InfraStruXure™ for Wiring Closets and Computer Rooms: Site Preparation, Site Planning, and Installation

InfraStruXure for Wiring Closets and Computer Rooms is an integrated power, rack, air, and management architecture consisting of standard, plug-and-play components. This architecture allows for fast, easy, hassle-free installation and helps eliminate the “chaos” within an IT environment by providing a foundation for your critical IT equipment that fosters organization, ease-of-use, and control.

This guide summarizes how to install your InfraStruXure System. For detailed installation, operation, and maintenance instructions, see the documentation included with each component in your system.

Contact your APC representative or visit the APC website (www.apc.com) for a complete list of InfraStruXure System options and additional documentation.

Before installing or operating any InfraStruXure System components, read the safety instructions and warnings included in each component’s manual.
System Components

Rack

NetShelter® VX
Enclosure

NetShelter VX
Open Frame

NetShelter
4-Post Open Frame

NetShelter
2-Post Open Frame

Power

Smart-UPS®
1500VA, 2200VA,
3000VA, 5000VA

Smart-UPS RT
3000VA, 5000VA,
7500VA, 10,000VA

Symmetra® RM
2–6kVA

Symmetra LX
4–8kVA, 8–16kVA

Power distribution

Basic
Rack PDUs

Metered
Rack PDUs

Switched
Rack PDUs
Management

System Components

InfraStruXure System Manager

Environmental Management System

Environmental Monitoring Unit

Network Management Card

Environmental Monitoring Card

Building Management System Integration Card

Air

NetworkAIR® Portable Air Conditioner

Rack Air Distribution Unit

Rack Air Removal Unit

Rack accessories

The following rack accessories are offered by APC for InfraStruXure Systems:

- Keyboard drawers
- Keyboards
- Rack-mounting hardware
- Rack fan systems
- Security devices
- Shelving
- Stabilization plates and brackets
- Shielding troughs and cable ladders
- Blanking panels
- Grounding kits
- Rack PDU mounting brackets

Services

The following service packages are offered by APC for InfraStruXure Systems:

- Installation and Start-Up Services
- Pre-Installation Consulting
- Extended Warranties
- On-Site Service
- Preventative Maintenance
- Battery Refresh Programs
- Network Integration for APC Software
- Remote Monitoring Service
Site Preparation

Verify the shipment

Ensure that all labeled pallets and boxes match your purchase order. Do not unpack the pallets and boxes until you are ready to install the system.

Environmental requirements

⚠️ Batteries can be permanently damaged if installed in a system that is not being used. Store battery modules at an ambient temperature below 25°C (77°F).

Select a site that is temperature-controlled, clean, dry, and free of conductive contaminants, and that meets the following specifications:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>0 to 40°C (32°C to 104°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity</td>
<td>0–95% non-condensing</td>
</tr>
<tr>
<td>Elevation above mean sea level</td>
<td>0–3000 m (0–10 000 ft)</td>
</tr>
</tbody>
</table>

Consider the heat dissipation ratings of equipment to determine cooling requirements. Additional cooling equipment may be required. Heat dissipation ratings of common InfraStruXure System UPS types are listed in the table.

<table>
<thead>
<tr>
<th>UPS</th>
<th>BTU/hr</th>
<th>kW</th>
<th>UPS</th>
<th>BTU/hr</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetra RM (2–6kVA)</td>
<td></td>
<td></td>
<td>Smart-UPS 1500 RM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batteries charging</td>
<td>3300</td>
<td>0.966</td>
<td>Batteries charged</td>
<td>171</td>
<td>.050</td>
</tr>
<tr>
<td>Batteries charged</td>
<td>1290</td>
<td>0.377</td>
<td>Smart-UPS 2200 RM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symmetra LX (4–8kVA)</td>
<td></td>
<td></td>
<td>Batteries charged</td>
<td>300</td>
<td>.088</td>
</tr>
<tr>
<td>Batteries charging</td>
<td>6472</td>
<td>1.895</td>
<td>Smart-UPS 3000 RM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batteries charged</td>
<td>3485</td>
<td>1.020</td>
<td>5U Batteries charged</td>
<td>400</td>
<td>.018</td>
</tr>
<tr>
<td>Symmetra LX (8–16kVA)</td>
<td></td>
<td></td>
<td>2U Batteries charged</td>
<td>375</td>
<td>.110</td>
</tr>
<tr>
<td>Batteries charging</td>
<td>10,312</td>
<td>3.019</td>
<td>Smart-UPS 5000 RM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batteries charged</td>
<td>4995</td>
<td>1.463</td>
<td>Batteries charged</td>
<td>430</td>
<td>.126</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Batteries charged w/transformer</td>
<td>1708</td>
<td>.500</td>
</tr>
</tbody>
</table>
Access and ventilation requirements

