



Controller Area Network (CAN) Bus Protocol for 48Vdc (sub 63V) (low voltage) Battery-Inverter Communications

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Revision	Changelog	Author	Date
1.0	Initial creation	William Hopkins	8/18/21
1.1	Updated Interface Configuration	William Hopkins	8/19/21
1.2	Update Protocol Information	Vincent Wei	4/20/22
1.3	Clarified Descriptions	Jonathan Nesbitt, BSEE	Jan 20 2023

See the latest battery integration guide link at lower left of webpage [Sol-Ark.com/support](https://sol-ark.com/support)

There is a separate CANBUS battery inverter CANBUS spec for high voltage battery inverters such as commercial 30k and 60k 3-phase inverter models. Follow electrical safety protections for max voltages in the inverter battery energy storage system (ESS): e.g. 500vdc photovoltaic strings.

Follow battery manual and inverter manual safety guidelines fully.

Sol-Ark CAN Bus Protocol for LV Battery-Inverter Communications

CAN Bus Interface Configuration:

The Sol-Ark [inverters](#) only recognize standard CAN Bus frames containing 8 bytes of data.

CAN FD with 64 data bytes per frame is not supported.

Communication Rate: 500 kbps

Data Endianness: Little Endian (least significant byte is at left end of multi or 2-byte values)

Transmission Cycle Rate: BMS full data set here shall be transmitted **to the inverter** once every second.

BMS sends first message with this full register set. Inverter Heartbeat Response: Each time the inverter correctly receives data, it will respond with CAN ID 0x305 containing "00 00 00 00 00 00 00 00" as data.

NOTE: All data sent to the inverter must represent aggregate, minimum, or maximum values from all batteries connected in parallel. Each battery cannot send this data to the inverter individually and must instead communicate to some form of aggregator responsible for combining and managing all the batteries' data. This aggregator can be either inside a single battery or external to the pack.

CAN Bus Data Definition Tables:

CAN ID 0x359 (explained in Table 1,2,3,4)

Byte Number	Name	Description
0	Protection Byte 1	See table 1 for bitfield settings
1	Protection Byte 2	See table 2 for bitfield settings
2	Alarm Byte 1	See table 3 for bitfield settings
3	Alarm Byte 2	See table 4 for bitfield settings
4	Module Number	8-bit integer representing quantity of parallel connected batteries.
5	"P", 0x50	
6	"N", 0x4E	
7	Reserved	Unused: byte should be "00"

Table 1 - Protection Byte 1 Bitfield: (If a bit is set, one of these caused batt self-protection mode)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Discharge Over-Current	N/A	N/A	Cell Under-Temp	Cell Over-Temp	Cell/Module Under-Voltage	Cell/Module Over-Voltage	N/A

Table 2 – Protection Byte 2 Bitfield:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	System Error	N/A	N/A	Charge Over-Current

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Table 3 – Alarm Byte 1 Bitfield: (Real Time Status)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Discharge High Current	N/A	N/A	Cell Low Temp	Cell High Temp	Cell or Module Low Voltage	Cell / Module High Voltage	N/A

Table 4 – Alarm Byte 2 Bitfield: (Real Time Status)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	Critical System Error	N/A	N/A	Charge High Current

CAN ID 0x351 (Setpoints from BMS to Inverter in DeciVolts and DeciAmps, enforced by inverter)

Byte Number	Name	Unit	Description
0	Charge Voltage Limit	0.1V	Maximum voltage at which the inverter should charge the battery. (16 bits unsigned int). Inverter limits voltage to this.
1			
2	Charge Current Limit	0.1A	Maximum charge current the inverter should source. (16 bits signed int, 2's complement). Inverter limits current to this.
3			
4	Discharge Current Limit	0.1A	Maximum discharge current the inverter should sink. (16 bits signed int, 2's complement). Inverter limits current to this.
5			
6	Discharge Voltage Limit	0.1V	Minimal voltage at which the inverter should discharge until. (16 bits unsigned int)
7			

CAN ID 0x355

Byte Number	Name	Unit	Description
0	State of Charge (SOC)	1%	Average SoC of all parallel connected batteries
1			
2	State of Health (SOH)	1%	Average SoH of all parallel connected batteries. Ratio of current capacity versus new capacity.
3			
4	Reserved		Unused: byte should be "00"
5	Reserved		Unused: byte should be "00"
6	Reserved		Unused: byte should be "00"
7	Reserved		Unused: byte should be "00"

CAN ID 0x356

Byte Number	Name	Unit	Description
0	Battery Terminal Voltage	0.1V	Instantaneous voltage present at the battery terminals
1			
2	Total Pack Current	0.1A	Instantaneous current into/out of the battery (signed value). Sign varies by maker.
3			
4	Battery Temperature	0.1C	Instantaneous temperature of the battery in tenths of degrees C.
5			

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6	Reserved		Unused: byte should be "00"
7	Reserved		Unused: byte should be "00"

CAN ID 0x35C

Byte Number	Name	Unit	Description
0	BMS Request Flag	Bitfield	See table 5 below
1	Reserved		Unused: byte should be "00"
2	Reserved		Unused: byte should be "00"
3	Reserved		Unused: byte should be "00"
4	Reserved		Unused: byte should be "00"
5	Reserved		Unused: byte should be "00"
6	Reserved		Unused: byte should be "00"
7	Reserved		Unused: byte should be "00"

Table 5 – BMS Request Flag & Use-Enabled Bitfield:

Bit Number	Name	Description
0	Reserved	Unused: bit should be "0"
1	Reserved	Unused: bit should be "0"
2	Reserved	Unused: bit should be "0"
3	Full Charge Request 1=charge; 0=normal	Set if the battery has not been fully charged for a long time. Fully charging the battery allows the SOC calculation algorithm in the BMS to re-calibrate itself.
4	Forced Charge Request 1 1=charge; 0=normal	Set when the battery reaches a low SoC threshold defined in the BMS itself.
5	Forced Charge Request 2 1=charge; 0=normal	Immediately charge the battery system until these 2 flags = 0
6	Discharge Enabled	BMS sets when discharge from the battery is allowed.
7	Charge Enabled	BMS sets when charging to the battery is allowed.

CAN ID 0x35E

Byte Number	Name	Unit	Description
0	Manufacturer Name	ASCII Char	Character 1 of manufacturer's name
1		ASCII Char	Character 2 of manufacturer's name
2		ASCII Char	Character 3 of manufacturer's name
3		ASCII Char	Character 4 of manufacturer's name
4		ASCII Char	Character 5 of manufacturer's name
5		ASCII Char	Character 6 of manufacturer's name
6		ASCII Char	Character 7 of manufacturer's name
7		ASCII Char	Character 8 of manufacturer's name

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CAN ID 0x379

Byte Number	Name	Unit	Description
0	Capacity	1Ah	Battery [Bank] Capacity, low byte, ui16
1			Battery [Bank] Capacity, high byte, ui16
2	Reserved		Unused: byte should be "00"
3	Reserved		Unused: byte should be "00"
4	Reserved		Unused: byte should be "00"
5	Reserved		Unused: byte should be "00"
6	Reserved		Unused: byte should be "00"
7	Reserved		Unused: byte should be "00"