

# RM30110A Rectifier Manual

Revision 1.0



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# 1 Principles of Operation


## 1.1 Introduction


The RM30110A is a telecommunications grade rectifier with the following features:

- Hot pluggable
- Forced Air Cooled
- Thermally Protected
- Power Factor Corrected
- Wide input AC Voltage
- Constant Power Output Limit
- Input/Output Voltage and Current Protected
- Active Load Sharing
- Serial alarm and control interface
- Microprocessor controlled

## 1.2 Indicators

There are 3 LED indicators on the front panel indicate the operational state of the rectifier.

: This green LED indicates that mains power is connected to the unit and that the primary stages of the rectifier are operating.

: This yellow LED indicates a Non-Urgent alarm state within the rectifier. This could be caused by the following:

- Rectifier in output power/current limit
- Rectifier over temperature
- Fan failed
- Rectifier soft starting

: This red LED indicates an Urgent alarm state within the rectifier. This could be caused by the following:

- Rectifier Failed
- The AC input voltage is outside the operating range.
- Rectifier shut down due to output over voltage or over temperature.

### **1.3 Power and Current Limit**

The rectifier automatically limits its output as load demand reaches its maximum capacity.

### **1.4 Output Over-Voltage Shut Down**

The rectifier will automatically shutdown if the output voltage exceeds the preset value. The Over Voltage Shut Down point reduces by about 1V at full load to ensure the rectifier producing the Over Voltage Shut Down turns off first. The Over Voltage Shutdown voltage is preset in the factory but may be adjusted.

### **1.5 Input Over/Under Voltage Shut Down**

If the input voltage is outside the specified range, the rectifier may shut down until the voltage returns within the specified range.

### **1.6 Rectifier Soft Start and Inrush Current**

On start-up, the peak mains inrush current is limited to twice the maximum operating current. The output voltage and current will rise slowly from zero during start-up. This means that the AC input power slowly increases over a 2 second period, providing a gentle load characteristic for any standby generators.

### **1.7 Over Temperature Turn Down/Shutdown**

When the rectifier reaches its maximum operating temperature (internal), the rectifier will progressively reduce the output current to attempt to reduce the heat within the unit. In extreme circumstances, the rectifier internal temperature may continue to rise even with reduced output current. In this case the rectifier will totally shutdown and will restart when the internal temperature returns within limits.

The maximum ambient operating temperature range at full power is: -25 to 65 °C.

The rectifier will operate in ambient temperatures up to 65°C but the rectifier will de-rate its output power to keep internal temperatures within the allowable range.

### **1.8 Reverse Polarity Protection**

The rectifier has an internal reverse polarity protection fuse and crowbar diode fitted. These parts are not user serviceable, and the rectifier will require returning for servicing if incorrect polarity is applied to the output.

### **1.9 Active Load Share**

The rectifier will actively current share with other rectifiers in the same DC system. The rectifiers are interconnected through pin 12 of their connector. The hardware in each rectifier looks at this current share bus and adjusts its output current to align with other rectifiers. In addition to this control, the monitor can compare rectifier output currents and adjust individual rectifiers to achieve current share. The rectifier current share bus is generally used within one rack of rectifiers and the monitor control is used to make separate racks share with each other.

### **1.10 Fan Cooling**

The rectifier constantly monitors its internal temperature, ambient temperature and output current, then adjusts fan speed to ensure continued operation. This control of fan speed ensures that rectifier acoustic noise and dust accumulation are minimized.

If the fan fails and cannot be restarted then the current limit will further reduce to 25A. The rectifier will continue to operate as long as the internal temperature stays within allowable limits.

### **1.11 Serial Alarm and Control Interface**

The rectifier, when installed in an our company ARS-4 rectifier shelf, is controlled via the serial interface by the system monitor. The system monitor can set up control parameters and receive alarm information via this interface.

If this interface is disconnected or fails for some reason the rectifier will operate with the parameters last sent from the monitor. Current share will revert to the rectifier current share bus.

### 1.11.1 Voltage Control

The rectifier voltages are set by the system monitor via the serial communications bus. The rectifier voltage can be set to any value between 90V and 155V. The monitor operates in a number of modes that will affect the rectifier voltage setting.

#### Float Voltage Mode (AVC Off)

The monitor sets the float voltage to its target level at start up, and then resends this same level at regular intervals thereafter. The voltage control is open loop.

#### Float Voltage Mode (AVC On)

The monitor sets the system voltage to its target float voltage, then monitors the system voltage and adjusts rectifier voltages to maintain the system voltage at the desired float voltage.

#### Equalise Voltage Mode

The monitor sets the system voltage to an elevated level (e.g. 126V) for a fixed period, and then resets the system voltage to the float voltage setting.

#### Fast Charge Mode

The monitor sets the system voltage to an elevated level after a battery discharge. This keeps the rectifiers in current limit for a longer period, leading to a faster battery recharge. When the battery is recharge the monitor resets the system voltage to the float voltage level.

### 1.11.2 Rectifier Alarm states

The rectifier will report the following states to the monitor via the serial communications:

<b>AC Fail</b>	The AC supply is not present at the rectifier.
<b>Rectifier Fail</b>	The rectifier is not functioning. This could be due to high output voltage, AC failure or a fault with the rectifier internally.
<b>Over Temperature</b>	The internal temperature of the rectifier is too high and the rectifier has begun to limit its output to control this temperature.
<b>Fan Fail</b>	The fan has ceased to work.
<b>Current Limit</b>	The rectifier output has reached maximum and the output current is being limited.
<b>Shutdown</b>	The rectifier has been shutdown by the monitor. It will restart again in 5 minutes unless the shutdown instruction is repeated.
<b>EEPROM Fault</b>	The rectifier microprocessor has encountered an error while reading from EEPROM.
<b>Soft Start</b>	The rectifier has just turned on and is slowly increasing its output.

### 1.11.3 Rectifier Shutdown

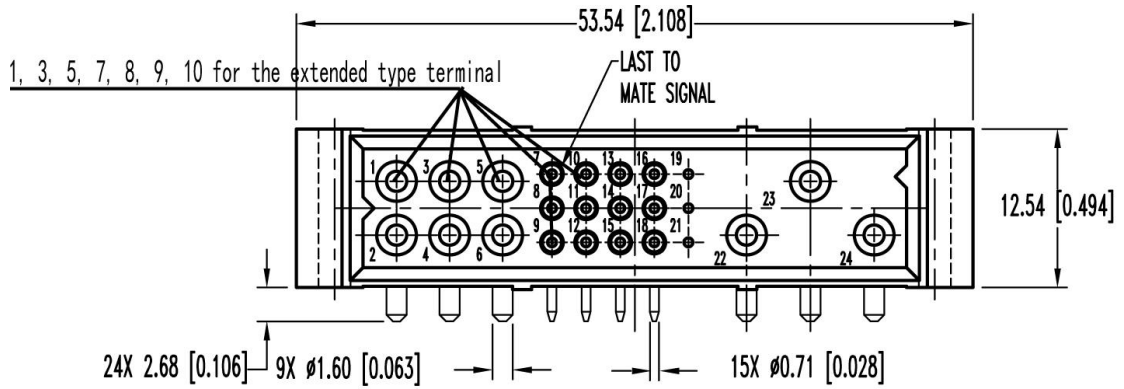
The rectifier can be remotely forced to shutdown, via the serial communications, by the system monitor and/or remote supervisory software. The rectifier will shut down for 5 minutes then restart. If a further shutdown signal is received by the rectifier before the 5 minutes is up, the timer will reset to 5 minutes. Hence, if a rectifier is to be kept shutdown a shutdown signal must be sent to it at regular intervals.

### 1.12 Post-mate Connection

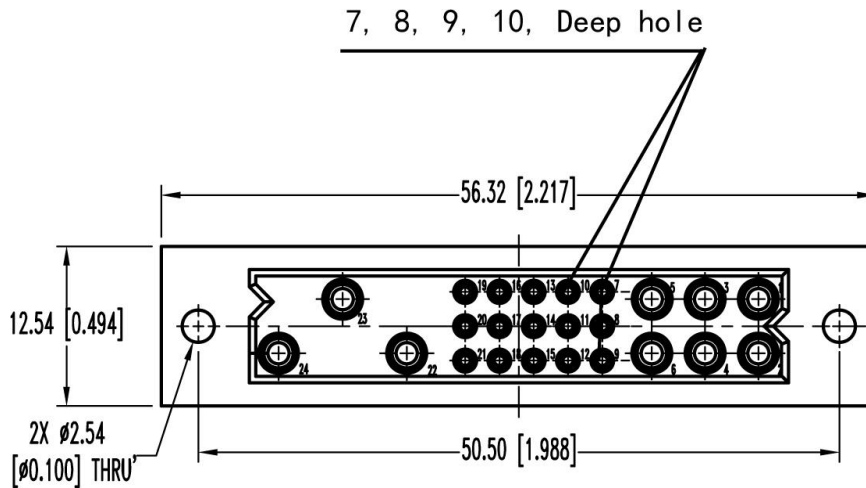
The rectifier is "hot plug" capable. This is achieved by having one pin on the rear connector that mates after the other pins. This pin must be connected to negative bus volts and the rectifier will not start until this pin engages. If a rectifier will not start, ensure the rectifier is fully engaged in the connector in the rectifier shelf.

### 1.13 Interface - Rear Connector

Definition for rectifier output pins as below:



Connector pin Layout (on the backplane)(view from rectifier plugging side):



#### Pin descriptions

Pin #	Function	Description
Pin 1,3,5	OUT-	Negative Output
Pin 2,4,6	OUT+	Positive Output
Pin 7,8,9	Hot pluggable	Hot pluggable +
Pin 10	GND	GND
Pin 11	12V	Not more than 100mA
Pin 12	SHARE-	Load Share-
Pin 13	5VGND	5V power supply to the RS485
Pin 14	ADDR1	Module address signals.
Pin 15	SHARE+	Load Share+
Pin 16	5V+	5V power supply to the RS485
Pin 17	RS485+	RS485+
Pin 18	RS485-	RS485-
Pin 19,20,21	NC	NC
Pin 22	PE	AC protective Earth
Pin 23	L	AC live (phase) conductor
Pin 24	N	AC neutral conductor

## 2 Installation

### 2.1 General Warnings

This rectifier contains no user serviceable components. Do not disassemble the rectifier.

To isolate the rectifier from the mains power, simply unplug from the rack or switch off at the distribution panel.

### **DANGER**

**Do not operate the rectifier if the covers are damaged or removed in any way**

- **The rectifier contains voltages that may be lethal even after the input supply has been removed**
- **The rectifier contains components at High Temperatures that may burn if touched**

### 2.2 Rectifier Shelf

The RM30110A rectifier must only be used in conjunction with an appropriate Rectronic designed or Rectronic approved system or rectifier shelf.

### 2.3 AC Supply Surge Protection

The AC supply that feeds the rectifiers should have surge protection installed to meet levels defined for terminal equipment. Rectronic recommend that IEC 62305-4(Protection against lightning - Part 4: Electrical and electronic systems within structures) be used to give guidance on the design of surge suppression systems.

### 2.4 Ventilation

The performance of the rectifier can be limited if the ventilation is restricted. The rectifier is cooled by drawing air into the front of the unit with a single fan. This air passes through the rectifier cooling the electronics and exiting the rectifier at the rear. To ensure this happens as efficiently as possible ensure the following:

- The air at the front of the rack is at ambient temperature and not being heated by other equipment.
- Ensure the rectifier shelf has at least 75mm clear horizontal space behind it. This space must be clear of cables and any other components that may restrict air movement.  
(Note: if multiple rectifier shelves are installed then there should be at least 75mm clear horizontal space **per shelf**.)
- The free space in the rack should continue vertically to the exhaust point at the top of the rack, without impediment.
- The hot exhaust air should not be allowed to re-circulate to the front of the rack as this will be drawn into the rectifiers again, in effect raising the apparent ambient temperature.

The rectifier should be operated in a low dust environment. If this cannot be guaranteed, then the rack should be fitted with air filters to prevent dust passing into the rectifier units. These filters need to be designed for adequate air volume and regularly maintained.

**Note:** If you are designing your own rectifier shelf, then particular care must be taken to ensure that any metalwork, cable or printed circuit boards are placed to maximise the flow of cooling air.

## 2.5 Rectifier Addressing

Each rectifier in the system has a unique address which identifies it to the monitor. This address is set by the position in the rectifier shelf and the number of the shelf. It is read by the rectifier from the backplane PCB and will change if the rectifier is moved to a new location. This address structure is set up when the system is built by the system manufacturer.

## 2.6 Commissioning the Rectifier

- 1) Ensure the polarity of the load and battery cables to the backplane is correct.
- 2) Plug the rectifier into the rectifier shelf using the following steps:
  - Locate the metal tag (at the bottom/rear of the rectifier) into the chosen slot in the backplane.
  - Engage the plastic front panel into the slot at the front of the rectifier shelf.
  - Push the rectifier into the rectifier shelf until the connector is fully engaged.
  - Lock the rectifier in position using the plastic retainers in the front panel.
- 3) Once the rectifier is installed into the rectifier shelf, the AC power can be turned on. After the initial start up period the rectifier will be set to the desired system parameters by the monitor module via the serial communications.



## 3 Specifications

*Due to ongoing product development specifications are subject to change without prior notice*

### 3.1 AC Input

Nominal	220V
Voltage Range	90 – 300V AC (reduced power below 175V)
Frequency Range	45 – 65Hz
Power Factor	> 0.99
Efficiency	93% (>50% output power)
Input Fuses	HRC Fuses in phase and neutral
Maximum Input Current	18.8A
Protection	
Input Voltage	Auto shutdown, auto restart when correct voltage restored.
Input Inrush	<1.5x maximum Input current

### 3.2 DC Output

Nominal	110V
Voltage Range	90-155V
Maximum Rated Power	3000W
Regulation	
Line	±0.1%
Load	±1.0% (no load to full load)
Hold-up time	>10ms for 20% output voltage drop
Start-up time	Start up delay 5 second. (varies with AC supply voltage) Walk-in delay 3 seconds at full output. (varies with DC output voltage)
Protection	
Current Limit	Adjustable to 50-100% of maximum rated current
Over Temperature	Automatic current turndown, backup shutdown protection
Polarity Reversal	Output fuse with crowbar diode
Over Voltage	Adjustable limit
Noise (under nominal conditions)	
Voice band	≤2mV rms psophometric
Wide band	3.4kHz-150kHz:<50mV rms unweighted 150kHz-30MHz:<20mV rms unweighted

Peak-Peak Voltage	<200mV P-P
Load Share	±5%

#### Isolation

Input to Output	3000V AC/1min/≤10mA
Input to Chassis	1500V AC/1min/≤10mA (VDR to chassis removed)
Output to Chassis	500V AC/1min/≤10mA

### 3.3 Environmental

#### Operating Ambient Temperature

Rated	25± 5 °C
Range	-25°C to 55°C
Extended range	55°C to 65°C automatically de-rates rectifier output
Storage Temperature	-45°C to 70°C
Humidity	5 – 95% RH (non-condensing)
Altitude	<2500m, de-rate maximum ambient temperature by 4 °C per 1000m above sea level

### 3.4 Mechanical

Dimensions (W, H, D)	156mm, 40mm, 270mm
Weight	2.5kg

### 3.5 Compliances

Safety	EN60950
Electrostatic Discharge	CISPR 24
Radiated Radio Frequency	CISPR 22
AC Harmonics	EN 61000-3-2
AC Flicker and Fluctuation	EN 61000-3-3

## 4 Servicing

If the rectifier develops an operational fault, or is damaged in any way, an Authorised Service Centre should service it immediately.

### 4.1 Warnings

**This rectifier contains no user serviceable components. Do not disassemble the rectifier.**

## DANGER

**Do not operate the rectifier if the covers are damaged or removed in any way.**

- **The rectifier contains voltages that may be lethal even after the input supply has been removed**
- **The rectifier contains components at High Temperatures that may cause burns if touched**

### 4.2 Troubleshooting

**If the red (•) LED is alight:**

- Unplug the rectifier and re-engage.
- Check AC power to the rectifier.
- Check for rectifier alarms in the monitor Urgent Alarm list.
- If symptoms persist, contact a service agent.

**If the yellow ⚠ LED is alight:**

- Check the monitor Non-Urgent Alarm list.

### 4.3 Fuses

Although there are fuses inside the rectifier, these are rated such that their failure indicates a fault requiring qualified service. **Do not attempt to repair these fuses.**

## 5 Warranty

Rectronic Ltd. warrants that this product is free from defects in material and workmanship and agrees to remedy any defect (or at its option replace the product) for a period of two year from the date of purchase. This warranty covers both parts and labour. Parts may be replaced under this warranty with new or remanufactured parts.

This warranty will not apply to any product that has been improperly installed (as described in the installation manual), misused, abused, used in ways the product was not designed, altered or repaired in any way which may affect the performance or reliability of operation, sustained damage by power surges or electrical storms, or sustained shipping damage, or repaired by any unauthorised repair centre.

Please contact Rectronic Customer Service to obtain a Returned Materials Authorisation (RMA) prior to shipping any products for repair. All shipments must be shipped prepaid and include proof of the date of your original purchase. Please include your name, address, phone number, email address and a brief description of the problem.

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