1. Other Types of Rechargeable Batteries for SA PV
   a. Nickel-Cadmium (Ni-Cd) Batteries

   → early type invented in 1899
   → construction:
      1. positive electrode plate: nickel oxide-hydroxide: anode
      2. negative electrode: cadmium: cathode
      3. electrolyte: KOH (potassium hydroxide): alkaline
      4. separator: a permeable membrane between the anode and cathode

   → nominal cell voltage: 1.2V

   → comparison with Pb-acid batteries
      1. Ni-Cds can be overcharged
      2. " " " " fully discharged
      3. " " have excellent low temp. performance
      4. " " can be frozen without damage
      5. " " " " charged at a much higher rate
      6. " " " maintain uniform voltage during discharge
      7. " " " have longer life
      8. " " " low maintenance requirements
      9. " " " low internal resistance
      10. " " " low discharge when unused
      11. " " " typically 2 to 3 times more expensive
      12. " " have lower storage efficiency (60% to 70%) disadvantage
      13. " " have a "memory effect" and must be fully charged and discharged or lose storage capacity
      14. Cd toxicity
b. Nickel-Metal-Hydride (NiMH) Batteries

- Work to develop NiMH battery technology began in 1967
- Construction: (similar to Ni-Cd batteries)
  1. Positive electrode: nickel oxyhydroxide
  2. Negative electrode: hydrogen absorbing metal alloy instead of Cd
     - 2 commonly used alloys: AB5 and AB2
       - AB5: A: rare earth mixture of lanthanum, cerium, neodymium, praseodymium,
         B: Ni, Co, Mn or Al
       - AB2: A: Ti or vanadium
         B: Zr or Ni, modified with Cr, Co, Fe or Mn
  3. KOH electrolyte
  4. Separator
- Nominal cell voltage is 1.2V (like Ni-Cd's)
- Higher energy efficiency than Ni-Cd's (80% to 90%)
- Memory effect less pronounced than with Ni-Cd's
- Less tolerant to voltage reversal than Ni-Cd's
- No Cd → possibly less toxic

c. Lithium-Ion (Li-Ion) Batteries

- Construction:
  1. Negative electrode: carbon (usually graphite)
  2. Positive electrode: one of three materials:
     i. a layered oxide such as lithium cobalt oxide
     ii. a polyanion such as lithium iron phosphate
     iii. a spinel such as lithium manganese oxide
5. electrolyte: typically a mixture of organic carbonates
   → must be non-aqueous
   → pure Li is highly reactive with water, forming lithium hydroxide and hydrogen gas

→ nominal cell voltage is 3.6 V
→ sealed for safety
→ Li results in a safety risk to explosion or fire
  → need to prevent: ① over-charging
     ② over-discharging
     ③ over-current
     ④ short-circuit
     ⑤ high temperatures
     ⑥ charging below 0°C

→ Compared to Pb-acid batteries:
   ① no heavy metals (Pb)
   ② may last longer
   ③ may weigh less
   ④ may cost less (over PV system lifetime)
Thank you for choosing Smart Battery®. We are committed to protecting the environment, health and safety of our customers and planet.

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Lithium Ion Chargers
Lithium Ion Solar Batteries

Lithium Ion Solar Batteries

Lithium Ion Solar Batteries are the ideal match for Solar Energy Storage Needs. Whether you already have a Solar System or you intend to have one installed, SmartBatteries can be your answer for Solar Energy. SmartBatteries give you the chance to replace your old obsolete battery storage system with the perfect match for Solar Systems. If you have a Solar Energy System with energy storage you know that you can only use the power generated when the sun is out. You cannot store and use it for other times. Much of your energy savings is not used, it is wasted. You also know your existing energy storage system for your solar system is inefficient, obsolete and a problem waiting to happen. Typical Lead Acid Batteries used for solar energy storage have many problems including: they are almost never adequate to handle generated energy storage needs, do not efficiently and effectively store generated power, do not last long, are they very heavy and made of a toxic material. If you are installing a new Solar System, SmartBatteries give you the chance to do energy storage right from day one. If you want a Solar System that can maximize use of energy from the sun SmartBatteries are your answer allowing you to store all of the solar generated energy and use it whenever you want. Most important for you are the facts that SmartBatteries can last for the duration of most solar energy systems meaning you buy the SmartBatteries and you are done. And considering their longevity and the efficiency they are less costly than the heavy and toxic Lead Acid batteries. If you want to "go green" the lithium ion SmartBatteries are not only virtually indestructible but they are non-toxic. The SmartBattery System is easily installed by Companies like Solar Source in Tampa Bay and those elsewhere. Many are finding that by coupling Smartbatteries with solar a Solar PV System they are not only saving money, but becoming energy independent, having a perpetual power back-up power system and making our planet a better and cleaner environment. If you want more specifics on what makes a SmartBattery so different here is a video explaining this fantastic technology.

