



Sentry-4412HV Sentry-2412 Sentry-1012

Battery Monitoring System (UPS Models)

CAT II Electrical Measurement Equipment

Installation and Service Manual (Updated on Oct-2022)



Only print the page(s) you need



Caution, possibility of electric shock
High Voltage Hazard exists on Battery Terminals,
Sampling Leads, Connectors and Inside Circuits!
Do NOT open the unit!

(Below Warning Label Must Be Presented on Battery Rack/Cabinets)

**Unplug ALL Battery Connection Terminals from
Sentry Unit before You Service/Replace Batteries.**

Please read through this manual before installation

Information in this document is subject to change without notice.

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Neither **BatteryDAQ** nor any of its employees shall be liable for any direct, indirect, incidental or consequential damages arising from the failure of the battery monitoring system due to the failure of a proprietary part of the battery monitoring system, even if **BatteryDAQ** had been advised in advance except for as provided by law.

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.

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.

Repair and Return

This product can only be repaired by authorized personnel.




If you determine that a repair is needed, please contact our Customer and Product Service (CaPS) department to have an RMA number issued. CaPS should also be contacted to obtain information regarding equipment currently in house or possible fees associated with repair.

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 in United States. However, Buyer shall pay all shipping charges, duties and taxes for products returned to **BatteryDAQ** from another country.

Telephone: 1-800-455-8970

Email: tech@batterydaq.com

Safety Instructions

	<p>Caution, follow the instruction</p>
	<p>Caution, possibility of electric shock</p>
	<p>Protective Earth (ground) Terminal</p>

This warning label must be permanently presented on battery rack/cabinet!

Unplug ALL Battery Connection Terminals from Sentry Unit before You Service/Replace Batteries.

The following safety precautions should be observed before any work is performed on the system containing the **BatteryDAQ** product.

1. **This system is intended for installation by personnel who are trained and qualified to recognize the hazards associated with working with such systems and are familiar with the safety precautions required to avoid possible injury.**
2. **Never work on any system that threatens life or injury through hazardous voltages except when applying absolute safety precautions.**
3. **Never work alone. Always ensure that you work with a properly trained colleague.**
4. **BatteryDAQ recommends that when performing any work concerning batteries, the safety procedures and safe working practices as described in the appropriate battery manufacturers documentation should be followed at all times.**
5. **Never make unauthorized changes or modifications to equipment. This may create unsafe, or even hazardous, situations.**
6. **Where the battery documentation recommends that links are removed for safe working, it is important to totally remove any unit which is connected across any link to be broken prior to separation and subsequent removal of the link. Failure to do so will result in the string not being totally isolated.**
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.

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* Drawings/pictures in this manual may be for reference only.

1 Overview of Sentry Models for UPS Applications

BatteryDAQ provides advanced technologies and products for a variety of battery applications. Our technologies are outstanding in many aspects:

- Measurement Precision
- System Reliability
- Communication and Networking
- Plug and Play Operator Interface
- Battery Data Management Software and Alarm Delivery

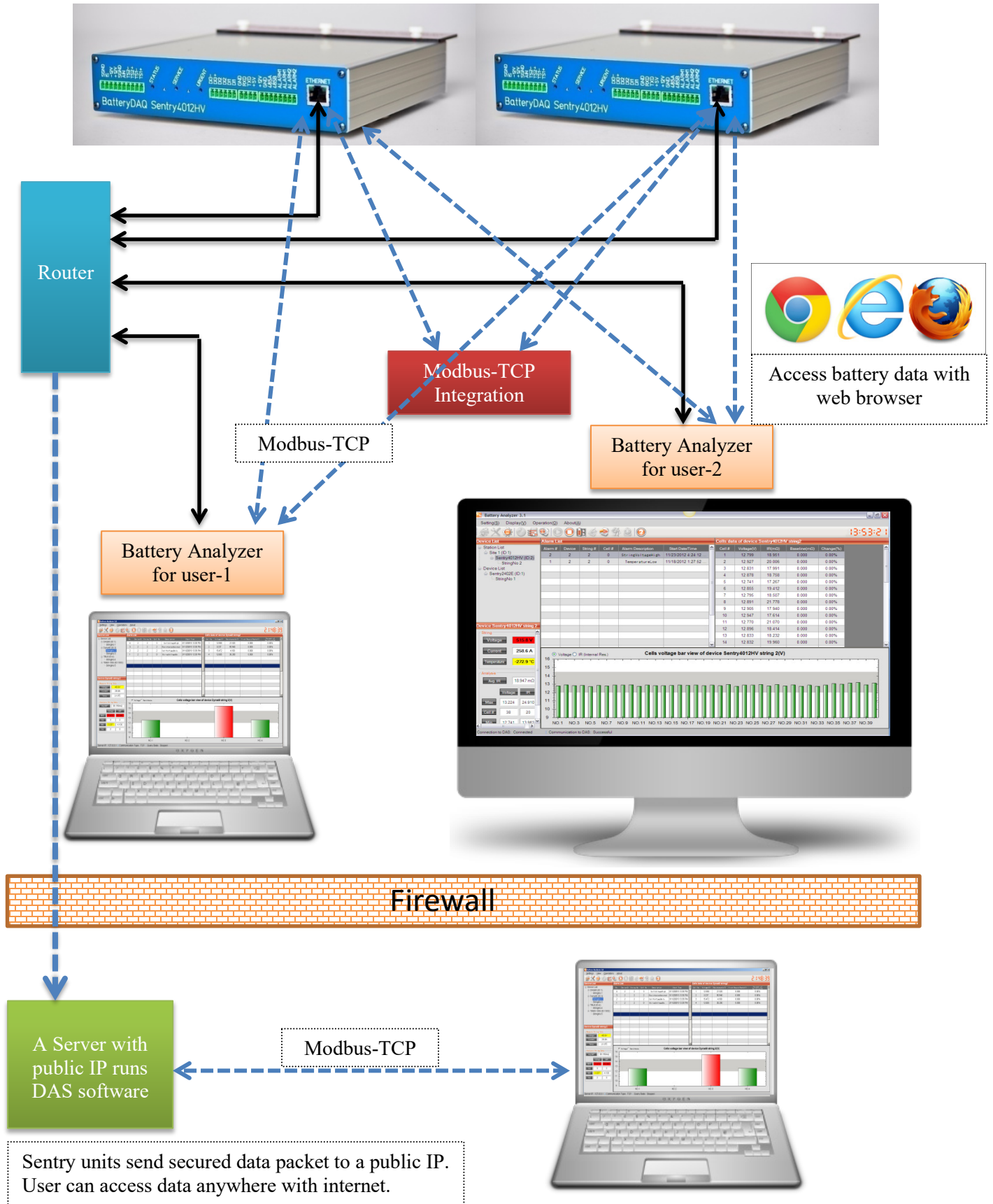
SENTRY UPS Models are designed to cover medium to large size Uninterruptible Power Supplies with 6V, 12V or 16V batteries. It utilizes our 3rd generation technologies for high performance and easy installation.

Model	Sentry-4412HV	Sentry-2412	Sentry-1012
Battery Configuration	Maximum 44x12V 40x12V or 32x16V	24x12V	10x12V 20x6V
String Voltage	Up to 630V	Up to 350V	Up to 150V

Please refer to **Sentry-GenPro** manual for Generator Starting Battery Monitoring.

Main Features	Main Measurements
<ul style="list-style-type: none"> ▪ Advanced precise IR (Internal Resistance) measurement technology ▪ Protection for over voltage input for each sampling channel ▪ Wide battery voltage range for each unit ▪ 16-bit high resolution data acquisition ▪ No mechanical relays, resulting high reliability for data center applications ▪ High noise immunity for high ripple ups system ▪ Industry standard Modbus/RTU communication for high reliability and quick integration ▪ Compact design allows for easy installation on the top or inside of the battery cabinet. ▪ Industrial grade reliable connections ▪ Plug and play HMI panel (optional) ▪ Full support to networking battery management system ▪ Compatible with Battery Analyzer and standard Modbus integration. 	<ul style="list-style-type: none"> ▪ Cell Voltage Monitoring ▪ Cell Internal Resistance (IR) Monitoring ▪ String Voltage Monitoring ▪ String Charge & Discharge Current Monitoring (optional) ▪ Ambient Temperature Monitoring ▪ Pilot Battery Temperature Monitoring

1.1 Communication and Software



Sentry battery monitoring units can be standalone, connected to Battery Analyzer software and or integrated with 3rd party software.

Working Mode	Description
Standalone	Sentry automatically scan battery parameters and generate alarm if any measurement bleaches threshold setting. Color LEDs on front panel indicates battery bank status/alarm. A HMI display can be installed on site if needed.
Communicate to Battery Analyzer in the same private network	Sentry unit onboard Ethernet module provides Modbus-TCP communication. Battery Analyzer polls data from Sentry's IP address.
Manage battery from public internet with Battery Analyzer	Sentry unit send out data to a public server. North bound data only so no IT security concern. Battery Analyzer obtain data from that public server.
Integrated with 3rd party software	Poll data with Modbus-TCP or serial Modbus-RTU. SNMP from/with Battery Analyzer software.

1.2 Specifications

1.2.1 Environmental Conditions

Sentry Battery Monitor UPS models are designed for normal environmental conditions as UL61010-1 standard:

- a) Indoor use;
- b) Altitude up to 2 000 m;
- c) Temperature 5 °C to 40 °C (41°F to 104°F);
- d) Maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
- e) MAINS supply voltage fluctuations up to ±10 % of the nominal voltage;
- f) TRANSIENT OVERVOLTAGES up to the levels of OVERVOLTAGE CATEGORY II;

NOTE 1: These levels of transient overvoltage are typical for equipment supplied from the building wiring.

- g) TEMPORARY OVERVOLTAGES occurring on the MAINS supply.
- h) Pollution Degree 2

1.2.2 Specifications for UPS models

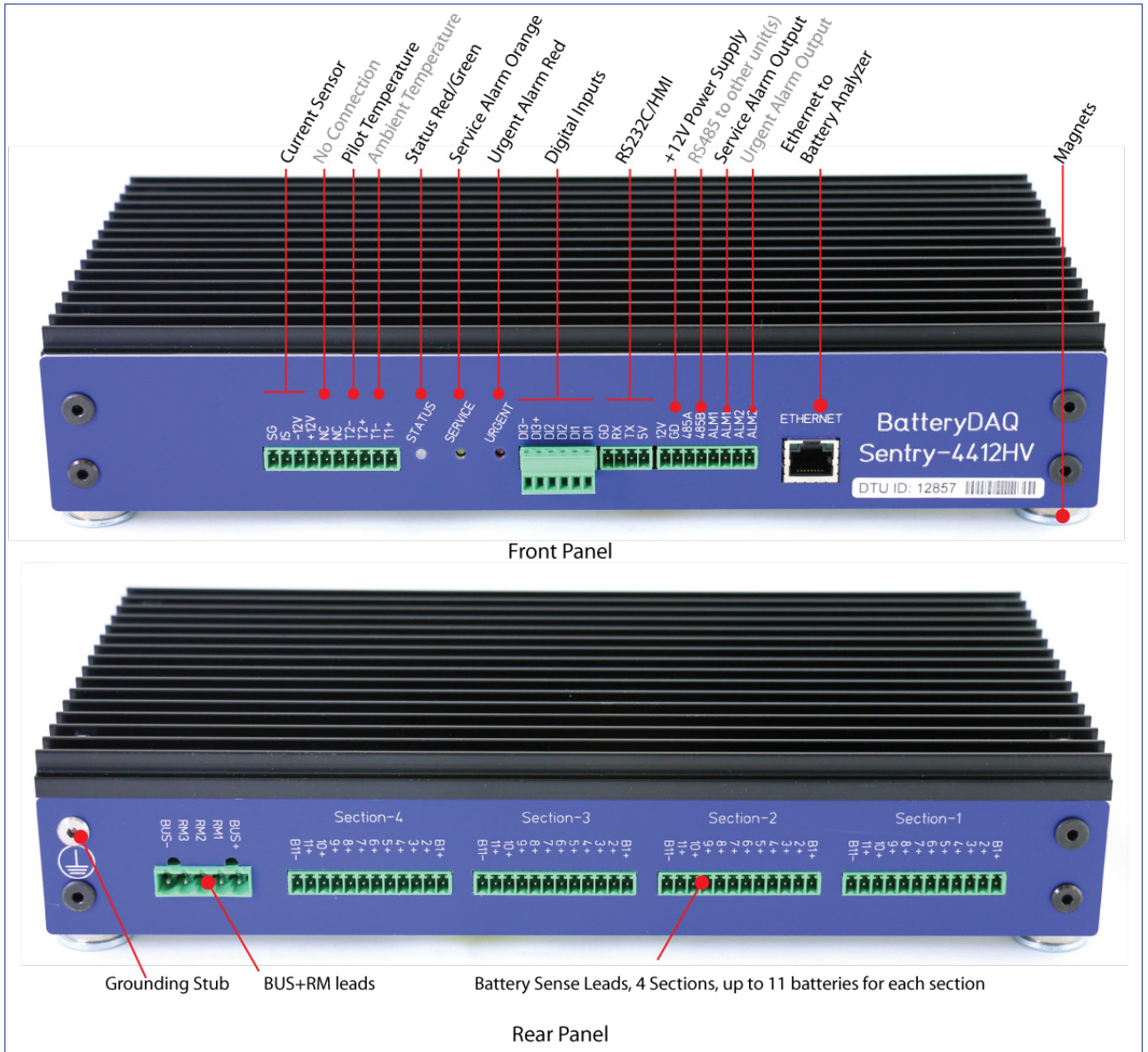
Model	Sentry-4412HV	Sentry-2412	Sentry-1012
Power Supply	Internal power supply Powered by battery bank. (External +12V adapter optional)	Internal power supply. Powered by battery bank.	Internal power supply. Powered by battery bank.
Channel	Max 44 channels (Field configurable for less than 44 channels)	Max 24 channels (Field configurable for less than 24 channels)	Max 20 channels (Field configurable for less than 20 channels)
Bus Voltage Range	0 – 630V	0 – 350V	0-150V
Dimensions	305W*60H*165D (mm) 12”W*2.35”H*6.2”D	150W*55H*200D (mm) 5.9”W*2.2”H*7.2”D	200W*35H*170D(mm) 8.0”W*1.38”H*7.9”D
Current Sensor	Supports LEM current sensor with internal +/-12V power supply Default range +/- 400A, window size D35mm Split core optional, window size 16x64mm or 40x104mm		
Current Accuracy	0.1% + sensor accuracy		
Temperature Sensors	1 ambient temperature sensor, 1 pilot temperature sensor		
Range	Measurement range: -20 to 60°C, operating range: 5°C to 40°C (41°F to 104°F)		
Accuracy	1 °C		
Input Range to Each Channel	+/- 20V for 12V or 16V batteries		
Accuracy	0.1%		
Wiring	1-wire from (+) positive of each battery plus the (-) negative of last battery.		
Internal Resistance	0 to 30mΩ, 0.01 mΩ resolution 1-wire mode. Reads total value of Internal Resistance + Connection Resistance for each battery.		
Serial Port	Isolated RS-232C and RS-485 interface		
Protocol	Modbus-RTU		

Serial Setting	9600-8-1-None
Modbus address	1 to 250, configurable with HMI
Ethernet	Onboard Ethernet port with embedded web and Modbus-TCP
LED indication	<ul style="list-style-type: none"> ▪ Dual-color LEDs for status ▪ Orange LED for service alarm ▪ Red LED for urgent alarm
Alarm Outputs	<p>Service Alarm (Normal Close, 60V 0.1A capacity, 2 ohm ON resistance)</p> <p>Urgent Alarm (Normal Close, 60V 0.1A capacity, 2 ohm ON resistance)</p> <p>*Alarm outputs are for signal connections (<60V) to other system. If a control for higher voltage or AC is needed, a relay has to be used for safety and capacity requirement.</p>

***Specifications subject to change without notice**

2 Sentry-4412HV Terminals and Wiring

2.1 Connection Panel for Sentry-4412



(Panel color may vary from this photo.)

