



## Orion BMS Connect Product Manual

Revision 1.4



### An Ewert Energy Systems, Inc Product

The Orion BMS and the Orion BMS Connect module are designed and manufactured by Ewert Energy Systems, Inc. Ewert Energy Systems is a research & development company focusing on developing solutions for plug-in hybrid and electric vehicles and other energy storage applications. Ewert Energy provides custom solutions as well as off the shelf components.

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## Product Description

The Orion BMS Connect is an internet based remote monitoring system that enables monitoring battery packs through a web browser, smartphone or tablet. When the Orion BMS Connect device is used with a WiFi connection, this service allows companies, installers, and end users to remotely monitor battery pack performance data from Orion BMS or Orion Jr BMS systems in real time. Instant data, charts of recent history, and diagnostic information including recent events, fault codes and freeze frame data are available. The device can also optionally log data to a local memory card and generate emailed alerts when certain events occur. Onboard memory allows this device to be used in certain mobile applications where data can be synchronized periodically when the device reconnects to WiFi.

## Product Specifications

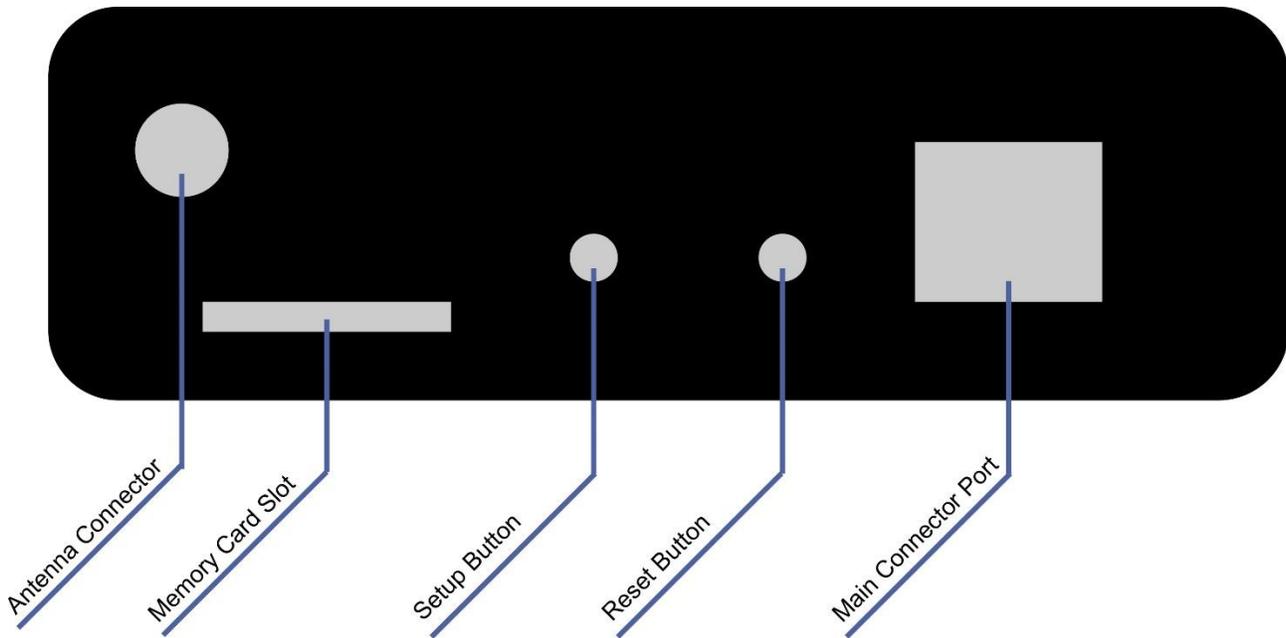
- Connects with BMS over CANBUS
- Supports multiple WiFi protocols (802.11 b/g/n)
- Compatible with Orion BMS and CANBUS enabled Orion Jr. BMS units
- Supported CANBUS Baud Rates: 125, 250, 500, 1,000 Kbps
- Can cache data for at least 6 hours when WiFi is not available and then transmit the data when WiFi is available.

