# Thornwave Labs Inc

PowerMon-5S

Bluetooth Low Energy

500A Advanced Battery Monitor / DC Power Meter

– USER MANUAL –

BRIEF

PowerMon-5S is a 500A Bluetooth Low Energy advanced battery monitor / DC power meter. This tool can be used in any battery or DC powered circuit to monitor, analyze, and log the most important electrical parameters: voltage (0-32V), current (0-500A), power (W), energy (Wh), battery charge (Ah), and temperature. Many other parameters are computed: the battery state of charge (% SoC), remaining time on battery at current load, and a multitude of battery / DC power statistics. The device can log the data for up to 3 years, allowing for advanced data analysis and troubleshooting. All battery monitors on the market that log data, do it inside the mobile application but PowerMon-5S logs it inside internal memory. This makes PowerMon-5S superior. The device can drive a mechanical or solid-state relay which allows it to function as a low voltage disconnect, high voltage disconnect, over-current disconnect, temperature controller, remote on/off switch, timer, and generator control. A mobile device running either Android or iOS and the PowerMonX app (available for free on Google Play Store and Apple App Store) is required for using this device.
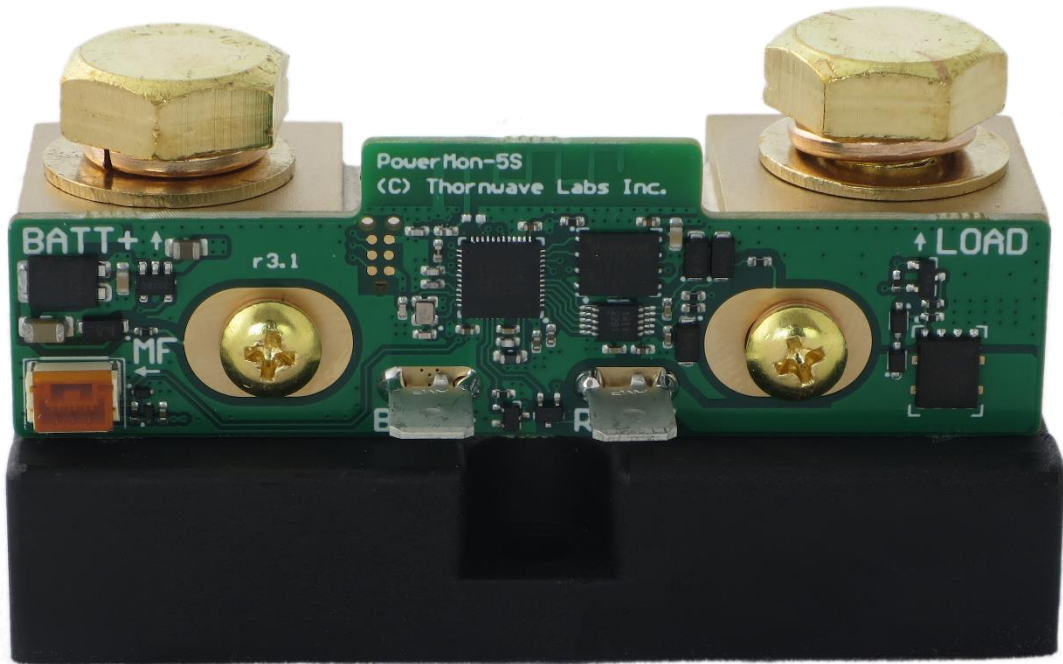
FEATURES

- Measures voltage, current, power (W), charge meter (Ah), energy (Wh), and temperature
- Operates at up to 32V and 500A of continuous current using the integrated current shunt
- Data logging for up to 3 years
- Can drive one relay or SSR (solid-state relay)
- Low / high voltage disconnect
- Over-current disconnect
- Low / high temperature disconnect
- Generator control
- Battery monitor (battery fuel gauge), displays the state of charge in percentage and the remaining time on battery at current load
- Works with all types of batteries

- Timers
- Can use an external temperature sensor (DS18B20 based)
- User / master password protection
- Very low power consumption (see Performance Parameters)
- Bluetooth LE radio with internal antenna and long range
- Measures only 3.25" x 1.75" x 1.75" (82mm x 45mm x 45mm) including
- Weatherproof
- Free PowerMonX app is available for Android and iOS.
- Most parameters can be configured, allowing it to achieve top performance with all kinds of batteries

TYPICAL APPLICATIONS

- RVs, boats, off-the-grid cabins
- Solar and wind alternative energy systems
- Vehicle batteries
- Backup electrical systems
- Automation: solar irrigation systems, solar streetlights, general-purpose DC timers

TERMINAL DESCRIPTION / INTERNAL DIAGRAM
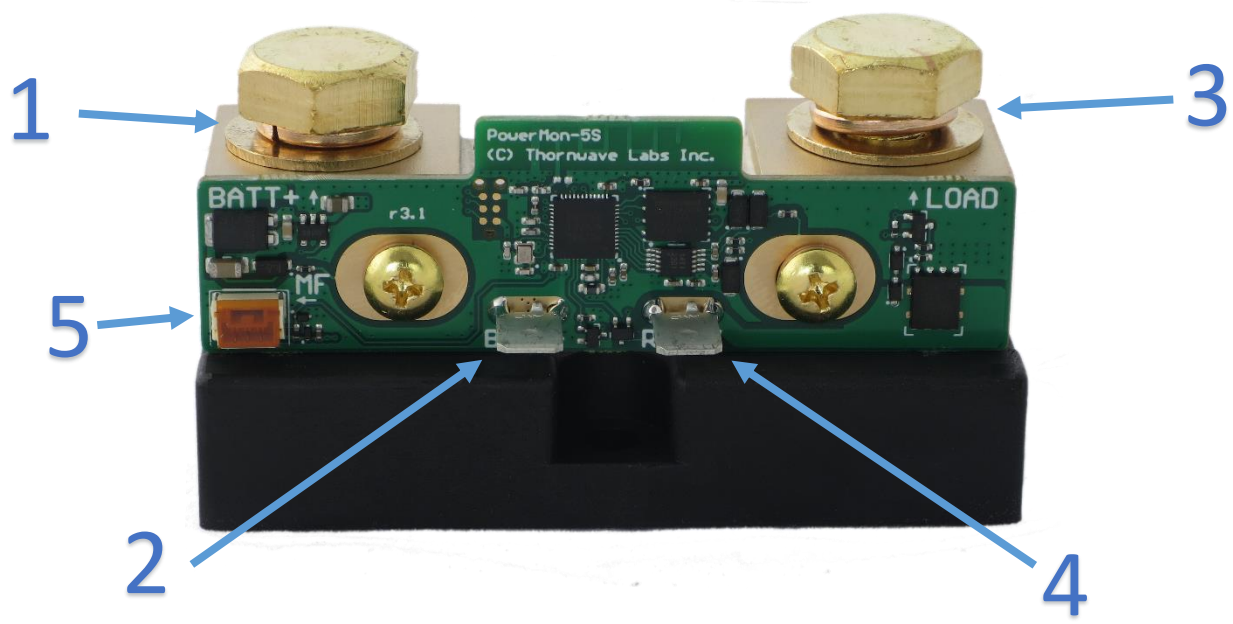
No.	Type	Name	Terminal Description
1	10mm hex bolt	BATT+	Battery positive. PowerMon-5S takes its power from this terminal. It also measures the voltage at this point. Connect to the battery positive.
2	¼" blade male terminal	BATT-	Battery negative. Usually also the chassis ground. Connect using the supplied black wire to the battery negative.
3	10mm hex bolt	LOAD	Connect to the loads / charger / solar charge controller
4	¼" blade male terminal	RELAY	Relay output. It drives a mechanical or solid-state relay. The device connects the RELAY terminal to the BATT- internally when the power is turned ON from the app. Use the supplied blue wire to connect to a relay.
5	connector	MF	MultiFunction connector. Can be used to connect an external temperature sensor or external pushbutton.

SPECIFICATIONS

Absolute Maximum Ratings [1,2]	
Maximum voltage at the BATT+ / LOAD terminals	**+32V**
Maximum voltage at the RELAY terminal	**+32V**
Maximum current through the RELAY terminal (maximum relay coil current)	**2A**
Maximum current through the shunt	**500A continuous**
Operating temperature	**-30°C to +85°C**

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.
2. All voltages are referenced to the ground (BATT- terminal) unless otherwise specified.

Performance Parameter	Value
Measured voltage (BATT+)	7 ~ 32V
Measured voltage accuracy	max 0.5%, typ. 0.25% (hw rev 3.0) max 0.2%, typ. 0.1% (hw rev 3.1)
Measured current	-500A to 500A
Current monitoring accuracy	0.5% - without calibration 0.25% - with calibration
Temperature	1°C / 1°F resolution
Data logging sample rate	1 sec – up to 18 days 2 sec – up to 36 days 5 sec – up to 90 days 10 sec – up to 180 days 20 sec – up to 1 year 30 sec – up to 1.5 years 1 min – up to 3 years
Current draw (current consumed by the device) (using the latest firmware version) at 12V at 24V at 32V	hw rev 3.0 hw rev 3.1 3.5 mA 1.5mA 3.7 mA 1.6mA 4.0 mA 1.7mA

COMPLIANCE STATEMENTS

FCC

ATTENTION: Changes or modifications not expressly approved by Thornwave Labs Inc could void the user's authority to operate the equipment.

