

SG Series UPS

10-600 kVA three phase 400 Vac
with ultra-high efficiency **eBoost™** technology





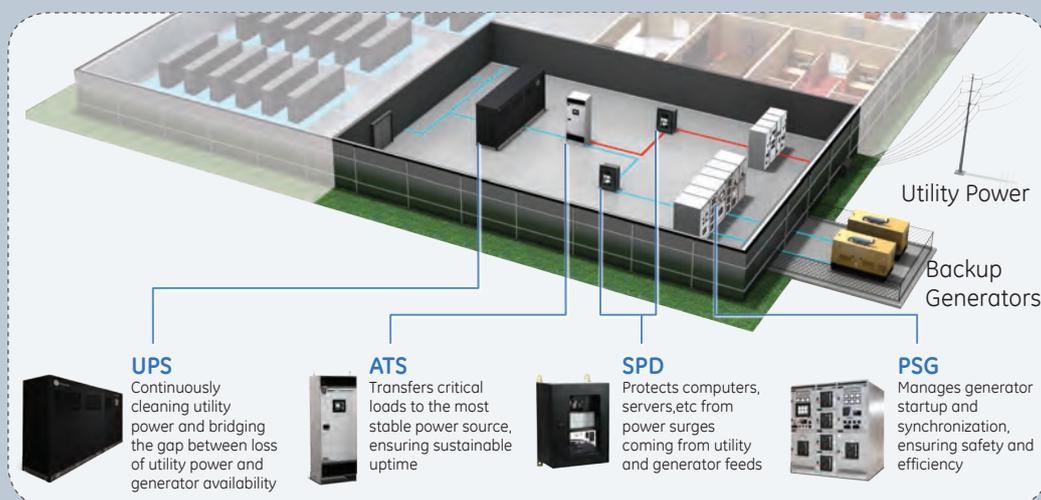
From protecting assets such as generators, transmission lines and motors, to ensuring secure wireless data transmission & **providing uninterruptible power**, GE delivers industry-leading technologies to solve the unique challenges of each customer.

GE SG Series Uninterruptible Power Supplies 10-600 kVA

The GE SG Series is one of the best performing and most reliable three-phase UPS systems providing critical power protection for a wide range of applications. The SG Series operates in VFI mode (Voltage Frequency Independent) and has been developed to satisfy the growing request of clean input performances through an innovative control algorithm on the IGBT rectifier power components instead of using standard filters. The SG Series is developed using GE's Design for Six Sigma methodology to ensure that the product fully meets customer requirements and expectations.

The SG Series UPS provides top class reliability and performance. With backfeed protection and compliance to EMC and safety standards the SG Series complies to current standards. Reliability can be further increased by paralleling more units utilising GE's unique RPA™ technology (Redundant Parallel Architecture). Through their complete life cycle, all GE UPS systems are fully supported by service teams which provide world-class, 24x7 preventive and corrective services, training and application expertise.

Ensuring uptime for critical processes



For mission critical processes, customers rely on our industry-leading power quality solutions to increase critical system reliability. GE's Critical Power business has technology that delivers superior performance and industry-leading energy efficiency for facility backup power management. In addition to our UPS Solutions, we provide the Standby Generator Paralleling Switchgear, Automatic Transfer Switches and Surge Suppression Devices that deliver power efficiently and reliably.

SG Series 10-600 kVA UPS

Delivering Best-in-Class Efficiency with eBoost Technology

GE's SG Series is one of the most efficient and reliable Three Phase UPS Systems, providing best-in-class output performance and critical power protection for your data center needs. The SG Series UPS solutions are designed and optimized to provide high efficiency at part load conditions.

The SG Series UPS assures low input current harmonic distortion and best-in-class output voltage regulation and dynamic response. This helps customers save operational costs while implementing environmentally-friendly solutions.

Low total cost of ownership

- High efficiency in double conversion up to 94% and eBoost mode operation up to 99%.
- eBoost* operation minimizes efficiency losses providing annual power & cooling savings up to \$300k for 5MW data center
- PurePulse IGBT rectifier keeps your supply network clean and provides advantages by reducing size of circuit breaker, cables and generator.

