

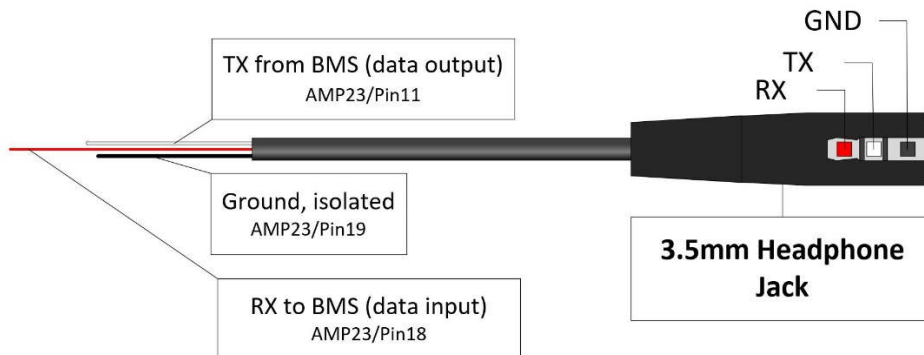
# NeverDie® Battery Management System (BMS) RS232-UART Serial Data Interface

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Latest designs of the BMS are equipped with AMPSEAL 23-pin connector, which includes pins for UART serial port. These pins are wired to a standard 3.5mm phone jack, which is used to connect to a UART-USB dongle, commonly available from suppliers like Mouser, Digikey, Allied, etc. This allows you to connect the BMS to a laptop via USB port used as a virtual COM port. Here is the link to the USB dongle at Mouser:

<https://www.mouser.com/ProductDetail/TTL-232R-5V-AJ?R=0virtualkey0virtualkeyTTL-232R-5V-AJ>

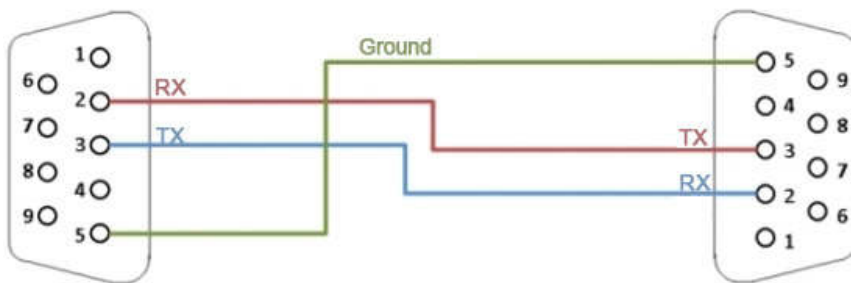
And a pinout of the 3.5mm jack to BMS Ampseal 23-pin connector



If your BMS is equipped with the optional RS232 Serial Data interface, then either a typical DB9 connector or more industrial M12 3-Pin A-Code connector can be used as the data cable. You can connect the Serial Data cable between the BMS and a Computer to communicate with the BMS. You can use a commonly available RS232 to USB adapters when connecting to PCs without a native RS232 port. We recommend adapters based on the “FTDI” brand chipset, which are robust and have native driver support in popular PC Operating Systems.

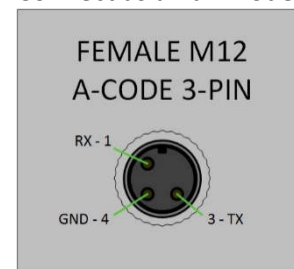
## DB9 Pin-out:

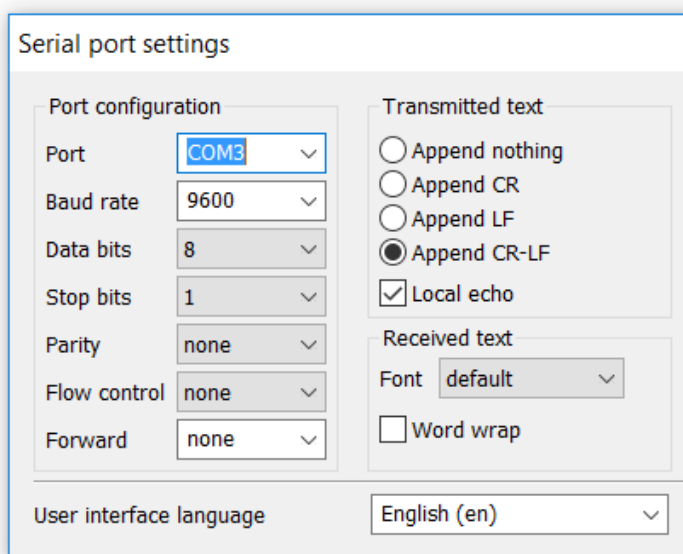
Connect as a null modem cable



## M12 A-code 3-Pin Pin-out:

Connect as a null modem cable





Any terminal emulator software with COM port support can be used to communicate with BMS. We recommend free software called Terminate, which allows data logging and has bidirectional command interface:

[http://www.compuphase.com/software\\_terminate.htm](http://www.compuphase.com/software_terminate.htm) .

