

# Eaton 9PXM

## 4-20kVA Split-Phase Rack-Tower UPS Guide Specification

### 1.1 Summary

This specification describes a modular, double-conversion, split-phase input/output, on-line UPS, with a 2-in-1 rack/tower configuration. This UPS provides scalability, modularity, redundant power protection for critical loads, compatibility with Eaton designed external Bypass Modules (BPM), and expandable backup time capability with Eaton designed smart External Battery Modules (EBM) that communicate with the UPS and its internal batteries.

- A. Manufacturer: The 9PXM UPS is designed and manufactured by Eaton.

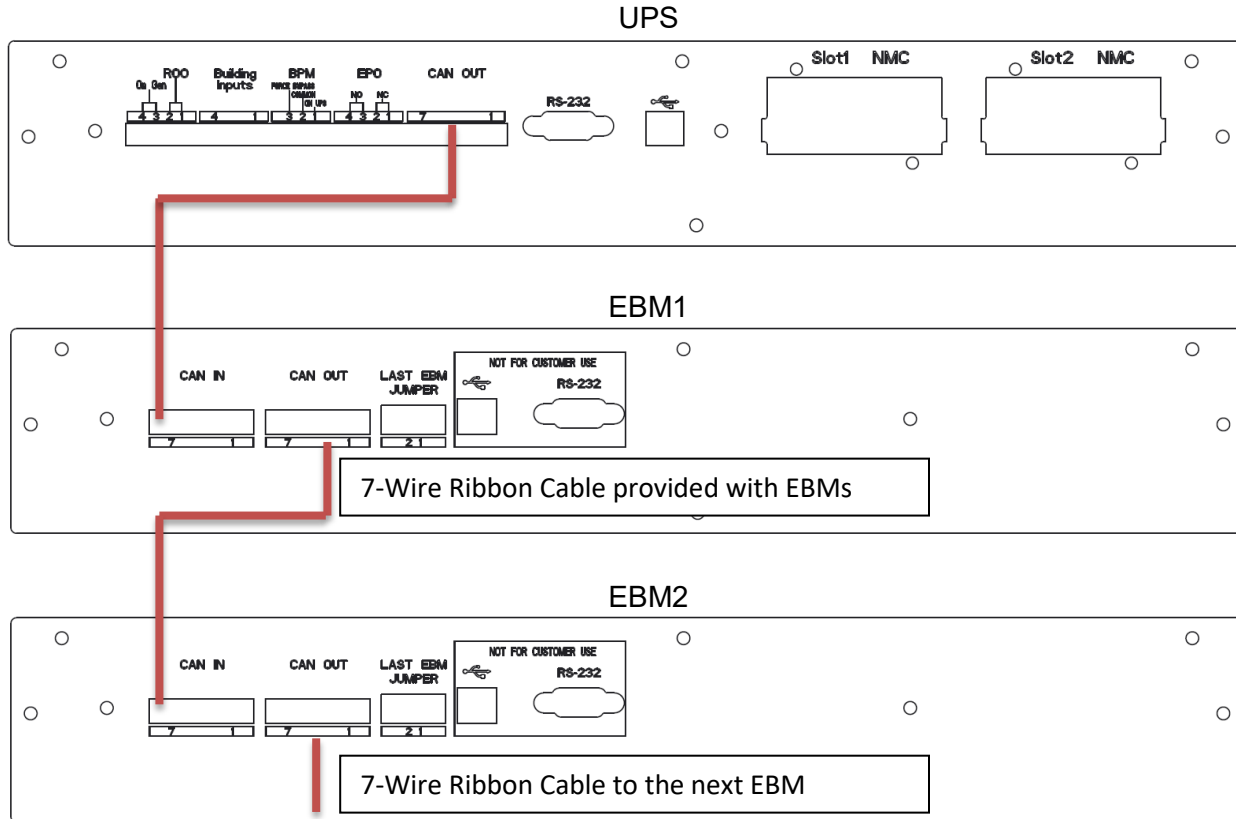
### 1.2 Model Summary

- A. Power Module (UPM)
  - 1. Each power module is rated at 4kVA, 3.6kW.
  - 2. The UPMs can only be installed in the left slots of the UPS chassis.
- B. UPS: The 9PXM offers two models
  - 1. 4kVA - 16kVA: 8-slot split-phase 4-wire I/O
    - a. L-N/L-L I/O voltages: 120V/208V; 120V//240V; 110V/220V; 127V/220V
    - b. 12kVA (N+1) for redundancy
  - 2. 4kVA - 20kVA: 12-slot split-phase 4-Wire I/O
    - a. L-N/L-L I/O voltages: 120V/208V; 120V//240V; 110V/220V; 127V/220V
    - b. 20kVA (N+1) for redundancy
- C. Battery module (one module = 60VDC)
  - 1. Two battery modules per chassis-slot = One battery string = 120VDC
  - 2. Each battery module has five 9Ah, 12Volts VRLA batteries to form a 60Volts battery.
  - 3. Two of these modules fit in one slot of the chassis and are connected in series to form a 120Volts battery string.
  - 4. Two battery modules per slot can be installed in any slot of the UPS chassis and the EBM chassis to form multiple parallel strings of 120VDC for extended backup time capability.
- D. Charger
  - 1. Each Power Module (UPM) can charge up to 5 battery strings (5 slots = 10 battery modules).
- E. Super Charger
  - 1. 9PXM also offers a Super Charger Module (SCM) that can charge up to 20 battery strings (20 slots = 40 battery modules). The SCM can be installed in

any of the left side slots of a UPS. A SCM can also be installed in the bottom left slot of an EBM. However, for the SCM to work in an EBM, the EBM needs to be powered by a separate AC Input (split-phase input similar to the UPS - 120V/208V or 120V/240V).

2. In addition, the CAN Cable provided with the EBM needs to be connected from the UPS CAN output to the EBM CAN Input as shown below.