Consult the NEC and your local codes for additional requirements.

Weight considerations

Ensure that the floor and sub-floor can support the total weight of the system when the enclosures are concentrated on the leveling feet. If you are placing equipment on a raised floor, consult the flooring manufacturer for loading requirements before installing equipment.

Decide what equipment will be installed in your racks and enclosures. Do not exceed the maximum capacity listed in the table.

<table>
<thead>
<tr>
<th>Rack or Enclosure</th>
<th>Maximum Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetShelter VX Enclosure</td>
<td>2000lb (907kg)</td>
</tr>
<tr>
<td>NetShelter VX Open Frame</td>
<td>2000lb (907kg)</td>
</tr>
<tr>
<td>NetShelter 4-Post Open Frame</td>
<td>1000lb (454kg)</td>
</tr>
<tr>
<td>NetShelter 2-Post Open Frame</td>
<td>750lb (340kg)</td>
</tr>
</tbody>
</table>
Electrical requirements and safety

Consult your UPS and power distribution manuals for detailed electrical requirements and installation instructions.

Consult the NEC and local codes for requirements other than those listed in the manual included with your products.

The UPS contains internal batteries and may present a shock hazard even when disconnected from the branch circuit (mains). See the safety information in your UPS manual for more information.

Electrical input

<table>
<thead>
<tr>
<th>Product</th>
<th>Connection Method</th>
<th>Connection Type</th>
<th>Voltages Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetra 2–6kVA†</td>
<td>Hard-wired</td>
<td>40A, 2-pole (external); #10 AWG (6mm²)</td>
<td>208, 240</td>
</tr>
<tr>
<td></td>
<td>Cord-connected</td>
<td>NEMA L6-30P</td>
<td></td>
</tr>
<tr>
<td>Symmetra LX 4–8kVA</td>
<td>Hard-wired</td>
<td>50A, 2-pole (external); #6 AWG (25mm²)</td>
<td>208, 240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-wire (G+L2+N+L1)</td>
<td></td>
</tr>
<tr>
<td>Symmetra LX 8–16kVA</td>
<td>Hard-wired</td>
<td>100A, 2-pole (external); #3 AWG (25mm²)</td>
<td>208, 240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-wire (G+L2+N+L1)</td>
<td></td>
</tr>
<tr>
<td>Smart-UPS 1500</td>
<td>Cord-connected</td>
<td>NEMA 5-15P</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 2200</td>
<td>Cord-connected</td>
<td>NEMA 5-20P</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 3000</td>
<td>Cord-connected</td>
<td>NEMA L5-30P</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 5000</td>
<td>Cord-connected</td>
<td>NEMA L6-30P</td>
<td>208</td>
</tr>
</tbody>
</table>
† The specifications apply to units with and without a step-down transformer.
## Electrical output

<table>
<thead>
<tr>
<th>Product</th>
<th>Connection Type</th>
<th>Voltages Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetra RM 2–6kVA</td>
<td>(2) NEMA L6-20R</td>
<td>208</td>
</tr>
<tr>
<td>Symmetra RM 2–6kVA with step-down transformer</td>
<td>(12) NEMA 5-20R, (2) NEMA L6-20R</td>
<td>120, 208</td>
</tr>
<tr>
<td>Smart-UPS 1500</td>
<td>(6) NEMA 5-15R</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 2200</td>
<td>(6) NEMA 5-15R, (2) NEMA 5-20R</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 3000</td>
<td>(8) NEMA 5-15R</td>
<td>120</td>
</tr>
<tr>
<td>Smart-UPS 5000</td>
<td>(2) NEMA 5-15R, (2) NEMA L6-20R</td>
<td>120, 208</td>
</tr>
</tbody>
</table>
## Emergency Power-Off (EPO)

A licensed electrician must connect the emergency power-off (EPO) device.

