

# Eaton 9PX Lithium-ion

## 1.5 - 3kVA 2U Rack-Tower UPS Guide Specification

### 1.1 Summary

This specification describes a continuous duty, on-line, solid state uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the existing building electrical system to protect electronic equipment from power disturbances that may occur in utility power such as voltage fluctuations, brown-outs and blackouts, power surges and sags. The UPS shall provide high-quality AC power for sensitive electronic equipment loads.

### 1.2 Model Summary

This specification shall outline the performance characteristics of the following Eaton 9PX UPS models: [9PX1500RT-L](#), [9PX2000RT-L](#), [9PX3000RT-L](#), [9PX1500GRT-L](#), [9PX2200GRT-L](#), [9PX3000GRT-L](#).

### 1.3 Standards

The UPS shall be designed in accordance with applicable sections of the current revision of the following documents.

- IEC/EN 62040-1
- IEC/EN 62040-2: Cat. C1
- IEC/EN 62040-3
- UL1778 5th edition
- CSA 22.2
- CISPR22 Class B
- FCC part 15 Class B / ICES-003
- IEC 61000-4-2, (ESD): 8 kV Contact Discharge / 15 kV Air Discharge
- IEC 61000-4-3, (Radiated field): 10 V/m
- IEC 61000-4-4, (EFT): Power (Coupling network) 4 kV / Ethernet (Coupling clamp) 2 kV
- IEC 61000-4-5, (Surges): 2 kV Differential Mode / 4 kV Common Mode / 1 kV Ethernet
- IEC 61000-4-6, (Electromagnetic field): 10 V
- IEC 61000-4-8, (Conducted magnetic field): 30 A/m

### 1.4 System Description

#### 1.4.1 Modes of Operation

The UPS shall operate as an on-line double-conversion UPS with the following modes:

- A. Normal mode: The rectifier shall derive power as needed from the commercial AC utility or generator source and supply filtered and regulated DC power to the on-line inverter. The inverter shall convert the DC power at its input to highly regulated and filtered AC power for the critical loads.
- B. High efficiency mode: In the presence of favorable incoming utility conditions, the UPS shall optimize its operating state to maximize its efficiency (user selectable).

- C. Battery mode: Upon complete failure of utility power, the UPS shall provide power to the critical loads through the inverter, from the internal or extended batteries. When utility power returns, the unit shall return to Normal operation.
- D. Bypass mode: The automatic bypass shall transfer the critical load to the commercial AC source, bypassing the UPS's inverter/rectifier, in the case of an overload, load fault, or internal failure.
- E. Standby mode: When initially attached to a utility or other power source, the UPS shall start in standby mode until the user initiates power to the critical load. In this mode, the UPS shall recharge the batteries, but power shall not be supplied to the critical load.

#### 1.4.2 Design Requirements

- A. Inverter Output
  - 1. Maximum power ratings: (VA / W)
    - a. 9PX1500RT-L, 9PX1500RTN-L
      - 120/125V: 1500VA / 1350W
      - 110V: 1350VA / 1215W
      - 100V: 1200VA / 1080W
    - b. 9PX2000RT-L, 9PX2000RTN-L
      - 120/125V: 2000VA / 1800W
      - 110V: 1800VA / 1620W
      - 100V: 1600VA / 1440W
    - c. 9PX3000RT-L, 9PX3000RTN-L
      - 120/125V: 3000VA / 2700W
      - 110V: 2700VA / 2430W
      - 100V: 2400VA / 2160W
    - d. 9PX1500GRT-L
      - 200/208V: 1500VA / 1350W
      - 220/230/240V: 1500VA / 1500W
    - e. 9PX2200GRT-L
      - 200/208V: 2200VA / 2000W
      - 220/230/240V: 2200VA / 2200W
    - f. 9PX3000GRT-L
      - 200/208V: 3000VA / 2700W
      - 220/230/240V: 3000VA / 3000W
  - 2. Nominal output voltage (user selectable):
    - a. 9PX1500RT-L, 9PX2000RT-L, 9PX3000RT-L
      - 120V default (100/110/120/125V)
    - b. 9PX1500GRT-L, 9PX2200GRT-L, 9PX3000GRT-L
      - 208V default (200/208/220/230/240V)
  - 3. Efficiency (full load, resistive load):
    - a. 9PX1500RT-L: 90%
    - b. 9PX1500GRT-L: 92%

- c. 9PX2000RT-L, 9PX3000RT-L: 91%
    - d. 9PX2200GRT-L, 9PX3000GRT-L: 93%
  - 4. Current overload capability:
    - a. The UPS shall attempt to clear overloads while remaining on inverter in normal operation (IT Mode) before transferring to bypass.
    - b. Bypass transfer thresholds in normal mode (percent is per nominal Watt/VA)
      - 102%-130%: 12 seconds
      - 130%-150%: 2 seconds
      - >150%: shutdown after 300 ms
    - c. Overload on battery
      - 102%-130%: 12 seconds
      - >130%: 2 seconds
  - 5. Waveform: Pure sinewave
  - 6. Voltage regulation:
    - Normal mode:  $\pm 1\%$  steady state
    - Battery mode:  $\pm 2\%$  steady state
  - 7. Harmonic Distortion THDV%:
    - a. Linear load:  $< 3\%$
    - b. Non-linear load:  $< 5\%$
  - 8. Dynamic voltage regulation:
    - a. 20%  $\rightarrow$  100%  $\rightarrow$  20% R load step:  $\pm 6\%$
  - 9. Recovery time (up to 90% voltage recovery):
    - a. 0%  $\rightarrow$  100  $\rightarrow$  0% non-linear load step: 100ms @ full RCD load
  - 10. Transient response:
    - a. IEC 62040-3 Classification 1 (test method defined by IEC62040-3 Editon2 2011 for R load and non-linear load)
- B. System input
- 1. Input voltage range
    - a. 9PX1500RT-L, 9PX2000RT-L, 9PX3000RT-L
      - at  $\leq 30\%$  load: 60-144V
      - at full load: 100-144V
    - b. 9PX1500GRT-L, 9PX2200GRT-L, 9PX3000GRT-L
      - at  $\leq 40\%$  load: 100V-276V
      - at full load: 176-276V
  - 2. Input voltage hysteresis: Low +10V / High -10V
  - 3. Frequency – 50/60Hz
    - a. Auto sensing upon initial startup
    - b. Selectable through front menu
  - 4. Frequency range
    - a. 50Hz: 40-60Hz
    - b. 60Hz: 50-70Hz

5. Frequency hysteresis: Low +0.5Hz / High -0.5Hz
6. Input power factor:  $\geq 0.99$
7. Input current distortion, THDi%:  $\leq 5\%$  at nominal input voltage, full load and battery fully charged ( $\leq 10\%$  frequency converter mode)

C. Batteries and Charger

1. Battery type: Lithium Iron Phosphate (LFP), maintenance free
2. Extended run time: The UPS shall have capability for addition of four external battery modules (EBMs) to increase total runtime. Refer to Table 1.4.2.C.3 below for runtimes. Battery times are approximate and vary depending on load configuration and battery charge.
3. UPS runtime estimate in minutes:

Load(Watts)	Internal batteries	+1 EBM	+2 EBMs	+3 EBMs	+4 EBMs
<b>9PX1500RT-L</b>					
1350	11.2	30	47.1	64.3	81.4
1215	12.6	33.5	52.7	71.9	91
1080	14.2	38	59.7	81.4	103
945	16.3	43.5	68.4	93.3	118.1
810	19.1	50.8	79.8	108.9	137.9
675	22.9	61	95.9	130.7	165.6
540	28.1	74.8	117.6	160.3	203.1
405	37	98.6	154.9	211.2	267.5
270	54.4	145.2	228.1	311	394
<b>9PX1500GRT-L</b>					
1350	12	31.9	50.2	68.4	86.7
1215	13.3	35.5	55.8	76	96.3
1080	15	39.9	62.7	85.4	108.2
945	17	45.2	71	96.9	122.7
810	19.7	52.5	82.5	112.5	142.5
675	23.4	62.5	98.2	133.9	169.6
540	28.7	76.4	120.1	163.8	207.5
405	37.1	99	155.6	212.1	268.7
270	52	138.7	218	297.3	376.6
<b>9PX2000RT-L</b>					
1800	13.6	36.3	57	77.8	98.5
1620	15.2	40.4	63.5	86.6	109.7
1440	17.1	45.5	71.6	97.6	123.6
1260	19.5	52	81.7	111.4	141.1
1080	22.6	60.3	94.8	129.3	163.8
900	27.1	72.3	113.6	154.8	196.1
720	33.5	89.3	140.3	191.4	242.4
540	43.8	116.7	183.4	250.1	316.8
360	62.6	167	262.4	357.8	453.2

<b>9PX2200GRT-L</b>					
2000	12.3	32.8	51.5	70.2	88.9
1800	13.6	36.3	57.1	77.8	98.6
1600	15.2	40.6	63.8	87	110.2
1400	17.3	46.2	72.6	99	125.4
1200	20.2	53.8	84.5	115.3	146
1000	23.9	63.8	100.3	136.7	173.2
800	29.4	78.4	123.1	167.9	212.7
600	38.2	101.8	159.9	218.1	276.2
400	54.3	144.7	227.4	310.1	392.9
<b>9PX3000RT-L</b>					
2700	9.1	24.1	37.9	51.7	65.5
2400	10.2	26.9	42.2	57.6	72.9
2160	11.3	30.3	47.7	65	82.3
1890	12.9	34.7	54.5	74.3	94.1
1620	14.8	40.4	63.5	86.5	109.6
1350	18	48.3	75.9	103.5	131.1
1080	23	59.9	94.2	128.4	162.6
810	28	79.1	124.3	169.5	214.7
540	43	114.3	179.5	244.8	310.1
<b>9PX3000GRT-L</b>					
2700	9.1	24.2	38	51.8	65.6
2400	10.5	26.9	42.2	57.5	72.9
2160	11.3	30.2	47.5	64.7	82
1890	12.8	34.6	54.4	74.2	94
1620	14.9	40.3	63.3	86.3	109.4
1350	18	47.9	75.3	102.7	130
1080	23	59.4	93.4	127.4	161.4
810	30	77.6	121.9	166.3	210.6

4. Battery replacement – Hot swappable UPS internal batteries (UPS only)
5. Battery Management System (BMS) – The UPS will provide a Battery Management System that uses sophisticated sensing circuitry and monitors every cell, improving cell and balancing efficiency. It actively tracks temperature and charge voltage variation, minimum and maximum voltages, multiple temperatures, state of charge, cycling and health to prevent battery safety issues or thermal runaway.

#### D. Form Factor

1. The UPS shall be able to be used in both rack and tower applications.
2. The front LCD menu shall be able to rotate 90 degrees so that the front menu displays vertically in both a rack and tower form factor.
3. Rack mounting: The UPS and EBM accessories shall ship with a 4-post rail kit included for mounting in a 4-post, 19-inch enclosure.
4. The UPS shall ship with pedestal feet to stabilize the UPS in the tower form factor.

## E. Dimensions:

1. The UPS/EBM shall have the following dimensions:
  - a. 1500VA UPS: 3.4" (2U) x 17.3" x 17.7" (H x W x D)
  - b. 9PXEBM48RT-L: 1.7" (1U) x 17.2" x 17.6" (H x W x D)
  - c. 2000-3000VA UPS: 3.4" (2U) x 17.3" x 23.8" (H x W x D)
  - d. 9PXEBM72RT-L: 1.7" (1U) x 17.2" x 23.7" (H x W x D)

## F. Input connection

1. 9PX1500RT-L, 9PX1500RTN-L: 5-15P
2. 9PX1500GRT-L: C14 inlet
3. 9PX2000RT-L, 9PX2000RTN-L: 5-20P
4. 9PX3000RT-L, 9PX3000RTN-L: L5-30P
5. 9PX2200GRT-L, 9PX3000GRT-L: C20 inlet with C19 to L6-20P detachable input cord

## G. Output receptacles

1. 9PX1500RT-L, 9PX1500RTN-L: (8) 5-15R
2. 9PX1500GRT-L: (8) C13
3. 9PX2000RT-L, 9PX2000RTN-L: (6) 5-20R, (1) L5-20R
4. 9PX3000RT-L, 9PX3000RTN-L: (6) 5-20R, (1) L5-30R
5. 9PX2200GRT-L, 9PX3000GRT-L: (8) C13, (2) C19

**1.4.3 Display and Controls**

## A. Local display:

1. The UPS shall be provided with a full graphical LCD display that provides the information and access to all settings and control features of the UPS.
2. The main status screen shall include all the following information at a single view:
  - a. UPS mode status
  - b. Load information:
    - Load wattage
    - Load VA
    - Load percentage
    - Graphical representation of load %
  - c. Battery Condition
    - Battery charge percentage
    - Estimated runtime
    - Number of EBMs connected
    - Graphical representation of battery %
  - d. Alert / Alarm conditions
  - e. Efficiency

## B. User menu:

1. Controls will consist of a 5-button configuration including:
  - ESC – Exit menu item / cancel changes
  - UP – Go to previous screen or menu/value selection
  - DOWN – Go to next screen of menu/value selection
  - ENTER – Enter menu or select value

- On/Off Button

#### 1.4.4 Optional Accessories

- A. Optional 2-post rail kit: There shall be an optional accessory to mount the UPS and EBM in a 2-post rack.

#### 1.4.5 Communications Option

- A. Network Card
  - 1. UPS shall include one communications slot that will allow the operator to field install an optional network communications card [NETWORK-M2 or equivalent]. Minimum features are described below.
    - a. The network communications card must be hot-installable.
    - b. Communicates with SNMPv3 and IPv6
    - c. Supports IETF UPS MIB
    - d. Supports redundant UPS configurations
    - e. Allows control of UPS managed load segments
    - f. Manual and scheduled on/off controls of UPS
    - g. Capable of mass firmware upgrades
    - h. Capable for mass configuration
- B. RS232 serial Communication
  - 1. The UPS will provide a RS232 serial connection. Cable provided to provide DB-9 interface.
- C. USB
  - 1. The UPS will provide a USB connection that is HID compliant for network connection
- D. RPO / ROO (Remote Power Off / Remote On/Off)
  - 1. The UPS will provide both Remote Power Off and Remote On/Off capability.
    - a. Remote Power Off – Allow a remote contact to be used to disconnect power to the UPS and all devices attached. Restarting the UPS requires manual intervention.
    - b. Remote On/Off – Allows remote contact to be used to turn the UPS On and Off. Resetting the contact to the normal position will automatically return the UPS back to normal state without manual intervention through the front menu.

#### 1.5 Management Software

The UPS will be compatible with power management software [Eaton Brightlayer Software Suite or equivalent]. This software will perform the following actions:

- Monitors power consumption at the load segment level
- Support redundant UPS configuration
- Lightweight software, not running in JRE
- Mass update of network card firmware
- Plugs into dashboard of major Virtualization players. Allows for monitor of power equipment through the same dashboard that the Virtualized data center uses.
- Triggers movement of virtual machines to avoid shutdown of server facing imminent power disruption

## 1.6 Warranty

The UPS will have a warranty that covers both the UPS electronics and the internal batteries for 5 years in the U.S. and Canada.

## 1.7 Environmental conditions

- A. Operating temperature: 0 to 40°C (32°F to 104°F)
- B. Storage temperature: 0 to 40°C (32°F to 104°F)
- C. Storage temperature less battery: -25 to 55°C (-13°F to 130°F)
- D. Relative humidity: 0 to 96% non-condensing
- E. Surge suppression: MOV: 510V, 296 Joules (208V models); MOV: 271V (from L-N) and 510 Volt (from L-G and N-G), 190 Joules (120V models)
- F. Audible noise
  - 1500VA models:  $\leq 40$  dBA at 1m
  - 2000-3000VA models:  $\leq 47$  dBA at 1m