

# SBP-1100e Smart Battery Power System

## User Manual

Software version 4.1.2



1100ENERGY

## Warranty Statement

All 1100 Energy products are warranted for 90 days from the date of purchase. Any defects due to workmanship or materials will be repaired or replaced, at 1100 Energy's discretion, within the warranty period.

- **Normal Wear and Tear:** Periodic maintenance, repair and replacement of parts due to normal wear and tear are excluded from coverage.
- **Abuse and Misuse:** Defects or damage that result from:
  - a. Improper operation or storage, misuse or abuse, accident or neglect, such as physical damage to the surface of the product resulting from misuse.
  - b. Subjecting the product to abnormal usage or conditions.
  - c. Other acts which are not the fault of 1100 Energy, are excluded from coverage.
- **Unauthorized Service or Modification:** Defects or damages resulting from service, testing, adjustment, installation, maintenance, alteration, or modification in any way by someone other than 1100 Energy, or its authorized service centers, are excluded from coverage.

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## General Description

The SBP-1100e Smart Battery Power System is a rugged, state of the art, lightweight, high energy density, rechargeable, portable power system that is an ideal solution for even the most demanding of applications. The SBP-1100e can be used as a source of power for applications such as communications equipment as well as 1100 Energy's infrared signaling and marking products. Based upon Lithium-Ion battery cell chemistry, the SBP-1100e delivers power with much less weight and bulk than traditional battery systems.

The SBP-1100e power output provides a regulated DC voltage for running various types of equipment for diverse applications. Capable of providing up to about 300 watts of power, the SBP-1100e can store up to 1100 watt-hours of energy internally, of which up to about 1000 watt-hours can be delivered to an external load before a recharge is needed. The system can power, for example, a 100 watt load for about ten hours, or lesser loads for proportionately longer periods of time using its stored energy.

The SBP-1100e provides graceful degradation of performance in the event that one or more Lithium-Ion battery units within the system should fail; the energy storage capacity will decrease proportionately, instead of resulting in system failure.

The SBP-1100e power input is configured for direct charging by solar panels designed for charging 12-volt lead-acid battery systems. The high-efficiency charging circuit is built-in. The SBP continues to power the application equipment during solar charging; and afterwards, using the stored energy. In using input power available to the SBP-1100e, priority is given to supplying power to the equipment load, and any additional input power which may be available is used to charge the internal batteries, until the batteries are fully charged. So long as some stored energy in the SBP-1100e is available to power the equipment load, fluctuations in the input voltage and power will not affect the load equipment.

The SBP-1100e may be charged from any continuous (filtered or low-ripple) DC power source of 10 volts to 28 volts, capable of supplying 200 watts. Acceptable power sources include vehicle 12-volt or 24-volt DC power systems, AC-powered DC power supplies and power adapters, and solar panels which are intended for charging 12-volt lead acid batteries. Specifically, the SBP-1100e may be charged using portable solar panels manufactured by PowerFilm, or by an AC power adapter, both provided by 1100 Energy. The AC adapter can be powered from any AC power source from 100 volts to 240 volts, 50 or 60 Hz, using a modular AC power cord. A modular cord for U.S. 120 volt outlets is provided. For use with other types of AC outlets, the appropriate IEC modular power cord is required. Consult 1100 Energy concerning other options for supplying charging and operating power to the SBP-1100e.

The SBP-1100e battery pack can be ordered with any fixed output voltage from 6 volts to 28 volts DC. The standard output voltages are 13.8 volts and 25.3 volts, for use with equipment designed to run on vehicle power that ranges from 12 to 14 volts DC. The output voltage is fixed at the time of manufacture.

## SBP-1100e Features

- External dimensions approx. 15" L x 11" W x 6.5" H, including receptacles with carrying handle folded.
- Fits within a space 16" L x 12" W x 7" H, but 12" additional length should be allowed for cable bends.
- Integrated battery monitor panel reports condition and state-of-charge percentage.
- Can be recharged more than 400 times, typically.
- Durable, rugged, water resistant, and crush resistant case; airtight (with pressure relief valve)
- 100% depth of discharge allowed, versus 30% to 60% for lead-acid storage battery technologies.
- Light weight—a third of the size and weight of comparable sealed lead acid packs with casing and venting.
- Deep discharge WITHOUT damage, no urgency to re-charge.
- Automatic shut-down at full discharge with preceding user notifications.
- Rapid charging—10 hrs to full charge from empty, using AC power adapter: **SBP-AC-ADAPTER-24V-130W**
- Integrated battery pack protection circuitry for safety.
- Partial charge/discharge cycles OK, no memory effects.
- Cells do not out-gas, environmentally benign compared to lead or nickel-cadmium chemistries.

