Polarium Energy Solutions & 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:
Polarium (www.polarium.com) offers two types of Lithium-ion battery chemistries.

Lithium Iron Phosphate (LFP)
In telecom the dominant technology. "Good enough" compared with VRLA and lower investment.
- Lower market price

Lithium Nickel Manganese Cobalt Oxide (NMC)
In telecom used for hybrid/ high cyclic applications and by long-term investment customers
- Higher energy density
- Higher cycle and calendar life
- Main technology for future EV markets

The Polarium batteries are available with 48V nominal models with three different cell configurations. The NMC models have 13 cells in series or 14 cells in series and the LFP models all have 15 cells in series.

Morningstar TriStar (PWM) and TriStar MPPT controllers can support 48V nominal battery banks.

Battery Models/ Specs:

Voltages: 48V nominal (all)

Battery Type	Model #	Ah	kWh
LFP (15 Cell)	SLB48-100-145-5	100 Ah	4.8 kWh
	SLB48-150-146-5	150 Ah	7.2 kWh
NMC 13S (13 Cell)	SLB48-100-144-1	100 Ah	4.75 kWh
	SLB48-100-144-1U	100 Ah	4.75 kWh
	SLB48-100-226-1	100 Ah	4.75 kWh
	SLB48-100-226-1U	100 Ah	4.75 kWh
	SLB48-110-225-1	110 Ah	5.19 kWh
	SLB48-150-146-1	150 Ah	7.18 kWh
	SLB48-200-146-1	200 Ah	9.44 kWh
	SLB48-200-228-1U	200 Ah	9.91 kWh
	SLB48-210-146-1	210 Ah	10.15 kWh
	SLB48-250-146-1	250 Ah	12.03 kWh
NMC 14S (14 Cell)	SLB48-100-144-2	100 Ah	5.11 kWh
	SLB48-100-226-2	100 Ah	5.11 kWh
	SLB48-150-146-2	150 Ah	7.62 kWh
	SLB48-200-146-2	200 Ah	10.16 kWh
	SLB48-210-146-2	210 Ah	10.93 kWh
	SLB48-250-146-2	250 Ah	12.96 kWh

NMC

End-of-Discharge Voltage Low Voltage BMS Disconnect (LVBD): NMC 13S = 39V; NMC 14S = 42V
Charge/ Discharge Cutoff Currents: 100A / 200A
Recommended max Charge/ Discharge Cutoff Currents: 80% of Charge/ Discharge Cutoff Currents
Operating Temperature Charging/ Discharging: 0 to +55°C/ -20 to +60°C

LFP

End-of-Discharge Voltage Low Voltage BMS Disconnect (LVBD): 39V
Charge/ Discharge Cutoff Currents: 33A / 66A (100Ah); 50A / 75A (150A)
Recommended max Charge/ Discharge Cutoff Currents: 80% of Charge/ Discharge Cutoff Currents
Operating Temperature Charging/ Discharging: 0 to +55°C/ -20 to +60°C

Communications: (monitoring, batteries in parallel and dry contact alarms)
Studio PC Application Software
Advanced Communication Interface Connect Alert: Extended Alarm Interface (dry contact alarms)
Connect Bridge: Advanced Communication Interface

Note: For more information regarding Polarium batteries, battery bank configuration and communications options please contact Polarium.

For optimal integration please use the following settings (12V settings are entered into the MSView Setup Wizard as indicated in the table):

48V Battery Settings: Enter 12V Settings into the MSView Setup Wizard

Parameter	NMC - 13 Cell	NMC - 14 Cell	LFP - 15 Cell
Charge Voltage Settings			
Absorption Voltage	52V / 13V	56V / 14V	51V / 12.75V
HVD (Battery)	53.2V / 13.3V	57.4V / 14.35V	52V/ 13V
HVR (Battery)	51.2V / 12.8V	55.2V / 13.8V	50V / 12.5V
Load Voltage Settings			
LVD (20% SOC)	45.6V / 11.4V	49V / 12.25V	47.6V / 11.9V
LVR	47.6V / 11.9V	51.2V/ 12.8V	49V / 12.25V

Additional Settings Details

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

Temp Comp = 0V/deg C

Float = Not enabled

Equalize = Not enabled

Battery Current Limit = Optional (Max recommended charge current = C/2 or C/1)

Delay Before Load LVD = 1 min (Possibly longer for cold temperatures)

Load High Voltage Disconnect is an optional setting for voltage sensitive loads

Optional calculation for LVD - Load Current Compensation:

Load Current Compensation = 1.8 / (Total Battery Bank Ah) ohms (V/A)

The configuration file downloads we offer are set to 0 ohms (V/A)

LED Transitions	NMC - 13 Cell	NMC - 14 Cell	LFP - 15 Cell
🟢 Green only	> 50.6V / 12.65V	> 54.6V / 13.65V	> 50V / 12.5V
🟢🟡 Green-Yellow	49V / 12.25V	52.8V / 13.2V	49.2V / 12.3V
🟡 Yellow only	47.6V / 11.9V	51.4V / 12.85V	48.6V / 12.15V
🟡🔴 Yellow Red	45.6 / 11.4V	49V / 12.25V	47.6V / 11.9V
🔴 Red only	< 45.6 / 11.4V	< 49V / 12.25V	< 47.6V / 11.9V

Notes:

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 Polarium BMS will limit the charge current to .07 X Ah rating of the battery. This is not likely to happen with the settings provided but If this does occur the lowering the charge voltage can be considered or cells of the battery may need to be balanced. Contact Polarium for more information about balancing the cell voltages.

Monitoring of the system with Morningstar Live View or MSView and Polarium Studio PC is recommended to determine if adjustments to the settings may be considered.

The Polarium Connect Alert communicates with SLB48 batteries and can translate information or alarms to operate two configurable dry connector relays to disable charging of the TriStar solar controllers before a BMS high voltage disconnect occurs. Please contact Morningstar support for more information on how to configure the.

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.

These settings are available for the Morningstar controllers listed below:

TriStar (PWM) - Solar Charging Control or Load Control (LVD)

TriStar MPPT (150V) and TriStar MPPT 600V - Solar Charging Control Only

Communications hardware required for programming Custom Settings with MSView:

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

EMC-1 Ethernet MeterBus Converter- https://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: https://www.morningstarcorp.com/msview/

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

IMPORTANT:

Polarium and Morningstar Corporation are separate companies with unaffiliated ownership.

Neither Polarium 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.