



Data Logging Display Module Product Manual

Revision 2.1



An Ewert Energy Systems, Inc Product

The Orion BMS and this display 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 CAN Data Logger and Display module for the Orion BMS / Orion Jr. BMS (CAN version only) provides visual feedback of the essential information on a battery pack as well as data logging capabilities for diagnostics. This display and logging combo connects to an Orion BMS unit via CAN (Controller Area Network) and logs data to a memory card while displaying State of Charge, Power Limited (reduced output power), and the Malfunction Indicator Status (error indicator)

Product Specifications

- Operates with the Orion BMS and Orion Jr. BMS (CAN version only) from Ewert Energy Systems (BMS sold separately)
- Full automotive operating temperature range (-40C to 80C)
- Logs BMS parameters to memory card at user selectable sampling rate
- Compact size and shape
- Connects to the Orion BMS via CAN (no analog connections)
- Supports brightness dimming for automotive use (via CAN)
- External “event trigger” input which can flag events for future review
- Log graphing and analysis software
- Real time clock to store data and time of each charge / discharge cycle
- Supports CAN frequencies of 125, 250, 500Kbps, and 1 Mbps
- User customizable logging frequency from 100mS to 10 seconds

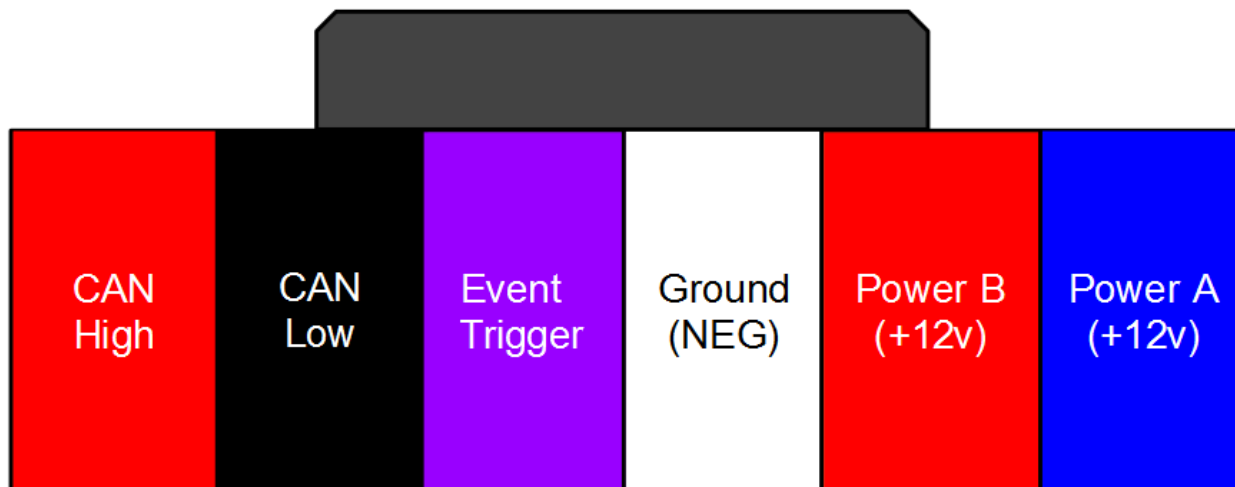
Ordering Options

The CAN data logging and display module can be ordered without an enclosure for easy integration into other enclosures. Contact Ewert Energy for this ordering option.

Installation & Wiring

The diagram below includes some signal wires that come from the Orion BMS. For information on signals connecting to the Orion BMS, please consult the Orion BMS wiring diagram (available at <http://www.orionbms.com/support>).

Wiring Diagram

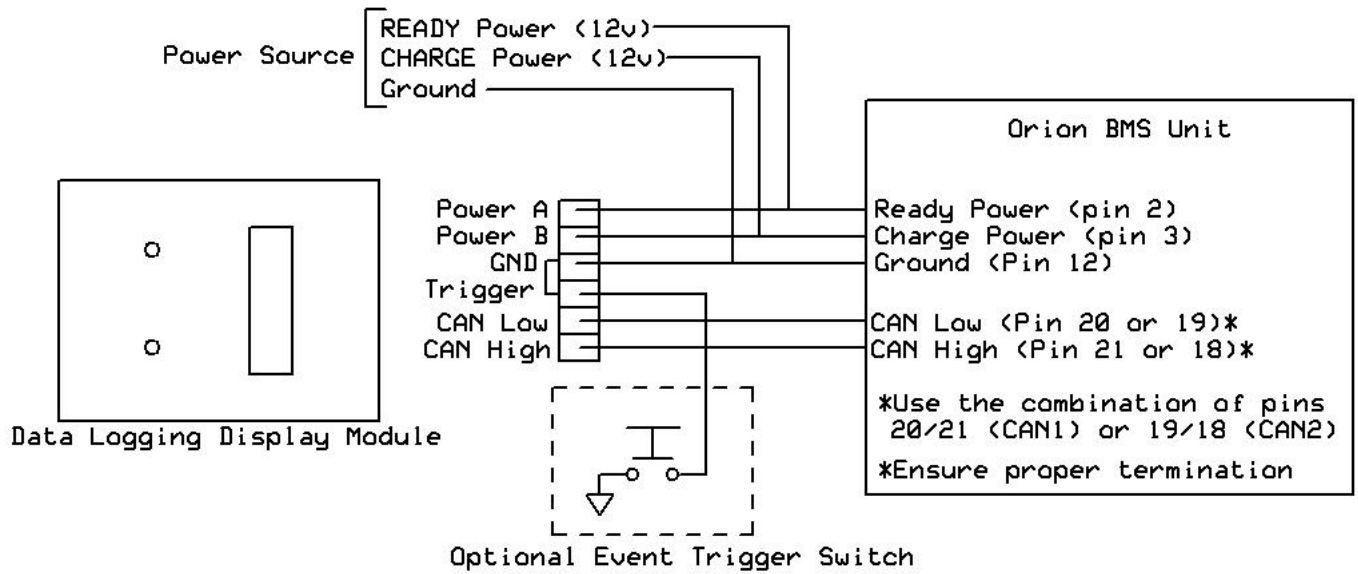


Looking into back of connector (wires coming towards viewer)

Description of Wiring Connections

Signal Name	Description
Power A (+12v)	This is power source A for the display module and should read approximately +12v. Either power source can fully power the module and will not back feed the other power source. This is typically connected to the same READY power source as the BMS.
Power B (+12v)	This is power source B for the display module and should read approximately +12v. Either power source can fully power the module and will not back feed the other power source. This is typically connected to the same CHARGE power source as the BMS.
Ground (NEG)	12V Power ground for the display module. This ground MUST be connected to the same ground / chassis that the Orion BMS is connected to.
Event Trigger	This input is designed to mark an event in the log file. Most commonly this is connected to a momentary switch the user can press to flag an event they want to review later in a data log. Short this output to ground to record an event.
CAN High and CAN Low	These are the 2 CAN BUS connections. These are connected to the Orion BMS using shielded twisted pair cable. There is no CAN termination inside the module.

Standard Connection to the Orion BMS



System Operation

When powered, the CAN data logging and display module will constantly monitor the CAN BUS for messages from the Orion BMS and will log and display the appropriate information. The Orion BMS unit must be configured to enable support for this module. Additionally, the data logging module may need to be configured in order to begin logging or to communicate with the BMS if a different baud rate is used.

On the display, the bar graph represents the measured voltage at the State of Charge pin, the yellow reduced power indicator represents if the battery is unable to output full power, and the error indicator illuminates if the BMS detects errors. Additionally, flashing LEDs indicate various status of the display module, such as memory card errors or CAN communication errors, etc.

Description of LED illuminations

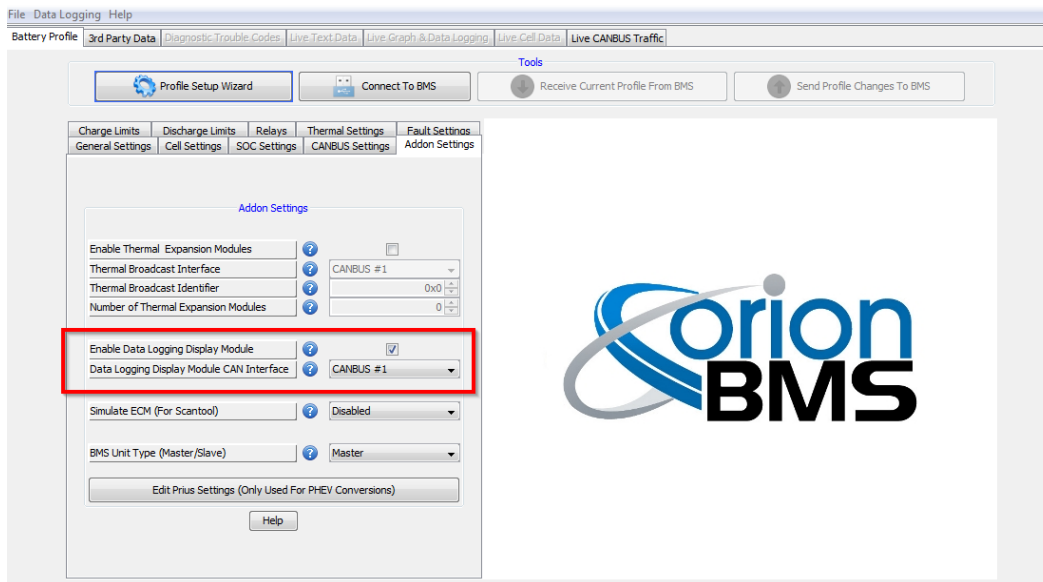
- SOC bar graph LEDs (1-10 LEDs correspond to 0-100% SOC.)
- Yellow power limited LED illuminates if the measured Discharge Current Limit drops below a specified percentage of the maximum discharge current limit (the default is 70%, but can be changed by altering the configuration).
- The red indicator LED illuminates if an error is detected. See the troubleshooting section for more information.

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 32Gb in size.

Configuring the Data Logging Display

Enable the data logging display by checking the box on the “Addon Settings” tab of the Orion BMS or Orion Jr. BMS utility.



The Data logger can be configured by using the Data Logging Display Module Utility. The utility can be downloaded from <http://www.orionbms.com/downloads>. Settings are uploaded to the Data Logger by placing the configuration file on the memory card and then inserting that memory card into the data logging display.

Important: The data logging display must be enabled AND configured in order to function!

