ENERGY STORAGE PARTNER PROGRAM™

Moura Lithium Batteries & 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 the 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:

With Lithium Iron Phosphate (LFP) technology and a differentiated structure, the Moura Solar Lithium (MSL) line features prismatic cells, highly reliable BMS (Battery Management System), management software to monitor key battery indicators, and other characteristics to enhance its operation. Developed for photovoltaic systems, feature a robust BMS that ensures all cells are balanced, delivering high performance in cycling applications. Suitable for commercial or residential use, they have a long lifespan and energy capacity in a compact and lightweight design, facilitating logistics for installation, especially in remote and hard-to-reach locations.

Moura Solar Lithium (MSL) Battery - model 48MSL100 (48V 100Ah)

Moura Solar Lithium Batteries – 48V

Model	48MSL50	48MSL75	48MSL100	48MSL150	48MSL200
Nominal Voltage	48 Volts				
Capacity	50 Ah	75 Ah	100 Ah	150 Ah	200 Ah
Maximum Charge/ Discharge Current	50 A	75 A	100 A	100 A	100 A
Recommended Max Charge Current	10 A	15 A	20 A	30 A	40 A

Ambient Temperature Range: -20°C to 65 °C

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

MSView Recommended Custom Settings for TriStar and Tristar MPPT Controllers

MSView custom settings are available for the following Morningstar controllers:

TriStar MPPT, TriStar MPPT 600V and TriStar [PWM]

Note: Morningstar TriStar and TriStar MPPT controllers are programmed using 12V nominal voltage setpoints with MSView software. The controllers use a multiplier of 4 for 48V batteries.
These settings are not for the GenStar MPPT Controller. See GenStar custom settings info on page 3.

Critical Charge Settings [MSView 12V Nominal Voltage Setpoints (Battery Voltages in parenthesis)]

Absorption Voltage: 13.2 V (52.8V)
Absorption Time: Arbitrary value (regulation voltage maintained indefinitely throughout the charging cycle)
Temperature Compensation: 0.0 V/°C (Disabled)
Float/Float Voltage/Timeout: Not enabled
Equalize: Not enabled
Battery HVD/High Voltage Disconnect/Reconnect: Enable/ 13.5V / 12.25V (54.0V / 49V)

Load Control Settings [TriStar PWM 45A & 60A Controller]
Load Low Voltage Disconnect (LVD): (~90% DoD*): 11.9V (47.6V)
Load Low Voltage Reconnect (LVR): 12.4V (49.6V)
Delay Before Load LVD …… 1 min (Possibly longer for cold temperatures or higher LVD settings)

Notes:

* It is important that proper low-voltage load disconnect settings are high enough to prevent an under-voltage cutoff due to self-consumption of the equipment.

An overvoltage cutoff may be caused during voltage regulation if there are imbalanced cell voltages or disconnecting very large loads. This can be a nuisance or cause a problematic voltage surge. If this occurs the Absorption voltage settings can be reduced.

Optional Recommended Settings:

Battery Service Reminder: Not enabled
Battery Current Limit: Optional; System Total Max Charge Current ≤ Battery Bank Max Charge Rate
Load Current Compensation …… Disabled or = 1 / (Total Battery Bank Ah) ohms (V/A)
Load HVD; High Voltage Disconnect/Reconnect: Enable; 13.6 V / 12.5V (54.4V / 50.0V) (Can be used to protect loads from voltage surge in the event of battery failure during charging operation)

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

LED Transitions	MSView 12V Setpoint	Battery Setpoint
Green only	> 12.5 V	> 50 V
Green-Yellow	12.35 V	49.4 V
Yellow only	12.25 V	49 V
Yellow Red	12.15 V	48.6 V
Red only	< 12.15 V	< 48.6 V

Communications hardware required for programming Custom Settings with MSView:
Includes an RS-232 port for connection to a PC.
TS-MPPT-60 (60A, 150V and 600V) models also include an Ethernet port and EIA-485 port.
EMC-1 Ethernet MeterBus Converter- www.morningstarcorp.com/products/ethernet-meterbus-converter/
Tripp Lite U209-000-R USB / Serial DB-9 (RS-232) Adapter Cable (not available from Morningstar)

MSView Software Download: http://www.morningstarcorp.com/msview/
MSView Configuration Files: In the MSView Setup Wizard select read from file to load settings
https://www.morningstarcorp.com/wp-content/uploads/Moura-MSView-Configuration-Files.zip

Also see:
Lithium Iron Phosphate Battery Custom Settings Document

Recommended Custom Settings for GenStar MPPT (60A, 80A, 100A)

Note: Older Morningstar controllers are programmed with MSView with 12V nominal voltage setpoints and use multiplier (x4 for 48V) systems. The GenStar MPPT controller must be programmed using the system's nominal voltage settings. Therefore, all settings are shown with 48V voltage setpoints only.
See MSView Recommended Custom Settings starting on page 1 for TriStar and TriStar MPPT controllers.

Commissioning
When powered up for the first time, the GenStar controller must be commissioned via the built-in digital display. Refer to section 3.5 Commissioning / Initial Configuration in the GenStar MPPT operation manual for details.
Local Meter Display Commissioning Steps

- Select Language
- Enable Ethernet Writes (allows control commands and custom programming over Ethernet)
- Select System Voltage (12V, 24V or 48V)
- Set the UTC Time (Universal Time)
- Set the Local Time Offset for the time zone
- Select NO for BMS Block
- Select Battery Charging Profile (6 LiFePO4-Low) or Custom Settings
- Battery Load (LVD) Profile (48V.00V / 52.80V) or Custom Settings
- Select NO for RTS Required?
- Reboot the controller after commissioning

After commissioning, the GenStar settings need to be custom-programmed. There is a link to download Configuration Files with the settings indicated at the end of this document. Transfer the files to the GenStar SD card to upload the settings to the controller. Settings can be manually adjusted after commissioning with the built-in digital display or with the LiveView webpage.

Critical Settings (48V): Requires the Installer Access Password: 141

Battery Info Settings
Set the Battery Size (Ah) in the Battery Info Charge Settings
Battery Charge Settings
Absorption Voltage: 52.8V
Absorption Time: Arbitrary value (regulation voltage maintained indefinitely throughout the charging cycle)
Temperature Compensation Coefficient: 0.0 V / ^{o}C (Disabled)
Float/Float Voltage/Timeout: Not enabled
Equalize Voltage: Not enabled
Battery HVD / High Voltage Disconnect / Reconnect Thresholds: Enable/ 54.0V / 49V
Load Control Settings
Load Low Voltage Disconnect (LVD): 47.6V
Load Low Voltage Reconnect (LVR): 49.6V
LVD/LSoCD Warning Time …… 1 min (Possibly longer for cold temperatures or higher LVD settings)

Notes:

* It is important that proper low-voltage load disconnect settings are high enough to prevent an under-voltage cutoff due to self-consumption of the equipment.

An overvoltage cutoff may be caused during voltage regulation if there are imbalanced cell voltages or disconnecting very large loads. This can be a nuisance or cause a problematic voltage surge. If this occurs the Absorption voltage settings can be reduced.

Optional Recommended Settings:
Battery Charge Settings (Optional)
Low Battery Temperature Foldback: Optional (100% High limit = 1^{o}C, 0% Low limit = 0^{o}C)
Battery Current Limit: Optional; System Total Max Charge Current < Battery Bank Max Charge Rate
Load Current Compensation: Disabled or = 1 / (Total Battery Bank Ah) ohms (V/A) for 48V lithium batteries
Max Regulation Limit: Not enabled
Low Battery Temperature Foldback = Optional - cold environments (0% Low limit = 0 C^{o}, 100% High limit = 1 C^{o})
Battery Info (Optional)
Battery Current Limit: Optional: System Total Max Charge Current < Battery Bank Max Charge Rate
Battery Current Limit Requires Shunt: No (This will cause a fault if there is no ReadyShunt detected. Select Yes only if ReadyShunt is installed.)
Battery SOC Efficiency: Lithium (99%) **VERY IMPORTANT** if using the Morningstar ReadyShunt for SOC.
Load Control Settings (Optional)
Load Current Compensation …… Disabled or = - 1 / (Total Battery Bank Ah) ohms (V/A)
Load HVD; High Voltage Disconnect/Reconnect: Enable; 54.4V / 50.0V (Can be used to protect loads from voltage spikes in the event of battery failure during charging operation)
Battery SOC Efficiency

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

LED Transitions		
Green only	> 50 V	> 80%
Green-Yellow	when below 50V	when below 80%
Yellow only	when below 49.4 V	when below 60%
Yellow Red	when below 49.0 V	when below 40%
Red only	During LVD	

Note: Morningstar's ReadyShunt accessory can provide precise Battery current, Ah and State of Charge (SOC) information in addition to the following custom settings options.

Low SOC Disconnect/ Reconnect
SOC LED Transition settings

Communications required for programming Custom Settings:

Monitoring, control, setup and firmware updates for the GenStar MPPT controllers are provided with the built-in meter display or the local LiveView HTML webpages (Ethernet). See section 4.0 Configuration of the GenStar MPPT manual for detailed setup instructions.

Settings profiles can be saved and loaded to and from the internal SD card only. See the link below for configuration files with the settings that can be transferred to an SD card.

GenStar MPPT SD Card Configuration File: In LiveView or on the meter display navigate to SETUP/ Save & Load.

https://www.morningstarcorp.com/wp-content/uploads/Moura-GenStar-SDCard-LiveView-Configuration-File.zip

WARNING: 12V, 24V and 48V files are provided. Always select the correct voltage for the system!

IMPORTANT:

MOURA and Morningstar Corporation are separate companies with unaffiliated ownership. Neither MOURA nor Morningstar Corporation make any warranties explicit or implied with this product information. Morningstar makes no representation or assumption of liability regarding the charging requirements for any type of battery or model.

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.