Easier Installation and Configuration Flexibility

- True front access for operation and maintenance, reduces mean time to repair (MTTR)
- Smaller size reduced installation and operational foot print
- Redundant Parallel Architecture for reliability, redundancy & scalability
- Parallel up to 6 UPS Modules

High Performance and Availability

- Enhanced output performance to protect and supply modern IT load with lagging-leading power factor (0.9) without derating
- Excellent dynamic performance and low output voltage distortion
- Inverter zig-zag isolation transformer provides better short circuit capability and load galvanic separation



Key Features



- PurePulse – IGBT rectifier clean input <2% THDi
- eBoost technology for high efficiency up to 99%
- Output power factor:
1.0 (10-40 kVA), 0.9 (160-600 kVA)
- True front access design
- Smaller foot print
- Inverter Zig-Zag isolation transformer
- Extremely low output voltage distortion
- Superior battery management
- Intelligent Energy Management integrated (IEMi)

* eBoost option is available on 160-500 kVA UPS models.

Energy Efficiency is our focus

The GE SG Series is one of the most energy efficient double-conversion UPS with output transformer topology in the industry, and provides world-class energy efficiency across the operating load range.

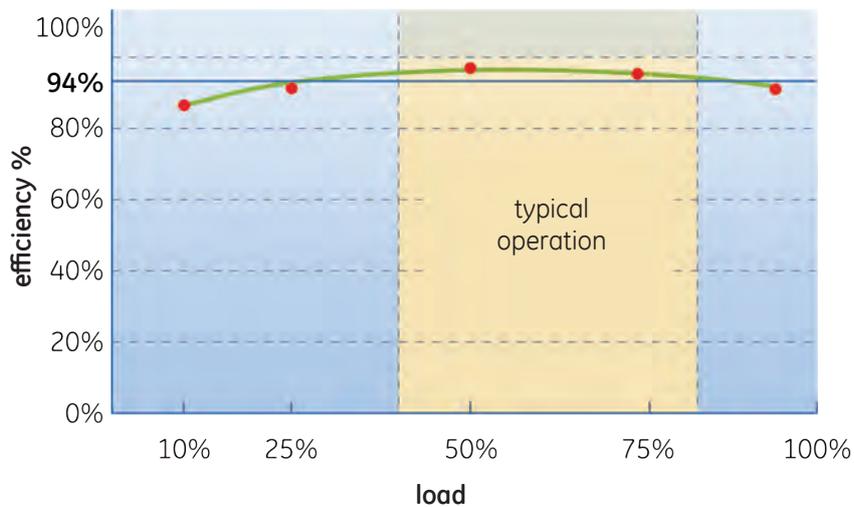
GE's UPS performance is optimized at 50-75% load operation, as this is the most common operating range. The optimization of the SG Series includes selecting all major power chain components based on maximizing the component efficiency at part load conditions.

True efficiency

GE UPS efficiency data are real values confirmed by measurements, representing the state of the art of power electronic technology.

This avoids any surprise in cooling system design and in economical evaluation of energy consumption over the life cycle, ensuring peace of mind for your investment.

SG Series 200 kVA Efficiency



eBoost Savings

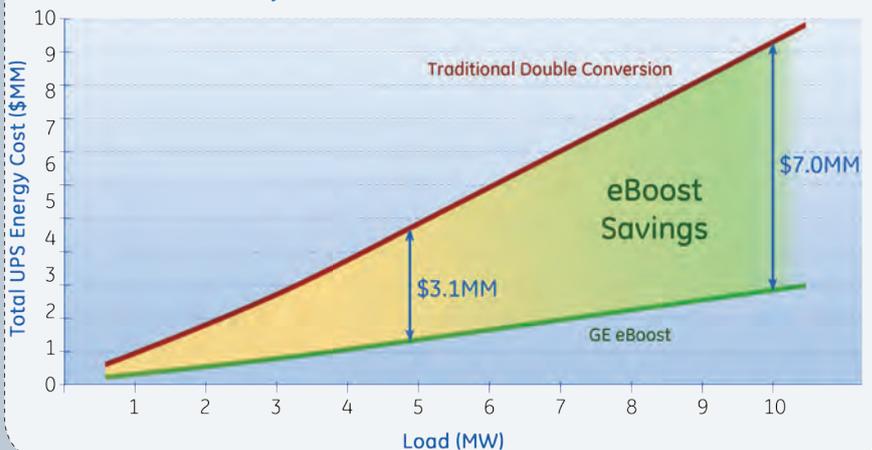
eBoost* operation provides considerable energy life cycle cost savings ranging from \$0.5MM to \$7MM**. Savings are dependent upon load, power costs and life cycle duration (years).

