

# **Sentry Battery Monitor**

Sentry-NB4 Sentry-NB4T Sentry-NB8

Compatible with MyBattery Platform™

Installation and Service Guide



# Voltage Hazard and High Energy Exist on Battery Terminals, Sampling Leads, Connectors and Inside Circuits! Do NOT Open the Unit!

Please read through this manual before installation Information in this document is subject to change without notice.

# BatteryDAQ Company, USA

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#### Liability

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#### **Specification**

**BatteryDAQ** makes every effort to ensure that the specifications and details in this manual are accurate and complete. **BatteryDAQ** reserves the right to alter or improve the specification, design or manufacturing process at any time, without notice.

#### Warranty

**BatteryDAQ** warrants this system free from defects in material and workmanship in operation for one year from the date of commissioning or sale by **BatteryDAQ** or its authorized dealer.

For warranty service or repair, this product must be returned to the BatteryDAQ factory. Buyer shall pay shipping charges to send the product to BatteryDAQ, and BatteryDAQ shall pay shipping charges to return the product to the Buyer. However, Buyer shall pay all shipping charges, duties and taxes for products returned to BatteryDAQ from another country.

#### **Limitation of Warranty**

This warranty does not apply to defects arising from system modification performed without **BatteryDAQ**'s written approval, or misuse of the system or any part of the system. The warranty excludes defects or malfunctions resulting from failure by the customer, or his designated personnel, to maintain and upkeep the batteries to which the system is fitted.

#### **Safety Notices**



The following safety precautions should be observed before any work is performed.

1. Sentry units are to be installed by trained personnel who are qualified to recognize the hazards associated with working on batteries and know the safety precautions required to avoid possible injury. The safety procedures and safe working practices as described in the appropriate battery manufacturers documentation should be followed at all times.

**3.** Never work on any system that threatens life or injury through hazardous voltages except when applying absolute safety precautions.

4. Never work on hazardous voltage system alone. Always ensure that you work with a properly trained colleague.

5. Never make unauthorized changes or modifications to equipment. This may create unsafe, or even hazardous, situations.

6. Where the battery bank is disconnected by switching off, the wire/cable(s) to battery monitor or any other circuit may also need to be unplugged or disconnected in order to fully isolate battery bank.

7. After replacing/servicing of the battery, any removed links must be fitted and reconnected before the modules are reconnected.

#### **Tools and Equipment**

1. Ensure all equipment and tools are proper, safe and in good working order.

2. Ensure electrical tools have been tested for proper insulation and grounding where appropriate.

3. Observe all **CAUTION, WARNINGS** and **DANGER** notices on equipment, tools, and building, whether internally or externally displayed.

#### **Service and Support**

If during the use of the **BatteryDAQ<sup>™</sup>** product any cracks, breaks or defects are found in any of the units, please contact our customer service or the dealer.

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\* Drawings/pictures in this manual are for reference only.

# 1 Quick Guide

Please read through the manual to familiarize yourself with Sentry unit and software.

For simple test, prepare at least 1 string of 2x12V(24V) battery string. (1 string of 4x12V is recommended.)

Step	Description	Reference	Check
1	Prepare battery connection cable/harness if not ordered from BatteryDAQ		
2	Run Ethernet cable to battery cabinet/location		
3	Secure Sentry unit next to battery bank		
4	Install current sensor (CT) and temperature probe to battery string	Chapter 4	
5	Wire battery cable/harness to battery posts	Chapter 4	
6	Power on check		
7	Connect Sentry unit to network		
8	Set/check IP address for Sentry unit	IpSetup.exe	
9	Check settings and battery data with web browser	Chapter 3	
10	Change settings for battery configuration		
11	Change settings for communication host/port		
12	Calibrate unit if necessary	Chapter 5	
13	Perform discharge/charge to test high level functions	Test SOC, SOH and Runtime	
14	Install Battery Analyzer software if needed		
15	Set alarm thresholds and delivery methods with Battery Analyzer	Chapter 6	
16	Subscribe/login to MyBattery Platform <sup>™</sup>	www.thisbattery.com	
17	Integrate to other management software/platform	Modbus-TCP Contact tech support for Modbus table	

# 2 Overview of Sentry NB

#### SENTRY NB battery monitoring unit is designed for *telecommunication outside cabinet* -48V and

24V systems with 2x12V, 4x12V or 8x6V, one or two strings. It utilizes our 3<sup>rd</sup> generation technologies for high performance and easy installation.

NB4	NB4T	NB8
1 string, 2 or 4 batteries	1 string with 2/3/4 batteries Active battery voltage balancing	1 or 2 strings Each string has 2 or 4 batteries

#### Main Features

- Advanced precise IR (Internal Resistance) measurement technology
- Protection for over voltage input for each sampling channel
- High resolution data acquisition
- Real-time SOC, SOH and runtime estimation
- No mechanical scanning relays, resulting high reliability for telecom industry
- Compact design allows for easy installation into a cabinet or battery tray
- Industrial grade reliability for outdoor applications
- Integrated Ethernet connection
- Full support to networking battery management system
- Compatible with MyBattery Platform<sup>TM</sup> for web based remote monitoring for large scale deployment
- Support Modbus TCP integration
- Active Balancing [only available on NB4T model]

#### Main measurements

- Individual battery voltage monitoring
- Individual battery Internal Resistance (IR) monitoring
- String voltage monitoring
- String float current and charge & discharge current monitoring (optional)
- Ambient or pilot temperature monitoring (Optional: individual battery temperature.)
- Discharge auto-detection and discharge curve recording (with MyBattery Platform<sup>TM</sup>)

### **Overview**

		DTU Configuration			
-	Description	Stored Value	New Value		
1	DTU ID	12310	12310		
2	Site Name	name a site here	name a site here		
3	Host Name	www.thisbattery.com	www.thisbattery.com		
4	Host IP	50.62.40.65	50.62.40.65		
5	Host UDP Port	5566	5566		
11	Monitor Code	1,2,4,20	1,2,4,20		
12 Report Interval(mins) 60 60					
Code:(1,1,N,10)for NB4 1 string, N batteries Code:(1,1,N,20)for NB8 1 string, N batteries Code:(1,2,N,20) NB8 2 strings total N batteries					

Unit can be configured by user for different battery applications.

