

Specification Requirements
DBL 700MX and 1000MX
Series UPS

Theory of Operation

Upon loss of utility power, the UPS inverter shall continue to provide seamless pure sine-wave AC from the batteries without switching, transfer or changing its' operating status. The UPS will use the battery mode in '0' ms. this will insure that the UPS provides pure sine wave power under all conditions, at all times without interruption.

The UPS system shall be capable of producing a fully regenerated, conditioned, pure sine wave AC online and be continuous to all connected loads 24 hours per day, 7 days per week. It shall incorporate a high frequency Pulse-Width Modulated technology and shall use an input rectifier, charger, battery and inverter in a single board configuration. The UPS shall be a double conversion type UPS and shall provide a clean, pure AC sine-wave output at all times with a voltage input variation of 85VAC to 145VAC while providing a constant 120VAC to the connected load at all times. The UPS shall be capable of operating in the specified voltage range without using batteries.

The system shall consist of 3 primary functions: Main board inverter and rectifier, charger, and control board. Input rectifier shall be rated at 2.5 times the output rating of the inverter. The Inverter circuit shall be in continuous operation at all times (constant duty). The inverter shall be rated for 100% duty cycle and simultaneously fed from the rectifier and battery to eliminate any switching to battery or transitions during power fluctuations or power interruption. The inverter's output shall be pure clean sine wave with an efficiency of up to 85%. The constant duty operation shall be rated in total watts. This will enable the traffic UPS to support any combination of signal heads whether incandescent, LED or Neon, by any manufacturer, regardless of power-factor as long as total wattage output is not exceeded. The UPS shall be equipped with an internal 200 watt charger to replenish batteries after a power outage. The UPS shall provide a control board to ensure proper output to all connected loads over the designed input variations.

The UPS shall be capable of operating from a generator source without the need for over-sizing the UPS system. During operation from a generator source, the UPS shall operate in a normal fashion and provide filtered and regulated power with or without automatic input/output frequency synchronization. Upon excessive generator frequency drift, the UPS shall compensate through regeneration and supplying both continuous frequency and voltage regulation to the protected load.

The UPS shall be eliminate short term power fluctuations and provide a seamless output to the connected load during this anomaly without the use of the batteries. The UPS shall be capable of providing an overload output rating of up to 120% for 60 seconds, 150% for 5 seconds to any combinations of signal types whether Incandescent, LED or Neon during inrush or overload conditions.

The UPS shall have an internal static bypass that will transfer to line power if over load exceeds 150% for more than 5 sec. This bypass will maintain the load until this overload has cleared.

The UPS shall have a separate Neutral detecting circuit that shall monitor loss of utility neutral and completely disconnect any input source to the UPS system. The UPS shall have an input back feed relay operating in series with the Neutral monitoring circuit.

1.0 Physical Description

1. The UPS shall consist of 3 major components. The main board rectifier/inverter, charger and control board.
 - 1.1.1.1 The Main Board shall consist of a True-Sine-Wave constant duty high frequency inverter utilizing High-Frequency Pulse-Width Modulated Technology. The Input Rectifier shall be rated for the total wattage output rating of the UPS including the 150% overload and the charger rating. The inverter shall be a high efficiency constant duty design with and maximum efficiency of 85%. The inverter shall include its' own static bypass which provides an alternate AC path during overload and or Inverter alarm conditions. The heat-sink shall be a continuous aluminum extrusion design with plenum directed airflow cooling. The 12VDC dual stage cooling fans shall be variable speed controlled by the logic board. The charger portion shall be a 3 stage hysteresis 2 amp, 36VDC charger with temperature compensation. The Automatic Battery Monitor is a parallel design rated for 200, 400 and 800 watts. The electronic control board shall monitor the rectifier and inverter functions. It shall also provide the overall control of all the UPS functions and or operational capabilities.
 - 1.1.2 The UPS shall be capable of operating in a full regenerated, power-conditioning mode with depleted batteries or failed batteries. The regenerative power conditioning will ensure that there will be regulated and conditioned pure AC power to the equipment. This regenerative mode will provide extended brown-output protection with wide input line regulation, noise filtering and surge protection.
 - 1.1.3 The UPS shall operate in an uninterruptible regenerative on-line mode during flash or normal signal operation.
 - 1.1.4 The UPS shall be rated at Unity Power Factor. The output VA and Watts rating shall be equal on the output at all times.
 - 1.1.5 The UPS shall be capable of COLD starting without AC present and provide AC power to the load.
 - 1.1.6 The UPS shall be capable of self-diagnostics during start up or with the use of the front panel TEST procedure as outlined in the manual.
 - 1.1.7 The UPS case shall be constructed from .064 aluminum and carbon steel.
 - 1.1.8 The UPS input and output connections shall be Anderson Power Pole quick lock connector to eliminate exposed terminals or connections
 - 1.1.9 The UPS to bypass interconnect harness shall be reversible with matching Anderson Power connectors that will prevent risk of shock, or damage to the connected equipment.
 - 1.1.10 The UPS shall be capable of Hot-Swapping the batteries or battery bank, without shutting down the UPS.
 - 1.1.11 The UPS shall be capable of being Hot-Swapped during normal operation when used with the external Hot Swap Bypass. The UPS may also be shut-off with the Hot Swap Bypass in place and in the bypass mode of operation without loss of AC to the loads.
 - 1.1.12 The UPS shall be capable of providing a replaceable relay card with relay output contacts for AC fail, Inverter ON, Low Battery, Battery Fail, Bypass and Alarms.
 - 1.1.13 The UPS relay card may be replaced with an SNMP card for Ethernet communications and information.
 - 1.1.14 The UPS shall provide an adjustable Dry Relay output for flash.
 - 1.1.15 The contacts shall be provided in N/O and N/C positions. The delay timer shall be a maximum of 10 hours
 - 1.1.16 The timer shall be front panel mounted.

1.1.17 The Timer dial shall be 4.7 inches in circumference:

- The timer shall have a scale in increments of 1s to 10seconds. This scale can be changed to indicate 1 minute, to 10 minutes or a maximum scale of 1 hour to 10 hours.
- The scale shall be controlled by two (2) separate dip switches on the timer face.
- The timer shall indicate using a flashing RED LED that the timing functions are operating.
- The timer shall use a steady RED LED to indicate that the timing is now completed
- The timer shall count in a down mode to '0' from the preset time indicated on the scale.

1.1.18 The LED indicators shall provide status for AC line input, A/C line output normal, dial timer-event counter-battery run time counter power normal, internal bypass within limits, and ups fault.

1.1.19 The Event counter and Hour meter may be reset to '0' using separate buttons.

1.1.20 The UPS shall have a battery charger rated at 200 watts @ 36VDC with an option of additional external automatic battery management system. These may be parallel for faster recharge time or for very big battery plants.

1.1.21 An optional automatic battery management system shall be available and shall be completely separate from the rectifier/inverter included with the main UPS board.

1.1.22 The automatic battery management system may be used in a parallel configuration for increased charger ratings. The automatic battery management system is optional. The automatic battery management system should be used when more than 3ea. 55 amp-hour batteries are deployed. The automatic battery management system will allow more even distribution of charge across the battery string allowing longer run times in the event of a power outage and also allows for faster battery recharge time and better battery charge balance after a/c power has returned to the cabinet.

1.1.23 The UPS includes an internal charger that that operates alone if the optional automatic battery management system is not used.

1.1.24 The UPS may be used with redundancy in mind with the use of the Dual Hot Swap Option. That will provide a secondary UPS source in less than 20ms. The Secondary UPS may be connected to the alternate input of the Hot Swap Bypass switch. In addition, the secondary source could be a generator or an inverter powered by a vehicle.

1.1.25 The Flash timer programming shall be a simple and field adjustable without the use an external connected device such as a laptop or computer.

1.1.26 The Hot swap Bypass shall allow the UPS to be removed or installed at any time during normal load operation without affecting the cabinet load.

1.1.27 The UPS shall include standard graphical real time software and connection cable.

2.0 Mounting Configuration

The UPS shall be shelf mounted or rack mounted per the procurement documents. Shelves and cabinets shall be supplied by others. Where rack mounting is required, the 170 style mounting method shall be 19" rack mount. Rack mounting ears shall be removable. A separate stand-alone NEMA Traffic cabinet may be supplied if required in the procurement documents. 4 rubber feet shall be installed on the bottom of the unit for shelf mounting.

3.0 Battery System

The UPS will continue to provide generated AC from the inverter until the batteries are depleted. When the batteries have been depleted, the UPS will ensure upon the return of Utility Power that the UPS will restart automatically and provide regenerated AC to the protected equipment and allow the equipment to resume normal operation.

The batteries shall be comprised of a minimum quantity of three (3), high temperature, deep cycle (45-105 AH) batteries which have been proven under extreme temperature conditions. The battery system or configuration shall consist of one or more strings. Each string shall be 36 VDC. The batteries shall be provided with the appropriate interconnect cables. The battery cables shall have a minimum conductor size rating of #10. The battery cable shall consist of a quick release Anderson connector rated at 25 amps. For the purpose of safety, the connector shall have recessed pins and keyed interlock to prevent reversal of connection or separation.

Recommended Battery construction shall be of a polycarbonate high temperature design combined with high, pure lead content with internal resistance of .0028 ohms and a high impact poly case construction, to withstand high vibration and shock. The connections shall be of stainless steel 3/8 stud, with 3/8 stainless nut and locking washer. Removable lifting handle shall be standard. The batteries shall also meet the following characteristics:

- Nominal voltage: 12VDC
- Capacity@ 25C: As supplied - 3 each of, 55AH, 100AH or 105AH
- Approx. weight: based on battery deployed
- Internal Resistance: 9.5 mOhms
- Dimensions: based on battery deployed
- Capacity (10hr rate) 75c-112% 65c-108% 55c-105% 25c-100% 0c- 85% -15c- 65%
- Self-Discharge: 3 months 91% capacity remaining 6 months 82% capacity remaining 12 months 65% capacity remaining
- Operating Temperature: -15c to +75C
- Float Voltage: 13.5 to 13.80
- Cyclic charging voltage: 14.5 to 14.90
- Maximum charge current: 12A
- Terminal material: Copper

3.1 The system must be 36 volts DC maximum (no exceptions).

4.0 Electrical Specifications

The unit shall meet the following electrical specifications:

- Design: Double Conversion true on line.
- Nominal input: 110, 115 & 120v AC single phase selectable.
- Input Voltage Range: 85v to 145vAC
- Input frequency: 50/60hz (47 to 63)
- Efficiency: 85 % maximum
- Input configuration: 3 wire with ground

- Input Protection: 15 amp resettable breaker (DBL 700MX)
- Input Current: 10.4 amps (includes charger) (DBL 700MX)
- Input Protection: 15 amp resettable breaker (DBL 1000MX)
- Input Current: 13.3amps (includes charger) (DBL 1000MX)
- Power Rating Continuous: 700 watts, 1000watts
- Output Current DBL 700MX: @ 700 watts continuous, 5.8 amps
- Output Current DBL1000MX: @ 1050 watts continuous, 8.2 amps.
- Output regulation: +/- 3% with 100% resistive load
- Output regulation w/low battery: +/- 3% with 100% resistive load
- Output Voltage: 120v AC, Also settable at 110, 115 and 127 volts
- Output Wave Form: Pure sine wave
- Harmonic Distortion: 3% Linear Load 5% Non Linear Load
- Dynamic Response: +/- 5% RMS for 100% step load change 1.0 ms recovery time
- Overload Capability: 120% for 60 sec 150% watts for 10 sec
- Charger: 80 watt 36VDC - DBL 700MX and DBL 1000MX
- Surge: ANSI-C62.41
- Fault Clearing: Current Limit and automatic to bypass
- Short Circuit protection: Output Breaker / Fuse, then shut down
- Load Power Factor: 6 leading to .6 lagging
- Output Connection: Anderson Power Pole Connector 6 pin keyed.
- DC Connection: Anderson 50 amp Keyed Recessed connector
- Recognition: UL Recognized & IEE 587 / C62.41 on main UPS board

