



IPN-ProRemote

IPN™ network compatible charge controller and battery system monitor

INSTALLATION AND OPERATION MANUAL



CONFORMS TO
EN 61326-1:2006
EN 60335-1:2002 + A11:2004 + A1:2004
EN 60335-2-29:2004

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.



THIS MANUAL INCLUDES IMPORTANT SAFETY INSTRUCTIONS FOR MODELS - IPNPRO, IPNPRO-S
SAVE THESE INSTRUCTIONS

ESTE MANUAL INCLUYE INSTRUCCIONES DE SEGURIDAD IMPORTANTES PARA LOS MODELOS - IPNPRO, IPNPRO-S
CONSERVE ESTAS INSTRUCCIONES

CE MANUEL CONTIENT D'INSTRUCTIONS IMPORTANTES POUR LES MODELES - IPNPRO, IPNPRO-S
PRIERE DE SAUVEGARDER CES INSTRUCTIONS

DIESES HANDBUCH ENTHÄLT WICHTIGE HINWEISE FÜR DIE MODELLE - IPNPRO, IPNPRO-S
BITTE BEHALTEN SIE DIESE HINWEISE

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IMPORTANT SAFETY INSTRUCTIONS

This manual contains important instructions for Models IPNPRO and IPNPRO-S
SAVE THESE INSTRUCTIONS

1. Refer installation and servicing to qualified service personnel. Incorrect installation or use may result in risk of electric shock or fire. No user serviceable parts in this unit.
2. To reduce the risk of electric shock, fire or personal injury, the following symbols are placed throughout this manual to indicate dangerous conditions, or important safety or operational instructions.

WARNING	CAUTION	IMPORTANT
		
Indicates dangerous conditions or electric shock potential. Use extreme caution.	Indicates items critical to safe installation or operation of the unit.	Follow these instructions closely for proper operation of the unit

3. **PERSONAL PRECAUTIONS**
 - a) Working in the vicinity of lead-acid batteries is dangerous. Batteries produce explosive gasses during normal operation.
 - b) 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.
 - c) Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
 - d) Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.
 - e) Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
 - f) 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 10 minutes and get medical attention immediately.
 - g) NEVER SMOKE or allow a spark or flame in vicinity of battery.
 - h) 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.
 - i) 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.
 - j) Remove all sources of power, photovoltaic and battery before servicing or installing.
4. **DISPLAY LOCATION & INSTALLATION**
 - a) This unit employs components that tend to produce arcs or sparks. NEVER install in battery compartment or in the presence of explosive gases.
 - b) This unit must be installed and wired in accordance with National Electrical Code, ANSI/NFPA 70.
 - c) Unit is not water tight. Do not expose to rain, snow or excessive moisture.
 - d) Insure all terminating connections are clean and tight.
 - e) This unit is designed to be used with Integrated Power Net™ (IPN™) compatible charge controllers. Do not plug into anything other than an IPN compatible communications port.

PRODUCT DESCRIPTION

The full featured IPN-ProRemote incorporates a multi-line backlit LCD display and three function keys to provide enhanced setup and monitoring of Blue Sky Energy's Integrated Power Net™ (IPN™) compatible charge controllers. The IPN-ProRemote provides the ability to access additional charge controller setup parameters and adjust setup parameters to wider ranges than with the accompanying charge controller alone. Both the individual status and combined total of up to 8 charge controllers can be monitored. The IPN-ProRemote also provides complete battery system monitoring. It displays net battery current and battery amp-hours from full by measuring the charge and discharge current from all charging sources and loads. Some of the many displays include; battery voltage and current, PV voltage and current, PV charge amp-hours, and a highly accurate "fuel gage" type battery capacity indicator.

PART NUMBERS AND OPTIONS

- IPNPROIPN-ProRemote, full featured IPN charge control and battery system monitor w/25 foot' cable
- IPNPRO-SIPN-ProRemote with required 500A/50mV current shunt
- CS-500500V/50m millivolt current shunt

DISPLAY PANEL

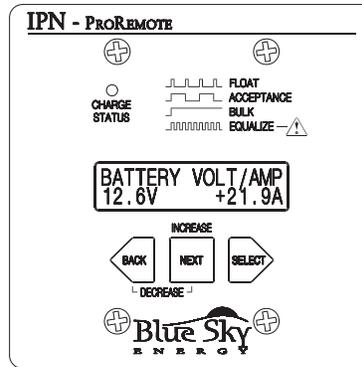


FIGURE 1

OPERATION

All IPN-ProRemote operations and displays are controlled with the three function keys, BACK, NEXT and SELECT. Information typically of interest to the casual user such as battery voltage, net battery current and remaining battery capacity are available in the Top menu. More technically inclined users may want to see additional information in the Advanced Display menu, whereas installers may need to access the Setup or Battery Charge Parameters menus. See Figures 2, 3, 4 and 5 for a complete description of each display screen.

USING THE FUNCTION KEYS

NEXT

The NEXT key is used primarily to scroll through menus. Each press of NEXT advances the display to the next screen in that menu. One more press once you reach the bottom of a menu returns you to the top of that menu.

BACK

The BACK key is used primarily to back out of functions, setting screens, or advanced menus, similar to the “escape” key on a computer. Each press of BACK backs you out of an advanced menu, function or setting screen without performing the function or changing the setting. Pressing in the BACK Top menu toggles between the two most commonly used screens, Battery Volt/Amp and Remaining Battery Capacity.

Using BACK & NEXT to Increase Or Decrease Settings

All settings are changed in a parameter setting screen where the word “SETTING” flashes in the display. Pressing NEXT while in a parameter setting screen causes the parameter to go to the next value or increases a numeric setting.

Pressing BACK while holding NEXT pressed in a parameter setting screen decreases numeric settings. If BACK is pressed without holding NEXT pressed, BACK will perform it’s normal function and exit the parameter setting screen. To decrease a setting, press and hold NEXT, then additionally press and hold BACK. The number or setting will decrease while BACK and NEXT are pressed. When the you have passed the desired setting going down, release BACK first and then release NEXT. Then use NEXT to increase the setting to the desired value.

SELECT

The SELECT key takes action based on the indicator in the lower right of the display, which may show SEL▶, SET▶, or CLR▶ (i.e., Select, Set or Clear). To minimize the possibility of taking unintended action, SELECT does not act immediately. You must press and hold the SELECT for 4 seconds before the action is taken.

- SEL▶ is used to select a next level menu, or enter a parameter setting screen.
- SET▶ is shown in parameter setting screens where the word “SETTING” flashes in the display. Once the parameter is raised or lowered to the desired value in a parameter setting screen, pressing SET▶ stores the new value into memory and returns to the previous screen. SET▶ is also shown in the Restore Default Settings and Reset Current Shunt Zero screens where SET▶ directly executes these functions following the normal 4 second delay.
- CLR▶ is used to clear values in stored data screens such as Min or Max Battery Voltage, Total Charge Amp-hours, etc. It will also appear in the Equalize Enabled screen and will manually cancel the present equalize cycle.

