



MK 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:

The following information is from the MK Battery web site:

"MK Battery is one of the largest sealed lead acid battery suppliers in North America."

"MK Battery provides the highest quality and most environmentally responsible sealed battery solutions for specialized deep-cycle and standby power applications. We take pride in our dedicated people and in our total commitment to offering the most reliable products, world-class service and support, and maximum overall value to the diverse markets we serve."

Morningstar controllers have up to seven factory presets and many controller models include custom programming options. Typically, one of the factory presets works perfectly fine for a specific Lead-Acid battery. Battery manufacturers provide voltage regulation set-points that closely match one of the factory preset options.

The custom settings being provided here are similar to several of Morningstar's factory presets. These settings include much longer cumulative time for the Absorption and Equalize stages. MK Battery has informed us that these longer Absorption times will be more of an advantage in applications where the batteries are traditionally susceptible to undercharging. Also, they indicated that if the charge controller voltage settings are within the recommended range, the batteries will not be overcharged.

The custom settings indicated here would be the maximum duration for the Absorption stage that would be considered. As with any battery charge settings, optimal performance may depend on adjustments that are based on many factors including battery bank size, average daily loads, battery temperatures and daily charge rates which depend on location specific criteria and array sizing. Cumulative Absorption Time adjustments should be considered on a case by case basis for best performance.



ENERGY STORAGE PARTNER PROGRAM



Web Sites:

East Penn: <http://www.eastpennmanufacturing.com/>

MK Battery/ Deka: <http://www.mkbattery.com/>

Battery Types and Models:

Flooded:

[DEKA SOLAR MAINTENANCE SAVER® FLOODED BATTERIES](#)

[DEKA SOLAR MONOBLOCK FLOODED BATTERIES](#)

Valve Regulated

Gel

[Deka Solar Valve Regulated Gel Monobloc Series](#)

[DEKA SOLAR Valve-Regulated Gel Electrolyte Battery](#)

AGM

[DEKA UNIGY II LINE](#)

[MK Powered AGM Monoblock Batteries](#)

[MK Powered Small Sealed AGM Batteries](#)

Recommended products by Morningstar:

12V systems with no DC Load Control included:

[SunSaver Duo](#)

12V and 24V systems with DC Load Control included:

[ProStar MPPT](#)

[SunSaver MPPT](#)

[ProStar \(PWM\) Gen 3](#)

12V, 24V and 48V systems:

[TriStar MPPT](#) (Does not include DC Load Control)

[TriStar MPPT 600V](#) (Does not include DC Load Control)

[TriStar](#) (Modes of operation: PWM Solar Charging control, DC Load Control or Diversion Charging Control)

Morningstar Custom Settings Overview:

The following configuration information and MSView Setup Wizard custom settings configuration files are designed in accordance with specifications from the manufacturer. These settings have been reviewed by MK Battery and are in accordance to their [Technical Bulletin regarding Renewable Energy Charging Parameters](#).

As with any battery charge settings, optimal performance may depend on adjustments that are based on many factors including battery bank size, average daily loads, battery temperatures and daily charge rates which depend on location specific criteria and array sizing. The Absorption Time might need to be adjusted so that it regularly completes the Absorption stage with the end condition as outlined in the Bulletin so that the change (reduction) in Net charge current is < -0.10 A per Hr.



In addition, the Deka Bulletin indicates the following.

“End condition parameters per charge & Equalize Charge intervals are application specific and will vary dependent upon site specific characteristics such as: temperature, days of autonomy, array to load ratio, etc...”

Options for batteries that are mostly sitting idle for long periods of time would be as follows.

1. Greatly reduce the daily Absorption Time allowing the Absorption Extension Settings to take over if the battery voltage gets low.
2. Use reduced Absorption and/or Float Voltages to prevent unnecessary charging.

Please note also that these settings are with the highest voltage settings possible for each battery as indicated in the tables in the Deka Bulletin.

Communications hardware required for programming Custom Settings with MSView:

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

[UMC-1 USB MeterBus Adapter](#)

[MSC PC RS-232 MeterBus Adapter](#)

[EMC-1 Ethernet MeterBus Converter](#)

Note: The ProStar MPPT and ProStar (Gen 3) can be custom programmed with the digital interface.

