SynQor’s Military Field-Grade Uninterruptible Power Supply units are designed for the extreme environmental and demanding electrical conditions of Military/Aerospace applications. SynQor’s UPS incorporates field proven high efficiency designs and rugged packaging technologies. This UPS will accept a wide range of input voltage and frequency values while delivering a well-conditioned AC output to the load. The use of lithium polymer batteries permits the lowest profile and lowest weight solution in its power class. It is designed to comply with a wide range of military standards. Options include two DC outputs, a DC input rated for military 28 VDC sources, and an electronic breaker on the AC output to permit fault-tolerant parallel operation for higher power and/or N+M redundant systems.

**Features**
- Shallow rack mount unit (17.00"W x 13.80"D x 3.40"H)
- Sealed, weather-proof, shock-proof construction
- Hot swappable internal battery pack (lithium polymer)
- >10 minute run-time at full power
- 1250 W (1500 VA) output power
- Full power operation: -20 °C to +50 °C
- Universal AC input: 80-265 VAC; 47-65 Hz
- Power factor correction at AC input
- Dual input (AC and optional DC)
- True on-line double conversion
- Cold start with no AC or DC input connections
- Pure sinusoidal AC output voltage (115 VAC, 60 Hz)
- Handles 0.0—1.0 power factor loads and non-linear loads
- Up to 3 units can be combined for higher power, voltage or a 3-Phase AC output
- Up to 32 units can be combined to form a higher power fault-tolerant, glitch-free system, perhaps with N+M redundancy, by ordering with the "AC Output Electronic Breaker" option and the appropriate configuration cable
- Low weight: 33 lbs. (including battery)

**Options**
- DC input (28 Vnom) for dual source
- Wide-range AC input frequency: 47 Hz to 800 Hz
- 115 Vrms or 230 Vrms AC output
- 50 Hz, 60 Hz, or 400 Hz output
- DC1: Auxiliary isolated DC output (up to 500 W)
- DC2: High power DC output (up to 1250 W) parallelable for higher power
- Shipboard version with floating neutral wire

**Specification Compliance**
UPS-1500 units are designed to meet:
- MIL-STD-1399-300B - Interface Std for Shipboard Systems
- MIL-STD-810G - Environmental Engineering Considerations
- MIL-STD-461F - Electromagnetic Interference
- MIL-STD-704F - Aircraft Electrical Power Characteristics
- MIL-STD-1275D - Vehicle Electrical Power Characteristics

**Contents**
- Technical Specification ............................................... 2
- Application Section .................................................. 5
- Mechanical Diagrams ................................................ 8
- Ordering Information ................................................. 10
**INPUT CHARACTERISTICS**

**Operating AC Input**
- **Voltage:** 80-265 Vrms*
- **Frequency:** 47-65 Hz
- **Input Power Factor:** >0.98 at 47-65 Hz
- **Input Power Factor:** >0.97 at 400 Hz
- **Input Power Factor:** >0.93 at 800 Hz
- **Maximum Input Current Continuous:** 20 A (full load, 85 Vrms)
- **AC Input Circuit Breaker Rating:** 25 A
  (* Power Derating to 80% below 90 Vrms)

**Operating DC Input (Optional)**
- **Voltage:** 22-33 V
- **Continuous Maximum Input Current:** 62 A (full load, 22 V)
- **Transient Maximum Input Current:** 75 A

**OUTPUT CHARACTERISTICS**

**Total Output Power Continuous**
- 1250 W (1500 VA)

**Maximum DC1 Output Power**
- 510 W

**Maximum DC2 Output Power**
- 1250 W
  (Note: Available AC power is reduced by power delivered to the DC output)

**AC Output**
- **AC Output Waveform:** Pure Sinusoidal
- **Voltage:**
  - 115 Vrms ± 3%
  - 230 Vrms ± 3%
- **Frequency:**
  - 60 Hz ± 0.5%
  - 50 Hz ± 0.5%
  - 400 Hz ± 0.5%
- **Peak Load Current:**
  - 26 A (115 Vrms)
  - 13 A (230 Vrms)
- **Load Power Factor:** 0-1.0 (leading or lagging)
- **Total Harmonic Distortion:** 2% (1000 W resistive load)

**DC1 Output (optional)**
- **Voltage Regulation (Over Load & Temperature):** ± 3%
- **Common Voltage/Power combinations (DC1):**
  - 12 V at 42 A = 504 W
  - 15 V at 34 A = 510 W
  - 24 V at 21 A = 504 W
  - 28 V at 18 A = 504 W
  - 40 V at 12.5 A = 500 W
  - 50 V at 10 A = 500 W

