

Technical Note

Link

512-0096-01-01 Rev 1

Negative or Positive Amp-Hour Accumulation

Introduction

When monitoring a battery bank with a Link battery monitor you may observe in some systems that the meter accumulates negative or positive Amp-Hours after the battery is fully charged. There are several conditions that may cause the rapid accumulation of negative Amp-Hours or an excessive accumulation of positive Amp-Hours. A slow or gradual accumulation of negative Amp-Hours is not necessarily an indication of a problem with the charging system or the Link meter.

Operational Characteristics

The Link products have a feature called Charge Efficiency Factor, also referred to as "CEF." This feature allows the Link meter to keep track of battery charging performance as batteries are not 100% efficient when deeply discharged and then recharged. For example, if the CEF is 90%, this means that the battery bank is 90% efficient, also meaning that there is an inefficiency of 10%. During recharge, the Link meter monitors the recharge Amp-Hours and takes into consideration the CEF. With a CEF of 90%, since there is a 10% inefficiency, for every Amp-Hour taken out of the battery, the charging source must put back in 1.1 Amp-Hours to account for this inefficiency. The meter compensates for this by counting the 1.1 amp hours as 1.0 amp hours.

Several things must occur before the CEF will recalculate and become more accurate:

- The battery must be discharged at least 10%.
- 100% of the kilowatt hours removed must be returned to the battery during charging.
- The charged parameters for voltage and current must be met.

If an inverter/charger is connected to AC power and left charging for an extended period of time, the charger will be in the "float" mode. This will normally result in a gradual accumulation of positive Amp-Hours as the Link measures trickle current. When there are cycling DC loads in the system (such as refrigerators and water pumps) that periodically draw power while the charger is in "float," the voltage will dip slightly and these loads will remove some "surface" charge from the battery. Once the load is switched OFF and the voltage rises back to the float voltage level and the charger replaces this surface charge. Surface charge is replaced at nearly 100% efficiency. During this removal and replacement of surface charge, the Link meter will count negative Amp-Hours (discharge) at 100% and count positive Amp-Hours at the CEF rate that the meter has "learned" during the process of deep discharge and recharge cycles. This can result in a gradual accumulation of negative Amp-Hours, even though the batteries were always in a charge mode. This same phenomenon can result if an alternator is the source of charging and cycling DC loads result in voltage fluctuations and the subsequent flow of surface charge into and out of the battery bank. Another cause is if the charger is connected to a source of AC that has fluctuating voltage. This fluctuating incoming AC voltage may cause the charger's output voltage to fluctuate too resulting in surface charge movement into and out of the battery.

Normal causes for negative Amp-Hour accumulation

If the battery is never fully recharged between discharge cycles, some negative Amp-Hours will accumulate. This leaves negative amp hours showing, and because the charged parameters have not been met, the CEF is never recalculated. The meter will use and display a CEF different than the actual CEF of the battery bank.

If the battery is never deeply discharged (at least 10% of capacity) like a starting battery for example, the meter will never recalculate the CEF. The default value for the CEF will likely be lower than the actual CEF of the battery, therefore the battery will actually be charged but negative amp hours will still be showing and will accumulate with each recharge cycle.

Normal causes for positive Amp-Hour accumulation

If the batteries are fully charged and attached to a charger that is in float mode, it is normal to have some positive Amp-Hour accumulation, up to 24 Amp-Hours per day, depending on bank size and age of the battery bank.

Abnormal causes for positive or negative Amp-Hour accumulation (installation related problems)

All negative connections to the battery bank must be made at the load/ground side of the battery shunt. The Link monitors the battery amps and Amp-Hours by measuring current flowing through the shunt. If any loads or charging sources are not connected to the load/ground side of the shunt then the Link meter cannot monitor these currents. If any negative circuit connections are made directly to the battery negative post or to the battery side of the shunt, any current going to or flowing from these circuits will not be measured. This will cause the Link to become "out of sync" with the battery bank. The symptoms of this occurring will be a rapid accumulation of either positive or negative amp-hours.

1. If a charging source is connected directly to the battery negative post or to the battery side of the shunt, negative Amp-Hours will accumulate.
2. If a load is connected directly to the battery negative post or to the battery side of the shunt, excessive positive Amp-Hours will accumulate.
3. Shunt sense leads wired backwards will result in both false positive or negative amp hour readings and the AMPS readings will be of incorrect polarity.

The only connections to the negative battery posts should be the cables interconnecting multiple batteries in the same bank, and a single connection from all common negative battery posts to the battery side of the shunt. All negative connections from loads or charging sources must be made to the load/ground side of the battery shunt.

Abnormal positive Amp-Hour accumulation (battery problems)

If a battery has a bad cell, excessive positive Amp-Hours will accumulate as the battery continues to draw excessive current from the charger.

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