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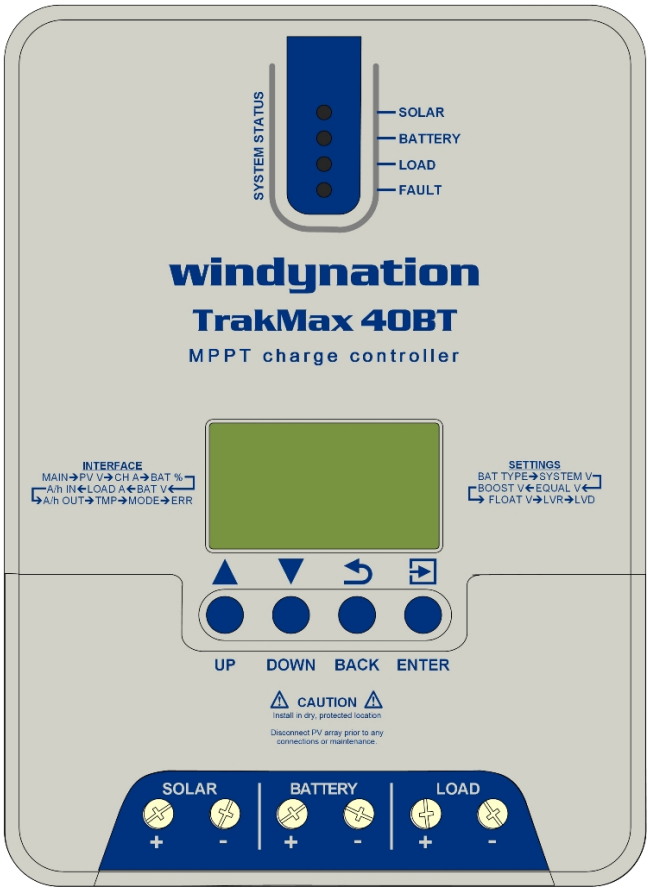


TrakMax 40BT

MPPT Solar Charge Controller

CHC-MPPT-40BT

User's Manual

Table of Contents

1 INTRODUCTION

Thank you for purchasing the TrakMax 40BT.

This manual is intended for anyone who needs to install and operate the solar charge controller and will provide safety guidelines, detailed procedures for installing and setting up the solar charge controller, as well as information about operating and troubleshooting the unit.

The manual will not provide details about any of the connected equipment to the controller (eg: PV panels, batteries, etc.). Information concerning any connected equipment should be available from the equipment manufacturer.

1.1 SAFETY

Windy Nation is not installing the solar system, and as such will not accept any liability or responsibility for damage to property, injury, or death arising out of, or related to the use or misuse of any product offered by Windy Nation. It is strongly recommended to read and adhere to all instructions and precautions before proceeding.

- If there is any uncertainty, installation and servicing should be referred to a qualified service personnel.
- Remove all sources of power, photovoltaic and battery, before servicing or installing.
- During operation, the controller can be very hot to the touch.

Battery Safety

Warning: Batteries can produce explosive gasses; observe extreme caution.

- Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.
- NEVER smoke or allow a spark or flame in the vicinity of the battery.
- Be cautious of metal items such as jewelry and tools to reduce risk of short circuit.
- Never charge a frozen battery.
- Be sure battery is mounted in a well-ventilated compartment.
- Purge excessive gas from the battery cells by filling each cell with distilled water until battery acid reaches level specified by battery manufacturer. For batteries without cell caps, carefully follow manufacturers charging instructions.

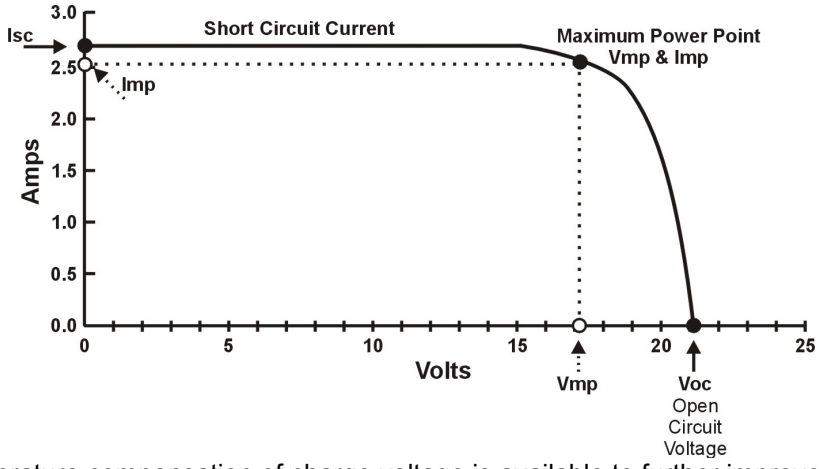
1.2 DEFINITIONS

- Ah — Amp-Hour
- V — Volts
- BTS — Battery Temperature Sensor
- DC — Direct Current
- LED — Light Emitting Diode
- LVD — Low Voltage Disconnect
- LVR — Low Voltage Reconnect
- TMP — Temperature
- BAT — Battery
- LCD — Liquid Crystal Display
- PV — Photovoltaic
- MPPT — Maximum Power Point Tracking
- PWM — Pulse Width Modulation

2 PRODUCT OVERVIEW

The TrakMax solar charge controller is a Maximum Power Point Tracking (MPPT) photovoltaic (PV) battery charge controller. The TrakMax product offers optional remote monitoring and logging capabilities via a hard wired or Bluetooth connection with full configurability of all charging parameters. Through the use of MPPT technology, TrakMax can increase charge current up to 30% or more compared to conventional solar charge controllers. TrakMax's sophisticated three stage charge control system can be configured to optimize charge parameters to precise battery requirements. The unit is fully protected against voltage transients, over temperature, over current, reverse battery, and reverse PV connections. An automatic current limit feature allows use of the full 40-amp capability without worrying about overload or unnecessary fuse blows from excessive current, voltage, or amp-hour based load control.

The advanced multi-peak tracking technology accurately tracks the maximum power point on the I-V curve even when the solar panel is partially shaded. The multiple tracking algorithm enables accurate tracking of the optimum working point on the I-V curve in an extremely short time for an optimum MPPT tracking efficiency of up to 99.9%.

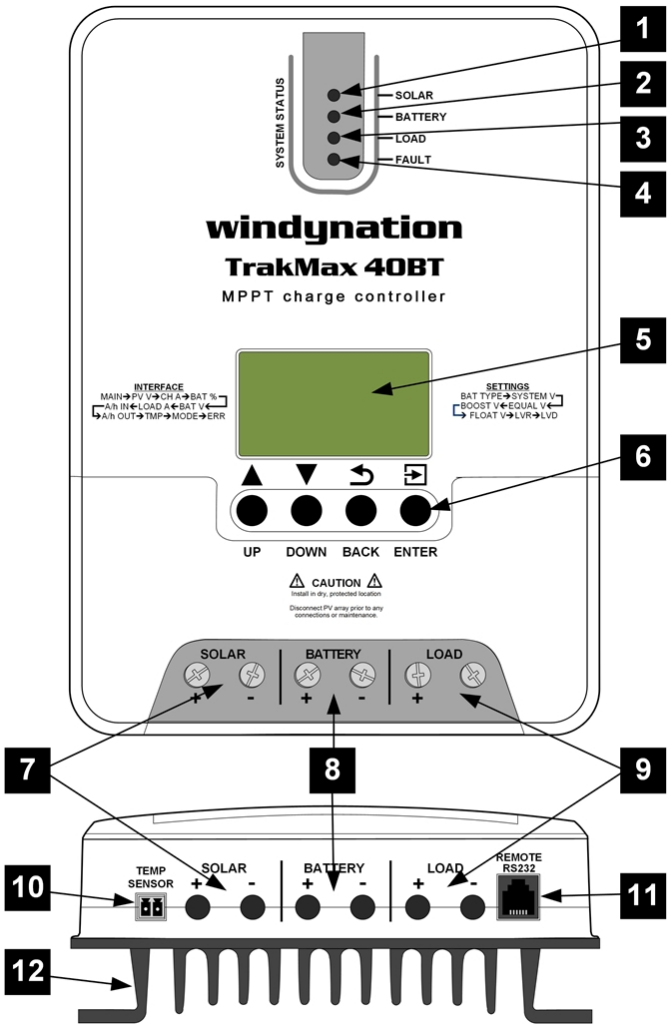


Fully automatic temperature compensation of charge voltage is available to further improve charge control and battery performance. The Battery Temperature Sensor (BTS) features an environmentally sealed sensor element encapsulated into a lug, for secure temperature readings. The TrakMax also includes an isolated RS232 communication interface for connection to a remote monitor or wireless Bluetooth transmitter (purchased separately).

For large system current applications (greater than 40 amps), multiple TrakMax units can be connected in parallel.

2.1 FEATURES

- ✓ Maximum energy conversion efficiency of up to 98%
- ✓ Wide PV Input Range (100V)
- ✓ DC Load Output Port (up to 20A)
- ✓ LCD and LED displays to indicate the status of charge
- ✓ Fully configurable parameters
- ✓ Lightning protection
- ✓ Reverse current protection at night
- ✓ Smart Error detection
- ✓ Automatic overload protection
- ✓ Natural Cooling with built in over temperature protection
- ✓ Historical data storage and retrieval (up to one year)
- ✓ Battery Temperature Compensation
- ✓ Compatible with all types of batteries including gel, sealed, lithium, etc.
- ✓ Optional Remote Monitoring using (Requires item CHC-TMRM-01 or CHC-TMBT-01)



1	PV LED	7	PV Terminal Input
2	BATTERY LED	8	Battery Terminal
3	LOAD LED	9	DC LOAD Terminal Output
4	FAULT LED	10	Temperature Sensor Connection
5	LCD Display	11	RS232 Remote Monitor Port*
6	Function Keys	12	Mounting Frame / Heat Sink

* Optional Equipment is required for operation (purchased separately)

2.2 SPECIFICATIONS

2.2.1 Electrical Specifications

Parameter	Value @25°C
Battery System Voltage	12 / 24 VDC (auto-detect)
Max Input Current	40 Amp
Max Battery Charging Current	40 Amp
Load Current	20 Amp
Max PV Open Circuit Array Voltage	100VDC
Efficiency	98% @ full current
Typical Idle Consumption	< 0.1A
Over-voltage Indication	16.0 / 32.0 VDC (default)
Under-voltage Indication	12.0 / 24.0 VDC (default)
Low Voltage Disconnect	11.1 / 22.2 VDC (default)
Low Voltage Reconnect	12.6 / 25.2 VDC (default)
Temperature Compensation	-3.0mV/°C (default)
Load Control	ON / OFF / TIMED
Altitude	Operating 9,843ft (3000m)
Enclosure Protection Class	IP32
Battery Temperature Sensor (BTS)	Sensor increases charging precision*
Terminal Size (fine/single wire)	Maximum 8 AWG

**NOTE: With the battery temperature sensor installed, the controller will increase or decrease the battery charging voltage depending on the temperature of the battery to optimize the charge to the battery and to maintain battery performance.*

2.2.2 Physical Specifications

Parameter	Value
Dimension (H x W x D)	9.4” (238mm) x 6.8” (173mm) x 2.9” (72.5mm)
Unit Weight	4.4 lb. (2Kg)
Mounting	Vertical wall mount - indoor only
Cooling	Natural cooling
Operating Temperature	-31°F to 113°F (-35°C to 45°C)
Storage Temperature	-35°C to 60°C
Operating Humidity	20 to 80% relative humidity (non-condensing)

2.2.3 Regulatory Information

The TrakMax has safety approvals as follows:

- CE
- IEC 62109

FCC Requirements:
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.

3 INSTALLATION

- Insure all terminating connections are clean and tight to prevent arcing and overheating.
- Do not connect to a PV array capable of producing greater than 40 amps of short circuit current @ 25°C.
- Do not connect to a PV array with an open circuit voltage (VOC) greater than 100VDC.

Important: Installations should meet all local codes and standards. Installations of this equipment should only be performed by skilled personnel such as licensed electricians and Certified Renewable Energy (RE) System Installers.

Caution: Install the Solar charge controller in a dry, protected location away from sources of high temperature, moisture, and vibration. Corrosion is not covered by the warranty.

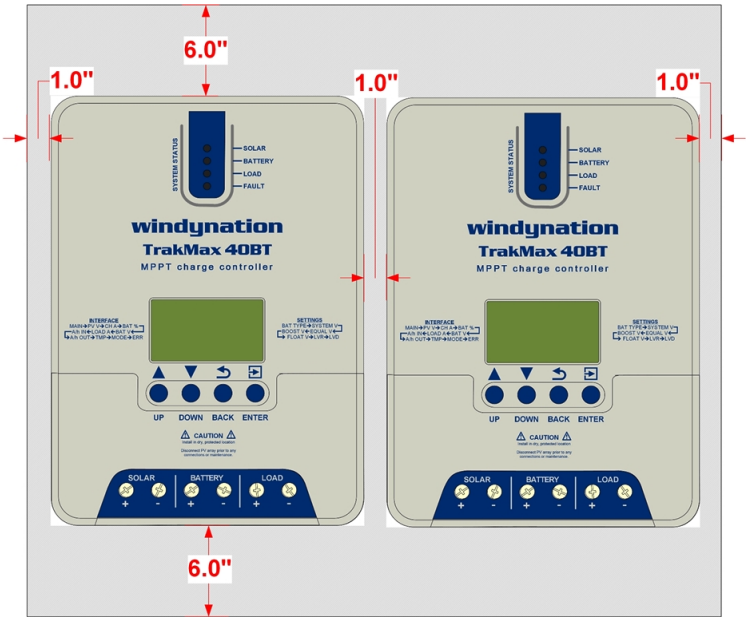
3.1 ELECTROSTATIC (ESD) PRECAUTIONS

All electronic circuits may be damaged by static electricity. To minimize the likelihood of electrostatic damage, discharge yourself by touching an electrical ground (e.g.: copper pipe) prior to handling the unit and avoid touching components on the circuit boards. The risk of electrostatic damage is highest when relative humidity is below 40%.

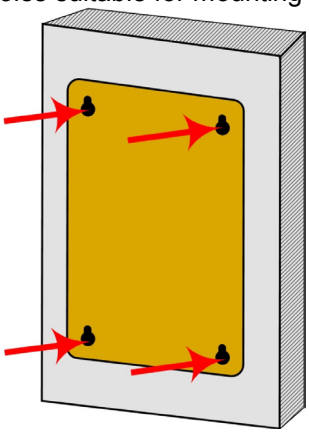
3.2 MOUNTING

The mounting location is important to the performance and operating life of the controller. The environment must be dry and protected from water. If required, the controller may be installed in a ventilated enclosure with sufficient airflow. Never install the TrakMax MPPT in a sealed enclosure. The controller may be mounted in an enclosure with sealed batteries, but never with vented/flooded batteries. Battery fumes from vented batteries will corrode and destroy the TrakMax MPPT circuits.

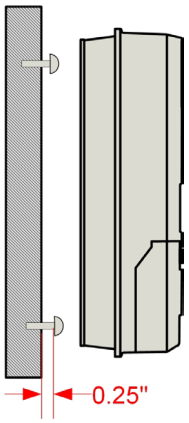
1) Place the TrakMax on a vertical surface protected from direct sun, high temperatures, and water. The TrakMax requires at least 6 in (150 mm) of clearance above and below and at least 1 in (25 mm) on each side for proper air flow as shown in figure below.



2) Place the included mounting template on the desired mounting surface, mark the location of four corner keyholes and drill the four installation holes suitable for mounting screws or the screw anchor.



3) Screw the mounting screws into the predrilled holes, leaving approximately 0.25” of the screw head from the mounting surface, and align the four keyholes on the back of the controller with the four mounting screws to secure the controller.



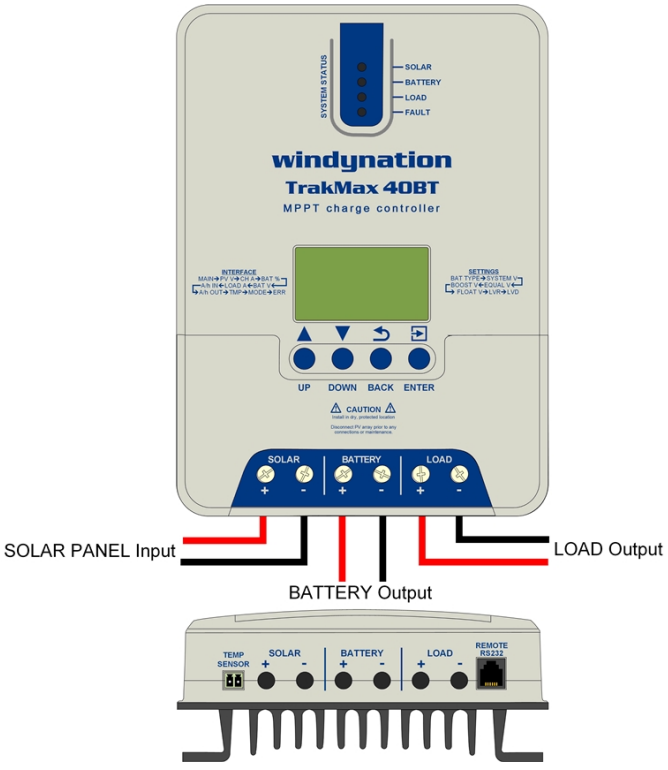
Warning: Explosion/Corrosion Hazard
Do not mount on flammable surface material (e.g.: wooden wall).

3.3 CONNECTIONS

WARNING: Shock Hazard
Solar PV array can produce open-circuit voltages in excess of 100 VDC when in sunlight. Verify that the solar input breaker or disconnect has been opened (disconnected) before installing the system wires. Note that the maximum PV open-circuit voltage for the TrakMax is 100 VDC. Do NOT attach the positive and negative PV cables to the TrakMax until the TrakMax has been connected to the positive and negative terminals of the battery bank.

WARNING: Loose connectors result in excessive voltage drop and may over heat wires, which can cause the wire insulation to melt. This can cause electrical fires. Verify all connections are secure and have no voltage drop.

IMPORTANT: The NEC requires that the wires carrying the system current never exceed 80% of the conductor's current rating (sizing recommendations are located in Section 6).



IMPORTANT: Strip the wire ends approximately 0.3" (7.6mm) before connecting to the charge controller. Use caution when handling the stripped wires to avoid electric shock.

WARNING: Connect the battery BEFORE connecting the solar panel(s).

1) Connect the Battery

Connect the charge controller to the battery BEFORE connecting the solar panels to the charge controller. Insert the battery wiring into the BATTERY terminals on the front of the charge controller and tighten the terminals from the top of the controller using a screwdriver to ensure a good connection is made.

- Connect a cable from the TrakMax terminal marked battery negative (–) to the negative (–) battery terminal and tighten the screw.
- Connect a cable from the TrakMax terminal marked battery positive (+) on the Solar charge controller to the positive (+) battery terminal and tighten the screw.

Be sure to note the polarity of each terminal; the charge controller self-protection feature will prevent damage from reverse polarity connections, but the controller will not function until the battery is connected properly.
A 50-amp fuse is recommended in the positive wire connecting the charge controller to the battery; See below for a complete fusing diagram.

