VERTIV.

HPL Lithium-Ion Energy Storage System

Protocol Guide

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1 Introduction

The purpose of this guide is to provide a reference for using the Modbus protocol with the Vertiv™ HPL products. Specifically, there are multiple versions of HPL firmware that support multiple register mappings. This document attempts to help the user determine which commands are compatible with the version of firmware that functioning on the HPL.

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2 Modbus Communications

The Modbus protocol provides a mechanism for client and server devices to communicate. The communications can be used for control and data acquisition and are based on a query and response process. This Modbus protocol comprises the rules for communication, controlling the message format between devices, how client and server devices initiate communications, as well as unit identification, message handling and error checking.

2.1 Transmission Format

The Vertiv™ HPL BMS interface supports Modbus TCP/IP transmission mode. The BMS will act as a server device on the TCP/IP Ethernet network.

- Transmission Mode: TCP/IP
- TCP Port Number: 502
- Maximum Client Connections: 50

2.2 Transaction Format

Each Modbus transaction consists of the following data:

- Device IP Address
- Function Code
- Reference Number (offset)
- Word (16-bit) Count

2.2.1 Device IP address

The BMS (server) address should consist of a standard unique IPv4 address. Only the addressed server will respond to a query that contains its IP address.

2.2.2 Function code

The function code field tells the addressed server what function to perform. Function codes are designed to invoke a specific action by the server device. The function code ranges from 1 to 127. The Vertiv™ HPL Modbus server only supports Input Registers making all registers read-only. The function code for input registers is 04. Contiguous input registers can be read from 1 to 125. Register data in the response message are packed as two bytes per register, with the first byte containing the high order bits. Register numbering ranges from 30001 to 39999.

2.2.3 Reference number

The reference number field provides the server BMS with the offset register value for the given function code designated register start point. This field value will be added to the function code starting address for the actual register value.

2.2.4 Word count

The word count field represents the number of 16-bit registers requested to be read or written.

2.2.5 Example

A Modbus client requests a BMS at the IP address of 126.4.91.4 to read 125 Input registers starting at register 36001.

- Device IP Address: 126.4.91.4
- Function Code: 04
- Reference Number: 6000
- Word Count: 125

3 Modbus Register Mapping

3.1 Overview

Multiple versions of firmware for the Vertiv™ HPL are supported. The firmware revisions consist of v1.0.4.x, v1.0.6.x and v1.1.0.x and the table below aids in breaking out some of the different configurations based on the revision. Footnotes below the System Data on the next page and Enclosure Data on page 9 help indicate which revisions support what configuration in more detail.

Table 5.1 Overview

Configuration	Versions Supported		
	1.0.4.x	1.0.6.x	1.1.0.x
8 Enclosure Maximum	√		
12 Enclosure Maximum		√	√
6M Battery Module Support Only	√	√	
4M/5M/6M/7M Battery Module Support			√
150 Enclosure Offset for Cell Voltages	√	√	
200 Enclosure Offset for Cell Voltages			√

3.2 Register Definitions

3.2.1 System enclosure enabled/online/faulted/comms faulted

Bitmap of the enclosures for the entire system that are either enabled, online, faulted or there's a communications fault. If an enclosure (bit) is set to one, it is enabled, online, faulted or comms faulted.

NOTE: For firmware revision v1.0.4.x only, the Online and Enabled registers responded with the number of enclosures online or enabled instead of a bitmap.

3.2.2 Battery cell average voltage

The average DC voltage of all 22 cells of the noted battery module.

3.2.3 Battery cell minimum voltage

Bitmap of the 22 cells of the noted battery module that are equal to the lowest cell voltage reading for that module.

3.2.4 Battery cell maximum voltage

Bitmap of the 22 cells of the noted battery module that are equal to the highest cell voltage reading for that module. If a cell (bit) is set to one, it equals the lowest cell voltage reading of the module.

3.2.5 Battery cell minimum difference voltage

The smallest difference DC voltage of all 22 cells of the noted battery module. Most likely this is 0.0VDC.

3.2.6 Battery cell maximum difference voltage

The largest difference DC voltage of all 22 cells of the noted battery module. Most likely is greater than 0.0VDC.

3.2.7 Battery cell balance

The total number of minutes all cells spent balancing for the noted battery module.

3.2.8 Battery cell active balancing

Bitmap of the 22 cells of the noted battery module that are actively balancing. If a cell (bit) is set to one, it is actively balancing.

3.3 Common Data

Table 5.2 Common Data

Data Description	Input Register	Number of Reg/Bit Number	Scale	Notes/Units	Versions Supported		
					1.0.4.x	1.0.6.x	1.1.0.x
BMS Protocol Major/Minor	30001	1	-	Major – upper 8-bits Minor – lower 8-bits	√	√	√
Enclosure Position	30002	1	-	Bitmap Enclosure Location Uint16	√	√	√

3.4 System Data

Table 5.3 System Data

Data Description	Input Register	Number of Register/Bit Number	Scale	Notes/Units	Versions Supported		
					1.0.4.x	1.0.6.x	1.1.0.x
BMS Enclosure Count	30101	1	-	Num of Enclosures Uint16	√	√	√
System Status Flags							
Reserved	30201	Bits 0-2	-	-	√	√	√
UPS Load Valid	30201	Bit 3	-	0 = Normal 1 = UPS Load Valid			√
Discharge Balance Warning	30201	Bit 4	-	0 = Normal 1 = Warning			√
End of Discharge	30201	Bit 5	-	0 = Normal 1 = End of Discharge			√
UPS Ready	30201	Bit 6	-	0 = UPS Not Ready 1 = UPS Ready			√
Celsius	30201	Bit 7	-	0 = Fahrenheit (°F)			√

Table 5.3 System Data (continued)

Data Description	Input Register	Number of Register/Bit Number	Scale	Notes/Units	Versions Supported		
					1.0.4.x	1.0.6.x	1.1.0.x
				1 = Celsius (°C)			
Stop GSE Request	30201	Bit 8	-	0 = Normal 1 = Stop GSE Request			√
GSE Operation	30201	Bit 9	-	0 = Normal 1 = GSE Operation			√
Contactor Welded	30201	Bit 10	-	0 = Normal 1 = Contactor Welded		√	√
Mains Fail	30201	Bit 11	-	0 = Normal 1 = Mains Fail	√	√	√
Faulted Racks	30201	Bit 12	-	0 = Normal 1 = Rack(s) Faulted	√	√	√
Unable to Carry Load	30201	Bit 13	-	0 = Normal 1 = Unable to Carry Load	√	√	√
LED Sync	30201	Bit 14	-	0 = Normal 1 = LED Sync	√	√	√
System Warning	30201	Bit 15	-	0 = Normal 1 = Warning	√	√	√
System Target SOC	30202	1	10	Units: % Uint16	√	√	√
System Average SOC	30203	1	10	Units: % Uint16	√	√	√
System Runtime Remaining	30204	1	-	Units: seconds Uint16	√	√	√
System Enclosure 1 Online	30205	Bit 0	-	0 = Offline 1 = Online	√[1]	√	√
System Enclosure 2 Online	30205	Bit 1	-	0 = Offline 1 = Online	√[1]	√	√
System Enclosure 8 Online	30205	Bit 7	-	0 = Offline 1 = Online	√[1]	√	√
System Enclosure 12 Online	30205	Bit 11	-	0 = Offline 1 = Online		√	√
System Enclosure 1 Fault	30206	Bit 0	-	0 = Normal 1 = Fault	√[2]	√	√
System Enclosure 2	30206	Bit 1	-	0 = Normal	√[2]	√	√

Table 5.3 System Data (continued)

Data Description	Input Register	Number of Register/Bit Number	Scale	Notes/Units	Versions Supported		
					1.0.4.x	1.0.6.x	1.1.0.x
Fault				1 = Fault			
System Enclosure 8 Fault	30206	Bit 7	-	0 = Normal 1 = Fault	√[2]	√	√
System Enclosure 12 Fault	30206	Bit 11	-	0 = Normal 1 = Fault		√	√
System Enclosure 1 Enabled	30207	Bit 0	-	0 = Disabled 1 = Enabled	√[1]	√	√
System Enclosure 2 Enabled	30207	Bit 1	-	0 = Disabled 1 = Enabled	√[1]	√	√
System Enclosure 8 Enabled	30207	Bit 7	-	0 = Disabled 1 = Enabled	√[1]	√	√
System Enclosure 12 Enabled	30207	Bit 11	-	0 = Disabled 1 = Enabled		√	√
System Enclosure 1 Communications Fault	30208	Bit 0	-	0 = Normal 1 = Comms Fault	√[2]	√	√
System Enclosure 2 Communications Fault	30208	Bit 1	-	0 = Normal 1 = Comms Fault	√[2]	√	√
System Enclosure 8 Communications Fault	30208	Bit 7	-	0 = Normal 1 = Comms Fault	√[2]	√	√
System Enclosure 12 Communications Fault	30208	Bit 11	-	0 = Normal 1 = Comms Fault		√	√
System DC Bus Voltage	30209	1	-	Units: VDC Uint16	√	√	√
System Current	30210	1	-	Units: A DC Int16	√	√	√
System DC Power	30211	1	-	Units: kW Int16	√	√	√
System Average SOH	30212	1	10	Units: % Uint16			√
System Battery Cell Temperature Min	30213	1	10	Units: °C/°F Int16			√

Table 5.3 System Data (continued)

Data Description	Input Register	Number of Register/Bit Number	Scale	Notes/Units	Versions Supported		
					1.0.4.x	1.0.6.x	1.1.0.x
System Battery Cell Temperature Max	30214	1	10	Units: °C/°F Int16			√
System Battery Cell Temperature Average	30215	1	10	Units: °C/°F Int16			√

[1] System Online and Enabled is supported in v1.0.4.x as a count instead of a bitmap and for up to 8 enclosures.

[2] System Fault and Communications Fault is supported in v1.0.4.x for only up to 8 enclosures.

3.5 Enclosure Data

Table 5.4 Enclosure Data

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Count	31001	100	1	-	Num of battery modules Uint16	√	√	√
Enclosure 1 Enabled	31002	100	1	-	0 = Disabled 1 = Enabled Uint16	√	√	√
Enclosure 1 Status 1								
Rack Enabled	31003	100	Bit 0	-	0 = Disabled 1 = Enabled	√	√	√
Rack Online	31003	100	Bit 1	-	0 = Offline 1 = Online	√	√	√
Check Main Contactor	31003	100	Bit 2	F	0 = Normal 1 = Current with C1 open	√	√	√
Door Open	31003	100	Bit 3	W	0 = Closed 1 = Open	√	√	√
Service Mode	31003	100	Bit 4	-	0 = Normal 1 = Service	√	√	√
C1 Closed	31003	100	Bit 5	-	0 = C1 Open 1 = C1 Closed	√	√	√
C2 Closed	31003	100	Bit 6	-	0 = C2 Open 1 = C2 Closed	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Rack At Target SOC	31003	100	Bit 7	-	0 = Normal 1 = At Target SOC	√	√	√
IOB Override	31003	100	Bit 8	-	0 = Normal 1 = IOB preventing C1 closure	√	√	
Safety Override	31003	100	Bit 8	-	0 = Normal 1 = Safety subsystem preventing C1 closure			√
Under Voltage	31003	100	Bit 9	W	0 = Normal 1 = Under Voltage	√	√	√
Over Voltage	31003	100	Bit 10	W	0 = Normal 1 = Over Voltage	√	√	√
Watchdog Fault	31003	100	Bit 11	WF	0 = Normal 1 = WD latched C1 open	√		
CIB Current Fault	31003	100	Bit 11	WF	0 = Normal 1 = C1 open by CIB		√	
Watchdog Override	31003	100	Bit 11	WF	0 = Normal 1 = C1 open by WD			√
Over Temperature	31003	100	Bit 12	WF	0 = Normal 1 = Over Temp	√		
High/Low Temperature	31003	100	Bit 12	WF	0 = Normal 1 = Temp High/Low		√	√
Discharge Over Current	31003	100	Bit 13	W	0 = Normal 1 = Current < -525A	√	√	√
Charge Over Current	31003	100	Bit 14	W	0 = Normal 1 = Current > 150A	√	√	√
Cell Under Voltage	31003	100	Bit 15	W	0 = Normal 1 = Cell Under Voltage	√	√	√
Cell Over Voltage	31004	100	Bit 0	W	0 = Normal 1 =Cell Over Voltage	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Cell Under Temp	31004	100	Bit 1	W	0 = Normal 1 = Cell Under Temp	√	√	√
Cell Over Temp	31004	100	Bit 2	W	0 = Normal 1 = Cell Over Temp	√	√	√
High SOC	31004	100	Bit 3	W	0 = Normal 1 = High SOC	√	√	√
CAN0 Error	31004	100	Bit 4	F	0 = Normal 1 = CAN0 Error	√	√	
SD Card I/O Error	31004	100	Bit 4	W	0 = Normal 1 = SD Card Issue			√
CAN1 Error	31004	100	Bit 5	WF	0 = Normal 1 = CAN1 Error	√	√	√
CAN0 Not Running	31004	100	Bit 6	F	0 = CAN0 Running 1 = CAN0 Not Running	√	√	√
CAN1 Not Running	31004	100	Bit 7	F	0 = CAN1 Running 1 = CAN1 Not Running	√	√	√
IOD Not Running	31004	100	Bit 8	F	0 = IOD Running 1 = IOD Not Running	√	√	√
Low Battery	31004	100	Bit 9	W	0 = Normal 1 = Low Battery	√	√	√
End of Discharge	31004	100	Bit 10	W	0 = Normal 1 = End of Discharge	√	√	√
Module Comms Error	31004	100	Bit 11	WF	0 = Normal 1 = Module Comms Error	√	√	√
Balancing Active	31004	100	Bit 12	-	0 = Balancing Not Active 1 = Balancing Active	√	√	√
Data Valid	31004	100	Bit 13	-	0 = Data Invalid 1 = Data Valid	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Warning Status	31004	100	Bit 14	W	0 = Normal 1 = Warning	√	√	√
FAULT Mode	31004	100	Bit 15	F	0 = Normal 1 = Fault	√	√	√
Enclosure 1 Status 2								
UPS Ready	31005	100	Bit 0	-	0 = UPS Not Ready 1 = UPS Ready	√	√	√
Module Fault	31005	100	Bit 1	F	0 = Normal 1 = Module Fault	√	√	√
Stop Request	31005	100	Bit 2	-	0 = Normal 1 = Stop Request	√	√	√
Start Request	31005	100	Bit 3	-	0 = Normal 1 = Start Request	√	√	√
MBB Volt/Temp Delta	31005	100	Bit 4	F	0 = Normal 1 = MBB Volt/Temp Delta	√	√	√
Simulated IOB Fault	31005	100	Bit 5	WF	0 = Normal 1 = IOB Fault	√		
High Battery Voltage	31005	100	Bit 5	W	0 = Normal 1 = High Battery Voltage		√	√
IOB Frame Error	31005	100	Bit 6	W	0 = Normal 1 = IOB Frame Error	√	√	√
Low Bus Voltage	31005	100	Bit 7	W	0 = Normal 1 = Low Bus Voltage	√	√	√
High Delta Voltage	31005	100	Bit 8	W	0 = Normal 1 = High Delta Voltage	√	√	√
Reset Fault Required	31005	100	Bit 9	F	0 = Normal 1 = Fault Needs Ack	√	√	√
Mains Fail	31005	100	Bit 10	-	0 = Normal 1 = Mains Fail	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Confirmation Required	31005	100	Bit 11	W	0 = Normal 1 = Enable Button – needs pressed again	√	√	√
High Battery Voltage	31005	100	Bit 12	W	0 = Normal 1 = High BatteryVoltage	√		
Peer Comms	31005	100	Bit 12	W	0 = Normal 1 = Peer Comms Issue		√	√
POS BATT Fuse Blown	31005	100	Bit 13	F	0 = Normal 1 = Fuse 5 Blown	√	√	√
DVT Mode	31005	100	Bit 14	-	0 = Normal 1 = Sim or DVT mode	√	√	√
Busbar Over Temp	31005	100	Bit 15	-	0 = Normal 1 = Busbar OverTemp	√	√	√
Disconnect Open	31006	100	Bit 0	W	0 = Disconnect Closed 1 = Disconnect Open	√	√	√
Enable Button Depressed	31006	100	Bit 1	-	0 = Normal 1 = Enable Button Depressed	√	√	√
Stop Button Depressed	31006	100	Bit 2	-	0 = Normal 1 = Stop Button Depressed	√	√	√
Service Mode – Close C1	31006	100	Bit 3	-	0 = Normal 1 = C1 closed while in Service Mode	√	√	√
Service Mode – Close C2	31006	100	Bit 4	-	0 = Normal 1 = C2 closed while in Service Mode	√	√	√
Configure Error	31006	100	Bit 5	F	0 = Normal 1 = Configure Error	√	√	√
High DC Bus Voltage	31006	100	Bit 6	W	0 = Normal 1 = DC Bus Voltage High	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Warm Battery	31006	100	Bit 7	-	0 = Normal 1 = Warm Batteries	√	√	√
Float Current	31006	100	Bit 8	-	0 = Normal 1 = Float Current	√	√	√
Discharging	31006	100	Bit 9	-	0 = Normal 1 = Discharging	√	√	√
Power Supply Redundancy Loss	31006	100	Bit 10	W	0 = Normal 1 = Power Supply Redundancy Loss	√	√	√
Calibration Fault	31006	100	Bit 11	-	0 = Normal 1 = Calibration Fault	√		
SD Card I/O Error	31006	100	Bit 11	-	0 = Normal 1 = SD Card Issue		√	
GSE Mode	31006	100	Bit 11	-	0 = Normal 1 = GSE Mode			√
BMS Low Memory	31006	100	Bit 12	W	0 = Normal 1 = BMS Memory Low	√	√	√
Replace Main Contactor	31006	100	Bit 13	F	0 = Normal 1 = Exceeded High Current Discharge Limit	√	√	√
Overload Possible	31006	100	Bit 14	W	0 = Normal 1 = Overload Possible	√	√	√
MBB Board Over Temp	31006	100	Bit 15	-	0 = Normal 1 = MBB Board Over Temp	√	√	√
Enclosure 1 Status 3								
Check Contactor	31007	100	Bit 0	WF	0 = Normal 1 = C1/C2 Failed	√	√	√
Temperature Fault	31007	100	Bit 1	WF	0 = Normal 1 = Temp Fault	√	√	√
Battery Voltage Fault	31007	100	Bit 2	WF	0 = Normal 1 = Battery Voltage Fault	√	√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Calibration Required	31007	100	Bit 3	W	0 = Calibration values set 1 = Calibration values not set	√	√	√
Charge Voltage Low	31007	100	Bit 4	W	0 = Normal 1 = Charge Voltage Low	√	√	√
DC Bus Voltage Fault	31007	100	Bit 5	WF	0 = Normal 1 = DC Bus Voltage Fault	√	√	√
Current Fault	31007	100	Bit 6	WF	0 = Normal 1 = Current Fault	√	√	√
Power Off Request	31007	100	Bit 7	W	0 = Normal 1 = Power Off Requested	√	√	√
Reboot Request	31007	100	Bit 8	-	0 = Normal 1 = Reboot Requested	√	√	√
Loopback Fault	31007	100	Bit 9	WF	0 = Normal 1 = Module Loopback Fault	√	√	√
UPS Comm Error	31007	100	Bit 10	W	0 = Normal 1 = UPS on CAN1 not talking	√	√	√
MBB Temp Fault	31007	100	Bit 11	-	0 = Normal 1 = MBB Temp Fault	√	√	√
MBB Voltage Fault	31007	100	Bit 12	-	0 = Normal 1 = MBB Voltage Fault	√	√	√
IOB Reg PS Failure	31007	100	Bit 13	WF	0 = Normal 1 = IOB has a regulated power supply problem	√	√	√
Force CIB Override	31007	100	Bit 14	-	0 = Normal 1 = Force CIB Override	√	√	
Force Safety Override	31007	100	Bit 14	-	0 = Normal			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
					1 = Force Safety Override			
Polarity Fault	31007	100	Bit 15	WF	0 = Normal 1 = Polarity Fault	√	√	√
Disconnect Requested	31008	100	Bit 0	W	0 = Normal 1 = Peer disconnect discrete asserted	√	√	√
Door Fault	31008	100	Bit 1	F	0 = Normal 1 = Door timer expired		√	√
Advanced IOB	31008	100	Bit 2	-	0 = IOB HW is not Rev 1 1 = IOB HW is Rev 1		√	
IOB Rev1	31008	100	Bit 2	-	0 = IOB HW is not Rev 1 1 = IOB HW is Rev 1			√
CIB Override	31008	100	Bit 3	-	0 = Normal 1 = CIB Override		√	
Safety Override	31008	100	Bit 3	-	0 = Normal 1 = Safety Override			√
Mains Fail Input	31008	100	Bit 4	-	0 = Normal 1 = External Mains Fail		√	√
CAN0 Sync Lost	31008	100	Bit 5	W	0 = Normal 1 = CAN0 disrupted but not yet faulted		√	√
IOB Rev2	31008	100	Bit 6	-	0 = IOB HW is not Rev 2 1 = IOB HW is Rev 2		√	√
SOC Valid	31008	100	Bit 7	-	0 = SOC Not Valid 1 = SOC Valid		√	√
IOB Rev3	31008	100	Bit 8	-	0 = IOB HW is not Rev 3 1 = IOB HW is Rev 3			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Current Warning	31008	100	Bit 9	W	0 = Normal 1 = Overcurrent sensed			√
Reserved	31008	100	Bits 10-15	-	-	√	√	√
Enclosure 1 SOH	31017	100	1	10	Units: % Uint16		√	√
Enclosure 1 Target SOC	31018	100	1	10	Units: % Uint16	√	√	√
Enclosure 1 Percent Charged	31019	100	1	10	Units: % Uint16	√[4]	√[4]	√[4]
Enclosure 1 Runtime Remaining	31020	100	1	-	Units: seconds Uint16	√	√	√
Enclosure 1 DC Bus Voltage	31021	100	1	-	Units: VDC Uint16	√	√	√
Enclosure 1 DC Power	31022	100	1	-	Units: kW Int16	√	√	√
Enclosure 1 Battery Voltage	31023	100	1	10	Units: VDC Uint16	√	√	√
Enclosure 1 Battery Current	31024	100	1	10	Units: A DC Int16	√	√	√
Enclosure 1 Battery Temperature Min	31025	100	1	10	Units: °C/°F Int16	√	√	√
Enclosure 1 Battery Temperature Max	31026	100	1	10	Units: °C/°F Int16	√	√	√
Enclosure 1 Battery Cell Voltage Min	31027	100	1	1000	Units: VDC Uint16	√	√	√
Enclosure 1 Battery Cell Voltage Max	31028	100	1	1000	Units: VDC Uint16	√	√	√
Enclosure 1 Rack Serial Number	31051	100	16	-	Each register contains 2 ASCII characters for the Serial Num		√	√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 PCA Serial Number	31067	100	16	-	Each register contains 2 ASCII characters for the Serial Num		√	√
Enclosure 1 BMS Firmware Revision Number (vA.B.C.D)								
Minor	31083	100	Bits 0-7	-	B		√	√
Major	31083	100	Bits 8-15	-	A		√	√
Patch 2	31084	100	Bits 0-7	-	D		√	√
Patch	31084	100	Bits 8-15	-	C		√	√
Enclosure 1 IOB Boot Firmware Revision Number (vA.B.C.D)								
Minor	31085	100	Bits 0-7		B		√	√
Major	31085	100	Bits 8-15	-	A		√	√
Patch 2	31086	100	Bits 0-7	-	D		√	√
Patch	31086	100	Bits 8-15	-	C		√	√
Enclosure 1 IOB Application Firmware Revision Number (vA.B.C.D)								
Minor	31087	100	Bits 0-7	-	B		√	√
Major	31087	100	Bits 8-15	-	A		√	√
Patch 2	31088	100	Bits 0-7	-	D		√	√
Patch	31088	100	Bits 8-15	-	C		√	√
Enclosure 1 Display Firmware Revision Number (vA.B.C.D)								
Minor	31089	100	Bits 0-7	-	B		√	√
Major	31089	100	Bits 8-15	-	A		√	√
Patch 2	31090	100	Bits 0-7	-	D		√	√
Patch	31090	100	Bits 8-15	-	C		√	√
Enclosure 1 BMS Hardware Revision Number (vA.B)								
Minor	31091	100	Bits 0-7	-	B		√	√
Major	31091	100	Bits 8-15	-	A		√	√
Enclosure 1 IOB Hardware Revision Number (vA.B)								
Minor	31092	100	Bits 0-7	-	B		√	√
Major	31092	100	Bits 8-15	-	A		√	√
Enclosure 1 Battery Cell Average Voltage 1	33001	150	1	1000	Units: VDC Uint16			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Cell Average Voltage 2	33002	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Average Voltage 3	33003	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Average Voltage 4 (4M)	33004	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Average Voltage 5 (5M)	33005	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Average Voltage 6 (6M)	33006	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Average Voltage 7 (7M)	33007	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Voltage 1								
Battery Cell 17	33011	150	Bit 0	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 18	33011	150	Bit 1	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 19	33011	150	Bit 2	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 20	33011	150	Bit 3	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 21	33011	150	Bit 4	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 22	33011	150	Bit 5	-	0 = Not at Min Voltage			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
					1 = At Min Voltage			
Reserved	33011	150	Bits 6-15	-	-			√
Battery Cell 1	33012	150	Bit 0	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 2	33012	150	Bit 1	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 3	33012	150	Bit 2	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 4	33012	150	Bit 3	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 5	33012	150	Bit 4	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 6	33012	150	Bit 5	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 7	33012	150	Bit 6	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 8	33012	150	Bit 7	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 9	33012	150	Bit 8	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 10	33012	150	Bit 9	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 11	33012	150	Bit 10	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 12	33012	150	Bit 11	-	0 = Not at Min Voltage 1 = At Min Voltage			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Battery Cell 13	33012	150	Bit 12	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 14	33012	150	Bit 13	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 15	33012	150	Bit 14	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Battery Cell 16	33012	150	Bit 15	-	0 = Not at Min Voltage 1 = At Min Voltage			√
Enclosure 1 Battery Cell Minimum Voltage 2	33013	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage1			√
Enclosure 1 Battery Cell Minimum Voltage 3	33015	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage 1			√
Enclosure 1 Battery Cell Minimum Voltage 4 (4M)	33017	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage 1			√
Enclosure 1 Battery Cell Minimum Voltage 5 (5M)	33019	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage 1			√
Enclosure 1 Battery Cell Minimum Voltage 6 (6M)	33021	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage 1			√
Enclosure 1 Battery Cell Minimum Voltage 7 (7M)	33023	150	2	-	See Cell layout for Enclosure 1 Battery Cell Minimum Voltage 1			√
Enclosure 1 Battery Cell Maximum Voltage 1								
Battery Cell 17	33031	150	Bit 0	-	0 = Not at Max Voltage			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
					1 = At Max Voltage			
Battery Cell 18	33031	150	Bit 1	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 19	33031	150	Bit 2	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 20	33031	150	Bit 3	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 21	33031	150	Bit 4	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 22	33031	150	Bit 5	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Reserved	33031	150	Bits 6-15	-	-			√
Battery Cell 1	33032	150	Bit 0	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 2	33032	150	Bit 1	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 3	33032	150	Bit 2	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 4	33032	150	Bit 3	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 5	33032	150	Bit 4	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 6	33032	150	Bit 5	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 7	33032	150	Bit 6	-	0 = Not at Max Voltage 1 = At Max Voltage			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Battery Cell 8	33032	150	Bit 7	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 9	33032	150	Bit 8	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 10	33032	150	Bit 9	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 11	33032	150	Bit 10	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 12	33032	150	Bit 11	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 13	33032	150	Bit 12	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 14	33032	150	Bit 13	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 15	33032	150	Bit 14	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Battery Cell 16	33032	150	Bit 15	-	0 = Not at Max Voltage 1 = At Max Voltage			√
Enclosure 1 Battery Cell Maximum Voltage 2	33033	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√
Enclosure 1 Battery Cell Maximum Voltage 3	33035	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√
