Battery Management Systems

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EMUS G1 BMS documentation

EMUS G1 Control Unit CAN Protocol

Version 3.2.0

Version Notes

Some messages have been updated to newer versions and might not be correct or included in previous G1 firmware versions. Consult the correct EMUS G1 Control Unit CAN Protocol version according to your G1 Control Unit firmware. To find other EMUS G1 Control Unit CAN Protocol versions:

EMUS' Website > Manual / Downloads > Communication protocols > G1 Control Unit CAN Protocol > "Show all versions"

NOTE! If a G1 Control Unit (G1CU) version is not mentioned in the table, take the closest lower version. For instance, G1 Control Unit firmware v2.15.1 is compatible with the same DBC and CAN protocol version as v2.15.0 which is included in the table.

DBC	G1CU firmware	Version	Author	Date	Description
-	2.0.21.1	1.0	M.M.	Jan 18, 2011	Initial version
-	2.0.21.1	1.1	M.M.	Jun 17, 2011	Added SOC and SOE messages
-	2.0.21.1	1.2	M.M.	Aug 25, 2011	Added optional Standard CAN Ids
-	2.0.21.1	1.5	M.M.	Oct 19, 2011	Added support for configurable ID base address and Remote Transfer Request
-	2.0.21.1	1.7	M.M.	Dec 12, 2011	Added Diagnostic Codes message, new charging error codes
-	2.0.21.1	2.0.0	J.B.	Feb 21, 2013	Some messages modified to support multiple parallel cell strings
-	2.0.21.1	2.0.1	J.B.	Apr 25, 2013	Reimplemented periodic cell detail broadcasting, using option A messages
-	2.0.21.1	2.0.2	J.B.	May 6, 2013	Modified Battery Voltage Overall Parameters message to support 4 byte long total voltage
-	2.0.21.1	2.0.3	J.B.	Jul 7, 2014	Added Configuration Parameters, Login, Set Password, Contactor Control messages. Added second byte of protection flags, and battery status flags to Diagnostic Codes message. Some naming fixes.
-	2.0.21.1	2.0.4	D.P.	Jul 7, 2014	Some naming corrections.
-	2.0.21.1	2.0.5	J.B.	Oct 1, 2014	New document title. New template applied. Added format table for each CAN message, separated value description into separate table. Many corrections of inaccuracies in previous version of this document. Many changes in effort to make this document clearer and more readable.
-	2.0.21.1	2.0.6	D.P.	Mar 16, 2015	Overall Parameters: Output Pin status field updated.
-	2.0.21.1	2.0.7	J.B.	Jul 2, 2015	Added description for „Statistics" and „Events" messages that were introduced in Control Unit firmware version 2.0.19_RC2.

DBC	G1CU firmware	Version	Author	Date	Description
-	2.0.21.1	2.0.8	J.B.	Nov 26, 2015	Added CAN messages related to cell temperature measurement support which was introduced in Control Unit firmware version 2.0.19_RC9. Updated „Statistics", „Events" and „Diagnostic Codes" message descriptions accordingly. Modified the names of some CAN messages.
-	2.0.21.1	2.0.9	J.B.	Jan 20, 2016	Corrected tables names of "Individual Cell Voltages," "Individual Cell Module Temperatures," "Individual Cell Temperatures," and "Individual Cell Balancing Rate" Option B CAN messages.
-	2.0.21.1	2.0.10	J.B.	Mar 10, 2017	Added CAN message to set SOC value and updated "Log in/Log Out" and "Set New Password" message descriptions to reflect changes introduced in Control Unit firmware version 2.0.21.0
-	2.0.21.1	2.0.11	J.B.	Mar 22, 2017	Updated "Diagnostic Codes" message according to the changes introduced in Control Unit firmware version 2.0.1
-	2.0.21.1	2.0.12	M.M.	Dec 10, 2018	Changed titles according to new company name
-	2.7.4.0	2.0.13	H.S.	Oct 15, 2021	Added J1939 chargers' protocol
-	2.7.4.0	2.0.14	H.S.	Jan 25, 2022	BMS Transmit / Charger Receive message description fix.
-	2.9.2	2.0.15	H.S.	Dec 20, 2022	Added Neuro messages, changed total voltage format in the Battery Voltage Overall Params messages.
-	2.13.1	2.0.16	D.R.	Mar 5, 2024	Adjusted Contactor Control documentation.
-	2.13.1	2.0.17	D.R.	Mar 7, 2024	Adjustment of Diagnostics messages.
-	2.13.1	2.0.18	D.R.	Mar 28, 2024	Adjustment of State of Charge messages.
-	2.13.2	2.0.19	D.B.	Apr 8, 2024	Fixed minor formatting, grammar as well as extended and standard ID description alignment issues.
-	2.13.2	2.0.20	D.B.	Apr 11, 2024	Aligned Diagnostic Codes and their description for extended and standard identifier.
-	2.14.0	2.0.21	D.R.	Apr 16, 2024	Neuro message adjustment and reduction values clarification.
-	2.14.0	2.0.22	D.B.	Apr 17, 2024	Added a note for the Estimated charge, adjusted the offset for additional values in the Statistics and corrected naming of some bits.
-	2.14.0	2.0.23	D.R.	Apr 17, 2024	Adjusted Events description.
-	2.14.0	2.0.24	D.B.	Apr 18, 2024	Updated Table of Contents, page numbering and the description of the Contactor Control. Unified the representation of units.

DBC	G1CU firmware	Version	Author	Date	Description
–	2.14.0	3.0.0	I.R.R.	May 3, 2024	Added new CAN messages and descriptions. Standard identifier base + num changed both to HEX. Added description individual cell voltage for LTO cells. Reserved bits and bytes included. Description issues corrected. Minor issues corrected. Page numbering corrected. New company format. Excluded Regennautic and Charging Station messages.
–	2.14.0	3.0.1	D.B.	May 21, 2024	Updated the description of Energy Parameters and Battery status flags.
–	2.14.0	3.0.2	D.B.	June 10, 2024	Fixed the CAN ID of 0x530 Neuro message.
–	2.14.0	3.0.3	D.B.	June 21, 2024	Fixed the confusion of 2nd and 3rd bytes in Protection Flags (Diagnostics Codes), Total Voltage (Battery Voltage Overall Parameters), Serial Number, Total Voltage (Battery Voltage Overall Parameters – 2).
–	2.15.0	3.1.0	I.R.R.	July 25, 2024	Added Charging Station message. Fixed SOC set message. Added CU firmware compatibility with CAN protocol version.
1.0.1	2.16.0	3.2.0	I.R.R.	November 01, 2024	Recovered previous SOC message for retro-compatibility. Added additional SOC message for higher resolution (SOC&SOH message). Included new Statistical parameters to Statistics, Events and Diagnostics. Added DBC compatibility column.

Table of Contents

Overview

EMUS Battery Management System utilizes a CAN interface, which is mainly used for control of a CAN-based charger or for cell communication (when CAN Cell Group Modules are used) but can optionally be used for retrieval of various information, control of certain features, and configuration of EMUS BMS, all done using CAN messages that are described in this document.

Most of the CAN messages that contain various information can be periodically broadcasted by EMUS BMS Control Unit using the display messages period. This period is configurable for active and idle states. Alternatively, the external application may request any of the information containing messages at any time, by sending a request CAN message to the Control Unit. Configuration and control of certain features over CAN is also done using request and response mechanism. Enabling of Remote Transfer Request (RTR) flag is optional.

The identifiers for CAN messages in EMUS CAN Protocol are partially configurable. Each identifier consists of two parts: base addres2 (later mentioned as "Base" in this document), and message Sub-ID. Base address is configurable from EMUS Control Panel. EMUS CAN Protocol works using both standard 11-bit identifiers and extended 29-bit identifiers, depending on configuration.

If standard 11-bit identifiers are used, message identifier is formed as a sum of base address and message Sub-ID (Base Address + Message Sub-ID). If extended 29-bit identifiers are used, then the message identifier is formed by placing Base Address in upper 13 bits of the identifier, and the message Sub-ID in lower 16 bits.

CAN bus speed is configurable from EMUS Control Panel and can be matched to the one used by the external application. EMUS CAN Protocol messages can be used at any CAN bus speed.

BMS Parameters

Overall Parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x00	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x00	1	0	8	INPUT SIGNALS	OUTPUT SIGNALS	NUMBER OF LIVE CELLS (MSB)	CHARGING STAGE	CHARGING STAGE DURATION (MSB)	CHARGING STAGE DURATION (LSB)	LAST CHARGING ERROR	NUMBER OF LIVE CELLS (LSB)

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 0h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 0h	0	0	8	INPUT SIGNALS	OUTPUT SIGNALS	NUMBER OF LIVE CELLS (MSB)	CHARGING STAGE	CHARGING STAGE DURATION (MSB)	CHARGING STAGE DURATION (LSB)	LAST CHARGING ERROR	NUMBER OF LIVE CELLS (LSB)

Description of response values:

Data	Value	Description
0	INPUT SIGNALS	Input signals encoded by bits: • Bit 0: Ignition Key, 1 = ignition is on; • Bit 1: Charger Mains, 1 = connected; • Bit 2: Fast Charge, 1 = fast charge selected; • Bit 3: Leakage Sensor, 1 = leakage detected; • Bits 4-7: Reserved.
1	OUTPUT SIGNALS	Output signals encoded by bits: • Bit 0: Charger Enable, 1 = enabled; • Bit 1: Heater Enable, 1 = enabled; • Bit 2 Battery Contactor, 1 = enabled; • Bit 3: Battery Fan, 1 = enabled; • Bit 4: Power Reduction, 1 = enabled; • Bit 5: Charging Interlock, 1 = enabled; • Bit 6: DCDC Control, 1 = enabled; • Bit 7: Contactor Pre-Charge, 1 = enabled.
2	NUMBER OF LIVE CELLS (MSB)	Most significant byte for number of cells detected.
3	CHARGING STAGE	Charging stage byte with following value meanings: • 0 = Disconnected – charger (any type) is disconnected; • 1 = Pre-heating – battery is being pre-heated to avoid charging in low temperature; • 2 = Pre-charging – battery is being pre-charged with small current; • 3 = Main Charging – battery is being charged with Slow or Fast charging current (depending on Fast Charge input state); • 4 = Balancing – cells are being balanced to equalize their charge level; • 5 = Charging Finished; • 6 = Charging Error.
4	CHARGING STAGE DURATION (MSB)	Time elapsed in current charging stage (in minutes). Most significant byte.
5	CHARGING STAGE DURATION (LSB)	Time elapsed in current charging stage (in minutes). Least significant byte.

Data	Value	Description
6	LAST CHARGING ERROR	Last charging error code with following value meanings: • 0 = No error; • 1 = No cell communication at the start of charging or communication lost during Pre-charging (using CAN charger), cannot charge; • 2 = No cell communication (using Non-CAN charger), cannot charge; • 3 = Maximum charging stage duration expired; • 4 = Cell communication lost during Main Charging or Balancing stage (using CAN charger), cannot continue charging; • 5 = Cannot set cell module balancing threshold; • 6 = Cell or cell module temperature too high; • 7 = Cell communication lost during Pre-heating stage (using CAN charger); • 8 = Number of cells mismatch; • 9 = Cell over-voltage; • 10 = Cell protection event occurred, see "Diagnostic Codes" message for determining specific protection reason.
7	NUMBER OF LIVE CELLS (LSB)	Least significant byte for number of cells detected.

Diagnostics Codes

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x07	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4				PROTECTION FLAGS (LSB)	PROTECTION FLAGS (2nd byte)	PROTECTION FLAGS (3rd byte)	PROTECTION FLAGS (MSB)	REDUCTION FLAGS	RESERVED	RESERVED	BATTERY STATUS FLAGS
Base (MSB)	Base (LSB)	0x00	0x07	1	0	8								

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 7h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 7h	0	0	8	PROTECTION FLAGS (LSB)	PROTECTION FLAGS (2nd byte)	PROTECTION FLAGS (3rd byte)	PROTECTION FLAGS (MSB)	REDUCTION FLAGS	RESERVED	RESERVED	BATTERY STATUS FLAGS

Description of response values:

Data	Value	Description
0-3	PROTECTION FLAGS (LSB → MSB)	Protection status, encoded by bits for each protection type. If byte value is 0, then system is OK, and no protection flag is active. Other byte values are encoded by bits listed below: • Bit 0: Cell Under-Voltage: one of the cells voltages is below minimum. • Bit 1: Cell Over-Voltage: one of the cells voltages is over maximum. • Bit 2: Discharge Over-Current – discharge current (negative current) exceeds the critical discharge current setting. • Bit 3: Charge Over-Current – charge current (positive current) exceeds the critical charge current setting. • Bit 4: Cell Module Over-Heat – cell module is above maximum temperature. • Bit 5: Leakage fault – leakage signal was detected on leakage input pin. • Bit 6: No Cell Communication – loss of communication to cells. • Bit 7: Master-Slave Configuration Error – error with master-slave configuration. • Bit 8: Master-Slave Internal CAN Bus Error – error with internal master-slave CAN bus. • Bit 9: Master-Slave Common CAN Bus Error – error with common master-slave CAN bus. • Bit 10: Charger Connected – notice that charger is connected. • Bit 11: Cell Over-Heat – one of the cells temperatures is above maximum. • Bit 12: No Current Sensor – no current sensor detected. • Bit 13: Pack Under-Voltage – battery pack voltage is below minimum. • Bit 14: Pack Over-Voltage – battery pack voltage is above maximum. • Bit 15: Cell Under-Heat: one of the cells temperatures is below minimum. • Bit 16: Cell Voltage Deviation – minimum and maximum cell values deviation. • Bit 17: Pack Voltage Deviation – minimum and maximum pack voltage deviation. • Bit 18: Cell Module Under-Heat – cell module is below minimum temperature. • Bit 19: External Temperature Sensor Loss – loss of external temperature sensors. • Bit 20: Wire break – cell wire break detection. • Bit 21: String Voltage Deviation – detected difference between maximum parallel and minimum parallel voltages. • Bit 22: Voltage And External Temperature Validation – voltages deviation between two sources. • Bits 23-31: Reserved.

Data	Value	Description
4	REDUCTION FLAGS	Power reduction status, encoded by bits for each warning (requested power reduction) type. If the byte value is 0, then no power reduction is requested. Other byte values are encoded by bits listed below: • Bit 0: Low Cell Voltage – some cells are below low voltage warning setting. • Bit 1: High Discharge Current – discharge current (negative current) exceeds the current warning setting. • Bit 2: High Cell Module Temperature – cell module temperature exceeds warning temperature setting. • Bit 3: Master/ Slave Configuration Mismatch – Configuration mismatch. • Bit 4: Master/Slave Common Bus Malfunction Reduction – Common CAN bus malfunction. • Bit 5: High Cell Temperature – cell temperature exceeds warning temperature setting. • Bits 6-7 – Reserved.
5	RESERVED	Reserved
6	RESERVED	Reserved
7	BATTERY STATUS FLAGS	Battery status and cell communication status flags. Bit meanings: • Bit 0: Cell voltages validity (1 if valid, 0 if invalid). • Bit 1: Cell module temperatures validity (1 if valid, 0 if invalid). • Bit 2: Cell balancing rates validity (1 if valid, 0 if invalid). • Bit 3: Number of live cells validity (0 if valid, 1 if invalid). • Bit 4: Battery charging finished (1 if active, 0 if inactive). This flag is used only when using Non-CAN charger. • Bit 5: Cell temperatures validity (1 if valid, 0 if invalid). • Bits 6-7: Reserved.

Battery Voltage Overall Parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x01	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x01	1	0	8	MIN CELL VOLTAGE	MAX CELL VOLTAGE	AVERAGE CELL VOLTAGE	TOTAL VOLTAGE (2nd byte)	TOTAL VOLTAGE (LSB)	TOTAL VOLTAGE (MSB)	TOTAL VOLTAGE (3rd byte)	RESERVED

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 1h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 1h	0	0	8	MIN CELL VOLTAGE	MAX CELL VOLTAGE	AVERAGE CELL VOLTAGE	TOTAL VOLTAGE (2nd byte)	TOTAL VOLTAGE (LSB)	TOTAL VOLTAGE (MSB)	TOTAL VOLTAGE (3rd byte)	RESERVED

Description of response values:

Data	Value	Description
0	MIN CELL VOLTAGE	Lowest cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V (for example, decimal value 101 means 3.01 V). Basis of 1.00V for LTO cells.
1	MAX CELL VOLTAGE	Highest cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V. Basis of 1.00V for LTO cells.
2	AVERAGE CELL VOLTAGE	Average cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V. Basis of 1.00V for LTO cells.
3	TOTAL VOLTAGE (2nd byte)	Total voltage of all cells in the battery pack, encoded in 0.01 V. (for example, decimal value 70501 from all four bytes means 705.01 V.
4	TOTAL VOLTAGE (LSB)	
5	TOTAL VOLTAGE (MSB)	
6	TOTAL VOLTAGE (3rd byte)	
7	RESERVED	Reserved

Cell Module Temperature Overall Parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x02	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x02	1	0	8	MIN CELL MODULE TEMP	MAX CELL MODULE TEMP	AVERAGE CELL MODULE TEMP	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 2h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 2h	0	0	8	MIN CELL MODULE TEMP	MAX CELL MODULE TEMP	AVERAGE CELL MODULE TEMP	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	MIN CELL MODULE TEMP	Lowest cell module temperature in the battery pack, encoded in 1°C with basis of −100°C (for example, decimal value 115 means +15°C).
1	MAX CELL MODULE TEMP	Highest cell module temperature in the battery pack, encoded in 1°C with basis of −100°C.
2	AVERAGE CELL MODULE TEMP	Average cell module temperature in the battery pack, encoded in 1°C with basis of −100°C.
3	RESERVED	Reserved
4	RESERVED	Reserved
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Cell Temperature Overall Parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x08	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x08	1	0	8	MIN CELL TEMP	MAX CELL TEMP	AVERAGE CELL TEMP	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 8h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 8h	0	0	8	MIN CELL TEMP	MAX CELL TEMP	AVERAGE CELL TEMP	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	MIN CELL TEMPERATURE	Lowest cell temperature in the battery pack, encoded in 1°C with basis of –100°C (for example, decimal value 115 means +15°C).
1	MAX CELL TEMPERATURE	Highest cell temperature in the battery pack, encoded in 1°C with basis of –100°C.
2	AVERAGE CELL TEMPERATURE	Average cell temperature in the battery pack, encoded in 1°C with basis of –100°C.
3	RESERVED	Reserved
4	RESERVED	Reserved
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Cell Balancing Rate Overall Parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	**Byte2**	**Byte3**	**Byte4**			
Base (MSB)	Base (LSB)	0x00	0x03	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	**Byte2**	**Byte3**	**Byte4**				MIN CELL BALANCING RATE	MAX CELL BALANCING RATE	AVERAGE CELL BALANCING RATE	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
Base (MSB)	Base (LSB)	0x00	0x03	1	0	8								

