



EMUS G1 BMS
CANopen device profile

Version: 1.0
26 July 2019
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History

Date	Version	Changes
<i>2019-07-26</i>	<i>1.0</i>	<i>Released as initial draft version</i>

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1. Remarks

Current version of object dictionary does fully not support CiA 418 (Battery module) profile yet. All write operations to Object Dictionary are not permitted. The following list of objects are implemented and available to use with G1 BMS system.

2. Object Dictionary

2.1. Object 4005_h: Output Signals

This object shall provide the status of the remappable pin functions.

VALUE DEFINITION

The output signals 1 byte shall have the following format:

7								0
MSB								LSB
<i>Bit 7</i>	<i>Bit 6</i>	<i>Bit 5</i>	<i>Bit 4</i>	<i>Bit 3</i>	<i>Bit 2</i>	<i>Bit 1</i>	<i>Bit 0</i>	

Bit 0: Charger enable

Bit 1: Heater enable

Bit 2: Battery contactor

Bit 3: Battery fan

Bit 4: Power reduction

Bit 5: Charging interlock

Bit 6: DC/DC control

Bit 7: Contactor pre-charge

0 = disabled

1 = enabled

OBJECT DESCRIPTION

INDEX	4005 _h
Name	output signals
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	00 _h
Description	Highest sub-index supported
Data type	Unsigned8
Access	ro
Value range	Unsigned8

Sub-index	01 _h
Description	output signals 1
Data type	Unsigned8
Access	ro
Value range	Unsigned8

2.2. Object 6020_h: Battery parameters

This object shall provide the battery parameters.

VALUE DEFINITION

Sub-index 4: *Number of cells*

Number of battery cells that make up the battery pack.

OBJECT DESCRIPTION

INDEX	6020 _h
Name	battery parameters
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	04 _h
Description	number of cells
Data type	Unsigned16
Access	ro
Value range	Unsigned16

2.3. Object 2100_h: Current charging stage

This object shall provide the current charging stage of charging process whether it is active or not.

VALUE DEFINITION

Battery charging stages are encoded in this manner:

- 0 = Disconnected (charger is disconnected)
- 1 = Preheating (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 pin function input state))
- 4 = Balancing (cells are being balanced to equalize their charge level)
- 5 = Charging finished
- 6 = Charging error

OBJECT DESCRIPTION

INDEX	2100 _h
Name	Current charging stage
Object code	VAR

ENTRY DESCRIPTION

Sub-index	00 _h
Data type	Unsigned8
Access	ro
Value range	06 _h

2.4. Object 2103_h: Last charging error

This object shall provide the error code of charging process. This code indicates reasons why charging process was terminated.

VALUE DEFINITION

Last charging error codes are encoded in this manner:

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 charger

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, for details see object: 4090_h: Diagnostic codes

OBJECT DESCRIPTION

INDEX	2103 _h
Name	last charging error
Object code	VAR

ENTRY DESCRIPTION

Sub-index	00 _h
Data type	Unsigned8
Access	ro
Value range	Unsigned8

2.5. Object 4090h: Diagnostic codes

This object shall provide the status of the battery, which indicates the readiness of the battery to accept a charge or not.

VALUE DEFINITION

Sub-index 1: *Protection flags 1*

Active protections that are currently triggered due to reached limits or faults occurred.

Sub-index 2: *Warning flags*

Active warning (reductions) that are currently triggered due to reached limits or faults occurred.

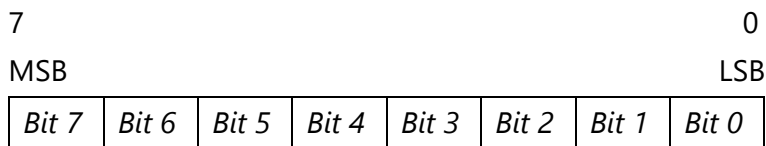
Sub-index 3: *Protection flags 2*

Active protections that are currently triggered due to reached limits or faults occurred (continued).

