

Battery for automated robotic systems in logistics



Lithium-Battery Pack with protection electronics (BMS single cells monitoring), protects the battery against overcharge, deep discharge, and short circuit, Implemented cell balancing, with BMS-interface for service purposes (number of cycles, capacity, temperature, etc.)

Applications

- Automated robotics systems in logistics
- Industrial Robot
- Automotive
- Military
- Medical
- and others

Pack Specifications	
Nominal Voltage	48.0 V
Capacity (Nominal) @0.5C	22800 mAh $\pm 6\%$
Energy	1094.4 Wh
Weight	9400 grams $\pm 50g$
Size, Max. (L x W x H) mm	280 x 253 x 87 ± 2
Operating Specifications	
Operating Voltage	43.0 V to 54.0 V
Charge Voltage	(Max. 54.0 V) $\pm 0.75V$
Discharge End Volt.	42.0V
Operating Temperature:	
Discharge	-10°C to 60°C
Charge	- 0°C to 50°C
Max. Discharge Current	30A continuous 45A (0°C-50°C) 65 A $\pm 5A$ (Peak)
Max. Charge Current	22A continuous @ (0°C-50°C) 40 A $\pm 5A$ (Peak)
Storage Specifications	
Storage Temperature	1 year : -20~25°C(1*)
Rh: (0% ~ 75%)	4 months : -20~45°C(1*)
SoC: State-of-Charge $\geq 70\%$	1 month : -20~60°C(1*)

Note (1): If the cell is kept as ex-factory status ($\geq 30\%$ of charge), the capacity recovery rate is more than 80%.

Standard charging method

0.5C CC (constant current) charge to Max. 54.0V, then CV (constant voltage Max. 54.0V) charge till charge current decline to $\leq 0.02C$

Overcharge/Overdischarge/Overcurrent Safety Circuits:

The controller IC measures the voltage for each cell (or for each parallel battery block) and shuts off a control switch to either prevent overcharging (if the voltage exceeds the specified voltage range) or to prevent over discharging (if the voltage falls below the specified voltage range). Moreover, the voltage of the control switch is measured on both ends and in order to prevent overcurrent, control switches are shut off if the voltage exceeds specifications.

• The Functions of the Safety Circuits (typical functions)

The voltages listed below are typical values and are not guaranteed. The charge voltage varies according to model number.

1. The Overcharge Safety Function

The charge stops when the voltage per cell rises above 3.85 ± 0.05 V.
The charge restarts when the voltage per cell falls below 3.50 ± 0.05 V.

2. The Overdischarge Safety Function

The discharge stops when the voltage per cell falls below 2.8 ± 0.05 V.
The discharge restarts when the voltage per cell rises above $3.1 \pm 0.5V$.

3. The Overcurrent Safety Function

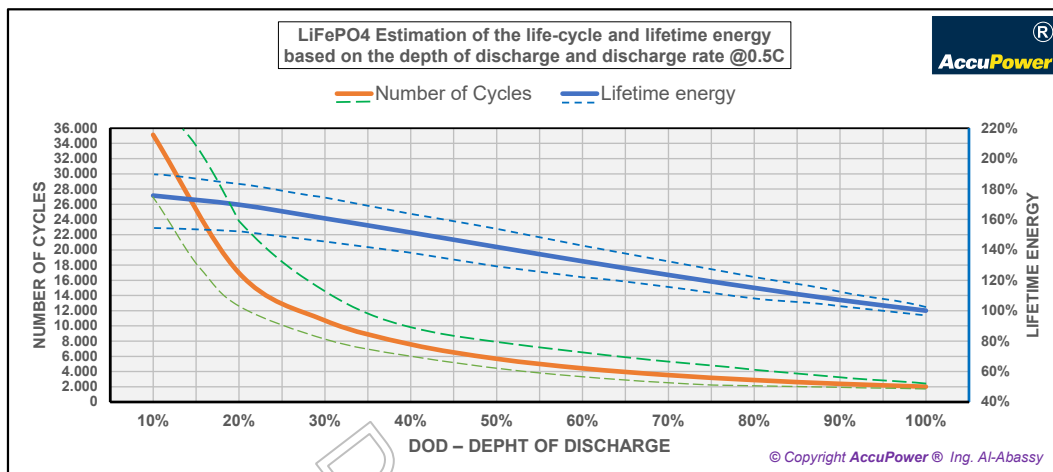
The discharge is stopped when the output terminals are shorted. The discharge restarts when the short is removed.

NOTE:

Cycle Characteristic:

100% DOD	> 2000 cycles
80% DOD	> 3000 cycles
50% DOD	> 5000 cycles
30% DOD	> 8000 cycles

the residual capacity $\geq 80\%$ of the nominal of the nominal capacity at the 0.2C rate and standard Operating conditions.