LCD DISPLAY AND BACKLIGHT

The Liquid Crystal Display (LCD) may be backlit for improved readability. Switching backlight ON increases IPN-ProRemote power consumption from roughly 0.25W to 1.0W. Backlight can be set for ON, OFF or AUTO from the Advanced Setup menu. The default setting of AUTO will cause backlight to remain ON for one minute following the last key press. When backlight has turned OFF in AUTO, the first press of any key turns backlight ON only without performing that key's normal function. The keys perform their normal function once backlight is ON.

CHARGE STATUS INDICATOR

An LED charge status indicator is provided on the face of the unit. The charge status indicator will be OFF when the charge controller is not charging, and will be ON solid or blinking when the battery is being charged.

CHARGE STATUS INDICATOR

CHARGE STATUS INDICATOR	CHARGE MODE
OFF	CHARGE OFF
CONTINUOUSLY ON	BULK
BLINKING • 1 SEC ON / 1 SEC OFF	ACCEPTANCE
BLINKING • 0.2 SEC ON / 1 SEC OFF	FLOAT
RAPID BLINKING • 0.2 SEC ON / 0.2 SEC OFF	EQUALIZE

TABLE 1

REMAINING BATTERY CAPACITY

The IPN-ProRemote provides a high accuracy indication of remaining battery capacity based on amp-hour counting. The resulting remaining battery capacity computation is displayed as both Percent Remaining and as a Bar Graph. Note that the amp-hours from full counter and the associated remaining battery capacity indication will show dashes (---) until the accompanying charge controller fully charges the battery which is required to initialize amp-hour counting.

How Remaining Battery Capacity Works

A battery stores electrical charge in units referred to as "amp-hours" (AH). An amp-hour is the product of current (in amps) times time (in hours). 10 amp-hours could be consumed by a 10 amp load operating for 1 hour, a 0.2 amp load for 50 hours, or 100A load for $\frac{1}{10}$ hour. The IPN-ProRemote uses net battery current as displayed in the Top Menu Battery Volt/Amp screen to compute amp-hours which is displayed in the Top Menu Battery Amp-Hrs From Full screen. As the battery is charged (positive current) or discharged (negative current) the IPN-ProRemote keeps a running total of how many battery amp-hours have been removed or restored. Discharge amp-hours are applied directly to the amp-hours from full counter causing amp-hours from full to increase. Charge amp-hours cause the amp-hours from full counter to decrease, but are reduced by the Charge Efficiency Factor to account for the fact that batteries are not 100% efficient at receiving charge. Additionally, batteries loose charge on their own due to self discharge which is periodically computed and added to the amp-hours from full counter. Self discharge changes with battery temperature and will be corrected for temperature if the accompanying charge controller includes a battery temperature sensor.

Counting amp-hours into and out of the battery and using charge efficiency and self discharge rate arrives at the amp-hours from full value displayed in the Top Menu Battery Amp-Hrs From Full screen. This value is used with the battery's published "20hr rate" amp-hour rating to compute remaining battery capacity. If the battery was 220 amp-hours and the amp-hours from full counter value was at -110 amp-hours, remaining battery capacity would show 50%. The battery amp-hour rating is specified at 25°C, but actual battery capacity changes with temperature. If the accompanying charge controller includes a battery temperature sensor, the IPN-ProRemote will correct available battery amp-hours based on battery temperature. Cooler batteries have reduced capacity, and if the battery was at 0°C, then actual battery capacity is reduced to 79% of 220 amp-hours and remaining capacity would show 37%.

Charge Efficiency

Charge efficiency refers to how many amp-hours are absorbed by the battery compared to how many charge amp-hours are delivered. A charge efficiency factor of 94% means that for each 100 amp-hours of charge delivered, the battery increases charge by 94 amp-hours. Charge efficiency is typically very high when the battery is highly discharged, and becomes lower when the battery is near full charge.

The Charge Efficiency factor can be set to a Fixed number or can be set to automatically update based on past battery behavior. Most systems will benefit from the Auto Adjust setting which is the factory default. In Auto Adjust, the IPN-ProRemote will compute actual charge efficiency if the battery was discharged at least 10%, and the accompanying charge controller is what brought the battery back to full charge. The Charge Efficiency factor update rate is filtered so that it takes approximately 5 charge/discharge cycles to completely update the Charge Efficiency factor.

Accuracy

Remaining Battery Capacity will tend to be better if;

- The charge controller delivers at least 3 amps per 100 amp-hours of battery capacity.
- The charge controller is what normally brings the battery back to full charge.
- The battery is fully charged by the charge controller often to minimize error build up resulting from the non-ideal characteristics of batteries. The more the battery is cycled without becoming fully charged, the greater the error buildup.
- Charge Efficiency Mode is set to AUTO ADJUST.

MENUS

There are four menus; Top, Advanced Display, Setup, and Battery Charge Parameters. Displays typically accessed by most users such as battery voltage, net battery current and remaining battery capacity are present in the Top menu. More technical users may access additional menus where advanced displays and setup capability reside. Refer to menu Figures 2, 3, 4 and 5.

