

Engine Start Module Product Overview



The Problem



❖ Trucks do not start due to weak or discharged batteries

- Hotel load drain on batteries
- Anti-idle Laws requiring more frequent starts in all weather conditions



❖ Costly downtime

- Jump starts
- Regular battery replacement
- Lost productivity



Maxwell Technologies Engine Start



Maxwell Technologies designed the Engine Start Module as an easy to install solution to enhance starting reliability in mission critical trucking environments for engines up to 15L.

By incorporating its patented ultracapacitor technology into an industry standard Group 31 form factor, Maxwell has developed a never before seen solution to improve efficiencies, create a more reliable fleet of trucks, reduce downtime & service costs, and improve return on investment.



Engine Start Module



Product Specification:

- 12V system voltage
- 16V maximum start voltage
- Up to 1900A starting current
- 15 minute recharge
- 3 cranks per charge cycle
- Built-in charger
- Water, shock and vibration resistant

Prototype



L: 13" W: 6¹³/₁₆" H: 9⁷/₁₆"
(330 mm x 173 mm x 240 mm)

Maxwell Technologies Engine Start

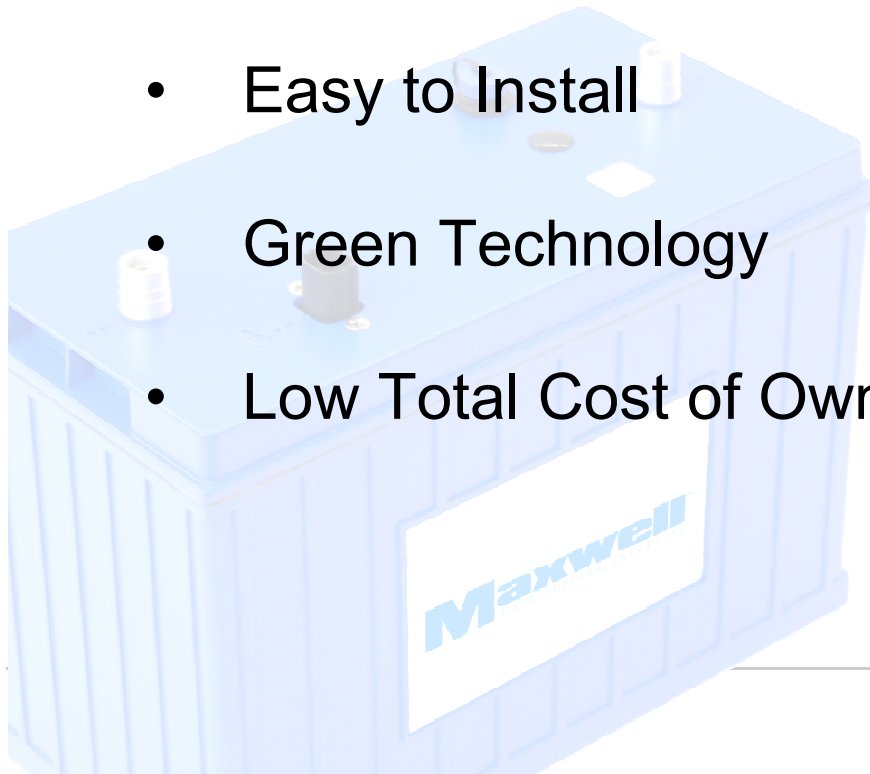


Key Value Proposition:

- Engine start reliability
- Easy to Install
- Green Technology
- Low Total Cost of Ownership



**BCI Group 31
Form Factor**



Engine Start Reliability



The Maxwell Engine Start Module provides improved starting reliability in the following circumstances where lead acid batteries fail...

- Situations when batteries are discharged
- Cold weather environments down to -40°
- Frequent starting requirements due to anti-idle laws / air pollution reduction



With Batteries



Benefits



Maxwell Technologies Engine Start Module includes these additional benefits....

- Engine Start Module lasts the lifetime of the truck
- By improving overall system power performance, lead acid battery life is extended
- Engine Start Module charges fully in 15 minutes or less



Easy to Install



Maxwell Technologies developed the Engine Start Module with ease of installation as a top consideration. The product was developed in a standard lead acid battery size and is installed in the following 5 easy steps

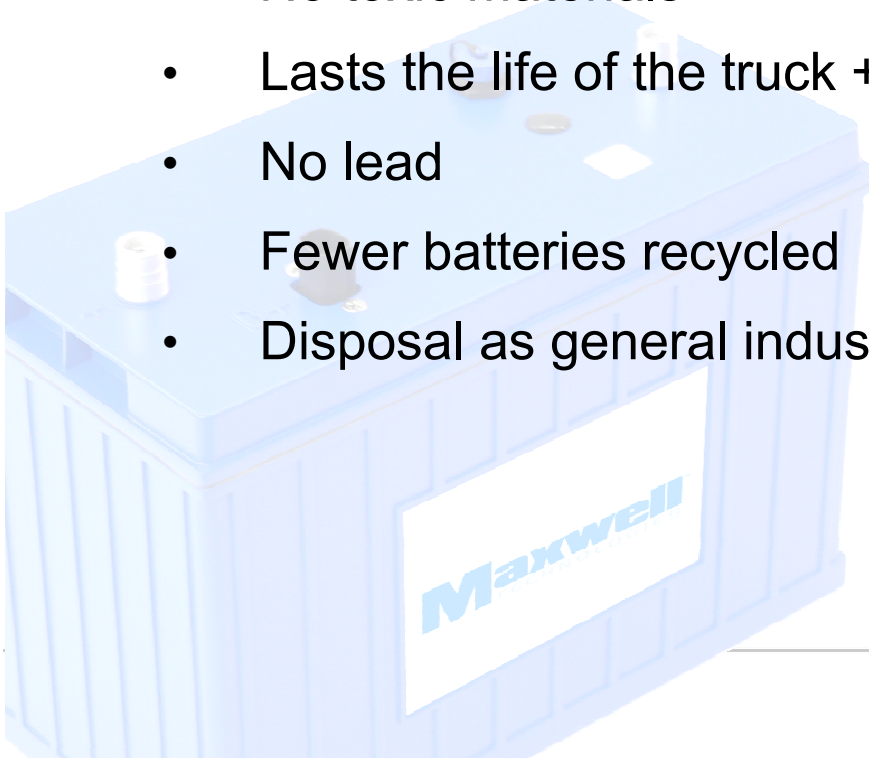
- 1 Disconnect battery from starter (1 cable)
- 2 Connect starter to Engine Start Module (2 cables)
- 3 Connect battery to Engine Start Module (1 cable)
- 4 Charge for 20 minutes
- 5 Start Engine

Green Initiatives



By incorporating Maxwell Technologies patented Ultracapacitor technology, the Engine Start Module provides fleets with an advanced, economical and Green Technology....

- No toxic materials
- Lasts the life of the truck ++
- No lead
- Fewer batteries recycled
- Disposal as general industrial waste



Total Cost of Ownership



By extending life of lead acid batteries and minimizing the need for expensive jump starting, the Maxwell Engine Start Module delivers a high value and a significant ROI for Fleets....

ROI Model: (Data used in calculations considered conservative)

- Truck life: 4 years
- Battery costs: \$200 / year (4 batteriesx\$200, 2 year replacement)
- Jump start: \$600 / occurrence
- **Direct value = \$1,400**

