PRO-POWER



942AH 4S 12V
BMS TECHNICAL
MANUAL

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1. INTRODUCTION

The PP-R10Q-4S is a battery management system (BMS) protection board designed for automotive starting battery packs. It supports four lithium iron phosphate ($LiFePO_4$) cells connected in series (4S) in a nominal 12 V battery pack and uses an N-MOS configuration with a one-touch forced-start function.

The system uses an analog front end (AFE) and a microcontroller (MCU). Certain parameters can be adjusted through a connected computer to meet customer requirements.

2.PRODUCT OVERVIEW AND FEATURES

- Dustproof, shock-resistant, and compression-resistant design
- Provides overcharge, low-voltage, overcurrent, and short circuit protection, along with cell balancing
- Integrates data acquisition, battery management, and communication functions into a single unit

3.ELECTRICAL CHARACTERISTICS

3.1 Basic Parameters

Parameter	Supplied Setting	Remark
Discharge		
Rated continuous current	200 A	
Charging		
Charging voltage	13.8 V	
Rated continuous current	200 A	
Passive cell balancing		
Cell balancing activation voltage	3.4 ± 0.05 V	Up to four balancing channels can operate simultaneously.
Cell balancing activation voltage difference	20 mV	
Cell balancing current	150 ± 30 mA	
Cell Balancing Activation Conditions (Both Must Be Met)	1. The configured balancing activation voltage difference has been reached. 2. The configured balancing activation voltage has been reached.	

Parameter	Supplied Setting
Single cell over-charge alarm	
Single cell over-charge alarm voltage	3.50 ± 0.05 V
Single cell over-charge alarm delay	5 ± 1 s
Single cell over-charge alarm release voltage	3.40 ± 0.05 V
Single cell over-charge protection	
Single cell over-charge secondary protection voltage	3.55 ± 0.05 V
Single cell over-charge secondary protection delay	5 ± 1 s
Single cell over-charge secondary protection release voltage	3.50 ± 0.05 V
Single cell over-charge third-level protection voltage	3.60 ± 0.05 V
Single cell over-charge third-level protection delay	1 ± 1 s
Single cell over-charge third-level protection release voltage	3.55 ± 0.05 V
Single cell low voltage alarm	
Single cell low voltage alarm voltage	3.15 ± 0.05 V
Single cell low voltage alarm delay	6 ± 1 s
Single cell low voltage alarm release voltage	3.30 ± 0.05 V
Single cell low voltage protection	
Single cell low voltage secondary protection voltage	3.00 ± 0.05 V
Single cell low voltage secondary protection delay	20 ± 1 s
Single cell low voltage secondary protection release voltage	3.02 ± 0.05 V
Single cell low voltage third-level protection voltage	2.55 ± 0.05 V
Single cell low voltage third-level protection delay	10 ± 1 s
Single cell low voltage third-level protection release voltage	2.65 ± 0.05 V

Parameter	Supplied Setting
Total over-charge alarm	
Overall voltage overcharge alarm voltage	13.7 ± 0.4 V
Overall voltage overcharge alarm delay	5 ± 1 s
Overall voltage overcharge alarm release voltage	13.55 ± 0.4 V
Total voltage overcharge protection	
Overall voltage overcharge secondary protection voltage	14.1 ± 0.4 V
Overall voltage overcharge secondary protection delay	5 ± 1 s
Overall voltage overcharge secondary protection release voltage	13.7 ± 0.4 V
Overall voltage overcharge third-level protection voltage	14.3 ± 0.4 V
Overall voltage overcharge third-level protection delay	3 ± 1 s
Overall voltage overcharge third-level protection release voltage	13.9 ± 0.4 V
Total low voltage alarm	
Overall under-voltage alarm voltage	12.8 ± 0.4 V
Overall under-voltage alarm delay	6 ± 1 s
Overall under-voltage alarm release voltage	13 ± 0.4 V
Total low voltage protection	
Overall low voltage secondary protection voltage	12.1 ± 0.4 V
Overall low voltage secondary protection delay	20 ± 1 s
Overall low voltage secondary protection release voltage	12.2 ± 0.4 V
Overall low voltage third-level protection voltage	9.3 ± 0.4 V
Overall low voltage third-level protection delay	0.3 ± 1 s
Overall low voltage third-level protection release voltage	9.5 ± 0.4 V
Discharge overcurrent protection	
Discharge overcurrent primary protection current	300 ± 50 A

