access to the Shelf via the Control Module.
- **Site Name** –sets the desired Site Name; this field accepts up to 19 characters.
- **Company Name** –sets the desired Company Name; this field accepts up to 19 characters.
- **Install Date** –sets the Installation Date for the Rectifier Shelf/System.



The screenshot shows a window titled "Controller Manager" with the following fields and values:

F/W	V2.0 (17-10-24)
H/W	1
Control S/N	17000002
LCD P/W	000000
Site Name	Dallas, TX
Company	Company Name

The **Install Date** section includes a calendar for December 2017. The calendar shows the following dates:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

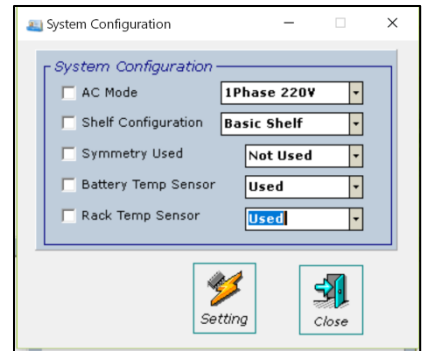
At the bottom of the window are two buttons: "Setting" (with a lightning bolt icon) and "Close" (with a door icon).

Figure 22. Controller Manager page

Section 5. Tools

5.5 System Configuration -allows settings for unique Shelf components including AC Input physical connections, the physical configuration, and internal hardware that measures Load Current, Battery Current, Battery Cell Voltages, and Battery & Rack Temps.

➤ **System Configuration page** contains:



- **AC Mode** –set to match the AC Input to the shelf, either 1Phase 110V or 1Phase 220V.
- **Shelf Configuration** –set to match the physical Shelf configuration for either:
 - **Main Shelf** (4RU with Control Module and up to 4 Rectifier Modules), or
 - **Extend Shelf** (Main Shelf with 4RU Expansion Shelf for total of 8 Rectifier Modules)
- **Symmetry Used** –set to:
 - **Not Used**, or
 - **Symmetry #1** (mid-string voltage monitored), or
 - **Symmetry #2** (all battery strings voltage-monitored)
- **Battery Temp Sensor** –**Unused** for no external Battery strings; **Used** for any Battery strings.
- **Rack Temp Sensor** –set to **Used** and always connect the Rack Temp sensor with the Shelf.

Section 5. Tools

5.6 Measurement Set –allows measured values to be corrected if a measurement error is confirmed with an accurate, calibrated measurement device.

- **Measurement Set page** -18 measured values can be corrected by using an accurate, calibrated measurement device for items in the AD Setting list, shown below. Note that Batt CT Value (+) relates to battery charging and Batt CT Value (-) relates to battery discharging.
- To edit any measurement, first make a note of the measured value that the Shelf is reporting so you can return to that same value, if needed. Then enter the actual measured value into the appropriate field, click the **Setting** button, wait for the **Setting Success** pop-up window, then **Close** the Measurement Set page to see the new adjusted measurement.

CAUTION – Use a high level of discretion before resetting any values. Always be 100% sure that a measurement error truly exists. If a large measurement error exists, first resolve that that issue before making any changes within the Measurement Set page.

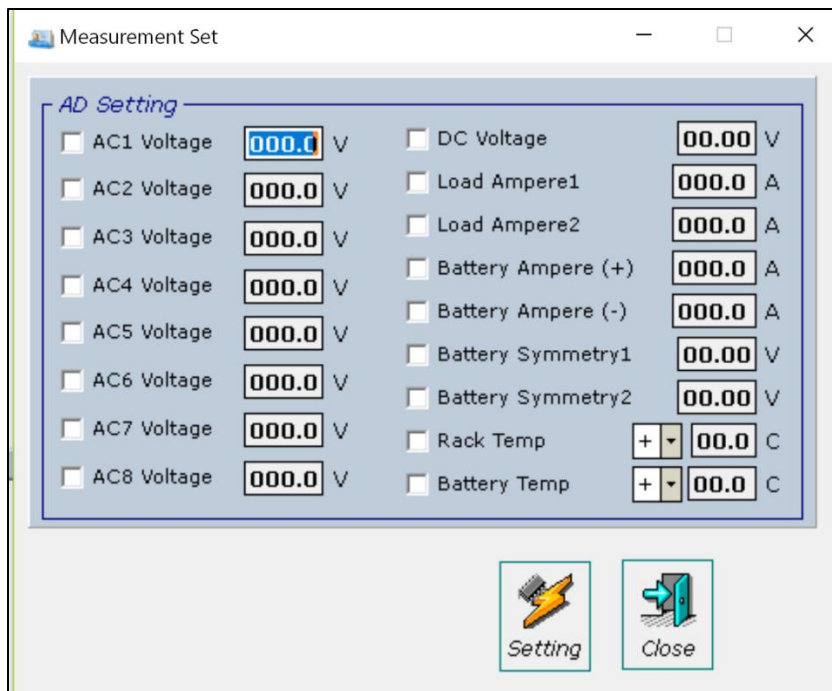


Figure 23. Measurement Set page

Section 5. Tools

5.7 Date Time Set –allows measured values to be corrected if a measurement error is confirmed with an accurate, calibrated measurement device.

- **Date Time Set page** –allows adjustment for the Date and Time that is reported in the GUI Main Page and for time-stamped items reported in the Alarm Log, Data Log, and Event Log.
- To reset to the current Date and Time, click the **Current DATE/TIME** button, click the **Setting** button. Wait for the **Setting Success** pop-up window, then **Close** the **Date Time Set** page to see the updated date and time.

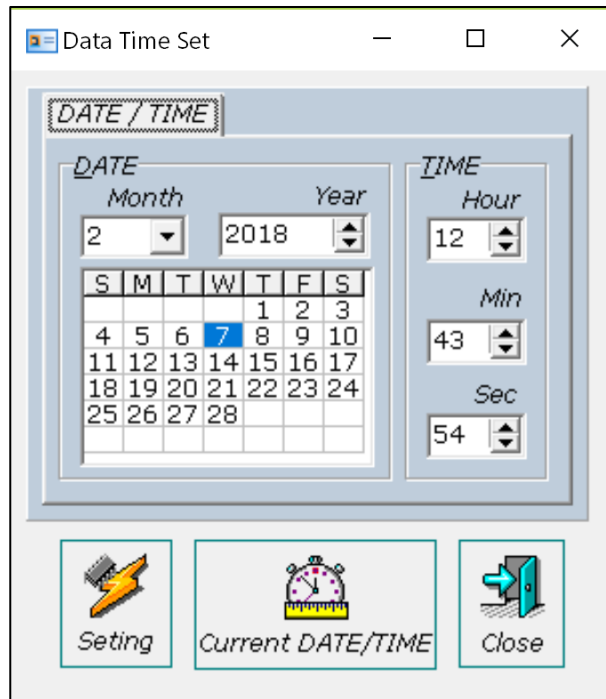


Figure 24. Date Time Set page

Section 5. Tools

5.8 Controller Reset page –forces the Control Module to reset.

➤ **Controller Reset** allows an intentional reset of the Control Module. To start the reset process:

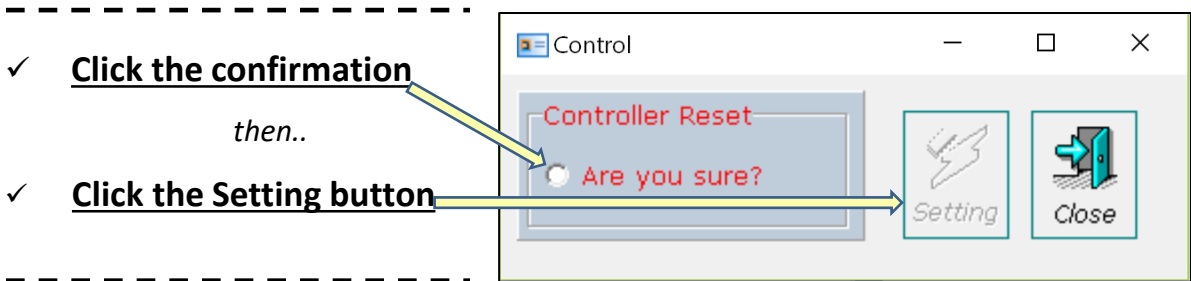


Figure 25. Controller Reset page

- The Control Module reset process completes within **less than 25 seconds**.
- During the reset process, external alarms are cleared (all Normal, all green), and the Control Module front-panel status LED is green. Network communication and Rectifier Module-to-Module communication is temporarily disabled but resumes immediately upon completing the Reset process.
- When the Control Module reset process is complete, all Shelf settings and alarm states should return to the same values and conditions as they were prior to the reset process.

Section 5. Tools

5.9 Factory Initial page –allows the user to reset all log files and separately reset all alarm settings to the factory default settings.

1. Click on the **Composition Initial** button then click the **Setting** button to clear all line items in the 3 log files (Alarm Log, Data Log, and Event Log) located under the **Log** heading in the GUI.
2. Click on the **Alarm Initial** button then click the **Setting** button to reset all alarm settings to the factory default settings.

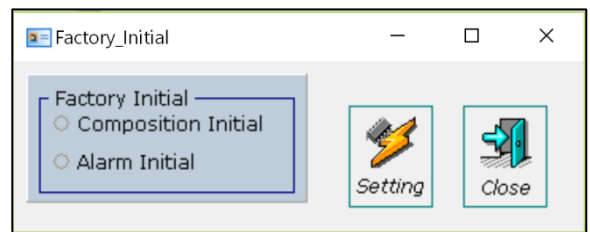


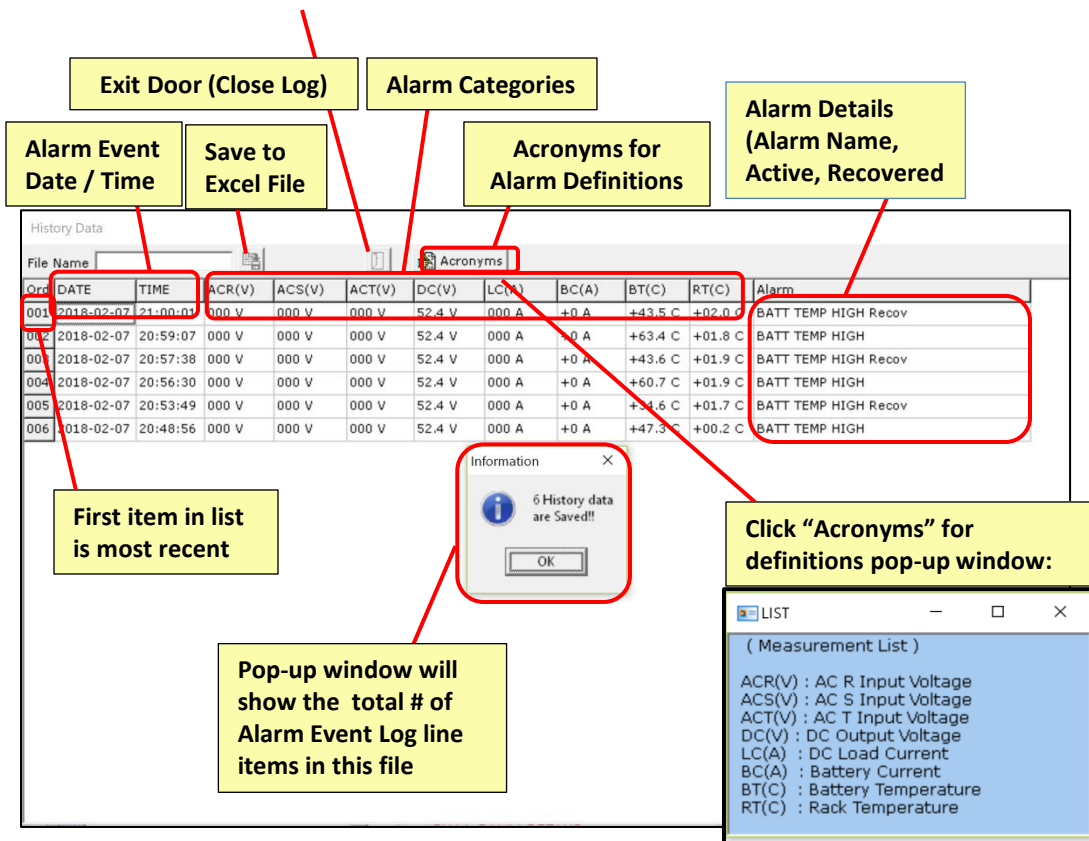
Figure 26. Factory Initial page

Section 6. Log

- Each log file contains up to 1000 line items. When the 1000-item limit is reached then the oldest line item drops from the list, utilizing a First-In/First-Out (FIFO) rotation method.
- There are 3 log files in the **Log** drop-down menu: **Alarm Log**, **Data Log**, and **Event Log**. A **Log Initial** page allows the user to separately clear all line items the Alarm Log and Event Log.

6.1 Alarm Log page –The **Alarm Log** lists alarm activity for all configured (Used) alarms. See **Figure 36** for **Alarm Log** details.

- Click on the Exit Door to close the **Alarm Log** page.



The screenshot shows the Alarm Log interface with the following annotated elements:

- Exit Door (Close Log)**: A button at the top right of the log area.
- Alarm Categories**: A dropdown menu at the top right.
- Alarm Event Date / Time**: A callout pointing to the first two columns of the log table.
- Save to Excel File**: A button above the log table.
- Acronyms for Alarm Definitions**: A callout pointing to the 'Acronyms' button above the table.
- Alarm Details (Alarm Name, Active, Recovered)**: A callout pointing to the 'Alarm' column of the table.
- First item in list is most recent**: A callout pointing to the first row of the log table.
- Information pop-up window**: A dialog box showing '6 History data are Saved!!' with an 'OK' button.
- Click "Acronyms" for definitions pop-up window:**: A callout pointing to a separate window titled 'LIST (Measurement List)' containing a list of acronyms and their definitions:
 - ACR(V) : AC R Input Voltage
 - ACS(V) : AC S Input Voltage
 - ACT(V) : AC T Input Voltage
 - DC(V) : DC Output Voltage
 - LC(A) : DC Load Current
 - BC(A) : Battery Current
 - BT(C) : Battery Temperature
 - RT(C) : Rack Temperature

Ord	DATE	TIME	ACR(V)	ACS(V)	ACT(V)	DC(V)	LC(A)	BC(A)	BT(C)	RT(C)	Alarm
001	2018-02-07	21:00:03	000 V	000 V	000 V	52.4 V	000 A	+0 A	+43.5 C	+02.0 C	BATT TEMP HIGH Recov
002	2018-02-07	20:59:07	000 V	000 V	000 V	52.4 V	000 A	+0 A	+63.4 C	+01.8 C	BATT TEMP HIGH
003	2018-02-07	20:57:38	000 V	000 V	000 V	52.4 V	000 A	+0 A	+43.6 C	+01.9 C	BATT TEMP HIGH Recov
004	2018-02-07	20:56:30	000 V	000 V	000 V	52.4 V	000 A	+0 A	+60.7 C	+01.9 C	BATT TEMP HIGH
005	2018-02-07	20:53:49	000 V	000 V	000 V	52.4 V	000 A	+0 A	+44.6 C	+01.7 C	BATT TEMP HIGH Recov
006	2018-02-07	20:48:56	000 V	000 V	000 V	52.4 V	000 A	+0 A	+47.3 C	+00.2 C	BATT TEMP HIGH

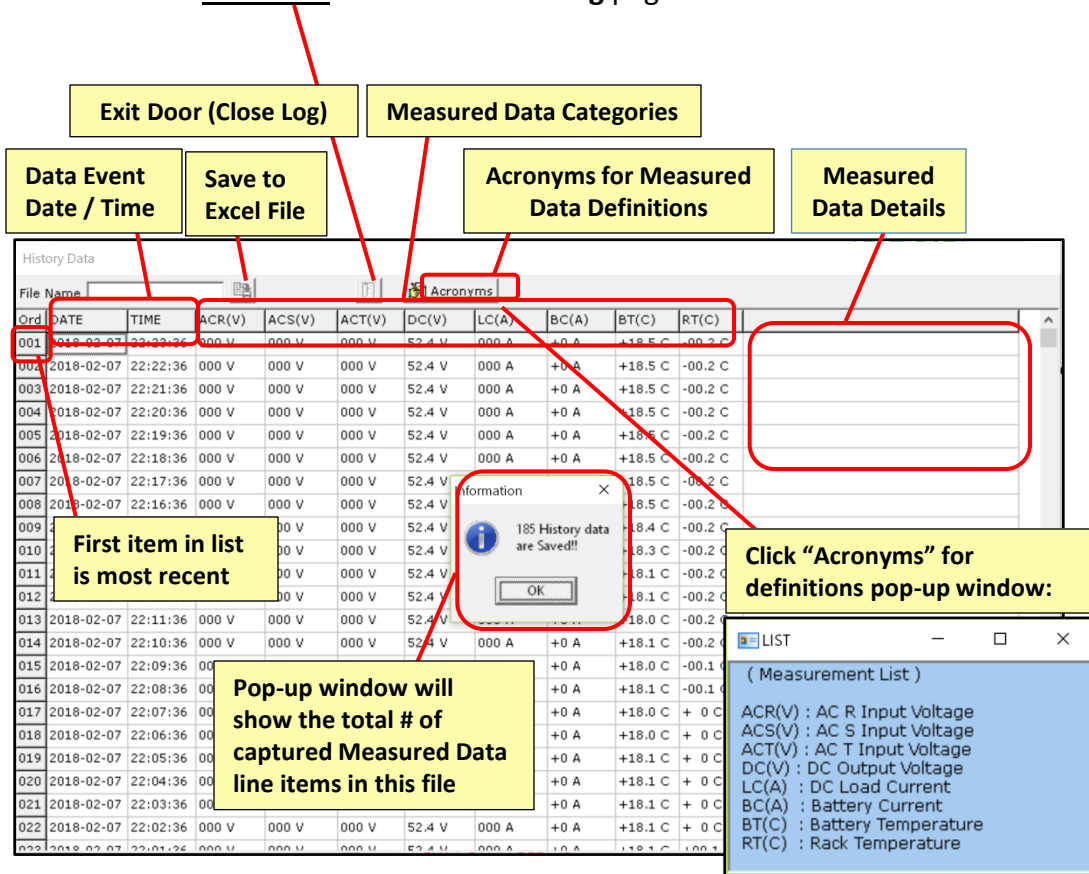
Figure 27. Alarm Log page

Section 6. Log

- Each log file contains up to 1000 line items. When the 1000-item limit is reached then the oldest line item drops from the list, utilizing a First-In/First-Out (FIFO) rotation method.
- There are 3 log files in the **Log** drop-down menu: **Alarm Log**, **Data Log**, and **Event Log**. A **Log Initial** page allows the user to separately clear all line items in the **Alarm Log** and **Event Log**.

6.2 Data Log page –The **Data Log** lists measured data for all listed category items. See **Figure 37** for **Data Log** details.

- Click on the Exit Door to close the **Data Log** page.



