

Battery Management Systems

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Display Unit

User Manual 1.2.0

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Chapter 1: Functional overview

Emus BMS Display Unit is a device dedicated to monitor battery status and other Emus BMS activity data in real time. It is designed for use indoors and outdoors having glare-free, high contrast and wide viewing angle display and control knob for accessing various information. Device has RS232 for communication with EMUS BMS Control Unit and Micro USB interface for firmware update using EMUS G1 Control Panel software.



Figure 1-1 Display Unit

Chapter 2: Installation

At the back of the device, you can find two connectors: USB 2.0 micro and Molex 43645-0400 RS-232 connectors. Device is communicating with PC via USB interface. This communication is used mainly for device firmware upgrade and configuration tasks. Device is also bus powered, meaning it can operate with USB cable attached. This connector uses USB 2.0 micro B pinout. RS-232 connector is used to connect to the Emus BMS Control Unit. All data is transmitted using Emus BMS Serial Communication Protocol. Pinout for RS-232 connector is described in the following list:

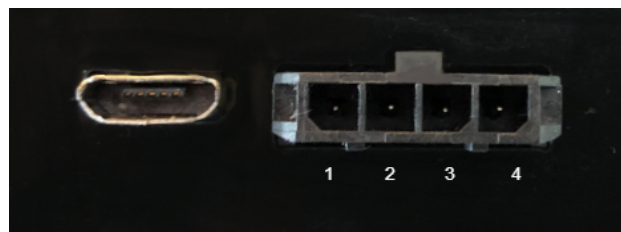


Figure 2-1 Display Unit connection pins

Table 2-1 Display Unit pin assignment

Pin No.	Assignment	Mating Housing	Terminal
1	GND	Molex 43645-0400	43030-0003 (recommended crimp tool Molex Hand Crimp Tool P/N: 638190000)
2	RS232 TX		
3	RS232 RX		
4	PWR		

In the picture below illustrated EMUS G1 Control Unit connection pins for the Display Module.

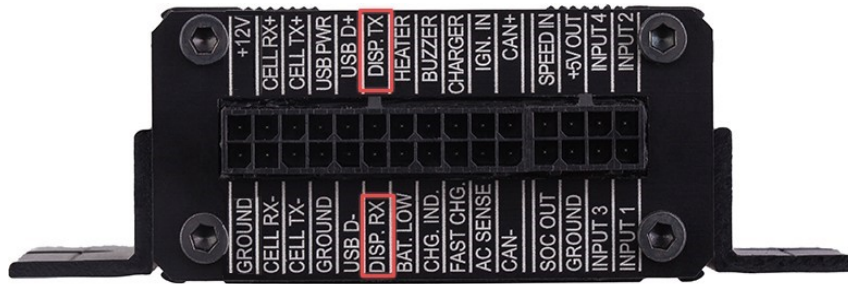


Figure 2-2 EMUS G1 Control Unit connection pins

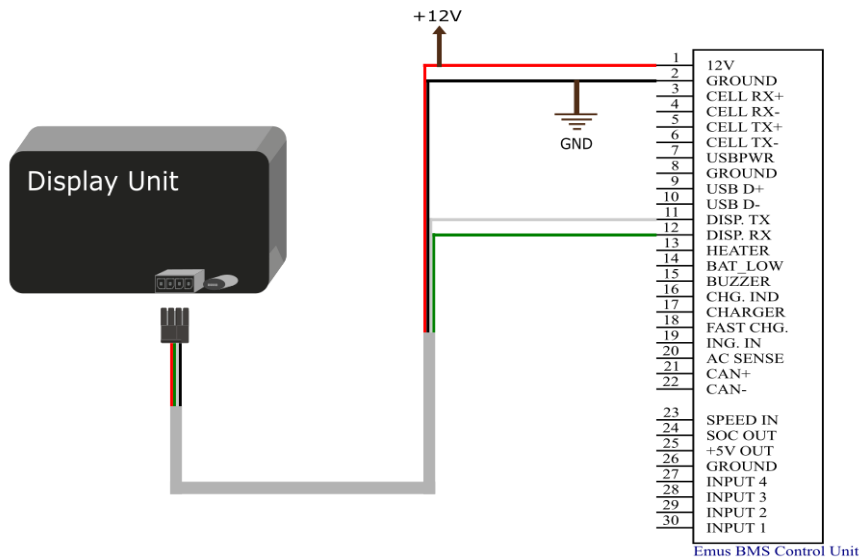


Figure 2-3 Display Unit RS232 connection scheme.



