



SMI-100 Stack Monitoring Interface Installation & Operation Manual



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For the latest product documentation, visit <http://aquionenergy.com/documentation> or email us at info@aquion-energy.com.

Warnings in This Document



WARNING

WARNING indicates a hazardous situation that, if not avoided, could result in death or injury.



CAUTION

CAUTION indicates a situation that, if not avoided, could damage equipment.

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1 Introduction

1.1 About This Manual

This manual provides technical information and safe practices regarding receiving, installing, operating, and servicing the Aquion Energy SMI-100 Stack Monitoring Interface.



WARNING: Failure to follow the instructions in this document could result in fire, electric shock, and/or other injury or damage.

1.2 Contact Information

Mail: Aquion Energy
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Web: <http://aquionenergy.com>

1.3 Aquion Products



Battery Stack: Smallest unit of Aquion's Aqueous Hybrid Ion (AHI™) batteries. In most cases, battery stacks must be connected to a SMI-100 to be monitored by a BMS-200.



Stack Monitoring Interface (SMI-100): Enclosed sensing board that measures the voltage, current, and temperature of battery stacks and relays that data to the BMS-200.



Battery Monitoring System (BMS-200): System that parses and processes the data from the battery module sensing board or the SMI-100. The BMS-200 then stores the processed data for access by the site controller on request.

2 Product Information

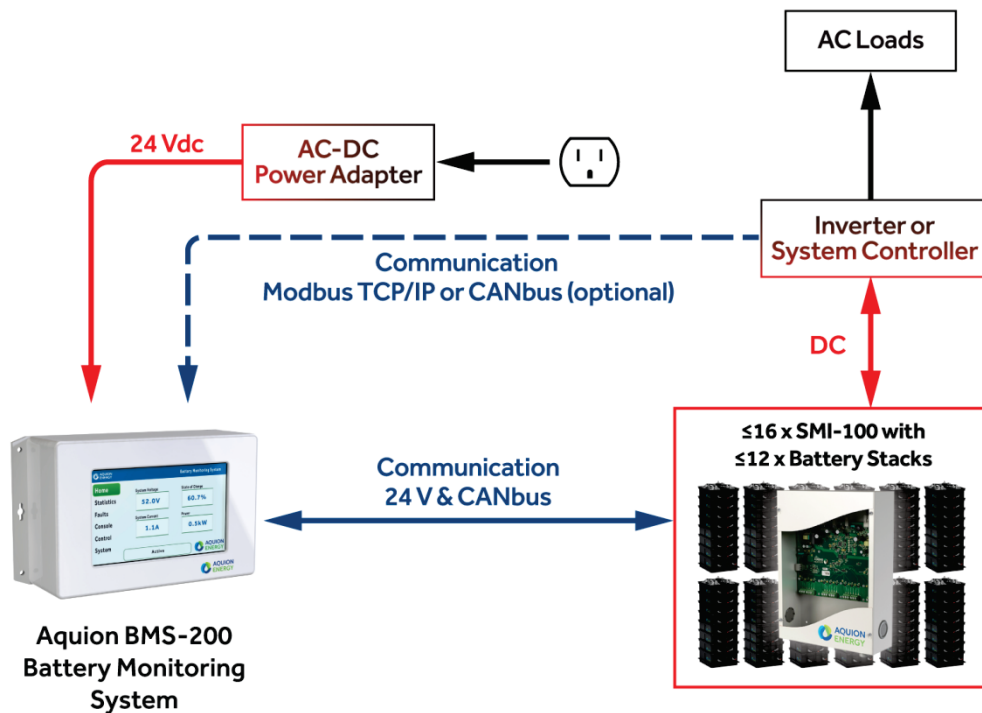
Any hard goods, weights, and dimensions in this document are estimates and are subject to updates and changes. This includes any connectors, pin outs, or other similar materials. Upon any updates or changes to the above described material, Aquion will provide new drawings and/or associated documentation, which will supersede those contained in this document.

Estimated performance characteristics are based on testing by Aquion Energy. Performance may vary depending on use conditions and application. Aquion Energy makes no express or implied warranties with this estimated technical information. Contents subject to change without notice.