(This applies to use under optimal conditions!)

In general, the aging of the batteries is accelerated with a higher C-rate, Temperature and an increasing the DOD as well as SOC-value. Our research has shown that the SOC value has a major influence on aging, with higher C values in the lower SOC values even causing less aging than the lower C values in the higher SOC values.

(It should also be noted that the lifespan of the LiFePo4 Rechargeable is very long. Doing thousands of cycles means many years of continuous operation. Added to this is the natural aging of the material, which also affects its service life)

Transportation

Transport according to the current regulations: ADR / RID / ADN / IATA / IMDG

Class: 9 / UN-Number: UN3480

Shipping name: Lithium-ion batteries

Environmental hazards / Marine pollutant: No

Care and safety recommendations:

Never open, short circuit or put in fire. Do not install backwards. Avoid short circuit with metal objects.

ATTENTION:

Please pay attention to following recommendations:

1. Always avoid Deep discharge of the battery
2. Charge the battery before longer Storage.
3. Use only the battery charger specified for this battery type.
4. Do not leave battery in charger over 24 hours.
5. Keep it in a cool and dry place.
6. Avoid exposure to high temperatures.
7. Do not disassemble or modify the battery, may cause the battery to generate heat, explode or ignite.
8. Dispose properly used batteries. Dispose it according to the applicable recycling regulations. Contact your city recycling coordinator. Thank you.



ATTENTION! Recharge batteries immediately after receipt:



Due to the new IATA Dangerous Goods Regulations since April 2016, the state of charge condition for air transport must not exceed 30% of the nominal capacity!

NOTE:



15S6P FR26650 Lithium-LiFePo4 Rechargeable Battery Pack

If you receive a battery pack with airfreight with 30% charge and it will be sent by air again after storage, the state of charge 30% must be checked every 2 months and recharged according to 30%.

NOTE:

Communication Connector for AccuPower 15S6P Battery-Packs:

Receptacle, Cable assembly:

PIN number 1: P+ Wire color Red

PIN number 2: SM Clock (SMC) Wire color Green

PIN number 3: SM Data (SMD) Wire color Yellow

PIN number 4: P- Wire color Black

PIN number 5: PRES Wire color Blue

(Enable Pin: Enable PIN pull down to Ground to enable battery (on Ground = ON, Open = OFF))

SM Bus Data (V1.1 konform)

Device address: 0x16 (default)

Bus frequency: 100kHz (default)

Bus voltage: 3.3V

Following information's can be accessed via the SMBus. / Folgende Informationen können über den SMBus abgerufen werden.

The values "actual current", "avg. current", "remaining capacity" and "full charge capacity" are scaled down by factor 10 due to high battery power and capacity.

Funktion / Function	Register	Type	Min Value	Max Value	Einheit / Unit
State of charge / Aktueller Ladezustand	0x0D	U1	0	100	%
Remaining capacity / Verbleibende Kapazität	0x0F	U2	0	65535	10 mAh
Full charge capacity / Vollständige Kapazität	0x10	U2	0	65535	10 mAh
Battery voltage / Aktuelle Akkuspannung	0x09	U2	0	65535	1 mV
Average current (smoothed) / Durchschnittlicher Strom	0x0B	I2	-32768	32767	10 mA
Actual current / Aktueller Strom	0x0A	I2	-32768	32767	10 mA
Battery temperature / Akkupack Temperatur	0x08	U2	0	65535	0.1 °K
Average time to „Empty“ at actual current / Voraussichtliche Zeit bis „Akku leer“ bei momentanem Strom	0x12	U2	0	65535	minutes
Average time to „Full“ at actual current / Voraussichtliche Zeit bis „Akku voll“ bei momentanem Strom /	0x13	U2	0	65535	minutes
Cycle count / Zyklenanzahl	0x17	U2	0	65535	cycles
Serial Number / Seriennummer	0x1C	H2	0x0000	0xFFFF	-

Abbreviations:

U1 unsigned integer of 1byte size

U2 unsigned integer of 2byte size

I1 signed integer of 1byte size

I2 signed integer of 2byte size

H2 unsigned integer in hex format

Die Daten liegen im Little Endian Format vor / the data is provided in little endian format.

Achtung, Bat- und Bat+ darf nicht mit mehr als 100 mA belastet werden (Kurzschlussgefahr) /

Attention, Bat- and Bat+ must not be loaded with a higher current than 100mA (Danger of short circuit)

For PC to battery communication you will need a SMBus to USB Converter (EV2400 from Texas Instruments) and as PC GUI the "Battery Management Studio" is needed. With this device all battery BMS data could be read out.

NOTE: