

LYNK Serial CAN

Interface Technical Reference Manual

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1. Introduction	2
1.1 Purpose	3
1.2 Scope	3
1.3 Audience	3
2. References	3
2.1 Terms and Definitions	3
2.2 Notation	3
3. Overview	4
3.1 CAN Overview	4
3.2 Data Endianness	4
3.3 Unused or RSVD Fields	4
4. Frames Sent From LYNK	5
4.1 Battery Limits (0x351)	5
4.2 Battery Capacity Information (0x354)	5
4.3 Battery Status (0x355)	6
4.4 Battery Measurements (0x356)	6
4.5 Battery Manufacturer Name ASCII (0x35E)	10
4.6 Model Name Upper ASCII (0x370)	10
4.7 Battery Model Name Lower ASCII (0x371)	11
4.8 LYNK Firmware (0x372)	11
4.9 Protocol Version (0x373)	11
5. Frames Sent to LYNK	12
5.1 Receiving Heartbeat (0x305)	12



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1. Introduction

Discover Advanced Energy Systems batteries and accessories primarily communicate over AEBus, a proprietary protocol that uses J1939 and NEMA2000 fast packets as the transport layer. This protocol requires nodes to auto address themselves if the node wishes to participate on the bus. In some instances, it may not be appropriate for third party devices to use AEBus, such is the case for systems that could introduce errors or unwanted behavior. There are also scenarios where third party devices and organizations are not able to implement J1939 nor NEMA2000 fast packets.

The following generic protocol uses CAN and serial frames in a broadcast fashion, removing the need to auto address, and decreasing complexity and time for implementation. This strategy however does require the use of LYNK as a communications gateway.



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1.1 Purpose

This protocol specification outlines the controller area network (CAN) communication interface for devices able to communicate with Discover's LYNK utilizing a general Serial CAN Protocol. The protocol enables the batteries to control chargers and loads as well as communicating relevant battery status and manufacturing information.

1.2 Scope

This document specifies the interface between the LYNK and a CAN enabled inverter, charger, or monitoring system. This document will define the protocol, signals, and functionality that can be achieved through integration with the devices.

1.3 Audience

This document is intended for the use of engineers both internal and external to Discover Energy Systems Corp. who intend to interface with Discover products through LYNK. It is expected that the audience has a working knowledge of the CAN physical layer.

2. References

Internal Documents

DOCUMENT NUMBER	DESCRIPTION
800-0003 AEBus Protocol Specifications	Discover J1939 Battery Communications Specifications
800-0008 Discover Serial CAN Specifications	Discover Serial Can Communication Specifications

2.1 Terms and Definitions

TERM	DEFINITION
Battery Bank	Statistics and values that represent a summary of all battery packs connected.
Battery Pack	Individual battery pack data
BMS	Battery Management System
LSB	Least Significant Byte
MSB	Most Significant Byte
VPC	Volts per cell module

2.2 Notation

FORMAT	MEANING
0x	Hexadecimal (base 16) values are prefixed with "0x"
0b	Binary (base 2) values are prefixed with "0b"

All arrays are referenced via an index range from 0 to length - 1 (as opposed to 1 to length), unless otherwise stated. When referencing bits within a byte, the most significant bit is labelled bit7, the least significant bit0.



MSB							LSB
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0

3. Overview

3.1 CAN Overview

- Standard CAN identifier (11 bit)
- Baud rate of 250.0 kbit/s
- Broadcast communication
- Little Endian - LSB, most significant byte of a value received first

3.2 Data Endianness

When the data to send inside a frame is larger than 1 byte the encoding is little endian. It means that if a 2-byte value has to be sent, the first byte sent on the network will be the LSB.

BYTE 0	BYTE 1
16 bit value	
LSB	MSB

Byte 0 sent before Byte 1 on the network

As an example, if the 2-byte value to be sent is 0x1234, it will be sent on the network like this:

0x34 then 0x12.

3.3 Unused or RSVD Fields

Reserved fields are set to 0.



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4. Frames Sent From LYNK

4.1 Battery Limits (0x351)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-1	16	unsigned integer (0.1 V)	Requested Charge Voltage [0 V, 6553.5 V] This value should be considered as a target.
2	2-3	16	signed integer (0.1 A)	Requested Charge Current [-3276.8 A, 3276.7 A] This value should be used as a limit.
3	4-5	16	signed integer (0.1 A)	Requested Maximum Discharge Current [-3276.8 A, 3276.7 A] This value should be used as a limit.
4	6-7	16	unsigned integer (0.1 V)	Low Battery Cut Out Voltage [0 V, 6553.5 V] This value should be used as a limit.

This frame is used to inform loads and charge sources about the dynamic battery limits and set points. LYNK will coordinate and manage all batteries on an AEBus network and determine the optimal set points for external devices.