2.1 Product Compatibility and Overview

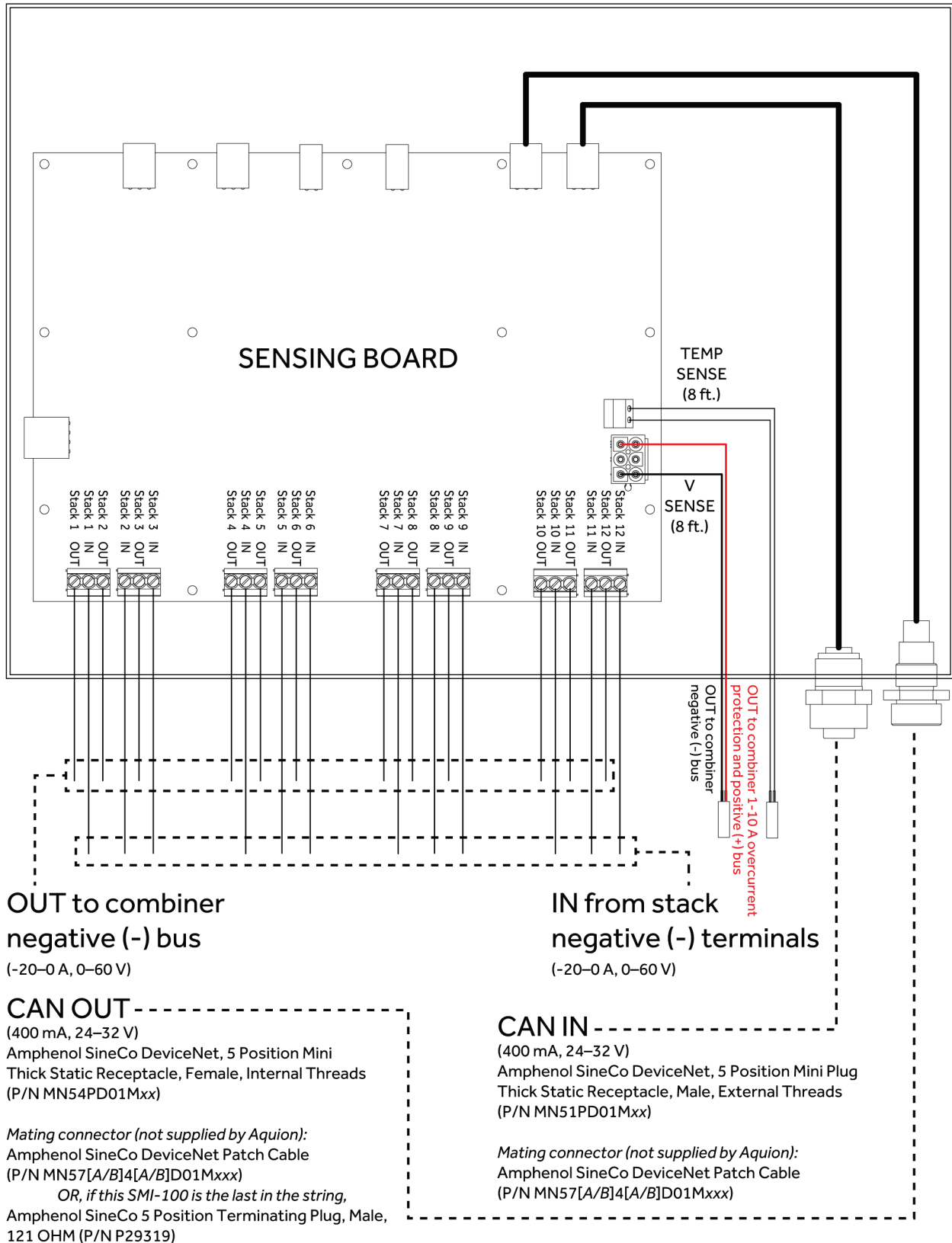
Aquion Energy's SMI-100 measures and collects the current, voltage, and ambient temperature of connected Aquion batteries. The SMI-100 is compatible with Aquion's Aspen 48S, S30, and S20-P battery stacks. For simplicity, this manual refers to them as *batteries*, *stacks*, or *battery stacks*. For instructions on monitoring Aquion battery models not listed, contact Aquion Technical Support (see Section 5).

The SMI-100 transmits the measurements to a master BMS-200, which uses this information to determine the batteries' state of charge (SOC), faults, current, voltage, and ambient temperature. See the BMS-200 Installation & Operation Manual, available at <http://aquionenergy.com/documentation>, for more information.



Typical BMS-200 configuration with SMI-100

2.2 SMI-100 Parallel Wiring Diagram

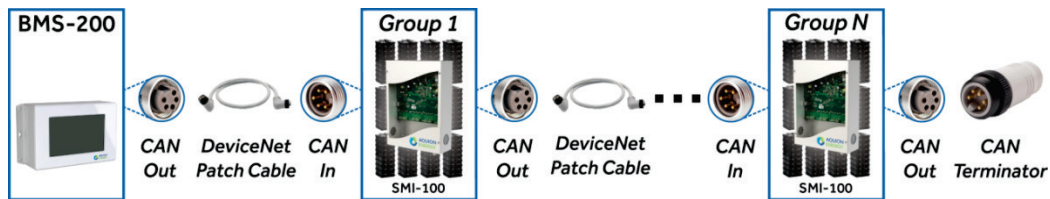


2.3 Product Specifications

For more information on the SMI-100, download its Product Specification Sheet. See your Aquion battery's product manual for full guidance on receiving, installing, and operating Aquion batteries. Product documentation is available at <http://aquionenergy.com/documentation>.

2.4 Communications Overview

The SMI-100 connects to the BMS-200 using Amphenol SineCo DeviceNet cordsets. Aquion supplies one DeviceNet cordset with each SMI-100. The entire battery system's CANbus must be terminated with a 120-ohm CAN terminator. Aquion supplies one CAN terminator with every BMS-200.



2.5 Safety, Precautions, and Warnings

Only qualified individuals are to install and service battery systems. If the SMI-100 is used in a manner not specified by this manual, the protection provided by the equipment may be impaired. Up to 16 SMI-100 units can be connected in a string that communicates with the BMS-200. Never connect more than 16 SMI-100 units to a single BMS-200, as this may draw too much current, blow the internal BMS-200 fuse, and damage the BMS-200.



WARNING: Do not connect the SMI-100 to batteries in a series configuration. Fire, serious injury, or death could result.

2.6 Electromagnetic Compatibility

2.6.1 FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

2.6.2 CE

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

3 Shipping and Receiving

3.1 Delivery Inspection

Immediately upon delivery, inspect all hard goods for signs of damage during transit, such as damaged enclosure or connectors, before signing for the delivery. Thoroughly document all instances of product damage on the bill of lading before accepting the shipment, and make a claim with the carrier as soon as possible. Contact Aquion immediately for further support (see Section 5).

3.2 Contents of Shipment

Each SMI-100 shipment includes four (4) items:

1. One (1) SMI-100 unit



2. One (1) temperature sensor (3 ft., installed)



3. One (1) set of voltage sense wires (1 red, 1 black, 10 ft., installed)



4. One (1) DeviceNet patch cable (2-m cordset, straight connectors, Amphenol P/N MN57A4AD01M020)
The patch cable provides CANbus connection between the SMI-100 and BMS-200.



3.3 Test for Hidden Damage

Within 10 days of receipt, test the SMI-100 units to confirm their normal operation. Doing so requires a complete set up of the BMS-200, including connection to all SMI-100 units. Be sure to have all required accessories available.

1. Follow Section 4.4 of the BMS-200 manual to power the BMS-200 and connect and address all SMI-100 units. The SMI-100 units do not need to be connected to battery stacks, combiner boxes, or any power control electronics.

-----COMPLETE BMS-200 SET-UP BEFORE CONTINUING TO STEP 2 BELOW -----

2. Once the BMS-200 has been set up and has rebooted to the Home screen, go to the Faults screen (see Section 5.2 of the BMS-200 manual) and confirm that "Lost String Communications" is green (i.e., no fault in string communications). This confirms that the SMI-100 units are sending data to the BMS-200. Ignore any other faults.

The hidden damage test is complete. Disconnect the DeviceNet cables, CAN terminator, and BMS-200 power supply. Turn off the system inverter before disconnecting the SMI-100 (see Section 4.5).

If the SMI-100 units do not function properly, contact Aquion Technical Support (see Section 5). You may need to request an inspection by the carrier and file a hidden damage claim. Do not delay this step. Delay may result in a loss of right of reimbursement for hidden damages.

4 Installation and Configuration

The SMI-100 is designed for simple hardware installation and configuration.

4.1 Site Requirements

Environmental specifications must be followed to optimize the performance of Aquion AHI batteries.

4.1.1 Exposure and Enclosure

The SMI-100 should be installed indoors or otherwise protected from the elements.

Install, operate, and store the SMI-100 out of direct exposure to sunlight. Exposure to sunlight can cause material degradation and potential failure of the SMI-100.

4.1.2 Dryness

Install the SMI-100 in dry, clean, ordinary conditions. Direct exposure of the SMI-100 to water ingress may cause shorting. The unit may be installed in humid or coastal regions with atmospheric salt.