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 3h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 3h	0	0	8	MIN CELL BALANCING RATE	MAX CELL BALANCING RATE	AVERAGE CELL BALANCING RATE	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	MIN CELL BALANCING RATE	Lowest cell module balancing rate in the battery pack, encoded in units from 0 to 255, that correspond to 0% and 100% (for example, decimal value 127 means that 50% of maximum possible balancing current is flowing through the balancing resistor(s)).
1	MAX CELL BALANCING RATE	Highest cell module balancing rate in the battery pack, encoded in units from 0 to 255, that correspond to 0% and 100%.
2	AVERAGE CELL BALANCING RATE	Average cell module balancing rate in the battery pack, encoded in units from 0 to 255, that correspond to 0% and 100%.
3	RESERVED	Reserved
4	RESERVED	Reserved
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Individual Cell Voltages – Option A

Using this method, individual cell voltages of the battery pack can be retrieved from EMUS BMS in series of CAN messages, each of them containing voltages of a group of 8 cells (last CAN message may be less than 8 bytes long, depending on the size of the last group). Number of the first group can be specified in the request message: if Byte4 in CAN Identifier is 0x00, all cell voltages, starting from the first cell in the battery pack are sent in a series of CAN Messages; if Byte4 in CAN Identifier is 0x01, first 8 cells of the battery pack are skipped, and Control Unit sends cell voltages starting from the 9th cell; etc. Group numbering starts from 0: cells 1 to 8 belong to group 0, cells 9 to 16 belong to group 1, and so on. Since EMUS BMS supports multiple parallel cell strings when using CAN Cell Group Modules, cell string number must be specified in Data0 field of the request message (0x00 if battery pack consists of only one cell string). Before sending response messages with cell voltage values, the Control Unit sends a one-byte-long CAN message containing cell string number. This message confirms that the request was successfully registered and informs which string the cell voltage values in the consecutive CAN messages belong to (when individual cell voltages are broadcasted periodically).

NOTICE! If configured to broadcast, Control Unit will attempt to register individual cell data request of a different parameter each time (voltages, temperatures, balancing rate) at the rate of broadcast period , yet request completion time depends on the number of cells in each string (or total number of cells if there is only one string). Also, request processing may be delayed if individual cell data is actively requested over the RS232/USB interface of the Control Unit, therefore actual broadcast period of individual cell values over CAN is not clearly defined and may vary.

NOTICE! If cell communication is lost and the request cannot be processed for more than 5 seconds, Control Unit will send an empty response message (same identifier as normal response message, but data length zero bytes), and unregister the request.

NOTICE! In the case of LTO cells the offset is 1.00V instead of 2.00V.

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x01	Group (G)				

Response: Confirmation message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x01	0x00				

Response: Data message(s) using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4	1	0	1-8	CELL 1 VOLTAGE	CELL 2 VOLTAGE	CELL 3 VOLTAGE	CELL 4 VOLTAGE	CELL 5 VOLTAGE	CELL 6 VOLTAGE	CELL 7 VOLTAGE	CELL 8 VOLTAGE
Base (MSB)	Base (LSB)	0x01	Group (G)											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 20h + Group (G)	0	0	1	CELL STRING NUMBER

Response: Confirmation message using standard identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 20h	0	0	1	CELL STRING NUMBER

Response: Data message(s) using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 20h + Group (G)	0	0	1-8	CELL 1 VOLTAGE	CELL 2 VOLTAGE	CELL 3 VOLTAGE	CELL 4 VOLTAGE	CELL 5 VOLTAGE	CELL 6 VOLTAGE	CELL 7 VOLTAGE	CELL 8 VOLTAGE

Description of response values:

Data	Value	Description
0-7	CELL (Nº) VOLTAGE	Cell voltage, encoded in 0.01 V with basis of 2.00 V (for example, decimal value 101 means 3.01 V). The cell is identified by 8-cell-group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows voltage of 43rd. cell in the string. Basis of 1.00V for LTO cells.

Individual Cell Voltages – Option B

Using this method, individual cell voltages can be retrieved from EMUS BMS using a single CAN identifier, one CAN message at a time, containing group number in Data0 field, and cell voltages of a group of 7 cells in the rest of the Data fields. The last group of the battery pack may contain less than 7 cells, therefore CAN message with values from this group may be less than eight bytes long. Cell string number must be specified in Data1 field of the request message (0x00 if one-pack battery). Before sending a response message, Control Unit sends one-byte-long CAN message containing cell string number. This message confirms that the request was successfully registered.

NOTICE! If cell communication is lost and the request cannot be processed for more than 5 seconds, Control Unit will send an empty response message (same identifier as normal response message, but data length zero bytes), and unregister the request.

NOTICE! In the case of LTO cells the offset is 1.00V instead of 2.00V.

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1
Byte1	Byte2	Byte3	Byte4	1	0	2	Group (G)	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0B					

Response: Confirmation message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0B				

Response: Data message(s) using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4	1	0	2-8	Group (G)	CELL 1 VOLTAGE	CELL 2 VOLTAGE	CELL 3 VOLTAGE	CELL 4 VOLTAGE	CELL 5 VOLTAGE	CELL 6 VOLTAGE	CELL 7 VOLTAGE
Base (MSB)	Base (LSB)	0x00	0x0B											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1
Base + Bh	0	0	2	Group (G)	CELL STRING NUMBER

Response: Confirmation message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + Bh	0	0	1	CELL STRING NUMBER

Response Data message(s) using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + Bh	0	0	2-8	Group (G)	CELL 1 VOLTAGE	CELL 2 VOLTAGE	CELL 3 VOLTAGE	CELL 4 VOLTAGE	CELL 5 VOLTAGE	CELL 6 VOLTAGE	CELL 7 VOLTAGE

Description of response values:

Data	Value	Description
0	Group (G)	Group numbering starts from 0: cells 1 to 7 belong to group 0, cells 8 to 14 belong to group 1, and so on.
1-7	CELL (N°) VOLTAGE	Cell voltage, encoded in 0.01 V with basis of 2.00 V (for example, decimal value 101 means 3.01 V). The cell is identified by 8-cell-group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows voltage of 43rd. cell in the string. Basis of 1.00V for LTO cells.

Individual Cell Module Temperatures – Option A

Using this method, individual cell module temperatures of the battery pack can be retrieved from EMUS BMS in series of CAN messages, each of them containing cell module temperatures of a group of 8 cells. Request and response CAN messages have the same format as "Individual Cells Voltages – Option A."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x02	Group (G)				

Response: Confirmation message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x02	0x00				

Response: Data message(s) using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1-8	CELL MODULE 1 TEMP	CELL MODULE 2 TEMP	CELL MODULE 3 TEMP	CELL MODULE 4 TEMP	CELL MODULE 5 TEMP	CELL MODULE 6 TEMP	CELL MODULE 7 TEMP	CELL MODULE 8 TEMP
Base (MSB)	Base (LSB)	0x02	Group (G)											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 40h + Group (G)	0	0	1	CELL STRING NUMBER

Response: Confirmation message using standard identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 40h	0	0	1	CELL STRING NUMBER

Response: Data message(s) using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 40h + Group (G)	0	0	1-8	CELL MODULE 1 TEMP	CELL MODULE 2 TEMP	CELL MODULE 3 TEMP	CELL MODULE 4 TEMP	CELL MODULE 5 TEMP	CELL MODULE 6 TEMP	CELL MODULE 7 TEMP	CELL MODULE 8 TEMP

Description of response values:

Data	Value	Description
0-7	CELL MODULE (Nº) TEMP	Cell module temperature, encoded in 1°C with basis of –100°C (for example, decimal value 115 means +15°C. The cell is identified by group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows cell module temperature of 43rd cell in the string.

Individual Cell Module Temperatures – Option B

Using this method, individual cell module temperatures can be retrieved from EMUS BMS using a single CAN identifier, one CAN message at a time. Request and response CAN messages have the same format as "Individual Cells Voltages – Option B."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1
Byte1	Byte2	Byte3	Byte4	1	0	2	Group (G)	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0C					

Response: Confirmation message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0C				

Response: Data message(s) using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4	1	0	2-8	Group (G)	CELL MODULE 1 TEMP	CELL MODULE 2 TEMP	CELL MODULE 3 TEMP	CELL MODULE 4 TEMP	CELL MODULE 5 TEMP	CELL MODULE 6 TEMP	CELL MODULE 7 TEMP
Base (MSB)	Base (LSB)	0x00	0x0C											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1
Base + Ch	0	0	2	Group (G)	CELL STRING NUMBER

Response: Confirmation message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + Ch	0	0	1	CELL STRING NUMBER

Response Data message(s) using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + Ch	0	0	2-8	Group (G)	CELL MODULE 1 TEMP	CELL MODULE 2 TEMP	CELL MODULE 3 TEMP	CELL MODULE 4 TEMP	CELL MODULE 5 TEMP	CELL MODULE 6 TEMP	CELL MODULE 7 TEMP

Description of response values:

Data	Value	Description
0	Group (G)	Group numbering starts from 0: cells 1 to 7 belong to group 0, cells 8 to 14 belong to group 1, and so on.
1-7	CELL MODULE (N°) TEMP	Cell module temperature, encoded in 1°C with basis of -100°C (for example, decimal value 115 means +15°C). The cell is identified by 7-cell-group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows cell module temperature of 37th cell in the string.

