SUPER B
lithium batteries

Manual

Version
February 2019

BATTERY INTERFACE BOX

12V/350A-600A
24V/350A-600A
48V/350A-600A

User Manual Battery interface box

Dear customer,

The Battery Interface Box (BIB) is a communication and control interface for Super B Lithium Batteries.
The Battery Interface Box (BIB) is a device that gathers data from multiple batteries and treats them as one single battery system. The BIB gathers data from all connected batteries and can cut-off the system when errors are detected. It also manages pre-charge and protocol conversions.

This manual contains all the information necessary to install, use and maintain the BIB. We kindly ask you to read this manual carefully before using the product. This manual is meant for the installer and the user of the BIB. Only qualified, certified personnel may install and perform maintenance on the BIB. Please consult the index at the start of this manual to locate information relevant to you.

The boundaries of its use, as described in this manual should always be upheld. The BIB may not be used in medical or in aviation related applications. The BIB may not be used for any purposes other than described in this manual. Using the BIB for any other purpose will be considered improper use and will void the warranty of the product. Super B cannot be held responsible for any damage caused by improper, incorrect or unwise use of the product. Read and understand this manual completely before using the product.

During the use of the product, user safety should always be ensured, so installers, users, service personnel and third parties can safely use the BIB. This is the original manual, keep it in a safe location! Please consult www.super-b.com for the latest version of all manuals.

For more information, or to order documents, contact:

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1. Introduction

1.1. Product description

The Battery Interface Box (BIB) is a communication and control interface for Super B traction Li-ion batteries.

The BIB is monitoring the batteries for proper operation.
The BIB is not a BMS (Battery Management System). In a Super B system every single battery has its own BMS and therefore makes its own decisions.
• The BIB collects the information of all individual batteries in the system, and presents it as one battery bank.
• The BIB collects the status and error messages of all the individual batteries in the system. In case of a battery or communication error, the BIB will disconnect the battery bank from the load and/or charger by opening the safety relay.
The BIB is equipped with 2 communication ports, one dedicated CAN port for the batteries and a second CAN port for communicating with an external network.
All system and individual battery parameters are available on the Slave communication port. Including Commands to control the battery string.

In Appendix I, the Declaration of Conformity for the BIB is given. ???

1.2. Glossary of Terminology

BMS	Battery Managent System
BIB	Battery Interface Box
BIB	Battery Communication Interface
LiFeP04	Lithium Iron Phosphate
SoC	State of charge
CCCV	Constant Current - Constant Voltage
DoD	Depth of Discharge

Table 1. Glossary of terminology

1.3. Used symbols

The following icons will be used throughout the manual:

⚠ **Warning!** A warning indicates severe damage to the user and/or product may occur when a procedure is not carried out as described.

⚠ **Caution!** A caution sign indicates problems may occur if a procedure is not carried out as described. It may also serve as a reminder to the user.

2. Product specifications

2.1. Product features

- Communication interface (CANOpen)
- Protocol conversion (e.g. NMEA2000)
- Main protection relay
- Pre-charge relay for preventing inrush currents
- Power the CAN bus (For 24 and 48 V systems, only the Master side)
- Programmable power down on user specified battery SoC level, to prevent deep discharge
- Programmable Auto-On function
- LED indication for device status
- Battery banks with 16 batteries maximum

Stand alone device

The BIB is a stand alone device, meaning that no PC or other device other then batteries are required for proper operation.
The BIB monitors all connected batteries through the CAN bus. Whenever one or more batteries report an error, for example excessive temperatures or high charge currents, the BIB will switch off the main relay to avoid any unsafe situation.
When the error is recovered, the BIB can enable the main relay(s) again.
This can be done in 3 ways:
• manually (S1,S2)
• through the battery monitor application
• automatically
Depending on preference, the auto-recover (Auto-On) function can be enabled or disabled through the battery monitor application.

2.2. General product specifications

Product name	
Producer	Super B
EAN number	
Product lifespan	>10 years

Table 2. General product specifications

2.3. Technical specifications

Product name	Mass	Ingress protection rating	EAN
SB BIB LV12V350A			8718531360891
SB BIB LV24V350A			8718531360907
SB BIB LV48V350A			8718531360914
SB BIB LV12V600A			8718531361072
SB BIB LV24V600A			8718531361218
SB BIB LV48V600A			8718531360921