Sub-index 4: *Battery status flags*

Current battery parameters validity and cell communication status.

The protection flags 1 byte shall have the following format:



Bit 0: Under-voltage (some cell is below critical minimum voltage)

Bit 1: Over-voltage (some cell is above critical maximum voltage)

Bit 2: Discharge over-current (discharge current (negative) exceeds the critical discharge current setting)

Bit 3: Charge over-current (charge current (positive) exceeds the critical charge current setting)

Bit 4: Cell module overheat (cell module temperature exceeds maximum critical temperature setting)

Bit 5: Leakage (leakage signal was detected on leakage pin function input pin)

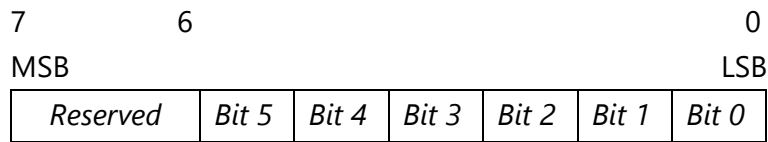
Bit 6: No cell communication (loss of communication to cells)

Bit 7: Master/Slave configuration error

0 = inactive

1 = active

The warning flags byte shall have the following format:



Bit 0: Under-voltage power reduction (some cell is below low voltage warning setting)

Bit 1: Discharge high-current (discharge current(negative) exceeds the discharge current warning setting)

Bit 2: High temperature (cell module temperature exceeds warning cell module temperature setting)

Bit 3: Master/Slave config warning (Master/Slave configuration mismatch)

Bit 4: Master/Slave common bus warning (Master/Slave common CAN bus malfunction)

Bit 5: High cell temperature (cell temperature exceeds warning cell temperature setting)

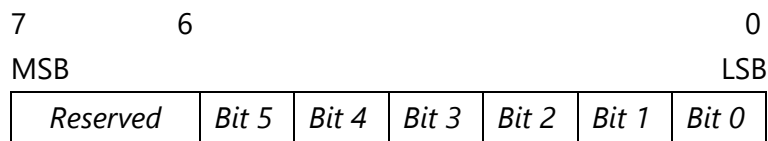
Bit 6: Reserved for future use

Bit 7: Reserved for future use

0 = inactive

1 = active

The protection flags 2 byte shall have the following format:



Bit 0: Master/Slave internal bus error (Master/Slave internal CAN bus failure)

Bit 1: Master/Slave common bus error (Master/Slave common CAN bus failure)

Bit 2: AC presence cut-off

Bit 3: Battery cell overheat (cell temperature exceeds maximum critical temperature setting)

Bit 4: Current sensor missing (current sensor presence was not detected by the system)

Bit 5: Pack undervoltage (total battery voltage exceeds minimum critical voltage setting)

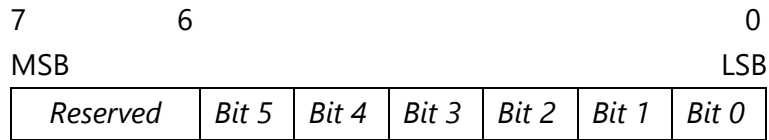
Bit 6: Reserved for future use

Bit 7: Reserved for future use

0 = inactive

1 = active

The battery status flags byte shall have the following format:



- Bit 0*: Cell voltages
- Bit 1*: Cell module temperatures
- Bit 2*: Cell balancing rates
- Bit 3*: Number of live cells
- Bit 5*: Cell temperatures
- Bit 6*: Reserved for future use
- Bit 7*: Reserved for future use

0 = invalid
1 = valid

Bit 4: Battery charging finished

0 = inactive
1 = active

OBJECT DESCRIPTION

INDEX	4090 _h
Name	diagnostic codes
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h
Description	Protection flags 1
Data type	Unsigned8
Access	ro
Value range	Unsigned8

Sub-index	02 _h
Description	Warning flags
Data type	Unsigned8
Access	ro
Value range	Unsigned8

Sub-index	03 _h
Description	Protection flags 2
Data type	Unsigned8
Access	ro
Value range	Unsigned8

Sub-index	04 _h
Description	Battery status flags
Data type	Unsigned8
Access	ro
Value range	Unsigned8

2.6. Object 5502_h: Battery voltage summary

This object shall provide the instantaneous voltage summary of the battery pack.

VALUE DEFINITION

Sub-index 1: *Minimum cell voltage*

The lowest cell voltage in battery pack.

Sub-index 2: *Maximum cell voltage*

The highest cell voltage in battery pack.

Sub-index 3: *Average cell voltage*

Average cell voltage of the battery pack.

Sub-index 4: *Total voltage*

Accumulated total voltage of the battery pack.

Voltage shall be given in mV with resolution 1mV per bit.

OBJECT DESCRIPTION

INDEX	5502 _h
Name	Battery voltage summary
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	01 _h
Description	minimum cell voltage
Data type	Unsigned16
Access	ro
Value range	Unsigned16

Sub-index	02 _h
Description	maximum cell voltage
Data type	Unsigned16
Access	ro
Value range	Unsigned16

Sub-index	03 _h
Description	average cell voltage
Data type	Unsigned16
Access	ro

Value range	Unsigned16
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Sub-index	04 _h
Description	total voltage
Data type	Unsigned32
Access	ro
Value range	Unsigned32

2.7. Object 5503_h: Battery internal temperature summary

This object shall provide the internal temperature summary of the battery pack.

VALUE DEFINITION

Sub-index 1: *Minimum internal temperature*

The lowest internal temperature in battery pack.

Sub-index 2: *Maximum internal temperature*

The highest internal temperature in battery pack.

Sub-index 3: *Average internal temperature*

Average internal temperature of the battery pack.

Temperature shall be given in °C with resolution 1 °C per bit.

OBJECT DESCRIPTION

INDEX	5503 _h
Name	Battery internal temperature summary
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	01 _h
Description	minimum internal temperature
Data type	Signed16
Access	ro
Value range	Signed16

Sub-index	02 _h
Description	maximum internal temperature
Data type	Signed16
Access	ro
Value range	Signed16

Sub-index	03 _h
Description	average internal temperature
Data type	Signed16
Access	ro
Value range	Signed16

2.8. Object 5504_h: Battery external temperature summary

This object shall provide the external temperature summary of the battery pack.

VALUE DEFINITION

Sub-index 1: *Minimum external temperature*

The lowest external temperature in battery pack.

Sub-index 2: *Maximum external temperature*

The highest external temperature in battery pack.

Sub-index 3: *Average external temperature*

Average external temperature of the battery pack.

Temperature shall be given in °C with resolution 1 °C per bit. When no external temperature sensors are connected, these fields would read value of 8000_h.

OBJECT DESCRIPTION

INDEX	5504 _h
Name	Battery external temperature summary
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	01 _h
Description	minimum external temperature
Data type	Signed16
Access	ro
Value range	Signed16

Sub-index	02 _h
Description	maximum external temperature
Data type	Signed16
Access	ro
Value range	Signed16

Sub-index	03 _h
Description	average external temperature
Data type	Signed16
Access	ro
Value range	Signed16

2.9. Object 5505_h: Battery balancing rate summary

This object shall provide the balancing rate summary of the battery pack.

VALUE DEFINITION

Sub-index 1: *Minimum balancing rate*

The lowest cell balancing rate in battery pack.

Sub-index 2: *Maximum balancing rate*

The highest cell balancing rate in battery pack.

Sub-index 3: *Average balancing rate*

Average cell balancing rate of the battery pack.

Balancing rate shall be given in % with resolution 1 % per bit.

OBJECT DESCRIPTION

INDEX	5505 _h
Name	Battery balancing rate summary
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	01 _h
Description	minimum balancing rate
Data type	Unsigned8
Access	ro
Value range	64 _h

Sub-index	02 _h
Description	maximum balancing rate
Data type	Unsigned8
Access	ro
Value range	64 _h

Sub-index	03 _h
Description	average balancing rate
Data type	Unsigned8
Access	ro
Value range	64 _h

2.10. Object 5600_h: Battery energy

This object shall provide information about energy and charge in battery.

VALUE DEFINITION

Sub-index 1: *Estimated charge*

Estimated remaining charge in battery pack.

Sub-index 2: *Estimated energy*

Estimated energy left in battery pack.

Estimated charge shall be given in Ah with resolution 0.1 Ah per bit.

Estimated energy shall be given in Wh with resolution 1 Wh per bit.

OBJECT DESCRIPTION

INDEX	5600 _h
Name	Battery energy
Object code	RECORD

ENTRY DESCRIPTION

Sub-index	01 _h
Description	estimated charge
Data type	Unsigned16
Access	ro
Value range	Unsigned16

Sub-index	02 _h
Description	estimated energy
Data type	Unsigned16
Access	ro
Value range	Unsigned16

2.11. Object 6081_h: Battery state of charge

This object shall provide the battery's measurement of the amount of energy contained in the battery, expressed as percentage of the total amount of energy the battery can store.

VALUE DEFINITION

Resolution shall be 1 % per bit.

OBJECT DESCRIPTION

INDEX	6081 _h
Name	Battery state of charge
Object code	VAR

ENTRY DESCRIPTION

Sub-index	00 _h
Data type	Unsigned8
Access	ro
Value range	00 _h to 64 _h and FF _h

2.12. Object 3080_h: Statistics value

This object shall provide the values of all collected statistics related to batteries and BMS itself.

VALUE DEFINITION

Value can be combined using up to 4 bytes. Each sub-index (starting at 01_h) is directly linked to unique statistic.

OBJECT DESCRIPTION

INDEX	3080 _h
Name	Statistic value
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h to 37 _h
Description	Value of statistic
Data type	Unsigned32
Access	ro
Value range	Unsigned32

2.13. Object 3081_h: Statistics additional value

This object shall provide the additional values of all collected statistics related to batteries and BMS itself.

VALUE DEFINITION

Additional value can be combined using up to 4 bytes. Each sub-index (starting at 01_h) is directly linked to unique statistic.

OBJECT DESCRIPTION

INDEX	3081 _h
Name	Statistic additional value
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h to 37 _h
Description	Additional value of statistic
Data type	Unsigned32
Access	ro
Value range	Unsigned32

2.14. Object 3082_h: Statistics timestamp

This object shall provide the timestamps of all collected statistics related to batteries and BMS itself.

VALUE DEFINITION

Timestamp of when the statistic was last updated, in number of seconds since January 1, 2000 time 00:00. Each sub-index (starting at 01_h) is directly linked to unique statistic.

OBJECT DESCRIPTION

INDEX	3082 _h
Name	Statistic timestamp
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h to 37 _h
Description	Timestamp of statistic
Data type	Unsigned32
Access	ro
Value range	Unsigned32

2.15. Object 3102_h: Event identifier

This object shall provide the event identifiers which were registered by the system when events occurred.

VALUE DEFINITION

Event identifier indicates which event was registered.

OBJECT DESCRIPTION

INDEX	3102 _h
Name	Event identifier
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h to 20 _h
Description	Event identifier
Data type	Unsigned8
Access	ro
Value range	Unsigned8

2.16. Object 3103_h: Event timestamp

This object shall provide the event timestamps which were registered by the system when events occurred.

VALUE DEFINITION

Timestamp of event occurrence is coded in number of seconds since January 1, 2000 time 00:00.

OBJECT DESCRIPTION

INDEX	3103 _h
Name	Event timestamp
Object code	ARRAY

ENTRY DESCRIPTION

Sub-index	01 _h to 20 _h
Description	Event timestamp
Data type	Unsigned32
Access	ro
Value range	Unsigned32