



Wilmore®
ELECTRONICS CO., INC.

USER MANUAL
Series 1652
DC-to-AC Inverters

**SERIES 1652
250VA
DC-to-AC Inverters**



This User's Information Manual is applicable for the following Models:

1652-xx-120-60-P
1652-xx-120-60-U
1652-xx-120-60-L
[substitute 12, 24, 48, or 130 for "xx"]



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WARNING - DANGER OF ELECTRIC SHOCK!

Hazardous voltages can be present on the rear-panel wiring terminals and receptacles. Disconnect the DC and AC input power at the source end of the input cables before working near the rear panel.

The installer should read all of Section II (Installation and Operation) and refer to Figures 1 & 2 for additional information **BEFORE MAKING ANY CONNECTIONS TO THE INVERTER.**

CAUTION - TO AVOID EQUIPMENT DAMAGE DURING INSTALLATION...

Prior to installing the inverter, verify that its front-panel input power switch (a "rocker-arm" circuit breaker) is in the **OFF** position, indicated by a wedge-shaped section of the rocker arm protruding from the front panel and exposing white plastic in the rocker assembly. If the inverter does not appear to be turned off, push against the word "OFF" printed on the switch face to expose the white plastic indicator before making any connections to the inverter.

**...DO NOT "HOT PLUG" OR APPLY AN ENERGIZED CONNECTION TO A
"TURNED ON" INVERTER!**

I. General Description

The Series 1652 dc-to-ac inverters provide a regulated, 120-Vac, 60-Hz output from station batteries and other widely-fluctuating battery systems. The output-voltage waveshape is a three-level stepped approximation to a sine wave with peak, average and rms values approximating those of a sine wave. Maximum rated output power is 250 volt-amperes. This is a continuous duty rating for the 24, 48, and 130Vdc input models at 60°C ambient temperature and free-air convection cooling. For the 12Vdc input models, the continuous duty rating is 250VA up to 40°C ambient temperature; derate the output volt-ampere rating linearly to 175VA up to 60°C. The dc input and the ac output are isolated from the chassis and from each other.

The suffix letter **P** in its model number indicates that this inverter is provided *without* integral sensing and transfer circuitry.

The suffix letter **U** or **L** in its model number indicates that this inverter is provided with integral sensing and transfer circuitry which allows it to function in one of two configurations:

- 1) **U Suffix** indicates that this inverter is designed to function as an inverter-preferred uninterruptible power system. In this configuration, the load power is normally provided by the inverter. However, if the inverter output is interrupted, an internal transfer switch automatically transfers the load from the inverter to an alternate ac power source (commercial ac power or another dc-to-ac inverter, for example). Upon restoration of inverter power, there is a delay of several seconds, and then transfer back to inverter power automatically takes place.
- 2) **L Suffix** indicates that this inverter is designed to function as a line-preferred uninterruptible power system. In this configuration, the load power is normally provided by the external ac power source (commercial ac power or another dc-to-ac inverter, for example). However, if the external source is interrupted, an internal transfer switch automatically transfers the load from the external source to the inverter. Upon restoration of the external ac power source, there is a delay of several seconds, and then transfer back to the external source automatically takes place.

This inverter is electronically protected against output overloads and short circuits. Recovery to normal inverter operation is automatic upon removal of the fault. The fault may also clear the front panel **AC LINE fuse** (U and L versions) which protects the alternate AC power source. This source will not be available to the load until the fuse is replaced. A front-panel circuit breaker provides protection against accidental reversal of dc-input voltage polarity during installation.

CAUTION for U and L Versions

Do not misinterpret unlit LED's to indicate the absence of AC power. The front-panel LED's will not remain lit if DC input power is removed from the input connector. However, AC input power, if present, will be connected to the AC output receptacle via the inverter's internal transfer switch, and so **AC voltage may still be present at the output receptacles even when no LED's are lit.**

II. Installation and Operation

WARNING – DANGER OF ELECTRIC SHOCK

Hazardous voltages can be present on the rear-panel wiring terminals and receptacles. Disconnect the DC and AC input power sources end of the input cables before working near the rear panel. Prior to making any wiring connections to the inverter, read all of Section II, and refer to Figures 1 and 2 for additional information.

Connection and operation of Series 1652 inverters are almost entirely self-explanatory from the front and rear panel markings on each unit.