F. CAN cable connections shown for UPS to multiple EBMs



**1.3 Standards**

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

- UL 1778 5<sup>th</sup> Edition
- cUL
- CSA C22.2 No. 107.3
- FCC 47 CFR
- IEC/EN 62040-2 (UPS EMC)
- IEC/EN 62040-3 (UPS Performance)
- IEC/EN 61000-2-2 (Environment)
- IEC/EN 61000-4-2 (ESD)
- IEC/EN 61000-4-3 (Radiated field 80-1000MHz)
- IEC/EN 61000-4-4 (Fast transient/burst)

- IEC/EN 61000-4-5 (Surge)
- IEC/EN 61000-4-6 (Conducted radio frequency common mode)
- IEC/EN 61000-4-8 (Immunity to power-frequency magnetic field)
- Seismic Requirements as per – IBC, CBC and OSHPD (Pending Certification)
- RoHS
- REACH
- WEEE

## 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 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 to normal conditions, the unit shall return to normal operation.
- D. Bypass mode:
  - 1. Automatic: The UPS shall transfer to bypass, and 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.
  - 2. Manual: The UPS can also be commanded to transfer to bypass
- E. Standby mode: When initially connected to a utility or other AC power source, the UPS shall start and stay in standby mode until the user turns the UPS on. In this mode, the UPS shall recharge the batteries, but power shall not be supplied to the critical load.
- F. Power-share mode: In this mode, the load draws power from both the input AC and the battery – this is typical in those cases where the input mains is lower than the nominal voltage, and the current reaches a maximum value of 20 Amps per phase. If the load is higher than what the input AC can provide, the battery converter is also turned on and it provides the remainder of the power to meet the load demand thus sharing the load with the input AC. The Battery LED is turned ON in this mode.
- G. Auto-restart mode: After complete shutdown on battery mode, the UPS shall restart

once input AC utility returns.

- H. Keep-alive mode: Occurs after a full battery mode discharge and shutdown. All the power converters are turned off. In this mode the output of the UPS is not powered. The logic is powered but remains idle till the AC line returns. The time for this mode is set to 1 hour. All LEDs are turned OFF.
- I. Shutdown Mode: UPS shuts down after the keep-alive mode timer times out. All LEDs are turned OFF.

## 1.4.2 Design Specifications

### A. Inverter Output

1. Maximum power ratings: (VA / W / Power factor)
  - a. 4kVA:
    - 4000VA/ 3600W / 0.9
  - b. 8kVA:
    - 8000VA / 7200W / 0.9
  - c. 12kVA:
    - 12000VA/ 10800W / 0.9
  - d. 16kVA:
    - 16000VA / 14400W / 0.9
  - e. 20kVA:
    - 20000VA / 18000W / 0.9
2. Nominal output voltage (user selectable):
  - a. 120VAC (L-N) /208V (L-L) (Default for 120°input)
  - b. 120VAC (L-N) /240V (L-L) (Default for 180° input)
  - c. 110V (L-N) /220V (L-L)
  - d. 127V (L-N) /220V (L-L)
3. Efficiency (full load, resistive load):
  - a.  $\geq 93\%$  with resistive load and charger off for line to neutral load
  - b.  $\geq 90\%$  with resistive load and charger off for line to line load
  - c.  $\geq 96\%$  with resistive load and charger off for high efficiency mode
4. Current overload capability:
  - a. The UPS shall transfer to bypass in overload conditions
  - b. Bypass transfer thresholds:
    - i. Loads of 100% to 110%, the UPS shall support the load for a minimum of 30 seconds
    - ii. Loads of >110%, the UPS shall support the load for a minimum of 200msecs
    - iii. The UPS will continue to support the overload in bypass mode as long as the overload doesn't exceed 200% of rated value. If the overload exceeds 200%, the UPS will turn the output off and disconnect from the load.
    - iv. If the overload causes the input breaker to trip, the UPS will shutdown
5. Waveform: Sinusoidal
6. Voltage regulation:
  - a. Normal mode:  $\leq 5\%$  steady state

- 7. Output voltage distortion THDV% in normal mode:
  - a. Linear load: <5%
- 8. Dynamic voltage regulation / recovery time / transient response:
  - a. Per IEC 62040-3 Dynamic Output Performance Classification 3

B. System input

1. Input voltage range

Nominal Voltage L-N / L-L	Input Voltage Range
120V / 208V	80-144V
120V / 240V	80-144V
110V / 220V	80-132V
127V / 220V	80-144V

- 1. Frequency: 60Hz
- 2. Frequency range: 55-65Hz
- 3. Input power factor:  $\geq 0.98$  at full load (resistive) and nominal sinusoidal input
- 4. Input current distortion, THDi%: <5% at nominal input voltage, full load and battery fully charged

C. Batteries and Charger

- 1. Battery type: Valve Regulated Lead Acid (VRLA), non-spillable, lead acid cells, maintenance free
- 2. Extended run time: The modular design of the UPS allows for extended runtime in the UPS cabinet as well as the capability for addition of extra battery modules (EBMs) to increase total runtime. Battery run times below are approximate and vary depending on load configuration, battery charge, and environmental conditions.
  - i. 9PXM runtimes at full load:

**Battery modules (part number 9PXMBAT).**

You must order two battery modules to occupy one slot.

Load		2	4	6	8	10	12	14	16	18	20	22	24
<b>kVA</b>	<b>kW</b>												
4 kVA	3.6 kW	6	17	28	39	52	65	78	92	107	121	136	152
8 kVA	7.2 kW		6	11	17	22	28	33	39	45	52	58	65
12 kVA	10.8 kW			6	9	13	17	20	24	28	31	35	39
16 kVA	14.4 kW				6	8	11	14	17	19	22	25	28
20 kVA	18.0 kW					6	8	10	12	14	17	19	21
<b>kVA</b>	<b>kW</b>	<b>26</b>	<b>28</b>	<b>30</b>	<b>32</b>	<b>34</b>	<b>36</b>	<b>38</b>	<b>40</b>	<b>42</b>	<b>44</b>	<b>46</b>	<b>48</b>
4 kVA	3.6 kW	167	183	200	216	233	250	267	284	302	320	338	356
8 kVA	7.2 kW	71	78	85	92	99	107	114	121	129	136	144	152
12 kVA	10.8 kW	43	48	52	56	60	65	69	74	78	83	87	92
16 kVA	14.4 kW	30	33	36	39	42	45	49	52	55	58	61	65
20 kVA	18.0 kW	23	25	28	30	32	35	37	39	42	44	47	49
<b>kVA</b>	<b>kW</b>	<b>50</b>	<b>52</b>	<b>54</b>	<b>56</b>	<b>58</b>	<b>60</b>	<b>62</b>	<b>64</b>	<b>66</b>	<b>68</b>	<b>70</b>	<b>72</b>
4 kVA	3.6 kW	374	393	411	430	449	468	487					
8 kVA	7.2 kW	160	167	175	183.4	192	200	208	216	224	233	241	250
12 kVA	10.8 kW	97	102	107	111	116	121	126	131	136	141	147	152
16 kVA	14.4 kW	68	71	75	78	82	85	89	92	96	99	103	107
20 kVA	18.0 kW	52	54	57	59	62	65	67	70	73	75	78	81
<b>kVA</b>	<b>kW</b>	<b>74</b>	<b>76</b>	<b>78</b>	<b>80</b>	<b>82</b>	<b>84</b>	<b>86</b>	<b>88</b>	<b>90</b>	<b>92</b>	<b>94</b>	<b>96</b>
4 kVA	3.6 kW												
8 kVA	7.2 kW	258	267	276	284	293	302	311	320	329	338	347	356
12 kVA	10.8 kW	157	162	166	173	178	183	189	194	200	205	211	216
16 kVA	14.4 kW	110	114	118	121	125	129	133	136	140	144	148	152
20 kVA	18.0 kW	84	87	89	92	95	98	101	104	107	109	112	115
<b>kVA</b>	<b>kW</b>	<b>98</b>	<b>100</b>	<b>102</b>	<b>104</b>	<b>106</b>	<b>108</b>	<b>110</b>	<b>112</b>	<b>114</b>	<b>116</b>		
4 kVA	3.6 kW												
8 kVA	7.2 kW	365	374	383	393	402	411	421	430	440	449		
12 kVA	10.8 kW	222	227	233	238	244	250	256	261				
16 kVA	14.4 kW	156	160	163	167	171	175	179					
20 kVA	18.0 kW	118	121	124	127	130	133						

