

## APC Power Protection for Cisco VoIP & IP Telephony Solutions

By Neil Whiting

### Abstract

The Cisco / APC relationship began in 1998 with a focus on non-stop networking and has since grown to include the integration of various platforms, the sharing of intellectual property for white papers and design specifications as well as joint field engagements.

Power protection is a crucial component of VoIP & IP Telephony networks and helps to ensure that they meet the demands of today's business needs. To achieve the levels of high availability required, it is essential that Layer 0 solutions support VoIP & IP Telephony networks, inline with your business requirements. This document discusses the elements that influence these Layer 0 requirements, including the power needs of Cisco® Catalyst® Switches, appropriate APC solutions including software management, guidelines for improving network availability and instructions on sizing the appropriate solution.

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2. The Cisco Solutions
3. APC UPS Families
4. Meeting your Availability Requirements
5. Sizing your Solution
6. APC Power Connections
7. System Management
8. Conclusions

## 1. The APC & Cisco Partnership

The Cisco / APC relationship began in 1998 with a focus on non-stop networking and has since grown to include the integration of various platforms, the sharing of intellectual property for white papers and design specifications as well as joint field engagements.

APC focuses strongly on Cisco's advanced technologies with an emphasis on the critical Layer 0 power and cooling needs of IP telephony and Service Oriented Network Architecture.

APC's approach towards specifying power for IP telephony looks at the critical physical infrastructure required to support Cisco's Catalyst switch applications.



## 2. The Cisco Solutions

Cisco's Intelligent Switching Portfolio is a core technology foundation of the Cisco Intelligent Network. Key products in the range which supports IP Telephony and VoIP include:

The Cisco Catalyst 2950 Series Switch is a fixed-configuration, stackable standalone switch that provides wire-speed Fast Ethernet and Gigabit Ethernet connectivity. The internal power supplies are rated from 30W to 45W, depending on the model in the series.



The Cisco Catalyst 3750 Series switches are innovative switches that improve LAN operating efficiency by combining industry-leading ease of use and the highest resiliency available for stackable switches. The internal power supplies are rated from 50W to 590W, depending on the model in the series.

The Cisco Catalyst 3560 Series is a line of fixed-configuration, enterprise-class switches that include IEEE 802.3af and Cisco pre standard Power over Ethernet (PoE) functionality in Fast Ethernet and Gigabit Ethernet configurations. The internal power supplies are rated from 50W to 590W, depending on the model in the series.



The Cisco Catalyst 4500 Series switches are designed for enterprise LAN access, branch offices, Layer 3 distribution points, small and medium-sized businesses, and metropolitan (metro) Ethernet deployments. This series accommodates Cisco power supplies rated from 1000W to the 4200W, with AC or nominal -48V DC input options.

The Cisco Catalyst 6500 and 6500-E Series provides IP communications and application delivery in enterprise campus and service provider networks by maximizing user productivity and enhancing operational control. This series accommodates Cisco power supplies rated from 1000W to the 6000W, with AC or nominal -48V DC input options.



For full details on all these and other Cisco products please go to [www.cisco.com](http://www.cisco.com)

### 3. APC UPS Families

The UPS families offered to support Cisco VoIP and IP Telephony equipment employ various topologies as detailed below:

#### Smart-UPS® & Smart-UPS® XL

The Smart-UPS & Smart-UPS XL use Line-interactive topology offering high reliability and efficiency with good voltage regulation.

With this approach the unit's inverter is always connected to the output of the UPS. Under normal operation the inverter works in reverse to charge the battery. When the input fails a transfer switch is operated and power flows from the battery via the inverter to provide the UPS output. In addition, the units include Automatic Voltage Regulation through a tap changing transformer which trims or boosts the output voltage to compensate for line deviations.

APC Smart-UPS series offers power outputs from 750VA to 5kVA (500W to 3750W). In addition Smart-UPS XL units are available that allow connection of additional battery strings to increase the system run time. At the 1.5kVA & 3kVA (1425W to 2850W) levels Smart-UPS XL units of modular design with pre-installed network management cards are also available.



SUA2200RM12U, (Single phase nominal 230V input)  
SUA2200RM2U, (Single phase nominal 120V input)



SUM3000RMXL12U, (Single phase nominal 230V input)  
SUM3000RMXL2U, (Single phase nominal 120V input)

#### Smart-UPS® RT

The Smart-UPS RT is an on-line double conversion unit offering excellent voltage conditioning and expandable runtime.

These products have two stages of conversion. The first takes the incoming AC supply and converts it to generate an internal DC bus, on which the systems batteries also sit. The second stage uses an inverter to convert back to AC to provide the output from the UPS. With this arrangement the output is always fed from the inverter unless there is an overload on the unit or an internal failure. If this occurs the load is transferred to the incoming AC supply via a built in Automatic By-pass.

APC Smart-UPS RT series are single stand alone units providing single-phase power protection from 1kVA to 10kVA (700W to 8kW), all with the facility to add additional battery strings to increase the system run time.



SURT2000RMXLI, (Single phase nominal 230V input)  
SURTA2000RMXL, (Single phase nominal 120V input)

Smart-UPS® VT



APC Smart-UPS VT series are also on-line double conversion units, offered in a single stand alone package providing three-phase power protection from 10kVA to 40kVA (8kW to 32kW) all with the facility to add additional battery strings to increase the system run time. With dual-mains input, automatic bypass, and scalable runtime with hot-swappable batteries increased availability is provided.

