Eagle Eye Power Solutions, LLC

BMS-icom

Battery Monitoring System for 48V

Installation Manual 062918

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Contents

1. Introduction

Thank you for choosing Eagle Eye Power Solution's BMS icom. The BMS icom is designed to monitor and analyze the aging status of up to (24) cells (4) jars by measuring and recording:

- **STRING:** Voltage & Current
- **JAR / CELL:** Voltage, Internal Resistance, Connection Resistance & Temperature

The BMS icom comes complete with the battery management software package that allows ALL battery systems to be monitored 24 hours a day, 365 days a year via remote computer(s). This software offers the most comprehensive battery diagnosis and reporting capabilities to ensure the integrity of your critical battery backup.

BMS *icom* MPU

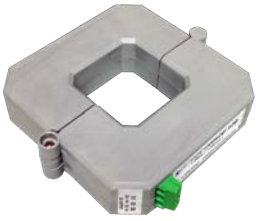
2. Safety Overview

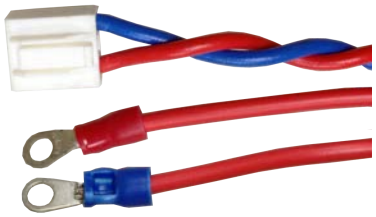
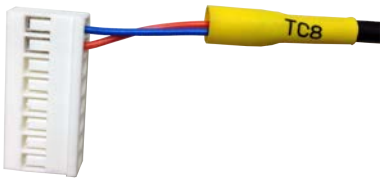
Eagle Eye Power Solutions is not responsible for personnel safety issues.

- Only qualified personnel with proper tools and equipment should work on battery systems.
- To avoid damage and injury due to the short circuiting of battery terminals, wrap insulated tape around all metallic-conducted parts. This is not necessary for the installation tool area.
- Do not wear metallic items such as jewelry and watches while working around batteries. Be sure to use insulated gloves and goggles when handling batteries.
- Ensure an installation supervisor is on hand when connecting the BMS and battery post to avoid fire or personal injury.
- Make all personnel fully aware of safety guidelines.

3. Package Contents

The following parts come standard in the BMS icom package. Each package will come with either O-Type clamps or C-Type clamps.

Part Name & Purpose	Picture
BMS icom Main body of the unit.	
C-Type Clamp Clamp used for connection to bus bars.	
O-Type Clamp Clamp used for connection to cables.	
Clamp Cover: C-Type Placed over clamp PCB	
Clamp Cover: O-Type Placed over clamp PCB	
CT Clamp Measures current	

Power Cable (3-Pin) Positive(+) red Negative(-) blue	
Temperature Cable (8-pin) & Sensors Measures temperature of battery posts	
Voltage Sensing Cable (6-pin) Measures voltage (Vs)	
Current Sensing Cable (4-pin) Measures current (Is)	
Temperature Sensors	

4. Required Tools

Tool Name & Purpose	Picture
Multimeter Verification of connection voltage & resistance	
#1 Phillips Screwdriver BMS clamp installation	
(2-3 mm) Flathead Screwdriver Termination of sensing cable to clamps	
Wire Stripper (16, 22 AWG req.) Adjustment of cable length	
Crimp Tool Crimp temp sensors to cable	
Cable Ties Cable management	

5. Installation Instructions

The following steps will provide the correct workflow for installing the BMS icom battery monitoring system and all of its components to a battery string.

Step 1: Mount BMS Unit

Parts:	BMS MPU, mounting hardware (not included)
Tools:	Drill, screwdriver

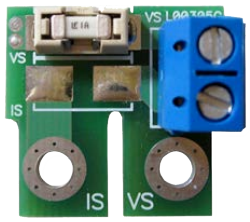
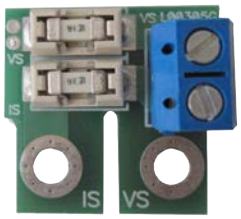
Mount the BMS icom close to the batteries which it will monitor using the mounting brackets on the side of the unit.

Step 2: Clamp Setup

Parts:	O-Type and/or C-Type Clamps
Tools:	Phillips screwdriver

The BMS uses two different types of clamps based on the battery connection. C-Type clamps are used for batteries connected by bus-bar; O-Type clamps for batteries connected by cable.

Connector Type	
	
C-Type for Bus-bar	O-Type for Cable

Board Type	
	
Voltage (1 fuse)	Voltage + Current (2 fuse)

There are two board types for clamps: voltage and voltage+current. The voltage clamp reads voltage whereas the voltage+current clamp reads voltage in addition to resistance. The connection pattern for the clamps is as follows:

Connection Number	Clamp Type
1	Voltage+Current
2	Voltage
3	Voltage+Current
4	Voltage
5	Voltage+Current

(1) Prepare for Connection

1. Organize clamps based on type and verify that all clamps are present
2. Ensure all intercell connections are secure and torqued to spec

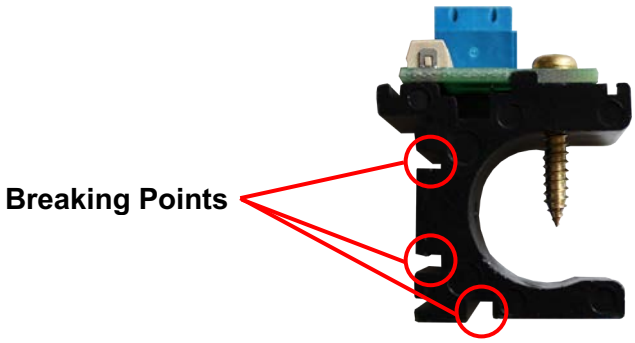
(2) Connection of Clamps (C-Type)

1. Place the clamp in the center of the bus-bar and tighten down using the provided screws
2. If the bus-bar has a cover, cut out an area so the cover sits snugly against the clamp
3. Attach additional clamps, be sure all clamps are facing the same direction

C-Clamp on Busbar

(3) Connection of Clamps (O-Type)

1. Place clamp in center of cable and tighten sensing screw into the cable
2. Ensure that the screw has penetrated sufficiently into the cable
   NOTE: If the cable is too large for the clamp it can cut down to accommodate the size
3. Attach additional clamps, be sure all clamps are facing the same direction



Step 3: Sensing Cable Connection

Parts:	Clamps, clamp covers, voltage sensing cables, current sensing cables
Tools:	Phillips screwdriver, 2-3mm flathead, duct, duct tape, cable ties/zip ties, wire cutter, wire stripper (22 AWG)

(1) Connection Order

There are two sensing cables, voltage and current, which connect to the clamps. Each cable has a number of sensing leads which are color coded to help with installation. The connection order for the sensing cable leads is:

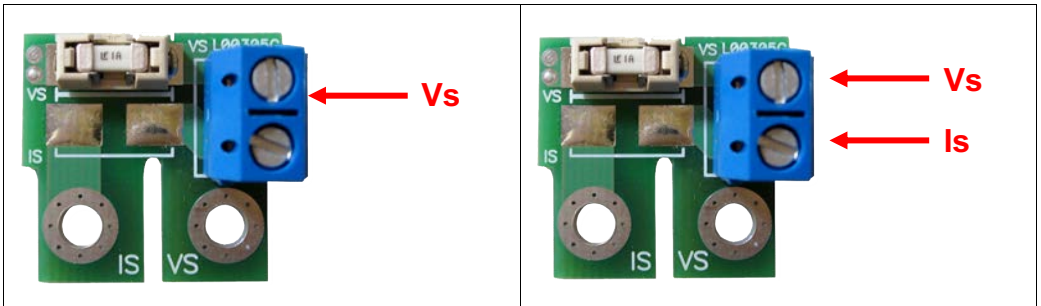
Connection of Vs & Is Leads		
Connection	Voltage	Current
Clamp 1	Grey	Black
	Battery 1	
Clamp 2	Green	
	Battery 2	
Clamp 3	Blue	Red
	Battery 3	
Clamp 4	Orange	
	Battery 4	
Clamp 5	Brown	White

NOTE: Total sensing cable length should be as short as possible to decrease noise, if cable length is longer than needed, shorten its length (see step 2)

WARNING: Do not plug connectors for any cable into BMS icom until all sensing leads have been connected to the clamps on the battery string

(2) Connect Sensing Leads to Clamps

1. Observe carefully which slot on the board is used for each cable.



Voltage Board	Voltage+Current Board

2. Insert the end of the sensing lead into the correct slot following the sequence in the “Connection of Vs & Is Leads” table above
3. Using a 2-3mm flathead driver, tighten the screw down all the way until you can firmly pull on the sensing lead without it coming out
4. Place protective covers over the clamps

Step 4: Control Power Cable

Parts:	Control Power Cable, C-Clamp (if applicable)
Tools:	Phillips driver, cable/zip ties

The BMS icom is powered by the batteries which it is connected to. The control power cables are also used to monitor string voltage.

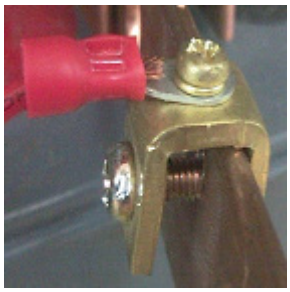
(1) Remove Fuses

1. Each control power cable has a fuse built in.
2. Remove each fuse prior to connecting cables to the batteries

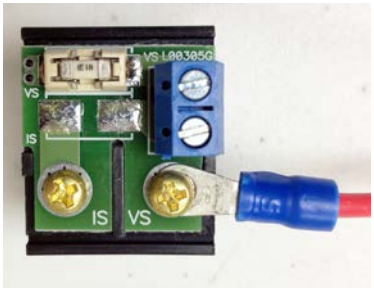
1A Fuse in Holder

(2) Verify Connection Location

1. Determine the best place to connect the control power cables
2. If using bus-bar connections, use the c-clamp to connect to the bus-bar
3. If using cable connections, connect directly to the post



C-Clamp for Control Power Cable



O-Clamp for Control Power Cable

(3) Connect Control Power Cables

1. Connect the red positive (+) cable to the most positive connection of the battery string
2. Connect the blue negative (-) cable to the most negative connection of the battery string.

NOTE: The connector for both cables is colored red, ensure that the correct colored cable is connected to the correct polarity of the string

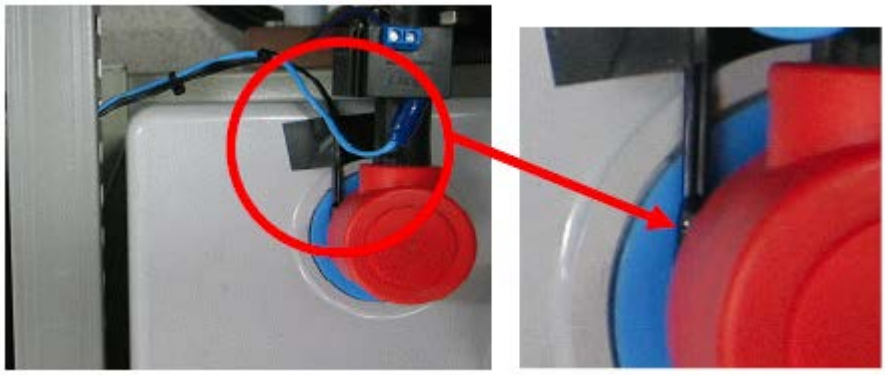
Step 5: Temperature Cable

Parts:	Temperature sensors, TS cable
Tools:	Tape, silicone

Each BMS unit comes standard with (2) temperature sensing leads. The lead is used to measure temperature near the battery post.

(1) Place Temperature Leads

1. Place the temperature lead near the negative post of each jar/cell
2. Adhere the lead as close to the post as possible using tape or hot glue
3. If possible, place the lead under a cover or in a tight place as close to the post as possible



Secure Temperature Lead

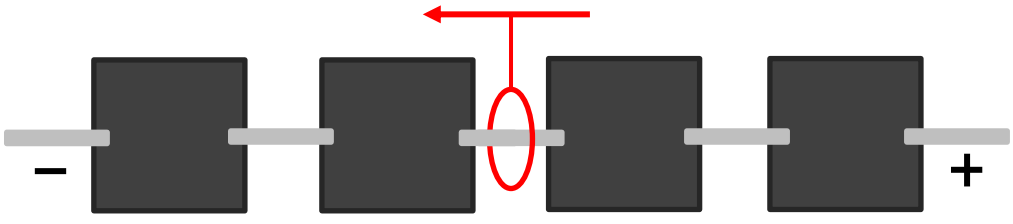
Step 6: Connect Current Clamp

Parts:	CT, CT cable
Tools:	Phillips screwdriver

The CT is used to measure the flow of current passing through the battery string.

(1) Attach Current Clamp

1. The CT can be placed anywhere on the battery string
2. The clamp hook is labeled with a small arrow, connect the clamp so that the arrow is pointing from positive to negative



Current Flow

Step 7: Verify Connections

Parts:	Sensing Cables, Clamps
Tools:	Multimeter or voltmeter

Before plugging cable connectors into the MPU, be sure to check each connection using a multimeter.

(1) Check Voltage & Current Sensing Connections

1. With the connector end of the cable in hand, insert the positive lead from the multimeter into the grey port
2. Insert the negative test lead into the green port
3. The Multimeter should display the same voltage as jar 1

Test Connection between Clamp 1 & Clamp 2

4. Move the negative test lead down the connector and verify each connection
5. The final connection (brown) should read the total voltage of the string

Test Connection for Entire String

(2) Troubleshooting Incorrect Voltage

1. If voltage is incorrect, connections will need to be checked
2. Set the Multimeter to measure resistance and test the connection between the sensing screw and the sensing cable
3. If the Multimeter displays zero resistance (0.00Ω) then the connection is good. If the connection has resistance, replace the fuse (1A)

Check to Verify Fuse

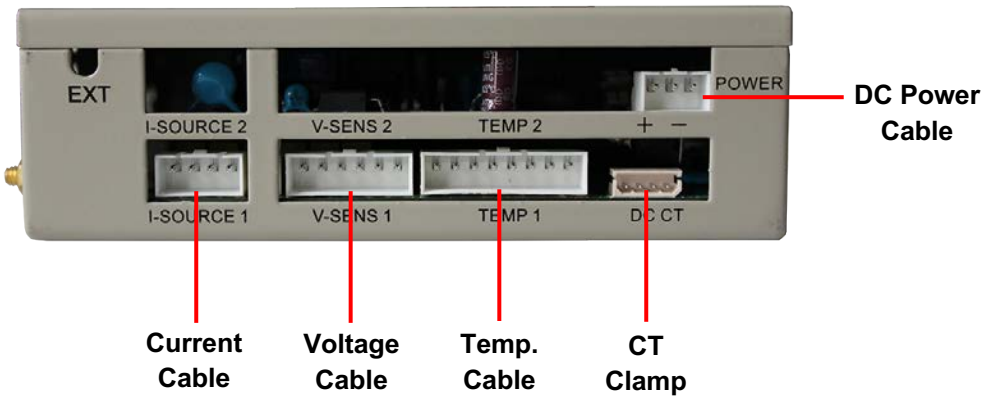
Step 8: Connect Cables to MPU

Parts:	BMS MPU, Cables Connected to Batteries
Tools:	N/A

With all cables connected to the batteries and verified for correct voltages, they can be connected to the MPU.

(1) Plug Connectors to MPU

1. Connect the current, voltage, and temperature cables
2. Connect current clamp
3. Connect the control power cable



6. Communication Setup

The BMS icom can communicate directly to a server PC or over a network for remote monitoring of battery systems. The following steps will provide the correct workflow for connecting the BMS icom to a PC or network.

Step 1: Cable Connection to Computer/Network

Parts:	BMS MPU, Ethernet Cable
Tools:	N/A

The MPU communicates directly to a computer or network using TCP/IP over Ethernet cable connection.

(1) Connect Ethernet Cable to BMS

1. Plug the Ethernet cable into the TCP/IP port on the side of the MPU
2. Do not use the RS-232 or RS-485 ports for communication
3. Connect the other end of the Ethernet cable to the computer or network
4. Flip the power switch to “ON”

Step 2: Configure MPU IP

Parts:	BMS MPU, Computer
Tools:	N/A

For communication, the BMS MPU needs to be assigned an IP address. Use the provided WIZ100SR configuration utility to establish connection. This configuration tool can be found on the provided USB drive.

Connection steps will vary depending on whether or not the BMS is connecting to a network or directly to a computer.

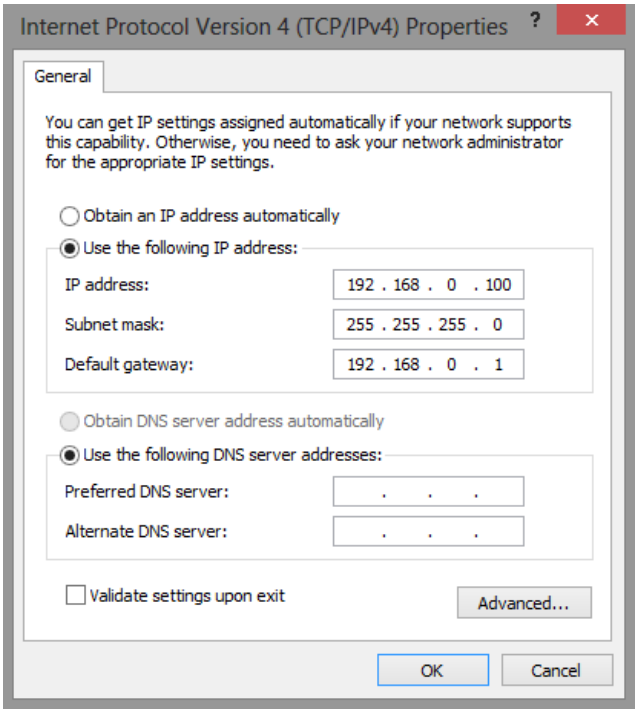
(1) Determine Computer and Network IP

A. Direct Connection to Computer

1. Disable the computer's firewall or open ports 9000, 9001
2. Set a static IP as shown below

B. Connection to Network

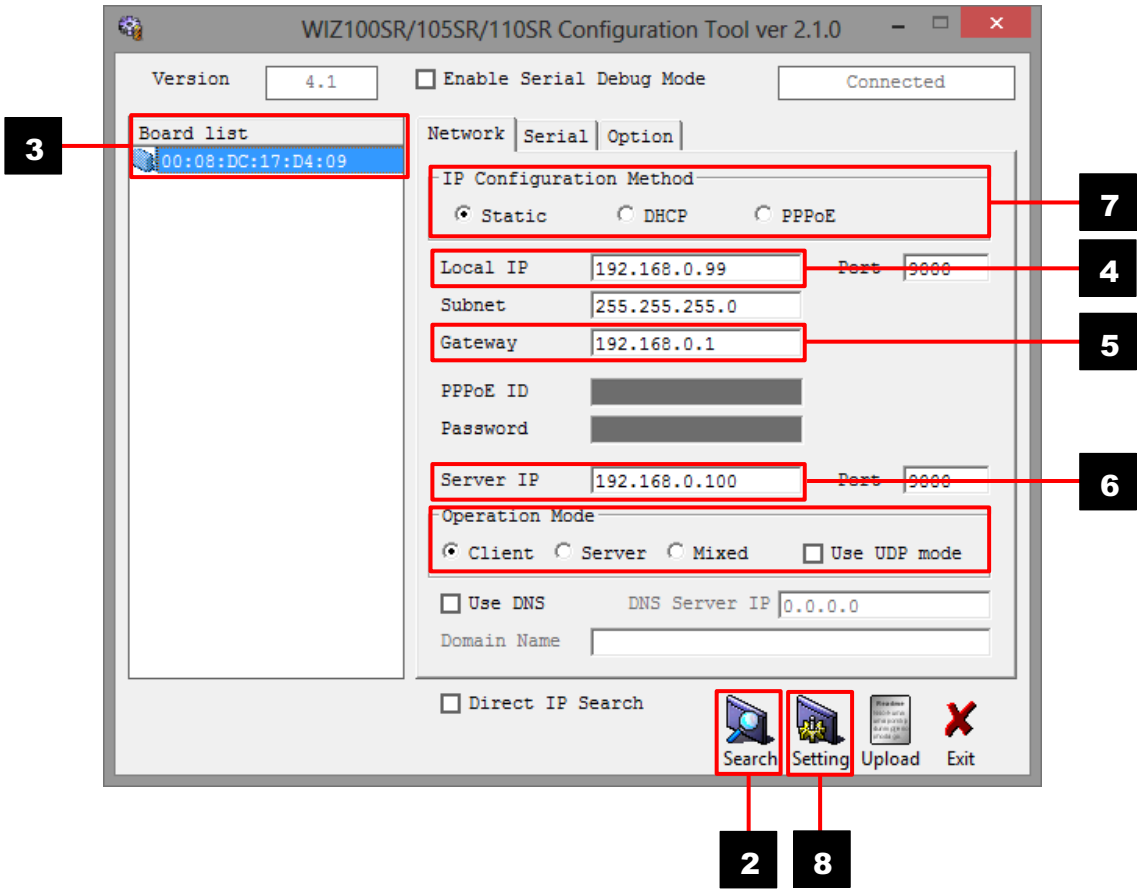
1. Contact the network administrator computer and server IP
2. Disable firewall



Static IP Settings

(2) Configure MPU IP Address

1. Launch “WIZ1x0SR_105SR_CFG.exe”
2. Click “Search” to locate the MPU
3. The MPU MAC address will appear under “Board List”
4. Local IP refers to the MPU IP address. To change the IP, enter it in this field
5. “Gateway” refers to the Network’s IP address
6. “Server IP” refers to the IP address of the server computer (computer with Centroid Snet)
7. Ensure “Operation Mode” is set to “Client” and “IP Configuration Method” is set to “Static”
8. Click “Setting” to save the settings



Step 3: Configure Centroid Snet

Parts:	BMS MPU, Computer
Tools:	N/A

To setup the BMS icom in Centroid Snet 2 battery management software, please refer to the software manual for steps to configure.

7. Specifications

Battery Types:	VLA, VRLA
Battery Capacity Range:	Up to 6000 Ah
Cell Voltage:	1 – 16 VDC
Accuracy:	DC Voltage / Current: ±0.5% / ±1% Temperature: ±2% Internal Resistance: ±2% Cell Voltage: ±1%
Resolution:	AC Voltage / Current: 0.1 V / 0.1 A DC Voltage / Current: 0.1 V / 0.1 A Cell Voltage: 10 mV Internal Resistance: 0.001 Ω Temperature: 0.5 °C
Test Speed:	3 – 4 seconds per cell
Test Load:	<2 A per cell
Measuring Interval:	Adjustable from 5 min to 24 hours (voltage & resistance)
Data Transfer:	TCP/IP (proprietary protocol)
Bandwidth Use:	Less than 3 Kbps peak
Operating Environment:	Temperature: 0 – 50 °C (32 – 122 °F) Relative Humidity: Under 80% RH
Power Requirements:	~44 VDC (from connected batteries)
Connections:	Ethernet, RS-232, RS-422
Dimensions:	140 x 121 x 44.5 mm (5.5 x 4.75 x 1.75 in)
Weight:	70 g (1.5 lbs)

8. Support

For further support or additional questions, please contact Eagle Eye via phone or email.