Exit Door (Close Log)

Measured Data Categories

Data Event Date / Time

Save to Excel File

Acronyms for Measured Data Definitions

Measured Data Details

First item in list is most recent

Pop-up window will show the total # of captured Measured Data line items in this file

Click "Acronyms" for definitions pop-up window:

Ord	DATE	TIME	ACR(V)	ACS(V)	ACT(V)	DC(V)	LC(A)	BC(A)	BT(C)	RT(C)
001	2018-02-07	22:23:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
002	2018-02-07	22:22:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
003	2018-02-07	22:21:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
004	2018-02-07	22:20:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
005	2018-02-07	22:19:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
006	2018-02-07	22:18:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
007	2018-02-07	22:17:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
008	2018-02-07	22:16:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.5 C	-00.2 C
009	2018-02-07	22:15:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.4 C	-00.2 C
010	2018-02-07	22:14:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.3 C	-00.2 C
011	2018-02-07	22:13:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	-00.2 C
012	2018-02-07	22:12:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	-00.2 C
013	2018-02-07	22:11:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.0 C	-00.2 C
014	2018-02-07	22:10:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	-00.2 C
015	2018-02-07	22:09:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.0 C	-00.1 C
016	2018-02-07	22:08:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	-00.1 C
017	2018-02-07	22:07:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.0 C	+0 C
018	2018-02-07	22:06:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.0 C	+0 C
019	2018-02-07	22:05:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	+0 C
020	2018-02-07	22:04:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	+0 C
021	2018-02-07	22:03:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	+0 C
022	2018-02-07	22:02:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	+0 C
023	2018-02-07	22:01:36	000 V	000 V	000 V	52.4 V	000 A	+0 A	+18.1 C	+0 C

Information

185 History data are Saved!!

OK

LIST

(Measurement List)

ACR(V) : AC R Input Voltage
 ACS(V) : AC S Input Voltage
 ACT(V) : AC T Input Voltage
 DC(V) : DC Output Voltage
 LC(A) : DC Load Current
 BC(A) : Battery Current
 BT(C) : Battery Temperature
 RT(C) : Rack Temperature

Figure 28. Data Log page

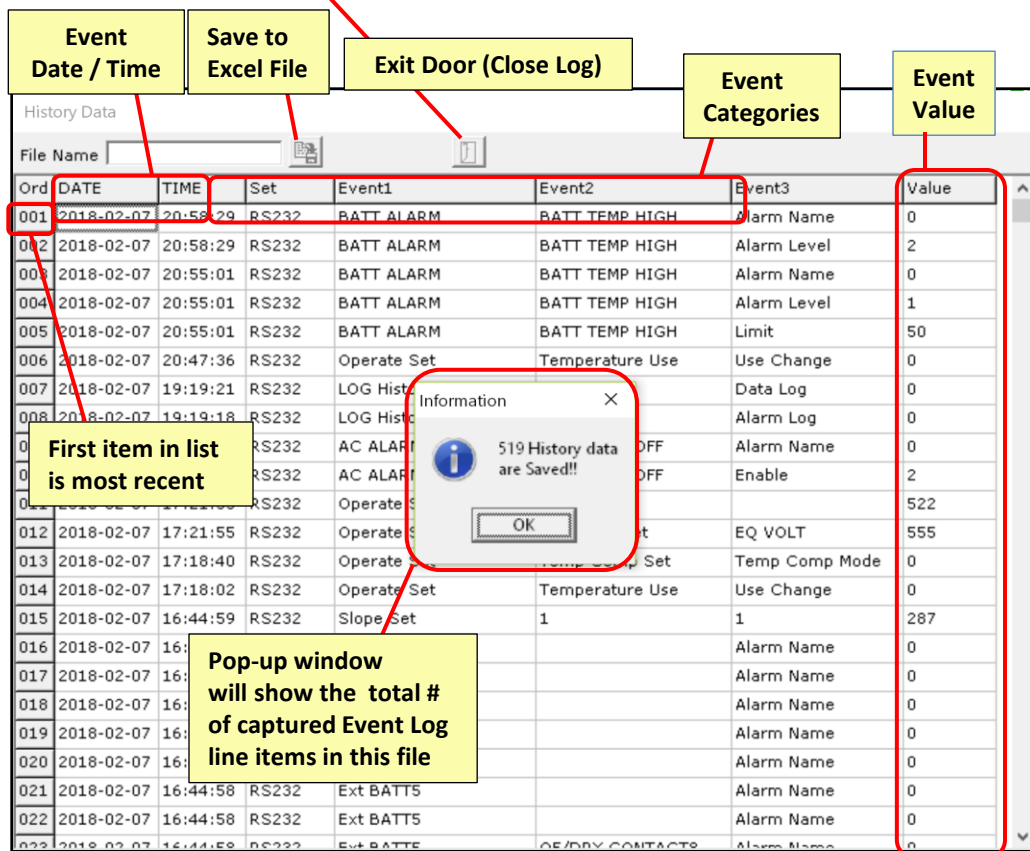
Section 6. Log

- Each log file contains up to 1000 line items. When the 1000-item limit is reached then the oldest line item drops from the list, utilizing a First-In/First-Out (FIFO) rotation method.
- There are 3 log files in the **Log** drop-down menu: **Alarm Log**, **Data Log**, and **Event Log**. A **Log Initial** page allows the user to separately clear all line items in the **Alarm Log** and **Event Log**.

6.3 Event Log page –The **Event Log** is a comprehensive list all events, activities, and alarms related to the shelf.

See **Figure 38** for **Event Log** details.

- Click on the **Exit Door** to close the **Event Log** page.



Ord	DATE	TIME	Set	Event1	Event2	Event3	Value
001	2018-02-07	20:58:29	RS232	BATT ALARM	BATT TEMP HIGH	Alarm Name	0
002	2018-02-07	20:58:29	RS232	BATT ALARM	BATT TEMP HIGH	Alarm Level	2
003	2018-02-07	20:55:01	RS232	BATT ALARM	BATT TEMP HIGH	Alarm Name	0
004	2018-02-07	20:55:01	RS232	BATT ALARM	BATT TEMP HIGH	Alarm Level	1
005	2018-02-07	20:55:01	RS232	BATT ALARM	BATT TEMP HIGH	Limit	50
006	2018-02-07	20:47:36	RS232	Operate Set	Temperature Use	Use Change	0
007	2018-02-07	19:19:21	RS232	LOG Hist		Data Log	0
008	2018-02-07	19:19:18	RS232	LOG Hist		Alarm Log	0
009	2018-02-07	19:19:18	RS232	AC ALARM		Alarm Name	0
010	2018-02-07	19:19:18	RS232	AC ALARM		Enable	2
011	2018-02-07	19:19:18	RS232	Operate Set			522
012	2018-02-07	17:21:55	RS232	Operate Set		EQ VOLT	555
013	2018-02-07	17:18:40	RS232	Operate Set	Temp Comp Set	Temp Comp Mode	0
014	2018-02-07	17:18:02	RS232	Operate Set	Temperature Use	Use Change	0
015	2018-02-07	16:44:59	RS232	Slope Set	1	1	287
016	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
017	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
018	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
019	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
020	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
021	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
022	2018-02-07	16:44:58	RS232	Ext BATT5		Alarm Name	0
023	2018-02-07	16:44:58	RS232	Ext BATT5	GE/DRY CONTACTS	Alarm Name	0

Figure 29. Event Log page

Section 6. Log

6.4 Log Initial page –Located under the **Log** heading in the GUI, the **Log Initial** page allows the user to separately clear all line items in the **Alarm Log** and the **Event Log**.

- To clear all line items in the **Alarm Log**:
 - Click on the **Alarm Log** button then click the **Setting** button. A setting Success window will pop up when the **Alarm Log** history is cleared.
- To clear all line items in the **Data Log**:
 - Click on the **Data Log** button then click the **Setting** button. A setting Success window will pop up when the **Data Log** history is cleared.

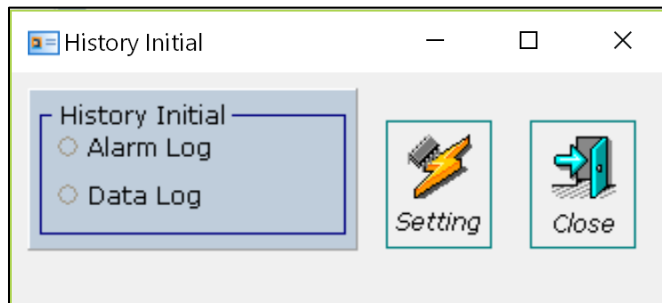


Figure 30. Log Initial page

Section 7. Exiting the GUI

Exit tab –It is recommended to completely close the GUI (use the **Exit> Exit** process) instead of using the Disconnect or Logout tabs.

The GUI can then be consistently re-opened using the standard Login process (shown in Section 2 of this GUI User Manual).

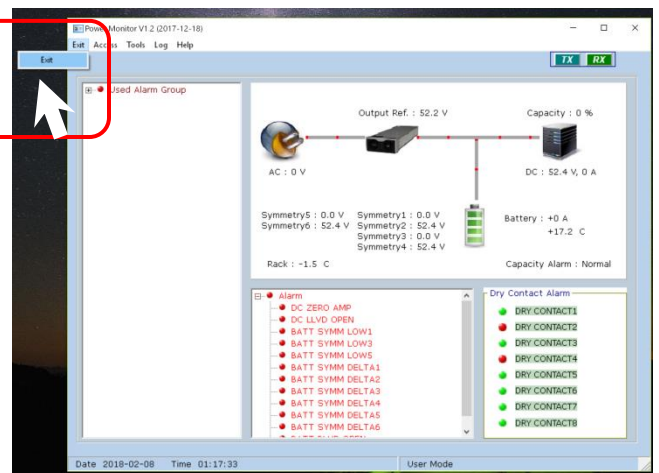


Figure 31. Exit> Exit

Section 8. Control Module

The DCPS-FRC-2421K **Control Module** is located in the DCPS-FRS-2421K Main shelf and performs tasks shown in the block diagram below.

CAUTION: Always turn the ON/OFF switch to OFF when the Control Module is removed from or re-inserted into the Shelf

To remove the Control Module from the shelf, the ON/OFF switch on the front panel must be turned off. Then back off the 2 thumb screws and use the pull handle to remove the module.

To replace the Control Module into the Shelf, turn off the ON/OFF switch, insert the Control Module until it seats into the backplane connector, tighten the 2 thumb screws, then turn the ON/OFF switch to the ON position.

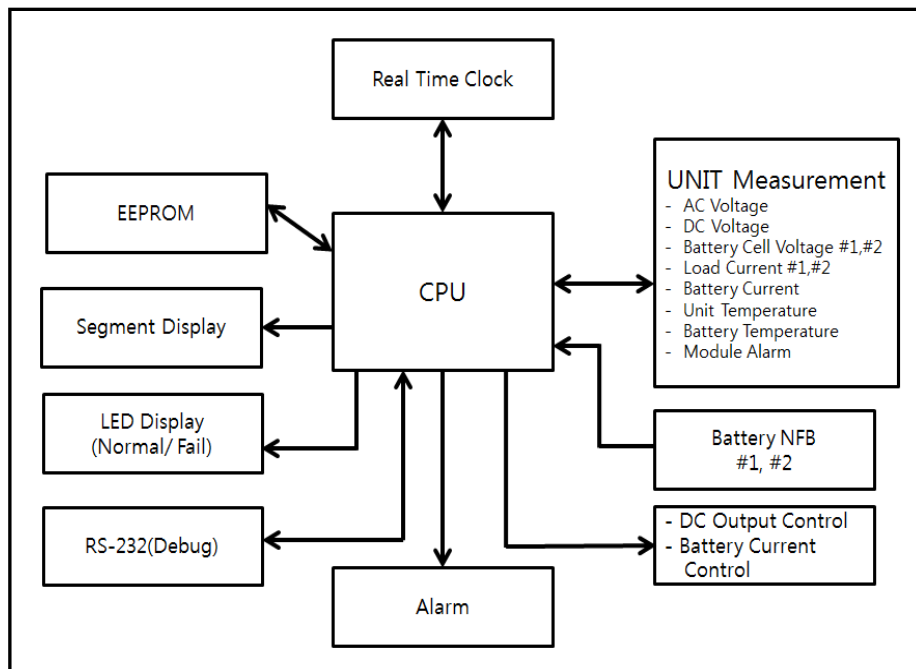
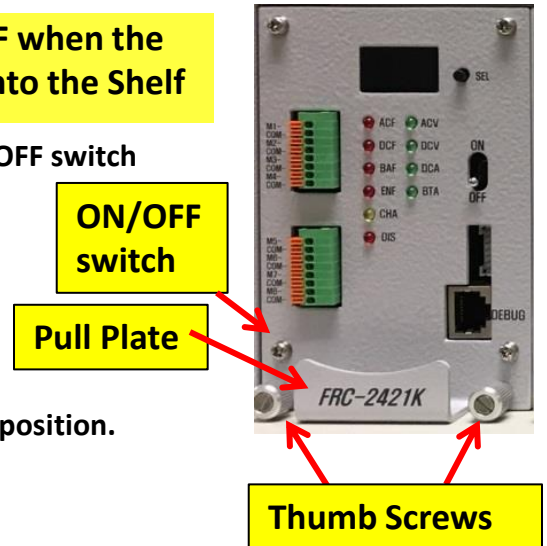


Figure 32. Control Module block diagram

Section 8. Control Module (DCPS-FRC-2421K)

8.1 Control Module –Front Panel

The **Control Module** is powered from the Shelf’s DC output bus so at least one Rectifier Module must be active in the Shelf to start.

There are 6 **Shelf Alarm LEDs** on the front panel that identify the following grouped alarms:

4 indicate abnormal conditions:

- **ACF** –any AC Input abnormal condition
- **DCF** –any DC Output abnormal condition
- **BAF** –any Battery String abnormal condition
- **ENF** –Environmental abnormal condition.
(including Rack and Batt temp).

2 general indicators:

- **CHA** –Battery is charging $\geq 2A$.
- **DIS** –Battery is discharging.

Shelf Alarm LEDs

LED Display shows one of these four **Display Values**

“SEL” Select Switch activates an LED beside one of the Display Values and displays that value on the LED Display

ON to power up the Control Module
OFF for removal or reinstalling the Control Module

DEBUG port (for GUI)

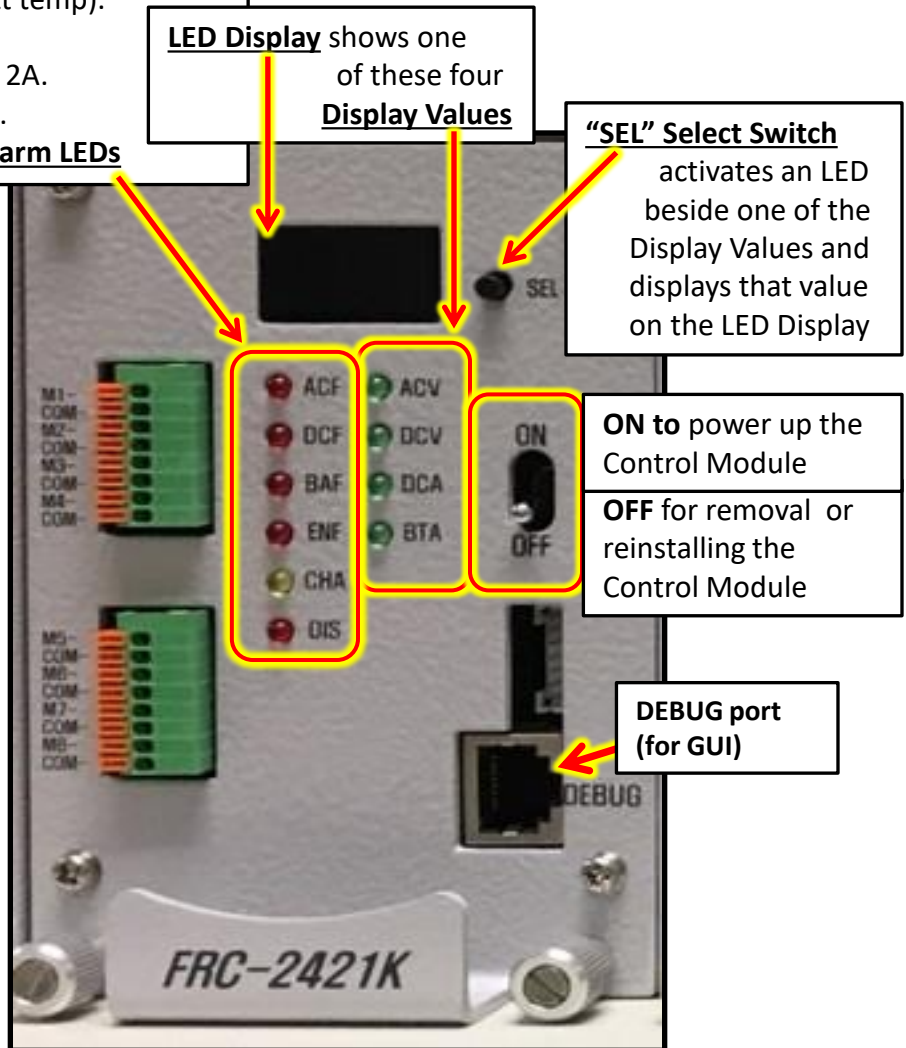


Figure 33. Control Module front panel

Section 8. Control Module (DCPS-FRC-2421K)

8.2 Control Module –Dry Relay Contacts

The **Control Module** has 8 Dry Relay (DR) Contact alarm ports. Each DR is fully configurable; any alarms can be mapped to any DR Contact (see Section 4.1.2).

The DR terminal block is a quick-connect, spring-lock style. Simply press a solid AWG 28~22 wire into the terminal until it locks.

Remove a wired port by pushing the release button next to the wired position and pull the wire straight out.

Each terminal is rated for 100V & 3A (maximum).

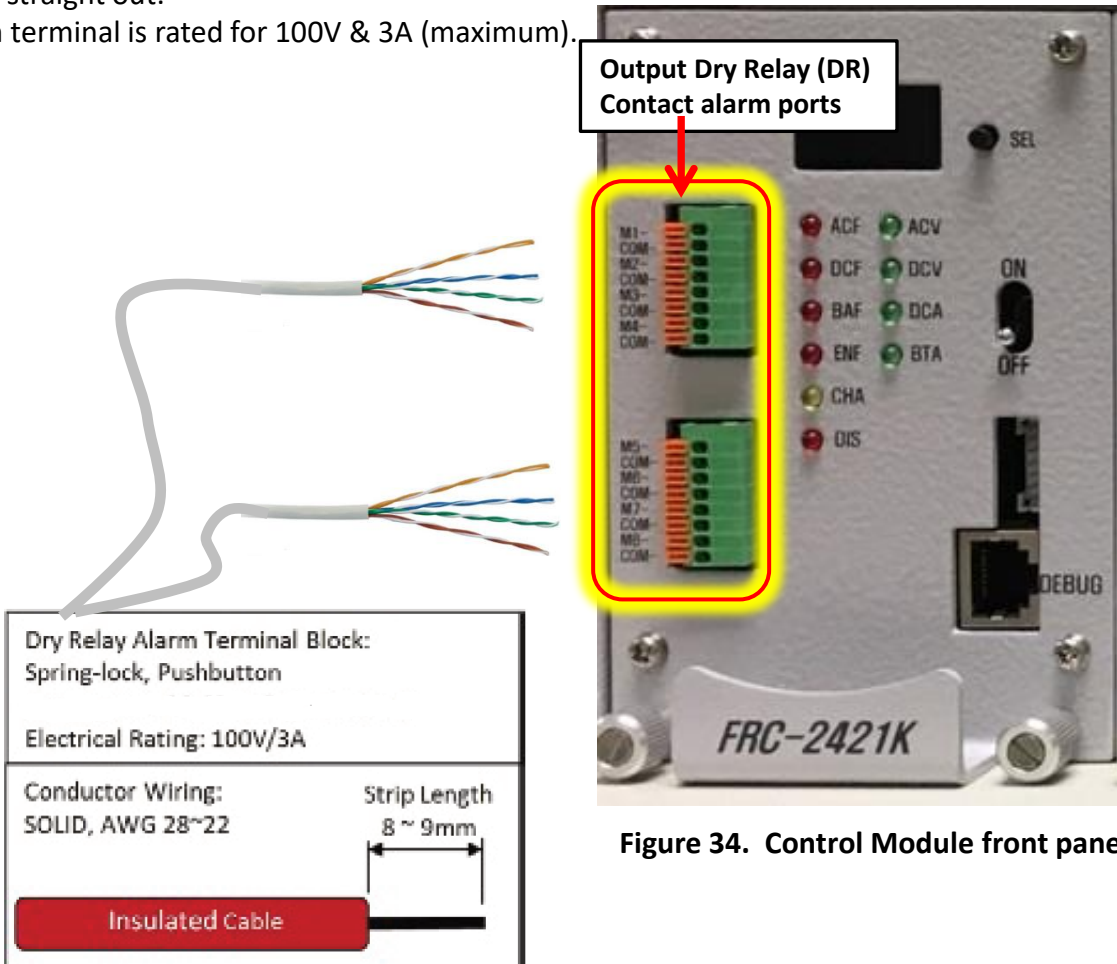


Figure 34. Control Module front panel

Figure 35. Terminal Block Electrical specs

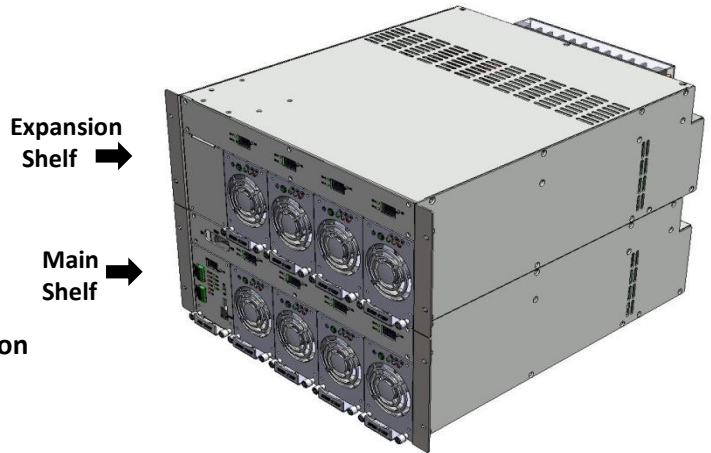
APPENDIX

<u>ITEM</u>	<u>APPENDIX</u>	<u>PAGE</u>
1. <i>Datasheet: DCPS-FRS-2421K Main Shelf and DCPS-FRS-2421KE Expansion Shelf</i>	A1	42
2. <i>Datasheet: DCPS-NDRM-2100F Rectifier</i>	A2	43
3. <i>Datasheet: DCPS-FRC-2421K Control Module</i>	A3	44
4. <i>Block Diagrams: DCPS-FRS-2421K, DCPS-FRS-2421KE</i>	A4	45
5. <i>Front/Rear Views: DCPS-FRS-2421K+DCPS-FRS-2421KE</i>	A5	46
6. <i>Dimensional Diagrams: DCPS-FRS-2421K (with KE)</i>	A6	47
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11. Definitions	A11	52

DCPS-FRS-2421K Rectifier (Main) Shelf with DCPS-FRIS-2421KE (Expansion) Shelf

Product Features :

- Modular design for accommodating high power applications
- +27V DC Output; 400A (Main Shelf) extends to 800A with Expansion Shelf
- Hot-pluggable 100A rectifier modules
- Active Current Sharing; n+1 Redundancy
- 19-inch Rack Mount
- Low voltage disconnect for battery protection (Battery LVD) with 100A Battery breaker
- Radiated and Conducted EMI, Class A
- UL certification (pending)



Input Specifications

VOLTAGE	1P3W 220VAC (93VAC ~ 275VAC) (Nominal 176~264VAC)
FREQUENCY	45-65Hz
PROTECTION	Under & Over voltage
EFFICIENCY	≥ 88.0% (100% Load)
PFC	≥ 0.98 (100% Load)

Output Specifications:

DC VOLTAGE	Default +27VDC
DC CURRENT	800A Max (2.7KW X 8modules)
ADJUSTMENT RANGE	23VDC~29.7VDC
LINE REGULATION	±1.0% Max
LOAD REGULATION	±1.0% Max
Overall REGULATION	±5.0% Maximum
NOISE	≤ 250mVp-p (2.7KW)
SETPOINT ACCURACY	±0.5%
OVER VOLTAGE	+31.0VDC
PROTECTION	Power derated, Thermal Shutdown
OVER CURRENT	105~130%

General Specifications:

OPERATING TEMP	-10°C to +55°C (Derating above +50°C)
STORAGE TEMP	-40°C ~ +85°C
OPERATING HUMIDITY	10% ~ 95% (Non-Condensing)
STORAGE HUMIDITY	0% ~ 95% (Non-Condensing)
COOLING	Fan cooling
ALTITUDE	2,000 Meter
SIZE (W×D×H)	482.6mm x 555mm x 354.8mm (19" x 21.85" x 13.97")

Electromagnetic Compatibility

EMISSIONS (pending)	EN61204/EN55022 Class A
HARMONIC CURRENT	EN61000-3-2
EMISSIONS	
\FLUCTUATIONS & FLICKER	EN61000-3-3
ELECTROSTATIC	EN61000-4-2
DISCHARGE RADIATED EFI	EN61000-4-3
EFT/BURSTS	EN61000-4-4
SURGE TRANSIENTS	EN61000-4-5
CONDUCTED IMMUNITY	EN61000-4-6
VOLTAGE DIPS AND SHORT INTERRUPTIONS	EN61000-4-11

Status & Control signal:

COMMUNICATION INTERFACE	RS485
-------------------------	-------

Standards & Approvals: (pending)

UL/CUL	60950-1
--------	---------

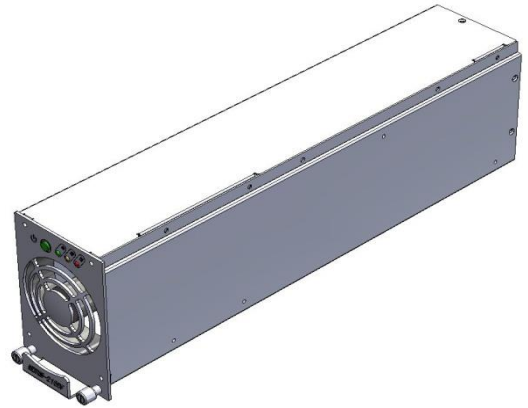
Appendix A1

DCPS-NDRM-2100F Rectifier Module

Rectifier Module
+27VDC / 2700W

Product Features:

- **Modular Design**
- **LED alarm indicated**
- **Energy saving operation**
- **Hot pluggable**



Input Specifications:

VOLTAGE	1Ø220VAC (93VAC ~ 275VAC) (Nominal 176~264VAC)
FREQUENCY	45-65Hz
INRUSH CURRENT	30A @ 220VAC
PROTECTION	Mains fuse in both lines
LEAKAGE	3.5mA Max @ 220VAC
EFFICIENCY	≥ 88.0% (100% Load)
POWER FACTOR	≥ 0.98 (100% Load)
PROTECTION	Input Under voltage, Overvoltage

Output Specifications:

OUTPUT VOLTAGE	+27.0VDC
OUTPUT CURRENT	100A@240VAC(160VAC ↓ 40%Io)
ADJUSTMENT RANGE	23.0~29.7VDC(TBD)
LINE REGULATION	±1.0% Max over entire input range
LOAD REGULATION	±1.0% Maximum
Overall REGULATION	±5.0% Maximum
RIPPLE & NOISE	≤ 250mVp-p
SETPOINT ACCURACY	±0.5%
OVER VOLTAGE PROTECTION	+31.0VDC Power derated, Thermal Shutdown

Status & Control Signals:

COMMUNICATION	RS485
---------------	-------

General Specifications:

OPERATING TEMP	-10°C to +55°C, (Derating above +50°C)
STORAGE TEMP	-40°C to +85°C
OPERATING HUMIDITY	10% to 95% (Non-Condensing)
STORAGE HUMIDITY	0% to 95% (Non-Condensing)
COOLING	Controlled Fan in a module
ACOUSTIC NOISE	< 60dBA(Nominal input , full load , Ta < 40°C)
RELIABILITY	>350,000 Hrs MTBF (Ambient : 25°C)
SIZE(W×D×H)	85mm × 405.5mm × 122.5mm (3.34" × 15.96" × 4.82")
WEIGHT	4.03 kg(8.88 lbs)

Electromagnetic Compatibility

EMISSIONS	EN55022 Level A (Conducted)
ELECTROSTATIC DISCHARGE	EN61000-4-2, 4KV Contact / 8KV Air
RADIATED SUSCEPTIBILITY	EN61000-4-3, 26-1000MHz, 10V/M, 80%AM
EFT/BURSTS	EN61000-4-4, 2KV
SURGE	EN61000-4-5
CONDUCTED IMMUNITY	EN61000-4-6, 0.15-800MHz, 10V 80%
VOLTAGE DIPS	EN61000-4-10, 95% Dip&10ms, 30% Dip&500ms
VOLTAGE INTERRUPTIONS	EN61000-4-11, 95% reduction, 5ms
FLUCTUATIONS & FLICKER	EN61000-3-3

Standards & Approvals: (TBD)

UL, CE, CB

Appendix A2

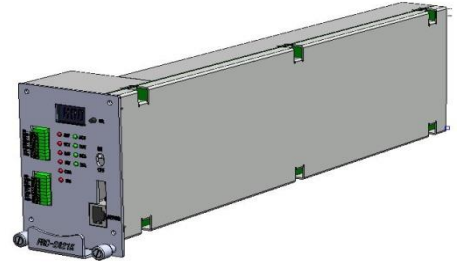
DCPS-FRC-2421k Control Module

Product Features :

- RS 232 interface for PC connection
- Adjustable Output Voltage
- AC Input High/Low Voltage Alarm

Display :

- Status of the rectifier system is displayed on the Display :
 - Input voltage
 - Output voltage
 - Output load current
 - Battery load current
- **Front Panel LED Status indicators of the Rectifier system :**
 - **ACF(AC Fail), DCF(DC Fail), BAF(Battery Fail), ENF(Ambient or battery temp. Fail), CHA(Battery Charging), DIS(Battery Discharging)**



Analog Measurements (Tolerance : Full Scale $\pm 0.5\%$) :

- Rectifier input AC voltage
- Rectifier output DC voltage
- Rectifier load current
- Rectifier temperature

Controller Unit Function :

- Failure of the rectifier controller shall not affect the operation of the rectifiers in the system
- Store and display 1,000 event alarm logs & 1,000 data logs
- † Dry Contact Alarm (User Defined alarms)
- † : *The number of alarms can vary depending on the shelf*

Battery Management:

- Battery charge/discharge current Display and Measurement
- Manual/Float/Equal charging mode exchangeable
- Battery Charging Current Limiting
- Temperature Compensated Charge Voltage for increased battery Lifetime
- Setting of Battery Temperature Compensation Curve

CPU :

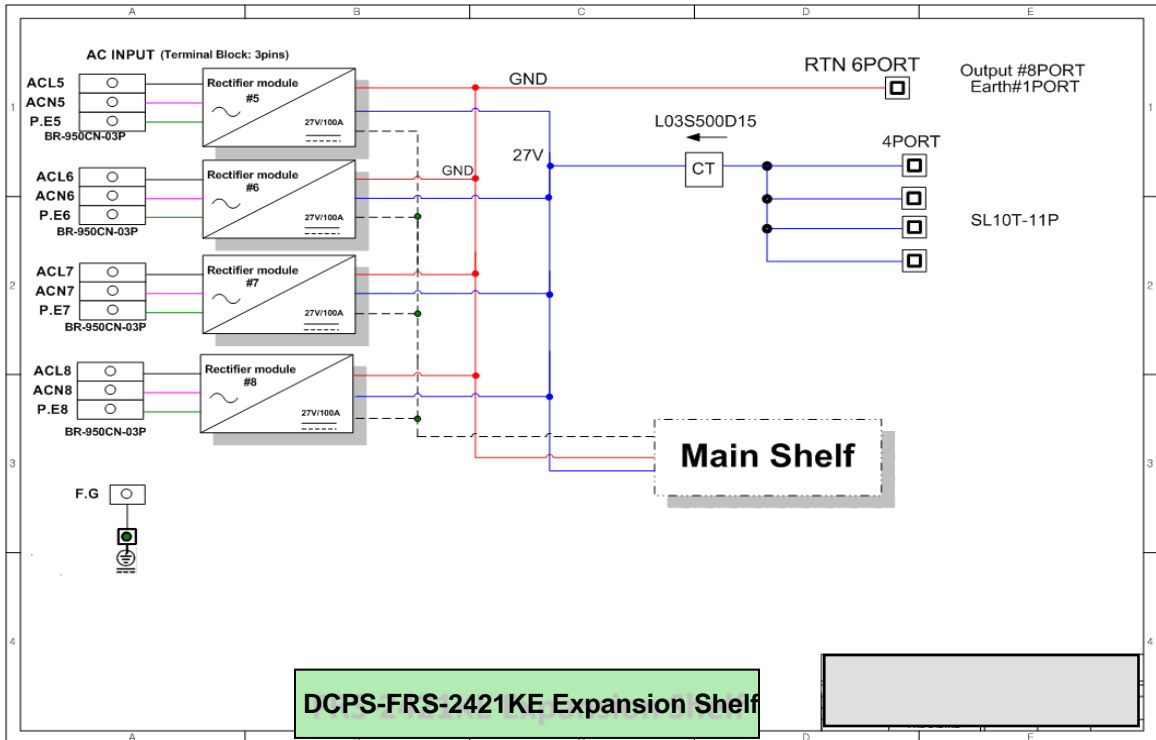
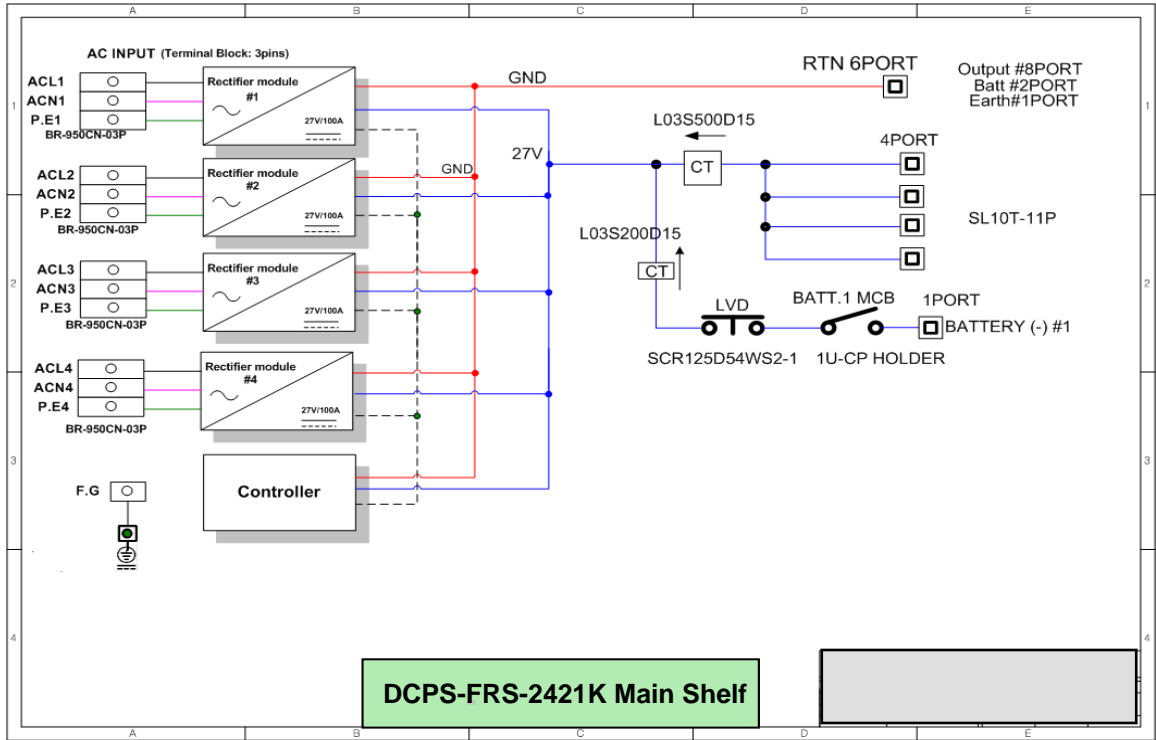
- CPU Clock 32MHz
- 16ch DMA floating-point unit
- Memory
 - : Flash 256Kbyte / EEPROM
 - / Flax RAM, Flax NVM
- UART, RS485

Interface :

- RS232
 - Baud Rate : 115,200 bps
 - Data Bits : 8Bit / Stop Bits : 1Bit / Parity Bits : N

