BLUE SKY ENERGY
BY SUNFORGE

SB1524iX Manual

Solar Boost™ 1524iX MPPT
Solar Boost™1524iX-Li MPPT

20 A @12 V | 15 A @24 V - MAXIMUM POWER POINT TRACKING
PHOTOVOLTAIC CHARGE CONTROLLER

MADE IN USA

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BLUE SKY ENERGY SB1524iX(-Li) MANUAL, REV F | 2022

This manual includes important safety instructions for the SB1524iX. Save these instructions.

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Safety Instructions

Refer installation and servicing to qualified service personnel. High voltage is present inside unit. Incorrect installation or use may result in risk of electric shock or fire. No user serviceable parts in this unit.

PERSONAL PRECAUTIONS

- Working in the vicinity of lead-acid batteries is dangerous. Batteries produce explosive gasses during normal operation.
- To reduce risk of battery explosion, follow these instructions and those published by battery manufacturer and manufacturer of any equipment you intend to use in vicinity of battery.
- Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
- Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.
- Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
- If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 15 minutes and get medical attention immediately.
- NEVER SMOKE or allow a spark or flame in vicinity of battery.
- Be extra cautious to reduce risk of dropping metal tool onto battery. It might spark or short circuit battery or other electrical part that may cause explosion.
- Remove personal metal items such as rings, bracelets and watches when working with a lead-acid battery. A lead-acid battery can produce a short circuit current high enough to weld a ring or the like to metal, causing a severe burn.
- Remove all sources of power, photovoltaic and battery before servicing or installing.

CHARGER LOCATION & INSTALLATION

- This unit is designed to charge 12 V or 24 V nominal lithium, flooded, or sealed type lead-acid chemistry batteries within the range of 10 to 5,000 amp-hours. Follow battery manufacturers charging recommendations when considering this unit for use with other battery chemistry.
- This unit employs components that tend to produce arcs or sparks. NEVER install in battery compartment or in the presence of explosive gases.
- This unit must be installed and wired in accordance with National Electrical Code, ANSI/NFPA 70.
- Over current protection for the battery must be provided externally. To reduce the risk of fire, connect to a circuit provided with 25 A maximum branch-circuit over current protection in accordance with National Electrical Code, ANSI/NFPA 70.
- Over current protection for the auxiliary load control output or auxiliary battery charge output must be provided externally. To reduce the risk of fire, connect to load or auxiliary battery with 25 A maximum over current protection in accordance with National Electrical Code, ANSI/NFPA 70.
- Insure that unit is properly configured for the battery being charged.
- This unit is not water tight. Do not expose to rain, snow or excessive moisture.
- Insure all terminating connections are clean and tight. Battery, PV and Auxiliary Output terminals are to be tightened to 9 in-lb (1 nm). IPN Network and battery temperature sensor compression terminals are to be tightened to 2.1 in-lb (0.24 nm).
- Do not connect to a PV (Panel) array capable of producing greater than 16 A short circuit current for 12 V systems, or 12 A short circuit for 24 V systems.
- Limit input short circuit current to 6 A if the 24 V input 12 V output mode is used or 8 A if the 18 V input 12 V output mode is used.
- This unit is not provided with a GFDI (ground-fault detector/interrupter) device and must be used with an external GFDI device as required by Article 690 of National Electrical Code for the installation location.

PREPARING TO CHARGE

- Never charge a frozen battery.
- Be sure battery is mounted in a well ventilated compartment.
- Add distilled water in each cell of a lead-acid battery until battery acid reaches level specified by battery manufacturer.

Product Description

Solar Boost™ 1524iX(-Li) is a 12 V or 24 V multi-stage Maximum Power Point Tracking (MPPT) photovoltaic battery charge controller is capable of delivering up to 15 A or 20 A depending on PV modules and battery voltage. An auxiliary output can serve as either a 2 A auxiliary battery charger, or as a load controller with or without variable Dusk-to-Dawn lighting control. The SB1524 includes an IPN Network interface which allows multiple charge controllers to communicate with each other and operate as a single charging machine.

Through the use of patented MPPT technology, the SB1524 can increase charge current up to 30% or more compared to conventional controllers. The SB1524's sophisticated multi-stage charge control system improves battery performance and longevity while minimizing battery maintenance. The SB1524iX optimally charges flooded, GEL and AGM lead-acid chemistry batteries and the SB1524iX-Li charges $LiFePO_4$ batteries. The SB1524 can be also programmed through a remote display or BT Connect, for a 2-Stage or Multi-Stage charge control for any type of battery. The unit is fully protected against voltage transients, over temperature, over current, reverse battery and PV connections.

Part Numbers and Options

SB1524iX	Solar Boost 1524iX Charge Controller for Lead Acid batteries
SB1524iX-Li	Solar Boost 1524iX Charge Controller for $LiFePO_4$ batteries
IPNREM	IPN Remote display
IPNPRO-S	IPN ProRemote with required 500 A / 50 mV current shunt
IPNPRO	IPN ProRemote display and battery monitor
506-0003-01	500 A / 50 mV current shunt
930-0022-20	Battery temperature sensor
BT Connect	Bluetooth adaptor
ProTouch	3.5" Touch-Screen display

Product Certifications

CE FC RoHS COMPLIANT

CONFORMS TO:
EN 61000-6-2:2005 (*)
EN 61000-6-3:2007 + A1:2011 (*)
AS/NZS 60000-6-3:2012 (*)

FCC CFR 47 Part 15 Subpart B (*)
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 operations.

COVERED UNDER ONE OR MORE OF THE FOLLOWING US PATENTS
6,111,391 • 6,204,645

(*) See Electromagnetic Compatibility at page 10.

Operation

Charge control and MPPT operation are fully automatic. At night when PV (Panel) power production stops, the PV (Panel) array is disconnected from the battery to prevent unwanted current drain eliminating the need for external blocking diodes. There is a 5 second turn-on delay, and a 45 second turn-off delay.

Charge Status Indicator

Charge Off: Off

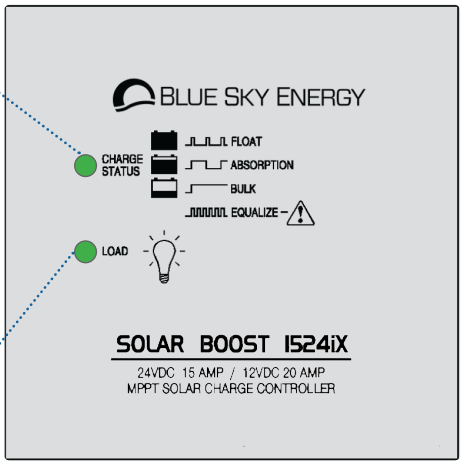
Bulk (<70% Full): Continuously On

Absorption/Acceptance (70% - 95% Full): Blinking - 1 SEC ON / 1 SEC OFF

Float (Fully Charged): Blinking - 0.2 SEC ON / 1 SEC OFF

Equalize: Rapid Blinking - 0.2 SEC ON / 0.2 SEC OFF

A charge status indicator is provided on the face of the SB1524, and on the optional remote displays. If net battery charge current is greater than 3 to 5 A per 100 amp-hours of battery capacity the charge status indicator can provide a rough indication of battery state of charge.



Auxiliary Output Indicator

An Auxiliary Output (AUX) indicator labeled LOAD is provided on the face of the SB1524. The indicator will be ON when the AUX is available to provide power to a load, or charge an auxiliary battery. Default operation of the AUX is Auxiliary Battery Charge and the indicator may turn ON even though an auxiliary battery may not be connected.

Note: The SB1524 operates on battery power, not PV (Panel) power. A battery must be connected with a minimum voltage of 9 V for the unit to operate.

It is normal for the front panel to be quite warm to the touch when operating at high power.

Optional Remote Displays and Bluetooth adapter

Three optional remote displays are available. The **IPN Remote** with basic AMPS/VOLT display functionality, the full featured **IPN ProRemote** provides setup capability and enhanced monitoring of charge controllers on the IPN network. It also provides a complete battery system monitor with various amp-hour counters and a highly accurate "fuel gage" type battery level indicator. The **ProTouch** 3.5" touch-screen display provides enhanced monitoring of charge controllers and setup capability by 5 preset configurations (Lead-Acid and Lithium). The **BT Connect** provides setup capability and monitoring through detailed app (Android and iOS). See Figure and Table at page 16.

SB1524iX Multi-Stage for Lithium (Li-ion or $LiFePO_4$) Battery

The SB1524iX-Li is programmed with a multi-stage charge profile for a $LiFePO_4$ batteries (4S or 8S) while the SB1524iX can be programmed for any type of Lithium battery with one of the following accessories: IPN ProRemote display, BT Connect, ProTouch display, or UCM. Consult the manual of the battery manufacturer for the appropriate charge profile. When programming the SB1524iX for Lithium, the battery temperature compensation must be disabled and/or the Battery Temperature Sensor (p/n 930-0022-20) removed. See the manual of the specific accessory for more information.

SB1524iX Multi-Stage for Sealed Lead-Acid batteries (Default)

The SB1524iX is factory configured for a three stage charging process: Bulk, Absorption and Float. The three stage charge process provides a somewhat higher 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 without excessive water loss. Three stage charging improves battery performance and longevity while minimizing battery maintenance.

BULK CHARGE

The SB1524iX will initially be in Bulk charge when battery voltage is below the Absorption (Acceptance) Charge Voltage setpoint. During Bulk, the SB1524iX delivers as much charge current as possible to rapidly recharge the battery and drive battery voltage up to the Absorption (Acceptance) Charge Voltage setpoint.

ABSORPTION CHARGE

When the battery recovers sufficient charge for battery voltage to rise to the Absorption (Acceptence) Charge Voltage setpoint (factory set to 14.2/28.4V), current is reduced as necessary to hold the battery at the Absorption (Acceptance) Voltage. The SB1524iX remains in Absorption (Acceptance) until the battery is fully charged as determined by either:

- The SB1524iX has remained in Absorption (Acceptance) continuously for the Charge Time period (factory set to 2 hours), or
- With the IPN ProRemote display, net battery charge current while in Absorption (Acceptance) decreases to the Float Transition Current setting (factory set to 1.5 A per 100 amp-hours of battery capacity).

FLOAT CHARGE

Once the battery is fully charged, a somewhat lower Float Voltage (factory set to 13.2/26.4 V) is applied to maintain the battery in a fully charged state without excessive water loss. During Float Mode a healthy fully charged lead-acid battery will draw 0.1–0.2 A per 100 amp-hours of battery capacity.

2-STAGE CHARGE CONTROL

Certain battery types (including lithium) or system configurations may require two stage charge control which eliminates the Float charge stage. The SB1524iX can be configured for two stage Bulk/Absorption charge control by setting the Float charge voltage setting to "No Float" using the IPN ProRemote, BT Connect, or the UCM. Refer to the IPN ProRemote, BT Connect, or UCM operators manual.

WARNING: Not all batteries can be safely equalized. Equalization should only be performed on vented liquid electrolyte lead-acid batteries. Always follow battery manufacturers recommendations pertaining to equalization. Equalization applies a high voltage producing significant battery gassing. Disconnect equipment that cannot tolerate the high equalization voltage which is temperature compensated.

Equalization (only for lead-acid battery)

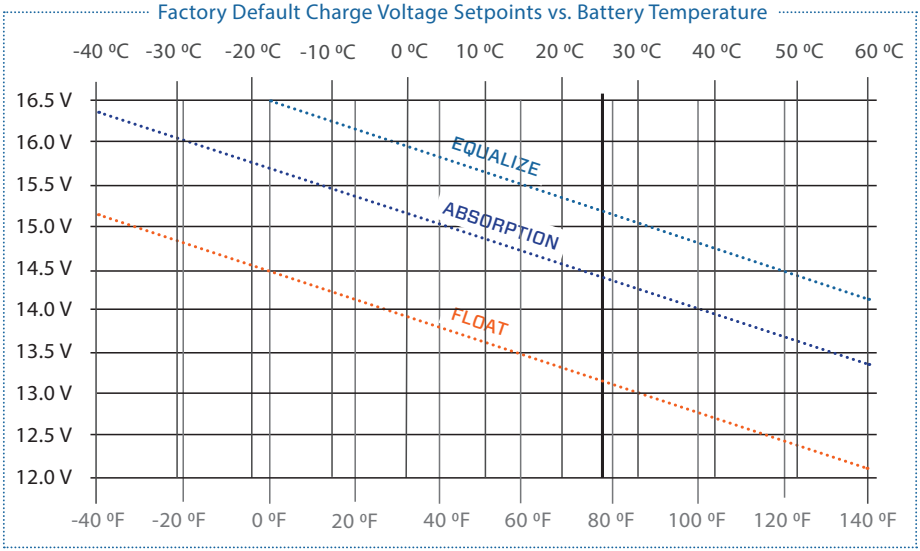
The SB1524 can perform automatic equalization alone, or manual equalization via the IPN ProRemote, BT Connect, or UCM. Equalization is essentially a controlled overcharge which applies relatively high voltage to bring all battery cells up to the same specific gravity and eliminates electrolyte stratification by heavily gassing the battery. While equalization parameters are adjustable with the IPN ProRemote, BT Connect, or UCM, factory default parameters of 15.2 V for 2 hours every 30 days are suitable for most applications. A minimum net charge current of approximately 3.5 A per 100 amp-hours of battery capacity is required for proper equalization. The equalization timer is a "time at voltage" time accumulator counting in 3 minute increments. The equalization timer will not count down unless the battery reaches the equalization voltage setpoint. If equalize does not complete by end of the charging day it will resume where it left off the next charging day, but will automatically cancel cycle if unable to complete within 24 hours.