NOTE: It is not possible to use Smartphone connectivity module with Display Unit at the same time.



NOTE: When you have finished configuring the Display Unit using the EMUS G1 Control Panel, please disconnect the Display Unit USB cable from the PC.

Chapter 3: Application Interface

3.1 Firmware Update

This topic will introduce you with firmware upgrade process.



NOTE: If the upgrade instructions are not followed properly, the firmware could be malfunctioning

- Please visit <https://emusbms.com/product/g1-display-unit> website to download latest firmware. Search for image file e.g. 'G1 Display Unit Firmware 1.2.7'.
- By this step we assume that you are familiar with EMUS G1 Control Panel. It can be download from the website <https://emusbms.com/support>. Search for file archive e.g. 'G1 Control Panel 2.7.1'.
- Open EMUS G1 Control Panel → External Devices page → select Display unit device.
- You should now see floating window with related information to Display Unit. In 'Device information' section you could find your device current firmware version. Below in 'Firmware upgrade' sector there are three information fields and two buttons:

Table 3-1 Firmware update information fields and buttons

Filename	displays selected firmware image name.
Version	displays selected firmware image version.
Release date	displays release date of selected firmware image.
Upload image	invokes navigation window. This window allows you to select desired firmware image file.
Start update	initializes firmware upgrade process.

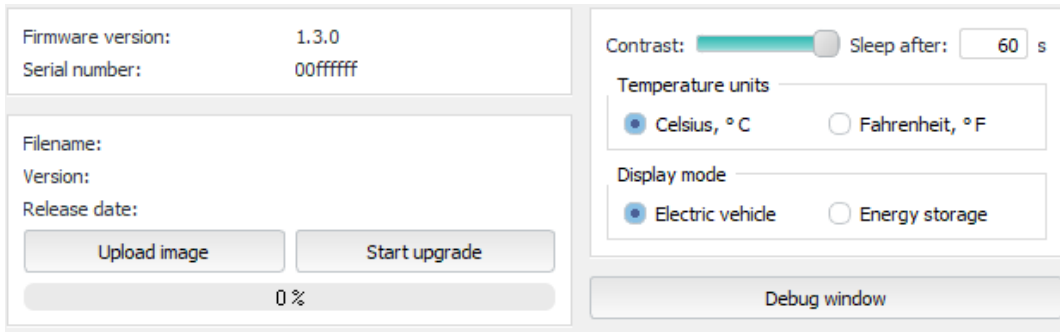


Figure 3-1 Display Unit menu window.

- Press '**Upload image**' button and select newly downloaded firmware image.
- After selecting image, **Filename**, **Version** and **Release** date fields will be updated with information from this image file.

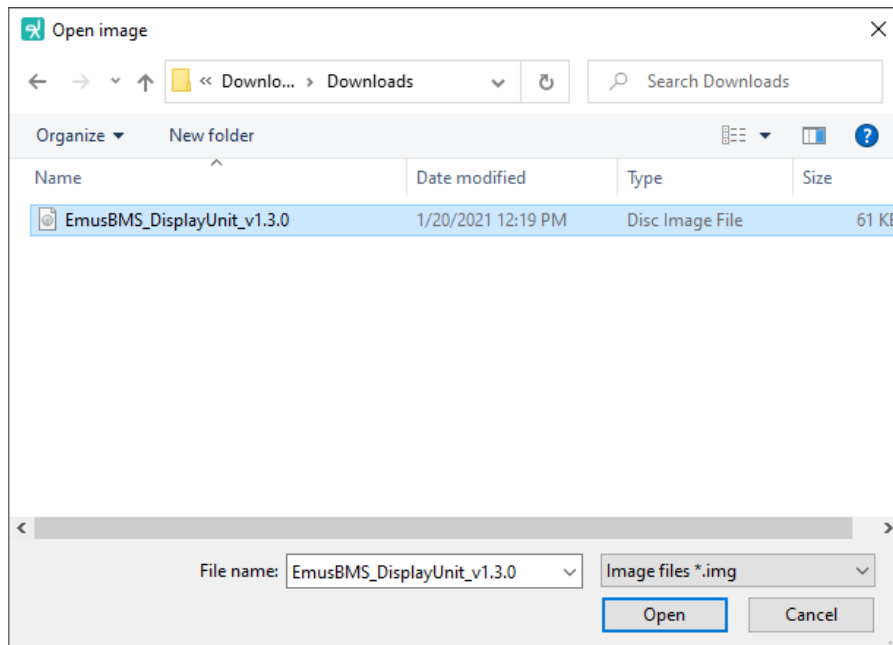


Figure 3-2 Firmware image file selection

- If you are satisfied with selected firmware image press '**Start upgrade**' button and wait until progress bar fills-up.