## SBP-1100e Specifications

Standard Output Voltages (factory-set)	13.8 volts DC, +/- 4%, for nominal 12-volt applications, 25.3 volts DC, +/- 4%, for nominal 24-volt applications
Other Output Voltages (examples)	6, 9, 12.4, 16, 24, or 28 volts DC, +/- 4 %, factory-set
Custom Output Voltages	Fixed voltages from 6 to 28 volts DC, +/- 4%, factory-set
Input (Charging) Voltage	10 to 28 volts DC, continuous (filtered or low-ripple) Use an approved power source
Input (Charging) Power	up to 200 watts, in increments of 50 watts.
Energy Storage Capacity (10 hr. discharge)	1100 watt-hours, initial capacity, 1000 watt-hours available for output
Amp-hour Storage Capacity (10 hr. discharge)	72 Amp-hours (13.8 volt model), 40 Amp-hours (25.3 volt model)
Temperature Range for charging	0° to 40° C (32 deg. F to 104 deg. F)
Temperature Range for discharging	-20° to 50° C (-4 deg. F to 122 deg. F)
Temperature Range for storage	-20° to 60° C (-4 deg. F to 140 deg. F)
Max. Continuous Discharge Load (less than 1 hour, at 25 deg. C, 77 deg. F)	25.3 volts: 300 watts 13.8 volts: 280 watts 9 volts: 180 watts 6 volts: 120 watts
Max. Continuous Discharge Load (more than 1 hour, at 25 deg. C, 77 deg. F)	25.3 volts: 200 watts 13.8 volts: 180 watts 9 volts: 120 watts 6 volts: 80 watts
Charge/discharge Cycle Life	more than 400 cycles, typical (20% reduced capacity after 300 discharge cycles)
Service Life	about 5 years, typical, for 20% reduced capacity due to aging. Batteries age faster at higher storage temperatures and at higher storage state-of-charge.
Weight	approx. 28.5 lbs.
Recharge time from empty	8 to 10 hours, using the 130 watt SBP AC adapter (SBP-AC-ADAPTER-24V-130W). Consult 1100 Energy for other charging options
Output Noise and Ripple	100 mV peak-to-peak at maximum load, for 25.3 volts DC output. Noise and ripple are proportionate to loading.
Power Input Receptacle	MS3112E14-5P, 5-pin contact male MIL receptacle, box mount
Power Input Mating Plug	MS3116F14-5S, 5-socket contact female MIL plug, cable-mount, with strain-relief clamp. (Plug is available from 1100 Energy as item no. SBP-CON-INPUT)
Power Output Receptacle	MS3112E14-5S, 5-socket contact female MIL receptacle, box mount
Power Output Mating Plug	MS3116F14-5P, 5-pin contact male MIL plug, cable-mount, with strain-relief clamp. (Plug is available from 1100 Energy as item no. SBP-CON-OUTPUT)
Serial Data Receptacle	MS3112E10-6P 6-pin contact male MIL receptacle, box mount
Serial Data Mating Plug	MS3116F10-6S 6-socket contact female MIL plug, cable-mount, with strain-relief clamp. (Plug is available from 1100 Energy as item no. SBP-CON-DATA)

## Turn-on/Wake-up from Hibernation

**Hibernation:** The SBP-1100e will automatically enter a hibernation state after 30 minutes of non-use (and provided that no live charging power source is connected). This is done to conserve the stored energy which powers the unit, and thereby extend the energy-retention shelf-life of the unit.

**Press RESET to wake up:** To turn on or wake up the unit, press firmly with a fingertip on the small silver dot labeled 'RESET', and release. The RESET dot is located just to the left of the SCROLL button on the LCD control panel on the top face (hinged lid) of the SBP-1100e. Within 3 seconds, the SBP-1100e will wake up and begin to initialize, flashing messages on the LCD screen.

