

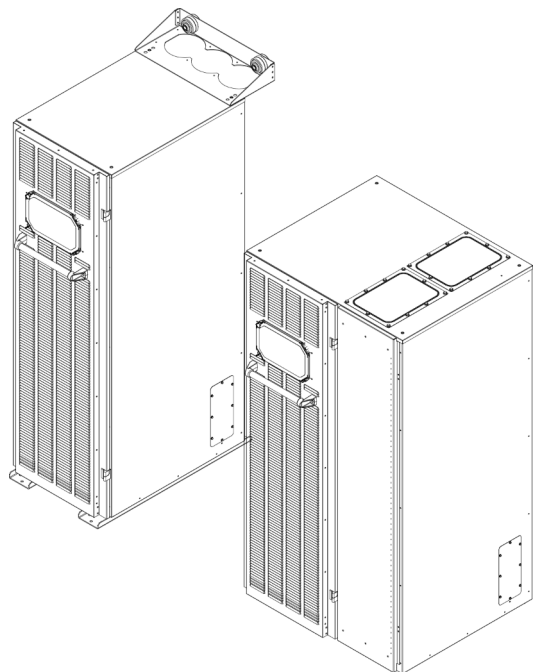


Powering Business Worldwide

User's and installation guide

Eaton 9PHD UPS 30–200 kW

P-164000531



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This manual contains important instructions that you should follow during installation and maintenance of the UPS and batteries. Please read all instructions before operating the equipment and save this manual for future reference.

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Eaton Power Quality Oy

Address: Koskelontie 13
FI-02920 Espoo
FINLAND

Internet: www.eaton.eu

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1 How to read this manual

1.1 Safety-related signs

The following table explains the safety-related signs used in this document.

 DANGER	DANGER indicates a hazard with a high level of risk which, if not avoided, will result in serious injury or death.
 WARNING	WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in serious injury or death, or damage to your machine.
 CAUTION	CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury, or damage to your machine.








Note: Notes are used to indicate important information and useful tips.

1.2 Safety symbols




1.2.1 Hazard symbols

These symbols indicate a hazardous situation or action. Symbols are used to warn of situations, which may cause environmental damage and personal injury.

	General warning sign		Explosion and fire hazard
	Electrical hazard		Corrosive hazard
	Battery hazard		




1.2.2 Prohibited action symbols

These symbols are used to indicate an action that should not be taken.

	General symbol for prohibited action		No smoking
	Limited or restricted access		

1.2.3 Mandatory action symbols

These symbols are used to indicate an action that must be taken.

	General symbol for mandatory action		Disconnect from power source
	Read the manual or instructions		

1.3 Conventions used in this document

This document uses the following type conventions:

- **Bold type** highlights important concepts in discussions, key terms in procedures and menu options, or represents a command or option that you type or enter at a prompt.
- *Italic type* highlights notes and new terms when they are defined.
- **Screen type** represents information that appears on the screen or LCD.

1.4 Glossary

Eaton documentation uses these acronyms to refer to Eaton UPS products or their parts:

Table 1: Glossary of acronyms

ABM	Advanced Battery Management
BIB	Bypass Input Breaker
EAA	Energy Advanced Architecture
EBC	External Battery Cabinet

EMBS	External Maintenance Bypass Switch
EPO	Emergency Power-off
ESS	Energy Saver System
FI-UPM	Field Installed UPM
IPM	Intelligent Power Manager
IPP	Intelligent Power Protector
MBP	Maintenance Bypass
MBS	Maintenance Bypass Switch
MCB	Miniature Circuit Breaker
MIS	Maintenance Isolation Switch
MOB	Module Output Breaker
REPO	Remote Emergency Power-off
RIB	Rectifier Input Breaker
SCR	Silicon-controlled Rectifier
SNMP	Simple Network Management Protocol
STSW	Static (bypass) Switch
UPM	Uninterruptible Power Module
UPS	Uninterruptible Power Supply
VMMS	Variable Module Management System

2 Safety instructions



DANGER

Important safety instructions!

Keep these instructions!

This document contains important instructions that must be followed during the installation, operation and maintenance of the UPS. Read all of the instructions before operating the equipment. Keep this manual for future reference.

In this manual, the term UPS refers only to the UPS cabinet and its internal elements. The term UPS system refers to the entire power protection system: the UPS cabinet, the battery cabinet, and options or accessories installed.

The UPS operates with mains, battery or bypass power. It contains components that carry high currents and voltage. A properly installed UPS is earthed and is protected against electrical shock. The UPS must be protected against unwanted objects and water with an IP23 rating at the minimum. The UPS is a sophisticated power system and only qualified personnel can install and service it.

DANGER



This UPS carries lethal voltages. All repairs and service must be done by authorized personnel only. There are no user-serviceable parts inside the UPS.

DANGER



Operations inside the UPS must be done by an authorized Eaton Customer Service Engineer or by a qualified service officer authorized by Eaton.

WARNING



The UPS is powered by its own energy source (batteries). The output terminals may be energized even when the UPS is disconnected from an AC source. To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled, indoor environment that is free of conductive contaminants.

The ambient temperature must not exceed 40°C (104°F), unless otherwise specified. Do not operate the UPS near water or excessive humidity (95% maximum). The system is not intended for outdoor use.

Before you start any installation or service work, make sure that all AC and DC power sources are disconnected. Power can come from multiple sources. Also ensure system grounding / PE continuity.

In a parallel system, the output terminals may be energized even when the UPS is turned off.

Batteries can present a risk of electrical shock or burn from high short-circuit current.

Electric energy hazard. Do not attempt to alter any battery wiring or connectors. Attempting to alter wiring can cause injury.

Do not open or mutilate batteries. Released electrolyte may be toxic and is harmful to the skin and eyes.

IMPORTANT: The battery can consist of multiple parallel strings. Make sure that you disconnect all strings before installation.

CAUTION



Only qualified service personnel knowledgeable of batteries and the required precautions can do the installation or service work on batteries. Keep unauthorized personnel away from the batteries. Before you install or replace batteries, consider all the warnings, cautions, and notes concerning appropriate handling. Do not disconnect the batteries when the UPS is in battery mode.

Make sure that your replacement batteries are of the same number and type as the battery that was originally installed.

Before you connect or disconnect battery terminals, disconnect the charging source by opening the corresponding battery circuit breaker.

Examine if the battery is inadvertently grounded. If it is, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. If you disconnect the grounding connection before you work on the batteries, the risk of an electric shock is less likely.

Discard batteries according to your local disposal requirements.

Do not discard batteries in a fire. When exposed to flame, batteries may explode.

To ensure proper cooling airflow and to protect personnel from dangerous voltages inside the unit, keep the UPS door closed and the front panels installed.

Do not install or operate the UPS system close to gas or electric heat sources.

Keep the operating environment within the parameters stated in this document.

Keep the surroundings of the UPS uncluttered, clean, and free from excess moisture.

Obey all DANGER, CAUTION, and WARNING notices inside and outside of the equipment.

2.1 Audience

The intended audience of this document is:

- People who plan and do the installation of the UPS
- People who use the UPS

This document supplies guidelines for how to examine the UPS delivery and how install and operate the UPS.

You should know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols. This document is written for a global reader.

CAUTION

Read this document before you start to operate or do any work on the UPS.



2.2 CE marking

The product has a CE marking in compliance with the following European directives:

- LV Directive (Safety) 2014/35/EU
- EMC Directive 2014/30/EU

Declarations of conformity with directives and UPS harmonized standards EN 62040-1 (Safety) and EN 62040-2 (EMC) are available at www.eaton.eu or by contacting your nearest Eaton office or authorized partner.

2.3 User precautions

You can do only these user operations.

- Startup and shutdown of the UPS, excluding the commissioning startup.
- Use of the LCD control panel and the Maintenance Bypass Switch (MBS).
- Use of optional connectivity modules and their software.

Obey the precautions and do only the described operations. Any deviation from the instructions can be dangerous to you or cause accidental load loss.

**DANGER**

Do not open any other screws in the unit than those holding the cover plates of the MiniSlots and the MBS locking plate. It can be fatal if you fail to recognize the electrical hazards.

2.4 Environment

The UPS must be installed according to the recommendations in this document. Never install the UPS in an airtight room, in the presence of flammable gases, or in an environment exceeding the specifications.

Ensure sufficient amount of ventilation air flow, preferably by natural ventilation. If this is not possible, forced (artificial) ventilation must be implemented. Where forced ventilation is used, the air extracted from the battery room must be exhausted to the atmosphere outside the building.

The air inlet and outlet must be located at the best possible location to create ideal conditions for the exchange of air. The following conditions are recommended:

- Position openings on opposite walls.
- Leave a minimum separation distance of 2 meters when openings are on the same wall.
- Locate the air inlet at the floor level and the air outlet close to the ceiling level.
- If you are installing multiple UPSs, create an airflow scheme.
- Configure the installation layout with cold aisles and hot aisles due to the UPS front-to-rear airflow protocol.
- Do not exceed the UPS specifications. For the free cooling applications, a cooling plan based on a psychometric chart is highly recommended.

Excessive amount of dust in the operating environment of the UPS may cause damage or lead to malfunction. Always protect the UPS from the outside weather and sunshine.





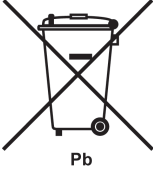

Note: For more information about the battery room ventilation requirements, including the calculation of the necessary air flow, see: IEC 62485-2: Safety requirements for secondary batteries and battery installations.

WARNING

During charge, float charge, heavy discharge, and overcharge, hydrogen and oxygen gases are emitted from lead-acid and NiCd batteries into the surrounding atmosphere. Explosive gas mixture may be created if the hydrogen concentration exceeds 4% by volume in air. Ensure the necessary air flow rate for the ventilation of the UPS location.

2.5 Symbols on the UPS and accessories

The following are examples of symbols used on the UPS or its accessories. The symbols are used to alert you of important information.

	<p>RISK OF ELECTRIC SHOCK</p> <p>Indicates that a risk of electric shock is present and the associated warning should be observed.</p>
	<p>CAUTION: REFER TO OPERATOR'S MANUAL</p> <p>Refer to your operator's manual for additional information, such as important operating and maintenance instructions.</p>
	<p>This symbol indicates that you may not discard the UPS or the UPS batteries in the trash. This product involves sealed, lead-acid batteries and they must be disposed of properly. For more information, contact your local recycling / reuse or hazardous waste center.</p>
	<p>This symbol indicates that you may not discard waste electrical or electronic equipment (WEEE) in the trash. For proper disposal, contact your local recycling / reuse or hazardous waste center.</p>

2.6 For more information

Address any inquiries about the UPS and the battery cabinet to the local office or an agent authorized by the manufacturer. Quote the type code and the serial number of the equipment.

Contact your local service representative if you need help with any of the following.

- scheduling initial startup
- regional locations and telephone numbers
- a question about any of the information in this manual
- a question that this manual does not answer



Note: For more information about the installation space, safe operation and working, see IEC 62485-2: Safety requirements for secondary batteries and battery installations.

3 Introduction to Eaton UPS

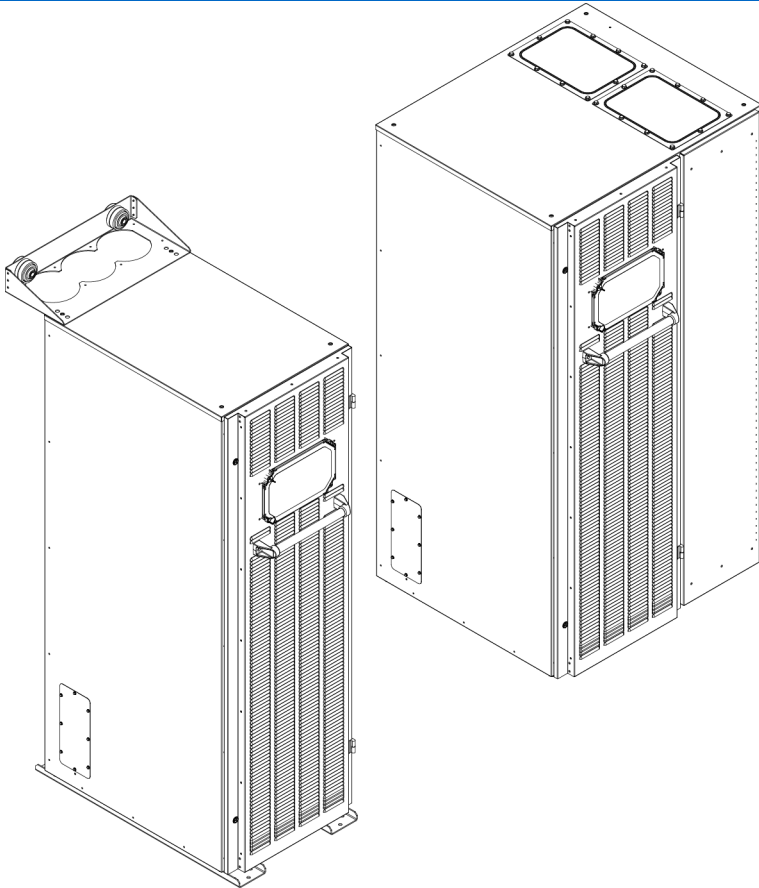


Figure 1. Eaton 9PHD UPS 50 kW with optional vibration dampers and 9PHD UPS 200 kW

The Eaton® 9PHD uninterruptible power supply (UPS) is intended for industrial and marine applications. It is a true online, continuous-duty, double-conversion, solid-state, three-phase system that supplies conditioned and uninterruptible AC power to critical load and protects it from power failures.

The UPS is used to prevent loss of valuable electronic information, minimize equipment downtime, and minimize the adverse effect on production equipment due to unexpected power problems.

The Eaton UPS continually monitors incoming electrical power and removes the surges, spikes, sags, and other irregularities that are inherent in commercial

utility power. Working with a building's or vessels electrical system, the UPS system supplies clean, consistent power that sensitive electronic equipment require for reliable operation. During brownouts, blackouts, and other power interruptions, batteries provide emergency power to safeguard operation.

The UPS unit is housed in a single, free-standing cabinet with safety shields behind the door for protection against hazardous voltage. The available static bypass ratings are 100 kW and 200 kW. The static bypass size is chosen according to UPS system power. For example, if a future requirement is to upgrade the UPS capacity, select the UPS bypass rating (100 kW, 200 kW) based on the requirements of the internal/external transformers and frequency converters. Pay also attention to voltage levels, phase shifts and frequencies. If the UPS cabinets are paralleled, their bypass ratings must be matched.

Eaton 9PHD output power ratings are demonstrated only on 50 kW uninterruptible power modules (UPMs) but also 40 kW and 30 kW power modules are available for extended selection of power ratings. A single UPS cabinet can house one to four UPM modules to get ratings of:

- 1 x 50 kW = 50 kW
- 2 x 50 kW = 100 kW
- 3 x 50 kW = 150 kW
- 4 x 50 kW = 200 kW

The unit may be equipped with certain options (for example, a higher IP rating enclosure), which may limit the maximum power of a single UPM. A UPM includes a rectifier, inverter, battery converter, and independent controls. Each UPM is able to operate independently from the other power modules.



Note: Startup and operational checks must be performed by an Eaton authorized Customer Service Engineer, or the warranty terms specified in the Warranty (see Chapter 10) become void. This service is offered as part of the sales contract for the UPS. Contact service in advance (usually a two-week notice is required) to reserve a preferred startup date.

3.1 Looking inside the UPS

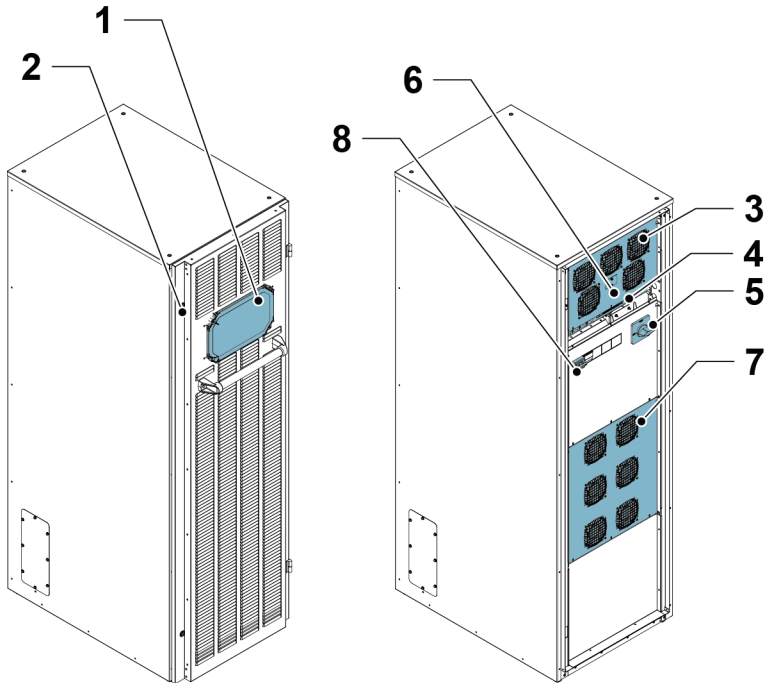


Figure 2. Looking inside the Eaton 9PHD UPS 50 kW with internal transformer

- | | |
|--|---|
| 1. Control panel (protected under a hatch) | 5. Maintenance bypass switch (optional) |
| 2. Door latch | 6. Battery start button |
| 3. Power module (UPM) | 7. Transformer (optional) |
| 4. Communications area | 8. Input switch S1 |

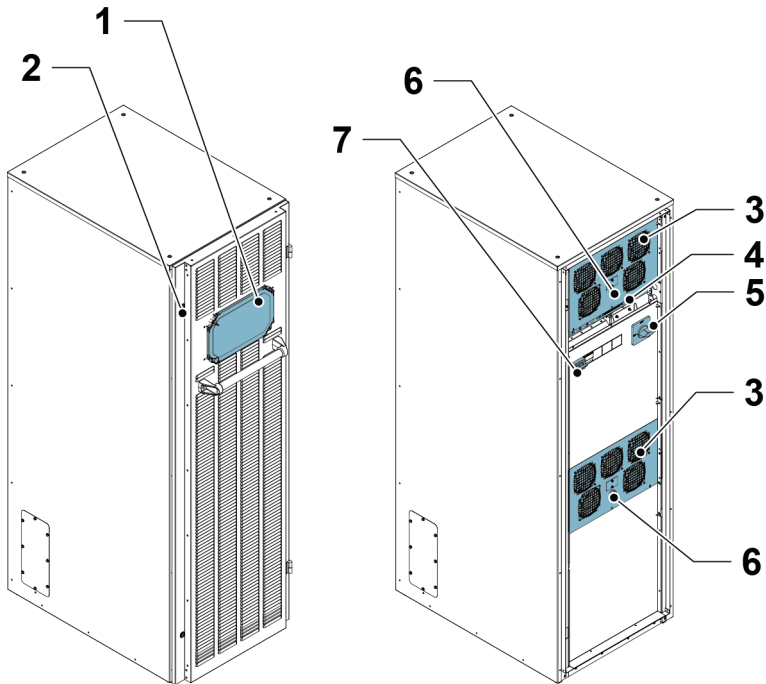


Figure 3. Looking inside the Eaton 9PHD UPS 100 kW

- | | | | |
|----|---|----|--------------------------------------|
| 1. | Control panel (protected under a hatch) | 5. | Maintenance bypass switch (optional) |
| 2. | Door latch | 6. | Battery start button |
| 3. | Power module (UPM) | 7. | Input switch S1...S2 |
| 4. | Communications area | | |

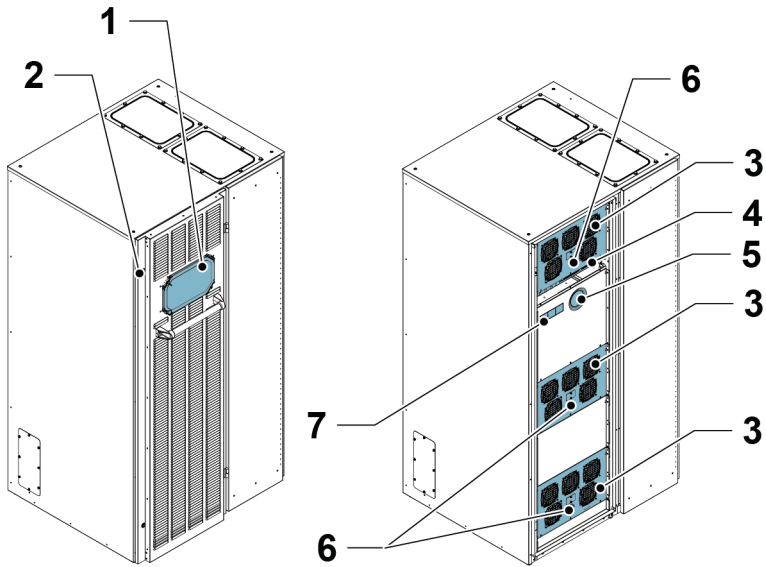


Figure 4. Looking inside the Eaton 9PHD UPS 150 kW

- | | |
|--|---|
| 1. Control panel (protected under a hatch) | 5. Maintenance bypass switch (optional) |
| 2. Door latch | 6. Battery start button |
| 3. Power module (UPM) | 7. Input switch S1...S4 |
| 4. Communications area | |

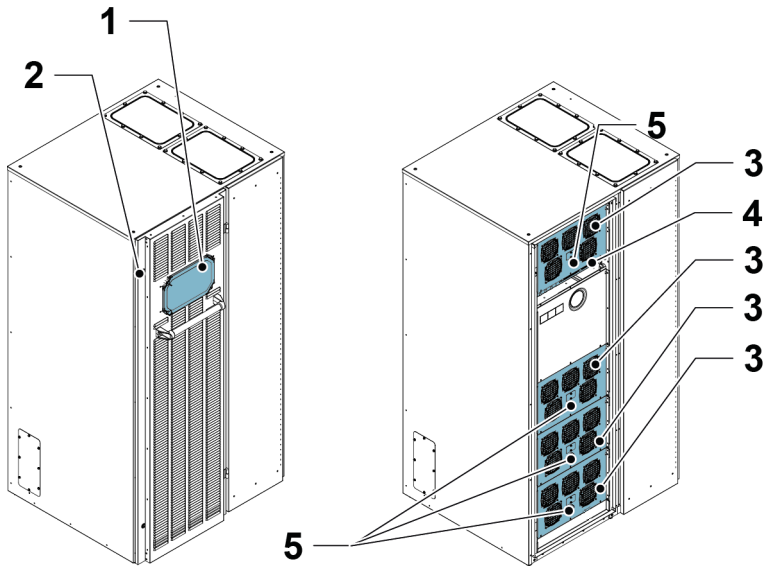


Figure 5. Looking inside the Eaton 9PHD UPS 200 kW

- | | |
|--|-------------------------|
| 1. Control panel (protected under a hatch) | 4. Communications area |
| 2. Door latch | 5. Battery start button |
| 3. Power module (UPM) | |

The system level static bypass in the Eaton 9PHD UPS cabinet determines the attainable output power of the UPS. The available static bypass ratings are 100 kW and 200 kW. The static bypass line consists of static switch and a backfeed protection isolation device connected in series. In addition, there is a system level control unit that constantly monitors the power delivered through the bypass line or to the input of the UPS. Transfers to static bypass are seamless and performed automatically by the system as needed, for example, in case of an extended system overload.

