Vertiv™ Liebert® GXE
1-3kVA, 230V; Tower and Rack/Tower
GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary

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

1.2 Standards

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

Statements	Applicable Standard
Safety	• EN/IEC 62040-1
EMI/RFI/Immunity	• EN/IEC 62040-2 • EN/IEC 61000-3-2 • EN 61000-3-3
ESD	• IEC/EN61000-4-2
Radiated Susceptibility	• IEC/EN61000-4-3
Electrical Fast Transient	• IEC/EN61000-4-4
Surge Immunity	• IEC/EN61000-4-5
Environmental	• ROHS, REACH, WEEE
Transportation	• ISTA Procedure 2A
Certification	• CE, UKCA, RCM, Morocco, EAC, KC/KCC, TISI, SABER, RoHS, WEEE

1.3 System Description

1.3.1 Modes of Operation

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

1. Normal – In normal operation incoming AC power shall be fed to the input power factor corrected (PFC) rectifier that converts the AC power to DC power for the inverter. In this mode, power shall also be derived from utility power for the battery charger. The inverter shall derive DC power from the PFC rectifier to regenerate filtered and regulated AC sinewave power for the connected load. The unit shall begin charging the battery once the UPS is connected to utility power, regardless of whether the UPS is *ON* or *OFF*. In the event of a utility outage or severe abnormality (sag or swell), the inverter shall support the connected load from battery power until the battery is discharged or the utility power returns, whichever occurs first.
2. Battery – Upon failure of utility/mains AC power, the critical AC load shall be supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility/mains AC source.
3. Recharge – Upon restoration of utility/mains AC power, after a utility/mains AC power outage, the input converter shall automatically restart and resume supplying power to the inverter and the battery charger begins to recharge the battery.
4. Automatic Restart – Upon restoration of utility/mains AC power, after a utility/mains AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load and the battery charger automatically recharges the battery.
5. Bypass – The integral bypass shall perform an automatic transfer of the critical AC load from the inverter to the bypass source, in the event of an overload, PFC failure, internal overtemperature, DC bus overvoltage or inverter failure conditions.
6. ECO – The UPS shall allow the user to enable and place the UPS in *ECO* mode of operation to reduce electrical consumption. The UPS will power the connected equipment through the bypass path and the UPS inverter shall be on and operating at no load to stay synchronized to the bypass to ensure rapid transfers to inverter power when input power falls outside of the user customizable parameters.
7. Frequency Converter Mode – When input frequency is within 40 Hz to 70 Hz, the UPS can be set at a constant output frequency, 50 Hz or 60 Hz. The UPS will still charge battery under this mode.

1.3.2 Design Requirements

1. Voltage

   Input/output voltage specifications of the UPS shall be:

   - Input 220/230/240 VAC (230 VAC default), 50/60 Hz, single phase, L-N-G
   - Output 230 VAC (user configurable: 220 V, 230 V, 240 V) ±1% (*Battery* mode), 50/60 Hz, single phase, 2-wire-plus-ground

2. Output Load Capacity

   The specified output load capacity of the UPS at 230 VAC Input shall be:

Model Number	VA	W	Output Power Factor (PF)
GXE3-1000IRT2UXL	1000	900	0.9
GXE3-1000IMT			
GXE3-1500IRT2UXL	1500	1350	0.9
GXE3-1500IMT			
GXE3-2000IRT2UXL	2000	1800	0.9
GXE3-2000IMT			
GXE3-3000IRT2UXL	3000	2700	0.9
GXE3-3000IMT			

3. Internal Battery

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

4. Reserve Time (with Internal battery)

Model Number	Run Time with 100% Load (Minutes)	Run Time with 50% Load (Minutes)
GXE3-1000IRT2UXL	3.1	9
GXE3-1000IMT	3.1	9
GXE3-1500IRT2UXL	3.2	9
GXE3-1500IMT	3.2	9
GXE3-2000IRT2UXL	3.2	9
GXE3-2000IMT	3.2	9
GXE3-3000IRT2UXL	3.3	9.5
GXE3-3000IMT	3.3	9.5

   These times shall be based upon new fully charged batteries installed in an ambient temperature of 25 °C with resistive loading.

5. Battery Recharge

   The UPS shall contain a two stage battery charger designed to prolong battery life. Recharge time for UPS internal batteries after a full discharge to 90% capacity shall be a maximum of 4 hours.

1.3.3 Performance Requirements

1. AC Input to UPS

   a. Voltage: The point at which the UPS transfers to battery operation shall be dependent on the amount of load that the UPS is supporting. The UPS shall operate from the following voltage ranges without drawing power from the batteries:

- Low Line Voltage Range

Load		Line Voltage (±5%)
100% to 80% of full load	L-N Transfer	180 V
	L-N Comeback	195 V
80% to 70% of full load	L-N Transfer	160 V
	L-N Comeback	175 V
70% to 50% of full load	L-N Transfer	140 V
	L-N Comeback	195 V
0% to 50% of full load	L-N Transfer	110 V
	L-N Comeback	125 V

- High Line Voltage Range

High Line Voltage	
High Line Transfer	300 VAC
High Line Comeback	290 VAC

b. Frequency: The UPS shall auto-sense input frequency when first powered up and shall operate within the following frequency specifications. UPS shall be capable of cold start with default frequency of 50 Hz. Once started the frequency operating window shall be 40-70 Hz. Three frequency settings shall be available:

- Auto frequency sensing (factory default setting), 50 Hz frequency conversion and 60 Hz frequency conversion.

c. Input Power Factor: ≧0.95 at nominal voltage (input voltage).

d. Input Current Harmonic Distortion: THD shall be less than 10% at linear, full load operation.

2. AC Output, UPS Inverter

a. Voltage Configuration: 230 VAC default, 50/60 Hz, single phase, 2-wire-plus-ground (L-N-G), configuration program selectable (220 V, 230 V, 240 V).

b. Voltage Regulation: ±1% steady state.

c. Frequency Regulation: ±3 Hz synchronized to bypass and ±0.1 Hz in *Battery* mode operation.

d. Frequency Slew Rate: 1.0 Hz/second maximum.

e. Voltage Distortion: 3% maximum at full linear load and 6% maximum at full RCD load (100% VA, 0.9 PF).

f. Inverter Overload Capability: Inverter output overload capacity in line mode shall be as shown in the table.

Overload	Duration Inverter shall Support Rated Load
105% to 110%	Warning, transfer to bypass after 10 minutes (± 30 seconds) or shutdown on *Battery* mode
110% to 130%	Warning, transfer to bypass after 30 seconds (± 0.4 seconds) or shutdown on *Battery* mode
130% to 150%	Warning, transfer to bypass after 3 seconds (± 0.5 seconds) or shutdown on *Battery* mode
>150%	Immediate shutdown

g. Voltage Transient Response: The transient response of the output voltage with resistor step loading will be ±6% for input supply from *OFF* to *ON* and for a load from 20% to 100% and 100% to 20%.

h. Transient Recovery Time: To nominal voltage <200 ms.

i. AC to AC Efficiency — Online Mode:

Model Number	AC to AC Efficiency (Maximum) Online Mode
GXE3-1000IRT2UXL	89%
GXE3-1000IMT	
GXE3-1500IRT2UXL	89%
GXE3-1500IMT	
GXE3-2000IRT2UXL	89%
GXE3-2000IMT	
GXE3-3000IRT2UXL	91%
GXE3-3000IMT	

j. AC to AC Efficiency — ECO Mode:

Model Number	AC to AC Efficiency (Maximum) ECO Mode
GXE3-1000IRT2UXL	95%
GXE3-1000IMT	
GXE3-1500IRT2UXL	
GXE3-1500IMT	
GXE3-2000IRT2UXL	96%
GXE3-2000IMT	
GXE3-3000IRT2UXL	
GXE3-3000IMT	

1.4 Environmental Conditions

1. Ambient Temperature

   Operating: The ambient temperature range, when UPS is operational, shall be from 0 °C to 40 °C. There shall not be any degradation in the performance when operating in this range. Automatic derating shall occur for operation in higher ambient temperatures.

   Storage:

   - -20 ºC to 50 ºC without batteries

2. Relative Humidity

   Operating: 5% to 95% non-condensing.

3. Altitude

   The normally operate altitude will be 2000 m without power derating. Load shall be derated by 1% for each additional 100 m above 2000 m.

4. Audible Noise

   The audible noise of the UPS shall be less than 53 dBA at 1 m from front.

5. Ingress protection level: IP 20

1.5 User Documentation

The specified UPS system shall be supplied with Safety Instructions, printed copy of Quick Install Guide (QIG), printed copy of Factory Test Report. The User Manual shall be downloadable from the web and includes installation instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures, and general maintenance guidelines.

1.6 Warranty

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

1.7 Quality Assurance

1. Manufacturer Qualifications

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

2. Factory Testing

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

2.0 PRODUCT

2.1 Fabrication

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

2.1.1 Wiring

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

2.1.2 Cabinet

The UPS unit shall be composed of input PFC converter, inverter, battery charger, input filter and internal bypass circuit, and batteries consisting of the appropriate number of sealed battery cells, and shall be housed in a rack/tower/mini tower enclosure and shall meet the requirements of IP20. The UPS cabinet shall be cleaned, primed, and painted RAL 9005 Black.

The product dimensions and weight are described in the table below with the respective model number:

Model Number	Dimensions D×W×H (mm)	Net Weight (kg)
GXE3-1000IRT2UXL	430×438×86	16
GXE3-1500IRT2UXL	430×438×86	19.6
GXE3-2000IRT2UXL	430×438×86	22.7
GXE3-3000IRT2UXL	630×438×86	31.5
GXE3-1000IMT	315×160×245	11.8
GXE3-1500IMT	420×160×245	16.4
GXE3-2000IMT	420×160×245	19.4
GXE3-3000IMT	425×200×345	27.7

2.1.3 Matching Battery Cabinets

The optional rack/tower battery cabinet shall contain valve-regulated, non-spillable, lead acid cells, housed in a separate cabinet that matches the UPS cabinet styling. The cabinet shall be cleaned and painted Black RAL 9005. The external battery system shall be sized to provide an additional reserve power specified in Section 1.3.2 to the load. The matching battery cabinet shall include detachable, molded interconnect cable, circuit breaker overcurrent protection and provisions for daisy-chain connection of additional battery cabinets. The dimensions and weight information of each optional external battery cabinet (EBC) shall not exceed below values.

Battery Cabinets	Dimensions D×W×H (mm)	Net Weight (kg)
GXE3-EBC24VRT2U	410×438×86	19
GXE3-EBC36VRT2U	410×438×86	24.3
GXE3-EBC48VRT2U	510×438×86	32
GXE3-EBC72VRT2U	630×438×86	44

2.1.4 Cooling

The UPS shall be forced air cooled by an internally mounted, continuously operating fan. Fan speed shall be controlled by the UPS and offer multi state operation to minimize noise. Air intake shall be through the front of the unit and exhausted out the rear of the unit.

2.2 Components

2.2.1 Input Converter

General

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

Input Protection

The UPS shall have built-in protection against under voltage, overcurrent and overvoltage conditions including low energy lightning surges, introduced on the primary AC source. The UPS shall be able to sustain input surge of 600 joules without damage.

Battery Recharge

The UPS shall contain a two stage battery charger designed to prolong battery life. Recharge time for the internal UPS batteries shall be less than 4 hours maximum to 90% capacity (full load discharge rate). There shall be DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the UPS will shutdown automatically and the critical load will be transferred to bypass.

2.2.2 Inverter

General

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

Overload

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

Inverter DC Protection

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

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

Output Frequency

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

Output Protection

The UPS inverter shall employ electronic current limiting circuitry.

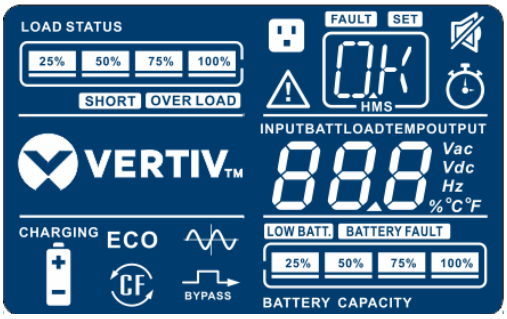
Battery Over Discharge Protection

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

2.2.3 Display and Controls

General

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



Controls

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

a. Button Operation

Button	Function
ON/Mute Button	• **Turn on the UPS:** Press and hold *ON/Mute* button for at least 2 seconds to turn on the UPS. • **Mute the alarm:** After the UPS is turned on, press and hold this button for at least 5 seconds to disable the alarm system. But it is not applied to the situations when warnings or errors occur. • **Up key:** Press this button to display previous selection in UPS *Setting* mode.
OFF/Enter Button	• **Turn off the UPS:** Press and hold this button at least 2 seconds to turn off the UPS in *Battery* mode. UPS will be in *Standby* mode under power normal or transfer to *Bypass* mode if the Bypass enable setting by pressing this button. • **Confirm selection key:** Press this button to confirm selection in UPS *Setting* mode.
Select Button	• **Switch LCD message:** Press this button to change the LCD message for input voltage, input frequency, battery voltage, output voltage and output frequency. It will return back to default display when pausing for 10 seconds. • **Setting mode:** Press and hold this button for 5 seconds to enter UPS *Setting* mode when UPS is off. • **Down key:** Press this button to display next selection in UPS *Setting* mode.
ON/Mute + Select Button	• **Switch to Bypass mode:** When the main power is normal, press *ON/Mute* and select buttons simultaneously for 5 seconds. Then UPS will enter to *Bypass* mode. This action will be ineffective when the input voltage is out of acceptable range.
ON/Mute + OFF/Enter Button	• **Switch to UPS Self-test mode:** Press *ON/Mute* and *OFF/Enter* buttons simultaneously for 5 seconds to enter UPS self-testing while in *AC* mode, *ECO* mode, or *Converter* mode.

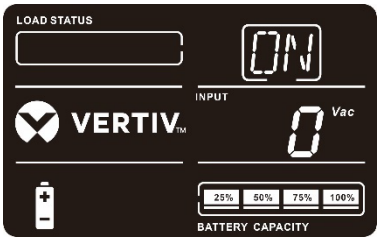
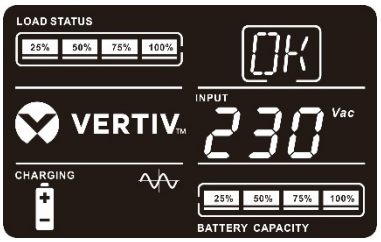
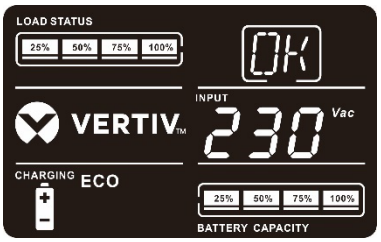
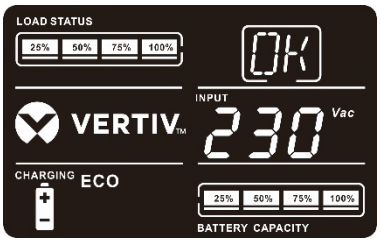
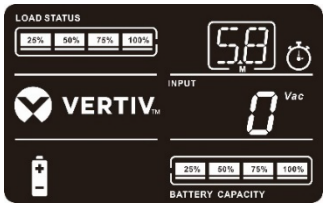
b. Settings

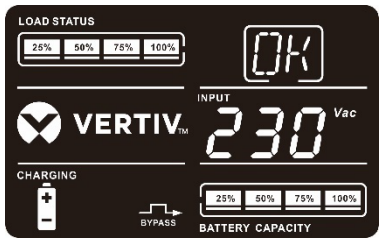
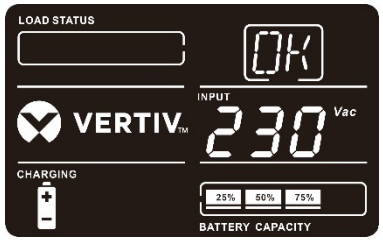
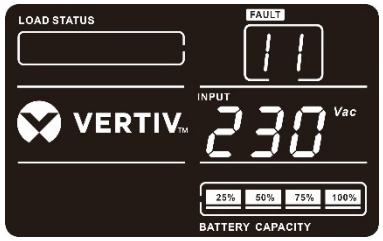
The UPS Configuration screens shall provide the following customizable parameters (default values are listed first):

- Output voltage
- Output frequency
- Frequency converter enable/disable
- ECO enable/disable
- ECO high loss voltage range
- ECO low loss voltage range
- Bypass enable/disable
- Bypass high voltage range

- Bypass low voltage range
- Autonomy limitation
- EBC setting (only for the UPS with external battery connection function)
- Exit

c. Operating mode description

Operating Modes	Function	LCD Display
Switch on	When pressing *ON/MUTE* button, if battery voltage is within acceptable range, *ON* will flash until the UPS is turned on.	
Online mode	When the input voltage is within acceptable range, UPS will provide pure and stable AC power to output. The UPS will also charge the battery at *Online* mode.	
ECO mode	Energy Saving mode: When the input voltage is within voltage regulation range, UPS will bypass voltage to output for energy saving.	
Frequency Converter mode	When input frequency is within 40 Hz to 70 Hz, the UPS can be set at a constant output frequency, 50 Hz or 60 Hz. The UPS will still charge battery under this mode.	
Battery mode	When the input voltage is beyond the acceptable range or power failure and alarm is sounding every 5 seconds, UPS will backup power from battery.	

