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AC Power

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Emerson Network Power is the world's leading provider of critical infrastructure technologies and services for IT information and communications systems.

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Trellis: Dynamic Infrastructure Optimization Platform

Unified Infrastructure

- Integrated Modular Solutions: Rapid Deployment of Unified Infrastructure for Greater Efficiency
- Smart Solutions: Intelligent, Integrated infrastructure for the Data Center

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- iCOM Controls: Intelligent Cooling Control Technology
- Room, Rack and Row Cooling Solutions
- Rack and Row High Density Applications
- Custom Air Handling Units
- Free-cooling chillers

Power Management

- AC Power: UPS for desktop and large facility applications & Rack and room PDU
- DC Power: HVDC, Converter Systems, Rectifiers and Batteries and Accessories
- Industrial Power: AC UPS, Rectifiers and Inverters, Diagnostics and Monitoring, Integrated Power protection systems

IT Management

- Serial Consoles
- Remote management: High performance KVM switches and softwares
- Local Management: LCD console tray and KVM solutions

Service and Consulting

- Project Management: Commissioning, Engineering services, code compliance
- Maintenance: Preventive & corrective, remote monitoring, repair and spare parts
- Performance: Engineering and assessment, Inspection and safety compliance, battery replacements

We believe in creating relationships with our customers that are built on a foundation of market knowledge, a focus on quality, and a commitment to help our customers make the future of their business possible.

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AC Power UPS

Company Profile

About Emerson Network Power

Emerson Network Power, a business of Emerson (NYSE:EMR), is the world's leading provider of critical infrastructure technologies and life cycle services for information and communications technology systems. With an expansive portfolio of intelligent, rapidly deployable hardware and software solutions for power, thermal and infrastructure management, Emerson Network Power enables efficient, highlyavailable networks. Learn more at www.EmersonNetworkPower.Asia.

About Emerson

Emerson (NYSE: EMR), based in St. Louis, Missouri (USA), is a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial, and consumer markets around the world. The company is comprised of five business segments: Process Management, Industrial Automation, Network Power, Climate Technologies, and Commercial & Residential Solutions. Sales in fiscal 2015 were $22.3 billion. For more information, visit Emerson.com.

Why Choose Emerson Network Power?

Mission-Critical Solutions
Emerson Network Power offers the broadest product portfolio from Grid to Chip that is unmatched in the regional and global market.

Extensive Service Coverage in Asia Pacific
Emerson Network Power has service offices located in 12 countries with more than 350 service engineers. We are equipped with a strong technical support network and multi-tiered parts availability.

Talent and Knowledge Pool
We are backed by the industry's most experienced service associates and factory trained engineers that can provided high level on-site technical support.

Total Service Solution across Mission-Critical Infrastructure
Our service helps minimize potential downtime in your mission-critical facility. It can also increase performance and overall system reliability, extend the useful life of your equipment, and ensure system optimization. This service includes availability assessments, maintenance agreements, professional management and performance monitoring and full service range covering all product lines.

Customer Focus
Our service programs are tailored to ensure that our customers' requirements are met. Our customer- centric programs include customer relationship management, satisfaction surveys, customized solutions from small to large size businesses and even customer advocacy on energy optimization efforts.

About This Document

History of this Document

Historically, Emerson has offered individual Product Manuals to key Customers and Consulting Engineers. These documents have taken on a variety of forms but have always been constructed with the intention of providing current and useful information. Data selection has been made with respect to the specification and installation of the described product so as to facilitate the appropriate selection of the Emerson solution.

The approach to information dissemination has evolved along with the general shift towards digital formats, however print versions continue to be utilized by sub sets of customers and more broadly within Consulting Engineering firms.

2016 Edition

This current edition sets out to meet the needs of this audience with two specific requirements in mind. Firstly to provide easily accessible information and then secondly to take into account the need for revisions that are made post print and prior to the next edition.

This document contains a selection of material deemed to be most critical to selection of an Emerson Solution but it is acknowledged as an excerpt from a broader data set. This shapes the final format of this edition, namely a shortened version of key documents but with clear references to the full unabridged document online.

Final Format and Environmental Considerations

This product manual is intended to be an annual edition and will be revised and reprinted in the first calendar quarter of each year. Emerson takes every effort to limit the scale of the document to minimize paper usage. The black and white format on this specific paper weight and quality reflects a deliberate decision to minimize material consumed in this resource.

Further to this, Emerson will continually canvass customers to track evolving preferences for content delivery apropos print versus online delivery.

Document Structure

Each product contained in this document is described through 4 sub sections.

Product Brochure	(abridged)
Guide Specification	(unabridged)
Technical Specification	(excerpt)
Submittal Drawings	(excerpt)

If you have questions, comments, or concerns please contact your local Emerson Network Power representative or send us an email at **Marketing.ap@emerson.com**

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UPS

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Liebert® itON BX

Reliable Power Protection for Desktop Workstations

■ 600VA ■ 850VA ■1000VA

The Liebert® itON is a feature-rich reliable line-interactive UPS designed for desktop computer workstations and standaloneIT equipment. It has an automatic voltage regulator (AVR) that allows flexibility and reliability for PCs and other sensitive electronic equipment. Designed with simple controls for easy operation, the Liebert® itON provides more than enough time to save work in process before shutting down the system.

Features

- Equipment with boost and buck AVR tostabilize the input voltage
- Micropocessor control guarantees high reliability
- Provides AC overload protection
- Auto restart with AC recover
- Compact size, lightweight
- Fast charging
- Off mode charging
- Cold start function
- Overload protection and alarm
- 4x IEC outlets for PSA600-BX, PSA600-UX, PSA850-BX, PSA850-UX, PSA1000-BX, and PSA1000-UX
- 6x NEMA/EU sockets for PSA1000H-BX



Key Advantages

- AVR features gives higher application availability by correcting high and low voltage without using valuable battery power

The Liebert® itON is Ideally Suited for

- Desktop PCs
- Professional workstations
- Small routers, bridges, and hubs
- Point-of-sale terminals
- Other sensitive electronics

Runtime Chart

	600VA	850VA	1000VA
120W	10 mins	15 mins	30 mins
240W	2 mins	3 mins	8 mins
300W	-	2 min	6 mins
360W	-	<1min	3 mins 15 sec
480W	-	-	1 min 20 sec

Technical Specifications

Model Number	PSA600-UX/PSA600-BX	PSA600H-UX/PSA600H-BX
Capacity (VA/W)	600/360	
Net Weight, kg. (lb.)	4.25 (9.37)	
Dimensions – W x D x H, mm. (in.)	100 x 287 x 142 (3.9 x 11.3 x 5.6)	
On-Line Input Voltage	160-290VAC, single phase	
On-Line Frequency	50/60Hz (auto sensing)	
Online Frequency Range (50Hz/60Hz)	45 - 55Hz ±1Hz / 55 - 65Hz ±1Hz	
Output Voltage (Utility Power Normal)	220VAC/ 230VAC/ 240VAC, single phase	
Output Voltage (Battery Operation)	+ / -10%	
On-Battery Wave Form	Stepped sinewave	
Output Frequency Battery Mode	50Hz (60Hz) ±1Hz	
Battery Type – VDC x Ah x Quantity	12V x 7 Ah x 1	
Typical Recharge Time	4 hours to 90%	
Battery Runtime* – Half Load	4 minutes	
Operating Temperature, °C (°F)	0 to 40 (32 to 104)	
Storage Temperature, °C (°F)	-20 to 50 (-4 to 122)	
Operating /Storage Relative Humidity	0 – 90%, non-condensing	
Outlet type and numbers	IEC C13 x 4	NEMA/EU x 4
Model Number	**PSA850-UX and PSA850-BX**	
Capacity (VA/W)	850/480	
Net Weight, kg. (lb.)	4.9 (10.8)	
Dimensions – W x D x H, mm. (in.)	100 x 287 x 142 (3.9 x 11.3 x 5.6)	
On-Line Input Voltage	160-290VAC, single phase	
On-Line Frequency	50/60Hz (auto sensing)	
Online Frequency Range (50Hz/60Hz)	45 - 55Hz ±1Hz / 55 - 65Hz ±1Hz	
Output Voltage (Utility Power Normal)	220VAC/ 230VAC/ 240VAC, single phase	
Output Voltage (Battery Operation)	+ / -10%	
On-Battery Wave Form	Stepped sinewave	
Output Frequency Battery Mode	50Hz (60Hz) ±1Hz	
Battery Type – VDC x Ah x Quantity	12V x 9 Ah x 1	
Typical Recharge Time	4 hours to 90%	
Battery Runtime* – Half Load	5 minutes	
Operating Temperature, °C (°F)	0 to 40 (32 to 104)	
Storage Temperature, °C (°F)	-20 to 50 (-4 to 122)	
Operating /Storage Relative Humidity	0 – 90%, non-condensing	
Model Number	**PSA1000-BX/PSA1000-UX**	**PSA1000H-BX**
Capacity (VA/W)	1000/600	
Net Weight, kg. (lb.)	8.0 (17.63)	
Dimensions – W x D x H, mm. (in.)	146 x 350 x 160 (5.75 x 13.8 x 6.3)	
On-Line Input Voltage	160-290VAC, single phase	
On-Line Frequency	50/60Hz (auto sensing)	
Online Frequency Range (50Hz/60Hz)	45 - 55Hz ±1Hz / 55 - 65Hz ±1Hz	
Output Voltage (Utility Power Normal)	220VAC/ 230VAC/ 240VAC, single phase	
Output Voltage (Battery Operation)	+ / -10%	
On-Battery Wave Form	Stepped sinewave	
Output Frequency Battery Mode	50Hz (60Hz) ±1Hz	
Battery Type – VDC x Ah x Quantity	12V x 7 Ah x 2	
Typical Recharge Time	4-6 hours to 90%	
Battery Runtime* – Half Load	6 minutes	
Operating Temperature, °C (°F)	0 to 40 (32 to 104)	
Storage Temperature, °C (°F)	-20 to 50 (-4 to 122)	
Operating /Storage Relative Humidity	0 – 90%, non-condensing	
Outlet types and numbers	IEC C13 x 4	NEMA/EU x 6

Liebert® PSA

Performance Power Protection for PCs and Office Equipment

■ 500VA ■ 650VA ■ 1kVA ■ 1.5kVA

The Liebert® PSA is an economical, environmentally-friendly line-interactive UPS that offers full- featured power protection for small office computers and electronic equipment. Liebert Multilink software automatically powers down your computer in the event of an extended power outage. It also has full event management and display UPS instrumentation on screen.

Designed with simple controls for easy operation, the Liebert® PSA provides up to five minutes of back-up time at full load ... more than enough time to save work in process and shut down your system. Liebert® MultiLink USB shutdown software and a USB cable are also included, to allow remote alerts and automated graceful shutdown of the UPS and connected systems.

Features

Flexibility

- Available in four sizes: 500, 650, 1000 and 1500VA; 120VAC or 230VAC
- Three to six battery-backed UPS outlets, depending on model size
- One to two surge-only outlets, differentiated by color

Reliability

- Up to five minutes of battery backup time at full load
- Full sequenced battery testing to ensure batteries are available when needed
- Advance early warning of UPS shutdown
- Lightning and surge protection (TVSS)
- RJ-45 port for data line surge protection
- USB communications / shutdown software and cable included
- User-replaceable batteries

Total Cost of Ownership

- Two-year replace or repair warranty

Environment Friendly

- Full RoHS R6 compliance

The Liebert® PSA is Ideally Suited for:

- Professional Desktop PCs
- Professional Workstations
- Small Routers, Bridges and Hubs
- Point-of-sale Terminals
- Other Sensitive Electronics



Liebert® Multilink software provides you:

- Warnings to computer users of power loss, and graceful operating system shutdown when needed
- Full functionality and automatic shutdown protection right out of box - virtually no configuration is required

Technical Specifications

Model Number	PSA500MT3-230U	PSA650MT3-230U	PSA1000MT3-230U	PSA1500MT3-230U
Input Connection	IEC-320 C14			
Output Connection	IEC-320 C13			
Number of battery-backed outlet	3	3	6	6
Number of surge outlet	1	1	2	2
Communication Interface	USB			
Dimensions: H x W x D (mm)	171 x 95 x 356		234 x 147 x 360	
Net Weight (kg)	6	6.5	10.3	12
Shipping Weight (kg)	7	7.5	12.3	14
Form Factor	Mini tower			
Software	Liebert Multilink 4, support for Windows NT / 2000 / XP / Vista			
Operation				
Capacity (VA / W)	500 / 300	650 / 390	1000 / 600	1500 / 900
Nominal Input Power	230VAC, single phase with ground, 50 or 60Hz auto-select			
Input Voltage Window	160 to 287VAC			
Input Frequency Window	50 / 60Hz ± 5%			
Input Protection Type	Resettable circuit breaker			
Default frequency	50Hz			
Boost Mode Voltage	Input Voltage x 115%			
Buck Mode Voltage	Input Voltage / 115%			
Transfer Time (AC to DC)	4 to 6ms typical			
Surge Protection	220J			
Output (battery mode)				
Voltage	230VAC			
Voltage Regulation	≤ 5%			
Wave Form	Stepped Sinewave			
Battery type	Sealed, non-spillage, maintenance-free, lead acid with 5 year typical lifetime			
Backup Time at Full Load (minutes)	4	3	4	4
Typical Recharge Time	6 to 8hr to 90%			
Agency Approvals				
EMI Classification	IEC / EN / AS62040-2			
Safety	IEC / EN/ AS62040-1-1			
Transportation	ISTA procedure 1A certification			
WEEE and ROHS	Yes			
Operation Condition	3,000 meter max. elevation, 0-90% humidity non-condensing 0 to 40°C			
Noise Level	< 40dBA on line mode			

Runtime (in minutes)

Load (VA)	500VA	650VA	1000VA	1500VA
200	18	20	50	65
400	5	7	18	25
600	-	4	10	14
800	-	-	7	10
1000	-	-	4	7
1200	-	-	-	5
1400	-	-	-	4

Communications / Shutdown Software

Windows (98 and later) built-in power management functions provide monitoring of UPS status and manage the automatic orderly shutdown of the computer if a power outage ever exceeds the battery capacity of the UPS. Liebert® Multilink USB shutdown and monitoring software is downloadable.

Liebert® PSA™ UPS
500VA to 1500VA
Single-Phase Uninterruptible Power Supply Systems
Guide Specification

1.0 GENERAL

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power system. The uninterruptible power system, hereafter referred to as the UPS, will provide high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS is designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification will govern.

120V Units

UL 1778, c-UL listed (to CSA 22.2 No. 107.1)
FCC Part 15, Subpart B, Class B
ANSI C62.41, Category A, Level 3 (IEEE 587, Category A);
EN60950-1
EN60146 series
EN60529
EN61000-4-5, Level 3, Criteria A
EN61000-4-2, Level 3, Criteria A
EN61000-4-3, Level 3, Criteria A
EN61000-4-4, Level 4, Criteria A
EN61000-4-6, Level 3, Criteria A
EN61000-3-2
ISTA Procedure 1A

230V Units

EN50091-1-1, TUV/GS listed, CE compliance mark
EN50091-2, Class B
EN62040-1-1
EN60950-1
EN60146 series
EN60529
EN61000-4-2, Level 3, Criteria A
EN61000-4-3, Level 3, Criteria A
EN61000-4-6
EN61000-4-4, Level 4, Criteria A
EN61000-4-5, Level 3, Criteria A
EN61000-3-2
EN62040-2 2nd Edition
ISTA Procedure 1 A

1.3. SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS is designed to operate as a line-interactive system in the following modes:

A. Normal - The critical AC load is continuously supplied with filtered power. The battery charger maintains a float-charge on the battery.

B. Voltage Boost/Buck - During input power source abnormalities (sags and swells), the AC output power is corrected by means of boost (sag correction) or buck (swell correction) compensation taps. Operation of the compensation taps automatically maintains the proper output voltage for the connected critical equipment. The compensation taps are designed for indefinite operation to their limits. Operation of the compensation taps will not discharge the battery.

C. Recharge - Upon restoration of utility / mains AC power, after a utility / mains AC power outage and complete or partial battery discharge, the unit automatically restarts and resumes supplying power to the critical AC load. The battery can be charged from the utility whether the UPS is ON or OFF.

D. Battery - When the input power source exceeds the parameters defined in section 1.3.3.1, the critical AC load is supplied power by the inverter, which obtains its power from the battery. Typical detection and transfer time is 4-6 ms.

E. Battery Start- The UPS is capable of starting without input power. The unit starts up and operates from the battery, with output frequency set to factory defaults of 60Hz for 120VAC units and 50Hz for 230VAC units.

1.3.2 Design Requirements

A. Voltage: Input/output voltage specifications of the UPS are:

Input:
120V Units: 0-150 VAC, 60/50 Hz auto-sensing, single-phase, 2-wire-plus-ground.
230V Units: 0-300 VAC, 50/60 Hz auto-sensing, single-phase, 2-wire-plus-earth.

Output:
120V Units: 120 ± 10VAC, 60/50 Hz, single-phase, 2-wire-plus-ground.

230V Units: 230 VAC ± 10VAC, 50/60 Hz, single-phase, 2-wire-plus-earth.

B. Output Load Capacity: Maximum specified output load capacity of the UPS, regardless of load power factor, is:

500VA / 300W 650VA / 390W

1000VA / 600W 1500VA / 900W

C. Internal Battery: The battery consists of valve regulated, non-spillable, maintenance-free, sealed, lead-acid cells. The battery is user replaceable and "Easy swappable", requiring the UPS to be powered off.

D. Battery Reserve Time: 5 + minutes typical runtime at full load and a ambient temperature of 77°F (25°C).

E. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. Recharge time is 6-8 hours typical to 90% capacity after a complete discharge into full resistive load.

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

A. Voltage Configuration: The UPS operates at these values without drawing power from the batteries.

120 VAC nominal: single phase, 2-wire-plus-ground: 84 — 140 VAC (±10VAC),
Buck compensation: 130VAC (±10VAC)
Boost1 compensation: 97VAC (±10VAC)

230 VAC nominal: single phase, 2-wire-plus-earth: 160 — 287 VAC (±10VAC)
Buck compensation: 250 VAC (±10VAC)
Boost1 compensation: 210 VAC (±10VAC)

B. Frequency: The UPS automatically senses the input frequency and operates within the following frequency specifications without drawing power from the batteries.

50 Hz Applications: 45 — 54 Hz (±0.1 Hz)
60 Hz Applications: 55 — 64 Hz (±0.1 Hz)

C. Surge Protection: The 120 VAC units can withstand input surges of up to 570J without damage per criteria listed in IEEE C62.41, Category A, Level 3. The 230 VAC units can withstand input surges of up to 220J without damage per criteria listed in EN61000-4-5, Level 3, Criteria A.

D. Input Connections: The 120 VAC units have an attached input cord 6.0 feet (1.8 meters) in length, measured between the outside edges of the connectors. The attached input cord has a NEMA 5-15 plug. The 230VAC unit requires a user supplied IEC-320-C14 input cord.

1.3.3.2 AC Output

A. Voltage Configuration:

120 VAC units: 120 VAC, 60/50 Hz, single-phase, 2-wire-plus-ground.

120VAC ± 5 % (Battery mode)

230 VAC units: 230 VAC, 50/60 Hz, single phase, 2-wire-plus-earth.

230 VAC ±5% (Battery mode)

B. Voltage Regulation: ±10% steady state.

C. Frequency Regulation: ±1Hz synchronized to utility / mains.

±0.5Hz free running or on battery operation.

D. Load Power Factor Range: 0.6 lagging to 1.0 (unity).

E. Inverter Overload Capability: 120/230VAC (Normal Mode) Units are capable of > 105% continuous overload (visual and audible alarms present) until AC breaker trips. With 110% load applied to 120/230VAC unit the UPS will shutdown immediately, and then the alarm will come on for 5 sec.

G. Transient Recovery Time: To within ±8% of nominal voltage in < 2 cycles.

H. Efficiency: >88% (Normal mode)

>85% (Buck/Boost mode)

>70% (Battery mode)

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 32°F — 104°F (0°C — 40°C) for altitudes 10,000 ft (3000 meters) above sea level.

77° F (25°C) for optimum battery performance

Storage: 5°F — 104°F (-15°C — 40°C) with batteries

68°F (20°C) for optimum battery storage

B. Relative Humidity

0 — 90% non-condensing

C. Altitude:

10,000 m (3,000 m max.), without power derating when operated within the temperature specified in section 1.4.A. Ambient temperature will be derated 5°C for each additional 500 m (1640 ft.)

D. Audible Noise

Noise generated by the UPS during normal operation < 40dB, and < 45dB in battery mode when measured at 1 meter from the surface of the UPS.

E. Electrostatic Discharge

The 120/230 VAC units are able to withstand an electrostatic discharge compliant to EN61000-4-2, level 3, Criteria A, without damage and without affecting the connected load.

1.5 USER ACCESSORIES AND PACKAGING

The specified UPS system is supplied with (1) Quick-Start guide. The manual includes installation drawings and instructions, a functional description of the equipment, safety precautions, illustrations, operating procedures, and general maintenance guidelines. The UPS is also supplied with (1) Liebert Shutdown software CD, and (1) USB cable (6-ft; 1.8m).The package meets the requirements of ISTA Procedure 1A.

1.6 WARRANTY

The manufacturer warrants the UPS against defects in materials and workmanship for two (2) years. The warranty covers all parts. An optional one (1) or three (3) year extended warranty is available from the manufacturer.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

Emerson Network Power provides more than twenty years experience in the design, manufacture, and testing of solid-state UPS systems and the company is certified to ISO 9001.

1.7.2 Factory Testing

Before shipment, the product is tested to assure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS are new, of current manufacture, and have not been in prior service except as required during factory testing. All relays are provided with dust covers.

2.1.2 Wiring

Wiring practices, materials, and coding are in accordance with the requirements of the standards listed in section 1.2. All wiring is copper.

2.1.3 Cabinet

The UPS unit comprised of: TVSS & EMI/RFI Filters, Bi-Directional Converter, Automatic Voltage Regulator and Battery consisting of the appropriate number of sealed battery cells; is housed in a mini-tower NEMA type 1 enclosure. The UPS cabinet is injection-molded standard color. Dimensions and weights are:

UNIT	120/230VAC DIMENSIONS W x D x H in (mm)	120 VAC WEIGHT lbs (kg)	230 VAC WEIGHT lbs (kg)
500VA	3.7 x 14 x 6.7 (95 x 356 x 171)	14.1 (6.4)	13.2 (6)
650VA	3.7 x 14 x 6.7 (95 x 356 x 171)	14.6 (6.6)	14.3 (6.5)
1000VA	5.8 x 14.2 x 9.2 (147 x 360 x 234)	23.8 (10.8)	22.7 (10.3)
1500VA	5.8 x 14.2 x 9.2 (147 x 360 x 234)	27.8 (12.6)	26.5 (12)

2.1.4 Cooling

The UPS is convection cooled.

2.2 COMPONENTS AND OPERATION

2.2.1 Input Protection

The UPS has built-in protection against under voltage, over current, and over voltage conditions including low-energy lightning surges introduced on the primary input power source. The UPS is provided with an input circuit protector.

2.2.2 Bi-Directional Converter

2.2.2.1 General

The Bi-Directional Converter incorporates solid-state devices and control circuitry to convert AC power to regulated DC power for battery charging; and convert DC power from the battery to regulated and conditioned stepped-sine wave AC power for supporting the critical load. The Bi-Directional Converter is a pulse width modulated (PWM) design. The Bi-Directional Converter operates in the following modes:

1. In Normal mode of operation, the Bi-Directional Converter maintains the battery system at a float charge.
2. In Battery mode of operation, the Bi-Directional Converter converts DC power from the battery to regulated and conditioned stepped-sine wave AC power for supporting the critical load.
3. In the recharge mode of operation, the Bi-Directional Converter converts AC power to regulated DC power to recharge the battery.

2.2.2.2 Battery Recharge

The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant voltage charged to recharge and maintain the battery in a fully charged state. Recharge time is 6-8 hours maximum to 90% rated capacity after discharge into full resistive load.

2.2.2.3 Bi-Directional Converter DC Protection

The following DC shutdown levels protect the UPS:

DC Over voltage Shutdown
DC Under voltage Shutdown (End of Discharge)
DC Under voltage Warning (Low Battery Reserve)

2.2.2.4 Output Protection

For output faults including short circuits and overloads, the UPS is protected by the input circuit protector during Normal mode and by electronic current limiting during Battery mode.

2.2.2.5 Overload

The UPS is capable of supplying power for overloads exceeding 100% and up to 105% of full load rating, until breaker trips. A visual indicator and audible alarm indicate overload operation. For greater current demands, the UPS employs circuit protector and electronic current-limiting protection to prevent damage to components. The UPS is self-protecting against any magnitude of connected output overload. The UPS control logic senses and disconnects the UPS from the critical AC load and clears the protective circuit breaker during Normal mode.

2.2.2.6 Output Frequency

An oscillator controls the output frequency of the UPS. The oscillator maintains the output frequency to $\pm$ 1 Hz of nominal when not synchronized to the utility/mains source.

2.2.2.7 Battery Over-Discharge Protection

To prevent battery damage due to excessive discharge levels, the UPS control logic automatically monitors the battery voltage and load level and switches off the output at the predetermined battery shutdown voltage set point.

2.2.3 Display and Controls

2.2.3.1 General

The UPS is provided with a microprocessor-based unit status and control display designed for convenient and reliable user operation. The status and alarm indicators are displayed on a status indicator display

2.2.3.2 System Indicators

There are three (3) status indicators on the front of the UPS (Utility, Battery and Fault) and one (1) on the rear (Site Wiring Fault):

The Utility Indicator illuminates when the UPS is operating and supplying power to connected loads: green indicates Normal, Buck, or Boost mode.

The (amber) overload light will illuminate and constant audible alarm will sound when there is an overload condition. This will continue until the load drops or the breaker trips.

The (amber) Battery Indicator flashes and the audible alarm sounds every 3 seconds to indicate the UPS is operating on battery. The (amber) Battery Indicator flashes and the audible alarm sounds every second to indicate low battery.

The (red) Fault Indicator illuminates when the UPS detects a problem. Solid (steady glow) until UPS shuts down after 5 seconds. When a battery replacement is required there will be a red flash every second for 5 seconds.

The Site Wiring Fault Indicator on the rear panel illuminates red, with the 120VAC units only, when the UPS detects a line-neutral reversal or a poor neutral-ground bond.

2.2.3.3 On/Off Controls

UPS start-up and shutdown operations are accomplished by the "On/Off" push button located on the front panel of the UPS. Depressing the button for more than 0.5 sec will start-up the UPS and to turn the UPS off the button will need to be depressed for > 2 sec.

2.2.3.4 On-Line Battery Test

The UPS is provided with an automatic or remote battery test feature. This test ensures the capability of the battery to supply power to the inverter while loaded. If the battery

fails the test, the fault indicator will illuminate (red) and alarm will sound every second for 5 seconds. The battery test feature is user accessible via Liebert Shutdown software.

2.2.3.5 Alarm Silence

The alarm silence function can only be controlled by the Liebert Shutdown software. Alarm Silence only works when unit in battery mode except when operating in overload/low battery/fault condition.

2.2.4 Internal Battery

Valve regulated, non-spillable, lead-acid cells are used as a stored-energy source for the specified UPS system. The battery is housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 77 ° F (25 ° C) for a minimum of 3 minutes reserve time. The expected life of the battery is 3 - 5 years or 250 complete discharge cycles.

2.2.5 Output Distribution

Output distribution is integral to the UPS and is located on the rear of the unit.

UNIT	120 VAC UNITS	230 VAC UNITS
500VA & 650VA	(3) NEMA 5-15R (Black) Battery backup + surge protection; (1) NEMA 5-15R (White)surge protection only	(3) IEC-320-C13 (Black) Battery backup + surge protection; (1) IEC-320-C13 (White) Surge protection only
1000VA & 1500VA	(6) NEMA 5-15R (Black) Battery backup + surge protection; (2) NEMA 5-15R (White) surge protection only	(6) IEC-320-C13 (Black) Battery backup + surge protection; (2) IEC-320-C13 (White) Surge protection only

2.2.5.1 Output Power Cords: The package of the 230 VAC units also includes two (2) IEC 320-C13 output power cords (6.6 ft; 2m).

2.2.6 Communications – USB Interface Port

The UPS shall have (1) USB Interface Port. The USB connector shall be a 4P Male connector. The USB interface port shall always be active. The UPS shall be capable of communicating system status and system shutdown via the USB. Hardware shall support and allow operating system communication for Windows 98 and newer. USB port shall be capable of communicating via Liebert Shutdown software, which is provided.

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Liebert® PSP

Best-Value Power Protection for Desktop PCs and Peripherals

■ **500VA - 600VA**

Liebert® PSP is a UPS that delivers cost-effective power protection in a compact package. It provides battery-backed outlets and a surge protection-only outlet. The Liebert® PSP battery offers four minutes of backup power at full load - ample time to shut down protected equipment if an outage occurs. Shutdown software and a USB cable are also included, to allow remote alerts and automated graceful shutdown of the connected equipment.

Higher Availability

- Up to four minutes of battery backup time at full load
- Protects against lightning, spikes and surges
- Full sequenced battery testing to ensure batteries are available when needed
- Advance early warning of UPS shutdown
- RJ-45 port for data line surge protection

Lowest Total Cost of Ownership

- Two-Year replacement warranty
- Optional one year warranty extension
- Bundled Liebert Multilink Software provides remote alerts and automatic shutdown

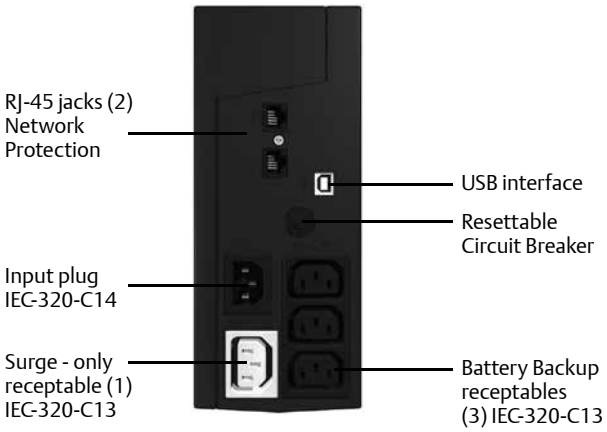
Flexibility

- Three color-coded, battery-backed UPS outlets, and one surge protection-only outlet
- USB port, MultiLink Software shutdown software and USB cable
- User replaceable batteries

The Liebert® PSI is ideally suited for:

- Desktop Computers
- Point of Sale Terminals
- Small Routers and Bridges
- Other desktop PC peripherals





Back view

Technical Specifications

Model Number	PSP500MT3-230U	PSP650MT3-230U
Capacity (VA/W)	500/300	650/390
Net Weight: kg.	3.9	
Shipping Weight: kg	4.8	
Dimensions: W x D x H, mm	87 x 215 x251	
On-Line Mains Voltage	160 – 287VAC	
On-Line Frequency	50/60Hz ±5Hz	
Output Voltage (Mains Normal)	Typical 160-287VAC	
Output Voltage (Battery Operation)	230VAC±5%	
On-Battery Wave Form	Stepped sinewave	
Battery Type – VDC x Ah x Quantity	12V x 7.2 Ah x 1	
Typical Recharge Time	6-8 hours to 90%	
Audible and Visual	Audible alarm / LED	
Backup Sockets	IEC 320 C13 (3)	
Surge Sockets	IEC 320 C13 (1)	
Operating Temperature, °C	0 to 40	
StrongTemperature, °C	-15 to 40	
Operating /Storage Relative Humidity	0%-90%, non-condensing	
EMI Classification	Class B	
Agency		
Safety	IEC/EN/AS 62040-1-1	
EMC	EN 62040-2:2005 Class B IEC 61000-4-2 Electrostatic discharge IEC 61000-4-3 Radiated E-RFI fields IEC 61000-4-4 Fast E transients IEC 61000-4-5 Surges/Lightning IEC 61000-4-6 Conducted RFI	
Transportation	ISTA Procedure 1A Certification	
Warranty	2 years standard (+1 year warranty extension available)	
Packaging	User Manual on CD, Software CD, USB cable, Safety Instruction Sheet, Environment protection sheet	
Model Number	PSA1000-BX/PSA1000-UX	PSA1000H-BX

Load Autonomy

Load (watts)	PSP500MT3-230U	PSP650MT3-230U
50	55	56
100	18	18
150	11	12
200	8	8
250	5	5
300	3	4
350	-	3

Liebert® PSI

High Performance Power Protection for Servers and Networking Equipment

■750VA ■1kVA ■1.5kVA ■2.2kVA ■3kVA

Liebert PSI is a feature-rich UPS system with industry leading 0.9 power factor. Its high power output delivers superior performance on power factor corrected (PFC) power supply and satisfactory backup time in the high demand environment. Liebert Multilink UPS software protects servers through local USB communication or via network. Matching external battery cabinets offer UPS backup time to several hours in the extended requirements (for Liebert PSI-XR models only).



Lowest Total Cost of Ownership

- Operates at a high 0.9 power factor that makes it ideal for today's modern IT equipment, providing 29% more power than typical UPS
- Reduced installation time and costs - shipped with batteries connected and charged
- Two-year warranty - no-hassle replacement
- Supports Liebert Multilink shutdown software

Higher Availability

- Greater than three to five minutes of internal battery backup time at 100% load provides ample time for an orderly shutdown of equipment.
- Buck/boost automatic voltage regulation technology protects against utility voltage fl uctuation by raising and lowering utility power to the level needed by connected equipment



Flexibility

- Eight to nine battery-backed outlets for Liebert PSI models, six to seven battery-backed outlets for Liebert PSI-XR models
- User replaceable and hot-swappable batteries
- Rack/Tower Convertible with rotatable display panel, 2U in height on all models
- Multiple remote communications and shutdown options provide remote monitoring and power management - EB/ SNMP, USB, contact closure and remote power off



Rotatable Display Panel 90 degrees rotatable LED display panel rotates 90° to make the readout of the LED display easy to see in rack or tower position.

Automatic Frequency Sensing The UPS automatically adjusts to the input frequency, 50Hz or 60Hz.

Optional Liebert MicroPOD Output Distribution And Maintenance Bypass Module

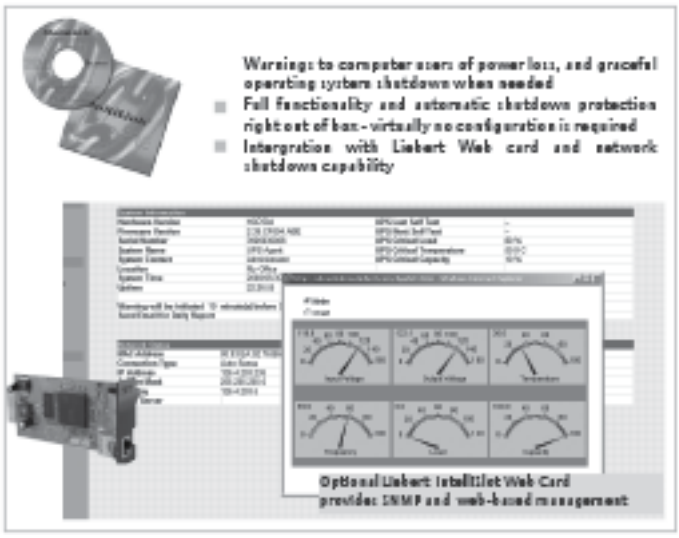
When your computer system can't be without power, even for scheduled UPS maintenance, the Liebert MicroPOD Maintenance Bypass and Output Distribution Unit ensures continuous uptime. It allows you to manually transfer connected equipment to utility power via a maintenance bypass switch, permitting scheduled service or UPS replacement without the need to shut down connected equipment. Features include:

- 2U height minimizes rack space requirements
- Installs with plug-and-play ease
- Two-year, no-hassle replacement warranty

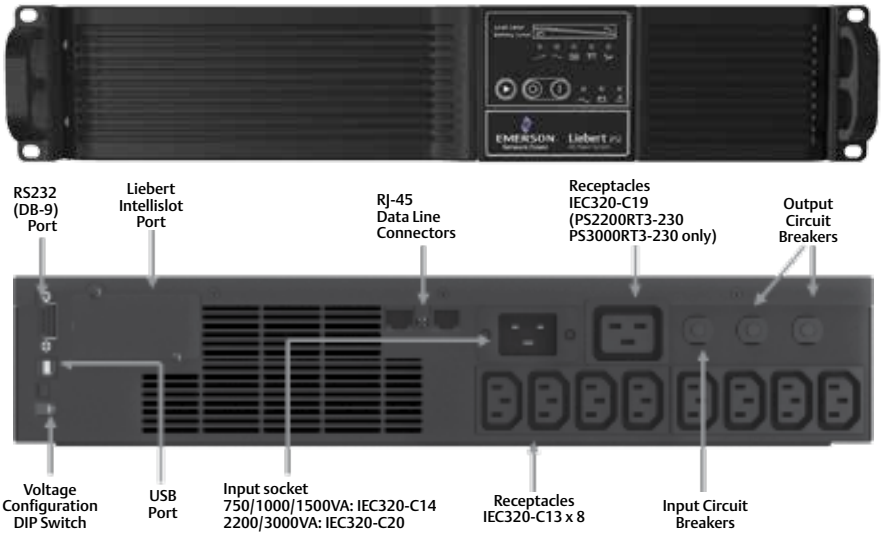
Reliable UPS Protection And Extended Battery Time To Keep Your Network Up And Running

The flexible design of Liebert PSI allows the unit to be configured as a self-standing tower or to be rack-mounted within a 2U space. It is available in four capacities, in both 120V or 230V models.

The UPS features an innovative design incorporating buck/boost automatic voltage regulation technology. This protects against utility voltage fluctuation by raising and lowering utility power to the level needed by the connected equipment. It also allows the UPS to prolong battery life by maximizing its time on utility power before going to battery.



Liebert PSI Rear View Parts



Liebert® PSI

Gude Specification

750VA to 3000 VA

Single-Phase Uninterruptible Power Supply Systems

1.0GENERAL

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power system. The uninterruptible power system hereafter referred to as the UPS, provides high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS is designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification will govern.

120V Units:

UL 1778, c-UL listed (to CSA 22.2 No. 107.1)
UL 497 B
FCC Part 15, Class A
ANSI C62.41, Category A, Level 3 (IEEE 587, Category A)
IEC62040-2
IEC60950-1
IEC60146
IEC60529
EN61000-4-2, Level 3, Criteria B
EN61000-4-3, Level 3, Criteria A
EN61000-4-4, Level 4, Criteria A
EN61000-4-5, Level 3, Criteria B
EN61000-4-6
EN61000-3-2
ISTA Procedure 1A

230V Units:

EN62040-1-1, TUV/GS listed, CE compliance mark
EN60950-1
EN60146
EN60529
EN62040-2
EN50091-2, Class B
EN61000-4-2, Level 3, Criteria B
EN61000-4-3, Level 3, Criteria A
EN61000-4-4, Level 4, Criteria A
EN61000-4-5, Level 3, Criteria B
EN61000-4-6
EN61000-3-2
ISTA Procedure 1A
ROHS Complaint
WEEE Complaint

1.3. SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS is designed to operate as a line-interactive system in the following modes:

A. Normal - The critical AC load is continuously supplied with filtered power. The battery charger maintains a float-charge on the battery.

B. Voltage Boost/Buck - During input power source abnormalities (sags and swells), the AC output power is corrected by means of boost (sag correction) or buck (swell correction) compensation taps. Operation of the compensation taps automatically maintains the proper output voltage for the connected critical equipment. The compensation taps are designed for indefinite operation to their limits. Operation of the compensation taps will not discharge the battery.

C. Recharge - Upon restoration of utility/mains AC power, after a utility/mains AC power outage and complete or partial battery discharge, the unit automatically restarts and resumes supplying power to the critical AC load; and the battery charger recharges the battery. The battery is charged from the utility whether the UPS is ON or OFF.

D. Battery - When the input power source exceeds the parameters defined in section 1.3.3.1, the critical AC load is supplied power by the inverter, which obtains its power from the battery. Typical detection and transfer time is 4-6 ms.

E. Battery Dark Start- The UPS is capable of starting without input power. The unit starts up and operates from the battery, with output frequency the same as the last operating frequency.

1.3.2 Design Requirements

A. Voltage - Input/output voltage specifications of the UPS are:

Input:
120V Units: 0-170 VAC, 60/50 Hz auto-sensing, single-phase, 2-wire-plus-ground.
230V Units: 0-340 VAC, 50/60 Hz auto-sensing, single-phase, 2-wire-plus-earth.

Output:
120V Units: 110/120/127 VAC ±10%, 60/50 Hz, single-phase, 2-wire-plus-ground. (DIP Switch selectable)

230V Units: 220/230/240 VAC ±10%, 50/60 Hz, single-phase, 2-wire-plus-earth. (DIP Switch selectable)

B. Output Load Capacity: Maximum specified output load capacity of the UPS, regardless of load power factor, is:

750VA / 675W	1000VA / 900W	1500VA / 1350W
2200VA / 1920W	3000VA / 2700W	

C. Internal Battery: The battery consists of valve regulated, non-spillable, maintenance-free, sealed, lead-acid cells. The battery is user replaceable and hot swappable.

D. Battery Reserve Time: 3 minutes minimum at full load with ambient temperature 77°F (25°C).

E. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. Recharge time is 5 hours typical to 90% capacity after a complete discharge into a full resistive load.

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

A. Voltage Configuration: The UPS operates at these values without drawing power from the batteries

120 Volt Units:

110 VAC setting: single phase, 2-wire-plus-ground: 83-138 VAC (±5VAC)
Buck compensation: 120VAC (±5VAC)
Boost compensation: 100VAC (±5VAC)

120 VAC setting: single phase, 2-wire-plus-ground: 90-150 VAC (±5VAC)
Buck compensation: 131VAC (±5VAC)
Boost compensation: 109VAC (±5VAC)

127 VAC setting: single phase, 2-wire-plus-ground: 96-159 VAC (±5VAC)
Buck compensation: 139VAC (±5VAC)
Boost compensation: 115VAC (±5VAC)

230 Volt Units:

220 VAC setting: single phase, 2-wire-plus-earth: 165-275 VAC (±10VAC)
Buck compensation: 240 VAC (±10VAC)
Boost compensation: 200 VAC (±10VAC)

230 VAC setting: single phase, 2-wire-plus-earth: 173-288 VAC (±10VAC)
Buck compensation: 251 VAC (±10VAC)
Boost compensation: 209 VAC (±10VAC)

240 VAC setting: single phase, 2-wire-plus-earth: 180-300 VAC (±10VAC)
Buck Compensation: 262 VAC (±10VAC)
Boost compensation: 218 VAC (±10VAC)

B. Frequency: The UPS automatically senses the input frequency and operates within 45-65 Hz (±0.5 Hz) without drawing power from the batteries.

1.1.1.2 AC Output

A. Voltage Configuration: The UPS has a DIP Switch to allow the operator to select the nominal utility voltage. This setting will change the transfer point (Low and High) of the UPS. The factory default settings on 120 VAC for the 120VAC models and 230 VAC for 230 VAC models. The Configuration switch is a 2 pin DIP-Switch type, and is located on the rear of UPS with a diagram of the setting.

B. Voltage Regulation: -6% to +9% on nominal mode. ±5% on battery backup

C. Frequency Regulation: ±0.5Hz synchronized to utility/mains

±0.5Hz free running or on battery operation.

D. Load Power Factor Range: 0.9 lagging to 1.0 (unity)

E. Voltage Distortion: < 12 % total harmonic distortion (THD) typical into a 100 % linear load, and < 16 % THD typical into a 100% non-linear load. < 16 % after low battery THD typical into a 100% linear load. < 20 % after low battery THD typical into a 100 % non-linear load.

F. Inverter Overload Capability: Overload Warning (visual and audible alarms) occurs between 100%-109% of rated capacity, continuous duty. Shutdown occurs at the following load levels:

> 110–120 %: shutdown after 10 minutes minimum (Normal Mode)

> 120 %: shutdown after 1 cycle minimum (Normal Mode)

> 100–120 %: after end of discharge (Battery mode)

> 120–130 %: after 10 seconds (Battery mode)

> 130 %: after 1 cycle (Battery mode)

G. Voltage Transient Response: ±15% in Battery mode for 0-100-0% loading of the UPS rating, ±5% in Battery mode for 20-100-20% loading of the UPS rating.

H. Transient Recovery Time: To within ±8% of nominal voltage in < 2 cycles.

I. Efficiency with resistive load:

>95% (Normal mode)

>90% (Buck/Boost mode)

>70% (Battery mode)

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 32°F-104°F (0°C-40°C) for altitude 10,000 ft max (3000 meters) above sea level.
77° F (25°C) for optimum battery performance

Storage: 5°F to 104 °F (-15°C to 40°C) with batteries
68°F (20°C) for optimum battery storage

B. Relative Humidity

0-90% non-condensing for storage and operation

C. Altitude:

10,000 ft.(3,000 m max.), without power derating when operated within the temperature specified in section 1.4.A. Ambient temperature is derated 41° F (5°C) for each additional 1640 ft (500m).

D. Audible Noise

Noise generated by the UPS during normal operation does not exceed the following values when measured at 1 meter from the surface of the UPS. In normal mode unit measures 40dB max, and in battery-mode unit measures 45dB max.

E. Electrostatic Discharge

The 120/230 VAC units are able to withstand an electrostatic discharge compliant to EN61000-4-2, level 3, Criteria B without damage and without affecting the connected load.

1.5 USER ACCESSORIES AND PACKAGING

The specified UPS system is supplied with one (1) Multi-language, User manual on CD. The manual includes installation drawings and instructions, a functional description of the equipment, safety precautions, illustrations, operating procedures, and general maintenance guidelines. The UPS is also supplied with one (1) Liebert MultiLink software CD, one (1) MultiLink software contact closer (6-ft; 1.82m), one (1) USB cable (6-ft; 1.82m), one (1) set of Tower Stands, one (1) pair of Rack mount handles, Mounting Hardware, and one (1) pair of Fixed rails.

1.6 WARRANTY

The manufacturer warrants the UPS against defects in materials and workmanship for two (2) years. The warranty covers all parts. An optional one (1) or three (3) year extended warranty is available.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

Emerson Network Power provides more than thirty years experience in the design, manufacturing, and testing of solid-state UPS systems and the company is certified to ISO 9001:2000.

1.7.2 Factory Testing

Before shipment, the product is tested to assure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS are new, of current manufacture, and have not been in prior service except as required during factory testing. All relays are provided with dust covers.

2.1.2 Wiring

Wiring practices, materials, and coding are in accordance with the requirements of the standards listed in section 1.2. All wiring is copper.

2.1.3 Cabinet

The UPS unit comprised of: TVSS & EMI/RFI Filters, Relay, Automatic Voltage Regulator, Battery Charger, Battery consisting of the appropriate number of sealed battery cells, Inverter (750, 1000, & 1500VA models only), DC-to-DC Converter (2200, & 3000VA models only) and
Bi-Directional Converter; is housed in a rack-tower NEMA type 1 enclosure. Dimensions and weights are:

UNIT	UNIT DIMENSIONS W x D x H in (mm)	120VAC UNITS WEIGHT lbs (kg)	230VAC UNITS WEIGHT lbs (kg)
750VA	17.3 x 16.2 x 3.5 (440 x 412 x 88)	N/A	33.1 (15)
1000VA		43.4 (19.7)	42.8 (19.4)
1500VA		46.5 (21.1)	46.1 (20.9)
2220VA	17.3 x 26 x 3.5 (440 x 657 x 88)	76.3 (34.6)	74.5 (33.8)
3000VA		84.2 (38.2)	82 (37.2)

2.1.4 Cooling

Air intake is through the front of the unit and exhausted out the rear of the unit. The following conditions will cause the fan to turn ON:

UPS is in Buck/Boost mode (> 50 % load)

Recharging (if battery voltage < 2.2VDC / cell)

Battery/Back up mode

2.2 COMPONENTS AND OPERATION

2.2.1 Surge Protection:

The 120 VAC units can withstand input surges of up to 570J without damage per criteria listed in IEEE C62.41, Category A, Level 3. The 230 VAC units can withstand input surges of up to 220J without damage per criteria listed in EN61000-4-5, Level 3, Criteria B.(1). Additionally, the UPS is supplied with one pair of Data Line Protection Connectors to provide phone, fax or modem line surge protection via RJ-45 connectors. These Data Line Ports provide transmission for 10/100 Base-T Ethernet connection.

2.2.2 Input Protection

The UPS has built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy lightning surges introduced on the primary input power source. The UPS is provided with a resettable input circuit breaker.

2.2.3 Input Connections

The 120 VAC units have an attached input cord 6 feet (1.8 meters) in length, measured between the outside edges of the connectors. The 230VAC 2200VA and 3000VA units ship with (1) "Shucko" CEE 7/7 to IEC-320-C19 input cord, and (1) UK plug to IEC-320-C19. The 230VAC 750/1000/1500VA units ship with (2) IEC-320-C13 cables.

Unit	120 VAC UNITS	230 VAC UNITS
750VA, 1000VA, & 1500VA	NEMA 5-15P	IEC-320-C14
2200VA	NEMA 5-20P	IEC-320-C20
3000VA	NEMA L5-30P	IEC-320-C20

2.2.4 Bi-Directional Converter

2.2.4.1 General

The Bi-Directional Converter incorporates solid-state devices and control circuitry to convert AC power to regulated DC power to "float charge" the battery during normal mode; and convert DC power from the battery to regulated and conditioned sinewave AC power for supporting the critical load during battery mode. The Bi-Directional Converter is a pulse width modulated (PWM) design. The Bi-Directional Converter operates in the following modes:

In Normal mode of operation, the Bi-Directional Converter maintains the battery system at a float charge.

In Battery mode of operation, the Bi-Directional Converter converts DC power from the battery, through the DC-to-DC Converter, to regulated and conditioned sinewave AC power for supporting the critical load.

In the recharge mode of operation, the Bi-Directional Converter converts AC power to regulated DC power to recharge the battery.

2.2.4.2 Battery Recharge

The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant voltage charged to recharge and maintain the battery in a fully charged state. Recharge time is 5 hours maximum to 90% rated capacity after discharge into full resistive load.

2.2.4.3 Bi-Directional Converter DC Protection

The following DC shutdown levels protect the UPS:

DC Overvoltage Shutdown
DC Undervoltage Shutdown (End of Discharge)
DC Undervoltage Warning (Low Battery Reserve)

2.2.4.4 Output Protection

For output faults including short circuits and overloads, the UPS is protected by the input circuit protector during Normal mode and by electronic current limiting during Battery mode. The UPS control logic senses and disconnects the UPS from the critical AC load and clears the protective circuit breaker during Normal mode.

2.2.4.5 Overload

The UPS is capable of supplying power for overloads exceeding 100% and up to 109% of full load rating, continuously. A visual indicator and audible alarm indicate overload operation. For greater current demands, the UPS employs circuit protector and electronic current-limiting protection to prevent damage to components. The UPS is self-protecting against any magnitude of connected output overload.

1.1.1.6 Output Frequency

An oscillator controls the output frequency of the UPS. The oscillator maintains the output frequency to ± 0.5 Hz of nominal when not synchronized to the utility/mains source.

2.2.4.7 Battery Over-Discharge Protection

To prevent battery damage due to excessive discharge levels, the UPS control logic automatically monitors the battery voltage and load level and switches off the output at the predetermined battery shutdown voltage set point.

2.2.5 Display and Controls

2.2.5.1 General

The UPS is provided with a microprocessor-based unit status and control display designed for convenient and reliable user operation. The status and alarm indicators are displayed on a status indicator display.

2.2.5.2 System Indicators

A row of Load Level indicators that display the approximate electrical load placed upon the UPS. A row of Battery Level indicators display the approximate battery capacity. There are six (6) status indicators on the front of the UPS as described below:

1. The “Normal Mode” indicator illuminates green when utility power is available and within the input specifications.
2. The “Battery mode” indicator illuminates green when the UPS is operating on battery, and an audible alarm sounds every 2 seconds. When a low battery condition is present the audible alarm will sound every second.
3. In the case of a “Weak Battery”, the LED display will indicate the relative load level on the output of the UPS and the battery condition LED will flash to warn users. Pressing status change button will display the battery capacity.
4. When UPS operates in “AVR Buck/Boost mode”, the LED display will indicate the relative load level on the output of the UPS and the boost or buck LED will flash to indicate UPS is operating in buck/boost mode. Pressing status change button will display the battery capacity.
5. In case of “Site-Wiring” fault, the LED display will indicate the relative load level on the output of the UPS and the Grounding/Site Wiring Fault flashes to warn users. Pressing status change button will display the battery capacity. (Not applicable for 230VAC units)
6. When UPS operates in overload status, the LED display will indicate the relative load level on the output of the UPS and flash the Overload indictor to warn users. There will also be a continuous audible alarm present. Pressing status change button will display the battery capacity.

2.2.5.3 ON/Alarm Silence/ Manual Self Diagnostic Test

This button controls output power to connected load(s) and has three functions:

ON - When the UPS is off, pressing the ON/Alarm Silence/Battery Test button for more than 3 seconds will start the UPS, and an audible alarm sounds briefly will continue until user releases ON button. The UPS is capable of starting on battery (dark start).

Alarm Silence – Audible alarms via an internal Beeper will be used in conjunction with the visual indicators to indicate to the operator a change in UPS operation status. Only Backup mode Alarm can be silenced via the front panel Alarm Silence

Button and Communication ports (Db9/USB). Once the audible alarm is silenced, the audible alarm will not sound, unless a new alarm condition is present. The audible alarm level will be a minimum of 60dBA at a distance of one-meter (3ft).

Note: ON BATTERY and OVERLOAD fault audible alarms CANNOT be silenced.

Manual Self Diagnostic Test - To initiate a manual battery test, press the ON/Alarm Silence/ Manual Self Diagnostic Test for 3 seconds or more while operating from utility power with no alarm conditions present. The UPS is also provided with an automatic and remote self diagnostic test feature. The tests ensure the capability of the battery, and also detect any internal UPS failures. If the battery/UPS fails the test, the UPS will display a warning to indicate the batteries need replaced. The battery test feature is user accessible via Liebert Multilink software.

Status Change Button–Switches the status displayed between battery level or load level. When UPS operates in normal mode, the LED display will indicate load capacity first, and change to indicate battery capacity for 5 seconds when the status change button is depressed. When UPS operates in battery mode, the LED display will indicate battery capacity first, and change to indicate load capacity for 5 seconds when the status change button is depressed.

2.2.5.4 OFF Button

When the UPS is on (in either Normal or Battery mode), pressing the OFF button for more than one (1) second will shut down the UPS. An audible alarm sounds briefly.

2.2.6 Internal Battery

Valve regulated, non-spillable, lead-acid cells are used as a stored-energy source for the specified UPS system. The battery is housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 77 ° F (25 ° C) for a minimum of 3 minutes reserve time. The expected life of the battery is 3 - 5 years or 250 complete discharge cycles.

2.2.7 Output Distribution

Output distribution is integral to the UPS and is located on the rear of the unit.

UNIT	120 VAC UNITS	230 VAC UNITS
750VA, 1000VA, & 1500 VA	(8) NEMA 5-15R	(8) IEC-320-C13
2220VA	(6) NEMA 5-15R (2) NEMA 5-20R T-Slot, accepts 15A plug	(8) IEC-320-C13 (1) IEC-320-C19
3000VA	(6) NEMA 5-15R (2) NEMA 5-20R T-Slot, accepts 15A plug (1) NEMA L5-30R	(8) IEC-320-C13 (1) IEC-320-C19

2.2.7.1 Output Power Cords: The 230 VAC 750/1000/1500VA units have two (2) detachable IEC-320-C14 output power cords measuring 2m (6.6 ft) in length. The 230 VAC 2200/3000VA units have two (3) detachable IEC-320-C14 output power cords measuring 2m (6.6 ft) in length.

2.2.8 Communications

The UPS contains a DB9 port on the rear panel to allow UPS status communications to a computer system. Additionally, it links to a computer system via MultiLink software. Users can remotely monitor Utility power/UPS output/battery status. Turing UPS on/off, scheduling operation, and triggering battery test also can be performed.

The DB9 also includes photo-couplers to signal “on battery” and “low battery” operational status. The UPS will be capable of receiving a signal from the connected host system to initiate a UPS shutdown, when operating from battery power. This signal will be a +5V to +12V level that must remain for at least a 1.6 second duration. The pin out configuration of the DB9F connector is:

The pin out configuration of the DB9 connector is:

Pin	Assignment Description
1	Low Battery (open collector)
2	UPS TxD (typical RS-232 levels)
3	UPS RxD (typical RS-232 levels)
4	Battery Mode Shutdown (5-12V)
5	Common
6	Any Mode Shutdown (short to pin 5)
7	Low Battery (open emitter)
8	AC Fail (open emitter)
9	AC Fail (open collector)

1.1.8.1 Any Mode Shutdown - Via Pins 5 & 6

When Pin 6 is shorted to Pin 5, the UPS output is shut Off regardless of what mode the UPS is operating in. The UPS cannot be started as long as the pins are shorted. When the short is removed, the UPS output can be enabled by pressing the ON/ Alarm Silence/ Manual Self Diagnostic Test.

1.1.8.2 Battery Mode Shutdown—Via Pins 4 & 5

While the UPS is operating on battery (with no battery test in progress), a 5-12VDC signal for 2 seconds or longer is required to signal a shutdown. Signals for less than 2 seconds are ignored. After Pin 4 receives the shutdown signal the timer cannot be stopped. If utility power returns during the 2-minute timer countdown, the shutdown timer continues until the end of 2 minutes and then the UPS turns Off. By default, auto restart is enabled so the UPS will restart after 10 seconds. If auto restart is disabled via Liebert Multilink software, the UPS remains off until a manual restart.

1.1.8.3 USB Interface Port

The UPS will have (1) USB Interface Port. The USB connector will be a 4P Male connector. The USB interface port will always be active. The UPS will be capable of communicating system status and system shutdown via the USB. Hardware will support and allow operating system communication for Windows 98 and newer. USB port will be capable of communicating via the included Liebert Multilink software.

1.1.8.4 Data Line Protection Connectors

Data line (in and out) connectors are on the rear of the UPS and provide transient voltage surge suppression (TVSS) for Phone/Fax/DSL/Internet/Modem devices.

1.1.8.5 UPS Intelligent Communications

The PSI is equipped with an IntelliSlot port to provide advanced communication and monitoring options.

Liebert® PSI-XR

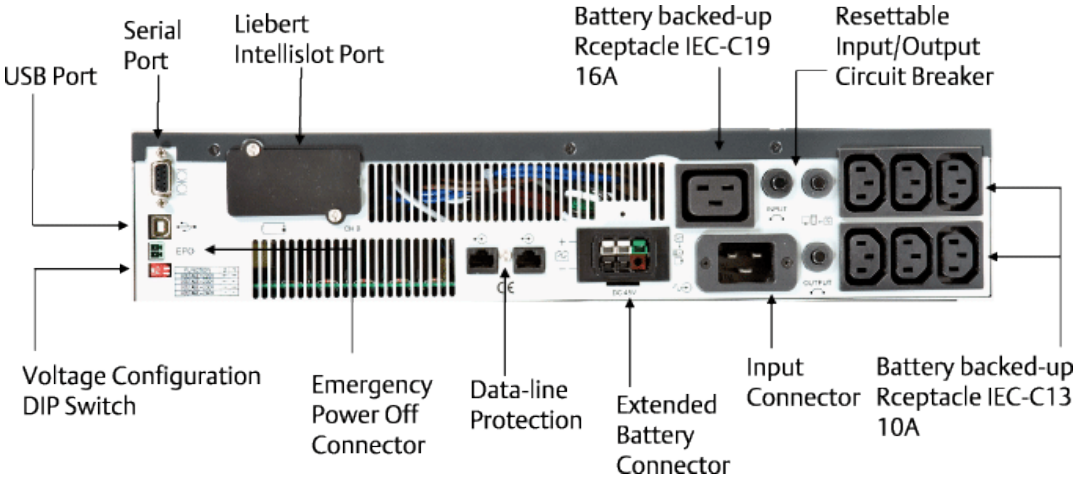
High Performance Power Protection for Server and Networking Equipment with Extended Run Capability

■1kVA ■1.5kVA ■2.2kVA ■3kVA

For servers and networks requiring extended runtime, Liebert PSI-XR provides longer backup time with additional features on top of Liebert PSI. Liebert PSI-XR has matching external battery cabinets that enables longer backup time to several hours in the extended requirements. It provides greater than five minutes of internal battery backup time at 100% load measured at pf 0.9.

Model Number		PS1000RT3-230XR		PS2200RT3-230XR	
Input Connection		IEC-320 C14		IEC-320 C20	
Output Connection		IEC-320 C13 x 6		IEC-320 C13 x 6 + C19 x 1	
Communication Interface		REPO, USB, Serial, Intellislot			
Dimensions: (mm)		88(2U) x 440 x 490.5		88 (2U) x 440 x 700.5	
Shipping Dimensions: (mm)		228 x 560 x 612		228 x 560 x 821	
Net Weight: (kg)		25	28	42	46
Shipping Weight: kg		29	32	47	51
Form Factor		Rack/Tower Convertible, Tower Stand included			
Input Power Cable		Nil		"Shucko" CEE 7/7 and BS1363 to IEC-320-C19	
Number of Output Cable		2		3	
Software		Liebert Multilink 4, support for Windows NT/2000/XP/Vista			
Operation			**PS1500RT3-230XR**	**PS2200RT3-230XR**	**PS3000RT3-230XR**
Capacity (Volt-Amps, Watts)		1000/900	1500/1350	2200/1980	3000/2700
Norminal Input Voltage		220/230/240VAC (configurable)			
Input Voltage Window		165-300VAC			
Input Frequency Window		45-65Hz			
Input Protection Type		Resettable Circuit Breaker			
Default frequency		50Hz			
Boost Mode Voltage		Input Voltage x 117%			
Buck Mode Voltage		Input Voltage ，115%			
Transfer Time (AC to DC)		4-6 ms typical			
Efficiency		>96% on Line Mode			
Surge Protection		220 J			
Output (battery mode)	Voltage	220/230/240VAC (configurable)			
	Voltage Regulation	>± 5%			
	Wave Form	Pure Sine Wave			
Battery type		Sealed, non-spillage, maintenance-free, lead acid with 5 year typical lifetime			
Backup Time at full load pf 0.9		>6 minutes	>5 minutes	>5 minutes	>5 minutes
Typical Recharge Time		5 hours to 90%			
Hot Swappable Battery		Yes			
EMI Classification		IEC/EN/AS62040-2			
Agency Approvals	Safety	IEC/EN/AS62040-1-1			
	Transportation	ISTA Procedure 1A Certification			
	WEEE and ROHS	Yes			
Operation Condition		3,000 meter max. elevation, 0-90% humidity non-condensing 0-40 deg. C			
Noise Level		>40dBA on Line Mode			
Accessories		**PS1000RT3-230XR**	**PS1500RT3-230XR**	**PS2200RT3-230XR**	**PS3000RT3-230XR**
Rack Mount Kit		RAILKITPS3G-AEC			
SNMP/WEB Management Card		IS-WEBRT3			
Maintenance Bypass Switch		MP2-210K			MP2-220L
Extended Battery Cabinets		PSRT3-24VBXR		PSRT3-48VBXR	
Typical Runtime (VA/W)		PS1000RT3-230XR	PS1500RT3-230XR	PS2200RT3-230XR	PS3000RT3-230XR
200/180		55 minutes	70 minutes	85 minutes	110 minutes
400/360		25 minutes	32 minutes	55 minutes	70 minutes
600/540		14 minutes	20 minutes	31 minutes	46 minutes
800/720		9 minutes	13 minutes	23 minutes	32 minutes
1000/900		6 minutes	10 minutes	18 minutes	24 minutes
1500/1350		-	5 minutes	11 miuntes	13 minutes
2000/1800		-	-	7 minutes	10 minutes
2500/2350		-	-	-	7 minutes
3000/2700		-	-	-	5 minutes

Liebert PSI-XR Rear View Parts



Battery Runtime Chart of Liebert PSI-XR

(Runtimes are in minutes, assuming fully charged batteries at 25°C)

Number of batteries	%Load	PS100RT3-230XR	PSI500RT3-230XR	PS2200RT3-230XR	PS3000RT3-230XR
Internal Battery	50	15	13	14	13
	100	6	5	5	5
Internal Battery+1 External Battery Cabinet	50	73	55	45	31
	100	31	18	15	12
Internal Battery+2 External Battery Cabinets	50	129	95	67	56
	100	65	46	29	18
Internal Battery+3 External Battery Cabinets	50	181	131	95	73
	100	96	64	48	31
Internal Battery+4 External Battery Cabinets	50	233	167	143	95
	100	124	82	72	47
Internal Battery+5 External Battery Cabinets	50	185	203	167	113
	100	151	109	84	56
Internal Battery +6 External Battery Cabinets	50	336	239	191	131
	100	179	124	102	65

* For connecting more external battery cabinets, please contact Emerson staff



Battery Cabinet Specifications

Model Number		PSRT3-24VBXR	PSRT3-48VBXR
Used w/ UPS Model		PS1000RT3-230XR / PSI500RT3-230XR	PS2200RT3-230XR / PS3000RT3-230XR
Unit Dimensions/ Shipping Dim. : (mm)		88(2U) x 440 x 490.5 / 560 x 675	
Net Weight / Shipping Weight: kg		29 / 33	
Battery Type		Sealed, non-spillage, maintenance-free, lead acid with 5 year typical lifetime	
Operation Condition		3,000 meter max. elevation, 0-90% humidity non condensing 0-40 deg. C	
Form Factor		Rack/ Tower Convertible, Tower Stand and rail kit included	
EMI Classification		IEC/EN/AS62040-2 2nd Ed Class A	
Agency Approvals	Safety	IEC/EN/ AS62040-1-1	
	Transportation	ISTA Procedure IA Certification	
	WEEE and ROHS	Yes	

Battery Runtime Chart of Liebert PSI

(Runtimes are in minutes, assuming fully charged batteries at 25°C)

Typical Runtime (Watts)	PS750RT3-230	PS1000RT3-230	PS1500RT3-230	PS2200RT3-230	PS3000RT3-230
200	25	45	60	85	120
400	10	15	20	45	65
600	5	8	12	20	30
800	-	5	8	14	18
1000	-	-	5	11	14
1500	-	-	-	6	8
2000	-	-	-	-	5
2500	-	-	-	-	4
100% load	>4 minutes	>4 minutes	>3 minutes	>3 minutes	>3 minutes

Actual runtime may vary depending on operating conditions.

Liebert PSI Specifications

Model Number		PS750RT3-230	PS1000RT3-230	PS1500RT3-230	PS2200RT3-230	PS3000RT3-230
Input Connection		IEC-320 C14			IEC-320 C20	
Output Connection		IEC-320 C13 x 8			IEC-320 C13 x 8 + C19 x 1	
Communication Interface		REPO, USB, Contact Closure, Intellislot				
Dimensions: (mm)		88(2U) x 440 x 412			88 (2U) x 440 x 657	
Shipping Dimensions: (mm)		228 x 560 x 595			228 x 560 x 776	
Net Weight: (kg)		15.0	19.4	20.9	33.8	37.2
Shipping Weight: kg		18.2	22.6	24.1	38.3	41.5
Form Factor		Rack/Tower Convertible, Tower Stand included				
Input Power Cable		Nil			"Shucko" CEE 7/7 and BS1363 to IEC-320-C19	
Number of Output Cable		2			3	
Software		Liebert Multilink, support for Windows NT/2000/XP/Vista, Linux				
Operation		**PS750RT3-230**	**PS1000RT3-230**	**PS1500RT3-230**	**PS2200RT3-230**	**PS3000RT3-230**
Capacity		750VA/675W	1000VA/900W	1500VA/1350W	2200VA/1980W	3000VA/2700W
Norminal Input Voltage		220/230/240VAC ± 10% (configurable)				
Input Voltage Window		165-300VAC				
Input Frequency Window		45-65Hz ± 0.5Hz				
Input Protection Type		Resettable Circuit Breaker				
Default frequency		50Hz				
Boost Mode Voltage		Input Voltage x 117%				
Buck Mode Voltage		Input Voltage / 115%				
Transfer Time (AC to DC)		4-6 ms typical				
Efficiency		>96% on Line Mode				
Surge Protection		220 J				
Output (battery mode)	Voltage	220/230/240VAC (configurable)				
	Voltage Regulation	± 5%				
	Wave Form	Pure Sine Wave				
Battery type		Sealed, non-spillage, maintenance-free, lead acid with 5 year typical lifetime				
Quantity x Voltage x Ah		2 x 12 x 7.2	3 x 12 x 7.2	3 x 12 x 9	6 x 12 x 7.2	6 x 12 x 9
Backup Time at full load pf 0.7		>6 minutes	>6 minutes	>5 minutes	>6 minutes	>5 minutes
Backup Time at full load pf 0.9		>4 minutes	>4 minutes	>3 minutes	>3 minutes	>3 minutes
Typical Recharge Time		5 hours to 90% of rated capacity, after full discharge into resistive load				
Hot Swappable Battery		Yes				
Electrical Fast Transient		IEC/EN/AS62040-2 2nd Ed Class A				
Agency Approvals	Safety	IEC/EN/AS 62040-1-1				
	Surge	IEC/EN/AS 61000-4-2				
	ESD	IEC/EN/AS 61000-4-3				
	Susceptibility	IEC/EN/AS 61000-4-4				
	Emission	IEC/EN/AS 61000-4-6				
	Conducted Immunity	IEC/EN/AS 61000-3-2				
	Harmonics	IEC/EN/AS 61000-4-6				
	Transportation	ISTA Procedure 1A Certification				
	WEEE and ROHS	Yes				
Operation Condition		3,000 meter max. elevation, 0-90% humidity non-condensing 0-40 deg. C				
Noise Level		<45dBA on Line Mode				
Accessories		**PS750RT3-230**	**PS1000RT3-230**	**PS1500RT3-230**	**PS2200RT3-230**	**PS3000RT3-230**
SNMP/WEB Management Card		IS-WEBRT3				
Maintenance Bypass Switch		MP2-210K				MP2-220L

Liebert® PSI™ UPS, XR Series

Guide Specification

1000VA to 3000 VA

Single-Phase Uninterruptible Power Supply Systems

1.0 GENERAL

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power system. The uninterruptible power system, hereafter referred to as the UPS, will provide high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS is designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification will govern.

120V Units

UL 1778, c-UL listed (to CSA 22.2 No. 107.1)
UL 497 B
FCC Part 15, Class A
ANSI C62.41, Category A, Level 3 (IEEE 587, Category A);
IEC60950-1
IEC60146
IEC60529
EN61000-4-5, Level 3, Criteria B
EN61000-4-2, Level 3, Criteria B
EN61000-4-3, Level 3, Criteria A
EN61000-4-4, Level 4, Criteria A
EN61000-4-6
EN61000-3-2
ISTA Procedure 1A

230V Units

EN62040-1-1, TUV/GS listed, CE compliance mark
EN60950-1
EN60146
EN60529
EN62040-1-1
EN50091-2, Class B
EN61000-4-2, Level 3, Criteria B
EN61000-4-3, Level 3, Criteria A
EN61000-4-6
EN61000-4-4, Level 4, Criteria A
EN61000-4-5, Level 3, Criteria B
EN61000-3-2
ISTA Procedure 1A

1.3. SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS is designed to operate as a line-interactive system in the following modes:

A. Normal - The critical AC load is continuously supplied with filtered power. The battery charger maintains a float-charge on the battery.

B. Voltage Boost/Buck - During input power source abnormalities (sags and swells), the AC output power is corrected by means of boost (sag correction) or buck (swell correction) compensation taps. Operation of the compensation taps automatically maintains the proper output voltage for the connected critical equipment. The compensation taps is designed for indefinite operation to their limits. Operation of the compensation taps will not discharge the battery.

C. Recharge - Upon restoration of utility / mains AC power, after a utility / mains AC power outage and complete or partial battery discharge, the unit automatically restarts and resumes supplying power to the critical AC load; and the battery charger recharges the battery. The battery can be charged from the utility whether the UPS is ON or OFF.

D. Battery - When the input power source exceeds the parameters defined in section 1.3.3.1, the critical AC load is supplied power by the inverter, which obtains its power from the battery. Typical detection and transfer time is 4-6 ms.

E. Battery Start- The UPS is capable of starting without input power. The unit starts up and operates from the battery, with output frequency the same as the last operating frequency.

1.3.2 Design Requirements

A. Voltage: Input/output voltage specifications of the UPS are:

Input:
120V Units: 0-170 VAC, 60/50 Hz auto-sensing, single-phase, 2-wire-plus-ground.
230V Units: 0-340 VAC, 50/60 Hz auto-sensing, single-phase, 2-wire-plus-earth.

Output:
120V Units: 110/120/127 VAC ±10%, 60/50 Hz, single-phase, 2-wire-plus-ground.
(DIP Switch selectable)

230V Units: 220/230/240 VAC ±10%, 50/60 Hz, single-phase, 2-wire-plus-earth.
(DIP Switch selectable)

B. Output Load Capacity: Maximum specified output load capacity of the UPS, regardless of load power factor, is:

120V units:

1000VA / 900W	1500VA / 1350W
1920VA / 1920W	3000VA / 2700W

230V units:

1000VA / 900W	1500VA / 1350W
2200VA / 1980W	3000VA / 2700W

C. Internal Battery: The battery consists of valve regulated, non-spillable, maintenance-free, sealed, lead-acid cells. The battery is user replaceable and hot swappable.

D. Battery Reserve Time: 5 minutes minimum at full load with ambient temperature 77°F (25°C).

E. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. Recharge time is 5 hours typical to 90% capacity after a complete discharge into full resistive load

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

A. Voltage Configuration: The UPS operates at these values without drawing power from the batteries

110 VAC setting: single phase, 2-wire-plus-ground: 83 □ 138 VAC (±5VAC),
Buck compensation: 120VAC (±5VAC)

Boost compensation: 100VAC (±5VAC)

120 VAC setting: single phase, 2-wire-plus-ground: 90 □ 150 VAC (±5VAC),
Buck compensation: 131VAC (±5VAC)
Boost compensation: 109VAC (±5VAC)

127 VAC setting: single phase, 2-wire-plus-ground: 96 □ 159 VAC (±5VAC),
Buck compensation: 139VAC (±5VAC)
Boost compensation: 115VAC (±5VAC)

220 VAC setting: single phase, 2-wire-plus-earth: 165 □ 275 VAC (±10VAC)
Buck compensation: 240 VAC (±10VAC)
Boost compensation: 200 VAC (±10VAC)

230 VAC setting: single phase, 2-wire-plus-earth: 173 □ 288 VAC (±10VAC)
Buck compensation: 251 VAC (±10VAC)
Boost compensation: 209 VAC (±10VAC)

240 VAC setting: single phase, 2-wire-plus-earth: 180 □ 300 VAC (±10VAC)
Buck Compensation: 262 VAC (±10VAC)
Boost compensation: 218 VAC (±10VAC)

B. Frequency: The UPS automatically senses the input frequency and operates within the following frequency specifications without drawing power from the batteries.

50 Hz Applications: 45 □ 55 Hz (±0.5 Hz)
60 Hz Applications: 55 □ 65 Hz (±0.5 Hz)

1.1.1.2 AC Output

A. Voltage Configuration:

The UPS shall contain a DIP Switch to allow the operator to select the nominal utility voltage. This setting will change the transfer point (Low and High) of the UPS. The factory default settings shall be 120 VAC for the 120VAC models and 230 VAC for 230 VAC models. The Configuration switch will be a 2 pin DIP-Switch type, and be located in rear of UPS with diagram of setting.

B. Voltage Regulation: -13.5% to +9% on nominal mode. ±5% on battery backup

C. Frequency Regulation: ±0.5Hz synchronized to utility / mains.

±0.5Hz free running or on battery operation.

D. Load Power Factor Range: 0.9 lagging to 1.0 (unity)

E. Voltage Distortion: < 12 % total harmonic distortion (THD) typical into a 100 % linear load, and < 16 % THD typical into a 100% non-linear load. < 16 % after low battery THD typical into a 100% linear load. < 20 % after low battery THD typical into a 100 % non-linear load.

F. Inverter Overload Capability: Overload Warning (visual and audible alarms) occurs between 100%□109% of rated capacity, continuous duty. Shutdown occurs at the following load levels: > 110 – 120 %: shutdown after 10 minutes minimum (Normal Mode)

> 120 %: shutdown after 1 cycle minimum (Normal Mode)

> 100 – 120 %: after end of discharge (Battery mode)

> 120 – 130 %: after 10 seconds (Battery mode)

> 130 %: after 1 cycle (Battery mode)

G. Voltage Transient Response: ±15% in Battery mode for 0-100-0% loading of the UPS rating, ±5% in Battery mode for 20-100-20% loading of the UPS rating.

H. Transient Recovery Time: To within ±8% of nominal voltage in < 2 cycles.

I. Efficiency with resistive load:

>96% (Normal mode)

>92% (Buck/Boost mode)

>80% (Battery mode)

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 32°F □ 104°F (0°C □ 40°C) for altitude 10,000 ft max (3000 meters) above sea level.

77° F (25°C) for optimum battery performance

Storage: 5°F to 104 °F (-15°C to 40°C) with batteries

68°F (20°C) for optimum battery storage.

B. Relative Humidity

0 □ 90% non-condensing.

C. Altitude:

1000VA, 1500VA, 1920VA, 2200VA, & 3000VA: 10,000 ft.(3,000 m max.), without power derating when operated within the temperature specified in section 1.4.A. Ambient temperature will be derated 5°C for each additional 500m

D. Audible Noise

Noise generated by the UPS during normal operation does not exceed the following values when measured at 1 meter from the surface of the UPS. In normal mode unit measures 40dB max, and in battery-mode unit measures 45dB max.

E. Electrostatic Discharge

The 120/230 VAC units are able to withstand an electrostatic discharge compliant to EN61000-4-2, level 3, Criteria B without damage and without affecting the connected load.

1.5 USER ACCESSORIES AND PACKAGING

The specified UPS system is supplied with one (1) Multi-language, User manual on CD. The manual includes installation drawings and instructions, a functional description of the equipment, safety precautions, illustrations, operating procedures, and general maintenance guidelines. The UPS is also supplied with one (1) Liebert Shutdown software CD, one (1) Liebert Shutdown software serial cable (6-ft; 1.82m), one (1) USB cable (6-ft; 1.82m), one (1) Tower Stand, one (1) pair of Rack mount handles, Mounting Hardware, one (1) pair of Fixed rails, and one (1) Battery-UPS tab. The package meets the requirements of ISTA

Procedure 1A.

1.6 WARRANTY

The manufacturer warrants the UPS against defects in materials and workmanship for two (2) years. The warranty covers all parts. An optional one (1) or three (3) year extended warranty is available from the manufacturer.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

Emerson Network Power provides more than twenty years experience in the design, manufacturing, and testing of solid-state UPS systems and the company is certified to ISO 9001:2000.

1.7.2 Factory Testing

Before shipment, the product is tested to assure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS are new, of current manufacture, and have not been in prior service except as required during factory testing. All relays are provided with dust covers.

2.1.2 Wiring

Wiring practices, materials, and coding are in accordance with the requirements of the standards listed in section 1.2. All wiring is copper.

2.1.3 Cabinet

The UPS unit comprised of: TVSS & EMI/RFI Filters, Relay, Automatic Voltage Regulator, Battery Charger, Battery consisting of the appropriate number of sealed battery cells, Inverter (1000 & 1500VA models only), DC-to-DC Converter (1920, 2200, & 3000VA models only) and Bi-Directional Converter; is housed in a rack-tower NEMA type 1 enclosure. Dimensions and weights are:

UNIT	UNIT DIMENSIONS W x D x H in (mm)	120VAC UNITS WEIGHT lbs (kg)	230VAC UNITS WEIGHT lbs (kg)
1000VA	17.3 x 19.3 x 3.5 (440 x 492 x 88)	55.6 (25.2)	55.1 (25)
1500VA	17.3 x 19.3 x 3.5 (440 x 492 x 88)	61.7 (28)	61.3 (27.8)
1920VA	17.3 x 27.6 x 3.5 (440 x 701 x 88)	92.2 (41.8)	N/A
2220VA	17.3 x 27.6 x 3.5 (440 x 701 x 88)	N/A	92.6 (42)
3000VA	17.3 x 27.6 x 3.5 (440 x 701 x 88)	105.4 (47.8)	102 (46.2)

2.1.4 Cooling

Air intake is through the front of the unit and exhausted out the rear of the unit. The following conditions will cause the fan to turn ON:

- UPS is in Buck/Boost mode (> 50 % load)

- Recharging (if battery voltage < 2.2VDC / cell)
- Back up mode

2.2 COMPONENTS AND OPERATION

2.2.1 Surge Protection:

The 120 VAC units can withstand input surges of up to 570J without damage per criteria listed in IEEE C62.41, Category A, Level 3. The 230 VAC units can withstand input surges of up to 660J without damage per criteria listed in EN61000-4-5, Level 3, Criteria B.(1). Additionally, the UPS is supplied with one pair of Data Line Protection Connectors to provide phone, fax or modem line surge protection via RJ-45 connectors. These Data Line Ports provide transmission for 10/100 Base-T Ethernet connection.

2.2.2 Input Protection

The UPS has built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy lightning surges introduced on the primary input power source. The UPS is provided with an input circuit breaker.

2.2.3 Input Connections

The 120 VAC units have an attached input cord 10 feet (3 meters) in length, measured between the outside edges of the connectors. The 230VAC 2200VA and 3000VA units ship with (1) "Shucko" CEE 7/7 to IEC-320-C19 input cord, and (3) IEC cables . The 230VAC 1000/1500VA units ship with (2) IEC cables.

Unit	120 VAC UNITS	230 VAC UNITS
1000VA & 1500VA	NEMA 5-15P	IEC-320-C14
1920VA	NEMA 5-20P	N/A
2200VA	N/A	IEC-320-C20
3000VA	NEMA L5-30P	IEC-320-C20

2.2.4 Bi-Directional Converter

2.2.4.1 General

The Bi-Directional Converter incorporates solid-state devices and control circuitry to convert AC power to regulated DC power to "float charge" the battery during normal mode; and convert DC power from the battery to regulated and conditioned sinewave AC power for supporting the critical load during battery mode. The Bi-Directional Converter is a pulse width modulated (PWM) design. The Bi-Directional Converter operates in the following modes:

1. In Normal mode of operation, the Bi-Directional Converter maintains the battery system at a float charge.

2. In Battery mode of operation, the Bi-Directional Converter converts DC power from the battery, through the DC-to-DC Converter, to regulated and conditioned sinewave AC power for supporting the critical load.

3. In the recharge mode of operation, the Bi-Directional Converter converts AC power to regulated DC power to recharge the battery.

2.2.4.2 Battery Recharge

The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant voltage charged to recharge and maintain the battery in a fully charged state. Recharge time is 5 hours maximum to 90% rated capacity after discharge into full resistive load.

2.2.4.3 Bi-Directional Converter DC Protection

The following DC shutdown levels protect the UPS:

DC Overvoltage Shutdown
DC Undervoltage Shutdown (End of Discharge)
DC Undervoltage Warning (Low Battery Reserve)

2.2.4.4 Output Protection

For output faults including short circuits and overloads, the UPS is protected by the input circuit protector during Normal mode and by electronic current limiting during Battery mode. The UPS control logic senses and disconnects the UPS from the critical AC load and clears the protective circuit breaker during Normal mode.

2.2.4.5 Overload

The UPS is capable of supplying power for overloads exceeding 100% and up to 109% of full load rating, continuously. A visual indicator and audible alarm indicate overload operation. For greater current demands, the UPS employs circuit protector and electronic current-limiting protection to prevent damage to components. The UPS is self-protecting against any magnitude of connected output overload.

1.1.1.6 Output Frequency

An oscillator controls the output frequency of the UPS. The oscillator maintains the output frequency to ± 0.5 Hz of nominal when not synchronized to the utility/mains source.

2.2.4.7 Battery Over-Discharge Protection

To prevent battery damage due to excessive discharge levels, the UPS control logic automatically monitors the battery voltage and load level and switches off the output at the predetermined battery shutdown voltage set point.

2.2.4.8 UPS External Battery Detection

The UPS is capable of automatically detecting the connection of external Liebert battery cabinets. The UPS and battery cabinets contain a Bat +, Bat -, and Sense pins. The XR series is able to detect up to 6 external Liebert battery cabinets to provide longer runtime.

2.2.5 Display and Controls

2.2.5.1 General

The UPS is provided with a microprocessor-based unit status and control display

designed for convenient and reliable user operation. The status and alarm indicators are displayed on a status indicator display.

2.2.5.2 System Indicators

A row of Load Level indicators that display the approximate electrical load placed upon the UPS. A row of Battery Level indicators display the approximate battery capacity. There are six (6) status indicators on the front of the UPS as described below:

1. The “Normal Mode” indicator illuminates green when utility power is available and within the input specifications.
2. The “Battery mode” indicator illuminates green when the UPS is operating on battery, and an audible alarm sounds every 2 seconds. When a low battery condition is present the audible alarm will sounds every second.
3. In the case of a “Weak Battery”, the LED display will indicate the relative load level on the output of the UPS and the battery condition LED will flash to warn users. Pressing status change button will display the battery capacity.
4. When UPS operates in “AVR Buck/Boost mode”, the LED display will indicate the relative load level on the output of the UPS and the boost or buck LED will flash to indicate UPS is operating in buck/boost mode. Pressing status change button will display the battery capacity.
5. In case of “Site-Wiring” fault, the LED display will indicate the relative load level on the output of the UPS and the Grounding/Site Wiring Fault flashes to warn users. Pressing status change button will display the battery capacity.
6. When UPS operates in overload status, the LED display will indicate the relative load level on the output of the UPS and flash the Overload indictor to warn users. There will also be a continuous audible alarm present. Pressing status change button will display the battery capacity.

2.2.5.3 ON/Alarm Silence/ Manual Self Diagnostic Test

This button controls output power to connected load(s) and has three functions:

ON - When the UPS is off, pressing the ON/Alarm Silence/Battery Test button for more than 3 seconds will start the UPS, and an audible alarm sounds briefly will continue until user releases ON button. The UPS is capable of starting on battery (dark start).

Alarm Silence – Audible alarms via an internal Beeper shall be used in conjunction with the visual indicators to indicate to the operator a change in UPS operation status. Only Backup mode Alarm can be silenced via the front panel Alarm Silence Button and Communication ports (RS232/USB). Once the audible alarm is silenced, the audible alarm shall not sound, unless a new alarm condition is present. The audible alarm level shall be a minimum of 60dBA at a distance of one-meter (3ft).

The BATTERY DISCHARGE, PREVENT SHUTDOWN, ABNORMAL OUTPUT and OVERLOAD fault audible alarms CANNOT be silenced.

Manual Self Diagnostic Test - To initiate a manual battery test, press the ON/Alarm Silence/ Manual Self Diagnostic Test for 3 seconds or more while operating from utility power with no alarm conditions present. The UPS is also provided with an automatic and remote self diagnostic test feature. The tests ensure the capability of the battery, and also detect any internal UPS failures. If the battery/UPS fails the test, the UPS will display a warning to indicate the batteries need replaced. The battery test feature is user accessible via Liebert Shutdown software.

Status Change Button – Switches status displayed between battery level or load level. When UPS operates in line mode, the LED display shall indicate load capacity first, and change to indicate battery capacity for 5 seconds when the status change button is

depressed. When UPS operates in battery mode, the LED display shall indicate battery capacity first, and change to indicate load capacity for 5 seconds when the status change button is depressed.

2.2.5.4 OFF Button

When the UPS is on (in either Normal or Battery mode), pressing the OFF button for more than one (1) second will shut down the UPS. An audible alarm sounds briefly.

2.2.6 Internal Battery

Valve regulated, non-spillable, lead-acid cells are used as a stored-energy source for the specified UPS system. The battery is housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 77 ° F (25 ° C) for a minimum of 5 minutes reserve time. The expected life of the battery is 3 - 5 years or 250 complete discharge cycles. Optional external battery cabinets are available to extend battery run times

2.2.7 Output Distribution

Output distribution is integral to the UPS and is located on the rear of the unit.

UNIT	120 VAC UNITS	230 VAC UNITS
1000VA & 1500 VA	(6) NEMA 5-15R	(6) IEC-320-C13
1920VA	(4) NEMA 5-15R (2) NEMA 5-20R T-Slot, accepts 15A plug	N/A
2220VA	N/A	(6) IEC-320-C13 (1) IEC-320-C19
3000VA	(4) NEMA 5-15R (2) NEMA 5-20R T-Slot, accepts 15A plug (1) NEMA L5-30R	(6) IEC-320-C13 (1) IEC-320-C19

2.2.7.1 Output Power Cords: The 230 VAC units have two (2) detachable IEC-320-C14 output power cords measuring 2m (6.6 ft) in length.

2.2.8 Communications

The UPS contains a DB9 port on the rear panel to allow UPS status communications to a computer system. Additionally, it links to a computer system via serial communication protocol of Liebert Shutdown and monitoring software. By computer, users can monitor Utility power/UPS output/ battery status. Turing UPS on/off, scheduling operation, and triggering battery test also can be mastered through the computer.

The DB9 also includes photo-couplers to signal “on battery” and “low battery” operational status. The UPS will be capable of receiving a signal from the connected host system to initiate a UPS shutdown, when operating from battery power. This signal will be a +5V to +12V level that must remain for at least a 1.6 second duration. The pin out configuration of the DB9F connector is:

The pin out configuration of the DB9 connector is:

Pin	Assignment Description
1	Low Battery (open collector)
2	UPS TxD (typical RS-232 levels)
3	UPS RxD (typical RS-232 levels)
4	Battery Mode Shutdown (5-12V)
5	Common
6	Any Mode Shutdown (short to pin 5)
7	Low Battery (open emitter)
8	AC Fail (open emitter)
9	AC Fail (open collector)

1.1.8.1 Any Mode Shutdown - Via Pins 5 & 6

When Pin 6 is shorted to Pin 5, the UPS output is shut Off regardless of what mode the UPS is operating in. The UPS cannot be started as long as the pins are shorted. When the short is removed, the UPS output can be enabled by pressing the ON/Alarm Silence/ Manual Self Diagnostic Test.

1.1.8.2 Battery Mode Shutdown—Via Pins 4 & 5

While the UPS is operating on battery (with no battery test in progress), a 5-12VDC signal for 2 seconds or longer is required to signal a shutdown. Signals for less than 2 seconds are ignored. After Pin 4 receives the shutdown signal the timer cannot be stopped. If utility power returns during the 2-minute timer countdown, the shutdown timer continues until the end of 2 minutes and then the UPS turns Off. By default, autorestart is enabled so the UPS will restart after 10 seconds. If auto restart is disabled via Liebert Shutdown software, the UPS remains off until a manual restart.

1.1.8.3 USB Interface Port

The UPS shall have (1) USB Interface Port. The USB connector shall be a 4P Male connector. The USB interface port shall always be active. The UPS shall be capable of communicating system status and system shutdown via the USB. Hardware shall support and allow operating system communication for Windows 98 and newer. USB port shall be capable of communicating via Liebert Shutdown software, which is provided.

1.1.8.4 Data Line Protection Connectors

Data line (in and out) connectors are on the rear of the UPS and provide transient voltage surge suppression (TVSS) for Phone/Fax/DSL/Internet/Modem devices.

1.1.8.5 UPS Intelligent Communications

The PSI is equipped with an Liebert IntelliSlot to provide advanced communication and monitoring options. Liebert Shutdown software continually monitors the UPS and can shut down your computer or server in the event of an extended power failure.

Liebert® ITA

True On-line Double Conversion Parallelable UPS

■5kVA ■6kVA ■10kVA ■16kVA ■20kVA

Liebert ITA Series is a full featured scalable UPS designed to provide long backup time for small computer rooms and network equipment. Using true on-line double conversion UPS technology, Liebert ITA Series provides high efficiency and reliability with 0.9/0.8 output power factor that can power 10-30% more load than other ordinary UPS. This UPS offers flexibility with parallelable configuration and extended backup time with external battery cabinets.



Features

Best-in-class Efficiency

- Supports parallel operation up to 4 units N+X configuration
- Backup time can be prolonged through cascaded connection or use of large capacity battery bank
- Outstanding energy-saving performance with more than 92% efficiency
- Input power factor of up to 0.99 with high electric energy utility rate
- Extra-wide input voltage / frequency range effectively reduces the discharging period of battery; thus, prolonging battery life
- Compatible with single-phase and 3-phase input power
- Optional strong charging capability effectively reduces battery recharging time

Highly Reliable

- Double-conversion online design that ensures continuous power even when the mains AC fails
- Supports N+X redundant mode up to 4 units for increased system reliability
- DSP full-digital control with high output voltage precision
- Uses state-of-the-art technology and components to withstand fluctuation of input main voltage
- Provides latest USB monitoring interface
- Optional WEB / SNMP card for remote management
- Available in standard and long backup for 4 to 8 hours runtime. External charger is also available

Best Total Cost

- 0.9 output power factor and can power 10-30% more load than other ordinary UPS, suitable for latest server models (0.8 output power factor for 6KVA model)
- Uses soft-wire parallel operation mode without the need for complex parallel subrack, allowing the user to save on system cost
- High system efficiency up to 94%, energy-saving and low operational cost
- High power density allows the rack to have a smaller footprint
- Standard two (2) years warranty for 5kVA and 6kVA models; one year warranty for 10, 16 and 20kVA models

Efficiency and Flexibility from the Liebert ITA UPS Family

The Liebert ITA UPS family from Emerson Network Power provides a truly modular, highly efficient and best-in-class power protection solution for your network. Featuring true on-line double conversion technology and extended runtime across all models, the Liebert ITA is parallelable for maximum flexibility.

- 5kVA and 6kVA
- 10kVA
- 16kVA and 20kVA



Technical Specifications

Specifications	5kVA		6kVA		10kVA		16kVA	20kVA
Model	Standard	Long back-up	Standard	Long back-up	Standard	Long back-up	Long back-up	Long back-up
Part Number	01200580	01200582	01200456	01200461	01200775	01200770	01200758	01200782
Input parameters								
Rectifier Type	IGBT							
Rate Voltage	230 / 400VAC single-phase, 3-wire or 3-phase, 4-wire system						400VAC 3-phase, 4-wire system	
Input Voltage Range	Single-phase, 120VAC to 276VAC				Single-phase, 120VAC to 288VAC		3-phase, 228VAC to 478VAC	
Input Frequency Range	45Hz to 55Hz				45Hz to 65Hz		45Hz to 70Hz	
Input Power Factor	Single-phase ≥ 0.99 / 3-phase ≥ 0.95						Full Load > 0.99	
Battery								
Battery Type	Sealed, non-spillage, maintenance-free lead-acid battery							
Charging Capability	< 3hrs for recharging to 90% capacity (standard mode)				< 6hrs for recharging to 90% capacity (standard mode)		4.5kW, max charging power	
Runtime @ pf 0.9 with 1 Battery Cabinet	Standard battery cabinet: ≤5 minutes (5 / 10kWA)						-	-
External Battery Cabinet	02351253 (16 blocks x 12V x 7.2Ah), Min. Qty Required: ITA 5 / 10kVA - 1pc; ITA 16 / 20kVA - 2pcs							
Battery Dimensions: H x W x D (mm)	85 (2U) x 435 x 640							
Battery Weight (kg)	50							
Output parameters								
Rated Power	5kVA / 4.5kW		6kVA/4.8kW		10kVA / 9kW		16kVA / 14.4kW	20kVA / 18kW
Rated Voltage	Single-phase, 220VAC						3-phase in / out and 3-phase in / Single-phase out	
Voltage Stability	3%						1%	
Frequency Stability	0.25%							
Output Voltage THD	< 3% linear load, <5% non-linear load						< 2% linear load, <5% non-linear load	
Load Crest Factor	3:1 (compliant with IEC 62040-3)							
Step Load Performance	100%							
Overload Capacity Performance (% rated load)	125% for 1min				105 to125% for 5min 125 to150% for 1min > 150% for 500ms		105 to125% for 5min 125 to150% for 1min > 150% for 200ms	
System parameters and standard								
Conversion Type	On-line double conversion							
Parallel Operation	3+1 parallel operation				1+1 parallel operation		3+1 parallel operation	
Form Factor	Tower and rack convertible, optional rail kit available							
System Efficiency	> 92%				> 92.5%		Up to 94%	
Transfer Time (power failure)	No transfer time, on-line operation							
Noise	< 50dB				< 55dB		≤ 58dB	
Language	English / Chinese							
Standards / Conformity	IEC/EN62040-1-1							
EMC	IEC / EN 62040-2, IEC / EN61000-3-11,IEC / EN61000-3-12, YD / T1095-2008							
Surge Protection	ICE / EN 62040-2, IEC / EN 61000-4-5							
Protection Level	IP20							
Unit Dimensions: H x W x D (mm)	85 (2U) x 435 x 625				85 (2U) x 435 x 640		130 (3U) x 435 x 750	
Net Weight (kg)	17				20.8		35	
Warranty	2 years				1 year			
Communication and management								
Interface Type	USB / Intellislot (Dry Contact / SNMP Card / Modbus Card / RS485 Card)							
Management Software	SiteMonitor							
Environmental parameters								
Operating Temperature	0 to 40°C							
Relative Humidity	5 to 95%, non-condensing							
Altitude (m)	1500						2000	

Runtime (in minutes)



5000 / 6000VA							
Load (# of battery cabinets)	4800W (6kVA only)	4500W	3500W	2500W	1500W	1000W	700W
1	4.2min	5min	8min	14min	30min	55min	1h20m
2	9.2min	11min	16min	28min	60min	1h50m	2h40m
3	20min	24min	34min	52min	1h44m	3h	4h50m
4	30min	36min	46min	1h20m	2h30m	3h50m	6h20m
5	35min	42min	52min	1h30m	2h34m	4h28m	7h6m
6	40min	48min	1h6m	1h44m	3h26m	5h36m	7h38m
7	44min	52min	1h10m	1h50m	3h40m	5h40m	8h
8	58min	1h10m	1h40m	2h20m	3h55m	5h50m	8h30m

Note: Battery cabinet=U16-07C1

10000VA						
Load (# of battery cabinets)	9000W	7000W	5000W	3000W	2000W	1400W
2	5.5min	8min	14min	30min	55min	1h20m
3	12min	17min	26min	52min	1h30m	2h25m
4	18min	23min	40min	1h15m	1h50m	3h10m
5	21min	26min	45min	1h25m	2h14m	3h33m
6	24min	33min	52min	1h43m	2h48m	3h49m
7	26min	35min	55min	1h50m	2h50m	4h
8	35min	50min	1h10m	1h59m	2h55m	4h15m

Note: Battery cabinet=U16-07C1

16000VA / 20000VA *(Requires adding battery cabinets in pairs)*											
Load (# of battery cabinets)	18kW	14.4kW	13.5kW	10.8kW	9kW	7.2kW	5.4kW	4.5kW	3.6kW	3kW	1.8kW	1.5kW
2	< 5min	< 5min	< 5min	< 5min	5min	8min	13min	17min	25min	30min	1h	1h25m
4	5min	8min	9min	13min	16min	25min	38min	50min	1h	1h25m	2h30m	3h
6	10min	15min	16min	25min	30min	45min	1h	1h25m	1h48m	2h10m	4h	4h53m
8	17min	25min	27min	38min	50min	1h	1h36m	1h54m	2h30m	3h	5h40m	7h
10	25min	33min	38min	50min	1h	1h30m	2h	2h30m	3h10m	4h	7h17m	8h21m



Liebert® ITA™

Guide Specification

True On-line Double Conversion Parallelable UPS

■5kVA ■6kVA ■10kVA ■16kVA ■20kVA

1.0 GENERAL

1.1 SUMMARY

The uninterruptible power supply hereinafter referred to as the UPS can supply the load with high-quality AC power and continuous power supply for certain time after the utility failure. Besides excellent electrical performance, this series UPS can satisfy the Safety and EMC Standard, with intelligent monitor and network management functions. Its perfect structure and appearance, outstanding performance, high reliability and long service long make it an internationally state-of-the-art product in the late 90s.

Features

Compatible with two input modes: 3-phase and single-phase input mode, with automatic input recognition function

Capable of parallel connection to achieve up to 3+1 redundant power supply

High-frequency double conversion topology structure, with high input power factor, wide input voltage range, and output immune to grid interference, thus adaptable to areas with unstable mains supply

High power density

Full digital control technology based on digital signal processor (DSP) to achieve high system reliability with self-protection and fault diagnosis

Intelligent battery management to extend the battery life

Operation and display panel with both LCD and LED indication to help you learn about the system operation status and operating parameters

2U thick. Tower installation and rack installation are optional to meet different installation requirements

Capable of ECO mode, which saves energy to the maximum extent

Flexible network management with Emerson monitoring software

Fan fault self-inspection and automated diagnosing function

SNMP card optional, providing network communication function

Capable of connecting multiple battery strings, extending the power supply time of Battery mode

1.2 STANDARDS

The UPS is designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

IEC/EN61000-3-2, IEC/EN61000-3-12
IEC/EN61000-3-3, IEC/EN61000-3-11
IEC/EN 62040-2
IEC/EN 61000-4-2, Level 3 based on B
IEC/EN 61000-4-3, Level 3 based on A
IEC/EN 61000-4-4

IEC/EN 61000-4-5
IEC/EN 61000-4-6, Level 3 based on B
IEC/EN 61000-4-8, Level 4 based on A
IEC/EN 61000-4-11

1.3. SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS is designed to operate as a true on-line double conversion system in the following modes:

A. Normal - After installing the UPS, press and hold the ON/SILENCE key for over one second until a beep sound is heard. The UPS is started and then enters Normal mode or Battery mode.
When the mains input and output load are normal, the load is powered by the mains after processing of the inverter and the rectifier; meanwhile, the internal charger charges the battery. When the UPS is in Normal mode, the UTILITY indicator and INVERTER indicator are on.

B. Battery Mode - Upon mains failure, rectifier overload or mains voltage outside the specifications, the rectifier and internal charger will become inoperative, and the battery will power the load through the inverter. When the UPS is in Battery mode, the BATTERY indicator and INVERTER indicator are on, and the buzzer beeps every 3.3 seconds, notifying the user that the battery is powering the load.
Note:
1. In Battery mode, when the battery voltage is low, the buzzer beeps rapidly (once per second) and the corresponding measures must be done in time.
2. The battery had been fully charged before delivery. However, storage and transportation will inevitably cause some charge loss. Therefore, it is required to charge the battery for eight hours before putting the UPS into operation, so as to ensure adequate battery autonomy.

C. ECO Mode - In ECO mode, when the bypass voltage is 220Vac +/-10% and the frequency is within 50Hz +/-2Hz, the bypass AC source supplies the load and the bypass indicator is on. You can use the ECO mode to power through bypass those loads that are insensitive to power supply quality, so as to reduce the power loss.
When the bypass voltage is normal, and the inverter is in no-load state, the load is supplied by the bypass AC source and the BYPASS indicator is on.
Note:
1. In ECO mode, if the bypass fails or bypass voltage is abnormal when the output is NOT overloaded, the UPS will switch to the
Normal mode. However, if the bypass fails or bypass voltage is abnormal when the output IS overloaded, the UPS swill not switch to the Normal mode, but shut down the bypass.
2. In ECO mode, the efficiency of the UPS is up to 97%.

D. Fault State - Upon inverter failure or UPS over-temperature, the UPS will switch to Bypass mode when the UPS is in Normal mode, or shut down and stop the output when the UPS is in battery state. In UPS Fault state, the FAULT indicator will turn on, the buzzer will keep beeping and the corresponding indicator will blink.
Note:
In Fault state, if the bypass fails or bypass voltage is abnormal when the output is NOT overloaded, the UPS will shut down and be powered by the inverter, such as radiator over-hot. However, if the bypass fails or bypass voltage is abnormal when the output
IS overloaded, the UPS will not switch to the inverter, but shut down the bypass.

E. Bypass - Upon output overload or faults during the UPS operation, the UPS will switch to Bypass mode, the load is powered by the bypass AC source, which comes directly from the AC mains input; meanwhile, the internal charger charges the battery. When the UPS is In Bypass mode, the BYPASS indicator is on.
Note:
In the event of a mains failure or mains voltage outside the specifications (120Vac ~ 253Vac) when the UPS is in Bypass mode, the UPS will cease power for the load.

1.3.2 Design Requirements

A. Voltage: Input/output voltage specifications of the UPS are:

Input: Single-phase: 220Vac, 3-phase: 380Vac 50Hz +/-5Hz

Output: 220Vac +/-2%, 50Hz +/-5Hz, 50Hz +/-0.2Hz (On Battery)

B. Output Load Capacity:

Specified output load capacity of the UPS is:

5kVA/4.5kW or 6kVA/4.2kW (selectable on site)

C. Internal Battery: Valve regulated, non-spillable, flame retardant, lead acid cells.

D. Reserve Time: The UPS will have 5.5 minutes back up time at full load with ambient temperature of 25°C (77°F). External battery cabinets can be added to prolong back up time.

E. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. Recharge time for UPS internal batteries is three (3) hours maximum to 90% capacity after a complete discharge into full load.

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

A. Voltage Configuration: The UPS operates at these values without drawing power from the batteries: 176Vac ~ 276Vac at full load.

B. Frequency: UPS auto senses input frequency when first powered up and will operate within the following frequency specifications. UPS is capable of Cold Start with default frequency of 50 Hz/ 220 VAC. Input frequency range from 45-55 Hz.

C. Input Power Factor: Single Phase >0.99 lagging at rated load, >0.95 Three Phase.

D. Inrush Current (initial start up, no load): The UPS has a maximum inrush current of 6 times the full load peak input current.

E. Input Line Transient Immunity: UPS conforms to an input line transient conforming to EN61000-4-2.3.4.6.8.11 Level III EN61000-4-5 Level IV

F. Surge Protection: Meet installation requirements of IEC60664-1 IV. Be able to withstand at least 6KV/3KA 1/2/50uS+8/20uS

1.3.3.2 AC Output, UPS Inverter

A. Voltage Configuration:

UPS will run at 220Vac nominal input voltage.

B. Voltage Regulation: ± 3% steady state.

C. Frequency Regulation: ± 5% Synchronized to utility / mains. ± 0.2 Hz free running or on battery operation.

D. Frequency Slew Rate: 0.2 Hz/s (default), 1.0 Hertz per second maximum

E. Voltage Distortion: ≤3% total harmonic distortion (THD) typical into a 100% linear load, ≤5% THD typical into a 100% non-linear load with crest factor ratio of 3:1.

F. Load Power Factor Range: 0.9 lagging to 1.0 (unity).

G. Output Power Rating: 5kVA/4.5kW or 6kVA/4.2kW (selectable on site)

H. Inverter Overload Capability: 105% ~ 125% rated load for 1min, 125% ~ 150% rated load for 100ms

J. Transient Recovery Time: To nominal voltage within 60 milliseconds.

K. Efficiency: ≥ 91% AC–AC, minimum

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature:

Operating: 0° C to $+40^{O}$ C ($+ 32^{O}$ F to $+ 104^{O}$ F) for altitudes 0 to 1500 meters (0 to 5,000 ft.) above sea level.

0° C to $+30^{O}$ C ($+ 32^{O}$ F to $+ 95^{O}$ F) for altitudes 1500 to 3000 meters (5,000 to 10,000 ft.) above sea level.

25° C ($+ 77^{O}$ F) for optimum battery performance

Storage: -40° C ~ $+70^{O}$ C (battery excluded); -20° C ~ $+55^{O}$ C (battery included)

B. Relative Humidity: Operating: 5 to 95% non-condensing.

C. Altitude: < 1500m, derating in accordance with GB/T3859.2 when higher than 1500m

D. Audible Noise:

Noise generated by the UPS under normal operation does not exceed 51dBA when measured at 1 meter from the surface of the UPS.

1.5 USER DOCUMENTATION

The specified UPS system is supplied with one (1) user's manual. The User's Manuals include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures, and general maintenance guidelines.

1.6 WARRANTY

The UPS manufacturer warrants the UPS against defects in materials and workmanship for two (2) years. An optional one (1) and three (3) years full coverage extension warranty are available from Emerson/Liebert Corporation.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

A minimum of twenty year's experience in the design, manufacture, and testing of solid-state UPS systems is required. The manufacturer is certified to ISO 9001.

1.7.2 Factory Testing

Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification. These tests include operational discharge and recharge tests on the internal battery to assure performance.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS are new, of current manufacture, and have not been in prior service except as required during factory testing. All relays are provided with dust covers.

2.1.2 Wiring

Wiring practices, materials, and coding are in accordance with the requirements the standards listed in section 1.2 and other applicable codes and standards. All wiring is copper.

2.1.3 Cabinet

The UPS unit is comprised of: input converter, battery charger, inverter, and battery consisting of the appropriate number of sealed battery cells; and is housed in a rack - tower NEMA type 1 enclosure and meet the requirements of IP20. The UPS cabinet is cleaned, primed, and painted IBM Black. Dimensions and weights are:

MODEL	DIMENSIONS (W x D x H)	WEIGHT
5000/6000VA	430W X 660D X 88H (2U)	23KG

2.1.4 Cooling

The UPS is forced air cooled by an internally mounted, continuous fan. Fan power is provided from the internal DC supply. Air intake is through the front of the unit and exhausted out the rear of the unit.

2.2 COMPONENTS

2.2.1 Input Converter

2.2.1.1 General

Incoming AC power is converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter provides input power factor correction and input current distortion reduction.

2.2.1.2 AC Input Current Limit

The input converter is provided with AC input current limiting whereby the maximum input current is limited to 125% of the full load input current rating.

2.2.1.3 Input Protection

The UPS has built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy lightning surges, introduced on the primary AC source.

2.2.1.4 Battery Recharge

The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant current charged to restore capacity, and then shall be constant voltage charged to maintain the battery in a fully charged state. Recharge time for the internal UPS batteries shall be three (3) hours maximum to 90% capacity (full load discharge rate). There is DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the UPS will shutdown automatically and the critical load is transferred to bypass.

2.2.2 Inverter

2.2.2.1 General

The UPS inverter is a pulse-width-modulated (PWM) design capable of providing the specified AC output. The inverter converts DC power from the input converter output, or the battery, into precise sine wave AC power for supporting the critical AC load.

2.2.2.2 Overload

The inverter is capable of supplying current and voltage for overloads exceeding 100% and up to 150% of full load current. A visual indicator and audible alarm indicates overload operation. For greater currents or longer time duration, the inverter has electronic current-limiting protection to prevent damage to components. The inverter is self-protecting against any magnitude of connected output overload. Inverter control logic senses and disconnects the inverter from the critical AC load without the requirement to clear protective devices.

2.2.2.3 Inverter DC Protection

The inverter is protected by the following DC shutdown levels:

DC Overvoltage Shutdown

DC Undervoltage Shutdown (End of Discharge)

DC Undervoltage Warning (Low Battery Reserve)

2.2.2.4 Output Frequency

The inverter holds the output frequency to ± 0.2 Hz of nominal when not synchronized to the utility/mains source.

2.2.2.5 Output Protection

The UPS inverter employs electronic current limiting circuitry.

2.2.2.6 Battery Over Discharge Protection

To prevent battery damage from over discharging, the UPS control logic automatically raises the shutdown voltage set point; dependent upon output load at the onset of battery operation.

2.2.3 Display and Controls

2.2.3.1 General

The UPS is provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. The monitoring functions such as status and alarm indicators are displayed on an LED display.

2.2.3.2 System Indicators

The UPS contains a row of LED's to indicate UPS load and battery capacity and five single LED's to indicate UPS status as described below:

The "Fault" LED indicator illuminates red to indicate a UPS fault condition.

The "Battery" LED indicator illuminates green to indicate the UPS is operating from battery power.

The "Bypass" LED indicator illuminates green to indicate the UPS is operating on Bypass power.

An audible alarm is provided and activated by any of the above alarm conditions.

The "UPS ON" LED indicator illuminates green to indicate the UPS inverter is operating and supplying power.

The "UTILITY" LED indicator illuminates green to indicate the UPS is operating from utility / mains power.

2.2.3.3 Controls

UPS start-up and shutdown operations are accomplished by the "ON" and "OFF" push buttons located on the front panel of the UPS. The "ON" push button is a means to turn the UPS on and also serve as a means to manually test the battery and to reset active visual and audible alarms. The "OFF" push button allows manual transfers of the load from the inverter to bypass power. Pressing the "OFF" push button twice within a four second time period will completely shutdown the UPS and its connected load in normal and battery mode.

2.2.4 On-Line Battery Test

The UPS is provided with an automatic battery test feature.

The battery test will ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS will display a warning message to indicate the internal batteries need replaced. The battery test feature is user accessible by the push button located on the front of the unit and with Communications Software.

2.2.5 Bypass

2.2.5.1 General

A bypass circuit is provided as an integral part of the UPS. The bypass control logic contains an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarms conditions. This control circuit provides a transfer of the load to the bypass source if available, and if the inverter is capable of powering the load (i.e. overload condition, if your unit is in Manual Bypass Mode, or if the voltage and or frequency is out of tolerance).

2.2.5.2 Automatic Transfers

The transfer control logic automatically activates the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

UPS overload

UPS over temperature

PFC failure

Inverter failure

DC Bus Overvoltage

Once overload condition is reduced, the load is automatically transferred back to inverter power.

2.2.6 Internal Battery

Valve regulated, non-spillable, flame-retardant lead acid cells are used as a stored-energy source for the specified UPS system. The battery is housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 25 ^{O} C (77 ^{O} F) for a minimum of 5.5 minutes reserve time. The expected life of the battery shall be 3 - 5 years or a minimum 250 complete discharge cycles. The UPS units have the capability to allow the operator to replace the internal battery.

2.2.7. Output Distribution

Output distribution is integral to the UPS, however, this UPS requires hardwire installation.

2.2.8 Communication Options

2.2.8.1 USB Interface Port

The UPS shall have (1) USB Interface Port. The USB connector shall be a 4P Male connector. The USB interface port shall always be active. The UPS shall be capable of communicating system status and system shutdown via the USB.. USB port shall be capable of communicating via UPS Shutdown software, which is provided.

2.2.8.2 Intellislot™ Communications

The UPS includes one Intellislot communication port to allow the operator to field-install optional communication cards. Intellislot cards may be installed during any state of UPS operation (On, Standby, or Off states). Available Intellislot options are described below.

SNMP Card
The option delivers SNMP and Web management to the UPS when connected to any 10 or 100 Mbit Ethernet network. The card supports 10 and 100 Mbit Ethernet and provides for in-the-field upgrade of SNMP firmware. The kit includes the Intellislot card, MIB, configuration cable and installation manual. Once the card is installed, the serial communications is disabled in the DB9F connector; however the photo-coupler signals (on battery, and low battery) will remain active.

Dry contact Card
This option provides contact closures for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS.

Liebert® GXT4

Intelligent, Reliable UPS Solution

■700VA - 3kVA

Increases in data center density require reliable and high performance power systems for maximum availability. In the area of critical power, organization require a dynamic power solution that gives the flexibility while lowering total cost of ownership.

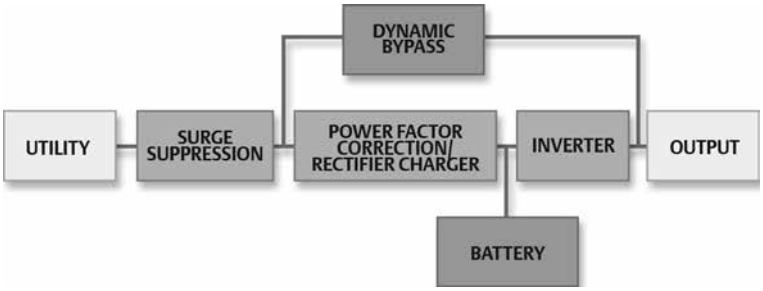
Introducing the Liebert® GXT4™, a true on-line UPS that delivers continuous, high-quality AC power to connected equipment with no interruption when transferring to battery. It protects equipment from virtually all power disturbances caused by blackouts, brownouts, sags, surges or noise interference.

For robust UPS protection up to 3kVA, the Liebert GXT4 UPS provides industry leading features in a compact design:

- Active Eco-Mode delivers best-in-class efficiency of up to 97% without compromising availability
- Two Programmable Outlets: can be programmed for load shedding and sequential restart if the UPS is in overload or when selected backup time remains
- User replaceable, hot-swappable batteries
- On-line design means zero transfer time. When utility power fails, your critical load remains supported by a seamless flow of power
- Array of value added accessories bundled with standard unit
- Automatic Frequency Sensing: the UPS automatically adjusts to the input frequency, 50Hz or 60Hz
- Mounting Flexibility: rack rails and tower supports included
- Intelligent Communications: DCIM and BMS ready



On-line and Double Conversion UPS for Best in Protection



The Proven Reliability Of True On-Line Power With The Features You Need Most

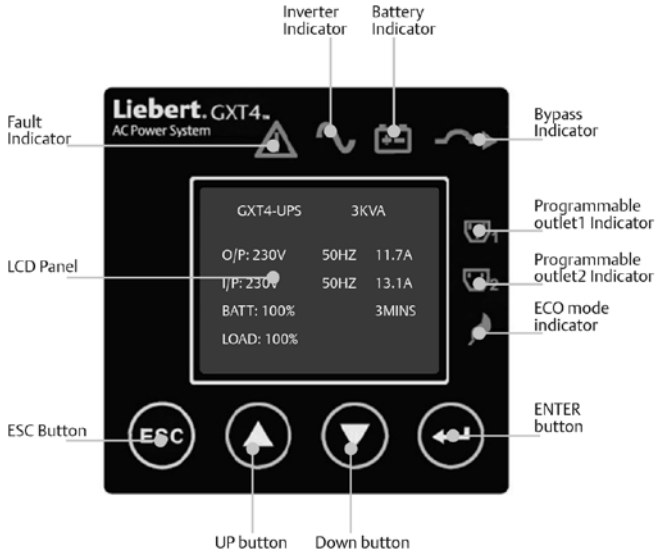
The Liebert® GXT4™ provides maximum resiliency & power protection so businesses can easily adapt to changing capacity demands.

Liebert® GXT4™ UPS includes:

- Power factor correction
- Internal batteries
- Frequency conversion
- Internal automatic bypass for protection against adverse conditions
- Manual bypass capability
- Support for up to six external battery cabinets

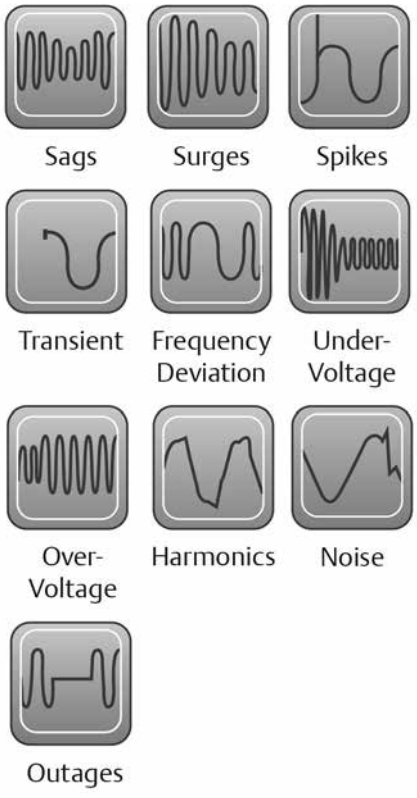
The Liebert® GXT4™ UPS requires just a slim 2U of rack space, but provides the capabilities often found only in larger systems. Get up to 3kVA of capacity and battery backup. External battery cabinets may be added for extended run time

Intuitive and Intelligent Operation



Liebert® GXT4™ UPS is a true on-line power source, which means power is always being conditioned and supplied to the connected device(s), whatever the quality of power coming in, a pure sinewave output results to ensure equipment is protected

The Protection You Need from Damaging Power Problems



- **Intuitive LCD Screen** - easy-to-follow menu structure for UPS configuration and control.
- **Optimized UPS Monitoring and Control** - up to 6-lines of texts providing more UPS details in just one single view.
- **UPS Programming On-Demand** - no need to run configuration programs to adjust UPS parameters. LCD screen allows for straight-forward UPS programming eliminating the need for a laptop on-site.
- **Efficient UPS Troubleshooting** - LCD screen shows up the exact UPS fault or operation status which helps user respond quickly to assess and clear fault.

High Availability:

- **Advance Early Warning of UPS System Status** - multiple audible and visual alarms immediately alert you to critical issues
- **3-11 minutes of Battery Backup Time at Full load** - provides ample time for an orderly shutdown. Optional matching external battery cabinets offer additional backup time
- **Periodic Battery Testing** - provides automatic and manual self-diagnostic battery testing for peace of mind to indicate if the battery is healthy
- **Replaceable Hot Swappable Batteries** - easy to replace batteries to protect your investment by extending the product life
- **Power-Factor Correction** - prevents noise, harmonics and distortion from being passed on to connected loads or from being fed back to the utility
- **Intelligent Battery Charging** - includes efficient three-stage charging technique and comprehensive discharging protection that extends battery life
- **Input Circuit Breaker** Provides increased protection to ease recovery from overloads
- **Lightning and Surge Protection** - the transient voltage surge suppression (TVSS) circuitry inside Liebert GXT4 UPS provides additional protection for the connected equipment

Low Total Cost Of Ownership:

- **High Output Power** - Liebert GXT4 UPS rated output power factor of up to 0.9 better matches switch-mode power supplies used in today's IT equipment, providing more efficient utilization of the UPS
- **Active Eco Mode** - connected equipment can be powered though the bypass while the inverter remains idle, reducing electricity consumption while raising efficiency up to 97% without compromise
- **Wide Input Voltage Window** - prolongs battery life by allowing the UPS to maximize the use of utility power before transferring to battery when input voltage exceeds specified limits
- **Intelligent Fan Operation** - automatically changes rotation speed depending on system requirements to decrease power consumption and noise
- **Arrays of Accessories with Standard Model** - extended amount of accessories bundled with standard model such as rail kit, IS-webcard, etc. saves capital expenses

Multiple Choices For Communication, Shutdown And Reporting

SNMP And Web-Based Communication Options

Liebert IntelliSlot Web Card provides SNMP (including SNMPv3), IPv.6 and web-based management to your Liebert GXT4 UPS. It provides the ability to monitor and control your UPS from your network management system or any PC running Microsoft Internet Explorer.

- Sends both SNMP traps and emails for event notification and automatically emails a daily UPS history
- Auto-senses 10M/100M Ethernet

The Liebert GXT4 UPS is also fully compatible with:

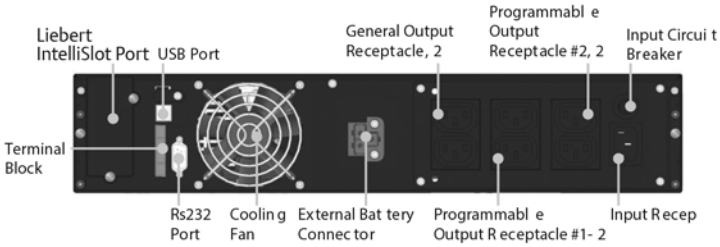
- Liebert Multilink™ shutdown software (included with the Liebert GXT4 UPS)
- Liebert Nform™ monitoring software
- Liebert Multiport multiplexing unit
- Liebert Intelli Relay Interface Card
- Liebert SiteScan™
- Trellis™ Platform
- USB Communications

Optional Liebert MicroPOD Output Distribution and Maintenance Bypass Module

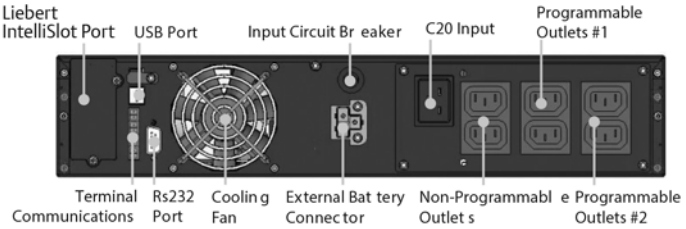
When your computer system can't be without power, even for scheduled UPS maintenance, the Liebert MicroPOD Maintenance Bypass and Output Distribution Unit ensures continuous uptime. It allows you to manually transfer connected equipment to utility power via a maintenance bypass switch, permitting scheduled service or UPS replacement without the need to shut down connected equipment. Features include:

- 2U height minimizes rack space requirements
- Easy plug-and-play installation

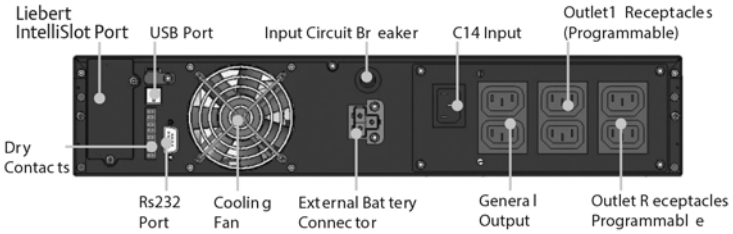
Rear View 700VA-1000VA



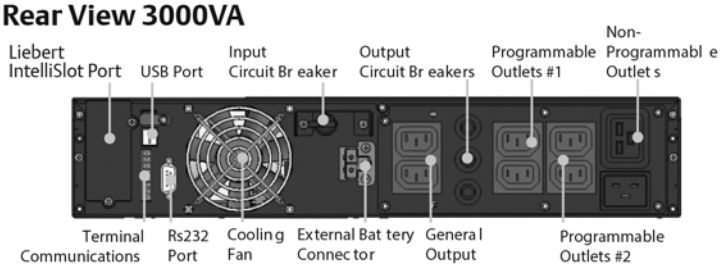
Rear View 2000VA



Rear View 1500VA



Rear View 3000VA



While today's smaller, rack-based UPS system offer relatively trouble-free operation, the growing criticality of the systems they support has increased the cost of downtime. As a result, the need to maintain these smaller UPS systems is increasingly important.

- **Extended Warranty**
  Choose additional of 1-yr or 3-yr warranty on top of the 2-yr standard warranty for worry free maintenance and total peace of mind.

- **Start-up**
  On-site system start up by a certified Emerson Network Power Customer Engineer assures confidence that the equipment is up and running at optimum performance

- **Preventive maintenance**
  Regular visits by an Emerson Network Power Customer Engineer guarantees higher reliability and availability

- **On-site service**
  Should you experience a problem, we will dispatch a certified Emerson Network Power Customer Engineer to repair or replace your equipment. Response guaranteed.

Battery Runtime Chart

External Battery Specification

Model Number	GXT4-48VBATT GXT4-48VBATTE	GXT4-72VBATT GXT4-72VBATTE
Used with UPS Model	GXT4-700RT230,GXT1000RT230 GEXT-1500RT230, GXT4-2000RT230	GXT4-3000RT230
Dimensions: H x W x D, mm(in)		
Unit (with bezel)	85(2U) x 430 x 497.7 (3.3 x 16.9 x 19.7)	85 (2U) x 430 x 602 (3.3 x 16.9 x 23.6)
Weight: kg (lb)		
Unit	32 (70.5)	42 (92.6)
Battery Parameters		
Type	Valve-regulated, non-spillable, lead acid	
Quantity x V	2 x 4 x 12V x 9.0Ah	2 x 6 x 12V x 9.0Ah
Environmental		
Operating Temp, °C (°F)	0 to 40 (32 to 104)	
Storage Temp, °C (°F)	-15 to 50 (5 to 122)	
Relative Humidity	0-95% non-condensing	
Operating Elevation	Up to 3000m (10,000 ft.) at 40°C (104°F) 15000m (50,000 ft.) maximum	
Agency		
Safety	IEC/EN/AS 62040-1:2008, GS mark	
Transportation	FCC PART 15, Class A=CISPR22 Class A	
Safety	IEC62040-2 2nd Ed.:2006	
Transportation	ISTA Procedure 1E	

Internal Battery

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	105	91	112	81	91
20	62	38	51	37	39
30	37	31	34	23	23
40	32	23	23	16	16
50	27	17	18	12	12
60	22	14	14	9	9
70	18	11	11	7	7
80	15	9	9	5	5
90	13	8	7	4	4
100	11	6	6	3	3

- The times above are approximate. They are based on new, fully charged standard batteries at a temperature of 25°C with 100% resistive UPS loading. The listed run times can vary by ±5% because of manufacturing variances of the batteries.

Internal Battery +1 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	427	334	330	222	302
20	303	166	160	137	139
30	164	138	128	94	95
40	145	108	97	66	66
50	126	92	72	49	48
60	106	72	54	39	41
70	94	56	46	34	34
80	78	48	38	28	27
90	69	40	34	23	23
100	61	37	31	20	21

Internal Battery +2 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	408	457	447	426	431
20	434	333	315	201	205
30	329	224	186	149	150
40	273	166	151	124	124
50	203	151	131	97	97
60	164	135	107	75	76
70	153	113	92	61	63
80	142	103	74	50	50
90	131	92	64	41	45
100	121	78	53	38	41

Internal Battery +3 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	480	480	467	451	455
20	461	442	424	322	325
30	439	337	311	195	196
40	345	305	199	154	155
50	323	208	160	136	136
60	300	166	146	111	112
70	213	155	131	96	98
80	189	144	111	78	79
90	163	132	99	68	70
100	156	122	83	56	60

Internal Battery +4 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	480	480	480	466	408
20	480	460	444	421	423
30	458	436	340	306	307
40	442	340	309	192	192
50	425	315	205	157	157
60	336	218	165	142	143
70	319	195	153	127	128
80	301	165	141	107	109
90	213	156	130	95	97
100	197	147	112	80	81

Internal Battery +5 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	480	480	480	480	480
20	480	467	457	438	440
30	465	447	431	331	332
40	452	428	333	224	225
50	438	341	307	189	189
60	425	320	208	158	159
70	344	227	167	146	147
80	329	208	158	133	135
90	315	189	148	120	122
100	301	164	139	104	106

Internal Battery +6 External Battery Cabinet

Load (%)	700VA	1kVA	1.5kVA	2kVA	3kVA
10	480	480	480	480	480
20	480	480	466	450	452
30	480	458	444	420	421
40	462	442	422	319	319
50	451	426	328	217	217
60	440	341	305	186	187
70	428	323	209	159	160
80	368	306	184	148	150
90	336	217	161	137	139
100	325	201	153	126	128

Technical Specifications

Parameters	GXT4-700RT230*	GXT4-1000RT230*	GXT4-1500RT230*	GXT4-2000RT230*	GXT4-3000RT230*
Rating	**700VA/630W**	**1000VA/900W**	**1500VA/1350W**	**2000VA/1800W**	**3000VA/2700W**
Input AC					
Voltage Range (typical)	230VAC nominal; variable based on output load				
Frequency Range	40Hz ~ 70Hz; Auto Sensing				
Input Power Receptacle	C14			C20	
Mechanical Parameters					
Dimensions: H x W x D mm (in)	85 (2U) x 430 x 408 (3.4 x 16.9 x 16.2)		85 (2U) x 430 x 497 (3.3 x 16.9 x 19.6)		85 (2U) x 430 x 602 (3.3 x 16.9 x 23.7)
Weight: kg (lb)	18.2 (40)		23.2 (51.1)	25.5 (56.1)	32.4 (71.4)
Output AC					
Voltage	200/208/220/230/240VAC (user configurable); ±3%				
Frequency	50Hz or 60Hz				
Waveform	Pure Sinewave				
Mains (AC) Mode Overload	The inverter shall be capable of supplying current and voltage for overloads exceeding 100%, and 105-130% for 1 minute, 131-150% 10 seconds, 151-200% for 1 seconds, and up to >200% for 5 cycles of full load current.				
Charger Current, Amperes	1.3		1.88	2.71	2.5
Output Receptacles	C13 x 6				C13 x 6; C19 x 1
Environment Parameters					
Operating Temp	0°C to +40°C (+32°F to 104°F)				
Storage Temp	-15°C to +50°C (5°F to 122°F)				
Operating Elevation	Up to 3000m (10,000 ft.) at 25°C (77°F) without derating				
Audible Noise	< 46 dBA at 1 meter(3.2ft) from the rear; < 43 dBA, at 1 meter (3.2 ft) from the front or side		< 45 dBA at 1 meter (3.2ft) from the front; < 46 dBA at 1 meter (3.2ft) rear	< 48 dBA at 1 meter (3.2ft) from the front; < 48 dBA at 1 meter (3.2ft) rear	
Battery					
Type	Valve-regulated, non-spillable, lead acid				
Qty x V x Rating	4 x 12V x 5.0Ah		4 x 12V x 9.0Ah		6 x 12 x 9.0Ah
Recharge Time	3 hours to 90% capacity after full discharge with 100% load till UPS auto-shutdown(Internal Batteries Only)		4 hours	3 hours	
Agency					
Safety	IEC/EN/AS 62040-1:2008, GS MARK				
RFI/EMI	IEC/EN/AS 62040-2 2nd Ed. (Category C2) = CISPR22 Class A				
Surge Immunity	IEC/EN 62040-2 2nd Ed (IEC/EN 61000-4-5)				

- * Standard model includes the Rail kit for UPS and battery models
- * * Specifications are subject to change without any prior notification

Liebert® GXT4™ 500-3000VA Rack-Tower

Gude Specification

1.0 GENERAL

1.1 SUMMARY

This specification shall define the electrical and mechanical characteristics and requirements for a continuous-duty, single-phase, solid-state uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS shall be designed in accordance with applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

120 and 208V Nominal Units

- Listed to UL Standard 1778, 4th Edition; and c-UL Listed
- CSA 22.2 No. 107.1
- ANSI C62.41, Category A, Level 3
- IEC 61000-3-2
- EN62040-2
- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5
- EN61000-4-6
- FCC Part 15, Class A
- ISTA Procedure 1A/1E
- RoHS2 (6 by 6) Compliant
- REACH and WEEE Compliant

230 Volt Nominal Units

- EN 62040-1:2008
- TUV/GS and CE compliance mark
- EN50091-1-1
- EN50091-2, Class A
- EN50082-1
- EN62040-2, 2nd Ed, Category C2
- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5
- EN61000-4-6
- EN61000-3-2
- ISTA Procedure 1A/1E
- RoHS2 (6 by 6) Compliant
- REACH and WEEE Compliant
- Listed to UL Standard 1778, 4th Edition; and c-UL Listed (700, 1000, and 3000VA models only)

1.3 SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS shall be designed to operate as a true on-line double-conversion system in the following modes:

A. Normal - In normal operation incoming AC power shall be fed to the input power factor corrected (PFC) rectifier that converts the AC power to DC power for the inverter. In this mode, power shall also be derived from utility power for the battery charger. The inverter shall derive DC power from the PFC rectifier to regenerate filtered and regulated AC sinewave power for the connected load. The unit shall begin charging the battery once the UPS is connected to utility power, regardless of whether the UPS is ON or OFF. In the event of a utility outage or severe abnormality (sag or swell), the inverter shall support the connected load from battery power until the battery is discharged or the utility power returns, whichever occurs first.

B. Battery - Upon failure of utility / mains AC power, the critical AC load shall be supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility / mains AC source.

C. Recharge - Upon restoration of utility / mains AC power, after a utility / mains AC power outage, the input converter shall automatically restart and resume supplying power to the inverter and the battery charger to recharge the battery.

D. Automatic Restart - Upon restoration of utility / mains AC power, after a utility / mains AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load and the battery charger automatically recharges the battery. This feature shall be capable of being disabled by the user.

E. Bypass - The integral bypass shall perform an automatic transfer of the critical AC load from the inverter to the bypass source, in the event of an overload, PFC failure, internal over temperature, DC bus overvoltage or inverter failure conditions.

F. ECO – The UPS shall allow the user to enable and place the UPS in ECO mode of operation to reduce electrical consumption. The ECO mode operation shall be an Active type, whereas the UPS will power the connected equipment through the bypass path and the UPS inverter shall be on and operating at no load in order to stay synchronized to the bypass to ensure rapid transfers to inverter power when input power falls outside of the user customizable parameters. The UPS shall also have a user customizable requalification time that input power must remain within the ECO mode parameters before transferring back to ECO operation. This is to minimize the number of transfers between bypass and inverter.

1.3.2 Design Requirements

A. Voltage

Input/output voltage specifications of the UPS shall be:

Input

- **120V units**: 0 - 140VAC, 50/60Hz, single-phase, 2-wire-plus-ground.
- **208V units**: 0 - 280VAC, 50/60Hz, single-phase, 2-wire-plus-ground.
- **230V units**: 0 - 280VAC, 50/60Hz, single-phase, 2-wire-plus-earth.

Output

- **120V units**: 120VAC (user configurable: 110V, 115V, 120V, 127V) ±3%, 50/60Hz, single-phase, 2-wire-plus-ground.
- **208V units**: 208VAC (user configurable: 208V, 220V, 230V, 240V) ±3%, 50/60Hz, single-phase, 2-wire-plus-ground.
- **230V units**: 230VAC (user configurable: 220V, 230V, 240V) ±3%, 50/60Hz, single-phase, 2-wire-plus-earth.

B. Output Load Capacity

Specified output load capacity of the UPS shall be:

- 500VA/450 Watts at 0.9 lagging power factor.

- 700VA/630 Watts at 0.9 lagging power factor.
- 1000VA/900 Watts at 0.9 lagging power factor.
- 1500VA/1350 Watts at 0.9 lagging power factor.
- 2000VA/1800 Watts at 0.9 lagging power factor.
- 3000VA/2700 Watts at 0.9 lagging power factor.

C. Internal Battery

The UPS shall utilize valve-regulated, non-spillable, lead acid cells.

D. Reserve Time

- **500VA**: 17 minutes
- **700VA**: 11 minutes (120V or 230V)
- **1000VA**: 7 minutes (120V); 3 minutes (230V)
- **1500VA**: 6 minutes (120V or 230V)
- **2000VA**: 3 minutes (120V or 230V)
- **3000VA**: 3 minutes (120V or 208V or 230V)

These times shall be at full load with ambient temperature of 77°F (25°C) with resistive loading.

E. Battery Recharge

The UPS shall contain a three-stage battery charger designed to prolong battery life. Recharge time for UPS internal batteries shall be 5 hours (for 500, 700, 1000, 2000, and 3000VA models) and 6 hours (for 1500VA models) to 90% capacity after a complete discharge with full load connected.

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

A. Voltage Configuration: The UPS shall incorporate a variable input voltage window feature that shall operate at the values in the following table, without drawing power from the batteries.

Load Level	500-1000 VA 120 VAC Input Voltage	1500-3000 VA 120 VAC Input Voltage	3000 VA 208 VAC Input Voltage	700-2000 VA 230 VAC Input Voltage	3000 VA 230 VAC Input Voltage
100%	90 VAC	102 VAC	177 VAC	177 VAC	196 VAC
90%	86 VAC	96 VAC	168 VAC	168 VAC	184 VAC
80%	81 VAC	90 VAC	159 VAC	159 VAC	173 VAC
70%	77 VAC	84 VAC	150 VAC	150 VAC	161 VAC
60%	73 VAC	78 VAC	142 VAC	142 VAC	150 VAC
50%	69 VAC	72 VAC	133 VAC	133 VAC	138 VAC
40%	64 VAC	66 VAC	124 VAC	124 VAC	127 VAC
30%	60 VAC	60 VAC	115 VAC	115 VAC	115 VAC

G. Frequency: UPS shall auto-sense input frequency when first powered up and shall operate within the following frequency specifications. UPS shall be capable of cold start with default frequency of 60Hz (120VAC and 208VAC units) and 50Hz (230VAC units). Once started the frequency operating window shall be 40-70Hz.

Three frequency settings shall be available in the Liebert GXT4 Configuration program: Auto frequency sensing (factory default setting), 50Hz frequency conversion and 60Hz frequency conversion.

H. Input Power Factor: >0.99 lagging at rated load.

I. Input Current reflected distortion: 5% THD typical.

J. Input Current Ratings

UPS Model #	120VAC Units	230VAC Units	208VAC Units
500RT	4.2A	N/A	N/A
700RT	5.8A	2.9A	N/A
1000RT	8.3A	3.9A	N/A
1500RT	12A	5.9A	N/A
2000RT	16A	7.8A	N/A
3000RT	24A	11.7A	N/A
3000RT208	N/A	N/A	12.9A

K. Inrush Current (initial startup, no load): The UPS shall have a maximum inrush current of 6 times the full load peak input current.

L. Input Line Transient Immunity: UPS shall conform to an input line transient conforming to IEEE C62.41, Category A, Level 3 tests for 120VAC and 208VAC models. The 230VAC models shall meet EN61000-4-5.

M. Surge Protection

- **120VAC units**: MOV ratings shall be 175V, 80 Joules minimum connected L-N.
- **208VAC units**: MOV ratings shall be 320V, 80 Joules minimum connected L1-L2, L1-G and L2-G.
- **230VAC units**: MOV ratings shall be 320V, 80 Joules minimum connected L-N.

1.3.3.2 AC Output, UPS Inverter

A. Voltage Configuration

- **120V units**: 120VAC, 50/60Hz, single-phase, 2-wire-plus-ground, configuration program selectable (110V, 115V, 120V, 127V).
- **208V units**: 208VAC, 50/60Hz, single-phase, 2-wire-plus-ground, configuration program selectable (208V, 220V, 230V, 240V).
- **230V units**: 230VAC, 50/60Hz, single-phase, 2-wire-plus-earth, configuration program selectable (220V, 230V, 240V).

N. Voltage Regulation

± 3% steady state.

O. Frequency Regulation

±5% synchronized to utility / mains. ±0.1Hz free running or on-battery operation.

P. Frequency Slew Rate

1.0Hz per second maximum

Q. Voltage Distortion

<3% total harmonic distortion (THD) typical into a 100% linear load, <5% THD typical into a 100% non-linear load with crest factor ratio of 3:1.

R. Load Power Factor Range

The load power factor range shall be 0.65 lagging to 1.0 (unity) without power derating.

S. Output Power Rating

Output power rating shall be 500VA/450 Watts, 700VA/630 Watts, 1000VA/900 Watts, 1500VA/1350 Watts, 2000VA/1800 Watts and 3000VA/2700 Watts at 0.9 lagging power factor.

T. Inverter Overload Capability

	500VA - 2000VA	3000VA
120V / 208V	105% to 125% - 60 seconds 125% to 150% - 50 seconds 150% to 200% - 2 seconds >200% - 250ms	105% to 125% - 15 seconds 125% to 150% - 10 seconds 150% to 200% - 2 seconds >200% - 250ms
230V	105% to 125% - 60 seconds 125% to 150% - 50 seconds 150% to 200% - 2 seconds >200% - 250ms	105% to 125% - 55 seconds 125% to 150% - 55 seconds 150% to 200% - 2 seconds >200% - 250ms

U. Voltage Transient Response

- ±7% in line mode 0-100-0 % loading of the UPS
- ±7% in battery mode for 0-100-0% loading of the UPS rating.

V. Transient Recovery Time

To nominal voltage within 90 milliseconds.

W. AC-AC Efficiency:

The 700VA-3000VA 120V; 3000VA 208V; and 700-3000VA 230V UPS models shall be EPA ENERGY STAR qualified and labeled

- **500RT120**: 88% AC –AC at full rated linear load
- **700RT120**: 89% AC –AC at full rated linear load
- **1000RT120**: 88% AC –AC at full rated linear load
- **1500RT120**: 89% AC –AC at full rated linear load

- **2000RT120**: 89% AC –AC at full rated linear load
- **3000RT120**: 89% AC –AC at full rated linear load

- **3000RT208**: 90% AC –AC at full rated linear load

- **700RT230**: 89% AC –AC at full rated linear load
- **1000RT230**: 89% AC –AC at full rated linear load
- **1500RT230**: 90% AC –AC at full rated linear load
- **2000RT230**: 91% AC –AC at full rated linear load
- **3000RT230**: 90% AC –AC at full rated linear load

X. Programmable & Controllable Outlets:

The UPS units shall have 2 groups of programmable and controllable outlets. These shall be user customizable to program to perform load shedding based upon battery capacity remaining, time on battery operation, battery time remaining, and overload condition when on battery power. The user shall also be able to program these groups for sequential restart of connected equipment based upon time after input power is restored. The user can also program these to always be turned off to prevent unauthorized equipment from being plugged into the UPS.

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: The ambient temperature range, when UPS is operational, shall be from 32°F to 77°F (0°C to 25°C). There shall not be any degradation in the performance when operating in this range. Automatic derating shall occur for operation in higher ambient temperatures based on the following table.

Ambient Temperature	78-86°F ±5°F (26-30°C ±3°C)	87-95°F ±5°F (31-35°C ±3°C)	96-104°F ±5°F (36-40°C ±3°C)
Max Output Power Factor degradation @ max load	100%-93%	92%-86%	85%-79%

Storage: 5°F to 122°F (-15°C to 50°C)

Y. Relative Humidity

Operating: 0 to 95% non-condensing.

Storage: 0 to 95% non-condensing.

Z. Altitude

10,000 ft. (3,000m) max., without power derating when operated within the temperature specified in Section 1.4, Item A. Ambient temperature shall be derated 9°F (5°C) for each additional 1600 ft. (500m) above 10,000 ft. (3,000m).

AA. Audible Noise

The audible noise of the UPS shall be:

- **500/700/1000VA**: <43dBA max @ 1 meter from front, sides, and rear
- **1500VA**: <45dBA max @ 1 meter from front and sides, <46dBA max @ 1 meter from rear
- **2000VA - 3000VA**: <48dBA max @ 1 meter from front sides, and rear

AB. Electrostatic Discharge

The UPS shall be able to withstand an electrostatic discharge compliant to ENC61000-4-2.

1.5 USER DOCUMENTATION

The specified UPS system shall be supplied with a Safety Instruction & Warning Sheet. The specified UPS system shall be supplied with quick start guides for ease of installation and UPS start up. Each UPS will also contain a full user manual located on the included CD. The user manual shall include installation instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-

step operating procedures and general maintenance guidelines. The included CD will shall also include a configuration program to allow user customization of UPS operating parameters and also UPS monitoring and computer/server shutdown software.

1.6 WARRANTY

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for two (2) years. The no-hassle replacement warranty shall include shipping costs to the customer site for the new replacement unit and shipping costs from the customer site for the return of the failed unit. Optional one (1) and three (3) year full coverage extension warranties shall be available from the manufacturer. The manufacturer's standard and extended warranties shall cover all parts, including the battery.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

More than 40 years' experience in the design, manufacture, and testing of solid-state UPS systems shall be required. The manufacturer shall be certified to ISO 9001:2008.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to ensure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS shall be new, of current manufacture and shall not have been in prior service except as required during factory testing. All relays shall be provided with dust covers.

2.1.1 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements the standards listed in Section 1.2 and other applicable codes and standards. All wiring shall be copper.

2.1.2 Cabinet

The UPS unit shall be composed of: input PFC converter, IGBT inverter, battery charger, input filter and internal bypass circuit; and batteries consisting of the appropriate number of sealed battery cells; and shall be housed in a rack-tower NEMA type 1 enclosure and shall meet the requirements of IP20. The UPS cabinet shall be cleaned, primed and painted RAL 7021 Black.

Unit dimensions and weights shall be (*rack mount orientation*):

Model	Dimensions W x D x H, in. (mm)	Weight lb. (kg)
500RT	16.9 x 16.2 x 3.4 (430 x 408 x 85)	40.0 (18.2)
700RT	16.9 x 16.2 x 3.4 (430 x 408 x 85)	40.0 (18.2)
1000RT	16.9 x 16.2 x 3.4 (430 x 408 x 85)	40.0 (18.2)
1500RT	16.9 x 19.7 x 3.4 (430 x 497 x 85)	54.6 (24.8)
2000RT	16.9 x 19.7 x 3.4 (430 x 497 x 85)	56.1 (25.5)
3000RT	16.9 x 23.7 x 3.4 (430 x 602 x 85)	71.4 (32.4)

2.1.3 Cooling

The UPS shall be forced-air cooled by an internally mounted, continuously operating fan. Fan power shall be provided from the internal DC supply. Air intake shall be through the front of the unit and exhausted out the rear of the unit.

2.2 COMPONENTS

2.2.1 Input Converter

2.2.1.1 General

Incoming AC power shall be converted to a regulated DC output by the input converter supplying DC power to the inverter. The input converter shall provide input power factor correction (PFC) and input current distortion reduction.

2.2.1.2 AC Input Current Limit

The input converter shall be provided with AC input current limiting whereby the maximum input current is limited to 125% of the full load input current rating.

2.2.1.3 Input Protection

The UPS shall have built-in protection against under voltage, over current and overvoltage conditions including low-energy lightning surges, introduced on the primary AC source. The 120 and 208VAC models shall be able to sustain input surges without damage per criteria listed in ANSI C62.41, Category A, Level 3. The 230VAC UPS shall be able to sustain input surges without damage per criteria listed in EN61000-4-5. The 120V, 208V and 230V models shall have resettable circuit breakers.

2.2.1.4 Battery Recharge

The UPS shall contain a three-stage battery charger designed to prolong battery life. Recharge time for the internal UPS batteries shall be 5 hours (500/700/1000/2000/3000VA models) and 6 hours (1500VA models) maximum to 90% capacity (full load discharge rate). There shall be DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the UPS will shut down automatically and the critical load will be transferred to bypass.

2.2.2 Inverter

2.2.2.1 General

The UPS inverter shall be a pulse-width-modulated (PWM) design capable of providing the specified AC output. The inverter shall convert DC power from the input converter output or the battery into precise sinewave AC power for supporting the critical AC load.

2.2.2.2 Overload

The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective devices.

2.2.2.3 Inverter DC Protection

The inverter shall be protected by the following DC shutdown levels:

- DC Overvoltage Shutdown
- DC Under voltage Shutdown (End of Discharge)
- DC Under voltage Warning (Low Battery Reserve); factory default set at 2 minutes (user configurable 2 to 30 minutes).

2.2.2.4 Output Frequency
An oscillator shall control the output frequency of the UPS. The inverter shall maintain the output frequency to ±0.1Hz of nominal frequency during Battery mode, Frequency Converter mode or when otherwise not synchronized to the utility/mains source.

2.2.2.5 Output Protection
The UPS inverter shall employ electronic current limiting circuitry.

2.2.2.6 Battery Over Discharge Protection
To prevent battery damage from over discharging, the UPS control logic shall automatically raise the shutdown voltage set point; depending on output load and connected battery system at the onset of battery operation.

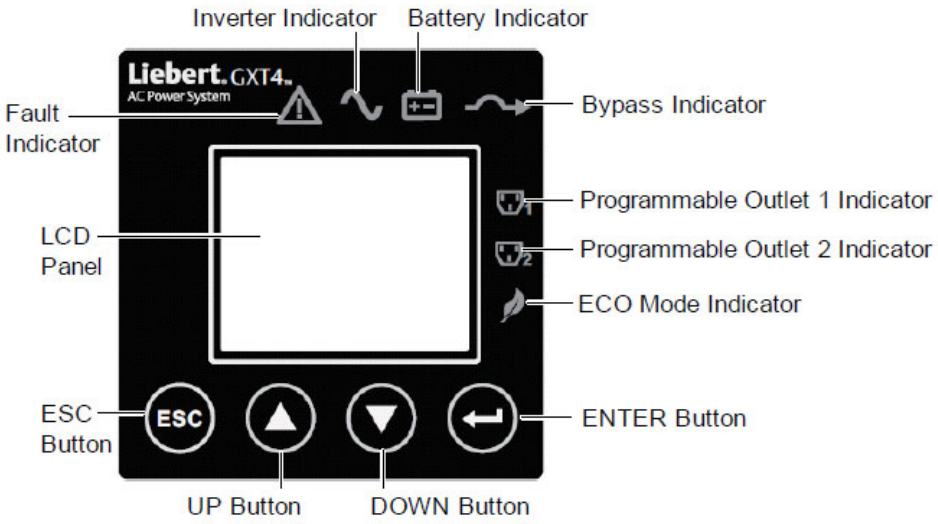
2.2.3 Display and Controls

2.2.3.1 General
The UPS shall be provided with a microprocessor-based unit status display and controls section designed for convenient and reliable user operation. The monitoring functions such as voltages, currents, UPS status and alarm indicators shall be displayed on an LCD display.

2.2.3.2 System Indicators
UPS display shall also include LED based system indicators. The system level indicators shall be: fault indicator, battery indicator, inverter indicator, bypass indicator, ECO mode indicator, and indicators for the two controllable outlet groups.

- **Fault Indicator**: 1 Red LED shall illuminate if the UPS has detected a fault; and shall be Off if there is no internal fault
- **Inverter Indicator**: 1 Green LED shall illuminate when the inverter is supplying power; and shall be Off when the inverter is not supplying power
- **Battery Indicator:** 1 Amber LED shall illuminate when the battery is supplying power; and shall be Off when the battery is not supplying power
- **Bypass Indicator**: 1 Amber LED shall illuminate when the bypass is supplying power; shall be Off when the inverter is not supplying power; and shall flash when utility power is outside bypass operating specifications
- **Programmable Outlet 1 Indicator**: 1 Green LED shall illuminate when the programmable outlet is supplying power and shall be Off when the outlet is not supplying power
- **Programmable Outlet 2 Indicator**: 1 Green LED shall illuminate when the programmable outlet is supplying power and shall be Off when the outlet is not supplying power
- **ECO Mode Indicator**: 1 Green LED shall illuminate when the UPS is operating in active ECO mode operation and shall be Off when the UPS is operating in the normal double conversion mode of operation

2.2.3.3 Controls
UPS startup and shutdown operations shall be accomplished by using push buttons on the front panel of the UPS. The display shall be menu driven navigation and use four control buttons for ease of navigation and selection of the configurable parameters.



2.2.3.3.1 Control Buttons

The UPS display control button functionality shall be as follows:

ESC button: This button shall return to the previous menu or abort any change before confirming the change

UP arrow button: This button shall move the cursor up or increase the value displayed when changing parameters. This button shall also be used to scroll up for navigating the screens

DOWN arrow button: This button shall move the cursor down or decrease the value displayed when changing parameters. This button shall also be used to scroll down for navigating the screens

ENTER button: This button shall enter the next level menu or confirm the parameter changes

2.2.3.3.2 Display Menu Structure

The UPS display shall have the following menu structure with the following status and configuration screens

2.2.3.3.2.1 System Status (Default screen)

The system status screen shall be the default screen to display the input voltage, frequency, and amperage; output voltage, frequency, and amperage; battery capacity and estimated battery time remaining; loading percentage. To prolong display life, the UPS LCD display shall go into “sleep” mode after two minutes of no user interaction. Pressing the ENTER shall wake up the display and this action shall not perform any operation.

2.2.3.3.2.2 Main Menu

The main menu shall list the submenu selections:

UPS Status Screens
Configuration Settings Screens
Control Settings Screens
Event Log
About
Network

2.2.3.3.2.3 UPS Status

The UPS status screens shall provide the following information:

Output

Voltage

Frequency

Amperage

Power (KWH)

Load

Capacity

Wattage

Volt-Amperes

Input

Voltage

Frequency

Amperage

Power (KWH)

Battery

Capacity

Runtime (minutes)

Voltage

Time Since Startup

Days / Hours / Minutes

2.2.3.3.2.4 Configuration

The UPS Configuration screens shall provide the following customizable parameters: (default values are listed first)

UPS

Audible Alarm (ON/OFF)

Startup on Bypass (NO/YES)

Guarantee Shutdown (YES/NO)

Enable Auto Restart (YES/NO)

Output Frequency Selection (Auto bypass Enable/Auto bypass disable/50Hz no bypass/60Hz no bypass)

Output Voltage Selection (110/115/120/127V for 120V models); (200/220/230/240V for 208 and 230V models)

Battery

External Battery Cabinets (0/1/2/3/4/5/6)

Low Battery Warning (2 to 30 minutes in 1 minute increments)

Battery Test Interval (8, 12, 16, 20, 26 weeks, Disable)

Battery Replacement Reminder (Year/Month/Day)

ECO Mode

ECO Mode (OFF/ON)

Voltage Tolerance (±10%, ±5%,±15%)

Frequency Tolerance (±3Hz, ±2Hz,±1Hz)

Requalification Time (5min, 15min, 30min)

Outlet Group 1

The programmable outlet group 1 screens shall provide the following customizable parameters: (default values are listed first)

Outlet Control

Turn OFF

Reboot

Turn ON (if was turned off)

Outlet Settings

Turn ON Delay (0-30 minutes)

Turn OFF on battery when output is overloaded (OFF/ON)

Turn OFF when on battery power (0-30 minutes)

Turn OFF when on battery time remaining (3, settable 0-30 minutes)

Turn OFF when on battery capacity (20-80 %)

Turn ON when on input power returns (0-30 minutes)

Outlet Group 2

The programmable outlet group 2 screens shall provide the following customizable parameters: (default values are listed first). There shall be a quick way to program group 2 the same as group 1 (NO/YES) or group 2 shall be capable of having different settings from group 1

Outlet Control

Turn OFF

Reboot

Turn ON (if was turned off)

Outlet Settings

Turn ON Delay (0-30 minutes)

Turn OFF on battery when output is overloaded (OFF/ON)

Turn OFF when on battery power (0-30 minutes)

Turn OFF when on battery time remaining (3, settable 0-30 minutes)

Turn OFF when on battery capacity (20-80 %)

Turn ON when on input power returns (0-30 minutes)

LCD Settings

Language, English (one other that is programmable using the included CD and configuration program)

Color (background color), Blue, Black, Red, Pink

Factory Settings

The factory settings screens shall provide a NO/YES selection to reset the UPS back to all factory setting

2.2.3.3.2.5 Control Settings

The UPS shall have the following controls from the display:

UPS ON/OFF

Turn UPS ON

Turn UPS OFF

Turn ON Bypass (manually transfer to bypass power)

Audible Alarm

Turn audible alarm ON (test alarm)

Turn audible alarm OFF (alarm silence)

Battery Test

Start manual battery test

Cancel manual battery test

View last battery test results

2.2.3.3.2.6 Event Log

The UPS shall be have an event log to record 255 events and shall be viewable from the display:

View Log

Navigate the event log to view the last 255 events.

Clear Log

User shall be able to clear the event log

The event log once full will begin to replace the first event logged to provide a FIFO process for maintaining event history. The event history shall record and display the number of events out of the 255 (xxx/255) as well as the time (days, hours, mins) from when viewing the event and the event that occurred.

2.2.3.3.2.7 About

The UPS shall be have an about screen to display the UPS model number, serial number, hardware version, and firmware version

2.2.3.3.2.8 Network

The UPS shall be have the ability to display the network information of the SNMP web card when installed. Information available shall be MAC address and IP address

2.2.3.4 Automatic Battery Test

The UPS shall feature an automatic battery test with the factory default test interval set at every eight weeks. The battery test shall ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS shall display a warning message to indicate the internal batteries need replaced. The battery test feature shall be user accessible by the push button on the front of the unit and with communication software. The Automatic Battery test feature shall be capable of being disabled or configured to operate every 8, 12, 16, 20, 26 weeks through the UPS Configuration Program or from the LCD display.

2.3 BYPASS

2.3.1 General

A bypass circuit shall be provided as an integral part of the UPS. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarms conditions. This control circuit shall provide a transfer of the load to the bypass source if available and if the inverter is capable of powering the load (i.e., if there is an overload condition, if the unit is in Manual Bypass mode or if the voltage or frequency is out of tolerance).

2.3.2 Automatic Transfers

The transfer control logic shall activate the bypass automatically, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

- UPS overload
- UPS over temperature
- PFC failure
- Inverter failure
- DC bus overvoltage

Once the overload condition is reduced, the load shall be automatically transferred back to inverter power.

2.4 INTERNAL BATTERY

Valve-regulated, non-spillable, lead acid cells (VRLA) shall be used as a stored-energy source for the specified UPS system. The battery shall be housed internal to the UPS cabinet and sized to support the inverter at rated load and power factor, with ambient temperature of 25°C (77°F) for a minimum of 3 minutes reserve time. The expected life of the battery shall be 3-5 years or a minimum 260 complete discharge cycles. The UPS units have the capability to allow the operator to replace the internal battery.

All UPS models shall allow connection of up to six external battery cabinets to provide extended run time capability. External battery cabinets shall match the UPS in aesthetics and color.

2.5 OUTPUT DISTRIBUTION

Output distribution shall be integral to the UPS and located on the rear of the unit. There shall be 2 groups of the identified outlets listed below that are programmable and controllable as defined in this specification

Model	120VAC Units	230VAC Units	208VAC Units
500RT	(6) NEMA 5-15R	N/A	N/A
700RT	(6) NEMA 5-15R	(6) EN60320/C13	N/A
1000RT	(6) NEMA 5-15R	(6) EN60320/C13	N/A
1000MT	(6) NEMA 5-15R	N/A	N/A
1500RT	(6) NEMA 5-15R	(6) EN60320/C13	N/A
2000RT	(6) 5-15/20R (T-Slot)	(6) EN60320/03	N/A
3000RT	(6) 5-15/20R (T-Slot) (1) NEMA L5-30R	(6) EN60320/03 (1) EN60320/09	(2) NEMA L6-15R (1) NEMA L6-20

2.6 COMMUNICATION OPTIONS

2.6.2.1 Liebert IntelliSlot® Communication

The UPS shall include one Liebert IntelliSlot communication port to allow the operator to field-install an optional Liebert IntelliSlot communication card. A Liebert IntelliSlot card may be installed during any state of UPS operation (On, Standby or Off states). Available Liebert IntelliSlot options are described below.

Liebert Intellislot Web Card (IS-WEBCARD)

The optional Liebert IntelliSlot Web Card shall deliver SNMP and Web management to the UPS when connected to any 10 or 100 Mbit Ethernet network. The card shall support 10 and 100 Mbit Ethernet and shall provide for in-the-field upgrade of SNMP firmware. The kit shall include the Liebert IntelliSlot card, MIB, configuration cable and user manual.

Liebert IntelliSlot Relay Interface Card (IS-RELAY)

The optional Liebert IntelliSlot Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS. The contacts shall be rated for 24VAC or 24VDC at 1A. Connections shall be to a terminal block connector with cable provided by the end user.

Liebert IntelliSlot Multiport Card (IS-MULTIPORT)

The optional Liebert IntelliSlot Multiport Card shall provide 4 sets of contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery and Low Battery for connection to up to 4 servers/computers for use with Liebert MultiLink Shutdown software. The contacts shall be rated for 24VAC or 24VDC at 1A. Connections shall be to a terminal block connector with cable provided by the end user.

2.6.2.2 Terminal Block Connections

The UPS shall contain on the rear panel a terminal block to provide low voltage signals for On Battery, Low Battery, Any Mode Shutdown and Battery Mode Shutdown

Any-Mode Shutdown

The purpose of Any-Mode Shutdown shall be to shut down the UPS output by turning Off the rectifier, inverter and bypass so that there is no power to the loads.

Any-Mode Shutdown can be operated locally and remotely, as described as follows:

- Local Any-Mode Shutdown can be performed by shorting Pin 1 and Pin 2
- Remote Any-Mode Shutdown can be performed by a switch connected to Pin 1 and Pin 2 and mounted at a remote location.

Remote Power Off shall be performed either by NO or NC contact of Any-Mode Shutdown, depending on the settings in the configuration program.

A current-limited source (+12VDC, 50mA) shall be available from the UPS.

The connection to the UPS for remote connection shall be via terminal block connector.

Any-Mode Shutdown wiring shall conform to all national, regional and local wiring regulations.

Battery Mode Shutdown

Battery Mode Shutdown shall permit shutting down the UPS by turning Off the rectifier, inverter and bypass so that there is no power to the load when the UPS is On Battery. Battery Mode Shutdown can be performed locally or remotely:

- Local Any-Mode Shutdown can be performed by shorting Pin 3 and Pin 4.
- Remote Any-Mode Shutdown can be achieved by a switch connected to Pin 3 and Pin 4 and mounted at a remote location.

On Battery

On Battery signal shall be a Normally Open (NO) dry contact. When the UPS is supplying output power from the battery this dry contact shall be closed.

Low Battery

Low Battery signal shall be a Normally Open (NO) dry contact. When the UPS is supplying output power from the battery and has reached the Low Battery Warning time selected in the configuration program, this dry contact shall be closed.

The rated values for the dry contacts shall be:

- Rated Voltage: 5V
- Working Voltage Range: 4.5-10V
- Rated Current: 30mA

2.6.2.3 USB Port

The USB port shall allow connection to a computer to use with Liebert MultiLink® shutdown software and for use with the UPS configuration program. The USB port shall be HID1 compliant and shall work with the Power Management system in Microsoft® Windows® XP or later, Linux and Mac OS X®.

2.6.2.4 Serial Port

A serial port shall be made available with a DB9F connector on the rear of the UPS. This connector shall communicate using Emerson proprietary protocol for use with Liebert MultiLink shutdown software. This port will provide more data points for use with MultiLink that is not part of the USB HID1 protocol

2.7 LIEBERT GXT4 CONFIGURATION PROGRAM

An included Microsoft Windows-based (Windows XP or later) Configuration Program and cable shall allow configuration of UPS features and operating parameters to meet specific application requirements, if required. Options that are configurable via this program shall include:

- Select one of five input/output voltages to match voltages found around the world.
- Enable / Disable Auto-Restart.
- Disable the Line-Neutral-Reversal/Missing-Ground receptacle wiring alarm.
- Select frequency converter operation with a fixed output frequency of 50 or 60Hz.
- Set the Low Battery Warning alarm time from 2 to 30 minutes.
- Disable the Auto-Battery test.
- Set the Auto-Battery test to 8, 12, 16, 20, 26 weeks or Disable the test.
- Select the number of external battery cabinets connected to the UPS to adjust the remaining run-time calculations reported by the UPS Liebert software products.
- Program the outlet groups individually
- Configure the unit for ECO mode operation
- Change the LCD display language

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Liebert® GXT4™

Intelligent, Reliable UPS Solution

■5kVA - 10kVA



Best Protection for Critical Network Applications

Today's converged networks require increased availability and reliability. IT professionals require higher density power protection systems that adapt to mixed load voltages and plug types, while remaining easy to install and maintain.

The Emerson Solution

The Liebert® GXT4™ UPS meets the need for higher power capacities in small spaces.

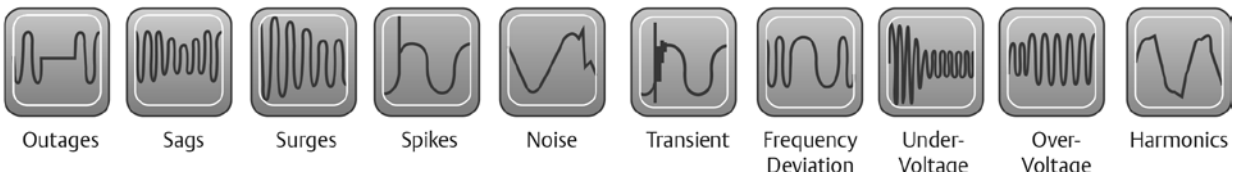
Energy Efficient Design	• High Efficiency up to 97% • ENERGY STAR Certified • Reduces OPEX
Flexible Configurations and Design	• Multiple Battery and Distribution Options • Parallelable up to 3 units *(for 10kva model only)*
Intuitive, Intelligent Operation	• Intuitive Color LCD Interface • Multiple Configuration Options. • Standard Web Cards.
Designed Easy Service and Warranty	• Hot -swappable Battery Configuration • Emerson Network Power Service Provides Ultimate Peace of Mind
Flexible Monitoring & Management Options	• Monitoring and Shutdown Software Adds Flexibility to Each Installation

The Liebert® GXT4™, a true on-line double conversion UPS system is available in larger capacity models of 5kVA - 10kVA, and features an integrated maintenance bypass, as well as optional extended battery runtime. Plus, Emerson Network Power Services provides maximum protection of your UPS. The Liebert GXT4 UPS is designed for use in either rack or tower configurations.

220V, 230V and 240V 50/60 Hz models are offered with CE and C-tick markings.

Always Protected!
Pure Sinewave

The protection you need against damaging power problems

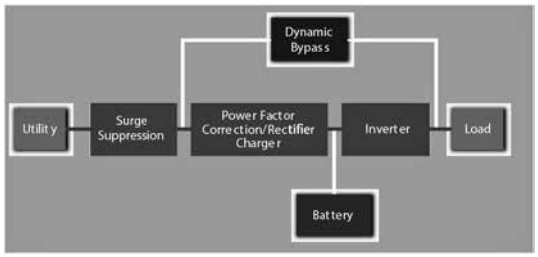


Energy Efficient Design

- **Active Eco-Mode** keeps the rectifier and inverter operating, allowing the inverter to remain synchronized to bypass.

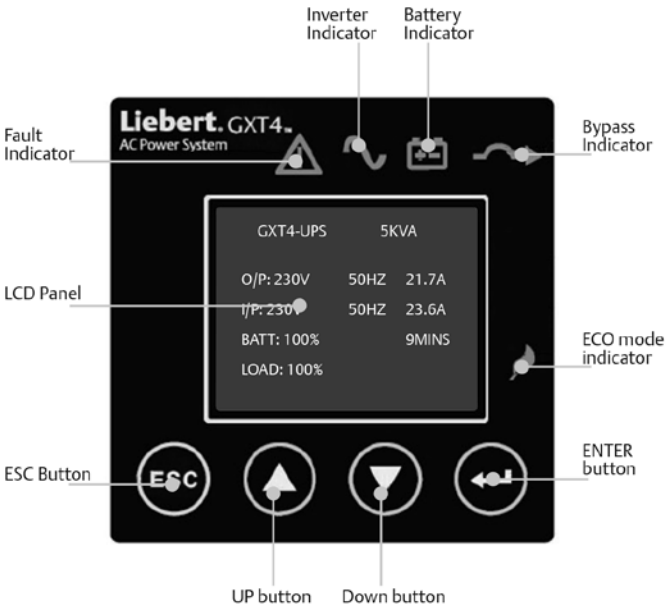
  This synchronization allows the transfer of the connected equipment to UPS inverter power almost seamlessly if bypass power falls outside the user-set limits.

  Once bypass power returns within the acceptable parameters, the UPS will return to Active Eco-Mode operation
  Active Eco mode provides best in class efficiency up to 97% without compromise.



- **ENERGY STAR certified UPS models** UPS products meeting the EPA's requirements use an average of 35% less energy than their standards counterparts.

Intuitive and intelligent Operation



Flexible Configuration

- **Wider input Voltage Window** - features a wide input voltage window that allows the UPS to support the critical load without having to transfer to battery, extending battery life for when it is truly needed
- **Rack/Tower Configuration** - the versatile unit installs in either configuration and includes a rotating color LCD display.
- **Replaceable Hot-Swappable Internal Batteries** - provide 4-9 minutes of runtime at full load depending on the model.
- **Additional Runtime with Additional Battery Cabinets** - up to 6 external battery cabinets. UPS cabinet includes rear panel plug-and-play connections for optional battery cabinets. 5kVA and 6kVA: 3U, 10kVA: 4U
- **Internal Automatic And Manual Bypass** - assures continuity of power to critical loads during system maintenance or in case of internal fault.
- **Automatic Frequency Detection** - detects and matches line input frequencies of either 60 or 50 Hz and can also be programmed to convert from one to the other.
- **Self-Diagnostics** - automatically tests unit electronics and batteries. Designed to simplify maintenance and troubleshooting.
- **Intuitive LCD Screen** - easy-to-follow menu structure for UPS configuration and control.
- **Optimized UPS Monitoring and Control** - up to 6-lines of texts providing more UPS details in just one single view.
- **UPS Programming On-Demand** - no need to run configuration programs to adjust UPS parameters. LCD screen allows for straight-forward UPS programming eliminating the need for a laptop on-site.
- **Efficient UPS Troubleshooting** - LCD screen shows up the exact UPS fault or operation status which helps user respond quickly to assess and clear fault.

5 and 6kVA Models Offer True On-Line Power In A Convenient Rack Configuration

The Liebert GXT4 is a true on-line, high power density UPS system, which provides clean power ideal for business-critical applications where battery backup power is needed to protect network closets or small data centers against costly downtimes.

Maintenance Bypass Included

The UPS arrives with a power distribution pack installed. This box always contains the UPS input circuit breaker. Hard-wired/receptacle boxes that include a manual bypass switch allow AC power to continue to flow from the mains input to the load while the box is removed from the UPS.

Power distribution specifications		
Model Number	**PD2-CE6HDWR-RMBS**	**PD2-CE10H-DWRMBS**
Amp Rating	32 Amps	63A
Input Power Connection	Single-phase (L-N-G) hardwire, 6-10mm (8-10AWG)	
Output Power Connection	Single-phase (L-N-G) hardwire, 6-10mm (8-10AWG)	
Includes(Manual Bypass Switch With Indicator Lamps)	Two IEC 320 C19 16A/250V Sockets Six C13 10A/250V Sockets	Four IEC 320 C19 16A/250V Sockets Four C13 10A/250V Sockets
Input Branch Circuit Breaker Supplied by User	32A	63A

Removable Maintenance Bypass and Power Distribution Box



For 5/6kVa

For 10kVA

10kVA Model Provide Even More Power

The Liebert® GXT4™ 10kVA units offer a flexible solution for protecting rackmount equipment, including VoIP and PoE. Specifically designed for use with the new generation of high power switches and blade servers, this compact UPS delivers up to 9kW of power in just 6U height. Increasing protection and availability to mission-critical loads, the 10kVA model offers up to 3 units of parallel redundancy.

The UPS includes built-in user replaceable batteries that can deliver upto 4 minutes at full load runtime and optional external battery cabinets to provide maximum flexibility in adding battery runtimes.

The standard 10kVA model also includes an integrated power distribution box (POD) which comes with input and output circuit breakers, terminal blocks for input and output hardwired connections, 4 x IEC-C19 output receptacles for blade servers or high-end networking switches; 4 x IEC C13 receptacles for typical 1U or 2U servers and manual maintenance bypass breaker for service or maintenance works - all in a single removable box.

Hot - Swappable Operation

Liebert GXT4 UPS 10kVA units feature three bays for one power modules and two battery modules. The chassis contains a bypass switch that allows all modules to be removed without powering down the connected load.

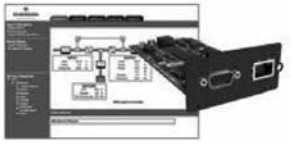


Flexible Monitoring & Management Options

Liebert GXT4 UPS offers a variety of communication options to provide the monitoring and control capabilities demanded by today's network computing systems.

Operations can be monitored using:

- Libert IntelliSlot® Web Card - provides SNMP (including SNMPv3) and IPv.6 and web based management of your UPS
- Built-in USB communications for use with Liebert Multilink™ Automated System Shutdown Software
- Liebert Nform™ Monitoring Software
- Liebert Universal Monitor and Remote Power Monitor Panels
- Liebert SiteScan®
- Trellis™ Platform
- Third-Party Monitoring Systems
- Built-in contact closure signals. Provides dry contact communications to remotely monitor UPS operating modes



Designed Easy Service and Warranty

While today's smaller, rack-based UPS systems offer relatively trouble-free operation, the growing criticality of the systems they support has increased the cost of downtime. As a result, the need to maintain these smaller UPS systems is increasingly important.

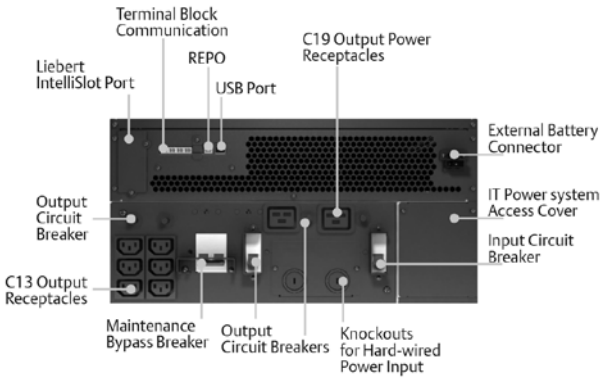
- **Extended Warranty**
  Choose additional of 1-yr or 3-yr warranty on top of the 2-yr standard warranty for worry free maintenance and total peace of mind.

- **Start-up**
  On-site system start-up by a certified Emerson Network Power Customer Engineer to assure confidence that the equipment is up and running at optimum performance

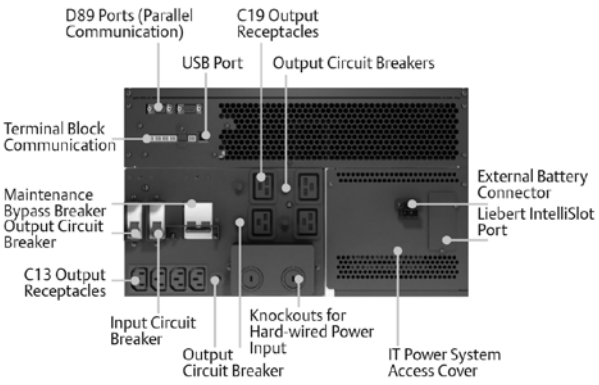
- **Preventive maintenance**
  Regular visits by an Emerson Network Power Customer Engineer for higher reliability and availability

- **On-site service**
  Should you experience a problem, we will dispatch a certified Emerson Network Power Customer Engineer to repair or replace, your equipment. Response guaranteed.

Rear View 5-6kVA



Rear View 10kVA



Battery Runtime Chart

External Battery Specification

Model Number	GXT4-240VBATT
Used with UPS Model	GXT4-5000RT230; GXT-6000RT230; GXT4-10000RT230
Dimensions: H x W x D, mm(in)	
Unit (with bezel)	173(4U) x 430 x 581 (6.8 x 16.9 x 22.9)
Weight: kg (lb)	
Unit	65 (143.3)
Battery Parameters	
Type	Valve-regulated, non-spillable, lead acid
Quantity x V	1 x 20 x 12V
Operating Temp, °C (°F)	0 to 40 (32 to 104)
Storage Temp, °C (°F)	-15 to 50 (5 to 122)
Relative Humidity	0-95% non-condensing
Operating Elevation	Up to 1000m (3280.83 ft.) at 25°C (77°F)
Agency	
Safety	IEC62040-1:2008 version
Transportation	ISTA Procedure 1E

10	105	97	98
20	52	47	42
30	40	33	25
40	27	22	17
50	21	17	12
60	17	14	9
70	14	11	7
80	12	9	6
90	10	8	5
100	9	6	4

- *The times above are approximate. They are based on new, fully charged standard batteries at a temperature of 25°C with 100% resistive UPS loading. The listed run times can vary by ±5% because of manufacturing variances of the batteries.*

Internal Battery +1 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	211	194	165
20	140	122	99
30	102	83	53
40	76	62	42
50	53	48	31
60	48	42	25
70	43	35	20
80	38	28	17
90	32	25	14
100	27	22	12

Internal Battery +2 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	427	341	311
20	220	185	144
30	154	140	99
40	130	108	68
50	105	91	49
60	91	72	42
70	74	53	35
80	64	49	28
90	51	45	25
100	48	41	21

Internal Battery +3 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	441	429	344
20	326	303	166
30	204	167	133
40	160	146	99
50	143	126	74
60	126	105	53
70	107	92	48
80	97	76	42
90	81	66	42
100	73	53	31

Internal Battery +4 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	480	463	436
20	428	338	213
30	312	227	153
40	209	166	127
50	164	150	99
60	151	134	77
70	138	113	64
80	124	103	51
90	108	92	47
100	100	78	42

Internal Battery +5 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	480	464	449
20	436	422	312
30	339	318	166
40	304	208	144
50	203	165	123
60	166	153	100
70	155	140	80
80	145	127	69
90	134	110	53
100	123	101	49

Internal Battery +6 External Battery Cabinet

Load (%)	5kVA	6kVA	10kVA
10	480	480	459
20	457	445	330
30	428	339	202
40	327	304	157
50	285	206	138
60	207	165	120
70	167	154	100
80	158	143	81
90	149	133	72
100	140	122	63

* Battery run time measured in minutes

Technical Specifications

Parameters	GXT4-5000RT230	GXT4-6000RT230	GXT4-10000RT230
Rating	**5000VA/4000W**	**6000VA/4800W**	**10000VA/9000W**
Mechanical Parameters			
Dimensions: H x W x D mm (in)	217 (5U) x 430 x 574 (8.5 x 16.9 x 22.4)		261 (6U) x 430 x 581 (10.3 x 16.9 x 22.9)
Weight: kg (lb)	60 (132.2)		70 (154.3)
Input AC			
Nominal Operating Frequency	50 or 60Hz (Factory Default is 50Hz)		
User-Configurable	200/208/220/230/240VAC		
Operating Voltage Range	176 - 280VAC		
Input Frequency Operation	40-70Hz		
Output AC			
Frequency	50HZ or 60Hz, Nominal		
VAC(Factory Default)	230VAC		
Waveform	Sinewave		
Main Mode Overload	>200% for 5 cycles; 151-200% for 1 seconds; 121-150% 10seconds;105-130% 1 minute		
Environment Parameters			
Operating Temp	0°C to +40°C (+32°F to 104°F)		
Storage Temp	-15°C to +50°C (5°F to 122°F)		
Operating Elevation	Up to 1000m (3281 ft.) at 25°C (77°F) without derating		
Audible Noise	Less than 55 dBA at 1 meter from the rear <50 dBA, at 1 meter from the front or sides		
Relative Humidity	0% to 95%, non-condensing		
Battery			
Type	Valve-regulated, non-spillable, lead acid		
Qty x V x Rating	20 x 12V		
Recharge Time	3 hours to 90% capacity after full discharge into 100% load		
Agency			
Safety	IEC62040-1:2008 version, GS mark		
EMI/EMC/C-Tick EMC	IEC 62040-2 2nd Ed		
ESD	IEC/EN EN61000-4-2, Level 4, Criteria A		
Radiated Susceptibility	IEC/EN EN61000-4-2, Level 3, Criteria A		
Electrical Fast Transient	IEC/EN EN61000-4-2, Level 2, Criteria A		
Surge Immunity	IEC/EN EN61000-4-2, Level 1, Criteria A		
Transportation	ISTA Procedure 1E		

Liebert® GXT4™
5000-10000VA RT230 Rack-Tower models
Guide Specification

1.0 GENERAL

1.1 SUMMARY
This specification shall define the electrical and mechanical characteristics and requirements for a continuous-duty, single-phase, solid-state uninterruptible power system (UPS). The UPS shall provide high-quality mains power for sensitive, electronic equipment loads. The UPS is not designed to support large inductive or half-wave rectified loads, for example: motors, compressors, vacuum pumps, electric drills, laser printers and hair dryers.

1.2 STANDARDS
The UPS shall be designed in accordance with applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

230 Volt Nominal Units

- EN 62040-1:2008
- TUV/GS and CE compliance mark and Australia C-tick (C√) mark
- EN50091-1-1
- EN50091-2, Class A
- EN50082-1
- EN62040-2, 2nd Ed, Category C2
- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5
- EN61000-4-6
- EN61000-3-2
- RoHS2 (6 by 6) Compliant
- REACH and WEEE Compliant
- ISTA Procedure 1A/1E

1.3 SYSTEM DESCRIPTION

1.3.1 Modes of Operation
The UPS shall be designed to operate in the following modes:

A. Normal - In normal operation incoming AC power shall be fed to the input power factor corrected (PFC) rectifier that converts the AC power to DC power for the inverter. In this mode, power shall also be derived from utility power for the battery charger. The inverter shall derive DC power from the PFC rectifier to regenerate filtered and regulated AC sinewave power for the connected load. The battery shall be charged once the unit is connected to utility power, regardless of whether the UPS is ON or OFF. In the event of a utility outage or severe abnormality (sag or swell), the inverter shall support the connected load from battery power until the battery is discharged or the utility returns, whichever occurs first.

B. Battery - Upon failure of utility / mains AC power, the critical AC load shall be supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility / mains AC source.

C. Recharge - Upon restoration of utility / mains AC power, after a utility / mains AC power outage, the input converter shall automatically restart and assume supplying power to the inverter and the battery charger to recharge the battery.

D. Internal Bypass - The integral bypass shall perform an automatic transfer of the critical AC load from the inverter to the bypass source, in the event of an overload, PFC failure, internal over temperature, DC bus overvoltage or inverter failure conditions.

E. Maintenance Bypass - Maintenance Bypass mode shall provide an alternate path for utility power to the connected load during UPS maintenance or UPS component replacement.

F. Automatic Restart - Upon restoration of utility / mains AC power, after a utility / mains AC power outage and complete battery discharge, the UPS shall automatically restart and assume supplying power to the critical load and the battery charger automatically recharges the battery. This feature shall be capable of being disabled by the user.

G. ECO – The UPS shall allow the user to enable and place the UPS in ECO mode of operation to reduce electrical consumption. The ECO mode operation shall be an Active type, whereas the UPS will power the connected equipment through the bypass path and the UPS inverter shall be on and operating at no load in order to stay synchronized to the bypass to ensure rapid transfers to inverter power when input power falls outside of the user customizable parameters. The UPS shall also have a user customizable requalification time that input power must remain within the ECO mode parameters before transferring back to ECO operation. This is to minimize the number of transfers between bypass and inverter.

1.3.2 Design Requirements

A. Voltage: Nominal mains/output voltage specifications of the UPS at rated load shall be:

Mains

The UPS shall operate from 230V, 50Hz without the use of selector switches or voltage taps. Mains wiring must be 2-wire (L, N) plus earth ground.

Output

Output voltage is present at terminals L and N. The output voltage shall be automatically set to match mains voltage upon initial startup. The UPS shall be configurable using the included configuration program to provide the following alternate voltages:

220V or 240V, all voltages ±3% at 50Hz.

(If the UPS is started on battery with no mains power present, the default output voltage shall be 230V, 50Hz from the factory. After the UPS has been started from mains, the output voltage/ frequency shall match the last known mains voltage/frequency that was applied.)

B. Output Load Capacity: Specified output load capacity of the UPS shall be:

UPS Model #	VA	Watts
GXT4-10000RT230	10000	9000

C. Internal Battery: Valve-regulated, non-spillable, lead acid cells.

A. Battery Reserve Time:

- **5000VA**: 9 minutes
- **6000VA**: 6 minutes
- **10000VA**: 4 minutes

These times shall be at full load with ambient temperature of 77°F (25°C) with resistive loading.

D. Battery Recharge: The UPS shall contain a three-stage battery charger designed to prolong battery life. Recharge time for UPS internal batteries shall be 5 hours maximum to 90% capacity after a complete discharge into full load.

1.3.3 Performance Requirements

1.3.3.1 Mains to UPS

A. Voltage: The point at which the UPS transfers to battery operation shall be dependent on the amount of load that the UPS is supporting. The following range defines where the UPS will transfer to battery and where it returns to operating from mains:

Low Line Voltage Range

Low Line Voltage		GXT4-10000RT230
100% to 91%	L/L Transfer	176 ± 5.0VAC
	L/L Comeback	188 ± 5.0VAC
90% to 71%	L/L Transfer	159 ± 5.0VAC
	L/L Comeback	171 ± 5.0VAC
70% to 31%	L/L Transfer	139 ± 5.0VAC
	L/L Comeback	151 ± 5.0VAC
30% to 0%	L/L Transfer	100 ± 5.0VAC
	L/L Comeback	112 ± 5.0VAC

High Line Voltage Range

High Line Voltage	230V Models
High Line Transfer	280 ± 5.0VAC
High Line Comeback	268 ± 5.0VAC

B. Frequency: The UPS shall auto-sense mains frequency of 50Hz or 60Hz when first powered up and shall use this frequency as the default output frequency. Once started the mains frequency operating window shall be 40-70Hz without going to batteries. The UPS shall be capable of cold start with a default output frequency of 50Hz.

C. Input Power Factor: >0.99 lagging at rated load.

D. Input Current reflected distortion: 5% THD maximum at rated load.

E. Input Current Ratings:

UPS Model #	VA	Watt	Total Amps
GXT4-10000RT230	10000	9000	39 Amps

F. Surge Protection: The UPS shall utilize metal oxide varistors (MOVs) rated at 385VAC(rms) @ 320 Joules.

G. Electrical Specifications:

UPS Model #	Recommended (Maximum) External Overcurrent Protection	Recommended Wire (Including ground wire) (75°C copper wire)	Maximum Wire Accepted by Terminal Block	Terminal Tightening Torque
GXT4-10000RT230	1 pole 63A	$10mm^2$ (6AWG)	$16mm^2$ (4AWG)	2.26 Nm (20 in-lb)

1.3.3.2

1.3.3.3 Mains Output, UPS Inverters

A. Voltage Configuration: 50Hz, single-phase, 2-wire-plus-ground.

Default setting 230V. Output L-N voltage shall be selectable via the included UPS configuration program. Optional settings shall be 220V or 240V. The UPS shall adjust sinewave amplitude to produce the selected voltage to match the mains.

B. Voltage Regulation: L-N: ±2% steady state.

C. Frequency Regulation: ±3.5Hz synchronized to mains.
±0.1Hz free running or on battery operation.

D. Frequency Slew Rate: 1.0Hz per second maximum

E. Load Power Factor Range: 0.65 lagging to 1.0 (unity)

F. Voltage Distortion: Sinusoidal Waveform; ≤3% total harmonic distortion (THD) into a 100% linear load; ≤5% THD into a 100% non-linear load with a crest factor ratio of 3:1.

G. Inverter Overload Capability:

Overload Percent	Duration Inverter shall support rated load
105% to 130%	1 minute
131% to 150%	10 seconds
151% to 200%	1 second
>200% (impact load)	At least 5 cycles

H. Voltage Transient Response: ±7% on-line or Battery mode for 0-100-0 % loading of the UPS, ±4% on-line or Battery mode for 20-100-20 % loading of the UPS.

I. Transient Recovery Time: To nominal voltage within 166 milliseconds.

J. AC-AC Efficiency:

The UPS shall be EPA ENERGY STAR qualified.

- 5 kVA: 93% AC-AC at full rated linear load
- 6 kVA: 92.9% AC-AC at full rated linear load
- 10 kVA: 93% AC-AC at full rated linear load

ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 0°C to 40°C (32°F to 104°F)
Storage: -15°C to +50°C (5°F to 122°F)
GXT4-240VBATT: 20°C (68°F) for optimum battery storage.

B. Relative Humidity

Operating: 0 to 95% non-condensing.
Storage: 0 to 95% non-condensing.

C. Altitude

Up to 1000m (3281 ft.) at 30°C (86°F) without power derating when operated within the temperature specified in Section 1.4, Item A. Ambient temperature shall be derated by 5°C (9°F) for each additional 500m (1640 ft.) above 3,000m (10,000 ft.).

D. Audible Noise

Noise generated by the UPS under normal operation shall not exceed 55dBA at 1 meter from the rear 50dBA, at 1 meter from the front or sides.

E. Electrostatic Discharge

The UPS shall be able to withstand an electrostatic discharge compliant to EN61000-4-2, level 4, Criteria A, without damage and shall not affect the connected load.

1.4 USER DOCUMENTATION

The specified UPS system shall be supplied with a Safety Warning Sheet. The specified UPS system shall be supplied with quick start guides for ease of installation and UPS start up. Each UPS will also contain a full user manual located on the included CD. The user manual shall include installation instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures and general maintenance guidelines. The included CD will shall also include a configuration program to allow user customization of UPS operating parameters and also UPS monitoring and computer/server shutdown software.

1.5 WARRANTY

The UPS shall be warranted against defects in materials and workmanship for two (2) years. Optional one (1) and three (3) year full coverage extended warranties shall be available from the manufacturer. The manufacturer's standard and extended warranty shall cover all parts including the battery.

1.6 QUALITY ASSURANCE

1.6.1 Manufacturer's Qualifications

More than 40 years experience in the design, manufacture and testing of solid-state UPS systems. The manufacturer shall be certified to ISO 9001:2008.

1.6.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to ensure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS shall be new, of current manufacture and shall not have been in prior service except as required during factory testing. All relays shall be provided with dust covers.

2.1.1 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements the standards listed in Section 1.2 and other applicable codes and standards. All wiring shall be copper.

2.1.2 Cabinet

The UPS unit shall be composed of: mains PFC converter, battery charger, dual-inverter, mains filter and internal bypass circuit; and batteries consisting of the appropriate number of sealed battery cells; and shall be housed in a rack-tower NEMA type 1 enclosure and shall meet the requirements of IP20. The UPS cabinet shall be cleaned and painted RAL 7021 Black.

2.1.3 Matching Battery Cabinets

The optional Rack-Tower battery cabinet shall contain valve-regulated, non-spillable, lead acid cells, housed in a separate cabinet that matches the UPS cabinet styling. The cabinet shall be cleaned and painted Black RAL 7021. The matching battery cabinet shall include an 18" (0.45m) detachable, molded interconnect cable, circuit breaker over current protection and provisions for daisy-chain connection of additional battery cabinets.

The model numbers, dimensions and weight information of the UPS cabinet and optional external battery cabinet shall be as follows:

Model	Rack Dimensions W x D x H, in. (mm)	Tower Dimensions W x D x H, in. (mm)	Weight lb. (kg)
GXT4-5000RT230	16.9 x 22.4 x 8.5 (430 x 574 x 217)	8.5 x 22.4 x 16.9 (217 x 574 x 430)	132.2 (60)
GXT4-6000RT230	16.9 x 22.4 x 8.5 (430 x 574 x 217)	8.5 x 22.4 x 16.9 (217 x 574 x 430)	132.2 (60)
GXT4-10000RT230	16.9 x 22.9 x 10.3 (430 x 581 x 261)	10.3 x 22.9 x 16.9 (261 x 581 x 430)	154.3 (70)
GXT4-240VBATT (Optional External Battery)	16.9 x 22.9 x 6.8 (430 x 581 x 173)	6.8 x 22.9 x 16.9 (173 x 581 x 430)	143.3 (65)

2.1.4 Cooling

The UPS shall be forced air cooled by internally mounted, continuous fans. Fan power shall be provided from the internal DC supply. Air intake shall be through the front of the unit, and air exhaust shall be out the rear of the unit.

2.2 COMPONENTS

2.2.1 Input Converter

2.2.1.1 General

Incoming mains power shall be converted to regulated DC power by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor correction (PFC) and input current distortion reduction.

2.2.1.2 Input Current Limit

The input shall use the power necessary to operate the load attached to the output before going to batteries. The UPS shall not use electronic input current limiting.

- The GXT4-5000RT230 shall include a 1-pole, 32A input circuit breaker.
- The GXT4-6000RT230 shall include a 1-pole, 32A input circuit breaker.
- The GXT4-10000RT230 shall include a 1-pole, 63A input circuit breaker.

2.2.1.3 Input Protection

The UPS shall have built-in protection against over current and overvoltage conditions including low-energy lightning surges, introduced on the primary input source. The UPS shall sustain input surges without damage per criteria listed in 61000-4-5 Surges/Lightning.

2.2.1.4 Battery Recharge

The UPS shall contain a three-stage battery charger designed to prolong battery life. The battery shall be constant current charged to restore capacity, then shall be constant voltage charged to maintain the battery in a fully charged state. Recharge time for the internal battery shall be 5 hours maximum to 90% capacity (full load discharge rate). There shall be DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the inverter shall shut down automatically and the critical load shall be transferred to internal bypass.

2.2.2 Inverter

2.2.2.1 General

The UPS inverter shall be of a pulse-width-modulated (PWM), IGBT design capable of providing the specified mains output. The inverters shall convert DC power from the input rectifier output or the battery into precise sinewave mains power for supporting the critical load.

2.2.2.2 Overload

The inverter shall be capable of supplying current and voltage for overloads exceeding 100%, and 105-130% for 1 minute, 131-150% for 10 seconds, 151 - 200% for 1 second, and up to >200% for 5 cycles of full load current. A visual indicator and audible alarm shall indicate overload operation. For

greater currents or longer time duration, the inverter shall have electronic current-limiting protection on the output to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective devices.

2.2.2.3 Inverter DC Protection

The inverter shall be protected by the following DC shutdown levels:

- DC Overvoltage Shutdown
- DC Undervoltage Shutdown (End of Discharge)
- DC Under voltage Warning (Low Battery Reserve); factory default set at 2 minutes (user configurable 2 to 30 minutes)

2.2.2.4 Output Frequency

An oscillator shall control the output frequency of the UPS. The inverter shall maintain the output frequency to ±0.1Hz of nominal frequency during Battery mode, Frequency Converter mode or when otherwise not synchronized to the mains source.

2.2.2.5 Output Protection

The UPS inverter shall employ electronic current limiting circuitry for protection during Normal mode and battery operation and the UPS shall employ input circuit breaker protection during Bypass mode operation.

2.2.3 Display and Controls

2.2.3.1 General

The UPS shall be provided with a microprocessor-based unit status display and controls section designed for convenient and reliable user operation. The monitoring functions such as voltages, currents, UPS status and alarm indicators shall be displayed on an LCD display.

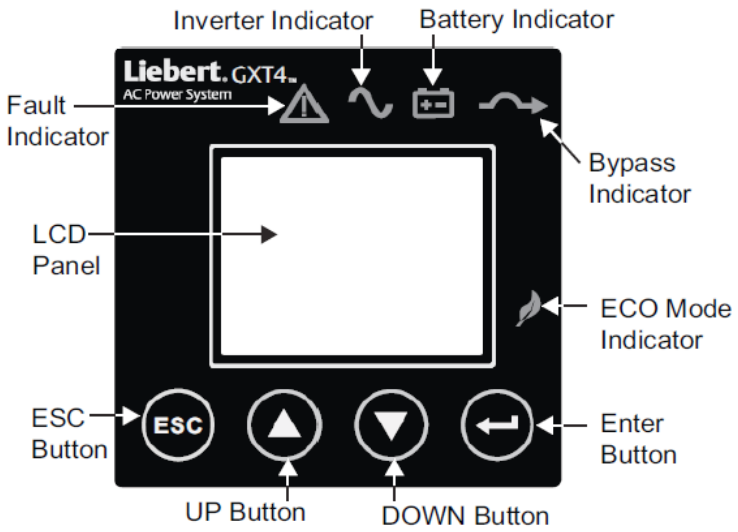
2.2.3.2 System Indicators

UPS display shall also include LED based system indicators. The system level indicators shall be: fault indicator, battery indicator, inverter indicator, bypass indicator, and ECO mode indicator.

- **Fault Indicator**: 1 Red LED shall illuminate if the UPS has detected a fault; and shall be Off if there is no internal fault
- **Inverter Indicator**: 1 Green LED shall illuminate when the inverter is supplying power; and shall be Off when the inverter is not supplying power
- **Battery Indicator:** 1 Amber LED shall illuminate when the battery is supplying power; and shall be Off when the battery is not supplying power
- **Bypass Indicator**: 1 Amber LED shall illuminate when the bypass is supplying power; shall be Off when the inverter is not supplying power; and shall flash when utility power is outside bypass operating specifications
- **ECO Mode Indicator**: 1 Green LED shall illuminate when the UPS is operating in active ECO mode operation and shall be Off when the UPS is operating in the normal double conversion mode of operation

2.2.3.3 Controls

UPS startup and shutdown operations shall be accomplished by using push buttons on the front panel of the UPS. The display shall be menu driven navigation and use four control buttons for ease of navigation and selection of the configurable parameters.



2.2.3.3.1 Control Buttons

The UPS display control button functionality shall be as follows:

ESC button: This button shall return to the previous menu or abort any change before confirming the change

UP arrow button: This button shall move the cursor up or increase the value displayed when changing parameters. This button shall also be used to scroll up for navigating the screens

DOWN arrow button: This button shall move the cursor down or decrease the value displayed when changing parameters. This button shall also be used to scroll down for navigating the screens

ENTER button: This button shall enter the next level menu or confirm the parameter changes

2.2.3.3.2 Display Menu Structure

The UPS display shall have the following menu structure with the following status and configuration screens

2.2.3.3.2.1 System Status (Default screen)

The system status screen shall be the default screen to display the input voltage, frequency, and amperage; output voltage, frequency, and amperage; battery capacity and estimated battery time remaining; loading percentage. To prolong display life, the UPS LCD display shall go into “sleep” mode after two minutes of no user interaction. Pressing the ENTER shall wake up the display and this action shall not perform any operation.