NOTE: When firmware upgrade process is started you should see '**boot**' text displayed inside '**Firmware version**' field. It means that device firmware indeed is being updated.

3.2 Settings

Using graphical user interface user is allowed to change device configuration. On the right side of 'Display Unit' window you can see 'Settings' menu. These changes reflect on device only when Display Unit is connected to a computer. Every single option can be modified from device interface.

Table 3-2 Settings

Contrast	sets display contrast level from 0 to 100 percent.
Sleep after	parameter that tracks time and decides when display must go to sleep by turning its lighting off. Setting '0' value prevents device to go to sleep and it stays awake all the time.
Temperature units	recalculate all temperature related parameters to <i>Celsius</i> or <i>Fahrenheit</i> scale.
Display mode	parameter allows to select information presentation mode. All modes have their own dedicated information types. More on this in later chapter.

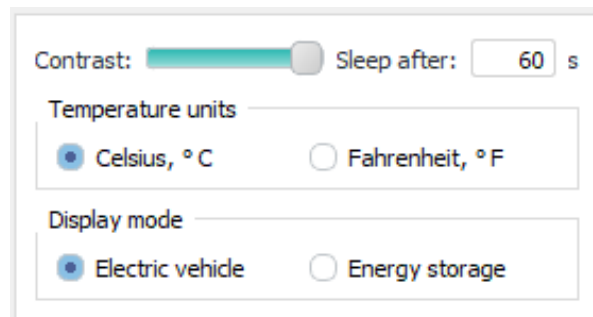


Figure 3-3 Settings menu

Chapter 4: Display Interface

4.1 Controls

Device has one control point – rotary switch knob. It has 3 degrees of freedom: rotate clockwise, rotate counter-clockwise, and push-release. All modifications and control are performed using it.

After device power-up main menu will be showed. To change to another layout knob should be rotated to the right or to the left. Menu is implemented in such way that rotating knob only to the right or to the left way eventually will get back to the same layout where was started from.

To switch to settings menu knob should be pressed and held for a second. There apply the same rotating rules. To change value of parameter, knob should be pressed one time and rotated in either way. By pressing knob one more time, value of selected parameter will be confirmed, and user will be returned to the settings menu. To return to main menu from settings menu knob should be pressed for a second and released when menu changes.



NOTE: Display unit will not work if it is not connected to the Emus BMS Control Unit. Only splash screen will be displayed.



Figure 4-1 Rotary switch knob

4.2 Settings

Display Unit has the same controls mentioned in chapter 4.2 Settings. List of all settings inside device:

- Contrast – set display contrast from 0 to 100 percent.



Figure 4-2 Contrast option

- Sleep after – parameter that tracks time and decides when display must go to sleep by turning its lighting off. Setting '0' value prevents device to go to sleep and it stays awake all the time.

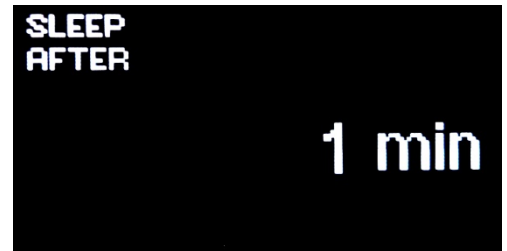


Figure 4-3 Sleep option

- Display mode - this parameter allows to select information presentation mode. All modes have their own dedicated information types.

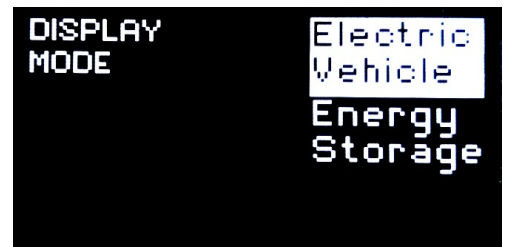


Figure 4-4 Display option

- Temperature units – are used to recalculate all temperature related parameters to Celsius or Fahrenheit scale.