Parameter	Supplied Setting	Remark
Charging and discharging overcurrent protection		Lock after 5 attempts
Discharge overcurrent primary protection delay	60 ± 1 s	
Discharge overcurrent secondary protection current	450 ± 50 A	
Discharge overcurrent secondary protection delay	10 ± 1 s	
Discharge overcurrent third-level protection current	700 ± 50 A	
Discharge overcurrent third-level protection delay	5 ± 1 s	
Release conditions	*Remove load to release*	
Charging overcurrent alarm current	240 ± 20 A	Currents exceeding this threshold will trigger MOSFET temperature protection.
Charging overcurrent alarm delay	3 ± 1 s	
Charging overcurrent protection current	300 ± 20 A	
Charging overcurrent protection delay	3 ± 1 s	
Charging overcurrent protection current	400 ± 20 A	
Charging overcurrent protection delay	2 ± 1 s	
Release conditions	*Remove load to release*	
Short circuit protection		
Short circuit protection current	2500 ± 500 A	
Short circuit protection delay	10–500 μs	Testing must be performed using the customer's battery pack submitted to our company.
Short circuit protection released	*Restart the BMS to release*	
Charging high-temperature protection temperature	65 ± 3 °C	
Charging high-temperature protection delay	3 ± 1 s	

Parameter	Supplied Setting	Remark
Temperature protection		
Charging high-temperature protection release temperature	60 ± 3 °C	
Charging low-temperature protection temperature	0 ± 3 °C	
Charging low-temperature protection delay	3 ± 1 s	
Charging low-temperature protection release temperature	5 ± 3 °C	
Discharge high-temperature protection temperature	75 ± 3 °C	
Discharge high-temperature protection delay	3 ± 1 s	
Discharge high-temperature protection release temperature	70 ± 3 °C	
Discharge low-temperature protection temperature	−40 ± 3 °C	
Discharge low-temperature protection delay	3 ± 1 s	
Discharge low-temperature protection release temperature	−35 ± 3 °C	
Differential voltage alarm		
Level 1 voltage difference alarm	0.5 V	
Level 1 voltage difference alarm recovery	0.45 V	
Level 2 voltage difference alarm	0.8 V	
Level 2 voltage difference alarm recovery	0.75 V	
Level 3 voltage difference alarm	1 V	
Level 3 voltage difference alarm recovery	0.95 V	
Internal impedance		
Main circuit on-resistance	<20 mΩ	
Current consumption		
Operating self-consumption current	<30 mA	Bluetooth switch only
Sleep-mode self-consumption current	<1000 μA	
Sleep time	Never	
Communication interfaces	UART (default), CAN (default)	

3.2 Reliability Parameters

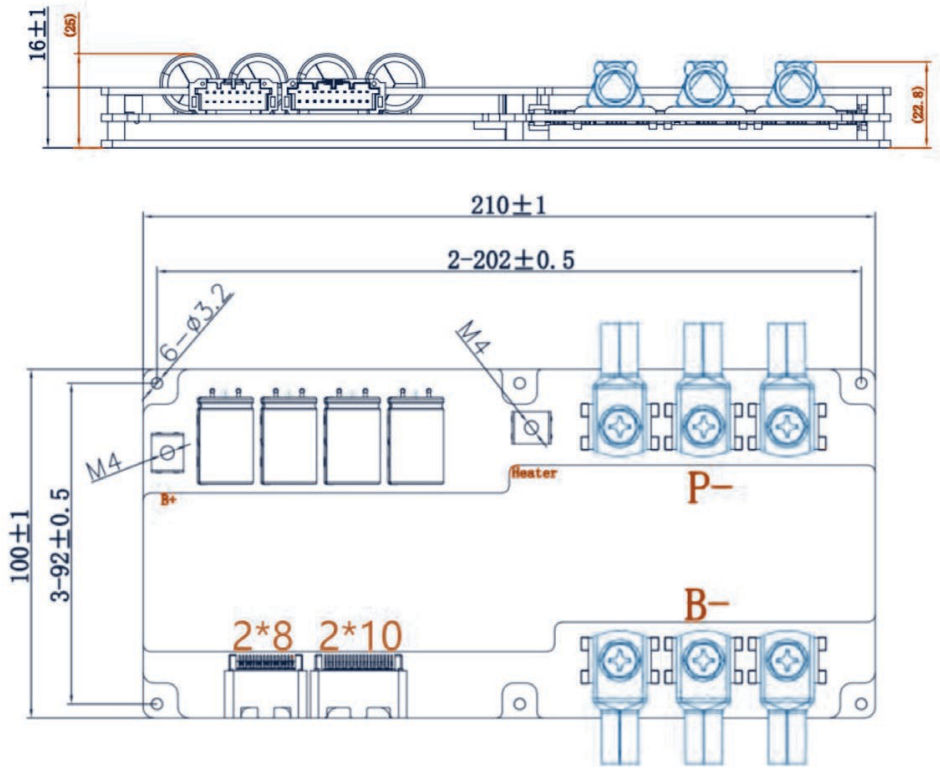
Project	Condition
Detection accuracy	Current detection accuracy: within ±3% FSR (room temperature) Voltage detection accuracy: within ±15 mV (room temperature) Temperature detection accuracy: ≤2 °C (room temperature)
Information storage	Stores up to 400 historical records, including protection event counts, total voltage, current, temperature, and state of charge (SOC).
SOC estimation	Uses current integration to estimate SOC. Accuracy: ≤10% (affected by ambient temperature).
Operating conditions	Operating temperature: −40 °C to 85 °C Relative humidity: 5% to 85% RH
Storage conditions	Storage temperature: −40 °C to 85 °C Relative humidity: 5% to 75% RH

4. DIMENSIONAL DRAWING OF BMS

Dustproof, shock-resistant, and compression-resistant design.

Provides overcharge, low-voltage, overcurrent, and short circuit protection, along with cell balancing.

BMS dimensions	Length × Width × Height
	210 × 100 × 25 mm



5. BUTTON FUNCTIONS

Button Wake-Up

When the BMS is in low-power sleep mode, press the button for 1 ± 0.5 s to wake it.

Key Forced Start

If the battery voltage is too low or another discharge-related fault occurs, the BMS disables the discharge MOSFET, preventing the vehicle from starting. Pressing and holding the button for 3 ± 1 s temporarily enables the discharge MOSFET for 60 ± 10 s to support starting.

Enter Loading Mode Using the Button

Press and hold for 10 seconds or more. The button light will turn on for 0.5 seconds and then off for 1 second to indicate that the loading mode is activated. Once in the loading mode, the MOSFET is turned off and the BMS enters sleep mode. It can be awakened by CAN communication, button press, or Bluetooth activation.

Warning: If forced start fails after pressing the button, check for an external short circuit.

Button operation	Description	Remark
Click	Lights the LED and activates Bluetooth and the BMS.	
Press and hold for 3–5 s	The BMS enters forced-start mode.	Forced start lasts 60 s and overrides protection to allow ignition.
Press and hold for at least 10 s	Enter sleep mode	The protection board enters sleep mode. Charging and discharging are disabled until the button is clicked to wake the board.

6. PRECAUTIONS

1. BMS units designed for different battery chemistries or voltage configurations are not interchangeable. For example, a BMS designed for NMC batteries must not be used with LFP batteries.

2. Cables from different manufacturers are not interchangeable. Use the matching cables supplied for this BMS.

3. Take precautions against static discharge when testing, installing, handling, or using the BMS.

4. Do not allow the BMS heat-dissipation surface to contact the battery cells directly. Transferred heat may affect battery safety.

5. Do not disassemble or modify BMS components.

6. The metal heat sink is anodized for insulation. If the oxide layer is damaged, the heat sink can conduct electricity. Avoid contact between the heat sink and the battery cells or nickel strips during assembly.

7. If the BMS operates abnormally, stop using it until the issue has been resolved.

8. Do not connect two BMS units in series or parallel.

9. The recommended torque for the B− and P− terminal screws is 8–10 N·m.

10. The internal resistance of the B− wire must be 0.5–0.8 mΩ.

11. Once a reliable connection at the B+ terminal has been confirmed, it is recommended to apply adhesive and allow it to cure.

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TECHNICAL SUPPORT & SERVICE

For technical assistance, battery troubleshooting, or general inquiries, please contact our support team.

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