

Product Design Requirements

For the

DBL MX DOUBLE CONVERSION DIGITAL UPS

Overview

The DBL MX DIGITAL Traffic UPS is a true on-line regenerative uninterruptible power system designed for transportation and traffic applications. The DBL MX is capable of operating at its maximum rated output in extreme and harsh environments with all existing equipment. The rated continuous minimum output shall be 700/ 1000 & 1400 watts. It is designed to operate continuously On-Line from any AC utility source or generator. The UPS shall use Digital control SMD technology to control and monitor all AC input output as well as all DC boost control, charger and battery monitoring. A full function LCD digital/LED display will provide full control and display of all operating function including I/O voltage D/C voltage, Temperature, I/O frequency, Frequency adjustments, Voltage settings, Voltage fine tuning, Alarm fault codes, Battery voltage, Battery charge, and UPS load. The DBL MX shall be SNMP ready and include relay output contacts with N/O or N/C capability. A 10 Hr adjustable Dial front panel mounted with front panel mounted terminal block. USB/RS 232 combination with real time monitoring software. Input Power factor correction to .99 with input RF filtering and 400 joule surge suppression. The DBL MX shall include Anderson 6-P 30 amp AC I/O connector and an Anderson 4 Pole DC connectors. High rated DC internal charger with Digital control. Out voltage regulation shall be +/- 1% with frequency +/- .1% synchronized to line.

Operation:

1. The DBL MX Series UPS system shall be capable of producing a fully regenerated, conditioned, pure sine wave AC. The online operational-mode, shall be continuous to all loads. It shall incorporate a high frequency IGBT technology and shall use an input rectifier, charger and inverter in a single board configuration. The DBL MX double conversion UPS shall provide a clean, pure AC sine-wave output at all times with a voltage input variation of 60VAC to 148VAC while providing 120VAC to the connected load at all times. The DBL MX shall be capable of operating in the voltage range of 60VAC to 148VAC without using the batteries and always provide a regulated 100/110/115/120 OR 127 output to the protected loads. Voltage compensation of -3, -2, -1, 0 and +1, +2, +3 VAC fine tuning.
2. The Input IGBT rectifier shall be rated at 2.5 times the output rating of the inverter.
3. 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 interruptions. The inverter's output shall be pure clean sine wave with a minimum efficiency of 88%.
4. The constant duty operation shall be rated in Total watts. This will enable the traffic DBL MX UPS to support any combination of signal heads whether Incandescent, LED or Neon, by any manufacturer, regardless of power-factor. The Inverter shall be rated for 185% of its' nominal output.
5. DC cooling fans shall be digital speed controlled.
6. The DBL MX shall be rated for an input power factor of .99 with a separate power factor correction module consisting of power factor correcting capacitors and inductors. This module shall be separated from the rectifier or inverter module.
7. The DBL MX includes LCD display panel with Led indicators. Input/Output Voltage, Input/Output Frequency, UPS temperature, UPS load, UPS battery Voltage, Battery discharge percentage, Battery Disconnected, Battery Failure, Low input Voltage boost, High Input Voltage, Service required, Alarm Codes, Program and set. On/Off Control with Delay, Manual Test Function, Overload. AC Outlet 1 and Outlet 2, AC present.

8. Alarm Codes; UPS fail, Over Load, Output Shorted, Fan Failure, Battery Failure, Eprom Failure, Input Shorted. Incorrect DC voltage Buss.etc
9. Hour Meter for UPS operating on battery mode, in 1/6 of an hour segments, Counter top register power failures, with individual reset.
10. Minimum Joule rating for surge of 400, with Normal and Common noise rejection.
11. The DBL MX shall operate in a static Bypass mode, from line to load, synchronized until the self-test has completed. The DBL MX will transfer to normal operation when ready in less than 10ms.
12. The DBL MX UPS shall be capable of glitch ride through capabilities and provide a seamless output to the connected load during this anomaly without the use of the batteries.
13. The DBL MX UPS shall be capable of providing an overload output rating of 120% for 60 seconds, 150% for 10 seconds to any combinations of signal types whether Incandescent, LED or Neon during inrush or overload conditions.
14. The DBL MX shall have an internal Static Bypass that will transfer to line power if over load exceeds 145% for more than 20 sec. This bypass will maintain the load until this overload has cleared. It will maintain overload of 120% for 250seconds. Audible Alarm will also be set.
15. The DBL MX 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.
16. The DBL MX UPS shall have an input back feed relay operating in series with the Neutral monitoring circuit.
17. Upon loss of utility power, the DBL MX UPS inverter shall continue to provide seamless pure sine-wave AC from the batteries without switching, transfer or changing its' operating status. The DBL MX will use the battery mode in '0' ms. This will insure that the DBL provides pure sine wave power under all conditions, at all times without interruption.
18. The DBL MX shall operate in Normal Mode with an input voltage of 60Vac and provides an output voltage of 120Vac, The output voltage will be +/- 1%.
19. The DBL MX output voltage may be set using the front panel, 100, 110, 115, 120 or 127Vac.
20. The DBL static switch may be set for sensitivity using the frequency 1,2 or 3Hz selection.
21. The DBL MX shall have an output sine wave THD of <=3Hz of 1Hz settable by software.
22. The DBL frequency stability in normal and battery operation shall be +/-0.1%
23. Crest Factor shall be 3:1
24. The DBL MX UPS will continue to provide generated AC from the inverter until the batteries are depleted.
25. When the batteries have been depleted, the DBP MX UPS will ensure upon the return of Utility Power that the UPS will restart automatically complete a self test and synchronize using the static Bypass Switch, and provide regenerated AC to the protected equipment and allow the equipment to resume normal operation.
26. The DBL MX 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.

27. The DBL UPS MX shall operate in an uninterruptible regenerative on-line mode during flash or normal signal operation.
28. The DBL MX shall be rated at Unity Power Factor. The output VA and Watts rating shall be equal on the output at all times.
29. The DBL MX 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 DBL MX 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 DBL MX shall compensate through regeneration and supplying both continuous frequency and voltage regulation to the protected load. The DBL MX may be tuned to compensate for frequency through the front panel.
30. The DBL MX UPS shall be capable of COLD starting without AC present and provide AC power to the load.
31. The DBL MX UPS shall be capable of self diagnostics during start up or with the use of the front panel TEST button.
32. The DBL MX UPS case shall be constructed from .064 aluminum and carbon steel.
33. The DBL MX, AC input and output connections shall be Anderson Power Pole 6P quick lock connector to eliminate exposed terminals or connections.
34. The DBL MX, DC connections shall be Anderson Power Pole 4P quick lock connector to eliminate exposed terminals or connections.
35. The DBL MX 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.
36. The DBL MX shall be capable of Hot-Swapping the batteries or battery bank, without shutting down the DBL MX UPS.
37. The DBL MX 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 without loss of AC to the loads.
38. The DBL MX 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.
39. Audible Alarms for Line Failure, Battery Low, Over Load, Systems Fault.
40. The DBL relay card may be replaced with an SNMP card for SNMP communications and information.
41. The DBL MX may use DB9 configuration for Dry Contact Relay Card, with UPS shut down, Line Fail, Normal Line, Low Battery, Common.
42. Dry Relay Contact Card for Bypass, AC Fail, AC Present, Inverter On, Battery Low, Battery Fail, UPS Alarm, Common, Shut Down Signal. May Be configured for N/O or N/C
43. EPO, DBL MX includes a Emergency Power off terminal connection..
44. The DBL UPS shall provide a programmable Dry Relay output for flash.
45. The DBL MX shall have an option provision for 40 to 80% battery low contact closure settable by software.
46. The DBL MX shall have a Panel Mounted dial timer.

47. The contacts shall be provided in N/O and N/C positions. The delay timer shall be a maximum of 10 hours
48. The timer shall be front panel mounted.
49. 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 function is 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.
50. The Event counter and Hour meter may be rest to '0' using separated buttons.
51. The DBL MX 700 and 1000 shall have a battery charger rated at 200 watts @ 36VDC with an optional 800 watts and 1000 watts.
52. The DBL MX 1400 shall have a battery charger rated @ 200 watts @ 72VDC with an optional 800 watts and 1000 watts
53. This charger shall be completely separate from the rectifier/inverter included with the main DBL board.
54. The DBL MX chargers may be used in a parallel configuration for increased charger ratings.
55. The DBL MX uses a redundant internal 1 amp charger that will continue to charge the batteries if the separate board charger fails.
56. The DBL MX 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
57. The Flash programming shall be a simple and field programmable without the use an external connected device such as a laptop or computer.
58. The Hot swap Bypass shall allow the UPS to be removed or installed at any time during normal load operation.
59. The DBL MX UPS shall include standard graphical real time software and USB connection cable.

1.0 Description:

The DBL MX shall consist of 3 major components. Main board Rectifier/Inverter, charger and control board.

- 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 IGBT Rectifier, is 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 efficiency of 88%.

The inverter includes 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 Digital logic board.

The charger portion is a 3 stage Hysterisis .5 amp, 36 or 72VDC charger with temperature compensation controlled by the Digital SMD processor.

The supplementary charger, is a parallel design rated for 200, 800 and 1000 watts.

The SMD digital processor technology with the control board monitors the Rectifier battery, DC Bi-directional, Ac input, AC output, battery charger, logic functions and Inverter functions. It provides the overall control of all the UPS functions and or operational capabilities.

2.0 Mounting Configuration

Shelf mounting, or rack mounting. Shelves, cabinets supplied by others.

170 style mounting method shall be 19" rack mount. Rack, angles or rails supplied by others

External: A separate stand alone NEMA Traffic cabinet may be supplied.

Rack mounting ears shall be removable. 4 additional rubber feet are installed for shelf mounting.

3.0 Battery System

The batteries shall be comprised of First Power High Temperature deep cycle (45, 55 and 100AH) batteries which have been proven under extreme temperature conditions..

The battery system or configurations shall consist of one or more strings. Each string shall be 36,72 or 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.

Battery construction shall be polycarbonate high temperature design. High pure lead content with internal resistance of.0028 ohms, Poly -case high impact construction, to with stand 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.

4.0 Electrical Specifications

Design:	Digital Double Conversion true on line.
Nominal input:	100, 110, 115, 120 and 127 AC single phase Control Panel selectable.
Input Voltage Range:	60v to 148v AC
Input frequency:	50/60hz (45 to 70) autosensing, Control Panel Selectable.
Frequency Stability:	+/- 0.1 until battery low
Input Power Factor:	>.99
Efficiency:	89 %
Input configuration:	3 wire with ground
Transfer Time;	0ms
Input Protection:	15 amp re-settable breaker (on DBL MX 700)
Input Current:	10.4 amps (includes charger) (on DBL MX 700)
Power Rating Continuous:	700 watts, 1000watts, 1400 watts
Output Current:	@ 700 watts 5.8 amps / 8.3 @1400/ 11.6@1400
Output regulation:	+/- 1% with 100% resistive load. Settable (-3, -2, -1, 0 and +1, +2, +3)
Output regulation w/low battery:	+/- 1% with 100% resistive load
Output Voltage:	110, 110, 115, 120, 127 VAC
Static Bypass:	200% load rated, 2ms to 10 ms reaction.
Frequency:	1 to 3Hz adjustments.
Output Wave Form:	Pure sine wave
Harmonic Distortion:	2% Linear Load 3% Non Linear Load
Dynamic Response:	+/- 5% RMS for 100% step load change 1.0 ms recovery time
Overload Capability:	105% continuous 120 % 250 seconds 150% watts for 10 sec
Charger:	200 watt 36VDC DBL 700, 72VDC on DBL 1400 Optional External, 400/800 and 1000 watt.
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 30 amp 4 Pole Keyed Recessed connector
Recognition:	UL Recognized, UL;1778 & IEE 587 / C62.41 on main UPS board
EMC Standard:	EN62040-2, EN61000-3-2, EN61000-3-3, FCC CLASS A

5.0 Mechanical

Dimensions

6.00 H x 10.5 D x 15.15 W (DBL 700) 5.27H x 12.5D x 17.15W (DBL 1400) 7H x 12D x 17.15W(DBL 2100)

Weight: unit only 18lbs, 28 & 49

Construction: 0.064 Carbon steel and Aluminum Case

Coating: Powder coating, with a minimum of 1.5mil of thickness.

6.0 Environmental

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

7.0 Communications Control & Diagnostics

LED indicators for: Line monitoring, Battery Mode, Charging, Low Battery, Fault / Bypass

Load level, Battery Level. Ground Fault.

Manual test function.

Alarm Function: Audible, Low Battery, Battery Fail, Bypass, Overload.

RS 232 port supplied with communication software. For real time UPS operational status.

USB ready.

Relay Card:

1. Bypass ON
2. AC fail or out of tolerance.
3. AC normal or in tolerance.
4. Inverter is operating (ON)
5. Battery low
6. Battery failed or bad
7. UPS general alarm
8. Ground (logic)
9. Apply 6 to +25VDC
10. between pin 9 and 10, will shut the UPS down

8.0 Reliability

Calculated MTBF is 120,000 hours based on component ratings

When Bypass is installed, system MTBF increases to 160,000 hrs

10.0 Hot Swap Bypass Switch

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. Internal fuse.
Connections:	Flush mounted Anderson Power connector. With locked and keyed.
Indicators:	LED for Line Available, Bypass, Ups On Line, UPS Available.
Dimensions:	7.5 x 5 x 2.5
Weight:	1.4 lbs

9.0 Options

- SNMP/WEB monitoring.
- 24/7 Adjustable perpetual timer.
- Parallel operation for redundancy
- Charger capacity up to 30 amps for long back up times and quick recharge.
- Hot Swap Bypass With alternate input option with monitoring circuitry for second input.
- Rack-Mount Hot swap Bypass Switch.

H) SNMP

Supports TCP/IP, UDP, SNMP. HTTP protocol, This provides the user with SNMP MIB for UPS monitoring and UPS status. Remotely provides UPS real time information including Data logging and UPS status in Real Time. Allow the identification and monitoring of an unlimited number of UPS systems. Each system has its' own identification. The system will send warning messages to the user if the UPS status has changed. Use Internet Explorer for Remote Viewing.

- 1) UPS load
- 2) Battery Charger status
- 3) UPS operation Normal/Alarm
- 4) Input Voltage
- 5) Output Voltage
- 6) Battery Voltage
- 7) UPS Temperature
- 8) UPS information logging
- 9) Remote UPS battery testing.
- 10) Send output email if UPS status has changed
- 11) Built in reset with panel mounted led indicators for SNMP status.

LED(1) Green LED: Status receiving
Yellow: Data Transmitting

LED(2)
Green: SNMP connecting
Yellow: SNM P functioning

BROWSING Internet Explorer.

- 1) UPS monitoring
- 2) UPS Information
- 3) UPS Control

Can be used to remotely service and test the UPS batteries.

Logging:

Date Time Voltage Load Temp Alarm Battery Status.

(I) TIMER 24/7

The timer is internally mounted in the UPS. It includes a DB9 connector. This provides the connection and programming to the timer.

This timer is completely programmable to any number of flash delays related to the time of day. It allows the complete flexibility of flash delay or skipping the flash during that particular event related to traffic flow and even holidays,

- 1) 7 days 24Hrs Flash delay timing.
- 2) Perpetual Clock.
- 3) Maximum of 31 setting per day.
- 4) Timing resolution to the minute.
- 5) 4 Possible commands per event.
- 6) Serial Port for schedule entry and editing.
- 7) Real-time operation, editing functions will not interrupt the units functions.
- 8) J-Tag port for instant preload of complete 7-day schedule file.
- 9) SPDT 10 amp 240VAC /24VDC ratings.
- 10) Input Voltage 110 to 240VAC or 24VDC unregulated supply.
- 11) Plus! Capable of scheduling for holidays or specific year/dates.
- 12) Capable of operating at 2400 baud micro-modem for direct phone connection
- 13) Capable of operating at 1200 to 230,000 baud rate on a serial port.
- 14) Capable of log retention.
- 15) OPTIONAL LED DISPLAY

Logging Display Timer Option.

- 1) The Logging option shall provide a continuous scroll logging function when included. This log function shall scroll and maintain 1500 individual log entries with date stamp based on a perpetual clock.

(J)

- 800 and 1000 watt charger
- Generator Input option on Bypass.
- Rackmount Bypass, with small form factor.
- Extended battery options.
- Parallel /Redundant for redundancy. (please call for application)

10.0

Warranty

Standard (2) two year on all components excluding batteries parts and labor, FOB Factory or Authorized Repair Depot

11.0

Batteries

Batteries shall be AGM flat plate high rate, high temperature design.

Nominal voltage: 12VDC

Capacity@ 25C: 55AH

Approx weight: 13.5Kg

Internal Resistance: 9.5 mOhms

Dimensions: 197mm x 165mm x 170mm (7.76 x 6.50 x 6.69)

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: -25c to +75C

Float Voltage: 13.5 to 13.80

Cyclic charging voltage: 14.5 to 14.90

Maximum charge current: 12A

Terminal material: Copper

Maximum discharge current: 400A (5 sec)