



**samlexpower**<sup>®</sup>

**Pure Sine Wave  
Power Inverter**

NTX-1000-12

NTX-1500-12

NTX-2000-12

NTX-3000-12

**Owner's  
Manual**

Please read this  
manual **BEFORE**  
installing your  
inverter

# SECTION 1 | Important Safety Instructions

**1.1 THIS MANUAL CONTAINS IMPORTANT INFORMATION REGARDING SAFETY, OPERATION, MAINTENANCE AND STORAGE OF THIS PRODUCT. BEFORE USE, READ AND UNDERSTAND ALL CAUTIONS, WARNINGS, INSTRUCTIONS AND PRODUCT LABELS, PLUS YOUR VEHICLE'S BATTERY MANUFACTURER GUIDELINES. FAILURE TO DO SO COULD RESULT IN INJURY AND/OR PROPERTY DAMAGE.**

1.2 To ensure reliable service, your power inverter must be installed and used properly. Please read the installation and operating instructions thoroughly prior to installation and use. Pay particular attention to the WARNING and CAUTION statements in this manual. The CAUTION statements advise against certain conditions and practices that may result in damage to your inverter. The WARNING statements identify conditions or practices that may result in personal injury. Read All Instructions Before Using This power inverter!

## 1.3 WARNINGS!

### TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, EXPLOSION OR INJURY

1. The AC output of the unit should never be connected directly to an Electrical Breaker Panel / Load Center which is also fed from the utility power / generator. Such a direct connection may result in parallel operation of the different power sources and AC power from the utility / generator will be fed back into the unit which will instantly damage the output section of the unit and may also pose a fire and safety hazard. If an Electrical Breaker Panel / Load Center is fed from this unit and this panel is also required to be fed from additional alternate AC sources, the AC power from all the AC sources (like the utility / generator / this inverter) should first be fed to an Automatic / Manual Selector Switch and the output of the Selector Switch should be connected to the Electrical Breaker Panel / Load Center. Samlex America, Inc. Automatic Transfer Switch Model No. STS-30 is recommended for this application.
2. Working with the unit may produce arcs or sparks. Thus, the unit should not be used in areas where there are flammable materials or gases requiring ignition protected equipment. These areas may include spaces containing gasoline-powered machinery, fuel tanks, battery compartments and engine compartments.
3. In NTX-3000-12, the Neutral terminal of the NEMA L5-30R outlets is electrically isolated from its Ground terminal and also from the metal chassis of the inverter. Hence, the Neutral terminal will be at elevated voltage of around 66 VAC with respect to the Ground terminal and with respect to the metal chassis of the inverter. **DO NOT TOUCH THE NEUTRAL TERMINAL!**
4. In NTX-1000-12, NTX-1500-12 and NTX-2000-12, the Neutral terminals of the Dual NEMA5-20R GFCI AC outlets are bonded to their Ground terminals and also to the metal chassis of the inverter. Hence, the Neutral terminals of the outlets will be at 0V with respect to their Ground terminals and with respect to the metal chassis of the inverter.
5. DC input is non-isolated from AC output.
6. Before working on an AC load connected to the inverter, switch OFF the inverter or, remove the power cord of the AC load from the inverter or from the multiple outlet power strip connected to the inverter. Switching OFF the AC load or the power strip disconnects only the "Line / Hot" line. However, the Neutral line remains connected. As indicated above, in NTX-3000-12, the Neutral will be at 60V with respect to Ground/chassis. Hence, touching any section of the load connected to the Neutral will produce electrical shock!
7. Do not make any electrical connections or disconnections in areas designated as IGNITION PROTECTED. This includes 12 VDC cigarette plug connections, and terminal connections.
8. This is not a toy - keep away from children.
9. Do not insert any object into the ventilation slots or the fan opening(s).

## SECTION 1 | Important Safety Instructions

### 1.4 CAUTION!

1. The metal chassis and the input Negative terminal of the inverter are internally connected to the Ground terminals of the AC outlets. **Hence, the input Negative terminal should be used as the grounding terminal.** Do not use with Positive Grounded Electrical Systems (the majority of modern automobiles, RVs and trucks are Negative Grounded Electrical Systems).
2. Use specified fuse in the Positive supply connection within 7" of the Positive battery post. See Table 4.1 and Fig 4.2.
3. Observe correct polarity when connecting the DC input terminals of the inverter to the battery. Connect Positive of the battery to the Positive input connector of the inverter and the Negative of the battery to the Negative input terminal of the inverter. **Reverse polarity connection will result in a blown fuse and may cause permanent damage to the inverter. Damage due to reverse polarity is not covered under warranty.**
4. This inverter will not operate high wattage appliances that exceed the output power limit or the surge power limit.
5. Grounding the Neutral terminal of the AC outlet in NTX-3000-12 will shut down the inverter. Similarly, grounding the Neutral terminal of the GFCI outlet in NTX-1000-12, NTX-1500-12 and NTX-2000-12 will trip the GFCI. **Hence, do not connect the AC output to a Load Center / Distribution Panel where the Neutral is bonded to the Earth Ground.**
6. **Installation Environment**
  - The inverter should be installed indoor only in a well ventilated, cool, dry environment.
  - Do not expose to moisture, rain, snow or liquids of any type.
  - To reduce the risk of overheating and fire, do not obstruct the suction and discharge opening of the cooling fan(s).
  - To ensure proper ventilation, do not install in a low clearance compartment.
7. **Precautions When Working With Batteries**
  - Batteries contain very corrosive diluted Sulfuric Acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
  - Batteries generate Hydrogen and Oxygen during charging resulting in evolution of explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
  - Never smoke or allow a spark or flame near the batteries.
  - Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
  - Remove metal items like rings, bracelets and watches when working with batteries. The batteries can produce a short circuit current high enough to weld a ring or the like to metal and, thus, cause severe burn.
  - If you need to remove a battery, always remove the ground (Negative) terminal from the battery first. Make sure that all the accessories are off so that you do not cause a spark.
8. This inverter is not tested for use with medical devices.

## SECTION 1 | Important Safety Instructions



### 1.5 **WARNING!**

Do not connect directly to AC distribution wiring. This inverter is NOT grid interactive.

### 1.6 IMPORTANT WIRING INFORMATION

Substantial power loss and reduced battery operating time results from inverters installed with wires that are not sized correctly based on the length and the current required to be carried. Current flowing through a wire produces voltage drop along its length due to the resistance of the wire and due to the value of the current carried through it. The resistance of the wire is inversely proportional to the cross-sectional area of the wire (designated in mm<sup>2</sup> or AWG) and directly proportional to its length i.e. thinner and longer wire has higher resistance and hence, produces higher voltage drop. Similarly, thicker and shorter wire has lower resistance and hence, produces lower voltage drop. Hence, symptoms of low DC input voltage / battery power can result from wires that are either excessively long or have an insufficient cross-sectional area (designated in mm<sup>2</sup> or AWG). **The wires should be sized based on (i) the maximum current they are required to carry based on the temperature rating of their insulation and (ii) the distance between the battery and the inverter to limit the voltage drop to 2% to 5%. Please refer to Table 4.1 for wire sizing.**

Wires are rated based on its insulation, temperature and operating environment. Please ensure that the wire insulation is of the appropriate type for the operating environment.

The installer/operator should be especially aware of the requirements to maintain secure, tight, water-resistant electrical connections and to provide for strain relief for DC wires and appliance wiring.

## SECTION 2 | Design Features And Principle Of Operation

### 2.1 GENERAL

The inverter converts low voltage DC (Direct Current) from a battery or other DC power source to the standard nominal 115 volt AC (Alternating Current) household power.

### 2.2 DESIGN FEATURES

- Pure Sine Waveform of AC output voltage
- High efficiency
- Compact size
- Very low Idle current
- Soft Start Technology
- LCD Remote Control Model NTX-RC
- Low noise variable speed fan

## SECTION 2 | Design Features and Principle of Operation

### 2.3 POWER RATINGS

The continuous power ratings of the models are as follows:

- NTX-1000-12 - 1000 Watts
- NTX-1500-12 - 1500 Watts
- NTX-2000-12 - 2000 Watts
- NTX-3000-12 - 3000 Watts

### 2.4 PRINCIPLE OF OPERATION

The voltage conversion takes place in two stages. In the first stage, the DC voltage of the battery is converted to a high voltage DC using high frequency switching and Pulse Width Modulation (PWM) technique. In the second stage, the high voltage DC is converted to 115 VAC, 60 Hz pure sine wave AC again using PWM technique. This is done by using a special wave shaping technique where the high voltage DC is switched at a high frequency and the pulse width of this switching is modulated with respect to a reference sine wave.

### 2.5 THE OUTPUT WAVEFORM

The AC output waveform of the NTX-series inverter is known as “Pure Sine Wave” or “True Sine Wave”. It is a waveform that has characteristics same as the sine wave shape of utility power (See Fig 2.1). Modified Sine Wave is also shown for comparison.

