# NeverDie® Battery Management System (BMS)

# CANBus Data Interface

Rev. 7.14. R2 

If your BMS is equipped with the optional CANBus interface, you can connect the BMS to any CANBus compatible receiver and read BMS data messages. The following messages have been defined for Advanced Series BMS. Default bus speed is 250kbps, but can be configured for 125kbps or 500kbps if required. Messages use 29-bit addressing and 8-byte data frames (CAN 2.0B). Messages are formatted for compatibility with RV-C, J1939, NMEA2000 and XanBus networks. The CANBus electrical interface circuit is galvanically isolated from the battery pack to prevent ground loops and allow multiple BMS units on the same bus. For additional protocol details see RV-C Application specs at http://www.rv-c.com/

1. **Node addressing**. Due to resource limitations BMS will not support dynamic address assignments at this time. Source Address (SA) will be configurable via BMS configuration interface and default value will be set to 69 (0x45) per RV-C specs for a BMS device. If multiple BMS devices are present on the network, then integrators can change SA from default value to another appropriate value. Per RV-C specs address 70 (0x46) can also be used.

2. **Instance addressing**. Many data messages include an instance number, allowing multiple instances of a device class to coexist on the network. Instance will be configurable as BATID in the BMS configuration interface with default value set to 1. If multiple BMS devices are present on the network, then integrators can change the instance number from default value to another appropriate value according to RV-C specs.

3. **Supported messages.** Below messages will be supported by the BMS as defined in the RV-C Application specs. Last 2 messages are proprietary for Lithionics BMS status reports and future development.

| Message | DGN / PGN | Notes |
|---|---|---|
| REQUEST | 0xEA00 | BMS listens and responds to these messages |
| ADDRESS_CLAIM | 0xEE00 | BMS will claim preset SA=0x45, but can be changed in config |
| DM_RV | 0x1FECA | Diagnostic data as defined in RV-C specs |
| PRODUCT_ID | 0xFEEB | Will fit in 3 frames – INITIAL_PACKET + Li3*BMS*v714** |
| DC_SOURCE_STATUS_1 | 0x1FFFD | provides battery Voltage and Current data |
| DC_SOURCE_STATUS_2 | 0x1FFFC | provides battery Temperature and SOC data |
| DC_SOURCE_STATUS_3 | 0x1FFFB | provides remaining Ah capacity |
| DC_SOURCE_STATUS_4 | 0x1FEC9 | provides desired charger state and charge specs |
| DC_SOURCE_STATUS_6 | 0x1FEC7 | provides HVC and LVC status |
| DC_SOURCE_STATUS_11 | 0x1FEA5 | provides more status bits, total Ah capacity and current Power |
| DC_SOURCE_COMMAND | 0x1FEA4 | accepts ON/OFF/Charge-ON commands |
| PROP_LITHIONICS_COMMAND | 0xEF45 | accepts request for proprietary status data |
| PROP_LITHIONICS_STATUS | 0xEF## | provides proprietary status bits and other data |

4. **DC_SOURCE_STATUS_11.** This is a newly proposed RV-C message with following format. It is pending official RV-C submission and acceptance.

| Byte | Bit | Name | Data Type | Unit | Value Definition |
|---|---|---|---|---|---|
| 0 | - | Instance | uint8 | - | Default = 1, see RV-C specs for details |
| 1 | - | Device Priority | uint8 | - | Default = 120, see RV-C specs for details |
| 2 | 0-1 | Power On/Off status | bit | - | State of Battery main power switch / contactor |
| | 2-3 | Charge On/Off status | bit | - | State of separate charge bus Battery switch / contactor |
| | 4-5 | Charge Detected | bit | - | Charge source was detected while power was off due to low state of charge |
| | 6-7 | Reserve Status | bit | - | Reserve level has been reached |
| 3-4 | - | Full capacity | uint16 | Ah | Nominal capacity of a fully charged battery<br>Precision = 1 Ah<br>Value range = 0 to 65530 Ah |
| 5-6 | - | DC Power | uint16 | W | Current DC Power level<br>Precision = 1 W<br>Value range = 0 to 65530 W |

