



Your Tailored Power Solutions Provider™

Staco Energy Products
FirstLine P Series 300kVA, 400kVA and 500kVA
Technical Specification
October 21, 2016

PURPOSE

This specification defines the technical characteristics of the FirstLine P Series 300kVA, 400 kVA and 500 kVA model UPS. The UPS is designed to supply precisely controlled and regulated energy to the connected load, without any interruption during normal operation and during any input disturbance including but not limited to a complete power interruption on the input service. (Limiting factors, duration, being controlled battery sizing and integration with an alternate input power source)

1. UPS DESCRIPTION

The FirstLine P series 300kVA, 400 kVA and 500kVA is an extension of the 65kVA to 250kVA product line of full double conversion, galvanic isolated and energy efficient uninterruptable power supply, UPS. The product is designed in accordance with UL1778, VFI-SS-111 and IEC EN 62040-3-with output transformer.

The main features are:

- a) Easy Source
 - Low input current distortion below 3% and power factor up to unity at loads from 75% to 100%. This is accomplished by the rectifier constructed using an IGBT three phase bridge and controlled by DSP technology;
 - Compatibility with motor generators using the adjustable power walk-in rate that guarantees a progressive start-up of the rectifier, power walk-in delay timer and battery inhibition.
- b) Battery Care System
 - Battery recharge with two voltage levels
 - Voltage Recharge with temperature compensation
 - Compatibility to recharge battery with long autonomy
 - Battery test to check a battery decay.
- c) Isolation transformer on the inverter that protects the load from network disturbances in all the working conditions while maintaining the overall efficiency that remains around 94-95%.
- d) Double load protection towards the battery: one furnished with intrinsic electronic protection in the control circuits and galvanic isolation with output transformer from the inverter.
- e) Thermal overrating of the inverter to guarantee an overload (kVA) at *110% for 60 minutes.
- f) The nominal output power rating of the UPS is a power factor of 0.9. **Unity for 300kVA & 400 kVA models**
- g) Back-feed protection.
- h) System expandability up to 8 units.
- i) "Energy Management System" function for systems in parallel configurations.
- j) The UPS system can operate with or without the neutral connection, no additional kits are required.

*Review overload specification for each model

Model Designations are as follows:

UPS 300 KVA	
FLU-300-00	UPS 300 KVA 480 V - 60 Hz Single , bottom cable entry
FLU-300-T	UPS 300 KVA 480 V - 60 Hz Single , bottom cable entry, MBY
FLU-300-CEC	UPS 300 KVA 480 V - 60 Hz Single, TCE
FLU-300-T-CEC	UPS 300 KVA 480 V - 60 Hz Single, TCE, MBY
FLU-300-00-P	UPS 300 KVA 480 V - 60 Hz Parallel , bottom cable entry
FLU-300-T-P	UPS 300 KVA 480 V - 60 Hz Parallel , bottom cable entry, MBY
FLU-300-CEC-P	UPS 300 KVA 480 V - 60 Hz Parallel, TCE
FLU-300-T-CEC-P	UPS 300 KVA 480 V - 60 Hz Parallel, TCE, MBY
UPS 400 KVA	
FLU-400-00	UPS 400 KVA 480 V - 60 Hz Single , bottom cable entry
FLU-400-T	UPS 400 KVA 480 V - 60 Hz Single , bottom cable entry, MBY
FLU-400-CEC	UPS 400 KVA 480 V - 60 Hz Single, TCE
FLU-400-T-CEC	UPS 400 KVA 480 V - 60 Hz Single, TCE, MBY
FLU-400-00-P	UPS 400 KVA 480 V - 60 Hz Parallel , bottom cable entry
FLU-400-T-P	UPS 400 KVA 480 V - 60 Hz Parallel , bottom cable entry, MBY
FLU-400-CEC-P	UPS 400 KVA 480 V - 60 Hz Parallel, TCE
FLU-400-T-CEC-P	UPS 400 KVA 480 V - 60 Hz Parallel, TCE, MBY
UPS 500 KVA	
FLU-500-00	UPS 500 KVA 480 V - 60 Hz Single , bottom cable entry
FLU-500-T	UPS 500 KVA 480 V - 60 Hz Single , bottom cable entry, MBY
FLU-500-CEC	UPS 500 KVA 480 V - 60 Hz Single, TCE
FLU-500-T-CEC	UPS 500 KVA 480 V - 60 Hz Single, TCE, MBY
FLU-500-00-P	UPS 500 KVA 480 V - 60 Hz Parallel , bottom cable entry
FLU-500-T-P	UPS 500 KVA 480 V - 60 Hz Parallel , bottom cable entry, MBY
FLU-500-CEC-P	UPS 500 KVA 480 V - 60 Hz Parallel, TCE
FLU-500-T-CEC-P	UPS 500 KVA 480 V - 60 Hz Parallel, TCE, MBY

2. STANDARDS

The construction and quality standards are governed within a certified ISO 9001/2000 facility. A list of other standard are as follows;

- VFI-SS-111 (EN62040-3, UPS Standards)
- UL 1778 5th Edition / CSA C22.2No 107.3-05 Uninterruptible Power System
- UL 60950-1 1:Information Technology Equipment – Safety Part 1 General Requirements
- National Electrical Code (NFPA-70)
- FCC Part 15 Subpart J Class A – Radio Frequency
- IEC 62040-3 – Methods of specifying the performance and test requirements

3. APPLICATIONS

The FirstLine P Series UPS are suitable for all applications requiring protection of the critical load, from simple installations to more complex systems where a higher level of reliability and maintainability is required.

Data Centers and Telecommunication: the uninterruptible power system is scalable and can grow together with your business. The basic system can be expanded with up to eight units connected in parallel.

Industrial processes and electro-medical systems: the UPS is particularly well suited for applications such as; industrial processes and powering electro-medical systems. Design aspects that lend themselves to this type of environment are:

- Inverter with an output transformer guaranteeing isolation of the load from mains interference in all conditions;
- High short circuit and overload capacity;
- High battery recharging capacity, enabling applications with different kinds of batteries (VRLA, flooded Lead Acid or flooded Nickel Cadmium) for long back-up requirements.

4. Modes of Operation

- The UPS shall always starts on Bypass and transfers to inverter after the rectifier and inverter have started. This means that the bypass source must be qualified (voltage, frequency, phase sequence) in order to start the UPS. The rectifier input must be qualified (voltage, frequency, phase sequence) in order to start the rectifier.
- The UPS shall be designed to operate as an on-line, reverse transfer system in the following modes:

A. On-Line (Normal)

The load shall always powered by the inverter, with stabilized voltage and frequency, using the energy from the mains power supply (INPUT). If there is a fault in the INPUT, the UPS shall switch to the batteries in zero time and the batteries shall supply energy to the inverter to keep the load powered (for the backup time of the batteries). When the INPUT is restored the batteries shall be automatically recharged by the rectifier.

