

# Mounting and Wiring

**Warning: Do not plug in cable 1 while doing installation. Verify cable number with terminal number for all 11 cables. Wrong connection may burn the PCB !!!**

**Unplug cable #1 to power off unit before servicing battery or opening any cell connection !!! The high reversed voltage presenting on a cell open can damage the circuit!**

## 1. Job Material Checklist

Bring all materials to the site for a variety of mounting methods.

#	Cat#	Name	Quantity	Check
<b>Unistrut and Hardware</b>				
11		Unistrut length (xx)	2+	<input type="checkbox"/>
12	ZCM1001/4-10	Cone Nut Steel ¼"	4+	<input type="checkbox"/>
13		¼" bolt 1-1/4" length		<input type="checkbox"/>
14	35020	Bonded Neoprene Washers ¼ x 5/8 IN O.D.		<input type="checkbox"/>
15	ZCM1001/2-10	Cone Nut Steel ½"		<input type="checkbox"/>
16		½" bolt 1-1/4" length		<input type="checkbox"/>
17		Washer 0.5" ID 1.5" OD		<input type="checkbox"/>
18		Self-Drilling Auto-perforantes #14 x 1-1/2"		<input type="checkbox"/>
19	SECB-B2-10	Unistrut End Cap for "B" Channel	4	<input type="checkbox"/>
<b>Concrete Wall Mounting</b>				
21		Tapcon 3/16" x 2-3/4 in. Hex-washer-head concrete anchor		<input type="checkbox"/>
22		Masonry Drill 5/32"		<input type="checkbox"/>
23	35020	Bonded Neoprene Washers ¼ x 5/8 IN O.D.		<input type="checkbox"/>
24				
<b>Harness and Wiring</b>				
31		Cable tier 4" [UV Resistant Flexible Nylon 295729]		<input type="checkbox"/>
32		Cable tier 11"		<input type="checkbox"/>
33				<input type="checkbox"/>
34		Cable polymer white labels (#1 to #12)		<input type="checkbox"/>
35	FSP-BLACKTC	Black Spiral wrapper ½"		<input type="checkbox"/>
36		5/16" bolt length 1" (for shunt connection)		<input type="checkbox"/>

37		Battery cable 10mm to 8mm (5/16") (for shunt connection)		<input type="checkbox"/>
38		Green/White 20AWG twisted wire (100FT for spare)		<input type="checkbox"/>
39		50 ft length 12P cable (for special case with long distance)	2+	<input type="checkbox"/>
<b>Spare Parts</b>				
41		10A fuses (spare)	10	<input type="checkbox"/>
42		500mA fuses (spare)	10	<input type="checkbox"/>
43		Temperature probe (spare)	2	<input type="checkbox"/>
44		Spare 12P 3.81mm plug	4	<input type="checkbox"/>
45		Spare 12P 3.50mm plug	4	<input type="checkbox"/>
46		3M stainless tape (spare)	5	<input type="checkbox"/>
47		SCY10-300Q (spare CT)	1	<input type="checkbox"/>

## 2. Tools Checklist

Battery tools are not specified here.

Bring all tools for to work on battery post, re-torque, and measure strap resistance after torquing.

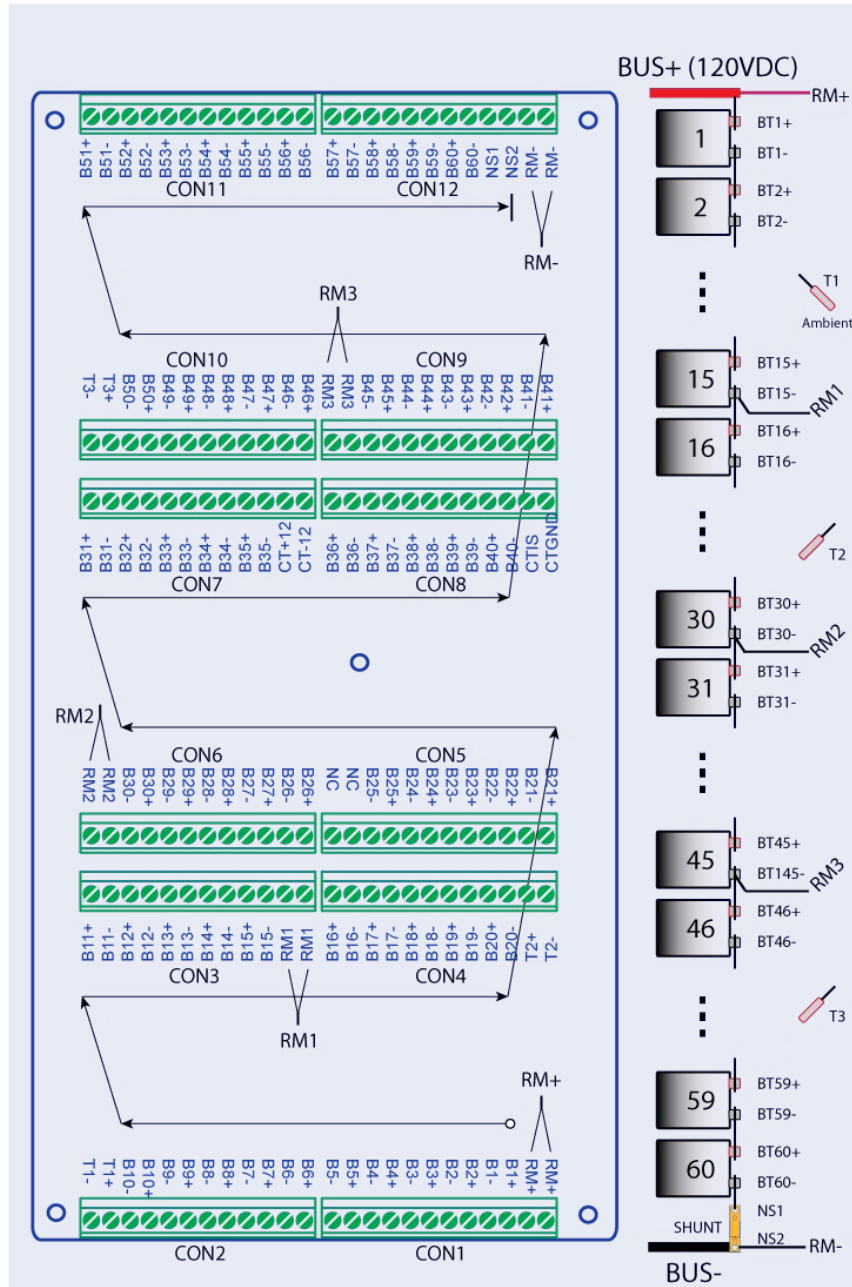
Arrange temporary battery if required for specific site.

Item	Name	Description	Check
<b>Mounting NEMA Box</b>			
11	NEMA Template	NEMA mounting template	<input type="checkbox"/>
12	Hand drill	Portable drill with proper bits, charger	<input type="checkbox"/>
13	Socket	3/8" socket (for #14 self-drilling screw)	<input type="checkbox"/>
14	Socket	7/16" socket (for 1/4" cap screw)	<input type="checkbox"/>
15	Wrench	Adjustable wrench (for 1/2" bolt)	<input type="checkbox"/>
16	Impact drill	Impact drill	<input type="checkbox"/>
17	Drill bit	Masonry drill bit	<input type="checkbox"/>
<b>Running Cables</b>			
21		Fishing cable (to pass through conduit)	<input type="checkbox"/>
22			
<b>Installing tab washer or O-ring leads</b>			
31		Insulated battery tools (not specified in this document)	<input type="checkbox"/>
32		Torque wrench	<input type="checkbox"/>
33			
<b>Crimping Leads</b>			
41	Butt crimper	STAKON ERG4001	<input type="checkbox"/>
42	Wire stripper	Wire stripper (with magnet)	<input type="checkbox"/>
43	Blade	Blades and blade holder	<input type="checkbox"/>
44	Tool Bag	Tool bag (modified with magnet)	<input type="checkbox"/>
45	Instruction Sheets	Wiring color instruction sheets (for 58x2V, 60x2V)	<input type="checkbox"/>
46	Screwdriver	2.5mm screwdriver	<input type="checkbox"/>
47	Screwdriver	3.0mm screwdriver	<input type="checkbox"/>
48	Ferrule Crimper	Ferrule crimper	<input type="checkbox"/>
49	Sharpie	Sharpie ultra-fine point (mark on label or cable)	<input type="checkbox"/>

### 3. Battery Connection Panel

The Sentry-6002 measurement unit connects to **battery posts**, **3 temperature probes** and **current transducer** via 12 multi-conductor (12C) cables. Please read this panel carefully to understand the name and purpose for each pin.

Choose the best and secure location to mount the NEMA box, so the cable length can be evenly spaced.

