



Uninterruptible Power Supply

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Power Quality University





Providing an educational environment for training, testing, and evaluation of today's power quality and data center solutions and equipment.

P3 leads Customer Education through Power Quality University (PQU):

- Highly Qualified, Expert Instructors
- Practical, Relevant Topics
- Continuing Education Credits (CEU's)*

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UPS Systems




Agenda



Introductions to P3

Program

- Purpose of UPS
- Types of UPS
- New Technology
- UPS Batteries
- Best Practices

Scan QR Code for today's presentation





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P3 sponsors all PQU Seminars



P3 is the industry's trusted and respected advisor for critical power, cooling and energy solutions.





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DATA CENTERS

Providing:

- Industry Knowledge,
- Product Expertise
- Technological Innovation
- Broad Portfolio of Products and Services

Reliable and efficient power and cooling infrastructure:


Modular & Scalable Data Center Equipment

Systems that grow and change with modern Data Centers.

Traditional Data Center Equipment

Systems built around existing older equipment.

We can provide both
Modular / Scalable and Traditional
Data Center Equipment





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INDUSTRIAL POWER SOLUTIONS

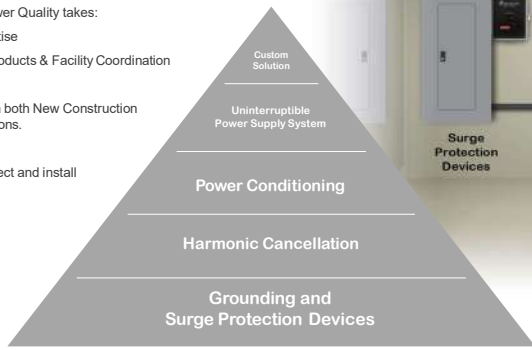
Power Quality Specialists with expertise in your Power Quality needs.

Proper Industrial Power Quality takes:


- Technical Expertise
- Investment in Products & Facility Coordination

P3 has experience in both New Construction and Retrofit Installations.

We can help you select and install the correct products.




We provide Industrial Power Quality Solutions



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Power Quality Monitoring

Providing solutions for the best possible performance from your existing power system.

- System wide analysis
- Identify and Remedy Power Quality Problems
- Lengthen the Life of Electrical Equipment
- Improve Power System Availability.



Our engineering technicians will help you understand your unique facility power system.

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Service Plans & Support Services

- ◆ Service Plans
- ◆ Energy Management Services
- ◆ Power & Cooling Analysis
- ◆ Data Center Assessments
- ◆ Project Management
- ◆ Battery Replacement

Full Service Packages that are Customized & Flexible:

- Hassle-free System Maintenance
- Predictable Cost
- Quick On-site Response
- Remote Monitoring

We provide top quality maintenance service & support





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UPS Systems


PQU seminars brought to you by P3 gives you the information you need to build confidence and reliability in your electrical system.

UPS System planning & designing is a complicated journey without a lot of direction and guidance but with the proper tools and people in place, a positive result is possible.




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UPS Systems



An **Uninterruptible Power Supply** (UPS) system is a device that provides power to your facilities equipment when the normal power provider cannot.


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UPS Systems



The energy to operate this UPS system typically comes from batteries, however, some other sources of energy are flywheels and fuel cells.

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Purpose of a UPS

- Originally to provide back-up power during power fail conditions
- Expanded application to cover line and load power quality issues

Dirty, AC Input

Uninterruptible Power Supply

Clean, continuous output during abnormal line/load conditions

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	Surge Protection Device (SPD)					Generator	Stand By Off Line UPS		
	Noise Filter	Isolation Transformer	Voltage Regulator	Line Interactive UPS	True On Line Double Conversion UPS				
Overvoltage	N	N	N	N	?	N	Y	Y	
Undervoltage	N	N	N	N	?	N	Y	Y	
Sag	N	N	N	Y	N	N	N	Y	
Swell	N	N	N	Y	N	N	N	Y	
Transient	Y	N	N	N	N	N	N	Y	
Noise	Y	Y	?	Y	N	N	N	Y	
Long term outage	N	N	N	N	Y	N	N	N	
Frequency variation	N	N	N	N	N	N	?	Y	

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Types of UPS

There are three basic types of Uninterruptible Power Supply systems available:

1. Stand by (Off-line)
2. Line interactive (Off-Line)
3. True On-line Double Conversion

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Stand By UPS System

Power from normal power provider

Batteries and DC to AC Inverter

Equipment that needs uninterruptible power

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Stand By UPS System

Benefits:

- Inexpensive
- Small Footprint

Disadvantages:

- Not Designed for Critical Loads
- No Power Conditioning
- Load Exposed to Surges, Sags, & transients
- Not Generator Compatible
- Switching Necessary to go from Utility to battery Power. Discontinuous Power during Switch to Battery
- Less Battery Life (Used more often)
- Poor Maintainability without maintenance Bypass

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Line Interactive UPS System

Line interactive (Off Line) UPS systems add extra features that give us, at a minimum, two advantages over the Stand By UPS system. One, they usually include some type of voltage regulator between the normal power provider and your equipment that needs uninterruptible power and two, they have activation times around 4-8 milliseconds.

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Line Interactive UPS System

Benefits:

- Less Costly than True on Line Technology
- Some Power conditioning

Disadvantages:

- Not Designed for Critical Loads
- Limited Power Conditioning
- Load Exposed to Surges, Sags, and Transients
- Not always Generator compatible
- Less Battery Life (Used more often)
- Poor Maintainability without a maintenance bypass

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True On Line UPS system

Double Conversion

Power from normal power provider

AC to DC Rectifier

DC to AC Inverter

Equipment that needs uninterruptible power

Batteries DC

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True On Line UPS system

Double Conversion

Benefits:

- Designed for Critical Loads
- Superior Power Conditioning
- Protects Loads from Surges, Sags, and Transients
- Generator Compatible
- Extended Battery Times available with Full Time inverter
- Extended Battery Life (Only used during emergencies)
- Easy to Maintain with maintenance Bypass Switch

Disadvantages:

- More Expensive than lessor technologies

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New Technology

Double conversion

Standard ECO mode

Advanced ECO mode

	✓	✗
Regulate Voltage	✓	✗
Regulate frequency	✓	✗
Recharge batteries	✓	✗
Load PFC	✓	✗
No time transfer	✓	✗
Efficiency : 96+%	✓	✗

	✗	✓
Regulate Voltage	✗	✓
Regulate frequency	✗	✓
Recharge batteries	✗	✓
Load PFC	✗	✓
No time transfer	✗	✓
Efficiency : 99 %	✗	✓

	✗	✓
Regulate Voltage	✗	✓
Regulate frequency	✗	✓
Recharge batteries	✓	✓
Load PFC	✓	✓
No time transfer	✓	✓
Efficiency : 98 %	✓	✓

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New Technology

Advances in Single Phase UPS

The smallest and lightest Lithium-ion 6kW UPS

30% smaller, 50% lighter, 1.5x more power

Next-gen semiconductor technology gives this UPS 1.5x more power in a 2U footprint.

High resolution LCD

Auto-rotating display with virtual touch keys

3x the battery life

The Lithium-ion battery lasts 8-10 years (3x VRLA) and won't need to be replaced under normal operating conditions, reducing Total Cost of Ownership

LED status indicator

At-a-glance indication of UPS Status

EcoStruxure Ready

Connect to EcoStruxure® IT via the embedded network port.

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New Technology


Advances in Single Phase UPS

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New Technology



Advances in Single Phase UPS



50% smaller, 60% lighter, 2.5x more power
Next-gen semiconductor technology gives this UPS 2.5x more power in half the size.

Redundant displays
Touchscreen display with Start-up wizard, access to status and configuration menus & data, including serial number. One-line diagram with UPS status when display is in power saving mode.

Modular, scalable & redundant
Smart-UPS Modular Ultra features more redundancy: power, battery, displays and intelligence modules.

LED status indicators
At-a-glance UPS and module status.


Universal Bays
Module Bays within the 9U UPS chassis allow you to add power or battery modules based on your current needs.

EcoStructure Ready
Connect to EcoStructure™ IT via the embedded network port.

3x the battery life
Lithium-ion batteries last 8-10 years (3x VRLA), reducing Total Cost of Ownership.


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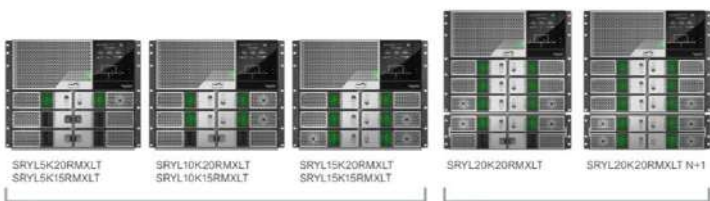


New Technology



Advances in Single Phase UPS

The modular design allows you to scale power, runtime or redundancy



5kW scalable to 15kW or 10kW N+1
Based on our most popular modular UPS


- 100A input AC Tray is backwards compatible with Symmetra LX wiring
- 9U height scales up to 15kW without changing your UPS footprint.

Scalable to 20kW N+1
Up to 20kW of single phase power protection

- 125A input AC Tray scales up to 20kW power protection in a single phase UPS
- 9U height up to 15kW, 12U height for 20kW
- 3U height external battery chassis included with SRYL20K20RMXLT

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Options for Maintenance Bypass Switch (MBS) OK

Internal Maintenance Bypass (MBS) OK

- An Internal Maintenance Bypass comes built in to the UPS
- Low Cost
- Easy to wire
- Some areas of the UPS are still live when in maintenance bypass mode
- Load power must be interrupted for major repair or replacement

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Options for Maintenance Bypass Switch (MBS) Better

External Maintenance Bypass (MBS) Better

- A 2 Breaker (MBS) is installed separate from the UPS
- Small Cost increase
- Need 2 UPS feeders
- Total UPS isolation for maintenance or replacement
- Load power is not interrupted
- Single point failure at UPS input

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Options for Maintenance Bypass Switch (MBS) Better

External Maintenance Bypass (MBS) Better

- A 3 Breaker (MBS) is installed separate from the UPS
- Small Cost increase
- Need only 1 UPS feeder
- Total UPS isolation for maintenance or replacement
- Load power is not interrupted
- Single point failure at UPS input

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Options for Maintenance Bypass Switch (MBS)

Why do the previous options only carry a BETTER label and not the BEST label?

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What if?

- Inverter fails catastrophically
- Trips the breaker in the MBS
- The UPS cant go to battery because the inverter is gone
- The UPS tries to switch to static bypass....BUT!
- The static bypass is fed from the tripped MBS Breaker
- Load is dropped

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Options for Maintenance Bypass Switch (MBS)

- Two UPS feeders
- The Rectifier has its own UPS feeder
- The Static Bypass has its own UPS feeder
- Eliminates the problem from previous slide
- Power can be supplied to inverter/converter section while in Maintenance Bypass (Service people prefer this for testing)

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UPS Batteries

Types of UPS Batteries

A. VRLA (10)

- Expect 3-7 Years of Useful Life
- Designed Around 77° F
- Minimal Out-gassing
- Generally Spill Containment not required.
- Lowest Cost
- Small Footprint
- Cabinetized
- **Base Cost**

B. Li-Ion (10)

- Expect 10-15 Years of Useful Life
- 50% Less footprint
- 60% Less weight
- 10x number of Cycles
- 4x Faster recharge
- Lower TCO
- **Base Cost x 1-1.5**

C. Flooded (20)

- Expect 12-17 Years of Useful Life
- Ventilation Needed to Remove Gases
- Spill Containment Needed
- Fire system needed
- Eye Wash Needed
- More Maintenance Required
- Large Footprint
- Higher Cost
- More Reliable
- **Base Cost x 8 + Room**

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The New Best Practice

The Lithium Ion Battery Solution

LIB Requirements for UPS application

- Top safety technology
- Standardized Battery Solution
- High energy and power density: 35kWh and up to 230kW per rack
- Backup time from 5-30 min
- 15-years design life
- Competitive CapEx
- Breakthrough TCO
- Small Footprint
- Less Weight

LIB Rack

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The new best practice

Lithium Ion vs. VRLA Battery Technology

- 2 to 3 X** Expected Life
- 10 X** #charge cycles
- 1 to 1.5 X** Initial Cost
- 40 to 60%** Less Footprint
- Faster** Recharge Time
- 30 to 80%** Less TCO
- 60 to 70%** Less weight
- Higher** Operating Temp

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The Modern Data Center

Modular and Scalable





250kVA

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 **The Modern Data Center** 


Modular and Scalable





500kVA

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 **The Modern Data Center** 


Modular and Scalable




750kVA

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The Modern Data Center




Modular and Scalable



1500kVA


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Galaxy VL UPS




50kW/480v Power Module





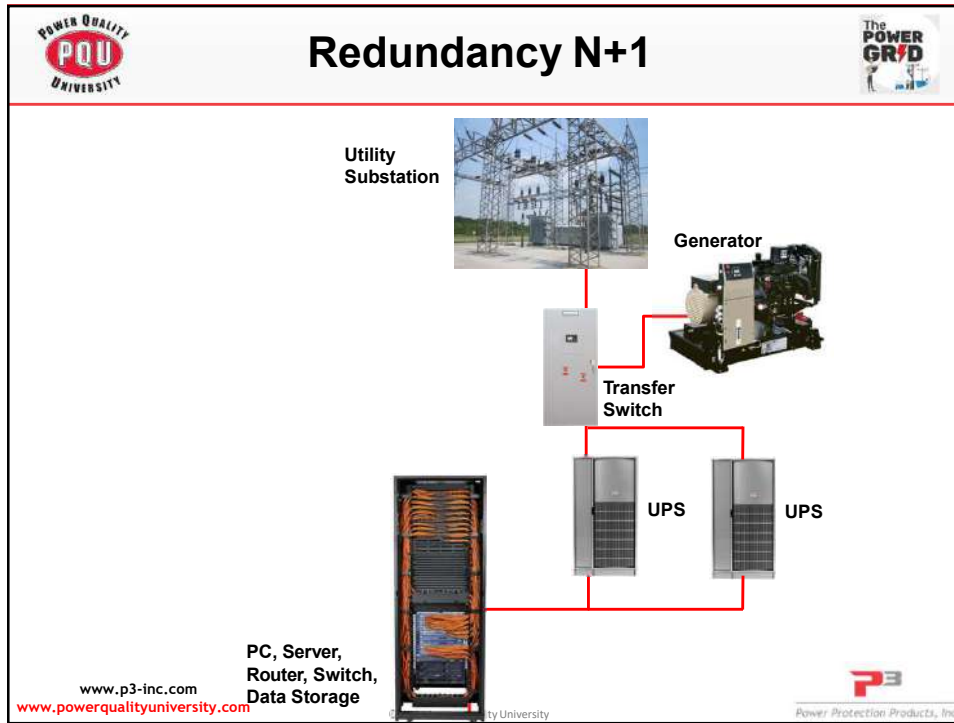
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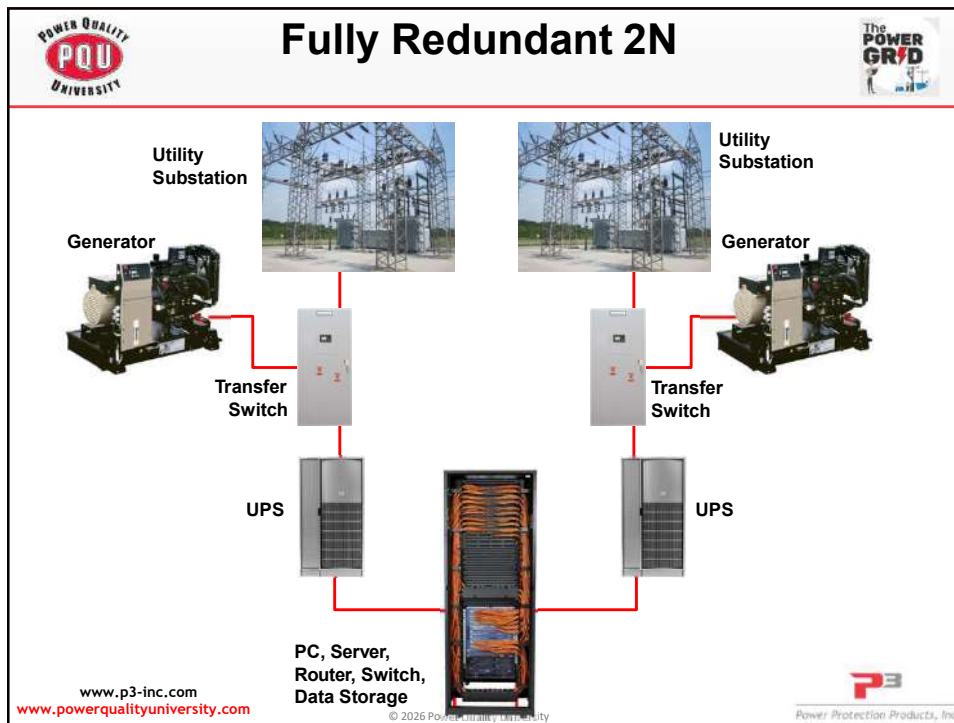


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UPS Systems



CHALLENGE ACCEPTED



At the end of the long UPS journey is the beginning of solution implementation and obtaining desired results.



 is here to guide you on this journey.

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Building Confidence in Power

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