Output Current limit

Automatic current limit prevents output current from exceeding 20 A with 12 V batteries and 12 V PV's (Panel). If PV (Panel) open circuit voltage (V_{OC}) ever exceeds 30 V, current limit will become 15 A until the SB1524 reboots. Note that when the SB1524 exits current limit the charge control system will briefly enter Absorption (Acceptance) on its way back to MPPT even though battery voltage may be low.

Optional Temperature Compensation (only for lead-acid battery)

The charge voltage required by batteries changes with battery temperature. Temperature compensation of charge voltage enhances battery performance and longevity, and decreases maintenance. Automatic temperature compensation can be provided by using the optional battery temperature sensor (BSE p/n 930-0022-20). The default compensation factor of –5.00 mV/ºC/cell is appropriate for most lead-acid batteries. If a proper temperature sensor signal is not detected the SB1524 will operate as if battery temperature is 25 ºC.



Maximum Setpoint Voltage Limit

Regardless of setpoint values entered by the user or resulting from temperature compensation, the SB1524 will not apply a charge voltage setpoint greater than the maximum voltage setpoint limit factory configured to 15.5/31.0 V. Note that actual battery voltage may briefly exceed this value by 0.1 – 0.2 V as the voltage control servo responds to changes in load.

Maximum Power Point Tracking (MPPT)

Patented MPPT technology can extract more power and increase charge current up to 30% or more compared to conventional controllers. The principal operating conditions which affect current boost performance are PV (Panel) array temperature and battery voltage. At constant solar intensity, available PV (Panel) voltage and power increase as PV (Panel) temperature decreases but it takes an MPPT controller to access this extra power. When PV (Panel) voltage is sufficiently high in Bulk for MPPT to operate, a constant power output is delivered to the battery. Since output power is constant, a decrease in battery voltage produces a further increase in charge current. This means that the SB1524 provides the greatest charge current increase when you need it most, in cold weather with a discharged battery. In cool comfortable temperatures, most systems see about 10 – 20 % increase. Charge current increase can go to zero in hot temperatures, whereas charge current increase can easily exceed 30% with a discharged battery and freezing temperatures. For a more complete MPPT description see "What Is MPPT and how does it work?" on the FAQ page at https://sunforgellc.com/learning-center.

Panel Temperature and Output Power

Internal power control devices use the front panel as a heatsink. It is normal for the front panel to become quite warm to the touch when the unit is operating at high power. When mounted vertically as described in the installation section, the unit can deliver full output in an ambient temperature of up to 50 ºC (122 ºF). If an over temperature condition exists, the unit will shut down and the Charge Status Indicator will display an OFF condition. The 1524 does not include a digital type temperature sensor and will always show the heatsink to be –55 ºC on the IPN ProRemote.

Multiple Charge Controllers on the IPN Network

The IPN network architecture allows multiple charge controllers to operate as a single charging machine. Up to 8 IPN compatible charge controllers can reside on a single network and can share a single display and battery temperature sensor. Charge controllers can be added to grow a small system into a large system and have this large system operate from the users standpoint as a single charge controller.

Installation

WARNING: Read, understand and follow the Important Safety Instructions in the beginning of this manual before proceeding. This unit must be installed and wired in accordance with National Electrical Code, ANSI/NFPA 70. Over current protection must be provided externally. To reduce the risk of fire, connect to a circuit provided with 20 A maximum branch-circuit over current protection (25 A with 12 V battery and 12 V PV modules) in accordance with National Electrical Code, ANSI/NFPA 70. Do not connect a PV (Panel) array capable of delivering greater than 12 A of short circuit current I_{sc} at STC (16 A with 12 V battery and 12 V PV modules). Do not connect BAT– and PV– together external to the unit. The unit is not provided with a GFDI (ground-fault detector/interrupter) device and must be used with an external GFDI device as required by Article 690 of NEC for the installation location. To reduce risk of electric shock, remove all sources of power before installing or servicing. The wiring diagrams show generalized connections only and are not intended to show all wiring, circuit protection and safety requirements for a photovoltaic electrical system.

CAUTION: The SB1524 is protected against reverse battery and PV (Panel) polarity, and swapped PV (Panel) and battery connections, but will be damaged by reverse battery to the PV (Panel) terminals. Transient voltage lightning protection is provided, but steady state voltage in excess of 57 VDC on the battery or PV (Panel) terminals will damage the unit. Damage of either type voids the limited warranty.

Electrostatic Handling Precautions

All electronic circuits may be damaged by static electricity. To minimize the likelihood of electrostatic damage, discharge yourself by touching a water faucet or other electrical ground prior to handling the SB1524 and avoid touching components on the circuit boards. The risk of electrostatic damage is highest when relative humidity is below 40%.

Battery and PV Voltage

Nominal battery voltage and PV (Panel) voltage are determined automatically. The battery is considered to be 12 V if battery voltage following boot is less than 16 V, or 24 V if battery voltage is greater. If the battery is determined to be 24 V all 12 V voltage setpoints are doubled. PV (Panel) voltage is also determined automatically. If nominal PV (Panel) voltage is changed following installation, power must be momentarily removed to reboot the SB1524 to reconfigure PV (Panel) voltage.

