BMS Main 2.x

CANopen PDO protocol

Contents

1 General information

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

The communication parameters of the board are:

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

The 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.

The 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 1 (bitfield): bit 0 – "Battery cover"; bit 1 – "Charger connected"; bit 2 – "Power down request"; bit 3 – "Inhibit charging"; bit 4 – "Inhibit discharging"; bit 5 – "CH contactor feedback"; bit 6 – "DCH contactor feedback"; bit 7 – "Insulation status".	U8	
1–2	Battery current	S16	0.1A/bit
3	Minimum cell temperature	S8	1ºC/bit
4	Maximum cell temperature	S8	1ºC/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	

bit 0 – "Low SOC";

bit 1 – "High charging current";

bit 2 – state of the charging contactor (0 – opened, 1 – closed);

bit 3 – "Allow charging";

bit 4 – "Charging current present";

bit 5 – state of the discharging contactor (0 – opened, 1 – closed);

bit 6 – "Discharging current present";

bit 7 – "Increased voltage" (EV);

bit 8 – "High DCH temperature";

bit 9 – "Cooler", state of the cooler (0 – turned off, 1 – turned on);

bit 10 – "HYG shutdown", command from the HYG forklift to open the discharging contactor;

bit 11 – "Init", signal of initializing the BMS (during the initialization current sensor is calibrating and BMS Logic boards are scanning);

bit 12 – state of the precharge contactor (0 – opened, 1 – closed);

bit 13 – "Combilift shutdown", command from the Combilift forklift to open the discharging contactor;

bit 14 – "Cell analysis", signal of started analysis of the cells;

bit 15 – "Balancing series 1";

bit 16 – "Balancing series 2";

bit 17 – state of the auxiliary discharging contactor (0 – opened, 1 – closed);

bit 18 – "Acknowledgement of power down";

bit 19 – "Crown EWS";

	bit 20 – state of the main contactor (0 – opened, 1 – closed);		
	bit 21 – "Service reset";		
	bit 22 – state of the charging/discharging contactor (0 – opened, 1 – closed);		
	bit 23 – "Ready to charge" (the voltage on the cells is less than the allowable value and there are no errors that prohibit charging);		
	bit 24 – "Ready to discharge" (the voltage on the cells is greater than the allowable value and there are no errors that prohibit discharging)		
	bits 25–31 – reserved.		
4–7	Errors register 1 (bitfield): bit 0 – "Overcurrent"; bit 1 – "Undervoltage"; bit 2 – "Overvoltage"; bit 3 – "Low DCH temperature", temperature is too low for discharging; bit 4 – "High DCH temperature", temperature is too high for discharging; bit 5 – "Battery cover"; bit 6 – "High humidity"; bit 7 – "Water"; bit 8 – "High logic temperature", some BMS Logic board is overheated; bit 9 – "Logic offline", connection with some BMS Logic board is lost; bit 10 – "Critical error"; bit 11 – "Crown error", connection with the Crown forklift is lost; bit 12 – "Cell count error", number of cells in	U32	

incorrect;

bit 13 – "HYG offline", connection with the HYG forklift is lost;

bit 14 – "Need acknowledgement", errors were detected in the past and should be acknowledged;

bit 15 – "Combilift offline", connection with the Combilift forklift is lost;

bit 16 – "Short circuit";

bit 17 – "High contactor temperature", the discharging contactor is overheated;

bit 18 – "Logic count error", number of BMS Logic boards is incorrect;

bit 19 – "ADC error", battery current cannot be measured by ADC;

bit 20 – "Current sensor error", wires which connect the current sensor with the BMS are damaged;

bit 21 – "CH contactor cycles error", the charging contactor switches very often;

bit 22 – "DCH contactor cycles error", the discharging contactor switches very often;

bit 23 – "Shunt offline", connection with the BMS Current sensor is lost;

bit 24 – "Shunt error", internal error of the BMS Current sensor;

bit 25 – "Settings error", checksum of the setting is incorrect;

bit 26 – "WDT reset", boards is reset by the watchdog timer;

bit 27 – "No temperature sensors";

bit 28 – "Temperature sensor is shorted";

bit 29 – "Spirit offline", connection with the Spirit

Byte number	Parameter name	Parameter type	Converting
	truck is lost; bits 30–31 – reserved.		

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"; bit 8 – "Insulation fault"; bit 9 – "PCH contactor feedback error"; bit 10 – "CH/DCH contactor feedback error"; bit 11 – "Main contactor feedback error"; bits 12–31 – reserved.	U32	
4-5	Discrete inputs 2 (bitfield): bit 0 – "Charge request", request to close the charging contactor is received; bit 1 – "Precharge request", request to close the	U16	

	precharge contactor is received;		
	bit 2 – "Discharge request", request to close the discharging contactor is received;		
	bit 3 – "PCH contactor feedback";		
	bit 4 – "CH/DCH contactor feedback";		
	bit 5 – "Main contactor feedback";		
	bits 6-15 – reserved.		
6-7	Reserved	U16	

3　Contacts

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4 Revision history

Revision number	Revision date	Changes
1	13–April–2021	First revision
2	03-August-2021	Added the discrete input signals "Charging contactor feedback" and "Discharging contactor feedback" to the description of the first PDO packet. Added the errors "Stuck contactor", "CH contactor feedback error" and "DCH contactor feedback error" to the description of the third PDO packet.
3	13-January-2022	Added the discrete input signal "Insulation status" to the description of the first PDO packet. Added the internal signal "Charging/Discharging" to the description of the second PDO packet. Added the error "Insulation fault" to the description of the third PDO packet.
4	10-February-2022	Added the internals states "Ready to charge" and "Ready to discharge" to the description of the second PDO packet. Added the discrete input signals "Charge request", "Precharge request", and "Discharge request" to the description of the third PDO packet.
5	19-April-2023	Added the discrete input signals "PCH contactor feedback", "CH/DCH contactor feedback", "Main contactor feedback". Added the errors "PCH contactor feedback error", "CH/DCH contactor feedback error", "Main contactor feedback error".