RA Range
AC/DC Rectifier and Chassis Power Supplies
1.2kW to 52.5kW

DS RA Range Rev. 5 September 2008

Description

The RA Range of high efficiency 1U AC/DC modules and AC/DC 19" rack systems offer output power from 1.2kW to 52.5kW incorporating digital control and I^2C interface features.
The RA Range can be purchased in shelf, rack, and custom cabinet configurations. Typical applications for products from the RA Range include servers, information technology equipment, networking, telecommunications, media & entertainment devices and a wide spectrum of industrial applications using distributed power architecture.
With power densities up to 21W/in^3, the RA Range enables increased functionality in a confined space, whilst offering the reliability and quality that customers have come to expect from ROAL.
The basic module is a 1Ux2U hot-pluggable single output AC/DC power supply offering 12V at 96A. A second module outputs 48V at 30A. Both modules can be used as stand-alone devices, or can be plugged into a standard 1U 19" rack.

Special Features

- 1U x 2U Form Factor
- Wide Input Voltage Range
- 1500 Watt Output Power
- Up to 21W/In^3 Power Density
- Auto select power limits depending on the input voltage
- Efficiency (Typ) >90%
- Up to 7500W in 1U x 19" Power Rack (Full Maximum Power)
- Suitable for 3 phase input
- Up to 6000W in 1U x 19" Power Rack (4+1 Redundant)
- Output Voltage Digital Adjustment
- No Minimum Load required
- Stand-by Output Voltage 12V@300mA (RAM accessible only)
- I²C Serial Communication System
- PMBus Communication Protocol
- Hot Plug Capability
- N+1 Redundancy
- Active Current Sharing
- Internal ORing FETs
- LED's logic status indicators
- Variable speed fan control
- Remote sense on main output
- Active Multiphase Power Factor Corrector with Digital Control (Patent No. US 6,975,524, Dec.13, 2005)
- RoHS 6 Compliant (Directive 2002/95/EC)

Applications

48 V or 12V Distributed Power Architectures
Power Over Ethernet (IEEE802.3af compliant)
Media & Entertainment
ITC Equipment
Servers
Telecommunication

Standard Models

Model	Output Voltage	Output Current	Output Power	Configuration	Number of Modules
RAM1K2-US12	12V	96A	1.2kW	Hot Plug 1U Module	1
RAR1K2-US12	12V	96A	1.2kW	Chassis 1U x 19"	1
RAR2K4-US12	12V	192A	2.4kW	Chassis 1U x 19"	2
RAR3K6-US12	12V	288A	3.6kW	Chassis 1U x 19"	3
RAR4K8-US12	12V	384A	4.8kW	Chassis 1U x 19"	4
RAR6K0-US12	12V	480A	6.0kW	Chassis 1U x 19"	5
RAM1K5-US48	48V	30A	1.5kW	Hot Plug 1U Module	1
RAR1K5-US48	48V	30A	1.5kW	Chassis 1U x 19"	1
RAR3K0-US48	48V	60A	3.0kW	Chassis 1U x 19"	2
RAR4K5-US48	48V	90A	4.5kW	Chassis 1U x 19"	3
RAR6K0-US48	48V	120A	6.0kW	Chassis 1U x 19"	4
RAR7K5-US48	48V	150A	7.5kW	Chassis 1U x 19"	5

Input Specifications

Specification	Condition	Min	Nom	Max	Units
Operating Voltage Range	Full Output Power Rating Power derating	180 90	230 115	264 140	Vac Vac
Turn-on Input Voltage				85	Vac
Turn-off Input Voltage	Shutdown if input voltage < 75Vac for more than 1 sec	75			Vac
Input Frequency		47		63	Hz
Inrush current limitation	25°C, for all line conditions, (single RAM module)			40	A
Input Current	90Vac, Vout=51V, Load=14.7A 180Vac, Vout=51V, Load=29.4A			10.5 10.1	A A
Power Factor	All line conditions 50% to 100% Load		0.97		
Input Leakage Current	264Vac, 60Hz			3.5	mA
Hold-up Time	Full Load in 1+1 configuration	20			ms
Input Protection	Time delay Internal fuse		16		A

Output Specifications for 48V Module RAM1K5-US48

Specification	Condition	Min	Nom	Max	Units
Output Voltage Adjustment		46	51	56	Vdc
Output Voltage Set Point			51		Vdc
Voltage Regulation	AC Line, load, temperature	-1		+1	%
Output Power – Single RAM module	115Vac 230Vac			750 1500	W W
Output Current – Single RAM module	115Vac 230Vac	0 0		15 30	A A
Efficiency	110 Vac, Vout=51V, Load=14.7A 230 Vac, Vout=51V, Load=29.4A		88 90.5		%
Load Sharing	Difference between two units at full load			10	%
Dynamic response	10% to 90 % max load variation, 1A/µs			3	%
Ripple & Noise (pk-pk)	20 MHz Bandwidth with 100nF and 1uF ceramic capacitors on the measure point			1	%
Remote sense	Line drop compensation			0.5	V
OVP	Hiccup with automatic recovery up to 5 cycles, then shutdown	59.5		63.5	Vdc
Output Over Current (OCP)	% of maximum output current All the conditions with automatic recovery up to 5 cycles, then permanent shutdown.	107		130	%
OCP Timing	Vout > 29.8 Vdc steady On 14.8Vdc < Vout < 29.8Vdc Vout < 14.8Vdc		10 3		s s
Output Short Circuit	% of maximum output current 3 sec delayed shutdown with automatic recovery up to 5 cycles, then permanent shutdown.	107		130	%
Auxiliary Output Voltage	12V Aux Output	11.4	12.0	12.6	V

Output Specifications for 12V Module RAM1K2-US12

Specification	Condition	Min	Nom	Max	Units
Output Voltage Adjustment Range		11	12.5	13	Vdc
Output Voltage Set Point			12.5		Vdc
Voltage Regulation	AC Line, load, temperature	-1		+1	%
Output Power – Single RAM module	115Vac 230Vac			700 1200	W W
Output Current – Single RAM module	115Vac 230Vac	0 0		56 96	A A
Efficiency	110 Vac, Vout=12.5V, Load=56A 230 Vac, Vout=12.5V, Load=96A		87 88		%
Load Sharing	Difference between two units at full load			10	%
Dynamic response	10% to 90 % max load variation, 1A/µs			3	%
Ripple & Noise (pk-pk)	20 MHz Bandwidth with 100nF and 1uF ceramic capacitors on the measure point			1	%
Remote sense	Line drop compensation			0.5	V
OVP	Hiccup with automatic recovery up to 5 cycles, then shutdown	14		15	Vdc
Output Over Current (OCP)	% of maximum output current All the conditions with automatic recovery up to 5 cycles, then permanent shutdown.	107		130	%
OCP Timing	Vout > 7.0 Vdc steady On 3.5Vdc < Vout < 7.0Vdc Vout < 3.5Vdc		10 3		 s s
Output Short Circuit	% of maximum output current 3 sec delayed shutdown with automatic recovery up to 5 cycles, then permanent shutdown.	107		130	%
Auxiliary Output Voltage	12V Aux Output	11.4	12.0	12.6	V

Auxiliary 12V Output Specifications (Single RAM module)

Specification	Condition	Min	Nom	Max	Units
Stand-by output Voltage Range		11.4	12.0	12.6	V
Stand-by output Current		0		300	mA
Over Current Protection	Stand-by condition	0.7		1.1	A
Over Current Protection	Power on condition	0.5		0.9	A

Serial Communications

Communications	Signal
Serial Communication System	I^2C with PMBus communication protocol.
Signals	AC Good DC Good Output Voltage Monitoring Output Current Monitoring Temperature Monitoring
Control Signals	Remote ON-OFF, Output Voltage Digital Adjustment
LED Signals	AC OK DC OK