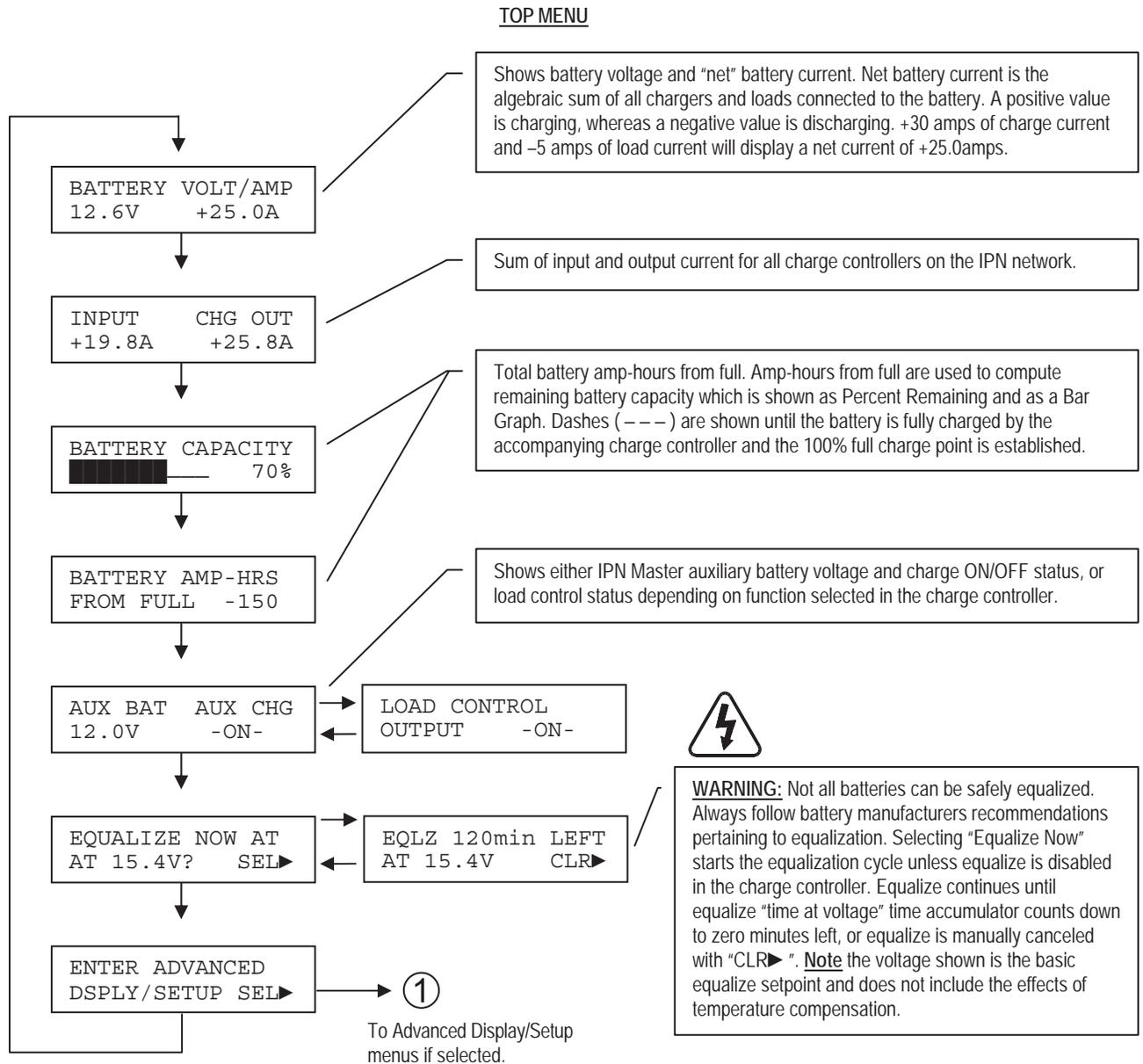


FIGURE 2

ADVANCED DISPLAY Menu

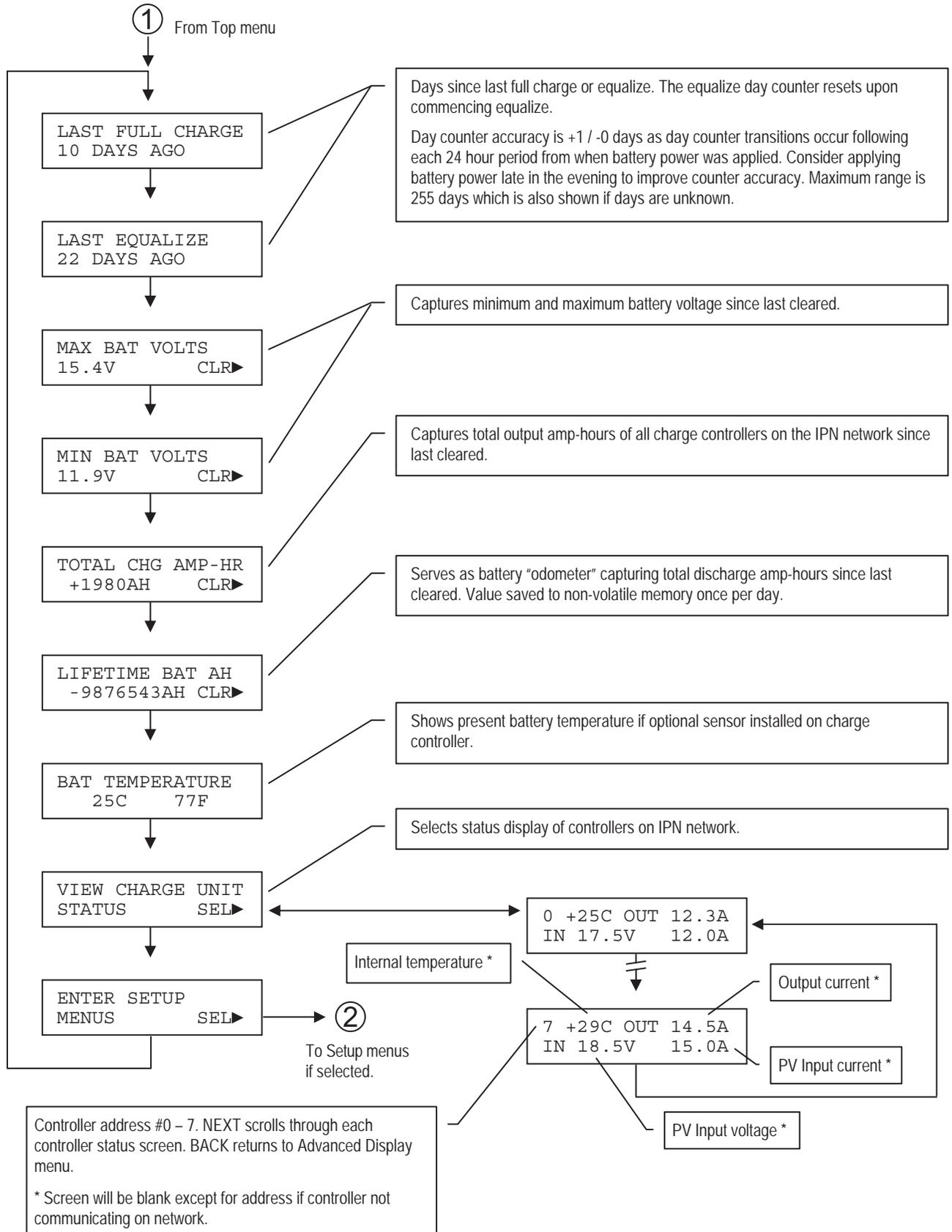


FIGURE 3

SETUP Menu

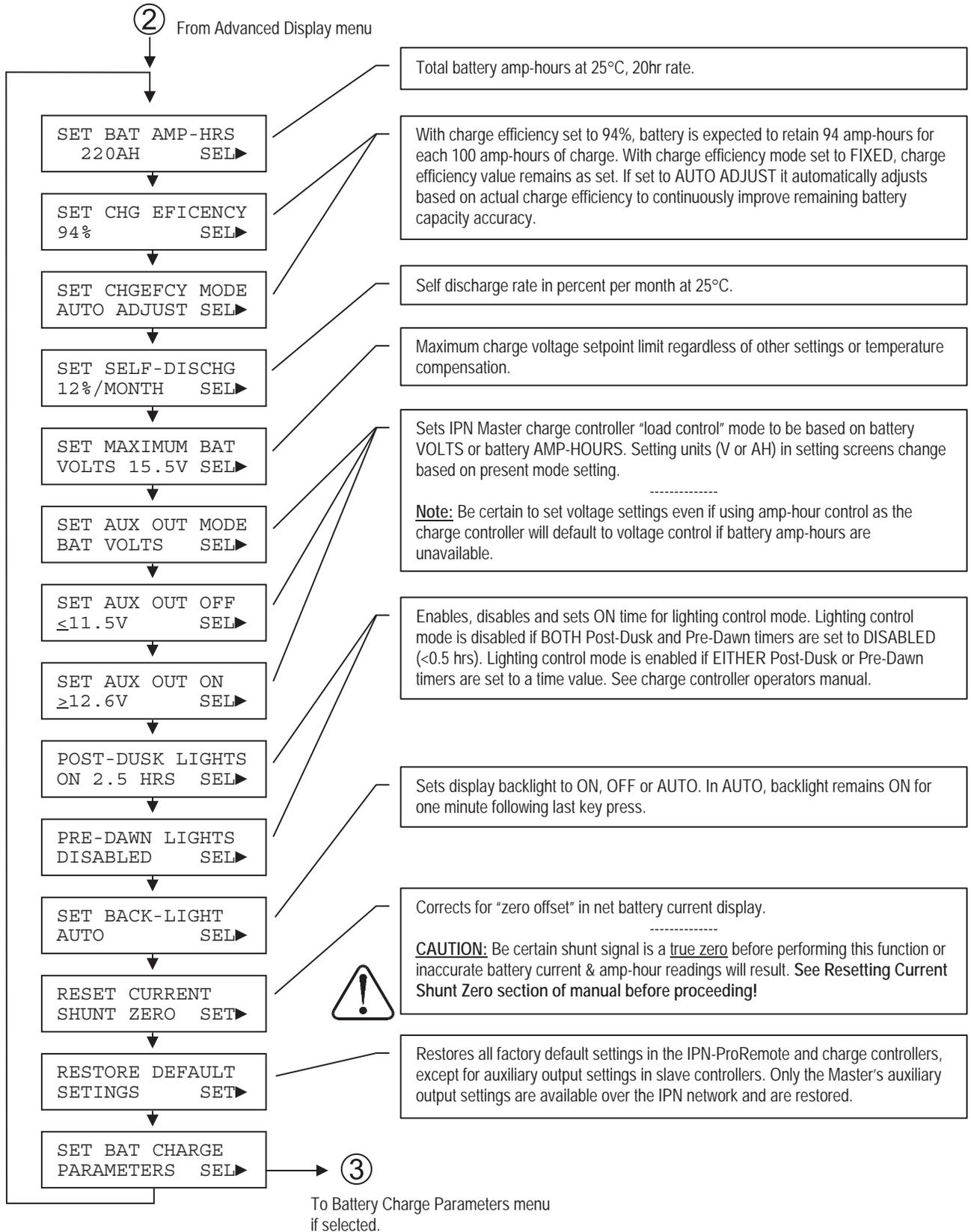


FIGURE 4

BATTERY CHARGE PARAMETERS Menu

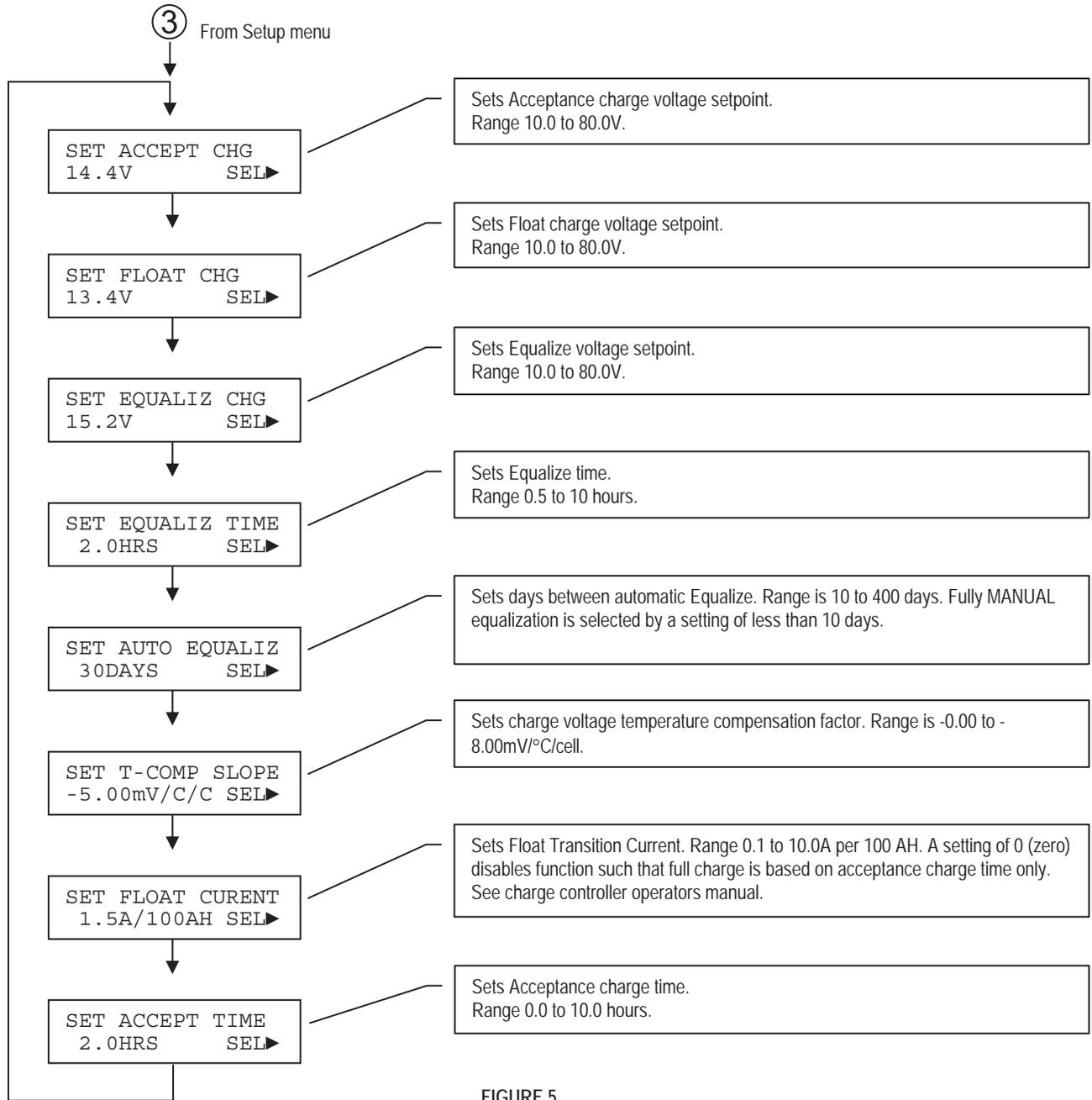
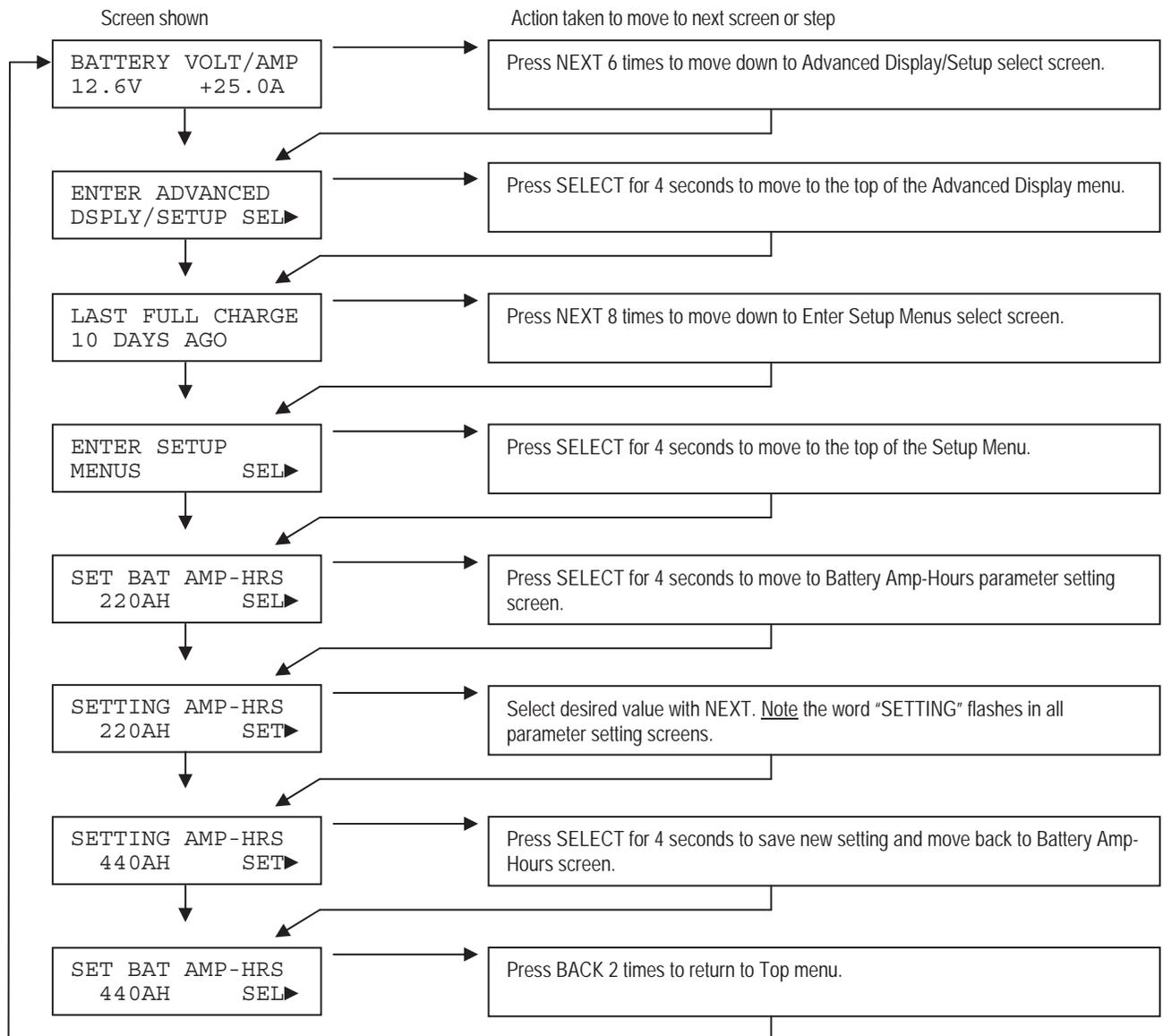


FIGURE 5

USING THE MENUS AND KEYS

Moving through the menus, functions and changing settings is consistent throughout all functions and screens. The following example illustrates typical operation.

Example – Setting Battery Amp-Hours (to 440 amp-hours in this example)



INSTALLATION



➤ **WARNING:** Read, understand and follow the Important Safety Instructions. Install in accordance with National Electrical Code, ANSI/NFPA 70. To reduce risk of electric shock, remove all sources of power before installing. Connections other than those shown in Figures 6 & 7 void the limited warranty. Note that Figures 6 & 7 are not meant to show all wiring, circuit protection and safety requirements for a photovoltaic electrical system.

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 unit and avoid touching components on the circuit boards. The risk of electrostatic damage is highest when relative humidity is below 40%.

IPN-ProRemote SETUP



