

# IPN ProRemote IPN ProRemote-S

## Installation and Operation Manual

IPN™ NETWORK COMPATIBLE CHARGE CONTROLLER  
AND BATTERY SYSTEM MONITOR/SETUP



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This manual includes important safety instructions for the IPN ProRemote (IPNPRO) and the IPN ProRemote-S (IPNPRO-S). Save these instructions.

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# Safety Instructions

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.

## 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 10 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 tools onto the 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.

## DISPLAY LOCATION & INSTALLATION

- 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.
- Unit is not water tight. Do not expose to rain, snow or excessive moisture.
- Ensure all terminating connections are clean and tight.
- 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(-S) 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(-S) provides the ability to access additional charge controller setup parameters and adjust setup parameters to wider ranges than with the accompanying charge controller alone, including those utilized with lithium batteries. Both the individual status and combined total of up to 8 charge controllers can be monitored. The IPN ProRemote-S 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 (SOC State-of-Charge).

## Part Numbers and Options

<b>IPN ProRemote</b>	IPN ProRemote, full featured IPN charge control and battery system monitor w/25 foot' cable
<b>IPN ProRemote-S</b>	IPN ProRemote with required 500 A / 50 mV current shunt
<b>506-0003-01</b>	500 V / 50 mV current shunt

## Product Certifications



### 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:

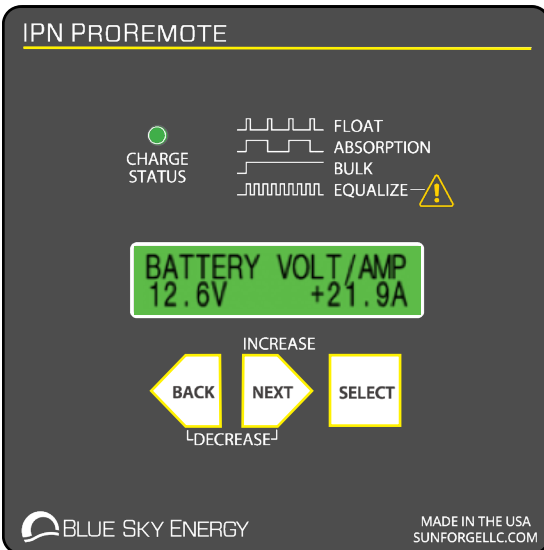
1) This device may not cause harmful interference, and 2) This device must accept any interference received, including interference that may cause undesired operations.

(\*) See Electromagnetic Compatibility at page 12.

## Operation

All IPN ProRemote(-S) 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 the *Menus* section 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.

## 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 (only for lead-acid battery) screen and will manually cancel the present equalize cycle.

## 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 its 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.

## LCD Display and Backlight

The Liquid Crystal Display (LCD) may be backlit for improved readability. Switching backlight ON increases IPN ProRemote(-S) power consumption from roughly 0.25 W to 1.0 W. 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.

	<b>Charge Off:</b> Off
	<b>Bulk (&lt;70 % Full):</b> Continuously On
	<b>Absorption (70 % - 95 % Full):</b> Blinking - 1 SEC ON / 1 SEC OFF
	<b>Float (Fully Charged):</b> Blinking - 0.2 SEC ON / 1 SEC OFF
	<b>Equalize:</b> Rapid Blinking - 0.2 SEC ON / 0.2 SEC OFF

## Remaining Battery Capacity

The IPN ProRemote-S 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 (SOC State-of-Charge) 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 A load operating for 1 hour, a 0.2 A load for 50 hours, or 100 A load for 1/10 hour. The IPN ProRemote(-S) 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(-S) 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 lose 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 “20 hr 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(-S) 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(-S) 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

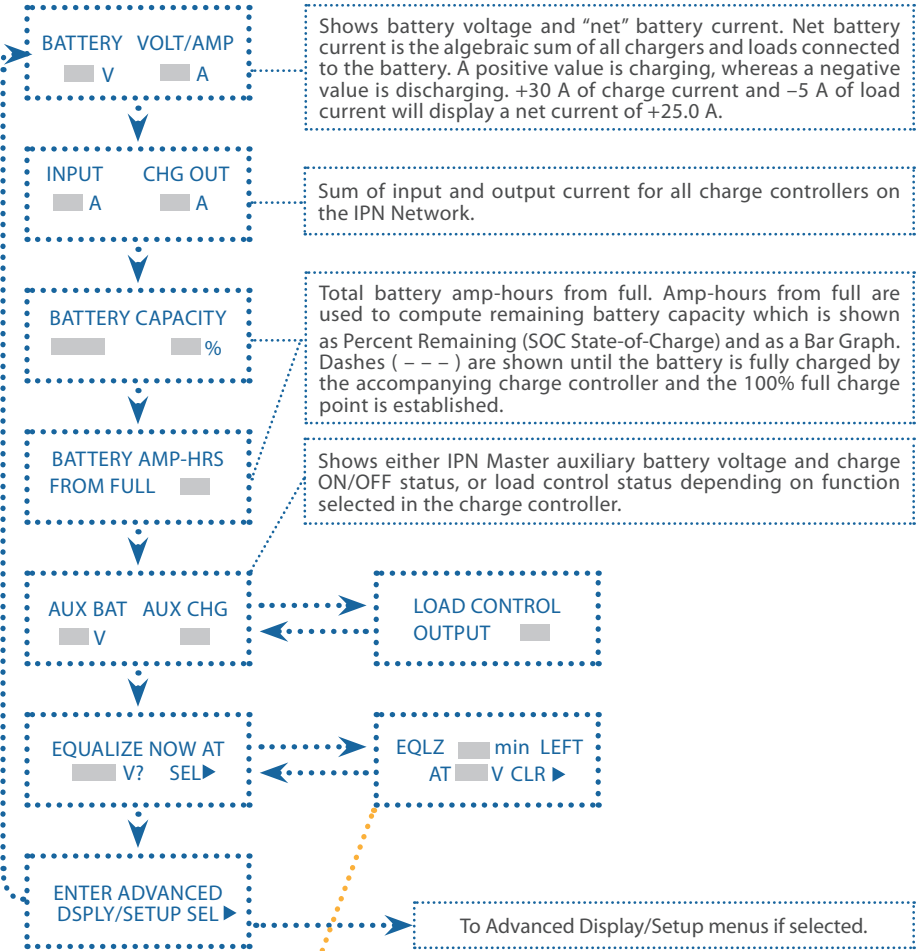
Remaining Battery Capacity will tend to be better if:

- The charge controller is capable of delivering at least 3 A 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.

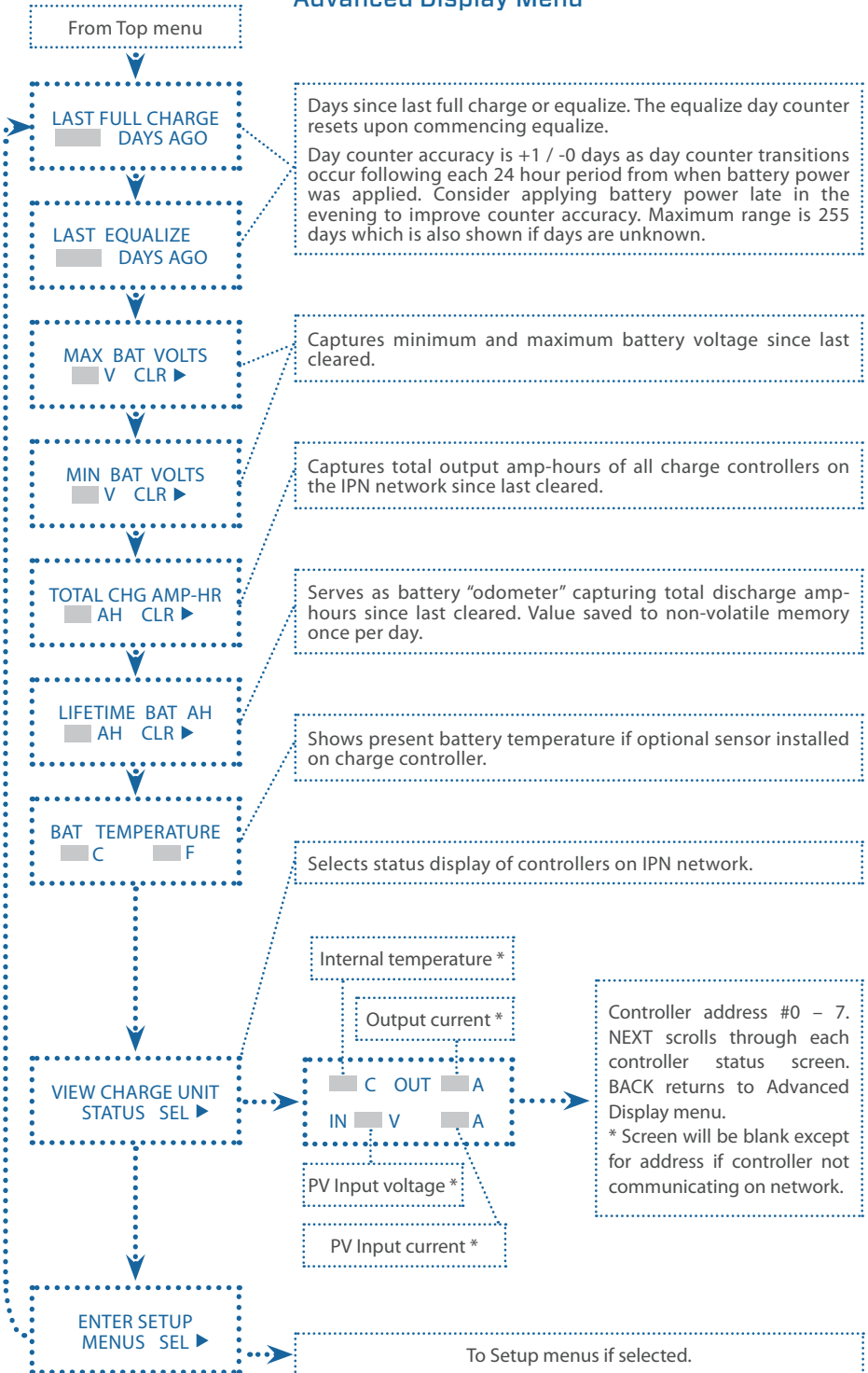
### Top Menu



**WARNING:** Not all batteries can be safely equalized. Always follow battery manufacturers recommendations pertaining to equalization. Selecting “Equalize Now” starts the equalization cycle unless equalize is disabled in the charge controller. Equalize continues until equalize “time at voltage” time accumulator counts down to zero minutes left, or equalize is manually canceled with “CLR ▶”, or the equalization cycle is not able to complete within 24 hours (newer firmwares).

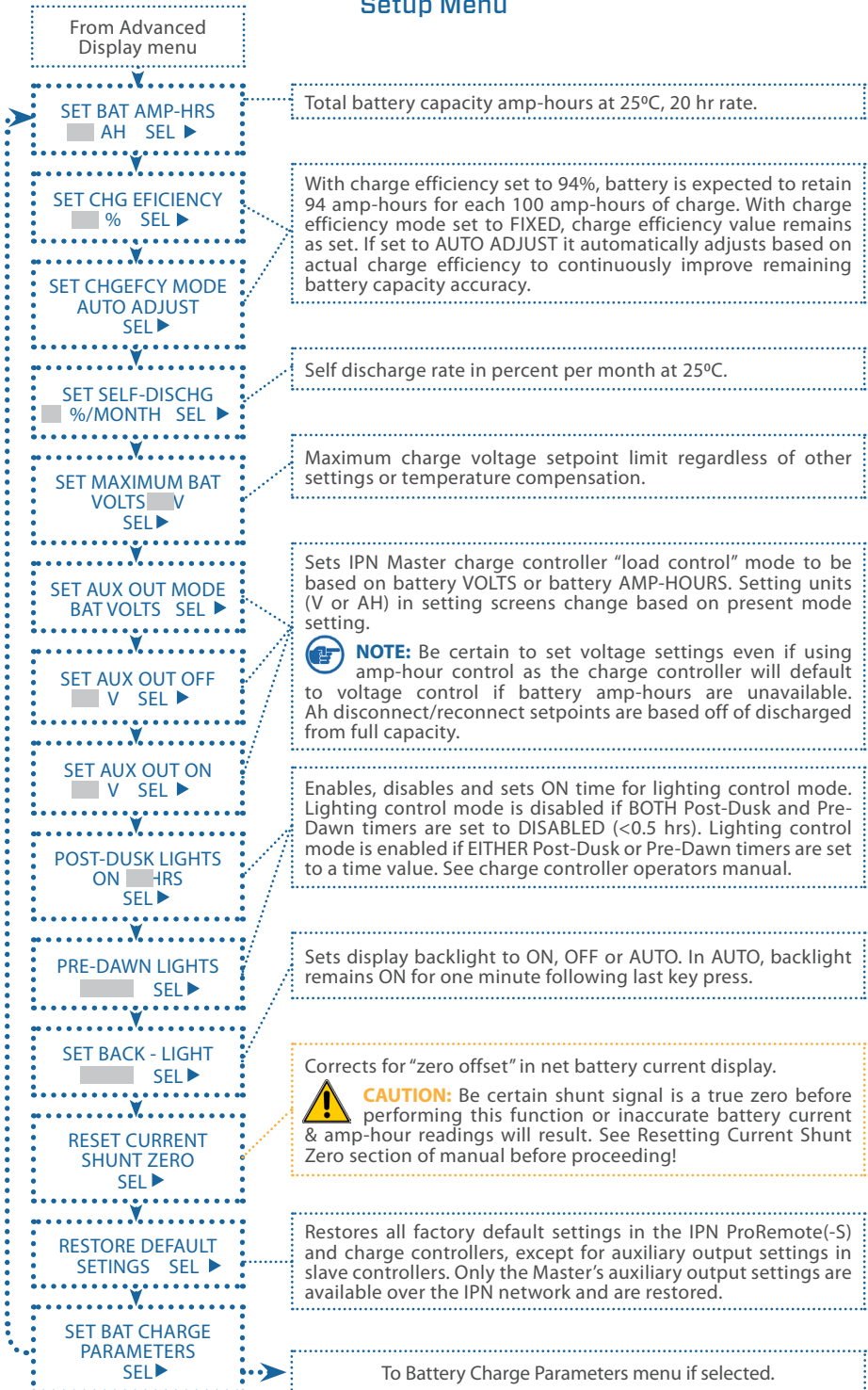
**Note:** the voltage shown is the basic equalize setpoint and does not include the effects of temperature compensation.

## Advanced Display Menu

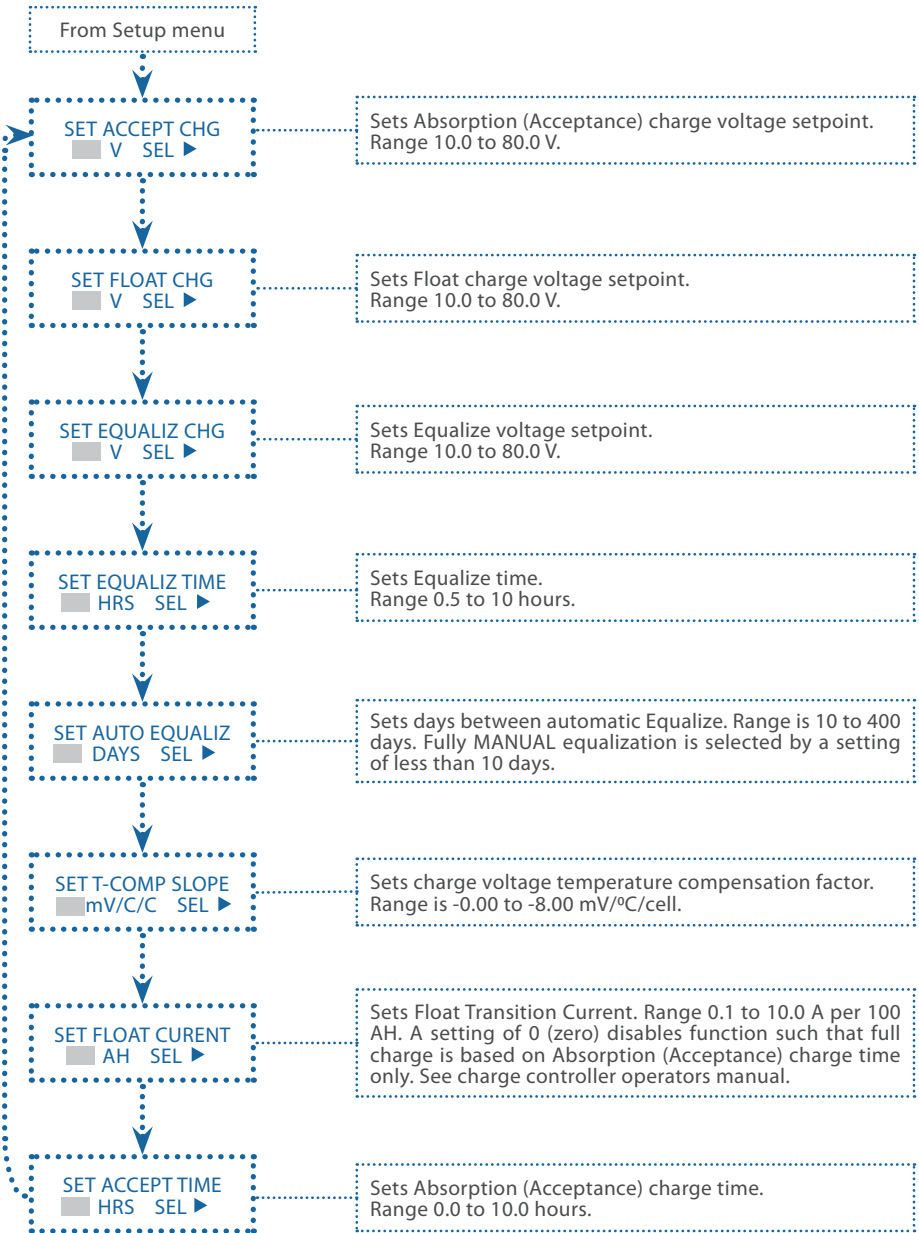




## Setup Menu



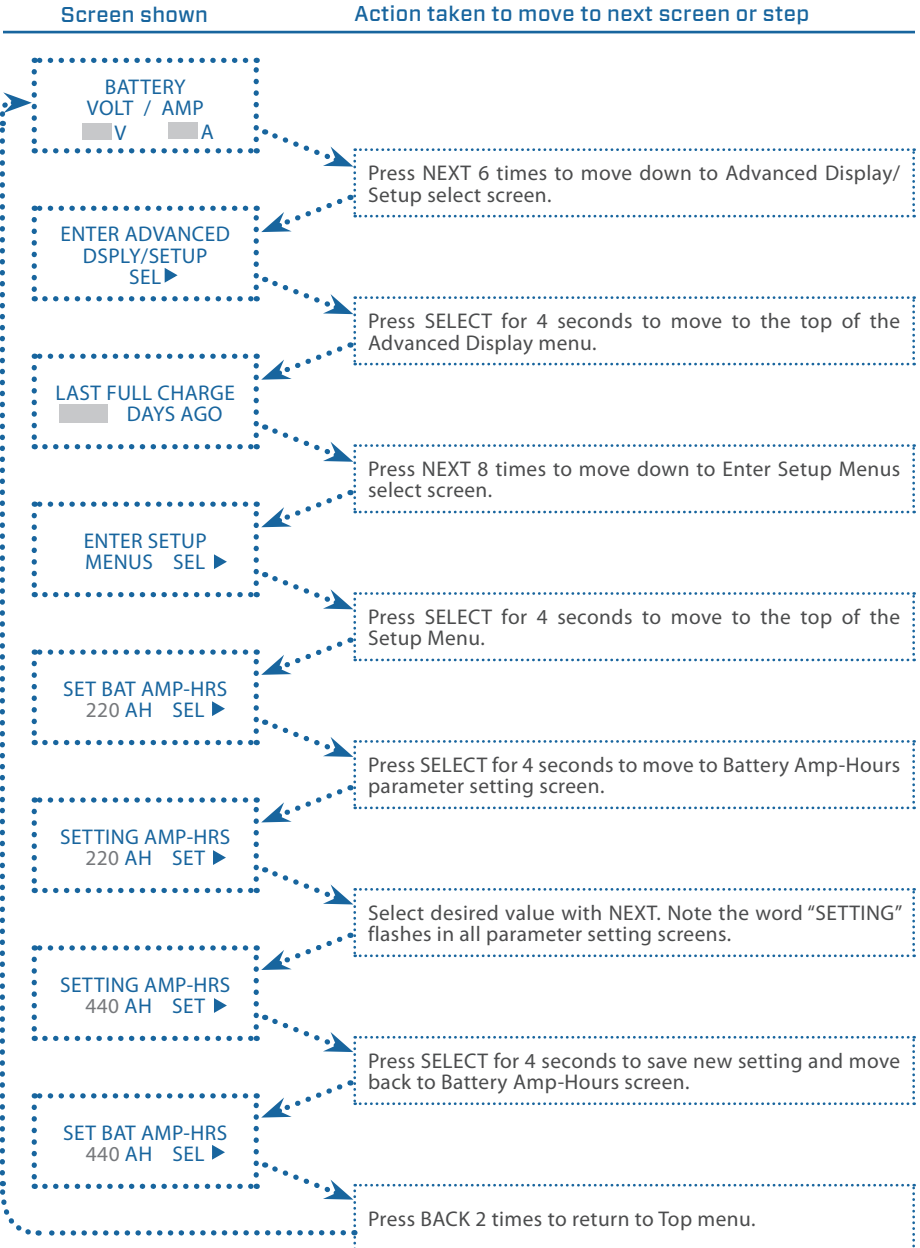
## Battery Charge Parameters Menu



# 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 the Wiring Diagram and the Network / Power Cable Schematic void the limited warranty. Note that the diagrams 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%.

## Electromagnetic Compatibility (CE and FCC Marks)

To comply with electromagnetic compatibility requirements the IPN ProRemote(-S) must be installed with a clamp on type ferrite suppressor (included with the products). The clamp suppressor must be installed around the remote display cable with the cables looped to pass through the core 2 times. Additional suppressors can be ordered as BSE p/n 523-0005-01.

## IPN ProRemote(-S) Setup



**NOTE:** The IPN ProRemote(-S) has various setup parameters all of which are preconfigured at the factory for lead-acid battery. Most installations require no setup changes other than increasing **Absorption (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(-S). All other settings shown in the Setup and Battery Charge Parameters menus reside in the charge controller.

### As-Shipped Factory Default Settings (for lead-acid battery)

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

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

## PROGRAMMING FOR LITHIUM BATTERY

As default, the Blue Sky Energy charge controllers are programmed for a lead-acid battery, via IPN ProRemote (or BT Connect, ProTouch, and UCM) the battery setpoints can be changed based on the specifications of the lithium battery. We recommend contacting the Lithium battery manufacturer for the correct charge profile. For further information, visit the Sunforge website to read the blog How to program BSE charge controllers for LiFePO4 batteries or watch the video IPN ProRemote.

## RESTORING FACTORY DEFAULT SETTINGS

Factory defaults can be easily restored into the IPN ProRemote(-S) 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 20 hr 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 A 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(-S) 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
Lithium	1% / month

### FLOAT TRANSITION CURRENT

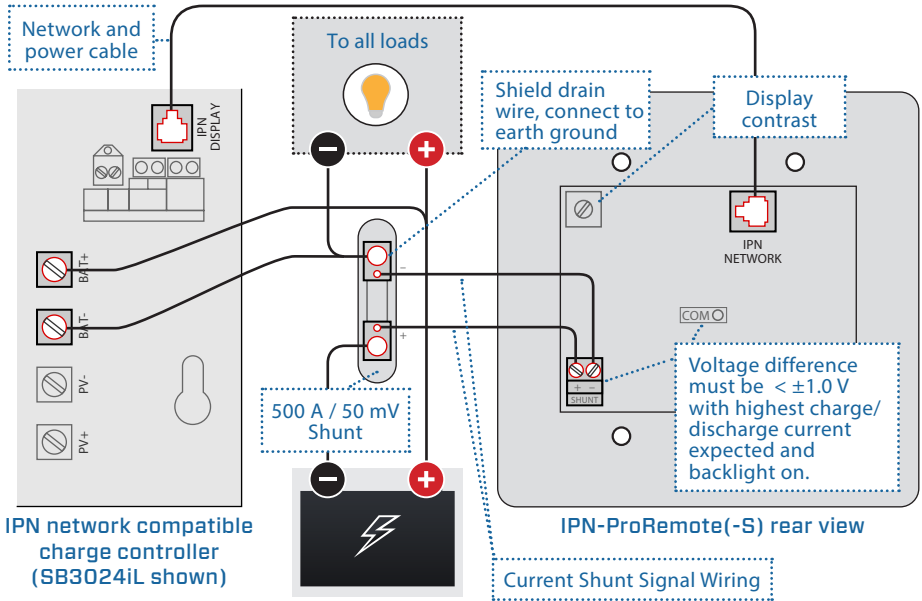
“Time in Absorption (Acceptance)” is an accepted method to determine when the battery is fully charged if net charge current is unknown. A preferred method provided by the IPN ProRemote(-S) is to use net battery charge current matched to battery size in amp-hours. With the IPN ProRemote(-S) the charge 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 Absorption (Acceptance) voltage setpoint. The factory default Float Transition Current setting (Float Current in the Battery Charge Parameters menu) of 1.5 A 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 A while at the Absorption voltage setpoint.

To assure that net charge current is what determines when the battery is full, Charge (Absorption) 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

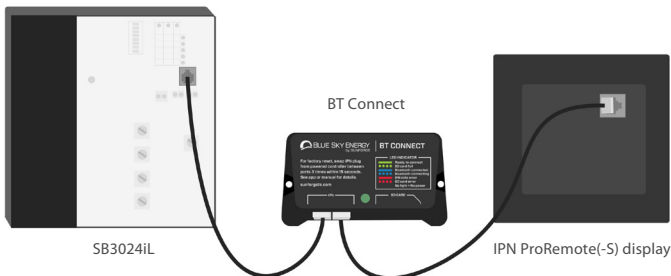


**NOTE:** This product can be installed with our optional 500 A / 50 mV external current shunt (506-0003-01). If not installed the "BATTERY VOLT/AMP" screen will reflect inaccurate NET amperage to the battery bank. For proper operation without the external current shunt, change the "SET FLOAT CURRENT" setting to "0.0 A / 100 AH" in order for the transition from Absorption (Acceptance) to Float mode to be based on time only vs both time and the NET current reaching the battery bank.



## Installing IPN ProRemote(-S) with BT Connect

The IPN ProRemote(-S) display can also communicate via the IPN cable with multiple accessories connected simultaneously via RJ-11 cables as shown below. For example, the Bluetooth adapter **BT Connect** or the **UCM**.



## Current Shunt (IPN ProRemote-S)



**CAUTION:** A 500 A / 50 mV current shunt must be used with the IPN ProRemote (IPN ProRemote-S). 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 the Wiring Diagram 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 (91.5 m) 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-S 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 the Wiring Diagram when the battery is being charged. The +/- shunt signal connections must connect to the corresponding +/- IPN ProRemote-S 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 (stranded/braided) twisted pairs. Lengths less than 35 feet (10.7 m) 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 (10.7 m) 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 (0.0 A) 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(-S). 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. For more details, watch the video "Resetting IPN ProRemote Display Current Shunt Zero Offset" on the Learning Center page of sunforge.com.

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  $\pm 0.1$  A 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

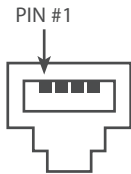
Each charge controller includes an IPN DISPLAY connector which provides power and IPN network connection. The IPN ProRemote(-S) can plug into any charge controller on the network using the standard 4 conductor RJ-11 voice telephone cable supplied.



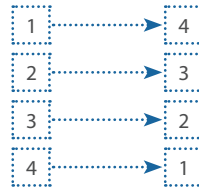
**NOTE:** Standard 4-pin telephone cables swap pin numbers end-to-end. If cables are custom terminated or cable couplers are used, be certain pin swap is maintained. Do not plug into anything other than a IPN-compatible communications port. Total maximum cable length should be limited to approximately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

### Network / Power Cable Schematic

RJ-11 Modular plug - viewed from open end where cable is inserted



Standard 4-pin telephone cable pin swap



**NOTE:** When Backlight is on, the IPN ProRemote(-S) can draw up to 100 mA 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  $\pm 1.0$  V 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-S to within  $\pm 1.0$  V or less at all times. Table 3 below shows wire size for a more conservative recommended voltage drop limit of 0.50 V maximum.