Environmental & Reliability Specifications

Specification	Condition	Min	Nom	Max	Units
Operating Temperature Range	All line conditions and Full load	-15		+50	°C
Operating Temperature Range with Derating	Power derating to 66% of max power	+51		+70	°C
Thermal Shutdown	Automatic recovery	+71			°C
Storage Temperature		-40		+85	°C
Humidity	Relative Humidity, non-condensing	5		95	% RH
Cooling	Internal fan cooled				
Fan Speed	Automatically adjusted based on load and ambient temperature				
MTBF	Calculated @ 50°C ambient temperature. (Telcordia Issue 1)	250k			Hours
Accelerated Temperature Cycling (ATC)	1400 cycles from –20°C up to +120°C. Demonstrated mechanical life by the Coffin-Manson equation taken in the worst point	9			Years
Temperature Step	Outperform specification, withstand 75°C for 2 hours without damage		2		Hours
Power Step	Outperform output power specification with 130% of max load without damage		2		Hours
Shock Test	Operating EN60068-2-27 30G half sine, 18ms minimum, 6 each axes (3 positive, 3 negative)	30			G
Shock Test	Non-operating EN60068-2-27 50G half sine, 11ms minimum, 6 each axes (3 positive, 3 negative)	50			G
Sinusoidal Vibration Test	Operating EN60068-2-6 10-500Hz 1G, 3 axes, 60 min	1			G
Random Vibration Test	Operating EN60068-2-64 5-500Hz 1Grms, 3 axes, 30 min	1			Grms
Random Vibration Test	Non-operating EN60068-2-64 5-500Hz, 2.46Grms, 3 axes 30 min	2.46			Grms

EMC Specifications

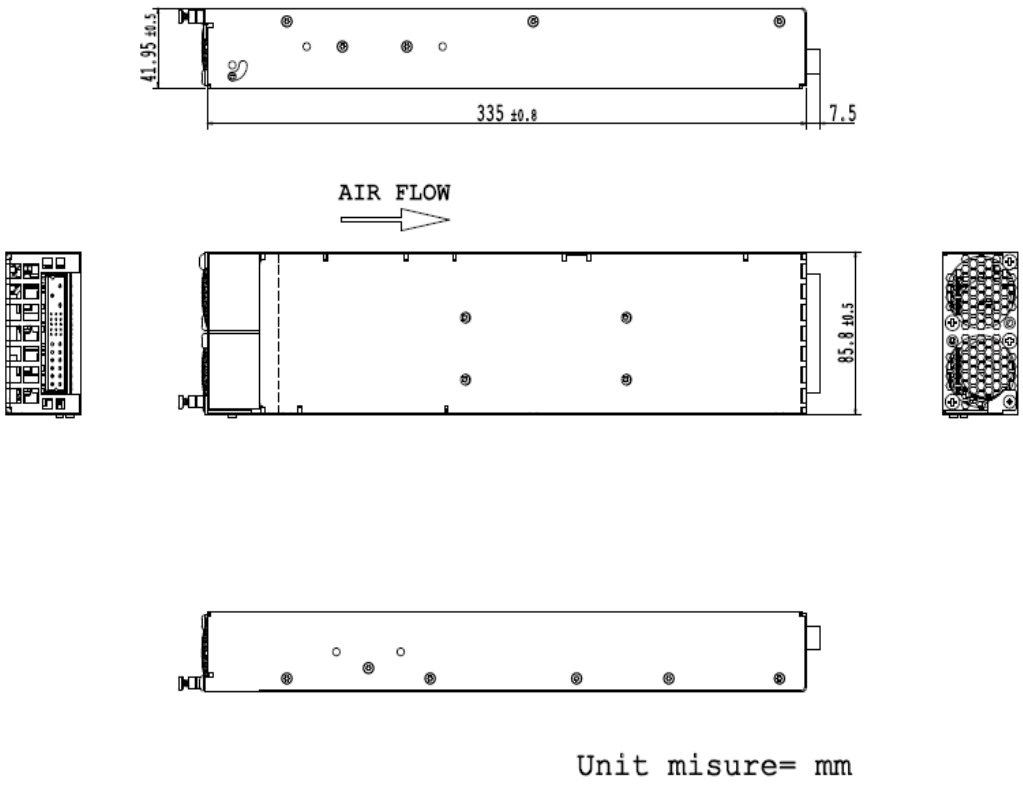
Specification	Test Condition	Min	Nom	Max	Units
Conducted Noise	EN55022-A FCC Class A		A A		
Radiated Noise	EN55022 Level A FCC Class A		A A		
Harmonic Distortion	EN61000-3-2				
Flicker and Fluctuation	EN61000-3-3				
Immunity	EN55024				
Electrostatic Discharge	EN61000-4-2, level 4 (contact/air)		A		
Radiated RFI	EN61000-4-3		A		
Fast Transient/bursts	EN61000-4-4, level 3		A		
Input Line surges	EN61000-4-5, level 3		A		
Conducted RFI	EN61000-4-6		A		
Voltage Dips and Interruptions	EN61000-4-11 Dip -30% 10ms/20ms EN61000-4-11 Dip -30%, 50ms/5000ms EN61000-4-11 Dip -60%, 10ms EN61000-4-11 Dip -60%, 50ms/5000ms EN61000-4-11 Int. -100%, 10ms EN61000-4-11 Int. -100%, 50/5000ms		A B A B A B		

Safety Specifications

Specification	Condition	Min	Nom	Max	Units
Isolation Voltage	Input to Chassis		1500		Vac
Isolation Voltage Output to Chassis	Output to chassis IEEE802.3af (48V versions only)		1500		Vac
Safety Agency Approvals	$_{c}UR_{US}$, D, CB Certificate				
Safety Standards	IEC60950-1 Ed.1.0 (2001), UL 60950-1:2003, First Edition; CSA C22.2 No.60950-1-03 1st Ed.				

Module Mechanical Specifications

Case	Fully enclosed metal box. IP20 conform.
Dimensions	1U x 2U x 13.19'' = 1.65" x 3.38" x 13.19" = 41.95mm x 85.8mm x 335mm
Weight	3.3lb = 1.5kg
Mating Connector	Positronic **PCIM30W15F400A1**
Mounting	Hot plugging module in chassis.



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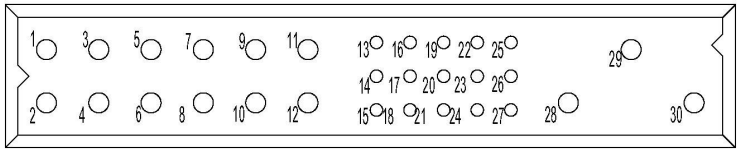
Module Input/Output Connections