**DC2 Output (optional)**
- **Voltage Setpoint:** ± 3%

**No Sharing**
- **Voltage Regulation (Over Load & Temperature):** -2%
- **Common Voltage/Power combinations (DC2):**
  - 50 V at 20 A = 1000 W
  - 24 V at 50 A = 1200 W
  - 28 V at 44.6 A = 1250 W

**Droop Share**
- **Voltage Regulation (Output droops vs. load to allow passive sharing among modules):**
  - **24 V Option:**
    - 26 V at 0 A = 1100 W
  - **28 V Option:**
    - 30 V at 0 A
    - 26 V at 48.1 A = 1250 W

**Specifications subject to change without notice.**

**ENVIRONMENTAL CHARACTERISTICS MIL-STD-810G**

**Temperature Methods 501.5, 502.5**
- **Operating Temperature:** -20 °C — +50 °C
- **Storage Temperature:** -40 °C — +65 °C
**Altitude Method 500.5**
- **Operating:** 0 - 18,000 ft
- **Non-operating:** 0 - 40,000 ft
**Environmental Tests**
- **Shock/Drop:** Method 516.6, Procedures 1,4,6
- **Temperature Shock:** Method 503.5, Procedure 1
- **Vibration:** Method 514.6, CAT 5, 7, 8, 9, 24
- **Fungus:** Method 508.6
- **Salt and Dust:** Method 510.5, Procedures 1,2
- **Rain:** Method 506.5 Procedure 1
- **EMI:** MIL-STD-461F
- **Humidity:** Method 507.5 Procedure 2
- **Mechanical Vibration of Shipboard Equipment:** Method 528 Procedure 1

**RELIABILITY CHARACTERISTICS MIL-HDBK-217F**
- **MTBF:**
  - 100 kHrs
  - MIL-217F Ground Benign, Ta=25 °C

**ELECTROMAGNETIC CAPABILITY MIL-STD-461F**
- **CE101:** 30 Hz - 10 kHz
- **CE102:** 10 kHz - 10 MHz
- **CS101:** 30 Hz - 150 kHz
- **CS106:** 10 kHz - 40 GHz
- **CS114:** 10 kHz - 200 MHz
- **CS116:** 10 kHz - 100 MHz
- **RE101:** 30 Hz - 100 kHz
- **RE102:** 10 kHz - 18 GHz
- **RS101:** 30 Hz - 100 kHz
- **RS103:** 2 MHz - 40 GHz

* Regarding MIL-STD-461 CE-101, the 50 uH series inductance of a standard LISN adversely affects the input ripple of the UPS (DC input only). Such a large series source inductance (50 uH in each power lead) is not generally encountered in a 28 V DC source of such high power rating. Therefore, testing for CE-101 (DC input) was conducted with 3 different configurations: two using 50 uH LISNs and a 54 mF capacitor connected across the input to the UPS, and one using 5 uH LISNs for which no additional capacitor was added. These configurations all passed CE-101 for all frequencies.

**MECHANICAL CHARACTERISTICS**

**Chassis**
- **Chassis Size:** 17.00"W x 13.80"D x 3.40"H
- **Case Material:** Aluminum
- **Total Weight:** 33 lbs. (with chassis & battery)

**Connectors**
- **AC Input Connector:** MS3470L14-4P
- **User I/O Ports:** HD DB15 Female
- **Configuration I/O Port:** HD DB15 Male
- **Ethernet Port:** Amphenol RJF22N00, Code B
- **DC Input Connector:** MS3470L18-8P
- **AC Output Connector:** MS3470L14-4S
- **DC1 Output Connector:** MS3470L14-4SW
- **DC2 Output Connector:** MS3470L18-8S

**Cooling Exhaust Fans**
- **Sound Pressure Level (SPL):** 54 dB(A)
- **Air Flow:** 0.67(m³/min) 23.7 CFM

Two fans in system, above specs are for each fan separately.
High Density DB15 Female (15 Pin Connector)

<table>
<thead>
<tr>
<th>Signal</th>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>2</td>
<td>RS232 DCE Device Transmit</td>
</tr>
<tr>
<td>RX</td>
<td>3</td>
<td>RS232 DCE Device Receive</td>
</tr>
<tr>
<td>GND</td>
<td>4, 5</td>
<td>Ground reference for all digital inputs and outputs</td>
</tr>
<tr>
<td>LOW_BATT</td>
<td>6</td>
<td>Open collector output where “low” indicates battery charge level &lt;10%</td>
</tr>
<tr>
<td>ACIN_GOOD</td>
<td>7</td>
<td>Open collector output where “low” indicates AC Input voltage is within range</td>
</tr>
<tr>
<td>+5V</td>
<td>8</td>
<td>Vout with minimal current drive usable as a pull-up voltage for open collector output signals. Load must be &lt;35 mA</td>
</tr>
<tr>
<td>ON_BATT</td>
<td>9</td>
<td>Open collector output where “low” indicates the UPS is running on battery power.</td>
</tr>
<tr>
<td>REMOTE_START</td>
<td>12</td>
<td>Drive this line “high” with ≥5 mA to enable UPS outputs</td>
</tr>
<tr>
<td>SHUTDOWN</td>
<td>13</td>
<td>Drive this line “high” with ≥5 mA to disable UPS outputs</td>
</tr>
<tr>
<td>OUT_OK</td>
<td>14</td>
<td>Open collector output where “low” indicates AC Output voltage is within range</td>
</tr>
<tr>
<td>OVER_TEMP</td>
<td>15</td>
<td>Open collector output where “low” indicates that the UPS is at or above its maximum temperature</td>
</tr>
</tbody>
</table>

Safety & Qualifications

IEC 62133 Safety requirements for portable secondary sealed cells.
ST/SG/AC.10/11 UN Recommendations on the Transport of Dangerous Goods
UL 1642 Lithium Batteries
EN 62040-1 General and safety requirements for UPS (Does not apply to 400Hz operation)
EN 62040-2 UPS Electromagnetic compatibility (Category C4)

LITHIUM-POLYMER BATTERY CHARACTERISTICS

<table>
<thead>
<tr>
<th>Standard 1U Battery Pack Run Time</th>
<th>1000 W : 13 min</th>
<th>625 W : 21 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Output Power</td>
<td>&lt; 1000 W</td>
<td>2 hrs</td>
</tr>
</tbody>
</table>

Temperature Range for Recharge: 0°C to 45°C
Internal heaters maintain battery temperature above 0°C when input power is present.
Battery charging only enabled below +45°C.
“R” Option: AC Output Electronic Breaker

Fault Tolerant, Glitch-Free Operation

The “R” option adds an electronic breaker to the AC output of the UPS to permit fault-tolerant, glitch-free parallel operation. With this option, when several UPS units are connected in parallel at their AC outputs and one unit has an internal fault that might otherwise have pulled down the AC output bus, the electronic breaker will disconnect the failed unit so that the remaining paralleled units can continue to power the bus. This allows the system to be “fault-tolerant”. The disconnect occurs very quickly so that the AC output voltage will remain within its specified parameters as long as the remaining paralleled units can deliver the total load power. This allows the system to continue running “glitch-free”.

The electronic breaker is a single-pole breaker present in the hot-side AC output wire only. The neutral AC output wire is left floating from the UPS chassis to facilitate the paralleling of units into various configurations.

Expanded Paralleling

The “R” option also increases the total number of UPS units that can be paralleled to a maximum of 32. AC output current sharing among the paralleled units is accomplished with a high speed digital configuration cable. The units will share the total load current to within ±2%, and for a split-phase or 3-phase system the AC voltages and AC currents will have phase balance within ±2 degrees.

N+M Redundancy

Besides permitting a higher number of UPS units to be paralleled, the “R” option also makes it possible to set up N+1, or more generally N+M, redundant systems with a total of up to 32 UPS units. In such a system the failure of one unit (or M units) will not cause the overall system to fail. A failed unit can then be replaced to return the redundancy level to its original design. The replacement unit can be inserted into a live, operating system with proper precautions, but for safety reasons it is recommended that the system be turned off first.

Output Power Cable Connection

UPS systems are formed by first connecting the neutral wires of all the individual units together. For single phase systems, the hot wires are also connected together to form a single bank of UPS units. Split-phase systems are formed by connecting the hot output wires into two banks. One bank will have its output voltage phase-shifted 180° from the other. The phase-shift is determined by the configuration cable. Similarly, 3-phase systems are formed by grouping the hot output wires into three banks, each bank having its output voltage phase-shifted by 120°. Again, the phase shift is determined by the configuration cable. Since 3-phase systems are formed by connecting the neutral wires together and phase shifting the hot wires, the AC outputs must be wye-connected to form 3-phase systems. Delta connection of UPS units is not supported. However, once a 3-phase system is formed, loads may be connected as wye or delta.