4.2 Battery Capacity Information (0x354)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-1	16	unsigned integer (1 Ah)	Battery Nominal Capacity [0 Ah, 65535 Ah]
2	2-3	16	unsigned integer (1 Ah)	Battery Remaining Capacity [0 Ah, 65535 Ah]
3	4-7	32	-	RESERVED

4.3 Battery Status (0x355)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-1	16	unsigned integer (1 %)	Battery State of Charge [0%, 65535 %]
2	2-3	16	unsigned integer (1 %)	Battery State of Health [0%, 65535 %]
3	4-7	-	-	RESERVED

4.4 Battery Measurements (0x356)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-1	16	unsigned integer (0.1 V)	Battery Voltage [0 V, 6553.5 V] This is the average of the measured terminal voltages of all batteries on AEBus.
2	2-3	16	signed integer (0.1 A)	Battery Current [-3276.8 A, 3276.7 A] This is the sum of the measured currents of all batteries on AEBus. Charge is represented by positive values, Discharge is represented by negative values.
3	4-5	16	signed integer (0.1)	Battery Temperature [-3276.8 , 3276.7] This is the average of the measured cell block temperatures of all batteries on AEBus.
4	6-7	-	-	RESERVED

Battery Alarms (0x35A)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1



FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0 (bit 0-1)	2	unsigned enum	General BMS Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
2	0 (bit 2-3)	2	unsigned enum	High Voltage Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
3	0 (bit 4-5)	2	unsigned enum	Low Voltage Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
4	0 (bit 6-7)	2	unsigned enum	High Temperature Discharge Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
5	1 (bit 0-1)	2	unsigned enum	Low Temperature Discharge Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
6	1 (bit 2-3)	2	unsigned enum	High Temperature Charge Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
7	1 (bit 4-5)	2	unsigned enum	Low Temperature Charge Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used



FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
8	1 (bit 6-7)	2	unsigned enum	Battery High Discharge Current Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
9	2 (bit 0-1)	2	unsigned enum	Battery High Charge Current Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
10	2 (bit 2-3)	2	unsigned integer	RESERVED
11	2 (bit 4-5)	2	unsigned enum	Internal BMS Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
12	2 (bit 6-7)	2	unsigned enum	Imbalanced Cell Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
13	3 (bit 0-1)	6	unsigned integer	RESERVED
14	3 (bit 2-3)	2	unsigned integer	RESERVED
15	3 (bit 4-5)	2	unsigned enum	High Voltage Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
16	3 (bit 6-7)	2	unsigned enum	Low Voltage Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used



FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
17	4 (bit 0-1)	2	unsigned enum	High Temperature Discharge Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
18	4 (bit 2-3)	2	unsigned enum	Low Temperature Discharge Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
19	4 (bit 4-5)	2	unsigned enum	High Temperature Charge Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
20	4 (bit 6-7)	2	unsigned enum	Low Temperature Charge Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
21	5 (bit 0-1)	2	unsigned enum	Battery High Discharge Current Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
22	5 (bit 2-3)	2	unsigned enum	Battery High Charge Current Warning [0, 3] 0 = Ignored – Not Used 1 = Warning 2 = Normal Operation 3 = Ignored – Not Used
23	5 (bit 4-5)	2	unsigned integer	RESERVED
24	5 (bit 6-7)	2	unsigned enum	Internal BMS Warning [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used



FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
25	6 (bit 0-1)	2	unsigned enum	Imbalanced Cell Warning [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
26	6 (bit 2-7)	6	unsigned integer	RESERVED

Warnings are problems that can be responded to by the load or charge sources to rectify the problem by some action (reducing voltage, current, etc). All warnings should be raised before their corresponding Alarms.

Alarms indicate that a warning situation has not been cleared, and the threshold has reached a value that requires the battery to disconnect itself from the DC bus.

4.5 Battery Manufacturer Name ASCII (0x35E)

Transmission Rate	10000 ms
Priority	0
Protocol Version Added	1

- 8 char long name, encoded in 7-bit ASCII.
- Unused characters are set to zero.

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-7	64	string	8 Chars

Example:

BYTE	7	6	5	4	3	2	1	0
CHARACTER	R	E	V	O	C	S	I	D
ASCII	0x52	0x45	0x56	0x4F	0x43	0x53	0x49	0x44

4.6 Model Name Upper ASCII (0x370)

Transmission Rate	10000 ms
Priority	0
Protocol Version Added	1

- 8 char long name, encoded in 7-bit ASCII.
- Unused characters are set to zero.



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FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-7	64	string	8 Chars

4.7 Battery Model Name Lower ASCII (0x371)

Transmission Rate	10000 ms
Priority	0
Protocol Version Added	1

- 8 char long name, encoded in 7-bit ASCII.
- Unused characters are set to zero.

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-7	64	string	8 Chars

4.8 LYNK Firmware (0x372)

Transmission Rate	10000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-3	32	unsigned integer (xx.yy.zz.tt)	8 bit major version number 8 bit minor version number 8 bit patch version number 8 bit tweak version number
2	4-7	32	-	RESERVED

4.9 Protocol Version (0x373)

Transmission Rate	10000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0	8	unsigned integer	Current Protocol Version
2	1-7	56	-	RESERVED



5. Frames Sent To LYNK

5.1 Receiving Heartbit (0x305)

Transmission Rate	1000 ms
Priority	0
Protocol Version Added	1

FIELD	BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
1	0-4	32	unsigned integer	UnixTime 0 = Ignored – Not Used Non 0 = UnixTime Stamp



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