➤ The IPN-ProRemote has various setup parameters all of which are preconfigured at the factory. Most installations require no setup changes other than increasing Acceptance Charge Time to 4 hours, and entering actual battery Amp-Hours and Self Discharge Rate. Factory default settings shown below reside in the IPN-ProRemote. All other settings shown in the Setup and Battery Charge Parameters menus reside in the charge controller.

As Shipped Factory Default Settings

Factory defaults are configured for two or four (12V or 24V respectively) deep cycle lead-antimony 6V GC2 golf cart batteries in series.

- Amp-hours 220 amp-hours
- Charge Efficiency 94%
- Charge Efficiency Mode Auto Adjust
- Self Discharge Rate 12%/month
- LCD Backlight Auto

Restoring Factory Default Settings



➤ Factory defaults can be easily restored into the IPN-ProRemote and accompanying charge controllers using the Restore Default Settings function in the Setup menu. All defaults are restored except for auxiliary output settings in slave charge controllers.

Battery Amp-Hour Rating

The amp-hour setting is used by both the Remaining Battery Capacity function and Advanced Charge Control. The setting should be the total published 25°C 20hr rate amp-hour rating of the total battery bank. For systems with more than one battery, battery amp-hours add when batteries are placed in parallel. When batteries are placed in series battery voltage adds and amp-hours do not.

Charge Efficiency & Charge Efficiency Mode

Charge Efficiency relates to how much charge is absorbed by the battery compared to charge delivered. With charge efficiency set to 94%, the battery is expected to retain 94 amp-hours for each 100 amp-hours of charge delivered. Charge Efficiency Mode determines whether Charge Efficiency remains at a fixed number or automatically updates based on actual battery behavior. The factory settings of 94% (Charge Efficiency) and AUTO ADJUST (Charge Efficiency Mode) are typically suitable for most systems and do not require adjustment.

Systems which may benefit from a FIXED Charge Efficiency Mode are those with less than 2 amps of charge current per 100 amp-hours of battery capacity, or where another charging source is what typically brings the battery back to full charge. For these systems a suitable Charge Efficiency value needs to be determined experimentally. Try AUTO ADJUST first and see what charge efficiency the IPN-ProRemote computes over 5 -10 "normal" charge/discharge cycles. You may then want to lock this value in place by setting Charge Efficiency Mode to FIXED. A perfect Charge Efficiency setting will cause the Amp-hours From Full counter to just reach 0 (zero) when the charge controller switches to Float indicating full charge.