5.0 Mechanical

The UPS shall meet the following physical dimensions:

- DBL 700MX UPS:
 - Size 6" H x 10.5" D x 15.15" W
 - Weight: 13 lbs
- DBL 1000MX UPS
 - Size: 6.00" H x 10.5" D x 15.15" W
 - Weight: 15 lbs
- Width for the DBL 700MX or DBL 1000MX systems is 19" when rack mount ears are used.
- The enclosure shall be constructed of 0.064 Carbon steel and aluminum. The enclosure shall be painted with powder coat paint with a minimum of 1.5 mil thickness.

6.0 Environmental

The UPS shall meet or exceed NEMA temperature standards from -40c to + 74c.

7.0 Communications, Control & Diagnostics

7.1 LED indicators shall be provided for line monitoring, battery mode, charging, low battery, fault / bypass load level, battery level and ground fault. Manual test functions shall be available for alarm function, low battery, battery fail, bypass and overload. An RS 232 port with communication software shall be provided for real time UPS operational status in place of a relay status card when required.

7.2 The relay status card shall have the following I/O via contact closure:

- Bypass ON
- AC fail or out of tolerance.
- AC normal or in tolerance.
- Inverter is operating (ON)
- Battery low
- Battery failed or bad
- Not used
- Ground (logic)
- to +25VDC
- between pin 9 and 10, will shut the UPS down

8.0 Options

The UPS must be able to accept the following options:

- SNMP/WEB monitoring.
- Generator input option for hot swap bypass switch.
- Rack mount hot swap bypass switch.

8.1 In place of the relay card, a SNMP card can be installed that shall support TCP/IP, UDP, SNMP, and HTTP protocols and shall provide the SNMP MIB for UPS monitoring and UPS status. Remote access to UPS real time information including unit identification, data logging and UPS status in real- time shall also be provided on a by unit basis. It shall be possible to use Microsoft Internet Explorer for remote viewing of the following:

- UPS load
- Battery Charger status
- UPS operation Normal/Alarm
- Input Voltage
- Output Voltage
- Battery Voltage
- UPS Temperature
- UPS information logging
- Remote UPS battery testing.
- Send output email if UPS status has changed
- Built in reset with panel mounted led indicators for SNMP status.
- Alternatively, the relay card can remain in place and an external SNMP adaptor can be connected to the RS 232 port on the ups and all the same information can be obtained.

8.2 The SNMP card shall have the following status LEDs:

- LED(1) Green LED: Status receiving Yellow: Data Transmitting
- LED(2) Green: SNMP connecting Yellow: SNM P functioning

8.3 An optional generator input shall be available for the UPS.

9.0 Reliability

Calculated MTBF shall be 120,000 hours based on component ratings. When bypass switch is installed, system MTBF shall increase to 160,000 hours.

10.0 Hot Swap Bypass Switch

A hot swap bypass switch shall be provided and wired to function within the UPS system. The bypass switch shall have the following characteristics:

- Bypass Rating: 30 amps maximum
- Bypass Transfer: Automatically to line in 20ms, '0' crossing at full load
- Control: Rocker On/Off switch indicating 'Auto' and Bypass
- Relays: AC internal Load relay at 'Zero Crossing' with parallel function DC relay for interlocking and protection failsafe mode to N/C for AC power direct to load when failure occurs or in Bypass position.
- Protection: Internal Snubber circuit for spike attenuation during transfer at 'Zero' crossing. External circuit breaker required.
- Connections: Flush mounted Anderson Power connector. With locked and keyed.
- Indicators: LED for Line Available, Bypass, Ups On Line, UPS Available.
- Switch shall be available in 4 configurations: Single, Dual, Single rack mounted and Dual rack mounted

11.0 Warranty

A standard (2) two year manufacturer warranty shall be provided for all electronic components. All batteries shall carry a one year warranty.

11.1 The cabinet assembly and all other components shall be warranted for a period of one year from date of shipment.