

**Designing Modular, Scalable,  
N+1 Redundant UPS**



**Energy Technologies, Inc.**  
Rugged Power ♦ Global Solutions

# ***Designing Modular, Scalable, N+1 Redundant Uninterruptible Power Systems***

***Timothy Lowe, PhD  
Energy Technologies, Inc.***





## ***Development and Application Drivers***

***Reduced Rack Mounting Space with additional power Capacity***

***Light weight but Rugged to Meet Shock and Vibration Specifications***

***High Reliability, High MTBF and Low MTBR Cost Effective in all applications***

***Modularity With Redundancy***

***Longer Battery Back up Time***

***Intelligent Monitoring and Performance History***

***Ease of Future Application expansion***

***Flexible Out Put Connector Selection***



## **Product Goals and Desires**

- **2000 Watts in “1U” of Rack Space (1.75 inches)**
- **Hot Swappable Power and Battery Modules**
- **N+1 Redundant Capable**
- **Paralleled Configurations**
- **Elimination of Output Power Cable Arm Retractors**
- **Single Phase or Three Phase Configuration**
- **Ease of Use Display (Single Button Management)**
- **Input Power Isolation**
- **13 Minute Full Load Battery Backup @ 2000 Watts**
- **High Efficiency and Overload Capable**
- **Wide Range Voltage Input and Output**
- **Full Power Capacity at Low and High Temp (-40C to +70C)**
- **Less Than 40 Pounds**
- **Flexible Remote Communication (SNMP, WAN, RS232, RS485)**



## ***Delivered Features***

- ***2000 Watts, 2500 VA output power per module***
- ***13 minute run-time per battery module at 2000 W***
- ***Field replaceable, hot swap battery modules***
- ***High reliability & capacity lithium iron phosphate***
- ***Full power operation from -20°C to +60°C***
- ***Power factor correction at AC input***
- ***True on-line double conversion***
- ***Cold start with no AC or DC input connections***
- ***Pure sinusoidal AC output voltage***
- ***Handles both linear and non-linear loads***

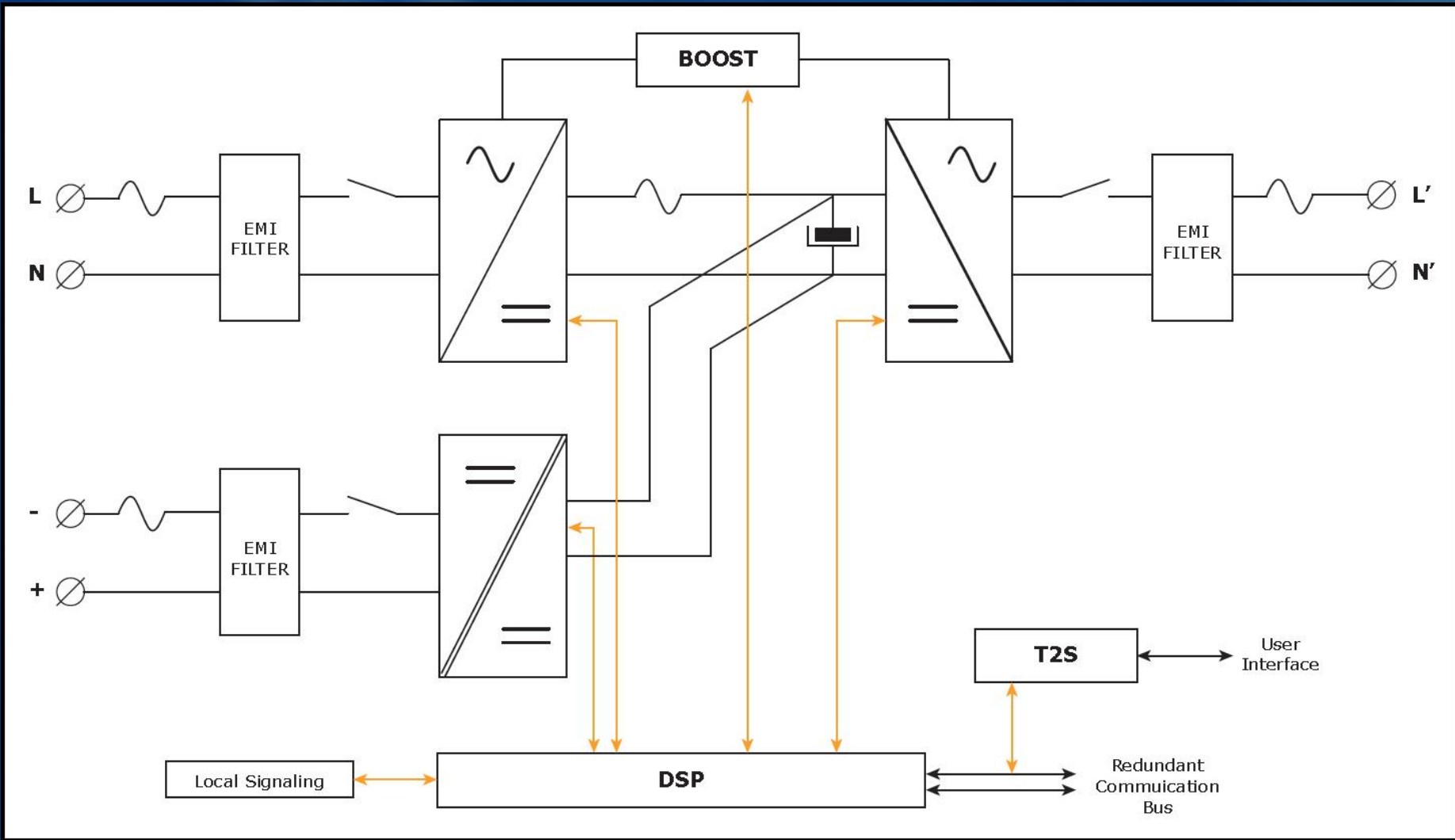


## ***Delivered Features***

- ***N+1 redundancy: Increased reliability***
- ***1-phase or 3-phase AC output configurations***
- ***Up to 32 units can be combined for increased power rating***
- ***1U high rack mount unit (1.73" x 19" x 23.0")***
  - ***Light weight: <40 lbs. including battery***
  - ***Meets Mil Spec mechanical shock and vibration standards***
- ***Multiple output connector configurations***
- ***User I/O and Configuration signal ports***