APC's Network Management Card with temperature monitoring provides remote monitoring and management through Web/SNMP. Serviceability is greatly enhanced with its user-replaceable batteries and manageable extended run frames.



SUVT10KH1B2S, (Three phase nominal 400V input)  
 SUVT10KF1B2S, (Three phase nominal 120/208V input)

Symmetra®

APC Symmetra is an on-line double conversion unit and takes advantage of the paralleling capability to offer expansion and redundancy within the system by using multiple power modules. The Symmetra offers outputs from 2kVA to 6kVA (1.4kW to 4.2kW) plus redundancy with a facility to add additional battery strings to increase the system run time.



Symmetra RM Frame

Intelligence Modules  
Hot-swappable

Battery Module  
Hot-swappable

PowerView Display

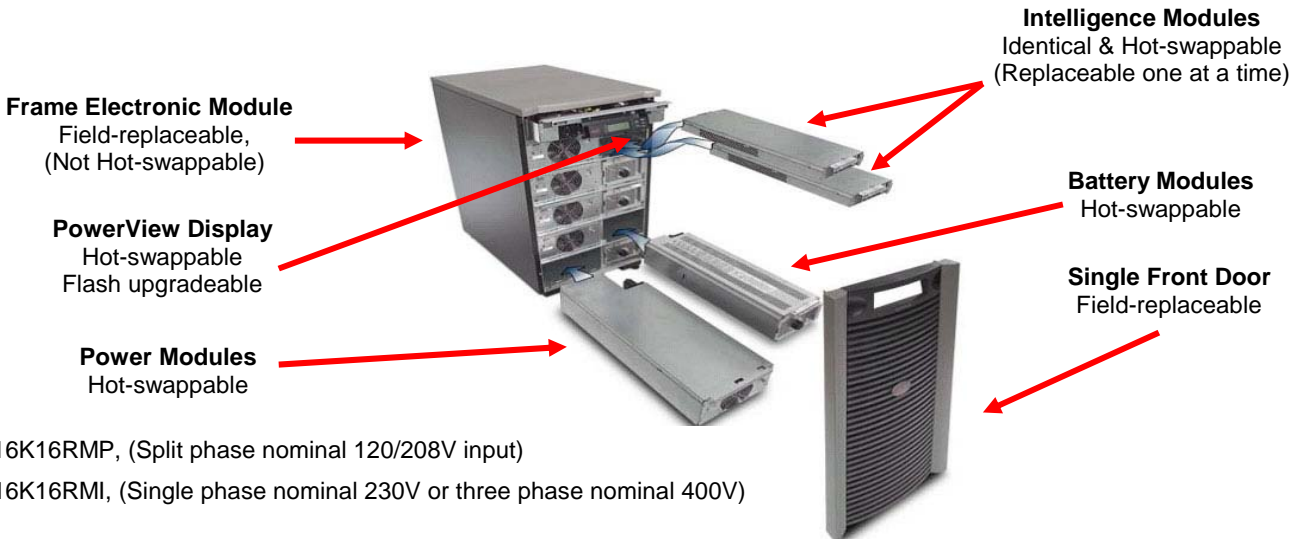
Cover

2kVA Power Modules  
Hot-swappable

SYH6K6RMI, (Single phase 230V input)  
 SYH6K6RMT, (Single phase nominal 208V input)

### Symmetra® LX

APC Symmetra LX, as part of the Symmetra family is also an on-line double conversion unit which takes advantage of the paralleling capability. The Symmetra LX offers outputs from 4kVA to 16kVA (3.2kW to 12.8kW) plus redundancy with a facility to add additional battery strings to increase the system run time.



The illustrations above show the full modularity of the Symmetra family, which allows easy scalability, maintenance as well as providing the option for redundancy.

### Symmetra® PX



APC Symmetra PX also engages an on-line double conversion topology with expansion and N+1 facilities, providing three-phase power protection from 10kVA to 80kVA (10kW to 80kW).

The modular architecture provides the foundation of building and scaling near-continuous availability power systems with a flexible range of power capacity.

The Symmetra PX packages the high availability requirements of easy power and runtime scalability into a very small footprint. Combined with the complete line of APC data center protection software and accessories it provides the four most critical elements of total data center protection.



For further details & discussions on these and other UPS Topologies please see APC White Papers #1 and #79.

## 4. Meeting your Availability Requirements

The availability of power to a system is dependent on how the power to that equipment is derived and supplied. The use of UPS units and generators in various configurations to augment the utility supply can greatly enhance the potential availability. The pictorial representations below show how changing the basic architecture and elements within the solution lead to higher availability.

Increasing Availability



This solution shows the utility supply feeding a single UPS (ie. the APC Smart-UPS) supplying a Cisco Voice / Data switch



This solution shows the utility supply feeding a single UPS with N+1 power modules and an integrated automatic by-pass, (ie. the APC Symmetra RM) powering a Voice / Data switch.



This solution shows both a utility supply and a generator feeding into an automatic transfer switch (ATS) which selects the available supply to then feed two separate UPS units each with N+1 power modules and an integrated automatic by-pass, (ie. the APC Symmetra LX) which in turn provide two individual feeds to the Cisco Voice / Data switch.



This solution shows a utility supply and two generators feeding into two separate automatic transfer switches which select the available supply to then feed two separate UPS units each with N+1 power modules and an integrated automatic by-pass, (ie. the APC Symmetra PX) which in turn provide two individual feeds to the Cisco Voice / Data switch.

For further details on meeting your availability needs please see APC White Paper #69. For a full assessment of your NCPI needs to meet your required availability, please contact an APC reseller or sales representative.

## 5. Sizing your solution

The typical Cisco IPT Network Architecture (as shown to the right) is made up of several layers. This document looks at the power requirements across these layers, from the IP phones on the desks to call servers in the data center.

Each facility or site would be broken into four areas, each with its own unique Layer 0 power solution requirements. These areas are the desktop, intermediate distribution Frame (IDF) or wiring closet, main distribution frame (MDF) alternatively known as a main equipment room (MER) or point of presence (POP) and the data center.

The power levels required in each area are different as will be seen in the following guide to meeting the power needs.

In order to select the appropriate UPS solution for either an IDF or MDF you first need to initially assess the following.

The total power required in Watts – The Watt ratings can normally be obtained from the equipment nameplate or manual.

The run time required in minutes – Typically 10 – 15 minutes for systems with a generator and 60 minutes without.

The level of availability required – See the “Meeting your Availability Requirements” section of this document

The voltage and connectors required to feed the equipment – See section 6, “APC Power Connections”.

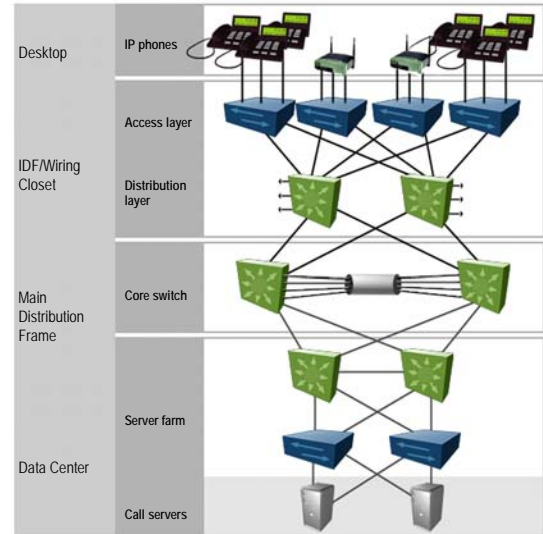
### Solutions for Desktop Communications Devices

Communications devices or end points may draw power over the Ethernet also known as ‘in-line’ power or from a wall outlet depending on their power consumption. Devices drawing < 15W of power will generally be fed by power over the Ethernet (PoE) by ‘mid-span’ or ‘end-span’ power supplies which should be protected by a UPS in the wiring closet. Communications devices/end points drawing higher power will be fed externally from wall outlets with plug-in adaptors and should be protected by a UPS with minimum one hour back up time.

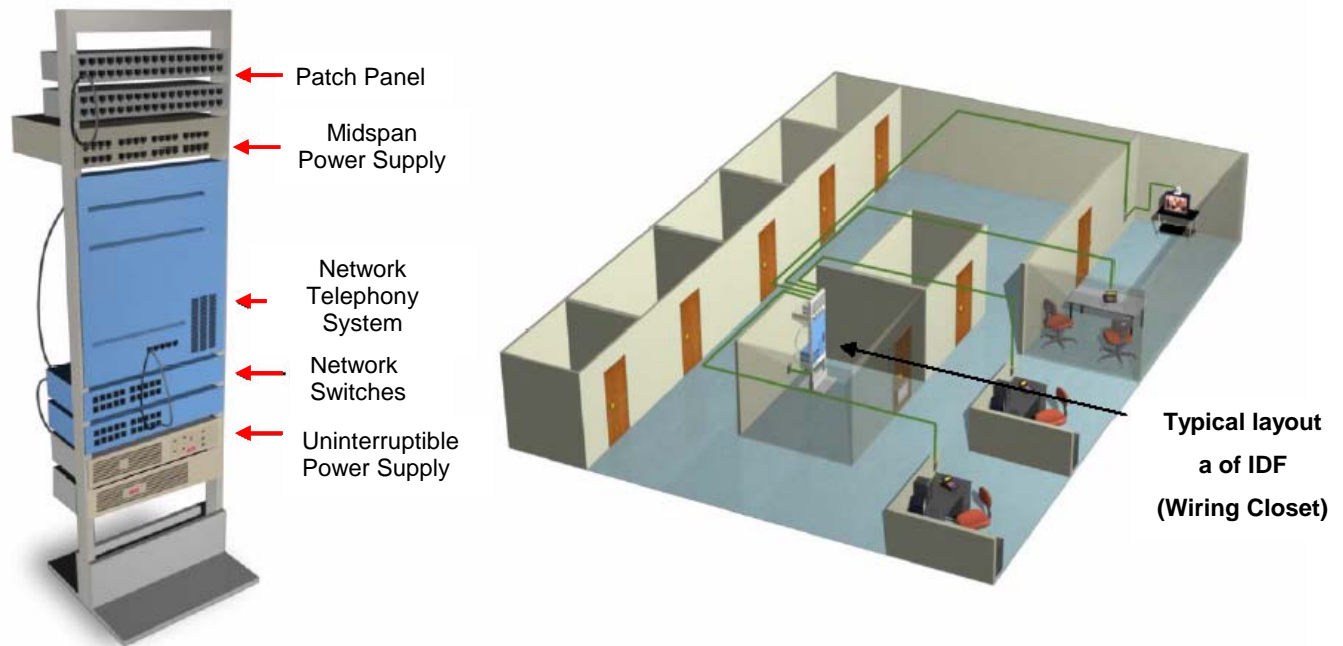
Typical solutions for devices with a wall plug-in adaptor can be found in the APC Back-UPS® ES range, please visit [www.apc.com](http://www.apc.com) to view the range and select the unit with the appropriate outlets for your country.

As an example the APC Back-UPS BE750BB, for use in North America, will provide approximately two hours of battery back up for a load of 50 watts. It can support a maximum load of 450 watts for over five minutes.

(North America) BE750BB



## Power protection for Wiring Closets (IDF)



## Verifications and Site Prep for Wiring Closets

- Ensure that the UPS capacity in watts and battery back up time meets the power and runtime requirements of your application. For any specific requirements visit [www.apc.com](http://www.apc.com) as described above or contact your APC sales representative.
- Ensure that the wiring closet has the correct input voltage e.g. 120, 208, or 230VAC, right receptacle e.g. L5-15R or L6-30R, IEC 320, C13, or C19 etc. and the right circuit breaker protection for the UPS.
- Ensure that the UPS or transformer or Power Distribution Unit has enough receptacles to plug in all the existing equipment and some spare for future needs.
- Ensure that there is appropriate cooling and airflow in the wiring closet.
- Ensure that the wiring closet is in a secure location with access control and there is sufficient space and lighting for any service or maintenance activities.

The table below shows the basic power supply options for a selection of the Cisco Catalyst switches.

Cisco Switch	PSU Size Options	Nominal Line Input to PSU	Available DC Power from PSU	AC Load on UPS
Series	Watts	Volts (AC)	Watts	Watts
2950	Internal	100 - 240	Internal	30 - 45
3550	Internal	100 - 240	Internal	65 - 190
3560	Internal	100 - 240	Internal	45 - 590
3750	Internal	100 - 240	Internal	50 - 590
4500	1000	100 - 240	1000	1176
	1300	100 - 240	1300	1529
	2800	200	2800	3294
	4200	Two 120V lines	2100	2471
		Two 200V lines	4200	4941
6000 6500	1000	100 - 240	1000	1176
	1300	100 - 240	1300	1529
	2500	120	1300	1529
		200	2500	2941
	3000	120	1400	1647
		200	3000	3529
	4000	200	4000	4706
	6000 * <sup>1</sup>	Two 120V lines	2900	3412
		One 200V line	2900	3412
		Two 200V lines	6000	7059
	8700 * <sup>2</sup>	Two 120V line	2800	3294
		Three 120V Lines	4200	4941
		One 220V line	2800	3294
		Two 220V line	5800	6824
		Three 220V Lines	8700	10235
All information shown is based on a single power supply in each chassis, in the larger systems an additional unit can be included to provide redundancy.				
* <sup>1</sup> Compatible with full output in Cisco Catalyst 6506-E, Catalyst 6509-E, and Catalyst 6513 switches. Works in Catalyst 6506 and Catalyst 6509 with a maximum output of 4000W.				
* <sup>2</sup> Available power is limited to 4000W in Cisco Catalyst 6506 and 6509 Switches, 4500W in the Cisco Catalyst 6509-NEB-A Switch and 6000W in the Cisco Catalyst 6513 Switch. Full power is available in the Cisco Catalyst 6506-E and 6509-E Switches.				
For full details on all Cisco Systems Power Supply units and system compatibility please visit <a href="http://www.cisco.com">www.cisco.com</a>				

The following tables provide a guide to selecting an appropriate size UPS to support your chosen Cisco Catalyst Series switch, please use these with reference to the table on the previous page.

Wiring Closets (IDF), Power Solution Guide (Nominal UPS input voltage ranges covered, 120V & 208V)							
Nominal Line Input to PSU <sup>*1</sup>	Available DC Power from PSU <sup>*2</sup>	AC Load on UPS <sup>*3</sup>	Rack mount Smart-UPS Family	Extension Battery Pack <sup>*4</sup>	Extension Battery Pack Qty.		
					0	1	2
V (AC)	Watts	Watts	APC Part Number	APC Part Number	Approximate Total Runtime		
120	100 Internal	118	SC450RM1U	N/A	25 min	N/A	N/A
120	250 Internal	294	SUA750RM2U	N/A	11 min	N/A	N/A
120	500	588	SU1400RMXLB3U	SU24R2XLBP	19 min	1 hrs 13 min	2 hrs 21 min
			SUM1500RMXL2U	SUM48RMXLBP2U	34 min	1 hrs 35 min	2 hrs 50 min
120	1000	1176	SUA2200RMXL3U	SUA48RMXLBP3U	15 min	46 min	1 hrs 24 min
			SU3000RMXL3U	SU48R3XLBP	19 min	1 hrs 13 min	2 hrs 22 min
120	1300	1529	SU3000RMXL3U	SU48R3XLBP	12 min	53 min	1 hrs 45 min
			SYH4K6RMT-P1	SYBT2 <sup>*5</sup>	27 min	43 min	60 min
				SYRMXR4B4	27 min	96 min	2 hrs 50 min
			SUM3000RMXL2U	SUM48RMXLBP2U	9 min	32 min	59 min
120	1400	1647	SYH4K6RMT-P1	SYBT2 <sup>*5</sup>	9 min	32 min	59 min
				SYRMXR4B4	24 min	38 min	56 min
				SYRMXR4B4	24 min	90 min	2 hrs 35 min
			SURT5000RMXLT	SURT192RMXLBP	7 min	33 min	1 hrs 0 min
200	2500	2941	SYH6K6RMT	SYRMXR4B4	19 min	55 min	1 hrs 32 min
			SURT6000RMXLT	SURT192RMXLBP	8 min	30 min	54 min
200	2800	3294	SYH6K6RMT	SYRMXR4B4	18 min	52 min	1 hrs 24 min
			SURT8000RMXL1TF5	SURT192RMXLBP	16 min	33 min	54 min
120	2900	3412	SYH6K6RMT-P1	SYRMXR4B4	16 min	46 min	1 hrs 09 min
			SURT8000RMXLT	SURT192RMXLBP	15 min	32 min	52 min
200	3000	3529	SYH6K6RMT	SYRMXR4B4	15 min	44 min	1 hrs 07 min
			SURT8000RMXLT	SURT192RMXLBP	11 min	22 min	37 min
200	4000	4706	SYA12K16RMP	SYARMXR3B3	17 min	42 min	1 hrs 8 min
			SURT8000RMXLT	SURT192RMXLBP	10 min	21 min	35 min
200	4200	4941	SYA12K16RMP	SYARMXR3B3	16 min	40 min	1hrs 03 min
			SURT10000RMXLT	SURT192RMXLBP	5 min	13 min	23 min
200	6000	7059	SYA16K16RMP	SYARMXR3B3	15 min	31min	48 min
			SURT10000RMXLT	SURT192RMXLBP	8 min	43min	1 hrs 20 min
200	8700	10235	SYA16K16RMP	SYARMXR9B9	8 min	43min	1 hrs 20 min
Line Interactive			Double Conversion On-Line		Double Conversion On-Line with scalability & N+1 options		
<sup>*1</sup> The "Nominal Line Input to PSU" is the nominal voltage supplied by the UPS to the Cisco power supply. Note some Cisco PSU derate on low nominal line voltages.							
<sup>*2</sup> The "Available DC Power from PSU" is the maximum output power of individual Cisco power supplies and relates to the data in the previous power supply options chart.							
<sup>*3</sup> The "AC Load on UPS" is the AC power drawn by the internal Cisco power supplies allowing for a typical efficiency of 85%							
<sup>*4</sup> With the Symmetra range run time can be increased by adding additional battery packs to the base unit as well as extension battery stacks, please go to <a href="http://www.apcc.com">www.apcc.com</a> for full details.							
<sup>*5</sup> SYBT2 & SYBT4 are additional battery packs which can be added to the main chassis before adding extension battery stacks.							

Wiring Closets (IDF), Power Solution Guide UPS input voltage ranges covered, 230V & 400V					(Nominal)		
Nominal Line Input to PSU <sup>*1</sup>	Available DC Power from PSU <sup>*2</sup>	AC Load on UPS <sup>*3</sup>	Rack mount Smart-UPS Family	Extension Battery Pack <sup>*4</sup>	Extension Battery Pack Qty.		
					0	1	2
V (AC)	Watts	Watts	APC Part Number	APC Part Number	Approximate Total Runtime		
230	100 Internal	118	SC450RM1U	N/A	25 min	N/A	N/A
	250 Internal	294	SUA750RM1U	N/A	16 min	N/A	N/A
	500	588	SU1400RMXLIB3U	SU24R2XLBP	18 min	1 hrs 13 min	2 hrs 21 min
			SUM1500RMXLI2U	SUM48RMXLB2U	34 min	1 hrs 35 min	2 hrs 50 min
	1000	1176	SUA2200RMXLI3U	SUA48RMXLB3U	15 min	46 min	1 hrs 24 min
			SUM3000RMXLI2U	SUM48RMXLB2U	19 min	1 hrs 13 min	2 hrs 22 min
	1300	1529	SUM3000RMXLI2U	SUM48RMXLB2U	11 min	36 min	1 hrs 4 min
			SYH4K6RMI	SYBT2 <sup>*5</sup>	28 min	45 min	1hrs 02 min
	2500	2941	SURT5000RMXLI	SURT192RMXLB	7 min	33 min	1 hrs 0 min
			SYH6K6RMI	SYRMXR4B4I	20 min	56 min	1 hrs 33 min
	2700	3176	SURT6000RMXLI	SURT192RMXLB	8 min	31 min	55 min
			SYH6K6RMI	SYRMXR4B4I	19 min	54 min	1 hrs 26 min
	2800	3294	SURT6000RMXLI	SURT192RMXLB	8 min	30 min	54 min
			SYH6K6RMI	SYRMXR4B4I	18 min	52 min	1 hrs 24 min
	2900	3412	SURT8000RMXLI	SURT192RMXLB	15 min	33 min	52 min
			SYH6K6RMI	SYRMXR4B4I	17 min	49 min	1 hrs 20 min
	3000	3529	SURT8000RMXLI	SURT192RMXLB	16 min	32 min	53 min
			SYH6K6RMI	SYRMXR4B4I	16 min	46 min	1 hrs 07 min
	4000	4706	SURT8000RMXLI	SURT192RMXLB	11 min	22 min	37 min
			SYA12K16RMI	SYARMXR3B3I	17 min	42 min	1 hrs 8 min
4200	4941	SURT8000RMXLI	SURT192RMXLB	10 min	21 min	35 min	
		SYA12K16RMI	SYARMXR3B3I	16 min	40 min	1 hrs 4 min	
6000	7059	SURT10000RMXLI	SURT192RMXLB	5 min	13 min	23 min	
		SYA16K16RMI	SYARMXR3B3I	15 min	31min	48 min	
8700	10235	SYA16K16RMI	SYARMXR9B9I	8 min	43min	1 hrs 20 min	
Line Interactive			Double Conversion On-Line		Double Conversion On-Line with scalability & N+1 options		

<sup>\*1</sup> The "Nominal Line Input to PSU" is the nominal voltage supplied by the UPS to the Cisco power supply. Note some Cisco PSU derate on low nominal line voltages.

<sup>\*2</sup> The "Available DC Power from PSU" is the maximum output power of individual Cisco power supplies and relates to the data in the previous power supply options chart.

<sup>\*3</sup> The "AC Load on UPS" is the AC power drawn by the internal Cisco power supplies allowing for a typical efficiency of 85%

<sup>\*4</sup> With the Symmetra range run time can be increased by adding additional battery packs to the base unit as well as extension battery stacks, please go to [www.apcc.com](http://www.apcc.com) for full details.

<sup>\*5</sup> SYBT2 & SYBT4 are additional battery packs which can be added to the main chassis before adding extension battery stacks.

Full solutions can be configured through the APC web based Design Portal to meet your Layer 0 or network-critical physical infrastructure needs, including equipment racks, cooling and system management.

To access the Design Portal, please go to the APC web site [www.apc.com](http://www.apc.com) and follow the onscreen instructions.

## InfraStruXure™ Solutions for Wiring Closets and Computer Rooms

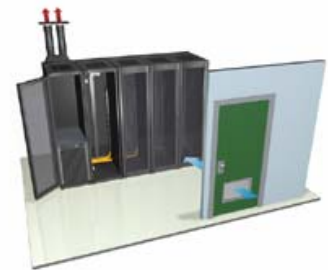
APC InfraStruXure is an ideal solution for wiring closets and computer rooms with 1 - 3 and 1 - 5 racks respectively, combining both power and cooling using modular, highly manageable, pre-engineered components, to provide a seamless and secure foundation for the IT environment.

InfraStruXure fully integrates power and cooling components, and services within a rack-optimized design giving the reliability, affordability, and predictability of standardized solutions, yet completely customized for your specific needs.



InfraStruXure solutions for these applications can be configured through the APC UPS selector, at [www.apc.com](http://www.apc.com).

The results from the on-line tool will give three alternative solutions, "Best Value", "Best Price" & "Best Performance", thus allowing you to select the appropriate solution to meet your needs and budget.



Wiring Closet 1 - 3 racks  
Computer Room 1 - 5 racks

## InfraStruXure solutions for Small and Medium Data Centers

APC InfraStruXure™ with its modular approach enables APC to provide a tailored solution from standard parts to Layer 0 power and cooling needs of a small data center with 5 – 20 racks or a medium data center with 20 – 100 racks.



Small Data Center 5 – 20 racks
















Medium Data Center 20 – 100 racks

These larger systems are configured to order using the APC InfraStruXure™ Design Portal, as previously, at [www.apc.com](http://www.apc.com). For further details on power & cooling requirements for data centers please see APC White Papers #3, 4, and 5.

## 6. APC Power Connections

The following tables show the array of AC input & output connections on the UPS products featured in the sizing guides.

North America		Input connections					Output connections					
Rack mount Family						Hard Wire Connection						Hard Wire Connection
APC Part Number	NEMA 5-15P	NEMA 5-20P	NEMA L5-30P	NEMA L6-30P	NEMA 5-15R		NEMA 5-20R	NEMA L6-20R	NEMA L6-30R	NEMA L14-30R		
SC450RM1U	Yes	No	No	No	No	4	0	0	0	0	No	
SUA750RM2U	Yes	No	No	No	No	6	0	0	0	0	No	
SU1400RMXLB3U	Yes	No	No	No	No	6	0	0	0	0	No	
SUM1500RMXL2U	Yes	No	No	No	No	8	0	0	0	0	No	
SUA2200RMXL3U	No	Yes	No	No	No	9	2	0	0	0	No	
SU3000RMXL3U	No	No	Yes	No	No	6	2	0	0	0	No	
SUM3000RMXL2U	No	No	Yes	No	No	6	2	0	0	0	No	
SURT5000RMXLT	No	No	No	Yes	No	0	0	2	2	0	No	
SURT6000RMXLT	No	No	No	Yes	No	0	0	2	2	0	No	
SURT8000RMXLT-1TF5	No	No	No	No	3-wire (2PH+G)	0	12	2	1	0	3-wire (2PH+G)	
SURT8000RMXLT	No	No	No	No	3-wire (2PH+G)	0	0	2	2	0	3-wire (2PH+G)	
SURT10000RMXLT	No	No	No	No	3-wire (2PH+G)	0	0	2	2	0	3-wire (2PH+G)	
SYH4K6RMT-P1	No	No	No	Yes	3-wire (2PH+G)	0	12	2	0	0	No	
SYH6K6RMT-P1	No	No	No	Yes	3-wire (2PH+G)	0	12	2	0	0	No	
SYH6K6RMT	No	No	No	Yes	3-wire (2PH+G)	0	0	2	1	0	No	
SYA12K16RMP	No	No	No	No	4-wire (2PH+N+G)	0	8	0	0	4	4-wire (2PH+N+G)	
SYA16K16RMP	No	No	No	No	4-wire (2PH+N+G)	0	8	0	0	4	4-wire (2PH+N+G)	

International		Input connections			Output connections			
Rack mount Family				Input Cables & Connections			Hard Wire Connection	Jumper Cables (Quantity)
APC UPS Part Number	IEC 320 C14	IEC 320 C20	IEC 320 C13		IEC320 C19			
SC450RM1U	Yes	No	None	None	4	0	No	(2) IEC Jumpers C13/C14
SUA750RM1U	Yes	No	None	None	4	0	No	(2) IEC Jumpers C13/C14
SU1400RMXLIB3U	Yes	No	(1) IEC 320 C13 cord plug	(1) IEC 320 C13 cord plug	8	0	No	(3) IEC Jumpers C13/C14
SUM1500RMXL2U	Yes	No	None	None	9	0	No	(4) IEC Jumpers C13/C14
SUA2200RMXL3U	No	Yes	(1) Shuckto to C19 (1) UK to C19	(1) Shuckto to C19 (1) UK to C19	8	1	No	(3) IEC Jumpers C13/C14
SUM3000RMXL2U	No	Yes	(1) Shuckto to C19 (1) UK to C19	(1) Shuckto to C19 (1) UK to C19	7	1	No	(3) IEC Jumpers C13/C14
SURT5000RMXLI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	8	2	No	(6) IEC Jumpers (1) IEC 320 C20 cord plug
SURT6000RMXLI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	8	2	No	(6) IEC Jumpers (1) IEC 320 C20 cord plug
SURT8000RMXLI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	4	4	(1) 3-wire (1PH + N + G)	(4) IEC Jumpers C13/C14 (2) IEC Jumpers C19/C20 (2) IEC 320 C20 cord plugs
SURT10000RMXLI	No	No	Hard Wire 5-wire (3PH + N + G)	Hard Wire 5-wire (3PH + N + G)	4	4	(1) 3-wire (1PH + N + G)	(4) IEC Jumpers C13/C14 (2) IEC Jumpers C19/C20 (2) IEC 320 C20 cord plugs
SYH4K6RMI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	8	2	No	No
SYH6K6RMI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	8	2	No	No
SYA12K16RMI	No	No	Hard Wire 3-wire (1PH + N + G)	Hard Wire 3-wire (1PH + N + G)	8	10	(1) 3-wire (1PH + N + G)	No
SYA16K16RMI	No	No	Hard Wire 5-wire (3PH + N + G)	Hard Wire 5-wire (3PH + N + G)	8	10	(1) 3-wire (1PH + N + G)	No

## 7. System Management

### Preventing Data Corruption for Cisco Unity Express

Cisco Unity Express (CUE) is a Linux-based card that installs in a router and provides voicemail and automated attendant services. Linux is not designed to support abrupt losses of power known as “hard” shutdowns, but rather relies on a set of built-in processes to perform an orderly shutdown. Hard shutdowns, on the other hand can result in lost or corrupted data hard drives and a lengthier time-to-recovery after power returns (for instance, while Linux performs an “fsck” file system check) -, For more information on this topic please see APC White Paper #10.

APC and Cisco engineers worked closely together to build support for APC’s Smart-UPS products into the Cisco Unity Express product in order to address these issues. Cisco specifically recommends utilizing this built-in support:

*"We highly recommend attaching an uninterruptible power supply (UPS) to the router housing the Cisco Unity Express module...Ideally, a UPS should include a signaling mechanism that directs the router to shut down Cisco Unity Express properly and then powers off the router....". (Source: Cisco CLI Administrator Guide for CUE)*

To deploy UPS monitoring on CUE: (Compatible with all APC’s Smart-UPS with prefix SUA, SUM & SURTA only.)

1. Purchase APC’s “Cisco Unity Express UPS Simple Signaling Cable” (APC Part# AP9840).
2. Connect the Smart-UPS to the CUE via the cable.
3. Add the following configuration to the router (supported on Cisco IOS Release 12.3(4)T & above):

```
line aux 0
privilege level 15
modem Dialin
autocommand service-module service-engine slot/0 shutdown no-confirm
```

where “slot” is the Cisco Unity Express module's slot number.

### Preventing Data Corruption for Cisco CallManager

The Cisco ICS 7750 is a modular, expandable solution that provides converged IP telephony services such as Call processing, Voice Applications, and Multi service IP routing within a single system chassis. Since CallManager runs on Windows, it is susceptible to similar issues outlined above for the Unity Express. In close collaboration with Cisco, APC developed a special driver which Cisco subsequently licensed and incorporated into CallManager which provides APC-exclusive support for UPS monitoring and safe system shutdown in the event of an extended power outage.

Cisco specifically recommends utilizing this built-in support:

"The appropriate UPS for the Cisco ICS 7750 is the APC Smart-UPS, manufactured by American Power Conversion...."

Note: If you are using a UPS other than the APC Smart-UPS, you might not be able to monitor its status through the Cisco ICS 7750..." (Sources: Cisco ICS 7750 System Description and Cisco ICS 7750 Getting Started Guide)

This support utilizes serial communications (using the serial cable that comes with APC's Smart-UPS) or alternately, if the APC Smart-UPS is equipped with an APC Network Management Card, network communications can be utilized instead. Detailed information on how to configure UPS monitoring can be found in Cisco's "ICS 7750 Administration and Troubleshooting Guide", please see link below.

<http://www.cisco.com/univercd/cc/td/doc/product/voice/ics7750/tblshoot/>

## PowerChute Network Shutdown & Cisco CallManager

With an APC Network Management Card, as illustrated below, installed into the "Smart Slot" of any InfraStruXure-certified UPS the system can be fully managed and monitored both locally and remotely across the network, once an IP address has been assigned.



AP9619 Network Management Card with Environmental Monitoring facility



All the UPS units featured in this document have a "SmartSlot" with a Network Management card fitted or the option to do so, bar the Back-UPS BE750BB and Smart-UPS SC250RM1U and SC250RM11U.

In addition, to ensure the integrity of the data within the Cisco CallManager a graceful unattended shutdown can be initiated through APC's PowerChute Network Shutdown (PCNS) software, should there be an extended power outage or system issue requiring it to be shutdown. Management cards that also include temperature and humidity monitoring can be fitted alternatively.

The shutdown parameters for the Cisco CallManager 4.0(2) are user definable and APC's PCNS Version 2.2.1 is installed on the Cisco CallManager Media Convergence Server. The wizard based installation software will auto-detect any APC management cards connected to the network and corresponding UPS systems. The actual shutdown parameters need to be enabled through the PCNS user interface.



PCNS is available as a free download at [www.apc.com](http://www.apc.com)

For more information, please go to <http://cisco.apc.com>

## Network-Critical Physical Infrastructure Management

For larger systems the APC InfraStruXure™ Manager can be deployed to monitor and manage your entire APC network-critical physical infrastructure. It enables you to have an overview of your entire APC power network and provides notification to designated people should your systems availability be jeopardized. Analysis features help you to plan for changes in availability, power, runtime or cooling requirements. By managing your APC devices from a single console or by integrating InfraStruXure Manager into your preferred management system, the overall complexity of your network-critical physical infrastructure is reduced.

InfraStruXure Manager Server Appliance, Pt # AP92200  
 InfraStruXure Manager, 25 Node License, Pt # AP9430  
 InfraStruXure Manager, 100 Node License, Pt # AP9431  
 InfraStruXure Manager, 500 Node License, Pt # AP9432  
 InfraStruXure Manager, 1000 Node License, Pt # AP9433



The above illustration shows an InfraStruXure™ Manager Appliance and a typical browser screen shot, as used to view and control the status of your APC network-critical physical infrastructure, along with the associated unit part & license numbers. Licenses can be purchased for 25, 100, 500, or 1000 nodes to accommodate different system sizes with the option to purchase additional licenses as your system grows.

## 8. Conclusions

APC has a wide range of solutions to meet the critical Layer 0 power and cooling needs of IP telephony and Service Oriented Network Architecture requirements. In addition APC also has in-house availability consulting services that can help customers design and build a high availability power protection infrastructure for their business critical IP Telephony network.

### Further reading:

APC White Paper # 1	The Different Types of UPS Systems.
APC White Paper # 3	Calculating Total Power Requirements for Data Centers.
APC White Paper # 4	Essential Power System Requirements for Data Centers.
APC White Paper # 5	Essential Cooling System Requirements for Next Generation Data Centers.
APC White Paper # 10	Preventing Data Corruption in the Event of Extended Power Outage.
APC White Paper # 69	Power and Cooling for VoIP and IP Telephony Applications.
APC White Paper # 79	Technical comparison of On-line vs. Line-interactive UPS designs.
Key web links	<a href="http://www.apc.com">www.apc.com</a> & <a href="http://cisco.apc.com">http://cisco.apc.com</a>

### About the Author:

**Neil Whiting** is a Senior Application Engineer with APC based in the UK just north of London. He has worked in the power solution industry for over 30 years starting with AC/DC power supply design through to DC power systems for the Telecommunications industry and more recently AC power solutions for the converging IT and Telecommunications industry. He has a HND in Electrical, Electronic and Control Engineering and joined APC in April 2000, when APC acquired Advance Power Systems, during which time he has fulfilled both product management and application engineering roles.