

CEGASA

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Annex 2:

CAN Bus Communication Protocol

Control of revisions

VERSION	DATE	DESCRIPTION
Version 1.2	09/10/2024	Formatting revision

Table of Contents

<u>A2.1 Purpose</u>	<u>3</u>
<u>A2.2 CAN Bus address table.....</u>	<u>3</u>
<u>A2.3 CAN Bus message content.....</u>	<u>4</u>
<u>A2.3.1 CONV_ALIVE</u>	<u>4</u>
<u>A2.3.2 BATTERY_DATA</u>	<u>4</u>
<u>A2.3.3 LIMITS</u>	<u>5</u>
<u>A2.3.4 CELL_TEMP</u>	<u>6</u>
<u>A2.3.5 ALARMS.....</u>	<u>7</u>
<u>A2.3.6 MODULE_TEMP</u>	<u>8</u>
<u>A2.3.7 LEVELS.....</u>	<u>9</u>

A2.1 PURPOSE

This document shows the CAN Bus communications protocol implemented in Cegasa's EBick HV and EScal batteries to communicate with the various HV inverters. This protocol is based on the standard integrated in most inverters on the market.

The protocol is based on a Battery System that acts reactively in CAN communication, responding to heartbeat messages from the inverter, requesting the type of data it wishes to receive back. In this way, system operation messages will be requested more frequently, while configuration messages will be requested less frequently. These requests will be decided by the inverter at the frequency programmed in the inverter.

A2.2 CAN BUS ADDRESS TABLE

The table below shows the CAN addresses used for communication between the inverter and the battery. Here you can see the messages expected from the inverter and the responses from the battery

CAN Messages		
Description	Message name	CAN Adress
Messages sent by the inverter	CONV_ALIVE	0x4200
Messages sent by battery with operation data request	BATTERY_DATA	0x4210
	LIMITS	0x4220
	CELL_TEMP	0x4240
	ALARMS	0x4250
	MODULE_TEMP	0x4270
Messages sent by battery with configuration data request	LEVELS	0x7320

A2.3 CAN BUS MESSAGE CONTENT

A2.3.1 CONV_ALIVE

The inverter heartbeat message. This message sends 8 bytes of data, all of them being 0, except the first (message[0]), in which it will ask for the type of data to be provided as a response. The possible values are as follows:

- 0: Operation data.
- 2: Configuration data.

A2.3.2 BATTERY_DATA

Message with the basic operating data of the battery, these are:

- Total battery system voltage in tenths of a Volt. Variable of 16 bits unsigned.
- Total current of the battery system in tenths of Ampere. It is transmitted with an offset of 3000 A, so if the variable is 0, it actually reads -3000 A. Variable of 16 bits unsigned.
- Global temperature of the system in tenths of a degree Celsius. It is transmitted with an offset of 100°C, so that, if the variable is 0, it really reads -100°C. Variable of 16 bits unsigned.
- State of charge of the system as a percentage. Variable of 8 bits unsigned.
- System health status as a percentage. Variable of 8 bits unsigned.

The distribution within the CAN message would be as follows:

DATA_FRAME	BATTERY_DATA
0	ui16_system_vol_dV (Low part)
1	ui16_system_vol_dV (High part)
2	ui16_system_curr_dA (Low part) (Offset: -3000 A)
3	ui16_system_curr_dA (High part) (Offset: -3000 A)
4	ui16_system_temperature_dC (Low part) (Offset: -100°C)
5	ui16_system_temperature_dC (High part) (Offset: -100°C)
6	ui8_system_SoC
7	ui8_system_SoH

A2.3.3 LIMITS

This message sets the operating limits set by the battery for the inverter to operate correctly. Its variables are as follows:

- **Upper charging voltage limit in tenths of a Volt.** Variable of 16 bits unsigned.
- **Lower discharge voltage limit in tenths of a Volt.** Variable of 16 bits unsigned.
- **Upper charging limit in tenths of an Ampere.** It is transmitted with an offset of 3000 A, so if the variable is 0, it actually reads -3000 A. Variable of 16 bits unsigned.
- **Upper discharge current limit in tenths of an Ampere.** It is transmitted with an offset of 3000 A, so if the variable is 0, it actually reads -3000 A. Variable of 16 bits unsigned.

