LYNK CANopen
Interface Technical Reference Manual

REV.	REVISION DATE	DESCRIPTION OF CHANGE
B	2022-08-31	Updated to include objects 6001h

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1. Introduction

1.1 Purpose

This CANopen interface technical reference document is designed to detail Discovers implementation of CANopen and provide a quick reference guide for interfacing with CANopen enabled Discover Battery devices.

1.2 Audience

This document is intended for the use of engineers both internal and external to Discover Battery who intend to interface with Discover products through the CANopen protocol. It is expected that the audience has a working knowledge of the CAN physical layer as well as the CANopen standards for communication. If you are inexperienced in this topic Discover Recommends that you seek help from experienced personnel.

2. References

2.2.1 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

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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
co	Constant: parameter is read-only and does not change
dyn	Dynamic: data changes based on real time conditions
LSB	Least Significant Byte
MSB	Most Significant Byte
OD	Object Dictionary
ro	Read Only Access
rw	Read and Write Access
VPC	Volts per cell module

2.2 Notation

FORMAT	MEANING
0h	Hexadecimal (base 16) notation

3. Overview

3.1 Network Management (NMT)

OBJECT	PRE-OPERATIONAL	OPERATIONAL	STOPPED
SDO	yes	yes	no
PDO	no	yes	no
NMT	yes	yes	yes
SYNC	no	yes	no
EMCY	yes	yes	no
Heartbeat	yes	yes	yes

3.2 Default PDO and SDO COB-IDs

OBJECT	COB-ID *	COB-ID WITH DEFAULT ADDRESS 10	COMMUNICATION PARAMETERS AT OD INDEX	MAPPING PARAMETERS AT OD INDEX
PDO 1 (transmit)	181h - 1FFh	18Ah	1800h	1A00h
PDO 1 (receive) **	201h - 27Fh	20Ah	1400h	1600h
PDO 2 (transmit)	281h - 2FFh	28Ah	1801h	1A01h
PDO 2 (receive) **	301h - 37Fh	30Ah	1401h	1601h
PDO 3 (transmit)	381h - 3FFh	38Ah	1802h	1A02h
PDO 3 (receive) **	401h - 47Fh	40Ah	1402h	1602h
PDO 4 (transmit)	481h - 4FFh	48Ah	1803h	1A03h
PDO 4 (receive) **	501h - 57Fh	50Ah	1403h	1603h
SDO (transmit/server)	581h - 5FFh	58Ah	1200h	N/A
SDO (receive/client)	601h - 67Fh	60Ah	1200h	N/A
NMT Error Control	701h - 77Fh	70Ah	1017h	N/A

*The COB-ID range covers the Node-ID range from 1 to 127.

**The Gateway does not have RPDO's enabled.

4. Integrations

4.1 Configuration with SDO

4.1.1 Expedited SDO Read

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	(command)	(index)		(sub-index)	data			

COMMAND CODE	MEANING
43h	Read Dictionary Object expedited, 4 bytes requested
47h	Read Dictionary Object expedited, 3 bytes requested
4Bh	Read Dictionary Object expedited, 2 bytes requested
4Fh	Read Dictionary Object expedited, 1 bytes requested

4.1.2 Expedited SDO Write

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	(command)	(index)		(sub-index)	data			

COMMAND CODE	MEANING
23h	Write Dictionary Object expedited, 4 bytes sent
27h	Write Dictionary Object expedited, 3 bytes sent
2Bh	Write Dictionary Object expedited, 2 bytes sent
2Fh	Write Dictionary Object expedited, 1 bytes sent

4.2 Manufacturer Configurations

4.2.1 Node-ID Selection

To set the gateway Node-Id send an SDO-write command with the intended ID to object 2100h, sub-index 00h. A device reset will be required before the new node-id will be used.

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	2Fh (command)	2100h (index)		00h (sub-index)	Requested Node-ID			

4.2.2 Baudrate Selection

To set the gateway kbaud rate send an SDO-write command with the intended kbaud rate to object 2101h, sub-index 00h. A device reset will be required before the new node-id will be used.

At the time of writing only 125, 250, 500, or 1000 kbaud are available.

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	2Bh (command)	2101h (index)		00h (sub-index)	Requested Baud Rate			

4.2.3 Number of Batteries Selection

the Number of batteries field allows the user to configure the gateway to monitor an expected number of batteries in a network. For example, if there are 4 batteries networked in a machine, if 1 battery is not communicating the gateway will send an alarm that it has lost communications with a battery.