Selecting PV Modules

Voltage, current and power produced by Photovoltaic (PV) modules fluctuate widely with operating conditions. As a result, a set of test conditions referred to as Standard Test Conditions (STC) are used to rate modules in a meaningful manner and accurately predict real world performance. STC ratings are not maximum or optimal ratings. Conditions can be present where V_{OC} and I_{SC} approach 1.25 times STC ratings which is why National Electrical Code and our recommendations call for 1.25 derating of both V_{OC} and I_{SC}. Yet in real world conditions IMP is commonly only about 75 – 80% of I_{MP} at STC.

Key PV module specifications

P_{MAX}	Maximum power in watts (PMAX = V_{MP} x I_{MP})
V_{OC}	Voltage with module open circuit (typically about 20 – 22 V for 12 V nominal 36 cell modules)
V_{MP}	Voltage where module produces Maximum Power (typically about 17 – 18 V for 12 V nominal 36 cell modules)
I_{MP}	Current where module produces Maximum Power
I_{SC}	Current with module Short Circuit

The SB1524 will provide the best MPPT current boost performance if all PV (Panel) modules are identical. If module types are mixed, do not put dissimilar modules in series. Dissimilar modules in parallel should have V_{MP} values within ≈0.5 V or better for 12 V modules, and be of the same basic cell technology so their V_{MP} will tend to track as operating conditions change. If module types are very different consider using a separate charge controller for each module type to obtain the best MPPT current boost performance. Select PV (Panel) modules that do not exceed the maximum ratings shown below, and preferably produce at least 3 A of I_{MP} per 100 amp-hours of battery capacity.

Nominal Battery Voltage	Automatic Current Limit	Max PV Power @ STC	Max PV I_{sc} @ STC	Max PV V_{OC} @ STC	Recommended range of V_{MP} @ STC		
					Nominal 12 V PV	Nominal 18 V PV	Nominal 24 V PV
12 V	20 A*	270 W	16 A*	24.0 V*	16.5 – 18.5 V	-	-
12 V	15 A	200 W	8 A	45.6 V	-	24.8 – 27.8 V	-
12 V	15 A	200 W	6 A	45.6 V	-	-	33.0 – 37.0 V
24 V	15 A	400 W	12 A	45.6 V	-	-	33.0 – 37.0 V

(*) Current rating and current limit are 20 A when charging a 12 V battery from nominal 12 V PV (Panel)modules. If PV (Panel) V_{OC} ever exceeds 30 V (>12 V nominal PV modules) current rating and current limit become 15 A.

As Shipped Factory Default Settings

NOTE: The SB1524 contains various user configurable settings all of which are preconfigured at the factory. Most installations require no changes to these settings which are typically suitable for most lead-acid batteries including sealed lead-acid batteries such as Gel and AGM. All software programmable settings, as for example Lithium batteries, require the IPN ProRemote, BT Conect, ProTouch, or UCM to change and are retained if power is lost or the IPN ProRemote/BT Connect/ProTouch/UCM is used as a setup tool only and removed.

SB1524iX Software Programmable

Charge mode	3-stage	**Equalize voltage**	15.2/30.4 V
Absorption voltage	14.2/28.4 V	**Equalize time**	2.0 hours
Float voltage	13.2/26.4 V	**Auto equalize days**	30 days
Charge Time	2.0 hours	**Maximum voltage setpoint limit**	15.5/31.0 V
Float Transition Current	1.5 A / 100 Ah	**Temperature compensation factor**	-5.00 mV/ºC/cell
Load control ON voltage	12.6/25.2 V	**Dawn-to-Dusk lighting control**	Disabled
Load control OFF voltage	11.5/23.0 V		

SB1524iX-Li Software Programmable

Charge mode	3-stage	**Equalize voltage**	Disabled
Absorption voltage	14.4/28.8 V	**Equalize time**	Disabled
Float voltage	13.6/27.2 V	**Auto equalize days**	Disabled
Absorption Time	0.5 hours	**Maximum voltage setpoint limit**	15.5/31.0 V
Float Transition Current	0.0 A / 100 Ah	**Temperature compensation factor**	Disabled
Load control ON voltage	12.0/24.0 V	**Dawn-to-Dusk lighting control**	Disabled
Load control OFF voltage	11.0/22.0 V		

SB1524 DIP Switch & Jumper Settings (All DIP's OFF, A2 open)

Auxiliary Output Mode	Auxiliary battery charger
Equalize	Disabled
IPN Network address	0 (zero, IPN Master)

Equalize Enable

If DIP switch #4 (see Setup and Wiring Diagram on page 11) is turned OFF, equalization is completely disabled. If DIP switch #4 is turned ON prior to the application of battery power, automatic equalization is enabled and the SB1524 will perform automatic equalization after the set number of Auto Equalize Days has elapsed. If DIP switch #4 is turned ON, after battery power is applied, an automatic equalization cycle will begin immediately. Equalization can also be started and stopped from the IPN ProRemote, BT Connect, or UCM if DIP switch #4 is ON.

Electromagnetic Compatibility (CE and FCC Marks)

To comply with electromagnetic compatibility requirements, the SB1524iX must be installed with as many as two ferrite suppressors . Clamp one suppressor (supplied with SB1524iX) around both PV+ and PV– cables twisted and looped to pass through the core 2 times. Clamp the second suppressor (supplied with either one of our optional remote displays) around the IPN cable , looped to pass through the core 2 times. A single supressor is included with each product (BSE p/n 523-0005-01).

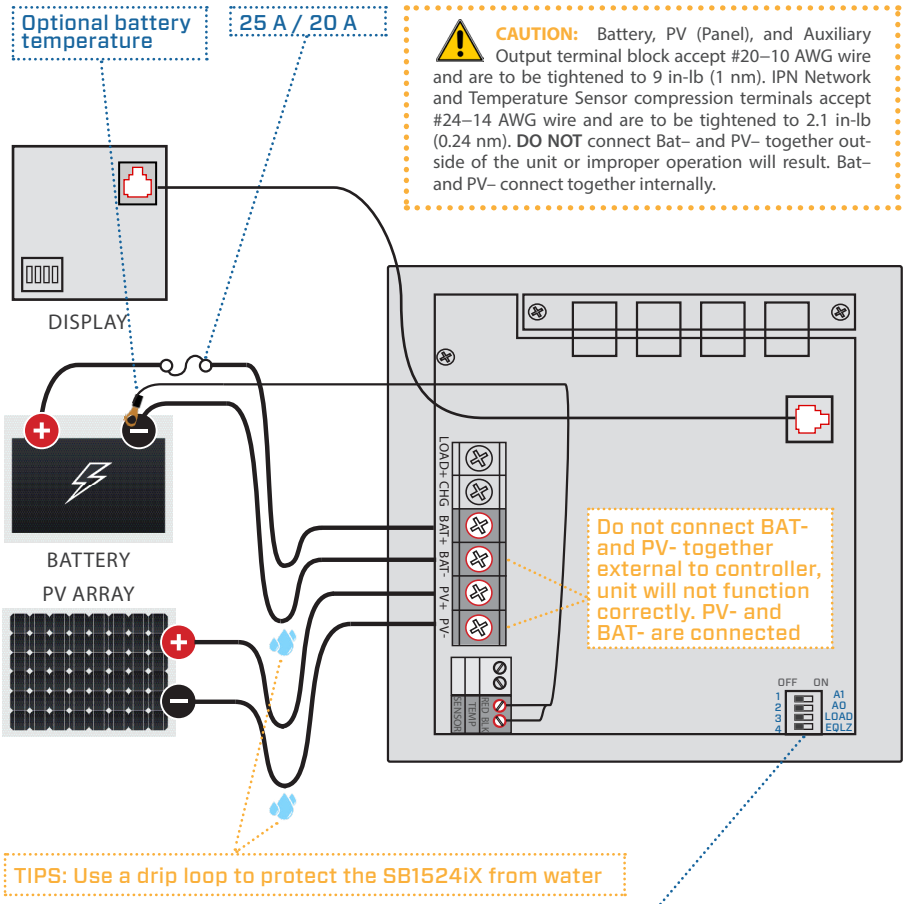
Battery Temperature Sensor (only for lead-acid battery)

Installation of the optional battery temperature sensor enables temperature compensation of all charge voltage setpoints in order to improve performance and extend the battery longevity. In a multi-controller system a single temperature sensor must connect to the IPN master. Do not attach sensors or components other than the Blue Sky Energy battery temperature sensor (p/n 930-0022-20) to the temp sensor terminal block. Be certain to observe proper RED/BLK polarity.

Battery and PV Wiring

A desirable installation will produce a total system wiring voltage drop of 3% or less. The lengths shown in the Table on page 12 are one way from the PV modules to the battery with the SB1524 located along the path. Wire length can be increased inversely proportional to actual current. If current was reduced by ½,wire lengths could be doubled and still provide the same 3% voltage drop.

Setup and Wiring Diagram



Operating Mode Setup - Factory Default = All Off								
IPN Network Address	0	1	2	3	4	5	6	7
Jumper (A2)	NO	NO	NO	NO	YES	YES	YES	YES
Switch 1 (A1)	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Switch 2 (A0)	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Aux Output Function	2 A Auxiliary Battery Charge				25 A Load Control			
Switch 3 (Load)	OFF				ON			
Equalize Function	Disabled				Enabled			
Switch 4 (Eqlz)	OFF				ON			

Maximum Conductor Pair Length - 3% Voltage Drop

Wire Gauge AWG	12 Volt System @16 A FEET/METERS	24 Volt System @12 A FEET/METERS
12	8.0 / 2.4	21.4 / 6.6
10	12.8 / 4.0	33.8 / 10.4
8	20.2 / 6.2	53.8 / 16.4
6	32.4 / 9.8	85.6 / 26.0
4	51.0 / 15.6	136.2 / 41.4

Auxiliary Output

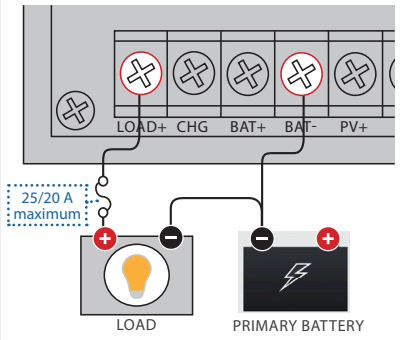
The auxiliary output can serve one of three functions; 1) a 2 A auxiliary battery charger, 2) a 20 A 12 V or 15 A 24 V load controller with Low Voltage Disconnect (LVD), or 3) a 15/20 A variable Dusk-to-Dawn lighting controller. The Charge/Load function is selected by DIP switch #3 shown in the Setup and Wiring Diagram. The IPN ProRemote, UCM, or BT Connect are required to adjust LVD thresholds or enable Dusk-to-Dawn lighting control. Auxiliary outputs in a networked multicontroller system will function normally, but only the auxiliary output in the master can be configured or monitored using the IPN ProRemote, UCM, or BT Connect. The auxiliary output Load Indicator will illuminate whenever the auxiliary output is ON (See NOTE* below).

CAUTION: The auxiliary output cannot perform both auxiliary battery charge and load control functions at the same time. Do not connect to the Load+ terminal for auxiliary battery charge.

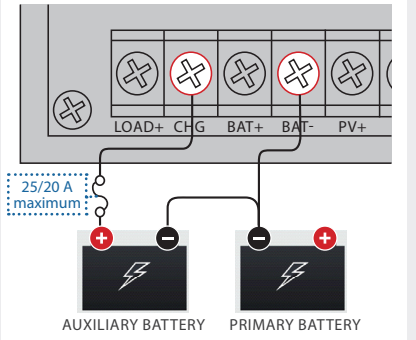
NOTE (*): The LOAD indicator light will be ON whenever power is available at the Load and Auxiliary Battery Charge terminals.

Auxiliary Output Wiring

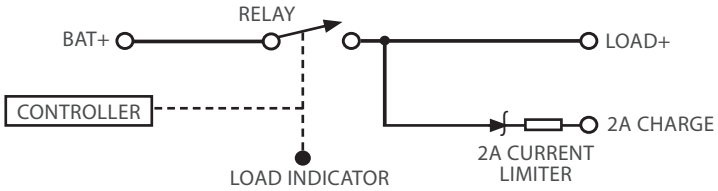
Auxiliary Output as Load Controller
DIP Switch #3 ON



Auxiliary Output as Auxiliary Battery
DIP Switch #3 OFF



Auxiliary Output Equivalent Circuit



AUXILIARY BATTERY CHARGE – DIP #3 OFF

The auxiliary charge function is used to charge an auxiliary battery of the same voltage as the primary battery. If the primary battery is charging in Absorption (Acceptance) or Float, up to 2 A is diverted to the auxiliary battery at the same charge voltage. Auxiliary battery charge is disabled during Bulk or Equalization. Use 10 or 12 awg wire to minimize voltage drop and the same 25/20 A over current protection shown in Table Load Control Ratings & Over Current Protection.

LOAD CONTROLLER – DIP #3 ON

The load controller operates as a high side switch from battery positive. Default settings are for Low Voltage Disconnect (LVD) with ON at V_{BAT} ≥12.6/25.2 V, and OFF at V_{BAT} ≤11.5/23.0 V. Adjusting these thresholds requires the IPN ProRemote, UCM, or BT Connect as a setup tool. Load ON/OFF operation can also be based on battery amp-hours from full if an IPN ProRemote is permanently installed. The ON/OFF condition must be valid for 20 seconds before switching will occur. If the higher/lower values are reversed the output control logic is inverted.

WARNING: Over current protection for the load control output must be provided externally. Maximum load current and required over current protection is specified in Table Load Control Ratings & Over Current Protection. If the load control is configured to operate based on battery amp-hours from full configure ON/OFF voltage thresholds as well. If amp-hour from full data is not available, voltage based operation will resume. ON/OFF thresholds must not be set to the same value or improper operation will result.

Load Control Ratings & Over Current Protection

Nominal Battery Voltage	Maximum Load Current	Maximum Switched Load Power	Maximum Over Current Protection
12 V	20 A	300 W	25 A
24 V	15 A	450 W	20 A

DUSK-TO-DAWN LIGHTING CONTROL – DIP #3 ON

A BT Connect, UCM, or IPN ProRemote with software version V2.00 or later is required to setup and enable lighting control. Refer to IPN ProRemote or BT Connect operators manuals for lighting control setup instructions. Variable time settings are available to turn lighting ON after Dusk (Post-Dusk timer) and/or ON before Dawn (Pre-Dawn timer). If both timers are set to DISABLED (factory default), the lighting control feature is disabled. If either the Post-Dusk or Pre-Dawn timers are set to a time value the lighting control feature is enabled. When lighting control is enabled the Load output is controlled by both the normal load control function and the lighting control function such that whichever function wants the Load output OFF prevails. Dusk or night time begins when the charge control system turns OFF which occurs when PV module current drops below about 50 mA at battery voltage. Dawn or day time begins when the charge control system turns ON which occurs when PV module current rises to about 100 mA at battery voltage. If the Post-Dusk timer is set to 1.0 hour and the Pre-Dawn timer is set

to 2.0 hours, lights would turn ON at Dusk, remain ON for one hour, and then turn OFF. Two hours before Dawn the lights would again turn ON and remain ON until Dawn. For full Dusk to Dawn lighting set the Post-Dusk timer to 20 hours. When the SB1524 first boots it does not know when Dawn is expected to occur so the Pre-Dawn control does not operate for the first night. Once a night time period of 4 hours or more is detected this night time period is stored and Pre-Dawn control will operate. Each subsequent night time period greater than 4 hours is added to a filtered average of night time.

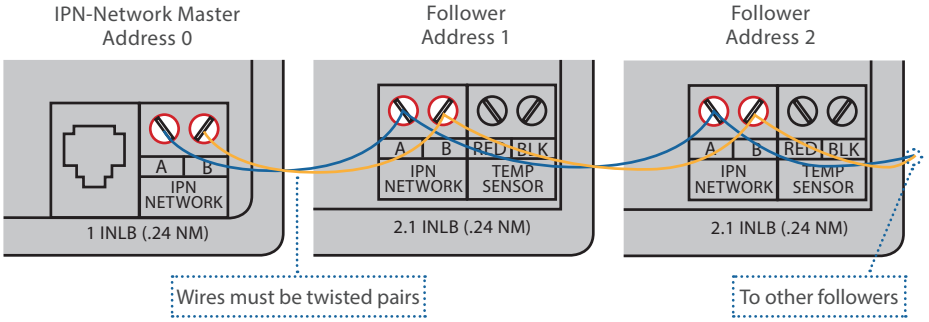
Installing a Multi-Controller System

A communication link is established between controllers by daisy chaining a twisted pair cable from the IPN Network terminal block, controller to controller (A-to-A, B-to-B) as shown in the IPN Network Wiring Diagram. Up to 8 IPN based charge controllers can be connected together in a multi-controller system. Device address 0 (zero) is the master and 1 – 7 are followers. The master controls the charging process and directs the activities of the followers.

CAUTION: A multi-controller system requires the following specialized installation and setup:

1. Each controller must be a separately installed charging system and connect to and charge the same battery.
2. Attached Follower controllers must be set to addresses 1 – 7 with no two controllers set the same. (SB3000i is fixed to IPN address 0 and is the charge control Master.)
3. Charge parameters are set in the Master only.
4. While outputs connect in parallel to a common battery, **PV (Panel) inputs must be completely separate.** A large PV (Panel) array must be divided into sub-arrays, each with separate PV+ and PV– wiring to their controller.
5. All controllers must be connected to the IPN network as shown in the IPN network wiring figure.

IPN Network Wiring



IPN Network Address -- DIPs #1, #2, & Jumper A2

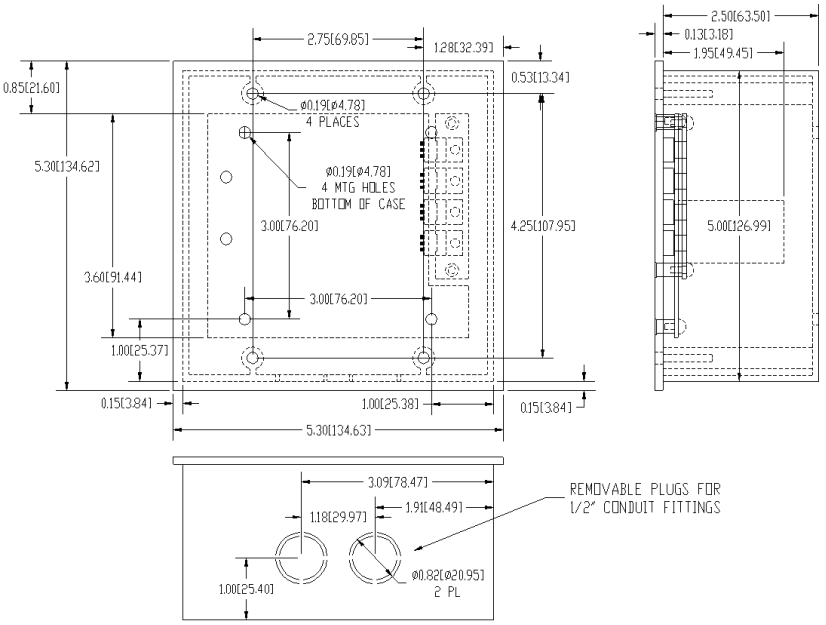
NOTE: A single controller must be set to IPN network address 0 (zero). In a multi-controller system one controller must be set to address 0 (zero) to serve as the master. The other controllers must be set to address 1-7 with no two controllers set the same. The SB1524 requires that a jumper be soldered across location A2 to select addresses 4 through 7.

IPN Network Address								
Dip Switch	Master	Followers						
	0	1	2	3	4	5	6	7
JUMPER (A2)	NO	NO	NO	NO	YES	YES	YES	YES
# 1 (A1)	OFF	OFF	ON	ON	OFF	OFF	ON	ON
# 2 (A0)	OFF	ON	OFF	ON	OFF	ON	OFF	ON

Mounting

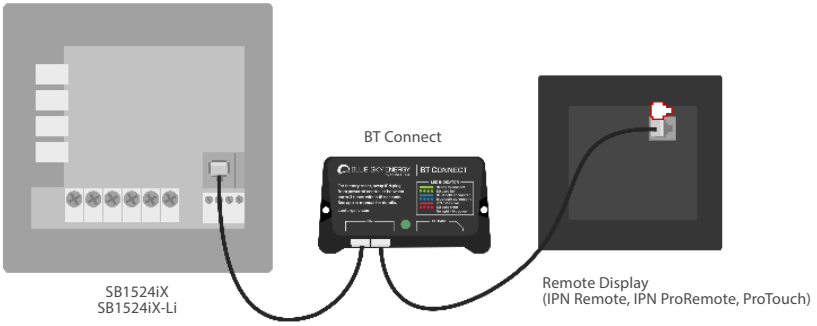
CAUTION: Mount the SB1524 vertically to promote air flow and do not enclose in a confined space. The SB1524 is not watertight and must be protected from rain, snow and excessive moisture. Included with the SB1524 (Retail package) is an optional plastic mounting box, it may also be installed in a standard 4 11/16" square galvanized electrical box. If a metal box is used. DO NOT remove or install into mounting box with power applied as damage resulting from shorting to the mounting box will void the limited warranty.

Detailed Dimensional Drawing



Installing Optional Accessories (Remote Displays and BT Connect)

The SB1524 can communicate via IPN cable with different accessories for full monitoring and advanced programming. Multiple accessories with different capabilities can be connected simultanelly to the SB1524 via RJ-11 cables (see figure below), as for example, a remote display (IPN Remote, IPN ProRemote, or ProTouch), the Bluetooth adapter BT Connect, and the UCM.



	IPN Remote	IPN ProRemote	ProTouch	BT Connect
Description:	1-Line LED Display	2-Line LCD Display	3.5" Touch-Screen Display	Bluetooth Adapter
Monitoring:	Basic	Full	Full	Full w/ historical graphs
Programming:	-	Full	5 Preset Charge Profiles	Full
Interface:	RJ-11	RJ-11	RJ-11	RJ-11, Bluetooth
Mounting:	Flush Mounting	Flush Mounting	Flush Mounting	Surface Wall Mounting

Troubleshooting Guide

Symptom	Probable Cause	Item to Examine or Correct
Completely dead, optional display blank	No battery power	Battery disconnected, overly discharged, or connected reverse polarity. Battery powers the SB1524, not PV (Panel).
Unit will not turn ON (charge status indicator OFF), Display if attached is ON	PV (Panel) disconnected or low in voltage	PV (Panel) must supply 0.10 A at greater than battery voltage to begin charge.
	PV (Panel) reverse polarity	Reverse polarity PV (Panel) will cause front to heat.
	IPN network address set wrong	A single unit must be set to IPN network address 0 (zero). One unit of a multi-unit network must be set to IPN network address 0 (zero), AND all other units must be set to different addresses.
	Microprocessor lockup	Momentarily remove all power to re-boot.
Charge status indicator ON, but no output charge current	Battery voltage greater than charge voltage setpoint	This is normal operation. Output is off due to high battery voltage which may be caused by other charging systems.
	Battery voltage too low	Battery voltage must be at least 9 V for the SB1524 to operate.
	PV- connected to BAT- external to controller	PV- & BAT- must be separate for proper operation. PV- must receive earth ground via shunts inside the SB1524 which internally connect PV- to BAT-. External connection prevents proper operation of current measurement system.
Charge status indicator blinks rapidly	System in equalize mode	Disable equalize via IPN ProRemote, or by turning DIP switch #4 off.
Charge OFF at high ambient temperature	System temporarily shuts down due to high heat sink temperature	Improve ventilation or reduce PV (Panel) power. Sufficient ventilation to prevent over temperature shut down will improve reliability.
Charge current is lower than expected, PV (Panel) current may be low as well	Battery is highly charged	Normal operation, current is reduced if battery voltage is at setpoint.
	Worn out or dissimilar PV modules	Replace, or use as is.
	Low insolation	Atmospheric haze, PV (Panel) is dirty or shaded, sun low on horizon, etc.
	PV- connected to BAT-	PV- & BAT- must be separate for proper operation. PV- must receive earth ground via shunts inside the SB1524 which internally connect PV- to BAT-. External connection prevents proper operation of current measurement system.

Symptom	Probable Cause	Item to Examine or Correct
MPPT Current boost is less than expected	PV maximum power voltage (V_{MP}) is not much higher than battery voltage, leaving little extra power to be extracted	PV (Panel)'s with low V_{MP}. PV (Panel)'s with higher V_{MP} work best, PV (Panel)'s with <36 cells tend to work poorly. Excessive PV (Panel) wiring voltage drop due to undersize wiring, poor connections etc. Battery is nearly charged and battery voltage is high. Output during MPPT operation is "constant power", higher battery voltage reduces charge current increase.
	PV (Panel) is hot	V_{MP} and available power decrease with increasing PV (Panel) cell temperature. Cooler PV (Panel)'s will produce greater boost. It is normal for boost to decrease as PV (Panel) temperature rises.
	Worn out or dissimilar PV modules	Replace, use as is, or use different controller for different PV modules.
Auxiliary battery not charging	Not configured for auxiliary battery charge	Confirm dip switch #3 is OFF.
	Primary battery not highly charged	Auxiliary battery will not receive charge unless primary battery is in Absorption (Acceptance) or Float.
	Load on Auxiliary battery too high	Maximum auxiliary charge current is roughly 2 A. Load may need to be reduced.
System appears OK, but will not switch between Bulk, Absorption (Acceptance) & Float	Not set for 3 stage charge	Double check Float voltage setpoint.
	Will not switch out of Bulk and into Absorption (Acceptance) or Float	Battery is so discharged that available net charge current cannot bring battery voltage up to the desired charge voltage setpoint. PV (Panel) power may be too low or loads too high.
	Will not switch from Absorption (Acceptance) to Float	Battery not fully charged. Unit will not switch to Float until battery voltage remains at the Absorption (Acceptance) voltage setpoint continuously for the Charge Time period (or net battery current drops to the Float Transition Current setpoint if using IPN ProRemote).
Load control not working properly	Auxiliary output not set for load control	Confirm dip switch #3 is ON.
	Output may have shut off due to low battery charge	Load will shut off if battery voltage drops below OFF threshold (default 11.5 V). Once shut off, the load will not come back on until battery voltage is above ON threshold (default 12.6 V).
	ON/OFF thresholds set incorrectly	Correct ON/OFF threshold settings.

Symptom	Probable Cause	Item to Examine or Correct
Dusk-to-Dawn feature, lights will not turn ON or remain ON	Auxiliary output not set for load control	Confirm dip switch #3 is ON and Dusk-to-Dawn enabled.
	Output may have shut off due to low battery charge	Load will shut off if battery voltage drops below OFF threshold (default 11.5 V). Once shut off, the load will not come back on until battery voltage is above ON threshold (default 12.6 V).
	Charge control system ON	Lights will not turn on if charge control system is ON and charging as this is day time.
	Timers set incorrectly	Check time settings Post-Dusk or Pre-dawn timer.
	Valid night time period not seen	Pre-Dawn lighting will not operate until a valid night time period of ≥ 4 hours detected. If PV (Panel) was removed/reconnected, night time period may be inaccurate. Remove & restore power to reboot.
Dusk-to-Dawn feature, lights will not turn OFF	Auxiliary output not set for load control	Confirm dip switch #3 is ON and Dusk-to-Dawn enabled.
	Timers set incorrectly	Either Post-Dusk or Pre-dawn timers must be set to time value to enable Dusk-to-Dawn feature.
	Charge control does not turn ON	Check charge control system related items.
Networked units do not seem to coordinate action or slaves do not turn on	IPN network address set wrong	One unit of a multi-unit network must be set to IPN network address 0 (zero), AND all other units must be set to different addresses 1 – 7.
	Network wiring problem	Confirm wiring correctly in place. Use IPN ProRemote, BT Connect or UCM to see View Charge Unit Status screens to confirm communication with followers.
Temperature related functions do not work.	Temperature sensor not installed on master	Temperature sensor must be installed on the master in a multi-controller system. Temperature sensor inputs on followers are disabled.
	Temperature sensor failed, reverse polarity, or not BSE sensor p/n 930-0022-20.	If sensor is open, short, reverse polarity or missing system will operate as if sensor was at 25º °C. Sensor temperature can be read directly on the IPN ProRemote or BT Connect. Sensor voltage when connected reads 2.98 V at 25 °C, changing at +10 mV/°C.

5 year limited warranty

Visit https://sunforgellc.com/product/solar-boost-1524ix/ for more information and terms of the warranty.

Specifications

	SB1524 @12 V	SB1524 @24V
Max. Recommended Panel Power	270 W w/ 36-cell PV panel (1)	400 W w/ 72-cell PV panel (1)
	200 W w/ 60/72-cell PV panel (1)	
Rated Battery (Output) Current	20 A w/ 36-cell PV panel (1)	15 A w/ 72-cell PV panel (1)
	15 A w/ 60/72-cell PV panel (1)	
Conversion Efficiency	97% (typical @28 V / 12 A output)	
Power Consumption	0.20 W (typical standby)	
Max. Recom. Panel Voc at STC	45.6 V (Max Panel Input 57 V)	
Min. Battery Voltage for Operation	9 V	
Auxliary Output (option A, B, or C)	A) Auxiliary 2 A Battery Charge (2nd battery)	
	B) Load Control w/LVD	
	C) Dusk-to-Dawn w/LVD (by IPN ProRemote, BT Connect)	
Load (LVD) Disconnect / Reconnect Voltage	11.5 V / 12.6 V (iX version) (2) 11.0 V / 12.0 V (iX-Li version) (2)	23.0 V / 25.2 V (iX version) (2) 22.0 V / 24.0 V (iX-Li version) (2)
Maximum Auxiliary Output Current (option B or C)	20 A	15 A
Display	w/ IPN ProRemote, IPN Remote, BT Connect, or ProTouch	
Operating Temperature	-40 °C – 50 °C	
Maximum Full Power Ambient	50 °C	
Environmental Protection	IP20	
Dimensions and Weight	5.3 x 5.3 x 2.5" (13.5 x 13.5 x 6.35 cm) ; 1.15 lb. (525 g)	
Charge Profile	Multi-Stage (2)	
	SB1524iX	
Battery Chemistry	12 V Lead Acid	24 V Lead Acid
Absorption Voltage	14.2 V (2)	28.4 V (2)
Float Voltage	13.2 V (2)	26.4 V (2)
Equalization Voltage (if enabled)	15.2 V (2)	30.4 V (2)
Temperature Compensation (by optional Battery Temp. Sensor)	-5.00 mV/°C/cell correct factor (Range 0.00 to -8.00 mV/°C/cell) (2)	
	SB1524iX-Li	
Battery Chemistry	4S $LiFePO_4$	8S $LiFePO_4$
Absorption Voltage	14.4 V (2)	28.8 V (2)
Absorption Time	0.5 Hr (2)	0.5 Hr (2)
Float Voltage	13.6 V (2)	27.2 V (2)
Temperature Compensation	Disabled	

(1) 36-cell panels are typically referred to as "12 V panels" providing V_{mp}/V_{oc} of ~18 V / 22 V at STC, 60-cell panels refers to "20 V panels" (V_{mp}/V_{oc} ~30 V / 37 V), 72-cell panels refers to "24 V panels" (V_{mp}/V_{oc} ~36 V / 44 V).
(2) Factory default voltages unless programmed with an IPN ProRemote, ProTouch, BT Connect, or UCM.