Battery runtimes are approximate and may vary with equipment, configuration, battery age, temperature, etc.

3. Battery replacement – Hot swappable internal batteries
4. Advanced Battery Management – The UPS will provide Advanced Battery Management that uses sophisticated sensing circuitry and a three-stage charging technique that extends the used service life of the UPS batteries while optimizing the battery recharge time. Additionally, the UPS should be able to provide up to 60 days’ notice of the end of useful battery service life to aid in scheduling of battery replacement.

D. Form Factor

1. The UPS shall be able to be used in both rack and tower applications.
2. The UPS shall be available in 8-slot and 12-slot tower form factors which are convertible to rack form with an additional rack mounting kit.
3. The UPS shall ship on a caster tray with pedestal feet to stabilize the UPS in the tower form factor.
4. The front LCD menu shall be able to be lifted 90 degrees so that the battery and power modules can be installed into the top slots.
5. Rack mounting: A rack tray shall be available as a finished goods part in the configure-to-order (CTO) guide allowing customers to convert a tower UPS to a rack UPS by removing it from the caster tray.

E. Configure-to-Order Solutions

1. The manufacturer shall offer customers the ability to select a range of output options on the back panel of the 9PXM
2. The 8-slot UPS shall have 2 panels available for outlet output
3. The 12-slot shall have 5 panels available for outlet output.
  - i. 9PXM output configuration options

Output connection options	Outlets per panel
Blank	0
5-20	4
C13	8
C19	4
L5-20R	2
L6-20R	2
L5-30R	2
L6-30R	2
L14-30R	2
IEC309	1

F. Pre-Configured Solutions

1. The manufacturer shall offer bundles in order to ship the UPS and accessories under one-part number. All configured UPS part numbers shall come with a network management card as standard. Bundles will also be available to provide unique outlet configurations for output.

- i. Recommended configurations hardwired input and receptacle output:

Pre-configured Systems with Hardwire Input and Output						
Catalog Number	Power Rating - Split-Phase	Input Connection	Output Connection	Dimensions (H x W x D) (in)	Weight (lb)	Included Items
9PXM8S4K	4 kVA expandabl	Hardwired	Hardwired	25 x 17.5 x 34.5	254.5	9PXM08AAXX X

	e to 12 kVA (N+X)					9PXMSPPM
						9PXMBAT
						Network-M2
9PXM8S8K	8 kVA expandable to 12 kVA (N+X)	Hardwired	Hardwired	25 x 17.5 x 34.5	347	9PXM08AAXX X
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM8S12K	12 kVA expandable to 12 kVA (N+1)	Hardwired	Hardwired	25 x 17.5 x 34.5	439.5	9PXM08AAXX X
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM8S16K	16 kVA	Hardwired	Hardwired	25 x 17.5 x 34.5	532	9PXM08AAXX X
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM12S8K	8 kVA expandable to 20 kVA (N+X)	Hardwired	Hardwired	36.5 x 17.5 x 34.5	392	9PXM12AAAA A
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM12S12K	12 kVA expandable to 20 kVA (N+X)	Hardwired	Hardwired	36.5 x 17.5 x 34.5	484.5	9PXM12AAAA A
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM12S16K	16 kVA expandable to 20 kVA (N+X)	Hardwired	Hardwired	36.5 x 17.5 x 34.5	577	9PXM12AAAA A
						9PXMSPPM
						9PXMBAT
						Network-M2
9PXM12S20K	20 kVA expandable to 20 kVA (N+1)	Hardwired	Hardwired	36.5 x 17.5 x 34.5	669.5	9PXM12AAAA A
						9PXMSPPM
						9PXMBAT
						Network-M2

## i. Recommended Configurations HW input/receptacle output:

Pre-configured Systems with Hardwire Input and Receptacle Output						
Catalog Number	Power Rating - Split Phase	Input Connection	Output Connection	Dimensions (H x W x D) (in)	Weight (lb)	Included Items
9PXM8S4K-	4 kVA	HW		25 x 17.5 x	262.5	9PXM08BHXX



PD	expandable to 12 kVA (N+X)		(4) 5-20 (2) L6-30	34.5		X 9PXMSPPM 9PXMBAT Network-M2
9PXM8S8K-PD	8 kVA expandable to 12 kVA (N+X)	HW	(4) 5-20 (2) L6-30	25 x 17.5 x 34.5	355	9PXM08BHXX X 9PXMSPPM 9PXMBAT Network-M2
9PXM8S12K-PD	12 kVA expandable to 12 kVA (N+1)	HW	(4) 5-20 (2) L6-30	25 x 17.5 x 34.5	447.5	9PXM08BHXX X 9PXMSPPM 9PXMBAT Network-M2
9PXM8S16K-PD	16 kVA	HW	(4) 5-20 (2) L6-30	25 x 17.5 x 34.5	540	9PXM08BHXX X 9PXMSPPM 9PXMBAT Network-M2
9PXM12S8K-PD	8 kVA expandable to 20 kVA (N+X)	HW	(8) 5-20 (2) L6-20 (2) L6-30 (2) L14-30	36.5 x 17.5 x 34.5	408	9PXM12BBFH K 9PXMSPPM 9PXMBAT Network-M2
9PXM12S12K-PD	12 kVA expandable to 20 kVA (N+X)	HW	(8) 5-20 (2) L6-20 (2) L6-30 (2) L14-30	36.5 x 17.5 x 34.5	500.5	9PXM12BBFH K 9PXMSPPM 9PXMBAT Network-M2
9PXM12S16K-PD	16 kVA expandable to 20 kVA (N+X)	HW	(8) 5-20 (2) L6-20 (2) L6-30 (2) L14-30	36.5 x 17.5 x 34.5	593	9PXM12BBFH K 9PXMSPPM 9PXMBAT Network-M2
9PXM12S20K-PD	20 kVA expandable to 20 kVA (N+1)	HW	(8) 5-20 (2) L6-20 (2) L6-30 (2) L14-30	36.5 x 17.5 x 34.5	685.5	9PXM12BBFH K 9PXMSPPM 9PXMBAT Network-M2

### 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 three languages supported are English, Spanish, and French

3. The main status screen shall include all the following information at a single view:
  - a. UPS mode status
  - b. Load information:
    1. Load wattage
    2. Load VA
    3. Load percentage
    4. Graphical representation of load percentage
  - c. Battery condition
    1. Battery charge percentage
    2. Estimated runtime
    3. Number of EBM's connected
    4. Graphical representation of battery percentage
  - 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. Eaton Bypass Power Module (BPM): The UPS will have an option for a compatible external maintenance bypass module. The BPM bypass shall provide a means to provide power to the critical load while isolating or removing the UPS for maintenance. The BPM shall act as both a maintenance bypass and a panelboard in the applications it supports.
  1. Transfer: The BPM shall be a rotary type and make-before-break type. There shall be no loss of power to the critical load during transition.
  2. BPM input:
    - a. All BPM model bypasses are hardwired input standard.
  3. BPM output:
    - a. BPM125HW: Hardwired output
    - b. BPM125AR: (6) L14-30R output plus hardwired output where applicable
    - c. BPM125BR: (3) L6-20R and (3) L14-30R output
    - d. BPM125CR: (6) C19 and (3) L14-30R output
    - e. BPM125DR: (6) 5-20R and (3) L14-30R output
    - f. BPM125ER: (6) 5-20R and (3) L6-30R output
    - g. BPM125FR: (3) L6-20R and (3) L14-30R output
  4. Mounting: The MBP shall be able to mount in a 4-post, 19-inch enclosure of wallmount adjacent to the UPS.
- B. Super charger: The UPS will have an option for a super charger to support faster battery recharge and to support extended runtime battery configurations.
  1. The super charger may be installed in any of the UPS left slots. However, in an EBM, a super charger can only function in the bottom left slot.
- C. External Battery Cabinet (EBM): The UPS will have an option for a compatible external

battery cabinet.

1. The compatible external battery cabinet (EBM) shall be available in an 8- and 12-slot chassis, matching the structure of the UPS.
2. The EBM shall be equipped with a communication server board (CSB) for communication with the UPS
  - a. When configured as a Smart EBM, the 9PXM UPS can communicate with EBMs connected to it
  - b. EBMs will be automatically detected by the UPS
  - c. Cumulative ampere hour capacity of batteries shall be automatically calculated
  - d. The UPS will be able to detect bad batteries in the UPS and EBMs as well.
3. The EBM slots shall be compatible with 9PXM battery modules (part number 9PXMCHAT) and the 9PXM super charger (part number 9PXMCHGR)
4. Wiring EBMs- three possible configuration as described below
  - a. Smart EBM with super charger capability
    - i. Shall require split-phase input, 20A input current
  - b. Smart EBM without super charger capability
    - i. Shall require 120V input (L-N), 10A input current
    - ii. Dumb EBM – no AC input needed to the EBM, however, user must input the ampere-hours information manually using the UPS LCD
    - iii. DC power wires from UPS to EBM DC terminal blocks
    - iv. CAN communication cable from UPS to CAN in port on EBM
5. Daisy-chaining EBMs
  - a. DC power wires from EBM terminal blocks to the next EBM
  - b. CAN cable from CAN out of one EBM to CAN in of the next EBM
  - c. AC inputs of each EBM need to be powered as described above in 4A and 4B if Smart EBM functionality is required
  - d. For Dumb EBMs, only the DC power wires need to be connected. The AC input and the CAN cable are not needed for this configuration.
- D. Optional rack track: EBM shall be rackmount capable with the addition of a rack tray.

#### **1.4.5 Communications Option**

- A. Network Card
  1. UPS shall include two communication slots, allowing for the installation of applicable communication card as follows:
    - a. Relay- MS
    - b. Network-M2
    - c. Modbus-MS
    - d. Network-M2
    - e. PXG-MS
- B. RS232 serial communication
  1. The UPS shall provide a RS232 serial connection. Cable shall provide DB-9 interface
- C. USB
  1. The UPS shall provide a USB connection

D. REPO (EPO) / ROO (Remote Emergency Power Off (Emergency Power Off) / Remote On/Off)

1. The UPS will provide both Remote Emergency Power Off and Remote On/Off capability.
  - a. Remote Emergency Power Off (Emergency Power Off (EPO)) – Allows 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 a 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.

### 1.5 Management software

The 9PXM UPS shall be compatible with Eaton designed power management software platforms. These perform the following actions:

- Support redundant UPS configuration
- Lightweight software, not running in JRE
- Performs mass configurations on alarms, alert notifications and shutdown parameters
- 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

Warranty for product installed (and currently located) in the fifty (50) United States, the District of Columbia and Canada is twenty-four (24) months from the date of purchase, or thirty (30) months from the date of shipment. Additional warranty shall be available from manufacturer upon request.

### 1.7 Environmental conditions

- A. Operating temperature: 0 to 40°C
- B. Storage temperature: 0 to 35°C
- C. Storage temp less battery: -40 to 60°C
- D. Relative humidity: 5 to 95% non-condensing
- E. Audible noise:
  - <62 dB at 1m for <80% load in nominal line mode with fully charged batteries
  - < 67 dB at 1m for all other operating conditions