2) Connect the Solar Panel (PV) Array

Insert the solar panel wiring to the SOLAR terminals on the front of the charge controller and tighten the terminals from the top of the controller using a screwdriver to ensure a good connection is made.

- Connect the PV array's positive (+) output to the terminal marked PV positive (+) on the TrakMax and tighten the screw.
- Connect the PV array's negative (–) output to the terminal marked PV negative (–) on the TrakMax and tighten the screw.

Be sure to note the polarity of each terminal; the charge controller self-protection feature will prevent damage from reverse polarity connections, but the charge controller will not function until the PV Array is connected properly.
A 50-amp in-line fuse is recommended in the positive wire connecting the charge controller to the solar panel(s); See below for a complete fusing diagram.

WARNING: High voltages may be present on the solar panel output wiring. Solar panels produce electricity when exposed to light. Make sure the solar panels are placed in the shade and are NOT in direct sunlight. Use caution and avoid touching any conductors in the system circuit to avoid electric shock.

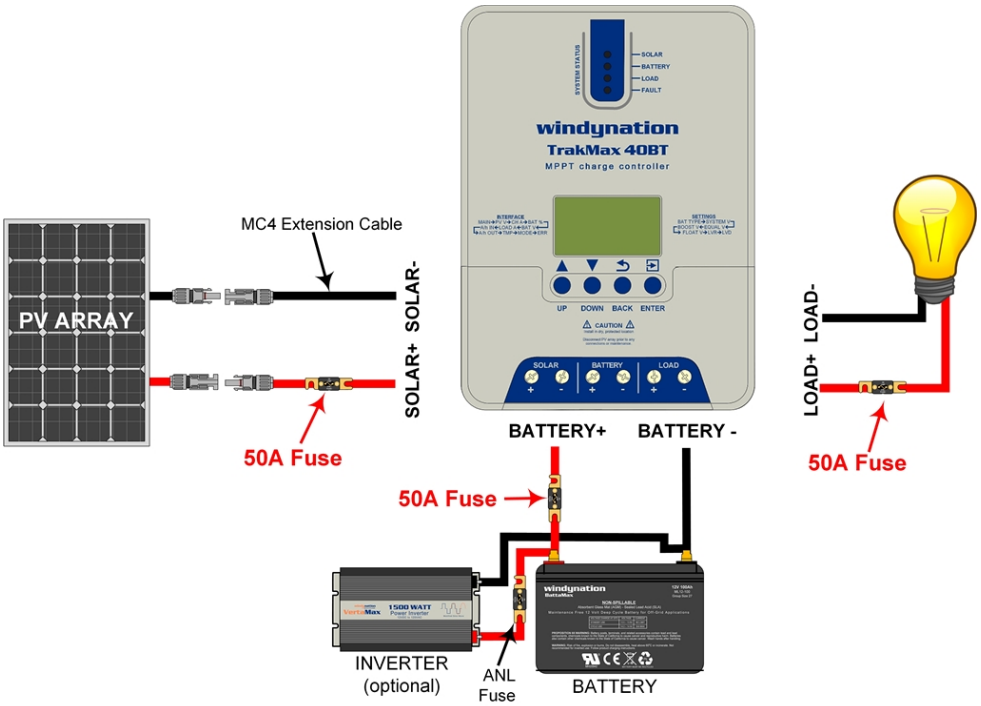
3) Connect the Load (Optional)

This step is optional and only required if you want to power a small DC load through the charge controller. Connect the wires from the appliance to the LOAD terminals on the front of the charge controller and tighten the terminals from the top of the controller using a screwdriver to ensure a good connection is made.

- Connect a cable from the TrakMax terminal marked load negative (–) to the negative terminal of your DC load and tighten the screw.
- Connect a cable from the TrakMax terminal marked load positive (+) to the positive terminal of your DC load and tighten the screw.

Be sure to note the polarity of each terminal; the charge controller self-protection feature will prevent damage from reverse polarity connections, but the load will not function until the load is connected properly.
A 50-amp fuse needs to be placed in the positive wire connecting the charge controller to the load; See below for a complete fusing diagram.

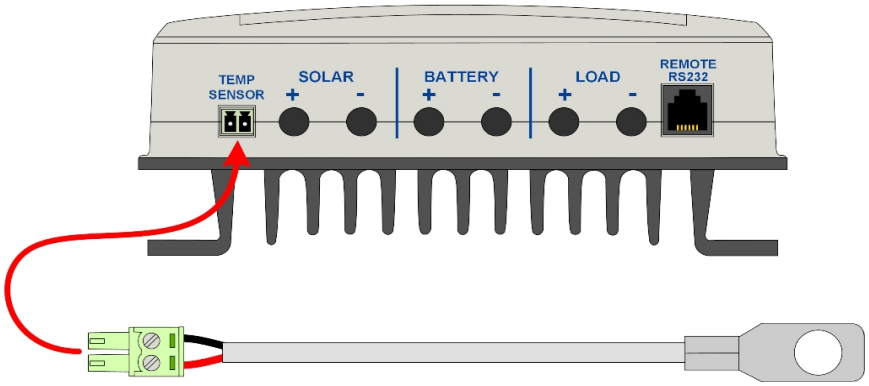
WARNING: Do NOT connect any power inverters or battery chargers to the LOAD terminals of the controller.



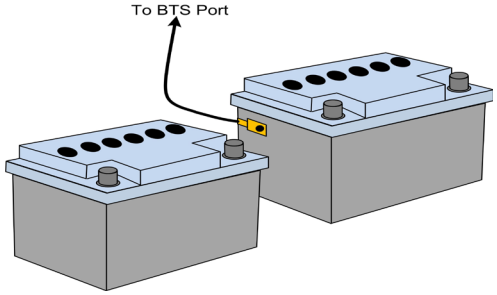
4) Connect the Battery Temperature Sensor – BTS

The charge voltage required by batteries changes with battery temperature. Temperature compensation of the charge voltage enhances battery performance and life, and decreases battery maintenance. Automatic temperature compensation can be provided through use of the battery temperature sensor (included). The Temperature compensation is -3.0mV/Cell/^{o}C.

1) Plug the provided BTS cable into the socket labeled “TEMP SENSOR” located on the front of the controller as shown below.



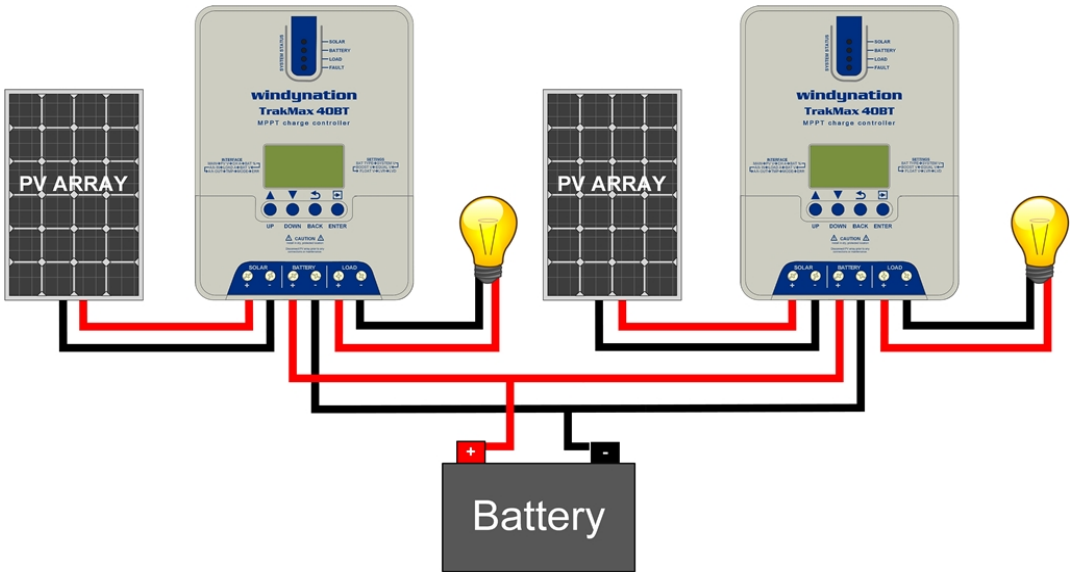
2) Secure the ring terminal on the BTS directly to any side of the battery to be monitored, below the electrolyte level as shown below. When multiple batteries are used, it is best to place the sensor between batteries and place the batteries in an insulated box to reduce the influence of the ambient temperature outside the battery enclosure.



IMPORTANT: If the temperature sensor is not connected to the controller, the battery temperature value will remain at 25°C.

3.4 PARALLEL CONNECTION

Multiple TrakMax controllers can be installed in parallel on the same battery bank to achieve higher charging current. For example, connecting two TrakMax units in parallel can allow for 80 amps of charging current, and connecting three TrakMax units in parallel can allow for up to 120 amps of charging current. Additional parallel controllers can also be added in the future. Each TrakMax MPPT Controller must have its own PV array. See figure below



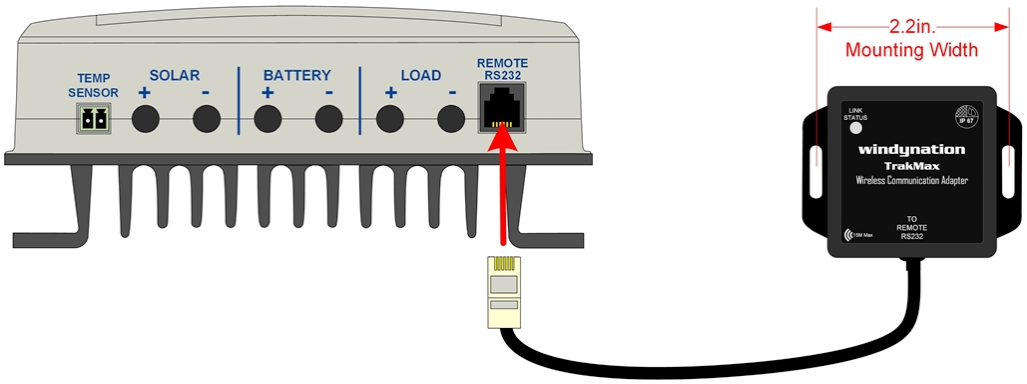
3.5 WIRELESS COMMUNICATION ADAPTER (OPTIONAL)

Windy Nation offers an optional Bluetooth wireless adapter (CHC-TMBT-01) that allows the user to monitor and configure the system from up to 50 feet away using a downloadable application on any smartphone or tablet with Bluetooth capabilities. The wireless transmitter comes with a 5m cable and mounting ears.