Download “complete setup” version to be able to save data log files for later analysis.

In the Terminate configuration screen set the port parameters as shown in the screenshot, selecting the COM port number which is connected to BMS. It’s critical to set “Transmitted text” parameters exactly as shown here to communicate with the BMS successfully.

Once the COM port is initialized there will be a continuous stream of data packets with 1 second time interval between

each packet. Each data packet is an ASCII string of 47 characters, containing 10 data fields. Each field starts with a label character and is followed by a numeric data of constant length, padded by leading zeroes. Each string is terminated by return and new line characters, bytes 0x0D and 0x0A.

### Example of Serial Data packet:

**B1H00000V0000F000S000DOA00000W000000T000R000000**

### Serial Data packet fields:

- B** – Battery address, typically 1, in multi-battery systems this will represent battery order – 1-digit long
- H** - AmpHours remaining, in 0.1Ah resolution, i.e. 123 = 12.3Ah – 5-digit long
- V** – Volts, in 0.1V resolution, i.e. 123 = 12.3V – 4-digit long
- F** - Bat Gauge, in percent, i.e. 100 = 100% – 3-digit long
- S** - SoC percent, in percent, i.e. 100 = 100% – 3-digit long
- D** – Current direction, 1 – charging, 0 – discharging – 1-digit long
- A** - Amps instant, in 0.1A resolution, i.e. 123 = 12.3Amp – 5-digit long
- W** - Watts instant, in 1W resolution, i.e. 20000 = 20000W – 6-digit long
- T** – Temperature, in degrees, units depends on setup parameter – 3-digit long
- R** – System Status – 6-digit long, see details below

**NOTE:** Two additional data formats are available by setting DTYPE value in Config mode. All 3 formats have the same data fields in the same order, with same line termination, the difference is only in delimiters.

**DTYPE=0** – fixed length data fields with labels as described above.

**EXAMPLE:** B1H00010V0135F100S100DOA00000W000000T077R008080

**DTYPE=1** – variable length data fields with labels, comma delimited, with label “E” indicating end of string

**EXAMPLE:** B1,H10,V135,F100,S100,DO,A0,W0,T77,R008080,E

**DTYPE=2** – fixed length data fields without labels, comma delimited

**EXAMPLE:** 1,00010,0135,100,100,0,00000,000000,077,008080

## System Status bits

One of the data values in the BMS Data Stream is called System Status, where each bit represents one of the basic conditions of a battery system in real time. Each HEX digit represents 4 bits of binary data, for a total of 24 bits of data.

**NOTE:** Some of the bits represent optional BMS features, which might not be enabled in your system.

### Description of System Status bits:

HEX Digit 6				HEX Digit 5				HEX Digit 4				HEX Digit 3				HEX Digit 2				HEX Digit 1			
23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

**Bit 0 – High Voltage State.** Indicates that battery voltage is above HVC, typically 3.70VPC.

**Bit 1 – Charge Source Detected.** Indicates that charge voltage was detected on the far side of the contactor, allowing contactor to close even when battery is in Low Voltage state. This bit resets when battery reaches Nominal voltage.

**Bit 2 – NeverDie Reserve State.** Indicates that battery is in the NeverDie Reserve State, allowing access to reserve energy.

**Bit 3 – OptoLoop® Cell Loop is open.** Indicates that Cell Loop is open, which means one or more cells is out of normal voltage range, or broken Cell Loop wiring between battery modules and/or NeverDie BMS unit.

**Bit 4 – Reserve Voltage Range.** Indicates that battery voltage is below RVC, typically 3.0VPC.

**Bit 5 – Low Voltage State.** Indicates that battery voltage is below LVC, typically 2.6VPC.

**Bit 6 – Battery Protection State.** Indicates that battery is recovering from abnormal event, such as short circuit, pre-charge failure, or contactor failure. See additional bits below for more details.

**Bit 7 – Power Off State.** Indicates that battery was turned off by a command or a button press.

**Bit 8 – AUX Contacts State.** State of Auxiliary contacts inside the contactor, reflects actual physical state of the main contactor. This optional feature requires special model of the contactor with AUX contacts.

**Bit 9 – AUX Contacts Error.** In case of contactor welding, this bit will indicate discrepancy between expected and actual state of contactor. It also sets Bit 6 – Battery Protection State.

**Bit 10 – Pre-charge Error.** Indicates that Pre-charge function failed to detect voltage rise on the load side of BMS, which could mean a short circuit condition or other issues with load wiring. It also sets Bit 6 – Battery Protection State. This optional feature requires Pre-charge relay and resistor to be installed inside the BMS unit.