The diagrams on the following page give examples of how multiple UPS units with the “R” option can be connected to create higher output power single-phase, split-phase, and 3-phase AC systems that will have N+M redundancy as long as N units are sufficient for the maximum load power per phase. Note, again, that the maximum total number of units that can be arranged in any of these configurations is 32.

Configuration Cables

Any system of “R” option UPS units requires a specific configuration cable that defines the arrangement of UPS units in the system. The configuration cable determines the phase shift for split-phase and 3-phase systems. The cable also provides high speed digital communication for current sharing on each phase.

Configuration cables for two parallel units and three parallel units in a single-phase system are available as standard products. Please contact the factory to purchase configuration cables for systems larger than three UPS units, or systems that have split-phase or 3-phase AC outputs.

Configuration cables are required for paralleling the AC output only. The DC2 output relies on droop share for paralleling, and does not require a configuration cable. See the “Ordering Information” page for DC2 output options with droop share that can be paralleled.
**Application Figures**

**Single Phase Output System**
- Hot
- Neutral
- **Line 1**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 32
- **Line 2**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 32
- Up to 16 units on Line 1
- Up to 16 units on Line 2
- *Configuration Cable*
- *AC Output*

**Split Phase Output System**
- **Line 1**
  - UPS Unit 1
  - UPS Unit 1
  - UPS Unit 16
- **Line 2**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 16
- Up to 16 units on Line 1
- Up to 16 units on Line 2
- *Configuration Cable*
- *AC Output*

**3-Phase Output System** *(Y - Connection Only)*
- **Phase A**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 10
  - Up to 10 units on Phase A
- **Phase B**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 10
  - Up to 10 units on Phase B
- **Phase C**
  - UPS Unit 1
  - UPS Unit 2
  - UPS Unit 10
  - Up to 10 units on Phase C
- Neutral
- *Configuration Cable*
- *AC Output*

* Contact factory for system specific configuration cables.
Mechanical Features

**UPS-1500-S-2S Unit**

**UPS-1500-S-2S Unit with DC Input / DC1 Output Options**

<table>
<thead>
<tr>
<th>DC1 Output Option</th>
<th>AC Output</th>
<th>Exhaust Fan</th>
<th>Ethernet Port</th>
<th>User I/O</th>
<th>CONFIG Port</th>
<th>DC Input Option</th>
<th>Exhaust Fan</th>
<th>AC Input</th>
<th>AC Circuit Breaker</th>
</tr>
</thead>
</table>

**UPS-1500-S-2S Unit with DC1 Output / DC2 Output Options**

<table>
<thead>
<tr>
<th>DC1 Output Option</th>
<th>AC Output</th>
<th>Exhaust Fan</th>
<th>Ethernet Port</th>
<th>User I/O</th>
<th>CONFIG Port</th>
<th>DC2 Output Option</th>
<th>Exhaust Fan</th>
<th>AC Input</th>
<th>AC Circuit Breaker</th>
</tr>
</thead>
</table>

**Ground Stud (1/4-20)**
Note:
1) ALL DIMENSIONS IN INCHES [mm]
   TOLERANCES: X.XXIN +/- 0.02 [0.5]
   X.XXXIN +/- 0.010 [0.25]
## Accessory Options

### Replacement Battery Packs

| 1U; 10 lbs. (200 Watt Hours) | BAT-0200-S-1U-000 |

### Rail Kits

| Slide Rail Kit² | SYN-9043 |
| Fixed Bracket Kit³ | SYN-9041 |

### Power Cables (10' long)

| AC Input (NEMA 5-20 Plug) | SYN-9101 |
| AC Input (NEMA 5-15 Plug) | SYN-9104 |
| AC Input (Hardwire) | SYN-9102 |
| AC Input, 10' Grounded (Hardwire) | SYN-9108 |
| AC Input, 10' UK 13 A 250 V Plug | SYN-9111 |
| AC Input, 10', SCHUKO 16 A, 250 V 3 W Euro Plug | SYN-9112 |
| AC Output, 10’ (115 Vrms) (NEMA 5-20R Receptacle) | SYN-9131 |
| AC Output, 10’, Hardwire | SYN-9130 |
| AC Output, 10’, UK 13 A 250 V Sockets | SYN-9137 |
| AC Output, 10’, Grounded Hardwire | SYN-9138 |
| DC Input (Ring Connectors) | SYN-9151 |
| DC Input (Hardwire) | SYN-9152 |
| DC Input (NATO Connector) | SYN-9154 |
| DC1 Output (Fork Connectors) | SYN-9171 |
| DC1 Output (Hardwire) | SYN-9172 |
| DC2 Output (Hardwire) | SYN-9174 |
| DC2 Output (Fork Connectors) | SYN-9175 |

