



BMS Main 2.x

CANopen PDO protocol

Revision 2 (03-August-2021)

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1 General information

BMS Main 2.x board supports CiA 301 CANopen protocol for configuring and monitoring the battery management system.

The communication parameters of the board are:

- CAN speed – 125, 250 (default), 500 or 1000 kbps.
- **COBID** of the board by default – 32 (0x20).

BMS Main 2.x supports the following features:

- SDO protocol (for configuring the system).
- PDO protocol (for interacting with external devices).
- Sync.
- Heartbeat producer.
- Heartbeat consumer.

BMS Main 2.x transmits TPDO packets on every Sync message (CANID = 0x80, data length is 0). The board can send Sync messages itself.

There is the description of the parameters in the TPDO packets below. Column "Parameter type" contains an integer type of the parameter:

U8 – unsigned 8-bit integer;

U16 – unsigned 16-bit integer;

S16 – signed 16-bit integer;

U32 – unsigned 32-bit integer.

Words are in the **little endian**.

2 TPDO packets

2.1 CANID = 0x180+COBID (0x1A0 by default)

Packet length – 8 bytes.

Packet content:

Byte number	Parameter name	Parameter type	Converting
0	Discrete inputs (bitfield): bit 0 – “Battery cover”; bit 1 – “Charger connected”; bit 2 – “Power down request”; bit 3 – “Inhibit charging”; bit 4 – “Inhibit discharging”; bit 5 – “Charging contactor feedback”; bit 6 – “Discharging contactor feedback”; bit 7 – reserved.	U8	
1-2	Battery current	S16	0.1A/bit
3	Minimum cell temperature	S8	1°C/bit
4	Maximum cell temperature	S8	1°C/bit
5	State of charge (SOC)	U8	1%/bit
6-7	Battery voltage	U16	0.1V/bit

2.2 CANID = 0x280+COBID (0x2A0 by default)

Packet length – 8 bytes.

Packet content:

Byte number	Parameter name	Parameter type	Converting
0-3	BMS internal state (bitfield):	U32	

<p>bit 0 – “Low SOC”;</p> <p>bit 1 – “High charging current”;</p> <p>bit 2 – state of the charging contactor (0 – opened, 1 – closed);</p> <p>bit 3 – “Allow charging”;</p> <p>bit 4 – “Charging current present”;</p> <p>bit 5 – state of the discharging contactor (0 – opened, 1 – closed);</p> <p>bit 6 – “Discharging current present”;</p> <p>bit 7 – “Increased voltage” (EV);</p> <p>bit 8 – “High DCH temperature”;</p> <p>bit 9 – “Cooler”, state of the cooler (0 – turned off, 1 – turned on);</p> <p>bit 10 – “HYG shutdown”, command from the HYG forklift to open the discharging contactor;</p> <p>bit 11 – “Init”, signal of initializing the BMS (during the initialization current sensor is calibrating and BMS Logic boards are scanning);</p> <p>bit 12 – state of the precharge contactor (0 – opened, 1 – closed);</p> <p>bit 13 – “Combilift shutdown”, command from the Combilift forklift to open the discharging contactor;</p> <p>bit 14 – “Cell analysis”, signal of started analysis of the cells;</p> <p>bit 15 – “Balancing series 1”;</p> <p>bit 16 – “Balancing series 2”;</p> <p>bit 17 – state of the auxiliary discharging contactor (0 – opened, 1 – closed);</p> <p>bit 18 – “Acknowledgement of power down”;</p> <p>bit 19 – “Crown EWS”;</p>		
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	<p>bit 20 – state of the main contactor (0 – opened, 1 – closed);</p> <p>bit 21 – “Service reset”;</p> <p>bits 22–31 – reserved.</p>		
4-7	<p>Errors register 1 (bitfield):</p> <p>bit 0 – “Overcurrent”;</p> <p>bit 1 – “Undervoltage”;</p> <p>bit 2 – “Overvoltage”;</p> <p>bit 3 – “Low DCH temperature”, temperature is too low for discharging;</p> <p>bit 4 – “High DCH temperature”, temperature is too high for discharging;</p> <p>bit 5 – “Battery cover”;</p> <p>bit 6 – “High humidity”;</p> <p>bit 7 – “Water”;</p> <p>bit 8 – “High logic temperature”, some BMS Logic board is overheated;</p> <p>bit 9 – “Logic offline”, connection with some BMS Logic board is lost;</p> <p>bit 10 – “Critical error”;</p> <p>bit 11 – “Crown error”, connection with the Crown forklift is lost;</p> <p>bit 12 – “Cell count error”, number of cells in incorrect;</p> <p>bit 13 – “HYG offline”, connection with the HYG forklift is lost;</p> <p>bit 14 – “Need acknowledgement”, errors were detected in the past and should be acknowledged;</p> <p>bit 15 – “Combilift offline”, connection with the Combilift forklift is lost;</p>	U32	

<p>bit 16 – “Short circuit”;</p> <p>bit 17 – “High contactor temperature”, the discharging contactor is overheated;</p> <p>bit 18 – “Logic count error”, number of BMS Logic boards is incorrect;</p> <p>bit 19 – “ADC error”, battery current cannot be measured by ADC;</p> <p>bit 20 – “Current sensor error”, wires which connect the current sensor with the BMS are damaged;</p> <p>bit 21 – “CH contactor cycles error”, the charging contactor switches very often;</p> <p>bit 22 – “DCH contactor cycles error”, the discharging contactor switches very often;</p> <p>bit 23 – “Shunt offline”, connection with the BMS Current sensor is lost;</p> <p>bit 24 – “Shunt error”, internal error of the BMS Current sensor;</p> <p>bit 25 – “Settings error”, checksum of the setting is incorrect;</p> <p>bit 26 – “WDT reset”, boards is reset by the watchdog timer;</p> <p>bit 27 – “No temperature sensors”;</p> <p>bit 28 – “Temperature sensor is shorted”;</p> <p>bit 29 – “Spirit offline”, connection with the Spirit truck is lost;</p> <p>bits 30–31 – reserved.</p>		
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2.3 CANID = 0x380+COBID (0x3A0 by default)

Packet length – 8 bytes.

Packet content:

Byte number	Parameter name	Parameter type	Converting
0-3	Errors register 2 (bitfield): bit 0 - "Low CH temperature", temperature is too low for charging; bit 1 - "High CH temperature", temperature is too high for charging; bit 2 - "SD mount error"; bit 3 - "SD read/write error"; bit 4 - "Unallowable charging", charging the battery through the discharging contactor; bit 5 - "Stuck contactor"; bit 6 - "CH contactor feedback error"; bit 7 - "DCH contactor feedback error"; bits 8-31 - reserved.	U32	
4-7	Reserved	U32	

3 Contacts

Movicom Electric LLC



117246, Russia, Moscow, Nauchniy proezd, 20-2



+7 (495) 989-56-47



electric@movicom.com

movicomelectric.com

4 Revision history

Revision number	Revision date	Changes
1	13-April-2021	First revision
2	03-August-2021	Added discrete input signals “Charging contactor feedback” and “Discharging contactor feedback” to the description of the first PDO packet. Added errors “Stuck contactor”, “CH contactor feedback error” and “DCH contactor feedback error” to the description of the third PDO packet.