To set the gateway number of expected batteries send an SDO-write command with the intended battery count to object 2102h, sub-index 00h. A device reset will be required before the new battery count will be used.

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	2Fh (command)	2102h (index)		00h (sub-index)	Requested Node-ID			

4.3 PDO

4.3.1 Default Discover TPDO Mapping

TPDO	SUB-INDEX	MAPPED PARAMETER	OBJECT INDEX	OBJECT SUB-INDEX	PARAMETER LENGTH (BITS)
TPDO 1	00h	Number of Sub-Indices			
	01h	Bank Voltage	2000h	03h	10h
	02h	Bank Current	2001h	03h	20h
	03h	Bank Cell Temp	2002h	01h	8h
	04h	Bank SOC	2003h	01h	8h
TPDO 2	00h	Number of Sub-Indices			
	01h	Charge Voltage Target	2000h	01h	10h
	02h	Low Battery Cut-Out	2000h	02h	10h
	03h	Max Charge/Discharge Current	2001h	01h	20h
TPDO 3	00h	Number of Sub-Indices			
	01h	Bank Alarm	2005h	01h	20h
	02h	Battery Identifier	2005h	02h	20h
TPDO 4	00h	Number of Sub-Indices			
	01h	Bank Warning	2006h	01h	20h
	02h	Battery Identifier	2006h	02h	20h

4.3.2 Default Device Profile 418 TPDO Mapping

TPDO	SUB-INDEX	MAPPED PARAMETER	OBJECT INDEX	OBJECT SUB-INDEX	PARAMETER LENGTH (BITS)
TPDO 1	00h	Number of Sub-Indices			
	01h	Battery Temperature	6010h	00h	10h
	02h	Battery Status	6000h	00h	08h
TPDO 2	00h	Number of Sub-Indices			
	01h	Battery Temperature	6010h	00h	10h
	02h	Battery Status	6000h	00h	08h
	03h	Battery Voltage	6060h	00h	20h
TPDO 3	00h	Number of Sub-Indices			
	01h	Charge Current Requested	6070h	00h	10h
	02h	Battery State of Charge	6081h	00h	08h

4.3.3 Dynamic TPDO Mapping

All transmit PDOs (TPDO0 - TPDO3) can be dynamically remapped. The total combination of variables configured in the PDO must not exceed 8 bytes.

to remap a TPDO (Example of TPDO1 and Node-ID 0Ah):

Step 1: Disable the TPDO by setting bit 31 of the COB-ID

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
60Ah	08h	23h	1800h		01h	8000 018Ah			

Step 2: Set the number of mapped objects to 0

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
60Ah	08h	2Fh	1A00h		00h	00h			

Step 3: Update the mapping entries

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
60Ah	08h	23h	1A00h		01h	2004 0220h (object Index 2004, sub-index 2, 20h bits long)			

Step 4: Set the number of mapped objects to the required number

The number of entries will be rejected if the entry was not originally 0, the number of entries is >8, the mapping include uninitialized entries, the total data count is > 8 bytes.

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
60Ah	08h	2Fh	1A00h		00h	01h			

Step 5: Enable the PDO by clearing bit 31

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
60Ah	08h	23h	1800h		01h	0000 018Ah			

4.4 Heartbeat Producer

By default the gateway heartbeat time is set to 0 which disables the feature.

To configure the device to produce a heartbeat set the periodic time > 0:

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h + Node-ID	08h	23h	1017h		02h	heartbeat time in ms (data in hex format)			

When the node produces a heartbeat the msg will appear as follows:

| MSG ID | LENGTH | DATA |
		B0
600h + Node-ID	01h	State

STATE	MEANING
0	Boot-up
4	Stopped
5	Operational
127	Pre-Operational

5. Object Dictionary

5.1 CANOpen 301 Objects

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
1000h	Device Type	00h	Discover networked device type	unsigned 32	enum (* refer to object description)	co	no	00h
1001h	Error Register	00h	Device Error	unsigned 8	enum (*refer to object description)	ro	no	dyn
1009h	Manufacturer hardware version	00h	Discover FGA Number	string	enum (* refer to object description)	ro	no	
100Ah	Manufacturer Software Version	00h	Gateway Firmware Version	unsigned 32	enum (* refer to object description)	ro	no	dyn
1010h	Save Parameters	00h	Number of Sub-Indices	unsigned 32		co	no	04h
		01h	Save all parameters	unsigned 32	enum (* refer to object description)	rw	no	01h
		02h	Save communiation parameters (1000h - 1FFFH)	unsigned 32	enum (* refer to object description)	rw	no	01h
		03h	Save application parameters	unsigned 32	enum (* refer to object description)	rw	no	00h
1011h	Restore Default Parameters	00h	Number of Sub-Indices	unsigned 32		co	no	04h
		01h	Restore all parameters	unsigned 32	enum (* refer to object description)	rw	no	01h
		02h	Restores communiation parameters (1000h - 1FFFH)	unsigned 32	enum (* refer to object description)	rw	no	01h
		03h	Restore application parameters	unsigned 32	enum (* refer to object description)	rw	no	00h
1014h	COB-ID EMCY	00h	COB-ID of Emergency Message	unsigned 32	enum (* refer to object description)	ro	no	CAN-ID: 80h + Node -ID

1017h	Producer Heartbeat Time	00h	Heart producer cycle time	unsigned 16	ms	rw	no	00h = heartbeat disabled.
1018h	Identity Object	00h	Number of Sub-Indices	unsigned 32		co	no	04h
		01h	Vendor ID	unsigned 32		ro		0x0503 (Discover vendor ID)
		02h	Product Code	unsigned 32		ro		2 = lynk II 3 = Lynk Lite
		03h	Revision Number	unsigned 32		ro		Not Used
		04h	Serial Number	unsigned 32		ro		Not Used
1F80h	NMT-Startup	00h	NMT Start-up	unsigned 32	enum (* refer to object description)	rw	no	00h

5.1.1 Object 1000h Device Type

31	16	15	0
Additional Information		Device Profile Number	

When the Discover device profile is configured the object will return 00000000h

When the 418 device profile is configured the object will return 000c01a2h which indicates that the 418 profile is active and that TPDO2 and TPDO3 are supported.

5.1.2 Object 1001h Device Error Register

5.1.3 Object 1009h Manufacturers Hardware Version

When using LYNK II hardware version will be reported as Lynk II-2

When using LYNK Lite hardware version will be reported as Lynk LITE-3

5.1.4 Object 100Ah Manufacturer Firmware Version

(MM.mm.pp.tt) 8 bit major, 8 bit minor, 8 bit patch, 8 bit tweak.

Note that leading 0's will not be printed.

5.1.5 Object 1010h Store Parameters

5.1.5.1 Read of Sub-index

Reading the sub-index will indicate if the action is available or not.

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BIT 31 - 2	BIT 1	BIT 0
AUTO		CMD

BIT	VALUE	DESCRIPTION
AUTO	0b 1b	CANopen device does not save parameters autonomously CANopen device saves parameters autonomously
CMD	0b 1b	CANopen device does not save parameters on command CANopen device saves parameters on command

5.1.5.2   Write of Sub-Index

Writing to the sub-index will initiate the action, to do so 'save' must be written to the sub index.

MSB			LSB
65h ('e')	76h ('v')	61h ('a')	73h ('s')

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	(command)	(index)		(sub-index)	data			

5.1.5.3   Sub-Index 01h - Save all parameters

Saving all parameters will save both communication and manufacturer parameters.

5.1.5.4   Sub-Index 02h - Save Communication Parameters

1017h, 1800h, 1801h 1802h, 1803h, 1A00h, 1A01h, 1A02h, and 1A03h can be saved.

5.1.5.5   Sub-Index 03h - Save Application Parameters

Application parameters are not saved.

5.1.5.6   Sub-Index 04h - Save Manufacturer Parameters

Manufacturer parameters are automatically saved on write. These include objects 2100h, 2101, and 2102h.

5.1.6   Object 1011h Reset Parameters

5.1.6.1   Read of Sub-index

Reading the sub-index will indicate if the action is available or not.

BIT 31 - 1	BIT 0
	CMD

BIT	VALUE	DESCRIPTION
CMD	0b 1b	CANopen device does not restore default parameters CANopen device restores parameters

5.1.6.2 Write of Sub-Index

Writing to the sub-index will initiate the action, to do so 'load' must be written to the sub index.

MSB			LSB
64h ('d')	61h ('a')	6Fh ('o')	6Ch ('l')

MSG ID	LENGTH	DATA							
		B0	B1	B2	B3	B4	B5	B6	B7
600h +Node-ID	08h	(command)	(index)		(sub-index)	data			

5.1.6.3 Sub-Index 01h - Reset all parameters

Resetting all parameters will reset both communication and manufacturer parameters.

5.1.6.4 Sub-Index 02h - Reset Communication Parameters

1017h, 1800h, 1801h 1802h, 1803h, 1A00h, 1A01h, 1A02h, and 1A03h can be reset to defaults.

5.1.6.5 Sub-Index 03h - Reset Application Parameters

Application parameters are not saved.

5.1.6.6 Sub-Index 04h - Reset Manufacturer Parameters

Manufacturer parameters can be returned to defaults. These include objects 2100h, 2101, and 2102h.

5.1.7 Object 1014h COB-ID EMCY

- Not implemented -

5.1.8 Object 1F80h NMT-Startup

- Not implemented -

5.2 Manufacturer Specific Objects

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
2000h	Battery Bank Voltage	00h	Number of Sub-Indices	unsigned 16		co	no	0x03
		01h	Requested Bank Charge Voltage	unsigned 16	1 mV	ro	yes	dyn
		02h	Bank Low Battery Cut-Off	unsigned 16	1 mV	ro	yes	dyn
		03h	Bank Voltage	unsigned 16	1 mV	ro	yes	dyn
2001h	Battery Bank Current	00h	Number of Sub-Indices	unsigned 32		co	no	03h
		01h	Bank Discharge Current Limit	signed 32	1 mA	ro	yes	dyn
		02h	Bank Charge Current Limit	signed 32	1 mA	ro	yes	dyn
		03h	Bank Current	signed 32	1 mA	ro	yes	dyn
2002h	Battery Bank Temperature	00h	Number of Sub-Indices	unsigned 8		co	no	0x03
		01h	Average Cell Temperature	signed 8	deg C	ro	yes	dyn
		02h	Average Relay Temperature	signed 8	deg C	ro	yes	dyn
		03h	Average Shunt Temperature	signed 8	deg C	ro	yes	dyn
2003h	Battery Bank State of Charge	00h	Number of Sub-Indices	unsigned 8		co	no	0x02
		01h	State of Charge (1-100%)	unsigned 8	%	ro	yes	dyn
		02h	State of Health(1-100%)	unsigned 8	%	ro	yes	100
2004h	Battery Bank Energy	00h	Number of Sub-Indices	unsigned 32		co	no	02h
		01h	Rated Energy	unsigned 32	1 Wh	ro	yes	dyn
		02h	Remaining Energy	unsigned 32	1 Wh	ro	yes	dyn

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
2005h	Battery Bank Alarms	00h	Number of Sub-Indices	unsigned 32		co	no	02h
		01h	Alarm Flags	unsigned 32	enum (* refer to object description)	ro	yes	dyn
		02h	Battery Alarm Identifier	unsigned 32	enum (* refer to object description)	ro	yes	dyn
2006h	Battery Bank Warnings	00h	Number of Sub-Indices	unsigned 32		co	no	02h
		01h	Warning Flags	unsigned 32	enum (* refer to object description)	ro	yes	dyn
		02h	Battery Warning Identifier	unsigned 32	enum (* refer to object description)	ro	yes	dyn
2007h	Battery Bank Lifetime Energy	00h	Number of Sub-Indices	unsigned 32		co	no	02h
		01h	Battery Bank Lifetime Discharge Energy	unsigned 32	100 Wh	ro	yes	dyn
		02h	Battery Bank Lifetime Charge Energy	unsigned 32	100 Wh	ro	yes	dyn
2008h	Battery Pack Terminal Voltage	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 voltage	unsigned 32	1 mV	ro	no	dyn
		to						
		14h	Battery 20 voltage	unsigned 32	1 mV	ro	no	dyn
2009h	Battery Pack Current	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 current	signed 32	1 mA	ro	no	dyn
		to						
		14h	Battery 20 current	signed 32	1 mA	ro	no	dyn

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
200Ah	Battery Pack Temperature	00h	Number of Sub-Indices	unsigned 8		co	no	28h
		01h	Battery 1 cell temperature	unsigned 8	1 deg C	ro	no	dyn
		02h	Battery 1 Electronics Temperature	unsigned 8	1 deg C	ro	no	dyn
		03h	Battery 2 cell temperature	unsigned 8	1 deg C	ro	no	dyn
		04h	Battery 2 Electronics Temperature	unsigned 8	1 deg C	ro	no	dyn
		to						
		27h	Battery 20 cell temperature	unsigned 8	1 deg C	ro	no	dyn
		28h	Battery 20 Electronics Temperature	unsigned 8	1 deg C	ro	no	dyn
200Bh	Battery Pack SOC	00h	Number of Sub-Indices	unsigned 8		co	no	14h
		01h	Battery 1 SOC (1-100%)	unsigned 8	%	ro	no	dyn
		to						
		14h	Battery 20 SOC (1-100%)	unsigned 8	%	ro	no	dyn
200Ch	Battery Pack Rated Energy	00h	Number of Sub-Indices	unsigned 32		co	no	02h
		01h	Battery 1 Rated Energy	unsigned 32	1 Wh	ro	yes	dyn
		to						
		14h	Battery 20 Rated Energy	unsigned 32	1 Wh	ro	no	dyn

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
200Dh	Battery Pack Lifetime Discharge Energy	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 Lifetime Discharge Energy	unsigned 32	Wh	ro	no	dyn
		to						
		14h	Battery 20 Lifetime Discharge Energy	unsigned 32	Wh	ro	no	dyn
200Eh	Battery Pack Lifetime Charge Energy	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 Lifetime Charge Energy	unsigned 32	Wh	ro	no	dyn
		to						
		14h	Battery 20 Lifetime Charge Energy	unsigned 32	Wh	ro	no	dyn
200Fh	Battery Pack Warnings	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 Warnings	unsigned 32	enum	ro	no	dyn
		to						
		14h	Battery 20 Warnings	unsigned 32	enum	ro	no	dyn
2010h	Battery Pack Alarms	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 Alarms	unsigned 32	enum	ro	no	dyn
		to						
		14h	Battery 20 Alarms	unsigned 32	enum	ro	no	dyn

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OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
2011h	Battery Pack Serial Number	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 serial byte 0-3	string	string	ro	no	dyn
		02h	Battery 1 serial byte 4-7	string	string	ro	no	dyn
		03h	Battery 1 serial byte 8-11	string	string	ro	no	dyn
		04h	Battery 1 serial byte 12-15	string	string	ro	no	dyn
		to						
		4Dh	Battery 20 serial byte 0-3	string	string	ro	no	dyn
		4Eh	Battery 20 serial byte 4-7	string	string	ro	no	dyn
		4Fh	Battery 20 serial byte 8-11	string	string	ro	no	dyn
		50h	Battery 20 serial byte 12-15	string	string	ro	no	dyn
2012h	Battery Pack Firmware Version	00h	Number of Sub-Indices	unsigned 32		co	no	14h
		01h	Battery 1 Firmware	unsigned 32	enum	ro	no	dyn
		to						
		14h	Battery 20 Firmware	unsigned 32	enum	ro	no	dyn

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
2013h	Battery Pack Cell Voltage	00h	Number of Sub-Indices	unsigned 16		co	no	3Ch
		01h	Battery 1 minimum cell voltage	unsigned 16	1 mV	ro	no	dyn
		02h	Battery 1 average cell voltage	unsigned 16	1 mV	ro	no	dyn
		03h	Battery 1 maximum cell voltage	unsigned 16	1 mV	ro	no	dyn
		04h	Battery 2 minimum cell voltage	unsigned 16	1 mV	ro	no	dyn
		05h	Battery 2 average cell voltage	unsigned 16	1 mV	ro	no	dyn
		06h	Battery 2 maximum cell voltage	unsigned 16	1 mV	ro	no	dyn
		to						
		3Ah	Battery 20 minimum cell voltage	unsigned 16	1 mV	ro	no	dyn
		3Bh	Battery 20 average cell voltage	unsigned 16	1 mV	ro	no	dyn
		3Ch	Battery 20 maximum cell voltage	unsigned 16	1 mV	ro	no	dyn
2014h	Number of Batteries	00h	Number of batteries communicating to the gateway	unsigned 8		ro	yes	dyn (max 20)
2088	System Time	00h	Time in seconds since Jan 1, 1970 - Unix Epoch	unsigned 32	s	ro	no	No
2100h	Node-ID	00h	setting the node-ID	unsigned 8		rw	no	10 (range 1 to 127)
2101h	Baudrate	00h	Setting the baudrate	unsigned 16	Kbaud	rw	no	500 (range 125, 250, 500, 1000)