Table 3. Technical specifications

2.3.1. Product designation

Table 4. Product designation

2.3.2. Electrical properties (23°C)

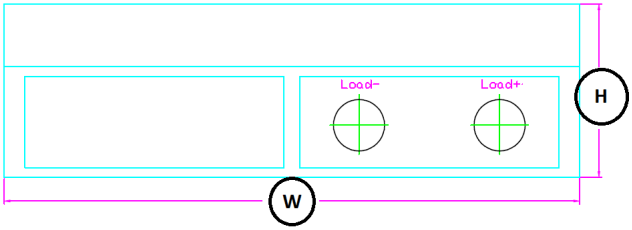
Power supply	13.2V dc
Current consumption with Relay ON	250mA
Current consumption during stand-by	1 Watt ?
Precharge resistor value	1 Ohm ?
Rated current	350A...600A

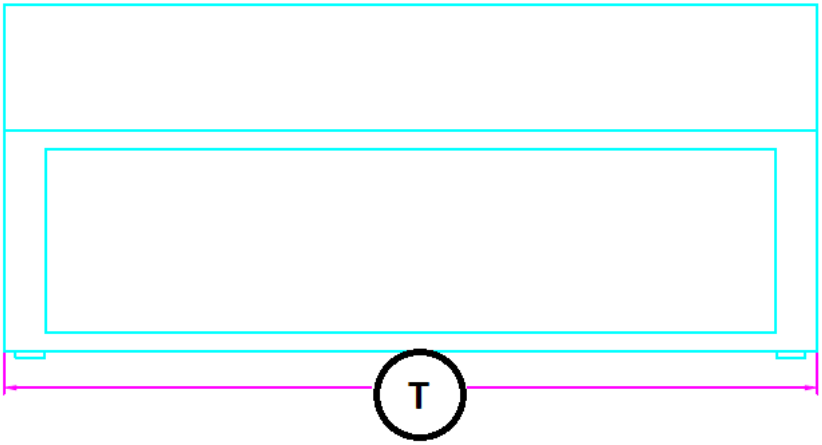
Table 5. Electrical properties (23 °C)
*In Appendix II, the main contactor's current capabilities are given

2.3.3. Dimensions (±1mm)

Product name	Height (H)	Width (W)	Thickness (T)
SB BIB LV12V350A	90 mm	255 mm	180 mm
SB BIB LV24V350A	90 mm	255 mm	180 mm
SB BIB LV48V350A	90 mm	255 mm	180 mm
SB BIB LV12V600A	108 mm	360 mm	254 mm
SB BIB LV24V600A	108 mm	360 mm	254 mm
SB BIB LV48V600A	108 mm	360 mm	254 mm

Table 6. Dimensions





2.4. Environmental conditions

⚠ **Warning!** The BIB may only be used in conditions specified in this manual. Exposing the BIB to conditions outside the specified boundaries may lead to serious damage to the product and/or the user.

Recommended operating temperature range	0°C to +45°C
Recommended storage temperature range*	-10°C to +20°C
Relative humidity	10-90%
Vibrations and shocks	

Table 7. Environmental conditions

2.5. Required tools

- 13mm Hexagon socket wrench
- Torque wrench
- Screwdriver straight 5mm

2.6. Components

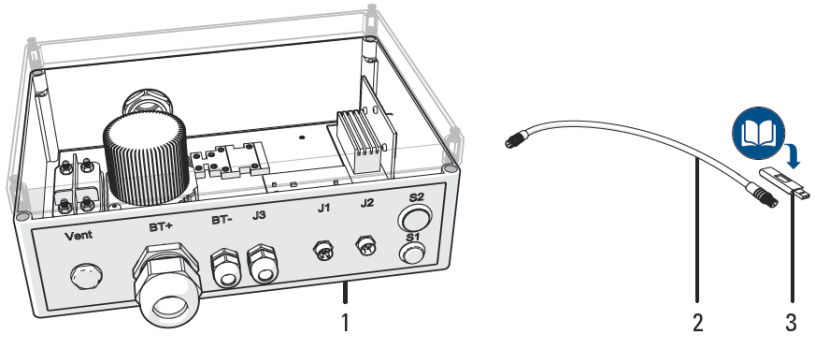


Figure 1. Components

2.6.1. List of components

1. (1x) Battery Interface Box
2. (1x) Male to male CAN cable 0.6m
3. (1x) USB stick (manual)

2.7. Connections, and indicators

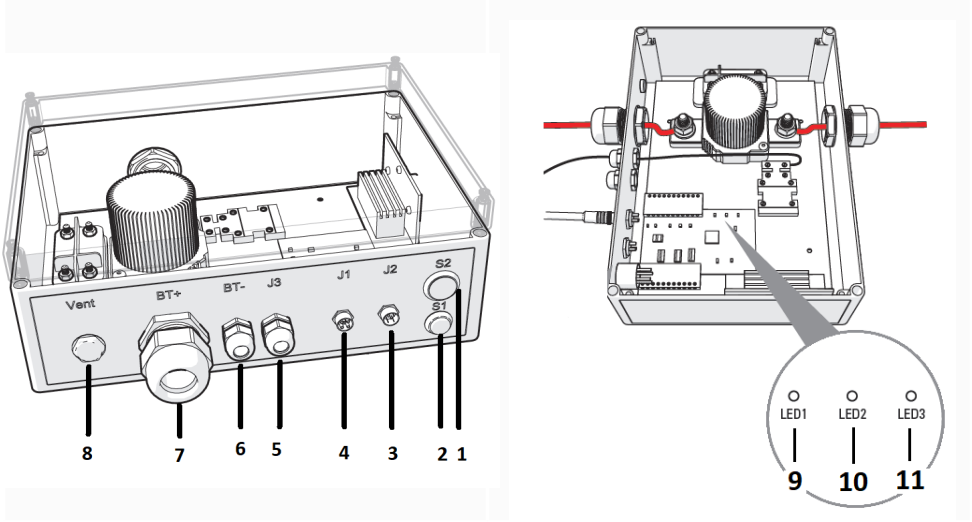


Figure 2. Connections, indicators and battery controls

2. S1 (Reset button)
3. S2 (On/Off push switch)
4. J1 Master connector (CANopen; 5-pin “micro” style connector)
5. J2 Slave connector (CANopen; 5-pin “micro” style connector)
6. J3 (Not used)
7. BT- (Terminal)
8. BT+ (Terminal)
9. Vent
10. LED 1 Indicator (Orange)
11. LED 2 Indicator (Green)
12. LED 3 Indicator (Red)

2.7.1. J1 / J2 (CANopen; 5-pin “micro” style connector)

PIN #	Signal	Description
1	CAN_SHLD	Optional CAN Shield
2	CAN_V+	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers. if galvanic isolation of the bus node applies)
3	CAN_GND	Ground / 0V
4	CAN_H	CAN_H bus line (dominant high)
5	CAN_L	CAN_L bus line (dominant low)

Table 11. J1 / J2 (CANopen; 5-pin “micro” style connector)

2.7.2. LED indicators

	LED 1 (Yellow)	LED 2 (Green)	LED 3 (Red)	Mode
1	Flashing	Off	Off	Precharge
2	Off	On	Off	Main relay On
3	On	On	Off	Main relay Off
4	On	On	On	Battery in error mode
5	Off	Flashing	Off	CAN network scanning

2.8. Peripheral equipment

2.8.1. Obligatory

In order for the BIB to be safely, the CAN network cables should be installed.

2.8.2. Compatible Components

The BIB can be used in combination with a number of (Super B) products:

Description	Article name	EAN code
SB12V160E-ZC	Traction battery SB12V160E-ZC	8718531360570
SB12V100E-ZC	Traction battery SB12V100E-ZC	8718531360198
Terminator Resistor Female	SB CAN Terminator Resistor Female	8718531360808
Terminator Resistor Male	SB CAN Terminator Resistor Male	8718531360815
CAN Male-female Cable 0.6m	SB CAN Male-female Cable 0.6m	8718531360716
CAN Male-female Cable 1m	SB CAN Male-female Cable 1m	8718531360723
CAN Male-female Cable 2m	SB CAN Male-female Cable 2m	8718531360730
CAN Male-female Cable 5m	SB CAN Male-female Cable 5m	8718531360747
CAN Male-female Cable 10m	SB CAN Male-female Cable 10m	8718531360754
T-splitter	SB CAN T-splitter	8718531360761
USB to CAN	CAN Compact to USB	8718531361201

Table 12. Optional components that can be used with the BIB

3. Safety guidelines and measures

3.1. General

- Do not short-circuit the BIB.
- Treat the BIB as described in this manual.
- Do not disassemble, crush, or puncture the BIB.
- Do not expose the BIB to heat or fire. Avoid exporusre to direct sunlight.
- Do not remove the BIB from its original packaging until required for use.
- Observe the plus (+) and minus (–) marks on the BIB and equipment and ensure correct use.
- Do not use any battery which is not designed for use with this BIB.
- Do not mix Li-ion batteries of different manufacture, capacity, size or type within a device.
- Keep the BIB clean and dry.
- Retain the original product documentation for future reference.
- Remove the BIB from the equipment when not in use.

⚠ **Warning!** Keep the BIB away from water, dust and contamination.
⚠ **Warning!** Always take safety precautions when working on battery systems.