If required by local or national codes, you must connect the EPO (to disable output power in an emergency) either as internally powered for use with non-powered switch circuits, or externally powered for use with +24 VDC-powered switch circuits. The EPO circuit must be a Class 2 (UL and CSA standard) and SELV (IEC standard) circuit, isolated from all primary circuitry. For instructions on wiring, see the installation section included with your UPS.

The connection of the UPS to the EPO requires one of the following cable types:

<table>
<thead>
<tr>
<th>Cable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL2</td>
<td>Class 2 cable for general use.</td>
</tr>
<tr>
<td>CL2P</td>
<td>Plenum cable for use in ducts, plenums, and other spaces used for environmental air-flow.</td>
</tr>
<tr>
<td>CL2R</td>
<td>Riser cable for use in a vertical run in a shaft from floor to floor.</td>
</tr>
<tr>
<td>CLEX</td>
<td>Limited use cable for use in dwellings and in raceways.</td>
</tr>
</tbody>
</table>

APC offers an Emergency Power Off System (EPW9) for your InfraStruXure System. Contact your APC sales representative, or go to the APC Web site ([www.apc.com](http://www.apc.com)) for more information.
Site Planning

The following are sample configurations you can use to plan the layout of your computer room. Actual number of racks supported may be less than shown depending upon the actual load per rack. The specified spacings are the minimum requirements. Check your local and national codes for additional requirements.

**Smart-UPS 1500VA**

Set up to two NetShelter VX enclosures and one UPS.

![Smart-UPS 1500VA Diagram]

**Smart-UPS 2200VA or 3000VA**

Set up to three NetShelter VX enclosures and one UPS.

![Smart-UPS 2200VA or 3000VA Diagram]

**Smart-UPS 5000VA or Symmetra RM (2–6 kVA)**

Set up to four NetShelter VX enclosures and one UPS.

![Smart-UPS 5000VA or Symmetra RM Diagram]
**Symmetra LX (4–8kVA)**

**One Row.** Three NetShelter VX enclosures, and one UPS, or four NetShelter VX enclosures, one UPS and one Rack PDU Extender.

![One Row Diagram]

**Parallel Rows.** Set up two short, parallel rows. Run APC Cable Ladders between the rows. Two NetShelter VX enclosures, one UPS and one Rack PDU Extender, or two NetShelter VX enclosures, two Rack PDU Extenders, and one UPS.

![Parallel Rows Diagram]

**Adjacent Short Rows.** Set up four short, adjacent rows using four NetShelter VX enclosures, three Rack PDU Extenders, and two UPSs.

![Adjacent Short Rows Diagram]
**Symmetra LX (4–16 kVA)**

**Parallel rows.** Set up three short, parallel rows, using twelve NetShelter VX enclosures, one UPS, and two Rack PDU Extenders. Run APC Cable Ladders between the rows.

![Parallel rows diagram]

**Adjacent short rows.** Set up three short, adjacent rows using twelve NetShelter VX enclosures, one UPS, and two Rack PDU Extenders. Run APC Cable Ladders between the rows.

![Adjacent short rows diagram]

**One row.** Set up one long row using twelve NetShelter VX enclosures, one UPS, and two Rack PDU Extenders.
Basic Installation Procedures

Unpack racks and enclosures

Unpack the racks and enclosures included with your shipment according to the unpacking instructions in the rack or enclosure manual.

⚠️ Note
Search all boxes and packaging to make sure they are empty before discarding.

Assemble racks and enclosures

Orient the racks and enclosures in the planned location (see “Site Planning” on page 9), and make any necessary adjustments to the enclosures that are needed for your location.

If you have enclosures as part of your system. Each row should include one enclosure with side panels. The other enclosures should be expansion enclosures without side panels.