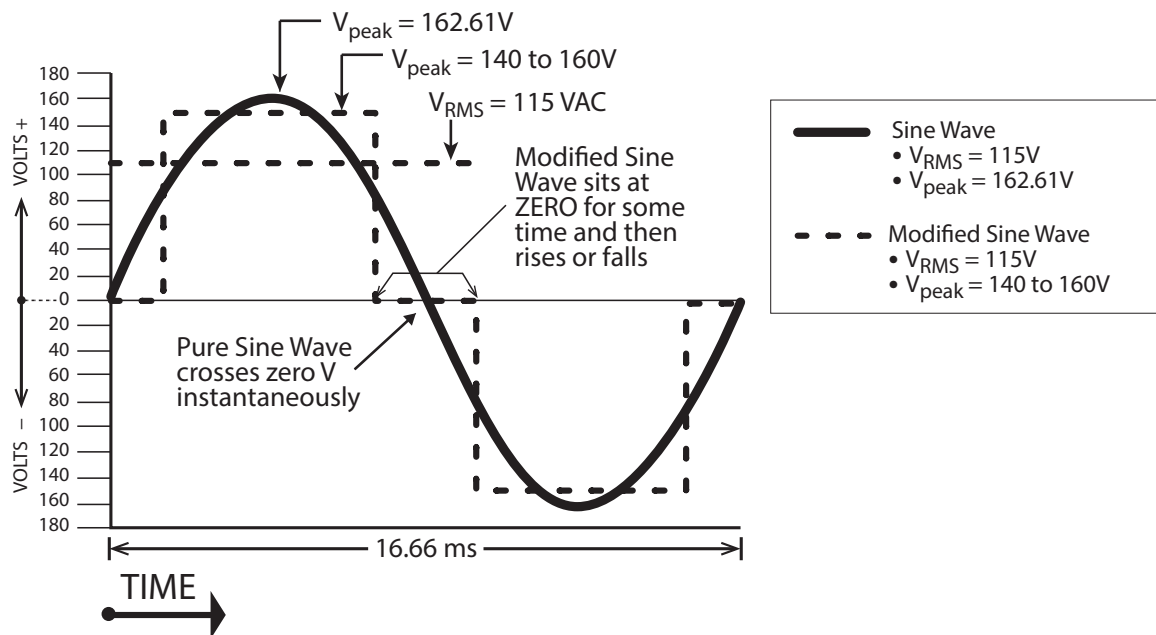


Fig 2.1 Pure and Modified Sine Waveforms for 115V, 60Hz

## SECTION 3 | Layout and Dimensions

### 3.1 NTX-1000-12, NTX-1500-12 AND NTX-2000-12 LAYOUT

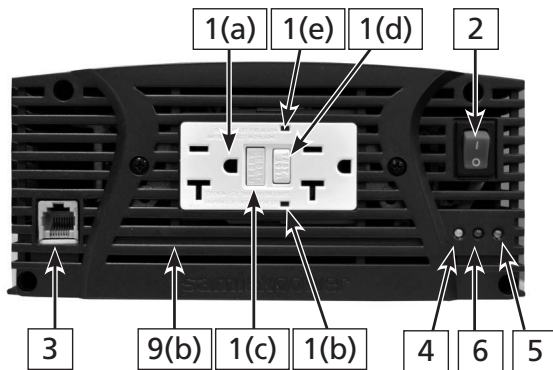


Fig 3.1.1 Front view of  
NTX-1000/1500/2000-12

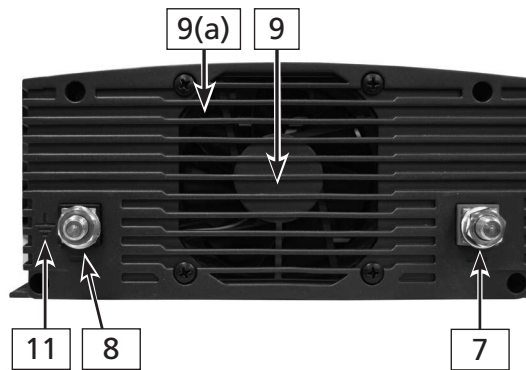
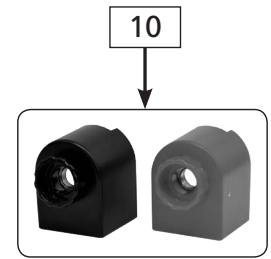


Fig 3.1.2 Back view of  
NTX-1000/1500/2000-12



#### Legend for Fig 3.1.1 and 3.1.2

- 1(a). AC Outlets: NEMA5-20R Duplex GFCI receptacles
- 1(b). Green indicator light on the GFCI receptacles. Will be ON when normal. Will be OFF when tripped.
- 1(c). GFCI Reset Button
- 1(d). GFCI Test Button
- 1(e). Red LED for end of life alarm for GFCI
2. ON/OFF Switch
3. 8P8C Modular Jack (Also called RJ-45 Jack) for connecting Remote Control Model NTX-RC
4. Yellow LED: Will be ON during (i) Over temperature shutdown, (ii) Shut down due to low DC input voltage and (iii) Shut down due to high DC input voltage.
5. Green LED: Will be ON when DC Section is operating normally
6. Red LED: Will be ON during shut down due to overload / short circuit on the load side.
7. Positive DC Input Connector: Stud and Nut – Size M9
8. Negative DC Input Connector: Stud and Nut – Size M9
9. Cooling fan [behind the fan grille 9(a)]
- 9(a). Ventilation grille for fan [Air from fan (9) is exhausted outwards]
- 9(b). Ventilation slots for air intake for the cooling fan (9)
10. Plastic covers with Thumb Nuts for protecting DC input terminals – Red for Positive and Black for Negative
11. Earth Ground symbol. The metal chassis of the inverter is internally bonded to the Negative DC input terminal (8). Connect the Negative DC input terminal (8) on the inverter or the battery Negative post on the battery to Earth Ground

## SECTION 3 | Layout and Dimensions

### 3.2 NTX-3000-12 LAYOUT

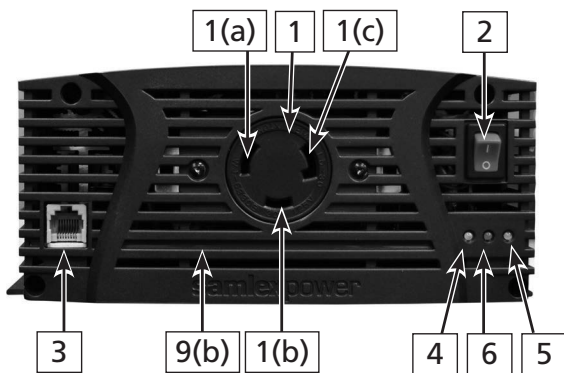


Fig 3.2.1 Front VIEW OF NTX-3000-12

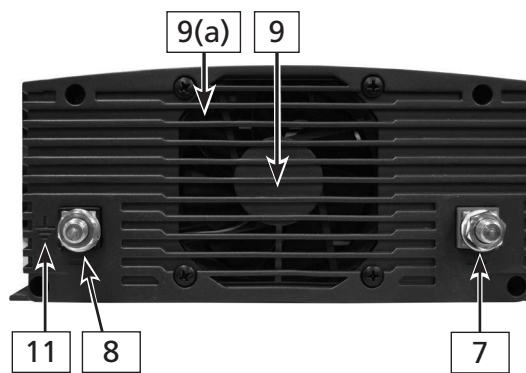
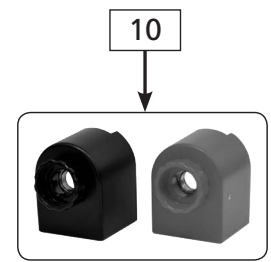


Fig 3.2.2 Back VIEW OF NTX-3000-12



#### Legend for Fig 3.2.1 and 3.2.2

- 125 VAC, 30A Locking Type Of AC Outlet (NEMA L5-30R)\*
  - Line Slot of NEMA L5-30R
  - Neutral Slot of NEMA L5-30R
  - Grounding Slot of NEMA L5-30R
- ON/OFF Switch
- 8P8C Modular Jack (Also called RJ-45 Jack) for connecting Remote Control Model NTX-RC
- Yellow LED: Will be ON during (i) Over temperature shutdown, (ii) Shut down due to low DC input voltage and (iii) Shut down due to high DC input voltage
- Green LED: Will be ON when DC Section is operating normally
- Red LED: Will be ON during (i) Shut down due to overload / short circuit on the load side and (ii) Shut down due to Ground fault on the load size.
- Positive DC Input Connector: Stud and Nut – Size M9
- Negative DC Input Connector: Stud and Nut – Size M9
- Cooling fan [behind the fan grille 9(a)]
- 9(a). Ventilation grille for fan [Air from fan (9) is exhausted outwards]
- 9(b). Ventilation slots for air inlet for the cooling fan (9)
- Plastic covers with Thumb Nuts for protecting DC input terminals – Red for Positive and Black for Negative
- Earth Ground symbol. The metal chassis of the inverter is internally bonded to the Negative DC input terminal (8). Connect the Negative DC input terminal (8) on the inverter or the battery Negative post on the battery to Earth Ground

\* **NOTE:** 125 VAC, 30A Locking Type of Plug (NEMA-30P) has been provided with the unit for wiring to Breaker Panel or Load Center that has Neutral to Ground bond [Refer to Section 4.13.2(c)].

# SECTION 3 | Layout and Dimensions

## 3.2 DIMENSIONS

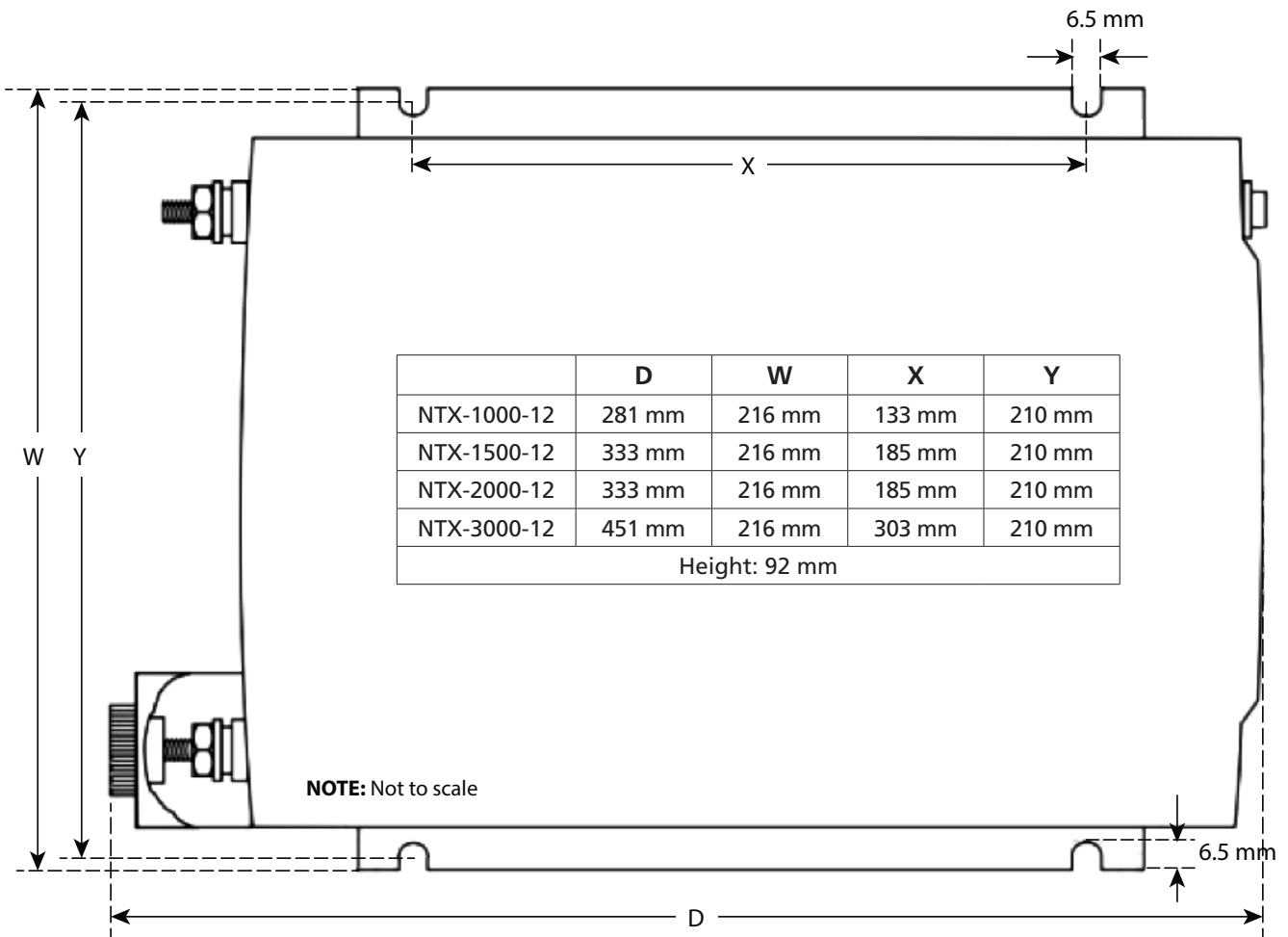


Fig 3.3 Dimensions



## SECTION 4 | Installation



### WARNING!

1. Before commencing installation, please read the safety instructions explained in Section 1 titled "Important Safety Instructions".
2. It is recommended that the installation should be undertaken by a qualified, licensed / certified electrician.
3. Various recommendations made in this manual on installation will be superseded by the National / Local Electrical Codes related to the location of the unit and the specific application.