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12V 20AH LITHIUM ION Price $2,399.99
12V 15AH LITHIUM ION Price $1,899.99
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12V 80AH LITHIUM ION B Price $1,049.99
12V 75AH Lithium Ion Batt Price $999.99
12V 50AH LITHIUM ION B Price $699.99
12V 40AH LITHIUM ION B Price $579.99
LG 300 Watt Solar Panel Price $499.99
12V 20AH LITHIUM ION B Price $289.99
12 / 24V 40A Solar Charge Price $201.54
12 / 24V 20A Solar Charge Price $149.79

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**SCM25 MPPT**

The SCM25 MPPT is Mastervolt's smallest MPPT charge regulator and just as powerful as its big brother. With 200 to 700 Wp in solar panels, switchable output and buzzer, this Solar ChargeMaster is very well suited to small and medium systems.

The innovative technology in the Mastervolt MPPT charge regulators increases the efficiency of the solar panels. The SCM25 MPPT charges your batteries up to 30% faster than PWM regulators – with the same number of panels.

**MPPT charge regulator for all solar panels**

Besides the traditional 36 and 72-cell panels, the SCM25 MPPT is also ideal for the inexpensive 60-cell panels. The high PV voltage makes it possible to connect several panels in series, significantly reducing the required cable length, installation time and power loss in solar cables.

**Easy to use, safe and flexible**

The SCM25 MPPT is suitable for all battery types, including Mastervolt Lithium Ion. The charging profiles for all types of batteries are pre-programmed and can be selected at the push of a button. The SCM25 MPPT is quiet and equipped with a very user-friendly, clear display. Built-in protection against overload, high/low battery voltage, overheating, short circuits and reverse polarity ensures that safety comes first. Moreover, the SCM25 MPPT has a robust casing and is protected against condensation in conformity with IP23.

* Very high efficiency for faster charging.
* Stable, accurate Mastervolt Maximum Power Point Tracker.
* Up to 30% faster charging compared with PWM technology.
* Suitable for inexpensive 60-cell panels.
* Capacity for solar panel configurations from 200 to 700 Wp.
* Suitable for all battery types, including Mastervolt Lithium Ion.
* Automatic 12/24 V detection.
* Flexible charging characteristics.
* Battery temperature sensor for long lifespan.
* Large and bright display.
* Secure switchable output.
* Safe operation, audio signal in case of malfunctions.
* Very quiet operation.
* Robust casing, suitable for humid environments (IP23).
Solar/PV AGM Batteries

Find maintenance-free, leak-proof replacement deep cycle batteries for your solar panel system at BatteryStuff.com. Unlike gel cell batteries, deep cycle AGM batteries are suitable for most solar charge controllers, requiring no special charger. Choose from top brands like Lifeline, Scorpion, Trojan and Universal to maximize your PV system with a reliable power source.

30 to 55 AH | 56 to 110 AH | 111 AH

### 30 to 55 Amp Hour AGM Batteries for PV and Solar Applications

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>Model</th>
<th>Price</th>
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<tr>
<td>MK Battery 12 Volt 32 AH Deep Cycle AGM Battery</td>
<td>BAU1H</td>
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<td>Scorpion 12v 33 AH Deep Cycle Sealed AGM Battery</td>
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<td>Lifeline 12v 33 AH Deep Cycle Sealed AGM Battery</td>
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<td>Scorpion 12v 50 AH Deep Cycle Sealed AGM Battery</td>
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