



Battery Pack for SAM



Functional Description

- Based on latest Li-ion polymer technology
- Cells capacity - 53Ah
- Nominal current – up to 3C
- Maximum momentary current – up to 5C
- Nominal voltage – 133.2V (108V-151.2V)
- Water-cooled
- Charge preheating circuit
- External power stage capacitors pre-charge circuit
- Integrated current measurement
- Full automatic or manual control operating modes
- On-Board Smart Battery Managing System (IAT's BMS) provides:
 - Monitoring of cell voltages, temperatures and current
 - Automatic cell balancing during charge cycle
 - Software and Hardware overdischarge and overcharge detection and protection (first and secondary protection)
 - Hardware overcurrent detection and protection
 - Advanced SOC (State of Charge) and SOH (State of Health) calculations
 - Dynamic Maximum Charge and Discharge Current calculation
- Managed through CAN interface

Case:

- ABS with aluminum rack
- Dust Protection according to DIN 40052 Part.48.
- Splash Water resistant according to DIN 40050 Part 9.
- Vibration proof

Specification

Capacity:	7 kWh (53Ah cells used)
Voltages:	
Max	151.2V
Min	108V
Nominal	133.2V
Current Load:	
Constant	up to 150 A
Peak	less than 250 A

Current consumption

Electronics – see BMS Data Sheet
Power contactor – < 20 mA

Mechanical Characteristics

Weight: 72 kg
Size (external, without plugs): LxWxH: 1490x338x159

Norms and standards

Device is fully compliant with the following norms and safety specifications:

- ISO/DIS 6469-1 Electric road vehicles – Safety specifications – Part 1: On-board energy storage
- ISO/DIS 6469-2 Electric road vehicles – Safety specifications – Part 2: Functional safety means and protection against failures
- ISO/DIS 6469-3 Electric road vehicles – Safety specifications – Part 3: Protection of persons against electric hazards

Manufactured by Wamtechnik for S.A.M. Group AG

Distributed by



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Battery Management System



Functional Description

- Monitoring System for batteries in series and parallel – voltage ranges can be factory configured (for standard Li-Ion, LFP and LTS).
- Monitoring of each cell voltages, temperatures and current
- Automatic cells equalization/balancing during charging and discharging
- 5 galvanically isolated outputs to drive external contactors
- Customizable pre-charge circuit
- Two independent over-discharge and overcharge protections – software (primary) and hardware (secondary protection)
- Hardware over-current detection and protection
- Advanced SOC (State of Charge) and SOH (State of Health) calculations, by coulomb-charge counting and/or estimation by voltage
- Dynamic Current calculations that provide information for auxiliary devices about acceptable charge or discharge current at present battery State of Charge.
- Calculation of internal cell resistance
- Galvanically isolated CAN interface providing battery information to the host system
- Galvanically isolated CPU and ADC circuits
- PC Software available to display and log battery data
- Modular concept: up to 96 cells may be supervised (12 per Monitoring Board)
- No power consumption from supervised cells in standby mode
- Battery grounding control circuit
- Battery data archive: charge/discharge cycles count, battery operating time
- Advanced calibration for voltages and current measurement
- Battery stack re-mapping options – to comply with non-standard battery-pack topologies and interconnection cables compensation
- Compliance with automotive general standards and directives
- Optional G-shock sensor

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Battery Management System

Specification

Current consumption

3V standby (on board battery):	less than 50uA
main battery (operating)	less than 16uA for each cell
main battery (standby)	0,0uA for each cell (relays, galvanic disconnection)
12V CAN:	less than 100mA
12V device (standby):	less than 2mA
12V device (operating):	50mA + 80mA per each MB

Measurements Characteristics

Cell voltages

measurement range:	2.0 – 4.5V
accuracy:	better than 15mV
sampling rate:	10 samples/sec

temperatures

measurement range:	-40 – 85 °C
accuracy:	better than 2.5 °C
sampling rate:	10 samples/sec

current

measurement range:	+/-300A , +/-600A, +/-900A (LEM*) and other supplied with 5V
accuracy:	better than 0.6A
sampling rate:	512 samples/sec

Second Protection Characteristics

overdischarge threshold:	depending of cell chemistry
overcharge threshold:	depending of cell chemistry
overcurrent threshold:	+/- 400A, +/-800A, +/-1.2kA

Other Features

balancing (cell equalization)

type:	passive
balancing current:	up to 0,5A

battery grounding sensor

sensitivity:	<500 Ohm/V
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G-shock sensing

optional G-shock sensor range:	> 5G
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power supply

optional 24V power supply can be arranged for the BMS

fan driver output

instead of water cooling circuit heat-sink with fan can be installed. The fan can be driven directly from BMS.

software boot-loader

firmware updates can be done in-field via CAN interface.

Mechanical Characteristics

BMS consist of the stack of:

n x Monitoring Boards where n = 1 to 8 depending number on cells in the main battery

1 x Controlling Board with piggy-back Supply Board

optional 1 x Current Transducer Board (300A, 600A, 1000A)

BMS can be delivered with optional universal cable harness. The proper cabling should be custom designed for the target system and is essential to successful system operation.

Board Dimensions

The size (W x L x H) of individual board is 100mm x 185 x 13,2mm

Stacking Dimensions

Total outside size (W x L x H) of BMS depends on Monitoring Boards number and can be calculated as:

100mm x 185 x (2+n)*13,2mm where n = 1 to 8 depending number on cells in the main battery

Norms and standards

BMS V3.50.xx is fully compliant with the following norms and safety specifications:

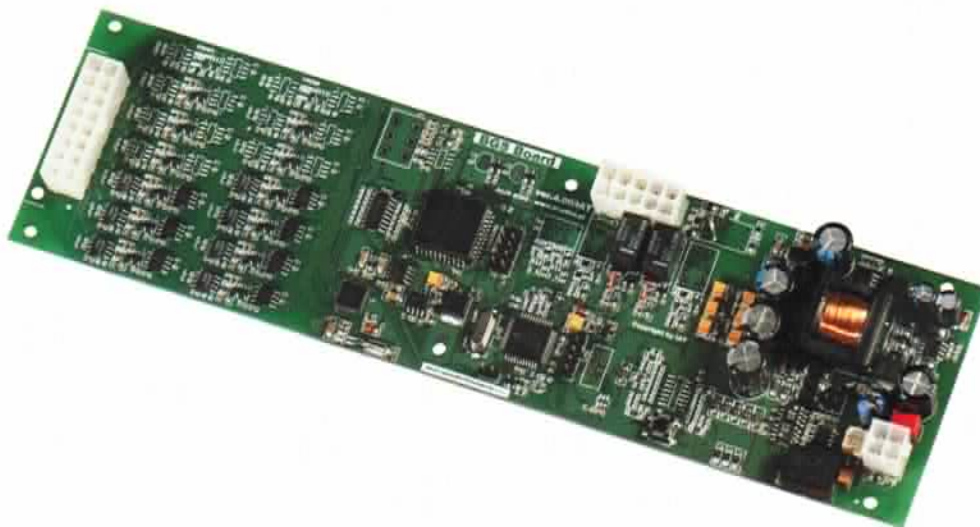
ISO 6469-1 Electric road vehicles - Safety specifications

EN 60664-1 Insulation coordination for equipment within low-voltage systems.

73/23/EEC Electrical Equipment - Low Voltage Directive



Battery Guard System



Functional Description

- Battery Guard System (BGS) for Lithium-Ion, Lithium-Polymer or Lithium Ferro-Phosphate cells connected in series (parallel cells seen as a single cell)
- Monitoring cell voltage
- Monitoring flowing current & energy counting option (with optional current sensor)
- Monitoring battery block and PCB temperature
- Dual software and hardware (analog) over-discharge and over-charge protections
- 3 galvanically isolated relay outputs for signaling alarms and/or user defined events
- Customizable pre-charge circuit
- Optional autonomous, processor driven cells balancing board with following features:
 - Cell equalization during charging and discharging,
 - Independent from analog measurement circuit
 - Dynamically (software) configurable equalizing current
- Galvanically isolated digital/analog interface providing battery information to the host system (CAN or other factory configurable interface)
- Can be operated as a single stand alone device or as a part of distributed system
- Very low power consumption from supervised cells

Specification

Power consumption

Powered from main battery	from range 10-68VDC
Main battery (analog only)	less than 0,5W
Main battery (analog & digital part)	less than 1,5W
Main battery (equalizing mode)	less than 0,4W

Measurements Characteristics

Cell voltages

Maximum measured cell no.	up to 16
Measurement range:	0.5 – 4.5V DC
Measurement precision:	1 mV
Measurement accuracy:	<3 mV

Equalization Characteristics

Maximum balanced cell no.	up to 16
Balancing current:	up to 1,5A
Cooling:	heat-sink required
Cell load when disabled:	<0,1µA
Overheat protection:	yes

Mechanical Characteristics

BGS consist of the single board mounted directly on a prismatic cell stack or conneted to the cells wia cables:

Board Dimensions

The size (W x L x H) of individual 14-cell board is 190 x 60 x 19mm

Optional Features

Could be delivered with customized number of channels for larger quantities. Optional custom software modifications on request.