Appendix A3

Block Diagrams DCPS-FRS-2421K/KE

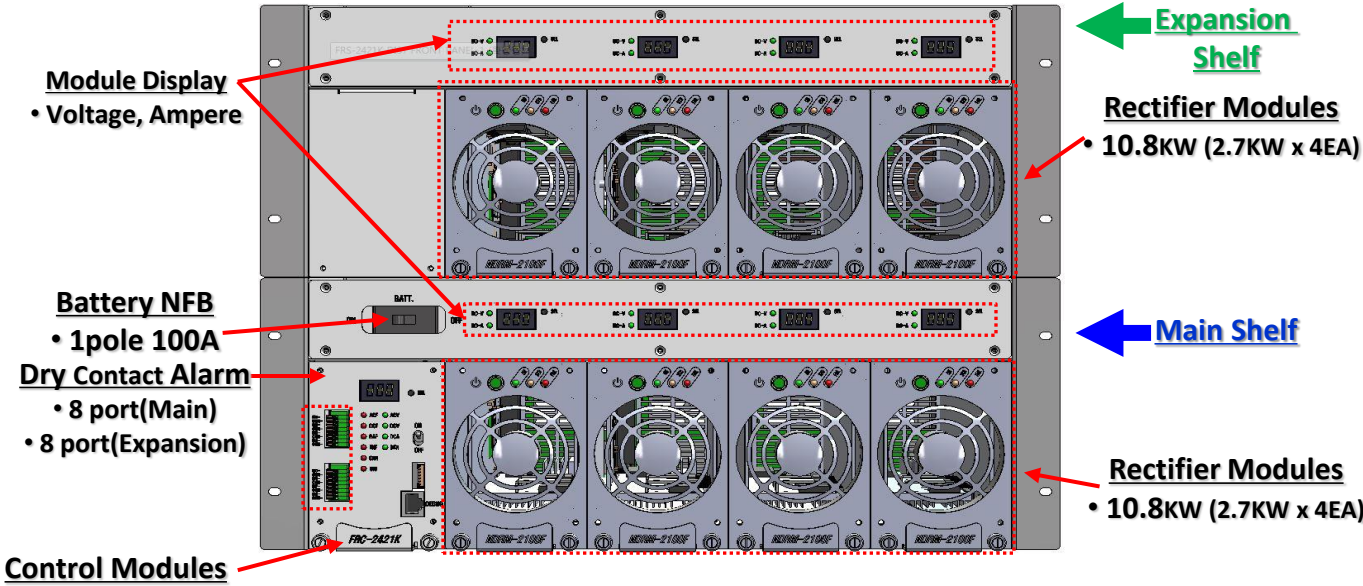


Appendix A4

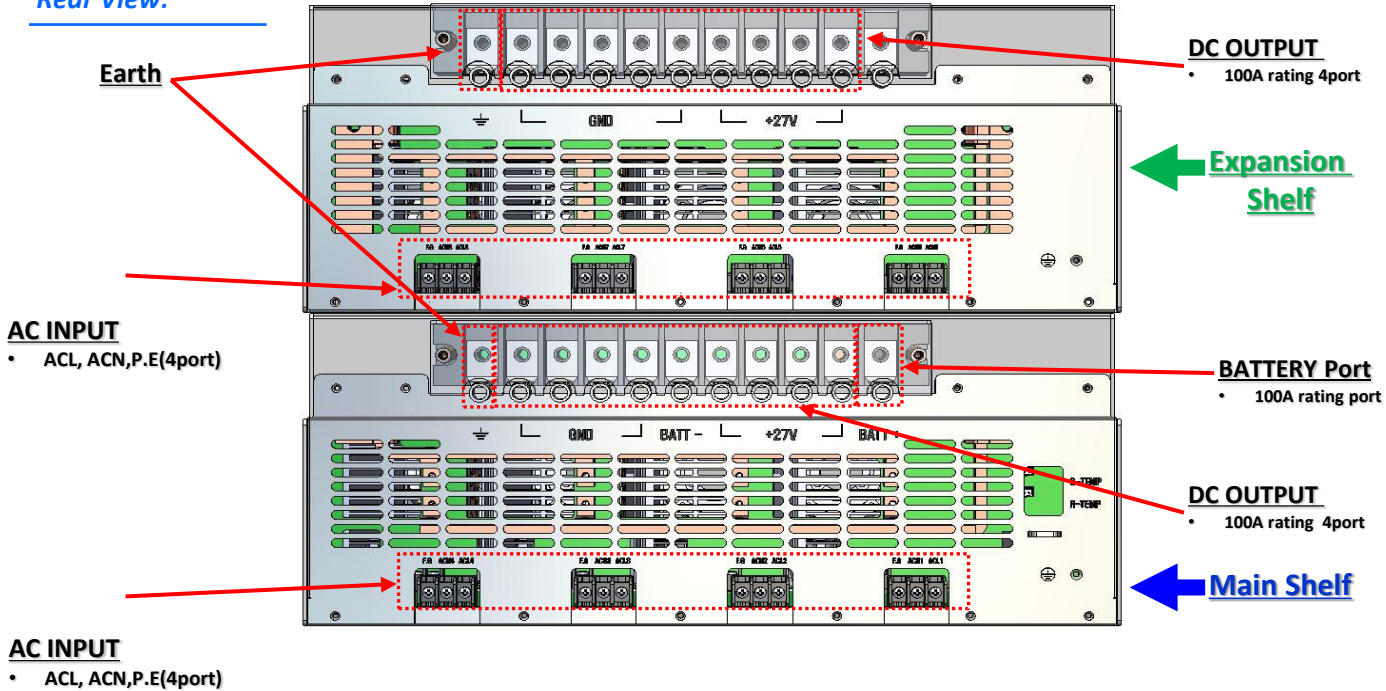
Front & Rear Views

DCPS-FRS-2421K with DCPS-FRS-2421KE

Front View:

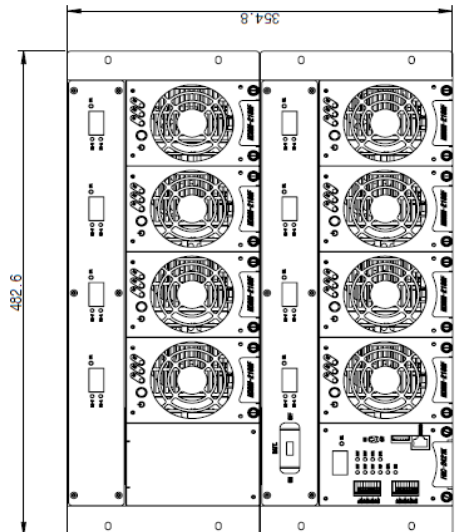
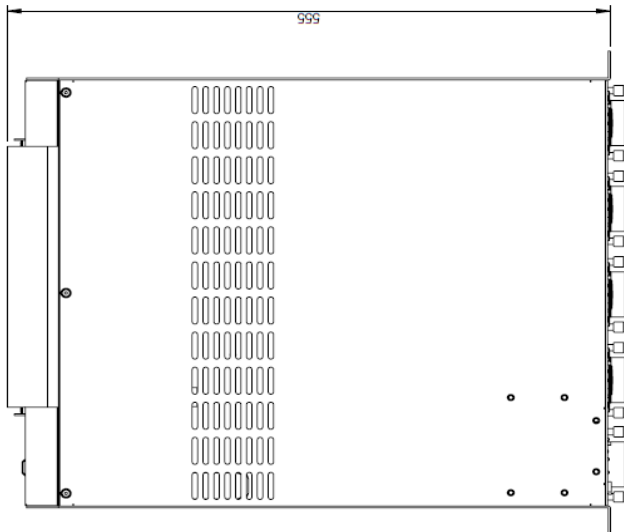
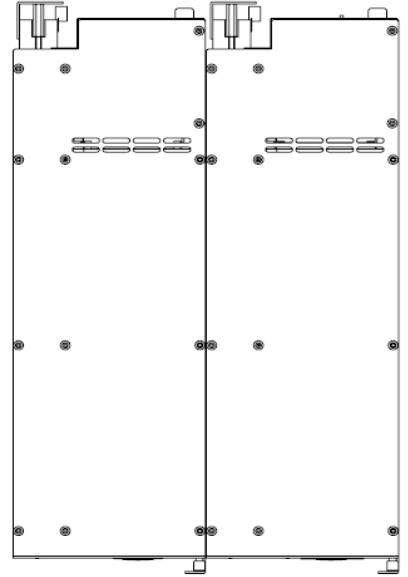
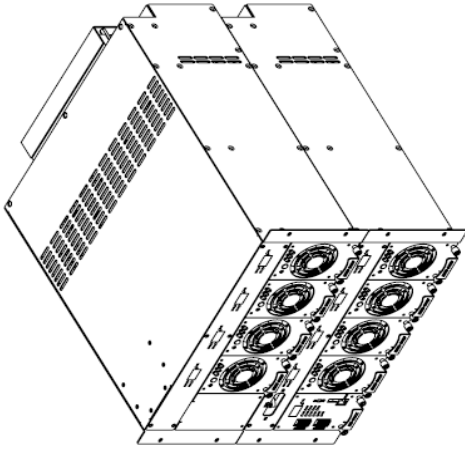


Rear View:



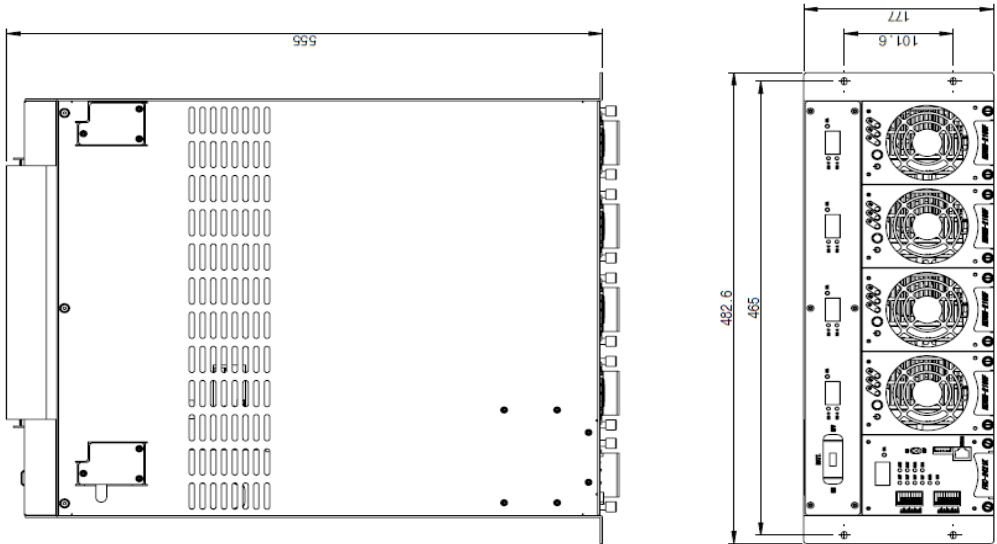
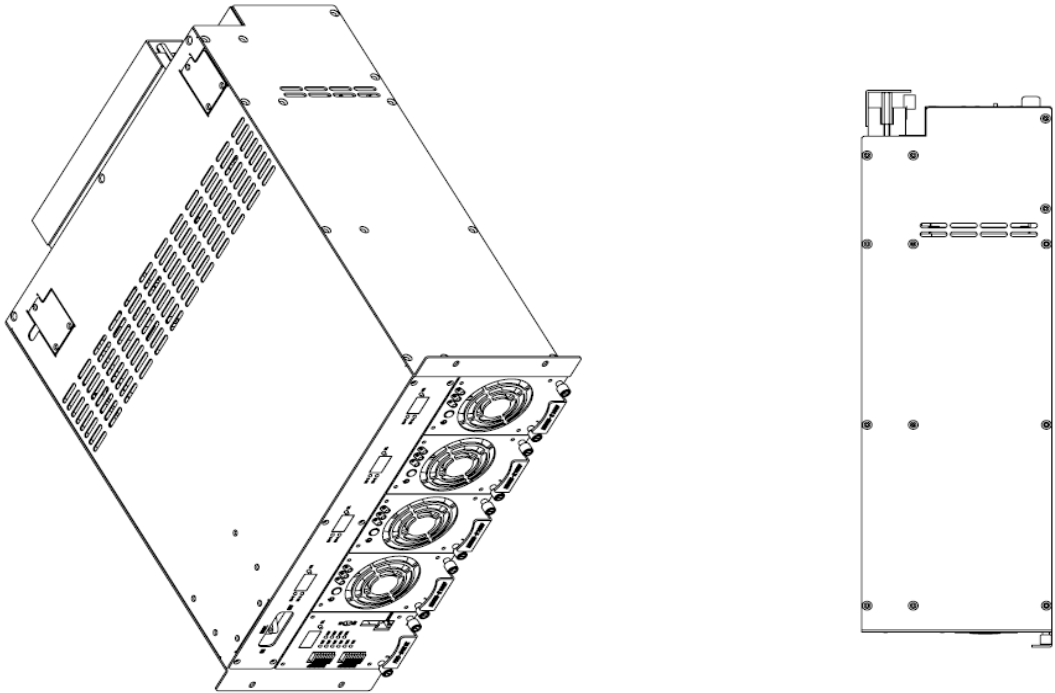
Appendix A5