4.1.3 Ambient Temperature

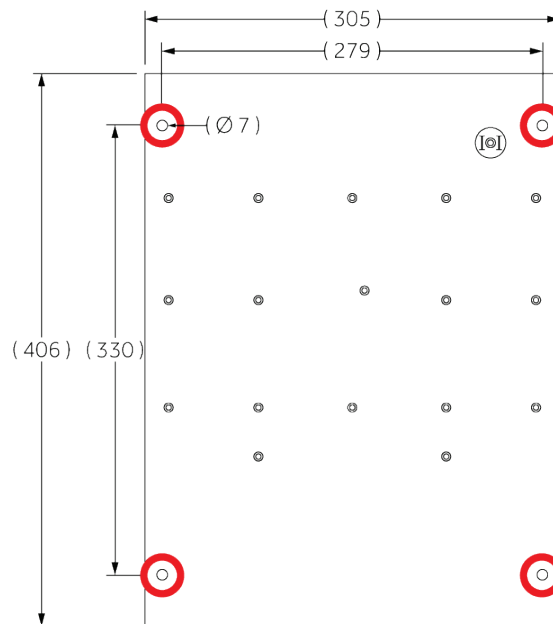
The SMI-100 must be operated in temperatures between -5°C and 40°C . The SMI-100 must be stored in temperatures between -5°C to 50°C .

4.1.4 Altitude

The SMI-100 is rated for operation at altitudes up to 2,000 m.

4.2 Hardware Installation

The SMI-100 should be mounted to a wall with standard drywall anchors and screws via the mounting holes shown below. Ensure that the installation location allows access to the unit for disconnection.



All dimensions in millimeters.

4.3 Electrical Interfaces and Connections

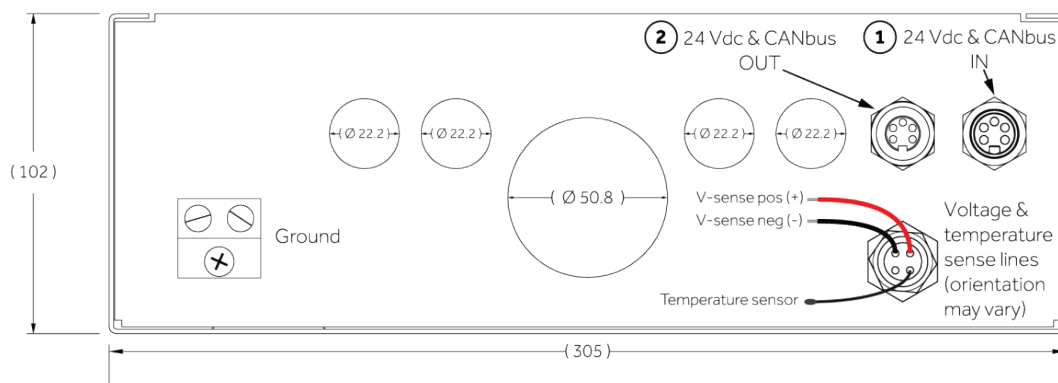


CAUTION: Only negative wires of the battery stacks should be run into or out of the SMI-100.

The SMI-100 measures stack currents via inline Hall effect current sensors. The negative wire from each stack goes into the corresponding STACKIN terminal block of the SMI-100. A separate negative wire per stack exits the corresponding STACKOUT terminal block and goes to the combiner box.

The supplied black (-) and red (+) voltage sense wires come pre-installed. They connect to the negative (-) and positive (+) buses of the combiner box. The positive (+) wire must connect to the positive (+) bus through an overcurrent protection device rated for 1-10 A and 14 AWG wire. Ensure that the combiner box can accommodate this device. Follow all applicable local electrical codes.

The temperature sensor comes pre-installed. The SMI-100 uses it to calculate the batteries' precise capacity and state of charge. The temperature sensor should be placed within 1 foot of the stacks to allow for accurate ambient temperature measurement.



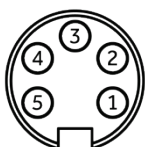
All dimensions in millimeters.

① Vdc & CANbus In



Function: Provides power and CANbus communication

Part: Amphenol SineCo DeviceNet MN51PD01M005 Male Receptacle, External Threads



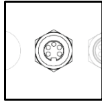
Pin #	Name	Wire Color	Description
1	CAN_GND	Bare	Isolated CAN Ground
2	24V_LOGIC_POS	Red	24 V Logic Positive
3	24V_LOGIC_NEG	Black	24 V Logic Negative
4	CAN_H	White	CAN High Signal
5	CAN_L	Blue	CAN Low Signal

Mating connector: Amphenol SineCo DeviceNet MN57[A/B]4[A/B]D01Mxxx* Patch Cable (one provided per SMI-100)



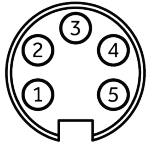
* Additional patch cables are available from Amphenol distributors (http://www.amphenol-sine.com/Distributors_c_108.html). In the part number, "A" refers to the straight connector style: the first "A" refers to the female connector, the second, the male. Right-angle connectors, indicated by the letter "B," may also be used. Aquion recommends straight connectors for SMI-100 connections, but choose

② Vdc & CANbus Out



Function: Provides power and CANbus communication

Part: Amphenol SineCo DeviceNet MN54PD01M005 Female Receptacle, Internal Threads



Pin #	Name	Wire Color	Description
1	CAN_GND	Bare	Isolated CAN Ground
2	24V_LOGIC_POS	Red	24 V Logic Positive
3	24V_LOGIC_NEG	Black	24 V Logic Negative
4	CAN_H	White	CAN High Signal
5	CAN_L	Blue	CAN Low Signal

Mating connector: Amphenol SineCo DeviceNet MN57[A/B]4[A/B]D01Mxxx Patch Cable (one provided per SMI-100)



Terminating connector: 120-ohm Terminator P29319, Male (one provided per BMS-200)

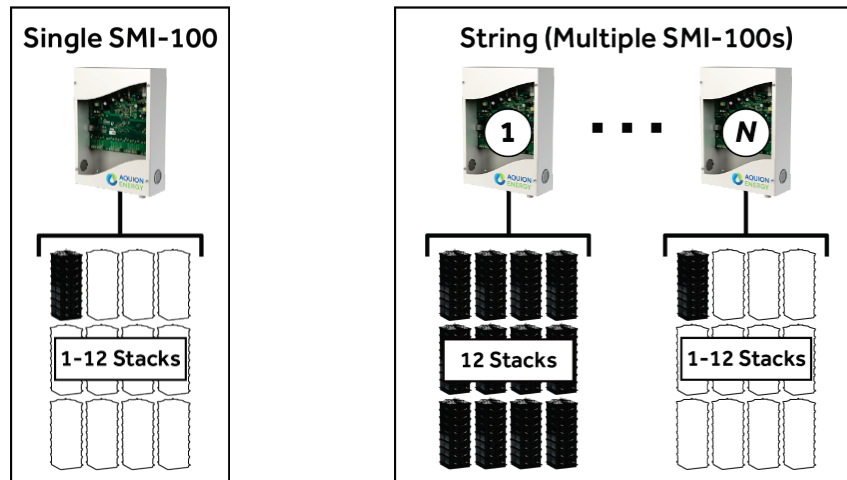


4.4 Set-up Instructions



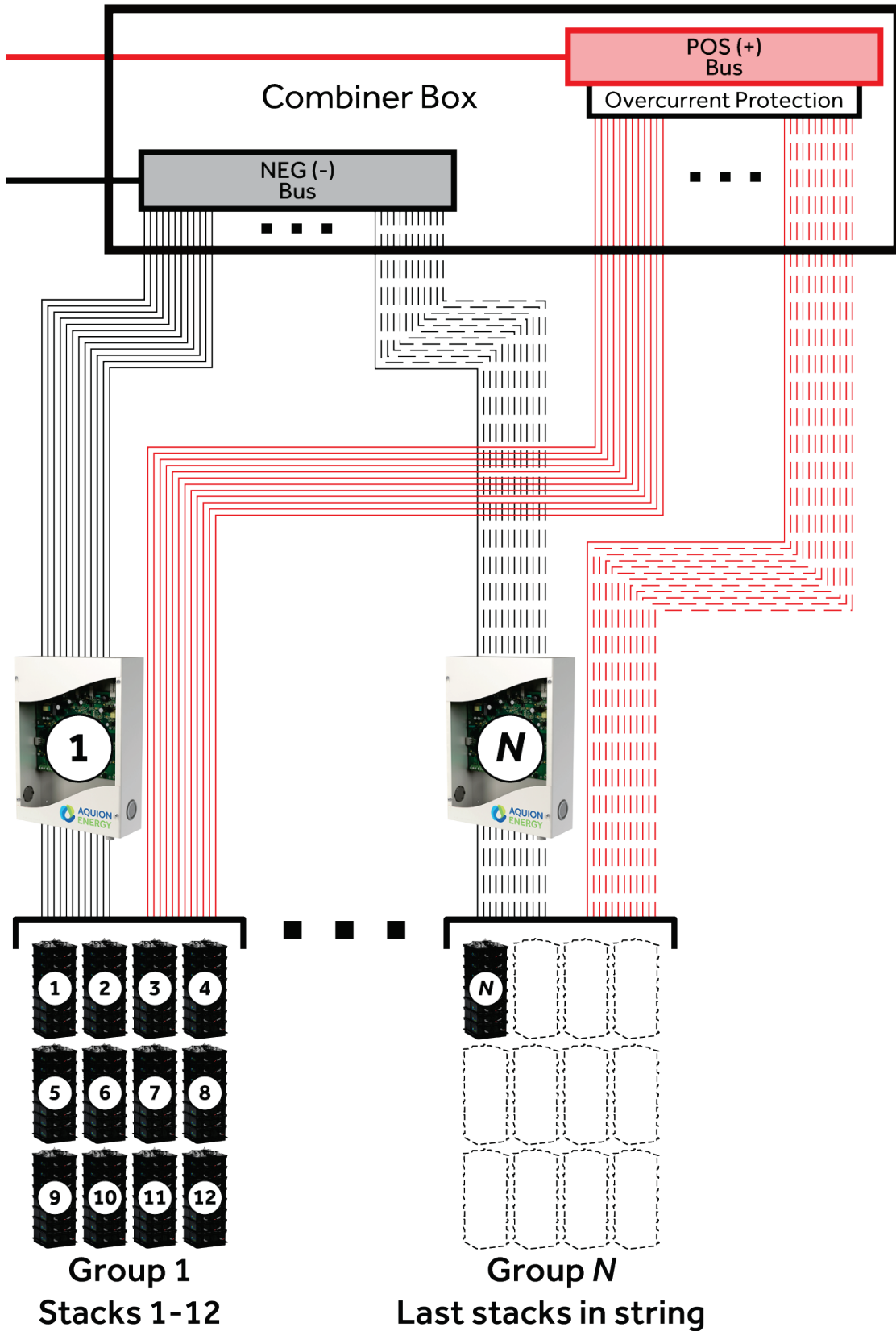
CAUTION: Set up the SMI-100 as shown below before connecting it to a BMS-200.

A single SMI-100 not in a string with other SMI-100 units may be connected to between 1 and 12 battery stacks. Each SMI-100 in a string of multiple SMI-100 units must be connected to groups of 12 battery stacks, except for the final SMI-100 in the string, which may be connected to fewer than 12 battery stacks.



Tip: Numbering and labeling each battery stack sequentially will make it easier to connect the correct battery stack's negative wire to the corresponding terminal block in the SMI-100. Doing so will also make servicing the system easier.

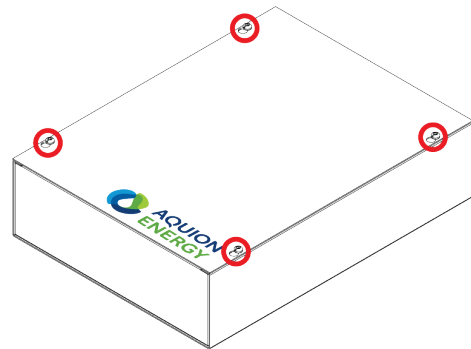
the appropriate connector style for your installation. "xxx" refers to cable length, which is determined by your installation's requirements.



Example system. Install according to local electrical codes.

1. Remove the front face plate of the SMI-100 enclosure.

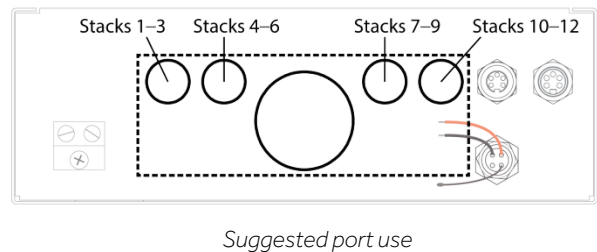
- a. Loosen the four screws securing the face plate. The screws do not need to be removed.
- b. Slide the face plate up so that the screw heads are inside the larger, circular portion of the keyhole mounting holes.
- c. Lift the face plate over the screw heads and off the enclosure.



2. Remove any plugs covering ports through which you will run wiring.

From inside the enclosure, raise any tabs holding the plug in place and push the plug out.

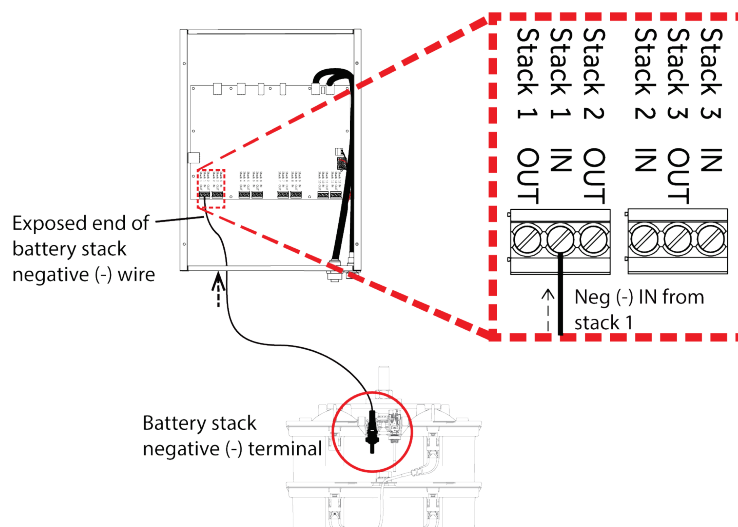
Tip: Running a stack's wiring through the small port closest to the corresponding stack's terminal blocks will help keep the wiring organized. However, any enclosure ports may be used.



3. Insert the exposed end of the negative (-) wire from battery stack 1 through the selected port and into the terminal block marked "STACKIN1."

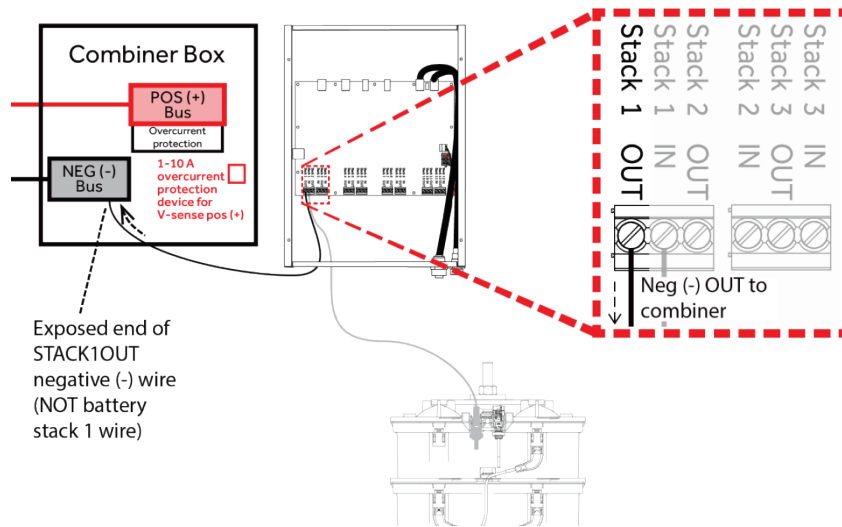
Using a small screwdriver, loosen the terminal block screw. Insert the exposed end of the negative (-) wire through the opening below the screw. Tighten the screw.

The other end of this wire will connect to the negative (-) terminal of battery stack 1.



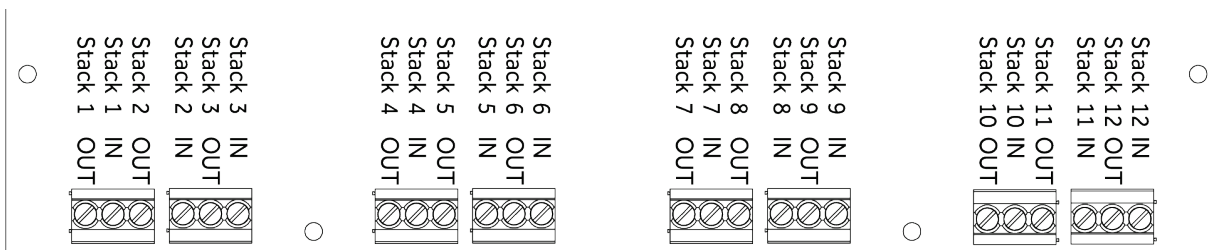
4. Insert the exposed end of a separate negative (-) wire through the selected port and into the terminal block marked "STACKOUT1."

The other end of this wire will connect to the combiner's negative (-) bus.



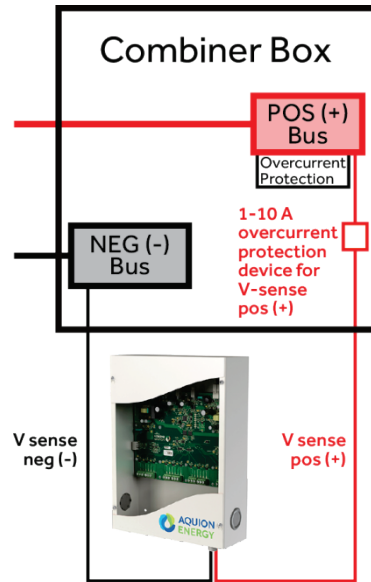
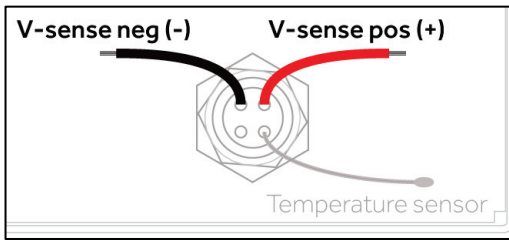
5. Repeat steps 3 and 4 for each remaining battery stack.

Be sure to run only negative wires through the terminal blocks. Carefully follow the "STACKIN" and "STACKOUT" markings above the terminal blocks.

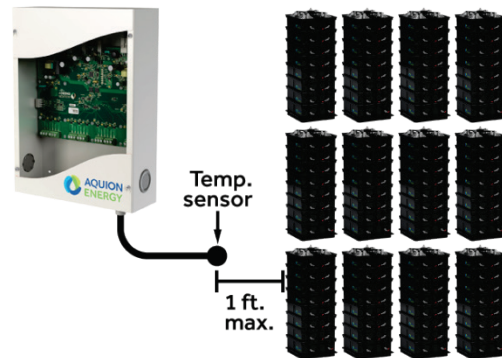
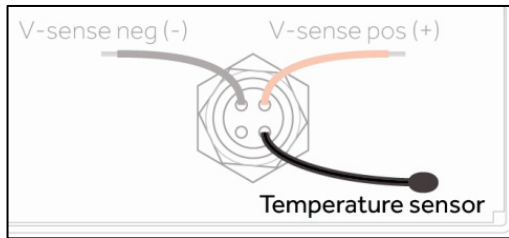


6. Connect the supplied voltage sense wires to the combiner box. Follow local electrical codes.

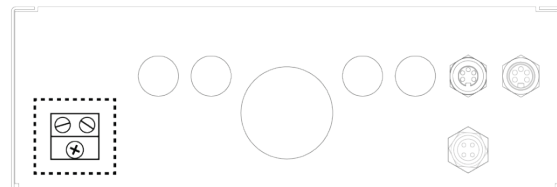
- a. Connect the exposed end of the red, positive (+) voltage sense wire to an overcurrent protection device rated for 1–10 A and 14 AWG wire. The device should be connected to the positive (+) bus of the combiner.
- b. Connect the exposed end of the black, negative (-) voltage sense wire to the negative (-) bus of the combiner.



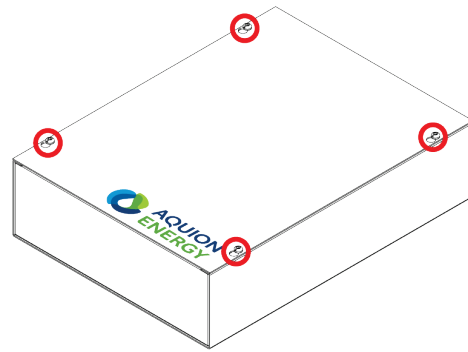
7. Position the end of the supplied temperature sensor wire so that it remains within 1 foot of the connected battery stacks.



8. Ground the SMI-100 as required by local code.



9. Replace the front face plate of the SMI-100 enclosure.



10. Follow the instructions in Section 4.4 of the BMS-200 manual to complete the set-up and configuration of your SMI-100, battery stacks, and BMS-200.

Download the BMS-200 manual at <http://aquionenergy.com/documentation>.

4.5 Disconnection



WARNING: Turn off the system inverter before disconnecting the SMI-100.
Disconnecting the SMI-100 with the inverter on poses a risk of arcing or electric shock.

Once the inverter is off, SMI-100 CANbus and power cables may be disconnected in any order.

5 Technical Support

If you need technical support, visit us on our website at <http://aquionenergy.com>.

If you purchased your products from an authorized Aquion Energy dealer, please contact the dealer for assistance.

If you require immediate assistance AND if you purchased your products directly from Aquion Energy, call our support line at +1 412.904.6400. Please have your Aquion Energy order number ready.