



**Lithionics Battery®**

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## CANBus Data Interface

Lithionics NeverDie BMS is equipped with CANBus interface, so you can connect the BMS to any CANBus compatible receiver and read BMS data messages. The following messages have been defined for External BMS and the Internal CS200 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/>

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 70 (0x46) per RV-C specs for a Battery. If multiple Batteries are present on the network, then integrators can change SA from default value to another appropriate value. Per RV-C specs addresses 128-143 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 is configurable as BATID in the BMS configuration interface with default value set to 1. If multiple Batteries are present on the network, then integrators must change the instance number from default value to another unique value in the range 1-9.
3. **Supported messages.** Below pages list messages that are supported by the BMS. Most are defined in the RV-C Application specs. Some messages are proprietary for Lithionics BMS.

Lithionics Battery BMS RV-C and J1939 Messages Table												
PGN Name	Broadcast Rate	PGN Number	Default Source Address	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	
Broadcasted messages, DLC = 8, CAN rate = 250kbps												
ACK_NACK	as needed	0x0E8xx	0x46	ACK/NACK	Battery ID (instance)					PGN acknowledged		
ADDRESS_CLAIM	1s	0x0EEFF	0x46	J1939 NAME Fields								
PRODUCT_ID	5s	0x0FEEB	0x46	Product ID								
DM_RV	5s/1s or change	0x1FECA	0x46	Operating Status	DSA	SPN MSB	SPN ISB	SPN-FMI LSB				
DC_SOURCE_STATUS_1	500ms	0x1FFFD	0x46	Battery ID (instance)	Device Priority	Battery DC Voltage		Battery DC Current				
DC_SOURCE_STATUS_2	500ms	0x1FFFC	0x46	Battery ID (instance)	Device Priority	Battery Temperature		State Of Charge	Time Remaining			
DC_SOURCE_STATUS_3	500ms	0x1FFFB	0x46	Battery ID (instance)	Device Priority	State Of Health	Remaining Discharge Capacity		State Of Charge			
DC_SOURCE_STATUS_4	5s or change	0x1FEC9	0x46	Battery ID (instance)	Device Priority	Desired Charge State	Desired Charge Voltage		Desired Charge Current		Battery Type	
DC_SOURCE_STATUS_6	5s or change	0x1FEC7	0x46	Battery ID (instance)	Device Priority	Flags 1	Flags 2	Flags 3				
DC_SOURCE_STATUS_11	1s or change	0x1FEA5	0x46	Battery ID (instance)	Device Priority	Flags 4	Full Battery Capacity		Battery DC Power			
PROP_BMS_STATUS_1	1s	0x0FF80	0x46	Battery ID (instance)	Number of Modules/Sensors	BMS Internal Temp	Max Recorded Temp	Min Recorded Temp	BMS Status Code			
PROP_BMS_STATUS_2	1s in trace mode	0x0FF81	0x46	Battery ID (instance)	Load Contactor Voltage		Charge Contactor Voltage		Last BMS Fault Code			
PROP_BMS_STATUS_3	5s	0x0FF82	0x46	Battery ID (instance)	Total Lifetime AH Consumed							
PROP_BMS_STATUS_4	1s in trace mode	0x0FF83	0x46	Battery ID (instance)	CAN Charger DC Voltage		CAN Charger DC Current		CAN Charger Status			
PROP_BMS_STATUS_5	on request	0x0FF84	0x46	Battery ID (instance)	Aging Factor SOC			Aging Factor Temp				
PROP_BMS_STATUS_6	on request	0x0FF85	0x46	Battery ID (instance)	Firmware Major	Firmware Minor	Serial Number					
PROP_BMS_CMD_RESPONSE	on request	0x0EFxx	0x46	Password Response	Battery ID (instance)	Response	Parameter ID	Parameter Value				
PROP_BMS_CMD_STATUS	on request	0x0EFxx	0x46	Legacy Password	Battery ID (instance)	Max Recorded Temp	Min Recorded Temp	BMS Status Code				
PROP_MODULE_COMMAND	on request	0x0FF90	0x46	Battery ID (instance)	Module ID	Command	Parameter ID	Parameter Value				

Received messages, DLC = 8, CAN rate = 250kbps												
PGN_REQUEST		0x0EAxx	any	Requested PGN Number								
DC_SOURCE_COMMAND		0x1FEA4	any	Battery ID (instance)	Flags 5							
PROP_BMS_COMMAND		0x0EFxx	any	Password	Battery ID (instance)	Command	Parameter ID	Parameter Value				

Definitions and Examples				
Value Name	Value Size	Value Definition	Example Bytes and Corresponding Data	
Battery ID (instance)	1 byte	Instance of the BMS on CAN network, range 1-9, defines a Battery ID	0x01	Battery ID = 1
Device Priority	1 byte	As described in RV-C specs for DC_SOURCE data priority, battery has value of 120 (dec)	0x78	always set to 120 (dec)
Battery DC Voltage	2 bytes	0.05V / bit, offset = 0V	0x010E	13.5 V
Battery DC Current	4 bytes	0.001A / bit, offset = -2000000A = 0x77359400, positive = discharge, negative = charge	0x77371AA0	100.0 A discharge
Battery Temperature	2 bytes	0.03125 °C / bit, offset = -273 °C = 0x2220	0x2540	25 °C
State Of Charge	1 byte	0.5% / bit, offset = 0	0xC8	100%
Time Remaining	2 bytes	1 min / bit, offset = 0, time to empty during discharge, time to full during charge	0x05A0	1440 min = 1 day
State Of Health	1 byte	0.5% / bit, offset = 0	0xC8	100%
Remaining Discharge Capacity	2 bytes	1 Ah / bit, offset = 0	0x015E	350 Ah
Desired Charge State	1 byte	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.	0x01	Charger must stop charging
Desired Charge Voltage	2 bytes	0.05V / bit, offset = 0V, typical bulk/absorption stage target voltage	0x0124	14.6 V
Desired Charge Current	2 bytes	0.05A / bit, offset = -1600A = 0x7D00, positive = charge, typical max charge current limit	0x9470	300.0 A
Battery Type	1 byte	3 – Lithium Iron Phosphate	0x03	LiFePO4 battery
Full Battery Capacity	2 bytes	1 Ah / bit, offset = 0, nominal capacity of a fully charged battery	0x015E	350 Ah
Battery DC Power	2 bytes	1 W / bit, offset = 0, current DC Power level, charge or discharge, always positive	0x03E8	1000 W
Number of Modules/Sensors	1 byte	count of distributed temp sensors, same as number of distributed BMS monitoring modules	0x01	1 module / temp sensor
BMS Internal Temp	1 byte	1 °C / bit, offset = -40 °C = 0x28	0x41	25 °C
Max Recorded Temp	1 byte	1 °C / bit, offset = -40 °C = 0x28	0x41	25 °C
Min Recorded Temp	1 byte	1 °C / bit, offset = -40 °C = 0x28	0x41	25 °C
BMS Status Code	3 bytes	up to 24 bits of individual status flags, see BMS documentation	0x000100	typical "All OK" state
Load Contactor Voltage	2 bytes	0.05V / bit, offset = 0V, voltage sensed at BMS Load terminal	0x010E	13.5 V
Charge Contactor Voltage	2 bytes	0.05V / bit, offset = 0V, voltage sensed at BMS Charge terminal (optional dual channel BMS)	0x010E	13.5 V
Last BMS Fault Code	3 bytes	last recorded Status Code which caused a BMS Fault event	0x000034	low voltage Fault
Total Lifetime AH Consumed	4 bytes	1 Ah / bit, offset = 0, lifetime counter of Ah discharged from battery	0x2710	10,000 Ah
Charger DC Voltage	2 bytes	0.05V / bit, offset = 0V	0x010E	13.5 V
Charger DC Current	2 bytes	0.05A / bit, offset = -1600A = 0x7D00, value always positive	0x80E8	50 A
Charger Status	2 bytes	2 byte value combines CAN charger status, error codes and charge stage	0x0003	typical value for bulk stage
Aging Factor SOC	3 bytes	numeric value for battery aging counter, see BMS documentation for details	0x012345	value depends on age of the battery
Aging Factor Temp	4 bytes	numeric value for battery aging counter, see BMS documentation for details	0x01234567	value depends on age of the battery
Firmware Major	1 byte	numeric value for major firmware version	0x50	major version 8.0
Firmware Minor	1 byte	numeric value for minor firmware version	0x0F	minor version 15
Serial Number	4 bytes	factory issued serial number in decimal format	0x01F651C5	32920005
Product ID	8 bytes	as required by RV-C specs, value = LI3*8*** in ASCII codes = 4C,49,33,2A,38,2A,2A,2A	0x4C49332A382A2A2A	LI3*8***