**Bit 11 – Contactor Flutter.** If BMS contactor changes state 10 times over 5-minute period, BMS enters Power Off state and sets this bit, so troubleshooting can be performed. This condition could be caused by wiring problems or other hardware issues and requires service attention.

**Bit 12 – AC Power Present.** Indicates that BMS detected AC power presence, so BMS expects charging to begin shortly. This optional feature requires special wiring inside BMS unit to connect to AC grid.

**Bit 13 – TSM Charger Present.** Indicates that CAN message from TSM charger was detected on CANBus interface. This indicates TSM charger is present and has AC power. Used for troubleshooting TSM chargers.

**Bit 14 – TSM Charger Error.** Message received from TSM charger indicating an issue with the charger. Further analysis of CAN data from the charger is needed to determine exact nature of the problem.

**Bit 15 – External Temp Sensor Error.** Indicates a problem with external temperature sensor installed inside the battery module. Temperature data from this sensor is used to cutoff battery power under extreme temperatures.

**Bit 16 – AGSR State.** State of optional AGSR Control circuit, used to start/stop generators when BMS is wired into supported generator’s auto start interface.

**Bit 17 – High Temperature State.** Temperature detected by external sensor exceeded allowed threshold.

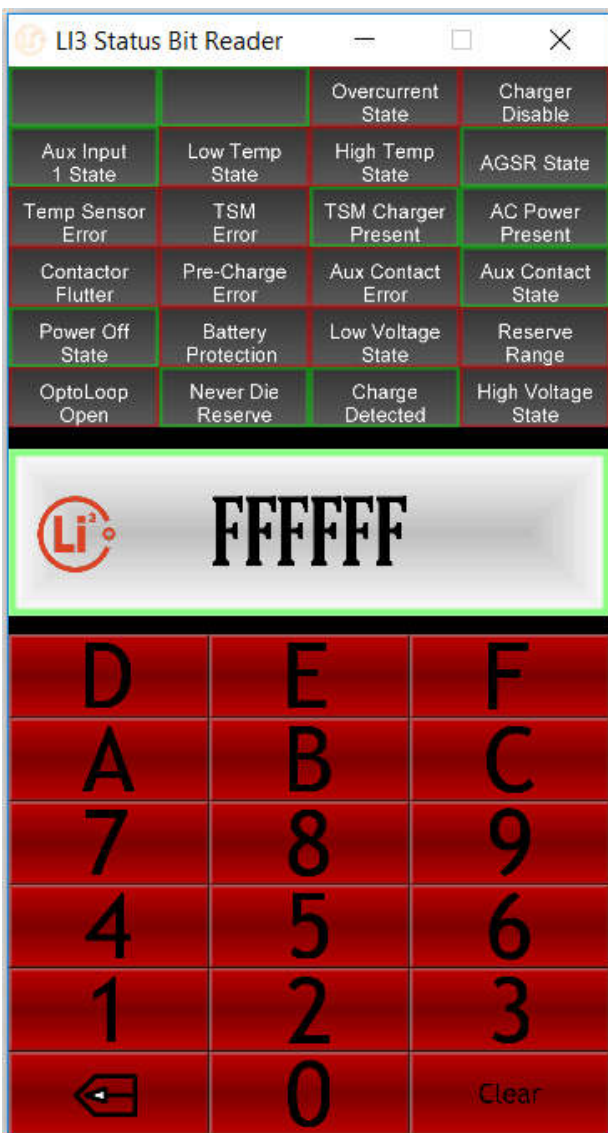
**Bit 18 – Low Temperature State.** Temperature detected by external sensor is below allowed threshold.

**Bit 19 – Auxiliary Input 1 State.** Reflects the state of AUXIN1 input, which is optional and application specific.

**Bit 20 – Charge Disable State.** Signals any charge source to stop charging the battery while this bit is set. This state is determined by BMS logic based on multiple factors including cell level and pack level protective functions.

**Bit 21 – Overcurrent State.** BMS detected current higher than preset limit.

**Bit 22 – Bit 23.** Not used, reserved for future functions.



Lithionics Battery has developed the **Li3 Status Bit Reader** application for Windows and Android platforms, which makes it easy to visualize status of each bit by typing in the System Status value and observing color coded table of bit values, see example below. You can download these applications from <http://www.lithionicsbattery.com/user-guides/>

Each bit description is color coded in green or red border, where green indicates informational bits and red indicates faults or critical conditions requiring attention, such as immediate need to charge the battery.

**NOTE: All 6 digits of the R value must be entered, including leading zeroes to trigger decoding function. To enter the new value, click Clear button first, then enter the new value.**