* eBoost option is available on 160-500 kVA UPS models.

** Assumptions:

- Power Cost = \$0.10/kw-hr
- Operating Hrs/Year = 8.760
- Configuration = S+S operating at 50% of capacity

Data Center Life Cycle Cost (10 Years)



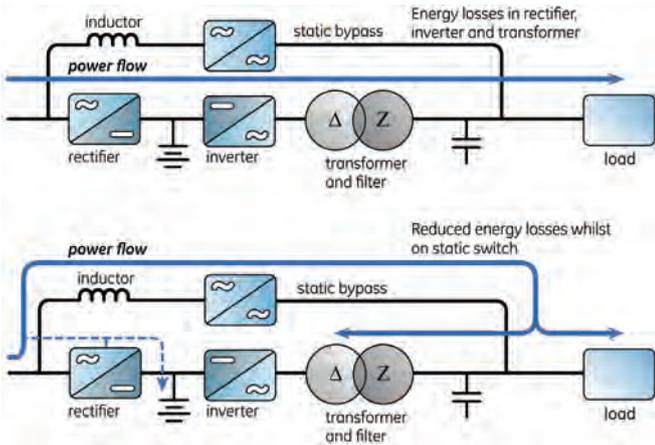
Ultra-High Efficiency Mode

eBoost™

Energy consumption is a critical issue for IT organizations as their datacenter energy demands continue to grow. Their goal is to reduce cost and keep the datacenter running. IT organizations can reduce energy consumption costs without sacrificing system reliability with GE's eBoost technology.

Technology Features

- Up to 99% UPS efficiency
- Compliant to ITI (CBEMA) curve during transient events
- Patented power electronics and magnetics ensures less than 2ms transfer time to inverter
- Patented power conditioning/filtering design via bypass inductor and output transformer/capacitor while in eBoost mode
- Battery trickle charge in eBoost operating mode
- Up to 3 MW UPS capacity using paralleled modules



What is eBoost?

e = high efficiency up to 99%

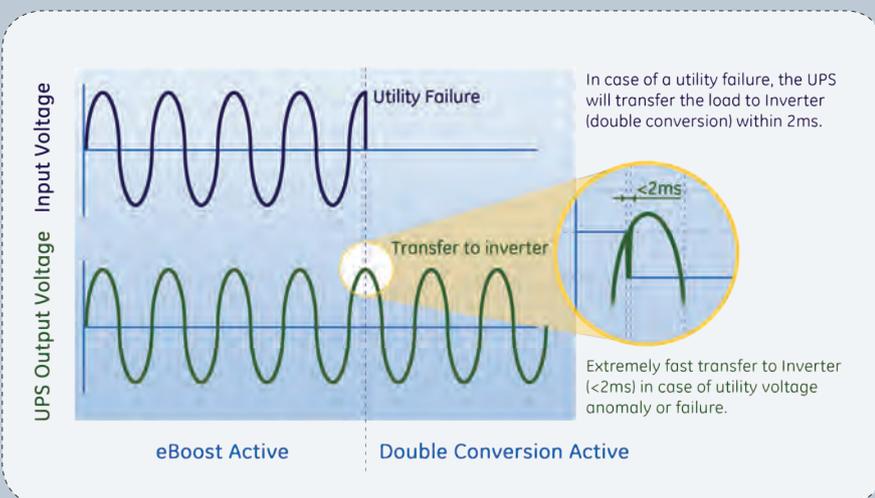
Boost = fast transfer to inverter < 2ms

Customer Benefits

- 80% reduction in UPS losses
- System energy cost savings
- Reduced heat (BTU) generation
- Energy savings from reduced cooling
- Extend UPS component life
- User-programmable scheduling



eBoost Performance



Specifications

On SG Series UPS products, 160-500 kVA, single module and Redundant Parallel Architecture (RPA) operation:

Transfer time:	<2ms
Input voltage range:	+/- 10%
Input frequency range:	+/- 2%
Efficiency:	up to 99%

Innovative Product Technology

PurePulse™ - IGBT rectifier clean input

PurePulse is an innovative control algorithm applied on the IGBT rectifier (available from 10 to 500 kVA).

This current source rectifier assures an input Total Harmonic Distortion (THDi) of less than 2% and draws a pure sinusoidal waveform from the mains.

Advantages

- UPS input performances
Total Current Harmonic Distortion THDi = 2% without additional harmonics filters
UPS input power factor: 0.99
- Constant behavior at all loads
Negligible harmonics contents at full and partial loads.

Superior Battery Management (SBM)

Every GE UPS incorporates a standard feature called Superior Battery Management (SBM) that can be configured to periodically test the battery system and calculate true battery runtime using measured values for temperature and load.

Advantages

- Works with all Battery Types: Flooded, VRLA, NiCD
- Online Battery Test: The risk of load loss is prevented by periodic rectifier/battery testing to insure proper operation
- Increases Battery Life: Monitors all key parameters of the battery plant to maximize reliability and warn of possible problems

Digital Signal Processor (DSP)

DSP (Digital Signal Processor) performance enables the high sampling rates required to achieve the appropriate bandwidth for the current and voltage controls for an efficient double-conversion UPS.

- High speed sampling rate for precise RPA control
- Faster transient response time
- Redundant high speed communication
- All digital controls for increased reliability and stability
- All system control parameters are adjustable from the front panel

Zig Zag Output Transformer

The ZigZag transformer enables the UPS to run with heavily unbalanced loads while supplying full kVA output capacity at 100% non-linear load.

The secondary windings of the output transformer form a ZigZag pattern to cancel triplen (third order) load harmonics. This reduces neutral conductor loading and losses in all the conductors and the input transformer. Inverter output transformer inductance filters noise during eBoost operation.

- Provides Galvanic Isolation of the Load
- Protects Inverter from Non-Linear Loads
- Protects Inverter from High Inrush Loads
- No Magnetizing Inrush Current during eBoost Transfers



Space Vector Modulation (SVM)

Space Vector Modulation is the next generation of Pulse Width Modulation (PWM) inverter control technology.

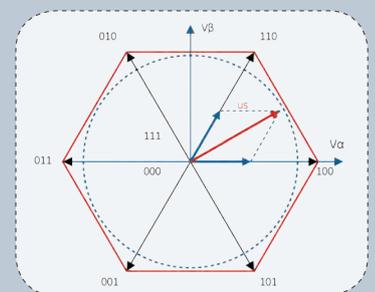
SVM uses an advanced switching technique for PWM driving Insulated Gate Bipolar Transistors (IGBT). The objective of SVM is to generate the output voltage vector using simpler switching pattern combinations.

In traditional PWM, the triangle wave is compared to a reference sine wave. The result is a pulse width modulated rectangular waveform, which is used to provide gate signals to the IGBTs.

PWM signals have to be calculated in real time and normally require 3-dimensional calculations (one for each three phase leg) to determine the inverter state. By using SVM, the calculation is simplified to a 2-dimensional "space vector" in a polar coordinate plane, speeding up the response and improving system performance.

Advantages

- Higher efficiency at full and partial load
Reduces IGBT switching losses
- Improved output performance
Reduces Total Harmonic Distortion (THD) with non-linear loads and improves transient response to step loads
- Precise paralleled system performance
More accurate load sharing for RPA operation.

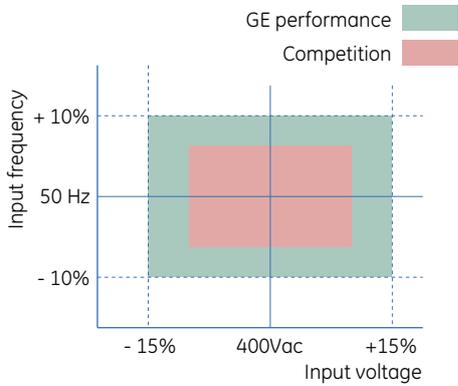


Input Performance

Input Performance

Robust Rectifier for Wide Input Range

The wide AC input voltage and frequency window avoids unnecessary battery discharge even when operating from an unstable AC source (i.e. diesel generator).



Programmable Soft Start

Allows the rectifier to ramp up in a programmable time period (0-15 seconds) eliminating in-rush current. This feature reduces the need of oversizing the input power system (gensets, feeder cables, and overcurrent devices).

Generator Compatibility

User-programmable features such as slew rate, phase angle rate-of-change and voltage rate-of-change allow the UPS to quickly sync to a genset during emergency back-up. GE's optional input filter also has user-programmable features ensuring quick and continuous synchronization to generator voltage.

PurePulse™ technology for clean input source

From thyristor to IGBT rectifier, a technology breakthrough innovation toward the future.

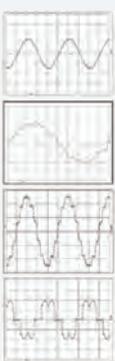
PurePulse is an innovative control algorithm applied on the IGBT rectifier. This current source rectifier assures an **input Total Harmonic Distortion (THDi) of less than 2% with input power factor PF = 0.99** and draws a pure sinusoidal waveform from the mains. The advantages of GE's PurePulse technology span from savings in the sizing of upfront equipment (such as emergency generator, cabling and circuit breakers) to a total elimination of cost for additional active or passive filters.

Benefits

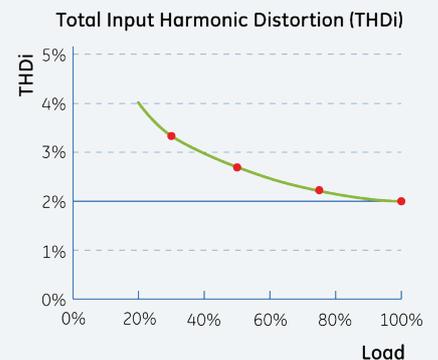
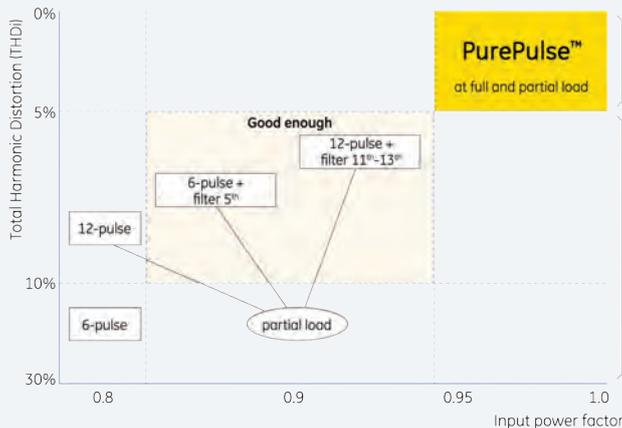
- Saving in the sizing of upfront equipment e.g. emergency generators, cablings, circuit breakers, ...
- Saving cost due to no additional filters; Avoid the installation and the tuning of additional harmonics traps
- No disturbances to nearby equipment; Eliminate any cause of perturbation and outage on upfront electrical equipment, avoiding also any investigation and analysis cost due to malfunction



PurePulse™ technology



Current waveform



Output Performance

Total Harmonic Distortion (THD)

A distorted output voltage waveform affects the proper function of the load's equipment. The SG Series has very low output voltage THD, even with connected 100% unbalanced or 100% non-linear loads.

Transient Response

With the use of SVM and the ZigZag transformer, the GE UPS can react very quickly to zero-100% step loads (within 1/3 cycle). This reduces the need to oversize the UPS for severe pulse-load applications.

Overload Capabilities

The SG Series UPS has a robust inverter capable of delivering 150% overload for 1 minute and 125% for 10 minutes, ensuring power protection safety for applications requiring start-up overcurrent and for temporary peak load.

Voltage regulation

SVM and the Zig-Zag transformer enable the inverter to react very quickly under step load conditions. As a result, the GE UPS has very tight voltage regulation during step loads and 100% phase-to-neutral (Ph-N) load imbalances.

Short-circuit capability

The SG Series inverter supplies 2.7 and 4.0 times (for 200 ms) the nominal current respectively for ph-ph and ph-N/PE short-circuit, ensuring the proper selectivity of the protection devices (fuses and breakers).

Output power capability

Nowadays IT installation requirements is driving to power sources able to supply loads with leading power (capacitive loads) without affecting the power capability. Whereas most of the UPS available in the market are designed to supply loads up to power factor 0.8 lagging, the SG Series UPS are able to supply full power without any derating for all loads from 0.9 lagging to 0.9 leading. This unique characteristic avoids any UPS oversizing in case of unity or leading power factor as for computer loads. The table below shows the additional power (kW) available compared to UPS designed according to traditional technology.

UPS rating	500 kVA			
Load power factor	0.8 lagging	0.9 lagging	1	0.9 leading
GE-SG Series	400 kW	450 kW	450 kW	450 kW
Traditional technology for PF=0.8	400 kW	387 kW	362 kW	300 kW
SG Series additional power available	0%	+16%	+24%	+50%

SG Series power capability (60-600 kVA)



- Designed to supply real power for any type of application
 - inductive loads
 - resistive loads
 - capacitive loads
- No de-rating required to supply resistive and capacitive loads (0.9)
- Suitable for modern power supply application with unity or capacitive power factor, crest factor up to 3:1

Redundant Parallel Architecture™ (RPA) System Configuration

GE provides RPA, a unique technology that can parallel UPS modules with true redundancy by eliminating any single point of failure. RPA provides a scalable paralleling technique that reduces operating footprint and increases system reliability by eliminating the need for external paralleling equipment and cabinets (centralized bypass and master control).

One of the UPS modules in the system intelligently takes the leadership role, while the other UPS modules have access to all control parameters. If one UPS fails to operate, the load is automatically redistributed among the others. If the lead UPS fails to operate, then another UPS automatically takes on the leadership role. GE's RPA technology is implemented by distributing the control electronics within each UPS module in the system.

RPA™ System Advantages

No Single Points of Failure

The RPA system provides complete redundancy of all critical components, allows paralleling of up to 6 units for increased load capacity or redundancy.

Bypass Inductor Design

Ensures excellent output voltage regulation between paralleled modules and assists bypass line conditioning (eBoost only). Bypass inductor design & RPA cable saver available only for eBoost unit 160-500 kVA.

Scalable and Modular

The system can be easily expanded for higher capacity and redundancy without any interruption to the critical load or transfer to bypass.

Distributed Control Logic

Each module in an RPA system has its own operational controller. Each one continuously communicates with all others in order to manage the entire system like a team.

Redundant Communication

Redundant high speed bus and control electronics provide higher system reliability.

Online Maintenance

N+1 configurations allow maintenance on any single module in the system while other modules provide online protection with battery backup.

Sequential Soft Start

Provides sequential soft start of each module to reduce instantaneous load on input feeders during mains recovery. This helps avoid over-rating of generator and overheating of cable and fuses.

RPA Cable Saver

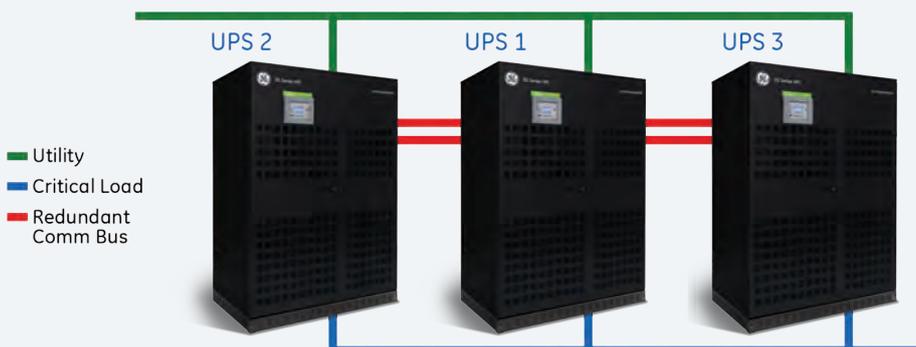
UPS Module input and output cable length variation up to 10% between modules. With eBoost technology this cable length flexibility is increased up to 25% between modules.

Smaller Footprint

RPA eliminates centralized control and external static bypass cabinet.

GE's RPA™ System

Standard RPA™ Configuration: True Redundancy with Distributed Control & Bypass



Configurable up to 6 units in parallel

- Future expansion
- Safe and reliable power supply
- Redundant Communication Bus

Easy to install and maintain

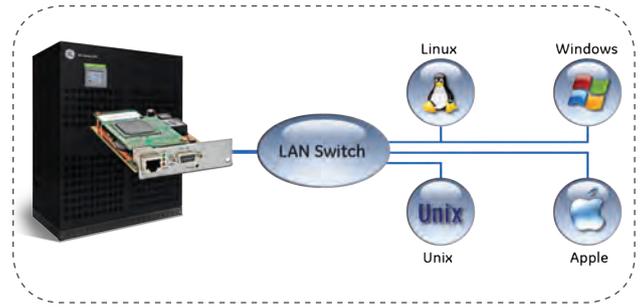
- Easy system upgrade/downgrade
- Maintenance operation without load interruption

Software & Connectivity Solutions

Protection Software

GE Data Protection software can communicate with the UPS over RS-232, USB or SNMP to receive status information and measurement values of the UPS. In case of a critical condition (time on battery, remaining battery autonomy time or low battery) for the load, the software starts a controlled shutdown.

An enhanced alarm management system provides the possibility to start applications, send messages, and send e-mails for every upcoming or disappearing alarm.



The diagram shows a mobile phone at the top left connected to a laptop. Below the laptop is a 'firewall' icon. A globe labeled 'internet' connects the laptop to a 'data center' consisting of server racks. From the data center, lines lead to an '@' email icon and an 'SMS' icon.

Remote Monitoring and Diagnostic Solution

GE remote monitoring solution is an anytime, anywhere concept in UPS status monitoring and alarm notification supporting all GE UPS product lines.

Accessing the latest site information via Web and being alerted by Email or SMS , it enables the user to make timely decisions in case of changing critical conditions. With comprehensive data collection and analysis it improves diagnostics capability and enhances response time.

- 24/7 remote access to your UPS data using standard web browser
- Automatic alerting in case of event direct and immediately to you cell phone or by email
- Regularly operational reports with proactive information on critical data
- Preventative information using PMAD (Preventative Maintenance & Advanced Diagnostics) feature
- Possibility to reduce intervention and onsite work

Remote Connectivity to Building Management Systems

This optional Standard Network Management Protocol (SNMP) Plug-In Card allows the UPS to communicate over a LAN or interface through all major building management systems (BMS).

Integrates a modern web server for UPS monitoring Via LAN, drives remote server shutdown in case of critical UPS alarms and works as Modbus TCP Converter "as well as Modbus RTU 485".



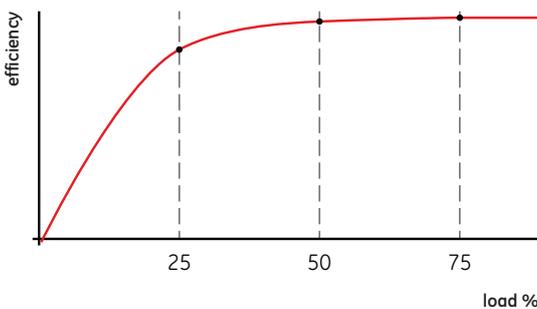
Intelligent Energy Management Integrated (IEMi)

GE's Intelligent Energy Management integrated (IEMi) operating mode offers the capability to optimize and increase system efficiency while maintaining the system reliability for UPS's in a redundant parallel architecture (RPA™).

UPS system sizing accounts for normal load requirement, over-load and capacity for future expansion. In addition, redundancy level of N+1 or N+2 is considered to enhance system reliability.

Most UPS systems typically operate at low load levels <50%. At load level of less than 30-40%, efficiency of UPS decreases in comparison to normal operating load range of 40%-75%. In redundant parallel architecture (RPA™) system of 4 UPS modules its more efficient to have 2 UPS operating at 40% load range than 4 units operating at 20% load range.

For parallel UPS installations, IEMi operating mode saves energy by dynamically utilizing the UPS modules as needed to meet the required output power without compromising power quality to the critical load.



Features & Benefits

- User programmable scheduling
- Front graphic panel accessible set-points
- Reduction in UPS losses and cooling
- Double conversion operation - no compromise on power quality
- System energy cost savings
- Redundant operation - no compromise on system reliability
- Cyclic operation ensures even UPS run-time



Power Quality Service

Performance Through People

Whether you are a large corporation with multiple sites or a small business owner with a single location, GE will enable you to have a constant supply of clean and reliable power to keep your business up and running.

GE has local offices in a number of countries around the globe and also a network of selected business partners, whose salespeople and service engineers combine expertise in our solutions with an in-depth knowledge of local market conditions.

GE's service & authorized service providers business partners, located in more than 100 countries around the world, use all that expertise and knowledge to adapt GE's products and services precisely to their customers' needs.

- On site & emergency services
- Service agreements
- Spare parts and repairs
- Support and remote services
- Online support



Technical Specifications

Power Rating	Output Power rating (kVA)	10	15	20	30	40	60	80	100	120	160	200	250	300	400	500	600		
	Output Power Rating (kW)	10	15	20	30	40*	54	72	90	108	144	180	225	270	360	450	540		
	Output Power Factor	0.9 lead. - 0.6 lag						0.9 lead. - 0.9 lag.											
Energy Usage	Efficiency (eBoost mode, option)	up to 99% (available for 160-500 kVA only)																	
	Efficiency	up to 92.3%						up to 94%											
Technology	Rectifier Technology	IGBT PurePulse™															Thyr.		
	RPA	up to 6 units																	
Physicals	Dimensions (w), mm	680				650		835		900		1300			1800		1950		
	Dimensions (d), mm	800				850												950	
	Dimensions (h), mm	1450						1900											
	Weight (kg)	285	335	335	400	400	550	630	860	1050 ¹	1220 ²	1470 ²	1560 ²	2190 ³	2470 ³	2950			
Input	Voltage Range	340 - 460 Vac																	
	Frequency Range	45 - 66 Hz						45 - 65 Hz											
	Current THD	2%															5%		
Output	Voltage	3x380/400/415Vac, user selectable																	
	Frequency	50/60 Hz +/- 0.1%																	
	Voltage THD at Linear Load	< 2%						< 1.5%											
	Voltage THD at Non-linear Load	< 3%						< 3%											
	Voltage Regulation Static	< +/- 1%																	
	Voltage Regulation Dynamic (100% step load)	+/- 3%						< +/- 2% (recovery time < 5 ms)											
	Overload Capability/Inverter	125% 10 min., 150% 1 min																	
	Topology	VFI (Voltage Frequency Independent) according to IEC 62040-3																	
General	Audible Noise, db(A)	< 65						< 69						72		< 75			
	Protection Degree	IP 20																	
	Ambient Operating Temperature	0-40° C																	
	Operating Modes	Double conversion, automatic bypass, Super ECO mode (60-120kVA), eBoost mode (160-500kVA, option), frequency converter, RPA																	
	Standard	CE Mark, IEC 62040-1, IEC 62040-2, IEC 62040-3, IEC 60950																	
	Safety Standards	EN/IEC 62040-1																	
	EMC Standards	EN/IEC 62040-2																	
	Color	160-500 kVA: RAL 9005, black; other models RAL 9003, white																	

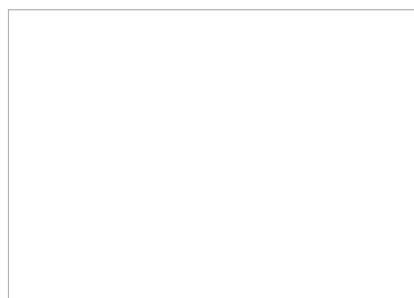
* at 30° C operating temperature

- 1 - add 20kgs if with eBoost option
- 2 - add 30kgs if with eBoost option
- 3 - add 75kgs if with eBoost option

Specifications subject to change without prior notice



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