



## RT4F-48V/50A-WAC RECTIFIER

The RT4F-48V/50A-WAC is a switched mode rectifier (SMR) module designed to provide up to 58A of output current into a 48V nominal system, over a wide range of AC input voltage. This rectifier has been designed to be used in conjunction with a battery to provide an uninterruptable DC power system. The low noise and high reliability make it ideally suited to telecommunications applications. Up to five rectifiers can fit in a single magazine and up to fifteen rectifiers can be configured as a system using one control and supervisory unit (MiniCSU). The system can be monitored and controlled remotely using WinCSU software and modem communications.

Illustrated are five rectifiers in a magazine.



Operating characteristics of the RT4F-48V/50A-WAC SMR at 25°C ambient, 220VAC unless otherwise stated:

### Input

#### Voltage:

Single phase: Active, Neutral and Earth  
Rated voltage: 220VAC;  
Rated voltage tolerance: 150 – 275VAC;  
Extended low voltage range: 90 – 150VAC;  
(With power limit increasing from 50% to 100%)  
Extended high voltage range: 275 – 290VAC;  
Must start voltage: 90VAC;  
Fully protected up to 440VAC;

#### Current:

21A RMS max at 150VAC;  
14A RMS at 220 VAC;

#### Frequency:

45 - 66Hz;

#### Power Factor:

> 0.98 at 40% - 100% load;

#### Harmonic Distortion:

Current THD < 5% at full load when operated with  
mains voltage THD < 1%;

#### Efficiency:

Better than 90% at > 50% load at 220VAC;

#### Inrush Current:

< 8A peak at nominal mains voltage;

#### Soft Start:

Ramp-up time 8 seconds to full load;

#### Protection:

HRC input fuse with fuse option for both lines;  
Overvoltage shutdown at approx. 300VAC;  
Undervoltage shutdown at approx. 85VAC;  
Input soft start – can be connected to live AC bus;  
Indefinite survival at 440VAC (for accidental phase  
to phase connection or neutral loss);

#### Voltage Withstand Test:

1500VAC input to chassis for 1 minute;  
(2200VDC 100% testing on production units);

#### Conversion Frequency:

140kHz for input stage;  
180kHz for output stage;





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## Output

### Voltage:

Float: 48 - 58V  
 Equalise: 50 - 59.9V

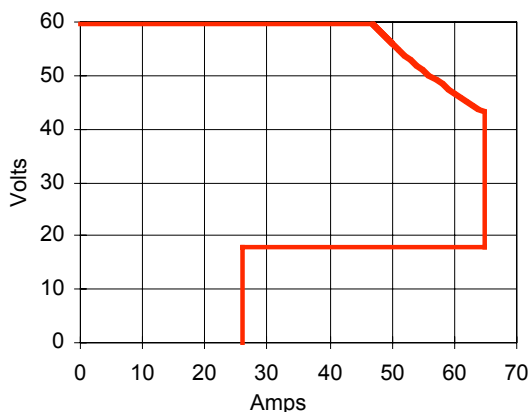
### Current Limit:

Range 5 - 65A

### Power Limit:

Current limit is automatically reduced in inverse proportion to output voltage above 48VDC to limit output power to 2800 watts;

Max. current limit : 65A\* at 43V  
 50A at 56V  
 47A at 59.5V



\*65A current limit automatically reduces by 0.4A/°C for heatsink temperatures above 75°C.

### Static Regulation:

Line: better than  $\pm 0.02\%$ ;

Load: terminal voltage drops by  $0.42V \pm 0.03V$  from zero to full load (for passive current sharing) for stand

alone units, or regulates to better than  $\pm 0.05\%$  for MiniCSU controlled units;

### Dynamic Regulation:

$\pm 5\%$  for 10% to 90% to 10% step load change;  
 $\pm 1\%$  of final value within 1ms of step change;  
 $\pm 0.1\%$  for a 25% step change in AC input voltage;

### Noise:

< 2mV RMS Psophometrically weighted;  
 < 10mV RMS (10kHz - 100MHz);  
 < 100mV peak to peak (10kHz - 100MHz);

### Load Sharing:

Better than  $\pm 5\%$  of full scale with active current sharing from MiniCSU;

### Protection:

Fuse at output of SMR protects against reverse polarity connection and protects DC bus when internal components fail;

Relay in output circuit prevents surges when connection is made to a live DC bus;

*Overvoltage* - only faulty unit shuts down;

*Overcurrent* - can sustain short circuit at output terminals indefinitely. Output current folds back when output voltage drops below 18V to less than 26A;

*Over-temperature* - gradual reduction of power limit if heatsink temperature exceeds pre-set limit; current limited to 40% of full scale when cooling air flow inadequate;

### Voltage Withstand Test:

1000VAC output to chassis for 1 minute;  
 (1500VDC 100% testing on production units);

## Remote Controls (from MiniCSU)

### Programmable parameters - Battery menu:

- Float Voltage
- Equalise Voltage

### Programmable parameters - SMR menu:

- Current Limit
- High Voltage Alarm level
- Low Voltage Alarm level
- High Voltage Shut-Down level (HVSD)
- HVSD Reset

### Equalise mode:

The SMR will automatically enter and exit equalise mode at user specified conditions, or can be manually

initiated. Under any fault condition the SMR will default to the float value.

