



ANALYTIC SYSTEMS

Power Conversion Solutions

INSTALLATION & OPERATION MANUAL

IPSi3600 Series PURE-SINE INVERTER



An ISO9001 Registered Company Battery Chargers • Inverters • Power Supplies • Voltage Converters

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INVERTER

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS — This manual contains important safety and operating instructions for the Inverter.

1. Do not expose the Inverter to rain or snow.
2. Use of an attachment not recommended or sold by the Inverter manufacturer may result in a risk of electric shock, fire, or injury to persons.
3. Do not disassemble the Inverter; take it to a qualified serviceman when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect the Inverter from the input power before attempting any maintenance or cleaning. Turning it off will not reduce this risk.
5. Never place the Inverter directly above a battery; gases from the battery will corrode and damage the Inverter.
6. Never allow battery acid to drip onto the Inverter.

GROUNDING AND AC POWER CORD CONNECTION INSTRUCTIONS — Inverters should be grounded to reduce risk of electric shock. This Inverter is equipped with a chassis grounding stud and electric receptacles capable of accepting an equipment-grounding conductor and a grounding plug.

Medical Equipment Notice

Analytic Systems does not recommend the use of their products in life support applications where failure or malfunction of the product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Analytic Systems does not recommend the use of any of its products in direct patient care. Examples of devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (whether used for anesthesia, pain relief, or other purposes), auto-transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, neonatal ventilator incubators, ventilators for both adults and infants, anesthesia ventilators, and infusion pumps as well as any other devices designated as “critical” by the U.S. FDA

HEAVY DEVICE - The IPSi2400 and IPSi3600 Series Inverters weigh more than 70 pounds and 90 pounds respectively. Please use appropriate safety measures when lifting or moving these units.



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Introduction

The IPSi3600 series of *Intelligent* Pure Sinewave Inverters are designed specifically for powering computers and other sensitive AC loads in rugged, mobile, off-grid environments. They produce pure sinewave AC power, identical to a conventional AC outlet.

Internally, the IPSi3600 is controlled by a sophisticated Digital Signal Processor (DSP) for optimal control and the most efficient operation possible. The heavy-duty Toroidal Power Transformer steps the low voltage AC produced by the Power MOSFET Transistors from 110 or 220 VAC at 50 or 60 Hz. Additional filtering on the AC output reduces or eliminates EMI noise that can interfere with sensitive communications equipment.

Built for the safest operation possible, this unit features low voltage warning with shutdown circuitry to protect the DC power source. While the inverter is safeguarded by high voltage and over temperature protection both with shutdown circuitry. All the alarm conditions can be monitored on the bright LED indicator display which can also be mirrored on the optional remote control panel.

Using the free-to-download *InverterWizard* software from Analytic Systems, you can change the output frequency, adjust the voltage shutdown thresholds and view and record operating data from any PC with a standard USB interface.

Box Contents

The box you have received should contain the following:

- 1 IPSi3600 Inverter
- 1 compatible USB cable
- 1 Warranty Card
- This User Guide (A PDF copy can be downloaded from www.analyticsystems.com)
- Optional InverterWizard software can be downloaded from www.analyticsystems.com

If anything is missing or damaged please contact your dealer or Analytic Systems for a replacement.



Main Parts



Front Panel

- | | |
|---|---|
| <ol style="list-style-type: none">1. Power Button2. Indicator LEDs3. USB Communications Port4. Hard Wire AC Output: Phoenix VDFK Connectors5. Remote Control Port6. AC Outputs (various available) | <ol style="list-style-type: none">7. AC Output Circuit Breakers (20 Amp)8. Chassis Grounding Stud9. DC Positive Input: 3/8 x 16 Inch Imperial Threaded Studs c/w nuts10. DC Negative Input: 3/8 x 16 Inch Imperial Threaded Studs c/w nuts |
|---|---|



Operation

Before operating, the Inverter must be properly installed and the load(s) and batteries must be properly connected. See *Installation*, *DC Connections*, and *AC connections* for more information.

Move the power switch to ON to energize the circuitry. The AC Power LED, Invert LED, and either the 50 Hz or 60 Hz LED will glow green indicating the presence of AC power at the output. The inverter will begin supplying the load with voltage and current printed on its label.

Controls and Indicators

The Inverter's front panel features 8 LED indicators to display the unit's operating condition. Their functions are detailed below.

Low Voltage: This LED blinks red when the input voltage nears the minimum limit for proper operation. It glows red when the input voltage is too low for proper operation. The Bypass LED will also glow red and the Invert LED and AC Power LED will turn off.

High Voltage: The LED blinks red when the input voltage nears the maximum limit for proper operation. It glows red when the input voltage is too high for proper operation. The Bypass LED will also glow red and the Invert LED and AC Power LED will turn off.

Over Temp: This LED blinks red if the unit's internal temperature nears the safe limit. The Inverter will automatically derate its maximum power rating to maintain a safe operating temperature. This LED glows red if the Inverter is too hot to operate. The Bypass LED will also glow red and the Invert LED and AC Power LED will turn off.

Over Load: This LED blinks red if the current drawn by the load reaches the unit's continuous rating. It glows red if the current drawn reaches the peak rating.

50 Hz: This LED glows green if the Inverter is set to output frequency of 50.00 Hz. This setting can be changed using InverterWizard.

60 Hz: This LED glows green if the Inverter is set to output frequency of 60.00 Hz. This setting can be changed using InverterWizard.

Bypass: This LED glows green if the Inverter is in Bypass mode. This feature is only available on units with the Off-Line UPS option. For more information, see *Off-line UPS* section. This LED glows red if the Inverter is experiencing an alarm condition.

Invert: This LED glows green when the Inverter operating normally.



Installation

MOUNTING

Mount the Inverter in a WELL VENTILATED and DRY area with at least 1 inch (2.54 cm) of clearance all around the unit.

DANGER: *Do not mount the unit anywhere explosive gases can accumulate.*

A slight arc may form when the power leads are connected and, in the unlikely event of a failure, sparks may be generated inside the unit.

CAUTION: *The unit must be mounted on a flat horizontal surface.*

The heavy-duty toroidal power transformer inside the inverter weighs almost 70 pounds. Unless the unit is mounted horizontally, it could break free from its single mounting bolt under severe vibration.

GROUNDING

The unit case is connected to AC Ground and AC Neutral in order to meet regulatory requirements and reduce the possibility of it generating any radio frequency interference.

The unit case must be bonded appropriately to the grounding system of the vehicle or marine vessel. On a vehicle, bond the case to the vehicle's frame. On a marine vessel, bond the case to the vessel's hull. A grounding stud is provided on the front panel for this purpose.

To ensure proper grounding, check the connection with an ohmmeter. The case is isolated from the DC input, so the DC power can be connected to a different ground from the AC output.

DISCONNECTING

If you need to disconnect the Inverter for service or storage:

1. Move the power switch to OFF and disconnect the DC power source.
2. With power disconnected, move the power switch to ON.
3. Leave the switch in this position for one minute to discharge the storage capacitors.
4. Return the power switch to the OFF position. Disconnect the load(s).
5. The inverter is ready for service or storage.



DC Connections

BEFORE MAKING ANY CONNECTIONS, MAKE THE POWER SWITCH IS OFF.

DC INPUT CONNECTION

Before making any connections, prepare a circuit breaker or fuse-protected power DC source with a suitable rating for operation. See *Specifications* for more details.

- The positive DC Input connection is a 3/8 x 16 Inch Imperial Threaded Stud with nut. Connect it to the positive terminal of the DC Power Source using appropriately sized cable.
- The negative DC Input connection is a 3/8 x 16 Inch Imperial Threaded Stud with nut. Connect it to the negative terminal of the DC Power Source using appropriately sized cable.

RECOMMENDATION: *Use the largest gauge (AWG 1/0) recommended) and shortest length of welding wire possible.*

The biggest effect on Inverter performance and EMI is the length and gauge of the DC Input connections.

CAUTION: *Do not reverse connect the input wires.*

This will cause serious damage to the Inverter and will not be covered under warranty.



AC Connections

BEFORE MAKING ANY CONNECTIONS, MAKE THE POWER SWITCH IS OFF.

AC OUTPUT CONNECTION

A set of Phoenix VDFK Connectors has been provided as a Hardwired AC Output Connection. Use wires of an appropriate gauge for the expected output current and voltage to make this connection. See *Specifications* for more details on these values for your unit.

The wiring of this connection can be found on the unit's front panel label and is as follows:

- Black: Hot/Live
- Grey: Neutral
- Green: Ground

CAUTION: *This terminal block is NOT protected by a circuit breaker.*

Each device wired to the distribution panel connected to the terminal block must have its own circuit breaker. Ensure that the total average load of all the devices does not exceed the continuous current rating of the unit.

110VAC Output - Two NEMA 5-15 Outlets are provided as alternate 110VAC Output Connections.

220VAC Output - Receptacles can be North American (Code N) or Worldwide (Code W).

Each of these connections is protected by a 20 Amp circuit breaker.



Hardwired



NA 110VAC



NA 220VAC
Part Code N



World 220VAC
Part Code W

CAUTION: *Do not apply AC voltage to any of the output connections.*

This will damage the Inverter and will not be covered under warranty.



Remote Control Port

This port is intended to connect to an Analytic Systems Digital Remote Control, but can also be used for as a remote ON/OFF switch, isolated RS232 communications terminal and dry contact output fail indicator.

The remote control port is a standard RJ45 style “telephone jack” connector with Analytic Systems proprietary connections. The wire colors in the table below correspond to colors found in any standard T-568B network cable.

CAUTION: Do not connect this port to a computer!

This will cause serious damage to the Inverter and computer. This damage is not be covered under warranty.

Pin Number	Wire Color	Function
1	White/Orange Stripe	Remote ON/OFF
2	Orange	Digital Ground
3	White/Green Stripe	+12V Out
4	Blue	RX RS232
5	White/Blue Stripe	TX RS232
6	Green	Gnd RS232
7	White/Brown	Dry Contact Relay
8	Brown	Dry Contact Relay

Remote On/Off

Pins 1 (White/Orange) and 2 (Orange) can be used to turn the Inverter ON or OFF. Connect the pins together through a switch or relay to turn the Inverter OFF and disconnect them to turn the Inverter ON. The front panel power switch must be ON for this connection to function.

Isolated RS232 Communications

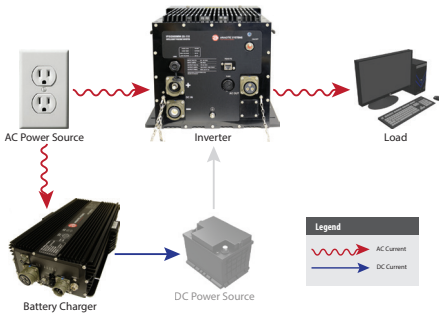
Pins 4 (Blue), 5 (White/Blue) and 6 (Green) are an isolated RS232 port that can be used for communication to/from the Inverter. Information on the standard data structure or custom programming is available from the Analytic Systems. Pin 4 is RX, Pin 5 is TX and Pin 6 is Return.

Dry Contact Output Fail Relay

Pins 7 (White/Brown) and 8 (Brown) are wired to the contacts of an output fail relay controlled by the processor. The contacts will be CLOSED if the Inverter is operating normally and OPEN if it has failed. An LED or buzzer can be wired to these pins to serve as a failure indicator.

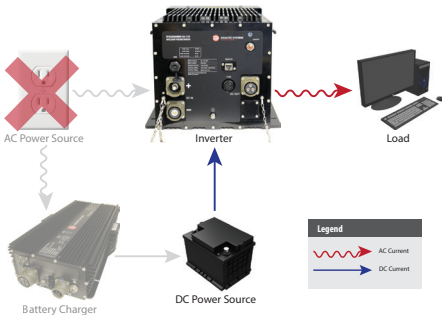
Off-line UPS (Optional)

The Off-line UPS (Uninterruptible Power Source) option allows the Inverter to function as a backup power source in the event of external AC power failure.



Normal Operation

- The AC power source supplies AC Power to both the battery charger and the load (Running through the Inverter's off-line).
- The battery charger supplies DC power to a battery, maintaining it at full charge. This battery is connected to the Inverter's DC Input Connection(s).



AC Power Failure

- The Inverter detects a drop in AC Voltage and starts operation.
- The Inverter draws DC power from the connected battery which inverts it to AC power to supply the load.
- The Inverter continues operating until it detects that the AC Voltage has been restored or the battery is discharged.

To set up the Off-line UPS

1. Connect the AC power source to the AC Input Connection.
2. Connect the battery bank(s) to the DC Input Connection.
3. Connect the load to the AC Output Connection.
4. Turn the Inverter ON. The Bypass LED will glow green indicating the load is being supplied with power from the AC Power Source through the Inverter's off-line.
5. If the AC Power fails, the Bypass LED will stop glowing and the Invert LED and 50/60Hz LED will start glowing green indicating the Inverter is operating.

The voltage thresholds for the Inverter to take over supplying and to stop supplying AC power can be changed using *InverterWizard* to fit your specific needs. For more information, see the *InverterWizard* manual.

TIP: Choose batteries with enough capacity to ensure that the Inverter can power the load for the required amount of time in the event of AC power failure.

For example, a 2000W Inverter running from 24 VDC input will draw ~100 amps, so for 2 hours of runtime the minimum required battery capacity is 280 amps hours of capacity at 24 volts.



Troubleshooting

This unit features eight LED indicators and an alarm buzzer to help diagnose any malfunctions. The Inverter will sound the buzzer to alert you prior to shutting down. You should immediately check the LED indicators to determine the cause of the shutdown.

LED Indicator	Meaning
LOW VOLTAGE	The input voltage is too low for normal operation.
Fix:	<p>Check that the rating of the DC power source is appropriate for the application. Check that the input cables and connections are not corroded or damaged.</p> <p>If using InverterWizard, check the Low Voltage parameters are set properly for the battery voltage you are using, for example: 21V for a 24V battery and 28V for a 32V battery.</p> <p>If everything else is normal, the cause is likely an internal component failure and the unit must be returned for repair.</p>
HIGH VOLTAGE	The input voltage is too high for normal operation.
Fix:	<p>Check that the rating of the DC power source is appropriate for the application. The Inverter can be damaged if the input voltage exceeds the maximum rating. Over-voltage damage is not covered under warranty.</p> <p>If the power source is functioning correctly, the cause is likely an internal component failure and the unit must be returned for repair.</p>
OVER TEMP	The unit's internal temperature is too hot for normal operation.
Fix:	<p>Check that the unit's cooling fans are functioning. If the fans are running, you may need to remount the Inverter for improved ventilation.</p> <p>If the fans are NOT running, the Inverter must be returned to the manufacturer for repair.</p>
OVER LOAD	The load is drawing too much current from the Inverter
Fix:	The unit has been operating at peak current for longer than its intended duty cycle. Reduce the load by disconnecting some devices from the unit's AC output.



InverterWizard Program

The Inverter is factory preset for the input voltage, output voltage, and output frequency on the label. If these parameters are satisfactory, the Inverter can be put immediately into service.

The low voltage shutdown parameters are set for the lowest battery voltage that the Inverter will support. They are:

- 12 Volts for a -12 model
- 24 Volts for a -20 model
- 48 Volts for a -40 model

If the Inverter is powered by alternate DC battery voltage such as 32/36 Volts for a -20 model or 72 Volts (rail) for a -40 model, then the low voltage shutdown parameters will need to be changed. You can do this using the free-to-download *InverterWizard* software from www.analyticsystems.com

With *InverterWizard*, you can also:

- Set the Output Frequency (50.00 or 60.00 Hz)
- Adjust the Output Voltage ($\pm 10\%$ range at 1 VAC intervals)
- Set the voltage thresholds for UPS (For units with the Off-line UPS Option)
- Update the Inverter's firmware version
- Monitor and record the Inverter's operating data



Specifications

Input	20	40
Nominal Voltage	24, 28, 32 or 36 VDC	48 or 72 (Rail) VDC
Actual Voltage	20 - 45 VDC	40 - 80 VDC
Input Amps (max)	180 A	90 A
Input Fuse (External, not supplied)	250 Amp	125 Amp

Output	110	220
Actual Voltage	110 ± 2 VAC	220 ± 4 VAC
Output Current (max)	30A (cont) / 36A (peak)	15A (cont) / 18A (peak)
Output Fuse	20 Amp	20 Amp
Output Frequency	50.00 or 60.00 Hz ± 0.1 Hz (user selectable)	
Output Distortion	<2% at 3600 Watts into resistive load	
Regulation (Line & Load)	< +/- 2.0%	
Duty Cycle Continuous	Continuous 100% for 24 hours per day	

Mechanical	
Length	15.6 in / 39.7 cm
Width	12.0 in / 30.5 cm (including lifting handles)
Height	8.0 in / 21.3 cm
Clearance	1 in / 2.5 cm (all around)
Material	Marine Grade Aluminum
Finish	Black Anodize
Fastenings	18-8 Stainless Steel
Weight	69.5 lbs / 31.5 kg
Connections	DC Positive & Negative Input Connections - 3/8 x 16 Inch Imperial Threaded Studs c/w nuts AC Output Connection - Phoenix VDFK Terminal Blocks (pos, neg, gnd) AC Output Connection (110VAC) - Two NEMA 5-15 AC Receptacles AC Output Connection (220VAC) - N. American or Worldwide available
Warranty	3 Years

Environmental	
Efficiency	> 90% @ Maximum Output
Temp Range	-25°C to +40°C @ maximum output
Isolation	Input-Output, Input-Case & Output-Case: 1500VDC
Humidity	0 - 95% Relative Humidity (non-condensing)

* Specifications subjects to change without notice.

Limited Warranty

1. The equipment manufactured by Analytic Systems Ware (1993) Ltd. (the "Warrantor") is warranted to be free from defects in workmanship and materials under normal use and service.
2. This warranty is in effect for:
 - a. 3 Years from date of purchase by the end user for standard products offered in our catalog.
 - b. 2 Years from date of manufacture for non-standard or OEM products
 - c. 1 Year from date of manufacture for encapsulated products.
3. Analytic Systems will determine eligibility for warranty from the date of purchase shown on the warranty card when returned within 30 days, or
 - a. The date of shipment by Analytic Systems, or
 - b. The date of manufacture coded in the serial number, or
 - c. From a copy of the original purchase receipt showing the date of purchase by the user.
4. In case any part of the equipment proves to be defective, the Purchaser should do the following:
 - a. Prepare a written statement of the nature of the defect to the best of the Purchasers knowledge, and include the date of purchase, the place of purchase, and the Purchasers name, address and telephone number.
 - b. Call Analytic Systems at 800-668-3884 or 604-946-9981 and request a return material authorization number (RMA).
 - c. Return the defective part or unit along with the statement at the Purchasers expense to the Warrantor; Analytic Systems Ware (1993) Ltd., 8128 River Way, Delta, B.C., V4G 1K5, Canada.
5. If upon the Warrantor's examination the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's option without charge, and returned to the Purchaser at the Warrantor's expense by the most economical means. Requests for a different method of return or special handling will incur additional charges and are the responsibility of the Purchaser.
6. Analytic Systems reserves the right to void the warranty if:
 - a. Labels, identification marks or serial numbers are removed or altered in any way.
 - b. Our invoice is unpaid.
 - c. The defect is the result of misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration or accident.
7. No refund of the purchase price will be granted to the Purchaser, unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so.
8. Only the Warrantor shall perform warranty service. Any attempt to remedy the defect by anyone else shall render this warranty void.
9. There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion except for equipment specifically stated to be waterproof.
10. No other express warranty is hereby given and there are no warranties that extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.
11. There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof.
12. The Warrantor assumes no liability for incidental or consequential damages of any kind




DESIGNED AND MANUFACTURED BY




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