ATTENTION**:** This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

ATTENTION: Cet appareil est conforme à la Partie 15 des règlements de la FCC. L'opération doit se conformer aux deux conditions suivantes: (1) cet appareil ne peut causer d'interférences nuisibles et (2) cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent provoquer un fonctionnement indésirable.

IC RSS-102 RF Exemption

This system has been evaluated for RF Exposure per RSS-102 and is in compliance with the limits specified by Health Canada Safety Code 6.

L'exposition aux radiofréquences de ce système a été évaluée selon la norme RSS-102 et est jugée conforme aux limites établies par le Code de sécurité 6 de Santé Canada.

IC RSS-Gen 8.4

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

SAFETY INSTRUCTIONS

Warning!

Read all the instructions and cautions before using the PowerMon-5S device. Thornwave Labs Inc does not assume responsibility for any injury or property damage caused by improper installation, bad wiring, or use of PowerMon-5S outside of its intended purpose. The device should be installed by a professional.

Warning!

The PowerMon-5S device should not be used for any medical purposes, life-sustaining equipment, safety applications, or any application where equipment failure can cause injury, death, fires, or any other hazard.

Warning!

There are no serviceable parts or fuses inside the power meter! Do not disassemble or attempt to repair! The unit operates with voltages up to 32V which can be lethal or cause serious and permanent injury.

Warning!

Do not submerge under water or other liquids. The device is neither weatherproof nor waterproof. Covering the device with liquid electrical tape may improve the resistance to the elements.

Warning!

The device is to be connected to DC circuits only, not exceeding 32V and 500A. Failure to do so will result in equipment damage. Confirm that all connections are tight to avoid excessive heating, sparks, or fires. Never connect without using a properly sized fuse or circuit breaker.

Warning!

Batteries are dangerous! Do not short-circuit a battery or the power meter. Batteries can produce flammable and explosive gases and can generate very high currents that can lead to serious consequences including explosion, fire, damage to equipment, personal injury, and even death. It is the user's responsibility to operate the equipment in a safe manner. Do not charge batteries in an enclosed environment unless allowed by the manufacturer of the battery. Never connect a load to a battery without using fuses or circuit breakers properly sized for the wires/ equipment.

Warning!

Although PowerMon-5S coupled with a relay can disconnect power if an over-current condition occurs, it should not be used to replace circuit-breakers. A properly rated circuit breaker or fuse should be used to protect the load and the wiring!

OVERVIEW

Installation. PowerMon-5S was designed to be installed inside an equipment bay, or inside a plastic enclosure where it will be protected from water, high humidity, condensation, and battery or other corrosive gases. The device should not be installed inside an all-metal enclosure since that will significantly reduce the Bluetooth range. Only one screw is required to mount the device on a flat surface. The second mounting hole is partially obstructed by the circuit board. If mounting using both holes is required, the circuit board can be removed. Pay attention to re-install the two washers between the shunt and the circuit board. Failure to do so will result in a short-circuit that will damage the circuit board. Thornwave Labs does not take responsibility for damage caused by removing the circuit board. Use the enclosed black wire to connect the battery negative to the left side terminal. Use the blue wire to connect the right-side terminal (RELAY) to the relay coil (if a relay is installed).

Device power. The PowerMon-5S device is drawing its supply power from the BATT+ / BATT- terminals. Power should always be present. If the device loses power, it will forget the internal clock.

Integrated current shunt. All loads and charging sources should be connected to the LOAD terminal. The shunt is rated at 500A / 0.25%. The shunt is can only be installed on the positive side of the circuit.

Zero the current offset. Due to the high sensitivity of the current measurement circuitry inside the PowerMon-5S device, the value displayed may have a small offset (measurement is different than zero even when the actual current is zero). Typically, this is less than 0.1A. In situations where the measurement precision is critical, the offset can be reduced to zero. To do this, disconnect the wire from the load side of the shunt or make sure the actual current is zero (turn off all the loads). This can also be achieved by turning the power relay off from the application (in case the system is wired with a relay). Long-tap on the "Current" tab and then "Zero Current". The operation will take 3 seconds to complete during which do not allow any current to pass through the device. Also, do not zero the current offset if the actual current is greater than zero. Doing so will introduce a very large offset. Any current that is flowing through the shunt when the Zero Current operation is performed will become the new indicated zero.