Monitor Code: ModbusID(1), String Number(1 or 2), Battery Number(2 to 8), Type Code(10 or 20).

NB4 Configuration Code	1,1,4,10	1,1,2,10	1,1,4,10
Battery String	4x12V, 1 string	2x12V,1 string	4x6V,1 string
String Voltage	48V	24V	24V
Battery Block	12V	12V	6V
Battery Number	4	2	4

**Sentry-NB4** can be configured for one string of 4x12V, 4x6V or 2x12V. (NB4 – type code 10)

Sentry-NB8 can be configured for one or two strings. (NB8 - type code 20)

NB8 Configuration	1,1,4,20	1,2,8,20	1,1,8,20	1,1,2,20	1,2,4,20	1,1,4,20	1,2,8,20
Battery String	4x12V 1 string	4x12V 2 strings	8x6V, 1 string	2x12V, 1 string	2x12V, 2 strings	4x6V, 1 string	4x6V, 2 strings
String Voltage	48V	48V	48V	24V	24V	24V	24V
Battery Block	12V	12V	6V	12V	12V	6V	6V
Battery Number	4	8	8	2	4	4	8

#### **NB4** function blocks





#### **Overview**

#### **NB4T** function blocks



#### **NB8 function blocks**





**Hazardous Voltage and High Energy Warning** – this monitor is designed for -48V/24V system, with a maximum battery string voltage of up to **60V**. Any shortage to battery terminals or wires may result in a high current burn or fire.

# 2.1 NB4 Specifications

Model: NB4				
	Power Supply			
Power Input	Internal DC/DC converter, 18-60V input; Maximum Consumption: 3W			
	Current/Temperature Measurement			
Current Sensor (CT)	Support LEM HASS current sensor with internal +5V power supply			
	(Default range +/- 50A, window size 20mm x 10mm)			
Temperature	1 ambient/pilot temperature sensor			
	Measurement range: -40 to 65°C, accuracy 1 °C			
	Voltage Measurement			
Battery	1 string, 2 x12V, 4 x 6V or 4 x 12V battery			
Bus Voltage	Range: 18 – 60V; Accuracy: 0.1%			
Battery Voltage	+/- 16V for 12V batteries; Accuracy: 0.1%			
	Internal Resistance			
Range and Resolution	Range and Resolution 0 to $30m\Omega$ , $0.01m\Omega$ resolution			
Wiring mode	Four-terminal sensing (separate current-carrying and voltage sensing wires)			
	Communication			
Ethernet	Onboard Ethernet, Modbus-TCP			
	Compatible with Battery Analyzer software and MyBattery Platform <sup>™</sup>			
	Indication and Alarm			
LED indication	Dual-color LEDs for status			
Alarm Outputs Urgent Alarm (Normal Close, 0.1A capacity)				
	Dimensions			
Unit Dimensions	115mm(H) x 90mm(D) x 32mm(W), 4.5" x 3.5" x 1.3" in.			
Mounting	Default: Magnetic cup (50 lbs force) DIN Rail optional			

\*Specifications subject to change without notice

# 2.2 NB4T Specifications

Model: NB4T				
	Power Supply			
Power Input Internal DC/DC converter, 18-60V input; Maximum Consumption: 3W				
	Current/Temperature Measurement			
Current Sensor(CT)Support LEM HASS current sensor with internal +5V power supply (Default range +/- 50A, window size 20mm x 10mm)				
Temperature	Default: 1 ambient and 1 pilot temperature sensor Optional: 1 ambient and 4 battery temperature sensors on a pre-made bus cord Measurement range: -40 to 65°C, accuracy 1 °C			
	Voltage Measurement			
Battery	4 x12V, up to 300Ah Compatible with 2x12V, 3x12V, 4x6V			
Bus Voltage	Range: 18 – 60V; Accuracy: 0.1%			
Battery Voltage +/- 16V for 12V batteries; Accuracy: 0.1%				
	Internal Resistance			
Range and Resolution0 to $30m\Omega$ , $0.01m\Omega$ resolution				
Wiring modeFour-terminal sensing (separate current-carrying and voltage sensing wires)				
	Communication			
Ethernet       Onboard Ethernet, Modbus-TCP         Compatible with Battery Analyzer software and MyBattery Platform <sup>TM</sup>				
	Indication and Alarm			
LED indication	<ul> <li>Dual-color LEDs for status</li> <li>LED for service alarm</li> <li>LED for urgent alarm</li> </ul>			
Alarm Outputs	Service Alarm (Normal Close, 0.1A capacity) Urgent Alarm (Normal Close, 0.1A capacity)			
	Dimensions			
Unit Dimensions	130mm(L) x 80mm(W) x 30mm(D) 5.2" x 3.2" x 1.2" in.			
Mounting	Default: Magnetic cup (50 lbs force)			

\*Specifications subject to change without notice

# 2.3 NB8 Specifications

Model: NB8				
	Power Supply			
Power Input Internal DC/DC converter, 18-60V input; Maximum Consumption: 3W				
	Current/Temperature Measurement			
Current Sensor (CT)	Support LEM HASS current sensor with internal +5V power supply (Default range +/- 50A, window size 20mm x 10mm) 2 CTs can be utilized if the window size is not big enough for 2 strings. 0.1% + sensor accuracy			
Temperature	1 ambient/pilot temperature sensor			
	Voltage Measurement			
Battery	2x12V, 4 x12V or 8 x 6V battery 1 to 2 strings, maximum 8 batteries			
Bus Voltage	Range: 18 – 60V; Accuracy: 0.1%			
Battery Voltage +/- 16V for 12V batteries; Accuracy: 0.1%				
	Internal Resistance			
Range and Resolution0 to $30m\Omega$ , $0.01m\Omega$ resolution				
Wiring mode         Four-terminal sensing (separate current-carrying and voltage sensing wires)				
	Communication			
Ethernet	Onboard Ethernet, Modbus-TCP Compatible with Battery Analyzer software and MyBattery Platform™			
	Indication and Alarm			
LED indication	<ul> <li>Dual-color LEDs for status</li> <li>LED for service alarm</li> <li>LED for urgent alarm</li> </ul>			
Alarm Outputs	Service Alarm (Normal Close, 0.1A capacity) Urgent Alarm (Normal Close, 0.1A capacity)			
	Dimensions			
Unit Dimensions	130mm(L) x 80mm(W) x 30mm(D) 5.2" x 3.2" x 1.2" in.			
Mounting	Default: Magnetic cup (50 lbs force)			

