PowerPlus Energy & 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:

PowerPlus Energy is an Australian manufacturer of Lithium Ferro Phosphate (LFP) batteries used in many solar and industrial applications. Currently, they offer 24V and 48V battery modules that are equipped with an internal Battery Management System (BMS). These units offer a level of operation and design flexibility often not found in alternative solutions.

Even though the LiFePO4 cells are considered to be a very stable and safe form of Lithium-ion, the internal BMS adds enhanced protection and cell balancing that enables drop-in replacement of lead-acid batteries with unlimited parallel storage capacity. To increase the functionality even further, PowerPlus Energy includes several additional features that will broaden the appeal to a more advanced audience. These features include:

- Increased safety and protection
- Programmable settings (i.e for voltage and current thresholds)
- Digital outputs within the batteries to allow remote monitoring *additional 3rd party equipment required.
- Inbuilt circuit breaker

This enhanced functionality, coupled with the ability to meet the demands of high temperature performance and the requirements of single- and 3-phase inverter systems, the PowerPlus Energy batteries are equipped to serve the needs of both current and future Morningstar products.

Models: LiFe1213N, LiFe2413N, LiFe4813N, ECO4840P, LiFe2433P, LiFe4833P, Eco4840P, Life4838P

Voltages: 12V, 24V, 48V
Energy (kWh)/ Amp Hour Capacities: 1.3kWh – 4.0kWh / 25-128Ah

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

MSView Recommended Custom Settings for Optimal Integration

Note: Morningstar controllers are programed using 12V nominal voltage setpoints with MSView software. The controllers use a multiplier of 2 for 24V batteries and 4 for 48V batteries.

These settings are not for the GenStar MPPT Controller. See GenStar custom settings info on page 4.

Critical Settings (Voltages for 12V, 24V and 48V):

Absorption Voltage = 14.4 V   [14.1V for Life4838P model only]

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

Temperature Compensation = 0.0 V/C^o (Disabled)

Float/Float Voltage/Timeout = Not enabled

Equalize = Not enabled

Battery HVD/High Voltage Disconnect/Reconnect = Enable/14.8 V / 14.0V

Load Low Voltage Disconnect (LVD): High (~90% DoD*) = 12.6 V/ Medium (~95% DoD*) = 12.4V/ Low (~100% DoD*) = 12V

Load LVR (Low Voltage Reconnect) @12V nominal = 1 V above LVD or 13.4V maximum

Delay Before Load LVD ………………… 1 min (Possibly longer for cold temperatures or higher LVD settings)

Notes:

* LVD DoD is based on a discharge rate of .2C at 25°C. In general, the DoD will be higher with higher discharge rates and lower temperatures or lower with lower discharge rates and higher temperatures.

It is important that proper low voltage load disconnect settings are high enough to prevent an undervoltage 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:

Absorption Ext = Not enabled

Low Battery Temperature Foldback = Optional (100% High limit = 1 C^o, 0% Low limit = 0 C^o)

Battery Service Reminder = Not enabled (Monitor battery health using Morningstar ReadyShunt shunt meter/coulomb counter)

Float Cancel = Not enabled

Max Regulation Limit = Not enabled

Battery Current Limit = .5 C

Load Current Compensation ……… Disabled

   or = 0.3 / (Total Battery Bank Ah) ohms (V/A) @12V (Multiplier does not apply for 24V or 48V settings: Multiply by 2 for 24V batteries, Multiply by 4 for 48V batteries)

Load HVD; High Voltage Disconnect/Reconnect: Enable; 15.0V/14.6V (Can be used to protect loads from voltage spikes in the event of battery failure during charging operation)

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

LED Transitions	4/8/16 Cell		
	12V	24V	48V
🟢 Green only	> 13.35	> 26.7	> 53.4
🟢🟡 Green-Yellow	13.2	26.4	52.8
🟡 Yellow only	13.05	26.1	52.2
🟡🔴 Yellow Red	12.95	25.9	51.8
🔴 Red only	< 12.95	< 25.9	< 51.8

MSView custom settings are available for the Morningstar controllers listed below:

12-24V systems:

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

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) [*not compatible w/ 12V*]

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.

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

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)

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

MSView Configuration Files: https://www.morningstarcorp.com/wp-content/uploads/Powerplus-MSView-Configuration-Files.zip

Other links:

Morningstar Best Practices by Battery Chemistry

Morningstar Custom Settings Info Pages

GenStar MPPT Recommended Custom Settings for Optimal Integration

Note: Older Morningstar controllers are programmed with MSView with 12V nominal voltage setpoints and use a multiplier (X2 for 24V) and (X2 for 48V) systems. The GenStar MPPT controller must be programmed using the system nominal voltage settings. Therefore, all settings are shown with 12V, 24V and 48V voltage setpoints. See MSView Recommended Custom Settings starting on page 2 for older Morningstar 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 (8 - LiFePO4 High: Absorption Voltage = 14.2V, 28.4V, 56.8V)
- Battery Load (LVD) Profile (6 - LiFePO4 Low: LVD = 12.5V, 25V, 50V)
- Select NO for RTS Required?
- Reboot controller after commissioning

After commissioning, the GenStar the settings need to be custom programmed. There is a link to download Configuration Files with the settings indicated 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 (Voltages for 12V, 24V and 48V): Requires the Installer Access Password = 141

Set the Battery Size (Ah) in the Battery Info Charge Settings
Absorption Voltage = 14.4 V, 28.8V, 57.6V   [56.4V for Life4838P model only]
Absorption Time = Arbitrary value (regulation voltage maintained indefinitely throughout charging cycle)
Temperature Compensation = 0.0 V/C^o (Disabled)
Float/Float Voltage/Timeout = Not enabled
Equalize = Not enabled
Battery HVD/High Voltage Disconnect/Reconnect = Enable/ 14.8 V/14.00 V, 29.6 V/28V, 59.2 V/ 56V
Load Low Voltage Disconnect (LVD): High (~90% DoD*) / Medium (~95% DoD*) / Low (~100% DoD*) =
        12.6 V / 12.4V / 12V,   25.2V / 24.8 V / 24V,   50.4V / 48.2V / 48V
Load LVR (Low Voltage Reconnect) @12V nominal = 1V/ 2V/ 4V above LVD or 13.4V/ 26.8V / 53.6V maximum
Delay Before Load LVD ………………… 1 min (Possibly longer for cold temperatures or higher LVD settings)

Notes:

* LVD DoD is based on a discharge rate of .2C at 25°C. In general, the DoD will be higher with higher discharge rates and lower temperatures or lower with lower discharge rates and higher temperatures. It is important that proper low voltage load disconnect settings are high enough to prevent an undervoltage 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:

Low Battery Temperature Foldback = Optional (100% High limit = 1 C^o, 0% Low limit = 0 C^o)

Battery Service Reminder = Not enabled (Monitor battery health using Morningstar ReadyShunt shunt meter/coulomb counter)

Max Regulation Limit = Not enabled

Battery Current Limit = .5 C

Load Current Compensation ……… Disabled

       or = -0.3 / (Total Battery Bank Ah) ohms (V/A) @12V (Multiply by 2 for 24V, Multiply by 4 for 48V)

Load HVD; High Voltage Disconnect/Reconnect: Enable; 15.0V/ 14.6V, 30.0V/ 29.2V, 60V/ 58.4V (Can be used to protect loads from voltage spikes in the event of battery failure during charging operation)

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

LED Transitions	4/8/16 Cell		
	12V	24V	48V
🟢 Green only	> 13.35	> 26.7	> 53.4
🟢🟡 Green-Yellow	< 13.35	< 26.7	< 53.4
🟡 Yellow only	< 13.2	< 26.4	< 52.8
🟡🔴 Yellow Red	< 13.05	< 26.1	< 52.2
🔴 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 and the local LiveView HTML pages (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 above for 12V, 24V and 48V that can be transferred to an SD card. It is very important to select the file that corresponds to the nominal voltage of the battery.

GenStar SD Card Configuration Files: https://www.morningstarcorp.com/wp-content/uploads/PowerPlus-GenStar-SDCard-LiveView-Configuration-Files.zip

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

IMPORTANT:

PowerPlus Energy and Morningstar Corporation are separate companies with unaffiliated ownership. Neither PowerPlus Energy 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.