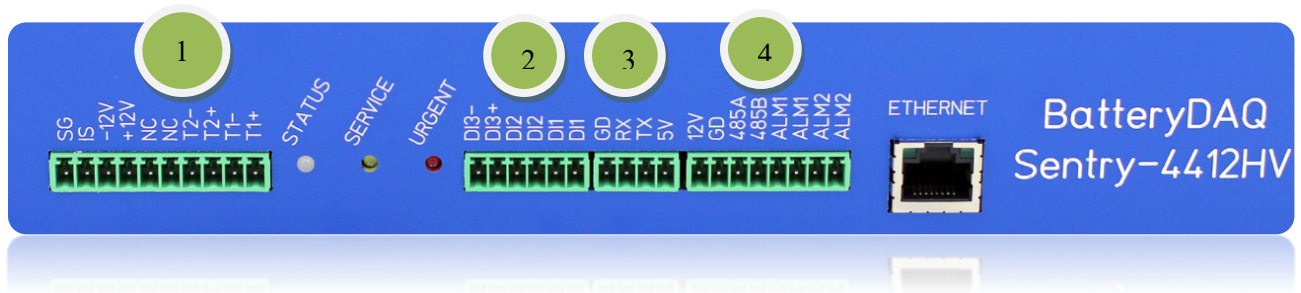


Caution, possibility of electric shock – monitor is designed for up to 44 x 12V, with a maximum battery string voltage of up to **630V**. Always wear gloves when you plug and/or unplug sensing lead connectors to/from monitor. Follow the installation steps for wiring.

(Don't connect any voltage sampling wires to front panel. Those ports are for the communication or temperature/current sensors. They are unprotected.)

2.2 Connection Panels for Sentry-4412HV

2.2.1 Front Panel Connection



Connector 1: Current Sensor and Temperature Sensors

Pin No	Signal Name	Description
1	TS1+	Ambient temperature sensor + (RED)
2	TS1-	Ambient temperature sensor – (BLACK)
3	TS2+	Pilot temperature sensor + (RED)
4	TS2-	Pilot temperature sensor – (BLACK)
5	NC	No connection
6	NC	No connection
7	+12V	Current sensor +12V, pin-1 (RED)
8	-12V	Current sensor -12V, pin-2 (WHITE)
9	IS	Current sensor output, pin-3 (GREEN)
10	SGND	Current sensor 0V, pin-4 (BLACK)

Connector 2: Digital signal input (optional)

Pin No	Signal Name	Description
1	DI1	Digital input 1, dry contact
2	DI1	Digital input 1, dry contact
3	DI2	Digital input 2, dry contact
4	DI2	Digital input 2, dry contact
5	DI3+	Digital input 3+ (0 to 10V)
6	DI3-	Digital input 3-

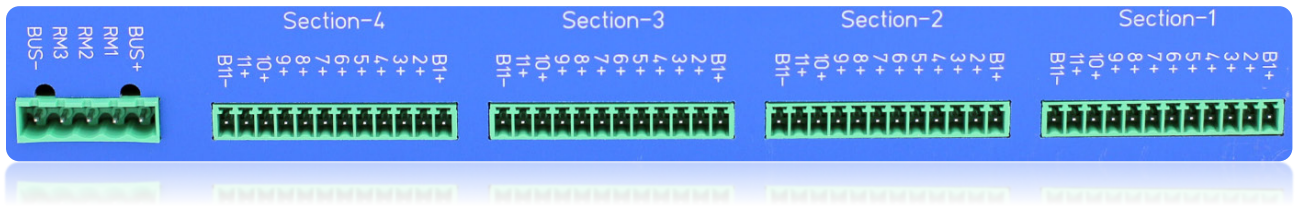
Connector 3: RS-232 or HMI

Pin No	Signal Name	Description
1	+5V	+5V power to HMI
2	TXD	RS-232 TXD
3	RXD	RS232 RXD
4	GND	GND

Connector 4: Power supply, RS485 and Alarm Output

Pin No	Signal Name	Description
1	Alarm 2	Urgent Alarm output, solid state relay, “dry” contact
2	Alarm 2	Urgent Alarm output
3	Alarm 1	Service Alarm output, solid state relay, “dry” contact
4	Alarm 1	Service Alarm output
5	RS485B	RS485B
6	RS485A	RS485A
7	GND	Power supply GND
8	+12V	Power supply from AC/DC adapter, +12V 1A (By default, unit is powered by battery bank.)

2.2.2 Rear Panel Connection



Divide battery string to 4 sections. Connect RM leads with separate wires with 3A fuse.

String	Section-1	Section-2	Section-3	Section-4
44x12V	11	11	11	11
43x12V	11	11	11	10
42x12V	11	11	10	10
41x12V	11	10	10	10
40x12V	10	10	10	10
38x12V	10	10	9	9
36x12V	9	9	9	9
34x12V	9	9	8	8
32x12V	8	8	8	8

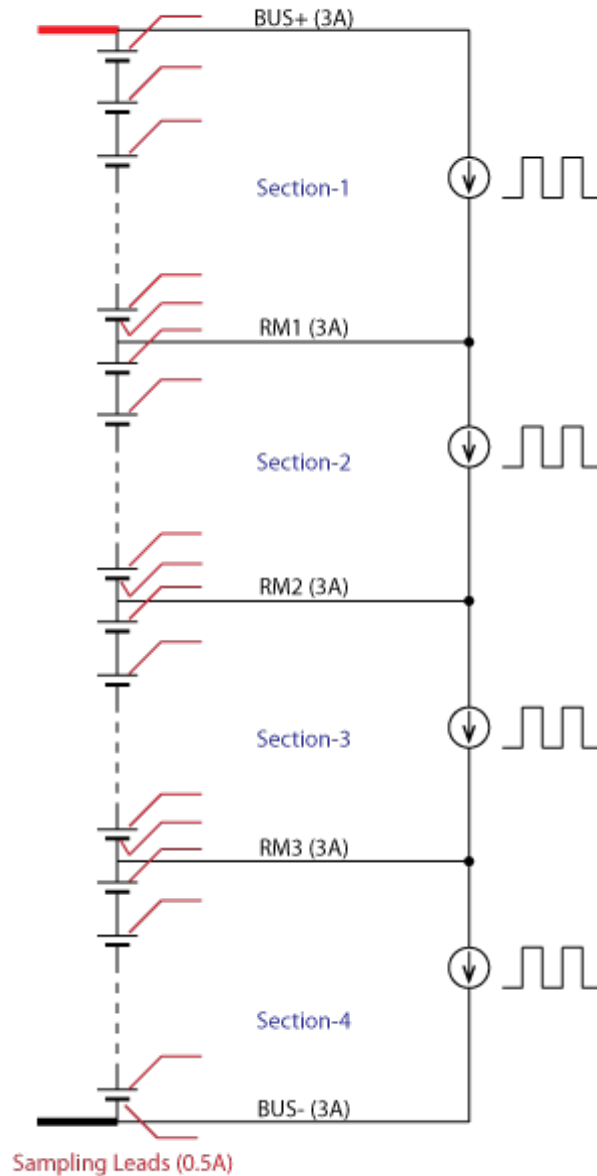
Pin No	Signal Name	Description
CON-1-1	BUS+	Section-1 start, Battery string/bank POSITIVE (BAT#1 POSITIVE post), separate wire with a 3A fuse
CON-1-2	RM1	Section-2 start, RM wire 3A fuse
CON-1-3	RM2	Section-3 start, RM wire 3A fuse
CON-1-4	RM3	Section-4 start, RM wire 3A fuse
CON-1-5	BUS-	Section-4 end, Battery bank NEGATIVE (Last battery NEGATIVE post), separate wire with a 3A fuse
Section-1	BT1+ to BT11+/BT11-	Battery #1 to #11 in section-1, 0.5A fuse Always count from positive, external 0.5A fuse required for each sampling wire.
Section-2	BT1+ to BT11+/BT11-	Battery #1 to #11 in section-2, 0.5A fuse
Section-3	BT1+ to BT11+/BT11-	Battery #1 to #11 in section-3, 0.5A fuse
Section-4	BT1+ to BT11+/BT11-	Battery #1 to #11 in section-4, 0.5A fuse

For less than 11 batteries per section, connect batteries in order including the NEGATIVE post of the last battery in that section. For example, for 8 batteries per section, connect terminal “B9+” to NEGATIVE post of #8; for 10 batteries per section, connect terminal “B11+” to NEGATIVE post of battery #10.

Sentry-4412 Terminals and Wiring

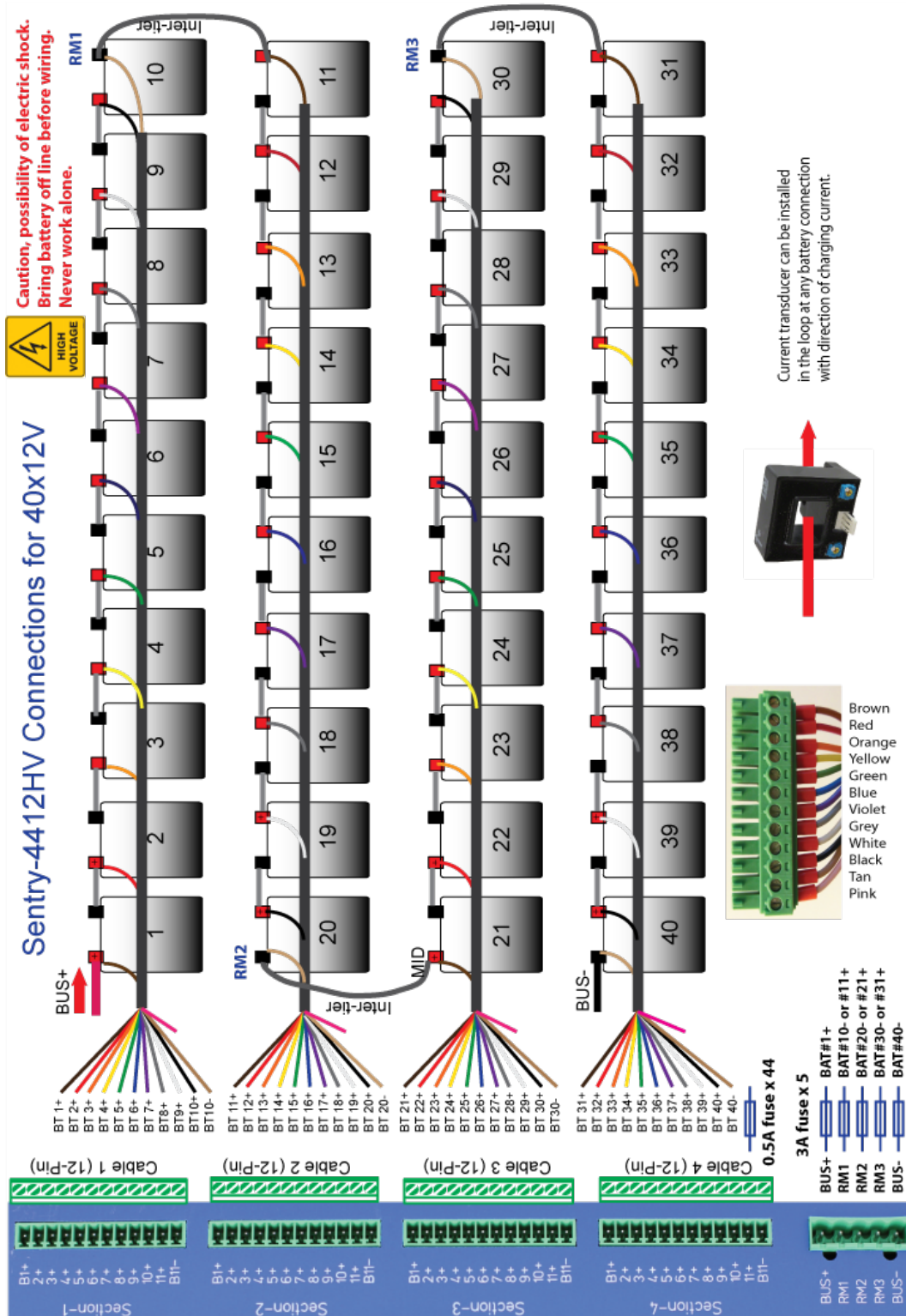
Sentry-4412HV treats a battery string as 4 sections. Each section has its current loop for Internal Resistance excitation.

Each 12-pin terminal picks voltage signal for that section. When it has 11 batteries, terminal connects to positive post for each battery and the negative post of the last battery in that section. In the case of less than 11 batteries for a section, leave the last one or more pins not connected.



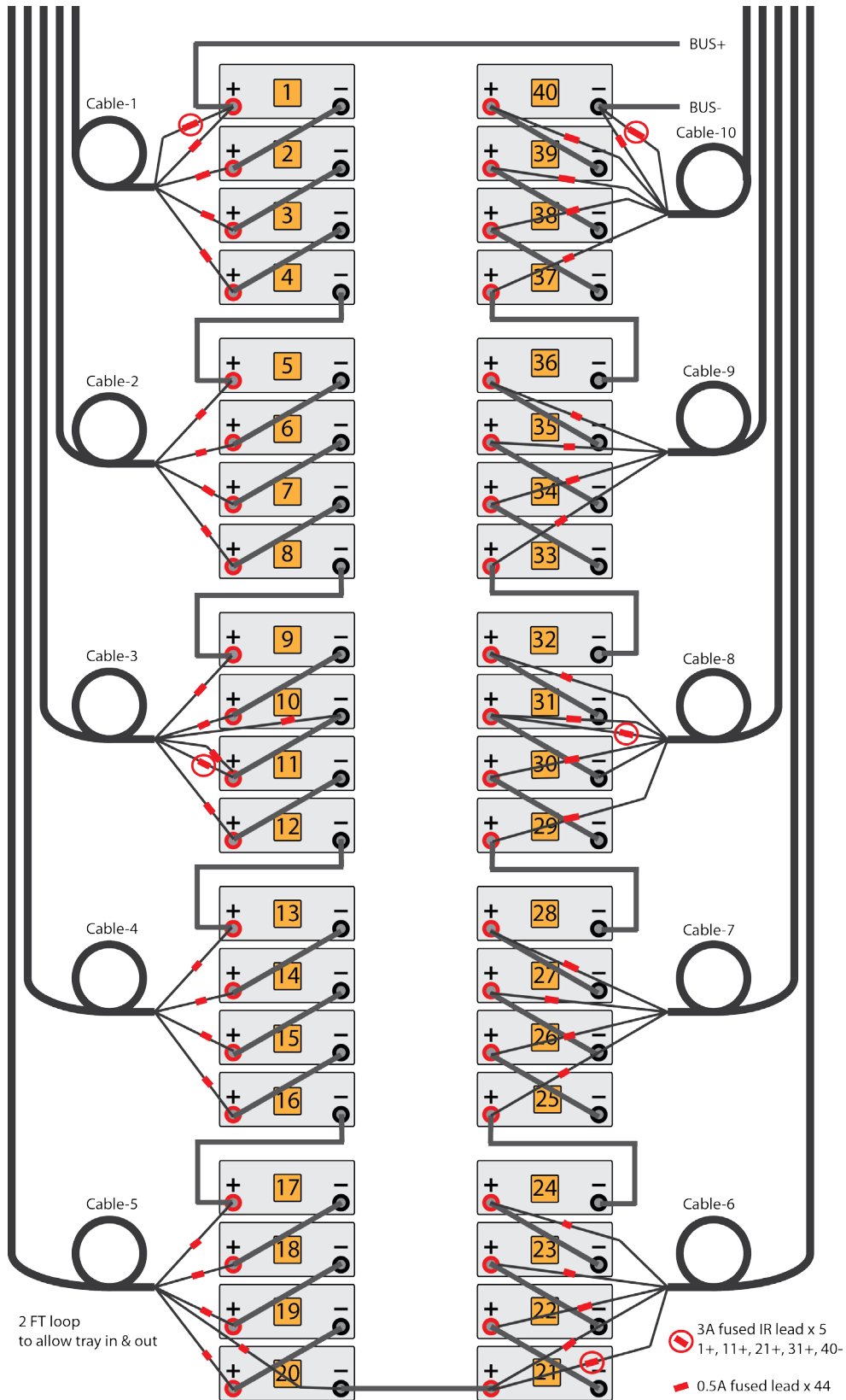
2.2.3 Sentry-4412HV Battery Wiring Examples