\*Specifications subject to change without notice

## 2.4 Layout of Connection Terminals for NB4



### 2.4.1 Panel Connection for NB4

Connector 1: Ethernet port, 10/100Mb RJ45

#### Connector 2: Current Sensors (CTs), Temperature Probe, and Alarm Output

Pin No	Signal Name	Note
1	ALM	Alarm Output (0.1A, 200V)
2	ALM	Alarm Output (0.1A, 200V)
3	P5V	Current Sensor Power Supply (+5V)
4	IS	Current Sensor Signal
5	SGND	Current sensor Ground
6	TGND	Temperature Sensor Ground
7	TS	Temperature Sensor Data Port
8	TS3V	Temperature sensor power supply (3.3V)

#### **Connector 3: Battery String Connection**

Pin No	Signal Name	Note	-48V (4x12V)	24V (2x12V)
1	BUS+	Always count #1 from positive Battery string POSITIVE bus	0V (BATT#1+)	24V+
2	BT1+	Battery #1 positive post	BATT#1+	BATT#1+
3	BT2+	Battery #2 positive post	BATT#2+	BATT#2+
4	BT3+	Battery #3 positive post	BATT#3+	BATT#2-
5	MID1	String-1 middle point	BATT#3+	BATT#2+
6	BT4+	Battery #4 positive post	BATT#4+	-
7	BT4-	Battery #4 negative post	BATT#4-	-
8	BUS-	Battery string NEGATIVE bus	-48V (BATT#4-)	0V (BATT#2-)

#### **Panel Layout**

### 2.5 Layout of Connection Terminals for NB8

#### 2.5.1 Front Panel Connection



Connector 1: Ethernet port, 10/100Mb RJ45

9

10

11

12

Pin No	Signal Name	Note
1	IS5V	Current Sensor Power Supply (+5V)
2	IS1	Current Sensor Signal-1
3	GND	Current sensor Ground
4	IS5V	Current Sensor Power Supply (+5V)
5	IS2	Current Sensor Signal-2
6	GND	Current sensor Ground
7	GND	Temperature Sensor Ground
8	TSQ	Temperature Sensor Data Port

Connector 2: Current Sensors (CTs), Temperature Probe, and Alarm Output

T3V

NC1

COM NC2 Temperature sensor power supply (3.3V)

Urgent Alarm Output (0.1A, 200V) Alarm Common (0.1A, 200V)

Service Alarm Output (0.1A, 200V)

# 2.5.2 NB8 Battery Connection Terminals



#### **Connector 1: Battery String-1**

Pin No	Signal Name	Note	-48V (4x12V)	24V (2x12V)
1	BUS+	Always count #1 from positive Battery string POSITIVE bus	0V (BATT#1+)	24V+
2	BT1+	Battery #1 positive post	BATT#1+	BATT#1+
3	BT2+	Battery #2 positive post	BATT#2+	BATT#2+
4	BT3+	Battery #3 positive post	BATT#3+	BATT#2-
5	MID1	Sting-1 middle point	BATT#3+	BATT#2+
6	BT4+	Battery #4 positive post	BATT#4+	-
7	BT4-	Battery #4 negative post	BATT#4-	-
8	BUS-	Battery string NEGATIVE bus	-48V (BATT#4-)	0V (BATT#2-)

#### **Connector 2: Battery String-2**

Pin No	Signal Name	Note	-48V (4x12V)	24V (2x12V)
1	BT5+	Battery #5 positive post, sensing lead	(BATT#5+	BATT#3+
2	BT6+	Battery #6 positive post	BATT#6+	BATT#4+
3	BT7+	Battery #7 positive post	BATT#7+	BATT#4-
4	MID2	String-2 middle point	BATT#7+	BATT#4+
5	BT8+	Battery #8 positive post	BATT#8+	-
6	BT8-	Battery #8 negative post, sensing lead	BATT#8-	-

#### **Panel Layout**

# 2.6 NB4T Battery Connection Terminals



### **Connector 1: Battery String**

Pin No	Signal Name	Note	-48V (4x12V)	36V (3x12V)	24V (2x12V)
1	BUS+	Always count #1 from positive Battery string POSITIVE bus	0V (BATT#1+)	36V+	24V+
2	BT1+	Battery #1+ sensing	BATT#1+	BATT#1+	BATT#1+
3	BT2+	Battery #2 balancing	BATT#2+	BATT#2+	BATT#2+
4	BT2+	Battery #2+ sensing	BATT#2+	BATT#2+	BATT#2+
5	BT3+	Battery #3 balancing	BATT#3+	BATT#3+	BATT#2-
6	BT3+	Battery #3+ sensing	BATT#3+	BATT#3+	-
7	BT4+	Battery #4 balancing	BATT#4+	BATT#3-	-
8	BT4+	Battery #4+ sensing	BATT#4+	-	-
9	BT4-	Battery #4- sensing	BATT#4-	-	
10	BUS-	Battery string NEGATIVE bus	-48V (BATT#4-)	0V (BATT#3-)	0V (BATT#2-)

**Connector 2: Daisy Chain Connector (Reserved)** 

### **Panel Layout**

#### 2.7 NB8 and NB4T panel indicators

**Urgent Alarm – Steady RED** 60111212140 876543 51 1) String Voltage High or Low BT 5+ | BT 6+ BT 7+ MID2 BT 8+ BT 8-BUS+ BT 1+ BT 2+ BT3+ MID1 BT 4+ BUS-BUS-2) Battery Voltage High or Low 3) Temperature High Battery Service Alarm – Flash Yellow 🔴 Urgent 1) String Voltage High or Low 2) Battery Voltage High or Low Service 3) Temperature High 4) Internal Resistance High IR Active Status Refer chapter 5.2 Calibration for alarm threshold settings. Sentry **IR Active – Flash Green** Flash when unit is doing internal resistance **Battery Monitor** measurement. Compatible with MyBattery Platform DTU ID: 12310 Ethernet NC2 Status - Red and Green Link | Speed 121110987654321 Green indicates unit is powered on and no alarm. Red flash indicates urgent or service alarm. 00508000008

NB8 and NB4T share the same front panel and indication design.