B. Stand-By or Smart Active

The load shall be powered from the bypass line (if the power supply line is within the specified limits); if there is a fault on the power supply line, the load shall switch automatically onto the inverter, powered by the battery.

In Stand-By- On mode, the rectifier remains powered and keeps the batteries charged. If the bypass line voltage or the frequency moves out of the specified limit, the load shall be automatically switched onto the inverter output. With Stand-By On operation, the energy dissipated by the system shall be reduced, leading to considerable savings.

When Smart-Active mode is activated, the input utility shall be monitored, after which, if the voltage has remained within the pre-set values, the output shall be then switched onto the bypass line. If the input utility voltage does not stay within pre-set values, the load remains powered by the inverter and the logic continues monitoring. This mode of operation will improve efficiency to greater than 98%.

C. Stand-By Off

In Stand-By Off mode, the load is powered through the bypass. The Rectifier is on to charge batteries and the inverter is off. If there is a disturbance, the inverter will turn on approximately 200ms and the load will be support by the batteries.

D. Battery System

Configurations with one (1) battery system for each UPS. Each unit shall draw the energy from its own battery. At the end of its backup time each UPS shall shutdown. The load shall then remain unpowered if the duration of the power source outage is greater than the backup time of the connected battery system. When the power source is restored the system shall restart automatically. Each UPS shall recharge its own battery system.

E. Overload

If the load condition to the system is not reduced, the UPS system shall switch onto the bypass line. When the overload is removed, the UPS shall automatically return to normal operation. If the overload is continuous, this shall trigger the external protection devices located at the UPS input on the bypass line. In this case the load shall remain unpowered.

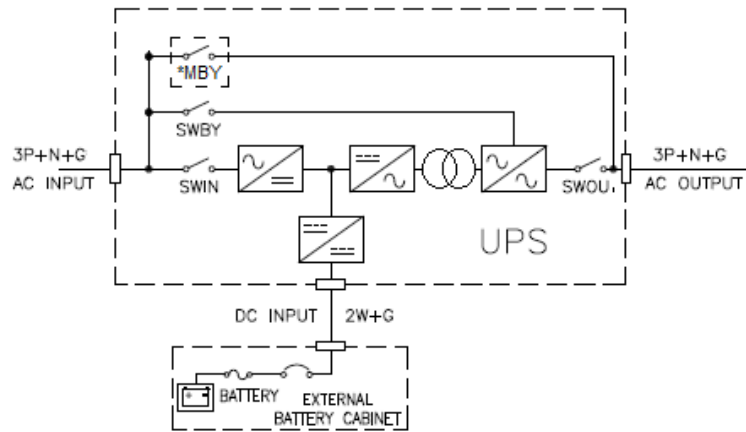
5. CONFIGURATIONS

As shown below, the FirstLine P Series UPS can be configured in single module mode using both single input supply methods; whereas, the input supplies both the rectifier input and the bypass supply circuit or dual input supply; whereas, the rectifier and bypass are supplied by separate sources.

Single Module (SMS)

Single input and single module mode are the most economical ways to install a UPS; thus, they are the most common modes of application. When configured in a single input and SMS mode the UPS redundant path for the bypass is same source derived and controlled by one circuit breaker feeding both the rectifier and the bypass.

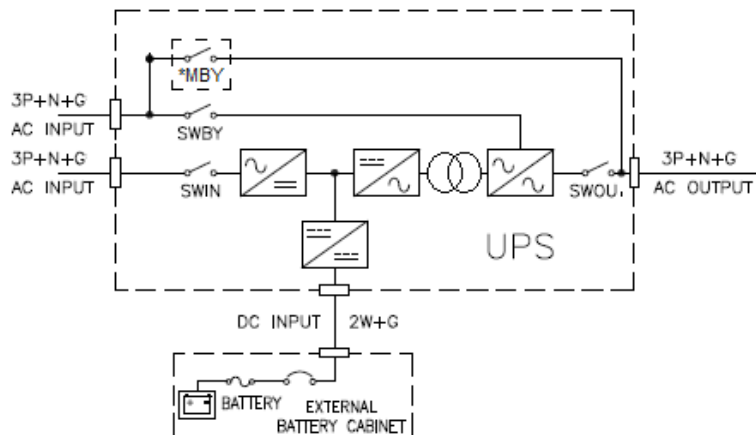
Single Input– Shown as 3W+N+G. 3W+G is also allowed



*Optional on “T” Models

Configured in a dual input mode, each input supply is dedicated to either the rectifier input or bypass circuit. This type of configuration is known for its higher state of reliability due to the ability to shut down the rectifier input on a fault without interrupting the bypass supply of the UPS.

Dual Input – Shown as 3W+N+G. 3W+G is also allowed



*Optional on “T” Models

Multi-Module (MMS)

The FirstLine P Series UPS can be configured to operate in parallel with other FirstLine P Series UPS of the same capacity. Up to eight units may be operated in parallel in either redundant mode (N+X) or in a capacity mode (N). When operated in parallel mode the units will equally share the load within 3% while in inverter mode. The load sharing is managed by the parallel controller which also manages the redundancy and/or capacity transitions to and from bypass. To ensure load sharing tolerance while in bypass mode, all cabling shall be the same size and length or within a 3% impedance differential.

When operated in redundant mode and provided the electrical infrastructure of switch has been provided, a UPS within the parallel array of units may be switched from online mode to offline mode and withdrawn from the active array of units for service without interruption to the load and without transitioning the system to bypass. The same unit may be returned to the active array of units without interruption to the load and without transitioning the system to bypass. This may be accomplished as long as the remaining units have sufficient capacity to maintain the load.