The distribution within the CAN message is as follows:

DATA_FRAME	LIMITS
0	ui16_end_of_charge_voltage (Low part) (dV)
1	ui16_end_of_charge_voltage (High part) (dV)
2	ui16_end_of_discharge_voltage (Low part) (dV)
3	ui16_end_of_discharge_voltage (Low part) (dV)
4	ui16_max_charge_current (Low part) (dA Offset: -3000 A)
5	ui16_max_charge_current (High part) (dA Offset: -3000 A)
6	ui16_max_discharge_current (Low part) (dA Offset: -3000 A)
7	ui16_max_discharge_current (High part) (dA Offset: -3000 A)

A2.3.4 CELL_TEMP

In this message the extreme values of temperature in the cells are sent, they are the following:

- **Maximum cell temperature within the system.** It is transmitted with an offset of 100°C, so that, if the variable is 0, it really reads -100°C. Variable of 16 bits unsigned.
- **Minimum cell temperature within the system.** It is transmitted with an offset of 100°C, so that, if the variable is 0, it really reads -100°C. Variable of 16 bits unsigned.
- **ID of the module with the maximum temperature cell.** Variable of 8 bits unsigned.
- **ID of the string with the maximum temperature cell.** Variable of 8 bits unsigned.
- **ID of the module with the minimum temperature cell.** Variable of 8 bits unsigned.
- **ID of the module with the minimum temperature cell.** Variable of 8 bits unsigned.

The distribution within the CAN message is as follows:

DATA_FRAME	CELL_TEMP
0	ui16_max_cell_temp_dC (Low part) (Offset: -100°C)
1	ui16_max_cell_temp_dC (High part) (Offset: -100°C)
2	ui16_min_cell_temp_dC (Low part) (Offset: -100°C)
3	ui16_min_cell_temp_dC (High part) (Offset: -100°C)
4	ui16_max_cell__temp_module_id
5	ui16_max_cell_temp_string_id
6	ui16_min_cell_temp_module_id
7	ui16_min_cell_temp_string_id

A2.3.5 ALARMS

Word with the status, alarms and warnings for the module. The alarms and warnings each occupy one bit. The "status" sent in the first BYTE can have the following values:

- SLEEP (0) (Not used)
- CHARGE (1)
- DISCHARGE (2)
- IDLE (3)

The distribution is as follows:

DATA_FRAME	Alarms and States	bits
0	Status	3
	Reserve	5
1 and 2	Reserve	16
3	volt_sensor_error	1
	temp_sensor_error	1
	internal_com_error	1
	internal_over_volt_error	1
	internal_transposition_error	1
	relay_check_error	1
	battery_cell_error	1
	other_error	1
4	single_cell_low_volt_alarm	1
	single_cell_high_volt_alarm	1
	dch_system_low_volt_alarm	1
	ch_system_high_volt_alarm	1
	ch_cell_low_temp_alarm	1
	ch_cell_high_temp_alarm	1
	dch_cell_low_temp_alarm	1
	dch_cell_high_temp_alarm	1
5	ch_over_current_alarm	1
	dch_over_current_alarm	1
	module_low_volt_alarm	1
	module_high_volt_alarm	1
	Reserve	4

6	single_cell_under_volt_protect	1
	single_cell_over_volt_protect	1
	dch_system_under_volt_protect	1
	ch_system_over_volt_protect	1
	ch_cell_under_temp_protect	1
	ch_cell_over_temp_protect	1
	dch_cell_under_temp_protect	1
	dch_cell_over_temp_protect	1
7	ch_over_current_protect	1
	dch_over_current_protect	1
	module_under_volt_protect	1
	module_over_volt_protect	1
	Reserve	4

A2.3.6 MODULE_TEMP

Message with the same variables as CELL_TEMP, but for the module case. The data distribution is as follows:

DATA_FRAME	MODULE_TEMP
0	ui16_module_max_temp_dC (Low part)
1	ui16_module_max_temp_dC (High part)
2	ui16_module_min_temp_dC (Low part)
3	ui16_module_min_temp_dC (High part)
4	ui16_max_temp_module_id
5	ui16_max_temp_string_id
6	ui16_min_temp_module_id
7	ui16_min_temp_string_id

A2.3.7 LEVELS

System configuration message. The information it sends is as follows:

- **Total number of modules in the system.** Variable of 16 bits unsigned.
- **Number of modules per string.** Variable of 8 bits unsigned.
- **Number of cells per module.** Variable of 8 bits unsigned.
- **Nominal system voltage in tenths of a Volt.** Variable of 16 bits unsigned.
- **Nominal installed capacity in Ah.** Variable of 16 bits unsigned.

The distribution within the CAN message is as follows:

DATA_FRAME	LEVELS
0	ui16_module_qty (Low part)
1	ui16_module_qty (High part)
2	ui8_string_module_qty
3	ui8_cell_per_module_qty
4	ui16_volt_level_dV (Low part)
5	ui16_volt_level_dV (High part)
6	ui16_capacity_installed_Ah (Low part)
7	ui16_capacity_installed_Ah (High part)

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