### External Digital Voltage Control (EDVC):

The SMR Float and Equalise voltages are digitally controlled over a limited range to achieve active current sharing between parallel connected SMRs, for temperature compensation, voltage drop in the DC bus, and to limit the maximum battery recharging current.

## Remote Controls (continued):





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## Rectifier Inhibit:

Rectifiers can be inhibited by a signal from a remote WinCSU terminal, transmitted via the MiniCSU;

## Test Function:

When the test function is activated on the MiniCSU the rectifier LEDs are flashed.

## Alarms and Monitoring

### Front Panel LED condition table:

Green	Yellow	Red	Condition
0	0	0	Primary power bad
1	0	0	Normal
1	F*	0	Alarm
1	1	0	Equalise
0	F*	1	Shutdown
0	0	1	µP fault

Note: F\* indicates flashing LED.

**Primary power bad:** Indicates that the input AC is off, too low or too high, or that the primary circuit is faulty;

**Normal:** Status is normal;

**Alarm:** See Alarm table;

**Equalise:** SMR is in equalise mode;

**Shutdown:** SMR is shut down by remote control, or there is an internal fault in the SMR, such as control loop out of limit or temperature sensor faulty;

**µP fault:** Internal micro-controller is faulty.

### SMR status monitoring:

MiniCSU and WinCSU monitor status of the SMR:

- Output current;
- Heatsink temperature;
- Software version;

### Current:

Monitored on MiniCSU and WinCSU with 1A resolution; Analog measurement accuracy ± 1% at full load; Optional bar-graph display on rectifier;

### Voltage:

System voltage normally displayed on MiniCSU alpha-numeric LCD display. Accuracy ± 0.5%

### SMR address:

The SMR address is automatically set by a resistor on the magazine.

### SMR alarm monitoring:

The Alarm table shows alarm conditions that are monitored by the SMR and are displayed on both MiniCSU and WinCSU. The mnemonics listed here appear on WinCSU, but full alarm description appears on MiniCSU.

### Alarm table:

Vh *	Output voltage too high
VI *	Output voltage too low
II *	Unit is in current limit
Po *	Unit is in power limit
Th *	Heatsink temperature high and thermal limit is active
Nd *	No demand (output terminal voltage higher than internal regulation value)
Lo *	Load current low (less than 0.9A)
Ma *	Operating parameters out of allowable range (or eeprom fault)
Sd	Unit is shut down by remote command - user shutdown
Mr	Internal voltage reference faulty
Mc	SMR communication fault. (Generated within MiniCSU)
Vs	High voltage shut down (output), latched alarm. User setting or fault
Unit Off	Unit is shut down due to AC out of range or SMR primary circuit fault. (normal operation or fault)
Ts	Temperature sensor fault
Dc	DC-DC feedback fault, latched alarm
Ff	Fan failure or inadequate air flow

Note: \* indicates flashing of alarm led on SMR.





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## Compliances

**Safety:** IEC60950:1999; EN60950; AS/NZS 60950:2000; (European group difference)

**EMC Generic Emissions:** EN50081-2

**EMC Generic Immunity:** EN50082-1

## EMC Test Levels

**Emissions:** (\* indicates that the standard is equivalent to first standard named in the section)

Category:	Tested to comply with:	
Harmonics	IEC 61000-3-2; EN61000-3-2*; AS/NZS 61000-3-2*:	Class A
Conducted RF	AC Terminals: CISPR 22; EN55022*; AS/NZS 3548*: DC Terminals: CISPR 14; EN55014*; AS/NZS 1044*.	Class B
Radiated RF	CISPR 22; EN55022*; AS/NZS 3548*:	Class B

