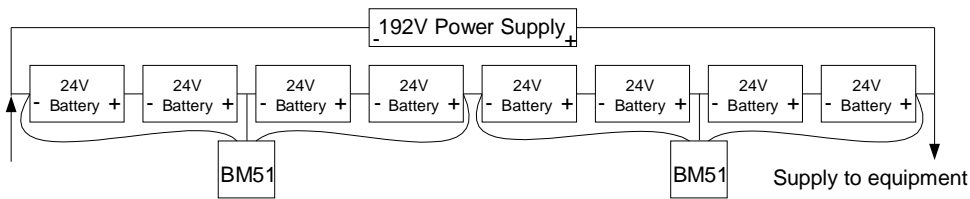


Battery String Monitor BM51 User Instructions

1. Wiring two Battery Monitors BM51 to a 192V Battery String



Maximum Voltages

Maximum / Minimum voltage between black wire and red wire: 70V DC / minimum 7V DC
Maximum voltage between black wire and green wire: 150V DC

Make firm connections to the battery poles in the following order:

Step 1: Connect **black wire** to minus terminal on battery.

Step 2: Connect **green wire** to plus terminal on battery.

Step 3: Connect **red wire** to center tap or close to center tap of battery.

As soon as you touch the battery pole with the cable lug a 60 seconds count down to the first measurement starts. Therefore, we recommend to prepare this connection such that fastening the cable lug to the battery is done within 15 seconds.

2. Operation of BM51 Battery Monitor

After a delay of 1 minute the first measurements are taken. These are the reference values used in the indefinite monitoring process. It monitors the battery voltage V_{hi} on **green wire** in 0.3 seconds intervals. It monitors the battery voltage V_{md} on **red wire** and the battery impedance R in intervals either factory set or set by the user. It can be changed from 1 hour to 999 hours. At the end of every interval 6 values and the Alarm Status are sent to the RS232 interface.

Factory set limits: 040,010,024;
040 = max. 40 % increase of midpoint impedance
010 = max. 10 % decay of voltage at green wire (V_{hi})
024 = measures impedance, midpoint voltage, and temp. every 24 hours

3. Status and Alarm

The green light indicates "**SUPPLY NORMAL**".

The flashing green light indicates "**BATTERY DISCHARGING**".

ALARM: Red light turns on and relay is closed, either V_{hi} is below limit or R increased above limit.

These status and alarm indications can at anytime be read via RS232 interface.

4. Setting Limits, Reading Data and Alarm Status from BM51 Battery Monitor

To communicate with the BM51 three RS232 commands are used. These are: val?, lim?, lim. Use a computer in terminal mode. Every command must be terminated with CR/LF.

val?	Is used to read 6 values and the alarm status from BM51. These are: V_md, V_hi, Ambient Temperature, Battery Resistance, Operating Time, Discharging Time and four different Alarm Status. ("BATTERY OK", "DISCHARGE ON", "ALARM R HIGH", "ALARM V LOW").	
Example: val? → response	25.381V_md 50.492V_hi 21.187degC 28.112mOhm 7.5872h_op 00.000h.dis BATTERY OK	(midpoint voltage on battery, red wire) (high point voltage on battery, green wire) (ambient temperature) (midpoint battery impedance) (maximum time 99'999 hours = 11.4 years) (total discharging time of battery since start) (Alarm status)
lim?	Is used to read the alarm limits from BM51. Note: The reference values are V_hi, V_md, and R obtained from first measurement at start-up.	
Example: lim? → response	040,010,024	040 = max. 40 % increase of midpoint impedance 010 = max. 10 % decay of voltage at green wire (V_hi) 024 = measures impedance, midpoint voltage, and temperature every 24 hours
lim 80,12,1	Sets new limits and stores them in non-volatile memory. Note: 1 space after lim required. The three integers must be within 1-999. 80 = Alarm at +80 % Ri increase 12 = Alarm at -12 % V_hi decrease 1 = Impedance measurement every hour	
We strongly recommend to change limits and use lim? to ensure that correct values have been stored.		

5. Examples of Far Distance Battery Monitoring

The diagrams below show solutions for simple single BM51 applications and multiple BM51 applications.