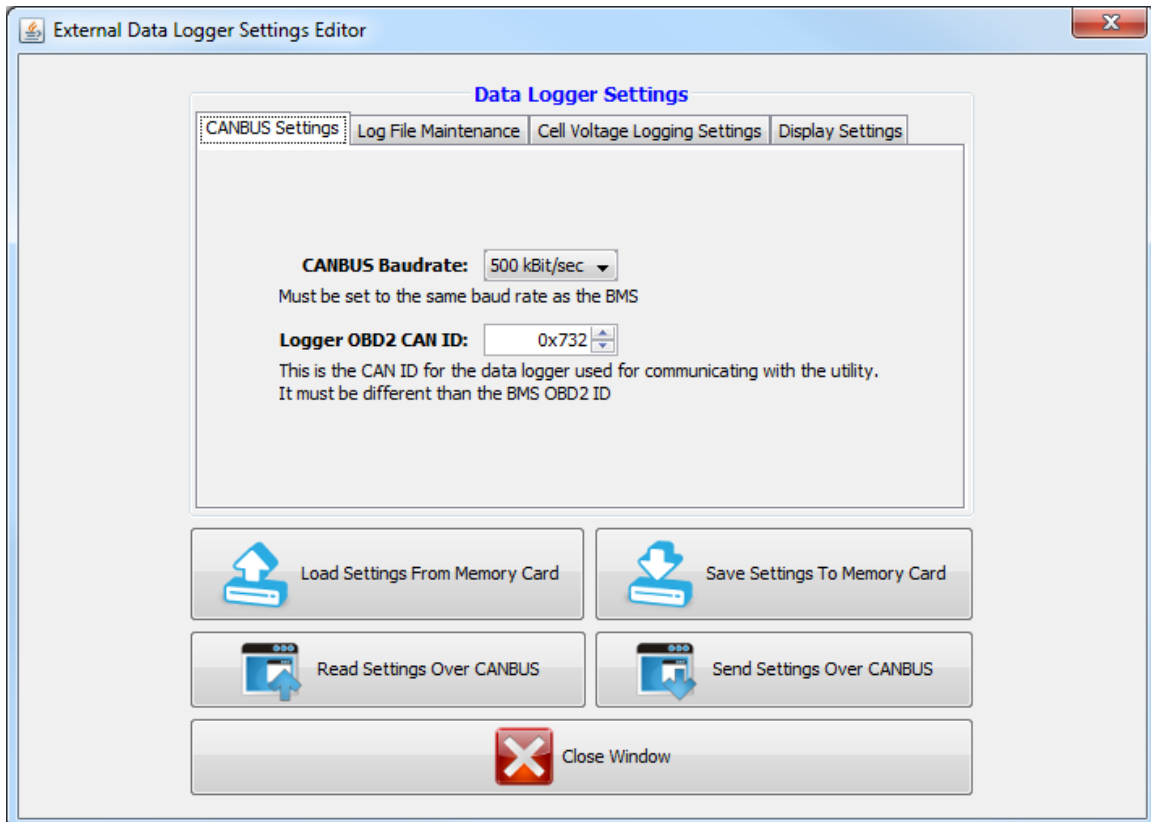
Settings are uploaded to the data logging display either by writing a configuration file to the memory card and then inserting the card into the display or by connecting to the logging module via CANBUS. While both methods are equally effective at changing the settings, a CANBUS connection has the added advantage of being able to set the clock and view live data.



To change settings, open the Data Logging Display Module Utility and click on the “Edit Settings” button. Four tabs appear at the top; the settings on each tab are described below. After settings have been changed, they must either be saved to the memory card or transmitted over the CANBUS to the data logging display module. Press the appropriate button (“Save Settings to Memory Card” or “Send Settings Over CANBUS”) to transmit the settings.

If saving to a memory card, the file must be saved in the root of the memory card with the filename “config_n.odc”. For example, if your memory card is the H: drive, the file must be H:\config_n.odc”. When the data logger reads the file, it will import the settings, delete the “config_n.odc” file and create a “config.odc” file which will contain the most recent configuration information.