3.2. Disposal

Dispose of the BIB in accordance with local, state and federal laws and regulations.
BIBs may be returned to the manufacturer.
Do not mix with other (industrial) waste.

3.3. Safety symbols and markings on product

Several safety symbols and markings can be found on the product. These markings are displayed below. Never remove these markings!

The meanings of the symbols:

	Shield eyes
	Note operating instructions
	Battery acid
	Explosive gas
	No smoking, no naked flames, no sparks
	Keep away from children
	Dispose of the BIB in accordance with local, state and federal laws and regulations. BIBs may be returned to the manufacturer. Do not mix with other (industrial waste)
	This product, or sections of this product can be recycled

Table 13. Safety symbols

4. Installation

4.1. General information

⚠ **Warning!** Never install or use a damaged BIB.

⚠ **Caution!** Do not reverse connect the BIB(polarity)

4.2. Unpacking

Check the BIB for damage after unpacking. If the BIB is damaged, contact your reseller or Super B. Do not install or use the BIB if it is damaged!

4.3. Preparing the battery for use

⚠ **Caution!** Do not operate the BIB beyond published maximum specifications.

⚠ **Caution!** In case of an under-voltage shutdown, charge immediately.

4.3.1. Placement of the BIB

Before it is used, the BIB must be positioned in such a way that it will not move around in its compartment during use. The BIB battery may be fixed in place by the mounting holes. The BIB can be secured in place by means of bolts or screws (See Table 6 mounting holes).

Product name	Height (H)	Lenght (L)
SB BIB LV12V350A	165 mm	239 mm
SB BIB LV24V350A	165 mm	239 mm
SB BIB LV48V350A	165 mm	239 mm
SB BIB LV12V600A	239 mm	346 mm
SB BIB LV24V600A	239 mm	346 mm
SB BIB LV48V600A	239 mm	346 mm

Table 6. Mounting holes

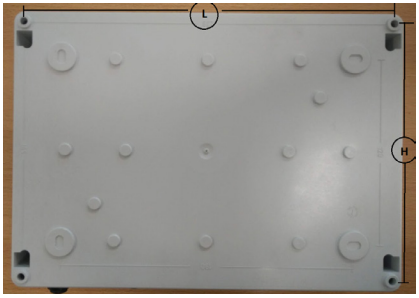


Figure 3. Installing the BIB by the mounting holes

4.4. Connection wires

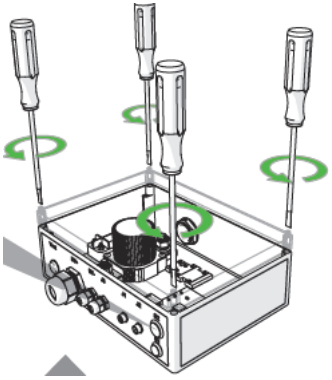
Use appropriate wire for the connection wires to ensure no overheating or unnecessary losses occur. Use appropriate fuses matching the wires and load. See appendix III for more details.

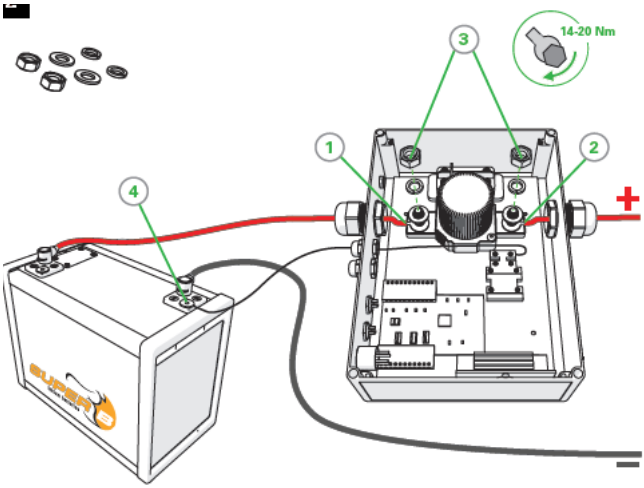
4.5. Connecting the power cables of the battery bank to the BIB

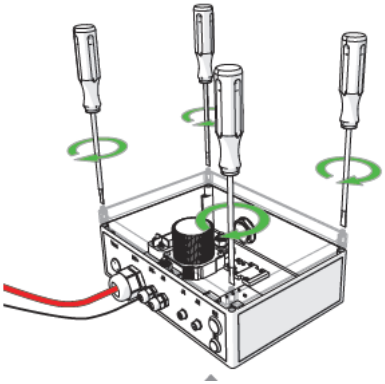
Use the following steps to connect the BIB with the battery bank (Figure):

1. Unscrew the protection cover.
2. Connect the + terminal of the battery bank to he relay terminal at the BT+ side.
3. Connect the + terminal of the load to the relay terminal at the LOAD + side.
4. Ensure both contacts are tightened to 20Nm.
5. Connect the BT- terminal of the BIB to the - terminal of the battery bank
   ⚠ Caution! The BT- terminal cable should be connected in the same spot as the - power cable. To the battery closest to the BIB.
6. Secure the protection cover

Figure 4. Connecting the power cables of the battery bak to the BIB




14-20 Nm
3
1
2
4
+



4.5.1. Connecting the CAN network cables

The CANopen interface of the Li-ion batteries must be used (Figure):
The CAN male to male cable should be connected first to the J1 terminal of the BIB

4.6. Powering the BIB

The BIB can be powered On/Off from the S2 push button.

4.7.

4.7.1. CAN Bus network topology

The CAN Bus must be used in a bus network topology. Do not use a ring- or a star topology. The maximum CAN bus legnth is limitted because the Li-ion battery has a fixed bitrate of 250kbps.

In Table 6 is an overview of these restrictions.

Bit rate	Bus length (L)	Max. stub length (S)	Accumulated stub length
250 kbps	250 m	11 m	55 m

Table 6. CAN bus speed

4.7.2. Termination Resistors

The CAN bus requires termination at the two ends of the bus. The USB-to-CAN interface may be connected in anywhere to the CAN bus.

Use termination resistors at the end nodes to prevent reflections on the line. The value of this resistor should be +/- 120 ohms.

4.8. Disconnecting the BIB

1. Turn off the BIB from the S2 push button.
1. Disconnect the positive wire from the BT+ terminal of the BIB.
2. Disconnect the BT- wire from the - terminal of the battery bank.

5. BIB use

5.1. General information

⚠ **Caution!** In case of an undervoltage shutdown, charge immediately.

⚠ **Warning!** Follow the safety guidelines and measures of chapter 3

5.2. Programming the battery bank and the BIB

The BIB can be programmed with the Battery Monitor Software.
Before the BIB and battery bank can be used, a few configurations need to be made with the Super B battery monitor application.
For connecting a computer to the BIB a CAN to USB converter is required, see 2.8 Peripheral equipment.

Battery ID's

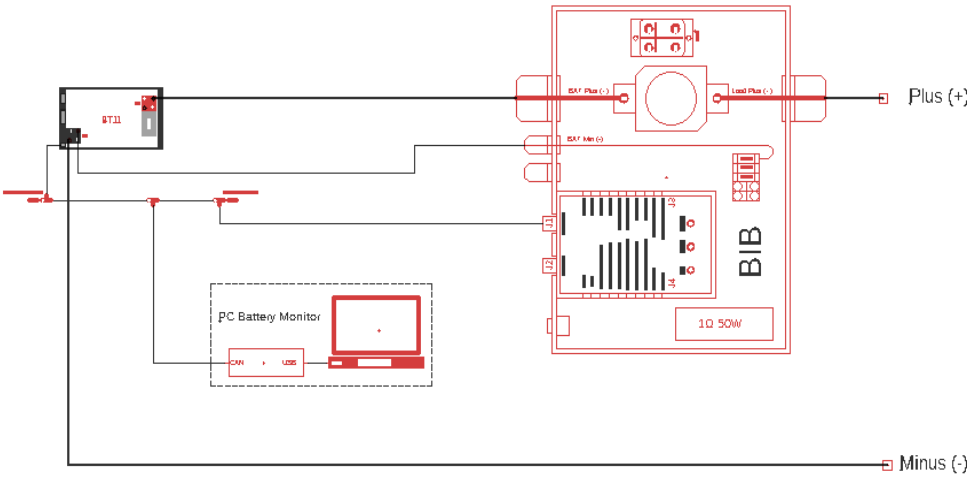
In multi-battery systems, each battery shall have a unique Node ID number. The default Node ID for a Super B battery is 10. This number shall be changed depending on the configuration.

If the system as a whole has been ordered at Super B, the batteries will have been preconfigured and renumbering is not necessary. If this is not the case, renumbering can be done manually.

