Rectifier controller

Electrical transformers, static converters .. Parts, Parts of

static converter
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1 Safety Precautions⚠️

Please read the following terms carefully before using this product. Improper installation and usage of this product might cause personal injury and product damage.

- Operators should abide by local laws and regulations, and safety precautions in this manual should be supplemented only by local safety regulations.
- This product can only be used in indoor or outdoor cabinets. It is forbidden to use Rectifier controller in inflammable, explosive gas or smoky environment.
- Please use the same nominal voltage power supply and battery pack, otherwise it may cause overvoltage protection or damage. Do not reverse the positive electrode and cathode of power supply and battery pack.
- The power supply should be an integrated switching power supply with perfect charging function.
- Do not use water to clean any part of the device and wear watches, bracelets, bracelets, rings and other conductive objects when operating the devices.
- The metal tools used in the installation must be insulated to avoid the short circuit of the power supply and battery.
- Installation or maintenance operations must comply with the user manual.
- Please measure the voltage of the contact point before contacting the surface of conductor or connection ports.
- When installing or dismantling the cable, it should confirm that the circuits has been disconnected to prevent arcing or electrical discharge.
- If the storage temperature of the cable is below zero, the cable must be stored at room temperature for more than 24 hours.
• It should be checked routinely according to the user manual after installing before power on.

2 Rectifier controller presentation

2.1 Application

Differential battery management system (Rectifier controller) is used to decomposes one dc voltage from a set of power supply into multiple dc voltage to meet differential battery packs for charging. When the battery is discharged, the Rectifier controller can also carry out the combined discharge of multiple battery packs, so as to ensure multiple battery packs running at the same time or different time no interaction. The typical application of Rectifier controller is shown as follow:

![Figure 1. Schematic diagram of a base station dc power supply system](image)

2.2 Main Function

• The floating chargeing and equalizing chargeing voltage of each battery port could been set up independently.
• The chargeing and discharging current of each battery port could been set up independently.
The technical parameters of each battery port for differential battery pack could been set independently.

The operating parameters (SOC/SOH/DOD) of each battery pack could been measured on live.

Dynamically store running data of a certain number of Rectifier controller and battery.

Supporting battery pack sharing in different periods, capacities and brands.

Support the sharing of lead-acid batteries and lithium batteries.

Support lithium batteries for preferential discharging and lead-acid batteries as a spare.

Support installating on walls, cable ladder and embedded installation.

2.3 Technical parameter

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>input Voltage（dc）</td>
<td>-60V ~ -40V</td>
</tr>
<tr>
<td>2</td>
<td>output Voltage（dc）</td>
<td>-58V ~ -42V</td>
</tr>
<tr>
<td>3</td>
<td>floating charge voltage setting range</td>
<td>48V ~ 58V</td>
</tr>
<tr>
<td>4</td>
<td>equalizing charge voltage setting range</td>
<td>48V ~ 58V</td>
</tr>
<tr>
<td>5</td>
<td>Charging Current（Each port）</td>
<td>≥ 100A</td>
</tr>
<tr>
<td>6</td>
<td>discharging Current（Each port）</td>
<td>≥ 100A</td>
</tr>
<tr>
<td>7</td>
<td>Voltage drop（Max）</td>
<td>≤ 400 mV</td>
</tr>
<tr>
<td>8</td>
<td>noise voltage (peak to peak)</td>
<td>≤ 200 mV</td>
</tr>
<tr>
<td>9</td>
<td>battery port number(pcs)</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>the capacity per battery pack</td>
<td>≤ 1000Ah</td>
</tr>
<tr>
<td>11</td>
<td>working efficiency</td>
<td>≥ 98 %</td>
</tr>
<tr>
<td>12</td>
<td>standby power consumption</td>
<td>≤ 10W</td>
</tr>
<tr>
<td>13</td>
<td>altitude</td>
<td>≤ 2000 m</td>
</tr>
<tr>
<td>14</td>
<td>ambient temperature</td>
<td>-5℃~55℃</td>
</tr>
<tr>
<td>15</td>
<td>storage and transportation temperature</td>
<td>-40℃~75℃</td>
</tr>
<tr>
<td>16</td>
<td>communication protocol</td>
<td>RS485</td>
</tr>
<tr>
<td>17</td>
<td>protection degree</td>
<td>IP20</td>
</tr>
<tr>
<td>18</td>
<td>dimension (mm）</td>
<td>482×363×66</td>
</tr>
</tbody>
</table>
2.4 Working principle

Rectifier controller as shown in Fig.2 are composed of power/battery access system, power supply voltage conversion/shunt controlling circuit, monitoring/communication system and management software. The dashed part are battery packs and the battery management units if necessary.

When electric supply is normal, the Rectifier controller charges batteries according to the pre-set battery management parameters. At the same time, the SOC and voltage of batteries are detected. The charging current of each battery is dynamically adjusted according to the feedback data. When the battery is full and the charging current changes to zero, it begins to sleep. The battery wakes up as the discharge voltage falls to the wake-up voltage value and returns to the floating charge state.

When electric supply is not normal, the batteries discharge, Rectifier controller adjusts the discharging current according to the voltage of each battery pack and SOC, controls battery circulation. When lithium batteries and lead-acid batteries are shared, the default priority discharge battery is lithium battery, and the backup discharge battery is lead-acid battery. In this mode, the lead-acid battery will be
connected into the system flexibly before the lithium battery is discharged over, and then the lithium battery will be cut off.

2.5 Appearance and structure

The following figure is the picture of 4-ports embedded type Rectifier controller. This product is mainly used indoor room or outdoor cabinet. It can be installed on the rack cases of the room and the battery cabinet in the outdoor station. It can meet the shared management of 2~4 groups differential battery packs.

![Rectifier controller image](image)

Figure 3. The picture of Rectifier controller

3 Rectifier controller applications

3.1 Operation interface

The following picture is the front face of Rectifier controller panel. Both sides of the panel are equipped with an input power supply and battery connection cable port. In the middle, display and operation keys and communication port are set in the middle of the panel. Specific instructions are illustrated and explained in the picture.
3.2 Installation

When the Rectifier controller is installed on a battery rack or integrated cabinet, a tray or other installation accessories should be configured to support the weight of the equipment, and the device is fastened to the column of the battery rack by a screw through the installation hole on the front panel of the product (Figure 5 left).

3.3 Cable connection

Figure 6 shows a connection of 4-port Rectifier controller applicating for a communication base station. The first battery is lithium and the others are lead-acid batteries.
Figure 6. The schematics of 2 groups batteries shared

The cable connection steps are as follows:

Step1: The protective cable is connected from the bolt of the Rectifier controller protective ground to the nearest grounding busbar. Connecting a cable (1.5mm²) from the RTN port on the product panel to the dc power supply (positive). Connecting a protective cable from the lithium battery grounding terminal to the grounding busbar.

Step2: Connecting a cable from the positive of a battery pack to the dc power supply or the battery cabinet (if has) grounding busbar. Connecting a cable from the negative of the battery pack to the battery port of the Rectifier controller. When a battery pack corresponds to a battery port, the Rectifier controller display is luminous, and the warning indicator lights red.

Step3: Connect two cable conductor from the port of batt fuse of the dc power supply to the power input ports of Rectifier controller.

Step 4: Connect a ethernet cable from the RS485 port of the Rectifier controller to the terminal of the user monitoring system, and then connect ethernet cable from the first lithium battery communication port to the product RS485/CAN network port, and the other lithium batteries communication ports are cascaded to the first battery by ethernet cable.

Note: Lithium battery can also be directly connected to the user monitoring terminal if necessary.

4 Rectifier controller settings
4.1 System power on

If the alarm red light on the panel will be extinguished immediately after close the battery fuse on the dc power supply, it indicates that the equipment has been powered correctly. To prevent extreme charging reactions, the default value of the working parameters has been set, shown in Table 3:

<table>
<thead>
<tr>
<th>No.</th>
<th>Setting content</th>
<th>Units</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery category(VRLA/LFP)</td>
<td>/</td>
<td>VRLA</td>
</tr>
<tr>
<td>2</td>
<td>Rated capacity (0-1000)</td>
<td>Ah</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>Floating charge voltage (48-59)</td>
<td>V</td>
<td>53.5</td>
</tr>
<tr>
<td>4</td>
<td>Equalizing charge voltage (48-59)</td>
<td>V</td>
<td>56.4</td>
</tr>
<tr>
<td>5</td>
<td>DOD(VRLA 400/LFP 1000)</td>
<td>times</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>Charge limiting coefficient (0.05-2.0)</td>
<td>C_{10}</td>
<td>0.1</td>
</tr>
<tr>
<td>7</td>
<td>Number of battery cell (0-100)</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>8</td>
<td>Temp collection point (0-26)</td>
<td>point</td>
<td>/</td>
</tr>
<tr>
<td>9</td>
<td>Charging enable (Y/N)</td>
<td>/</td>
<td>Y</td>
</tr>
<tr>
<td>10</td>
<td>Discharging enable (Y/N)</td>
<td>/</td>
<td>Y</td>
</tr>
<tr>
<td>11</td>
<td>Current limiting enable (Y/N)</td>
<td>/</td>
<td>Y</td>
</tr>
</tbody>
</table>

The user can modify the working parameters of the equipment according to the actual needs after the equipment is powered on. All operations are carried out on the operation keys on the front panel of the Rectifier controller.

4.2 System parameter

- The Rectifier controller system parameter setting steps are as follows:

  **Step1:** Press “←”, and enter the screen display function interface.

  **Step2:** Press “∨”, find "parameter settings" and press “←”, then enter the setting interface.

  **Step3:** Select the "system parameters", press “←”, then enter the setting interface.

  **Step4:** Set time parameters, press “←”, and complete the operation.

4.3 Functional parameters
● The equipment function parameters setting steps are as follows:

**Step1:** Press “←”, and enter the screen display function interface.

**Step2:** Press “∨”, find "parameter settings" and press “←”, then enter the setting interface.

**Step3:** Select the "Management", press “←”, then enter the setting interface.

**Step4:** Set battery sharing mode and other parameters, press “←”, and complete the operation.

### 4.4 Battery parameters

● Battery parameters setting steps are as follows:

**Step1:** Press “←”, and enter the screen display function interface.

**Step2:** Press “∨”, find "parameter settings" and press “←”, then enter the setting interface.

**Step3:** Select the "Battery pack", press “←”, then enter the setting interface.

**Step4:** Select the "Battery pack 1", press “←”, then enter the setting interface.

**Step5:** Set the parameters of the battery pack 1 according to the prompt, press “←”, repeat the above operation until complete all batteries setting, and complete the operation.

### 4.5 Alarm parameters

● Battery alarm parameters setting steps are as follows:

**Step1:** Press “←”, and enter the screen display function interface.

**Step2:** Press “∨”, find "parameter settings" and press “←”, then enter the setting interface.

**Step3:** Select the "Alarm parameters", press “←”, then enter the setting interface.

**Step4:** Select the "Battery pack X", press “←”, then enter the setting interface.

**Step5:** Set the alarm parameters of the battery pack 1 according to the prompt, repeat the above operation until complete all batteries alarm setting, press “←”, and complete the operation.

### 5 Power supply setting
The base station dc power supply is usually a switching power supply. All operations should be carried out under the guidance of the switching power manual. The purpose of Rectifier controller is only to expand the battery management function of the switching power supply, so there will be some changes in the battery parameter setting. The following is only a hint to the changes, which does not represent all the parameters setting of the switching power supply.

5.1 Sharing of AGM battery packs

**Note1:** The floating charge and the equalizing charge voltage of the dc power supply are set according to the highest voltage value of batteries.

**Note2:** Setting the battery capacity of the switching power supply is the sum of all batteries capacity.

**Note3:** If the switching power supply has two battery ports, the capacity of each battery port is half of the total capacity.

**Note4:** The working parameters of each battery port should be set according to the requirements of actual battery pack, and the battery manual can be seen in detail.

5.2 Sharing of LFP battery packs

**Note1:** The switching power supply equalizing voltage is set according to the maximum voltage limit of the lithium battery pack, and the floating charging voltage is set according to the default voltage.

**Note2:** If the voltage parameter of lithium battery pack is different, then set up the lithium battery pack according to the highest voltage value.

**Note3:** Setting the battery capacity of the switching power supply is the sum of all battery capacity.

**Note4:** If the switching power supply has two battery ports, the capacity of each battery port is half of the total capacity.

5.3 Sharing of AGM and LFP battery packs

**Note1:** The floating charge and the equalizing charge voltage of the dc power supply are set according to a battery voltage value with the highest voltage in the two kinds of batteries.
Note2: Setting the battery capacity of the switching power supply is the sum of all battery capacity.

Note3: If the switching power supply has two battery ports, the capacity of each battery port is half of the total capacity.

Note4: The working parameters of each battery port should be set strictly according to the requirements of lead-acid and lithium battery packs, and the battery manual can be seen in detail.

Note5: If you need to select lithium batteries for priority discharge, please go back to section 3.4.4. After entering the menu, follow the prompts in the management option.