Specifications	Min	Typ	Max	Units
Supply Voltage	8	12-48	60	Vdc
Power Consumption		0.8		Watts
Operating Temperature	-20		60	C
Internet Data Caching Time (when WiFi not available)	6			Hours

## Environmental Information

The Orion BMS Connect module is designed for use only in environmentally protected environments. Do not expose the device to liquids, condensing humidity/fogs or other environmental debris

## Device Diagram

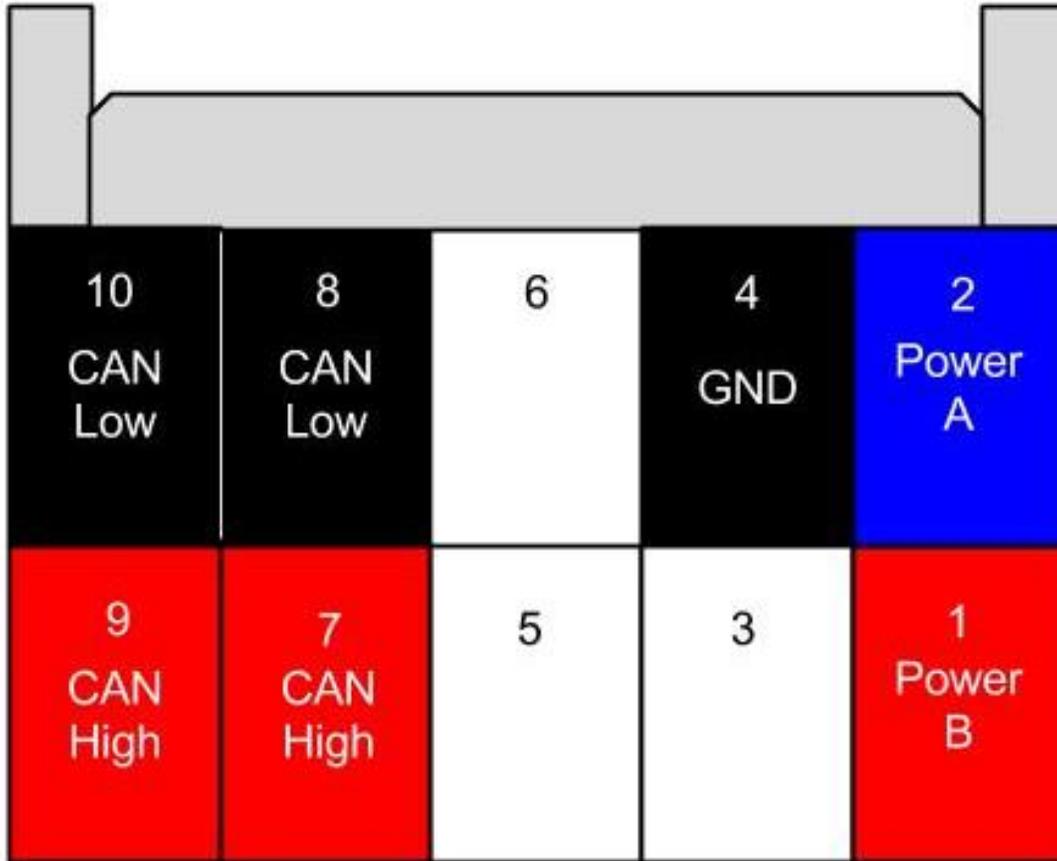


Signal Name	Description
Memory Card Slot	Optionally insert a micro SD memory card into this slot to record data to the card for later manual analysis. All BMS data, including individual call voltages, can be logged to this card as fast as every 100mS. This card is only used for logging data for later analysis. Inserting a card into this slot does not increase the maximum amount of time that the device can cache data for WiFi syncing.
Setup Button	This button is used to put the device into setup mode and is used only for configuration. This button is also used for performing firmware updates. Press this button using a paperclip or similar item.
Reset Button	This button is used to reset the device. The device can also be reset by removing and reapplying power.
Antenna Connector	Connect the included WiFi antenna here. Only connect the included antenna – do not use with any other antenna.

## Installation & Wiring

The diagram below shows the pinout for the Main Connector.

### Wiring Diagram

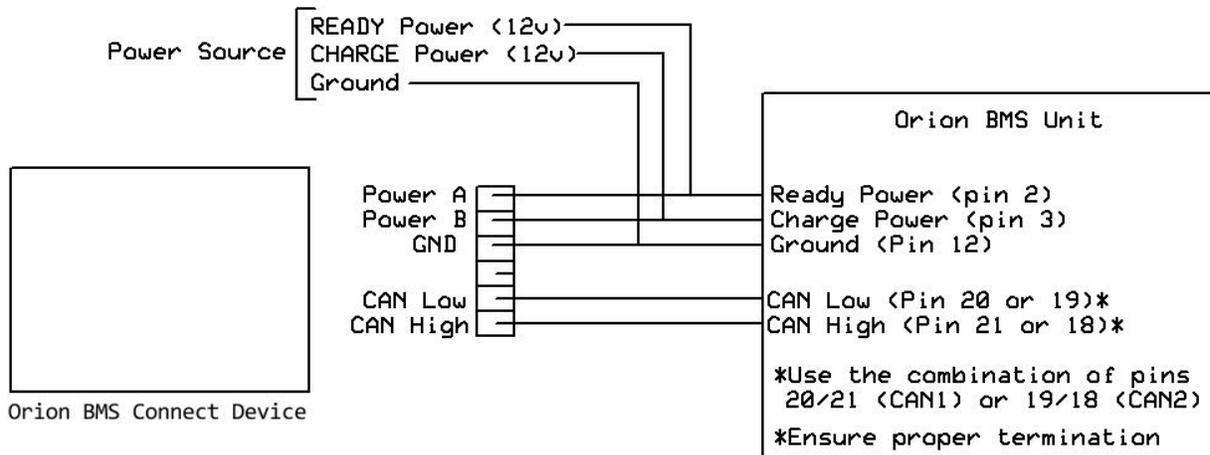


*Looking into back of connector (wires coming towards viewer)*

## Description of Wiring Connections

Signal Name	Description
Power A and Power B	<p>Two power pins (Power A and Power B) are provided and either pin may be used to fully power the device. Internal diodes inside the Orion BMS Connect device prevent backfeeding the other power source. The different power sources can be used as a redundant backup power supply for the device (i.e. if power A fails, power B will keep the device working). This feature may also be useful if power is supplied from a different source during charging than during discharge, for example. The device will pull current primarily from whichever power supply is a higher voltage. The absolute minimum / maximum voltage range for either pin is 9V to 60V. The voltage on either power pin may not exceed 60v for any period of time.</p> <p>Power may be provided from a 12V - 48V DC nominal power source. This source may be a battery pack or other power supply. The device will operate any time power is present from either one of these power sources. If a battery pack is used to provide power to the device, care must be taken to ensure that the Orion BMS Connect device will not cause over-discharge of the battery pack. Typical power consumption is less than 1 watt, but the device may briefly draw up to 6 watts when WiFi is in use.</p> <p>Input power sources must be current limited with a fuse no larger than 2A. Fuses must be rated for the maximum DC working voltage and must have an appropriate DC interrupting current rating. Fuses should be placed as close to the power source as possible in order to protect the power conductors.</p>
Ground (NEG)	The ground pin must be connected to the negative of the power supplies. The ground pin <i>must</i> be connected to the same ground as any other devices on the connected CANBUS, including any Orion BMS or Orion Jr. BMS units.
CAN High and CAN Low	These are the CANBUS connections. These are connected to the Orion BMS using shielded twisted pair cable. For information on signals connecting the CANBUS signals to the Orion BMS or to a CANBUS enabled Orion Jr. BMS, please consult the Orion BMS wiring manual (available at <a href="http://www.orionbms.com/support">http://www.orionbms.com/support</a> ).

## Standard Connection to the Orion BMS

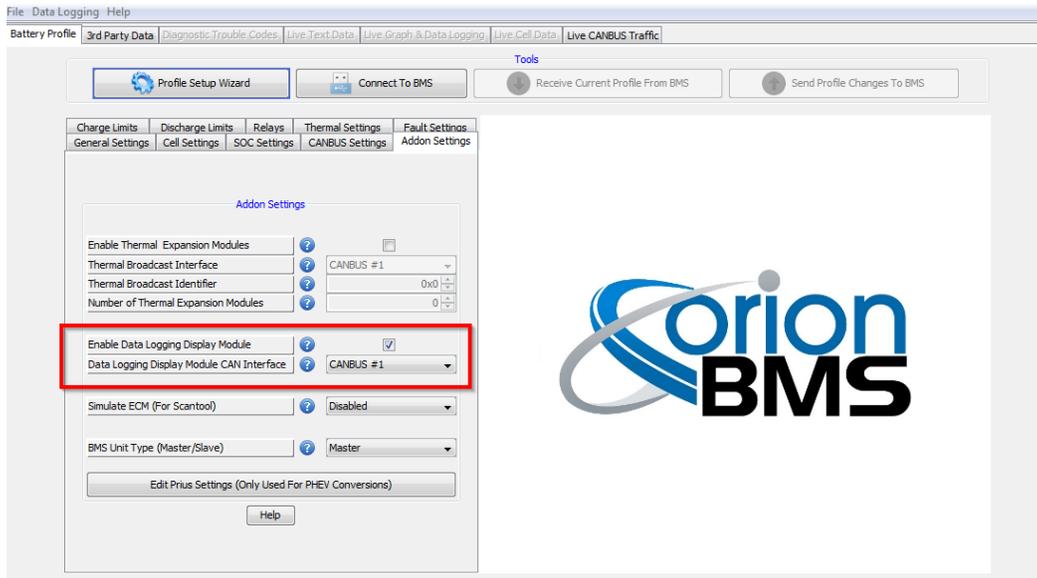


## Configuring the Orion BMS Connect

Before configuration the Orion BMS Connect device, the Orion BMS or Orion Jr. BMS must be set up to transmit the required information for the Connect device. This is done by enabling support for the “Data Logging Display Module” in the Orion BMS profile as shown below. This is available under the “Addon Settings” tab for the Orion BMS or under the “CANBUS Settings” tab for the Orion Jr. BMS.

Important: This setting **MUST be enabled** for the device to function!

Important: The BMS must be configured with an OBD2 ECU ID of either 0x7E3 (default) or with an OBD2 ID in the range of 0x750 through 0x75A in order for the Connect to be able to communicate with it. As the default settings are already set to these specifications, this is only an issue if more than one Orion BMS is connected to the same CANBUS or if the default OBD2 ID has been modified.



Important: The Orion BMS Connect must be enabled AND configured in order to function!

## Connecting Your Orion BMS Connect to WiFi

1. Enable support for the Orion BMS Connect device in the Orion BMS itself by following the directions in the “Configuring the Orion BMS Connect” section of the manual above.
2. Connect and wire the provided wiring harness in accordance with the wiring diagram in the “Installation and Wiring” section of the manual above.
3. Visit <http://connect.orionbms.com/setup>
4. Follow the on-screen instructions to connect your Orion BMS Connect device with your local WiFi network. During the setup process, a Device UID will be generated. **You will need to copy the Device UID during the setup process (there is a button that will copy it). This will be used in later on during the setup.**
5. Visit <http://connect.orionbms.com>
6. Fill out the registration form and sign up as a new user (if this is the first device being activated). An email will be sent to the provided email address to confirm ownership. Click the link in the email to activate your account. This will take you back to the Orion BMS Connect dashboard.
7. Select the “Devices” tab at the top of the website.
8. Click the “+New” button to bring up the dialog to create a new device.
9. Paste the Device UID saved in step 3 into the Device UID field, give the device a nickname, and select the stream type for the device. The stream type cannot be changed once the device is set up (the device must be deleted and re-created to change this).
10. The device should now be operational and communicating with the Orion BMS Connect cloud services. If the device is properly wired, powered, and connected, it should begin transmitting data to the Orion BMS Connect cloud services and be visible under the Dashboard screen.
11. To view and manage data, visit <http://connect.orionbms.com>

## Safety and Security Information

### **Digital Security**

All internet connected devices inherently contain some level of security risk from malicious users. Risks typically include the unauthorized viewing of data as well as the unauthorized transmission of data. In the case of the Orion BMS Connect device, risks also include unauthorized access to the CANBUS, which could potentially be used to view, control, or disrupt communication between connected devices. Since connected devices may include critical systems, including the Orion BMS or Orion Jr. BMS, it is essential that steps be taken to ensure safety and security in the event that the device were to become compromised.

A good strategy for assessing and mitigating potential risks is to first design internet connected devices to be as secure as possible and then to assume that any internet connected device will at some point become compromised and plan accordingly. This strategy is especially important when battery systems are involved as a compromise could potentially lead to unsafe conditions. In those cases, it is essential that the system designer must think about what harm could possibly come from the worst case scenario of someone maliciously transmitting or viewing data. For the Orion BMS or Orion Jr. BMS, a particular risk is that a compromised internet connected device could update settings on the Orion BMS or other devices, which could lead to unsafe operation. It is also possible for a compromised device to send malicious commands by communicating directly with devices such as battery chargers.

### **Hardware Firewall**

With these risks in mind and using this design strategy, the Orion BMS Connect Device contains a second level hardware firewall for the CANBUS. This hardware firewall restricts the type of data the Orion BMS Connect device may transmit onto the CANBUS. This firewall is provided on the board by a dedicated processor. The firmware for the dedicated firewall processor cannot be updated from the internet connected processor for security reasons. Updates for this firewall processor, should they ever be necessary, must be performed via the CANBUS.

By default, the hardware firewall restricts the transmission of all but the following CANBUS messages:

ID 0x7DF (Note: Only OBD2 mode 9 is allowed for this ID)  
ID 0x7E3  
IDs 0x750-0x75A

These are the message IDs that the Orion BMS Connect will use to communicate with the BMS via the OBD2 protocol in order to retrieve additional data that may not be regularly available on the CANBUS.

In addition to restricting the CANBUS ID range, the OBD2 mode is also restricted by the firewall (thus preventing the Connect from being able to alter or change settings on the BMS). The following OBD2 modes are allowed to be requested:

Mode 0x01	Mode 0x17
Mode 0x02	Mode 0x21
Mode 0x03	Mode 0x22
Mode 0x04	Mode 0xB0
Mode 0x04	Mode 0xB2
Mode 0x09	Mode 0xB3
Mode 0x12	

Important note: If the device were to ever become compromised, malicious data could be transmitted on the above IDs. The installer must ensure that malicious data on these CANBUS IDs cannot cause unsafe operation. This could potentially occur if other systems are connected to the CANBUS that respond to messages with any of the above IDs.

While the transmission of data is limited even when the primary processor on the device is compromised, it may be possible for a compromised device to monitor data. The device should not be connected to CANBUS networks where sensitive data is being transmitted.

In order to add additional layers of security, we strongly recommend making use of the password protection feature on the Orion BMS or the Orion Jr. BMS when any internet connected or wireless devices are connected to the BMS. Additionally, when used with the Orion BMS, it may be possible to place the Orion BMS Connect device on a dedicated CANBUS line since the standard Orion BMS contains 2 CANBUS interfaces. This allows for additional segmenting of the CANBUS in the event of a security breach.

### **Safety Warnings**

1. Data transmitted from the monitoring device is received, stored, and displayed on the cloud to be reviewed by the user. Data is ***not*** actively monitored for faults by Ewert Energy. The user is responsible for monitoring data and ensuring that sufficient safety systems are in place.
2. While the Orion BMS Connect system allows for email alerts and other forms of alert, these alerts are intended as informational alerts only. ***This remote monitoring system may never be used for the purposes of controlling any safety related aspects including, but not limited to the control of battery chargers or controlling other loads.*** Never rely on receiving alerts to prevent unsafe conditions.
3. While the service is designed to be reliable, internet connectivity may be interrupted for a variety of reasons. The system must continue to operate in a safe manner in the even that connectivity is lost for any reason for any length of time.

## System Operation

When powered, the Orion BMS Connect device will constantly monitor the CANBUS for messages from the Orion BMS and will interpret, log (if memory card is provided), and transmit the relevant data to the cloud-based data services. The Orion BMS unit must be configured to enable support for this module. Additionally, the Orion BMS Connect module may need to be configured in order to begin logging or to communicate with the BMS if a different baud rate is used.

Functions such as changing settings, viewing and converting collected log files can be performed by using the Orion BMS Connect utility, which is available for download on the main Orion BMS website. Firmware updates to the device itself are carried out over the internet via Over The Air (OTA) updates.

### *Description of LED illuminations*

- **Blinking deep blue:** This means that the device is in **Listening Mode** and is waiting for WiFi credentials. This should not be confused with the lighter **Cyan** color sequence.
- **Blinking green:** The device is attempting to connect to a WiFi network, but is waiting for information from the WiFi hotspot / router.
- **Blinking yellow:** The device has entered Firmware Update Mode, most likely because the **Setup Button** was held down longer than it should be when trying to enter **Listening Mode**. Simply press the **Reset Button** to exit Firmware Update Mode.
- **Blinking Magenta:** The device is currently receiving an OTA (over the air) firmware update via WiFi. This state can last up to a minute and may be followed by a device reset and additional OTA updates.
- **Blinking cyan:** The device has successfully negotiated credentials with the WiFi router / hotspot and is now attempting to connect to the Orion BMS Connect cloud services.
- **Slow pulsing cyan:** Also known as “breathing cyan”, this state means the device has successfully connected to a WiFi network and is actively communicating with the Orion BMS Connect cloud services.

## Memory Card

The data logging and display module does not ship with a memory card. If the data logging capabilities of the module are desired, a card must be acquired and inserted into the unit. The display is compatible with any size “micro SD” type memory card up to 16Gb in size. A class 4 or faster memory card is recommended.

## Troubleshooting

Problem Symptom	Likely Causes & Solutions
The LED does not turn on at all.	<ul style="list-style-type: none"> <li>• Verify that the wiring harness is connected to the Orion BMS Connect device.</li> <li>• Verify that either Power A or Power B is energized with at least +12vDC (up to +60vDC maximum) and that the ground is properly connected.</li> <li>• If the device LED still fails to turn on it may be damaged.</li> </ul>
The LED continues to blink green indefinitely.	<ul style="list-style-type: none"> <li>• The provided WiFi credentials may be incorrect <b>or out of range in the device's current physical location</b>. Try entering the WiFi credentials again by visiting <a href="http://connect.orionbms.com/setup">http://connect.orionbms.com/setup</a> and completing the setup process again. <b>You do not need to re-add the device to the Orion BMS Connect website.</b></li> <li>• There may be a problem with the WiFi router / hotspot. If possibly, try power cycling the WiFi router / hotspot.</li> <li>• Try moving the Orion BMS Connect device physically closer to the WiFi router / hotspot to determine if distance is a problem.</li> </ul>
The LED continues to blink cyan (light blue) indefinitely.	<ul style="list-style-type: none"> <li>• The signal strength to the WiFi router / hotspot may be weak. Try moving the Orion BMS Connect device closer to the WiFi router / hotspot to determine if distance is a problem.</li> <li>• Traffic to / from the Orion BMS Connect device may be getting blocked or dropped by a firewall or other internet security device. <b>Please ensure that outgoing traffic on ports 5683 and 80 are allowed.</b></li> <li>• There may be an outage or technical difficulty with the Orion BMS Connect cloud services. Try again later in the day, or check online to see if the Orion BMS Connect cloud services can be reached.</li> </ul>
The LED stays a solid color without blink, pulsing, or "breathing."	<ul style="list-style-type: none"> <li>• The device may have locked up. Try pressing the Reset Button briefly to restart the device, or the power connector can be disconnected and reconnected.</li> <li>• If the device continues to lock up, it may need to be serviced.</li> </ul>
The device fails to log data to the Micro-SD card.	<ul style="list-style-type: none"> <li>• Ensure that the Micro-SD card is properly formatted (it should be formatted as a FAT32 filesystem).</li> <li>• Verify that the Micro-SD card is inserted in the proper direction (gold plated contacts facing down) and is inserted all the way (it should click in place once it's fully inserted – if it does not click, it may need to be pushed in further).</li> <li>• Verify that the device is properly powered and is connecting to the Orion BMS Connect cloud services (breathing cyan) and that data is being properly uploaded to the cloud.</li> <li>• Verify that the device is properly connected to the CANBUS and is actively receiving CANBUS traffic from the Orion BMS.</li> </ul>
The device is connected to the Orion BMS Connect cloud services (breathing cyan), but no data is being uploaded.	<ul style="list-style-type: none"> <li>• Make sure that the Orion BMS Connect device is properly connected to the CANBUS and is actively receiving CANBUS traffic from the BMS.</li> <li>• Make sure that the Orion BMS (or Orion Jr.) is properly powered and configured to be communicating with the Orion BMS Connect device. If it is not configured properly (or the CANBUS baud-rate is incorrect), the two devices cannot communicate and no data will be uploaded.</li> </ul>

## Electrical & Product Specifications

### **Product Dimensions**

3.29 in [8.34 cm] (W) x 2.42 in [6.15 cm] (L) x 1.00 in [2.54 cm] (H) plus antenna

### **Product Weight**

2.8 oz

### **Connector**

Connector is PADP-10V-1-S.

Crimp is SPH-001T-P0.5L.

### **Electrical Specifications**

Item	Min	Max	Typical	Units
Supply Voltage	12	60 (absolute)	-	Vdc
Supply Current	-	-	0.8	Watts
Operating Temperature	-20	60	-	C

## FCC Statement

**Federal Communication Commission Interference Statement** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. 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.

**FCC Radiation Exposure Statement:** This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter. This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

**IMPORTANT NOTE:** In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**Contains FCC ID: 2AEMI-PHOTON**