Current calibration. Typically, the device can measure current with better than 1% precision. If higher precision is required, the current measurement can be calibrated allowing up to 0.25% of precision. To calibrate the current reading, an amp-meter capable of measuring current with a precision better than 0.25% is required. Connect the amp-meter leads in series with the shunt and read the actual value of the current. Long-tap on the "Current" tab, tap on "Calibrate Current" and then type the actual value measured by the amp-meter. The sign of the current does not matter. Once calibrated, the only way to change the calibration is to reset the device to factory defaults or re-calibrate. The device will not accept a calibration current different from the actual current reading by more than 10%.

Power relay control. PowerMon-5S can drive a power relay (either mechanical or solid-state) using the RELAY output. When active (relay turned on), the RELAY terminal is internally connected to BATT- by the device. The relay should be connected between the power supply (battery positive, typically) and the RELAY terminal.

The low/high voltage disconnect, temperature disconnect, over-current disconnect, and generator control functions require the use of a relay / SSR (Solid State Relay).

Low voltage disconnect. When this feature is enabled, and the battery voltage drops below a specified threshold, the device turns the relay off, disconnecting the loads to protect the battery from over-discharge. To disconnect the load, the voltage must be below the set threshold for a configurable amount of time. This feature helps in situations like cranking an engine or a short high current load that causes the battery voltage to momentarily drop. The device will re-engage the power relay a configured amount of time after the voltage goes back above the connect threshold.

High voltage disconnect. This function is similar to the low voltage disconnect, but as the name suggests it will disconnect the load when the voltage goes above the disconnect threshold and will reconnect the load when the voltage goes below the reconnect threshold. This mode can be used together with the low voltage disconnect.

Over-current disconnect. When this feature is enabled and the measured current increases above a user-specified trip value, the device disconnects the load, protecting the batteries and load from over-current. The device will re-engage the power relay a configured amount of time after the current drops below the trip threshold.

Battery fuel gauge. PowerMon-5S computes the battery state of charge and various statistics. This is accomplished by using coulomb counting. Due to the complex nature of chemical batteries, small errors in measurement and integrating current over long periods of time will introduce errors in the state-of-charge estimation. This is normal and expected. For this reason, the device will re-synchronize its SoC counter with the battery every time a full charge is performed. A full charge is detected based on the chemistry of the battery but in general, it requires the voltage to be higher than a threshold while at the same time the charging current is lower than a threshold. The battery fuel gauge will also take into consideration the Peukert effect. The next table shows the Peukert coefficients used for various battery chemistries.

Battery Chemistry	Peukert Coefficient
Lead Acid - Flooded	1.25
Lead Acid – AGM	1.15
LiFePO$_4$	1.02
Li-Ion/LiPoly	1.02

External temperature sensor. PowerMon-5S can read the temperature from an external DS18B20 based sensor. To use an external sensor, purchase the PowerMon-5S MF Wiring Kit from Thornwave Labs. The documentation that comes with the kit explains how to connect the sensor. Configure the MF function to temperature sensor in the general configuration. If the sensor is recognized by PowerMon-5S, the temperature reading in the Live Data page will change to "Ext. Temperature".

Internal clock. PowerMon-5S keeps track of time internally. The internal clock can be set by tapping on the Device Clock tab for longer than one second. The internal date and time will be updated using the system time provided by the mobile device. If the internal clock is not set the device is not logging data.

Timer function. The device supports controlling the relay using a set of up to 16 timers. Each timer contains a start time, stop time and repetition. The start time specifies the time of day (HH:MM) when the relay turns on. Stop time specifies the time of day when the relay turns off. A timer does not need to have both the start and stop times. One of them can be disabled. This kind of timer should be used in pairs: one turns the relay on and the second one turns it off. 'Repetition' controls the days when a timer will trigger. This can be either DoW (Day of Week) where the timer repeats on specific days of the week or DoM (Day of Month) where the timer repeats on specific days of the month.

Using multiple timers, users can create very complex time schedules.

Examples:

Timer1: START 4:50PM, STOP 5:10PM, REPETITION DOW Mon Tue Wed Thr Fri Sat Sun

This timer will run every day and turn the relay on for 20 minutes, from 4:50PM until 5:10PM

Timer2: START 8:00PM. STOP: disabled, REPETITION DOW Mon Tue Wed Thr Fri Sat Sun

Timer3: START disabled, STOP: 7:00AM, REPETITION DOW Mon Tue Wed Thr Fri Sat Sun

This set of timers used together will turn the relay on every day at 8:00PM and turn it off the following day at 7:00AM. The same effect can be achieved using a single timer. This is just an example.

Timer4: START 12:00AM. STOP: disabled, REPETITION DOM: 1

Timer5: START disabled, STOP: 12:00AM, REPETITION DOM: 8

 This set of timers used together will turn the relay on every 1st of the month at 12:00AM and turn it off 7 days later on the 8th of the month at 12:00AM.