### 4.1 LOCATION OF INSTALLATION

Please ensure that the following requirements are met:

**Working Environment:** Indoor use.

**Cool:** Heat is the worst enemy of electronic equipment. Hence, please ensure that the unit is installed in a cool area that is also protected against heating effects of direct exposure to the sun or to the heat generated by other adjacent heat generating devices.

**Well ventilated:** The unit is cooled by convection and by forced air-cooling by a load and temperature controlled variable speed fan (9, Figs 3.1.2 and 3.2.2). The fan will start running slowly at around 15% loading. At around 70% rated load, it will run at high speed. At any point, if the internal temperature is  $> 70^{\circ}\text{C}$ , the fan will run at high speed (temperature control will override load control). The fan draws cool air from air intake openings in the front [9(b) in Figs 3.1.1 and 3.2.1] and discharges hot air through the exhaust openings next to the fan [9(a) in Figs 3.1.2 and 3.2.2]. To avoid shut down of the inverter due to over temperature, do not cover or block these intake / exhaust openings or install the unit in an area with limited airflow. Keep a minimum clearance of 10" around the unit to provide adequate ventilation. If installed in an enclosure, openings must be provided in the enclosure, directly opposite to the air intake and air exhaust openings of the inverter.

**Dry:** There should be no risk of condensation, water or any other liquid that can enter or fall on the unit.

**Clean:** The area should be free of dust and fumes. Ensure that there are no insects or rodents. They may enter the unit and block the ventilation openings or short circuit electrical circuits inside the unit.

**Protection against fire hazard:** The unit is not ignition protected and should not be located under any circumstance in an area that contains highly flammable liquids like gasoline or propane as in an engine compartment with gasoline-fueled engines. Do not keep any flammable / combustible material (i.e., paper, cloth, plastic, etc.) near the unit that may be ignited by heat, sparks or flames.

## SECTION 4 | Installation

**Closeness to the battery bank:** Locate the unit as close to the battery bank as possible to prevent excessive voltage drop in the battery cables and consequent power loss and reduced efficiency. However, the unit should not be installed in the same compartment as the batteries (flooded or wet cell) or mounted where it will be exposed to corrosive acid fumes and flammable Oxygen and Hydrogen gases produced when the batteries are charged. The corrosive fumes will corrode and damage the unit and if the gases are not ventilated but allowed to collect, they could ignite and cause an explosion.

**Accessibility:** Do not block access to the front panel. Also, allow enough room to access the AC receptacles and DC wiring terminals and connections, as they will need to be checked and tightened periodically.

**Preventing Electromagnetic Interference (EMI):** The unit uses high power switching circuits that generate un-intentional conducted and radiated EMI that can not be eliminated entirely. This EMI is limited to the required standard [FCC Part 15(B), class A]. These limits are designed to provide reasonable protection against harmful interference when this unit is operated in business / commercial / industrial environments. Locate any electronic equipment susceptible to radio frequency and electromagnetic interference as far away from the inverter as possible.

### 4.2 MOUNTING

Please refer to Fig 3.3 for dimensions and mounting details.

The inverter has four mounting slots that allow the unit to be fastened against a bulkhead, floor, wall or other flat surface. Ideally, the mounting surface should be cool to the touch.

**It is more electrically efficient to use longer AC wiring than DC wiring, so install the inverter as close as possible to the 12 VDC power source.**

The inverter can be operated in any position, however, if it is to be mounted on a wall, mount it horizontally as shown in Fig 4.1(a) so that indicators, switches, outlets and terminal blocks located on the front panel are visible and accessible. Do not mount on wall in positions shown in Figs. 4(b) & 4(c) because small metal objects may fall into the unit through the ventilation slots and cause electrical short circuit.

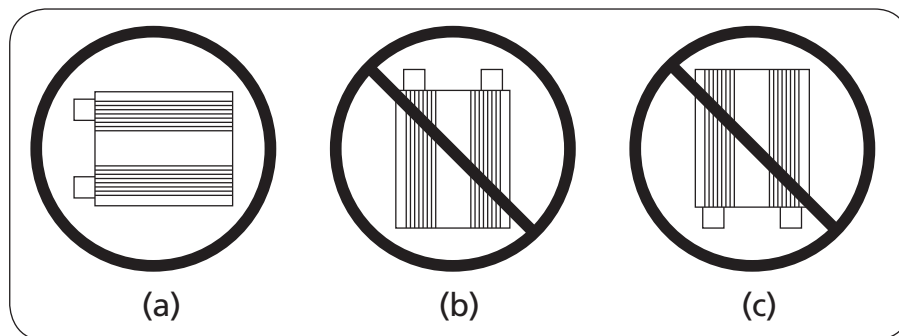


Fig. 4.1 Mounting arrangement on wall



#### CAUTION!

The power inverter must be connected only to batteries with a nominal output voltage of 12V. The unit will not operate from a 6 Volt battery, and will sustain **permanent damage** if connected to a 24V battery.

## SECTION 4 | Installation



### CAUTION!

Loose connectors may cause overheated wires and melted insulation. Check to make sure you have not reversed the polarity of battery input connections. Reverse polarity connection will result in a blown fuse and may cause **permanent damage** to the inverter. **Damage due to reverse polarity is not covered by warranty.**

### 4.3 BATTERY / DC POWER SOURCE REQUIREMENTS

The battery / DC power source must provide  $>11.0 \pm 0.3V$  and  $< 16.3 \pm 0.3V$  DC and must be able to supply the necessary current to operate the load. The power source may be a battery or a well-regulated DC power supply. To obtain a rough estimate of the current (in Amperes) the power source must deliver, simply divide the power consumption of the load (in Watts AC) by 10.

**Example:** If a load is rated at 100 Watts AC, the DC power source must be able to deliver:  $100 / 10 = 10A$ .

The inverter will provide you nominal 115 VAC when powered by a 12 VDC source such as is found in a vehicle or multiple battery configurations as shown in Fig 4.2. **This manual does not describe all of the possible types of battery configurations, battery charging configurations and battery isolation configurations.**

For normal operation of the inverter, the DC power source must provide  $>11.0 \pm 0.3V$  and  $< 15.3 \pm 0.3V$  and the required current. This DC power source must be a well-regulated DC power supply or alternator and deep cycle battery system typically found in vehicles. The DC power source may also be two or more 12 volt batteries connected in parallel. On larger applications, the power source may be several batteries connected in parallel as shown in Fig 4.2.

## SECTION 4 | Installation

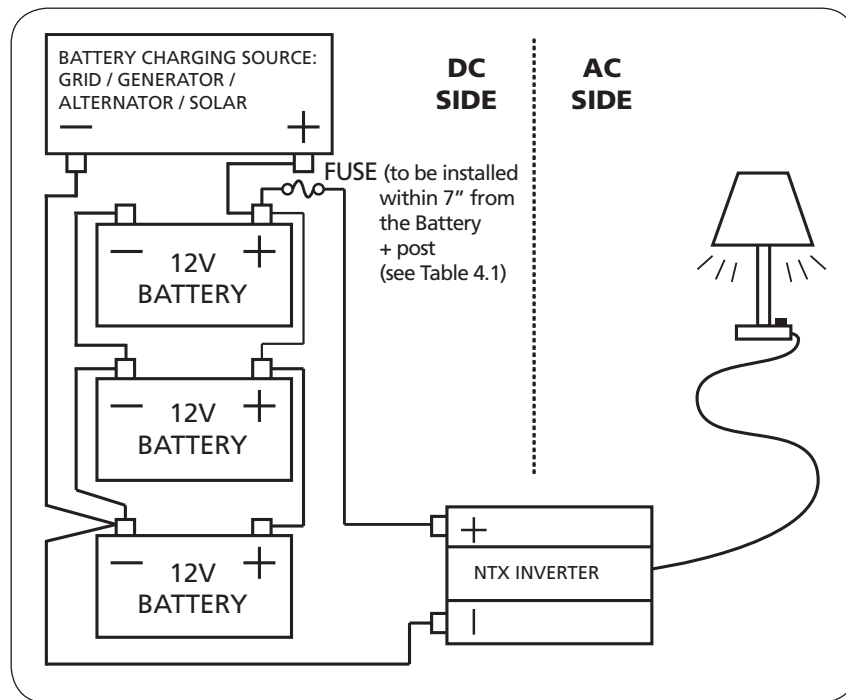


Fig 4.2 Connecting to a 12V Battery Source

### 4.4 DC INPUT SUPPLY FROM 12V BATTERY OR FROM OTHER 12V DC POWER SOURCE



#### WARNING!

It is mandatory to install appropriate size of external DC Fuse as close to the Battery Positive Post as possible, preferably within 7 inches to protect against fire hazard due to short circuit along the battery cable run (See Fig 4.2). A battery is an unlimited current source that can supply thousands of Amperes of current under short circuit conditions. If a short circuit occurs in the cable run at a point between the battery and the inverter, the section of the cable from the battery to the point of short circuit will be fed with thousands of Amperes of current, the section of the cable will overheat / melt and is likely to cause fire. It is, therefore, recommended that the fuse / fuse assembly should have Ampere Interrupting Capacity (AIC) of at least 10,000 A. Class-T type of fuses are recommended as these fuse provide fast acting, current limited protection.

Please note that internal DC side fuses have been provided to protect against over current in the internal DC input circuitry. **These internal fuses will NOT blow due to external short circuit in the battery cable run.**

## SECTION 4 | Installation

Table 4.1 provides details of Battery Cables and DC Fuses for connecting the battery to the DC input terminals of the inverter (7, 8 in Figs 3.1.2 and 3.2.2)

<b>Table 4.1 Sizing of Cables and Fuses for DC Input</b>					
Model No.	Rated DC Input Current	NEC Ampacity	Ampere Rating of the Fuse (Note 1)	Cable Size for up to 4 ft from Battery to Inverter (Note 2)	Cable Size for up to 6 ft from Battery to Inverter (Note 2)
(1)	(2)	(3)	(4)	(5)	(6)
NTX-1000-12	100A	125A	150A	AWG#4	AWG#2
NTX-1500-12	150A	187.5A	200A	AWG#2	AWG#1/0
NTX-2000-12	200A	250A	300A	AWG#2/0 or 2X AWG#2	AWG#2/0 or 2X AWG#2
NTX-3000-12	300A	375A	400A	AWG#3/0 or 2X AWG#1	AWG#4/0 or 2X AWG#1/0

### Notes for Table 4.1

1. Ampere ratings of the fuse (Column 4) is based on the NEC Ampacity (Column 3) = 1.25 times the rated DC input current of the inverter (Column 2).
2. Cable sizing (Columns 5 and 6) is based on: (i) the Ampere rating of the fuse (Column 4) or 2% voltage drop, whichever is thicker (ii) Ambient temperature of 30°C (iii) Wire insulation rated at 105°C (iv) Cables routed in free air.

### 4.5 DC INPUT TERMINALS

DC input is fed through Stud and Nut – size M9 (7, 8 in Figs 3.1.2 and 3.2.2).

### 4.6 CABLE TERMINATION FOR DC INPUT CONNECTORS

The inverter side of the DC input cable has to be terminated with a Ring / Tongue type of terminal lug to fit M9 or 3/8" size of stud on the DC Input terminals (7, 8 in Figs 3.1.2 and 3.2.2). The terminal lug may be crimped / soldered.

## SECTION 4 | Installation

### 4.7 DC SIDE CONNECTIONS

1. Ensure that appropriate cable size is used as per columns 5 and 6 of Table 4.1. Cable terminal lugs should be properly crimped / soldered at the bare ends of the cables for secure connections. The lugs should fit M-9 stud used for the DC input terminals.
2. Ensure that the bare Positive and Negative terminals of NTX-1000/1500/2000/3000 (7 and 8 in Figs 3.1.2 and 3.2.2) are protected using plastic covers with Thumb Nuts (10 in Figs 3.1.2 and 3.2.2).
3. Ensure that the inverter's power switch is turned OFF and that no flammable fumes are present.
4. Identify the Positive (+) and Negative (-) terminals of the 12V battery or the other 12V DC source.
5. Install a fuse holder close to the Positive (+) terminal of the battery (or other DC source), preferably within 7" of the terminal (see Fig 4.2).
6. Insert a suitable fuse in the fuse holder. For fuse sizes, please refer to column 4 of Table 4.1.
7. Check to be sure that all connections are secure and tight.
8. Test the inverter by turning it on and plugging in a 100 Watt lamp or equipment.
9. If the inverter does not operate properly, then refer to Section 7, Troubleshooting Guide.



#### CAUTION!

Loose connectors may cause overheated wires and melted insulation.

### 4.8 GROUNDING AND "GROUND FAULT" - GENERAL INFORMATION

Grounding means connecting (bonding) to Earth Ground or to the other designated Ground. For example, in a motorhome / RV, the metal frame of the motorhome / RV is normally designated as the Negative DC Ground / RV Ground. Grounding is required for (i) protection against damage due to lightning strike and (ii) protection against electric shock due to "Ground Fault". "Ground Fault" may occur due to inadvertent contact between an energized ungrounded current carrying conductor and exposed metal surface resulting in voltage getting fed to (i) the metal chassis of the inverter or (ii) to the metal chassis of the devices connected to inverter or (iii) to the metal frame/ chassis in an RV / motorhome. When this energized exposed surface is touched, the voltage will drive current through the human body to Earth Ground producing electric shock. When properly grounded to Earth Ground (or Frame / Chassis Ground in motorhome or RV), the Ground Fault Circuit Interrupter (GFCI) or, the Over Current Protection Device (like Circuit Breaker or Fuse) will trip and interrupt the circuit feeding power from the AC source or the DC source (12V battery). Proper grounding will ensure that all exposed metal surfaces will have equal potential and will be bonded to (i) a single common Earth Ground point i.e. the Ground Rod / buried metallic water / gas pipe at the premises or (ii) the Frame / Chassis Ground in a motorhome / RV.

Internally, an inverter consists of a DC Section and an AC Section that are isolated through a transformer. Both these sections are required to be grounded appropriately.

## SECTION 4 | Installation



### INFO

Please read following on-line White Papers at [www.samlexamerica.com](http://www.samlexamerica.com) (Home > Support > White Papers) for complete understanding of Grounding:

- "Grounded Electrical Power Distribution"
- "Grounding System and Lightning / Ground Fault Protection"

## 4.9 GROUNDING ARRANGEMENT IN NTX-1000-12 / NTX-1500-12 / NTX-2000-12

### 4.9.1 DC Side Grounding in NTX-1000-12 / NTX-1500-12 / NTX-2000-12

DC side grounding involves bonding of the metal frame/chassis of inverter and the Battery Negative Terminal to Earth Ground in shore based installation or to the metal frame / "Chassis" of the motorhome / RV. This ensures that in case of a ground fault in the +12V circuit, the fuse in the +Battery line blows to clear the fault (Please see Section 4.8 for more information on "Ground Fault"). This fuse in the +Battery line has Ampere capacity based on the rated DC input current of the inverter (Refer to Column 4 of Table 4.1). The wire size used for DC side grounding should be minimum AWG #6 or of the same size as the battery cable, whichever is thicker. This recommendation on sizing of the DC Side Grounding Wire will be superseded by the National / Local Electrical Codes.

### 4.9.2 AC Side Grounding in NTX-1000-12 / NTX-1500-12 / NTX-2000-12

AC output of the inverter is supplied through NEMA 5-20R, 20A Duplex GFCI Receptacles [1(a) in Fig 3.1.1]. The round Grounding Slot and the rectangular T-shaped Neutral Slot of the receptacles are internally bonded to the metal chassis of the inverter.

### 4.9.3 Grounded Neutral in NTX-1000-12 / NTX-1500-12 / NTX-2000-12

The T-shaped Neutral Slot is internally bonded to the metal chassis of the inverter / the round Grounding Slot. Hence, there will be no AC voltage between the T-shaped Neutral Slot and the chassis of the inverter / round Grounding Slot.

## 4.10 GROUNDING ARRANGEMENT IN NTX-3000-12

### 4.10.1 DC Side Grounding in NTX-3000-12

DC side grounding involves bonding of the metal frame/chassis of inverter and the Battery Negative Terminal to Earth Ground in shore based installation or to the metal frame / "Chassis" of the motorhome / RV. This ensures that in case of a ground fault in the +12V circuit, the fuse in the +Battery line blows to clear the fault. This fuse in the +Battery line has Ampere capacity based on the rated DC input current of the inverter (Refer to Column 4 of Table 4.1). The wire size used for DC side grounding should be minimum AWG #6 or of the same size as the battery cable, whichever is thicker. This recommendation on sizing of the DC Side Grounding Wire will be superseded by the National / Local Electrical Codes.

### 4.10.2 AC Side Grounding in NTX-3000

AC output of the inverter is supplied through NEMA L5-30R, 30A Locking Receptacle [1 in Fig 3.2.1]. The Grounding Slot [1(c) in Fig 3.2.1] is internally **NOT** bonded to the metal chassis of the inverter. It is internally wired to built-in GFCI circuitry to shut down the AC output of the inverter in case of any ground fault on the AC load side. See Section 4.13.5 for more details

### 4.10.3 Floating Neutral in NTX-3000

The Neutral Slot [1(b) in Fig 3.2.1] is floating i.e. it is internally **NOT** bonded to the metal chassis of the inverter / Grounding Slot [1(c) in Fig 3.2.1]. Hence, there will be around 66 VAC between the Neutral Slot and the metal chassis of the inverter / the Grounding Slot [1(c) in Fig 3.2.1]. See CAUTION! below:

## SECTION 4 | Installation



### CAUTION!

As the Neutral slot of the NEMA L5-30R Receptacle in NTX-3000 [1(b) in Fig 3.2.1] is floating i.e. it is internally **NOT** bonded to the metal chassis of the inverter / the Grounding Slot, there will be a voltage of around 66 VAC between the Neutral Slot and the L-shaped Grounding Slot. Do not touch the Neutral Slot or bare conductor connected to the Neutral Slot!

### 4.11 PARALLEL OPERATION IS NOT PERMITTED



#### WARNING! Preventing Paralleling of the AC Output

- a) The AC output of these inverters cannot be synchronized with another AC source and hence, it is not suitable for paralleling. The AC output of the inverter should never be connected directly to an electrical breaker panel / load center which is also fed from utility power/ generator. Such a connection will result in paralleling of AC output of the inverter and AC power from utility / generator. AC power from utility / generator will be fed back into the inverter which will instantly damage the output section of the inverter and may also pose a fire and safety hazard. If an electrical breaker panel / load center is being fed from utility power / generator and the inverter is also required to feed this panel as backup power source, the AC power from the utility power/ generator and the inverter should first be fed to a manual selector switch / Automatic Transfer Switch and the output of the manual selector switch / Automatic Transfer Switch should be connected to the electrical breaker panel / load center.
- b) To prevent possibility of paralleling and severe damage to the inverter, never use a simple jumper cable with a male plug on both ends to connect the AC output of the inverter to a handy wall receptacle in the home / RV.



## SECTION 4 | Installation

### 4.12 AC SIDE INSTALLATION FOR MODELS NTX-1000-12 / NTX-1500-12 / NTX-2000-12

AC output for Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12 is provided through NEMA5-20R, 20A Duplex GFCI protected receptacles [1(a) in Fig 3.1.1]. The two, NEMA5-20R, 20A outlets are protected through integrated, self monitoring GFCI (Ground Fault Circuit Interrupter). This type of GFCI receptacle is available commercially in electrical / hardware stores. Function, features and operation of Self Monitoring GFCI protection used are explained at Section 4.12.1.

#### 4.12.1 Function of Ground Fault Circuit Interrupter (GFCI) in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12

An un-intentional electric path between a source of current and a grounded surface is referred to as a "Ground Fault" (Refer to Section 4.8 for additional details on grounding and ground fault). Ground faults occur when current is leaking somewhere. In effect, electricity is escaping to the ground. How it leaks is very important. If your body provides a path to the ground for this leakage (dry human body has a low resistance of only around 1 K Ohm), you could be injured, burned, severely shocked or electrocuted. A Ground Fault Circuit Interrupter (GFCI) protects people from electric shock by detecting leakage and cutting off the AC source. In the Self-Monitoring GFCI used in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12 (See further details at Section 4.12.2), the leakage detection circuit compares the current sent to the load and returned back from the load. If the returned current is less by 4 to 6 mA due to leakage, the GFCI trips. The GFCI also trips if it sees Neutral to Ground bond on the load side of the GFCI. The AC output of this inverter is available through a NEMA5-20R, 20A GFCI Duplex Receptacle [1(a) in Fig 3.1.1]. The T-shaped Neutral slot of the GFCI Receptacle used in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12 is internally bonded to the metal chassis of the inverter (Refer to Section 4.9.3)

#### 4.12.2 Integrated Self-Monitoring GFCI in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12

Integrated GFCI protection used in Models NTX-1000/1500/2000 is "Self Monitoring Type" as per UL Standard UL-943. As soon as the Inverter is switched ON and 115 VAC is available on the internal Line Side of the GFCI, the Green LED [1(b) in Fig 3.1.1] will switch ON indicating that AC power is available at the Load Side outlets. The self monitoring circuit of the GFCI constantly tests the operation of the internal ground fault protection. If self testing fails at any time, Red LED marked "Life End Alarm" [1(e) in Fig 3.1.1] will be switched on and the Green LED [1(b) in Fig 3.1.1] will be switched off. Under this condition, the entire NEMA5-20R Duplex GFCI Receptacle will be required to be replaced

#### 4.12.3 Monthly Testing of GFCI Function in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12

Test the operation of the GFCI monthly as follows:

- Switch ON the inverter. As soon as 115 VAC output from the inverter is available on the internal Line Side of the GFCI, the Green LED [1(b) in Fig 3.1.1] will switch ON indicating that AC power is available at the NEMA5-20 outlets.
- Plug a test lamp into the outlet and switch ON the test lamp.
- Press the "Test Button" [1(d), Fig 3.1.1]. The "Reset Button" [1(c) in Fig 3.1.1] will pop out. The GFCI will be forced to trip and cut off AC power to the outlets. Green LED [1(b) in Fig 3.1.1] will switch OFF. The test lamp will also switch OFF.