Flags 1	1 byte	bits 0-1: High Voltage Alarm Status, 01b = active, 00b = inactive bits 2-3: High Voltage Disconnect Status, 01b = active, 00b = inactive bits 4-5: Low Voltage Alarm Status, 01b = active, 00b = inactive bits 6-7: Low Voltage Disconnect Status, 01b = active, 00b = inactive	0x50	Low Voltage Alarm and Disconnect NOTE: See RV-C protocol specs for details
Flags 2	1 byte	bits 0-1: Low SOC Alarm Status, 01b = active, 00b = inactive bits 2-3: Low SOC Disconnect Status, 01b = active, 00b = inactive bits 4-5: Low Temperature Alarm Status, 01b = active, 00b = inactive bits 6-7: Low Temperature Disconnect Status, 01b = active, 00b = inactive	0x05	Low SOC Alarm and Disconnect NOTE: See RV-C protocol specs for details
Flags 3	1 byte	bits 0-1: High Temperature Alarm Status, 01b = active, 00b = inactive bits 2-3: High Temperature Disconnect Status, 01b = active, 00b = inactive	0x05	High Temperature Alarm and Disconnect NOTE: See RV-C protocol specs for details
Flags 4	1 byte	bits 0-1: Load Contactor On/Off Status, 01b = active, 00b = inactive bits 2-3: Charge Contactor On/Off Status, 01b = active, 00b = inactive bits 4-5: Charge Source Detection Status, 01b = active, 00b = inactive bits 6-7: Reserve Status, 01b = active, 00b = inactive	0x05	Load and Charge contactors are on NOTE: See RV-C protocol specs for details
Flags 5	1 byte	bits 0-1: Desired Power On/Off status, 01b = active, 00b = inactive bits 2-3: Desired Charge On status, 01b = active, 00b = inactive	0x01	Command Power ON NOTE: See RV-C protocol specs for details

#### NOTES for MFD Development

Parameters shaded in green should be displayed on MFD Display.  
Parameters which require PGN request should be requested/updated once in 30 seconds.  
Firmware version should be printed as X.X.YY , where XX is Major Version in decimal and YY is Minor Version in decimal, i.e. 8.0.19  
Serial Number should be printed as NDxxxxxxx, where 9 digits are decimal with leading zeroes, i.e. ND010720001  
Battery Power can be calculated from Power = Voltage \* Current, and printed in kW with 0.1 resolution  
Battery\_ID should be integrated in a small corner print with each parameter, not as a separate parameter, to allow displaying parameters from multiple batteries