Self Discharge Rate

All batteries self discharge at some rate which varies greatly based on battery type and temperature. The Self Discharge Rate entered should be the battery manufacturers 25°C value. In systems that cycle regularly, self discharge is typically a small contributor to total discharge compared to load current and an accurate Self Discharge Rate value is not as important. In systems where load current is low, self discharge may be a large contributor to total discharge and an accurate Self Discharge Rate is much more important. The Self Discharge Rate will be automatically corrected for temperature if the accompanying charge controller includes a battery temperature sensor.

TYPICAL SELF DISCHARGE RATE

BATTERY CONSTRUCTION	SELF DISCHARGE RATE
Vented Liquid Electrolyte • Lead-Antimony	12%/Month
Vented Liquid Electrolyte • Lead-Calcium	5%/Month
Gel • Lead-Calcium	3%/month
AGM • Lead-Calcium	2%/month

TABLE 2

Float Transition Current

“Time in Acceptance” is an accepted method to determine when the battery is fully charged if net charge current is unknown. A preferred method provided by the IPN-ProRemote is to use net battery charge current matched to battery size in amp-hours. With the IPN-ProRemote the charge controller will consider the battery fully charged and to switch to Float if net battery current drops below the Float Transition Current setting while the battery is at the Acceptance voltage setpoint. The factory default Float Transition Current setting (Float Current in the Battery Charge Parameters menu) of 1.5 amps per 100 amp-hours of battery capacity is suitable for most batteries. With the factory default Battery Amp-Hour setting of 220 amp-hours, the battery would be considered fully charged when net battery charge current decreases to less than 3.3 amps while at the Acceptance voltage setpoint.

To assure that net charge current is what determines when the battery is full, Charge Time should be increased to approximately 4 hours. This is so that if battery current is unable to decrease to the Float Transition Current due to battery age or damage, charge will terminate after a reasonable time period.

WIRING DIAGRAM

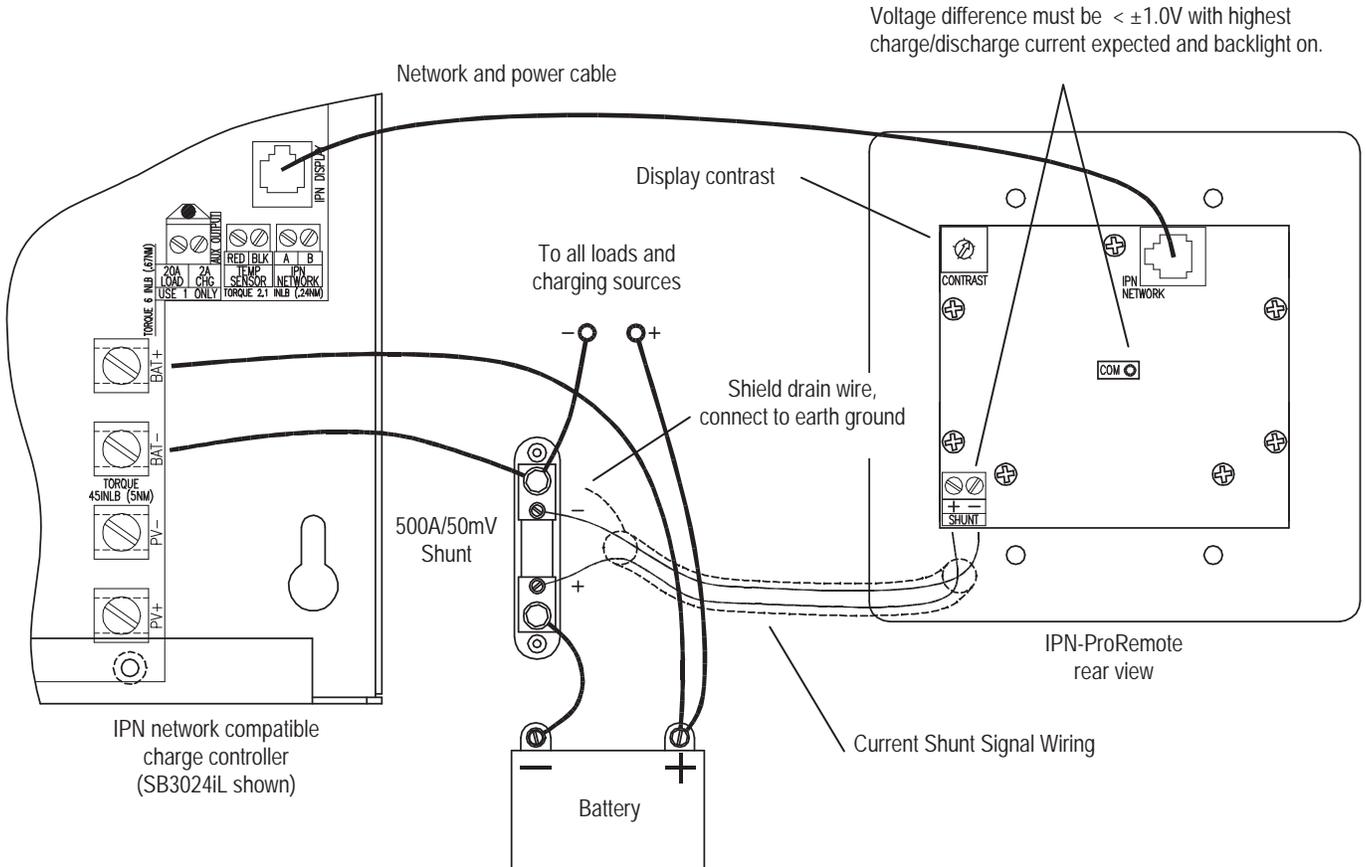


FIGURE 6

CURRENT SHUNT



➤ **CAUTION:** A 500A/50mV current shunt must be used with the IPN-ProRemote. The shunt is used to measure net battery current and must be installed in series with battery negative. Damage caused by installation in series with battery positive will void the limited warranty. All negative current carrying conductors from all charging sources and loads must connect to the charge controller side of the shunt as shown in Figure 6 such that all current flowing to or from battery negative flows through the shunt. Current carrying conductors (other than the shunt) attached to battery negative will produce inaccurate battery current readings and amp-hour counting. Shunt signal cable length should be limited to roughly 300 feet (91.5m) maximum. Tighten shunt power connection bolts to 11 ft-lb (14.9 nm) and #10 sensing screws to 20 in-lb (2.3 nm). IPN-ProRemote shunt signal wire compression terminals are to be tightened to 2.1 in-lb (0.24 nm). Note that the battery temperature sensor lug is not a current carrying conductor and must remain on battery negative.

Current Shunt Signal Wiring

The shunt itself is not a polarized device. Once installed in series with battery negative it produces the +/- signal polarity shown in Figure 6 when the battery is being charged. The +/- shunt signal connections must connect to the corresponding +/- IPN-ProRemote shunt terminal block locations for proper current polarity reading on the Battery Volt/Amp screen. The shunt produces very sensitive microvolt level signals and signal wires must be twisted pairs. Lengths less than 35 feet (10.7m) can be unshielded twisted pairs if routed away from power or noise generating conductors. Shielded twisted pair cable is preferred for lengths greater than 35 feet (10.7m) or where electrical noise is expected. Terminate shield drain wire to earth ground at one end only.

Resetting Current Shunt Zero

The sensitive nature of the shunt signal measurement circuits can produce a slight drift or offset in the zero reading (0.0A) due to several factors including normal electronic component aging. A Reset Current Shunt Zero function is provided to compensate for zero offset and provide an accurate zero reading.



➤ **CAUTION:** It is critically important that a Reset Current Shunt Zero function not be performed without first providing a true zero current signal to the IPN-ProRemote. This is accomplished by temporarily placing both shunt sensing wires at the current shunt under the same #10-32 signal screw. Failure to provide a true zero signal in this manner before executing the Reset Current Shunt Zero function will result in inaccurate battery current readings and amp-hour counting.

Do not confuse small charge or discharge currents flowing in the shunt due to normal system operation as zero offset error. For the purpose of testing the accuracy of the current shunt measurement system zero, a true zero must be applied as described above. Failure to provide a true zero signal in this manner will not reflect the true accuracy of the current shunt measurement system zero.

To reset current shunt zero and remove zero offset error:

1. Place both shunt signal wires under the same #10 shunt sense signal screw on the current shunt to provide a true zero signal.
2. Perform the Reset Current Shunt Zero function from the Setup Menu.
3. Press BACK twice to return to the Battery Volt/Amp screen to examine the new zero reading. If zero is not within $\pm 0.1A$ or better repeat the Reset Current Shunt Zero function and check again.
4. Zero offset correction data is now stored in memory and retained if power is lost.
5. Return current shunt signal wires to their normal shunt sense screw positions.

CHARGE CONTROLLER CONNECTION

Each charge controller includes an IPN DISPLAY connector which provides power and IPN network connection. The IPN-ProRemote can plug into any charge controller on the network using the standard 4 conductor RJ-11 voice telephone cable supplied.



➤ Standard 4-pin telephone cables swap pin numbers end-to-end. If cables are custom terminated or cable couplers are used, be certain pin swap is maintained. Do not plug into anything other than a IPN-compatible communications port. Total maximum cable length should be limited to approximately 500 feet (152.4m).

NETWORK / POWER CABLE SCHEMATIC

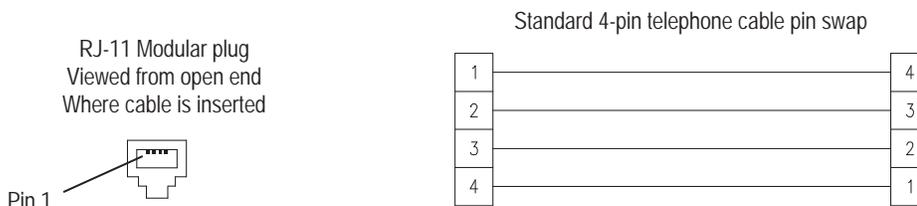


FIGURE 7



➤ When Backlight is on, the IPN-ProRemote can draw up to 100mA from the charge controller. For proper operation of the shunt current measurement circuits, total voltage difference between the IPN-ProRemote circuit common and the shunt must be kept to less than ±1.0V when Backlight is on and maximum charge or discharge current is flowing in the system. If long network/power cables are used, wire size may need to be increased to keep voltage difference between the “COM test point” and “SHUNT –” on the back of the IPN-ProRemote to within ±1.0V or less at all times. Table 3 below shows wire size for a more conservative recommended voltage drop limit of 0.50V maximum.

MAXIMUM NETWORK/POWER CABLE LENGTH FOR 0.50V DROP

WIRE GAUGE AWG	MAXIMUM RECOMMENDED CABLE LENGTH FEET / METERS
30 AWG	45 / 13.7
28 AWG	73 / 22.2
26 AWG	117 / 35.7
24 AWG	187 / 57.0
22 AWG	295 / 89.9
20 AWG	475 / 144.8

TABLE 3

MOUNTING



➤ **CAUTION:** The unit is designed to mount into a standard US duplex wall mount box. It is not watertight and must be protected from rain, snow and excessive moisture.

DETAILED DIMENSIONAL DRAWING

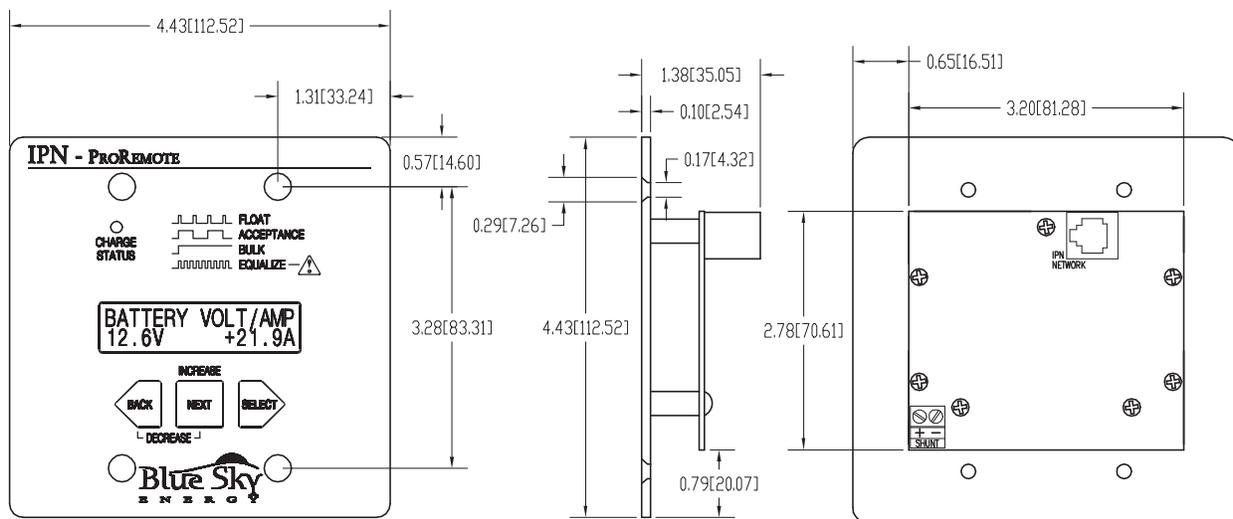


FIGURE 8

TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	ITEMS TO EXAMINE OR CORRECT
Display blank	No power	Charge controller not properly powered. Network cable faulty, not plugged in or cable pins do not swap per Figure 7.
Display turns on, but battery voltage shows --.-V rather than a number	IPN-ProRemote not communicating with charge controller	Network cable faulty. Charge controller or IPN-ProRemote may have locked up, re-boot by momentarily removing battery and PV power from charge controller. One charge controller is not set to Master, or more than one charge controller is set to Master. Controller-to-controller network cable not wired A-to-A, B-to-B, or wires are open or short.

SYMPTOM	PROBABLE CAUSE	ITEMS TO EXAMINE OR CORRECT
No data shows in the View Charge Unit Status screen	Charge controller not communicating with IPN-ProRemote	Controller-to-controller network cable not wired A-to-A, B-to-B, or wires are open or short. More than one charge controller is set to be Master or more one charge controller set to same slave address.
Days since last equalize or full charge shows 1 day too many	The day counter increments once each 24 hours since battery power was applied.	Normal operation. This potential 1 day error may be eliminated by rebooting the charge controller in the middle of the night so that the counter increments at this time rather than during the day.
Days since last equalize reset without equalize completing	Day counter updates when equalize starts	Normal operation. The equalize day counter is reset when equalize starts rather than when it ends.
Net battery current polarity reversed	Signal wires on shunt reversed	Swap signal wire positions on shunt.
Battery current seems inaccurate	Some charging sources or loads do not go through shunt Shunt wiring incorrect or faulty. Shunt signal wires picking up electrical noise Excessive voltage drop in network cable to IPN-ProRemote or in system power wiring Net battery current not reading 0.0A with zero amps flowing	Confirm that no other current carrying conductors other than the shunt cable is connected to battery negative. Shunt wired in series with battery positive, should be negative. One or both shunt signal wires open or short. Confirm signal wires are twisted pairs. Consider using shielded twisted pair cable for signal wires. Relocate signal wires away from power or noise generating wiring. Confirm that with backlight ON and with highest possible charge or discharge current flowing in system, voltage difference between "COM test point" and "SHUNT -" on the back of the IPN-ProRemote is less than $\pm 1.0V$ at all times, with less voltage drop being better. Correct wiring as necessary. Consider not using backlight. Perform Reset Current Shunt Zero function <u>exactly as described in this manual</u> to remove zero offset.
Remaining Battery Capacity & Amp-Hours From Full show dashes (---)	Charge controller has not finished charging battery	Normal operation. Remaining Battery Capacity & Amp-Hours From Full displays show dashes until the battery is fully charged which initializes amp-hour counting.
Remaining Battery Capacity or Amp-Hours From Full seem inaccurate	Shunt not properly reading net battery current Incorrect battery amp-hours entered Incorrect Charge Efficiency factor Battery not fully charged for an extended period Charge controller is not what normally fully charges the battery Self Discharge Rate set incorrectly Temperature sensor faulty	Net battery current must read correctly to properly count Amp-Hours From Full, which is used to compute Remaining Battery Capacity. See Battery Current Seems Inaccurate. Confirm correct 25°C 20Hr rate battery amp-hour value. Confirm Charge Efficiency factor and Charge Efficiency Mode are set correctly. Incorrect net battery current readings can cause Charge Efficiency to become very inaccurate. Reset to 94%. Since battery charge / discharge behavior is not ideal, error in the Amp-Hours From Full counter builds as the battery cycles without becoming full. Try to fully charge the battery often. To get the best accuracy, the charge controller should be what normally or at least regularly brings the battery back to full charge. Confirm proper 25°C value is entered. Many factors are temperature compensated. Confirm proper temperature sensor operation as described in the charge controller manual.

SPECIFICATIONS

SPECIFICATIONS	IPN-ProRemote
Current Shunt	50 mV / 500 amp
Battery Ammeter	Range ±773.3A FS • Accuracy ±0.5% FS
Battery Size	20 – 10,000 Amp-hours
Power Consumption	0.25W Typical • 1.0W Typical with backlight on
Remaining Battery Capacity	Based on amp-hour counting • Appropriate factors temperature compensated [ⓐ]
Amp-hours From Full	0 – 16,383 Amp-hours
Total Charge Amp-hours	0 – 16,383 Amp-hours, user resettable
Lifetime Battery Amp-hours	0 – 9,999,999 Amp-hours
Days Since Full Charge	0 – 255 Days
Days Since Equalize	0 – 255 Days
Backlight Mode	ON, OFF or AUTO
Panel Dimensions	4½"H x 4½"W x 1½"D (11.4cm x 11.4cm x 3.8cm) • Fits standard duplex wall mount box
Communication, Power & Cabling	Powered by IPN compatible charge controller via 4-pin telephone cable. Charge controller cable length to 500' (152.5m). Current shunt connection via twisted pair cable, Length to 300' (91.5m)
Environmental	-40 – +40°C, 10 – 90% RH non-condensing

As a part of our continuous improvement process specifications are subject to change without prior notice

[ⓐ] With optional battery temperature sensor

TWO YEAR LIMITED WARRANTY

Blue Sky Energy, Inc. (hereinafter BSE), hereby warrants to the original consumer purchaser, that the product or any part thereof will be free from defects due to defective workmanship or materials for a period of two (2) years subject to the conditions set fourth below. If within the coverage of this limited warranty, BSE will repair or replace the product at BSE's discretion. The original consumer purchaser is responsible for all transportation costs and insurance related to returning the product to BSE. BSE will cover standard ground transportation costs and insurance to return the product to the original consumer within the continental US.

1. This limited warranty is extended to the original consumer purchaser of the product, and is not extended to any other party.
2. The limited warranty period commences on the date the product is sold to original consumer purchaser.
3. This limited warranty does not apply to any product or part thereof damaged by: a) alteration or disassembly, b) repair or service not rendered by a BSE authorized repair facility, c) accident or abuse, d) corrosion, e) lightning or other act of God, or f) operation or installation contrary to instructions pertaining to the product.
4. BSE's liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at BSE's discretion. BSE will not be liable for any loss or damage to person or property, or any other damages, whether incidental, consequential or otherwise, caused by any defect in the product or any part thereof. Some states do not allow exclusions or limitations of incidental or consequential damages, so the above limitation may not apply to you.
5. Any implied warranty for merchantability or fitness for a particular purpose is limited in duration to the length of this warranty. Some states do not allow exclusions or limitations on how long an implied warranty lasts, so the above limitation may not apply to you.
6. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
7. To obtain warranty repairs, contact BSE at 800-493-7877 or 760-597-1642 to obtain a Returned Goods Authorization (RGA) number. Mark the outside of the package with the RGA number and return the product, postage prepaid and insured to the address below. A copy of the purchase receipt identifying original consumer purchaser and date purchased must accompany the product to obtain warranty repairs.

Blue Sky Energy, Inc.
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