Example-1: 10 batteries per rack, 4 racks per string/bank



Sentry-4412 Terminals and Wiring

Example-2: battery cabinet, 4 batteries per tray, 5 trays on each site, total 40 batteries per cabinet



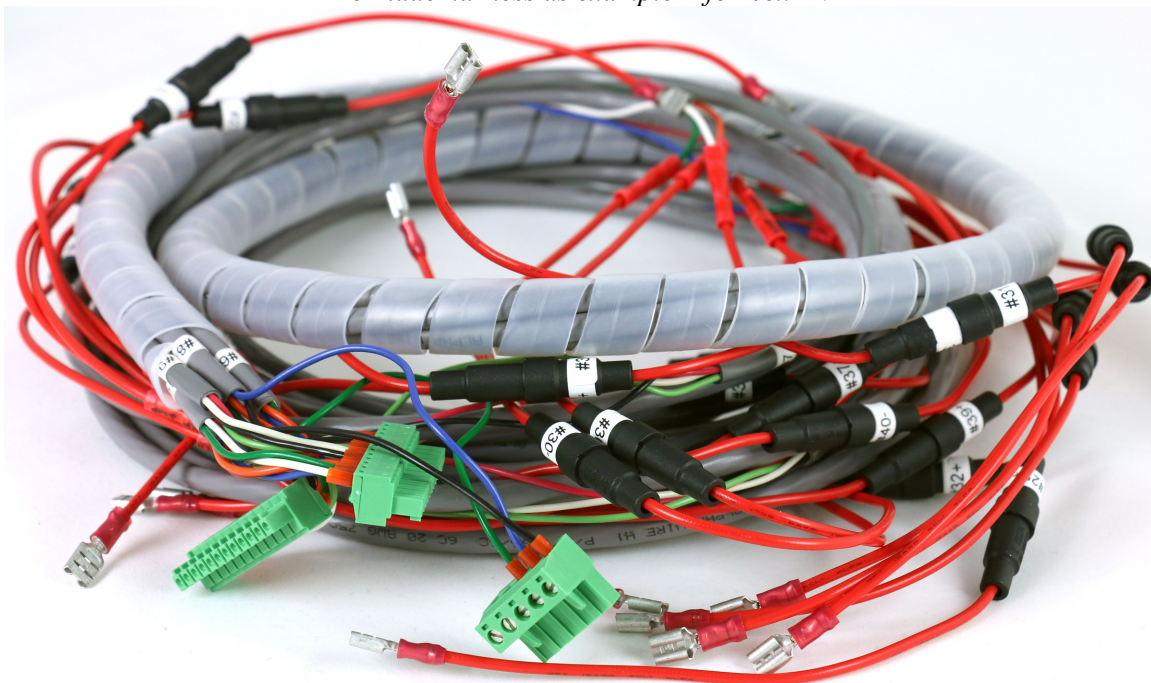
Sentry-4412 Terminals and Wiring

*Wire connections as example-2
Terminal Connections as example-2 for 40x12V*



5 IR wires can come from multi-conduct 20 AWG cable or run individual 18 AWG wire.

Pre-made harness as example-2 for 40x12V

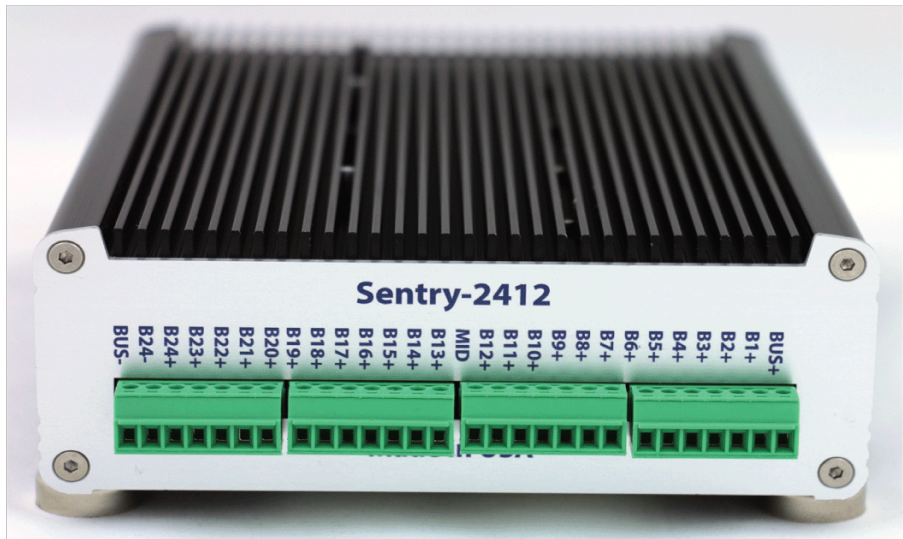
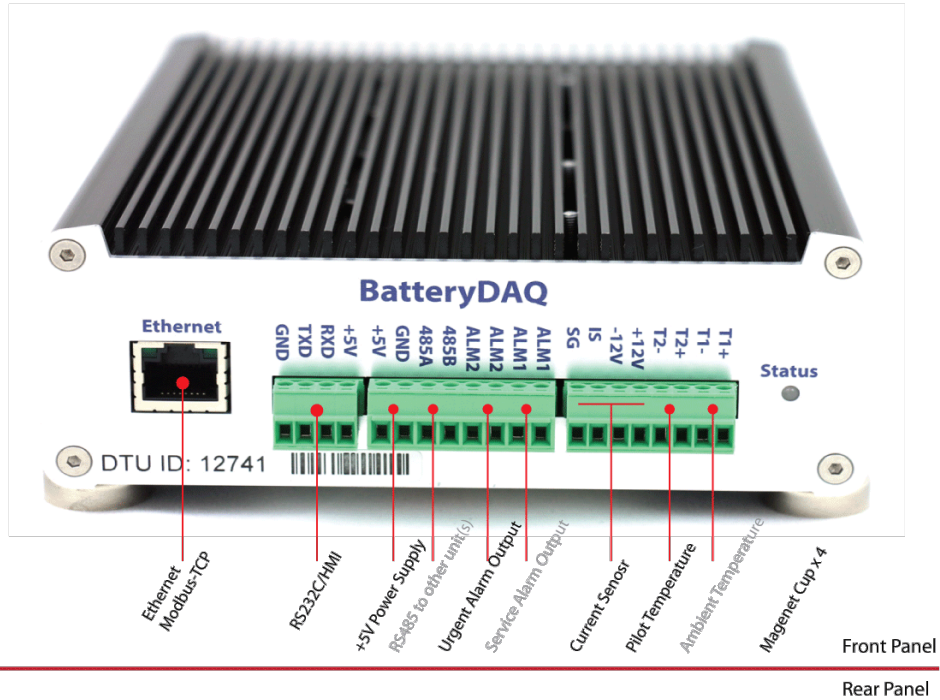


(Pre-made harness can be ordered from BatteryDAQ for specific cabinet.)

Please provide cabinet or rack layout and photos to order customized harness.

3 Sentry-2412 Terminals and Wiring

3.1 Connection Panels for Sentry-2412



Caution, possibility of electric shock – monitor is designed for up to 24 x 12V, with a maximum battery string voltage of up to **350V**. Always wear gloves when you plug and/or unplug sensing lead connectors to/from monitor. Follow the installation steps for wiring.

(Don't connect any voltage sampling wires to front panel. Those ports are for the communication or temperature/current sensors. They are unprotected.)

3.1.1 Front Panel Connection



Connector 1: Current Sensor and Temperature Sensors

Pin No	Signal Name	Note
1	TS1+	Ambient temperature sensor + (RED)
2	TS1-	Ambient temperature sensor – (BLACK)
3	TS2+	Pilot temperature sensor + (RED)
4	TS2-	Pilot temperature sensor – (BLACK)
5	+12V	Current sensor +12V, pin-1
6	-12V	Current sensor -12V, pin-2,
7	IS	Current sensor output, pin-3
8	SGND	Current sensor 0V, pin-4

Connector 2: Power supply, RS485 and Alarm Output

Pin No	Signal Name	Note
1	Alarm 1	Service Alarm output, solid state relay, “dry” contact
2	Alarm 1	Service Alarm output
3	Alarm 2	Urgent Alarm output, solid state relay, “dry” contact
4	Alarm 2	Urgent Alarm output
5	RS485B	RS485B
6	RS485A	RS485A
7	GND	Power supply GND
8	+5V	Power supply from AC/DC adapter, +5V 2A

Connector 3: RS-232 or HMI

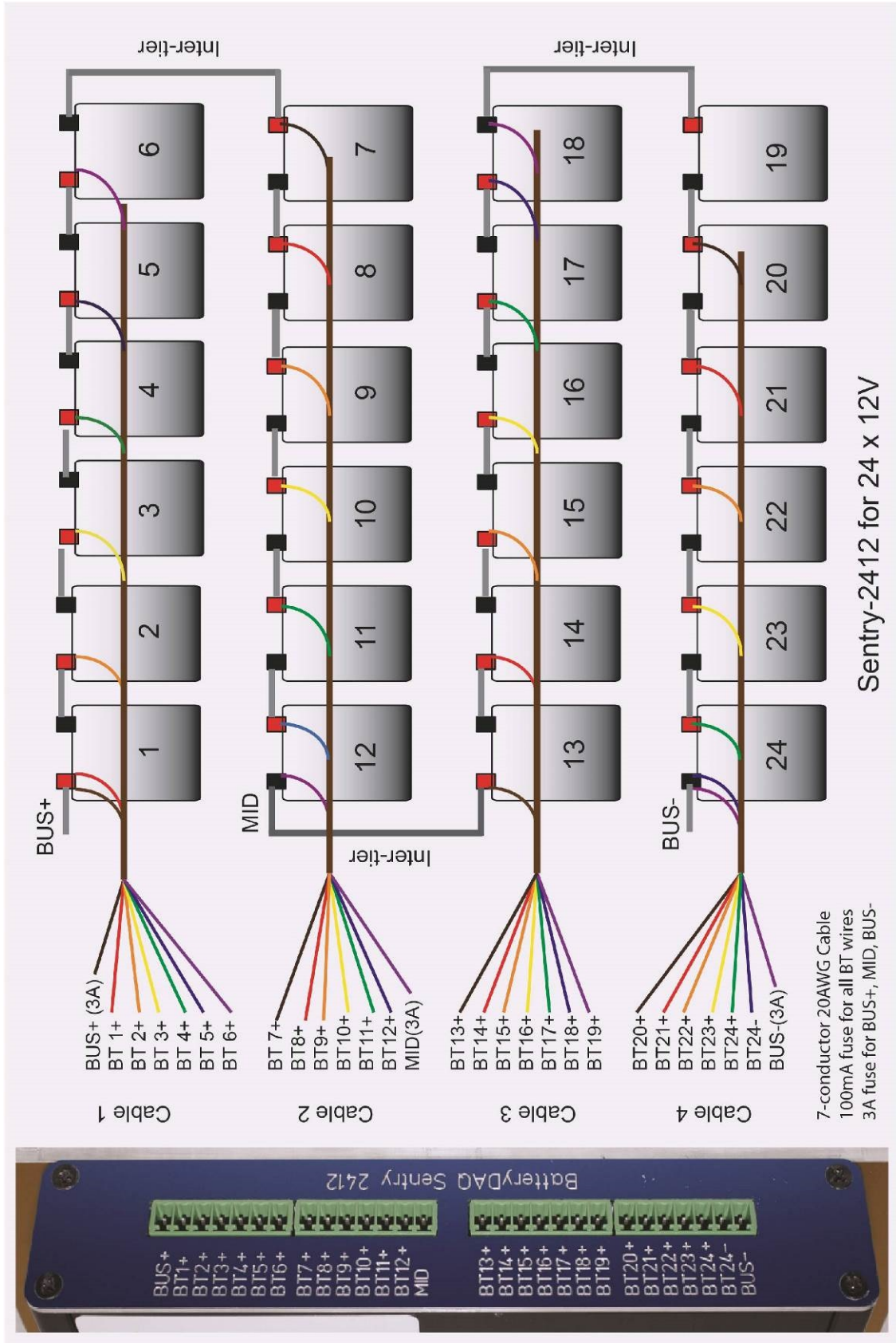
Pin No	Signal Name	Note
1	+5V	+5V power to HMI
2	TXD	RS-232 TXD
3	RXD	RS232 RXD
4	GND	GND

3.1.2 Rear Panel Connection



Pin No	Signal Name	Description
CON1(1)	BUS+	Battery string/bank POSITIVE, separate wire with a 3A fuse
CON1 (2 to 7)	BT1+ to BT6+	Battery 1 to 6 positive terminal <i>Always count from positive, external 0.1A fuse required for each sampling wire.</i>
CON2 (1-6)	BT7+ to BT12+	Battery 7 to 12 positive terminal
CON2(7)	MID	Middle point for internal resistance measurement. Separate wire with a 3A fuse. When battery number = 24, MID is at the battery 12- (Not 13+). When battery number = 18, MID is at the battery 9- (Not 10+). When battery number is odd, the POSITIVE side has one more battery . With 23 as an example, divide them to 12+11. Connect MID to 12-.
CON3 (1 to 7)	BT13+ to BT19+	Battery 13 to 19 positive terminal
CON4 (1 to 5)	BT20+ to BT24+	Battery 20 to 24 positive terminal. When battery number is <24, leave the extra pins unconnected. Connect the NEGATIVE of last battery next to its POSITIVE lead input.
CON4(6)	BT24-	Battery 24- When battery number is <24, no connection to this pin.
CON4(7)	BUS-	Battery bank NEGATIVE, separate wire with a 3A fuse

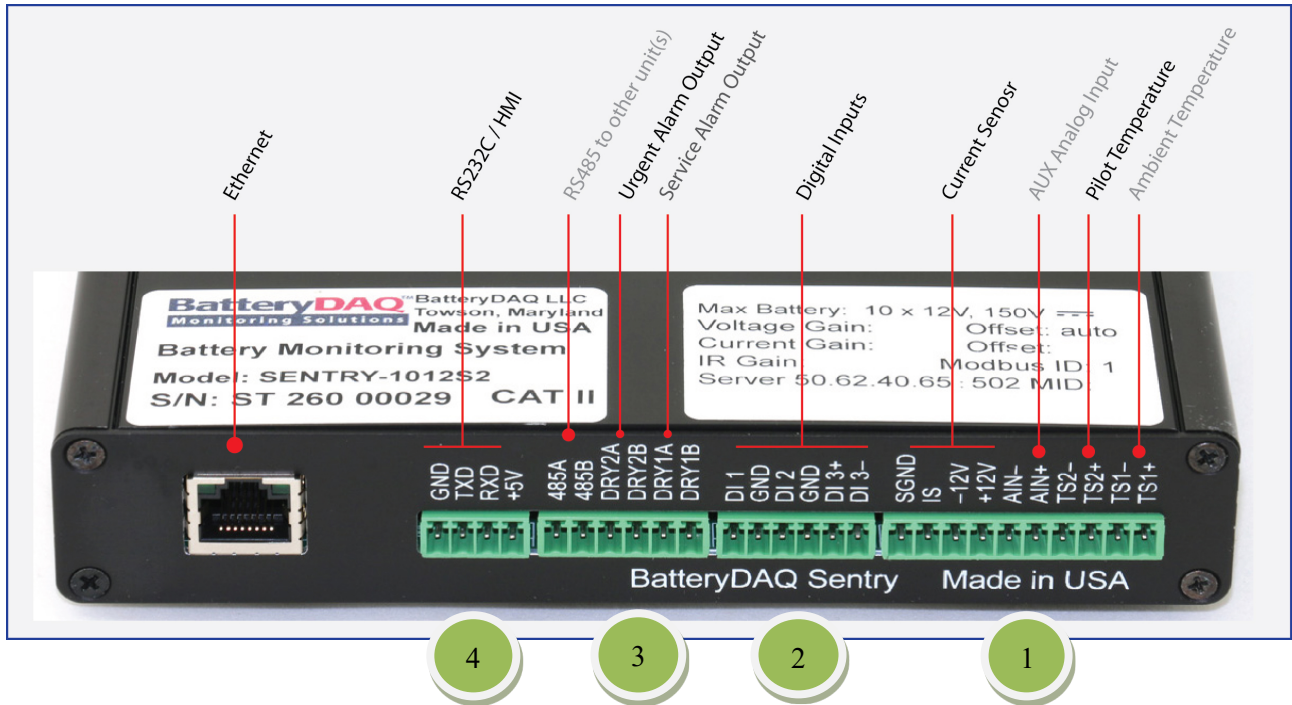
3.1.3 Sentry-2412 Battery Wiring



4 Sentry-1012 Terminals and Wiring

4.1 Connection Panel for Sentry-1012

4.1.1 Front Panel Connection



Connector 1: Current Sensor and Temperature Sensors

Pin No	Signal Name	Note
1	TS1+	Ambient temperature sensor + (RED)
2	TS1-	Ambient temperature sensor - (BLACK)
3	TS2+	Pilot temperature sensor + (RED)
4	TS2-	Pilot temperature sensor - (BLACK)
5	NC	No connection
6	NC	No connection
7	+12V	Current sensor +12V, pin-1 (RED)
8	-12V	Current sensor -12V, pin-2 (WHITE)
9	IS	Current sensor output, pin-3 (GREEN)
10	SGND	Current sensor 0V, pin-4 (BLACK)

Connector 2: Digital signal input (optional)

Pin No	Signal Name	Note
1	DI3-	Digital input 3-
2	DI3+	Digital input 3+ (0 to 10V)
3	DI2	Digital input 2, dry contact
4	DI2	Digital input 2, dry contact
5	DI1	Digital input 1, dry contact
6	DI1	Digital input 1, dry contact

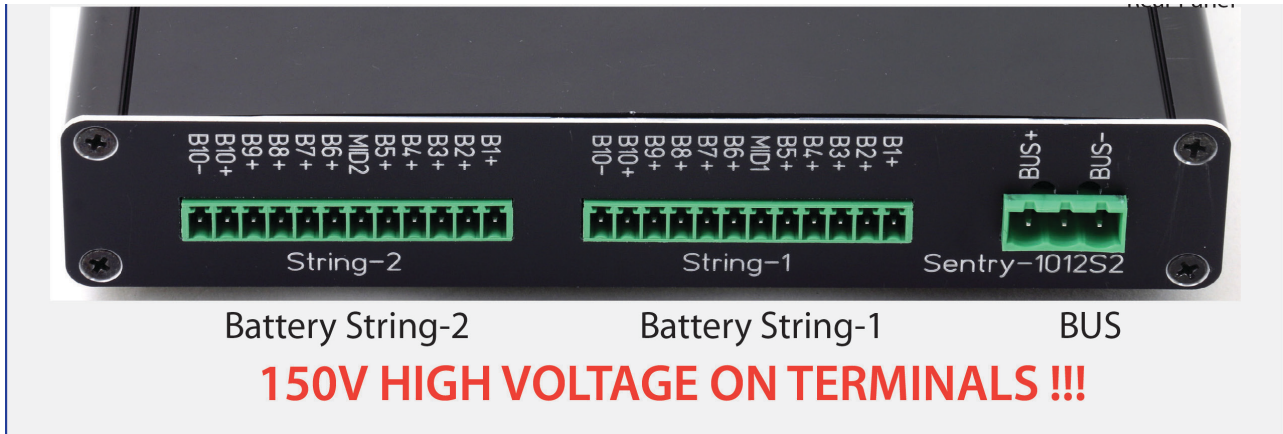
Connector 3: RS-232 or HMI

Pin No	Signal Name	Note
1	+5V	+5V power to HMI
2	TXD	RS-232 TXD
3	RXD	RS232 RXD
4	GND	GND

Connector 4: Power supply, RS485 and Alarm Output

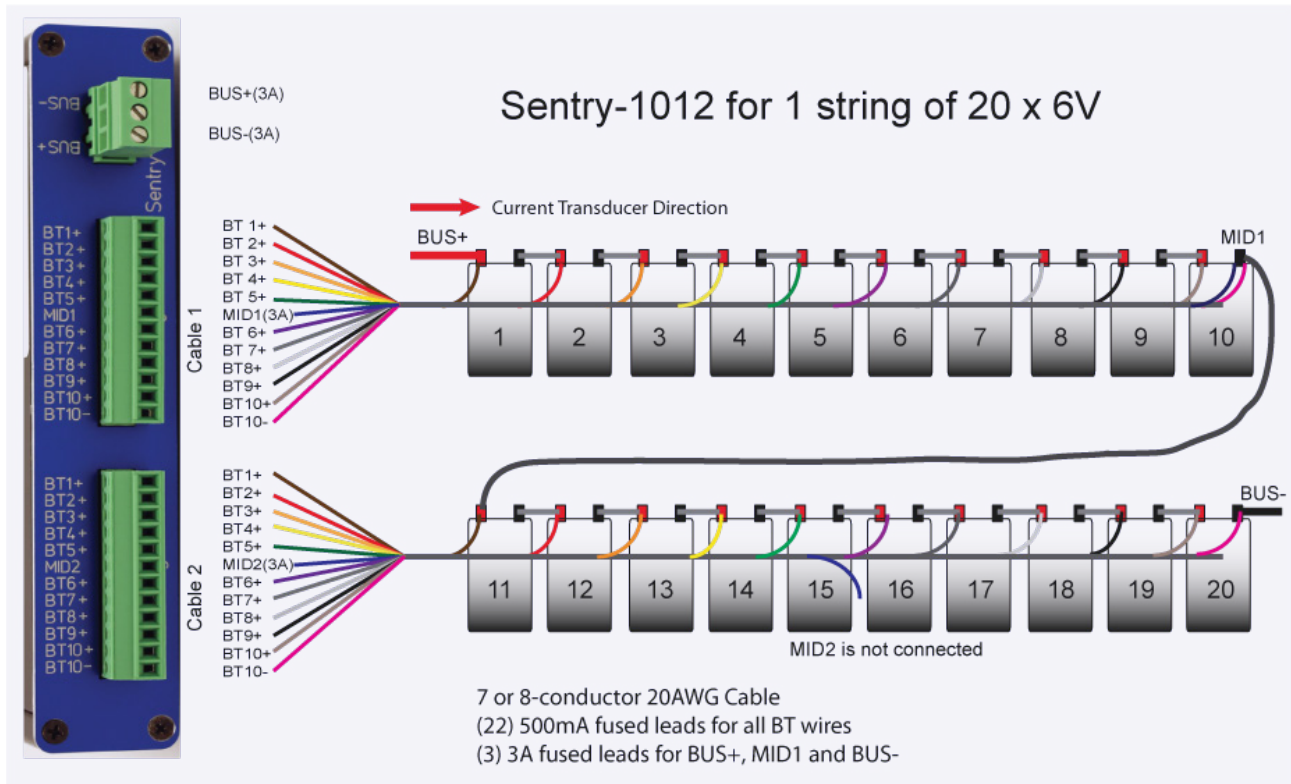
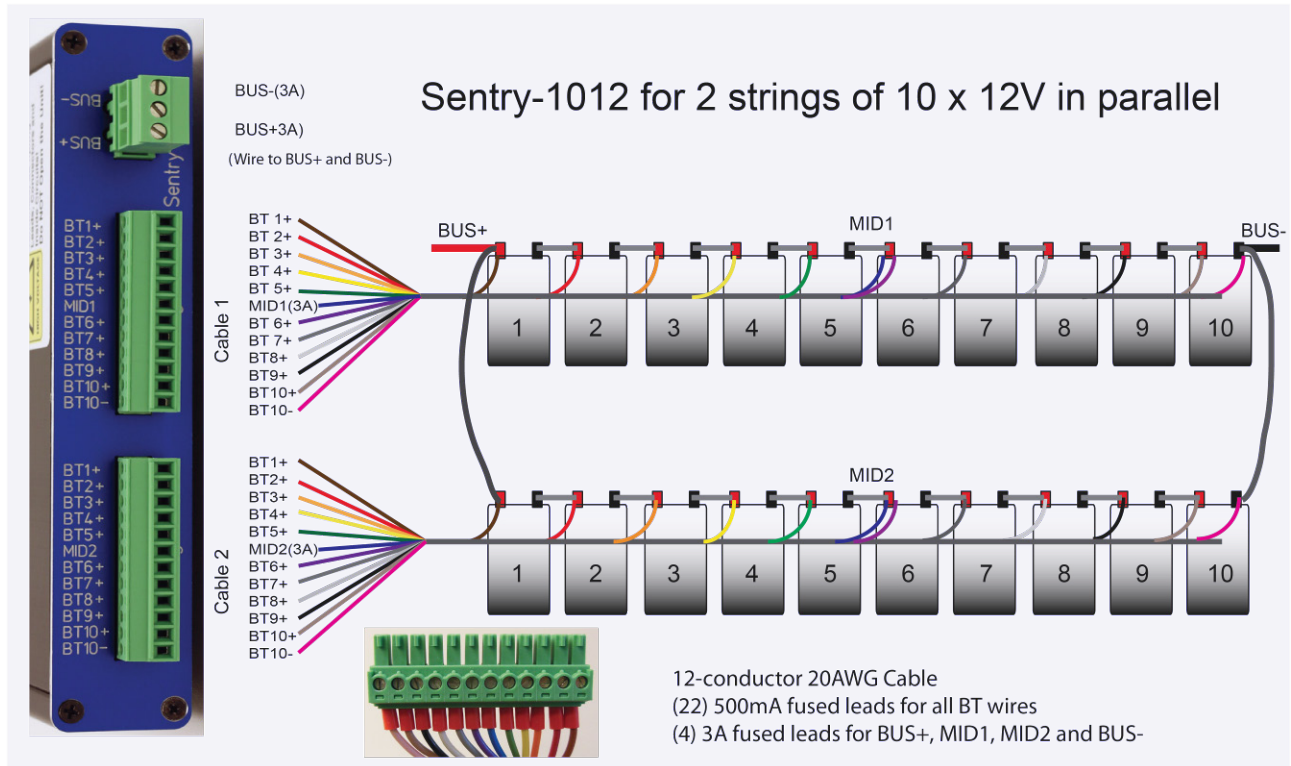
Pin No	Signal Name	Note
1	Alarm 1	Service Alarm output, solid state relay, “dry” contact
2	Alarm 1	Service Alarm output, pulsed output, 1 second on. 1 second off
3	Alarm 2	Urgent Alarm output, solid state relay, “dry” contact
4	Alarm 2	Urgent Alarm output
5	RS485B	RS485B
6	RS485A	RS485A

4.1.2 Rear Panel Connection



Pin No	Signal Name	Note
CON1(1)	BUS-	Battery bank NEGATIVE, last battery NEGATIVE post, separate wire with a 3A fuse
CON1(2)	-	No connection
CON1(3)	BUS+	Battery bank POSITIVE, BATT#1 + post, separate wire with a 3A fuse
CON2 (1 to 5)	String-1 BT1+ to BT5+	Battery 1 to 5 positive terminal Always count from positive, external 0.5A fuse required for each sampling wire.
CON2(6)	MID1	Middle point for internal resistance. Connect to post with a 3A fuse. When battery number = 10, MID is at the battery 5- (Not 6+). When battery number = 9, MID is still at the battery 5-. When unit is used for 1 string of 20x6V, connect to MID1 to BAT#10 negative.
CON2 (7-12)	BT6+ to BT10+, BT10-	Battery #6 to #10 positive post. Battery #10 negative post. When battery number is <10, leave the extra pins unconnected. Connect the Negative of last battery to the next Positive lead input.
CON3 (1 to 5)	String-2 BT1+ to BT5+	Battery 11 to 20 positive terminal
CON3(6)	MID2	Middle point for string-2.
CON3 (7to 12)	BT6+ to BT10+, BT10-	Battery #6 to #10 positive post. Battery #10 negative post.

4.1.3 Sentry-1012 Battery Wiring



5 Installation Guide

- Batteries can present a risk of electrical shock or burn from high short-circuit current. Observe proper 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 ensured before installation.



5.1 Installation Requirement and Procedure

CAUTION

- 1) Ensure all equipment and tools are properly safe and in good working order.
- 2) Ensure electrical tools have been tested for proper insulation and grounding.
- 3) Observe all **CAUTION**, **WARNINGS** and **DANGER** notices on any equipment.
- 4) Never work alone.

CAUTION: 630V High Voltage



Please follow the detailed instructions for each step.

Only a qualified electrician with battery knowledge can perform the installation.

Never work alone with high voltage.

Disconnect battery string from UPS before installation.

5.2 Preparation for Installation

Before going to the site, prepare all parts and tools.

Parameters in Sentry unit may need to be adjusted for a specific battery application such as battery number in a string.

Network functions shall be verified prior to site installation.

Step	Preparation Check Points	Description	Check
1	Unpacking	Unpack product and all accessories Check with packing list	
2	Software	Install software to a laptop which can be brought to site. With the demo sites, get familiar with software configuration and functions. Verify database installation.	
3	Power on	Power on with external AC/DC power adapter. +12V for Sentry-4412 +5V for Sentry-2412 and Sentry-1012 LEDs will blink/flash when unit is powered on.	
4	HMI	1) Plug in HMI to RS232 port 2) Check the unit with HMI 3) Connect the cable with temperature sensor/current sensor 4) Check temperature reading with HMI	
5	Alarm Settings	With HMI, check alarm settings in Sentry unit, confirm with end user if necessary. :: Cell Voltage High/Low :: String Voltage High/Low :: Temperature High :: Internal Resistance High (absolute value) :: Connection Resistance High	
6	Ethernet Connection	Connect to network with Ethernet cable Refer to Ethernet chapter, run IPSetup.exe, check the IP address, set to static IP for each unit. Use web browser to check the DTU setting. Run Battery Analyzer software, check data. Hold temperature sensor in your hand to warm it up, and check whether temperature data is changing.	
7	Ethernet on Site	Contact the end user for the availability of the Ethernet port on site.	

		<p><i>Check with end user for IP settings; change the gateway IP, DNS IP if necessary.</i></p> <p>Prepare the proper length of Ethernet cable. Test the cable before site installation. Prepare the conduit for Ethernet cable if needed.</p>	
8	Current Sensor	<p>Product is delivered with either LEM current sensor option or Shunt option.</p> <p>For LEM current sensor option, verify the battery bus cable size and sensor window size. Installer may need to customize a cable to fit into the current sensor before crimping the compression lugs.</p>	
9	Temperature Sensor(s)	<p>Check the cable length for ambient and pilot temperature sensor. Extend them if needed.</p>	
10	Harness	<p>Prepare full set of harness for the job.</p> <p>Installer may need to purchase 12-conduct, 20 AWG (18AWG is acceptable) unshielded cable if not ordered from BatteryDAQ. (Such cable often has a long lead time.)</p> <p>Calculate the cable length. If possible, cut the cable to proper length, connect one end to 12-pin terminal plugs, and label them. <i>(This will significantly save installation time.)</i></p>	
	Voltage Sampling Leads	<p>Make cables for each section or each tier.</p> <p>For 40 batteries, prepare at least 44 leads.</p> <p>Sampling lead comes with safety inline fuse (0.5A)</p> <p>Check the tab washer size against battery post size.</p>	
	IR leads	<p>IR leads are protected with 3A fuse.</p> <p>For Sentry-4412, 5 leads are required for each battery string.</p> <p>Check tab washer size.</p>	
11	Mounting	<p>Unit can be mounted in the top of battery cabinet, close to batteries.</p> <p>Decide the proper mounting method and prepare all necessary hardware</p> <p>Confirm mounting method with end user if needed.</p> <p>Magnetic cups are installed on the unit. If a different mounting method is preferred, take off the magnetic cups and use those screws (4mm) for DIN rail. (DIN rail is not included.)</p>	
12	Wire duct	<p>Prepare conduit and/or wire duct if needed.</p> <p>Prepare material to mount wire duct</p>	





5.3 Basic Steps for Performing Installation on Site

Step	Description	Check
1	Prepare harness with in-line fuses and QDC (Quick Disconnect Connector) terminals	
2	Disconnect battery from UPS	
3	Locate/secure the Sentry unit	
4	Label the batteries with numbers	
5	Install tab washers if not pre-installed	
6	Place harness and connect to tabs	
7	Install current transducer	
8	Verify connection before plugging into Sentry unit	
9	Plug into Sentry unit and test	

The following instruction is based on Sentry-4412HV unit. For Sentry-1012 and Sentry-2412, please refer to their specific wiring diagram.

5.3.1 Prepare Harness

It is strongly recommended to make full set of harness in your shop rather than on site.

	
<p>Cable can be ordered from BatteryDAQ with specified length.</p>	<p>Prepare proper length to match the cabinet/battery layout <i>To save time, always prepare your harness in your shop instead of customer's site.</i></p>
<div style="text-align: center;">  <p>(2.5mm screwdriver)</p>  </div> <p><i>Self-adjusting Ferrule Crimper HSC8 6-4 0.25-6mm²</i> Tools for Installing Ferrules</p>	<div style="text-align: center;">  <p><i>Quick connector and butt crimping tool: STAKON ERG4001</i></p> </div> <p>Crimping Tool</p>

5.3.2 Disconnect Battery String from UPS

Never install a BMS with the high voltage battery string connected to UPS or charger.
 Make the arrangement with IT or other administrator when you schedule the installation.



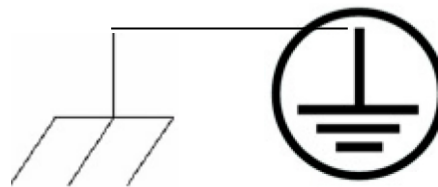
After disconnecting from UPS, measure the voltage between battery terminals and enclosure/Ground. Make sure it is isolated and floating.

Disconnect inter-tier connection if possible.

5.3.3 Locate and Secure the Sentry Unit.



Connect/secure the protective grounding wire to battery enclosure/chassis which has already been grounded to earth.



The strong magnets on the bottom are utilized for placement on top of battery cabinet.



For other installation such as wall mounting, unscrew magnets and mount the unit to DIN rail or other bracket by using the same screws and holes.

(Screws must be shorter than 8 mm. Longer screws may damage the circuit board or cause short circuit and electric shock.)

Do not unscrew magnets for ST-4412HV. The bottom panel may fall off without those screws. Mount with the side aluminum profile if needed. Contact BatteryDAQ for help.

5.3.4 Label the Batteries



Labels on batteries

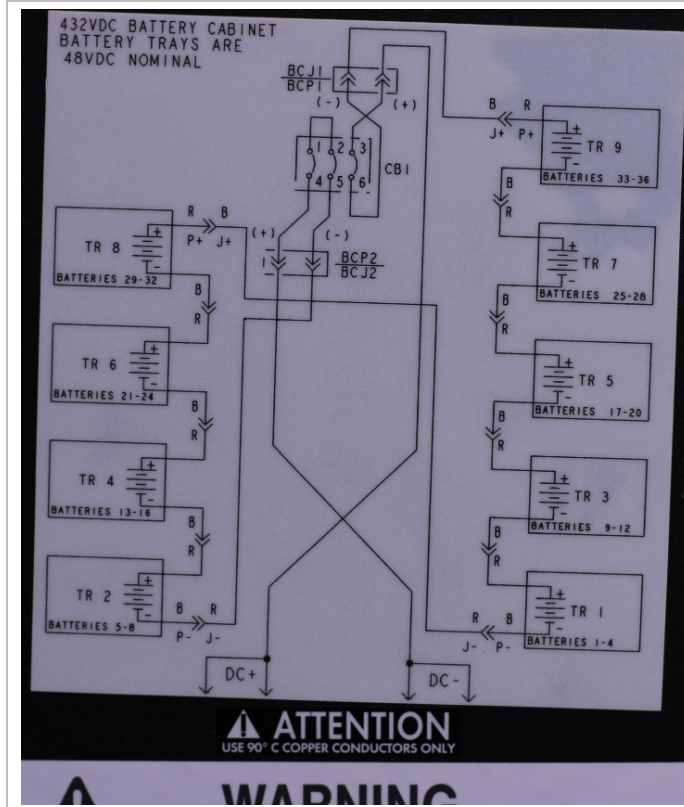


Florescence Label

Label all batteries in a string with number 1 to 40. The first one to POSITIVE bus is “1”.

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 label the rest sequentially.

The battery numbers and the displayed numbers on the software/HMI screen shall match in order to identify battery for alarm and maintenance.



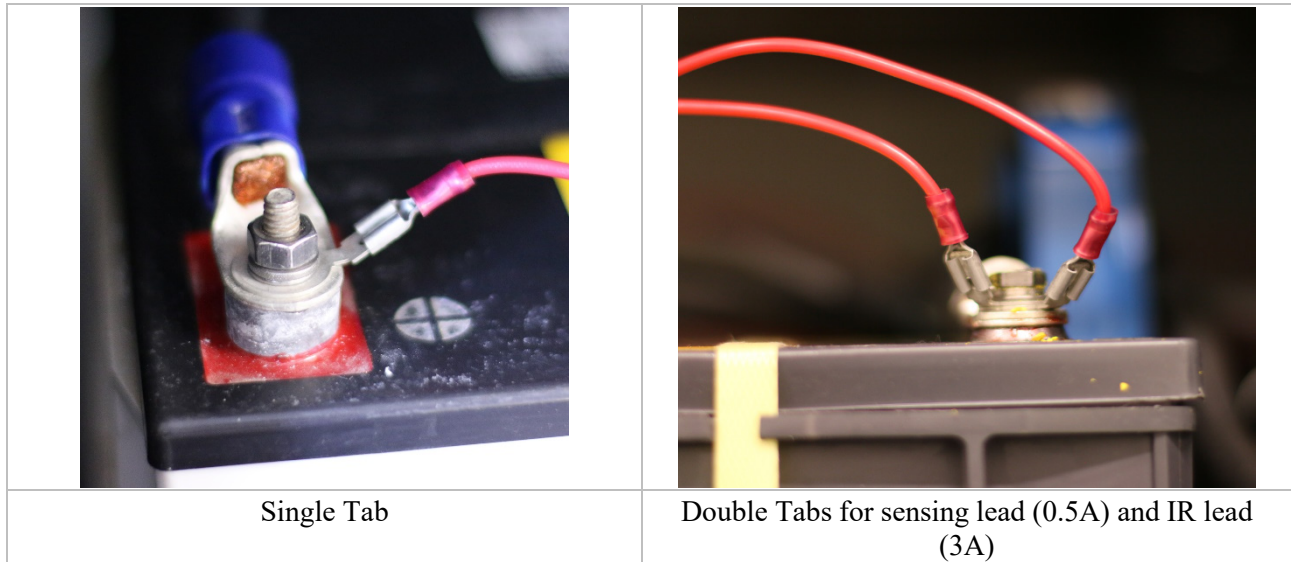
Some battery cabinets may have original WRONG label. Correct it before installation.

The battery numbers shall always start from Positive Bus and go by incremental order.

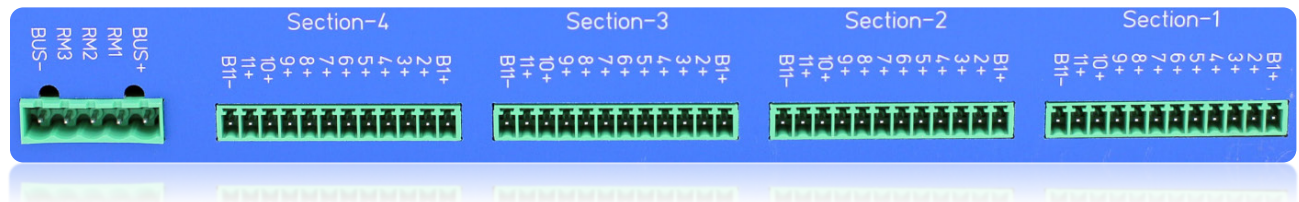
The battery numbers shall be posted on an eye-catching position on the battery.

5.3.5 Install Tab Washers

Install tab washer to battery posts. High quality 6mm/8mm/10mm tab washers are available from BatteryDAQ.



Refer to battery connection to determine which post to have tab installed.



5.3.6 Place Harness and Connect to Tabs

Cable tray on top of battery blocks



Place harness in cable duct or protection wrap. Connect in-line fuse terminal to tabs.

Double tabs on post



Two wires come to one post, one for IR (3A) and another for sensing (0.5A).



Follow safety requirements to work with high voltage and high energy battery banks. All leads/wires to BMS unit shall have inline fuse for protection.

5.3.7 Install Current Transducer

Open battery connection cable and pass it through CT.

The arrow direction shall match the charging current direction.

 <p>P/N: CK-300A, D-35mm (Default)</p>	
	<p>HAL and HTA have the small connector.</p> <p>P/N: HAS-300A, 10mm x 20mm P/N: HAL-300A, 15mm x 20mm P/N: HTA-300A, D-32mm</p>
	<p>Split core is available.</p> <p>P/N: CY5-300A, window size 16mm x 64mm P/N: CY10-300A, window size 40mm x 104mm</p>

5.3.8 Verify Connections

- 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 RM1/2/3 and BUS-. Voltage shall be evenly divided for 4 sections.
- 5) Go through battery 1 to 40 at terminals to check voltage.



Troubleshooting Hints:

- 1) If voltage between BUS+ and BUS- is negative, you may have an incorrect order. **ALWAYS COUNT BATTERY ONE FROM POSITIVE OF BATTERY POWER.**
- 2) If the voltage between adjacent terminals is high than 13.5V (12V battery), check the connection order.
- 3) If a channel registers no voltage, measure from the connector: if no voltage, check the inline fuse; If there is voltage on connector, replace a Sentry unit and contact BatteryDAQ customer service. **DO NOT OPEN THE UNIT.**

5.3.9 Power-on Test

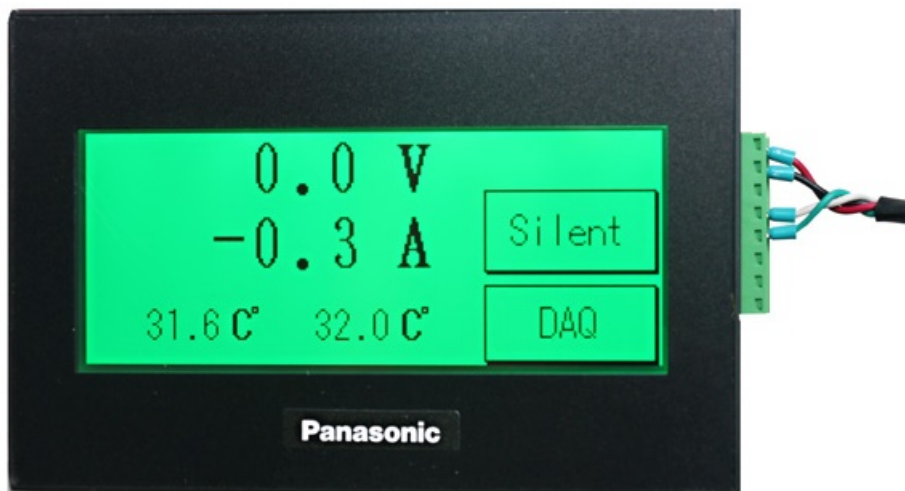
- 1) Test voltage sampling.
After powering on, verify there are no abnormal voltage readings.
- 2) Test internal resistance.
Internal resistance measurement will be automatically started 30 seconds after power on. Using HMI to check the data. Wait for it to finish all channels. (Unfinished channel will show “-1”.)
- 3) Fill out the installation report.

6 HMI Panel Operation

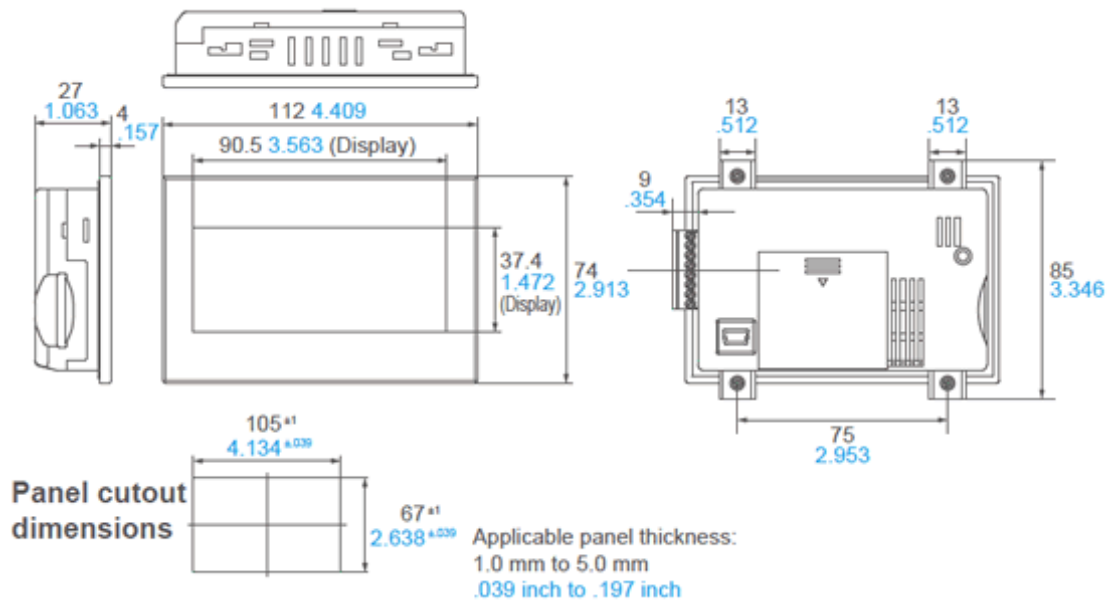
HMI (Human Machine Interface) is a touch screen panel. It has been programmed for comprehensive battery monitoring tasks. It is simple but very useful for field installation and maintenance.

