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User's Guide

Ultra UL1741

Pure Sine Wave Inverter Chargers

Model Numbers

FULAGDA1512A, FULAGDA2524A, FULAGDA3524A

FULAGDA4524A, FULAGDA3548A, FULAGDA4548A

FULAGDA6048D, FULAGDA1512T, FULAGDA2524T

FULAGDA3524T, FULAGDA4524T, FULAGDA3524D

FULAGDA3548D, FULAGDA4524D, FULAGDA4548D

Exclusion for documentation

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FULAGDA4524T, FULAGDA3524D, FULAGDA4524D, FULAGDA3548D, FULAGDA4548D

Contact information

Telephone: 0086 755 33266371
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Information about your system

As soon as you open your product, record the following informtion and be sure to keep your proof of purchase

Series Number ______________________________

Product Number ______________________________

Purchased From ______________________________

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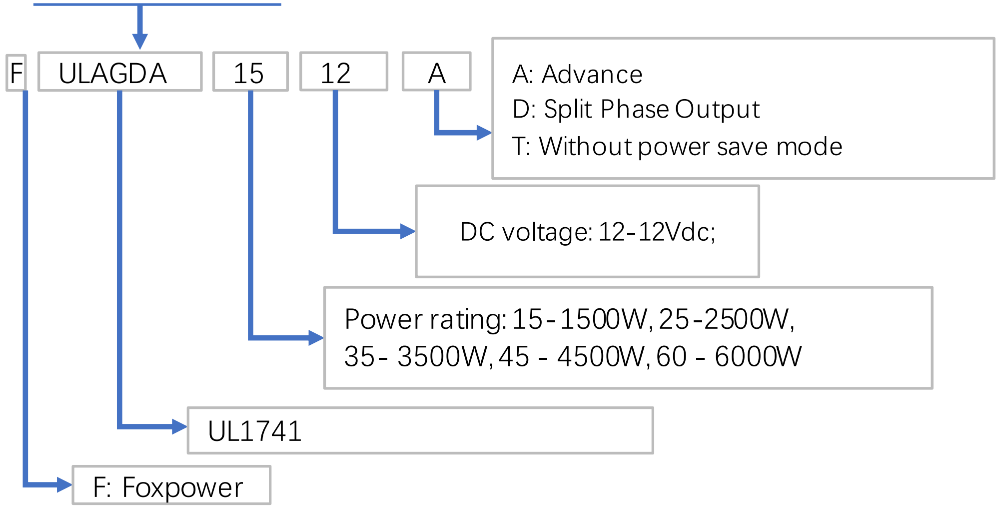
To view, download, or print the latest revision, visit the website shown under contact information.

Part Nunber Explain:

FULAGDA1512A



About This Guide

Purpose

The purpose of this Installation Guide is to provide explanations and procedures for installing the Ultra UL1741 Inverter/Charger.

Scope

The Guide provides safety and installation guidelines as well as information on con tools and wiring. It does not provide details about particular brands of batteries. You need to consult individual battery manufacturers for this information.

Audience

The information in this Guide is intended for qualified personnel. Qualified personnel have training, knowledge, and experience in:

• Installing electrical equipment and PV power systems (up to 1000 volts).

• Applying all applicable installation codes.

• Analyzing and reducing the hazards involved in performing electrical work.

• Selecting and using Personal Protective Equipment (PPE).

Conventions Used

The following conventions are used in this guide.

⚠ DANGER
DANGER indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING
WARNING indicates a potentially hazardous situation, which, if not avoided, can result in death or serious injury.

⚠ CAUTION
CAUTION indicates a potentially hazardous situation, which, if not avoided, can result in moderate or minor injury.

NOTICE
NOTICE indicates a potentially hazardous situation, which, if not avoided, can result in equipment damage.

IMPORTANT: These notes describe things which are important for you to know, however, they are not as serious as a caution or warning.

Related Information

You can find more information about Foxpower-branded products and services at **www.fox-power.com**

Important Safety Instructions

IMPORTANT: READ AND SAVE THIS INSTALLATION GUIDE FOR FUTURE REFERENCE.

This chapter contains important safety and installation instructions for the Ultra UL1741 Inverter/Charger (Ultra UL1741). Each time, before using the Ultra UL1741, READ ALL instructions and cautionary markings on or provided with the inverter/charger, the batteries, and all appropriate sections of this guide.

NOTE: The Ultra UL1741 contains no user-serviceable parts.

⚠ DANGER

ELECTRICAL SHOCK HAZARD

- Do not expose the Ultra UL1741 to rain, snow, spray, or bilge water. This inverter/charger is designed for marine applications only when additional drip protection is installed in certain orientations. See "Mounting Orientations" on page 24 for more information.
- Do not operate the inverter/charger if it has received a sharp blow, been dropped, has cracks or openings in the enclosure including if the AC terminal cover has been lost, damaged, or will not close, or otherwise damaged in any other way.
- Do not disassemble the inverter/charger. Internal capacitors remain charged after all power is disconnected.
- Disconnect both AC and DC power from the inverter/charger before attempting any maintenance or cleaning or working on any circuits connected to the inverter/charger. The INVERTER ENABLE button on the front panel does not function like a power switch that energizes or de-energizes the unit arbitrarily. When AC and DC power sources are connected and present, the unit is always energized.
- Do not operate the inverter/charger with damaged or substandard wiring. Make sure that all wiring is in good condition and is not undersized.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

FIRE AND BURN HAZARD

- Do not cover or obstruct the air intake vent openings and/or install in a zero-clearance compartment.
- Do not use transformerless battery chargers in conjunction with the inverter/charger due to overheating.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

EXPLOSION HAZARD

- Charge only properly rated (such as 12 V) rechargeable batteries because other battery types may explode.
- Do not work in the vicinity of lead-acid batteries. Batteries generate explosive gases during normal operation. See note #1.
- Do not install and/or operate in compartments containing flammable materials or in locations that require ignition-protected equipment. See notes #2 and #3.

Failure to follow these instructions will result in death or serious injury.

NOTES:

1. Follow these instructions and those published by the battery manufacturer and the manufacturer of any equipment you intend to use in the vicinity of the battery. Review cautionary markings on these products and on the engine.

2. This inverter/charger contains components which tend to produce arcs or sparks.

3. Locations include any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.

Precautions When Working With Batteries

⚠ WARNING

BURN FROM HIGH SHORT-CIRCUIT CURRENT, FIRE AND EXPLOSION FROM VENTED GASES HAZARDS

- Always wear proper, non-absorbent gloves, complete eye protection, and clothing protection. Avoid touching your eyes and wiping your forehead while working near batteries. See note #4.
- Remove all personal metal items, like rings, bracelets, and watches when working with batteries. See notes #5 and #6 below.
- Never smoke or allow a spark or flame near the engine or batteries.
- Never charge a frozen battery.

Failure to follow these instructions can result in death or serious injury.

NOTES:

1. Mount and place the Ultra UL1741 Inverter/Charger unit away from batteries in a well ventilated compartment.

2. Always have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.

3. Always have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.

4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.

5. Use extra caution to reduce the risk or dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.

6. Batteries can produce a short circuit current high enough to weld a ring or metal bracelet or the like to the battery terminal, causing a severe burn.

7. When removing a battery, always remove the negative terminal from the battery first for systems with grounded negative. If it is grounded positive, remove the positive terminal first. Make sure all loads connected to the battery and all accessories are off so you don’ t cause an arc.

Precautions When Preparing to Charge

⚠ WARNING
EXPOSURE TO CHEMICALS AND GASES HAZARD • Make sure the area around the battery is well ventilated. • Make sure the voltage of the batteries matches the output voltage of the inverter/charger. • Be careful to keep corrosion from coming into contact with your eyes and skin when cleaning battery terminals. **Failure to follow these instructions can result in death or serious injury.**

NOTES:

• Study and follow all of the battery manufacturer's specific precautions, such as removing or not removing cell caps while charging, whether equalization is acceptable for your battery, and recommended rates of charge.

• For flooded non-sealed batteries, add distilled water in each cell until battery acid reaches the level specified by the battery manufacturer. This helps to purge excessive gas from cells. Do not overfill. For a battery without removable cell caps, carefully follow manufacturer's instructions.

Precautions When Placing the Inverter/Charger

NOTICE
RISK OF DAMAGE TO THE INVERTER/CHARGER • Never allow battery acid to drip on the inverter/charger when reading gravity, or filling battery. • Never place the Ultra UL1741 Inverter/Charger unit directly above batteries; gases from a battery will corrode and damage the inverter/charger. • Do not place a battery on top of the inverter/charger. Failure to follow these instructions can damage the unit and/or damage other equipment.

Regulatory

The Ultra UL1741 Inverter/Charger is certified to appropriate US and Canadian standards. For more information see “Regulatory Approvals” on the Specifications section in the Owner’ s Guide.

The Ultra UL1741 Inverter/Charger is intended to be used for mobile or commercial applications. This inverter/charger is designed for marine applications only when additional drip protection is installed in certain orientations.

It is not intended for other applications as it may not comply with the additional safety code requirements needed for those other applications. See "Limitations On Use" below.

⚠ CAUTION

LIMITATIONS ON USE

Do not use in connection with life support systems or other medical equipment or devices.

Failure to follow these instructions can result in death or serious injury.

Contents

Introduction

General Information

Ultra UL1741 series pure sine wave inverter charger is a combination of an inverter, battery charger and AC auto-transfer switch into one complete system with a peak DC to AC conversion efficiency of 90%. It is packed with unique features and it is one of the most advanced inverter charger in the market today. It features power factor corrected, sophisticated multi-stage charging and pure sine wave output with unprecedenetedly high surge capability to meet demanding power needs of inductive loads without endangering the equipment.
The powerful battery charger of this series inverter charger goes as high as 90Amps (varying on different models), and with power factor corrected, it uses 20-30% less energy from AC input than a standard charger, avoiding nuisance breaker trips or generator overloads.

The overload capacity is 300% of continuous output for up to 20 seconds to reliably support tools and equipment longer.
The transformers have been consistently improved for years to achieve the best balance of conversion efficiency, The consumption and miminum THD.
The idle consumption of the line is ultra low, roughly 1.5% of its rated power.
The models are available in 120Vac (single phase)

In AC priority mode, when AC power cuts off (or falls out of acceptable range), the transfer relay is de-energized and the load is automatically transferred to the inverter output. Once the qualified AC power is restored, the relay is energized and the load is automatically reconected to AC utility.
When customized to battery priority mode via LCD setting, the inverter will extract maximum power from external power sources in renewable energy systems and a minimal cycle of battery will be required.

Thus the Ultra UL1741 series pure sine wave inverter charger is suitable for a myriad of applications including renewable energy systems, utility, truck, RV and emergency vehicles etc.
To get the most out of the power inverter, it must be installed, used and maintained properly. Please read the instructions in this manual before installing and operating.

Applications

Power tools–circular saws, drills, grinders, sanders, buffers, weed and hedge trimmers, air compressors.

Office equipment – computers, printers, monitors, facsimile machines, scanners.
Household items – vacuum cleaners, fans, fluorescent and incandescent lights, shavers, sewing machines.
Kitchen appliances – coffee makers, blenders, ice markers, toasters.
Industrial equipment – metal halide lamp, high – pressure sodium lamp.
Home entertainment electronics – television, VCRs, video games, stereos, musical instruments, satellite equipment.

Basic Protection Features

The Ultra UL1741 inverter charger is equipped with extensive protections against various harsh situations/faults. These protections include:

- AC input over voltage protection/ AC input low voltage protection
- Low batter alarm/high voltage alarm
- Over temperature protection/Over load protection
- Short circuit protection(1s after fault)
- Back feeding protection

When Over temperature /Over load occur, after the fault is cleared, the master switch has to be reset to restart the inverter.
The Low batter voltage trip point can be customized from defaulted value 10VDC to 10.5VDC thru the LCD display.
The inverter will go to Over temp protection when heat sink temp. ≥105ºC, and go to Fault (shutdown Output) after 30 seconds. The switch has to be reset to activate the inverter.
The Prime series Inverter has back feeding protection which avoids presenting an AC voltage on the AC input terminal in Invert mode.
After the reason for fault is cleared, the inverter has to be reset to start working.

Key Features

- Designed to operate under harsh environment
- Automatic voltage regulator (AVR) when working in charger mode and line mode.
- DC start & automatic self-diagnostic function
- True sine wave output (THD<3%) to operate sensitive electronic and electrical equipment.
- Automatic Generator Start Function (AGS)
- Easy to install & easy to operate & easy to solve
- Low DC voltage supports home and office appliances
- Charge rate selectable from 0%-100%
- High efficiency design.
- 13Vdc battery recovery point, dedicated for renewable energy systems.
- 8 pre-set battery type selector plus De-sulphation for totally flat batteries.
- Power factor corrected multi-stage charger for fast, efficient charging, minimizing charging time.
- 10ms max transfer time between utility and battery, guarantees power continuity.
- 15s delay before transfer when AC resumes, protection for load when used with generator.
- Conformal coated circuit boards for humid environments.
- Battery temperature sensoring (BTS)
- LCD and LED display to indicate the status of the inverter charger
- UL listed to UL1741 & CSA C22.2 #107.1
- Surge capacity to start difficult loads like refrigerators or A/C compressors.
- Power save mode to reduce idle consume.

Key Features Explained

Multi-Stage Charger

Bulk Charging: This is the initial stage of charging. While Bulk Charging, the charger supplies the battery with controlled constant current. The charger will remain in Bulk charge until the Absorption charge voltage (determined by the Battery Type selection) is achieved. Software timer will measure the time from A/C start until the battery charger reaches 0.3V below the boost voltage, then take this time as T0.

Charge Mode LED will be orange during this stage

Absorb Charging: This is the second charging stage and begins after the absorb voltage has been reached. Absorb Charging provides the batteries with a constant voltage and reduces the DC charging current in order to maintain the absorb voltage setting. In this period, the inverter will start a T1 timer; the charger will keep the boost voltage in Boost CV mode until the T1 timer has run out. Then drop the voltage down to the float voltage. The timer has a minimum time of 30 Mins and a maximum time of 45 Mins.

Charge Mode LED will blink orange during this stage

Float Charging: The third charging stage occurs at the end of the Absorb Charging time. While Float charging, the charge voltage is reduced to the fl oat charge voltage (determined by the Battery Type selection*). In this stage, the batteries are kept fully charged and ready if needed by the inverter. If the A/C is reconnected or the battery voltage drops below 12Vdc/24Vdc, the charger will reset the cycle above.

Charge Mode LED will be green during this stage

If the charge maintains the float state for 10 days, the charger will deliberately reset the cycle to protect the battery.

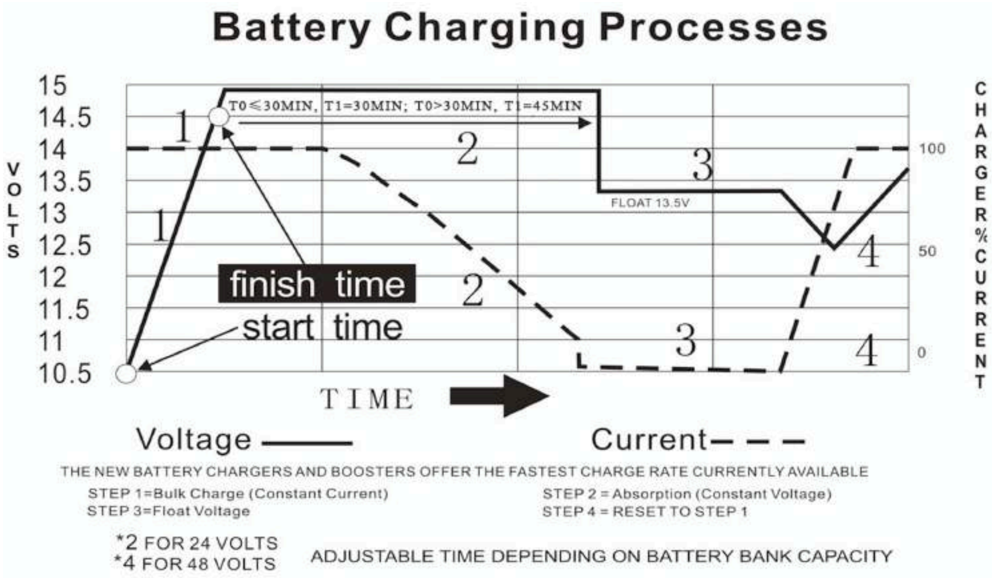


Figure 1

Battery Type Selector Setting

Battery Type Selector Settings			
Switch Position	Description	Boost / Vdc	Float / Vdc
0	Charger Off		
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	Gel EURO	14.4	13.8
6	Open lead acid	14.8	13.3
7	Calcium	15.1	13.6
8	De-sulphation	15.5 (4 Hours then Off)	
9	Not used or customized*		
Above figures based on 12Vdc models, *2 for 24Vdc, *4 for 48Vdc. *For some customized models, position 9 is programmed with a customized algorithm. Please refer to the product label or the manufacturer for more information.			

De-sulphation

The de-sulphation cycle, switch position 8, is marked in red because this is a very dangerous setting if you do not know what you are doing. Before attempting to use this cycle you must clearly understand what it does and when and how you would use it. What causes sulphation? This can occur with infrequent use of the batteries, or if the batteries have been discharged so low that they will not accept a charge. This cycle is a very high voltage charge cycle designed to try to break down the sulphated crust that is preventing the plates from taking a charge and thus allow the plates to clean up and accept a charge once again.

Charging depleted batteries

The Ultra UL1741 series inverter allows start up and through power with depleted batteries.
For 12VDC models: after the battery voltage goes below 10V and the power switch is kept in the "ON" position and the inverter stays connected to the battery and the battery voltage doesn't drop below 2V, the inverter will be able to charge the battery once qualified AC inputs are present. Before the battery voltage goes below 9VDC, the charging can be activated when the switch is turned to "Off", then to "ON".
When the voltage goes below 9VDC, and you accidently turn the switch to OFF or disconnect the inverter from the battery, the inverter will not be able to charge the battery once again, because the CPU loses memory during this process.

Charing Current For Each Model

Model	Rated Power	Battery Voltage	Max Current
FULAGDA1512A/T	1500W	12Vdc	50A
FULAGDA2524A/T	2500W	24Vdc	40A
FULAGDA3524A/T	3500W	24Vdc	50A
FULAGDA4524A/T	4500W	24Vdc	60A
FULAGDA3548A	3500W	48Vdc	25A
FULAGDA4548A	4500W	48Vdc	30A
FULAGDA6048D	6000W	48Vdc	55A
FULAGDA3524D	3500W	24Vdc	50A
FULAGDA4524D	4500W	24Vdc	60A
FULAGDA3548D	3500W	48Vdc	25A
FULAGDA4548D	4500W	48Vdc	30A

The charging capacity will go to peak charge rate in about 3 seconds. This may cause a generator to drop frequency, making the inverter transfer to battery mode.
It is suggested to gradually put the charging load on the generator by switching the charging switch from min to max. Together with the 15s switch delay our inverter gives the generator enough time to spin up. This will depend on the size of the generator and rate of charge.
As a general Rule, the Bulk Charging Current should be limited to 30% of the capacity of the battery bank. Higher charging current may be used if permitted by the battery manufacturer.

⚠ CAUTION

CAUTION: Please use a small jeweler's style flat-head screwdriver to turn the charge current control switch gently to avoid breakage due to over-turning.
To guarantee the best performance of AC charger when the AC input is from a generator, the standby generator should be of at least 150% higher capacity than the inverter.
Warning! Operation with an under-rated generator or generator with unqualified wave form may cause premature failure which is not under warranty.

Transfer

Swift Power Transfer
While in the Standby Mode, the AC input of the inverter is continually monitored. Whenever AC power falls below the low AC voltage trip voltage (90VAC default setting for 120VAC), the inverter automatically transfers back to the Invert Mode with minimum power interruption to your appliances - as long as the inverter is turned on. The transfer from Standby mode to Inverter mode occurs in approximately 10 milliseconds. And it is even shorter from Inverter mode to Standby mode.
This transfer time is usually fast enough to keep your equipment (including computers) powered up, thus our inverter can be used as a line interactive UPS.

Synchronized Power Transfer
When a load is transferred from inverter AC output to another backup AC source of power through a transfer switch, there will be a finite interruption of power to the load for the transfer to take place.
A mismatch of phase and frequency of the inverter AC output and the backup AC source in transfer is likely to damage the backup AC source / a reactive load.
With sophisticated circuitry design, our inverter will first lock on the frequency and phase of the input shore power/generator power and make a smooth and safe transfer at the zero voltage point to minimize the impact on the power modules.

Transfer Delay
There is a 15-second delay from the time the inverter senses that continuously qualified AC is present at the input terminals to when the transfer is made. This delay is built in to provide sufficient time for a generator to spin-up to a stable voltage and frequency and avoid relay chattering. The inverter will not transfer to generator until it has locked onto the generator’ s output. This delay is also designed to avoid frequent switching when input utility is unstable.

Battery Temperature Sensor

Applying the proper charge voltage is critical for achieving optimum battery performance and longevity. The ideal charge voltage required by batteries changes with battery temperature.
The battery temperature sensor allows the charge controller to continuously adjust charge voltage based on actual battery temperature.
Temperature compensation of charge voltage assures that the battery receives the proper charge voltage as battery temperature varies.
The entire line is equipped with Battery Temperature Sensing for increased charging precision.
It sends precise information to the charger, which automatically adjusts voltage to help ensure full battery charge depending on the ambient temperature of your battery installation.
When the battery voltage is over 40°C(104°F), it will reduce the charging voltage by 0.1Vdc with every degree of temperature rise.
We recommend that you install Battery Temperature Sensors on all banks to protect your batteries and to provide optimal charging of each bank.
The battery temperature sensor mounts on the side of a battery or any other location where the precise temperature of battery can be detected such as battery mounting racks.
The following table describes approximately how much the voltage may vary depending on the temperature of the batteries.

Inverter Condition	Temperature on BTS	Charger Operation
Charger Mode	BTS⩾50°C (122ºF)	Automatically turns off charger
	BTS⩽40°C (104ºF)	Automatically turns on charger
Inverter Mode	40°C (104ºF)⩽BTS⩽40°C (104ºF)	Increases low voltage shut down point by 0.5Vdc
	BTS⩾50°C (122ºF)	Over Temp Fault

IMPORTANT: If the battery temperature is allowed to fall to extremely cold temperatures, the inverter with a BTS may not be able to properly recharge cold batteries due to maximum voltage limits of the inverter. Ensure the batteries are protected from extreme temperatures.
For more detailed technical information, please contact us.

A Battery Temperature Sensor (Part #:ULTRAFEBTS) has been provided as a separate accessory. It comes with 32.8'/10m cable.	

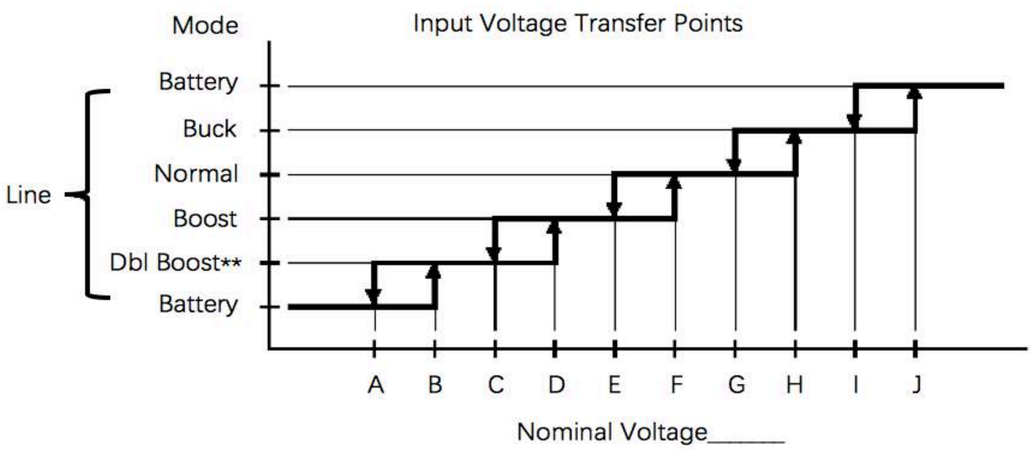
Automatic Voltage Regulator(AVR)

Note: UL-6048D don't have this function

The automatic voltage regulator function is available for the full series of Foxpower Ultra UL1741 pure sine wave inverter charger models.Instead of simply bypassing the input AC to power the loads, the Ultra UL1741 series inverter stabilizes the input AC voltage to a range of 120V±10%.

AVR function	Ultra UL1741		
Acceptable input voltage range (Vac)		0-160	
Nominal input voltage (Vac)	100	110	120
(A) Line low loss N/W (on battery)	75/65	84/72	92/78
(B) Line low comeback N/W(on boost)	80/70	89/77	97/83
(C) Line 2nd boost threshold (on boost)	**	**	**
(D) Line 2nd boost comeback(on normal)	**	**	**
(E) Line 1st boost threshold (on boost)	90	99	108
(F) Line 1stboost comeback (on normal)	93	103	112
(G) Line buck comeback (on normal)	106	118	128
(H) Line buck threshold (on buck)	110	121	132
(I) Line high comeback (on buck)	115	127	139
(J) Line high loss (on battery)	120	132	144

** Only if applicable



Auto Generator Start

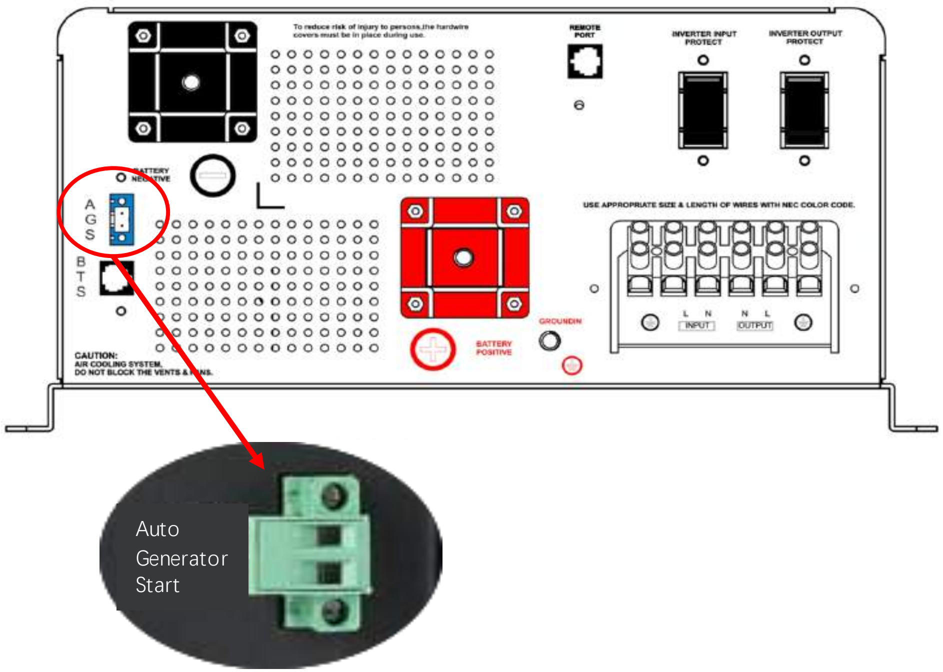
The inverter can start up generator when battery voltage goes low. When the inverter goes to low battery alarm, it can send a signal to start a generator and turn the generator off after battery charging is finished.

The auto gen start feature will only work with generators which have automatic starting capability. The generator must have start and stop controls [i.e., an electric starter and electric choke (for gasoline units)], and the safety sensors to be able to start and stop automatically.

There is an open/close relay that will short circuit the positive and negative cables from a generator start control. The input DC voltage can vary, but the max current the relay can carry is 16Amp.

The Auto Generator Start terminal pins are not polarized.

In addition, these two pins can also be used as dry contacts to send out "Low Battery Voltage" signal to an external alarm device.



Remote Control

Apart from the switch panel on the front (or top) side of the inverter, an extra LCD remote switch panel (Figure 7) connected to the remote port at the DC side of the inverter through a standard Ethernet cable can also control the operation of the inverter.
If an extra switch panel is connected to the inverter via "remote control port", together with the panel on the inverter case, the two panels will be connected and operated in parallel.
Whichever first switches from "Off" to "Power saver off" or "Power saver on", it will power the inverter on.
If the commands from the two panels conflict, the inverter will operate according to the following priority: Power saver on> Power saver off> Power off
Only when both panels are turned to the "Unit Off" position, will the inverter be powered off.
The Max length of the LCD remote control data cable is 60 feet (18 meters).
The LCD remote control panel will display the operation status of the inverter, including:

- Input AC Voltage
- Output AC Voltage
- Battery Voltage
- Output Frequency
- Output Load
- Work Mode
- Alarm
- Fault
- Battery Capacity

Figure 6

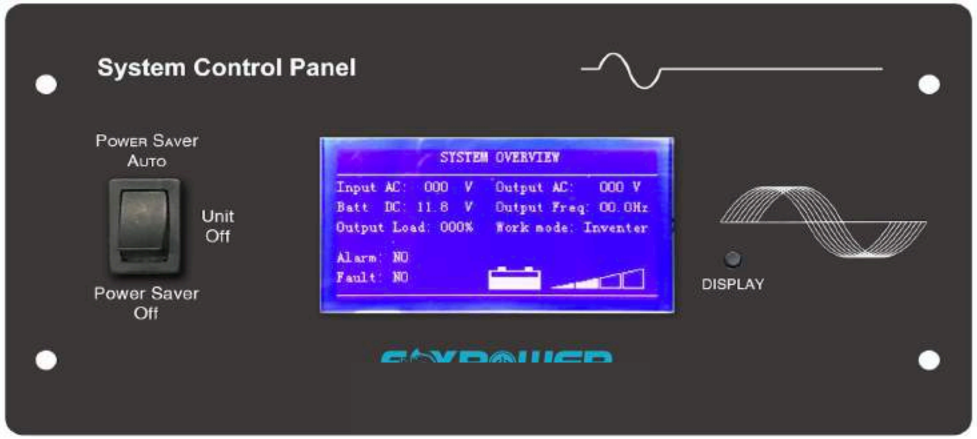


Figure 7

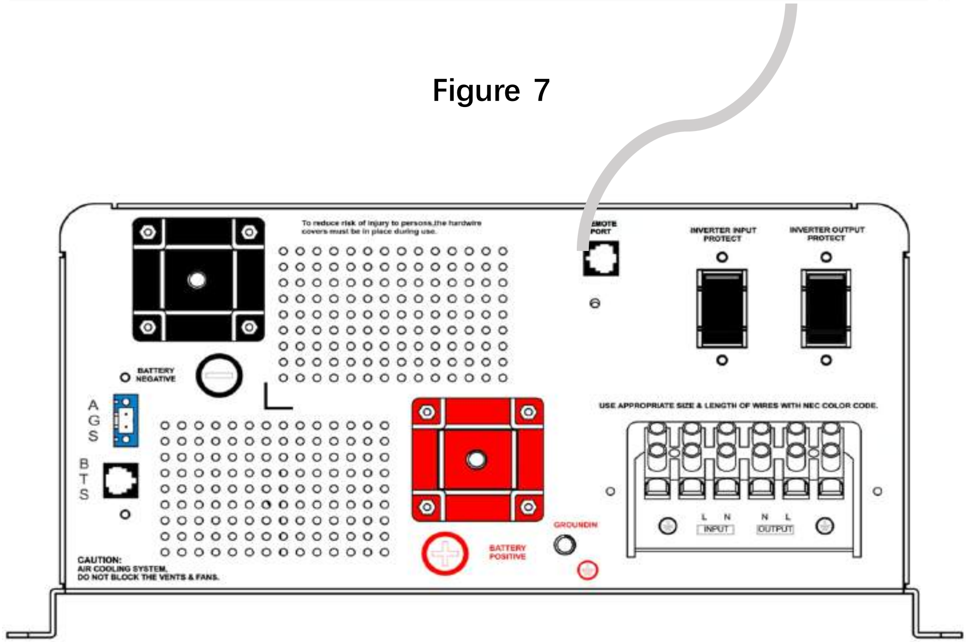


Figure 8

Power Saver

There are two different working statuses for our Ultra UL1741 inverter: "Power On" and "Power Off".
When the power switch on power switch panel (Figure 2) is in "Unit Off" position, the inverter is powered off.
When the power switch is turned to either of "Power Saver Auto" or "Power Saver Off", the inverter is powered on.
Power saver function is designed to conserve battery power when AC power is not or rarely required by the loads.
In this mode, the inverter pulses the AC output looking for an AC load (i.e., electrical appliance). Whenever an AC load (greater than 50 watts) is turned on, the inverter recognizes the need for power and automatically starts inverting and output goes to full voltage. When there is no load (or less than 50 watts) detected, the inverter automatically goes back into search mode to minimize energy consumption from the battery bank.
In "Power saver on" mode, the inverter will draw power mainly in sensing moments, thus the idle consumption is significantly reduced.
The inverter is factory defaulted to detect load for 250ms every 3 seconds. This power sensing can be customized to "Unit off charging" via the LCD setting. In the searching mode, the power draw to less than 25W

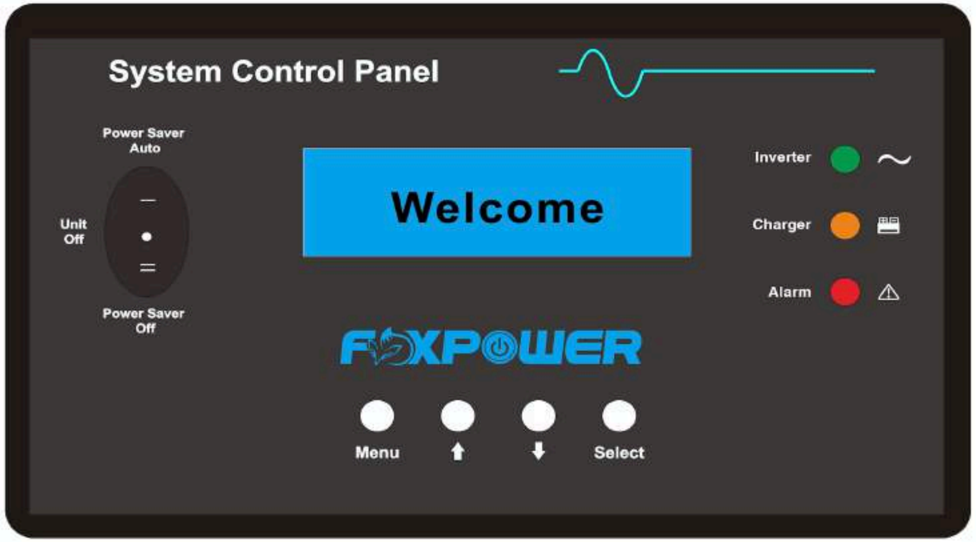


Figure 2

Power saver on

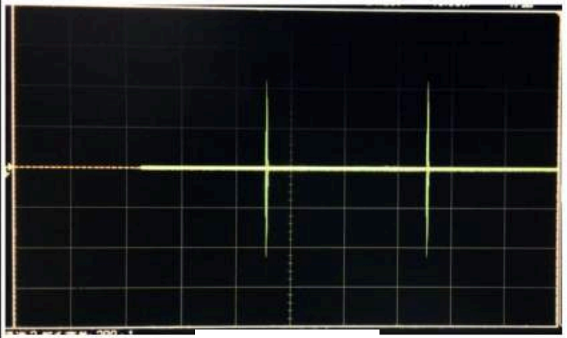


Figure 3

Power saver off

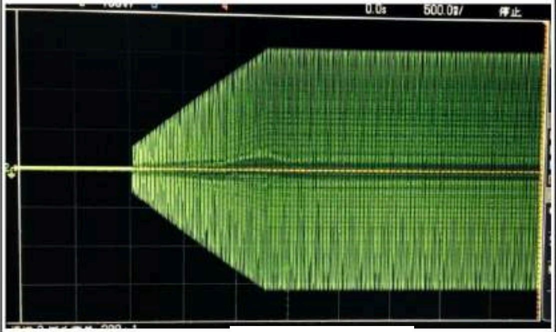


Figure 4

Power saver on (Load detected)

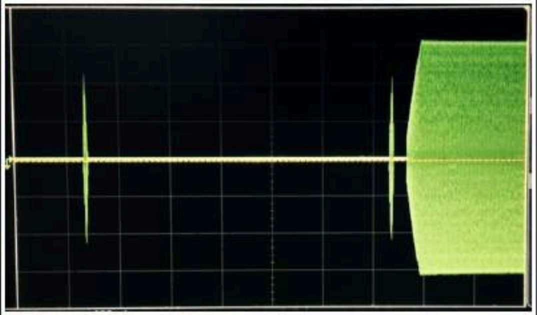


Figure 5

Audible Alarm

Battery Voltage Low	LCD displays "BATT LOW", and the buzzer beeps 0.5s every 5s
Battery Voltage High	LCD displays "BATT HIGH", and the buzzer beeps 0.5s every 1s and Fault after 60s
Inverter Mode Over-Load	(1) 110%<load<125% (±10%), No audible alarm in 14 minutes, Deeps 0.5s every 1s in 15th minutes and fault after 15 minutes; Fault LED on. (2) 125%<load<150% (±10%), Beeps 0.5s every 1s and Fault after 60s; Fault LED on. (3) Load>150% (±10%), Beeps 0.5s every 1s and Fault after 20s; Fault LED on
Over Temperature	Heatsink temp.⩾105ºC, Fault LED blinks and LCD Displays "Over temp", beeps 0.5s every 1s.

Fan Operation

The Operation of the DC fan at the DC terminal side is controlled by the following logic

Condition	Enter condition	Leave condition	Speed
Heat sink temperature	T⩽60ºC	T>65ºC	OFF
	65ºC⩽T<85ºC	T⩽60ºC/T⩾85ºC	50%
	T>85ºC	T⩽85ºC	100%
Charger Current	I ⩽ 15%	I ⩾20%	OFF
	20%<I⩽50%	I ⩽ 15%/ I⩾50%	50%
	I>50%	I⩽40%	100%
Load %	Load <30%	Load⩾30%	OFF
INV Mode	30%⩽Load<50%	Load⩽20%/Load⩾50%	50%
	Load⩾50%	Load⩽40%	100%

Allow at least 30CM of clearance around the inverter for air flow. Make sure that the air can circulate freely around the unit.
Variable speed fan operation is required in invert and charge mode. This is to be implemented in such a way as to ensure high reliability and safe unit and component operating temperatures in an operating ambient temperature up to 50°C.

- Speed to be controlled in a smooth manner as a function of internal temperature and/or current.
- Fan should not start/stop suddenly.
- Fan should run at minimum speed needed to cool unit.
- Fan noise level target <60db at a distance of 1m.

Battery voltage recovery start

After low battery voltage shut off (10V for 12V model/20V for 24V model), the inverter is able to restore to work after the battery voltage recovers to 13Vdc/26Vdc (with power switch still in the "On" position). This function helps to save the users extra labor to reactivate the inverter when the low battery voltage returns to an acceptable range in the renewable energy systems.

⚠ WARNING

Never leave the loads unattended, some loads (like a Heater) may cause accidents in such cases. It is better to shut everything off after low voltage trip than to leave your load in the risk of fire.

Conformal Coating

The entire line of inverters has been processed with a conformal coating on the PCB, making it water, rust, and dust resistant. While these units are designed to withstand corrosion from the salty air, they are not splash proof.

View of Front Panel (For FULAGDA1512T, FULAGDA2524T, FULAGDA3524T, FULAGDA4524T)

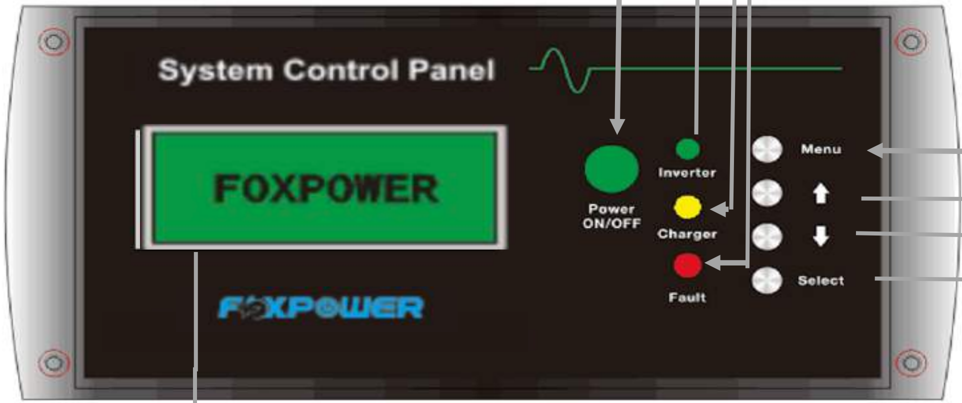
LED	Signification
Inverter Mode LED (Green)	Inverter Mode when LED is ON
Fault LED (Red)	Inverter fault when LED is ON
Charger Mode LED	LED Orange ON indicates Bulk Stage
	LED Orange blinking indicates Absorption Stage
	LED Green ON indicates Float Stage

Power ON/OFF

Inverter Mode LED

Charger Mode LED

Fault LED



Enter Key

Page Up

Page Down

Function/ESC Key

AC: Normal
I/P-V: 120V

1. AC Status & Input Voltage
"AC: abnormal" will be displayed when AC input is not qualified

O/P-V: 120V F: 60Hz
BAT-V: 24.0V

2. Output Voltage/Frequency and Battery Voltage

O/P Current: 100%

3. Output Current (Percentage)

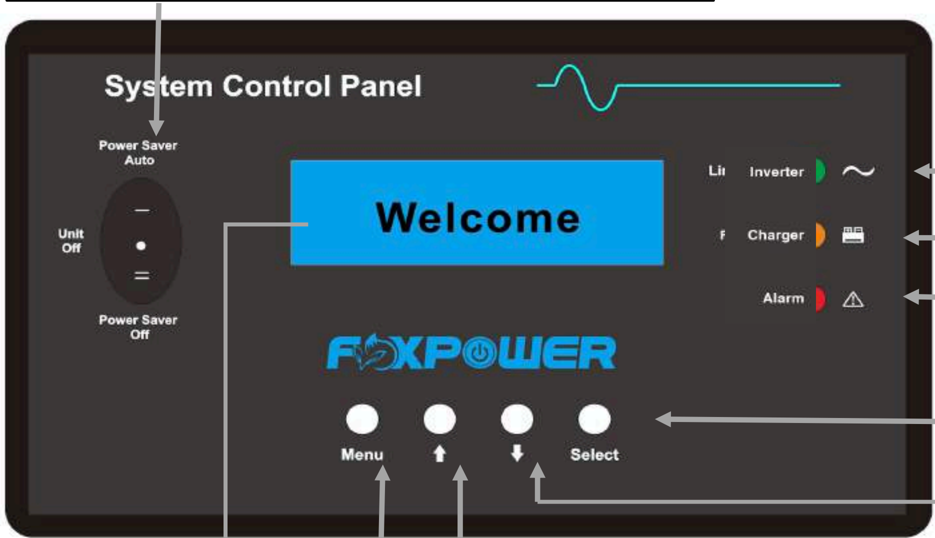
Setting Option	Battery Type	Charger Current	Bat Low S.D	Input Range	Battery Priority
1. Battery Type	1.Charger off	1. 100%	1. 10V	1. Narrow	1. Grid First
1.Battery Type	1.Charger off	1. 100%	1. 10V	1. Narrow	1. Grid First
2.Charger Current	2.Gel USA	2. 75%	2. 10.5V	2. Wide	2. Battery First
3.Bat Low S.D	3.AGM 1	3. 50%	3. 11V		
4.Input Range	4.AGM 2	4. 25%	4. 12V		
5.Battery Priority	5.Sealed Lead Acid				
	6.Gel Europe				
	7.Open Lead Acid				
	8.Calcium				
	9.Equalization				

Main Menu

Sub-Menu

View of Front Panel (For FULAGDA1512A, FULAGDA2524A, FULAGDA3524A, FULAGDA4524A, FULAGDA3548A, FULAGDA4548A, FULAGDA6048D, FULAGDA3524D, FULAGDA4524D, FULAGDA3548D, FULAGDA4548D)

Power ON/OFF:
1. Power Saver Auto: Turn on Unit and in Power Saver Mode
2. Unit off: Turn off unit



Inverter Mode LED

Charger Mode LED

Fault LED

LED	Signification
Inverter Mode LED (Green)	Inverter Mode when LED is ON
Fault LED (Red)	Inverter fault when LED is ON
Charger Mode LED	LED Orange ON indicates Bulk Stage
	LED Orange blinking indicates Absortion Stage
	LED Green ON indicates Float Stage

Enter Key

Page Down

Page Up

Function/ESC Key

Setting Option	Battery Type	Charger Current	Bat Low S.D	Input Range	Battery Priority
1. Battery Type	1.Charger off	1. 100%	1. 10V	1. Narrow	1. Grid First

Main Menu	Sub-Menu				
1.Battery Type	1.Charger off	1. 100%	1. 10V	1. Narrow	1. Grid First
2.Charger Current	2.Gel USA	2. 75%	2. 10.5V	2. Wide	2. Battery First
3.Bat Low S.D	3.AGM 1	3. 50%	3. 11V		
4.Input Range	4.AGM 2	4. 25%	4. 12V		
5.Battery Priority	5.Sealed Lead Acid				
	6.Gel Europe				
	7.Open Lead Acid				
	8.Calcium				
	9.Equalization				

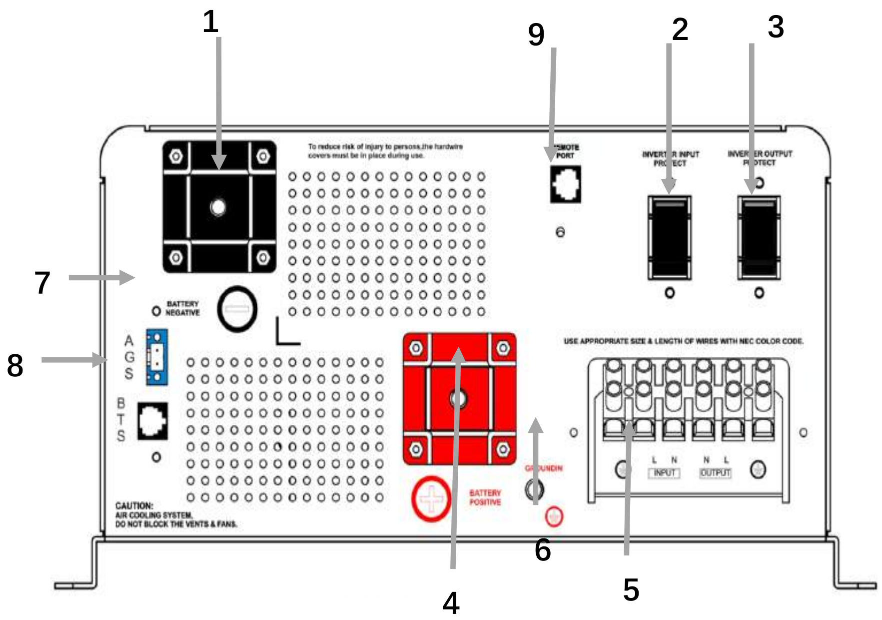
Main Menu

Sub-Menu

AC: Normal I/P-V: 120V	1. AC Status & Input Voltage "AC: abnormal" will be displayed when AC input is not qualified
O/P-V: 120V F: 60Hz BAT-V: 24.0V	2. Output Voltage/Frequency and Battery Voltage
O/P Current: 100%	3. Output Current (Percentage)

AC and DC Side Panels

The DC side of the Ultra UL1741 has the equipment ground lug, the positive (+) battery terminal, and the negative (-) battery terminal plus the remote network com port and battery temperature sensor com port.



Item	Description
1	**Negative (–) DC terminal** (black). Use a qualified personnel for connecting cables.
2	**AC Input Circuit Breaker** reset buttons
3	**AC Output Circuit Breaker** reset buttons
4	**Positive (+) DC terminal (red).** Use a qualified personnel for connecting cables.
5	**Terminal Block** provide access for AC cables (both input and output wiring).
6	**Chassis ground lug connects the chassis of the Trace UL1741 to your system's chassis grounding point. Use a qualified personnel for connecting wires.**
7	**Auto Generator Start (AGS)** Jack provides connection for the auto generator start
8	**Battery temperature Sensor (BTS)** jack provides connection for the battery temperature sensor (supplied).
9	**Remote (REM)** jack provides connection for the Ultra Sine Wave remote panel.

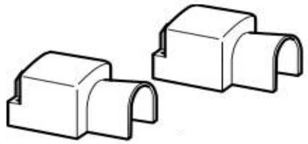
Materials List

The Ultra UL1741 ships with the following items:

- One Ultra UL1741 unit
- Installation Guides
- DC terminal covers (one red, one black)

NOTE: If any of the items are missing, contact customer service or any authorized Foxpower dealer for replacement.

IMPORTANT: Keep the carton and packing material in case you need to return the Ultra UL1741 for servicing.



Installation Information

Before You Begin the Installation

Before beginning your installation:

- Read the entire Installation Guide so you can plan the installation from beginning to end.
- Assemble all the tools and materials you require for the installation.
- Review the Important Safety Instructions on page iii
- Be aware of all safety and electrical codes which must be met.

⚠ DANGER

ELECTRICAL SHOCK AND FIRE HAZARDS

- All wiring should be done by qualified personnel to ensure compliance with all applicable installation codes and regulations.
- Disconnect all AC and DC power sources.
- Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

Failure to follow these instructions will result in death or serious injury.

Installation Codes

Applicable installation codes vary depending on the specific location and application of the installation. Some examples are:

- U.S. National Electrical Code (NEC)
- Canadian Electrical Code (CEC)
- Canadian Standards Association (CSA) and RV Industry Association (RVIA) for installation in RVs
- ABYC E11 - Alternating Current and Direct Current Electrical Systems on Boats
- ABYC A31 - Battery Chargers and Inverters

Planing the Installation

This section provides information to help you plan for a basic installation of the Ultra UL1741.

Two Key Performance Factors

Two key factors in particular will have a major impact on system performance.

Size and Length of DC Cables

To select the appropriate size and length of DC cables, see "Recommended Cable Sizes and Lengths and Fuse Size" on page 24. The DC cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. If there are long battery cables which are in excess of 10 feet each and not of sufficient size, the voltage drop across the cables will have a negative impact on overall system performance.

Mounting Location of the Ultra UL1741

To choose an appropriate location for mounting the inverter/charger, see "Step 1: Choosing a Location for the Inverter/Charger" on page 21.

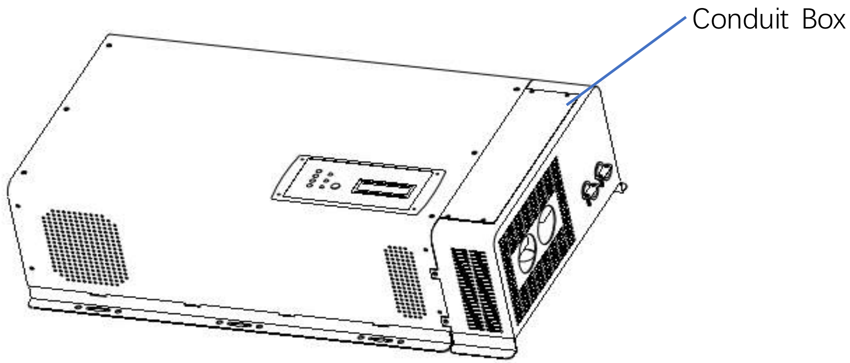
⚠WARNING
Must keep connecting with the utility when use the inverter charger

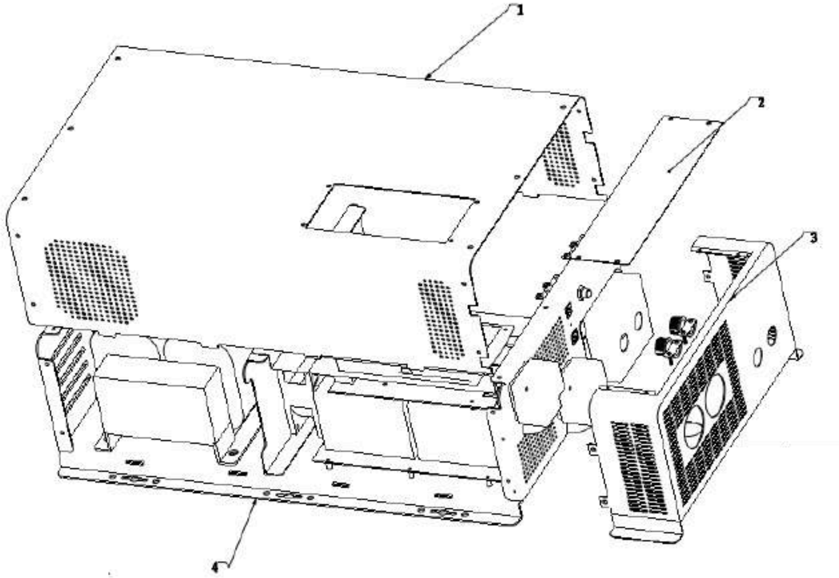
Planing Preparations

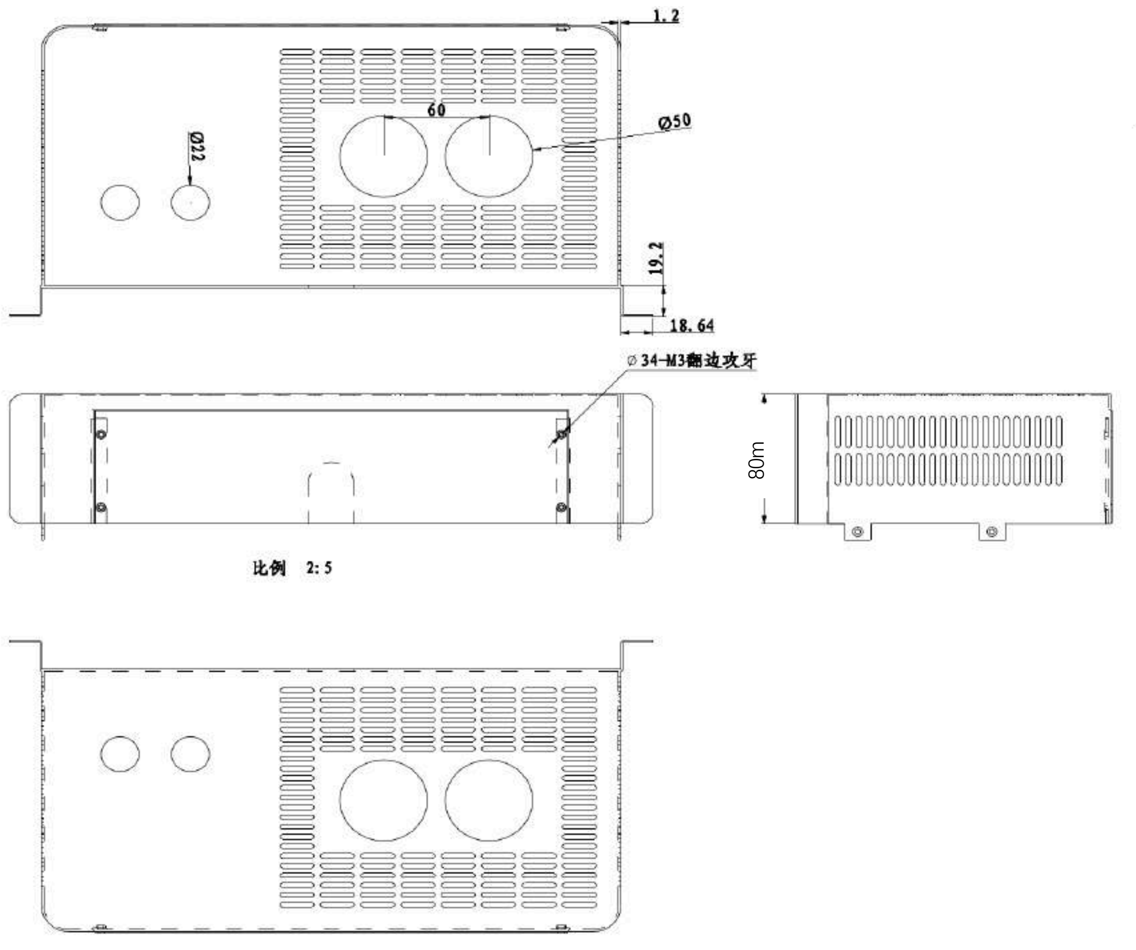
AC, DC, and Network Components

For a successful installation, you need to plan for AC, DC, and network components of the power system. The AC and DC components are described in this section and illustrated in Figure 9 on page 17.
AC components include:
• AC Input for Single AC Line Models
• AC Loads
• AC Disconnect and Over-Current Protection Device
• Distribution Panels
• AC Wiring
• AC Output Neutral Bonding DC components include:
• Batteries
• DC Cabling
• DC Disconnects and Over-Current Devices
• DC Grounding

Conduit Box Design







Basic Configulation

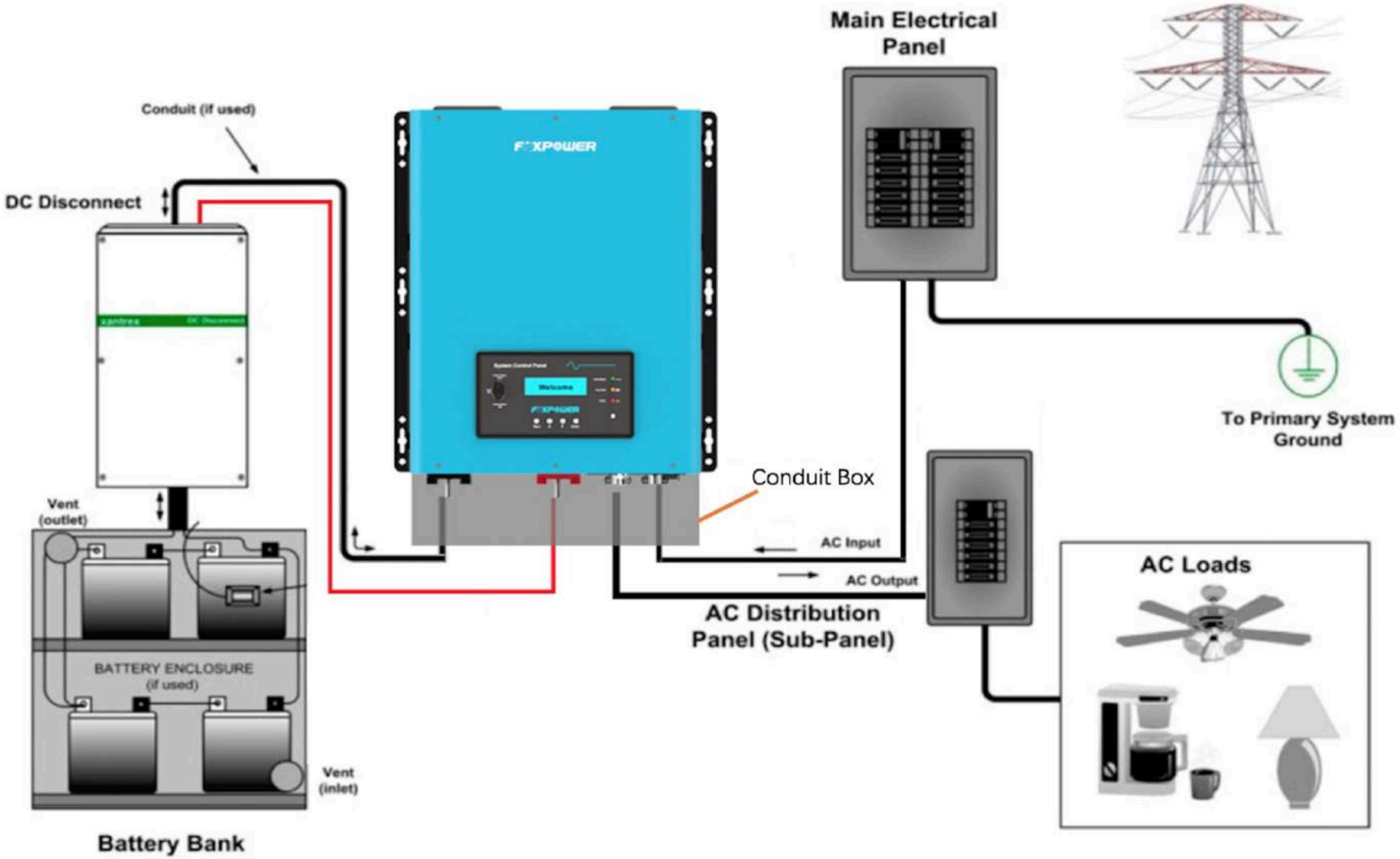


Figure 2-1 On-Grid Basic Configuration (Utility Backup)

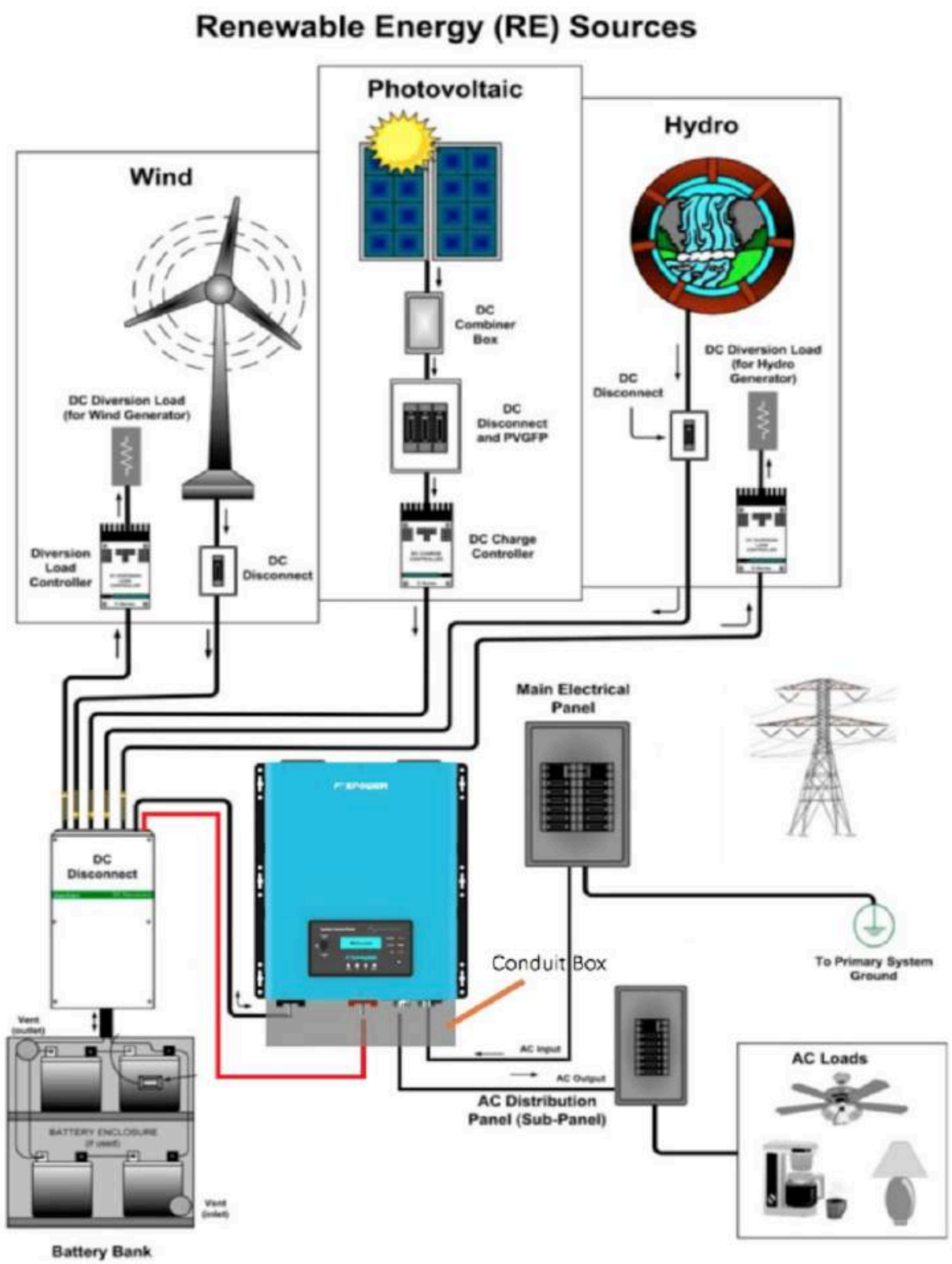


Figure 2-3 On-Grid Configuration - with Renewable Energy Sources

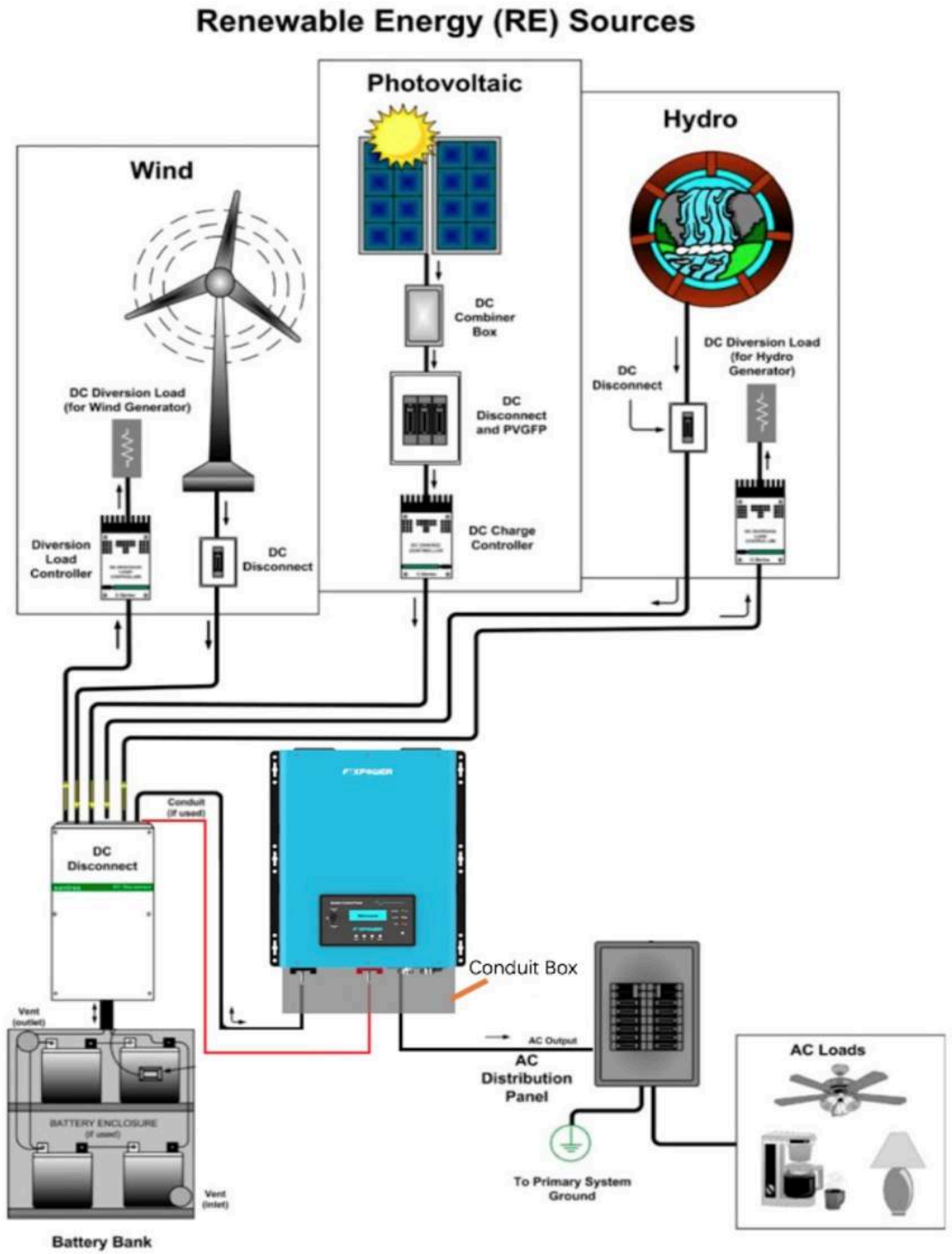


Figure 2-4 Off-Grid Configuration - with Renewable Energy Sources

Unpacking and Inspection the Ultra UL1741 Inverter/Charger

⚠ CAUTION

HEAVY ITEM

The Ultra UL1741 Inverter/Charger is heavy (see "Specification" on page 40). The unit is too heavy for one person to safely lift and mount. It is recommended that two people lift and mount the unit. Always use proper lifting techniques during installation to prevent personal injury.

Failure to follow these instructions can result in minor or moderate injury.

To unpack and inspect

Carefully remove the inverter/charger from its shipping package and inspect all contents. Verify the following items are included:

- The Ultra UL1741 Inverter/Charger
- Red and black DC terminal covers
- Ultra UL1741 Series Installation Manual

If items appear to be missing or damaged, contact our authorized dealer or us. If at all possible, keep your shipping box. It will help protect your inverter from damage if it ever needs to be returned for service. Save your proof-of-purchase as a record of your ownership; it will also be needed if the unit should require warranty work.

Installation Tools

You will need the following tools to install the Ultra UL1741 and the battery temperature sensor.

❒ Wire stripper
❒ Crimping tools for fastening lugs and terminals on DC cables
❒ Phillips screwdriver: #2
❒ Slot screwdriver (1/4" wide blade max.)
❒ Needle-nose pliers
❒ Wrench for DC terminals: 9/16"

Installation Materials

You will need the following materials to complete your installation:

❒ Rightly sized DC battery cables
❒ Terminals and/or crimp connectors for DC cables
❒ Copper wire for DC grounding: No. 8 AWG.
❒ Terminal or crimp connector for DC grounding cable (for 1/4" stud size)
❒ AC output and input wire.
❒ If the AC ground wire is stranded, each ground wire requires a ring terminal
❒ Six 1/4"–20 1.25" length steel screws or bolts to mount the inverters

Installation

Step 1. Choosing a Location for the Inverter/Charger

⚠ DANGER

FIRE AND EXPLOSION HAZARD

Do not install this equipment in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment because this equipment contains components that could produce arcs or sparks. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

HEAT HAZARD

Do not cover or obstruct the ventilation openings. Do not install this equipment in a compartment with limited airflow. Overheating may result.

Failure to follow these instructions can result in minor or moderate injury.

Follow all the local regulations to install the inverter.
Please install the equipment in an INDOOR location of Dry, Clean, Cool with good ventilation.
Working temperature: -10°C to 40°C(-14°Fto 104°F)
Storage temperature: -40 to 70°C(-40°Fto 158°F)
Relative Humidity: 0% to 95%, non-condensing
Cooling: Forced air

⚠ CAUTION

CAUTION: Some models of the inverters are heavy. Use proper lifting techniques during installation to prevent personal injury.

⚠ WARNING

The inverter should not be installed in an area that allows dust, fumes, insects or rodents to enter or block the inverter's ventilation openings.
This area also must be free from any risk of condensation, water or any other liquid that can enter or fall on the inverter.
The entire line of inverters has been processed with a conformal coating on the PCB, making it water, rust, and dust resistant.
While these units are designed to withstand corrosion from the salty air, they are not splash proof.
The inverter's life is uncertain if used in these types of environments, and inverter failures under these conditions are not covered under

Applicable installation codes vary depending on the specific location and application of the installation. Some examples are:

- The U.S. National Electrical Code (NEC)
- The Canadian Electrical Code (CEC)
- Canadian Standards Association (CSA) and RV Industry Association (RVIA) for installation in RVs.

Please follow the code that is in effect at the time of installation.

Step 2: Mounting the Inverter/Charger

Considerations

Before mounting the Ultra UL1741, take the following two factors into account.

1. The weight of the Ultra UL1741 inverter/charger requires two people to install it.
2. Mounting considerations are shown in Figure 10~Figure 13 on page21.

⚠ CAUTION
HEAVY LOAD HAZARD **• The Ultra UL1741 Inverter/Charger is heavy (see "Specifications" on page 40). Do not lift the unit by yourself. Use two people to lift and mount the unit. Always use proper lifting techniques during installation to prevent injury. • Make sure that the wall can support a load of up to 70 lbs (32 kg). • Do not install in plasterboard (drywall) using dywall anchors. Attach the unit to wall studs. Use appropriately sized screws depending on wall material and thickness. Failure to follow these instructions can result in minor or moderate injury.**

The Ultra UL1741 mounting orientations are shown in Figures on next page.

Mount your inverter/charger before you connect any wires or cables.

To mount the inverter/charger:

1. Remove the inverter/charger from its shipping container.
2. Verify that all components are present.
3. Select an appropriate mounting location and orientation. To meet regulatory requirements, the Ultra UL1741 must be mounted in one of the orientations shown in Figures on next page.
4. Mark the position of the mounting holes.
5. Pilot drill the six mounting holes.
6. Fasten the inverter/charger to the mounting surface with six 1/4" pan-head steel screws.

In order to mount the inverter securely, the surface and the mounting hardware must also be able to support at least twice the weight of the inverter. To meet regulatory safety requirements, the Ultra UL1741 Series must be mounted:

Figure 10

On a horizontal surface (shelf or table top) with top side up

After determining the mounting position, refer to the physical dimensions as shown in below figures or use the base of the inverter as a template to mark your mounting screw locations. After marking the mounting screw locations, mount the unit with appropriate mounting hardware.

Step 3: Connecting the AC Input and AC Output Wires

DANGER

FIRE, ELECTRICAL SHOCK, AND ENERGY HAZARDS

Make sure wiring being connected to the inverter/charger is de-energized by a breaker or switch upstream. Lockout/Tagout is a recommended practice by many electrical contractors. Always lockout and tag disconnect devices before making connections. All wiring must be done in accordance with local and national electrical wiring codes.

Failure to follow these instructions will result in death or serious injury.

General AC Wiring Considerations

AC and DC Wiring Separation Do not mix AC and DC wiring in the same conduit or panel. Consult the applicable installation code for details about DC wiring and AC wiring in vicinity to each other.

AC Input and Output Isolation The AC input and output circuits of this inverter/charger are isolated from each other when in invert mode to ensure safe operation. This isolation must be maintained in the installation, by being sure not to connect AC input and output wiring to a common point. For example, do not route the AC input and output neutrals to a common neutral bus. It is highly recommended to use a separate inverter load panel to distribute power to inverter loads. All wiring to this panel must be through the inverter/charger and none to the main panel upstream of the inverter/charger.

IMPORTANT: wiring the output inverter to back to the main panel could result in ground bonding to occur in multiple locations in contravention of applicable wiring codes and may result in nuisance tripping of Ground fault protection equipment. All wiring must be performed by a qualified electrician.

AC Wiring Compartment For your reference, the AC wiring compartment is shown in Figure 14 on page 23.

AC Knockouts There is one dual trade-size knockouts on the side panel for AC wiring. Use the same trade size of strain relief as the trade size of the knockout(s) you are using.

AC Wiring Terminals The AC wiring terminals accept cables of a specific size. See "AC Wiring" in the following table for required sizes.

Models	AC Input Breaker Size Used (A)	AC Input	AC output breaker size used (A)	AC Output
FULAGDA1512A/T	20 amps	#10 AWG	15 amps	#10 AWG
FULAGDA2524A/T	30 amps	#10 AWG	30 amps	#10 AWG
FULAGDA3524A/T	40 amps	#8 AWG	40 amps	#8 AWG
FULAGDA4524A/T	50 amps	#6 AWG	50 amps	#8 AWG
FULAGDA3548A	40 amps	#8 AWG	40 amps	#8 AWG
FULAGDA4548A	50 amps	#6 AWG	50 amps	#8 AWG
FULAGDA6048D	40 amps	#8 AWG	30 amps*2	#10 AWG
FULAGDA3524D	40 amps	#8 AWG	40 amps	#8 AWG
FULAGDA4524D	50 amps	#6 AWG	50 amps	#8 AWG
FULAGDA3548D	40 amps	#8 AWG	40 amps	#8 AWG
FULAGDA4548D	50 amps	#6 AWG	50 amps	#8 AWG

NOTICE

NOTICE: The torque value for terminal connections is 16 in-lbs (1.8nm)

Connecting AC Input and AC Output Wires (Single Phase)

Figure 14 shows the wiring compartment, which contains a terminal block (used to wire the AC input and AC output connections).

Figure 14 AC Wiring Compartment

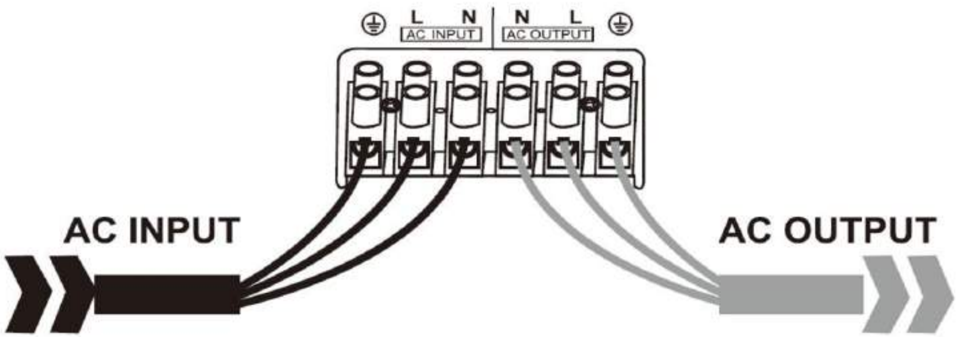


Figure 15 AC Wiring Compartment

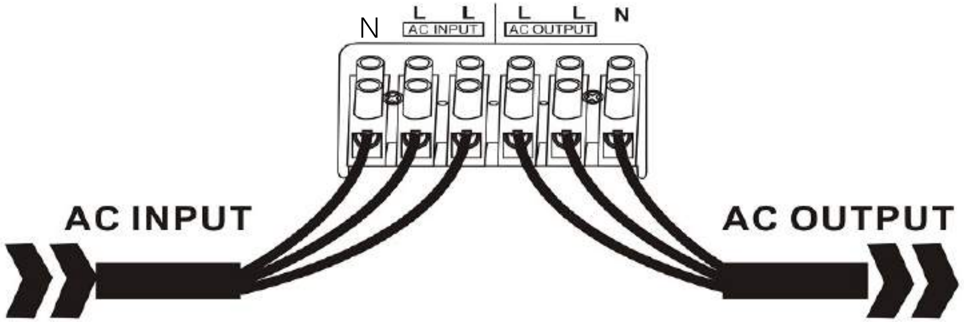
120V single phase
Input: Hot line+Neutral+Ground
Output: Hot line+Neutral+Ground

NOTICE
EQUIPMENT DAMAGE Connect wires to the correct terminals in the terminal block that is split into INPUT and OUTPUT sections. Damage may occur if the unit is wired incorrectly to the wrong terminals. Do not remove or loosen factory installed wiring. **Failure to follow these instructions can damage the unit and/or damage other equipment.**

To make the AC Input and AC Output connections:

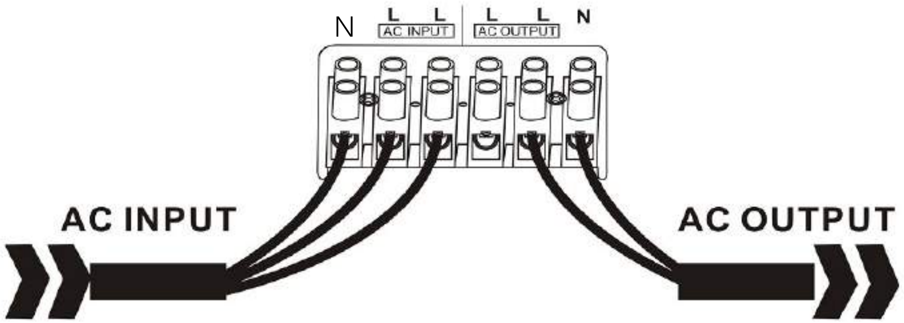
1. Locate the wiring compartment cover panel and remove the four screws.
2. Remove the cover panel from the unit to access the wiring compartment.
3. Remove one of the AC knockouts from the front or side of the unit. Do not leave the knockout inside the wiring compartment.
4. Run the AC wiring through the strain-relief clamp (Two strain-relief clamps are Installed in the AC knockout).
5. Strip approximately 2 inches (50 mm) off the jacket from the AC cable and separate the wires.
6. Using a 1/4" blade slot screwdriver, loosen the terminal screws on the terminals. Do not remove the screws.
7. Connect the line and neutral wires to the input/ouput terminals (labeled AC Input on the terminal block, Labeled AC Output on the terminal block, Figure 15).
8. Tighten the terminal screws. Leave some slack wire inside the wiring box.
9. Secure the strain-relief clamp on the AC input/output cable jacket.

Connecting AC Input and AC Output Wires (Split Phase)



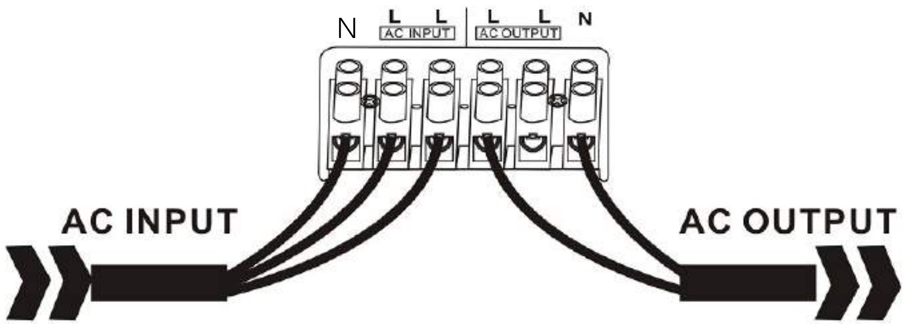
Daul-Phase Wiring

240Vac split phase
Input: Hot line + Hot Line + Ground
Output: Hot line + Hot Line + Neutral



Daul-Phase Wiring

120Vac split phase
Input: Hot line + Hot Line + Ground
Output: Hot line + Ground + Neutral
Remark: In such cases, each output hot line can only carry a half the rated capacity Max



Step 4: Connecting the DC Cables

DC Connection Precautions

⚠ DANGER

ELECTRICAL SHOCK HAZARD

Connect and disconnect DC wiring only after opening the disconnect switches or breakers at all AC and DC sources.

Failure to follow these instructions will result in death or serious injury.

Recommended Cable Sizes and Lengths and Fuse Size

It is suggested the battery bank be kept as close as possible to the inverter.
The following is a suggested wiring option for 3 meter DC cable.
Please find the following minimum wire size. In case of DC cable longer than 3m, please increase the cross section of cable to reduce the loss.

Models	Minimum Fuse Size (A)	Wire Gage
FULAGDA1512A/T	200	#3/0 AWG (90°C)
FULAGDA2524A/T	160	#1/0 AWG (90°C)
FULAGDA3524A/T	225	#4/0 AWG (90°C)
FULAGDA4524A/T	300	#250 Kcmil (90°C)
FULAGDA3548A	125	#2 AWG (90°C)
FULAGDA4548A	160	#1/0 AWG (90°C)
FULAGDA6048D	200	#3/0 AWG (90°C)
FULAGDA3524D	225	#4/0 AWG (90°C)
FULAGDA4524D	300	#250 Kcmil (90°C)
FULAGDA3548D	125	#2 AWG (90°C)
FULAGDA4548D	160	#1/0 AWG (90°C)

Please follow the above minimum wire size requirement.
One cable is always best, but if there is a problem obtaining the recommended size or larger cable, multiple smaller cables will work. Performance of any product can be improved by thicker cable and shorter runs, so if in doubt round up and keep the length as short as possible.

Battery cables must have crimped (or preferably, soldered and crimped) copper compression lugs unless aluminum mechanical lugs are used. Soldered connections alone are not acceptable. High quality, UL-listed battery cables are available .These cables are color-coded with pressure crimped, sealed ring terminals.

Battery terminal must be clean to reduce the resistance between the DC terminal and cable connection. A buildup of dirt or oxidation may eventually lead to the cable terminal overheating during periods of high current draw. Use a stiff wire brush and remove all dirt and corrosion from the battery terminals and cables.

Guidelines for Routing the DC Cables

Follow these guidelines to ensure maximum performance.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

• Route the cables away from sharp edges that might damage the insulation. Avoid sharp bends in the cable.
• Do not attempt to use the chassis in place of the battery negative connection for grounding. The inverter requires a reliable return path directly to the battery.
• To reduce the chance of radio frequency interference, keep the positive and negative cables close together—ideally, held together by straps, loom, or insulated clamps at regular intervals.
• To ensure maximum performance from the inverter/charger, do not route your DC cables through a DC distribution panel, battery isolator, or other device that will cause additional voltage drops. The exception is the DC fuse and Disconnect or the DC circuit breaker which is required at the battery to protect the DC wiring.
• To help avoid damage caused by reverse polarity battery connection, it is a good idea to mark each end of each cable to identify it as a positive (red) or negative (black) cable before routing the wiring.

Failure to follow these instructions can result in minor or moderate injury.

Connecting the DC Cables to the Inverter/Charger

⚠ WARNING

FIRE HAZARD

Use only appropriately sized copper cable. Loose connections, improper connections, and under-rated cables will overheat. Make sure that the supplied bolts on the inverter/charger are tightened to a torque of
15–16 ft-lbs (20.4–21.7 Nm). Torque all other connections to the manufacturer's specifications. Make sure the DC cable, washers, and bolt are assembled in the order shown in Figure 16.

Failure to follow these instructions can result in death or serious injury.

NOTICE

EQUIPMENT DAMAGE DUE TO REVERSE POLARITY

Before making the final DC connection or closing the DC breaker or disconnect, check cable polarity at both the battery and the inverter/charger. Positive (+) must be connected to positive (+). Negative (–) must be connected to negative (–).

Failure to follow these instructions can damage the unit and/or damage other equipment.

To connect the DC cables:

1. Route the DC cables from the battery bank to the inverter/ charger. Observe the "Guidelines for Routing the DC Cables" on page 25.

2. Install a DC fuse and disconnect switch or a DC circuit breaker between the inverter/charger and the battery. It must be installed in the positive side of the DC circuit, as close as possible to the battery.
This protects your battery and wiring in case of accidental shorting. See "Recommended Cable Sizes and Lengths and Fuse Size" on page 24 for required fuse or breaker size.

3. Open the DC disconnect switch or turn off the DC circuit breaker.

4. Connect one connector on the POSITIVE (+) cable to the POSITIVE DC terminal on the inverter/charger, as shown in Figure 16. The connector goes on first, then the flat washer (steel), lock washer (steel), and 3/8" bolt (brass).

5. Connect the other connector to the POSITIVE (+) terminal on the fuse or breaker. Observe polarity carefully while completing the installation.
Use a wrench to tighten the bolt to a torque of 15–16 ft-lbs (20.4–21.7 Nm) at the inverter/charger end. Observe the fuse holder or breaker manufacturer's recommendation at the other end.

6. Connect one connector on the NEGATIVE (–) cable to the NEGATIVE (–) DC terminal on the inverter/charger, as shown in Figure 16. The connector goes on first, then the flat washer (steel), lock washer (steel), and 3/8" bolt (brass).

7. Before proceeding, check that the cable polarity is correct: POSITIVE (+) on the inverter/charger is connected to the POSITIVE (+) on the battery, and NEGATIVE (–) cable is connected to the NEGATIVE (–) terminal on the inverter/ charger.

IMPORTANT: The next step is the last cable connection you need to make. A spark is normal when the DC disconnect switch is turned on or the DC circuit breaker is closed so be sure step #3 is done before proceeding.

8. Connect the other end of the cable to the NEGATIVE (–) terminal on the battery.
Use a wrench to tighten the bolt to a torque of 15–16 ft-lbs (20.4–21.7 Nm) at the inverter/charger end.

9. To protect the DC terminals, attach the DC terminal covers (Figure 17) to the inverter/charger, using the screws provided.

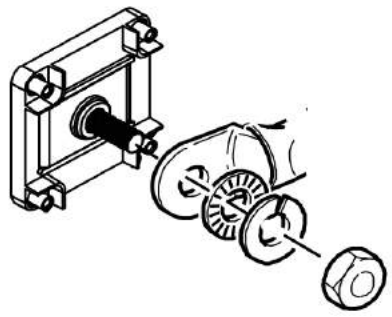


Figure 16 DC Cable Connections

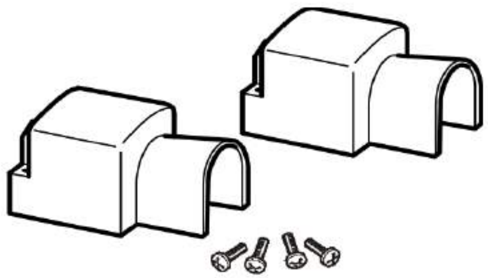


Figure 17 DC Terminal Covers

DC Grounding

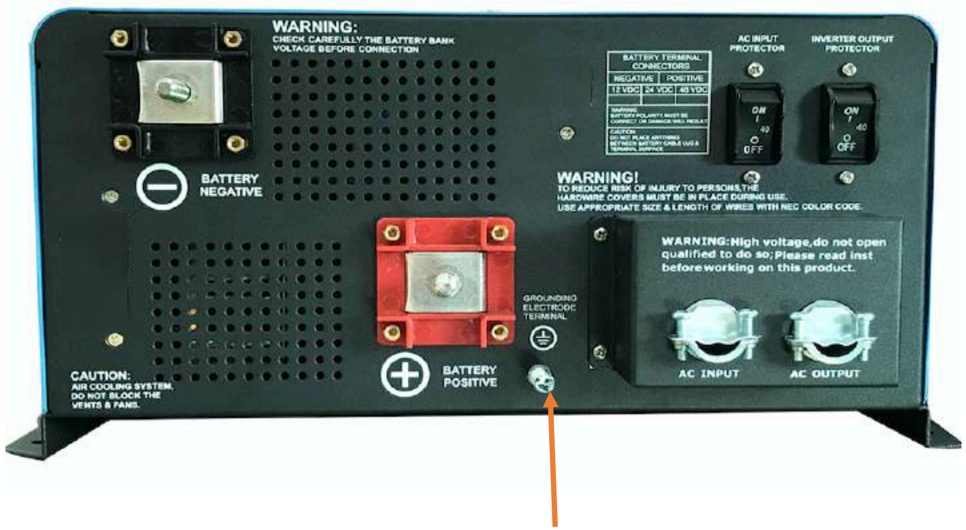
The Chassis Ground point on the inverter/charger is used to connect the chassis of the inverter/charger to your system’ s DC grounding point, as required by regulations for some installations. Use copper wire that is either bare or provided with green insulation.
The grounding guideline given below assumes you are using the code-compliant DC supply cable and fuse sizes indicated on page 24. If you are using different sizes, refer to the applicable code for DC grounding detail.

To connect the chassis ground:

1. Using the appropriate wrench, loosen the nut on the bolt of the chassis ground point shown in Figure 18.

2. Connect the grounding cable between the chassis ground point and the DC grounding point for your system.
In an RV or vehicle installation, the DC grounding point will usually be the vehicle chassis or a dedicated chassis ground bus.
For marine installations, refer to the applicable local code for marine DC grounding detail.

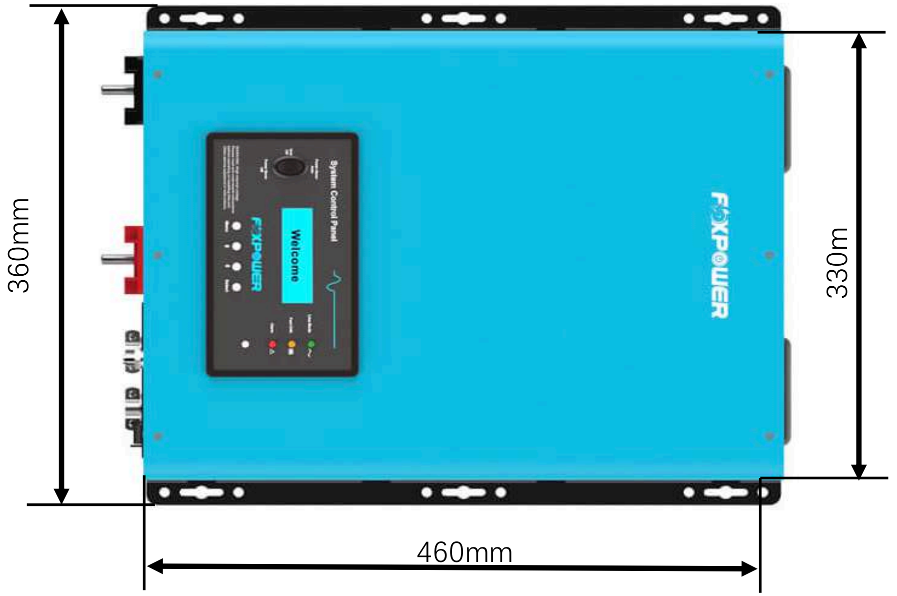
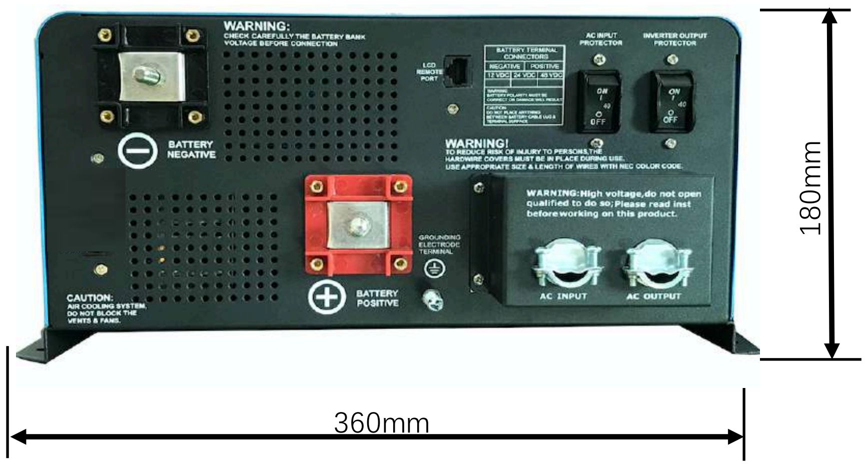
3. Tighten the nut to a torque of 1.0–1.25 ft-lbs (1.47–1.7 Nm).

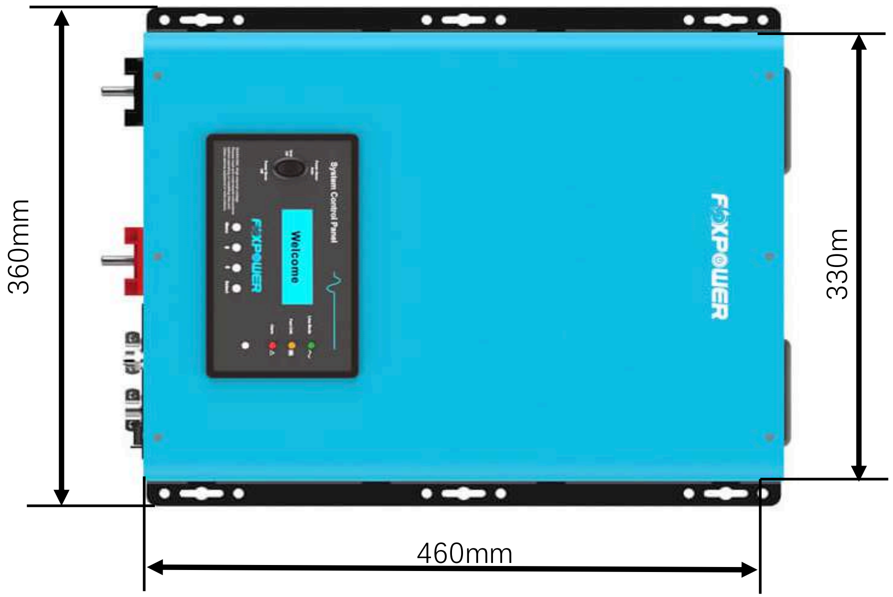


Chassis Grounding Point

Figure 18 DC Wiring and DC Grounding

Inverter/Charger Physical Specifications

	**Top View** (FULAGDA1512A, FULAGDA2524A, FULAGDA3524A, FULAGDA4524A, FULAGDA3548A, FULAGDA4548A)
	**Side View** (FULAGDA1512A, FULAGDA2524A, FULAGDA3524A, FULAGDA4524A, FULAGDA3548A, FULAGDA4548A)



Top View

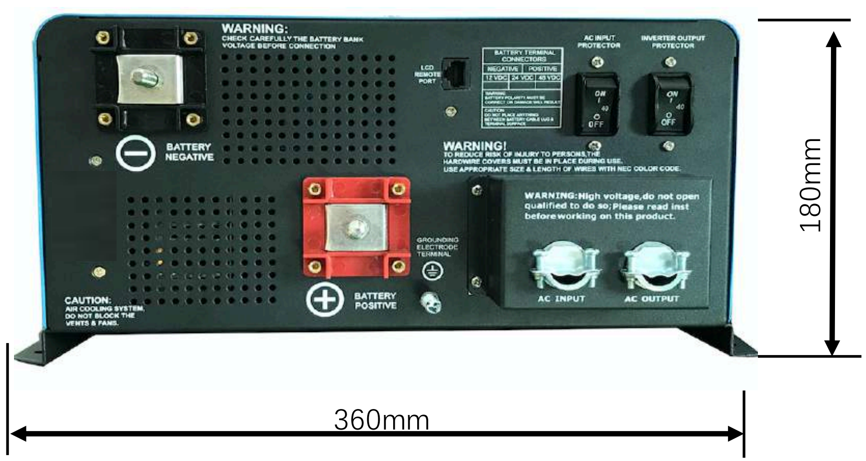
(FULAGDA3548D,FULAGDA4548D, FULAGDA6048D, FULAGDA3524D, FULAGDA4524D)

Side View

(FULAGDA3548D,FULAGDA4548D, FULAGDA6048D, FULAGDA3524D, FULAGDA4524D)

Top View

(For FULAGDA1512T, FULAGDA2524T, FULAGDA3524T, FULAGDA4524T)



Side View

(For FULAGDA1512T, FULAGDA2524T, FULAGDA3524T, FULAGDA4524T)

Battery Information

Battery Bank Sizing

Battery capacity   Battery size or capacity is just as important as the battery type selected for use with the Ultra UL1741. The batteries are the most important part of your system, so it is recommended that you purchase as much battery capacity as possible. A large battery will extend running time and ensure that your inverter/ charger delivers full rated surge.
It is recommended a minimum battery size of 200 amp-hours (Ah) for moderate loads (<1000W) and greater than 400 Ah for heavy loads.
See "Estimating Battery Requirements" for information on a more detailed calculation.
About Amp-hours A number of different standards are used to rate battery energy storage capacity. Automotive and marine starting batteries are normally rated in cranking amps. This is not a relevant rating for continuous loads like an inverter. Deep-cycle batteries use a more suitable rating system such as amp-hours (Ah).
Amp-hour capacity is the number of amps a battery can continuously deliver during a specified number of hours. It is represented by the product of the two —amps multiplied by hours.

A typical marine or RV battery rated for 100 Ah can deliver 5 amps for 20 hours (5 amps × 20 hours = 100 Ah). This same battery can deliver a higher or lower current for less or more time, limited approximately by the 100 Ah figure (50 amps for 2 hours or 200 amps for 1/2 hour), but usually the capacity figure given is only accurate for the specified duration (20 hours).
For Ultra UL1741 inverter systems requiring a 24-volt battery bank,

• A pair of 200 Ah@12 volts batteries may be connected in series to create a 24-volt bank of 200 Ah@24 volts capacity,

• While two of these series pair branches may be connected in parallel to create a higher capacity 400 Ah@24 volts battery bank.

Estimating Battery Requirements

Calculating Battery Size

Step 1: Compute Amp-hours
For each appliance, compute the number of amp-hours that will be used between charging cycles, as follows:
1. Obtain the wattage. If the wattage is marked on the nameplate rating, use that. Otherwise, multiply the marked voltage and amperage:
WATTS = VOLTS × AMPS.
2. Obtain the Watt-hours by multiplying that amount by the hours the appliance will be used:
WATT-HOURS = WATTS × HOURS.
3. Obtain the amp-hours that the appliance requires by dividing that amount by 10 (the factor for the Ultra UL1741, which is a 12-volt system):
BATTERY AMP-HOURS USED = AC WATT-HOURS/10
For example, a 100 W light bulb that is used for 4 hours will use 400 watt-hours (Wh) and the inverter will consume approximately 40 Ah from a 12 volt battery.
4. Enter this information on the blank calculation worksheet (page 33).

Step 2: Calculate Battery Size

5. Complete the rest of the worksheet; "Battery Sizing Example" on page 32 for an example.
Size the batteries at approximately twice the estimated total amp- hour usage. Doubling the expected amp-hour usage ensures that the batteries will not be overly discharged and extends battery life.
Do not skip this doubling step. More capacity is better since you will have more reserve capacity, be better able to handle large loads and surge loads, and your battery won't be discharged as deeply. Battery life is directly dependent on how deeply the battery is discharged. The deeper the discharge, the shorter the battery life.
Troubleshooting If you find that the system shuts down when appliances with large motors are started, the problem may be that this motor is too much for the battery. Even though you calculated the amp-hour requirements appropriately, the startup of a large motor makes high demands on the battery. You may find that adding more amp-hours (in the form of extra batteries or replacement with a bigger battery) solves the problem.

Battery Sizing Example

Applicance	(A) Power Consumption (Watts	(B) Operating Time per Day (Hours)	Daily watt-hours needed for this appliance (= A × B)
TV & VCR	200W	2 hours	400 Wh
Small microwave oven	800W	15 min = 1/4 hour	200 Wh
3 lamps, 60 W each	180W	4 hours	720 Wh
Coffee maker	600W	15 min = 1/4 hour	150 Wh
Hair dryer	1500W	6 min = 1/10 hour	150 Wh
Total daily watt-hours of AC load			1620 Wh

x Number of days between charges	3
=Total watt-hours of AC load between charges	4860 Wh
Battery Ah used between charges (divide by 10 for 12volt system; divide by 20 for 24 volt system	486 Ah
Recommended Battery Bank Size in Ah (multiply by 2)	972 Ah

This example illustrates how quickly your battery needs can escalate. To reduce the required battery bank size, you can either conserve energy by eliminating or reducing the use of some loads, or recharge more frequently.

Battery Banks

As your power requirements increase, you may need to use more than one battery to obtain sufficient capacity. Batteries can be connected in parallel, in series, or in series-parallel to create higher capacity systems.
See "Battery Cabling and Hook-up Configurations" on page 34 for more information about battery inter-connection schemes.

Mixing Batteries Batteries connected in parallel should be of the same type and amp-hour rating and from the same manufacturer.
It is not recommended to connect batteries of different types, amp- hour ratings or manufacturers. Improper charging and decreased battery life will result.

⚠ DANGER

EXPLOSION HAZARD

Do not mix different battery types within the same battery bank.

Failure to follow these instructions will result in death or serious injury.

Battery Bank Sizing Worksheet

The following worksheet is a guide to help you determine your battery needs. Be generous in estimating the time for which you will run each of the loads to ensure sufficient battery capacity.

Battery Sizing Worksheet

Applicance	(A) Power Consumption (Watts	(B) Operating Time per Day (Hours)	Daily watt-hours needed for this appliance (= A × B)
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
Total daily watt-hours of AC load			Wh

x Number of days between charges	
=Total watt-hours of AC load between charges	Wh
Battery Ah used between charges (divide by 10 for 12volt system; divide by 20 for 24 volt system	Ah
Recommended Battery Bank Size in Ah (multiply by 2)	Ah

Battery Cabling and Hook-up Configurations

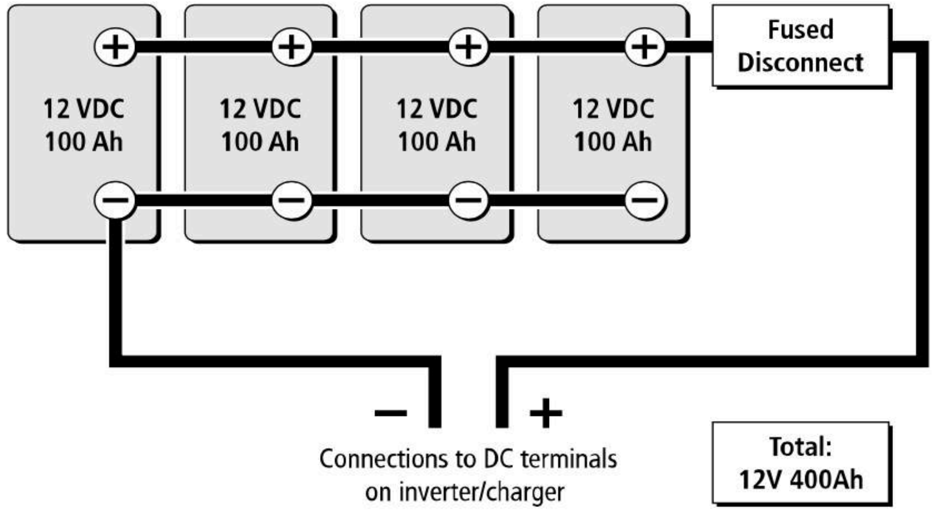
Several smaller batteries can be connected to create a battery bank of substantial size. You can connect batteries in three ways: in parallel, series, or series-parallel.

To make a larger battery bank, connect individual batteries with heavy cables. The actual size of the cable depends on whether the batteries are connected in parallel or series. Generally, the cable should not be smaller than the inverter cables—if the main cables are 4/0 AWG, the battery interconnects should be 4/0 AWG.

The best configuration is to connect the batteries in series and parallel. This requires additional cables, but reduces imbalances in the battery bank and can improve the overall performance. Consult your battery supplier for more information regarding the hook-up configuration required for your system.

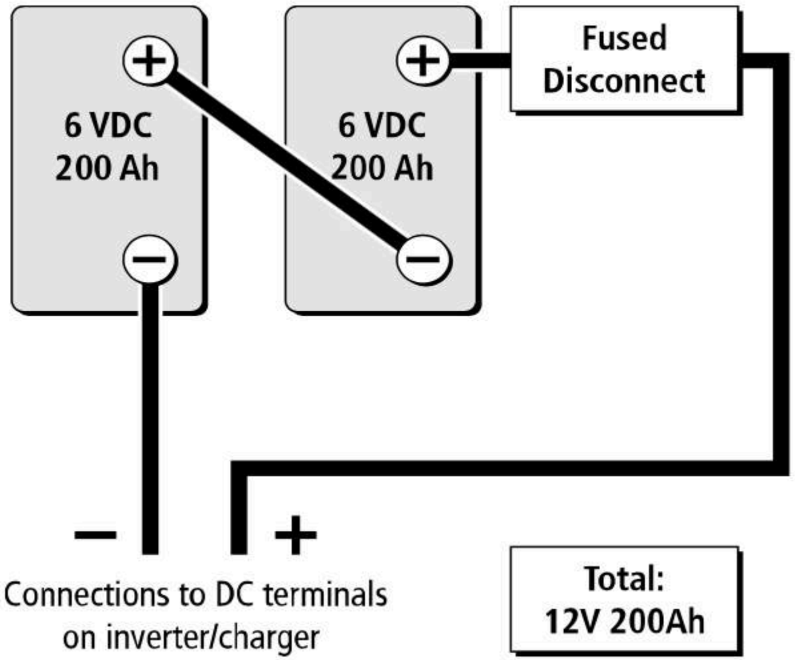
Battery Parallel Connection

Batteries are connected in parallel when all the positive terminals of a group of batteries are connected and then, separately, all the negative terminals are connected. In a parallel configuration, the battery bank has the same voltage as a single battery, but an Ah rating equal to the sum of the individual batteries. See below.



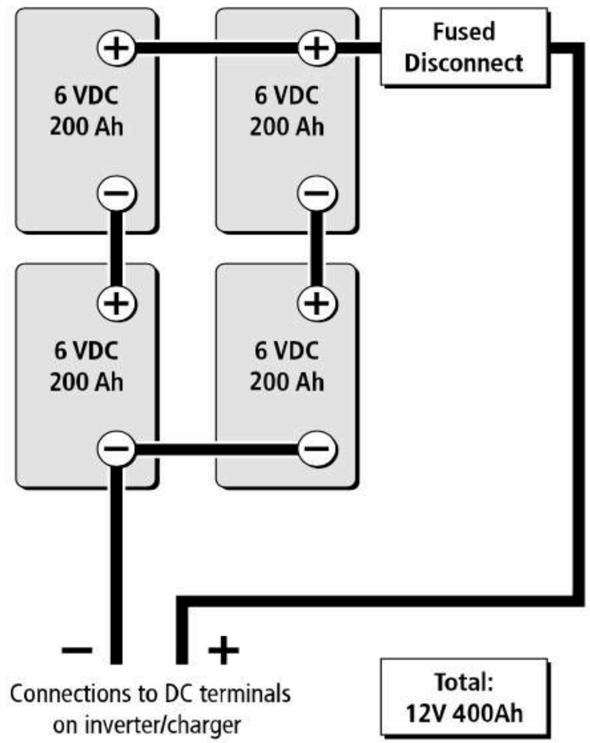
Battery Series Connection

When batteries are connected with the positive terminal of one battery to the negative terminal of the next battery, they are connected in series. In a series configuration, the battery bank has the same Ah rating of a single battery, but an overall voltage equal to the sum of the individual batteries. See below.



Battery Series-Parallel Connections

As the name series-parallel implies, both the series and parallel configurations are used in combination. The result is an increase in both the voltage and the capacity of the total battery bank. This is common with all battery-inverter system voltages. The smaller, lower voltage batteries are first connected in series to obtain the necessary voltage, and then these "batteries connected in series" sets are connected in parallel to increase the battery bank capacity. See below.



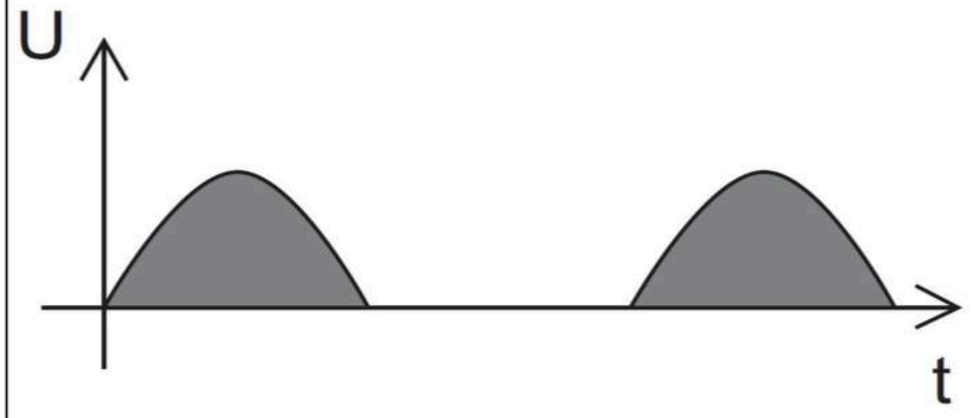
Troubleshooting Guide

Troubleshooting contains information about how to troubleshoot possible error conditions while using the Ultra UL1741 Series Inverter Charger

Symptom	Possible Cause	Recommended Solution
Inverter will not turn on during initial power up	Batteries are not connected, loose battery-side connections. Low battery voltage.	Check the batteries and cable connections. Check DC fuse and breaker. Charge the battery.
No AC output voltage and no indicator lights ON.	Inverter has been manually transitioned to OFF mode.	Press the switch to Power saver on or Power saver off position.
AC output voltage is low and the inverter turns loads OFF in a short time.	Low battery	Check the condition of the batteries and recharge if possible.
Charger is inoperative and unit will not accept AC.	AC voltage has dropped out-of-tolerance	Check the AC voltage for proper voltage and frequency.
Charger is supplying a lower charge rate.	Charger controls are improperly set. Low AC input voltage. Loose battery or AC input connections.	Refer to the section on adjusting the "Charger Rate". Source qualified AC power.. Check all DC /AC connections.
Charger turns OFF while charging from a generator.	High AC input voltages from the generator.	Load the generator down with a heavy load. Turn the generator output voltage down.
Sensitive loads turn off temporarily when transferring between grid and inverting.	Inverter's Low voltage trip voltage may be too low to sustain certain loads.	Choose narrow AC voltage in the LCD setting, or Install a UPS if possible.
Noise from Transformer/case*	Applying specific loads such as hair drier	Remove the loads

*The reason for the noise from transformer and/or case**

When in inverter mode sometimes the transformer and/or case of the inverter may vibrate and make noise. If the noise comes from transformer: According to the characteristics of our inverter, there is one type of load which most likely may cause rattles of transformer.
That is a half wave load: A load that uses only half a cycle of the power. This tends to cause an imbalance of the magnetic field of the transformer, reducing its rated working freq from 20KHz to, say, maybe 15KHz (it varies according to different loads). In such a case the frequency of noise falls exactly into the range (200Hz-20KHz) that human ears can hear.
The most common load of such kind is a hair drier.
If the noise comes from the case:
Normally when loaded with inductive loads, the magnetic field generated by the transformer keeps attracting or releasing the steel case at a specific freq, this may also cause noise.
Reducing the load power or using an inverter with bigger capacity will normally solve this problem.
The noise will not do any harm to the inverter or the loads.



Half Cycle Load Waveform

Specification

Electrical Specifications - Inverter	FULAGDA1512A FULAGDA1512T	FULAGDA2524A FULAGDA2524T	FULAGDA3524A FULAGDA3524T	FULAGDA4524A FULAGDA4524T	FULAGDA3548A	FULAGDA4548A	FULAGDA6048D
Coninuous output power	1500W	2500W	3500W	4500W	3500W	4500W	6000W(240Vac) 3000W(120Vac)
Surge Rating (20s)	4500W	7500W	10500W	13500W	10500W	13500W	18000W(240vac) 9000W (120vac)
Capable of starting electric motor	1.5HP	2HP	3HP	4HP	3HP	4HP	5HP (240vac) 2HP (120vac)
Output waveform	Pure sine wave/same as input(bypass mode)						
Nominal efficieny	>88% (peak)						
Line mode efficiency	>95%						
Power factor	0.9-1.0						
Nominal output voltage	120Vac						120/240Vac
Output voltage regulation	±10% RMS						
Output frequency	50/60Hz±0.3Hz						
Short Circuit Protection	Yes, current limit function (fault after 1 sec)						
Power consumption- invertering (no load)	3.5Adc	3.5Adc	4.0Adc	4.0Adc	2.0Adc	2.0Adc	3.5Adc
Power consumption- searching mode	<1.4Adc	<1.4Adc	<1.6Adc	<1.6Adc	<0.5Adc	<0.5Adc	<1.05Adc
Transfer time	10ms (max)						
Total harmonic distortion (THD)	<3%	<3%	<3%	<3%	<3%	<3%	<3%
Electrical Specifications - DC Input	**FULAGDA1512A FULAGDA1512T**	**FULAGDA2524A FULAGDA2524T**	**FULAGDA3524A FULAGDA3524T**	**FULAGDA4524A FULAGDA4524T**	**FULAGDA3548A**	**FULAGDA4548A**	**FULAGDA6048D**
Nominal input voltage	12.0Vdc	24.0Vdc			48.0Vdc		
Minimum start voltage	10.0Vdc	20.0Vdc			40.Vdc		
Low battery alarm	10.5/11/11.5/12.5Vdc	21/22/23/25Vdc			42/44/46/50Vdc		
Low battery trip	10/10.5/11/12Vdc	20/21/22/24Vdc			40/42/44/48Vdc		
High voltage alarm & fault	16.0Vdc	32.0Vdc			64.0Vdc		
High DC input recovery	15.5Vdc	31.0Vdc			62.0Vdc		
Low battery voltage recovery	13.0Vdc	26.0Vdc			52.0Vdc		
Full load operation DC range	10.5~15.0Vdc	21.0~30.0Vdc			42.0~60.0Vdc		

Electrical Specifications - Charger	FULAGDA1512A FULAGDA1512T	FULAGDA2524A FULAGDA2524T	FULAGDA3524A FULAGDA3524T	FULAGDA4524A FULAGDA4524T	FULAGDA3548A	FULAGDA4548A	FULAGDA6048D
Input voltage range	Narrow: 100-145Vac; Wide: 90-145Vac						200-254Vac/150-260Vac
Input frequency range	Narrow:47-55±0.3Hz for 50Hz,57-65±0.3Hz for 60Hz						
Input frequency range	Wide: 42-70±0.3Hz plus for 50Hz/60Hz						
Max charge current	50A	40A	50A	60A	25A	30A	55A
Charger efficiency	80%						
Over charge current shutdown	15.7V	31.4V	31.4V	31.4V	62.8V	62.8V	62.8V
Output voltage (Battery Type)	Absorption mode (Vdc)		Float mode (Vdc)				
	*2 for 24Vdc; *4 for 48Vdc						
Output voltage (Gel U.S.A)	14		13.7				
Output voltage (A.G.M 1)	14.1		13.4				
Output voltage (A.G.M 2)	14.6		13.7				
Output voltage (Sealed lead acid)	14.4		13.6				
Output voltage (Gel Euro)	14.4		13.8				
Output voltage (Open lead acid)	14.8		13.3				
Output voltage (Calcium)	15.1		13.6				
Output voltage (De-sulphation)	15.5 for 4hrs		15.5 for 4hrs				

Electrical Specifications - Bypass & protection	FULAGDA1512A FULAGDA1512T	FULAGDA2524A FULAGDA2524T	FULAGDA3524A FULAGDA3524T	FULAGDA4524A FULAGDA4524T	FULAGDA3548A	FULAGDA4548A	FULAGDA6048D
Input voltage waveform	Sine wave (grid or generator)						
Nominal voltage	120Vac						240Vac
Low voltage trip (Wide/Narrow)	78V/92V±4%						140V/190V±4%
Low voltage re-engage (Wide/Narrow)	83V/97V±4%						150V/200V±4%
High voltage trip	140V±4%						270V/264V±4%
High voltage re-engage	135V±4%						260V/254V±4%
Max AC input voltage	150Vac						300Vac
Nominal input frequency	50Hz or 60Hz (auto detect)						
Low frequency trip	Narrow: 47±0.3Hz for 50Hz, 57±0.3Hz for 60Hz						
Low frequency trip	Wide: 40±0.3Hz for 50Hz/60Hz						
Low frequency re-engage	Narrow: 48±0.3Hz for 50Hz, 58±0.3Hz for 60Hz						
Low frequency re-engage	Wide: 452±0.3Hz for 50Hz/60Hz						
High frequency trip	Narrow: 55±0.3Hz for 50Hz, 65±0.3Hz for 60Hz						
High frequency trip	Wide: 70±0.3Hz for 50Hz/60Hz						
High frequency re-engage	Narrow: 54±0.3Hz for 50Hz, 64±0.3Hz for 60Hz						
High frequency re-engage	Wide: 68±0.3Hz for 50Hz/60Hz						
Output short circuit protection	Breaker						

Electrical Specifications - General	FULAGDA1512A FULAGDA1512T	FULAGDA2524A FULAGDA2524T	FULAGDA3524A FULAGDA3524T	FULAGDA4524A FULAGDA4524T	FULAGDA3548A	FULAGDA4548A	FULAGDA6048D
Mounting method	Versatile mounting						
Display	LCD+LED status display						
Warranty	2 Years						
Automatic Generator Start (AGS)	Yes						
Battery termperature sensor	Option						
Remote control panel	Option						
Regulatory and environment compliance	UL & c-UL certificated to CSA 107.1, UL1741						
Inverter dimensions (L*W*H)	460mm*328mm*178mm						
Inverter weight (kg)	23		26.5		25.5		31.5
Shipping dimensions (L*W*H)	580mm*450mm*285mm						
Shipping weight (kg)	28		31.5		30.5		36.5
Working temperature	0-40C°						
Storage temperature	0-70C°						

Specification

Electrical Specifications - Inverter	FULAGDA3524D	FULAGDA4524D	FULAGDA4548D	FULAGDA4548D
Coninuous output power	3500W (240Vac) 1750W (120Vac)	4500W (240Vac) 2250W (120vac)	3500W (240Vac) 1750W (120Vac)	4500W (240Vac) 2250W (120vac)
Surge Rating (20s)	10500W (240vac) 5250W (120Vac)	13500W (240vac) 6750W (120Vac)	10500W (240vac) 5250W (120Vac)	13500W (240vac) 6750W (120Vac)
Capable of starting electric motor	3HP (240vac) 1HP (120Vac)	4HP (240vac) 2HP (120Vac)	3HP (240vac) 1HP (120Vac)	4HP (240vac) 2HP (120Vac)
Output waveform	Pure sine wave/same as input(bypass mode)			
Nominal efficieny	>88% (peak)			
Line mode efficiency	>95%			
Power factor	0.9-1.0			
Nominal output voltage	120/240Vac			
Output voltage regulation	±10% RMS			
Output frequency	50/60Hz±0.3Hz			
Short Circuit Protection	Yes, current limit function (fault after 1 sec)			
Power consumption- invertering (no load)	4.0Adc	4.0Adc	2.0Adc	2.0Adc
Power consumption- searching mode	<1.6Adc	<1.6Adc	<0.5Adc	<0.5Adc
Transfer time	10ms (max)			
Total harmonic distortion (THD)	<3%	<3%	<3%	<3%

Electrical Specifications - DC Input	**FULAGDA3524D**	**FULAGDA4524D**	**FULAGDA3548D**	**FULAGDA4548D**
Nominal input voltage	24.0Vdc		48.0Vdc	
Minimum start voltage	20.0Vdc		40.Vdc	
Low battery alarm	21/22/23/25Vdc		42/44/46/50Vdc	
Low battery trip	20/21/22/24Vdc		40/42/44/48Vdc	
High voltage alarm & fault	32.0Vdc		64.0Vdc	
High DC input recovery	31.0Vdc		62.0Vdc	
Low battery voltage recovery	26.0Vdc		52.0Vdc	
Full load operation DC range	21.0~30.0Vdc		42.0~60.0Vdc	
Electrical Specifications - Charger	**FULAGDA3524D**	**FULAGDA4524D**	**FULAGDA3548D**	**FULAGDA4548D**
Input voltage range	200-254Vac/150-260Vac			
Input frequency range	Narrow:47-55±0.3Hz for 50Hz,57-65±0.3Hz for 60Hz			
Input frequency range	Wide: 42-70±0.3Hz plus for 50Hz/60Hz			
Max charge current	50A	60A	25A	30A
Charger efficiency	80%			
Over charge current shutdown	31.4V	31.4V	62.8V	62.8V
Output voltage (Battery Type)	Absorption mode (Vdc)	Float mode (Vdc)	Absorption mode (Vdc)	Float mode (Vdc)
Output voltage (Gel U.S.A)	28	27.4	56	54.8
Output voltage (A.G.M 1)	28.2	26.8	56.4	53.6
Output voltage (A.G.M 2)	29.2	27.4	58.4	54.8
Output voltage (Sealed lead acid)	28.8	27.2	57.6	54.4
Output voltage (Gel Euro)	28.8	27.6	57.6	55.2
Output voltage (Open lead acid)	29.6	26.6	59.2	53.2
Output voltage (Calcium)	30.2	27.2	60.4	54.4
Output voltage (De-sulphation)	31 for 4hrs	31 for 4hrs	62 for 4hrs	62 for 4hrs

Electrical Specifications - Bypass & protection	FULAGDA3524D	FULAGDA4524D	FULAGDA3548D	FULAGDA4548D
Input voltage waveform	Sine wave (grid or generator)			
Nominal voltage	240Vac			
Low voltage trip (Wide/Narrow)	140V/190V±4%			
Low voltage re-engage (Wide/Narrow)	150V/200V±4%			
High voltage trip	270V/264V±4%			
High voltage re-engage	260V/254V±4%			
Max AC input voltage	300Vac			
Nominal input frequency	50Hz or 60Hz (auto detect)			
Low frequency trip	Narrow: 47±0.3Hz for 50Hz, 57±0.3Hz for 60Hz			
Low frequency trip	Wide: 40±0.3Hz for 50Hz/60Hz			
Low frequency re-engage	Narrow: 48±0.3Hz for 50Hz, 58±0.3Hz for 60Hz			
Low frequency re-engage	Wide: 452±0.3Hz for 50Hz/60Hz			
High frequency trip	Narrow: 55±0.3Hz for 50Hz, 65±0.3Hz for 60Hz			
High frequency trip	Wide: 70±0.3Hz for 50Hz/60Hz			
High frequency re-engage	Narrow: 54±0.3Hz for 50Hz, 64±0.3Hz for 60Hz			
High frequency re-engage	Wide: 68±0.3Hz for 50Hz/60Hz			
Output short circuit protection	Breaker			
Electrical Specifications - General	**FULAGDA3524D**	**FULAGDA4524D**	**FULAGDA3548D**	**FULAGDA4548D**
Mounting method	Versatile mounting			
Display	LCD+LED status display			
Warranty	2 Years			
Automatic Generator Start (AGS)	Yes			
Battery termperature sensor	Option			
Remote control panel	Option			
Regulatory and environment compliance	UL & c-UL certificated to CSA 107.1, UL1741			
Inverter dimensions (L*W*H)	460mm*328mm*178mm			
Inverter weight (kg)	23	23	26.5	26.5
Shipping dimensions (L*W*H)	580mm*450mm*285mm			
Shipping weight (kg)	32	32	32	32
Working temperature	0-40C°			
Storage temperature	0-70C°			

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