BMS Command-Response

Lithionics Battery proprietary BMS Command-Response protocol										
PGN Name	PGN Number	Default Source Address	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PROP_BMS_COMMAND	0x0EFxx	any	Password	Battery ID (instance)	Command	Parameter ID	Parameter Value Update			
PROP_BMS_CMD_RESPONSE	0x0EFxx	BMS Source Address	Password Response	Battery ID (instance)	Response	Parameter ID	Parameter Value Response			
Definitions and Examples										
Value Name	Value Size	Value Definition								
Password	1 byte	always = 0x55								
Password Response	1 byte	always = 0x56								
Battery ID (instance)	1 byte	Instance of the BMS on CAN network, range 1-9, defines a Battery ID								
Command	1 byte	1 = request existing value, 2 = set new value								
Response	1 byte	same as Command								
Parameter ID	1 byte	BMS parameter number or command number, list provided below								
Parameter Value Update	4 byte	numeric value to be assigned to given parameter ID, only used when Command = 2, otherwise ignored								
Parameter Value Response	4 byte	numeric value currently assigned to given parameter ID								
List of available Parameters										
Parameter Name	Parameter ID (dec)	Parameter Value Range	Parameter Notes							
BMS Configuration Parameters										MFD Increment Steps
Battery_ID	24	1-9	Identifies specific battery in a multi-battery system							1
CAN_SA	25	1-250	RV-C CAN Source Address, default value 0x46 (70), see RV-C specs							1
AmpHours	26	1-3000	Nominal battery capacity							10
Full_Voltage	27	345-365	Cell level full voltage. Used to sync SOC to 100%							1
Charge_Voltage	28	345-365	Cell level charge voltage. Used in CAN charger control and RV-C PGNs							1
Reserve_SOC	29	0-80	SOC level to trigger NeverDie Reserve, default = 10%							1
Reserve_Mode	31	0-2	0-disabled, 1-enabled, 2-extended by 0.1VPC							1
AGSR_Level_On	32	0-90	0-disabled, 1-90 SOC percent value when AGSR relay turns on							1
AGSR_Level_Off	33	0-100	0-disabled, 1-100 SOC percent value when AGSR relay turns off							1
Heater_Level_On	34	35-65 or 0	Heater On temp in F, hysteresis for Off is 5 deg above On point							1
Idle_Load	35	0-20	Value in 10mA increments, used for small SOC decrements due to idle BMS load							1
Alarm	36	0-1	Controls BMS audible alarm buzzer, 0-disabled, 1-enabled							1
PowerUp_Mode	37	0-1	1 = Single Stage, 0 = Dual Stage, separate BMS and Battery power on/off							1

BMS Command-Response

Precharge_Time	39	0-240	125ms increments. Time allowed for voltage rise during pre-charge cycle	1
Precharge_Voltage	40	0-100	Percentage voltage rise required for successful pre-charge cycle	1
LEDPod_Mode	41	0-1	0 - two color red/green , 1 - tri-color red/yellow/green	
Serial_Data_Format	42	0-2	0-fixed width values, 1-comma , 2-fixed length comma delimited values	
Current_Calibration	49	500-4000	0.1A resolution value of measured current between 50A and 400A	
Voltage_Calibration	50	1000-60000	0.01V resolution value of measured voltage between 10V and 600V	
V_Drop	51	0-250	extra length in feet of 4/0 cable between battery module and BMS	

**BMS Runtime Commands**

Command Name	Parameter ID (dec)	Command Notes
BMS_Info	1	triggers PGNs - PROP_BMS_STATUS_1 , _2 , _3 , _5 , _6 , send at low frequency e.x. 30 to 60 sec
Battery_On	2	turns battery power On, only send on change, not repeatedly
Battery_Off	3	turns battery power Off, only send on change, not repeatedly
BMS_Off	4	turns BMS Off, only send on change, not repeatedly
Charge_On	5	turns BMS contactor on to receive available charge when BMS is in Low Voltage mode
Data_Poll	6	requests single cycle of BMS data when data streaming is turned off
Data_On	7	enable continuous streaming of BMS data ( enabled by default ), only send on change, not repeatedly
Data_Off	8	disables continuous streaming of BMS data, only send on change, not repeatedly
Trace_On	9	enables additional "trace" data for troubleshooting or advanced data logging, only send on change
Trace_Off	10	disables additional "trace" data for troubleshooting or advanced data logging, only send on change
BMS_Reset	11	resets BMS power to try and clear any persistent error, only send when absolutely required
List_Values	23	triggers a batch of PROP_BMS_CMD_RESPONSE PGNs listing all available BMS Parameters

**NOTES for MFD Development**

Configuration menu should include 15 parameters shaded in green above. Incremens should be stepped as listed above, within defined range. Possible to use runtime command "List\_Values" to trigger batch of responses for all values, rather than requesting each one.

