

Smart Battery

LiFePO₄ 12.8V

Application Notes

Please read all of the instructions in this application note before transportation, installation, storage and maintenance of your Smart LiFePO₄ Battery

Battery Features

Construction	The Smart LiFePO4 battery is constructed from a combination of 32650 cells
Outstanding Life Cycle	The Smart LiFePO4 batteries are manufactured to last and will outperform (by as much as 10x) the life cycle of conventional lead acid, gel and AGM batteries
Built in Battery Protection: BMS	A Battery Monitoring System (BMS) is fitted to every battery to keep it in optimal operating condition, by monitoring and equalising the charge for each individual cell in the pack. The BMS also provides protection for charging, discharging and overload conditions.
Wide operating temperature range	Smart LiFePO4 batteries operate reliably over a wide range and provide unmatched high temperature performance
Light weight	LiFePO4 batteries are on average 70% lighter than same sized lead acid batteries which make them attractive for mobile or portable applications.
Higher charging efficiency than conventional batteries	Up to 30% of the energy is lost when charging lead acid batteries due to inherent cell inefficiency. The lost energy is converted into heat and results in an undesirable temperature rise in the battery. Charging of LiFePO4 batteries is 98% efficient and causes negligible battery heating. This makes the Smart Battery the preferred choice for storing energy from renewable resources, where every joule of energy is precious and not to be wasted on battery inefficiency
Faster charging	Lead acid batteries typically take 12 to 16 hours to charge and absorb about 70% of the bulk charge in the first 5 to 8 hours (boost) and the remaining 30% top up charge (float) in 7 to 10 hours. This is not a desirable characteristic for replenishing depleted batteries employed in standby or emergency systems. The Smart Battery is the preferred choice for storing energy from renewable sources (such as solar or wind) as these batteries can be recharged in 4 to 5 hours at normal charge rates or in 1 hour at accelerated charging rates
Flat Discharge Curve	LiFePO4 batteries exhibit excellent voltage stability whilst discharging and will supply voltages in excess of 12 Volt for 90% of the full discharge period
Low self-discharge rate	LiFePO4 batteries exhibit excellent self-discharge characteristics and typically retain 65% of their charge after standing for a year, or 90% of their charge after 3 months. Most lead acid batteries will be depleted after 3 months of standing.
Robustness and Orientation	LiFePO4 batteries can withstand relatively high levels of vibration and shock and can be mounted in any orientation
Environmental Impact	Lead acid batteries require much more raw material than lithium-ion batteries to achieve the same energy storage, consequently the mining process has a much larger impact on the environment. The lead processing industry is also very energy intensive, leading to large amounts of pollution. Lithium iron phosphate batteries are far less toxic to produce and recycle. Even when compared to other lithium battery technologies, LiFePO4 batteries use more abundant and non-toxic materials, that can be produced with less energy.

Safety Features

The Smart LiFePO4 batteries have been engineered for safety and the internal BMS can withstand over charge, over discharge and short circuits with out the risk of fire or explosion.

The individual cells have also been engineered to withstand puncturing by a sharp objects without the risk of fire or explosion. The Phosphates which are used in the cathode material are stable under short circuit conditions, making LiFePO4 batteries inherently superior and safer than other Lithium-ion batteries.

Electrical Characteristics

Nominal Voltage	12.8 V
Nominal Capacity	40 Ah (at 0.5C and 25°C)
Minimum Capacity	38 Ah (at 0.5C and 25°C)
Battery life Cycle	More than 3000 (at 0.2C charge and discharge rate at 25°C and 80% depth of discharge).

Mechanical Characteristics

Battery Size	5 Ah	10 Ah	20 Ah	40 Ah	80 Ah	100 Ah
Length (mm)	151	151	181.5	198		
Width (mm)	65	98.5	77	166		
Height (mm)	95 (+10)	98.5	166	170 (+15)		
Net Weight (kg)	~0.8	~1.8		~5.5		