# **3 Network Management**

#### 3.1 Onboard Ethernet Connection

The onboard Ethernet is utilized for multiple functions:

- 1) Web page for battery data, communication settings and calibrations.
- 2) Connect Sentry monitor(s) to MyBattery Platform<sup>TM</sup>.
- 3) Connect to DAS software for Battery Analyzer software or other Modbus-TCP integration.
- 4) Direct Modbus-TCP data server.

The product will come with pre-configured DTU-ID and monitor configuration.

For example,

DTU-ID: 12501 Host: www.thisbattery.com Monitor configuration: 1,1,4,10 (Modbus address 1, 1 string, 4 batteries, 10 for NB4 model).

In either case, if you need to change any configuration, you may find IPSetup.exe in the software disk. Or, download from this link:

http://batterydaq.com/tech/IPSetup.exe

In order to access the embedded web page, a static IP shall be assigned to the device, along with mask and gateway.

Use "IPSetup.exe" to seach for a device in the local network. The IP may sometimes be set to static. If dynamic is needed, set all numbers to "0" as below, DTU will reset back to DHCP.

NetBurner	IPSetup ¥2.1		×
NDK Setting	19 P 192 . 168 . 1 . 8		Select a Unit SBL2E [00-03-F4-05-80-4C] at 192.168.1.8 running :
Network Ma	sk 255 . 255 . 255 . 0		SBL2E [00-03+4-06-43+5] at 192.168.1.122 running
GateWa	ay 192.168.1.1	Set>	Search
DN	6 192 . 168 . 1 . 1		Sentry NB
Baudra	te 115200 💌		Search Again Dovice
			Device
		Laund	nch Webpage Advanced Help <u>C</u> lose

Launch Webpage for configuration

Authorized user can obtain password from BatteryDAQ to update DTU configuration. Each time if the gateway is changed, the unit has to be rebooted. This can be done remotely with Reboot Passcode "77882".

IPSetup.exe V2.1 or V2.2 may not work well in Win 8 or Win 10 when the unit doesn't have a static IP. In that case, find a Win XP or Win 7 computer to set static IP to unit.

## 3.2 DTU Settings

# BatteryDAQ<sup>™</sup> Data | DTU Settings | Calibration

-	Description	Stored Value	New Value
1	DTU ID	13273	13273
2	Site Name	name a site here	name a site here
3	Host Name	www.thisbattery.com	www.thisbattery.com
4	Host IP	50.62.40.65	50.62.40.65
5	Host UDP Port	5566	5566
6	Report Interval(mins)	60	60
7	Disable(0)/Enable(1) Thermal Control	1	1
8	<pre>Disable(0)/Enable(1) Active Balancing</pre>	1	1
9	0:Normal Open/1:Normal Close(NB4)	1	1
10	0:Celsius/1:Fahrenheit	1	1
11	0:Resistance/1:Conductance	0	0
12	0:Standby/1:Deep Cycle	0	0
13	Monitor Code	1,1,4,10	1,1,4,10

### **DTU Configuration**

Code:(1,1,N,10)for NB4T, 1 string, N batteries

Enter Password:

Update DTU

Only authorized person can make changes. Click "Update" to send a packet of battery data to host server.

IP Address	192.168.1.103
IP Mask	255.255.255.0
IP Gateway	192.168.1.1

Use IPSetup.exe to config IP address.

DTU ID is unique for each Sentry unit on MyBattery Platform. It can only be programmed in factory.

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# 4 Installation Guide



- Batteries can present a risk of electrical shock or burns from high short-circuit current. Observe proper safety precautions.
- Installation should be performed by qualified service personnel knowledgeable of batteries and required precautions.
- Keep unauthorized personnel away from batteries.
- This handbook must be read thoroughly before installation.
- Device location must be considered before installation.
- Ensure all equipment and tools are properly safe and in good working order.
- Ensure electrical tools have been tested for proper insulation and grounding.
- Observe all CAUTION, WARNINGS and DANGER notices on any equipment.

### 4.1 Installation Requirement and Procedure

# **CAUTION: 60V Voltage, High Battery Energy Hazard.**

#### **Basic Installation Steps**

Step	Description	Check
1	Prepare battery connection cable/harness if not ordered from BatteryDAQ	
2	Locate/mount the Sentry unit	
3	Run Ethernet cable to Sentry unit	
4	Label the batteries with numbers	
5	Install current sensor and secure temperature sensor	
6	Connect harness to battery posts	
7	Verify connections	
8	Power on test	
9	Validation test	



# 4.2 Essential Tools



Use ferrules to protect wire to ensure long term reliability.



Recommended clamping tool: Phoenix Contact CRIMPFOX 6 (PN: 1212034) Mouser Part #: 651-1212034



Use 2.5mm, isolated screwdriver for terminals. *(a free screwdriver in your first order)* 



Isolated wrench with proper size sockets. (11mm and 13mm are must-have for popular battery 6mm/8mm posts.)

# 4.3 Locate and Secure Sentry Unit

Both NB4 and NB8 come with strong magnetic cups for easy mounting.



#### 4.4 Label the batteries with number

Label all batteries with string number and battery number 1 to 4. The first one to POSITIVE bus is "1". In the software, battery number will be displayed as 1 to 4, 5 to 8.

The principle of numbering the batteries is to define the battery which is connected to the **positive** bus of the string as NO.1 and to number sequentially.

The battery serial number and the battery interface number on the monitoring module are a one-to-one correspondence. The system/software display is relative to the battery serial number which is important to later battery alarm maintenance.

The battery number must be posted on a prominent position on the battery or on the shelf/rack.



#### 4.5 Install Current and Temperature Sensors



The current sensor can be installed at a convenient location in the string loop.

The direction arrow follows the direction of charging current.



In the case of 2 strings, if the 2 bus cables cannot fit into 10mmx20mm window, 2 current sensors can be utilized.





Unit will automatically activate additional CT when it is connected.

The temperature sensor can be used for ambient or pilot temperature measurement.





6mm, 8mm and 10mm O-rings are available for order.

*In our 20+ years, it is our experience that O-ring leads provide the most reliable connection.* For the battery with tab for monitoring, please order WL-1T leads.

Apply thin layer coating grease such as NO-OX-ID to O-ring surface. http://www.sanchem.com/docs/NO-OX-ID%20A-Special%20Electrical%20Grade.pdf

### 4.6 Install Battery Sampling Harness

### 4.7 Individual Battery Temperature Probes

If the option for individual temperature is ordered, unit will come with an assembled bus cord with multiple sensor.

For 4x12V, there are 5 sensors in the cord. The last one is for ambient temperature.



Using the strong adhesive strip to mount the sensor to each battery surface. Clean the surface if necessary.

### 4.8 Verify Connection

- 1) Check all connections to confirm they are accurate and reliable.
- 2) Verify connection with multimeter at terminals.
- 3) Measure the string voltage between BUS+ and BUS-.
- 4) Measure BUS+ to MID and MID to BUS-.
- 5) Go through battery sampling connection at terminals to check voltage.

### 4.9 Validation Test

If connecting to network, PC software or MyBattery Platform<sup>™</sup>, check if the data is updating.

Unplug sampling connector, the voltage reading shall change.

Warm the temperature sensor with your finger tip. The temperature data shall change accordingly.

Most measurement parameters can be read and validated with the HMI.

	Parameter	Description	Check
1	Temperature	Read temperature from screen. ( <i>Temperature cannot be re-calibrated.</i> )	
2	Current	If necessary, switch off battery from the main loop, read ZERO and calibrate to zero. Current gain is factory calibrated and shall not be changed.	
3	Voltage	Use a reliable & accurate meter to measure voltage at the terminal or connector. Verify there are no abnormal voltage readings.	
4	Internal Resistance	Internal resistance measurement will be automatically started 30 seconds after powering on. Use HMI to check the data. Wait for it to finish all channels. (Unfinished channel will show "-1".)	

Fill out the installation report.

### 4.10 Troubleshooting Hints

- 1) If the unit is not powered on, check BUS+ and BUS- input. Make sure not reversed.
- 2) If voltage between BUS+ and BUS- is negative, you may have an incorrect order. ALWAYS COUNT BATTERY ONE FROM POSITIVE OF BATTERY POWER.
- 3) If the voltage between adjacent terminals is higher than 15V (12V battery), check the connection order.
- 4) If a channel registers no voltage, check the settings, make sure it is set for correct battery configuration.
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# 5 Test and Calibration

#### 5.1 Test with Internet Browser

# BatteryDAQ<sup>™</sup> Data | DTU Settings | Calibration

#### Sentry ID: 13273 Site:name a site here

9/1/2019, 11:55:37 AM Refresh

String Voltage	54.33 V	String High	54.36 V	String Low	54.23 V
Remaining	220 min	Current	0.1 A	Analog	0.00 V
Total Runtime	220 min	Ambient/Peak	79.8 / 79.8°F	Pilot/Peak	80.6 / 80.7°F
SOH(Health)	45.9%	SOC(Charge)	100.0%	ThermalRisk(Max)	0 (0)
Discharge Counter	0	Deep Discharge	0	Full Discharge	0

Batt#	Voltage(V)	IR(mohm)	T(°F)
#1	13.555	12.75	79.7
#2	13.602	15.24	79.8
#3	13.588	29.47	80.6
#4	13.594	12.51	79.8

Voltage(V) BT# Resistance(mohm)



BatteryDAQ LLC, USA

# Print/save a screenshot after installation.

# 5.2 Calibration

Calibration can be done through web browser.

# BatteryDAQ<sup>™</sup> Data | DTU Settings | Calibration

# Sentry ID: 13273 Calibration and Alarming Settings:

<u> </u>			
-	Description	Stored Value	New Value
1	Calibration: Voltage Offset[8482]	-10	-10
2	Calibration: Voltage Gain	10000	10000
3	Calibration: Current Offset	-15	-15
4	Calibration: Current Gain(500 for 50A CT)	500	500
5	Calibration: IR Gain	1425	1425
6	Battery Capacity(Ah)	100	100
7	Battery Designed Runtime(min)	480	480
8	Battery SOH Compensation(x0.1%)	0	0
9	Internal Resistance Baseline(x0.01mohm)	100	100
10	Alarm: String Charge High(x0.1V)	565	565
11	Alarm: String Charge Low(x0.1V)	525	525
12	Alarm: String Discharge(x0.1V) Low	432	432
13	Alarm: Battery Charge High(x0.001V)	14500	14500
14	Alarm: Battery Charge Low(x0.001V)	12900	12900
15	Alarm: Battery Discharge Low(x0.001V)	10800	10800
16	Alarm: Temperature High (x0.1°C)	450	450
17	Alarm: Temperature Low(x0.1°C)	50	50
18	Alarm: Internal Res. Threshold(%)	50	50
19	Discharge: Depth of Discharge(%)	50	50
20	Discharge: Discharge Counter	0	0

#### 5.2.1 Temperature

Temperature reading is from laser calibrated digital sensor. No further calibration is required through its life time.

#### 5.2.2 Current Calibration

Calibrate Gain if necessary. The rough gain is about CT's specified current x 10.

HASS-50 is a 50A CT, set gain to 500.

HASS-100 is a 100A CT, set gain to 1000.

If high precision is desired, use standard current source to calibrate gain.

Calibrate Zero:

- 1) Connect to current sensor/CT, (1 or 2 sensors) switch off battery or make sure there is no current passing through CT.
- 2) Adjust offset, until the reading is close to 0. (within  $\pm -0.5A$ )

#### 5.2.3 Voltage Calibration

#### Voltage Gain

String voltage is the sum of the battery voltage.

New gain = previous gain x actual string voltage / readout string voltage

#### Voltage offset

New offset = previous value - (actual voltage - readout )/2.33

#### 5.2.4 Internal Resistance Calibration

Obtain standard/reference internal resistance from battery manufacturer datasheet or use a high performance internal resistance meter to conduct a manual measurement.

New value = previous value x (actual value / readout)

For example, actual value is 3.050 mohm, readout is 2.751 mohm, new calibration = previous calibration x (3.050/2.751=1.108)

#### 5.2.5 Save to Onboard Flash

Type the passcode to save. Contact tech support to obtain passcode.

# 6 Battery Analyzer Software Setup

For software installation, please refer to software manual. Please note that the Analyzer and DAS can be installed in separate computers within the same network. The monitor devices connect to the computer which runs the DAS. Both Analyzer and DAS will need .NET framework.

### 6.1 DAS Configuration

Sentry-NB4 and NB8 units support direct Modbus-TCP for up to 3 simultaneous connections. In the case of using direct Modbus-TCP, there is no need to run DAS software.

Device Management × Battery DAS  $\overline{\mathbf{x}}$ × Device List Operation Equipment Status Device Parameters 👼 Tele-2(4x12 Exit  $(\mathbf{X})$ 👼 idle Modbus ID: ---🟺 Tele-1(24x2 Config Sentry4012H Dummy Sentry Device Name: Remote NB-1 2402E Serial Port 4 Cell Number: Language Acquire cell temperature Acquire inter-tier connection Indicator Communication Transmitting • MODBUS COM Port: Disconnected DTU DTU ID: 15052 dbus ID: 1 Time out ·Logical dev ce configuration 🗖 Enabl nfiguration string Logical [1(1 MyBattery Platform Connection Enable MyBattery Platform Server IP 96.244.87.9 5556

After installation, run Battery DAS. Click "Config" to add device.

Click "+" to add new device or Click "Modify" to change selected device.

Give the unique Modbus ID (It is a virtual ID, not necessary the actual Modbus ID of that Sentry unit.) Give the unit or power system a name for easy read and identification.

Set the correct battery number.

Uncheck "Acquire cell temperature" and "Acquire inter-cell connection".

Select "DTU", type the correct DTU ID and Modbus ID. Click right/up corner to save.

#### Software Setup 6

# When adding NB device, click DTU, type in DTU ID. Assign a MODBUS ID to this DTU. (This Modbus ID can be different from the actual Modbus ID for that battery monitoring unit.)

DAS can at the same time connect to other battery monitors with regular serial ports or remote serial ports.

Logical device can be used when one string is monitored by multiple units so the software will treat it as one large monitor. For example, a 240x2V battery string is monitored by 10 units of Sentry-2402W2, Modbus from 1 to 8, set to [1(1,2,3,4,5,6,7,8,9,10)].

Serial Port Management	t.		X	) 🔼	Battery DAS				×
					Operation	Devices State			
Port List			*		Exit System	0	$\otimes$	$\otimes$	
COM1	Port Setting				Module Manage	Dyna48	DAQ65	TBL8	
COM13	Port #:	COM1			Serial Port Manage				
	Baudrate:	9600	~		Language				
	Data Bits:	8	~		State Description				
	Stop Bits:	One	~		S Transmitting				
					区 Disconnect				
	Parity:	NONE	<u>×</u>		🚺 Time out				
	Port Control					<u> </u>			
	Open Port	Clos	e Port						

Click "Serial Port Manage" to set correct baud rate and others as above. By Default, Sentry is set in factory to 9600, 8, 1, NONE. No change shall be made here.

Click "Open Port" for **each serial port**, the DAS will run and the status should be GREEN.

When you close this application by clicking "X" on upper-right corner, DAS will continue to run in background.



#### 6 Software Setup

# 6.2 Battery Analyzer configuration

Run Battery Analyzer in the client computer.

🖳 Battery Analyzer 3.1													_ 7 🔀
Setting( <u>S</u> ) Display( <u>V</u> ) Ope	eration( <u>O</u> )	About(A	A)										
ا کې 🖉 🗶 😥	0)		iB 🏈	2 Q									13:39:89
Device List	Alarm Lis	st	_	_			_	Cells dat	ta of device S	entry4012H	V string2		
Station List	Alarm #	Device	String #	Cell #	Alarm Description	Start Date/Time	^	Cell #	Voltage(V)	IR(mΩ)	Baseline(mΩ)	Change(%)	<u> </u>
Site 1 (ID:1)								1	0.000	0.000	0.000	0.00%	
StringNo 2								2	0.000	0.000	0.000	0.00%	
Device List								3	0.000	0.000	0.000	0.00%	
Sentry2402E (ID:1)								4	0.000	0.000	0.000	0.00%	
Sungivo I							=	5	0.000	0.000	0.000	0.00%	
								6	0.000	0.000	0.000	0.00%	
								7	0.000	0.000	0.000	0.00%	
								8	0.000	0.000	0.000	0.00%	
								9	0.000	0.000	0.000	0.00%	
								10	0.000	0.000	0.000	0.00%	
Device Senter (012LN/ string 2								11	0.000	0.000	0.000	0.00%	
Device Sentry401211V Stilling 2								12	0.000	0.000	0.000	0.00%	
Suing								13	0.000	0.000	0.000	0.00%	
Voltage 0.0 V							-	14	0.000	0.000	0.000	0.00%	
Current 0.0 A	• v	/oltage O	IR (Internal	Res)	Cells	oltage bar view o	ofdev	ice Sen	try4012HV s	string 2(V	)		
Temperature 0.0 °C	16 +						· ·	- · · ·			· · · · ·		
	15 🕂												1
Analysis	14 🕴												-
Avg. IR 0.000 mΩ	13												1
Voltage	12												
Max 0.000 0.000	11 🕂												1
	10 🕂												
	9 ±												
	NO.	.1 NO.3	8 NO.5	NO.7	NO.9 NO.11 NO.1	3 NO.15 NO.17 NO	D.19 N	10.21 N	0.23 NO.25	NO.27 NC	0.29 NO.31 NO	.33 NO.35 N	10.37 NO.39
Connection to DAS: Not connected	Comm	nunication t	to DAS: no	communic	ation								

# 6.2.1 System Setting

System Setting
ODP Setting  Switch interval at alarming Long query interval (Min) 720 Short query interval (S): 30
General Setting String # independent Alarm Serial Output Software Language: English Data Saving Interval (day): 1
Automatic Discharge Recording     Record discharge data by interval (s) 10     Record discharge by voltage drop (%) 0.1
Apply Cancel

No need to set anything for "UDP Setting" and Alarm Serial Output.

For "Automatic Discharge Recording", "Record discharge by voltage drop" is recommended.

### 6.2.2 Server Setting

If the DAS and Analyzer are running in the same computer, set the IP as below. Otherwise, find out the IP for DAS computer.

When the DAS is running on the same computer, set IP to local 127.0.0.1

When DAS is running on a remote computer, set IP to the actual address.



One DAS server can provide battery data to many clients, including Battery Analyzer software or other standard Modbus client using Modbus TCP.

Battery Analyzer software can manage data from multiple DAS sources.

#### 6.2.3 Equipment (Device) Management

In the Device Manager, you can modify the parameters for your batteries. The Device ID must match the Module Number in DAS.

🖳 Add New Device	
Equipment Management	
Equipment ID: 1	Name: Sentry2402E
Modbus ID: 1	Site #: 1
Equipment Parameters	
String Number:	1
Norminal Voltage:	2
Battery Number per String	24
Apply	Cancel

Click "Add" on Device Management

Select 12V to automatically generate default parameters. Later you can make changes to those numbers/parameters.

# 6 Software Setup

Device Management				X	
Equipment List					
Sontry2402E		Page information			L
Sentry/012HV		CalleParString	24	H	L
Sentryforzitv		DeviceID	1		L
		DeviceName	Sentry2402E		L
		DisplayCellsTemperat			I.
		DisplayContactResista	True		I.
		ModbusID	1		I.
		NominalVoltage	2		L
		ServerlpAddress	127.0.0.1		
		ServerPort	502		
		Show Strings	True		
		Station ID	0		
		StringNum	1		
		StringVoltage	ByMeasure		
		Cells limits for alar	m	=	
		ChargeVoltageHigh	2.55		L
		DischargeVoltageLow	1.8		I.
		FloatVoltageHigh	2.5		L
		FloatVoltageLow	2		
		ResistanceThreshold(	100		
	Ξ	String limits for ala	rm		
		ChargeCurrentHigh	500		
		ChargeVoltageHigh	61.2		
		CurrentThreshold	10		
		DischargeCurrentLow	-10		
		DischargeVoltageLow	43.2		
		FloatVoltageHigh	60		
		FloatVoltageLow	48		
		TemperatureHigh	40		
		TemperatureLow	15	<b>~</b>	
Add Delete	C	ellsPerString ells per string in this de	vice		
Config S	Site		Apply Cancel		

Battery alarm parameters shall be adjusted for battery type and UPS/charger settings.

#### 6.2.4 Data Viewer

If the setting is correct, select the device and start it. The real-time data should show on the screen.



~			
Call/Datton	n noltago	han di	anla
Cell/Daller	v vonage	nar ai	snav
C C C C C C C C C C C C C C C C C C C	, ,	· · · · · · · · · · · · · · · · · · ·	spree,

#### Internal resistance bar display

🖳 Battery Analyzer 3.1													_ C 🖄
Setting(S) Display(⊻) Operation(Q) About(A)													
اي 🖉 🔅 🗶 🚇	<u>)</u>	0		29	1 🙆 🙆								13:53:50
Device List	Alarm List	_	_	_			_	Cells dat	a of device S	Sentry4012H	V string2		
Station List	Alarm #	Device	String #	Cell #	Alarm Description	Start Date/Time		Cell #	Voltage(V)	IR(mΩ)	Baseline(mΩ)	Change(%)	<u>^</u>
Site 1 (ID:1)	2	2	2	0	StringVoltageHigh	11/23/2012 4:24:12		1	12.798	18.951	0.000	0.00%	
StringNo 2	1	2	2	0	TemperatureLow	11/18/2012 1:27:52		2	12.927	20.006	0.000	0.00%	
Device List								3	12.831	17.991	0.000	0.00%	=
Sentry2402E (ID:1)								4	12.881	18.758	0.000	0.00%	
- Stringivo I							=	5	12.741	17.267	0.000	0.00%	
								6	12.851	19.412	0.000	0.00%	
								7	12.795	18.507	0.000	0.00%	
								8	12.893	21.778	0.000	0.00%	
								9	12.906	17.940	0.000	0.00%	
								10	12.943	17.614	0.000	0.00%	
Dovice Senta/4012HV string 2								11	12.771	21.070	0.000	0.00%	
Device Sentry4012HV sung 2								12	12.896	18.414	0.000	0.00%	
String								13	12.833	18.232	0.000	0.00%	
Voltage 515.7 V							~	14	12.832	19.960	0.000	0.00%	V
Current 258.0 A	O Ve	oltage 💿 I	R (Internal	Res.)	Cells resis	tance bar view of	dev	ice Sen	try4012HV	string 2(m	Ω)		
Temperature -272.9 °C	50				, , , , , , _ ,		,						
Analysis													
18.947 m0	40 +												
Avg. IK 10.547 1152	30 +												-
Voltage IR	1 1												
	20												
Max 13.220 24.910	10												
Cell # 38 20													
	0 11					╨╵╨╵╨╵╨				╷┻╶╽┦┛╶┤╸┻╶╽	┉┈┈	╒┹╌╌┩╴╌┥┹	
< <u>12/41 13963</u>	NO.1	NO.3	NO.5	NO.7	NO.9 NO.11 NO.13	NO.15 NO.17 NO.	19 1	10.21 N	J.23 NO.25	NO.27 NO	.29 NO.31 NO	0.33 NO.35 N	IO.37 NO.39
Connection to DAS: Connected	Commu	unication t	o DAS: Su	ccessful									

#### 6 Software Setup

If the link is not correct, or battery data is out of range, the color will change with alarm highlighted.