## Block Diagram of Power Chain





# Lithium Battery Specifications

UNDOT 38.3 Tested | RoHS Compliant |  
IEC 62133 Certified\*\* | UL Listed

**SPECIFICATIONS**

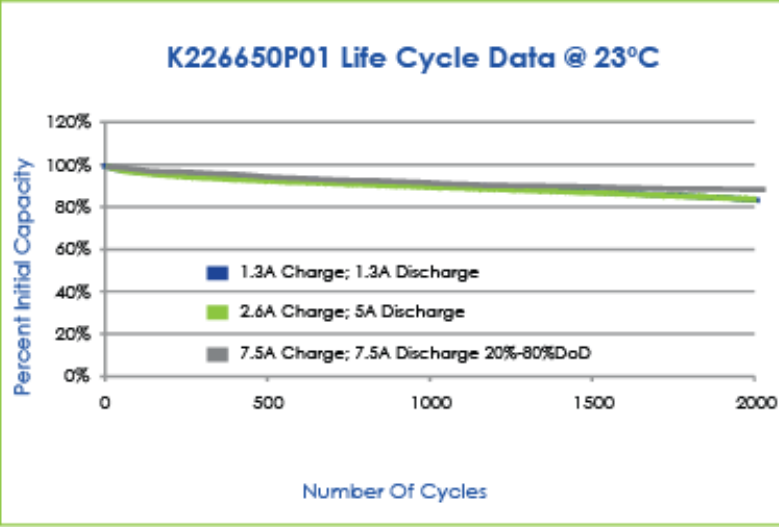
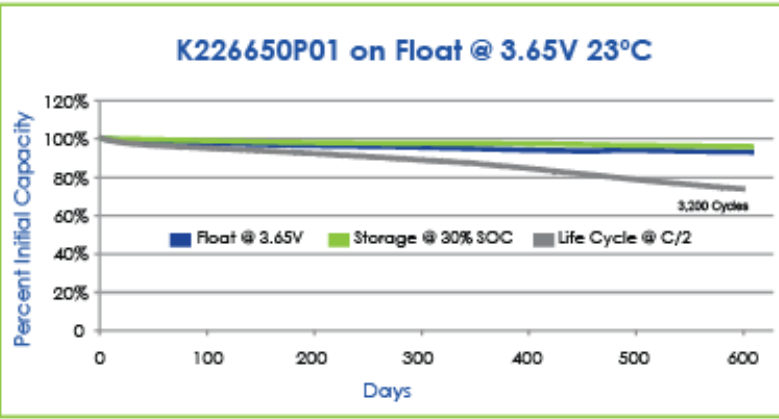
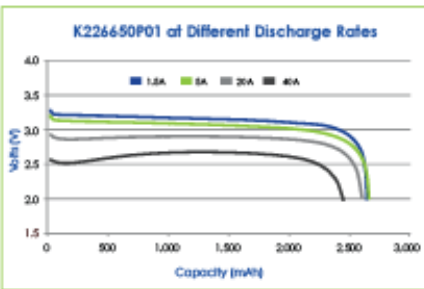
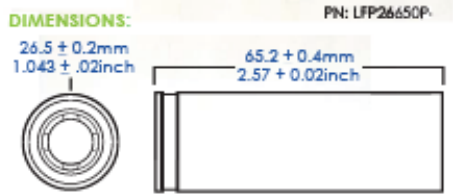
Nominal Capacity @ C/5 (Ah)	2.6
Average Operating Voltage@ C/5 (V)	3.2
Internal Impedance @ 1kHz, AC(mΩ)	9
Weight (g/oz)	80.5 ± 2 / 2.84

**RECOMMENDED OPERATING CONDITIONS**

Continuous Discharge (A)	≤ 10
Pulse Discharge (A) 30 Seconds	26
Charge Current (A)	≤ 2.6
Charge Voltage Cutoff (V)	3.65
Discharge Voltage Cutoff (V)	2.50
High Operating Temp (°C)	60
Low Operating Temp (°C)	-20