**If needed, connect power to wake up:** An SBP-1100e unit which holds a 50% charge when entering hibernation, and which has remained in hibernation for a few weeks or less, should be able to be awakened by pressing the RESET dot. Should the unit become completely exhausted while in hibernation, pressing the RESET dot will not awaken the unit. In that case, connect a charging power source, such as the SBP AC Power Adapter, item no. SBP-AC-ADAPTER-24VDC-130W, to the INPUT receptacle on the left side of the SBP-1100e. Be sure the AC Adapter is plugged into a live AC outlet, and that the adapter power switch is on. Within 3 seconds, the unit should wake up and begin to initialize, flashing messages on the LCD screen. If not, contact 1100 Energy for assistance.

**Press SELECT to view product ID:** the initialization process takes, one minute until the LCD display goes blank, except for a row of grey raster rectangles which may appear dimly on the LCD screen.

After the display goes blank, wait one more minute (or less) for initialization to complete, then press the SELECT button to see the product identification and software version. The software version should match the software version listed on the cover of this User Manual.

**Press SCROLL to view mode and charge state:** Press the SCROLL button to view the state of charge and the operational mode. The state of charge will appear as text on the top line of the LCD display (e.g. 43%), and in a graphical representation (e.g. four black blocks for a state of charge from 40% to 49%). The operational mode will appear on the bottom line of the LCD display, unless the unit is charging, in which case 'Charging' will appear. If the mode is 'Idle', the unit is ready for use. If the mode is 'Twilight', connect a charging power source as described above, and allow the unit to charge, at least until the state of charge reaches about 15%. To check whether the unit is ready for use, disconnect or turn off the charging power, and press SCROLL to check the mode; if the mode is 'Idle', the unit is ready for use. If desired, re-connect (or turn on) the charging power to continue charging. The SBP-1100e does not have to be fully charged before being put to use powering a load, and the unit may deliver power to the load while continuing charging.

## Control Panel Buttons and the LCD Display

If the LCD display does not respond to pressing the SCROLL and SELECT buttons, wait one minute for the condition to correct itself, and try again. If the display still does not respond, press the RESET dot, then wait two minutes, and try again.

After pressing the SCROLL or SELECT button, the LCD display will light up and show data for 8 seconds, then blink off. During the 8 seconds display time, the data is not updated in real time, so if at any time up-to-date data is needed, press the SCROLL button until the desired data set is displayed.

At any time, status messages may appear which will over-ride the data which would otherwise appear in response to button presses. Sometimes, a long series of such status messages may appear which may interfere with using button presses to obtain data. In that case, wait until the status messages have stopped before again pressing buttons.

## Master Reset

The master RESET button is located about ¼ inch to the left of the domed 'SCROLL' button. The RESET button is not domed to prevent it from being activated by accident. The SBP-1100e may be reset at any time by pressing the button. The process takes about two minutes, and the output power will turn off during the reset, then automatically turn on when the process is complete.

## Battery Charging Using the AC Adapter

If the SBP-1100e Smart Battery Power System is to be charged from an AC power source, connect the AC power adapter (**SBP-AC-ADAPTER-24V-130W**) to an AC power source of 100 volts to 240 volts, 50 or 60 Hz.

When the connection is made, the charging status may be viewed on the control panel display on the SBP-1100e (push

the SCROLL button). The SBP-1100e may be used to provide power to a load while the battery pack is being charged. Charging stops automatically when it reaches the highest state of charge possible. There is no need to turn off or disconnect the charging power source when charging is complete, or be concerned about over-charging.

### Battery Charging Using DC Power Sources

Generally, the SBP-1100e may be charged from filtered DC power sources ranging from 10 volts to 28 volts, provided the source can supply 200 watts. The power source need not be voltage-regulated (e.g. solar panels, 12V – 24V generators), but the voltage must not exceed 28 volts. However, only charging sources supplied or approved by 1100 Energy, should be used for charging the SBP-1100e. Please contact 1100 Energy for details. Unfiltered DC power sources, such as automotive battery chargers, should not be used for charging the SBP-1100e. Automotive power, by direct connection to the battery of a vehicle with the engine running, may generally be used to charge the SBP-1100e. At low voltages (10 – 12 volts) the SBP-1100e may draw 20 amps while charging, so avoid connecting the unit to an automotive DC power jack (cigarette lighter jack) if the jack is fused at less than 20 amps.