Individual Cell Temperatures – Option A

Using this method, individual cell temperatures of the battery pack can be retrieved from EMUS BMS in series of CAN messages, each of them containing cell temperatures of a group of 8 cells. Request and response CAN messages have the same format as "Individual Cells Voltages – Option A."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x08	Group (G)	1	0	1	CELL STRING NUMBER

Response: Confirmation message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x08	0x00	1	0	1	CELL STRING NUMBER

Response: Data message(s) using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x08	Group (G)	1	0	1-8	CELL 1 TEMP	CELL 2 TEMP	CELL 3 TEMP	CELL 4 TEMP	CELL 5 TEMP	CELL 6 TEMP	CELL 7 TEMP	CELL 8 TEMP

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 100h + Group (G)	0	0	1	CELL STRING NUMBER

Response: Confirmation message using standard identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 100h	0	0	1	CELL STRING NUMBER

Response: Data message(s) using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 100h + Group (G)	0	0	1-8	CELL 1 TEMP	CELL 2 TEMP	CELL 3 TEMP	CELL 4 TEMP	CELL 5 TEMP	CELL 6 TEMP	CELL 7 TEMP	CELL 8 TEMP

Description of response values:

Data	Value	Description
0-7	CELL (Nº) TEMP	Cell temperature, encoded in 1°C with basis of –100°C (for example, decimal value 115 means +15°C). The cell is identified by group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows cell temperature of 43rd cell in the string.

Individual Cell Temperatures – Option B

Using this method, individual cell temperatures can be retrieved from EMUS BMS using a single CAN identifier, one CAN message at a time. Request and response CAN messages have the same format as "Individual Cells Voltages - Option B."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1
Byte1	Byte2	Byte3	Byte4	1	0	2	Group (G)	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0E					

Response: Confirmation message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0E				

Response: Data message(s) using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4	1	0	2-8	Group (G)	CELL 1 TEMP	CELL 2 TEMP	CELL 3 TEMP	CELL 4 TEMP	CELL 5 TEMP	CELL 6 TEMP	CELL 7 TEMP
Base (MSB)	Base (LSB)	0x00	0x0E											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1
Base + Eh	0	0	2	Group (G)	CELL STRING NUMBER

Response: Confirmation message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + Eh	0	0	1	CELL STRING NUMBER

Response Data message(s) using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + Eh	0	0	2-8	Group (G)	CELL 1 TEMP	CELL 2 TEMP	CELL 3 TEMP	CELL 4 TEMP	CELL 5 TEMP	CELL 6 TEMP	CELL 7 TEMP

Description of response values:

Data	Value	Description
0	Group (G)	Group numbering starts from 0: cells 1 to 7 belong to group 0, cells 8 to 14 belong to group 1, and so on.
1-7	CELL MODULE (Nº) TEMP	Cell temperature, encoded in 1°C with basis of –100°C (for example, decimal value 115 means +15°C). The cell is identified by 7-cell-group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows cell temperature of 37th cell in the string.

Individual Cell Balancing Rates – Option A

Using this method, individual cell balancing rate values of the battery pack can be retrieved from EMUS BMS in series of CAN messages, each of them containing balancing rate values of a group of 8 cells. Request and response CAN messages have the same format as "Battery Individual Cells Voltages – Option A."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x03	Group (G)				

Response: Confirmation message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x03	0x00				

Response: Data message(s) using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	**Byte2**	**Byte3**	**Byte4**	1	0	1-8	CELL 1 BALANCING RATE	CELL 2 BALANCING RATE	CELL 3 BALANCING RATE	CELL 4 BALANCING RATE	CELL 5 BALANCING RATE	CELL 6 BALANCING RATE	CELL 7 BALANCING RATE	CELL 8 BALANCING RATE
Base (MSB)	Base (LSB)	0x03	Group (G)											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 60h + Group (G)	0	0	1	CELL STRING NUMBER

Response: Confirmation message using standard identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 60h	0	0	1	CELL STRING NUMBER

Response: Data message(s) using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 60h + Group (G)	0	0	1-8	CELL 1 BALANCING RATE	CELL 2 BALANCING RATE	CELL 3 BALANCING RATE	CELL 4 BALANCING RATE	CELL 5 BALANCING RATE	CELL 6 BALANCING RATE	CELL 7 BALANCING RATE	CELL 8 BALANCING RATE

Description of response values:

Data	Value	Description
0-7	CELL (Nº) BALANCING RATE	Cell balancing rate, encoded in units from 0 to 255, which corresponds to 0% and 100% (for example, decimal value 127 means that 50% of maximum possible balancing current is flowing through the balancing resistor(s)). The cell is identified by group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows balancing rate of 43rd cell in the string.

Individual Cell Balancing Rates – Option B

Using this method, individual cell balancing rate values can be retrieved from EMUS BMS using a single CAN identifier, one CAN message at a time. Request and response CAN messages have the same format as "Battery Individual Cells Voltages – Option B."

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1
Byte1	Byte2	Byte3	Byte4	1	0	2	Group (G)	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0D					

Response: Confirmation message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4	1	0	1	CELL STRING NUMBER
Base (MSB)	Base (LSB)	0x00	0x0D				

Response: Data message(s) using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4	1	0	2-8	Group (G)	CELL 1 BALANCING RATE	CELL 2 BALANCING RATE	CELL 3 BALANCING RATE	CELL 4 BALANCING RATE	CELL 5 BALANCING RATE	CELL 6 BALANCING RATE	CELL 7 BALANCING RATE
Base (MSB)	Base (LSB)	0x00	0x0D											

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1
Base + Dh	0	0	2	Group (G)	CELL STRING NUMBER

Response: Confirmation message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + Dh	0	0	1	CELL STRING NUMBER

Response Data message(s) using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + Dh	0	0	2-8	Group (G)	CELL 1 BALANCING RATE	CELL 2 BALANCING RATE	CELL 3 BALANCING RATE	CELL 4 BALANCING RATE	CELL 5 BALANCING RATE	CELL 6 BALANCING RATE	CELL 7 BALANCING RATE

Description of response values:

Data	Value	Description
0	Group (G)	Group numbering starts from 0: cells 1 to 7 belong to group 0, cells 8 to 14 belong to group 1, and so on.
1-7	CELL (Nº) BALANCING RATE	Cell balancing rate, encoded in units from 0 to 255, which corresponds to 0% and 100% (for example, decimal value 127 means that 50% of maximum possible balancing current is flowing through the balancing resistor(s)). The cell is identified by 7-cell-group number (G) and Data byte position starting from 0. For example, byte Data2 of packet with (G)=5 shows balancing rate of 37th cell in the string.

State of Charge parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x05	0x00	1	0	0

Request message to set SOC using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x05	0x00	1	0	8	0x00	0x00	0x00	0x00	0x00	0x00	NEW STATE OF CHARGE	0x00

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x05	0x00	1	0	8	CURRENT (MSB)	CURRENT (LSB)	ESTIMATED CHARGE (MSB)	ESTIMATED CHARGE (LSB)	RESERVED	RESERVED	USER STATE OF CHARGE	STATE OF HEALTH

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 5h	0	0	0

Request message to set SOC using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 5h	0	0	8	0x00	0x00	0x00	0x00	0x00	0x00	NEW STATE OF CHARGE	0x00

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 5h	0	0	8	CURRENT (MSB)	CURRENT (LSB)	ESTIMATED CHARGE (MSB)	ESTIMATED CHARGE (LSB)	RESERVED	RESERVED	USER STATE OF CHARGE	STATE OF HEALTH

Description of response values:

Data	Value	Description
0	CURRENT (MSB)	Momentary current value, most significant byte (data type is signed 16-bit word). Encoded in 0.1 A units. For example, decimal word value –4098 means –409.8 A (discharging). A decimal value of 173 means 17.3 A (charging).
1	CURRENT (LSB)	Momentary current value, least significant byte.
2	ESTIMATED CHARGE (MSB)	Estimated remaining charge in the battery pack, most significant byte. Encoded in 0.1 Ah units (for example, decimal value 1301 means that it is estimated that 130.1 Ah of charge left in battery pack). **NOTE!** If the Cell Capacity is changed in the Control Panel, resetting the BMS is required so that the estimated charge would also change correspondingly.
3	ESTIMATED CHARGE (LSB)	Estimated remaining charge in the battery pack, least significant byte.
4	RESERVED	Reserved
5	RESERVED	Reserved
6	USER STATE OF CHARGE	User State of Charge. Encoded in 1%. For example, decimal value 56 means 56% SOC.
7	STATE OF HEALTH	Estimated state of health of the battery pack, encoded in 1% units (for example, decimal value 75 means that it is estimated that battery pack has 75% state of charge).

State of Charge & Health parameters

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x10	1	0	0

Request message to set SOC using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Byte1	Byte2	Byte3	Byte4							
Base (MSB)	Base (LSB)	0x00	0x10	1	0	4	RESERVED	RESERVED	NEW STATE OF CHARGE (MSB)	NEW STATE OF CHARGE (LSB)

Request message to set SOH using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x10	1	0	8	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	NEW STATE OF HEALTH (MSB)	NEW STATE OF HEALTH (LSB)

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x10	1	0	8	RESERVED	RESERVED	STATE OF CHARGE (MSB)	STATE OF CHARGE (LSB)	USER STATE OF CHARGE (MSB)	USER STATE OF CHARGE (LSB)	STATE OF HEALTH (MSB)	STATE OF HEALTH (LSB)

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 10h	0	0	0

Request message to set SOC using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Base + 10h	0	0	4	RESERVED	RESERVED	NEW STATE OF CHARGE (MSB)	NEW STATE OF CHARGE (LSB)

Request message to set SOH using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 10h	0	0	8	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	NEW STATE OF HEALTH VALUE (MSB)	NEW STATE OF HEALTH VALUE (LSB)

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 10h	0	0	8	RESERVED	RESERVED	STATE OF CHARGE (MSB)	STATE OF CHARGE (LSB)	USER STATE OF CHARGE (MSB)	USER STATE OF CHARGE (LSB)	STATE OF HEALTH (MSB)	STATE OF HEALTH (LSB)

Description of response values:

Data	Value	Description
0	RESERVED	Reserved
1	RESERVED	Reserved
2	STATE OF CHARGE (MSB)	State of Charge, most significant byte. Encoded in 0.01% units (for example, decimal value 04FD means that it is estimated that 12.77% of State of Charge).
3	STATE OF CHARGE (LSB)	State of Charge, least significant byte.
4	USER STATE OF CHARGE (MSB)	User State of Charge, most significant byte. Encoded in 0.01% units (for example, decimal value 04FD means that it is estimated that 12.77% of User State of Charge).

Data	Value	Description
5	USER STATE OF CHARGE (LSB)	User State of Charge, least significant byte.
6	STATE OF HEALTH (MSB)	State of Health, most significant byte. Encoded in 0.01% units (for example, decimal value 04FD means that it is estimated that 12.77% of State of Health).
7	STATE OF HEALTH (LSB)	State of Health, least significant byte.

Configuration Parameters

Using CAN messages described below, it is possible to retrieve and to set EMUS BMS configuration parameter values.

NOTE! If Control Unit is password protected, setting parameter over CAN interface will fail, and Control Unit will respond with one-byte-long "Login" message, containing 0x3F in Data0 field ("?" in ASCII), requesting logging in.

NOTE! For safety, Control Unit will not allow to change configuration parameters when charger is connected and will respond with a message that contains unchanged parameter value.

Request message to retrieve parameter using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2
Byte1	Byte2	Byte3	Byte4				PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE
Base (MSB)	Base (LSB)	0x04	0x00	1	0	3			

Request message to set parameter using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4				PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE	PARAMETER DATA (MSB)	PARAMETER DATA (3rd byte)	PARAMETER DATA (2nd byte)	PARAMETER DATA (LSB)	RESERVED
Base (MSB)	Base (LSB)	0x04	0x00	1	0	8								

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4				PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE	PARAMETER DATA (MSB)	PARAMETER DATA (3rd byte)	PARAMETER DATA (2nd byte)	PARAMETER DATA (LSB)	RESERVED
Base (MSB)	Base (LSB)	0x04	0x00	1	0	8								

Login request response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				0x3F ("?" in ASCII)
Base (MSB)	Base (LSB)	0x04	0x02	1	0	1	

Request message to retrieve parameter using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2
Base + 80h	0	0	3	PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE

Request message to set parameter using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 80h	0	0	8	PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE	PARAMETER DATA (MSB)	PARAMETER DATA (3rd byte)	PARAMETER DATA (2nd byte)	PARAMETER DATA (LSB)	RESERVED

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 80h	0	0	8	PARAMETER ID (MSB)	PARAMETER ID (LSB)	PARAMETER SIZE	PARAMETER DATA (MSB)	PARAMETER DATA (3rd byte)	PARAMETER DATA (2nd byte)	PARAMETER DATA (LSB)	RESERVED

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 80h	0	0	1	0x3F ("?" in ASCII)

Description of response values:

Data	Value	Description
0	PARAMETER ID (MSB)	Most significant byte of the parameter ID. For list of parameter IDs, see EMUS BMS Serial Protocol.
1	PARAMETER ID (LSB)	Least significant byte of the parameter ID. For list of parameter IDs, see EMUS BMS Serial Protocol.
2	PARAMETER SIZE	Parameter size in bytes. Used for checking request validity both when retrieving and setting the parameter. Values: 0x01, 0x02, 0x04.
3	PARAMETER DATA (MSB)	Most significant byte of parameter value (filled with 0x00 if parameter size is less than four bytes)
4	PARAMETER DATA (3rd byte)	Third byte of parameter value (filled with 0x00 if parameter size is less than four bytes)
5	PARAMETER DATA (2nd byte)	Second byte of parameter value (filled with 0x00 if parameter size is less than two bytes)
6	PARAMETER DATA (LSB)	Least significant byte of parameter value.
7	RESERVED	Reserved

Log-in & Log-out

Using CAN messages described below it is possible to log in and log out if the Control Unit is password protected. To log into level 1 access from level 0 access or into level 2 access from level 1 access, a corresponding password string of four to eight bytes must be sent in the data field of the message. To log out of the current access level, message length must be zero bytes long, and the data field empty. In both cases the Control Unit will respond with an eight-bytes-long message, containing AUTHENTICATION STATUS in Data0, with value of 0x00, 0x01, or 0x02 which corresponds to statuses "access level 0", "access level 1", and "access level 2" respectively.

Log in request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x02	1	0	4-8	CHARACTER 1	CHARACTER 2	CHARACTER 3	CHARACTER 4	CHARACTER 5	CHARACTER 6	CHARACTER 7	CHARACTER 8

Log out request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x02	1	0	0

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x02	1	0	8	LOG-IN STATUS	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Log in request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 82h	0	0	4-8	CHARACTER 1	CHARACTER 2	CHARACTER 3	CHARACTER 4	CHARACTER 5	CHARACTER 6	CHARACTER 7	CHARACTER 8

Log out request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 82h	0	0	0

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 82h	0	0	8	LOG-IN STATUS	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0-7	CHARACTER IN	N^{th} character of the login password. Example: if password is "12345678" in ASCII, Data2 byte should be 0x32 ("2" in ASCII)

Set New Password

The CAN messages described below are used for setting or clearing EMUS BMS Control Unit passwords. To set a new password, the request message must be four to eight bytes long and contain the new password in the data field. The format of this request is like "Log in" request (see "Description of values in login request" in page 30). Level 1 password is set if current access level is 1, and level 2 password is set if current access level is 2. To clear the password, an empty CAN message must be sent while logged into corresponding access level. In both cases Control Unit will respond with eight bytes long message, containing SET PASSWORD STATUS in Data0, with either 0x00 or 0x01 (corresponds to "fail" and "success" respectively).

NOTE! Attempt to set a password while at access level 0 will fail, and along with the response Control Unit will send a one-byte-long "Login" message, containing 0x3F inf Data0 field ("?" in ASCII), requesting logging in.

NOTE! When setting a new password, it is advised to use ASCII characters from the standard computer keyboard.

Set new password request using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x03	1	0	4-8	CHARACTER 1	CHARACTER 2	CHARACTER 3	CHARACTER 4	CHARACTER 5	CHARACTER 6	CHARACTER 7	CHARACTER 8

Clear password request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x03	1	0	0

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x03	1	0	8	SET PASSWORD STATUS	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Login request response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x04	0x02	1	0	1	0x3F ("?" in ASCII)

Set new password request using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 83h	0	0	4-8	CHARACTER 1	CHARACTER 2	CHARACTER 3	CHARACTER 4	CHARACTER 5	CHARACTER 6	CHARACTER 7	CHARACTER 8

Clear password request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 83h	0	0	0

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 83h	0	0	8	SET PASSWORD STATUS	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Login request response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 82h	0	0	1	0x3F ("?" in ASCII)

Contactor Control

Using CAN message described below it is possible to externally control battery contactor (PF12 pin function) over CAN interface: one-byte-long message must be sent with 0x00 or 0x01 in Data0, which corresponds to "OPEN CONTACTOR" and "CLOSE CONTACTOR". Control Unit responds with eight-bytes-long message, containing command acknowledge in Data0, with values 0x00 and 0x01, that correspond to status "CONTACTOR OPEN" and "CONTACTOR CLOSED".

NOTE! Contactor control over CAN will have no effect if "External Contactor Control" feature is turned off from the Control Panel (or by changing corresponding parameter over CAN).

NOTE! Contactor control over CAN does not override normal contactor operation: if contactor is open due to an active protection, a request to close it will have no effect.

NOTE! If "External Contactor Control" is enabled, contactor is open by default when Control Unit is powered up, and will be closed when a request to close is received over CAN.

Contactor control request using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x04	0x01	1	0	1	OPEN/CLOSE CONTACTOR

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x01	1	0	8	OPEN/CLOSE CONTACTOR	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Contactor control request using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 81h	0	0	1	OPEN/CLOSE CONTACTOR

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 81h	0	0	8	OPEN/CLOSE CONTACTOR	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Energy Parameters

NOTE! Estimated Energy can be periodically broadcasted. Estimated Consumption, Estimated Distance Left and Distanced Traveled can be broadcast upon special request by the client. Otherwise, Data0-1 and Data4-7 are empty.

Request message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x06	0x00	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4				ESTIMATED CONSUMPTION (MSB)	ESTIMATED CONSUMPTION (LSB)	ESTIMATED ENERGY (MSB)	ESTIMATED ENERGY (LSB)	ESTIMATED DISTANCE LEFT (MSB)	ESTIMATED DISTANCE LEFT (LSB)	DISTANCE TRAVELED (MSB)	DISTANCE TRAVELED (LSB)
Base (MSB)	Base (LSB)	0x06	0x00	1	0	8								

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 6h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 6h	0	0	8	ESTIMATED CONSUMPTION (MSB)	ESTIMATED CONSUMPTION (LSB)	ESTIMATED ENERGY (MSB)	ESTIMATED ENERGY (LSB)	ESTIMATED DISTANCE LEFT (MSB)	ESTIMATED DISTANCE LEFT (LSB)	DISTANCE TRAVELED (MSB)	DISTANCE TRAVELED (LSB)

Description of response values:

Data	Value	Description
0	ESTIMATED CONSUMPTION (MSB)*	Estimated momentary energy consumption per distance unit, most significant byte. Encoded in 1 Wh/distance units. For example, decimal word value 214 means that estimated energy consumption is 214 Wh per distance unit.
1	ESTIMATED CONSUMPTION (LSB)*	Estimated momentary energy consumption per distance unit, least significant byte. Encoded in 1 Wh/distance units.
2	ESTIMATED ENERGY (MSB)	Estimated energy left in battery pack, most significant byte. Encoded in 10 Wh units. For example, decimal value 1296 means that it is estimated that 12.96 kWh of energy left in battery pack.
3	ESTIMATED ENERGY (LSB)	Estimated energy left in battery pack, least significant byte. Encoded in 10 Wh units.
4	ESTIMATED DISTANCE LEFT (MSB)*	Estimated distance remaining, most significant byte. Encoded in 0.01 of distance units. For example, if distance unit is configured to be a kilometer, then decimal value 1257 means that estimated achievable distance with energy left in the battery pack is 12.57 km.
5	ESTIMATED DISTANCE LEFT (LSB)*	Estimated distance remaining, least significant byte. Encoded in 0.01 of distance units.
6	DISTANCE TRAVELED (MSB)*	Distance traveled since the last full charge of the battery, most significant byte. Encoded in 0.01 of distance units. For example, if distance unit is configured to be a kilometer, then decimal value 362 means that 3.62 km traveled since last full charge.
7	DISTANCE TRAVELED (LSB)*	Distance traveled since the last full charge of the battery, most significant byte. Encoded in 0.01 of distance units.