A Battery Analyzer 3.0													
Settings View Operations About													
9 🛃 🛞 💭 🛃	<u>) (</u>			29								- 24:48:	39
Devive List	Alarm	List					C	ells dat	a of device	Dyna48 string2			
Device List		Devicel	String No	Cell No	Description	Start Time	<b>•</b> 0	ell No	Voltage(V)	Resistance(m Q)	First Record Res(m Q)	Percent of Deviation(%)	-
B-DAQ65 (ID:1)	4	2	2	3	CellVoltageHigh	3/11/2009 9:13:38 PM		1	12.558	21.520	0.000	0.00%	
Dyna48 (ID:2)	3	2	2	2	ResistanceAbnormal	3/11/2009 9:13:38 PM		2	0.237	90.940	0.000	0.00%	-11
StringNo 2	2	2	2	2	CellVoltageBelo	3/11/2009 9:13:38 PM		3	15.472	4.100	0.000	0.00%	-11
E TBL8 (ID:4)	1	2	2	0	StringVoltageBe	3/11/2009 9:13:38 PM		4	12.605	36.200	0.000	0.00%	-11
StringNo 4		_											-11
TM65-1002 (ID: 1002) StringNo 5													
ounigrio o													
		-											-11
Device Dyna48 string 2													
Device Dynavo Scing 2													
Measure String Data													
Voltage 40.6V													
Current 20.0A													
Temp 21.5°C													
-Analysis String Data	16 -	Voltage C	Resistance		Cell	s voltage bar view	of de	vice D	yna48 strii	ng 2(V)			
Avg IMP 38.190mΩ			'			T							
Voltage	15												
MAX 15.472 90.940	14												
No. 3 2	13												
Mix 0.097 4.400	12												
Min <u>0.237</u> 4.100	11												
No 2 3	10												
					<b>\</b>								
	9 1		NO 1			NO 2			NO	3	NO	4	1
Server IP: 127.0.0.1   Commu	nication	Type: T		State: S	Stopped		_						
Convertition 127.0.0.1 Commu	meation	гтурс. г	or addeny	otate. d	hopped								

If you need to change any setting, click "Stop" to make the setting visible.

Right click data window to export data to Excel sheet. If you are not sure the data is within correct range, you can send the file to BatteryDAQ technical support.

#### 6.2.5 Alarm Notification

Alarm Notification Setting	Email Server Setting
Email(s): Send a test	Email Server     batterydatacenter.com       Port     587       Email     analyzer@hatten/datacenter.com
Seperate multiple emails with ';' like: me@abc.com; you@abc.com	Password Enable SSL
SMS Receiver: Add Send a test	Cancel Apply Close
Advanced Apply Cancel	

Click "Advanced" to config mail server. You may continue to use our server for email if you don't have one. However, no performance or availability guaranty is made by BatteryDAQ.

### Software Setup 6

Add SMS Receiver			Alltel
			AT&T
			Boost Mobile
Mobile Number:			Nextel
			Sprint PCS (now Sprint Nextel)
Mobile Provider:	Alltel	<b>~</b>	T-Mobile
	Alltel		US Cellular
	AT&T		Verizon
	Boost Mobile		
L	INextel	=	virgin Niobile

SMS (mobile phone message) may only work for certain carriers. After setting, send a test to confirm.

### 6.2.6 SNMP Setting

You may set up to 3 SNMP recipients.

Please find MIB file in your software CD or contact us at tech@batterydaq.com

SNMPSetting									
Trap Setting									
Recipient 1	IP 96.244.87.9	Port 1620 Version V2	~						
Recipient 2	IP 127.0.0.1	Port 162 Version V2	~						
Recipient 3	IP 192.168.1.4	Port 1620 Version V2	~						
Trap Interval	60 Min	Send a test							
Location Name	ALANLONG	Community Strings public							
Enable SNMP F	Polling Port 161	Polling Delay 100	ms						
Apply Cancel									

For other functions not mentioned in this manual, please refer to Battery Analyzer software manual.

# 7 Installation Record

#### <u>Measurement</u>

Parameters	Value or Range	Note
Battery Capacity		
Cell Number		
Cell Voltage		
Nominal Bus Voltage		
Floating Charge Voltage:		
Maximum Discharge Current		
Maximum Charge Current		
Temperature Range		

#### <u>Data Analysis</u>

Parameters	Low Value	High Value	Note
Cell Voltage Abnormal			
Cell IR Threshold (Absolute setting to Sentry)			
Cell IR Abnormal (Percentage setting to PC software)	N/A		
Bus Voltage Abnormal			
Discharge Current	N/A		
Charge Current	N/A		
Ambient Temperature			
Deep Discharge (Percentage or Voltage)			

#### **Communication/Networking**

Network Adapter IP Address (if set to static):	
Modbus Address (Default 01)	
DTUID	
Host: (www.thisbattery.com)	

#### **Other Notes**

# 8 Installation Acceptance Report

Company Name:	Sentry Monitor Serial No:	
Engineer:	DTU ID:	
Site Name:	Address:	
Installation Date:		
Battery type:	Capacity: Ah	
Cell Voltage: V	Battery Number in This String:	
Bus Voltage: V	Designed Maximum Current: A	

#### **Current and Temperature Measurement**

Sensor model:	Calibrati	on Offset:	Calibration Gain:		
	Current Test 1(open aircuit)	Current	Current	Temperature	
Measured Value		1081 2	Test 5		
Readout					
Difference					

#### Voltage Measurement

Calibration Offset: Calibration Gain:

Battery #	1	2	3	4	5	6	7	8
Reference								
Readout								
Percentage								

#### Internal Resistance Measurement Comparing to Reference

Instrument name/model:	IR Calibration:
------------------------	-----------------

Battery #	1	2	3	4	5	6	7	8
Reference								
Readout								
Percentage								

Signature	Date

If there is any concern of accuracy, please send this report to <u>customerservice@batterydaq.com</u>

### Records

Note:
