

# NeverDie® Battery Management System (BMS) CANBus Data Interface

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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 protocol, which is also partially compatible with 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/>

- 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.
- 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.
- 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	0xEA##	BMS listens and responds to these messages
ADDRESS_CLAIM	0xEE##	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	0xFEED	Single frame ID string = LI3*8**
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

- REQUEST (PGN = 0xEA##).** BMS listens for this “request for DGN” and responds with requested DGN message or a NAK message if requested DGN is not supported. NAK is only sent if REQUEST was sent to BMS’s specific address, no response is sent if REQUEST was broadcasted and DGN is not supported. Destination address is coded in the low byte of the DGN, for example 0xEA45 will get a response if BMS’s Source Address is set to 0x45. Destination address 0xFF is a broadcast to all nodes.

Byte	Bit	Name	Data Type	Unit	Value Definition
0-2	-	Requested DGN	uint24	-	LSB sent first, for example FD-FF-01 is a request for DC_SOURCE_STATUS_1

5. **ADDRESS\_CLAIM (PGN = 0xEE00 & 0xEEFF)**. BMS sends this message to reserve its Source Address and to let other devices know that the address is taken by an active node. BMS currently does not support dynamic addressing and will use address 0x45 by default. Address can be set manually in the BMS configuration by changing the CANSA value. Message is sent every 1 second. A duplicate message with last PGN byte 0xFF is also sent for better compatibility with Xantrex and legacy RV-C devices.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Serial number LSB	uint8	-	BMS serial number byte 1
1	-	Serial number byte 2	uint8	-	BMS serial number byte 2
2	0-4	Serial number MSB	uint8	-	BMS serial number byte 3
	2-3	Manufacturer code LSB	uint8	-	Manufacturer code set to 119 for Xantrex
3	-	Manufacturer code MSB	uint8	-	Manufacturer code set to 119 for Xantrex
4	-	Instance	uint8	-	Default = 1, see RV-C specs for details
5	-	Compatibility Field	uint8	-	Set to 0x89
6	-	Compatibility Field	uint8	-	Set to 0x3C
7	-	Compatibility Field	uint8	-	Set to 0x00

6. **DM\_RV (PGN = 0x1FECA)**. BMS sends this diagnostic message to indicate its general operating status. Current implementation only sends general ON/OFF status of the main contactor for minimal RV-C compliance. Message is sent every 5 seconds.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	0-1	Operating Status	bit	-	Always = 01(b) to indicate BMS is on
	2-3	Operating Status	bit	-	Power Off = 00(b), Power On = 01(b)
1	-	Source Address	uint8	-	Default SA = 0x45, but can be changed in config
2	-	SPN data	uint8	-	N/A, set to 0x00
3	-	SPN data	uint8	-	N/A, set to 0x00
4	-	SPN data	uint8	-	N/A, set to 0x00
5	-	Occurrence count	uint8	-	N/A, set to 0xFF
6	-	DSA extension	uint8	-	N/A, set to 0xFF
7	-	Bank select	uint8	-	N/A, set to 0xFF

7. **PRODUCT\_ID (PGN = 0xFEED)**. This message contains a short text string to identify the BMS on the RV-C network and is required for RV-C compliance. Message is sent every 5 seconds.

Byte	Bit	Name	Data Type	Unit	Value Definition
0-7	-	Product ID text string	text	-	ASCII string of 8 bytes = LI3*8***, where "LI3" is a trademark for Lithionics Battery and "8" is a major hardware version, with separators "*" as required by RV-C compliance

8. **DC\_SOURCE\_STATUS\_1 (PGN = 0x1FFD)**. This message provides battery Voltage and Current data. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2-3	-	Battery Voltage	uint16	V	Precision = 0.05V Example – 0x010E = 13.5V
4-7	-	Battery Current	uint32	A	Precision = 0.001A Positive value = discharge Negative value = charge Offset - 0A = 0x77359400 Example – 0x77371AA0 = 100.0A discharge Example – 0x7734D0B0 = 50.0A charge

9. **DC\_SOURCE\_STATUS\_2 (PGN = 0x1FFFC)**. This message provides battery temperature and SOC data. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2-3	-	Battery Temperature	uint16	°C	Precision = 0.003125 °C Offset – 0 °C = 0x2220 Example – 0x2540 = 25 °C
4	-	State of Charge	uint8	%	Precision = 0.5% Example – 0xC8 = 100%
5-6	-	Remaining Discharge Time	uint16	min	Precision = 1 minute Example – 0x05A0 = 1440 min = 1 day

10. **DC\_SOURCE\_STATUS\_3 (PGN = 0x1FFFB)**. This message provides remaining battery capacity. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2	-	State of Health	uint8	%	Precision = 0.5% Example – 0xC8 = 100% NOTE: in current version always set to 100%
3-4	-	Remaining Discharge Capacity	uint16	Ah	Precision = 1Ah Example – 0x015E = 350Ah
5	-	Remaining Relative Capacity	uint8	%	Same as State of Charge data. Precision = 0.5% Example – 0xC8 = 100%

11. **DC\_SOURCE\_STATUS\_4 (PGN = 0x1FEC9)**. This message provides desired charger state and charge specs. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2	-	Desired Charge State	uint8	-	0 – undefined, charger decides, usually indicates bulk stage. This is default value. 1 – Do not charge. Signals the charger to stop immediately, based on BMS decision to protect the battery from cell level or pack level overcharge or a fault condition. 3 – Final stage. Charger should reduce the current to a fraction of bulk, for a gentle final charge stage where voltage rise is much faster than during bulk stage.
3-4	-	Desired Charge Voltage	uint16	V	Precision = 0.05V Example – 0x0124 = 14.6V
5-6	-	Desired Charge Current	uint16	A	Precision = 0.05A Positive value = charge Offset - 0A = 0x7D00 Example – 0x9470 = 300.0A charge
7	-	Battery Type	uint8	-	3 – Lithium Iron Phosphate

12. **DC\_SOURCE\_STATUS\_6 (PGN = 0x1FEC7)**. This message provides LVC and HVC alarms and disconnect status, signaling to other equipment when Lithium battery is at risk of overcharge or over-discharge. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2	0-1	High Voltage Alarm Status	bit	-	01b = active, 00b = inactive Indicates cell level or pack level overcharge alarm. Charge sources must stop charging immediately to prevent imminent battery disconnect.
	2-3	High Voltage Disconnect Status	bit	-	01b = active, 00b = inactive Indicates that battery has been disconnected due to cell level or pack level overcharge risk.

	4-5	Low Voltage Alarm Status	bit	-	01b = active, 00b = inactive Indicates cell level or pack level over-discharge alarm. Loads must be removed, or charging must begin immediately to prevent imminent battery disconnect.
	6-7	Low Voltage Disconnect Status	bit	-	01b = active, 00b = inactive Indicates that battery has been disconnected due to cell level or pack level over-discharge risk.

13. **DC\_SOURCE\_STATUS\_11 (PGN = 0x1FEA5)**. This is a newly proposed RV-C message with following format. It is pending official RV-C submission and acceptance. Message is sent every 1 second.

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	-	Device Priority	uint8	-	Default = 120, identifies device type as BMS, see RV-C specs for details
2	0-1	Power On/Off status	bit	-	01b = active, 00b = inactive State of Battery main power switch / contactor
	2-3	Charge On/Off status	bit	-	01b = active, 00b = inactive State of separate charge bus Battery switch / contactor
	4-5	Charge Detected	bit	-	01b = active, 00b = inactive Charge source was detected while power was off due to low state of charge
	6-7	Reserve Status	bit	-	01b = active, 00b = inactive Reserve level has been reached
3-4	-	Full capacity	uint16	Ah	Nominal capacity of a fully charged battery Precision = 1 Ah Value range = 0 to 65530 Ah
5-6	-	DC Power	uint16	W	Current DC Power level Precision = 1 W Value range = 0 to 65530 W

14. **DC\_SOURCE\_COMMAND (PGN = 0x1FEA4)**. This is a newly proposed RV-C message with following format. It is pending official RV-C submission and acceptance. BMS listens for and responds to this message.

**NOTE: If BMS receives the Power Off command, it will turn itself off to preserve battery power and will disengage from the CANBus network. Pressing BMS On/Off button will be required to power the BMS back on.**

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Instance	uint8	-	Default = 1, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
1	0-1	Desired Power On/Off status	bit	-	01b = active, 00b = inactive Request to turn on main Battery power switch / contactor
	2-3	Desired Charge On status	bit	-	01b = active, 00b = inactive

					Request to allow charging while power is off due to low state of charge
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15. **PROP\_LITHIONICS\_COMMAND (PGN = 0xEF##)**. 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. Last byte of the PGN is the Destination Address of the BMS device, default is 0x45.

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, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.

16. **PROP\_LITHIONICS\_STATUS (PGN = 0xEF##)**. This is a newly proposed proprietary message for Lithionics BMS. It provides additional status data proprietary to Lithionics BMS system. Last byte of the PGN is the Destination Address of the device which sent the request command.

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, battery instance or BAT_ID, can be changed in BMS config to allow multiple BMS systems on the same bus.
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.
	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. 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.

17. **Example of broadcasted messages.** Below is a capture of typical RV-C messages broadcasted by the BMS, provided as a sample to help customers with data integration into their systems.

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x0	0xFE	0xEB	0x45	0xFEEB	0x4C 49 33 2A 38 2A 2A 2A

**Product ID – LI3\*8\*\*\***

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFE	0xCA	0x45	0x1FECA	0x05 45 00 00 00 FF FF FF

**DM\_RV – BMS On, Power On**

Priority	R	DP	PF	DA	SA	PGN	Data Field
0x6	0x0	0x0	0xEE	0x0	0x45	0xEE00	0xD9 EB ED 0E 01 89 3C 00

**Address claim – SA = 0x45, DA = 0x00**

Priority	R	DP	PF	DA	SA	PGN	Data Field
0x6	0x0	0x0	0xEE	0xFF	0x45	0xEE00	0xD9 EB ED 0E 01 89 3C 00

**Address claim – SA = 0x45, DA = 0xFF**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFF	0xFD	0x45	0x1FFFD	0x01 78 16 01 00 94 35 77

**Voltage = 13.9V, Current = 0.0A**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFF	0xFC	0x45	0x1FFFC	0x01 78 A0 24 C8 F0 37 00

**Temperature = 20°C, SOC = 100%**

**Time remaining = 14320 min**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFF	0xFB	0x45	0x1FFFB	0x01 78 C8 58 02 C8 00 00

**Remaining Capacity = 600Ah, SOH = 100%**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFE	0xC9	0x45	0x1FEC9	0x01 78 00 24 01 70 94 03

**Desired charge state – default (bulk)**

**Desired Voltage = 14.6V, max Current = 300A**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFE	0xC7	0x45	0x1FEC7	0x01 78 00 00 00 00 00 00

**HVC & LVC alarms – off**

**HVC & LVC disconnects – off**

Priority	R	DP	PF	GE	SA	PGN	Data Field
0x6	0x0	0x1	0xFE	0xA5	0x45	0x1FEA5	0x01 78 05 58 02 00 00 00

**Power On state, Battery Capacity = 600AH**