**MAXIMUM OPERATING CONDITIONS**

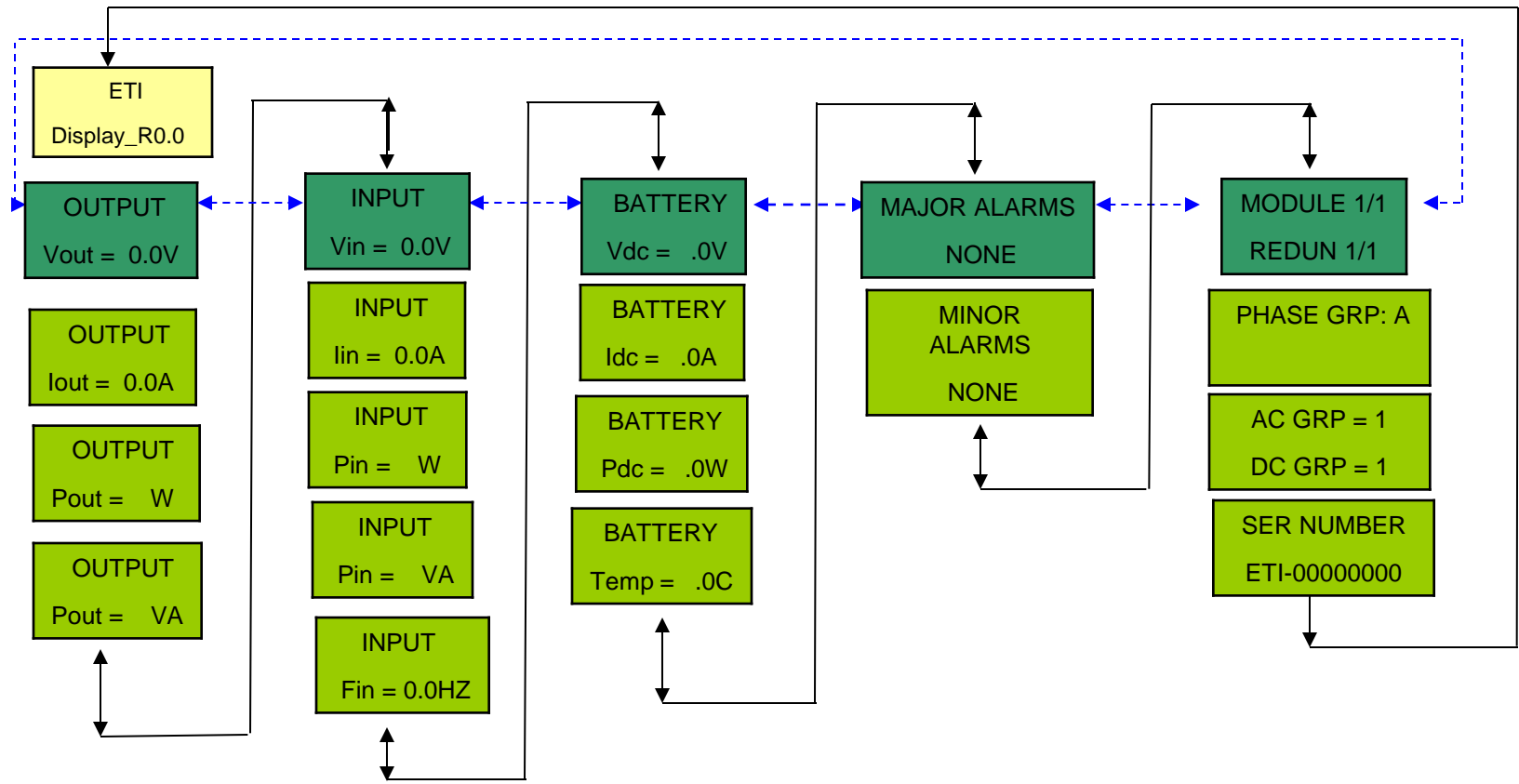
Continuous Discharge (A)	42
Pulse Discharge (A) 30 Seconds	50
Short Pulse Discharge Current (A)	150
Charge Current (A)	5
Charge Voltage Cutoff (V)	4.1
Discharge Voltage Cutoff (V)	2.0
High Operating Temp (°C)	85*
Low Operating Temp (°C)	-40*



Performance may vary depending on application. All specifications and operation conditions are subject to change without notice. This data is for evaluation purposes only. No guarantee is intended or implied by this data. \*May reduce cycle life \*\* Tested and certified - MDS. C0005 REV- D



# UPS Single Button Flowchart



----- PUSH to select MAJOR menu items.  
 \_\_\_\_\_ TURN to select MINOR menu items.



# Designing Modular, Scalable, N+1 Redundant UPS



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## Ultimate Power Source™ Rugged, Compact, Light Weight with N+1 Parallel Redundancy



Front View of Single  
1U Module

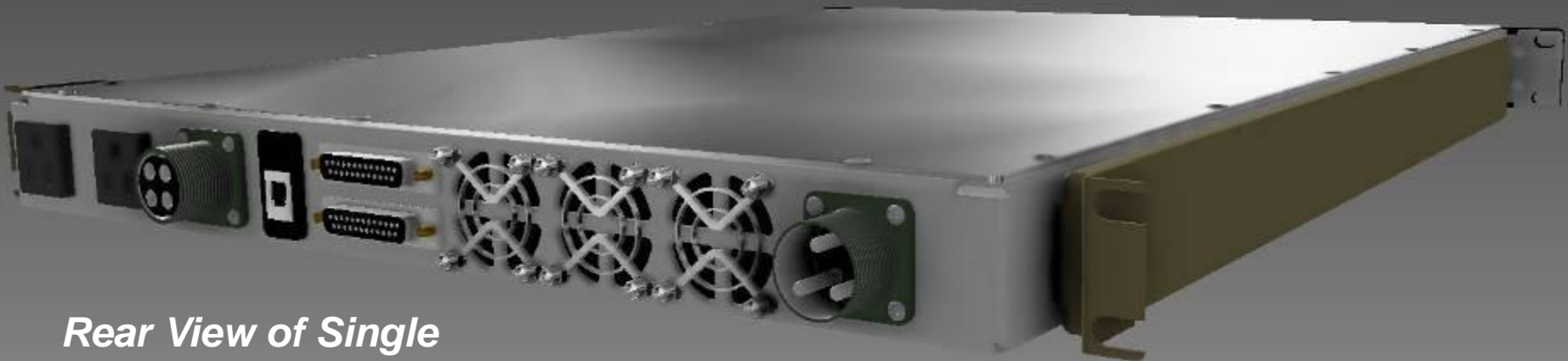
Output Power	AC Input Voltage Options	AC Output Voltage Options	DC Input Voltage Options	DC Output Options	Stand Alone Battery Run Time
2000 Watts, 2500 VA	80-140 Vrms or 150-265 Vrms @ 47-65 Hz	115 Vrms or 230 Vrms 50Hz or 60Hz	28 V nominal or 48 V nominal	up to 1250 Watts of DC total	13 Min. @2000 W 26 Min. @1000 W Lithium Iron Phosphate

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## Combine up to 32 Units for increased power! 1-phase or 3-phase AC output!