- Displays the battery string information. (Voltage, current and temperature)
- Displays each cell (Battery Unit) voltage, internal resistance, connection resistance in numeric data or bar chart
- Displays (Flash) the alarm sign for abnormal battery condition. (Alarm Sound if selected)
- Sets alarm parameters for monitors
- Calibrates monitors.

(HMI content may vary based on your order.)



HMI Cut off Dimensions



6.1 HMI Screen Contents

<p>BatteryDAQ™ Remote Battery Monitoring www.batterydaq.com</p>	<p>Cell Voltage High Low 2.350 2.200</p> <p><< Change >></p>
<p>Normal - Green</p>	<p>Alarm – Red or Orange</p>
<p>535.4 V 0.2 A 15.4 C 15.7 C</p> <p>Silent DAQ</p>	<p>ERFF Error</p> <p>If the Sentry monitor is not powered on or the communication cable connection is not correct, the panel will display “ERFF”.</p> <p>Occasionally, when battery monitor is busy with other tasks, an “ERFF” may show up.</p>
<p>Home screen, displays string voltage, current, ambient and pilot temperature.</p>	
<p>DATA HISTORY HELP ALARM SETTING EXIT</p>	<p>CELL DATA Start IR STRING DATA EXIT</p>
<p>DAQ → Data</p>	<p>Start an IR measurement manually if needed.</p>
<p>2V Cells IR/CR x.xxx mohm 12V (6 - 16V) IR x.xx mohm</p> <p>ESC</p>	<p>13.449 13.400 13.379 13.448 13.327 13.333 13.334 13.382 13.412 13.488</p> <p>ESC Chart Vol 10>></p>
<p>Choose 12V to view data</p>	<p>Each page displays 10 batteries.</p>
<p>4.62 4.36 4.63 4.74 4.67 4.73 4.68 4.92 4.94 4.95</p> <p>ESC Chart IR 10>></p>	<p>4.59 4.48 5.23 4.46 4.86 5.00 4.41 4.58 5.04 4.99</p> <p>ESC <11 IR 20></p>
<p>Internal resistance</p>	<p>Page to next</p>
<p>ALARM CHECK ALARM SETTING CHECK</p> <p>ESC</p>	<p>Number of Alarm Battery Voltage 0</p> <p>ESC << >></p>
<p>Check alarm</p>	<p>Display number of batteries having this alarm</p>

<p>IR alarm</p>	<p>Connection resistance high, for 2V batteries.</p>
<p>Thermal risk range 0 -- 120</p>	<p>Settings</p>
<p>Alarm setting - voltage</p>	<p>Click on 0.000 to make changes</p>
<p>Click on 0 to make changes</p>	<p>For 2V batteries</p>
<p>String voltage threshold</p>	<p>Low voltage alarm when discharging</p>
<p>Voltage drop, for 2V 2-wire mode</p>	<p>Ambient and pilot are using the same limit</p>

 <p>Battery Capacity (Ah) 1200 to 0</p> <p><< ESC >></p>	 <p>Designed Runtime (minutes) -1 to 0</p> <p><< ESC >></p>
<p>For Telecom models</p>	<p>For Telecom models</p>
 <p>Deep Discharge Percentage 80.0% to 0.0</p> <p><< ESC >></p>	 <p>Alarm/Capacity Silent</p> <p><< ESC ENTER >></p>
<p>For Telecom models</p>	<p>Setting → System</p>
 <p>Battery Number 40 to 0</p> <p><< ESC >></p>	 <p>Battery Number 40 to 32</p> <p>1 2 3 4 5 ESC F4 6 7 8 9 0 E_s ↵</p>
<p>Battery number for this unit</p>	<p>Change to correct number</p>
 <p>Wiring/Demo Mode 1 to 0</p> <p><< ESC >></p>	 <p>Modbus Address 3 to 0</p> <p><< ESC >></p>
<p>1-wire mode</p>	<p>Modbus address</p>
 <p>Calibration?</p> <p><< ESC Yes</p>	 <p>Noise 50/60Hz -1 to 0</p> <p><< ESC >></p>
<p>Access to calibration</p>	<p>For early version filtering</p>
 <p>IR Duration (hrs) 24 to 0</p> <p><< ESC >></p>	 <p>Current 1 Offset -1 to 0 0.2 A</p> <p><< ESC >></p>
<p>24 hours by default, change to longer if needed</p>	<p>CT offset</p>

<p>Current 1 Offset -1 to 5</p> <p>CT-1 offset</p>	<p>Current 1 Gain 3000 to 0 0.3 A</p> <p>CT-1 gain</p>
<p>Current-2/Analog Offset -1 to 0 0.0 A</p> <p>Ripple current offset, no need to change</p>	<p>Current-2/Analog Gain 3000 to 0 0.0 A</p> <p>Same gain as CT-1</p>
<p>RM Calibration 5000 to 0</p> <p>Calibrate only when you have a reliable reference data.</p>	<p>Voltage Offset (Auto) 16384 to 0</p> <p>Automatic</p>
<p>Voltage Gain 10000 to 0 535.5 V 53.55</p> <p>Calibrate with 0.1% or higher accuracy meter</p>	<p>TS1 Offset 15.4 -0.1 to 0.0</p> <p>Ambient temperature offset</p>
<p>TS1 Offset 15.4 -0.1 to 0.5</p> <p>Change the offset to match actual/accurate temperature</p>	<p>TS2 offset 15.7 -0.1 to 0.0</p> <p>Pilot sensor</p>
<p>Are you a service engineer? Save change?</p> <p>Yes No ESC</p> <p>Make sure you are authorized.</p>	<p>Save to Device ESC</p> <p>Save Not Save</p> <p>Save to board, otherwise it will lose if power off.</p>

6.2 Calibrate Sentry Unit

6.2.1 Temperature Calibration

TS1 offset = previous offset + actual temperature – readout

You can read the calibrated temperature on the same page. So, fine tune it until it displays the accurate value.

6.2.2 Current Calibration

Current offset and gain can be calibrated and adjusted with HMI.

Calibrate Offset

It is often needed to calibrate offset so the readout reflects actual floating current.

Calibrate zero at battery string open circuit or when the sensor is out of current loop

HMI → DAQ → Settings → System Settings

Page down to Calibration → Current-1 offset. Adjust offset to reflect actual current.

Calibrate Gain

Calibrate gain when you select different CT, otherwise the gain does not need to be calibrated.

For 300A CT, set gain to 3000.

For 100A CT, set gain to 1000.

If more accurate reading is desired, with 0.1% accuracy current generator, unit gain can be re-calibrated.

New gain input = previous x (actual current/readout).

For example, readout is 98.0A for actual 100A input, new gain = previous gain x (100/98.0)

Ripple current takes the same gain as main current.

6.2.3 Voltage Calibration

Battery/Cell Voltage Gain

Measure the string voltage with a reliable/calibrated meter. Set Gain = previous gain x Standard/Readout.

Zero offset

Offset is automatically obtained. No need to calibrate.

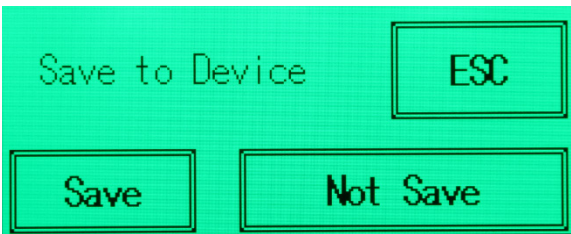
6.2.4 Internal Resistance Calibration

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 * (actual value / readout)

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

6.2.5 Save to Onboard Flash



If not saved, it will be lost after a power off/on cycle.

7 Network and DTU Settings

Ethernet port has been programmed as **DTU mode** with embedded web page

In some circumstances, customer may want to re-program DTU mode to S2E (Serial-to-Ethernet) mode.

Contact BatteryDAQ to downgrade the DTU firmware to S2E.

7.1 IP Address Settings

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

For example,

DTU-ID: 12501

Host: www.thisbattery.com

Monitor configuration: 3,1,40,120, 10 [*no space in between*]

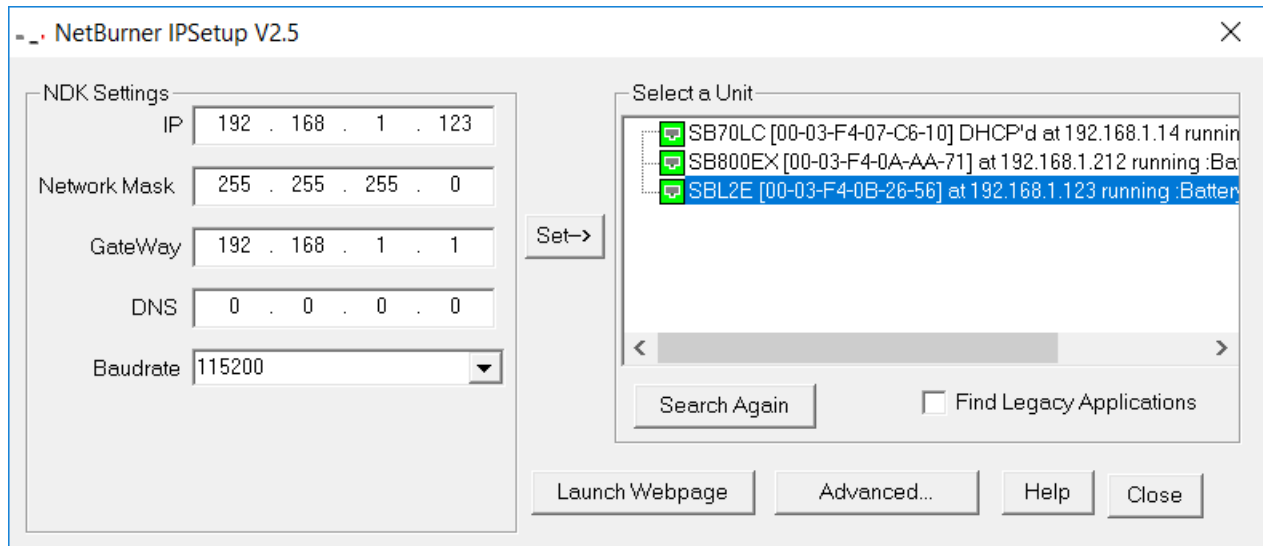
(Modbus address 3, 1-wire mode, 40 batteries, 12V, 10 for BatteryDAQ Sentry product).

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

<https://batterydaq.com/tech/IPSetup.exe>

By default, DTU has been set for static IP as 192.168.1.1xx (xx is the same as the last two digits of Serial Number. For example, unit with SN ST410010375 will have IP pre-set to 192.168.1.175.)

Use “IPSetup.exe” to search 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.



Leave DNS to “0, 0, 0, 0”.

Launch Webpage for battery data and configuration

7.2 Access Battery Data from Web Page

BatteryDAQ™ Unit #1 - Unit #2 - Unit #3 - Unit #4 | DTU Settings

Sentry DTU ID: 12856

Site: name a site here Unit #1: bank 1 name

12/28/2018, 12:53:03 PM [Refresh](#)

String Vol.	535.4 V	High(Low)	535.6 V (535.2)
Current	0.2 A	Ripple	0.0 A
Ambient(Max)	15.3°C (15.4)	Pilot(Max)	15.6°C (15.6)

Voltage(V)	BT#	Resistance(mohm)
13.446	#1	4.62
13.377	#2	4.63
13.328	#3	4.67
13.331	#4	4.68
13.411	#5	4.94
13.396	#6	4.36
13.446	#7	4.74
13.328	#8	4.73
13.383	#9	4.92
13.483	#10	4.95
13.437	#11	4.59
13.555	#12	5.23
13.296	#13	4.86
13.445	#14	4.41
13.526	#15	5.04
13.327	#16	4.48
13.371	#17	4.46
13.125	#18	5.00
13.538	#19	4.58
13.382	#20	4.99
13.305	#21	4.43
13.425	#22	4.69
13.368	#23	4.59
13.363	#24	4.72
13.374	#25	5.02
13.394	#26	4.94

7.3 DTU Settings

Authorized user can obtain password from BatteryDAQ to update DTU configuration

When set Monitor to none (all 0,0,0,0, no space in between), the RS485 port is available as slave.

BatteryDAQ™ Unit #1 - Unit #2 - Unit #3 - Unit #4 | DTU Settings

Sentry DTU ID: 12856

-	Description	Value	New Value
1	DTU ID	12856	<input type="text" value="12856"/>
2	Site Name	name a site here	<input type="text" value="name a site here"/>
3	Host Name	www.thisbattery.com	<input type="text" value="www.thisbattery.com"/>
4	Host IP	50.62.40.65	<input type="text" value="50.62.40.65"/>
5	Host UDP Port	5566	<input type="text" value="5566"/>
6	Report Interval(mins)	60	<input type="text" value="60"/>
7	Specific Gravity(x0.001)	1230	<input type="text" value="1230"/>
8	0:Celsius/1:Fahrenheit	0	<input type="text" value="0"/>
9	0:Resistance/1:Conductance	0	<input type="text" value="0"/>
11	Monitor 1 Code	3,1,40,120,10	<input type="text" value="3,1,40,120,10"/>
-	Battery Bank 1	bank 1 name	<input type="text" value="bank 1 name"/>
12	Monitor 2 Code	0,0,0,0,0	<input type="text" value="0,0,0,0,0"/>
-	Battery Bank 2	bank 2 name	<input type="text" value="bank 2 name"/>
13	Monitor 3 Code	0,0,0,0,0	<input type="text" value="0,0,0,0,0"/>
-	Battery Bank 3	bank 3 name	<input type="text" value="bank 3 name"/>
14	Monitor 4 Code	0,0,0,0,0	<input type="text" value="0,0,0,0,0"/>
-	Battery Bank 4	bank 4 name	<input type="text" value="bank 4 name"/>

Monitor Code Example: (3,1,40,120,10)

re-mode,battery number,nominal voltage(x0.1V),monitor type:10 standalone;11,12...mul

Enter Password:

Only authorized person can make changes.Click "Update" to send a data packet.

8 Battery Analyzer Software Setup

Software CD contains both Battery Analyzer and DAS software. Analyzer can obtain data from Sentry units via Ethernet connection without DAS software.

Name	Date modified	Type	Size
Ethernet DTU Tool	7/13/2018 10:10 A...	File folder	
Modbus Tables	10/17/2018 6:08 A...	File folder	
Sentry Manuals	6/20/2018 12:25 PM	File folder	
SNMP Tool	6/20/2018 12:25 PM	File folder	
SqlExpress Database	6/20/2018 12:25 PM	File folder	
BatteryAnalyzerSetup	5/1/2018 6:31 PM	Application	3,229 KB
EquipmentConfigForClient	10/30/2015 2:37 PM	XML Document	4 KB
EquipmentConfigForServer	6/24/2014 2:30 PM	XML Document	1 KB
mobilecarriers	12/9/2012 3:54 PM	Text Document	1 KB
Quick Guide	11/7/2017 6:35 AM	Microsoft Word D...	20 KB
Quick Guide	10/6/2017 6:49 AM	Adobe Acrobat D...	455 KB

DAS software is only needed when you are setting your own cloud server or directly communicate to Sentry with serial port. Contact BatteryDAQ if DAS is needed.

8.1 Software and Database Installation

For software installation, please refer to software manual:
<https://batterydaq.com/battery-analyzer-online-manual/>

Database is required if you wish to archive battery history data.
<https://batterydaq.com/battery-analyzer-database-installation-notes/>

If you have trouble to install software, please install TeamViewer on your computer before request technical support from BatteryDAQ.
<https://www.teamviewer.com/en-us/download/windows/>

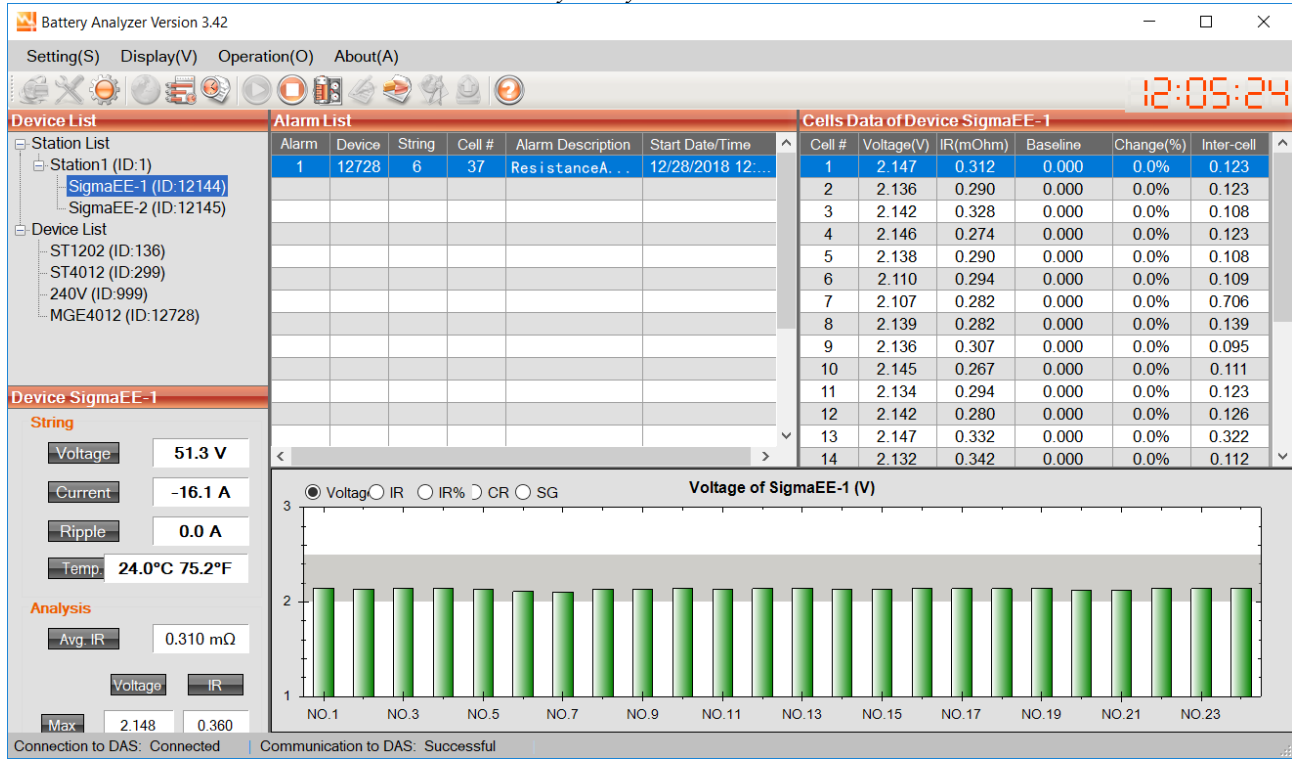
For the first installation, copy this XML files to C:\BatteryDAQ\Analyzer folder:
 EquipmentConfigurationForClient.XML

For upgrade or re-installation, the previous XML file stays in the folder so you don't need to re-configure Analyzer for your sites and battery banks.

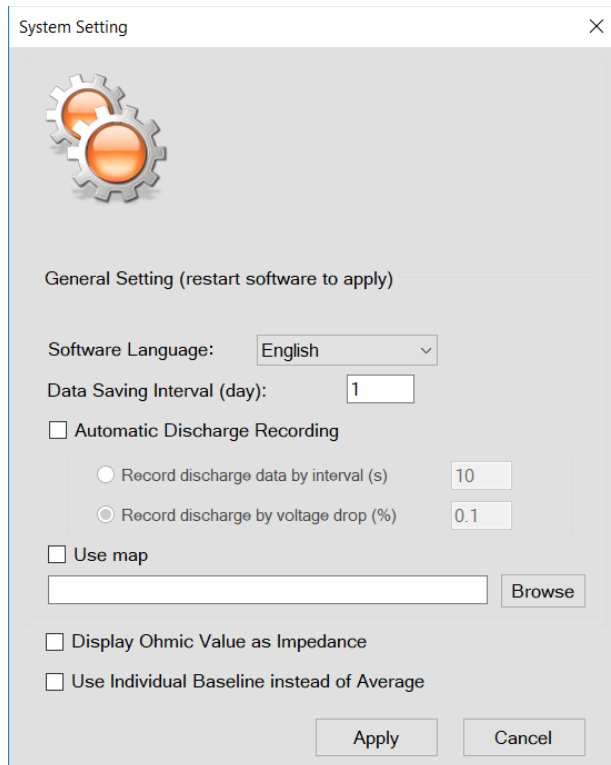
8.2 Battery Analyzer Configuration

Run Battery Analyzer in the client computer.

Battery Analyzer main screen



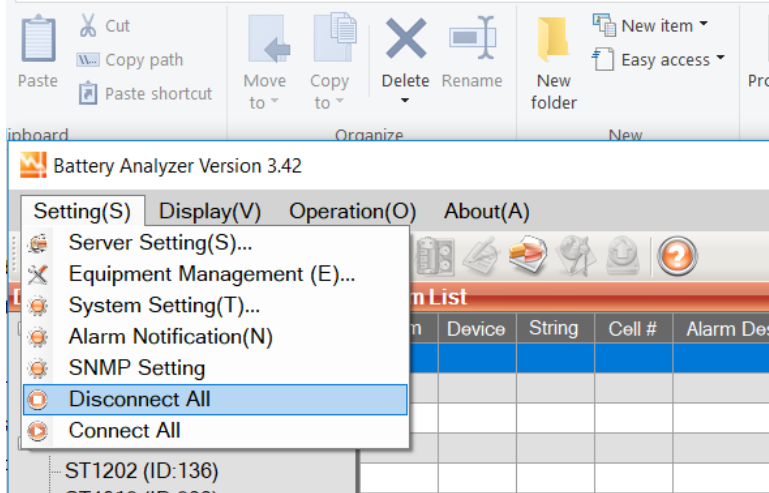
8.2.1 System Settings



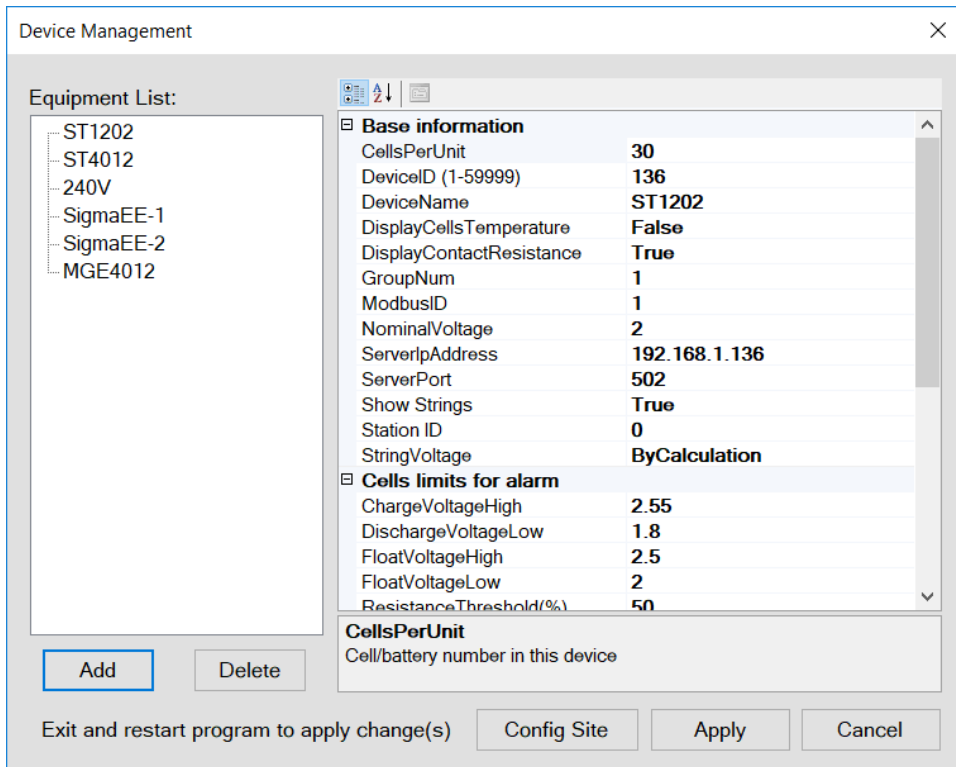
When “Automatic Discharge Recording” is checked, “Record discharge by voltage drop” is recommended.

8.2.2 Equipment (Device) Management

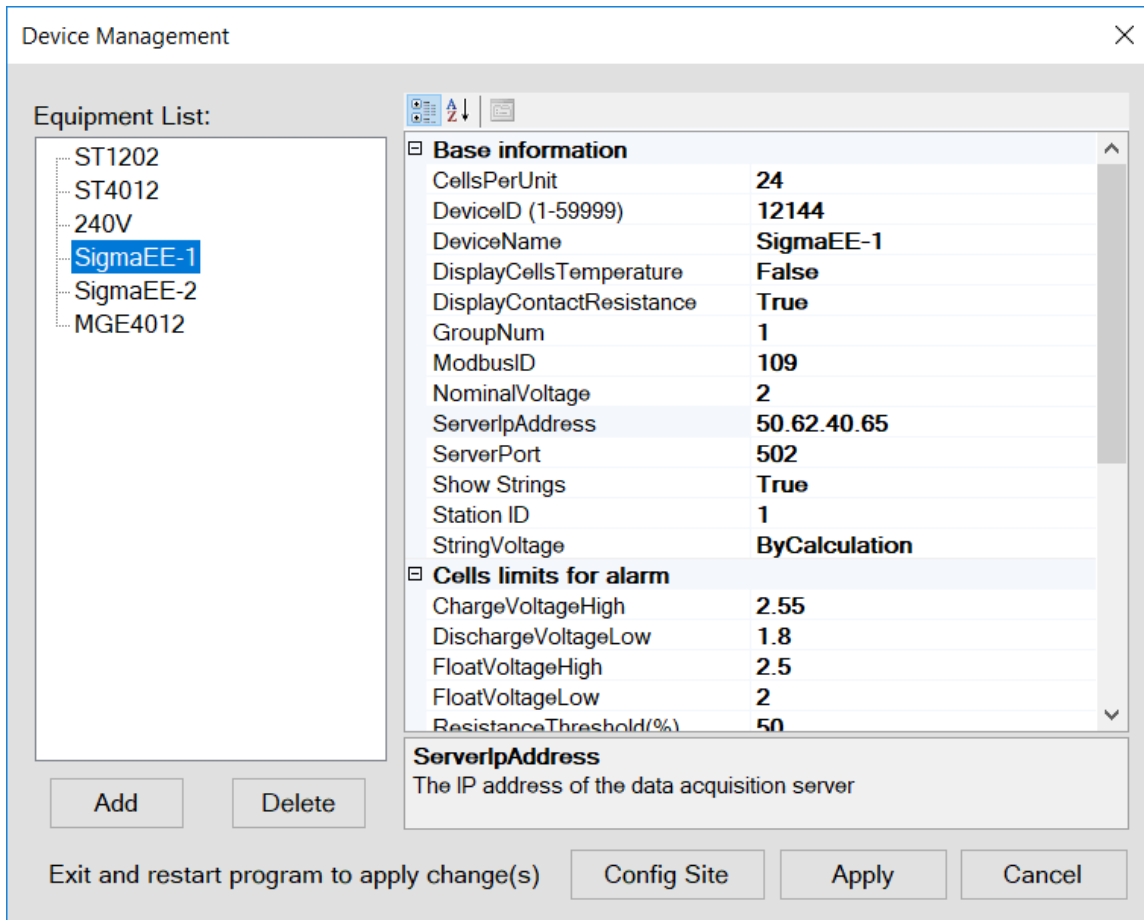
“Disconnect All” before you make any change to Equipment Management.
 “Connect All” after change is made.



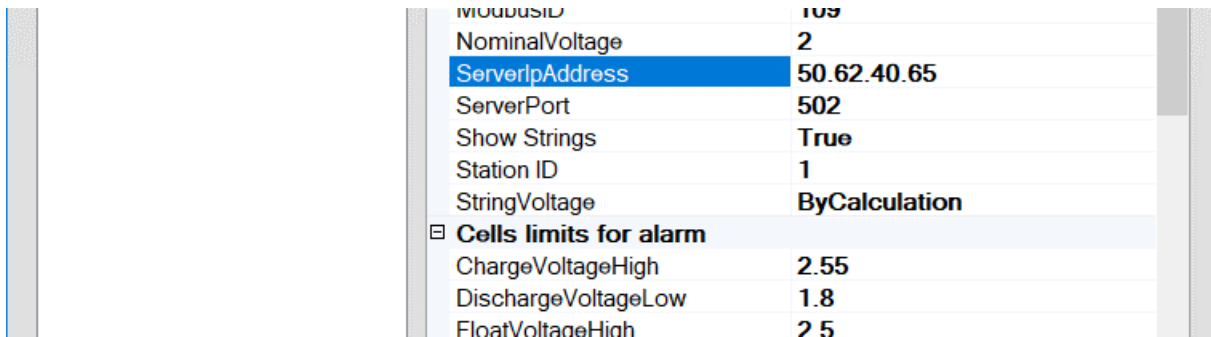
Open “Equipment Management”



Click on the device to select it. Make any change to match battery parameters and network setting.



The IP address is what you have assigned to Sentry unit with IPSetup.exe.



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

Add New Device.

Equipment Management

Equipment ID: (1 to 59999) 12589 Name: Liebert_23

Modbus ID: (1 to 254) 1 Site ID#: (1 to 999) 0

Equipment Parameters

Nominal Voltage: 12

Battery Number per String 40

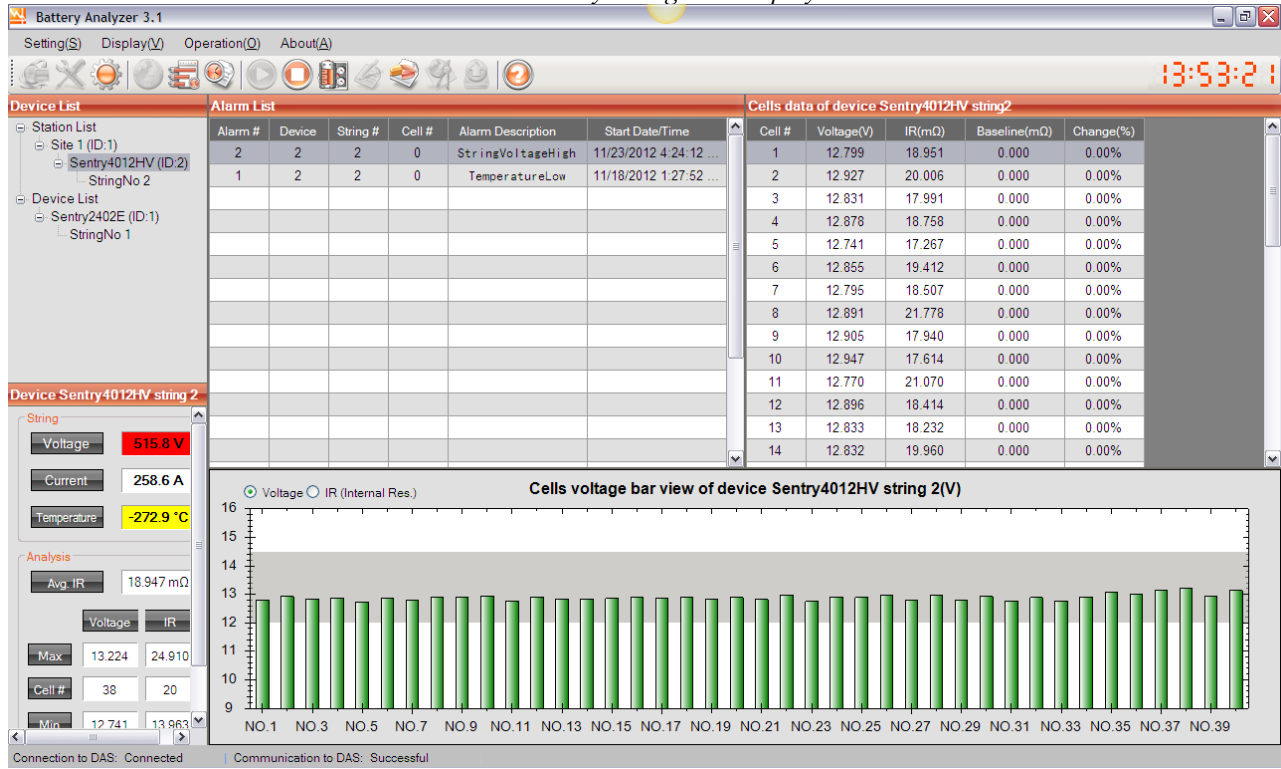
Apply Cancel

By default, software may have two demo sites configured. Click on it, and Delete it if you wish to remove.

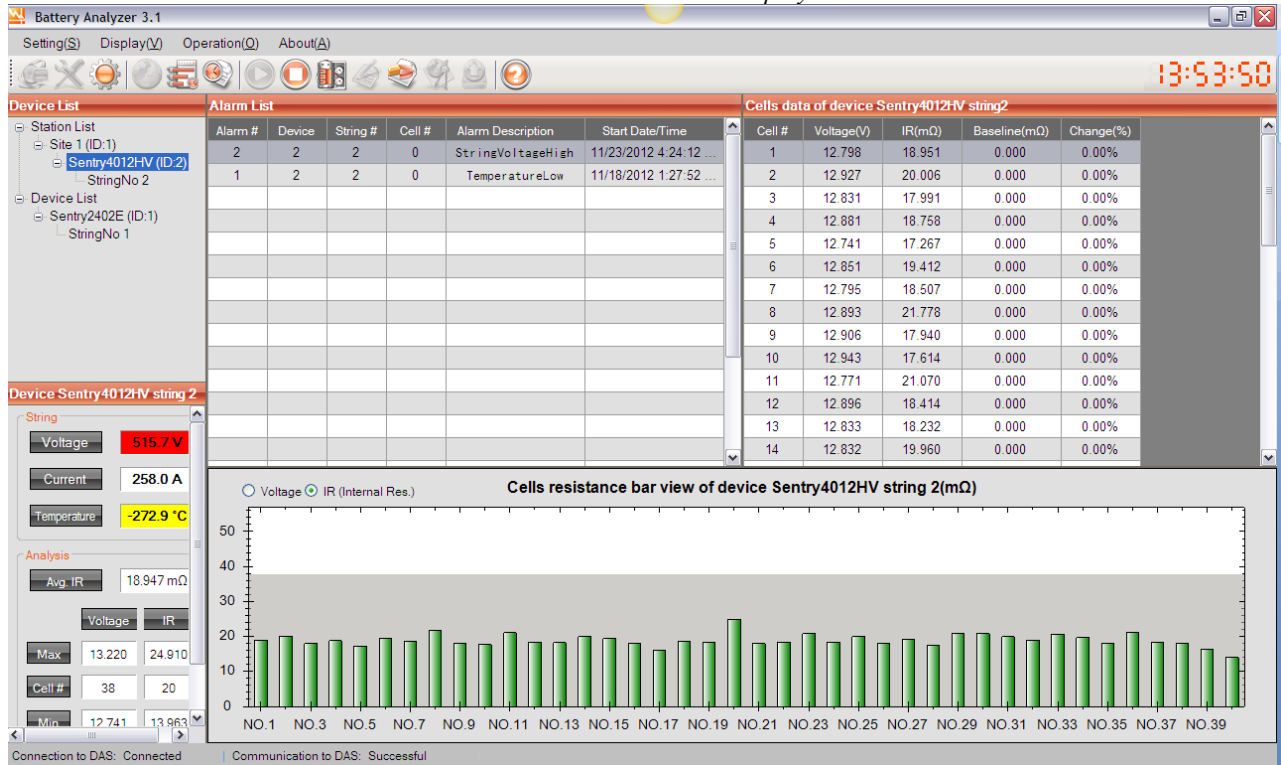
8.2.3 Data Viewer

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

Cell/Battery voltage bar display

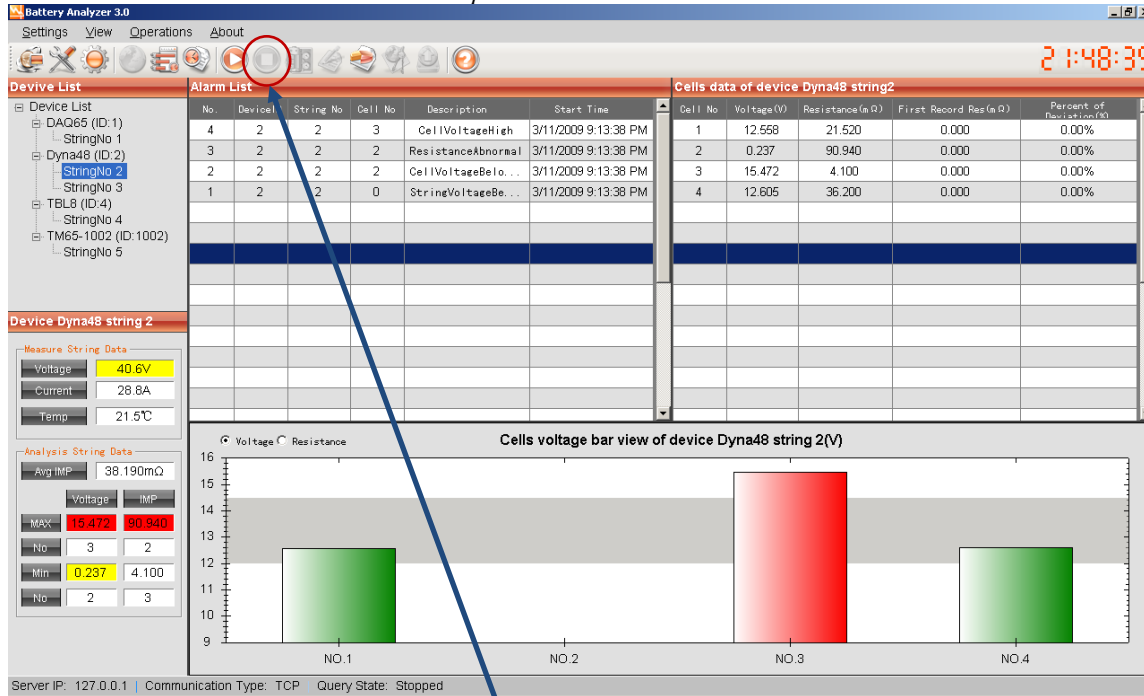


Internal resistance bar display



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

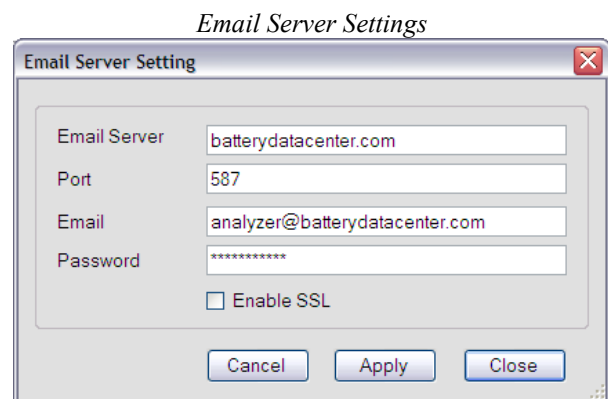
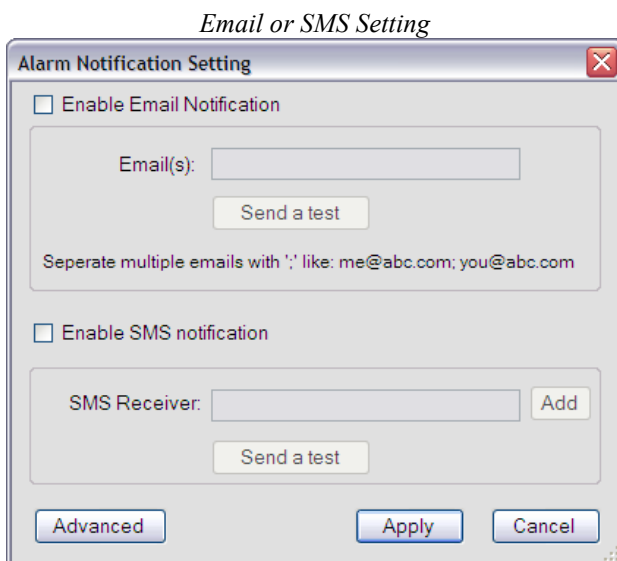
Run/Stop Communication



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

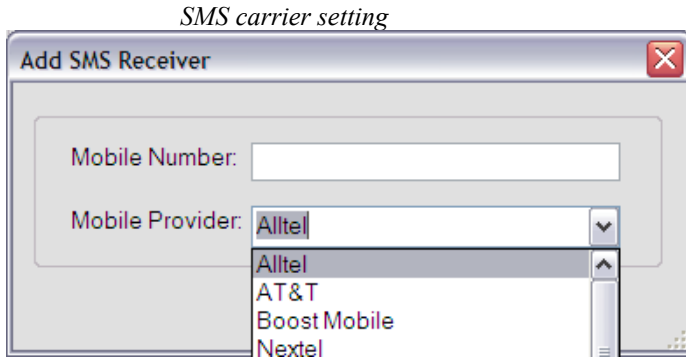
Right click data window to export data to Excel sheet. If you are not sure the data is within correct range, you can send the file to BatteryDAQ technical support.

8.2.4 Alarm Notification



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.

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



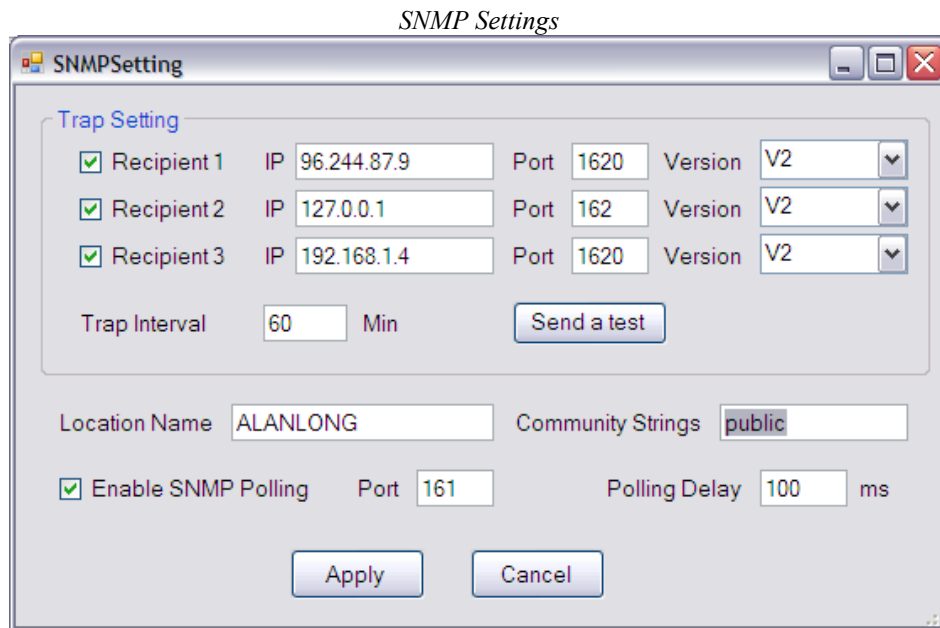
- Alltel**
- AT&T**
- Boost Mobile**
- Nextel**
- Sprint PCS (now Sprint Nextel)**
- T-Mobile**
- US Cellular**
- Verizon**
- Virgin Mobile**

Edit carriers for your cell phone provider in text file: C:\BatteryDAQ\Analyzer\mobilecarries.txt.

8.2.5 SNMP Settings

You may set up to 3 SNMP recipients.

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



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

<https://batterydaq.com/battery-analyzer-online-manual/>

9 BMS Installation Acceptance Report

Client Name:	Client Representative:
Installation Company:	Installer:
Site Name:	Site Address:
Battery Type/Model:	Capacity: Ah
DTU ID:	Sentry Monitor Model:
IP Address:	Sentry Serial No:
Cell Voltage: V	Battery Number in This String:
Bus Nominal Voltage: V	Designed Maximum Current: A

Alarm Threshold Settings

Alarm 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		
String Voltage Abnormal			
Ambient/Pilot Temperature			

Current and Temperature Measurement

Sensor model:	Calibration Offset:	Calibration Gain:		
	Current Test 1(open circuit)	Current Test 2	Ambient Temperature	Pilot Temperature
Meter Measured Value				
BMS Readout				
Pass \checkmark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Voltage Measurement

Voltage Offset:	Voltage Gain:
String Voltage Meter Readout:	BMS String Voltage:

Sample	1	2	3	4	5	6	7	8	9	10
Cell #										
Meter Readout										

BMS Readout										
Pass ✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Internal Resistance Measurement Comparing to Reference

Instrument name/model:	IR Calibration:
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Sample	1	2	3	4	5	6	7	8	9	10
Cell #										
Hand Meter Reference										
BMS Readout										
Pass ✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Installer Signature	Date
Client Signature	Date

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