Enclosure 1 Battery Cell Maximum Voltage 4 (4M)	33037	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Cell Maximum Voltage 5 (5M)	33039	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√
Enclosure 1 Battery Cell Maximum Voltage 6 (6M)	33041	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√
Enclosure 1 Battery Cell Maximum Voltage 7 (7M)	33043	150	2	-	See Cell layout for Enclosure 1 Battery Cell Maximum Voltage 1			√
Enclosure 1 Battery Cell Minimum Difference Voltage 1	33051	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Difference Voltage 2	33052	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Difference Voltage 3	33053	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Difference Voltage 4 (4M)	33054	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Difference Voltage 5 (5M)	33055	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Minimum Difference Voltage 6 (6M)	33056	150	1	1000	Units: VDC Uint16			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Cell Minimum Difference Voltage 7 (7M)	33057	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 1	33061	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 2	33062	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 3	33063	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 4 (4M)	33064	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 5 (5M)	33065	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 6 (6M)	33066	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Maximum Difference Voltage 7 (7M)	33067	150	1	1000	Units: VDC Uint16			√
Enclosure 1 Battery Cell Balance 1	33071	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Balance 2	33073	150	2	-	Units: minutes Uint32			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Cell Balance 3	33075	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Balance 4 (4M)	33077	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Balance 5 (5M)	33079	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Balance 6 (6M)	33081	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Balance 7 (7M)	33083	150	2	-	Units: minutes Uint32			√
Enclosure 1 Battery Cell Active Balancing 1								
Battery Cell 17	33091	150	Bit 0	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 18	33091	150	Bit 1	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 19	33091	150	Bit 2	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 20	33091	150	Bit 3	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 21	33091	150	Bit 4	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 22	33091	150	Bit 5	-	0 = Not Balancing 1 = Balance Active			√
Reserved	33091	150	Bit 6-15	-	-			√
Battery Cell 1	33092	150	Bit 0	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 2	33092	150	Bit 1	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 3	33092	150	Bit 2	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 4	33092	150	Bit 3	-	0 = Not Balancing			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
					1 = Balance Active			
Battery Cell 5	33092	150	Bit 4	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 6	33092	150	Bit 5	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 7	33092	150	Bit 6	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 8	33092	150	Bit 7	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 9	33092	150	Bit 8	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 10	33092	150	Bit 9	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 11	33092	150	Bit 10	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 12	33092	150	Bit 11	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 13	33092	150	Bit 12	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 14	33092	150	Bit 13	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 15	33092	150	Bit 14	-	0 = Not Balancing 1 = Balance Active			√
Battery Cell 16	33092	150	Bit 15	-	0 = Not Balancing 1 = Balance Active			√
Enclosure 1 Battery Cell Active Balancing 2	33093	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√
Enclosure 1 Battery Cell Active Balancing 3	33095	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√
Enclosure 1 Battery Cell Active Balancing 4 (4M)	33097	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery Cell Active Balancing 5 (5M)	33099	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√
Enclosure 1 Battery Cell Active Balancing 6 (6M)	33101	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√
Enclosure 1 Battery Cell Active Balancing 7 (7M)	33103	150	2	-	See Cell layout for Enclosure 1 Battery Cell Active Balancing 1			√
Enclosure 1 Temperature Values per Battery	35001	50	1	-	Num of Temperatures per battery module Uint16	√	√	√
Enclosure 1 Battery Temp 1	35002	50	1	10	Units: °C/°F Int16	√	√	√
Enclosure 1 Battery Temp 2	35003	50	1	10	Units: °C/°F Int16	√	√	√
Enclosure 1 Battery Temp 8 (4M)	35009	50	1	10	Units: °C/°F Int16			√
Enclosure 1 Battery Temp 10 (5M)	35011	50	1	10	Units: °C/°F Int16			√
Enclosure 1 Battery Temp 12 (6M)	35013	50	1	10	Units: °C/°F Int16	√[5]	√[5]	√
Enclosure 1 Battery Temp 14 (7M)	35015	50	1	10	Units: °C/°F Int16			√
Enclosure 1 Battery 1 SOH	35031	50	1	10	Units: % Uint16		√	√
Enclosure 1 Battery 2 SOH	35032	50	1	10	Units: % Uint16		√	√
Enclosure 1 Battery 3 SOH	35033	50	1	10	Units: % Uint16		√	√
Enclosure 1 Battery 4 SOH (4M)	35034	50	1	10	Units: % Uint16			√

Table 5.4 Enclosure Data (continued)

Data Description	Input Register	Encl Offset[6]	Number of Register/Bit Number	Scale/ Status	Notes/Units	Versions Supported		
						1.0.4.x	1.0.6.x	1.1.0.x
Enclosure 1 Battery 5 SOH (5M)	35035	50	1	10	Units: % Uint16			√
Enclosure 1 Battery 6 SOH (6M)	35036	50	1	10	Units: % Uint16		√[5]	√
Enclosure 1 Battery 7 SOH (7M)	35037	50	1	10	Units: % Uint16			√
Enclosure 1 Cell Voltages Per Battery	36001	200	1	-	Uint16	√[3]	√[3]	√
Enclosure 1 Cell Voltage 1	36002	200	1	1000	Units: VDC Uint16	√[3]	√[3]	√
Enclosure 1 Cell Voltage 2	36003	200	1	1000	Units: VDC Uint16	√[3]	√[3]	√
Enclosure 1 Cell Voltage 88 (4M)	36089	200	1	1000	Units: VDC Uint16			√
Enclosure 1 Cell Voltage 110 (5M)	36111	200	1	1000	Units: VDC Uint16			√
Enclosure 1 Cell Voltage 132 (6M)	36133	200	1	1000	Units: VDC Uint16	√[3,5]	√[3,5]	√
Enclosure 1 Cell Voltage 154 (7M)	36155	200	1	1000	Units: VDC Uint16			√

Notes to Table :

[3] The register offset for Cell Voltages between enclosures is 150 compared to 200 in the Enclosure Data Table. Starting Input Register for Enclosure n Cell Voltages Per Battery are listed below.

Enclosure n: 1 – 36001, 2 – 36151, 3– 36301, 4– 36451, 5– 36601, 6– 36751, 7– 36901, 8 – 37051

[4] Percent Charged (SOC) for v1.0.6.x and v1.1.0.x is a raw value. For v1.0.4.x the SOC is a percentage of the Target SOC (raw SOC / Target SOC).

[5] Six Battery Modules are only supported for these versions of firmware. v1.1.0.x can support 4, 5, 6 and 7 module HPL models.

[6] Register number for subsequent enclosures is calculated as: Input Register = Enclosure 1 Register number + [(Enclosure number - 1) x Offset]

NOTE: Version v1.0.4.x supports up to 8 enclosures whereas v1.0.6.x and newer versions support up to 12 enclosures.

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4 SNMP

The SNMP protocol is not enabled by default and is available in versions v1.0.6.x and newer firmware. It can be enabled and configured via running the polaris_config script when setting up other configuration items during installation. The Management Information Base (MIB) for the Vertiv™ HPL is available and named.

4.1 Management Information Base (MIB)

VERTIV_GP_LITHIUM_ION.MIB. All objects listed in this MIB are very similar to the Modbus registers.

NOTE: This MIB object identifications (OID) follows a path utilizing Vertiv and the Energy Storage LOB. See below for the full OID layout that includes the HPL System, Enclosure and Event Notification data object sections.

```
.iso.org.dod.internet.private.enterprises.vertiv.vertivGlobalProducts.energyStorageProduc
ts.
energyStorageLithiumIonModule
lithiumIonHplSystem
lithiumIonHplEncl
lithiumIonHplEnclTable
lithiumIonHplBatteryTempTable
lithiumIonHplBatterySohTable
lithiumIonHplBatteryVoltTable
lithiumIonHplBatteryAvgVoltTable
lithiumIonHplBatteryMinVoltTable
lithiumIonHplBatteryMaxVoltTable
lithiumIonHplBatteryMinDiffVoltTable
lithiumIonHplBatteryMaxDiffVoltTable
lithiumIonHplBatteryBalancingTimeTable
lithiumIonHplBatteryBalancingTable
lithiumIonHplNotifications
lithiumIonHplEventNotifications
lithiumIonHplEventParameters
```

4.2 Event Notification

Event notifications, or traps, have been setup to alert the user of three alert types. Just like enabling and setting up users with polaris_config, as noted above, traps can be configured for both levels of v1/2 and v3 security levels. The three alerting traps are Online, Warning and Fault for all enclosures in the system for any change in those states. The trap will indicate which enclosure it occurred, so that the user can then look at that particular enclosure for further detail. Since these notifications cover all the enclosures in the system, it is only necessary to set up traps on a single enclosure of the system. Otherwise, if multiple enclosures have traps configured, duplicated traps will be received by the user. Thus, SNMP data for all enclosures can be attained from a single enclosure, similar to Modbus.

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Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

1050 Dearborn Drive

Columbus, OH, 43085, USA

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong

Appendix B: Glossary

Unit	Description	Unit	Description
A	Ampere	MIB	Management Information Base
BMS	Battery Management System	MBB	Module Balancing Board
°C	Celsius	IOD	Input Output Data
CAN	Controller Area Network	OID	Object Identification
CIB	Contactor Interrupt Board	nM	HPL model with 4, 5, 6 or 7 modules installed
C1	Main Contactor	PCA	Power Chassis Assembly
C2	Charge Enable Contactor	SD	Secure Digital
DC	Direct Current	Sim	Simulator
DVT	Design Verification Testing	SNMP	Simple Network Management Protocol
°F	Fahrenheit/Fault	SOC	State of Charge – Percent Charged
GSE	Grid Support Energy	SOH	State of Health
HPL	High Powered Lithium	TCP	Transmission Control Protocol
Int16	Signed Integer 16-bit	Uint16	Unsigned Integer 16-bit
I/O	Input/Output	UPS	Uninterruptible Power Supply
IOB	Input Output Board	V	Voltage
IP	Internet Protocol	W	Warning
kW	Kilowatt	WD	Watch Dog
LOB	Line of Business	WF	Warning that Becomes a Fault

Connect with Vertiv on Social Media

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https://www.instagram.com/vertiv/

https://www.linkedin.com/company/vertiv/

https://www.twitter.com/Vertiv/

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