### Fan Replacement Kit

| Replaceable Fan Modules | SYN-9450 |

### AC Output Power Strips (Circular Connector)

| 6 NEMA Receptacles with Breaker (1U Rackmount & 3' Cable) | SYN-9232 |
| 6 NEMA Receptacles (1U Rackmount & 3' Cable) | SYN-9231 |

### User Communications (I/O) Cables

| HD DB15M to DB9F (RS232, 10') | SYN-9301 |
| HD DB15M to DB15M (RS232 and Digital I/O, 10') | SYN-9305 |
| Mil-Circular to RJ45 (Ethernet, 10') | SYN-9321 |

### Configuration Cables (AC Output Sharing Only)

| HD DB15F to DB15F (2 Units Parallel, 3') | SYN-9311 |
| HD DB15F to DB15F (3 Units Parallel, 6') | SYN-9315 |
| HD DB15F to DB15F (2 Units Series, 3') | SYN-9313 |
| HD DB15F to DB15F (3 Units 3 Phase, 6') | SYN-9317 |

### R-Option Configuration Cables (AC Output Sharing Only) *

| HD DB15F to DB15F (2 Units, Expanded Paralleling, 3') | SYN-9341 |
| HD DB15F to DB15F (3 Units, Expanded Paralleling, 3') | SYN-9343 |

* Contact factory for additional configuration cables.

**Notes:**

1: Other Options also available, check the website or contact power@synqor.com for further information.
2: Slide Rail Kit (SYN-9043) is not recommended for ruggedized use.
3: Fixed Bracket Kit (SYN-9041) is required for ruggedized use
### Ordering Information

#### Base Models

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Power</th>
<th>Battery Run-Time @Full Power (80% Power)</th>
<th>Height (W x D x H)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS-1500-S-2S</td>
<td>1250 W 1500 VA</td>
<td>&gt;10 min. (&gt;13 min.)</td>
<td>2U (17.00” x 13.80” x 3.40”)</td>
<td>33 lbs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UPS-1500-S-2S-L1G6D28-E00, UPS-1500-S-2S-L2GSS00-E00</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS-1500-S-2S-L2GSS00-ECE (230 V output with CE marking)</td>
</tr>
</tbody>
</table>

#### Options

<table>
<thead>
<tr>
<th>Base Models</th>
<th>Options</th>
<th>Additional Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS-1500-S-2S-L1G6D28-E00</td>
<td>DC2 Out 24 VDC with Droop Share</td>
<td>DC2 Out 28 VDC with Droop Share</td>
</tr>
<tr>
<td>UPS-1500-S-2S-L2GSS00-ECE</td>
<td>DC2 Out 28 VDC No Share</td>
<td>DC2 Out 50 VDC No Share</td>
</tr>
</tbody>
</table>

Not all combinations make valid part numbers, please contact SynQor for availability. See the Product Summary web page for more options.

*Notes:
- Order "F: Floating" option when configuring the AC output for multi-unit combinations of up to 3 units.
- Order "R: AC Output Electronic Breaker" option for fault-tolerant, glitch-free parallel systems of up to 32 units with N+M redundancy.

Examples:
- UPS-1500-S-2S-L1G6D28-E00
- UPS-1500-S-2S-L2GSS00-E00
- UPS-1500-S-2S-L2GSS00-ECE

Contact SynQor for further information and to order:

Phone: 978-849-0600
Toll Free: 888-567-9596
Fax: 978-849-0602
E-mail: power@synqor.com
Web: www.synqor.com
Address: 155 Swanson Road
Boxborough, MA 01719
USA

**PATENTS**

SynQor holds numerous U.S. patents, one or more of which apply to most of its power conversion products. Any that apply to the product(s) listed in this document are identified by markings on the product(s) or on internal components of the product(s) in accordance with U.S. patent laws. SynQor’s patents include the following:

- 6,545,890
- 6,594,159
- 6,894,468
- 6,896,526
- 6,927,987
- 7,050,309
- 7,085,146
- 7,119,524
- 7,765,687
- 7,787,261
- 8,149,597
- 8,644,027

**WARRANTY**

SynQor offers a 1 year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.