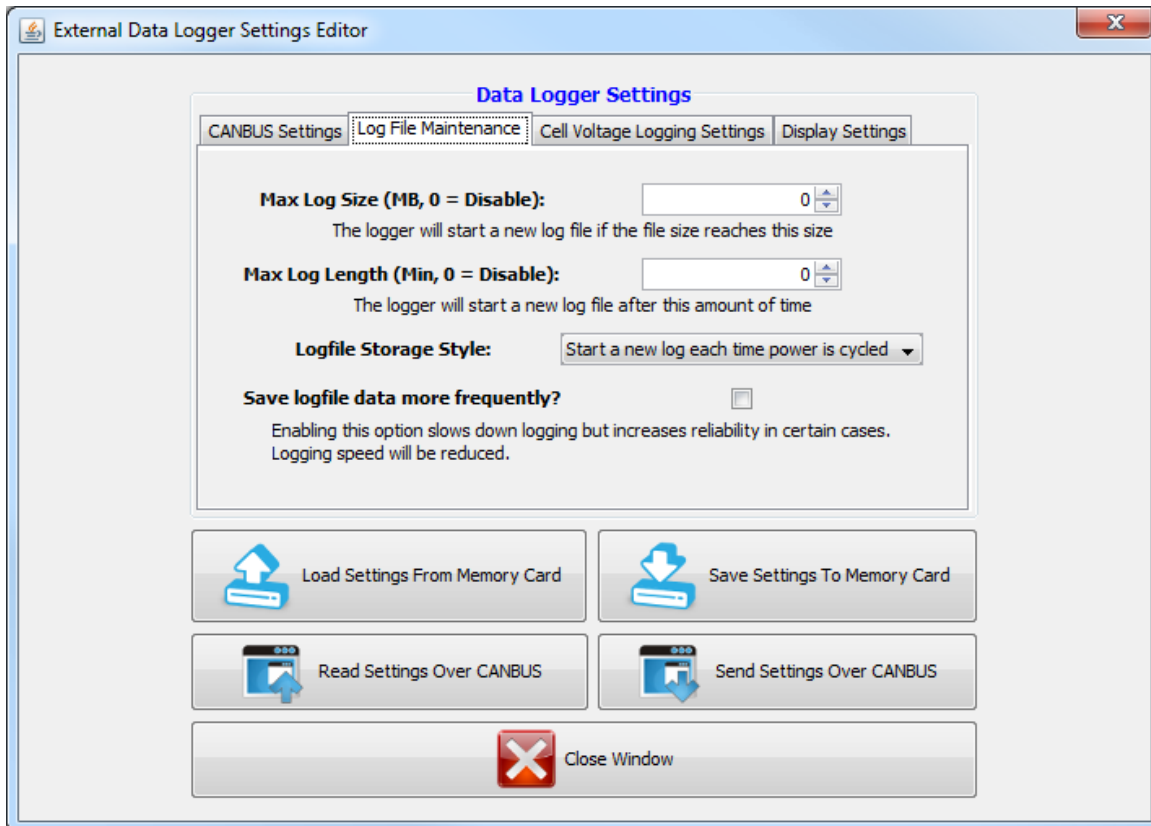
CANBUS Settings Tab:



CANBUS Baud Rate - This value is the baud rate at which the CANBUS is operating. This must be set to the same baud rate as the BMS and any other devices on this CANBUS network. The Orion BMS defaults to 500kBps.

Logger OBD2 CAN ID - This is the identification code that the data logger will respond to when connecting via the PC utility. This ID must be unique to any devices on the CANBUS and cannot be the same value as the Orion BMS unit.

Log File Maintenance Tab:



Max Log Size - This value is the maximum file size in megabytes that the logger will record. If a file becomes longer than this, the logger will save the file it is currently recording and begin a new log file. To disable this limit and allow any size log file, enter 0 into this field.

Max Log Length - This is the maximum amount of time in minutes which the data logger will record. If a log is longer than this, the logger will save the file it is currently recording and begin a new log file. To disable this and allow any length of time, enter 0 into this field.

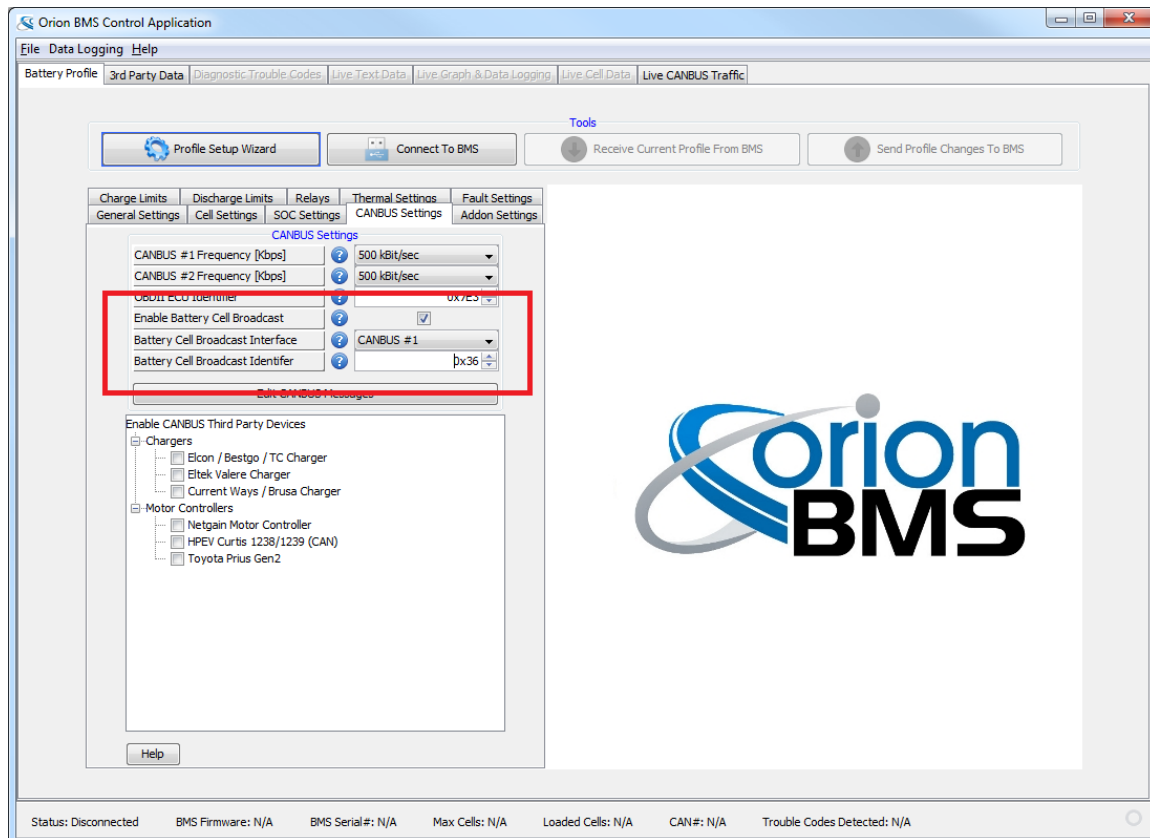
Logfile Storage Style - The logger can be configured to record only the last 5 log files or to record as many log files as the memory card will hold. For very small memory cards, storing only the last logs is recommended, but for larger memory cards it is usually more desirable to start a new log each time.

Save logfile data more frequently - This option reduces the likelihood of a corrupted log file. However, it comes at the expense of not recording information as quickly. For the highest log file resolution, leave this box unchecked. For applications where reliability is more important than speed, it may be desirable to check this box.

Cell Voltage Logging Settings:

The Data logging display module has the option to record individual cell voltages. Recording individual cell voltages may be very useful for diagnosing battery pack problems, but it comes at the expense of requiring significantly more storage space on the memory card. The exact amount of space required depends on the number of cells being monitored and the frequency the messages are being recorded.

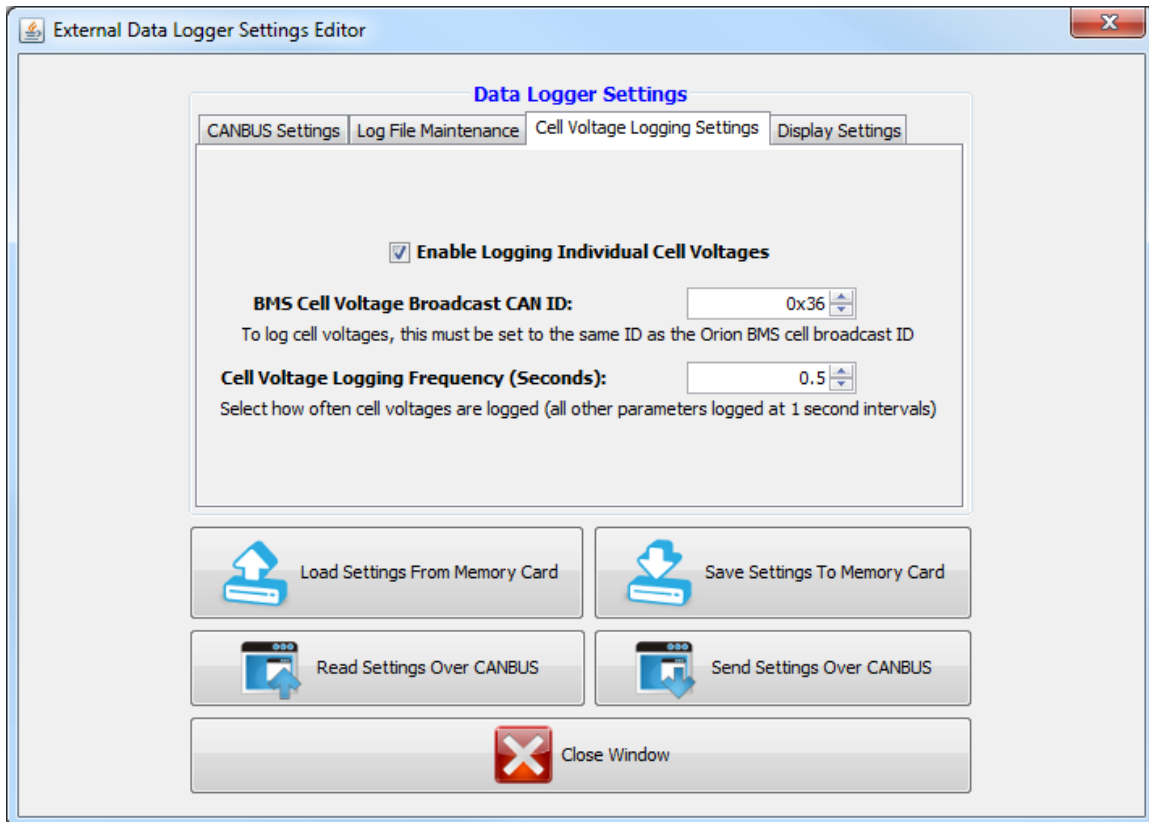
This feature is disabled by default and requires setup both in the data logging display and on the Orion BMS or Orion Jr. BMS unit. For both BMS units, the CANBUS interface must be configured to transmit cell voltages on the CANBUS and the CANBUS message identifier must be the same on the BMS and on the data logger.



To do this, open the Orion BMS or Orion Jr BMS utility and load the BMS configuration into the utility by pressing the “Receive profile from BMS” button and loading the saved profile from disk. Click on the CANBUS Settings tab. Ensure that the box labeled “Enable Battery Cell Broadcast” is checked. For the Orion BMS, ensure that the proper CANBUS interface is selected. This must be the CANBUS interface that the Data Logging Display is connected to. Below this, the Battery Cell Broadcast Identifier must be selected. This is usually set to 0x36 unless this CAN ID is already used by something else. Once the changes have been made, the profile must be transmitted back to the BMS unit for the settings to take effect.

Back on the Data logging display module settings, insert the value selected for the Battery Cell Broadcast Identifier in the field that says “BMS Cell Voltage Broadcast CAN ID” (this value must exactly match the value in the BMS to work).

Then select the frequency to log individual cell voltages. The fastest supported speed is every 0.5 seconds (which will log twice per second.)



Display Settings Tab

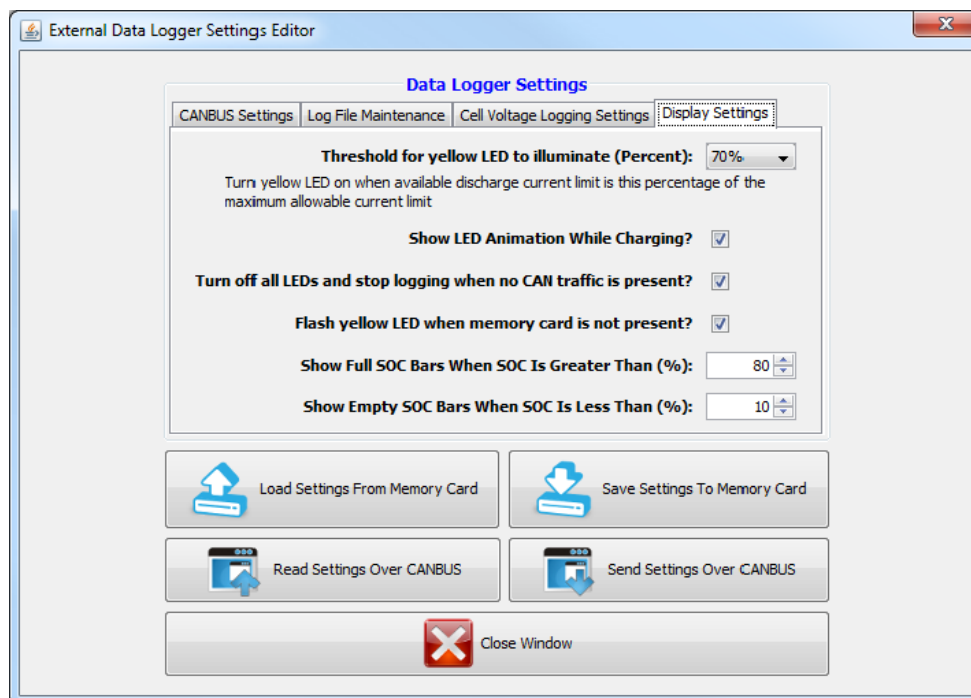
Threshold for yellow LED to illuminate (percentage) - The yellow LED on the data logging display can be used to warn the operator that the battery is not able to output full power for whatever reason. This setting controls when the LED will illuminate based on the percentage of power available. The criteria used for illuminating the yellow LED is based on the discharge current limit vs. the maximum possible discharge current limit. The yellow low power warning LED can be disabled by selecting “disable.”

Show LED Animation While Charging - Selecting this option will cause the SOC bars on the display to progress in an animation when the BMS is in charge mode and there is charging current flowing into the battery pack. It is useful for being able to identify when a charger is active.

Turn off all LEDs and stop logging when no CAN traffic is present - This option will cause the data logger to effectively shut down when CAN traffic is not present. Note: While this option conserves some power, the data logging display module does not have a super low power sleep mode and will still consume power when power is applied to the logger.

Flash yellow LED when memory card is not present - This option causes the yellow LED to flash at about a 1 second interval when the module detects that it does not have a memory card loaded or when the memory card cannot be written. It is recommended to leave this option enabled unless the data logger is intentionally being used only as a display with no memory card.

Show full SOC bars / Show empty SOC bars when SOC is greater / less than (%) - This option is used for showing a user that the battery pack is fully charged or fully discharged when a smaller portion of the battery pack is being used (often times for lifespan reasons, only 80% of a battery pack is used.) Enter the maximum SOC and minimum SOC into these fields and the display will adjust the SOC bars accordingly. For example, if the lower 15% and upper 5% of a battery is not being used, the effective usable range of the battery is from 15% - 95% SOC. In this case, 15% would be entered into “Show Empty SOC Bars When SOC Is Less Than (%)” and 95% would be entered into “Show Full SOC Bars When SOC Is Greater Than (%)”

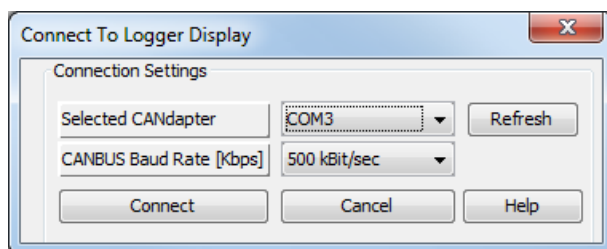


Setting the Clock & Monitoring Live Diagnostic Data

The module contains a real time clock used for creating timestamps for logfiles. Over time it may be necessary to set the clock. This is especially true if the module is left sitting without power for a period of several months which may lead to an internal battery that is discharged.


Setting the clock or monitoring live data information from the display module requires connecting the PC to the CANBUS that the data logging display is connected to via a CANdapter. Only a CANdapter brand USB to CAN adapter can be used for this connection; other CAN to USB adapters will not work. Additionally, to communicate with the data logging display, the display must be powered by either of the two power sources.

To set the clock, first ensure that the clock on the computer is accurate. Then click the “Set Clock” button. A dialog will pop up asking to select a CANdapter and a baud rate. Select the CANdapter and the proper baud rate and press Connect. The clock will then be updated.



Likewise, to view live data on the performance of the data logging display module, click on the “Live Data” button. The utility will pop up a dialog asking to select the CANdapter and baud rate. After selecting those and pressing Connect, a window will appear showing diagnostic information from the data logging display. Live data parameters are sometimes helpful for diagnosing issues and can be used to determine the version of firmware on the Data Logging Display module.

Parameter	Value	Unit
Device Firmware	0.3	
Run-time	1.4	Min
Communication With BMS	YES	
Cell Broadcast Received	YES	
BMS Fault Status	OFF	
BMS Power Limited	NO	
Logfile Open (Logging)	YES	
Memory Card Inserted	YES	
Power-A Present	YES	
Power-B Present	NO	
File-System Fault State	OFF	
File-System Full	OFF	
File-System Fault Code	0.0	
RTC Month	8.0	Month
RTC Day	14.0	Day of Month
RTC Year	2014.0	Year
RTC Hour	11.0	Hour
RTC Minute	24.0	Minute
RTC Second	54.0	Second

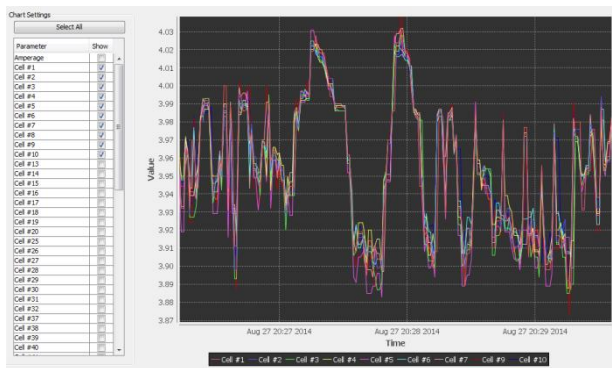
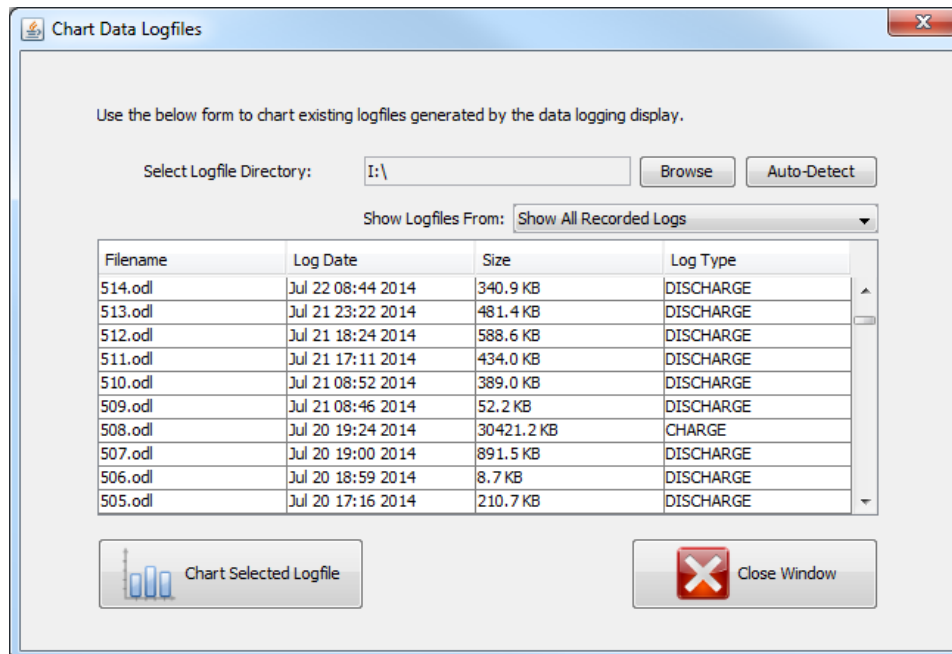


Displaying or Converting Log Files

Log files from the data logging display can be either graphed through the utility or be saved as CSV files which can be imported into other graphing or analysis software. The files stored on the memory card are in a compressed binary format which must be interpreted using the data logging display module.

To display a log file:

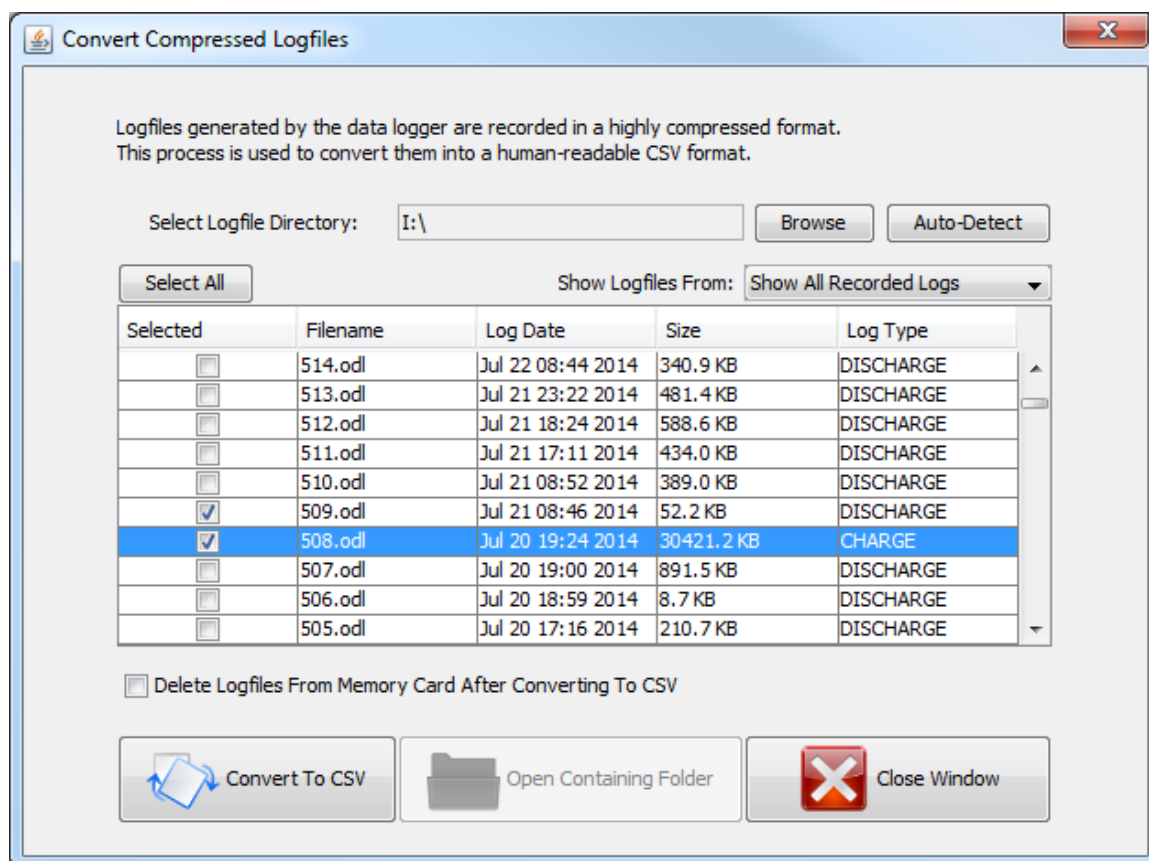
With the memory card inserted into a card reader, click the “Chart Logfile” button on the utility. Select the location of the memory card or press auto-detect for the utility to attempt to automatically locate the memory card. Once the proper location for the memory card has been selected, a list of available log files will appear. Select the log file you would like to graph and press “Chart Selected Logfile.” The utility will then open one or two graph windows depending on whether individual cell voltage logging is enabled or not. One window will contain the BMS parameters while the second window will contain individual cell voltages and pack amperage if individual cell logging is enabled. On the left hand side, select the parameters you wish to view. Larger logs may require a significant amount of time and processing power to display.



Example charts of log files

To convert a log file to CSV format:

With the memory card inserted into a card reader, click the “Convert Logfiles” button. Select the location of the memory card or press auto-detect for the utility to attempt to automatically locate the memory card. Once the proper location for the memory card has been selected, a list of available log files will appear. On this list, multiple log files can be selected for export at the same time. After selecting the logfiles to convert, press the “Convert Logfiles” button at the bottom. A dialog will appear asking for a location to export the files. Select a desired location, ensuring that you have proper file permissions to save documents to this location. The utility will then begin converting the log files. Depending on the size, it may take a considerable amount of time to convert. A dialog showing the status is displayed during the conversion process. If individual cell voltage logging is enabled, two files will be generated for each log file, one with the BMS parameters, one with the individual cell voltages. Once completed the “Open containing folder” button will open up a file manager window with the converted files.



Troubleshooting

Flashing LEDs on the display can indicate various error states

Yellow LED fast blink: memory card full
 Yellow LED slow blink: memory card missing or invalid
 Yellow LED solid: Discharge current limit reduced on BMS
 Yellow LED quick single flash: User triggered event

Red LED slow blink: The logger has lost CAN connectivity with the BMS
 Red LED fast blink: CAN in error passive state (CAN lock down)
 Red LED solid: Error code present on BMS

Red & yellow LED blink slow at the same time: The data logger is updating configuration settings or the configuration is invalid.

Problem Symptom	Likely Causes & Solutions
None of the LED indicators will turn on.	Verify that least one of the power sources (A or B) is powered with +12v DC. Also verify that the ground to the basic display module is connected properly.
The display module will not turn off.	The data logging display module is designed to stay on whenever it is powered (it can be powered by "Power A" or "Power B"). To turn the display module off, ensure power is removed from both power sources. Only one power source is necessary to turn on the display.

Electrical & Product Specifications

Product Dimensions

2.7 in [6.9 cm] (W) x 1.9 in [5.0 cm] (L) x 0.78 in [2.0 cm] (H)

Product Weight

1.7 oz

Connector

Connector is Molex part number 0050579406

Electrical Specifications

Item	Min	Max	Typical	Units
Supply Voltage	10	16	-	Vdc
Supply Current	-	-	65 (all LEDs on)	mA
Operating Temperature	-40	80	-	C