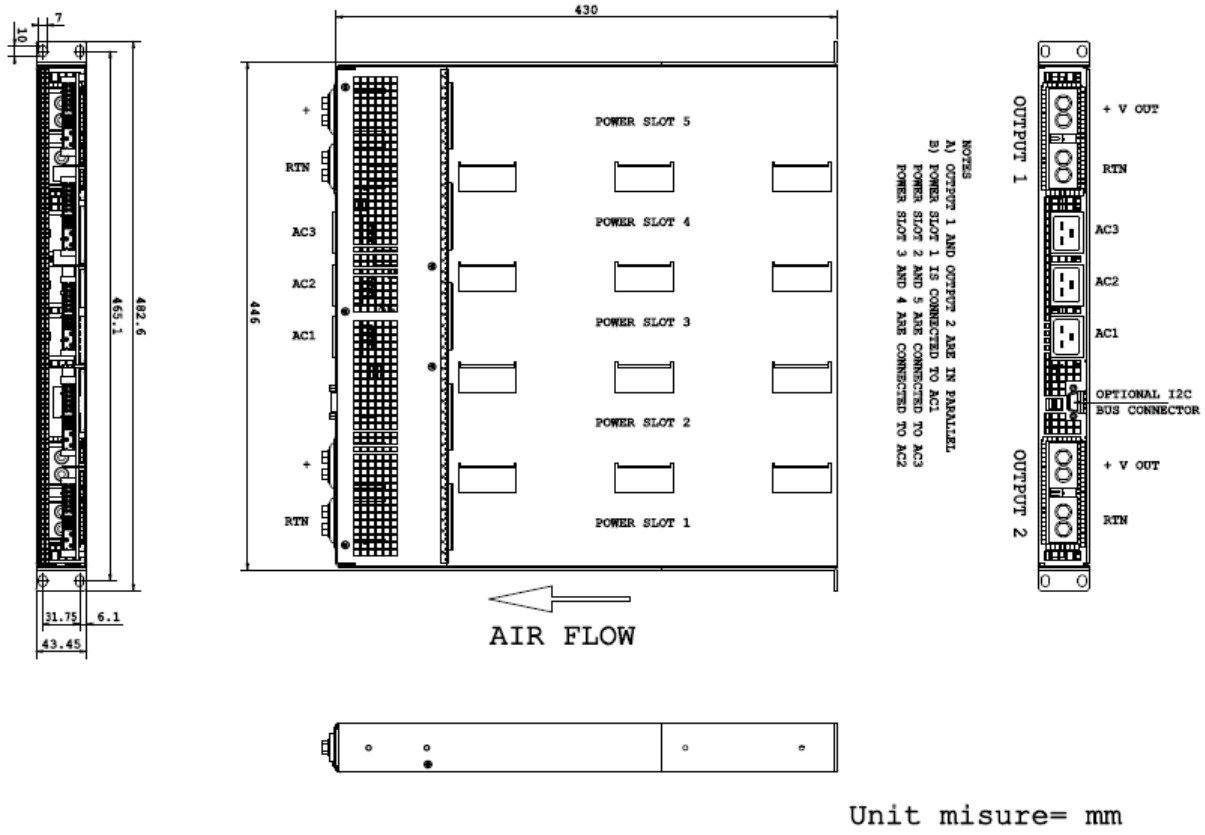
Module Pin Assignment

Pin	Signal	Type	Description	Low Level High Level
1	+ Vout	Output	+Vout	—
2	+ Vout	Output	+Vout	—
3	+ Vout	Output	+Vout	—
4	+ Vout	Output	+Vout	—
5	+ Vout	Output	+Vout	—
6	+ Vout	Output	+Vout	—
7	RTN	Output	Return	—
8	RTN	Output	Return	—
9	RTN	Output	Return	—
10	RTN	Output	Return	—
11	RTN	Output	Return	—
12	RTN	Output	Return	—
13*	Power Presence	Input	Connect to RTN for Vout enable	LOW = Power ON HIGH = Stand-by
14	Reserved	—	—	—
15	SDA	Input/Output	I²C bus data line for PMBus protocol	5V logic
16	RTN	Output	Return	—
17	RTN	Output	Return	—
18	SCL	Input/Output	I²C bus clock line for PMBus protocol	5V logic
19	+12 Vaux	Output	Auxiliary voltage present when the AC input is present	—
20	+12 Vaux	Output	Auxiliary voltage present when the AC input is present	—
21	ALERT	Output	SMBALERT - PMBus protocol	5V logic
22	I²C _A2	Input	PMBus A_2 address select (left unterminated for 1, connect to RTN for 0)	5V logic
23	- Vout Remote sense	Input	Connect to RTN close to the load	—
24	+ Vout Remote sense	Input	Connect to + Vout close to the load	—
25	I²C _A0	Input	PMBus A_0 address select (left unterminated for 1, connect to RTN for 0)	5V logic
26	I²C _A1	Input	PMBus A_1 address select (left unterminated for 1, connect to RTN for 0)	5V logic
27	I share	Input/Output	Connect together the pins when two or more powers are in parallel	0V< I share < 5V Referred to RTN
28	Chassis Ground - PE	Input	Protection Earth connected to the chassis	—
29	AC Line - N	Input	AC Input Line - Neutral	—
30	AC Line - L	Input	AC Input Line - Phase	—

* Pin 13 is the shortest pin.

Chassis Mechanical Specifications

Case	Fully enclosed metal box IP20 conform
Dimensions (HxWxD)	1U x 19'' x 16.93'' = 1.71" x 19" x 16.93" = 43.45mm x 482.6mm x 430mm
Weight	Rack only: 9.80lb = 4.44kg
	Rack fully equipped with 5 power supplies: 26.35lb = 11.95kg



Unit misure= mm

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