Each UPM includes a rectifier, battery converter, inverter and independent controls. Each UPM is able to operate and share the load independently, despite the status of the other UPMs.

The 30–50 kW 9PHD UPS includes one UPM. In the 60–200 kW units, the UPMs are paralleled internally.

The rectifier input switch is available for the 30–150 kW units. The internal MBS is available as optional for the 30–150 kW units. These options are not available for the 160–200 kW units, and will have to be included externally in the installation if needed.

Internal transformers are available as option for the 30–100 kW units. The 30–50 kW unit may be equipped with a maximum of two transformers. The 80–100 kW unit can only have one transformer. Transformers can be used to match the UPS input, output or bypass source configuration and voltage to the input supply and load requirements. They can also be used for galvanic isolation, changing the grounding system, creating neutral wiring (and, in a way, improving the short circuit capability).

If utility power is interrupted or falls outside the parameters specified in Chapter 9, the UPS uses a backup battery supply to maintain power to the critical load for a specified period of time or until the utility power returns. For extended power outages, the UPS allows you to either transfer to an alternative power system (such as a generator) or shut down your critical load in an orderly manner. The UPS bypass consists of a continuous-duty static switch and a backfeed protection isolation device K5. All models also include an internal fuse in the bypass line. The backfeed protection and bypass fuse are located in series with the static switch.

3.2 UPS operating modes

The UPS operating modes are as follows.

Operating mode	Description
Normal operating modes:	
- Double conversion mode	Critical load is supplied by the inverter, which derives its power from rectified utility AC power. In this mode, the battery charger also provides charging current for the battery, if needed.
- Variable Module Management System (VMMS) mode	Critical load is supplied by the inverter. The inverter derives its power from rectified utility AC power, identically to double conversion mode. In the VMMS mode, the UPS system is able to optimise the load level per power module: the operating efficiency is significantly improved when operating load is below 50% of UPS capacity. The UPS system automatically places the redundant power modules to suspended mode. In case of any anomalies in utility or a sudden load increase, the suspended power modules are able to transfer to on-line mode with less than 2 ms transition time.

Operating mode	Description
- Energy Saver System (ESS) mode	Critical load is supported securely by utility power through the static bypass switch with double conversion available on-demand with typically less than a 2 ms transition time, should any abnormal condition be detected in the utility. When operating in the ESS mode, the load is protected with inherent surge suppression. Operating the UPS in the ESS mode increases system efficiency up to 99%, allowing significant savings in energy losses without compromising system reliability
Stored energy mode	Energy is drawn from a DC backup power source and converted to AC power by the UPS inverter. Most commonly VRLA batteries are introduced to the system for this purpose, and the mode of operation is called the battery mode
Bypass mode	Critical load is supported directly by utility power through the UPS static switch.

3.2.1 Normal operating modes

During normal UPS operation, power for the system is derived from a utility input source. **Unit Online** is displayed on the front panel, indicating that the incoming power is within voltage and frequency acceptance windows.

3.2.1.1 Double conversion mode

Figure 6 shows the path of electrical power through the UPS system when the UPS is operating in the double conversion mode.

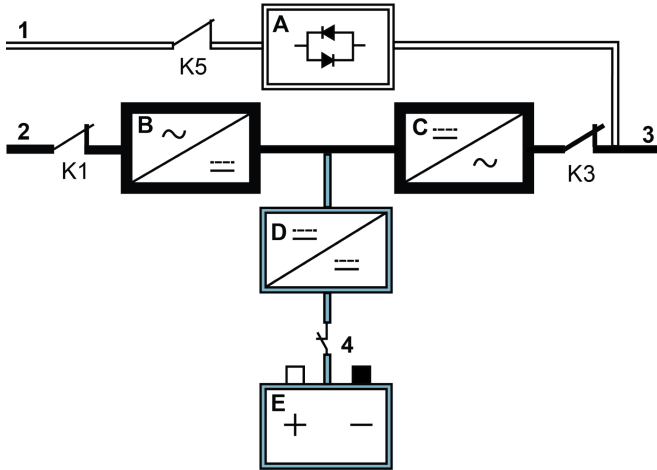


Figure 6. Path of current through the UPS in the double conversion mode

A	Static switch	1	Bypass input		Main power flow
B	Rectifier	2	Rectifier input		Energized
C	Inverter	3	Output		De-energized
D	Battery converter	4	Battery breaker		Trickle current
E	Battery		Closed		Open

Three-phase AC input power is converted to DC using a multilevel converter with IGBT devices to produce a regulated DC voltage to the inverter. The UPS status indicated on the display is **Unit Online** and the UPM status is **Active**.

The battery converter derives its input from the regulated DC output of the rectifier and provides regulated charge current to the battery. The battery is always connected to the UPS and ready to support the inverter should the utility input become unavailable.

The inverter produces a three-phase AC output to the critical load. The inverter uses multilevel converter technology with IGBT devices and pulse-width modulation (PWM) to produce a regulated and filtered AC output.

If the utility AC power is interrupted or is out of specification, the UPS automatically switches to the battery mode to support the critical load without interruption. When utility power returns, the UPS returns automatically to the double conversion mode.

If the UPS becomes overloaded or unavailable, the UPS seamlessly switches to the bypass mode and continues supplying the load through the static bypass. The UPS automatically returns to the double conversion mode when the abnormal condition, such as an extended time overload, is cleared and the system operation is restored within the specified limits.

If a UPM within the UPS suffers an internal failure, the remaining UPMs continue to support the load in the double conversion mode. The UPS is automatically internally redundant when the UPS is not operating at full load. However, if internal redundancy between the UPMs is not possible due to high load, the UPS switches automatically to the bypass mode and remains in that mode until the failure is corrected and the UPS is back in operation.

In an external parallel redundant system, each UPS can be isolated from the system for service while the remaining UPSs support the load in the double conversion mode.

3.2.1.2 Variable Module Management System mode

When Variable Module Management System (VMMS) mode is enabled, the load is powered by UPMs in double conversion mode. The UPS status indicated on the display is **Unit Online VMMS** and the UPM status is **Active**.

UPS efficiency varies according to the load level at which the UPS operates. VMMS technology enables achieving optimised system efficiency by automatically optimising the UPM load level. As an example, when the load is very low, a minimum of one UPM is online. This enhances the UPS system efficiency by several percentage points.

The remaining UPMs are ready to switch to double conversion mode instantaneously, if the load increases. The load will remain protected by double conversion UPS the entire time, even during and after a load step.

It is possible to configure VMMS mode to include power module redundancy at all times, so that a number of additional redundant UPMs are always online.

When the UPMs are in ready state, the IGBT converters are constantly powered, since the rectifier input and inverter output contactors are closed. The DC link is also powered. Only the IGBT gate signals are suspended. The only step needed to come out of ready state is to gate the IGBT switches. Since DC voltage is constantly present, the inverter is able to start instantaneously: the 2 ms transfer to double conversion is practically seamless.

3.2.1.3 Energy Saver System mode

Figure 7 shows the path of electrical power through the UPS system when the UPS is operating in the Energy Saver System (ESS) mode.

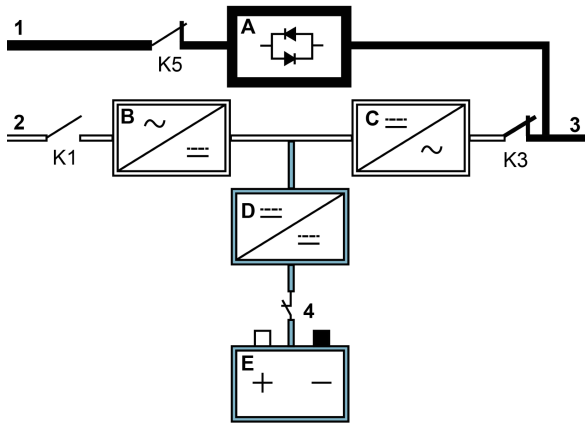


Figure 7. Path of current through the UPS in the Energy saver System mode

A	Static switch	1	Bypass input		Main power flow
B	Rectifier	2	Rectifier input		Energized
C	Inverter	3	Output		De-energized
D	Battery converter	4	Battery breaker		Trickle current
E	Battery				Closed
					Open

In the ESS mode, the UPS safely provides mains current directly to the load when the input is within the acceptable limits by its voltage and frequency. The UPS status indicated on the display is **Unit Online ESS**, and the UPM status is **Active**. Surge protection and some filtering is also provided, making sure that clean power is delivered to the load equipment. In case any disturbances are detected in the incoming power, the UPS switches to the double conversion mode and continues to supply the critical load through its inverter. In case of a complete utility outage or if the input power is outside the tolerances of the system, the UPS transfers to the battery mode and continues to supply conditioned, clean power to the critical load.

When operating in the ESS mode, the UPS's superior detection and control algorithms continuously monitor the incoming power quality and allow fast engagement of the power converters. Typical transition time to the double conversion mode is less than 2 milliseconds, which is practically seamless.

When the power conditions are within acceptable limits, the UPS operates as a high efficiency, energy-saving system, providing surge protection for IT equipment and making sure that clean power is delivered to the facility. The energy saver system increases system efficiency up to 99% when supplying 20–100% of nominal load, reducing energy losses by up to 80%.

3.2.2 Stored energy and battery mode

When running normally in the double conversion or ESS mode, the UPS automatically transfers to supply the load from batteries or some other stored energy source if a utility power outage occurs, or if the utility power does not conform to the specified parameters. The UPS status indicated on the display is **On Battery**, and the UPM status is **Active**. In the battery mode, the battery provides emergency DC power, which is converted to regulated output power by the inverter.

Figure 8 shows the path of electrical power through the UPS system when operating in the battery mode.

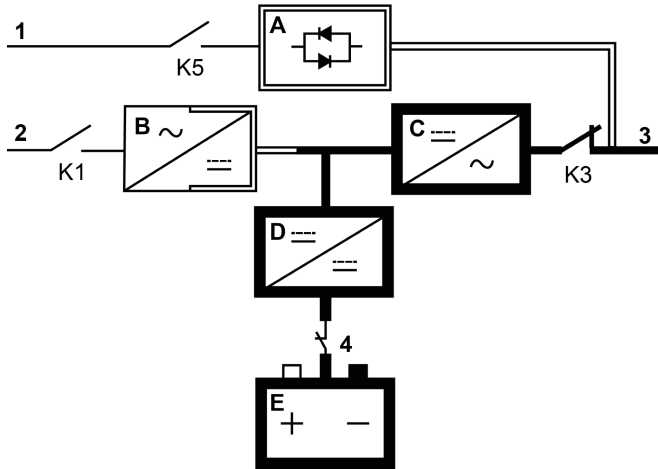


Figure 8. Path of current through the UPS in the battery mode

A	Static switch	1	Bypass input		Main power flow
B	Rectifier	2	Rectifier input		Energized
C	Inverter	3	Output		De-energized
D	Battery converter	4	Battery breaker		Trickle current
E	Battery		Closed		Open

During a utility power failure, the rectifier no longer has an AC utility source from which to supply the DC output current required to support the inverter. The input relay K1 opens and the UPS output is powered from the batteries through the inverter. As the inverter operates uninterrupted through the transition, the load remains supported continuously without disturbance. If the UPS static bypass is supplied from the same source as the UPS rectifier, the backfeed protection contactor K5 also opens. The opening of K1 and K5 prevent system voltages from bleeding backwards and re-entering the input source through the static switch or rectifier.

If the input power fails to return or is not within the acceptance windows required for normal operation, the battery continues discharging until a DC voltage level is reached where the inverter output can no longer support the connected loads. When this event occurs, the UPS issues a set of audible and visual alarms indicating that the batteries have a minimal capacity left and a system shutdown is imminent. Unless utility power is restored, the output can be supported for a

maximum of 2 minutes before the output of the system shuts down. If the bypass source is available, the UPS transfers to the bypass mode instead of shutting down.

If the input power becomes available again at any time during the battery discharge, K1 and K5 close and the UPS returns to normal operation. The UPS also starts to recharge the batteries to restore the capacity.

3.2.3 Bypass mode



CAUTION

The critical load is not protected while the UPS is in bypass mode.

The UPS automatically switches to the bypass mode if it detects an overload, load fault, or internal failure. The bypass source supplies the commercial AC power to the load directly. The UPS can also be commanded to transfer to the bypass mode manually through the display. The UPS status indicated on the display is **On Bypass**.

The UPS returns from the bypass mode back to online mode, if the condition (for example overload) that caused the transfer is cleared. If there is a condition that does not clear by itself (for example UPS internal failure), the UPS remains on bypass operation.

Figure 9 shows the path of electrical power through the UPS system when operating in the bypass mode.

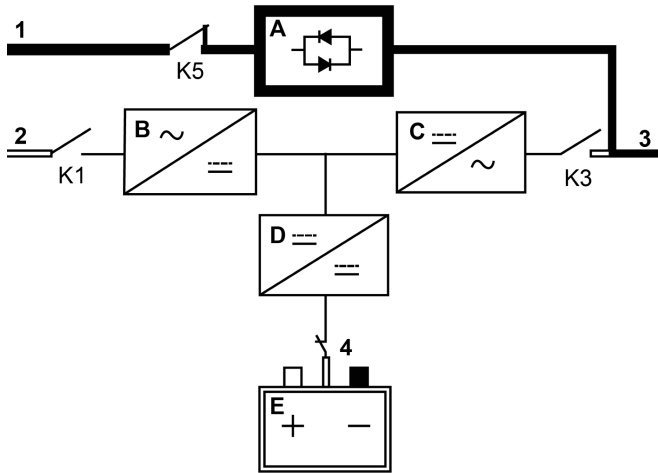


Figure 9. Path of current through the UPS in the bypass mode

A	Static switch	1	Bypass input		Main power flow
B	Rectifier	2	Rectifier input		Energized
C	Inverter	3	Output		De-energized
D	Battery converter	4	Battery breaker		Trickle current
E	Battery	5	Closed		Open

In the bypass mode, the output of the system is supplied with three-phase AC power directly from the system input. While in this mode, the output of the system is not protected from voltage or frequency fluctuations or power outages from the source. Some power line filtering and transient protection is supplied to the load, but no active power conditioning or battery support is available to the output of the system in the bypass mode.

The static bypass consists of a solid-state, silicon-controlled rectifier (SCR) static switch (STSW) and a backfeed protection isolation device K5. The static switch is rated as a continuous-duty device that is used anytime the inverter is unable to support the applied load. The static switch is wired in series with the backfeed protection. As the static switch is an electronically-controlled device, it can be turned on immediately to pick up the load from the inverter without interruption. The backfeed protection is normally always closed, ready to support the static switch unless the bypass input source becomes unavailable.

3.3 UPS features

The Eaton UPS has many features that provide cost-effective and consistently reliable power protection. The feature descriptions provide a brief overview of the UPS standard features.

3.3.1 Advanced Battery Management

The Advanced Battery Management technology uses sophisticated sensing circuitry and a three-stage charging technique that extends the useful service life of UPS batteries while optimizing the battery recharge time. ABM also protects batteries from damage caused by high current charging and inverter ripple currents. Charging at high currents can overheat and damage batteries.

In the *charge mode*, the batteries are recharged. Charging lasts only as long as it takes to bring the battery system up to a predetermined float level. Once this level is reached, the UPS battery charger enters the *float stage* and the charger operates in the constant voltage mode.

The *rest mode* begins at the end of the charge mode; that is, after 48 hours of float charging (user-adjustable). In the rest mode, the battery charger is completely turned off. The battery system receives no charge current during this rest period of approximately 28 days (user-adjustable). During the rest mode, the open circuit battery voltage is monitored constantly, and battery charging is resumed when necessary.

3.3.2 Powerware Hot Sync

The Eaton Powerware Hot Sync technology is an algorithm that eliminates the single point of failure in a parallel system and therefore enhances system reliability. The Hot Sync technology is incorporated in all Eaton 9PHD UPSs, and it is utilized in both multi-module internal parallel and external parallel systems.

The Hot Sync technology enables all UPMS to operate independently in a parallel system, even without inter-module communications. The power modules utilizing the Hot Sync technology are completely autonomous; each module monitors its own output independently to remain in complete synchronization with the other modules. The UPM power modules share the load perfectly even in changing capacity or load conditions.

The Powerware Hot Sync technology combines digital signal processing and an advanced control algorithm to provide automatic load sharing and selective tripping in a parallel UPS system. The load share control algorithms maintain synchronization and load balance by constantly making minute adjustments to variations in the output power requirements. The modules conform to demand and are not in conflict with each other for the load. The Powerware Hot Sync systems are capable of paralleling for both redundancy and capacity.

3.3.3 Power Conditioner

The Power Conditioner mode is characterized by the UPS running in the double conversion mode without batteries connected. In the Power Conditioner mode, the UPS provides conditioned output voltage and frequency. The UPS can also support high nonlinear loads without ITHD on the input. The UPS meets the qualifications outlined in this product specification, except for the conditions below.

When in the Power Conditioner mode, the UPS has the following functionality and limitations:

1. The UPS runs in the double conversion mode and the battery alarms are turned off.
2. Because there is no battery, loss of utility power results in the UPS losing power and shutting down.
3. The UPS sustains up to -50% input voltage tolerance, unless the current limit is reached.
4. If the rectifier is turned off, the UPS attempts a transfer to the bypass mode.
5. The ESS mode is not available.

3.3.4 Frequency Converter

The Frequency Converter mode is characterized by the UPS running without the bypass mode available. The output frequency can be configured to be different from the standard input frequency (e.g. 60 Hz output, 50 Hz input). The UPS can also support high nonlinear loads without iTHD on the input. The UPS meets the qualifications outlined in this product specification, except for the conditions below.

When in the Frequency Converter mode, the UPS has the following functionality and limitations:

1. Operation is the same as when in the double conversion mode with no bypass available.
2. Bypass alarms are suppressed.

3.3.5 Sync Control

The Eaton® Sync Control maintains the critical load outputs of two separate single UPS systems in synchronization. Use of the Eaton Fixed Master Sync Control provides uninterrupted transfer of the load from one load bus to another by means of downstream, dual-source, solid-state transfer switches. Without the load sync option, the two system output (critical load) buses can become out of phase with each other. This condition occurs when suitable bypass sources are not available or when the bypass sources feeding each system are not in sync with each other. Examples of this condition are two systems supplied by

separate generator sets, or situation where the bypass sources for the two systems are lost.

3.4 Software and connectivity features

3.4.1 Customer interface

MiniSlot Communication Bays — there are 4 communication bays for MiniSlot connectivity cards. MiniSlot cards are quickly installed and are hot-pluggable. See Chapter 6 for additional information.

3.4.2 Power Management Software

Intelligent Power software products offer tools for monitoring and managing power devices across the network. See Chapter 6 for more information.

3.5 Options and accessories

Contact your Eaton sales representative for more information about the available options and accessories.

3.5.1 Maintenance Bypass Switch

You may not remove or replace a UPS unless you have an external Maintenance Bypass Switch (Ext MBS), or other switchgear for separating the cabinet. However you may remove and replace a UPS Power Module (UPM) when an internal or external MBS is installed.

An internal Maintenance Bypass Switch is provided as a factory-installed option for 30–150 kW units. See Section 7.3.4 for instructions. The Ext MBS units are available as accessory items (including the operating instructions).

External Maintenance Bypass Switch Panel (accessory)

The external MBS is enclosed in its own separate cabinet, which can be either a wall-mounted or stand-alone cabinet depending on the MBS power rating. The MBS wiring has two different options: two- and three switch configuration. The two-switch model contains a maintenance isolation switch and a maintenance bypass switch. In addition to these, the three-switch model contains a bypass input breaker. The external MBS enclosures are IP22 classified.

The two-switch model assumes that the UPS rectifier and bypass are coupled through dedicated breakers and separate cables from the switchgear. However, the three-switch model can be connected to the switchgear with only a single cable, and the cable connections between the panel and UPS are run separately.

For external MBS installation instructions, see a separate manual.

3.5.2 Top air exhaust kit

The top air exhaust kit is used to direct the UPS cooling air front-to-top. The kit eliminates the cooling clearance requirement from the back of the unit, and enables the installation of the UPS even against a wall, in a corner or back-to-back. The kit increases the depth of the unit by 200 mm.

Refer to Section [4.3.1](#) for further information.

3.5.3 Field Installed UPM

A Field Installed UPM (FI-UPM) can be installed in the cabinet any time in the future when power needs change. This enables the UPS system to grow with the business, thus lowering the initial investment required for the system on day one.

In order to install an FI-UPM, the UPS cabinet needs to have upgradeability, which is determined when purchasing the UPS.

For a listing of the upgradeable configurations, see [Table 3](#).

CAUTION



Only qualified service personnel can install a FI-UPM.



Note: Make sure the cable and fuse rating are correct before power upgrading.

3.5.4 IP classifications

A properly installed 9PHD UPS enclosure is at a minimum IP23 rated against electrical shock and foreign objects. The following IP classifications are available for 9PHD UPS as standard and option:

Table 2: 9PHD UPS standard and optional IP classes

	30–40 kW, 80 kW, 120 kW, 160 kW	50 kW, 100 kW, 150 kW, 200 kW
IP23	Standard	Standard
IP33	Option	-
IP54	Option	-

3.5.5 Internal transformer

Internal transformers can be used to match the input source and load requirements to the internal voltages of the UPS. Auto or isolation transformers are used to match the input or output voltage to the UPS requirements. Isolation

transformers can also be used to change the distribution system (for example IT or TN-S).

The 9PHD 30–50 kW UPS can be equipped with 1 or 2 internal transformers and the 80–100 kW UPS can be equipped with 1 internal transformer. These transformers can be installed in the UPS output, UPS input (single feed for rectifier and bypass), rectifier input or bypass inputs paths.

3.5.6 Earth fault monitoring

Earth fault monitoring is an option that can be used to monitor the earth fault condition and give alarms if the condition changes. If your model has this option, connect the monitored UPS system (input or output) to a distribution system, which is isolated from earth.

The alarm level can be set between 5 k Ω and 100 k Ω .

3.5.7 Emergency power off 24 V

By default, the emergency power off terminals in the UPS are drycontact type. A 24 V emergency power off input is available as option. With this option, the emergency power off sequence is activated when a 24 V control signal is supplied to the UPS.

3.5.8 Lifting eyes

Lifting eyes is an optional feature that can be incorporated into all 9PHD UPS models. When unpacking and unloading the UPS, lifting eyes can be used to lift the UPS to its installation location.

For more information on unpacking and unloading the UPS, see Section [4.4](#).

3.5.9 Vibration dampers

Vibration dampers are an optional feature that can be incorporated into all 9PHD cabinet models. They are typically used in marine or offshore environments to eliminate vibration that could have a negative impact on the unit's performance.

Vibration dampers are alternative to casters and levelling feet: only one or the other can be incorporated to any 9PHD cabinet. The vibration damper option also features wall and floor mounting steel rails that enable firm fastening to vessel structure.

Contact your Eaton representative for dimensional drawings of vibration dampers.



Note: If your unit is equipped with vibration dampers, a minimum of 30 mm clearance is recommended on both sides of the cabinet to avoid the vibrating cabinet hitting any paralleled UPS or accessory cabinets.

3.5.10 External battery cabinets (EBC-F and EBC-G)

The Eaton external battery cabinets provide emergency short-term backup power to safeguard operation during brownouts, blackouts, and other power interruptions. The battery cabinets line-up and match with the Eaton UPS product line, and should only be used in Eaton UPS system. There are two battery cabinets: the narrow-frame EBC-F and the wide-frame cabinet EBC-G.

The EBC-F is designed to be used with a UPS rated up to 100 kW and the EBC-G is designed to be used with a UPS that is rated up to 200 kW output power. Both of them have one battery string of 36 or 40 battery blocks.

If you choose to run the wiring through the side panels of the UPS and the battery cabinet, the battery cabinet must be located on the right side of the UPS. See the User's and Installation Guide (P-164000538) for more details.

3.5.11 External transformer cabinet

If internal transformers cannot be used, the required transformers can also be installed externally. The 9PHD external transformer cabinet TFC-A can be used to house two transformers for the 9PHD 30–100 kW UPSs. The external transformer cabinet has monitored fans and a temperature alarm feature. The transformer over temperature signal input can be configured for both normally closed and normally open type temperature alarms. Other external transformers can also be used with 9PHD UPS.

TFC-A is available as an accessory item. See User's and Installation Guide (P-164000538) for more details.

3.6 Battery system

The battery system provides short-term emergency backup power to safeguard operation during brownouts, blackouts, and other power interruptions. By default, this UPS is configured to use VRLA batteries. If other type of batteries or other energy storage means need to be connected, consult a certified service technician prior to proceeding with the installation.

For detailed battery specifications, see Section [9.5](#).

3.6.1 UPS Battery Switchgear (UBS)

The purpose of the UBS (or external battery circuit breaker cabinet) is to ease the installation of external battery cabinets or battery racks. One cabinet can parallel up to four battery cabinets or racks. The cabinet contains individual input breaker for each battery cabinet or rack and common output breaker. There is a dedicated circuit breaker cabinet for each 50 kW, 100 kW, 150 kW and 200 kW units. The UBS enclosures are IP22 classified. They are available as accessory items (including the operating instructions).

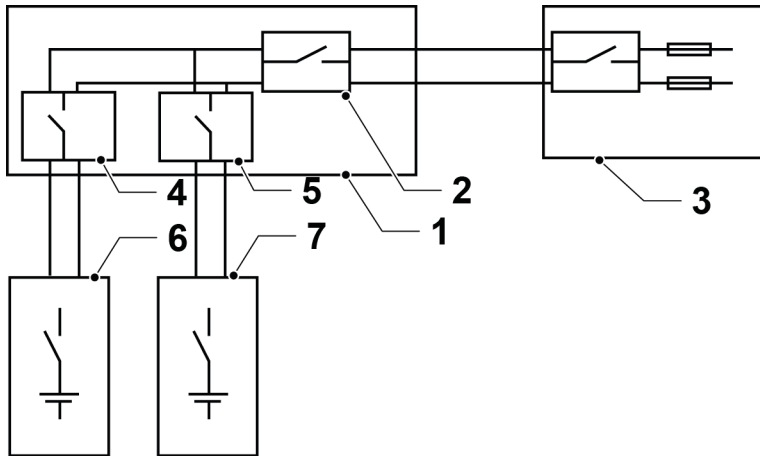


Figure 10. External battery circuit breaker cabling diagram

- | | | | |
|---|---------------------------------|---|---------------------|
| 1 | Battery circuit breaker cabinet | 5 | String breaker n |
| 2 | Main breaker | 6 | Battery cabinet 1 |
| 3 | UPS | 7 | Battery cabinet n |
| 4 | String breaker 1 | | |

3.7 Basic system configurations

UPS power rating

The maximum attainable UPS system power rating is determined by the frame size and options such as internal transformers. The number of UPM power modules determines the nominal power rating of the UPS. If upgradeability is required, choose the system static bypass according to the future maximum load rating, and the number of UPMs is chosen according to the capacity requirements on day one.

A single UPS frame can house maximum four UPM power modules, resulting in maximum power rating of 200 kW. In addition, the UPS frames can be connected in parallel to create even larger systems. A maximum of eight UPSs can be connected in parallel.

UPS options and accessories

The following table shows different standard and optional UPS features and the models where they apply.

Table 3: Standard and optional UPS features

Feature	30–50 kW	60–100 kW	120–150 kW	160–200 kW
Smart touch screen display for system control and monitoring	Standard	Standard	Standard	Standard
Internal MBS	Option	Option	Option	-
Rectifier input switch IS	Option	Option	Option	-
Top air exhaust kit	Option	Option	Option	Option
Battery start	Standard	Standard	Standard	Standard
Integrated backfeed protection	Standard	Standard	Standard	Standard
Internal transformers	Option	Option	-	-
Earth fault monitoring	Option	Option	Option	Option
Emergency Power Off	Option	Option	Option	Option
24 V input				
Lifting eyes	Option	Option	Option	Option
External MBS	Accessory	Accessory	Accessory	Accessory
External transformer cabinet	Accessory	Accessory	-	-
External UBS (battery switchgear)	Accessory	Accessory	Accessory	Accessory

Additional options and accessories are also available. These include different software and connectivity options and external switchgear and power distribution options.

4 UPS installation plan and unpacking

Use the following basic sequence of steps to install the UPS:

1. Create an installation plan for the UPS system.
2. Prepare your site for the UPS system.
3. Inspect and unpack the UPS cabinet.
4. Unload and install the UPS cabinet and wire the system.
5. Complete the installation checklist provided in Section [4.2](#).
6. Have authorized service personnel perform the preliminary operational checks and startup.



Note: Startup and operational checks must be performed by an Eaton authorized Customer Service Engineer, or the warranty terms specified in the Warranty (see Chapter [10](#)) become void. This service is offered as a part of the sales contract for the UPS. Contact service in advance (usually a two-week notice is required) to reserve a preferred startup date.

4.1 Creating an installation plan

Before you install the UPS system, read and understand how these instructions apply to the system that you are going to install. Use the procedures and illustrations in Section [4.3](#) and Chapter [5](#) to create a logical plan for installing the system.

4.2 Installation checklist

Action	Yes / No
All packing materials and restraints are removed from each cabinet.	
Each cabinet in the UPS system is placed in its installed location.	
A cabinet grounding kit / mounting kit is installed between any cabinets that are bolted together.	
All conduits and cables are properly routed to the UPS and any ancillary cabinets.	
All power cables are properly sized and terminated.	
Neutral conductors are installed and bonded to ground according to the requirements.	
A ground conductor is properly installed.	
Battery cables are terminated and connected to battery connectors.	
Battery Shunt trip and Aux contact signal wiring is connected from the UPS to the battery breaker.	
LAN drops are installed.	
All LAN connections are completed.	
Air conditioning equipment is installed and operating correctly.	
There is adequate workspace around the UPS and other cabinets.	
Adequate lighting is provided around all the UPS equipment.	
A 230 VAC service outlet is located within 7.5 meters of the UPS equipment.	
The Remote Emergency Power-off (REPO) device is mounted in its installed location and its wiring is terminated inside the UPS cabinet.	
If EPO is used in the NC configuration, a jumper is installed on the EPO between pins X10:13 and X10:14.	
(OPTIONAL) Alarm relays and signal outputs are wired appropriately.	
(OPTIONAL) A remote battery disconnect control is mounted in its installed location and its wiring is terminated inside the UPS and battery cabinet.	
(OPTIONAL) Accessories are mounted in their installed locations and their wiring is terminated inside the UPS cabinet.	
Start-up and operational checks are performed by an authorized Eaton Customer Service Engineer.	

4.3 Site preparations

For the UPS system to operate at peak efficiency, the installation site must meet the environmental parameters outlined in these instructions. If the UPS needs to be operated at an altitude higher than 1,000 m, contact your service representative for important information about high altitude operation. The

operating environment must meet the height, clearance, and environmental requirements specified.

4.3.1 Environmental and installation considerations

The UPS system can be installed where there is TN, TT, or IT power distribution system. The three phases must be symmetrical about ground (from a Wye source). If an optional isolation transformer is used in the rectifier and bypass inputs, the UPS can also be connected to unsymmetrical (for example, delta source and corner grounded) configurations.

The requirement of input neutral depends on the UPS model. Refer to the type plate on the UPS enclosure for the input wiring configuration.

- If the configuration is 3/N/PE, input neutral wire for rectifier and bypass feed is required.
- If the configuration is 3/PE, neutral wire is not required.
- If the output configuration is 3/N/PE, a neutral terminal is also available in the UPS output.

The UPS system installation must meet the following guidelines:

- Install the system indoors on a level floor suitable for computer or electronic equipment. The floor must be suitable for heavy weight and wheeling.
- Install the system in a temperature and humidity controlled area, where the dew point cannot be reached.
- Install the system in an area that is free of conductive contaminants.
- Install the cabinet either in line-up-and-match or standalone configurations.

CAUTION



Make sure that the prospective short circuit current of the supply source is lower than the conditional short circuit current rating (Icc) of the UPS. Refer to the type plate or technical specification for the Icc rating of the unit.

Failure to obey these guidelines may void your warranty.

The UPS equipment operating environment must meet the weight requirements shown in Table 5, and the size requirements shown in Table 4 and Table 6.

Table 4: UPS cabinet dimensions

Dimensions (W x D x H)	Narrow frame		Wide frame	
	30–50 kW [mm]	60–100 kW without internal transformer [mm]	80–100 kW with internal transformer [mm]	120–200 kW [mm]
IP23/33 industrial cabinet with casters	625 x 937 x 1958		1045 x 937 x 1958	
IP23/33 marine cabinet with vibration dampers	625 x 1174 x 1978		1045 x 1174 x 1978	
IP54 industrial cabinet with casters	625 x 987 x 1958		1045 x 987 x 1958	
IP54 marine cabinet with vibration dampers	625 x 1183 x 1978		1045 x 1183 x 1978	
IP23/33 cabinet with casters and optional top exhaust kit	625 x 1121 x 1958		1045 x 1121 x 1958	
IP23/33 cabinet with vibration dampers and optional top exhaust kit	625 x 1174 x 1978		1045 x 1174 x 1978	
IP54 cabinet with casters and optional top exhaust kit	625 x 1130 x 1958		1045 x 1130 x 1958	
IP54 cabinet with vibration dampers and optional top exhaust kit	625 x 1183 x 1978		1045 x 1183 x 1978	

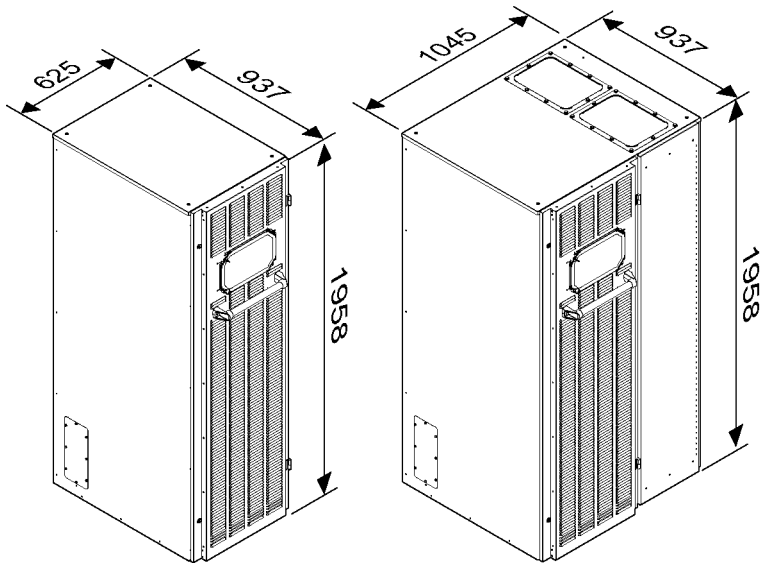


Figure 11. Dimensions of Eaton 9PHD 30–100 kW and 80–200 kW UPS with IP23/33 rating (height with casters 1958 mm / with vibration dampers 1978 mm)

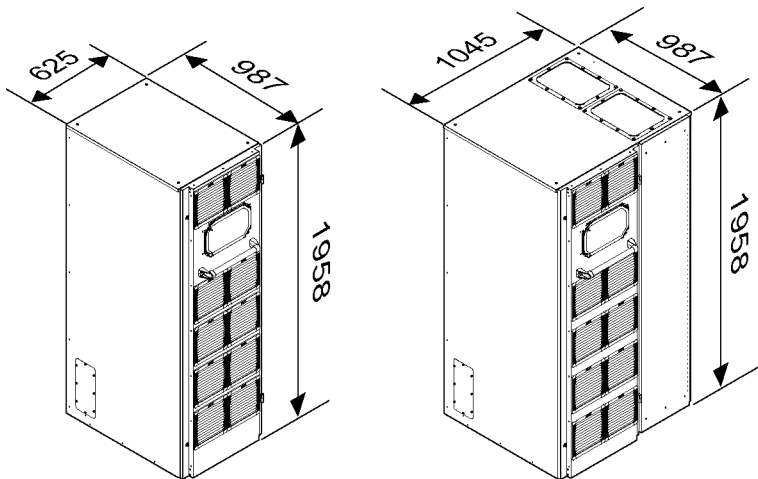


Figure 12. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW UPS with IP54 rating (height with casters 1958 mm / with vibration dampers 1978 mm)

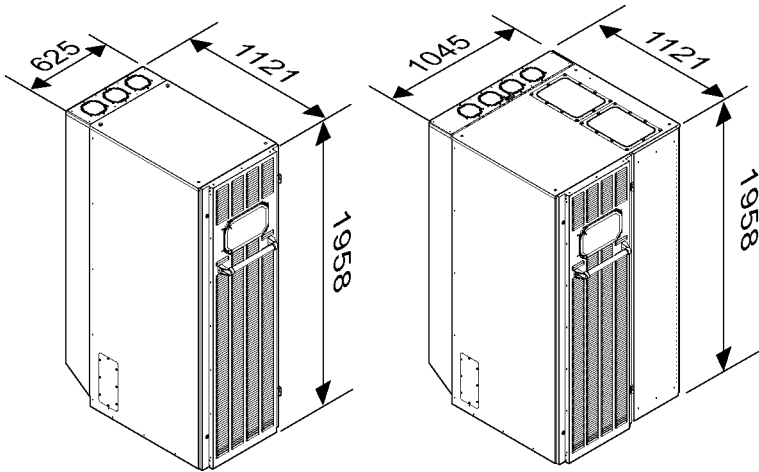


Figure 13. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW with IP 23/33 rating and top air exhaust kit (height with casters 1958 mm / with vibration dampers 1978 mm)

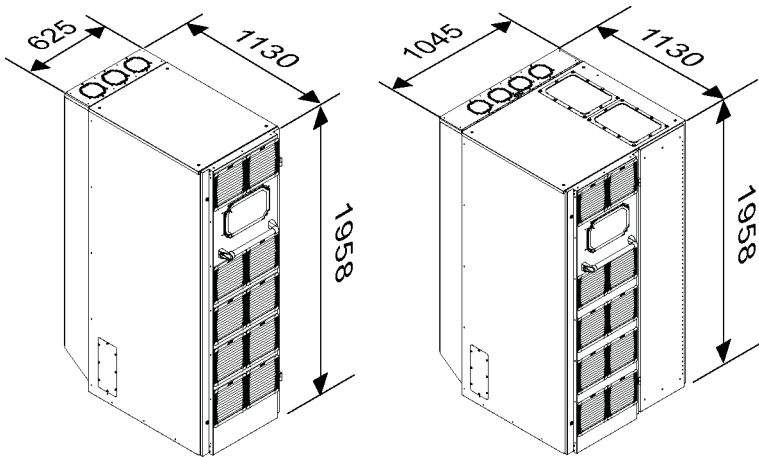


Figure 14. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW UPS with IP54 rating and top air exhaust kit (height with casters 1958 mm / with vibration dampers 1978 mm)

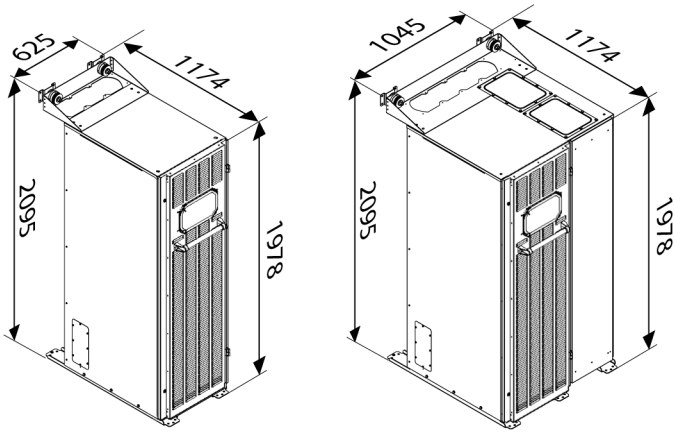


Figure 15. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW UPS with IP 23/33 rating, and vibration dampers

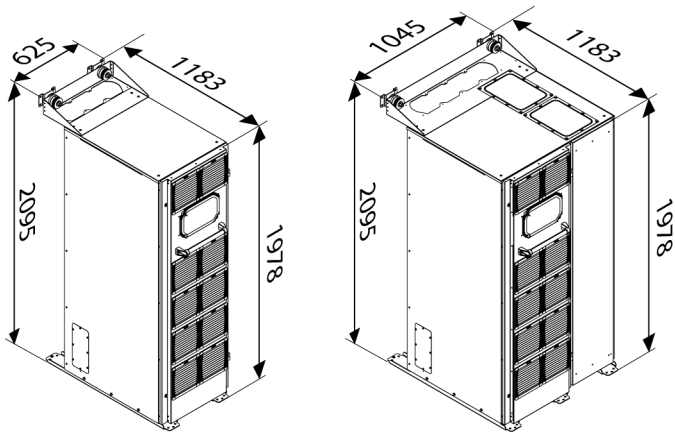


Figure 16. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW UPS with IP 54 rating and vibration dampers

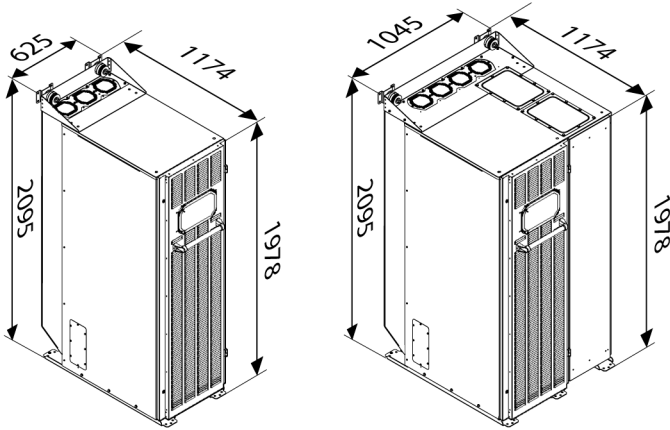


Figure 17. Dimensions of Eaton 9PHD 30–100 kW and 80–200 kW UPS with IP 23/33 rating, top air exhaust kit and vibration dampers

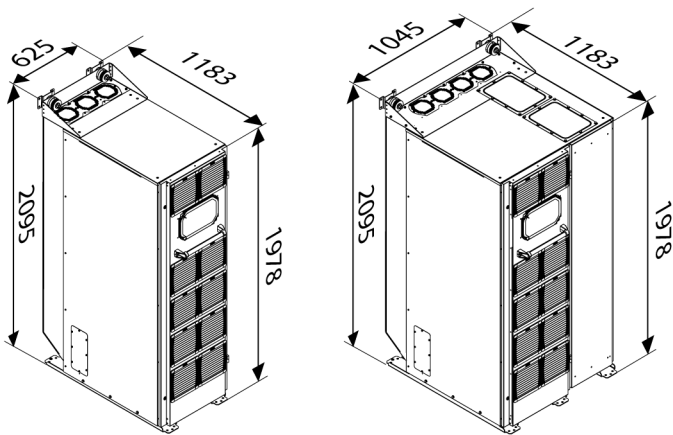


Figure 18. Dimensions of Eaton 9PHD 30–80 kW and 80–160 kW UPS with IP 54 rating, top air exhaust kit and vibration dampers

Table 5: UPS cabinet maximum weights

	Shipping weight [kg]	Installed weight [kg]	Floor loading [kg/m ²]
30–50 kW without internal transformer	350	290	565
30–50 kW with one internal transformer	590	530	

	Shipping weight [kg]	Installed weight [kg]	Floor loading [kg/m ²]
30–50 kW with two internal transformers	830	770	1,500
80–100 kW without internal transformer	430	370	720
80–100 kW with internal transformer	1,020	940	1,060
120–150 kW	700	620	700
160–200 kW	780	700	780

The UPS cabinets use forced air cooling to regulate internal component temperature. By default, air inlets are in the front of the cabinet and outlets are in the back. Allow clearance in front of and behind each cabinet for proper air circulation.

With the optional top air exhaust kit, it is possible to configure the air outlets in the top rear of the cabinet. With this option, the UPS can be installed against a wall or back-to-back.

The clearances required around the UPS cabinet in both of these situations are shown in Table 6. In addition, a minimum of 20 mm clearance is recommended on the right and left side of the cabinet.

If your unit is equipped with vibration dampers, a minimum of 30 mm clearance is recommended on both sides of the cabinet to avoid the vibrating cabinet hitting any paralleled UPS cabinets or accessory cabinets.

Table 6: UPS cabinet clearances

	From the top of the cabinet	From the front of the cabinet	From the back of the cabinet	From the side of the cabinet
30-50 kW with or without one internal transformer [mm]	500	900	200	0
30-50 kW with two internal transformers [mm]			300	
60-100 kW without internal transformer [mm]			200	
80-100 kW with internal transformer [mm]			300	
80-200 kW with top air exhaust kit [mm]			0	
120-200 kW [mm]			300	

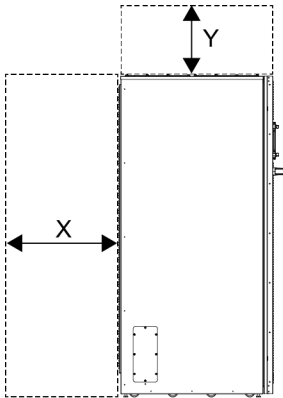


Figure 19. UPS cabinet clearances

X = clearance at the back of cabinet

Y = clearance at the top of cabinet

The basic environmental requirements for the operation of the UPS:

- Ambient temperature range: from +0 to +40°C (+45°C at sea level)
- Recommended operating range: from +20 to +25°C
- Maximum relative humidity: 95%, non-condensing

The UPS room must be properly ventilated. Sufficient amount of air cooling keeps the maximum room temperature rise at the desired level:

- Temperature rise of max. +5°C requires the airflow of 600 m³/h per 1 kW of losses
- Temperature rise of max. +10°C requires the airflow of 300 m³/h per 1 kW of losses

An ambient temperature from +20 to +25°C is recommended to achieve a long life for the UPS and batteries. In standard configurations the cooling air must not exceed +40°C. Avoid high ambient temperature, moisture, and humidity.

Tables 7 and 8 show the 9PHD heat rejection.

Table 7: Air conditioning or ventilation requirements during full load operation, units without internal transformers

Rating	Heat rejection (BTU/h x 1,000)	Heat rejection [kW]
30 kW	4.30	1.3
40 kW	5.73	1.7
50 kW	7.16	2.1
80 kW	11.45	2.4
100 kW	14.32	4.2

Rating	Heat rejection (BTU/h x 1,000)	Heat rejection [kW]
120 kW	17.18	5.0
150 kW	21.48	6.3
160 kW	22.91	6.7
200 kW	28.64	8.4

Table 8: Air conditioning or ventilation requirements during full load operation, units with internal transformers

Rating	Heat rejection (BTU/h x 1,000)	Heat rejection [kW]
30 kW, with 1 internal transformer	8.2	2.4
40 kW, with 1 internal transformer	10.6	3.1
50 kW, with 1 internal transformer	13.3	3.9
30 kW, with 2 internal transformers	11.9	3.5
40 kW, with 2 internal transformers	15.7	4.6
50 kW, with 2 internal transformers	19.8	5.8
80 kW, with 1 internal transformer	21.5	6.3
100 kW, with 1 internal transformer	26.6	7.8

4.3.2 UPS system power wiring preparations



Note: If you are installing a maintenance bypass, provide one of these:

- a minimum of 2 separate feeds with upstream feeder breakers
- a single feed with 2 upstream feeder breakers: one for the UPS or rectifier input breaker (if installed) and one for the maintenance bypass input.

Do not use a single feed or a single feeder breaker to supply both

- the UPS or rectifier input breaker
- the maintenance bypass.

If you install a bypass input breaker in the maintenance bypass on a single-feed UPS, a single feed to the maintenance bypass is acceptable for supplying both the UPS and the bypass.

When you plan and do the installation, read and understand these notes:

- Refer to national and local electrical codes for acceptable external wiring practices.
- To allow for future kVA upgrades, consider using conductors sized for full bypass rating of the UPS.
- Material and labor for external wiring requirements must be supplied by designated personnel.
- For external wiring, use copper cable rated for 70°C at minimum. See the appropriate information in Tables 9, 10, 11, 12, 13 and 14. Refer to the UPS type plate for the input and output voltages of the UPS. Cable sizes are based on using the specified breakers.
- If cables are run in an ambient temperature greater than 30°C, higher temperature cable and/or larger size cable may be necessary.
- The bypass feed into this equipment uses three phases or three phases and neutral. The rectifier feed into this equipment uses three phases or three phases and neutral. If an isolation transformer is not used in the input, the phases must be symmetrical about ground (from a Wye source) for proper equipment operation.



WARNING

Do not disconnect the bypass neutral without disconnecting the bypass phases at the same time.

- Neutral wire must be sized according to the load. With non-linear load equipment, neutral wire with a rating of 1.7 times the phase wire is recommended.
- A readily accessible disconnect device must be incorporated in all fixed input wiring.
- For 9PHD UPS narrow frame models that have no separate connection for bypass neutral, the bypass source neutral must be connected to the same terminal as the rectifier neutral X1/X2:N.
- If the UPS is installed in an IT network with neutral, the disconnected devices should disconnect the neutral wire as well.

Table 9: Minimum recommended multi-core cable and fuse sizes for rectifier input and bypass input connection, 9PHD 30–100 kW UPS

Input supply line-to-line voltage [V]		UPS rating [kW]				
		30	40	50	80	100
208	Phase cables	1 x 50	1 x 70	1 x 95	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	125	160	200	315	400
	PE cable	1 x 25	1 x 35	1 x 50	1 x 95	1 x 120

Input supply		UPS rating [kW]				
line-to-line voltage [V]		30	40	50	80	100
230	Phase cables	1 x 50	1 x 70	1 x 95	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	125	160	200	315	400
	PE cable	1 x 25	1 x 35	1 x 50	1 x 95	1 x 120
380	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	Rectifier and bypass fuse [A]	63	80	100	160	200
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
400	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	Rectifier and bypass fuse [A]	63	80	100	160	200
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
415	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	Rectifier and bypass fuse [A]	63	80	100	160	200
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
440	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	Rectifier and bypass fuse [A]	63	80	100	160	200
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
480	Phase cables	1 x 10	1 x 25	1 x 35	1 x 70	1 x 95
	Rectifier and bypass fuse [A]	50	80	100	160	200
	PE cable	1 x 10	1 x 16	1 x 16	1 x 35	1 x 50
690	Phase cables	1 x 6	1 x 10	1 x 16	1 x 35	1 x 50
	Rectifier and bypass fuse [A]	40	50	63	100	125
	PE cable	1 x 6	1 x 10	1 x 16	1 x 16	1 x 25

Table 10: Minimum recommended multi-core cable and fuse sizes for rectifier input and bypass input connection, 9PHD 120–200 kW UPS

Input supply		UPS rating [kW]			
line-to-line voltage [V]		120	150	160	200
380	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	250	315	315	400
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120

Input supply		UPS rating [kW]			
line-to-line voltage [V]		120	150	160	200
400	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	250	315	315	400
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
415	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	250	315	315	400
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
440	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	Rectifier and bypass fuse [A]	250	315	315	400
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
480	Phase cables	1 x 95	1 x 120	1 x 120	1 x 185
	Rectifier and bypass fuse [A]	200	250	250	315
	PE cable	1 x 50	1 x 70	1 x 70	1 x 95

Table 11: Minimum recommended multi-core cable and fuse sizes for UPS output connection, 9PHD 30–100 kW UPS

Input supply		UPS rating [kW]				
line-to-line voltage [V]		30	40	50	80	100
208	Phase cables	1 x 50	1 x 70	1 x 95	1 x 185	1 x 240
	PE cable	1 x 25	1 x 35	1 x 50	1 x 95	1 x 120
230	Phase cables	1 x 50	1 x 70	1 x 95	1 x 185	1 x 240
	PE cable	1 x 25	1 x 35	1 x 50	1 x 95	1 x 120
380	Phase cables	1 x 16	1 x 25	1 x 35	1 x 95	1 x 95
	PE cable	1 x 16	1 x 16	1 x 16	1 x 50	1 x 50
400	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
415	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
440	Phase cables	1 x 16	1 x 25	1 x 35	1 x 70	1 x 95
	PE cable	1 x 16	1 x 16	1 x 16	1 x 35	1 x 50
480	Phase cables	1 x 10	1 x 25	1 x 35	1 x 70	1 x 95
	PE cable	1 x 10	1 x 16	1 x 16	1 x 35	1 x 50

Input supply		UPS rating [kW]				
line-to-line voltage [V]		30	40	50	80	100
690	Phase cables	1 x 6	1 x 10	1 x 16	1 x 35	1 x 95
	PE cable	1 x 6	1 x 10	1 x 16	1 x 16	1 x 50

Table 12: Minimum recommended multi-core cable and fuse sizes for UPS output connection, 9PHD 120–200 kW UPS

Input supply		UPS rating [kW]			
line-to-line voltage [V]		120	150	160	200
380	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
400	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
415	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
440	Phase cables	1 x 120	1 x 185	1 x 185	1 x 240
	PE cable	1 x 70	1 x 95	1 x 95	1 x 120
480	Phase cables	1 x 95	1 x 120	1 x 120	1 x 185
	PE cable	1 x 50	1 x 70	1 x 70	1 x 95

Table 13: Minimum recommended multi-core cable and fuse sizes for battery connection, 9PHD 30–100 kW UPS

Input supply		UPS rating [kW]				
line-to-line voltage [V]		30	40	50	80	100
Battery cables	Pos. & neg. line	1 x 35	1 x 35	1 x 50	2 x 35	2 x 50
	Battery fuse [A]	200	200	200	400	400

Table 14: Minimum recommended multi-core cable and fuse sizes for battery connection, 9PHD 120–200 kW UPS

Input supply		UPS rating [kW]			
line-to-line voltage [V]		120	150	160	200
Battery cables	Pos. & neg. line	2 x 70	2 x 95	2 x 95	2 x 120
	Battery fuse [A]	500	500	630	630



Note: Power upgrading of the UPS is possible only if the sizing of external cables is sufficient. Alternatively, external cabling must be upgraded as well. The type of the fuses is gG.

Cable sizing is based on IEC 60364-5-52. Sizing is for installation method C (wall installation) with max conductor temperature: 70°C, ambient temperature: 30°C. Non-halogenated XLPE insulated cables (90°C), as an example, can be used for marine applications.

If you use aluminium cables, Eaton product support gives you sizing recommendations.

Table 15: Rated and maximum currents for rated power and voltage, battery

Rated power [kW]	Battery	
	Rated current [A]	Maximum current* [A]
30	73	88
40	97	117
50	122	146
80	195	233
100	244	292
120	292	350
150	365	438
160	390	467
200	487	584

*Maximum battery current calculated at rated load and 1.67 V cell voltage for 36 block string length.

Table 16: UPS power cable terminations

Terminal function	Terminal	Function
AC input to UPS rectifier	X1	L1, L2, L3, N
AC input to bypass	X2	L1, L2, L3, N
UPS output	X3	L1, L2, L3, N
DC input from external battery to UPS	X4	battery +, battery –
Protective Earth	PE	PE

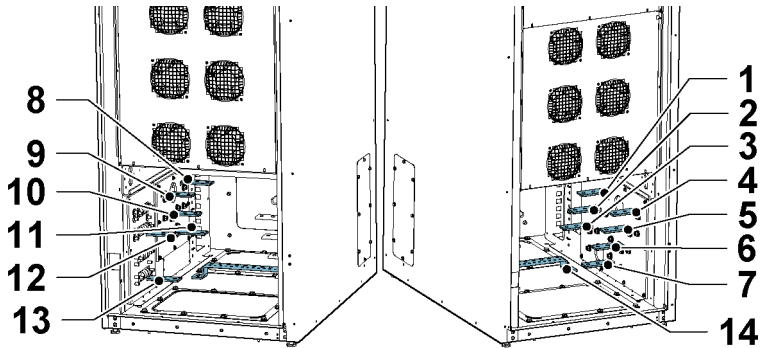


Figure 20. 9PHD UPS narrow cabinet frame power cable terminals

- | | | | |
|----------|-------------------------|-----------|----------------------------------|
| 1 | <i>L1, UPS output</i> | 8 | <i>N, rectifier/bypass input</i> |
| 2 | <i>L2, UPS output</i> | 9 | <i>L1, rectifier input</i> |
| 3 | <i>L3, UPS output</i> | 10 | <i>L2, rectifier input</i> |
| 4 | <i>L1, bypass input</i> | 11 | <i>L3, rectifier input</i> |
| 5 | <i>L2, bypass input</i> | 12 | <i>+ DC</i> |
| 6 | <i>L3, bypass input</i> | 13 | <i>- DC</i> |
| 7 | <i>N, UPS output</i> | 14 | <i>PE</i> |

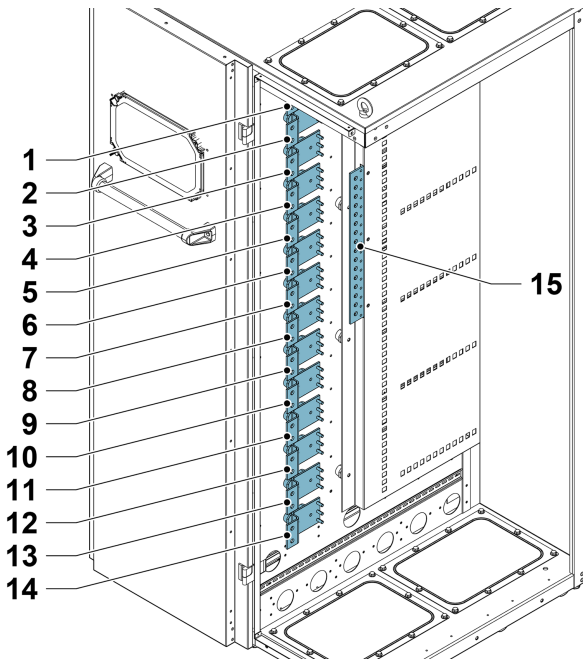


Figure 21. 9PHD UPS wide frame cabinet power cable terminals

- | | | | |
|----------|---------------------|-----------|----------------|
| 1 | L1, rectifier input | 9 | L1, UPS output |
| 2 | L2, rectifier input | 10 | L2, UPS output |
| 3 | L3, rectifier input | 11 | L3, UPS output |
| 4 | N, rectifier input | 12 | N, UPS output |
| 5 | L1, bypass input | 13 | + DC |
| 6 | L2, bypass input | 14 | - DC |
| 7 | L3, bypass input | 15 | PE |
| 8 | N, bypass input | | |

Table 17: UPS power cable terminal bolt torques

Function	Narrow frame		Wide frame	
	30-50 kW [mm]	60-100 kW without internal transformer [mm]	80-100 kW with internal transformer [mm]	120-200 kW [mm]
Tightening torque [Nm]	47		80	

	Narrow frame		Wide frame	
	30-50 kW [mm]	60-100 kW without internal transformer [mm]	80-100 kW with internal transformer [mm]	120-200 kW [mm]
Bolt size	M10 (DC connectors are M12)		M12	

CAUTION



To reduce the risk of a fire, connect only to a circuit that is provided with maximum input circuit breaker current ratings on Table 15 in accordance with the national and local installation rules.



Note: External overcurrent protection is not provided by this product, but is required by relevant standards. Refer to Tables 9, 10, 11, 12, 13, and 14 for wiring requirements. If an output lockable disconnect is required, it is to be supplied by the user.

The line-to-line unbalanced output capability of the UPS is limited only by the full load per phase current values for AC output to critical load shown in Table 15. The recommended line-to-line load unbalance is 50% or less.

Source protection for the AC input to bypass must suit the characteristics of the load and take into account effects such as inrush or starting current.

Bypass and output overcurrent protection and bypass and output disconnect switches must be provided by the user.

CAUTION



Install an additional warning label at the UPS input terminals and all the primary power isolators used to isolate the UPS unit if the UPS input is connected through external isolators that, when opened, isolate the neutral OR the UPS is installed in an IT distribution system. You can get these warning labels from your local service representative.

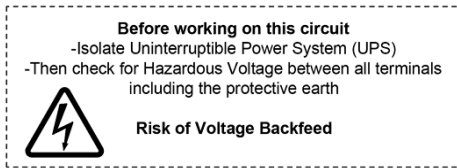


Figure 22. Warning label



WARNING

Models with internal transformers do not have neutral to ground bonding. Where such bonding is required, it must be done separately in the power terminals of the UPS. It is not allowed to bond the neutral to ground in an UPS system without isolation transformers.

4.4 Unpack and unload the UPS

There are two options on how to unpack and unload the UPS:

- Unpack and unload Eaton 9PHD UPS with casters
- Unpack and unload Eaton 9PHD UPS with vibration dampers

For more information about these options, see Sections [4.4.1](#) and [4.4.2](#).

Before you start to unpack and unload the UPS, look at the TipNTell indicator on the package surface. When you have unpacked and unloaded the UPS, look at the DropNTell indicator on the back of the UPS. If the equipment has been correctly transported in the upright position, the indicators should be intact. If the TipNTell indicator arrow has turned all blue or the arrow head(s) of the DropNTell are black, contact the appropriate parties to report inappropriate transportation.



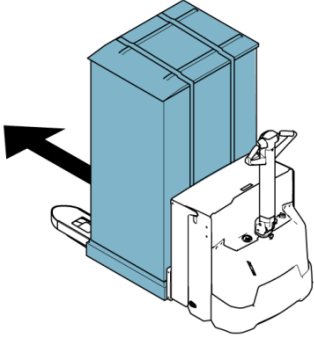
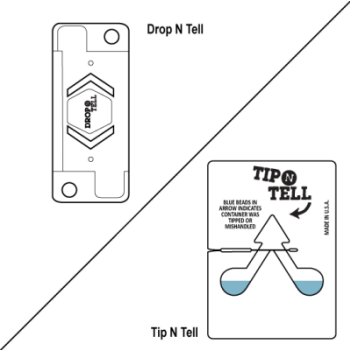
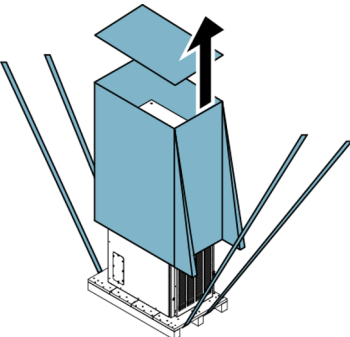
WARNING

The UPS cabinet is heavy. If you do not obey the unpacking instructions, the cabinet may tip over and cause serious injury.

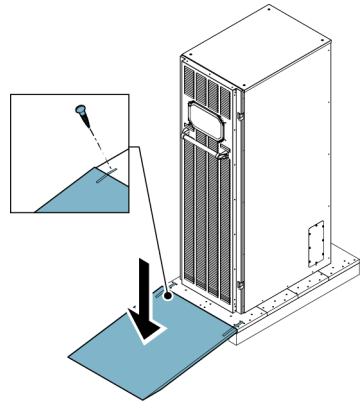
Do not tilt the UPS cabinet more than 10 degrees from the vertical or the cabinet can tip over.

For transportation purposes, the UPS cabinet is bolted onto a wooden pallet.

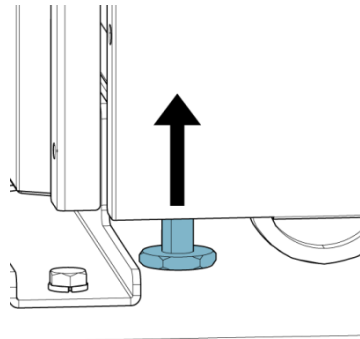
4.4.1 Unpack and unload Eaton 9PHD UPS with casters

<p>1. Before you unload the cabinet from the pallet, use a forklift or other material handling equipment to move the cabinet to the installation area. Insert the forks of the forklift between the skids on the bottom of the unit.</p>	 A diagram showing a white forklift with a black arrow pointing left, indicating movement. The forklift's forks are positioned between the skids of a blue cabinet on a pallet.
<p>2. Do a visual inspection and make sure that there are no signs of shipping damages. Examine the indicators. See the instructions next to the indicators on the package.</p>	 A diagram showing two indicators. On the left is a 'Drop N Tell' indicator, a rectangular device with a central sensor. On the right is a 'Tip N Tell' indicator, a rectangular device with a central sensor and a blue liquid level indicator. The text 'Drop N Tell' is above the first indicator, and 'Tip N Tell' is below the second. The 'Tip N Tell' indicator also has text: 'BLUE BEADS IN CENTER INDICATE CONTACT HAS TAKEN PLACE' and 'MADE IN U.S.A.'.
<p>3. Open the UPS package. A ramp for moving the UPS off the pallet is attached on one side of the package.</p>	 A diagram showing a blue cabinet on a pallet. The top of the cabinet is open, and a ramp is attached to one side. A black arrow points upwards from the top of the cabinet, indicating the direction of movement.

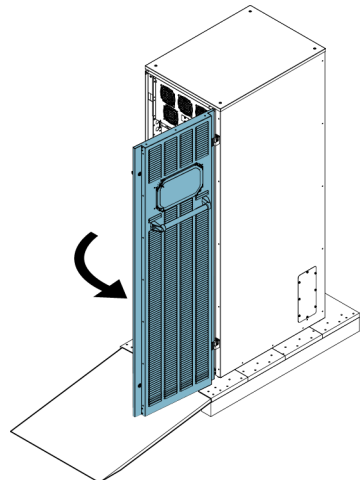
4. Place the ramp on the floor and attach it to the pallet with nails or screws so that it can be safely used for wheeling the cabinet off the pallet.



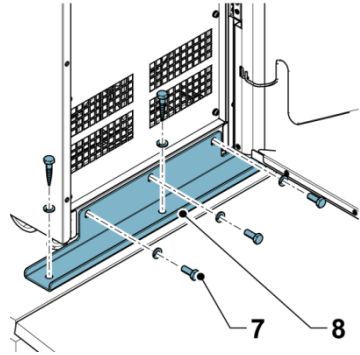
5. If the leveling feet are not fully retracted, turn them until they are retracted.



6. Open the cabinet door.



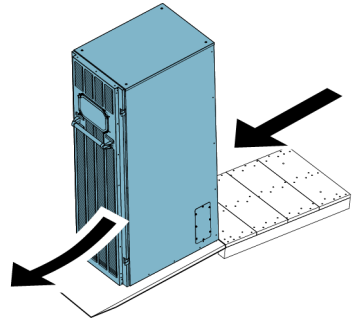
7. Remove the bolts that fasten the shipping brackets to the cabinet and to the pallet.
8. Remove the shipping brackets.



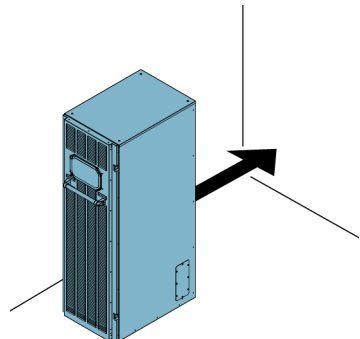
Note: After you have removed the shipping brackets, move the unit immediately away from the pallet.

After you have removed the shipping brackets and retracted the leveling feet, do not use a forklift to move the unit while it is still on the pallet. Note that the UPS cabinet is heavy and there are casters under the cabinet.

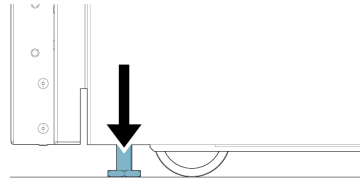
9. Slowly roll the cabinet toward the ramp edge. Be careful not to push the cabinet too much or too fast since it may cause the cabinet to tip over.



10. Roll the cabinet to its final installation location.



- To secure the UPS cabinet in position, lower the leveling feet until the cabinet is level. Only use the leveling feet for leveling. Do not lift the casters off the ground, as the casters should still carry most of the cabinet's weight.



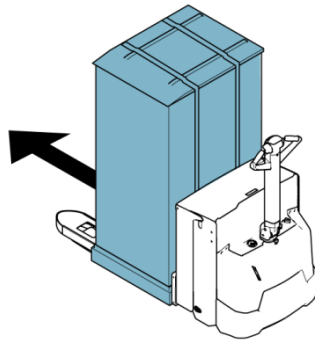
- Reattach the shipping brackets to the UPS cabinet to provide extra support. Position the shipping brackets on the front and rear of the unit.



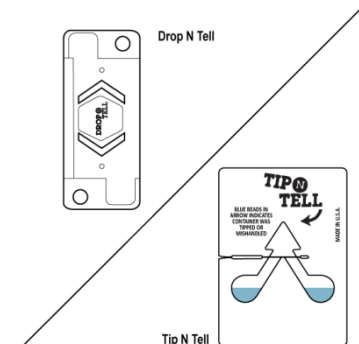
Note: If you remove the cabinet from its original installation location and transfer it to a new location on a pallet, lower the leveling feet until the cabinet is not resting on the casters. In addition, attach the shipping brackets to the cabinet and the pallet.

4.4.2 Unpack and unload Eaton 9PHD UPS with vibration dampers

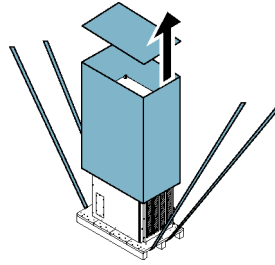
- Before you unload the cabinet from the pallet, use a forklift or other material handling equipment to move the cabinet to the installation area. Insert the forks of the forklift between the skids on the bottom of the unit.



- Do a visual inspection and make sure that there are no signs of shipping damages. Examine the indicators. See the instructions next to the indicators on the package.



3. Open the UPS package.



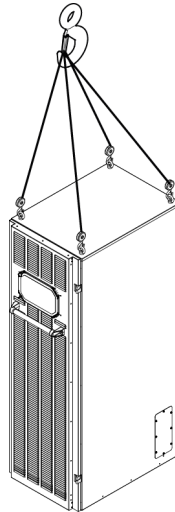
4. Remove the bolts that fasten the cabinet to the transportation pallet.

5. Lift the UPS carefully from the pallet with your chosen method. You can lift the cabinet either

- from the bottom with lifting slings, or
- from the top with optional lifting eyes.

If you lift from the bottom with lifting slings:

- disconnect the display cables, remove the door stoppers and remove the cabinet door to avoid damaging it during lifting, and
- support the cabinet from both sides with adequate manpower.



CAUTION



If you lift the UPS from the top, always use all four lifting eyes to avoid cabinet falling and serious injury.

If you lift the UPS from the bottom with lifting slings, support the cabinet from the sides during lifting to avoid cabinet tipping and serious injury.

6. Carefully lower the UPS to its installation location.

7. Fix the vibration dampers to the floor and the wall behind the cabinet with appropriate steel hardware or by welding.

5 UPS system installation

The operator has to supply the wiring to connect the UPS to the local power source. The installation of the UPS must be made by a locally qualified electrician. The electrical installation procedure is described in the following section. The installation inspection and the initial start-up of the UPS and installing an extra battery cabinet must be carried out by qualified service personnel such as a licensed service engineer from the manufacturer or from an agent authorized by the manufacturer.



CAUTION

To avoid physical injury or death, or damage to the UPS or the load equipment, follow these instructions during the UPS system installation.



CAUTION

In case of condensed moisture inside the UPS cabinet, dry the cabinet with a blower before starting up the system.

5.1 Steps to install the UPS

Power and control wiring can be routed through the rear, bottom, or top of the cabinet, depending on the model of the cabinet. See Figure 23 and Figure 24 for the location of the cabinet through-holes. The connections to power and signal terminals are easily accessible, see Figure 20, Figure 21, Figure 31, and Figure 32.

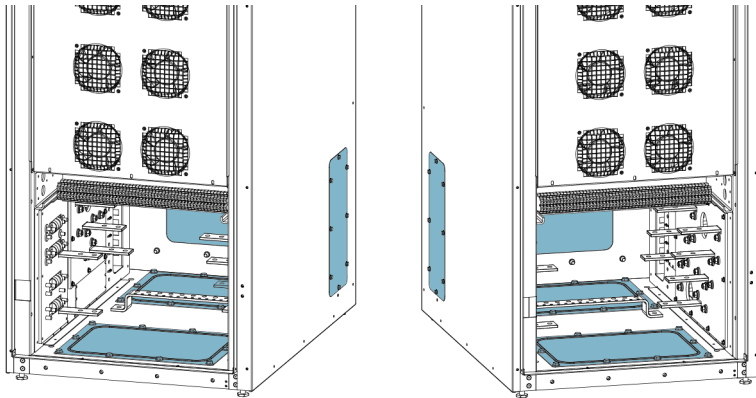


Figure 23. 9PHD UPS smaller cabinet size through hole locations

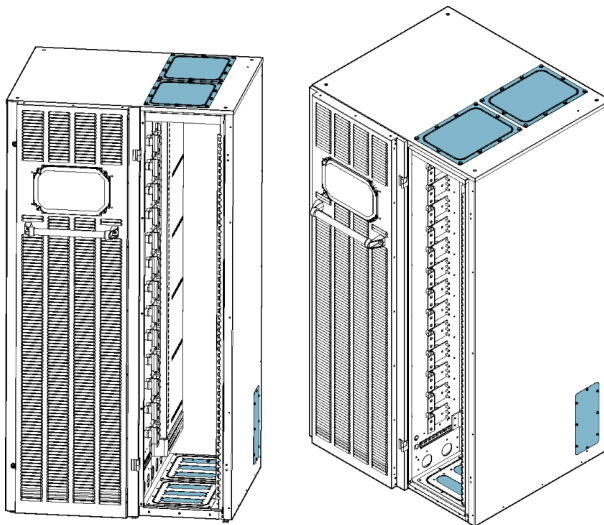


Figure 24. 9PHD UPS larger cabinet size through hole locations

Follow these steps to install the UPS:

1. Unfasten the UPS door latch and open the door.
2. Remove the screws securing the safety shield panel in front of the connectors to gain access to terminals.
3. To gain access to the terminals, remove the screws securing the gland plate through which you have chosen to install the cables.
4. Install suitable cable glands into the gland plate.
5. Route the cables through the glands.

6. If you are installing power wiring, see instructions for the battery cabinet wiring in the 9PHD Accessory Cabinets manual.
7. Connect the power cables to the respective terminals, see Figure 20, Figure 21 and Table 16.
8. Connect the communication cables to the respective terminals and peripherals. For detailed information, see Table 19, Figure 31 and Figure 32.
9. Install battery and interface wiring according to Sections 5.2 and 5.6.
10. When all wiring is complete, reinstall safety shield panels removed in previous steps.
11. Close the door and secure with latch.
12. If installing a parallel system, repeat the above steps to all units in the system.

5.2 Battery system installation

DANGER



The batteries in UPS battery cabinets are designed to deliver a large amount of energy and an incorrect connection may lead to short circuit and cause serious injuries to the personnel or damages to the equipment.

If installing a customer-supplied battery system, install the battery system according to the battery and battery system manufacturer's instructions and all applicable national codes and regulations. Only qualified personnel may install the battery system. Battery cables must be protected against current and thermal overload, that is, the battery system must include proper fuses or breaker with protection function.

The default battery settings of the UPS are for 12 VDC VRLA batteries. If requested to use other battery types, contact your Eaton representative. For the battery specification, see Section 9.5.



Note: If you need to replace the battery cables with longer ones, remember to use EMC shielded battery cables to avoid radio disturbances.

5.2.1 Battery trip wiring

Eaton 9PHD UPS cabinets do not have internal battery breakers. The external battery breaker is a crucial part of the external battery cabinet or rack and must be placed in it.

External battery breakers can be tripped (switched off) by energizing its shunt trip coil. The shunt trip coils are energized (controlled) through connector X6. The status signal of the external battery breaker is connected to the Signal Inputs connector X10. There are five signal inputs and the user may utilize any one of them; the recommended input is number five. Status contacts of the

Eaton battery breakers are open if the breaker itself is open. The default voltage of the shunt trip coil is 24Vdc. For 48Vdc shunt trip, contact local Eaton Service Engineer.

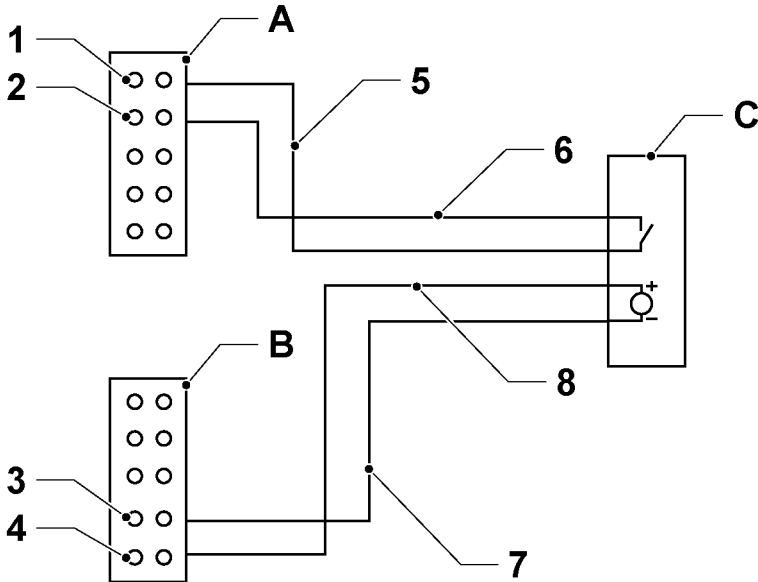


Figure 25. Battery trip wiring

A	Signal interface connections	4	X6:1
B	Battery breaker signal connections	5	Aux contact return
C	External battery breaker	6	Aux contact
1	X10:10	7	Shunt trip return
2	X10:9	8	Shunt trip
3	X6:2		

5.3 Installing UPS external battery cabinet and battery power cabling

For instructions on how to install the external battery cabinet and battery power cabling, see the instruction manual provided with the external battery cabinet. Earth the external battery cabinet / customer-supplied battery system to the PE terminal shown in Figure 20 and Figure 21 .



Note: If batteries are wired outside the cabinets, follow the installation instructions given in Section 4.3.2. See Tables 9, 10, 9, 12, 13, and 14 for the recommended cable and fuse sizes.

5.4 Installing a remote EPO switch

A remote EPO switch can be used in case of an emergency to shut down the UPS and remove power to the critical load from a location away from where the UPS is installed.

EPO is connected to above or next to the power wiring terminals, on connector X10. Figure 26 below shows the NO and NC connections of the EPO switch.

EPO connector (front view):

A= Normally open

B= Normally closed

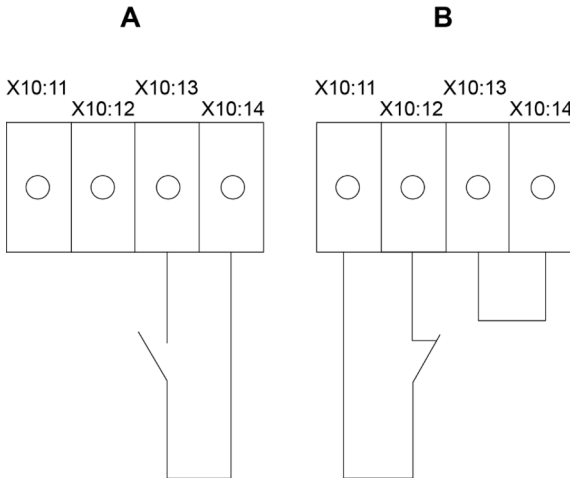


Figure 26. Connections of the EPO switch. Note that in "Normally closed" (B) situation a jumper between pins X10:13 and X10:14 is needed.

Table 18: Remote EPO wire terminations

From remote EPO switch	To user interface terminal block EPO in UPS cabinet	Remarks
NO	X10:13 X10:14	
NC	X10:11 X10:12	For proper function, install a wire jumper between pins X10:13 and X10:14.

5.5 Installing EPO 24 V input (option)

The EPO 24 V input can be used to activate the emergency power off procedure by applying 24 V power. The input is to a relay coil, which is separated from other circuits.

The EPO 24 V input is connected to the signal interface terminal X10. The +24 V is connected to X10:22 and the return is connected to X10:23.

5.6 Installing interface connections

9PHD UPS contains a total of 5 signal input connectors for operators. These can be used to give remote control commands to the UPS. User interface connector X10 can be used for these purposes. Each input is a dry relay contact input and requires two wire signaling. None of the inputs are pre-programmed but need to be separately programmed by qualified service personnel.

When using an external battery system (either the original 9PHD battery cabinet or a customer sourced battery cabinet/rack), external signaling wiring is recommended to be connected.

One (1) general alarm relay output is also on the signal interface connector X10. This output is either normally open (NO) or normally closed (NC). Polarity selection is made with wiring connection. By default, the general alarm relay activates when a system alarm is active, that is, any ALARM condition in the system is active. Alternatively, it can be activated with any particular event but this must be programmed separately by qualified service personnel. The alarm relay is designed for signal level (ELV or SELV) voltages only, not for utility use. For higher signaling circuit voltage requirements, please use Industrial Relay Adapter in MiniSlot.

5.6.1 Installing signal input interface

These inputs are located above or next to the power wiring terminals, on connector X10. See Figure 31 and Figure 32 for connector locations.

Signal inputs can be configured to different functions. Normally these functions are either informative (for example “On Generator”) or functional (for example remote “Go to bypass” command).

5.6.2 Battery breaker wiring interface

When using the original accessory battery cabinet from the manufacturer, the battery breaker interface wiring is provided with the cabinet. Connecting it requires only routing the wires from the cabinet to the bottom section of the UPS. The connector for the battery circuit breaker monitoring signal and battery circuit breaker trip signal are above or next to the power wiring terminals.

When using a third-party battery system, the breaker must be equipped with auxiliary signal and should have a 24 V shunt trip for remote opening of the breaker, when needed.

Wire entry for battery breaker signal wiring is through the same cable routing options as power wiring.

See Section [5.2.1](#) for installation instructions.

5.6.3 Relay output interface connections

The general alarm relay is a dry relay signal output. The relay can be used for informing the operators about UPS alarm conditions, for example through a building management system. By default, the relay is configured to activate when the UPS general alarm is active, that is, any event when the *ALARM* status is active.

Relay signal wiring can be installed through the same cable routing options as power wiring.

Additional relay outputs are available with MiniSlot cards. Relay outputs can be configured by a service engineer, or for the end user there are instructions for configuring relays in Section [6.5](#).

5.6.4 MiniSlot interface connections

For MiniSlot accessories and communication devices selection, see Chapter [6](#). For installation and setup of a MiniSlot card, please contact your Eaton representative.

Perform the installation and removal of MiniSlot cards while the UPS is shut down or switched to maintenance bypass mode (optional feature). Installation and removal can be done while the unit is in the online mode but there is theoretical risk of abnormal functioning, which is why this is not recommended.



Note: Perform the signal interface wiring for the MiniSlot cards when the UPS is shut down, as the wiring needs to be routed through the power wiring area. There are wiring ducts inside the UPS for pulling the cabling to the communications area.

To install wiring to the connections:

1. If not already installed, install the LAN and telephone drops.
2. Open the front door of the UPS.
3. Remove the protective covers of the communications area.
4. To remove a MiniSlot cover plate, remove the 2 screws securing each plate.
5. To install the MiniSlot communication device, push it all the way in.
6. Secure the MiniSlot communication device with the cover plate and 2 screws.

7. Route and install the LAN, telephone, and other cables to the appropriate MiniSlot cards. The cable route is through the conduits in the corner posts of the UPS.
8. For operator instructions, refer to the manual supplied with the MiniSlot card.
9. When all the wiring is completed, reinstall the protective covers of the communications area, close the front door and secure it with the latch.

5.6.5 Insulation monitor signals (option)

The insulation monitor is installed to one of the UPS signal inputs and is metering insulation resistance between the UPS output and optional internal output isolation transformers. Additionally, an auxiliary contact is available for use outside the UPS equipment. The insulation monitor contact is available in signal terminal X10, with the following pins:

- X10:24 NC
- X10:25 Return
- X10:26 NO

This interface is separated from the UPS signal input, but it should maintain SELV characteristic, as it is not properly isolated from the UPS signal input. The maximum contact rating is 24 Vdc or 30 VAC. If utility level signaling is required, it can be arranged through an industrial relay card. To accomplish this, contact your local service representative.

5.6.6 Installing signal interface connections in a parallel system

The installation of the signal interface connections in a parallel system is done by following the aforementioned instructions. Signal inputs can be paralleled between the units, that is, the same contact can be used for several units' signal input signaling. This concerns also the EPO signal.

5.7 Wiring parallel 9PHD UPS systems

The outputs of multiple 9PHD UPS systems can be connected in parallel. Up to 8 units can be paralleled. The UPS static bypass power rating needs to be identical among all the paralleled units. However, paralleled UPS cabinets can be housed with different number of UPM power modules.

The outputs are paralleled to increase the load capacity of the power system and for redundancy. The system is paralleled for (N+1) redundancy, as long as there is always one or more UPS online than required to support the load. The system is paralleled for capacity if all UPSs in a system are required to support the load.

Communication between the UPSs is required for system metering and mode control. The system level communication and control are accomplished using a

Controller Area Network (CAN). A pull-chain signal in each UPS, connected to the other UPSs in parallel and tied to the bypass status relay in each UPS, is used for a secondary communication path. This arrangement ensures bypass control even if the CAN bus is lost.

WARNING



Do not connect in parallel units equipped with an internal Maintenance Bypass Switch (MBS) or internal transformers.

5.7.1 Power wiring overview

See Section 4.3.2 for the recommended cable and external fuse sizes and installation practices.

Input feed

The input feed is defined as the power source connected to the UPS rectifier. The feed to all UPS's inputs must be derived from the same source.

Bypass feed

The bypass feed is defined as the power source connected to the UPS bypass. The feed to all UPS's bypass must be derived from the same source. The shortest length of power wire from the source to the UPS must be a minimum of 95% of the length of the longest wire.

Output

The neutrals of all the UPSs must be connected. The shortest length of wire from the source to the UPS must be a minimum of 95% of the length of the longest wire. The measurement is with respect to where the UPS's outputs are tied.

Dual source

The input feed and bypass feed may be separate sources. The sources must share a common neutral.

Battery connection

A separate battery shall be connected to each UPS, and the battery capacity for each UPS must be identical. A common battery for all UPSs is not supported.

MOBs

Module Output Breakers (MOBs) allow the output of an UPS to be disconnected from other UPSs and the system load for maintenance and service. Design considerations assume that each UPS has a Module Output Breaker (MOB). The breaker should also disconnect the neutral for improved safety during maintenance.

The MOB must have a Form "C" auxiliary contact. The N.C contact is connected to the corresponding UPS's input used for signal input. The N.O. contact is used

to disconnect the bypass pull-chain when the MOB is open. Figure 27 shows the principles of paralleled UPS systems including MOBs and outputs from UPSs.

MOB override

Users without MOB installed can simply leave the MOB signal input disabled. The user should be aware that systems without MOB have limited maintenance capability.

Parallel system cabling

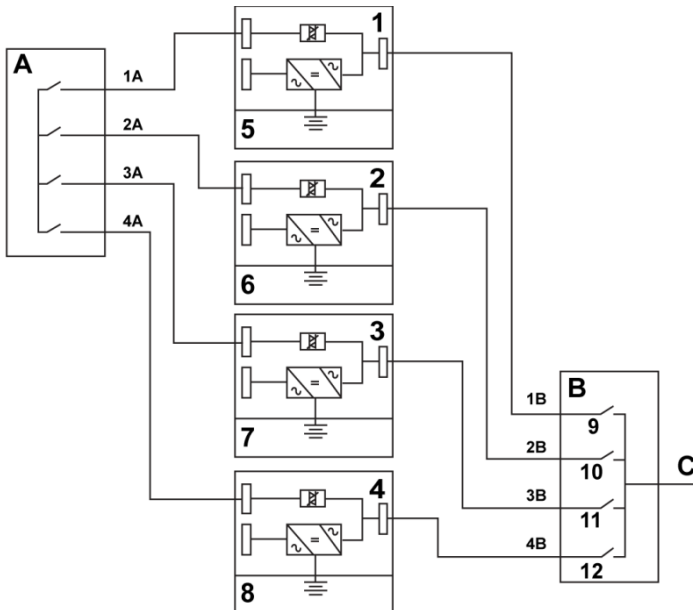


Figure 27. Principle of paralleled UPS systems

A	Bypass inputs to UPSs	1	UPS 1	7	Battery
B	Outputs from UPSs	2	UPS 2	8	Battery
C	Load	3	UPS 3	9	MOB1
		4	UPS 4	10	MOB2
		5	Battery	11	MOB3
		6	Battery	12	MOB4

The required parallel system wiring length must be equal to ensure approximately equal current sharing when in the bypass mode.

For proper operation, the following must be true: $1A+1B=2A+2B=3A+3B=4A+4B$.

Any differences in wire length result in decreased capacity and improper operation of the UPS system while in the bypass mode.

5.7.2 Control signals overview

Two controls signals (External CAN Network, Bypass Pull-Chain) are required for external paralleling. Both of these control signals are fault-tolerant and alarmed when disconnected.

External CAN (ECAN)

ECAN provides means for communications between the UPSs in a parallel system. The system continues to share load and protect the load when this network fails.

Bypass Pull-Chain

Bypass Pull-Chain is an open collector signal that goes low when the bypass static switch of any UPS is online. When External CAN (ECAN) is down, the pull-chain is low and the UPS is online, the UPS locks to and transfers to the bypass mode. Service can manually shorten this signal in some rare failure modes to force the system transfer to bypass.

Signal Inputs Actions

None of the inputs are pre-programmed. They need to be separately programmed by qualified service personnel. See [5.6](#) for default values. Each UPS has a maximum of 9 signal inputs, 5 native and one in each MiniSlot when using a suitable connectivity device. These inputs can be configured with action items. These action items affect all the UPSs in the system. When an action item is active on a UPS and the MOB is closed, the action item is transmitted on the ECAN to all the UPSs. All the UPSs react in the same manner as if the action item was active on that UPS.

Wiring the EPO switch in parallel

Use separate EPO circuits for each parallel unit.

5.7.3 Installing bypass control wiring

1. During the installation, obey all the safety instructions given in this document.
2. Terminal block X13 for external parallel control signals is accessible on the signal interface area, above or next to the power wiring terminals (see [Figure 31](#) and [Figure 32](#)).

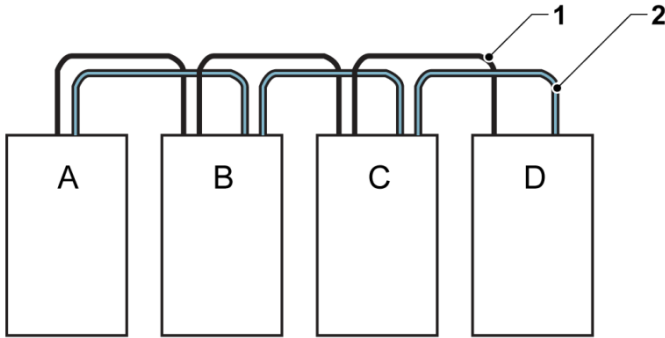


Figure 28. Simplified CAN and Pull-Chain wiring for parallel UPS system

A	UPS 1	1	CAN
B	UPS 2	2	Pull chain
C	UPS 3 (if installed)		
D	UPS 4 (if installed)		



Note: This drawing is for distributed bypass wiring purposes and is not a floor layout plan. UPSs can be placed in any physical order.

External CAN connections between UPSs require shielded twisted pair wire.

Use twisted pair wiring between the UPS and MOB AUX contacts.

The shield cable must be connected on one end only.

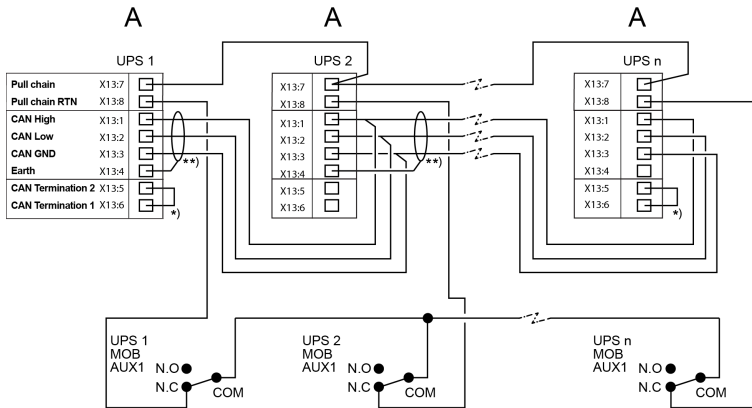


Figure 29. CAN and Pull-Chain wiring for parallel UPS with MOBs

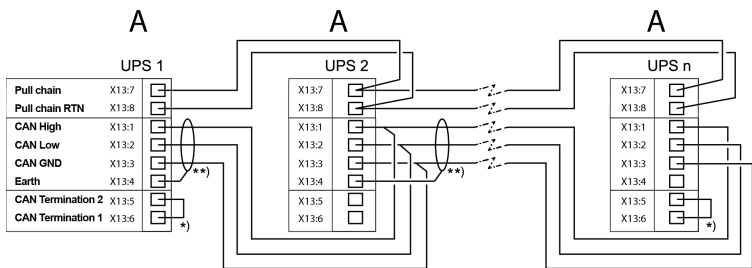


Figure 30. CAN and Pull-Chain wiring for parallel UPS without MOBs

- A External parallel connectors X13
- *) First and last UPS are terminated with a jumper
- **) Shield connected on one end only



Note: NC and NO designations on MOB AUX contacts are defined with the breaker in the OFF (open) position. If the MOB contacts have pigtail leads, use the same wire gauge to connect to the UPS and use the correct crimp connections for the wire gauge. External CAN connections between the UPS cabinets require shielded twisted pair wire. Use twisted pair wiring between the UPS and MOB AUX contacts. Always confirm contact operation prior to wiring.

5.8 UPS system interface wiring preparations

Control wiring for features and options should be connected at the user interface terminal blocks located above or next to the power terminals.

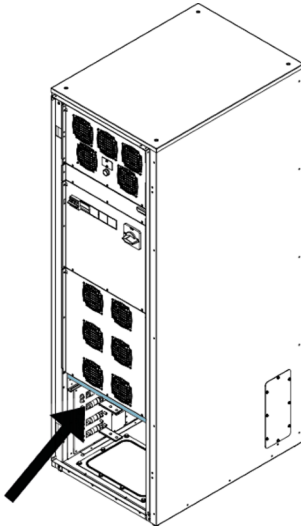


Figure 31. Signal cable terminals, 9PHD narrow cabinet frame

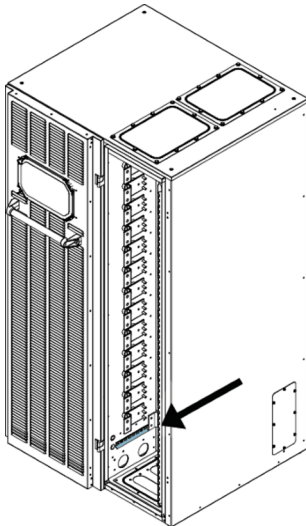


Figure 32. Signal cable terminals, 9PHD wide cabinet frame

Table 19: Signal cable terminals

Terminal	Terminal function	Pin	Pin function
X6	Battery breaker signals	X6:1	External battery shunt trip
		X6:2	External battery shunt trip return
		X6:3	External battery cabinet temp. monitoring (BATT_NTC)
		X6:4	External battery cabinet temp. monitoring (BATT_NTC_RTN)
X10	Signal interface	X10:1	Signal input 1
		X10:2	Signal input 1 return
		X10:3	Signal input 2
		X10:4	Signal input 2 return
		X10:5	Signal input 3
		X10:6	Signal input 3 return
		X10:7	Signal input 4
		X10:8	Signal input 4 return
		X10:9	External battery cabinet breaker trip detection (DET)
		X10:10	External battery cabinet breaker trip detection (GND)
		X10:11	EPO NC
		X10:12	EPO NC return
		X10:13	EPO NO
		X10:14	EPO NO return
		X10:15	Alarm relay NC
		X10:16	Alarm relay NO
		X10:17	Alarm relay return
		X10:18	Transformer fan fail input
		X10:19	Transformer fan fail input return
		X10:20	Int. transformer fan fail
		X10:21	Int. transformer fan fail return
		X10:22	EPO 24 V input (optional)
		X10:23	EPO 24 V input return (optional)
		X10:24	Insulation monitor NC (optional)
		X10:25	Insulation monitor return (optional)
		X10:26	Insulation monitor NO (optional)

Terminal	Terminal function	Pin	Pin function
X12	Relay card terminals (optional)	X12:1	Relay K1 NC
		X12:2	Relay K1 return
		X12:3	Relay K1 NO
		X12:4	Relay K2 NC
		X12:5	Relay K2 return
		X12:6	Relay K2 NO
		X12:7	Relay K3 NC
		X12:8	Relay K3 return
		X12:9	Relay K3 NO
		X12:10	Relay K4 NC
		X12:11	Relay K4 return
		X12:12	Relay K4 NO
		X12:13	Relay K5 NC
		X12:14	Relay K5 return
		X12:15	Relay K5 NO
		X12:16	Signal input
		X12:17	Signal input return
X13	External parallel terminals	X13:1	External CAN high
		X13:2	External CAN low
		X13:3	External CAN GND
		X13:4	External CAN earth
		X13:5	External CAN termination
		X13:6	External CAN termination return
		X13:7	Pull chain
		X13:8	Pull chain return



Note: Do not connect relay contacts directly to the mains-related circuits (except the relay contacts of the industrial relay card X12). Reinforced insulation to the mains is required.

When you are planning and performing the installation, make sure you understand the following notes:

- All the interface wiring is provided by the operator.
- When installing internal interface wiring to MiniSlot terminals, route the wiring through the conduits in the corner posts of the UPS.
- All signal inputs or remote features require an isolated normally open (NO) contact or switch (rated at 24 VDC, 20 mA minimum) connected between the alarm input and the common terminal. All control wiring and relay and switch

contacts are supplied by the operator. Use twisted-pair wires for each alarm input and common.

- The signal inputs can be programmed to display the alarm's functional name.
- LAN and telephone drops for use with MiniSlot cards are provided by facility planners or the operator.
- The UPS Battery Aux and 24 VDC Shunt Trip signal wiring from the UPS must be connected to the DC source disconnect device. The 48 VDC Shunt Trip signal can also be utilized via jumper change. See Figure 25.
- Battery Aux and 24 VDC Shunt Trip wiring should be a minimum of 1.5 mm².
- The Remote EPO feature opens all switchgear in the UPS cabinet and isolates power from your critical load. Local electrical codes may also require tripping upstream protective devices to the UPS.
- The Remote EPO switch must be a dedicated switch that is not tied to any other circuits or 24 V input, if the option has been installed.
- If the normally-closed (NC) Remote EPO contact is used, a jumper wire must be connected between X10:11 and X10:12 on connector EPO.
- Remote EPO wiring should be a minimum of 0.75 mm² and a maximum of 2.5 mm².
- The distance between the Remote EPO and the UPS cannot exceed 150 meters.
- Alarm relay contacts have a maximum current rating of 5 A and a switched voltage rating of 30 VAC (RMS) and 30 VDC.
- Alarm relay wiring must be a minimum of 0.75 mm².

6 Communication interfaces

This section describes the communication features of the Eaton 9PHD UPS.

The UPS has the following communication interfaces:

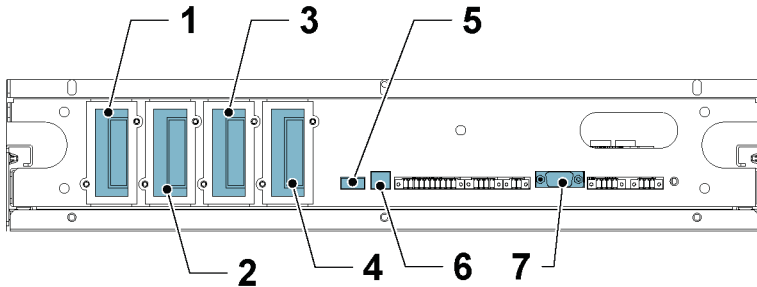


Figure 33. 9PHD UPS communication area

1	MiniSlot 1	5	USB device (connection to computer)
2	MiniSlot 2	6	USB host (connection to accessories)
3	MiniSlot 3	7	RS-232 port for service
4	MiniSlot 4		

For information on the location and connections of signal cable terminals, see Figure 31, Figure 32 and Table 19.

6.1 MiniSlot cards

The Eaton 9PHD UPS has 4 MiniSlot communication bays. To install a MiniSlot card, follow the instructions in MiniSlot interface connections..

The UPS is compatible with the following MiniSlot cards:

- Network Card-MS
Provides remote monitoring through a web browser interface, e-mail, and a network management system (NMS) using SNMP and connects to a twisted-pair Ethernet (10/100BaseT) network.

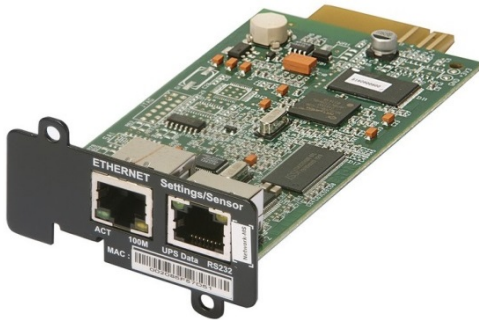


Figure 34. Network Card - MS

- **PX Gateway Card**
Provides remote monitoring through a web browser interface, e-mail, and a network management system (NMS) using SNMP and connects to a twisted-pair Ethernet (10/100BaseT) network. The card also provides direct integration of UPS information (meters and status) to a Building Management System (BMS) using the Modbus RTU and TCP protocols.



Figure 35. PX Gateway Card

- **Network and MODBUS Card - MS**
Provides remote monitoring through a web browser interface, e-mail, and a network management system (NMS) using SNMP and connects to a twisted-pair Ethernet (10/100BaseT) network. The card also provides direct integration of UPS information (meters and status) to a Building Management System (BMS) using the Modbus RTU protocol.

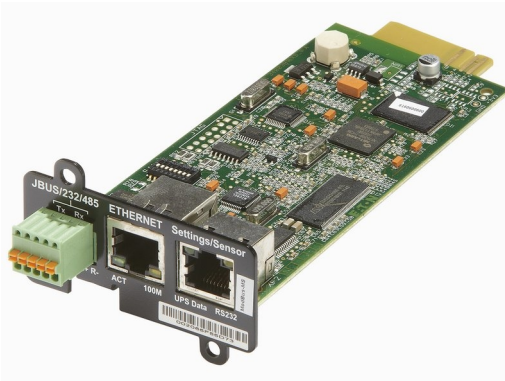


Figure 36. Network and MODBUS Card - MS

- Industrial Relay Card-MS

The MiniSlot Industrial Relay Card provides a way of connecting the UPS to industrial and electrical monitoring systems. It also enables a wide range of control applications by allowing up to 250 volts and 5 Amperes through its 5 relay connections. By connecting wires to the corresponding places in its terminal blocks, you can choose Normally Open or Normally Closed setup for each output.

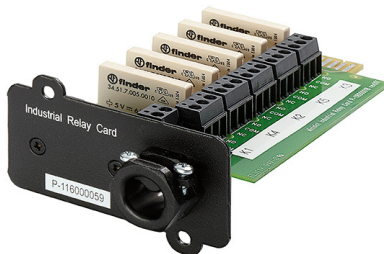


Figure 37. Industrial Relay Card-MS

6.2 Intelligent Power Software

Intelligent Power Software are productivity tools for UPS power management. The Intelligent Power Protector (IPP) application provides automatic, graceful shutdown of computers and virtual machines or servers powered by an Eaton UPS during a power outage that lasts longer than your available battery runtime. Intelligent Power Protector can be remotely supervised and managed by the Intelligent Power Manager (IPM) application. The IPM delivers a global view of power devices across the network from any PC with an Internet browser. The software enables single, web-based interface for remote monitoring and

management of Eaton and other manufacturers' UPSs, environmental sensors and Power Distribution Units (ePDU) products, even in virtualized environments.

The Intelligent Power Software is delivered on a CD with the UPS. Alternatively, you can download it from the Eaton web page.

6.3 Signal input monitoring

This standard feature lets you connect smoke detectors or overtemperature alarms to your signal inputs. The user interface terminals for external connections are located above or next to the power terminals of the UPS (see Figures 31 and 32). Use twisted-pair wires for each alarm input and common.

The signal inputs can be programmed to display the alarm's functional name.

6.4 General purpose relay contact

One general purpose relay contact is provided as a standard feature on the UPS. An alarm contact is also provided.

You can use a normally-closed or normally-open contact. If the state of the contact changes from the state you specify as normal, a signal is issued. You can connect this contact to equipment at your facility (such as a light or an alarm bell) to let you know when an alarm is active on the UPS. This feature is useful if the UPS is located in a remote area where the UPS horn may not be heard immediately.



Note: Do not operate the contacts in excess of 30 VAC (RMS) and 30 VDC at 5 A maximum.

6.5 Configuring relays

9PHD offers one native relay output. Additionally, each of the 4 MiniSlots can be equipped with a relay card, including 5 relays. The following instructions guide you through the relay configuration. For additional information on alarms, see Alarms Manual for Eaton 91PS/93PS/93PM (P-164000681).

Currently the relay configuration can be done using the display. The maximum voltage of the relay is 30 V. Examine the voltage and current specifications of the other cards from the previous sections.

The process for relay configuration is as follows:

1. In the home screen of the display, click the lock icon in the top right corner to type in the service password.
2. In the sign in window, click the password field containing the 4 dots.

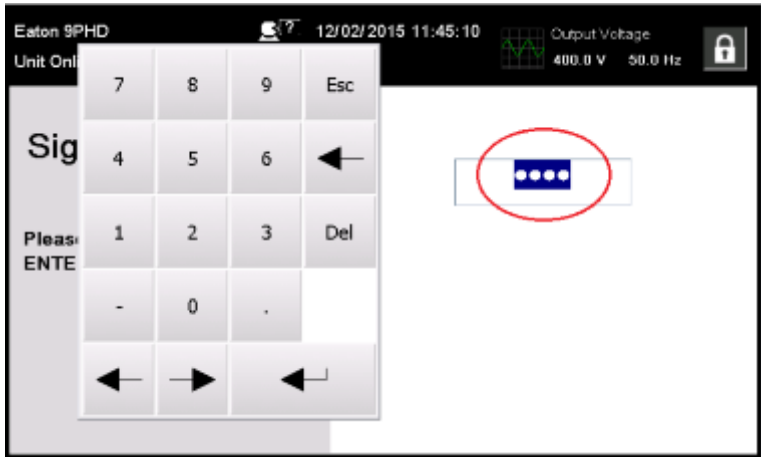



Figure 38. Sign in window with the password field

3. Enter the password 0101 and press .
4. Select **Continue**.
5. Select **Configuration** and then **Relay Outputs**.

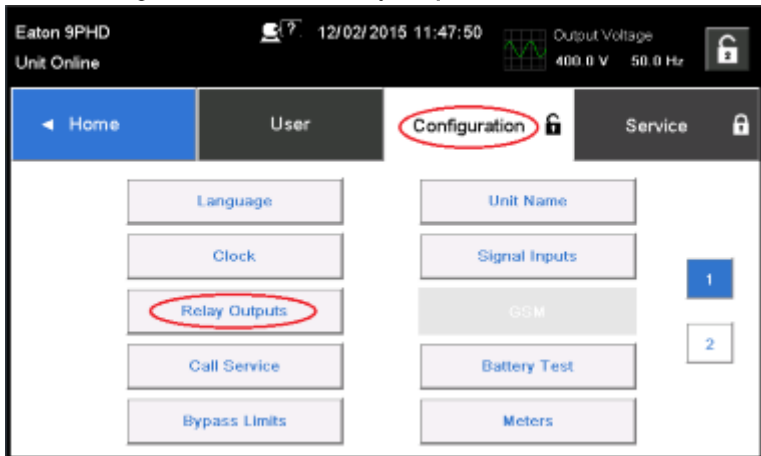


Figure 39. Selecting Relay Outputs in the Configurations screen

6. Select out of the following options:
 - Native (Alarm) relay
It is possible to set 8 different events for the native relay and for optional relay outputs installed in MiniSlots. If any of the set events occurs, the relay is activated

- MiniSlot 1
- MiniSlot 2
- MiniSlot 3
- MiniSlot 4

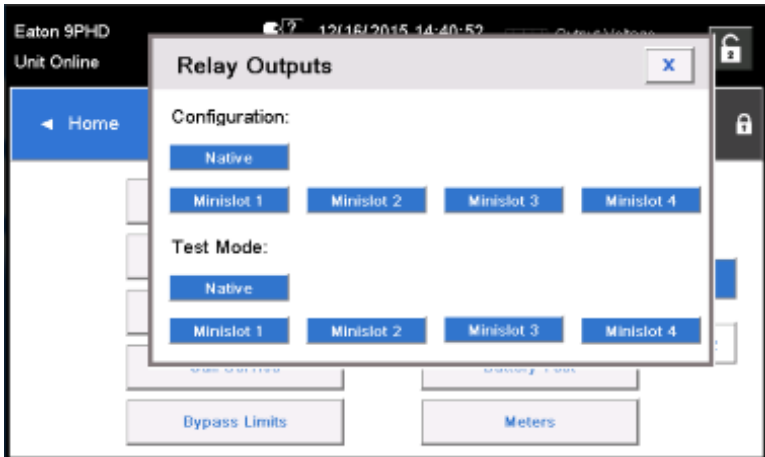


Figure 40. Options for relay outputs configuration

7. Enter the code(s) of the function(s) that you want to trigger the relay when they become active.
8. Press **OK** and **Save** to save the changes.

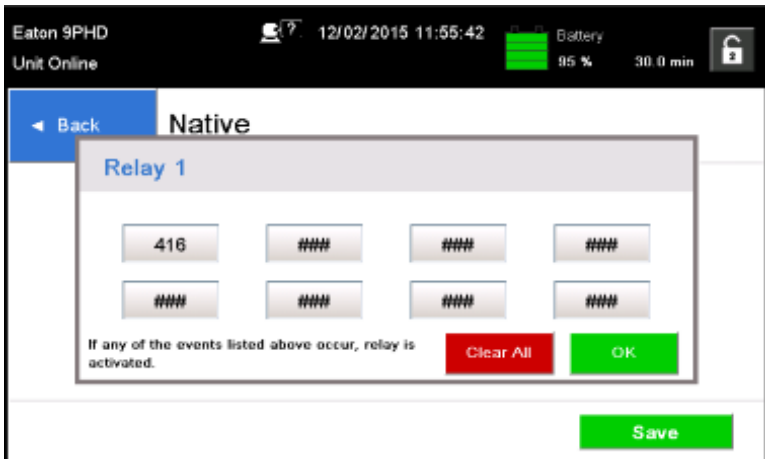


Figure 41. Entering the codes of the functions that will trigger the relay

9. If you selected one of the MiniSlots, the following default values are available:

- Relay 1: #262 On Line (LED is lit)
- Relay 2: #260 On Battery (LED is lit)
- Relay 3: #352 Alarm (LED is lit)
- Relay 4: #261 On Bypass (LED is lit)
- Relay 5: #15 Low Battery warning

Alternatively, you can configure the relays with any event you want.

10. You can test the relays by selecting any of the options in the test mode (see Figure 40).

7 UPS operating instructions

This section describes how to operate the UPS.



CAUTION

Before you operate the UPS, make sure that all the installation tasks are completed and a preliminary startup has been performed by authorized service personnel. The preliminary startup verifies all the electrical interconnections to make sure that the installation was successful and the system operates properly.

Before you operate any of the controls, read these instructions and have a thorough understanding of the UPS operation.

The UPS is configured to operate with one of following nominal voltages: 380, 400, 415, 440 or 480 VAC. Before you start to operate the UPS, confirm the UPS nominal voltage and frequency from the display by selecting **Settings > Information**. If the UPS need to be operated with another voltage or frequency, contact your closest Eaton office or Eaton authorized partner.



Note: The UPS is not a measuring device. All the displayed measurements are approximate values only.

7.1 UPS controls and indicators

7.1.1 Control panel

The control panel, located on the UPS front door under a protective hatch door, contains a color touch screen display. It is used to display the status of the UPS system and control the operation of the UPS.

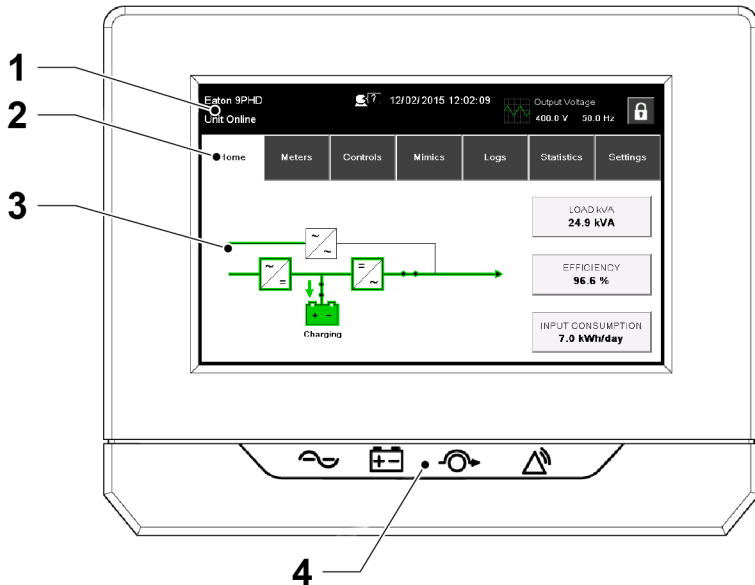


Figure 42. Parts of the display


The display consists of the following parts:




1	Status bar	The status bar displays the UPS name, state, current date and time, meters information, and a sign in/out button. It also shows any active alarms and warnings.
2	Main navigation	Select a screen by tapping on its name.
3	Content area	This is the main area for showing information on the UPS status and operations.
4	Status indicators	See Section 7.1.2 .

7.1.2 Status indicators

The four symbols below the display are status indicators. They are colored light emitting diode (LED) lamps, and they work in conjunction with the alarm horn to let you know the operating status of the UPS.

Table 20: Status indicators

Indicator	Status	Description
	On	The UPS is operating normally and supplying power to the critical load.
	Off	The UPS is turned off.

Indicator	Status	Description
Yellow symbol for battery mode 	On	The UPS is in the battery mode. Because the battery mode is a normal condition of the UPS, the green indicator for normal operation also remains illuminated.
Yellow symbol for bypass mode 	On	The UPS is in the bypass mode. The critical load is supported by the bypass source. The green indicator for normal operation is not illuminated when the system is in the bypass mode.
Red symbol for active alarm 	On	The UPS has an active alarm and requires immediate attention. The screen shows the highest priority active alarms. All alarms are accompanied by an audible horn. To silence the horn, press any control panel button once. The alarm indicator may be illuminated along with other indicators.

7.1.3 System events

When the UPS system is running in the double conversion mode, it continually monitors itself and the incoming utility power. In the battery or bypass mode, the UPS may issue alarms to let you know exactly what event caused the change from the double conversion mode. System events on the UPS can be indicated by horns, lights, messages, or all three.

Select **Logs** in the home screen to look at any currently active events.

- System event horn
The system event horn beeps to alert the user that an event requiring attention is taking place.
- System event indicators
The status indicators on the UPS control panel and the event horn let you know when the UPS system is operating in any mode other than the double conversion mode. Only the green indicator for normal operation is visible during normal UPS system operation. The other indicators illuminate to indicate alarms or events. When an alarm occurs, first examine these indicators to see what type of event has taken place.
- System event messages
When a system event occurs, a message appears in the status bar of the display. This message is also written to the Active Events log. Some notices and alarms may be accompanied by an audible horn. To silence the horn, press any button once.

7.1.4 Menu structure of the 9PHD UPS

The following table shows the menu structure of the 9PHD UPS.

Table 21: Menu structure of the 9PHD UPS

Main menu	Submenu	Functions
Home	-	An overview of the UPS operation, including information on load, efficiency and consumption.
Meters	Meters summary	A summary of the UPS or system meters.
	Input meters	Detailed information on UPS or system input meters.
	Bypass meters	Detailed information on UPS or system bypass meters.
	Output meters	Detailed information on UPS or system output meters. UPM Power
	Battery meters	Detailed information on UPS or system battery meters.

Main menu	Submenu	Functions
Controls	System controls	Start system Go to bypass Load Off
	UPS controls	Start charger Run battery test Shut down UPS Start UPS
	Module controls	Start charger Run battery test Shut down module Start module
	Service controls	ESS: <ul style="list-style-type: none"> • Enable • Disable • Configure VMMS: <ul style="list-style-type: none"> • Enable • Disable • Configure ABM: <ul style="list-style-type: none"> • Enable • Disable • Configure Clear status Clear Alarms Clear Logs
Mimics	UPS mimics	An overview of the UPS operation, including information on load, efficiency and consumption. If there is an error, an error indicator is displayed next to the affected part. Active events log can be opened by tapping the error indicator.
	UPS module map	Module map shows the status of each UPM.
	System overview	System overview shows the status and meters summary for each UPS.
	ESS	The ESS mimic screen shows the approximated consumption and energy savings of the ESS mode.

Main menu	Submenu	Functions
Logs	Active events	All active events are displayed.
	System log	A log of all system events.
	Service log	A detailed log of UPS operations.
	Change log	A log of all changed settings and their values.
Statistics: UPS, Battery	Statistics summary	A summary of UPS statistics
	Statistics details	Details are available by pressing on different statistics.
Settings	Setting group	Configurable user settings. For details, see Section 7.1.4.1 .

7.1.4.1 User settings

The UPS has the following settings that are user-modifiable. In the Home screen, select **Settings**.

Table 22: User settings

Setting	Description
Info	Information on the UPS model, including part number and serial number.
About	Version information.
GSM	GSM Modem.
Call Service	Send automatic e-mail to service center in case of a failure.

To modify the **Configuration** settings, you need to sign in.

Table 23: Configuration settings

Setting	Description
Language	Change the user interface language.
Unit Name	Change the unit name.
Clock	Change the date and time, change the clock format or enable/disable NTP clock setup.
Signal Inputs	Select signal input name and function.
Relay Outputs	Configure the relay outputs.
Battery Test	Change the power level and duration for battery test.
Bypass Limits	Change bypass voltage, bypass frequency or bypass slew rate limits.
Screen Saver Timeout	Change the screen saver timeout.
Meters	Change the meters format.
Lamp Test	Enable the lamp test.

Setting	Description
HMI backlight	Adjust the backlight brightness.
Control P/W level 1	Change the level 1 password, or remove the password on level 1. The default value is 1111.
Control P/W level 2	Change the level 2 password. The default value is 1010.

7.2 Signing in

If the level 1 password is enabled, you need to sign in.

1. Press the lock icon in the top right corner of the screen.
2. Type in your password and press **OK**.
You are signed in.
3. Press **Continue** to return to the previous screen.

You have 3 attempts to type in the password. If an incorrect password is given more than 3 times, you need to wait for 30 minutes before trying again.

To modify the user settings, you need to enter the level 2 password. For the default passwords, see Section [7.1.4.1](#).

7.3 System control instructions

7.3.1 Starting the UPS system in the double conversion mode

The UPS system can consist of a single UPS or several parallel UPSs. UPSs with their MOB open are not considered as part of the system.

To start the UPS system:

1. Open the UPS front door.
2. If included inside the UPS system, make sure that the rectifier input switches are closed.
3. Make sure that the battery breaker is closed.
4. If included inside the UPS system, make sure that the transformer fan MCB (F12) is closed.
5. Close the UPS front door.
6. Close the UPS input feeder circuit breaker.
7. Close the UPS bypass input feeder circuit breaker.
8. Wait for the UPS control panel display to become active and to indicate logic power.
9. Repeat steps 1–8 for each individual UPS in the system.
10. In the home screen, press **Controls**.
The System controls screen appears.

11. In the System controls screen, make sure that the system status is **SHUTDOWN**.
12. In the System controls screen, press the **Go online** button.
If Auto Bypass is enabled (factory default), the critical load is immediately supplied by the bypass source, in the bypass mode, until the inverter turns on and the UPS transfers to the double conversion mode. The status indicator on the UPS control panel indicates that the UPS is in the bypass mode. If auto bypass is not enabled, the UPS output remains off until the UPS system transfers to double conversion mode.
13. Wait for the following messages to appear sequentially on the System controls screen:
STARTING
ONLINE
The rectifier and inverter turn on. The DC voltage continues to ramp up to full voltage. Once the DC link reaches full voltage and the battery breaker is closed, the UPS output relay K3 closes and the static switch turns off. Power is now supplied to the critical load in the double conversion mode. It takes approximately 20 seconds for the UPS system to achieve the double conversion mode.

The UPS system now operates in the double conversion mode. The green status indicator for normal operation is lit in all the UPSs in the system.

7.3.2 Starting the UPS system in the bypass mode

CAUTION



In the bypass mode, the critical load is not protected from mains power interruptions and abnormalities.

If the inverter output of the UPS is not available and the critical load needs to be energized, do the following:

1. Open the UPS front door.
2. If included inside the UPS system, make sure that the rectifier input switches are closed.
3. Make sure that the battery breaker is closed.
4. If included inside the UPS system, make sure that the transformer fan MCB (F12) is closed.
5. Close the front door.
6. Close the UPS input feeder circuit breaker.
7. Wait for the UPS control panel to become active and indicate logic power.
8. Repeat steps 1–7 for each single UPS in the system.
9. In the home screen, press **Controls**.
The System controls screen appears.

10. In the System controls screen, make sure that the system status is shown as **SHUTDOWN**.
11. In the System controls screen, press the **Go to bypass** button.
The critical load is immediately supplied by the bypass source, in the bypass mode.

The UPS system now operates in the bypass mode. The critical load is immediately supplied by the bypass source. The yellow bypass status indicator is lit.

7.3.3 Starting the UPS in the battery mode

The UPS system can consist of a single UPS or several parallel UPSs. UPSs with their MOB open are not considered as part of the system.

Use the battery start feature to start the system in the battery mode when utility voltage is not present.

To start the UPS system in battery mode:

1. Close the battery breakers of the system.
2. Open the UPS front door
3. Press the battery start button in each UPM.
4. Close the UPS front door.
5. Wait for the UPS control panel display to become active and to indicate logic power.
6. Repeat the steps for each individual UPS in the system.
7. In the home screen, press **Controls**. The system controls screen appears.
8. Make sure that the system status is **SHUTDOWN**
9. Press the **Go online** button.
10. Wait for the following messages to appear sequentially on the System controls screen:
 - **STARTING**
 - **ONLINE**

The battery converter and inverter turn on. The DC voltage ramps up to full voltage. Once the DC link reaches full voltage, the UPS output relay K3 closes. Power is now supplied to the critical load in the battery mode. The green and yellow status indicators for battery mode are lit in all the UPSs in the system.

7.3.4 Transferring from the double conversion mode to the bypass mode



CAUTION

In the bypass mode, the critical load is not protected from mains power interruptions and abnormalities.

To transfer the critical load to the bypass mode.

1. In the home screen, press **Controls**.
The System controls screen appears.
2. In the System controls screen, press the **Go to bypass** button.
The UPS system transfers to the bypass mode and the critical load is immediately supplied by the bypass source. If the bypass source is not available, the power processor remains on and an alarm sounds.

The UPS system now operates in the bypass mode and the yellow bypass status indicator is lit. The UPM status is shown as **Ready**. The system status is shown as **ON BYPASS**.

7.3.5 Transferring from the bypass mode to the double conversion mode

To transfer the critical load to the double conversion mode.

1. In the home screen, press **Controls**.
The System controls screen appears.
2. In the System controls screen, press the **Go online** button.
The UPS system transfers to the double conversion mode. If there is not enough UPM capacity available, the system remains in the bypass mode and an alarm sounds.

The UPS now operates in the double conversion mode. The green status indicator for normal operation is lit. The system status is shown as **UNIT ONLINE**.

7.3.6 Transferring from the double conversion mode to the Energy Saver System mode



Note: Note that the Energy Saver System mode commands are displayed only if enabled at the factory or by an Eaton authorized Customer Service Engineer.

To transfer the critical load to the Energy Saver System mode:

1. In the home screen, press **Controls**.
2. Select **Service controls**.

3. Select **Enable ESS**.

The entire UPS system transfers to the Energy Saver System mode and the critical load is supplied by the bypass source. If the bypass source is not available or the conditions are not correct for the ESS mode, the power module remains on and an alarm sounds. The green status indicator for normal operation is illuminated. The UPS status is shown as **UNIT ONLINE**, **ESS**. The UPM status is shown as **READY**.

7.3.7 Transferring from the Energy Saver System mode to the double conversion mode



Note: Note that the Energy Saver System mode commands are displayed only if enabled at the factory or by an Eaton authorized Customer Service Engineer.

To transfer the critical load to the double conversion mode:

1. In the home screen, press **Controls**.
2. Select **Service controls**.
3. Select **Disable ESS**.

The UPS system transfers to the battery mode and then to the double conversion mode. If the power module is not available, the system remains in the bypass mode and an alarm sounds. The green status indicator for normal operation is illuminated. The UPS status is shown as **UNIT ONLINE**. The UPM status is shown as **ACTIVE**.

7.3.8 Shutting down the UPS system and critical load

To perform maintenance or service on the critical load, shut down the power to the load:

1. Turn off all the equipment that is powered by the UPS system.
2. Perform the LOAD OFF procedure (see Section [7.3.9](#)).
The input, output, and bypass backfeed contactors open, the battery breaker or disconnect is tripped, and the power module is turned off.
3. Open the UPS front door.
4. If included in the UPS system, open the rectifier input switches.
5. Make sure that the battery breaker is open.
6. Close the UPS front door.
7. Open the UPS input and bypass feeder circuit breakers.
8. Repeat steps 3–7 for all the UPSs in the system.

**DANGER**

Power is still present inside each UPS cabinet until the upstream feeder circuit breaker is opened, and in case of a parallel system, the output is isolated or parallel units are shut down as well.

7.3.9 De-energizing the critical load

Press the **Load Off** button in the **Controls > System Controls** screen to initiate a UPS system Load Off. This button can be pressed to control the UPS output. The **Load Off** button de-energizes the critical load and shuts down the UPS system. The UPS system (including bypass) remains off until it is restarted.

1. Press **Load Off**.
The shut down screen appears, providing a choice to proceed or abort the shutdown.
2. To shut down the UPS, press **Load Off**. To abort the shutdown, press **Abort**.



Note: All power to the critical load is lost when Load Off is selected. Only use this feature when you want to de-energize the critical load.

When you select **Load Off**, the input, output, and bypass backfeed contactors open, the battery breaker or disconnect is tripped, and all the UPSs in the system are turned off.

To restart the UPS system, see Section [7.3.1](#) or Section [7.3.2](#).

CAUTION

Do not attempt to restart the system after Load Off until you have identified and cleared the cause of the shutdown.

7.4 UPS control instructions

7.4.1 Starting a single UPS

Make sure that the load level does not exceed the single UPS capacity.

To start the UPS:

1. Open the UPS front door.
2. If included inside the UPS system, make sure that the rectifier input switches are closed.
3. Make sure that the battery breaker is closed.
4. If included inside the UPS system, make sure that the transformer fan MCB (F12) is closed.
5. Close the UPS front door.

6. Close the UPS input feeder circuit breaker.
7. Close the UPS bypass input feeder circuit breaker.
8. Wait for the UPS control panel display to become active and indicate logic power.
9. In the home screen, press **Controls**.
10. Press the **UPS controls** button.
In the UPS controls screen, the system status is shown as **SHUTDOWN**.
11. In the UPS controls screen, press the **Go online** button.
If Auto Bypass is enabled (factory default), the critical load is immediately supplied by the bypass source in the bypass mode, until the inverter turns on and the UPS transfers to the double conversion mode. The yellow status indicator on the UPS control panel indicates that the UPS is in the bypass mode. If auto bypass is not enabled, the UPS output remains off until the UPS system transfers to the double conversion mode.
12. In the UPS control screen, press the **Go online** button.
13. Wait for the following messages to appear sequentially on the UPS status line:
STARTING
ONLINE
The rectifier and inverter turn on. The DC voltage continues to ramp up to full voltage. Once the DC link reaches full voltage and the battery breaker is closed, the UPS output relay K3 closes. Power is now supplied to the critical load in the double conversion mode. It takes approximately 20 seconds for the UPS system to achieve the double conversion mode.

The UPS system is now operating in the double conversion mode and the green status indicator for normal operation is illuminated.

7.4.2 Shutting down a single UPS

A single UPS in the system can be shut down only if it is redundant. In practice, this means that a UPS is not allowed to be shut down if doing so would lead to an overload condition in the remaining UPSs in the system.

To shut down a single UPS:

1. In the home screen, press **Controls**.
The System controls screen is displayed.
2. In the System controls screen, press **UPS controls**.
3. In the UPS control screen, select **Shut down UPS**.

7.4.3 Enabling and disabling the battery charger

To turn the battery charger on or off, perform the following procedure:

1. In the home screen, press **Controls**.
The System controls screen appears.

2. In the System controls screen, press **UPS controls**.
3. Press the **Start charger / Stop charger** button.

7.5 UPM control instructions

7.5.1 Starting the UPMs

Make sure that the load level does not exceed the single UPM capacity.

To start an individual power module in the double conversion mode:

1. Open the UPS front door.
2. If included inside the UPS system, make sure that the rectifier input switches are closed.
3. If included inside the UPS system, make sure that the transformer fan MCB (F12) is closed.
4. Close the UPS front door.
5. Close the UPS input feeder circuit breaker.
6. Close the UPS bypass input feeder circuit breaker.
7. Wait for the UPS control panel to become active and indicate logic power.
8. In the home screen, press **Controls**.
The System controls screen is displayed.
9. In the System controls screen, make sure that the UPS status is shown as **SHUTDOWN**.
10. Make sure that there are no active alarms.
11. In the System controls screen, press **Module controls**.
The Select module screen is displayed.
12. Select the UPM you want to start (**UPM 1 – UPM 4**).
The UPM control screen is displayed. The UPM status is shown as **SHUTDOWN**.
13. In the UPM control screen, select **Start module**.
14. Wait for the following messages to appear sequentially on the UPM status line:
READY
ACTIVE

The UPM rectifier and inverter turn on and the UPM transfers to the double conversion mode and supplies the critical load, if the load level does not exceed the power module capacity.

7.5.2 Shutting down the UPMs

A single UPM in the system can be shut down only if it is redundant. In practice, this means that a UPM is not allowed to be shut down if doing so would lead to an overload condition in the remaining UPMs or UPSs in the system.

To shut down a single UPM:

1. In the home screen, press **Controls**.
The System controls screen is displayed.
2. In the System controls screen, press **Module controls**.
The Select module screen is displayed.
3. Select the UPM you want to shut down (**UPM 1 – UPM 4**).
4. In the UPM control screen, select **Shut down module**.

7.6 Using the Remote Emergency Power-off switch

A UPS emergency power-off is initiated by the EPO pushbutton switch. In case of an emergency, you can use this switch to control the UPS output. The EPO switch de-energizes the critical load and powers down the UPS immediately without asking for verification. The UPS, including the static bypass switch, remains off until it is restarted.

CAUTION



When the EPO switch is activated, all power to the critical load is lost. Use this feature only in case of emergency.



Note: The following instructions are for the EPO switch supplied by Eaton Corporation. If you are using a customer-supplied EPO switch, it may not activate in the same way. For operating instructions, see the documentation provided with the switch.

To use the EPO switch:

1. Press the EPO pushbutton switch.
The input, output, and bypass backfeed relays open, the battery breaker or disconnect is tripped, and the power module is turned off immediately, without asking for verification.

To restart the UPS after using the EPO pushbutton, reset the EPO switch and then follow the procedure in Section [7.3.1](#) or Section [7.3.2](#).

WARNING



Do not attempt to restart the system after using the EPO switch until the conditions for safe start-up have been confirmed.

7.7 Turning the UPS from the double conversion mode to the maintenance bypass

Only trained personnel who are familiar with the behavior and functions of the UPS are allowed to operate the internal MBS.

To turn the UPS to maintenance bypass:

1. Follow the normal start position:

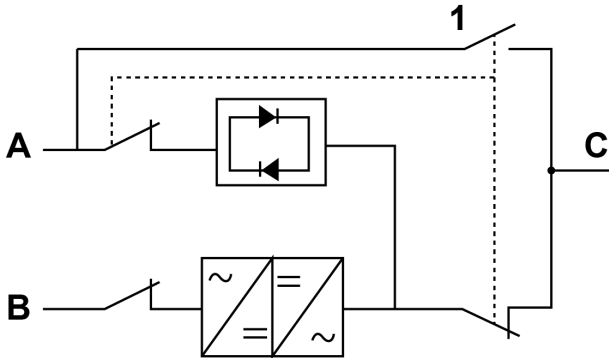


Figure 43. The normal positions of the internal MBS switches and rectifier input switch. UPS is in the online mode, and static bypass is available. MBS is open. Note that there are UPM rectifier input switches on the UPS, and external input breaker for the rectifier input on the switchgear. If single feed for rectifier and bypass is used for the UPS, external breaker must not be operated.

- | | | | |
|---|---------------------|---|---------------------------------|
| A | Static bypass input | 1 | Maintenance Bypass Switch (MBS) |
| B | Rectifier input | | |
| C | Out | | |
2. Perform the transfer from the double conversion mode to the bypass mode as instructed in Section 7.3.4. Remember to verify the transfer before proceeding to the next step.
 3. Turn the MBS from the UPS position to the Test position. This will close the MBS switch.
 4. Perform the LOAD OFF procedure as described in Section 7.3.9.
 5. Turn the MBS from the Test position to the Bypass position. This will open the static bypass input and open the UPS output, feeding the load via the MBS.
 6. Turn off the rectifier switch (S1-S3) to disconnect the UPS rectifier input. If separate feeds for the rectifier and the bypass are used, the possible external input breaker for the rectifier can now be opened.

The UPS is now in the maintenance bypass mode:

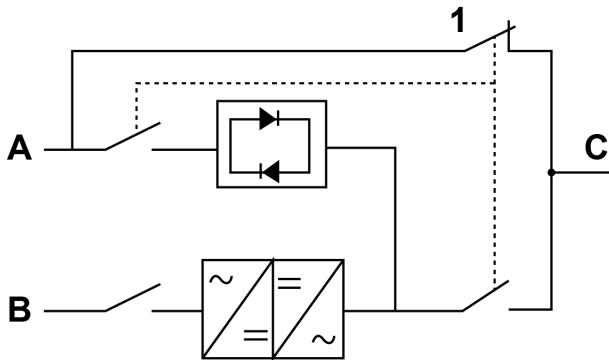


Figure 44. Maintenance bypass mode

- A Static bypass input 1 Maintenance Bypass Switch (MBS)
 B Rectifier input
 C Out

7.8 Turning the UPS from the maintenance bypass mode to the double conversion mode

To turn the UPS back to the double conversion mode:

1. Follow the normal start position:

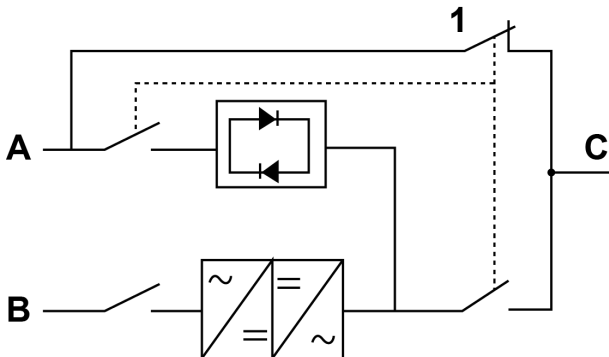


Figure 45. Maintenance bypass mode

- A Static bypass input 1 Maintenance Bypass Switch (MBS)
 B Rectifier input
 C Out
2. Turn on the rectifier switch to connect rectifier input (S1-S3) to the UPS.

3. Close the possible external rectifier input breaker.
4. Turn the MBS from bypass position to Test position to connect bypass input to the UPS.
5. Perform the UPS start-up procedure (bypass mode) described in Section [7.3.2](#).
6. Turn the MBS from the Test position to the UPS position to open the MBS. Load is now fed via static bypass.
7. Perform the transfer from the bypass mode to the double conversion mode as described in Section [7.3.5](#).

The UPS is now in the double conversion mode:

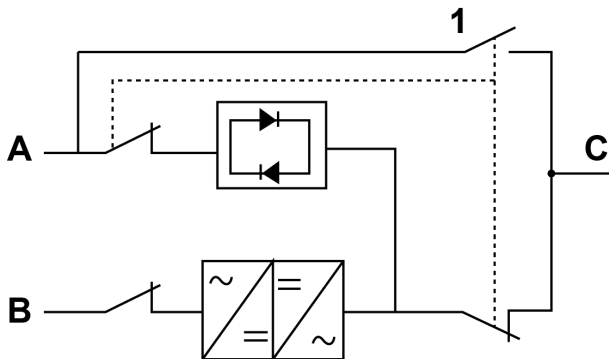


Figure 46. Double conversion mode

- | | | | |
|---|---------------------|---|---------------------------------|
| A | Static bypass input | 1 | Maintenance Bypass Switch (MBS) |
| B | Rectifier input | | |
| C | Out | | |

8 UPS maintenance

The components inside the UPS cabinet are secured to a sturdy metal frame. All repairable parts and assemblies are located for easy removal with very little disassembly. This design allows authorized service personnel to perform routine maintenance and servicing quickly. Schedule periodic performance checks of your UPS system to keep it running properly. Regular routine checks of the operation and system parameters enable your system to function efficiently for many trouble-free years.

8.1 Important safety instructions

Remember that your UPS system is designed to supply power **EVEN WHEN IT IS DISCONNECTED FROM THE UTILITY POWER**. The UPS module interiors are unsafe until the DC power source is disconnected and the electrolytic capacitors are discharged.

After disconnecting the utility power and the DC power, authorized service personnel must wait at least 5 minutes for capacitor bleed-off before attempting internal access to the UPS module.

DANGER



LETHAL VOLTAGE. Do not operate the UPS system without the cabinet doors or protective panels secured. Do not make any assumptions about the electrical state of any cabinet in the UPS system.

WARNING



All service and maintenance work must be performed by an Eaton authorized Customer Service Engineer or by a qualified service officer authorized by Eaton.

Since each battery string is an energy source in itself, opening the battery circuit breaker does not de-energize the voltage within the battery string.

DANGER



Do not attempt to access any internal area of the battery string yourself. Voltages are always present in the battery strings. If you suspect that a battery string needs service, contact your service representative.

Observe these precautions when working on or around batteries:

- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of batteries or battery cabinets.

- Prior to connecting or disconnecting terminal, disconnect the charging source.
- Determine if the battery is inadvertently grounded. If it is, remove the source of the ground. Contact with any part of a grounded battery can result in an electrical shock. The likelihood of such a shock is reduced if such grounds are removed during installation and maintenance.
- When replacing batteries, use the same number of sealed, lead-acid batteries.
- Dispose of batteries according to your local codes for disposal requirements.

8.2 Performing preventive maintenance

The UPS system requires very little preventive maintenance. However, inspect the system periodically to verify that the units are operating normally and that the batteries are in good condition.

The majority of the service and maintenance work must be performed by service personnel qualified by Eaton. Only the actions described in Section [8.2.1](#) and Section [8.2.2](#) are allowed to be performed by the user.

8.2.1 Daily maintenance

Do this every day:

1. Examine the area surrounding the UPS system. Make sure that the area is not cluttered, allowing free access to the unit.
2. Examine that the air intakes (vents on the front doors) and exhaust opening (the back of the UPS cabinet sections) are not blocked.
3. Make sure that the operating environment is within the parameters specified in Section [4.3.1](#) and Chapter [9](#).
4. Make sure that the UPS is in the normal operation mode (the green status indicator for normal operation is lit). If the red alarm status indicator is lit or the green status indicator for normal operation is not lit, contact your service representative.

8.2.2 Monthly maintenance

Do this once a month:

1. Monitor the system parameters on the control panel (see Section [7.1.4](#)).
2. If the optional air filters are installed, examine them (located behind the front doors) and wash or replace them, if needed. Contact your service representative for replacement filters. To replace the filters:
 - a. Open the UPS front door.
 - b. Examine the filters. Increase the check-up frequency if site conditions are dusty.
 - c. Close the UPS front door.

- Record the results and any corrective actions in a service log.

8.2.3 Periodic maintenance

Inspect the UPS periodically to determine if components, wiring, and connections exhibit evidence of overheating. Pay particular attention to bolted connections. Bolted connections must be re-torqued periodically.

8.2.4 Annual maintenance

CAUTION



Only authorized personnel that are familiar with the maintenance and servicing of the UPS system are allowed to perform annual preventive maintenance. Contact your service representative for more information about service offerings.

8.2.5 Battery maintenance

WARNING



Only authorized personnel are allowed to perform battery replacement and maintenance. Contact your service representative for battery maintenance.

8.3 Recycling the used UPS or batteries

Remove the battery bank before disposing of the UPS or its battery cabinet. Follow the local requirements regarding battery recycling or disposal.

WARNING



Only authorized personnel are allowed to remove the batteries due to the risk caused by high energy and voltage.

Do not discard waste electrical or electronic equipment in the trash. For proper disposal, contact your local collecting/recycling/reuse or hazardous waste center and follow the local legislation.

The following symbols indicate a product requiring special handling:



Figure 47. WEEE symbol

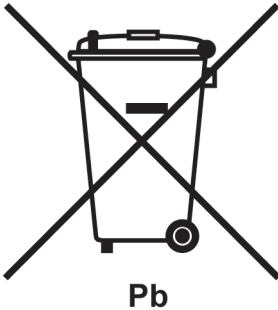


Figure 48. Recycling batteries symbol

When handling waste from electrical and electronic equipment, use proper local collecting centers that meet local legislation.

WARNING



HAZARDOUS MATERIALS.

Batteries may contain high voltages and caustic, toxic and flammable substances. If used improperly, batteries can injure or kill people and damage equipment.

Do not discard of unwanted batteries or battery material in the public waste disposal system. Follow all the applicable local regulations regarding the storage, handling and disposal of batteries and battery materials.

8.4 Maintenance training

For more information about training and other services, contact your Eaton representative.

9 Technical data

For a complete technical specification, contact your Eaton representative. Due to continuous product improvement programs, specifications are subject to change without notice.

9.1 Directives and standards

Safety	IEC 62040-1: Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS IEC 60950-1: Information technology equipment - Safety - Part 1: General requirements (as referred through the IEC 62040-1)
EMC	IEC 62040-2: Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements / Ed. 2 <ul style="list-style-type: none"> • Emissions: category C2 • Immunity: category C3
Performance & tests	IEC 62040-3: Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements
Environmental	IEC62040-4: Uninterruptible Power Systems (UPS) - Part 4: Environmental Aspects - Requirements and Reporting IEC 62430: Environmentally conscious design for electrical and electronic products
RoHS	2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment
WEEE	2012/19/EU on waste electrical and electronic equipment (WEEE)
ECO Design Directive	2009/125/EC establishing a framework for the setting of eco-design requirements for energy-related products
Batteries	2006/66/EC on batteries and accumulators and waste batteries and accumulators
Packaging	94/62/EC on packaging and packaging waste

9.2 UPS system input

Rated input voltage	220/380 V; 230/400 V; 240/415; 254/440; 277/480 V. 208-690 V available with optional transformers.
----------------------------	---

Voltage tolerance without transformers, (Rectifier input)	380–415 V -15% / +20% 440 V +/- 15% 480 V -10% / +8%
Voltage tolerance without transformers (Bypass input)	-15% / +10%
Rated input frequency	50 or 60 Hz, user configurable
Frequency tolerance	40 to 72 Hz
Number of input phases (rectifier & bypass)	3 phases + N + PE or 3 phases + PE as an option
Input power factor	0.99
Rated mains input current	See section 11 and Table 15
Maximum mains input current	
Input current distortion at rated input current, iTHD	30 kW: < 4,5% 40-200 kW: < 3%
Rectifier ramp-up, rectifier start and load step	10 A/s (default), configurable. Min 1A/s
Backfeed protection	Yes, for rectifier and bypass lines

9.3 UPS system output

	9PHD 30-200 kW	9PHD 30-160 kW with increased overload capability
Number of output phases	3 phases + N + PE or 3 phases + PE as an option	3 phases + N + PE or 3 phases + PE as an option
Rated output voltage	220/380 V; 230/400 V; 240/415 V; 254/440; 277/480 V, configurable. 208–690 V available with optional transformers	220/380 V; 230/400 V; 240/415 V; 254/440; 277/480 V, configurable. 208–690 V available with optional transformers
Rated output frequency	50 or 60 Hz, user configurable	50 or 60 Hz, user configurable
Total voltage harmonic distortion:		
100 % linear load	< 1%	< 1%
100 % non-linear load	< 5%	< 5%

	9PHD 30-200 kW	9PHD 30-160 kW with increased overload capability
Output frequency variation	±0.1 Hz	±0.1 Hz
Slew rate	1 Hz/s	1 Hz/s
Output current	See section 11 and Table 15	See section 11 and Table 15
Overload capability at ambient 40 °C (on inverter)	10 min 102 – 110% load 60 s 111 – 125% load 10 s 126 – 150% load 300 ms > 150% load	60 min 102 – 110% load 10 min 111 – 125% load 60 s 126 – 150% load 300 ms > 150% load
Overload capability at ambient 40 °C (in the stored energy mode)	10 min 102 – 110% load 60 s 111 – 125% load 300 ms > 126% load	60 min 102 – 110% load 10 min 111 – 125% load 300 ms > 126% load
Overload capability at ambient 40 °C (in the bypass mode)	Continuous ≤ 125% load 10 ms 1,000% load Note! Bypass fuses may limit the overload capability. Note! Models with output transformer have limited overload capability.	Continuous ≤ 150% load 10 ms 1,250% load Note! Bypass fuses may limit the overload capability. Note! Models with output transformer have limited overload capability.
Load power factor (rated)	Nominal 1.0	Nominal 1.0
Load power factor (permitted range)	From 0.8 lagging to 0.8 leading	From 0.8 lagging to 0.8 leading

9.4 UPS environmental specifications

Acoustic noise at 1 m	to be defined
Ambient UPS storage temperature range	From -25 °C to +55 °C in the protective package
Ambient operating temperature range, up to 1,000 m elevation	From 0 °C to +40 °C
Ambient operating temperature range, at sea level	From 0 °C to +45 °C
Relative humidity range	5-95%, no condensation allowed
Maximum service altitude	1,000 m (3,300 ft) above sea level Maximum 2,000 m (6,600 ft) with 1% derating per each additional 100 m above 1,000 m.

9.5 Battery specification

Battery type	VRLA, 12 VDC
Battery quantity	36 blocks, 216 cells per battery string, or 40 blocks, 240 cells per battery string. Note: Do not connect battery strings with different battery quantity and voltage in parallel!
Battery voltage	432 V (36 blocks) or 480 V (40 blocks)
Recharge profile	ABM or float charge
End of discharge voltage	1.67 VPC to 1.75 VPC, configurable or automatic (load adaptive)
Charge current	Configurable:
30–50 kW units	Configurable 0...29.3 A At > 40kVA load automatically limited to 16.5 A.
80–100 kW units	Configurable 0...58.9 A At > 80kVA load automatically limited to 33A.
120–150 kW units	Configurable 0...87.9 A At > 120kVA load automatically limited to 49.5A.
160–200 kW units	Configurable 0...117.2 A At > 160kVA load automatically limited to 66 A. Note that the maximum charge current is 29.3 A per UPM.
Battery start option	Yes

10 Warranty

10.1 General

The product is warranted against defects in materials and workmanship for a period of twelve (12) months from its original date of purchase. The local office or distributor may grant a warranty period different to the above. Please refer to local terms of liability as defined in the supply contract.

The UPS manufacturer is not responsible for:

- Any costs resulting from a failure if the installation, commissioning, repair, alteration, or ambient conditions of the equipment do not fulfill the requirements specified in the documentation delivered with the unit and other relevant documentation.
- Equipment subjected to misuse, negligence or accident.
- Equipment comprised of materials provided or designs stipulated by the purchaser.

The warranty is only valid if the installation inspection and initial startup of the UPS unit is carried out by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton. Service and maintenance of the UPS shall also be performed only by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton. Otherwise the warranty will be voided.

If the product fails to meet its published specifications due to a defect in material and workmanship, covered by this warranty, the seller will repair or replace the warranted product. Such repair or replacement will be made by Eaton or by a service provider approved by Eaton. Repair or replacement during the warranty period does not extend the original warranty. Warranty does not cover taxes, which will be due in connection with replacement or repair of the product.

Batteries are warranted against failures in material and workmanship, not against the normal aging and reduction of ampere-hour capacity. The product storage environment has to meet manufacturer's specifications, failure to do this will cause the warranty to be voided.

Under no circumstances shall the manufacturer, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, losses or penalties.

The technical data, information and specifications are valid at the time of printing. The UPS manufacturer reserves the right to modifications without prior notice.

10.2 Whom to contact in case of Warranty

In case of Warranty, or while unsure if the unit in question is covered by warranty, contact the respective sales organization where the unit was purchased. Have the following information available:

- Purchase order number and purchase order date
 - Installation date
- OR
- Serial number and part number of the unit (information available on the unit's label)

11 Appendix



Note: "NA" indicates that output transformer does not affect input values, and input transformer does not affect output values.



Note: In the "Combined" column, I indicates transformer input and O transformer output.

11.1

Table 24: 20kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com- bined*	Rectifier input			Bypass input		UPS out- put
		Rated current [A]	Maximum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	Rated current [A]
380	20_380	40	40	40	30	32	30
400	20_400	38	40	40	29	32	29
415	20_415	37	40	40	28	32	28
440	20_440	34	34	63	26	32	26
480	20_480	32	32	50	24	32	24
208	20_208I	76	80	125	56	63	NA
230	20_230I	69	72	125	50	63	NA
380	20_380I	42	44	63	30	32	NA
400	20_400I	39	42	63	29	32	NA
415	20_415I	38	40	63	28	32	NA
440	20_440I	36	38	63	26	32	NA
480	20_480I	33	35	50	24	25	NA
690	20_690I	23	24	40	17	20	NA
208	20_208O	NA	NA	NA	NA	NA	56
230	20_230O	NA	NA	NA	NA	NA	50
380	20_380O	NA	NA	NA	NA	NA	30
400	20_400O	NA	NA	NA	NA	NA	29
415	20_415O	NA	NA	NA	NA	NA	28
440	20_440O	NA	NA	NA	NA	NA	26
480	20_480O	NA	NA	NA	NA	NA	24
690	20_690O	NA	NA	NA	NA	NA	17

11.2

Table 25: 30kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com-bined*	Rectifier input			Bypass input Rated current [A]	Fuse [A]	UPS out-put Rated current [A]
		Rated current [A]	Maxi-mum current [A]	Fuse [A]			
380	300_380	56	57	63	46	50	46
400	30_400	53	57	63	43	50	43
415	30_415	51	57	63	42	50	42
440	30_440	48	51	63	39	50	39
480	30_480	44	48	50	36	40	36
208	30_208I	106	114	125	83	100	NA
230	30_230I	96	103	125	75	100	NA
380	30_380I	58	63	63	46	50	NA
400	30_400I	55	59	63	43	50	NA
415	30_415I	53	57	63	42	50	NA
440	30_440I	50	54	63	39	50	NA
480	30_480I	46	49	50	36	40	NA
690	30_690I	32	34	40	25	32	NA
208	30_208O	NA	NA	NA	NA	NA	83
230	30_230O	NA	NA	NA	NA	NA	75
380	30_380O	NA	NA	NA	NA	NA	46
400	30_400O	NA	NA	NA	NA	NA	43
415	30_415O	NA	NA	NA	NA	NA	42
440	30_440O	NA	NA	NA	NA	NA	39
480	30_480O	NA	NA	NA	NA	NA	36
690	30_690O	NA	NA	NA	NA	NA	25

11.3

Table 26: 40kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com-bined*	Rectifier input			Bypass input		UPS out-put Rated current [A]
		Rated current [A]	Maxi-mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	40_380	72	76	80	61	63	61
400	40_400	68	76	80	58	63	58
415	40_415	65	76	80	56	63	56
440	40_440	62	68	80	52	63	52
480	40_480	57	62	80	48	63	48
208	40_208I	136	152	160	111	125	NA
230	40_230I	123	138	160	100	125	NA
380	40_380I	75	83	80	61	63	NA
400	40_400I	71	79	80	58	63	NA
415	40_415I	68	76	80	56	63	NA
440	40_440I	64	72	80	52	63	NA
480	40_480I	59	66	80	48	63	NA
690	40_690I	41	46	50	33	40	NA
208	40_208O	NA	NA	NA	NA	NA	111
230	40_230O	NA	NA	NA	NA	NA	100
380	40_380O	NA	NA	NA	NA	NA	61
400	40_400O	NA	NA	NA	NA	NA	58
415	40_415O	NA	NA	NA	NA	NA	56
440	40_440O	NA	NA	NA	NA	NA	52
480	40_480O	NA	NA	NA	NA	NA	48
690	40_690O	NA	NA	NA	NA	NA	33

11.4

Table 27: 50kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com- bined*	Rectifier input			Bypass input		UPS out- put Rated current [A]
		Rated current [A]	Maxi- mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	50_380	87	95	100	76	80	76
400	50_400	83	95	100	72	80	72
415	50_415	80	95	100	70	80	70
440	50_440	75	85	100	66	80	66
480	50_480	69	75	100	60	80	60
208	50_208I	166	190	200	139	160	NA
230	50_230I	150	172	200	126	160	NA
380	50_380I	91	104	100	76	80	NA
400	50_400I	86	99	100	72	80	NA
415	50_415I	83	95	100	70	80	NA
440	50_440I	79	90	100	66	80	NA
480	50_480I	72	82	100	60	80	NA
690	50_690I	50	57	63	42	50	NA
208	50_208O	NA	NA	NA	NA	NA	139
230	50_230O	NA	NA	NA	NA	NA	126
380	50_380O	NA	NA	NA	NA	NA	76
400	50_400O	NA	NA	NA	NA	NA	72
415	50_415O	NA	NA	NA	NA	NA	70
440	50_440O	NA	NA	NA	NA	NA	66
480	50_480O	NA	NA	NA	NA	NA	60
690	50_690O	NA	NA	NA	NA	NA	42

11.5

Table 28: 60kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com- bined*	Rectifier input			Bypass input		UPS out- put Rated current [A]
		Rated current [A]	Maxi- mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	60_380	103	114	125	91	100	91
400	60_400	98	114	125	87	100	87
415	60_415	94	114	125	83	100	83
440	60_440	89	102	125	79	80	79
480	60_480	81	97	100	72	80	72
208	60_208I	196	228	250	167	200	NA
230	60_230I	177	207	250	151	160	NA
380	60_380I	107	125	125	91	100	NA
400	60_400I	102	119	125	87	100	NA
415	60_415I	98	114	125	83	100	NA
440	60_440I	93	108	125	79	80	NA
480	60_480I	85	99	100	72	80	NA
690	60_690I	59	69	80	50	63	NA
208	60_208O	NA	NA	NA	NA	NA	167
230	60_230O	NA	NA	NA	NA	NA	151
380	60_380O	NA	NA	NA	NA	NA	91
400	60_400O	NA	NA	NA	NA	NA	87
415	60_415O	NA	NA	NA	NA	NA	83
440	60_440O	NA	NA	NA	NA	NA	79
480	60_480O	NA	NA	NA	NA	NA	72
690	60_690O	NA	NA	NA	NA	NA	52

11.6

Table 29: 80kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com- bined*	Rectifier input			Bypass input		UPS out- put Rated current [A]
		Rated current [A]	Maxi- mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	80_380	145	152	160	122	125	122
400	80_400	138	152	160	115	125	115
415	80_415	133	152	160	111	125	111
440	80_440	125	136	160	105	125	105
480	80_480	115	124	160	96	125	96
208	80_208I	276	304	315	287	250	NA
230	80_230I	249	275	315	260	250	NA
380	80_380I	151	167	200	157	125	NA
400	80_400I	143	158	16	149	125	NA
415	80_415I	138	153	160	144	125	NA
440	80_440I	130	144	160	136	125	NA
480	80_480I	119	132	160	124	125	NA
690	80_690I	83	92	100	87	80	NA
208	80_208O	NA	NA	NA	NA	NA	287
230	80_230O	NA	NA	NA	NA	NA	260
380	80_380O	NA	NA	NA	NA	NA	157
400	80_400O	NA	NA	NA	NA	NA	149
415	80_415O	NA	NA	NA	NA	NA	144
440	80_440O	NA	NA	NA	NA	NA	136
480	80_480O	NA	NA	NA	NA	NA	124
690	80_690O	NA	NA	NA	NA	NA	87

11.7

Table 30: 90-100 kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com- bined*	Rectifier input			Bypass input		UPS out- put Rated current [A]
		Rated current [A]	Maxi- mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	90_380	170	171	200	137	160	137
400	90_400	161	171	200	130	160	130
415	90_415	156	171	200	125	125	125
440	90_440	147	153	160	118	125	188
480	90_480	134	137	160	108	125	108
380	100_380	176	190	200	152	160	152
400	100_400	168	190	200	144	160	144
415	100_415	162	190	200	139	160	139
440	100_440	152	170	200	131	160	131
480	100_480	140	150	200	120	160	120
208	100_208I	336	381	400	278	315	NA
230	100_230I	304	344	400	251	315	NA
380	100_380I	184	208	200	152	160	NA
400	100_400I	175	198	200	144	160	NA
415	100_415I	168	191	200	139	160	NA
440	100_440I	159	180	200	131	160	NA
480	100_480I	145	165	200	120	160	NA
690	100_690I	101	115	125	84	100	NA
208	100_208 O	NA	NA	NA	NA	NA	278
230	100_230 O	NA	NA	NA	NA	NA	251
380	100_380 O	NA	NA	NA	NA	NA	152
400	100_400 O	NA	NA	NA	NA	NA	144
415	100_415 O	NA	NA	NA	NA	NA	139
440	100_440 O	NA	NA	NA	NA	NA	131

Rated voltage [V]	Com-bined*	Rectifier input			Bypass input		UPS out-put Rated current [A]
		Rated current [A]	Maximum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
480	100_480 O	NA	NA	NA	NA	NA	120
690	100_690 O	NA	NA	NA	NA	NA	84

11.8

Table 31: 120-200 kW: Rated and maximum currents for rated power and voltage, fuse sizes

Rated voltage [V]	Com-bined*	Rectifier input			Bypass input		UPS out-put Rated current [A]
		Rated current [A]	Maximum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
380	120_380	217	228	250	182	200	182
400	120_400	206	228	250	173	200	173
415	120_415	199	228	250	167	200	167
440	120_440	188	179	250	157	160	157
480	120_480	172	186	200	144	160	144
380	150_380	265	285	315	228	250	228
400	150_400	252	285	315	217	250	217
415	150_415	242	285	315	209	250	209
440	150_440	229	255	315	197	200	197
480	150_480	210	225	250	180	200	180
380	160_380	290	304	315	243	250	243
400	160_400	275	304	315	231	250	231
415	160_415	265	304	315	223	250	223
440	160_440	250	204	315	210	250	210
480	160_480	229	245	250	192	200	192
380	200_380	353	380	400	304	315	304
400	200_400	335	380	400	289	315	289
415	200_415	323	380	400	278	315	278
440	200_440	305	340	400	262	315	262

Rated voltage [V]	Com-bined*	Rectifier input			Bypass input		UPS out-put Rated current [A]
		Rated current [A]	Maxi-mum current [A]	Fuse [A]	Rated current [A]	Fuse [A]	
480	200_480	279	300	315	241	250	241



Powering Business Worldwide

Eaton Power Quality Oy
Koskelontie 13
FI-02920 Espoo, Finland
www.eaton.eu

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