### Battery Charging Using MF15-3600 Solar Panels

If the SBP-1100e is to be charged from MF15-3600 Solar Panels, connect a minimum of three solar panels, using a compatible solar adapter cable (see Accessories). Depending on the average power requirements of the load, and the amount of sunlight available, up to eight solar panels may be needed. The 2-pin connectors used to connect the solar panels to the cables should be tightly mated to keep out rain water, and all the connectors should be kept out of rain puddles if possible. Any unmated connectors should have the rubber safety caps which are tethered to them, installed securely onto the connectors, to protect from rain water. Avoid using the connectors near hazardous voltages.

When the cable and panel connections have been made, the charging status may be viewed on the status display on the SBP-1100e (push the SCROLL button). The SBP-1100e may be used to provide power to a load while the battery pack is being charged. Charging stops automatically when the SBP-1100e reaches the highest state of charge possible. There is no need to turn off or disconnect the charging power source when charging is complete, and there is no need to be concerned about over-charging.

Ideally, the solar panels should be oriented so sunlight strikes them approximately perpendicular to the panel surface during the mid-day hours, when the sun is strongest. For example, in the Northern hemisphere, at 40 degrees north latitude, for best performance the panels should face south, elevated about 40 degrees from the horizontal. In a location near the equator, the panels should lie on a level surface. The panels should not be in shadow during the mid-day hours, to the extent possible.

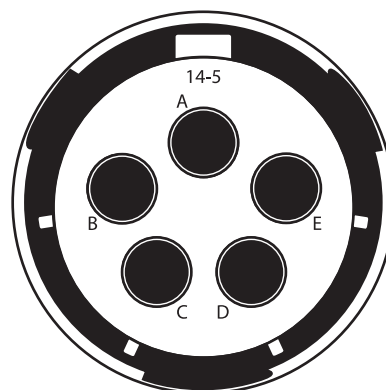
### Power Input Connection Specifications

**Input Mating Plug:** Model № **SBP-CON-INPUT** Input mating plug, miniature cylindrical, 5-pin female. MIL-C-26482 Series 1, shell size 14 plug, 5 socket contacts, 16 AWG. MS3116F14-5S

**Cable:** 16/4 type SOOW 4-conductor 16 AWG cable. Water and oil resistant rubber jacketed cable.

### Connection Wiring Diagram

Pin	Description	Wire Color
A	+DC Input	Red
B	+DC Input	White
C	-DC Input (Return)	Black
D	-DC Input (Return)	Green
E	No Connection	No Connection



5-Pin Female Input Mating Plug (mating face view)

### Supplying Power to a Load

To use the SBP-1100e to power a DC load, first determine whether the fixed voltage provided by the SBP-1100e (e.g. 13.8 VDC or 25.3 VDC, etc) is appropriate for the load, and that the power demanded by the load will not exceed 300 watts on a continuous basis. If continuous power in excess of 300 watts is required, consult 1100 Energy.

Connect the SBP-1100e power output jack on the right side of the unit to the load using the provided cable or other approved cable. A short output cable terminated with ring terminals, provided by 1100 Energy, may be used to connect with another, longer, user-provided cable if appropriate. User-specified extension cables should be of a wire gauge adequate to avoid an excessive voltage drop in the extension cable.

The panel display may be controlled to show the voltage, current and an estimate of the remaining battery pack charge as a percentage of the charge capacity. The SBP-1100e may be used to provide power to a load while the battery pack is being charged.

If the SBP-1100e becomes fully discharged, and the output cuts off, a small amount of residual stored energy will maintain functionality of the user interface for one hour or more. This feature is partly for user convenience during attended operation and testing, and it also keeps the serial control and monitor interface functioning. If no new charge is added after the output cuts off, the user interface will cut off as well, after 30 minutes, and the unit will then appear to be totally dead, with no power output, no display, and no response to button pressing. The SBP-1100e is in hibernation. However, the user interface will come back to life within 3 seconds after external power is applied, and after a suitable period of charging, the SBP-1100e battery pack may again be used normally. In the event that charging power is applied after the output has been cut off, the state of charge must rise to about 15% before the output will be turned on again.