DM-RV SPN-FMI Details

DM-RV Message Details		
<b>Operating Status</b>	1 byte	bits 3-2-1-0: Operating Status, 0001b = Battery Power is OFF, 0101b = Battery Power is ON bits 5-4: Yellow Lamp Status, 01b = active, 00b = inactive bits 7-6: Red Lamp Status, 01b = active, 00b = inactive
<b>DSA</b>	1 byte	0x46 - RV-C Standard DSA for a Battery Device
<b>SPN MSB</b>	1 byte	See details below
<b>SPN ISB</b>	1 byte	See details below
<b>SPN-FMI LSB</b>	1 byte	bits 7-6-5: LSB of SPN, value range 0-7, see details below bits 4-0: FMI value, see details below

Battery SPNs				
MSB	ISB	LSB	Description	Combined MSB with 5 bit left shifted LSB
0	0-FFh	0-7	Global Standard SPNs	
1	Instance	0	Battery Voltage	0x0100
1	Instance	1	Battery Current	0x0120
1	Instance	2	Battery Temperature	0x0140
1	Instance	3	Battery State Of Charge	0x0160
1	Instance	4	Battery State Of Health	0x0180
1	Instance	5	BMS main power switch	0x01A0
1	Instance	6	BMS charge buss switch	0x01C0
1	Instance	7	Cell Voltage	0x01E0

FMI		
Value	Description	MFD Label Text
0	Datum value above normal range	High
1	Datum value below normal range	Low
2	Datum value erratic or invalid	Invalid
3	Sensor input failure	Failure

**NOTES for MFD Development**

Only Battery specific SPNs are supported, MSB=1. Global SPNs are not supported.

BMS Status Code Flags

BMS Status Code Flags - 3 byte value			
Byte	Bit	Name	Value Definition
0	0	High Voltage State	Indicates that battery voltage is above HVC, typically 3.70VPC.
	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.
	2	NeverDie Reserve State	Indicates that battery is in the NeverDie Reserve State, allowing access to reserve energy.
	3	OptoLoop 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.
	4	Reserve Voltage Range	Indicates that battery voltage is below RVC, typically 3.0VPC.
	5	Low Voltage State	Indicates that battery voltage is below LVC, typically 2.9VPC.
	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.
	7	Power Off State	Indicates that battery was turned off by a command or a button press.
1	0	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.
	1	AUX Contacts Error	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	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	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	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	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	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	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.
2	0	AGSR State	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	Temperature detected by Temperature Intervention Sensor exceeded allowed threshold.
	2	Cold Temperature State	Temperature detected by Temperature Intervention Sensor is below allowed threshold.
	3	AUXIN1 State	Reflects the state of AUXIN1 input, which is optional and application specific.
	4	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.
	5	Over-current State	BMS detected current higher than preset limit.



UART-CAN Mapping

Standard data fields reported in BMS serial data stream			
Field Header	Description	PGN	Notes
B	Battery ID, typically 1, in multi-battery systems this will represent battery order – 1-digit long	DC_SOURCE_STATUS_1	
H	AmpHours remaining, in 0.1Ah resolution, i.e. 123 = 12.3Ah – 5-digit long	DC_SOURCE_STATUS_3	comes in 1AH resolution
V	Volts, in 0.1V resolution, i.e. 123 = 12.3V – 4-digit long	DC_SOURCE_STATUS_1	
F	SoC percent, in percent, i.e. 100 = 100% – 3-digit long	DC_SOURCE_STATUS_2	
S	SoC percent, in percent, i.e. 100 = 100% – 3-digit long	DC_SOURCE_STATUS_2	
D	Current direction, 1 – charging, 0 – discharging – 1-digit long	DC_SOURCE_STATUS_1	derived from sign of current value
A	Amps instant, in 0.1A resolution, i.e. 123 = 12.3Amp – 5-digit long	DC_SOURCE_STATUS_1	
W	Watts instant, in 1W resolution, i.e. 20000 = 20000W – 6-digit long	DC_SOURCE_STATUS_11	can also be calculated in real time from V and A
T	Temperature, in degrees, units depends on setup parameter – 3-digit long	DC_SOURCE_STATUS_2	
R	System Status – 6-digit long, see details below	PROP_BMS_STATUS_1	legacy support in PROP_BMS_CMD_STATUS
TRACE-ON Additional data fields enabled by \$traceon command			
Field Header	Description	PGN	Notes
X	Battery ID	DC_SOURCE_STATUS_1	
L	Voltage at Contactor1	PROP_BMS_STATUS_2	
C	Voltage at Contactor2	PROP_BMS_STATUS_2	
K	Temperature of internal BMS sensor	PROP_BMS_STATUS_1	
N	Number of TIS sensors detected, number of CAN modules	PROP_BMS_STATUS_1	
U	CAN charger reported voltage	PROP_BMS_STATUS_4	
Y	CAN charger reported current	PROP_BMS_STATUS_4	
Z	CAN charger reported status	PROP_BMS_STATUS_4	
\$INFO Additional data fields reported by \$info command			
Field Header	Description	PGN	Notes
	Total AmpHours used by the system	PROP_BMS_STATUS_3	
	Last fault code	PROP_BMS_STATUS_2	
	Highest recorded cell temperature	PROP_BMS_STATUS_1	legacy support in PROP_BMS_CMD_STATUS
	Lowest recorded cell temperature	PROP_BMS_STATUS_1	legacy support in PROP_BMS_CMD_STATUS
	Firmware version Major/Minor	PROP_BMS_STATUS_3	
	Aging factor for temperature	PROP_BMS_STATUS_5	
	Aging factor for SOC	PROP_BMS_STATUS_5	
	Serial number	PROP_BMS_STATUS_6	

Lithionics Battery proprietary Module Command-Response protocol											
PGN Name	Broadcast Rate	PGN Number	Default Source Address	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PROP_MODULE_COMMAND	as needed	0x0FF90	any	Battery ID (instance)	Module ID	Command	Parameter ID	Parameter Value			
PROP_MODULE_STATUS_1	1s	0x0FF91	any	Battery ID (instance)	Module ID	Cell Count	Status	Cells Temperature	Cell Voltage Average	Cell Voltage High	Cell Voltage Low
PROP_MODULE_STATUS_2	on request	0x0FF92	any	Battery ID (instance)	Module ID	Cell Count	Last Fault Code	Balance Map		BMS Temperature	Firmware Version
PROP_MODULE_CELL_BLOCK_1	on request	0x0FF93	any	Battery ID (instance)	Module ID	Cell Count	Status	Cell 1 Voltage	Cell 2 Voltage	Cell 3 Voltage	Cell 4 Voltage
PROP_MODULE_CELL_BLOCK_2	on request	0x0FF94	any	Battery ID (instance)	Module ID	Cell Count	Status	Cell 5 Voltage	Cell 6 Voltage	Cell 7 Voltage	Cell 8 Voltage
PROP_MODULE_CELL_BLOCK_3	on request	0x0FF95	any	Battery ID (instance)	Module ID	Cell Count	Status	Cell 9 Voltage	Cell 10 Voltage	Cell 11 Voltage	Cell 12 Voltage
PROP_MODULE_CELL_BLOCK_4	on request	0x0FF96	any	Battery ID (instance)	Module ID	Cell Count	Status	Cell 13 Voltage	Cell 14 Voltage	Cell 15 Voltage	Cell 16 Voltage
Definitions and Examples											
Value Name	Value Size	Value Definition									
Battery ID (instance)	1 byte	Instance of the BMS on CAN network, range 1-9, defines a Battery ID. To broadcast to all, set = 0 in command PGN									
Module ID	1 byte	Instance of the Module on CAN network, range 1-250, auto-assigned during address claim process									
Command	1 byte	1 = request existing value or execute command, 2 = set new value									
Parameter ID	1 byte	BMS parameter number or command number, list provided below									
Parameter Value	4 byte	numeric value to be assigned to given parameter ID, only used when Command = 2, otherwise ignored									
Cell Count	1 byte	number of series connected cells or P-blocks in the module, range 4-16									
List of available Parameters											
Command Name	Parameter ID (dec)	Command Notes									
Claim Address	1	force initiate address claim process, should not be needed normally as modules detect and resolve address conflicts automatically									
Assign Battery ID	2	must set Module ID = 0 to set new Battery ID on all connected modules. If multiple systems are on the same CAN network, disconnect those prior to running this command, so only modules that belong to one system will hear this command.									
Report Status 1	3	Requests a module to send PROP_MODULE_STATUS_1									
Report Status 2	4	Requests a module to send PROP_MODULE_STATUS_2									
Report Cells	5	Requests a module to send PROP_MODULE_CELL_BLOCK_1, _2, _3, _4 (depending on cell count 1 to 4 messages will be sent)									
Signal Module LED	6	Causes Module LED to long blink for 30 min, so a specific module can be visually identified.									
Soft Reset Module BMS	7	Causes soft reset of BMS firmware inside the module.									