

Powerware series

Eaton 9390 UPS  
40-160 kVA

# Enhanced energy efficiency



**EATON**

*Powering Business Worldwide*





# Introduction and overview

The Eaton® 9390 uninterruptible power system (UPS) 40-160 kVA of Powerware® series is a double-conversion UPS that resolves all utility power problems and supplies clean, continuous, uninterruptible power to connected equipment. Whether you're selecting a UPS for a branch office, manufacturing floor, medical facility or data centre, there's a 9390 model that delivers just the right combination of performance and price for your needs.

## Benefits

### Enhanced power performance

- Double-conversion design for highest power protection
- Wide voltage range offering
- The UPS is optimised for protecting modern 0.9 p.f. -rated IT equipment
- Low input ITHD enhances compatibility with extended back power sources (generators)

### Outstanding efficiency and cost savings

- High efficiency ratings in double-conversion mode lower utility costs substantially
- Innovative Energy Saving System (ESS) technology enables UPS to achieve an impressive efficiency of 99 percent
- Low total cost of ownership and lifecycle carbon footprint
- Low transportation and installation costs with the small footprint and weight
- Reduction in energy consumption during testing with Easy Capacity Test (ECT) technology

### Highest reliability and availability

- Powerware Hot Sync® paralleling technology erases single point of failure in parallel systems. Hot Sync systems are capable of paralleling for both redundancy and capacity.
- Superior battery management with ABM® technology
- Scalable architecture adapts to match your power requirements

### Robust manageability

- Superior control of networked UPSs with innovative Intelligent Power® Manager software tool
- Connectivity options are available to suit virtually any communication requirement, from standard serial communications to secure remote monitoring over the web

### Customised solutions

- Customised systems to meet different customer and market requirements
- A range of service agreement options can be easily customised for customers' needs and budget



## Key applications

- Data centres
- Financial services
- Building management
- Telecommunications
- Industrial automation equipment

# Enhanced power performance

## Double-conversion design for highest power protection

Unlike some other commercially available UPS technologies, the double-conversion design used in the 9390 completely isolates output power from input power anomalies and delivers 100-percent conditioned, perfect sine wave output, regulating both voltage and frequency. Even when presented with the most severe power disturbances, power output remains stable.

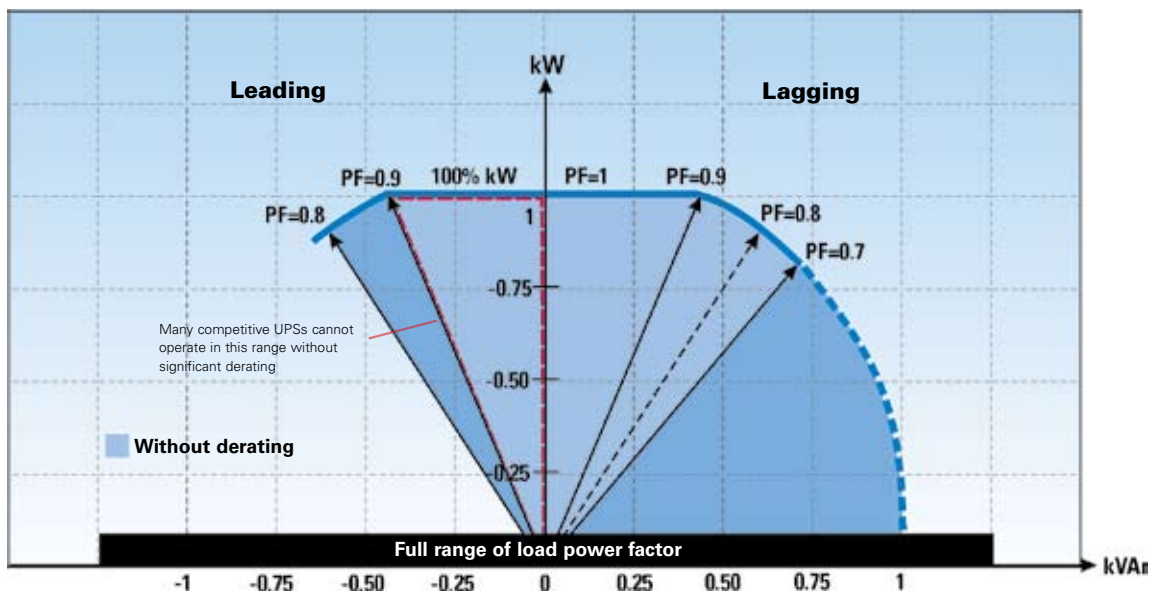
## Enhanced power performance

Power performance, which is measured by system efficiency, ITHD, input and output power factor is the foundation of the 9390.

In the standard double-conversion mode, the 9390 delivers efficiency of up to 94 percent. This high level of power performance is enabled by modern transformer-free technology that incorporates small, lightweight filter inductors, high performance IGBTs in both rectifier and inverter, and an advanced control algorithm. Thanks to the IGBT technology, the 9390 does not require input filters to obtain excellent input ITHD.

Due to its low input ITHD (below 4.5 percent at full load) and high input power factor (over 0.99), the 9390 is exceptionally compatible with diverse power sources, especially generators. The 9390 is also extremely mains friendly due to its low harmonic content.

The 9390 UPS is optimised for 0.9 p.f., meaning you get more real power for your money. On the output side the 9390 can provide its full power capability, as it supports leading power factor loads, which are becoming more prevalent in new and updated data centres. The 9390 UPS handles down to 0.8 leading power factor of modern computer and server loads.



Load power factor range chart

## Consistent efficiency throughout the UPS load range.

Many UPSs cite greater than 90 percent efficiency without mention of low or no load range. Today's average system operates at only 55 percent of its rated load or capacity range. However, efficiency is usually reduced in this lower load operating status. This is not the case with the 9390, which reaches optimal efficiency rates at less than half load - and maintains this optimal efficiency throughout the load range.

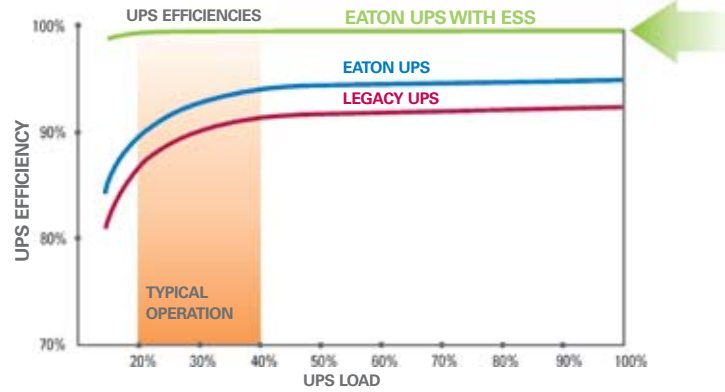


# Outstanding efficiency and cost savings

## Substantially improved efficiency with Energy Saver System

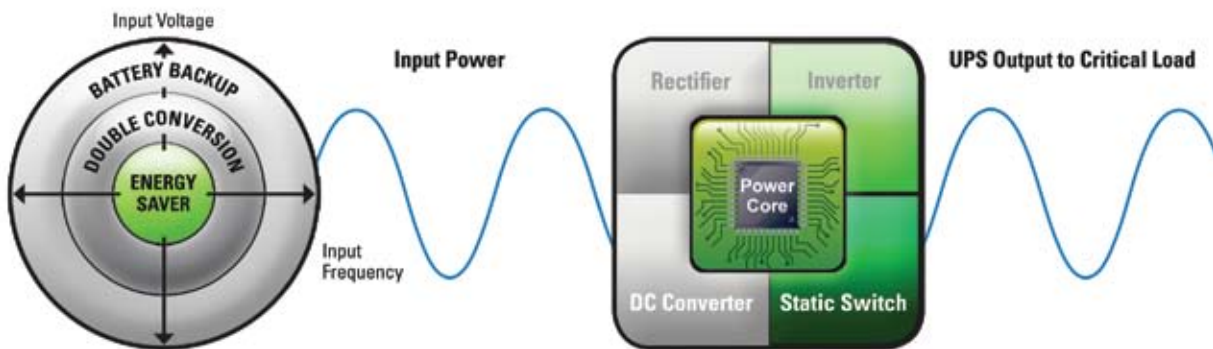
Eaton’s innovative Energy Saver System (ESS) technology enables UPS efficiency to reach an impressive 99 percent. In the standard double-conversion mode the UPS operates as normal, supplying power through the power converters. With ESS the power converters are in “ready” state and the static bypass switch is used to safely provide mains current directly to the load. If mains power is lost or exceeds preset output limits, the DC link that is kept active enables a seamless switchover to double conversion in less than two milliseconds. While in ESS, the UPS is also able to detect whether a fault has been caused by a source or by a load. A fault at the bypass source results in immediate switchover to the inverter; a fault in the load keeps the UPS in ESS mode.

The table below shows examples for a UPS system at different load levels. The ESS enables 100 percent of the UPS cost to be recovered within three to five years.



Critical load	50 kW	125 kW	250 kW	500 kW	700 kW
Electric costs (energy + demand) in € per kWhr	0.11	0.11	0.11	0.11	0.11
Legacy UPS efficiency (%)	92.5	92.5	93	93	93
Eaton Energy Saver System UPS efficiency (%)	99	99	99	99	99
Three-year energy savings (MWhrs)	145	363	670	1340	1876
Three-year CO2 savings (metric tons)	104	261	481	962	1347
Three-year utility cost savings (€)	<b>15.972</b>	<b>39.929</b>	<b>73.715</b>	<b>147.431</b>	<b>206.403</b>

ESS savings are significant across all load ranges and compound based on data centre size. Preset DCIE (Data centre infrastructure efficiency) in this example is 70 percent.



Active components engaged in ESS mode.

# Highest reliability and availability

## Powerware Hot Sync technology boosts power reliability

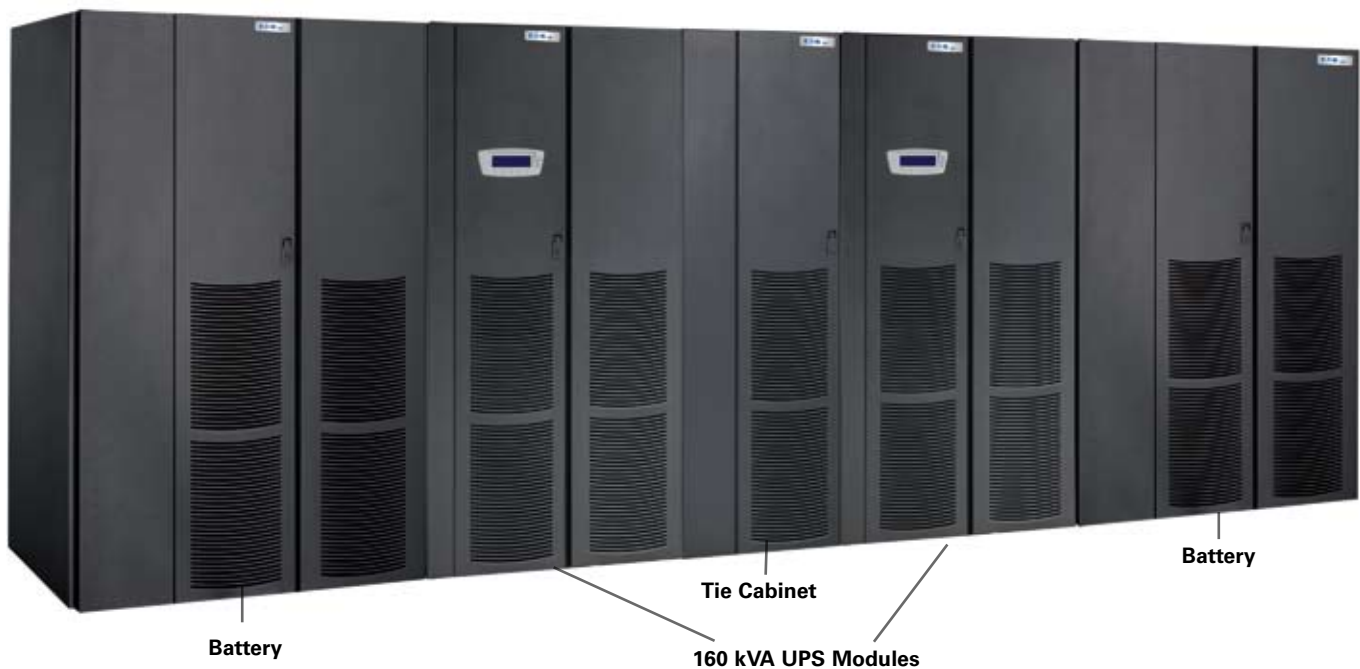
Eaton's Hot Sync technology is designed for parallel redundant N+1 systems to satisfy 24/7 applications. It can also be used in parallel capacity systems to enable customers with ever-increasing load demands to take advantages of the scalability benefits it offers. Thanks to Hot Sync, up to seven equivalent 9390 modules can be paralleled for additional capacity or redundancy.

Accurate, equal load share is the number one characteristic that determines the integral quality and reliability of a parallel UPS system. With Hot Sync technology this is achieved without the need for communication between the UPSs thus no single point of failure is added when introducing parallel modules to a system. From an operational and economical viewpoint, the achieved "close to perfect" reliability brings clear savings in the long run, as every downtime incident is costly and might lead to unpredictable consequences.

The two-module system shown in the picture below can be configured as 160 kVA N+1 redundant (320 kVA capacity with a tie cabinet).

## The benefits of Hot Sync:

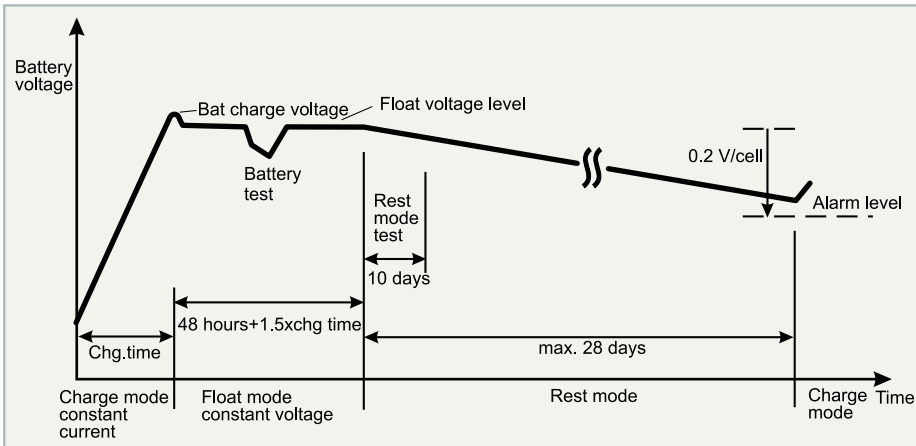
- Erases single point of failure
- Systems are capable of paralleling for both redundancy and capacity
- Ensures that each module is operating independently
- No added circuitry or components are required for a standard UPS to be switched in to operate in parallel
- A proven technology - thousands of systems are operating successfully around the world



# ABM optimises battery performance and service life

The ABM technology used in the 9390 UPS maximises the health and service life of batteries:

- ABM technology uses a unique three-stage charging technique that significantly extends battery service life and optimises recharge time compared to traditional trickle charging
- Temperature-compensated charging monitors battery temperature and adjusts the charge rate accordingly, which properly charges the battery and greatly extends battery life
- An integrated battery management system tests and monitors battery health and remaining lifetime, providing user notifications to guide preventive maintenance

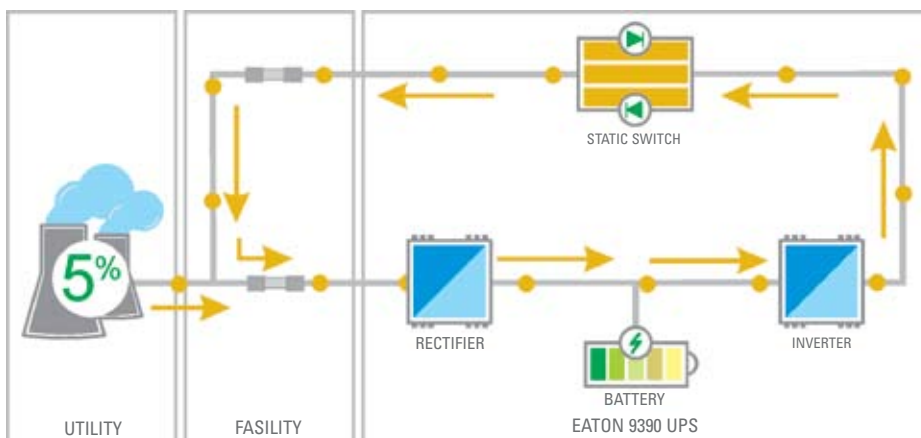


Battery voltage during one ABM charging cycle

## Easy Capacity Test reduces costs

The 9390 has the unique ability to test its entire power train under full load stress without the requirement of an external load thanks to Easy Capacity Test (ECT). With no load connected, the 9390 is able to test all of its power handling components, including the rectifier, inverter, contactors, fuses, power busses, cabling, batteries, bypass (static switch), magnetics and filter capacitors. Furthermore, the 9390 has the ability to test the upstream bypass input breaker (BIB), the rectifier input breaker (RIB) and all of the

electrical cables between them. The net result of this innovative load test is that there are no load banks to rent, no temporary load connections to make, no wasted energy, thus saving you time and money during startup and commissioning tests. Eaton field technicians are trained to use this load testing capability during a startup service to ensure optimum calibration, maximum efficiency and inherent redundancy.

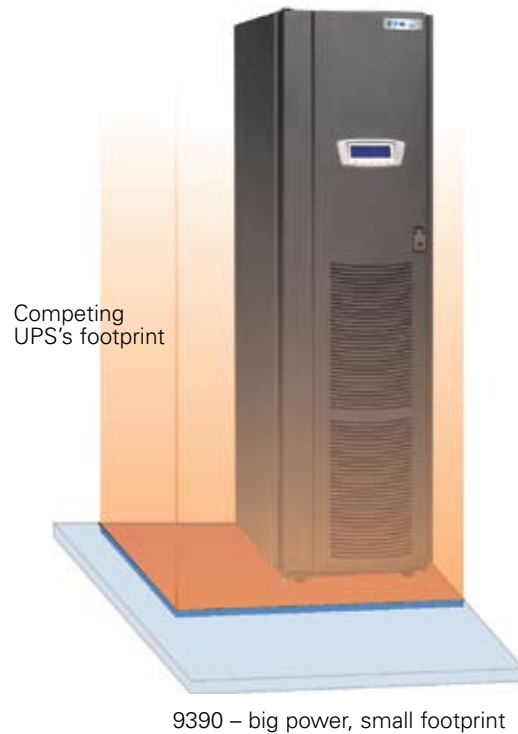


Easy Capacity Test Power Flow

## Cost-effective design

The 9390 offers the smallest footprint of any UPS in its class – 10 to 35 percent smaller than competing units. With a transformer-free design, the Eaton 9390 UPS meets or exceeds virtually all floor loading standards, and its low weight means units can be moved without heavy lifting equipment and will fit in all standard freight elevators.

Cabling can enter the UPS from either the top or bottom of the cabinet to provide easier and flexible installation. The 9390 provides front-panel access for all services and operation, increasing serviceability and reducing mean time to repair (MTTR). And since the compact, front-accessible 9390 cabinet can be installed against back and side walls, you have more location options, installation and service is fast and easy, deployment cost is lower, and you save valuable floor space.



## External battery cabinets

Eaton offers two versions of battery cabinets, which line up and match with the 9390 cabinet design, each offering a wide array of runtimes.

- Daisy chain cabinets together for extended runtimes
- Remote configurations are available
- Front-access-only design and top/bottom cable entry provides installation flexibility and enhances servicing
- Optional temperature-compensated charging is available





# Robust manageability

## Enhanced communication capabilities

The 9390 UPS is equipped with a variety of standard communications features for network connectivity and remote management applications, including:

- RS-232 serial port
- Four X-Slot® communication bays
- Relay output contacts
- Two programmable signal inputs
- Remote emergency power-off (REPO)

## Easy network connectivity and monitoring

### ConnectUPS-X card

The ConnectUPS-X Web/SNMP X-Slot card connects the 9390 directly to an Ethernet network and the Internet and enables graceful shutdown of multiple computers over the network. The ConnectUPS-X Web/SNMP also features a three-port switching hub.

### Environmental Monitoring Probe

The Environmental Monitoring Probe (EMP) works with the 9390 and ConnectUPS-X card to remotely monitor ambient temperature and relative humidity of the remote environment. The EMP can also be configured to provide the status of two additional contact devices such as smoke detectors or open-door sensors.

### Modbus® card

The Modbus card is an X-Slot device that allows continuous, real-time monitoring of the 9390 through a Building Management System (BMS) or industrial automation system.

## Relay interface cards

The X-Slot relay interface card provides four programmable isolated dry contact Form-C relay outputs (default setting: utility failure, low battery, UPS alarm/OK, on bypass) and one input.

**NetWatch** is a shutdown agent for the ConnectUPS Web/SNMP card. It is a very compact piece of software, but still features powerful configuration options for shutdown actions, timings and user notification.

**LanSafe®** is a network shutdown software product that currently supports up to 20 operating systems. It ensures controlled sequential shutdown of the whole network across platforms in case of a prolonged power failure. LanSafe allows the shutdown of up to 64 computers protected by a single UPS.

**Intelligent Power Manager** is a software tool for managing networked UPS and PDU systems more easily and at lower cost than the major NMS platforms, and is dedicated to power management functions. Administrators have an overall, consolidated view of the main operating parameters of all UPS systems. The web-based interface is intuitive and easy to use, while also offering high configurability and powerful features.

Intelligent Power Manager centralises alarm management. It can collate several events into a single message and deliver the message via email or SMS.

Intelligent Power Manager is very easy and fast to install. Once running, the software discovers manageable power devices automatically and is operational in just a few seconds.

A version of Intelligent Power Manager limited to 10 monitored devices is available free with each networked Eaton UPS.



ConnectUPS-X Web/SNMP X-Slot card



Modbus card



Relay Interface cards



Environmental Monitoring Probe



Intelligent Power Manager



LanSafe

# Customised solutions

Eaton is experienced in delivering solutions for the most demanding applications. As an example, marine UPSs have special dependability requirements due to the harsh operational conditions they have to withstand and the critical nature of the equipment they protect. Eaton has supplied marine UPSs to hundreds of vessels over the years.

The 9390 has been also tested and certified for use in medical imaging system applications by all major suppliers of X-ray, MRI and CT machines.

Eaton offers 9390 based customized systems for different markets, including:

- Marine/offshore
- Healthcare/medical
- Oil & Gas
- Rail & Track/underground/traffic/tunnel/mines
- Aviation
- Industrial applications
- Defence/military
- Emergency lighting



# Expertise and reliability through Eaton service

Eaton provides an extensive technical support network to cover the power protection needs of our customers. We offer a number of distinct service packages to match different types of maintenance needs and budgets. Whichever package you choose, you can rest assured that it will deliver power security and reliability to keep your core business running.

For more information, please contact your local Eaton service organisation or authorised service partner.



## TECHNICAL SPECIFICATIONS

### UPS output power rating (0.9 p.f.)

kVA	40	60	80	100	120	160
kW	36	54	72	90	108	144

### General

Efficiency in double-conversion mode (full load)	94%
Efficiency in double-conversion mode (half load)	92.5%
Efficiency in Energy Saver System (ESS)	Up to 99%
Distributed parallelling with Hot Sync technology	Max 6 + 1
Field upgradeable	Yes
Inverter/rectifier topology	Transformer-free IGBT with PWM
Audible noise	<65 dB
Altitude (max)	1000 m without derating (max 2000 m)

### Input

Input wiring	3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz
Input voltage range	Low -15% at 100% load/-30% at 50% load without battery discharge; High +10%/max +20%
Input frequency range	45-65 Hz
Input power factor	0.99
Input ITHD	Less than 4,5%
Soft start capability	Yes
Internal backfeed protection	Yes

### Output

Output wiring	3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz

Output UTHD	<3% (100% linear load); <5% (reference non-linear load)
Output power factor	0.9 (e.g. 72 kW at 80 kVA)
Permitted load power factor	0.7 lagging - 0.8 leading
Overload on inverter	10 min 100-110%; 30 sec 110-125%; 10 sec 125-150%; 300 ms >150%
Overload when bypass available	Continuous 100-110%, 10 min 110-150%, 5 ms 1000% Note! Bypass fuses may limit the overload capability

### Battery

Type	Maintenance free VRLA batteries, NiCd
Charging method	ABM technology or Float
Temperature compensation	Optional
Battery nominal voltage (lead-acid)	480 V (40 x 12 V, 240 cells)
Charging current / Model	40 60 80 100 120 160
Default A	10 20 20 30 30 40
Max* A	20 40 40 60 60 80

\*May be limited by maximum UPS input current rating

### Accessories

External battery cabinets with long-life batteries, X-Slot connectivity (Web/SNMP, ModBus/Jbus, Relay, Hot Sync, ViewUPS-X remote display), Hot Sync parallel tie cabinet, integrated manual bypass up to 80 kVA, external maintenance bypass switch

### Communications

X-Slot	4 communication bays
Serial ports	1 available
Relay inputs/outputs	6/3 programmable

### Compliance with standards

Safety (CB certified)	IEC 62040-1, IEC 60950-1
EMC	IEC 62040-2
Performance	IEC 62040-3

### Standard UPS

Part number	Description	Rating	Dimensions (HxWxD)	Weight
1028510	9390-40-N-4x0	40 kVA / 36 kW	1879x519x808 mm	257 kg
1028511	9390-60-U-4x0	60 kVA / 54 kW	1879x519x808 mm	313 kg
1028512	9390-80-N-4x0	80 kVA / 72 kW	1879x519x804 mm	313 kg
1028513	9390-100-U-4x0	100 kVA / 90 kW	1879x944x804 mm	430 kg
1028514	9390-120-N-4x0	120 kVA / 108 kW	1879x944x804 mm	430 kg
1028515	9390-120-U-4x0	120 kVA / 108 kW	1879x944x804 mm	530 kg
1028516	9390-160-N-4x0	160 kVA / 144 kW	1879x944x804 mm	530 kg

### Standard external battery

1025570	9390-BAT10-S-40x38Ah (250A)	38 Ah	1877x575x773 mm	700 kg
1025572	9390-BAT10-S-200 (250A)	200 W	1877x575x773 mm	1176 kg
1026327	9390-BAT10-S-205 (250A)	205 W	1879x1125x808 mm	1270 kg
1025467	9390-BAT10-280 (250A)	280 W	1879x1125x808 mm	1430 kg
1025468	9390-BAT10-500 (250A)	500 W	1879x1125x808 mm	1444 kg
1025469	9390-BAT10-280 (400A)	280 W	1879x1125x808 mm	1625 kg
1025470	9390-BAT10-330 (400A)	330 W	1879x1125x808 mm	2188 kg
1025471	9390-BAT10-500 (400A)	500 W	1879x1125x808 mm	2188 kg

### Battery racks

1026273	9390-RACK10-1x40x200W	200 W	1714x566x1246 mm	985 kg
1026274	9390-RACK10-1x40x280W	280 W	1726x690x1246 mm	1228 kg
1026275	9390-RACK10-1x40x330W	330 W	1726x690x1546 mm	1431 kg
1026276	9390-RACK10-1x40x390W	390 W	1729x690x1546 mm	1587 kg
1026277	9390-RACK10-1x40x500W	500 W	1789x690x1546 mm	1995 kg
1026278	9390-RACK10-2x40x500W	500 W	1714x866x1856 mm	3879 kg
1026279	9390-RACK10-3x40x500W	500 W	1789x690x3666 mm	5865 kg

See runtime from the runtime specification

### Standard accessories

1021887	External Bypass Switch 60-80 kVA (wall-mount)	wall	840x380x130 mm	17 kg
1021888	External Bypass Switch 120 kVA (wall-mount)	wall	1040x560x130 mm	25 kg
1024626	External Bypass Switch 160 kVA (wall-mount)	wall	1040x560x130 mm	25 kg
1025476	SPM-60-2	wall	700x500x250 mm	50 kg
1023540	SPM-80-4	floor	1530x520x788 mm	230 kg
1024687	9390 Tie Cabinet 3x120 kVA	floor	1879x519x808 mm	217 kg
1024506	9390 Tie Cabinet 3x160 kVA	floor	1879x519x808 mm	217 kg

For assistance with your power quality needs, contact your local Eaton service and sales representatives.

**[www.eaton.com/powerquality](http://www.eaton.com/powerquality)**

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