

## Closed-Loop BMS Communication Integration Guide: Pylon Technologies, Co. Ltd & Morningstar Corporation

### 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.

### BMS Communication Integration with Morningstar ReadyBMS:

The Morningstar ReadyBMS builds "lithium DNA" into any system equipped with a Morningstar Integrated Series parent component equipped with ReadyRail/ReadyBlock expansion technology. It delivers true closed-loop control and communications with the Tier 2 lithium battery brands in Morningstar's Energy Storage Partner program, delivering total peace of mind with charger and battery working together in a system.



This document provides essential instructions and recommendations for implementing closed-loop control and communications with PYLONTECH lithium batteries using Morningstar's ReadyBMS accessory with Morningstar charge controllers.

The closed loop communication and integration was developed and tested in tandem between PYLONTECH and Morningstar to provide safe, effective charging of the batteries with the following capabilities:

- Improved charging control during absorption for high SoC with less stress on the battery
- Increased battery capacity
- maintains better health of the battery
- Battery data monitoring including State of Charge (SoC) and State of Health

**Battery Overview:**

Pylontech offers several rack mount Lithium battery “modules” that are often used in the off-grid solar market. These modules include CAN communications for integration with Morningstar’s ReadyBMS and for communicating between multiple modules in parallel. For more information about Pylontech batteries please visit their website at <https://en.pylontech.com.cn/products/>.



Models: UP2500, US2000C, Phantom-S, US3000C and US5000

Voltages: 24V, 48V

Amp Hour Capacities: 2.4- 4.8 kWh (50 - 100Ah)

Battery	UP2500	US2000C Phantom-S	US3000C	UP5000
Nominal Voltage	25.6V	48V	48V	48V
Capacity kWh / Ah	2.84 kWh / 111 Ah	2.4 kWh / 50 Ah	3.55 kWh / 74 Ah	4.8 kWh / 100 Ah
Max Charge/Discharge Currents				
Peak (60 seconds)	100 Amps	50 Amps	74 Amps	120 Amps
Recommend/ Continuous	56 Amps	25 Amps	37 Amps	80/ 100 Amps

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

**ReadyBMS Setup Instructions:**

The ReadyBMS is one of Morningstar’s “ReadyRail Integrated Series” of accessory products. The ReadyBMS provides a communications interface over CANbus for implementing closed loop charging control between the GenStar MPPT controller (and other future Morningstar host device products) and PYLONTECH batteries.

Please refer to the GenStar MPPT and BMSBlock Installation operation manuals for complete instructions.

An 8-conductor straight-through **RJ-45 cable** (provided with the BMSBlock) is used to connect the Morningstar BMSBlock to the PYLONTECH battery. Attach one end of the RJ-45 cable to one of the RJ-45 ports on the BMSBlock and the other end to one of the CAN Ports of the PYLONTECH Battery (do not connect the Cable to either of the Ethernet Ports on the PYLONTECH battery!).

### Commissioning:

After the BMSBlock has been installed with the RJ-45 cable connected between the BMSBlock and PYLONTECH battery, the system can be powered up and commissioned for Closed Loop operation via the local meter of the host device. See the Commissioning / Initial Configuration in the host device manual for commissioning instructions (section 3.5 for the GenStar MPPT controller). If the host device has previously been commissioned it is necessary to perform a “Factory Reset” in order to recommission the device for closed-loop operation with the PYLONTECH battery.

#### Host Device Local Meter Display Commissioning Steps

- Select Language
- Enable/ Disable Ethernet Writes (allows control commands and custom programming over Ethernet)
- Select System Voltage
- Set the UTC Time (Universal Time)
- Set the Local Time Offset for the time zone
- Select YES for BMS Block
- Select PYLON for BMS Type
- Battery Load (LVD) Profile: Use custom settings with LVD/ LVR = 47.2V/ 49.8V ; or LVD/ LVR Preset = 25.4V/ 26.5V (for UP2500 model)
- Reboot controller after commissioning

### Load Control Settings:

After selecting the battery type, the last settings to be made during commissioning are the Low Voltage Disconnect (LVD) and Low Voltage Reconnect (LVR) load control settings. However, when configured for closed-loop BMS with a Pylon lithium battery, the system will enforce a minimum Load SOC Disconnect of 20 percent, and a minimum Load SOC Reconnect of 25 percent. This affects the Load Profile setup as follows:

- If a selected preset or custom load profile has the SOC Load Disconnect and Reconnect disabled, the system will automatically set the SOC Load Disconnect to 20 percent and SOC Load Reconnect to 25 percent at boot-up.
- If a selected preset or custom load profile has the SOC Load Disconnect and Reconnect below 20 and 25 percent, respectively, the system will automatically raise the values to 20 and 25 percent, respectively, at boot-up.
- If a selected preset or custom load profile has the SOC Load Disconnect and Reconnect above 20 and 25% respectively, no settings are overridden at boot-up.

Override warnings will appear in the local display during commissioning, and in LiveView in the Load Setup menu. When the LVD/LVR settings are set the 20/25% LSoCD/ LSoCR settings are still enabled and the load will be disconnected when it reaches LVD or LSoCD, whichever is first. These minimum LSoCD and LSoCR setpoints are required by PYLONTECH in order to comply with their warranty requirements.

#### WARNING NOTES:

Overridden SOC Disconnect and Reconnect value(s) will be displayed correctly in the local meter and LiveView “Settings” displays. However, when entering the Load Setup menus, it will always display the last saved SOC Disconnect and Reconnect settings, even if those settings were overridden.

### **Operation:**

The closed loop operation of the Genstar (and other future Morningstar host equipment) is implemented with control signals sent to the controller from the PYLONTECH BMS. This will include control of the following charging parameters.

- Target regulation voltage
- Maximum charge/ load currents
- Disable charging/ load

The closed-loop operation has been fully tested with the GenStar MPPT controller and meets all of the requirements specified by PYLONTECH. When used with the GenStar MPPT controller, the Genstar will charge to the requested voltage using up to the requested current. If the requested charge current is 0A, then the GenStar will not provide any current to the battery but can still power the GenStar load output with power from the PV array input to maintain 0A.

### **Morningstar ReadyShunt and ReadyRelay Integration:**

For systems that include an external load or external charging source, independent from the GenStar MPPT controller, installing a ReadyShunt is recommended in order to maintain the requested current from the PYLONTECH BMS. Please refer to the ReadyShunt Installation operation manual for complete instructions.

When a ReadyShunt Block is installed with a Net Shunt for the battery circuit the GenStar MPPT controller is able to limit the charge current to battery as requested by the BMS using the net shunt current. There must be no load or charge circuits connected between the Net Shunt and the battery.

A ReadyRelay Block can be used to control power to the connected load or to control external charging sources. Please refer to the ReadyRelay Installation operation manual for complete instructions.

For load control the ReadyRelay can be configured to turn a load relay OFF in the event of a low battery power condition. Once the reconnect threshold has been reached, the GenStar can reenale the load. A minimum LSoCD/LSoCR setting of 20%/25% is required to comply with warranty requirements for the PYLONTECH battery.

There are External Source Control (ESC) settings that can be used with the ReadyRelay to control external charging sources also. It is recommended to use a SoC threshold or voltage threshold Stop Charging settings to achieve the desired charging from the external source and prevent overcharging of the battery.

### **Disclaimer:**

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