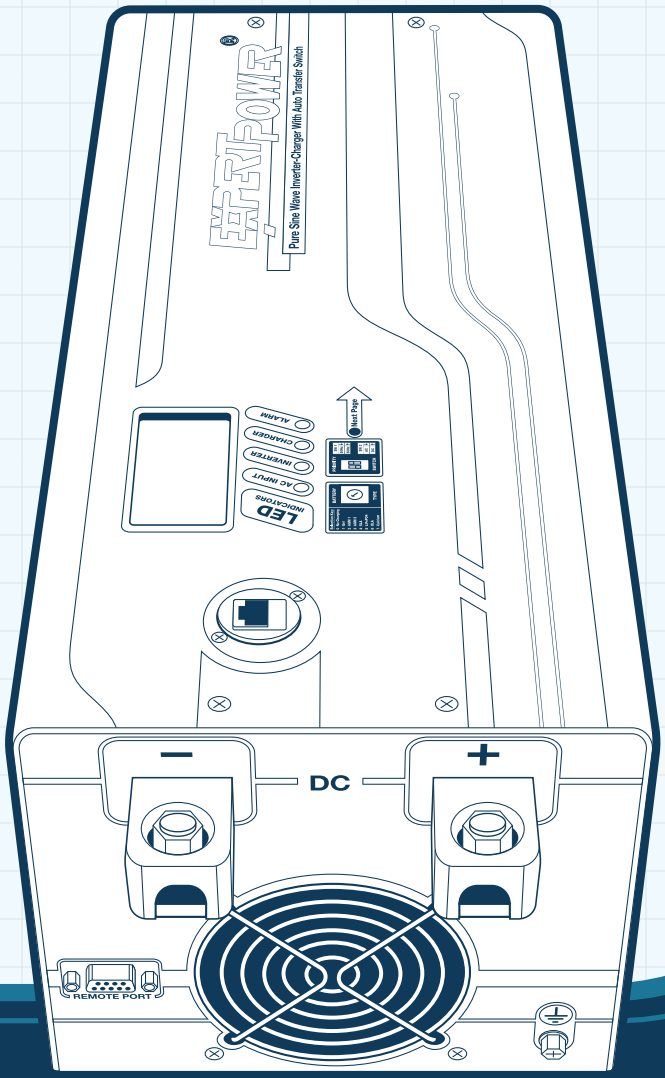
12V – 110V Inverter-Charger

Pure Sine Wave 2000W/3000W

OWNER'S MANUAL

For Models:
IVOCH2KW / IVOCH3KW



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WARNING

PLEASE READ INSTRUCTIONS BEFORE CONTINUING

This manual contains important safety installation, and operation instructions for the ExpertPower Inverter-Charger. Please do not operate the Inverter-Charger without reading this manual first.

General Information

Safety Information and Warnings

The safety of the consumer has been considered prior to designing and creating this product. Please follow the user instructions carefully to operate and install this component to your power system. In order to prevent accidents and injuries please keep this manual for future reference.

1. The installation of the inverter should be done by professionals or under the assistance of a local dealer.
2. Verify whether the input DC voltage range meets voltage polarity requirements (12V±20%). Confirm whether the load device voltage is single-phase 100V ~ 120VAC; power should not be more than rated output power of the inverter.
3. Do not spill any liquid on the inverter, or use a damp cloth to wipe the inverter casing. Do not touch the unit's terminals when running, especially with wet hands, otherwise electric shock injury can occur.
4. If you need to change the operating environment, do not do so yourself. It should be done by professionals or with assistance from the supplier/local dealer.
5. The operating environment of the inverter should be well-ventilated with a temperature range of -4° to 113° F. Keep away from fuel sources and direct sunlight. Do not run in humid or dusty environments this can cause failures to occur. During operation, the inverter-charger will reach medium to high temperatures; this is normal. Remember to maintain proper ventilation during operation to keep the inverter-charger running in the best condition. To facilitate this, please keep a clean environment around the unit and DO NOT allow any vents or fans to be blocked.
6. Keep children away from this unit at all times. It is not a toy. Serious injury or death could occur if inappropriately handled.
7. Confirm if the inverter can be connected with existing wiring. The AWG rating should be sufficient for the loads that will be ran.
8. Do not open the inverter under any circumstances. Besides voiding the warranty, you are risking severe electric shock to yourself and others around you.

Introduction

ExpertPower 12V Inverter-Charger

Our inverter-charger is **Pure Sine-Wave**, **Low-Frequency**, and comes equipped with an **On-board Intelligence System** that handles most of the heavy lifting within your electrical system. The inverter converts 12 volt direct current (VDC) into 110 volt alternating current (VAC), or more commonly, the power you utilize at home through your wall outlets. A typical solar power system consists of a solar panel, solar charge controller, inverter, battery, and intermediary components such as fuses and breakers.

This inverter also has an **Auto Transfer Switch** also known as the **Bypass Feature** which allows the system to be used with or without batteries meaning it can depend solely on shore-power for all your AC and DC appliances.

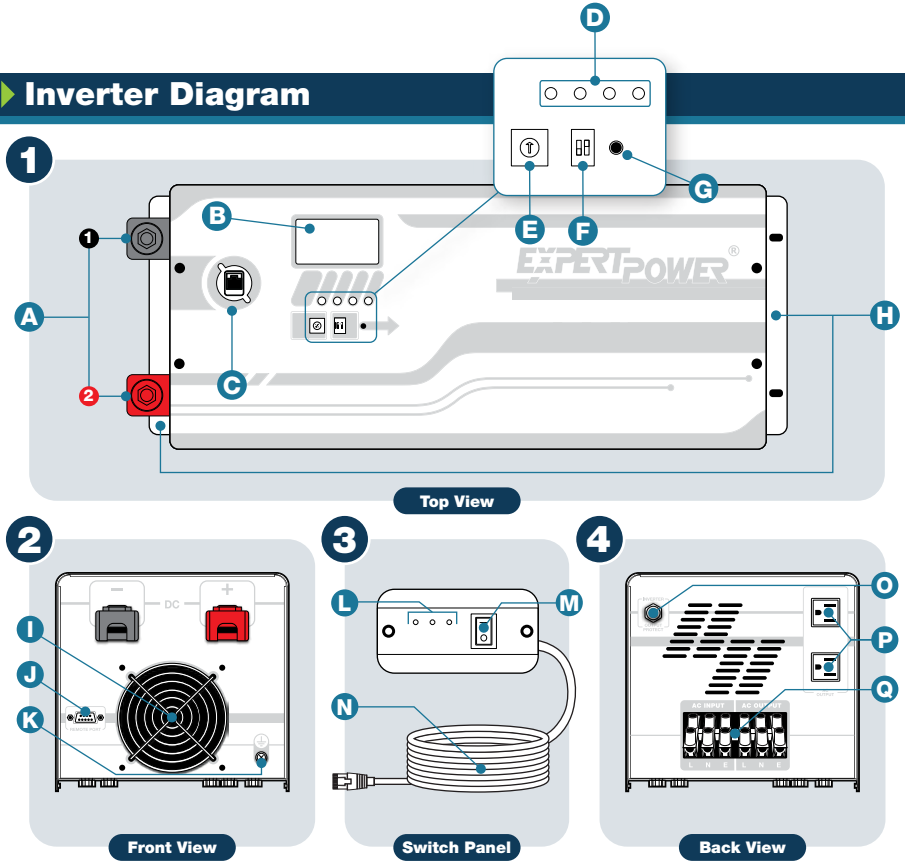
Core Advantages:

- Low frequency - Heavy duty transformer
- High conversion efficiency (90%～98%)
- Intelligent CPU management
- Latest inverter technology
- Best electric components

Applications

Home Power Tools	Circular saws, drills, grinders, sanders, buffers, air compressors, weed and hedge trimmers.
Office Equipment	Computers, phones, monitors, printers, scanners, 3D printers, fax machines, internet and Wi-Fi modems.
Household Appliances	Vacuum cleaners, fans, clippers, electric shavers, sewing machines, lights, washers and dryers.
Kitchen Appliances	Coffee makers, blenders, ice makers, toasters, electric stoves, dish washers, refrigerators, and water pumps.
Industrial Equipment	Metal halide lamps, high-pressure sodium lamp, air compressors, and ventilation systems.
Home Entertainment	Televisions, blue-ray players, gaming consoles, stereos, musical instruments, and satellite TV receivers.

Inverter Diagram



Component Key

1 Top View

- **A.** Terminals:
  - 1. Negative (-)
  - 2. Positive (+)
- **B.** LCD Screen
- **C.** Switch Panel Port
- **D.** Status LEDs
- **E.** Battery Type Multi-Switch
- **F.** 50Hz/60Hz Switch & Priority Modes
- **G.** Next Page Button
- **H.** Mounting Brackets

2 Front View

- **I.** Fan
- **J.** RS232 Communication Port
- **K.** Grounding Terminal

3 Switch Panel

- **L.** Switch Panel LEDs
- **M.** On/Off Switch
- **N.** 26 ft Communication Cable

4 Back View

- **O.** Inverter Output Protection
- **P.** AC Outlets
- **Q.** AC Terminal

Technical Specifications

Inverter Specifications

Rated Output Voltage	110Vac	
Output Voltage Range	±10% rms	
Nominal Output Frequency	50 / 60 ± 0.3Hz	
Efficiency	>90%	
No Load / Idle Consumption	2000W Model	3000W Model
	60W	90W
Safety Certifications	CE / EMC / UL	
Communication Port	RS232	
Cooling Activation	Fan Activates According to Temperature Variations	
Operating Temperature Range	32°F to 140°F	
Storage Temperature Range	5°F to 140°F	
Operating Humidity Range	5% to 95%	
Noise	Max 60dB	

Inverter Safety Specifications

	2000W Model	3000W Model	Behavior
Inverter Overload	2200 - 2500W	3300 - 3750W	Inverter shutoff after 15 min.
	2500 - 3000W	3750 - 4500W	Inverter shutoff after 60s.
	3000W	4500W	Inverter shutoff after 20s.
Low Battery Alarm			10.5Vdc ± 0.3Vdc
Low DC Input Voltage Auto Shutoff			10.0Vdc ± 0.3Vdc
Low DC Input Voltage Recovery			12.0Vdc ± 0.3Vdc
High DC Input Voltage Auto Shutoff			16Vdc ± 0.3Vdc
High DC Input Voltage Recovery			15.5Vdc ± 0.3Vdc

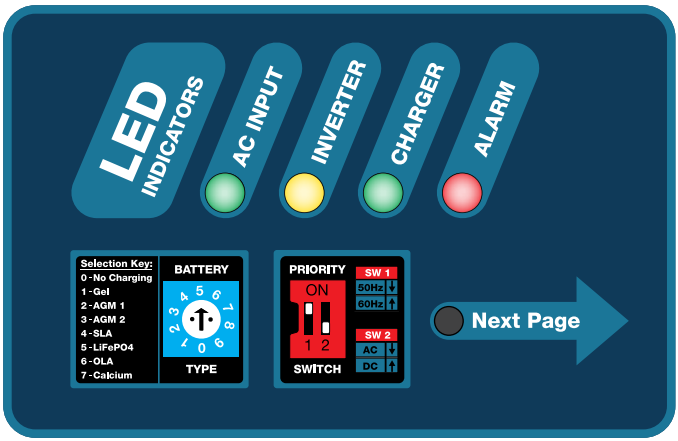
AC Bypass Specifications

Efficiency	≥98%
Input Wave Type	Pure Sine Wave
Input Voltage Range	AC 75V to 135V
Nominal Input Voltage	110Vac
Low Voltage Shutoff	92Vac ± 4%
Low Voltage Recovery	97Vac ± 4%
Over Voltage Shutoff	127Vac ± 4%
Over Voltage Recovery	122Vac ± 4%
Nominal Input Frequency	50Hz / 60Hz (Auto Detect)
Output Wave Type	Pure Sine Wave
Automatic Transfer Switch	30A
Transfer Time (AC to DC)	<5ms
Transfer Time (DC to AC)	<5ms

Charger Specifications

Charging Current	**2000W Model**	**3000W Model**
	40A	60A
Theoretical Charge Voltage	According to the battery type	
Charging Circuit Protection	Circuit breaker	

Top Panel Overview



Panel Components

AC Input		AC Input LED light GREEN when shore power is connected.
Inverter		Inverter LED lights YELLOW when it is active.
Charger		Charger LED lights GREEN when charging.
Alarm		Alarm LED lights RED when fault is detected.
Battery Type		Battery Type selector 0-9 (See Pg. 11).
Priority Switch	**SWITCH #1**	Frequency Selector (See Pg. 11).
	SWITCH #2	AC/DC Priority Selector (See Pg. 11).
Next Page		Switch to the next page on the LCD display.

WARNING:

The output voltage of this unit must never be connected in its input AC terminal, overload or damage may result. Always switch on the inverter before plugging in any appliance.

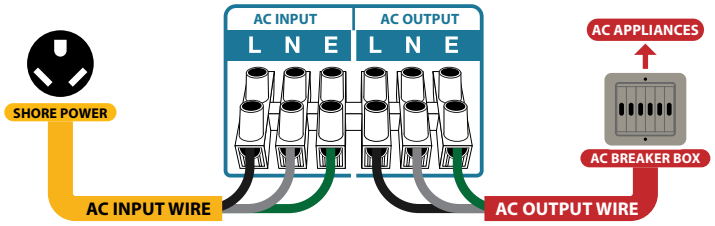
AC Wiring Connection

110V Single Phase

This connection method is completely optional. We recommend using 10 -12 AWG wires for AC terminal block connection. The diagram below shows an example of **both AC input and output** being used. This inverter charger **can also be used with just AC input or output connection** depending on your needs. Please contact our support team if you are unsure how to wire any part of your inverter.

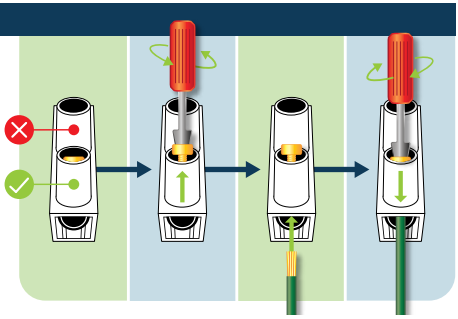
110V Connection Guide

L = Live / Hot	N = Neutral	E = Earth / Ground



AC Terminal Block Wiring:

- Slightly unscrew the first row of screws to open the wire clamp.
- Insert exposed wire segment into the bottom opening.
- Tighten the screw back in while the exposed wire segment is inserted. Ensure all wires are properly fastened.



DC Wiring Connection

Cable Size, Material, and Safety

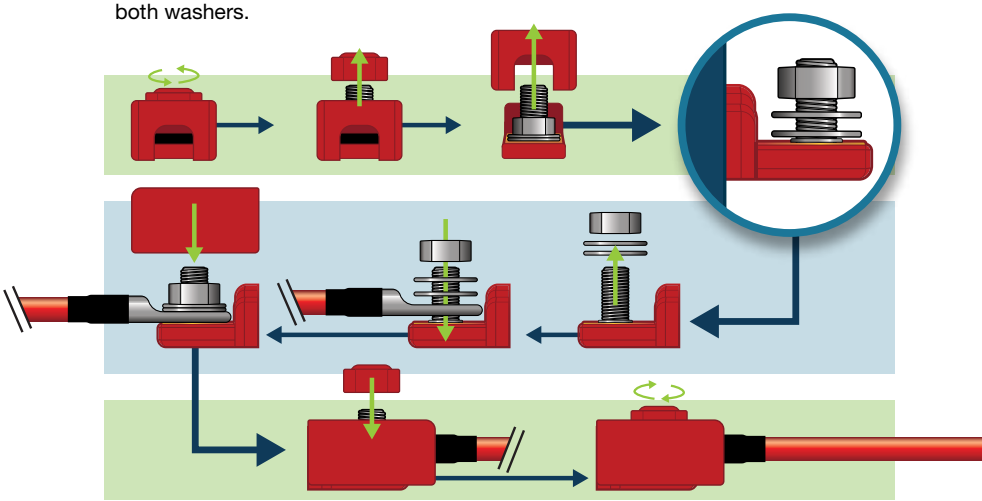
It is recommenced that the battery bank be kept as close as possible to the inverter. The following table is a **suggested fuse and wiring guide** for a 3 ft cable. If wiring is longer than 3 ft, please increase the diameter (AWG) of cable for stability and safety.

Model	Battery Voltage	Fuse Size	Wire Gauge / Min	
			0~3 ft	3~16 ft
2000W	12 Vdc	300A	0 AWG	3/0 AWG
3000W	12 Vdc	400A	3/0 AWG	4/0 AWG

- The stability and safety of this product can be improved by using one shorter-thicker cable. Therefor, if in doubt, round up in wire size and keep the length as short as possible. Another important aspect of your power system is to take into consideration the cable material. We highly recommend that you use only coper cables for your wiring needs as they are the gold standard for this type of product.

Connecting Battery Bank

- Unscrew the top plastic screw on the protective plastic cover.
- Remove protective plastic cover to get access to the positive and negative terminals.
- Unscrew the metal bolt and remove both washers.
- Attach the Battery Pack Cables to the appropriate terminal, place washers over the cable, and screw the bolt back on firmly.
- Return the protective plastic cover and fasten it back on with the plastic screw.



Grounding Your Inverter

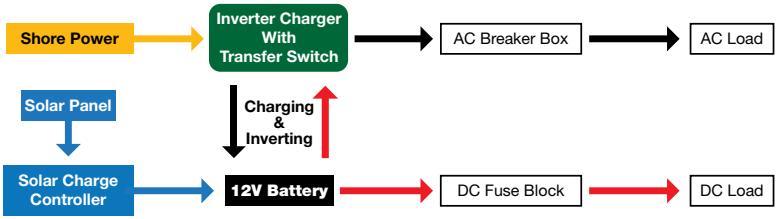
Grounding Your System

Grounding is an important step for any electrical system and is highly recommended. Grounding your electrical system can help with safety and to prevent faults. It is also a requirement for certain Local and National Electric Codes (NEC). Please consult with NEC for more information on this subject regarding local regulations and suggestions.

- The recommended wire size for grounding this inverter is an **8 AWG copper wire**.
- Connecting to ground must be done via the available grounding cables for house applications or to the metal frame of an RV for mobile home applications.

Basic Connection

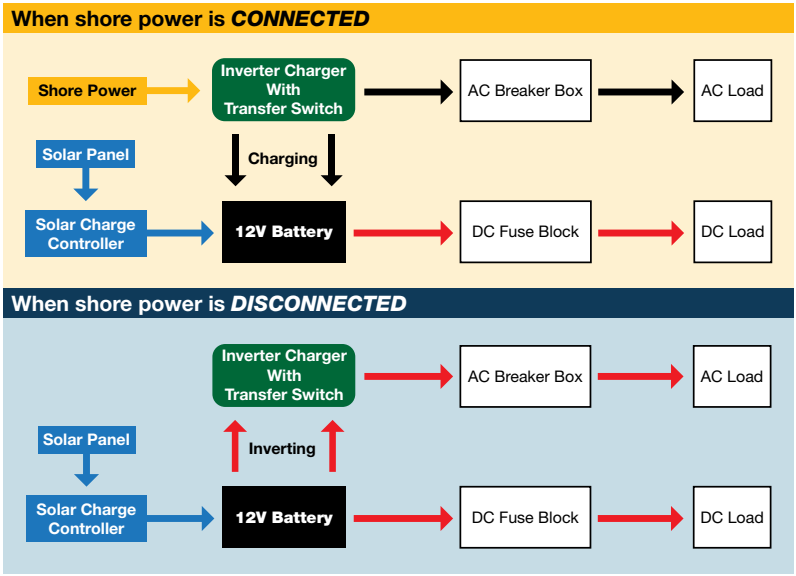
Below is a typical example of what the electrical system is like. Shore power also known as AC Input flows through the inverter-charger to provide AC power guarded by breakers or fuses while charging the battery bank. The same concept applies while under battery power, as the inverter will be powered by DC (battery) and then converted to AC while protected with battery specific fuses and breakers. The battery can be charged utilizing solar panels in conjunction with a solar charger controller.



Auto Transfer Switch

AC Priority (Recommended)

When set to AC priority, you will draw from shore power and not the battery bank to power the 110V appliances. When disconnected from shore power, DC power from the battery bank/solar will be converted into AC.



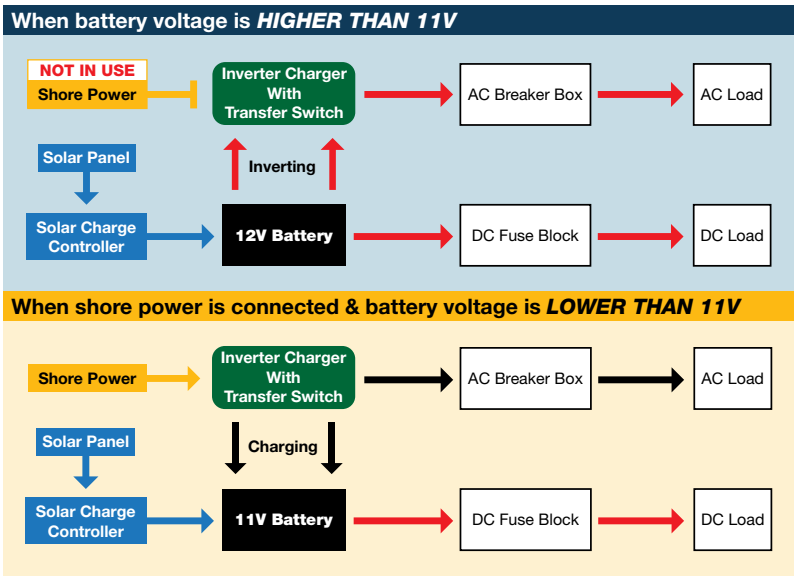
- When shore power is connected, it will be utilized over the battery bank to power

the inverter while simultaneously charging the battery bank this is also known as the bypass function. Charging can be turned off by setting Battery Type switch to 0. (See page 10)

- When shore power is disconnected, the inverter automatically switches to solar/battery bank power in 5ms.
- When shore power is restored, the inverter will automatically switch the power source from battery bank to shore power in 5 ms.

DC Priority

When set to DC priority, the inverter will utilize the battery bank for electricity over shore power. When battery voltage gets too low, it will automatically switch to shore power if it is connected. Charging can be turned off by setting battery switch to 0. (See Page 10)



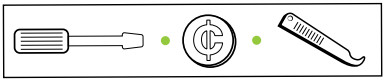
- AC loads will be powered by the battery with the inverter if battery voltage is higher than **11V**.
- When battery voltage drops below **11V**, the inverter automatically switches to shore power (if connected) and charges the batteries.
- When battery is charged to **13.5V**, the inverter will automatically switch back to battery power.
- When shore power is not detectable and battery voltage is lower than 10V, the inverter will shut down. When shore power is detected again, the inverter will turn on automatically and switch to shore power and charge the battery or when battery is charged to **12V**, inverter will automatically turn on and switch to battery power.

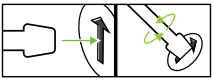
Battery Type Selections and Priority Switch

Different kinds of batteries have varying charging algorithms. In order to protect your power system, our inverter is designed to be suitable for a variety of different types of batteries. On the top of the inverter, you can choose the battery type to your needs using the Battery Type Dial and the Battery Type Settings Table below to ensure that your battery is with in optimal condition.

Using the Battery Type Dial:

- To move the dial use a small screwdriver, coin, or other flat tool and insert it into the arrow shown on the left. Turn the screwdriver so that the arrow in the BAT Type Dial points to the desired **Switch Setting** shown below.





Battery Type Settings Table:

Switch Setting	Description	Boost Voltage 12V	Float Voltage 12V
0	FACTORY DEFAULT	No Charging	No Charging
1	Gel USA	14.0	13.7
2	AGM 1	14.1	13.4
3	AGM 2	14.6	13.7
4	Sealed Lead Acid	14.4	13.6
5	Lithium Iron-Phosphate (LiFePO4)	14.4	13.8
6	Open Lead Acid	14.8	13.3
7	Calcium	15.1	13.6
8	Desulphation	15.5	4 Hours Then Off
9	Not Used	-	-

Using the Priority Switch:

- Use your fingernail, pen, or small enough object to change the switches to the desired priority.

  - **Switch 1:**
    Move to "ON" to set frequency to **60Hz.** For **50Hz**, set the switch back down (not usually used in the USA).

  - **Switch 2:**
    Move to "ON" to set priority to **DC.** For **AC** priority, set the switch back down (Recommended).

Alarms & Protections

Alarm Indications

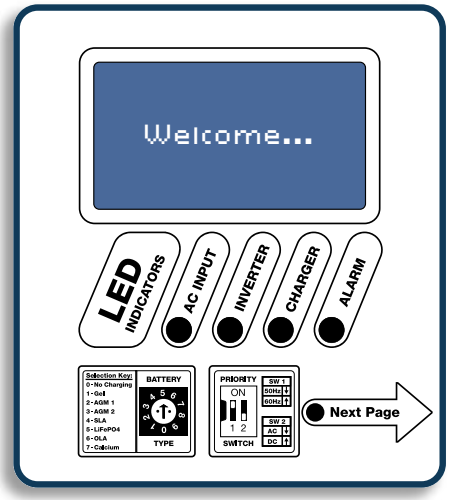
Fault	2000W Model	3000W Model	Audio Alarm Behavior	Alarm LED
Inverter Overload	2200 - 2500W	3300 - 3750W	Beeps every 1s after 14 min., and inverter shutoff after the 15th min.	None
	2500 - 3000W	3750 - 4500W	Beeps every 1s, and inverter shutoff after 60s.	
	3000W	4500W	Beeps every 1s, and inverter shutoff after 20s.	
Low Battery Voltage			Buzzer beeps every 5s.	ON
High Battery Voltage			Buzzer beeps every 5s. Then inverter shutoff after 60s.	ON
Over-Temperature			When heat sink temperature goes over 221°F buzzer beeps every 5s.	Flashes

Fan Protection

Over Temperature Protection	When heat sink temperature goes over 221°F, the inverter shuts down after 30 seconds.
Back-Feed Protection	Yes
Recover From Fault Shutoff	Restarts the inverter.

LCD Display

LCD Will Display as Follows:



Output
Voltage: 110.0 V
Out-Fre: 60.0 Hz
Status: P-Grid
Percent: 050%

Output Information

- **Voltage:** AC Output Voltage
- **Out-Fre:** AC Frequency - 60Hz
- **Status:** P-Grid: AC Input Inverter: Battery Input
- **Percent:** Rated inverter power usage in percentages

Input
AC Volt: 110.0 V
BAT Volt: 012.0V

Input Information

- **AC Volt:** AC Input Voltage.
- **BAT Volt:** Battery Input Voltage.

Normal.

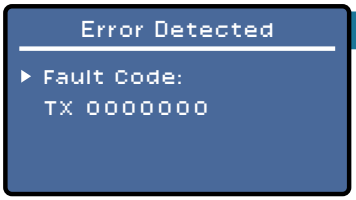
Operation Status

- Inverter status.

Error Codes

Interpreting Faults

Faults can occur for a variety of reasons. When an error is detected the inverter charger will show a fault code. Use the fault code and reference the table below to troubleshoot the error. If the fault persists please feel free to contact us for support.



Fault Detection

- Shows error codes for detected faults.

Fault Status Table:

Code	Fault Description
TX 0000000	Communication Failure
1000000	Battery Below-Voltage
0100000	Inverter Internal Failure
0010000	Fan Failure
0001000	Output Overload
0000100	Output Short Circuit
0000010	Battery Failure
0000001	Battery Over-Voltage

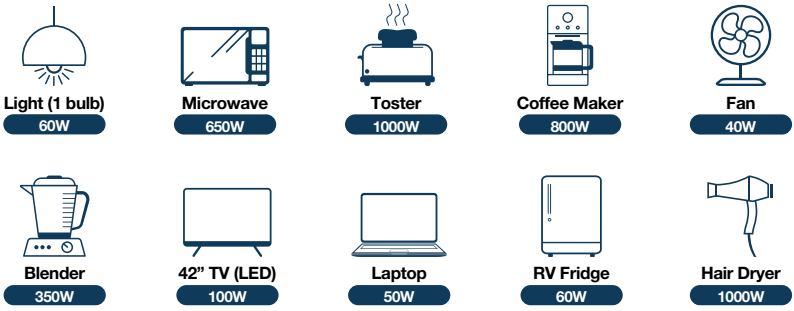
Determining Battery Bank Size

Battery Bank — Size and Example

To select the correct battery bank size you must determine the amount of total watts (load) and how long the load needs to operate. This can vary depending on your needs, applications, and appliances.

1 Estimate Wattage (Load) — Appliances to be Powered

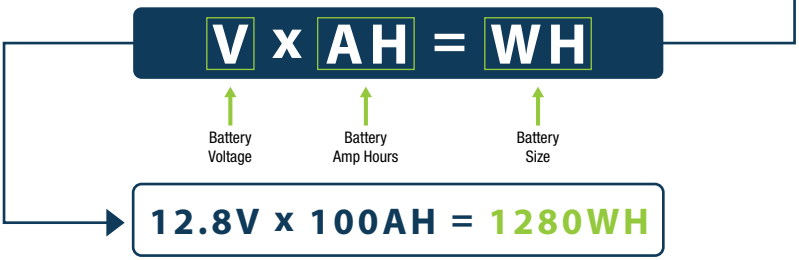
NOTE: This is a general Running Watt guide. Be sure to verify the correct Power Consumption & Surge of your appliances.



2 Example for Determining Battery Sizes

Battery Size: The total **Watt Hours (WH)** determines the size of the battery.

- A watt-hour is the **Voltage (V)** multiplied by the **Current (Amps)** that the battery can provide during a period of use known as **Amp Hours (AH).**
- Using the equation below multiply the **Volts (V)** of your battery by the **Amp Hours (AH)** of each battery to determine total **Watt Hours (WH)**.



In this example we used one 12V 100Ah battery to determine its Watt Hours.
(For more than one battery use: WH x the number of batteries)

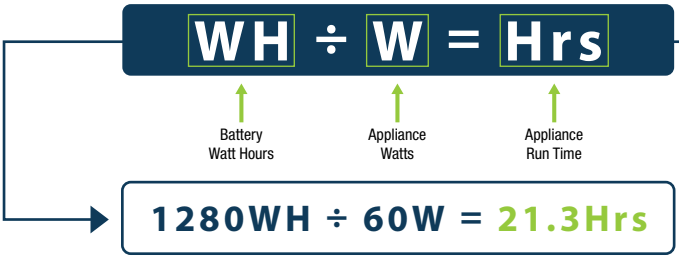
For an example of a rough estimate on appliance runtime, use the provided information above in conjunction with the example of 12V applications table on the next page.

3 Examples With 12V 100Ah Battery

Example of Appliance Runtimes

Appliances	Running Watts	Estimated Runtime (100AH / 1280WH)	Estimated Runtime (2 x 100AH / 2560WH)
Lights	60W	21.3 Hrs	42.6 Hrs
Fan	40W	32 Hrs	64 Hrs
42" LED TV	100W	12.8 Hrs	25.6 Hrs

Use the equation below to determine the amount of hours an appliance can run based on the battery WH and the appliances' Watts:



In this example we also used one 12V 100Ah battery (1280WH) & Lights at 60W.
(For a more accurate runtime use the Wattage stated on your appliances' label.)

Determining Inverter Size & Use

Inverter - Size, Appliance Variables, & Surge

Our inverters are rated to handle specific surge or starting watts for large or heavy duty appliances. To select the appropriate inverter for your system you also need to take into consideration its **Rated Continuous Power** and **Peak / Surge Power**. For the best operation of your appliances you will need to understand **Appliance Variables** such as duty cycles or variable active running times, and **Starting Surges**. Furthermore, you must also take into consideration the Inverters' **Idle Power Consumption** and include this in your total power draw from your Battery Bank.

1 Selecting Inverter Size - Idle, Rated, and Surge Power

Model	Idle Power Consumption	Rated Continuous Power	Peak / Surge Power
IVOCH2KW	60W	2000W	6000W
IVOCH3KW	90W	3000W	9000W

2 Appliance Variables

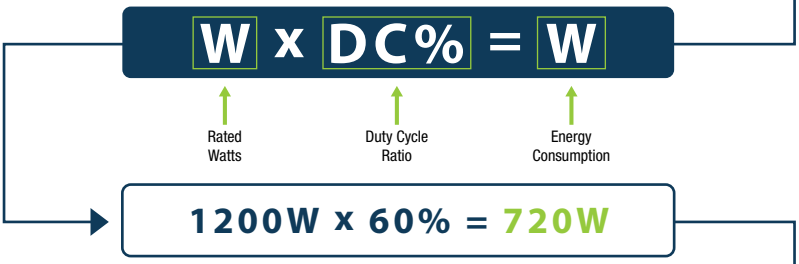
Duty Cycles: All appliances have operation behaviors but most commonly run on a constant wattage consumption. Other appliances function on variables that change there power consumption. Variables can be environment temperature, specific conditions, set or automatic functions. These are known as *Duty Cycles or Power Cycles* which is the fraction of a period that the appliance is active. Simply put, a duty cycle is the ratio of the active time of an appliance in comparison to the total time period it is in use.

Example of RV Appliances With Duty Cycles

Appliances	Rated Watts	Example of Duty Cycles	Estimated Energy Consumption
Refrigerator	700W	40%	280W
Heater	1800W	60%	1080W
AC	1200W	60%	720W

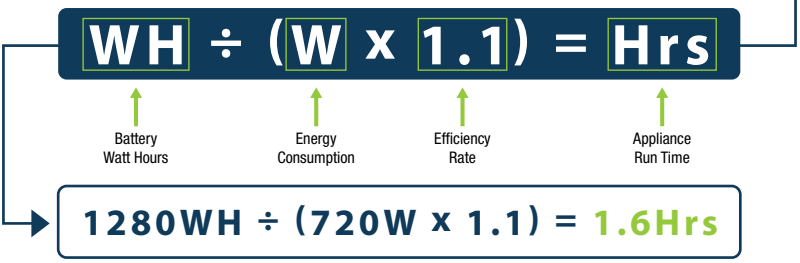
The Duty Cycle in this table is just an example and does not reflect the actual duty cycles of any appliance. Actual appliance duty cycles can sometimes be extremely varied and thus can only be estimated.

(For a more accurate runtime find the duty cycle or operation habits stated on your appliances' label.)



In this example we used the AC with 1200W and 60% Duty Cycle.

To get a more accurate runtime you must take into consideration the efficiency of the inverter which is 90%. To do this, take the calculated Energy Consumption of your appliance and apply it to the equation below:



NOTE: Efficiency of the inverter also needs to be considered which is 90% when inverting 12V to 110V.

(The Inverter's 90% efficiency is represented by "1.1" in the equation as Efficiency Rate.)

3 Starting / Surge Watts

Starting Surges: An initial surge of electrical power that lasts for less than a second but is necessary for appliance start up and operation. Starting surges can typically be found on appliances with motors or compressors, they are usually 2 to 3 times the appliance's rated running watts.

- Common appliances that have these surges and or intermittent run times are Air Conditioners, Heaters, Refrigerators, Microwaves, etc...

Example of RV Appliances Surge Watts

	Appliance	Rated Watts	Surge Watts	*Duty Cycles
RV Essentials	4 Light Bulbs (75W)	300	300	100%
	Electric Water Heater (6 Gal.)	1440	1440	100%
	Fan	200	200	100%
	Furnace Fan (1/3 HP)	700	1400	100%
	RV Roof-Top AC (11,000 BTU)	1010	3030	60%
	RV Roof-Top AC (13,500 BTU)	1500	4500	60%
	RV Roof-Top AC (15,000 BTU)	2000	600	60%
	Space Heater	1800	5400	60%
	Water Pump	60	60	100%
Personal	Blow Drier (Hair)	1250	1250	100%
	Electric Blanket	100	100	50%
	Shaver	35	35	100%
	Vacuum	1100	1100	100%
Kitchen	Blender	350	500	100%
	Coffee Maker	800	800	100%
	Crockpot	250	250	100%
	Deep Fryer	1200	1200	100%
	Electric Fry Pan	1200	1200	100%
	Electric Grill	1650	1650	100%
	Microwave	800	2400	100%
	Toaster	850	850	100%
	Refrigerator (4.8 cu ft)	60	180	40%
	Refrigerator (8 cu ft)	150	450	40%
Entertainment	CD/DVD/Blu-ray Player	50	50	100%
	Laptop	50	50	100%
	Printer	500	500	100%
	Satellite Dish & Receiver	30	250	100%
	Stereo	450	450	100%
	Television (19 in)	20	20	100%
	Television (27 in)	35	35	100%

**The Duty Cycle in this table is just an example and does not reflect the actual duty cycles of any appliance. Actual appliance duty cycles can sometimes be extremely varied and thus can only be estimated.*

4 Calculate Your Appliances

Use the table below to keep a record of your appliances energy consumption.

	Appliances	Rated Watts	Surge Watts	*Duty Cycles	Time Per Day (Hr)	Energy Consumption (WH / Day)
Example	TV	100	100	100%	2	200
	Fridge	60	120	40%	24	576

Appliances	Rated Watts	Surge Watts	*Duty Cycles	Time Per Day (Hr)	Energy Consumption (WH / Day)
Total Energy Consumption Per Day:					(WH / Day)

12V DC Appliances:

Energy Consumption (WH / Day) = Rated Watts x Duty Cycles% x Time Per Day (Hr)

110V AC Appliances:

Energy Consumption (WH / Day) = Rated Watts x 1.1 x Duty Cycles% x Time Per Day (Hr)

NOTE: Efficiency of the inverter also needs to be considered for 110V appliances.

(The Inverter's 90% efficiency is represented by "1.1" in the equation as Efficiency Rate.)

Notes

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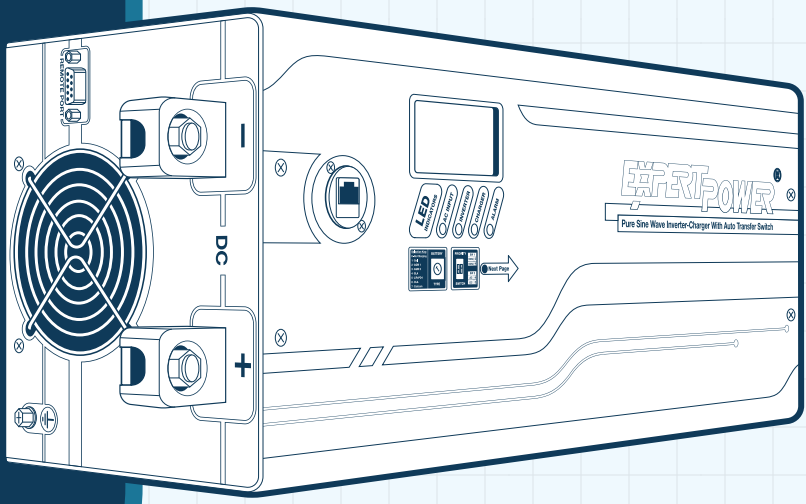

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