

48 Volt, 600 Watt Rectifier

Installation / Operation Manual

**Model:
RM648**

Newmar

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M-RM648
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1 Principles of Operation

1.1 Introduction

The RM848 and low power version RM648 are telecommunications grade rectifiers 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.

AC: 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

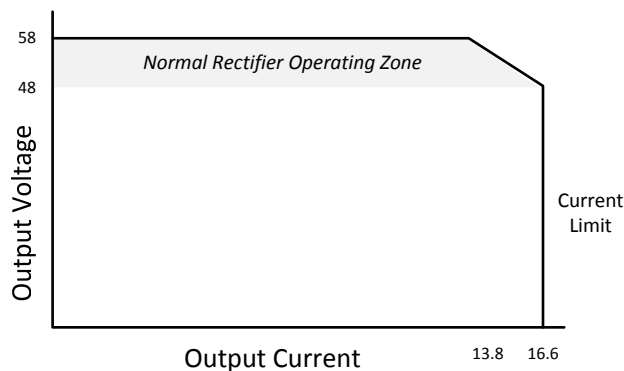
: This red LED indicates an Urgent alarm state within the rectifier. This could be caused by the following:

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

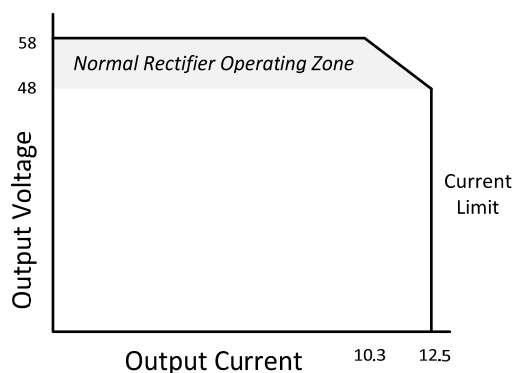
1.3 Power and Current Limit

The rectifier automatically limits its output as load demand reaches its maximum capacity. The figures below show the maximum operating envelope for the RM848 and for low power version RM648 rectifier.

Operating envelop for RM848



Operating envelop for RM648



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 0.5V 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: -10 to 50 °C.

The rectifier will operate in ambient temperatures up to 70°C but the rectifier will de-rate its output power to keep internal temperatures within the allowable range.

1.8 Reverse Polarity Protection

A crowbar diode is fitted to the back plane for protection in this state. If batteries are connected to the system with reverse polarity, the corresponding battery breaker will trip with no degradation to the rectifier system. The rectifier has no reverse polarity protection and relies on the protection provided by the backplane.

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 P108 of the backplane 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 or 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.

1.11 Serial Alarm and Control Interface

The rectifier, when installed in the 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 43V and 58V. 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. 56V) 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 recharged 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:

AC Fail	The AC supply is not present at the rectifier.
Rectifier Fail	The rectifier is not functioning. This could be due to high output voltage, AC failure or a fault with the rectifier internally.
Over Temperature	The internal temperature of the rectifier is too high and the rectifier has begun to limit its output to control this temperature.
Fan Fail	One or more of the fans has ceased to work.
Current Limit	The rectifier output has reached maximum and the output current is being limited.
Shutdown	The rectifier has been shutdown by the monitor. It will restart again in 5 minutes unless the shutdown instruction is repeated.

EEPROM Fault The rectifier microprocessor has encountered an error while reading from EEPROM.

Soft Start 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.

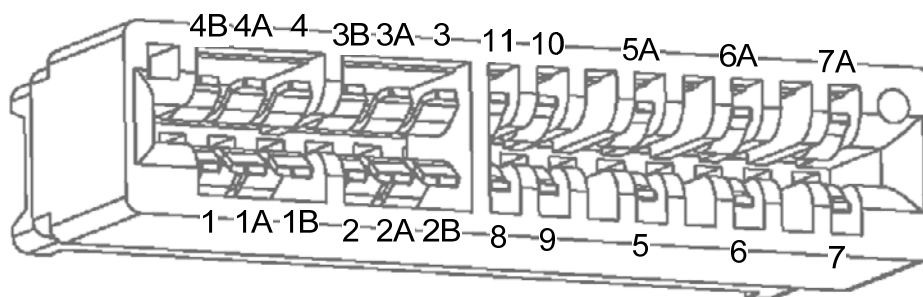
1.12 Post-mate Connection


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 Goldfish connector in the rectifier shelf.

1.13 Interface - Rear Connector

The rear connector on the rectifiers is a TYCO Card Edge Connector. (The part number for the backplane side is 2085089-1)

Pin descriptions



Pin #	Description
Pin 1,4	Positive Output
Pin 2,3	Negative Output
Pin 5	AC protective Earth 
Pin 6	AC neutral conductor N
Pin 7	AC live (phase) conductor P
Pin 8	Postmate
Pin 9	Rack Position
Pin 10	SBI Comms
Pin 11	Loadshare

Note: Unassigned pins should not be connected to anything and should be left isolated and voltage free.

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 RM848/RM648 rectifiers are designed to be used with the Sentinel Rectifier system.

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. Newmar recommends 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 1" (25mm) 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 systems are installed then there should be at least ¾" (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. To assist in this a drawing of the rear area of the rectifier, show air flow areas, has been included in appendix 5.

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 system are correct.
- 2) Plug the rectifier into the rectifier shelf using the following steps:
 - Locate the metal case into the chosen slot in the system.
 - Push the rectifier into the rectifier system until the connector is fully engaged. (audible click will be heard, RM848/RM648 uses an automatic locking catch)



- Rectifier removal is achieved by, pressing and holding the unlock button then gentle pulling on 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*

3.1 AC Input

Nominal	230V [110V for RM648]
Voltage Range	90 – 300V AC (reduced power below 175V for RM848) [reduced power below 100V for RM648]
Frequency Range	45 – 66Hz
Power Factor	> 0.99
Efficiency	> 91% (>45% output power) [>88% (>45% output power for RM648)]
Input Fuses	HRC Fuses in phase and neutral
Maximum Input Current	5.1A [6.7A for RM648]

Protection

Input Voltage	Automatic shutdown, restarts when correct voltage restored.
Input Inrush	< 2 times Maximum Input Current

3.2 DC Output

Nominal	48V
Rated Voltage	54V
Adjustable Voltage Range	43V – 58V
Maximum Rated Current	16.6A [12.5A for RM648]
Maximum Rated Power	0.8kW [0.6kW for RM648]
Regulation	
Line	±0.1%
Load	±0.5% no load to full load
Hold-up time	>15ms for 20% output voltage drop
Start-up time	Start-up delay 1 second. (varies with AC supply voltage) Walk-in delay 6 seconds at full output. (varies with DC output voltage)
Protection	
Power Limit	Adjustable to 50 – 100% of maximum rated current
Over Temperature	Automatic current turndown, backup shutdown protection
Polarity Reversal	Output Fuse with Crowbar diode in back plane
Over Voltage	Adjustable limit
Noise	
Ripple	Below 100Hz <1mV _{RMS} Unweighted
Voice band	100Hz to 5 kHz <2mV _{RMS} Psophometric
Wide band	5 kHz to 1MHz <5mV _{RMS} Unweighted
Peak to Peak	0 to 20MHz <50mV Peak to peak

Isolation

Input to output	4000V DC
Input to Chassis	3500V DC (VDR to chassis removed)
Output to Chassis	2100V DC

3.3 Environmental

Operating Ambient Temperature

Rated	25± 5 °C
Range	-10°C to 50°C

Humidity 5 – 95% RH (non-condensing)

Altitude <2500m above sea level
De-rate maximum ambient temperature
by 4°C per 1000m above sea level.

3.4 Mechanical

Dimensions (W, H, D) 2.2" (55mm), 1.73" (44; 1U), 10.25" (260mm) overall, 9.65" (245mm shelf)
Weight 1.4 lbs. (635g)

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
Other	CE & RoHS compliant

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

* Note: The specifications cover both rectifiers RM848 and low power version RM648, where specifications differ between rectifiers, the RM648 rectifier specifications are specified in the parenthesis i.e. [].

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.**

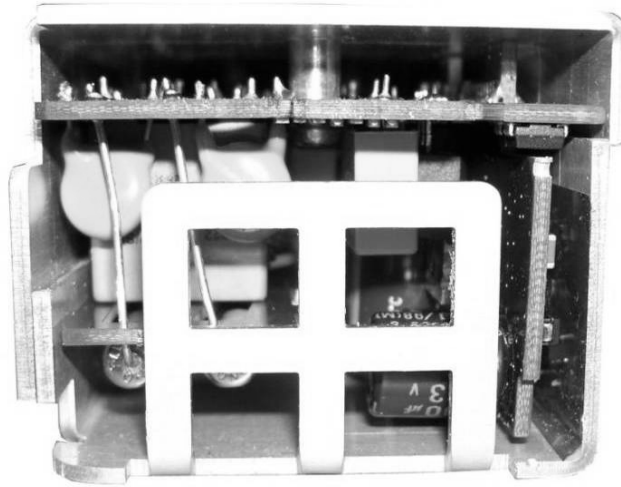
However for IEC 60950 the fuse ratings are required to be specified. The following fuses are soldered to the PCB:

FH100 10A 250V ceramic slow blow wire end Fuse

FH101 10A 250V ceramic slow blow wire end Fuse

5 Ventilation Details

Rear view of rectifiers, the RM848/RM648 is designed for fitting into a Sentinel Rectifier systems. These systems allow for the flow path of the exit air form the rectifier.



6 Warranty and Factory Contact Information

Newmar warrants that Sentinel Rectifier System be free from defects in material and workmanship for two years from date of purchase. If a problem with your Sentinel Rectifier System, or if you have any questions about the installation and proper operation of the unit, please contact NEWMAR's Technical Services Department:

Phone: 714-751-0488 - From the hours of 7:30 a.m. to 5:00 p.m. weekdays, P.S.T.

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E-mail: techservice@newmarpower.com