Monitor. PowerMon-5S monitors the following parameters in real time (two times a second):

Voltage: This is the voltage measured at the BATT+ terminal (referenced to BATT-).

Current: This the current going through the shunt. The value can be zeroed to eliminate any offset. If higher accuracy is required, it can also be calibrated.

Power: This value is computed as voltage multiplied by current.

Power Meter: This value is the accumulated energy. It counts in Wh (Watt-hour), and it can be reset to zero. The measurement is purely informational. It is not used for any other purpose by the device.

Charge Meter: This value is the accumulated coulombs. It counts in Ah (Ampere-hour), and it can be reset to zero. The measurement is for informational. It is not used for any other purpose by the device.

Battery SoC: The battery state-of-charge is displaying in percentage, from 0% to 100%. If the value displays "unset" is because the battery fuel gauge component inside the PowerMon-5S is not yet synchronized with the battery. The fuel gauge will synchronize automatically when a full charge is detected. It is important that the battery fuel gauge is configured correctly (battery chemistry, battery voltage, and battery capacity). For Lithium batteries a small discharge is required (about 10%) before applying a full charge to initially synchronize the SoC reading.

Battery Remaining: The time left before the battery is completely discharged assuming the current rate of discharge. This value is only shown when the discharge current is higher than -0.1A.

Power Status: Displays the current power status of the device (RELAY output status). Possible values are: OFF, ON, LVD (Low Voltage Disconnect – device is OFF due to an LVD condition), HVD (High Voltage Disconnect), OCD (Over-Current Disconnect), LTD (Low Temperature Disconnect), HTD (High Temperature Disconnect). The power can be manually turned OFF. For all disconnect functions to operate the power must be manually set to ON.

Generator Status: This is shown only when the generator control feature is enabled in the device configuration. It displays the generator state (the relay state: ON / OFF)

Temperature: This is the internal device temperature. If an external temperature sensor is connected and configured properly this will change to "Ext. Temperature" indicating that this is now the external sensor temperature.

Device Clock / Device Date: The internal clock and date of the device. It can be set from the system time and date.

Bluetooth Signal: The strength of the Bluetooth signal received from the PowerMon device. It is measured in dBm, and it will be a negative value. The higher the value (closer to zero) the stronger the Bluetooth signal is. If this value is lower than about -90dBm it will become more difficult to connect and maintain a connection to the device. This means that you are either too far from the device or there are too many walls / obstacles in between PowerMon and the mobile phone.

Configuration. The device configuration can be changed using the PowerMonX app. The configuration parameters are grouped in a few categories based on the function affected by these parameters.

General.

Max. Shunt Current (amperes): The maximum current that the shunt is expected to see. Typically, this is set to the maximum rated current of the shunt, 500A. It can be set lower to potentially increase the resolution of the reading. To do this it has to be set to lower than 273A. By doing this the resolution will be increased 4 times. Obviously, the maximum current PowerMon-5S can now measure is only 273A.

Turn On at Startup: The default power status when powering the device. If set to on, the relay will be turned on automatically when the device is first powered up.

Trigger on Relay Active: If enabled, the device will turn the power on as a response to the RELAY terminal being temporarily pulled to the ground (BATT-) using a push button.

Invert Relay Logic: Enabling this option will invert the behavior of the RELAY terminal: when the power is on the RELAY terminal will be floating and when the power is off it will be driven to the ground (BATT-). When this option is enabled "Trigger on Relay Active" is ignored (disabled).

Connect Filter (milliseconds): The duration of time in milliseconds the LVD (Low Voltage Disconnect), HVD, and OCD (Over-Current Disconnect) conditions must be removed for the PowerMon-5S to re-engage the power relay.

MF Terminal Function: Selects the function of the MF terminal: Data Output or External Temperature Sensor. The external temperature sensors are only available for hardware revision 2.2 or higher.

Data Logging Mode: Configure the data logging sample rate. Possible values are disabled, every second, 2 seconds, 5 sec, 10 sec, 20 sec, 30 sec, or 1 minute.

Low Voltage Disconnect

LVD Disconnect Threshold (V): The voltage in volts below which the power relay will disengage.

LVD Connect Threshold (V): The voltage in volts above which the power relay can re-engage (after the connect filter time has passed). This must be higher than LVD Disconnect Threshold.

LVD Disconnect Filter (milliseconds): The duration of time the voltage must be below the disconnect threshold for the relay to disengage. It is used to filter voltage spikes.

High Voltage Disconnect

HVD Disconnect Threshold (V): The voltage in volts above which the power relay will disengage.

HVD Connect Threshold (V): The voltage in volts below which the power relay can re-engage (after the connect filter time has passed). This must be lower than HVD Disconnect Threshold.

HVD Disconnect Filter (milliseconds): The duration of time the voltage must be above the disconnect threshold for the relay to disengage.

Over-Current Disconnect

OCD Disconnect Threshold (A): The current in amperes above which the power relay disengages.

OCD Disconnect Filter (milliseconds): The duration of time the current must be above the disconnect threshold to disengage the relay.

Low Temperature Disconnect

LTD Disconnect Threshold: The temperature below which the power relay will disengage.

LTD Connect Threshold: The temperature above which the power relay can re-engage (after the connect filter time has passed). This must be higher than LTD Disconnect Threshold.

LTD Disconnect Filter (milliseconds): The duration of time the temperature must be below the disconnect threshold for the relay to disengage.

High Temperature Disconnect

HTD Disconnect Threshold: The temperature above which the power relay will disengage.

HTD Connect Threshold: The temperature below which the power relay can re-engage (after the connect filter time has passed). This must be lower than HTD Disconnect Threshold.

HTD Disconnect Filter (milliseconds): The duration of time the temperature must be above the disconnect threshold for the relay to disengage.

Auto-off Timer: If enabled the power will turn off automatically after a specified time since it was turned on has passed. This effectively becomes a turn-off timer.

Auto-on Timer: If enabled the power will turn on automatically after a specified time since it was turned off has passed. This effectively becomes a turn-on timer.

Battery Fuel Gauge

Battery Chemistry: The chemistry of the battery used (Lead Acid – Flooded, Lead Acid – AGM, LiFePO4, Li-Ion, Li-Poly).

Battery Voltage: The battery voltage (can be the standard 12V, 24V, 48V, … or custom, in which case the number of cells in the battery can be configured).

Number of Cells: Number of cells of the battery. 12V Lead Acid batteries have 6 cells. 12V LiFePO$_4$ batteries have 4 cells. If you have batteries connected in series, add the number of cells in each of them. If batteries are connected in parallel the number of series cells does not change. This is the number of cells that contribute to the battery nominal voltage.

Total Battery Capacity: Battery capacity in Ah. If batteries are connected in parallel, add their capacities. If batteries are connected in series the capacity does not change.

Disconnect on Battery SoC Threshold (%): The device will disconnect power (turn the relay OFF) when the battery state of charge becomes lower than this threshold (in percentage).

Connect on Battery SoC Threshold (%): The device will re-connect power (turn the relay ON) when the battery state of charge becomes higher than this threshold (in percentage).

Generator Control

Turn On Based on Voltage: If enabled the generator will be turned on when the battery voltage drops under a specified threshold.

> Turn On Voltage Threshold (V): The threshold in volts below which the generator will be turned on.

> Turn On Voltage Filter (milliseconds): The duration of time the voltage must be below the turn-on threshold for the generator to be turned on.

Turn On Based on SoC: If enabled the generator will be turned on when the battery SoC (State-of-Charge) drops under a specified threshold.

> Turn On SoC Threshold (%): The threshold in percentage below which the generator will be turned on.

Turn Off Based on Voltage: If enabled the generator will be turned off when the battery voltage increases above a specified threshold.

> Turn Off Voltage Threshold (V): The threshold in volts above which the generator will be turned off.

<u>Turn Off Based on SoC</u>: If enabled the generator will be turned off when the battery SoC (State-of-Charge) increases above a specified threshold.

<u>Turn Off SoC Threshold (%):</u> The threshold in percentage above which the generator will be turned off.

<u>Turn Off Delay (minutes)</u>: Delay applied between the conditions to turn the generator off become true and turning the generator off. For example, if set to 1 minute, the generator will stay on for an extra minute after the voltage or SoC increases above the turn-off threshold.

Default Factory Settings. The device can always be reset to the default configuration using the PowerMonX app. To do this, connect to a device, tap the top right corner menu and then "Device Information". Tap on Factory Reset.

WARNING: When resetting to the factory defaults, all custom settings, and timers will be erased, including the device calibration, the battery fuel gauge internal state, and the data log.

Password lock. The device can be locked using a master/user password scheme. Upon connecting, the app will prompt the user to enter the user password if the device is locked. Once the correct password is entered, the device becomes unlocked and will stay unlocked for the duration of the connection.

The master password locks only certain functions that are critical to the correct and safe operation of the device. The manufacturer of a custom system using the PowerMon-5S battery monitor can use the master password to protect those critical areas of the configuration. The critical areas protected by the master password can be unlocked by tapping on "Master Access Unlock" on the Device Information page.

The following features are not available if the device is locked by the master password: resetting the power meter/battery statistics, saving the configuration, resetting to factory settings, zeroing, or calibrating the current reading, clearing the data log, updating the device firmware.
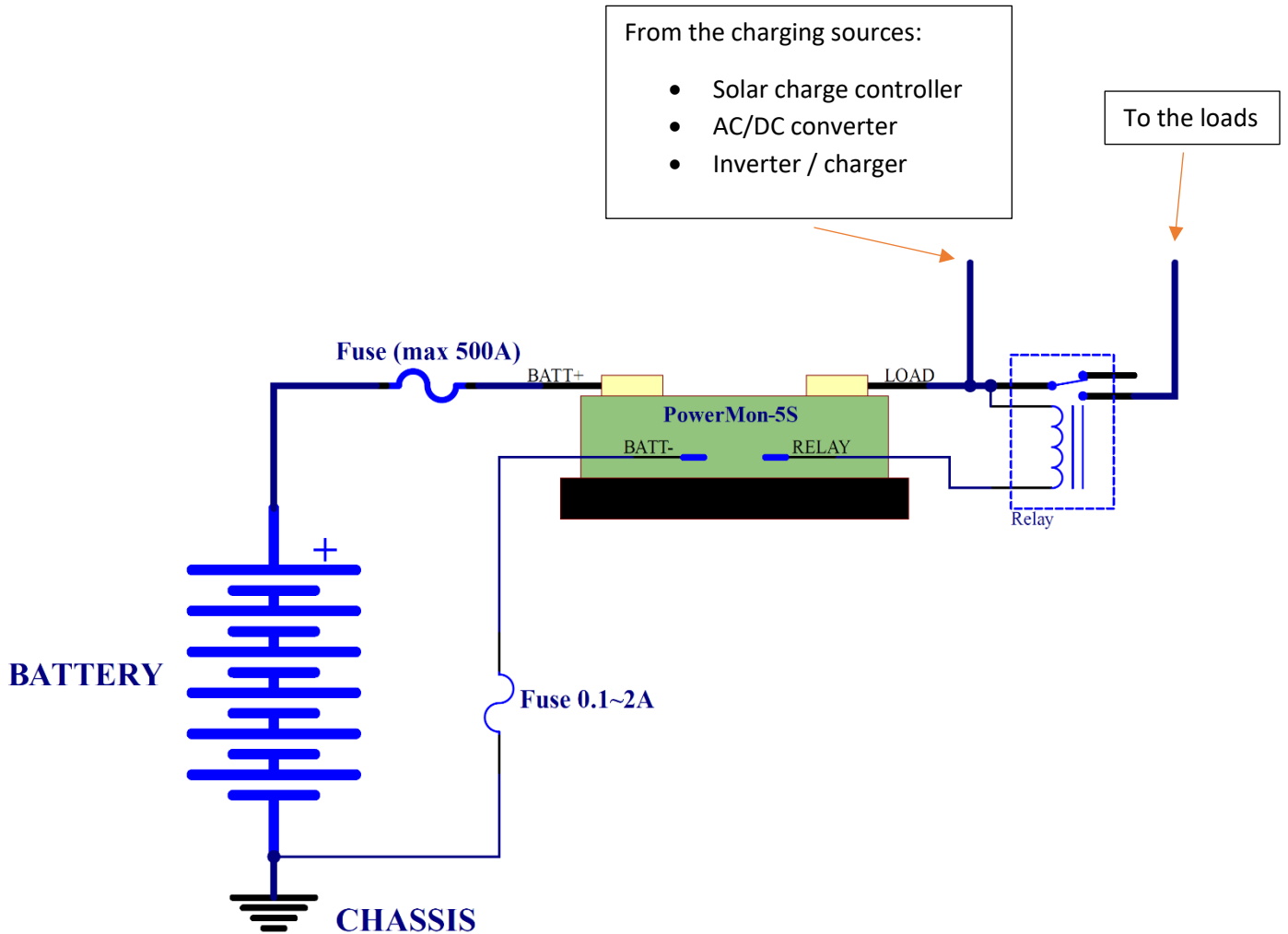
If the device is locked with the user password, entering the master password instead will unlock the entire device.

Operation. PowerMon-5S is continuously advertising its presence over Bluetooth. PowerMonX is the required app, and it can be found on the App Store / Play Store for both Apple and Android devices. The app allows you to scan for PowerMon devices, connect, view the live data, view the battery statistics, change the configuration, rename the device, configure the password protection, visualize the logged data, and more.

Radio performance. The device contains an internal Bluetooth Low Energy radio operating in the 2.4GHz ISM band and an internal antenna. For best performance, the device should be installed in such a way as to offer a path for radio waves to reach it. Metal walls or enclosures can attenuate or completely shield the device. Installation on non-metallic surfaces is preferred. The mobile device app displays the RSSI value (Received Signal Strength Indication) in real-time.

Renaming the device. Renaming the device can be achieved using the top-right menu button and taping on "Device Information". The maximum name length is 8 characters.

WIRING DIAGRAM

From the charging sources:

- Solar charge controller
- AC/DC converter
- Inverter / charger

To the loads

Fuse (max 500A)

BATT+

PowerMon-5S

BATT-   RELAY

LOAD

Relay

BATTERY

+

Fuse 0.1~2A

CHASSIS

Typical application with a power relay

- The disconnect functions are available (relay installed)
- The charging sources are connected before the relay. This is done so they cannot be disconnected from the battery during a low voltage or other disconnect events (very important for an MPPT charge controller).
- The main fuse should be sized based on the maximum system current and the wire size

DIMENSIONS
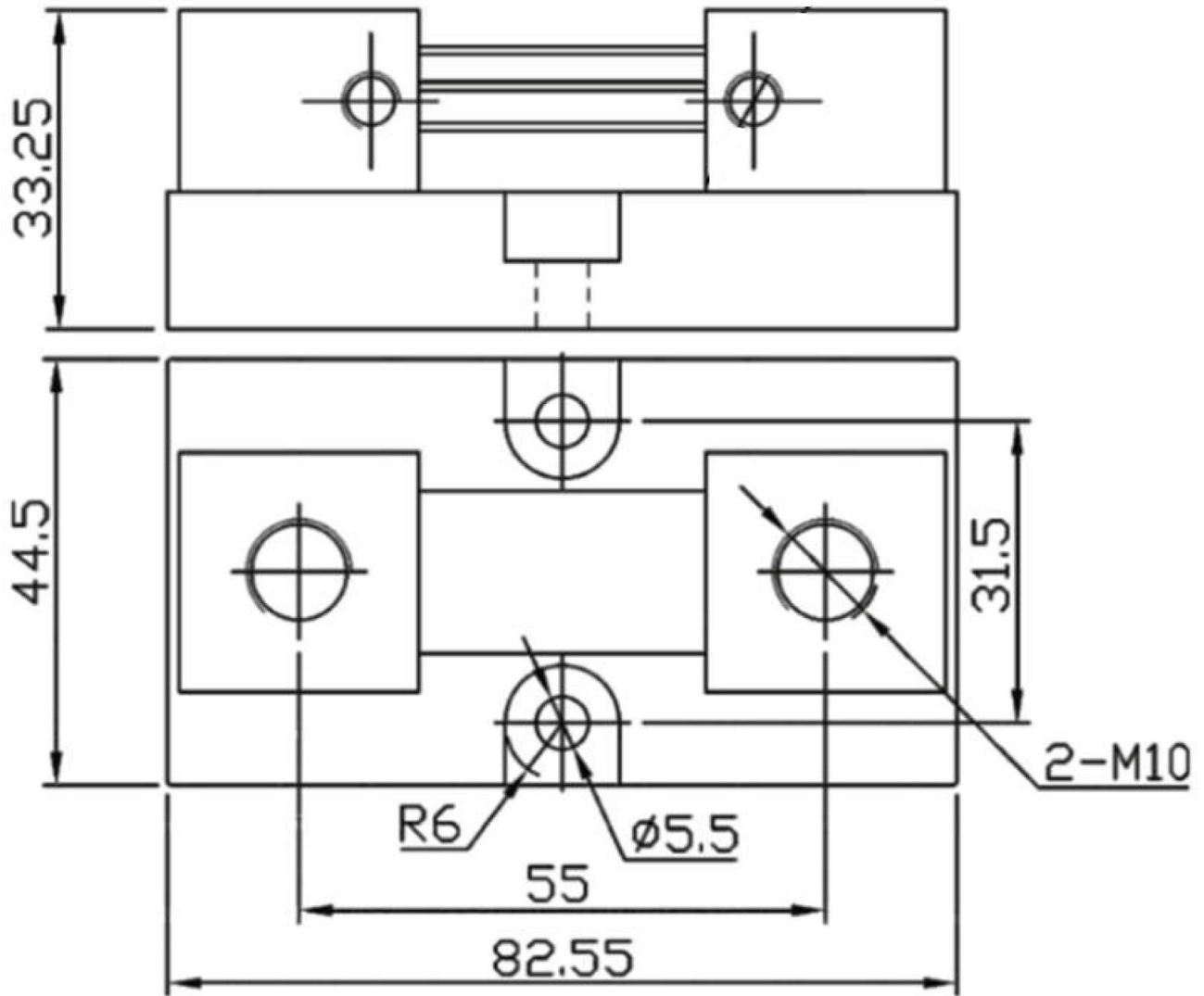
Dimensions are in mm.

ORDERING

Part Number	Description
PowerMon-5S	PowerMon-5S - Bluetooth LE 500A Advanced Battery Monitor / DC Power Meter