## SECTION 4 | Installation

- Press the “Reset Button” [1(c) in Fig 3.1.1]. The GFCI will reset and AC power to the load side outlets will be restored. Green LED [1(b) in Fig 3.1.1] will switch ON. The test lamp will also switch ON.
- If the above test / reset operation cannot be carried out, replace the GFCI.

### 4.12.4 GFCI Tripping and Reset in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12

If there is a leakage of 4 to 6mA due to ground fault on the load side or, there is a Neutral to Ground bond on the load side, the GFCI will trip and the “Reset Button” [1(c) in Fig 3.1.1] will pop out. AC power to the two NEMA5-20R outlets (on the Load Side of the GFCI) will be cut off. Green LED [1(b) in Fig 3.1.1] will switch OFF. Remove the ground fault in the load circuit. Reset the tripped GFCI as follows:

- a) Remove the cause of ground fault on the load side
- b) Ensure that the inverter is in ON condition so that 115VAC power is available to the internal Line Side of the GFCI [Green LED (5 in Fig 3.1.1) will be ON.
- c) Press the “Reset Button” [1(c) in Fig 3.1.1]. The GFCI will reset and AC power to the NEMA5-20R outlets (on the Load Side of the GFCI) will be restored. Green LED [1(b) in Fig 3.1.1] will switch ON.



#### INFO

For the Reset Button [1(c) in Fig 3.1.1] to operate, the Inverter has to be in ON condition so that 115 VAC power is available to the internal Line Side of the GFCI [When the inverter is ON and is feeding 115 VAC to the internal Line Side of the GFCI, Green LED (5 in Fig 3.1.1) will be ON]. Tripped GFCI can be reset only if AC power is available on the internal Line Side of the GFCI.



#### CAUTION!

- a) Do not feed the output from the GFCI receptacle to a Breaker Panel / Load Center where the Neutral is bonded to the Earth Ground. This will trip the GFCI.
- b) If an extension cord is used, please ensure that the cord is 2-Pole Grounding Type (3 pin).

## 4.13 AC SIDE INSTALLATION FOR MODEL NTX-3000-12

### 4.13.1 NEMA L5-30R, 30A Locking Receptacle for AC Output for NTX-3000-12

AC output of NTX-3000-12 is supplied through NEMA L5-30R, 30A Locking Receptacle (1 in Fig 3.2.1). Internal conductors connected to the 3 slots of the outlet are as follows:

- a) **The longer “Line” Slot [1(a) in Fig 3.2.1]:** This is internally connected to the first current carrying conductor
- b) **The shorter “Neutral” Slot [1(b) in Fig 3.2.1]:** This is internally connected to the second current carrying conductor. Internally, this slot is **NOT** connected to the metal chassis of the inverter and hence, technically, it cannot be considered as “Neutral” (A “Neutral” is a current carrying conductor that is intentionally bonded to Earth Ground). The Neutral Slot is, therefore, floating.

## SECTION 4 | Installation



### CAUTION!

As the Neutral Slot [1(b) in Fig 3.2.1] is floating i.e. it is internally **NOT** bonded to the metal chassis of the inverter / the Grounding Slot, there will be a voltage of around 66 VAC between the Neutral Slot and the L-shaped Grounding Slot. Do not touch the Neutral Slot or bare conductor connected to the Neutral Slot!

- c) **L shaped “Grounding” Slot [1(c) in Fig 3.2.1]:** This is internally **NOT** connected to the metal chassis of the inverter. It is wired to a customized Ground Fault Circuit Interruption (GFCI) circuitry (Refer to Section 4.13.5 for details).



### CAUTION!

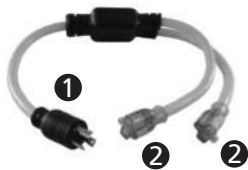
As the L-shaped Grounding Slot is wired to a customized Ground Fault Circuit Interruption (GFCI) circuitry (See Section 4.13.5), the AC output of the inverter will be shut down due to Ground Fault on the load side. Hence, if a 30A power cord with standard NEMA L5-30P Plug is used to feed AC output of this inverter to an Electrical Breaker Panel / Load Center where the Neutral is bonded to Earth Ground, the inverter will trip immediately due to activation of the internal customized Ground Fault Circuit Interruption (GFCI) circuitry. To circumvent this situation, a NEMA L5-30P Plug has been provided. Use this plug on the inverter side of the 30A cord as per wiring connections described in Section 4.13.2 (c).

## SECTION 4 | Installation

### 4.13.2 Connecting AC loads to NTX-3000-12 through NEMA L5-30R, 30A Locking Receptacle

A suitable power cord will be required to feed AC loads as follows:

- Loads that use 30A power cord with NEMA L5-30P Locking Plug: Plug directly into the Receptacle
- Loads that use 15A power cord with NEMA5-15P Plug or 20A Power Cord with NEMA5-20P Plug: Use appropriate Adapter Type of Power Cord that has NEMA L5-30P Locking Plug for mating with the NEMA L5-30R Locking Receptacle on the NTX-3000-12 end and NEMA5-20R Adapter Receptacles on the other end for connecting to the loads. Example is shown at Fig 4.3:



- NEMA L5-30P Plug:** Insert this into the NEMA L5-30R Receptacle on NTX-3000-12.
- NEMA5-20P Plug:** For loads provided with 15A power cord with NEMA5-15P Plug or 20A cord with NEMA5-20P Plug.

Fig 4.3 Adapter to convert NEMA L5-30R outlet to NEMA5-15 / NEMA5-20 outlets

- Hard wiring to 30A Breaker Panel or Load Center that has Neutral to Ground Bond:** As the L-shaped Grounding Slot of the NEMA L5-30R outlet ([1(c) in Fig 3.2.1] is wired to a customized Ground Fault Circuit Interruption (GFCI) circuitry (See Section 4.13.5), the AC output of the inverter will be shut down due to Ground Fault on the load side (Please refer to Section 4.8 for more information on Ground Fault). Hence, if a 30A pre-wired power cord with molded NEMA L5-30P Plug is used to feed AC output of this inverter to a Breaker Panel / Load Center where the Neutral is bonded to Earth Ground, the inverter will trip immediately due to activation of the internal customized Ground Fault Circuit Interruption (GFCI) circuitry. To circumvent this situation, a NEMA L5-30P Plug has been provided to connect the 3 wires of the inverter end of the 30A Cord as shown in Fig 4.4 and described on next page:
  - Connect the "Line" conductor (Black wire) to the Line Prong of the NEMA L5-30P Plug (Terminal for Line Prong has brass screw)
  - Join the "Neutral" conductor (White wire) and the "Grounding" Conductor (Green wire) together and connect both the wires to the same Neutral Prong (W) of the NEMA L5-30P Plug (Terminal for Neutral Prong has steel screw)
  - The "Grounding" Prong of the NEMA L5-30P Plug is **NOT** connected [Terminal for Grounding Prong (G) has Green colored screw]

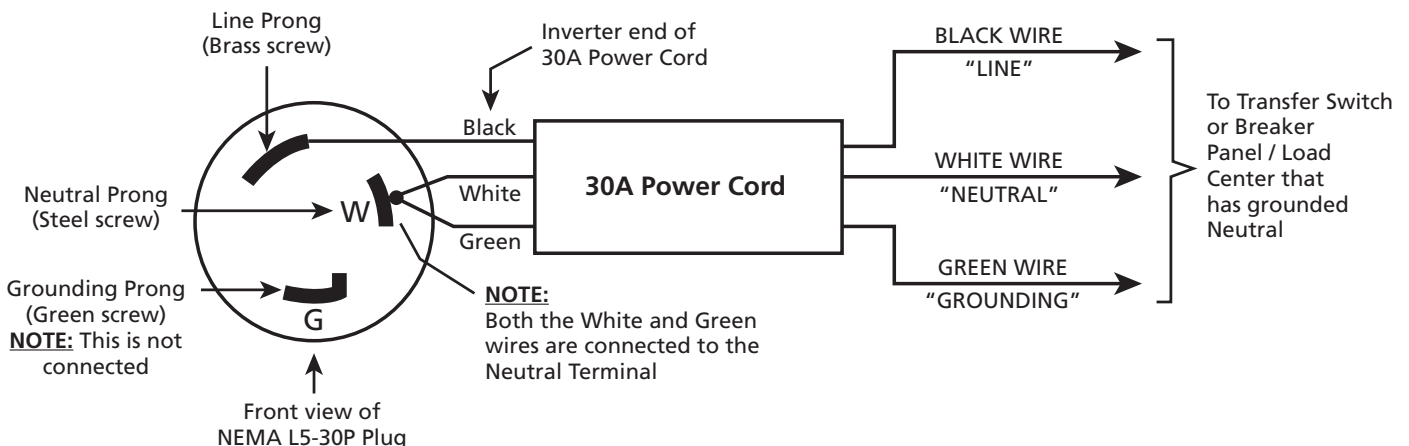


Fig 4.4 NEMA L5-30P Plug connection for 30A Power Cord that will feed AC output of NTX-3000-12 to Transfer Switch or Breaker Panel / Load Centre that have Neutral to Ground Bond

## SECTION 4 | Installation

Wiring arrangement shown in Fig 4.4, the NTX-3000-12 will result in the following:

- The Grounding Conductor (Green wire) from the Transfer Switch or Electrical Panel / Load Center will NOT be connected to the Grounding Terminal (G) of the inverter side NEMA L5-30P Plug. Hence, the built-in customized GFCI will not trip despite the fact that the Neutral and Ground in the Transfer Switch or Breaker Panel / Load Center are bonded (See details of operation of this GFCI at Section 4.9.3.4).
- The internal GFCI of NTX-3000-12 will be disabled.

### 4.13.3 AC Side Grounding in NTX-3000-12

AC output of the inverter is supplied through NEMA L5-30R, 30A Locking Receptacle [1 in Fig 3.2.1]. The Grounding Slot [1(c) in Fig 3.2.1] is internally NOT bonded to the metal chassis of the inverter. It is internally wired to built-in GFCI circuitry to trip the inverter in case of any ground fault on the AC load side. See Section 4.13.5 for more details.

### 4.13.4 Floating Neutral in NTX-3000-12

The Neutral Slot [1(b) in Fig 3.2.1] is floating i.e. it is internally NOT bonded to the metal chassis of the inverter / Grounding Slot [1(c) in Fig 3.2.1]. Hence, there will be around 66 VAC between the Neutral Slot and the metal chassis of the inverter / the Grounding Slot [1(c) in Fig 3.2.1]. See CAUTION! below:



#### CAUTION!

As the Neutral slot of the NEMA L5-30R Receptacle in NTX-3000 [1(b) in Fig 3.2.1] is floating i.e. it is internally NOT bonded to the metal chassis of the inverter / the Grounding Slot, there will be a voltage of around 66 VAC between the Neutral Slot and the L-shaped Grounding Slot. Do not touch the Neutral Slot or bare conductor connected to the Neutral Slot!

### 4.13.5 Ground Fault Circuit Interrupter (GFCI) in Model NTX-3000-12

An un-intentional electric path between a source of current and a grounded surface is referred to as a "Ground Fault" (Refer to Section 4.8 for additional details on grounding and ground fault). Ground Faults occur when current is leaking somewhere. In effect, electricity is escaping to the ground. How it leaks is very important. If your body provides a path to the ground for this leakage (dry human body has a low resistance of only around 1 K Ohm), you could be injured, burned, severely shocked or electrocuted. A Ground Fault Circuit Interrupter (GFCI) protects people from electric shock by detecting leakage and cutting off the AC source

In NTX-3000-12, a customized, built-in GFCI circuitry has been used. The Grounding Slot of the NEMA L5-30R receptacle is NOT connected to the chassis of the inverter but to the input section of a customized GFCI circuitry. If a "Ground Fault" occurs in the load side (Please see Section 4.8 regarding information on "Ground Fault"), fault current from the load will travel along the Grounding Conductor from the load to the Grounding Slot of the NEMA L5-30R Receptacle. A fault current of 4 to 5 mA will activate the built-in GFCI circuit and the AC output of the inverter will be shut down and Red Fault LED (6 in Fig 3.2.1) will be lighted. The unit will be required to be reset manually as follows:

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- Remove the cause of Ground Fault in the load side
- Switch off the unit using the On/Off Switch (2 in Fig 3.2.1)
- Wait for 2 minutes and switch the unit on again

### 4.14 REMOTE CONTROL

Remote Control Model NTX-RC has been provided with the unit. Please refer to separate manual provided for this remote control.



#### CAUTION!

When using Remote Control NTX-RC, the ON/OFF Switch on the inverter (2, Fig 3.1.1 and 3.2.1) should be in OFF position. If this switch is left in ON condition and the Remote Control is switched OFF using the ON/OFF Button on the Remote control, the inverter will not switch OFF completely. This will result in draining of the battery due to (i) self consumption of the inverter and (ii) continuous running of the cooling fan at slow speed.

## SECTION 5 | Operation

### 5.1 OPERATING ENVIRONMENT

Before operating the inverter, please ensure that all installation requirements given in Section 4 and safety requirements given in Section 1 have been met.

### 5.2 SWITCHING ON AND SWITCHING OFF ON LOAD

Please ensure that the following procedure is used for switching ON and switching OFF the inverter when a load is already connected to the inverter:

#### 5.2.1 Switching ON

1. Switch OFF the load connected to the inverter
2. Switch ON the inverter
3. Wait for a few seconds
4. Switch ON the load

#### 5.2.2 Switching OFF

1. Switch OFF the load connected to the inverter
2. Switch OFF the inverter

### 5.3 CONNECTING LOADS

1. Make sure that the single load or the combined load requirement of your equipment does not exceed the inverter's output rating.
2. Switch OFF the inverter
3. Switch OFF the load
4. Plug the cord(s) from the load(s) into the AC receptacle(s) of the inverter
5. Switch on the inverter. Wait for a few seconds
6. The Green LED indicator (5 in Figs 3.1.1 and 3.2.1) will be lighted to indicate that the inverter is functioning. Green LED on the GFCI Receptacle on NTX-1000/1500/2000 [1(b) in Fig 3.1.1] will also be lighted if the GFCI is not in tripped condition.
7. Switch on the load(s)

### 5.4 RATED VERSUS ACTUAL CURRENT DRAW OF EQUIPMENT

Most electrical tools, appliances and audio/video equipment have labels that indicate the power consumption in Amps or Watts. Be sure that the power consumption of the item(s) you wish to operate is less than inverter's power. (If the power consumption is rated in Amps AC, simply multiply by the AC Volts (115) to determine the Apparent Input Power in Volt Amps (VA). The inverter will shut down if it is overloaded. The overload must be removed before the inverter will restart. Resistive loads are the easiest for the inverter to run. However, larger resistive loads, such as electric stoves or heaters, usually require more power than a smaller inverter can deliver. Inductive loads, such as TV's and stereos, etc. require more current to operate than do resistive loads of the same power rating. Induction motors, as well as some televisions, may require 2 to 6 times their power rating to start up. The most demanding in this category are those that start under load, such as compressors and pumps. To restart the unit after a shutdown due to overloading, remove the overload if necessary, turn the power switch OFF, **wait for 2 to 3 minutes** and then switch ON again (Refer to Sections 6.4 and 7 for more details regarding overload symptoms and protections).



## SECTION 5 | Operation

### 5.5 SIZING CHART FOR TYPICAL LOADS THAT REQUIRE HIGH STARTING SURGE

The manufacturers' specifications of the appliances and devices indicate only the running power required.

The surge power required by some specific types of devices has to be checked with the manufacturer, actually tested or guessed at best.

Table 5.1 lists some common loads that require high surge power on start up. A "Sizing Factor" has been recommended against each which is a Multiplication Factor to be applied to the rated running Watt rating of the load to arrive at the continuous power rating of the inverter (Multiply the running Watts of the device / appliance by the Sizing Factor).

Type of Device or Appliance	Sizing Factor
Air conditioner	5
Refrigerator / Freezer (Compressor based)	5
Air Compressor	4
Sump Pump / Well Pump / Submersible Pump	3
Dishwasher	3
Clothes Washer	3
Microwave (In cases where the rated output power is the Cooking Power)	2
Furnace Fan	3
Industrial Motor	3
Portable Kerosene / Diesel Fuel Heater	3
Circular Saw	3
Bench Grinder	3
Incandescent / Halogen / Quartz Lamps	3
Laser Printer / Other Devices using Infrared Quartz Halogen Heaters	4
Switched Mode Power Supplies (No Power Factor correction)	2
Photographic Strobe / Flash Lights (with respect to its Watt Sec rating)	4*

\* In the case of photographic strobe / flash unit, the RMS surge power of the inverter should be more than 4 times the Watt Sec rating of the photographic strobe / flash unit.

### 5.6 DETERMINING BATTERY SIZE

The power inverter will require **DEEP CYCLE Lead Acid Batteries of appropriate capacity.**  
The automotive SLI (Starting/lighting/ignition) battery is not designed for repeated deep discharges.  
The SLI battery may not supply enough energy and its service life may be reduced.

To determine the minimum battery size that you will need to operate appliances, follow these steps:

1. Determine the Active AC Input Power in Watts for each appliance and / or tool you will need to simultaneously operate from the inverter. To do this, read the label on the equipment to be operated. Usually, the label will specify the Active Power drawn in Watts. Sometimes the label will specify the current draw in Amperes (A). Multiply this value of current draw in Amperes (A) by the AC input voltage (V) to determine the Apparent AC Input Power in Volt Amperes (VA). The Active Input Power will be equal to the Apparent Input Power (VA) multiplied by the Power Factor (PF) of the load. Depending upon the type of load, the Power Factor (PF) may range from 1 (Resistive type of load) to 0.6 (Reactive type of load). For practical purposes, the Power Factor (PF) may be considered as 1. Hence, Active Power in Watts will be equal to the Apparent Power (VA).



## SECTION 5 | Operation

2. For each appliance, estimate the number of hours the appliance will be in use between battery recharges.
3. For each appliance, determine the Watt-Hours of energy required by multiplying the AC wattage by the number of hours of use.
4. Add the Watt-Hours of energy for each appliance to get the total Watt-Hours of energy for all appliances to be used.
5. Divide the total Watt-Hours of energy on the AC side by 10 to get the total Ampere-Hour of energy on the 12 VDC side to support the operation of the appliances.
6. The Ampere-Hour (Ah) capacity of the battery should be 2 times the total Ampere-Hour energy required on the 12 VDC side to support the operation of the devices (as calculated at step 5 above). Two times factor is necessary because batteries are normally not discharged below 50% capacity.

To get an estimate of the current (in Amps) that the battery is delivering to power a particular AC side load, divide the load's AC consumption power (in Watts) by (10).

Keep in mind that most appliances are not operating for long periods of time. For example, a typical home-use coffee maker draws 500 Watts during its brew time of 5 minutes, but it maintains the temperature of the pot at about 100 Watts. Typical use of a microwave is only for a few minutes, sometimes at low power. Similarly, refrigerator compressor does not remain ON at full rated power at all times but switches ON and OFF based on its thermostat setting, ambient temperature, frequency of opening/closing and the temperature of food item(s) when first stored. As a Rule of Thumb, its operating Duty Cycle  $[\text{ON Time} \div (\text{ON Time} + \text{OFF Time})]$  is around 30%. Hence, a refrigerator rated at say 100W will draw Watt-Hour Energy of 720 Watt Hour in a 24 Hour cycle  $[(100\text{W} \times 24\text{Hrs}) \times 30\% = 720\text{W}]$ . Some exceptions to brief operating times are TVs, computers etc.

In most instances, the inverter can be left connected to the battery when not in use. However, make sure that the inverter is switched OFF using the ON/OFF Switch (2 in Fig 3.1.1 and 3.2.1) or using the ON/OFF Button on the Remote Control Model NTX-RC (Section 4.14). This will prevent unnecessary drain on the batteries due to self consumption and operation of cooling fan(s).

Battery performance drops in low temperature environment. Higher capacity batteries should be installed if the environmental temperature is below 20°C.

### 5.7 MONITORING OF ALARMS & FAULTS

Please refer to Section 6.8 for monitoring of alarms and faults through front panel LEDs and buzzer.

### 5.8 PROTECTIONS

Please refer to Section 6 for details on various protections.

### 5.9 TROUBLESHOOTING

Please refer to Section 7 for Troubleshooting Guide.

## SECTION 6 | Protections

### 6.1 OVER TEMPERATURE PROTECTION

In case the fan fails or if the cooling is inadequate due to higher ambient temperature or restricted air flow, the temperature inside the inverter will rise. Temperature rise is sensed at a critical internal hot spot. If this temperature is around 105°C, the AC output will be switched OFF temporarily. The unit will reset automatically after the internal hot spot has cooled down. The unit may be reset manually by switching off the ON/OFF Switch (2 in Figs 3.1.1 and 3.2.1), waiting for 15 minutes for the unit to cool down and then, switching ON again.

Refer to Table 6.1 for front panel indications for this condition.

Refer to Section 7 - Troubleshooting Guide for more details of symptoms, causes and remedies related to this protection.

### 6.2 LOW BATTERY VOLTAGE PROTECTION

This condition is not harmful to the inverter but could reduce life of the batteries. The inverter automatically shuts down when input voltage drops to  $10.5V \pm 0.3V$ . Auto-reset at  $11.5 \pm 0.2V$ .

Refer to Table 6.1 for front panel indication for this condition.

Refer to Section 7 - Troubleshooting Guide for more details of symptoms, causes and remedies related to this protection.

### 6.3 OVER VOLTAGE PROTECTION

The inverter will automatically shut down when the input voltage exceeds  $16.3V \pm 0.3V$ . The unit will reset automatically when the voltage drops to  $16.0 \pm 0.3V$ .

Refer to Table 6.1 for front panel indications for this condition.

Refer to Section 7 - Troubleshooting Guide for more details of symptoms, causes and remedies related to this protection.

### 6.4 OVERLOAD PROTECTION

The inverter will automatically shut down under overload of 115% to 125% lasting for 3 to 5 sec. Refer to Table 6.1 for front panel indications under this condition.

The inverter will remain latched in shut down condition and will require manual reset as described below:

**a) From the Front Panel of the unit:**

- i. Switch off the On/Off Switch (2 in Figs 3.1.1 and 3.2.1).
- ii. Wait for around 2 minutes (Internal latching circuit does not de-energize immediately after switching off )
- iii. Switch on using the On/Off Switch

**b) From Remote Control Model No. NTX-RC**

- i. Ensure that the On/Off Switch (2 in Figs 3.1.1 and 3.2.1) on the front panel of the unit is in off position. (**NOTE:** When Remote Control NTX-RC is being used to operate the inverter, the On/Off Switch on the front panel of the inverter is required to be in off condition. If the front panel On/Off Switch is in on condition, the inverter cannot be switched off (Please refer to the manual for the Remote Control NTX-RC)
- ii. Press the On/Off Key to switch off the inverter
- iii. Wait for around 3 minutes
- iv. Press the On/Off Key to switch on the inverter

## SECTION 6 | Protections

Refer to Section 7 – Troubleshooting Guide for more details of symptoms, causes and remedies related to this protection.

### 6.5 SHORT CIRCUIT PROTECTION

During a short circuit, abnormally high current is drawn by the inverter. The inverter will automatically shut down under short circuit condition within a very short period of around 0.1 sec. Refer to Table 6.1 for front panel indications under this condition.

The inverter will remain latched in shut down condition and will require manual reset as described below:

- a) **From the Front Panel of the unit:**
  - i. Switch off the On/Off Switch (2 in Figs 3.1.1 and 3.2.1).
  - ii. Wait for around 3 minutes (Internal latching circuit does not de-energize immediately after switching off )
  - iii. Switch on using the On/Off Switch
- b) **From Remote Control Model No. NTX-RC**
  - i. Ensure that the On/Off Switch (2 in Figs 3.1.1 and 3.2.1) on the front panel of the unit is in off position. (**NOTE:** When Remote Control NTX-RC is being used to operate the inverter, the On/Off Switch on the front panel of the inverter is required to be in off condition. If the front panel On/Off Switch is in on condition, the inverter cannot be switched off (Please refer to the manual for the Remote Control NTX-RC)
  - ii. Press the On/Off Key to switch off the inverter
  - iii. Wait for around 3 minutes
  - iv. Press the On/Off Key to switch on the inverter

### 6.6 GROUND FAULT PROTECTION

#### 6.6.1 Ground Fault Circuit Interrupter (GFCI) Protection in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12

Please see Sections 4.12.1 to 4.12.4 for complete details of function, features and operation of GFCI protection in Models NTX-1000-12 / NTX-1500-12 / NTX-2000-12,

If there is a leakage of 4 to 6mA due to ground fault on the load side or, there is a Neutral to Ground bond on the load side, the GFCI will trip and the "Reset Button" [1(c) in Fig 3.1.1] will pop out. AC power to the two NEMA5-20R outlets (on the Load Side of the GFCI) will be cut off. Green LED [1(b) in Fig 3.1.1] will switch OFF. Remove the ground fault in the load circuit. Reset the tripped GFCI as follows:

- a) Remove the cause of ground fault on the load side
- b) Ensure that the inverter is in ON condition so that 115VAC power is available to the internal Line Side of the GFCI [Green LED (5 in Fig 3.1.1) will be ON].
- c) Press the "Reset Button" [1(c) in Fig 3.1.1]. The GFCI will reset and AC power to the NEMA5-20R outlets (on the Load Side of the GFCI) will be restored. Green LED [1(b) in Fig 3.1.1] will switch ON.



#### INFO

For the Reset Button [1(c) in Fig 3.1.1] to operate, the Inverter has to be in ON condition so that 115VAC power is available to the internal Line Side of the GFCI. Tripped GFCI [When the inverter is ON and is feeding 115 VAC to the internal Line Side of the GFCI, Green LED (5 in Fig 3.1.1) will be ON] can be reset only if AC power is available on the Load Side of the GFCI

#### 6.6.2 Ground Fault Circuit Interrupter (GFCI) Protection in Model NTX-3000-12

Please see Section 4.13.5 for complete details on function, features and operation of GFCI protection in NTX-3000-12.

## SECTION 6 | Protections

In NTX-3000-12, a customized, built-in GFCI circuitry has been used. The Grounding Slot of the NEMA L5-30R receptacle is NOT connected to the chassis of the inverter but to the input section of a customized GFCI circuitry. If a "Ground Fault" occurs in the load side, fault current from the load will travel along the Grounding Conductor from the load to the Grounding Slot of the NEMA L5-30R Receptacle. A fault current of 4 to 5 mA will activate the built-in GFCI circuit and the AC output of the inverter will be shut down and Red Fault LED (6 in Fig 3.2.1) will be lighted. The unit will be required to be reset manually as follows:

- Remove the cause of Ground Fault in the load side
- Switch off the unit using the On/Off Switch (2 in Fig 3.2.1)
- Wait for 2 minutes and switch the unit on again

### 6.7 LOW INPUT VOLTAGE ALARM

An alarm will sound when the voltage at the input terminals of the inverter drops to  $11.0V \pm 0.3V$ . This is an indication that either the battery terminal voltage has dropped due to its discharged condition and needs to be re-charged OR there is an excessive voltage drop across the wires connecting the inverter to the battery (due to use of thinner and longer length of wires that will produce higher voltage drop at higher loads OR due to loose connections). The user should stop operation of the load at this time since the inverter will shut down automatically shortly thereafter, when the input voltage at the inverter further drops to  $10.5 \pm 0.3$  Volts. In case the alarm is due to the discharged condition of the battery, start your engine to recharge the battery / use an appropriate battery charger.

The alarm resets automatically when the DC input voltage rises to  $11.5 \pm 0.2V$ .

Refer to Section 7 - Troubleshooting Guide for more details of symptoms, causes and remedies related to this protection.

**NOTE:** It is normal for the alarm to sound while the unit is being connected to or disconnected from the power source. This is not indicative of a problem.

### 6.8 MONITORING OF ALARMS AND FAULTS THROUGH FRONT PANEL LEDS AND BUZZER

Table 6.1 below shows operation of Green, Yellow and Red monitoring LEDs in the front panel (4,5 and 6 in Figs 3.1.1 and 3.2.1), Green and Red LEDs on the GFCI for NTX-100/1500/2000 [1(b) and 1(e) in Fig 3.1.1] and internal Buzzer under various alarm / fault conditions. Refer to Troubleshooting Guide under Section 7 for additional details.

Description of Fault / Alarm	Buzzer	LED			GFCI Green LED [1(b), Fig 3.1.1]	GFCI Red LED [1(e), Fig 3.1.1]	AC Output
		Green	Yellow	Red			
Low voltage shutdown	On	On	On	Off	Off	Off	No
Low voltage alarm	On	On	Off	Off	On	Off	Yes
High voltage shutdown	Off	On	On	Off	Off	Off	No
Over temperature shutdown	Off	On	On	Off	Off	Off	No
Overload shutdown	Off	On	Off	On	Off	Off	No
Short circuit shutdown	Off	On	Off	On	Off	Off	No
Ground fault on load side (Only for NTX-1000/1500/2000)	Off	On	Off	Off	Off	Off	No
Ground fault on load side (Only for NTX-3000)	Off	On	Off	On	-	-	No
GFCI end of life (Only for NTX-1000/1500/2000)	Off	On	Off	Off	Off	On	No

# SECTION 7 | Troubleshooting Guide

TROUBLE / SYMPTOMS	POSSIBLE CAUSE(S)	SUGGESTED REMEDIES
<p><b>NO AC OUTPUT</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Yellow LED is ON</li> <li>Red LED is OFF</li> <li>There is no buzzer alarm</li> </ul> <p><i>On Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>DC input voltage is being displayed</li> <li>Power Bar Graph is OFF</li> <li>Message "Input Fault" is flashing</li> </ul>	<p><b>Over Temperature Shutdown</b></p> <p>In case the fan fails or if the cooling is inadequate due to higher ambient temperature or restricted airflow, the temperature inside the inverter will start rising. Temperature rise is sensed at a critical hot spot. If this temperature is around 105°C, the AC output will be switched OFF.</p>	<ol style="list-style-type: none"> <li>The inverter will remain latched in this shut down condition and will be required to be reset manually by switching OFF, waiting for 15 minutes and switching ON again.</li> <li>Before using the inverter again, please ensure that the cause of over temperature has been removed</li> </ol>
<p><b>NO AC OUTPUT</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green, Yellow &amp; Red LED are OFF</li> <li>There is no buzzer alarm</li> </ul> <p><i>On Remote Control NTX-RC</i></p> <p>Remote Control display is OFF and cannot be switched ON</p>	<p><b>No activity due to loss of DC input power to the inverter</b></p> <ol style="list-style-type: none"> <li>If there is no voltage at the DC input terminals: <ul style="list-style-type: none"> <li>Battery is dead</li> <li>External DC input fuse is blown</li> <li>Loose connection along the circuit from the battery to the DC input terminals</li> </ul> </li> <li>If there is voltage at the DC input terminals: <ul style="list-style-type: none"> <li>Internal DC input fuses have blown</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Check DC side wire connections and fuses OR contact Technical Support</li> </ol>
<p><b>NO AC OUTPUT</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Yellow LED is OFF</li> <li>Red LED is ON</li> <li>There is no buzzer alarm</li> </ul> <p><i>On Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>DC input voltage is being displayed</li> <li>Power Bar Graph is OFF</li> <li>Message "Output Fault" is flashing</li> </ul>	<p><b>Shut down due to overload or short circuit or ground fault / leakage</b></p> <ol style="list-style-type: none"> <li>Inverter has shut down because the power drawn by the load is more than the continuous / surge ratings or there is a short circuit on the load side.</li> <li>In Model NTX-3000-12, this shut down could also be due to ground fault / leakage on the load side (This model has built in Ground Fault Protection Circuit. Refer to Section 6.6.2 for details).</li> </ol>	<ol style="list-style-type: none"> <li>Reduce the load or disconnect the load that is causing overloading</li> <li>Check for short circuit and remove the short. Also, check for ground fault on the load side</li> <li>When the inverter shuts down due to overload / short circuit, it will be latched in shutdown condition and will require a manual reset as follows: <ol style="list-style-type: none"> <li>From the front panel of the unit: <ul style="list-style-type: none"> <li>Switch the On/Off Rocker Switch to off position</li> <li>Wait for 2 to 3 minutes for the internal latching circuit to de-energize completely</li> <li>Switch the On/Off Rocker Switch to on position</li> </ul> </li> <li>From the Remote Control NTX-RC <ul style="list-style-type: none"> <li>Switch off the inverter by pressing the On/Off Key on the remote (<b>NOTE:</b> The inverter cannot be switched off through the Remote Control NTX-RC if the On/Off Rocker Switch on the front panel of the inverter is in on condition. When NTX-RC is being used, the On/Off Switch on the front panel of the inverter should be in off condition)</li> <li>Wait for 2 to 3 minutes for the internal latching circuit to de-energize completely</li> <li>Press the On/Off Key on the remote to switch on the inverter</li> </ul> </li> </ol> </li> </ol>
<p><b>NO AC OUTPUT</b> (For NTX-1000 / 1500 / 2000)</p> <p><i>On the NEMA5-20R Duplex GFCI outlet</i></p> <ul style="list-style-type: none"> <li>The small Green LED light on the GFCI outlet is OFF</li> <li>The "Reset Button" has popped out</li> </ul> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Yellow LED and Red LED are OFF</li> <li>There is no buzzer alarm</li> </ul> <p><i>On the Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>Power Bar Graph is OFF</li> <li>Backlight is dimmed</li> <li>DC input voltage is being displayed</li> </ul>	<p><b>GFCI has tripped due to ground fault / leakage on the load side (Refer to Section 6.6.1 for more details)</b></p> <ol style="list-style-type: none"> <li>Due to ground fault / leakage on the Load Side of the GFCI, the Load Side has been mechanically disconnected from its AC input side by the relay inside the GFCI.</li> <li>Internally, the inverter will still be working normally and the rated AC output voltage will be available on the internal Line Side of the GFCI but not on the external Load Side of the GFCI due to tripped relay in the GFCI.</li> </ol>	<p>Press the "Reset" button on the GFCI outlet to reset the GFCI after removing the cause of the ground fault / leakage.</p>