A combination circuit breaker and ON/OFF switch is provided on the front panel for **DC INPUT** power. Its rocker handle is flush with the front panel while in the ON position to guard against unintentionally turning the circuit breaker OFF through incidental contact. An **AC LINE INPUT fuse** (U and L versions) is accessible from the front panel, and a spare fuse is located on the inside cover of the fuseholder. Front-panel indicators on the U and L versions include LED's to display the ac source connected to the output receptacle (**AC LINE** or **INVERTER**) and to alert the user in the event of an **ALARM CONDITION**. See Figure 1 for more information.

All electrical connections to the inverter are located on the rear panel. The **DC INPUT** power connections are made via a two-part (i.e. header and plug) connector. Input cabling can be connected to the inverter without separating the plug from the header. Alternately, the plug may be removed from the inverter by disengaging its mounting-flange screws, and the cabling can be connected to the plug prior to re-engaging it with the header on the inverter's rear panel (be sure to re-engage the mounting-flange screws as well). The positive and negative terminals on each power connector are clearly marked, and deliberate caution should be exercised to avoid polarity mistakes. To connect the power cables, simply strip 3/8" – 1/2" from one end of each cable and insert into the appropriate connector wire clamp. Tighten the wire-clamp screw securely and, if using stranded wire, check to make sure that all wire strands have been captured by the wire clamp.

Suggested wire sizes for dc-input cabling are shown in the chart below. It is desirable that these cables be kept as short as possible, and, if their length must exceed 10 feet, it may be desirable to use larger diameter (lower gauge) cables.

MODEL	INPUT VOLTAGE RANGE (VDC)	INPUT CURRENT (ADC)*	SUGGESTED CABLE (AWG)
1652-12-120-60	10.5-16	28.6	#8
1652-24-120-60	21-29	13.9	#10
1652-48-120-60	42-58	6.8	#12
1652-130-120-60	105-145	2.7	#16

*Typical at full load and minimum input voltage

Note that these inverters are constant-output-power devices, i.e., with a constant output load, the dc-input current and dc-input voltage are inversely proportional. This means that the maximum input current is drawn at the minimum input voltage.

The **AC INPUT** receptacle (U and L versions) should be connected to the user's alternate ac source using the supplied detachable power cord. The **AC OUTPUT** receptacle provides output power to the user's load. The **CHASSIS GROUND** screw provided on the rear panel is electrically common with the ground connections on both the **AC INPUT** and **AC OUTPUT** receptacles.

The **ALARM** connector (U and L versions) provides a set of Form C contacts for remote monitoring of inverter status. This is a two-part (i.e. header and plug) connector and, as with the dc-input power connector described previously, wiring connections can be made without separating the plug from the header. Alternately, the plug may be removed from the converter, and the cabling can be connected to the plug prior to re-engaging it with the header. This plug is held in place by a friction lock – to remove it from the header, grasp the plug firmly and pull it straight out from the rear panel. To connect signal wires to this connector, simply strip approximately $\frac{1}{4}$ " from one end of each wire and insert into the appropriate connector wire clamp. Tighten the wire-clamp screw securely and, if using stranded wire, check to make sure that all wire strands have been captured by the wire clamp. For system wiring flexibility, access to both normally-open and normally-closed contacts is provided (see Figure 2). "Normal" condition, as used in this context, means that the inverter is ON and operating normally. The maximum voltage, current and power ratings (resistive) for these contacts are 125 volts, 1 ampere and 30 watts, respectively.

For more information on rear-panel connectors, see Figure 2.

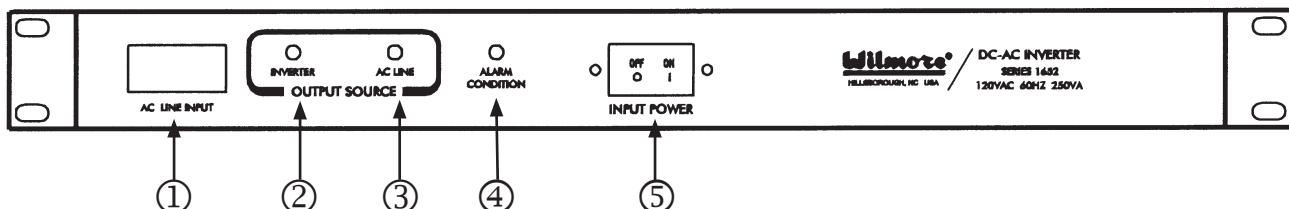
INPUT PROTECTION

Good installation practice for power conversion equipment dictates that an input fuse or circuit breaker should be located at the power-source end of the cables feeding the equipment. The type and rating of such devices are largely dependent on local and/or national codes and installation variables such as cable routing and wire gauge. Wilmore cannot anticipate these variables and consequently does not recommend specific fuse or circuit breaker values. However, it is important to note a few operating characteristics of this unit that may affect an installer's choice of protection devices.