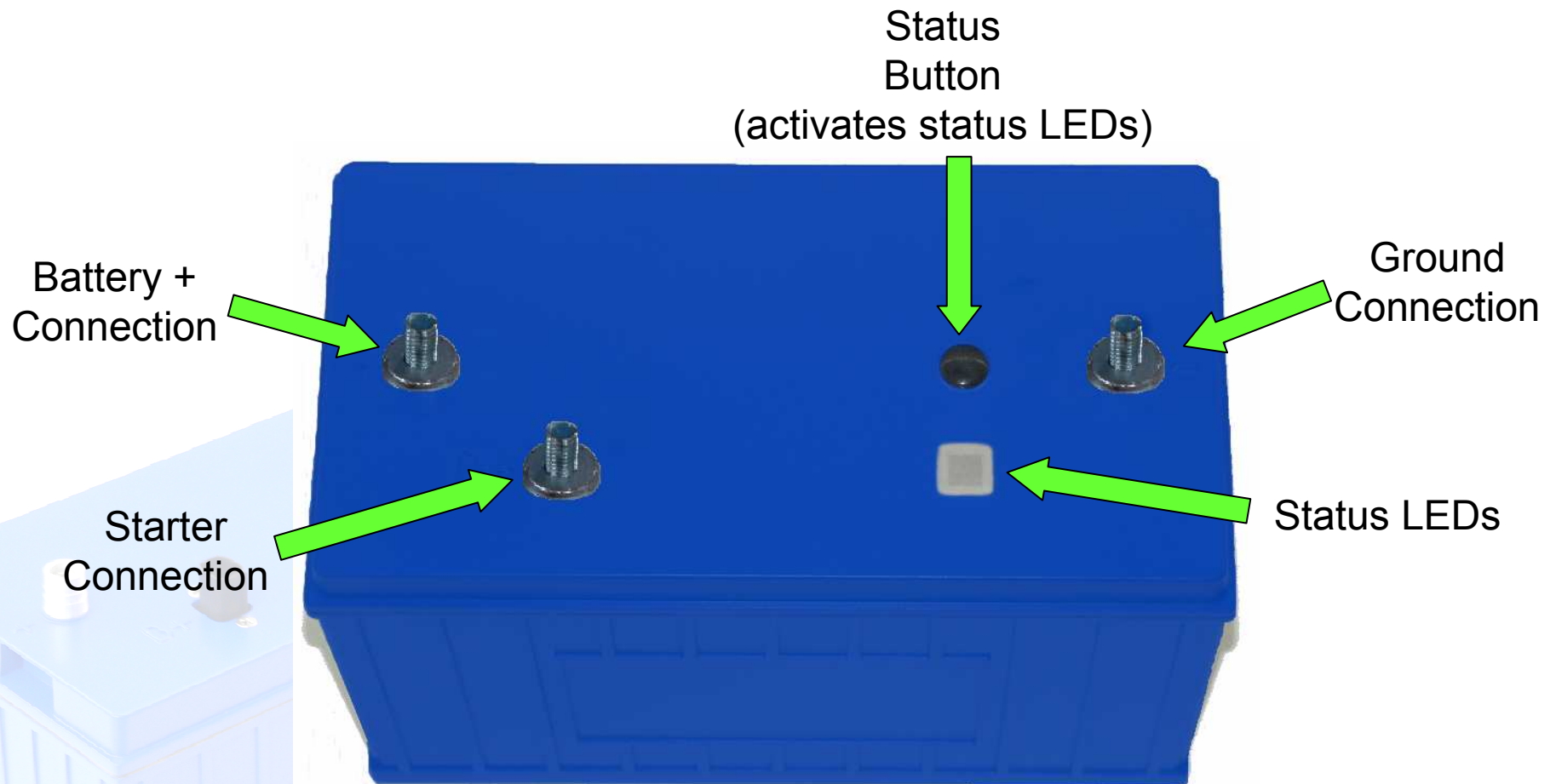
Other Factors Not Considered:

- Cost of downtime: late delivery, lost product (perishable goods)
- Weight savings (carry more load or fuel savings)
- Residual value of module
- **Fuel savings due to not idling**

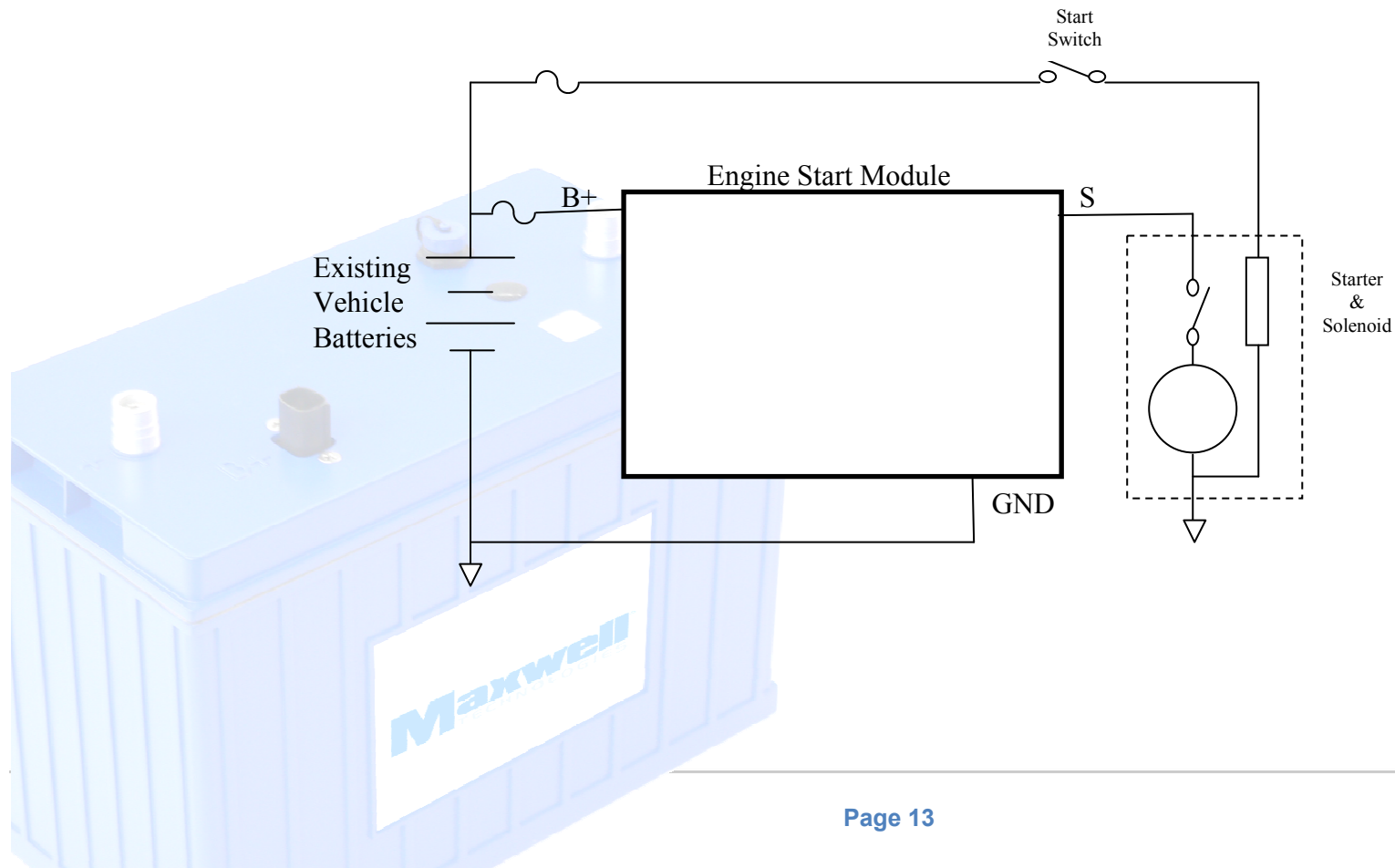
Technical Background



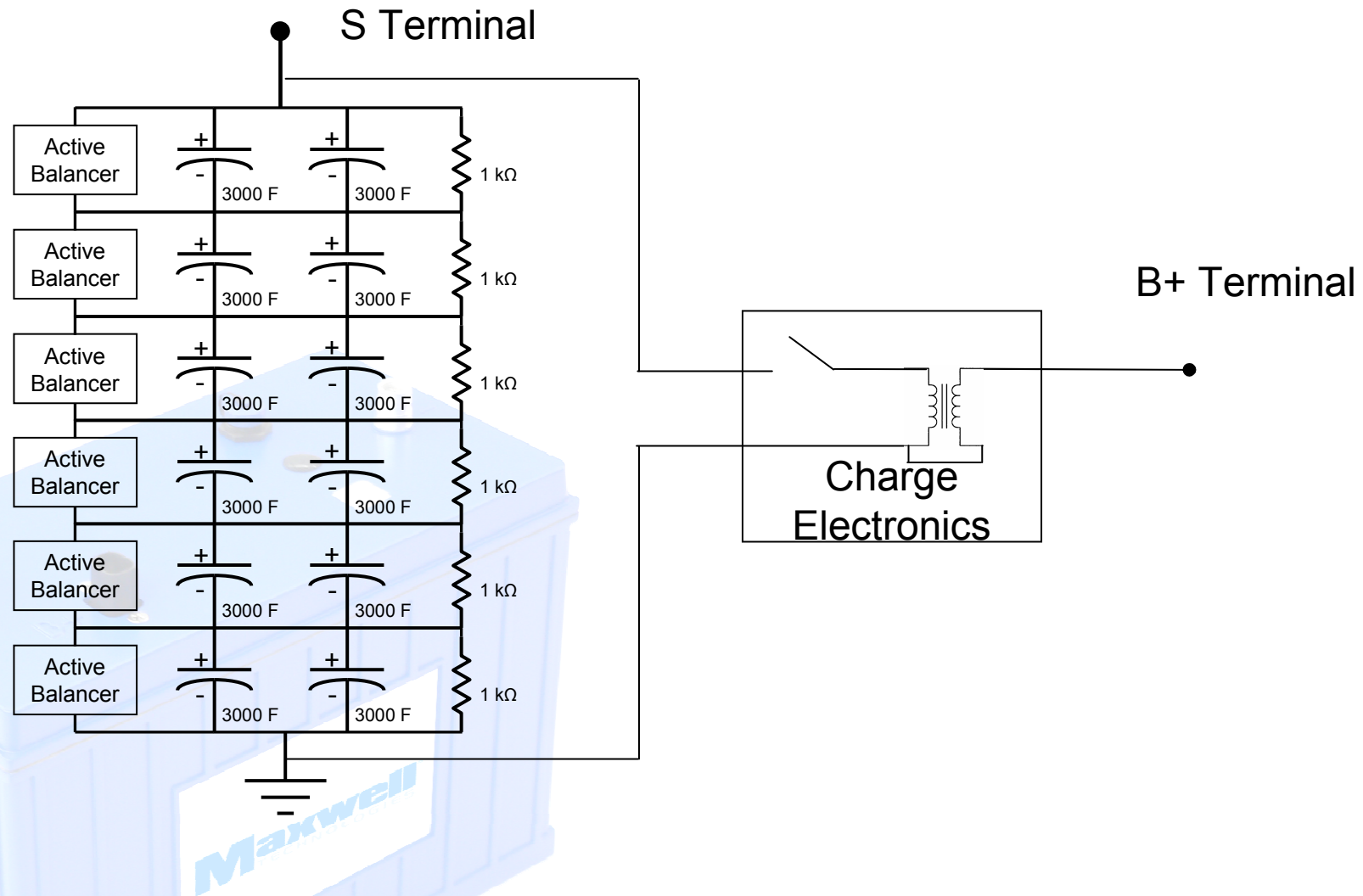
Module Details



System Level Diagram



Module Block Diagram Configuration



Summary



- Maxwell Technologies Engine Start Module provides reliable starting for large transport trucks in all weather conditions and in support of anti-idle laws (higher frequency of starts)
- The ESM is easy to install and provides a significant return on investment
- Like all Maxwell energy storage products, the ESM is a green solution for engine starting

