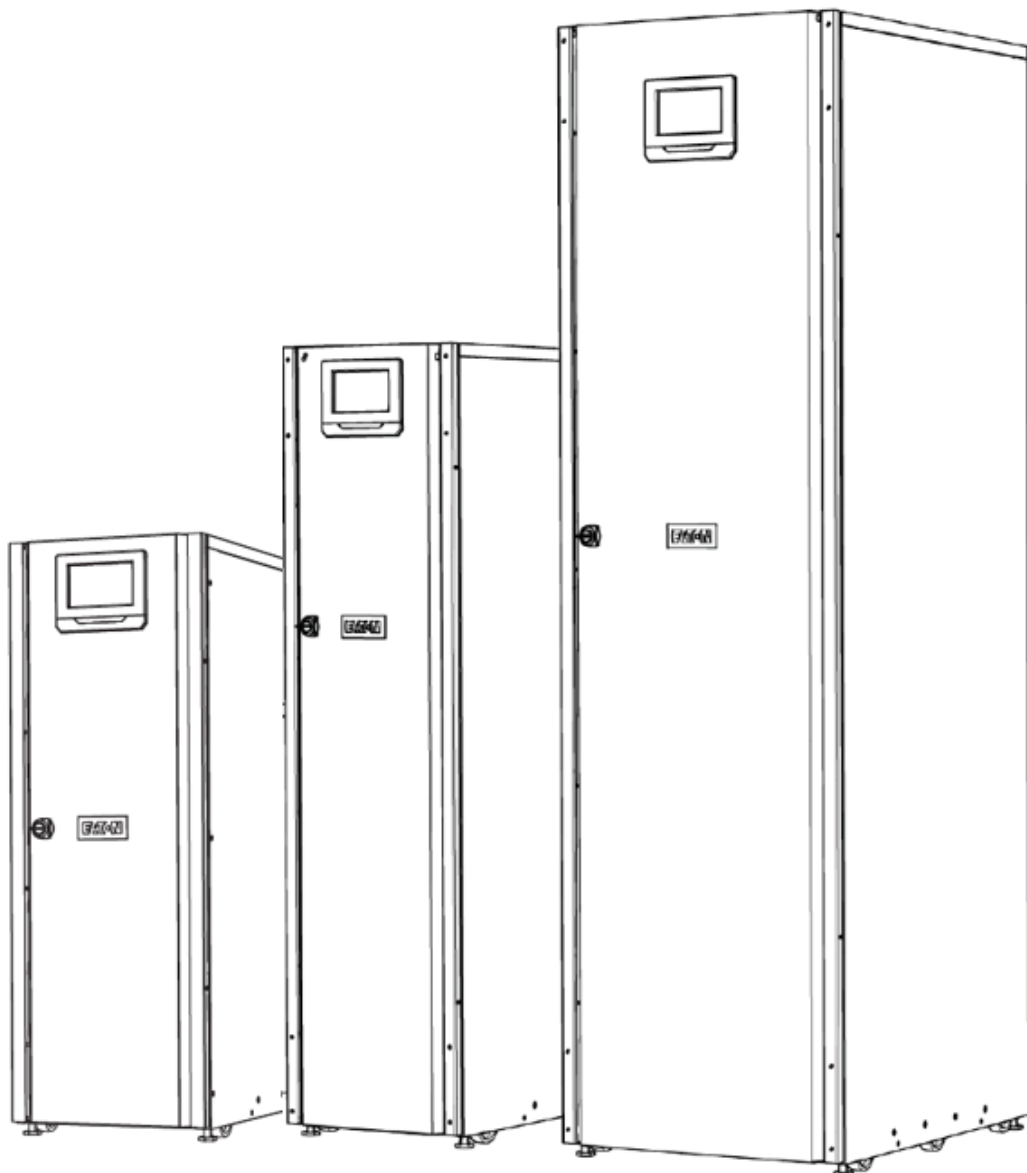




Powering Business Worldwide

LoadStar-PS User and Installation Manual

Manual: P-164001279 EN – rev.2



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

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1 How to read this manual

1.1 Safety-related signs



DANGER

DANGER indicates a hazard with a high level of risk which, if not avoided, may 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 the equipment.



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 the equipment.

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

1.2 Symbols and abbreviations

Hazard symbols

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



General warning sign



Explosion and fire hazard



Battery hazard



Corrosive hazard



Electrical hazard

Prohibited action symbols

These symbols are used in warnings and notifications to indicate an action that should not be taken. The prohibited action symbols are shown below.



No smoking



Limited or restricted access



General symbol for prohibited action



Do not touch

Mandatory action symbols

These symbols are used in warnings and notifications to indicate an action that must be taken. The mandatory action symbols are shown below.



Wear eye protection



General symbol for mandatory action



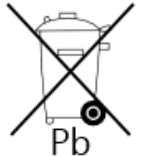
Read the manual or instructions



Disconnect from power source



First aid



Batteries marked with this sign must be recycled

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

The following acronyms are used in Eaton documentation to refer to Eaton LoadStar-PS products or their parts.

Table 1. Glossary of acronyms

| | |
|-------------|---|
| ABM | Advanced Battery Management |
| EAA | Energy Advanced Architecture (ESS, VMMS, ABM) |
| BIB | Bypass Input Breaker |
| BIS | Bypass Input Switch |
| EBC | External Battery Cabinet |
| EPO | Emergency Power-Off |
| ESS | Energy Saver System |
| IPM | Intelligent Power Manager |
| IPP | Intelligent Power Protector |
| MBP | Maintenance Bypass |
| MBS | Maintenance Bypass Switch |
| MIS | Maintenance Isolation Switch |
| MOB | Module Output Breaker |
| REPO | Remote Emergency Power-Off |
| RIS | Rectifier Input Switch |
| SCR | Silicon-Controlled Rectifier |
| STSW | Static Switch |
| UPM | Uninterruptible Power Module |

2 Safety instructions

2.1 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 LoadStar-PS and the batteries. Read all the instructions before operating the equipment.

Keep this manual for future reference. These instructions are also available for download at www.eaton.com/xxxxxxx



DANGER

Operations inside the LoadStar-PS must be performed by an authorized Eaton Field Service Engineer or by other qualified service personnel authorized by Eaton. There are no user-serviceable parts inside the LoadStar-PS.

The LoadStar-PS operates with mains, battery or bypass power. It contains components that carry high currents and voltage. A properly installed enclosure is earthed and IP20 rated against electrical shock and foreign objects. However, the LoadStar-PS is a sophisticated power system and only qualified personnel can install and service it.



DANGER

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



WARNING

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

The ambient temperature must not exceed 40 °C (104 °F, non-condensing conditions). Do not operate the LoadStar-PS near water or excessive humidity (95% relative humidity 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 may come from multiple sources. Also ensure system grounding / PE continuity. In a parallel system, the output terminals may be energized even when the LoadStar-PS is turned off.



WARNING

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

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. Batteries may contain HIGH VOLTAGES, and CORROSIVE, TOXIC and EXPLOSIVE substances. Because of the battery string the output receptacles may carry high voltage even when the AC supply is not connected to the LoadStar-PS. Read the shutdown instructions carefully.

IMPORTANT: The battery may 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 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 LoadStar-PS is in the Battery mode. Make sure that your replacement batteries are of the same number and type as the battery that was originally installed in the LoadStar-PS. See more accurate instructions on the LoadStar-PS. 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 dispose of 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 LoadStar-PS door closed and the front panels installed. Do not install or operate the LoadStar-PS system close to gas or electric heat sources. Keep the operating environment within the parameters stated in this document.



CAUTION

Keep the surroundings of the LoadStar-PS uncluttered, clean, and free from excess moisture. Obey all DANGER, CAUTION, and WARNING notices affixed to the equipment.

2.2 Audience

The intended audience of this document are as follows:

- People who plan and do the installation of the LoadStar-PS
- People who use the LoadStar-PS

This document provides guidelines for how to examine the LoadStar-PS delivery and how to install and operate the LoadStar-PS.

The reader is expected to 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 work on the LoadStar-PS.

2.3 CE Marking

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

- LVD Directive (Safety) 2014/35/EU
- EMC Directive 2014/30/EU
- RoHS Directive 2011/65/EU

Declarations of conformity with harmonized standards and directives EN 62040-1 (Safety), EN 62040-2 (EMC) and EN 63000 (RoHS) are available at www.eaton.com or by contacting your nearest Eaton office or authorized partner.

2.4 User precautions

The only permitted user operations are as follows:

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

Follow the precautions and only perform the described operations. Any deviation from the instructions can be dangerous to the user 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. Failure to recognize the electrical hazards can prove fatal.



CAUTION

The LoadStar-PS can be placed both in residential and commercial or industrial environments. When included in a residential environment, this product may cause radio interference, in which case you may have to take additional preventive measures.

2.5 Environment

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

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

To maximize internal battery service lifetime, the recommended operating temperature range is from +20 °C to +25 °C.



WARNING

During charge, float charge, heavy discharge, and overcharge, hydrogen and oxygen gases are emitted from lead-acid and NiCad 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 LoadStar-PS location. Regulation may change country by country, always refer to local regulation and rules to define the required air flow.

2.6 Symbols on the LoadStar-PS and accessories

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



RISK OF ELECTRIC SHOCK

Indicates that a risk of electric shock is present and the associated warning should be observed.



CAUTION: REFER TO OPERATOR'S MANUAL

Refer to your operator's manual for additional information, such as important operating and maintenance instructions.



This symbol indicates that you may not discard the LoadStar-PS or the LoadStar-PS 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.



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.

2.7 For more information

Address any inquiries about the LoadStar-PS and the battery cabinets to the local Eaton office or authorized distributor. Quote the type code and the serial number of the equipment.

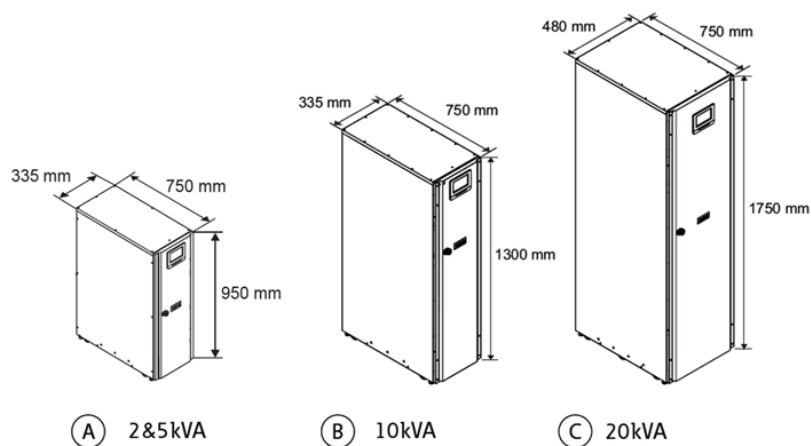
Contact your local service representative if you need help with any of the following.

- 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

3 Introduction to Eaton LoadStar-PS

3.1 About the Eaton LoadStar-PS

Picture 1. The three different housings of LoadStar-PS



LoadStar-PS is a range of central power systems (CPS) designed to feed emergency lighting systems. The range includes four units with 2, 5, 10 and 20 kVA supplied with or without internal batteries and connected with external batteries cabinets (when needed).

Internal and external batteries are selected based on the load and the duration needed.

The range is designed to meet the requirements of the standard EN50171:2001

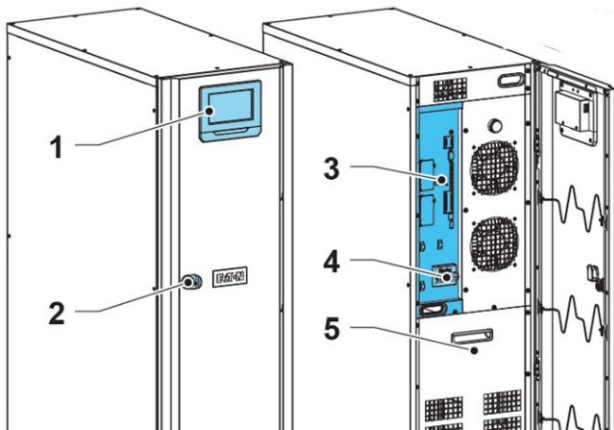
Table 2. LoadStar-PS table of ratings

| Rating | Cabinet (illustration 1) | Number of UPM (Power modules) |
|-------------|-----------------------------|----------------------------------|
| 2 kVA / kW | Type A | 1 |
| 5 kVA / kW | Type A | 1 |
| 10 kVA / kW | Type B | 1 |
| 20 kVA / kW | Type C | 2 |

NOTE: Startup and operational checks must be done by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton, or the terms specified in the Warranty (see 10.1 General information about warranty) become void. This service is offered as part of the sales contract for the LoadStar-PS. Contact service in advance (usually a two-week notice is required) to reserve a preferred startup date.

3.2 Looking inside the LoadStar-PS system

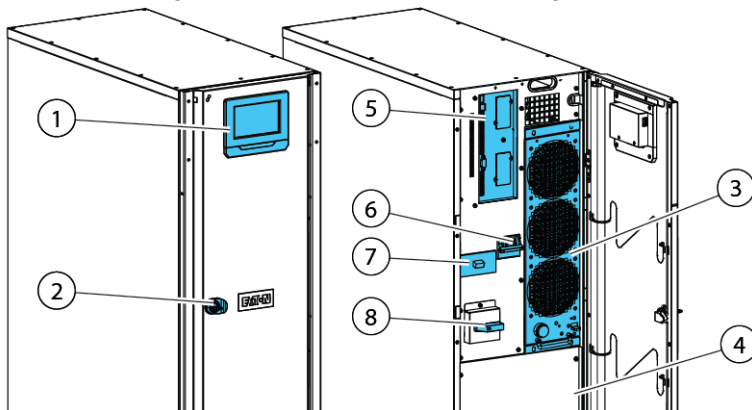
Picture 2. Looking inside the 2/5 kVA variants – housing Type A



Main parts for 2/5 kVA systems:

1. Control panel (HMI)
2. Door latch
3. Communications area
4. Battery breaker
5. Internal battery area

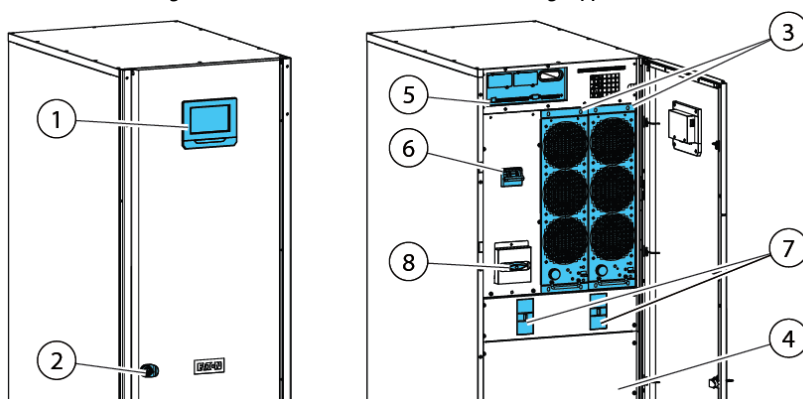
Picture 3. Looking inside the 10 kVA variant – housing Type B



Main parts for 10 kVA system:

1. Control panel (HMI)
2. Door latch
3. Power module (UPM)
4. Internal battery area
5. Communications area
6. Input switch (optional in some regions)
7. Battery breaker for internal batteries
8. Maintenance bypass switch (optional)

Picture 4. Looking inside the 20 kVA variant – housing Type C



Main parts for 20 kVA system:

1. Control panel (HMI)
2. Door latch
3. Power modules (UPM)
4. Internal battery area
5. Communications area
6. Input switch (optional in some regions)
7. Battery breaker for internal batteries
8. Maintenance bypass switch (optional)

The system level static bypass in the LoadStar-PS cabinet determines the attainable output power of the LoadStar-PS. The static bypass line consists of a static switch and a back-feed 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 LoadStar-PS. 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 can operate and share the load independently, despite the status of the other UPMs.

In addition, the system can have an internal maintenance bypass switch as a factory-installed option.

Table 3. LoadStar-PS available configurations

| Part number | Description | Rating | Internal battery |
|-------------|--------------------------------|--------|-------------------------|
| LSPS1P2KB0 | LoadStar-PS 2KVA 1ph NO BATT | 2 kVA | No internal batteries |
| LSPS1P5KB0 | LoadStar-PS 5KVA 1ph NO BATT | 5 kVA | No internal batteries |
| LSPS3P10KB0 | LoadStar-PS 10KVA 3ph NO BATT | 10 kVA | No internal batteries |
| LSPS3P10KB1 | LoadStar-PS 10KVA 3ph 1x9-LL-8 | 10 kVA | 1 string 32 blocks 9Ah |
| LSPS3P10KB2 | LoadStar-PS 10KVA 3ph 2x9-LL-8 | 10 kVA | 2 strings 32 blocks 9Ah |
| LSPS3P20KB0 | LoadStar-PS 20KVA 3ph NO BATT | 20 kVA | No internal batteries |
| LSPS3P20KB3 | LoadStar-PS 20KVA 3ph 3x9-LL-8 | 20 kVA | 3 strings 32 blocks 9Ah |
| LSPS3P20KB4 | LoadStar-PS 20KVA 3ph 4x9-LL-8 | 20 kVA | 4 strings 32 blocks 9Ah |

**WARNING**

Hazardous voltage can exist in the battery circuit until disconnected from external battery source.

In the 20 kVA unit, the two UPMs are paralleled internally.

The rectifier input switch and battery breaker are available as standard for all the models.

If utility power is interrupted or falls outside the parameters specified in *Chapter 9.1 About technical data*, the unit uses a backup battery supply to maintain power to the emergency lighting load for a specified period of time or until the utility power returns. The unit bypass consists of a continuous-duty static switch and a backfeed protection isolation device. All the models also include an internal fuse in the bypass line. The backfeed protection and bypass fuse are located in series with the static switch.

3.3 LoadStar-PS operating modes

The LoadStar-PS operating modes are as follows:

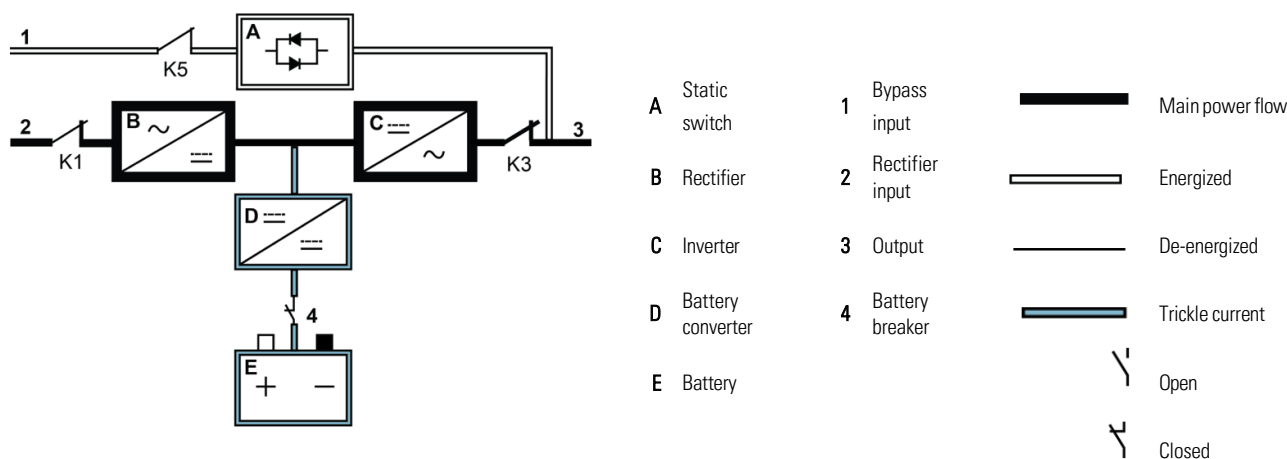
| Operating mode | Description |
|---|---|
| Normal operating modes: | |
| Double conversion mode | Emergency lighting is supplied by the inverter, which derives its power from rectified utility AC power. In this mode, the battery charger also provides charging current for the battery, if needed. |
| Variable Module Management System (VMMS) mode | Emergency lighting 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 LoadStar-PS system is able to optimise the load level per power module: the operating efficiency is significantly improved when operating load is below 50 % of LoadStar-PS capacity. The LoadStar-PS system will automatically place the redundant power modules to suspended mode. In case of any anomalies in utility or a sudden load increase, the suspended power modules can transfer to online mode with less than 2 ms transition time. |
| Energy Saver System (ESS) mode | Emergency lighting 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 LoadStar-PS in the ESS mode increases system efficiency up to 99 %, allowing significant savings in energy losses without compromising system reliability |
| Battery mode (emergency operation) | Energy is drawn from a DC safety source (batteries) and converted to AC power by the LoadStar-PS 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 | Emergency lighting is supported directly by utility power through the LoadStar-PS static switch. |

3.3.1 Normal operating modes

This is a LoadStar-PS with several normal operating modes: Double conversion, Double conversion with VMMS, and ESS with double conversion on-demand. During normal LoadStar-PS operation, power for the system is derived from a utility input source. Unit Online, Unit Online VMMS, or Unit Online ESS is displayed on the front panel, indicating that the incoming power is within voltage and frequency acceptance windows.

3.3.1.1 Double conversion mode

Figure 4: Path of current through the LoadStar-PS in the double conversion mode.



Single-/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 LoadStar-PS 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 LoadStar-PS and ready to support the inverter should the utility input become unavailable.

The inverter produces a single-/three-phase AC output to the emergency lighting. 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 LoadStar-PS automatically switches to the battery mode to support the emergency lighting without interruption. When utility power returns, the LoadStar-PS returns automatically to the double conversion mode.

If the LoadStar-PS becomes overloaded or unavailable, the LoadStar-PS seamlessly switches to the bypass mode and continues supplying the load through the static bypass. The LoadStar-PS 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 LoadStar-PS suffers an internal failure, the remaining UPMs continue to support the load in the double conversion mode. The LoadStar-PS is automatically internally redundant when the LoadStar-PS is not operating at full load. However, if internal redundancy between the UPMs is not possible due to high load, the LoadStar-PS switches automatically to the bypass mode and remains in that mode until the failure is corrected and the LoadStar-PS is back in operation.

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

3.3.1.2 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 LoadStar-PS status indicated on the display is `Unit Online VMMS` and the UPM status is `Active`.

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

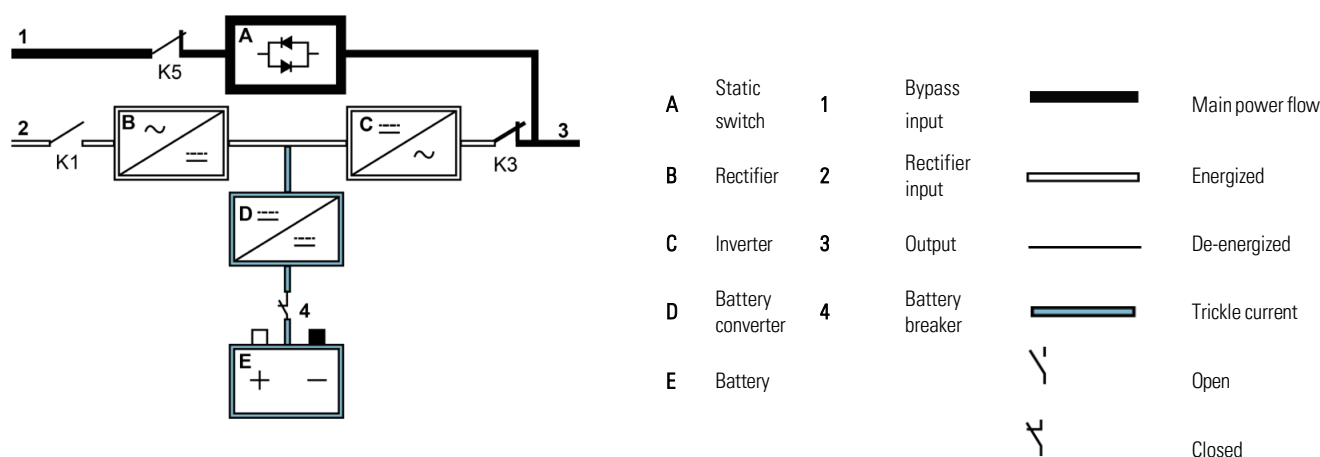
The remaining UPMs are ready to switch to online mode instantaneously if the load increases. The load will remain protected by double conversion LoadStar-PS the entire time, even during and after a load step.

It is possible to configure VMMS mode to always include power module redundancy, so that several 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 relays 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 can start instantaneously: the 2 ms activation is practically seamless.

3.3.1.3 Energy Saver System mode

Figure 5: Path of current through the LoadStar-PS in the Energy Saver System (ESS) mode.



In the ESS mode, the LoadStar-PS safely provides mains current directly to the load when the input is within the acceptable limits by its voltage and frequency. The LoadStar-PS status indicated on the display is `Unit Online ESS`, and the UPM status is `Active`. In case any disturbances are detected in the incoming power, the LoadStar-PS switches to the double conversion mode and continues to supply the emergency lighting through its inverter. In case of a complete utility outage or if the input power is outside the tolerances of the system, the LoadStar-PS transfers to the battery mode and continues to supply conditioned, clean power to the emergency lighting.

When operating in the ESS mode, the LoadStar-PS'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.

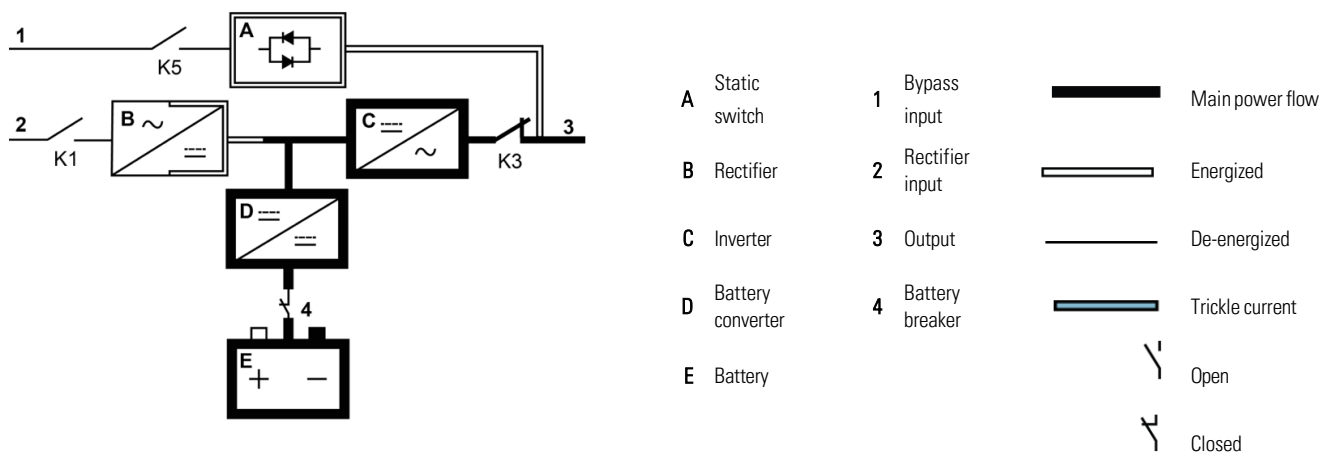
When the power conditions are within acceptable limits, the LoadStar-PS operates as a high efficiency, energy- saving system, providing surge protection for IT equipment and making sure that clean power is delivered to the facility. The energy saver system increases system efficiency up to 99 % when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

ESS mode is automatically activated when the battery is 100% charged and the input voltage is stable.

3.3.1.4 Battery mode (emergency operation)

When running normally in the double conversion or ESS mode, the LoadStar-PS automatically transfers to supply the load from batteries if a power outage occurs, or if the input voltage does not conform to the specified parameters. The LoadStar-PS 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 6: Path of current through the LoadStar-PS in the battery mode (emergency operation).



During a 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 LoadStar-PS 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 LoadStar-PS static bypass is supplied from the same source as the LoadStar-PS rectifier, the back-feed 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 the battery deep discharge level is reached where the inverter output can no longer support the connected loads. The LoadStar-PS issues a Deep Discharge (Low Battery) alarm to indicate that the battery voltage level is running low. The LoadStar-PS continues to discharge the batteries until the battery voltage reaches the threshold level of the Low Battery alarm. If the bypass is available, the LoadStar-PS transfers the load to the static bypass switch when the Battery DCUV Trip Imminent alarm activates.

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

3.3.1.5 Bypass mode

**CAUTION**

In bypass mode Emergency Lighting is powered directly from the bypass input but in case of mains failure the system will not switch to battery mode (emergency operation).

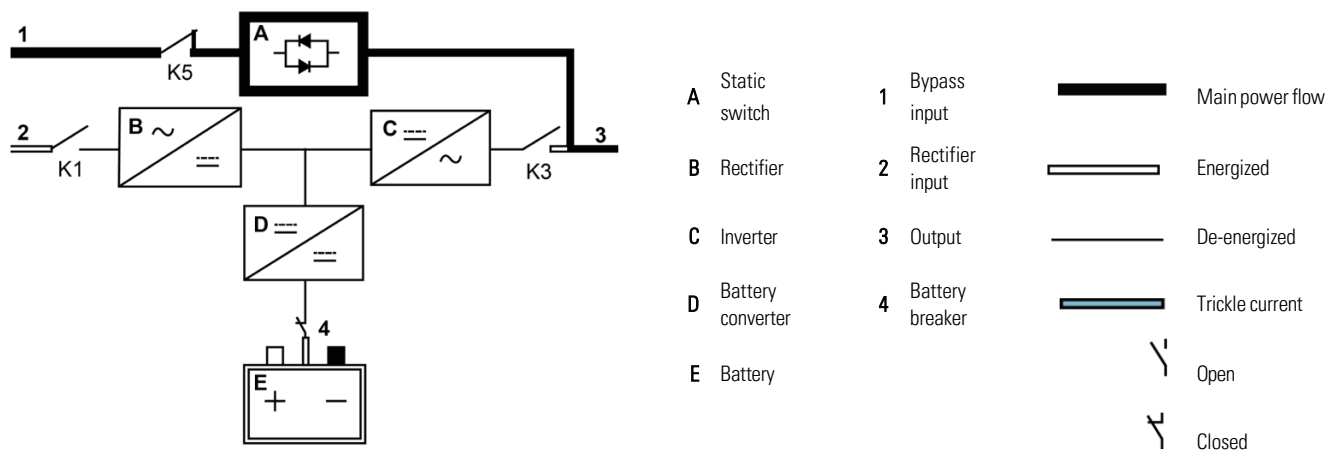
The bypass mode is intended to be used only in case of maintenance, for example when replacing batteries, to keep the luminaires on.

During the bypass mode the building should be empty or non-operative and the building safety manager should be informed by the operator before activating the bypass mode.

The LoadStar-PS 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 LoadStar-PS can also be commanded to transfer to the bypass mode manually through the display.

The LoadStar-PS status indicated on the display is *On Bypass*. The system will return 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 will not clear by itself (for example LoadStar-PS internal failure), the LoadStar-PS will remain on bypass operation.

Figure 7: Path of current through the LoadStar-PS in the bypass mode.



In the bypass mode, the output of the system is provided with AC power directly from the bypass input. While in this mode, the output of the system is not protected from voltage or frequency fluctuations or power outages. Some power line filtering and transient protection is provided 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 back-feed 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 back-feed 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 back-feed protection is normally always closed, ready to support the static switch unless the bypass input source becomes unavailable.

3.4 LoadStar-PS features

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

3.4.1 Advanced Battery Management (ABM)

The Advanced Battery Management (ABM) technology uses sophisticated sensing circuitry and a three-stage charging technique that extends the useful service life of LoadStar-PS batteries while optimizing the battery recharge time. The LoadStar-PS 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 LoadStar-PS battery charger enters the float stage and the charger operates in the constant voltage mode.

The rest mode begins at the end of the float 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.

3.4.2 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 three-phase LoadStar-PSs, 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 LoadStar-PS 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.

3.5 Battery system

The battery system provides backup power to the emergency lighting luminaires in case brownouts, blackouts, and other power interruptions. By default, unit is configured to use VRLA batteries. If other type of batteries need to be connected, consult a certified service technician prior to proceeding with the installation.

The Eaton LoadStar-PS systems could be equipped with internal or external batteries to provide full load runtime depending on the load rating. For detailed battery specifications, see *Chapter 9.1 About technical data*.

Battery part numbers and configuration

For a proper system and battery configuration, pls select the required kW load (from 1 to 20kW) and the duration needed (from 60 to 180 minutes), then select the LoadStar-PS unit, internal batteries and external batteries.

Example 1: 5kW 3h system: LoadStar-PS unit LSPS1P5KB0 + internal batteries P-103003010-002 + external batteries, one cabinet P-105000084-002

Example 2: 16kW 1h system: LoadStar-PS unit LSPS3P20KB3 (internal batteries are already included) + external batteries, one cabinet P-105000084-002

Internal batteries

| Part number | Model | Weight (net/gross) |
|-----------------|--|--------------------|
| P-103003010-002 | KIT INTERNAL BATTERY STRING (32x9AH Long Life 10y EN50171) | 50 / 60 kg |

External battery cabinets

| Part number | Model | Housing | Batteries | Weight (net/gross) |
|-----------------|------------------------------------|---------|-------------------------|--------------------|
| P-105000111-002 | BATTERY SIDECAR 1x32 9AHLL | Sidecar | 1 string (32x9Ah) | 103 / 130 kg |
| P-105000041-006 | EBC-A-2x32-9AHLL-BB-63A | EBC-A | 2 strings (32x9Ah) | 247 / 268 kg |
| P-105000041-007 | EBC-A-3x32-9AHLL-BB-63A | EBC-A | 3 strings (32x9Ah) | 328 / 349 kg |
| P-105000084-002 | EBC-B-1x32-CSBHRL12200W-BB-63A-M6 | EBC-B | 1 string (32xHRL12200W) | 706 / 733 kg |
| P-105000017-004 | EBC-C-1x36-CSBHRL12200W-BB-200A-M6 | EBC-C | 1 string (36xHRL12200W) | 795 / 822 kg |
| P-105000017-010 | EBC-C-1x40-CSBHRL12200W-BB-200A-M6 | EBC-C | 1 string (40xHRL12200W) | 865 / 892 kg |



IMPORTANT

According to EN50171 chapter 6.14.3.f “Equipment marking”, during the system commissioning, the operator must write (using a permanent marker) the battery type and the number of cells on the specific field of the system label.

System and battery configuration

| Rating and duration required | | LoadStar-PS units | | | Internal batteries | | External batteries and q.ty required | |
|------------------------------|----------------|-------------------|-----------------------------------|-------------|------------------------|-----------------|--------------------------------------|---------------|
| System kVA | Duration (min) | Unit (kVA) | Max load (W) for rated duration** | Unit P/N | Internal batteries P/N | | External batteries P/N | Q.ty required |
| 1 | 60 | 2 | 950 | LSPS1P2KB0 | to be added | P-103003010-002 | not needed | N/A |
| | 90 | | 950 | LSPS1P2KB0 | to be added | P-103003010-002 | not needed | N/A |
| | 120 | | 950 | LSPS1P2KB0 | to be added | P-103003010-002 | P-105000111-002 | 1 |
| | 180 | | 950 | LSPS1P2KB0 | to be added | P-103003010-002 | P-105000111-002 | 1 |
| 2 | 60 | | 1900 | LSPS1P2KB0 | to be added | P-103003010-002 | P-105000111-002 | 1 |
| | 90 | | 1900 | LSPS1P2KB0 | to be added | P-103003010-002 | P-105000111-002 | 1 |
| | 120 | | 1900 | LSPS1P2KB0 | not needed | | P-105000041-007 | 1 |
| | 180 | | 1900 | LSPS1P2KB0 | not needed | | P-105000041-007 | 1 |
| 4 | 60 | | 3800 | LSPS1P5KB0 | not needed | | P-105000041-007 | 1 |
| | 90 | | 3800 | LSPS1P5KB0 | to be added | P-103003010-002 | P-105000041-007 | 1 |
| | 120 | | 3749 | LSPS1P5KB0 | to be added | P-103003010-002 | P-105000041-007 | 1 |
| | 180 | | 3800 | LSPS1P5KB0 | not needed | | P-105000084-002 | 1 |
| 5 | 60 | | 4750 | LSPS1P5KB0 | not needed | | P-105000041-007 | 1 |
| | 90 | | 4750 | LSPS1P5KB0 | to be added | P-103003010-002 | P-105000041-007 | 1 |
| | 120 | | 4687 | LSPS1P5KB0 | not needed | | P-105000041-006 + P-105000041-007 | 1 |
| | 180 | | 4750 | LSPS1P5KB0 | to be added | P-103003010-002 | P-105000084-002 | 1 |
| 6 | 60 | | 5700 | LSPS3P10KB1 | included in the unit | | P-105000041-007 | 1 |
| | 90 | | 5700 | LSPS3P10KB2 | included in the unit | | P-105000041-007 | 1 |
| | 120 | | 5700 | LSPS3P10KB0 | not needed | | P-105000084-002 | 1 |
| | 180 | | 5700 | LSPS3P10KB2 | included in the unit | | P-105000084-002 | 1 |
| 8 | 60 | | 7600 | LSPS3P10KB2 | included in the unit | | P-105000041-007 | 1 |
| | 90 | | 7600 | LSPS3P10KB0 | not needed | | P-105000084-002 | 1 |
| | 120 | | 7600 | LSPS3P10KB2 | included in the unit | | P-105000084-002 | 1 |
| | 180 | | 7600 | LSPS3P10KB0 | not needed | | P-105000084-002 | 2 |
| 10 | 60 | | 9500 | LSPS3P10KB0 | not needed | | P-105000084-002 | 1 |
| | 90 | | 9500 | LSPS3P10KB2 | included in the unit | | P-105000084-002 | 1 |
| | 120 | | 9500 | LSPS3P10KB0 | not needed | | P-105000084-002 | 2 |
| | 180 | | 9500 | LSPS3P10KB2 | included in the unit | | P-105000084-002 | 2 |
| 12 | 60 | | 11400 | LSPS3P20KB0 | not needed | | P-105000017-004 | 1 |
| | 90 | | 11400 | LSPS3P20KB3 | included in the unit | | P-105000084-002 | 1 |
| | 120 | | 11400 | LSPS3P20KB0 | not needed | | P-105000084-002 | 2 |
| | 180 | | 11400 | LSPS3P20KB0 | not needed | | P-105000084-002 | 3 |
| 14 | 60 | | 13300 | LSPS3P20KB0 | not needed | | P-105000017-010 | 1 |
| | 90 | | 13300 | LSPS3P20KB0 | not needed | | P-105000084-002 | 2 |
| | 120 | | 13300 | LSPS3P20KB0 | not needed | | P-105000017-004 | 2 |
| | 180 | | 13300 | LSPS3P20KB0 | not needed | | P-105000017-004 | 3 |
| 16 | 60 | | 15200 | LSPS3P20KB3 | included in the unit | | P-105000084-002 | 1 |
| | 90 | | 15200 | LSPS3P20KB0 | not needed | | P-105000084-002 | 2 |
| | 120 | | 15200 | LSPS3P20KB0 | not needed | | P-105000017-010 | 2 |
| | 180 | | 15200 | LSPS3P20KB0 | not needed | | P-105000017-010 | 3 |
| 18 | 60 | | 17100 | LSPS3P20KB4 | included in the unit | | P-105000084-002 | 1 |
| | 90 | | 17100 | LSPS3P20KB3 | included in the unit | | P-105000084-002 | 2 |
| | 120 | | 17100 | LSPS3P20KB0 | not needed | | P-105000084-002 | 3 |
| | 180 | | 17100 | LSPS3P20KB0 | not needed | | P-105000084-002 | 4 |
| 20 | 60 | | 19000 | LSPS3P20KB0 | not needed | | P-105000084-002 | 2 |
| | 90 | | 19000 | LSPS3P20KB0 | not needed | | P-105000017-010 | 2 |
| | 120 | | 19000 | LSPS3P20KB0 | not needed | | P-105000017-004 | 3 |
| | 180 | | 19000 | LSPS3P20KB0 | not needed | | P-105000017-004 | 4 |

* Only 2 and 5 kVA require a separate order for internal batteries, 10 and 20 kVA units already includes internal batteries

** In accordance with EN50171, battery aging factor of 1,25 is already considered.

4 LoadStar-PS installation plan and unpacking

4.1 About LoadStar-PS installation

Use the following basic sequence of steps to install the LoadStar-PS:

1. Create an installation plan for the LoadStar-PS system.
2. Prepare your site for the LoadStar-PS system.
3. Inspect and unpack the LoadStar-PS cabinet.
4. Unload and install the LoadStar-PS cabinet and wire the system.
5. Complete the installation checklist provided in Section 4.3 Installation checklist.
6. Have authorized service personnel perform the preliminary operational checks and startup.

NOTE: Startup and operational checks must be performed by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton, or the terms specified in the Warranty (see Chapter 10.2 Whom to contact in case of Warranty) become void. This service is offered as a part of the sales contract for the LoadStar-PS. Contact service in advance (usually a two-week notice is required) to reserve a preferred startup date.

4.2 Create an installation plan

Before you install the LoadStar-PS system, read and understand how these instructions apply to the system that you are going to install. Use the procedures and illustrations in *Section 4.4 Site preparations* and *Section 5.1 About LoadStar-PS system installation to create a logical plan for installing the system.*

4.3 Installation checklist

| Action | Yes/No |
|--|--------|
| All packing materials and restraints are removed from each cabinet. | |
| Each cabinet in the LoadStar-PS 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 LoadStar-PS 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 LoadStar-PS to the battery breaker. | |
| There is adequate workspace around the LoadStar-PS and other cabinets. | |
| Adequate lighting is provided around all the LoadStar-PS equipment. | |
| A 230 VAC service outlet is located within 7.5 meters of the LoadStar-PS equipment. | |
| The Emergency Power-off (EPO) device is mounted in its installed location and its wiring is terminated inside the LoadStar-PS cabinet. | |
| If EPO is used in the NC configuration, a jumper is installed on the EPO between pins 3 and 4. | |
| (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 LoadStar-PS and battery cabinet. | |
| (OPTIONAL) Accessories are mounted in their installed locations and their wiring is terminated inside the LoadStar-PS cabinet. | |
| Start-up and operational checks are performed by an authorized Eaton Field Service Engineer. | |
| Battery Shunt trip and Aux contact signal wiring is connected from the LoadStar-PS to the battery breaker. | |

4.4 Site preparation

For the LoadStar-PS system to operate at peak efficiency, the installation site must meet the environmental parameters outlined in these instructions. If the LoadStar-PS 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.

4.4.1 Environmental considerations

Install the LoadStar-PS to a temperature and humidity controlled indoor area, free of conductive contaminants. Do not expose the LoadStar-PS to direct sunlight or install it near a heat source. The environmental requirements specified in Section 9.5 are for the air at the intake ports of the LoadStar-PS, and are the maximum, not to exceed, ratings.

- Do not expose the LoadStar-PS to overly aggressive environments, like salt mist or corrosive gases. High relative humidity will accelerate the effects of contaminants. LoadStar-PS should be installed in a G1 environment (based on ANSI/ISA S-71.04 classifications). Use in a more aggressive environment can lead to reduced product life and possibly early failure. If the installation location does not meet the recommended environment, contact Eaton service representative for further information.
- Do not place the LoadStar-PS near a source of dust or sand. Excessive amount of dust or sand can cause damage or lead to malfunction.

Observe caution regarding LoadStar-PS operating environmental conditions. The newer, more energy efficient data center cooling methods (such as air side economizing) can create much wider ranges of temperature and Relative Humidity (RH) in the LoadStar-PS room and/or data center. There are two aspects of this increased operating environment that can, if ignored, create issues:

- The creation of microclimates, which are persistent variations of temperature and/or RH within a single room; for example, one side of the room is always cooler than the other side, no matter what the actual temperature is.
- The rate of change of temperature and/or RH, which can occur during transitions within the cooling system. Examples: changing the mixture ratio of inside versus outside air, or external changes in the outside air when going from nighttime into day, and back to night.

When ignored, either one of these aspects can create an undesirable microclimate at the LoadStar-PS location. If the environment created by this microclimate exceeds the LoadStar-PS operating specification, the LoadStar-PS reliability is reduced over time. These same environmental extremes also create reliability concerns for any servers that are exposed to them.

4.4.2 Installation considerations

The LoadStar-PS system installation requires a TN, TT or IT power distribution system (the IT distribution system shall include a neutral wire).

The LoadStar-PS system installation must meet the following guidelines:

- The system must be installed on a level floor suitable for computer or electronic equipment. The floor must be suitable for heavy weight and wheeling.
- The cabinet can be installed in line-up-and-match or standalone configurations. If you do not obey these guidelines your warranty may become void.



CAUTION

Do not stack anything on top of the LoadStar-PS cabinet.

Do not stack the LoadStar-PS cabinet on top of any other similar cabinet(s).

If installed on a shelf, use suitable supports to prevent the LoadStar-PS from tipping or dropping.



CAUTION

If the unit is installed in an IT network, the voltage between neutral and protective earth during normal operation must be less than 50 V (AC, RMS), 71 V (AC, peak) or 120 V (DC).



CAUTION

This product can cause a DC current in the PE conductor. Where a residual current-operated protective device (RCD) is used for protection against electrical shock, only an RCD of Type B is allowed on the supply side of this product.

The LoadStar-PS equipment operating environment must meet the weight requirements shown in the table below.

| | 2 / 5 kVA (cabinet type A) | 10 kVA (cabinet type B) | 20 kVA (cabinet type C) |
|---|-------------------------------|----------------------------|----------------------------|
| Shipping weight | 92 kg | 111 kg (273 kg) | 234 kg (558 kg) |
| Installed weight | 67 kg | 90 kg (252 kg) | 208 (532 kg) |
| Floor loading | *770 kg/m ² | *1107 kg/m ² | *1478 kg/m ² |
| (Value in brackets includes maximum internal battery setup) | | | |
| *Floor loading is considering max units weight inc. batteries and battery sidecar for 2/5 kVA | | | |

The LoadStar-PS 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, see illustration 3. Allow clearance in front of and behind each cabinet for proper air circulation. Make sure that the cooling air that enters the LoadStar-PS does not exceed +40 °C.

LoadStar-PS cabinet minimum clearances

| | 2 / 5 / 10 kVA (cabinets type A / B) | 20 kVA (cabinet type C) |
|-------------------------------|---|----------------------------|
| From the top of the cabinet | 500 mm | 500 mm |
| From the front of the cabinet | 500 mm | 650 mm |
| From the back of the cabinet | 150 mm | 250 mm |
| From the side of the cabinet | 0 mm | 0 mm |

The basic environmental requirements for the operation of the LoadStar-PS system are as follows:

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

It is required that there is proper ventilation in the LoadStar-PS room. In order to keep the maximum room temperature rise at the desired level, the air flow must be sufficient and at the following levels:

- To limit the temperature rise to a maximum of +5 °C, the required air flow is 600 m³/h per 1 kW of losses.
- To limit the temperature rise to a maximum of +10 °C, the required air flow is 300 m³/h per 1 kW of losses.

An ambient temperature from +20 °C to +25 °C is recommended to achieve a long life of the LoadStar-PS and batteries. The cooling air that enters the LoadStar-PS must not exceed +40 °C. Avoid high ambient temperature, moisture, and humidity.

For ventilation requirements, see heat rejection in tables below:

| Model | Heat rejection (BTU/h x 1,000) | Heat rejection (kW) |
|---------|-----------------------------------|------------------------|
| 2/5 kVA | 1.46 | 0.4 |
| 10 kVA | 2.19 | 0.6 |
| 20 kVA | 4.38 | 1.3 |

Battery locations and enclosures must be ventilated to maintain the hydrogen concentration below the 4% vol safety limit. Adequate air ventilation must be provided to locations where the LoadStar-PS and batteries are located.

| Model | Minimum air flow | Minimum free area of opening for inlet and outlet (for natural ventilation) |
|---------|------------------|--|
| 2/5 kVA | 1,5 m³/hour | 42 cm² |
| 10 kVA | 3 m³/hour | 84 cm² |
| 20 kVA | 6 m³/hour | 168 cm² |

The table above refers to systems with internal battery only. For systems with external batteries, the ventilation air flow must be calculated according to EN62485-2.

4.4.3 LoadStar-PS system power wiring preparations

NOTE: If you install a maintenance bypass, provide one of the following:

- a minimum of 2 separate feeds with upstream feeder breakers
- a single feed with 2 upstream feeder breakers: one for the LoadStar-PS or rectifier input breaker and one for the maintenance bypass input.

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

- the maintenance bypass and the LoadStar-PS, or
- the maintenance bypass and the rectifier input breaker.

If a bypass input breaker is installed in the maintenance bypass and a single-feed LoadStar-PS is being installed, a single feed to the maintenance bypass is acceptable for supplying both the LoadStar-PS and the bypass.

When you plan and do the installation, read and understand the following notes.



WARNING

HIGH TOUCH CURRENT. EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY.

As a result of the connected loads, high leakage current is possible. Connection to earth/ground is required for safety and proper product operation.

Do not install or operate the LoadStar-PS without an earth/ground connection.

Maximum earth leakage current (valid for LoadStar-PS 20kVA)

| | | Mean (A) | Min (A) | Max (A) |
|--------------|-----------|----------|---------|---------|
| Normal mode | No load | 0,138 | 0,129 | 0,158 |
| | Full load | 0,129 | 0,106 | 0,162 |
| ESS mode | No load | 0,057 | 0,045 | 0,115 |
| | Full load | 0,062 | 0,042 | 0,083 |
| Battery mode | No load | 0,104 | 0,082 | 0,132 |
| | Full load | 0,093 | 0,079 | 0,135 |

- Refer to the national and local electrical codes for acceptable external wiring practices.
- To allow for future kVA upgrades (software and/or hardware), consider using conductors that are sized for the full bypass rating of the LoadStar-PS.
- Material and labor for external wiring requirements must be provided by designated personnel.
- For external wiring, use copper cable rated for 70 °C at minimum. See the appropriate information in Table 13: Minimum recommended multi-core cable and fuse sizes for rectifier and bypass input and LoadStar-PS output cables. (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 10/20 kVA uses four wires. The bypass feed into 2/5 kVA uses two wires. The rectifier feed uses three or four wires. The phases must be symmetrical about ground (from a Wye source) for proper equipment operation.
- The rectifier needs a neutral line from the supply that feeds the rectifier. In 2/5 kVA this neutral is connected to the bypass neutral input terminal with a wire suitable for the bypass rating of the unit.
- A readily accessible disconnect device must be incorporated in all fixed input wiring.



WARNING

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

Table 13: Minimum recommended multi-core cable and fuse sizes for rectifier and bypass input and output cables.

| LoadStar-PS rating | 2 kVA (1ph) | 5 kVA (1ph) | 10 kVA (3ph) | 20 kVA (3ph) |
|---------------------------------|---|-------------|--------------|--------------|
| Cable [mm ²] | 2.5 | 10 | 4*4 | 4*10 |
| Rectifier fuse [A] | 16 | 40 | 25 | 50 |
| Bypass fuse [A] | 16 | 40 | 25 | 50 |
| PE cable [mm ²] | 2.5 | 10 | 4 | 10 |
| Maximum conductor cross section | 2/5 kVA: solid wire 50 mm ² , stranded wire with ferrule: 35 mm ² 10 kVA: solid wire 16 mm ² , stranded wire with ferrule: 10 mm ² 20 kVA: solid wire 70 mm ² , stranded wire with ferrule: 50 mm ² | | | |



CAUTION

Make sure that prospective short-circuit current resulting at the input terminals of the LoadStar-PS is equal or less than conditional short-circuit current declared on the type plate (and technical specification) of the LoadStar-PS. Also make sure that the prospective short-circuit current meets the minimum requirements listed in Table 14: Minimum required short circuit current ratings for AC source and battery supply .

Table 14: Minimum required short circuit current ratings for AC source and battery supply.

| LoadStar-PS rating | 2 kVA / 5 kVA (1ph) | 10 kVA (3ph) | 20 kVA (3ph) |
|---|---|--------------|--------------|
| Minimum short circuit current, AC ports [A] | 630 | 320 | 630 |
| Minimum short circuit current, battery port [A] | N/A the SCPD are in the external battery cabinets | 500 | 1000 |

Table 16: Minimum recommended cable and fuse sizes for external battery bank

| LoadStar-PS rating | 2 / 5 kVA (1ph) | 10 kVA (3ph) | 20 kVA (3ph) |
|-------------------------------------|---|--------------|--------------|
| Pos. & neg. line [mm ²] | 10 | 16 | 35 |
| Battery fuse [A] | 32 | 63 | 160 |
| PE cable [mm ²] | 10 | 16 | 16 |
| Maximum conductor cross section | 2 / 5 / 10 kVA: solid wire: 25 mm ² , stranded wire with ferrule: 16 mm ² 20 kW: solid wire: 90 mm ² , stranded wire with ferrule: 70 mm ² | | |

NOTE: LoadStar-PS power upgrading is possible only if the sizing of the external cables is sufficient. Alternatively, the external cabling must be upgraded as well. Fuses are of the type gG.

Cable sizing is based on the standard IEC 60364-5-52 table B.52.2 and IEC 60364-5-54 table B.54.2. Sizing is for 70 °C rated copper cables.

When you connect external batteries to LoadStar-PS, Eaton recommends that you use the following NZM series molded case circuit breakers.

Table 17: Recommended external battery breakers

| LoadStar-PS rating | Type | Article No | Nominal battery voltage | 12V VRLA Blocks |
|--|------------|-------------------------|-------------------------|-----------------|
| 2 & 5 kVA | NZMN1-A63 | 259083 (P-122000209) | 336–384 V | 28–32 |
| | NZMH2-A63 | 259097 | 396–480 V | 33–40 |
| 10 / 20 kVA | NZMN1-A160 | 281234 (P-122000199) | 336–384 V | 28–32 |
| | NZMN2-A160 | 259092 | 396–480 V | 33–40 |
| NOTE: Maximum string length for the 91PS/93PS C-model is 32 blocks, 192 cells (384 V). | | | | |

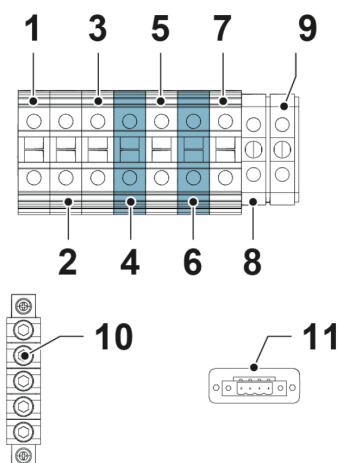
For NZM1 series breakers, use the following 24 V shunt release with early-make auxiliary contact together with the above circuit breakers.

| Type | Article No |
|--------------------|----------------------|
| NZM1-XAHIVL24AC/DC | 259792 (P-152001062) |

Table 18: Rated output power / Overload capability / Output current limitation / Fault clearing capability

| LoadStar-PS rating | 2 kVA (1ph) | 5 kVA (1ph) | 10 kVA (3ph) | 20 kVA (3ph) |
|---------------------------------|--|--|--|--|
| Rated output power | 2 kVA – 2 kW | 5 kVA – 5 kW | 10 kVA – 10 kW | 20 kVA – 20 kW |
| Overload capability on inverter | Continuous 120 % 20 min 145 % 60 sec 200 % 10 sec 400 % | Continuous 120 % 20 min 145 % 60 sec 200 % 10 sec 300 % | Continuous 120 % 20 min 145 % 60 sec 175 % 10 sec 200 % | Continuous 120 % 20 min 145 % 60 sec 175 % 10 sec 200 % |
| Overload capability ESS mode | Continuous 120% | | | |
| Output current limitation | 109 A for 300 ms | 109 A for 300 ms | 54 A for 300 ms (per phase) | 108 A for 300 ms (per phase) |
| Fault clearing capability | B20 / C10 | | B10 / C6 | B16 / C10 |

Figure 8: Power cable terminal for 2/5 kVA variants

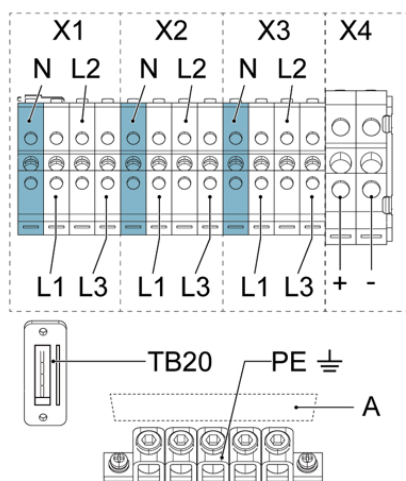


The terminals are as follows:

1. X1: rectifier input L1*
2. X1: rectifier input L2*
3. X1: rectifier input L3*
4. X1: bypass input N
5. X2: bypass input L
6. X3: LoadStar-PS output N
7. X3: LoadStar-PS output L
8. X4: external battery cable +
9. X4: external battery cable –
10. PE
11. TB20, external battery trip

*The single phase (2/5kVA) units requires a bridge between L1, L2, L3.
Single feed kits are included in the LoadStar-PS package.

Figure 9: Power cable terminal for 10 kVA variants

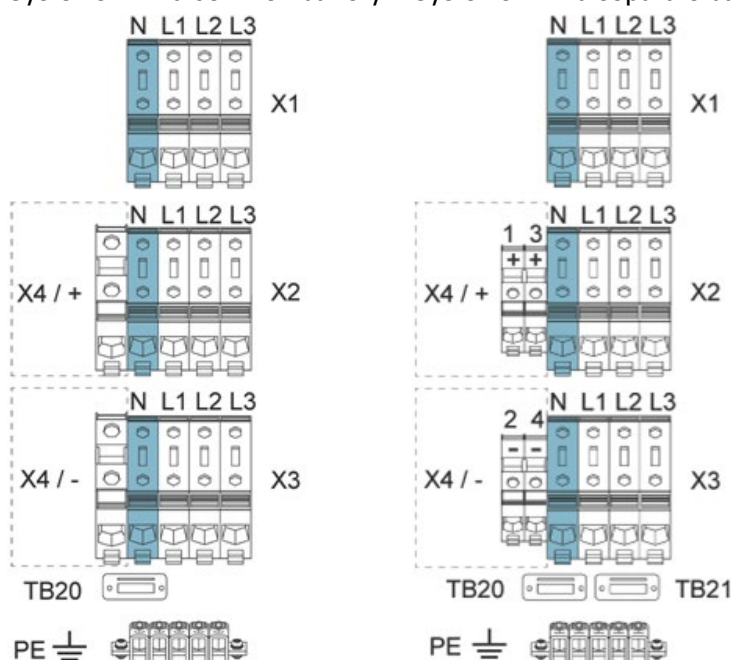


The terminals are as follows:

- X1: Rectifier input
- X2: Bypass input
- X3: LoadStar-PS output
- X4: External battery + and –
- TB20: External battery trip and aux signal (NO)
- PE: Protective earth
- A: Connection information sticker

Figure 10: Power cable terminal for 20 kVA variants

Systems with a common battery Systems with a separate battery (option)



The terminals are as follows:

- X1: Rectifier input
- X2: Bypass input
- X3: LoadStar-PS output
- X4: External battery + and – (1/2 for UPM1 and 3/4 for UPM2)
- TB20: External battery trip and aux signal (NO) for UPM1
- TB21: External battery trip and aux signal (NO) for UPM2
- PE: Protective earth

Table 19. LoadStar-PS power cable terminal torques

| LoadStar-PS (1ph) | Function | Tightening torque |
|-------------------|---------------------------|---|
| 2 / 5 kVA | L, N | 3,5 Nm |
| | Battery (+/-) | 3 Nm (Pos. & Neg. line) |
| | PE (ground) | 10 Nm for 16-35 mm ² wire (PE) 6 Nm for 4-10mm ² wire (PE) |
| LoadStar-PS (3ph) | Function | Tightening torque |
| 10 kVA | X1, X2, X3: L1, L2, L3, N | 1.6 Nm |
| | X4: battery +/- | 3 Nm |
| | PE (ground) | 10 Nm for 16-35 mm ² wire 6 Nm for 4-10 mm ² wire 4 Nm for 2.5 mm ² wire |
| 20 kVA | X1, X2, X3: L1, L2, L3, N | 6 |
| | X4: battery +/- | 6 |
| | PE (ground) | 10 Nm for 16-35 mm ² wire 6 Nm for 4-10 mm ² wire 4 Nm for 2.5 mm ² wire |

4.5 Unpack and unload the unit

The unpacking and unloading of the LoadStar-PS is shown in illustrations 3.1 - 3.8.

Before you start to unpack and unload the LoadStar-PS, check the TipNTell and DropNTell indicators on the package surface. 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 arrowhead(s) of the DropNTell indicator are black, contact the appropriate parties to report inappropriate transportation.

For transportation purposes, the LoadStar-PS cabinet is bolted onto a wooden pallet. Before you unload the cabinet from the pallet, use a forklift or other material handling equipment to move the cabinet to the installation area.



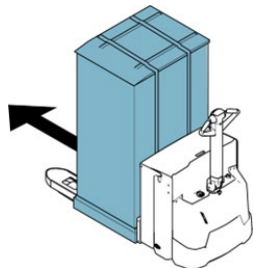
CAUTION

The LoadStar-PS cabinet is heavy. If the unpacking instructions are not closely obeyed, the cabinet may tip over and cause serious injury.

Do not tilt the LoadStar-PS cabinet more than 10 degrees from the vertical or the cabinet may tip over.

For transportation purposes, the LoadStar-PS cabinet is bolted onto a wooden pallet. To remove the pallet, do the following:

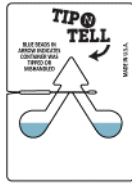
1. Before you unload the cabinet from the pallet, use a forklift or other material handling equipment to move the cabinet to the installation area. Insert the forks of the forklift between the skids on the bottom of the unit.



2. Make a visual inspection and examine that there are no signs of shipping damages. Examine the TipNTell and refer to the instructions next to the indicator on the package. The DropNTell indicator is located on the rear panel of the LoadStar-PS and can be verified after the next step.

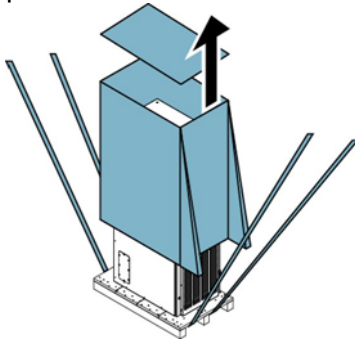


Drop N Tell

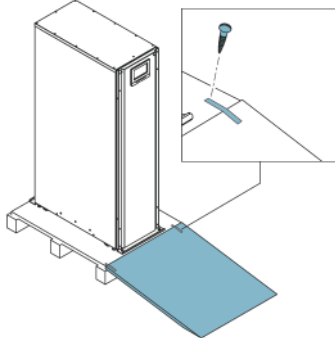


Tip N Tell

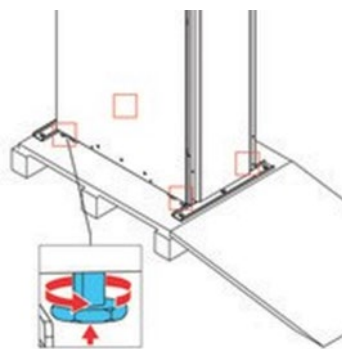
3. Open the LoadStar-PS package. The roof of the package is used as a ramp for moving the LoadStar-PS off the pallet.



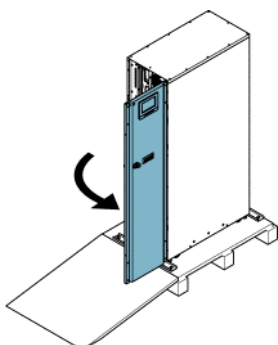
4. Place the ramp on the floor and attach it to the pallet with nails or screws so that it can be safely used for wheeling the LoadStar-PS off the pallet.



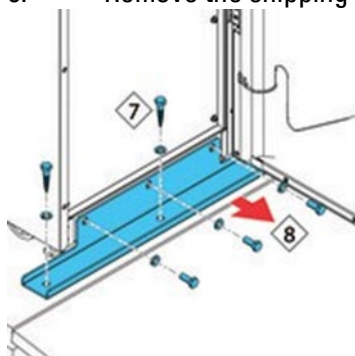
5. If the leveling feet are not fully retracted, turn them until they are retracted.



6. Open the LoadStar-PS front door.

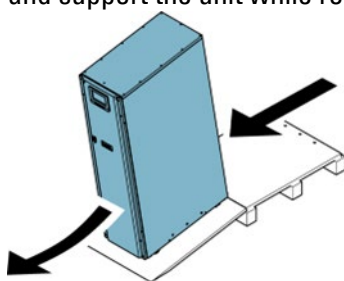


7. Remove the bolts that fasten the shipping brackets to the LoadStar-PS cabinet and to the pallet.
8. Remove the shipping brackets.



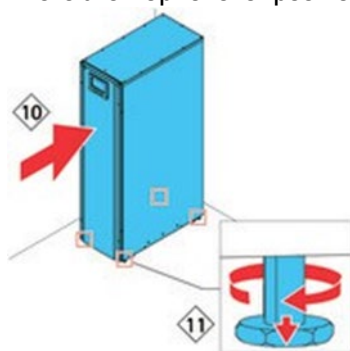
NOTE: After you have removed the shipping brackets, move the unit immediately away from the pallet. After you have removed the shipping brackets and retracted the leveling feet, do not use a forklift to move the unit while it is still on the pallet. Note that the LoadStar-PS cabinet is heavy and there 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. Note that the cabinet is heavy. Make sure that you have enough manpower to handle and support the unit while rolling it off the pallet.



10. Roll the cabinet to its final installation location.
11. To secure the LoadStar-PS cabinet in position, lower the leveling feet until the cabinet is not resting on the casters and the cabinet is level.

With the 10 kVA frame, reattach the shipping brackets to the LoadStar-PS cabinet to provide extra support. There are 2 options for positioning the shipping brackets: on both sides of the unit or 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.

5 LoadStar-PS system installation

5.1 About LoadStar-PS system installation

The operator has to supply the wiring to connect the LoadStar-PS to the local power source. The installation of the LoadStar-PS must be made by a locally qualified electrician. The electrical installation procedure is described in the following section. The installation inspection and the commissioning of the LoadStar-PS and installing an extra battery cabinet must be carried out by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton.



CAUTION

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



CAUTION

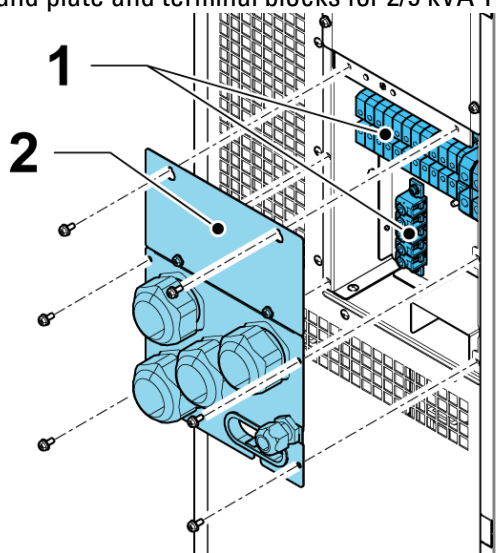
In case of condensed moisture inside the LoadStar-PS cabinet, dry the cabinet with a blower before starting up the system.

5.2 Steps to install the LoadStar-PS

Power and control wiring are routed through the rear of the cabinet with connections made to easily accessible terminals, see Figures 11 and 12 for Gland plate and terminal blocks locations for single phase and 3-phase models. To install and connect the power cabling of the external battery to the LoadStar-PS, see Section 5.3 Battery system installation.

Figure 11.

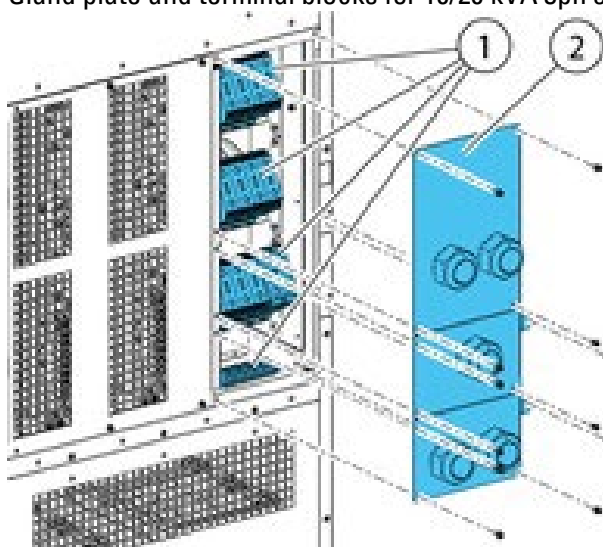
Gland plate and terminal blocks for 2/5 kVA 1ph systems



1. Terminal blocks
2. Gland plate

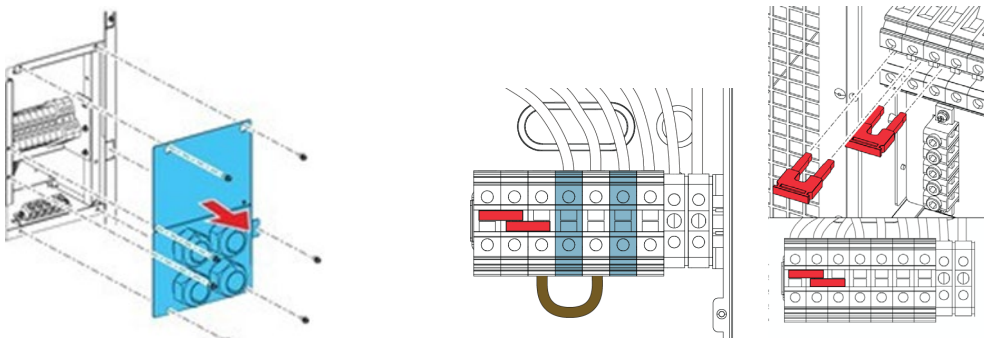
Figure 12.

Gland plate and terminal blocks for 10/20 kVA 3ph systems



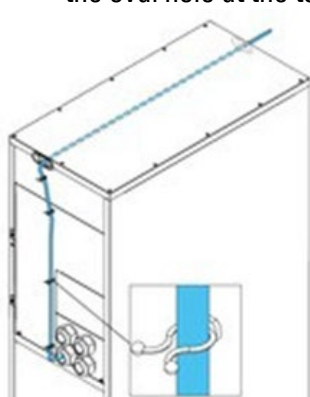
1. Terminal blocks
2. Gland plate

1. To gain access to the terminal blocks, remove the screws securing the gland plate at the back of the LoadStar-PS

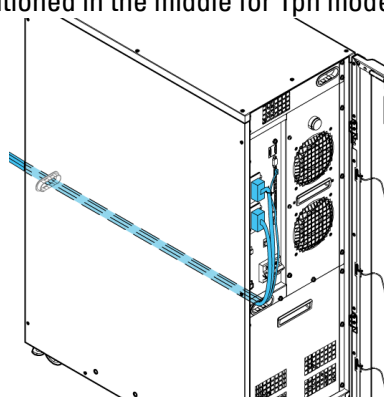


For 2/5 kVA 1ph install the additional single feed kit supplied in the box.

2. Install suitable cable glands into the gland plate.
3. Route the cables through the glands.
4. Connect the cables to the respective terminal blocks, see Figures in Section 4.4.3 LoadStar-PS system power wiring preparations.
5. Route the communication cables to the front of the unit through the cable clips at the back of the unit and through the oval hole at the top. They hole is positioned in the middle for 1ph models and on the top for 3ph models.

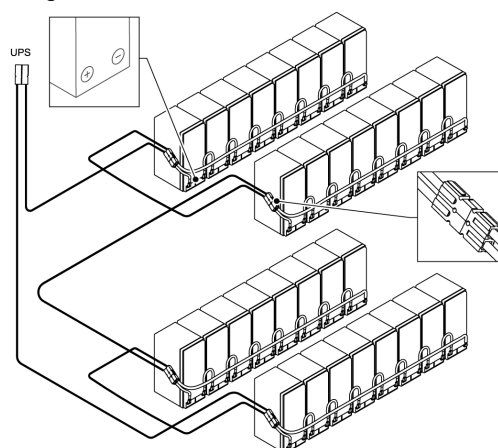
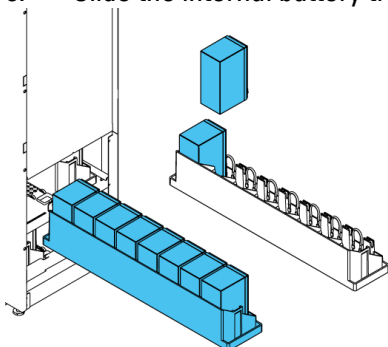


3ph models



1ph models

6. Connect the communication cables to the respective terminals and peripherals.
7. Assemble the internal batteries into the battery trays. Connect the battery blocks in series within the battery tray. Only use cables specified by Eaton. Note that the battery trays may differ from the illustration.
8. Slide the internal battery trays into place and mount the locking brackets.



10. Connect the internal batteries.

5.3 Battery system installation



DANGER

LoadStar-PS systems may have internal batteries. The batteries are designed to deliver a large amount of energy and an incorrect connection may lead to a short circuit and cause serious injuries to the personnel or damages to the equipment. In order to avoid damages to the equipment or injuries to personnel, only commissioning personnel are allowed to perform the connection of these batteries.

If you are installing a customer-supplied battery system, install the battery system according to the battery and battery system manufacturer's instructions and all the 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.

Ground the external battery cabinet to the LoadStar-PS.

The default battery settings of the LoadStar-PS are for 12 V VRLA batteries. If you need to use any other type of batteries, contact your Eaton representative. For the battery specification, see Section 9.6 Battery specification.



CAUTION

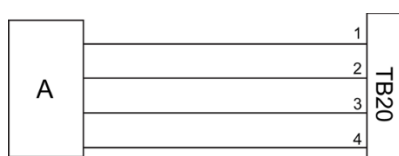
External Battery compartments and external battery arrangements need to follow the requirements acc. EN 62485-2.

5.3.1 Battery trip wiring

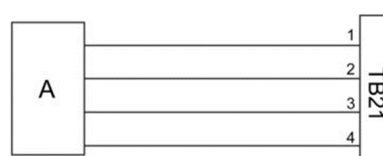
The LoadStar-PS units are always equipped with an internal battery breaker, **which affects only the internal batteries**. The external battery breaker is a crucial part of the external battery cabinet or rack and must be placed in it. With the external battery breaker, signal cabling is important.

Both internal and external battery breakers can be tripped (switched off) by energizing its shunt trip coil. The shunt trip coils of external battery breakers are energized (controlled) through connectors TB20 and TB21 (TB21 available only in the separate battery 20 kVA system). The voltage of the shunt trip coil is 24 Vdc.

Figure 13: Battery trip wiring, TB20 and TB21



1. Pin 1, shunt trip coil +
2. Pin 2, shunt trip coil -
3. Pin 3, AUX contact



4. Pin 4, AUX contact return
- A: External battery breaker

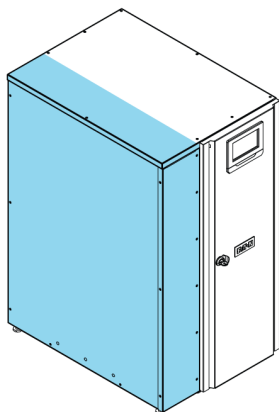
5.4 Install LoadStar-PS external battery cabinet and battery power cabling

When needed, battery capacity can be extended with an optional external battery cabinets (EBC).

Here below the list of battery cabinets available for LoadStar-PS, designed and manufactured by Eaton:

| Part number | Model | Housing | Batteries | Weight (net/gross) |
|-----------------|------------------------------------|---------|-------------------------|--------------------|
| P-105000111-002 | BATTERY SIDECAR 1x32 9AHL | Sidecar | 1 string (32x9Ah) | 103 / 130 kg |
| P-105000041-006 | EBC-A-2x32-9AHL-BB-63A | EBC-A | 2 strings (32x9Ah) | 247 / 268 kg |
| P-105000041-007 | EBC-A-3x32-9AHL-BB-63A | EBC-A | 3 strings (32x9Ah) | 328 / 349 kg |
| P-105000084-002 | EBC-B-1x32-CSBHRL12200W-BB-63A-M6 | EBC-B | 1 string (32xHRL12200W) | 706 / 733 kg |
| P-105000017-004 | EBC-C-1x36-CSBHRL12200W-BB-200A-M6 | EBC-C | 1 string (36xHRL12200W) | 795 / 822 kg |
| P-105000017-010 | EBC-C-1x40-CSBHRL12200W-BB-200A-M6 | EBC-C | 1 string (40xHRL12200W) | 865 / 892 kg |

The “sidecar” battery cabinet is designed to work specifically with 2/5 kVA 1ph units and is placed on the left side of the unit itself.



The 2/5 kVA unit with the “sidecar” external battery cabinet (P-105000111-002)

Battery cabinets EBC-A and EBC-B can be used with all LoadStar-PS systems.

Battery cabinet EBC-C can be used on with 20 kVA units.

Power and control wiring for the external battery cabinets are supplied with the cabinets. The battery cabinet can be located freely of the LoadStar-PS cabinet. All the wiring goes through the back wall of the LoadStar-PS cabinet. 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 Section 4.4.3 LoadStar-PS system power wiring preparations.

5.5 Temperature compensation

Temperature compensation in battery charging is a feature where the charger adjusts the charging voltage based on the environment temperature to ensure optimal charging and longevity.

LoadStar-PS is equipped with a temperature compensation feature as requested by EN50171. The probe is located in the main unit and it automatically adapt charging current based on the room temperature.

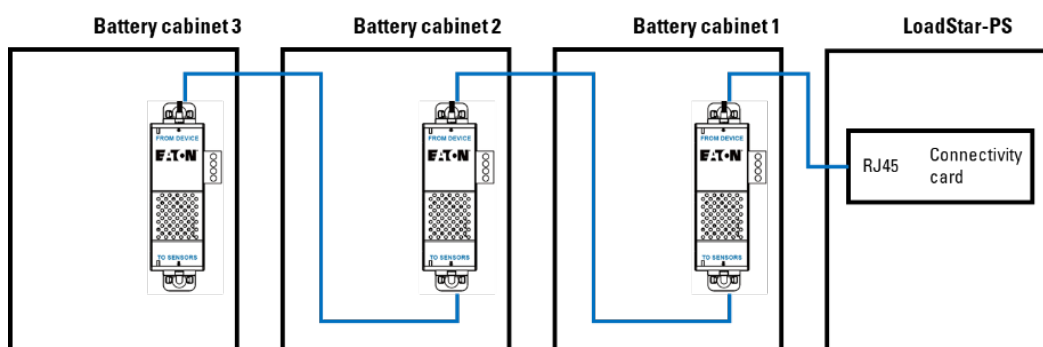
5.5.1 External environmental monitoring probe (optional)

When external battery cabinets are installed in different room than LoadStar-PS unit, for temperature compensation, an external environmental monitoring probe (EMP) is needed to monitor the temperature in the battery room.

The EMP is connected via patch cable (Ethernet cable) to the network card (optional).

Up to 3 battery cabinets (rooms) can be monitored via a single IN/OUT connection.

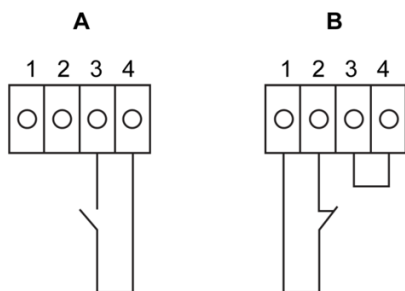
For the installation and the configuration of the network card and EMP pls refer to their specific manuals. Configuration can be done by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton.



5.6 Install a remote EPO switch (Emergency Power OFF)

You can use a remote EPO switch in case of an emergency to shut down the LoadStar-PS and remove power to the emergency lighting system from a location away from where the LoadStar-PS is installed.

EPO is connected to the LoadStar-PS's top front panel, on connector EPO.



EPO connector (front view):

- A = Normally open
- B = Normally closed

NOTE: In "Normally closed" (B) situation a jumper between pins 3 and 4 is needed.

| From remote EPO switch | To user interface terminal block EPO in LoadStar-PS cabinet | Remarks |
|------------------------|--|---|
| NO | 3-4 | - |
| NC | 1-2 | Wire jumper between 3-4 must be installed for proper functions. |

5.7 Installing interface connections

5.7.1 Battery breaker wiring interface

When using the original battery cabinet from Eaton, the battery breaker interface wiring is provided with the cabinet. Connecting it requires only routing the wires from the cabinet to terminal TB20 (and TB21).

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 the battery breaker signal wiring is located in the middle of the LoadStar-PS cabinet. Punch holes are located on the left or right side panel, back wall or bottom plate.

See Section 5.3.1 Battery trip wiring for installation instructions.

5.7.2 Input signal for system testing

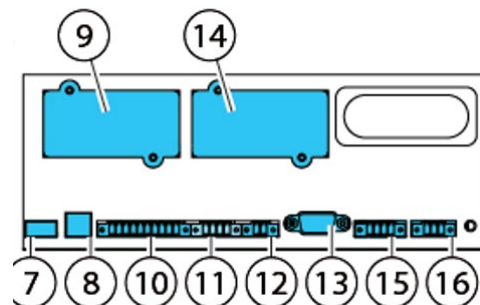
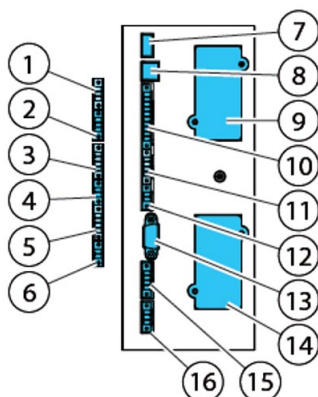
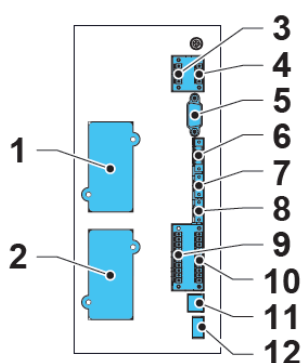
All LoadStar-PS systems are provided with a specific input signal to force the system to switch in battery mode.

This function can be used to test the switch-over functionality and to measure the duration in battery mode.

This input is called "Mains Failure Simulation" (battery test) and is located at signal input 1/TB1.

For 2/5 kVA 1ph units, the input 1 (TB1) is located in the communication area n.4

For 10/20 kVA 3ph units, the input 1 (TB1) is located in the communication area n.10



5.7.3 Relay output interface connections

The general alarm relay is a dry relay signal output. The relay can be used for informing the operators about LoadStar-PS alarm conditions, for example through a building management system. By default, the relay is configured to activate when the LoadStar-PS general alarm is active, that is, any event when the ALARM status is active. The relay can also be configured to activate by some other event, but this needs to be done by authorized service personnel.

The relay rating is 30 V AC or DC, 5 A.

Relay signal wiring can be installed only through the signal cabling canal, from back to front, in the top section of the LoadStar-PS.

Additional relay outputs are available with mini-slot cards. Relay outputs can be configured to be activated by various events. Configuration can be done by an authorized Eaton Customer Service Engineer or by other qualified service personnel authorized by Eaton.

5.7.4 Industrial Relay Card interface connections

Connections to the relay card is described in detail in Section 6.

5.7.5 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. The signal polarity must be taken into account when putting signal inputs and EPO wiring in parallel. 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.

5.8 Wiring parallel LoadStar-PS systems

The outputs of multiple LoadStar-PS systems can be connected in parallel. Up to 6 units can be paralleled (4 units for 2/5 kVA 1ph variants). The LoadStar-PS static bypass power rating needs to be identical among all the paralleled units. However, paralleled LoadStar-PS 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 LoadStar-PS online than required to support the load. The system is paralleled for capacity if all LoadStar-PSs in a system are required to support the load.

Communication between the LoadStar-PSs 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 LoadStar-PS, connected to the other LoadStar-PSs in parallel and tied to the bypass status relay in each LoadStar-PS, is used for a secondary communication path. This arrangement ensures bypass control even if the CAN bus is lost.



WARNING

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

5.8.1 Power wiring overview

See Section 4.4.3 LoadStar-PS system power wiring preparations 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 LoadStar-PS rectifier. The feed to all LoadStar-PS's inputs must be derived from the same source.

Bypass feed

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

Output

The neutrals of all the LoadStar-PSs must be connected. The shortest length of wire from the source to the LoadStar-PS must be a minimum of 95% of the length of the longest wire. The measurement is with respect to where the LoadStar-PS'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 LoadStar-PS, and the battery capacity for each LoadStar-PS must be identical. If a common battery for multiple LoadStar-PS frames is needed, contact Eaton Technical Support.

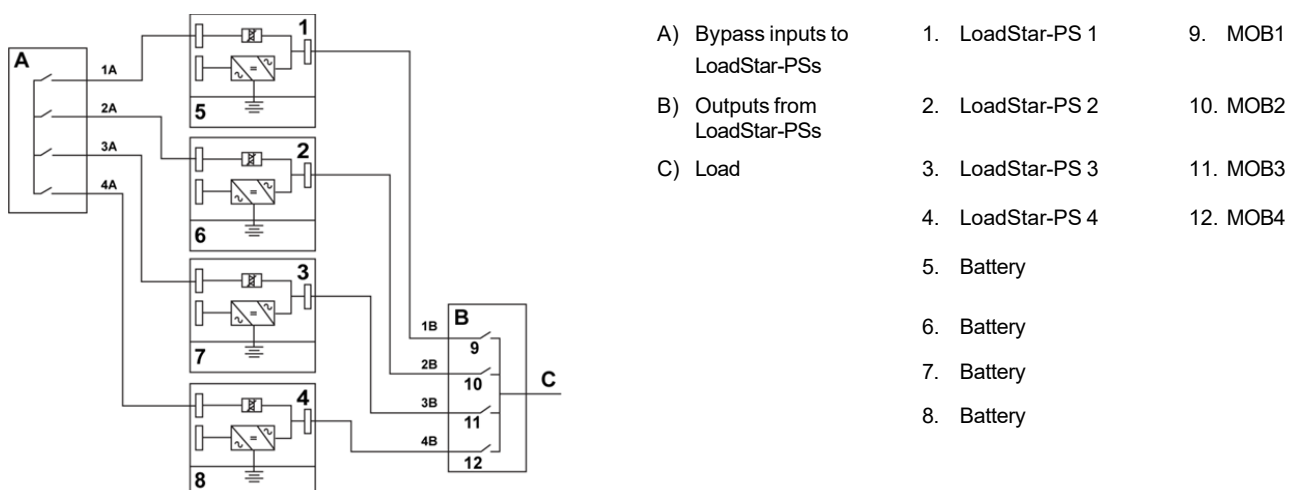
MOBs

Module Output Breakers (MOBs) allow the output of an LoadStar-PS to be disconnected from other LoadStar-PSs and the system load for maintenance and service. Design considerations assume that each LoadStar-PS 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 LoadStar-PS's input used for signal input. The N.O. contact is used to disconnect the bypass pull-chain when the MOB is open. Figure 22: Principle of paralleled LoadStar-PS systems shows the principles of paralleled LoadStar-PS systems including MOBs and outputs from LoadStar-PSs.

MOB override

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

Figure 14: Principle of paralleled LoadStar-PS systems



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 LoadStar-PS system while in the bypass mode.

5.8.2 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 communication between the LoadStar-PS's in a parallel system. When this network fails, the system continues to share load and protect the load.

Bypass Pull-Chain

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

Signal Inputs Actions

Each LoadStar-PS has a maximum of 7 signal inputs, 5 native and one in each MiniSlot when using a suitable connectivity device. These inputs can be configured with action items. The following action items affect all the LoadStar-PSs in the system. When an action item is active on a LoadStar-PS and the MOB is closed, the action item is transmitted on the ECAN to all the LoadStar-PSs.

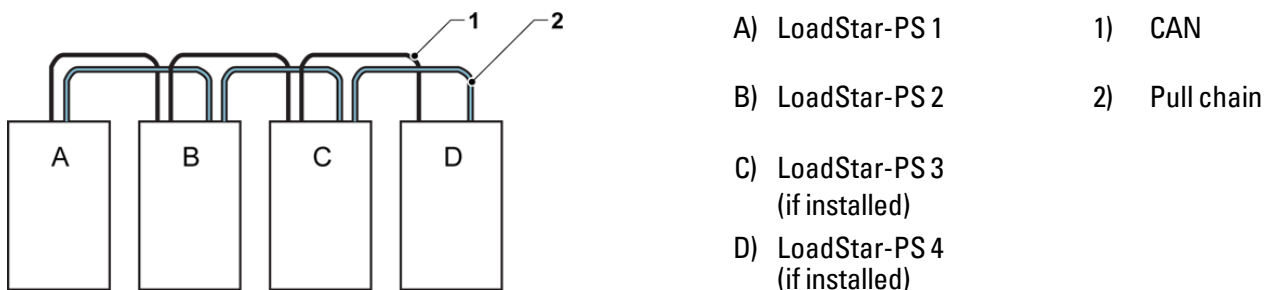
Wiring the EPO switch in parallel

It is recommended to use separate EPO circuits for each parallel unit.

5.8.3 Installing parallel control wiring

1. During the installation, follow all the safety instructions given in this document.
2. Terminal blocks TB2, TB3 and TB4 are for external parallel control signals
3. The Phoenix Contact FRONT-MSTB 2,5/2-STF-5,08 and 2,6/4-SFT-5,08 plug components are used for cable wiring termination.

Figure 15: Simplified CAN and Pull-Chain wiring for parallel LoadStar-PS system



NOTE: This drawing is for distributed bypass wiring purposes and it is not a floor layout plan. LoadStar-PSs can be placed in any physical order.

Figure 16: CAN and Pull-Chain wiring for parallel LoadStar-PS with MOB

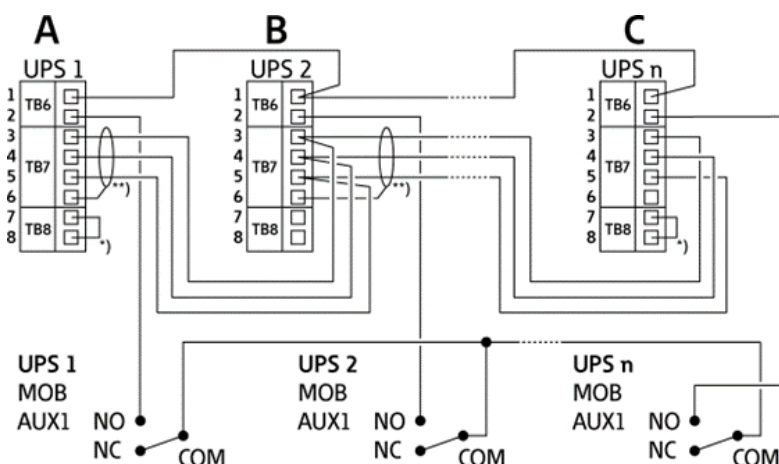
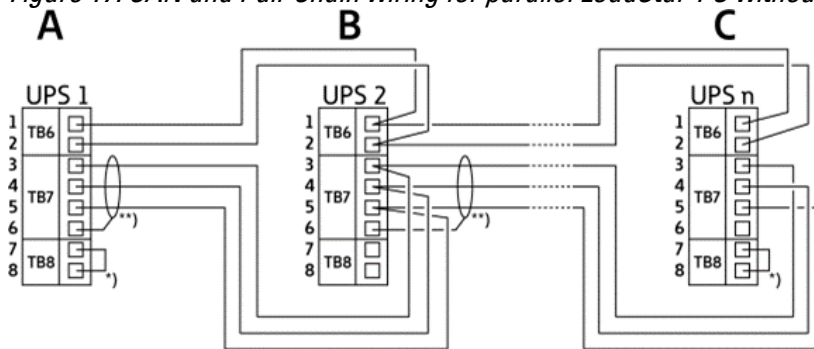


Figure 17. CAN and Pull-Chain wiring for parallel LoadStar-PS without MOBs



| | | | |
|--------|------------------------------------|-------|--|
| A,B,C) | External parallel connectors TB6–8 | 6) | TB7:1: Earth |
| 1) | TB6:2: Pull chain | 7) | TB8:1: CAN Termination 2 |
| 2) | TB6:1: Pull chain RTN | 8) | TB8:2: CAN Termination 1 |
| 3) | TB7:4: CAN High | *) | Terminate the first and last LoadStar-PS with a jumper |
| 4) | TB7:3: CAN Low | **)) | Connect the shield on one end only |
| 5) | TB7:2: CAN GND | | |

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 LoadStar-PS and use the correct crimp connections for the wire gauge. External CAN connections between the LoadStar-PS cabinets require shielded twisted pair wire. Use twisted pair wiring between the LoadStar-PS and MOB AUX contacts.

5.9 LoadStar-PS system interface wiring preparation

Control wiring for features and options should be connected at the user interface terminal blocks located on top front of the LoadStar-PS, behind the door.

NOTE: Do not connect relay contacts directly to the mains-related circuits. Reinforced insulation to the mains is required.

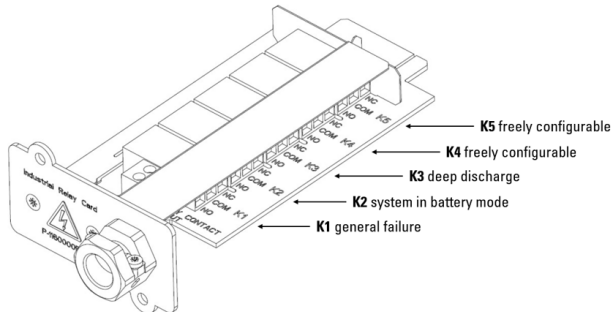
When you plan and do the installation, make sure you understand the following notes:

- All the interface wiring is provided by the operator.
- When you install internal interface wiring to MiniSlot terminals, route the wiring through the internal opening in the MiniSlot communication bay.
- All signal inputs or remote features require an isolated normally-open 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 drops for use with MiniSlot cards are provided by facility planners or the operator.
- The LoadStar-PS Battery Aux and 24 VDC Shunt Trip signal wiring from the LoadStar-PS must be connected to the DC source disconnect device. See Figure 18: Battery trip wiring, TB20.
- Battery Aux and 24 VDC Shunt Trip wiring must be a minimum of 1.5 mm².
- The Remote EPO feature opens all switchgear in the LoadStar-PS cabinet and isolates power from your emergency lighting. Local electrical codes may also require tripping upstream protective devices to the system.
- The Remote EPO switch must be a dedicated switch that is not tied to any other circuits.
- If the normally-closed (NC) Remote EPO contact is used, a jumper wire must be connected between pins 3 and 4 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 LoadStar-PS 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 interface – Relay card

6.1 About the relay card

All LoadStar-PS systems are delivered with a pre-mounted relay card installed in Minislot 1 or 2 (depending on unit). The relay are pre-configured according to EN50171 requirements:



K1 general failure: is active when one of the system's alarms is active (i.e. charging failure, battery failure, inverter failure)

K2 system in battery mode: is active when, during a mains failure, the system is powered by the internal energy source (batteries)

K3 deep discharge: is active when, after a mains failure and a prolonged period in battery mode, the batteries have reached deep discharge mode (low charge).

As requested by EN50171, the deep discharge mode requires the user acknowledgement on the display.

K4 / K5 freely configurable relays: those relays can be setup to inform the user on different types of status/alarms/conditions (i.e. operation mode Bypass, ESS, Online). Configuration process is described in chapter 6.2.

To wire the relay card follow the below procedure:

- 1) Make sure that the LoadStar-PS system is not powered and switched off
- 2) Locate the Relay Card in Minislot 1 or 2 (depending on the system)
- 3) Unscrew and extract the card from the slot (keep the screws)
- 4) Pass the cable trough the cable gland
- 5) Wire the cables of the required output on the specific relay (K1 K5)
- 6) Insert the Relay Card into the slot and tight the two screws

NOTE: Maximum contact rating: 250 Vac, 30 Vdc @ 8A Wire Range: 12–22 AWG (0.5-2.5mm²)



CAUTION

All the communication interfaces are SELV circuits. When connecting to other equipment, make sure that you maintain this characteristic.

6.2 Configuring relays

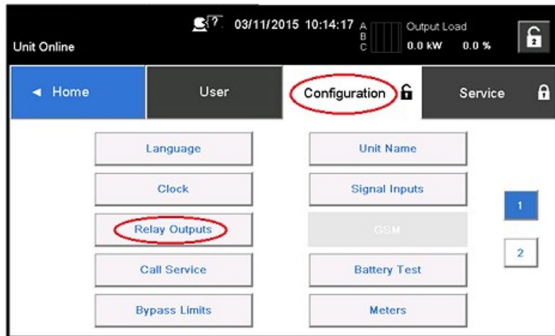
Relays configuration can done via the user display (HMI) following the below process:

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.



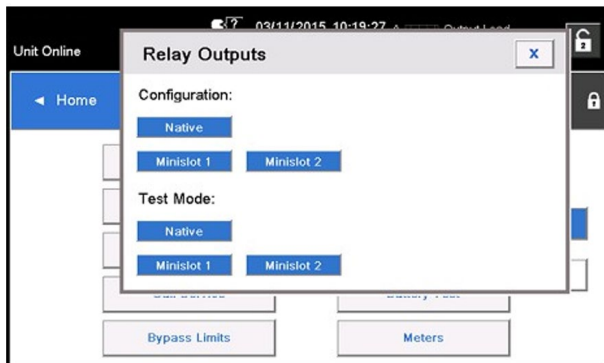
3. Enter the password 0101 and press
4. Select **Continue**

5. Select **Configuration** and then **Relays Outputs**



6. Select out of the following options:

- Native (Alarm) relay
It is possible to set 8 different events for the native relay. If any of the set events occurs, the relay is activated
- MiniSlot 1
- MiniSlot 2



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.



Examples of status/function code:

#262 OnLine

#261 On bypass

For the complete list of codes pls refer to Eaton Service Engineer.

7 LoadStar-PS operating instructions

7.1 How to operate the LoadStar-PS



CAUTION

Before you operate the LoadStar-PS, 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 LoadStar-PS operation.

The LoadStar-PS is configured to operate with one of the following nominal voltages:

220/380, 230/400, or 240/415 VAC. Before you start to operate the LoadStar-PS, confirm the nominal voltage and frequency from the display by selecting: **Settings**→**Information**.

If the LoadStar-PS need to be operated with another voltage or frequency, contact your closest Eaton office or Eaton authorized partner.

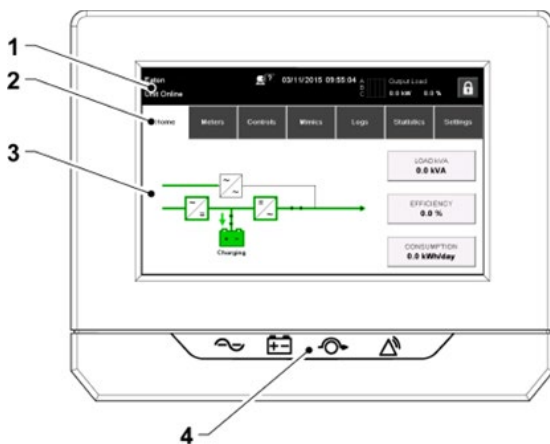
NOTE: The LoadStar-PS is not a measuring device. All the displayed measurements are approximate values only.

7.2 LoadStar-PS controls and indicators

7.2.1 Control panel

The control panel (HMI), is located on the LoadStar-PS front door, contains a color touch screen display. It is used to display the status of the LoadStar-PS system and control all the operation of the system.





Figure 38. The control panel (HMI)



The display consists of the following parts:

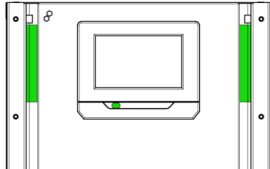
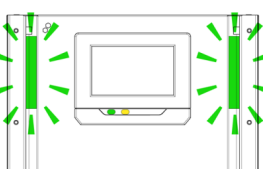
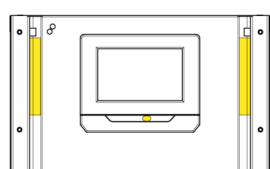
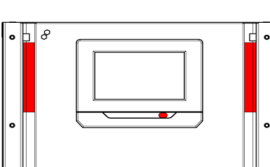
1. Status bar. The status bar displays the LoadStar-PS name, state, current date and time, meters information, and a sign in/out button. It also shows any active alarms and warnings.
2. Main navigation. Select a screen by tapping on its name.
3. Content area. This is the main area for showing information on the LoadStar-PS status and operations.
4. Status indicators. See Section 7.2.2 Status indicators.

7.2.2 Status indicators

| Indicator | Status | Description |
|--|--------|--|
|  Green symbol for normal operation | On | The LoadStar-PS is operating normally and supplying power to the emergency lighting. |
| | Off | The LoadStar-PS is turned off. |
|  Yellow symbol for battery mode | On | The LoadStar-PS is in the battery mode. Because the battery mode is a normal condition of the LoadStar-PS, the green indicator for normal operation also remains illuminated. |
|  Yellow symbol for bypass mode | On | The LoadStar-PS is in the bypass mode. The emergency lighting 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 LoadStar-PS 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. |

7.2.3 Color LED indicators

The LED indicators consists of two rows of LEDs located on the left and right sides of the LoadStar-PS cabinet door. The LEDs are red, green and yellow (RGY). The color of the LED is used to indicate the condition of the LoadStar-PS. The most urgent condition is always the one shown. Only one color is shown at a time. The table below defines which color is shown:

| Color LED indicators (screen and door) | LoadStar-PS status |
|---|---|
|  | Normal operation |
|  | Battery mode (emergency mode) The green LEDs on the sides of the LoadStar-PS cabinet door are blinking and the yellow symbol for battery mode is illuminated below the display. Since the battery mode is a normal condition of the LoadStar-PS, the green symbol for normal operation is also illuminated below the display. |
|  | Bypass mode |
|  | Alarm |

7.2.4 System events

When the LoadStar-PS system is running in the double conversion mode, it continually monitors itself and the incoming utility power. In the battery or bypass mode, the LoadStar-PS may issue alarms to let you know exactly what event caused the change from the double conversion mode. System events on the LoadStar-PS 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 LoadStar-PS control panel and the event horn let you know when the LoadStar-PS system is operating in any mode other than the double conversion mode. Only the green indicator for normal operation is visible during normal LoadStar-PS 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.

7.2.5 Menu structure of the LoadStar-PS

The following table shows the menu structure of the LoadStar-PS.

| Main menu | Submenu | Functions |
|-----------|----------------------|--|
| Home | - | An overview of the LoadStar-PS operation, including information on load, efficiency and consumption. |
| Meters | Meters summary | A summary of the LoadStar-PS or system meters. |
| | Input meters | Detailed information on LoadStar-PS or system input meters. |
| | Bypass meters | Detailed information on LoadStar-PS or system bypass meters. |
| | Output meters | Detailed information on LoadStar-PS or system output meters. UPM Power |
| | Battery meters | Detailed information on LoadStar-PS or system battery meters. |
| Controls | System controls | Go Online Go to bypass Turn off Charger Load Off |
| | LoadStar-PS controls | Run battery test Shut down UP |

| | | |
|------------|----------------------------|--|
| | Module controls | Start charger Run battery test Shut down module / Start module UPM 1: <ul style="list-style-type: none"> • Charger • Battery test • UPM status UPM 2: <ul style="list-style-type: none"> • Charger • Battery test • UPM status |
| | EAA controls | ESS: <ul style="list-style-type: none"> • Enable • Disable • Configure VMMS: <ul style="list-style-type: none"> • Enable • Disable • Configure Enable High Alert Clear status ABM: <ul style="list-style-type: none"> • Enable • Disable • Configure • Clear Alarms • Clear Logs |
| Mimics | LoadStar-PS mimics | An overview of the LoadStar-PS 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. |
| | LoadStar-PS module map | Module map shows the status of each UPM. |
| | System overview | System overview shows the status and meters summary for each LoadStar-PS. |
| | ESS | The ESS mimic screen shows the approximated consumption and energy savings of the ESS mode. |
| Logs | Active events | All active events are displayed. |
| | System log | A log of all system events. |
| | Service log | A detailed log of LoadStar-PS operations. |
| | Change log | A log of all changed settings and their values. |
| Statistics | Statistics summary | A summary of LoadStar-PS statistics |
| | Statistics details | Details are not available. |
| Settings | User Configuration Service | Configurable user settings. For details, see <i>Section 7.2.5.1 User settings</i> . |

7.2.5.1 User settings

The LoadStar-PS includes information for the user.

You can modify the **User** settings. In the Home screen, select -> **Settings**

| Setting | Description |
|-------------|--|
| Information | Information on the LoadStar-PS model, including part number and serial number. |
| About | Version information. |

You need to sign-in to modify the **Configuration** settings.

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. |
| GSM | GSM modem. |
| Call Service | Send automatic e-mail to the service center in case of a failure. |
| Signal Input | Select signal input name and function or change contact polarity. |
| Relay Outputs | Configure the relay outputs. |
| Battery test | Change the power level and duration for battery test. |
| Bypass Limits | Change the bypass voltage or bypass frequency. |
| Screen Saver Timeout | Change the screen saver timeout. |
| Meters | Change the meters format. |
| Lamp Test | Enable the lamp test. |
| 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. |
| Reset statistics | Reset all statistics. |
| Minimum required kVA | Change the minimum required kVA. |

7.3 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 7.2.5.1 User settings.

7.4 System control instructions

7.4.1 Starting the LoadStar-PS system in the double conversion mode

The LoadStar-PS system can consist of a single LoadStar-PS or several parallel LoadStar-PSs. LoadStar-PSs with their MOB open are not considered as part of the system.

To start the LoadStar-PS system:

1. Open the LoadStar-PS front door.
2. Make sure that the rectifier input switch S1 closed.
3. Make sure that the battery breaker CB1 is closed.
4. Close the LoadStar-PS front door.
5. Close the LoadStar-PS input feeder circuit breaker.
6. Close the LoadStar-PS bypass input feeder circuit breaker.
7. Wait for the LoadStar-PS control panel display to become active and to indicate logic power.
8. Repeat steps 1-7 for each individual LoadStar-PS 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 **SHUTDOWN**.
11. In the System controls screen, press the **Go online** button.
If Auto Bypass is enabled (factory default), the emergency lighting is immediately supplied by the bypass source, in the bypass mode, until the inverter turns on and the LoadStar-PS transfers to the double conversion mode. The status indicator on the LoadStar-PS control panel indicates that the LoadStar-PS is in the bypass mode. If auto bypass is not enabled, the LoadStar-PS output remains off until the LoadStar-PS system transfers to double conversion mode.
12. Wait for the following messages to appear sequentially on the System controls screen:
STARTING
ONLINE

The LoadStar-PS system is now operating in the double conversion mode. The green status indicator for normal operation is illuminated in all the LoadStar-PSs in the system.

7.4.2 Start the LoadStar-PS system in the bypass mode



CAUTION

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

The bypass mode will not guarantee the proper emergency lighting operations in case of blackout/mains failure and therefore must be used only for maintenance purpose !!

If the inverter output of the LoadStar-PS is not available and the emergency lighting needs to be energized, do the following procedure:

1. Open the LoadStar-PS front door.
2. Make sure that the rectifier input switch S1 is closed.
3. Make sure that the battery breaker CB1 is closed.
4. Close the front door.
5. Close the LoadStar-PS input feeder circuit breaker.
6. Close the LoadStar-PS bypass input feeder circuit breaker.
7. Wait for the LoadStar-PS control panel to become active and indicate logic power.
8. Repeat steps 1-7 for each single LoadStar-PS in the system.
9. In the home screen, press **Controls**.
The System controls screen appears.
10. In the System Controls screen, check that the system status is shown as `SHUTDOWN`.
11. In the System controls screen, press the **Go to bypass** button.
The emergency lighting is immediately supplied by the bypass source, in the bypass mode.

The LoadStar-PS system is now operating in the bypass mode. The yellow bypass status indicator is lit.

7.4.3 Transfer 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.

The bypass mode will not guarantee the proper emergency lighting operations in case of blackout/mains failure and therefore must be used only for maintenance purpose !!

To transfer the emergency lighting 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 LoadStar-PS system transfers to the bypass mode and the emergency lighting is immediately supplied by the bypass source. If the bypass source is not available, the power processor remains on and an alarm sounds.

The LoadStar-PS 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`.

7.4.4 Transfer from the bypass mode to the double conversion mode

To transfer the emergency lighting 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 LoadStar-PS 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 LoadStar-PS now operates in the double conversion mode. The green status indicator for normal operation is lit. The system status is shown as `UNIT ONLINE`.

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

NOTE: For energy saving purpose, in LoadStar-PS the ESS mode is automatically activated when batteries are fully charged.

To transfer the emergency lighting load to the Energy Saver System mode:

1. In the home screen, press **Controls**.
2. Select **EAA Controls**.
3. Select **Enable ESS**.
The entire LoadStar-PS system transfers to the Energy Saver System mode and the emergency lighting 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 LoadStar-PS status is shown as `UNIT ONLINE, ESS`.
The UPM status is shown as `READY`.

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

To transfer the emergency lighting to the double conversion mode:

1. In the home screen, press **Controls**.
2. Select **EAA Controls**.
3. Select **Disable ESS**.
The LoadStar-PS 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 LoadStar-PS status is shown as `UNIT ONLINE`.
The UPM status is shown as `ACTIVE`.

7.4.7 Transferring from double conversion to Variable Module Management System mode

NOTE: Note that the Variable Module Management System mode commands are displayed only if enabled at the factory or by an authorized Eaton Customer Service Engineer.

To transfer the emergency lighting to the Variable Module Management System mode:

1. In the home screen, press **Controls**.
2. Select **EAA Controls**.
3. Select **Enable VMMS**.
The entire LoadStar-PS system transfers to the Variable Module Management System mode and the emergency lighting is supplied by the bypass source. If the bypass source is not available or the conditions are not correct for the VMMS mode, the power module remains on and an alarm sounds.
The green status indicator for normal operation is lit. The LoadStar-PS status is shown as `UNIT ONLINE, VMMS`.
The UPM status is shown as `READY`.

7.4.8 Transferring from Variable Module Management System to the double conversion mode

NOTE: Note that the Variable Module Management System mode commands are displayed only if enabled at the factory or by an authorized Eaton Customer Service Engineer.

To transfer the emergency lighting to the double conversion mode:

1. In the home screen, press **Controls**.
2. Select **EAA Controls**.
3. Select **Disable VMMS**.

The LoadStar-PS 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 lit.

The LoadStar-PS status is shown as `UNIT ONLINE`.

The UPM status is shown as `ACTIVE`.

7.4.9 Shut down LoadStar-PS system and the emergency lighting luminaires connected to it

Before you do maintenance or service on the emergency lighting luminaires, shut down the power to the load:

1. Turn off all the equipment that is powered by the LoadStar-PS system.
2. Do the **LOAD OFF** procedure (see *Section 7.4.10 De-energize the emergency lighting*).
The input, and output relays, and bypass backfeed contactor open, the battery breaker or disconnect is tripped, and the power module is turned off.
3. Open the LoadStar-PS front door.
4. Open the rectifier input switches.
5. Make sure that the battery breaker is open.
6. Close the LoadStar-PS front door.
7. Open the LoadStar-PS input and bypass feeder circuit breakers.
8. Repeat steps 3-7 for all the LoadStar-PSs in the system.



DANGER

Power is still present inside each LoadStar-PS 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.

7.4.10 De-energize the emergency lighting system

Initiate a LoadStar-PS system Load Off by pressing the **Load Off** button in the **Controls**→**System Controls** screen.

This button can be pressed to control the LoadStar-PS output. The **Load Off** button de-energizes the emergency lighting and shuts down the LoadStar-PS system.

The LoadStar-PS system (including bypass) remains off until it is restarted.

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

NOTE: All power to the emergency lighting system is lost when Load Off is selected.

Only use this feature when you want to de-energize the load.

When **Load Off** is selected, the input, and output relays, and bypass backfeed contactor open, the battery breaker CB1 or disconnect is tripped, and all the LoadStar-PSs in the system are turned off.



CAUTION

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

7.5 LoadStar-PS control instructions

7.5.1 Starting a single LoadStar-PS

Make sure that the load level does not exceed the single LoadStar-PS capacity. To start the LoadStar-PS:

1. Open the LoadStar-PS front door.
2. If included inside the LoadStar-PS system, check that the rectifier input switch S1 is closed.
3. Make sure that the battery breaker CB1 is closed.
4. Close the LoadStar-PS front door.
5. Close the LoadStar-PS input feeder circuit breaker.
6. Close the LoadStar-PS bypass input feeder circuit breaker.
7. Wait for the LoadStar-PS control panel display to become active and indicate logic power.
8. In the home screen, press **Controls**.
9. Press the **LoadStar-PS controls** button.
In the LoadStar-PS controls screen, the system status is shown as SHUTDOWN.
10. In the LoadStar-PS controls screen, press the **Go online** button.
If Auto Bypass is enabled (factory default), the emergency lighting is immediately supplied by the bypass source in the bypass mode, until the inverter turns on and the LoadStar-PS transfers to the double conversion mode. The yellow status indicator on the LoadStar-PS control panel indicates that the LoadStar-PS is in the bypass mode. If auto bypass is not enabled, the LoadStar-PS output remains off until the LoadStar-PS system transfers to the double conversion mode.
11. In the LoadStar-PS control screen, press the **Go online** button.
12. Wait for the following messages to appear sequentially on the LoadStar-PS status line:
STARTING
ONLINE

The LoadStar-PS system is now operating in the double conversion mode and the green status indicator for normal operation is lit.

7.5.2 Shut down a single LoadStar-PS

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

To shut down a single LoadStar-PS.

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

7.5.3 Enable and disable the battery charger

To turn the battery charger on or off.

1. In the home screen, press **Controls**.
The System controls screen appears.
2. In the System controls screen, press **LoadStar-PS controls**.
3. Press the **Turn on / Turn off** button.

7.6 UPM control instructions

7.6.1 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 LoadStar-PS front door.
2. If included inside the LoadStar-PS system, make sure that the rectifier input switches are closed.
3. Make sure that the battery breaker is closed.
4. Close the LoadStar-PS front door.
5. Close the LoadStar-PS input feeder circuit breaker.
6. Close the LoadStar-PS bypass input feeder circuit breaker.
7. Wait for the LoadStar-PS 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 LoadStar-PS 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.
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 emergency lighting.

7.6.2 Shut 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 LoadStar-PSs 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.
4. In the UPM control screen, select **Shut down** module.



CAUTION

The UPM must be in the shutdown state before it can be removed from the LoadStar-PS. The UPM will suffer serious damage if it is removed from the LoadStar-PS under loading.

7.7 Using the Remote EPO (Emergency Power-off) switch

A LoadStar-PS emergency power-off is initiated by the EPO push button switch.

In case of specific needs (for example when required from the fire brigades), you can use this switch to control the LoadStar-PS output. The EPO switch de-energizes the emergency lighting system and powers down the LoadStar-PS immediately without asking for verification. The LoadStar-PS, including the static bypass switch, remains off until it is restarted.



CAUTION

When the EPO switch is activated, all power to the critical load (emergency lighting) is lost. Use this feature only in case of maintenance or when specifically required.

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 push button switch.
The input, and output relays, and bypass backfeed contactor open, the battery breaker or disconnect is tripped, and the power module is turned off immediately, without asking for verification.

To restart the LoadStar-PS after using the EPO pushbutton, reset the EPO switch and then follow the procedure in *Section 7.4.1 Starting the LoadStar-PS system in the double conversion mode* or *Section 7.4.2 Start the LoadStar-PS system in the bypass mode*.



WARNING

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

7.8 Turning LoadStar-PS from the double conversion mode to maintenance bypass mode

Only trained personnel who are familiar with the behavior and functions of the LoadStar-PS are allowed to operate the internal MBS. A full LoadStar-PS wiring diagram with MBS switch is presented in the schematic diagram.

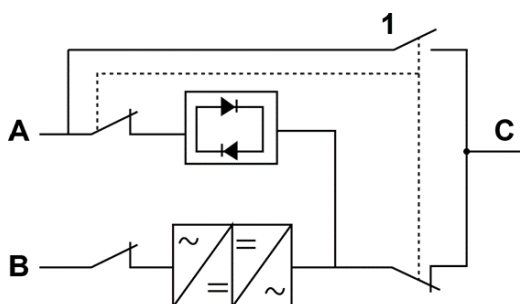
NOTE: The internal MBS and static bypass must be supplied by the same source.

The MBS has 3 positions: LoadStar-PS, Test and Bypass. When the MBS is turned to the Test position, the LoadStar-PS is already turned to maintenance bypass and it no longer provides protected input to the load, but enables testing of the LoadStar-PS internal functionality.

To turn the LoadStar-PS to maintenance bypass:

1. Follow the normal start position:

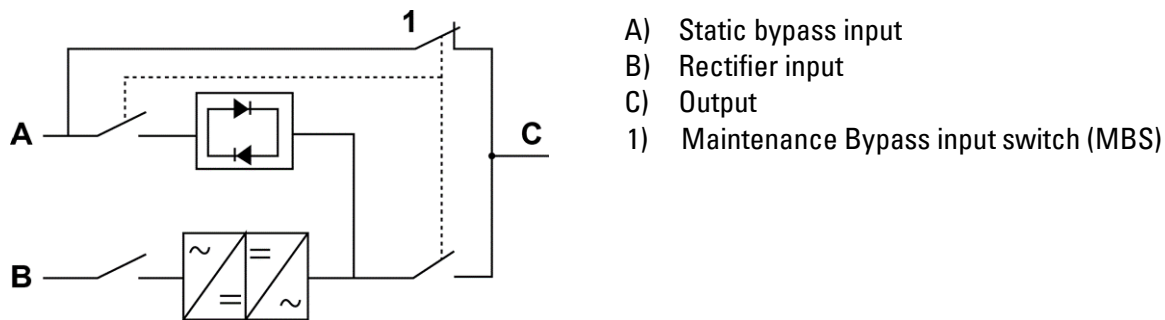
Normal positions of the MBS switches and rectifier disconnect switch (must be located in the site wiring)



- A) Static bypass input
- B) Rectifier input
- C) Output
- 1) Maintenance Bypass input switch (MBS)

2. Do the transfer from the double conversion mode to the bypass mode as instructed in *Section 7.4.3 Transfer from the double conversion mode to the bypass mode*. Remember to verify the transfer before proceeding to the next step.
3. Turn the MBS from the LoadStar-PS position to the Test position.
4. Do the LOAD OFF procedure as described in *Section 7.4.10 De-energize the emergency lighting*.
5. Turn the MBS from the Test position to the Bypass position.
6. Turn off the rectifier switch to disconnect the LoadStar-PS rectifier input.
7. Turn off the static bypass switch to disconnect the LoadStar-PS
The LoadStar-PS is now in the maintenance bypass mode:

Maintenance bypass mode

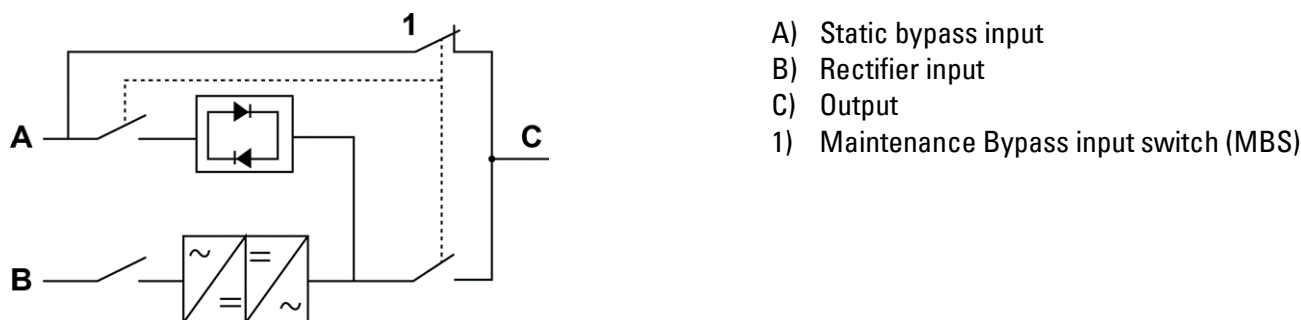


7.9 Turning LoadStar-PS from maintenance bypass mode to the double conversion mode

To turn the LoadStar-PS back to the double conversion mode:

1. Follow the normal start position:

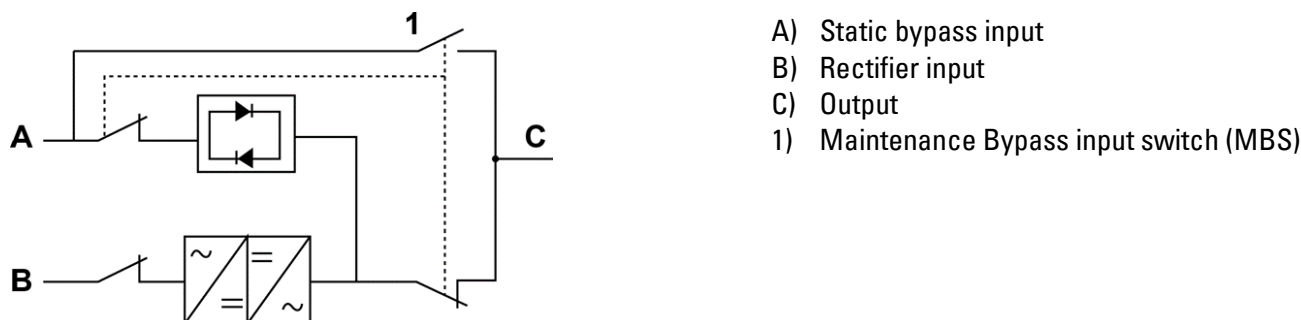
Maintenance bypass mode



2. Turn on the rectifier switch to connect rectifier input to the LoadStar-PS.
3. Turn on the static bypass switch to connect bypass input to the LoadStar-PS.
4. Turn the MBS from the bypass position to the test position.
5. Do the LoadStar-PS start-up procedure (bypass mode).
6. Turn the MBS from the test position to the LoadStar-PS position.
7. Do the transfer from the bypass mode to the double conversion mode as described in *Section 7.4.4 Transfer from the bypass mode to the double conversion mode*.

The LoadStar-PS is now in the double conversion mode.

Double conversion mode



8 LoadStar-PS maintenance

8.1 Introduction to LoadStar-PS maintenance

The components inside the LoadStar-PS 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 LoadStar-PS 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.

Maintenance of emergency lighting systems (including central battery systems and luminaires) shall be performed in accordance with the EN50172 or specific deviations / laws in your country.

8.2 Important safety instructions

Remember that your LoadStar-PS system is designed to supply power **EVEN WHEN IT IS DISCONNECTED FROM THE UTILITY POWER**. The LoadStar-PS 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 LoadStar-PS module.



DANGER

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



WARNING

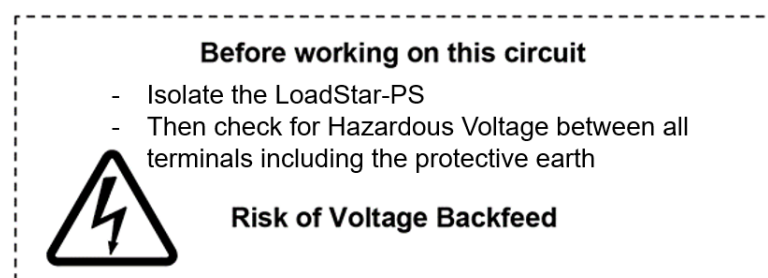
All service and maintenance work must be performed only by service personnel qualified and authorized by Eaton.



CAUTION

An additional warning label, shown in Figure 43: Warning label, must be installed at the LoadStar-PS input terminals and all the primary power isolators used to isolate the LoadStar-PS unit if the LoadStar-PS is connected to an IT earthed supply, or the LoadStar-PS input is connected through external isolators that, when opened, isolate the neutral. These warning labels can be obtained from your local service representative.

Figure 43: Warning label



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.

Obey 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.

8.3 Preventive maintenance

The LoadStar-PS 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 done by service personnel qualified by Eaton. Only the actions described in Section 8.3.1 Daily maintenance and Section 8.3.2 Monthly maintenance can be done by the user.

The European standard EN50172:2024 is the best resource to identify the daily, monthly, annual and in general the periodic inspections and maintenance. We strongly suggest to follow the indication of the EN50172:2024.

8.3.1 Daily maintenance

Do the following steps every day:

1. Examine the area surrounding the LoadStar-PS 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 LoadStar-PS cabinet sections) are not blocked.
3. Make sure that the operating environment is within the parameters specified in *Sections 4.4.1 Environmental considerations* and *4.4.2 Installation considerations* and *Chapter 9.1 About technical data*.
4. Examine that the LoadStar-PS is in the normal operation mode (the green status indicator for normal operation is illuminated). If the red alarm status indicator is lit or the green status indicator for normal operation is not lit, contact your service representative.

8.3.2 Monthly maintenance

Do the following steps once a month:

1. Examine the system parameters on the control panel (Section 7.2.5 Menu structure of the LoadStar-PS).
2. If the optional air filters are installed, check 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 LoadStar-PS front door.
 - B) Replace the filters.
 - C) Close the LoadStar-PS front door.
3. Record the check results and any corrective actions in a service log.

8.3.3 Periodic maintenance

Inspect the LoadStar-PS 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.

8.3.4 Annual maintenance



CAUTION

Only authorized personnel that are familiar with the maintenance and servicing of the LoadStar-PS system are allowed to do annual maintenance.
Contact your service representative for more information about service offerings.

8.3.5 Battery Maintenance



CAUTION

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

8.4 Recycling the used LoadStar-PS or batteries

Remove the battery bank before you discard the LoadStar-PS or its battery cabinet. Obey 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:

WEEE symbol



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 unwanted batteries or battery material in the public waste disposal system. Obey all the applicable local regulations regarding the storage, handling and disposal of batteries and battery materials.

8.5 Maintenance training

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

9 Technical data

9.1 About technical data

For a complete technical specification, pls check updated datasheet on Eaton.com website.

Due to continuous product improvement programs, specifications are subject to change without notice.

9.2 Directives and standards

| | |
|----------------------|---|
| Safety | IEC 62040-1: Uninterruptible power systems - Part 1: General and safety requirements for LoadStar-PS IEC 62477-1: Safety requirements for power electronic converter systems and equipment - Part 1: General |
| EMC | IEC 62040-2: Uninterruptible power systems - Part 2: Electromagnetic compatibility (EMC) requirements / Ed.2 Emissions: category C2 Immunity: category C3 |
| Performance & tests | EN50571:2001 Central Power Supply Systems IEC 62040-3: Uninterruptible power systems - Part 3: Method of specifying the performance and test requirements |
| Environmental | IEC62040-4: Uninterruptible Power Systems - 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 | IEC 62040-3: Uninterruptible power systems - Part 3: Method of specifying the performance and test requirements |
| ECO Design Directive | 2009/125/EC establishing a framework for the setting of eco-design requirements for energy-related products |
| Batteries | 2023/1542/EU on batteries and accumulators and waste batteries and accumulators |
| Packaging | 94/62/EC on packaging and packaging waste |
| | |
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| | |

9.3 General specifications

| | | | | |
|---|---|--------|---|----------------------------|
| Unit ratings | 2 kVA | 5 kVA | 10 kVA | 20 kVA |
| Number of power modules | 1 | 1 | 1 | 2 |
| Systems phases IN:OUT | 1:1 | | 3:3 | |
| Number of internal batteries (optional) | 0 to 1 string (32 blocks) | | 0 to 2 strings (32 blocks) | 0 to 4 strings (32 blocks) |
| Options | Internal maintenance bypass switch MBS External battery cabinets | | | |
| Paralleling | Up to 4 units for single phase and 6 units for 3-phase both with HotSync technology (all units with same rating) | | | |
| Standard operation | When powered, the system is working by-default in ESS mode (Energy Saver System). The Energy Saver System uses an intelligent “power core” to adapt to incoming power conditions delivering clean power to the load while maximizing the efficiency. | | | |
| Mechanical | | | | |
| Housing type | Type A | | Type B | Type C |
| Dimensions (mm) | W 335 x D 750 x H 950 | | W 335 x D 750 x H 1300 | W 480 x D 750 x H 1750 |
| Housing material | Metallic enclosure with RAL9005 black matt coating | | | |
| Protection degree | IP20 (IP21 kit on request) | | | |
| Units net weight (without batteries) | 67 kg | | 90 kg | 208 kg |
| Units gross weight (without batteries, with packaging) | 92 kg | | 111 kg | 234 kg |
| Cable entry | Rear | | | |
| Housing configuration | Front door, key locked - HMI 5" touchscreen | | | |
| Environmental parameters | | | | |
| Acoustic noise @1m with 25°C ambient temp. | < 47 dBA in ESS mode <60 dBA in Emergency mode | | | |
| Storage ambient temperature | -25°C to +55°C without batteries 0°C to +25°C with batteries indoor in the protective package | | | |
| Operation ambient temperature | 0°C to +40°C without output power derating +20°C to +25°C recommended for 10Y battery lifetime | | | |
| Relative humidity range | 5 to 95%, no condensation allowed | | | |
| Maximum service altitude | 1000 m above sea level at 40°C max 2000 m with 1% derating every 100 m increase | | | |
| RoHS/WEEE compliance | Yes | | | |
| Efficiency | | | | |
| Efficiency in ESS mode: | | | | |
| 100% load | 95.5 % | 97.8 % | 98.5 % | 98.7 % |
| 75% load | 94.1 % | 97.2 % | 98.2 % | 98.5 % |
| 50% load | 91.4 % | 96.2 % | 97.5 % | 98.0 % |
| 25% load | 84.4 % | 93.0 % | 95.6 % | 96.3 % |
| Electrical characteristics - INPUT | | | | |
| Rated input voltage | (1:1) 220-240 V | | (3:3) 220-380 V / 230-400 V / 240-415 V | |
| Bypass input | 187 to 264 V (rated voltage -15% +10%) | | | |
| Rated input frequency (tolerance) | 50 or 60 Hz user selectable (40 to 72 Hz) | | | |
| N. of input phases Rectifier input (Bypass input) | 1 ph + neutral (1 ph + neutral) | | 3 ph + neutral (3 ph + neutral) | |
| AC power distribution systems compatibility | TN, TT, IT (4-wire) | | | |
| Back feed protection | Yes, for rectifier and bypass lines | | | |

| | | | | |
|---|--|---|--|---|
| | | | | |
| Electrical characteristics - OUTPUT | | | | |
| N. of output phases | 1 ph + neutral | | 3 ph + neutral | |
| Crest factor | 3 | | | |
| Rated output voltage | 220 V ; 230 V ; 240 V configurable | | 220/380 V ; 230/400 V ; 240/415 V configurable | |
| Output voltage variation, steady state | < 1% | | | |
| Total voltage harmonic distortion 100% linear load (100% non-linear load) | 1.5 % (2.0 %) | | 1.5 % (3.5 %) | |
| Rated output frequency (frequency variation) | 50 or 60 Hz user selectable (+/- 0,1 Hz 1 UPM; +/- 0,15 Hz 2 UPM) | | | |
| Rated output power | 2.000 VA – 1.900 W (pf 0,95) | 5.000 VA – 4.750 W (pf 0,95) | 10.000 VA – 9.500 W (pf 0,95) | 20.000 VA – 19.000 W (pf 0,95) |
| Overload capability on inverter | Continuous 120 % 20 min 145 % 60 sec 200 % 10 sec 400 % | Continuous 120 % 20 min 145 % 60 sec 200 % 10 sec 300 % | Continuous 120 % 20 min 145 % 60 sec 175 % 10 sec 200 % | Continuous 120 % 20 min 145 % 60 sec 175 % 10 sec 200 % |
| Overload capability ESS mode | Continuous 120% | | | |
| Output current limitation | 109 A for 300 ms | 109 A for 300 ms | 54 A for 300 ms (per phase) | 108 A for 300 ms (per phase) |
| Fault clearing capability | B20 / C10 | | B10 / C6 | B16 / C10 |
| Load power factor | Permitted range: 0.8 lagging to 0.8 leading | | | |
| Batteries and battery chargers | | | | |
| Battery technology | 12V VRLA (for other battery technologies like NiCad or Lithium pls contact our sales application engineers) | | | |
| Design life | 10 years @ 20°C (EN50171) | | | |
| Battery quantity Internal (External) | 32 blocks, 192 cells per battery string (28 – 40 per string) | | | |
| Recharge profile | ABM or Float | | | |
| Charge current limit | Default 5 A configurable Load <25% 1 ... 8 A Load <80% 1 ... 5 A Load >80% 1 ... 3.5 A | Default 5 A configurable Load <50% 1 ... 12.5 A Load <80% 1 ... 10 A Load >80% 1 ... 7 A | Default 5 A configurable Load <80% 1 ... 18 A Load >80% 1 ... 14 A | Default 10 A configurable Load <80% 2 ... 36 A Load >80% 2 ... 28 A |
| Recharge period | 80 % of recharge in 12 h (EN50171) | | | |
| Communications | | | | |
| Inputs (potential free contacts) | Mains failure simulation (force battery mode), EPO (emergency power OFF) | | | |
| Outputs (potential free contacts) | General failure, battery mode active, battery deep discharge active | | | |
| Potential free contacts rating | Max 250 Vac, 30 Vdc @ 8A Wire Range: 12–22 AWG (0.5-2.5mm2) | | | |

Notes:

