

RT7-48V/6kW

Specification



The RT7-48V/6kW is a 3 phase, active power factor corrected, switched mode rectifier (SMR) module designed to provide up to 6kW of output power (100A nominal) into a 48V nominal system. This rectifier is primarily used in conjunction with a battery to provide an uninterruptible DC power system for telecommunications applications. Up to 20 rectifiers can fit in a rack and up to 225 rectifiers can be configured as a system using one control and supervisory unit (CSU). The system can be monitored and controlled remotely using WinCSU software (see CSU specification for more details).

Illustrated is a single rectifier module.

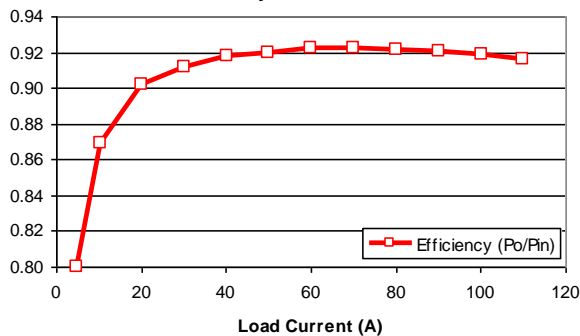


Operating characteristics of the RT7-48V/6KW at 25°C ambient, 400VAC, 50Hz unless otherwise stated:

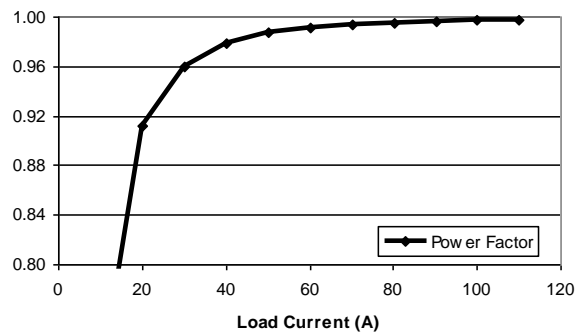
Input

Voltage	Three phase, three wire and Earth 400 +32/-20% VAC (320VAC - 530VAC) Phase to phase delta connection; Tolerable phase imbalance 10% (Measured L-L as defined by IEEE/IEC) Voltage withstand 575VAC line-line indefinitely
Current	13A RMS max line current at 320VAC; 10A RMS line current at 400 VAC; Sinusoidal waveform;
Frequency	45 - 66Hz;
Phase Rotation	Insensitive to Phase Rotation
Harmonic Distortion	Current THD < 5% typically at full output power when operated with mains voltage THD < 2%; ($\pm 1\%$ phase imbalance)
Inrush Current	< 16A peak at nominal mains voltage;
Soft Start	Output current ramp-up time 7 seconds to 100A;
Protection	HRC fuses at input of SMR; power circuit is turned off if the AC voltage exceeds ~535VAC or falls to less than ~315VAC; unit re-activates when AC voltage is within approximately 340 – 510 VAC; input inrush limiting circuit prevents high surge currents when connecting to a live AC bus;
Voltage Withstand Test	1500VAC input to chassis for 1 minute; (2200VDC 100% testing on production units);
Efficiency	Typically >91% at > 40% output power;
Power Factor	> 0.98 for >50% output power; > 0.99 for 100% output power;

Efficiency vs Load at 54V



Power Factor vs Load at 54V



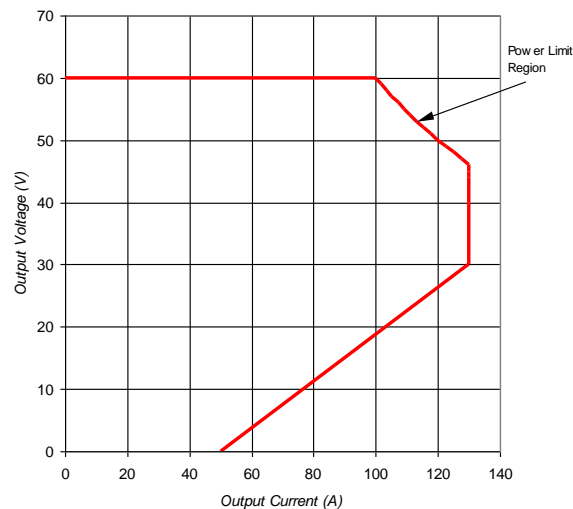
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Output