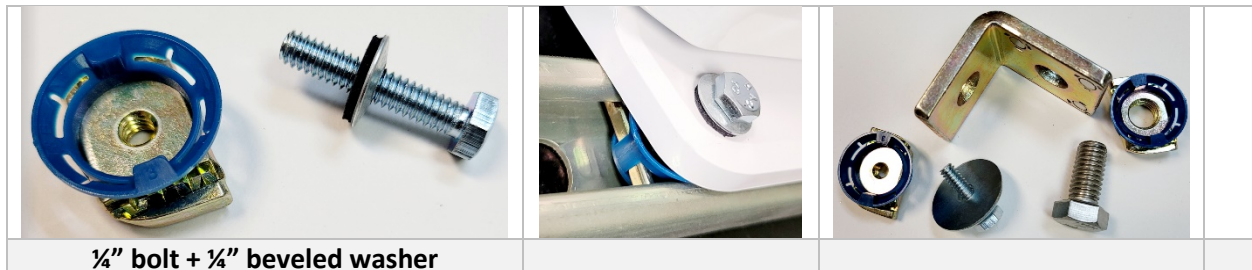
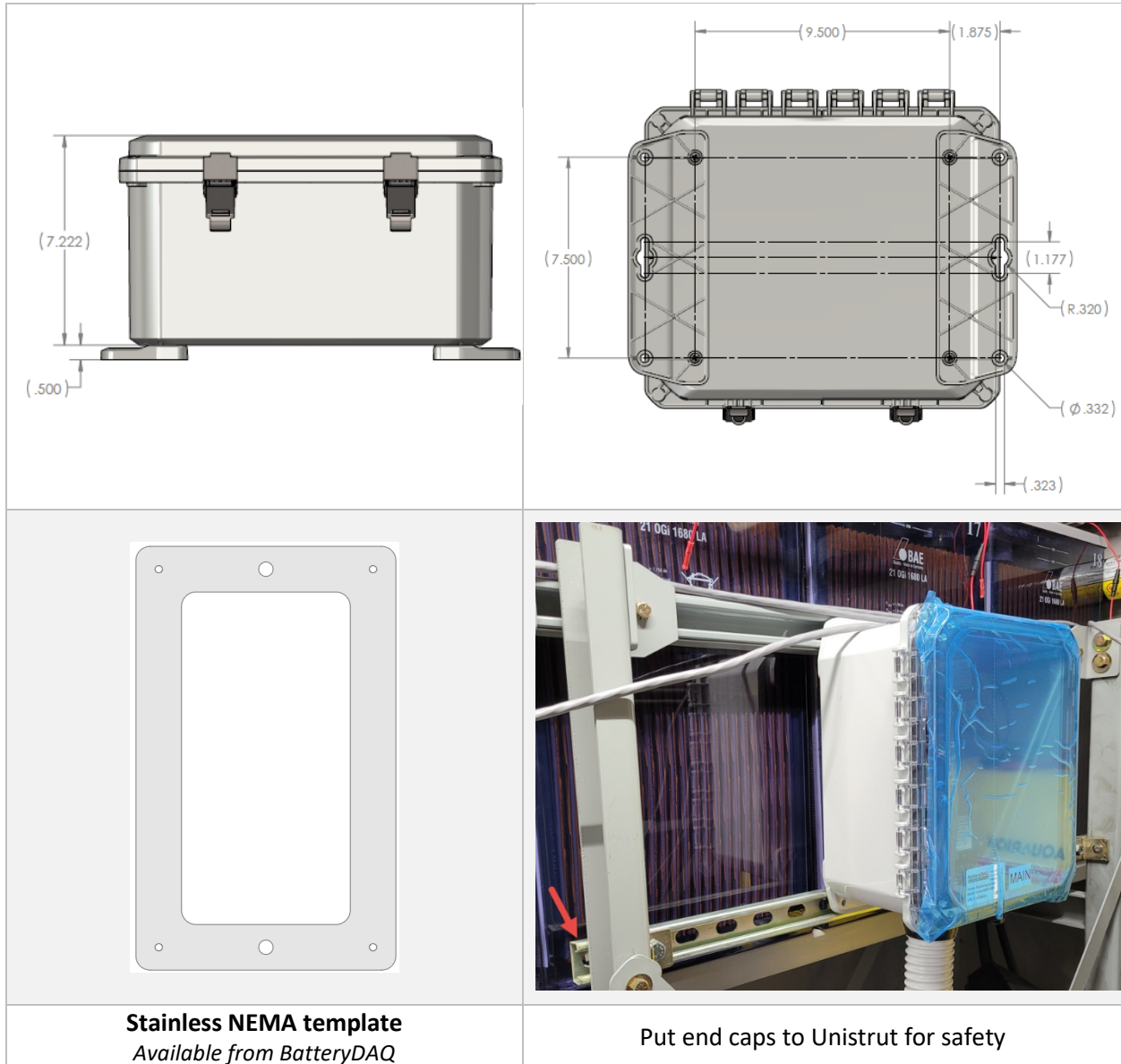


\* NS1 and NS2 are not utilized.

**Version 6 has a separate terminal for CT and Temperature.**

## 4. Mounting NEMA Box

Use NEMA mounting template (stainless steel) to align the Unistrut, or pre-drill precise holes on wall.



## Mounting Examples

Mounted on wall with Unistrut



Mounted on beam with Unistrut



Mounted on wall directly without Unistrut



## Installing Tab Washers or O-ring Leads

*This step requires to take battery offline.*

*Battery can be back to online after all leads are installed to battery posts and torqued.*

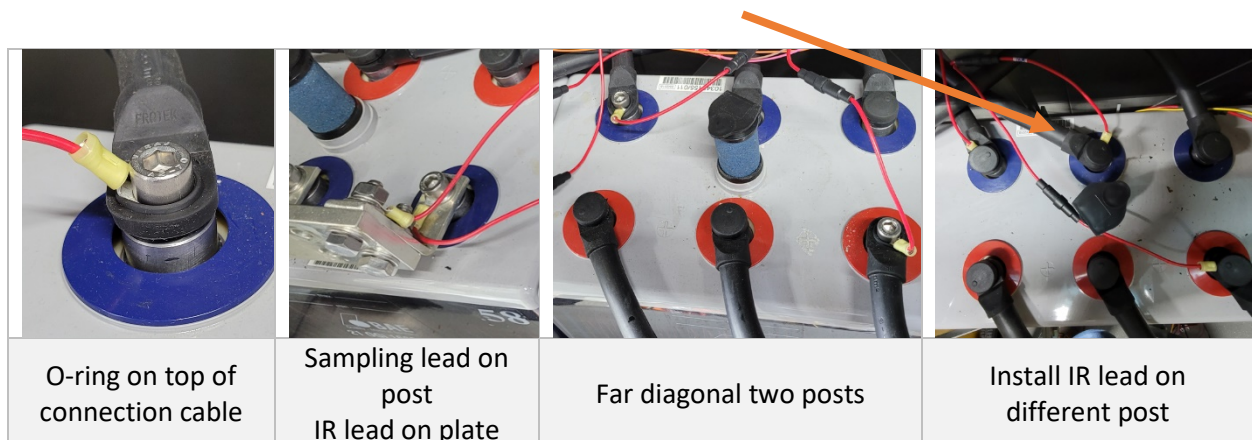
### 125V string

Besides sensing lead (500mA) on each battery (+) and (-), there are 5 RM leads (10A) for each string.

For single post batteries, put RM washer on top of sensing lead.

10A Fuse	RM+	RM1	RM2	RM3	RM-
58 x 2V Section 15 + 14 + 14 + 15	Bus plate Positive or BT#1+	BT#15-	BT29-	BT#43-	Bus plate Negative or BT#58-
60 x 2V Section 15 + 15 + 15 + 15	Bus plate Positive or BT#1+	BT#15-	BT#30-	BT#45-	Bus plate Negative or BT#60-

For batteries with multiple sets of posts, the sensing leads shall be installed to the far diagonal posts. For the battery with both sensing leads and RM lead, install RM lead to a different post.



O-ring on top of connection cable      Sampling lead on post      IR lead on plate      Far diagonal two posts      Install IR lead on different post

## Wiring color reference for 58x2V

Print out this page for field wiring. Check as you go. Section setting: **15+14+14+15**

Wire	Color	CB#1	✓	CB#2	✓	CB#3	✓	CB#4	✓	CB#5	✓	CB#6	✓
#1	BROWN	RM+	BUS+	B6+		B11+		B16+		B21+		B26+	
#2	RED	RM+		B6-		B11-		B16-		B21-		B26-	
#3	ORANGE	B1+		B7+		B12+		B17+		B22+		B27+	
#4	YELLOW	B1-		B7-		B12-		B17-		B22-		B27-	
#5	GREEN	B2+		B8+		B13+		B18+		B23+		B28+	
#6	BLUE	B2-		B8-		B13-		B18-		B23-		B28-	
#7	VIOLET	B3+		B9+		B14+		B19+		B24+		B29+	
#8	SLATE	B3-		B9-		B14-		B19-		B24-		B29-	
#9	WHITE	B4+		B10+		B15+		B20+		B25+		B30+	
#10	BLACK	B4-		B10-		B15-		B20-		B25-		B30-	
#11	TAN	B5+		T1+		RM1	1	T2+		NC		RM2	2
#12	PINK	B5-		T1-		RM1	5	T2-		NC		RM2	9
							-						-

Wire	Color	CB#7	✓	CB#8	✓	CB#9	✓	CB#10	✓	CB#11	✓	CB#12	✓
#1	BROWN	B31+		B36+		B41+		B46+		B51+		B57+	
#2	RED	B31-		B36-		B41-		B46-		B51-		B57-	
#3	ORANGE	B32+		B37+		B42+		B47+		B52+		B58+	
#4	YELLOW	B32-		B37-		B42-		B47-		B52-		B58-	
#5	GREEN	B33+		B38+		B43+		B48+		B53+		B59+	
#6	BLUE	B33-		B38-		B43-		B48-		B53-		B59-	
#7	VIOLET	B34+		B39+		B44+		B49+		B54+		B60+	
#8	SLATE	B34-		B39-		B44-		B49-		B54-		B60-	
#9	WHITE	B35+		B40+		B45+		B50+		B55+		NS1	
#10	BLACK	B35-		B40-		B45-		B50-		B55-		NS1	
#11	TAN	CT+12		CTIS		RM3	4	T3+		B56+		RM-	BUS-
#12	PINK	CT-12		CTGD		RM3	3	T3-		B56-		RM-	
							-						

T1: Ambient Temperature, mount to battery rack. T2: Pilot, mount to BAT#20. T3: Pilot, mount to BAT#50.

## Wiring color reference for 60x2V

Print out this page for field wiring. Check as you go. Section setting: **15+14+14+15**

Wire	Color	CB#1	✓	CB#2	✓	CB#3	✓	CB#4	✓	CB#5	✓	CB#6	✓
#1	BROWN	RM+		B6+		B11+		B16+		B21+		B26+	
#2	RED	RM+	BUS+	B6-		B11-		B16-		B21-		B26-	
#3	ORANGE	B1+		B7+		B12+		B17+		B22+		B27+	
#4	YELLOW	B1-		B7-		B12-		B17-		B22-		B27-	
#5	GREEN	B2+		B8+		B13+		B18+		B23+		B28+	
#6	BLUE	B2-		B8-		B13-		B18-		B23-		B28-	
#7	VIOLET	B3+		B9+		B14+		B19+		B24+		B29+	
#8	SLATE	B3-		B9-		B14-		B19-		B24-		B29-	
#9	WHITE	B4+		B10+		B15+		B20+		B25+		B30+	
#10	BLACK	B4-		B10-		B15-		B20-		B25-		B30-	
#11	TAN	B5+		T1+		RM1	1	T2+		NC		RM2	3
#12	PINK	B5-		T1-		RM1	5	T2-		NC		RM2	0
							-						-

Wire	Color	CB#7	✓	CB#8	✓	CB#9	✓	CB#10	✓	CB#11	✓	CB#12	✓
#1	BROWN	B31+		B36+		B41+		B46+		B51+		B57+	
#2	RED	B31-		B36-		B41-		B46-		B51-		B57-	
#3	ORANGE	B32+		B37+		B42+		B47+		B52+		B58+	
#4	YELLOW	B32-		B37-		B42-		B47-		B52-		B58-	
#5	GREEN	B33+		B38+		B43+		B48+		B53+		B59+	
#6	BLUE	B33-		B38-		B43-		B48-		B53-		B59-	
#7	VIOLET	B34+		B39+		B44+		B49+		B54+		B60+	
#8	SLATE	B34-		B39-		B44-		B49-		B54-		B60-	
#9	WHITE	B35+		B40+		B45+		B50+		B55+		NS1	
#10	BLACK	B35-		B40-		B45-		B50-		B55-		NS1	
#11	TAN	CT+12		CTIS		RM3	4	T3+		B56+		RM-	
#12	PINK	CT-12		CTGD		RM3	5	T3-		B56-		RM-	BUS-
							-						

T1: Ambient Temperature, mount to battery rack. T2: Pilot, mount to BAT#20. T3: Pilot, mount to BAT#50.

All voltage sensing leads to battery posts are using 500mA fuses. 5 IR leads are using 10A fuses.

Battery	Section	5 RM leads, 10A fuses
55x2V	14+14+14+13	RM+ (2-wire) on positive plate or BAT#1+ post. RM-(2-wire) on Negative plate or BAT#55- post. RM1 (2-wire) on BT#14-. RM2 (2-wire) on BT#28-. RM3 (2-wire) on BT#42-.
58x2V	15+14+14+15	RM+ (2-wire) on positive plate or BAT#1+ post. RM-(2-wire) on Negative plate or BAT#58- post. RM1 (2-wire) on BT#15-. RM2 (2-wire) on BT#29-. RM3 (2-wire) on BT#43-.
60x2V	15+15+15+15	RM+ (2-wire) on positive plate or BAT#1+ post. RM-(2-wire) on Negative plate or BAT#60- post. RM1 (2-wire) on BT#15-. RM2 (2-wire) on BT#30-. RM3 (2-wire) on BT#45-.

Current Transducer	CT+12V, CT-12V, CTIS, CTGD to Current Transducer 4-wire (Red/White/Green/Black).
Temperature Probes	T1+, T1- for ambient temperature T2+, T2- for pilot temperature for first half of string, attach to any cell #1 to #30. T3+, T3- for pilot temperature for 2 <sup>nd</sup> half of string, attach to any cell #31 to #60.

NC is not connected. (Spare wire, replace broken wire.)

NS1 and NS2 are not connected.

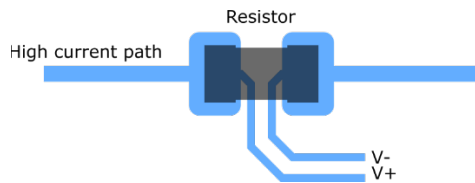
**Version 6 has a separate terminal for CT and Temperature.**

Pin	10	9	8	7	6	5	4	3	2	1
Name	T0	T0	T1	T1	T2	T2	SGBD	IS	-12V	+12V

\*Version 6 uses PT1000 probe, no direction.