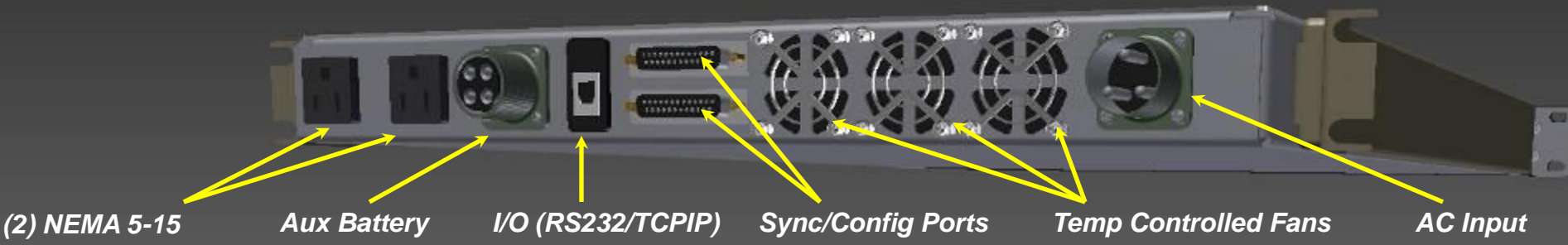


Rear View of Single  
1U Module

Battery Modules	Configuration	Overload Capabilities	Efficiency
Hot Swappable Battery Modules Light Weight Lithium	Parallelable (up to 32 Units) 1 or 3 Phase AC output	150% Power for 5 sec. 110% w/o degradation	95% Enhanced Power Conversion 90% Online



## 1U UPS with Several Output Connector Configurations





## **1U Battery Expansion Module (BEM)**

- **Hot swappable Battery Modules**
- **Same Battery Modules used in the 1U UPS**



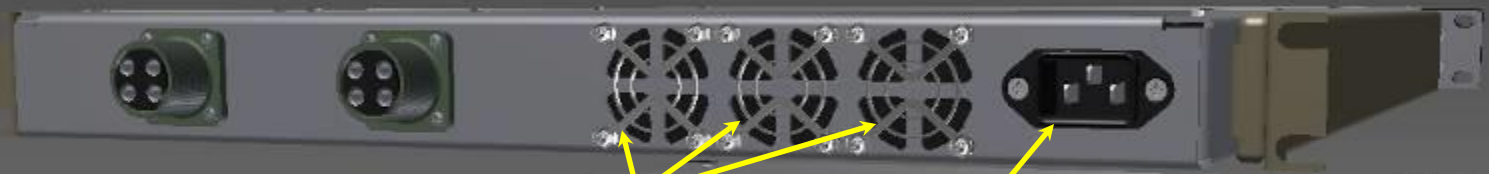
**2 Lithium Iron Phosphate Modules**



## Connector Options for 1U BEM

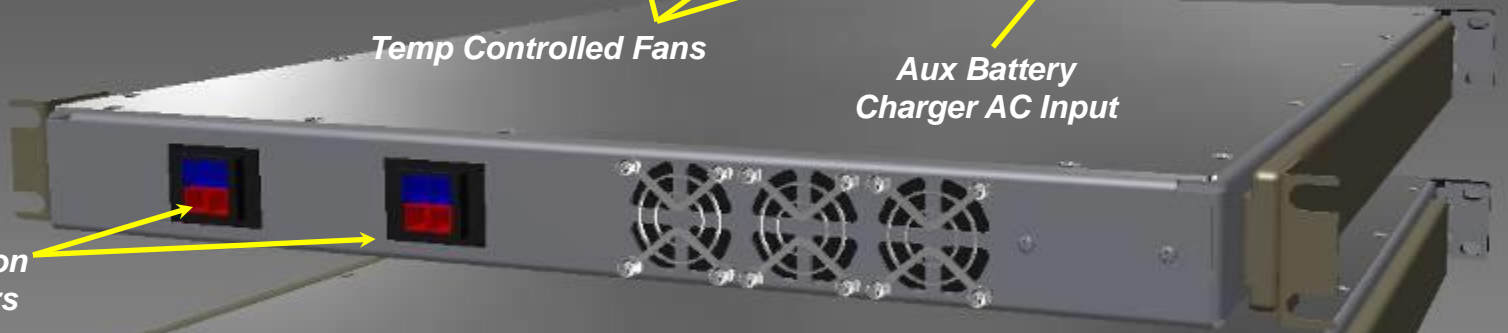


(2) MS connectors. Dual connectors allow BEMs to be daisy chained for increased backup time

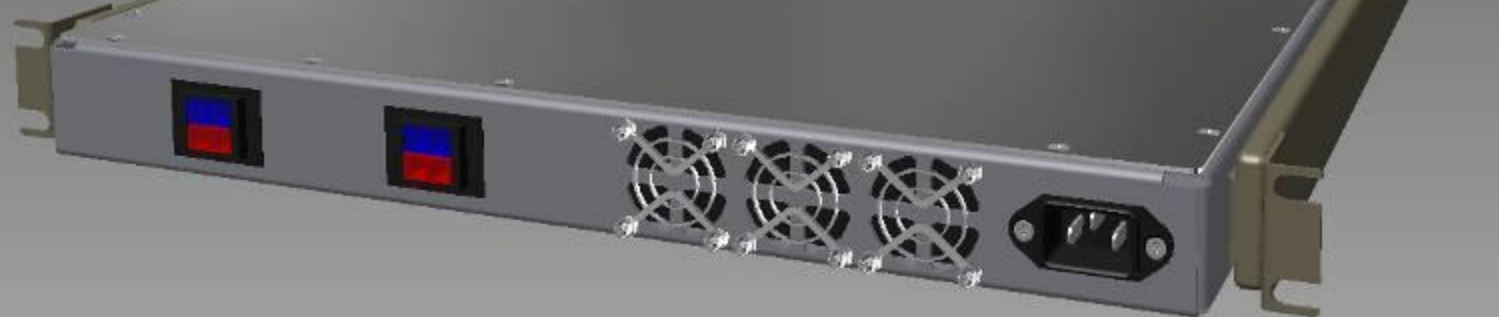


Temp Controlled Fans

Aux Battery Charger AC Input

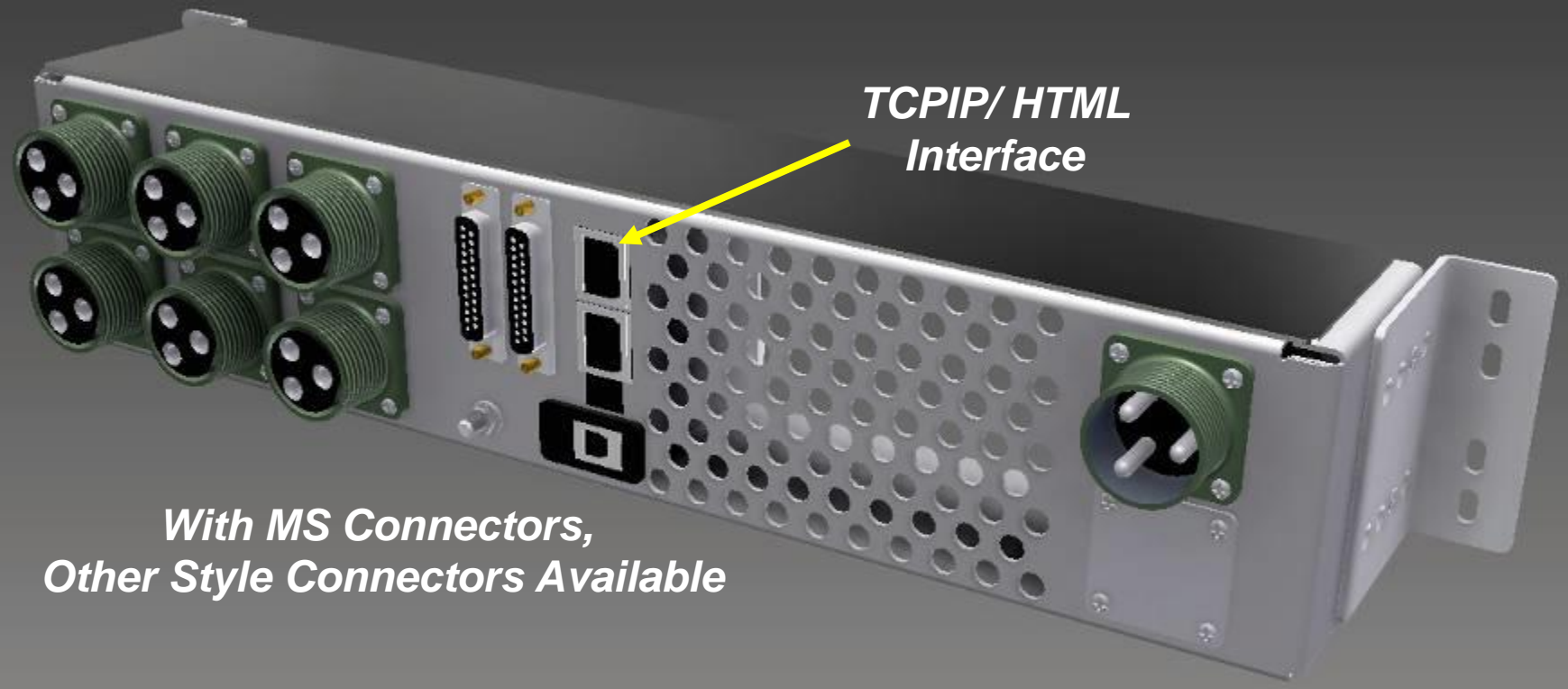


(2) Anderson Connectors





## ***2U Hot Swappable Paralleling Interface Backplane Cage Rear View***



**TCPIP/HTML  
Interface**

***With MS Connectors,  
Other Style Connectors Available***

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**2U Hot Swappable Paralleling Interface  
Fully Assembled in Rack  
Rear View**