1. Place the enclosure with side panels at the end of the row, and remove the side panel that will be adjacent to an expansion enclosure. Place the side panel that you have removed on the expansion enclosure at the end of the row.

2. Join adjacent enclosures.

See the manual included with your enclosures for instructions.
3. Level the enclosures.

Leveling feet are attached under the enclosure at the corners. The leveling feet can help provide a stable base if the selected floor space is uneven, but cannot compensate for a badly sloped surface. To level the enclosure:

a. Fit the 14-millimeter end of the open-ended wrench (provided) to the hex head just above the round pad on the bottom of a leveling foot. Turn the wrench clockwise to extend the leveling foot until it makes firm contact with the floor.

b. Repeat step a for each of the remaining leveling feet.

c. Use a level to determine which feet need further adjustment to level the enclosure. Adjust as necessary.

**Install the UPS**

Follow the installation procedures in the manual included with your UPS.

Use two people to install the UPS.

Install the UPS in the bottom of the selected rack or enclosure. (See “Site Planning” on page 9 for suggestions.) If you have a Symmetra RM UPS, install the power and battery modules after you install the UPS in the rack.
Install the Cord-Connected PDU

The Cord-Connected PDU is used primarily with the Symmetra 4-8kVA and 8-16kVA UPSs, and the NetShelter VX Enclosures. Install it in the bottom 2U behind the rear vertical mounting rails.

Follow the procedures in the instruction sheet included with your Rack PDU Extender.

Install the Step-down Transformer

The Step-Down Transformer is used with the Symmetra 2–6 kVA or Smart-UPS 5000. It can be installed in the same enclosure as your UPS, or in an enclosure with a Rack PDU Extender.

Follow the procedures in the manual included with your Step-Down Transformer.

Install Rack PDUs

See the manual included with your Rack PDUs for detailed safety and installation instructions.
Install vertical APC Rack PDUs in the rear of a NetShelter VX Enclosure, in the cable channel directly behind the rear vertical mounting rails. You can install the Rack PDU in one of two ways: using toolless mounting pegs (provided) or the mounting brackets (sold separately). You can mount two Rack PDUs on one side of the enclosure by using the toolless mounting method.

1. Slide the mounting pegs into the holes located in the channel in the rear panel of the enclosure.

2. Snap the Rack PDU into place by pushing it downward until it locks into position.

**Install optional equipment in the enclosures**

See the manual included with your InfraStruXure optional equipment for detailed safety and installation instructions.
Overview

The diagrams in this section illustrate typical configurations. Your configuration may vary. If you have questions, consult the user manual of each component, visit the APC website (www.apc.com), or contact Customer Support at a number on the back cover of this manual. The diagrams are only a guide as to what steps you will need to take.

Do not use only these diagrams to connect your equipment. Read and follow the safety and connection instructions in the manual included with your UPS and power distribution equipment.

Smart-UPS 1500VA, 2200VA, 3000VA

Caution
Symmetra RM 2–6kVA UPS

Symmetra LX 4–16 UPS
Connect Rack PDU to the UPS

Route the Rack PDU power cords to the UPS through the bottom of the enclosures, using the holes in the enclosures’ vertical posts. Plug each power cord into an outlet on the UPS, Step-Down Transformer, or Rack PDU Extender. The diagram shows vertical Rack PDUs; however, you can use any APC Rack PDUs with plugs that match your UPS, Step-Down Transformer, or Rack PDU Extender outlets. See “Electrical requirements and safety” on page 6 for information on the outlet type of each UPS.

Connect UPS Batteries

The Smart-UPS models are shipped with the batteries installed; however, you must make the necessary connections to energize the batteries before the UPS will operate.

Ensure that the battery modules in the Symmetra RM or Symmetra LX UPS are seated properly.

See the manual included with your UPS for detailed safety and installation instructions.

Configure APC management devices

Your InfraStruXure System for computer rooms can be managed through the APC Network Management Card or through the InfraStruXure System Manager.

If you have an InfraStruXure System Manager as part of your system, connect each Network Management Card to the InfraStruXure System Manager hub using CAT5 network cables, and configure the InfraStruXure System Manager.