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
2102h	Number of Batteries	00h	Setting the number of installed battery packs	unsigned 8		rw	no	0

5.2.1 Object 2005h (Battery Bank Alarms)

BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
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
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
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
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
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
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
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
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

BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
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
2 (bit 2-3)	2	unsigned enum	Missing Battery Alarm (Active battery count does not equal configured number) [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
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
3 (bit 6-7)	2	unsigned enum	Load Qualification Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
3 (bit 0-1)	2	unsigned enum	No Battery Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
3 (bit 2-7)	6	unsigned enum	RESERVED
4 (bit 0-8)	8	unsigned enum	RESERVED

5.2.2 Object 2006h, 200Fh, 2010h (Battery Bank Warnings, Battery Alarm/Warning)

BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
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
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
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
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
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
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
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
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

BYTE	FIELD LENGTH (BITS)	FIELD TYPE	FIELD DESCRIPTION
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
2 (bit 2-3)	2	unsigned enum	Missing Battery Alarm (Active battery count does not equal configured number) [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
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
3 (bit 6-7)	2	unsigned enum	Load Qualification Alarm [0, 3] 0 = Ignored – Not Used 1 = Alarm 2 = Normal Operation 3 = Ignored – Not Used
3 (bit 0-7)	6	unsigned enum	RESERVED
4 (bit 0-8)	8	unsigned enum	RESERVED

5.2.3 Object 2011h Battery Pack Serial Number

The first letter of the serial number is not transmitted, and a maximum of 16 characters will be sent.

For example, the serial number DET4248210790001 will be shown as ET4248210790001.

5.2.4 Object 2012h Battery Pack Firmware Version

B7 - B6	B5 - B4	B3 - B2	B1 - B0
8 bit major	8 bit minor	8 bit patch	8 bit tweak

5.3 Device Profile Specific Objects

OBJECT #	NAME	SUB-INDEX	FUNCTION	DATA TYPE	DATA UNITS	RO / RW / CO	MAPPING	DEFAULT
6000h	Battery Status	00h	Readiness of battery to accept a charge or not	unsigned 8	enum (* refer to object description)	ro	no	00h
6001h	Charger Status	00h	Readiness of charger to deliver a charge or not	unsigned 8	enum (* refer to object description)	ro	no	00h
6010h	Temperature	00h	Temperature of the battery pack	signed 16	0.125 degC [-320d to 680d] [FEC0h to 02A8h]	ro	yes	No
6020h	Battery Parameters	00h	Number of Sub-Indices	unsigned 8		co	no	04h
		01h	Battery Type	unsigned 8		ro	no	0Ah (lithium-ion)
		02h	Ah Capacity	unsigned 16	Ah	ro	no	No
		03h	Max Charge Current	unsigned 16	A	ro	no	No
		04h	Number of Cells	unsigned 16	1 Series Cell	ro	no	No
6050h	Battery Lifetime Charge Ah	00h	Ah charged over the life of the battery	unsigned 32	Ah	ro	no	No
6060h	Battery Voltage	00h	Battery voltage	unsigned 32	(1/1024) V	ro	no	No
6070h	Charge Current Requested	00h	Charge Current Requested	unsigned 16	(1/16) A	ro	no	No
6081h	Battery State of Charge	00h	Battery State of Charge	unsigned 8	%	ro	Yes	No

5.3.1 Object 6000h Battery Status

Indicates the readiness of the battery to receive charge or not.

BIT	FIELD TYPE	DESCRIPTION
0	unsigned enum	status [0,1] 0 = Not Ready 1 = Ready
1 to 7	Reserved (always 0)	

The status flag will be set to not ready if:

- There are no batteries detected

- There is a low temperature fault, high temperature, or high cell voltage fault detected.

5.3.2 Object 6001h Charger Status

Indicates the readiness of the charger to deliver charge or not.

BIT	FIELD TYPE	DESCRIPTION
0	unsigned enum	status [0,1] 0 = Not Ready 1 = Ready
1 to 7	Reserved (always 0)	

The status flag will be set to not ready if:

- There are no batteries detected

- Any detected charger is reporting that it is in an error state