



NetSure™ Lithium Batteries for Telecom

Application Guide

For Use with NetSure™ DC Power Systems in North America

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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1 Lithium Battery Standard vs. Monitoring Mode

1.1 Standard Mode

Standard Mode is when the power system and Lithium-Ion Battery (LIB) are connected with power cables only, just like a Valve Regulated Lead Acid (VRLA) battery. To ensure the power system works with the battery correctly, it is necessary to adjust various parameters in the NetSure Control Unit (NCU) based on the battery manufacturer's specifications. Some of those parameters are:

Set Float and Equalize Voltage

Confirm Equalize and Temp Comp are Off

Enter Battery String Capacity

Set Charge Current Limit

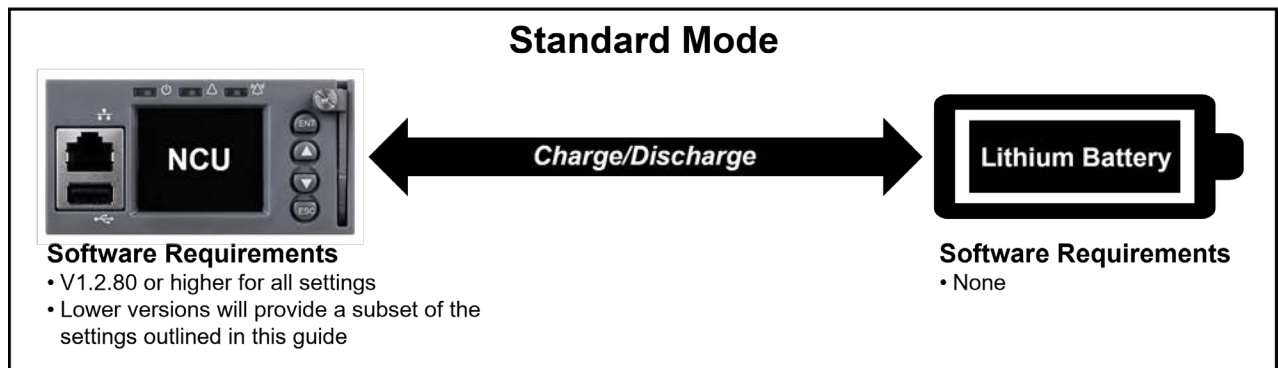
Update LVD Voltage

Adjust Rectifier Walk-In Time

In Standard Mode, no specific NCU software or communication cabling is required. Detailed information regarding Standard Mode adjustments for LIBs are located in section “Standard Mode Set-up Procedure” starting on page 11.

Standard Mode will work with just about any brand of LIB. See Figure 1.1.

Figure 1.1 Standard Mode



1.2 Monitoring Mode

Monitoring Mode is when the power system and LIB are connected with power and communication cables. The communication cabling enables key Battery Management System (BMS) data and alarms to be viewed in the NCU. Below is the type of BMS Data that can be *viewed locally or remotely* via the NCU.

Asset Management: model #, serial #, SW version, etc.

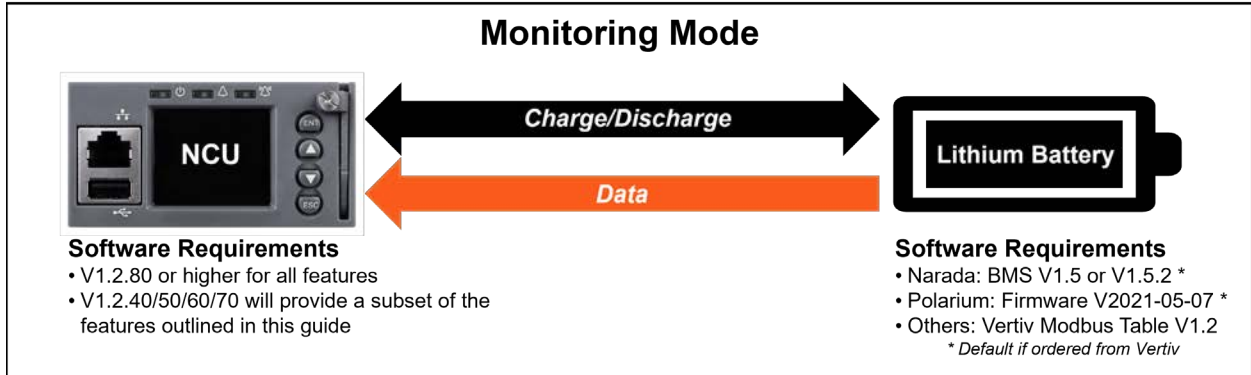
Operational Performance and History: SOC (state of charge), cycle count, temperature, SOH (state of health), etc.

Alarms: Displays key battery alarms and assigns criticality level.

NCU screen shots of Monitoring Mode for Narada Batteries are available in Section 1.3 starting on page 2 of this document. Polarium Monitoring Mode screen shots are available in Section 1.4 starting on page 6 of this document. Other brands of batteries loaded with Vertiv Modbus Table V1.2 will provide data and alarms similar to what is shown/described for Narada and Polarium batteries.

In North America, Monitoring Mode will work with only Narada, Polarium, or other brands of batteries loaded with Vertiv Modbus Table V1.2. Detailed information regarding Monitoring Mode adjustments, cabling and other requirements are located in section “Monitoring Mode Set-up Procedure” starting on page 21. See Figure 1.2.

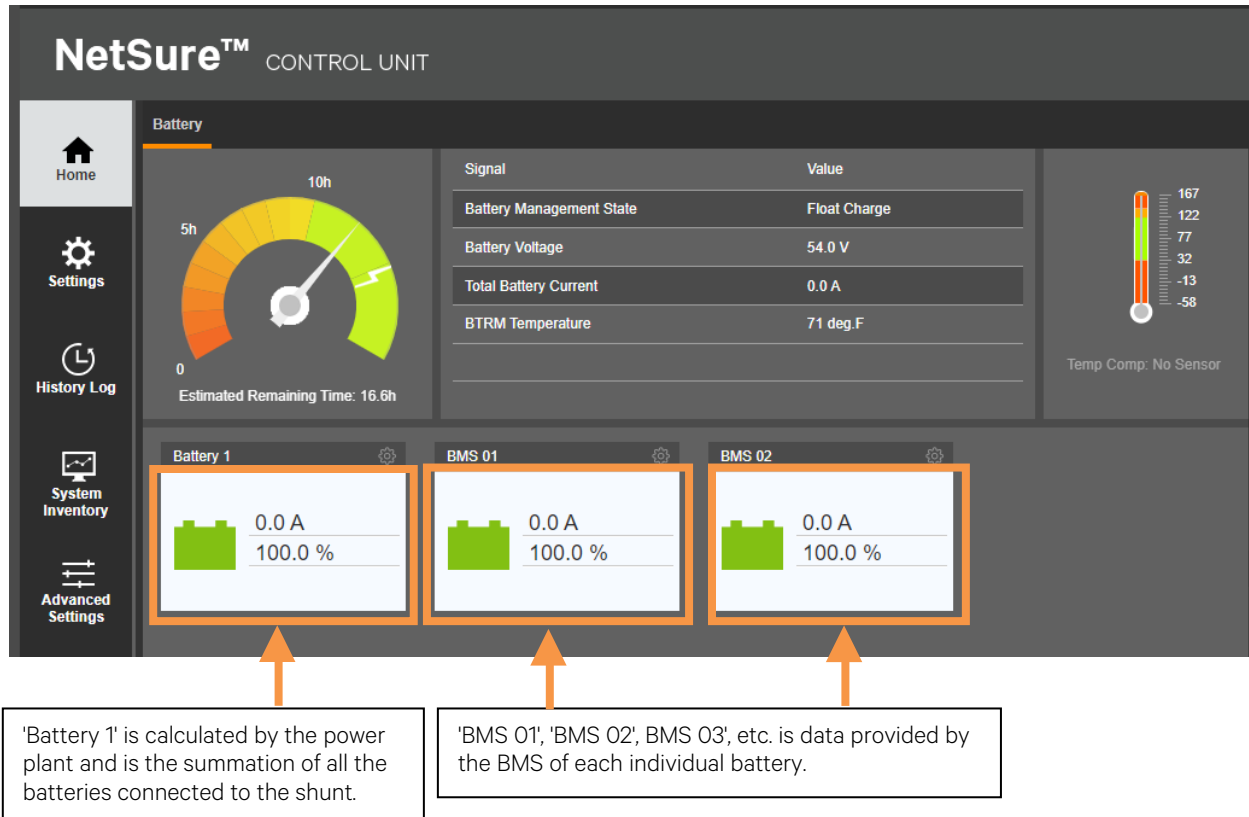
Figure 1.2 Monitoring Mode



1.3 NCU Monitoring Mode Screen Shots for Narada Batteries

1.3.1 Battery Dashboard

Image is representative and subject to change.



Note: Data for 'Battery 1' and 'BMS 01', 'BMS 02', etc. are derived from different algorithms and sensors; therefore, it is likely there will be differences in the values shown.

Battery Details

Image is representative and subject to change.



This data will be available for each individual battery.

If data for a parameter is not available from the BMS of the battery it will be displayed as 'N/A'.

Temperature scale (C°/F°) will be the same as the power system setting.

1.3.2 Battery Product Information in System Inventory Screen

Image is representative and subject to change.

Equipment	Product Model	Hardware Revision	Serial Number	Software Revision
NCU	M830D	B00	03220700238	1.2.42B
Rectifier #1	1R482000e3	D12	03220609794	1.10
Rectifier #2	1R482000e3	D12	03220408080	1.10
Rectifier #3	1R482000e3	D12	03220609732	1.10
Rectifier #4	1R482000e3	B03	03140710989	1.08
Rectifier #5	1R482000E3	D00	03170400070	1.04
EIB-1	1MA455U41	A01	03220101367	1.02
IB2-1	1MA4C5U31	A11	03220606317	1.03
BMS 01	48NPFC200	0.0.8.1.1	1180000725150432404000190	11.0
BMS 02	48NPFC200	0.0.8.1.1	11800007251504324040	11.0
IB4	NA	NA	NA	NA

This data will be available for each individual battery.

If data for a parameter is not available from the BMS of the battery it will be displayed as 'N/A'.

1.3.3 Alarms and Severity Level Settings

Image is representative and subject to change.

The screenshot shows the NetSure™ CONTROL UNIT interface with the 'Alarms' tab selected. The left sidebar contains navigation options: Home, Settings, History Log, System Inventory, and Advanced Settings. The main content area displays a table of BMS alarms, indexed 1 through 10. Each row includes the alarm name, its severity level, the relay number, and a 'Modify' button.

Index	Name	Alarm Level	Relay Number	Modify
1	Communication Fail	CR	None	Modify
2	Cell Over Temperature Alarm	MN	None	Modify
3	Cell Under Temperature Alarm	MN	None	Modify
4	Environment Over Temperature	MN	None	Modify
5	Environment Under Temperature	MN	None	Modify
6	PCB Over Temperature Alarm	MN	None	Modify
7	SOC Low Voltage Alarm	MJ	None	Modify
8	Diff Voltage Alarm	CR	None	Modify
9	Front End Sample Error	CR	None	Modify
10	Temp Sensor Disconnect	CR	None	Modify

The screenshot shows the NetSure™ CONTROL UNIT interface with the 'Alarms' tab selected. The left sidebar contains navigation options: Home, Settings, History Log, System Inventory, and Advanced Settings. The main content area displays a table of BMS alarms, indexed 11 through 20. Each row includes the alarm name, its severity level, the relay number, and a 'Modify' button.

Index	Name	Alarm Level	Relay Number	Modify
11	Short Circuit Protection	CR	None	Modify
12	Charge Over Temperature Protect	CR	None	Modify
13	Charge Under Temperature Protect	MJ	None	Modify
14	Discharge Over Temp Protect	CR	None	Modify
15	Discharge Under Temp Protect	MJ	None	Modify
16	Charge Overcurrent Protect	MJ	None	Modify
17	Discharge Overcurrent Protect	MJ	None	Modify
18	Inversed Graft Error	CR	None	Modify
19	Module Failure but in Operation	CR	None	Modify
20	Module Out Of Operation	CR	None	Modify



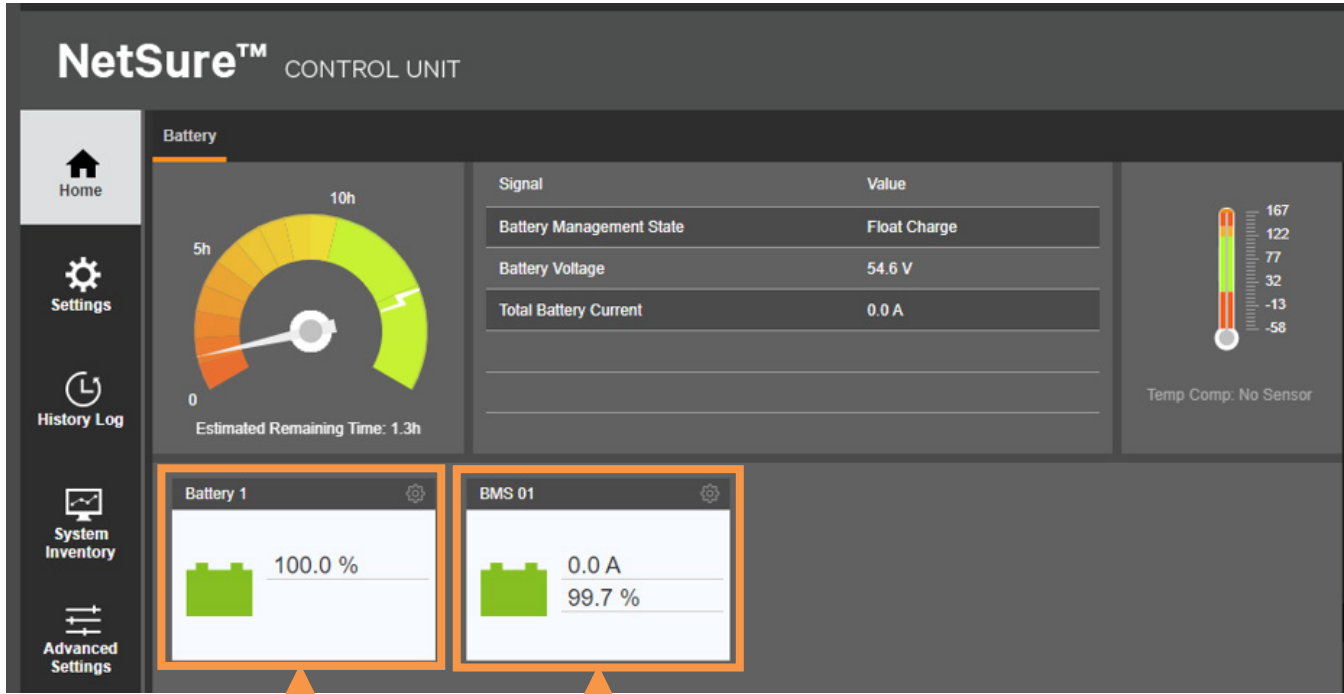
These alarms and their associated criticality levels are automatically mapped.

Alarm criticality level can be adjusted by the operator.

1.4 NCU Monitoring Mode Screen Shots for Polarium Batteries

1.4.1 Battery Dashboard

Image is representative and subject to change.



'Battery 1' is calculated by the power plant and is the summation of all the batteries connected to the shunt.

'BMS 01', 'BMS 02', 'BMS 03', etc. is data provided by the BMS of each individual battery.

Note: Data for 'Battery 1' and 'BMS 01', 'BMS 02', etc. are derived from different algorithms and sensors; therefore, it is likely there will be differences in the values shown.

1.4.2 Battery Details

Image is representative and subject to change.



This data will be available for each individual battery.

If data for a parameter is not available from the BMS of the battery it will be displayed as 'N/A'.

Temperature scale (C°/F°) will be the same as the power system setting.

1.4.3 Battery Product Information in System Inventory Screen

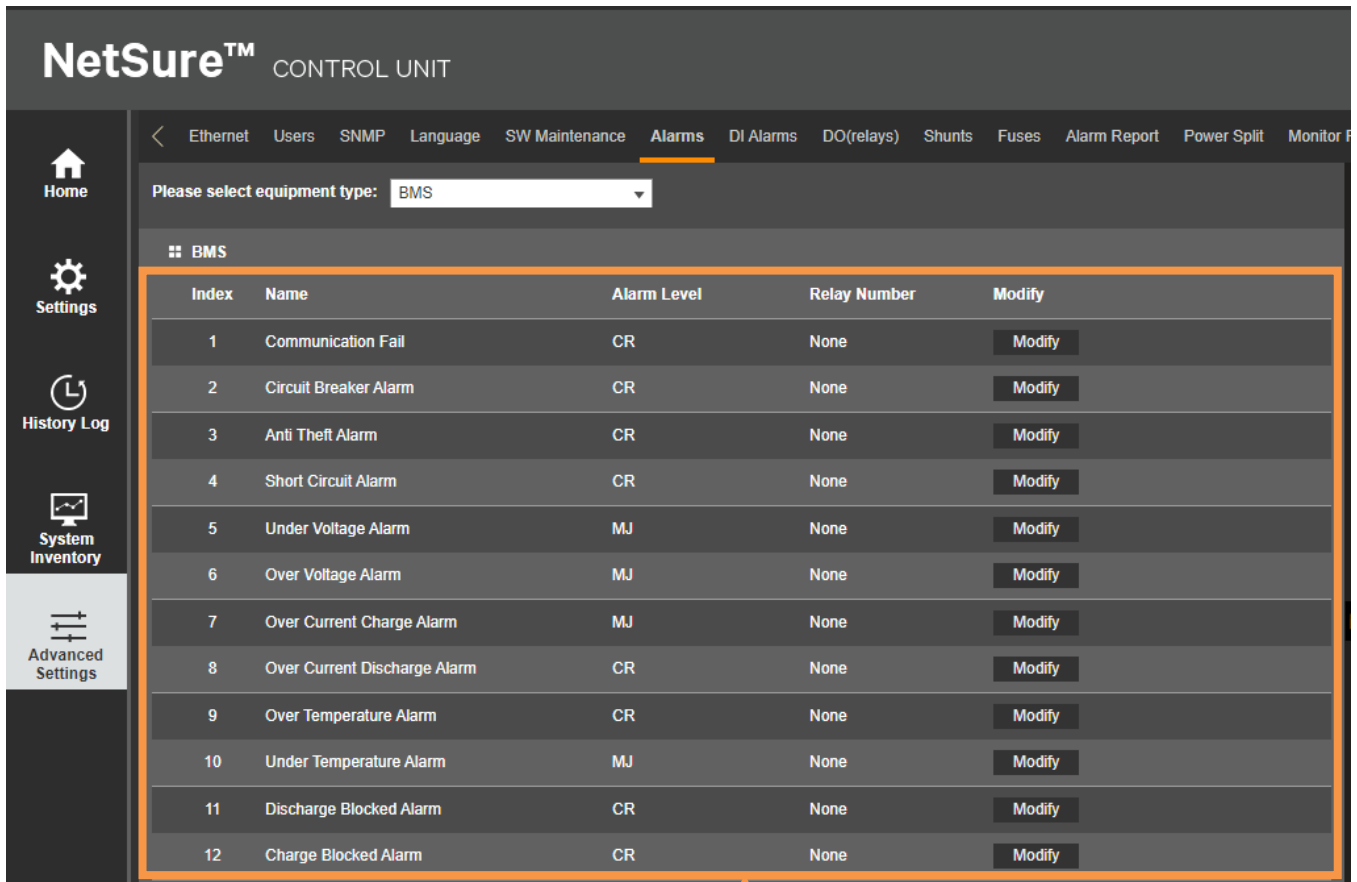
Image is representative and subject to change.

Equipment	Product Model	Hardware Revision	Serial Number	Software Revision
NCU	M830D	B00	03220700238	1.2.70B
Rectifier #1	1R482000e3	D12	03220609794	1.10
Rectifier #2	1R482000e3	D12	03220408080	1.10
Rectifier #3	1R482000e3	D12	03220609732	1.10
EIB-1	1MA455U41	A01	03220101367	1.02
IB2-1	1MA4CSU31	A11	03220606317	1.03
BMS 01	SLB48-050-124-1	N/A	80000037189822420578	20210507.165118
IB4	NA	NA	NA	NA

This data will be available for each individual battery.
If data for a parameter is not available from the BMS of the battery it will be displayed as 'N/A'.

1.4.4 Alarms and Severity Level Settings

Image is representative and subject to change.



NetSure™ CONTROL UNIT

Ethernet Users SNMP Language SW Maintenance **Alarms** DI Alarms DO(relays) Shunts Fuses Alarm Report Power Split Monitor F

Please select equipment type: BMS

☰ BMS

Index	Name	Alarm Level	Relay Number	Modify
1	Communication Fail	CR	None	Modify
2	Circuit Breaker Alarm	CR	None	Modify
3	Anti Theft Alarm	CR	None	Modify
4	Short Circuit Alarm	CR	None	Modify
5	Under Voltage Alarm	MJ	None	Modify
6	Over Voltage Alarm	MJ	None	Modify
7	Over Current Charge Alarm	MJ	None	Modify
8	Over Current Discharge Alarm	CR	None	Modify
9	Over Temperature Alarm	CR	None	Modify
10	Under Temperature Alarm	MJ	None	Modify
11	Discharge Blocked Alarm	CR	None	Modify
12	Charge Blocked Alarm	CR	None	Modify

These alarms and their associated criticality levels are automatically mapped.

Alarm criticality level can be adjusted by the operator.

1.5 Standard vs. Monitoring Mode Reference Guide

Standard Mode Parameters	Narada	Polarium
View Detailed BMS Data Locally	Yes (see “Narada Detailed BMS Data via Viewer Software - Screen Shots” starting on page 41.)	Yes (see “Polarium Detailed BMS Data via Studio Software - Screen Shots” starting on page 44.)
Battery To Laptop Cable for Local BMS Access	RJ45 to USB Cable (acquire from Narada)	RJ45 to USB Cable (acquire from Vertiv)
View Detailed BMS Data Remotely	No	No
NCU Software Version	V1.2.80/6.2.80 (or later) preferred	V1.2.80/6.2.80 (or later) preferred
Inter-Battery Communications Cabling	Not Required	RJ45 Patch Cable (included with battery)
First and Last Battery Communication Port Termination	Not Required	Terminator Plug (included with battery)
Monitoring Mode Parameters	Narada	Polarium
View Detailed BMS Data Locally	Yes (see “Narada Detailed BMS Data via Viewer Software - Screen Shots” starting on page 41.)	Yes (see “Polarium Detailed BMS Data via Studio Software - Screen Shots” starting on page 44.)
Battery To Laptop Cable for Local BMS Access	RJ45 to USB Cable (acquire from Narada)	RJ45 to USB Cable (acquire from Vertiv)
View Detailed BMS Data Remotely	No	No
View Summary BMS Data Locally and Remotely via NCU	Yes (see “NCU Monitoring Mode Screen Shots for Narada Batteries” starting on page 2.)	Yes (see “NCU Monitoring Mode Screen Shots for Polarium Batteries” starting on page 6.)
Battery BMS	Modbus V1.5 or V1.5.2	Gen 5 battery w/ FW V2021-05-07
NCU Software Version	Min: V1.2.40 / Prefer V1.2.80 (or later)	Min: V1.2.40 / Prefer V1.2.80 (or later)
Maximum Devices (batteries + other) Supported by NCU	16	16
Maximum Batteries Supported	16	16
Battery Baud Rate Setting	9600 (default)	9600 (needs to be changed from default setting)
NetSure™ Power System to Battery Cabling	RJ45 Patch Cable (customer provided) (for Vertiv™ NetSure™ 211, Vertiv™ NetSure™ 502, Vertiv™ NetSure™ 5100 Integrated; Vertiv™ P/N 547674 cable also required.)	RJ45 Patch Cable (customer provided) (for Vertiv™ NetSure™ 211, Vertiv™ NetSure™ 502, Vertiv™ NetSure™ 5100 Integrated; Vertiv™ P/N 547674 cable also required.)
Inter-Battery Communications Cabling	RJ45 Patch Cable (customer provided)	RJ45 Patch Cable (included with battery)
Last Battery Communication Port Termination	RJ45 Patch Cable (customer provided)	Terminator Plug (included with battery)

2 Standard Mode Set-up Procedure

2.1 Important Notice

This procedure highlights the main parameters within the NCU that need to be adjusted when utilizing lithium-ion batteries. The technician still needs to set all other appropriate power system and battery parameters as normally required per the operator's procedures and requirements.



Before proceeding, please ensure the following:

NCU V1.2.80/V6.2.80 software or later is loaded. Other software versions will support Standard Mode but without all the settings outlined in this application guide (refer to NCU manual for software loading instructions).

Battery power and ground connections have been made (refer to battery installation manual).

Detailed specification and settings for battery are readily available.

2.2 Set Float Voltage and Equalize Voltage to Same Value

Refer to battery datasheet, manual and warranty statement to determine proper setting for your battery.

NetSure™ CONTROL UNIT

Quick Settings System **Battery** ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Battery Charge

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	06/20/2023 13:39:38	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes <input type="radio"/> No	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set

Typically, '52V' to '55V' depending on battery and application.

2.3 Confirm Equalize and Temperature Compensation are 'Off'

The screenshot shows the NetSure™ CONTROL UNIT interface. The 'Battery Charge' settings page is displayed, with the following settings highlighted and annotated:

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	06/28/2023 14:37:39	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input type="radio"/> No <input checked="" type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input type="radio"/> No <input checked="" type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set
BTRM Temp Sensor	None	—	<input type="text" value="None"/>	Set
Low Capacity Point	75 %	—	<input type="text" value="25-100"/>	Set
Battery Current Limit Mode	Disabled	—	<input type="text" value="Disabled"/>	Set
Battery Current Limit	0.20 C10	05/23/2023 15:30:38	<input type="text" value="0.01-1"/>	Set
Over Current Limit	0.40 C10	05/23/2023 15:30:47	<input type="text" value="0.1-1.5"/>	Set
Automatic Equalize	No	02/07/2023 12:27:46	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set

Annotations from the image:

- Set Equalize/Float Charge Control to 'Float Charge'.
- Set Temp Comp Sensor to 'None'.
- Set Automatic Equalize to 'No'.

For cyclic applications where the NCU will control the start/stop of an AC Generator, follow these steps:

1. Set Equalize/Float Charge Current to 'Equalize Charge'.
2. Set Temp. Comp. Sensor to 'None'.
3. Set Automatic Equalize to 'Yes'.
4. Ensure Float Voltage and Equalize Voltage are set to the same value (see step 2.2).
5. Refer to the 'AC Generator Function' section in the NCU User Manual.
6. Follow the instructions for NCU AC generator control by '**battery capacity threshold**'.

Note: NCU control by 'voltage threshold' can be used in place of 'battery capacity threshold' with **NMC lithium batteries ONLY**.

2.4 Set Battery String Capacity

NetSure™ CONTROL UNIT

Scroll Down Page to Access Setting ↓

Quick Settings System **Battery** ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Battery Charge

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	06/20/2023 13:39:38	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes <input type="radio"/> No	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set

Calculate Total Battery String Capacity:

1. Determine Ah size of battery.
2. Determine total quantity of batteries.
3. Ah x Quantity = String Capacity.

Example:

1. 100 Ah battery.
2. Four batteries.
3. $100 \times 4 = \text{Set to '400'}$.

2.5 Disable Battery Thermal Runaway Management (BTRM)

NetSure™ CONTROL UNIT

Scroll Down Page to Access Setting ↓

Quick Settings System **Battery** ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	02/08/2024 11:21:02	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/13/2020 00:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 10:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 13:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 10:29:49	<input type="text" value="None"/>	Set
BTRM Temp Sensor	None	02/14/2024 21:25:13	<input type="text" value="None"/>	Set

Set BTRM Temp Sensor to 'None'.

2.6 Turn On and Set Battery Charge Current Limit

Refer to battery datasheet, manual and warranty statement to determine proper setting for your battery.

NetSure™ CONTROL UNIT

Quick Settings System **Battery** ECO LVD Temp Probes Recifiers Battery Test Time Settings

Battery Charge

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	08/13/2024 11:43:29	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	–	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	–	<input checked="" type="radio"/> Yes	Set
Number of Battery Fuses	0	–	<input type="text" value="0"/>	Set
Calculate Battery Current	No	–	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set
BTRM Temp Sensor	None	07/08/2024 15:03:09	<input type="text" value="None"/>	Set
Low Capacity Point	75 %	–	<input type="text" value="25-100"/>	Set
Battery Current Limit Mode	Voltage	08/14/2024 14:29:17	<input type="text" value="Disabled"/>	Set
Min Voltage for BCL	47.0 V	–	<input type="text" value="40-60"/>	Set
Battery Current Limit	0.20 C10	05/23/2023 15:30:38	<input type="text" value="0.01-1"/>	Set
Over Current Limit	0.40 C10	05/23/2023 15:30:47	<input type="text" value="0.1-1.5"/>	Set
Peak Load Shift Enable	Disabled	08/14/2024 14:39:38	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set

Set Battery Current Limit Mode to 'Voltage'

Set Min Voltage for BCL to '40' or the Low Voltage Battery Disconnect value *of the battery*, whichever is higher.

Set Battery Current Limit (typically 0.1C to 0.5C). If a value of $>.25C$ is desired, NCU V1.2.40/6.2.40 software or later must be loaded.

Set Over Current Limit higher than the charge current limit of the battery.

2.7 Input Battery Discharge Current Times

NetSure™ CONTROL UNIT

Scroll Down Page to Access Setting

Home Settings History Log System Inventory Advanced Settings

Quick Settings System **Battery** ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Equalize Stop Current	0.010 C10	—	<input type="text" value="0.002-0.02"/>	0.002-0.02	Set
Equalize Stop Delay Time	180 min	—	<input type="text" value="0-1440"/>	0-1440	Set
Maximum Equalize Charge Time	1080 min	—	<input type="text" value="60-2880"/>	60-2880	Set
Cyclic Equalize	No	02/09/2023 08:50:35	<input checked="" type="radio"/> No <input type="radio"/> Yes		Set
Cyclic Equalize Start Time	12/01/2016 12	—	<input type="text" value=">01/01/1970 00"/>	>01/01/1970 00	Set
EIB-1 Voltage Type	Disabled	12/31/2019 23:03:57	48 (Block4)		Set
EIB-1 Block In-Use Num	0	—	<input type="text" value="0-8"/>	0-8	Set
Charging Efficiency	96 %	—	<input type="text" value="10-100"/>	10-100	Set
Time to 0.1C10 Discharge Current	10.00 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.2C10 Discharge Current	4.90 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.3C10 Discharge Current	3.00 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.4C10 Discharge Current	2.00 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.5C10 Discharge Current	1.40 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.6C10 Discharge Current	1.20 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.7C10 Discharge Current	1.10 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.8C10 Discharge Current	0.90 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 0.9C10 Discharge Current	0.70 h	—	<input type="text" value="0-10"/>	0-10	Set
Time to 1.0C10 Discharge Current	0.50 h	—	<input type="text" value="0-10"/>	0-10	Set

Input the following values into the corresponding location in the NCU.

Discharge (xC10)	Time (hours)
0.1	10.00
0.2	5.00
0.3	3.31
0.4	2.46
0.5	1.96
0.6	1.63
0.7	1.42
0.8	1.22
0.9	1.07
1.0	0.90

2.8 Input LVD Voltage

Refer to battery datasheet, manual and warranty statement to determine proper setting for your battery.

NetSure™ CONTROL UNIT

Home Settings History Log System Inventory Advanced Settings

Quick Settings System Battery ECO LVD Temp Probes Rectifiers Battery Test Time Settings

signal	Value	Time Last Set	Set Value	Set
LVD 1	Enabled	01/21/2020 21:42:04	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
LVD 1 Mode	Voltage	--	<input checked="" type="radio"/> Voltage <input type="radio"/> Time	Set
LVD 1 Disconnect Voltage	46.0 V	--	<input type="text" value="36-60"/>	Set
LVD 1 Reconnect Voltage	49.0 V	--	<input type="text" value="40-60"/>	Set
LVD 1 Reconnect Delay	1 min	--	<input type="text" value="1-30"/>	Set
LVD 1 Time	300 min	--	<input type="text" value="1-1000"/>	Set
LVD 1 Dependency	None	--	<input type="text" value="None"/>	Set
LVD 1 High Temp Disconnect	Disabled	--	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
LVD 2	Enabled	--	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set

Determine which LVD has been designated as the last to open (in this example LVD1).

Set the disconnect voltage at least 0.5V higher than the LVBD level of the battery.

If the LVD is monostable, do not set below '38V'.

For cyclic applications with a generator, the LVD voltage should be set to at least '0.5V' below the generator start voltage.

2.9 Adjust Rectifier Default Voltage and Walk-In Time

NetSure™ CONTROL UNIT

Quick Settings System Battery ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Rectifiers

Signal	Value	Time Last Set	Set Value	Set
Current Limit	Disabled	04/27/2023 10:20:58	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
Default Voltage Select	Default Voltage	06/30/2023 15:32:55	<input checked="" type="radio"/> Float Voltage <input type="radio"/> Default Voltage	Set
Default Voltage	48.0 V	06/30/2023 15:33:16	<input type="text" value="42-58"/>	Set
HVSD	Disabled	-	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
HVSD Limit	59.0 V	-	<input type="text" value="56-59"/>	Set
Restart on HVSD	Disabled	06/30/2023 15:29:22	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
HVSD Restart Time	300 s	06/28/2023 14:37:40	<input type="text" value="50-300"/>	Set
Walk-In	Enabled	06/30/2023 15:32:37	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled	Set
Walk-In Time	60 s	06/30/2023 15:28:23	<input type="text" value="8-128"/>	Set

Select 'Default Voltage' and set to '48V' *.

Ensure Walk-In is 'Enabled'. Set rectifier Walk-In Time to '60S'.

* NCU V1.250/V6.250 software or later must be loaded.

2.10 Calibrate 'Estimated Remaining Time' Gauge *

* Even though some customer specific configurations may not include this gauge, this calibration/reset should still be completed.



NetSure™ CONTROL UNIT




Home Settings History Log System Inventory Advanced Settings

Quick Settings System **Battery** ECO LVD Temp Probes Rectifiers Battery Test Time Settings

Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	06/20/2023 13:39:38	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set

After all batteries reach 100% charge, Set 'Reset Battery Capacity'.

2.11 After The Settings Have Been Made...

	<p>Wait two to three minutes for changes to be implemented.</p>
	<p>Confirm there are no unexpected alarms.</p>
	<p>Set-up complete for non-Polarium batteries. See next section for Polarium batteries.</p>

2.12 Polarium Communication Cable Connections

Applies to Polarium Batteries Only!

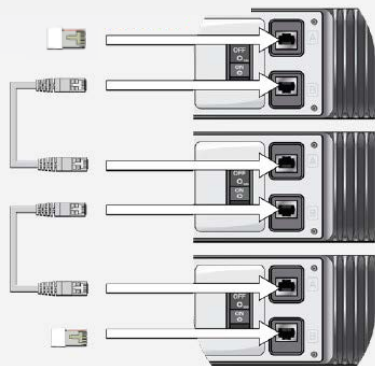
Utilize RJ45 cables and terminator plugs provided with the batteries.

Daisy chain batteries together as illustrated below.

Use terminator plugs at the start and end of each battery array.

interconnect batteries via included communication cable. All communication cables must be shielded and grounded RJ45.

Terminator Plug
at start of Series



Terminator Plug
at end of Series

3 Monitoring Mode Set-up Procedure

3.1 Important Notice



Before proceeding, please ensure the following:

Battery power and ground connections have been made (refer to battery installation manual).

NCU V1.2.80/V6.2.80 software or later is loaded. V1.2.40/V6.2.40 software or later will support Monitoring Mode but without all the features outlined in this application guide (refer to NCU manual for software loading instructions).

Where applicable, Vertiv™ jumper cable 547674 has been ordered and is available on site. See "NetSure™ RS485 Cabling Diagrams" starting on page 26 to determine when the jumper cable is required.

'Standard Mode' set-up has been completed - see section 2 starting on page 11 in this guide.

For Narada ONLY: Customer supplied RJ45 patch cables are available on site. The quantity and length of cables will depend on the number of batteries being connected and the distance between the power system and the first battery in the string. See remaining connection instructions to determine quantity and length(s) needed.

For Polarium ONLY: Polarium supplies an RJ45 patch cable with each battery. A longer, customer supplied, patch cable may be necessary depending on the distance between the power system and the first battery in the string.

3.2 Narada Monitoring Mode Set-Up Procedure

3.2.1 Battery Set-Up

Confirm battery has BMS Modbus Version V1.5 or V1.5.2 (default if ordered via Vertiv).

Set battery addresses as outlined in Narada Installation and Operations Manual (summarized in photo below).

PACK 1 0000 ADD 	PACK 2 0001 ADD 	PACK 3 0010 ADD 	PACK 4 0011 ADD 	PACK 5 0100 ADD 	PACK 6 0101 ADD 	PACK 7 0110 ADD 	PACK 8 0111 ADD
PACK 9 1000 ADD 	PACK 10 1001 ADD 	PACK 11 1010 ADD 	PACK 12 1011 ADD 	PACK 13 1100 ADD 	PACK 14 1101 ADD 	PACK 15 1110 ADD 	PACK 16 1111 ADD
<p>NOTE: Counting of ADD shall begin from 0000, without interruption, or parallel communication cannot be available</p>							

3.2.2 Power System to Battery Cable Preparation

Cut off the RJ45 connector on one patch cable.

Strip jacketing back to expose conductors.

3.2.3 Last Battery Modbus Termination Cable Preparation

Cut a patch cable ~4-6" inches away from one of the connectors.

Tape raw end with electrical tape.

3.2.4 Cabling Sequence

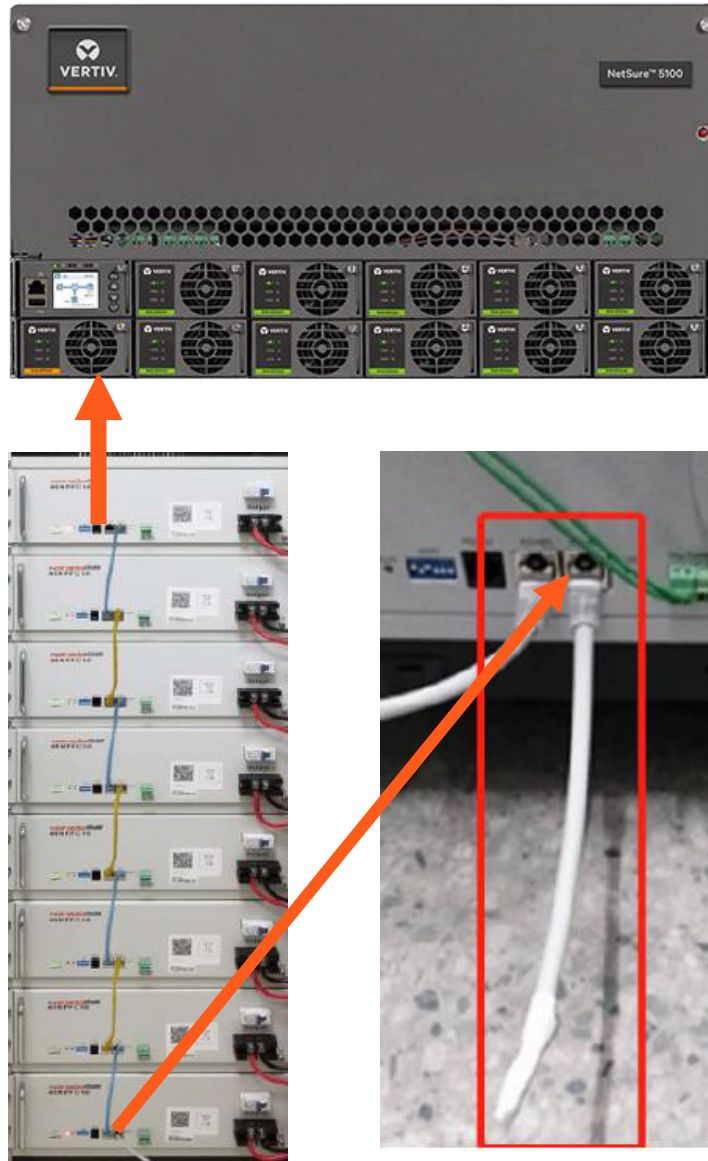
See also Figure 3.1.

1. Terminate 'Power System to Battery Cable' to Vertiv™ NetSure™ Power System based on type of power system (see "NetSure™ RS485 Cabling Diagrams" starting on page 26).
2. Plug 'Power System to Battery Cable' into the left RS485 jack on first battery.
3. Daisy chain RS485 jacks on batteries together using RJ45 patch cables.
4. Plug 'Last Battery Modbus Termination Cable' into the right RS485 jack on last battery of string.

3.2.5 NCU Setting Adjustments

Continue with "Post Cabling NCU Adjustments" starting on page 37.

Figure 3.1 Cabling Sequence



3.3 Polarium Monitoring Mode Set-Up Procedure

3.3.1 Battery Set-up

Confirm battery is an SLB48 Generation 5 with firmware version 2021-05-07 (default if ordered via Vertiv).

The BMS on Polarium batteries need to be changed from 115,200 to 9600 baud rate by following the procedure outlined below:

1. Download Polarium Studio Software and [Studio User Guide](https://polarium.com/studio/) from this link: <https://polarium.com/studio/>. It is suggested that this software be loaded prior to going to the field to change the baud rate.
2. Connect Polarium USB/RJ45 Communication Cable (Polarium p/n: 105-00006 - Vertiv p/n: 10020692) to the top RJ45 port on the battery and the USB port on your computer.
3. Open Device Manager on your computer and note the number of the COM port being used by the USB Serial Port.
4. Turn on the battery by turning on the battery circuit breaker and pushing the power button for five seconds.
5. Open Studio and choose the 'Connect' Section of the menu. Make the following selections:
 - For 'Device' choose 'SLB48'.
 - For 'Interface' choose 'MODBUS COMx' (x=the COM port noted in Step 3 above).

6. Click on 'Open'.
7. Choose the 'Details' Section. On the 'Settings' Tab, double-click on the 'Value' cell (blue highlight) on the 'RS485 bitrate' row.