5. **DC_SOURCE_COMMAND.** This is a newly proposed RV-C message with following format. It is pending official RV-C submission and acceptance.

| Byte | Bit | Name | Data Type | Unit | Value Definition |
|---|---|---|---|---|---|
| 0 | - | Instance | uint8 | - | Default = 1, see RV-C specs for details |
| 1 | 0-1 | Desired Power On/Off status | bit | - | Request to turn on main Battery power switch / contactor |
| | 2-3 | Desired Charge On status | bit | - | Request to allow charging while power is off due to low state of charge |

6. **PROP_LITHIONICS_COMMAND**. This is a newly proposed proprietary message for Lithionics BMS. It is currently only used to request response message. In the future it could be used to change BMS configuration parameters.

| Byte | Bit | Name | Data Type | Unit | Value Definition |
|---|---|---|---|---|---|
| 0 | - | Double-check | uint8 | - | Always = 0xAA, helps to avoid conflicts with other vendors proprietary messages |
| 1 | - | Instance | uint8 | - | Default = 1, see RV-C specs for details |

7. **PROP_LITHIONICS_STATUS**. This is a newly proposed proprietary message for Lithionics BMS. It provides additional status data proprietary to Lithionics BMS system.

| Byte | Bit | Name | Data Type | Unit | Value Definition |
|---|---|---|---|---|---|
| 0 | - | Double-check | uint8 | - | Always = 0xAB, helps to avoid conflicts with other vendors proprietary messages |
| 1 | - | Instance | uint8 | - | Default = 1, see RV-C specs for details |
| 2 | - | Max recorded temp | uint8 | °C | Offset -40°C, range -40°C to 210°C |
| 3 | - | Min recorded temp | uint8 | °C | Offset -40°C, range -40°C to 210°C |
| 4 | 0 | High Voltage State | bit | - | Indicates that battery voltage is above HVC, typically 3.70VPC. |
| | 1 | Charge Source Detected | bit | - | 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. |

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| | 2 | NeverDie Reserve State | bit | - | Indicates that battery is in the NeverDie Reserve State, allowing access to reserve energy. |
| | 3 | OptoLoop is Open | bit | - | 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. |
| | 4 | Reserve Voltage Range | bit | - | Indicates that battery voltage is below RVC, typically 3.0VPC. |
| | 5 | Low Voltage State | bit | - | Indicates that battery voltage is below LVC, typically 2.9VPC. |
| | 6 | Battery Protection State | bit | - | 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. |
| | 7 | Power Off State | bit | - | Indicates that battery was turned off by a command or a button press. |
| 5 | 0 | AUX Contacts State | bit | - | 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. |
| | 1 | AUX Contacts Error | bit | - | In case of contactor welding, this bit will indicate discrepancy between expected and actual state of contactor. It also sets Battery Protection State bit. |
| | 2 | Pre-charge Error | bit | - | 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. |
| | 3 | Contactor Flutter | bit | - | 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. |
| | 4 | AC Power Present | bit | - | Indicates that BMS detected AC power presence, so BMS expects charging to begin shortly. This optional feature requires AC/DC supply wired to the BMS unit to connect to AC grid. |
| | 5 | TSM Charger Present | bit | - | 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. |
| | 6 | TSM Charger Error | bit | - | 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. |
| | 7 | Temperature Intervention Sensor Error | bit | - | Indicates a problem with temperature intervention sensor installed inside the battery module. |

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| | | | | | Temperature data from this sensor is used to cutoff battery power under extreme temperatures. |
| 6 | 0 | AGSR State | bit | - | State of optional AGSR Control circuit, used to start/stop generators when BMS is wired into supported generator's auto start interface. |
| | 1 | Hot Temperature State | bit | - | Temperature detected by Temperature Intervention Sensor exceeded allowed threshold. |
| | 2 | Cold Temperature State | bit | - | Temperature detected by Temperature Intervention Sensor is below allowed threshold. |
| | 3 | AUXIN1 State | bit | - | Reflects the state of AUXIN1 input, which is optional and application specific. |
| | 4 | Charge Disable State | bit | - | 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. |
| | 5 | Over-current State | bit | - | BMS detected current higher than preset limit. |