*Unless it is requested, this Byte will be sent empty (0x00). Since firmware 2.15.0.

Statistics

Request message to return all statistics using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x04	1	0	0

Request message to return single statistic using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x04	0x04	1	0	1	STATISTIC IDENTIFIER

Request message to clear statistics using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x04	0x04	1	0	1	0xFF

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x04	1	0	8	STATISTIC IDENTIFIER	DATA TYPE	DATA (MSB)	DATA (3rd byte)	DATA (2nd byte)	DATA (LSB)	RESERVED	RESERVED

Request message to return all statistics using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 84h	0	0	0

Request message to return single statistic using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 84h	0	0	1	STATISTIC IDENTIFIER

Request message to clear statistics using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 84h	0	0	1	0xFF

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 84h	0	0	8	STATISTIC IDENTIFIER	DATA TYPE	DATA (MSB)	DATA (3rd byte)	DATA (2nd byte)	DATA (LSB)	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	STATISTICS IDENTIFIER	Identifier of the statistic to which the following data belongs. List of statistic identifier can be found in the table below.
1	DATA TYPE	Charging stage byte with following value meanings: • 0 = Statistic value; • 1 = Additional value; • 2 = Statistic timestamp.
2	DATA (MSB)	Most significant byte of the statistics data. If the actual data length is less than four bytes, this byte is equal to 0x00. For more information on a particular statistic value, additional value, and timestamp format, see the table below.

Data	Value	Description
3	DATA (3rd byte)	Third byte of statistic data. If the actual data length is less than four bytes, this byte is equal to 0x00. For more information on a particular statistic value, additional value, and timestamp format, see the table below.
4	DATA (2nd byte)	Second byte of statistic data. If actual data length is less than two bytes, this byte is equal to 0x00. For more information on particular statistic value, additional value, and timestamp format, see the table below.
5	DATA (LSB)	Least significant byte of statistic data. For more information on a particular statistic value, additional value, and timestamp format, see the table below.
6	RESERVED	Reserved
7	RESERVED	Reserved

Description of each statistic value:

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
0	Total discharge	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned • unit: Ah	-	-
1	Total charge	• uint32_t offset: 0 • multiplier: 1 • result: unsigned • unit: Ah	-	-
2	Total discharge energy	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned • unit: Wh	-	-
3	Total charge energy	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned • unit: Wh	-	-
4	Total discharge time	• uint32_t • offset: 0	-	-

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
		• multiplier: 1 • result: unsigned • unit: s		
5	Total charge time	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned • unit: s	-	-
6	Total distance	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned • unit: pulses	-	-
7	Master clear count	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-	-
8	Max Discharge Current	• uint16_t • offset: 0 • multiplier: 0.1 • result: unsigned • unit: A	-	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t offset: 0 • multiplier: 1 • result: unsigned
9	Max Charge Current	• uint16_t offset: 0 • multiplier: 0.1 • result: unsigned • unit: A	-	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t offset: 0 • multiplier: 1 • result: unsigned
10	Min Cell Voltage	• uint8_t • offset: 200	• uint16_t • offset: 1	The timestamp of when the statistic was last updated, in number of seconds

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
		• multiplier: 0.01 • result: unsigned • unit: V	• multiplier: 1 • result: unsigned • unit: cell ID	since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
11	Max Cell Voltage	• uint8_t • offset: 200 • multiplier: 0.01 • result: unsigned • unit: V	• uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
12	Max Cell Voltage Difference	• uint8_t • offset: 0 • multiplier: 0.01 • result: unsigned • unit: V	• uint32_t LSB – Min cell voltage at the time max cell voltage difference was registered, with following format: • uint8_t • offset: 200 • multiplier: 0.01 • result: unsigned • unit: V 2nd byte – Max cell voltage at the time max cell voltage difference was registered, with following format: • uint8_t • offset: 200 • multiplier: 0.01 • result: unsigned • unit: V	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			3rd and 4th bytes (word) – ID of cell with min voltage at the time max cell voltage difference was registered, with following format: • uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	
13	Min Pack Voltage	• uint32_t • offset: 0 • multiplier: 0.01 • result: unsigned • unit: V	-	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
14	Max Pack Voltage	• uint32_t • offset: 0 • multiplier: 0.01 • result: unsigned • unit: V	-	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
15	Min Cell Module Temperature	• uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C	• uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
16	Max Cell Module Temperature	• uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C	• uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
17	Max Cell Module Temperature Difference	• uint8_t • offset: 0 • multiplier: 1 • result: signed • unit: °C	• uint32_t LSB – Min cell module temperature at the time max temperature difference was registered, with following format: • uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C 2nd byte – Max cell module temperature at the time max temperature difference was registered, with following format: • uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C 3rd and 4th bytes (word) – ID of cell module with min temperature at the time max cell temperature difference was registered, with following format: • uint16_t	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			• offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	
18	BMS starts count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
19	Under-voltage protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
20	Over-voltage protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
21	Discharge over-current protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • • uint32_t

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
				• offset: 0 • multiplier: 1 • result: unsigned
22	Charge over-current protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
23	Cell module overheat protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
24	Leakage fault protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
25	No cell comm. protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
				• multiplier: 1 • result: unsigned
26	Low voltage power reduction count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
27	High current power reduction count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
28	High cell module temperature power reduction count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
29	Charger connect count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
30	Charger disconnect count	-	• uint16_t • offset: 0 • multiplier: 1	-

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			• result: unsigned • unit: occurrences	
31	Pre-heat stage count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
32	Pre-charge stage count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
33	Main charge stage count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
34	Balancing stage count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
35	Charging finished count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
36	Charging error count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
37	Charging retry count	-	• uint16_t • offset: 0	-

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			• multiplier: 1 • result: unsigned • unit: occurrences	
38	Trips count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
39	Charge restarts count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	-
40	Configuration error count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
41	Common can error count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
42	Internal can error count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
				• offset: 0 • multiplier: 1 • result: unsigned
43	Configuration mismatch count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
44	Common can malfunction count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
45	Cell overheat protection count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
46	High cell temperature power reduction count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
				• result: unsigned
47	Min Cell Temperature	• uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C	• uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
48	Max Cell Temperature	• uint8_t • offset: –100 • multiplier: 1 • result: signed • unit: °C	• uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
49	49 – Max Cell Temperature Difference	• uint8_t • offset: 0 • multiplier: 1 • result: signed • unit: °C	• uint32_t LSB – Min cell temperature at the time max temperature difference was registered, with following format: • uint8_t offset: –100 • multiplier: 1 result: signed unit: °C 2nd byte – Max cell module temperature at the time max temperature difference was registered, with following format: • uint8_t • offset: –100 • multiplier: 1 result: signed unit: °C 3rd and 4th bytes (word) – ID of cell	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t Offset: 0 • Multiplier: 1 Result: unsigned

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			with min temperature at the time max cell temperature difference was registered, with following format: • uint16_t • offset: 1 • multiplier: 1 • result: unsigned • unit: cell ID	
50	Reserved	-	-	-
51	No Current Sensor Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
52	Heater Relay Activation Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
53	Under Voltage Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
54	CAN Comm Watchdog Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
55	Pack Over Voltage Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
56	Cell Under Heat Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
57	Cell Voltage Deviation Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
58	Pack Voltage Deviation	-	• uint16_t • offset: 0	The timestamp of when the statistic was

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
	Protection Count (if Master-Slave Clustered enabled)		• multiplier: 1 • result: unsigned • unit: occurrences	last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
59	Cell Module Under Heat Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
60	External Temperature Sensor Loss Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
61	Cell Wire Break Protection Count	-	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned
62	Battery Parallel String Voltage Deviation Protection Count	-	• uint16_t • offset: 0 • multiplier: 1	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00

St. ID	Identifier	Value Format	Additional Value Format	Timestamp Format
			• result: unsigned • unit: occurrences	• uint32_t • offset: 0 • multiplier: 1 • result: unsigned
63	Voltage Reading Deviation Protection Count	–	• uint16_t • offset: 0 • multiplier: 1 • result: unsigned • unit: occurrences	The timestamp of when the statistic was last updated, in number of seconds since January 1, 2000, time 00:00 • uint32_t • offset: 0 • multiplier: 1 • result: unsigned

Events

Request message to return all events using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x05	1	0	0

Request message to clear events using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0
Byte1	Byte2	Byte3	Byte4				
Base (MSB)	Base (LSB)	0x04	0x05	1	0	1	0xFF

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x05	1	0	8	EVENT ENTRY NUMBER	DATA TYPE	DATA (MSB)	DATA (3rd byte)	DATA (2nd byte)	DATA (LSB)	RESERVED	RESERVED

Request message to return all events using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 85h	0	0	0

Request message to clear events using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0
Base + 85h	0	0	1	0xFF

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 85h	0	0	8	EVENT ENTRY NUMBER	DATA TYPE	DATA (MSB)	DATA (3rd byte)	DATA (2nd byte)	DATA (LSB)	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	EVENT ENTRY NUMBER	Number of the event entry.
1	DATA TYPE	Type of the following data. Values: • 0 = Event info; • 1 = Event timestamp.
2	DATA (MSB)	Most significant byte of event data. If data type is 0 (Event info), this byte contains the event ID. List of event IDs: • 0 – No event. • 1 – BMS Started. • 2 – Lost communication to cells. • 3 – Established communication to cells. • 4 – Cells voltage critically low. • 5 – Critical low voltage recovered. • 6 – Cells voltage critically high. • 7 – Critical high voltage recovered. • 8 – Discharge current critically high. • 9 – Discharge critical high current recovered. • 10 – Charge current critically high.

Data	Value	Description
		• 11 – Charge critical high current recovered. • 12 – Cell module temperature critically high. • 13 – Critical high cell module temperature recovered. • 14 – Leakage detected. • 15 – Leakage recovered. • 16 – Warning: Low voltage - reducing power. • 17 – Power reduction due to low voltage recovered. • 18 – Warning: High current - reducing power. • 19 – Power reduction due to high current recovered. • 20 – Warning: High cell module temperature - reducing power. • 21 – Power reduction due to high cell module temperature recovered. • 22 – Charger connected. • 23 – Charger disconnected. • 24 – Started pre-heating stage. • 25 – Started pre-charging stage. • 26 – Started main charging stage. • 27 – Started balancing stage. • 28 – Charging finished. • 29 – Charging error occurred. • 30 – Retrying charging. • 31 – Restarting charging. • 32 – Cell temperature critically high. • 33 – Critically high cell temperature recovered. • 34 – Warning: High cell temperature – reducing power. • 35 – Power reduction due to high cell temperature recovered. • 36 – No current sensor detected. • 37 – Detected current sensor. • 38 – Pack voltage critically low. • 39 – Critically low pack voltage recovered. • 40 – CAN Communication watchdog timed out. • 41 – Pack voltage critically high. • 42 – Critically high pack voltage recovered. • 43 – Cell temperature critically low. • 44 – Critically low cell temperature recovered.

Data	Value	Description
		• 45 – Difference between max and min cell voltages critically high. • 46 – Critically high difference between max and min cell voltages recovered. • 47 – Difference between max and min total voltages critically high. • 48 – Critically high difference between max and min total voltages recovered. • 49 – Cell Module temperature critically low. • 50 – Critically low cell module temperature recovered. • 51 – External temperature sensor loss detected. • 52 – External temperature sensor loss recovered. • 53 – Cell Wire Break detected. • 54 – Cell Wire Break recovered. • 55 – Voltage difference between parallel battery strings is critically high. • 56 – High parallel battery strings voltage difference is recovered. • 57 – Voltage difference between two sources is critically different. • 58 – Voltage difference between two sources is recovered. • 59 – Cell module under heat protection • 60 – Cell module under heat protection recovered • 61 – External temperature sensor loss protection • 62 - External temperature sensor loss recovered • 63 – Cell wire break protection • 64 – Cell wire break recovered • 65 – Parallel string voltage deviation protection • 66 – Parallel string voltage deviation recovered • 67 – Voltage reading deviation protection • 68 – Voltage reading deviation recovered If data type is 1 (Event timestamp), this byte contains the most significant byte of the event timestamp. The timestamp of event occurrence is coded in number of seconds since January 1, 2000, time 00:00: • uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
3	DATA (3rd byte)	Third byte of the event data. If data type is 0 (Event info), this byte is reserved. If data type is 1 (Event timestamp), this byte contains the third byte of the event timestamp. The timestamp of event occurrence is coded in number of seconds since January 1, 2000, time 00:00:

Data	Value	Description
		• uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
4	DATA (2nd byte)	Second byte of the event data. If data type is 0 (Event info), this byte is reserved. If data type is 1 (Event timestamp), this byte contains the second byte of the event timestamp. The timestamp of event occurrence is coded in number of seconds since January 1, 2000, time 00:00: • uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
5	DATA (LSB)	Least significant byte of event data. If data type is 0 (Event info), this byte is reserved. If data type is 1 (Event timestamp), this byte contains the least significant byte of the event timestamp. The timestamp of event occurrence is coded in number of seconds since January 1, 2000, time 00:00: • uint32_t • Offset: 0 • Multiplier: 1 • Result: unsigned
6	RESERVED	Reserved
7	RESERVED	Reserved

CAN Reset BMS

Reset BMS request using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x06	1	0	0

Reset BMS request using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 86h	0	0	0

Charging Station

Charging Station message can be sent to the BMS to set charger limits. The BMS will request the charger the minimum current between the Charging current limits detailed below:

- Charging current limit 1 = Charging current configured in Control panel

- Charging current limit 2 = DC CURRENT

- Charging current limit 3 = AC VOLTAGE * AC CURRENT / Battery Voltage

- Charging current limit 4 = POWER LIMIT / Battery Voltage

Request message to set Charging Station limits using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x04	0x07	1	0	8	DC CURRENT (MSB)	DC CURRENT (LSB)	AC CURRENT (MSB)	AC CURRENT (LSB)	AC VOLTAGE (MSB)	AC VOLTAGE (LSB)	POWER LIMIT (MSB)	POWER LIMIT (LSB)

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x04	0x07	1	0	0

Request message to set Charging Station limits using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 87h	0	0	8	DC CURRENT (MSB)	DC CURRENT (LSB)	AC CURRENT (MSB)	AC CURRENT (LSB)	AC VOLTAGE (MSB)	AC VOLTAGE (LSB)	POWER LIMIT (MSB)	POWER LIMIT (LSB)

Request message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 87h	0	0	0

Description of response values:

Data	Value	Description
0	DC CURRENT (MSB)	DC current limit to be requested by the BMS to the charger, encoded in 0.1A.(for example, decimal value 7051 from both bytes means 705.1 A.
1	DC CURRENT (LSB)	
2	AC CURRENT (MSB)	AC current limit of the charging station, encoded in 0.1V.(for example, decimal value 7051 from both bytes means 705.1 A.
3	AC CURRENT (LSB)	
4	AC VOLTAGE (MSB)	AC voltage limit of the charging station, encoded in 0.1V.(for example, decimal value 7051 from both bytes means 705.1 V.
5	AC VOLTAGE (LSB)	
6	POWER LIMIT (MSB)	Power limit of the charging station, encoded in 10W.(for example, decimal value 7051 from both bytes means 70510 W.
7	POWER LIMIT (LSB)	

Firmware Version

Request message to return firmware version using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x07	0x00	1	0	0

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Byte1	Byte2	Byte3	Byte4							
Base (MSB)	Base (LSB)	0x07	0x00	1	0	4	DIGIT 1	DIGIT 2	DIGIT 3	DIGIT 4

Request message to return firmware version using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + E0h	0	0	0

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Base + E0h	0	0	4	DIGIT 1	DIGIT 2	DIGIT 3	DIGIT 4

Description of response values:

Data	Value	Description
0	DIGIT 1	The value can be achieved from straight translation HEX to DEC. As an example, the version 2.13.1_11 would be:
1	DIGIT 2	• Data0 = 02(Hex) = 02(Dec) • Data1 = 0D(Hex) = 13(Dec)
2	DIGIT 3	• Data2 = 01(Hex) = 01(Dec)
3	DIGIT 4	• Data3 = 0B(Hex) = 11(Dec)

Serial Number

Request message to return serial number using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4	1	0	0
Base (MSB)	Base (LSB)	0x07	0x10			

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Byte1	Byte2	Byte3	Byte4	1	0	4	SERIAL NUMBER (MSB)	SERIAL NUMBER (3rd Byte)	SERIAL NUMBER (2nd Byte)	SERIAL NUMBER (LSB)
Base (MSB)	Base (LSB)	0x07	0x10							

Request message to return serial number using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + F0h	0	0	0

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3
Base + F0h	0	0	4	SERIAL NUMBER (MSB)	SERIAL NUMBER (3rd Byte)	SERIAL NUMBER (2nd Byte)	SERIAL NUMBER (LSB)

Description of response values:

Data	Value	Description
0	SERIAL NUMBER (MSB)	The value can be achieved from straight translation HEX to DEC. As an example, 1,234,567,890 serial number would be:
1	SERIAL NUMBER (3rd Byte)	• Data0 = 49(Hex)
2	SERIAL NUMBER (2nd Byte)	• Data1 = 96(Hex) • Data2 = 02(Hex)
3	SERIAL NUMBER (LSB)	• Data3 = D2(Hex)

Overall Parameters - 2

Request message to return overall battery voltages using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x04	1	0	0

Response message using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4				NUMBER OF LIVE CELLS (MSB)	NUMBER OF LIVE CELLS (LSB)	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
Base (MSB)	Base (LSB)	0x00	0x04	1	0	8								

Request message to return overall battery voltages using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 4h	0	0	0

Response message using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 4h	0	0	8	NUMBER OF LIVE CELLS (MSB)	NUMBER OF LIVE CELLS (LSB)	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

Description of response values:

Data	Value	Description
0	NUMBER OF LIVE CELLS (MSB)	Most significant byte for number of cells detected.
1	NUMBER OF LIVE CELLS (LSB)	Least significant byte for number of cells detected.
2	RESERVED	Reserved
3	RESERVED	Reserved
4	RESERVED	Reserved
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Battery Voltage Overall Parameters - 2

Request message to return overall battery voltages using Extended Identifier:

CAN Identifier				Ext. ID	RTR	DLC
Byte1	Byte2	Byte3	Byte4			
Base (MSB)	Base (LSB)	0x00	0x09	1	0	0

Response message using Extended Identifier (can be periodically broadcasted):

CAN Identifier				Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Byte1	Byte2	Byte3	Byte4											
Base (MSB)	Base (LSB)	0x00	0x09	1	0	8	MINIMUM VOLTAGE	MAXIMUM VOLTAGE	AVERAGE VOLTAGE	TOTAL VOLTAGE (MSB)	TOTAL VOLTAGE (3rd Byte)	TOTAL VOLTAGE (2nd Byte)	TOTAL VOLTAGE (LSB)	RESERVED

Request message to return overall battery voltages using Standard Identifier:

CAN Identifier	Ext. ID	RTR	DLC
Base + 9h	0	0	0

Response message using Standard Identifier (can be periodically broadcasted):

CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
Base + 9h	0	0	8	MINIMUM VOLTAGE	MAXIMUM VOLTAGE	AVERAGE VOLTAGE	TOTAL VOLTAGE (MSB)	TOTAL VOLTAGE (3rd Byte)	TOTAL VOLTAGE (2nd Byte)	TOTAL VOLTAGE (LSB)	RESERVED

Description of response values:

Data	Value	Description
0	MINIMUM VOLTAGE	Lowest cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V (for example, decimal value 101 means 3.01 V). Basis of 1.00V for LTO cells.
1	MAXIMUM VOLTAGE	Highest cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V. Basis of 1.00V for LTO cells.
2	AVERAGE VOLTAGE	Average cell voltage in the battery pack, encoded in 0.01 V with basis of 2.00 V. Basis of 1.00V for LTO cells.
3	TOTAL VOLTAGE (MSB)	Total voltage of all cells in the battery pack, encoded in 0.01 V. (for example, decimal value 70501 from all four bytes means 705.01 V.
4	TOTAL VOLTAGE (3rd Byte)	
5	TOTAL VOLTAGE (2nd Byte)	
6	TOTAL VOLTAGE (LSB)	
7	RESERVED	Reserved

Neuro Messages

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
-	0x521	0	0	8	RESERVED	RESERVED	RESERVED	DEPTH OF DISCHARGE (LSB)	DEPTH OF DISCHARGE (MSB)	RESERVED	RESERVED	RESERVED

Data	Value	Description
0	RESERVED	Reserved
1	RESERVED	Reserved
2	RESERVED	Reserved
3	DEPTH OF DISCHARGE (LSB)	0.1%/byte offset: 0 e.g., Depth of discharge = 700, its corresponding 70.0%
4	DEPTH OF DISCHARGE (MSB)	
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
-	0x522	0	0	8	RESERVED	RESERVED	RESERVED	RESERVED	MIN. DISCHARGE BATTERY VOLTAGE (LSB)	MIN. DISCHARGE BATTERY VOLTAGE (MSB)	MAX. DISCHARGE BATTERY VOLTAGE (LSB)	MAX. DISCHARGE BATTERY VOLTAGE (MSB)

Data	Value	Description
0	RESERVED	Reserved
1	RESERVED	Reserved
2	RESERVED	Reserved
3	RESERVED	Reserved
4	MIN. DISCHARGE BATTERY VOLTAGE (LSB)	0.1 V/byte offset: 0 e.g., Min discharge battery voltage = 700, its corresponding 70.0 V
5	MIN. DISCHARGE BATTERY VOLTAGE (MSB)	
6	MAX. DISCHARGE BATTERY VOLTAGE (LSB)	0.1 A/byte offset: 0 e.g., Max discharge battery current = 700, its corresponding 70.0 A
7	MAX. DISCHARGE BATTERY VOLTAGE (MSB)	

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
-	0x523	0	0	8	MAX. REGENERATION VOLTAGE (LSB)	MAX. REGENERATION VOLTAGE (MSB)	MAX. CHARGE BATTERY VOLTAGE (LSB)	MAX. CHARGE BATTERY VOLTAGE (MSB)	RESERVED	RESERVED	RESERVED	RESERVED

Data	Value	Description
0	MAX. REGENERATION VOLTAGE (LSB)	0.1 V/byte offset: 0 e.g., Min discharge battery voltage = 700, its corresponding 70.0 V
1	MAX. REGENERATION VOLTAGE (MSB)	
2	MAX. REGENERATION VOLTAGE (LSB)	0.1 A/byte offset: 0 e.g., Max discharge battery current = 700, its corresponding 70.0 A

Data	Value	Description
3	MAX. REGENERATION VOLTAGE (MSB)	0.1 A/byte offset: 0 e.g., Max discharge battery current = 700, its corresponding 70.0 A
4	RESERVED	Reserved
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
-	0x530	0	0	8	CONTROL	CHARGING STATUS	AVERAGE TEMPERAT.	TEMPERAT. VALIDITY	RESERVED	RESERVED	RESERVED	RESERVED

Data	Value	Description	
		Bits	Description
0	CONTROL	Bit 0: Discharge control;	0: Disable. 1: Enable
		Bit 1: Regeneration control;	0: Disable. 1: Enable
		Bit 2: Reserved;	-
		Bit 3: Reserved;	-
		Bit 4: Reserved;	-
		Bit 5: Reserved;	-
		Bit 6: Reserved;	-
		Bit 7: Reserved.	-

Data	Value	Description	
1	CHARGING STATUS	**Value**	**Description**
		0x00	Not charging
		0x01	Charging in progress
		0x02	Charging completed
		0x03	Charging fault
2	AVERAGE TEMPERATURE	1°C/byte offset: 40 e.g., Depth of discharge = 40, its corresponding 0°C	
3	TEMPERATURE VALIDITY	**Value**	**Description**
		0x00	Temperature valid
		0x01	Temperature invalid
4	RESERVED	Reserved	
5	RESERVED	Reserved	
6	RESERVED	Reserved	
7	RESERVED	Reserved	

J1939 Chargers Communication Protocol

Communication Specification

The principle for the data link layer.
Communication speed for bus line: 250 Kbps.
The provision for data link layer: Refer to the related regulation of CAN2.0B and J1939.
Use 29 identifiers of CAN extended frame.

Operation Mode

1. The charger sends broadcast messages at intervals of 1s. The display meter can show the status of the charger according to up-to-date information.
2. The BMS, after receiving charger broadcast message sends operating information to the charger. Upon receipt of the message, the charger will operate according to the voltage and current set in the message. If the message is not received within 5 seconds, it will enter the connection error status and stop charging.

BMS Transmits / Charger Receives Messages

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
1000 ms	0x1806E5F4	1	0	8	MAX. ALLOWABLE CHARGING VOLTAGE (MSB)	MAX. ALLOWABLE CHARGING VOLTAGE (LSB)	MAX. ALLOWABLE CHARGING CURRENT (MSB)	MAX. ALLOWABLE CHARGING CURRENT (LSB)	CONTROL	RESERVED	RESERVED	RESERVED

Data	Value	Description
0	MAX. ALLOWABLE CHARGING VOLTAGE (MSB)	0.1 V/byte offset: 0 e.g., Vset = 3201, its corresponding 320.1 V
1	MAX. ALLOWABLE CHARGING VOLTAGE (LSB)	
2	MAX. ALLOWABLE CHARGING CURRENT (MSB)	0.1 A/byte offset: 0 e.g., Iset = 582, its corresponding 58.2 A
3	MAX. ALLOWABLE CHARGING CURRENT (LSB)	
4	CONTROL	0: Start Charging, 1: Stop Charging
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

BMS Receives / Charger Transmits Messages

Cycle	CAN Identifier	Ext. ID	RTR	DLC	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
1000 ms	0x18FF50E5	1	0	8	CHARGER OUTPUT VOLTAGE (MSB)	CHARGER OUTPUT VOLTAGE (LSB)	CHARGER OUTPUT CURRENT (MSB)	CHARGER OUTPUT CURRENT (LSB)	Charger Status	RESERVED	RESERVED	RESERVED

Data	Value	Description	
0	CHARGER OUTPUT VOLTAGE (MSB)	0.1 V/byte offset: 0 e.g., Vset = 3201, its corresponding 320.1 V	
1	CHARGER OUTPUT VOLTAGE (LSB)		
2	CHARGER OUTPUT CURRENT (MSB)	0.1 A/byte offset: 0 e.g., Iset = 582, its corresponding 58.2 A	
3	CHARGER OUTPUT CURRENT (LSB)		
4	CHARGER STATUS	**Bits**	**Description**
		Bit 0: Hardware Failure;	0: Normal. 1: Hardware Failure
		Bit 1: High Temperature Protection;	0: Normal. 1: Over Temperature Protection
		Bit 2: Input Voltage Protection;	0: Normal Input Voltage. 1: Incorrect Input Voltage, Charger Stop Working
		Bit 3: Starting State;	0: Normal Battery connecting. 1: Battery Disconnecting or Reverse
		Bit 4: Communication State;	0: Normal Communication. 1: Communication Receiving Time-out
		Bit 5: Reserved;	Reserved
		Bit 6: Reserved;	Reserved
		Bit 7: Reserved.	Reserved

Data	Value	Description
5	RESERVED	Reserved
6	RESERVED	Reserved
7	RESERVED	Reserved

***

Support

Please contact EMUS for BMS installation or support questions to:

support@emusbms.com

Thank you for choosing EMUS BMS!

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