2.2.3.3.2.2 Main Menu

The main menu shall list the submenu selections:

UPS Status Screens
Configuration Settings Screens
Control Settings Screens
Event Log
About
Network

2.2.3.3.2.3 UPS Status

The UPS status screens shall provide the following information:

Output

Voltage

Frequency

Amperage

Power (KWH)

Load

Capacity

Wattage

Volt-Amperes

Input

Voltage

Frequency

Amperage

Power (KWH)

Battery

Capacity

Runtime (minutes)

Voltage

Time Since Startup

Days / Hours / Minutes

2.2.3.3.2.4 Configuration

The UPS Configuration screens shall provide the following customizable parameters: (default values are listed first)

UPS

Audible Alarm (ON/OFF)

Startup on Bypass (NO/YES)

Guarantee Shutdown (YES/NO)

Enable Auto Restart (YES/NO)

Output Frequency Selection (Auto bypass Enable/Auto bypass disable/50Hz no bypass/60Hz no bypass)

Output Voltage Selection (110/115/120/127V for L-N voltages); (200/220/230/240V for L-L voltages)

Battery

External Battery Cabinets (0/1/2/3/4/5/6)

Low Battery Warning (2 to 30 minutes in 1 minute increments)

Battery Test Interval (8, 12, 16, 20, 26 weeks, Disable)

Battery Replacement Reminder (Year/Month/Day)

ECO Mode

ECO Mode (OFF/ON)

Voltage Tolerance (±10%, ±5%,±15%)

Frequency Tolerance (±3Hz, ±2Hz,±1Hz)

Requalification Time (5min, 15min, 30min)

LCD Settings

Language, English (one other that is programmable using the included CD and configuration program)

Color (background color), Blue, Black, Red, Pink

Factory Settings

The factory settings screens shall provide a NO/YES selection to reset the UPS back to all factory setting

2.2.3.3.2.5 Control Settings

The UPS shall have the following controls from the display:

UPS ON/OFF

Turn UPS ON

Turn UPS OFF

Turn ON Bypass (manually transfer to bypass power)

Audible Alarm

Turn audible alarm ON (test alarm)

Turn audible alarm OFF (alarm silence)

Battery Test

Start manual battery test

Cancel manual battery test

View last battery test results

2.2.3.3.2.6 Event Log

The UPS shall be have an event log to record 255 events and shall be viewable from the display:

View Log

Navigate the event log to view the last 255 events.

Clear Log

User shall be able to clear the event log

The event log once full will begin to replace the first event logged to provide a FIFO process for maintaining event history. The event history shall record and display the number of events out of the 255 (xxx/255) as well as the time (days, hours, mins) from when viewing the event and the event that occurred.

2.2.3.3.2.7 About

The UPS shall be have an about screen to display the UPS model number, serial number, hardware version, and firmware version

2.2.3.3.2.8 Network

The UPS shall be have the ability to display the network information of the SNMP web card when installed. Information available shall be MAC address and IP address

2.3 AUTOMATIC BATTERY TEST

The UPS shall feature an automatic battery test with the factory default test interval set at every eight weeks. The battery test shall ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS shall display a warning message to indicate the internal batteries need replaced. The battery test feature shall be user accessible by the push button on the front of the unit and with communication software. The Automatic Battery test feature shall be capable of being disabled or configured to operate every 8, 12, 16, 20, 26 weeks through the UPS Configuration Program or from the LCD display.

2.4 BYPASS

2.4.1 General

A maintenance bypass circuit shall be provided as an integral part of the UPS. The maintenance bypass shall have a break-before-make transfer, shall have a maximum detect and transfer time of 4-6 milliseconds and shall be a double-pole device. The maintenance bypass shall be configured to wrap around the PFC converter, battery charger, DC-DC converter, inverter and battery. The maintenance bypass circuit shall use the rear-panel mounted UPS mains circuit breaker and route bypass power through the UPS input filters and surge suppression circuit. The maintenance bypass circuit default position shall be in the Bypass mode (mains).

2.4.2 Automatic Transfers

The transfer control logic shall activate the bypass automatically, transferring the critical mains load to the bypass source, after the transfer logic senses one of the following conditions:

- UPS overload
- UPS over temperature
- PFC failure
- Inverter failure
- DC bus overvoltage

Once the overload condition is reduced, the load shall be automatically transferred back to inverter power. An over temperature requires manual transfer back to inverter power after cooling.

2.5 INTERNAL BATTERY

Valve-regulated, non-spillable, lead acid cells shall be used as a stored-energy source for the specified UPS system. The battery kit shall be internal to the UPS cabinet and sized to support the inverter at rated load and power factor with an ambient temperature of 77°F (25°C) for a minimum of 4 minutes reserve time. The expected life of the battery shall be 3-5 years or a minimum 260 complete discharge cycles at ambient temperature of 77°F (25°C). To promote battery service life and eliminate over-discharge of the battery, the end-of-discharge DC shutdown voltage shall be automatically adjusted by the microprocessor based upon the percentage load at the onset of battery operation.

All UPS models shall allow connection of up to six external battery cabinets to provide extended run time capability. External battery cabinets shall match the UPS in aesthetics and color.

2.6 OUTPUT DISTRIBUTION

Output distribution shall be integral to the UPS cabinet and located on the rear of the unit. The integrated distribution panels that come standard on the UPS are listed below:

UPS	Power Distribution P/N	Input	Output
GXT4-10000RT230	PD2-CE10HDWRMBS	Hardwired	(4) IEC-C19, (4) IEC-C13, & Hardwired
GXT4-10000RT230	PD2-203	Hardwired	(4) IEC-C13, (2) IEC-32A
GXT4-10000T230	N/A	Hardwired	Hardwired

2.7 ON-BOARD COMMUNICATION

The Liebert GXT4 shall offer multiple communication options such as:

A. USB: All models shall work with the Power Management system in Microsoft® Windows® 2000, Windows XP, Windows Vista®, Linux and Mac OS® X.

B. Remote Emergency Power Off (REPO): The UPS shall be equipped with rear-panel terminal connections for interface with a normally closed (N.C.) field-supplied switch. The remote emergency power off function shall allow the user to disable all UPS outputs in an emergency situation. Connections must not exceed NEC Class 2 limits. Activation of the REPO circuit shall disable the UPS until the following occurs:

- REPO contacts are reset.
- User restart of the UPS using the front control panel.

C. Terminal Block Communication: includes 8 pins

Pin	Definition
1 & 2	Low Battery Warning
3 & 4	On Battery Warning
5 & 6	Any Mode Shutdown
7 & 8	Battery Mode Shutdown

D. Liebert IntelliSlot® Port

Simultaneous communication shall be available via terminal block (EPO), USB and Liebert IntelliSlot.

2.8 LIEBERT INTELLISLOT COMMUNICATION OPTIONS

The UPS shall include one Liebert IntelliSlot communication port with SNMP web card factory installed. The communication port shall also allow the operator to field-install optional Liebert IntelliSlot communication cards. Liebert IntelliSlot cards may be installed during any state of UPS operation (On, Standby or Off states). Available Liebert IntelliSlot options are described below.

Liebert IntelliSlot Web Card (IS-WEBCARD)

The standard Liebert IntelliSlot Web Card shall deliver SNMP and Web management to the UPS when connected to any 10 or 100 Mbit Ethernet network. The card shall support 10 and 100 Mbit Ethernet and shall provide for in-the-field upgrade of SNMP firmware. The kit shall include the Liebert IntelliSlot card, MIB, configuration cable and user manual. Once the card is installed, serial communication shall be disabled in the DB9F connector; however, the photo-coupler signals (On Battery and Low Battery) shall remain active.

Liebert IntelliSlot Relay Interface Card (RELAYCARD-INT)

The optional Liebert IntelliSlot Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS. The contacts shall be rated for 24VAC or 24VDC at 1A. Connection shall be to a terminal block connector with cable provided by the end user.

Liebert IntelliSlot Multiport Card (IS-MULTIPORT)

The optional Liebert IntelliSlot Multiport Card shall provide 4 sets of contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery and Low Battery

for connection to up to 4 servers/computers for use with Liebert MultiLink Shutdown software. The contacts shall be rated for 24VAC or 24VDC at 1A. Connections shall be to a terminal block connector with cable provided by the end user.

2.9 LIEBERT GXT4 CONFIGURATION PROGRAM

An included Microsoft Windows-based (Windows XP or later) Configuration Program and cable shall allow configuration of UPS features and operating parameters to meet specific application requirements, if required. Options that are configurable via this program shall include:

- Select one of five output voltages to match input voltages of 200, 220, 220, 230 or 240.
- Enable / Disable Auto-Restart.
- Select frequency converter operation with a fixed output frequency of 50 or 60Hz. Bypass is disabled during Frequency Converter mode.
- Set the Low Battery Warning alarm time from 2 to 30 minutes.
- Disable the Auto-Battery test.
- Set the Auto-Battery test interval to 8, 12, 16, 20, 26 weeks or Disable the test.
- Select the number of external battery cabinets connected to the UPS to adjust the remaining run-time calculations reported by the UPS Liebert software products.
- Modify the shutdown setting of the Any Mode Shutdown.
- Configure the unit for ECO mode operation
- Change the LCD display language

Liebert® GXT MT+™

Compact Tower UPS for High Performance Power Protection

■1kVA - 3kVA



The Liebert GXT MT+ features best-in-class power protection for critical applications with the use of true on-line double conversion technology.

The Liebert GXT MT+ has a comprehensive specification that provides a higher level of availability to the IT equipment. It satisfies safety criteria and electromagnetic compatibility standards while offering intelligent monitoring and network management functions. This high performance UPS with proven reliability is available in a compact tower design.

Features

- Double conversion on-line technology
- Compact tower design
- Standard models and long backup models available
- Extended runtime cap abilities by building up additional battery resources
- Flexible (site specific) battery configuration
- Standard model comes with internal battery
- Generator-compatible with wide input frequency range (40 to 70 Hz)
- 0.8 output power factor
- Class A electromagnetic interference (EMC)
- Ultra wide input voltage range
- High input power factor & low THDi
- Emergency power off (EPO)
- Configurable to energy saving mode (ECO)
- LCD display for operational convenience and status / fault information
- Multiple AC output interfaces via IEC standard sockets with Programmable output
- Remote Monitoring is available through USB / RS232, and optional via dry contacts and SNMP

Applications

- Small-size Data Center
- Telecommunication Equipment
- VoIP
- Small Office Network
- Computer Rooms
- Process Automation Equipment
- Network Storage Devices

Technical Specifications

Part Number	Standard Model	GXT-1000MTPLUS230	GXT-2000MTPLUS230	GXT-3000MTPLUS230
	Long Backup Model	GXT-1000LMTPLUS230	GXT-2000LMTPLUS230	GXT-3000LMTPLUS230
Capacity (VA/W)		1000 / 800	2000/1600	3000/2400
Input Parameters				
Frequency Range		40Hz ~ 70 Hz		
Phase		Single phase with ground		
Power Factor		≥ 0.99 @ 220 to 230 VAC (input voltage)		
Voltage Range				
Low Line Transfer		160 VAC / 140 VAC / 120 VAC / 110 VAC ± 5 % (based on load percentage 100% - 80 % / 80 % - 70 % / 70 - 60 % / 60 % - 0)		
Low Line Comeback		175 VAC ± 5 %		
High Line Transfer		300 VAC ± 5 %		
High Line Comeback		290 VAC ± 5 %		
Output Parameters				
Output Voltage		208/220/230/240VAC		
AC Voltage Regulation		± 3% (Batt. Mode)		
Frequency Range		47 to 53 Hz or 57 to 63 Hz (Synchronized Range)		
Frequency Range *(Batt. Mode)*		50 Hz ± 0.25Hz		
Overload		100% to 110%: audible warning 110% to 130%: UPS shuts down in 30 seconds at battery mode or transfers to bypass mode when the utility is normal. >130%: UPS shuts down immediately at battery mode or transfer to bypass mode when the utility is normal.		
Current Crest Ratio		3:1		
Harmonic Distortion		≤ 3 % THD (Linear Load) ≤ 6 % THD (Non-linear Load)	≤ 4 % THD (Linear Load) ≤ 7 % THD (Non-linear Load)	
Waveform (Batt. Mode)		Pure Sinewave		
Efficiency				
AC Mode		~ 85%	~ 88%	
Battery Mode		~ 83%		
Transfer Time				
AC Mode to Batt. Mode		Zero		
Inverter to Bypass		4 ms (Typical)		
Battery Charger (Standard Model)				
Battery Type		12 V / 7 AH	12 V /7 AH	12 V / 9 AH
Numbers		3	6	6
Typical Recharge Time		4 hours recover to 90% capacity (Typical)		
Charging Current		1.0 A(max.)		
Charging Voltage		41.0 VDC ± 1%	82.1 VDC ±1%	
Battery Charger (Long back-up Model)				
Numbers		3	8	
Charging Current		4.0 A or 8.0 A(max.)		
Charging Voltage		41.0 VDC ± 1%	109.6 VDC ±1%	
Physical Parameters				
Dimension, D X W X H		220 x 145 x 397	318 x 190 x 421	
Net Weight (kgs)		13 / 7	26 / 13	28 / 13
Emvironmental Parameters				
Operation Humidity		20 to 90 % RH @ 0 to 40°C (non-condensing)		
Noise Level		Less than 55dBA @ 1 Meter		
Management				
Smart RS-232 or USB		Supports Windows 98/2000/2003/XP/Vista/2008/ 7, Linux, and MAC		
Optional SNMP		Power management from SNMP manager and web browser		

Runtime (in minutes)

Load %	1000VA	2000VA	3000VA
25	38	39	31
50	17	16	12
75	10	10	7
100	6	6	4

Liebert® GXT MT+™

Compact Tower UPS for High Performance Power Protection

■6kVA -10kVA

The Liebert GXT MT+ features best-in-class power protection for critical applications with the use of true on-line double conversion technology. The Liebert GXT MT+ has a comprehensive specification that provides a higher level of availability to the IT equipment. It satisfies safety criteria and electromagnetic compatibility standards while offering intelligent monitoring and network management functions. This high performance UPS with proven reliability is available in a compact tower design.

Features

- True on-line double-conversion technology
- DSP technology guarantees high performance
- 0.8 Output Power Factor
- Wide input voltage range (110-300 VAC)
- 0.99 input power factor correction
- 50Hz/60Hz frequency converter mode
- Configurable to energy saving mode (ECO)
- Programmable power management outlets
- Emergency power off function (EPO)
- Generator compatible
- Charger capacity expansion to 8A for long-run models
- SNMP/USB/RS-232 communications
- 3-stage extendable charging design for optimized battery performance
- Extended runtime capability by building up additional battery resources
- Maintenance bypass available
- Optional N+X parallel redundancy



The Liebert GXT MT+ Is Ideally Suited For:

- Small Size Data Center
- Telecommunication Equipment
- VoIP
- Small Office Network
- Computer Rooms
- Process Automation Equipment
- Network Storage Devices

Technical Specifications

MODEL/PART NUMBER		GXT-6000MTPLUS230-9
PHASE		1 phase in / 1 phase out
CAPACITY		6000 VA / 4800 W
Voltage Range	Low Line Transfer	176 VAC ± 3% @ 100% load 110 VAC ± 3% @ 50% load
	Low Line Comeback	186 VAC ± 3% @ 100% load 120 VAC ± 3% @ 50% load
	High Line Transfer	300 VAC ± 3%
	High Line Comeback	290 VAC ± 3%
Frequency Range		6000 VA / 4800 W
Phase		Single phase with ground
Power Factor		≥ 0.99 @ 100%load
OUTPUT		
Output Voltage		208/220/230/240 VAC
AC Voltage Regulation (Batt. Mode)		± 1%
Frequency Range (Synchronized Range)		46~54 Hz ~ 50 Hz / 56~64 Hz ~ 60 Hz
Frequency Range (Batt. Mode)		50 Hz ± 0.1 Hz or 60 Hz ± 0.1 Hz
Current Crest Ratio		3:1 (max.)
Harmonic Distortion		≤ 3 % THD (Linear Load), ≤ 6 % THD (Non-linear Load)
Transfer Time	AC Mode to Batt. Mode	Zero
	Inverter to Bypass	Zero
Waveform (Batt. Mode)		Pure Sinewave
EFFICIENCY		
AC Mode		89%
Battery Mode		88%
BATTERY		
Standard Model	Battery Type	12 V / 9 AH
	Numbers	20
	Typical Recharge Time	7 hours recover to 90% capacity
	Charging Current (max.)	1.0 A
	Charging Voltage	273 VDC ± 1%
Long-run Model	Battery Type	Depending on applications
	Numbers	18-20
	Charging Current (max.)	4.0 A
	Charging Voltage	273 VDC ± 1%
Runtime	Full Load	8 Minutes
INDICATORS		
LCD Panel		UPS status, Load level, Battery level, Input/Output voltage, Discharge timer, and Fault conditions
ALARM		
Battery Mode		Sounding every 4 seconds
Low Battery		Sounding every second
Overload		100% to 105% for 10 minutes
Fault		Continuously sounding
PHYSICAL		
Standard Model	Dimension, D X W X H (mm)	592 X 250 X 576
	Net Weight (kgs)	83
Long-run Model	Dimension, D X W X H (mm)	592 X 250 X 576
	Net Weight (kgs)	25
ENVIRONMENT		
Operation Humidity		20-90 % RH @ 0- 40°C (non-condensing)
Noise Level		Less than 55dBA @ 1 Meter
MANAGEMENT		
Smart RS-232		Supports Windows® 2000/2003/XP/Vista/2008, Windows® 7, Linux, Unix, and MAC
USB		
Optional SNMP		Power management from SNMP manager and web browser

Liebert® APS™

Flexible, efficient modular UPS for row-based applications

■5kVA -20kVA UPS





Low TCO

With the Liebert APS, you can maintain flexibility for the future and ensure the availability of your critical systems– all without sacrificing cost or energy efficiency.

Additional features to help lower costs include:

- **Industry-leading efficiency:**
  - **91.5-92%** efficiency: 200-240V in/out transformer-free systems.
  - **90-91%** efficiency: 200/100-240/120V in/out transformer-free systems.
  - **88.5-89.9%** efficiency: transformer-based systems.
- **Scalability** that allows you to cost-effectively add power capacity or battery modules as needed.
- **Modular batteries, controls and power components** to help reduce maintenance costs with user replacement.
- **Two year hassle-free factory warranty program** for repair or replacement of your Liebert APS UPS.
- **Module-level redundancy** eliminates the expense of purchasing and planning for any additional cabinets.
- **Reduced installation time and cost** because units are shipped in modules and on site assembly is easy and simple
- **Everything you need for efficiency and availability in one box**: power modules, batteries, maintenance bypass, and distribution in a single, small-footprint cabinet.
- **Integral battery monitoring** with temperature compensated charging to prolong battery life and help reduce replacement costs.

Reliability and Serviceability

At the core of your business sits your data center and the services running in it. With the Liebert APS UPS solution, you get peace of mind that **your critical IT functions – and your business – will be available and running as expected through power disruptions, fluctuations and outages.**

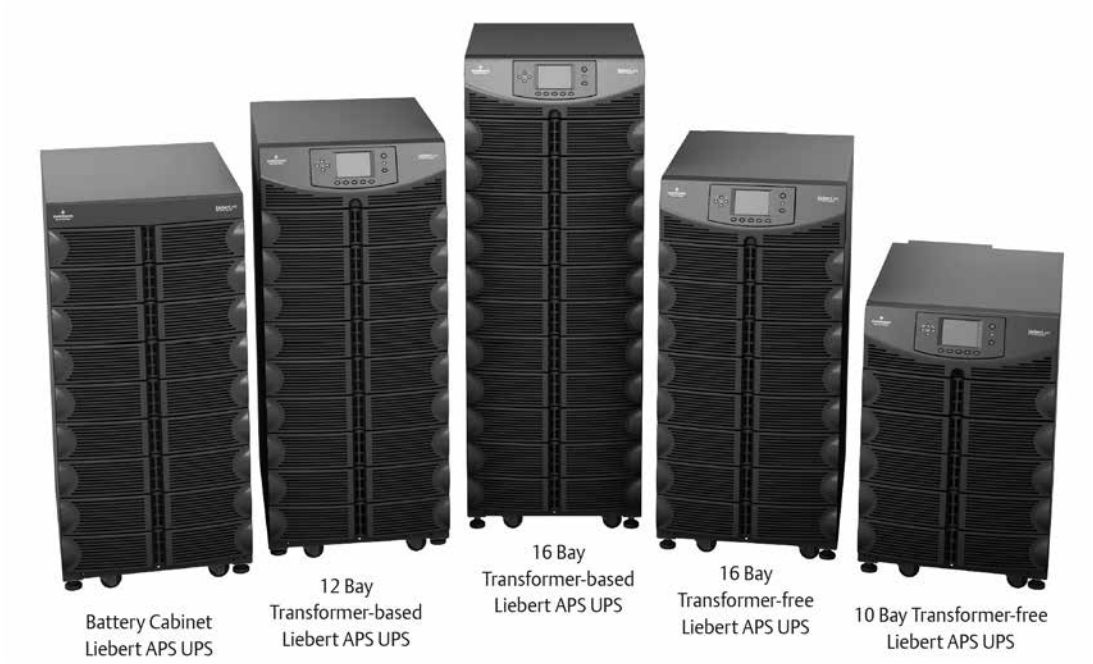
- **Internal redundancy capability** (N+2/20kVA) enhances reliability and provides multiple layers of power protection.
- **No single point of failure -** Full redundant design allows the critical load to run on conditioned power if there is a failure of any component in the system.
- **Configurable** design allows you to customize the Liebert APS UPS for your desired level of capacity and redundancy.
- **Fault-tolerant design**, enables the power, battery and control modules to take themselves offline if there is a problem, without sacrificing overall system integrity.
- **Superior overload capabilities**, able to provide conditioned power to temporary overloads without transfers to/from bypass power.
- **Internal wrap-around maintenance bypass and Frame-level bypass with independent controls in separate assembly** provide higher reliability and availability.

Flexibility
What is the key to your business' success in the future? Being able to adapt efficiently and effectively as the needs of your users and core business power requirements change. It's about managing uncertainty, equipment density and capacity. The Liebert® APS™ UPS helps you stay ready for what's next:

- **Capacity on demand** with FlexPower™ core modules that allow you to change capacity as needed in 5 kVA/4.5 kW increments - without powering down.
- **More real kW** - 0.9 power factor provides more real power to support the I.T. load than other solutions in this size range.
- **Isolated and non-isolated models** to provide the right solution for your power protection needs.
- **Integrated distribution PODs** allow selection of a variety of distribution options to meet application requirements.
- ***Trellis*™ platform connectivity**, so the Liebert APS can easily be integrated with this robust, real-time data center optimization solution.
- **Three Liebert Intellislot® ports** allow integration and communication with a variety of infrastructure management solutions, leading to better power optimization and visibility.
- **Optional matching external battery cabinets** provide longer battery run times to protect against sustained power issues.
- **Installation Flexibility** – use on raised floors, traditional flooring, or in rack enclosures.
- **Large input voltage window,** which minimizes transfer to battery and increases battery life; low line transfer can range down to 110v.

Service Solutions to Keep You Up and Running
To enhance the availability and trouble-free operation of your Liebert APS UPS, Emerson Network Power offers a range of optional service programs, including:

- **Included two year warranty** includes onsite repair.
- **Start-up** by factory-trained engineers to ensure proper installation and operation.
- **Customer resolution center** provides direct access to our engineers, whenever you need them.



Technical Specifications

Liebert® APS™ UPS Specification								
Parameters		Units	10 Bay Xfmr-free	16 Bay Xfmr-free	12 Bay Xfmr-based	16 Bay Xfmr-based	10 Bay Xfmr-free dual inverter	16 Bay Xfmr-free dual inverter
Frame Rating		kVA	15	20	15	20	15	20
		kW	13.5	18	13.5	18	13.5	18
General & Environmental								
Conducted and radiated EMC levels			IEC/EN/AS 62040-2 Cat 2, CISPR22 Class A, FCC Part 15 Class A					
Compliant safety standards			IEC/EN/AS 62040-1:2008, UL 1778 4th Ed and CSA 22.2 No. 107.1				UL 1778 4th Ed and CSA 22.2 No. 107.1	
Compliant immunity standards			IEC/EN/AS 61000-4-2, 3, 4, 5, 6					
Environmental			WEEE and ROHS2 (6 by 6), REACH Compliant					
Mechanical		**Units**	**10 Bay**	**16 Bay**	**12 Bay**	**16 Bay**	**10 Bay**	**16 Bay**
Width		mm (in)	440 (17)	440 (17)	440 (17)	440 (17)	440 (17)	440 (17)
Depth		mm (in)	800 (32)	850 (34)	800 (32)	850 (34)	800 (32)	850 (34)
Height		mm (in)	695 (27)	970 (38)	1060 (42)	1240 (49)	695 (27)	970 (38)
Weight (frame rating populated)	Unit weight	kg (lbs)	256.3 (565)	317.5 (700)	360.6 (795)	417.3 (920)	256.3 (565)	317.5 (700)
	Shipping weight	kg (lbs)	274.4 (605)	335.7 (740)	378.7 (835)	435.4 (960)	274.4 (605)	335.7 (740)
Environmental		**Units**						
Operating temperature		°C (°F)	0 - 40 (32 - 104)					
Relative humidity		%	0 - 95%, non-condensing					
Altitude		m (ft)	3000 (10000) @ 25°C (77°F)					
Efficiency (AC-AC)		%	91.8-92.0	91.6-92.0	88.5-89.9	88.6-89.7	90.4-91.0	90.0-91.0
Nominal heat dissipation		BTU/Hr (max)	4208	5747	5528	7965	4904	6768
Input Data		**Units**						
Nominal input voltage		VAC	200/208/220/230/240; Single Phase				200/100, 208/120, 220/110, 230/115, 240/120; Single Phase	
			380/400/415; 3 Phase					
Input voltage range		VAC	The input voltage range based on the ouput loading, refer to User Manual					
Power factor		Cos	Single-phase input, > 0.99; three-phase input, > 0.95		Single-phase input, > 0.99			
Input frequency range		Hz	40 to 70 auto-sensing					
Battery Module		**Units**						
Battery capacity		W	36W @ 15min-rate to 1.67V per cell @ 25°C (77°F)					
Backup time (full load)		minutes	5 (for non-redundant system which has equal number of battery strings and power modules)					
Maximum charge current (full load)		Amps	Power module internal charger: 1.8A / Charger module: 10A					
Nominal voltage		VDC	144					
Recharge time		Hrs	< 5 to 90% capacity (PM internal charger with 1:1 ratio of PM to Battery Strings)					
Output Data		**Units**						
Output voltage		VAC	200/208/220/230/240; Single Phase		100/100/173/200,110/110/190/220, 115/115/199/230, 120/120/208/240; Single Phase		200/100, 208/120, 220/110, 230/115, 240/120; Single Phase	
Voltage regulation		%	±3					
Voltage stability (100% step load)		%	±7					
Voltage Recovery time		ms	≤ 60					
Voltage distortion		%	≤ 3, linear load					
			≤ 5, non-linear load		≤ 7, non-linear load		≤ 5, non-linear load	
Output frequency		Hz	50/60					
Output overload capability		%	< 104% continuous					
			105% - 130% for 1 min					
			131% - 150% for 10 sec					
			151% - 200% for 1 sec					
			> 201% for 250 msec					

2.2.4 Automatic Battery Test

The UPS shall initiate an automatic battery testing sequence periodically, at a programmed day and time of day, selectable by the end user. The user shall be able to select the interval of the battery test and shall be able to select 8-, 12-, 16-, 20- or 26-week intervals or shall be able to disable the automatic battery test.

Should a battery failure occur, the UPS shall immediately return to normal mode and fault signals (visual, audible and remote via serial) shall be communicated. No audible or remote (via serial/contact closures) indication of the battery test shall be communicated during the automatic battery test.

The automatic battery test factory default settings shall be enabled at an 8-week interval and occur on Wednesdays at 0600 hours (based on the 24 hour clock).

2.2.5 Remote Emergency Power Off (REPO)

The remote emergency power off function (REPO) shall allow the user to disable all UPS outputs in an emergency situation. The REPO, in order to be flexible, shall be able to interface with either normally open (N.O.) or normally closed (N.C.) systems. The REPO shall be activated when a pair of Safety Extra Low Voltage (SELV) contacts, external to the UPS, shall be activated. The REPO connection shall be through a simple terminal block type connector.

The REPO function shall not operate if the UPS manual bypass switch is in the bypass position. The user shall also supply a means of interfacing with the REPO circuit to allow disconnecting the UPS input feeder breaker to remove all sources of power to the UPS and the connected equipment to comply with local wiring codes/regulations.

Regardless of the UPS mode of operation when the REPO is activated, the UPS output shall not be re-enabled until the following occurs:

- REPO contacts are reset (closed if N.C. contacts are used and open if N.O. contacts are used)
- Input circuit breaker is closed
- Control enable switch is turned On
- User interface On/Off switch is depressed

2.2.6 Bypass

A. General

A bypass circuit shall be provided as an integral part of the UPS. The bypass shall have an overload rating of 300% rated full load for 10 cycles and 1000% for subcycle fault clearing. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.

B. Automatic Transfers

The transfer control logic shall automatically activate the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

- Inverter overload capacity exceeded
- Inverter overtemperature
- UPS fault condition

For inverter overload conditions, the transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if one of the following conditions exists:

- Inverter/Bypass voltage difference exceeds preset limits (+10%, -15% of nominal)
- Bypass frequency out of preset limits (±5Hz of nominal frequency)

C. Automatic Retransfer

Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

- Bypass out-of-synchronization range with inverter output
- Overload condition exists in excess of inverter full load rating
- UPS fault condition present

D. Manual Transfer

In addition to the internal bypass function, the UPS shall have a manual bypass function. The manual bypass function shall be provided by a switch mounted on the bottom-front of the UPS. Removal of the lower front bezel shall be required for access. The actual AC break time between inverter and bypass shall be less than 4 milliseconds.

The manual bypass shall also be a partial "wrap-around" bypass and shall be configured to wrap around the rectifier, battery charger, inverter and battery in the same manner as the automatic bypass. The manual bypass shall not wrap around the EMI filtering, overcurrent protection or isolation transformer.

The UPS shall initiate an audible alarm upon transfer to manual bypass. The user shall be able to silence the audible alarm. The alarm shall continue to sound (unless silenced) while in bypass mode. This shall provide a reminder to the user that the load continues to be powered from utility supply alone.

2.3 COMMUNICATIONS

The UPS shall allow for flexibility in communication. The UPS shall be able to communicate through all communication ports simultaneously; the media of either communications port may change without affecting the operation of the UPS. The use of relay contacts shall not affect the operation of the communications ports.

2.3.1 Relay Contacts

The relay contacts shall be available through the terminal block connector and shall be compatible with the Liebert MultiLink® shutdown software. The UPS shall indicate via relay contact closure the following information:

- Low Battery
- On Battery

Relay contacts shall be rated 24VDC, 0.3 A. Additional signals (such as on bypass and summary alarm) shall be provided by an Liebert IntelliSlot® relay card option.

The following terminal block pins shall be:

Position	Name	Description
1	Battery Mode	Output dry contact of battery mode operation
2	Battery Mode	Output dry contact of battery mode operation
3	Low Battery	Output dry contact of low battery operation
4	Low Battery	Output dry contact of low battery operation
5	Any Mode Shut Down	Input dry contact of any mode shut down
6	GND	Any mode shutdown GND
7	Battery Mode Shut Down	Input dry contact of battery mode shut down
8	GND	Battery mode shutdown GND

2.3.2 Serial Communication

The UPS shall be able to communicate via a USB communication port for connection to a PC or server compatible with Liebert MultiLink® shutdown and monitoring software.

2.3.3 Network Communication

All models of the Liebert APS UPS product line shall have three Liebert IntelliSlot® ports standard. The UPS shall have be compatible with Emerson Network Power® Trellis™ DCIM software as well as LIFE service monitoring software as standard. The user shall have the option to have either one or two external protocols through the same Liebert IntelliSlot interface card to provide SNMP communication over a local area network or Modbus 485. 10/100Mbit Ethernet support shall be included.

2.4 ACCESSORIES (OPTIONAL COMPONENTS)

2.4.1 Non-Modular Battery Cabinets

The UPS shall have the capability to add third-party battery cabinets to the base UPS product. The connections between the UPS and the extended battery cabinets shall contain DC power only. All of these shall be able to be connected or disconnected safely by the user without interrupting power to the load. The UPS shall have a terminal block to allow connection of an optional temperature sensor in order to provide temperature compensated charging to prolong battery life.

2.4.2 Modular Battery Cabinets

The Modular Battery Cabinet shall be pre-configured with one to seven strings using Liebert APS Battery Modules installed. Each Extended Battery Cabinet shall include an External Battery Card (EBC) and two (2) communications cables. Each Extended Battery Cabinet shall communicate to the Liebert APS UPS for monitoring of the battery modules. A maximum of four modular Battery Cabinets shall be able to be used with each Liebert APS UPS.

2.4.3 Free-standing Maintenance Bypass Cabinet with Optional Distribution

The Maintenance Bypass Cabinet shall provide an external complete "wrap-around" protection and shall allow the Liebert APS UPS to be shut down for service without interrupting power to the connected equipment. The Maintenance Bypass Cabinet controls shall include a manual break before make bypass transfer switch, UPS input disconnect switch and a branch rated output circuit breaker. The Maintenance Bypass Cabinet controls shall be located behind a lockable front panel to provide operation security.

Maintenance Bypass Cabinet models shall be available with an isolation transformer in the bypass path. The Maintenance Bypass Cabinet shall be in a free standing enclosure.

Every Maintenance Bypass Cabinet model shall be able to be ordered with up to 10 output options. These options shall include receptacles as well as conduit fittings with branch-rated breakers. Each receptacle or conduit fitting shall include a power available indicator lamp.

2.4.4 Rack-Mount Maintenance Bypass Cabinet with Optional Distribution

The Maintenance Bypass Cabinet shall provide an external complete "wrap-around" protection and shall allow the Liebert APS UPS to be shut down for service without interrupting power to the connected equipment. The Maintenance Bypass Cabinet controls shall include a manual break-before-make bypass transfer switch, UPS input disconnect switch and a branch-rated output circuit breaker. The Maintenance Bypass Cabinet controls shall be located behind the front bezels.

Maintenance Bypass Cabinet models shall be in a rack-mount enclosure and every Maintenance Bypass Cabinet model shall be able to be ordered with up to two output POD options. These options shall include receptacles as well as individual branch-rated breakers.

3.0 FIELD SERVICES (OPTIONAL)

3.1 FIELD QUALITY CONTROL

The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

3.1.1 Visual Inspection

A. Inspect equipment for signs of shipping or installation damage.

B. Verify installation per drawings.

C. Inspect cabinets for foreign objects.

D. Verify neutral and ground conductors are properly sized and configured.

3.1.2 Mechanical Inspection

A. Verify all power modules are correctly fitted.

B. Verify all battery modules are correctly fitted.

C. Check all terminal screws, nuts and/or spade lugs for tightness.

3.1.3 Electrical Inspection

A. Confirm input voltage and phase rotation is correct.

B. Verify bypass voltage jumper is correct for voltages being used.

3.2 UNIT STARTUP AND SITE TESTING

The manufacturer's field service personnel shall provide site testing, if requested. Site testing shall consist of a complete test of the UPS and the associated accessories supplied by the manufacturer. A partial battery discharge test shall be provided as part of the standard startup procedure. The test results shall be documented, signed and dated for future reference.

3.3 MANUFACTURER'S FIELD SERVICE

3.3.1 Service Personnel

The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory-trained Customer Engineers dedicated to the startup, maintenance and repair of UPS and power equipment. The organization shall consist of factory-trained Customer Engineers working out of District Offices in most major cities. An automated procedure shall be in place to ensure that the manufacturer dedicates the appropriate technical support resources to match escalating customer needs.

The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours a day, 7 days a week and 365 days a year. If emergency service shall be required, call-back response time from a local Customer Engineer shall be 4 hours or less.

3.3.2 Replacement Parts Stocking

Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.

Local Customer Engineers shall stock replacement spare parts with backup available from District Service offices and the manufacturing location.

Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

3.3.3 UPS Maintenance Training

Maintenance training courses for customer employees shall be available from the UPS manufacturer. This training shall be in addition to the basic operator training conducted as a part of the system startup.

The training course shall cover UPS theory, location of subassemblies, safety, battery considerations and UPS operational procedures. The course shall include AC-to-DC conversion and DC-to-AC inversion techniques, as well as control and metering. Troubleshooting and fault isolation using alarm information and internal self-diagnostics shall be stressed.

3.3.4 Maintenance Contracts

A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available. Warranty and preventive maintenance service shall be performed by factory trained Customer Engineers.

3.3.5 LIFE™ Technology Services

The UPS shall be "out of the box" enabled to interface with the LIFE™ Technology Service. LIFE™ Technology uses advanced service level data and IP-based communication to alert customer service personnel of potential issues that may impact the life of systems within the data center infrastructure. In the event of a failure, the response shall include the immediate dispatch of a service technician with detailed knowledge of the problem and the parts needed to fix it.

1.3.2 Modes of Operation

The UPS shall be designed to operate as a true on-line system in the following modes:

A. Normal—The critical AC load shall be continuously supplied by the UPS inverter. The power module rectifiers derive power from a utility AC source and supply regulated DC power to the inverter. The module's inverter regenerates precise AC power to supply the connected equipment. The battery charger shall be in the power module and maintain a float-charge on the batteries of the UPS; additionally, the optional charger module shall also be used to maintain a quicker recharge time for long backup time applications.

B. Backup—Upon failure of utility AC power, the critical AC load shall be supplied by the inverter, which obtains power from the battery system. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

C. Recharge—Upon restoration of utility AC power, after a utility AC power outage, the input converter shall automatically restart and resume supplying power to the inverter. Also the battery charger shall begin to recharge the battery system.

D. Automatic Restart—Upon restoration of utility AC power, after a utility AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load. Also the battery charger shall automatically recharge the battery. This feature shall be enabled from the factory and shall be capable of being disabled by the user. The user shall also be able to program two auto restart delay settings.

- Battery capacity % level
- Countdown timer

E. Bypass—The bypass shall provide an alternate path for power to the critical load that shall be capable of operating in the following manner:

- Automatic—In the event of an internal failure or should the inverter overload capacity be exceeded, the UPS shall perform an automatic transfer of the critical AC load from the inverter to the bypass source.
- Manual—Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the bypass shall cause an immediate transfer of the critical AC load from the inverter to the bypass source.

1.3.3 Performance Requirements

1.3.3.1 System

A. Configuration—Select UPS systems shall be configured or upgradeable to power ratings as follows: (select one)

15kVA rated, 10-Bay Frame Transformer-Free Systems

- 5kVA non-redundant to 5kVA redundant systems or to 10 or 15kVA non-redundant or redundant systems
- 10kVA non-redundant to 10kVA redundant systems or to 15kVA non-redundant or redundant systems
- 15kVA non-redundant to 15kVA redundant systems

15kVA rated, 12-Bay Frame Transformer-Based Systems

- 5kVA non-redundant to 5kVA redundant systems or to 10 or 15 kVA non-redundant or redundant systems
- 10kVA non-redundant to 10kVA redundant systems or to 15kVA non-redundant or redundant systems
- 15kVA non-redundant to 15kVA redundant systems

20kVA rated, 16-Bay Frame Transformer-Free Systems

- 5kVA non-redundant to 5kVA redundant systems or to 10, 15 or 20kVA non-redundant or redundant systems
- 10kVA non-redundant to 10kVA redundant systems or to 15 or 20kVA non-redundant or redundant systems
- 15kVA non-redundant to 15kVA redundant systems or to 20kVA non-redundant or redundant systems
- 20kVA non-redundant to 20kVA redundant systems

20kVA rated, 16-Bay Frame Transformer-Based Systems

- 5kVA non-redundant to 5kVA redundant systems or to 10, 15 or 20kVA non-redundant or redundant systems
- 10kVA non-redundant to 10kVA redundant systems or to 15 or 20kVA non-redundant or redundant systems
- 15kVA non-redundant to 15kVA redundant systems or to 20kVA non-redundant or redundant systems
- 20kVA non-redundant to 20kVA redundant systems

B. Isolation (Only for transformer-based systems)

Input to output isolation shall be provided, via the output transformer, regardless of operating mode. (UPS or bypass)

C. Remote Stop

The UPS shall provide provisions for remote stop capability, both N.O. and N.C. system compatible.

D. Energy Star Qualified

The following systems shall be EPA Energy Star qualified (select one)

15kVA rated, 10-Bay Frame Transformer-Free Systems

- 5, 10 or 15 kVA non-redundant or redundant systems

15kVA rated, 12-Bay Frame Transformer-Based Systems

- 10 or 15 kVA non-redundant or redundant systems

20kVA rated, 16-Bay Frame Transformer-Free Systems

- 5, 10, 15 or 20 kVA non-redundant or redundant systems

20kVA rated, 16-Bay Frame Transformer-Based Systems

- 10, 15 or 20 kVA non-redundant or redundant systems

1.3.3.2 AC Input to UPS

A. Voltage Configuration: (select one)

- 200, 208, 220, 230, 240VAC nominal, single-phase, 2-wire-plus-ground (L-L-G or L-N-G) (select for any frame listed above)
- 380/400/415/200/100, 208/120, 220/110, 230/115, 240/120VAC nominal, single-phase, 3-wire-plus-ground. (select for transformer-free frames listed above)

B. Frequency: 40 to 70 Hz.

C. Input Current Distortion: 5% THD maximum at full load.

D. Input Power Factor: 0.99 lagging at 100% rated load.

E. Inrush Current: 150% of full load input current maximum for 3 cycles.

F. Surge Protection: Sustains input surges without damage per criteria listed in IEEE C62.41, Category A, Level 3 and IEC/EN/AS 61000-4-2, 3, 4, 5, 6 Category 2, Table 6.

1.3.3.3 AC Output

A. Voltage Configuration: (select one)

- 200, 208, 220, 230, 240VAC nominal, single-phase, 2-wire-plus-ground (L-L-G or L-N-G) (select for transformer-free frames listed above)
- 200/100, 208/120, 220/110, 230/115, 240/120VAC nominal, single-phase, 3-wire-plus-ground. (L-L-N-G) (select for any frame listed above)

  Output voltage shall be field configurable.

B. Voltage Regulation: ± 3% steady state.

C. Frequency Regulation: 50 or 60 Hz, ± 0.2 Hz.

D. Frequency Slew Rate: 0.3 Hz per second maximum.

E. Bypass Frequency Synchronization Range: ± 3.5 Hz.

F. (Select for transformer-free systems)

Voltage Distortion: 3% total harmonic distortion (THD) maximum into a 100% linear load, 5% THD maximum into a 100% non-linear load with crest factor ratio of 3:1.

(Select for transformer-based systems)

Voltage Distortion: 3% total harmonic distortion (THD) maximum into a 100% linear load, 7% THD maximum into a 100% non-linear load with crest factor ratio of 3:1.

G. Load Power Factor Range: 0.65 lagging to 0.90 leading.

H. Output Power Rating: Rated kVA at: 0.9 lagging power factor.

I. Overload Capability: >100% - 104% indefinitely, 105% - 130% for 1 minute, 131% - 150% for 10 seconds, 151% - 200% for 1 second, >201% for 250 msec, The load shall be transferred to bypass when any of the above conditions shall be exceeded. A short circuit shall cause an immediate system shutdown.

J. Voltage Transient Response: ± 7% maximum for any load step up to and including 100% of the UPS rating.

K. Transient Recovery Time: To within 1% of steady state output voltage within 60 milliseconds.

1.3.3.4 Batteries

A. Internal Battery: The battery shall consist of gas recombination, valve regulated, lead acid cells. Flame retardant batteries shall be provided, which render the UPS suitable for installation inside a computer room per requirements of UL Standard 1778 and NFPA70.

B. Reserve Time: (with ambient temperature between 20 and 25°C [68 and 77°F]). The UPS shall contain an internal battery system to provide a reserve time of 5 minutes at 100% load with an equal number of power and battery strings fitted. The UPS shall contain provisions to fit additional battery modules internally if space permits. The UPS shall also interface with an external battery cabinet to extend reserve time capabilities.

C. Battery Recharge: To prolong battery life, the UPS shall contain temperature-compensated battery charging. When equal numbers of power modules and battery strings shall be fitted, the battery charger shall be able to recharge a fully discharged battery system to 90% capacity in 5 hours at nominal input voltage and nominal ambient temperature. An optional charger module shall be available to provide a quick recharge time for systems with extended run time.

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

- Operating: UPS 0°C to +40°C [32°F to 104°F]; battery 20°C to 25°C [68°F to 77°F] for optimum performance.
- Storage: UPS -20°C to +60°C [-4°F to 140°F]; battery -20°C to 25°C [-4°F to 77°F]for a maximum of 6 months.

B. Relative Humidity

- Operating: 0 to 95% non-condensing.
- Storage: 0 to 95% non-condensing.

C. Altitude

- Operating: To 3000 meters (10,000 feet). Derating or reduced operating temperature range required for higher altitudes.
- Storage: To 10,000 meters (30,000 feet).

D. Audible Noise

Noise generated by the UPS during normal operation shall not exceed 55 dBA for output loading of <50%; 65 dBA for output loading of 51-100%, measured at 1 meter from the surface of the UPS

E. Electrostatic Discharge

The UPS shall be able to withstand a 4 kV contact, 8 kV air electrostatic discharge without damage and shall not affect the critical load. These limits shall be per Standard IEC 62040-4-2 2nd Edition, Cat 2, Table 6 and IEC 61000-4-2.

1.5 USER DOCUMENTATION

The specified UPS system shall be supplied with one (1) user's manual. Manuals shall include installation instructions with illustrations, a functional description of the equipment with block diagrams, safety precautions, illustrations, step by step operating procedures, troubleshooting assistance and routine maintenance guidelines.

1.6 WARRANTY

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for two (2) years. The warranty shall cover all parts for two (2) years and onsite labor for ninety (90) days. With startup provided by Liebert Services, the warranty shall cover all parts and onsite labor for two (2) years. Maintenance contract packages shall also be available.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer's Qualifications

A minimum of 30 years experience in the design, manufacture and testing of solid-state UPS systems shall be required.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the configured system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on the internal battery to guarantee rated performance. A hard copy test report shall be included at no additional cost with every unit.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS shall be new, of current manufacture and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.

2.1.1 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70) and other applicable codes and standards.

2.1.2 Cabinet

The UPS unit comprised of: power module, battery module, control module, system interconnect module and user interface module shall be housed in a single free-standing enclosure and meet the requirements of IP20. The UPS system shall be designed such that the battery modules may be installed into any module bay in the cabinet and power modules into any module bay in the top portion of the cabinet. The UPS cabinet shall be cleaned, primed and painted with the manufacturer's standard color. Casters and leveling feet shall be provided.

UPS cabinet dimensions shall not exceed (select one)

10-bay Frame / 15kVA rated Transformer-Free Systems

440mm W x 800 mm D x 695 mm H (17 in W x 32 in D x 27 in H)

12-bay Frame / 15kVA rated Transformer-Based Systems

440mm W x 800 mm D x 1060 mm H (17 in W x 32 in D x 42 in H)

16-bay Frame / 20kVA rated Transformer-Free Systems

440mm W x 850 mm D x 970 mm H (17 in W x 34 in D x 38 in H)

16-bay Frame /20kVA rated Transformer-Based Systems

440mm W x 850 mm D x 1240 mm H (17 in W x 34 in D x 49 in H)

Additionally the 15 and 20kVA rated transformer-free and 15kVA rated transformer-based frames shall be capable of being installed in a standard 600mm wide (24 in) four post rack enclosure with the optional rack-mount kit.

2.1.3 Cooling

The UPS shall be forced air cooled by internally mounted fans. Air intake shall be from the front, and exhaust out shall be from the rear of the unit. Air intake shall contain air filters with a PPI = 30 rating.

2.2 COMPONENTS

2.2.1 Input Converter

A. General

Incoming AC power shall be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor and input current distortion correction.

B. AC Input Current Limit

The input converter shall be provided with AC input over current protection.

C. Input Protection

The UPS shall have built-in protection against undervoltage, overcurrent and overvoltage conditions including low-energy surges introduced on the primary AC source and the bypass source. The UPS shall sustain input surges without damage per criteria listed in IEEE C62.41, Category A, Level 3 and IEC/EN/AS 61000-4-2, 3, 4, 5, 6 Category 2, Table 6. The UPS cabinet shall contain an input breaker sized to supply full rated load and to recharge the battery at the same time.

D. Battery Recharge

To prolong battery life, the UPS shall contain temperature-compensated battery charging. When an equal number of power modules and battery strings shall be fitted, the battery charger shall be able to recharge the internal batteries to 90% capacity in 5 hours at nominal input voltage and nominal ambient temperature.

E. Charger Output Filter

The battery charger shall have an output filter to minimize ripple current into the battery.

2.2.2 Inverter

A. General

The inverter shall convert DC power from the input converter output or the battery, into precise regulated sine wave AC power for supporting the critical AC load.

B. Overload

The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without requiring clear protective fuses. The load shall be transferred to bypass when any of the above conditions are exceeded.

C. Maximum Load Alarm

The user shall be able to set the alarm point to a value of less than 100% rating so that the UPS shall alarm before an overload condition or loss of redundancy is reached.

D. Output Frequency

The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall hold the inverter output frequency to ± 0.2 Hz for steady state and transient conditions. The inverter shall track the bypass continuously, providing the bypass source maintains a frequency within the user selected synchronization range. If the bypass source fails to remain within the selected range, the inverter shall revert to the internal oscillator.

E. Output Protection

The UPS inverter shall employ electronic current limiting.

F. Battery over Discharge Protection

To prevent battery damage from over discharging, the UPS control logic shall control the shutdown voltage setpoint. This point shall be dependent on the rate of discharge.

2.2.3 Display and Controls

A. General

The front panel shall consist of multiple status LEDs, switches and a 320x240 dot matrix LCD display for additional alarm/configuration information. All mimic display LEDs shall indicate the following:

- AC Input
- On Battery
- Load On/Off
- On Inverter
- On Bypass

The UPS fault indicator shall be used with additional indicators and audible alarms to notify the user that a UPS fault condition has occurred. The color of the fault indicator LED shall be red.

- Replace Battery Module
- Replace Power Module
- Replace Control Module
- On Bypass
- Low Battery
- OverTemp Warning
- UPS Shutdown

If there is a fault condition, the UPS shall attempt to maintain conditioned power to the load or at minimum transfer to bypass.

There shall also be indication on each module should the module fail and need to be replaced.

In addition to a visual fault signal, the UPS shall also record fault occurrences in a rolling event log. The event log on the standard unit shall record up to 1024 occurrences, with the oldest events discarded first. The user shall have access to the event log through the LCD display. Every alarm and/or event recorded in the event log shall contain a time and date stamp.

B. Audible Alarms

The volume of all audible alarms shall be at least 65dBA at a distance of one meter (three feet). An audible alarm shall be used in conjunction with the LED/LCD indication to indicate a change in UPS status.

The audible alarms shall annunciate for utility line loss, low battery (while on battery) and all other alarm conditions. For all alarm conditions, the user must look at the display to determine the cause of error/alarm. All alarm tones shall be a continual tone until the condition rectifies itself or the alarm shall be silenced. Once silenced, the audible alarm shall not sound until a new alarm condition shall be present.

C. Alarm Silence Button

In addition to the load on/off switch, the user interface shall include an audible 'Alarm Silence' switch. If the alarm silence switch shall be pressed for one second, all current audible alarms shall be disabled. If a new alarm occurs or if a canceled alarm condition disappears and then re-appears, the audible alarm shall be re-enabled.

D. Liquid Crystal Display (LCD)

The LCD shall be used to provide information to the user. The display shall also be used to program ALL information (voltage, frequency, etc.) into the UPS. The LCD shall be multilingual with seven languages (English, French, Italian, German, Spanish, Chinese and Russian).

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Liebert® NXC™

Compact and Reliable Power in a Fully Integrated Packaged Solution

■10kVA -40kVA

Compact, Reliable Power

Liebert® NXC™ offers reliable and flexible secure power in a fully integrated package solution. It comes complete with highly efficient transformer-free double conversion technology allowing it to provide installation and operating cost savings.

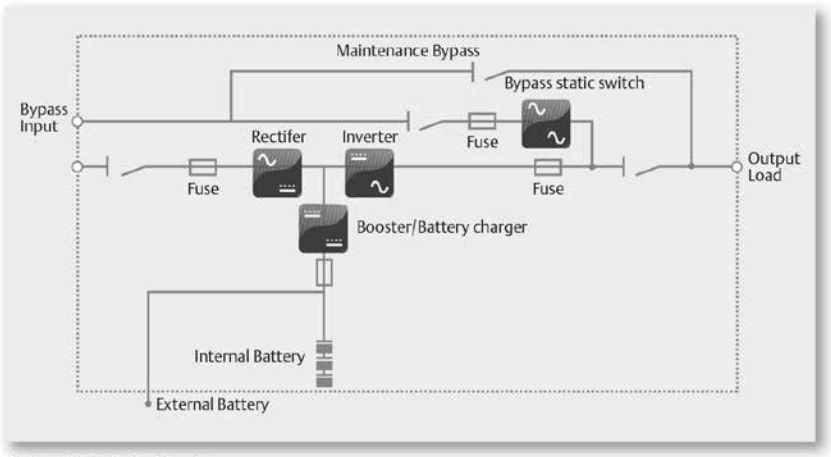
With a rated output power factor of 0.9, the Liebert® NXC™ is also able to provide 11% more active power than a traditional 10-40 kVA UPS. Liebert® NXC™'s combination of performance features, impressive integrated autonomy and compact footprint make it ideal for guaranteeing clean, continuous power for a wide range of applications from IT, medical facilities and laboratories, office facilities, and retail brands.

Liebert® NXC™ achieves up to 94.5% efficiency in double conversion mode and up to 98% in Eco mode ensuring effective load protection while reducing the total cost of ownership (TCO) and environmental impact.



Features and Performances

- 0.9 output power factor
- Double conversion efficiency over 94%
- Integrated battery compartment capable of up to 57 mins. of integrated autonomy
- Easy site installation and configuration
- Ecomode efficiency up to 98%
- Active input power factor correction (PFC)
- Input current total harmonic distortion correction (THDi) < 5%
- High capacity battery charger
  - 10-20kVA ~ 4.5kW
  - 30-40kVA ~ 6kW
- Input/output and bypass circuit breakers
- Integrated manual bypass
- Integrated parallel load bus and synchronization port (LBS)



Liebert® NX single-line diagram

Flexibility

Liebert® NXC™ is a compact solution designed to optimize installation space requirements and provide enhanced flexibility to ensure superior protection for all load types (leading and lagging).

The internal battery component allows customized configuration options for greater flexibility. It is capable of having different number of battery strings resulting into longer and higher backup time. *

Liebert® NXC™'s flexibility is further enhanced through:

- **Built-in transformer option***
- **Common or distributed battery bank**
- **Reduced footprint**

Output Configuration
Liebert® NXC™ can be configured on-site to deliver three (3/3) phase output giving it the flexibility to adapt to changes in installation environments.



In The Field

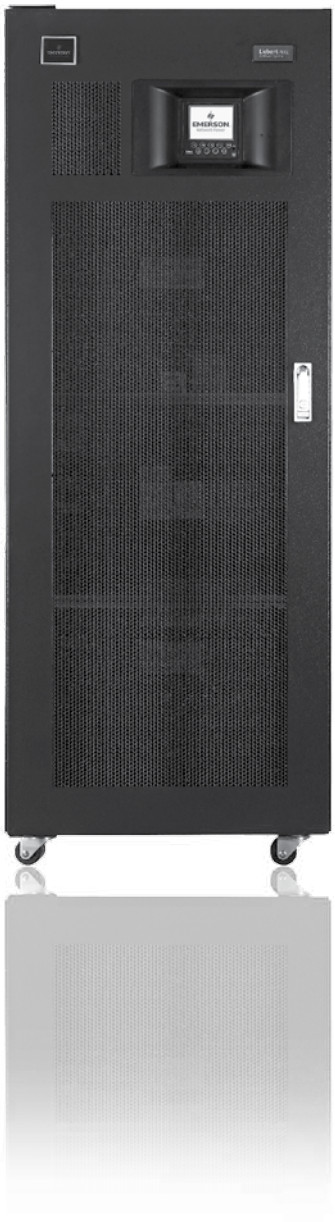
Integrated autonomy
Liebert® NXC™ provides an excellent integrated autonomy which results in back up times of up to one hour.

The batteries housed inside the UPS cabinet which are responsible for delivering Liebert® NXC™'s integrated autonomy have the added advantage of virtually eliminating the need for an external battery cabinet, further reducing installation costs and minimizing the demand on physical space.

The powerful 6 kW battery charger of the Liebert® NXC™ allows the reduction of battery re-charging time and increases its ability to manage longer back up times.

Parallel Ready
Liebert® NXC™ can be connected with up to four units in parallel, one of which is redundant. A single unit can be upgraded to parallel operation via easy to modify software settings which allow the system to be customized for the requested configuration.

The Loop BUS connection used in paralleling the system delivers ultimate reliability and eliminates the possibility of a single point of failure, ensuring perfect load sharing and fast detection of any variation in the system status.



Communication

Liebert® NXC™ features a multi-lingual LCD user interface allowing close control and monitoring of system status and performance.

The UPS offers the following communication features:

- **Voltage-free contact ports**
- **USB interface**
- **Internal Intellislot for SNMP or Modbus communication**

These communication capabilities make Liebert® NXC™ compatible with any building management system.



Software Connectivity



Liebert® Multilink™ software prevents unexpected server shutdowns and minimizes downtime warning of pending power losses and initiating safe shutdown of operating systems if required.



Liebert® Nform™ network communications system enables customers to leverage the distributed monitoring capabilities of network connected equipment providing centralized management of distributed systems.



Serviceability

The architecture of the Liebert® NXC™ is designed to optimize installation and simplify service with its easily removable power assembly. This architecture considerably minimizes the time needed for repairs and optimizes serviceability.



Liebert® NXC™ also comes equipped with casters to facilitate ease of movement and relocation.

Liebert® NXC™ Specifications

Technical Characteristics				
Ratings (kVA)	**10**	**20**	**30**	**40**
Output active power at 40° C (kW)	9	18	27	36
Output power factor	0.9			
Parallel configuration	3+1		4+0	
Input				
Input voltage range (possible to reach 100%)	229V-477V	305V-477V	266V-477V	305V-477V
Bypass voltage tolerance (%)	Selectable within -40% to +20%			
Input frequency tolerance (Hz)	40 - 70			
Input power factor	0.99			
Input Total Harmonic Distortion	<5%			
Output				
Nominal output voltage - three phase (V)	380/400/415			
Nominal output frequency (Hz)	50 / 60			
Frequency synch. range (Hz)	2 Hz (selectable 0.5 - 3 Hz)			
Frequency track rate (Hz)	1 Hz			
Inverter overload capacity (%)	105% continuous; 125% 5min ; 150% 1 min			
Double conversion efficiency (%)	up to 94.5%			
Eco mode efficiency (%)	up to 98%			
General				
Noise at 1 m (dBA)	<56	<58	<56	<58
Protection level	IP20			
Frame color	BLACK ZP 7021			
Display	graphic multi-lingual LCD			
Dimensions And Weight				
Height (mm)	1240		1600	
Width (mm)	500		600	
Depth (mm)	860		850	
UPS weight (kg)	115		215	

Autonomy time (in mins.)*

Internal Battery Configuration	10kVA	20kVA
1 x 32 x 9AH	8	n/a
2 x 32 x 9AH	23	8
3 x 32 x 9AH	42	15
4 x 32 x 9AH	57	23
Internal Battery Configuration	**30kVA**	**40kVA**
1 x 38 x 34AH	15	10

**Notes:*
1. Longer back-up time is available. Please consult Emerson representative for proper configuration.
2. Autonomy time is based on 100% load and 0.9 UPS Output Power Factor.
3. Condition applies.

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Liebert® eXM™ UPS

Efficient, Flexible Power Optimized for Midsize Applications

■10-200kVA/kW



Medium Size UPS As Dynamic As Your Business

Small and medium sized businesses need UPS solutions that deliver lower first costs and ongoing operational savings, high reliability, and enable speed and flexibility in a dynamic IT environment

Emerson commitment is to deliver the most technologically advance product for our customer's mission critical applications, is once again reiterated by our next generation UPS series Liebert® eXM

Highly Efficient, most flexible and reliable transformer free UPS for small and mid-tier applications.

Efficient power protection that can meet your capital requirements. Our latest ECO Mode option delivers over 99% efficiency, while the Double Conversion Mode has been optimized to exceed 96%.

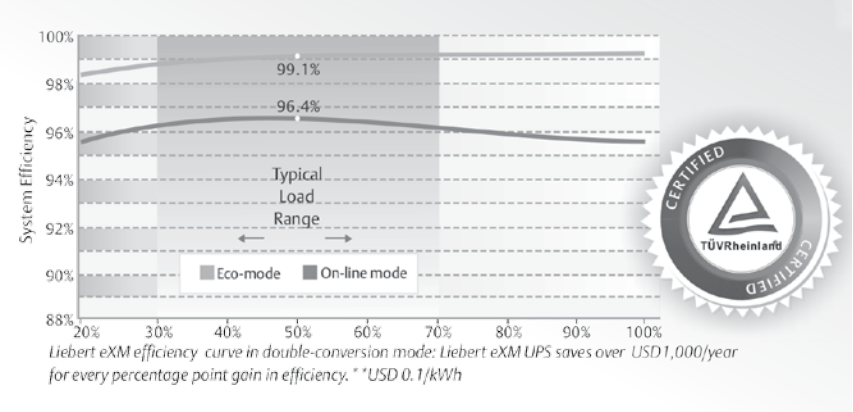
Flexible configurations provides an ideal mix of both row-based and room-based benefits, optimized to deliver excellent performance at low total cost of ownership and allow organizations to meet stringent Service Level Agreements.

Reliability is the epicenter of Liebert® eXMTM. Its Internal and external architecture is rugged enough to handle input faults, load faults, temporary overloads, input power disturbances and even industrial environment.

Highlights

- Double Efficiency exceeding 96% at partial load
- ECO mode availability for parallel configurations
- Unity output PF (kVA=kW)
- Powerful battery charging capability
- Flexible air flow management ; from back and top
- Top or bottom cable entry Integrated transformer option
- Full frontal access for installation and service
- LIFETM remote diagnostic and preventive monitoring service
- Robust internal architecture makes it suitable for light industrial application

Liebert *e*XM UPS (40kVA/kW, 208V) in Double Conversion Mode



*Liebert eXM efficiency curve in double-conversion mode: Liebert eXM UPS saves over USD1,000/year for every percentage point gain in efficiency. * *USD 0.1/kWh*

Liebert® eXM™s Efficiency credentials and performance is certified by TUV -Rheinland in accordance with IEC/ EN 62040-1, IEC/ EN 62040-3

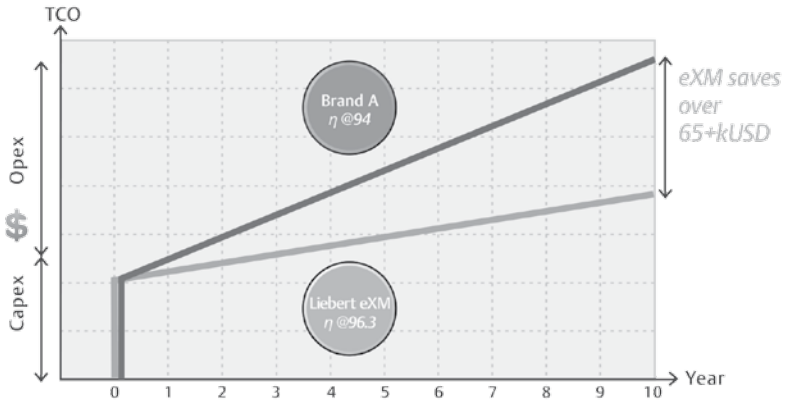
Efficient System

Since the need for improving energy efficiency has become more ubiquitous, many manufacturers have introduced energy efficient UPS system to meet the customers' needs on energy conservation. But they fail to communicate the true picture of efficiency with respect to load at the typical operating condition

Mostly, UPS efficiency is judged at full load calculations –but your system rarely runs at full load. Compare double conversion efficiencies in the 30-70 percent load ranges to get a true picture of operating costs. *This is where Liebert eXM draw out the critical difference by consistently exceeding unmatched over 96% efficiency level.*

Similarly, under ECO mode Liebert® eXM™ constantly delivers over 99% efficiency across the typical load range and It is able to do so even in parallel operation without the need for an external

TCO performance at typical 40-60% load level



accessories thus saving on initial cost and also, while ensuring high level of availability by transferring the load to inverter and vice versa in less than 2ms, in case of utility voltage anomaly or failure.

When two or more UPS are paralleled to reach the required capacity, an integrated Intelligent Paralleling algorithm can be established. Intelligent Paralleling evenly distributes the operating hours across the connected UPS units by rotating the active ones thus maximizing

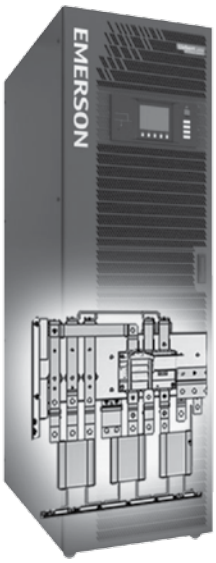
the total system efficiency.

With its advanced efficiency techniques, Liebert® eXM™ contributed to minimizing the carbon footprints of mission critical applications, helping data centers to meet the industry's environmental and efficiency compliance standards.

Flexible Configuration and Design Options

Liebert® eXM™ provides a power protection solution of proven quality for customer's IT services. Attributes like flexible air flow management; from front and top and top cable entry optimized the total cost of ownership of the electrical infrastructure and easily adapts to different installation requirement. **From a row of racks in a data center to the corner of a equipment room** (fed from cables running above the units or beneath the raised floor)

For installations that require full galvanic isolation. Some ratings of Liebert® eXM™ can come equipped with an integrated transformer, offering a certified proven solution with a zero footprint impact.



Liebert eXM with inbuilt isolation transformer

Customized to fit specific needs

Liebert® eXM™ is designed to take care of your dynamic distribution needs, Liebert® eXM™; 80-120kVA can house complete distribution assembly; including input, output, bypass and maintenance switch . Inbuilt distribution assembly reduces the capital and commissioning expenses to be incurred to set up switch distribution infrastructure .

For higher ratings, an optional switch side car can be ordered to felicitate the full arrangement of switch assembly. This side car arrangement greatly optimized the overall space and initial cost by also enabling top cable entry.



Liebert eXM detached from the wall



Liebert eXM adjacent to the wall

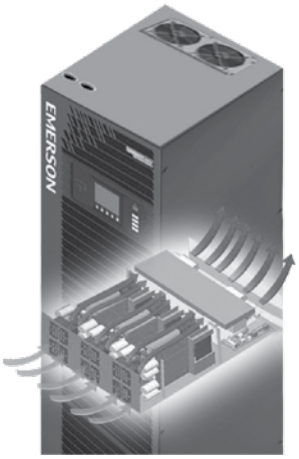


Liebert eXM (160-200 kVA)with switch sidecar

High Availablity

Liebert® eXM™ has been designed to maximize the availability of secure power, leveraging Emerson's experience and expertise in designing high MTBF UPS solutions and Low MTTR through a Design-for-Serviceability/Maintainability construction.

There are numerous factor contributes to the reliability of **Liebert® eXM™**. But, One of them is the **rugged internal topology** wherein the internal air channel is designed in such a way that internal hot air drives directly towards heat sink without distressing the PCB's and other internal sensitive circuits consequently the improved service life of component prevent premature failure and ensure utmost reliability.

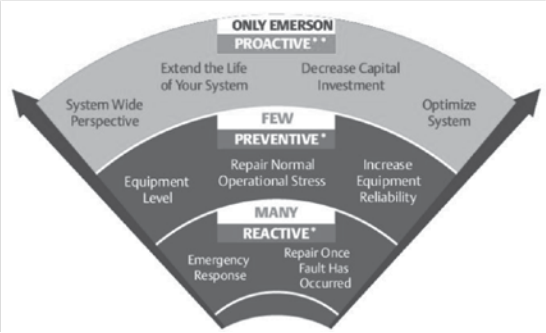


Liebert® eXM™ provides enhanced fault tolerance at partial load versus a traditional fixed capacity monolithic UPS. It can tolerate internal power module failures and still support a partial load without going to bypass.

Liebert® eXM™ battery charger can deliver 15% of the nominal UPS power for battery recharge, so being able to provide adequate current to charge even batteries with a long backup time, thus making it ideal for prolong battery powered application.

Serviceability

Many Services organizations can perform basic repair activities and maintain equipment at the some level of competency, but Emerson Network Power services can take your critical maintenance to the next level -proactive maintenance that can significantly extend the life of you power systems.



LIFE™ Remote Diagnostic and Preventive Monitoring Service

The **LIFE™** remote diagnostic and preventive monitoring service provides early warning of UPS conditions and out of tolerances. This allows effective proactive maintenance, fast incident response and remote trouble shooting, giving customers complete security and peace of mind.

With **LIFE™** services you will benefit from:

- Uptime Assurance
- First Time Fix Rate
- Proactive Analysis
- Minimized Total Cost of Ownership of Your Equipment
- Fast incident Response
- Reporting

Customer Monitoring Interfaces

Human-Machine Interface

A comprehensive, easy to use LCD interface provides robust monitoring and control, as well as a user-friendly graphical display, reducing the likelihood of human error.

A Single-line mimic diagram shows system status at a glance.

Hardware Connectivity

Liebert® eXM™ allows for the monitoring and control of networked UPS through different protocol options:

- The integration of UPS with Building Monitoring and Automation Systems via MODBUS RTU, MODBUS/TCP protocols
- The integration with synoptical panels via a dry contact board

Software Connectivity

Liebert® Nform™ will monitor the Liebert eXM via SNMP protocol. Authenticated alarm management, trend analysis and event notification delivers a comprehensive monitoring solution.

Liebert® SiteScan™ Web allows users to virtually monitor and control any piece of critical support equipment. Its features include real-time monitoring and control, data analysis, trend reporting, and event management.



Trellis™ Platform Emerson Network Power's Trellis™ platform is a real-time infrastructure optimization platform that enables the unified management of data center IT and facilities infrastructure.

The Trellis platform software can manage capacity, track inventory, plan changes, visualize configurations, analyze and calculate energy usage, and optimize cooling and power equipment.

The Trellis platform monitors the data center, providing a thorough understanding of system dependencies to help IT and facilities organizations keep the data center running at peak performance. This unified and complete solution, delivers the power to see the real situation in your data center, make the right decision and take action with confidence.

trellis™

Liebert® eXM™ Technical Specifications

Nominal Ratings(kVA/kW)	80kVA/kW	100kVA/kW	120kVA/kW	160kVA/kW	200kVA/kW
Input					
Nominal input voltage(V)	380/400/415				
Input voltage range without battery discharge(V)	229~478				
Nominal input frequency(Hz)	50/60				
Input frequency range(Hz)	40-70				
Bypass voltage tolerance(%)	Upper limit: +10%, +15%, or +20% default: +15%; Lower limit: -10%, -20%, -30% or -40% default: -20%				
Bypass frequency tolerance(%)	+/- 10% or +/- 20%, default: +/-10%				
Input power factor(kW/kVA)	>0.99				
Current THD at full linear load(THDi%)	<3%				
Battery					
Number 12V battery per string(min-Max)	30-44				
Temperature compensation (mV/°C/cl)	-3.0 (selectable from 0 to -5.0 around 25°C or 30°C, or inhibit)				
Battery Charger max. power (A)	20	30	30	40	50
Output					
Nominal output voltage (V)	380/400/415				
Nominal output frequency (Hz)	50/60				
Nominal active power (kW)	PF=1				
THDv with 100% linear load (%)	<1%				
Inverter overload capacity	110% for 60 min; 125% 10min; 150% for 1 min				
Efficiency					
Double conversion efficiency	Up to 96.4%				
ECO mode efficiency	Up to 99.1%				
Dimensions and weight					
Dimensions (W x D x H) mm	600 x 1000 x 2000				
Weight(Net weight)	385	430	430	475	520
General					
Nosie at 1 m(dBA)	61				65
Altitude	≤1500; derate power by 1% per 100m between 1500m and 300m				
Ventilation	Front to back standard/ Front to top (optional)				
Protection level IEC (60529)	IP 20 STANDARD				
General and safety requirements for UPS	EN62040-1 / IEC62040-1 /AS62040-1				
EMC requirements for UPS	EN62040-2 / IEC62040-2 / AS62040-2 (Class C2*)				
Method of specifying the performance and test requirements of UPS	EN62040-3 / IEC62040-3 / AS62040-3 (VFI-SS-111)				

*Class C3 is standard whereas class C2 is optional
Specifications are subject to change without any prior notification

Liebert® eXM™ UPS

Single-Module Uninterruptible Power System
80-200kVA
GUIDE SPECIFICATIONS

Important Instructions:

1. While submitting to consultant or customer for tender specking, kindly input the project specific information in dash Box (_____)
2. This document includes VRLA SMF battery specifications.

1.0 GENERAL

1.1 SUMMARY

These specifications describe requirements for an Uninterruptible Power System (UPS) optimized for maximum efficiency. The UPS shall automatically maintain AC power to the critical load within specified tolerances and without interruption during failure or deterioration of the normal power source.

The manufacturer shall design and furnish all materials and equipment to be fully compatible with electrical, environmental and space conditions at the site. The UPS shall include all equipment to properly interface the AC power source to the intended load and shall be designed for unattended operation.

1.2 STANDARDS

The UPS and all associated equipment and components shall be manufactured in accordance with the following applicable standards:

- Safety Requirements: IEC 62040-1-1, EN 50091-1-1
- EMC: IEC 62040-2 (Class A), EN 50091-2 (Class A)
- Performance: IEC 62040-3 (VFI SS 111), EN50091-3

The above mentioned product standards incorporate relevant compliance clauses with generic IEC and EN standards for safety (60950), electromagnetic emission and immunity (61000 series) and construction (60146 series and 60529).

For more details, see below:

- IEC 61000-3-4
- IEC 61000-4-2, 4, 5, 6, 8, 11
- EN60950
- EN60529
- IEC 60146-1-1

The UPS is CE marked in accordance with EEC directives 73/23 "low voltage" and 89/336 "electromagnetic compatibility".
The Quality System for the engineering and manufacturing facility certificated to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics.

1.10.4 Inverter Bypass Operation

When maintenance is required or when the inverter cannot maintain voltage to the load due to sustained overload or malfunction, a bypass circuit shall be provided to isolate the inverter output from the load and provide a path for power directly from an alternate AC (bypass) source. The UPS control system shall constantly monitor the availability of the inverter bypass circuit to perform a transfer. The inverter bypass circuit shall consist of a continuous duty bypass static switch and an overcurrent protection device to isolate the static bypass switch from the bypass utility source. The bypass static switch shall denote the solid-state device incorporating SCRs (silicon controlled rectifiers) that can automatically and instantaneously connect the alternate AC source to the load.

A. Static Bypass Switch Rating

The static bypass switch shall be rated for continuous duty operation at full rated load for highest reliability without the use of mechanical devices as used with a momentary rated device.

B. Manual Load Transfers

A manual load transfer between the inverter output and the alternate AC source shall be initiated from the control panel. Manually initiated transfers shall be make-before-break, utilizing the inverter and the bypass static switch.

C. Automatic Load Transfers

An automatic load transfer between the inverter output and the alternate AC source shall be initiated if an overload condition is sustained for a period in excess of the inverter output capability or due to a malfunction that would affect the output voltage. Transfers caused by overloads shall initiate an automatic retransfer of the load to the inverter only after the load has returned to a level within the rating of the inverter source and the alarm has been acknowledged.

D. Momentary Overloads

In the event of a load current inrush or branch load circuit fault in excess of the inverter rating, the bypass static switch shall connect the alternate AC source to the load for at least 100 milliseconds, allowing up to 1000% of the normal rated output current to flow. Output voltage shall be sustained to the extent the alternate AC source capacity permits. If the overload condition is removed before the end of the 100-millisecond period, the bypass static switch shall turn Off and the load shall remain on inverter power. If the overload remains, then a transfer to the alternate AC source is to be completed.

E. Back-Feed Protection

As required by IEC/EN 62040-1, the static transfer switch shall not back-feed UPS power to the bypass distribution system while the UPS is operating on battery during a bypass power outage. The purpose of this requirement is to prevent the risk of electrical shock on the distribution system when the normal source of power is disconnected or has failed. If a shorted SCR is detected, the static transfer switch shall be isolated by an external contactor based circuit breaker and an alarm message shall be annunciated at the UPS control panel. The load shall remain on conditioned and protected power after detection of a shorted SCR and isolation of the bypass static switch.

F. Active ECO-Mode

When selected, this mode of operation shall transfer the load to the bypass source and maintain it there as long as the bypass source frequency, slew rate and voltage are within the adjusted operating parameters. While in this mode, the inverter shall remain operating to demonstrate the ability to instantaneously assume the load without interrupting the output voltage. Should the bypass source go outside the adjusted limits, the bypass static switch shall turn off, isolating the load from the bypass while the inverter assumes the full critical load. The load shall be transferred from the bypass source to the inverter while maintaining the output voltage within the ITIC and CBEMA curves.

1.10.5 Display and Controls

A. UPS Control Panel

Each UPS module shall be equipped with a dot graphic LCD display. This shall automatically provide all information relating to the current status of the UPS as well as being capable of displaying metered values. The display shall be menu-driven, permitting the user to easily navigate through operator screens.

B. Logic

UPS system logic and control programming shall reside in a microprocessor-based control system with nonvolatile flash memory. Rectifier, inverter and system control logic shall utilize high-speed digital signal processors (DSPs). CAN bus shall be used to communicate between the logic and the User Interface as well as the options. Switches, contacts and relays shall be used only to signal the logic system as to the status of mechanical devices or to signal user control inputs. Customer external signals shall be isolated from the UPS logic by relays or optical isolation.

C. Metered Values

A microprocessor shall control the display and memory functions of the monitoring system. All three phases of three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accuracy to ±3% of voltage, ±5% AC current. The following parameters shall be displayed:

- Input voltage, line-to-line
- Input current per phase
- Input frequency
- Input Power factor
- Battery voltage
- Battery charging/discharging current
- Output voltage, line-to-line
- Output frequency
- Bypass input voltage, line-to-line
- Bypass input frequency
- Load current
- Load real power (kW), total and percentage
- Load apparent power (kVA), total and percentage
- Load percentage of capacity
- Battery temperature, each battery string
- Battery state of charge
- Real time Efficiency Curve

D. Power Flow Indications

A power flow diagram shall graphically depict whether the load is being supplied from the inverter, bypass or battery and shall provide, on the same screen, the status of the following components:

- AC Input Circuit Breaker (optional)
- Battery Circuit Breaker, each breaker connection of complete battery complement, complete disconnection and partial connection (one or more, but not all breakers open.)
- Maintenance Bypass Status

E. Main Display Screen

The following UPS status messages shall be displayed:

- Rectifier (Off / Soft Start / Main Input On / Battery Input On)
- Input Supply (Normal Mode / Battery Mode / All Off)
- Battery Self Test (True / False)
- Input Disconnect (Open / Closed)
- EPO (True / False)
- Charger (On / Off)
- Output Disconnect (Open / Closed)
- Maint. Disconnect (Open / Closed)
- Bypass Disconnect (Open / Closed)
- Inverter (Off / Soft Start / On)
- Bypass (Normal / Unable To Trace / Abnormal)
- Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
- Inverter On (Enable / Disable)

F. HMI Control Buttons

Buttons shall be provided to start and stop the inverter. A pop-up message requesting confirmation shall be displayed whenever a command is initiated that would change the status of the UPS.

Other buttons shall be provided to reset faults and silence the alarm buzzer.

G. Event Log

This menu item shall display the list of events that have occurred recently while the UPS was in operation. The Event Log shall store up to 1000 events, with the oldest events being overwritten first if the log's capacity is reached.

H. Battery Status Indicator

A battery status indicator shall display DC alarm conditions, temperature, battery state of charge, the present battery voltage, total discharge time, status of last battery test and battery time remaining during discharge.

The UPS shall provide the operator with controls to perform the following functions:

- Configure and manage manual battery test.
- Modify test duration and minimum voltage
- Start battery test
- Monitor test status and progression
- Stop battery test
- Battery test status

I. Alarms

The following alarm messages shall be displayed:

- Mains Voltage Abnormal
- Mains Under voltage
- Mains Freq. Abnormal
- Charger Fault
- Battery Reversed
- No Battery
- Parallel Comm. Fail
- Bypass Unable To Track
- Bypass Abnormal
- Inverter Asynchronous
- Fan Fault
- Control Power Fail
- Unit Over Load
- System Over Load
- Bypass Phase Reversed
- Transfer Time-Out
- Load Sharing Fault
- Bypass Over Current.

J. Controls

System-level control functions shall be:

- Start Inverter (and transfer to inverter)
- Stop Inverter (after transferring to bypass)
- Startup Screen
- Battery Test Set point Adjustment
- Configure Manual Battery Test
- Initiate Manual Battery Test
- System Settings (Time, Date, Language, LCD Brightness, Password, Audio Level)
- Alarm Silence Command
- Fault Reset Command
- ECO mode

K. Manual Procedures

- Load Transfers: HMI buttons (START INVERTER, STOP INVERTER) shall provide the means for the user to transfer the load to bypass and back on UPS.

1.10.6 Self-Diagnostics

- Event Log File - The control system shall maintain a log of the event conditions that have occurred during system operation. Each log shall contain the event name, event time/date stamp and a set/clear indicator.

1.10.7 Remote Monitoring and Integration Capabilities

A. 24 X 7 remote monitoring services: The UPS manufacturer shall provide as an optional services, which provides 24x7 continuous monitoring of events and parametric data, event and data analysis reports and dispatch of factory trained field service personnel. The UPS shall be able to initiate periodic and critical event-driven communication with a remote service center to transfer event and parametric data for analysis and action. The remote service center shall be staffed with factory-trained service personnel who are capable of receiving, analyzing and interpreting the communicated events and data. The remote service center personnel shall also be capable of dispatching factory-trained field service personnel to the location of the UPS.

B. Communication Cards: The UPS can be equipped with up to three optional communication card(s) including:

- SNMP protocols (v1, v2, v3)
- Modbus RTU or Modbus TCP
- BACnet MSTP or BACnet IP

Note: Modbus RTU or BACnet MSTP can be enabled depends on the site requirement.

SNMP protocol should have capability to communicate with any third party monitoring system

C. Output Alarm Contacts: Dry contact outputs shall be provided for Summary Alarm, Bypass Active, Low Battery and AC Input Failure.

D. Customer Input Contacts: The UPS shall have four discrete input contacts available for the input and display of customer-provided alarm points or to initiate a pre-assigned UPS operation. Each input can be signaled by an isolated, external, normally open contact.

When an assembly is selected as a pre-assigned UPS operation, the following actions shall be initiated:

- On Generator— Provides selectable choices to enable or disable battery charging, and enable or disable ECO Mode operation while on generator.
- Transfer to Bypass—Manual command to transfer from inverter operation to static bypass operation.
- Fast Power Off—Emergency Module Off (EPO) command to stop UPS operation.
- Acknowledge Fault—Acknowledge a UPS alarm condition and present faults will be reset.
- Bypass/Inverter Off—Emergency Power Off (EPO) command to stop UPS operation.
- External Maintenance Bypass Breaker (MBB) status (open or closed)

1.10.8 Battery Disconnect Breaker

The battery cabinet shall have a properly rated circuit breaker to isolate it from the UPS. When this breaker is open, there shall be no battery voltage in the UPS enclosure.

Battery Plant

The battery plant shall comply with the specifications of:

- Matching Battery Power Pack, or
- Valve-Regulated, Sealed Cell Battery System on Rack.

Valve-Regulated, Sealed Cell Battery System on Rack

The battery shall be a lead-acid, sealed maintenance free type with a one-year full warranty

Ratings

Backup time: ____ minutes

Load kW: ____kW

Battery Design Life ____years

Electrolyte Immobilization

The battery shall utilize absorbent glass mat (AGM) technology to immobilize electrolyte.

Alloys

Grids shall be manufactured of lead-calcium alloys to assure long life and consistently low gassing rate over the entire service life; all internal wetted parts shall be of similar non-antimonial alloy to preclude interfacial corrosion at the bonded area.

Plates

Both positive and negative plates shall be of the flat pasted plate design to ensure highly reliable electrical performance throughout the life of the battery.

Terminals

Terminal posts shall be of sufficient strength to support normal inter-tier or inter-step cabling without additional bracing.

Container

The cell container and cover shall be of a flame-retardant material The cell cover shall include a low-pressure release vent.

Intercell Connections

For each bolted connection, tin-plated copper connectors and corrosion-resistant bolts shall be provided; interconnecting hardware shall be sized so as to permit discharge at the maximum published rate.

Along with the necessary hardware, the supplier shall furnish terminal connection coating compound if required by the battery manufacturer.

Manufacturing Controls

Each cell shall be clearly identified as to cell type, voltage and capacity as well as manufacturing control group for future quality assurance traceability.

The equipment shall be designed and manufactured under a quality assurance program that is controlled and documented by written policies, procedures or instructions and that shall be carried out throughout the performance of the work.

The quality control assurance program and testing shall conform to the applicable standards/ISO 9001 and JIS standard.

1.10.9 Optional Accessories and Features

A. Load Bus Sync

The Load Bus Sync (LBS) shall enable two independent single-module UPS units to stay in sync when operating on battery or unsynchronized input sources. The LBS shall determine the master and slave relationship between UPS units. The LBS shall be installed within each single-module UPS.

B. Communication Card

A communication card shall provide Web-based UPS monitoring and management capabilities and one or two of the following remote monitoring protocols: SNMP (v1, v2, v3), Modbus or BACnet for remote monitoring.

C. Relay Contact Card

A relay contact card shall provide output dry contact signals communicating the following UPS states: Summary Alarm, Bypass Active (On Bypass), Low Battery, AC Input Failure (UPS Fault) and On UPS.

D. Seismic Anchorage Kits

Seismic anchorage kits shall be provided with the UPS unit, and if included the optional matching battery cabinet, for use in seismic restraint as required for IBC 2012 or OSHPD certification

2.0 EXECUTION

2.1 FIELD QUALITY CONTROL

The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

A. Visual Inspection

- Inspect equipment for signs of damage.
- Verify installation per drawings supplied with installation manuals or submittal package.
- Inspect cabinets for foreign objects.
- Verify that neutral and ground conductors are properly sized and configured per OEM requirements as noted in OEM drawings supplied with installation manuals or submittal package.
- Inspect each battery jar for proper polarity.
- Verify that all printed circuit boards are configured properly.

B. Mechanical Inspection

- Check all control wiring connections for tightness.
- Check all power wiring connections for tightness.
- Check all terminal screws, nuts and/or spade lugs for tightness.

C. Electrical Inspection

- Check all fuses for continuity.
- Confirm input and bypass voltage and phase rotation are correct.
- Verify control transformer connections are correct for voltages being used.
- Ensure connection and voltage of the battery string(s).

2.2 UNIT STARTUP

1. Energize control power.
2. Perform control/logic checks and adjust to meet OEM specification.
3. Verify DC float and equalize voltage levels.
4. Verify DC voltage clamp and overvoltage shutdown levels.
5. Verify battery discharge, low battery warning and low battery shutdown levels.
6. Verify fuse monitor alarms and system shutdown.
7. Verify inverter voltages and regulation circuits.
8. Verify inverter/bypass sync circuits and set overlap time.
9. Perform manual transfers and returns.
10. Simulate utility outage at no load.
11. Verify proper recharge.

2.3 MANUFACTURER'S FIELD SERVICE

A. Service Personnel

The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory-trained field service personnel dedicated to the startup and maintenance of UPS and power equipment.

The manufacturer shall provide a national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours a day, 7 days a week and 365 days a year. If emergency service is required, on-site response time shall be 4 hours or less within 150 miles of an OEM service center.

Two local customer engineers shall be assigned to the site with a regional office as a backup. Escalation procedures shall be in place to notify Power Technical Support if a site is not functioning within 24 hours.

B. Automated Site Monitoring

The UPS manufacturer shall provide as an option an automated site monitoring service. This service shall be staffed by a qualified support person 24 hours a day, 7 days a week and 365 days a year. At the detection of an alarm within the UPS, the controls shall initiate communication with the monitoring service. The monitoring service shall be capable of interpreting the communicated alarms to allow dispatch of a service engineer.

C. Replacement Parts Stocking

Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the country.

Spare parts shall be stocked by local field service personnel with backup available from national parts centers and the manufacturing location. A Customer Support Parts Coordinator shall be on call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

D. Maintenance Contracts

A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available.

UNINTERRUPTIBLE POWER SYSTEM TECHNICAL DATA:

Parameters	Specification data	Suppliers Data
Input Characteristics		
Nominal Voltage	380/400/415, 3-phase 3-wire	
Tolerance on voltage	+20%, -15% at full at full load; -40% at half load	
Nominal frequency(60Hz selectable)	50Hz	
Tolerance on frequency	40-70 Hz	
Input Power factor @nominal voltage	0.99 at 100% load	
	>0.98 at 50% load	
Total harmonic distortion (THDi) @ full load	<3%	
INVERTER OUTPUT CHARACTERISTICS		
Nominal voltage (380/415 selectable)	400V Three Phase +N	
Nominal frequency(60Hz selectable)	50Hz	
Nominal Power @ 40 Deg C (kVA)	80/100/120/160/200	
Output Voltage Stability in steady state condition	+/-1%	
Stability in dynamic conditions for 100% load step variations	+/-5%	
Load crest factor without derating	3:1	
Output voltage distortion with 100% linear load	<2%	
Output voltage distortion with 100% non-linear load as specified by IEC/EN 62040-3	<5%	
Trasnfer time from bypass to online mode and vice versa in ECO Mode (in sync condition)	<2msec	
Output frequency stability in synchronization with mains (± 0.5 to +/-3 hz)	+/-2Hz	
Output frequency stability with internal clock	± 0.05%	
Frequency slew rate (Hz/s)	Adjustable from 0.1 to 3	
Permitted overload:		
. For 60 Minutes	110%	
. For 10 Minutes	125%	
. For 60 seconds	150%	
Characteristics of electronic static changeover switch		
Nominal voltage (380/415 selectable)	400V	
Tolerance on voltage	+15%,-20%	
Nominal frequency (60 Hz selectable)	50Hz	
Tolerance on frequency	±10%	

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

The UPS shall be rated to provide a minimum of ____kW on the output.

The required UPS kVA rating will be set the same as the minimum kW rating. (Unity power factor)

The UPS shall be able to supply full required output kVA loads with power factor from 0.5 lagging to 0.9 leading. The UPS shall also work from with a leading power factor of 0.8 to 0.5 subject to de-rating

Load voltage and bypass line voltage shall be 400VAC, three-phase, four-wire plus ground. Input voltage shall be 400VAC, three-phase, four-wire plus ground. The AC input source and bypass input source shall each be a solidly grounded wye service.

The battery shall support the UPS at the rated kW load for at least _____ minutes at 25°C at the beginning of battery life

1.3.2 Modes of Operation

The UPS shall operate as an on-line reverse transfer system in the following modes:

A. Normal: The critical AC load shall be continuously powered by the UPS inverter. The rectifier/charger shall derive power from the utility AC source and supply DC power to the DC-DC converter, which in turn shall supply the inverter while simultaneously float charging the battery.

B. ECO Mode: The critical AC load shall be continuously powered by the bypass with the inverter available to power the load if the bypass source voltage or frequency exceeds adjustable parameters of power quality.

C. Battery: Upon failure of utility AC power, the critical load shall be powered by the inverter, which, without any switching, shall obtain its power from the battery plant via the DC-DC converter. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

D. Recharge: Upon restoration of the utility AC source, the rectifier shall supply power to the output inverter and to the DC-DC converter, which shall simultaneously recharge the batteries. This shall be an automatic function and shall cause no interruption to the critical load.

E. Bypass: If the UPS must be taken out of service, the static transfer switch shall transfer the load to the bypass source. The transfer process shall cause no interruption in power to the critical load. An optional external wrap-around maintenance bypass shall be used to ensure full isolation of the unit for the service of internal components .

F. Off-Battery: If the battery only is taken out of service, it shall be disconnected from the DC-DC converter by means of an external disconnect circuit breaker. The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for the power outage backup time capability. If multiple battery strings are used, each string shall be capable of being electrically isolated for safety during maintenance.

Permitted overload:		
. For 10 Minutes	125%	
. For 60 seconds	150%	
. For 200 milli seconds	>150%	
UPS characteristics		
Maximum UPS cabinet dimensions W x H x D in mm	600 X 2000 X 1000	
Noise level measured @ 1 meter and @ 100% load according to ISO 3746	61dB (Up to 160kVA), 65dB (200kVA)	
Performance in double conversion mode	95.6% @ 100%load	
	>96% @ 50-75% load	
	95.6% @ 25% load	
	>93.5% at 10% load	
Performance in ECO Mode (at 100% Load)	Up to 99.2%	
Transformer	Optional (built in up to 120kVA)	
Ventilation	Front to Top (or) Front to Back	
Degree of protection	IP 20	
Colour of cubicles	Black ZP7021	

1.3.3 Performance Requirements

The solid-state power components, magnetics, electronic devices and overcurrent protection devices shall operate within the manufacturer's recommended temperature when the UPS is operating at 100% critical load and maintain battery charging under either of the following conditions:

- Any altitude within the specified operating range ≤1500m elevation.
- Any ambient temperature within the specified operating range of 0°C to 40°C

1.3.4 Input

A. Voltage: Input/output voltage specifications of the UPS shall be
- Rectifier AC Input: 380/400/415V, three-phase, four-wire-plus-ground (Also compatible with 3-wire system)
- Bypass AC Input: 380/400/415V, three-phase, four-wire-plus-ground
- AC Output: 380/400/415V, three-phase, four-wire-plus-ground

B. Voltage Range: +20%, -15% at full at full load; -40% at half load

C. Frequency Range: 40 - 70Hz

D. Maximum Inrush Current: UPS inrush current not to exceed 1.5 times rated input current

E. Power Factor: Minimum 0.99 at full load with nominal input voltage

F. Current Distortion: Less than 3% THD at full load input current in double-conversion mode

G. Surge Protection: Sustains input surges of 4kV (Line to ground) without damage as per criteria listed in EN 61000-4-5: 1995

1.3.5 AC Output

A. Load Rating: 100% of load rating at 40°C for any load from 0.5 lagging to unity

B. Voltage Regulation:
- ±1% RMS average for a balanced, three-phase load
- ±2% for 100% unbalanced load for line-to-line imbalances

C. Voltage Adjustment Range: ±5% for line drop compensation adjustable by factory service personnel

D. Frequency Regulation:
- Synchronized to bypass: ±2.0Hz default setting, (adjustable by factory service personnel)

E. System Efficiency : defined as output kW/input kW at rated lagging load power factor; and not less than the values listed below

95.6% at 100% Load,

>96% at 75-30% Load,

95.6%at 20% load,

& >93.5% at 10% load.

F. Phase Imbalance:
- Balanced loads 120° ±1°
- 100% unbalanced loads 120° ±2°

G. Voltage Transients (average of all three phases):
- **0-100% or 100-0%**
  Response Meets IEC 62040-3: 2010 Figure 2 Curve 1, Class 1
  Meets ITIC and CBEMA Curve Requirements
- **10-100% or 100-10%**
  Transient Voltage Deviation, RMS 5%

H. Overload at Full Output Voltage with ±1% voltage regulation:

- 100% continuously
- 105% - 110% of full load for 60 minutes at 40°C ambient
- 110% - 125% of full load for 10 minutes at 40°C ambient
- 125% - 150% of full load for 60 seconds at 40°C ambient
- >150% of full load for a minimum of 200 milliseconds at 40°C ambient

1.3.6 Grounding

The UPS chassis shall have an equipment ground terminal.

1.4 ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

A. Operating Ambient Temperature

- UPS: 0°C to 40°C
- Battery: 25°C ± 3°C

B. Storage/Transport Ambient Temperature

- Storage: -25°C ~ +55°C; transportation: -40°C ~ +70°C

C. Relative Humidity

- 0 to 95%, non-condensing

D. Altitude

- ≤ 1500m; derate power by 1% per 100m between 1500m and 3000m

E. Audible Noise Level

- 62 dBA measured 1m from the surface of the unit

1.5 SUBMITTALS

1.5.1 Proposal Submittals

Submittals with the proposal shall include:

- Descriptions of equipment to be furnished, including deviations from these specifications.
- Document showing the efficiency certification by certified agency.
- System configuration with single-line diagrams.
- Detailed layouts of customer power and control connections.
- Functional relationship of equipment, including weights, dimensions and heat dissipation.
- Information to allow distribution system coordination.
- Size and weight of shipping units to be handled by contractor.

1.5.2 Order Submittals

Submittals supplied at time of order shall include:

- All of the documentation presented with the proposal, per Section 1.5.1 above.
- Detailed installation drawings including all terminal locations.
- Interconnect wiring diagrams showing conduit wiring with terminal numbers for each wire.

1.5.3 UPS Delivery Submittals

Submittals upon UPS delivery shall include:

- A complete set of submittal drawings.
- Two (2) sets of instruction manuals. Manuals shall include a functional description of the equipment, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.6 WARRANTY

1.6.1 UPS Warranty

The UPS manufacturer shall warrant the unit against defects in workmanship and materials for 12 months after initial startup or 18 months after the shipping date, whichever comes first.

1.6.2 Warranty – End User

Warranties associated with items not manufactured by the UPS supplier but included as part of the system shall be passed through to the end user.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer's Qualifications

A minimum of 20 years' experience in the design, manufacture and testing of solid-state UPS systems shall be required.

The quality system for the engineering and manufacturing facility shall be certified to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the UPS unit to ensure compliance with the specification. The UPS unit shall be tested at the system-specified capacity.

1.8 FABRICATION

1.8.1 Materials

All materials of the UPS shall be new, of current manufacture, high grade and shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. All power semiconductors shall be sealed. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat.

1.8.2 UPS Internal Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code and applicable local codes and standards. All bolted connections of bus bars, lugs and cables shall be in accordance with requirements of the National Electric Code and other applicable standards. All electrical power connections shall be torqued to the required value and marked with a visual indicator.

1.8.3 Field Wiring

All field wiring power connections shall be to tin-plated copper busbars for connection integrity. Busbars shall have adequate space to allow two-hole, long-barrel, compression type lugs forming a permanent connection between field wiring and field-installed lugs.

Provisions shall be made in the cabinets to permit installation of input, output and external control cabling using raceway or conduit. Provision shall be made for top and bottom access to input, output, bypass and DC connections. In conformance with the NEC, connection cabinets shall provide for adequate wire bend radius.

1.8.4 Construction and Mounting

The UPS shall be housed in an IP20 enclosure, designed for floor mounting. The UPS shall be structurally adequate and have provisions for forklift handling. Maximum cabinet height shall be 2 meters for all UPS range.

1.8.5 Cooling

Adequate ventilation shall be provided to ensure that all components are operated well within temperature ratings.

Temperature sensors shall be provided to monitor the UPS's internal temperature. Upon detection of temperatures in excess of the manufacturer's recommendations, the sensors shall cause audible alarms to be sounded and visual alarms to be displayed on the UPS control panel. Air filters shall be located at the point of air inlet and shall be changeable. No service clearance or ventilation shall be required in the rear of the system.

1.9 EQUIPMENT

1.9.1 UPS System

The UPS system shall consist of an IGBT power factor-corrected rectifier, DC-DC converter and three-phase, transformer-free inverter, bypass static transfer switch, bypass synchronizing circuitry, protective devices and accessories as specified. The specified system shall also include a battery disconnect breaker and battery system.

1.9.2 Surge Protection

The UPS shall have built-in protection against surges, sags and overcurrent from the AC source. The protection shall meet the requirements of IEC/EN 61000-4-5 including:
Level 4 (4kV) (Line to Earth), Level 3 (2kV) (Line to Line) Based on B

1.9.3 Output Protection

The UPS shall be protected against sudden changes in output load and short circuits at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. Fast-acting, current-limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for tripping off-line. The

load shall be automatically transferred to the bypass line uninterrupted for an internal UPS malfunction. The status of protective devices shall be indicated on a graphic display screen on the front of the unit.

1.10 COMPONENTS

1.10.1 Rectifier

The term rectifier shall denote the solid-state equipment and controls necessary to convert alternating current to regulated direct current to supply the inverter and charge the battery. The DC output of the rectifier shall meet the input requirements of the inverter without the battery being connected.