DCPS-FRS-2421K with DCPS-FRS-2421KE



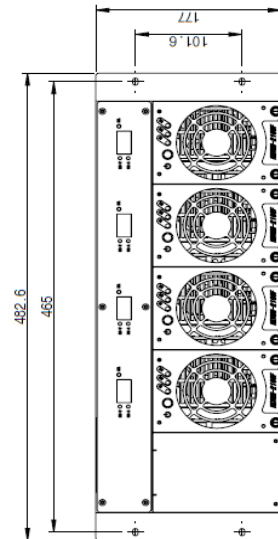
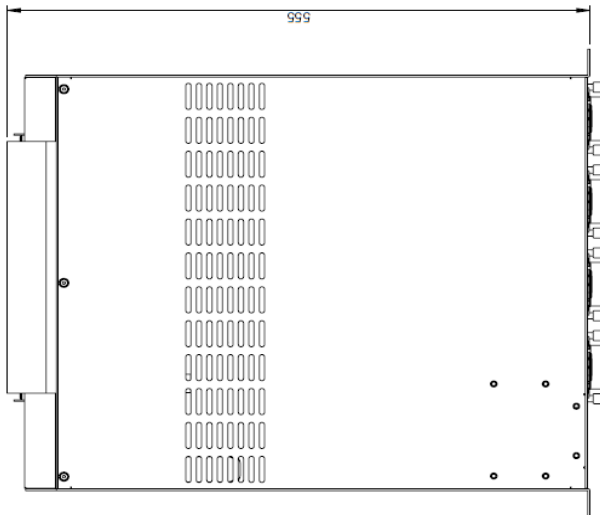
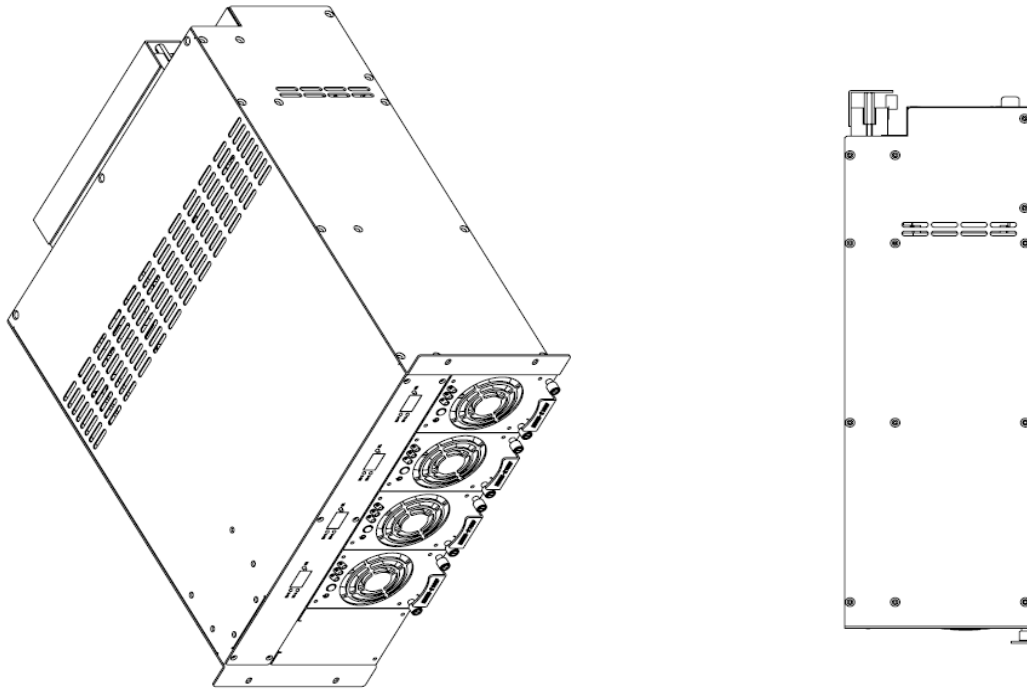
Appendix A6

DCPS-FRS-2421K Main Shelf



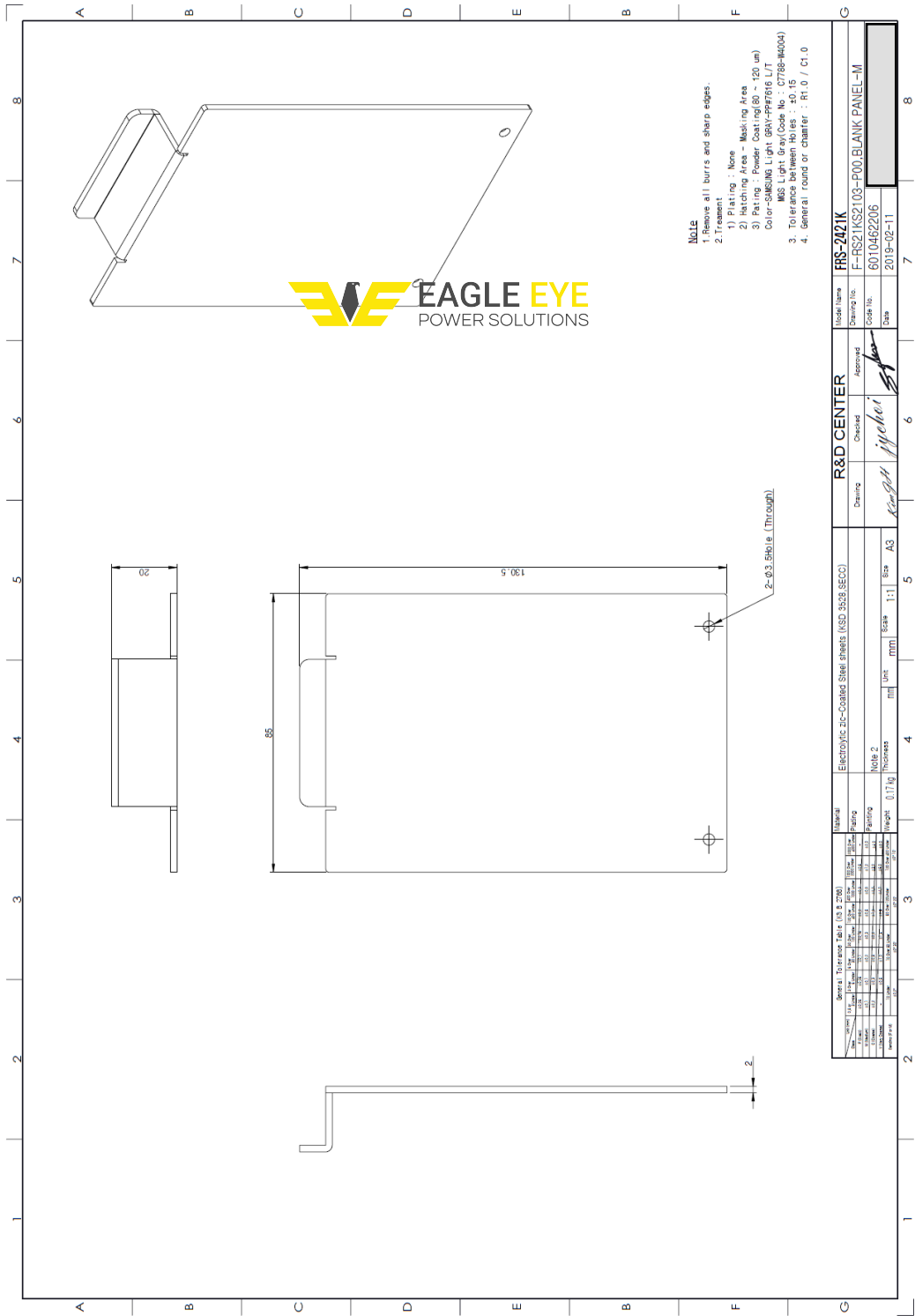
Appendix A7

DCPS-FRS-2421KE Expansion Shelf



Appendix A8

Blank Panel DCPS-FRS-2421K with DCPS-FRS-2421KE



Model Name FRS-2421K		Drawing No. F-RS21K32103-P00-BLANK PANEL-M	
Code No. 601042206		Date 2018-02-11	
Checked <i>[Signature]</i>	Approved <i>[Signature]</i>	R&D CENTER	
Drawing <i>[Signature]</i>	Size A3	Scale 1:1	
Material Electrolytic ZC-Coated Steel Sheets (MSD 3528 SECC)	Thickness 0.17mm	Weight 0.11kg	
Plating None 2	Notes None 2		

Appendix A10

Appendix

A11. Definitions

ACF : AC Fail(power failure)

ACV : AC Voltage

ALM : ALarM

AMP : AMPere

AUTO-FL MODE : AUTO-Floating charging **MODE**

AUTO-EQ MODE : AUTO-EQualize charging **MODE**

Batt : Battery

BCA : Battery Current Ampere

BF : Battery Fail

BTC – FL : Battery Temp Comp- FLoating charging

BTC – EQ : Battery Temp Comp- EQualize charging

C/B : Circuit Breaker

CHA : CHArge

Comm. Fail : Communication Fail

Comp. : Compensation

Curr. : Current

DC : Direct Current

DCF : DC Fail

DCH : DisCHarge

DCOV : DC Over Voltage

DCUV : DC Under Voltage

DCV : DC Voltage

ENT : ENTer

EQ MODE : EQualize charging **MODE**

EQ : EQualize charging

ERR : ERRor

FF : Fan Fail

FL MODE : FLoating charging **MODE**

FL : FLoating charging

LCA : Load Current Ampere

LDA : output LoaD Ampere

LED : Light Emitting Diode

LVD : Low Voltage Disconnect

MANUAL-FL MODE : MANUAL –Float
charging **MODE**

MANUAL-EQ MODE : MANUAL –Equalize
charging **MODE**

MCB :Miniature Circuit Breaker

MF : Module Fail

OCA : Over Current Ampere

OT : Over Temperature

OV : Over Voltage

REC : RECTifier

RMS : Root Mean Square

RX : Receipt channel

S/W : SWitch

Temp : Temperature

TX : Transmit channel

UV : Under Voltage

V1.0 : Version 1.0