- 1) As mentioned previously, this unit is a constant-power device; that is, it draws its maximum input current at its minimum input voltage.
- 2) As with essentially all electronic equipment with significant input capacitance, the unit will draw an initial peak current many times its normal operating current for a very brief period (a few milliseconds or so) when power is initially applied. **Consequently, instantaneous-trip circuit breakers or non-time-delay fuses may be activated by normal power-up events and are not recommended.**
- 3) Following the brief capacitor-charging current described above, the unit will exhibit a "soft-start" characteristic that limits its input current to approximately that of its full load current (see Section I for specific load current information) as the circuit reaches its normal operating mode. Consequently, and even though the user's application may only require a fraction of the unit's power rating, the input circuit breaker or fuse must be sized to accommodate the full-load input current to avoid nuisance tripping.

III. Front-Panel Controls and Indicators

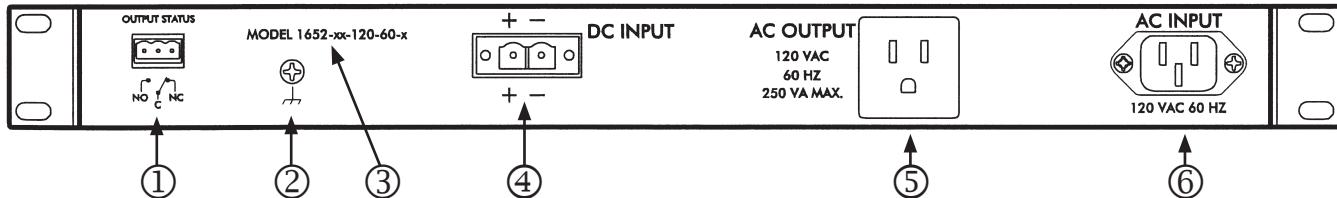
Figure 1. Front Panel of U and L Versions (shown with mounting brackets)



- ① **AC LINE FUSE (U and L Versions):** This is an 8-ampere normal-blow type 3AB fuse which protects against load faults appearing on the commercial AC line when it is selected by the transfer circuitry to power the load. The fuse is accessible by carefully pressing downward on the top surface of the fuse holder, and rotating it outward. A spare fuse is provided and stored inside this fuse holder.
- ② **INVERTER LED (U and L Versions):** This LED is “on” when the transfer circuitry has selected the inverter output to power the load.
- ③ **AC LINE LED (U and L Versions):** This LED is “on” when the transfer circuitry has selected the commercial ac line (or another alternate AC power source connected to the AC-input receptacle) to power the load. **AC power may be present at the output receptacle even though the LED is not “on”;** e.g. if the circuit breaker is turned off or under certain fault conditions.
- ④ **ALARM CONDITION LED (U and L Versions):** This red LED is “on” when the Form C alarm contacts on the rear panel indicate an alarm condition .
- ⑤ **DC INPUT CIRCUIT BREAKER:** This is a combination DC input switch and circuit breaker, provided in the positive (+) input line. It does NOT interrupt the commercial AC line input (U and L Versions).

IV. Rear-Panel Wiring Connections and Information

Figure 2. Rear Panel of U and L Versions



- ① **OUTPUT STATUS CONNECTOR (U and L Versions):** This three-position connector provides access to a set of Form C relay contacts. These contacts are provided for a remote indication of an inverter output fault and/or loss of the alternate ac source. The maximum voltage, current and power ratings (resistive) for these contacts are 125 volts, 1 ampere and 30 watts, respectively.
- ② **CHASSIS GROUND TERMINAL:** Connection to chassis ground is provided for use with #8 hardware.
- ③ **MODEL NUMBER:** This is the complete model number of the inverter, including any standard or special factory-assigned modification codes.
- ④ **DC INPUT CONNECTOR:** Connections for DC input power are provided via a two-part (plug and header) connector, which accommodates appropriate wire sizes. Please refer to Section II for recommended wire sizes for this inverter.
- ⑤ **AC OUTPUT RECEPTACLE:** Connections to the AC output power source selected by the internal transfer circuitry (inverter or alternate AC source) are provided via a standard NEMA 5-15R three-prong receptacle. The load should not exceed the power rating of the inverter.
- ⑥ **AC INPUT RECEPTACLE (U and L Versions):** This is an IEC 60320-C14 receptacle for connecting an alternate 120-Vac, 60-Hz power source (commercial ac line or another dc-to-ac inverter, for example) to power the load. A three-conductor detachable cable terminated in a NEMA 5-15P plug is provided with the inverter for this purpose.

V. Maintenance Information and Trouble-Shooting Guide

Other than preventing dust and debris accumulation on internal components and external surfaces of the inverter, no periodic maintenance should be required.

If a problem is encountered using the inverter, the user should first make sure that the problem is definitely within the inverter before returning it for repair. The following chart lists a few common operating modes and system problems external to the inverter that may occur during installation or operation. Taking a few moments to read through this chart may save an unnecessary return for repair.

SYMPTOM	POSSIBLE EXTERNAL CAUSES
All LED's are OFF (all versions).	DC input source is not present at the input connector. CAUTION: AC VOLTAGE MAY STILL BE PRESENT AT AC OUTPUT RECEPTACLE.
Only red LED is ON (all versions).	DC input source is present but front-panel circuit breaker is OFF or DC input voltage is abnormally low. CAUTION: AC VOLTAGE MAY STILL BE PRESENT AT AC OUTPUT RECEPTACLE.
Front-panel circuit breaker trips immediately when applying DC input power (all versions).	DC input has polarity reversed.
"L" Version (part number includes "L" suffix): Yellow & Red LED's are ON.	Transfer from AC line to inverter has occurred. AC line is not present at AC input terminals or front-panel fuse has opened.
"U" Version (part number includes "U" suffix): Yellow and Red LED's are ON.	A severe overload or short circuit is present at the AC output (front-panel fuse has opened).
"L" Version (part number includes "L" suffix): internal transfer relay cycles between inverter and AC line.	A severe overload or short circuit is present at the AC output (front-panel fuse has opened).
"U" Version (part number includes "U" suffix): internal transfer relay cycles between inverter and AC line.	A moderate overload is present at the AC output (front-panel fuse has opened).

A damaged or malfunctioning unit should be returned to Wilmore for repair. Multiple-component cascade failures in power conversion circuitry can greatly complicate trouble-shooting procedures, and factory technicians familiar with the circuitry can locate the problem quickly, explore adjacent circuitry for stressed or damaged components, and subject the inverter to a thorough retest.

Wilmore maintains a **Return Material Authorization** system in order to efficiently track your inbound shipment and expedite its repair and return to you. Before shipping material for repair to Wilmore, please call (919) 732-9351 or email info@wilmoreelectronics.com and request an **RMA Number** for your shipment. If possible, please provide the complete model number of the equipment, its serial number, and a brief description of the problem. Place this **RMA Number** on the outside of the package and ship prepaid to:

WILMORE ELECTRONICS CO., INC.
 607 U.S. 70A East
 P.O. Box 1329
 Hillsborough, NC 27278

VI. Limited Warranty

Wilmore Electronics Company, Inc. warrants this product to be free from defects in material and workmanship for one (1) year after delivery to the original purchaser. During this period, a defective product for which an authorization to return the product has been given, shall be returned to Wilmore freight prepaid. The products will be repaired, replaced, or credit allowed only if the defect, after examination by Wilmore, is determined to be a defect in material or workmanship. If this returned product is determined by Wilmore to have suffered from user misuse or abuse or to have been opened or modified without written instructions from Wilmore, or if the date of receipt of a request for return authorization exceeds the 1-year warranty period, the warranty is null and void. In such cases, Wilmore will determine the cost of repair, quote this price to the purchaser, and continue as advised by the purchaser.

The sole obligation of Wilmore and the purchaser's exclusive remedy under this or any other warranty, expressed or implied, is the repair or replacement of a defective product as provided above, or the issuance of credit in an amount not to exceed the contract price for the product deemed to be defective. Wilmore makes no warranty of merchantability or fitness for a particular use. Wilmore shall not be responsible for incidental or consequential damage, whether or not foreseeable, caused by defects in this product. There are no other warranties which shall extend the description above.