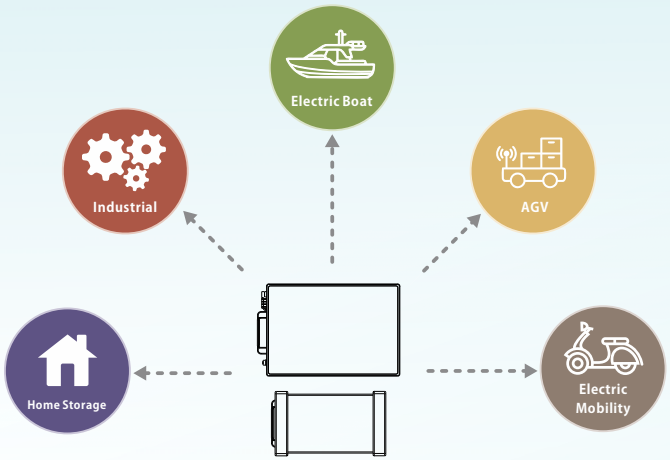
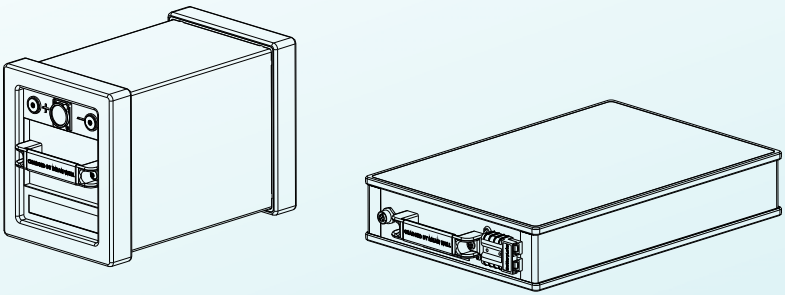
CAN Communication MEAN WELL EUROPE

Charged by



Intelligent Lithium Battery Pack

- *Compatible with multiple MEAN WELL smart chargers*



The intelligent battery pack of QHB and FMB series from MEAN WELL EUROPE are designed for various battery configurations and uses:

The QHB supports 7S-13S (24V-48V) Li-ion and 4S (12V) LiFePO4 batteries. The durable design, consisting of fiber reinforced plastics, makes this battery suitable for operating in harsh environments.

The FMB series is designed for multipurpose use within i-ion 7S (24V), 14S (48V), and 17S (60V) battery setups. This battery is suitable for parallel operation. Due to the modular concept, it is possible to suit the battery with different types of connectors and with or w/o a digital indicator, CAN or Bluetooth connectivity and an IoT database connection.

These batteries are suited for multipurpose use in various environments and applications, providing robust and flexible solutions for battery management and connectivity.

Contents

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1.Introduction

This document describes the CAN communication interface.

The battery pack configuration can consist of a single battery or multiple batteries combined. In case of multiple batteries, one will be 'master' and the others will be 'slaves'. The mastercommunicates as if it were a single 'virtual' battery. A single battery is a 'master' without 'slaves'.
The mainprocess data objects (PDOs) are sent by the master battery. Individual process data objects (PDOs) are sent by each individual battery. The service data objects (SDOs) are sent and retrieved per individual battery.

2.CAN baudrate and termination

The main baud rate of the CAN bus is 500 kbps. The CAN does not contain a termination node.

3.Master-Slave ranking

When multiple batteries exist on the same CAN bus, only one of them can be 'master'. The algorithm will address one battery as master. The other batteries will get a successive slave Id.
When the master battery disappears for 5 seconds, one of the 'slave' batteries will become master. The other other slaves may get a different slave Id in this case.
When a single 'master' battery is added to a CAN bus on which another battery is already 'master'. The two master batteries will battle which will be the master and which the slave: a successive Id or empty 'slave' Id will be claimed by the slave.

4.Messages overview

The CAN communication sends the following messages when the BSI (Battery Status Interface) is not in start-up or off state. All data will be send in 'little endian' format with data type 'unsigned byte' unless specified. The messages are based on the CAN open protocol.

In case of a single or 'master' battery main process data objects (PDOs) are sent with the specific COB-IDs or CAN frame identifiers, based on Node-ID: 15.
For individual PDO's and the SDO's, the single or 'master' battery will communicate under Node-ID: 15, and the 'slave' batteries will communicate under successive Node Ids: e.g. the fist slave Node-ID+1, which is 16 and so on, if more 'slave' batteries are available.
The number of batteries available can be extracted from the PDO message [PACK DATA 1 - COB-ID 18F], by adding up the number of active and the number of passive batteries.