A. Input Current Harmonic Distortion

The rectifier shall actively control and reduce input current distortion over the full operating range of the UPS without the need for an additional passive input filter. Input current THD shall be less than 3% at rated load and nominal voltage in double-conversion mode.

B. Dynamic Current Input Limit Reduction

The rectifier, in conjunction with the other UPS controls and circuitry, shall adjust the current demanded for battery charging as a function of UPS wattage load and input voltage level.

1.10.2 DC-DC Converter

The term DC-DC converter shall denote the equipment and controls to regulate the output of the rectifier to the levels appropriate for charging the battery and to boost the battery voltage to the level required to operate the inverter. The DC-DC converter shall be solid-state, capable of providing rated output power and, for increased performance, shall be a pulse width-modulated design and shall utilize insulated gate bipolar transistors (IGBTs). The DC-DC converter shall control charging of the battery. The AC ripple voltage of the charger DC shall not exceed 1% RMS of the float voltage.

A. Battery Recharge

In addition to supplying power for the load, the rectifier/charger shall be capable of supplying a minimum of 5% of the module full load power rating for recharging the battery. The battery recharge rate capability shall be sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time while running at 95% of full load at nominal voltage, provided that the battery can accept recharge at that rate. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

B. Battery Equalize Charge

A manually initiated equalize charge feature shall be provided to apply an equalize voltage to the battery. The duration of equalize charge time shall be adjustable from 8 to 30 hours. A method shall be available to deactivate this feature for valve regulated battery systems.

C. Stop Battery Charging Function

Battery charging may be stopped by a shunt trip of the battery cabinet breaker when over temperature is sensed in the battery cabinet, on generator or when environmental contact is closed.

D. Overvoltage Protection

There shall be DC overvoltage protection so that if the DC voltage rises to the pre-set limit, the UPS shall shut down automatically and initiate an uninterrupted load transfer to bypass or shall disconnect the battery via the DC breaker(s) in the battery string.

E. Temperature-Compensated Charging

The UPS shall adjust the battery charging voltage based on the battery temperature reported from external battery temperature sensors. When multiple sensors are used, the voltage shall be based on the average temperature measured. Excessive difference in the temperature measurements shall be reported and the charging voltage adjusted to protect the batteries from excessive current.

F. Battery Load Testing

The UPS shall be capable of performing battery load testing under operator supervision. To accomplish this, the rectifier shall reduce charging voltage to force the batteries to carry the load for a short time. If the curve of battery voltage drop indicates diminished battery capacity, the UPS shall display an alarm message. If the voltage drop indicates battery failure, the UPS shall terminate the test immediately and annunciate the appropriate alarms.

1.10.3 Inverter

The term *inverter* shall denote the equipment and controls to convert direct current from the rectifier or battery via the DC-DC converter to precise alternating current to power the load. The inverter shall be solid-state, capable of providing rated output power and, for increased performance, the inverter shall be a pulse-width-modulated design and shall utilize insulated gate bipolar transistors (IGBTs). To further enhance reliable performance and efficiency, the inverter shall not require an inverter output series static switch/isolator for the purposes of overload or fault isolation or transfers to bypass.

A. Overload Capability

The inverter shall be able to sustain an overload across its output terminals while supplying full rated voltage of up to 150% for 60 seconds. The inverter shall be capable of at least 200% current for short-circuit conditions including phase-to-phase, phase-to-ground and three-phase faults. After the fault is removed, the UPS shall return to normal operation without damage. If the short circuit is sustained, the load shall be transferred to the bypass source and the inverter shall disconnect automatically from the critical load bus.

B. Output Frequency

The inverter shall track the bypass continuously, providing the bypass source maintains a frequency of 50Hz ±1% (0.5 Hz).

C. Phase-to-Phase Balance

The inverter shall provide a phase-to-phase voltage displacement of no worse than ±3% with a 100% unbalanced load.

D. Inverter Fault Sensing and Isolation

The UPS shall be provided with a means to detect a malfunctioning inverter and isolate it from the critical load bus to prevent disturbance of the critical load voltage beyond the specified limits.

E. Battery Protection

The inverter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Inverter shutdown shall be initiated when the battery voltage has reached the end of discharge voltage. The battery end-of-discharge voltage shall be calculated and automatically adjusted for partial load conditions to allow extended operation without damaging the battery. Automatic shutdown based on discharge time shall not be acceptable.

Liebert® APM™

The Compact, Row-Based UPS with Flexpower Technology™

■30kW -300kW

The Liebert® APM is the compact UPS system designed to operate with the maximum energy efficiency in the minimum footprint for the protection of the small and medium computer rooms.

It features FlexPower™ technology, which incorporates distributed intelligence and scalable power in a common assembly.

It is suitable for small and medium businesses with the attitude to grow fast: thanks to its architecture that enables the UPS system capacity to start as low as 30kW which can grow with the business up to 600kW*.

Lowest Cost Of Ownership
Liebert® APM is designed to minimize capital equipment expense, to protect your technology investment and to optimize operational efficiency.

Enhanced Operational Flexibility
In response to the demands for new technologies, adaptability to customer and market's changing needs, Emerson Network Power has developed a scalable platform that allows you to configure your own AC Power system with basic building blocks, that is able to grow accordingly with your future requirements.

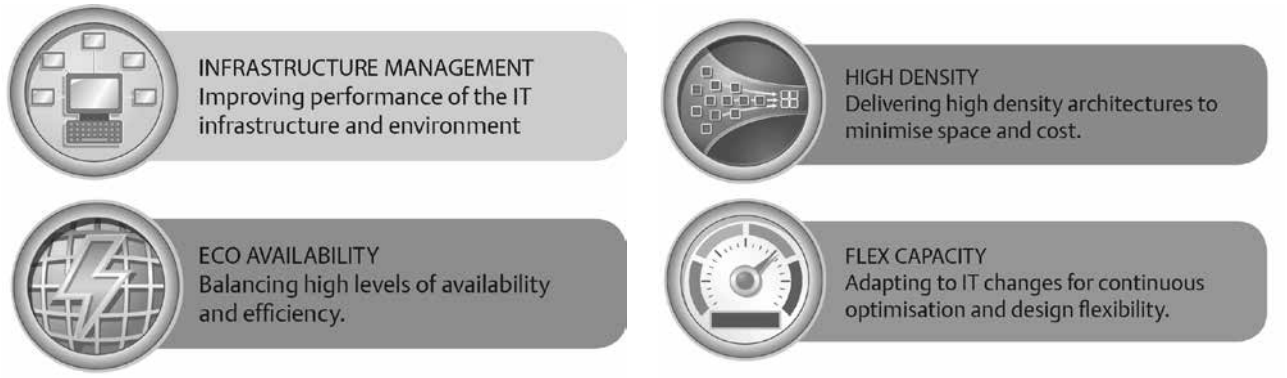
"All The Power You Need, Just The Power You Need"
With Liebert® APM you can deploy power modules that best match your system rating and its enhanced flat efficiency curve (up to 96% for load above 30% and up to 94% for loads above 20%) ensuring that the system is always optimized dramatically reducing energy waste.

Higher System Availability
Liebert® APM provides a mission-critical technology minimizing the single points of failure in your infrastructure. A UPS that delivers the highest possible level of availability to your IT system, with Liebert® proven reliability, and by decreasing MTTR with the new hot-swappable power modules.



Liebert® APM delivers
Efficiency Without Compromise™

Efficiency Without Compromise provides a path to optimize data center infrastructure around design, operating and management efficiencies - while maintaining or improving availability.
This is achieved through the proper selection and utilization of cooling, power and monitoring technologies, supported by key services and local expertise.



Efficient And Adaptive Power For All Your Critical Applications

- High efficiency rating of up to 96% in true online double conversion mode
- FlexPower Technology™ : Allows the configuration of a completely redundant power system, sized to match the capacity of the protected equipment. The unit capacity is easily added, without increasing the system footprint
- Parallel technology allowing maximum system capacity of up to 600kW, without the need for centralized bypass cabinet and additional external control modules*
- Thanks to the compactness of the power module, the best in the market, within the same rack there is room to accommodate internal batteries providing a backup time up to 30 minutes in the 30kW configuration and up to 5 minutes in the 90kW configuration**. Different combinations of internal and external batteries are available to cope with the various application scenarios
- Flexible battery configuration: 30 to 40 battery blocks per string allow you in most cases to keep your existing battery solution
- Lower mean time to repair (MTTR) with hot swappable modules



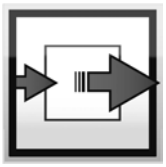
ENERGY EFFICIENCY
Liebert® APM has been designed to be the benchmark of efficiency for double conversion UPS.



COMPACT FOOTPRINT
A UPS and Battery system that could give you 60kW of UPS power complete with 10 minutes runtime in just 0.66sqm would be unimaginable just a few years ago!



MODULARITY
With fewer basic building blocks you can build a power source tailored to your needs and ready to evolve with them.



HOT SWAP
Up and running in a few seconds thanks to the hot swappable modules.



WIDER SAFE OPERATING AREA
Lagging or Leading Power factors, there's virtually no load that cannot be driven by Liebert® APM

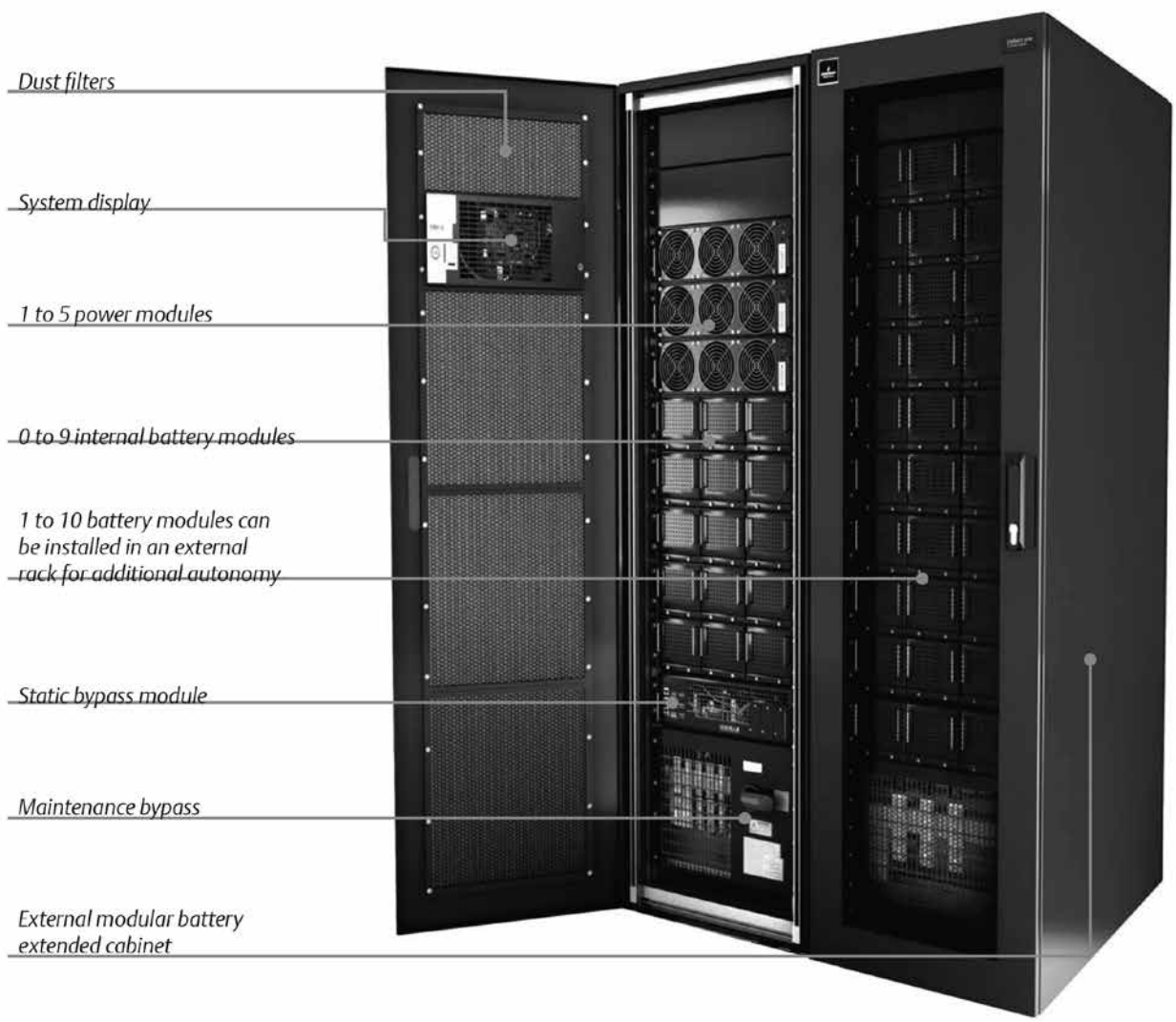


FLEXPOWER TECHNOLOGY™
Liebert® APM features Flexpower Technology™, which incorporates distributed intelligence and scalable power in a common assembly.

The Liebert® APM by Emerson Network Power is an efficient, space saving and flexible solution for your network.

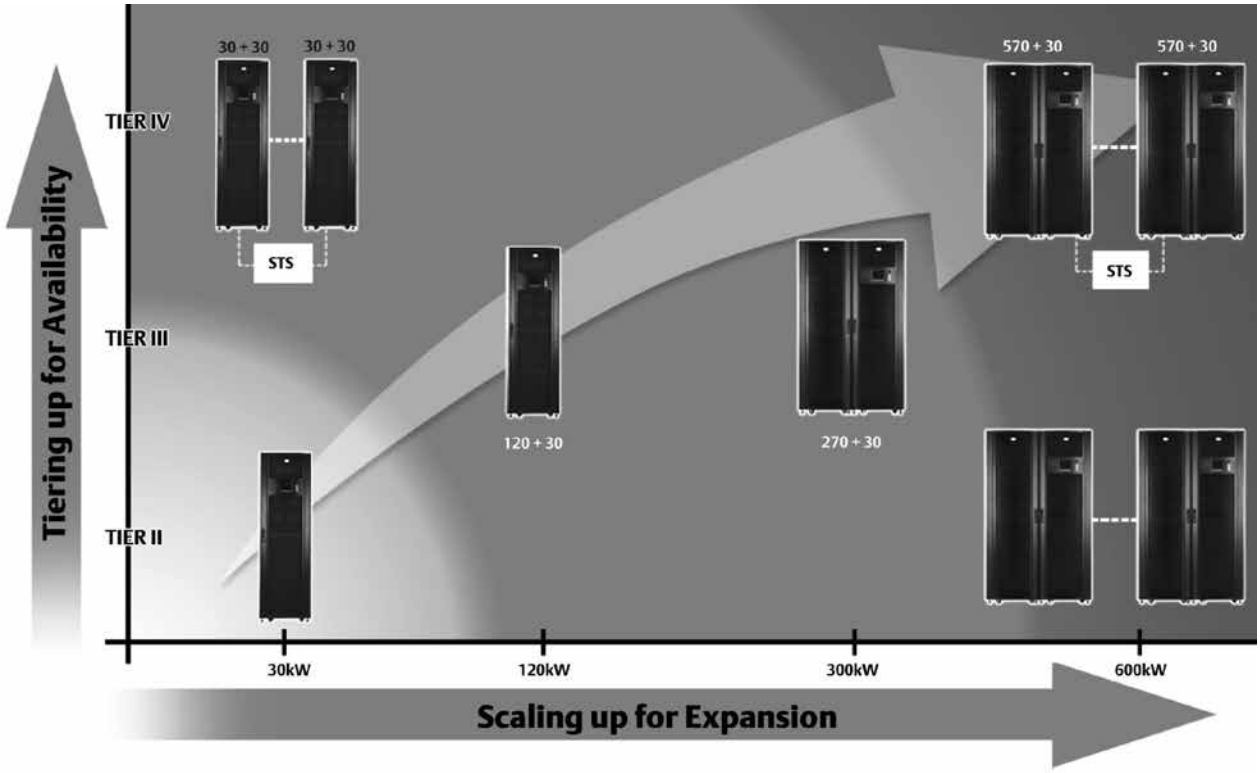
With Best In class true online double conversion efficiency of 96% in a compact, single frame 19" enclosure, Liebert® APM keeps your network protected while saving on cost and data center space.

With redundancy options and flexible battery configurations, Liebert® APM provides high level of reliability you have come to expect from a Liebert® UPS.



Liebert® APM Grows With Your Business

Over dimensioning your data center represents both a high CAPEX and OPEX (the latter due to an unoptimized data center or computer room). On the other hand under dimensioning it can imply down time and unnecessary installation costs if your equipment does not allow growth and flexibility. Liebert® APM is designed for a “pay-as-you-grow” deployment, making this process efficient and convenient.



The Liebert® APM UPS system can be utilized with either single or dual power inputs. The dual power features allows you to take advantage of a secondary power source. In addition, up to 4 racks can be paralleled to achieve increased redundancy for more power and 2 sets of racks can be deployed in a Dual Bus architecture.



Efficiency, Reliability And Value In A Compact Package.

Get The Most Out Of Your Investment

- Liebert® APM, with its unity power factor (kVA=kW), offers more real power to support customer's mission critical load satisfying the requirements of the latest servers
- With up to 96% online double conversion efficiency, Liebert® APM saves you operating cost compared to traditional UPS Systems

Get The Optimum Protection

- Liebert® APM's outstanding efficiency curve lets you rely on the protection of Double Conversion Technology without compromising your solution
- High overload protection handles 110% overload for 60 minutes, 125% for 10 minutes, and 150%for 1 minute.

Get The Minimum Footprint

- Liebert® APM is a compact UPS with low footprint
- It is the only UPS in the market that can achieve 30 minutes of backup time for 30kW or 10 min for 60kW or almost 5 min for 90kW in just 0.66m^2 *
- Grows from 30kW to 300kW in a single standard rack cabinet. (additional I/O Box needed)*
- Internal output PDU*
- Internal BCMS*
- Standard Bottom/Top cable entry

Get The Highest Availability

- Liebert® APM offers you the possibility to choose between internal module/ vertical redundancy and/ or external frame horizontal redundancy up to Tier 4, dual bus configuration without the need any external option of 305V-477V and a frequency tolerance of 40Hz to 70Hz to provide high quality power, even when input parameters are below standard. This helps to minimize the transfer to battery, reducing the charging and discharging cycles
- Back-feed protection sensing ensures system integrity

Modular design of Liebert® APM allows you to swap power modules without disrupting the whole system

- Replacing failed battery strings can be made by swapping the new battery module while system is running
- With Liebert® APM's modular design lowers the UPS system's MTTR at the same time increasing system availability

Get The Liebert® APM, Simply with Additional Features

- Monitoring: Offers communications through Web, Modbus and SNMP protocol
- Flexibility: Allows variable number and type of batteries, from single to multi-unit configurations, and an array of internal and external power and communication options
- Ultra-quiet operations with noise levels below 52 dBA
- Long battery life with wide input voltage tolerance down to 305V, reducing transfers to batteries. Moreover, temperature compensated battery charging extends battery life

*on selected configurations

Adaptive Power Management thru Liebert® APM

Scalable Power and Distribution*
Designed to improve the utilization and management of your IT systems, Liebert® APM increases your system's availability and flexibility as you deal with change. The features of Liebert® APM flex as IT applications and systems evolve, removing constraints to growth and allowing you to implement new systems and applications while leveraging on your initial investment.

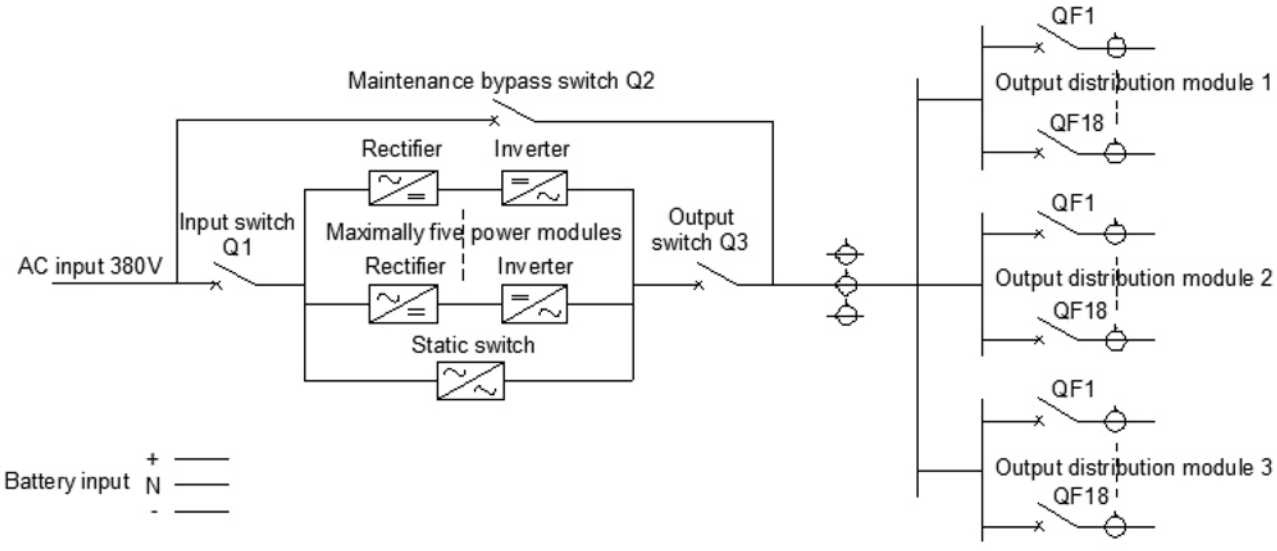
- **Scalable** – Designed to power high density equipment, the Liebert® APM comes in power ratings of 30, 60, 90, 120 and 150kW in N+1 redundancy
- **Modular** – Its modular redundancy features allow capacity to grow as needed while reducing maintenance cost. Its modules are hot-swappable, allowing more flexibility for the user.
- **Adaptive** – Easy to configure dual-bus system. Users can also choose battery cell quantity from 30, 32, 36, 40 x 12V battery block



As row solution for power protection, Liebert® APM features FlexPower™ technology, which incorporates distributed intelligence and scalable power in a common assembly.

Liebert® APM does not only benefit the user with a scalable solution by adding power modules to a UPS for future expansion. It offers more than power scalability for availability as it also addresses power distribution among the equipment in the data center in a scalable manner.

As an Adaptive Power Manager, Liebert® APM provides a long term solution for power distribution for vertical scalability. This means that whichever way the data center grows and expands, whether by adding loads to a UPS module or adding more servers and racks, Liebert® APM provides increased redundancy in power distribution as well as power availability.



In turn, this enables the data center to scale up and be more flexible as its availability goes from Tier 2 to Tier 3. Liebert® APM allows the user to easily add modules using a plug-and-play structure while distributing work load through its intelligent control system.

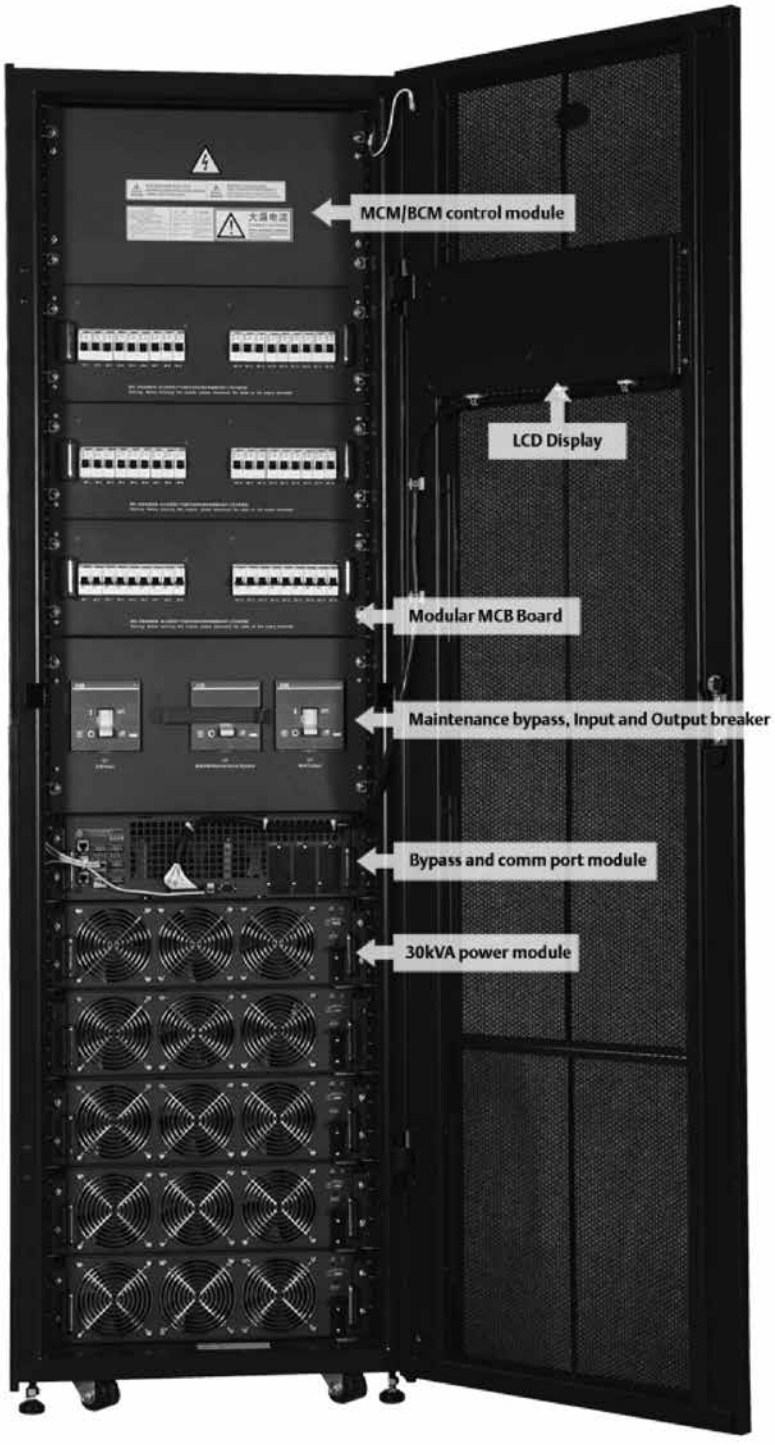
*on selected configurations

Unique in its class, the Liebert® APM

provides complete, high efficient power protection and distribution in a single cabinet, eliminating the complexity of two-stage power distribution.

- UPS and battery systems fit in an IT rack
- Built-in 30kW rack-mounted UPS (weight 35kg, height: 3U, up to 5 sets paralleled in one rack)
- Built-in swappable 150kW bypass module
- Built-in input/output distribution switch and manual maintenance bypass
- Built-in intelligent server power management system SPM, able to detect status, voltage, current, power factor, harmonic and electricity consumption of each branch, and set 2-level current load pre-warning
- Optional swappable distribution module with 18-way circuit breaker for expansion and output distribution circuit adjustment
- Optional hot swappable circuit breaker. Branch switch expansion or load phase adjustment can be done without turning off the main circuit UPS power supply. Load distribution uses dynamic configuration, with the UPS capacity and number of load distribution circuits changed with the increase in IT systems.

Integrated Power and Distribution Management in a Modular Rack



Energy Efficient:

- Up to 96% Efficiency at 50-75% load; Up to 95% Efficiency at 25% load. Input Power Factor ≈1; Input Harmonic current <3%

Powerful Loading Capacity:

- Output Power Factor ≈1 with leading and lag power factor (no derating)

Easy to Install:

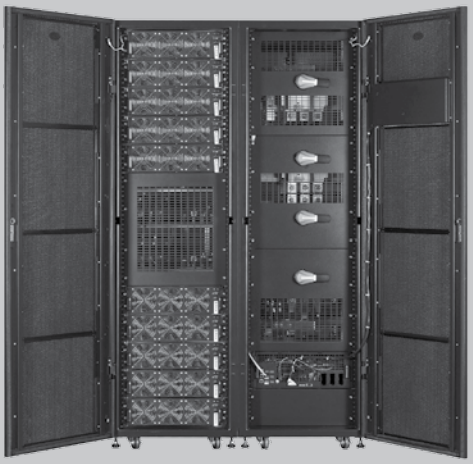
- Top/bottom cable inlet/outlet available; Needs no feeder cabinet; Integrates UPS and power distribution in a single cabinet

Easy to Maintain:

- Front access provides easy bypass maintenance and replacement of rectifiers, inverters and fansy

Easy to Configure:

- Battery adopts 12Vx30/32/34/40 cell design and features flexible configuration. Original battery system can be modified and poor cells can be replaced without affecting UPS performance.



Meeting Your Power Demand

Taking into account the growing need for higher availability and energy efficiency, Liebert® APM provides 96% efficiency and is most suitable for midsize data centers of financial & securities, IDC and enterprise markets.

To meet your power demand, Liebert® APM allows you to parallel up to two Liebert® APM each with 300kW of highest power quality to support your growing business' power need. You can start having 30kW of power to grow up to 600kW as your business grow without sacrificing your systems efficiency and availability.

To further support your business' growth and power demand, you can configure Liebert® APM as a standalone UPS configuration or you can use Liebert® APM in either parallel or dual bus configuration to increase your system's availability all by just adding parallel or LBS cables between APM UPS systems. *(configuration shown in page 6)*

Liebert® APM will be available in modular racks of your choice for 150kW and 300kW in a single rack. Which ever you go with, rest assured that you will get the same rich features, high efficiency & maximum availability UPS for your mission critical systems.



Monitoring And Control Capabilities That Keep You Informed

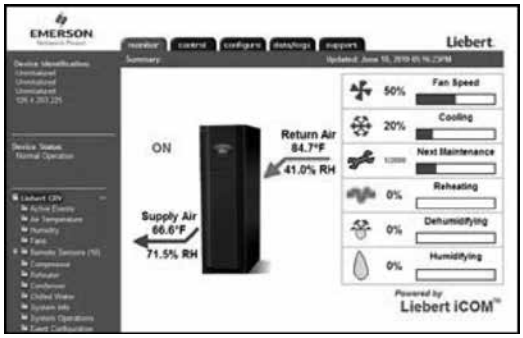
Liebert® APM has a large display that leads the user through logical menu sequences to view the required information. The micro-processor based display is autonomous of the system control logic. The simple menu-driven system virtually eliminates the possibility for human error. The large display can be set to show a system one-line diagram or mimic panel. It can also display advanced metering information, alarms, configuration or start-up/ shutdown/transfer information.

- Quickly check operational status
- Monitor power flow through UPS along with all meter readings
- Menu-driven operator procedures to ensure safe operation
- Check status reports and history files
- Adjustment of programmable parameters (access limited by security access function)



Centralized Monitoring And Control For The IT Enviroment

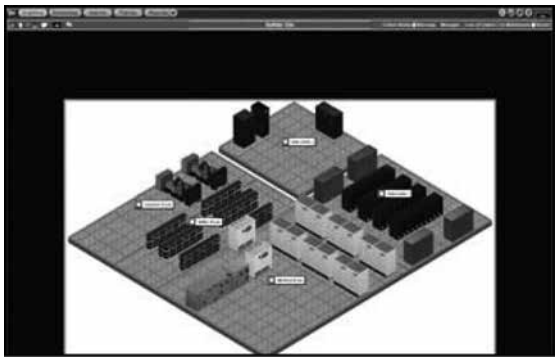
Intended for the IT Manager, Liebert® Nform™ is a network communications system that will enable you to leverage the distributed monitoring capabilities of your network connected equipment. This software solution combines full-scale monitoring with cost-effective deployment through the use of the existing network infrastructure. It is both scalable and adaptable so it can grow as your systems expand and business needs change. Liebert® Nform™ can be configured to monitor your Liebert APM for alarm notifications. These alarms can be processed to trigger event actions such as email alerts or local notifications.



Liebert® Nform - Monitoring Software 4.0

Centralized Monitoring And Control Through Your Existing Network

Liebert® Sitescan is a centralized site monitoring system assuring maximum visibility and availability of your critical operations. Liebert® Sitescan Web allows you leverage Web technology to oversee and control critical support systems - anywhere, anytime. Liebert® SiteScan Web allows you to monitor and control virtually any piece of critical support equipment - whether it's located in the next room or in a facility on the other side of the country. The web-based system provides centralized oversight of any Liebert precision air,
power and UPS units, as well as many other analog or digital devices. Features include real-time monitoring and control, data analysis and trend reporting, and event management.



Liebert® SiteScan® Web

Note: Please consult Emerson representative for software compatibility.

Technical Specifications

Model		Liebert APM	
Power (kVA/kW)		30 - 150	30 - 300
Physical Parameters			
W x D x H (mm)		600 x 1100 x 2000	1200 x 1100 x 2000
Weight (kg)		420 (weight w/out internal batteries)	670
Input features (rectifier)			
Rated input voltage		380/400/415VAC, three-phase four-wire	
Rated operating frequency		50/60Hz	
Input voltage range		305V - 477V, 209V - 304V with linear derating up to 70% load	
Input frequency range		40Hz - 70Hz	
Input power factor		> 0.99 at full load, > 0.98 at half load	
Input THDi *		<3%	
Input walk-in function		Available, 5 - 30s settable	
DC Features			
Charger output voltage regulation accuracy		1%	
DC ripple voltage		≤1%	
Output Features (inverter)			
Inverter output voltage		380/400/415VAC, three-phase four-wire	
Output power factor		1 (kW=kVA)	
Voltage stability	Steady State	< ± 1% typical	
	Transient State	< ± 5% typical	
Steady state response time		< 20ms	
Inverter overload capacity		1 hour for 110%, 10mins for 125%, 1mins for 150%, 200ms for >150%	
Phase shift	With 100% balanced load	< 1°	
	With 100% unbalanced load	< 1°	
Total THD (THDv)	100% linear load	< 1%	
	100% nonlinear load	< 4%	
Frequency		50Hz / 60Hz (settable)	
Slew rate		0.6 HZ / sec	
Measured frequency precision (internal clock)		50Hz/60Hz ± 0.02%	
Bypass			
Bypass input voltage		380/400/415VAC, three-phase four-wire	
Bypass voltage range		Default: -20% - +15%, other values, such as -40%, -30%, -10% - +10%, +15% settable through software	
Bypass overload capacity		Long term for 110%, 1 hour for 170%, 100ms for 1000%	
SPM intelligent distribution system **			
Number of branch switches		18 routes x 3	
Capacity of branch switches		25A as standard, 10 - 63A optional	
Monitoring function		Main circuit and branch ON/OFF status, voltage, current, power factor, harmonic, electricity consumption, 2-level current pre-warning	
System			
Paralleling		Up to 4*	Up to 2
System efficiency		up to 96% at =>50% load up to 95% at =>95% load	
Operating environment			
Operating temperature range *		0 - 40°C (For details, refer to user manual)	
Storage temperature		-25 - 70°C (excluding battery)	
Relative humidity		0 - 95%, no condensing	
Maximum operating altitude		≤1000m, When operating at 1000 - 2000m, derated by 1% for every 100m increase of altitude	
Noise (1m) (max capacity)		56	65
IP class		IP20 (with built-in dust filter)	
Standards		Safety: IEC60950-1; IEC62040-1-1/AS62040-1-1, EMC: IEC62040-2/AS62040-2/ EN50091-2 CLASS A; Design and test: IEC62040-3/AS62040-3	

* Conditions apply
** On selected configurations only

Please consult with Emerson representative for specific Liebert APM configuration

Liebert® APM™
For a 30 to 300 KW Modular Digital
Guide Specification
Uninterruptible Power Supply (UPS) System

1.0 GENERAL

1.1 SUMMARY

These specifications describe requirements for a Modular & Scalable, Digital Uninterruptible Power System (UPS) consisting of one or more 30 kW power module units connected in parallel inside a standard 1200mm x 1100mm x 2000mm (WxDxH) rack without the need for any additional system controller; The UPS shall automatically maintain AC power within specified tolerances to the critical load, without interruption (for specified duration as per battery run time), during failure or deterioration of the mains power supply. The UPS shall be expandable by paralleling additional modules of the same rating, to provide for module redundancy or load growth requirements. One UPS modular cabinet can hold a maximum of ten (10) 30kW modules for either increasing capacity or redundancy.

The manufacturer shall design and furnish all materials and equipment to be fully compatible with electrical, environmental, and space conditions at the site. It shall include all equipment to properly interface the AC power source to the intended load and be designed for unattended operation.

1.2 STANDARDS

The UPS and all associated equipment and components shall be manufactured in accordance with the following applicable standards:

- Safety Requirements: IEC 62040-1-1, EN 50091-1-1
- EMC: IEC 62040-2 (Class A), EN 50091-2 (Class A)
- Performance: IEC 62040-3 (VFI SS 111), EN50091-3

The above mentioned product standards incorporate relevant compliance clauses with generic IEC and EN standards for safety (60950), electromagnetic emission and immunity (61000 series) and construction (60146 series and 60529).

For more details, see below:

- IEC 61000-3-4
- IEC 61000-4-2, 4, 5, 6, 8, 11
- EN60950
- EN60529
- IEC 60146-1-1

The UPS is CE marked in accordance with EEC directives 73/23 “low voltage” and 89/336 “electromagnetic compatibility”.

The Quality System for the engineering and manufacturing facility certificated to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

A. For non-redundant operation (applicable, not applicable), the UPS system shall be sized to provide a minimum of_____kVA / kW output.

B. For redundant operation (applicable, not applicable), the UPS system shall be sized to provide a minimum of_____kVA / kW output with____module(s) out of service.

Load voltage and bypass line voltage will be___VAC, three phases and neutral. Input voltage will be_____VAC, three phases.

The battery system shall have a capacity of____kW for at least____minutes at 25°C.

The battery will be installed:

On open racks	( )
On cladded racks	( )
In battery cabinets	( )

1.3.2 Modes of Operation

The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

A. **Normal:** UPS inverters continuously powers the critical AC load. The rectifier/chargers derives power from the mains AC power supply source converting this to DC power to supply the inverters, while simultaneously float/boost charging the battery system. Power supplied by the UPS inverters is, to within specified tolerances, at rated voltage and frequency.

B. **Battery:** Upon failure of the mains AC power supply source, the critical AC load is powered by the inverter, which gets, without interruption, power from the battery system. There shall be no interruption in power to the critical load upon failure or restoration of the mains AC power supply source. Upon restoration of the mains AC power supply source, power to the rectifier initially is restricted by a gradual power walk-in. Following the short power walk-in period, the rectifier powers the inverter and simultaneously recharges the battery through the battery converter. This shall be an automatic function and shall cause no interruption to the critical load.

C. **Off-Battery or Frequency Converter:** When the battery system is taken out of service for maintenance or the UPS is used as a frequency converter, it is disconnected from the battery converter and inverter by means of (an) external disconnect breaker(s). The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for the power outage back-up time capability.

D. **Bypass:** If the inverter fails, or the inverter overload capacity is exceeded, or the inverter is manually turned off by user, and at this time the inverter is synchronous with the bypass, the static transfer switch shall perform a transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load. If the inverter is asynchronous with the bypass, the static switch will perform a transfer of the load from the inverter to the bypass with interruption in power to critical AC load. This interruption must be less than 15ms (in 50Hz), or less than 13.33ms (in 60Hz). The static bypass shall be able to support continuously 110% of rated UPS capacity.

E. **Maintenance:** Each UPS system is equipped with a separate I/O rack cabinet that has an internal maintenance bypass. If the UPS needs to be maintained or repaired, after the inverter is turned off and the load is transferred to bypass, the internal maintenance bypass or external maintenance bypass can be turned on and the UPS can be shut down and the battery can be disconnected for maintenance purposes.

F. **Paralleling:** For higher capacity or higher reliability, power modules can be paralleled inside the UPS rack cabinet; parallel power modules automatically share the load. The largest possible capacity inside the same UPS rack cabinet is up to ten times the nominal load of each power module composing the system. Each power module shall have its own intelligent control logic to avoid single point of failure. There should not be any common controller that controls all power modules in parallel. Furthermore, to increase capacity or redundancy, UPS modular rack cabinet paralleling can be made. The total load shall be shared the total number of power module in each modular rack cabinet. Maximum of two UPS modular rack cabinet can be paralleled.

G. **Regen Mode:** The UPS rack system shall have the ability to perform self test for full rated capacity without using any external load banks. In this mode, UPS rectifier, inverter and static bypass shall be tested up to full load capacity without any failure. Power consumption in this mode shall only be full load losses of UPS. This mode shall be possible to use with reserve batteries.

1.3.3 Scalability & Modularity

Each UPS rack system shall consist of hot swappable power modules with each module rated for 30kW and scalable up to 300kW in each modular rack cabinet.
Modularity design of the UPS system shall enable ease of service and upgradability or downgrade-ability of the UPS rack system without interruption to the whole system.

Two (2) UPS system can be paralleled to increase redundancy or capacity
.Paralleling shall be done with the use of control cables only without any additional external synchronization boxes.

1.3.4 Performance Requirements

The UPS is VFI classified (according to IEC 62040-3) producing an output waveform that is independent of both the input supply frequency and voltage.

1.3.4.1 UPS Module AC Input

A. **Voltage Range:** 305 to 477V

B. **Frequency Range:** 40~70Hz

C. **Power Walk-In:** maximum 30 seconds to full rated input current. Field selectable from 5 to 30 seconds adjustable with 5-second increments.

D. **Power Factor:** Shall be > 0.99 without any option at full rated UPS output load.

E. **Generator Adaptability:**

UPS input current limit can be adjusted to suit the generator power rating.

Wide input frequency range is permissible.

F. **Current Distortion:** Less than 3% at full rated UPS output load and 100% balanced non-linear load (with input voltage THD ≤ 1%).

1.3.4.2 UPS Module AC Output

Three-phase, 4-wire plus ground.

A. **Load Rating:** UPS shall be able to support utility power factor load rating at the specified operating temperature range for any combination of linear and non-linear loads.

B. **Voltage Stability:** 1% steady state for balanced loads, 2% for 100% unbalanced loads.

C. **Bypass Line Sync Range:** Field selectable ±0.5 to 3.0 Hz at 1.0 Hz increments. Default shall be ± 2.0 Hz

D. **Frequency Stability:** Frequency regulation, whilst free-running on battery, shall be ± 0.05 Hz. If the bypass is available and within limits, even if the UPS is on battery operation, in this case, the output will sync to the bypass. Nominal frequency shall be +/-0.05% in single module mode, and 0.25% in parallel mode.

E. **Frequency Slew Rate:** The slew rate shall be 0.6Hz/s.

F. **Efficiency:** It is defined as output kW / input kW:

- Up to 96% at full rated load, nominal input, no battery. Greater than 95% for loads over 30%.
- Not less than 98% at full rated load when supplying the load through the static bypass.

G. **Phase Unbalance:** 120º ±1º el. for 100% balanced or unbalanced loads.

H. **Voltage Transients:** ± 5% for 100% output load step up or step down.

I. **Transient Recovery Time:** Return to within 5% of steady state output voltage within half a cycle.

J. **Voltage Distortion (at 400V, 100% rated load):**

- Less than 1% total harmonic distortion (THD) for linear loads
- Less than 4% THD for 100% non-linear loads

K. **Module Overload Capability at Rated Output Voltage:**

- 150% of UPS rated output with a resistive load for one minute.
- 125% of UPS rated output with a resistive load for ten minutes. The UPS will achieve the overload mentioned at the specified operating temperature, nominal input voltage and when the battery is in a full charged condition.
- 110% of UPS rated output with a resistive load for one hour. The UPS will achieve the overload mentioned above with 380/400/415V nominal input and output voltage and when the battery is fully charged.

L. **Module Current Limit**: I_{peak} is equal to 3.4xIn for up to 200ms.

1.3.4.3 Bypass Static Switch

A. Voltage Range:

Upper limit: +10%, +15% or +20%, default shall be +15%
Lower limit: -10%, -20%, -30% or -40%, default shall be -20%

B. Frequency Range: ±2.5%, ±5%, ±10%, ±20% Field Selectable

C. Overload Capability: (specified without fuses)

For 135% rated output current, long-term operation (no time limitation).

For 170% rated output current, 10 minutes.

For 1000% of full UPS rated output current, 100 milliseconds.

D. Neutral Conductor Sizing: 1.7 times rated current.

1.3.5 Earthing

The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment earth terminal. Provisions for local bonding are to be provided.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Operating Ambient Temperature

UPS: 0ºC to 40ºC

Battery: 25ºC ± 5°C for optimum battery performance.

1.4.2 Storage/Transport Ambient Temperature

UPS: -20ºC to 70ºC.

Battery: -20°C to 30°C, 20ºC for optimum battery storage.

1.4.3 Relative Humidity

0 to 95%, non-condensing.

1.4.4 Altitude

Operating: To 1000 m above sea level without de-rating.

1.4.5 Immunity

A. Conduction

IEC 62040-2, class A

B. Radiation

IEC 62040-2, class A

C. Harmonic

IEC 61000-3-4

D. Immunity

EN 61000-4-2.3.4.6.8.9.11 Level III

EN 61000-4-5 Level IV

1.5 UPS DIMENSION

The modular UPS system shall consist of standard rack cabinet size of 1200 x 1100 x 2000mm. All ten 30kW modules shall be housed in a single modular rack cabinet to give maximum power of 30kW.

1.6 UPS DELIVERY SUBMITTALS

The specified UPS shall be supplied with one (1) user manual to include details of:

A. Functional description of the equipment with block diagrams.

B. Detailed installation drawings, including all terminal locations for power and control connections for both the UPS and battery system.

C. Safety precautions.

D. Step-by-step operating procedures

E. General maintenance guidelines

The UPS shall be supplied with a record of pre-shipment final factory test report.

1.7 WARRANTY

1.7.1 UPS Warranty

The UPS manufacturer shall warrant the unit against defects in workmanship and materials for 12 months after initial start-up date or 15 months after ship date, whichever comes first.

1.7.2 Battery Warranty

The battery manufacturer's standard warranty shall be passed through to the end user.

1.8 QUALITY ASSURANCE

1.8.1 Manufacturer Qualifications

A minimum of twenty years experience in the design, manufacture and testing of solid-state UPS systems is required. The manufacturer shall be certified to ISO 9001.

1.8.2 Factory Testing

Before shipment, the system shall be fully and completely tested to ensure compliance with the specification.

2.0 PRODUCT

3.1 FABRICATION

3.1.1 Materials

All materials of the UPS Rack System shall be new, of current manufacture, high grade and shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat. All electronic components shall be accessible from the front.

3.1.2 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of IEC. All electrical power connections shall be torqued to the required value and marked with a visual indicator (English tag).

Provision shall be made in the cabinets to permit installation of input, output, and external control cabling. Provision shall be made for bottom access, allowing for adequate cable bend radius, to the input and output connections.

3.1.3 Construction

The UPS shall be housed in an IP20 enclosure, designed for floor mounting. The UPS rack shall be structurally adequate and have provisions for forklift handling. Maximum cabinet height shall be 2 meters for all UPS range.

3.1.4 Cooling

Adequate ventilation shall be provided to ensure that all components are operated well within temperature ratings.

Temperature sensors shall be provided to monitor UPS internal temperature. Upon detection of temperatures in excess of manufacturer's recommendations, the sensors shall cause audible and visual alarms to be sounded at the UPS control panel. A separate room ambient temperature sensor shall be provided to allow control of the battery charging voltage with change of temperature.

The air should flow into the cabinet from the front and ventilate from the rear.

A minimum of 350mm clearance is required at the rear of the UPS for the purpose of ventilation or maintenance.

3.2 EQUIPMENT

3.2.1 UPS System

The UPS system shall consist of an appropriate number of how-swappable power module units to meet capacity and redundancy requirements. Each UPS System shall consist of standard rack enclosure, three phase power module/s, mains bypass static, protective devices and accessories as specified. Each UPS system shall also include a battery system either using conventional battery or modular battery system. The UPS system shall be modular/scalable in design.

3.2.2 Configurations

The UPS rack system shall consist of either a single power module unit, or two or more (up to a maximum of ten) units in the same UPS rack enclosure. Systems greater than one power module shall operate simultaneously in a parallel configuration with the load shared equally between the connected modules. With the exception of a single module configuration, the system shall be redundant or non-redundant as stated elsewhere in this specification.

A. **Non-redundant system:** all the modules making up the UPS system shall supply the full rated load. If a module should malfunction, and that the remaining modules cannot support the load, the load has to be transferred, automatically and uninterrupted, to the bypass line by the use of the internal static mains bypass switch.

B. **Redundant system:** the UPS system shall have one or more module(s) than required to supply the full rated load. The malfunction of one of the modules shall cause that module to be disconnected from the critical load and the remaining module(s) shall continue to carry the load. Upon repair of the module, it shall be reconnected to the critical load to resume redundant operation. Any module shall also be capable of being taken off the critical load manually for maintenance without disturbing the critical load bus. Module redundancy level shall be a predefined number of modules that are required to supply the full rated load. With the number of connected modules equal to this value, a malfunction of another module shall cause the load to be transferred automatically and uninterrupted to the bypass line by the use of the static mains bypass switch.

C. **Parallel System:** It shall be possible to connect one UPS system, with one or more (up to ten power modules) with another UPS with the same configuration for increased capacity or redundancy. all the modules making up the UPS system shall supply the full rated load. If a module should malfunction, and that the remaining modules cannot support the load, the load has to be transferred, automatically and uninterrupted, to the bypass line by the use of the internal static mains bypass switch.

3.2.3 System Protection

The UPS shall have built-in protection against: surges, sags, and over-current from the AC rectifier input source, over-voltage and voltage surges from output terminals of paralleled sources, and load switching and circuit breaker operation in the distribution system.

The UPS rack system shall be protected against sudden changes in output load and short circuits at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. Fast-acting current limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for tripping off line. The load shall be automatically transferred to the bypass line uninterrupted, should the connected critical load exceed the capacity of the available on-line modules. The status of protective devices shall be indicated on a graphic display screen on the front of the unit.

3.3 STANDARD COMPONENTS

3.3.1 Rectifier

The term rectifier shall denote the solid-state equipment and controls necessary to convert AC to regulated DC for input to the inverter. The rectifier shall be of DSP (Digital Signal Processor) controlled design and utilize insulated gate bipolar transistors (IGBTs).

A. **Input Current Total Harmonic Distortion:** Less than 3% at full rated UPS output load and 100% balance non-linear load (with input voltage THD ≤ 1%).

B. Power factor correction: The rectifier also performs a PFC function; input power factor shall be a minimum 0.99.

C. **AC Input Current Limiting:**

The maximum Input current limit can be reduced at 100% for generator operation.

D. **Input Power Walk-in:** The rectifier/charger shall provide a feature that limits the total initial power requirements; the power of rectifier will increase gradually and power walk-in time can be set from 5 seconds to 30 seconds (default shall be 10 seconds).

E. **Mains AC Input phase sequence reverse protection:** Before soft starting of the rectifier, if the phase sequence of the main AC input is reversed, the rectifier will not start and an alarm displayed on the LCD.

F. **Input Over Current Protection:** Each AC phase is individually fused so that loss of any semiconductor shall not cause cascading failures.

3.3.2 Battery converter

Batteries shall be VRLA (Maintenance-Free), type.

Constant current boost charging, constant voltage boost charging, float charging (float charging compensation) and EOD protection are available for different kinds of batteries.

A. **Charging:** In addition to supplying power to the load, the battery converter shall be capable of producing a battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. Ripple voltage at the battery terminal (RMS) should be less than 1%, and ripple current must not exceed 5% (of C-10 Ah rating) nominal discharging current. (Number of battery is 30- 40 blocks, nominal voltage is 12V per block).

When using modular battery, each string shall be composed of 30blocks of 12V battery.

B. **Discharging**: The battery converter will supply power to the inverter when the rectifier is shut down or in joint mode, and also the rectifier is current limiting.

3.3.3 Inverter

The term inverter shall denote the equipment and controls to convert DC from the rectifier or battery converter to provide AC power to the load. The inverter shall be solid-state, capable of providing the rated output power. The inverter shall be of Vector Controlled design and utilize insulated gate bipolar transistors (IGBTs), switching at high frequency in order to minimize output voltage distortion.

A. Overload Capability:

- 150% of UPS rated output with a resistive load for one minute. The UPS will achieve the overload mentioned at the specified operating temperature, nominal input voltage and when the battery is in a full charged condition.
- 125% of UPS rated output with a resistive load for ten minutes. The UPS will achieve the overload mentioned at the specified operating temperature, nominal input voltage and when the battery is in a full charged condition.
- 110% of UPS rated output with a resistive load for one hour. The UPS will achieve the overload mentioned at the specified operating temperature, nominal input voltage and when the battery is in a full charged condition.

B. Output Frequency: The inverter shall track the bypass mains supply continuously providing the bypass source remains within the limits for the rated frequency (of either 50 or 60Hz). The inverter will change its frequency at 0.1Hz (0.1-3Hz adjustable) per second to maintain synchronous operation with the bypass. This shall allow make-before-break transfers of the load between the inverter and the bypass mains supply. If the bypass mains supply frequency falls outside of these limits, the inverter shall revert to an internal digital oscillator that maintains the inverter output frequency to within +/-0.05% of nominal frequency in single module mode and 0.25% in parallel mode.

C. Phase-to-Phase Balance: System logic shall provide individual phase voltage compensation to obtain phase balance of ±1% under all conditions including up to 100% unbalanced non-linear load.

D. Fault Sensing and Isolation: Fault sensing shall be provided to isolate a malfunctioning inverter from the critical load bus to prevent disturbance of the critical load voltage beyond the specified limits.

E. Battery Protection: The inverter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Shutdown of the inverter shall be initiated when the battery has reached the end of discharge (EOD) voltage. The battery EOD voltage shall be calculated and automatically adjusted (increased) for reduced load conditions to allow for extended autonomy periods without damage to the battery.

3.3.4 Static Bypass

For time when maintenance is required or when the inverter cannot maintain voltage to the load due to sustained overload, current limiting or malfunction, a bypass circuit shall be provided for each single module that forms part of the UPS system. The modular bypass circuit(s) shall provide a path for power directly from an alternate AC (bypass) source. The UPS control shall constantly monitor the availability of the inverter bypass circuit to perform a transfer. The inverter bypass of each module shall consist of a static transfer switch, operating in conjunction with the inverter output static switch. The static switches shall denote the solid-state devices that, operating simultaneously, can instantaneously connect the load to the alternate AC source.

A. **Manual Load Transfers:** A manual load transfer between the inverter output and the alternate AC source shall be initiated from the control panel.
B. **Automatic Load Transfers:** An automatic load transfer between the inverter output and the alternate AC source shall be initiated if an overload or short circuit condition is sustained for a period in excess of the inverter output capability or due to a malfunction that would affect the output voltage. Transfers caused by overloads shall initiate an automatic retransfer of the load back to the inverter only after the load has returned to a level within the rating of the inverter source.
C. **Back-feed Protection:** Using another optional (customer-supplied) contactor located upstream of the UPS Bypass input and whose trip coil control voltage comes from the input bypass line voltage, the UPS shall provide a normally closed contact to be used for isolating the bypass source to protect the operator against back-feed of energy resulting from a short-circuit of the bypass line SCRs. That is, in the event that the UPS works on Battery mode and no main input (Rectifier and Bypass) is available, the contactor cannot be closed. So if the bypass line SCRs are short-circuited, the UPS will be still disconnected from the Bypass supply.

3.3.5 2.3.5 Internal Maintenance Bypass

A fully rated bypass circuit shall be fitted on all single module UPS systems to provide an alternative path for power flow from the alternate AC supply to the critical load for the purpose of maintaining the UPS when it is completely powered down. A Maintenance Bypass protection shall be provided; it will be activated when the Maintenance Bypass Switch is closed before the inverter shutdown.

3.3.6 Man-Machine Interface (MMI)

A. **UPS Display and Control Panel:** Each UPS module shall be equipped with a 320 x 240 dot graphic LCD display. This shall automatically provide all information relating to the current status of the UPS as well as being capable of displaying metered values. The display shall be menu-driven, permitting the user to easily navigate through operator screens. The LCD shall be able to store 1024 historical event records that can be retrieved and reference and diagnosis.
B. **Metered Values:** An MCU or DSP shall control the display functions of the monitoring system. All three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accurate (±1%) representation of non-sinusoidal waveforms typical of computers and other sensitive loads. The following parameters shall be displayed:

- **Main input**
  - Three-phase main input line-to-neutral voltage
  - Three-phase main input line-to-line voltage
  - Three-phase main input current
  - Main input frequency
  - Three-phase input power factor
- **Bypass**
  - Each phase bypass input line-to-neutral voltage
  - Bypass input line-to-line voltage

- **UPS output**
  - Each phase output voltage of UPS
  - Each phase output current of UPS
  - Output line-to-line voltage of UPS
  - Power factor of each phase
  - UPS output frequency
- **Local load**
  - Load of each phase (% of total load)
  - Active power, apparent and reactive power of each phase (output)
  - Load crest factor
- **Battery**
  - Battery bus voltage
  - Battery current
  - Forecasted Battery backup time (remaining time)
  - Battery temperature (in degree centigrade)
- **Parallel load**
  - Apparent power of each output phase (for parallel operation system)
  - Active power of each output phase (for parallel operation system)
  - Inactive power (Reactive power) of each output phase (for parallel operation system)
- **Input/Output transformer when installed**
  - Phase to Neutral (L-N) voltage (V)
  - Phase to Phase (L-L) voltage (V)

C. **Power Flow Mimic:** Each UPS module shall be equipped with a mimic to indicate power flow to the critical load along with an indication of the availability of the rectifier/charger, battery, automatic bypass, inverter, load. The mimic shall provide a quick and easy indication of the load level (displayed on LCD), including for overload conditions (displayed on LCD). This power flow is also shown in the LCD menu.

D. **Alarms and Status Information:** Alarm and status conditions shall be reported at a single module UPS system or at a paralleled module UPS or both. The display and control panel shall report the alarms and status information listed below. Each alarm shall be visually displayed in text form and an audible alarm will sound for each alarm displayed (see the following table).

Inverter comm. Fail	Bypass phase reverse	Rectifier in setting	Batt. capacity testing
Rectifier comm. Fail	Load impact transfer	MBP-T cabinet Fans Fault	Batt. maint. Testing
Parallel comm. Fail	Battery boost charging	Ext Input TX Overtemp	UPS system testing
Battery overtemp.	Battery discharging	Ext Output TX Overtemp	Inverter in setting
Ambient overtemp.	Battery period testing	Battery Room Alarm	Rectifier in setting
Battery fault	Transfer time-out	Battery reverse	MBP-T cabinet Fans Fault
Replace battery	DC bus abnormal	No battery	Ext Input TX Overtemp
Battery low pre-warning	Parallel board fault	Auto start	Ext Output TX Overtemp
Battery end of discharge	DC bus over voltage	REC FLASH UPDATE	Battery Room Alarm
Mains volt. Abnormal	Bypass over current	INV FLASH UPDATE	Battery reverse

Mains undervoltage	Setting save error	MONITOR FLASH UPDATE	No battery
Mains freq. abnormal	Mains neutral lost	Input contactor fault	Auto start
Rectifier fault	Protocol version clash	Contactor P.S. 1 fault	REC FLASH UPDATE
Rectifier overtemp.	Battery ground fault	Contactor P.S. 2 fault	INV FLASH UPDATE
Charger fault	Inv. turned ON manually	DSP firmware error	MONITOR FLASH UPDATE
Control power 1 fail	Inv. turned OFF manually	SPM Board Not Ready	Input contactor fault
Mains phase reversed	EPO	SPM CRC Check Error	Contactor P.S. 1 fault
Rectifier overcurrent	Transfer confirm	SPM Branch Curr Over LL	Contactor P.S. 2 fault
Soft start fail	Transfer cancel	SPM Branch Curr Over HL	DSP firmware error
Bypass unable to trace	Fault reset	SPM Branch Over Current	SPM Board Not Ready
Bypass abnormal	Alarm silence	SPM Branch 1 Inrush OC	SPM CRC Check Error
Inverter asynchronous	Bypass mode	SPM Branch Breaker Fail	SPM Branch Curr Over LL
Inverter fault	Normal mode	SPM Internal Comm Failure	SPM Branch Curr Over HL
Inverter overtemp.	Battery mode	SPM Maitainance Bypass Breaker Close	SPM Branch Over Current
Fan fault	Check UPS output	SPM Output Breaker Open	SPM Branch 1 Inrush OC
Main STS fail	Generator connected	Bypass mode	SPM Branch Breaker Fail
Bypass STS fail	BCB open	Normal mode	SPM Internal Comm Failure
Operation invalid	BCB closed	Battery mode	SPM Maitainance Bypass Breaker Close
Output fuse fail	Battery float charging	Check UPS output	SPM Output Breaker Open
Control power 2 fail	Battery boost charging	Generator connected	Turn on fail
Unit over load	Battery discharging	BCB open	Alarm reset
Byp. abnormal shutdown	Battery period testing	BCB closed	UPS system testing
Inverter over current	Batt. capacity testing	Battery float charging	Inverter in setting
	Batt. maint. Testing		

E. Inverter ON/OFF: Each UPS module shall be equipped with an inverter ON/OFF buttons which will transfer the load from all UPS modules to the bypass mains supply, if it is available. The inverter ON/OFF control shall be protected under menu confirm protect if the bypass mains is not available.

3.3.7 Communication Ports

The UPS shall have input and output volt-free contacts to provide the following interfaces:

- EPO
- Environment parameter input interface
- User communication interface
- Intellislot intelligent card interface
- Temperature detection interface

See Section 2.4 for a description of the required optional equipment.

3.3.8 Software Compatibility

The UPS shall have optional software available for monitoring, control and event management.
The available solutions shall provide:

- users with basic UPS operating status plus automated shutdown of a computers' Operating System in the event of an extended power outage.
- cost-efficient, centralized monitoring and event management of UPS, Environmental

3.3.9 LBS (Load Bus Synchronizer)

The objective of the Load Bus Synchronizer (LBS) is to keep the output of two independent UPS systems (either two independent single units OR two independent parallel systems each with and without Main Static Switch) in synchronization even when the two systems are operating on different modes (bypass/inverter) or on batteries. It is usually used with Static Transfer Switches to achieve Dual Bus Power Supply configuration.
LBS shall be able to synchronize systems of same type and brand, each system composed of same type and brand paralleled UPS's (with TWO completely different sources of incoming power to UPS systems).
With optional LBS adapter it shall be possible to synchronize systems of different type and brand, each system composed of same type and brand paralleled UPS's (with TWO completely different sources of incoming power to UPS systems).

3.4 OPTIONS

3.4.1 Optional Communications

A. **SNMP/HTTP Network Interface Card:** The UPS shall have an optional, internally fitted network interface card that will provide real-time status information over an 10/100 base T Ethernet to / for users. The network interface card will support SNMP v1 and v2c. UPS information will also be available over the network via a web browser via an HTTP page. The card supports static as well as DHCP. The card shall also be configurable via the network using the HTTP web page and Telnet session. Configuration properties shall include device naming and specific service enable / disable and control enable / disable. The card provides configuration and control security through a user name and password. The cards firmware can also be update such that future releases can be downloaded to enjoy card enhancements.

B. **RS-485 Interface Card:** The UPS shall have an optional, internally fitted RS-485 interface card that will provide real-time status information over a 2 or 4-wire RS-485 connection. The RS-485 Interface Card will support ModBus RTU, and JBus.

C. **Dry Contact Card:** The UPS provides dry contact communication through the dry contact card. The card shall be able to provide four channels of digital signal output to remote site. The contact card shall be able to receive three channels of digital input signal, two of which control the UPS turn on and turn off.

3.4.2 Battery Start

The UPS shall be able to start up and run on battery without any incoming mains available. The above functionality shall be achieved also when more UPSs are connected in parallel (either for redundancy or for capacity).

3.4.3 External battery temperature sensor

To ensure temperature compensated charging to protect battery life, a battery temperature-monitoring probe is necessary to monitor the battery enclosure temperature rise caused by the AC mains power loss and of the battery's internal resistance when operating. The probe system includes one battery temperature sensor and one temperature transport.

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Liebert® NX™

Enterprise-Scale UPS Protection For Medium And Large Data Centers

■250 -800kVA

Efficiency. Availability. Capacity. Control.



Facility managers continue to face the increasing cost of energy consumption and the call for greener means of operating the facility. Today, going into energy-efficient options and generating less CO_2 in every possible way can no longer be ignored.

Introducing the Liebert® NX™ 250-800kVA, a next generation three-phase UPS solution from Emerson Network Power. The Liebert® NX™ delivers the best combination of availability, reliability and energy-efficiency. It presents an industry-leading features such as intelligent energy management that promotes efficient energy measures in the infrastructure and outstanding power protection technology that is designed to use less energy, generate less CO_2, less space requirement in order to provide significant cost savings.

The Liebert® NX™250-800kVA is equipped with a transformer-free design with full IGBT double-conversion technology that enables cost-savings on installation and operating the equipment while delivering high quality protection to your critical load.

The Liebert® NX™ best applies to:



Large IDC/EDC equipment rooms



Banking and financial services



Communication network management centers

The Best Investment You Can Make In A UPS System Efficiency, Reliability And Value In A Compact Package.

Get The Most Out Of Your Investment

- The Liebert® NX™ offers 12.5% additional active power compare to a .8 PF UPS system to support customer's mission critical load, meeting the requirements of the latest servers.
- The Liebert® NX™ offers up to 99% efficiency in smart VFD mode.
- The Liebert® NX™ is a compact UPS with low footprint compared to traditional UPS systems of the same capacity.

Get The Highest Availability & Reliability

- Super-wide input voltage range and frequency tolerance of 40Hz to 70Hz to provide high quality power, even when input parameters are below standard.
- Back-feed protection promoting critical system continuity

Ease of Maintenance

- Dual bus compatibility enables user to transfer the load to an alternative power source for all maintenance activities. The Liebert® NX™ features easy access for servicing, thanks to the front door accessibility of critical components, self diagnostics and various monitoring options.
- Large and user-friendly LCD display provides operating information in twelve different languages.

Efficiency Savings

Energy Cost/kWH (USD)		$0.10				
Ratings (kVA)	Traditional UPS (92%)	Liebert® NX™ (95%)	Annual Energy Saving	Annual Air Con Savings	Total Annual Saving	Saving @ 10 Years
250	$214,239	$207,474	$6,765	$2,899	$9,665	$96,649
300	$257,087	$248,968	$8,119	$3,479	$11,598	$115,979
400	$342,783	$331,958	$10,825	$4,639	$15,464	$154,639
600	$514,174	$497,937	$16,237	$6,959	$23,196	$231,958
800	$685,565	$663,916	$21,649	$9,278	$30,928	$309,278

Note: Cost is based on $0.10kWH

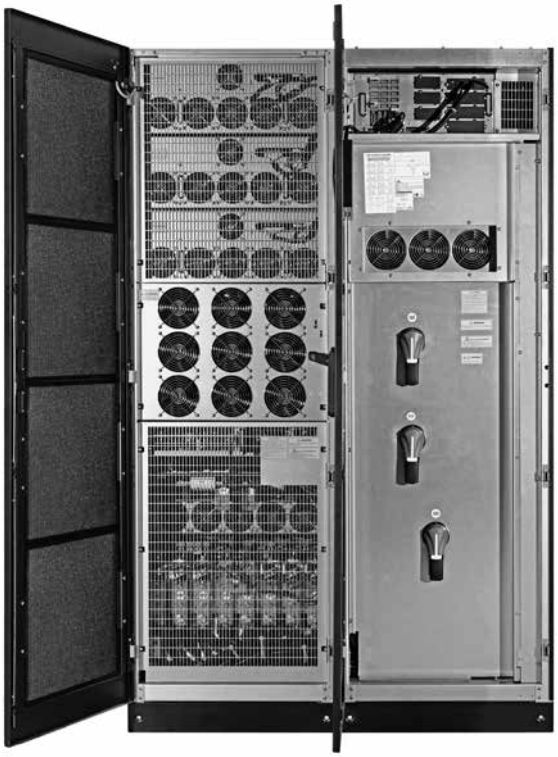


Features

Main Technical Features

- Online double conversion technology; protecting the power load from disturbances brought by the utility power or the generator system
- Adopts advanced 6th generation DSP control with highter system reliability that allows online maintenance and capacity expansion
- Super-wide input voltage and frequency range
- Advanced distributed parallel technology
- Standard built-in LBS function
- User-friendly large LCD display with 12 available language interfaces
- Longer battery life thru smart battery management feature
- Safe & reliable battery system thru battery system grounding failure detection function





Capacity

- High efficiency up to 95% in dual conversion mode
- Up to 99% in ECO mode

Input Power

- THDi less than 3% Input current distortion
- Clean grid

High Power Factor

- Input power factor > 0.99

Compatibility

- Compatible with 0.9 leading power factor

Availability

- Maximum power availability with 0.9 output power factor

Space Saving

- Compact footprint

Flexibility

- Super wide input voltage window

High efficiency and minimum cost of ownership

The Liebert® NX™ adopts the transformer-free design and 6th generation DSP control technology.

It delivers high efficiency at partial and rated loads (up to 99% in smart VFD mode). This level of efficiency reduces hugely the Total Cost of Ownership of the UPS during its life cycle.



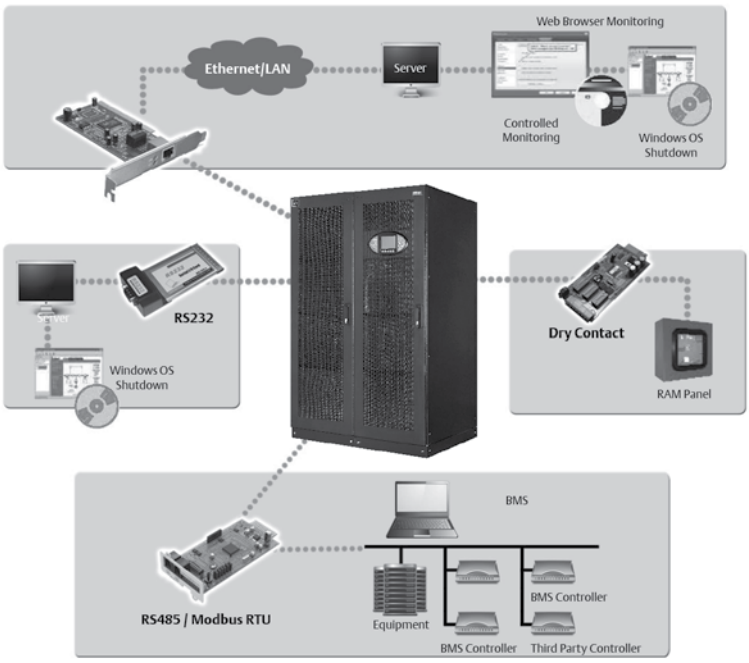
	Total Cost of Ownership	Highest Availability	Higher Performance & Flexibility	Improved Manageability	Extra Value Delivered
Ultra High Efficiency	★		★		★
Small Footprint	★		★		★
Wide Input Voltage	★	★	★		★
Wide Input Frequency	★	★	★		★
IGBT Inverter & Rectifier		★	★		★
Dual Bus Ready		★	★	★	★
Advanced Microprocessor	★	★	★	★	★
Low THDI & THDv (<3%)	★	★	★		★
Higher Input & Output PF	★	★	★		★
Parallel-able		★	★		★
Full Digital Control	★	★	★		★
Advanced Battery Management System	★	★	★	★	★
24x7 Services	★			★	★

Communication Option

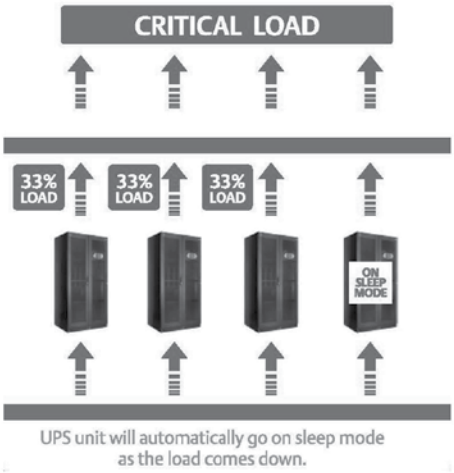
The Liebert® NX™ is capable of communicating with interface options that enables the user to get updates on local and remote monitoring, status signaling, control, maintenance and firmware upgrade.

The interface options are:

- RS 232 for maintenance
- Programmable dry contacts for remote monitoring
- RS 485 for MODBUS/JBUS interface
- Ethernet card for LAN/WAN monitoring



Dynamic Capacity Modulation



This scalable architecture keeps the purchasing and operating costs of your power protection solutions exceptionally low

The Liebert® NX™ can operate in single or in parallel mode to improve the power availability, and to increase the system capacity and redundancy.

- In a 1 +N system , if the load is much less than the connected UPS units, one or more UPS units will turn to sleep mode.
  Customer Benefit: Improves efficiency without compromising availability.
- Load profiling (weekly or monthly) to monitor the off-peak times and adaptively schedule modules to take off-line.
- Track each module's off-line hours and schedule other modules to be off-line to distribute the intelligent tracking of each module and switching UPS in dormant status if facility doesn't require full capacity.

Technical Specifications

Rated Power		250kVA	300kVA	400kVA	600kVA	800kVA
Dimension						
Width (mm)		1200			2400	
Depth x Height (mm)		900 x 1900				
Weigth (kg)		800	850	900	1850	1950
Input feature (rectifier)						
Rated input voltage		380/400/415Vac, 3-phase and 4-wire				
Rated frequency		50Hz / 60Hz				
Input voltage range		324 ~ 478Vac				
Input frequency range		40 ~ 70Hz				
Input power factor		> 0.99				
Input current distortion (THDi)		< 3%				
DC feature						
Number of battery cells per string		240				
Recharger output voltage regulation		0.01				
DC ripple voltage		< 1%				
Temperature compensation		-3.0 (selectable from 0 to -5.0 around 25°C or 30°C)				
Output features						
Inverter output voltage		380/400/415Vac, 3-phase and 4-wire				
Output power factor		0.9 (90kW for every 100kVA)				
Voltage Regulation	Stable state	±1%				
	Transient state	±5%				
Transient response time		20 ms				
Phase angle displacement accuracy with balanced load		±1°				
Phase angle displacement accuracy with 100% unbalanced load		±1.5°				
THDv	100% linear load	< 2%				
	100% nonlinear load	< 5%				
Inverter overload capacity	105%	continuous				
	125%	10 minutes				
	150%	30 millisecond				
Power handling capability without derating		0.7 lagging - 0.8 leading				
Bypass						
Bypass input voltage		380/400/415Vac, 3-phase and 4-wire				
Bypass voltage range		-20% ~ +15%, other values settable through software				
System						
Operating temperature		0 ~ 40°C				
Storage temperature		-20 ~ 70°C (without battery)				
Relative Humidity		0 ~ 95% (without condensation)				
Max operation altitude		< 1000m above sea level (without derating)				
Noise (1m)		74 dB			76 dB	
IP degree of protection		IP20				
Standard						
General safety		EN62040-1/IEC62040-1/AS62040-1				
EMC		EN62040-2/IEC62040-2/AS62040-2 (Class C3)				
Design and Test		EN62040-3/IEC62040-3/AS62040-3 (VFI SS 111)				

Liebert® NXL™ UPS

High Availability UPS for Medium & Large Data Centers

■500kVA ■600kVA ■800kVA

The industry's most reliable power protection and advanced technology has been combined into a new generation of three-phase UPS systems for high power applications – the Liebert NXL from Emerson Network Power. The Liebert NXL provides excellent dynamic performance, with the ability to handle virtually any input condition while still providing computer grade output to critical loads. The leader in large UPS system installations, Emerson offers complete and unequalled support, including engineering consultation, the largest and most wide-spread factory trained service organization, and the industry's largest and most advanced production and withness test facility.

Flexibility

Liebert NXL is designed for flexibility in application:

- Matching battery and maintenance bypass cabinets for easy configuration
- Top or bottom cable entry
- Internal cabinet cable wiring simplifies installation.
- Ship-ahead I/O section can be installed before UPS installation



High Availability

Availability is a primary consideration in any UPS selection. Liebert NXL is inherently reliable:

- Liebert ActiveStar® Digital Signal Processor (DSP) controls - no potentiometers
- Redundant fans & system power supplies to ensure maximum availability
- Built-in zig-zag transformer to ensure high fault current handling capability increasing availability
- Provide superior handling of present and future leading power factor loads
- High fault current capability
- Color touch screen controls improve user interface and reduce risk of human error
- Excellent dynamic performance
- Generator and utility friendly with low current distortion

Lowest Total Cost of Ownership

Liebert NXL addresses ownership costs with intelligent design and operating efficiency:

- Front access for installation and service
- Compact cabinets require less floorspace
- Standard Top and Bottom cable entry
- Inter-cabinet cabling requires less hard wiring
- Built-in battery cabinet breaker isolates string for ease of service
- High efficiency
- Intelligent Paralleling optimizes UPS performance thus improving system efficiency

The Liebert NXL Series is Ideally Suited for

- **Enterprise data centers**
- **Industrial process equipment**
- **Laboratories**
- **Any application requiring high levels of power availability and computer-grade power quality**

Liebert NXL System Features

Advanced UPS Design
- True on-line double conversion topology
- Superior overload and fault-clearing capability
- High operating efficiency level
- Intelligent Paralleling of UPS control capability
- Excellent dynamic performance - medium frequency PWM inverter
- Compatible with Generation 3 server power supplies to meet current and future needs
- Supports leading power factor loads
- Latest generation IGBTs
- Advanced inverter control provides active harmonic cancellation
- Output isolation transformer
- Continuous duty static bypass switch
- Output filter reduces total harmonic distortion to 2.5%
- Power factor management and generator friendly operation
- Liebert AF2 compatible to reduce input current harmonic to less than 3% and improved power factor >= 0.98
- Compact footprint

Large Touch-Screen User Display
- Easy operation, monitoring and control
- System one-line view
- Advanced metering and key statistics
- Input/Output breaker control

Customer's Value Added Features

Source Share Mode of Operation
- Improve generator compatibility
- Reduce generator sizing, even lower generator capacity can can be used
- Reduce generator operating & maintenance expenses.
- Reduce investment on generator & associated switchgear and distribution.
- Low CO2 emission due to less fuel burned.

Liebert NXL Battery Cabinet
- Flexible runtime solutions by paralleling cabinets
- Built in battery disconnect
- Front access only for installation and service
- Battery isolation minimizes the risk of downtime due to a catastrophic battery failure, and reduces the risk of electric shock during service
- Battery ground fault alarm
- Battery temperature compensation
- Equalize charging
- Optional integrated technology battery monitoring

Service ability & Safety
- Full front access design for installation and service
- Improved contractor cable access for ease of installation
- Meets NEC requirements
- Inner door design for safety meets Arc Flash requirements
- CE Marked

Regen Mode of Operation
- UPS ability to burn-in test itself
- Reduce testing expenses for on-site load bank testing including reduction in energy cost
- No need for permanent expensive switchgears for load testing purposes



Technical Specifications

Model Name		Liebert NXL		
Nominal Power Rating at 0.9 PF Load	kVA	500	600	800

Input Parameters		
Input Voltage to Rectifier	Vac	380 / 400 / 415 3-phpase , 3-wires plus ground
Permissible Input Rectifier Voltage Range	Vac	380V system: 291 (-23%) to 438 (+15%) 400V system: 300 (-25%) to 460 (+15%) 415V system: 310 (-25%) to 477 (+15%)
Input Voltage to Bypass	Vac	380 / 400 / 415 3-phase, 4-wire plus ground
Input Frequency	Hz	50 or 60
Permissible Input Frequency Range	Hz	45 to 66
Input THDi at nominal voltage at full load	%	up to 3%(1)
Input Power Factor at nominal voltage	-	up to 0.98%(1)
Flexi Power Walk-In	sec	3 to 30 (selectable) in 1 sec. Increments

Battery & DC Parameters		
Battery Type		VRLA (Valve Regulated Lead Acid) or Wet or NiCD
Float Voltage	Vdc / Cell	2.15 - 2.3
End Of Discharge (EOD)	Vdc / Cell	Selectable from 1.60 to 1.88 (for VRLA / Wet Cells)
Equalize Charge	Vdc / Cell	2.30(adjustable in 0.01 volt increments from 2.3-2.45 V/cell)
DC Ripple Voltage in float & Const V Ch.mode	%	<1 (RMS value)

Output Parameters				
Inverter Type		IGBT-based Sine-Sine PWM Controlled		
Output Power	kW	450	540	720
Output Voltage	Vac	380 / 400 / 415 3-phase, 4-wires plus ground		
Output Voltage Regulation (loss & return of utility)	%	< % 1 (3-phase RMS average)		
Output voltage Regulation (100% unbal. Load)		< % 2 (3-phase RMS average)		
Output Frequency	Hz	50 or 60		
Output Frequency Regulation	%	+/- 0.1		
Voltage Displacement	º el	120 deg +/- 1 deg electrical (with 100% unbalanced load)		
Output THDu at nominal voltage	%	<2%		
Output THDu at nominal voltage on Non Linear load as per EN 62040-3	%	2.5% (max)		
Capability to handle High Crest Factor Load as per IEC 62040-3		3:1		
Capability to handle Step Load	%	0-100 or 100-0		
Transient Recovery	msec	20 (recovery to 95% of the voltage level)		
Leading Power Factor handing capability		Up to 0.8 Leading (1)		
Overload				
Inverter	% FL	110% for 60 minutes 125% for 10 minutes 150% for 1 minute		
Bypass	% FL	1150% for 10 ms 1050% for 20 ms 775% for 100 ms 460% for 5 secs		

Liebert® NXL™ UPS

for a 500-750 kVA (per module) (Centralized Static Switch)

Gude Specification

Multi-Module Uninterruptible Power System

1.0 GENERAL

1.1 SUMMARY

These specifications describe requirements for an Uninterruptible Power System (UPS) consisting of one or more multi-module UPS units (MMU) and system controls including a system-level bypass static switch (SCC). The UPS shall be designed for maximum availability and high performance. The UPS shall automatically maintain AC power within specified tolerances to the critical load without interruption during failure or deterioration of the AC input power. All performance values specified shall be for the equipment needed to operate at the same voltage as the electrical system, including necessary voltage transformation and load sharing components. The UPS shall be expandable by paralleling additional modules of the same rating to provide for module redundancy or load growth requirements.

The manufacturer shall design and furnish all materials and equipment to be fully compatible with electrical, environmental and space conditions at the site. The UPS shall include all equipment to integrate the AC power source to the intended load and be designed for unattended operation.

1.2 STANDARDS

The UPS and all associated equipment and components shall be manufactured in accordance with the following applicable standards:

- The UPS shall be UL listed per UL Standard 1778, latest edition, Uninterruptible Power Supplies, and shall be CSA certified.
- The UPS shall be provided with a Short Circuit Withstand Rating label denoting the maximum source fault short circuit current that is applicable to the unit. The withstand rating shall be independently verified by a nationally recognized third-party lab. Self certification shall not be acceptable.
- The UPS shall withstand input surges to both the rectifier and bypass, when configured as a dual-input unit, without damage per the criteria listed in ANSI C62.41, category B3 (6kV). The manufacturer shall provide evidence of compliance and test data upon request.
- The UPS shall comply with FCC Rules and Regulations, Part 15, Subclass B, Class A. This compliance is legally required to prevent interference with adjacent equipment. The UPS shall have a label stating FCC compliance. The manufacturer shall provide evidence of compliance upon request.
- The UPS shall be compatible with the wiring practices, materials and coding in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. Overcurrent devices provided in the UPS shall include trip functions as indicated on the project drawings. Provisions shall be made in the cabinets to permit installation of input, output and external control cabling, using raceway or conduit for top and bottom access to input, output, bypass and DC connections. Connection cabinets shall provide for wiring gutter and wire bend radius as defined by the NEC and UL.
- The UPS and matching Battery Cabinets shall be certified to the International Building Code (IBC) 2012 and pre-certified to the State of California Office of Statewide Health Planning and Development (OSHPD) with seismic performance of Sds=2.00, Ip=1.5 and z/h=1.0. Optional seismic brackets shall be available from the UPS manufacturer for use in compliance with this certification.
- The Quality System for the engineering and manufacturing facility shall be certified to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

The UPS shall be sized to provide a minimum of ____ kW and a minimum of ____ kVA output.

The UPS shall be able to power at full rated output kW loads with power factor between 0.9 lagging and 0.95 leading.

Load voltage and bypass line voltage shall be ___VAC, three-phase, three-wire in and out or four-wire in and out. When the bypass is three-wire, the UPS shall be supplied with a main bonding jumper to configure the UPS source as separately derived.

Input voltage shall be ___VAC, three-phase, three-wire.

The battery shall support the UPS at 100% rated kW load for at least _____ minutes at 77°F (25°C) at startup.

The UPS shall have a 12-pulse solid-state rectifier with input filter, with automatic disconnect for input power factor control. The disconnecting level shall be adjustable to allow operation with generators that are sensitive to leading power factor loads.

The UPS shall be equipped with an input isolation transformer to provide isolation for DC ground faults and an output isolation transformer to allow connection as a separately derived source when a main bonding jumper is installed and the bypass input is three wire.

1.3.2 Modes of Operation

The UPS shall operate as an on-line reverse transfer system in the following modes:

A. **Normal:** The critical AC load shall be continuously powered by the UPS inverter. The rectifier/charger shall derive power from the utility AC source and supplies DC power to the inverter while simultaneously float charging the battery. Float charging shall be continuous without cycling to be in compliance with the battery manufacturers' published float service warranty requirements.

B. **(Optional) Energy Optimization Mode (Active Inverter Eco-Mode):** The critical load shall be continuously powered by a method that provides higher efficiency than that provided with normal operation. Battery float charging shall be the same as during Normal operation.

C. **Emergency:** Upon failure of utility AC power, the critical AC load shall be powered by the inverter which, without any switching, shall obtain its power from the battery plant. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

D. **Recharge:** Upon restoration of the utility AC source, the rectifier/charger shall power the inverter and simultaneously recharge the battery. This shall be an automatic function and shall cause no interruption to the critical AC load.

E. **Bypass:** If the UPS must be taken out of service for maintenance or repair, the static transfer switch shall transfer the load to the bypass source. The transfer process shall cause no interruption in power to the critical AC load. An optional external wrap-around maintenance bypass shall be used to ensure full isolation of the unit for the service of internal components.

F. **Battery Unavailable:** If the battery is unavailable, the UPS shall continue to function and meet all of the specified steady-state performance criteria except for the power outage backup time capability.

G. **Self-Load Test:** During system commissioning, the charger, battery, inverter and bypass of the UPS module shall be tested at full load without the need for an external load bank. Testing mode shall use the bypass source as the load.

1.3.3 Performance Requirements

The UPS shall be able to support 100% critical load and maintain full battery charging with the following conditions existing simultaneously:

- Any altitude, within the specified operating range up to 5000 ft. (1500m) elevation
- Any ambient temperature, within the specified operating range of 32°F to 104°F (0°C to 40°C)
- Any one failed fan
- Any input voltage within the specified range, +10% to -15% of nominal
- Air filters 50% blocked per the criteria included in UL1778

1.3.4 AC Input

A. Rectifier Voltage Range: +10%, -30% of nominal (no battery charging below -15%)

B. Rectifier Frequency Range: ±5Hz

C. Rectifier Walk-In: 0% to 100% of full rated load over 1-30 seconds (adjustable)

D. Rectifier Subcycle Magnetizing Inrush: Not to exceed eight times normal full load input current

E. Rectifier Power Factor: Minimum 0.89 lagging at full load with nominal input voltage

F. Two-Step Rectifier Input Current Limit:

Step 1 - Independently adjustable 25-125% of normal full load input current

Step 2 - Independently adjustable 25-125% for on-generator operation

G. Two-Step Battery Charge Current Limit:

Step 1 - Independently adjustable 0-20% of maximum battery discharge current

Step 2 - Independently adjustable 0-20% of maximum battery discharge current

H. Rectifier Current Distortion: Less than 4% THD at full load input current

I. Bypass Voltage Range: +15%, -20%

J. Bypass Frequency Range: ±5Hz

K. Rectifier and Bypass Surge Protection: Sustains input surges without damage per criteria listed in ANSI C62.41, category B3 (6kV)

L. Withstand Rating: Units shall carry a (65kA at 480V) (35kA at 600V) standard short circuit withstand rating, (100kA at 480V) (65kA at 600V) rating shall be available as options. All withstand ratings shall be UL tested and certified and a label applied to the unit clearly identifying this rating as required by the National Electric Code.

1.3.5 AC Output

A. Load Rating: 100% continuous load rating at 104°F (40°C) for any combination of linear and non-linear loads

B. Voltage Regulation: ±1% for balanced load, ±2% for 50% unbalanced load for both line-to-line and line-to-neutral unbalances

C. Voltage Adjustment Range: ±5% manually

D. Line Drop Compensation: Adjustable 0 to +5% of nominal voltage

E. Frequency Regulation: 0.1%

F. Efficiency: Defined as output kW/input kW at rated lagging load power factor. Greater than 97% in high-efficiency mode and 91.6% in double conversion mode from 50 to 100% load.

G. Phase Imbalance:

H. Voltage Transients (Average of All Three Phases):

100% load step: ±5%

Loss of/return to AC input power: ±1%

I. Output Voltage Transients

Voltage transients shall be limited to a maximum deviation from nominal system output volts of plus or minus 5% (RMS average for one cycle), with recovery to within 1% of output voltage within four electrical cycles (64 milliseconds) for each of the following conditions. Limits shall apply to any UPS load within the UPS rating, and frequency shall be maintained at 60 Hz ±0.1 Hz. The system shall not transfer to bypass under these conditions (except Item 3).

1. 5 - 100 - 5% load step
2. Loss or return of AC input power, or momentary sags, surges or spikes on the input to the UPS (all three phases or single phase)
3. Uninterrupted transfer of the critical load to and from the UPS output and bypass power line (manually initiated or automatic)
4. Dropping one MMU off the UPS output power bus by manual switching.
5. Connecting one MMU onto the UPS output bus.
6. Dropping one MMU off the UPS output power bus by internal failure.

J. Voltage Harmonic Distortion:

Maximum 2% RMS total (linear load)

Maximum 2.5% RMS total for up to 100% non-linear load, per IEC 62040-3

K. Overload at Full Output Voltage with ±1% Voltage Regulation:

The overload rating of the UPS shall be the rating that can be demonstrated after operating at full load continuously at maximum operating temperature with a fan failed.

104% continuously

110% of full load for 60 minutes

125% of full load for 10 minutes

150% of full load for a minimum of 60 seconds

L. Current Limit: Up to 200% of full load current

M. Fault Clearing:

- **Inverter Only:** 200% of normal full load current for 200 milliseconds, or 155% of normal full load current for 5 seconds (including a bolted fault condition when bypass is not available).
- **Bypass Available:** 1000% for 200 milliseconds in inverter pulse-parallel operation when bypass is available for more rapid fault clearance downstream of the UPS.

N. Energizing a Transformer:

- **Inverter only:** Energize a transformer of the same kVA rating as the UPS without the inverter shutting down.
- **Bypass available:** Energize a transformer of the same kVA rating as the UPS without the inverter shutting down and without transferring to bypass.
- **Bypass available with full rated load:** Energize a transformer rated 20% kVA of the system rating without the inverter shutting down and without transferring to bypass.

1.3.6 Grounding

The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. A terminal for bonding the system neutral to the facility service entrance ground (customer-supplied cable) shall be provided.

1.4 ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

A. Operating Ambient Temperature

UPS: 32°F to 104°F (0°C to 40°C) without derating
(Consult factory for performance derating over 104°F [40°C])

Battery: 77°F (25°C), ±5°F (±3°C)

B. Storage/Transport Ambient Temperature

-4°F to 158°F (-20°C to 70°C)

C. Relative Humidity

0 to 95%, non-condensing

D. Altitude

Operating: To 5000 ft. (1500m) above Mean Sea Level without derating
Consult factory for derating above 5000 ft. (1500m) elevation.

Storage/Transport: To 50,000 ft. (15,000m) above Mean Sea Level

1.5 SUBMITTALS

1.5.1 Proposal Submittals

Submittals with the proposal shall include:

- Descriptions of equipment to be furnished, including deviations from these specifications
- Document stating compliance with FCC requirements
- Document stating listing to UL, including edition used for listing
- Document showing compliance with required short circuit withstand rating and labeling
- System configuration with single-line diagrams
- Detailed layouts of customer power and control connections
- Functional relationship of equipment, including weights, dimensions and heat dissipation
- Information to allow distribution system coordination, including any overcurrent device in the bypass, and the manufacturer's part number or trip curve
- Size and weight of shipping units to be handled by contractor

1.5.2 Order Submittals

Submittals produced for the order shall include:

- All of the documentation presented with the proposal, per Section 1.5.1 above.
- Detailed installation drawings including all terminal locations.
- Interconnect wiring diagrams showing terminal numbers for each wire.

1.5.3 UPS Delivery Documents

Submittals upon UPS delivery shall include:

- A complete set of submittal drawings
- Two (2) sets of installation manuals; manuals shall include receiving and handling instructions.
- Two (2) sets of instruction manuals; manuals shall include a functional description of the equipment, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.6 WARRANTY

1.6.1 UPS Warranty

The UPS manufacturer shall warrant the unit against defects in workmanship and materials for 12 months after initial startup or 18 months after the shipping date, whichever comes first.

1.6.2 Warranty - End User

Warranties associated with items not manufactured by the UPS supplier, but included as part of the system, such as switchgear and batteries, shall be passed through to the end user.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer's Qualifications

The manufacturer shall have a minimum of 20 years experience in the design, manufacture and testing of solid-state UPS systems.

The quality system for the engineering and manufacturing facility shall be certified to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics.

1.7.2 Factory Testing

Before shipment, the manufacturer shall test the UPS fully and completely to ensure compliance with the specification.

The UPS shall be tested at the system-specified capacity. Testing shall be done using load banks at both part-load and the full kW rating of the unit and the system.

Operational discharge and recharge tests shall be performed to ensure guaranteed rated performance.

System operations such as startup, shutdown and transfers shall be demonstrated.

A certified copy of test results shall be available for each system as indicated on the order.

2.0 PRODUCT

2.1 FABRICATION

2.1.1 Materials

All materials of the UPS shall be new, of current manufacture and high-grade. They shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. All power semiconductors shall be sealed. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat. All electronic components shall be accessible from the front without removing subassemblies for service access.

2.1.2 Capacitor Assemblies

All power, AC and DC filter capacitors shall be mounted allowing field replacement of the capacitors separately from power switching controls and components.

2.1.3 UPS Internal Wiring

Internal power wiring shall be extra flexible terminated with compression type lugs. Lugs shall be attached with a hardware method that ensures long-life integrity. All factory-installed electrical power connections shall be torqued to the required value and marked with a visual indicator. All power connections not serviceable from the front of the unit shall be permanent, without any need for periodic tightening.

2.1.4 Field Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. All bolted connections of busbars, lugs and cables shall be in accordance with requirements of the National Electric Code and other applicable standards.

All field wiring power connections shall be to tin-plated copper busbars for connection integrity. Busbars shall have adequate space to allow two-hole, long-barrel, compression-type lugs forming a permanent connection between field wiring and field-installed lugs.

Provisions shall be made in the cabinets to permit installation of input, output and external control cabling, using raceway or conduit. Provision shall be made for top and bottom access to input, output, bypass and DC connections. In conformance with NEC, connection cabinets shall provide for adequate wire bend radius.

2.1.5 Construction and Mounting

The UPS shall be in a NEMA Type 1 enclosure, designed for floor mounting. The UPS shall be structurally adequate and have provisions for hoisting, jacking and forklift handling. Maximum cabinet height shall be 76.8 in. (1950mm).

The UPS shall be NEMA Type 1-compliant, with front doors open to enable safe change of air filters without the need for shutdown.

2.1.6 Cooling

Adequate ventilation shall be provided to ensure that all components are operated well within temperature ratings. The cabinet blowers shall be redundant so that a single blower failure will not cause temperatures to increase beyond acceptable continuous operation limits. Each blower shall be individually monitored for proper operation.

Temperature sensors shall be provided to monitor UPS internal temperature. Upon detection of temperatures in excess of the manufacturer's recommendations, the sensors shall initiate audible and visual alarms on the UPS control panel. A sensor for room ambient temperature shall be provided to give an alarm if the temperature of the inlet air to the UPS is above specified limits. Air filters shall be located at the point of air inlet and be replaceable. No service clearance or ventilation shall be required in the rear of the system.

2.2 EQUIPMENT

2.2.1 UPS System

The UPS system shall consist of the appropriate number of multi-module units for capacity or redundancy, system controls and system level bypass static switch (SCC), battery disconnect breaker(s) and battery system(s).

1. Each multi-module unit shall consist of a rectifier/charger and three-phase inverter with associated transformers.
2. The system control cabinet shall contain the bypass static transfer switch, the system-level monitoring and controls and bypass synchronizing circuitry.

2.2.2 Configurations Central Bypass Multi-Module

The UPS system shall consist of one or more multi-module unit (MMU) of the same kVA and kW rating operating in parallel. All MMUs shall operate simultaneously and share the load. The system shall be redundant or non-redundant as stated elsewhere in this specification.

In a non-redundant system, all the modules making up the UPS system shall supply the full rated load. If a module should malfunction, placing an overload on the remaining on-line modules, the load shall be transferred automatically and without interruption to the bypass line by the use of the system level bypass static switch.

For redundant operation, the UPS system shall have one or more modules than required to supply the full rated load. The malfunction of a module shall cause that module to be disconnected from the critical load by its output circuit breaker, and the remaining module(s) shall continue to carry the load. Upon repair of the malfunctioning module, it shall be reconnected to the critical load to resume redundant operation.

Any module shall also be capable of being isolated from the critical load manually for maintenance without disturbing the critical load bus. With one or more modules off-line, a malfunction of another module shall cause the load to be transferred automatically and without interruption to the bypass line by the use of the system level bypass static switch, if the load exceeds the capacity of the modules remaining on-line.

2.2.3 System Efficiency

The UPS system shall be provided with a high-efficiency mode of operation to increase the system efficiency when the bypass source is within voltage and frequency tolerance of the load. When the bypass power quality goes outside of the adjusted limits, the inverter shall assume the load in a seamless fashion without any interruption. During operation in high-efficiency mode the rectifier in each module shall continuously charge the battery and the inverter shall demonstrate synchronism with the bypass and current delivery by circulating current through the output filter. Isolating the inverter from the load by mechanical or solid state means shall not be allowed.

2.2.4 System Protection

A. Surge Protection

The UPS shall have built-in protection against surges, sags and overvoltage from the AC source. The protection shall meet the requirements of ANSI C62.41 B3 including:

- 6kV, 100kHZ ring wave, line-to-line, line-to-neutral, line-to-ground and neutral-to-ground
- 6kV, combined wave, line-to-line, line-to-neutral, line-to-ground and neutral-to-ground

B. Output Protection

The UPS shall be protected against sudden changes in output load and overload at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. Fast-acting current-limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for tripping off-line. The load shall be automatically transferred to the bypass line without any interruption for an internal UPS malfunction. The status of protective devices shall be indicated on a graphic display screen on the front of the unit.

C. Containment During Fault Conditions

The UPS shall be designed for and demonstrate, as a part of testing for the short circuit withstand rating, adequate bracing of energized internal components. Testing shall include a three-phase short circuit at the input to the rectifier solid state switching devices and separately on the UPS output terminals. For the rectifier, the short circuit shall expose the customer input terminals, any interconnecting conductors and magnetic elements to the current, due to a fault on the line side of the input isolation transformer. A short circuit of the UPS output terminals shall expose the bypass input terminals, backfeed isolation device; bypass static switch and interconnecting conductors to the fault current. Testing shall demonstrate that the short circuit fault current will not cause a ground fault or internal arcing. Equipment compliance shall not require a specific manufacturer model or type of overcurrent device be supplied by the user.

2.3 COMPONENTS

2.3.1 Rectifier/Charger

The term *rectifier/charger* shall denote a 12-pulse solid-state bridge with equipment and controls necessary to convert alternating current to regulated direct current for input to the inverter and for charging the battery.

The rectifier shall have a three-winding transformer providing full galvanic isolation between the utility power and the DC-Bus/Battery.

A. Input Current Harmonic Distortion

Input current THD shall be less than 4% at full rated output load with nominal input voltage.

B. AC Input Current Limiting

The rectifier/charger shall include a circuit to limit AC input current to an adjustable level of 25% to 125% of the full input current rating. A second circuit shall provide an additional selection (25% to 125%) when signaled by an external contact (e.g, operation of generator). AC input current limit shall be factory-set at 125% for normal operation and 100% for generator operation.

C. Battery Charge Current Limiting

The rectifier/charger shall include a circuit to limit battery charging current to an adjustable level of 0% to 20% of maximum battery discharge current. A second circuit shall provide an additional selection (0% to 20%) when signaled by an external contact (e.g., operation of generator). Battery charge current limit shall be factory-set at 10% for normal operation and 0% for generator operation.

D. Input Current Walk-In

The rectifier/charger shall provide a feature that limits the total initial power requirement at the input terminals to 0% of rated load and gradually increases power to 100% of full rating over the 30-second (adjustable) interval.

E. Input Circuit Breaker

The rectifier/charger shall have an input circuit breaker. The circuit breaker shall be of the frame size and trip rating to supply full rated load and recharge the battery at the same time. The circuit breaker shall have an undervoltage release to open automatically and isolate all input power components if the control voltage is lost or if Emergency Power Off is signaled. The input circuit breaker interrupting capacity shall be equal to or greater than the UPS withstand rating. Switching devices with a lower rating are not acceptable.

F. Rectifier Fuse Protection

Each rectifier AC phase shall be individually fused with fast-acting fuses so that loss of any semiconductor shall not cause cascading failures. Fuses shall be bolted to busbars at both ends to ensure mechanical and electrical integrity. The display panel on the front of the unit shall indicate a blown fuse occurring on any phase of the rectifier.

G. DC Filter

The rectifier/charger shall have an output filter to minimize ripple current into the battery. The AC ripple voltage of the rectifier DC output shall not exceed 1% RMS of the float voltage. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter without the battery connected. The DC filter shall be fused independently from the rectifier fuses. DC filter fuse failure shall result in

an orderly shutdown of the rectifier and inverter.

H. Battery Recharge

In addition to supplying full power for the load, the rectifier/charger shall be capable of supplying a minimum of 5% of the module full load power rating for recharging the battery provided that the battery can accept recharge at that rate. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

I. Battery Equalize Charge

A manually initiated equalize charge feature shall be provided to apply an equalize voltage to the battery. The duration of equalize charge time shall be adjustable from 0 to 200 hours. A method shall be available to deactivate this feature for valve regulated battery systems.

J. Stop Battery Charging Function

Battery charging may be stopped by an external signal that is activated by a contact closure to indicate a condition (including battery overtemperature, presence of excessive hydrogen or failure of room ventilator fan) under which battery charging is undesirable or inadvisable.

K. Overvoltage Protection

There shall be DC overvoltage protection so that if the DC voltage rises to the pre-set limit, the UPS shall shut down automatically and initiate an uninterrupted load transfer to bypass.

L. Temperature-Compensated Charging

The UPS shall adjust the battery charging voltage based on the battery temperature reported from external battery temperature sensors. One temperature sensor shall be supplied for each battery string. Temperature sensors shall be monitored for faulty measurements and ignored if a fault is detected to prevent overcharging or undercharging the battery. When multiple sensors are used, the voltage shall be based on the average temperature measured. Excessive difference in the temperature measurements shall be reported and the charging voltage adjusted to protect the batteries from excessive current.

M. Battery Load Testing

The UPS shall be capable of performing battery load testing under operator supervision. To accomplish this, the rectifier/charger shall reduce charging voltage to force the batteries to carry the load for a short time. If the curve of battery voltage drop indicates diminished battery capacity, the UPS shall display an alarm message. If the voltage drop indicates battery failure, the UPS shall terminate the test immediately and annunciate or display the appropriate alarms.

2.3.2 Inverter

The term *inverter* shall denote the equipment and controls to convert DC current from the rectifier/charger or battery to precise AC current to power the load. The inverter shall be solid-state and capable of providing rated output power. For increased performance, the inverter shall be a pulse-width-modulated design and utilize insulated gate bipolar transistors (IGBTs). The inverter shall be fully self-protected from load changes and an output short circuit. To further enhance reliable performance and efficiency, the inverter shall not require an inverter output series static switch/isolator for the purposes of overload or fault isolation or transfers to bypass. The output circuit breaker interrupting capacity shall be equal to or greater than the UPS short circuit withstand rating. Switching devices with a lower rating are not acceptable.

A. Overload Capability

The inverter shall be able to sustain an overload across its output terminals up to 150% with ±2% output voltage regulation. The inverter shall be capable of at least 200% current for short circuit conditions including phase-to-phase, phase-to-ground and three-phase faults. If the short circuit is sustained, the load shall be transferred to the bypass source and the inverter shall disconnect automatically from the critical load bus.

B. Output Frequency

The inverter shall track the bypass continuously, provided that the bypass source maintains a frequency of 60Hz ±0.1Hz. The inverter shall change its frequency (slew rate) at 0.1Hz per second (adjustable 0.1 to 3.0Hz per second) to maintain synchronous operation with the bypass. This shall allow make-before-break manual or automatic transfers. If the bypass fails to maintain proper frequency, the inverter shall revert to an internal oscillator, which shall be temperature-compensated and shall hold the inverter output frequency to 0.1% from the rated frequency for steady-state and transient conditions. Drift shall not exceed 0.1% during any 24-hour period. Total frequency deviation, including short-term fluctuations and drift, shall not exceed 0.1% from the rated frequency.

C. Phase-to-Phase Balance

The inverter shall provide a phase-to-phase voltage displacement of no worse than ±1% with a 50% unbalanced load and up to 125% of the system output rating.

D. Fault Sensing and Isolation

Fault sensing shall be provided to isolate a malfunctioning inverter from the critical load bus to prevent disturbance of the critical load voltage beyond the specified limits. The inverter shall monitor the load current for distribution system faults. When a fault occurs, the inverter shall go into protection mode, preventing any damage to the inverter.

E. Output Circuit Breaker

The inverter shall be provided with a molded-case circuit breaker to isolate the inverter from the critical load bus. This circuit breaker shall be of the correct frame size and trip rating to supply full rated load and overload current as specified elsewhere in this document. The circuit breaker shall have an undervoltage release to open automatically and isolate all output power components if the control voltage is lost or if Emergency Power Off is signaled.

F. Battery Protection

The inverter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Inverter shutdown shall be initiated when the battery voltage has reached the end-of-discharge voltage. The battery end-of-discharge voltage shall be calculated and automatically adjusted for partial load conditions to allow extended operation without damaging the battery. Automatic shutdown based on discharge time shall not be acceptable.

2.3.3 Power Conversion Bypass

When maintenance is required or when the inverter cannot maintain voltage to the load due to inadequate DC power, sustained overload or malfunction, a bypass circuit shall be provided to isolate the inverter output from the load and provide a path for power directly from an alternate AC (bypass) source. The UPS control system shall constantly monitor the availability of the inverter bypass circuit to perform a transfer. The inverter bypass circuit shall consist of a continuous-duty bypass static switch and a circuit breaker to isolate the bypass static switch from the bypass source. The bypass static switch shall be a solid-state device consisting of two reverse-paralleled SCRs (silicon-controlled rectifiers) per phase that can automatically and instantaneously connect the alternate AC source to the load or isolate the load from the bypass source. The bypass circuit shall not include fuses in the path for the load. Fuses may prevent proper load circuit breaker tripping coordination.

A. Manual Load Transfers

A manual load transfer between the inverter output and the alternate AC source shall be initiated from the control panel. Manually initiated transfers shall be make-before-break, utilizing the inverter and the static bypass switch.

B. Automatic Load Transfers

An automatic load transfer between the inverter output and the alternate AC source shall be initiated if an overload condition is sustained for a time in excess of the inverter output capability or due to a malfunction that would affect the output voltage. Transfers caused by overloads only shall initiate an automatic retransfer of the load to the inverter only after the load has returned to a level within the rating of the inverter source. The UPS system logic shall allow up to five retransfers (adjustable) within any one-hour period to prevent cyclical transfers

caused by overloads.

C. Momentary Overloads

In the event of a load current inrush, such as energizing a load with high inrush current or branch load circuit fault in excess of the inverter's total rating, the bypass static switch shall connect the alternate AC source to the load for at least 200 milliseconds, allowing up to 1000% of the normal rated output current to flow. Output voltage shall be sustained to the extent the alternate AC source capacity permits. If the overload condition is removed before the end of the 200 milliseconds, the bypass static switch shall turn off and the load shall remain on inverter power. If the overload remains, then a transfer to the alternate AC source shall be completed.

D. Backfeed Protection

As required by UL 1778 and CSA, the static bypass transfer switch shall not backfeed UPS power to the bypass input terminals and, therefore, to the distribution system while the UPS is operating on battery during a bypass power outage. The purpose of this requirement is to prevent the risk of electrical shock on the distribution system when the normal source of power is disconnected or has failed. If a shorted SCR is detected, the static transfer switch shall be isolated by an internal automatic circuit breaker and an alarm message shall be annunciated at the UPS control panel. The load shall remain on conditioned and protected power after detection of a shorted SCR and isolation of the static bypass switch. A device that cycles due to loss of utility and is, therefore, at a higher risk of failure than a device that normally remains closed is not acceptable. The backfeed prevention circuit breaker interrupting capacity shall be equal to or greater than the UPS withstand rating. Switching devices with a lower rating or series-rated devices are not acceptable.

E. (Optional) Active Inverter Eco-Mode Operation

Economy operation shall be provided and shall be selectable by the user.

When selected, this mode of operation shall transfer the load to the bypass source and maintain it there as long as the bypass source frequency, slew rate and voltage are within the adjusted operating parameters. While in this mode, the inverter shall remain operating to demonstrate the ability to instantaneously assume the load without interrupting the output voltage. Should the bypass source go outside the adjusted limits, the bypass static switch shall turn Off, isolating the load from the bypass while the inverter assumes the full critical load. The load shall be transferred from the bypass source to the inverter without an interruption of the output voltage.

Operating adjustments shall include:

- Limit the frequency of transfer into Intelligent Eco-Mode caused by an out-of-tolerance bypass source.
- Specify day of the week and time of day to enable or disable Intelligent Eco-Mode operation.
- Enable and disable Intelligent Eco-Mode operation.

F. (Optional) Intelligent Paralleling Operation

When selected, this mode of operation shall place units in standby mode based on the available capacity of the installed units, the current load and the number of redundant units selected. While in standby mode a unit shall continue to charge the battery to maintain full battery capacity and as required by the battery manufacturers' published operating instructions. Units in standby mode shall be returned to full operation to maintain balanced operating hours and confirm proper operation. In the case of a utility outage units in standby mode shall be returned to full operating mode to allow the full battery capacity of the system to be available during the outage. Upon the return of utility power, units shall be placed in standby based on operating hours.

2.3.4 Display and Controls

A. UPS Control Panel

Each Multi-Module Unit and the System Bypass Control shall be provided with a microprocessor-based control panel for operator interface (also referred to as *User Interface*, or *UI*) to configure and monitor the UPS. The control panel shall be located on the front of the unit and shall be operated without opening the hinged front door. The display shall not be attached to the front door so the door can be easily removed for maintenance.

A backlit, menu-driven, full graphics, color touchscreen liquid crystal display shall be used to enter setpoints, and it shall display system information, metering information, a one-line diagram of the UPS and its ancillaries, active events, event history, startup instructions and transfer and shutdown screens. No mechanical push buttons shall be used.

All configuration and settings shall be password-protected, and an optional key lock shall be available to restrict display functions to permit monitoring only, preventing any unauthorized operation from the display.

B. Logic

UPS logic and control programming shall reside in a microprocessor-based control system with non-volatile flash memory. Rectifier, inverter and bypass control logic shall utilize high-speed digital signal processors (DSPs). CANbus shall be used to communicate between the logic and the UI as well as the options. Switches, contacts and relays shall be used only to signal the logic system as to the status of mechanical devices or to signal user control inputs. Customer external signals shall be isolated from the UPS logic by relays or optical isolation.

C. Metered Values

A microprocessor shall control the display and memory functions of the monitoring system. All three phases of three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accurate (±1%) representation of non-sinusoidal waveforms typical of computers and other sensitive loads. These parameters shall be displayed:

Module Level Metering

- Input voltage, line-to-line
- Input current
- Input frequency
- Battery voltage, each battery string
- Battery charging/discharging current
- Output voltage, line-to-line and line-to-neutral
- Output frequency
- Bypass input voltage, line-to-line
- Bypass input frequency
- Load current
- Load kVA, total and percentage of full load
- Load kW, total and percentage of full load
- Load power factor, per phase
- Total operating hours
- Battery temperature, each battery string
- Battery state of charge

System Bypass Control

- Bypass input voltage, line-to-line
- Bypass input frequency
- Output voltage, line-to-line and line-to-neutral
- Output frequency
- Load current
- Load kW
- Load kVA
- Load power factor, per phase
- Number of redundant modules on line

D. Power Flow Indications

A power flow diagram shall graphically depict whether the load is being supplied from the inverter, bypass or battery and provide, on the same screen, the status of these components:

Module Level Mimic

- AC input circuit breaker
- Battery circuit breaker, each breaker
- Inverter output circuit breaker
- Maintenance bypass cabinet breakers (when used)

System Level Mimic

- Module Status
- Backfeed breaker
- Bypass Breaker (SCC)
- System Output (SCC)
- Bypass Static Switch (SCC)
- Module Output Breakers (optional)
- Maintenance Bypass Cabinet Breakers (optional)

E. Battery Status Indicator

A battery status indicator shall display DC alarm conditions, battery state of charge, the present battery voltage, total discharge time and battery time remaining during discharge. A graphical representation of the battery voltage during the discharge shall be displayed. The graphical representation shall remain in the monitoring system memory until the next discharge occurs and shall be available for review of the battery performance.

F. Battery Cycle Monitor

The UPS shall have a Battery Cycle Monitor (BCM) built into system firmware to document the cycle service of the battery. It shall collect and retain information on the last 132 events that involved discharging the UPS battery. Each battery discharge cycle shall be put into one of nine categories, depending on the duration of the event:

- 0-30 seconds discharge
- 31-90 seconds discharge
- 91-240 seconds discharge
- 4-15 minutes discharge
- 15-30 minutes discharge
- 30-60 minutes discharge
- 60-240 minutes discharge
- 4-8 hours discharge
- 8 hours and up discharge

The BCM shall collect and retain this information for each discharge cycle:

- System time and date
- Event number
- Duration of cycle
- Lowest kW
- Maximum kW
- kW carried by the batteries at the start of cycle
- Ampere hours
- Status of battery breakers at start and end of the cycle

In addition, the BCM shall retain summary information on the total number of events, the cumulative ampere hours and the total discharge time since a given date.

The BCM shall be capable of storing information for up to 132 discharge cycle events in its data buffer. When the buffer approaches its capacity, a warning message shall be broadcast. Once the buffer is filled, new data shall replace the old on a first-in, first-out basis as new cycles occur.

The UPS operator shall be able to select either the BCM Summary screen, one of nine time buckets or a list of all records in order of occurrence. The records displayed for each of the time buckets or for all records shall display detailed information for each of the cycles.

During a battery discharge event, the Summary screen shall change to show information about the current discharge cycle. The screen shall display Active Battery Discharge Time in place of Total Battery Discharge Time and substitute Active Battery Amp Hours with Total Battery Amp Hours.

The UPS shall allow this information to be collected remotely through the Remote Service Terminal application program.

G. Events

The control panel shall report the system-level events listed below. An audible alarm shall be activated when any of the following events occurs. All events shall be displayed in text form.

Input Not Available
Rectifier Fault
Input Current Imbalance
Input Phase Rotation Error
Input Current Limit
Input Filter Cycle Lock
DC Link Ground Fault Alarm (positive)
DC Link Ground Fault Alarm (negative)
Bypass Not Available
Bypass Frequency Error
Backfeed Breaker Open
Bypass Static Switch Unable
Excessive Pulse Parallels
Bypass Overload Phase A
Bypass Overload Phase B
Bypass Overload Phase C
Bypass Static Switch Overload Exceeded
Excessive Auto Retransfers
Auto Retransfer Failed
Transfer Failed - Shutdown
Battery Discharging
Battery Low Warning
Battery Low Shutdown
Battery Ground Fault
Battery Temperature Imbalance
Battery Overtemperature Warning
Battery Overtemperature Limit
Battery Capacity Low
Battery Test Failed
Module Battery Disconnect Open
Battery CB "#" Open
Main Control Fault
Inverter Fault
Inverter Overload Phase A
Inverter Overload Phase B
Inverter Overload Phase C
Inverter Overload Exceeded
Low Power Factor Warning
Leading Power Factor
Maximum Load Alarm Phase A
Maximum Load Alarm Phase B
Maximum Load Alarm Phase C
Output Fault
Redundant Fan Failure
Multiple Fan Failure
Inlet Air Overtemperature Warning
Outlet Air Overtemperature Limit
Equipment Overtemperature Warning
Equipment Overtemperature Limit
Equipment Temperature Sensor Fail
Battery Sensor Fail
Breaker Open Fail
Breaker Close Fail
Fuse Failure
Power Supply Failure
Controller Error
Internal Communication Error
Auto Restart Failed
LBS Inhibited
EMO Shutdown
REPO Shutdown
Controls Communication Fail
Communication Fail

H. Controls

System-level control functions shall be:

- UPS/Bypass Transfer Command
- Startup Screen
- UPS/System Shutdown Commands
- Maximum Load Exceeded Setpoint Adjustment
- Manual Transfer - Bypass Voltage High and Low Limit Adjustments
- Inlet Air Temperature Warning Setpoint Adjustment
- Battery Test Setpoint Adjustment
- Low Battery Warning (Minutes) Setpoint Adjustment
- Battery Temperature Warning and Limit Adjustments
- Open Battery Disconnect
- Battery Cell Count Adjustment
- Battery Float Voltage Setpoint Adjustment
- Event Mask (Latch, Audible, Event Log) Screen
- System Settings (Time, Date, Language, LCD Brightness, Password, Audio Level) Adjustments
- Audio Silence Command
- Alarm Reset Command
- Input Contact Isolator Setup Screen (optional)
- Programmable Relay Setup Screen (optional)
- Emergency Module Off Push Button with Protective Cover (optional)

I. Manual Procedures

Startup

The Startup screen shall be user-interactive on the display panel in text and graphic form and provide a step-by-step guide for the user to bring the UPS module on-line. Push buttons are also provided to enable the battery breaker and the input trap.

Load Transfers

Two buttons (UPS, BYPASS) shall provide the means for the user to transfer the load to Bypass and back on UPS. A synchroscope shall be provided to display the phasing between Bypass and Output in graphical representation.

Shutdown

Two buttons (UPS, SYSTEM) shall provide the means for the user to shut down the inverter and transfer the load to bypass or shut down the entire system. Push buttons are also provided to trip the battery breaker and the input trap.

J. (Optional) Emergency Module Off

A local Emergency Module Off push button with protective cover shall be provided. Pressing the Emergency Module Off push button shall:

- Initiate an uninterrupted transfer of the load to bypass and
- Cause the input, output and battery breakers to open, completely isolating the UPS (except bypass) from power.

Provisions shall be available for a remote Emergency Power Off signal that shall either transfer the load to bypass or completely remove power from the critical bus (operator-selectable) when activated.

2.3.5 Self-Diagnostics

A. History Log File

Three History Log files shall be provided to record multiple incidents to aid in system troubleshooting. Security to protect the files from accidental erasure shall be provided. Each History Log file shall contain all metering, events and status information in 128 frames. The control system shall maintain this information in discrete 2-millisecond frames. This shall provide status recall of a period of 256 milliseconds (128 frames). Each frame is represented by a re-creation of the one-line mimic (replay). The breaker status and power flow shall be re-created to display the condition of the UPS in each frame.

B. Event Log File

The control system shall maintain a log of the event conditions that have occurred during system operation. System memory shall be capable of storing up to 2048 events. Each log shall contain the event name, event type (status, alarm, fault), event time/date stamp, event ID, parametric data associated with the event and a set/clear indicator.

A. System Status File

The control system shall monitor and display the total operating hours of the UPS system.

2.3.6 Remote Monitoring Capability

A. Network Communication

The UPS shall be equipped with provisions for remote communication. IP20 isolation, to avoid exposure to any energized part, shall be provided during installation and configuring of the communication card.

Standard communication protocols shall be Emerson Protocol, Remote Service Delivery Protocol and HTTP Web. Communication shall be compatibility with DCIM Trellis platform and Liebert Nform® management software.

Two of three optional protocols shall be supported with simultaneous communication - SNMP, BACnet IP, Modbus IP/485.

2.3.7 Optional Features

A. System Efficiency

The UPS module shall be provided with a high-efficiency mode of operation to increase the module efficiency when the bypass source is within voltage and frequency tolerance of the load. When the bypass power quality goes outside the adjusted limits, the inverter shall assume the load in a seamless fashion without the output voltage being interrupted. During operation in high-efficiency mode the rectifier shall continuously charge the battery and the inverter shall demonstrate synchronism with the bypass and current delivery by circulating current through the output filter. Isolating the inverter from the load by mechanical or solid state means shall not be allowed.

B. Load Bus Sync Interface

The Load Bus Sync Interface shall enable independent UPS systems to remain synchronized when operating on battery or on unsynchronized input sources.

C. Remote Alarm Contacts

Two Remote Alarm Contact assemblies, rated at 30VDC, 1A, shall be provided, as an option, for customer signaling. Two sets of Form C contacts shall be provided for each of eight alarm signal channels per assembly. The activation for each alarm signal channel shall be customer-selected for up to four individual alarms or as a summary of all alarms.

D. Customer Contact Inputs

Two Customer Contact Interface assemblies shall be provided, as an option, for the input and display of customer-supplied alarm points or to initiate pre-assigned UPS operations. Each assembly shall provide eight channels, with a 24VDC, 100mA signal to be triggered by an isolated, normally open contact. When an assembly is selected as a customer-named event, the customer may also assign a name of up to 16 characters and the following actions individually to each alarm:

- Annunciate horn while alarm is present
- Latch horn on and display alarm until manually reset
- Include this alarm in the summary alarm
- Freeze the history status file
- Initiate external communication
- Delay action from this signal for 0 to 99.9 seconds

When an assembly is selected as a pre-assigned UPS operation, these actions shall be initiated:

- Reduced Rectifier Input Current
- Reduced Battery Charge Current
- Stop Battery Charging (up to seven separate signals)
- Inhibit Rectifier Restart
- Inhibit Bypass Autorestart
- Inhibit Inverter Autorestart
- Input Trap Filter Disconnect
- Suspend High-Efficiency Mode
- Transfer from Inverter to Bypass
- Transfer from Bypass to Inverter

E. Remote Alarm Panel

The remote alarm panel shall have LED alarm lights. An audible alarm shall sound upon any alarm condition. The surface- or flush-mounted NEMA 1 enclosed panel shall indicate:

- Load on UPS
- Load on Bypass
- Battery Discharging
- Low Battery Warning
- Overload Warning
- Ambient Overtemp Warning
- UPS Alarm Condition
- New Alarm Condition (for a second UPS alarm condition)
- Audible Alarm with Reset Push Button
- Lamp Test/Reset Push Button

F. Seismic Anchorage Kits

Seismic anchorage kits shall be provided with the UPS unit, and if included the (optional) Matching Battery Cabinet, for use in seismic restraint as required for IBC 2012 or OSHPD certification.

3.0 BATTERY PLANT

The UPS system shall be provided with a battery plant that shall comply with the specifications of:

- Matching Battery Power Pack,
- Flooded-Cell Battery System on rack, or
- Valve-Regulated, Sealed Cell Battery System on rack.

The battery shall be fully charged per the manufacturer's instructions during startup and shall demonstrate the specified operating time.

3.1 MATCHING BATTERY POWER PACK

The battery power pack shall consist of sealed, valve-regulated batteries, circuit breaker for isolating the battery pack from the UPS and a control interface to the UPS module. The circuit breaker shall be sized to allow discharge at the maximum published rating of the battery. The interface to the UPS module shall provide status and thermal data to allow the UPS to regulate the charging voltage and inhibit the conditions associated with battery thermal runaway. If the temperature measurement in a battery cabinet indicates that thermal runaway is occurring, then the UPS controls shall isolate the cabinet from the charger by tripping the battery breaker in that cabinet while leaving other battery cabinets connected to allow UPS operation during a loss of power to the rectifier.

The battery cabinet shall be rated NEMA 1, matching the UPS style and design.

- **Battery Cabinets Connected Directly to the UPS**: The manufacturer shall provide all power and control parts necessary to interconnect the UPS and battery cabinets.
- **Battery Cabinets Separated from the UPS**: The manufacturer shall provide all power and control parts necessary to interconnect the battery cabinets. The installer shall provide all cabling necessary to interconnect the UPS and the battery cabinets.

Both overhead and under-floor site installed cabling shall be accommodated. Installing cabling shall not require removal of batteries or any other battery cabinet assemblies.

The battery system shall be sized to support a _____kW load for _____ minutes. The battery system shall provide 100% initial capacity upon delivery.

The battery shall be lead-calcium, sealed, valve-regulated type with a three (3) -year full warranty and a seven (7) -year pro rata warranty under full float operation. The battery design shall utilize absorbent glass mat (AGM) technology to immobilize the electrolyte.

3.1.1 Optional Battery System Monitor

The battery system shall be provided with an Alber® universal battery diagnostic system. The system shall provide predictive on-line test, analysis and remote monitoring.

The system shall include automatic monitoring, alarming, recording and displaying of these battery parameters.

- Individual jar voltage (high and low alarm).
- Individual jar DC resistance (high and low alarm) accomplished by applying a momentary load at user-defined intervals.
- Individual inter tier and disconnect switch resistance measurements (high alarm) performed at user-defined intervals.
- Total overall battery voltage per string (high and low alarm).
- Two ambient temperatures per string for temperature trending (high and low alarm).
- Real time system discharge logging of the overall voltage, individual jar voltage (low alarm), discharge current (high alarm), and temperatures.
- Ripple current per string.
- String current (high alarm).
- Optional float current per string (high and low alarm).

The system shall provide reports for evaluation of the battery condition. Reports shall include:

- Alarm condition reporting – tabular, fax or e-mail.
- Jar out-of-limits summary report – tabular.
- Individual jar voltages over time – graph or tabular.
- Individual jar resistance values over time – graph or tabular.
- Total battery voltage over time – graph or tabular.
- Ambient temperature over time – graph or tabular.
- Discharge report: total battery voltage decay vs. time – graph or tabular.
- Discharge report: jar voltage decay vs. time – graph or tabular.
- Discharge hit summary report – tabular.
- Discharge hit interval summary report – tabular.
- General summary report of battery and monitor status of all systems to the battery or string level based on user-set thresholds.
- Detail summary reports of battery and monitor status of all systems with a line graph trend of any parameter that violated a threshold.
- Executive report showing overall system health.

Data from universal battery diagnostic system shall viewed through an Ethernet port with one of the following protocols - SNMP, TCP/IP/Modbus, SMS or HTTP. An optional RS-485 port shall be available for Modbus communication.

3.2 FLOODED-CELL BATTERY SYSTEM ON RACK

The battery shall be a lead-calcium stationary battery with a 20-year pro rata warranty under full float operation.

Ratings

Backup Time: ____ minutes.

Load kW: ____ kW.

Maximum Specific Gravity: ____.

Racks shall be ____-tier, certified for seismic zone ____.

Alloys

Grids shall be manufactured of lead-calcium alloys to ensure long life and consistently low gassing rate over the entire service life; all internal wetted parts shall be of similar non-antimonial alloy to preclude interfacial corrosion at the bonded area.

Plates

Both positive and negative plates shall be of the flat pasted plate design to ensure highly reliable electrical performance throughout the life of the battery. Positive plates shall be at least 0.16 in. (4mm) thick. Physical support of the positive plate group shall be via a suspension system that allows for normal plate expansion without stressing the jar or cover. The plates shall be of the "wrapped plate design," such as C&D XT Plus or Enersys DXC, for high cycle application.

Terminals

All batteries larger than 1.5kW/cell (15-minute rate to 1.67 volts per cell) shall include copper inserted terminal posts allowing connector torque of 160 pound-inches and copper-to-copper interface with the intercell connector (except for flashing). Terminal posts shall be of sufficient strength to support normal inter-tier or inter-step cabling without additional bracing.

Container

The cell cover shall be of a flame-retardant material with an oxygen index of at least 28; all jars must be transparent to allow visual inspection of the plates and sediment spaces. Cell covers shall include provision for sampling of the electrolyte below the tops of the plates.

Intercell Connections

For each bolted connection, lead-plated copper connectors and corrosion-resistant bolts shall be provided; interconnecting hardware shall be sized to permit discharge at the maximum published rate while allowing no more than 30 mV of voltage drop between adjacent units at the one-minute rate to 1.75 volts per cell (VPC). Along with the necessary hardware, the supplier shall furnish NO-OX-ID grease to coat the contact area of all electrical connections.

Racks

Racks shall have welded steel support frames and unitized rail construction to prevent long-term warping and resulting stresses on the cells and interconnections. All metallic rack components that directly contact the battery shall be insulated by removable covers.

Packaging

Packaging must allow lifting straps to be inserted beneath the cells without moving, lifting or tilting the cells. Packaging shall ensure that plates are oriented perpendicular to the normal direction of travel during transportation.

Manufacturing Controls

Each cell shall be clearly identified as to cell type, voltage and capacity, as well as manufacturing control group, for future quality assurance traceability. All cells in the battery shall be tested to ensure 100% system capacity. The equipment shall be designed and manufactured under a quality assurance program that is controlled and documented by written policies, procedures or instructions, and that shall be carried out throughout the performance of the work. The quality assurance program shall conform to the requirements of ANSI N45.2, MIL I-45208A and MIL-Q-9858.

3.2.1 Battery Disconnect Breaker for Battery System on Racks

Each battery string shall be supplied with a molded-case circuit breaker listed to UL 489, supplement SC, for applications greater than 250VDC. The trip rating of the breaker shall be sized to allow the battery to operate at full rated capacity at the five-minute discharge rate. This shall allow a partially loaded UPS to operate even if one or more battery strings are offline. The molded-case circuit breaker interrupting rating shall be greater than the battery string fault current capability. The molded-case circuit breaker trip unit shall have an instantaneous trip of 135% of the breaker trip rating to ensure that a partially charged battery has sufficient fault current to trip the breaker. For other trip values greater than 135%, UPS manufacturer shall provide, upon request, calculations demonstrating proper coordination between battery and breaker.

The battery breaker shall be in a separate NEMA 1 enclosure for all systems on racks. When the breaker is open, there shall be no battery voltage in the UPS enclosure. The UPS shall automatically be disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level or when signaled by other control functions. The UPS shall be provided with a push button to trip the breaker from the control panel.

3.2.2 Optional Battery System Monitor

The battery system shall be provided with an Alber® battery diagnostic system. The system shall provide predictive on-line test, analysis and remote monitoring.

The system shall include automatic monitoring, alarming, recording and displaying of these battery parameters:

- Individual cell voltage (high and low alarm)
- Individual cell DC resistance (high and low alarm) accomplished by applying a momentary load at user-defined intervals.
- Individual inter-tier and disconnect switch resistance measurements (high alarm) performed at user-defined intervals.
- Optional individual intercell resistance measurements performed at user defined intervals.
- Total overall battery voltage per string (high and low alarm).
- Ambient temperatures per string for temperature trending (high and low alarm), with ability to add up to 10 temperatures per string for temperature trending (optional).
- Real time system discharge logging of the overall voltage, individual cell voltage (low alarm), discharge current (high alarm), and temperatures.
- String current (high alarm).
- Optional float current per string (high and low alarm).

The system shall provide reports for evaluation of the battery condition. Reports shall include:

- Alarm condition reporting – tabular, fax or email.
- Cell out-of-limits summary report – tabular.
- Individual cell voltages over time – graph or tabular.
- Individual cell resistance values over time – graph or tabular.
- Total battery voltage over time – graph or tabular.
- Ambient temperature over time – graph or tabular.
- Discharge report: total battery voltage decay vs. time – graph or tabular.
- Discharge report: cell voltage decay vs. time – graph or tabular.
- Discharge hit summary report – tabular.
- Discharge hit interval summary report – tabular.
- General summary report of battery and monitor status of all systems to the battery or string level based on user-set thresholds.
- Detail summary reports of battery and monitor status of all systems with a line graph trend of any parameter that violated a threshold.
- Executive report showing overall system health.

One RS-232 serial port shall be configurable for either a local PC to be connected at all times, for temporary viewing with a computer or permanently connected to a Building Management System. An optional RJ-45 Ethernet port shall be provided with one of the following protocols - SNMP, TCP/IP/Modbus.

3.3 VALVE-REGULATED, SEALED CELL BATTERY SYSTEM ON RACK

The battery shall be a lead-calcium, sealed, reduced-maintenance type with a one-year full warranty and a nine-year pro rata warranty under full float operation.

Ratings

Backup Time: ____ minutes

Load kW: ____kW

Racks shall be ____-tier, certified for seismic zone ____.

Electrolyte Immobilization

Battery shall utilize absorbent glass mat (AGM) technology to immobilize electrolyte.

Alloys

Grids shall be manufactured of lead-calcium alloys to ensure long life and consistently low gassing rate over the entire service life; all internal wetted parts shall be of similar non-antimonial alloy to preclude interfacial corrosion at the bonded area.

Plates

Both positive and negative plates shall be of the flat pasted plate design to ensure highly reliable electrical performance throughout the life of the battery. Positive plates shall be equipped with fibrous retention mats to inhibit the loss of active material as a result of repeated cycling.

Terminals

All batteries shall include copper inserted terminal posts allowing connector torque of 110 pound-inches and copper-to-copper interface with the intercell connector (except for flashing). Terminal posts shall be of sufficient strength to support normal inter-tier or inter-step cabling without additional bracing.

Container

The cell container and cover shall be of a flame-retardant material with an oxygen index of at least 28. The cell cover shall include a low-pressure release vent. All cells larger than 25kW/cell (15 minute rate to 1.67 volts per cell) shall include an integral flash arrestor.

Intercell Connections

For each bolted connection, tin-plated copper connectors and corrosion-resistant bolts shall be provided; interconnecting hardware shall be sized to permit discharge at the maximum published rate while allowing no more than 30 mV of voltage drop between adjacent units at the one-minute rate to 1.75 volts per cell (VPC). Along with the necessary hardware, the supplier shall furnish terminal connection coating compound if required by the battery manufacturer.

Manufacturing Controls

Each cell shall be clearly identified as to cell type, voltage and capacity, as well as manufacturing control group, for future quality assurance traceability. All cells in the battery shall be tested to verify 100% system capacity. The equipment shall be designed and manufactured under a quality assurance program that is controlled and documented by written policies, procedures or instructions and that shall be carried out throughout the performance of the work. The quality assurance program shall conform to the requirements of ANSI N45.2, MIL-I-45208A and MIL-Q-9858.

3.3.1 Battery Disconnect Breaker for Battery System on Racks

Each battery string shall be supplied with a molded-case circuit breaker listed to UL 489, supplement SC, for applications greater than 250VDC. The trip rating of the breaker shall be sized to allow the battery to operate at full rated capacity at the five-minute discharge rate. This shall allow a partially loaded UPS to operate even if one or more battery strings are offline. The molded-case circuit breaker interrupting rating shall be greater than the battery string fault current capability. The molded-case circuit breaker trip unit shall have an instantaneous trip of 135% of the breaker trip rating to ensure that a partially charged battery has sufficient fault current to trip the breaker. For other trip values greater than 135%, UPS manufacturer shall provide, upon request, calculations demonstrating proper coordination between battery and breaker.

The battery breaker shall be in a separate NEMA 1 enclosure for all systems on racks. When the breaker is open, there shall be no battery voltage in the UPS enclosure. The UPS shall automatically be disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level or when signaled by other control functions. The UPS shall be provided with a push button to trip the breaker from the control panel.

3.3.2 Optional Battery System Monitor

The battery system shall be provided with an Alber® universal battery diagnostic system. The system shall provide predictive on-line test, analysis and remote monitoring.

The system shall include automatic monitoring, alarming, recording and displaying of these battery parameters.

- Individual jar voltage (high and low alarm).
- Individual jar DC resistance (high and low alarm) accomplished by applying a momentary load at user-defined intervals.
- Individual inter-tier and disconnect switch resistance measurements (high alarm) performed at user-defined intervals.
- Total overall battery voltage per string (high and low alarm).
- Two ambient temperatures per string for temperature trending (high and low alarm).
- Real time system discharge logging of the overall voltage, individual jar voltage (low alarm), discharge current (high alarm), and temperatures.
- Ripple current per string.
- String current (high alarm).
- Optional float current per string (high and low alarm).

The system shall provide reports for evaluation of the battery condition. Reports shall include:

- Alarm condition reporting – tabular, fax or email.
- Jar out-of-limits summary report – tabular.
- Individual jar voltages over time – graph or tabular.
- Individual jar resistance values over time – graph or tabular.
- Total battery voltage over time – graph or tabular.
- Ambient temperature over time – graph or tabular.
- Discharge report: total battery voltage decay vs. time – graph or tabular.
- Discharge report: jar voltage decay vs. time – graph or tabular.
- Discharge hit summary report – tabular.
- Discharge hit interval summary report – tabular.
- General summary report of battery and monitor status of all systems to the battery or string level based on user-set thresholds.
- Detail summary reports of battery and monitor status of all systems with a line graph trend of any parameter that violated a threshold.
- Executive report showing overall system health.

Data from universal battery diagnostic system shall viewed through an Ethernet port with one of the following protocols - SNMP, TCP/IP/Modbus, SMS or HTTP. An optional RS-485 port shall be available for Modbus communication.

4.0 EXECUTION

4.1 FIELD QUALITY CONTROL

The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

A. Visual Inspection

- Inspect equipment for signs of damage.
- Verify installation per drawings supplied with installation manuals or submittal package.
- Inspect cabinets for foreign objects.
- Verify that neutral and ground conductors are properly sized and configured per the manufacturer's requirements as noted in the manufacturer's drawings supplied with installation manuals or submittal package.
- Inspect electrolyte level in cells (flooded cells only).
- Inspect all cell cases.
- Inspect each cell for proper polarity.
- Verify that all printed circuit boards are configured properly.

B. Mechanical Inspection

- Check all control wiring connections for tightness.
- Check all power wiring connections for tightness.
- Check all terminal screws, nuts and/or spade lugs for tightness.

C. Electrical Inspection

- Check all fuses for continuity.
- Confirm input and bypass voltage and phase rotation are correct.
- Verify control transformer connections are correct for voltages being used.
- Verify connection and voltage of the battery string(s).

D. Unit Startup

- Energize control power.
- Perform control/logic checks and adjust to meet the manufacturer's specification.
- Verify DC float and equalize voltage levels.
- Verify DC voltage clamp and overvoltage shutdown levels.
- Verify battery discharge, low battery warning and low battery shutdown levels.
- Verify fuse monitor alarms and system shutdown.
- Verify inverter voltages and regulation circuits.
- Verify inverter/bypass sync circuits and set overlap time.
- Perform manual transfers and returns.
- Simulate utility outage at no load.
- Verify proper recharge.

4.2 MANUFACTURER'S FIELD SERVICE

A. Service Personnel

The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory-trained field service personnel dedicated to the startup and maintenance of UPS and power equipment.

The manufacturer shall provide a national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, and 365 days/year. If emergency service is required, on-site response time shall be four hours or less within 150 miles of an Emerson Network Power Liebert Services center.

Two local customer engineers shall be assigned to the site with a regional office as a backup. Escalation procedures shall be in place to notify Power Technical Support if a site is not functioning within 24 hours.

B. LIFE™ Services

The UPS manufacturer shall provide LIFE™ services, which provides 24x7 continuous monitoring of events and parametric data, event and data analysis reports, and dispatch of factory-trained field service personnel. The UPS shall be able to initiate periodic and critical event driven communication with a remote service center to transfer event and parametric data for analysis and action. The remote service center shall be staffed with factory-trained service personnel who are capable of receiving, analyzing and interpreting the communicated events and data. The remote service center personnel shall also be capable of dispatching factory-trained field service personnel to the location of the UPS.

C. Replacement Parts Stocking

Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the continental United States.

Spare parts shall be stocked by local field service personnel with backup available from regional parts centers and the manufacturing location. A national parts center Customer Support Parts Coordinator shall be on call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

D. Maintenance Contracts

A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available.

Chloride Trinergy®

High Power Modular Scalable UPS With Three Functioning Modes

■200-1200kW



An Industry First
Chloride Trinergy®'s revolutionary architecture comes from incorporating the three industry standard functioning configurations for the first time in one high power UPS:

- **Maximum Power Control (VFI)**
- **Maximum Energy Saving (VFD)**
- **High Efficiency and Power Conditioning (VI)**

Chloride Trinergy®'s unique combination of technology allows it to monitor the environment and operating conditions of the network before intelligently selecting the functioning mode best suited to the line conditions.

Chloride Trinergy®'s ability to choose the most efficient operating mode based on the different network conditions ensures that the supply to the load remains in optimum condition at all times.

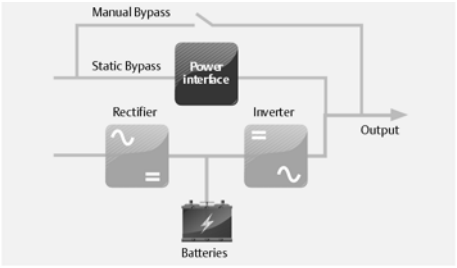
This allows the system to achieve extraordinary energy savings, first class performance and maximum power protection.[1] The high level of flexibility, energy efficiency and adaptability of Chloride Trinergy® are in line with the European Union's Code of Conduct on Best Practices, thus further confirming its outstanding performance capabilities.

Features And Performances

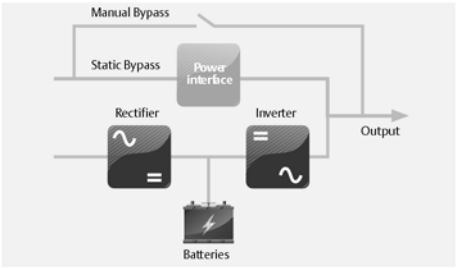
- Transformer free design
- Full IGBT double conversion technology
- Excellent input performances
  - PF > 0.99
  - THDi < 3%
- Output Power Factor 1
- Output Power Factor diagram symmetrical respect to zero
- Permanent 100% kVA - no derating with any load (lagging or leading)
- Optimum space/power ratio
- Automatic output power upgrade up to +10%
- High conversion efficiency (certified up to 99%).

1) Class 1 (IEC 62040-3) CBEMA

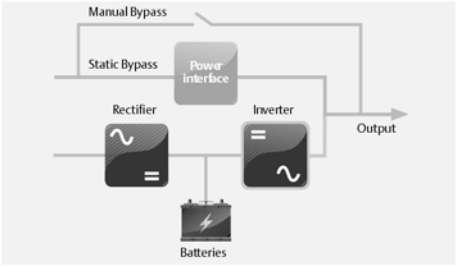
Dynamic Functioning Modes



Maximum Power Control (VFI) provides the highest level of power conditioning and protects the load from all electrical network disturbances.



Maximum Energy Saving (VFD) detects when conditioning is not required and allows the energy flow to pass through the bypass line.



High Efficiency & Power Conditioning (VI) compensates the load THDi, PF and main sags and swells.

Extraordinary Savings
On Mains Input Equipment
The modular architecture of the Chloride Trinergy® UPS allows for great advantages in terms of installation:

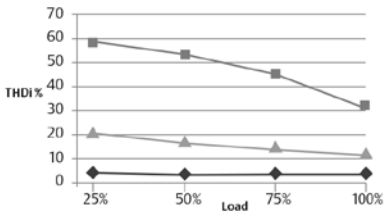
- Reduced size of electrical infrastructure
- Reduced size of circuit protection devices
- Reduced cabling

Chloride Trinergy® features unitary input Power Factor and low content of harmonics providing full compatibility with gensets and greatly contributing to reduced installation and running costs.

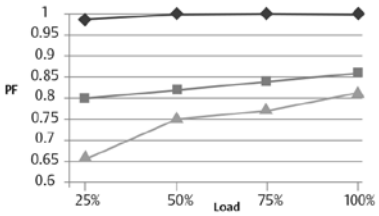
Running Cost Savings
Circular redundancy
Chloride Trinergy®'s circular redundancy feature adjusts available UPS capacity to meet immediate load requirements by automatically switching excess module capacity to standby, thus greatly improving efficiency at partial load and reducing operating costs.

Air conditioning
The extremely high efficiency achieved with Chloride Trinergy® reduces the energy dissipated by the UPS (kW), thus minimizing the demand and consumption of the air conditioning system.

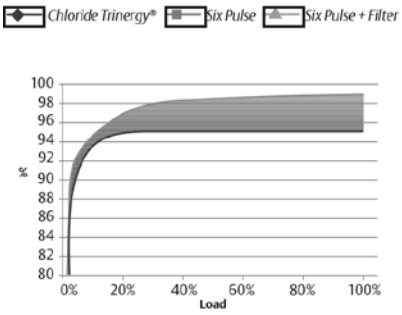
Minimized Total Cost Of Ownership



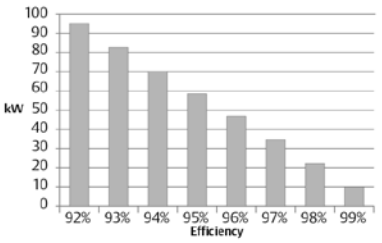
Input Harmonic Distortion vs Load Percentage



Input Power Factor vs Load Percentage



95 - 99% efficiency at down to 20% load



Air conditioning size & power reduced by 400%

Maximized Savings
Chloride Trinergy®'s design features and outstanding efficiency up to 99%, greatly minimize the total cost of ownership from installation through to operation:

- Optimum space/power ratio
- Reduced footprint
- Reduction in size and power of air conditioning system
- Fast and safe maintenance

Delivering

- Minimized installation costs
- Minimized running costs
- Minimized air conditioning requirements
- 99% efficiency

High Efficiency

Chloride Trinergy®'s unique architecture and technology have been purposely developed to enhance efficiency.

Able to discriminate between the different network input conditions and select the best functioning mode in relation to the disturbance, Chloride Trinergy® can achieve maximum energy savings by using only the necessary amount of energy required to provide the best output power quality and conditioning to the load.

Advantages Include:

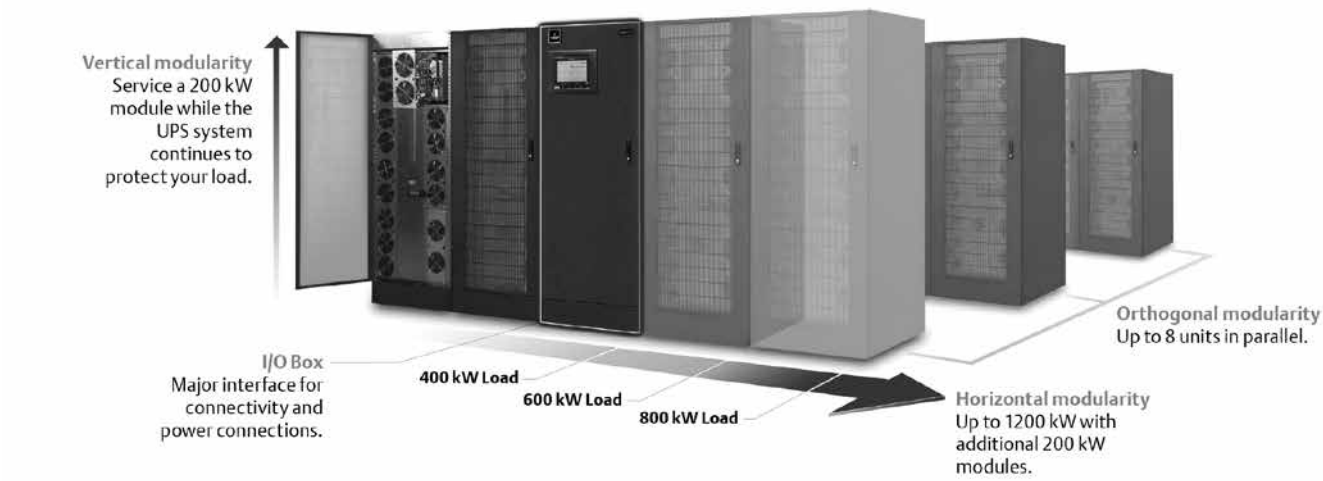
- Premium energy savings via transformer free technology and Chloride Trinergy®'s algorithm
- Quietest UPS in its power range
- Maximized battery life with Advanced Battery Care (ABC)
- Circular redundancy



High Efficiency

Sizing Your System

Scalable up to 9.6 MW; the highest active power rating available thanks to three dimensional modularity: Vertical, Horizontal and Orthogonal.



Vertical Modularity:
the stacked drawers in each module can be individually extracted for service purposes while the UPS system continues to protect your load.

Horizontal Modularity:
Chloride Trinergy® can scale up to 1.2 MW in power by adding complete 200 kW UPS modules side-by-side and around the input/output power section.

Orthogonal Modularity:
is the ability of Chloride Trinergy® to work with up to 8 complete UPS (fully populated with UPS modules) in parallel.

Three Dimensional Modularity

Chloride Trinergy®'s three dimensions of modularity allow businesses to expand their power protection needs at the same pace as their evolving load requirements by simply adding additional power modules. These three dimensions of modularity are built around Chloride Trinergy®'s I/O Box which is the major interface for connectivity and power connections as well as centralized and distributed battery configurations.



Modules can be added at anytime during the lifecycle of the UPS allowing it to reach up to 9.6 MW of active power, the most ever available in one UPS.



3 Dimensional Modularity

Chloride LIFE®.net 24/7
Remote Diagnostic System

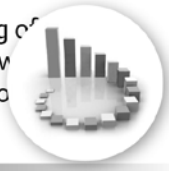
It is essential that your critical power protection system is maintained in an optimum state of readiness at all times.

Chloride LIFE®.net remote diagnostic and monitoring system provides early warning of UPS and single module alarm conditions and out of tolerances. This allows effective proactive maintenance and fast incident response, giving customers complete securityand peace of mind.

Maximize Availability

Pre-Emptive Maintenance

Chloride LIFE®.net provides early warning of more than 150 separate parameters allow real-time diagnosis and swift identificatio and resolution of operating anomalies.



Minimize Downtime

Immediate Identification of Problems

Should an emergency condition arise, an engineer in the 24/7 manned service center carries out an immediate fault analysis an instigates appropriate corrective action.



Reduce Operating Costs

Superior Asset Management

Through comprehensive data collection and analysis, Chloride LIFE®.net's detailed reporting system provides valuable information on po and equipment trends, over any selected period of time.



Connectivity And Tracking
Real-time connectivity, tracking and Chloride LIFE®.net remote diagnosis ensure that your system is closely monitored 24 hours a day.

LCD Touch Screen Features

- High security access with separate password levels for users and service engineers
- User-friendly graphical interface
- Single-line mimic diagram showing system status
- Contemporary dashboard-style indicators for major system values and conditions
- Automatic charting display for logged power and environmental data

Information Tracking

- Overall system and module readiness
- Module level alerts for all major subsystems including rectifier, inverter, batteries, static switch and bypass
- System voltages and power
- Load vs. capacity indicator
- System temperature gauge
- Battery charge indicator
- Service history logs

Hardware Connectivity

Chloride ManageUPS NET ensures the monitoring and control of the networked UPS, through two different options of the TCP/IP protocol:

- The integration of Chloride UPS with Building Monitoring and Automation Systems via MODBUS RTU, MODBUS/TCP or JBUS protocols
- The monitoring of environmental installation conditions.

Software Connectivity

Chloride MopUPS Professional allows for safe shutdown of the operating system in the event of load interruption. This includes event logging and e-mail notifications. Chloride ManageUPS CIO software provides a central management system for critical power infrastructures distributed within a building, campus or wide area network environment.

Technical Specifications

Technical Characteristics					
Rating	**400**	**600**	**800**	**1000**	**1200**
Nominal output active power at 40° C (kW)	400	600	800	1000	1200
Apparent nominal output power at 40° C (kVA)	400	600	800	1000	1200
Apparent nominal output power at 25° C (kVA)	440	660	880	1100	1320
Redundant configuration active power (N + 1) (kW)	200	400	600	800	1000
Input					
Nominal primary mains input voltage/voltage range (V)*	400 (250 to 460), three phase + neutral				
Nominal bypass input voltage/voltage tolerance (V)	400 ± 10% (380 V, 415 V selectable) three phase + neutral				
Nominal input frequency/frequency tolerance (Hz)	45 - 65 Hz				
Input current distortion (THDi) (%)	<3				
Primary input Power Factor	>0.99				
Output					
Nominal output voltage (V)	400 (380 V, 415 V selectable) three phase + neutral				
Output voltage stability by load variation 0 - 100% (%) **- static** **- dynamic**	 ± 1 Complies with IEC/EN 62040-3, Class 1				
Output frequency (nominal) (Hz)	50 (60 Hz selectable)				
Output frequency variation (%) **- with mains synchronization** **- with internal reference**	 ± 1 (2, 3, 4 selectable) ± 0.1				
Inverter overload capacity*	125% for 10 min., 150% for 1 min.				
Compatibility with loads	Any power factor (leading or lagging) up to 1 without output derating; crest factor up to 3:1				
Automatic adjustment of nominal output power with temperature	110% at 25°C, 100% at 40°C				
General					
Classification according to IEC/EN 62040-3	VFI - SS - 111				
Operating temperature (°C)	0 - 40				
Relative humidity (without condensation at 20°C)	<95%				
Protection level	IP 20				
Frame colour	RAL 5004				
Noise at 1 m (dBA)*	71	73	74	75	76
AC/AC efficiency (%) with Chloride Trinergy® technology	up to 99%				
Parallel configuration	up to 8 UPS = Max 9.6 MW				
Dimensions And Weight					
Height (mm)	1780				
Width (mm)	1800	2775	3450	4450	5125
Depth (mm)	860				
UPS weight (kg)	1450	2370	3040	3890	4560

* Conditions apply

Trinergy™ Cube

Beyond the Power Revolution

■ **300kW - 3 MW**



Trinergy™Cube The New Generation of Trinergy UPS Delivering Unsurpassed Performance to Enterprise Data Centers

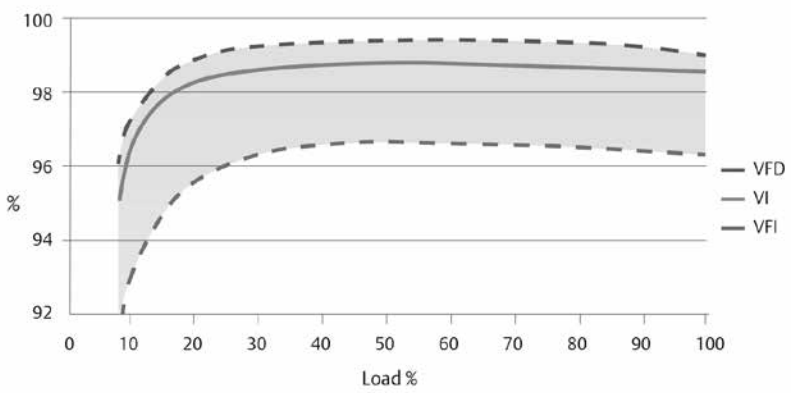
Designed around your IT space, Trinergy Cube is ready to evolve with growing business demands. It offers the highest level of power availability as well as reduced TCO, minimum energy consumption and CO_2 emissions. Trinergy Cube boasts unparalleled features including an average operational efficiency of 98.5 % and power density per core running up to 400 kVA.
Its optimized efficiency at partial load conditions and hot scalability up to 3 MW means that Trinergy Cube delivers adaptability not available anywhere else in the market.

Trinergy Cube's hot scalability, allows it to meet any power system requirement from 300 kW up to 24 MW in parallel.

Trinergy Cube goes beyond the power revolution, to allow the greatest advantages in terms of availability, capacity and efficiency.

Highlights

- Highest average operating efficiency in the industry: 98.5%
- Hot scalability up to 3 MW in a single unit and up to 24 MW in a parallel system
- Unprecedented levels of installation flexibility
- Smart capacity - adaptive power rating
- LIFE™ remote diagnostic and preventive monitoring services



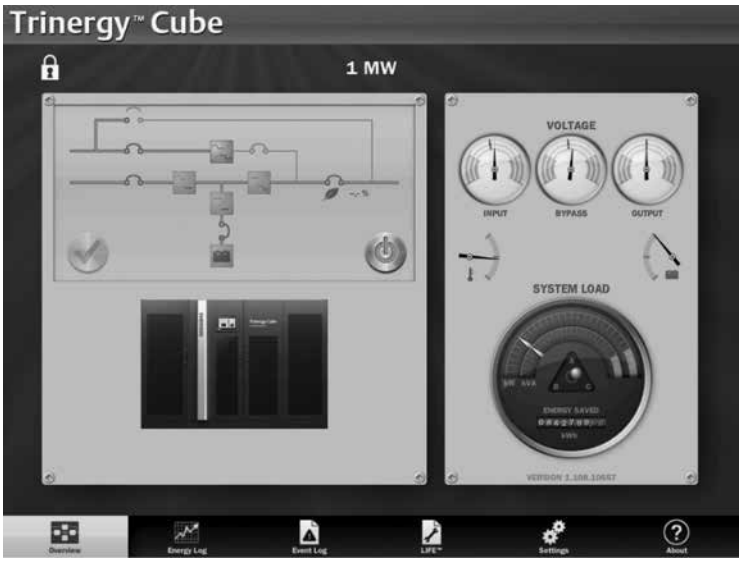
Trinergy Cube average operating efficiency of 98.5%

Availability - Uptime Enhancement

Trinergy™ Cube makes your mission critical space a peaceful place through its advanced diagnostic capability, data tracking, measuring and logging, as well as predictive maintenance and event analysis features. Combined with a fault tolerant architecture, concurrent maintainability and hot scalability, **Trinergy Cube** guarantees continuous operation and premium protection for your customers' business.

Key availability features:

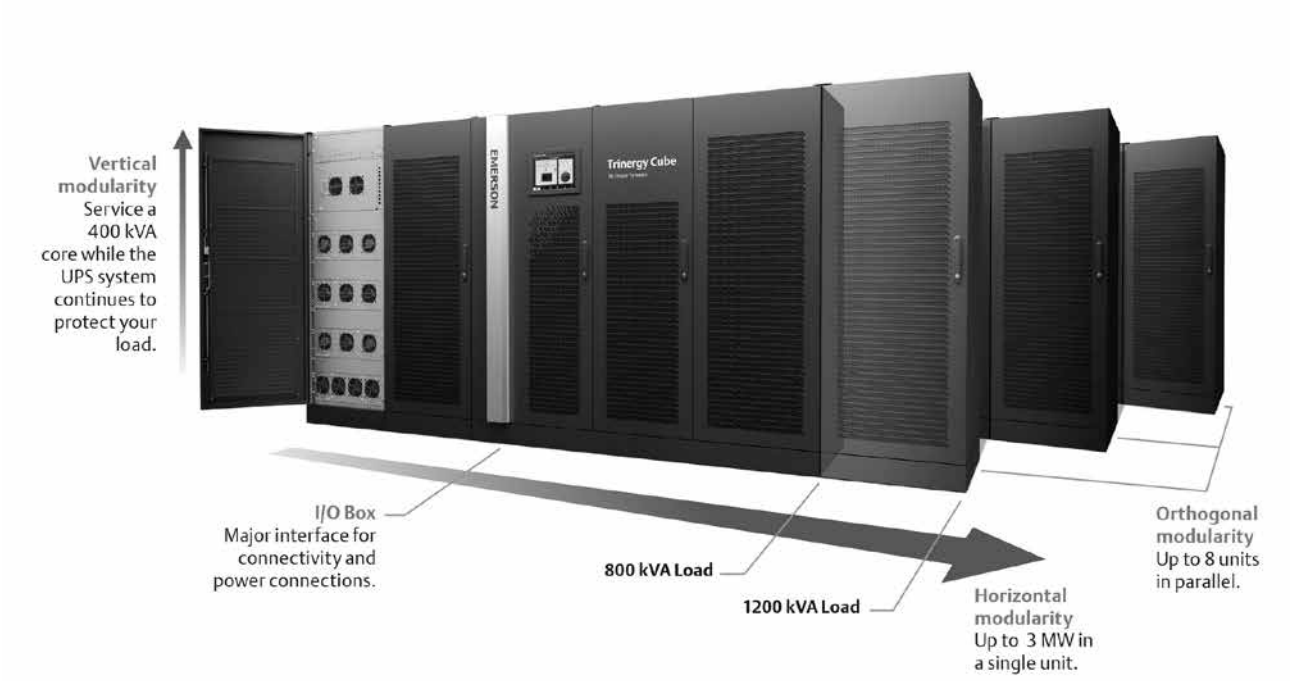
- **Remote Diagnostics**: LIFE™ remote diagnostic and preventive monitoring service, increases uptime and operational efficiency by continuously monitoring and tracking performance trends.
- **Predictive Maintenance**: **Trinergy Cube** is capable of verifying the health of its IGBT, capacitors, fans, contactors and batteries to determine maintenance needs and ensure critical continuity.
- **Event Analysis**: precise event tracking, waveform capturing and harmonic spectrum analyses allow the detection of external phenomena that have the potential of impacting data center availability.
- **Data Logging**: **Trinergy Cube** is capable of capturing all relevant data from efficiency to uptime parameters. Access to this information allows data center managers to control their physical space, optimize its usage and independently calculate PUE.



Trinergy Cube *LCD touch screen: interface for data tracking, logging and event analysis*

Sizing Your System

Scalable up to 24 MW; the highest active power rating available thanks to three dimensional modularity: Vertical, Horizontal and Orthogonal.



Vertical Modularity:
the stacked drawers in each core can be individually extracted for service purposes while the UPS continues to protect your load.

Horizontal Modularity:
Trinergy™ Cube can scale up to 3 MW in power by adding complete cores (UPS modules) side-by-side and around the input/output power section.

Orthogonal Modularity:
is the ability of **Trinergy Cube** to work with up to 8 complete UPS (fully populated with cores) in parallel.

Capacity & Installation Flexibility

With its high power density cores, **Trinergy**™ Cube is the only static UPS today able to reach up to 3 MW in a single unit, thus allowing extraordinary capacity levels. Furthermore, its new generation architecture and connection types allow **Trinergy Cube** to deliver unprecedented levels of installation flexibility. The system can thus be configured in a vast range of layouts, whether it be a **straight row, L-shape or back-to-back**, the system easily adapts to available floor space.

Adaptability
The Trinergy Cube architecture and flexibility features deliver significant infrastructure upgrade cost savings, easily adapting to new or existing installations without impacting power infrastructure.

This is possible through:

- Hot scalability - minimized initial investment (CAPEX), adding power cores as business demands grow
- Centralized and distributed paralleled capabilities
- Simplified cable routing with unlimited input/output power connection availability
- Three dimensions of modularity for maximum capacity or redundancy
- Smart Capacity - adapting required power to meet the specific installation conditions in terms of climate management and circuit breaker size
- Three and four wire - allowing effortless replacement of legacy equipment
- Seismic compliance - ensuring power protection is available in any geographical location from Italy to Japan.

Smart Capacity Adaptive Power Rating

Trinergy Cube intelligently adapts load power supply to respond to the environment conditions of the installation site. The system's I/O Box and cores are rated to operate continuously up to 55°C and provide increased power down to 20°C. Furthermore, the maximum input current is adjustable to meet specific protection rating requirements.
Trinergy Cube's smart capacity ensures the best possible usage of physical infrastructure, providing maximized power to the load and optimizing each individual configuration based on the specific site conditions.



Unparalleled Efficiency

Trinergy™ Cube delivers an unparalleled **98.5%** average operating efficiency and up to 99.5% maximum efficiency, thus reducing operating costs to a minimum.

The unparalleled levels of efficiency and consequent electricity cost savings can be attributed to:
Latest generation IGBT

- Adoption of a three-level NPC2 topology for both rectifier and inverter
- Hot scalable power cores
- Three dynamic functioning modes (VFI, VFD, VI)
- Adaptive fast transfer

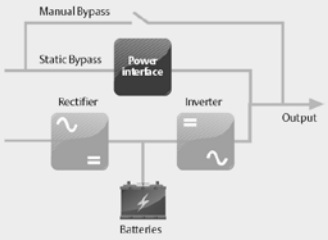
The seamless activation of Trinergy Cube's functioning modes ensures the highest level of efficiency without compromising power quality and availability.

The adaptive fast transfer ensures the quickest response time under various conditions:

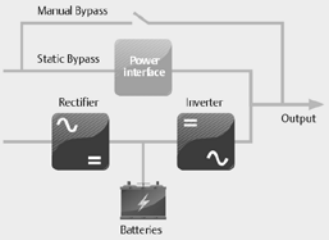
- Network fault (voltage variation, high/low impedance mains failures)
- Load fault (short circuit downstream of the UPS)
- Type of load connected (PDU transformer)

The unit is able to discriminate between the various types of interferences and rapidly respond, while at the same time ensuring compatibility with downstream equipment such as servers, transformers, STS or mechanical loads.

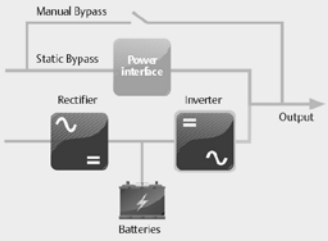
Maximum Power Control (VFI) provides the highest level of power conditioning and protects the load from all electrical network disturbances.



Maximum Energy Saving (VFD) detects when conditioning is not required and allows the energy flow to pass through he bypass line.



High Efficiency & Power Conditioning (VI) compensates the load THDi, PF and main sags and swells.



Trinergy Cube dynamic functioning modes

Optimized TCO

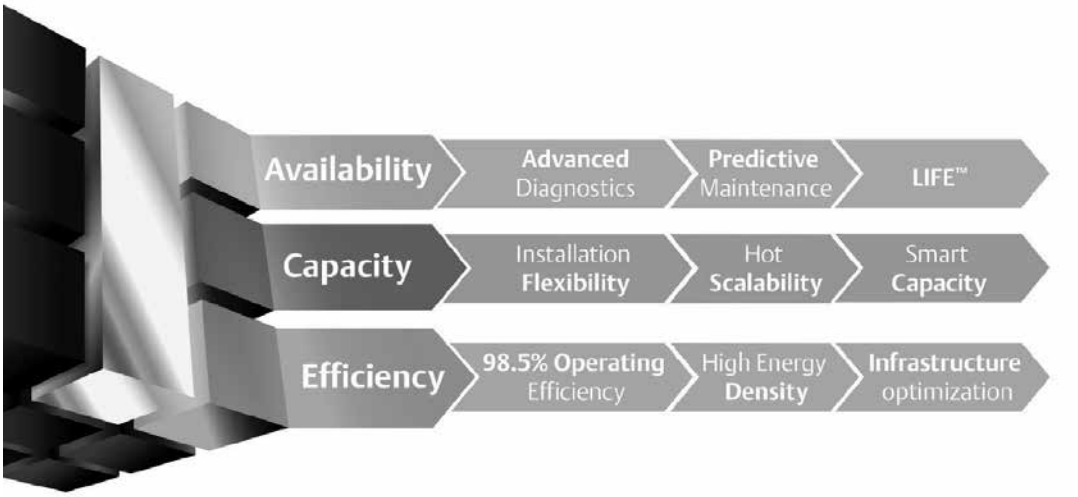
Continuous availability, unparalleled operating efficiency, optimized installation space, smart capacity and minimized electrical infrastructure costs, make **Trinergy™ Cube** the ultimate UPS solution with an optimized TCO and rapid return on investment.

Trinergy Cube is the only unit in the market which allows for hot scalability from 300 kW up to 3 MW in a single UPS, thus providing significant electrical infrastructure and space savings.Furthermore, its high power density running up to 400 kVA per core, allows customers to maximize the number of racks and servers housed in their data center, thus granting more space for IT equipment.

Trinergy Cube's highly efficient technology and TCO capabilities also come from Emerson Network Power's expertise in the area of thermal management. An in-depth study of the ventilation system and internal aerodynamics of the unit has brought extraordinary results in terms of power density and power adaptability for efficient operation in all climates.

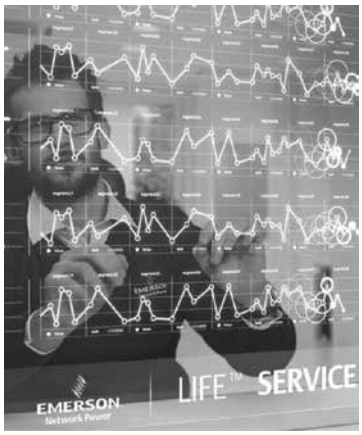
Neutral Carbon Footprint

Trinergy Cube's new generation architecture has been designed to reduce energy and heat dissipation, thus minimizing the demand and consumption of air conditioning systems.
The combination of these factors, coupled with its 98.5% average operating efficiency, reduces CO_2 emissions to a minimum. This contributes to ensuring that your customers' data centers are a step closer to meeting the industry's environmental and efficiency compliance standards.



LIFE™ Remote Diagnostic and Preventive Monitoring Service

Emerson Network Power's service program is designed to ensure that your critical power protection system is maintained in an optimum state of readiness at all times. The **LIFE** remote diagnostic and preventive monitoring service provides early warning of UPS conditions and out of tolerances. This allows effective proactive maintenance, fast incident response and remote trouble shooting, giving customers complete security and peace of mind.



With **LIFE** services you will benefit from:

Uptime Assurance
Constant monitoring of UPS parameters, thus maximizing the system's availability.

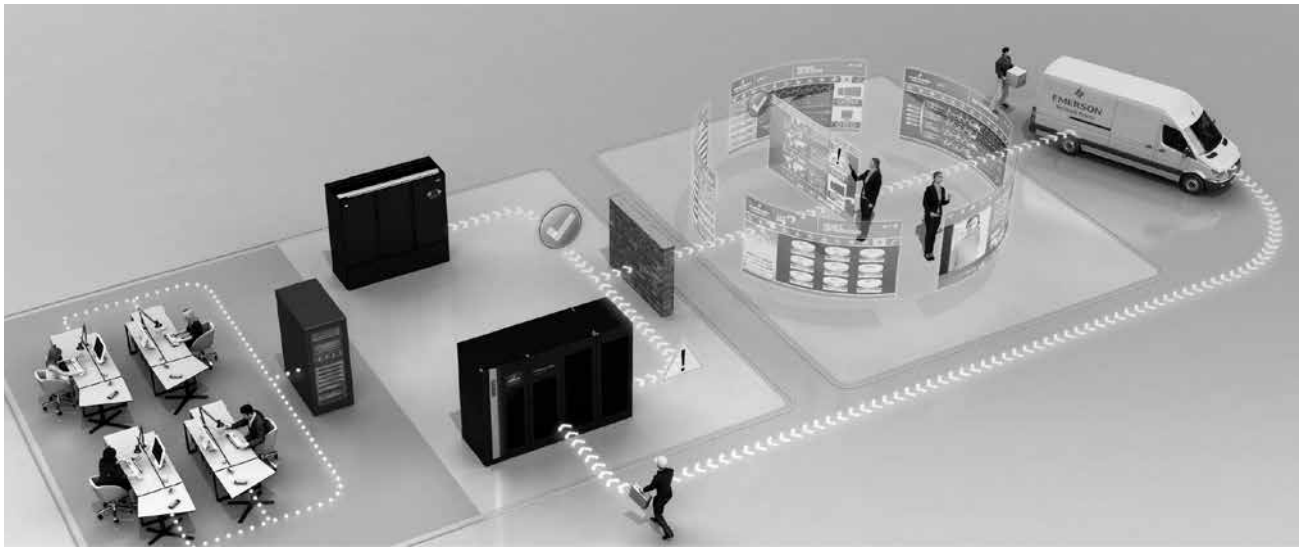
First Time Fix Rate
Pro-active monitoring and data measuring ensure that when our customer engineers are dispatched on-site, they arrive prepared for first time resolution.

Proactive Analysis
From **LIFE** service centers, our experts proactively analyze the data and trends of your equipment, to recommend actions to ensure their best performance.

Minimized Total Cost of Ownership of Your Equipment
The continuous monitoring of all relevant parameters in turn maximizes unit performance, reduces on-site maintenance and extends the life of your equipment.

Fast Incident Response
LIFE allows for immediate definition of the best course of action, as a result of the regular communication between your **Trinergy™ Cube** system and our **LIFE** service centers.

Reporting
You will receive a comprehensive report detailing the working order of your equipment and its operational performance.



Customer Monitoring Interfaces

LCD Touch Screen Features

- High security access withseparate password levels for users and service engineers
- User-friendly graphical interface
- Single-line mimic diagramshowing system status
- Contemporary dashboard-style indicators for major system values and conditions
- Automatic charting display for logged power and environmental data

Hardware Connectivity

Trinergy™ Cube allows for the monitoring and control of networked UPS, through different protocol options:

- The integration of UPS with Building Monitoring and Automation Systems via MODBUS RTU, MODBUS/TCP or JBUS protocols
- The integration of UPS in Network Management Systems through SNMP protocol
- Two slots for additional connectivity cards are available for specific protocol requirements.

Software Connectivity

Liebert® Nform™ will monitor the Trinergy Cube via SNMP protocol. Authenticated alarm management, trend analysis and event notification delivers a comprehensive monitoring solution. Available in a variety of versions to suit anything from small computer rooms to multiple location distributed IT networks, Liebert Nform enables:

- Condition based system state recording
- Alarm event exporting to disk
- SMTP email
- Execution of external program
- Shut down clients

Liebert SiteScan® is a centralized site monitoring system which ensures maximum visibility and availability of critical operations.Liebert SiteScan Web allows users to virtually monitor and control any piece of critical support equipment. Its features include real-time monitoring and control, data analysis, trend reporting, and event management.

Trellis™ Platform

Emerson Network Power's Trellis™ platform is a real-time infrastructure optimization platform that enables the unified management of data centre IT and facilities infrastructure.

The Trellis™ platform software can manage capacity, track inventory, plan changes, visualize configurations, analyze and calculate energy usage, and optimize cooling and power equipment.

The Trellis™ platform monitors the data center, providing a thorough understanding of system dependencies to help IT and facilities organizations keep the data center running at peak performance. This unified and complete solution, delivers the power to see the real situation in your data center, make the right decision and take action with confidence.



Trinergy™ Cube Specifications

Technical Specifications		
System Range 300 kW - 24 MW		
Core Adaptive Power Rating (kVA)	up to 400	
Core Adaptive Power Rating (kW)	up to 360	
General		
Average Operating Efficiency	98.5%	
Maximum Efficiency	up to 99.5%	
Airflow (m^3/h)	up to 2600	
Heat Dissipation at Full Load in VFI (kW)	17-9	
Paralleling	up to 10 cores in one unit, up to 8 units in parallel	
Hot Swappable core	Yes	
Withstand Rating (kAIC)	up to 100	
Audible Noise (dB)	65 dBA (at partial load)	
Altitude Max (m)	1000 m without derating	
Operating Temperature (°C)	0-55	
Input		
Input Wiring	3 ph + N + PE, 3 ph + PE	
Input Voltage Range (V)	200-480	
Input Frequency Range (Hz)	45-65	
Input Power Factor	0.99	
Input THDi	3%	
Soft Start Capability	Yes	
Internal Backfeed Protection	Optional	
Output		
Output Wiring	3 ph + N + PE, 3 ph + PE	
Configurable Voltage Rating	380, 400, 415 V, 440 V, 50/60 Hz	
Permitted Load Power Factor	up to 1, any PF leading or lagging without derating; crest factor up to 3:1	
Output UTHD	<3% (100% linear load); <5% (reference non linear load)	
Overload on Inverter	see Trinergy Cube APP dynamic specification	
Short Circuit Current (A)	1300/850	
General Characteristics		
HMI	12-inch Color Touchscreen Including Web, SNMP, MODBUS/Jbus Protocols	
Multi-language	Standard	
Battery		
Type	VRLA (Li On, Flywheel on Request)	
Charging Method	ABM Technology or Float	
Battery Voltage Range	396-700	
Selectable Charging Current	5 - 70A	
Dimension and Weight	**(W x D x H mm)**	**(kg)**
Core	675 x 910 x 1950	620
I/O Box for up to 2 Core Connection	1625 x 910 x 1950	1000
I/O Box for up to 4 Core Connection	2150 x 910 x 1950	1300
I/O Box for up to 6 Core Connection	3800 x 910 x 1950	On request
I/O Box for up to 8 Core Connection	2700x1820x1950 (back to back configuration)	On request
I/O Box for up to 10 Core Connection	3050x1820x1950 (back to back configuration)	On request
Accessories		
	External Battery Cabinets with Long-life Batteries, Li-Ion Batteries and Flywheel on Request, Intellislot Connectivity, Maintenance Bypass Switch	
Communications		
Slots	2 Intellislots	
Protocols	SNMP, MODBUS TCP/IP, MODBUS RTU	
Inputs/Outputs	9/8 Programmable	
Compliance with Standards		
Safety	IEC 62040-1, IEC 60950-1	
EMC	IEC 62040-2	
Performance	IEC 62040-3	

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Surge Protection

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500 Series Surge Protective Devices

Introduction

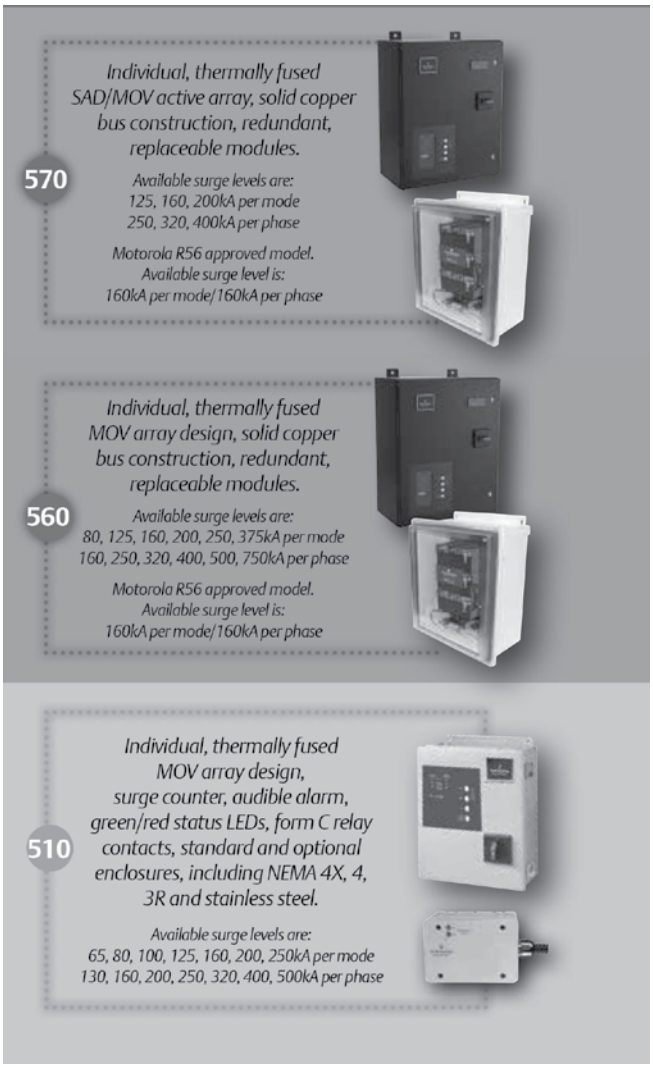
Emerson Network Power's 500 Series SPDs are designed with strict industry requirements in mind. This diverse family of products uses patented surge technology to provide survivability and exceptional performance in the most extreme conditions. With a variety of technology, monitoring and packaging solutions, each model line within the 500 Series can be tailored to meet your specific requirements.



The 500 Series includes:

- True Surge Capability–handles multiple impulses at its highest rated level
- Individually Thermally Fused Surge Arrays–ensures industry's highest levels of safety and performance
- Redundant Protection–multiple surge components each with a dedicated fuse
- Repetitive Impulse Capability–life cycle testing results demonstrate industry's most rugged design
- Temporary Overvoltage Survivability–able to withstand greater than twice the voltage for 30 cycle (IEEE defined swell condition); surviving where other commercially available thermally protected MOV designs fail
- Industry Best Transient Response at High Surge Levels– multi-stage hybrid design clamps transients at hundreds of volts lower than traditional MOV designs at impulse levels above 10kA

A mission-critical design for your most important applications...



A mission-critical design for your most important applications...









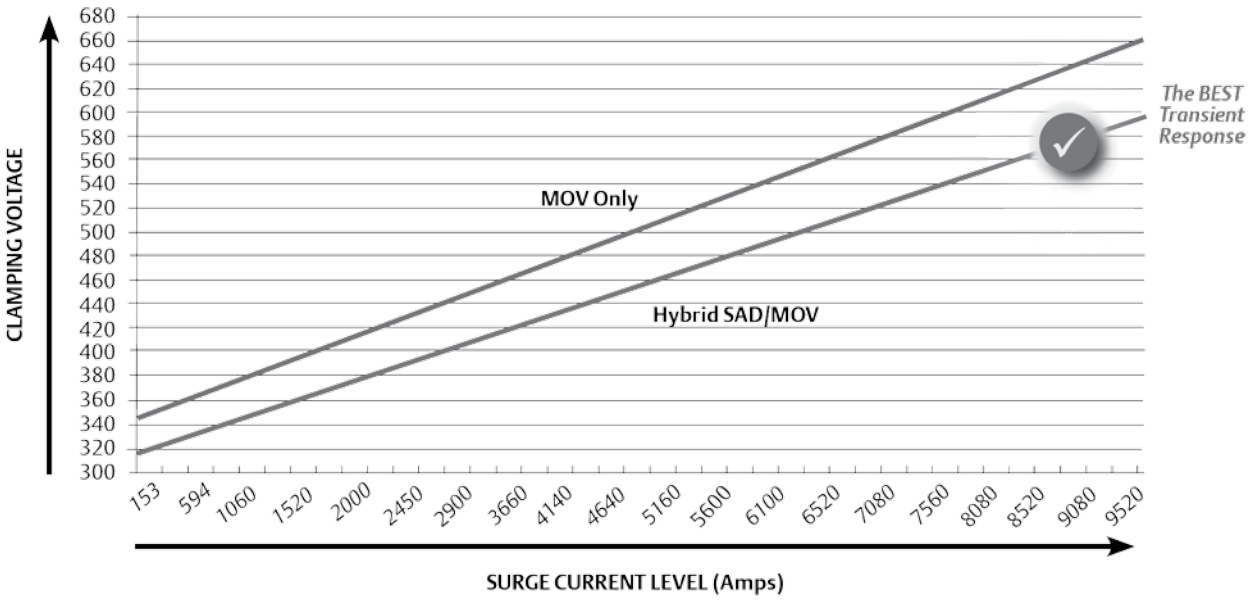
			570	560	510	510
Components, Construction & Performance	Superior High-Energy Transient Response*		✓			
	Component Transition Circuit		✓			
	SAD/MOV Hybrid		✓			
	Redundant, Replaceable Module Arrays		✓	✓		
	Solid Copper Bus Construction		✓	✓		
	Life Cycle Testing	*up to 45,000 per mode*	✓	✓		
		up to 24,000 per mode	✓	✓	✓	
		up to 8,000 per mode	✓	✓	✓	✓
	Replaceable Surge Modules		✓	✓	✓	
	Disconnect Switch		***Optional***	***Optional***	***Optional***	
	Swell Ride-through		✓	✓	✓	✓
	Thermally Fused MOV Arrays		✓	✓	✓	✓
	EMI/RFI Filtering		✓	✓	✓	✓
	UL 1449 Inominal Rating / Location Type (20kA / Type 1)		✓	✓	✓	✓
	Short Circuit Current Rating (SCCR) (200kAIC)		✓	✓	✓	✓
	Warranty	*up to 5 Years Onsite Labor*	✓	✓		
		up to 10 Years Parts or Replacement	✓	✓	✓	✓
Surge Rating	Up to 375kA/750kA (Mode/Phase)		✓	✓		
	Up to 250kA/500kA (Mode/Phase)		✓	✓	✓	
	Up to 80kA/160kA (Mode/Phase)		✓	✓	✓	✓
Monitoring	Built-in-test		✓	✓		
	Surge & Swell Counters		***Optional***	***Optional***		
	Surge Counter		***Optional***	***Optional***	***Optional***	
	Audible Alarm		✓	✓	✓	✓
	Green/Red Status LEDs, Form C Relay Contacts		✓	✓	✓	✓

570 Surge Protective Device

Multi-Stage System of Suppression
The Emerson Network Power 570 surge protective device (SPD) is the first hybrid product in the industry to offer a true, coordinated multi- stage system of suppression. It integrates the fast response time of the Silicone Avalanche Diode (SAD) with the high-energy capability of our 560 Metal Oxide Varistor (MOV) product line. Testing shows the 570 SPD is particularly effective at mitigating high events beyond 20,000 amps, making it the ideal choice for high-risk locations; areas where we would expect to see the highest energy levels.



Comparison MOV vs SAD/MOV Hybrid
The graph below represents a transient response performance comparison of differing technologies. The hybrid technology clearly demonstrates an advantage over the MOV only technology; with approximately a 10% improvement as the energy levels increase. This could equate to a difference of several hundred volts during high energy events.

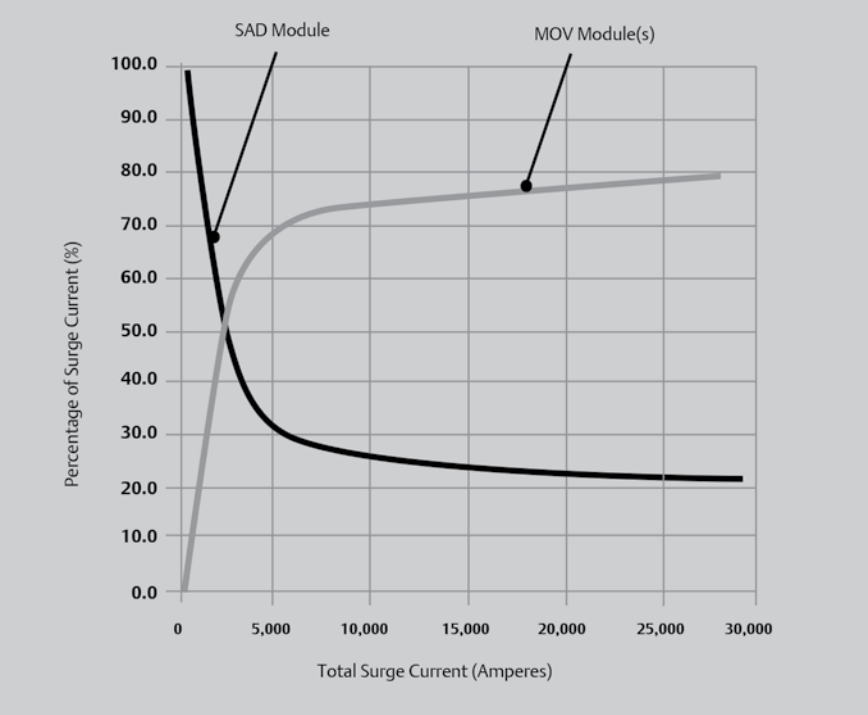


Advanced Hybrid Surge Suppression Technology

A closely regulated amount of energy is transitioned between
the primary SAD module and
the secondary MOV module(s). The primary/secondary hybrid design takes advantage of the
tight clamping and rapid response characteristics of the SADs while incorporating the high-energy handling characteristics of the MOV. This is accomplished through an impedance matching network utilizing a series of controlled copper geometries in conjunction with custom engineered high- voltage/high-energy component distribution. This ultimately limits the amount of high-energy surge current through the SAD module to an acceptable level and diverting the remaining surge current through the MOV module(s).

The Emerson Answer Transitional Method

Emerson Network Power 570 Hybrid Surge Current Sharing Data



Other "Hybrid" Products Fall Into One of Two Categories:

- Self-sacrificing: This system significantly degrades or fails with nominal fluctuations or high-energy events. This design is extremely inconvenient to the customer, and more importantly, it leaves an opportunity for critical load upsets/failures.

- Oversize components: Higher rated components allow the system to survive nominal fluctuations or high-energy events–as a result clamping levels drastically increase and the level of protection decreases, defeating what it's designed to do.

570 Surge Protective Device
General Specifications

General Specifications *(All Models)*	
Connection Type	Parallel Connected
Agency Listings	ANSI/UL 1449 Third Edition, UL 1283 (Type 2 Locations), cUL (Type 2 Locations), FCC Part 15 Class B
Maximum Continuous Operating Voltage Range	120VAC 125%, all others 115%
Short Circuit Rating	200kAIC
Maximum Surge Current Rating	125kA-200kA per mode/250kA-400kA per phase
UL1449 Location Type	Type 1, Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Operating Frequency Range	47 - 63 Hertz
50 ohm EMI/RFI Attenuation	63dB max from 10kHz to 100MHz
Protection Modes	All applicable modes standard (Line to Neutral, Line to Ground, Neutral to Ground and Line to Line)
Monitoring Features	Internal/External Status LEDs, Audible Alarm, Summary Alarm Contact (2 sets), Built-in-test circuit tests MOV/ fuse array capacities, Phase loss indication, Low voltage indication, Loss of power indication, Surge counters.
Response Time	<0.5 nanoseconds
Temperature	-40 to +60 degrees C
Operating Humidity	0% to 95% noncondensing
Enclosure	NEMA 4
Altitude	0 to 18,000 feet
Audible Noise	Less than 45dBa
Labor Warranty	5 Years on site labor
Parts Warranty	10 Years on all parts



General Specifications *(Motorola R56 Approved Models Only)*	
Connection Type	Parallel Connected
Maximum Surge Current Capacity	160kA per mode/160kA per phase
Short Circuit Current Rating (SCCR)	65kAIC
Motorola R56 Unit Type	Type 1 (SAD/MOV Hybrid)
Status Indication	LEDs, Relay alarm contacts
Enclosure	NEMA 4X
Protection Mode	L-N, L-L



Chart A

Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC

Chart B

Code	Monitoring Options
C	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets, Surge Counter
D	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets, Surge and Swell Counters

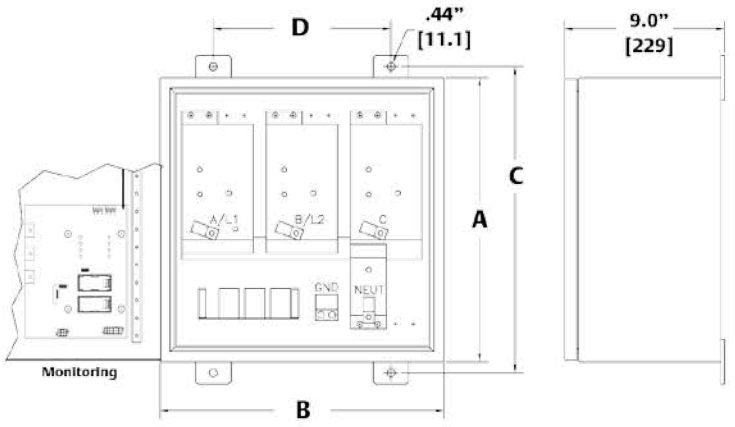
Life Cycle Surge Testing (10kA, 20kV, IEEE Cat. C3)

Surge Rating	Per Mode	Per Phase
125kA	15,000	30,000
160kA-200kA Per Mode	30,000	60,000

Ordering Information
Dimensional Data

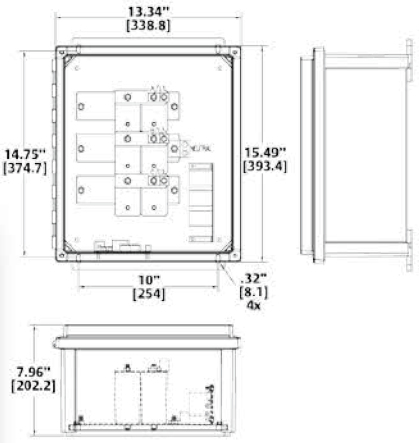
Ordering Information								
Example Model Number: 570YC20ARDG1S								
570	YC	20	A	R	D	G	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
570	**See Chart A on pg.16**	**12** 125kA/Mode	A All Modes	**N** Terminal Block	**See Chart B on pg.16**	G NEMA 4 *(Standard)*	1 UL Type 1	S Standard
		16 160kA/Mode		R Rotary Disconnect		**R** NEMA 3R *(Optional)*	**2** UL Type 2 UL 1283	
		20 200kA/Mode				**H** NEMA 4X *(Stainless Steel)* *(Optional)*		

Ordering Information *(Motorola R56 Approved Models)*								
Example Model Number: 570YC16FNRJ1S								
570	YC	16	F	N	R	J	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
570	**See Chart A on pg.16**	16 160kA/Mode	F Line to Neutral	N Terminal Block	R LED, Relay Contacts	J NEMA 4X *(Non-Metallic)*	1 UL Type 1	S Standard



Dimensional Data					
Unit	Connection Type	A x B	C	D	Weight
125kA	Wire Lug (N)	16" x 12" (406 x 305)	17.25" (438)	9.5" (241)	35lb (15.9kg)
	Disconnect (R)	16" x 16" (406 x 406)	17.25" (438)	10" (254)	45lb (20.4kg)
160kA-200kA	Wire Lug (N)				
	Disconnect (R)	20" x 16" (508 x 406)	21.25" (540)	10" (254)	55lb (24.9kg)

Dimensional Data *(Motorola R56 Approved Models Only)*	
Unit	Weight
570SA16FNRJ1S	28lb (12.7kg)
570YA16FNRJ1S	32lb (14.5kg)



500 SERIES
570 SURGE PROTECTIVE DEVICE
GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a modular, high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Underwriters Laboratories; UL 1283 5th Edition 2005 (complimentary listing for Type 2 locations)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
Federal Communications Commission (FCC)

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.

1.3 System Description: The system shall be constructed using a primary and secondary stage hybrid transient suppression system. The primary stage shall be constructed utilizing silicon avalanche diode (SAD) technology. The SAD module shall not "self-sacrifice" to protect the system; rather it shall provide immediate transition to the secondary stage when subjected to potentially harmful levels.

The secondary stage shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to a variance of ±1 volt and tested for manufacturing defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal system operating voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

1.5 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Life Cycle Surges: **(Selection Required)**
_____ Life Cycle Surges per Mode **(12,000), (15,000), (30,000), (45,000)**
_____ Life Cycle Surges per Phase **(12,000), (30,000), (60,000), (90,000)**

1.6 Overcurrent Protection: Fusing: All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. For every 100k amps of surge current capacity, 120 amps RMS of internal, integral fusing shall be required. Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Individual surge components shall be sand packed and shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.7 Performance Ratings:
Surge Current Capacity: **(Selection Required)**
_____kA Surge Rating per Mode **(125), (160), (160), (200)**
_____kA Surge Rating per Phase (L-N and L-G) **(250), (160), (320), (400)**

1.8 Design Requirements

1.8.1 Noise Attenuation: The filter shall provide an attenuation of 63 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system

1.8.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

1.8.3 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR			
	L-N	N-G	L-G	L-L
120/208	700 v	700 v	700 v	1000 v
277/480	1000 v	1000 v	1200 v	1800 v
480			1800 v	1800 v

1.8.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

1.9 Submittals

1.9.1 Documentation: These specifications are based on the Emerson Network Power 570 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception

statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, UL1449 Third edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.9.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

1.9.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.10 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified. The specified interconnect assembly shall be designed and manufactured in the USA by a qualified manufacturer of SPD products and line conditioning equipment. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.11 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +60°C (-40 to +140°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

1.12 Warranty: The manufacturer shall provide a full ten-year parts and five-year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct factory trained, ISO 9001:2000 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

2.0 PRODUCTS

2.1 Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-proof, drip-proof enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be 20 in. (508 mm) high x 16 in. (406) mm wide x 10 in. (254 mm) deep.

2.2 Connections: The terminals shall be provided to accommodate wire sizes up to #2/0 AWG.

2.3 Internal Connections and Serviceability: All surge current diversion module connections shall be by way of low-impedance copper plates. Surge current diversion modules shall use bolted connections to the plates for reliable, low-impedance connections. The system shall be designed for easy servicing by a qualified field electrician, providing simple change out of any or all SPD modules. Designs that require factory service are not acceptable. Any unit using "plug-in" type modules are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.4 Standard Features:

2.4.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The SPD

must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules. The integrity of all fuses in test must be indicated on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

2.4.2 Unit Status Indicators—SPD shall be equipped with red and green solid state indicators for each phase and N-G (where applicable). Indicators must be mounted within the enclosure and must be externally visible.

2.4.3 Dry Contacts for Remote Monitoring—SPD must have a minimum of 2 sets of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.4.4 Undervoltage Detection—SPD shall be equipped with 70% undervoltage detection.

2.4.5 Phase Loss Monitoring—SPD shall be equipped with phase loss monitoring.

2.4.6 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.4.7 Audible alarm—The specified system shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off switch shall be provided to silence the alarm, and an alarm push-to-test switch shall be provided to test the alarm's function. A visible LED will confirm whether alarm is on or disabled. Both switches shall be located on the unit's hinged front cover.

2.5 Optional Features

2.5.1 Transient Counters—Single or dual adjustable transient counters shall be available to tally Normal & Common mode transient voltage surges in both surge and swell conditions. The readout shall be at least a seven-digit LCD located on the unit's hinged front cover. The counter reset switches may be inhibited and must be remotely located. Counter must utilize lithium batteries with a 10-year nominal life to maintain accurate counts in the event of total power loss.

2.5.2 Remote Monitoring Panel—The monitoring system display panel shall be capable of mounting remotely to the SPD enclosure. A [6-foot (183cm)] **[10-foot (305cm)] [20-foot (610cm)]** long harness shall be used to connect the remote monitoring panel assembly to the SPD assembly.

2.5.3 Rotary Disconnect Switch—The specified system shall include a disconnect located in-line with the SPD system enclosure with an external manual operator. The switch shall disconnect all phase conductors, not including neutral, from the high-energy surge current diversion modules.

2.5.4 Advanced Transient Detection System- The SPD shall be equiped with a power quality monitor including the following monitoring features:

* Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet with Embedded Webpage
* Integral LCD Display providing real-time system RMS Voltage, Average Voltage, VTHD, Crest Factor, Phase Imbalance, & Frequency.
* Event Date/Time stamp with Duration/Magnitude for Surge, Sag, Swell, Temporary Overvoltage (TOV), Overvoltage, Phase Loss/Outage, Voltage Interruption/Dropout, Voltage Harmonics (VTHD), Over/Under Frequency, & Neutral Bond conditions. Event thresholds shall be capable of password-protected user modification at the system display and Embedded webpage.
* System memory shall be capable of on-board storage & retreival of a minimum of 1000 logged events.
* Event diagnostics providing SPDs life cycle status with remaining surge protection percentage, and a resettable counter providing the number of Surge, Sag, and Swell events since last reset.
* Voltage quality analysis reporting capable of producing a downloadable report detailing recorded power quality events, potential solutions, and statistical summaries.

2.5.5 Remote Monitor Unit—A self-contained monitoring device shall be available to allow remote annunciation of the system status. Input power to the monitoring device shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitoring device shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.6 Testing

2.6.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50μs], 500 amp [8x20 μs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50μs], 500 amp [8x20 μs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.

3.0 EXECUTION

3.1 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These Guide Specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88

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560 Surge Protective Device

Proven Performance

Repetitive life cycle capability, high-energy capacity and years of proven field experience allow us to confidently recommend the 560 surge protective device for any "HIGH-RISK" location or "CRITICAL" process.

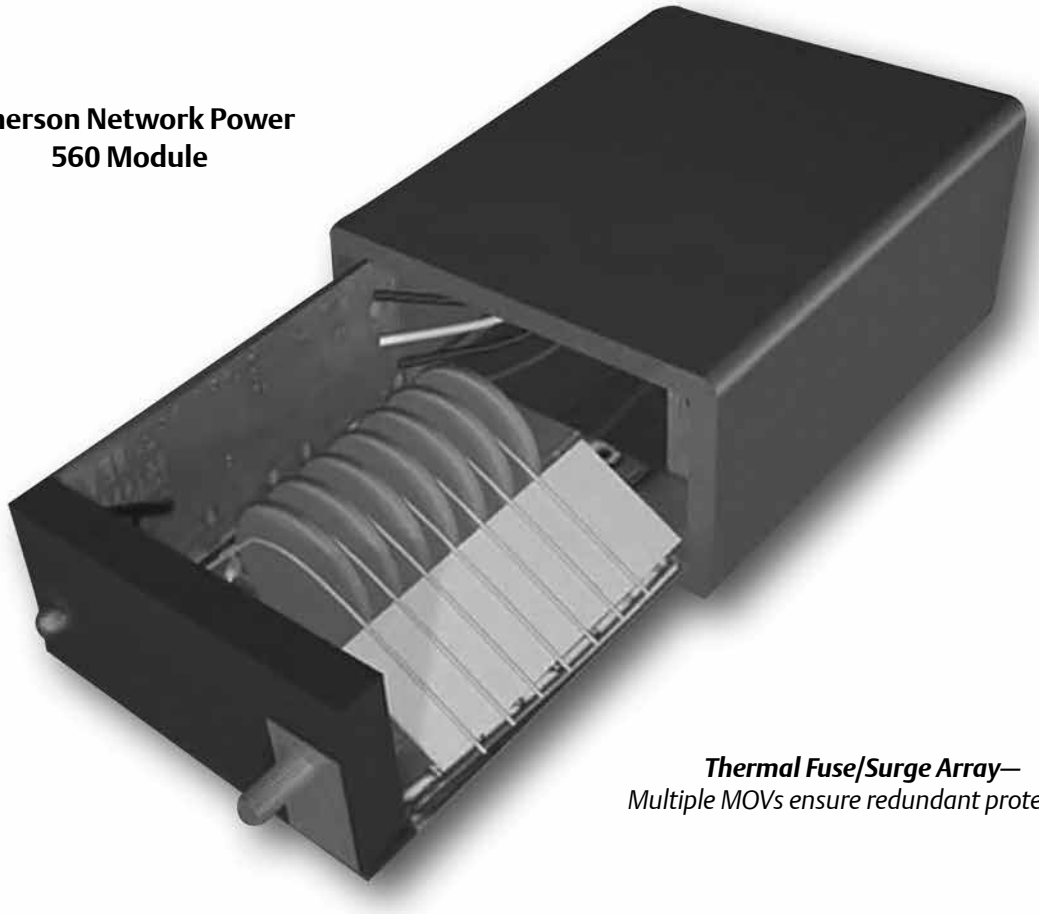


Fusing

It all starts with our patented surge arrays, a fuse technology that's the core of our design advantage. We were the first in the industry to provide fusing with both thermal and fault current protection in an SPD, consistently exceeding industry safety and performance levels.

- Coordinated Surge Path — the surge path between the suppression element and the fuse ensure the array can deliver its rated surge performance without interruption to the link.
- Fault Tested Array — the fuse/surge array is designed to quickly and safely open in the case of both limited and high current fault conditions.
- Balanced Configuration — placement of the fuse link and surge components in a custom engineered geometrical pattern serve to balance the array, resulting in improved repetitive capability and an over-voltage withstand that's unmatched in the surge protection industry.

Emerson Network Power
560 Module



Thermal Fuse/Surge Array—
Multiple MOVs ensure redundant protection



Testing the Limits...Emerson Network Power's state-of-the-art surge protection test lab in Binghamton, NY

Surge Current

Real world events look a little different than what is simulated in a controlled lab setting. An 8x20µs waveform is a nice place to start when testing a surge protector, but in reality, impulse levels and waveform characteristics are diverse. Factors such as the magnitude of the event, the number of impulses in the event and the proximity of the event to your system, all impact what the surge protective device will actually experience when installed.

We put the design of our Emerson Network Power 560 surge protective device to the test by subjecting it to a wide variety of impulse characteristics and levels; testing the limits and longevity of the design.

Survivability

To ensure our 560 surge protective device is ready for your harshest environments, we tested it to multiple waveforms, multiple times and at the highest rated levels:

- **Endurance Testing** — Minimum of 15,000 impulses per module at 20,000 volts and 10,000 Amps.
- **Waveforms** — Long duration (10x350µs) representing a close strike and shorter duration (8x20µs) representing an indirect impulse is applied at a variety of levels.
- **High-Energy Testing** — Testing conducted on the complete unit – including fuse elements, and accessories such as disconnects and monitoring boards. The entire product withstands and performs multiple times at its highest rated level.



560 Surge Protective Device
General Specifications

General Specifications *(All Models)*	
Connection Type	Parallel Connected
Agency Listings	ANSI/UL 1449 Third Edition, UL 1283 (Type 2 Locations), cUL (Type 2 Locations), FCC Part 15 Class B
Maximum Continuous Operating Voltage Range	120VAC 125%, all others 115%
Maximum Surge Current Rating	80kA-375kA per mode/160kA-750kA per phase
Short Circuit Rating	200kAIC
UL 1449 Location Type	Type 1, Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Operating Frequency Range	47 - 63 Hertz
50 ohm EMI/RFI Attenuation	63 dB max from 10kHz to 100MHz
Protection Modes	All applicable modes standard (Line to Neutral, Line to Ground, Neutral to Ground and Line to Line)
Monitoring Features	Internal/External Status LEDs, Audible Alarm, Summary Alarm Contact (2 sets), Built-in-test circuit tests MOV/fuse array capacities, Phase loss indication, Low voltage indication, Loss of power indication, Surge counters (optional)
Response Time	<0.5 nanoseconds
Temperature	-40 to +60 degrees C
Operating Humidity	0% to 95% noncondensing
Enclosure	NEMA 4
Altitude	0 to 18,000 feet
Audible Noise	Less than 45 dBa
Labor Warranty	5 Years on site labor
Parts Warranty	10 Years on all parts



General Specifications *(Motorola R56 Approved Models Only)*	
Connection Type	Parallel Connected
Maximum Surge Current Capacity	160kA per mode/160kA per phase
Short Circuit Current Rating (SCCR)	65kAIC
Motorola R56 Unit Type	Type 2 (MOV only)
Status Indication	LEDs, Relay alarm contacts
Enclosure	NEMA 4X
Protection Mode	L-N, L-L



Chart A

Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC

Chart B

Code	Monitoring Options
A	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets
C	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets, plus Surge Counter
D	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets, plus Surge and Swell Counters

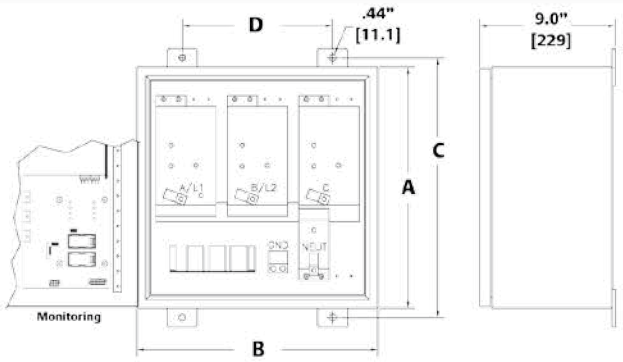
Life Cycle Surge Testing (10kA, 20kV, IEEE Cat. C3)

Surge Rating	Per Mode	Per Phase
80kA-125kA Per Mode	15,000	30,000
160kA-200kA Per Mode	30,000	60,000
375kA Per Mode	45,000	90,000

Ordering Information
Dimensional Data

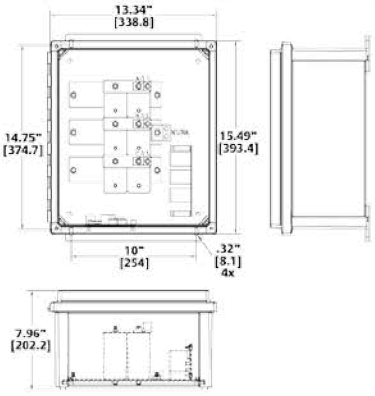
Ordering Information								
Example Model Number: 560YA16ARCG1S								
560	YA	16	A	R	C	G	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
560	**See Chart A on pg.20**	**08** 80kA/Mode	A All Modes	**N** Terminal Block	**See Chart B on pg.20**	G NEMA 4 *(Standard)*	1 UL Type 1	S Standard
		12 125kA/Mode		R Rotary Disconnect		**R** NEMA 3R *(Optional)*	**2** UL Type 2 UL 1283/cUL	
		16 160kA/Mode				**H** NEMA 4X *(Stainless Steel) (Optional)*		
		20 200kA/Mode						
		25 250kA/Mode						
		37 375kA/Mode						

Ordering Information *(Motorola R56 Approved Models)*								
Example Model Number: 560SA16FNRJ1S								
560	SA	16	F	N	R	J	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
560	**See Chart A on pg. 20**	16 100kA/Mode	F Line to Neutral	N Terminal Block	R LED, Relay Contacts	J NEMA 4X *(Non-Metallic)*	1 UL Type 1	S Standard



Dimensional Data					
Surge Rating	Connection Type	A x B	C	D	Weight
08-12	Wire Lug (N)	16" x 12" (406 x 305)	17.25" (438)	9.5" (241)	35lb (15.9kg)
	Disconnect (R)	16" x 16" (406 x 406)	17.25" (438)	10" (254)	45lb (20.4kg)
16-25	Wire Lug (N)				
	Disconnect (R)	20" x 16" (508 x 406)	21.25" (540)	10" (254)	55lb (24.9kg)
37	Wire Lug (N)				
	Disconnect (R)	20" x 20" (508 x 508)	21.25" (540)	14" (356)	85lb (38.6kg)

Dimensional Data *(Motorola R56 Approved Models Only)*	
Unit	Weight
560SA16FNRJ1S	24lb (12.7kg)
560YA16FNRJ1S	28lb (14.5kg)



500 SERIES
560 SURGE PROTECTIVE DEVICE
GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a modular, high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Underwriters Laboratories; UL 1283 5th Edition 2005 (complimentary listing for Type 2 locations)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
Federal Communications Commission (FCC)

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.

1.3 System Description: The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to a variance of ±1 volt and tested for manufacturing defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal system operating voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

1.5 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Life Cycle Surges: **(Selection Required)**
_____ Life Cycle Surges per Mode **(12,000), (15,000), (30,000), (45,000)**
_____ Life Cycle Surges per Phase **(12,000), (30,000), (60,000), (90,000)**

1.6 Overcurrent Protection: Fusing: All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. For every 100k amps of surge current capacity, 120 amps RMS of internal, integral fusing shall be required. Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Individual surge components shall be sand packed and shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.7 Performance Ratings:
Surge Current Capacity: **(Selection Required)**
_____kA Surge Rating per Mode **(80), (125), (160), (200), (250), (375)**
_____kA Surge Rating per Phase (L-N and L-G) **(160), (250), (320), (400), (500), (750)**

1.8 Design Requirements

1.8.1 Noise Attenuation: The filter shall provide an attenuation of 63 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system

1.8.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

1.8.3 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR			
	L-N	N-G	L-G	L-L
120/208	700 v	700 v	700 v	1000 v
277/480	1000 v	1000 v	1200 v	1800 v
480			1800 v	1800 v

1.8.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

1.9 Submittals

1.9.1 Documentation: These specifications are based on the Emerson Network Power 560 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, UL1449 Third edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.9.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation,

1.9.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.10 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified. The specified interconnect assembly shall be designed and manufactured in the USA by a qualified manufacturer of SPD products and line conditioning equipment. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.11 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +60°C (-40 to +140°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

1.12 Warranty: The manufacturer shall provide a full ten-year parts and five-year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct factory trained, ISO 9001:2000 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

2.0 PRODUCTS

2.1 Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-proof, drip-proof enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be 20 in. (508 mm) high x 20 in. (508 mm) wide x 10 in. (254 mm) deep.

2.2 Connections: The terminals shall be provided to accommodate wire sizes up to #2/0 AWG.

2.3 Internal Connections and Serviceability: All surge current diversion module connections shall be by way of low-impedance copper plates. Surge current diversion modules shall use bolted connections to the plates for reliable, low-impedance connections. The system shall be designed for easy servicing by a qualified field electrician, providing simple change out of any or all SPD modules. Designs that require factory service are not acceptable. Any unit using "plug-in" type modules are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.4 Standard Features:

2.4.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The SPD must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules. The integrity of all fuses in test must be indicated on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

2.4.2 Unit Status Indicators—SPD shall be equipped with red and green solid state indicators for each phase and N-G (where applicable). Indicators must be mounted within the enclosure and must be externally visible.

2.4.3 Dry Contacts for Remote Monitoring—SPD must have a minimum of 2 sets of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.4.4 Undervoltage Detection—SPD shall be equipped with 70% undervoltage detection.

2.4.5 Phase Loss Monitoring—SPD shall be equipped with phase loss monitoring.

2.4.6 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.4.7 Audible alarm—The specified system shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off switch shall be provided to silence the alarm, and an alarm push-to-test switch shall be provided to test the alarm's function. A visible LED will confirm whether alarm is on or disabled. Both switches shall be located on the unit's hinged front cover.

2.5 Optional Features

2.5.1 Transient Counters—Single or dual adjustable transient counters shall be available to tally Normal & Common mode transient voltage surges in both surge and swell conditions. The readout shall be at least a seven-digit LCD located on the unit's hinged front cover. The counter reset switches may be inhibited and must be remotely located. Counter must utilize lithium batteries with a 10-year nominal life to maintain accurate counts in the event of total power loss.

2.5.2 Remote Monitoring Panel—The monitoring system display panel shall be capable of mounting remotely to the SPD enclosure. A [6-foot (183cm)] **[10-foot (305cm)] [20-foot (610cm)]** long harness shall be used to connect the remote monitoring panel assembly to the SPD assembly.

2.5.3 Rotary Disconnect Switch—The specified system shall include a disconnect located in-line with the SPD system enclosure with an external manual operator. The switch shall disconnect all phase conductors, not including neutral, from the high-energy surge current diversion modules.

2.5.4 Advanced Transient Detection System- The SPD shall be equiped with a power quality monitor including the following monitoring features:

* Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet with Embedded Webpage
* Integral LCD Display providing real-time system RMS Voltage, Average Voltage, VTHD, Crest Factor, Phase Imbalance, & Frequency.
* Event Date/Time stamp with Duration/Magnitude for Surge, Sag, Swell, Temporary Overvoltage (TOV), Overvoltage, Phase Loss/Outage, Voltage Interruption/Dropout, Voltage Harmonics (VTHD), Over/Under Frequency, & Neutral Bond conditions. Event thresholds shall be capable of password-protected user modification at the system display and Embedded webpage.
* System memory shall be capable of on-board storage & retreival of a minimum of 1000 logged events.
* Event diagnostics providing SPDs life cycle status with remaining surge protection percentage, and a resettable counter providing the number of Surge, Sag, and Swell events since last reset.
* Voltage quality analysis reporting capable of producing a downloadable report detailing recorded power quality events, potential solutions, and statistical summaries.

2.5.5 Remote Monitor Unit—A self-contained monitoring device shall be available to allow remote annunciation of the system status. Input power to the monitoring device shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitoring device shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.6 Testing

2.6.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.

3.0 EXECUTION

3.1 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These Guide Specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88

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510 Surge Protective Device

The Emerson Network Power 510 is a multi-phase, multi-mode surge protector, which incorporates the same fuse/surge array design philosophy as the 570 and 560 products. A coordinated, multi-component/multi-fuse approach is the key to addressing even the harshest conditions. With a short circuit rating of 200kAIC, a UL 1449 Type 1 rating, along with a myriad of enclosure and surge levels; the 510 can be placed on any panel within your facility, making it the ideal choice for cascaded applications.

Protection Redundancy – Cascaded Surge Protection

In engineering, redundancy is the duplication of critical components or functions of a system with the intent of increasing reliability of the system – usually in the form of back-up.

IEEE encourages protection redundancy by cascading multiple surge protection devices throughout a facility.

Emerson Network Power carries this recommendation to the product level with built-in redundant features; including multiple surge arrays which consist of multiple surge components.

Not only will your facility be fully or "redundantly" protected, but the SPD itself is designed with redundancy in mind.



IEEE Recommends CASCADING Surge Protection

This Strategy is as Easy as...

1

Cascade multiple surge protective devices throughout your facility.

Make sure to choose the Emerson Network Power 500 Series...

2

Multiple surge arrays within each SPD.

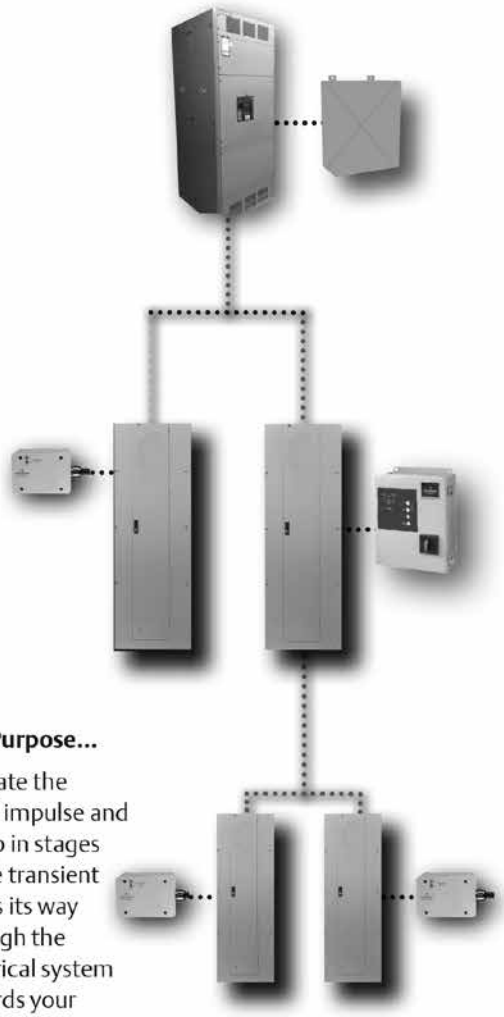
3

Multiple fuse/surge components placed within each SPD array.

Protection Redundancy Explained

Facility-Wide Protection Redundancy

1 Cascade surge protection throughout your facility. Place high-capacity SPDs at your high-risk locations, followed by protection at downstream electrical panels.

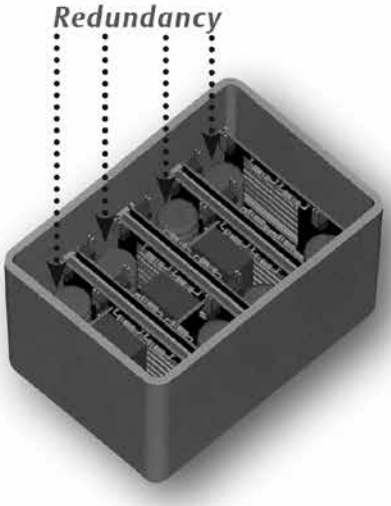


The Purpose...

Mitigate the initial impulse and clamp in stages as the transient works its way through the electrical system towards your critical loads.

The SPD – Redundant Surge Arrays

2 We carry the cascaded concept into our surge design by using multiple surge modules within our SPD.



Component Level

3 Our individual component level fuse design is the key to addressing high surge levels. Each fuse link can be coordinated with the requirements of the individual component – sized to handle the surge yet disconnect immediately in case of a fault. Having multiple components in an array and multiple arrays in a device not only allows the surge protection levels to expand while maintaining the safety, but it also provides "*Protection Redundancy*".

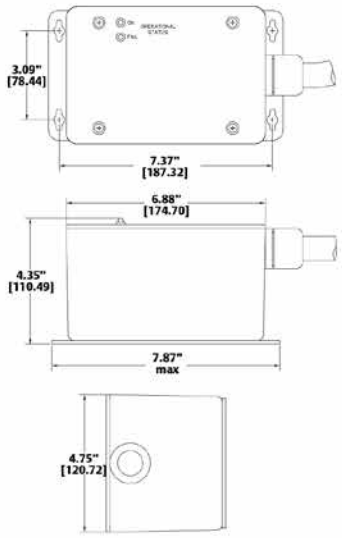


510 Surge Protective Device
General Specifications

General Specifications	
Connection Type	Parallel Connected
Agency Listings	ANSI/UL 1449 Third Edition, UL 1283 (Type 2 Locations), cUL (Type 2 Locations)
Maximum Continuous Operating Voltage Range	120VAC 125%, all others 115%
Maximum Surge Current Rating	65kA-250kA per mode/130kA-500kA per phase
UL 1449 Short Circuit Rating	200kAIC
UL 1449 Location Type	Type 1, Type 2
Nominal Discharge Current (I_n)	20kA
Operating Frequency Range	47 - 63 Hertz
50 ohm EMI/RFI Attenuation	63dB max from 10kHz to 100MHz
Protection Modes	All applicable modes standard (Line to Neutral, Line to Ground, Neutral to Ground and Line to Line)
Monitoring Features	Internal/External Status LEDs, Audible Alarm, Summary Alarm Contact, Built-in-test circuit tests MOV/fuse array capacities, Phase loss indication, Low voltage indication, Loss of power indication, Surge counter (optional)
Response Time	<0.5 nanoseconds
Temperature	-40 to +60 degrees C
Operating Humidity	0% to 95% non-condensing
Status Indication	LEDs, Relay Alarm Contacts, Audible Alarm
Enclosure	NEMA 4X, 12, 1
Altitude	0 to 18,000 feet
Audible Noise	Less than 45dBa
Parts Warranty	10 Years on all parts

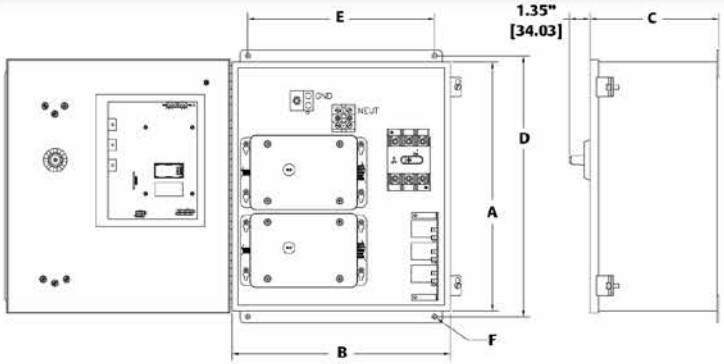
Dimensional Data

❶ NEMA 4X (Non-Metallic) Enclosure



❷ NEMA 12 (Metallic) Enclosure

Surge Rating (2)	A x B x C	D	E	F	Weight
06, 08	16" x 14" x 8" (406 x 356 x 203)	16.75" (425.5)	12" (304.8)	0.31" (7.9)	32lb (14.5kg)
10, 12, 16	16" x 14" x 8" (406 x 356 x 203)	16.75" (425.5)	12" (304.8)	0.31" (7.9)	41lb (18.6kg)
20, 25	20" x 16" x 9" (508 x 406 x 229)	21.25" (539.8)	10" (254)	0.44" (11.2	56lb (25.4kg)



Ordering Information

Ordering Information

Example Model Number: 510YA08ANAJ1S

510	YA	08	A	N	A	J	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
NEMA 4X (Non-Metallic) Enclosure *(See dimensional data ❶ on page 24)*								
510 	**See Chart A Below**	**06** 65kA/Mode **08** 80kA/Mode	A All Modes	N Terminal Block	**See Chart B Below**	**J** NEMA 4X *(Non-Metallic)*	**1** UL Type 1 **2** UL Type 2 UL 1283/cUL	S Standard
NEMA 12 (Metallic) Enclosure *(See dimensional data ❷ on page 24)*								
	**See Chart A Below**	**06** 65kA/Mode 08 80kA/Mode **10** 100kA/Mode	A All Modes	N Terminal Block **R** Rotary Disconnect	**See Chart B Below**	**L** NEMA 12 *(Standard)* **G** NEMA 4 *(Optional)* **R** NEMA 3R *(Optional)*	**1** UL Type 1 **2** UL Type 2 UL 1283/cUL	S Standard
		12 125kA/Mode **16** 160kA/Mode **20** 200kA/Mode **25** 250kA/Mode				**H** NEMA 4X *(Stainless Steel) (Optional)*		
NEMA 1 (Non-Metallic) Panelboard Extension								



Chart A

Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC

Chart B

Code	Monitoring Options
A	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets
C	Green/Red LEDs, Audible Alarm w/Silence Switch, Relay Contacts (2) Sets, plus Surge Counter

500 SERIES

510 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards**:**

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Underwriters Laboratories; UL 1283 5th Edition 2005 (complimentary listing for Type 2 locations)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.

1.3 System Description: The system shall be constructed using single or multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to a variance of ±1 volt and tested for manufacturing defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

1.5 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(8,000), (16,000), (24,000)**
_____ Life Cycle Surges per Phase **(16,000), (32,000), (48,000)**

1.6 Overcurrent Protection: Fusing: All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Individual surge components shall be sand packed and shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.7 Performance Ratings:

1.7.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(65), (80), (100), (125), (160), (200), (250)**
_____ kA Surge Rating per Phase (L-N & L-G) **(130), (160), (200) (250), (320), (400), (500)**

1.8 Design Requirements

1.8.1 Noise Attenuation: The filter shall provide an attenuation of 63 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system

1.8.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

1.8.3 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR Type 4X Non-Metallic / All others			
	L-N	N-G	L-G	L-L
120/240	600/800	600/700	700/900	900/1200
120/208	600/800	600/700	700/900	900/1200
240	n/a	n/a	1000/1200	1200/1200
277/480	1000/1200	900/1000	1000/1200	1800/2000
347/600	1500/1500	1200/1200	1500/1500	2500/2500
480	n/a	n/a	1800/1800	1800/2000
600	n/a	n/a	2000/2000	2500/2500

1.8.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

1.9 Submittals

1.9.1 Documentation: These specifications are based on the Emerson Network Power 500 Series – 510 Surge Protective Device. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 Third Edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.9.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

1.9.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.10 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.11 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +60°C (-40 to +140°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

1.12 Warranty: The manufacturer shall provide a full ten year warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.0 PRODUCTS

2.1 Enclosure (Selection Required):

The specified system shall be provided in a heavy duty **NEMA 12** dust-tight, drip-tight enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. A drawing pocket shall be provided inside the door for storage of unit drawings and installation/operation manual. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be 20 inches (508 mm) high, 16 inches (407 mm) wide and 9 inches (229 mm) deep.

The specified system shall be provided in a heavy duty **NEMA 4X** enclosure rated UL94-5V, the best rating for resistance to flammability available. Further, the enclosure shall be designed and tested to NEMA 12, 4 and 4X standards.

2.2 Connections: The terminals shall be provided to accommodate wire sizes up to #2 AWG for units with surge ratings above 80kA per mode. The terminals shall be provided to accommodate wire sizes up to #10 AWG for units with surge ratings equal to or below 80kA per mode.

2.3 Internal Connections and Serviceability:. The system shall be designed for simple change out of any or all SPD modules by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.4 Standard Features:

2.4.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The integrity of all fuses must be indicated on the status panel.

2.4.2 Unit Status Indicators—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems.The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.

2.4.3 Dry Contacts for Remote Monitoring—SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed. SPD's rated higher than 80kA Per Mode must have two or more sets.

2.4.4 Undervoltage Detection—SPD shall be equipped with 70% undervoltage detection.

2.4.5 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.4.6 Audible alarm—The specified system shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off feature shall be provided to

silence the alarm. For units greater than 80kA Per Mode an alarm push-to-test switch shall be provided to test the alarm's function. A visible LED will also confirm whether alarm is on or disabled. Both switches shall be located on or below the unit's front cover.

2.5 Optional Features

2.5.1 Transient Counter—An adjustable transient counter shall be available to tally transient voltage surge conditions. The readout shall be at least a seven-digit LCD located on the unit's hinged front cover. The counter reset switches may be inhibited and must be remotely located. Counter must utilize lithium batteries with a 10-year nominal life to maintain accurate counts in the event of total power loss.

2.5.2 Remote Monitor Panel—A self-contained monitoring panel shall be available to allow remote annunciation of the system status. Input power to the monitoring panel shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitor panel shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.5.3 Rotary Disconnect Switch—The specified system shall include a disconnect located in-line with the SPD system enclosure with an external manual operator. The switch shall disconnect all phase conductors, not including neutral, from the high-energy surge current diversion modules.

2.6 Testing

2.6.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50μs], 500 amp [8x20 μs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50μs], 500 amp [8x20 μs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.

3.0 EXECUTION

3.1 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

GS-70103 Rev 0 1-13

400 Series Surge Protective Devices

Introduction

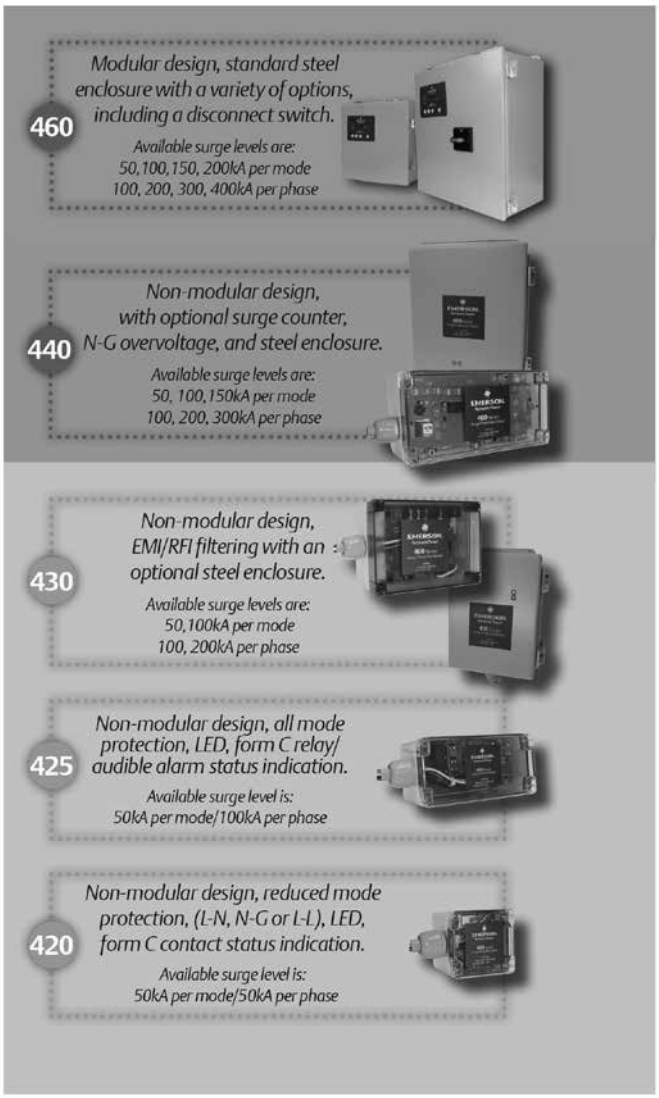
Emerson Network Power's 400 Series is a UL listed
Type 1 family of surge protectors that are designed around the latest thermally protected MOV technology. This platform of products is available in any voltage and phase configuration and offers a wide range of surge levels and optional accessories. The compact design and robust performance make the 400 Series products an ideal choice for reliable, high-energy protection.



The 400 Series includes:

- **Thermally Protected MOV Technology**
- **Surge Current Ratings** – meets or exceeds industry performance requirements
- **UL 1449 3rd Edition Type 1 SPD, UL 1283 EMI/RFI filter, IEC and CE compliant**
- **Short Circuit Current Rating of 200kAIC**
- **Surge Impulse Rated and Tested**
- **Series Status Includes** – audible alarm, surge counters, form C contacts, and green/red status LEDs; including N-G overvoltage

Technology, agency listing and design flexibility, make the 400 Series an ideal choice to meet most project specifications...



How Do They Compare?



			460	440	430	425	420
Components, Construction & Performance	Replaceable Surge Modules		✓				
	Disconnect Switch		*Optional*				
	Life Cycle Testing	*up to 12,000 per mode*	✓				
		up to 8,000 per mode	✓				
		up to 6,000 per mode	✓	✓			
		up to 3,500 per mode	✓	✓	✓		
		up to 500 per mode	✓	✓	✓	✓	✓
	EMI/RFI Filtering		✓	✓	✓		
	Steel Enclosure		✓	*Optional*	*Optional*		
	Warranty	*up to 10 Years Parts or Replacement*	✓	✓	✓	✓	
		up to 5 Years Parts or Replacement	✓	✓	✓	✓	✓
	UL 1449 Inominal Rating / Location Type (20kA / Type 1)		✓	✓	✓	✓	✓
	Short Circuit Current Rating (SCCR) (200kAIC)		✓	✓	✓	✓	✓
	Thermally Protected MOV		✓	✓	✓	✓	✓
Surge Rating	Up to 200kA/400kA (Mode/Phase)		✓				
	Up to 150kA/300kA (Mode/Phase)		✓	✓			
	Up to 100kA/200kA (Mode/Phase)		✓	✓	✓		
	Up to 50kA/100kA (Mode/Phase)		✓	✓	✓	✓	
	Up to 50kA/50kA (Mode/Phase)		✓	✓	✓	✓	✓
Monitoring	Surge Counter		*Optional*	*Optional*			
	Surge Indication LED		✓	✓			
	N-G Overvoltage Indication		✓	✓	✓		
	Audible Alarm		✓	✓	✓	✓	
	Green/Red Status LEDs, Form C Relay Contacts		✓	✓	✓	✓	✓

460 Surge Protective Device

High Capacity/Modular Surge Protection Solutions

The Emerson Network Power 460 is a modular, surge protective device capable of diverting high-energy transients. The 460 incorporates either single or dual modules that contain multiple, large block MOVs. Each MOV incorporates a thermal disconnecting feature that monitors the status of each inner metal disc and safely removes the component during abnormal conditions. The 460 has been tested under a variety of transient conditions. It's rugged design, performance and versatility makes this product an ideal choice for applications anywhere in your facility.



At A Glance

- **UL**–1449 3rd edition, type 1 or 2, I_n 20kA, cUL (type 2)
- Surge Current Rating: 50, 100, 150, 200kA/mode 100, 200, 300, 400kA/phase
- **All Modes of Protection**–L-L, L-N, L-G, N-G *Optional–discrete 10-mode available*
- Large Block, Utility Grade 34mm MOVs
- Thermally Protected MOV Technology
- **Short Circuit Rating**–200kAIC
- **Status Monitoring**–green/red LEDs, N-G overvoltage, surge indication, audible alarm w/silence switch, form C contacts and surge counter
- **NEMA 12/4 Steel Enclosure**–standard
- **Optional Accessories**–rotary disconnect
- **UL 1283 EMI/RFI Filtering**
- **ANSI/IEEE**–C62.11, C62.41, C62.45
- **IEC 61643-11 Tested, CE compliant**
- **Warranty**–10 Years

460 Surge Protective Device General Specifications

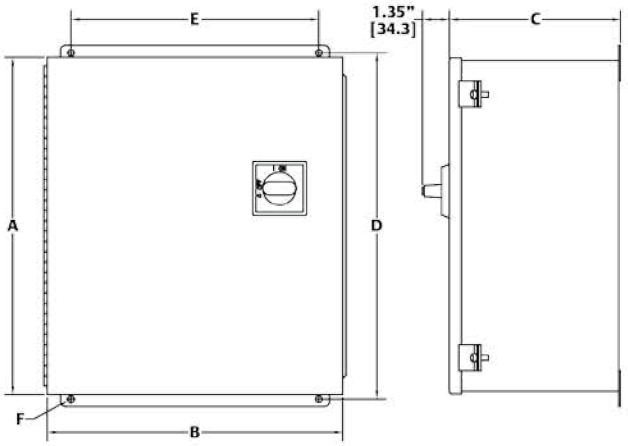
General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 150%, all others 115%
Short Circuit Current Rating (SCCR)	200kAIC
Protection Modes	All Possible Modes including (L-N, L-G, N-G, L-L)
Operating Frequency Range	47-63Hz
UL 1449 Location Type	Type 1/Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Status Indication - Standard	Green/Red LEDs, Audible Alarm, Relay Alarm Contacts, N-G Overvoltage
Standard Enclosure	NEMA 12/4 *(Steel)*
50 ohm EMI/RFI Attenuation	60/40dB Max
Certifications	ANSI/UL 1449, Third Edition Type 1 or Type 2; cUL 1283 (ROHS Compliant), IEC, CE
Warranty	10 Years

Ordering Information
Dimensional Data

Ordering Information								
Example Model Number: **460YC10ARCL1S**								
460	YC	10	A	R	C	L	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
460	**See Chart A Below**	**05** 50kA/Mode	**A** All Modes	**N** Terminal Block	**See Chart B Below**	**L** NEMA 12/4 *(Steel)*	**1** UL Type 1	**S** Standard
		10 100kA/Mode	**L** Discrete 10-Mode *(See Below)*	**R** Rotary Disconnect			**2** UL Type 2 UL 1283	
		15 150kA/Mode	NOW AVAILABLE					
		20 200kA/Mode						

Chart A		
Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
YD		346/600VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC
DG		600VAC

Chart B	
Code	Monitoring Options
L	Green/Red LEDs, Audible Alarm w/ Silence Switch, Relay Contacts (2) Sets, plus N-G Overvoltage, Surge LED
C	Green/Red LEDs, Audible Alarm w/ Silence Switch, Relay Contacts (2) Sets, plus N-G Overvoltage, Surge Counter



Dimensional Data					
Surge Rating	A x B x C	D	E	F	Weight
100-150kA Mode	12x12x6 [305x305x152]	12.75 [324]	10.00 [254]	.31 [8]	21lb (9.5kg)
200kA Mode	16x14x8 [406x356x203]	16.75 [426]	12.00 [305]	.31 [8]	35lb (15.9kg)

Discrete 10-Mode Option

The 460 offers a Discrete "10-Mode" protection option, (up to 200kA/mode, 600kA/phase when adding L-N+L-G+L-L modes). This may be a requirement on some commercial projects based on performance advantage claims; including increased operational life, enhanced durability due to lower component stress, improved transient response and increased surge current sharing. We have a long history of achieving those same results with our standard mode/connection methods and configurations. However, for those projects that are specified with this requirement, the 460 is available in a Discrete 10-Mode construction format. Simply enter the letter 'L' in the mode selection column for all WYE configured models.

NOW AVAILABLE

400 SERIES

460 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.
International Electrotechnical Commission (IEC)

1.3 System Description: The system shall be constructed using single or multiple surge current diversion modules utilizing thermally protected metal oxide varistors (TPMOV). The surge current circuit shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

2.0 PRODUCTS

2.1 Performance Ratings

2.1.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50) (100) (150) (200)**
_____ kA Surge Rating per Phase (L-N & L-G) **(100), (200) (300) (400)**

2.1.2 Noise Attenuation: The filter shall provide an attenuation of 40 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

2.1.3 Enhanced EMI/RFI Filtering: Up to 60db from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. (Type 2 devices only)

2.1.4 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed Voltage Protection Ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR's			
	L-N	N-G	L-G	L-L
120/240, 120/208	800Vpk	800Vpk	800Vpk	1200Vpk
240 Delta	NA	NA	1200Vpk	2000Vpk
277/480	1200Vpk	1200Vpk	1200Vpk	2000Vpk
347/600	1500Vpk	1500Vpk	1500Vpk	2500Vpk
480 Delta	NA	NA	1800Vpk	2000Vpk
600 Delta	NA	NA	2000Vpk	3000Vpk

2.1.5 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

2.1.6 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(500)**, **(3500), (6000) (12000)**
_____ Life Cycle Surges per Phase **(1000)**, **(7,000), (12,000) (24,000)**

2.2 Design Requirements

2.2.1 Overcurrent Protection/Fusing: All suppression components shall be thermally protected and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not accepted. Individual surge components shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

2.2.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

2.2.3 Enclosure: The specified system shall be provided in a weather-proof **NEMA 4** metal enclosures. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. Monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be 16 inches (406 mm) high, 16 inches (406 mm) wide and 8 inches (203 mm) deep.

2.2.4 Connections: Terminals/Compression lugs shall be provided to accommodate connection to phases, neutral, and ground where applicable. A three position terminal block with "NO", "NC", & "COM" indication shall be provided to accommodate relay alarm contact connection.

2.2.5 **Internal Connections and Serviceability:**. The system shall be designed for simple change out of any SPD by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.3 Standard Features:

2.3.1 **Unit Testing Capability**—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The integrity of all fuses must be indicated on the status panel.

2.3.2 **Unit Status Indicators**—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems.The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.

2.3.3 **Dry Contacts for Remote Monitoring—**SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.3.4 **Power Loss Monitoring**—SPD shall be equipped with power loss monitoring.

2.3.5 **Audible Alarm—**SPD shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off feature shall be provided to silence the alarm.

2.4 Optional Features:

2.4.1 **Surge Counter**—A resettable transient counter shall be available to tally transient voltage surge conditions. The readout shall be at least a six-digit LCD located on the unit's front cover. Counter must maintain accurate counts for 10-years in the event of total power loss.

2.4.3 **Surge Event LED—**The SPD shall include LED indication on the front cover that illuminates when the SPD's Nominal voltage is exceeded by 50%. Once activated, the Surge Event LED must remain illuminated until a reset function is manually activated.

2.4.4 **N-G Overvoltage Detection—** The SPD shall include LED indication on the front cover that illuminates when the neutral to ground voltage exceeds 20VRMS.

2.4.5 **Remote Monitor Unit—**A self-contained monitoring device shall be available to allow remote annunciation of the system status. Input power to the monitoring device shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitoring device shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.4.6 **Rotary Disconnect Switch—**The specified system shall include a disconnect located in-line with the SPD system enclosure with an external manual operator. The switch shall disconnect all phase conductors, not including neutral, from the high-energy surge current diversion modules.

2.4.7 **Advanced Transient Detection System**- The SPD shall be equiped with a power quality monitor including the following monitoring features:

* Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet with Embedded Webpage
* Integral LCD Display providing real-time system RMS Voltage, Average Voltage, VTHD, Crest Factor, Phase Imbalance, & Frequency.
* Event Date/Time stamp with Duration/Magnitude for Surge, Sag, Swell, Temporary Overvoltage (TOV), Overvoltage, Phase Loss/Outage, Voltage Interruption/Dropout, Voltage Harmonics (VTHD), Over/Under Frequency, & Neutral Bond conditions. Event thresholds shall be capable of password-protected user modification at the system display and Embedded webpage.
* System memory shall be capable of on-board storage & retreival of a minimum of 1000 logged events.
* Event diagnostics providing SPDs life cycle status with remaining surge protection percentage, and a resettable counter providing the number of Surge, Sag, and Swell events since last reset.

* Voltage quality analysis reporting capable of producing a downloadable report detailing recorded power quality events, potential solutions, and statistical summaries.

2.5 Quality Assurance: The manufacturer shall be ISO 9001:2008 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

2.6 Warranty: The manufacturer shall provide a full ten year warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.7 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +85°C (-40 to +185°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

2.8 Testing

2.8.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

3.0 EXECUTION

3.1 Submittals

3.1.1 Documentation: These specifications are based on the Emerson Network Power 460 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statement to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 Third Edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

3.1.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

3.1.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

3.2 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

440 Surge Protective Device

High-Capacity/Non-Modular Surge Protection Solutions

The Emerson Network Power 440 is a non-modular, surge protective device that incorporates the same design platform as the 460 SPD; high-energy capable, thermally protected large block MOVs and a similar assortment of accessories. The 440 is ideal for use in distribution and sub-distribution applications and its non-modular construction allows it to be installed in areas where space is limited.



At A Glance

- **UL**–1449 3rd edition, type 1 or 2, I_n 20kA, cUL (type 2)
- **Surge Current Rating:** 50, 100, 150kA/mode 100, 200, 300kA/phase
- **All Modes of Protection**–L-L, L-N, L-G, N-G *Optional–discrete 10-mode available*
- **Large Block, Utility Grade 34mm MOVs**
- **Thermally Protected MOV Technology**
- **Short Circuit Rating**–200kAIC
- **Status Monitoring**–green/red LEDs, N-G overvoltage, surge indication, audible alarm, form C contacts and surge counter
- **NEMA 4X Non-Metallic Enclosure**–standard, optional NEMA 12 steel enclosure
- **Optional Construction**–direct bus connection
- **UL 1283 EMI/RFI Filtering**
- **ANSI/IEEE**–C62.11, C62.41, C62.45
- **IEC 61643-11 Tested, CE compliant**
- **Warranty**–10 Years

440 Surge Protective Device General Specifications

General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 150%, all others 115%
Short Circuit Current Rating (SCCR)	200kAIC
Protection Modes	All Possible Modes including (L-N, L-G, N-G, L-L)
Operating Frequency Range	47-63Hz
UL 1449 Location Type	Type 1/Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Status Indication - Standard	Green/Red LEDs, Audible Alarm, Relay Alarm Contacts
Standard Enclosure	NEMA 4X *(Non-Metallic)*
50 ohm EMI/RFI Attenuation	60/40dB Max
Certifications	ANSI/UL 1449, Third Edition Type 1 or Type 2; cUL 1283 (ROHS Compliant), IEC, CE
Warranty	10 Years

Ordering Information
Dimensional Data

Ordering Information

Example Model Number: 440YC10ANLJ1S

440	YC	10	A	N	L	J	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
440	**See Chart A Below**	**05** 50kA/Mode	**A** All Modes	**N** Terminal Block	**See Chart B Below**	**J** NEMA 4X *(Non-Metallic)*	**1** UL Type 1	**S** Standard
		10 100kA/Mode	**L** Discrete 10-Mode *(See Below)*			**L** NEMA 12 *(Steel)* *(Optional)*	**2** UL Type 2 UL 1283	
		15 150kA/Mode						

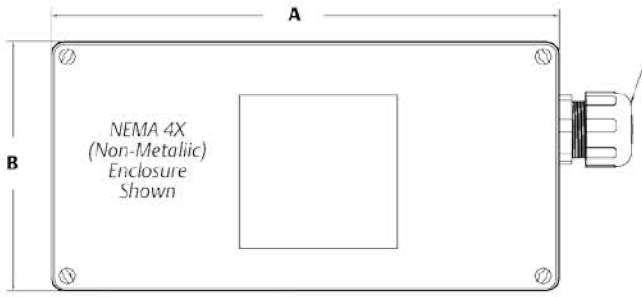
NOW AVAILABLE

Chart A

Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
YD		346/600VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC
DG		600VAC

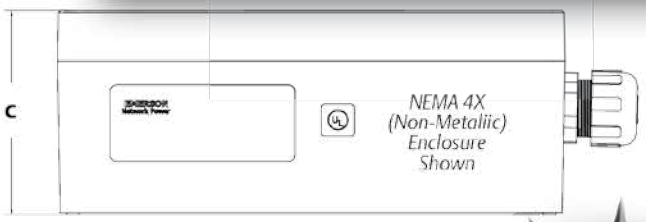
Chart B

Code	Monitoring Options
A	Green/Red LEDs, Audible Alarm, Relay Contacts (2) Sets
L	Green/Red LEDs, Audible Alarm, Relay Contacts (2) Sets, plus N-G Overvoltage, Surge LED
C	Green/Red LEDs, Audible Alarm, Relay Contacts (2) Sets, plus N-G Overvoltage, Surge Counter



Dimensional Data

Enclosure	A	B	C	Weight
NEMA 4X	9.6" [244]	4.9" [124]	3.2" [81]	3.8lb (1.8kg)
NEMA 12	10" [254]	8" [203]	4.25" [107.95]	12.7lb (7.8kg)



Discrete 10-Mode Option

The 440 offers a Discrete "10-Mode" protection option, (up to 100kA/mode, 300kA/phase when adding L-N+L-G+L-L modes). This may be a requirement on some commercial projects based on performance advantage claims; including increased operational life, enhanced durability due to lower component stress, improved transient response and increased surge current sharing. We have a long history of achieving those same results with our standard mode/connection methods and configurations. However, for those projects that are specified with this requirement, the 440 is available in a Discrete 10-Mode construction format. Simply enter the letter 'L' in the mode selection column for all WYE configured models.

NOW AVAILABLE

400 SERIES

440 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.
International Electrotechnical Commission (IEC)

1.3 System Description: The system shall be constructed using multiple surge current diversion thermally protected metal oxide varistors (TPMOV). The surge current circuit shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

2.0 PRODUCTS

2.1 Performance Ratings

2.1.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50) (100) (150)**
_____ kA Surge Rating per Phase (L-N & L-G) **(100), (200) (300)**

2.1.2 Noise Attenuation: The filter shall provide an attenuation of 40db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

2.1.3 Enhanced EMI/RFI Filtering: Up to 60db from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. (Type 2 devices only)

2.1.4 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed Voltage Protection Ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR's			
	L-N	N-G	L-G	L-L
120/240, 120/208	800Vpk	800Vpk	800Vpk	1200Vpk
240 Delta	NA	NA	1200Vpk	2000Vpk
277/480	1200Vpk	1200Vpk	1200Vpk	2000Vpk
347/600	1500Vpk	1500Vpk	1500Vpk	2500Vpk
480 Delta	NA	NA	1800Vpk	2000Vpk
600 Delta	NA	NA	2000Vpk	3000Vpk

2.1.5 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

2.1.6 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(500), (3500), (6000)**
_____ Life Cycle Surges per Phase **(1000), (7,000), (12,000)**

2.2 Design Requirements

2.2.1 Overcurrent Protection/Fusing: All suppression components shall be thermally protected and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not accepted. Individual surge components shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

2.2.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

2.2.3 Enclosure (selection required): The specified system shall be provided in a heavy duty **NEMA 4X** enclosure rated UL94-5V, the best rating for resistance to flammability available.

2.2.4 Connections: Terminals/Compression lugs shall be provided to accommodate connection to phases, neutral, and ground where applicable. A three position terminal block with "NO", "NC", & "COM" indication shall be provided to accommodate relay alarm contact connection.

2.2.5 Internal Connections and Serviceability:. The system shall be designed for simple change out of any SPD by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.3 Standard Features:

2.3.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The integrity of all fuses must be indicated on the status panel.

2.3.2 Unit Status Indicators—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems.The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.

2.3.3 Dry Contacts for Remote Monitoring—SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.3.4 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.3.5 Audible Alarm—SPD shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off feature shall be provided to silence the alarm.

2.4 Optional Features:

2.4.1 Surge Counter—A resettable transient counter shall be available to tally transient voltage surge conditions. The readout shall be at least a six-digit LCD located on the unit's front cover. Counter must maintain accurate counts for 10-years in the event of total power loss.

2.4.3 Surge Event LED—The SPD shall include LED indication on the front cover that illuminates when the SPD's Nominal voltage is exceeded by 50%. Once activated, the Surge Event LED must remain illuminated until a reset function is manually activated.

2.3.4 N-G Overvoltage Detection— The SPD shall include LED indication on the front cover that illuminates when the neutral to ground voltage exceeds 20VRMS.

2.4.5 NEMA 12 Metal Enclosure—The SPD may be provided in NEMA 12 metal enclosure.

2.4.6 Remote Monitor Unit—A self-contained monitoring device shall be available to allow remote annunciation of the system status. Input power to the monitoring device shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitoring device shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.4.7 Advanced Transient Detection System- The SPD shall be equiped with a power quality monitor including the following monitoring features:

* Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet with Embedded Webpage
* Integral LCD Display providing real-time system RMS Voltage, Average Voltage, VTHD, Crest Factor, Phase Imbalance, & Frequency.
* Event Date/Time stamp with Duration/Magnitude for Surge, Sag, Swell, Temporary Overvoltage (TOV), Overvoltage, Phase Loss/Outage, Voltage Interruption/Dropout, Voltage Harmonics (VTHD), Over/Under Frequency, & Neutral Bond conditions. Event thresholds shall be capable of password-protected user modification at the system display and Embedded webpage.
* System memory shall be capable of on-board storage & retreival of a minimum of 1000 logged events.
* Event diagnostics providing SPDs life cycle status with remaining surge protection percentage, and a resettable counter providing the number of Surge, Sag, and Swell events since last reset.
* Voltage quality analysis reporting capable of producing a downloadable report detailing recorded power quality events, potential solutions, and statistical summaries.

2.5 Quality Assurance: The manufacturer shall be ISO 9001:2008 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

2.6 Warranty: The manufacturer shall provide a full ten year warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.7 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +85°C (-40 to +185°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

2.8 Testing

2.8.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

3.0 EXECUTION

3.1 Submittals

3.1.1 Documentation: These specifications are based on the Emerson Network Power 440 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statement to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 Third Edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

3.1.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

3.1.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

3.2 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

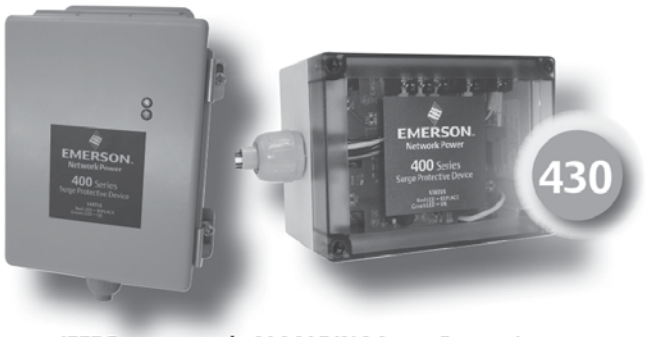
These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

GS-70108 Rev 2 1-15

430 Surge Protective Device

Non-Modular Surge Protection Solutions

The Emerson Network Power 430 is a non-modular compact, surge protective device that offers high-end surge capability at a competitive price. The 430 uses thermally protected MOVs, provides EMI/RFI filtering in a package that focuses on basic features and reliable performance. A great product for the IEEE recommended "cascaded surge protection" approach–install at important branch panel locations.



IEEE Recommends CASCADING Surge Protection

At A Glance

- **UL**–1449 3rd edition, type 1 or 2, I_n 20kA**,** cUL (type 2)
- **Surge Current Rating**– 50 or 100kA/mode 100 or 200kA/phase
- **All Modes of Protection**–L-L, L-N, L-G, N-G
- **Large Block, Utility Grade 34mm MOVs**
- **Thermally Protected MOV Technology**
- **Short Circuit Rating**–200kAIC
- **Status Monitoring**–green/red LEDs, audible alarm, form C contacts
- **NEMA 4X Non-Metallic Enclosure**–standard, *optional* NEMA 12 steel enclosure
- **UL 1283 EMI/RFI Filtering**
- **ANSI/IEEE**–C62.11, C62.41, C62.45
- **IEC 61643-11 Tested, CE compliant**
- **Warranty**–10 Years

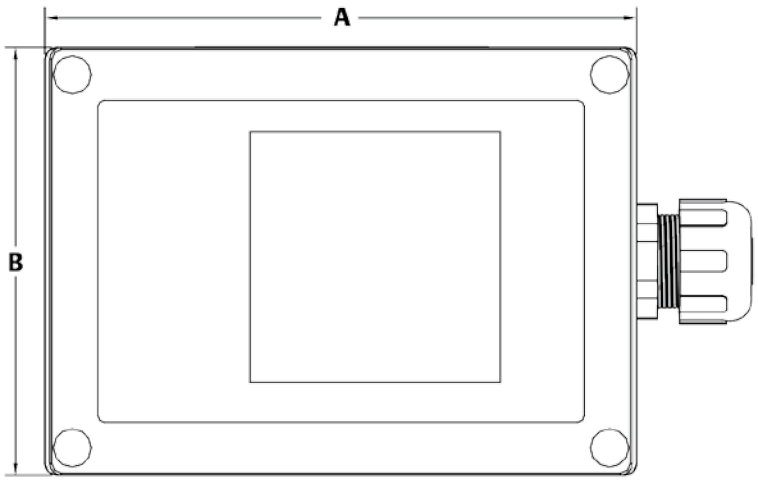
430 Surge Protective Device General Specifications

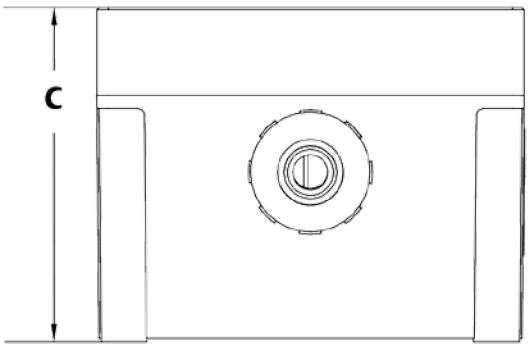
General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 150%, all others 115%
Short Circuit Current Rating (SCCR)	200kAIC
Protection Modes	All Possible Modes including (L-N, L-G, N-G, L-L)
Operating Frequency Range	47-63Hz
UL 1449 Location Type	Type 1/Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Status Indication - Standard	Green/Red LEDs, Audible Alarm, Relay Alarm Contacts
Standard Enclosure	NEMA 4X *(Non-Metallic)*
50 ohm EMI/RFI Attenuation	60/40dB Max
Certifications	ANSI/UL 1449, Third Edition Type 1 or Type 2; cUL 1283 (ROHS Compliant), IEC, CE
Warranty	10 Year Replacement

Ordering Information
Dimensional Data

Ordering Information								
Example Model Number: **430YA10ANAJ1S**								
430	**YA**	**10**	**A**	**N**	**A**	**J**	**1**	**S**
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
430	**See Chart A Below**	**10** 100kA/Mode	**A** All Modes	**N** Terminal Block	**A** LED, Audible Alarm, Relay Contacts	**J** NEMA 4X *(Non-Metallic)*	**1** UL Type 1	**S** Standard
						L NEMA 12 *(Steel) (Optional)*	**2** UL Type 2 UL 1283	

Chart A		
Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
YD		346/600VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC
DG		600VAC





Dimensional Data				
Enclosure	A	B	C	Weight
NEMA 4X	7.1" [180]	5.1" [130]	4.0" [102]	3.1lb (1.4kg)
NEMA 12	8" [203]	6" [152]	3.0" [76]	8.4lb (3.8kg)

400 SERIES

430 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.
International Electrotechnical Commission (IEC)

1.3 System Description: The system shall be constructed using multiple surge current diversion thermally protected metal oxide varistors (TPMOV). The surge current circuit shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

2.0 PRODUCTS

2.1 Performance Ratings

2.1.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50) (100)**
_____ kA Surge Rating per Phase (L-N & L-G) **(100) (200)**

2.1.2 Noise Attenuation: The filter shall provide an attenuation of 40db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

2.1.3 Enhanced EMI/RFI Filtering: Up to 60db from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. (Type 2 devices only)

2.1.4 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed Voltage Protection Ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR's			
	L-N	N-G	L-G	L-L
120/240, 120/208	800Vpk	800Vpk	800Vpk	1200Vpk
240 Delta	NA	NA	1200Vpk	2000Vpk
277/480	1200Vpk	1200Vpk	1200Vpk	2000Vpk
347/600	1500Vpk	1500Vpk	1500Vpk	2500Vpk
480 Delta	NA	NA	1800Vpk	2000Vpk
600 Delta	NA	NA	2000Vpk	3000Vpk

2.1.5 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

2.1.6 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(500) (3500)**
_____ Life Cycle Surges per Phase **(1000) (7,000)**

2.2 Design Requirements

2.2.1 Overcurrent Protection/Fusing: All suppression components shall be thermally protected and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not accepted. Individual surge components shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

2.2.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

2.2.3 Enclosure (selection required): The specified system shall be provided in a heavy duty **NEMA 4X** enclosure rated UL94-5V, the best rating for resistance to flammability available.

2.2.4 Connections: Terminals/Compression lugs shall be provided to accommodate connection to phases, neutral, and ground where applicable. A three position terminal block with "NO", "NC", & "COM" indication shall be provided to accommodate relay alarm contact connection.

2.2.5 Internal Connections and Serviceability:. The system shall be designed for simple change out of any SPD by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.3 Standard Features:

2.3.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The integrity of all fuses must be indicated on the status panel.

2.3.2 Unit Status Indicators—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems.The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.

2.3.3 Dry Contacts for Remote Monitoring—SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.3.4 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.3.5 Audible Alarm—SPD shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off feature shall be provided to silence the alarm.

2.4 Optional Features:

2.4.1 NEMA 12 Metal Enclosure—The SPD may be provided in NEMA 12 metal enclosure.

2.4.2 Remote Monitor Panel—A self-contained monitoring panel shall be available to allow remote annunciation of the system status. Input power to the monitoring panel shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitor panel shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.5 Quality Assurance: The manufacturer shall be ISO 9001:2008 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

2.6 Warranty: The manufacturer shall provide a full ten year warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.7 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +85°C (-40 to +185°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

2.8 Testing

2.8.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.

3.0 EXECUTION

3.1 Submittals

3.1.1 Documentation: These specifications are based on the Emerson Network Power 440 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statement to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 Third Edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

3.1.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

3.1.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

3.2 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

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425 Surge Protective Device

Type 1/All-Mode Surge Protection Solutions

The Emerson Network Power 425 is a compact surge protective device that offers protection in each connected mode–line to neutral, line to ground, neutral to ground or line to line and line to ground. The 425 uses thermally protected MOVs, is designed in a NEMA 4X enclosure, and is tested as a UL 1449 Type 1 device, so it can be placed on the line or load side of the main disconnect. The compact design and extensive testing makes this device ideal for most panel and equipment locations.



IEEE Recommends CASCADING Surge Protection

At A Glance

- **UL**–1449 3rd edition, type 1 or 2, I_n 20kA, cUL (type 2)
- **Surge Current Rating**– 50kA/mode 100kA/phase
- **All Modes of Protection**–L-L, L-N, L-G, N-G
- **Large Block, Utility Grade 34mm MOVs**
- **Thermally Protected MOV Technology**
- **Short Circuit Rating**–200kAIC
- **Status Monitoring**–green/red LEDs, form C contacts, audible alarm
- **NEMA 4X Non-Metallic Enclosure**–standard
- **ANSI/IEEE**–C62.11, C62.41, C62.45
- **IEC 61643-11 Tested, CE compliant**
- **Warranty**–10 Years

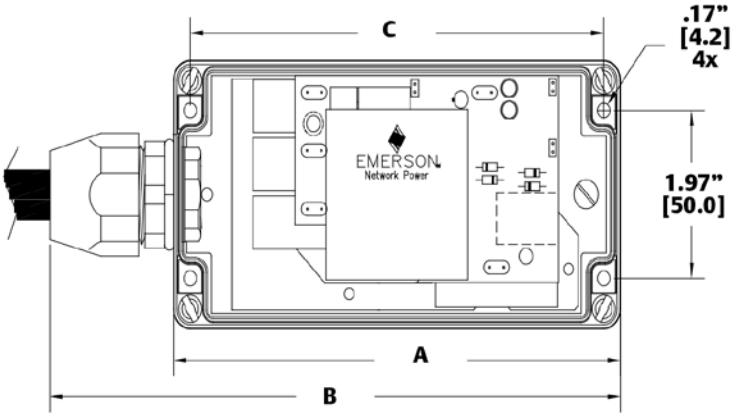
425 Surge Protective Device General Specifications

General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 150%, all others 115%
Short Circuit Current Rating (SCCR)	200kAIC
Maximum Surge Current Rating	50kA per Mode/100kA per Phase
Operating Frequency Range	47-63Hz
UL 1449 Location Type	Type 1/Type 2
UL 1449 Nominal Discharge Current (I_n)	20kA
Status Indication	Green/Red LEDs, Audible Alarm, Relay Alarm Contacts
Standard Enclosure	NEMA 4X *(Non-Metallic)*
Certifications	ANSI/UL 1449 Third Edition Type 1 or Type 2; cUL (ROHS Compliant)
Warranty	10 Year Replacement

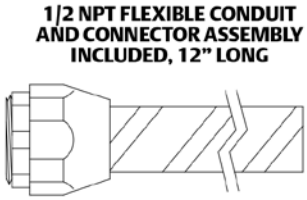
Ordering Information
Dimensional Data

Ordering Information								
Example Model Number: 425SA05AWAJ1S								
425	SA	05	A	W	A	J	1	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
425	**See Chart A Below**	05 50kA/Mode	A All Modes	W Wire Leads	A LED, Audible Alarm, Relay Contacts	J NEMA 4X *(Non-Metallic)*	1 UL Type 1	S Standard
							2 UL Type 2 cUL	

Chart A		
Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
YD		346/600VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC
DG		600VAC



Dimensional Data				
Enclosure	A	B	C	Weight
NEMA 4X	6.30 [160]	8.04 [204.2]	5.83 [148.0]	1.9lbs [.86kg]





400 SERIES

425 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall also be cUL listed and labeled.

1.3 System Description: The system shall be constructed using multiple surge current diversion thermally protected metal oxide varistors (TPMOV). The surge current circuit shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range of the system shall be at least 47 - 63 Hz.

1.5 Overcurrent Protection: Fusing: All suppression components shall be thermally protected and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not accepted. Individual surge components shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.6 Performance Ratings:

1.6.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50)**
_____ kA Surge Rating per Phase (L-N & L-G) **(100)**

1.7 Design Requirements

1.7.1 Noise Attenuation: The filter shall provide an attenuation of 40 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

1.7.2 Protection Modes: The SPD shall provide protection as follows: All modes; L-L, L-N, L-G, N-G or L-L, L-G. Note: L = Line, G = Ground, N = Neutral

1.7.3 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed Voltage Protection Ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Third Edition VPR's			
	L-N	N-G	L-G	L-L
120/240, 120/208	700	700	700	1200
240 Delta	n/a	n/a	1200	1200
277/480	1200	1200	1200	2000
347/600	1500	1500	1500	2500
480 Delta	n/a	n/a	1800	2500
600 Delta	n/a	n/a	2000	2500

1.7.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

1.7.5 Life Cycle Testing: The SPD shall be duty life cycle tested to withstand 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(500)**
_____ Life Cycle Surges per Phase **(1000)**

1.8 Submittals

1.8.1 Documentation: These specifications are based on the Emerson Network Power 425 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statement to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 Third Edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.8.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

1.8.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.9 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.10 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +85°C (-40 to +185°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

1.11 Warranty: The manufacturer shall provide a full ten year warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.0 PRODUCTS

2.1 Enclosure: The specified system shall be provided in a heavy duty NEMA 4X enclosure rated UL94-5V, the best rating for resistance to flammability available.

2.2 Connections: 24 inches of 12AWG Wire Leads shall be provided to accommodate connection to phases, neutral, and ground where applicable. 24 inches of 18AWG Wire Leads shall be provided to accommodate relay alarm contact connection.

2.3 Internal Connections and Serviceability:. The system shall be designed for simple change out of any SPD by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.4 Standard Features:

2.4.1 Unit Testing Capability—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The integrity of all fuses must be indicated on the status panel.

2.4.2 Unit Status Indicators—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems.The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.

2.4.3 Audible Alarm—SPD shall be equipped with an audible alarm that is activated during a fault condition

2.4.4 Dry Contacts for Remote Monitoring—SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed.

2.4.5 Undervoltage Detection—SPD shall be equipped with 70% undervoltage detection.

2.4.6 Phase Loss Monitoring—SPD shall be equipped with phase loss monitoring.

2.4.7 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.5 Optional Features

2.5.2 **Remote Monitor Panel—**A self-contained monitoring panel shall be available to allow remote annunciation of the system status. Input power to the monitoring panel shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitor panel shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

2.6 Testing

2.6.1 **Component Testing and Monitoring:** The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.

3.0 EXECUTION

3.1 **Installation:** The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

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300 Series Surge Protective Devices

Introduction

Emerson Network Power's 300 Series is a UL listed non-modular family of surge protectors. The 300 series incorporates thermally protected MOVs, has a surge capacity up to 80kA per mode and is available in a variety of voltage and phase configurations. The compact footprint, short circuit rating and basic features make this family an ideal choice for cascaded, branch panel protection.



The 300 Series includes:

- **Thermally Protected MOVs**
- **UL 1449 3rd Edition Type 2 SPD**
- **Short Circuit Current Rating**–65 and 22kAIC
- **Single Surge Impulse Rated**
- **Status Indication**–LEDs and form C contacts

Non-modular design, steel enclosure, green/red LEDs, form C relay contacts.

Available surge levels are:
50, 80kA per mode
100 & 160kA per phase



Non-modular design, form C relay contacts

Available surge levels are:
25kA per mode – 50kA per phase



How Do They Compare?





			330	320
Components, Construction & Performance	Steel Enclosure		✓	
	Short Circuit Current Rating (SCCR)	*up to 65kAIC*	✓	
		up to 22kAIC	✓	✓
	UL 1449 Inominal Rating / Location Type	*10kA / Type 2*	✓	
		3kA / Type 2	✓	✓
	Thermally Protected MOV		✓	✓
	Warranty	*up to 5 Years Parts or Replacement*	✓	✓
Surge Rating	Up to 80kA/160kA (Mode/Phase)		✓	
	Up to 50kA/100kA (Mode/Phase)		✓	
	Up to 25kA/50kA (Mode/Phase)		✓	✓
	Up to 25kA/25kA (Mode/Phase)		✓	✓
Monitoring	Green/Red Status LEDs		✓	
	Status LED, Form C Relay Contacts		✓	✓

330 Surge Protective Device

Medium Exposure Surge Protection

The Emerson Network Power 330 offers protection from transients on distribution panels or any medium exposure locations. Available in 50kA/mode, 100kA/phase or 80kA/mode, 160kA/phase. The 330 features a small footprint, NEMA 12 enclosure, silver link fusing with thermal protection, all voltage and phase configurations, along with a 5 year warranty.



At A Glance

- **Thermally Protected**–metal oxide varistor (MOV) technology
- **Surge Current Rating**–of 50kA/mode, 100kA/phase or 80kA/mode, 160kA/phase
- **All Modes of Protection**–including L-L, L-N, L-G, N-G
- **Status Monitoring**–green/red LEDs and relay alarm contacts
- **Short Circuit Current Rating**–65kAIC
- **UL Type 2, I_n 10kA or 3kA**
- **NEMA 12 Steel**–rated enclosure
- **ANSI/IEEE**–C62.11, C62.41, C62.45 categories A, B, C3 tested
- **Warranty**–5 Years



Ordering Information
Dimensional Data

General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 125%, all others 115%
Short Circuit Current Rating (SCCR)	65kAIC
Maximum Surge Current Rating	50kA-80kA per mode/100kA-160kA per phase
Operating Frequency Range	47-63Hz
EMI/RFI Noise Rejection	40dB Max
UL 1449 Location Type	Type 2
UL 1449 Nominal Discharge Current (I_n)	3kA (50kA unit) ,10kA (80kA unit)
Connection Type	(50kA unit) #12 Wire Leads, 18" Long; (80kA unit) #10 Wire Leads, 24" Long
Status Indication	Green/Red LEDs, Relay Alarm Contacts
Standard Enclosure	NEMA 12 *(Steel)*
Certifications	ANSI/UL 1449 Third Edition Type 2; cUL
Warranty	5 Year Replacement

Ordering Information

Example Model Number: **330SA08AWRL2S**

330	SA	08	A	W	R	L	2	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
330	**See Chart A Below**	**05** 50kA/Mode	A All Modes	W Wire Leads	R LED, Relay Contacts	L NEMA 12 *(Steel)*	2 UL Type 2 cUL	S Standard
		08 80kA/Mode						

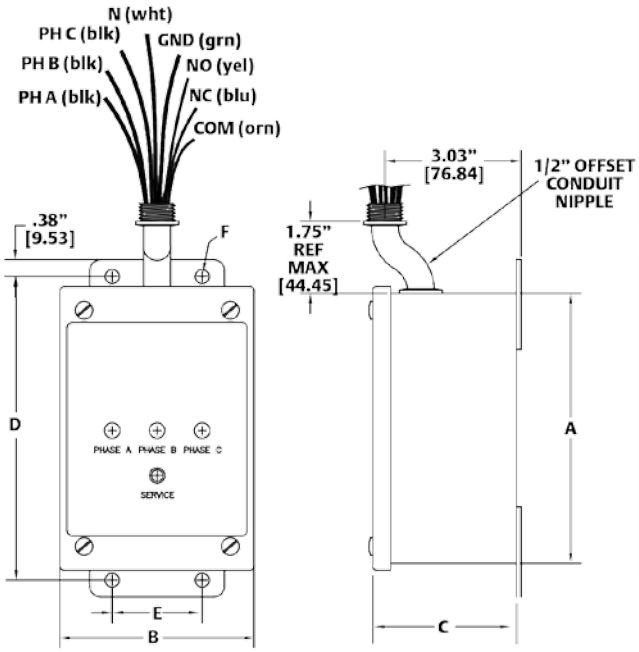

Chart A		
Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC

Dimensional Data				
Surge Rating	A	B	C	Weight
50kA Mode/100kA Phase	6.00 [152.4]	4.00 [101.6]	3.23 [81.9]	10lbs [4.5kg]
80kA Mode/160kA Phase	8.25 [209.6]	6.95 [176.7]	3.78 [96.0]	14lbs [6.3kg]
	D	E	F	
50kA Mode/100kA Phase	6.75 [171.5]	2.00 [50.8]	0.31 Dia [8.0]	10lbs [4.5kg]
80kA Mode/160kA Phase	8.75 [222.3]	4.00 [101.6]	0.31 Dia [8.0]	14lbs [6.3kg]

300 SERIES

330 SURGE PROTECTIVE DEVICE

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a non-modular, high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 2, 10kA/3kA device per ANSI/UL1449 Third Edition.

1.2 Standards : The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
Underwriters Laboratories; ANSI/UL 1449 Third Edition
Underwriters Laboratories; UL 1283 (complimentary listing for Type 2 locations)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001:2000 for manufacturing, design and service

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD.

1.3 System Description: The system shall be constructed using multiple surge current diversion arrays utilizing metal oxide varistors (MOV) computer matched to a variance of ±1% and tested for manufacturing defects. The arrays shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable.

1.4 Electrical Requirements (selection required)

1.4.1 Nominal System Operating Voltage

_____ VAC
_____ Configuration
_____ Phase
_____ Wires plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV): The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

1.4.3 Operating Frequency: The operating frequency range shall be at least 47-63 Hz.

1.5 Overcurrent Protection: Fusing: All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Individual surge components shall be sand packed and shall be UL listed to be capable of interrupting up to 65 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.7 Performance Ratings:

1.7.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50), (80)**
_____ kA Surge Rating per Phase (L-N & L-G) **(100), (160)**

1.8 Design Requirements

1.8.1 Noise Attenuation: The filter shall provide an attenuation of 40 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.

1.8.2 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

1.8.3 ANSI/UL 1449 ratings: The maximum UL 1449 Third Edition listed Voltage Protection Ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	80kA Per Mode/160kA Per Phase Models				50kA Per Mode/100kA Per Phase Models			
	L-N	N-G	L-G	L-L	L-N	N-G	L-G	L-L
120/240	600	600	600	900	600	700	700	1000
120/208	600	600	600	900	600	700	700	1000
240	N/A	N/A	1000	900	N/A	N/A	1200	1000
277/480	1200	1200	2000	1200	1000	900	1000	1800
480	N/A	N/A	1800	1800	N/A	N/A	2000	2000

1.8.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 10kA for units rated higher than 50kA per mode, 3kA for units rated at 50kA per mode or less.

1.9 Submittals

1.9.1 Documentation: These specifications are based on the Emerson Network Power 300 Series – 330 Surge Protective Device. All other manufacturers shall submit for 10-day pre-approval by providing detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL1449 Third edition VPRs, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.9.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

1.9.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.10 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified and shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.11 Environmental Requirements

Storage Temperature: **-55 to +85°C (-67 to +185°F)**
Operating Temperature: **-40 to +45°C (-40 to +113°F)**
Relative Humidity: **0% to 95% (non-condensing)**
Operating Altitude: **0 to 18,000 feet above sea level**

1.12 Warranty: The manufacturer shall provide a full five-year replacement warranty from date of shipment against any unit failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. A 24-hour 800 number must be available to support warranty.

2.0 PRODUCTS

2.1 Enclosure: The unit case shall be metallic enclosure and shall be designed and tested to NEMA 12. The enclosure dimensions shall be a minimum of 6.0" (152.4 mm) x 4.0" (101.6 mm) x 3.2" (81.9) mm deep for the 50kA per mode unit, and 8.3" (209.6 mm) x 7.0" (176.7 mm) x 3.8" (96.0 mm) for the 80kA per mode unit. The unit shall weigh a maximum of 6.3 kg. (14 lbs.).

2.2 Connections: All parallel connections to the SPD shall be kept as short as possible. The connection to the SPD shall be made using the wire provided.

2.3 Standard Features:

2.3.1 Unit Status Indicators— The unit shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression systems. If the unit does fail, the green LED will go out, the red LED with light and the alarm will sound.

2.3.3 Undervoltage Detection—SPD shall be equipped with 70% undervoltage detection.

2.3.4 Phase Loss Monitoring—SPD shall be equipped with phase loss monitoring.

2.3.5 Power Loss Monitoring—SPD shall be equipped with power loss monitoring.

2.3.6 Summary Alarm Relay Contacts— In addition to the LED indicators, the unit shall be equipped with a summary alarm relay with one set of Normally Open and Normally Closed (Form C) dry contacts rated for 125 VAC, 1 amp (minimum). The contacts will change state and indicate a failure of the unit, an under-voltage condition, a phase loss condition or a full power loss condition.

2.5 Testing

2.5.1 Component Testing and Monitoring: The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50μs], 500 amp [8x20 μs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50μs], 500 amp [8x20 μs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

3.0 EXECUTION

3.1 Installation: The installing contractor shall connect the SPD in parallel to the power source, keeping conductors as short and straight as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor impedance. When installed, the unit shall be supplied by a 30 amp circuit breaker for the LPM160 unit and a 20 amp breaker for the LPM100-2 unit. The contractor shall follow the SPD manufacturer's recommended installation practices and comply with all applicable codes.

Note: These guide specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88.

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320 Surge Protective Device

Low Exposure Surge Protection Solutions

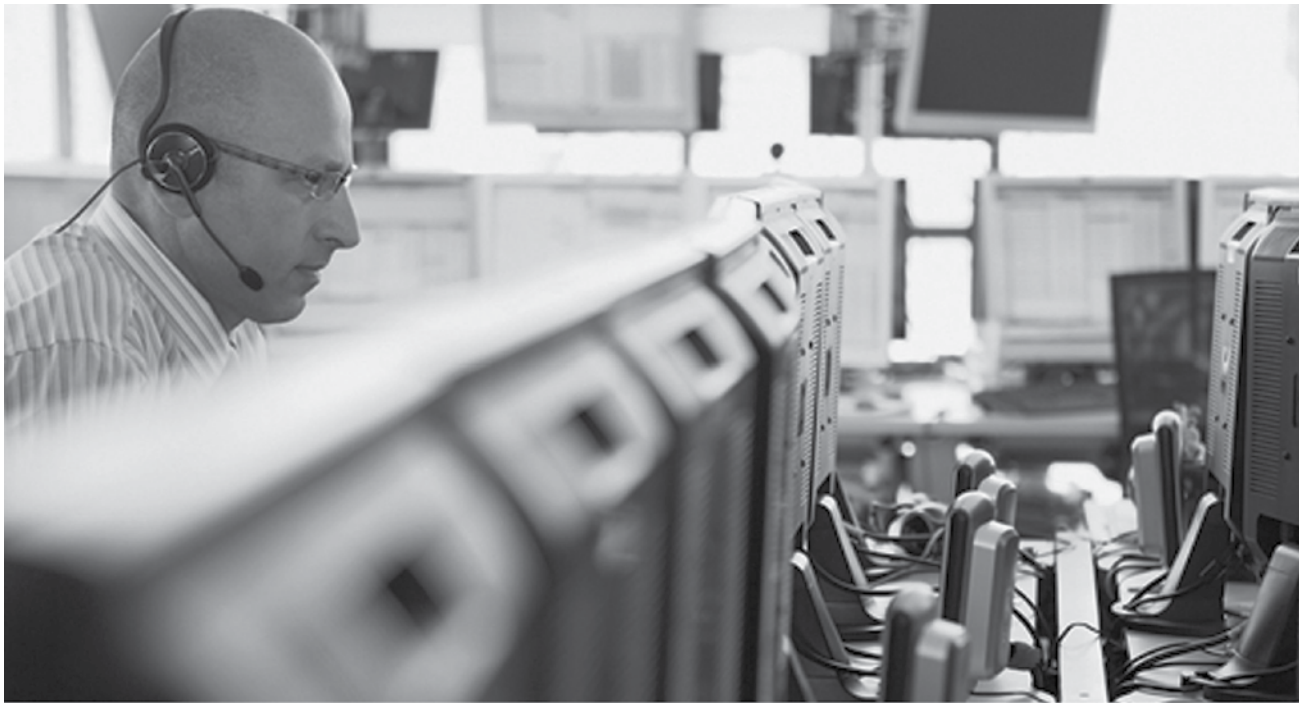
The Emerson Network Power 320 is designed for use on branch panels or equipment in low exposure locations. Available in 25kA/mode, 25kA/phase or 25kA/mode, 50kA/phase. The 320 features a small footprint, NEMA 1 enclosure, silver link fusing with thermal protection, all voltage and phase configurations, plus a 5 year warranty.



IEEE Recommends CASCADING Surge Protection

At A Glance

- **Thermally Protected**–metal oxide varistor (MOV) technology
- **Surge Current Rating**–of 25kA/mode, 25kA/phase or 25kA/mode, 50kA/phase
- **All Modes of Protection**–or reduced mode of protection design
- **Status Monitoring**–green LED and relay alarm contacts
- **Short Circuit Current Rating**–22kAIC
- **UL**–Type 2, I_n 3kA
- **NEMA 1 Non-Metallic**–rated enclosure
- **ANSI/IEEE**–C62.11, C62.41, C62.45 categories A, B tested
- **Warranty**–5 Years



320 Surge Protective Device
General Specifications

General Specifications	
Connection Type	Parallel Connected
Maximum Continuous Operating Voltage Range	120VAC 125%, all others 115%
Short Circuit Current Rating (SCCR)	22kAIC
Maximum Surge Current Rating	25kA per mode
Operating Frequency Range	47-63Hz
EMI/RFI Noise Rejection	40dB Max
UL 1449 Location Type	Type 2
UL 1449 Nominal Discharge Current (I_n)	3kA
Connection Type	#12 Wire Leads, 18" Long
Status Indication	Green LED, Relay Alarm Contacts
Standard Enclosure	NEMA 1 *(Non-Metallic)*, 94V-0
Certifications	ANSI/UL 1449 Third Edition Type 2; cUL
Warranty	5 Year Replacement

Ordering Information

Example Model Number: 320SA02AWRC2S

320	SA	08	A	W	R	C	2	S
SPD Series	Source Configuration	Surge Rating	Modes of Protection	Connection Type	Monitoring Options	Enclosure Type	UL 1449 Type	MOV Option
320	**See Chart A Below**	02 25kA/Mode	A All Modes	W Wire Leads	R LED, Relay Contacts	C NEMA 1 *(Non-Metallic)*	2 UL Type 2 cUL	S Standard

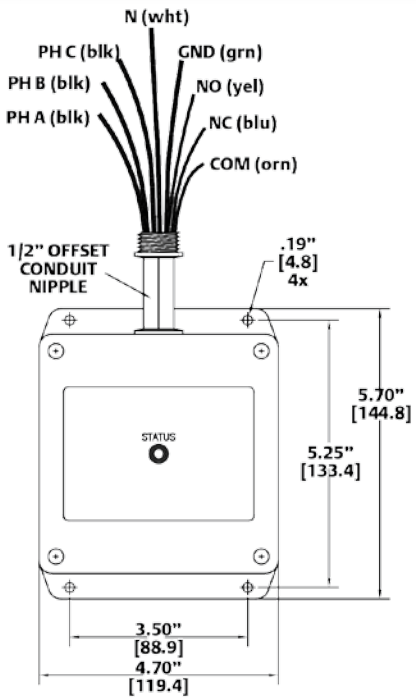
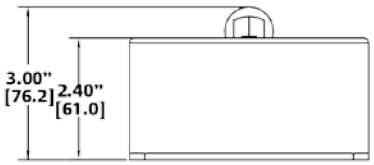


Chart A		
Code	Source Configuration	Voltage
SA	Single Phase, 3W+G (L1, L2, N, G)	120/240VAC
YA	Three Phase Wye, 4W+G (L1, L2, L3, N, G)	120/208VAC, 127/220VAC
YC		277/480VAC, 254/440VAC
DB	Three Phase Delta, 3W+G (L1, L2, L3, G)	220VAC, 230VAC, 240VAC
DF		480VAC



Dimensional Data	
Enclosure	Weight
NEMA 1	5lb (2.3kg)

300 SERIES
320 SURGE PROTECTIVE DEVICE
GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary: These specifications describe the electrical and mechanical requirements for a high energy surge protective device (abbreviated as SPD in this specification and on all drawings). The specified system shall provide effective high energy surge current diversion, sine wave tracking for electrical line noise filtering and be suitable for application in ANSI/IEEE C62.41 Category A, B, and C environments, as tested by ANSI/IEEE C62.11, C62.45 and MIL-STD-220A. The system shall be connected in parallel with the protected system; no series connected elements shall be used which limit load current or kVA capability.

1.1 Standards: The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 3rd Edition 2006 Revision (effective 9/29/2009)
Canadian Underwriters Laboratories (cUL)
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIPS PUB 94)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
MIL-STD-220A
CE

The system shall be UL listed and labeled under ANSI/UL 1449 Third Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD.

1.2 System Description: The SPD shall be constructed using multiple surge current diversion arrays of metal oxide varistors (MOV). No gas tubes, silicon avalanche diodes or selenium plates/rectifiers shall be used. The status of each array shall be continuously monitored and a green LED shall be illuminated if the array is in full working order.

1.3 Electrical Requirements

1.4.1 Nominal system operating voltage shall be:

_____VAC _____Configuration _____Phase_____ Wire plus Ground

1.4.2 Maximum Continuous Operating Voltage (MCOV)
The SPD maximum continuous operating voltage shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS overvoltage (swell) conditions.

1.4.3 Operating Frequency
The operating frequency range of the system shall be at least 47 to 63 Hertz.

1.5 Testing

1.5.1 Maximum Continuous Operating Voltage (MCOV) Testing
The unit shall be factory tested to assure proper MCOV of the unit.

1.6 Overcurrent Protection (Fusing): The TVSS shall be internally fused at the component level. The fusing shall be capable of interrupting up to 22kA symmetrical fault current with 480 VAC applied. This overcurrent protection circuit shall be monitored and provide indication of suppression failure/operability. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

1.7 Performance Ratings:
Surge Current Capacity: **(Selection Required)**
_____kA Surge Rating per Mode **(25)**
_____kA Surge Rating per Phase (L-N and L-G) **(25), (50)**

1.8 Design Requirements:

1.8.1 Protection Modes: The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

1.8.2 Noise Attenuation: The filter shall provide an attenuation of 40 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

1.8.3 ANSI/UL 1449 Voltage Protection Ratings: The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

1200 Volts for 120, 120/208, or 120/240 Volt systems
1200 Volts for 208, 240, 277, 220/380, 240/415 or 277/480 Volt systems
1800 Volts for 480 Volt systems

1.8.4 ANSI/UL 1449 Nominal Discharge Current: The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 3kA.

1.8.5 Response Time
Typical response time of all suppression components shall be .5 nanoseconds.

1.9 Submittals

1.9.1 Documentation: These specifications are based on the Emerson Network Power 320 Series. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, UL1449 Third edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

1.9.2 Equipment Manual: The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

1.9.3 Drawings: Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

1.10 Quality Assurance: The manufacturer shall be ISO 9001:2000 certified. The specified interconnect assembly shall be designed and manufactured in the USA by a qualified manufacturer of SPD products and line conditioning equipment. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

1.11 Environmental Requirements

Storage Temperature:	**-55 to +85°C (-67 to +185°F)**
Operating Temperature:	**-40 to +60°C (-40 to +140°F)**
Relative Humidity:	**0% to 95% (non-condensing)**
Audible Noise:	**less than 45dB at 5 feet (1.5m)**
Operating Altitude:	**0 to 18,000 feet (5,486m) above sea level**

1.12 Warranty: The manufacturer shall provide a full five-year parts warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct factory trained, ISO 9001:2000 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

2.0 PRODUCTS

2.1 Enclosure: The unit case shall be an enclosure rated Type 1, UL94-V0. The enclosure dimensions shall be a maximum of 4.72 inches long by 4.72 inches wide by 2.36 inches deep. The unit shall weigh 12 pounds maximum.

2.2 Connections: The unit shall be supplied with #12 AWG wire leads for connection to the power source. Wires should be cut as short as possible.

2.3 Unit Status Indicators—SPD shall be equipped with a green solid state indicator. Indicator must be mounted within the enclosure and must be externally visible.

2.4 Summary Alarm Relay Contacts: In addition to the LED indicator, the unit shall be equipped with a summary alarm relay with one set of Normally Open and Normally Closed (Form C) dry contacts rated for 125 VAC, 1 amp (minimum). The contacts will change state and indicate a failure of the unit, a phase loss condition or a full power loss condition.

3.0 EXECUTION

3.1 Installation: The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

These Guide Specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88

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Power Switching & Control

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ASCO 7000 Series Power Transfer Switches

Critical Loads Demand ASCO

As we become more depen- dent on the quality and reliability of electrical power, interruption or complete loss of power can create serious and even crippling financial losses, or impose dangers to life and safety.

ASCO Power Technologies (ASCO) provides the solutions to handle the transfer of critical loads to emergency sources reliably and with state of the art products. Using ASCO products can mean the difference between a minor inconve- nience and a major catastrophe. You'll find ASCO Power Transfer Switches wherever there is a critical load to be protected.
When flexibility in power switching is a must, ASCO offers a variety of product solutions to meet virtually every application require- ment, including distributed generation applications. That's why the 7000 SerieS is available in open, delayed, closed and closed soft load configurations. Additionally, switched or overlapping neutral options provide for reliable operation of ground fault protection systems and reduction of voltage transients from unbalanced load switching.

ASCO Power Transfer Switches are the first CE Marked, IEC 60947-6-1 compliant Transfer Switches in the world.

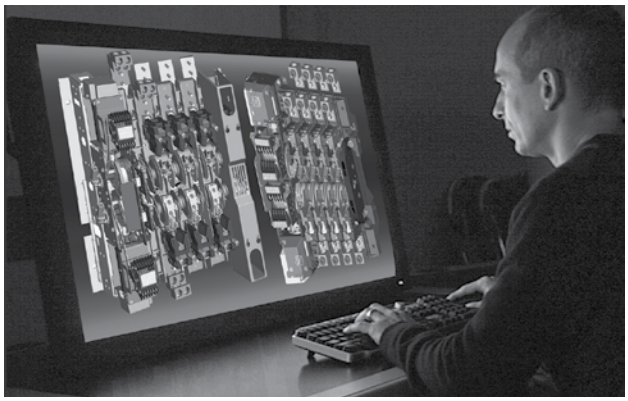


Protecting:

- Healthcare Facilities
- Web Hosting, Internet Data Centers
- Commercial Buildings / Industrial Buildings
- Telecom Central Offices
- Process Manufacturing
- Distributed Power / Load Management



The Recognized Leader in Power Transfer Switch Technology Offers the Most Advanced Transfer Switches in the World.



ASCO 7000 Series Power Switching Solutions

ASCO Power Transfer Switches are the standard of the industry. High speed transfer of loads between alter- nate sources of power, regardless of ampacity size, is achieved by a reliable, field proven solenoid operating mechanism. When combined with a programmable microprocessor controller with keypad and LCD display, they offer the most advanced method of transferring all types of loads, such as motors, electronic drives, UPS's and microprocessor based systems. 7000 SerieS Power Transfer Switches are available open or enclosed, in ampacity sizes from 30 through 4000 Amperes with the largest selection of optional accessories offered any- where. All switching configurations are available with an integrally mounted bypass-isolation switch and/or rated for use in service entrance applications.

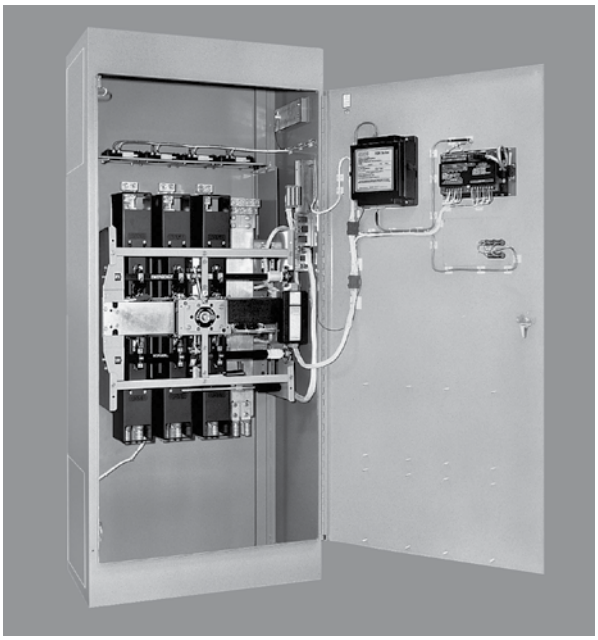


Fig. 1: Three Pole 7000 SerieS Automatic Transfer Switch rated 1600 Amperes (shown with optional front connected terminals and Power Manager).

7000 Series Power Transfer Switches Product Features

- Conventional two-position transfer configuration,plus closed and delayed transition modes of operation. All configurations available with either automatic or non-automatic control.
- UL listed to 1008 Transfer Switch Equipment & CSA certified to CSA 22.2 No.178-1978 Automatic Transfer Switches.
- Qualified and certified to IEC 60947-6-1, CE marked (optional). (Limited to certain accessories.)
- Rated up to 600 VAC, 30 through 4000 Amperes.
- Reliable and field proven solenoid operating mechanism.
- High withstand and close-on ratings including short time withstand current rating for optimum flexibility in circuit breaker coordination (600-4000 Amperes).
- Solid, switched, or overlapping neutral conductor options.
- Front replaceable main and arcing contacts (800-4000 Amperes).
- Programmable microprocessor controller with keypad and LCD display.
- Centrally located terminal block for customer control connections (260-4000 Amperes).
- 16mm, industrial grade control switches and indicating lights.
- Switch position LED indicators and source acceptability lights.
- Standard ground conductor connections.
- Four auxiliary contacts, two contacts closed when switch is in normal position and two contacts closed when switch is in emergency position.
- Local/remote communications capability for interfacing with ASCO POWERQUEST® communication products.
- Protected by a comprehensive warranty.

ASCO 7000 Series Power Switching Solutions

Closed Transition Transfer Switching

ASCO Automatic Closed Transition Transfer Switches feature main contacts that overlap, permitting the transfer of electrical loads without power interruption. The switch transfers in a make-before-break mode if both sources are within acceptable parameters. Control logic continuously monitors source conditions and automatically determines whether the load transfer should be open (conventional non-overlap mode) or closed transition. Available 150 through 4000 Amperes.

Closed Transition Transfer within 5 electrical degrees is achieved passively, without control of engine generator set. Therefore,no additional control wire runs are required between the ATS and engine generator set governor. Plus, protective relaying may not be required under normal operation since the contact over- lap time is less than 100 milliseconds (consult your local utility on protective relay requirements).

Failure to synchronize indication and extended parallel time protection is built-in to all 7000 SerieS closed transition controls to prevent abnormal operation.



Fig. 2: Four pole, Closed Transition Transfer Switch rated 1000 Amperes in Type 1 enclosure.



Delayed Transition Transfer Switching

ASCO Delayed Transition Transfer Switches are designed to provide transfer of loads between power sources with a timed load disconnect position for an adjustable period of time. Applications include older style variable frequency drives, rectifier banks, and load management applications.

- Available in 150 through 4000 Amperes.
- Utilizes reliable, field proven solenoid operating mechanisms.
- Mechanical interlocks to prevent direct connection of both sources.
- Indicator light (16mm, industrial grade type LED) for load disconnect position.
- Adjustable time delay for load disconnect position.

Fig. 3: Four pole, Delayed Transition Transfer Switch rated 2000 Amperes.

ASCO 7000 Series Power Switching Solutions

Non-Automatic Transfer Switching

ASCO Non-Automatic Transfer Switches are electrically operated units which are operated with manual control switches mounted locally or at remote locations.

- Sizes from 30 through 4000 Amperes.
- Microprocessor based controller provides for addition of optional accessories.
- Controller prevents inadvertent operation under low voltage conditions.
- Low control circuit operating currents allow for long line runs between remotely mounted manual control switches and the transfer switch.
- Source acceptability lights inform operator if sources are available to accept load.
- Standard inphase monitor can be activated for transferring motor loads.



Fig. 4: Three pole Non-Automatic, electrically operated 400 ampere switch shown in Type 1 enclosure.

Withstand and Close-On Ratings for all 7000 series Products1,2
(RMS Symmetrical Amps)

Frame	Switch Rating (Amps)		Current Limiting Fuses				Specific Breaker			Time Based				Short Time Ratings3 (sec)							
														480V Max.				600V Max.			
	Transfer Switches	Bypass Switches	480V	600V	Max Size.	Class	240V	480V	600V	Time	240V	480V	600V	.1	.13	.3	.5	.1	.13	.3	.5
D	30	-	100kA	-	60	J	22kA	22kA	10kA	0.025	10kA	10kA	10kA	-				-			
D	70, 100	-	35kA	35kA	200	RK1	42kA	22kA	10kA	0.025	10kA	10kA	10kA	-				-			
			200kA	35kA	200	J															
D	150	-	35kA	35kA	200	RK1	65kA	25kA	10kA	0.025	10kA	10kA	10kA	-				-			
			200kA	35kA	200	J															
D	200	-	200kA	-	200	J	65kA	25kA	-	0.025	10kA	10kA	-	-				-			
D	230	-	100kA	-	300	J	65kA	25kA	-	0.025	10kA	10kA	-	-				-			
E	260, 400	-	200kA	-	600	J	65kA	42kA	35kA	0.05	35kA	35kA	22kA	-				-			
J	150[7], 200[7], 230[7], 260, 400	150[7], 200[7], 230[7], 260, 400	200kA	200kA	600	J	50kA	50kA	42kA	0.05	65kA	42kA[6]	35kA	-				-			
J	600	600	200kA	200kA	800	L	50kA	50kA	42kA	0.05	65kA	42kA[6]	35kA	-				-			
H	600	600	200kA	200kA	800	L	65kA	65kA	65kA	0.05	50kA	50kA	50kA	36kA		-		36kA		-	
P	600	600	200kA	200kA	800	L	65kA	65kA	65kA	0.05	50kA	50kA	50kA	36kA		30kA		36kA		-	
P	800	800 - 1200	200kA	200kA	1600	L	65kA	65kA	65kA	0.05	50kA	50kA	50kA	36kA		30kA		36kA		-	
H	800 - 1200	800 - 1200	200kA	200kA	1600	L	65kA	65kA	65kA	0.05	50kA	50kA	50kA	36kA		-		36kA		-	
Q	600-1600	600-1600	200kA	200kA	2000	L	65kA	65kA	65kA	0.05	65kA	65kA	65kA	50kA				50kA			
S	800 - 1200	800 - 1200	200kA	200kA	2500	L	100kA	100kA	65kA	0.05	100kA	100kA	65kA	65kA				65kA			
G	1000 - 1200	1000 - 1200	200kA	200kA	2000	L	85kA	85kA	85kA	0.05	85kA	85kA	85kA	-				-			
G	1600 - 2000[4]	-	200kA	200kA	2500	L	85kA[4]	85kA[4]	85kA[4]	0.05	85kA[4]	85kA[4]	85kA[4]	-				-			
G	1600 - 2000	1600 - 2000	200kA	200kA	3000	L	125kA[5]	125kA[5]	100kA	0.05	100kA	100kA	100kA	42kA		-		42kA		-	
S	1600 - 2000	1600 - 2000	200kA	200kA	2500	L	100kA	100kA	85kA	0.05	100kA	100kA	85kA	85kA		65kA		85kA		65kA	
G	2600 - 3000	2600 -3000	200kA	200kA	4000	L	100kA	100kA	100kA	0.05	100kA	100kA	100kA	42kA		-		42kA6		-	
G	3200	-	200kA	-	4000	L	100kA	100kA	-	0.05	100kA	100kA	-	-				-			
G	4000	4000	200kA	200kA	5000	L	100kA	100kA	100kA	0.05	100kA	100kA	100kA	85KA		65kA		65kA			
U	2600 - 4000	2600 - 4000	200kA	200kA	5000	L	125kA[9]	125kA[9]	125kA[9]	0.06	125kA[9]	125kA[9]	125kA[9]	100kA				100kA			

Notes:
1) All WCR values indicated are tested in accordance with the requirements of UL 1008, 7th Edition. See ASCO Pub. 1128 for more WCR information
2) Application requirements may permit higher WCR for certain switch sizes.
3) Short Time ratings are provided for applications involving circuit breakers that utilize trip delay settings for system selective coordination
4) Optional front connected service (Accy 40MY and 40NY) limits WCR on 1600 and 2000A G Frame switches
5) Switches utilizing overlapping neutral (code "C") have 35kA, 0.050 Sec time based rating at 480V Max
6) 3000A ratings are for Transfer Switch configurations only
7) J150, 200, 230 Amp available in 7ACTS, 7ADTS, 7ASLS, & All 7000 Bypass Switches only
8) Rating shown is for Bypass switches only, Transfer Switch rating is 100kA
9) Service Entrance Switches rating is 100kA

Automatic Transfer Bypass-Isolation Switches



Fig. 5: Rated 150-600 Amps



Fig. 6: Rated 600- 1200 Amps

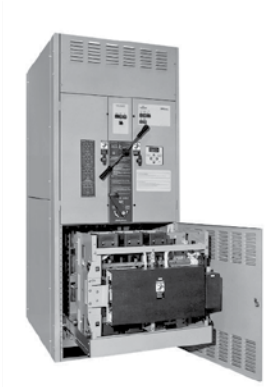


Fig. 7: Rated 800-3000 Amps



Fig. 8: Rated 4000 Amps

ASCO Automatic Transfer & Bypass-Isolation Switches are available in open transition, closed transition and delayed transition designs. The bypass and isolation features allow the primary automatic transfer switch to be inspected, tested, and maintained without any interruption of power to the load. They also provide redundant power transfer in the event the ATS is disabled or removed from service.

- Available 150 to 4000 Amperes.
- Allows bypass-isolation without load interruption.
- Bypass switch and transfer switch have identical electrical ratings.
- Heavy duty mechanical interlocks prevent undesirable operation.
- Bypass contacts carry current only during bypass mode.
- Transfer switch is drawout design for ease of maintenance.
- Bypass and isolation handles are permanently mounted. The bypass switch has dead front quick-make, quick-break operation for transferring of loads between live sources.
- Bypass switch is fully rated for use as a manual 3-position transfer switch.
- Bypass and isolation functions are simple, requiring a total of two operating handles.
- No toggle switches, push buttons, selector switches or levers are required for bypass-isolation operation.
- Mechanical indicators show bypass and transfer switch positions.
- 800 -1200 ampere available in shallow depth, front connected or rear connected designs.

Transfer Switch Drawout Features (150-4000 Amperes)

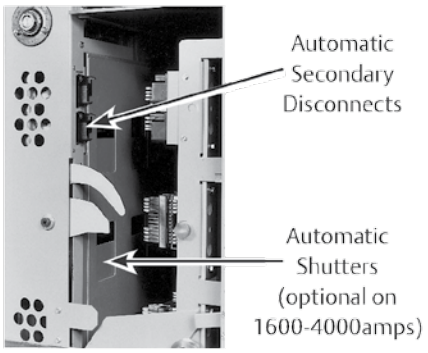


Fig. 9: Bypass-Isolation Transfer Switch secondary disconnects and optional automatic shutters.

- Automatic secondary disconnects remove all control power as switch is withdrawn.
- Drawout carriage provides for easy transfer switch maintenance and/or removal via commercially available breaker hoists.
- Optional transfer switch lifting yoke kit available
- Optional automatic shutters which close when the transfer switch is withdrawn to provide bus isolation, specify accessory 82C.(1600-4000A only)

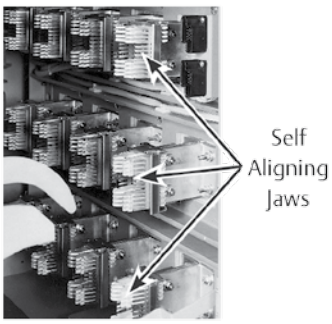


Fig. 10: Bypass-Isolation Transfer Switch self aligning power jaws.

Bypass and Isolation Handles - Simple as 1, 2, 3

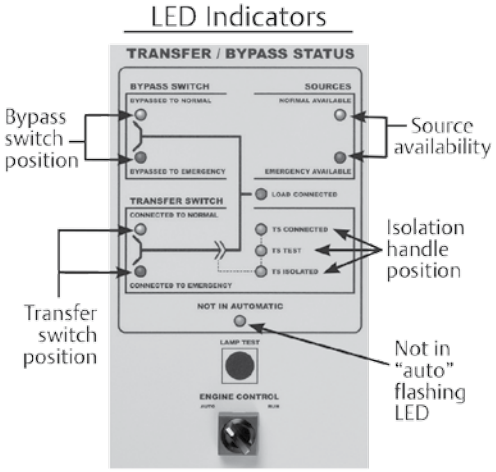


Fig. 11: Transfer Bypass Status Panel*

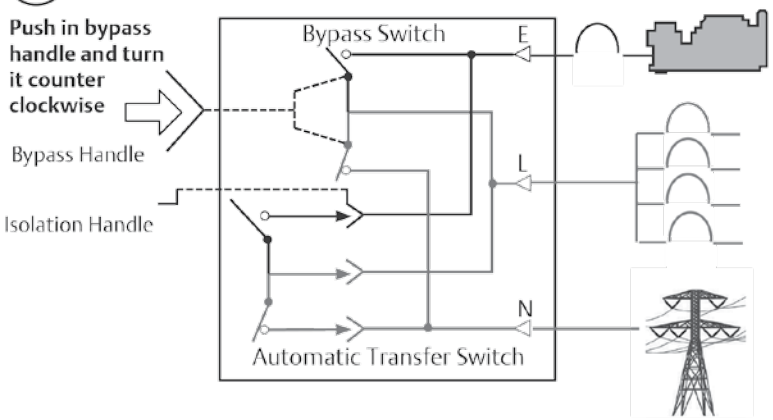
*Standard on switches up through H 1200A. Specify ACC 82E for G frame 1600-4000A



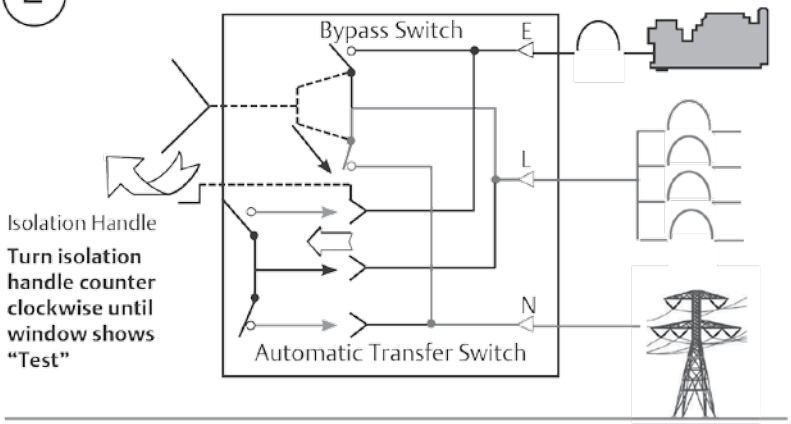
Fig. 12: Bypass-Isolation Switch user interface

1 Bypass to Normal

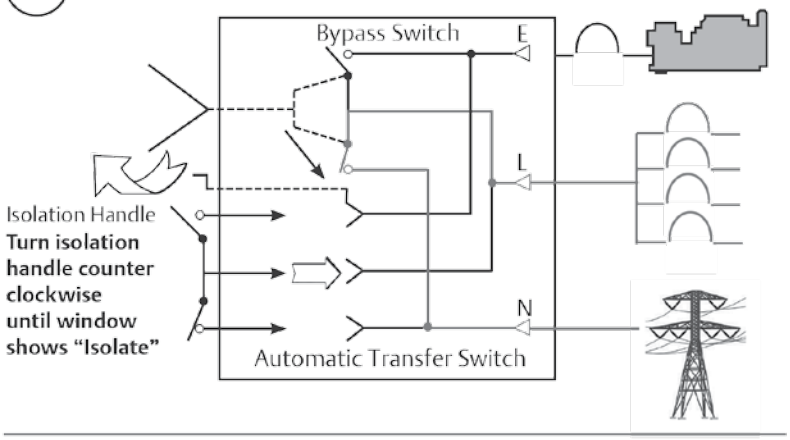
Push in bypass handle and turn it counter clockwise



2 Test Position



3 Isolation Position



Key:
- Represents Current Flow
- In test position control panel remains energized to allow for electrical operation of a transfer switch.

ASCO® 7000 Series Service Entrance Power Transfer Switches

The ASCO Service Entrance Power Transfer Switch combines automatic power switching with a disconnect and overcurrent protective device on the utility source. The power transfer switch meets all National Electric Code requirements for installation at a facility's main utility service entrance. Service entrance rated transfer switches generally are installed at facilities that have a single utility feed and a single emergency power source. A circuit breaker serves as the utility disconnect and links are provided to dis-connect both neutral and ground connections.

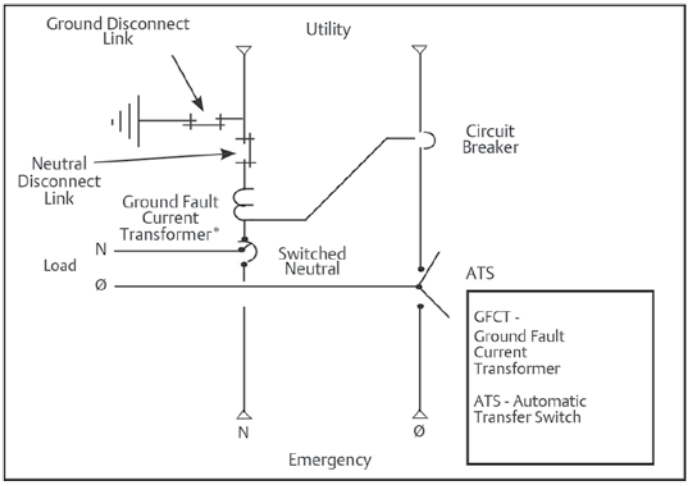
This product is either UL 1008 or UL 891 listed and is available up to 600V and 4000A in Standard, Delayed, Closed Transition, Soft Load, and Bypass Isolation Configurations.



Fig. 13: Ground and neutral disconnect links

Standard Features

- Available from 150 to 4000 Amperes
- ASCO 7000 Series Power Transfer Switch is UL 1008 Listed
- Standard UL Type 1 Enclosure
- Disconnect and overcurrent protective device on the utility source: molded case circuit breaker 150 to 2000 Amp; insulated case 3000 to 4000 Amp
- Disconnect link on Neutral
- Disconnect link on Ground
- Ground and Neutral Bus, all silver-plated copper
- Solderless screw type terminals for External Power Connections
- Meets all NEC requirements for use as service entrance
- Internet enabled monitoring and control
- Service entrance breakers are rated: - 100% for 1000 Amps and above; 80% below 1000 Amps for all bypass switches - 100% for 2500 Amps and above; 80% below 2500 Amps for all standard transfer switches



One line diagram of a typical service entrance rated transfer switch available in Solid, Switched or Overlapping Neutral
* Ground fault trip protection provided on sizes of 1000 Amperes and above

Optional Features

- Enclosures - Secure Double Door
  - UL Type 3R w/strip heater & thermostat
  - UL Type 4 or 4X
  - UL Type 12
- Connections
  - Crimp lugs
  - Bus Riser on Normal, Emergency or Load
- Protective Relays/Metering
  - Accessory 85L , see page 15
- Surge Suppression
  - Accessory 73, Surge protector (see pg. 14)
- ASCO POWERQUEST® products (see pages 16-21)
  - ASCO 72E Ethernet Connectivity module, page 17
  - ASCO 5310/5350 Remote annunciators, page 17
  - ASCO 5400 Power Quality Meters, page 17
- Additional Breaker(s)
  - Circuit Breaker on Emergency
  - Load Distribution Panel
- Optional high AIC ratings on breakers

Consult ASCO for additional features

ASCO® 7000 Series Service Entrance Power Transfer Switches

Ordering Information

To order an ASCO 7000 Series Service Entrance Power Transfer Switch, complete the following catalog number.

7 A US + A + 3 + 400 + N + 5X + C

	Product	Neutral Code*	Phase Poles	Amperes	Voltage Code	Grp Code	Enclosure
A Automatic N Non-Automatic	US Conventional 2-Position UB Open Transition Bypass CUS Closed Transition CUB Closed Transition Bypass DUS Delayed Transition DUB Delayed Transition Bypass	A Solid Neutral (standard) B Switched Neutral C Overlapping Neutral	2 3	70, 100 150, 200 225, 250 400, 600 800,1000 1200,1600, 2000,2500, 3000 4000	C 208 D 220 E 230 F 240 H 380 J 400 K 415 L 440 M 460 N 480 P 550 Q 575 R 600	5 5X- optional accessories	C Type 1 enclosure M Type 3R secure double door N Type 4 secure double door P Type 4X secure double door (316 SS) Q Type 12 secure double door S Type 4X secure double door (304 SS)

*Note: Switches rated 150-4000 amps available with 2, 3 or either conventional switched neutral 4 pole (B3) or optional overlapping neutral (C3). For 4 pole applications on E7AUS, and E7NUS switch sizes 250 and 400 amps specify optional overlapping neutral (C3).

The Example Catalog Number above is 7AUSA3400N5XC (X is used to specify optional accessories).

Dimensions and Weights for non-bypass configurations

Type 1 and 3R Enclosures[4]

Frame	Switch Amp Ratings	Type 1 Dimensions, In. (mm)			Approx. Shipping Weight Lb. (kg)
		Width	Height	Depth	
D	70, 100, 150, 200, 225 7AUS/7NUS Only	36.5 (927)	48.5 (1232)	13.25 (337)	490 (226)
J	250, 400	38 (965)	91 (2311)	28 (711)	880 (407)
J	150, 200, 225 7ADUS/7NDUS and 7ACUS/7NCUS only	38 (965)	91 (2311)	28 (711)	880 (407)
J	600[1]	38 (965)	91 (2311)	28 (711)	980 (452)
H	800[1]	38 (965)	91 (2311)	28 (711)	1280 (590)
H	1000[1]	38 (965)	91 (2311)	48 (1219)	1280 (590)
H	1200[1]	38 (965)	91 (2311)	48 (1219)	1480 (683)
G	1600[1], 2000[1]	38 (965)	91 (2311)	48 (1219)	2890 (1333)
G	2500[1], 3000[1]	38 (965)	91 (2311)	72 (1829)	5200 (2400)

Frame	Switch Amp Ratings	Type 3R Dimensions, In. (mm)			Approx. Shipping Weight Lb. (kg)
		Width	Height	Depth	
D	70, 100, 150, 200, 225 7AUS/7NUS Only	36 (914)	48 (1219)	16 (406)	540 (249)
J	250, 400	41 (1041)	95½ (2426)	33 (838)	1880 (544)
J	150, 200, 225 7ADUS/7NDUS and 7ACUS/7NCUS only	41 (1041)	95½ (2426)	33 (838)	1880 (544)
J	600[1]	41 (1041)	95½ (2426)	33 (838)	1280 (590)
H	800[1]	41 (1041)	95½ (2426)	33 (838)	1480 (683)
H	1000[1]	41 (1041)	95½ (2426)	62 (1575)	1480 (683)
H	1200[1]	41 (1041)	95½ (2426)	62 (1575)	1940 (895)
G	1600[1], 2000[1]	41 (1041)	95½ (2426)	62 (1575)	2990 (1379)
G	2500[1], 3000[1]	41 (1041)	96 (2437)	85 (2159)	5300 (2444)

System Short Circuit Rating 7AUS/7ACUS/7ADUS

Switch Amp Ratings	@480V
70 - 225	22,000
250, 400	35,000
600	50,000
800	65,000
1000, 1200	50,000
1600, 2000	65,000
2500, 3000	100,000
4000	100,000

System Short Circuit Rating 7AUB/7ACUB/7ADUB

Switch Amp Ratings	@480V
150 - 400	35,000
600	50,000
800	65,000
1000, 1200	85,000
1600, 2000	100,000
2500, 3000	100,000
4000	100,000

Notes: 1. Unit is designed for top and bottom cable entry for all services and load.
2. Enclosures for 600 – 3000 amps are free standing.
3. When temperatures below 32°F can be experienced, special precautions should be taken, such as the inclusion of strip heaters, to prevent condensation and freezing of this condensation. This is particularly important when environmental enclosures (Type 3R, 4 & 12) are ordered for installation outdoors. Type 3R enclosures are not suitable for installations conducive to windblown snow or rain conditions.
4. Dimensional data is approximate and subject to change. Certified dimensions available upon request. Type 3R enclosures are not suitable for installations conducive to windblown snow or rain conditions.
5. A comprehensive ASCO Limited Guardian Warranty covers 7000 Series Power Transfer Switch(s) and warranties the product to be free of defects in material and workmanship from date of shipment. The warranty provides:

- 2 years for labor and travel expenses (extendable in 1 year increments up to 5 years for a nominal fee).
- 5 years for parts (2 years for circuit breakers).
- 10 years for main contacts.

Refer to Publication *3221* for warranty details, terms and conditions.



Fig. 14: 7000 Series Microprocessor Controller.

The 7000 Series Microprocessor Based Controller is used with all sizes of Power Transfer Switches from 30 through 4000 Amperes. It represents the most advanced digital controller in the industry and includes, as standard, all of the voltage, frequency, control, timing and diagnostic functions required for most emergency and standby power applications.

Because of severe voltage transients frequently encountered with industrial distribution systems, the microprocessor logic board is separated and isolated from the power board as shown below. This improves electrical noise immunity performance and helps assure compliance with the rigorous transient suppression standards highlighted below.

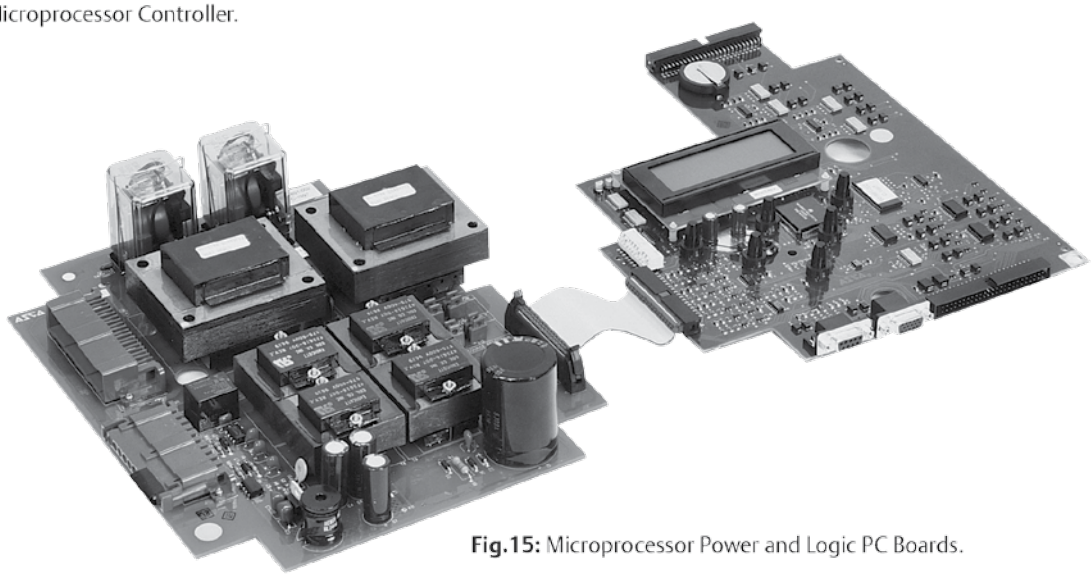


Fig.15: Microprocessor Power and Logic PC Boards.

7000 Series Microprocessor Based Controller	
Emission Standard - Group 1, Class A	EN 55011:1991
Generic Immunity Standard, from which:	EN 50082-2:1995
Electrostatic Discharge (ESD) Immunity	EN 61000-4-2:1995
Radiated Electromagnetic Field Immunity	ENV 50140:1993
Electrical Fast Transient (EFT) Immunity	EN 61000-4-4:1995
Surge Transient Immunity	EN 61000-4-5:1995
Conducted Radio-Frequency Field Immunity	EN 61000-4-6:1996
Voltage Dips, Interruptions and Variations Immunity	EN 61000-4-11:1994

Features

- Digital microprocessor.
- Touch pad programming of features and settings without the need for meters, or variable power supplies.
- Sixteen (16) selectable operating voltages available in a single Controller.
- On-board diagnostics provide control panel and ATS status information to analyze system performance.
- Displays and counts down active timing functions.
- Selectable multi-language display (English, German, Portuguese, Spanish, or French. For others contact ASCO).
- Password protection to prevent unauthorized tampering of settings.
- Remote monitoring and control with ASCO POWERQUEST® communications products. Specify optional accessory 72E.
- Load shed option for bus optimization applications. Specify optional accessory 30B.
- Historical event log
- Statistical ATS systems monitoring information

Voltage and Frequency Sensing

- 3-Phase under and over voltage settings on normal and emergency sources.
- Under and over frequency settings on normal and emergency.
- True RMS Voltage Sensing with +/- 1% accuracy; Frequency Sensing Accuracy is +/- 0.2%.
- Selectable settings: single or three phase voltage sensing on normal and emergency; 50 or 60Hz.
- Phase sequence sensing for phase sensitive loads.
- Voltage unbalance detection between phases.

Status and Control Features

- Output contact (N/O or N/C) for engine-start signals.
- Selection between "commit/no-commit" on transfer to emergency after engine start and normal restores before transfer.
- Advanced inphase algorithm which automatically measures the frequency difference between the two sources and initiates transfer at appropriate phase angles to minimize disturbances when transferring motor loads.
- Event log displays 99 logged events with the time and date of the event, event type and event reason.
- Output signals for remote indication of normal and emergency source acceptability
- Statistical ATS/System monitoring data screens which provide:
  - Total number of ATS transfers.
  - Number of ATS transfers caused by power source failure.
  - Total number of days ATS has been in operation.
  - Total number of hours that the normal and emergency sources have been available.

Time Delays

- Engine start time delay - delays engine starting signal to override momentary normal source outages - adjustable 0 to 6 seconds.
- Transfer to emergency time delay - adjustable 0 to 60 minutes.
- Emergency source stabilization time delay to ignore momentary transients during initial generator set loading - adjustable 0 to 6 seconds.
- Retransfer to normal time delay with two settings:
  - Power failure mode - 0 to 60 minutes.
  - Test mode - 0 to 10 hours.
- Unloaded running time delay for engine cool down - adjustable 0 to 60 minutes.
- Pre and post transfer signal time delay for selective load disconnect with a programmable bypass on source failures - adjustable 0 to 5 minutes. This signal can be used to drive a customer furnished relay, or for (2) sets of double throw contacts rated 3 amps at 480 volts AC, specify ASCO optional accessory 31Z.
- Fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without loads, on a daily, weekly, bi-weekly or monthly basis.
- Contains all alarm signals, logic and time delays for use with closed transition switches.
  - In synch time delay - 0 to 3 seconds.
  - Failure to synchronize - 1 to 5 minutes.
  - Extended parallel - 0.1 to 1.0 seconds.
- Delayed transition load disconnect time delay - adjustable 0 to 5 minutes.

ASCO® 7000 Series User Controls and Indicators

Control Switches and Indicating Lights for Conventional 2-Position Switches

- Switch position indicating lights (16 mm, industrial grade LEDs).
- Source acceptability indicating lights with true indication of the acceptability of each source, as determined by the voltage, frequency, voltage unbalance, and phase sequence settings of the control panel (16mm, industrial grade LEDs).
- Three position (16mm, industrial grade type) selector switch:
- Automatic: Normal maintained position.
- Test: Momentary position to simulate normal source failure for system test function.
- Reset Delay Bypass: Momentary position to bypass transfer and re-transfer time delay.

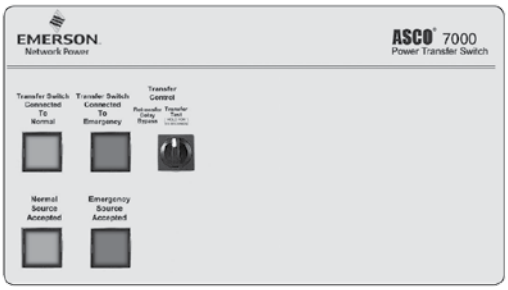


Fig. 16: 7000 Series User Controls and Indicators.

Control Switches and Indicating Lights for Closed Transition Switches

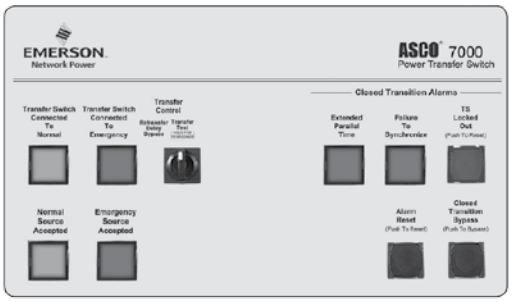


Fig. 17: 7000 Series User Controls and Indicators.

- Extended Parallel Time - Provides visual indication when the pre-set extended parallel time has been exceeded. The controls automatically open the emergency or normal main contacts. Separate contact also available to shunt trip external breaker.
- Failure To Synchronize - Visually displays a failure to synchronize alarm if the time delay settings is exceeded, during closed transition transfer operation.
- TS Locked Out - Prevents transfer in either direction if the extended parallel time is exceeded.
- Alarm Reset - Resets extended parallel and failure to synchronize alarms.
- Closed Transition Bypass - Pushbutton allows transfer between sources in an open transition mode.

7000 Series Power Control Center



Fig. 18: 7000 Series Power Control Center.

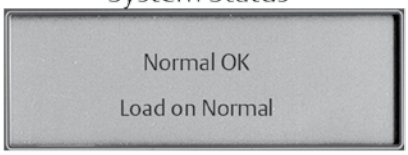
The 7000 Series microprocessor controller is a Power Control Center which allows the user to easily access detailed information on: system status; power source parameters; voltage, frequency and time delay settings; optional feature settings; historical event log; and system diagnostics. A four line, (20) character LCD has a backlit display which enables easy viewing under all conditions. The user can navigate through all screens using only six buttons, which also allows selection of: (18) different source parameter settings; (16) standard time delays; (12) standard feature settings; up to seven independent engine exercise routines; and even the language (English, German, Spanish, French, etc.) which appears on the display.

Since the Power Control Center must be visible and operable through the enclosure door, it has been qualified for use in industrial and outdoor applications. This includes installation in Type 3R (outdoor/rainproof), 4 (weatherproof) and 12 (indoor/industrial) enclosures. For applications with regular exposure to direct sunlight a double door for UV protection is recommended.

ASCO® 7000 Series Power Control Center Screens

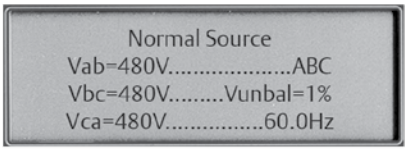
Status

System Status



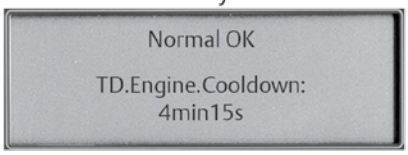
Displays system status in clear, concise language. Message shown indicates normal source is acceptable and the load is connected to the normal source.

Source Status



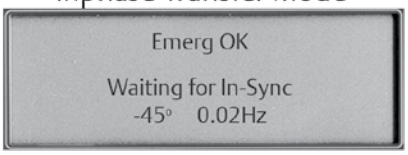
Displays voltage for each phase, frequency, phase rotation and voltage unbalance for both normal and emergency sources.

Time Delay Status



Active time delay status displays time remaining until next control event.

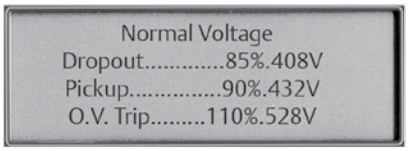
Inphase Transfer Mode



Displays the relative phase angle between sources and frequency differential to indicate the controller is awaiting an inphase condition.

Settings

Voltage and Frequency Settings



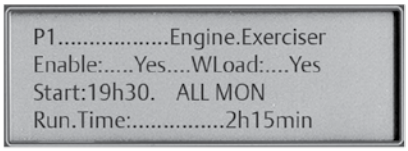
Provides voltage and frequency setting values for normal and emergency sources. Voltage pick-up, dropout and trip settings are set in percentage of nominal voltage and are also displayed in rms voltage values.

Time Delay Settings



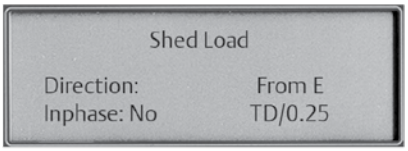
Provides direct reading display for setting time delays.

Engine Exerciser



Seven independent programs, load/no load selection, flexible run times and daily, weekly, bi-weekly and monthly exercise routines.

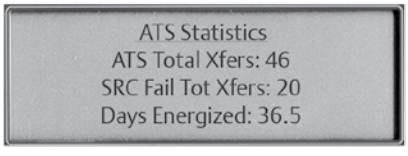
Feature Settings



Standard features can be activated with the keypad. As an example, when enabled, the "shed load" option causes the transfer switch to transfer the load off of the specified source. If desired, the load shed transfer can be made inphase.

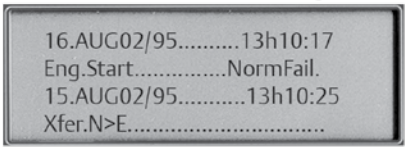
Data Logging

ATS Statistics



Instant availability of statistical information on total number of ATS transfers, number of transfers caused by power failures and total days controller has been energized, plus more.

Historical Event Log



Displays detailed information for last 99 events, including time of occurrence, length of event, date and reason for event.

ASCO® 7000 Series Optional Accessories

Time Delays

2C Provides an extended time delay on engine starting. The standard feature one time delay is adjustable from zero to six seconds. Accessory 2C allows this time delay to be adjustable from zero to sixty minutes in one second intervals factory set at five minutes.

1G Similar to accessory 2C except using 24 volt DC external input signal. 7000 Series controller remains active when both power sources are de-energized*

1GB Same as accessory 1G except using 120 volt AC external input*

* add suffix 1 to include external power to power manager or power meter when applicable

Manual Controls for Automatic Transfer Switches

6C Reset switch for manual retransfer to normal with automatic retransfer in the event of emergency source failure.

6D Selector switch for automatic/manual retransfer to normal. Automatic bypass if emergency fails.

Indicators

14A/14B Additional auxiliary contact sets to indicate switch position. Two sets are standard. Specify total number of sets if more are required.

18B Two-pole, double-throw contacts operate when emergency source voltage is present at transfer switch terminals.

18G Two-pole, double-throw contacts operate when normal source voltage is present at transfer switch terminals.

99 "Push-to-Test" feature on all pilot light indicators.

Customer Control Circuits

30A Load-shedding circuit initiated by opening of a customer-supplied contact.

30B* Load-shedding circuit initiated by removal of customer-supplied control voltage. *(Specify voltage).

31Z Selective load disconnect control contacts (two provided) which operate with time delay prior to and/or after load transfer and retransfer.

43R Terminal block for all customer control connections on 30-150 amp only (standard on all other sizes).

Note: An externally operable quick-make, quick-break (QMQB), manual handle is available on some 7000 Series product configurations. (Consult ASCO for guidance.)

Neutral Conductor Options

- Solid neutral, with fully-rated terminals. (AL-CU) UL Listed.
- Conventional neutral switching pole.
- Overlapping neutral transfer contacts. Allows for proper ground-fault sensing and avoids generator voltage transients during transfer.

Note: Specify neutral option in catalog number, see page 22 for instructions.

Extension Harness

37B Six foot (6') extension harness to increase distance between transfer switch and control panel on open-type units.

Communications

72E 5150 Ethernet Connectivity Module offers communication to transfer switch and metering with embedded web pages.

72SW An Industrial Ethernet Switch mounted in the enclosure used in conjunction with 5150 Connectivity Module (acc. 72E) metering device. Includes 2 available Ethernet ports and 2 multimode ST Fiber connectors.

Surge Protection

ASCO Pulsar 450 rated 65KA

73AC1 Normal source protection. (3Ø, 4wire WYE)
73AC2 Emergency source protection. (3Ø, 4wire WYE)
73AC3 Load side protection. (3Ø, 4wire WYE)

Note: Other distribution voltages available (Contact ASCO).

Special Applications

45 Custom Alphanumeric nameplate mounted on the front of the switch

111A Generator - to - Generator for Standby Applications

111B Generator - to - Generator for Prime Power Applications

125 Seismic Certification to the requirements of the international building code for electrical equipment

131 Certification of compliance with the American Recovery & Reinvestment ACT (Buy American Provision) - Must be specified at time of order placement

Bypass-Isolation Switch Options

14A1 Auxiliary contact to close in "Bypass to Normal" position.

14B1 Auxiliary contact to close in "Bypass to Emergency" position.

14T Auxiliary contact to close when transfer switch is in "Automatic" position.

14U Auxiliary contact to close when transfer switch is in "Isolate" position.

14V Auxiliary; contact to close when transfer switch is in "Test" position.

82C Automatic shutters for bus isolation when transfer switch is withdrawn. (see page 6 for details)

82E LED Bypass status indicator, optional on G frame 1600A-4000A only. Standard for all other size switches

ASCO 5200 Series Metering Power Manager

The ASCO 5200 Series Power Meters are microprocessor based metering devices that provides real-time measurement of single and three phase power systems. The 5200 Series uses digital signal processing technology to measure voltage and current per phase; real, reactive and apparent power, and bi-directional energy. All measurements can be viewed locally with a backlit liquid crystal display and/or displayed remotely with ASCO POWERQUEST® products.

Direct voltage input for systems up to 600 Volts AC can be monitored without the use of external potential transformers (PTs). Measures three phase currents and a fourth current input is available for measuring current in the neutral conductor. The 5200 Series includes one discrete input for transfer switch position.

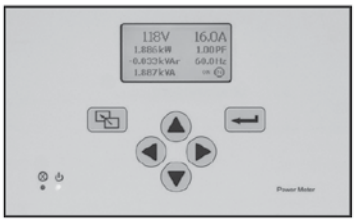


Fig. 19: ASCO 5210 Series Power Meter.



Fig. 20: ASCO 5220 Series Power Manager.

Power Metering

- Voltage:
  Line - Line: VAB, VBC, VCA, VAVERAGE
  Line - Neutral: VAN, VBN, VCN, VAVERAGE
- Frequency: 45.0 to 66.0 Hertz
- Current: IA, IB, IC, IAVERAGE
- Unbalance %: Voltage, Amps
- Real Power: KWA, KWB, KWC, KWNET
- Reactive Power: KVARA, KVARB, KVARC, KVARNET
- Apparent Power: KVAA, KVAB, KVAC, KVANET
- Real Energy: KWHIMPORT, KWHEXPORT, KWHNET
- Reactive Energy: KVARHIMPORT, KVARHEXPORT, KVARHNET
- Power Factor: PFA, PFB, PFC, PFNET

5220 Power Manager Data Access

- Eight digital inputs, four relay outputs.
- Input/Output 15-character, user definable screen display for identification of input/output signals.

Communications

- Modbus RTU and TCP/IP capability
- Ethernet compatible when combined with 5150 Connectivity Module (72E).

Configurable Designations

- Local - A four line, 20 character LCD backlit display.
- 5220 Power Manager provides user programmable setpoints based on twelve metering and I/O parameters. Each setpoint allows the user to select the parameter, the trip & reset levels, the trip & reset time delays and the alarm type or relay output to trigger. This can be used for protective relaying and peak shaving applications.
- 100 event data logging feature.

Integrated ATS Features

When configured on load of ATS:

- Displays ATS position.
- Displays power data as a function of ATS position (normal/emergency).
- Accumulates energy data separately for normal and emergency sources.

Optional Configurations and Connection Arrangements

Connected To:	5210	5220
Load	Acc. 135L	Acc. 85L
Normal	Acc. 135L	Acc. 85N
Emergency	Acc. 135E	Acc. 85M
Load (BPS only)	N/A	Acc. 85SB*

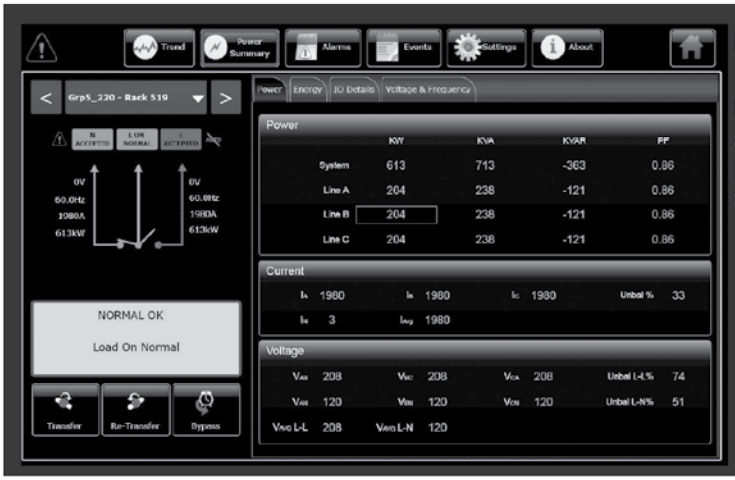
Add suffix A1 to above metering designation if neutral conductor monitoring is required

Note: Accessory 85L and 135L includes component mounting, CTs, shorting blocks and all necessary interwiring.

**Bypass & isolation switch contacts wired to discrete Power Manager inputs.*

Note: The ASCO Power Manager is also available as a separate unit for monitoring electrical parameters anywhere in the power distribution system.

ASCO® PowerQuest® Power Monitoring and Control Systems



FULFILL YOUR NEED

Drill down for a closer look - Each transfer switch, generator, breaker and any other power equipment has its own dedicated screens.

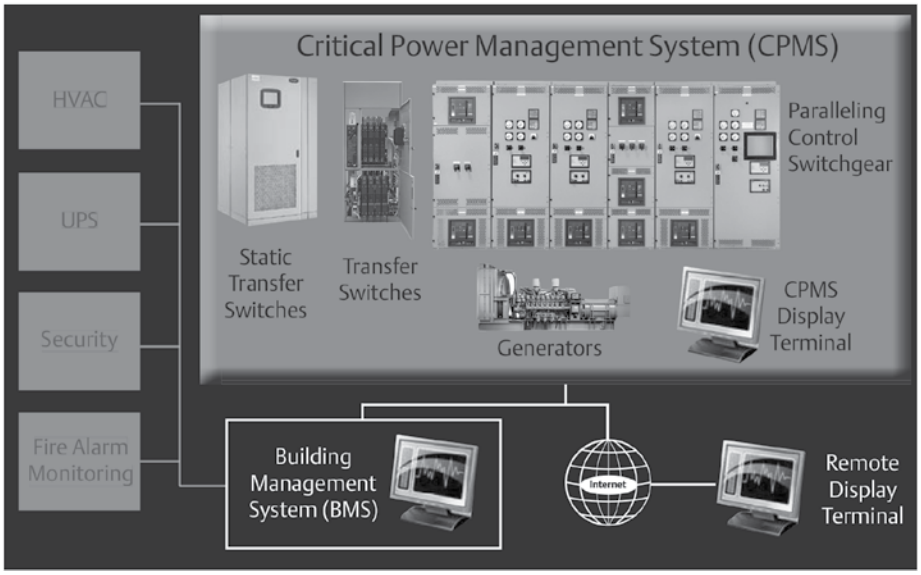
It's the new ASCO PowerQuest® Power Monitoring and Control family.

The PowerQuest® family is the most comprehensive communication, monitoring and control solution ever offered by ASCO. It empowers you. It fulfills your need to test, manage loads, optimize the bus bar, remotely monitor and otherwise be aware of the status of your facility's utility source and on-site power. You have both the Power to Know and the Power to Do.

Whether you require standard monitoring and control, or a comprehensive Critical Power Management System, PowerQuest can satisfy your needs.

Hardware. Software. Installation and testing. Service. And upgrades and technology refreshes. A truly complete solution for all your communication, monitoring and control needs.

The following PowerQuest® pages can help you determine—easily— the type of PowerQuest system you need for your ASCO power switching and controls, and third-party equipment.



PowerQuest® provides monitoring, alarming and control of Critical Power Management Systems, which comprise transfer switches, paralleling control switchgear, gensets, circuit breakers, distribution and other gear. It also integrates with building management systems.

BE EMPOWERED

PowerQuest® can enable you to:

- **Monitor and control power transfer switches, paralleling control switchgear, gensets, breakers, bus bars and other equipment**
- **Monitor normal and emergency voltages and frequency and their settings**
- **Know transfer switch position and source availability**
- **Transfer and re-transfer loads for system testing**
- **View and adjust transfer switch time-delay settings**
- **Know each transfer switch's rating and identification**
- **Receive automatic alerts on system operation via e-mail, pager, or selected system alarms**
- **View current, power and power factor**
- **View transfer switch event log and know the transfer switch test schedule**

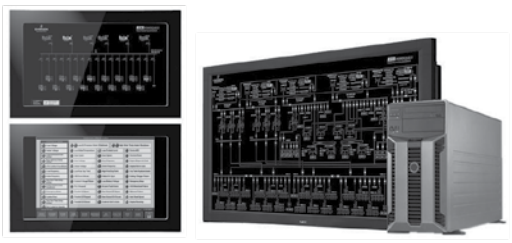
ASCO® 7000 SERIES PowerQuest Monitoring & Control

The Power To Know

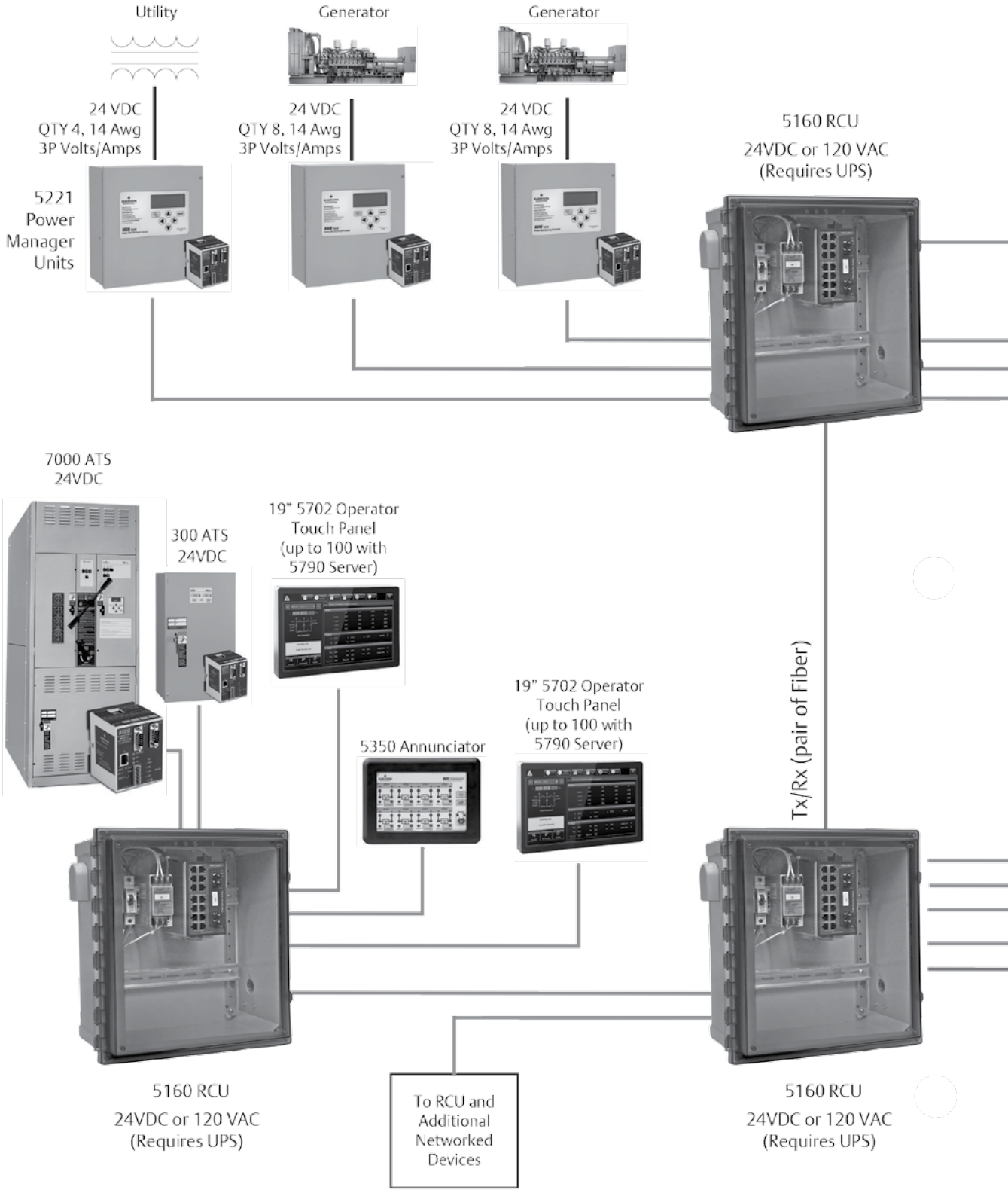
Selecting the system that provides your level of need-to-know information and control...

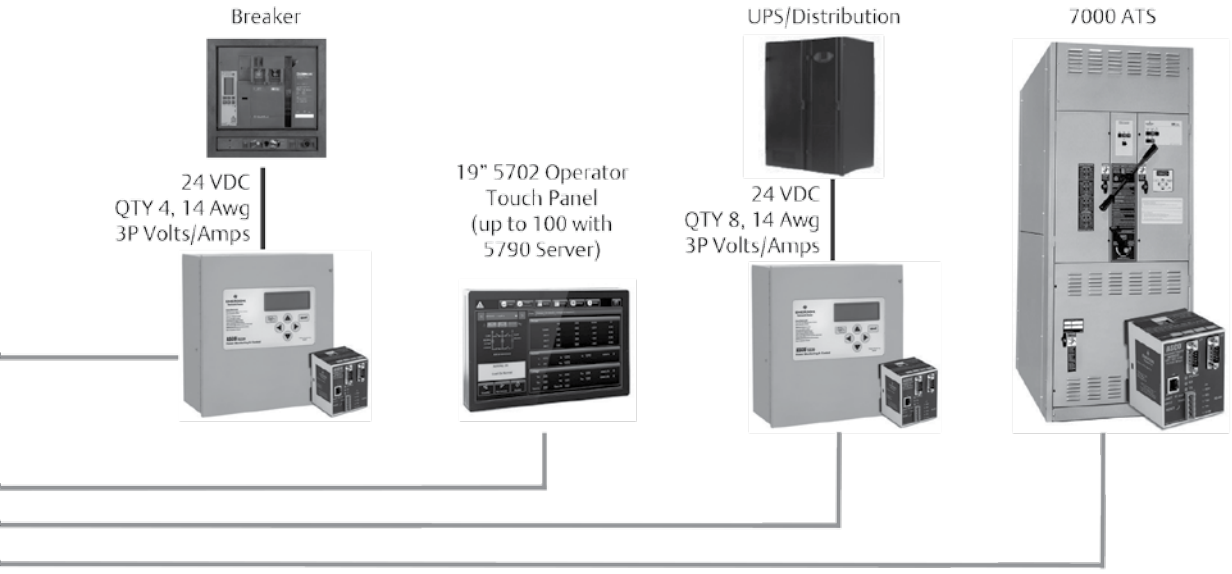
	You Need...	Your Application Is...	Desired Capabilities
PowerQuest Standard Capabilities	Basic monitoring, remote alarming and control, or, if you simply want to know transfer switch status or perform monthly transfer testing	Residential, light commercial and retail establishments	Local or remote, floor-level monitoring and control, or as part of a larger, facility-wide monitoring and control system
PowerQuest Configurable Flexibility Essential / Professional / Enterprise	A 'specify-your-own' Critical Power Management System (CPMS) that includes gensets, circuit breakers, and reports on energy, trending, power demand, bypass status, diagnostics, alarming, and component-level monitoring and control.	Commercial, retail, telecom, agriculture, municipal, such as waste water treatment, light industrial plants, educational campuses and healthcare facilities requiring distributed power and load management	Local, floor-level, or facility-level monitoring and control; 5700 systems can be configured in three capability levels: • Essential (single building) • Professional (multiple buildings, single campus) • Enterprise (multiple campuses)
PowerQuest Ultimate Customization	A Critical Power Management System providing system-wide monitoring, alarming and control of transfer switches, paralleling control switchgear, gensets and distribution, both on and off site; also integrates PLCs, building management systems and on-site, simulator training. Power quality and a range of other information is provided.	Regional and global networks of data centers, financial institutions, Web hosting companies and healthcare campuses that operate expansive and sophisticated on-site power systems that are essential for providing 24/7 power reliability	Local floor-level monitoring and control, and remote system-wide monitoring and control seamlessly integrated with building management systems; communication paths can be Ethernet, Web-based PC's and monitors; simulator training that mimics the live system allows conducting 'what if' scenarios, without risking system operation.

Identifies the ASCO products and components required to provide the functionality you need.

Products	Required Components	Functionality
ASCO Series 185 and Series 300 Automatic Transfer Switches	Connectivity Modules and Annunciators 	Locally monitor switch position, source availability and the status of on-site power system devic-es via customized Web page. Initiate tests and push-button remote transfer. Aural, visual alarms.
ASCO 4000 Series and 7000 Series Automatic Transfer Switches, including 7000 Series Bypass-Isolation	Standard components, plus Power Control System Management and Operator Interface Terminals 	Monitor voltage and phase currents. Capture/store more data points. Display data on screen up to 42" inches. Interface with power control system, BMS. Integrate with Group 5 Controller. Get email alerts. For single buildings, single campuses and global facilities. Provides Energy, Alarm, and Outage/Test Reports that can be used to fulfill Joint Commission Requirements.
ASCO 7000 Series Automatic Transfer Switches, including Bypass-Isolation and 7000 Series Generator Paralleling Control Switchgear	Standard and Configurable components, plus higher performance Power Control System and Data Management Screens, and an on-site Simulator Training System 	Interact fully with incoming utility service boards, mission critical paralleling gear, transfer switches, UPSs, STSs and PDUs... and interface with Building Management Systems. Capture, store and analyze quantities of data to optimize on-site power operation. Use your display devices and/or ASCO 42" LCD screen. Highly customize your GUI with sophisticated HMI/ SCADA software.

ASCO® PowerQuest® 5700 Critical Power Management System







5350 Annunciator
ATS Status Annunciation
Transfer Test
Supports 8 ATS's
24VDC/120VAC/220VAC



5710 CPMS Server
- Drives 3 Remote 5702 Panels
- Supports 32 Power Devices
- Basic Monitoring and Control
- Standard Performance

5700 CPMS Servers
Note - Select One Server to install in Centralized Office
50° to 95°F (10°C to 35°C)



5750 CPMS Server
Essential Features PLUS:
- Drives 10 Remote 5702 Panels
- Supports 64 Power Devices
- Historical Trending
- 5 Reporting Packages
- BMS Modbus Support
- Remote E-Mail Alarming



5790 CPMS Server
Professional Features PLUS:
- Drives 100 5702 Touch Panels
- Redundant Power
- Redundant Storage
- Redundant Processors
- Ultimate Performance
- 128 Power Devices
- Expanded Storage
- Inter-facility Messaging

To RCU and Additional Networked Devices

AWG Wire Size and Distance by others
Category 6 Ethernet (300 Feet Max)
Multi-Mode Fiber, 1300nm, 50/125um, ST Connectors (6500) Feet Max

NOTES -
1. This Drawing is to be used as a Model only; Actual network architecture will depend on equipment placement, cable length and type.
2. 5700 Series Products Operating Temperature is 50° to 95°F (10°C to 35°C) For altitudes above 2950 feet, the maximum operating temperature is derated 1°F/550 ft.

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ASCO® 7000 Series PowerQuest® Monitoring & Control Components

Building-block components can be configured easily to provide exactly the degree of monitoring, control and communication you want for your on-site power system.

5150, 5160 Connectivity Modules





An ASCO 5150 Connectivity Module (left) provides 100 Mbps Ethernet Connectivity for ASCO Transfer Switches and Power Meters and includes AES 128-bit Encryption, as per NIST, for enhanced security.

The ASCO 5160 Remote Connectivity Unit (RCU) (right) provides 10 Ethernet and Dual-Fiber Optic connections in a NEMA 3R enclosure.

5210, 5220 Power Meters





ASCO 5210 (left) and 5220 (right) Power Meters measure, displays and provides single- or 3-phase Energy and Power information with Ethernet via the ASCO 5150 Communication Module.

5310, 5350 Annunciators





ASCO 5310(left) and 5350(right) ATS Remote Annunciators provide distributed monitoring of transfer switch position and source availability as well as transfer test and re-transfer control.

Note: On the 7000 Series Non-Automatic Transfer Switch, the Remote Annunciator (5350) will provide switch status but not control.

5010 Remote Display Unit,(left) 5490 Critical Power Quality Meter, (right)





ASCO 5400 Series Power Quality Meters
The ASCO Power Quality Meters provide intelligent power analysis, energy measurement and event recording for critical and sensitive loads. Its unique continuous waveform and harmonic recording capabilities ensure all events are captured, improves response time, and helps identify corrective action to power quality related issues.

Enterprise Critical Power Management System



5700 Series provide various levels of monitoring, control and management capability of power equipment. It seamlessly monitors ASCO transfer switches as well as generators, breakers, paralleling bus, panel boards and other power equipment via a 5221 PMU. It consists of servers and touch screen interfaces.

ASCO® 7000 Series Ordering Information

To order an ASCO 7000 Series Power Transfer Switch, complete the following catalog number:

7 ___A___ + ___TS___ + ___A___ + ___3___ + ___400___ + ___N___ + ___5X___ + ___C___

		Product		Neutral Code*		Phase Poles	Amperes	Voltage Code		Grp Code	Enclosure	
A	Automatic	TS	Conventional 2-Position	---	No Neutral	2	30	A	115	5	---	No enclosure
		TB	Open Transition Bypass	A	Solid Neutral	3	70	B	120	5X- optional accesso-ries	C	Type 1 enclosure
N	Non-Automatic	CTS	Closed Transition				100	C	208		F	Type 3R[3] enclosure
		CTB	Closed Transition Bypass	B	Switched Neutral		150	D	220		G	Type 4 enclosure
M	Manually Operated	DTS	Delayed Transition	C	Overlapping Neutral		200[1]	E	230		H	Type 4X[2] enclosure (304 stainless steel)
		DTB	Delayed Transition Bypass				230[1]	F	240		L	Type 12 enclosure
							260	H	380		M	Type 3R[3] secure double door
							400	J	400		N	Type 4 secure double door
							600	K	415		P	Type 4X[2] secure double door (304 stainless steel)
							800	L	440		Q	Type 12 secure double door
							1000	M	460		R	Type 3RX[2] secure double door (304 stainless steel)
							1200	N	480		U	Type 4X enclosure (316 stainless steel)
							1600	P	550		V	Type 4X secure double door (316 stainless steel)
							2000	Q	575			
							2600	R	600			
							3000					
							4000					

*Notes: 1. 200 and 230 amp switch limited to 480 volts maximum.
2. Type 304 stainless steel is standard. To provide an improved reduction in corrosion in salt or marine environments, specify optional type 316 stainless steel.
3. Type 3R enclosures are not suitable for installations conducive to windblown snow or rain conditions.
4. Conventional switch neutral is provided on closed and delayed transition transfer products when specified.

5. A comprehensive ASCO Limited Guardian Warranty covers 7000 Series Power Transfer Switch(s) and warranties the product to be free of defects in material and workmanship from date of shipment. The warranty provides:

- 2 years for labor and travel expenses (extendable in 1 year increments up to 5 years for a nominal fee).
- 5 years for parts (2 years for circuit breakers).
- 10 years for main contacts.

Refer to Publication 3227 for warranty details, terms and conditions.

The Example Catalog Number above is 7ATSA3400N5XC
(X is used to specify optional accessories).

Transfer Switch Configurations

7ATS, 7NTS, 7ADTS, 7ACTS, 7NDTS, 7NCTS

Sizes of UL-Listed Solderless Screw-Type Terminals for External Power Connections

Switch Rating amps	Max # of Conductors per Terminal	Range of AL-CU Conductor Sizes
30 - 230[3] ATS & NTS Only	One	#14 to 4/0 AWG
150*, 260, 400 *150 for CTS and DTS Only	One	#4 AWG to 600 MCM
	Two	#1/0 AWG to 250 MCM
600	Two	#1/0 AWG to 600 MCM
800-1200[1]	Four	#1/0 AWG to 600 MCM
1600-2000[2]	Six	#1/0 AWG to 600 MCM
2600-3000[2]	Twelve	#1/0 AWG to 600 MCM
4000[2]	Twelve	#2/0 AWG to 600 MCM

Notes: 1. Unit is designed for top cable entry of emergency and load and bottom entry of normal. Optionally, the switch may be supplied with reverse source and/or bottom entry load, when specified.
2. All main terminals are rear connected.

Transfer/Bypass Configurations

7ATB, 7NTB, 7ADTB, 7ACTB, 7NDTB, 7NCTB

Sizes of UL-Listed Solderless Screw-Type Terminal for Power Connections

Switch Rating amps	Max # of Conductors per Terminal	Range of AL-CU Conductor Sizes
150, 200, 230 260,400	One	# 4 AWG to 600 MCM
	Two	# 1/0 AWG to 250 MCM
600[4]	Two	# 2 AWG to 600 MCM
800,1000,1200 Front Connect	Three	# 1/0 AWG to 600 MCM
800,1000,1200[4]	Four	# 1/0 AWG to 600 MCM
1600-2000[4]	Six	# 1/0 AWG to 600 MCM
2600, 3000[4]	Ten	# 1/0 AWG to 600 MCM
4000[4]	Twelve	# 2 AWG to 600 MCM

3. 200 and 230 amp rating for copper conductors only for transfer switch configurations only.
4. All main terminals are rear connected. A front connected version is available in 600 and 1200 amp ratings only with top cable entry only. See pages 25-27 for dimensional data and additional information.

ASCO® 7000 Series Designed to Fit Anywhere*

2-Position Transfer Switching 7ATS, 7NTS (Non-Bypass)

Frame	Switch Rating Amps	Width Inches (mm)	Height Inches (mm)	Depth Inches (mm)
	Enclosed UL Type 1[2]			
D	30, 70, 100, 150, 200, 230	18 (457)	48 (1219)	13 (330)
J	260, 400	24 (610)	56 (1422)	14 (356)
J	600	24 (610)	63 (1600)	17 (432)
H	800, 1000	34 (864)	72 (1829)	20 (508)
H	1200	38 (965)	87 (2210)	23 (584)
G	1600, 2000[1]	38 (965)	91 (2311)	60 (1524)
G	1600, 2000[3] (Front Connected)	38 (965)	87 (2210)	23(584)
G	2600, 3000[1]	38 (965)	91 (2311)	60 (1524)
G	4000[1]	60 (1524)	92 (2311)	72 (1829)
	Open Configuration			
D	30, 70, 100, 125, 150, 200, 230	10¼ (260)	10¼ (260)	5½ (140)
J	260, 400	18½ (470)	25 (635)	8 (203)
J	600	19 (483)	30 (762)	9⅞ (251)
H	800, 1000, 1200	27 (686)	31 (787)	12⅞ (327)
G	1600, 2000	33¼ (845)	28 (711)	26¼ (667)
G	2600, 3000	33¼ (845)	29 (711)	30¾ (781)
G	4000	60 (1524)	70 (1778)	53 (1272)

Notes:
1. Enclosures are free-standing with removable top, sides, and back.
2. Consult ASCO for dimensions on enclosures other than UL type 1.
3. Order accessory 40MY for 1600A and 40NY for 2000A F/C design.

**All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

Shipping Weights

2-Position Transfer Switching 7ATS, 7NTS

Frame	Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg
D	30, 70, 100	2	70 (32)	30 (14)
D	30, 70, 100	3	80 (36)	35 (16)
D	30, 70, 100	3 with B/C	85 (39)	40 (18)
D	150, 200, 230	2	115 (52)	35 (16)
D	150, 200, 230	3	120 (55)	40 (18)
D	150, 200, 230	3 with B/C	130 (59)	45 (21)
J	260, 400	2	270 (123)	220 (100)
J	260, 400	3	280 (128)	230 (105)
J	260, 400	3 with B/C	290 (132)	240 (109)
J	600	2	370 (169)	260 (119)
J	600	3	380 (173)	270 (123)
J	600	3 with B/C	390 (178)	280 (128)
H	800, 1000	2	470 (214)	260 (119)
H	800, 1000	3	480 (219)	270 (123)
H	800, 1000	3 with B/C	490 (223)	280 (128)
H	1200	2	670 (308)	300 (137)
H	1200	3	680 (310)	310 (141)
H	1200	3 with B/C	690 (315)	320 (146)

Frame	Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg
G	1600, 2000[2]	2	1330 (606	450 (205)
G	1600, 2000[2]	3	1350 (616)	470 (214)
G	1600, 2000[2]	3 with B/C	1400 (638)	500 (228)
G	2600, 3000	2	2150 (980)	890 (406)
G	2600, 3000	3	2180 (994)	920 (420)
G	2600, 3000	3 with B/C	2230 (1017)	1000 (456)
G	4000	2	2250 (1026)	990 (451)
G	4000	3	2280 (1040)	1020 (465)
G	4000	3 with B/C	2330 (1062)	1100 (502)

Notes:
1. Open weights include transfer switch and controller. 1200-4000 amp enclosures require ventilation openings, refer to drawing for details.
2. Weights for 1600 and 2000 amp are based on rear connected design.

**All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

ASCO® 7000 Series Designed to Fit Anywhere*

Closed Transition and Delayed Transition Transfer Switching
7ADTS, 7ACTS, 7NDTS, 7NCTS

Frame	Switch Rating Amps	Width Inches (mm)	Height Inches (mm)	Depth Inches (mm)
	Enclosed UL Type 1[2]			
J	150, 260, 400	24 (610)	56 (1422)	14 (356)
J	600	24 (610)	63 (1600)	17 (432)
H	800, 1000	34 (864)	72 (1829)	20 (508)
H	1200	38 (965)	87 (2210)	23 (584)
G	1600, 2000[1]	38 (965)	91 (2311)	48 (1219)
G	1600, 2000[3] (Front Connected)	38 (965)	87 (2210)	23½ (597)
G	2600, 3000[1]	38 (965)	91 (2311)	60 (1524)
G	4000[1]	60 (1524)	92 (2311)	72 (1829)
	Open Configuration			
J	150, 260, 400	18½ (470)	25 (635)	8 (203)
J	600	19 (483)	30 (762)	9⅞ (251)
H	800, 1000, 1200	27 (686)	31 (787)	12⅞ (327)
G	1600, 2000	33¼ (845)	28 (711)	26¼ (667)
G	2600, 3000	33¼ (845)	29 (711)	30¾ (781)
G	4000	60 (1524)	70 (1778)	53 (1272)

Notes:
1. Enclosures are free-standing with removable top, sides, and back.
2. Consult ASCO for dimensions on enclosures other than UL type 1.
3. Order accessory 40MY for 1600A and 40NY for 2000A front connected design.

**All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

Shipping Weights
Closed Transition and Delayed Transition Transfer Switching
7ADTS, 7ACTS, 7NDTS, 7NCTS

Frame	Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg
J	150, 260, 400	3	320 (146)	220 (100)
J	150, 260, 40	3 with B	330 (150)	230 (105)
J	600	3	380 (173)	260 (119)
J	600	3 with B	390 (178)	270 (123)
H	800, 1000	3	480 (219)	360 (164)
H	800, 1000	3 with B	490 (223)	370 (169)
H	1200	3	680 (310)	360 (164)
H	1200	3 with B	690 (315)	380 (173)
G	1600, 2000[2]	3	1350 (616)	580 (264)
G	1600, 2000[2]	3 with B	1400 (638)	600 (274)
G	2600, 3000	3	2180 (994)	1060 (483)
G	2600, 3000	3 with B	2230 (1017)	1100 (502)
G	4000	3	2290 (1044)	1060 (483)
G	4000	3 with B	2380 (1085)	1140 (520)

Notes:
1. Open weights include transfer switch and control panel. 1200-4000 amp enclosures require ventilation openings, refer to drawings for details.
2. Weights for 1600 and 2000 amp are based on rear connected design
**All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

ASCO® 7000 Series Designed to Fit Anywhere*

Automatic Transfer Bypass-Isolation Switching with Transfer Switch Engaged 7ATB, 7NTB

Frame	Switch Rating Amps	Power Connection Configuration	Width Inches (mm)	Height Inches (mm)	Depth Inches (mm)
	Enclosed UL Type 1				
J	150, 200, 230, 260, 400, 600	Front Connected	34 (864)	85 (2159)	28 (711)
H	800[3]	Front Connected	38 (965)	91 (2311)	32 (813)
H	1000, 1200[3]	Front Connected	38 (965)	91 (2311)	34 (864)
H	600, 800, 1000, 1200[1]	Rear Connected	38 (965)	91 (2311)	48 (1219)
G	1600, 2000[2]	Rear Connected	38 (965)	91 (2311)	60 (1524)
G	2600, 3000[2]	Rear Connected	38 (965)	91 (2311)	72 (1829)
G	4000[2]	Rear Connected	60 (1524)	91 (2311)	96 (2438)
	Open Configuration				
J	150, 200, 230, 400, 600	Front Connected	34 (864)	85 (2159)	28 (711)
H	600, 800, 1000, 1200[2]	Rear Connected	38 (965)	72 (1829)	38 (965)
G	1600, 2000, 2600, 3000[2]	Rear Connected	38 (965)	72 (1829)	38 (965)
G	4000[1]	Rear Connected	60 (1524)	91 (2311)	96 (2438)

Notes: 1. Handles extend 6-1/4 inches (159mm).
2. Recommended clearance to enclosure: 3 feet (914mm) from rear, 4 feet (1219mm) from front (25 inches required for transfer switch drawout). Side or rear access required.
3. Specify optional accessory 40JY for 800 Amp front, 40KY for 1000 Amp, and 40LY for 1200 Amp - connected arrangement. All service and load cables limited to top entry only.
** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

Shipping Weights

Automatic Transfer Bypass-Isolation Switching with Transfer Switch Engaged 7ATB, 7NTB

Frame	Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg
J	150, 200, 230, 260, 400 (Front Connected)	2	1230 (561)	1100 (502)
J	150, 200, 230, 260, 400 (Front Connected)	3	1240 (565)	1110 (506)
J	150, 200, 230, 260, 400 (Front Connected)	3 with B/C	1260 (575)	1130 (515)
J	600 (Front Connected)	2	1290 (588)	1190 (543)
J	600 (Front Connected)	3	1300 (593)	1200 (547)
J	600 (Front Connected)	3 with B/C	1320 (602)	1220 (556)
H	600, 800, 1000 (Rear Connected)	3	1720 (784)	1260 (575)
H	600, 800, 1000 (Rear Connected)	3 with B/C	1740 (793)	1280 (584)
H	1200 (Rear Connected)	3	1820 (830)	1290 (588)
H	1200 (Rear Connected)	3 with B/C	1840 (839)	1310 (597)
H	800 (Front Connected)	3	1400 (638)	1320 (602)
H	800 (Front Connected)	3 with B/C	1420 (648)	1340 (611)
G	1600, 2000 (Rear Connected)	3	2360 (1076)	1500 (684)
G	1600, 2000 (Rear Connected)	3 with B/C	2540 (1158)	1680 (766)
G	2600, 3000 (Rear Connected)	3	2730 (1245)	1690 (771)
G	2600, 3000 (Rear Connected)	3 with B/C	3360 (1532)	2290 (1044)
G	4000 (Rear Connected)	3	6300 (2873)	Contact ASCO
G	4000 (Rear Connected)	3 with B/C	6900 (3146)	Contact ASCO

Notes: 1.Open weights include transfer switch, bypass-isolation switch and controller. 1600-4000 amp enclosures require ventilation openings, refer to drawings for details.

** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

ASCO® 7000 Series Designed to Fit Anywhere*

Automatic Transfer Bypass-Isolation in Closed Transition and Delayed Transition Switching. 7ADTB, 7ACTB, 7NDTB, 7NCTB

Frame	Switch Rating Amps	Power Connection Configuration	Width Inches (mm)	Height Inches (mm)	Depth Inches (mm)
	Enclosed UL Type[1]				
J	150, 200, 230, 260, 400, 600	Front Connected	34 (864)	85 (2159)	28 (711)
H	800[3]	Front Connected	38 (965)	91 (2311)	32 (813)
H	1000, 1200	Front Connected	38 (965)	91 (2311)	34 (864)
H	600, 800, 1000, 1200[2]	Rear Connected	38 (965)	91 (2311)	48 (1219)
G	1600, 2000[2]	Rear Connected	38 (965)	91 (2311)	60 (1524)
G	2600, 3000[2]	Rear Connected	38 (965)	91 (2311)	72 (1829)
G	4000[2]	Rear Connected	60 (1524)	91 (2311)	96 (2438)
	Open Configuration				
J	150, 200, 230, 400, 600	Front Connected	34 (864)	85 (2159)	28 (711)
H	600, 800, 1000, 1200[2]	Rear Connected	38 (965)	72 (1829)	38 (965)
G	1600, 2000, 2600, 3000[2]	Rear Connected	38 (965)	72 (1829)	38 (965)
G	4000[2]	Rear Connected	60 (1524)	91 (2311)	96 (2438)

Notes: 1. Handles extend 6-1/4 inches (159mm).
2. Recommended clearance to enclosure: 3 feet (914mm) from rear, 4 feet (1219mm) from front (25 inches required for transfer switch drawout). Side or rear access required.
3. Specify optional accessory 40JY for 800 Amp front, 40KY for 1000 Amp, and 40LY for 1200 Amp - connected arrangement. All service and load cables limited to top entry only.
** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

Shipping Weights

Automatic Transfer Bypass-Isolation in Closed Transition and Delayed Transition Switching. 7ADTB, 7ACTB, 7NDTB, 7NCTB

Frame	Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg
J	150, 200, 230, 260, 400 (Front Connected)	2	1255 (572)	1125 (513)
J	150, 200, 230, 260, 400 (Front Connected)	3	1265 (577)	1135 (518)
J	150, 200, 230, 260, 400 (Front Connected)	3 with B/C	1285 (586)	1155 (527)
J	600 (Front Connected)	2	1315 (600)	1215 (554)
J	600 (Front Connected)	3	1325 (604)	1225 (559)
J	600 (Front Connected)	3 with B/C	1345 (613)	1245 (568)
H	600, 800, 1000 (Rear Connected)	3	1745 (796)	1285 (586)
H	600, 800, 1000 (Rear Connected)	3 with B/C	1765 (805)	1280 (595)
H	1200 (Rear Connected)	3	1845 (841)	1315 (600)
H	1200 (Rear Connected)	3 with B/C	1865 (850)	1335 (609)
H	800 (Front Connected)	3	1425 (650)	1345 (613)
H	800 (Front Connected)	3 with B/C	1445 (659)	1365 (622)
G	1600, 2000 (Rear Connected)	3	2385 (1088)	1525 (695)
G	1600, 2000 (Rear Connected)	3 with B/C	2565 (1170)	1705 (777)
G	2600, 3000 (Rear Connected)	3	2755 (1256)	1715 (782)
G	2600, 3000 (Rear Connected)	3 with B/C	3385 (1544)	2315 (1056)
G	4000 (Rear Connected)	3	6325 (2884)	Contact ASCO
G	4000 (Rear Connected)	3 with B/C	6925 (3158)	Contact ASCO

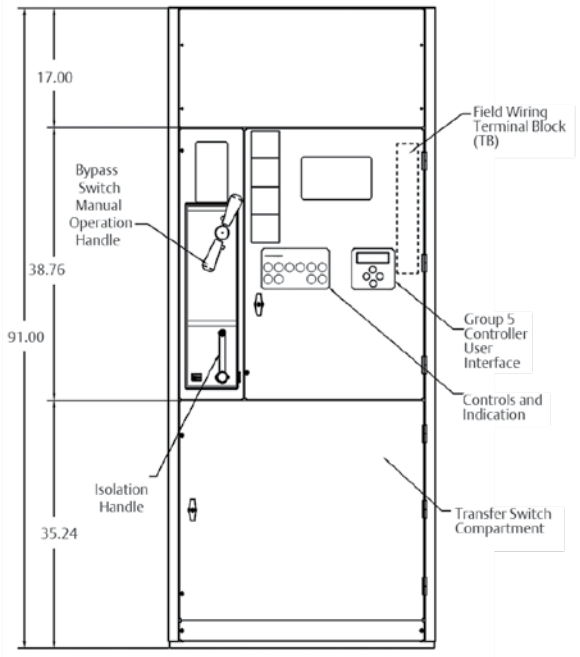
Notes: 1. Open weights include transfer switch, bypass-isolation switch and controller. 1600-4000 amp enclosures require ventilation openings, refer to drawings for details.

** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

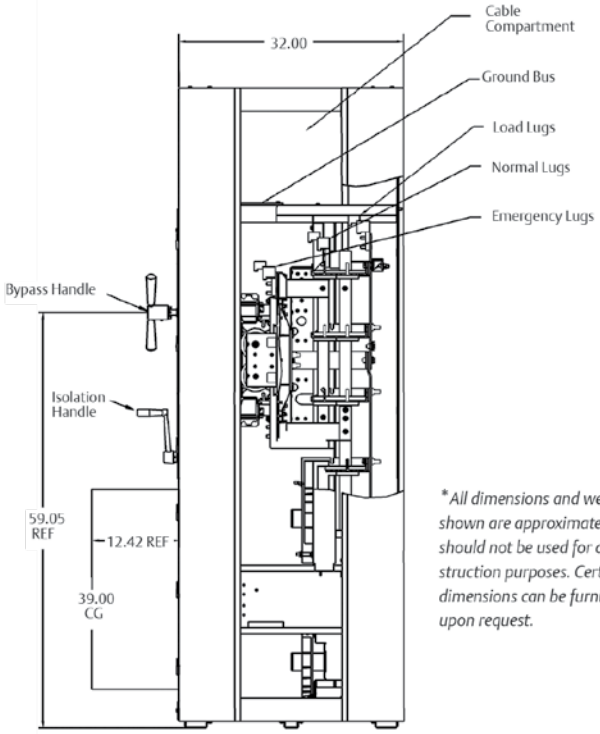
ASCO® 7000 Series Designed to Fit Anywhere*

Optional Front Connected Design Saves Valuable Space

800 Amp Optional Front Connected Design



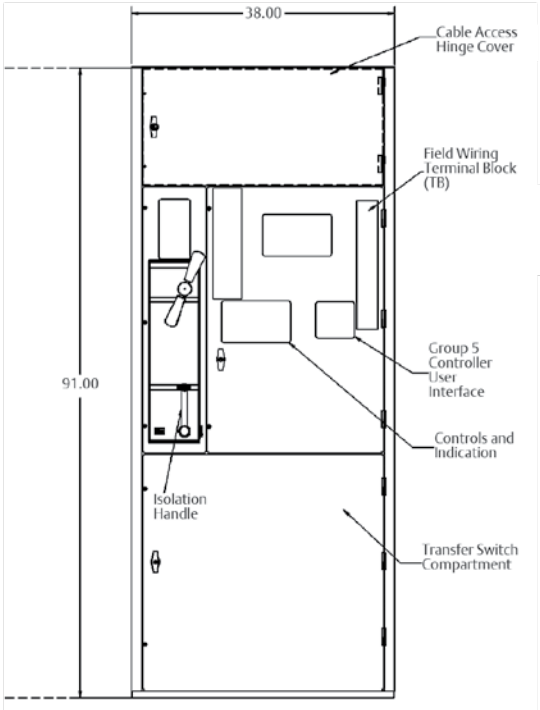
Front Views (Covers Installed)

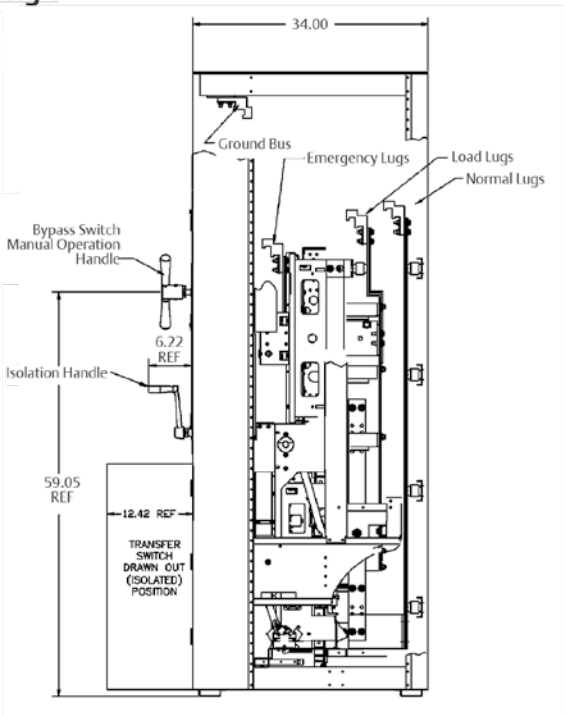


Right Side Views (Covers Removed)

*All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.

1000-1200 Amp Optional Front Connected Design





SUGGESTED SPECIFICATION
For
Automatic Transfer Switches

Division 16 - Electrical
Standby Power Generator Systems

PART 1 GENERAL

1.01 Scope

A. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer switch shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

1.02 Codes and Standards

The automatic transfer switches and controls shall conform to the requirements of:

A. UL 1008 - Standard for Transfer Switch Equipment

B. CSA certified to CSA 22.2 No. 178 – 1978 Automatic Transfer Switches

C. IEC 60947-6-1 Low-voltage Switchgear and Controlgear; Multifunction equipment; Automatic Transfer Switching Equipment

D. NFPA 70 - National Electrical Code

E. NFPA 99 - Essential Electrical Systems for Health Care Facilities

F. NFPA 110 - Emergency and Standby Power Systems

G. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

H. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

I. UL 508 Industrial Control Equipment

1.03 Acceptable Manufacturers

Automatic transfer switches shall be ASCO 7000 Series. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Alternate bids must list any deviations from this specification.

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

B. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

C. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

D. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

E. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 800 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

F. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

G. Where neutral conductors must be switched as shown on the plans, the ATS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

H. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

2.02 Microprocessor Controller

A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.

C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.

D. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1.	EN 55011:1991	Emission standard - Group 1, Class A
2.	EN 50082-2:1995	Generic immunity standard, from which:
	EN 61000-4-2:1995	Electrostatic discharge (ESD) immunity
	ENV 50140:1993	Radiated Electro-Magnetic field immunity
	EN 61000-4-4:1995	Electrical fast transient (EFT) immunity
	EN 61000-4-5:1995	Surge transient immunity
	EN 61000-4-6:1996	Conducted Radio-Frequency field immunity

2.03 Enclosure

A. The ATS shall be furnished in a Type 1 enclosure unless otherwise shown on the plans.

B. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.

PART 3 OPERATION

3.01 Controller Display and Keypad

A. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency
2. Single or three phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration
   (Open transition, Closed transition, or Delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.02 Voltage, Frequency and Phase Rotation Sensing

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

B. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

E. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

F. The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side, single phase failures on a Grounded Wye – Grounded Wye transformer which regenerates voltage when unloaded. The algorithm shall also inhibit retransfer to the normal (utility) source upon detection of a single phasing condition until a dedicated timer expires, the alternate source fails, or the normal source fails completely and is restored during this time delay period. The time delays associated with this feature shall be adjustable by the user through the

3.03 Time Delays

A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.
5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

F. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:

1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
3. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.

G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

3.04 Additional Features

A. A three position momentary-type test switch shall be provided for the ***test / automatic / reset*** modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to

B. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:

F. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

G. An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

H. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.

I. **Engine Exerciser -** The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.

2. Enable or disable transfer of the load during routine.

3. Set the start time, .
- time of day
- day of week
- week of month (1st, 2nd, 3rd, 4th, alternate or every)

4. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

The following feature shall be built - into the controller, but capable of being activated through keypad programming or the communications interface port.

Note: The transfer switch will operate in a non-automatic mode with this feature activated.

J. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.

K. System Status - The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

Normal Failed
Load on Normal
TD Normal to Emerg
2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

L. Self Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed..

M. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging

1. Data and time and reason for transfer normal to emergency.
2. Data and time and reason for transfer emergency to normal.
3. Data and time and reason for engine start.
4. Data and time engine stopped.
5. Data and time emergency source available.
6. Data and time emergency source not available.

2. Statistical Data

1. Total number of transfers.
2. Total number of transfers due to source failure.
3. Total number of days controller is energized.
4. Total number of hours both normal and emergency sources are available.

N. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:

1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line; ATS controls status, alarms, metering, event logging as well as settings.
4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.
5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactivating of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of ninety-nine (99) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, five (5) serial ports, Termination dip-switches and LEDs for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE2

O. External DC Power Supply – An optional provision shall be available to connect an external 24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead. This option shall be equivalent to ASCO accessory 1G.

PART 4 ADDITIONAL REQUIREMENTS

4.01 Withstand and Closing Ratings

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.

B. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 0.025 and 0.05 second, time based ratings. ATSs which are not tested and labeled with time based ratings and have series, or specific breaker ratings only, are not acceptable.

4.02 Tests and Certification

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. The ATS manufacturer shall be certified to ISO 9001:2008 International

Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001:2008

4.03 Service Representation

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

Note Spec Writer: *The following section is optional and should be deleted if not used.*

PART 5 OPTIONAL FEATURES

5.01 POWER METER

1. *Furnish Power Meters at locations shown to monitor all functions specified below.*

2. *The Power Meters shall be listed to UL 3111-1, CSA, CE Mark, and industrially rated for an operating temperature range of -20°C to 60°C.*

3. *The Power Meter shall be accurate to 1% measured, 2% computed values and display resolution to .1%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).*

4. *The Power Meter shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 – 32VDC.*

5. *Each Power Meter shall be capable of interfacing with an optional communications module to permit information to be sent to central location for display, analysis, and logging.*

6. *The Power Meter shall accept inputs from industry standard instrument transformers (120 VAC secondary PTs and 5A secondary CTs.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PTs.*

7. *The Power Meter shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.*

8. *All setup parameters required by the Power Meter shall be stored in non-volatile memory and retained in the event of a control power interruption.*

9. *The following metered readings shall be communicated by the Power Meter, via serial communication, when equipped with optional serial*

communications module:

a) *Current, per phase RMS and neutral (if applicable)*
b) *Current Unbalance %*
c) *Voltage, phase-to-phase and phase-to-neutral*
d) *Voltage Unbalance %*
e) *Real power (KW), per phase and 3-phase total*
f) *Apparent power (KVA), per phase and 3-phase total*
g) *Reactive power (KVAR), per phase and 3-phase total*
h) *Power factor, 3-phase total & per phase*
i) *Frequency*
j) *Accumulated Energy, (MWH, MVAH, and MVARH)*

10. *The following energy readings shall be communicated by the Power Meter:*

    a) *Accumulated real energy KWH*
    b) *Accumulated reactive energy KVAH*
    c) *Accumulated apparent energy KVARH*

    NOTE: For real and reactive energy reported values, separate total for energy flow from each source shall be stored, including the arithmetic sum.

****Note Spec Writer:*** *The following section is optional and should be deleted if not used. The* Power Meter *shall flush mount to an enclosure.*

1. *The Power Meters shall be equipped with an optional continuous duty, long-life, 4 line x 20 character LCD backlit display to provide local access to the following metered quantities:*
    a) *Current, per phase RMS and neutral (if applicable)*
    b) *Current Unbalance %*
    c) *Voltage, phase-to-phase and phase-to-neutral*
    d) *Voltage Unbalance %*
    e) *Real power, per phase and 3-phase total*
    f) *Apparent power, per phase and 3-phase total*
    g) *Reactive power, per phase and 3-phase total*
    h) *Power factor, 3-phase total & per phase*
    i) *Frequency*
    j) *Accumulated Energy, (MWH, MVAH, and MVARH)*

2. *Displaying each of the Power Meter quantities shall be accomplished through the use of menu scroll buttons.*

3. *For ease in operator viewing, the display shall remain on continuously, with no detrimental effect on the life of the Power Meter.*

4. *Setup for system requirements shall be allowed from the front of the Power Meter. Setup provisions shall include:*
    a) *CT rating (xxxxx:5)*
    b) *PT rating (xxxxxxx:120) (if applicable; 24000V maximum)*

5. *Reset of the following electrical parameters shall also be allowed from the front of the Power Meter:*

a) *Real energy (MWH), apparent energy (MVAH) and reactive energy (MVARH).*

6. *All reset and setup functions shall have a means for protection against unauthorized/accidental changes.*

5.02 ATS REMOTE ANNUNCIATOR

General

Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

A. Hardware Specifications

The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings:

- *User-configured labels with ATS names and power sources*
- *Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports*
- *LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity*
- *Push button for transfer/retransfer control operations and time delay bypass*
- *Push buttons for Alarm Silence and Lamp Test*
- *Key lock to enable and disable the transfer push button*
- *Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs*
- *Programmable watchdog timer that can generate a system reset upon timeout (min 1 sec)*
- *Factory reset capability*
- *100 ms power ride-through*

B. Software Specification

The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:

- *Configuration for protocol and communications management with the ability of auto discovering transfer switches on network*
- *Ability to create and print customized labels for ATS names and power sources*
- *The ability to choose a continuous or periodic audible alarm with customizable interval time*
- *Ability to configure up to 8 discrete inputs as alarms*
- *View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters*
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware locally without interfering with installation*

C. Communications

Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisy-chained serial modules into a single Connectivity Module. Additional features include:

- *Supports Full Duplex Flow Control (IEEE 802.3x)*
- *3.3V power supply with 5V I/O tolerance*
- *Supports 3 LEDs to indicate traffic link speed and collision*

D. Mounting

The ATS Remote Annunciator is suitable for:

- *Surface mounting using mounting screws studs*
- *Flush Mount from behind a cutout section (Enclosure Door Mounting)*
- *Flush Mount from the front of a cutout section (Enclosure Door Mounting)*

E. Power Supply

The ATS Remote Annunciator shall be capable of accepting 24VDC 120 VAC or 240 VAC power source.

F. Environmental

The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 ° to 158 ° F (-20 ° to +70 ° C) @ 5~85% humidity and Ambient Storage Temperature of -40 ° to 185 ° F (-40 ° to 85 ° C).

ASCO 4000 Series Power Transfer Switches

Critical Loads Demand ASCO

As we become more dependent on the quality and reliability of electrical power, interruption or complete loss of power can create serious and even crippling financial losses, or impose dangers to life and safety.



ASCO Power Technologies (ASCO) provides the solutions to handle the transfer of critical loads to emergency sources reliably and with state of the art products. Using ASCO products can mean the difference between a minor inconvenience and a major catastro- phe. You'll find ASCO Power Transfer Switches wherever there is a critical load to be protected.

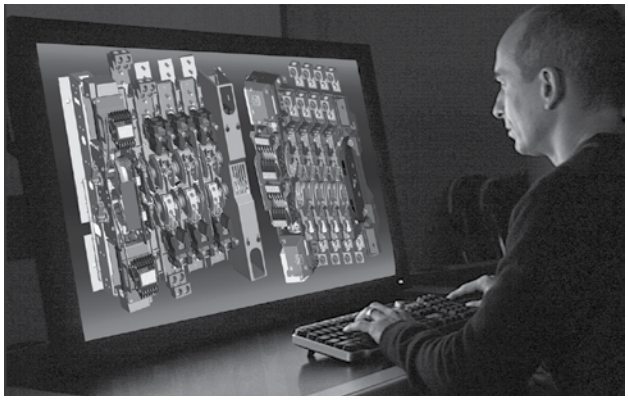
When flexibility in power switching is a must, ASCO offers a variety of product solutions to meet virtually every application requirement, including distributed generation applications. That's why the 4000 SERIES is available in open, delayed, closed and closed soft load configurations. Additionally, switched or overlapping neutral options provide for reliable operation of ground fault protection systems and reduction of voltage transients from unbalanced load switching.

Protecting:

- Healthcare Facilities
- Web Hosting, Internet Data Centers
- Commercial Buildings / Industrial Buildings
- Telecom Central Offices
- Process Manufacturing
- Distributed Power / Load Management



The Recognized Leader in Power Transfer Switch Technology Offers the Most Advanced Transfer Switches in the World.



ASCO 4000 Series Power Switching Solutions

ASCO Power Transfer Switches are the standard of the industry. High speed transfer of loads between alter- nate sources of power, regardless of ampacity size, is achieved by a reliable, field proven solenoid operating mechanism. When combined with a programmable microprocessor controller with keypad and LCD display, they offer the most advanced method of transferring all types of loads, such as motors, electronic drives, UPS's and microprocessor based systems. 4000 SERIES Power Transfer Switches are available open or enclosed, in ampacity sizes from 30 through 4000 amperes with a limited selection of optional accessories.



Fig. 1: Three Pole 4000 SERIES Automatic Transfer Switch rated 800 amperes

4000 Series Power Transfer Switches Product Features

- Conventional two-position transfer configuration, plus closed and delayed transition modes of operation. All configurations available with either automatic or non-automatic control.
- UL listed to 1008 Transfer Switch Equipment & CSA certified to CSA 22.2 No.178-1978 Automatic Transfer Switches.
- Qualified to IEC 60947-6-1, CE marked (optional). (Limited to certain accessories.)
- Rated up to 600 VAC, 30 through 4000 amperes.
- Reliable and field proven solenoid operating mechanism.
- High withstand and close-on ratings including short time withstand current rating for optimum flexibility in circuit breaker coordination (800-4000 amperes).
- Solid, switched neutral configurations available.
- Front replaceable main and arcing contacts (800-4000 amperes).
- Programmable microprocessor controller with keypad and LCD display.
- Industrial grade user interface with integrated controls and indicating lights.
- Convenient one line diagram with switch position and source acceptability LED indicators.
- Standard ground conductor connections.
- Four auxiliary contacts, two contacts closed when switch is in normal position and two contacts closed when switch is in emergency position.*
- Local/remote communications capability for interfacing with ASCO POWERQUEST® communication products.

*Only two contacts standard on 150-400A 4ACTS and 4NCTS

ASCO 7000 Series Power Switching Solutions

Closed Transition Transfer Switching

ASCO Automatic Closed-Transition Transfer Switches feature main contacts that overlap, permitting the transfer of electrical loads without power interruption. The switch transfers in a make-before-break mode if both sources are within acceptable parameters. Control logic continuously monitors source conditions and automatically determines whether the load transfer should be open (conventional non-overlap mode) or Closed-Transition. Available 150 through 4000 amperes.

Closed-Transition Transfer within 5 electrical degrees is achieved passively, without control of engine generator set. Therefore, no additional control wire runs are required between the ATS and engine generator set governor. Plus, protective relaying may not be required under normal operation since the contact overlap time is less than 100 milliseconds (consult your local utility on protective relay requirements).

Failure to synchronize indication, extended parallel time protection, and transfer switch lock out are standard features.



Fig. 2: Four pole, Closed-Transition Transfer Switch rated 1000 amperes in Type 1 enclosure.



Delayed Transition Transfer Switching

ASCO Delayed-Transition Transfer Switches are designed to provide transfer of loads between power sources with a timed load disconnect position for an adjustable time period. Applications include older style variable frequency drives, rectifier banks, and load management applications.

- Available 150 through 4000 amperes.
- Utilizes reliable, field proven solenoid operating mechanisms.
- Mechanical interlocks to prevent direct connection of both sources.
- Indicator light (LED Type) for load disconnect position.
- Adjustable time delay for load disconnect position.

Fig. 3: Four pole, Delayed-Transition Transfer Switch rated 400 amperes in Type 1 enclosure.

ASCO 4000 Series Power Switching Solutions

Non-Automatic Transfer Switching

ASCO Non-Automatic Transfer Switches are electrically operated units which are operated with manual control switches mounted locally or at remote locations.

- Sizes from 30 through 4000 Amperes.
- Microprocessor based controller provides for addition of optional accessories.
- Controller prevents inadvertent operation under low voltage conditions.
- Low control circuit operating currents allow for long line runs between remotely mounted manual control switches and the transfer switch.
- Source acceptability lights inform operator if sources are available to accept load.
- Standard inphase monitor can be activated for transferring motor loads.



Fig. 4: Three pole Non-Automatic, electrically operated 200 ampere switch shown in Type 1 enclosure.

Withstand and Close-On Ratings for all 4000 SERIES Products

Switch Rating (Amps)	UL 1008 Withstand and Close-On Ratings [1]									
	Ratings (RMS Symmetrical)						Recommended Fuses		Short Time Ratings @ 480V [4]	
Transfer Switches	"Specific" Breaker [2]	Volts Maximum	"Any" Breaker [3]	Volts Maximum	Current-Limiting Fuse Rating	Volts Maximum	Max Size, A	Class	Rating (RMS Sym),A	Duration (Cycles)
30			10kA	600V	100kA	480V	60	J	N/A	-
70, 100, 125, 150	22kA	480V	10kA	600V	200kA	480V	200	J	N/A	-
200	22kA	480V	10kA	480V	200kA	480V	200	J	N/A	-
230	22kA	480V	10kA	480V	100kA	480V	300	J	N/A	-
260, 400, 600	50kA	480V	65kA	240V	200kA	600V	600	J	N/A	-
			42kA [6]	480V						
	42kA	600V	35kA	600V			800	L		
800 - 1200	65kA	600V	50kA	600V	200kA	600V	1600	L	36kA	18
1600, 2000	125kA	480V	100kA [5]	600V	200kA	600V	3000	L	42kA	18
2600, 3000	-	600V	100kA	600V	200kA	600V	4000	L	42kA	18
4000	-	600V	100kA	600V	200kA	600V	5000	L	85KA	8
									65kA	30

1) All WCR values indicated are tested in accordance with the requirements of UL 1008. See ASCO Pub. 1128 for more WCR information.
2) Application requirements may permit higher WCR for certain sizes of switch. Contact ASCO for guidance if application requires higher WCR.
3) Based on 3 cycles for 260-4000A and 1.5 cycles for 30-230A switches. Applicable to circuit breakers with instaneous trip elements.
4) Short Time ratings are provided for applications involving circuit breakers that utilize trip delay settings for system selective coordination.
5) Optional front connected service (Accy 40MY and 40NY) limits 1600 and 2000A G Frame switches to 85kA Any Breaker rating.
6) J Frame switches utilizing overlapping neutral (code "C") are limited to 35kA Any Breaker rating at 480V.



Fig. 5: 4000 Series Microprocessor Controller.

The 4000 Series microprocessor controller is used with all sizes of Power Transfer Switches from 30 through 4000 amperes. It represents the most advanced digital controller in the industry and includes, as standard, all of the voltage, frequency, control, timing and diagnostic functions required for most emergency and standby power applications.

Because of severe voltage transients frequently encountered with industrial distribution systems, the microprocessor logic board is separated and isolated from the power board as shown below. This improves electrical noise immunity performance and helps assure compliance with the rigorous transient suppression standards highlighted below.

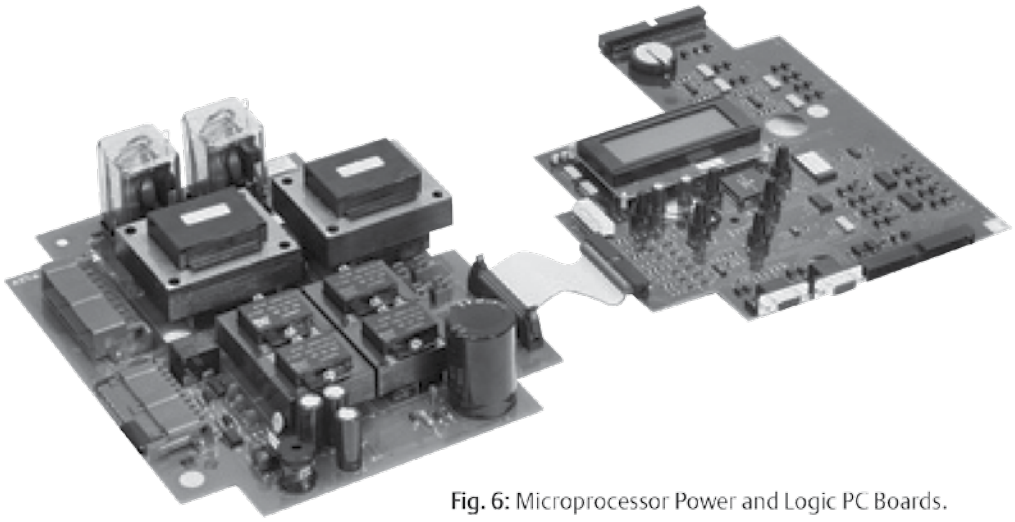


Fig. 6: Microprocessor Power and Logic PC Boards.

4000 Series Microprocessor Controller

Emission Standard - Group 1, Class A	EN 55011:1991
Generic Immunity Standard, from which:	EN 50082-2:1995
Electrostatic Discharge (ESD) Immunity	EN 61000-4-2:1995
Radiated Electromagnetic Field Immunity	ENV 50140:1993
Electrical Fast Transient (EFT) Immunity	EN 61000-4-4:1995
Surge Transient Immunity	EN 61000-4-5:1995
Conducted Radio-Frequency Field Immunity	EN 61000-4-6:1996
Voltage Dips, Interruptions and Variations Immunity	EN 61000-4-11:1994

Features

- Digital microprocessor.
- Touch pad programming of features and settings without the need for meters, or variable power supplies.
- Sixteen (16) selectable operating voltages available in a single controller.
- On-board diagnostics provide control panel and ATS status information to analyze system performance.
- Displays and counts down active timing functions.
- Selectable multi-language display (English, German, Portuguese, Spanish, or French. For others contact ASCO).
- Password protection to prevent unauthorized tampering of settings.
- Remote monitoring and control with ASCO POWERQUEST® communications. products. Specify optional accessory 72A or 72E.
- Load shed option for bus optimization applications. Specify optional accessory 30B.
- Lamp Test - Provides a convenient way to verify functionality of all LED's on the user interface.

Voltage and Frequency Sensing

- 3-Phase under and over voltage settings on normal and emergency sources.
- Under and over frequency settings on normal and emergency.
- True RMS Voltage Sensing with +/- 1% accuracy; Frequency Sensing Accuracy is +/- 0.2%.
- Selectable settings: single or three phase voltage sensing on normal and emergency; 50 or 60Hz.
- Phase sequence sensing for phase sensitive loads.
- Voltage unbalance detection between phases.

Status and Control Features

- Output contact (N/O or N/C) for engine-start signals.
- Selection between "commit/no-commit" on transfer to emergency after engine start and normal restores before transfer.
- Terminals for remote test or customer contact for peak shaving applications
- Advanced inphase algorithm which automatically measures the frequency difference between the two sources and initiates transfer at appropriate phase angles to minimize disturbances when transferring motor loads.
- Output signals for remote indication of normal and emergency source acceptability.
- Statistical ATS/System monitoring data screens which provide:
  - Total number of ATS transfers.
  - Number of ATS transfers caused by power source failure.
  - Total number of days ATS has been in operation.
  - Total number of hours that the normal and emergency sources have been available.

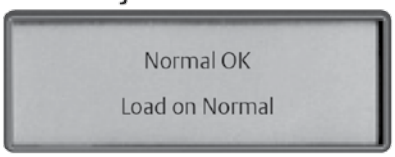
Time Delays

- Engine start time delay - delays engine starting signal to override momentary normal source outages - adjustable 0 to 6 seconds.
- Transfer to emergency time delay - adjustable 0 to 60 minutes.
- Emergency source stabilization time delay to ignore momentary transients during initial generator set loading - adjustable 0 to 6 seconds.
- Retransfer to normal time delay with two settings:
  - Power failure mode - 0 to 60 minutes.
  - Test mode - 0 to 10 hours.
- Unloaded running time delay for engine cooldown - adjustable 0 to 60 minutes.
- Fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without loads, on a daily, weekly, bi-weekly or monthly basis.
- Contains all alarm signals, logic and time delays for use with closed transition switches.
  - Insynch time delay - 0 to 3 seconds.
  - Failure to synchronize - 1 to 5 minutes.
  - Extended parallel time - 0.1 to 1.0 seconds.
  - Transfer switch locked out.
- Delayed transition load disconnect time delay - adjustable 0 to 5 minutes. (Delayed Transition Switches only.)

ASCO® 4000 Series Power Control Center Screens

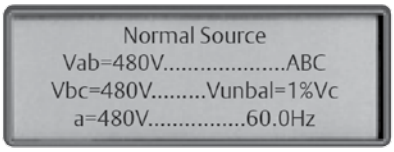
Status

System Status



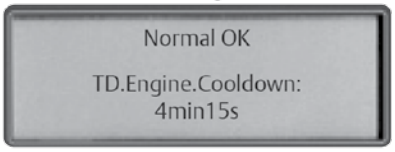
Displays system status in clear, concise language. Message shown indicates normal source is acceptable and the load is connected to the normal source.

Source Status



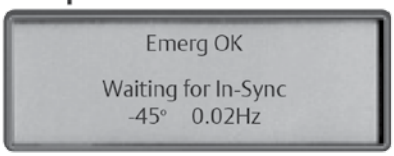
Displays voltage for each phase, frequency, phase rotation and voltage unbalance for both normal and emergency sources.

Time Delay Status



Active time delay status displays time remaining until next control event.

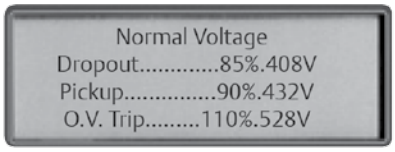
Inphase Transfer Mode



Displays the relative phase angle between sources and frequency differential to indicate the controller is awaiting an inphase condition.

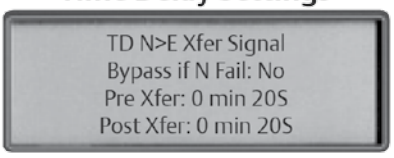
Settings

Voltage and Frequency Settings



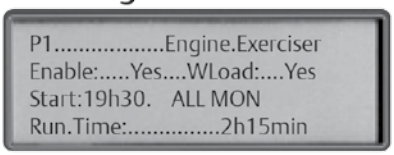
Provides voltage and frequency setting values for normal and emergency sources. Voltage pick-up, dropout and trip settings are set in percentage of nominal voltage and are also displayed in rms voltage values.

Time Delay Settings



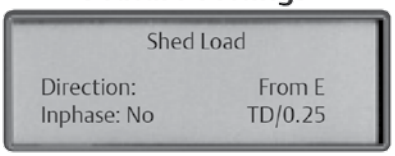
Provides direct reading display for setting time delays.

Engine Exerciser



Seven independent programs, load/no load selection, flexible run times and daily, weekly, bi-weekly and monthly exercise routines.

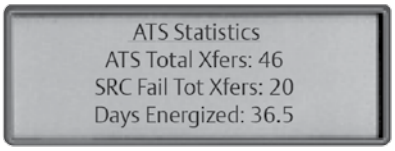
Feature Settings



Standard features can be activated with the keypad. As an example, when enabled, the "shed load" option causes the transfer switch to transfer the load off of the specified source. If desired, the load shed transfer can be made inphase.

Data Logging

ATS Statistics



Instant availability of statistical information on total number of ATS transfers, number of transfers caused by power failures and total days controller has been energized, plus more.

User Interface Features

- **Convenient One Line Diagram** - Provides a clear view of the position of the transfer switch, as well as the acceptability of the Normal and Emergency sources.
- **Source Acceptability LEDs** - Provide true indication of the acceptability of each source, as determined by the voltage, frequency, voltage unbalance, and phase sequence settings of the control panel.
- **Transfer Switch Position LEDs** - Provide an indication of which source the transfer switch is connected to.
- **Transfer Test** - Allows the user to test the operation of the transfer switch under a simulated failure of the normal source. Holding for 15 seconds allows time for the engine generator to come online and the transfer switch to transfer the load.
- **Retransfer to Normal** - Allows the user to bypass the programmed Retransfer to Normal time delay upon the return of the normal source when the switch has transfered to emergency either during normal operation or a transfer test.

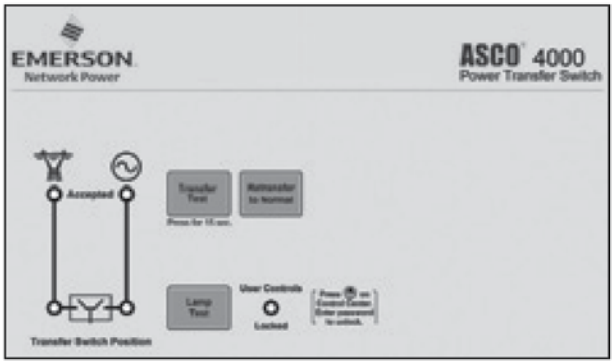


Fig. 7: 4000 SERIES Open Transition User Interface

- **Lamp Test** - Provides a convenient way to verify the functionality of all LEDs on the User Interface.
- **User Controls Locked** - Visually displays the status of the keypad lock feature of the control panel. When illuminated, the buttons of the User Interface are disabled and the user must enter a password into the control panel to unlock the switch. When LED is blinking, the controls are temporarily unlocked for five minutes from the last button pressed.

Additional Closed Transition User Interface Features

- **Extended Parallel Time** - Provides visual indication when the pre-set extended parallel time has been exceeded. The controls automatically open the emergency or normal main contacts. Separate contact also available to shunt trip to an external breaker.
- **Failure To Synchronize** - Visually displays a failure to synchronize alarm if the time delay settings is exceeded, during closed transition transfer operation.
- **Transfer Switch Locked Out** - Prevents transfer in either direction if the extended parallel time is exceeded.
- **Alarm Reset** - Resets extended parallel and failure to synchronize alarms.
- **Closed Transition Bypass** - Pushbutton allows transfer between sources in an open transition mode.

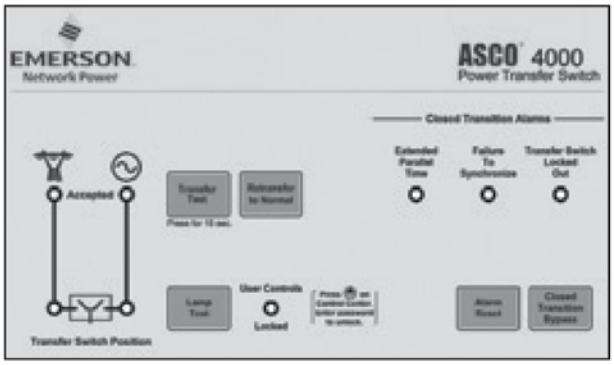


Fig. 8: 4000 SERIES Closed Transition User Interface

ASCO® 4000 Series Optional Accessories

Time Delays

2C Provides an extended time delay on engine starting. The standard feature one time delay is adjustable from zero to six seconds. Accessory 2C allows this time delay to be adjustable from zero to sixty minutes in one second intervals factory set at five minutes.

1G Similar to accessory 2C except using an external 24 volt DC power input. Available only as a feature of accessory 18Z.

Indicators & Controls

14A/14B Additional auxiliary contact sets to indicate switch position. Two sets are typically standard. Maximum number of two additional sets. (Varies by configuration)

6C Reset Switch for manual retransfer to normal with automatic override upon emergency source failure.

Neutral Conductor Options

- Solid neutral, with fully-rated terminals. (AL-CU) UL Listed.
- Conventional neutral switching pole.

Note: Specify neutral option in catalog number, see page 18 for instructions.

Communications Options

72A Serial communication module for remote communications to ASCO POWERQUEST® products. Also allows 4000 Series Transfer Switches to communicate via Modbus/RTU.

72E Ethernet connectivity module for remote communications to ASCO POWERQUEST® products. Contains embedded web pages for the remote monitoring of ASCO products as well as some 3rd party devices. Also provides Serial-to-Ethernet link with ability to communicate using Modbus/TCP.

Customer Control Circuits

30A Load-shedding circuit initiated by opening of a customer-supplied contact.

30B Load-shedding circuit initiated by removal of customer-supplied control voltage. (Specify voltage).

44G Strip Heater with thermostat recommended for outdoor applications on temperatures below 32° F (0°C) to prevent condensation and freezing.

Add-on Boards

18Z Includes one Form C contact (Rated 2A @ 30VDC or .5A @ 125VAC) for each of the following:

- Normal Source Acceptability.
- Emergency Source Acceptability.
- Selective Load Disconnect. - Pre and post transfer signal time delay for selective load disconnect with a programmable bypass on source failures - adjustable 0 to 5 minutes.
- Fourth contact can be set to mimic the acceptability contacts or annunciate any combination of the acceptability contacts and/or any switch alarm conditions available:

  Extended Parallel Time (Closed transition),

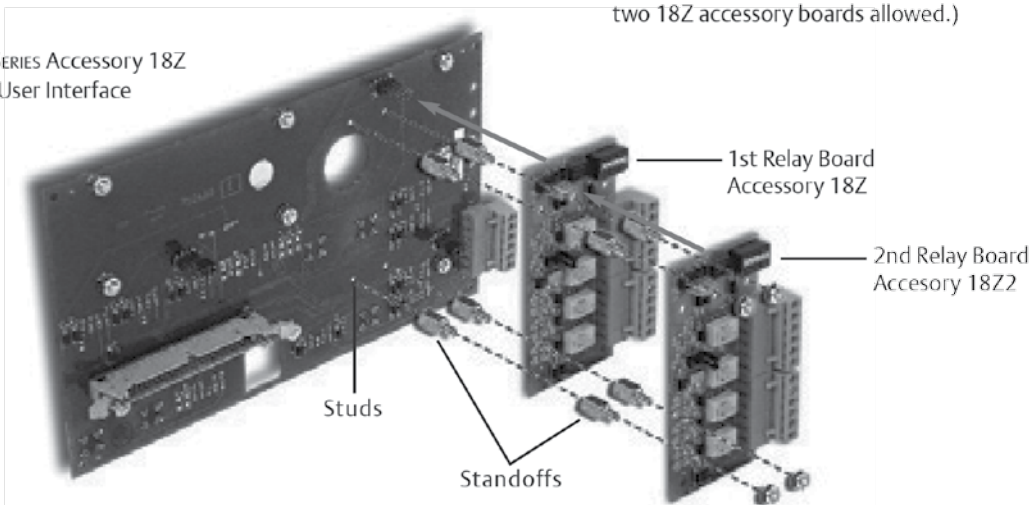
  Failure to Synchronize (Closed transition),

  Transfer Switch Locked Out (Closed transition),

  Load Disconnected (Delayed transition).
- Accessory 18Z includes an extension of the engine start time delay (feature) to 60 seconds if an external 24VDC supply is connected to a 4000 series controller. This external power source will also allow the LCD display to be active when both normal and emergency sources are unavailable.

18Z2 Includes two 18Z accessory boards. (Maximum of two 18Z accessory boards allowed.)

Fig. 9: 4000 Series Accessory 18Z mounting on User Interface



ASCO 5200 Series Power Manager

The ASCO 5200 Series Power Manager is a microprocessor based metering device that provides real-time measurements of single and three phase power systems. The Power Manager uses digital signal processing technology to measure voltage and current per phase; real, reactive and apparent power, and bi-directional energy. All measurements can be viewed locally with a backlit liquid crystal display and/or displayed remotely with ASCO POWERQUEST® products.

Direct voltage input for systems up to 600 Volts AC can be monitored without the use of external potential transformers (PTs). Measures three phase currents and a fourth current input is available for measuring current in the neutral conductor. The Power Manager includes one discrete input for transfer switch position, eight general purpose discrete inputs, and four relay outputs for monitoring and controlling external devices.

Power Metering

- Voltage:
  Line - Line: VAB, VBC, VCA, VAVERAGE
  Line - Neutral: VAN, VBN, VCN, VAVERAGE
- Frequency: 45.0 to 66.0 Hertz
- Current: IA, IB, IC, IAVERAGE
- Unbalance %: Voltage, Amps
- Real Power: KWA, KWB, KWC, KWNET
- Reactive Power: KVARA, KVARB, KVARC, KVARNET
- Apparent Power: KVAA, KVAB, KVAC, KVANET
- Real Energy: KWHIMPORT, KWHEXPORT, KWHNET
- Reactive Energy: KVARHIMPORT, KVARHEXPORT, KVARHNET
- Power Factor: PFA, PFB, PFC, PFNET

Data Access

- Eight digital inputs, four relay outputs.
- Input/Output 15-character, user definable screen display for identification of input/output signals.

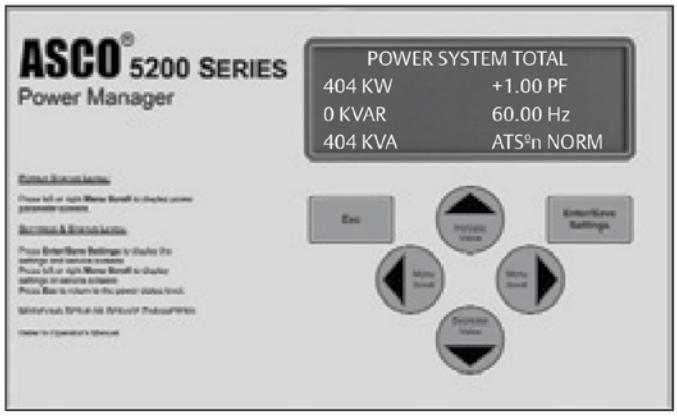


Fig. 10: ASCO 5200 Series Power Manager.

Configurable Designations

- Local - A four line, 20 character LCD backlit display.
- Remote - With optional Acc. 72A or 72E and Power Manager monitoring systems.
- Provides user programmable setpoints based on twelve metering and I/O parameters. Each setpoint allows the user to select the parameter, the trip & reset levels, the trip & reset time delays and the alarm type or relay output to trigger. This can be used for protective relaying and peak shaving applications.

Integrated ATS Features

When configured on load of ATS:

- Displays ATS position.
- Displays power data as a function of ATS position (normal/emergency).
- Accumulates energy data separately for normal and emergency sources.

Optional Configurations and Connection Arrangements

Connected To:	With Display	Without Display
Load	Acc. 85L	Acc. 75L
Normal	Acc. 85N	Acc. 75N
Emergency	Acc. 85M	Acc. 75M

Add suffix "A" to above designations if neutral conductor monitoring is required.

Note: Accessory 75 and 85 includes component mounting, CTs, shorting blocks and all necessary interwiring.

Note: The ASCO Power Manager is also available as a separate unit for monitoring electrical parameters anywhere in the power distribution system.

ASCO® 4000 Series Power Monitoring & Control

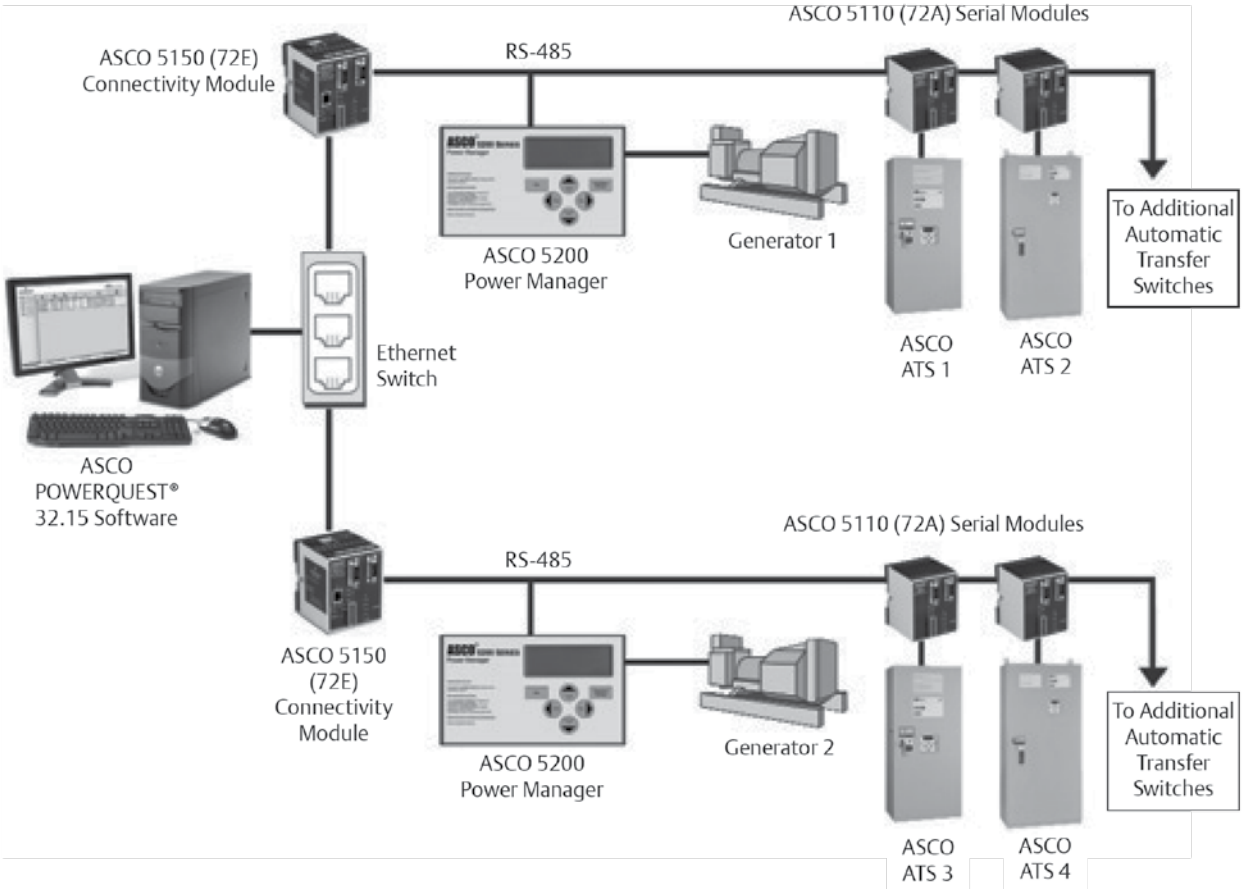
ASCO POWERQUEST Solutions

ASCO POWERQUEST® communications products allow for the monitoring and control of power transfer switches in your Emergency or Standby Power Distribution System. Local Area networks and Remote networks are supported with either single or multiple points of access, and web-enabled communications allow access to your power system from anywhere around the world.

Features

- Monitors and controls Power Transfer Switches and Engine Generators
- Monitors normal and emergency voltages and frequency
- Indicates transfer switch position and source availability
- Provides transfer and re-transfer of loads for system testing
- View normal and emergency voltage and frequency settings
- View transfer switch time-delay settings
- Provides transfer switch rating and identification
- Automatic paging notifies personnel, by e-mail or text message, of selected system alarms
- View current, power and power factor with ASCO Power Managers Connected to the System
- View transfer switch event log
- Provides transfer switch test schedule

ASCO® POWERQUEST Typical Network Architecture



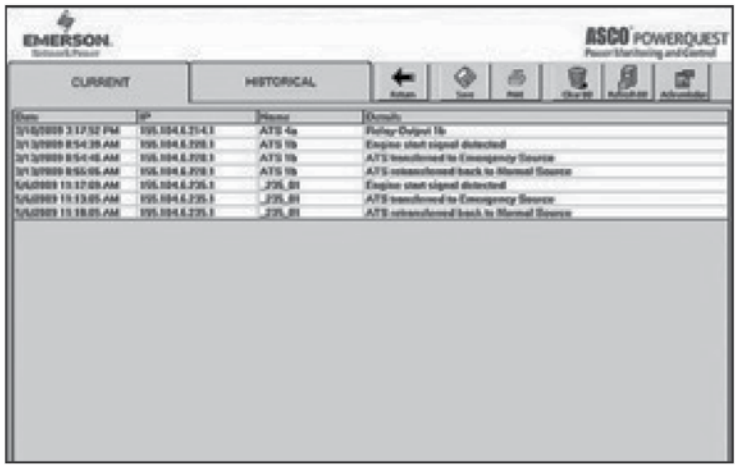
ASCO® POWERQUEST 32.15

ASCO 32.15 POWER INTERFACE SOFTWARE

The ASCO 32.15 Power Interface is a computer-based monitoring and control software package. When combined with ASCO 72E/72A Communications Interface modules and the ASCO 5200 SERIES Power Manager, it provides a centralized and comprehensive monitoring and control interface of power transfer switches and engine generators. A one-line diagram, power metering information, transfer switch controls and event-log data, and engine-generator screens are available to users with password protected controls.

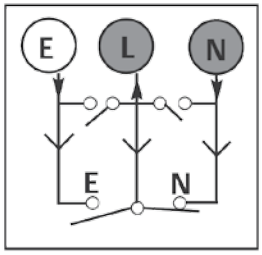
Summary Screen





Current and Historical Alarms

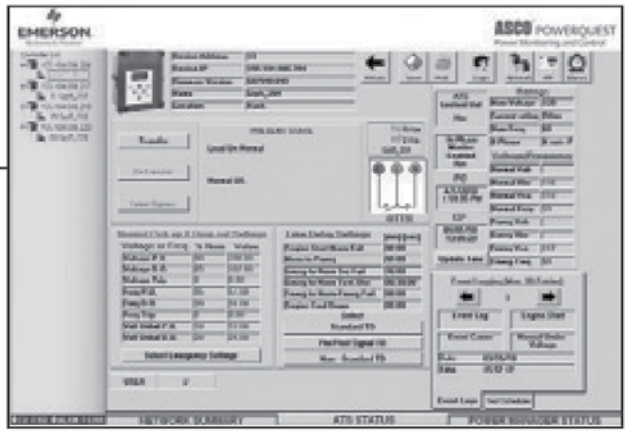
The Current Alarm screen displays all currently active alarms. It provides the date of the alarm, along with IP and Name of the device with the issue. In addition, a detailed description of the alarm is provided to help the operator in pin-pointing the issue. All historical alarms can be viewed as well by selecting the "Historical" tab.



Convenient One-Line Diagram

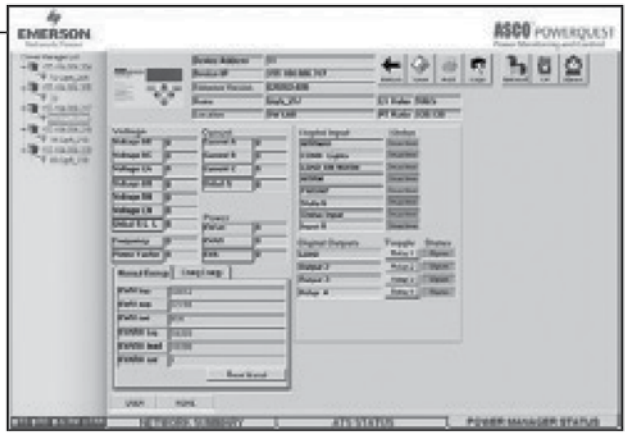
- Colored icons highlighted to show source availability and which source is connected to load.

ASCO® POWERQUEST 32.15



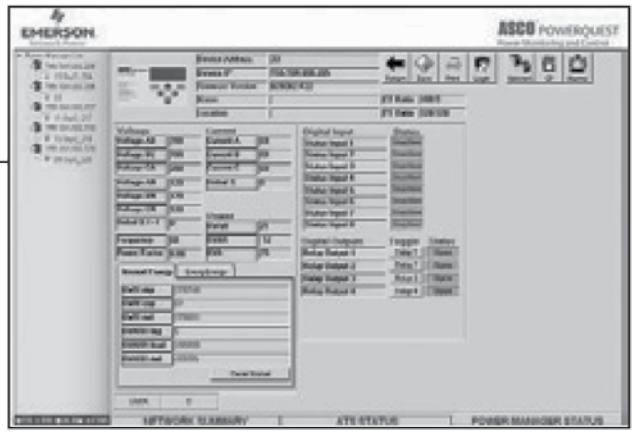
Transfer Switch Detail Screen

- ATS rating and identification data is displayed.
- Allows remote testing and time delay bypass.
- Voltage, frequency, phase sequence, voltage unbalance and time delay settings can be checked.
- Viewing of engine exercise schedules.
- Displays phase to phase voltage on normal and emergency.
- Provides complete system status message from 4000 series microprocessor controller.
- View event log on the last 99 events for each ATS.
- Arrange test schedules for transfer switches.
- Provides for monitoring of local site or remote sites.



Power Manager Detail Screen

- Voltage: phase to phase; phase to neutral and voltage unbalance.
- 3 phase currents and neutral (optional).
- Frequency.
- Kilowatt hours - normal and emergency.
- Status and control of four relay outputs.
- Status of eight digital inputs.
- Device ratings: CT and PT ratio.



Engine-Generator Details

- Voltage: Phase to phase; Phase to neutral
- Current for each phase.
- Kilowatts and kilowatt hours total.
- Frequency and power factor.
- Status and control of four digital outputs which can be customized by the user.
- Status of eight digital inputs.
- "Alarm Enabled" selection. These alarms flash the "engine-generator" icon on the summary screen.
- Digital inputs for engine malfunctions are derived from engine mounted sensors (supplied by others).



Fig. 11: Serial Module 72A

5110 Serial Module

The 5110 Serial Module is used to allow local or remote communications with ASCO POWERQUEST® communication products.

The module is used to connect the 4000 SERIES transfer switches to a serial network via an RS-485 interface. The module has two port connectors used for ATS & Power Manager connectivity.

The serial connection is accomplished from a 5-pin terminal header/socket block. RS- 485 serial networks allow for up to 32 modules to be set up in a daisy chain configuration to connect to POWERQUEST® systems.



Fig. 12: Connectivity Module 72E

5150 Connectivity Module

The 5150 Connectivity Module is used to bring several different serial devices that communicate at different baud rates and with different protocols to a common Ethernet media.

The module is used to connect 4000 SERIES transfer switches, and ASCO Remote Annuciators to a standard Ethernet TCP/IP network with standard 10base T(RJ-45) connectors. The module has customized embedded JAVA™ applets (program applications for an internet browser) for each monitored device that loads automatically to a standard Web Browser.

The module is designed to communicate with up to 8 clients such as Web applications (web pages), POWERQUEST®, or third party *Modbus*® devices simultaneously over an Ethernet connection.



Fig. 13: ASCO Remote Annuciator

5350 Remote Annunciator

The ASCO Power Transfer Switch Remote Annunciator is a stand-alone, industrial grade interface device providing you with the most critical transfer switch status indication and transfer/retransfer control for up to eight switches. Ethernet technology is built in for faster and more reliable communications. LEDs indicate switch status and position, while separate push buttons individually initiate transfer switch operation and testing. Transfer switch annunciators can be set up in multiple locations to monitor various transfer switches, allowing redundant and distributed annunciation.

ASCO® POWERQUEST Solutions

5500 Series Thin Web Server

The ASCO Thin Web Server is an internet-based thin client application, which provides monitoring and control of transfer switches and engine generators from anywhere in the world. With ASCO 72E/72A Communications Interface modules and ASCO 5200 Series Power Managers, it brings the power interface to your browser with your user name and password. Alarms and event logs are provided through the browser, while simultaneously transmitting an email indicating that an alarm has occurred with one or more transfer switches.



Fig. 24: Thin Web Server

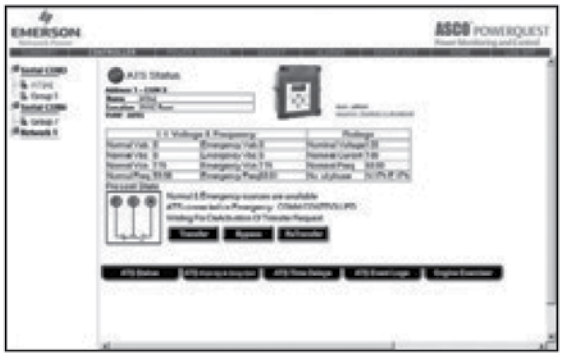


Fig. 25: Thin Web's html interface screen shot

Communications Products for 4000 Series Transfer Switches

Description	Acc. Option	Catalog No.
Serial Module	72A	5110
Connectivity Module	72E	5150
Power Manager with Display*	85L	5220D
Thin Web Server*	–	5510E
Software Package*	–	32.15

* These products are available as separate items only. They can be ordered by catalog numbers shown in above chart.

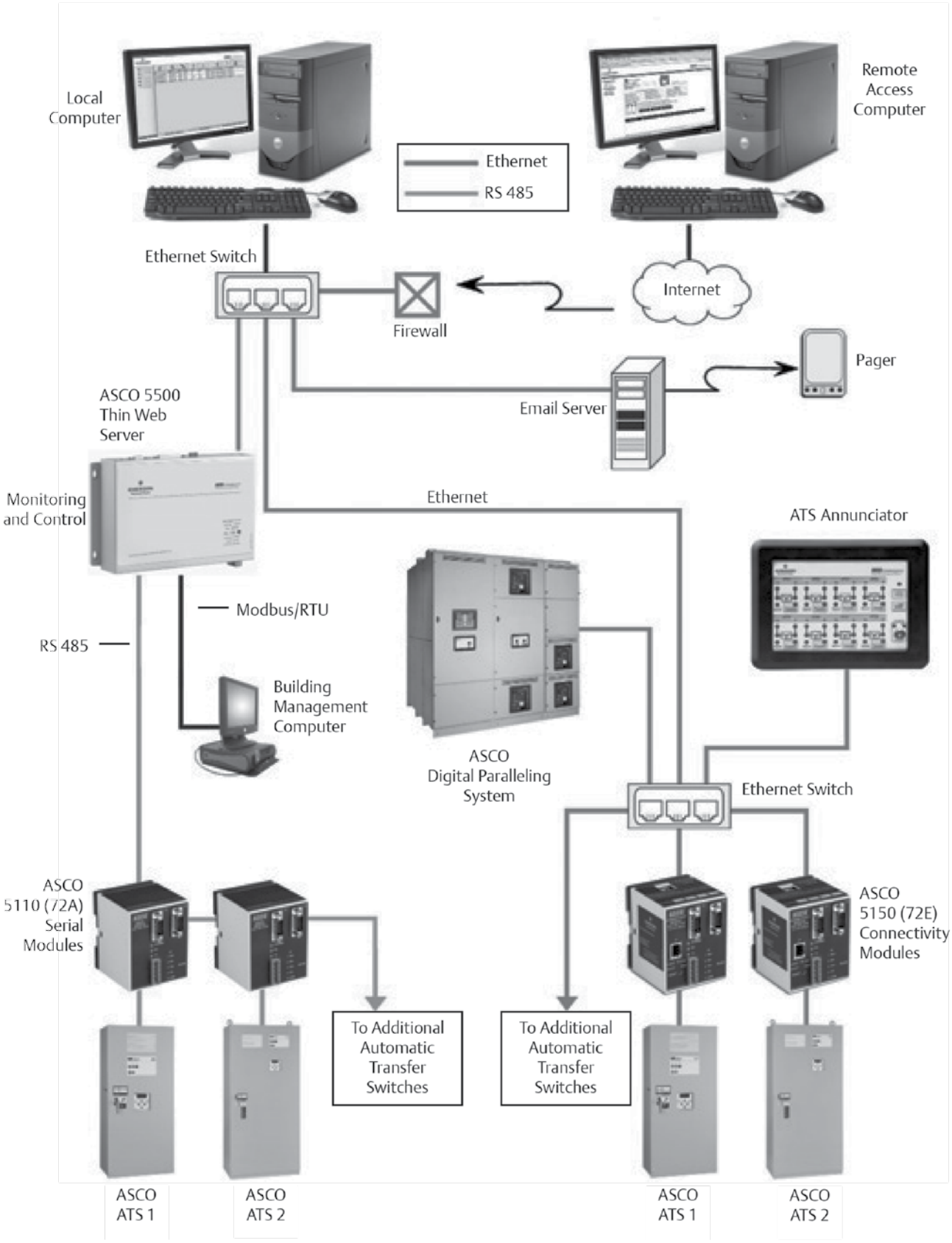
ASCO® POWERQUEST Solutions Comparison

ASCO Connectivity Solution Guide Feature	POWERQUEST® 32.15	5500 Thin Web Server	5150 Connectivity Module	5350 Remote Annunciator
Quantity of Monitored / Controlled Power Transfer Switches per LAN	32	64	1024+	8
Number of Monitored / Controlled Gensets	4	8	1024+	0
Control & Monitoring Capability	Yes	Yes	No	Yes
Embedded Web Pages	No	Yes	Yes	Yes
Ethernet Network Compatible	Yes	Yes	Yes	Yes
Monitor Multiple Protocols & Baud Rates (ASCO I, ASCO II, Modbus)	No	No	Yes	Yes
Monitor Multiple Sites	Intranet	Internet	Intranet	Intranet
Multiple Client Access	No	Up to 8	Up to 8	Up to 8
Client Software Required	Yes	Internet Explorer	Internet Explorer	Internet Explorer*
Monitors Dissimilar ASCO Controllers on Common LAN	No	No	Yes	Yes
Communicates with ASCO Remote Annuciators	No	No	Yes	Yes
Email / Paging Alarms	No	Yes	No	No
Historical Trending Option Alarms	No	Yes	No	Yes**

* Internet Explorer only required for initial communications setup.

** Historical trending not available on Remote Annuciator.

ASCO® POWERQUEST Solutions



ASCO® 4000 Series Ordering Information

To order an ASCO 4000 Series Power Transfer Switch, complete the following catalog number:

4 A TS + A + 3 + 400 + N + 5X + C

		Product		Neutral Code*		Phase Poles	Amperes		Voltage Code		Grp Code	Enclosure	
A	Automatic	TS	Conventional 2-Position	---	No Neutral	2	30	1000	A	115	5	---	No enclosure
		CTS	Closed Transition	A	Solid Neutral	3	70	1200	B	120	5X- optional acces-sories	C	Type 1 enclosure
N	Non-Automatic	DTS	Delayed Transition	B	Switched Neutral		100	1600	C	208		F	Type 3R enclosure
							125	2000	D	220		G	Type 4 enclosure
							150	2600	E	230		H	Type 4X enclosure[2]
							200[1]	3000	F	240		L	Type 12 enclosure
							230[1]	4000	H	380		M	Type 3R secure double door
							260		J	400		N	Type 4 secure double door
							400		K	415		P	Type 4X secure[2] double door
							600		L	440		Q	Type 12 secure double door
							800		M	460		R	Type 3RX secure double door (Stainless Steel)
									N	480			
									P	550			
									Q	575			
									R	600			

*Note: 1. 200 and 230 amp switch limited to 480 volts maximum.
2. Type 304 Stainless steel is standard. To provide an improved reduction in corrosion in salt or marine environments, specify optional type 316 stainless steel.

The Example Catalog Number above is 4ATSA3400N5XC (X is used to specify optional accessories).

Transfer Switch Configurations

4ATS, 4NTS, 4ADTS, 4NDTS, 4ACTS, 4NCTS

Sizes of UL-Listed Solderless Screw-Type Terminals for External Power Connections

Switch Rating amps	Max # of Conductors per Terminal	Range of AL-CU Conductor Sizes
30 -230[1] ATS,NTS	One	#14 to 4/0 AWG
150 DTS, CTS	One	#4 AWG to 600 MCM
	Two	#1/0 AWG to 250 MCM
260-400	One	#4 AWG to 600 MCM
	Two	#1/0 AWG to 250 MCM
600	Two	#2 AWG to 600 MCM
800-1200	Four	#1/0 AWG to 600 MCM
1600-2000[2]	Six	#1/0 AWG to 600 MCM
2600, 3000[2]	Twelve	#1/0 AWG to 600 MCM
4000[2]	Twelve	#2/0 AWG to 600 MCM

Notes:

1. 200 and 230 amp rating for copper conductors only.

2. All main terminals are rear connected. 1600 & 2000 amp switches are available in optional front connected arrangement. Specify optional accessory 40MY for 1600 amp and 40NY for 2000 amp. WCR rating limited to 85,000 amp rms symmetrical. see pages 20, 21 for enclosure dimensions.

ASCO® START-UP COMMISSIONING, SERVICE & SCHEDULED MAINTENANCE



ASCO Services Inc., provides a wide range of technical services to users of automatic transfer switches in emergency and standby power systems. These services include comprehensive scheduled maintenance programs, modifications, upgrades and emergency repairs. Systems serviced range in complexity from a single automatic transfer switch to multiple transfer switches and engine generators.

ASCO Services is a wholly owned subsidiary and the exclusive OEM service arm of ASCO Power Technologies, the world's largest manufacturer of power transfer switching and control equipment. Serving the needs of ASCO's customers is a major focus; however, ASCO Services is also routinely called upon to perform regular maintenance and emergency repairs on equipment manufactured by others.

ASCO Services offers comprehensive maintenance agreements that detail the preventive care needed to keep emergency power systems ready to respond. A service agreement is an effective way to budget in advance and avoid unexpected expenditures. A 35 point checklist is utilized to assure critical systems and components are kept in top operating condition. These preventive programs can be customized for national accounts. This customization permits central corporate control of costs and scheduling. Periodic reports provide detailed information as to activity, maintenance performed and corrective action.

ASCO Services deploys more than 75 service personnel strategically located throughout the nation to provide 24-hour response in emergency situations. Each region is manned by experienced personnel who receive ongoing support and training in the newest equipment concepts, design and controls. Because equipment can be utilized for a long number of years, field representatives also receive education on older designs. This knowledge can be invaluable in addressing total system concerns, evaluating problems and providing solutions on site. Service vans are equipped with parts and advanced testing equipment that facilitate these on-the-spot repairs. ASCO Services 1-800-800-ASCO.

ASCO® 4000 Series Designed to Fit Anywhere*

2-Position Transfer Switching 4ATS, 4NTS

Switch Rating Amps	Poles	Width inches (mm)	Height inches (mm)	Depth inches (mm)
Enclosed UL Type 1[2]				
30, 70, 100, 125, 150, 200, 230	2, 3 or 3 with neutral A/B	18 (457)	48 (1219)	13 (330)
260, 400	2, 3 or 3 with neutral A/B	24 (610)	56 (1422)	14 (356)
600	2, 3 or 3 with neutral A/B	24 (610)	63 (1600)	17 (432)
800, 1000	2, 3 or 3 with neutral A/B	34 (864)	72 (1829)	20 (508)
1200	2, 3 or 3 with neutral A/B	38 (965)	87 (2210)	23 (584)
1600, 2000[1]	2, 3 or 3 with neutral A/B	38 (965)	91 (2311)	48 (1219
1600, 2000 (front connected)[3]	2, 3 or 3 with neutral C	38 (965)	87 (2210)	23 (584)
2600, 3000[1]	2, 3 or 3 with neutral A/B	38 (965)	91 (2311)	60 (1524)
4000[1]	2, 3 or 3 with neutral A/B	60 (1524)	91 (2311)	72 (1829)
Open Configuration				
30, 70, 100, 125,150, 200, 230	2, 3 or 3 with neutral B	10-1/4 (260)	10-1/4 (260)	5-1/2 (140)
260, 400	2, 3 or 3 with neutral B	18-1/2 (470)	25 (635)	8 (203)
600	2, 3 or 3 with neutral B	19 (483)	30 (762)	9-7/8 (251)
800, 1000, 1200	2, 3 or 3 with neutral B	27 (686)	31 (787)	12-7/8 (327)
1600, 2000	2, 3 or 3 with neutral B	33-1/4 (845)	28 (711)	26-1/4 (667)
2600, 3000	2, 3 or 3 with neutral B	33-1/4 (845)	28 (711)	30-3/4 (781)
4000	2, 3 or 3 with neutral B	60 (1524)	70 (1778)	53 (1272)

Notes:
1. Enclosures for 1600 - 4000 amp are free-standing with removable top, sides, and back.
2. Consult ASCO for dimensions on enclosures other than UL type 1.
3. Optional arrangement.

Shipping Weights[1]
2-Position Transfer Switching 4ATS, 4NTS

Switch Rating Amps	Poles	Enclosed lb (kg)	Open lb (kg)
30, 70, 100, 125	2	67 (31)	15 (7)
30, 70, 100, 125	3	70 (32)	18 (8)
30, 70, 100, 125	3 with B	73 (33)	21 (10)
150, 200, 230	2	69 (32)	17 (8)
150, 200, 230	3	72 (33)	20 (9)
150, 200, 230	3 with B	75 (34)	23 (11)
260, 400	2	216 (98)	82 (37)
260, 400	3	223 (101)	89 (40)
260, 400	3 with B	230 (105)	102 (46)
600	2	316 (143)	88 (40)
600	3	324 (147)	96 (44)
600	3 with B	332 (151)	104 (47)
800, 1000	2	400 (182)	150 (68)
800, 1000	3	420 (192)	170 (78)
800, 1000	3 with B	446 (203)	196 (90)
1200	2	685 (312)	150 (68)
1200	3	705 (321)	170 (78)
1200	3 with B	731 (333)	196 (90)
1600, 2000	2	1110 (503)	370 (167)
1600, 2000	3	1160 (525)	420 (190)
1600, 2000	3 with B	1210 (548)	470 (213)
2600, 3000	2	1365 (620)	405 (184)
2600, 3000	3	1430 (649)	470 (213)
2600, 3000	3 with B	1495 (679)	535 (243)
4000	2	1969 (893)	1258 (571)
4000	3	2149 (975)	1451 (658)
4000	3 with B	2328 (1056)	1623 (736)

Notes:
1. Open weights include transfer switch and control panel. 1200-4000 amp enclosures require ventilation openings, refer to drawings for details. Export shipments may require a wooden box, contact ASCO for weights and dimensions.

** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

Closed Transition and Delayed Transition Transfer Switching 4ACTS, 4NCTS, 4ADTS, 4NDTS

Switch Rating Amps	Poles	Width inches (mm)	Height inches (mm)	Depth inches (mm)
Enclosed UL Type 1[2]				
150, 260, 400	2, 3 or 3 with neutral A/B	24 (610)	56 (1422)	14 (356)
600	2, 3 or 3 with neutral A/B	24(610)	63 (1600)	17(432)
800, 1000	2, 3 or 3 with neutral A/B	34 (864)	72 (1829)	20 (508)
1200	2, 3 or 3 with neutral A/B	38 (965)	87 (2210)	23 (584)
1600, 2000[1]	2, 3 or 3 with neutral A/B	38 (965)	91 (2311)	48 (1219)
1600, 2000 (front connected)	2, 3 or 3 with neutral C	38 (965)	87 (2210)	23 (584)
3000[1]	2, 3 or 3 with neutral A/B	38 (965)	91 (2311)	60 (1524)
4000[1]	2, 3 or 3 with neutral A/C	60 (1524)	91 (2311)	72 (1829)
Open Configuration				
150, 260, 400	2, 3 or 3 with neutral B	18-1/2 (470)	25 (635)	8 (203)
600	2, 3 or 3 with neutral B	19 (483)	30 (762)	9-7/8 (251)
800, 1000, 1200	2, 3 or 3 with neutral B	27 (686)	31 (787)	12-7/8 (327)
1600, 2000	2, 3 or 3 with neutral B	33-1/4 (845)	28 (711)	26-1/4 (667)
2600, 3000	2, 3 or 3 with neutral B	33-1/4 (845)	28 (711)	30-3/4 (781)
4000	2, 3 or 3 with neutral B	60 (1524)	70 (1778)	53 (1272)

Notes:

1. Enclosures for 1600 - 4000 amp are free-standing with removable top, sides, and back.

2. Consult ASCO for dimensions on enclosures other than UL type 1.

Shipping Weights

Closed Transition and Delayed Transition Transfer Switching 4ACTS, 4NCTS, 4ADTS, 4NDTS

Switch Rating Amps	Poles	Enclosed lb (kg)	Open* lb (kg)
150, 260, 400	2	235 (107)	101 (46)
150, 260, 400	3	242 (110)	108 (49)
150, 260, 400	3 with B	250 (113)	115 (52)
600	2	335 (152)	107 (48)
600	3	343 (156)	115 (52)
600	3 with B	352 (159)	124(56)
800, 1000	2	420 (192)	175 (80)
800, 1000	3	450 (205)	205 (94)
800, 1000	3 with B	480 (219)	235 (108)
1200	2	710 (324)	175 (80)
1200	3	740 (337)	205 (94)
1200	3 with B	770 (351)	235 (108)
1600, 2000	2	1300 (590)	505 (229)
1600, 2000	3	1350 (612)	555 (252)
1600, 2000	3 with B	1400 (635)	605 (274)
2600, 3000	2	1555 (706)	540 (245)
2600, 3000	3	1620 (735)	660 (300)
2600, 3000	3 with B	1685 (765)	725 (329)
4000	2	1969 (893)	1258 (571)
4000	3	2149 (975)	1451 (658)
4000	3 with B	2328 (1056)	1623 (736)

Notes:

1. Open weights include transfer switch and control panel. 1200-4000 amp enclosures require ventilation openings, refer to drawings for details. Export shipments may require a wooden box, contact ASCO for weights and dimensions.

** All dimensions and weights shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.*

SUGGESTED SPECIFICATION
For
Automatic Transfer Switches

Division 16 - Electrical
Standby Power Generator Systems

PART 1 GENERAL

1.01 Scope

Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

1.02 Codes and Standards

The automatic transfer switches and controls shall conform to the requirements of:

A. UL 1008 - Standard for Transfer Switch Equipment

B. CSA certified to CSA 22.2 No. 178 – 1978 Automatic Transfer Switches

C. IEC 60947-6-1 Low-voltage Switchgear and Controlgear; Multifunction equipment; Automatic Transfer Switching Equipment

D. NFPA 70 - National Electrical Code

E. NFPA 99 - Essential Electrical Systems for Health Care Facilities

F. NFPA 110 - Emergency and Standby Power Systems

G. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

H. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

I. UL 508 Industrial Control Equipment

1.03 Acceptable Manufacturers

Automatic transfer switches shall be ASCO 4000 Series. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Alternate bids must list any deviations from this specification.

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators utilizing overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

B. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

C. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

D. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

E. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 800 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

F. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

G. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

2.02 Microprocessor Controller

A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module or Ethernet connectivity module.

B. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.

C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.

D. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1.	EN 55011:1991	Emission standard - Group 1, Class A
2.	EN 50082-2:1995	Generic immunity standard, from which:
	EN 61000-4-2:1995	Electrostatic discharge (ESD) immunity
	ENV 50140:1993	Radiated Electro-Magnetic field immunity
	EN 61000-4-4:1995	Electrical fast transient (EFT) immunity
	EN 61000-4-5:1995	Surge transient immunity
	EN 61000-4-6:1996	Conducted Radio-Frequency field immunity

2.03 Enclosure

A. The ATS shall be furnished in a Type 1 enclosure unless otherwise shown on the plans.

B. All standard door mounted switches and indicating lights described in section 3 shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall include a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. The membrane panel shall be suitable for mounting by others when furnished on open type units.

PART 3 OPERATION

3.01 Controller Display and Keypad

A. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications interface port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency

2. Single or three phase sensing

3. Operating parameter protection

4. Transfer operating mode configuration

(Open transition, Closed transition, or Delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.02 Voltage, Frequency and Phase Rotation Sensing

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

B. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via the communications interface port.

D. The controller shall be capable (when activated by the keypad or the communications interface port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

E. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

3.03 Time Delays

A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the

ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.
5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

F. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:

1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
3. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.

G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the communications interface port.

3.04 Additional Features

A. Membrane-type switches shall be provided for the ***test*** and ***retransfer to normal*** functions. The test position will simulate a normal source failure. The retransfer to normal position shall bypass the time delays on retransfer to normal.

B. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.

D. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

E. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

F. A membrane switch shall be provided on the membrane panel to test all indicating lights when pressed.

The following features shall be built-in to the controller, but capable of being activated through keypad programming or the communications interface port only when required by the user:

G. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

H. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or the communications interface port.

I. An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

J. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode when a non-automatic version of the user interface membrane is furnished.

K. Engine Exerciser – The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time, .
   - time of day
   - day of week
   - week of month (1st, 2nd, 3rd, 4th, alternate or every)
4. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

L. Key Locking Feature – The control switches on the interface membrane shall be capable of being locked via password protected screens on the controller LCD display to prevent unauthorized tampering. A red LED indicator shall be illuminated on the interface membrane when the membrane controls are locked.

M. System Status – The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

Normal Failed
Load on Normal
TD Normal to Emerg
2min15s

N. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

O. Self Diagnostics – The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

P. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:

1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line; ATS controls status, alarms, metering, event logging as well as settings.
4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.
5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactivating of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of ninety-nine (99) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, five (5) serial ports, Termination dip-switches and LEDs for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE2

Q. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging

1. Data and time and reason for transfer normal to emergency.
2. Data and time and reason for transfer emergency to normal.
3. Data and time and reason for engine start.
4. Data and time engine stopped.
5. Data and time emergency source available.
6. Data and time emergency source not available.

2. Statistical Data

1. Total number of transfers.
2. Total number of transfers due to source failure.
3. Total number of days controller is energized.
4. Total number of hours both normal and emergency sources are available.

PART 4 ADDITIONAL REQUIREMENTS

4.01 Withstand and Closing Ratings

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.

B. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

4.02 Tests and Certification

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

4.03 Service Representation

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

**Note Spec Writer:* *The following section is optional and should be deleted if not used.*

PART 5 OPTIONAL FEATURES

5.01 POWER METER

A. *Furnish Power Meters at locations shown to monitor all functions specified below.*

B. *The Power Meter shall be listed to UL 3111-1, CSA, CE Mark, and industrially rated for an operating temperature range of -20°C to 60°C.*

C. *The Power Meter shall be accurate to 0.25% of measured and computed values and display resolution to 0.25%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).*

D. *The Power Meter shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 – 32 VDC.*

E. *The Power Meter shall accept inputs from industry standard instrument transformers (120 VAC secondary PT's and 5A secondary CT's.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PT's.*

F. *The Power Meter shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.*

G. *All setup parameters required by the Power Meter shall be stored in non-volatile memory and retained in the event of a control power interruption.*

H. *Each Power Meter shall be capable of interfacing to a communications network to permit information to be sent and received by a central location for display, analysis, logging, and control.*

I. *The Power Meter shall have an embedded 4-wire RS-485 serial interface for stand alone applications. Additionally, 4-wire RS-485, 2-wire RS-485, and Ethernet communications shall also be available via an optional communications interface module. One communications module shall allow for connections from both a Transfer Switch and Power Manager simultaneously to the communications network.*

J. *The Power Meter shall be able to interface to 3rd party applications using the ModbusRTU and ModbusTCP open standard protocols. Communications interface modules shall be used as needed to provide the RS-485 or Ethernet Connection. This connection shall allow for monitoring of metered readings, event logs, and status inputs, as well as control of status outputs and setpoint acknowledgements.*

K. *The following metered readings shall be communicated by the Power Meter over the communications network interface. All readings shall provide indication of which source is being measured.*

1. *Current, per phase RMS and neutral (if applicable)*
2. *Current Unbalance %*
3. *Voltage, phase-to-phase and phase-to-neutral (if applicable)*
4. *Voltage Unbalance %*
5. *Real power (KW), per phase and 3-phase total*
6. *Apparent power (KVA), per phase and 3-phase total*
7. *Reactive power (KVAR), per phase and 3-phase total*
8. *Power factor, 3-phase total & per phase*
9. *Frequency*
10. *Accumulated Energy, (MWH, MVAH, and MVARH)*

L. *The following energy readings shall be communicated by the Power Meter:*

1. *Accumulated real energy KWH*
2. *Accumulated reactive energy KVAH*
3. *Accumulated apparent energy KVARH*

NOTE: For real and reactive energy reported values, separate total for energy flow from each source shall be stored, including the arithmetic sum.

M. *Power Meters shall be equipped with the following hardwire Input/Output Options:*

1. *Provide one dedicated solid state status input to indicate transfer switch position if used to monitor a transfer switch.*
2. *Provide eight solid state status inputs.*
3. *Provide four relay output contacts. Relay outputs shall be Form C dry contacts, UL/CSA rated 1A@30Vdc, 0.5A@125Vac resistive load.*

N. *Power Meter shall be equipped with protective programmable setpoints. These setpoints shall be able to be used to annunciate an alarm or trigger an output relay on the following conditions.*

1. *KW overload pre-alarm*
2. *KW overload alarm*
3. *Over voltage*
4. *Under voltage*
5. *Over frequency*
6. *Under frequency*
7. *Reverse/Under power*
8. *Reverse VARS*
9. *Reverse over current*
10. *Negative sequence over current*
11. *Negative sequence voltage*
12. *Digital Inputs(1:8)*

O. *Each programmable setpoint shall allow the user to select:*

1. *The parameter*
2. *The trip level*
3. *The reset level*
4. *The trip time delay*
5. *The reset time delay*
6. *The alarm type or digital output*
7. *Whether acknowledgement of the alarm is required*

P. *The Power Meter shall have a Device 86 feature that can latch an output relay closed whenever a setpoint configured to that relay is tripped. The relay shall only open when the reset conditions have been met, and the alarm is acknowledged by an operator.*

****Note Spec Writer:*** *The following section is optional and should be deleted if not used.*

A. *The Power Meter shall flush mount to an enclosure.*

B. *The Power Meters shall be equipped with an optional continuous duty, long-life, 4 line x 20 character LCD backlit display to provide local access to the following metered quantities:*

1. *Current, per phase RMS and neutral (if applicable)*
2. *Current Unbalance %*
3. *Voltage, phase-to-phase and phase-to-neutral (if applicable)*
4. *Voltage Unbalance %*
5. *Real power (KW), per phase and 3-phase total*
6. *Apparent power (KVA), per phase and 3-phase total*
7. *Reactive power (KVAR), per phase and 3-phase total*
8. *Power factor, 3-phase total & per phase*
9. *Frequency*
10. *Accumulated Energy, (MWH, MVAH, and MVARH)*

C. *Displaying each of the Power Meter quantities shall be accomplished through the use of menu scroll buttons.*

D. *For ease in operator viewing, the display shall remain on continuously, with no detrimental effect on the life of the Power Meter.*

E. *Setup for system requirements shall be allowed from the front of the Power Meter. Setup provisions shall include:*

1. *CT rating (xxxxx:5)*
2. *PT rating (xxxxxxx:120) (if applicable; 24000V maximum)*
3. *System type (single; three phase; 3 and 4 wire)*
4. *Source to be monitored (Normal, Emergency, Load, Other)*
5. *Nominal Values (kW capacity, voltage, current, frequency)*
6. *Communication parameters*

F. *Reset of the following electrical parameters shall also be allowed from the front of the Power Meter:*

1. *Accumulated real energy KWH*
2. *Accumulated reactive energy KVAH*
3. *Accumulated apparent energy KVARH*

G. *The Power Meter shall have the ability to display entries from the Setup log on the LCD display. It shall also have the ability to clear the Setup log database from the display.*

H. *The Power Meter shall have the ability to display entries from the Event log both locally on the LCD display and remotely over the communications interface. It shall also have the ability to clear the Event log database from the display.*

I. *All reset and setup functions shall have a means for protection against unauthorized/accidental changes.*

5.02 ATS REMOTE ANNUNCIATOR

General

Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

A. Hardware Specifications

The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings:

- *User-configured labels with ATS names and power sources*
- *Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports*
- *LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity*

- *Push button for transfer/retransfer control operations and time delay bypass*
- *Push buttons for Alarm Silence and Lamp Test*
- *Key lock to enable and disable the transfer push button*
- *Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs*
- *Programmable watchdog timer that can generate a system reset upon timeout (min 1 sec)*
- *Factory reset capability*
- *100 ms power ride-through*

B. Software Specification

The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:

- *Configuration for protocol and communications management with the ability of auto discovering transfer switches on network*
- *Ability to create and print customized labels for ATS names and power sources*
- *The ability to choose a continuous or periodic audible alarm with customizable interval time*
- *Ability to configure up to 8 discrete inputs as alarms*
- *View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters*
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware locally without interfering with installation*
  View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware locally without interfering with installation*

C. Communications

Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisy-chained serial modules into a single Connectivity Module. Additional features include:

- *Supports Full Duplex Flow Control (IEEE 802.3x)*
- *3.3V power supply with 5V I/O tolerance*
- *Supports 3 LEDs to indicate traffic link speed and collision*

D. Mounting

The ATS Remote Annunciator is suitable for:

- *Surface mounting using mounting screws studs*
- *Flush Mount from behind a cutout section (Enclosure Door Mounting)*
- *Flush Mount from the front of a cutout section (Enclosure Door Mounting)*

E. Power Supply

The ATS Remote Annunciator shall be capable of accepting 24VDC 120 VAC or 240 VAC power source.

F. Environmental

The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 º to 158 º F (-20 º to +70 º C) @ 5~85% humidity and Ambient Storage Temperature of -40 º to 185 º F (-40 º to 85 º C).

5.03 Control Relay Interface Board

A. *An optional plug-in relay board shall be furnished which mounts on the back of the membrane interface board. The relay board shall contain four relays with form C contacts rated 2A @ 30Vdc, 0.5A@125Vac.*

B. *The function of relays RL1 through RL3 is as follows:*

1. *RL1 energized if emergency source acceptable output is active.*
2. *RL2 energized if normal source acceptable output is active.*
3. *RL3 energized if load disconnect signal output is active.*

C. *The function of RL4 shall be capable of being configured via DIP switches on the control relay board, as shown:*

4. *position 1 on relay energized if normal source acceptable output is active*
5. *position 2 on relay energized if emergency source acceptable output is active*
6. *position 3 on relay energized if extended parallel output is active (for Closed Transition Switches only).*
7. *position 4 on relay energized if ATS locked out output is active (for Closed Transition Switches only).*
8. *position 5 on relay energized if fail to sync / load disconnect output is active (for Closed or Delayed Transition Switches only).*

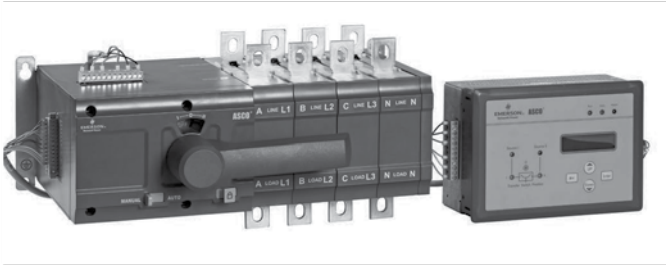
D. *Multiple conditions can be used to energize RL4 by activating more than one switch. For example, if both positions 1 and 2 are on, the relay will be energized if either the normal or emergency source is acceptable.*

5.04 Provisions for External DC Power Supply *– An optional provision shall be available to connect an external 24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead. The option shall be equivalent to ASCO accessory 1G.*

ASCO Series 230 Automatic Transfer Switch

Product Overview

The Series 230 automatic transfer switch consists of an intelligent controller and a modular load break switch which automatically transfers the load to the emergency power source when it detects the normal power source under/over voltage, under/ over frequency, or phase loss. The switch has three operational positions (Source I, Center-off, Source II). The two sources are isolated when the switch is in the center- off position. A center-off position locking mechanism is also provided.



Application

The Series 230 transfer switch is rated up to 800A and is available from 220 to 415 volts for both 50 and 60 Hz, single and three phase. Typical applications include commercial and residential buildings, hospitals, telecom, subway and transportation, data centers, military and fire pumps.

Parameter

Rated Operational Current Ie (A)		16	32	63	80	100	125	160	200	225	250	315	400	500	630	800
Rated Insulation Voltage U_i (V)		800				1000			1000			1000		1000		
Rated Impulse Withstand Voltage U_{imp} (kV)		8				8			12			12		12		
Rated Operation Voltage U_e (V)		220, 230, 240, 380, 400, 415														
Rated Frequency (Hz)		50 / 60														
Poles		2,4				2, 3, 4										
Rated Short-Time Withstand Current I_{cw} (kA, RMS)		6 (0.03s)				10 (0.1s)			15 (0.1s)			25 (0.1s)		40(0.1s)/ 20(1s)		
Rated Short-Circuit Making Capacity I_{cm} (kA, PEAK)		8				17			31.5			65		80		
Withstand and Close-On Rating I_q (kA)	When Used With Current Limiting Fuses	65				65			200			200		200		
	When Used With Specific Circuit Breakers	15				50			150			150		80		
Making and Breaking Capacity		10 I_e														
Mechanical Operation Performance (cycles)		10,000														
Utilization Category		AC-32A, AC-33B														
Operation Voltage range (AC)	Ue=220V / 230V / 240V / 380V / 400V	125～300V (L-N)				(0.7～1.2) Ue										
	Ue= 415V					(0.7～1.15) Ue										
EMC Class		Class A														
Wiring Way		Front														
Separate Lock Mechanism		Standard														
Auxiliary Contact (Optional)		4 contacts maximum				8 contacts maximum										



The Recognized Leader in Power Transfer Switch Technology Offers the Most Advanced Transfer Switches in the World.

ASCO Series 230 Automatic Transfer Switch

Product Features:



Performance Features

Meets or exceeds the requirements of the following regulatory agencies

- EN60947-6-1/IEC60947-6-1: Transfer Switching
- EN60947-3/IEC60947-3: Suitable for Isolation
- EN55022: Radiated and Conducted Emission, Class A
- EN61000-3-2: Harmonic Current Emission, Class A
- EN61000-3-3: Limits of Voltage fluctuation and Flicker
- EN 61000-4-5: Immunity to Surge
- EN 61000-4-4: Immunity to Electrical Fast Transient
- EN61000-4-2: Immunity to Electrostatic Discharge
- EN61000-4-3: Immunity to Radiated Electric Fields
- EN 61000-4-6: Immunity to Continuous Conducted Interference

Structure

- PC Class ATS
- High ability to withstand lightning strikes (40kA 8/20μs)
- Simple reliable mechanism, compact and stylish appearance
- Modular design, convenient operation, easy maintenance
- Three operating positions. Both sources can be isolated in a center-off position

Arc Extinguish

- The utilization categories are AC-32A, AC-33B, and the ability to withstand and break is10 I_e
- Rotating dual contact design extinguishes the arc quickly and effectively
- Arcing contacts and main contacts are separate; main contacts are protected from arc damage
- Wiping-action contacts are self cleaning
- High short-circuit closing ratings

Switching Mechanism

- Automatic, manual and remote operation are available
- Unique contacts design limits contact bounce
- Unique clutch design makes manual operation easy and low force
- Electrical and mechanical interlocks prevent two sources from connecting simultaneously
- Innovative motor circuit protection ensures precision operation
- Cast steel bevel gear mechanism provides high transmission efficiency, and extends operating life

Controller

- Different Operating Modes (Source I priority / No Source priority)
- C300 and C2000 can work with an external 24VDC power supply
- High frequency switching power supply, and wide power voltage range
- Data (e.g. Event log, Setting, etc) remains intact if power is lost
- Intelligent fault diagnostics enable self-protecting motor feature
- RS485 communication interface is available
- Priority Source Swap

ASCO Series 230 Automatic Transfer Switch

Ordering Information

To order an ASCO Series 230 Automatic Transfer Switch, complete the following catalog number:

E2ADTL	B3	0800	H	D	X	0	1H
Frame size	Poles	Amperes Continuous Rating	Voltage Code	Controller	Options	Enclosure	Optional Accessories

Frame size		Poles	Amperes Continuous Rating	Voltage Code		Controller		Options	Enclosure		Optional Accessories
A2ADTL	16 ~ 80A Frame	B1: 2 Poles (L-N) (2-wire with Neutral)	0016, 0032	D	220V	B	C300*	Insert "X" If optional accessories are required	O	Open type	132JA ~ 132JC B2ADTL Frame BusBar
B2ADTL	100 ~ 160A Frame	02: 2 poles (L-L) (2-wire without Neutral)	0063, 0080	E	230V	D	C1000		C	IP20	132A ~ 132F Auxiliary Contacts
C2ADTL	200 ~ 250A Frame		0100, 0125	F	240V	E	C2000		Q	IP54	
D2ADTL	315 ~ 400A Frame	B2: 3 Poles (3-wire with Neutral)	0160, 0200	H	380V						72D C300, C1000 with RS-485
E2ADTL	500 ~ 800A Frame		0225, 0250	J	400V						
		03: 3 Poles (3- wire without Neutral)	0315, 0400	K	415V						1H C2000 with Energy Storage
			0500, 0630								
		B3: 4 Poles (4-wire with Neutral)	0800								

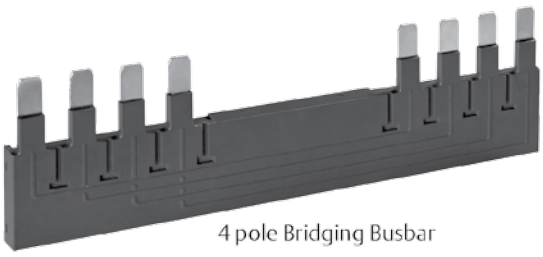
* The A2ADTL frame is only available with the embedded C300 controller

Optional Accessory Model Description and Order Information

B2ADTL Frame Bridging Bus Bar

132 J A

- A: Poles
  - A: 2 poles (02356097)
  - B: 3 poles (02357091)
  - C: 4 poles (02355942)
- Function Code 132J: Bridging Busbar



4 pole Bridging Busbar

For example: **132JC** , means Bridging Busbar for a 4 pole transfer switch

Auxiliary Contacts

132 A A

- Auxiliary Contact Quantity
  - BLANK: 1 contact
  - A: 2 contacts
  - B: 3 contacts
  - C: 4 contacts
- Function Code 132A-132F: Auxiliary Contact



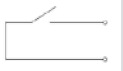
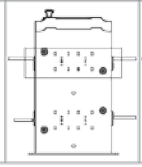
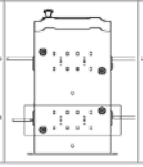
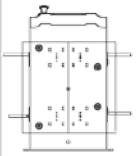
Auxiliary Contact

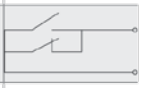
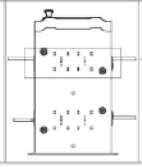
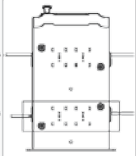
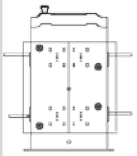
For example: **132BA** , means 2 sets of contacts, which close when the ATS transfers to the Source II position.

ASCO Series 230 Automatic Transfer Switch

Auxiliary Contact Definition

132A-132C : The auxiliary contacts can be used to indicate position with the CLOSE contact, see Schematic 1.
132D-132F: The auxiliary contacts can be used to indicate position with the OPEN contact, see Schematic 2.

Position of The Transfer Switch		Auxiliary Contact Function Code		
		132A	132B	132C
I				
O				
II				
Auxiliary Contact Code	LAP1F100 (16021426)	√	√	-
	LAP1F010 (16021427)	-	-	√
Auxiliary Contact Mounting Position (only showing C2ADTL, D2ADTL, E2ADTL).				

Position of The Transfer Switch		Auxiliary Contact Function Code		
		132D	132E	132F
I				
O				
II				
Auxiliary Contact Code	LAP1F100 (16021426)	-	-	√
	LAP1F010 (16021427)	√	√	-
Auxiliary Contact Mounting Position (only showing C2ADTL, D2ADTL, E2ADTL).				

72D

C300 or C1000 Controller with RS-485 interface

A RS485 interface installed in the C300 or C1000 controller to enable serial communications, supporting MODBUS protocol. This Accessory can only be installed in the factory. Use accessory code 72D when ordering this function.



1H

C2000 Controller with energy storage

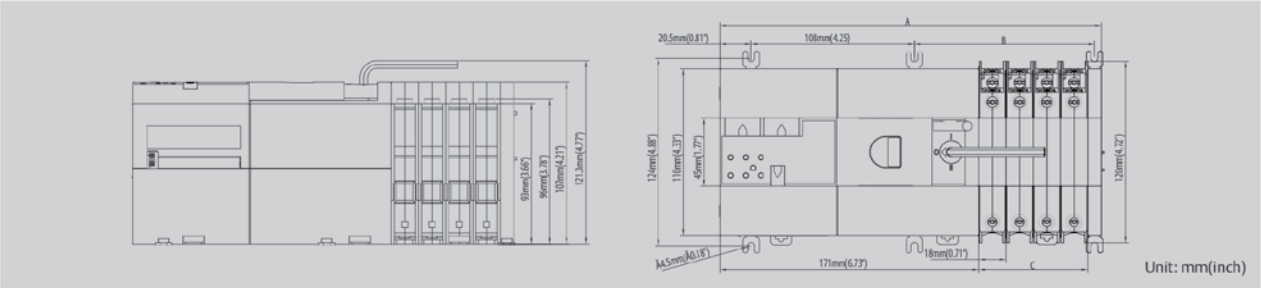
The optional controller with energy storage (Accessory 1H) has an added feature to switch the transfer switch to the center-off position during Source I and Source II failure at the same time. The controller will remain in center-off until either Source I or Source II power is restored and voltage and frequency are both stable. This optional feature can work in Source I Priority and No Source Priority operating modes. This feature is available only after the controller has been powered by AC input for at least10 minutes to charge a capacitor. This Accessory can only be installed in the factory. Use accessory code 1H when ordering this function.



Avoid Losing Critical information When Power is Lost

ASCO Series 230 Dimensions and Weight

A2ADTL Frame

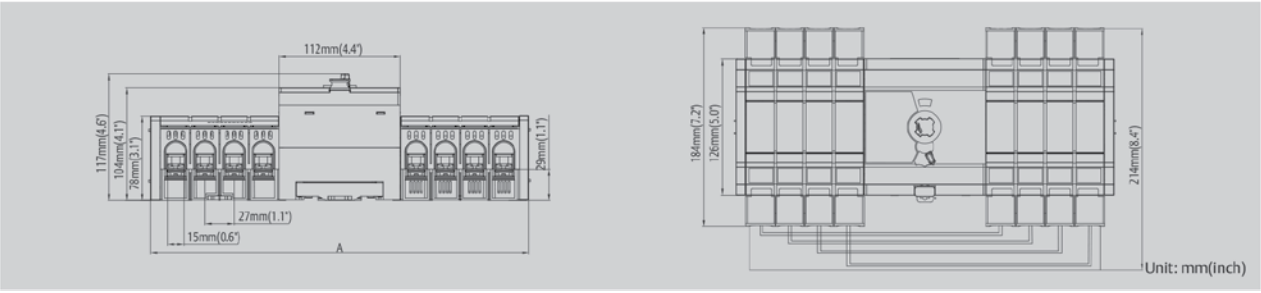


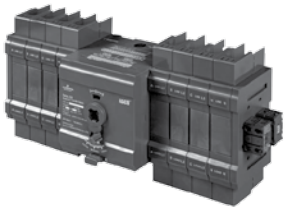


A2ADTL		2P	4P
Size (mm)	A	216.0	252.0
Weight (kg)		1.6	2.0

Note: unit must be installed in the cabinet using a DIN35 rail

B2ADTL Frame



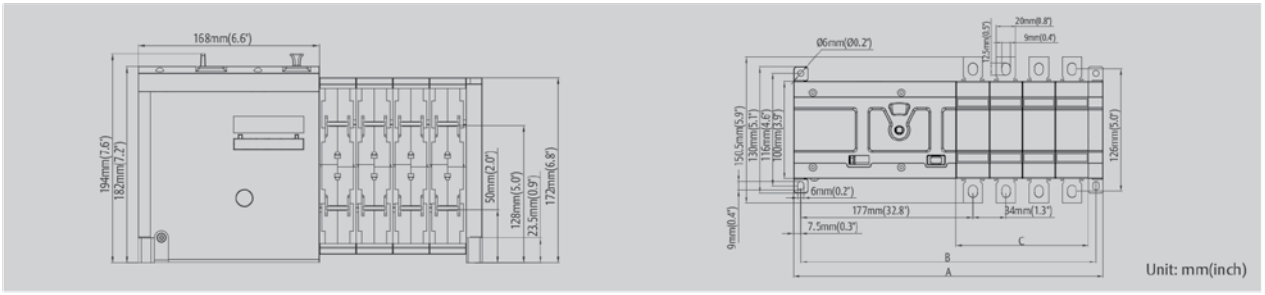


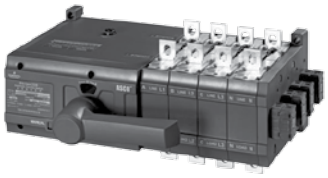
B2ADTL		2P	3P	4P
Size (mm)	A	241.0	349.0	349.0
Weight (kg)		2.6	2.8	2.8

Note: unit must be installed in the cabinet using a DIN35 rail

ASCO Series 230 Automatic Transfer Switch

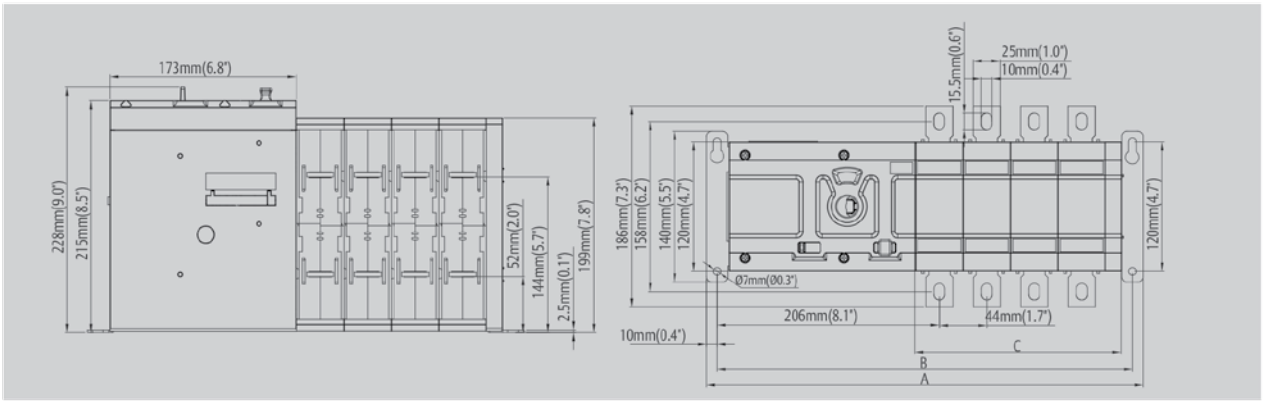
C2ADTL Frame



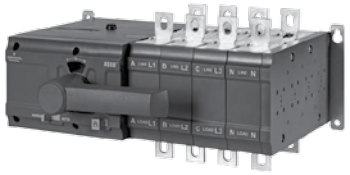


C2ADTL		2P	3P	4P
Size (mm)	A	251.0	285.0	319.0
	B	236.0	270.0	304.0
	C	68.0	102.0	136.0
Weight (kg)		4.6	5.2	5.8

D2ADTL Frame

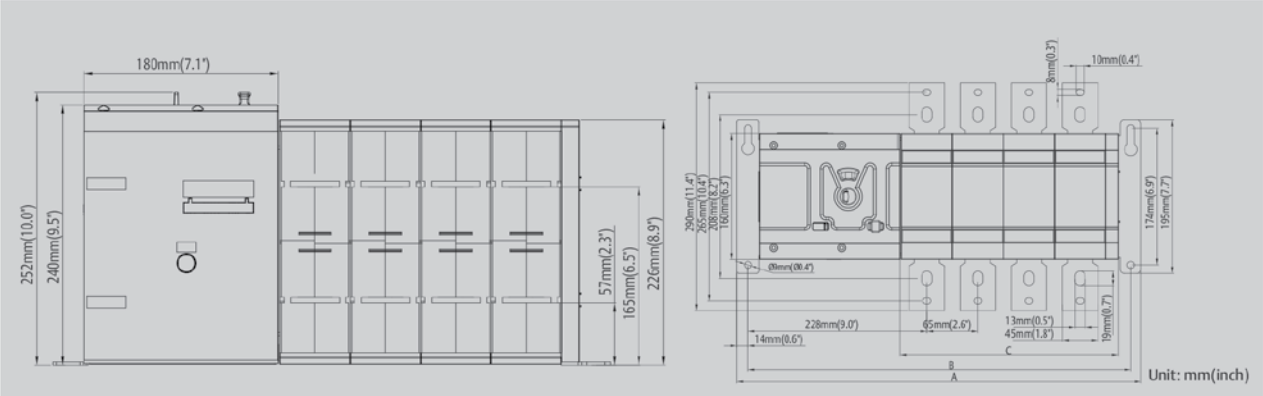


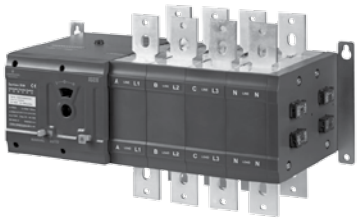
D2ADTL		2P	3P	4P
Size (mm)	A	317.0	361.0	405.0
	B	297.0	341.0	385.0
	C	103.0	147.0	191.0
Weight (kg)		8.6	9.8	11.0



ASCO Power Transfer Switch Solutions for Powerful Peace of Mind

E2ADTL Frame





E2ADTL		2P	3P	4P
Size (mm)	A	384	449	514
	B	357	422	487
	C	146	211	276
Weight (kg)		14	17	20

Shipping Dimensions and Weights (Including TS and controller, without options)

Frame	Width (mm)	Height (mm)	Depth (mm)	Weight (kg) with C300		Weight (kg) with C1000			Weight (kg) with C2000		
				2P	4P	2P	3P	4P	2P	3P	4P
A2ADTL	310	170	175	1.9	2.3						
B2ADTL	602	220	267			4.9	5.5	5.7	5.2	5.8	6.0
C2ADTL	602	335	227			8.9	9.5	10.1	9.2	9.8	10.4
D2ADTL	650	350	300			13.0	14.5	16.0	13.4	14.9	16.4
E2ADTL	767	350	352			16.0	19.0	22.0	16.5	19.5	22.5

** All information is subject to change, for the latest information please contact ASCO sales team.*



Series 230 Controller Feature Comparisons

C300 Controller

Voltage and Frequency Sensing

- Single phase under and over voltage settings on Source I and Source II
- Phase loss sensing on Source I and Source II
- Under and over frequency settings on Source I and Source II

Time Delays

- Time delay sensing accuracy is ±1%
- Transfer time delay can be set manually

Controller Display and Keypad

- LED display
- Touch key for clearing alarm and manual operation
- Switch position indicator lights
- Source acceptability indicator lights

Operating Modes

- Automatic and manual operation available
- Source I Priority/ No Source Priority
- Priority Source Swap

Center-off with time delay and center-off with protection

- The center-off time delay can be set to avoid large current inrush to inductive loads
- Center-off with protection is available to protect critical loads (e.g. Fire Pump)

Remote Control and Communication

- Can control switch remotely (e.g. Position Control, Time Delay, etc.)
- Fire control signal input (24VDC)

Power Supply of Controller

- Operation Voltage (VAC): 220/ 230/ 240
- C300 has ability to work with 24VDC power supply

C1000 Controller

Voltage and Frequency Sensing

- Single phase under and over voltage settings on Source I and Source II
- Phase loss sensing on Source I and Source II
- Under and over frequency settings on Source I and Source II

Time Delays

- Time delay sensing accuracy is ±1%
- Transfer time delay can be set manually

Controller Display and Keypad

- LED display
- Touch pad for clearing alarm and manual operation
- Switch position indicator lights
- Source acceptability indicator lights

Operating Modes

- Automatic and manual operation available
- Source I Priority/ No Source Priority
- Priority Source Swap

Center-off with time delay and center-off with protection

- The center-off time delay can be set to avoid large current inrush to inductive loads
- Center-off with protection is available to protect critical loads (e.g. Fire Pump)

Remote Control and Communication

- Can control switch remotely (e.g. Position Control, Time Delay, etc.)
- Fire control signal input (24VDC)

Power Supply of Controller

- Operation Voltage (VAC): 220/ 230/ 240/ 380/ 400/ 415

C2000 Controller

Voltage and Frequency Sensing

- 3-Phase under and over voltage settings on Source I and Source II
- Under and over frequency settings on Source I and Source II
- Voltage unbalance detection between phases

Time Delays

- Time delay can be set by operating parameter setting menu
- Time delay sensing accuracy is ±1%
- Time delay can be set under different working modes
- Transfer time delay can be set manually

Controller Display and Keypad

- LCD display
- Touch pad for programming the features and settings
- Switch position indicator lights
- Source acceptability indicator lights

Operating Modes

- Automatic and manual operation available
- Source I Priority/ No Source Priority
- Priority Source Swap

Center-off with time delay and center-off with protection

- The center-off time delay can be set to avoid large current inrush to inductive loads
- Center-off with protection is available to protect critical loads (e.g. Fire Pump)

Events Display

- Event log displays: 100 most recently logged events with time and date of each event, event type and event reason

Remote Control and Communication

- Uses RS485 interface, and supports MODBUS Communication
- Can control switch remotely (e.g. Position Control, Time Delay, etc.)
- Fire control signal input (24VDC)

Power Supply of Controller

- Operation Voltage (VAC): 220/ 230/ 240/ 380/ 400/ 415
- C2000 has ability to work with 24VDC power supply

ASCO Series 230 Automatic Transfer Switch

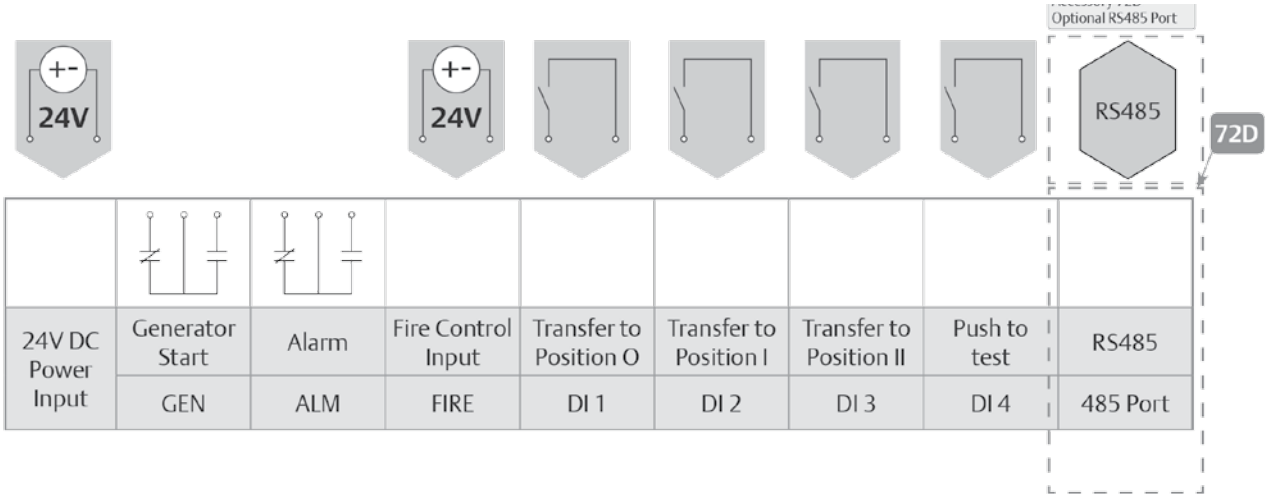
24-hour Protection No Matter When Trouble Strikes

	C300	C1000	C2000
			
Rated Operation Voltage Ue(V)	220/230/240	220/230/240/380/400/415	220/230/240/380/400/415
Rated Frequency (Hz)	50/60Hz	50/60Hz	50/60Hz
Display Indicator			
Source(I,II) Available	■	■	■
ATS Position	■	■	■
Control Mode			
Manual/Automatic	■	■	■
Source I Priority	■	■	■
No Source Priority	■	■	■
Remote Control	■	■	■
Unique Control Funcation			
Remote control Priority [1]	■	■	■
Priority Source Swap	■	■ [2]	■
Center-off with protection when Source I and II are lost [3]			Optional
Diagnosis fault intelligent with self -protection function	■	■	■
Source Sensing Setting			
Voltage Sensing [4]	L1-N,L2-N,L3-N	L1-L3	L1-L2,L2-L3,L3-L1
Frequency Sensing	■	■	■
Power loss	■	■	■
Phase loss [5]	L1,L2,L3	L1,L3	L1,L2,L3
Undervoltage	65%, 70%, 80%, 85%	70%, 85%	70% ~ 98%
Overvoltage [6]	120% / OFF	120% / OFF	102% ~ 120% / OFF
Overfrequency Transfer	115%	115%	102% ~ 115%
Underfrequency Transfer	85%	85%	85% ~ 98%
Time Delay Setting			
Override Momentary Source Outage	1s	1s	0 ~ 3s
Transfer to Source II	0s, 5s, 30s, 5min	0 ~ 5min	0 ~ 5min
Transfer to Source I	1s, 30s, 5min, 30min	1s ~ 30min	0 ~ 30min
Engine Cooldown	2min	2min	0 ~ 60min
Center-Off Position Delay	OFF / 5s	OFF / 5s	0 ~ 5s
Others			
RS-485	Optional	Optional	■
Additional 24V DC Power Input	■		■
Generator Control Signal Output	■	■	■
Fire Control Signal Input	■	■	■
Alarm	■	■	■
Auxiliary Contact	Optional	Optional	Optional
Event Log			■
Display Type	LED	LED	LED+LCD
Installation	DIN rail installation and Panel installation	DIN rail installation and Panel installation	Panel installation

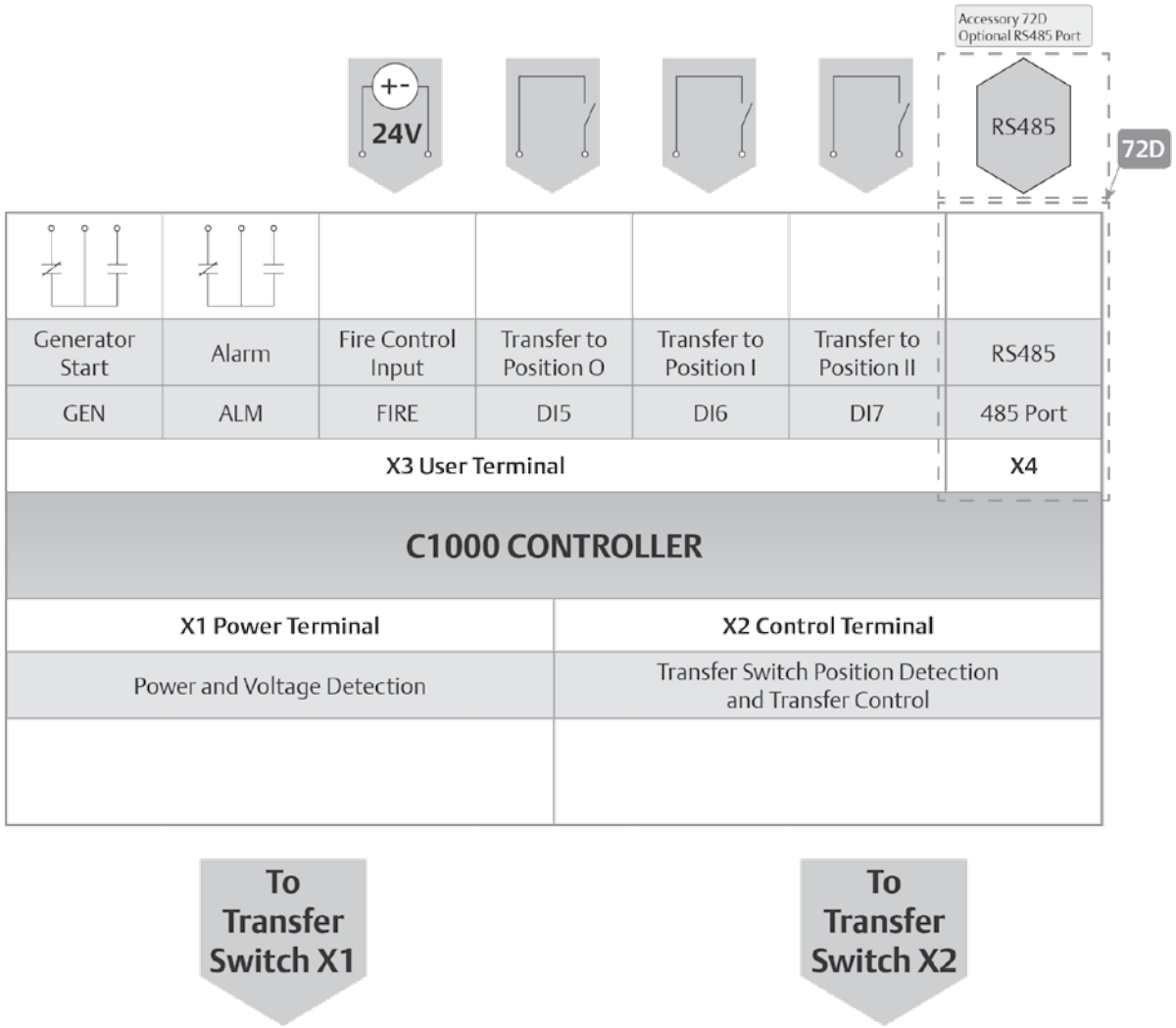
■: Yes, Standard; Blank: Not Available/ Not Applicable

Remarks:
1. Only available for source priority mode
2. C1000 controller with priority swap function requires special soft ware to be field installed
3. Need to use controller with energy storage (Accy 1H)
4. For C300 controller, Source II Voltage sensing is only on L1
5. For C300 controller, Source II Phase loss sensing is only on L1
6. When the controller is used on 415V, its Overvoltage Droupout is 115% both on Source I and Source II

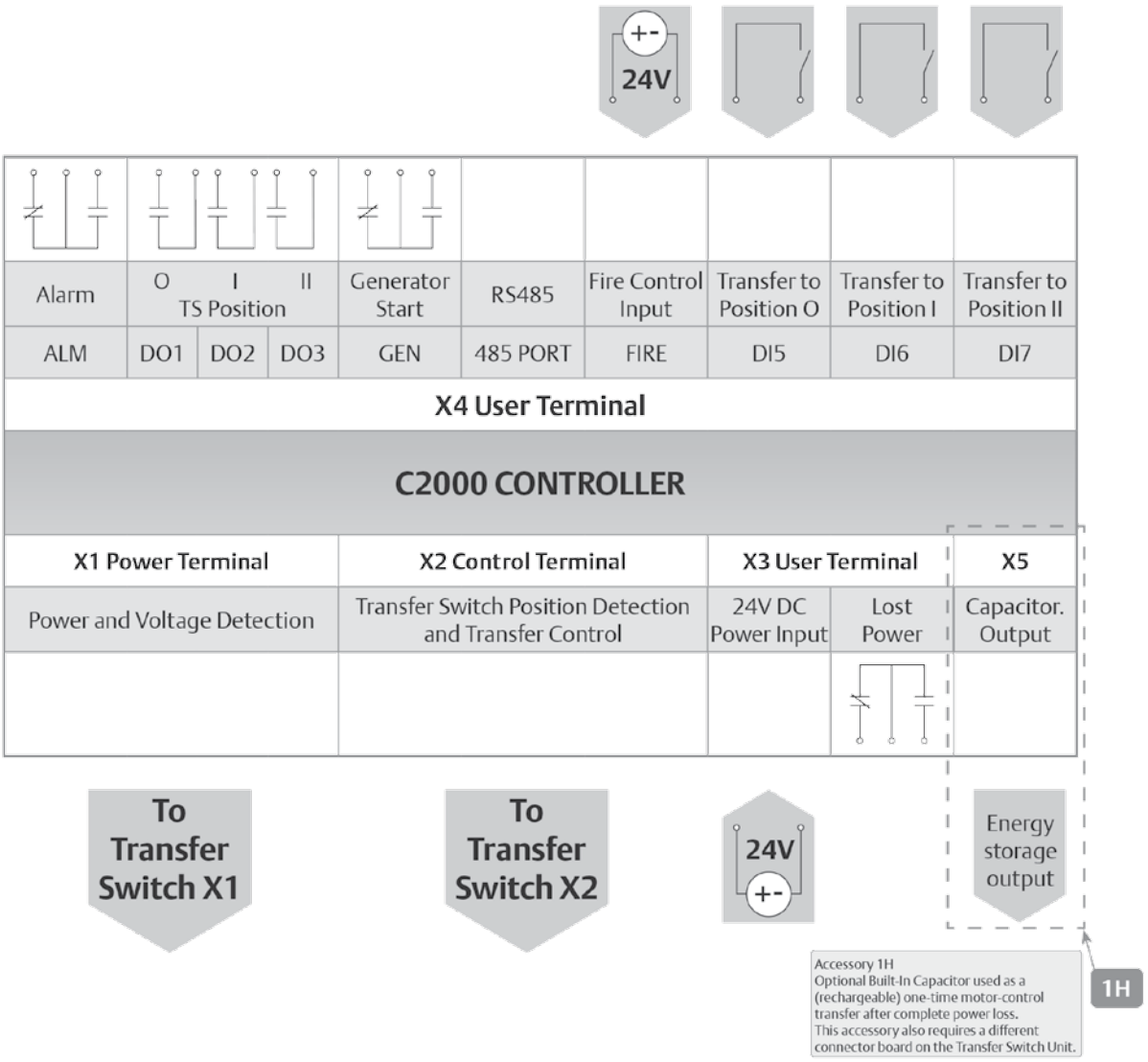
C300 Controller Port Function Description



C1000 Controller Port Function Description

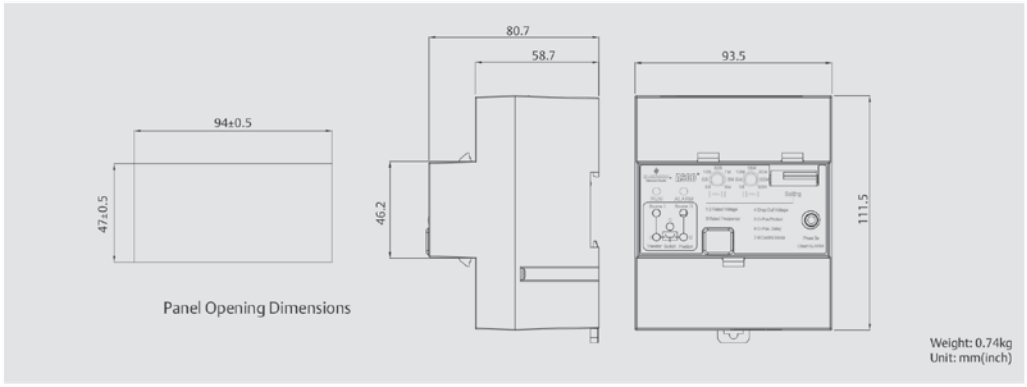


C2000 Controller Port Function Description

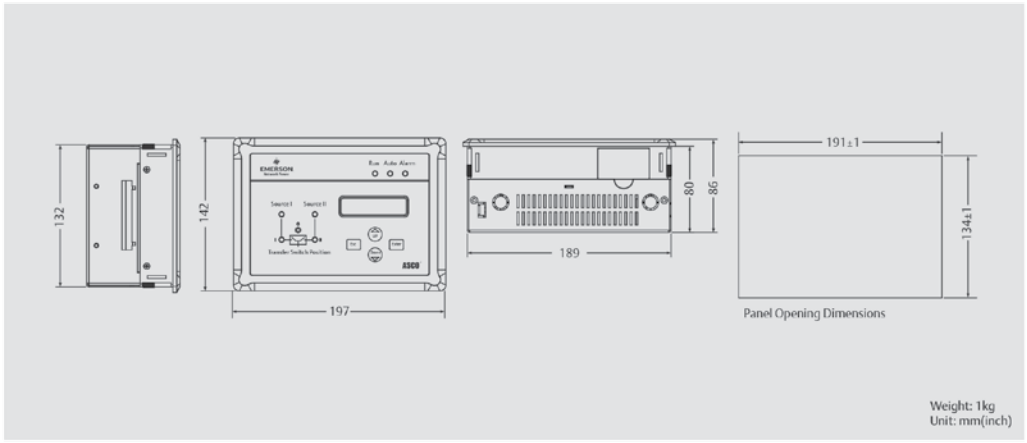


Controller Dimensions and Weight*

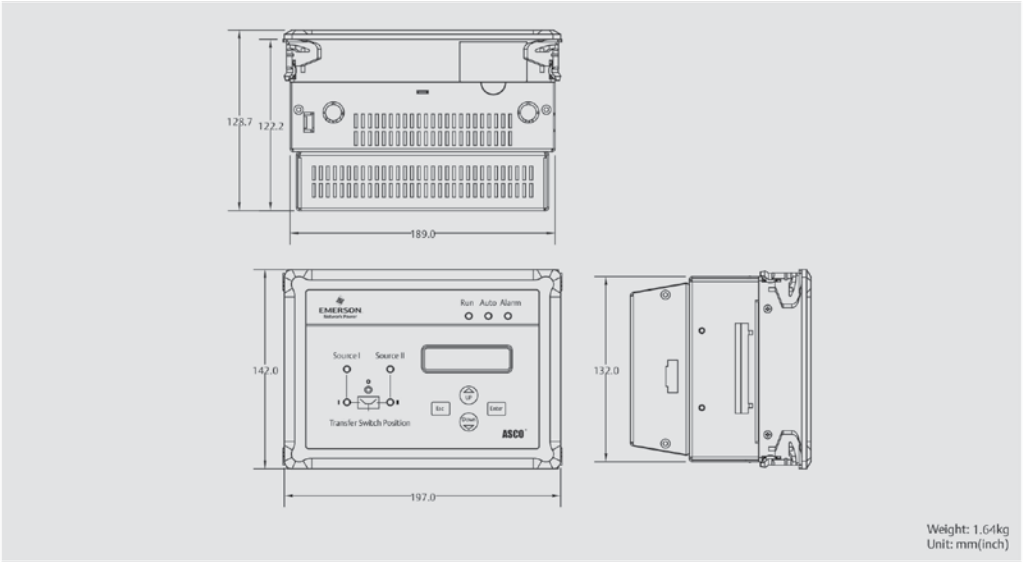
C1000 Controller (With or Without optional 72D Accessory)



C2000 Controller



C2000 Controller with Energy Storage (Accessory 1H)



*Not Shipping weight, Actual unit weight

NOTES:

1. This suggested specification is applicable for standard ASCO Series 230 ATS with C1000 controller
2. This template is only provided for reference only. Contents with 'blue font' words indicate the parts that need to be modified according to the specified product or project information.
3. The 'red font' words indicate the important parameters or technical features in the critical clause.

ATS Suggested Specification

In order to ensure the long-time continuous power supplying for the critical loads, this project needs to purchase ATS with international well-known brands, including ASCO. The critical parameters and technical features requirements of the ATSs are listed as below.

- To ensure high quality, the manufacturer that supplying the ATS should comply with ISO international quality standards, and provide a valid ISO9001 certificate.
- The ATS must comply with the IEC 60947-6-1 standard, and pass strict tests in a third party test lab. A valid type test report should be made available to prove that ATS complies with the latest IEC 60947-6-1 standard.
- PC class ATS, available for both manual and automatic operation.
- Applicable for AC-33B utilization category.
- Basic electrical parameters:
  - Rated voltage and frequency: 380Vac/50Hz
  - Rated current: 400A
  - Poles: 4
  - Rated insulation voltage: 800Vac
- The mechanism should have reliable electrical and mechanical interlock, which can prevent two sources from connecting simultaneously.
- The main contacts can operate at stable two operation positions or three operation positions. When operating at three operation positions mode, two sources can be isolated in the center-off position. An isolating position lock is required to ensure safe maintenance when operating at center-off mode.
- Has a large current withstand capability:
  - Rated short-time withstand current: 25kA@100ms (15kA@100ms for C2ADTL, 10kA@100ms for B2ADTL)
  - Rated short-circuit making capacity: 65kA peak (31.5kA peak for C2ADTL, 17kA peak for B2ADTL)

  - Rated conditional short-circuit current (with specified current limiting fuse): 200kA (120kA for B2ADTL)
- Mechanical operation performance (times) should be not less than 10,000.
- The switch and the controller should withstand at least 40kA surge current when cooperating with Class C surge protective devices.
- The switch body can configure at least 8 auxiliary contactors.
- The controller panel should have LED indicators to indicate the status of the two sources and contacts position.
- The controller should monitor the status of the two sources and can transfer when over-voltage, under-voltage, over-frequency, under-frequency, and phase loss faults occur.
  - Over-voltage setting: 120 or OFF
  - Under-voltage setting : 70 , 85
  - Over-frequency setting: 110 , 115
  - Under-frequency setting: 85 , 90
- The controller can operate normally when the power supply voltage ranges -30 U_e to +30 U_e.
- Multiple operating modes are optional, including manual/automatic, source I priority/no source priority, and remote control.
- Can accept the 24Vdc fire control signal input to transfer the non-essential loads to the disconnect position in case of fire.
- Time delay can be adjustable to avoid the mis-operation because of the source interference and the inrush current during the transition. Time delay contents should include:
  - override momentary power outage for source I and II: 0-3s
  - source I to source II: 0-5min
  - source II back to source I: 1s-30min
  - engine cool down: 5min
  - center-off position delay: OFF or 5s

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T: 603-78845000
F: 603-78845188

New Zealand
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F: 64-3-3392063

Pakistan
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F: 92-42-36622530

Philippines
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