### Maximum Network/Power Cable Length for 0.50 V Drop

Wire Gauge (AWG)	Maximum Recommended Cable Length (Feet / Meters)
30	45 / 13.7
28	73 / 22.2
26	117 / 35.7
24	187 / 57.0
22	295 / 89.9
20	475 / 144.8

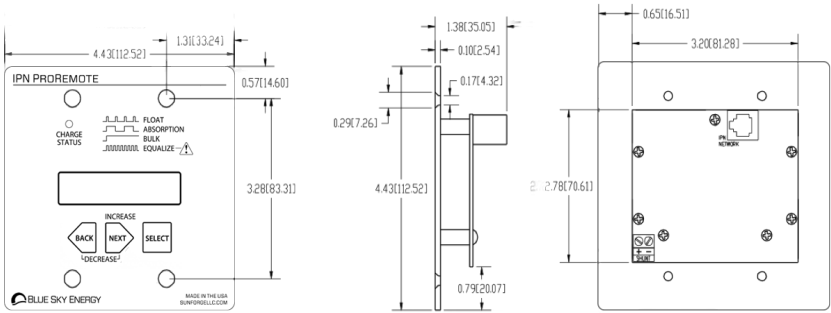


## Mounting



**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



# 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 the network / power cable schematic (page 16).
Display turns on, but battery voltage shows --V rather than a number	IPN ProRemote(-S) not communicating with charge controller	Network cable faulty.
		Charge controller or IPN ProRemote(-S) 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.
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 follower address.
Battery current seems inaccurate	Some charging sources or loads do not go through shunt	Confirm that no other current carrying conductors other than the shunt cable is connected to battery negative.
	Shunt wiring incorrect or faulty.	Shunt wired in series with battery positive, should be negative.
		One or both shunt signal wires open or short.
	Shunt signal wires picking up electrical noise	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.
	Excessive voltage drop in network cable to IPN ProRemote(-S) or in system power 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(-S) is less than $\pm 1.0$ V at all times, with less voltage drop being better. Correct wiring as necessary. Consider not using backlight.
Net battery current not reading 0.0 A with zero amps flowing	Perform Reset Current Shunt Zero function <b>exactly as described in this manual</b> to remove zero offset.	

Symptom	Probable Cause	Items to Examine or Correct
Days since last equalize or full charge shows 1 day too many	Day counter updates when equalize starts	Normal operation. The equalize day counter is reset when equalize starts rather than when it ends.
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.
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	Net battery current <b>must</b> read correctly to properly count Amp-Hours From Full, which is used to compute Remaining Battery Capacity. See Battery Current Seems Inaccurate.
	Incorrect battery amp-hours entered	Confirm correct 25°C 20 Hr rate battery amp-hour value.
	Incorrect Charge Efficiency factor	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%.
	Battery not fully charged for an extended period	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.
	Charge controller is not what normally fully charges the battery	To get the best accuracy, the charge controller should be what normally or at least regularly brings the battery back to full charge.
	Self Discharge Rate set incorrectly	Confirm proper 25°C value is entered.
	Temperature sensor faulty	Many factors are temperature compensated. Confirm proper temperature sensor operation as described in the charge controller manual.

# Specifications

	IPN ProRemote   IPN ProRemote-S
Power Consumption	0.25 W (typical standby), 1.0 W backlit ON
Battery Ammeter	Accuracy $\pm 1\%$ FS / Range $\pm 773.3A$ FS
Battery Size	20 – 10,000 Amp-hours
Amp-Hours from Full	0 – 16,383 Amp-hours
Full Charge Determination	Automatically matched to IPN setup
Remaining Battery Capacity	0 – 100% in 1% increments, self discharge rate and self tuning charge efficiency. Temperature compensated <sup>1</sup>
Lifetime Battery Ah	0 – 9,999,999 Amp-hours
Total Charge Amp-Hours	0 – 16,383 Amp-hours, user resetable
Days since Full Charge	0 – 255 Days
Days since Full Equalize	0 – 255 Days
Backlit	Can be set to ON, OFF or AUTO
Communication and Cabling	Communication via 25' (7.6 m) RJ-11 4-pin telephone cable provided
Current Shunt	(IPN ProRemote-S) 500 A / 50 V Current Shunt via twisted pair cable
Operating Temperature	-40 °C – 40 °C
Environmental Protection	IP00
Weight	0.35 lb. (160 g)
Dimensions	4.43" x 4.43" x 1.38" (11.2 x 11.2 x 3.5 cm)

<sup>(1)</sup> With optional Battery Temperature Sensor connected to the charge controller.

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

## 5 year limited warranty

Visit <https://sunforge.com/ipn-pro/> for more information and terms of the warranty.