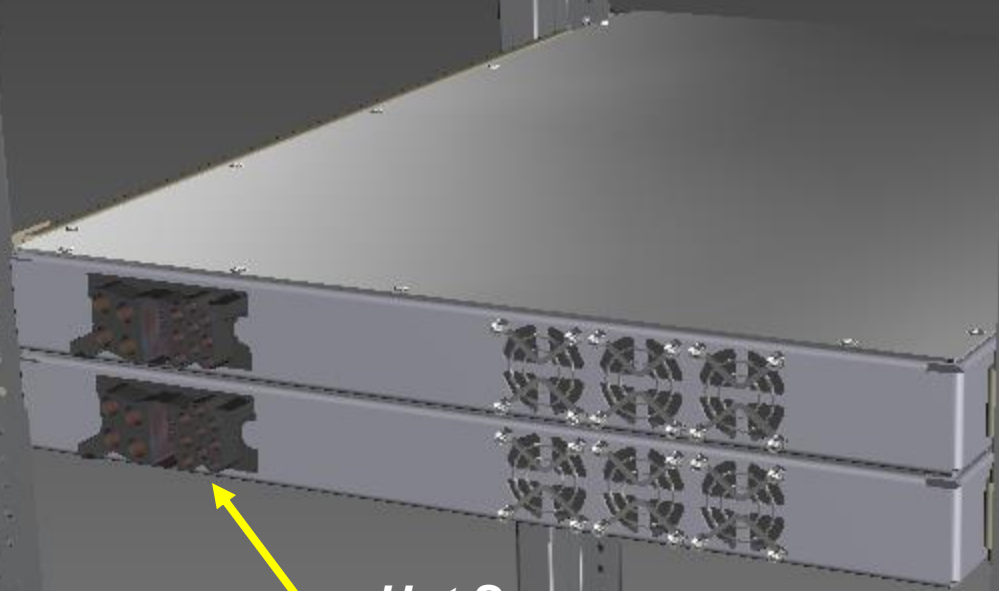


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## Hot Swappable Paralleling Interface Rear View (Backplane Cage not shown)



Hot Swap  
Pin Protected  
Connectors

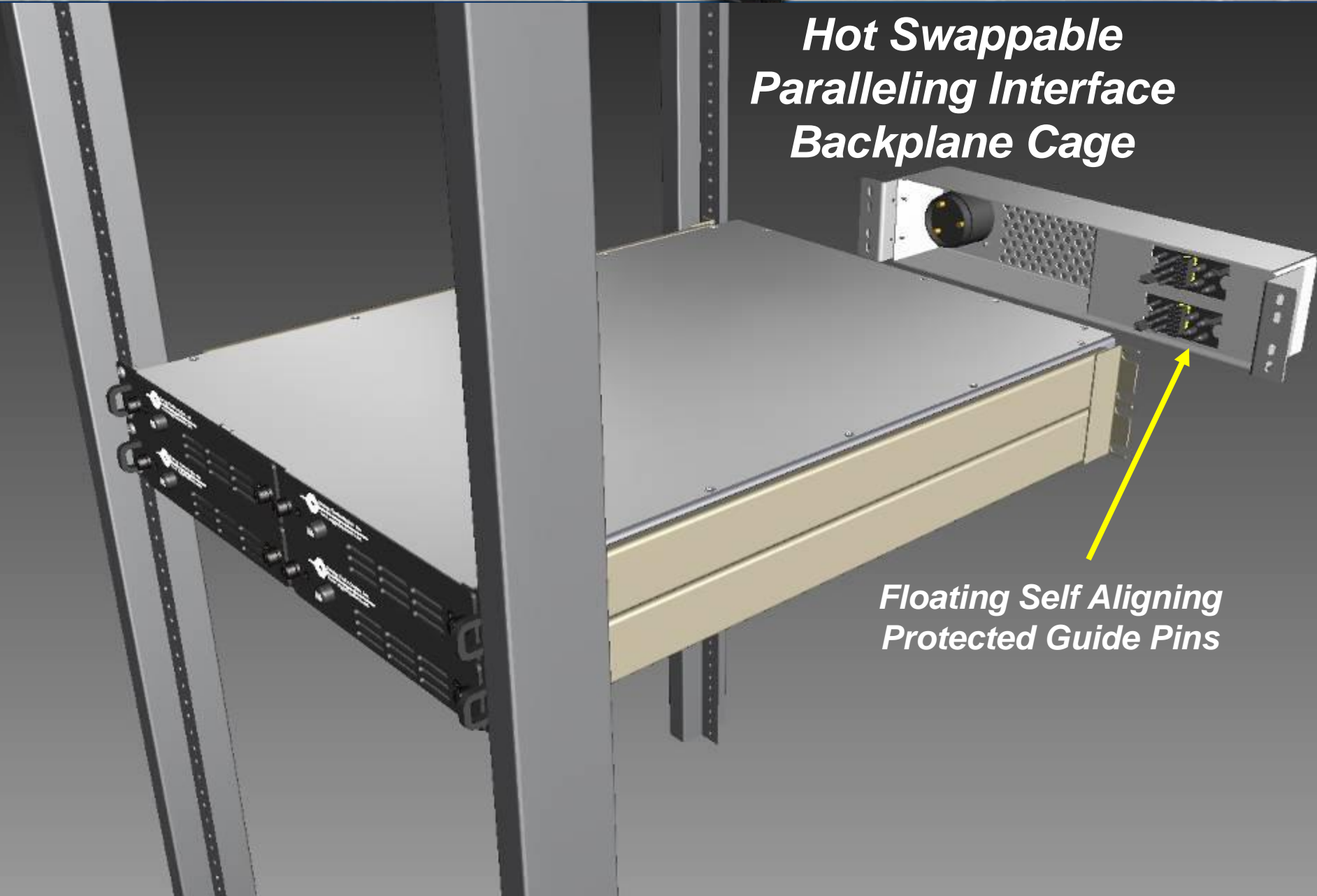


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## Hot Swappable Paralleling Interface Backplane Cage



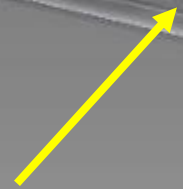
Floating Self Aligning  
Protected Guide Pins



**2U Hot Swappable Paralleling Interface  
Backplane Cage Inside View**



**Floating Self Aligning  
Protected Guide Pins**



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## *3U Backplane Cage with MS Connectors*