## SECTION 7 | Troubleshooting Guide

TROUBLE / SYMPTOMS	POSSIBLE CAUSE(S)	SUGGESTED REMEDIES
<p><b>AC OUTPUT IS AVAILABLE</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Red LED is OFF</li> <li>Buzzer alarm sounds intermittently when DC input voltage drops to Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V when delivering high power loads</li> <li>Yellow LED comes ON when buzzer alarm is sounded.</li> </ul> <p><i>On the Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>DC input voltage is being displayed and intermittently drops to Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V when delivering high power loads</li> <li>Message "Input Fault" intermittently flashes whenever DC input voltage drops to Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V</li> <li>Power Bar Graph will be ON if the output power is &gt; 50W to 100W</li> </ul>	<p><b>Intermittent buzzer alarm due to intermittent high AC loads</b></p> <ol style="list-style-type: none"> <li>DC input wire size is not adequate for higher capacity loads OR there is loose connection between the battery and the inverter leading to DC input voltage falling below the Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V</li> <li>The battery has developed sulfation due to undercharging. In this condition, the internal resistance of the battery rises above normal and hence, causes abnormal voltage drop on its terminals at higher discharge current consumed by higher capacity load</li> </ol>	<ol style="list-style-type: none"> <li>Use thicker wires between the battery and the inverter and tighten all DC input circuit connections</li> <li>Check internal resistance of the battery and remove sulfation by equalizing the battery or replace the battery</li> <li>Alarm resets automatically when battery voltage rises to 11.5 VDC ± 0.2 VDC</li> </ol>
<p><b>NO AC OUTPUT</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Red LED is OFF</li> <li>Buzzer alarm sounds all the time</li> <li>Yellow LED is ON</li> </ul> <p><i>On the Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>DC input voltage is being displayed and has dropped to Low DC Input Voltage Shutdown Threshold of 10.5V +/- 0.3V</li> <li>Message "Input Fault" is flashing</li> <li>Power Bar Graph is OFF</li> <li>LCD is dimmed</li> </ul>	<p><b>Shutdown due to low DC input voltage</b></p> <ol style="list-style-type: none"> <li>DC input wire size is not adequate for the capacity of the AC load OR there is loose connection between the battery and the inverter leading to DC input voltage falling below the Low DC Input Voltage Shutdown Threshold of 10.5V +/- 0.3V</li> <li>The battery has developed sulfation due to undercharging. In this condition, the internal resistance of the battery rises above normal and hence causes abnormal voltage drop on its terminals at higher discharge current consumed by higher capacity load</li> </ol>	<ol style="list-style-type: none"> <li>Use thicker wires between the battery and the inverter and tighten all DC input circuit connections</li> <li>Check internal resistance of the battery and remove sulfation by equalizing the battery or replace the battery</li> <li>Alarm resets automatically when battery voltage rises to 11.5 VDC ± 0.2 VDC</li> </ol>
<p><b>AC OUTPUT IS AVAILABLE</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>Green LED is ON</li> <li>Red LED is OFF</li> <li>Buzzer alarm sounds when DC input voltage drops to Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V even on low AC loads</li> <li>Yellow LED is OFF.</li> </ul> <p><i>On the Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>DC input voltage is being displayed and drops to Low DC Input Voltage Alarm Threshold of 11V +/- 0.3V even at low loads</li> <li>Power Bar Graph is ON if the output power is &gt; 50W to 100W</li> </ul>	<p><b>Buzzer alarm due to low DC input voltage even at low AC loads</b></p> <p>The battery is almost discharged</p>	<ol style="list-style-type: none"> <li>Recharge the battery.</li> <li>Alarm resets automatically when DC input voltage rises to &gt; 11 VDC ± 0.3 VDC</li> </ol>



## SECTION 7 | Troubleshooting Guide

TROUBLE / SYMPTOMS	POSSIBLE CAUSE(S)	SUGGESTED REMEDIES
<p><b>NO AC OUTPUT</b></p> <p><i>On the Inverter Front Panel</i></p> <ul style="list-style-type: none"> <li>• Green LED is ON</li> <li>• Red LED is OFF</li> <li>• Buzzer alarm is OFF</li> <li>• Yellow LED is ON</li> </ul> <p><i>On the Remote Control NTX-RC</i></p> <ul style="list-style-type: none"> <li>• DC input voltage is being displayed and has risen to High DC Input Voltage Shutdown Threshold of 16.3V +/- 0.3V</li> <li>• Message "Input Fault" is flashing</li> <li>• Power Bar Graph is OFF</li> <li>• LCD is dimmed</li> </ul>	<p><b>Shutdown due to high DC input voltage</b></p> <p>DC input voltage has risen to High DC Input Voltage Shutdown Threshold of 16.3V +/- 0.3V</p>	<ol style="list-style-type: none"> <li>1. Switch OFF the AC load and the inverter.</li> <li>2. Disconnect the DC input to the inverter</li> <li>3. Check the output voltages of the battery and charging source and ensure these are below the High DC Input Voltage Shutdown Threshold of 16.3V +/- 0.3V</li> <li>4. Check that a 24V battery is not being used instead of 12V battery</li> <li>5. The unit will reset automatically once the voltage drops to 16.0 +/- 0.3V</li> </ol>
<p><b>INVERTER DOES NOT SHUT DOWN WHEN IT IS SWITCHED OFF USING REMOTE CONTROL NTX-RC</b></p>	<p><b>The ON / OFF switch on the front panel of the inverter is in ON condition</b></p>	<p>When using the remote control NTX-RC, ensure that the ON / OFF switch on the inverter is in OFF position</p>
<p><b>MOTORIZED POWER TOOL WILL NOT START</b></p>	<p>Excessive start-up current from the load is activating the Soft Start Circuit and is reducing the output voltage and consequently, the current to a level where the starting torque required by the motor is not sufficient to turn the motor. (Starting torque in a motor is proportional to Voltage and the Current)</p>	<p>If appliance does not start, then the appliance is drawing excessive power and will not work with the inverter</p>
<p><b>MOTORIZED POWER TOOL DOES NOT OPERATE AT CORRECT SPEED</b></p>	<p>Purely inductive load with higher reactive power and lower Power Factor is activating the soft start circuitry and reducing the output voltage resulting in reduced speed</p>	<p>Make the load not purely inductive. Operate an incandescent lamp at the same time as the motor. This will reduce the reactive power and raise the Power Factor so that the Soft Start Circuit is not activated</p>

## SECTION 8 | Fuse Replacement

### 8.1 FUSES INSIDE THE INVERTER

The AC side is protected by an integral electronic overload circuit and will automatically reset in some cases.

The DC side is protected by fuses that are located inside the inverter. Normally, these fuses will not blow unless a serious problem occurs. See Section 9 - Specifications for details of fuses.

Please DO NOT replace the fuses yourself. We recommend you contact technician to find and fix the problems. High voltage and high temperature inside!



#### CAUTION!

NO USER-SERVICEABLE COMPONENTS INSIDE. DO NOT ATTEMPT TO OPEN THE INVERTER.

## SECTION 9 | SPECIFICATIONS

MODEL NO.	NTX-1000-12	NTX-1500-12	NTX-2000-12	NTX-3000-12
<b>INPUT</b>				
DC INPUT VOLTAGE RANGE	10.5 - 16.3 VDC ( $\pm 0.3$ VDC)			
DC INPUT CURRENT AT RATED LOAD	100A	150A	200A	300A
DC INPUT CURRENT AT NO LOAD	< 0.8A	< 0.9A	< 1.0A	<1.1A
<b>OUTPUT</b>				
AC OUTPUT VOLTAGE	115 VAC ( $\pm 5$ VAC)			
AC OUTPUT FREQUENCY	60 Hz ( $\pm 1$ Hz)			
AC OUTPUT WAVE FORM	Pure Sine Wave			
CONTINUOUS ACTIVE OUTPUT POWER	1000W	1500W	2000W	3000W
MAXIMUM ACTIVE SURGE POWER (LESS THAN 1 SEC)	2000W	3000W	4000W	6000W
PEAK EFFICIENCY	90.5%	90.5%	90.5%	90.5%
<b>PORTS</b>				
REMOTE CONTROL PORT (RJ-45 JACK, 8P8C)	Yes	Yes	Yes	Yes
<b>PROTECTIONS</b>				
LOW INPUT VOLTAGE WARNING ALARM	11.0 VDC $\pm 0.3$ VDC			
LOW INPUT VOLTAGE SHUTDOWN	10.5 VDC $\pm 0.3$ VDC			
HIGH INPUT VOLTAGE SHUTDOWN	16.3 VDC $\pm 0.3$ VDC			
GROUND FAULT/OVERLOAD/SHORT CIRCUIT SHUTDOWN	Yes. Manual reset			
OVER TEMPERATURE SHUTDOWN	Yes. Auto reset			
COOLING	Load and temperature controlled variable speed fan			
INTERNAL FUSES	4 x 40A in parallel	8 x 30A in parallel	10 x 35A in parallel	16 x 30A in parallel
(Automotive Blade Fuses, Type ATO/ATC, 32 VDC)				
<b>CONNECTIONS</b>				
INPUT	NUT AND BOLT (M9)			
OUTPUT	NEMA5-20R Duplex Receptacles			NEMA L5-30R Receptacle
<b>ACCESSORIES INCLUDED</b>				
REMOTE CONTROL NTX-RC	Yes	Yes	Yes	Yes
<b>COMPLIANCE</b>				
SAFETY	Intertek - ETL Listed. Conforms to UL Std. 458 and certified to CSA Std. C22.2 No.107.1			
EMI / EMC	FCC Part 15(B), Class A			
<b>ENVIRONMENT</b>				
OPERATING AMBIENT TEMPERATURE	0°C to 40°C; 32°F to 104°F			
STORAGE TEMPERATURE	-30°C to 70°C; -26°F to 158°F			
<b>GENERAL</b>				
DIMENSIONS, IN (W X D X H)	8.50 x 11.06 x 3.62	8.50 x 13.11 x 3.62	8.50 x 13.11 x 3.62	8.50 x 17.75 x 3.62
DIMENSIONS, MM (W X D X H)	216 x 281 x 92	216 x 333 x 92	216 x 333 x 92	216 x 451 x 92
WEIGHT, KG	2.5	3.5	3.9	5.5
WEIGHT, LB	5.4	7.8	8.6	12.0

- NOTES:**
1. All power ratings are specified for resistive load at Power Factor = 1
  2. All specifications given above are at ambient temperature of 25°C / 77°F
  3. Specifications are subject to change without notice