Parameter	Value
Dimension (H x W x D)	2.6” (66mm) x 2.0” (51mm) x 0.6” (16mm)
Unit Weight	4.2oz (0.12kg)
Mounting	Surface mount using key hole
Enclosure Protection Class	IP67
Operating Temperature	-4°F to 167°F (-20°C to 75°C)
Power Consumption@12V	<14mA (operating) / <11mA (standby)
Communication Type - Port	RS-232 – RJ12
Communication Baud Rate	9600bps
Signal Range	≤ 50’ (15m)
Connection cable length	16’ (5m)

3.5.1 Adapter Installation

Mount the wireless adapter (CHC-TMBT-01) on any flat surface in a central location to where the signal would be desired. Plug the RJ12 connector on the adapter into the Remote RS232 port on the front edge of the controller as shown below. The RJ12/RS232 communication port on the controller will provide power to the wireless adapter.



IMPORTANT: Never route network cables in the same conduit as the power conductors.

3.5.2 Application Set-Up

IMPORTANT: WindyNation did not develop its own application and can use nearly any vendors app.

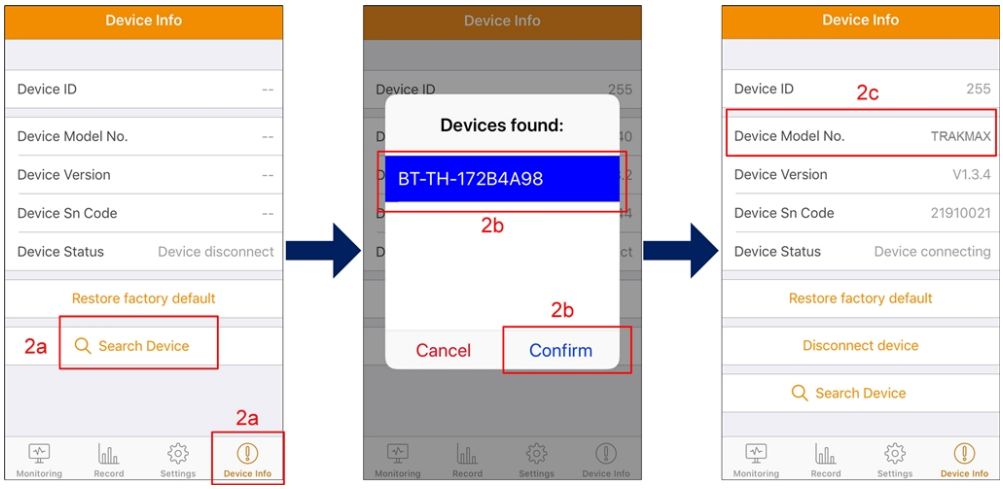
1. Download the application from the App store directly onto your smartphone.
   - Android System: go to Google Play Store and search "SolarLink App":

   - IOS System: Go to Apple app Store and search "SRNE Solar app":

2. Be sure Bluetooth is enabled on your smartphone and open the application.
   a. Select the “Device Info” icon and click “Search device”
   b. Once the wireless adapter is found, it will appear as “BT-TH-xxxxxxx”, select the device and click “Confirm”
   c. The TrakMax should then appear in the Device Model No. with other relevant application information



The “LINK STATUS” indicator on the wireless adapter will blink when information is being exchanged between the controller and the application.

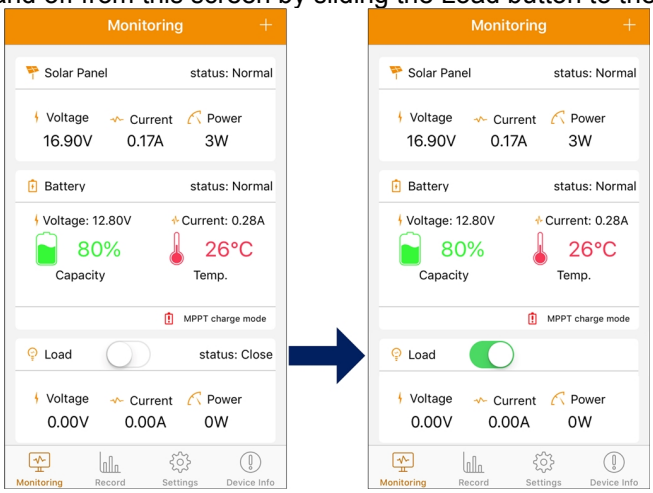
3.5.3 Application Use

The application features four functional areas: Monitoring, Record, Settings, Device Info. Each area is selectable using the associated icon at the bottom of the application

3.5.3.1 Monitoring

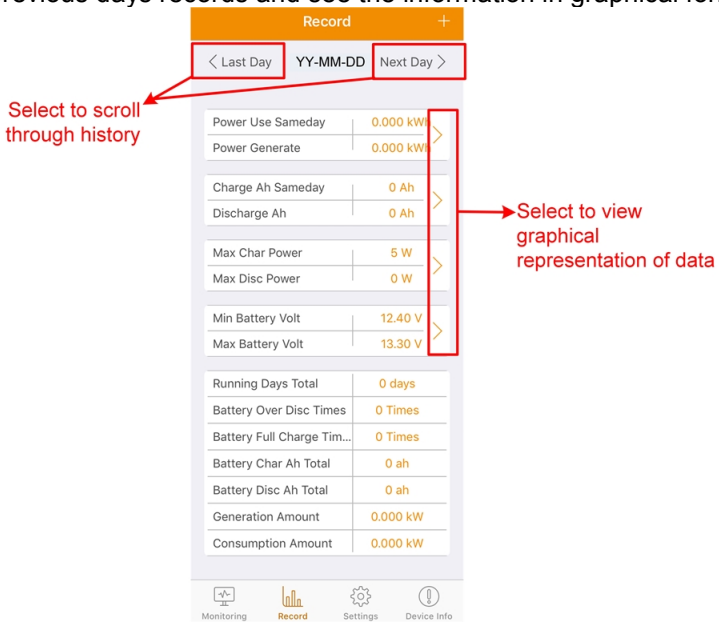
Select the “Monitoring” icon from the bottom of the application screen to see real-time performance of the Solar Panel, Battery, and Load.

The Load can be turned on and off from this screen by sliding the Load button to the right as shown.



3.5.3.2 Record

Select the “Record” icon from the bottom of the application screen to see historical performance logged by the controller. You can view previous days records and see the information in graphical format as shown.



3.5.3.3 Settings

Select the “Settings” icon from the bottom of the application screen to view and edit the various parameters set on the controller.
There are two adjustable categories: Battery and Load, selectable by the associated button as shown

Clicking the “Read” button will load the current settings of the controller.
In order to adjust any parameter, select the value from the app and select “Set” to save the changes to the controller.

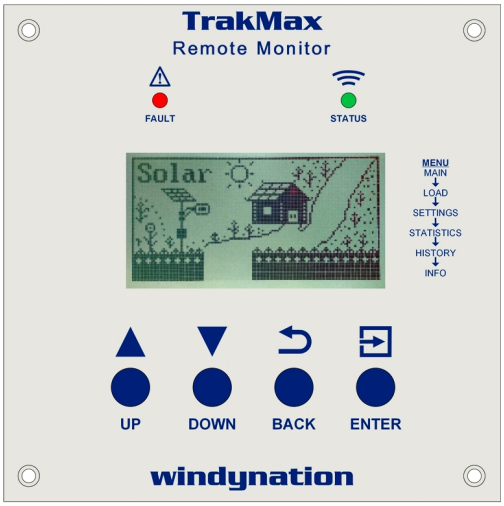
All changes require the admin password to be entered on the app, which is **135790123**

The successful entry of the password and/or parameter change will be acknowledged within the app.

3.6 REMOTE MONITOR (OPTIONAL)

Windy Nation offers an optional remote monitor (CHC-TMRM-01) that allows the user to monitor and configure the system from the remote LCD interface as opposed to the LCD interface located on the TrakMax. The Remote Monitor comes with a 5m cable and mounting enclosure.

- ✓ Real-time monitoring
- ✓ Setting adjustments
- ✓ Load control
- ✓ Wall mount or Flush mount options



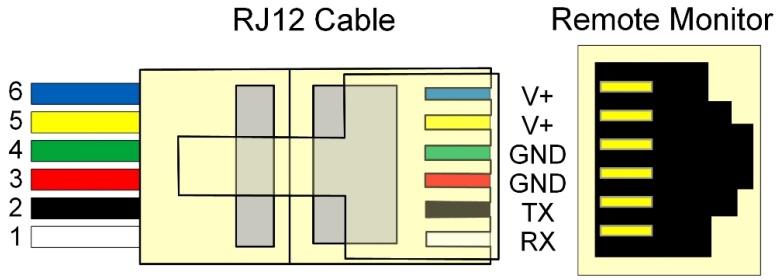
Parameter	Value
Dimension (H x W x D)	4.57” (116mm) x 4.57” (116mm) x 1.89” (48mm)
Unit Weight	1.1lb (0.5kg)
Mounting	Vertical wall mount or flush mount - indoor only
Enclosure Protection Class	IP20
Operating Temperature	-31°F to 149°F (-35°C to 65°C)
Power Consumption@12V	<35mA (LCD on) / <25mA (LCD off)
Communication Type - Port	RS-232 – RJ12
Communication Baud Rate	9600bps

IMPORTANT: For mounting and operation instructions, please refer to the Remote Monitor manual.

3.6.1 Communication Cable

The remote monitor uses RS232 communication via a standard 6-wire RJ12 telephone cable (straight-through, not a Null Modem / cross-over). If possible, pull the cable through conduit before crimping on the RJ12 connectors. If using pre-assembled cables, take care not to damage the plugs when the cables are pulled through conduit.

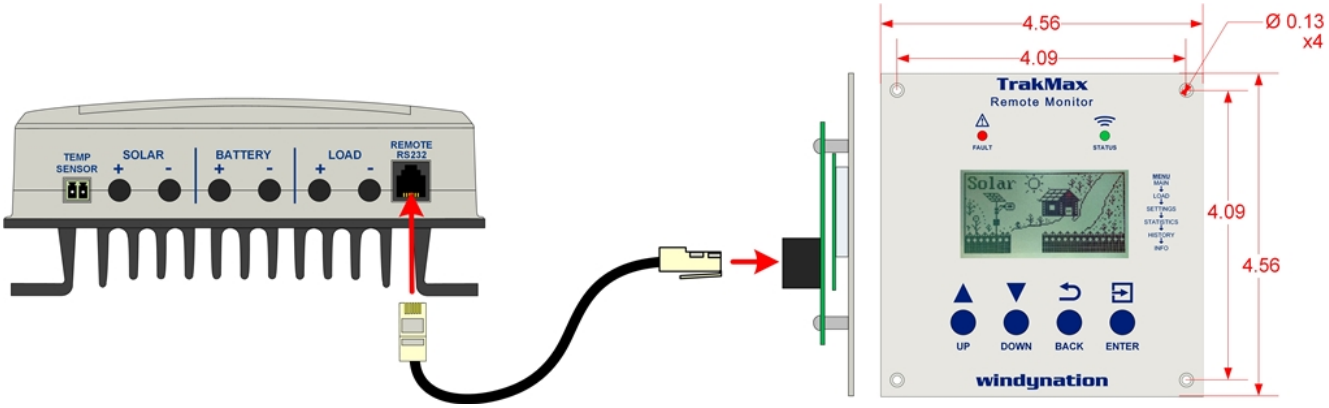
The RJ12/RS232 communication port on the controller will provide power to the Remote Monitor for lengths of 5M or less.



WARNING: Shock Hazard
Never route network cables in the same conduit as the power conductors.

3.6.2 Connections

The remote monitor is able to be mounted in the included enclosure or may be flush mounted on any wall or surface for a clean look. Be sure the communication cable is routed to the monitor in the desired manner and make the connections as shown.



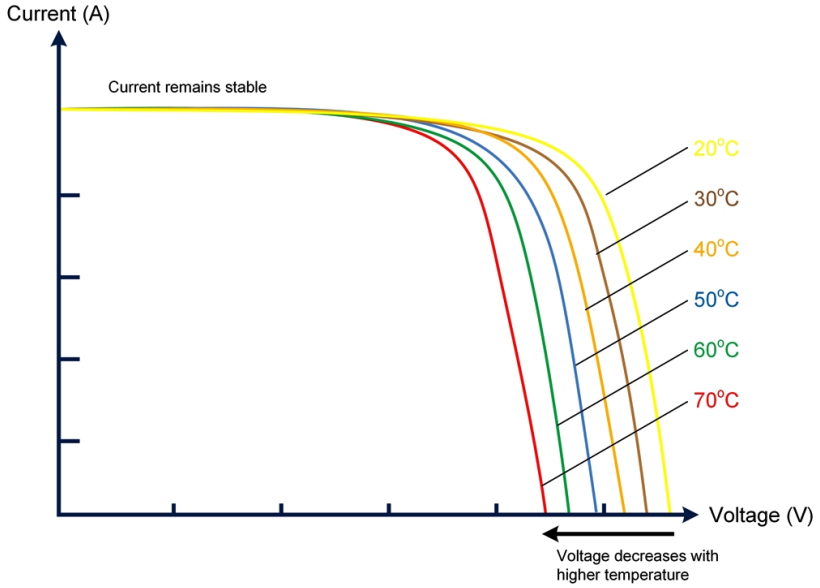
4 OPERATION

4.1 Maximum Power Point Tracking (MPPT)

Maximum Power Point Tracking (MPPT) is an advanced charging technology that enables the solar panel to output more power by adjusting the electric module's operating status. Due to the nonlinearity of solar arrays, there exists a maximum energy output point (maximum power point) on their output curve. When compared with

traditional PWM (Pulse Width Modulation) controllers, which use a switching technology, energy utilization can increase by 15% to 20%, by locking onto this maximum point and get the most power from the solar panel.

The key operating conditions that affect performance are PV array temperature and battery voltage. At constant solar intensity, available PV power will change with PV temperature. A PV array's power vs. temperature characteristic is such that a cool PV array can produce a higher voltage and more power, than a hot PV array. Similarly, a decrease in battery voltage produces a corresponding increase in charge current. This means that the greatest current increase occurs with a combination of cool ambient temperature and low battery voltage. The TrakMax will dynamically adjust parameter settings according to the environmental conditions in real time, so the system remains close to the maximum operating point. When conditions are such that insufficient PV power is available to produce an increase in output current, the unit will stop its internal DC-DC power conversion and operate as a series pass PWM controller with very low forward voltage drop.



PV Current / Voltage vs. Temperature

4.1.1 How MPPT Works

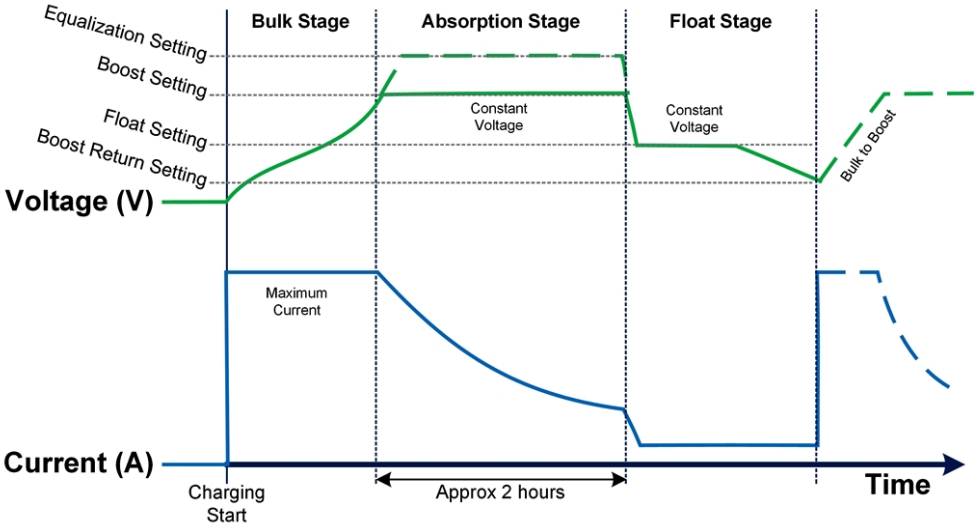
A typical 100-watt PV module will deliver approximately 5.88 amps @ 17 volts @ 25 C cell temperature. When this 100 watt PV module is connected directly to a battery charging at 12 volts, the PV module will still provide approximately the same current but because output voltage is now at 12 volts rather than 17 volts, the PV module's power production is artificially limited and the 100W PV module will only deliver 70 watts of power. This wastes 30 watts of available power.

MPPT technology operates in a very different fashion, where the TrakMax calculates the maximum power voltage (V) at which the PV module delivers maximum power, in this case 17 volts. It then operates the PV module at 17 volts which extracts maximum available power from the PV module. TrakMax continually recalculates the maximum power voltage as operating conditions change. Input power from the maximum power tracking controller, in this case 100 watts, feeds a switching type power converter which reduces the 17 volt input to battery voltage at the output. The full 100 watts which is now being delivered at 12 volts would produce a current of 8.3 amps. A charge current increase of 2.5 amps or 42% is achieved by converting the 30 watts that would have been wasted into useable charge current. Note that this example assumes 100% efficiency to illustrate the principal of operation. In actual operation, the power boost will be somewhat less and on average between 92-94%.

4.2 CHARGE MODE

4.2.1 Four Stage Charge

The TrakMax has a four-stage charging process, Bulk, Absorption, Float, and Equalization. The four-stage charge process provides a somewhat higher charge voltage to charge the battery quickly and safely. Once the battery is fully charged, a somewhat lower voltage is applied to maintain the battery in a fully charged state.



4.2.1.1 Bulk Stage

When charge starts the TrakMax attempts to apply the bulk charge voltage to the battery. The system will switch to Bulk charge if the battery is sufficiently discharged and/or insufficient charge current is available to drive the battery up to the boost voltage set point.

During this stage, the batteries are charged to the boost voltage setting and the unit delivers as much charge current as possible to rapidly recharge the batteries. When the battery voltage reaches the boost voltage setting, the charge controller activates the next stage (Absorption). TrakMax will again switch to Bulk charge if battery voltage drops below the present charge voltage set point.

4.2.1.2 Absorption Stage

During this stage, the unit changes to a constant voltage mode where the absorption voltage is applied to the battery. The Absorption charging stage consists of two sub-stages, equalizing and boost charging, which are not carried out simultaneously. Boost charging lasts for 2 hours by default but the duration and voltage point can be manually adjusted according to actual needs. When the duration reaches the set value, the system will then switch to float charging.

4.2.1.3 Float Stage

During this stage, the float voltage is applied to the battery to maintain it in a fully charged state. When the battery voltage drops to the Boost Return setting, the system will exit floating charging and reenter into bulk charging.

4.2.1.4 Equalization

Equalization is an intentional overcharge of the battery to remove sulfate crystals that build up on the plates over time and reverse acid stratification, where acid concentration is greater at the bottom of the battery than the top.

WARNING: Risk of Explosion!
Equalizing charging to an excessively high level or for too long a period may cause damage. Read carefully the actual requirements of the battery deployed in the system.

IMPORTANT: Remove all loads to batteries when in Equalization
Equalizing charging may raise the battery voltage to a level that may cause damage to sensitive DC loads.

Some batteries will benefit from regular equalizing which will gasify the battery electrolyte and finish the electrochemical reaction. When the controller automatically enters the battery into equalizing charging, the duration is 120 mins (default). As a precaution to avoid excess generated gas or battery overheating, equalizing charging and boost charging will not occur in one complete charging cycle.

NOTE:
If the system is unable to stabilize the battery voltage at a constant level, the TrakMax will initiate a 3-hour timed charge, where the system will then automatically switch to equalization charging.

Equalization can be carried out once a month to once or twice a year.

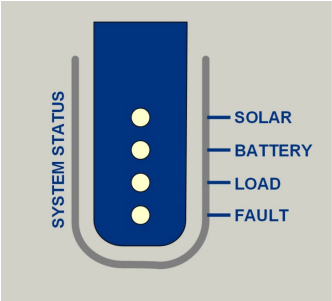
4.3 POWER

Once the controller is properly connected to a battery, the solar controller will start automatically. The controller LCD will display a brief boot-up sequence and the current battery voltage will be displayed. Press the 'UP' or 'DOWN' buttons to cycle through the eleven (11) different interfaces available on the TrakMax controller. The cycle pattern of the interfaces is presented in Section 4.7. Long pressing the "ENTER" button will open the programming interface where there are an additional seven (7) interfaces available to adjust system parameters that are user configurable.

To power down the controller, cover and block the solar panel(s) from the sun's rays and disconnect the PV input to the controller. Remove the battery connection and check the charge controller status. Once the LEDs and LCD display turn off, the charge controller is shut off.

4.4 LED MODES

The TrakMax has four LED indicators to quickly observe the operating status of the controller.



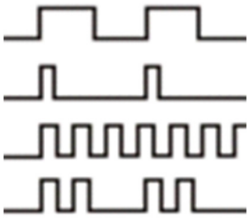
LED	ON - SOLID	BLINK*	OFF
SOLAR	Normal Bulk Charging	SLOW: Boost Charging SINGLE: Float Charging FAST: Equalization Charge DOUBLE: Current Limit	No input PV voltage
BATTERY	Normal BATTERY voltage	SLOW: Battery Over-discharged FAST: Battery Over-voltage	No BATTERY voltage
LOAD	LOAD ON	FAST: LOAD Overloaded	LOAD OFF
FAULT	FAULT present	NA	Normal Operation

*Blink Definitions: SLOW: 1s on; 1s off

SINGLE: 0.1s on; 1.9s off

FAST: 0.1s on; 0.1s off

DOUBLE: 0.1s on; 0.1s on; 1.8s off

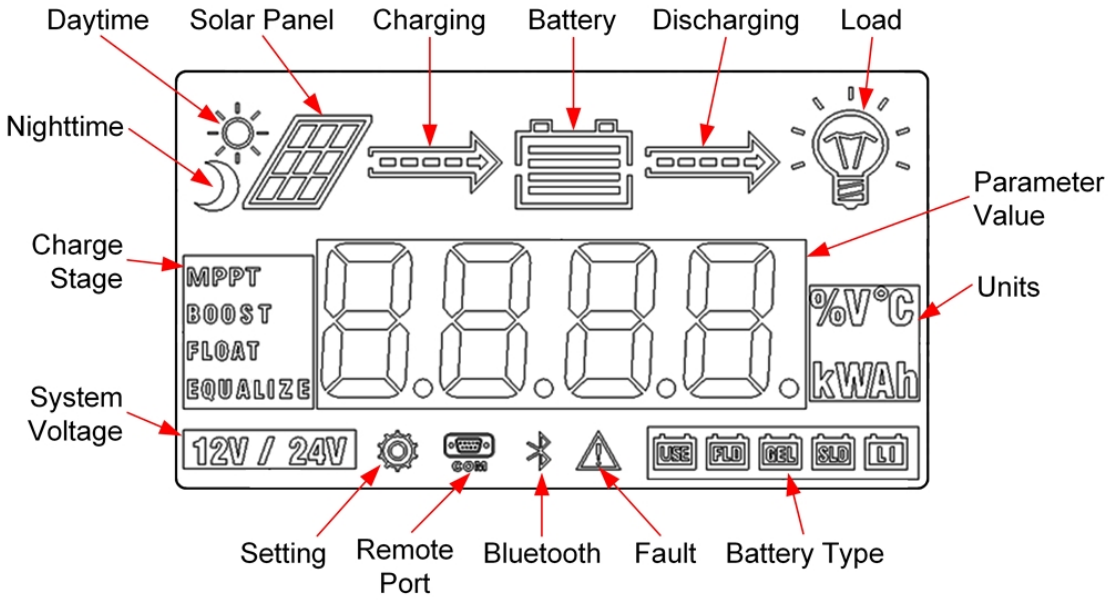


4.5 BUTTON DEFINITIONS

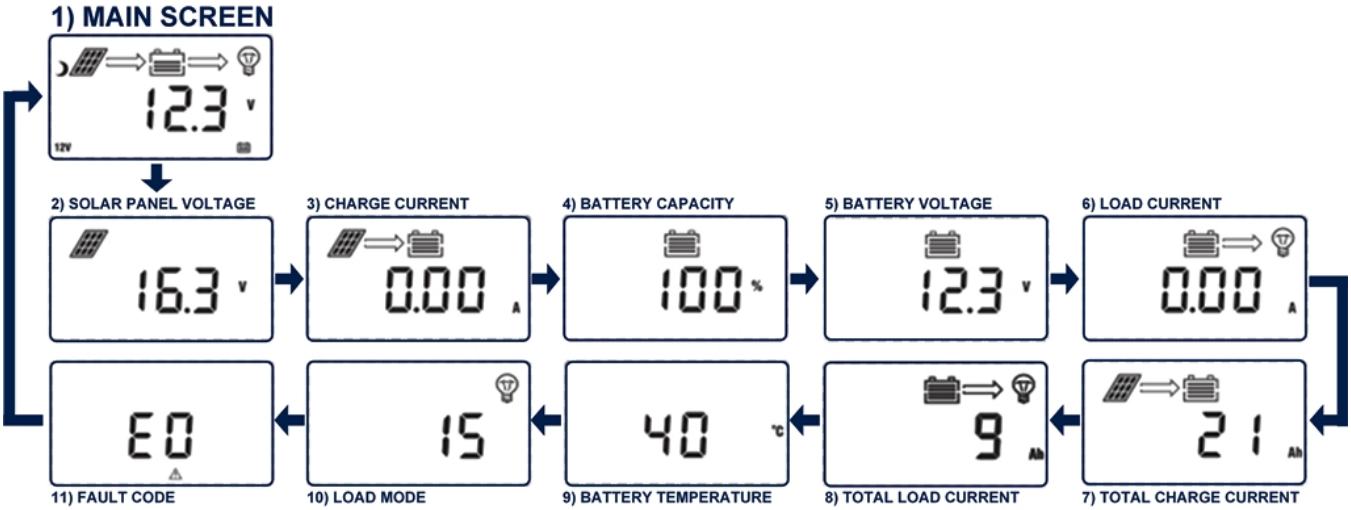
Button	Name	Description
	ENTER	Enter sub-menu or long press to enter programming interface. Save parameter settings Turn LOAD ON or OFF from Main screen
	UP	Cycle interface settings to next available interface. Positive (+) parameter adjustments to modify parameter values.

▼	DOWN	Cycle interface settings to previous available interface. Negative (-) parameter adjustments to modify parameter values.
↩	BACK	Escape interface setting without saving the current parameters and return to previous menu

4.6 LCD Graphic Indicators



4.7 LCD Interface Cycle



4.8 Interface Definitions

The TrakMax has eleven different graphical interfaces. Each interface contains different information.
By holding down the ENTER button from any interface except “LOAD MODE” you will enter the programming interface, where seven additional interfaces are available, these interfaces contain configurable parameters as explained in Section 4.9. Holding down the ENTER button from the “LOAD MODE” interface will enter the programming interface for the LOAD Mode.

4.8.1 Main Screen

This is the MAIN Interface and the displayed number is the present Battery voltage (displayed in Volts). Also indicated is the charging or discharging status, the battery type currently selected, and the system voltage.

4.8.2 Solar Panel Voltage

Display shows the real-time voltage being measured from the solar panels.
NOTE: This may be “0” at night time conditions

4.8.3 Charge Current

Display shows the real-time current being sent from solar panel(s) to the battery.
NOTE: The amount of current sent to the battery is dependent on the battery State of Charge (SOC)

4.8.4 Battery Capacity

The value displayed is an estimate of the battery capacity in percentage based on the battery type and the measured voltage.

4.8.5 Battery Voltage

The value displayed is the real-time battery voltage.

4.8.6 Load Current

The value displayed is the real-time current being delivered from the controller to the load; i.e.: the current being consumed by the load (displayed in Amps).

4.8.7 Total Charge Current

The value displayed is the cumulative current delivered from solar panel(s) to battery (displayed in Amp Hours).

4.8.8 Total Load Current

The value displayed is the cumulative current delivered from the controller to the load (displayed in Amp Hours).

4.8.9 Battery Temperature

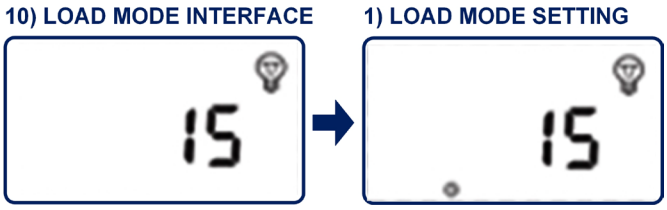
Display shows the measured temperature from the temperature sensor
NOTE: If no temperature sensor is connected the value will read 25°C

4.8.10 Load Mode

The display shows the current ‘Mode” selected for the LOAD as shown in the following table:

Value	Type	Description
0	Dusk/Dawn	Once the solar panel is not producing voltage, the load will automatically turn on and will turn off once the panel voltage is restored. Note: There is a delay between switching to avoid overcast sensing
1 - 14	Timed Control	Once the solar panel is not producing voltage, the load will automatically turn on and will turn off after the set duration of 1 to 14 hours
15	Manual	The load can be turned on or off at any time by pressing the ENTER button
16	Dusk/Dawn Test	Once the solar panel is not producing voltage, the load will automatically turn on and will turn off once the panel voltage is restored. Note: There is a No delay between switching in this mode
17	On	The load is always on in this mode

From the Load Mode Interface, press the ENTER key and hold for 3 seconds to enter setup mode. Once in setup mode, the “Setting” icon will appear and you will be able to adjust the mode using the “UP” or “DOWN” buttons.



Once the desired mode is selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.8.11 Fault Code

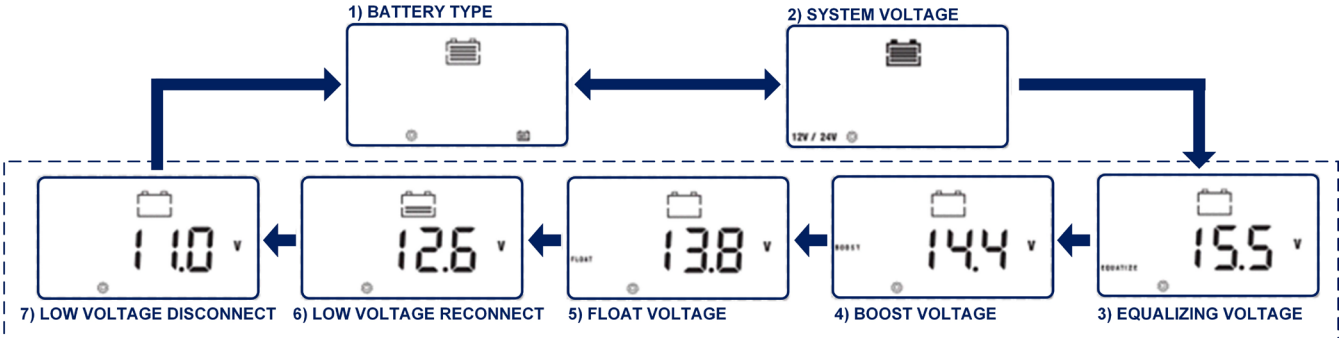
The value displayed is the Fault Code as shown in the following table:

Value	Type	LED Behavior
E0	No Fault; Normal Operation	Fault: OFF
E1	Battery Over-Discharge	Battery: Slow Blink Fault: ON
E2	Battery Over-Charge	Battery: Fast Blink Fault: ON
E3	Low Battery Warning	Fault: ON
E4	Load Short Circuit	Load: Fast Blink Fault: ON
E5	Load Overload	Load: Fast Blink Fault: ON
E6	High Controller Temperature	Fault: ON
E8	Solar Input Current Overload	Fault: ON
E10	Solar Input Voltage Overload	Fault: ON
E13	Solar Input Reverse Polarity	Fault: ON

4.9 PROGRAMMING INTERFACE

The TrakMax has seven programming interfaces available by holding down the ENTER button from any interface except “LOAD MODE”. All programming interfaces will display the Setting Icon ⚙

NOTE: All seven interfaces are not available unless the battery type selected is “USE” from the battery type interface. Otherwise only two programming screens are available.



Parameter Interfaces 3 – 7 are only available when Battery Type is “USE”

4.9.1 Battery Type

From this screen, you can select the Battery type being used in the system. Select the battery icon in the controller using the “UP” or “DOWN” buttons.

The charge parameters are fixed for each type except “USER” which will enable screens 3 – 7 for additional programming. The values for each type are shown in the table below:

Parameter	Sealed	Gel	Flooded	Lithium	User Custom
Equalization	14.6V	--	14.8V	--	9 – 17V
Boost	14.4V	14.2V	14.6V	14.4V	9 – 17V
Float	13.8V	13.8V	13.8V	--	9 – 17V
Low Voltage Reconnect (LVR)	12.6V	12.6V	12.6V	12.6V	9 – 17V
Low Voltage Disconnect (LVD)	11.1V	11.1V	11.1V	11.1V	9 – 17V

NOTE:12V Set Points are listed in the table above; for 24V double the value

Once the desired value is selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.9.2 System Voltage

From this screen, you can select “12V” or “24V” to manually select the system voltage, or “12V / 24V” for auto-detect of the system voltage.

4.9.3 Equalizing Voltage

Only available with Battery Type USER
Select the desired value using the “UP” or “DOWN” buttons. Once selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.9.4 Boost Voltage

Only available with Battery Type USER
Select the desired value using the “UP” or “DOWN” buttons. Once selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.9.5 Float Voltage

Only available with Battery Type USER
Select the desired value using the “UP” or “DOWN” buttons. Once selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.9.6 Low Voltage Reconnect

The TrakMax will also provide automatic reconnection of the loads at the low voltage reconnect (LVR) setting. Reconnection of the load is allowed once the battery voltage has exceeded the low voltage reconnect (LVR)
Select the desired value using the “UP” or “DOWN” buttons. Once selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.9.7 Low Voltage Disconnect

The TrakMax will disconnect the load from the batteries when it reaches the low voltage disconnect (LVD).
Select the desired value using the “UP” or “DOWN” buttons. Once selected, press and hold the ENTER button to save and return to main page.

NOTE: If you do not want to save the setting, press the BACK key to return to main page and original set value.

4.10 PROTECTION FEATURES

4.10.1 Overcurrent Protection

Circuit breakers or fuses must be installed in both the battery and solar circuits. The protection device ratings and installation methods must conform to NEC requirements.

The battery circuit fuses or circuit breaker must be rated to 125% of the maximum current or more. The minimum fuse/breaker rating allowed for use with each TrakMax is 1.25 x 40 Amps = 50 Amps.

If the TrakMax controller system detects an overload status, it will automatically limit the solar panel power to prevent excessively large currents from damaging the controller and enter into current-limited charging.

4.10.2 Overvoltage – Reverse Polarity Protection

The TrakMax is fully protected against reverse polarity and high voltage transients for both the PV and the battery connections. If the PV panel is connected in the reverse polarity position, the TrakMax inner fuse will open. If the Battery is connected in the reverse polarity position, the TrakMax will not turn on.

4.10.3 PV Short Circuit Protection

If the PV input is short circuited, the TrakMax will stop charging until the fault is cleared

4.10.4 Load Protection

When the load is short-circuited or overloaded, the controller will turn the load off. After a time delay, the TrakMax will automatically try to switch the load on. This will continue up to five times and then the load will be disabled until the fault is cleared.

4.10.5 Temperature

If the internal temperature of the controller exceeds 65°C, the TrakMax will automatically reduce the charging current. If the controller reaches 80°C, the TrakMax will shut down.

5 TROUBLESHOOTING AND SUPPORT

The TrakMax is ruggedly constructed and requires minimal care. It is recommended to inspect all the controller connections two times per year for insulation damage or corrosion and to ensure all connections are tight and secure.

5.1 CARE

- Clean the heat sink and area around the controller of any dirt or debris with a moistened cloth.
- Tighten the screws on the terminals. Inspect for loose, broken, or burnt wire connections.
- Inspect the battery bank for cracked or bulging cases and corroded terminals.
- For wet cell flooded batteries, make sure the water level is maintained according to the manufacturer's recommendations.

5.2 TROUBLESHOOTING

Problem	Possible Remedies
No LED indications, controller does not appear to be powered	• Check the voltage at the battery terminals on the TrakMax. Battery voltage must be a constant 12 VDC or greater. If no voltage is measured, check wiring connections, fuses, and breakers. • If the voltage on the battery terminals of the controller is between 12 and 36 VDC and no LEDs are lit, contact your dealer for service.
SOLAR LED on, but no output charge current	• Is the battery voltage greater than the charge voltage set point? This is normal operation. Output is off due to high battery voltage which may be caused by other charging systems. • Battery voltage must be at least 9VDC for the unit to operate.
Unit is on, but SOLAR LED is off	• Check PV connections for reverse polarity. • PV must supply at least 0.25Amp at 3V more than battery voltage to begin charge. • Check ground (-) connections. PV- & BAT- must be separate for operation.
Charge current or PV current is lower than expected	• Check battery voltage, current is reduced if battery voltage is at set points. • Check atmospheric haze, dirty PV's, or sun low on horizon, etc. • Check PV voltage; if system has been changed from 24VDC to 12VDC (or vice versa), battery and PV power must be momentarily disconnected from the TrakMax to reboot the unit and load initial 12 or 24VDC control values. • Check ground (-) connections. PV- & BAT- must be separate for operation.
Charge OFF at high temperature	• The system temporarily shuts down due to high heat sink temperatures. • Improve ventilation or reduce PV power to prevent over temp shut down.

5.3 SUPPORT

If you are experiencing technical problems, and cannot find a solution in this manual, you can contact Windy Nation Inc. for further assistance.

- Call: (805) 323-6445
- Email: support@windynation.com
- Write: 1404 Fleet Avenue, Ventura, CA 93003

For challenging issues or to just ask a question, consider using our FREE Community Forums! Consult our community of DIY'ers for fast answers to all your questions.

Post on our Forums: Windy Nation Community Forum

5.4 LIMITED WARRANTY

Windy Nation warrants that the MPPT Charge Controller (the "Product"), will be free from manufacturing defects in materials and workmanship under normal authorized use consistent with product instructions for a period of

one (1) year from the date the original purchaser ("Customer") receives the Product (the "Warranty Period"). This warranty extends only to the original purchaser. The Customer's sole and exclusive remedy and the entire liability of Windy Nation, its suppliers and affiliates for breach of the warranty is, at Windy Nation's option, either (i) to replace the Product (or defective component part(s)) with a new or reconditioned Product (or component part(s)); (ii) to repair the reported problem; or (iii) to refund the purchase price of the Product. Repaired or replaced products are warranted for the remainder of the original warranty period only. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Windy Nation not expressly set forth in this limited warranty.

5.5 RESTRICTIONS

No warranty will apply if the Product (i) has been altered or modified except by Windy Nation; (ii) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by Windy Nation; (iii) has been subjected to abnormal physical, thermal or electrical stress, misuse, negligence, or accident. If Windy Nation determines that the problem with the Product is not due to a manufacturing defect in Windy Nation's workmanship or materials, or otherwise does not qualify for warranty repair, then the Customer will be responsible for the costs of all necessary repairs and expenses incurred by Windy Nation.

5.6 WARRANTY CLAIMS & RETURN PROCEDURES

To be eligible for service under this warranty, the Customer must submit a service request within the Warranty Period by contacting Windy Nation in writing or via telephone and obtaining a Returned Materials Authorization ("RMA") number. This RMA must be obtained before returning any product under this warranty. Notification must include a description of the alleged defect, the manner in which the Product was used, the serial number, and the original purchase date in addition to the name, address, and telephone number of the Customer. Within five (5) business days of the date of notification, Windy Nation will provide the Customer with an RMA number and the location to which the Customer must return the defective Product. Any Product returned for warranty service shall be shipped at the expense and risk of the Customer. The Customer must return the entire Product kit (or, if authorized by Windy Nation, the defective component parts), within fifteen (15) days after issuance of the RMA number. Windy Nation will be under no obligation to accept any returned Product that does not have a valid RMA number. Customer's failure to return the Product within fifteen (15) days of its receipt of an RMA number may result in cancellation of the RMA. All parts that Windy Nation replaces shall become Windy Nation's property on the date Windy Nation ships the repaired Product or part back to the Customer. Windy Nation will use all reasonable efforts within thirty (30) days of receipt of the defective Product to repair or replace such Product. If a warranty claim is invalid for any reason, the Customer will be charged at Windy Nation's then-current rates for services performed and will be charged for all necessary repairs and expense incurred by Windy Nation. If Windy Nation determines that a warranty claim is valid, it will ship the repaired or replaced Product to Customer at Windy Nation's cost.

5.7 DISCLAIMER

EXCEPT FOR THE EXPRESS LIMITED WARRANTY SET FORTH IN THE PREVIOUS PARAGRAPH, WINDY NATION DISCLAIMS ALL WARRANTIES, EXPRESS, IMPLIED AND STATUTORY INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS PROVIDED BY WINDY NATION. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY WINDY NATION, ITS DEALERS, DISTRIBUTORS, AGENTS OR EMPLOYEES SHALL IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. WINDY NATION DOES NOT WARRANT THAT THE QUALITY OR PERFORMANCE OF THE PRODUCTS WILL MEET YOUR

REQUIREMENTS OR THAT YOU WILL BE ABLE TO ACHIEVE ANY PARTICULAR RESULTS FROM USE OR MODIFICATION OF THE PRODUCTS. Some jurisdictions do not allow the limitation or exclusion of implied warranties or how long an implied warranty may last, so the above limitations may not apply to you. In any such jurisdiction, the warranty shall be limited to the minimum warranty and period required by law.

WINDY NATION EXPRESSLY DISCLAIMS ALL LIABILITY FOR BODILY INJURIES OR DEATH THAT MAY OCCUR, DIRECTLY OR INDIRECTLY, BY USE OF THE PRODUCT BY ANY PERSON.

5.8 LIMITATION OF LIABILITY

UNDER NO CIRCUMSTANCES WILL WINDY NATION OR ITS AFFILIATES OR SUPPLIERS BE LIABLE OR RESPONSIBLE FOR ANY LOSS OF USE, INTERRUPTION OF BUSINESS, LOST PROFITS, LOST DATA, OR INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, EVEN IF WINDY NATION OR ITS AFFILIATE OR SUPPLIER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so these limitations may not apply to you. Neither Windy Nation nor its affiliates or suppliers will be held liable or responsible for any damage or loss to any items or products connected to, powered by or otherwise attached to the Product. The total cumulative liability to Customer, from all causes of action and all theories of liability, will be limited to and will not exceed the purchase price of the Product paid by Customer. This warranty gives the Customer specific legal rights and the Customer may also have other legal rights that vary from state to state.

6 APPLICATION

6.1 BATTERIES

Batteries come in different sizes, types, amp-hour capacity, voltages and chemistries. Here are a few guidelines that will help in battery selection, and ensure that the batteries are properly maintained. The best source of the most appropriate settings for the TrakMax will be from the manufacturer or supplier of the batteries.

6.1.1 Automotive Batteries

Automotive and truck batteries are designed for high cranking power – not deep-cycling. Do not use them unless no other battery type is available. They simply will not last long in a cycling application.

6.1.2 Maintenance-Free Batteries

This type of battery is often sold as a RV or marine battery, but is rarely appropriate for use with a PV system. They typically have an additional reserve of electrolyte, but are vented. This is not the same as a sealed battery.

6.1.3 Deep-Cycle Batteries

Best suited for use with PV systems, this type of battery is designed to be more deeply discharged before being recharged. Deep-cycle batteries are available in many sizes and types. The most common is the vented liquid electrolyte battery. Vented batteries usually have battery caps. The caps may appear to be sealed, but are not. The caps should be removed periodically to check the level of electrolyte. When a cell is low, distilled water should be added after the battery is fully charged. If the level is extremely low, add only enough distilled water to cover the plates before recharging. The electrolyte volume increases during the charging process and the battery will overflow if it is filled all of the way up before recharging. Use only distilled water because impurities will reduce battery performance. A popular and inexpensive deep-cycle battery is the “golf cart” battery. It is a 6-volt design, typically rated at 220amp-hours. RV and marine deep-cycle batteries are also popular for small

systems. They are usually referred to as Group 24 or Group 27 batteries and are rated at 80 to 100 amp-hours at 12volts. Many larger systems use L16 batteries, which are usually rated at 350amp-hours at 6-volts each. They are 17 inches high and weigh about 130pounds. 8D batteries are available with either cranking or deep-cycle construction. Purchase only the deep-cycle version. The 8D is typically rated at 220 amp hours at 12 volts.

6.1.4 Sealed Batteries

Another type of battery construction is the sealed gel cell. They do not use battery caps. The electrolyte is in the form of a gel rather than a liquid, which allows the batteries to be mounted in any position. The advantages are no maintenance, long life (800 cycles claimed) and low self-discharge. Absorbed glass mat (AGM) electrolyte batteries are also acceptable. Their electrolyte is contained in mats between the battery plates. Sealed batteries reduce the maintenance requirements for the system and are good for remote applications. They are much more sensitive to the charging process and can be ruined in as little as a day of overcharging.

6.1.5 Battery Sizing

Batteries are the fuel tank of the system. The larger the batteries, the longer the system can operate before recharging is necessary. An undersized battery bank results in short battery life and disappointing system performance. To determine the proper battery bank size, compute the number of amp-hours that will be used between charging cycles. Once the required amp-hours are known, size the batteries at approximately twice this amount. Doubling the expected amp-hour usage ensures that the batteries will not be overly discharged and will extend battery life.

6.2 Wire Gauge Reference

AWG	Diameter inches (mm)	Ohms per 1000ft	Break Force	Square mm2
16	0.051 (1.29)	4.016	75 lbs	1.30
14	0.064 (1.63)	2.525	119 lbs	2.08
12	0.081 (2.05)	1.588	197 lbs	3.30
10	0.102 (2.59)	0.999	314 lbs	5.26
8	0.129 (3.26)	0.628	480 lbs	8.30
6	0.162 (4.11)	0.395	760 lbs	13.30
4	0.204 (5.19)	0.249	1210 lbs	21.15
2	0.258 (6.54)	0.156	1930 lbs	33.62
1	0.289 (7.35)	0.124	2430 lbs	42.41
0 (1/0)	0.325 (8.25)	0.098	3060 lbs	53.49
00 (2/0)	0.365 (9.27)	0.078	3860 lbs	67.43
000 (3/0)	0.410 (10.4)	0.062	4860 lbs	85.01
0000 (4/0)	0.460 (11.68)	0.049	6120 lbs	107.22