All Dimensions tolerances are +/- 1mm and subject to change without notice

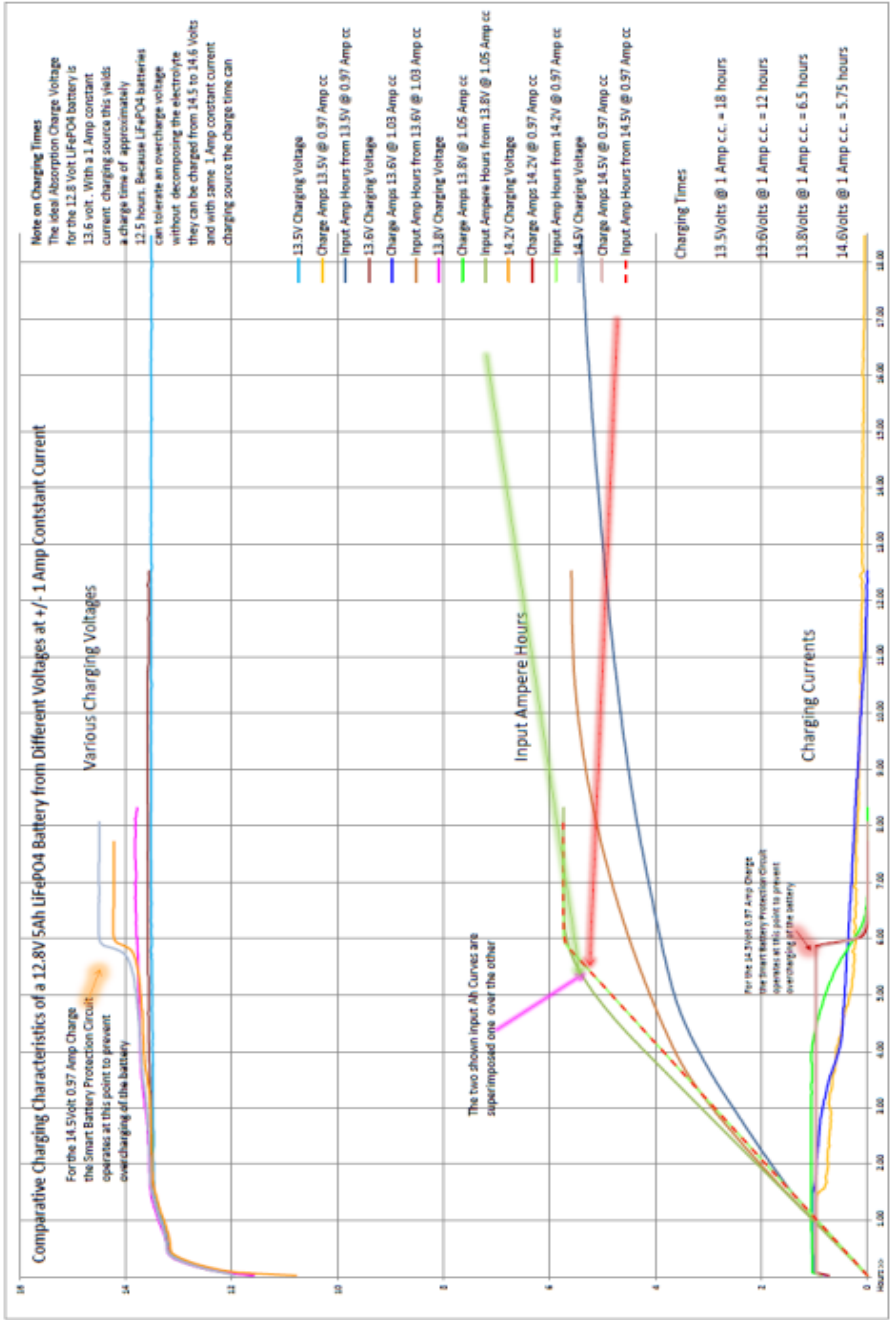
Smart Battery Protection

Over Charge Protection	15.6 V +/-0.2 V
Over Charge Detection Delay	960mS to 1.4 Secs
Over Charge Reset	15.2 V +/-0.2V
Max Charge Voltage	14.5 to 14.6 Vdc
Over Discharge Protection	8.0 V +/-0.2 V
Over Discharge Detection Delay	115 mS to 173 mS
Over Discharge Protection Reset	9.2 V +/-0.2V