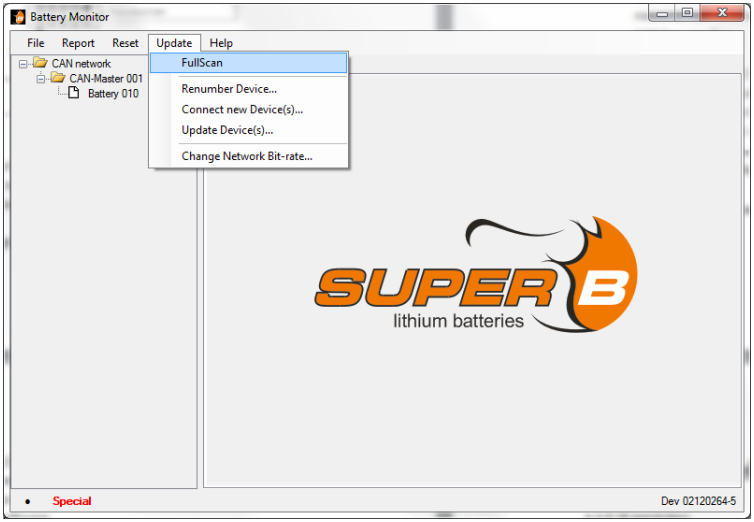
Any Node ID number between 2 and 127 can be assigned to a battery.
Node ID 1 should not be used for batteries as it is reserved for the BIB.
We recommend not to use Node ID 10 for multi battery configurations as it may be confusing in case a battery is added to the system.
Multiple batteries with the same number will result in unpredicted behavior of the system.
We recommend numbering of the batteries in such a way that the bank configuration (number in parallel, number in series) can be easily recognized.

Renumbering procedure

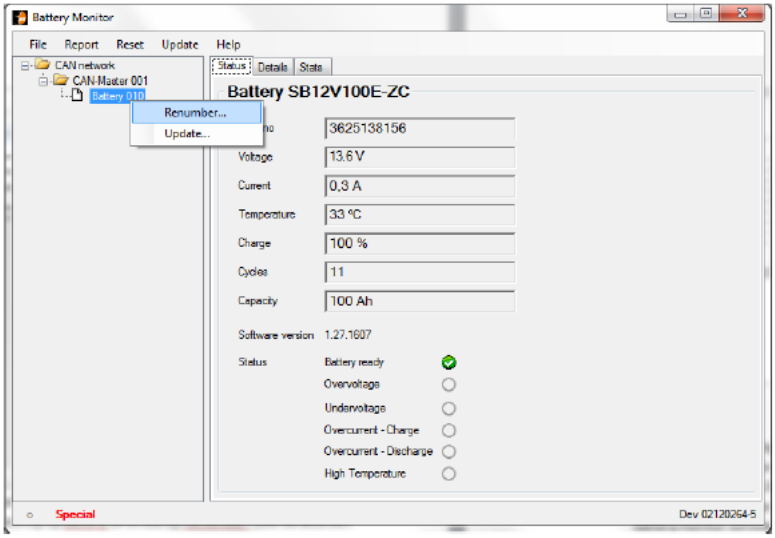
a) Connect one battery to the BIB , see Figure Renumber battery 1.

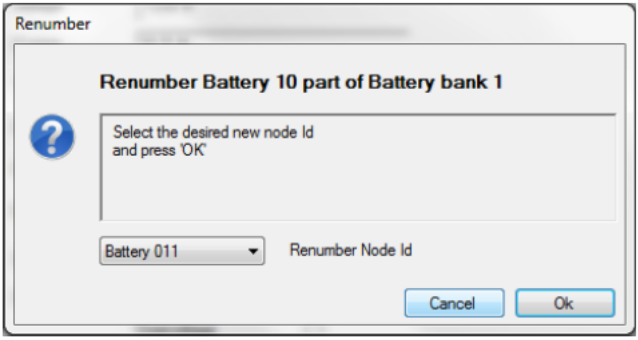


b) Perform a FullScan in the update menu. For default setups you should see one battery with ID 10 and one BIB with ID 1, see Figure 20 Full-Scan.



c) Right-click Battery 10 and select Renumber. Assign a new ID to the battery with new node ID, see Figure 21 and Figure 22.




Renumber
Renumber Battery 10 part of Battery bank 1
Select the desired new node Id
and press 'OK'
Battery 011
Renumber Node Id
Cancel
Ok

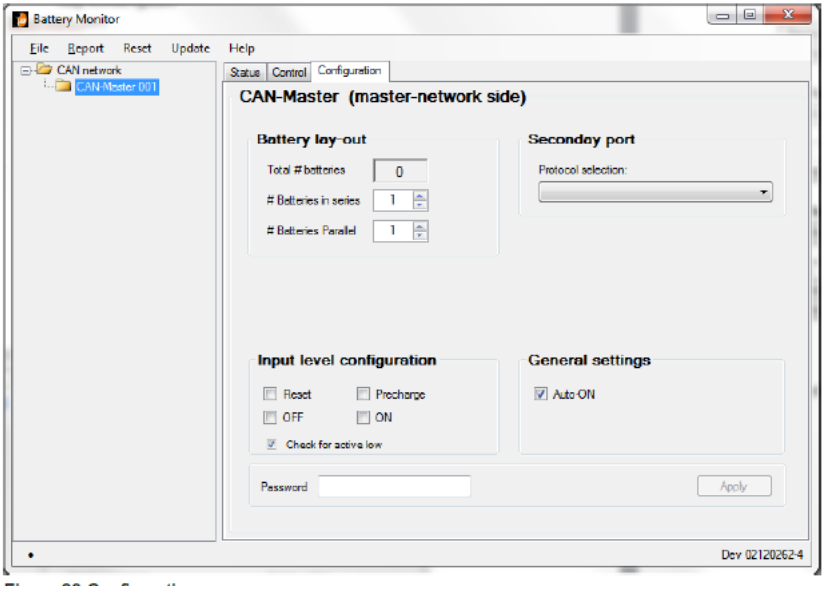
d) Verify if the correct number is assigned to that battery
e) Connect the next battery and repeat the procedure a) trough d) until all batteries have been assigned a unique Node ID
f) Continue with the battery layout

Battery layout

1. Start the Super B battery monitor application
2. Click Update and then FullScan. Confirm with Yes.

The Super B battery monitor application will now trigger the BIB to scan for connected batteries.
When the scan is completed, batteries found will be shown in the “configuration tab” in the “Total # batteries” field. See Figure 23.

3. Configure the battery bank with the up- and down fields in “#Batteries in series” and “#Batteries parallel”.



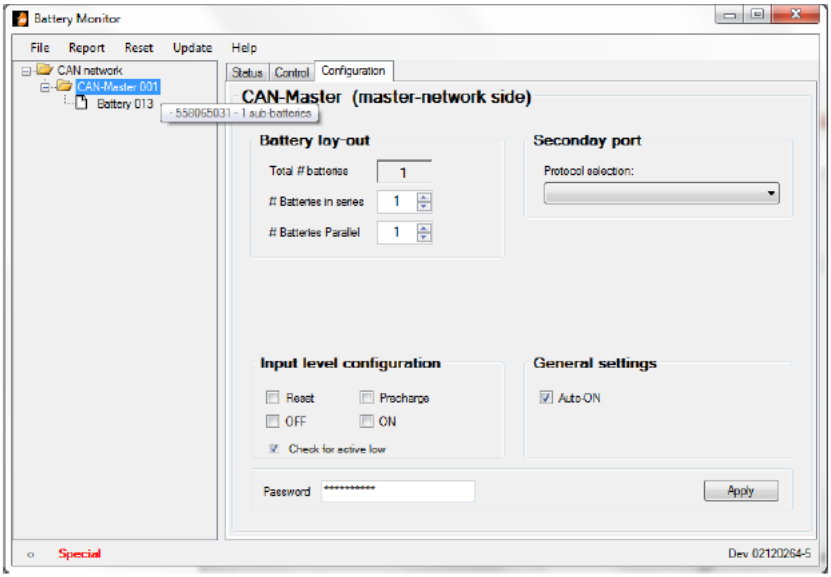
Input level configuration
Not Applicable for BIB

Secondary port
This is used to select the communication protocol for CAN bus connector J2:
• CANOpen (CiA418 and Super B features)
This selection can also be used to monitor the battery bank through the BIB.
• NMEA2000 subset.
• Propriety protocols. This is dedicated communication for proprietary devices like displays or inverters.
Note: This list is subject to change. Options may look different depending on the software version you are using.

State of charge and Automatic control
The Auto On enables the automatic start up option.
The main relay will be engaged automatically when the BIB starts up, see Figure 23.
Note! The Auto On should be always enabled.

The State of charge control will shut down the BIB once the set threshold is reached.

Saving a configuration
To save a configuration, enter the password, then click “apply”.
The password is the serial number of the BIB, followed by an exclamation mark (“!”).
The serial number can be found by keeping the mouse pointer on CAN-master 001 as shown in Figure 24.


Battery Monitor
File
Report
Reset
Update
Help
CAN network
CAN-Master 001
Battery 013
- 558065031 - 1 sub-batteries
Status
Control
Configuration
CAN-Master (master-network side)
Battery lay-out
Total # batteries
1
Batteries in series
1
Batteries Parallel
1
Secondary port
Protocol selection:
Input level configuration
Reset
Precharge
OFF
ON
Check for active low
General settings
Auto-ON
Password
****
Apply
Special
Dev 02120264-5

6. Inspection, cleaning and maintenance

6.1. General information

⚠ **Warning!** Never attempt to open or dismantle the BIB!

1. Disconnect the BIB from all loads and charging devices before performing cleaning and maintenance activities (see paragraph 4.7).

6.2. Inspection

Inspect for loose and/or damaged wiring and contacts, cracks, deformations, leakage or damage of any other kind. If damage to the BIB is found, it must be replaced. Do not attempt to use a damaged BIB.

6.3. Cleaning

If necessary, clean the BIB with a soft, dry cloth. Never use liquids, solvents, or abrasives to clean the BIB.

7. Storage

Follow the storage instructions in this manual to optimize the lifespan of the BIB during storage. If these instructions are not followed and the Li-ion battery has no charge remaining when it is checked, consider it to be damaged. Do not attempt to recharge or use it. Replace it with a new Li-ion battery.
See chapter 2.4 for storage temperature conditions.
The self-discharge of the Li-ion battery is 1-2% per month.

1. Charge the Li-ion battery to 100% of its capacity before storage.
2. Disconnect the Li-ion battery from all loads and, if present, the charging device
3. Remove the fuse from the Li-ion battery during storage. (See paragraph 4.3.2)
4. Place the terminal covers over the Li-ion battery's terminals during storage.
5. Charge the Li-ion battery to 100% of its capacity every year.

8. Transportation

8.1. General

Always check all applicable local, national, and international regulations before transporting a Lithium Iron Phosphate battery.

Transporting an end-of-life, damaged, or recalled Li-ion battery may, in certain cases, be specifically limited or prohibited.
The transport of the Li-ion battery falls under hazard class UN3480, class 9. For transport over water, air and land, the Li-ion battery falls within packaging group PI965 Section II.

Use Class 9 Miscellaneous Dangerous Goods and UN Identification labels for transportation of lithium ion batteries which are assigned Class 9. Refer to relevant transportation documents. Lithium batteries and lithium ion cells are regulated in the U.S. in accordance with Part 49 of the Code of Federal Regulations, (49 CFR Sections 105-180) of the U.S. Hazardous Materials Regulations.
Visit www.iata.org for the complete transport regulations and packing instructions for this product. The relevant information for Li-ion batteries can be found under "Programs" > "Cargo" > "Dangerous goods (HAZMAT)".

9. Disposal and recycling

9.1. General information

Always discharge the Li-ion battery before disposal. Use electrical tape or other approved covering over the Li-ion battery connection points to prevent short circuits.
Battery recycling is encouraged. Dispose of the Li-ion battery in accordance with local, state and federal laws and regulations. Batteries may be returned to the manufacturer.

USA & Canada:
Lithium Iron Phosphate batteries are subject to disposal and recycling regulations that vary by country and region. Always check and follow your applicable regulations before disposing of any Li-ion battery. Contact Rechargeable Battery Recycling Corporation (www.rbrc.org) for U.S.A. and Canada, or your local Li-ion battery recycling organization.

EC
Waste must be disposed of in accordance with relevant EC Directives and national, regional and local environmental control regulations. For disposal within the EC, the appropriate code according to the European Waste Catalogue (EWC) should be used.

Other
Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles.

10. Troubleshooting

Problem	Possible reason	Solution
Green LED blinking	BIB in bootloader	Check the BIB settings by connecting a PC with the monitor software. Perform a software flash. (contact Super B for the latest software version)
Green LED blinking with short off intervals	BIB scans for batteries	Wait 10 minutes after booting until the blinking stops.
Yellow LED blinking	BIB is in pre-charge mode	Configure BIB to ON-state
	BIB has just booted and has not yet switched the relay	Typically the relay should be enabled within 5 seconds.
	The difference in voltage between battery bank and charger is too high to safely switch on the main relay.	Wrong configuration of precharge system, for example no pre-charge resistor connected or wrong resistor value.
Red LED is on	The BIB can not find all batteries	Check the CAN cabling and terminators
Red LED blinking, 2 flashes in 1 second	BIB waiting for battery communication	Wait 10 minutes after booting. If the LED is still blinking, check the CAN cables and the CAN terminators.
Red LED blinking. 1 flash in 1 second	Battery layout configuration incorrect	Doublecheck the battery layout. Does it match completely with the configuration as stored in the BIB?
	One or more batteries are reporting an error or the BIB is not configured (first bootup)	Determine which battery is reporting the error. Check for excessive heat, any damage, short circuits etc. Take appropriate safety precautions. If the problem has been resolved, reset the system (pushbutton or through the Super B battery monitor application).

Table 7. Troubleshooting

SUPER B
lithium batteries

For more information, or to order documents, contact:

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LI-ION

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