### Power Output 'On' and 'Off' Control

To check the output voltage and current, press the 'SCROLL' button on the Control Panel repeatedly (slowly) until the second line of text of the LCD display shows the output voltage and current, for example:

```
Out 13.8V 00.0A
```

This display will persist for eight seconds, during which time the 'SELECT' button may be pressed to toggle the power output 'on' and 'off'. That is, if the power output is 'on', pressing "SCROLL" once will turn it off, and if the power output is 'off', pressing "SCROLL" once will turn it on. The change in output voltage and current resulting from turning the output 'on' or 'off' will not appear immediately on the LCD display, because the display is a frozen snapshot of the state existing when the 'SCROLL' button was pressed. To see the new output voltage and current, again press the 'SCROLL' button repeatedly (slowly) until the new data is displayed. Note that if there is no load connected to the SBP-1100e and the power output is turned off, it may take 30 seconds or more for the indicated output voltage to fall below one volt, due to stored charge in the output regulation circuit. If a load is present, the output voltage will instantly drop to zero when the output power is turned off.

**The SBP-1100e has a very high power and energy density. Mishandling may present a risk of fire or explosion. Exercise common sense precautions when handling, transporting, or testing. DO NOT OPEN the battery pack case and replace individual cells or modules. Usage should be carefully coordinated with 1100 Energy to ensure proper operation and safety.**



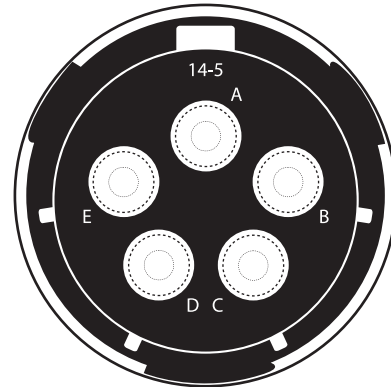
**Power Output Connection Specifications**

**Output Mating Plug:** Model № **SBP-CON-OUTPUT** Output mating plug, miniature cylindrical, 5-pin male MIL-C-26482 Series 1, shell size 14 plug, 5 pin contacts, 16 AWG. MS3116F14-5P

**Cable:** 16/4 type SOOW 4-conductor 16 AWG cable. Water and oil resistant rubber jacketed cable.

**Connection Wiring Diagram**

Pin	Description	Wire Color
A	+DC Output	Red
B	+DC Output	White
C	-DC Output (Return)	Black
D	-DC Output (Return)	Green
E	No Connection	No Connection



5-Pin Male Output Mating Plug (mating face view)

**Serial data port**

The SBP-1100e has a serial data port which permits the unit to be controlled and/or monitored remotely using a serial RS-232 data terminal or a computer which emulates a data terminal. Contact 1100 Energy for detailed information concerning this feature.

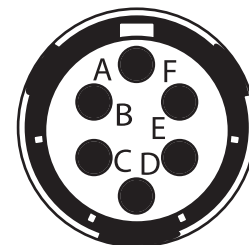
**Serial Data Port Connection Specifications**

**Note:** Fully assembled 10-foot (**SBP-CBL-RS232-10FT**) or 5-foot (**SBP-CBL-RS232-5FT**) RS-232 Data Cables are available from 1100 Energy. The cables will connect the SBP-1100e directly to a 9-pin serial port of a personal computer.

**Mating Plug:** Model № **SBP-CON-DATA** Serial Data Port mating plug, miniature cylindrical, 5-pin female, for SBP-1100e. MIL-C-26482 Series 1, shell size 10 plug, 6 socket contacts, 20 AWG. MS3116F10-6S

**Connection Wiring Diagram**

Pin	Signal Description	Serial Data Pin # (9-pin PC D-Connector)	Serial Data Pin # (9-pin Modem D-Connector)
A	Data Input to SBP	3 (PC to SBP, TxD)	2 (Modem to SBP, RxD)
B	Data Out from SBP	2 (SBP to PC, RxD)	3 (SBP to Modem, TxD)
C	Signal Ground	5 (Signal Ground)	5 (Signal Ground)
D	No Connection	No Connection	No Connection
E	No Connection	No Connection	No Connection
F	No Connection	No Connection	No Connection



6-Pin Female Data Mating Plug (mating face view)

**Control panel buttons**

The SBP-1100e has two domed buttons for user interaction in addition to the non-domed 'RESET' button. The buttons are tactile-feedback membrane switches that give the user a positive indication by feel that the button has been activated.