## Critical Leads Positions

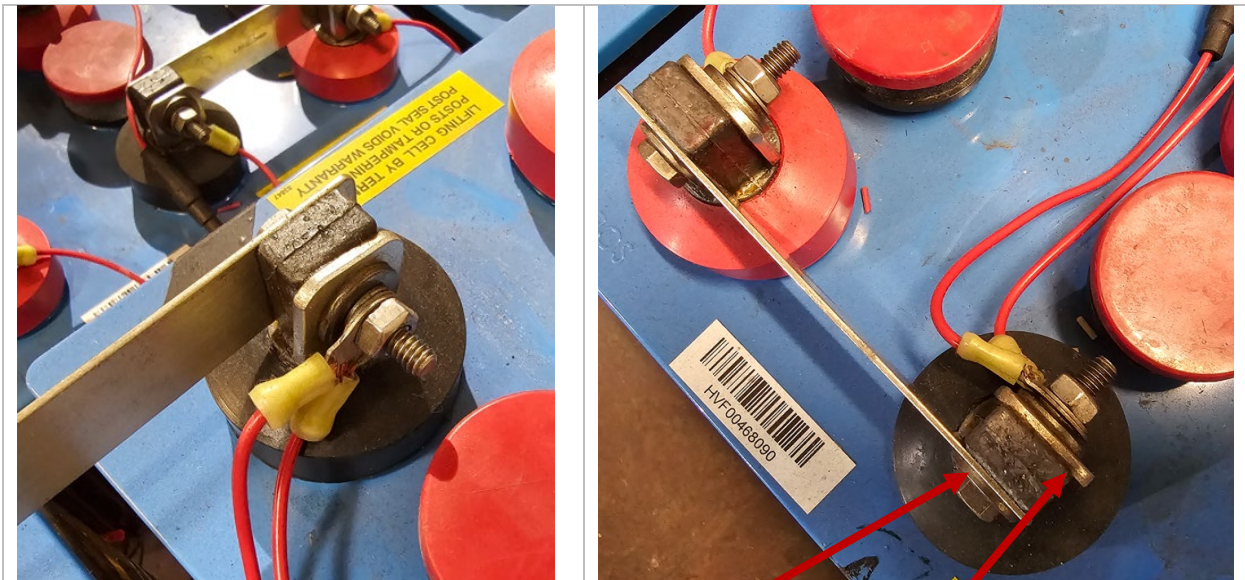
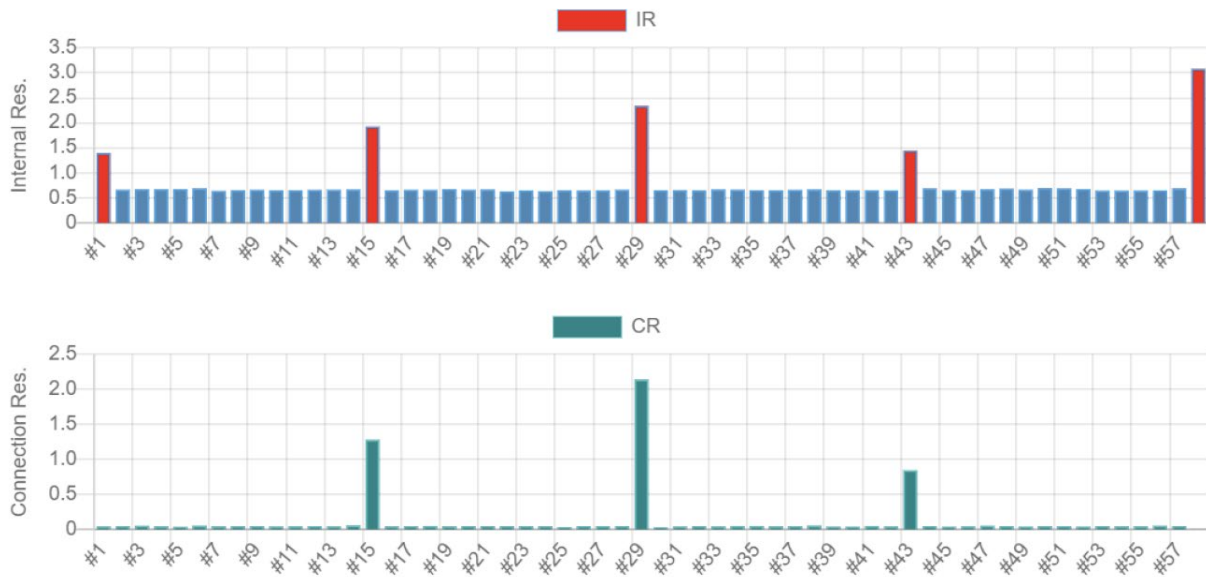
Sentry unit utilizes the **four-terminal sensing** method for precise measurement of internal resistance and connection resistance. The RM leads act as two current terminals and signal is picked up by sensing leads. Please evaluate the actual battery connections and choose the correct position for leads hooking up.



**Correct Connections** will guarantee the measurement precision. RM leads (10A) are on top of sensing leads, and sensing leads has direct contact with battery posts.



**Wrong Connection** will generate huge reading errors.



In above photos, the IR leads are on top of sensing leads (which is correct.) BUT the sensing leads are not in direct contact with battery posts. There is a stainless-steel square washer in between which has very high resistance. For other posts, because there is no current passing through the stainless washer, the accuracy is not affected by small resistance.

**Correction:** re-install the 5 k $\Omega$  leads, put the sensing leads between the stainless-steel washer and battery post, or on the other side of post. If the O-ring size is not long enough, change to a tab washer and QDC lead. Connections for other sensing leads are correct, no changes.

## Wire color for 48V string

There are 3 RM leads (10A) for each string.

	BUS+	MID	BUS-
<b>23 x 2V</b>	Positive plate	Batt#12-	Negative plate
<b>24 x 2V</b>	Positive plate	Batt#12-	Negative plate

For **23 x 2V**, the last channel (B24+ B24-) is not connected.

Wire	Color	CB#1	✓	CB#2	✓	CB#3	✓	CB#4	✓
#1	BROWN	B1+		B7+		B13+		B19+	
#2	RED	B1-		B7-		B13-		B19-	
#3	ORANGE	B2+		B8+		B14+		B20+	
#4	YELLOW	B2-		B8-		B14-		B20-	
#5	GREEN	B3+		B9+		B15+		B21+	
#6	BLUE	B3-		B9-		B15-		B21-	
#7	VIOLET	B4+		B10+		B16+		B22+	
#8	SLATE	B4-		B10-		B16-		B22-	
#9	WHITE	B5+		B11+		B17+		B23+	
#10	BLACK	B5-		B11-		B17-		B23-	
#11	TAN	B6+		B12+		B18+		24+	
#12	PINK	B6-		B12-		B18-		B24-	

**Attention:** Battery #1 is at the most **positive** of a string. It is important to note that some battery banks may be labeled as reverse order. In such case, a secondary label must be applied to match the battery cell data. Connecting the batteries in reverse order will prevent Sentry-2402 from powering up, but it will not cause any damage to the circuit. You may start with a new set of (4) 12-pin 3.50mm terminals to migrate each wire to correct terminal position, instead of swapping battery leads.

## Cable Arrangement and Wiring

### Pass cable through flex pipe

	Description	Check
1	Cut the pipe to shorter if not needed to pass through wall. (2 ft for battery rack installation).	
2	Pass one cable at a time from #1, run it to proper location, then next cable.	
3	Pass through conduit between two battery racks. There might be wires in one cable need to split among two racks.	

### Cut cable to length

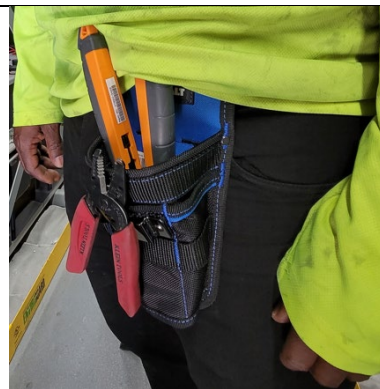
	Description	Check
1	Leave a service loop (2ft) for each cable, reach to the far battery for max length	
2	Split cable with blade (only need a gentle cut on skin)	

### Crimp butt to wire as color sheet

	Description	Check
1	Power unit on with external power, HMI shall work by now	
2	Unplug 4P Power and 8P RM (to avoid circuit damage with wrong wiring)	
3	Match each wire to color and length, cut off excess length, strip 10mm, crimp to butt	
4	As you do with connecting more batteries to harness, HMI shall read cell voltage, switch page on HMI as you go	



Color sheet



Tools



Tools

## CT Installations

### Install split core hall CT

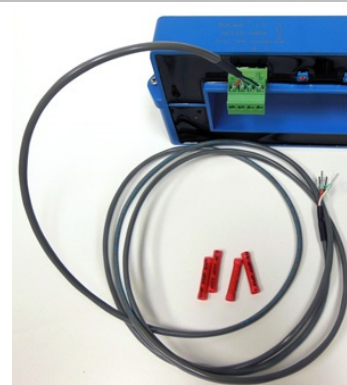
The arrow direction is the same as charging current.



Secure CT with cable ties.

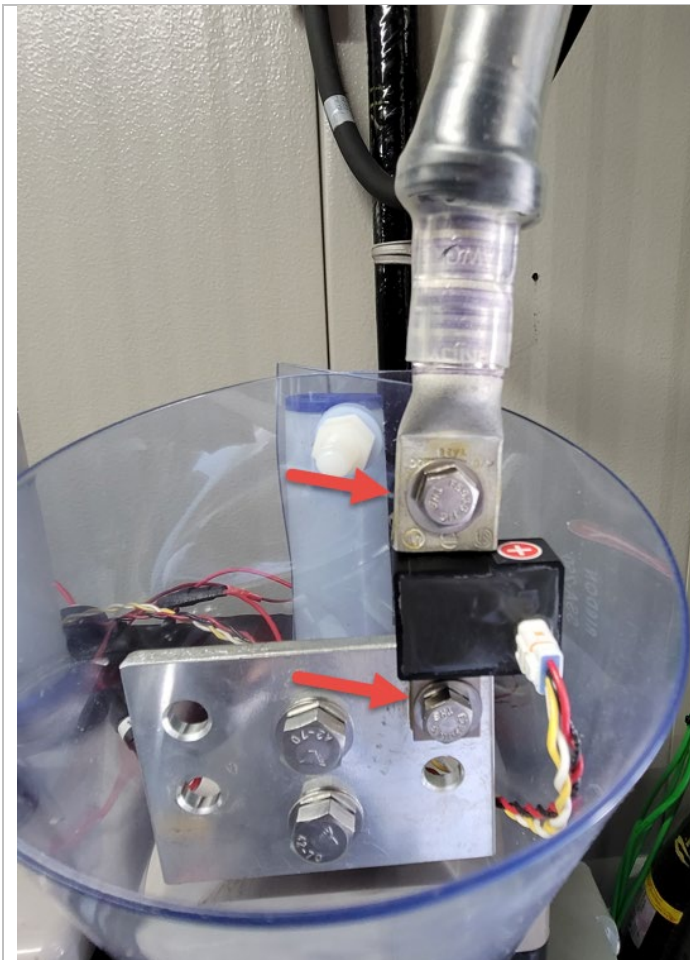


Arrow direction is the charging current direction, from BAT+ to BAT-.



Butt and cable

### Install shunt CT



Install Shunt CT on terminal plate.  
Direction is the same as charging current.

5/16" hardware

#### Calibration

- 1) Measure on shunt body (not on bolts) with high resolution mV, read out 0.01mV (Fluke 87V) or 0.001mV (Fluke 287)
- 2) Actual float current for SSA-250 =  $x.xxx \text{ mV} / 0.175 \text{ milliohm}$   
Example **1.75mV for 1.0A**
- 3) Calibrate current **offset** with HMI to actual value

**(Do NOT change CT gain)**

**Default Shunt CT gain 1530, ripple gain 1600**

**If replaced with 300A Hall CT, change CT gain to 585, ripple gain to 600.**

Verify and correct wiring

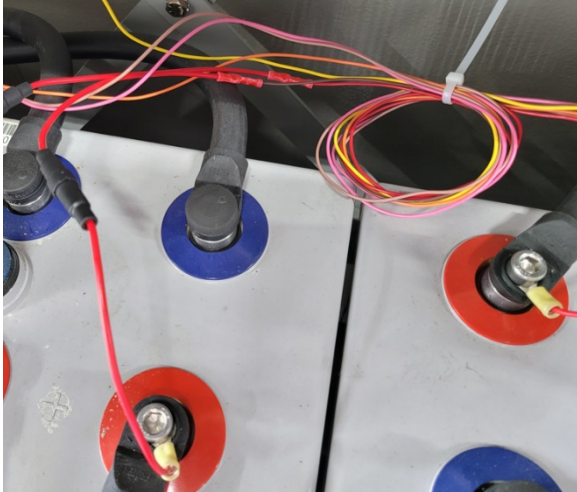
**Do not plug in cable 1 while doing installation. Verify cable number with terminal number for all 11 cables. Wrong connection may burn the PCB !!!**

**Unplug cable #1 to power off unit before service battery or open any cell connection !!!**

	Description	Check
1	Voltage shall be all correct, shall not have any negative voltage	<input type="checkbox"/>
2	String voltage shall be correct	<input type="checkbox"/>
3	Check sections, use multi-meter voltage measurement, measure voltage to confirm correct connections. RM- to RM3, RM- to RM2, RM- to RM1, RM- to RM+. Voltage shall be increasing $\frac{1}{4}$ of string for consecutive section.	<input type="checkbox"/>
4	Take off external power adapter. Plug back power connector to DTU.	<input type="checkbox"/>
5	Plug back 8P	<input type="checkbox"/>
6	Unplug Cable#1, Plug back 4P to the top corner, then plug cable#1, unit is now powered by battery.	<input type="checkbox"/>

Organize wires and cables

	Description	Check
1	When all data is correct, organize wires and cable for a clean job.	<input type="checkbox"/>
2	Seal 2" flex tubing end with electric tape	<input type="checkbox"/>
3	Seal 0.75" fitting with rubber plug if not used	<input type="checkbox"/>
4	Seal Ethernet through hole with plug if not used	<input type="checkbox"/>



More photos

