

ANALYTIC SYSTEMS

Power Conversion Solutions

INSTALLATION & OPERATION MANUAL

IPSi365 INTELLIGENT PURE-SINE INVERTER



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

Tecknowledgey Defense, 8 John Walsh Blvd, Peekskill, NY 10566 USA - T. 914.739.4499 F. 914.739.5599

defense.tecknowledgey.com



INVERTER

IMPORTANT SAFETY INSTRUCTIONS

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

INVERTER PRECAUTIONS

1. Do not expose the Inverter to rain or snow unless it is a sealed model.
2. Do not use any attachments with the Inverter unless recommended or sold by the manufacturer, this may result in a risk of fire, electric shock, or injury to persons.
3. Do not disassemble the Inverter; if service or repair is required, return it to the manufacturer or an authorized service center. Incorrect reassembly may result in a risk of fire, electric shock, or injury to persons. Voltages in excess of 350 volts are present inside the charger any time it is plugged into an AC outlet, even if switched off.
4. To reduce risk of electric shock, unplug the Inverter from the AC power before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.
5. Do not place Inverter directly above a battery; gases generated by battery will corrode and damage Inverter.
6. Do not allow battery acid to drip on the Inverter.

GROUNDING AND AC POWER CORD CONNECTION INSTRUCTIONS

The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

HEAVY DEVICE - The IPSi1000, 2000 and 3000 Inverters weigh more than 30lbs (13.6kg). Please use appropriate safety measures when lifting or moving these units.

DANGER: Never alter the AC power cord or plug provided. If it will not fit the output, use an approved adapter or have the proper AC power cord installed by a qualified electrician. Improper connection can result in the risk of electric shock.

MEDICAL EQUIPMENT NOTICE

Analytic Systems does not recommend the use of their products in life support applications where failure or malfunction of this 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



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Introduction

The IPSi365 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 IPSi365 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 to 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

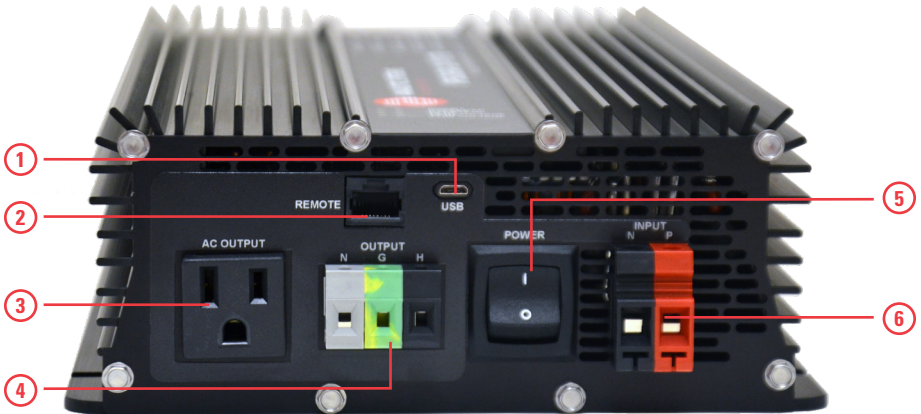
The box you have received should contain the following:

- 1 IPSi365 *Intelligent* Pure Sine 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

1. Remote Control Connection
2. USB Communications Port
3. **AC Output Connection 1:** NEMA 5-15 Outlet
4. **AC Output Connection 2:** Color-coded Phoenix VFDK Terminal Blocks (Gray: AC Neutral, Green: AC Ground, Black: AC Hot)
5. Power Switch
6. **DC Input Connection:** Color-coded Phoenix VFDK Terminal Blocks (Red: DC Positive, Black DC Negative)



Top Chassis

1. Indicator LEDs
2. Unit Label



Operation

This unit is designed for simple operation. Before operating, the inverter must be properly installed and connected. See *Installation* and *AC/DC Connections* for more information.

TO OPERATE THE INVERTER:

1. Move the Power Switch to ON to energize the circuitry.
2. The Invert LED and either the 50 Hz or 60 Hz LED will glow green indicating proper operation and the presence of AC power at the outputs.
3. The inverter will automatically begin supplying the connected load with voltage and current printed on its label.

TO END OPERATION:

1. Move the Power Switch to OFF to end operation.
2. Wait for all the LEDs to turn off.
3. The inverter can now be safely disconnected from the load and power source. It can then be serviced or put into storage.



Operational Indicators

There are eight LED indicators on the inverter's top chassis which display the unit's operating condition. The table below details their meaning:

LEDs	Meaning
LOW VOLTAGE	<ul style="list-style-type: none">Blinks red when the input voltage nears the minimum limit for operation.Glow red when the input voltage is too low for operation. The Bypass LED will also glow red and the Invert LED will turn off.The shutdown and start-up thresholds for the low voltage alarm can be adjusted using <i>InverterWizard</i>. See <i>InverterWizard</i> for more information.
HIGH VOLTAGE	<ul style="list-style-type: none">Blinks red when the input voltage nears the maximum threshold for operation.Glow red when the input voltage is too high for operation. The Bypass LED will also glow red and the Invert LED will turn off.
OVER TEMP	<ul style="list-style-type: none">Blinks red when the unit's internal temperature nears the safe limit. The inverter will automatically derate its maximum power rating to try to maintain a safe operating temperature.Glow red when the inverter is too hot to operate. The Bypass LED will also glow red and the Invert LED will turn off.
OVER LOAD	<ul style="list-style-type: none">Blinks red when the current being drawn reaches the unit's continuous rating.Glow red when the current being drawn reaches the unit's peak rating.
50 HZ	<ul style="list-style-type: none">Glow green if the inverter's output frequency is set to 50.00 Hz. This setting can be changed using <i>InverterWizard</i>.If the alarm sounds and both the 50 Hz and 60 Hz LEDs glow red. The unit is experiencing a ground fault and the Ground Fault Interruptor has shut down the unit.
60 HZ	<ul style="list-style-type: none">Glow green if the inverter's output frequency is set to 60.00 Hz. This setting can be changed using <i>InverterWizard</i>.If the alarm sounds and both the 50 Hz and 60 Hz LEDs glow red. The unit is experiencing a ground fault and the Ground Fault Interruptor has shut down the unit.
BYPASS	<ul style="list-style-type: none">Glow green if the inverter is in Bypass mode and functioning as an Off-line Uninterruptible Power Supply. For more information, see <i>Off-line UPS</i>.Glow red when the inverter is experiencing a malfunction.
INVERT	<ul style="list-style-type: none">Glow green when the inverter operating normally.



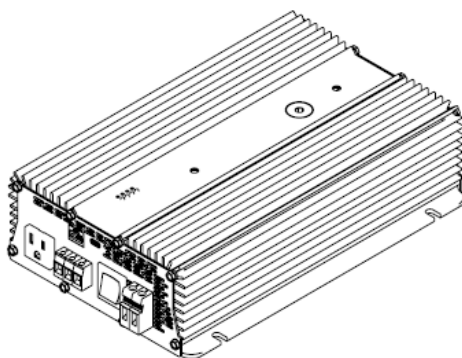
Installation

MOUNTING

Mount the unit in a DRY and WELL VENTILATED area. Allow at least one inch (2.54 cm) of clearance all around the unit for adequate cooling.

CAUTION: DO NOT MOUNT THE UNIT ANYWHERE EXPLOSIVE GASES CAN ACCUMULATE.

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



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.

IMPORTANT: BEFORE CONNECTING OR DISCONNECTING ANYTHING TO THE INVERTER, MAKE THE UNIT IS OFF.



DC Input Connections

DC INPUT POWER CONNECTION

This unit is equipped with a pair of color-coded Phoenix VDFK6 terminal block connectors to serve as a DC Input Connection.

Connect the DC input power here using AWG8/10mm² wire. The wires should be stripped 0.4 inches/9mm and tightened securely to 16 inch-pounds/1.8 Newton Meters. The terminal blocks are color-coded to indicate polarity which is as follows:

Connector Color	Polarity
Red	DC Input Positive
Black	DC Input Negative

CAUTION: DO NOT REVERSE CONNECT THE DC INPUT POWER

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

AC Output Connections

AC OUTPUT CONNECTION

This unit is equipped with three color-coded Phoenix VDFK4 terminal block connectors to serve as a hard wired AC Output Connection.

Connect the AC load here using wires from AWG24/0.25mm² to AWG10/ 6mm². The wires should be stripped 0.3 inches/ 8mm and tightened securely to 16 inch-pounds/1.8 Newton Meters. The terminal blocks are color-coded to indicate polarity which is as follows:

Connector Color	Polarity
Black	AC Hot/Live
Gray	AC Neutral
Green/Yellow	AC Ground (Chassis)

This unit is also equipped with a NEMA 5-15 AC outlet as a secondary AC Output Connection. This outlet is identical to a North American AC Mains outlet. This unit can also be constructed with a European AC or Worldwide AC mains compatible outlets by custom order.

CAUTION: DO NOT APPLY AC VOLTAGE TO ANY AC OUTPUT CONNECTION.

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



NA 220VAC 60HZ

- part code "U" -



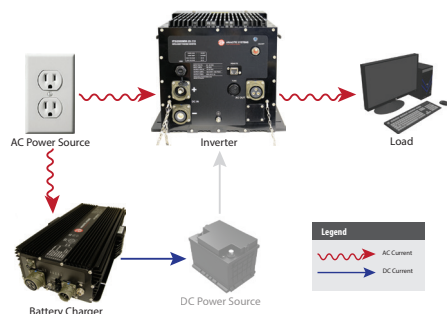
WW 220VAC 50HZ

- part code "W" -



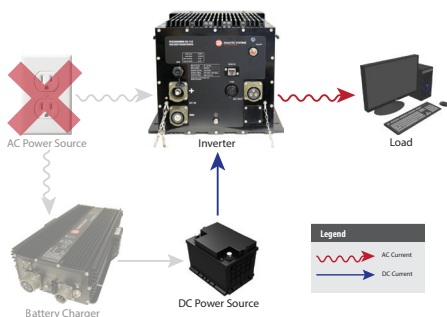
Off-line UPS (Optional)

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 DC power source (batteries) 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 turn off and the Invert LED and 50/60Hz LED will glow green indicating the Inverter is operating.

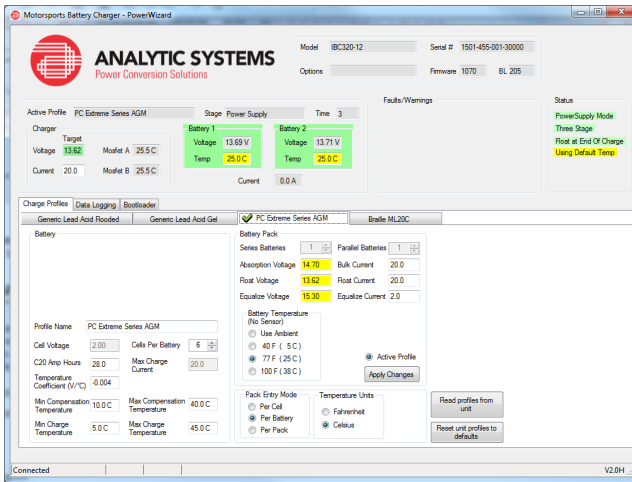
The AC input voltage thresholds for the inverter to take over supplying and to end supplying AC power can be changed using *InverterWizard* to fit your specific needs. For more information, see the *InverterWizard* manual.

TIP: MAKE SURE THE BATTERIES HAVE WITH ENOUGH CAPACITY TO POWER THE LOAD FOR THE REQUIRED AMOUNT OF TIME IN THE EVENT OF AC POWER FAILURE.

For example, a 2000 watt Inverter with 24 VDC input will draw ~100 A, so for 2 hours of runtime the minimum required battery capacity is 280 amps-hours @ 24 volts.



InverterWizard (Optional)



InverterWizard is optional software that can be used to adjust the inverter's operating settings. *InverterWizard* is free-to-download from www.analyticssystem.com or available by emailing sales@analyticssystem.com

Using *InverterWizard*, you can:

- Set the inverter's output frequency to either 50.00 or 60.00 Hz.
- Adjust the inverter's output voltage over a $\pm 10\%$ range in 1 VAC intervals.
- Set the voltage thresholds for the low voltage alarms.
- Set the voltage thresholds for the UPS function to start and stop. This function is only available on units with the UPS option. *See Off-line UPS for more information.*
- Update the inverter's firmware.
- Monitor and record the inverter's operating data.

ALTERNATE DC VOLTAGES AND LOW VOLTAGE SHUTDOWN

IPSi series *Intelligent* inverters are factory-preset for the low voltage alarm/shutdown to trigger if the unit detects an input voltage drop of:

- <12 VDC for a -12 model
- <24 VDC for a -20 model
- <48 VDC for a -40 model

If the inverter uses an alternate input voltage such as 32 VDC, 36 VDC, or 72 VDC (rail) battery then the low voltage shutdown thresholds will need to be adjusted using *InverterWizard*.

NOTE: INVERTERWIZARD IS NOT REQUIRED TO OPERATE THE INVERTER.

The inverter can immediately be put into service if its default operating settings are suitable for your needs. The inverter's default settings are listed its label.



Troubleshooting

This unit features eight LED indicators and an alarm buzzer to help diagnose any malfunctions. In the event of malfunction, the inverter will sound the buzzer to alert you prior to shutting down its output. You should immediately check which LEDs are glowing to determine the cause of the malfunction.

LED / Issue	Meaning
LOW VOLTAGE LED is ON	The input voltage is too low for normal operation.
Fix:	<p>Check that the power source is appropriately rated for the application. Check that the input wiring and connections are not corroded or damaged.</p> <p>If using <i>InverterWizard</i>, check the Low Voltage Alarm parameters are properly set for the voltage of battery you are using, for example: 21V for a 24V battery and 28V for a 32V battery.</p> <p>If the above are checked and in working order, the cause is likely an internal component failure and the unit must be returned for repair.</p>
HIGH VOLTAGE LED is ON	The input voltage is too high for normal operation.
Fix:	<p>Check that the power source is appropriately rated for the application. The inverter can be damaged if the input voltage exceeds the rating indicated on the label. Over-voltage damage is not covered under warranty.</p> <p>If the above are checked and in working order, the cause is likely an internal component failure and the unit must be returned for repair.</p>
OVER TEMP LED is ON	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>The inverter will automatically derate its max. power rating to try to maintain a safe operating temperature. If the internal temperature exceeds the safe maximum, the unit will shut off its outputs. When the temperature drops to safe operating range, the inverter will autorecover.</p> <p>If the fans are NOT running, the unit must be returned for repair.</p>
OVER LOAD LED is ON	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.

TIP: FOR QUICK REFERENCE, IF THE UNIT IS EXPERIENCING A MALFUNCTION THE INVERT LED WILL BE OFF AND ALSO THE BYPASS LED WILL GLOW RED.



Specifications

Input	-12	-20	-40
Nominal Voltage	12 VDC	24, 28, 32, or 36 VDC	48 or 72 (Rail) VDC
Actual Voltage	10.5-18 VDC	19 - 48 VDC	39 - 84 VDC
Input Amps (Max.)	49 A	24 A	12 A
Input Fuse (Internal)	2x 30A 32 VDC Blade Mini	1x 30A 58 VDC Blade Mini	1x MDA - 15A fuse
Under Voltage Input Alarm Shutdown Range	10.5-14 VDC (Default setting: 10.5 VDC)	19-36 VDC (Default setting: 21 VDC)	39-70 VDC (Default setting: 42 VDC)
Under Voltage Input Alarm Start-up Range	11-14 VDC (Default setting: 11VDC)	20-36 VDC (Default setting: 23VDC)	40-70 VDC (Default setting: 10.5 VDC)
Under Volt Input Shutdown Delay	1-120 seconds (Default setting: 30 seconds)		
Over Voltage Input Shutdown	19 VDC	49 VDC	86 VDC
Inrush Current (From fully discharged)	1.8 Amp Peak	4.8 Amp Peak	8.4 Amp Peak

Output	-110	-220
Nominal Voltage	110 VAC	20 VAC
Continuous Amps	3 A	1.5 A
Peak Amps	3.6 A	1.8 A
Output Frequency	50.00 or 60.00 Hz \pm 0.01 Hz (User-selectable)	
Output Distortion (THD)	<2% at 360 VA into resistive load	
Regulation (Line & Load)	< +/- 2.0%	
Duty Cycle	100% for 24 hours per day / 1 min @ peak with 10 minute cool down	
Efficiency	85% @ Full load	
Ground Fault Trip Current	4-6 mA	



General	
Length	13.0 in / 32.8 cm
Width	8.0 in / 20.3 cm (Including mounting flanges)
Height	3.3 in / 8.3 cm
Clearance	1.0 in / 2.5 cm
Weight	16.0 lb / 7.3 kg
Material	Marine-grade aluminum
Finish	Black anodized
Fastenings	18-8 Stainless steel
Input Connections	AC: Phoenix VDFK4 32 Amp / 500V terminal block (Off-line UPS Option mandatory) DC: Phoenix VDFK6 50 Amp / 300V terminal block
Output Connections	Hardwire: Phoenix VDFK4 32 Amp / 500V terminal block 110 VAC Model: NEMA 5-15 receptacle 220 VAC North American Model (220N): NEMA 6-20 receptacle 220 VAC Worldwide Model (200W): 220V Universal receptacle
Other Connections	Data/Communication: MicroUSB port Remote Control: RJ45 'telephone jack' connector with proprietary pinout

Environmental and Safety	
Operating Temperature	-25°C to +40°C @ Full load (Expanded -40°C to +55°C Operating Temperature Option available)
Storage Temperature	-55 °C to 105°C
Cooling	One internal thermostatically controlled cooling fan
Humidity	0 - 95% relative humidity (non-condensing) with standard conformal coating
Audible Noise	< 27 dB @ 3 ft/ 1m with fan running
Typical Service Life	> 10 Years (86,700 hours)
Isolation	Input to Chassis: <1100VDC. Input to Output, Output to Chassis: <1500 VAC
Warranty	5 Years Parts and Labour
Emissions	Complies with FCC Class B, Part 15

* 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





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