TriStar, TriStar MPPT, TS-MPPT-600V

Includes an RS-232 port for connection to a PC.

[EMC-1 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](#)

[MSView Custom Settings Configuration Files for Deka/ MK Batteries](#)



Recommended Settings; Morningstar Custom Settings Basic Setup Overview:

Morningstar DIP Switch Settings by Product and Type of Settings

DIP Switch	TriStar MPPT (150V)		TriStar MPPT (600V)		TriStar PWM Solar Charging		TriStar PWM Load Control		TriStar PWM Diversion	
	↑ / ↓	Details	↑ / ↓	Details	↑ / ↓	Details	↑ / ↓	Details	↑ / ↓	Details
Switch 1	↓	Future use	↓	Future use	↓	Solar Mode	↑	Load/Light Mode	↑	Diversion Mode
Switch 2	24/48↑, 12V↓	Nominal Voltage 48V (↑↑), 24V(↑↓), 12V(↓↑)	↓	Not Used (OFF)	24/48↑, 12V↓	Nominal Voltage 48V (↑↑), 24V(↑↓), 12V(↓↑)	24/48↑, 12V↓	Nominal Voltage 48V (↑↑), 24V(↑↓), 12V(↓↑)	24/48↑, 12V↓	Nominal Voltage 48V (↑↑), 24V(↑↓), 12V(↓↑)
Switch 3	12/48V↑, 24V↓		12/48V↑, 24V↓	48V (↓), 24/36V(↑)*	12/48V↑, 24V↓		12/48V↑, 24V↓		12/48V↑, 24V↓	
Switch 4	↑	Enables Custom	↑	Enables Custom	↑	Enables Custom	↑	Enables Custom	↑	Enables Custom
Switch 5	↑		↑		↑		↑		↑	
Switch 6	↑		↑		↑		↑		↑	
Switch 7	↓	Auto Equalize Off**	↓	Auto Equalize Off**	↓	Auto Equalize Off**	↓	Load/Light Mode	↑	Diversion Mode
Switch 8	Optional	Ethernet Security	Optional	Enable Ethernet Write	Optional	Slow Switching to reduce noise	Optional	Load (OFF), Lighting (ON)	↓	Auto Equalize Off**

↑Up(ON)/ ↓Down (OFF)

* - Switch 3 on, up ↑ enables Custom Settings of nominal voltage for 24V with TS-MPPT 600V; 48V Nominal if off.

** - Switch 7 (8 for TS Diversion) does not disable Manual Equalize. If Auto Equalize is required set Switch 7 (8 for TS Diversion) to UP/ON (↑).

DIP Switch	ProStar MPPT		ProStar Gen3 PWM		SunSaver MPPT		SunSaver Duo	
	↑ / ↓	Details	↑ / ↓	Details	↑ / ↓	Details	↑ / ↓	Details
Switch 1	Optional	Load (OFF), Lighting (ON)	Optional	Load (OFF), Lighting (ON)	↑	Enables Custom	↑ / ↓	Battery #1 Type
Switch 2	12V↓, 24V↑	24V (↑↓), 12V(↓↑)	12V↓, 24V↑	24V (↑↓), 12V(↓↑)	N/A	LVD set with Custom	↑ / ↓	Battery #2 Type
Switch 3	12V↑, 24V↓		12V↑, 24V↓		↓	Auto Equalize Off	Charging Priority	Custom Priority
Switch 4	↑	Enables Custom	↑	Enables Custom	Auto Detects 12/24V; Battery Select Jumper provides two different custom settings.		↑	Enables Custom
Switch 5	↑		↑				Optional	Slow Switching to reduce noise
Switch 6	↑		↑				Charges two separate batteries with a single array. Select Type for 2 different custom settings for each battery.	
Switch 7	↓	Auto Equalize Off*	↓	Auto Equalize Off*				
Switch 8	Optional	Ethernet Security	Optional	Slow Switching to reduce noise				

↑Up(ON)/ ↓Down (OFF)

* - Switch 7 (3 for SS-MPPT) does not disable Manual Equalize. If Auto Equalize is required set Switch 7 (3 for SS-MPPT) to UP/ON (↑).

Notes:

- Custom settings are recommended for best results. However, there are factory PreSets that can be enabled with alternative DIP Switch settings which may be applicable for a particular model, system and environmental conditions.
- Different controllers will have different options and charging parameters. Please use the information below and adjust as needed. Not all settings are critical and certain conditions may or may not require some of the optional settings. Review all the settings and consider what adjustments may be required for your particular system.
- Max. Charge Limits can be imposed for the TriStar MPPT and ProStar MPPT controllers.
- All custom settings must be programmed with 12V nominal voltages which will be multiplied accordingly for 24V and 48V battery banks. DIP Switch nominal voltage multiplier settings are recommended whenever possible.

Morningstar Custom Settings Details:

Different controllers will have different options and charging parameters. Please use the information below and adjust as needed. Not all settings are critical and certain conditions may or may not require some of the optional settings. Review all the settings and consider what adjustments may be required for your particular system.



Custom Options for MK/Deka Flooded Monoblock & 2V Flooded Batteries

Absorption Voltage 14.7 V *

Absorption Time..... 6 hr

Enable Absorption Extension Checked/ 12.5V/ 12 hr

Battery Temperature Compensation -0.018 V/°C

Maximum Compensation Temp..... 35°C

Minimum Compensation Temp 15°C

Charge Mode – Float Settings

Enable Float Checked

Float Voltage 14.1V

Float Timeout 3 hr **

Enable Float Cancel Checked/12.3V

Enable Equalize Checked/15.3V

Equalize Time 6 hr

Auto Equalize interval 28 days

Equalize Timeout 12 hr

Enable Battery HVD Checked ***

High Voltage Disconnect 15.6V

High Voltage Reconnect 14.3V

Enable Maximum Regulation Limit Optional

Enable Battery Current Limit Optional

Battery Current Limit Optional

LED transition voltages (Green Only) 13.3V

LED transition voltages (Green and Yellow) 12.9V

LED transition voltages (Yellow Only) 12.6V

LED transition voltages (Yellow and Red) 12.3V

LED transition voltages (Red Only)

Tristar - TS-60 (60A), TS-45 (45A) Special Considerations

Chose a TriStar Mode - Solar/ Diversion

Solar Charge Control checked

Charge Mode - Float Settings

Transition to Float when duty cycle is 98% or less for 6 hrs (Diversion - After 4 h in Absorption (d > 0%)...) ****

Exit Float when duty cycle is 100% for..... 3 hr (Diversion - Exit Float if d=0% for a cumulative 2h)

Enable Low battery trip Enable, 12.5V, 12 hr

Enable Float cancel Voltage Enable. 12.3V

Load Settings (TriStar in Load Control Mode, ProStar, ProStar MPPT, SunSaver MPPT)

Low Voltage Disconnect 11.5-12V (typically)

Low Voltage Reconnect 12.5-13V

Delay Before LVD 5 min

Load Current Compensation 0.02 ohms (V/A)

* - Settings must be programmed with 12V nominal voltages with all Morningstar controllers and will be multiplied by 2 or 4 for 24V and 48V batteries respectively. Use DIP Switches to set the battery voltages as indicated in the DIP Switch tables above.



- ** - Float Timeout is the cumulative time that voltage drops below the Float Target Voltage before returning to Bulk/Absorption. If a system drops out of float this setting will attempt to recharge the battery late in the day
- *** - High Voltage Disconnect/ Reconnect will disable charging when there is overcharging from other sources.
- **** - For TriStar Solar Control Applications: Transition to Float with a lower duty cycle can be considered but Absorption Time should reflect the time it takes to reach the lower duty cycle. (For example ... 30% or less for 3 hrs)

Caution: There are few limits to the changes that can be made using Morningstar's Setup Wizard Tools in MSView. It is the responsibility of the user to be certain all changes are appropriate. Any damages to the controller or the system from setpoint adjustments will not be covered under warranty.

Disclaimer: Morningstar makes no representation, warranty or assumption of liability regarding the use of these custom settings configuration files. These custom settings configuration files are based on information provided by other parties (such as battery specs) and makes calculations based on assumptions which may or may not prove to be valid.

Custom Options for MK/Deka VRLA (8A, 8G & Unigy II) Batteries

Absorption Voltage 14.4 V *

Absorption Time..... 6 hr

Enable Absorption Extension Checked/ 12.5V/ 11 hr

Battery Temperature Compensation -0.018 V/°C

Maximum Compensation Temp..... 35°C

Minimum Compensation Temp 15°C

Charge Mode – Float Settings

Enable Float Checked

Float Voltage 13.5

Float Timeout 3 hr **

Enable Float Cancel Checked/12.3V

Enable Equalize Checked/14.6V

Equalize Time 12 hr

Auto Equalize interval 28 days

Equalize Timeout 4 hr

Enable Battery HVD Checked ***

High Voltage Disconnect 14.9V

High Voltage Reconnect 13.8V

Enable Maximum Regulation Limit Optional

Enable Battery Current Limit Optional

Battery Current Limit Optional

LED transition voltages (Green Only) 13.3V

LED transition voltages (Green and Yellow) 12.9V

LED transition voltages (Yellow Only) 12.6V

LED transition voltages (Yellow and Red) 12.3V

LED transition voltages (Red Only)

See Custom Options for MK/Deka Flooded Monoblock & 2V Flooded Batteries above for TriStar special considerations, Load control settings and * notes and Caution/ Disclaimers.



Custom Options for MK/Deka Sealed (2V Gel) Batteries

Absorption Voltage 14.52 V *

Absorption Time..... 6 hr

Enable Absorption Extension Checked/ 12.5V/ 11 hr

Battery Temperature Compensation -0.018 V/°C

Maximum Compensation Temp..... 35°C

Minimum Compensation Temp 15°C

Charge Mode – Float Settings

Enable Float Checked

Float Voltage 13.8V

Float Timeout 3 hr **

Enable Float Cancel Checked/12.3V

Enable Equalize Checked/14.88V

Equalize Time 6 hr

Auto Equalize interval 28 days

Equalize Timeout 12 hr

Enable Battery HVD Checked ***

High Voltage Disconnect 15.2V

High Voltage Reconnect 14V

Enable Maximum Regulation Limit Optional

Enable Battery Current Limit Optional

Battery Current Limit Optional

LED transition voltages (Green Only) 13.3V

LED transition voltages (Green and Yellow) 12.9V

LED transition voltages (Yellow Only) 12.6V

LED transition voltages (Yellow and Red) 12.3V

LED transition voltages (Red Only)

See Custom Options for MK/Deka Monoblock & 2V Flooded Batteries above for TriStar special considerations, Load control settings and * notes and Caution/ Disclaimers.

Custom Options for MK Battery Small VRLA (ES Series) Batteries

Absorption Voltage 15.0 V *

Absorption Time..... 6 hr

Enable Absorption Extension Checked/ 12.5V/ 11 hr

Battery Temperature Compensation -0.030 V/°C

Maximum Compensation Temp..... 40°C

Minimum Compensation Temp -15°C

Charge Mode – Float Settings

Enable Float Checked

Float Voltage 13.8V

Float Timeout 3 hr **

Enable Float Cancel Checked/12.3V

Enable Equalize Checked/15.01V

Equalize Time 6 hr

Auto Equalize interval 28 days



Equalize Timeout	12 hr
Enable Battery HVD	Checked ***
High Voltage Disconnect	15.9V
High Voltage Reconnect	14.6V
Enable Maximum Regulation Limit	Optional
Enable Battery Current Limit	Optional
Battery Current Limit	Optional
LED transition voltages (Green Only)	13.3V
LED transition voltages (Green and Yellow)	12.9V
LED transition voltages (Yellow Only)	12.6V
LED transition voltages (Yellow and Red)	12.3V
LED transition voltages (Red Only)	

See Custom Options for MK/Deka Flooded Monoblock & 2V Flooded Batteries above for TriStar special considerations, Load control settings and * notes and Caution/ Disclaimers.

IMPORTANT:

MK Battery and Morningstar Corporation are separate companies with unaffiliated ownership.

Neither MK Battery 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.