Trojan Battery & Morningstar

Introduction:

With over four million sold since 1993, Morningstar is recognized as the expert in charging technology throughout the solar industry. As solar-plus-storage becomes more prevalent in mainstream installations, battery chemistries are becoming more advanced—and battery makers are increasingly looking for ways to help their customers maintain and protect their long-term investment.

Morningstar's *Energy Storage Partner Program* ™ (ESP) makes it possible for selected premium battery partners to offer additional value and support for their customers by offering them a more proven, better documented and controlled storage system. With energy storage typically accounting for a very large share of the overall system's cost, ESP helps advanced chemistry battery manufacturers to provide the maximum level of assurance that system owners and operators need. This document is intended to provide essential information and recommendations for integrating Morningstar charge controllers with the Energy Storage Partner's batteries. Proper integration of these products is dependent upon successful implementation of the custom settings outlined in the sections below. These settings are the result of cooperation between manufacturers and have been agreed upon by both parties.

Battery Overview:

Designed and engineered in the USA, Trillium™ can be used in a variety of stationary and motive power applications. From its superior cell and battery design to its intelligent, built-in diagnostics, Trillium offers a range of advanced safety, environmental and electronic features not found in competitive products. With life expectancy well over 5,000 cycles, Trillium will deliver outstanding return on investment over time, plus the legendary quality Trojan Battery is known for.

Common characteristics include:

- Trillium features a Trojan-specific cell, which undergoes a 128-point quality control check and is 100 percent X-ray inspected to ensure the highest quality. It's cobalt-free and nickel-free, and it features the industry's safest chemistry. Most importantly, Trillium features extraordinary life—greater than 5,000 cycles— and this power is packed into a battery that's a 20 percent smaller footprint.
- Trillium has automotive-grade components for durability, safety, and a current sensor, fuse, and temperature sensor. It's waterproof and dust proof, with an IP67 environmental rating—the highest in its class by far. Trillium is designed to be a true replacement for lead-acid batteries and can be used with existing lead-acid chargers with AGM/GEL settings (IE).

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- Trillium offers unique, advanced electronic features such as a visual SOC (state of charge) gauge on the top of the battery. A Microprocessor* ensures the battery is completely self-protected, and if a problem is detected, will turn itself off. When a problem goes away, it turns back on, automatically self-healing. Integrated Controller Area Network (CAN)** communications share battery data— state of charge, state of health, and fault status—with other devices. Trillium also has the built-in ability to track lifetime amp hours throughput and historical fault data is stored.
- Trillium gives you more runtime and a longer life than competitors' batteries in its class and delivers consistent power across the state of charge range. It can be charged in less than two hours and features simple, scalable system configurability for a variety of applications. Up to 48 volts.
- Trillium is designed and engineered in the USA by Trojan, the world's leading supplier of deep-cycle batteries for nearly 100 years. You can be confident Trillium is the highest quality product on the market—backed by Trojan's extraordinary customer support.

Models: TR 12.8-92 Li-ion, TR 12.8-110 Li-ion, TR 25.6-25 Li-ion
Voltages: 12V, 24V
Amp Hour Capacities: 25-110Ah

Note: For information regarding battery bank configuration options, please contact the battery manufacturer.

For optimal integration, the recommended settings (based on 12V nominal values) are as follows:

Critical Settings:

Absorption Voltage = 14.60 V

Absorption Time = Arbitrary value (regulation voltage maintained indefinitely throughout charging cycle)

Temperature Compensation = 0.0 V/degC (Disabled)

Float = Not enabled

Equalize = Not enabled

Battery HVD/High Voltage Disconnect/Reconnect = Enable/14.80 V/14.60 V

Load LVD (Low Voltage Disconnect) ..... 12.50 V

Load LVR (Low Voltage Reconnect) ..... 13.25 V

Note:

Many lithium batteries include a BMS that can implement an internal battery disconnect in the event of a deep discharge to prevent permanent damage to the battery chemistry. It is important that proper low voltage load disconnect settings are used

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to prevent this from occurring during charging. Damage to the controller due to a battery disconnect during charging is typically not covered under warranty. Incidental damage to loads is also not covered under warranty.

Optional Recommended Settings:

Absorption Ext = Not enabled

Low Battery Temperature Foldback = Optional (High limit = 5 degC, Low limit = 0 degC)

Battery Service Reminder = Not enabled (Monitor Ah capacity with external shunt or compatible CAN-bus software)

Max Regulation Limit = Not enabled

Battery Current Limit = Optional (Max charge current: G27 = 110A per string, G24 = 92A per string, U1 = 25A per string)

Delay Before Load LVD ..... 1 m (Possibly higher for cold temperatures)

Load Current Compensation ..... G27: 0.003 Ω (Default), G24: 0.004 Ω, U1: 0.014 Ω (i.e V/A) - Reduces Load LVD based on size of load with respect to battery Ah capacity

Load HVD/High Voltage Disconnect/Reconnect..... Enable/15.00 V/14.80 V (May help to protect loads from potentially harmful voltage spikes that can be caused by external charging sources continuing to operate during battery removal)

Battery Charge LED Indications (Not intended for accurate SoC measurement):

LED G –> G/Y 75%+ = 14.2 V (3.55 V/per cell)

LED G/Y –> Y 50% - 74% = 14.0 V (3.50 V/per cell)

LED Y –> Y/R 25% - 49% = 13.8 V (3.45 V/per cell)

LED Y/R –> R 10% or below = 13.6 V (3.40 V/per cell)

(*More information regarding these settings provided by Morningstar*)

These settings are available for the Morningstar controllers listed below:

12-24V systems:

ProStar MPPT (includes low temperature foldback to limit the max. charge current)

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SunSaver MPPT

ProStar (PWM) Gen 3 (includes low temperature foldback to limit the max. charge current)

12-48V systems:

TriStar MPPT (compatible with 12V, 24V, 36V, 48V, 60V nominal systems)

TriStar MPPT 600V (compatible with 24V, 36V, 48V and 60V nominal systems)

TriStar [PWM] (compatible with 12V, 24V, 36V and 48V nominal systems)

Communications hardware required for programming Custom Settings with MSView:

ProStar MPPT, ProStar (Gen 3), SunSaver MPPT

UMC-1 USB MeterBus Adapter- http://www.morningstarcorp.com/products/usb-meterbus-adapter/

MSC PC RS-232 MeterBus Adapter- http://www.morningstarcorp.com/products/pc-meterbus-adapter/

EMC-1 Ethernet MeterBus Converter-
http://www.morningstarcorp.com/products/ethernet-meterbus-converter/

TriStar, TriStar MPPT, TS-MPPT-600V
Includes an RS-232 port for connection to a PC.

EMC-1 Ethernet MeterBus Converter-
http://www.morningstarcorp.com/products/ethernet-meterbus-converter/

Tripp Lite U209-000-R USB / Serial DB-9 (RS-232) Adapter Cable (not available from Morningstar)

All TS-MPPT-60 (150V and 600V) models also include an Ethernet port and EIA-485 port.

MSView Software Download: http://www.morningstarcorp.com/msview/

MSView Configuration Files:
https://www.morningstarcorp.com/wp-content/uploads/2018/11/Trojan-MSView-Configuration-Files.zip

Other links:

Morningstar Best Practices by Battery Chemistry

Morningstar Custom Settings Info Pages

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Some of the material being presented may be based on information that has been provided by other parties such as battery specs and operational parameters.

Performance may vary depending on use conditions and application.

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