## Immunity

Category:	Tested to comply with:	
Electrostatic Discharge (ESD)	IEC 61000-4-2; EN61000-4-2*: (Level 4: Air 15kV, Contact 8kV)	Criterion A
Radiated RF	IEC 61000-4-3; EN61000-4-3*: (Level 4: 10V/m, 1kHz 80% AM)  ENV50204 - GSM Radiation (Mobile Phone) (Level 4: 10V/m, 100% AM, 50% duty)	Criterion A  Criterion A
Electrical Fast Transient (EFT)	IEC 61000-4-4; EN61000-4-4*: (Level 4: 4kV on AC lines) (Level 3: 1kV on load lines)	Criterion A Criterion A
Surge Protection	ANSI C62.41-1991 category B3 - AC lines (Combination Wave 6kV/3kA; Ring Wave 6kV/500A)  IEC 61000-4-5; EN61000-4-5* (Impulse) (Level X: 6kV/3kA Common Mode [CM] on AC lines) (Level X: 6kV/3kA Differential Mode [DM] on AC lines) (Level 1: 0.5kV/0.25kA CM & DM on DC lines)  IEC 61000-4-12; EN61000-4-12* (Ring Wave) (Level X: 6kV/500A, 100kHz CM & DM on AC lines) (Level 3: 2kV CM, 1kV DM on DC lines)	Criterion A Criterion B Criterion A  Criterion A Criterion A
Conducted RF	IEC 61000-4-6; EN61000-4-6*: (Level 3: 10V on AC, load and comms lines)	Criterion A
Voltage Dip, Interruptions	IEC 61000-4-11; EN61000-4-11*: (Level: 30% dip for 10ms) (Level: 60% dip for 100ms) (Level: 100% dropout for 5s)	Criterion A Criterion B Criterion B





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### Environmental

#### Cooling:

Forced convection cooling using 80mm fan with variable speed temperature control, finger guard and filter. Fan stops if AC power fails or rectifier inhibited remotely. The fan is mounted externally to the rectifier in the magazine;

#### Temperature:

Operating range\*: -25°C to +50°C  
Storage and Transportation: -40°C to +70°C

\*Adequate cooling required to obtain full power range. 65A current limit automatically reduces by 0.4A/°C for heatsink temperatures above 75°C

The rectifier senses its internal heat-sink temperature and, if necessary, adjusts power limit in order to protect itself against over-heating;

#### Humidity:

0 to 90% non-condensing;

#### Altitude:

Operational to 3000m.(Consult factory above 3km)  
Derate maximum ambient temperature by 5°C per 1000m above sea level.

#### Vibration:

*Operational:* 0.075mm displacement 5-33Hz, vertical direction.

*Transport:* 9.8m/s<sup>2</sup> acceleration 5-30Hz, vertical direction.

#### Drop test:

*Transport:* 65cm drop when packaged

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### Mechanical

#### Size:

Width: 87mm  
Height: 266 mm (6U)  
Depth: 320 mm  
Mass: < 6kg

#### Magazine size:

The RTMag4F-5way magazine allows 5 rectifiers to fit side by side in a standard 19 inch rack and one row of rectifiers in every 10U of rack height. The magazine fits a rack 400 mm or greater in depth.

#### Acoustic Noise:

< 55dB ( A Weighted)

### Connections

#### Input, Output, Fan, and Communications:

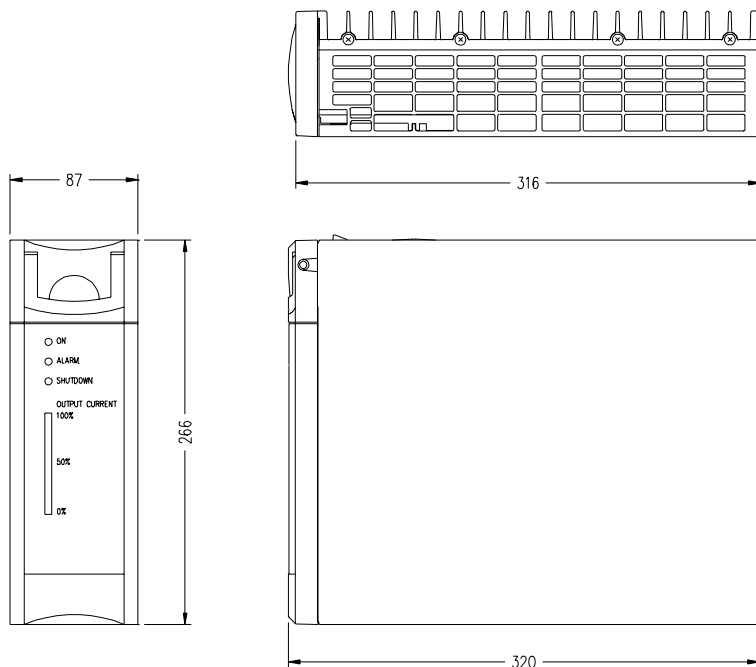
A multi-purpose connector is mounted on the back of the rectifier module; a matching connector is located at the back of the magazine; mating of connectors occurs when unit is plugged into the magazine; the rectifier is mechanically latched to ensure reliable mating.





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## RT4F Rectifier dimensions:



## RT4F Magazine dimensions:

