Thank you for purchasing a Studer Battery Monitor. Please read this owner’s manual for information about using the product correctly and safely. Keep this owner’s manual close to the battery monitor for future reference.

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High Precision Battery Monitor
SBM 02
Owner’s manual

Before proceeding with this owner’s manual, please make sure you have carefully read the enclosed installation and quick start guide as well!

1. SBM 02 display and control overview

2. Synchronisation

It is recommended to keep your battery monitor providing adequate status information about your battery. It is important to regularly synchronise your battery monitor with your battery. As explained, the battery monitor is designed to synchronise with your battery on a 1-minute cycle. If your battery monitor is connected to a battery charger it can automatically be synchronised to your battery. You can actually use your battery monitor during operation, the battery monitor automatically indicates when a synchronisation is required, by displaying the message SYNCHRONISE.

A synchronisation step means nothing more than performing a complete charge cycle on your battery. A charge cycle will be considered complete when the battery charger's required energy is restored in the battery and Auto-synchronisation F1.0, F1.1 and F1.2 (see chapter 5) are met. This typically means: when the battery charger switches to float mode. By meeting these conditions, the battery is completed full, which will be indicated by showing a FULL message on the display. Besides this, the State-of-charge readout will be set to 100% and the selected alarm relay will be activated (depending on the selected F4.0 Auto-sync parameter). The FULL message will disappear when a key is pressed, or automatically, when the battery starts discharging again.

Performing synchronisations regularly is also important to keep your battery healthy and to increase its lifetime. You will notice if you are often performing full charge cycles yourself, the battery monitor will most likely not display the SYNCHRONISE message, since your battery is already kept at a perfect charge.

Besides automatic synchronisations based on meeting the Auto-synchronisation Functions, you can also manually synchronise the battery monitor with your battery when you are sure your battery is fully charged. This can be accomplished by pressing both < and > keys at the same time. If your battery monitor is connected to a battery charger, this will also save any Function value changes to internal memory. When no keys are pressed, the synchronisation will automatically return to the Normal Operating Mode again without saving any Function value changes.

3. Status menu

The Status menu is a read only menu that shows the battery monitor’s current status of several items. This menu can be accessed by the following sequence:

- Pressing the MENU key, the selected status item can be viewed. Pressing the MENU key again, will then step back to the Status menu. From any menu position, the Normal Operating Mode can be accessed again by pressing the MENU key for 3 seconds (see Model H.

- All selected alarms are deactivated, the < and > keys to browse through the different status items. By pressing the MENU key, the selected status item can be viewed. Pressing the MENU key again, will then step back to the Status menu. From any menu position, the Normal Operating Mode can be accessed again by pressing the MENU key for 3 seconds (see Model H.

4. History menu

The History menu is a read only menu that shows the battery monitor’s History data. History data are special events that are stored in internal memory. This menu can be accessed by the following sequence:

Clearing the history log, you can use the < and > keys to browse through the different History items. Pressing the MENU key, the selected History item can be viewed. Pressing the MENU key again, will then step back to the History menu. From any menu position, the Normal Operating Mode can be accessed again by pressing the MENU key for 3 seconds. The following History menu items are available:

H1. Battery history:

- Average discharge in Ah: This number will be recalculated after each synchronisation.
- Average discharge in %. This number will be recalculated after each synchronisation.
- Deepest discharge in Ah: This number will be recalculated after each synchronisation.
- Deepest discharge in %.
- Total Ah at 100%: The total Ah at 100% and the value displayed must be multiplied by 1000.
- Total Ah at 100%: The total Ah at 100% and the value displayed must be multiplied by 1000.

H2. Low battery alarm:

- Number of times the battery has been fully charged (depending on F4.0).
- Number of full discharges. The number of times the battery has been fully discharged reaching a State-of-charge of 0.0%.

H3. Alarm history:

- Low battery alarm On condition, F1.0, F1.1 and F1.2 must be met in order to consider the battery as fully charged.
- Main battery low voltage alarm On condition, F3.0, F3.1 must be met in order to consider the battery as fully charged.
- Main battery high voltage alarm On condition, F3.0, F3.1 must be met in order to consider the battery as fully charged.
- Auxiliary battery low voltage alarm On condition, F3.0, F3.1 must be met in order to consider the battery as fully charged.
- Auxiliary battery high voltage alarm On condition, F3.0, F3.1 must be met in order to consider the battery as fully charged.

5. Function setup menu

In the Function setup menu, your battery monitor can be adjusted to fit into your system. Low battery alarms, orientation and Setting can be set according to your needs. This menu can be accessed by the following sequence:

When the Function setup menu is entered, you can use the < and > keys to browse through the different Functions. By pressing the MENU key, the selected Function value can be edited. After pressing the MENU key again, will then step back to the Function menu. From any menu position, the Normal Operating Mode can be accessed again by pressing the MENU key for 3 seconds (see Model H.

F1. Interface Setting:

- Alarm relay: When the Low battery alarm condition is met, the alarm relay will be activated (depending on F4.0). The message “Lo” will appear on the display and the selected alarm relay will be activated (depending on F4.0).
- High voltage alarm: When the High voltage alarm condition is met, the alarm relay will be activated (depending on F4.0).
- Main battery low voltage alarm: When the Main battery low voltage alarm condition is met, the alarm relay will be activated (depending on F4.0).
- Main battery high voltage alarm: When the Main battery high voltage alarm condition is met, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery low voltage alarm: When the Auxiliary battery low voltage alarm condition is met, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery high voltage alarm: When the Auxiliary battery high voltage alarm condition is met, the alarm relay will be activated (depending on F4.0).

F2. Low battery alarm:

- Low battery alarm On (V): When the voltage of the battery falls below this value, the alarm relay will be activated (depending on F4.0).
- Low battery alarm Off (% SOC): When the State-of-charge percentage has risen above this value, the alarm relay will deactivate again. When "FULL" is selected, the alarm relay is deactivated when the State-of-charge percentage is met.
- Main battery low voltage alarm: When the voltage of the battery falls below this value, the alarm relay will be activated (depending on F4.0).
- Main battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery low voltage alarm: When the voltage of the battery falls below this value, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).

F3. Low voltage alarm setting:

- Main battery low voltage alarm: When the voltage of the battery falls below this value, the alarm relay will be activated (depending on F4.0).
- Main battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery low voltage alarm: When the voltage of the battery falls below this value, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).

F4. High voltage alarm setting:

- Main battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).
- Auxiliary battery high voltage alarm: When the voltage of the battery falls above this value, the alarm relay will be activated (depending on F4.0).
F6.4 Auxiliary battery high voltage alarm Delay. This is the time the Auxiliary battery high voltage alarm On condition, must be reset before the alarm is activated.

F6.5 Voltage prescaler: This function is only important when an optional voltage prescaler is installed on the battery monitor. All voltage functions are linked to the Function F6.5. Always keep the voltage function set to "1" when no prescaler is installed.

F6.6 Temperature unit selection: Enables selection between degrees Celsius (°C) and degrees Fahrenheit (°F) in the temperature readout.

F6.7 Auxiliary battery input mode. This function is used to configure the Vx input terminal on the rear side of the battery monitor, and can be set in two modes. In mode "0", the Vx input operates in normal voltage measurement mode. In mode "1", the Vx input can be used to control the backlight. In this mode, the backlight is switched ON at an input voltage higher than 2V and switched OFF again if the voltage is below 1V.

F6.8 Communication mode. This function is used to configure the data output mode. There are four data output modes: Mode "0": SBM-02 (broadcasting) Mode "1": SBM-02 (request mode) Mode "2": SBM-01 compatibility mode (broadcasting) Mode "3": SBM-01 compatibility mode (request only)

6. Reset menu

In the Reset menu, you can reset a number of items of your battery monitor. This menu can be accessed by the following sequence:

Code:

When the menu is entered, you have to use the + and - keys to browse through the different options. By pressing the MENU key, the selected reset item can be viewed. The default value for all reset items is "OFF". To actually reset the selected item, use the + and - keys to set the value from "OFF" to "ON". Pressing the MENU key again will resets the menu to its default settings. It is recommended to keep the setting "OFF" for all reset items except the "Reset battery status" function. To reset the menu key, press the MENU key for 5 seconds.

The following Reset menu items are available:

- Reset alarm. Use this item to reset or ignore all current alarms
- Reset battery status. Use this item to reset your current battery status (SBM, State-of-charge and battery history). You can use this reset item after you have installed a fresh battery of the same specifications as the previous one.
- Reset Functions. This menu is used to reset all functions to default values.
- Reset zero-off current. Use this menu item to remove small current readings which are displayed when the current is not flowing in- or out of the battery. When performing this reset action, please be 100% sure that all external loads/chargers are disconnected or turned-off.

7. Troubleshooting guideline

<table>
<thead>
<tr>
<th>Problem</th>
<th>Remedy or suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>The monitor doesn't operate (no display)</td>
<td>- Check monitor- and battery side connections. - Make sure the input fuses are installed and not blown. - Check battery voltage. Battery might be flat. Vbat must be &amp;99HAV. - Try to restart the monitor by replacing/ - plug the fuses by hand.</td>
</tr>
<tr>
<td>The monitor needs all the time</td>
<td>- Check the wiring for corrosion and / or loose contacts.</td>
</tr>
<tr>
<td>No changes can be made in the function setup</td>
<td>- Check if the setup code is OFF (function F6.1).</td>
</tr>
</tbody>
</table>

8. Warranty conditions

Studer warrants the product to be free from defects in workmanship or materials for 24 months from the date of purchase. During this period Studer will repair the defective product free of charge. Studer is not responsible for any costs of the transport of this product.

This warranty is void if the product has suffered any physical damage or alteration, either internally or externally, or does not cover damage arising from improper use or use in an unsuitable environment.

This warranty will not apply where the product has been misused, neglegted, improperly installed or repaired by anyone other than Studer. Studer is not responsible for any loss or damage costs arising from improper use, use in an unsuitable environment or improper installation, setup and malfunctioning of the product.

Since Studer cannot control the use and installation (according to local regulations) of their products, the customer is always responsible for the actual use of these products. Studer products are not designed for use as critical components in life support devices or systems, that can potentially harm humans and/or the environment. The customer is always responsible when implementing Studer products in these kind of applications. Studer does not accept any responsibility for any variation of protocols or other rights of third parties, resulting from the use of the Studer product. Studer keeps the right to change product specifications without previous notice.

9. Technical specifications

SBM-02

Supply voltage range 9.35VDC
Supply current 1) @V=24VDC 7mA
@V=12VDC 3mA
Input voltage range (auxiliary battery) 2.35VDC
Input voltage range (main battery) 0.35VDC
Input current range 9999..9999A
Battery capacity range 20,999Ah
Operating temperature range -25..+50°C
Residual resistance range (0..35V) ± 0.15Ω
Current (0..200A) ± 0.1A
Current (0..100A) ± 0.1A
Current (0..50A) ± 0.01A
Current (0..20A) ± 0.01A
Current (0..5A) ± 0.01A
Current (0..1A) ± 0.01A
Current (0..05A) ± 0.01A
Voltage measurement accuracy ± 0.3%
Current measurement accuracy ± 0.4%
Dimensions 46mm body diameter 45.5mm total depth 79mm
Weight 95grams
Shunt dimensions: footprint 45 x 87mm height 17mm (based) / 38mm (UM screw)
Protection class IP20 (top panel only IP 65)
Accessories SBM-CA1-20, Conn.kit 20m SBM-TEMP-20, Temp.kit 20m SBM-COM Communication kit RS232 SBM-APS-01, Voltage prescaler 1.5

Note: the given specifications are subject to change without notice

1) Measured with backlight and alarm relay turned off.
2) Depends on selected shunt. With standard delivered 500A/50mV shunt (350A continuous), the range is limited to -400...+400A.
3) Only available when optional temperature sensor is connected.

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