Name	Min	Max	Value
LVD	0.00 V	60.00 V	
Over current charge delay	0 A²s	250000 A²s	
Ripple gain	-1000 %	1000 %	
Charge stop depth	0.0 %	25.0 %	
Config flags	0x00	0xFF	
RS485 address	0	255	
RS485 protocol	0	3	
RS485 bitrate	0	1	

8. Change the value from '0' to '1' and press ENTER.
9. The 'Value' cell should now show '9600 bps'.

10. Disconnect cable from battery and perform these steps on each battery in the string.

Note: Battery addresses are automatically set when the batteries are connected via the RJ45 communication cable(s) outlined later in this manual.

Note: For more detailed instructions and troubleshooting, please see Polarium Studio User Guide downloaded in Step 1.

3.3.2 Power System to Battery Cable Preparation

Cut off the RJ45 connector on one patch cable.

Strip jacketing back to expose conductors.

3.3.3 Cabling Sequence

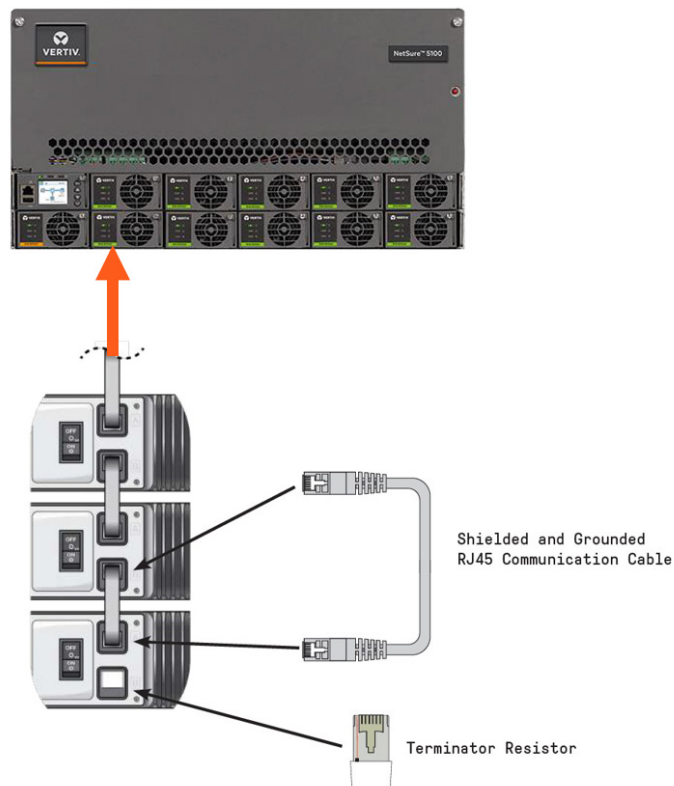
See also Figure 3.2.

1. Terminate 'Power System To Battery Cable' to Vertiv™ NetSure™ Power System based on type of power system (see “NetSure™ RS485 Cabling Diagrams” starting on page 26).
2. Plug 'Power System to Battery Cable' into the 'A' RJ45 jack on first battery.
3. Daisy chain RJ45 jacks on batteries together using supplied RJ45 cables.
4. Plug Terminator Resistor supplied with battery into the 'B' RJ45 jack on last battery of string.

3.3.4 NCU Setting Adjustments

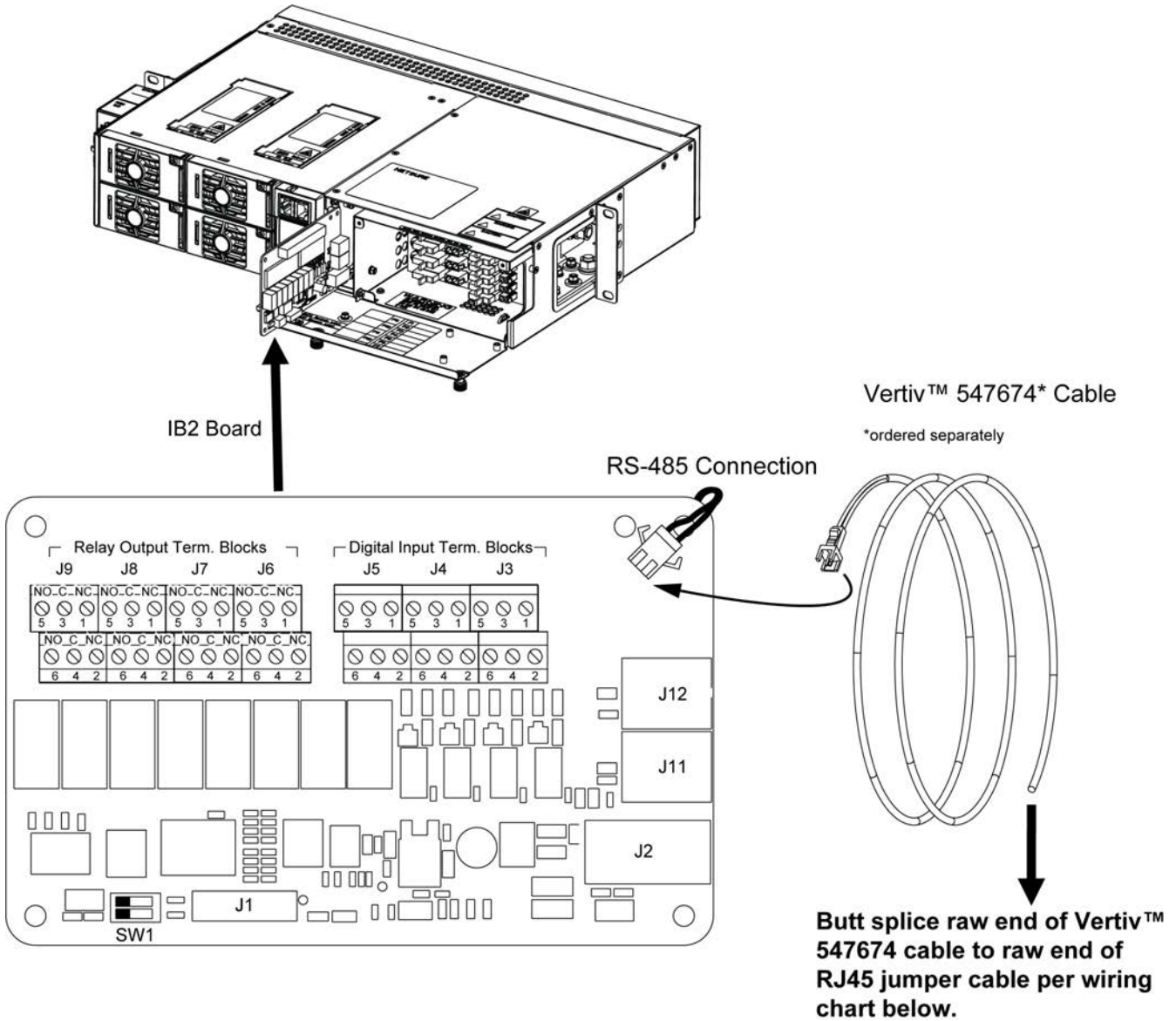
Continue with “Post Cabling NCU Adjustments” starting on page 37.

Figure 3.2 Cabling Sequence



3.4 NetSure™ RS485 Cabling Diagrams

3.4.1 Vertiv™ NetSure™ 211 (582136600) Modbus Connection Location and Wiring

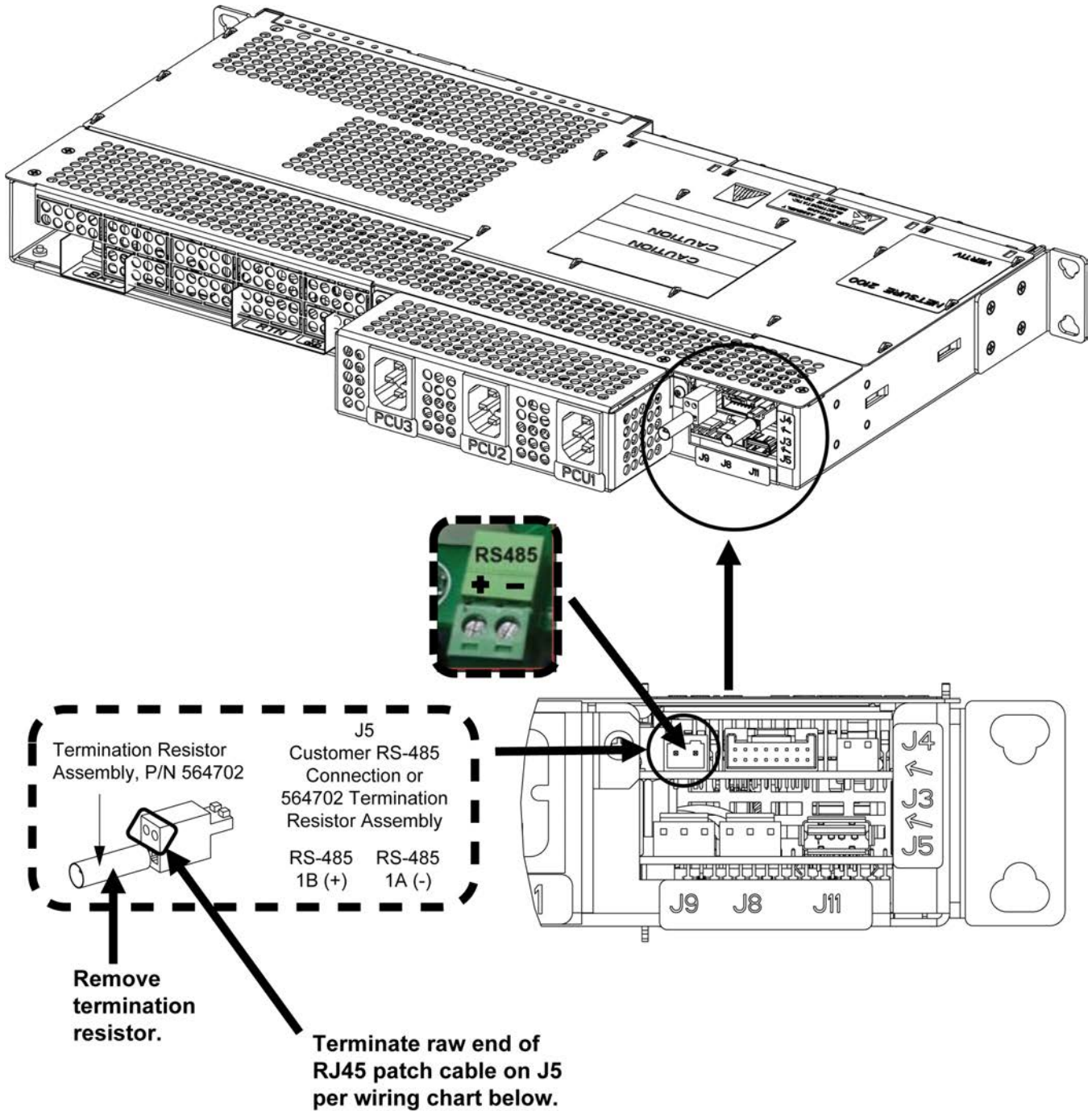


RJ45 Cable Wiring Chart

Signal	Vertiv™ P/N 547674 Cable	Narada (RJ45 Plug)	Polarium (RJ45 Plug)
RS485 (+)	Red Wire (Pin 1)	Pin 2	Pin 4
RS485 (-)	Black Wire (Pin 2)	Pin 3	Pin 5



3.4.2 Vertiv™ NetSure™ 2100 (582138000) Modbus Connection Location and Wiring



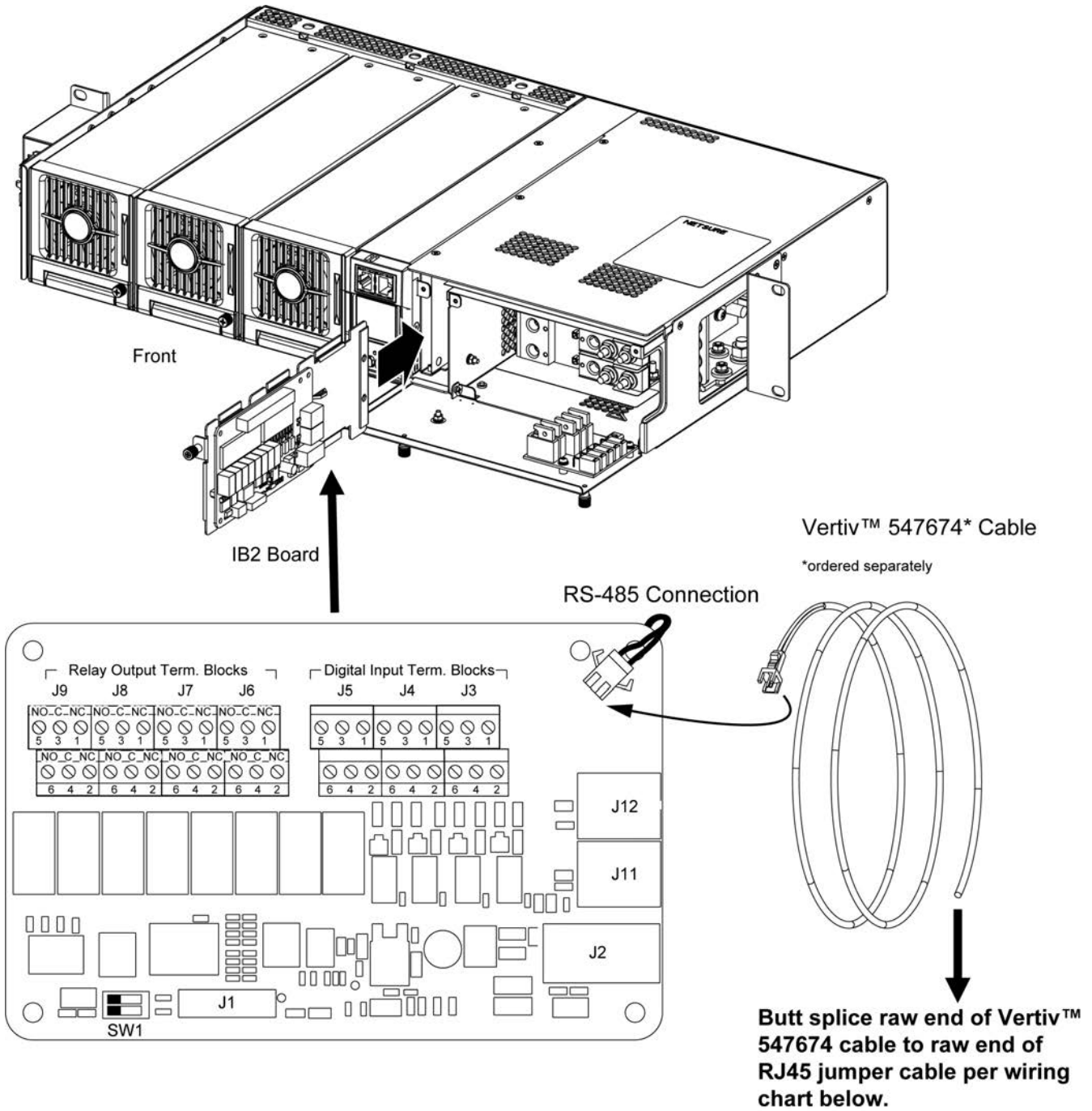
RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 2100 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)
RS485 (+)	J5-1B (left side)	Pin 2	Pin 4
RS485 (-)	J5-1A (right side)	Pin 3	Pin 5



RJ-45 Plug (Male)

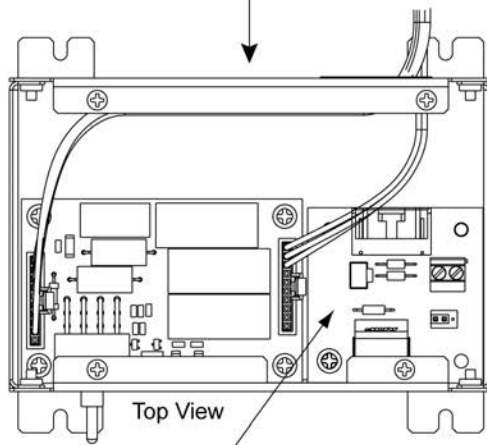
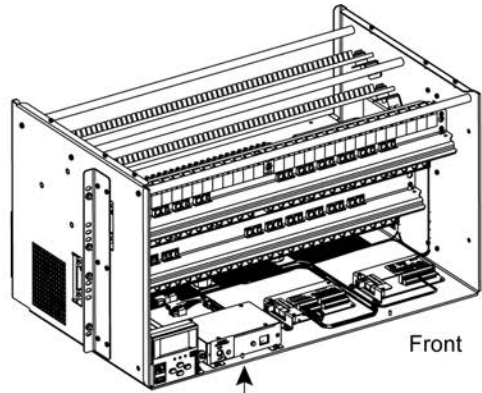
3.4.3 Vertiv™ NetSure™ 502 (582136700) Modbus Connection Location and Wiring



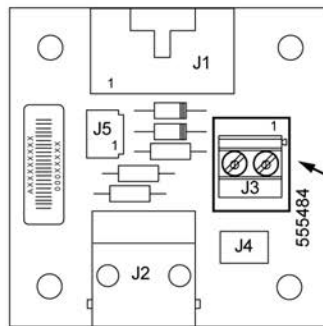
RJ45 Cable Wiring Chart

Signal	Vertiv™ P/N 547674 Cable	Narada (RJ45 Plug)	Polarium (RJ45 Plug)	
RS485 (+)	Red Wire (Pin 1)	Pin 2	Pin 4	
RS485 (-)	Black Wire (Pin 2)	Pin 3	Pin 5	

3.4.4 Vertiv™ NetSure™ 512 (58213700027) Modbus Connection Location and Wiring



System Interface Board



J3 on System Interface Board

RS485 Connection

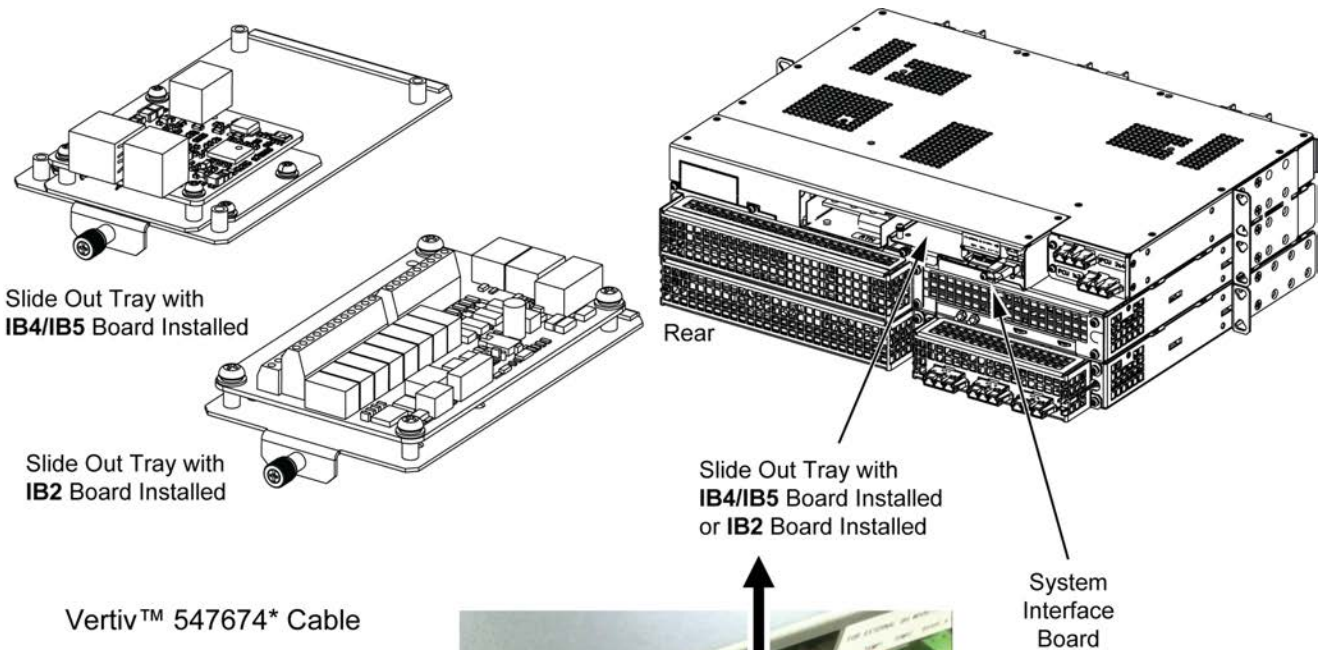
- J3-1: RS485+
- J3-2: RS485-

Terminate raw end of RJ45 patch cable on J3 per wiring chart below.

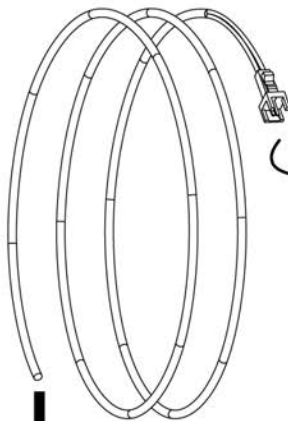
RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 512 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)	<p>Rj-45 Plug (Male)</p>
RS485 (+)	J3-1	Pin 2	Pin 4	
RS485 (-)	J3-2	Pin 3	Pin 5	

3.4.5 Vertiv™ NetSure™ 5100 Integrated (582137200) Modbus Connection Location and Wiring



Vertiv™ 547674* Cable
*ordered separately



Butt splice raw end of Vertiv™ 547674 cable to raw end of RJ45 jumper cable per wiring chart below.

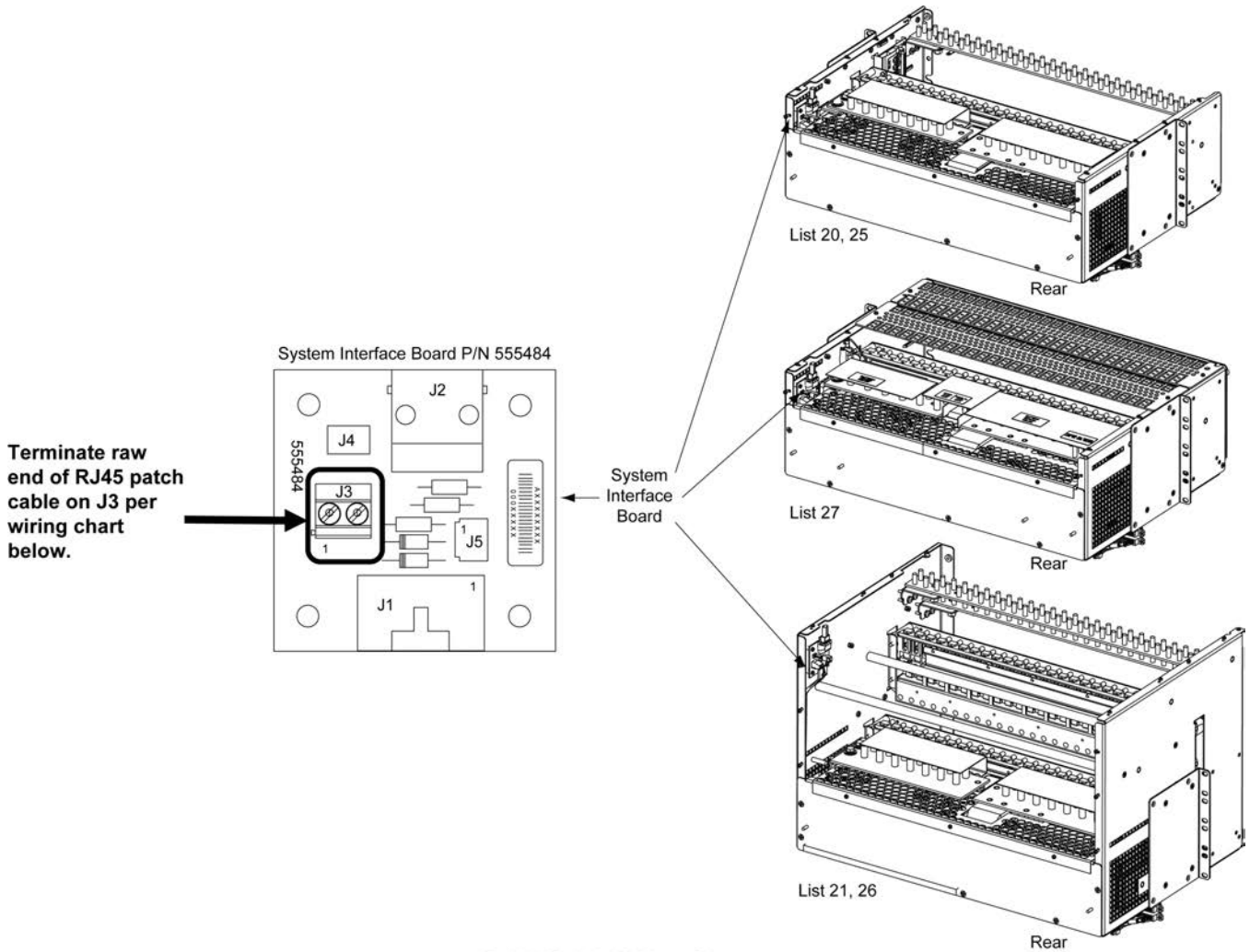
Look for the female plug with red/black wires located near the IB4/IB5 or IB2 board. In some systems this connector may be cable tied to a bundle of wires inside the unit. If this situation exists, the power system should be shut down and the top cover removed so the connector can be accessed and routed to the back of the system.

RJ45 Cable Wiring Chart

Signal	Vertiv™ P/N 547674 Cable	Narada (RJ45 Plug)	Polarium (RJ45 Plug)
RS485 (+)	Red Wire (Pin 1)	Pin 2	Pin 4
RS485 (-)	Black Wire (Pin 2)	Pin 3	Pin 5



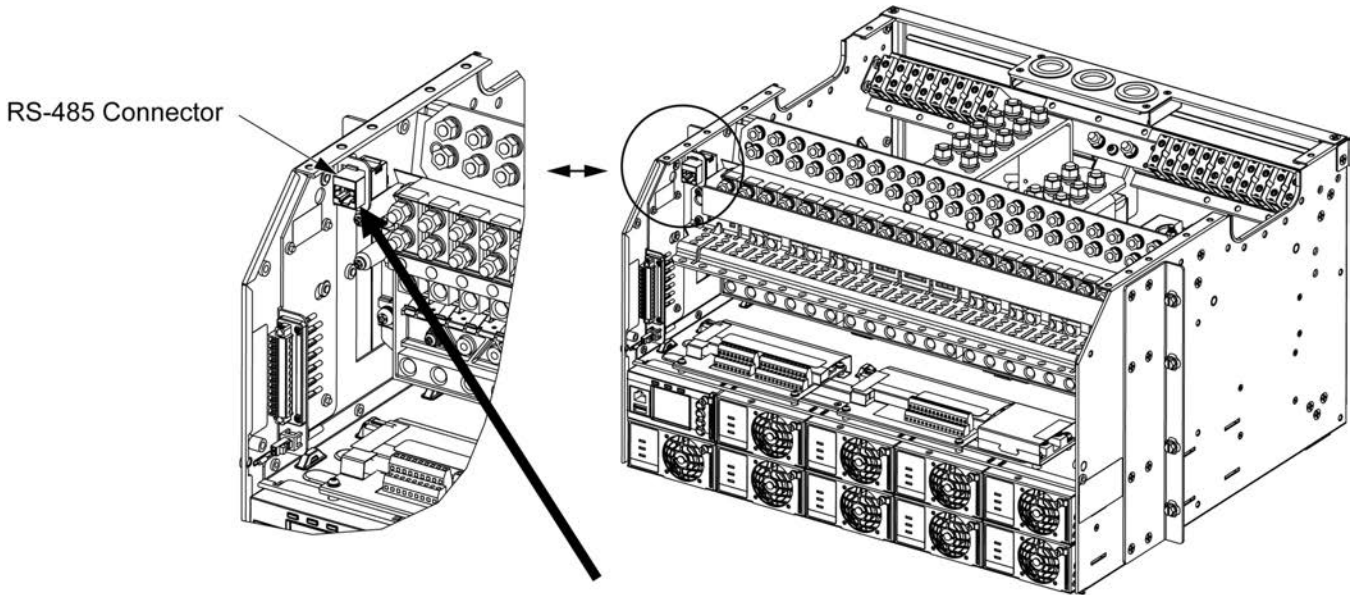
3.4.6 Vertiv™ NetSure™ 5100 (582137100) Modbus Connection Location and Wiring



RJ45 Cable Wiring Chart

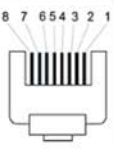
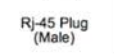
Signal	Vertiv™ NetSure™ 5100 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)	
RS485 (+)	J3-1	Pin 2	Pin 4	
RS485 (-)	J3-2	Pin 3	Pin 5	

3.4.7 Vertiv™ NetSure™ 7100 Compact (582137100101, 582137100102, 582137100103, 582137100104, 582137100105, 582137100106) Modbus Connection Location and Wiring

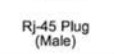


Terminate a new connector on the raw end of the RJ45 patch cable but connect **ONLY** the **TWO** applicable pins based on the brand of battery, as outlined in the table below. Plug the patch cable into the RJ45 jack on the power system and the first battery in the string.

Narada RJ45 Cable Wiring Chart

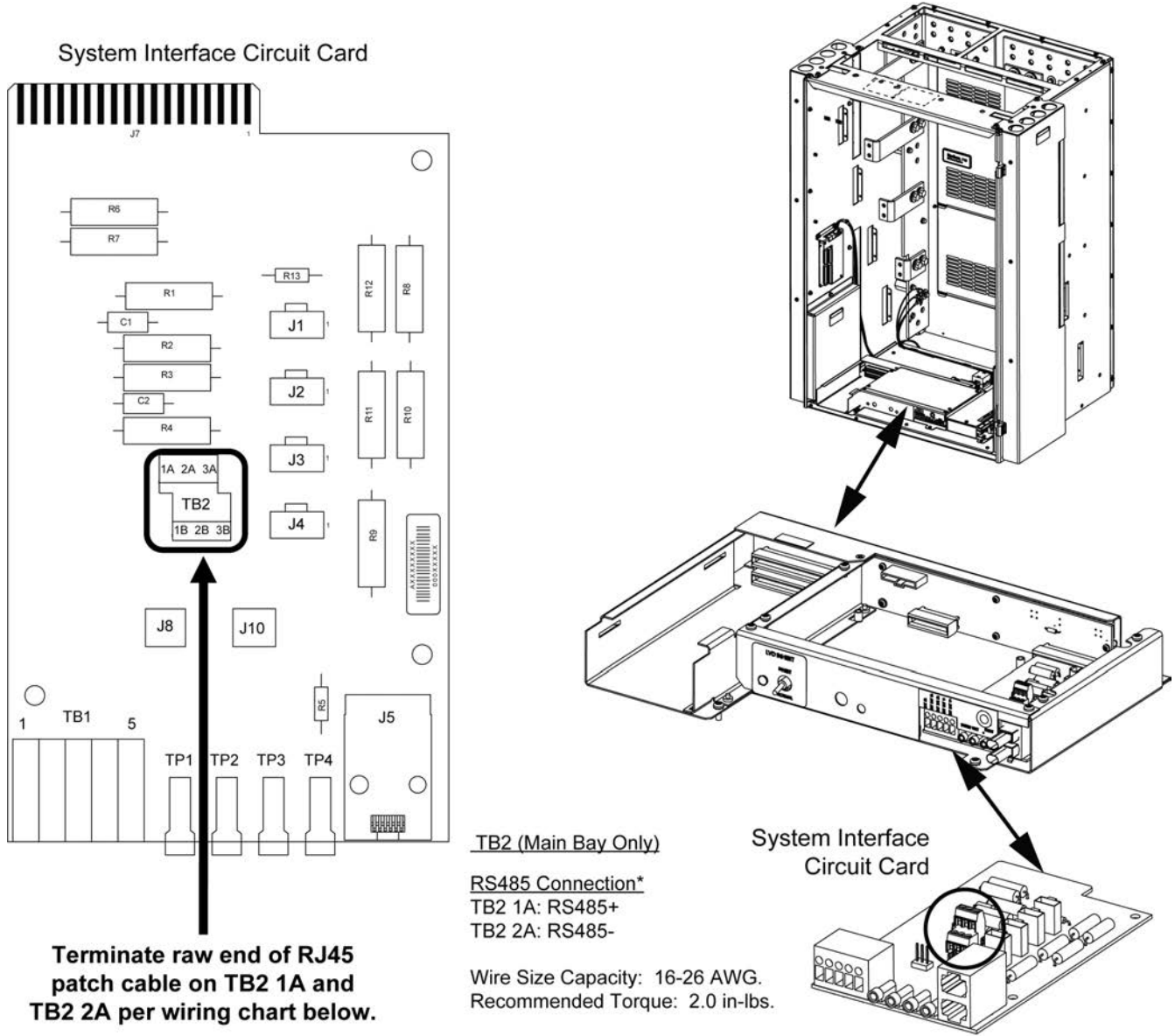
Signal	Vertiv™ NetSure™ 7100 System	Narada (RJ45 Plug)	
RS485 (+)	Pin 2	Pin 2	
RS485 (-)	Pin 3	Pin 3	

Polarium RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 7100 System	Polarium (RJ45 Plug)	
RS485 (+)	Pin 4	Pin 4	
RS485 (-)	Pin 5	Pin 5	

3.4.8 Vertiv™ NetSure™ 721 / Vertiv™ NetSure™ 7100 (582127000) Modbus Connection Location and Wiring

Note: For all other NetSure™ 7100 list numbers, please see sections 3.4.9 and 3.4.10 for Modbus connection location and wiring.



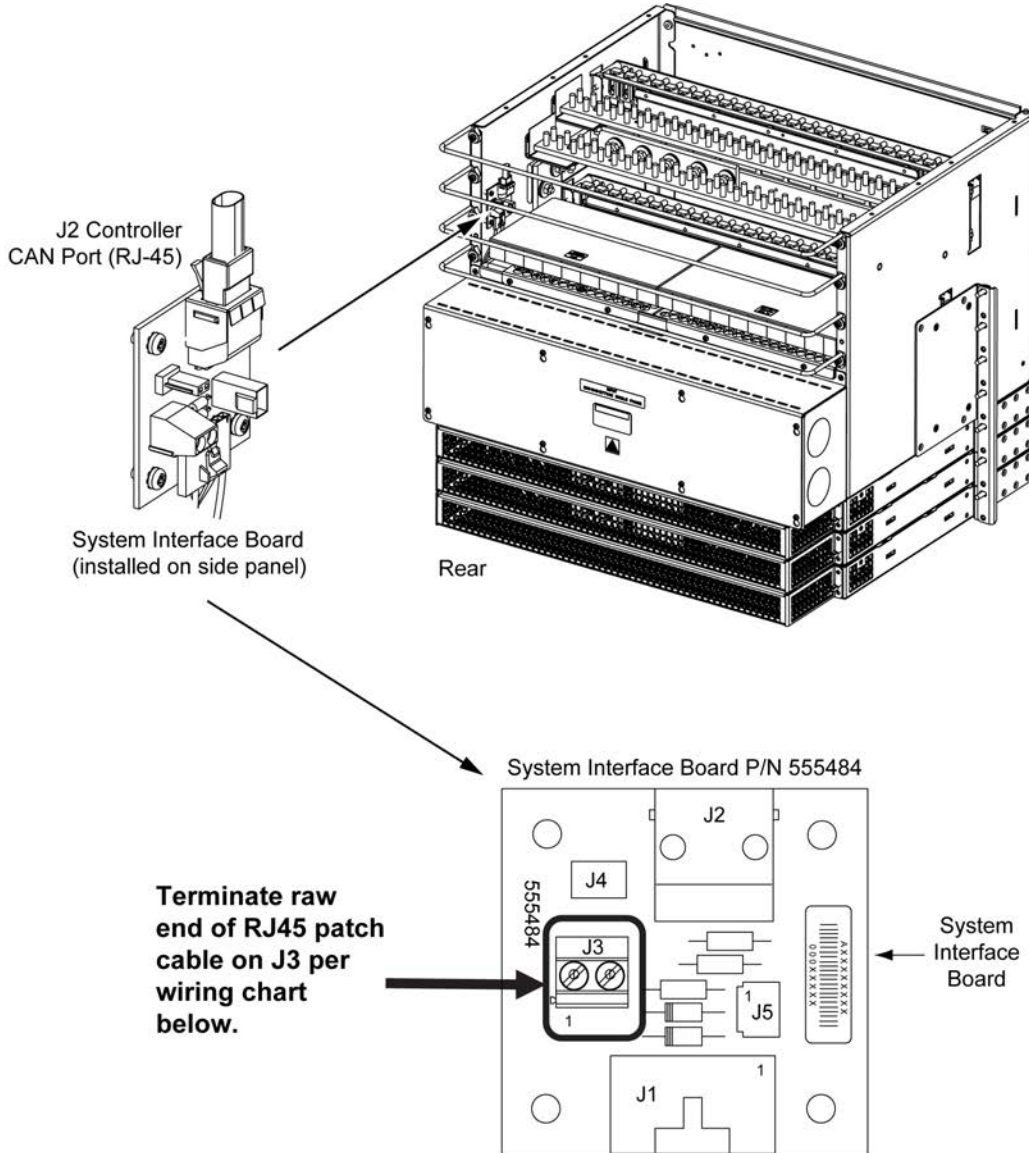
RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 7100 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)	 RJ-45 Plug (Male)
RS485 (+)	TB2-1A	Pin 2	Pin 4	
RS485 (-)	TB2-2A	Pin 3	Pin 5	

3.4.9 Vertiv™ NetSure™ 7100 (582127000600, 582127000601, 582127000900, 582127000901) Modbus Connection Location and Wiring

Note: Only available in systems manufactured on or after July 1, 2026.

Note: For all other NetSure™ 7100 list numbers, please see sections 3.4.8 and 3.4.10 for Modbus connection location and wiring.

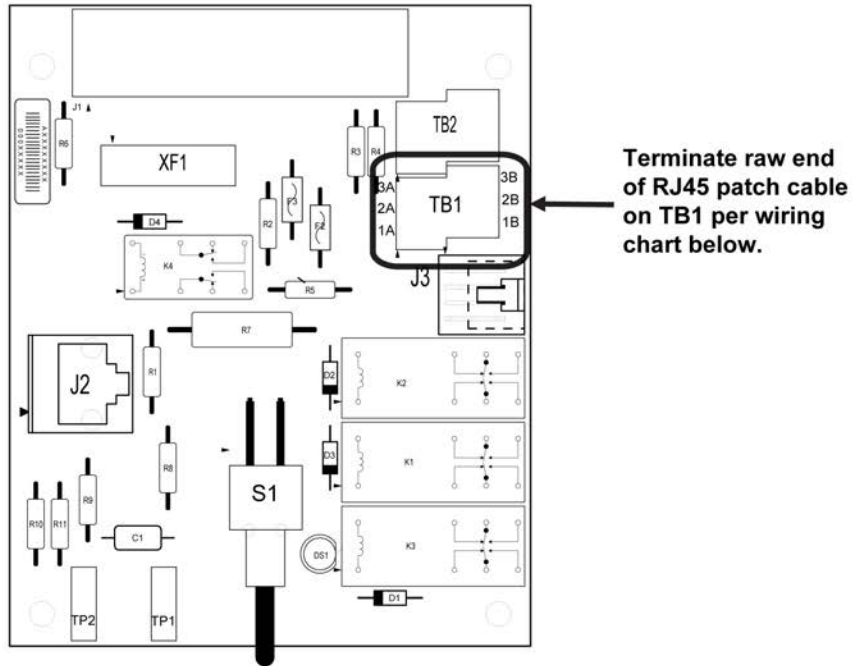
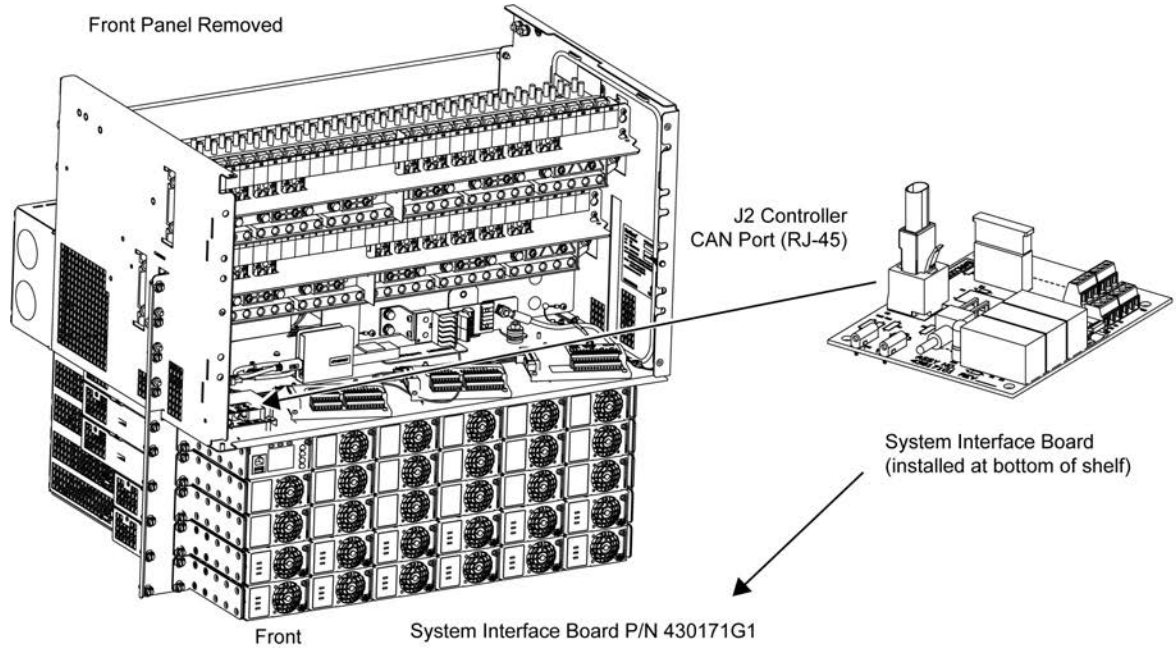


RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 7100 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)	 RJ-45 Plug (Male)
RS485 (+)	J3-1	Pin 2	Pin 4	
RS485 (-)	J3-2	Pin 3	Pin 5	

3.4.10 Vertiv™ NetSure™ 7100 (582127000930, 582127000931, 582127000990) Modbus Connection Location and Wiring

Note: For all other NetSure™ 7100 list numbers, please see sections 3.4.8 and 3.4.9 for Modbus connection location and wiring.



RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 7100 System	Narada (RJ45 Plug)	Polarium (RJ45 Plug)
RS485 (+)	TB1-1A	Pin 2	Pin 4
RS485 (-)	TB1-1B	Pin 3	Pin 5

RJ-45 Plug (Male)

3.4.11 Vertiv™ NetSure™ 802 NCU Retrofit and Vertiv™ NetSure™ 8200 (582140000) Modbus Connection Location and Wiring

Primary Power/Distribution Bay
Primary Power Only Bay Similar

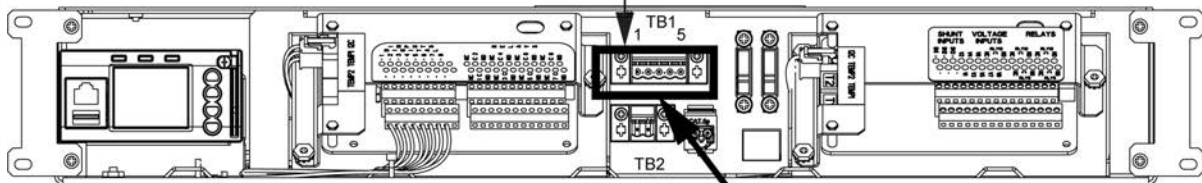
Primary Bay Control Shelf

Front door removed in illustration for clarity only.

- | | | |
|-------|----------|--------------------|
| TB1-1 | RS485_1A | } South Bound Port |
| TB1-2 | RS485_1B | |
| TB1-3 | C_GND | |
| TB1-4 | RS485_2A | } North Bound Port |
| TB1-5 | RS485_2B | |

TB1
RS-485 Port 1 / Port 2

Primary Bay Control Shelf



Plug connector into TB1



Terminate raw end of RJ45 patch cable on five pin connector per wiring chart below.

RJ45 Cable Wiring Chart

Signal	Vertiv™ NetSure™ 8200 (TB1)	Narada (RJ45 Plug)	Polarium (RJ45 Plug)
RS485 (+)	TB1-1 RS485_1A	Pin 2	Pin 4
RS485 (-)	TB1-2 RS485_1B	Pin 3	Pin 5



3.5 Post Cabling NCU Adjustments

3.5.1 Run Auto Config

Note: Auto Config needs to be re-run in the following situations:

If a battery is replaced in the string.

If a battery is removed from the string.

If a battery is added to the string.

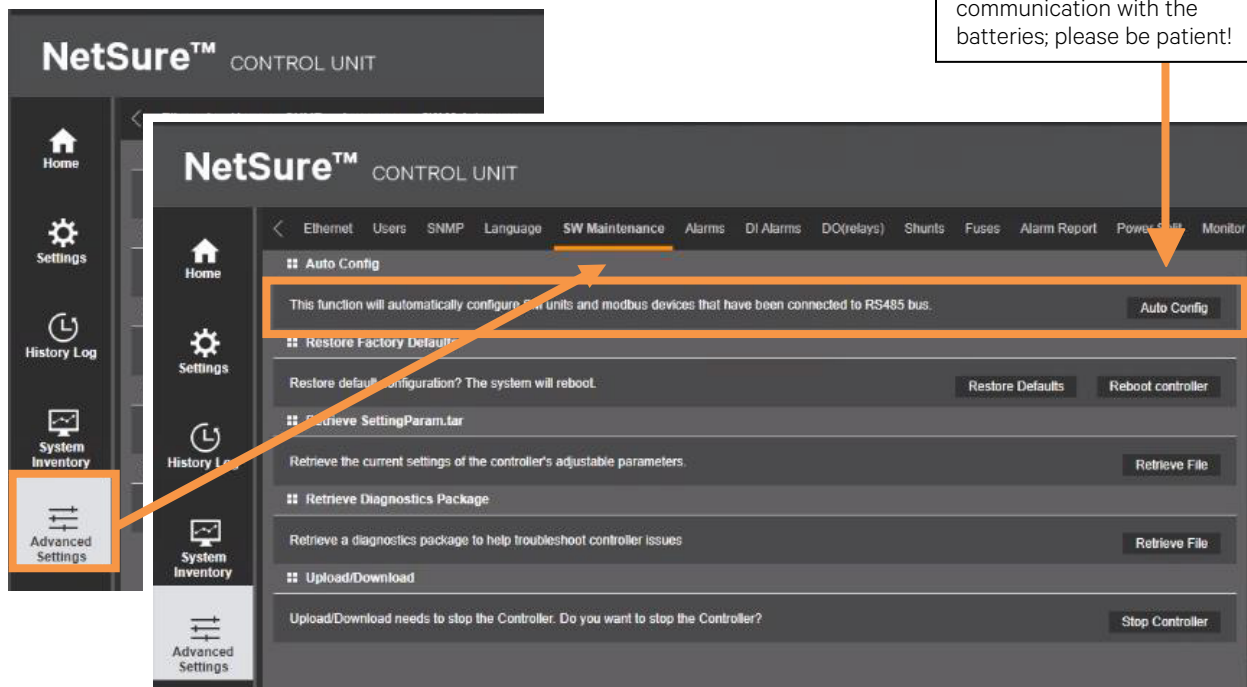
If NCU software is updated.

If the batteries have been turned off / fully discharged and the power plant has lost grid power.

Run 'Auto Config'

It may take up to eight (8) minutes for the battery icons 'BMS01', 'BMS02', etc. to appear on the battery page AFTER Auto Config is complete and you have logged back into the system.

During this time, there will be no indication on the screen that the NCU is establishing communication with the batteries; please be patient!



3.5.2 Enter Battery Ah Rating for Each Battery

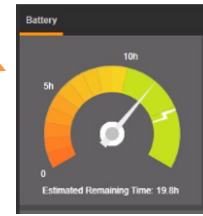
The screenshot shows the NetSure™ CONTROL UNIT interface. The top left shows the 'Home' screen with a power system diagram. An orange arrow points from the 'Home' icon to the 'Battery' icon in the bottom right of the diagram. The top right shows the 'Battery' dashboard with a gauge for 'Estimated Remaining Time: 16.6h' and a table of battery signals. An orange box highlights the gear icons for 'Battery 1', 'BMS 01', and 'BMS 02'. A callout box points to these gear icons with the text: "Click on gear icon for each battery." The bottom screenshot shows the 'Battery' settings for 'BMS 01'. A table is displayed with the following data:

Signal	Value	Time Last Set	Set Value	Set
Rated Capacity	50 Ah	10/14/2021 15:01:53	<input type="text" value="50-50000"/>	Set

An orange box highlights the 'Rated Capacity' row, and an orange arrow points from the text box below to the 'Set Value' input field. The text box contains: "Enter the Ah rating for each battery in the string – BMS 01, BMS 02, BMS 03, etc."

3.6 Calibrate 'Estimated Remaining Time' Gauge *

* Even though some customer specific configurations may not include this gauge, this calibration/reset should still be completed.



Signal	Value	Time Last Set	Set Value	Set
Equalize/Float Charge Control	Float Charge	06/20/2023 13:39:38	<input checked="" type="radio"/> Float Charge <input type="radio"/> Equalize Charge	Set
Float Charge Voltage	54.0 V	01/12/2020 23:18:36	<input type="text" value="42-58"/>	Set
Equalize Charge Voltage	54.0 V	01/06/2023 09:29:03	<input type="text" value="42-58.5"/>	Set
NCU Battery 1 Shunt	Yes	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Batt1 Rated Capacity	400 Ah	01/18/2020 12:54:10	<input type="text" value="10-50000"/>	Set
Reset Battery Capacity	Yes	—	<input checked="" type="radio"/> Yes	Set
Number of Battery Fuses	0	—	<input type="text" value="0"/>	Set
Calculate Battery Current	No	—	<input checked="" type="radio"/> No <input type="radio"/> Yes	Set
Temp Comp Sensor	None	01/06/2023 09:29:49	<input type="text" value="None"/>	Set

After all batteries reach 100% charge, Set 'Reset Battery Capacity'.

3.7 After The Settings Have Been Made...

	Wait one to two minutes for changes to be implemented.
	Confirm there are no unexpected alarms.
	Set-up complete.

3.8 Monitoring Mode Reference Guide

Monitoring Mode Parameters	Narada	Polarium
View <u>Detailed</u> BMS Data Locally	Yes (see “Narada Detailed BMS Data via Viewer Software - Screen Shots” starting on page 41.)	Yes (see “Polarium Detailed BMS Data via Studio Software - Screen Shots” starting on page 44.)
Battery To Laptop Cable for Local BMS Access	RJ45 to USB Cable (acquire from Narada)	RJ45 to USB Cable (included with battery)
View <u>Detailed</u> BMS Data Remotely	No	No
View <u>Summary</u> BMS Data Locally and Remotely via NCU	Yes (see “NCU Monitoring Mode Screen Shots for Narada Batteries” starting on page 2.)	Yes (see “NCU Monitoring Mode Screen Shots for Polarium Batteries” starting on page 6.)
Battery BMS	Modbus V1.5 or V1.5.2	Gen 5 battery w/ FW V2021-05-07
NCU Software Version	Min: V1.2.40 / Prefer V1.2.80 (or later)	Min: V1.2.40 / Prefer V1.2.80 (or later)
Maximum Devices (batteries + other) Supported by NCU	16	16
Maximum Batteries Supported	16	16
Battery Baud Rate Setting	9600 (default)	9600 (needs to be changed from default setting)
NetSure™ Power System to Battery Cabling	RJ45 Patch Cable (customer provided) (for Vertiv™ NetSure™ 211, Vertiv™ NetSure™ 502, Vertiv™ NetSure™ 5100 Integrated; Vertiv™ P/N 547674 cable also required.)	RJ45 Patch Cable (customer provided) (for Vertiv™ NetSure™ 211, Vertiv™ NetSure™ 502, Vertiv™ NetSure™ 5100 Integrated; Vertiv™ P/N 547674 cable also required.)
Inter-Battery Communications Cabling	RJ45 Patch Cable (customer provided)	RJ45 Patch Cable (included with battery)
Last Battery Communication Port Termination	RJ45 Patch Cable (customer provided)	Terminator Plug (included with battery)

4 Appendix - Battery Management System (BMS) Access Overview

In some situations, access to the data contained in the Battery Management System (BMS) may be required. This section provides screen shots of the type of data that can be viewed along with what cables and software are required, to gain access.

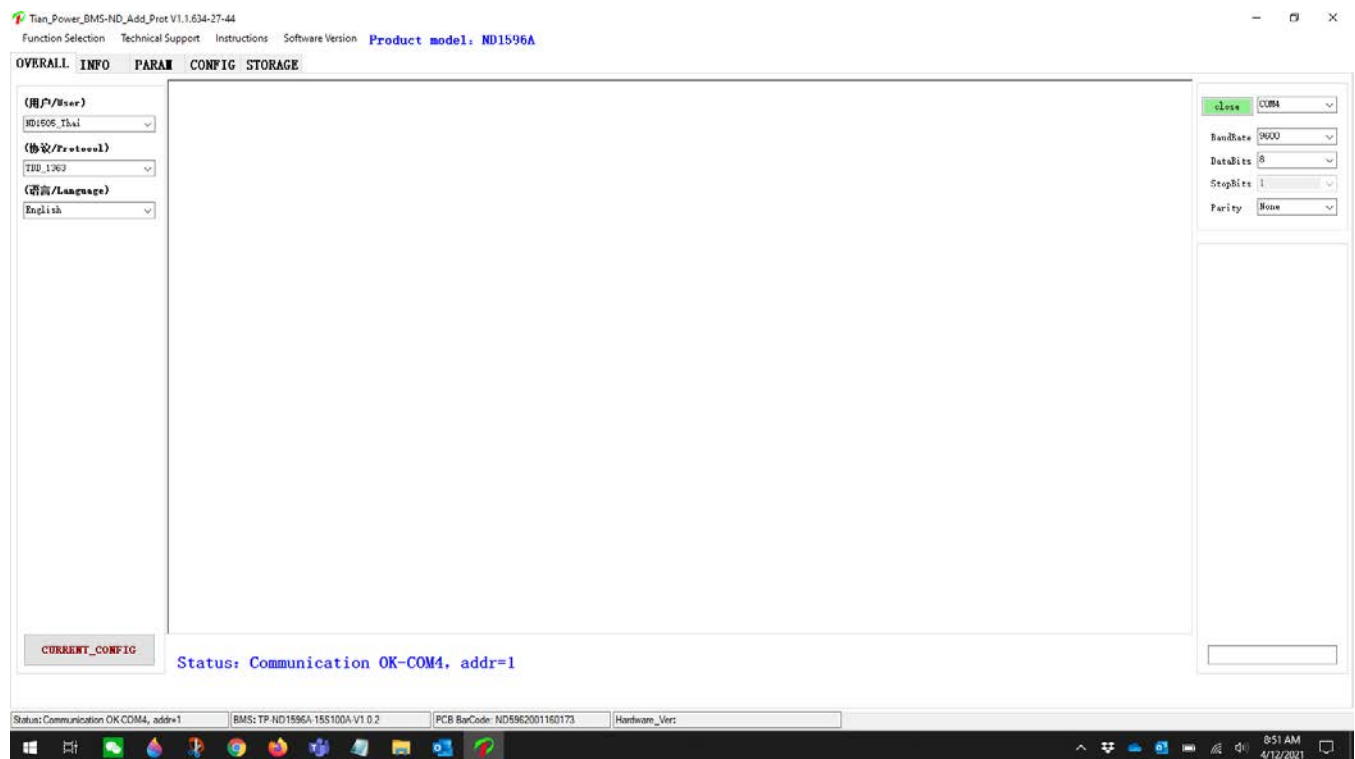
4.1 Narada Detailed BMS Data via Viewer Software - Screen Shots

Data can only be viewed locally.

Narada Viewer Software required

Narada Communication Cables required (Narada P/N 31120200011 and 31120100032).

Battery Connection Settings



Battery Data Logging/Reporting

Tian_Power_BMS-ND_Add_Prot V1.1.634-27-44
 Function Selection Technical Support Instructions Software Version Product model: ND1596A

OVERALL INFO PARAM CONFIG STORAGE

ID	Time	Alarm Code	Cell ...	CELL1	CELL2	CELL3	CELL4	CELL5	CELL6	CELL7	CELL8	CELL9	CELL10	CELL11	CELL12	CELL13	CELL14	CE
1	2020-01-19 11:17:11	Battery undervolta...	15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
2	2020-01-19 11:17:12	Overall undervolta...	15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
3	2020-01-18 11:17:19	Timing record	15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
4	2020-02-25 13:12:37	Timing record	15	2.972	2.966	2.974	2.977	2.966	2.973	2.972	2.976	2.960	2.964	2.972	2.972	2.975	2.968	2.1
5	2020-02-25 16:45:23	Timing record	15	2.971	2.965	2.973	2.976	2.965	2.972	2.970	2.974	2.957	2.963	2.970	2.970	2.973	2.966	2.1
6	2020-02-25 16:46:25	Start charging	15	2.977	2.972	2.980	2.983	2.970	2.978	2.975	2.979	2.963	2.969	2.974	2.975	2.978	2.971	2.1
7	2020-02-25 16:52:27	Stop charging	15	3.320	3.325	3.322	3.321	3.324	3.325	3.323	3.322	3.323	3.322	3.323	3.326	3.326	3.325	3.1
8	2020-02-25 17:45:23	Timing record	15	3.230	3.230	3.230	3.232	3.230	3.230	3.231	3.232	3.230	3.231	3.232	3.233	3.232	3.232	3.1
9	2020-02-25 18:18:08	Start charging	15	3.241	3.242	3.242	3.242	3.242	3.240	3.242	3.243	3.243	3.243	3.243	3.244	3.243	3.243	3.1
10	2020-02-25 18:18:16	Timing record	15	3.247	3.248	3.248	3.248	3.248	3.247	3.249	3.249	3.249	3.249	3.248	3.250	3.250	3.249	3.1
11	2020-02-25 19:18:16	Timing record	15	3.415	3.421	3.416	3.417	3.418	3.419	3.421	3.422	3.427	3.420	3.419	3.422	3.423	3.421	3.1
12	2020-02-25 20:18:16	Timing record	15	3.544	3.544	3.549	3.535	3.530	3.546	3.548	3.581	3.568	3.539	3.557	3.548	3.600	3.547	3.1
13	2020-02-25 20:21:00	Battery overvoltage...	15	3.578	3.567	3.608	3.558	3.536	3.579	3.562	3.657	3.583	3.525	3.588	3.556	3.602	3.553	3.1
14	2020-02-25 20:21:01	Stop charging	15	3.578	3.567	3.608	3.558	3.536	3.579	3.562	3.657	3.583	3.525	3.588	3.556	3.602	3.553	3.1
15	2020-02-25 20:51:02	Single overvoltage...	15	3.314	3.312	3.314	3.312	3.310	3.333	3.333	3.324	3.306	3.312	3.336	3.337	3.342	3.336	3.1
16	2020-02-25 20:51:02	Start discharging	15	3.314	3.312	3.314	3.312	3.310	3.333	3.333	3.324	3.306	3.312	3.336	3.337	3.342	3.336	3.1
17	2020-02-25 21:18:16	Timing record	15	3.256	3.252	3.256	3.257	3.254	3.252	3.254	3.243	3.252	3.252	3.254	3.252	3.255	3.253	3.1
18	2020-02-25 22:18:16	Timing record	15	3.203	3.198	3.202	3.204	3.200	3.196	3.199	3.199	3.195	3.195	3.196	3.198	3.194	3.200	3.1
19	2020-02-25 22:59:21	Overall undervolta...	15	2.727	2.723	2.733	2.751	2.725	2.734	2.715	2.684	2.622	2.655	2.688	2.691	2.676	2.668	2.1
20	2020-02-25 22:59:22	Stop discharging	15	2.760	2.753	2.763	2.781	2.756	2.764	2.752	2.718	2.659	2.689	2.710	2.724	2.711	2.700	2.1
21	2020-02-29 19:44:22	Timing record	15	2.975	2.975	2.963	2.973	2.954	2.975	2.966	2.977	2.978	2.978	2.965	2.974	2.972	2.971	2.1
22	2020-02-29 20:24:54	Start charging	15	2.981	2.978	2.966	2.977	2.958	2.979	2.970	2.982	2.981	2.981	2.969	2.978	2.976	2.975	2.1
23	2020-02-29 20:30:55	Stop charging	15	3.320	3.321	3.319	3.322	3.322	3.321	3.320	3.323	3.325	3.325	3.321	3.324	3.323	3.325	3.1
24	2020-02-29 20:44:22	Timing record	15	3.238	3.238	3.237	3.238	3.237	3.237	3.238	3.239	3.238	3.239	3.238	3.240	3.239	3.239	3.1
25	2020-03-01 02:33:51	Start charging	15	3.235	3.235	3.235	3.235	3.235	3.233	3.234	3.236	3.236	3.236	3.235	3.236	3.235	3.236	3.1
26	2020-03-01 02:33:59	Timing record	15	3.244	3.244	3.243	3.244	3.244	3.243	3.243	3.244	3.245	3.244	3.243	3.246	3.244	3.245	3.1
27	2020-03-01 03:33:59	Timing record	15	3.415	3.417	3.414	3.417	3.417	3.415	3.417	3.422	3.426	3.421	3.419	3.421	3.417	3.421	3.1
28	2020-03-01 04:33:59	Timing record	15	3.536	3.543	3.522	3.536	3.540	3.546	3.532	3.564	3.571	3.560	3.552	3.546	3.547	3.558	3.1
29	2020-03-01 04:43:53	Battery overvoltage...	15	3.501	3.501	3.427	3.457	3.477	3.619	3.444	3.706	3.616	3.656	3.499	3.553	3.778	3.711	3.1
30	2020-03-01 04:43:54	Stop charging	15	3.501	3.501	3.427	3.457	3.477	3.619	3.444	3.706	3.616	3.656	3.499	3.553	3.778	3.711	3.1
31	2020-03-01 05:13:55	Single overvoltage...	15	3.353	3.470	3.331	3.326	3.328	3.384	3.341	3.402	3.354	3.399	3.365	3.367	3.461	3.422	3.1
32	2020-03-01 05:13:55	Start discharging	15	3.353	3.470	3.331	3.326	3.328	3.384	3.341	3.402	3.354	3.399	3.365	3.367	3.461	3.422	3.1
33	2020-03-01 05:33:59	Timing record	15	3.266	3.267	3.265	3.266	3.264	3.264	3.264	3.263	3.256	3.262	3.265	3.266	3.266	3.265	3.1
34	2020-03-01 06:33:59	Timing record	15	3.222	3.221	3.220	3.222	3.217	3.218	3.219	3.217	3.208	3.214	3.219	3.219	3.219	3.219	3.1
35	2020-03-01 07:23:38	Overall undervolta...	15	2.720	2.712	2.706	2.718	2.679	2.710	2.711	2.702	2.679	2.691	2.652	2.706	2.696	2.683	2.1
36	2020-03-01 07:23:39	Stop discharging	15	2.740	2.741	2.733	2.744	2.708	2.740	2.737	2.732	2.715	2.722	2.682	2.733	2.729	2.707	2.1
37	2020-03-09 15:50:21	Start charging	15	2.945	2.942	2.924	2.941	2.918	2.942	2.932	2.945	2.947	2.945	2.928	2.945	2.939	2.939	2.1
38	2020-03-09 15:50:29	Timing record	15	2.959	2.957	2.939	2.956	2.933	2.957	2.948	2.959	2.963	2.960	2.942	2.959	2.954	2.954	2.1
39	2020-03-09 16:50:29	Timing record	15	3.405	3.406	3.405	3.407	3.407	3.406	3.408	3.412	3.416	3.412	3.408	3.411	3.407	3.412	3.1
40	2020-03-09 17:23:15	Stop charging	15	3.388	3.390	3.389	3.391	3.391	3.389	3.391	3.396	3.395	3.395	3.392	3.395	3.393	3.396	3.1

Read EMS Time 2021-04-12 20:56:36 Write System Time

General Storage

Read Record 400 (ms)step Save Record

Stop_Read 400 (ms)delay Delete Record

Start Time Double Click Get Time Write Read

End Time Double Click Get Time Write Read

Interval Time 60 (min) Write Read

Start reading storage record

Status: Communication OK COM4, addr=1 BMS: TP-ND1596A-1S5100A-V1.0.2 PCB BarCode: ND5962001160173 Hardware_Ver:

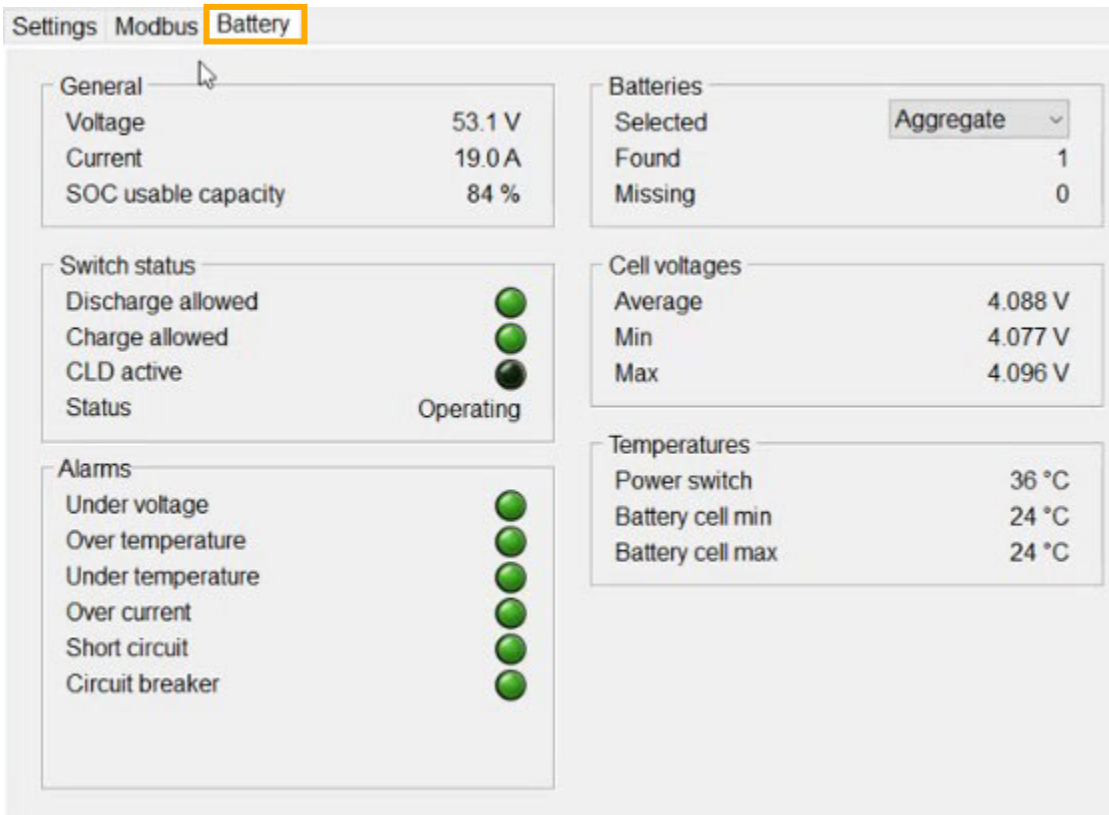
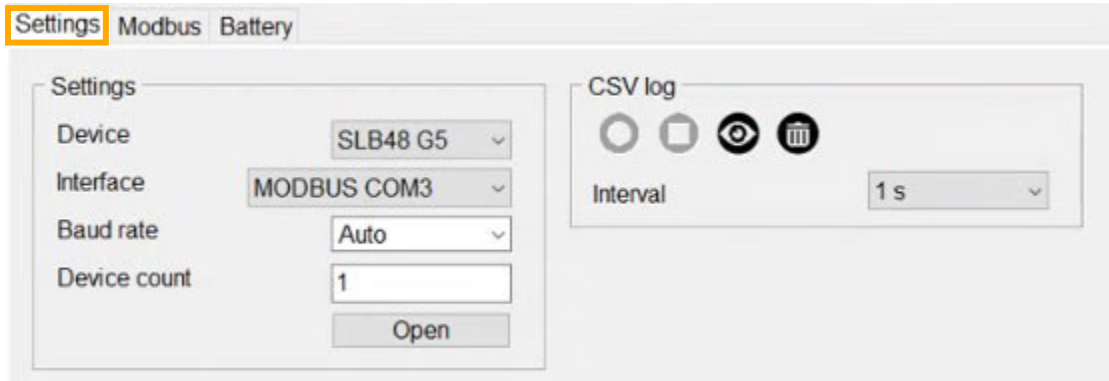
4.2 Polarium Detailed BMS Data via Studio Software - Screen Shots

Data can only be viewed locally.

Polarium Studio Software required.

Polarium Modbus Communication Cable required (Polarium P/N 105-00006 - Vertiv™ P/N 10020692).

BMS Connection Settings and Battery String Dashboard



Battery Product Information, Dashboard and Details

Settings Modbus Battery			
1			
Settings Program Battery			
Name	Min	Max	Value
SOC	0.00 %	100.00 %	85.42 %
LVD	-327.68 V	327.67 V	0.00 V
Over current charge delay	0 A²s	255000 A²s	45000 A²s
RS485 protocol	0	2	Incell Modbus
RS485 bitrate	0	1	115,200 bps

File Settings Modbus Battery			
1			
Settings Program Battery			
Name	Min	Max	Value
Product ID			
Hardware revision			06
Product name			
Production date			20200723
Customer serial			
Market name			SLB48-100-226-2
Incell serial			80000040069820290010

Settings Modbus Battery			
1			
Settings Program Battery			
Name	Min	Max	Value
SOC			89.84 %
Capacity			209.89 Ah
Battery voltage			51.96 V
Rail voltage			51.61 V
Current			-98.49 A
Min cell voltage			3.942 V
Max cell voltage			4.021 V
Min cell temp			22.1 °C
Max cell temp			22.7 °C
FET temp			57.3 °C
Model			SLB48-210-1-21700

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