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*3U Hot Swappable  
Backplane Cage  
Fully Assembled  
with MS  
Connectors*

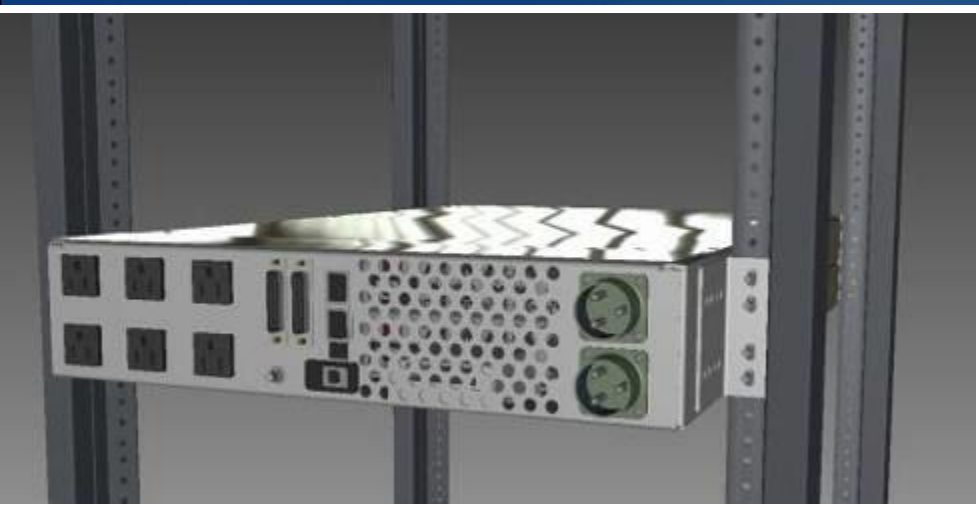
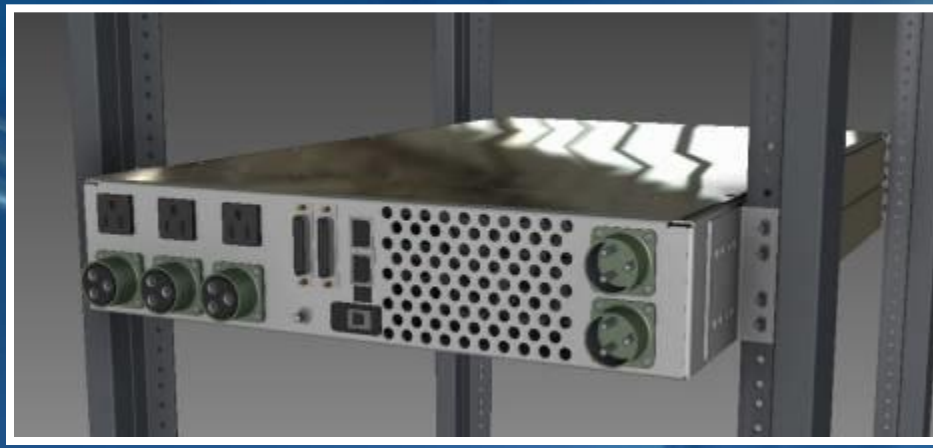


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*Multiple Output connector configurations available to fit  
your application (2U Configurations)*



# Designing Modular, Scalable, N+1 Redundant UPS



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## Multiple Output connector configurations available to fit your application (3U Configurations)



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***Ultimate Power Source Mil Spec® Version  
1U 2000 Watt Ultra Compact UPS with  
1U Battery Extension Module (BEM)  
39 Minutes @ 2000 W, 78 Minutes @ 1000 W***



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**1U 2000 Watt Ultra Compact UPS with  
(2) 1U Battery Extension Modules (BEM)  
65 Minutes @ 2000 W, 130 Minutes @ 1000 W**





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**(2) 1U 2000 Watt Ultra Compact UPS with  
1U Battery Extension Module (BEM)  
26 Minutes @ 4000 W, 52 Minutes @ 2000 W**



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## Hot Swappable Paralleling Interface Front View



*(2) 1U 2 kW UPS in parallel in  
hot swap configuration*

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## Front Controlled 6 Load PDU with Status & Alarm Indicators

UPS 1 or 2 AC Input Breakers

Emergency Power Off (Press Both)

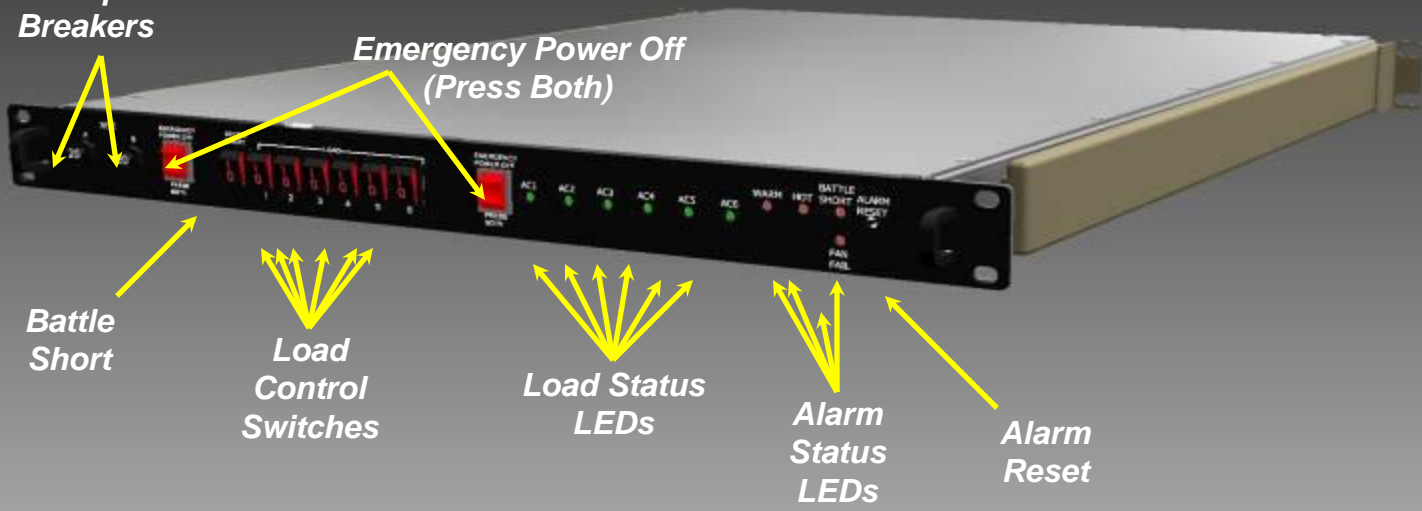
Battle Short

Load Control Switches

Load Status LEDs

Alarm Status LEDs

Alarm Reset

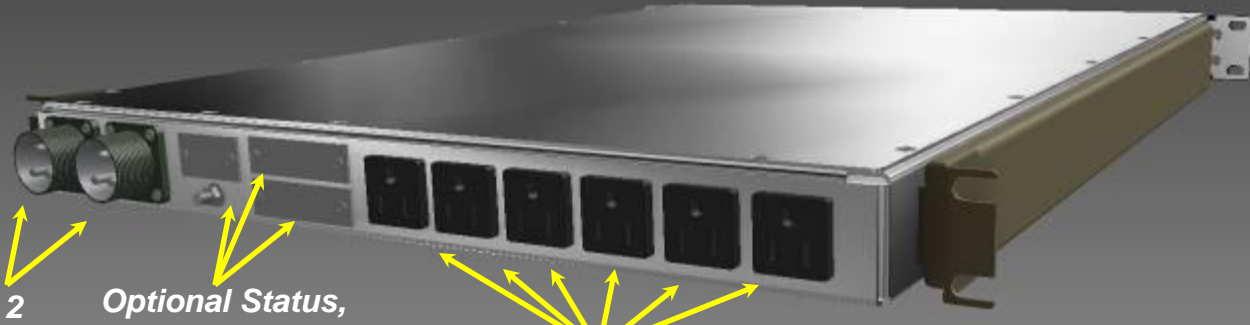


## Rear View with NEMA 5-15 Option

UPS 1 or 2 AC Inputs

Optional Status, Safety Interlock and Remote Control Ports

Choice of NEMA, IEC or MS Connectors

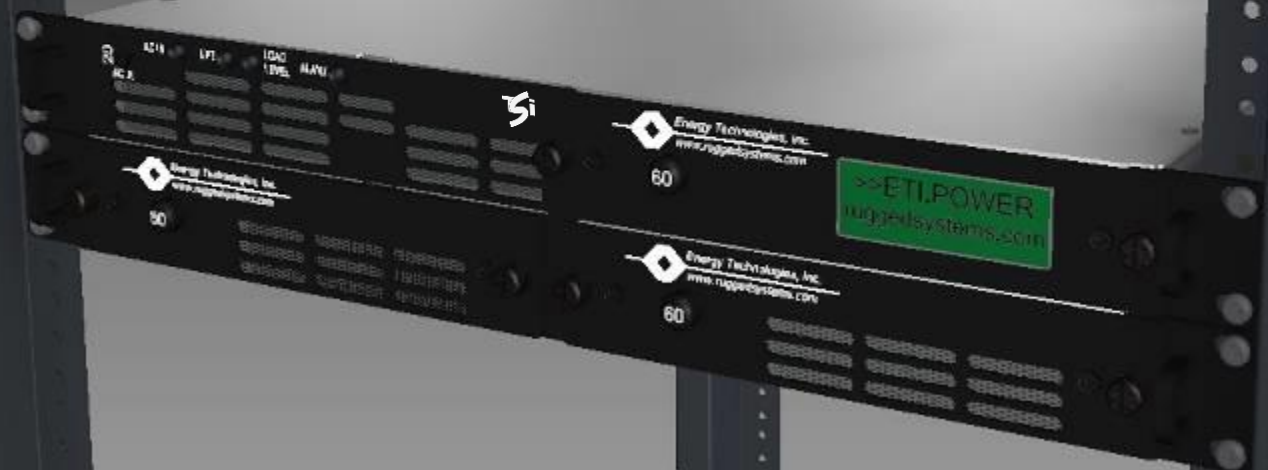




## PDU, UPS & BEM in Rack



*PDU can be mounted Remotely from UPS and BEM*



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# **1U Power Distribution Unit (PDU) with 1U 2000 Watt Ultra Compact UPS and 1U Battery Extension Module (BEM)**



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**12 kW, 3 Phase UPS or 6 kW, 3 Phase N+1 UPS**  
**Field Replaceable Modules and Individual Phase Monitoring**



**Power Distribution  
Management (PDM)**

**(6) 2 kW UPS  
Paralleled  
together  
(13 min backup @ 12 kW)**

**Allows Easy Field  
Replacement**

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**Tactical Case with 4 kW total UPS power**  
**26 Minutes of Battery Backup @ 4 kW**  
**52 Minutes of Battery Backup @ 2 kW**  
**In a 3U high configuration**



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***Tactical, Shock Isolated Rack Case with:  
1U UPS, 2 kW, 13-30 Min Backup  
1U Workstation or Server and  
1U Key Board, Touchpad and Display***





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For more information go to  
[www.UltimatePowerSource.com](http://www.UltimatePowerSource.com)

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