TPH Series Transformer based 3 Phase Pure Sine Wave Inverter Charger 48V to 120/208Vac, 220/380Vac & 277/480vac 6KW to 45KW User's Manual Version 2.0

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1. Important Safety Information

WARNING!

This manual contains important instructions for all TPH Inverter/Charger models that shall be followed during installation and maintenance of the inverter.

1-1. General Safety Precautions

1. Before installing and using the TPH Inverter/Charger, read all instructions and cautionary markings on the TPH Inverter /Charger and all appropriate sections of this guide. Be sure to read all instructions and cautionary markings for any equipment attached to this unit.
2. This unit is designed for indoor use only. Do not expose the TPH Inverter/Charger to rain, snow, or spray.
3. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the TPH Inverter/Charger in a zero-clearance compartment. Overheating may result.
4. Use only attachments recommended or sold by the manufacturer. Doing otherwise may result in a risk of fire, electric shock, or injury to persons.
5. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the TPH Inverter/Charger with damaged or substandard wiring.
6. Do not operate the TPH Inverter/Charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the TPH Inverter/Charger is damaged, see the Warranty section.
7. Do not disassemble the TPH Inverter/Charger. It contains no user-serviceable parts. See Warranty for instructions on obtaining service. Attempting to service the TPH Inverter/Charger yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
8. The TPH Inverter contains more than one live circuit (batteries and AC line). Power may be present at more than one source. To reduce the risk of electrical shock, disconnect both AC and DC power from the TPH Inverter/Charger before attempting any maintenance or cleaning or working on any circuits connected to the TPH Inverter/Charger. Turning off controls will not reduce this risk.
9. Use insulated tools to reduce the chance of short-circuits when installing or working with the inverter, the batteries, or PV array.

1-2. Precautions When Working with Batteries

1. Make sure the area around the battery is well ventilated.
2. Never smoke or allow a spark or flame near the engine or batteries.
3. Use 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.
4. Remove all metal items, like rings, brace lets, and watches when working with lead-acid batteries. Lead-acid batteries produce a short circuit current high enough to weld metal to skin, causing a severe burn.
5. Have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
6. Have plenty of fresh water and soap near by in case battery acid contacts skin, clothing, or eyes.
7. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near batteries.
8. If battery acid contacts skin or clot hing, 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.

9. If you need to remove a battery, always remove the grounded terminal from the battery first. Make sure all accessories are off so you don’t cause a spark.

10. Always use identical types of batteries.

11. Never install old or untested batteries. Check each battery’s date code or label to ensure age and type.

12. Batteries are temperature sensitive. For optimum performance, the should be installed in a stable temperature environment.

13. Always recycle old batteries. Contact your local recycling center for proper disposal information.

2. Introduction

2-1. General Information

Thank you for purchasing the TPH Series three phase Inverter/Charger.
TPH Series Pure Sine Wave Inverter is a combination of an inverter, charger, solar power and Auto-transfer switch into one complete system. It is packed with unique features and it is one of the most advanced inverter/chargers in the market today.
There are two main voltage outputs: 120/208Vac & 277/480Vac for America, 230/400Vac for Europe.
The inverter features an AC pass-through circuit, powering your home appliances from utility or generator power while charging the battery. When utility power fails, the battery backup system keeps your appliances powered until utility power is restored. Internal protection circuits prevent over-discharge of the batteries by shutting down the inverter when a low battery condition occurs. When utility or generator power is restored, the inverter transfers to the AC source and recharges the batteries.

Accessories allow the TPH series to also serve as a central hub of a renewable energy system. Set the TPH Series inverter to battery priority mode, designates the inverter-preferred UPS configuration. In this configuration, the load power in normally provided by the inverter. However, if the inverter output is interrupted, an internal transfer switch automatically transfers the load from the inverter to commercial AC power. The transfer time between inverter and line is short(8ms typical), and such transfers are normally not detected by even highly sensitive loads. Upon restoration of inverter power, the inverter will transfer back to inverter power.
On the line priority mode, when utility 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 utility is restored, the relay is energized and the load is automatically reconnected to AC utility.
It features power factor corrected, sophisticated multi-stage charging and pure sine wave output with unprecedentedly high surge capability to meet demanding power needs of inductive loads without endangering the equipment.

TPH Series Inverter is equipped with a powerful charger. The overload capacity is 300% of continuous output for up to 20 seconds to reliably support tools and equipment longer

Another important feature is that the inverter can be easily customized to Battery priority via a DIP switch, this helps to extract maximum power from battery in renewable energy systems. Thus, the TPH-PV Series Pure Sine Wave Inverter is suitable for Renewable energy system, Utility, RV, Marine and Emergency appliances.

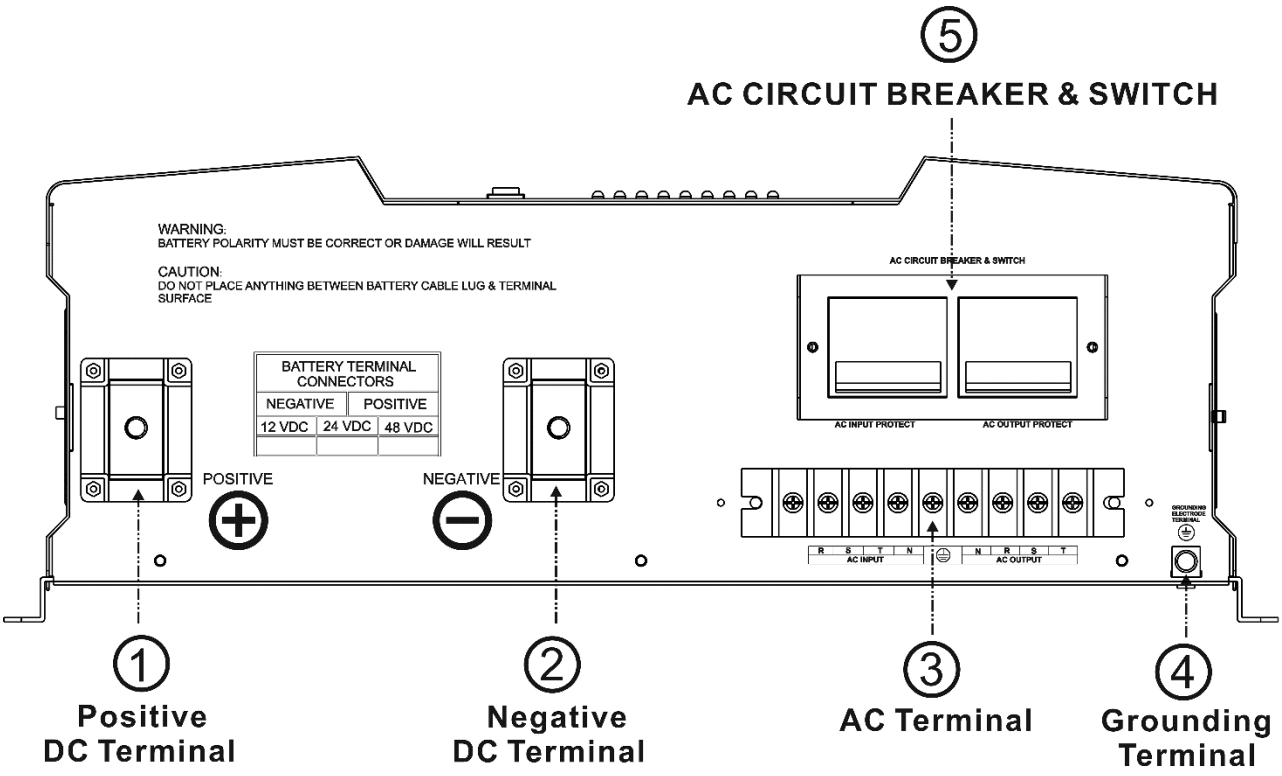
To get the most out of the power inverter, it must be installed, used and maintained properly. Please read the instructions in this manual before installing and operating.

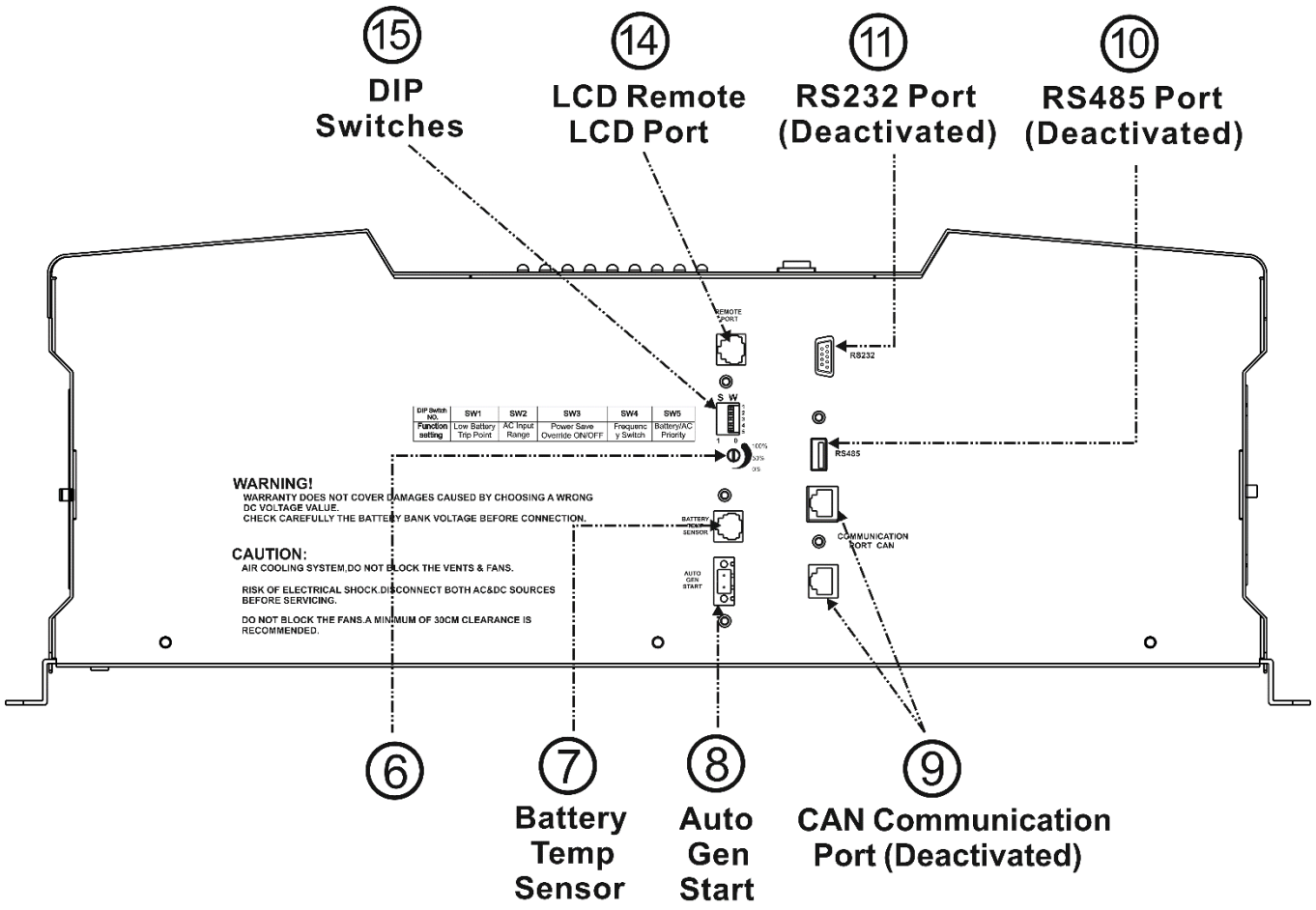
2-2. Application

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.

2-3 The Appearance and Mechanical Drawing of TPH Series





6 LCD Remote LCD Port

7 DIP Switches

8 Charge Current Control Knob

9 Battery Temperature Sensing Port

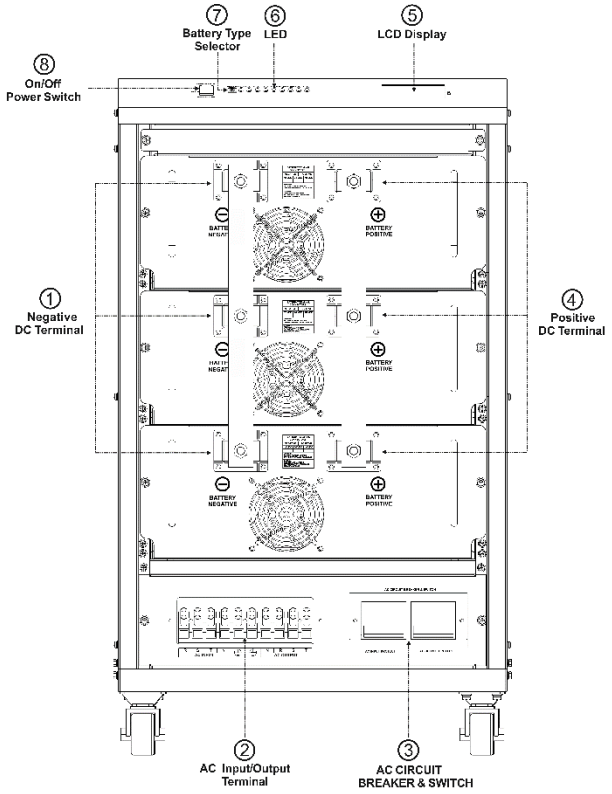
10 Automatic Generator Start

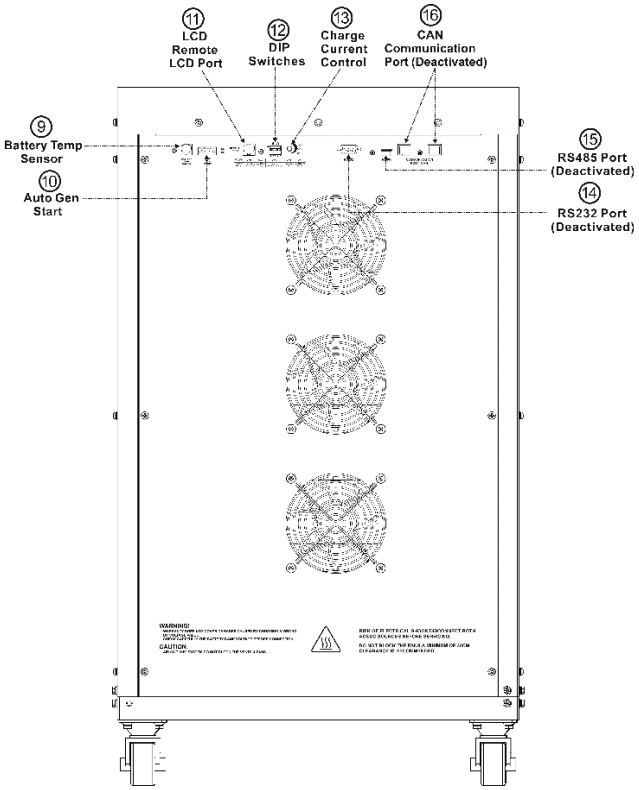
11 RS232 Port (Deactivated)

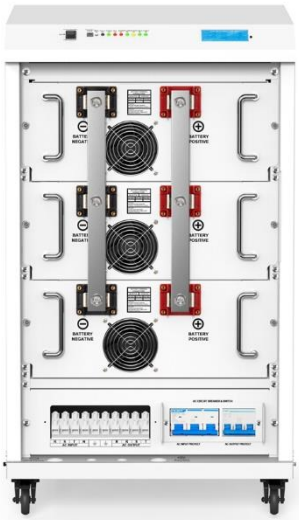
12 RS485 Port (Deactivated)

13 CAN Communication Port(Deactivated)

14 CAN Communication Port(Deactivated)







2-4 Features

Smart LED Remote Control
Battery Temperature Sensor (BTS)
Automatic Generator Start (AGS)
Designed For Harsh Environment Operation
Capable of Accepting 100% unbalance On Hotlines
DC Start & Automatic Self-Diagnostic Function
Easy to Install & Easy to Operate & Easy to Solve
Low DC Voltage Supports Home & Office Appliances
High Energy Charging Function, Selectable From 0%-100%
High Efficiency Design & “Power Saving Mode” to Conserve Energy
Battery Priority Mode, Designates the Inverter-Preferred UPS Configuration
52Vdc Battery Recover Point, Dedicated for Renewable Energy Systems
8 pre Set Battery Type Selector plus De-sulphation for Totally Flat Batteries
4-step Intelligent Battery Charging, PFC (Power Factor Correction) for Charger
Independently controlled three-phase output voltages & Load,100% Unbalanced load
0ms Transfer Time From Battery to Utility ;6-8ms Typical Transfer Time From Utility to Battery
15s Delay Before Transfer when AC Recover, Protection for Load when Used with Generator

2-5 Electrical Performance

2.5.1 Inverter

Topology
The TPH inverter/charger is built according to the following topology.

Inverter: Full Bridge Topology.
AC Charger: Isolate Boost Topology
Solar Charger: MPPT PV Controller
Because of high efficiency IGBT and 32bit, 30MHz microprocessor and heavy transformers, it outputs PURE SINE WAVE Waveform with an average THD of 3% (Max 8%) depending of load connected and battery voltage.
The peak efficiency of TPH series is 89%.

Overload Capacity
The TPH series inverters have different overload capacities, making it ideal to handle demanding loads.
1 For 110%<Load<125%(±10%), no audible alarm in 14 minutes, beeps 0.5s every 1s in the 15th minute, and Fault(Turn off) after the 15th minute.
2 For 125%<Load<150%(±10%), beeps 0.5s every 1s and Fault(Turn off) after the 1 minute.
3 For 300%≧Load>150%(±10%), beeps 0.5s every 1s and Fault(Turn off) after 20s.

2.5.2 AC Charger

TPH Series is equipped with an active PFC (Power Factor Corrected) multistage battery charger. The PFC feature is used to control the amount of power used to charge the batteries in order to obtain a power factor as close as possible to 1.
Unlike other inverters whose max charging current decreases according to the input AC voltage, TPH-PV series charger is able to output max current as long as input AC voltage is in the range of 164-243VAC (95-127VAC for 120V model), and AC freq is in the range of 48-54Hz(58-64Hz for 60Hz model).
The TPH-PV series inverter is with a strong charging current of 120Amp (for 4KW,12V), and the max charge current can be adjusted from 0%-100% via a linear switch at the right of the battery type selector. This will be helpful if you are using our powerful charger on a small capacity battery bank. Fortunately, the linear switch can effectively reduce the max charging current to 20% of its peak.
Choosing “0” in the battery type selector will disable charging function.

There are mainly 3 stages:
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 asT0 and T0×2 = T1.
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 1 hour and a maximum time of 12 hours.
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/48Vdc, the charger will reset the cycle above.
If the charge maintains the float state for 10 days, the charger will deliberately reset the cycle to protect the battery.

Table 2.5.1 Battery Charging Processes

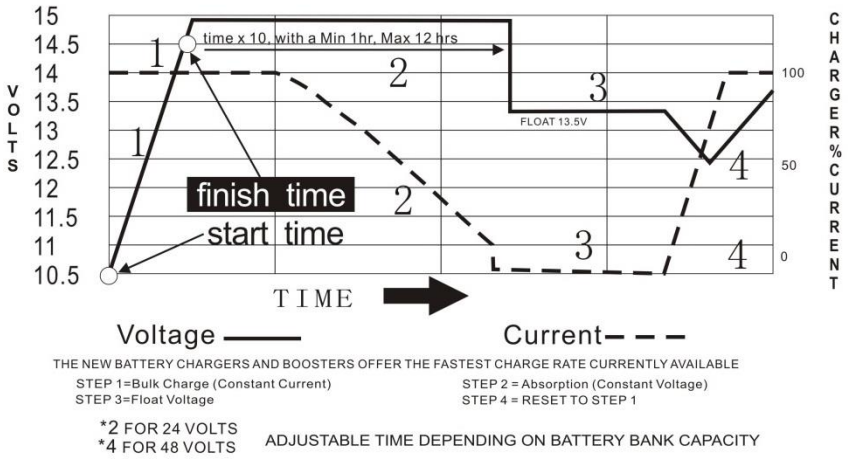


Table 2.5.2 Battery Type Selector for 48Vdc Model

Switch Setting	Description	Fast Mode / VDC	Float Mode / VDC
0	Charger Off		
1	Gel USA	56	54.8
2	AGM 1	56.4	53.6
3	LiFePO4	58.4	54.8
4	Sealed Lead Acid	57.6	54.4
5	Gel EURO	57.6	55.2
6	Open Lead Acid	59.2	53.2
7	Calcium	60.4	54.4
8	De-sulphation	62 (4 Hours then Off)	
9	Classic LFP	54.4	54

Note: The battery type selector 9 works with Sigineer Power LiFePO4 lithium batteries, the CV is 54.4V, the battery low cut off voltage is 44V and 46Vdc.

De-sulphation

The de-sulphation cycle on switch position 8 is marked in red because this is a very dangerous setting if you do not know what you are doing. Before ever 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(nor), or if the batteries have been left 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 sulfated crust that is preventing the plates taking a charge and thus allow the plates to clean up and so accept charge once again.

Charging depleted batteries

The TPH series inverter allows start up and through power with depleted batteries.

For 48VDC model, after the battery voltage goes below 40V, if the switch is still (and always) kept in "ON" position, the inverter is always connected with battery, and the battery voltage does not drop below 8V, the inverter will be able to charge the battery once qualified AC inputs are present.

Before the battery voltage goes below36VDC, the charging can be activated when the switch is turned to “Off”, then to “ON”.

When the voltage goes below 36VDC, and you accidently turn the switch to OFF or disconnect the inverter from battery, the inverter will not be able to charge the battery once again, because the CPU loses memory during this process.

Table 2.5.3 AC Charging Current for TPH model

Model Watt	Battery Voltage	AC Charger Current Max	Model Watt	Battery Voltage	AC Charger Current Max
6000	48 Vdc	50 ± 5 Amp	12.000	48 Vdc	100 ± 5 Amp
18,000	48 Vdc	150 ± 5 Amp	24,000	48 Vdc	200± 5 Amp
36,000	48 Vdc	300± 5 Amp	45,000	48 Vdc	350± 5 Amp

The charging capacity will go to peak in around 3 seconds. This may cause a generator to drop frequency, making inverter transfer to battery mode.
It is suggested to gradually put 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.

2.5.3 Transfer

While in the Standby Mode, the AC input is continually monitored. Whenever AC power falls below the VAC Trip voltage (154 VAC, default setting for 230VAC,90VAC for 120VAC), the inverter automatically transfers back to the Inverter Mode with minimum interruption to your appliances - as long as the inverter is turned on. The transfer from Standby mode to Inverter mode occurs in approximately 8 milliseconds. And it is the same time from Inverter mode to Standby mode.
Though it is not designed as a computer UPS system, this transfer time is usually fast enough to keep your equipment powered up.
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 time for a generator to spin-up to a stable voltage 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.
The transfer time from DC to AC is 0ms.
The transfer time from AC to DC is typically 6-8ms, 10ms max.

2.5.4 Frequency Adjust

The frequency of the inverter is arranged by the SW4. Refer to the Table 2.5.11.
The factory default configuration for 220/230/240VAC inverter is 50Hz, and 60Hz for 100/110/120VAC inverter. While the output frequency can be easily changed once a qualified frequency is applied to the inverter.

2.5.5 Power Saver Mode

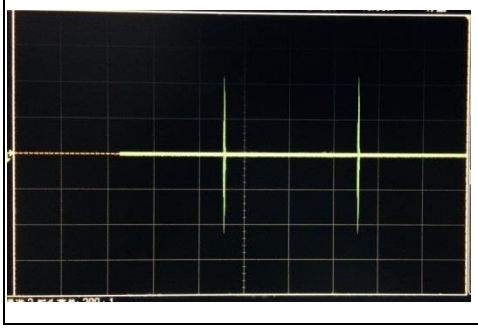
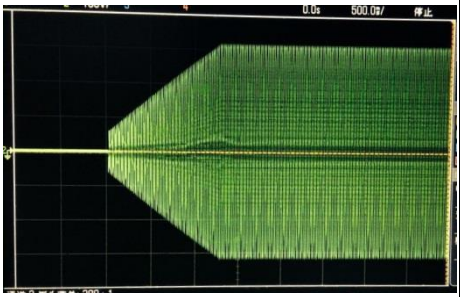
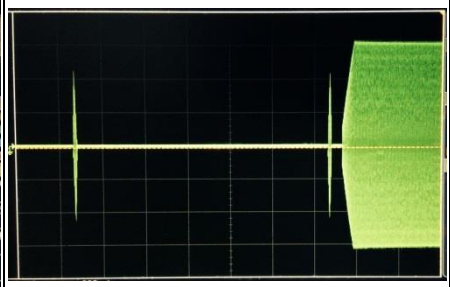
There are 3 different working status for TPH inverter: “Power Saver Auto” 、“Power Saver Off” and “Power Off”.

When power switch is in “Unit Off” position, the inverter is powered off.

When 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 25 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 25 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.

Power saver on	Power saver off	Power saver on (Load detected)
		

Note: The minimum power of load to take inverter out of sleep mode (Power Saver On) is 25 Watts.

Table 2.5.6 TPH Series Idle Power Consumption

Model	Power Saver Off	Power Saver Auto	
	Idle(Max)	3Secs(Max)	Stand-By Mode
1.0KW	18W	7.5W	2.5W
1.5KW	18W	7.5W	
2.0KW	30W	10.0W	
3.0KW	60W	15.0W	
4.0KW	70W	20.0W	
5.0KW	80W	25.0W	
6.0KW	90W	25.0W	
8.0KW	120W	30.0W	
10.0KW	150W	35.0W	
12.0KW	180W	40.0W	
18KW	240W	60W	
24KW	360W	80W	
36KW	480W	120W	
45KW	680W	150W	

When in the search sense mode, the green power LED will blink and the inverter will make a ticking sound. At full output voltage, the green power LED will light steadily and the inverter will make a steady humming sound. When the inverter is used as an “Un-interruptible power supply” the search sense mode or “Power Saver On” function should be defeated.

Exceptions
Some devices when scanned by the load sensor cannot be detected. Small fluorescent lights are the most common example. (Try altering the plug polarity by turning the plug over.) Some computers and sophisticated electronics have power supplies that do not present a load until line voltage is available. When this occurs, each unit waits for the other to begin. To drive these loads either a small companion load must be used to bring the inverter out of its search mode, or the inverter may be programmed to remain at full output voltage.

2.5.6 Protections

The TPH series inverter is equipped with extensive protections against various harsh situations/faults.
These protections include:
AC Input over voltage protection/AC Input low voltage protection
Low battery alarm/High battery alarm
Over temperature protection/Over load protection
Short Circuit protection (1sec 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 turn the SW1 on DIP switch.
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 TPH 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.

2.5.7 Remote control Module

Apart from the switch panel on the front of the inverter, an extra switch panel connected to the RJ45 port at the DC side of the inverter through a standard CAT-7 cable can also control the operation of the inverter remotely.
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 “Unit 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 accept command according to the following priority:
Power saver on> Power saver off> Power off
Only when both panels are turned to “Unit Off” position, will the inverter be powered off.
The suggested length between the switch panel and inverter is 10 meters.

The inverter can be connected to a remote LCD control panel.

WARNING

Never cut the telephone cable when the cable is attached to inverter and battery is connected to the inverter. Even if the inverter is turned off. It will damage the remote PCB inside if the cable is short circuited during cutting.

2.5.8 LED Indicator & LCD

Table 2.5.7 TPH Series LED Indicators

LINE MODE	GREEN LED lit in AC Mode	Please refer to **'Indicator and Buzzer'** for the detailed information.
INVERTER MODE	GREEN LED lit in Inverter Mode	
FAST CHARGE	YELLOW LED lit in Fast Charging Mode	
FLOAT CHARGE	GREEN LED lit in Float Charging Mode	
ALARM MODE	RED LED lit in Error State	
OVER TEMP TRIP	RED LED lit in Over Temperature	
OVER LOAD TRIP	RED LED lit in Over Load	
POWER SAVER ON	GREEN LED lit in Power Saver Mode	

2.5.9 Audible Alarm

Table 2.5.9 TPH Series Audible Alarm Spec

Battery Voltage Low	Inverter green LED lit, and the buzzer beeps 0.5s every 5s.
Battery Voltage High	Inverter green LED lit, and the buzzer beeps 0.5s every 1s and Fault after 60s.
Invert Mode Over-Load	(1)110%<load<125%(±10%), No audible alarm in 14 minutes, Beeps 0.5s every 1s in 15th minute and Fault after 15 minutes; (2)125% <load<150%(±10%), Beeps 0.5s every 1s and Fault after 60s; (3)Load>150%(±10%), Beeps 0.5s every 1s and Fault after 20s;

Over Temperature	Heat-sink temp. ≥105ºC, Over temp red LED Lighting, beeps 0.5s every 1s;

2.5.10 FAN Operation

For 1-3KW, there is one multiple controlled DC fan， For 4-6KW, there is two multiple controlled DC fan which starts to work according to the following logic
For 8-12KW, there is two multiple controlled DC fan and one AC fan. The DC fan will work in the same way as the one on 1-3KW, while the AC fan will work once there is AC output from the inverter.
So when the inverter is in power saver mode, the AC fan will work from time to time in response to the pulse sent by the inverter in power saver mode.
The Operation of the DC fan at the DC terminal side is controlled by the following logic
(Refer to Table 2.5.10):

Table 2.5.10 TPH Series Fan Operation Logic

Condition	Enter condition	Leave condition	Speed
HEAT SINK TEMPERATURE	T ≤ 60℃	T > 65℃	Off
	65℃≤ T <85 ℃	T ≤ 60℃ / T ≥ 85℃	50%
	T > 85℃	T ≤ 80℃	100%
CHARGER CURRENT	I ≤ 15%	I ≥ 20%	Off
	20%< I ≤ 50%	I ≤ 15% / I ≥ 50%	50%
	I > 50%	I ≤ 40%	100%
LOAD% (INV MODE)	Load < 30%	Load ≥ 30%	Off
	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 inverter 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.

2.5.11 DIP Switches

On the front panel of inverter, there are 5 DIP switches which enable users to customize the performance of the device.

Table 2.5.11 TPH Series Dip Switch Function Setting

DIP Switch NO.	Switch Function		Position: 0	Position: 1
SW1	Low Battery Trip Volt		40Vdc	42Vdc
SW2	AC Input Range	AC	For Utility Mode	For Generator

	/ (AVR)	Source		Mode
		230Vac HV	184-253Vac / (176-276Vac)	140-270Vac / (150-276Vac)
		120Vac LV	100-135Vac / (92-144Vac)	90-135Vac / (78-144Vac)
SW3	Power Saver Auto Setting		Night Charger Function	Detect Load Per 3Secs
SW4	O/P Frequency Setting		50Hz	60Hz
SW5	Battery/AC Priority Setting		Utility Priority	Battery Priority

SW1: Low Battery Trip Volt:

For 48VDC model, the Low Battery Trip Volt is set at 40.0Vdc by typical deep cycle lead acid battery. It can be customized to 42 Vdc using SW1 for sealed car battery, this is to prevent batteries from over-discharging while there is only a small load applied on the inverter.

SW2: AC Input Range:

There are different acceptable AC input ranges for different kinds of loads.

For some relatively sensitive electronic devices, a narrow input range of 184-253VAC (100-135V for 120VAC model) is required to protect them.

While for some resistive loads which work in a wide voltage range, the input AC range can be customized to 140-270VAC (90-135V for 120VAC model), this helps to power loads with the most AC input power without frequent switches to the battery bank.

In order to make the inverter accept dirty power from a generator, when the SW2 is switched to position“1” , the inverter will bypass an AC input with a wide voltage and frequency(40Hz-70Hz for 50Hz/60Hz). Accordingly, the AC charger will also work in a wide voltage and frequency range (43Hz-67Hz for 50Hz/60Hz). This will avoid frequent switches between battery and generator. But some sensitive loads will suffer from the low quality power.

The pros and cons should be clearly realized.

SW3: Power Saver Auto Setting :

In Power Saver Mode, when the SW3 is switched to position“0”, inverter will work in Unit Off Charging mode, it will stay in standby mode without sensing loads. It won’t output any power even if a load is turned on. The inverter will not perform any function and only stay idle in this mode. When a qualified AC input present, it will switch to AC input power to charge the battery and supply the load at the same time.

When the SW3 is switched to position“0”, the inverter is initially in standby mode and sends a pulse to detect the presence of a load every 3 seconds. Each pulse lasts for 250ms. The inverter will remain in standby mode until a load has been detected. Then it will wake up from standby mode and start to inverter electricity from the battery bank to supply the load.

SW4: Frequency Switch:

The output frequency of the inverter can be set at either 50Hz or 60Hz by SW4.

SW5: Solar Mode/AC Mode Priority:

Our inverter is designed with AC priority by default. This means, when AC input is present, the battery will be charged first, and the inverter will transfer the input AC to power the load. Only when the AC input is stable for a continuous period of 15 days, the inverter will start a battery inverting cycle to protect the battery. After 1 normal charging cycle ac through put will be restored.

The AC Priority and Battery Priority switch is SW5. When you choose battery priority, the inverter will inverting from battery despite the AC input. Only when the battery voltage is reaches low voltage alarm point(10.5V for 12V), the inverter transfers to AC Input, charge battery, and switch back to battery when battery is charged full. This function is mainly for wind/solar systems taking utility power as back up.

2.5.12 Other features

Battery voltage recovery start

After low battery voltage shut off 40V for 48V model), the inverter is able to restore operation after the battery voltage recovers to 52Vdc (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. The built in battery charger will automatically reactivate as soon as city/generator ac has been stable for 15 seconds.

WARNING

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

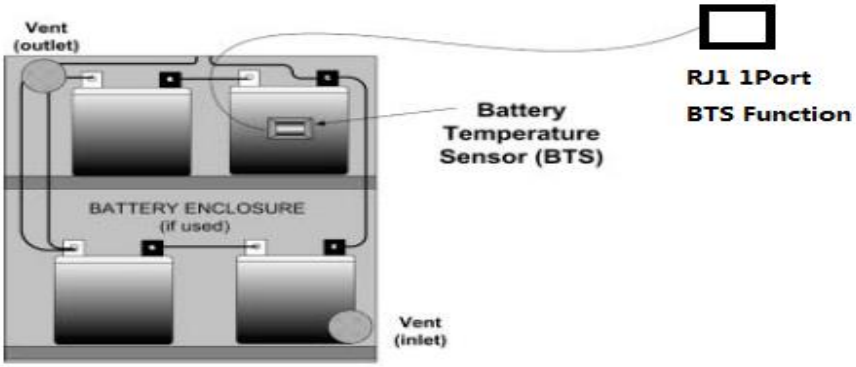
Auto Generator Start (AGS)

The inverter can be customized to start up a 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 generator start feature will only work with generators designed to work with this feature. There is an open/closed relay that will short circuit the positive and negative cable from a generator. The input DC voltage can vary, but the Max current the relay can carry is 16Amp.

Battery temperature sensor (BTS)

A battery temperature sensor (BTS) option can easily be installed in the system to ensure proper charging of the batteries based on temperature. Installing a BTS extends battery life by preventing overcharging in warm temperatures and undercharging in cold temperatures.

To install the Battery Temperature Sensor:
1. Run the battery temperature sensor wire in the DC conduit (if used) and route the RJ11 connector end to the BATTERY SENSE port located on the front of the inverter.
2. Secure the sensor to one of the batteries located in the center of the battery pack.



Conformal Coating

Entire line of TPH inverters have been processed with a conformal coating on the PCB making it water, rust, and dust resistant.

3 Installation

3-1 Location

Follow all the local regulations to install the inverter.
Please install the equipment in a location that is Dry, Clean, Cool and that has good ventilation.
Working temperature: -10℃-40℃
Storage temperature: -40-70℃
Relative Humidity: 0%-95%，non-condensing
Cooling: Forced air

3-2 DC Wiring recommendation

It is suggested the battery bank be kept as close as possible to the inverter. The following able is a suggested wiring option for 1m DC cable.
Please find the following minimum wire size. In case of DC cable longer than 1m, please increase the cross section of cable to reduce the loss.

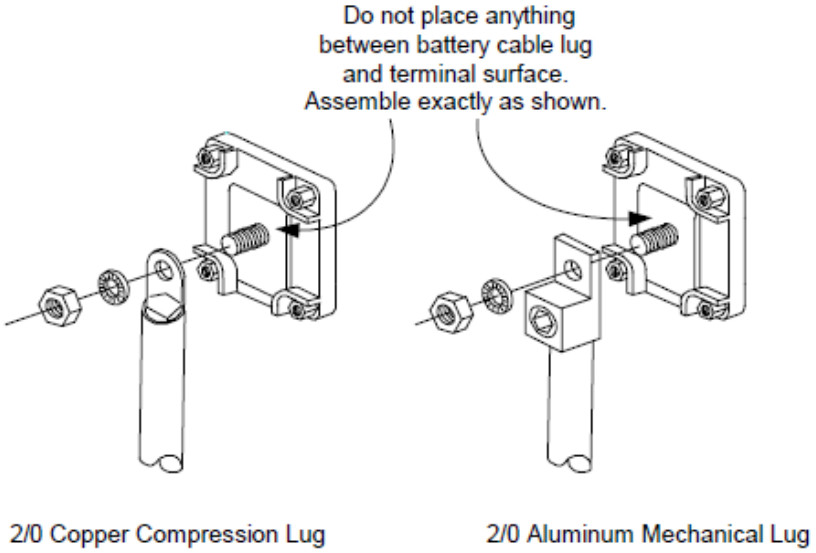
Model Watt	Battery Voltage	Wire Gage /Min		Model Watt	Battery Voltage	Wire Gage /Min	
		0~1.0m	1.0~5.0m			0~1.0m	1.0~5.0m
1.000 ~ 1.500	12 Vdc	30mm²	40mm²	2.000	12 Vdc	60mm²	75mm²
	24 Vdc	15mm²	20mm²		24 Vdc	30mm²	45mm²
	48 Vdc	10mm²	15mm²		48 Vdc	15mm²	25mm²
3.000	12 Vdc	90mm²	120mm²	4.000	12 Vdc	120mm²	150mm²
	24 Vdc	45mm²	60mm²		24 Vdc	60mm²	75mm²
	48 Vdc	25mm²	30mm²		48 Vdc	30mm²	40mm²
5.000	24 Vdc	75mm²	95mm²	6.000	24 Vdc	90mm²	120mm²
	48 Vdc	40mm²	50mm²		48 Vdc	45mm²	60mm²

8.000	24 Vdc	120mm²	150mm²	**10.000**	48 Vdc	75mm²	95mm²
	48 Vdc	60mm²	75mm²	**12.000**	48 Vdc	90mm²	120mm²

Please note that if there is a problem obtaining for example 100mm²cable, use 2*50mm²or 3*35mm². One cable is always best , but cable is simply copper and all you require is the copper, so it does not matter if it is one cable or 10 cables as long as the square area adds up. 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.

Figure 3.2.1 Battery Cable Connections



CAUTION: Equipment Damage

The inverter is not reverse polarity protected. Reversing the battery polarity on the DC input connections will cause permanent damage to the inverter which is not covered under warranty. Always check polarity before making connections to the inverter.

WARNING: Shock Hazard

Ensure the inverter is off before disconnecting the battery cables, and that AC power is disconnected from the inverter input.

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.

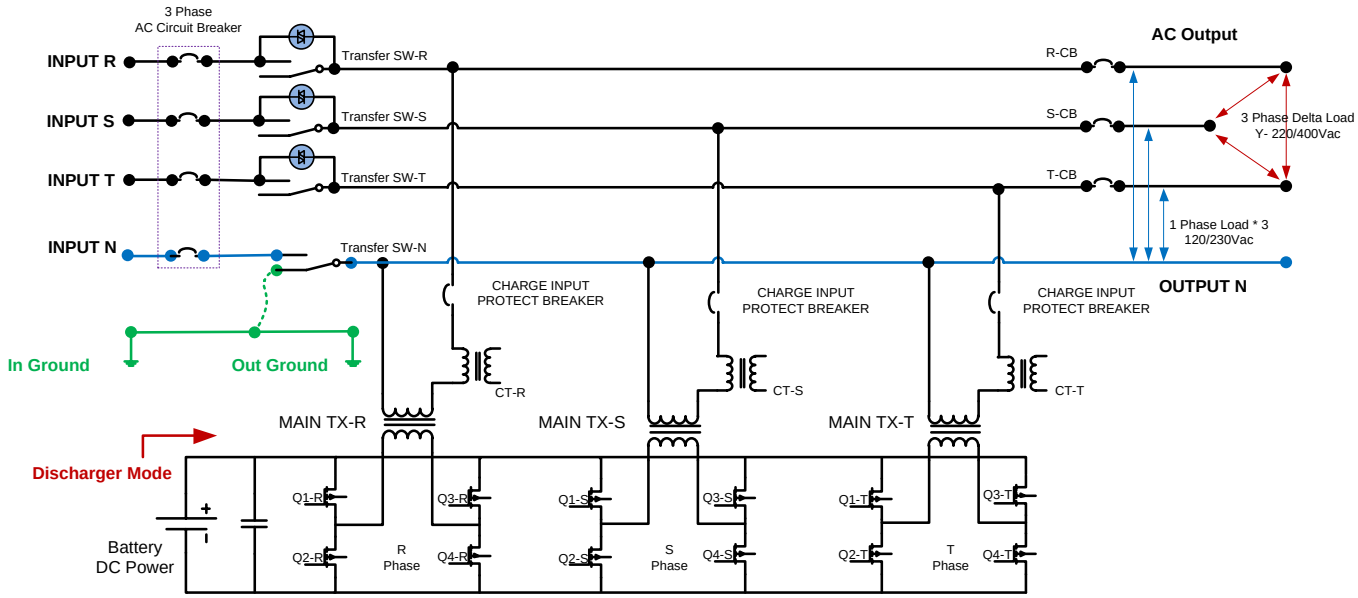
3-3 AC Wiring

We recommend using 10-5AWG wire to connect to the AC terminal block.
On the AC input side, the three phase inverters only supports Y connection, AC input neutral is mandatory, they don't not support delta input.
All the wirings are CE compliant, Call our tech support if you are not sure about how to wire any part of your inverter.
The TPH inverter will automatically bond the neutral with ground in DC to AC battery mode, and separate neutral with ground in AC model.

3-Phase Wiring Mode

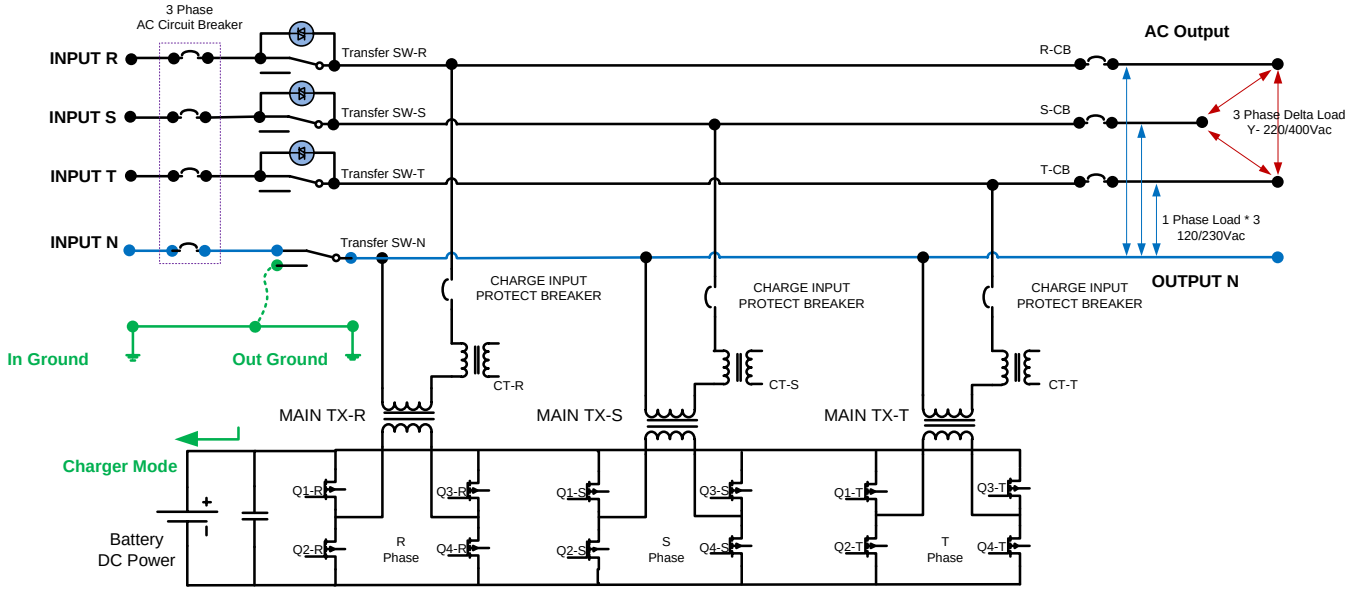
TPP Series Inverter&Charger Topology Diagram

Inverter Mode



TPP Series Inverter&Charger Topology Diagram

Bypass & Charger Mode



Note:

For the TPH series inverters, the AC input must be wired to the AC neutral for the charger and transfer switch to work.

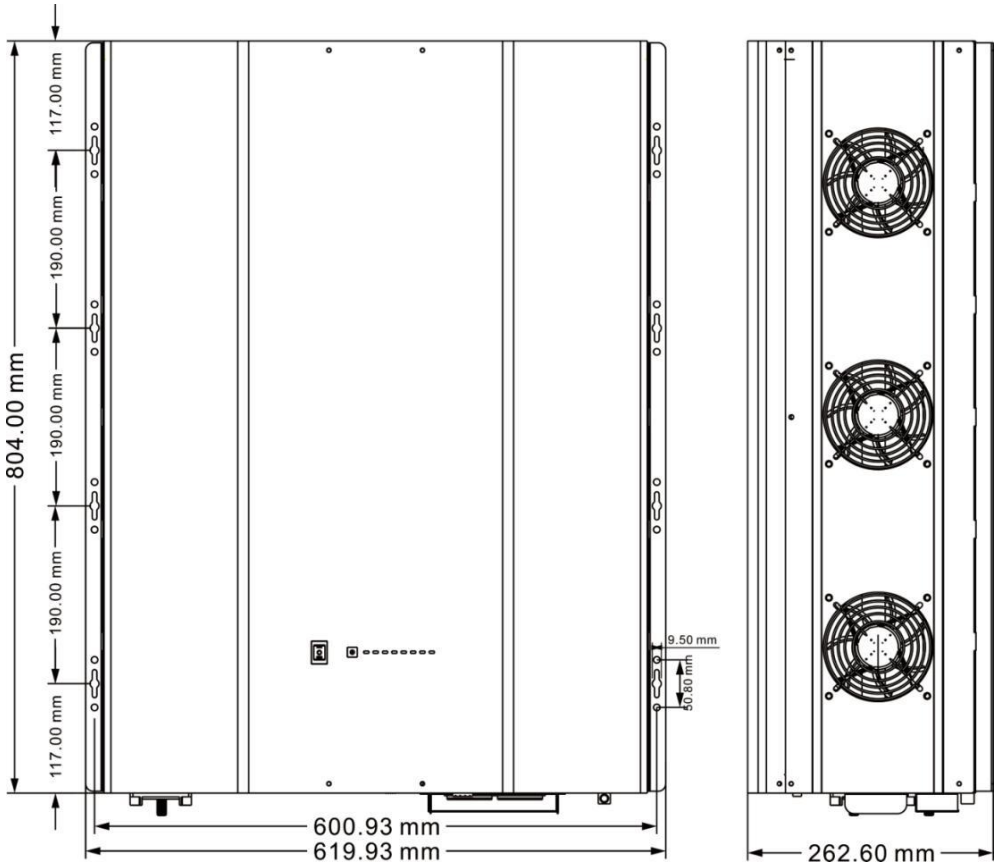
The AC input must be a Y connection with R,S,T, N & G.

On the AC output side, the AC output neutral can be connected to loads or left unwired.

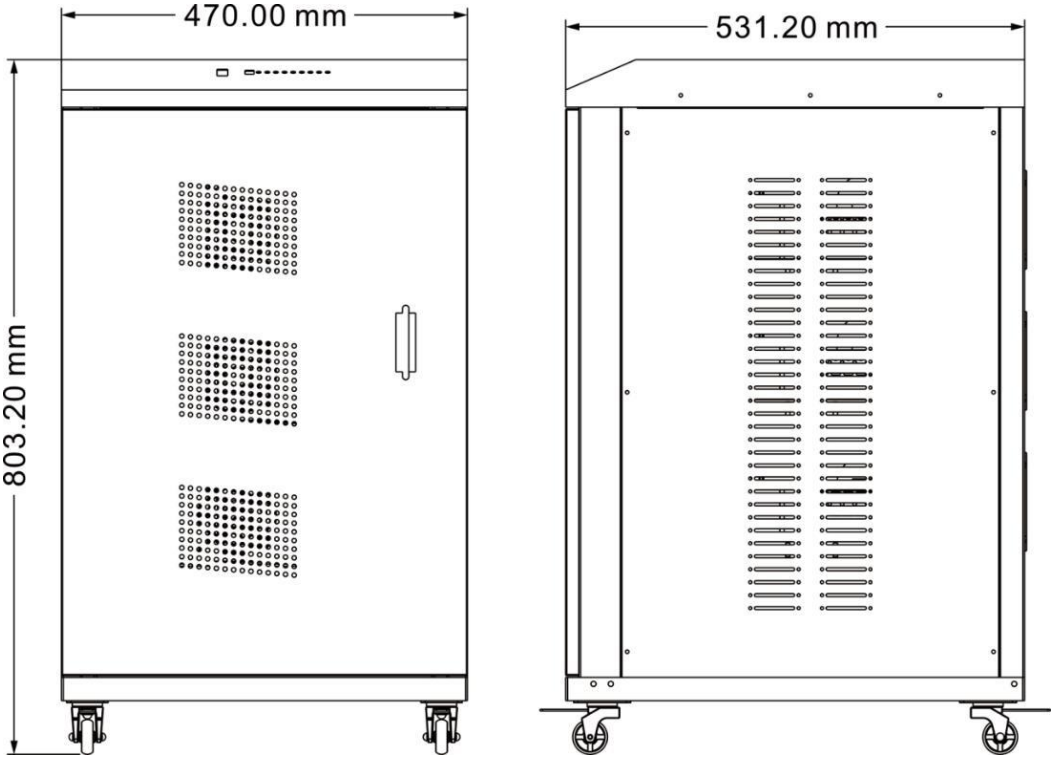
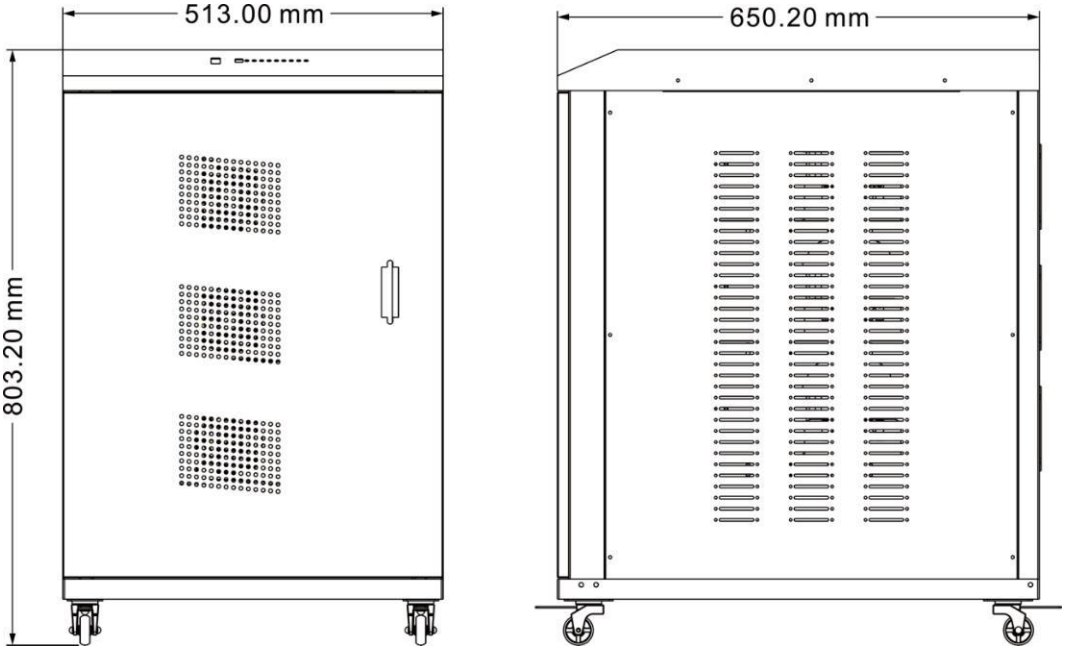
The AC output could either be a Y connection with R,S,T, N & G or delta connection with R,S,T& G.

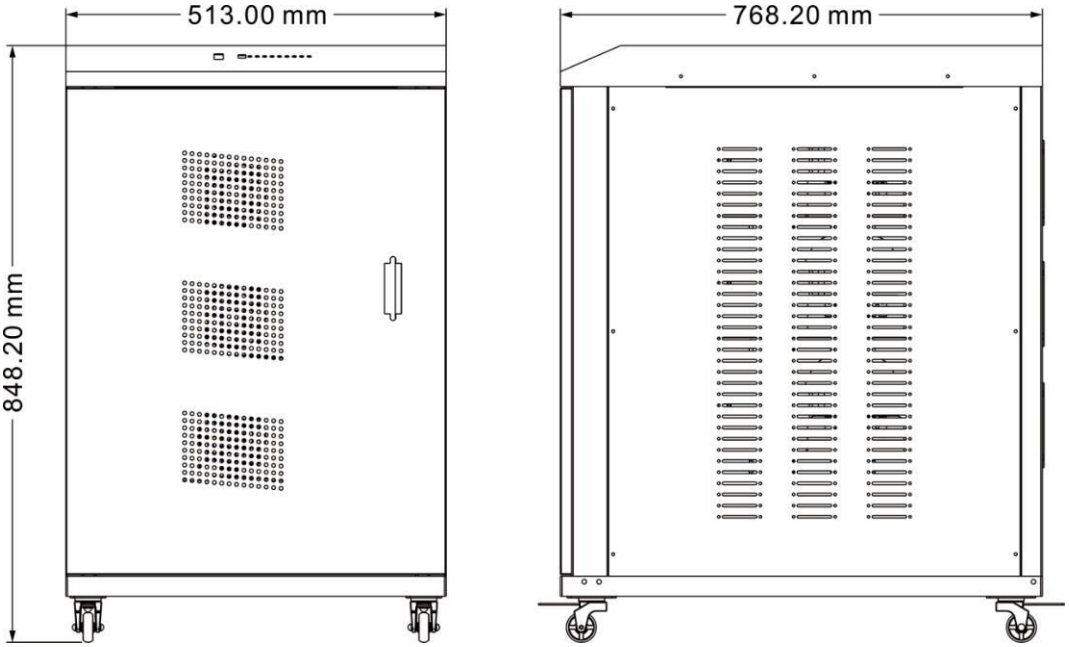
In case AC input power is without neutral, an isolation transformer should be deployed to generate a neutral for the inverter.

3-4 Install Flange

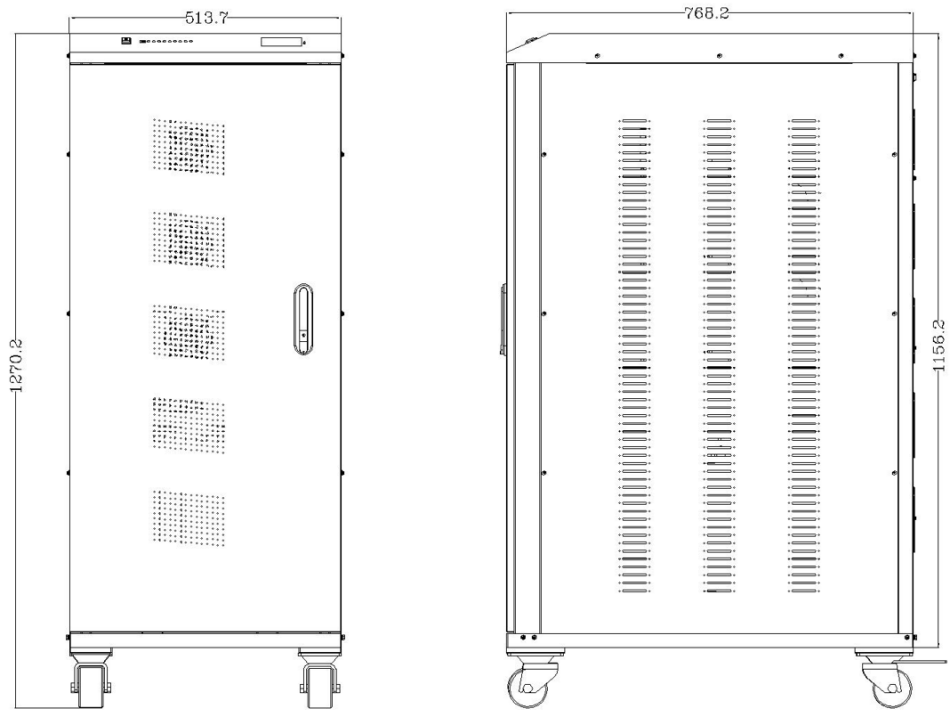


TPH 6-18KW Wall mount

	TPH 6-18KW Model Tower
	TPH 24-36KW 220/230V Model



TPH 45KW Model



TPH 24-36KW
120/208V Model

4 Battery Information

4-1 Battery Type

There are two principal types of batteries: Starting type and Deep-Discharge type. Batteries can be either sealed or non-sealed(Vented).
A. Starting type: Automotive(Starting type) batteries are designed to provide high starting current for short periods of time and are not appropriate for solar system.
B. Deep-Discharge type: The battery types recommended for use in the inverter system are Flooded Lead Acid
* Sealed construction, safety and no leakage
* Maintenance-free, convenient for installation
* Broad operating temperature range
* High capacity, high energy density
* Long service life, Excellent recharge and discharge performance
* Low self-discharge rate, more deep cycle times

4-2 Battery Capacity Rating

4.2.1 Battery Discharge Rate

Deep cycle batteries have their amp-hour rating expressed as “at the x-hour rate”.
The hour rating refers to the time it takes to discharge the batteries. A faster hour rate (10 hour rate) means more current is withdrawn from the batteries during their discharge period. There is an inevitable amount of heat associated with the flow of current through a battery and the higher amount of current the greater the amount of heat will be generated. The heat is energy which is no longer available to the battery to power loads. a relatively long discharge rate (120 hour rate) will result in a larger number of amp-hours being available for electrical loads.

4.2.2 Depth of Discharge

The battery bank`s size determines the length of time the inverter can supply AC output power. The larger the bank, the longer the inverter can run.
In general, the battery bank should be designed so the batteries do not discharge more than 60% of their capacity on a regular basis. Discharging up to 80% is acceptable on a limited basis, such as a prolonged utility outage. Totally discharging a battery can reduce its effective life or permanently damage it.

4.2.3 Understanding Amp-Hour Requirements

To estimate the battery bank requirements, you must first calculate the amount of power you will draw from the batteries during your period of autonomy. This power draw is then translated into Amp-Hours (Ah) the unit of measure to express deep-cycle battery capacity.
Amp Hours are calculated multiplying the current drawn by the load by the length of time it will operate.
To calculate amps when the power consumption is expressed in watts, use the following equation:

A = P/V

P = Watts ; V = Volts DC ;

For example:

A 60 watt light bulb will draw approximately 5.0 Amps.
5.0 = 60 /12
If the light runs for three hours it will consume (5.0 x 3) or 15 Ah of power.

The length of time a load is operated will affect the power draw. In some cases, an appliance which draws a large wattage may not consume as many amp hours as a load drawing fewer watts but running for a longer period of time.

For Example:

A circular saw draws 1500 watts or 125 amps. It takes 5 seconds to complete a cross cut. Twelve such cuts would take a minute and you would consume 125A x 0.016 hour = 2 Ah. (*0.016 = 1/60)*

Suggestion :

All electrical appliances have labels which state their energy consumption. Look for an amps rating on motors and a watts rating on other appliances. If the label plate has expressed power consumption in amps, multiply by volts for the watts required. (watts = volts x amps).

When calculating battery bank size, consider the following:
Motors typically require 3 to 6 times their running current when starting. Check the manufacturer's data sheets for their starting current requirements. If you will be starting large motors from the inverter, increase the battery bank size to allow for the higher start-up current.

4.2.4 Battery Configurations

The battery bank must be wired to match the inverter's DC input voltage specifications (12 or 24 or 48Vdc). In addition, the batteries can be wired to provide additional run time.

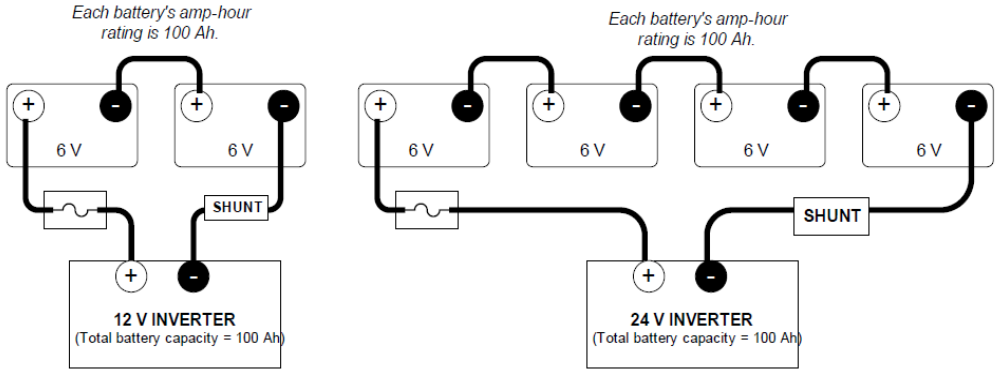
Series： Wiring batteries in series increases the total bank output voltage. This voltage MUST match the DC requirements of the inverter or inverter and/or battery damage may occur.

Parallel： Wiring the batteries in parallel increases the total run time the batteries can operate the AC loads. The more batteries connected in parallel the longer the loads can be powered from the inverter.

Series-Parallel： Series-parallel configurations increase both the battery voltage (to match the inverter's DC requirements) and run-time for operating the AC loads. This voltage must match the DC requirements of the inverter.
Batteries with more than two or three series strings in parallel often exhibit poor performance characteristics and shortened life.

4.2.5 Wiring Batteries

Table 4.2.1 Battery Wiring In Series Configuration



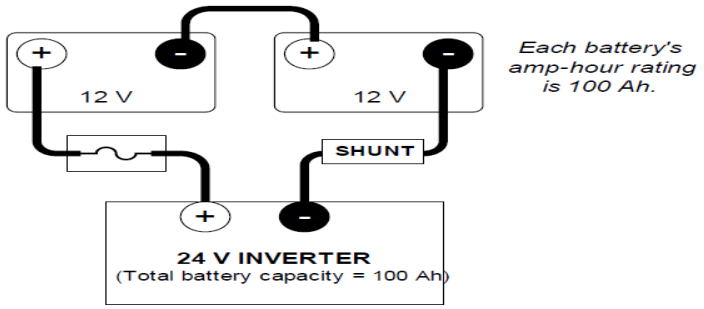


Table 4.2.2 Battery Wiring In Parallel Configuration

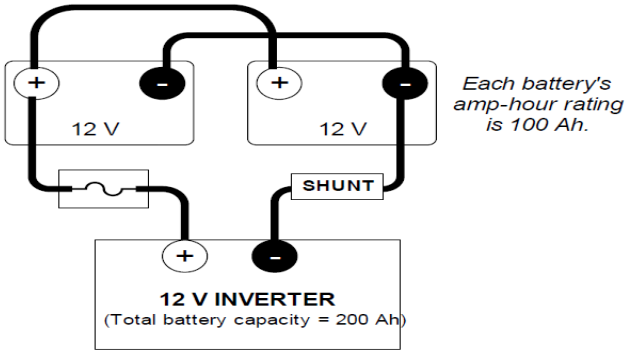
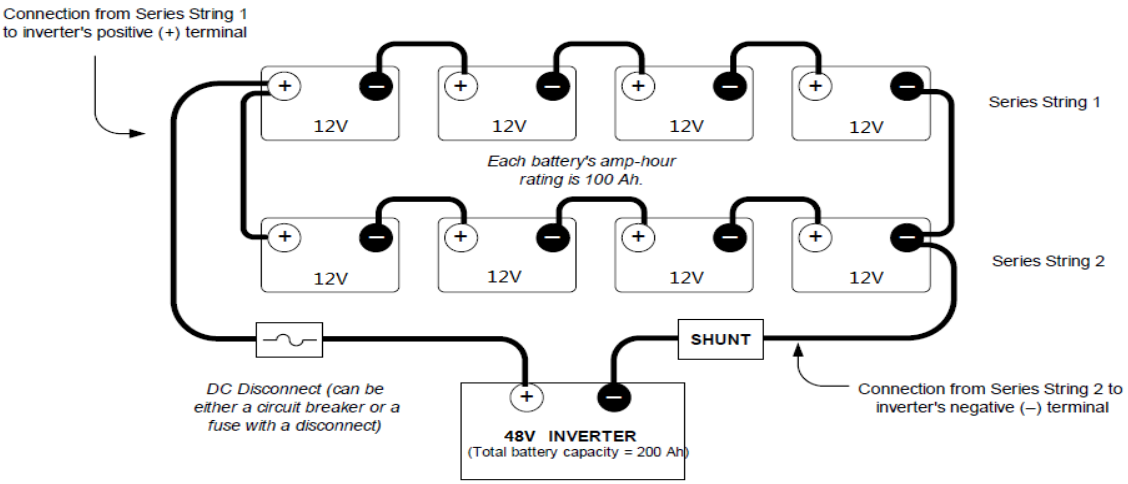


Table 4.2.3 Battery Wiring In Series-Parallel Configuration



Important: Connecting the positive and negative wires to the inverter from different strings ensures a balanced charge/discharge through the batteries, resulting in longer run times and improved battery life.

4.2.6 Batteries Maintenance

To get the best performance from an inverter system, the batteries must be properly setup and maintained. This includes setting the proper voltages for Bulk and Float charging. See the "**CAUTIONS**" in the section on Equalization Charging that follows. In addition, the battery terminals should be inspected,cleaned, and re-torqued if necessary.

Battery posts must be clean to reduce the resistance between the battery post 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. Use an alkaline solution of baking soda and water to clean the terminals and neutralize any battery acid on the terminals or cable lugs.

Charge Rate
The maximum safe charge rate is related to the size and type of the batteries. Flooded lead acid batteries (with removable caps) can be charged at a high rate. Small batteries may require a lower charge rate. Check with your battery vendor for the proper battery charging rate for the batteries used in the system.

Bulk Voltage
This is the maximum voltage the batteries will be charged to during a normal charge cycle. Gel cell batteries are set to a lower value and non-sealed batteries are set to a higher voltage setting.

Float Voltage
The Float voltage is set lower than the Bulk voltage and provides a maintenance charge on the batteries to keep them in a ready state.

Temperature Compensation
For optimal battery charging, the Bulk and Float charge rates should be adjusted according to the temperature of the battery. This can be accomplished automatically by using a BTS. The sensor attaches directly to the side of one of the batteries in the bank and provides precise battery temperature information. When battery charging voltages are compensated based on temperature, the charge voltage will vary depending on the temperature around the batteries. The following table describes approximately how much the voltage may vary depending on the temperature of the batteries.

If you have liquid lead acid batteries (non-sealed), you may need to periodically equalize your batteries. Check the water level monthly to maintain it at the appropriate level.

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.

5 Troubleshooting Guide

Troubleshooting contains information about how to troubleshoot possible error conditions while using the TPH Series Inverter & Charger.
The following chart is designed to help you quickly pinpoint the most common inverter failures.

Indicator and Buzzer

Status Information From LED Indicator & Buzzer Alarm											
Status	TPH Mode	LED Indicator									Buzzer Alarm
		Line Mode	Inverter Mode	Fast Charge	Float Charge	Over-Temp Trip	Over-Load Trip	Alarm	PowerSave On	Charger On	
Line Mode	C.C Mode	√	×	√	×	×	×	×	×	√	
	C.V Mode	√	×	√Blink	×	×	×	×	×	√	
	Float Mode	√	×	×	√	×	×	×	×	√	
	Standby Mode	√	×	×	×	×	×	×	×	×	
	Over-Temp In Charge Mode	√	×	×	×	√	×	√	×	×	R:0.5s On 0.5s Off; S:1.0s On 0.5s Off; T:2.0s On 0.5s Off; Beep continuous After 30s.
	Over-Charger	√	×	×	×	×	×	√	×	×	0.5s On 0.5s Off; Beep continuous After 30s.
Inverter Mode	Inverter On	×	√	×	×	×	×		×	×	
	PowerSave On	×	×	×	×	×	×		√	×	
	Battery Low In Inv Mode	×	√	×	×	×	×	√	×	×	0.5s On 0.5s Off; Battery Voltage< SW1=0 10.0/20.0/40.0V SW1=1 10.5/21.0/42.0V
	Battery High On Inv Mode	×	√	×	×	×	×	√ Blink	×	×	0.5s On 0.5s Off; Beep continuous After 30s.
	Battery Low On PowerSave Mode	×	×	×	×	×	×	√	√	×	0.5s On 0.5s Off; Battery Voltage< SW1=0 10.0/20.0/40.0V SW1=1 10.5/21.0/42.0V
	Battery High In PowerSave Mode	×	×	×	×	×	×	√ Blink	√	×	0.5s On 0.5s Off; Beep continuous After 30s.
	OverLoad	×	√		×	×	√	√	×	×	
	Over-Temp	×	√	×	×	√	×	√	×	×	R:0.5s On 0.5s Off;

											S:1.0s On 0.5s Off； T:2.0s On 0.5s Off； Beep continuous After 30s.
Fault Mode	Abnormal By Self-Test	×	×	×	×	×	×	√Blink	×	×	R:0.5s On 0.5s Off； S:1.0s On 0.5s Off； T:2.0s On 0.5s Off； Beep Off After 3 Cycles
	Fan Lock On Inverter Mode	×	√ Blink	×	×	×	×	√ Blink	×	×	R:0.5s On 0.5s Off； S:1.0s On 0.5s Off； T:2.0s On 0.5s Off； Beep continuous After 5s.
	Fan Lock On Line Mode	√ Blink	×	×	×	×	×	√ Blink	×	×	R:0.5s On 0.5s Off； S:1.0s On 0.5s Off； T:2.0s On 0.5s Off； Beep continuous After 5s.
	Abnormal Mains Phase Sequence	√ Blink	/	×	×	×	×	√ Blink	/	×	0.5s On 0.5s Off；②
	Output Short							√			R:0.5s On 0.5s Off； S:1.0s On 0.5s Off； T:2.0s On 0.5s Off； Beep continuous After 30s.
	Disconnection Protection										Beep continuous
	Back Feed Fail							√ Blink			Beep continuous

①：(1)110%<load<125%, No audible alarm in 14 minutes, Beeps R：0.5s every 1s / S：1s every 1.5s

T：2s every 2.5s in 15th minute and Fault after 15 minutes;

(2)125% <load<150%, Beeps R：0.5s every 1s/S：1s every 1.5s/T：2s every 2.5s and Fault after 60s;

(3)Load>150%, Beeps R：0.5s every 1s/S：1s every 1.5s/T：2s every 2.5s and Fault after 20s;

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 DIP switch, or Install a UPS if possible.
Noise from Transformer/case*	Applying specific loads such as hair drier	Remove the loads

We warrant this product against defects in materials and workmanship for a period of one year from the date of purchase and will repair or replace any defective High Power Inverter when directly returned, postage prepaid, to manufacturer. This warranty will be considered void if the unit has suffered any obvious physical damage or alteration either internally or externally and does not cover damage arising from improper use such as plugging the unit into an unsuitable power sources, attempting to operate products with excessive power consumption requirements, reverse polarity, or use in unsuitable climates.
WARRANTY DOES NOT INCLUDE LABOR, TRAVEL CHARGES, OR ANY OTHER COSTS INCURRED FOR REPAIR, REMOVAL, INSTALLATION, SERVICING, DIAGNOSING OR HANDLING OF EITHER DEFECTIVE PARTS OR REPLACEMENT PARTS. THE WARRANTOR ASSUMES NO LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND.
LOSS OR DAMAGE: Loss or damage in transit is the responsibility of the carrier. Any claim should be filed with the delivering transport company. Invoice, Bill of Lading and Delivery receipt with damage noted therein must accompany any claims for freight damage. Claims for shortage and lost shipments must be made in writing to the shipper within 3 days of the receipt of shipment. Claims not reported within this time frame will not be honored.

This warranty does not apply to and we will not be responsible for any defect in or damage to:
a) the product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment; violations of the warnings in the manual will invalid the warranty.
b) the product if it has been subjected to fire, water, generalized corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the product specifications including high input voltage from generators and lightning strikes;
c) the product if repairs have been done to it other than by us or its authorized service centers;

Appendix 1 TPH Series Three Phase Inverter & Charger

Electrical Specifications								
	Model	TPH 6KW	TPH 12KW	TPH 18KW	TPH 24KW	TPH 30KW	TPH 36KW	TPH 45KW
Inverter Output	Continuous Output Power	6000W	12000W	18000W	24000W	30000W	36000W	45000W
	Surge Rating(20s)	18000W	36000W	54000W	72000W	90000W	108000W	135000W
	Capable of Starting Electric Motor	6HP	12HP	18HP	24HP	30HP	36HP	45HP
	Acceptable Unbalanced Load	100%						
	Output Waveform	Pure Sine wave/Same as input(Bypass mode)						
	Nominal Efficiency	89%(Peak)						
	Line Mode Efficiency	>95%						
	Power Factor	0.9-1.0						
	Connection mode	3-phase 4-wire system+Ground						
	Output voltage rating	3AC/N 208V 400V or 480V						
	Output phase voltage	120/230/277V AC	120/230/277V AC	120/230/277V AC	230/277VAC	230/277VAC	230/277VAC	230/277VAC
	Output Line voltage	208/400/480V AC	208/400/480V AC	208/400/480V AC	400/480Vac	400/480Vac	400/480Vac	400/480Vac
	Output Voltage Regulation	±10% RMS						
	Output Frequency	50/60Hz ± 0.3Hz						
	Short Circuit Protection	Yes, Current Limit Function (Fault after 60ms)						
	Typical transfer Time	Typical 6-8ms,10ms(Max)						
	THD	< 3%（Linear Load）						
DC Input	Nominal Input Voltage	48Vdc						
	Minimum Start Voltage	42Vdc / 44Vdc						
	Low Battery Alarm	42Vdc / 44Vdc						
	Low Battery Trip	40V/42V						

	High Voltage Alarm & Fault	64Vdc						
	High DC Input Recovery	62Vdc						
	Low Battery Voltage Recover	52Vdc						
	Idle Consumption-Search Mode	< 100 W when Power Saver On						
Charge	Input Phase Voltage Range	For 120Vac models: Narrow: 96~132Vac±4% Wide: 70~135Vac±4% For 230Vac models: Narrow: 184~253Vac±4%;Wide: 140-270Vac±4% For 277Vac models: Narrow: 222-305Vac±4%;Wide: 169-325Vac±4%						
	Input Frequency Range	Narrow: 47-55±0.3Hz for 50Hz, 57-65±0.3Hz for 60Hz Wide:40-70±0.3Hz for 50Hz/60Hz						
	Output Voltage	Same as input						
	Charger Breaker Rating(220Vac)	10A	20A	30A	40A	50A	60A	80A
	Charger Breaker Rating(120Vac)	20A	40A	60A				
	Max Charge Rate	60A	120A	180A	240A	300A	360A	450A
	Power Factor	0.97 MAX						
	Over Charge Protection Shutdown	62.8V						
	Battery type	Fast Vdc			Float Vdc			
	Gel U.S.A	56.0			54.8			
	A.G.M 1	56.4			53.6			
	A.G.M 2	58.4			54.8			
	Sealed Lead Acid	57.6			54.4			
	Gel Euro	57.6			55.2			
	Open Lead Acid	59.2			53.2			
	Calcium	60.4			53.8			
	De-sulphation	62V for 4hrs						
Bypass & Protection	Input Voltage Waveform	Sine wave (Grid or Generator)						
	Nominal Phase Voltage	120Vac			230Vac		277Vac	
	Low Voltage Trip	70V/96V±4%			184V/154V±4%		222V/185V±4%	
	Low Voltage re engage	75V/100V±4%			194V/164V±4%		234V/198V±4%	
	High Voltage Trip	140V±4%			253V/280V±4%		305V/337V±4%	
	High Voltage re engage	135V±4%			243V/270V±4%		293V/325V±4%	

	Max Input AC Voltage	150VAC±4%			300VAC±4%		300VAC±4%	
	Nominal Input Frequency	50Hz or 60Hz (Auto detect)						
	Low Freq Trip	Narrow: 47±0.3Hz for 50Hz, 57±0.3Hz for 60Hz Wide:40±0.3Hz for 50Hz/60Hz						
	Low Freq re engage	Narrow: 48±0.3Hz for 50Hz, 58±0.3Hz for 60Hz Wide:42±0.3Hz for 50Hz/60Hz						
	High Freq Trip	Narrow: 55±0.3Hz for 50Hz, 65±0.3Hz for 60Hz Wide:70±0.3Hz for 50Hz/60Hz						
	High Freq re engage	Narrow: 54±0.3Hz for 50Hz, 64±0.3Hz for 60Hz Wide:68±0.3Hz for 50Hz/60Hz						
	Output Short circuit protection	Circuit breaker						
	Bypass breaker rating(230Vac)	10A	20A	30A	40A	50A	60A	80A
	Bypass breaker rating(120Vac)	20A	40A	60A				
Other	Communication methods	RS232/458/CAN						
	Display	LED+LCD						
	Unit Size(L*W*H)	804*620*263mm/31.65*24.4*10.4"			650*513*803 mm	650*513*803 mm	650*513*803 mm	760*513*848 mm
	Package Size	980*730*370mm/38.6*28.7*14.6"			800*670*1000 mm	800*670*1000 mm	800*670*1000 mm	930*670*1100 mm
	Net Weight KG	70	105	120	175	190	210	270
	Gross Weight KG	85	120	135	205	220	240	300

MODEL #	AC Voltage	Size	Packing Size	NW(KG)	GW(KG)
TPH6048NC	120/208V	804*620*263mm	980*730*370mm	70	85
TPH12048NC	120/208V	804*620*263mm	980*730*370mm	105	120
TPH18048NC	120/208V	804*620*263mm	980*730*370mm	120	135
TPH6048E	220/380V	804*620*263mm	980*730*370mm	70	85
TPH12048E	220/380V	804*620*263mm	980*730*370mm	105	120
TPH18048E	220/380V	804*620*263mm	980*730*370mm	120	135
TPH6048NCT180	120/208V	650*513*803mm	800*670*1000mm	145	165
TPH12048NCT180	120/208V	650*513*803mm	800*670*1000mm	155	175
TPH18048NCT180	120/208V	650*513*803mm	800*670*1000mm	165	185
TPH6048ET180	220/380V	650*513*803mm	800*670*1000mm	145	165
TPH12048ET180	220/380V	650*513*803mm	800*670*1000mm	155	175
TPH18048ET180	220/380V	650*513*803mm	800*670*1000mm	165	185

TPH24048E	220/380V	650*513*803mm	800*670*1000mm	175	205
TPH30048E	220/380V	650*513*803mm	800*670*1000mm	190	220
TPH36048E	220/380V	650*513*803mm	800*670*1000mm	210	240
TPH45048E	220/380V	760*513*848mm	930*670*1100mm	270	300
TPH24048NC	120/208V	760*513*1200mm	890*620*1060mm	225	255
TPH24048NCH	277/480V	760*513*870mm	930*670*1200mm	225	255
TPH30048NC	120/208V	760*513*1200mm	930*670*1350mm	240	270
TPH36048NC	120/208V	760*513*1200mm	930*670*1350mm	320	350

SAVE THIS MANUAL!

READ THIS MANUAL BEFORE INSTALLATION, IT CONTAINS IMPORTANT SAFETY, INSTALLATION AND OPERATING INSTRUCTIONS. KEEP IT IN A SAFE PLACE FOR FUTURE REFERENCE.

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