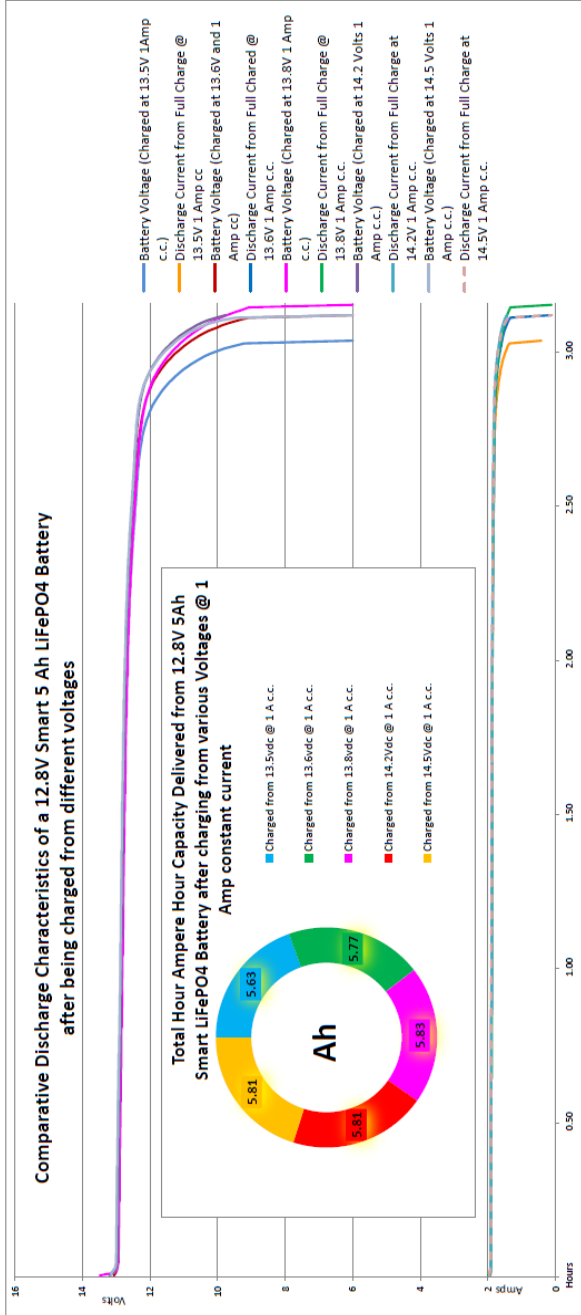
Operational Conditions

Charge Method	Constant Current–Constant voltage CC-CV
<p>Two Stage Charging: 1st stage = Bulk Stage Recommended Constant Current Charging from 14.2 to 14.5 Volts dc Switch to absorption stage at 14V 2nd Stage = Absorption Stage Charge from 13.8 Volts and terminate charging (disconnect from charger) when charge current drops below 5% of Capacity Rating</p>	<p>20% of Capacity Rating for eg (0.2x5Ah = 1 Amps) (0.2x20Ah = 4 Amps) (0.2x40Ah = 8 Amps) (0.2x100Ah) = 20 Amps)</p> <p>Disconnect charger at 0.05xAh for eg: (0.05x5Ah = 250mA) (0.05x20Ah = 1 Amp) (0.05x40Ah = 2 Amps) (0.05x100Ah = 5 Amps)</p>
<p>Single Stage Charging Fast Charge This will charge the battery to 95% of full capacity but will take less than 6 hours <i>Terminate Charging (disconnect from charger) when current falls below 5% of capacity</i></p>	<p>Constant Current–Constant voltage CC-CV From 14.5V at current limited at 20% of Capacity Rating. See examples above for calculating values</p>
<p>Single Stage Charging Slow Charge This will charge the battery to 100% of full capacity but can take up to 18 hours <i>Terminate Charging (disconnect from charger) when current falls below 5% of capacity</i></p>	<p>Constant Current–Constant voltage CC-CV From 13.8V at current limited at 20% of Capacity Rating. See examples above for calculating values</p>
<p>Single Stage Charging Emergency Fast Charge- not recommended for extended battery life This will charge the battery to 94% of full capacity but will reduce battery life cycles <i>Terminate Charging (disconnect from charger) when current falls below 5% of capacity</i></p>	<p>Constant Current–Constant voltage CC-CV From 14.5V at current limited at 100% of Capacity Rating. This fast charge method will reduce the rated overall battery life cycle</p>
Max Charge Voltage	14.5-14.6 V
Max Charge Current	40 Amps
Max Discharge Current	40 Amps
Peak Discharge Current	80 Amps (10 Seconds)
Discharge Cut off Voltage	10.0 V
Charge Temperature	0 °c to 45 °c
Operational Temperature	-20 °c to 65 °c
Self-Discharge Rate	less than 3% per month (stored at 50% SOC)
Storage Temperature	-20 °c to 45 °c
Long Term Storage Temperature	10 °c to 45 °c

Charging Curves



Discharge Curves



Precautions

In order to prevent Battery Leakage, Over Heating and or Exploding

Observe the following:

- o Keep the battery in cool dry conditions and well shielded from sources of heat radiation
- o Never submerge the battery or allow the battery to get wet
- o Do not apply reverse polarity to the battery
- o Do not allow the battery terminals to be shorted and take care to prevent the terminals coming into inadvertent contact with, tools, metal brackets or enclosure bodies
- o Never store or transport the battery with metal or loose conductors
- o Never crush, throw, drop or allow impact to the battery
- o Never pierce or cut through the battery casing
- o Never use the battery beyond its temperature limits. This will cause overheating possible fire and or explosion and environmental pollution
- o Never dispose the battery in a fire or incinerating machine as this will result in battery explosion and environmental pollution
- o Never use the battery under strong magnetic or high voltage fields as this may interfere with or destroy the smart battery monitoring system
- o If the battery electrolyte has leaked and accidentally come into contact with eyes, do not rub eyes, wash with plenty of water and seek immediate medical attention.
- o Should any battery exhibit any form of physical distortion, bad smell, heating or uncharacteristic operation cease charging and use of the battery and remove it from its place of installation and place it in a safe area
- o Never connect the battery to an AC or unregulated DC supply: Always use a suitable charger to charge the battery
- o Prior to charging always check the battery condition. Ensure there is no physical damage and that the battery voltage is above the discharge protection voltage. If the voltage is below this level this is an abnormal condition and the battery must be returned to the supplier for analysis and possible repair.
- o The battery should be put into storage at 50% SOC and should be recharged and cycled every six months to maintain the battery's optimal operating parameters.
- o Ensure that the battery terminals and connections are kept clean, tight and in good condition as a bad contact can cause battery malfunction or damage.
- o Batteries should be regularly inspected and corrective action taken if necessary
- o Do not disassemble the battery and if the housing is damaged take care not to touch exposed contents
- o Do not dispose of battery and send for appropriate recycling