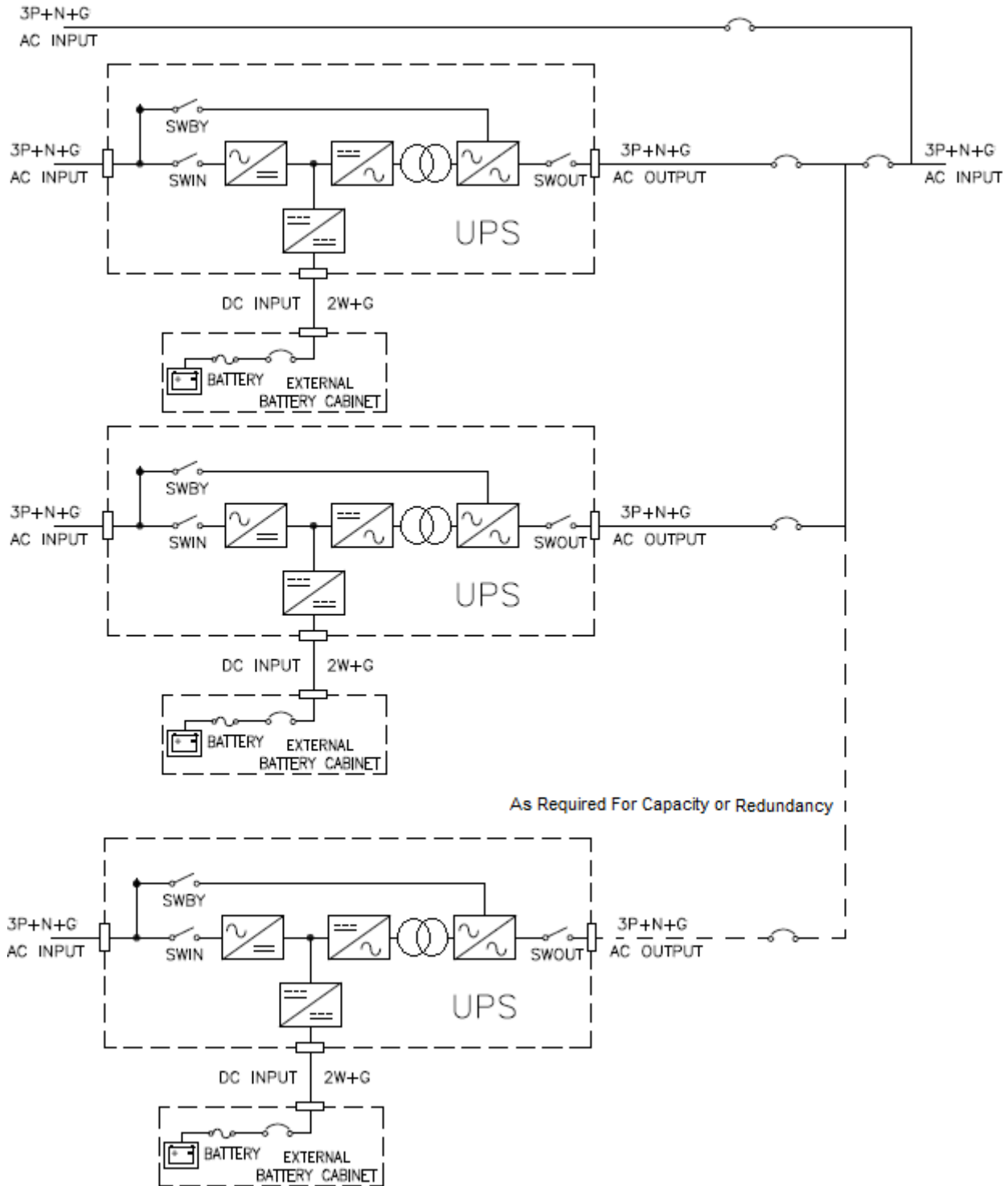
The parallel system management is designed with redundancy in mind. Each unit has the capacity to serve as the controller and as a follower. In the unlikely event that the unit serving as the controller were to fail, the next unit in the priority chain will assume the controller role and then an alert would be generated depicting the controller failure. This process can continue until the capacity of the system is reduced to "N" nominal capacity. In the unlikely event of a failure of the parallel controller in a non-redundant system, the system will transition to bypass and send an alert depicting the failure.

While operating in redundant mode, the system is capable of being operated in an efficiency manner. Efficiency Control System, ECS may be enabled. In this mode, the user may define the level of redundancy and idle units in hot standby mode not required for capacity. This will allow the remaining units carrying load to operate at a higher efficiency. This option is highly suitable for the industrial or production applications where loads vary due to factory capacity loading.

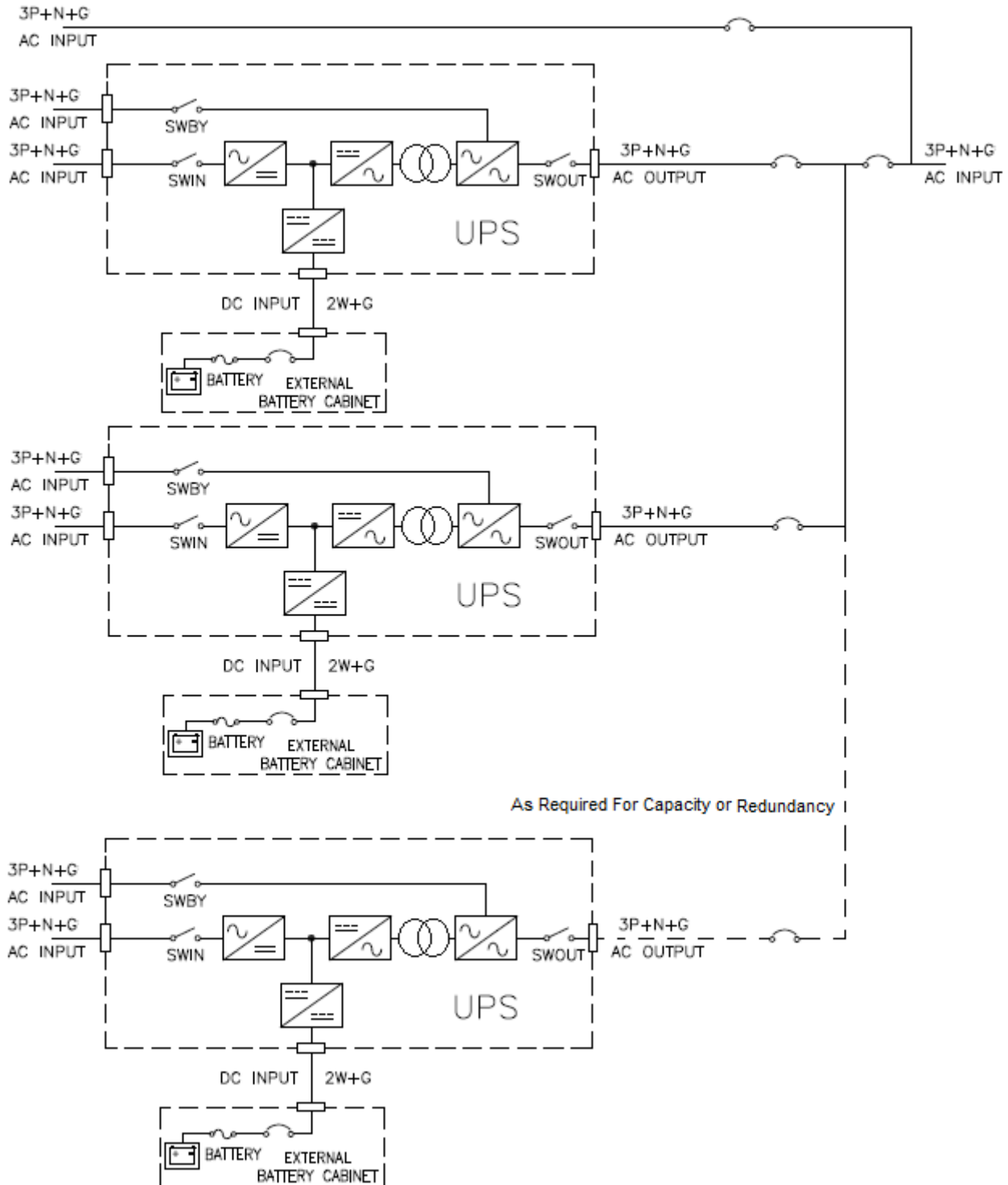
NOTE:

1. When ordering the FirstLine P Series UPS for parallel or (MMS) operation, you must order the parallel control kit that includes all the control logic for the UPS to operate in MMS mode. (FLU-PAR-KIT) one each per unit.
2. When configuring the FirstLine P Series UPS in a parallel environment, typically the optional internal manual maintenance bypass switch is not part of the configuration. This switch is removed as to not allow an illegal operation of a manual switch within the UPS parallel system.

Multi-Module (MMS) – Continued - Single Input (Parallel Gear Sold Separately) – Shown as 3W+N+G. 3W+G is also allowed



Multi-Module (MMS) – Dual Input (Parallel Gear Sold Separately) – Shown as 3W+N+G. 3W+G is also allowed



6. Components

A. Rectifier

The IGBT rectifier shall be capable of receiving utility input and rectifying it to produce Direct Current (DC) power at levels sufficient enough to supply the load via the inverter and charge the batteries.

I. Input Protection

The rectifier shall include protection against primary power surges, (except for lightning transients) and under or over voltage conditions. This protection is provided via fuses, Circuit Breakers, and Microprocessor Control of the rectifier.

II. Filtering

Sufficient filtering of the rectifier/charger output shall be provided to prevent damage to the battery. Ripple voltage shall not exceed $\leq 1\%$ RMS.

III. In-Rush Limiting

When the primary power is applied to the rectifier, the current surge shall be limited to no more than nominal input current when the UPS is operating at 480VAC input.

IV. Power Walk-In

When the utility power is applied to the rectifier, the current shall be $< 25\%$ of the full load current and shall gradually increase to full load rating within 10 seconds (adjustable 0-125 sec.).

V. Automatic Restart

Upon restoration of utility AC power after a power outage, the rectifier shall automatically restart and assume the inverter and battery recharge loads.

VI. Charger

An integral charging circuit shall be capable of recharging the batteries during normal operation to ensure maximum life from the battery system.

VII. Charger Capacity

The charger shall have sufficient capacity to recharge a fully discharged battery to 90% capacity within ten times discharge time.

VIII. Battery Test

The UPS shall periodically check the battery system for an open cell. If the UPS detects an open cell, an alarm condition shall be displayed and an audible alarm shall sound.

B. Inverter

The inverter section of the power converter module shall utilize Insulated Gate Bipolar Transistors (IGBT's). This solid-state device that incorporates digital signal processing (DSP) pulse width modulation (PWM) technology capable of accepting the output of the rectifier or the battery system voltage and delivering AC power within specified limits to the critical load bus. The inverter shall be microprocessor controlled and include all necessary timing logic and control circuits.

C. Inverter Start-Up

The inverter shall automatically startup when a start command is generated and shall be stable and ready to deliver power to the load.

1. Inverter Protection

Inverter IGBT's shall be protected by current limiting circuits. The inverter shall be capable of running indefinitely with the batteries disconnected. For rapid removal of the inverter from the critical load, the inverter's control electronics shall instantaneously turn off the inverter when the inverter's capacity is exceeded. Simultaneously, the static transfer switch shall transfer the load to utility power without interruption to maintain continuous power to the critical load.

2. Inverter Oscillator

The inverter shall contain an oscillator capable of operating and maintaining the output frequency of the inverter within specified limits. The inverter oscillator shall be capable of frequency synchronization and phase locking to the bypass utility power source frequency. When operating as a slave to the utility power and a failure occurs in the slaving signal, the inverter oscillator shall automatically revert to a free running state and maintain the specified limits. The oscillator shall not drift more than 0.05% while operating at maximum rated operating temperature.

3. Phase Balance

Electronic controls shall be provided to regulate each phase so that an unbalanced load will not cause the output voltage to go outside of the specified voltage unbalance or phase displacement limits.

D. Static Transfer Switch – 100% Rated, Continuous Duty

An internally mounted static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be naturally commutated high speed devices rated to conduct full load current continuously while on bypass power. The static switch shall be designed to avoid back-feed into the utility supply. Failure of one device shall not affect the operation of the UPS and the failure shall be shown on the LCD display.

1. Bypass Transfer

The static switch shall automatically and successfully transfer the critical load from the inverter to the bypass source under the following conditions:

- DC voltage out-of-limits
- Inverter failure
- Critical load current exceeds inverter overload rating
- Over-temperature develops within the inverter
- Manual command is given

Transfer shall be automatically inhibited whenever bypass source parameters are outside predetermined (adjustable) limits, or UPS output and bypass are not synchronized and phase locked.

2. Retransfer

The static switch shall automatically retransfer the critical load from the bypass source to the inverter under the following conditions:

- Inverter output voltage returns to within specified limits.
- Critical load current reduces to within inverter limits.

E. Battery

1. General

The UPS module shall use a valve-regulated sealed lead acid (VRLA) heavy duty industrial battery, designed for auxiliary power service in an UPS application. The primary battery shall be housed in a line up and match cabinet(s) installed both adjacent to or standalone versions.

2. Protection against Deep Discharge and Self-Discharge

The UPS shall be designed to protect the battery against deep discharge, depending on discharge conditions, with isolation of the battery by a circuit breaker. In particular, the UPS shall adjust the battery shutdown voltage as a function of a discharge coefficient to avoid excessive discharge at less than the rated output. The UPS shall avoid self-discharge of the battery into the UPS control circuits during an extended shutdown of the UPS (over two hours).

3. Battery Self-Tests

1. The battery monitoring system shall be able to perform the following automatic functions:

- Battery circuit checks every 12 hours.
- Open circuit battery test once a month.
- Partial discharge test every three months.

2. This self-test system shall signal faults via LEDs on the front panel or a message to remote supervision systems.

4. Battery Cycle Monitor

The system shall be capable of monitoring and retrieving Battery Cycle information from the Front Display Panel. The information provided shall be:

- a. Hours of normal operation
- b. Hours of operation from bypass
- c. Time spent operating on battery
- d. Number of discharges
- e. Number of full discharges

F. Manual Maintenance Bypass – (Optional)

Bypass switching shall allow the critical load to be fed from the bypass power source, while providing isolation of the static switch during maintenance.



8. Electrical Specifications

Electrical Data	300kVA	400kVA	500kVA
Input	480VAC 3 Phase without neutral		
Tolerance	+10%/-10% (@100% Load) +10%/-20% (@85% Load) +10%/-30% (@75% Load) +10%/-40% (@65% Load)		
Frequency	60 Hz		
Tolerance	45 Hz to 65 Hz		
Nominal kVA @ 480 VAC	320	425	484
I Max @ 100%	433	640	640
Input PF (25% to 100% Load)	>.99		
iTHD with input VTHD <1%			
Load @ 100%	≤3%		
Load @ 75%	≤3%		
Load @ 50%	≤8%		
Load @ 25%	≤8%		
Rectifier Start (Walk-in)	Adjustable 0 to 125 seconds		
Rectifier Start Delay	Adjustable 0 to 125 seconds		

Electrical Data	300kVA	400kVA	500kVA
Battery Link Voltage	480 VDC		
Typical Arrangement	40 each - 12 VDC VRLA		
Ripple Current @ Full Charge (%)	≤.5%		
Typical Float Voltage	2.26 VPC - 542.5 VDC		
Typical Equalize / High Rate Voltage	2.40 VPC - 576 VDC		
Max Charging Voltage	600 VDC		
End of discharge	1.6 VPC - 384 VPC Adjustable		
Battery Temp Compensation	-.11% per °C		
Max Charge Current @ 480 VAC			
Load @ 100%	60	150	100
Load @ 75%	115	225	190
Load @ 50%	170	230	285
Load @ 25%	210	360	360



Electrical Data	300kVA	400kVA	500kVA
Inverter Output			
Power Rating Inductive	300	400	500
Power Rating Active PF Unity	300	400	450
Nominal Current (AAC)	360	481	601
Power Rating .8 to .9 leading	.95 / 1	.95 / 1	.85 / .89
Rated Voltage	480 VAC 3 Phase + Neutral		
Rated Frequency	60 Hz		
Frequency Stability (Not Synced)	+/- 0.05%		
Sync Rate (Slew Rate)	1 Hz/sec - Adjustable		
Static Regulation (Linear Load)	+/- 1%		
Dynamic Regulation	+/-5%		
Recovery Rate	<20 ms IEC 62040-3 class1		
VTHD linear Load	≤1% Typical, < 2% Max		
VTHD non-linear Load	≤3%		
Phase Voltage asymmetry with balanced and unbalanced loading	≤1%		
Voltage phase shift with balanced and unbalanced loading	120° +/- 1°		
Overload Capacity			
3 Phase	110% for 60 min.		110% for 60 min.
	125% for 10 min.		125% for 10 min.
	150% for 1 min.		150% for 1 min.
1 Phase	200% 7 Seconds		
Short Circuit Capacity			
Phase to Phase	200% for 1 second		
Phase to Neutral	300% for 1 second		
DC to AC Efficiency 100% Load	95%		

Electrical Data	300kVA	400kVA	500kVA
Bypass			
Input	480VAC 3 Phase with or without neutral		
Tolerance	+10%/-10% Adjustable +/-5 to 15%		
Frequency	60 Hz		
Tolerance	+/- 2% Adjustable +/-1% to +/- 6%		
Switching to Bypass (Synced)	≤1ms		
Switching to Bypass (Async)	20 ms		
Switching from Bypass (Hot Standby Mode)	2 to 5 mS		
Delay Auto Transfer to inverter	4 seconds		
Overload Capacity (Provided up stream breaker is properly coordinated)	110% for 60 minutes 125% for 10 minutes 150 % for 1 minute		
Short circuit Capacity of bypass at nominal voltage I/In			
1 second	12	10	7
500 ms	14	11	8
200 ms	16	12	9
100 ms	18	14	10
10 ms	25	20	15

9 Mechanical Design & Ventilation

- a. Enclosure: The UPS shall be housed in a freestanding NEMA 1 enclosure with dead front construction. The mechanical structure of the UPS shall be sufficiently strong and rigid to withstand handling and installation operations without risk and have provisions for forklift handling. The sheet metal elements in the structure shall be protected against corrosion by a suitable treatment, primed and powder coat painted black with a textured finish.
- b. Combined Convection and Redundant, forced air-cooling shall be provided to ensure that all components are operated within specification with air entry at the front with 36" clearance, lower sides. At least one of the three side walls, right, left or back, shall be free with 24" top clearance for air exit.
- c. Cable Access: The standard UPS available shall accommodate bottom entry cables (top or side cable entry shall be optional).

- d. Cabinet Dimensions: The width of the UPS shall be:
 - i. 300kVA : Base Only 59.0" (1,500mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - ii. 400kVA : Base Only 59.0" (1,500mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - iii. 500kVA : Base Only 59.0" (1,500mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - iv. 300kVA : Base & TCE 74.80" (1,900mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - v. 400kVA : Base & TCE 74.80" (1,900mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - vi. 500kVA : Base & TCE 74.80" (1,900mm) Wide x 39.37" Deep (1,000 mm) x 74.80" High (1,900 mm).
 - vii.
- e. Cabinet Weights: The UPS shall have a maximum weight of:
 - i. 300kVA : Base Only 4190 LBS. [1900 kg].
 - ii. 400kVA : Base Only 4741 LBS. [2150 kg].
 - iii. 500kVA : Base Only 4741 LBS. [2150 kg].
 - iv. 300kVA : Base & TCE 4410 LBS. [2000 kg].
 - v. 400kVA : Base & TCE 4961 LBS. [2250 kg].
 - vi. 500kVA : Base & TCE 4961 LBS. [2250 kg].
- f. Ventilation and Heat Rejection: The UPS shall be designed for forced air cooling. Air inlets shall be provided from the front and bottom of the UPS enclosure. Air exhaust shall be from the top portion of the unit. Full load heat rejection shall be:
 - i. 300kVA : Base Only 55,011 BTU/hr.
 - ii. 400kVA : Base Only 70,324 BTU/hr.
 - iii. 500kVA : Base Only 80,815 BTU/hr.

10. Environmental Requirements

- A. The System shall withstand any combination of the following external environmental conditions without operational degradation.
 - 1. Operating Temperature Range: 32°F (0°C) to 104°F (40°C) for the electronics, however the batteries should not be exposed to prolonged periods of temperature above 77°F (25°C). For every 15°F (8°C) above 77°F battery life is cut in half, and may void the battery warranty.
 - 2. Storage Temperature Range: -4°F (-20°C) to 158°F (70°C) however batteries should not be exposed to temperatures above 77°F (25°C). For every 15°F (9.5°C) above 77°F battery life is cut in half, and may void the battery warranty.
 - 3. Relative Humidity: Continuous operation with a relative humidity up to 95% non-condensing at 77°F (25°C).
 - 4. Altitude: Normal operation without de-rating is 3,281 feet.
 - 5. Audible Noise: Audible noise generated by the UPS shall not exceed 72 dBA when measured at 1 meter in front of the power converter using scale "A" of a standard ASA sound level-measuring device.

11. System Controls and indicators

The UPS unit shall incorporate the necessary controls, instruments and indicators to allow the operator to monitor the system status and performance, as well as take any appropriate action. The UPS shall meet, at a minimum the following requirements:

A. Panel Functions

1. LED Control Panel Functions

- Menu Selections
- Mimic Screen
- Function Indicator LED's
- Function Selection Keys
- EPO Button

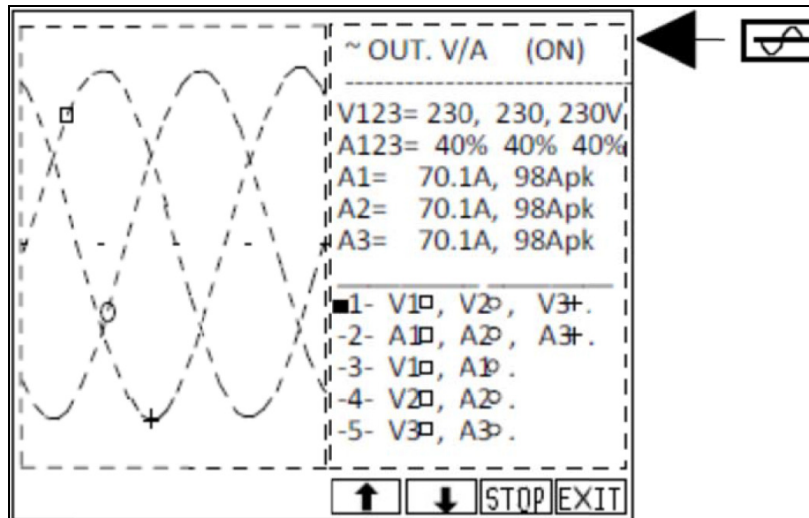
2. Graphic Display

A graphic display shall be on the UPS door, which provides the user to have a detailed overview in real time of the status of the UPS. The user shall be able to switch the UPS on and off, consult electrical mains, output, battery measurements and perform the main UPS settings. The display shall be divided into four main areas, each with its own specific role.

- a. **General Information:** Area of the display where the set date and time and, according to the screen, UPS model or title of the menu which is active at that moment is displayed permanently.
- b. **Data Display/Menu Navigation:** Main display area designed for displaying the UPS measurements (constantly updated in real time) and for consulting the various menus which the user shall select using the designated function keys.
- c. **UPS Status/Errors-Faults:** Area where the UPS operating status is displayed. The first line shall always be active and constantly display the status of the UPS at that moment. The second only becomes active in the presence of an error and/or fault with the UPS and shall display the type of error/fault encountered.
- d. **Key Function:** Area divided into four boxes, each relative to the function key below its area. According to the menu which is active at that moment, the display shall indicate the function belonging to the corresponding key in the appropriate box, access main menu, go back to previous menu or display, scroll, confirm selection and silence function keys.

3. Menu Display

- System Diagram
- Measures
- *Waveforms
- Commands
 - Battery Test
 - Command
 - Bypass
 - System
 - Stand-By Mode ON
 - Smart Mode ON
- Customizing
 - Date/Time
 - Normal Output Voltage
 - Battery Capacity
- History
- Firmware
- Language

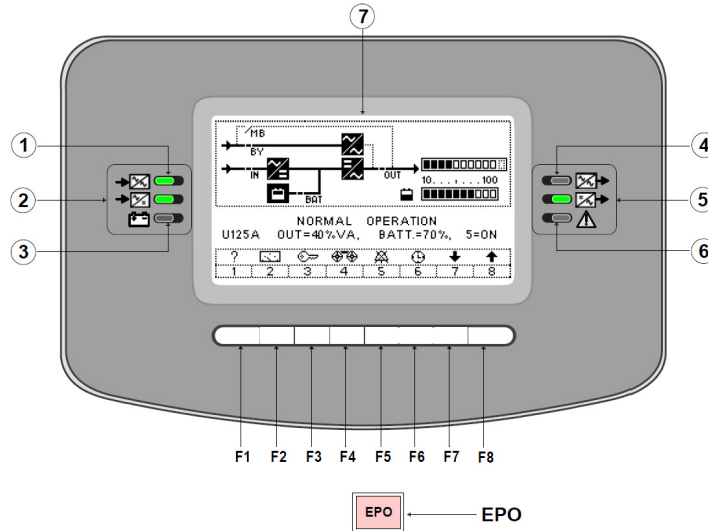


Example of displaying wave forms of the UPS output.

4. LED Status Indication

- Bypass Line
- Main Power
- On Battery
- Load on Bypass
- Normal Output
- Alarm for Internal Fault

Display Layout



- | | |
|------------------------------------|---------------------------------|
| 1. LED Bypass Input Line Indicator | 5. LED Bypass Output |
| 2. LED Main Input Line Indicator | 6. LED Alarm for Internal Fault |
| 3. LED Battery Indicator | 7. Graphic Display |
| 4. LED Bypass Output | EPO – EMERGENCY POWER OFF |

F1-F8 Perform various functions and change based off the active screen.

Display instructions and labels are available in different languages such as; English, Italian, French, German, Spanish, Dutch, Swedish, Polish, Hungarian, Turkish, Czech, Russian, Romanian and Portuguese.

The display stores up to 120 events within its log file. This is a FIFO, first in first out filling system allowing the latest messages to be displayed.

a. Alarm Messages/Events

The Display Panel shall provide the following alarm and event messages.

Normal Operation	Battery test ON	Power
Disturbances on Bypass Line	Parallel Cable Fault	Parallel Redundant Lost: Unit OFF
Manual Bypass (SWMB) On	Fuse Fault	Break Circuit Fail
Bypass Line Volt, Failure	Battery Discharge Fail	Break Circuit Overload
Main Line Voltage Failure	High Battery Temperature	Rectifier Switched Off by Remote Command
Pre-alarm, Low Battery Voltage	Slave UPS OFF	UPS Service Required
Low Battery Charge or Closed	Fan Fault	Battery Service Required
Disconnect	Parallel Redundant Lost: High Unit	Input Switch Off
Low Input Voltage	Input Voltage Sequence not OK	Insulation Loss-AC
Output Overload	Output Off	Insulation Loss-DC
Internal Fault	System OFF Command ON or OFF	Over-temperature On Bypass Line Transfer
Temporary Bypass, Wait	Remote System Command ON or OFF	Inverters Off
Bypass for Output Overload	Auto-shutdown Timer ON	
Bypass Command ON or OFF	System Off	
Remote Bypass Command Active		

B. Control Functions

1. Configurable Alarms

The UPS shall have the following user configurable control functions accessible from the Display Panel.

A. Basic Functions

- Output Voltage – Selects the rated output voltage
- Operating Mode – Selects the operating Mode: On-Line, Stand-By ON, Smart Active
- Auto Off – If bypass line is present and the load is < of the set value than the load will be supplied from the bypass line. If the bypass line is not present and the load is < of the set value than the load will not be supply (configurable 0 to 99%).

- Battery Low Warning – Estimated battery time remaining for low battery warning (configurable).
- Battery Capacity – Sets the Amp Hour Battery installed.
- Audible Alarm – Audible alarm operating mode: Enable/Disable
- Language – Selects area Language – English, Italian, German, French, Spanish, Polish or Turkish.

B. Advanced Functions

- Input Frequency Tolerance Range – Selects the acceptable range for the input frequency for switching to the bypass and for the synchronization of the output: +/- 1 to +/- 5 in % stages.
- Bypass Voltage Thresholds – Selects the acceptable voltage range for switching to the bypass: +/- 5 to +/- 25 in 1% stages.
- Bypass Voltage Threshold for ECO – Selects the acceptable voltage range for operation in ECO Mode: +/- 5 to +/- 25 in 1% stages.
- Switch-On Delay – Waiting time for automatic power-on after the return of power source voltage:
- Disable or configurable 1 to 255 in 1 second stages.
- Power Walk-In – Activates the gradual return to power source mode: Activated or Deactivate.
- Power walk-In Duration – Sets the duration of the gradual return to power source voltage (only if Power Walk-In is activated: Minimum 0 seconds to maximum 125 seconds in 1 second stages.
- Inverter Synchronization Speed to Bypass Line – Selects the synchronization speed of the inverter to the bypass line: 0.1 to 1 Hz/sec (parallel units), 0.1 to 2 Hz/sec (single units).

C. Remote Emergency Power Off (EPO)

The UPS shall be equipped with provisions for local and remote emergency power off and Dry Contact input that shall be used to command UPS shutdown remotely.

D. DB-9 Connector: One DB-9 connector with serial output shall be provided for field diagnostics.

E. Dry Contacts: The UPS shall be provided standard with a programmable input/output Relay board. This board shall have 5 dry contacts (i.e., 2 for input signals and 3 for output signals).

1. Contacts shall be programmed as:

- a. Bypass
- b. Battery Discharging
- c. End of battery Discharge
- d. Inverter Off (input).
- e. EPO (input).

2. The contacts shall capable of switching up to 24 VAC or DC at UP 1 Amp.

3. In place of the three standard ALARM functions above, the unit shall have the capability to be reprogrammed to any (3) of the customized alarms below:

- | | |
|------------------------------------|------------------------------------|
| a. Disturbances on Bypass Line | f. Output Overload |
| b. Manual Bypass ON | g. Internal Fault |
| c. Bypass Line Voltage Fail | h. Bypass for Output Overload |
| d. Main Line Voltage Fail | i. Over Temperature or Fan Failure |
| e. Pre-alarm , Low Battery Voltage | j. Input Voltage Sequence OK |
| | k. Output OFF |

12. Parallel Configuration - Detail

- A. The UPS shall have expansion capabilities for up to 8 modules (same rating) in a parallel configuration for capacity or redundancy as required to support future growth and to increase both the reliability of the to the load. The UPS units shall be connected in parallel and shall share the connected load.

Having a redundant unit means having one more UPS than the minimum number of elements required to power the load, so that if a faulty unit is automatically excluded, power is still supplied correctly. The UPSs connected in parallel are coordinated by a card which ensures the interchange of information. The information shall be exchanged between the UPSs via a cable connecting them in a loop. The loop connection provides redundancy in the connection cable (communication in the cables between the individual units). This is the most reliable means of connecting the UPS and also allows the hot insertion or disconnection of a UPS. Each UPS has its own controller that continuously communicates with the whole system so as to guarantee the operation of the system. The cable transmits the signals from a CONTROLLER is chosen on start-up. The CONTROLLER and FOLLOWER units shall be capable of exchanging roles. If a unit is being serviced, e.g. due to an inverter fault, it will automatically be excluded. The load at this point shall be shared between the units that are still active; if the power in the output is excessive for the remaining UPSs, the system logic shall switch all the units, including the UPS that was excluded, onto the bypass line.

1. Single Module Paralleling

A Parallel Systems card shall be installed in each UPS Module enabling the connection of the outputs from separate UPS Modules in a parallel configuration into a dynamic dual bus for system expansion, fault tolerance and ease of maintenance.

2. Group Module Paralleling

A UPS Group Synchronizer (UGS) shall be included and shall synchronize the outputs from two separate groups of parallel UPS Modules which may be supplied from separate AC sources. It shall enable the outputs from the groups to be configured into a dual bus format.

The UPS maintains synchronization between the outputs of the parallel groups, regardless of input supply variations. For example, one group may be on battery power or standby power and the other powered by the mains power supply. The device can be generally used with up to eight UPS modules between two separate groups.

If one of the UPS modules within the two parallel systems fails, or has to be switched off for maintenance or emergency service work, the two outputs of the parallel UPS systems are merged by the PSJ (which acts as an output coupling switch) to allow power sharing.

3. Parallel System Static Transfer Switch (STS)

When UPS Modules are connected in Group Paralleling configuration a STS devices shall be used to provide a source of power from one of two primary input sources. This can include either two separately derived power sources, the outputs from two uninterruptible power supplies or a combination of the two. The (STS) on the output shall enable the protected load to be supplied from either of the parallel groups. In this configuration, if one of the UPS groups fails, the STS can transfer the load to the second group - providing there is spare capacity. The STS shall free standing and include a Master Switch. This configuration is designed for sites that have large three phase loads.

4. Hot Insertion/Removal

The system shall have the capability to insert or remove additional UPS modules without disconnecting the load. The hot insertion and removal of the UPS shall make technical support easier and improves the reliability of the system.

13. Options

A. UPS Options

1. Top or Side Cable Entry

Standard cable entry shall be from the bottom with provisions for top or side entry using a matching side car cabinet not to exceed 75" high x 15.75" wide x 39.37" deep.

2. Input / Output Transformer Cabinet with Maintenance Bypass (Make-Before-Break)

The UPS shall have provisions to accept an input power source of 208 VAC and /or output of 208/120V. An input Auto or Isolation transformer 208 VAC to 480 VAC and/or 480V to 208/120V output transformer shall be housed in a single cabinet. As an integral part of the cabinet, it shall also accept a three (3) Breaker Maintenance Bypass with electronic interlocks and top cable entry capability. The cabinet shall match the UPS cabinet.

3. Output Distribution Unit (PDU)

The UPS shall have provisions to provide a 208Y/120 VAC transformerless output distribution unit (PDU) to distribute power to the load. The PDU shall contain two (2) branch circuit distribution panel boards accepting any combination of 1, 2 or 3 pole branch circuit breakers housed in a matching cabinet not to exceed 75" high x 22" wide x 33.35" deep. Branch circuit breakers shall be provided by others. UPS output must be 208Y/120VAC.

4. Output Sub-Feed Distribution Unit (Sub-Feed PDU)

The UPS shall have provisions to provide a 208V output distribution unit to distribute power to existing distribution panels. The Sub-Feed PDU shall contain three (3) 125 Amp sub-feed distribution circuit breakers housed in a matching cabinet not to exceed 75" high x 22" wide x 33.35" deep. UPS output must be 208Y/120VAC.

5. Output Parallel Cabinet

A. An Output Parallel Cabinet shall be available for connection of all UPS System connected in parallel.

6. Battery System Options

a. External Battery Cabinet System

Line up and match extended run time battery cabinet(s) shall be furnished in both adjacent or standalone versions. The battery cabinet shall be capable of accepting a minimum of (40) each of VRLA Maintenance Free Cell type batteries, wired and installed. Interconnecting cables and lugs shall be provided by others.

b. Open Rack Battery System

The UPS shall be capable of utilizing Wet Cell or NiCad batteries installed in an open type seismic qualified rack construction.

c. String and Cell Level Battery Monitoring

A Battery Monitoring System (BMS) shall have provisions to accept a wireless battery system that monitors each battery or string. It shall also be capable of monitoring the battery cabinet internal temperature and provide cycle data and other reports and graphs.

7. External Maintenance Bypass

b. Wrap-Around System Maintenance Bypass Switch

An External Maintenance Bypass (MBPS), (make-before-break) shall be available: The MBPS shall provide a means to isolate the load for removal of the UPS. For 480V x 480V power requirements, the maintenance bypass option shall provide for three (3) circuit breakers mounted in a matching cabinet with electronic interlocks.

The total enclosure shall provide a wrap-around bypass configuration for total UPS isolation during maintenance or removal of the UPS. Maintenance bypass transfers shall be without interruption and shall have electronic interlocks to protect the UPS from damage in the event of out-of-sequence transfers.

B. Communications

A. Communication Cards

Open slots shall be available to accept any (2) of the following:

FLU-Netman: Internal SNMP Card with UPSMON Monitoring & Control Software allows management of a single Firstline P UPS across a LAN using any of the main network communication protocols – MODBUS/TCP/IP, HTTP, Bacnet IP and network interface (SNMP). NetMan enabled UPS's to integrate easily into medium and large sized networks and provide reliable communications between the UPS and management systems employed.

FLU-MultiCOM1: Internal MODBUS/JBUS Card (external model shall be available), Protocol converter shall be used to monitor the UPS using the MODBUS/JBUS protocol on RS232 or RS485 serial lines. It can also manage a second independent RS232 serial line that can be used to connect to other devices such as the Netman SNMP Card with a PC using UPSMON or PowerShield software.

FLU-I/O Expansion: Internal Card shall provide addition remote alarm functions as identified below. The card shall contain 6 outputs: potential-free contacts for alarms (programmable from the display panel) and capable of switching up to 30 V AC or DC at UP 1 Amp, 2 inputs (programmable from the panel) and 1 12V DC maximum 100mA auxiliary input. 2 additional slots shall be available for a total of 12 additional contacts.

- Disturbances on Bypass Line
- Manual Bypass ON
- Bypass Line Voltage Fail
- Main Line Voltage Fail
- Pre-alarm , Low Battery Voltage
- Low Input Voltage
- Output Overload
- Internal Fault
- Bypass for Output Overload
- Over Temperature or Fan Failure
- Input Voltage Sequence OK

B. Monitoring and Shutdown Software

The UPS shall have Monitoring and Shutdown Software available to provide communication across a LAN networks:

FLU-Powershield: Communication Software shall provide efficient, user-friendly management of multiple Firstline P UPS's using bar chart displays to show major operational information such as the input voltage, UPS load percent and batteries charge percent. The software also provides detailed information on fault conditions and UPS operating characteristics. PowerShield has been developed with a client/server architecture that makes it flexible and easy to use, and provides multi-lingual and on-line support.

Operating systems supported include Windows 2000, 2003Server, XP, Vista, 2008 Server, 7, Linux, Novell Netware, Mac OS X and most common UNIX operating systems such as: IBM AIX, HP, SUN Solaris INTEL and SPARC, SCO Uniware and Open Server, Silcon Graphics IRIX, Compaq Tru64 UNIX and DEC UNIX, Open BSD UNIX and FreeBSD UNIX, NCR UMIX, HP Open VMS VMWare ESX and VSPHERE.

FLU-PowerNETGuard Supervision software shall centralize UPS management using network interface (SNMP) communications. It is ideal for Data Centre managers and medium to large sized networks. PowerNETGuard uses the RFC1628 standard Management Information Base (MIB) and ensures standardized UPS management wherever they are located.

Operating systems supported include Windows (98, ME, NT, 2000, 2003, XP and Vista), Kinux, MacOSX, Solaris 8, 9 and 10 and Silcon Grapics IRIX.

C. Battery Sensor Module

FLU-Sensor: The Battery Sensor Module shall monitor the battery internal cabinet environmental conditions of one (1) Battery Cabinet connected to the UPS and displayed on the UPS front mimic panel. For units with multiple battery cabinets, only the first cabinet will be monitored.

D. Remote Monitor Alarm Panel (RMP)

FLU-MultiPanel: Remote Monitoring Panel device shall provide remote monitoring and control, same functions as the UPS main mimic panel. The RMP shall provide detailed UPS status overview in real time. It shall display values for UPS specific input and output supplies, and battery set measurements. The RMP shall have a high-definition graphical display and can report in 7 languages: English, Italian, German, French, Spanish, Russian and Chinese.

It shall have (3) independent serial ports, one of which allows for UPS monitoring via the MODBUS/JBUS protocol (on either an RS485 or RS232 serial line). The others can be used with devices such as the Netman SNMP Card, HTTP, MODBUS/TCP, Bacnet IP and a PC running UPSMON or PowerShield software.

E. IBC Seismic Withstand Certification - TBD

Contact Factory - Site specific Seismic Withstand Certification per IBC (International Building Code) Areas A through F. Bracing hardware with drawings shall be available. All unit shall have bolt down capability without the use of external brackets.



Your Tailored Power Solutions Provider™

F. Harsh Environment Enclosure

The UPS and any accessory cabinet(s) shall have the capability to be mounted and completely wired internal to, include AC cooling, inside any NEMA type enclosure (NEMA 12, 3R, 4X) by the manufacturer.