Voltage	Float: 43.0 – 58.0V Equalise: 50.0 – 59.5V
Current Limit	Range: 10 - 130A
Power Limit	Current limit is automatically reduced in inverse proportion to output voltage above 46VDC to limit output power to 6 kW (min); Max. current: <ul style="list-style-type: none">• 125A at 48.0V• 110A at 54.0V• 101A at 59.5V
Voltage Withstand Test	1000VAC output to chassis for 1 minute; (1500VDC 100% testing on production units);
Conversion Frequency	>20kHz;
Static Regulation	<i>Line:</i> better than $\pm 0.05\%$; <i>Load:</i> terminal voltage drops by $0.42V \pm 0.03V$ from zero to 100A load (for passive current sharing) for stand-alone units, or regulates to better than $\pm 0.05\%$ for CSU controlled units;
Dynamic Regulation	$\pm 2\%$ for 10A to 90A to 10A step load change; $\pm 1\%$ of final value within 4ms of step change; $\pm 1\%$ 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 CSU;
Protection	Fuse at output of SMR; Soft start circuit prevents surges when connection is made to a live DC bus; <i>Overvoltage</i> - only faulty unit shuts down; <i>Overcurrent</i> - can sustain short circuit at output terminals indefinitely. Output current starts folding back when output voltage drops below 30V to less than 50A at zero terminal voltage; <i>Over-temperature</i> - gradual reduction of power limit if heatsink temperature exceeds pre-set limit;



*130A current limit automatically reduces by 1A/°C for heatsink temperatures above 60°C.

Remote Controls

Equalise Mode	Equalise mode is initiated by a signal from the CSU. In case of loss of communication with the controller the SMR will default to the Float mode.
Rectifier Inhibit	Rectifiers can be inhibited by a signal from a remote WinCSU terminal, transmitted via the CSU;
External Digital Voltage Control (EDVC)	The CSU uses the optically isolated communications lines to digitally control rectifier Float and Equalise voltages over a limited voltage range in order to adjust battery voltage for temperature and voltage drop in DC bus, limit the maximum battery recharging current and to achieve active current sharing;

SMR Parameters Programmed by CSU

In the SMR menu on the CSU	<ul style="list-style-type: none"> • Current Limit • High Voltage Shut-Down (HVSD) • High Voltage Alarm • Low Voltage Alarm • Latched Fault Reset
In the Battery menu on the CSU	<ul style="list-style-type: none"> • Float Voltage • Equalise Voltage
Test Function (when activated on CSU)	Test function causes all rectifier LEDs to flash.

Alarms and Monitoring

SMR Status Monitoring	CSU and WinCSU monitor status of the SMR: <ul style="list-style-type: none"> • Output current of SMR; • Temperature of heatsink of SMR; • SMR alarms;
Current	Monitored on CSU and WinCSU with 1A resolution; Analogue measurement accuracy $\pm 1\%$ at full load; Optional bar-graph display on rectifier;
Voltage	System voltage normally displayed on CSU alphanumeric display. Accuracy $\pm 0.5\%$
SMR address	The SMR address is automatically set by resistors in the magazine

Front Panel LED condition table

Green	Yellow	Red	Condition	
Off	Off	Off	No AC power	No AC Power available to SMR
Blink	Off	Off	Primary power bad	Indicates the input AC is too low or too high, or the primary circuit is faulty
ON	Off	Off	Normal	Status is normal
ON	Flash	Off	Alarm	See Alarm table
ON	ON	Off	Equalise	SMR is in equalise mode
Off	Flash	ON	Shutdown	SMR is shut down by remote control, or due to environmental conditions, or there is an internal control circuit fault
Off	Off	ON	Microcontroller fault	

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

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
Lo	Low output current (less than 1A)
Ma	Operating parameters out of range (or EEPROM fault)
No Response	SMR communication fault. Generated within CSU
Sd *	Unit is shut down by remote command - user shutdown
Mr *	Internal voltage reference faulty
Vs *	High voltage shut down (output), latched alarm. User setting or fault
Unit Off *	Unit is shut down due to AC out of range (normal operation) or SMR primary circuit fault.
NC *	SMR incorrectly inserted into the magazine
Ff *	Fan failure
TI **	Low temperature (below -25°C)
Oh *	Overheat (heatsink temp. > 95°C)
Ts *	Temperature sensor fault
Rs *	Resonance on primary converter
Dc *	DC-DC converter feedback fault, latched alarm

Notes: * indicates unit shut-down,

** shut-down below -28 °C

Compliances

Safety	Designed to IEC60950; AS/NZS 60950; (with European group difference); UL60950
EMC Emissions and Immunity	ETSI EN300 386 V1.3.1(2001-09)
Environmental	ETSI EN 300 019

EMC Test Levels

Emissions:		
Harmonics	IEC 61000-3-2	Class A
Flicker	IEC 61000-3-3	
Conducted RF	AC Terminals: CISPR 22; DC Terminals: CISPR 22	Class B Class A
Radiated RF	CISPR 22; EN55022*; AS/NZS 3548*:	Class B

Immunity:		
Electrostatic Discharge (ESD)	IEC 61000-4-2 (Level 4: Air 15kV, Contact 8kV)	Criterion A
Radiated RF	IEC 61000-4-3 (Level 4: 10V/m, 1kHz 80% AM) ENV50204 - GSM Radiation (Mobile Phone) (Level 4: 10V/m, 100% AM, 50% duty)	Criterion A Criterion A

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Electrical Fast Transient (EFT)	IEC 61000-4-4 (Level 4: 4kV on AC lines) (Level 3: 2kV on load and 1kV on comms 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 (Impulse) (Level X: 6kV/3kA Common Mode [CM] on AC lines) (Level X: 6kV/3kA Differential Mode [DM] on AC lines) (Level 3: 2kV CM, 1kV DM on DC lines) IEC 61000-4-12 (Ring Wave) (Level X: 6kV/500A, 100kHz CM & DM on AC lines) (Level 3: 2kV CM, 1kV DM on DC lines)	Criterion B Criterion B Criterion A Criterion A Criterion A
Conducted RF	IEC 61000-4-6 (Level 3: 10V on AC, load and comms lines)	Criterion A
Voltage Dip, Interruptions	IEC 61000-4-11 (Level: 100% dip for 10ms) (Level: 30% dip for 500ms) (Level: 60% dip for 1000ms) (Level: 100% dropout for 5s)	Criterion B Criterion B Criterion B Criterion B

Environmental

Environmental Class (EN 300 019)	<i>Operational:</i> Class 3.3 (Stationary Use at Non-Temperature-Controlled Locations) <i>Transport:</i> Class 2.3 (Public Transportation) <i>Storage:</i> Class 1.2 (Weather Protected Non-Temperature-Controlled Locations)	
Cooling	Forced convection cooling using 80mm fans with variable speed temperature control and finger guards. Fans stop if AC power fails or rectifier inhibited remotely;	
Temperature	Operating range: -25°C to +70°C Full power range: -25°C to +50°C Derated operation: 50% power at +70°C Storage: -25°C to +60°C Transport: -40°C to +70°C The rectifier senses its internal heat-sink temperature and, if necessary, adjusts power limit in order to protect itself against over-heating;	
Humidity	<i>Class 3.3:</i> 0 to 100% RH condensing including dripping water and icing conditions	
Altitude	Operational to 4000m.(Consult factory above 4km) Derate maximum ambient temperature by 5°C per 1000m above sea level.	
Vibration	<i>Operational:</i> 1.5mm displacement 2-9Hz, 5m/s ² acceleration 9-200Hz, Continuous, in any direction. <i>Transport(packaged):</i> 3.5mm displacement 2-9Hz, 10m/s ² acceleration 9-200Hz, 15m/s ² acceleration 200-500Hz, One hour, in any direction.	
Shocks	<i>Operational:</i> 40m/s ² half sine, 11ms duration, Any direction <i>Transport(packaged):</i> 180m/s ² half sine, 6ms duration, Any direction	
Drop Test	<i>Transport:</i> 0.8m drop when packaged	

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Mechanical

Dimensions	Width: 441mm (17.35") Height: 86mm (2U) (3.40") Depth: 458mm (18.03")
Mass	< 19kg (42 lb)
Acoustic Noise	< 55dB (A Weighted)
Magazine size	The RT7-48V/6kW magazine is installed in a standard 600mm (23.6") deep 19-inch rack and takes up 2U of height. No additional clearance needs to be left at the top and bottom of the rack.

Connections

Input, Output, and Communications:

Connectors are mounted on the back of the rectifier module; with matching connectors located at the back of the magazine; mating of connectors occurs when unit is plugged into the magazine; the rectifier is mechanically secured to ensure reliable mating.

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RT7-48V/6kW Dimensions