Figure 4-5 Temperature scale option

- Default page – are used to select startup initial page from all Display Unit pages.



Figure 4-6 Default page option

4.3 Modes

Mode is a group of layouts that is dedicated to a specific type of application. Layout is a group of unique parameters which contain broadcasted information from Emus BMS and has dynamic presentation style. Dynamic presentation style could be described as data and its units change in time domain. All data can be scaled and according to its scale factor, units are also changed to make a match.

Display unit has several display modes:

- Electric vehicle – contains layouts related to consumption, speed information.
- Energy storage – mode focuses on displaying detailed information about system.

4.4 Layouts

There are several different layouts implemented into device. Each layout has various parameters, which will be discussed in this chapter. Parameters in these layouts are combined in such way that they have relations to each other.

Layout #1 has 3 parameters:

- Total battery voltage – accumulated voltage value from all cells. Parameter precision is 1 digit after decimal point.
- State of Charge (SOC) – amount of charged remaining inside batteries. Presented in percentage format. Parameter precision is 1 digit after decimal point.
- Current – momentary current flowing from/to batteries. Parameter precision is 1 digit after decimal point.



Figure 4-7 Layout #1

Layout #2 has 3 parameters:

- Power – momentary power used by system. Parameter precision is 2 digits after decimal point.
- Consumption – power consumed over hour to travel 1 distance unit. It is a momentary value. Parameter precision is 1 digit after decimal point.
- Battery cell temperature – average cell temperature measured from all cells. Temperature can be scaled to *Celsius* or *Fahrenheit*. Parameter has no decimal point.



Figure 4-8 Layout #2

Layout #3 has 3 parameters:

- Distance left – Estimated travel distance left. Calculated based on remaining batteries charge. This parameter can have any type of distance unit. e.g. km, mi, yr, nm. Its precision is 1 digit after decimal point.
- Speed – momentary travel speed. Moving speed equals to distance unit traveled over an hour. Parameter precision is 1 digit after decimal point.
- Distance traveled – Distance traveled from last time batteries were charged. This parameter can have any type of distance unit. e.g. km, mi, yr, nm. Its precision is 1 digit



Figure 4-9 Layout #3

after decimal point.

Layout #4 has 4 parameters:

- Total battery voltage – accumulated voltage value from all cells. Parameter precision is 2 digits after decimal point.
- Minimum battery cell voltage – minimum voltage value from all cells. Parameter precision is 2 digits after decimal point.
- Average battery cell voltage – average voltage value from all cells. Parameter precision is 2 digits after decimal point.
- Maximum battery cell voltage – maximum voltage value from all cells. Parameter precision is 2 digits after decimal point.



Figure 4-10 Layout #4

Layout #5 has 7 parameters:

- Charging stage – battery management system has 8 different charging stages: disconnected, not charging, pre-heating, pre-charging, main charging, balancing, finished, charging error.
- Total voltage – accumulated voltage value from all cells. Parameter precision is 2 digits after decimal point.
- Current – momentary charging current. Parameter precision is 1 digit after decimal point.
- Charging stage duration – counts time for how long particular charging stage is active. It is reset when stages change.
- Fan indicator – symbol presence indicates whether fan is turned on or off.
- Heater indicator – symbol presence indicates whether heater is turned on or off.
- Battery State of Charge (SOC) – graphically displays state of charge for battery pack.



Figure 4-11 Layout #5

Layout 6 has 6 parameters:

- Minimum internal temperature.
- Average internal temperature.
- Maximum internal temperature.
- Minimum external temperature.
- Average external temperature.
- Maximum external temperature.

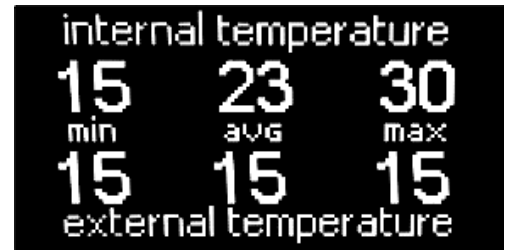


Figure 4-12 Layout #6

Support

Please contact EMUS for BMS installation or support questions to:

support@emusbms.com

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