Operating Modes	Function	LCD Display
Bypass mode	When input voltage is within acceptable range but UPS is overload, UPS will enter *Bypass* mode or *Bypass* mode can be set by front panel. Alarm is sounding every 10 seconds.	
Standby mode	UPS is powered off without output power, but the battery still can be charged.	
Fault mode	The UPS is in *Fault* mode when no output power is supplied from the UPS and the fault icon flashes on the LCD display, although the information of UPS can be displayed in the screen.	

d. Warning

- Low battery
- Overload
- Battery is not connected
- Overcharge
- Overtemperature
- Charger failure
- Out of bypass voltage range
- Battery fault
- Battery replace
- Bypass frequency unstable
- EEPROM error
- EPO enabled

Automatic self-diagnostic test: Power ON and Auto restart

Whether the utility power has been applied, pressing the UPS *ON/Mute* switch will initiate the UPS to perform startup tests. The tests at a minimum should consist of a battery test, will occur prior to enabling output power. Once the UPS passes the startup tests the output receptacles will be powered. If the UPS fail any startup test, the output power will not be enabled, and fault signals (visual and audible) will be enunciated.

Automatic battery test

The UPS contains an automatic battery test at each startup and then once every 8 weeks. If a failure of the battery occur, the UPS will immediately transfer the load to *Normal* mode operation and fault signals (visual, audible, and remote via USB) will be enunciated. The automatic battery test interval counter will be reset after a remote battery test, *Back-up* mode operation or if the UPS is switched off. No audible or remote (via USB/contact closures) indication of the battery test will be enunciated during the duration of the automatic battery test.

Manual battery test

Pressing the *ON and OFF* button for at least 5 seconds with the UPS operating from utility power, will manually initiate the battery test. The test will be the same as the automatic battery test.

2.3 Bypass

2.3.1 Automatic Transfers

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

- UPS overload
- UPS overtemperature
- PFC failure
- Inverter failure
- DC bus overvoltage

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

2.4 Internal Battery

Valve regulated, non-spillable, lead acid cells (VRLA) shall be used as a stored energy source for the specified UPS system. The internal battery shall be hot-swappable user replaceable. The battery shall be housed internal to the UPS cabinet and sized to support the inverter at rated load and power factor, with ambient temperature of 25 °C (77 °F) for a minimum reserve time noted in product documentation. The expected life of the battery shall be 3-5 years or a minimum 260 complete discharge cycles. The UPS units have the capability to allow the operator to replace the internal battery without power down or disconnecting the load.

2.5 Optional External Battery Cabinet (EBC)

The rack/tower UPS models shall allow connection of up to 4 EBCs to provide extended run time capabilities only for rack/tower model. EBCs shall match the UPS in aesthetics and color.

2.6 Output Distribution

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

Capacity	230 VAC Units
1000 VA	(8) IEC C13
1500 VA	
2000 VA	
3000 VA	(8) IEC C13 + (1) IEC C19

2.7 Communication Options

2.7.1 Vertiv™ Liebert® IntelliSlot™ Communication

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

- Vertiv™ Liebert® Intellislot™ IS-UNITY-SNMP Communications Card (IS-UNITY-SNMP)

  The optional Liebert® Intellislot™ IS-UNITY cards shall deliver SNMP and web access to the UPS via 10/100 Mb/s ethernet port. This card shall enable remote or local field upgrades of the SNMP firmware, and managed device firmware and configuration updates.

- Vertiv™ Liebert® Intellislot™ IS-UNITY-DP Communications Card (IS-UNITY-DP)

  The optional Liebert® Intellislot™ IS-UNITY cards shall deliver SNMP and web access to the UPS via 10/100 Mb/s ethernet port. This card shall enable remote or local field upgrades of the SNMP firmware, and managed device firmware and configuration updates.

  This card shall support two protocols at the same time for SNMP, and Modbus or BACnet in addition to support for environmental monitoring via Vertiv™ Liebert® SN Sensors.

- Vertiv™ Liebert® IntelliSlot™ Relay Interface Card (IS-RELAY)

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

2.7.2 USB Port

The USB communications port (Version 2.0) shall meet the HID Power Device standard, version 1.0 or later. All models shall work with the Vertiv™ Power Assist and Power Management system in Microsoft Windows XP or later. They shall also support the equivalent functions in Linux, and Mac OSX.

2.8 UPS Management Software

Vertiv offers two UPS management software packages:

1. Vertiv™ Power Insight software provides UPS management and graceful unattended system shutdown in the event of an extended power outage. Power Insight requires an optional network card. Visit http://www.vertiv.com/powerinsight for a free download of the software and additional information.
2. Vertiv™ Power Assist is an easy to use management and shutdown software package. Power Assist connects locally to the UPS via a USB port. Visit http://www.vertiv.com/powerassist for a free download of the software and additional information.