

## UPG Universal 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:

UPG's Universal Battery® LiFePO<sub>4</sub> (LFP) batteries are the future in battery technology. Engineered for exceptional power, yet ultra-light weight, and more powerful than traditional sealed lead-acid batteries, Universal Battery® LFP batteries deliver the best in quality and performance.

### Universal Battery® LFP compared to traditional sealed lead-acid batteries:

#### Performance

- Cycle life over 2000 cycles – 10x greater cycle life
- Charges 3x faster
- Ultra-lightweight – 1/3 of the weight
- 2.5x longer shelf life
- Performs at close to 100 percent of the battery capacity even at higher currents

#### Safety

- Smart Battery Management System protection
- Built-in low voltage protection to prevent damage to the battery
- Built-in high current protection to prevent overloading and damage to the battery
- Eco-friendly – No harmful pollutants, corrosive acids, or toxic heavy metals

Models: UPG Universal Battery®

**12.8 Volt Models:** LFP1260 (6 Ah), LFP12120 (12 Ah), LFP12180 (18 Ah) and LFP121030 (103 Ah), LFP122800 (280 Ah)

**25.6 Volt Models:** LFP4D (200 Ah), LFP242800 (280 Ah)

**Note:** Battery Bank Configuration Options:

**12.8V LFP:** 4 batteries max in series (up to 48v) and 2 batteries/strings max in parallel.

**25.6V LFP:** 2 batteries max in parallel. **No series connection supported currently.**

Battery voltages should not differ by more than 0.1V when wiring a battery bank. Ensure that all batteries are balanced by fully charging each battery individually before connecting batteries in parallel or series.

**Max/ Recommended Charge and Max Discharge currents:**

Model	Charge Current		Discharge Current
	Maximum	Recommended	Maximum
12.8V models			
LFP1260 (6 Ah)	6 A	3 A	6 A
LFP12120 (12 Ah)	12 A	6 A	12 A
LFP12180 (18 Ah)	15 A	9 A	15 A
LFP121030 (103 Ah)	100 A	20 A	100 A
LFP122800 (280 Ah)	100 A	100 A	100 A
25.6V models			
LFP241030 (103 Ah)	100 A	20 A	100 A
LFP4D (200 Ah)	100 A	100 A	100 A
LFP242800 (280 Ah)	100 A	100 A	100 A

**Important: For battery banks wired in parallel do not exceed the maximum charge or discharge current for a single battery.**

**Solar Charge Controller Selection**

Select a charge controller for the voltage and max charge current required. Depending on the current rating of the controller and battery it may be necessary to undersize the PV array or use battery current limit settings (available with ProStar MPPT and TriStar MPPT controllers only). To undersize the PV array for PWM controllers ensure that the PV array maximum power current (Imp) < 80% of the battery max charge current rating.

**Recommended Morningstar Solar Charge Controllers**

**PWM Controller Models**

**SunKeeper (12V only):** SK-6, SK-12 (non-programable)

**ProStar (12V or 24V):** PS-15, PS-30

**TriStar (12-48V):** TS-45 or TS-60

**MPPT Controller Models**

**SunSaver MPPT:** SS-MPPT-15

**ProStar MPPT (12 or 24V):** PS-MPPT-25, PS-MPPT-40

**TriStar MPPT (12 – 48V):** TS-MPPT-30, TS-MPPT-45 & TS-MPPT-60

**SunKeeper Charge Settings (non-programable): 12V Systems only**

Absorption Voltage = 14.1 V

Absorption Time = 120 minutes

Float Voltage = 13.7 V

Temperature Compensation: Disabled (Cut blue Temperature Compensation Wire Loop)

Please note that SunKeeper controllers do not include Low Voltage Disconnect (LVD). However, the SunKeeper can operate with battery voltage = 0 V and wake up the battery in case there is an internal low voltage cutout.

**For optimal integration please use the following custom settings. 12V nominal settings are always entered into the MSView Setup Wizard and are multiplied for 24V or 48V systems.**

Absorption Voltage = 14.1 V Absorption Time = 20 minutes Absorption Ext = not enabled

Temperature Compensation = 0.0 V/deg C (Disabled)

Low Battery Temperature Foldback = Optional (High limit = 2 deg C, Low limit = 0 deg C) with ProStar (PWM) and ProStar MPPT only

Battery Service Reminder (Optional)

Float/Float Voltage/Timeout = Enable/ 13.5 V / 30 minutes

Float Cancel = Not enabled

Equalize = Not enabled

Battery HVD/High Voltage Disconnect/Reconnect = Enable/ 14.5 V/ 13.45 V

Regulation Limit = Not enabled

Battery Current Limit (< Max allowable charge current) for PS-MPPT and TS-MPPT only

LFP1260 (6 Ah) = 6A, LFP12120 (12 Ah) = 12A, LFP12180 (18 Ah) = 15A, and no battery current limit for LFP121030 (103 Ah). 2X for 2 in parallel. **Important! Do not exceed the max allowable charge current.**

#### **Load Settings:**

Low Voltage Disconnect (LVD) = 12.5 - 12.65 V (increase LVD for higher self-consumption and smaller battery banks)

Low Voltage Reconnect (LVR) = 13 V

Delay Before LVD = 1 minute

Load Current Compensation (Optional)  $\Omega$  (V/A) (reduces LVD Voltage based on load current)

Should be calculated based on 0.35/ battery Ah (Reduces Load LVD based on size of load with respect to battery bank Ah capacity)

HVD/High Voltage Disconnect/Reconnect: Enable/ 14.5 V/ 13.35 V (Load HVD)

#### **Note:**

The performance of systems using these settings may vary depending on use conditions and application.

Lithium batteries include a Battery Management System (BMS) that can implement an internal battery disconnect in the event of an internal fault, high or low temperatures, high or low battery voltages or other conditions. In case of a battery cell high voltage condition the BMS may disconnect the battery circuit internally. Also, if the LVD is set too low then the self-consumption of the controller may cause a Low Voltage Cutout that will shut off the controller and prevent it from recharging the battery. This is not likely to happen with the settings provided. If this does occur, lowering the charge voltage or increasing the LVD voltage can be considered. Monitoring of the system with Morningstar Live View or MSView is recommended to determine if adjustments to the settings may be necessary.

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.

For more information regarding settings adjustments please contact Morningstar at [support@morningstarcorp.com](mailto:support@morningstarcorp.com).

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

LED G → G/Y 75%+ = 13.3 V

LED G/Y → Y 50% - 74% = 13.1 V LED Y →

Y/R 25% - 49% = 12.9 V

LED Y/R → R 10% or below = 12.7 V

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

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

SunSaver MPPT

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

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

**Communications hardware required for programming Custom Settings with MSView:**

SunSaver MPPT, ProStar MPPT, ProStar (PWM) (Gen 3)

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/>

**MSView Software Download:** <http://www.morningstarcorp.com/msview/>

**MSView Configuration Files:** <https://www.morningstarcorp.com/wp-content/uploads/UPG-MSView-Configuration-Files.zip>

**Other links:**

[Morningstar Best Practices by Battery Chemistry](#)

[Morningstar Custom Settings Info Pages](#)

**IMPORTANT:**

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