CAN Message Overview

COB-IDs	Communication Object	CAN Message Name	Contents
0x18F	Transmit PDO 1	PACK DATA1	Battery Pack Operational Values 1
0x28F	Transmit PDO 2	PACK DATA2	Battery Pack Operational Values 2
0x40F	Receive PDO 3	INDIVIDUAL DATA REQUEST	Individual Data Request [confidential]
0x38F	Transmit PDO 3	INDIVIDUAL DATA 1	Individual Data 1
0x48F	Transmit PDO 4	INDIVIDUAL DATA 2	Individual Data 2 [confidential]
0x58F	Transmit SDO	BAT DATA UPLOAD	Individual Battery Data Upload Response
0x60F	Receive SDO	BAT DATA REQUEST	Individual Battery Data Upload Request

CAN Message Content Overview

CAN Message Name	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PACK DATA 1	Pack SOC	Voltage				-	# Active Batteries	# Passive Batteries
PACK DATA 2	Pack State	Pack Current	-	-	-	-	Max Pack Temp	Min Pack Temp
INDIVIDUALDA TA 1	Virtual Identifier	Individual Battery State	Individual Current		Individual SOC	-	Individual Temp 1	Individual Temp 2
BAT DATA UPLOAD	SDO Overhead	SDO Overhead	SDO Overhead	SDO Overhead	data	data	data	data
BAT DATA REQUEST	SDO Overhead	SDO Overhead	SDO Overhead	SDO Overhead	empty			

5.Battery Pack Operational Values 1: PACK DATA 1

Name	PACK DATA 1
COB-ID	0x18F
Interval	1000 ms
Length	8

Byte	Bit	Data Type	Unit	Offset	Scale	Description
0	-	byte	%	-	-	State of Charge [0-100%]
1	-	byte	V	-	1/1024	Voltage
2	-	byte				
3	-	byte				
4	-	byte				
5	-	byte	-	-	-	-
6	-	byte	#	-	-	Number of Active Batteries
7	-	byte	#	-	-	Number of Active Batteries

Specification:
The number of active batteries are batteries that are connected to the CAN bus and are able to be charged or discharged. The number of passive batteries are batteries that are connected to the CAN bus but not able to be charged or discharged. The SOC covers the total of active batteries.

6.Battery Pack Operational Values 2: PACK DATA 2

Name	PACK DATA 2
COB-ID	0x28F
Interval	1000 ms
Length	8

Byte	Bit	Data Type	Unit	Offset	Scale	Description
0	-	byte	%	-	-	Battery State (see specification)
1	-	byte	A	-	-	Current
2	-	byte				
3	-	Split byte	Bin	-	-	0x00 – 0x0F Heating mode, 0x10 Heating active
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	byte	°C	-55	-	Maximum Pack Temperature
7	-	byte	°C	-55	-	Minimum Pack Temperature

Specification:
Battery States: 10=Standby, 20=Ready, 30=Disengaged, 40=Discharging, 50=Charging

The pack maximum and minimum temperatures concern any pack configuration: from a single battery to any number of combined battery packs.

7.Battery Pack Individual Date 1: INDIVIDUAL DATA 1

Name	INDIVIDUAL DATA 1
COB-ID	0x48 + Node ID
Interval	Approx. 1000 ms
Length	8

Byte	Bit	Data Type	Unit	Offset	Scale	Description
0	-	byte	#	-	-	Virtual internal identifier
1	-	byte	#	-	-	Virtual internal identifier
2	-	byte	#	-	-	Virtual internal identifier
3	-	byte	#	-	-	Virtual internal identifier
4	-	byte	%	-	-	Individual State of Charge [0-100%]
5	-	byte	#	-	-	Individual Battery State (see specification)
6	-	byte	A	-	-	Individual Current
7	-	byte	°C	-55	-	Individual Temperature

Battery States: 10=Standby, 20=Ready, 30=Disengaged, 40=Discharging, 50=Charging

8.Individual Battery Service Values: BATTERY DATA REQUEST

Individual battery service values are not available by default. This extensive option can be made available for custom based projects.

Name	BAT DATA REQUEST
COB-ID	0x600 + Node ID
Interval	Not applicable
Length	8

Byte	Data Value	CANopen Specification	Description
0	0x40	CS	SDO Overhead
1	*Specification	Index 0	SDO Overhead
2	*Specification	Index 1	SDO Overhead
3	*Specification	Sub-index	SDO Overhead
4	0	Data 0	Empty
5	0	Data 1	
6	0	Data 2	
7	0	Data 3	

*Specification (values in DEC):

Data Specification	Explanation	Battery ID	Lowest lifetime voltage	Highest lifetime voltage	Number of Cycles	Number of Deep Discharges	Number of Low Temp Charges
Index 0	Index low byte (Unsigned16, LSB)	30	10	20	50	60	70
Index 1	Index high byte (Unsigned16, MSB)	60	21	21	21	21	21
Sub-index	Sub-index (Unsigned8)	0	0	0	0	0	0

9.Battery Pack Operational Values for Victron based Service

Name	Victron based service 1
COB-ID	0x356
Interval	Approx. 1000 ms
Length	8

Byte	Bit	Data Type	Unit	Offset	Scale	Description
0	-	byte	V	-	*10	Voltage
1	-	byte				
2	-	byte	A	-	*10	Current (signed data type, positive represents charging, negative values discharging)
3	-	byte				
4	-	byte	°C	-	*10	Temperature
5	-	byte				
6	-	-	-	-	-	-
7	-	-				

10.Battery Pack Maximum allowed Values

These values represent the maximum allowed values in different battery states.

Name	Maximum allowed pack values
COB-ID	0x351
Interval	Approx. 1000 ms
Length	8

Byte	Bit	Data Type	Unit	Offset	Scale	Description
0	-	byte	V	-	*10	Max charge Voltage
1	-	byte				
2	-	byte	A	-	*10	Max charge Current
3	-	byte				
4	-	byte	A	-	*10	Max discharge Current
5	-	byte				
6	-	byte	V	-	*10	Max discharge Voltage
7	-	byte				

11.Individual Battery LEDs: BATTERY LED SEQUENCE ACTIVATION

Individual battery LED activation is not available by default. This extensive option can be made available for custom based projects.

Name	BAT LED SEQUENCE ACTIVATION
COB-ID	0x600 + Node ID
Interval	Not applicable
Length	8

Byte	Data Value	CANopen Specification	Description
0	0x23	CS	SDO Overhead
1	10(dec)	Index 0	SDO Overhead
2	45(dec)	Index 1	SDO Overhead
3	0	Sub-index	SDO Overhead
4	*Specification	Data 0	LED sequence choice
5	*Specification	Data 1	LED interval speed
6	*Specification	Data 2	LED sequence duration
7	0	Data 3	0

*Specification (values in DECIMALS):

Data Specification	Description	Data Value Range	Info + examples
Data 0	LED sequence choice	1 - 4	1: All 5LEDS on 2: All 5 LEDs blinking 3: Outside to inside blinking 4: 'Knight rider'
Data 1	LED interval speed	0 - 255	[10 ms] example: value 15 -> interval speed 150 milliseconds
Data 2	LED sequence duration	0 - 255	[1 sec] example: value 20 ->sequence duration20 seconds

The battery will respond to the received SDO with a 0x580 + Node ID message with a CS: 0x60 and all other values corresponding to the values of the received SDO.

To terminate LED sequence immediately send message:
0x600 + Node ID, CS: 0x23, Index0: 20, Index1: 45, Sub Index: 0, no payload.

12.Battery heating activation

Battery heating Mode 3 is activated by default. Any change of mode will be stored in the eeprom of the battery and can only be changed by a CAN bus command with just one exception; When operating in Mode 4 and an SOC of <2% is reached, the Mode will switch to Mode 0 automatically.

Name	BAT HEATING ACTIVATION
COB-ID	0x600 + Node ID
Interval	Not applicable
Length	8

Byte	Data Value	CANopen Specification	Description
0	0x23	CS	SDO Overhead
1	10(dec)	Index 0	SDO Overhead
2	35(dec)	Index 1	SDO Overhead
3	0	Sub-index	SDO Overhead
4	*Specification	Data 0	Heating mode options
5	0	Data 1	0
6	0	Data 2	0
7	0	Data 3	0

*Specification (values in DECIMALS):

Data Specification	Description	Data Value Range	Info + examples
Data 0	Heating mode options	0 - 4	The explanation of the modes can be found in the schematic below.

The battery will respond to the received SDO with a 0x580 + Node ID message with a CS: 0x60 and all other values corresponding to the values of the received SDO.

The base condition for starting heating is the measured battery temperature ≤2 °C. Additional conditions can be found in this schematic:

Additional conditions	Heating will start with or without any measured current	Heating will start at any measured charge current	Heating will start at any discharge current	Battery cells will be cut-off at any charge current
Mode 0	NO	NO	NO	NO
Mode 1	NO	NO	NO	YES
Mode 2	NO	YES	NO	YES
Mode 3	NO	YES	YES	YES
Mode 4	YES	NO	NO	NO

Heating will stop after one of the following actions:

- Battery temperature reaches 16°C.
- Heating time calculated by algorithm expires.

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