See the manual included with your InfraStruXure System Manager for quick configuration instructions, and see the on-line help on the InfraStruXure System Manager’s interface for more information on managing the system.

If you do not have an InfraStruXure System Manager as part of your system, configure the network settings of each Network Management Card in your system.

See the manual included with your Network Management Card for quick configuration instructions and the supporting documentation on the CD for more detailed information.
**Warranty**

**InfraStruXure Standard Warranty**

APC warrants that all components of the InfraStruXure system will be free from defect in material and workmanship for a period of two years from the date of start up when start up has been performed by APC authorized service personnel*. If assembly services are included in the original purchase and are also performed by APC authorized service personnel, APC offers an additional year of warranty at no additional charge. In the event that the system fails to meet the forgoing warranty, APC shall repair or replace, at its sole discretion, any such defective parts. Under this warranty, APC will ship all parts to your site at no cost to be available for you the next business day after APC is notified of this requirement. If you choose to upgrade the system to include an on site contract, APC offers modular service packages to match your needs.

Each point product incorporated into the system has a separate factory warranty that is applied when sold as a standalone unit. When incorporated into an InfraStruXure solution, the unit will be covered by the InfraStruXure warranty. In cases where one warranty favors the customer over the other, the stronger of the two warranties will take precedence.

*All warranties are null and void unless installation and startup are performed by authorized APC Global Services service centers.

APC shall not be liable under this warranty if its testing and examination disclose that the alleged defect in the product does not exist or was caused by purchaser’s or any third person’s misuse, negligence, improper installation or testing, unauthorized attempts to repair or modify, or any other cause beyond the range of the intended use, or by accident, fire, lightening or other hazard.

There are no warranties, express or implied, by operation of law or otherwise, of products sold, serviced or furnished under this agreement or in connection herewith. APC disclaims all implied warranties of merchantability, satisfaction and fitness for a particular purpose. APC’s express warranties will not be enlarged, diminished, or affected by and no obligation or liability will arise out of, APC’s rendering of technical or other advice or service in connection with the products. The foregoing warranties and remedies are exclusive and in lieu of all other warranties and remedies. The warranties set fourth above constitute APC’s sole liability and purchaser exclusive remedy for any breach of such warranties. APC’s warranties run only to purchaser and are not extended to any third parties. In no event shall APC, its officers, directors, affiliates or employees be liable for any form of indirect, special consequential or punitive damages, arising out of the use, service or installation, of the products, whether such damages arise in contract or tort, irrespective of fault, negligence or strict liability or whether APC has been advised in advance of the possibility of such damages.
APC Worldwide Customer Support

Customer support for this or any other APC product is available at no charge in any of the following ways:

- Visit the APC Web site to access documents in the APC Knowledge Base and to submit customer support requests.
  
  - www.apc.com (Corporate Headquarters)
    
    Connect to localized APC Web sites for specific countries, each of which provides customer support information.
  
  - www.apc.com/support/
    
    Global support searching APC Knowledge Base and using e-support.

- Contact an APC Customer Support center by telephone or e-mail.
  
  - Regional centers:
    
    | Direct InfraStruXure Customer Support Line | (1)(877)537-0607 (toll free) |
    |-------------------------------------------|-------------------------------|
    | APC headquarters U.S., Canada             | (1)(800)800-4272 (toll free)  |
    | Latin America                             | (1)(401)789-5735 (USA)       |
    | Europe, Middle East, Africa               | (353)(91)702000 (Ireland)    |
    | Japan                                     | (0) 35434-2021               |
    | Australia, New Zealand, South Pacific area | (61) (2) 9955 9366 (Australia) |

- Local, country-specific centers: go to www.apc.com/support/contact for contact information.

Contact the APC representative or other distributor from whom you purchased your APC product for information on how to obtain local customer support.

Entire contents copyright © 2004 American Power Conversion. All rights reserved. Reproduction in whole or in part without permission is prohibited. APC, the APC logo, InfraStruXure, NetShelter, Symmetra, Smart-UPS, and NetworkAIR are trademarks of American Power Conversion Corporation and may be registered in some jurisdictions. All other trademarks, product names, and corporate names are the property of their respective owners and are used for informational purposes only.