The 'SCROLL' button allows the user to scroll through a number of options presented on the display. Pressing the 'SCROLL' button once will turn on the LCD status display (and backlight) for about 8 seconds. Repeatedly pressing the button (slowly), will cycle through the display options.

The SELECT button enables a display of product identification information, including the software version number. In future versions of the SBP-1100e, the 'SELECT' button will implement a menu system. Pressing the 'SELECT' button once will turn on the LCD status display (and backlight) for about eight seconds, and display:

```
SBP-1100 V4.1.2
1100 ENERGY CORP
```

Repeatedly pressing the 'SELECT' button (slowly) does the same.

### LCD Backlighting

The LCD on the top of the SBP-1100e has backlighting which makes the display readable in the dark. The backlighting turns on automatically whenever one of the buttons on the control panel is pressed. The backlighting will remain on for about 8 seconds and then automatically turn off to save power, unless a button is pressed again before the backlight has turned off, in which case the backlight will remain on for eight seconds after the last button press.

### LCD panel indications

The LCD panel on the top face of the SBP-1100e indicates the status of the unit, in response to pressing the 'SCROLL' button. There is space for two lines of text or graphics on the display, and when the 'SCROLL' button is pressed, the top line will display the present charge state in two formats: the numerical percentage and a horizontal bar graph. The percentage indicated is the relative state of charge between 0% (fully discharged) and 100% (fully charged).

The bar graph indication uses darkened blocks to represent full increments of 10% charge capacity. In the example below, the unit shows that it has 78% of full capacity left and the bar graph shows 7 blocks.

```
78% ██████████
```

The second line of the LCD is used to display other operating parameters for the SBP-1100e, including the status of charging or discharging, output voltage and current, and input voltage and current. The charging or discharging status includes an estimate of the amount of time remaining for the unit to reach the end state of fully charged, in the case of charging, or discharged to the point of output cut-off in the case of discharging, assuming that charging or discharging continues at the present rate.

When the SCROLL button is pressed while the display is blank, the backlight turns on and the state of charge appears on the top line of the display, while the second line will show one of the following typical display formats:

```
Charging 4.5HR
Dscharging 3.0HR
Idle
Twilight mode
In 23.5V 3.2A
Out 13.8V 4.3A
In Temptr +27C
Out Temptr +43C
```

Press the 'SCROLL' button (slowly) to cycle the LCD display through the series of screens which show input and output voltages and currents, and other informational displays including the temperatures of the input and output power conversion modules inside the SBP-1100e.

At any given time, the SBP-1100e will be in one of several operating modes including: Charging, Discharging, Idle, Twi-

light, or Hibernation. Accordingly, the second line of the LCD will display Charging, Dschging, Idle, or Twilight in response to pressing the 'SCROLL' button, at the appropriate step in the display cycle, when the unit is not in hibernation. When in hibernation mode, the control panel is not active and there will be no response to button presses. The SBP-1100e will come out of hibernation mode and the user interface will come back to life within three seconds after external power is applied, or usually, if RESET is pressed.

In the example below, the unit is taking in power on the input connector, and if it continues at this rate it will be fully charged in approximately 4.5 hours.

Charging 4.5HR

In the example below, the unit is discharging, and if it continues at this rate it will be fully discharged in approximately 3.0 hours.

Dschging 3.0HR

In the example below, the unit is neither charging nor discharging, and is not powering a load, and thus is said to be 'idle'.

Idle

In the example below, the unit is both charging or discharging, that is, some internal batteries are being charged while others are being discharged.

Dschrge & Charge

In the example below, the input voltage and input current are displayed.

In 23.5V 3.2A

In the example below, the output voltage and output current are displayed.

Out 13.8V 4.3A

In the examples below, the input power converter operating temperature, and the output power converter operating temperature, respectively, in degrees Celsius, are displayed.

In Temptr +27C  
Out Temptr +43C

In the event that the operating temperature of the input power converter reaches 95° C, charging will be automatically cut off until the temperature falls below 90° C. Likewise, if the operating temperature of the output power converter reaches 95° C, the power output will be automatically cut off until the temperature falls below 90° C.

In addition to the informational responses which appear on the LCD in response to pressing the 'SCROLL' button, spontaneous informational messages or warnings may appear on the LCD.

## Storage

- Recommended temperature range for storage: -20 °C (-4 °F) and 60 °C (140 °F) (store at low to moderate temperatures to maximize battery life.). Storage at temperatures above 45 °C (113 °F) reduces battery life.
- Prolonged storage periods: Store the SBP-1100e at 20% to 50% capacity and at low to moderate temperatures. Prolonged storage at a high state of charge will degrade the storage capacity of lithium-ion batteries.

### Outdoor use

The SBP-1100e is weather-resistant and ruggedly packaged, but when used outdoors, it should not be left fully exposed to the weather, if it can be avoided. Direct sun can cause overheating, and prolonged exposure to sun, rain, snow, salt spray, dust and wind-blown debris may accelerate deterioration of the case and control panel. Some covering, such as a rain-shedding, sun-blocking tarp or lean-to should be provided, and the covering should allow for some natural circulation of air around the SBP-1100e case during hot weather.

If the SBP-1100e is to be used in extremely hot or extremely cold outdoor environments, shallow burial of the unit in the earth will moderate the temperature extremes. Shallow burial might also be used as a means of hiding the SBP-1100e. Since the earth may tend to become saturated with water from time to time due to rain, some waterproof protective wrapping or bagging, and/or provision for drainage, may be desirable.

### Lithium-Ion

Lithium-Ion packs, unlike Lead-Acid batteries, do not have to be fully charged before use. If charging is stopped prior to full charge, the SBP-1100e can be discharged without diminishing cycle life. In addition, unlike NiCd and NiMH batteries, Li-Ion batteries can be recharged at any state-of-charge without degradation to the battery's cycle life performance and without memory (voltage depression) problems.

The ideal usage pattern for lithium-ion batteries is to be charged and discharged on a daily to weekly cycle, as would be typical of a solar panel-based application. Prolonged storage at a high state of charge should be avoided, as it degrades battery capacity, but prolonged storage at a moderate or low state of charge (40% or less), or in a fully discharged state, is not harmful. All batteries, including lithium-ion batteries, will slowly self-discharge while in storage. After several months in storage, lithium-ion batteries may go dead, but the batteries can be readily brought back to life by applying a suitable 'wake-up' charging regimen. The SBP-1100e automatically applies the 'wake-up' charge regimen when appropriate, and when charging power is made available. The SBP-1100e should be ready for normal use after a couple of hours of 'wake-up' charging from a dead state, although it will take longer than two hours to reach full charge.

Lithium-ion batteries slowly degrade over time, whether or not they are being 'used' (charged and discharged) on a regular basis. Provided the batteries have not been subject to prolonged storage at a high state of charge, a typical useful service life might range from two to five years. Typically, the capacity rating will degrade by about 20% after about 300 charge/discharge cycles. When degradation of the internal batteries reduces the energy storage capacity of the SBP-1100e below a level which is suitable for the application, the SBP-1100e has reached the end of its service life. In some cases, an SBP-1100e unit may be returned to 1100 Energy, reloaded with new lithium-ion batteries, and refurbished for continued use. Contact 1100 Energy for details.

### Cautions

- **DO NOT open the battery pack case! Doing so may risk personal injury.**
- **DO NOT submerge battery pack in water.**
- **DO NOT use battery pack cables not specified as compatible by 1100 Energy.**
- **Charge the SBP-1100e at temperatures between 0° and 40° C. The discharge and storage temperature ranges are -20° C to 50° C and -20° C to 60° C, respectively.**
- **The SBP-1100e may present a risk of fire or chemical burn if mistreated. DO NOT short circuit, drop, crush, mutilate, nail penetrate, reverse polarity, disassemble, or expose to temperatures above 100° C.**
- **Lithium-Ion batteries are Class 9 hazardous materials subject to transportation restrictions including commercial air transportation. Caution and planning should be exercised before transporting the SBP-1100e by common carrier ground transportation.**

### Standard Accessories<sup>1</sup>

Standard accessories for use with the SBP-1100e include an AC Power Adapter for charging from utility power, solar panels and solar panel adapter cables for solar charging, and various power input and output cables for connection to charging power sources and to load equipment, and data cables for control and monitoring purposes. To see a list of accessories, please visit our website at [www.1100energy.com](http://www.1100energy.com), or contact us.

**Disposal**

At end of life, please contact 1100 Energy for advice concerning disposal or recycling, including options for returning the unit for refurbishing and renewal of the internal batteries. Keep away from children. Do not disassemble and do not dispose of in fire.

**Contact information**

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