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ISO 9001:2008 Registered Company

Dimensions

DC to AC Power Inverter System

Owners Manual for Models:

MIL-24U10AN

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Safety Instructions

Important: Read this manual before installation, it contains important safety, installation, and operating instructions. Save this manual and keep it in a safe place.

1.1 Warning and Danger Symbols:

To reduce the risk of electrical shock and to ensure the safe operation of your Dimensions power inverter, the following symbols are used throughout the manual.

ATTENTION:  Important operating instructions. Follow them closely.	DANGER:  Risk of personal harm and/or electrocution exists in this area. Use extreme caution.
SAFETY CERTIFICATION:  This is a UL and CUL Certified product that complies with all the safety standards required in the USA and Canada for land vehicle inverters.	

1.2 Inverter System Precautions:

- DC to AC inverters produces hazardous voltages. To avoid risk of harm or fire, the unit must be properly installed.
- There are no user serviceable parts inside, do not remove the cover.
- The inverter Systems should not be mounted in a location that may be exposed to rain or spray.
- The inverter Systems should not be installed in a zero clearance enclosure.
- Damage to the inverter Systems will occur if correct polarity is not observed when installing the DC input cables.
- Damage to the inverter Systems will occur if an external AC power source is applied to the inverter's AC hardwire output.
- The inverter System contains a circuit breaker and capacitor that may produce a spark. Do not mount in a confined battery or gas compartment.
- Be sure the inverter Systems is turned OFF during installation.

1.3 Battery Precautions:

- Working in the vicinity of lead-acid batteries is dangerous. There is a risk of acid exposure.
- Batteries generate explosive gases during operation.
- There is risk of high current discharge from shorting a battery that can cause fire and explosion. Use insulated tools during installation.
- Remove all rings, watches, jewelry or other conductive items before working near the batteries.
- Inspect the batteries once a year for cracks, leaks or swelling.
- Dispose of the batteries according to local regulations. Do not incinerate batteries; risk of explosion exists.

Specifications

Millennium Series Power Inverters

MIL-24U10AN

Output Voltage (VAC)	120 ±5%
Output Frequency:	60 Hz ± 0.05%
Output Waveform:	Pure sine wave, < 5% THD
Input Voltage: (VDC)	22 to 30
Operating Temperature:	-20° to 40° C (0° to 104° F)
Efficiency:	Up to 88%

**Environmentally Friendly,
Quiet, Reliable, AC Power**

Other Design Features:

- Patented construction and cooling methods
- 16 bit, 5 MHz DSP (Digital System Processor) control
- Thermally-controlled cooling fan
- Enclosed AC and DC cable connections with strain relief
- Remote ON/OFF switch hookup
- GFCI outlet and hardwire output protected
- LED for Inverter power, Low battery, High temperature, & Overload
- Water resistant cover
- Fully coated circuit board
- Optional NATO slave plug connector with cable
- Built to UL 458 standards

Unit Protection:

- Automatic electronic short circuit/overload protection
- Automatic high temperature shutdown
- Output circuit breakers
- DC input reverse polarity protection

Battery Protection:

Automatic low battery shutdown at 21 VDC (with in-rush delay)

Usage:

Any 120 VAC, 60 Hz single-phase products within the inverter power rating.

MODEL NUMBER	MIL-24U10AN
National Stock Number	6130-01-495-0740
Output Power (Watts Cont.)	1,000
Output Current (Amps AC)	Up to 8.3
Peak Output (Amps AC)	25
Output Rating: (hp)	¼
Input Current (Amps DC)	Up to 50
Weight (lbs.)	32
Dimensions in. (LxWxH)	15 x 11 x 6¾

Technical Description

3.1 Power Inverter System:

3.1.1 Overview: A DC to AC power inverter system converts DC current storage in batteries to usable 120 VAC 60Hz power. The inverter have a main "On/Off" switch to control the inverter operation, it also have LED indication lights built on the front of the inverter to provide system status. The inverter can also be controlled by a customer-supplied remote "On/Off" switch connected to the violet wire labeled "remote switch hook-up" located in the field-wiring compartment.

3.1.2 Theory of Operation: The inverter converts DC power from batteries to usable 120 VAC, 60 Hz power. The direct current (DC) that enters the inverter system is filtered by a large input capacitor and switched "On" and "Off" by the Metal Oxide Silicon Field Effect Transistors (MOSFET) at a rate of 60 cycles per second, and directed into the transformer which steps the voltage up to 120 volts.

The inverter has a 16 bit, 5MHz Digital System Processor (DSP) to control the output voltage and frequency as the DC input voltage and/or output load varies. The signal output waveform shape is sinusoidal; it has a total harmonic distortion of less than 5%.

A thermally controlled cooling fan triggers when the temperature inside the electronics circuitry reaches a preset temperature limit keeping the inverter within the operating temperature range.

The water resistant cover and the fully coated circuit board protects the inverter's electronics from the elements, specially from moisture and water that may rust the electronic board components.

The inverter cover has special venting openings that are not directly exposed to the surround ambient, the venting openings are located from beneath on both sides of the inverter to allow airflow circulation to cool down the inverter for efficient operation.

3.2 Available Options and Features

3.2.1 GFCI Protected AC Output – "A" Option: The inverter have one GFCI protected AC output circuit with a 15A output breaker. With the "A" option, the 120VAC 60Hz AC outlets on front of the inverter and the set of hardwire leads are both GFCI protected therefore it is not necessary to install remote GFCI protected outlets.

3.2.2 Remote "On/Off Switch: The inverter can be controlled by a customer supplied remote "On/Off" switch connected to the 18-gauge violet wire labeled "remote switch hook-up" which is located in the inverter's field-wiring compartment, the line side of the switch must be fused and connected to +24Volts.

Inverter Physical Description

4.1 Inverter Module

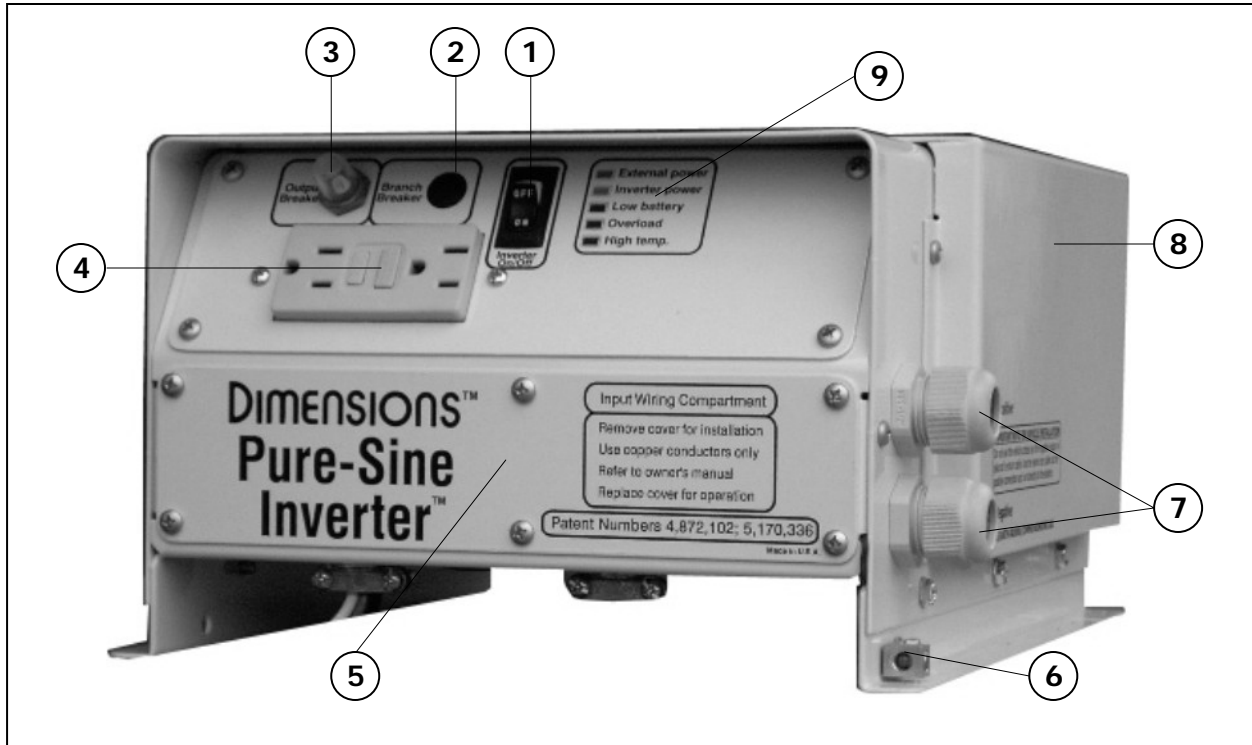


FIGURE 1: Inverter module physical description

Item #	Description	Function
1	"On/Off" Switch.	Switches the inverter ON or OFF
2	Branch Breaker	Not available
3	Output Breaker – 15A	Trips to protect the inverter from hardwire AC output short circuit or overload.
4	GFCI Outlets	Two outlets, 120 VAC 60 Hz out put power.
5	Field Wiring Compartment Cover	Remove the faceplate to access the AC output lead wires and the DC input connectors.
6	Bonding Lug	Connects to the ground system.
7	Water resistant DC input strain reliefs	Clamp the DC input cables for mechanical protection.
8	Water resistant cover	Protects the inside electronics from the elements
9	LED Status Control Panel	Provides system status – See next page

4.1.1 LED Control Panel Description

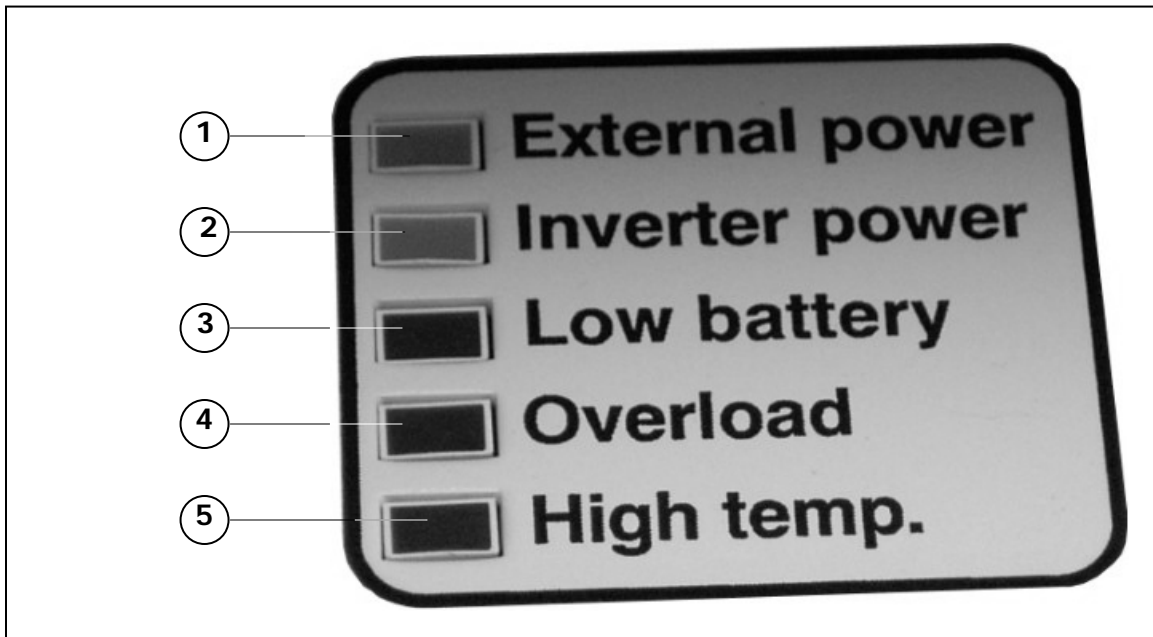
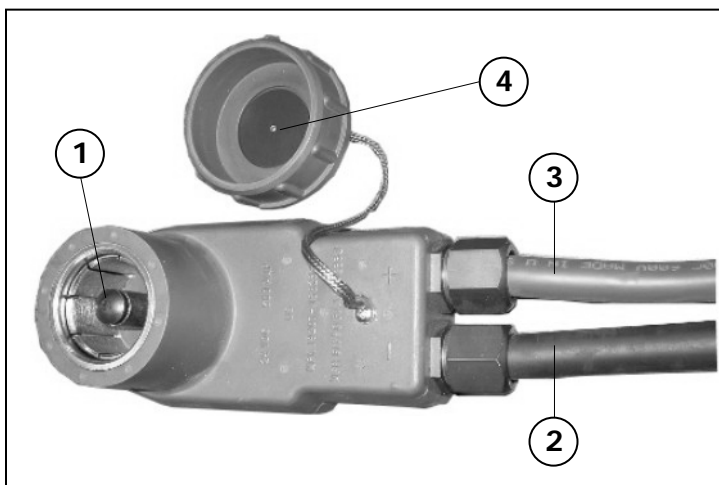


FIGURE 2: LED Front Control Panel

- (1) **External power:** Disabled – Not available with this inverter model.
- (2) **Inverter power:** The green LED indicates that the inverter is operating from batteries in “inverter mode”.
- (3) **Low battery:** The red LED indicates that the inverter is in a low battery voltage condition.
- (4) **Overload:** The red LED indicates that the inverter is in an overload condition.
- (5) **High temp:** The red LED indicates that the inverter has a high internal temperature.

4.2 NATO Connector Plug - Optional



- (1) **Pin Connector:** Plugs to the female connector for DC input power
- (2) **Black Wire (-):** Negative DC input voltage from batteries
- (3) **Red Wire (+):** Positive DC input voltage from batteries.
- (4) **Cover:** Protects the plug from dust when not plugged.

Figure 3: NATO Plug – Optional item

Installation

5.1 Tools for Installation:

Tools required for installation: Straight screwdriver, connectors (butt type and insulated), drill, Crimpers (for insulated and non-insulated connectors), electrical tape, #2 Phillips screwdriver, wire cutters, wire strippers, cable ties, tape measure.

5.2 System Components:

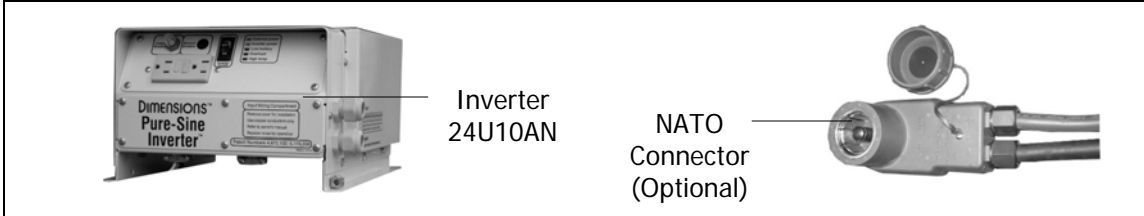



Figure 4: System components

5.3 Mounting the Inverter:

	<p><i>The inverter mounting location should provide adequate ventilation and clearance to maintain room temperature during operation. At least 1/2 inch of clearance is required on all sides.</i></p>
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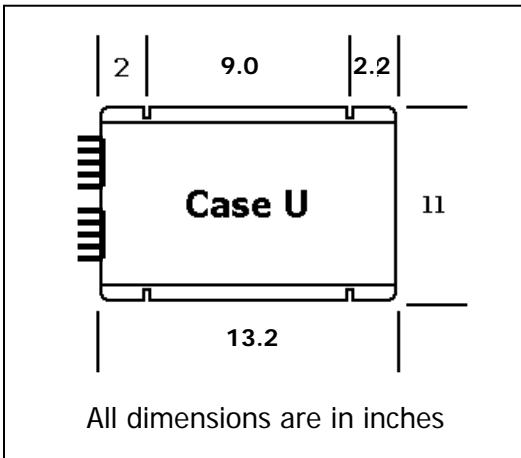
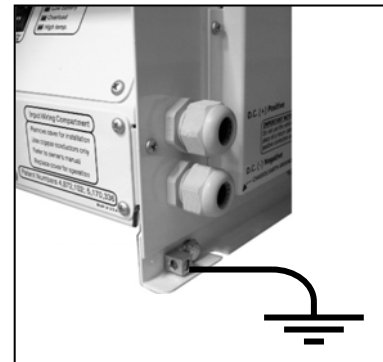


Figure 5: Inverter footprints

- Locate a suitable, secure vertical or horizontal mounting surface as close to the batteries as possible without being in the same airtight compartment.
- If mounting the inverter on a vertical surface, it is recommended that the front control panel be pointing down whenever possible.
- Locate the mounting holes on the chassis flanges and fasten them using 1/4 inch diameter screws to secure the inverter. See figure 5.

5.3.1 Chassis Bonding Lug: Connect the bonding lug located at the right side of the inverter chassis to the earth grounding system using an 8-gauge copper wire.

Figure 6: Inverter grounding



Inverter Wiring:

6.1 DC Wiring:

- 1 It is recommended in all cases to use stranded copper wires.
- 2 Use SGX cross-linked polyurethane insulation type that complies with the high temperature insulation requirements (125°C.) of SAE J-1127 and vehicle manufacturer requirements.
- 3 Wire gauge recommendations are minimum. For higher temperature rated, applications inside engine spaces or large motor loads and other applications with high surge currents use wire gauge 1 to 2 sizes larger than shown on table I.
- 4 Keep the wire runs between battery and SPS as short as possible.
- 5 Use Bussmann fuse type ANN-XXX and fuseblock # 3576 where XXX is the size of the fuse.

6.1.1 Inverter Cable: This is the cable that runs from the inverter module to the batteries. Estimate the "inverter cable" length and locate your inverter model on table I, cross-reference the wire gauge and fuse size.

Table I: Wire and Fusing Guide for 24VDC systems at 5% Voltage Drop at Full Output

Inverter Model	Full Load (Amps DC)	Inverter to battery estimated cable length in feet		
		1' – 10'	11' – 15'	16' – 20'
24U10	50	8-gauge, 100A fuse	6-gauge, 150A fuse	6-gauge, 150A fuse

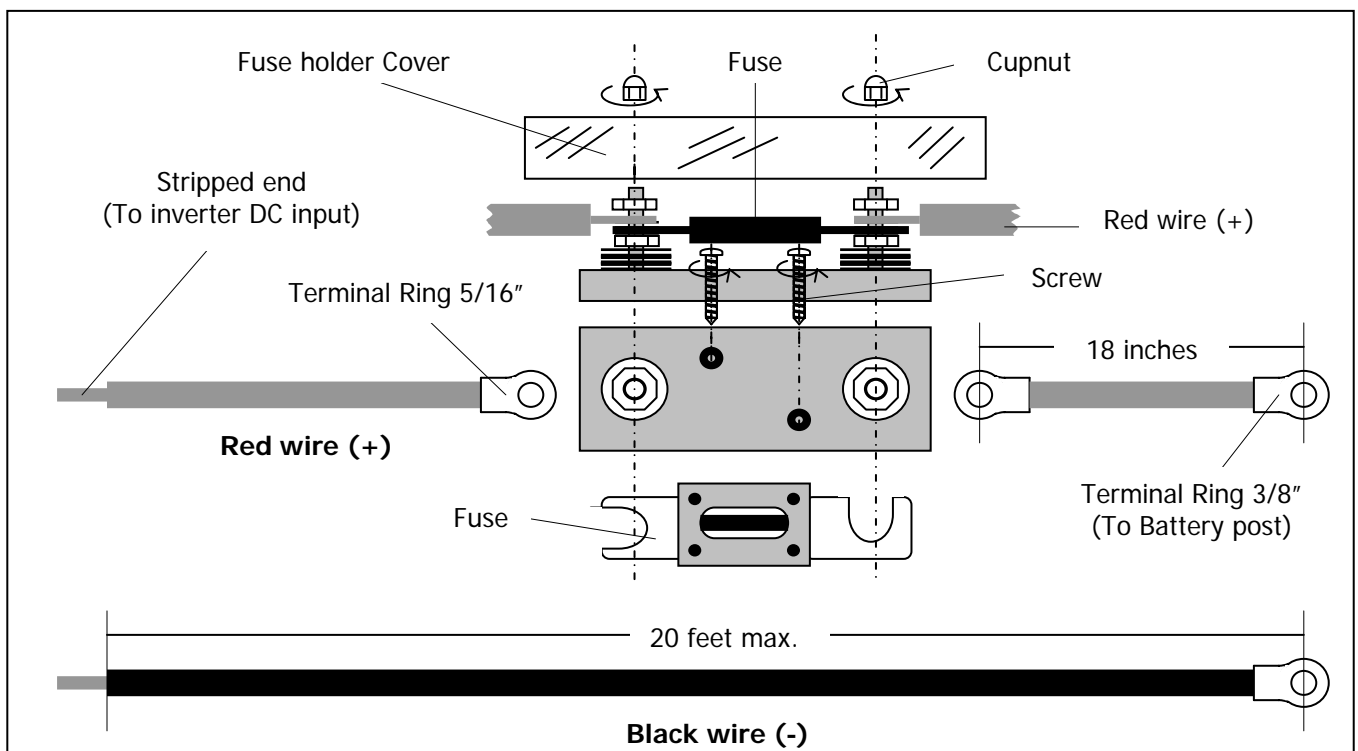



Figure 7: Inverter cable assembly

6.1.2 Charge Cable: This is the cable that runs from the batteries to vehicle alternator or OEM engine battery. Use 2-gauge cables and 250A fuse for small OEM alternators and 1/0-gauge and 350A for heavy-duty alternators.

6.1.3 NATO Connector: If the inverter comes with a NATO connector option, plug the pin male connector extending from the inverter to the female connector for 24-volt DC input power.

6.1.4 Connecting the DC wires:

	<i>Damage to the inverter not covered under warranty will occur if correct polarity is not observed when installing the DC input cables.</i>
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- Refer to Figure 5A: DC wiring diagram.
- Open the inverter field-wiring compartment to access the DC input lugs.
- Unscrew the DC input lug POS (+) and NEG (-) screws.
- Remove the fuse from the fuseholder for cable installation.
- Remove 1 inch of insulation from the un-terminated ends of the red and black cables.
- Insert the stripped end of the red wire into the DC input lug labeled POS (+) and the stripped end of the black wire into the DC input lug labeled NEG (-). Tighten the lug screws to 10 Ft. Lbs.
- Tighten the cover DC cable strain relief screws to 1 Ft. Lb.
- Connect the end of the short red cable to a POS (+) battery post.
- Connect the terminated end of the black cable (neg. return cable) directly to a battery NEG (-) post (DO NOT connect to the chassis).
- Install the in-line fuse in the fuseholder that is within 18" of the positive post of the battery bank (a one-time spark will occur when this final DC connection is made). To determine the fuse size, refer to section 6.1.1.

6.1.5 Remote "On/Off"

Switch: An optional customer supplied "On/Off" switch may be connected to the inverter. The remote switch will operate only if the main "On/Off" switch on the face of the inverter is turned ON.

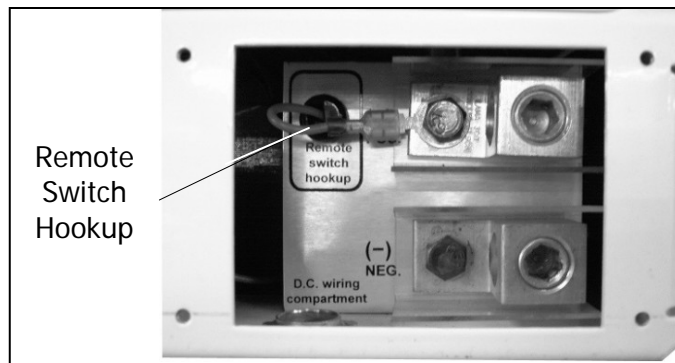


Figure 8: Remote Switch Hookup

- Open the inverter field-wiring compartment to access the DC input connector.
- Locate the violet wire labeled "Remote Switch Hook-up" and remove it from the positive battery connector.
- Connect the violet wire to the load side of the "On/Off" remote switch.
- Using an 18-gauge wire, connect a fused (5 amp recommended) +24VDC battery voltage to the line side of the switch.
- The fuse should be mounted within 18 inches of the battery's positive post.
- All material used for the remote switch should be UL listed and installed per code.

6.1.6 Deep Cycle Batteries:



Do not use vehicle-starting batteries; deep discharge cycles typical with SPS applications can shorten the life of this type of batteries.

- Install at least one 24 VDC auxiliary deep cycle battery (two 12-volt batteries in series or four 6-volt batteries in series) to feed the inverter directly. Depending on the application running time more batteries could be added if necessary. The vehicle alternator will recharge the batteries.
- It is recommended to mount the battery bank close to the inverter. The maximum recommended distance between the inverter and the battery bank is 20 feet.
- The battery compartment must be vapor-tight to the interior of the vehicle and vented directly to the exterior.
- Install several vent-plugs within one inch of the top of the battery compartment to allow for ventilation. Install a ventilation assembly as needed.
- Allow space around the battery and especially above the battery for inspection, and maintenance purposes.
- The battery should not be able to move more than 1 inch in any direction.

6.2 AC Wiring:

Remove the inverter field-wiring compartment cover plate to access the 120VAC, 60Hz output hardwire leads and follow the color code connections: Hot - Black wire, Neutral - White wire, Ground - Green wire.

6.2.1 AC Output: The 120 VAC, 60 Hz current produced by the inverter is provided at the GFCI receptacle outlets located on front of the inverter. The output is also presented behind the wiring compartment panel for direct hardwire leads. The hardwire leads are GFCI protected; remote outlets do not need to be GFCI outlets.



Do not connect another source of AC power directly to the output of the inverter. This will result in damage to the inverter that is not covered under warranty.

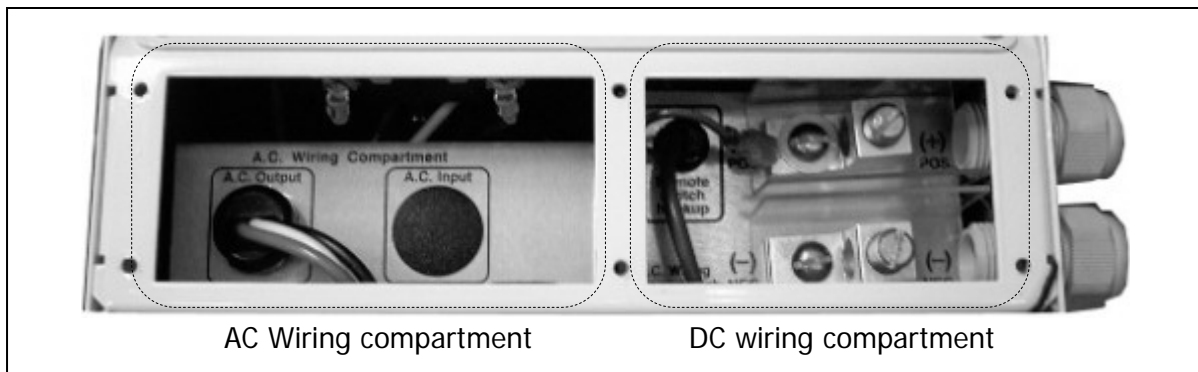


Figure 9: AC/DC Wiring compartment

6.3 DC Wiring Diagram

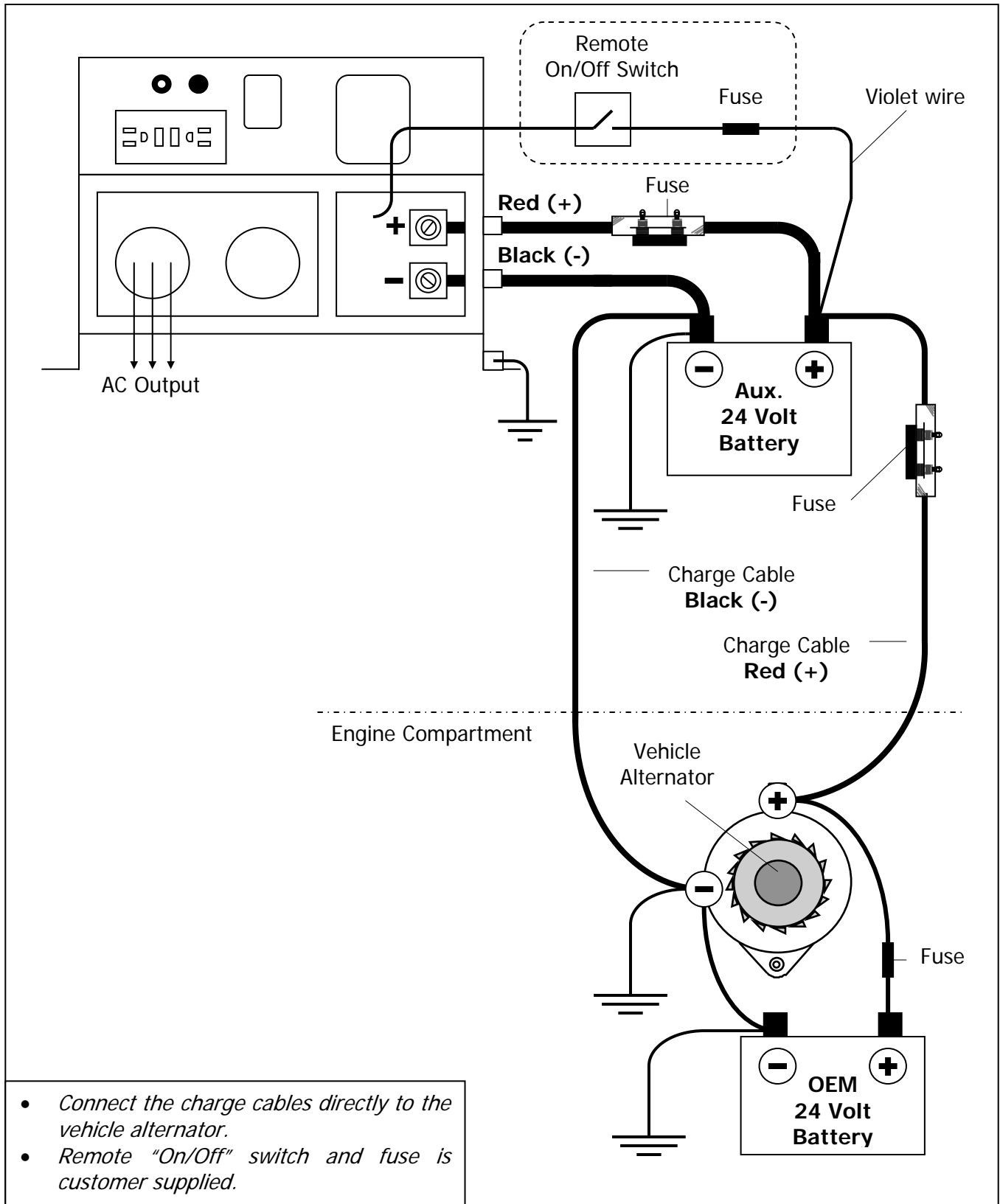


Figure 10: DC wiring diagram

6.4 AC Wiring Diagram

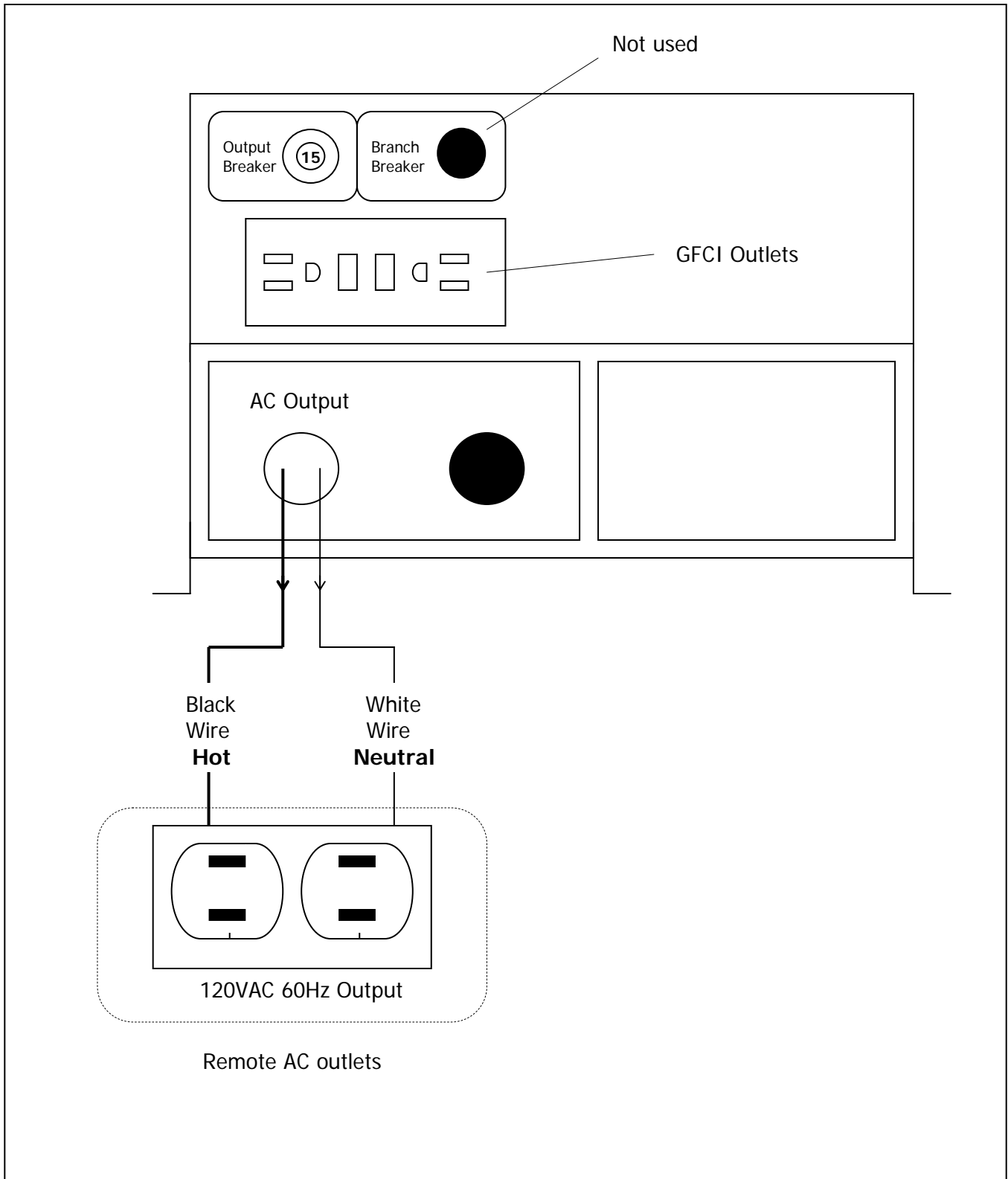



Figure 11: AC wiring diagram

Operation and Troubleshooting

7.1 Operation

7.1.1 Turning the Inverter “ON”: To turn the inverter ON, set the Inverter On/Off switch to the “On” position. The green LED “Inverter Power” will come on. If the remote switch is used, the inverter is turned ON or OFF by the remote switch.

	<i>Turn the inverter OFF if not in use. There is an approximately 1 to 2 amps DC draw from the batteries at idle or no load.</i>
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7.2 Troubleshooting

Call or e-mail Customer Service Department for free consultation during business hours (central time zone) at: 1-800-553-6418 or 1-651-653-7000; fax: 1-651-653-7600; e-mail: inverterinfo@sensata.com

- Unplug all loads and connect a 100-watt light bulb to the inverter output. Observe the LEDs light coming on at the control panel then check the troubleshooting table.

Table V

PROBLEM	POSSIBLE CAUSES OR SOLUTIONS
No LEDs: No power output. The inverter is not connected to the batteries; the battery voltage is below 18 volts DC or fault in the remote On/Off circuit.	Check the in-line fuses for continuity. Make sure the DC wires are clean and tight. Check the DC voltage at the inverter DC input. Check or bypass the remote On/Off circuit.
Low battery: Red LED indicator light. Indicates that the inverter will shut off due to a low battery voltage condition.	Fault in the battery wiring, battery capacity and voltage or the in-line fuse. This message will automatically clear or the inverter will shut off.
Overload: Red LED indicator light. Indicates that the inverter will shut off due to an overload condition.	The inverter output wiring is shorted or loads exceed the inverter rating. This message will automatically clear or the inverter will shut off. Remove the short circuit or excessive load from the output, and then switch the inverter Off then On.
High Temp: Red LED indicator light. Indicates that the inverter has shut off due to high internal temperature. The unit will automatically turn back on when it has cooled to 40°C (104°F)	Verify that the inverter is in a vented compartment and that the fan is not blocked. High ambient temperatures combined with poor ventilation may also contribute to the shut down.

Warranty

SHIPPING TERMS: F.O.B. St. Paul Minnesota. Freight prepaid and billed, subject to prior credit approval.

MINIMUM ORDER: \$50.00 Net Price

LOSS OR DAMAGE: Loss or damage in transit is the responsibility of the carrier. Any claim should be filed with the delivering transport company. Invoice, Bill of Lading and Delivery receipt with damage noted therein must accompany any claims for freight damage. Claims for shortage and lost shipments must be made in writing to Sensata Technologies, St. Paul, MN within 10 days of date of shipment. Claims not reported within this time frame will not be honored.

PRICES: Prices are subject to change without notice. All orders are subject to acceptance at the factory. We reserve the right to invoice prices in effect at time of shipment.

TERMS: Net 30 days with approved credit, credit card or C.O.D.

RETURN GOODS POLICY

- No returned materials will be accepted without an accompanying Returned Materials Authorization Number (RMA) from factory.
- Credit will be issued for returned goods to the original purchaser within 60 days of purchase, provided the inverter is returned to Sensata unused and not mounted. The amount of credit will be issued at Sensata's discretion based on the condition of the product.
- Customer must be in good standing with Sensata.
- Inverters that are discontinued, high-voltage (over 24vdc), special-order or used are excluded and will not be eligible for credit. Non-inverter items such as cable assemblies, fuses and fuse holders, will not be eligible for credit.
- Support components supplied by Sensata vendors will be covered under that manufacturer's credit return policy.
- Customer pays return freight.

PLEASE SHIP FREIGHT PREPAID AUTHORIZED RETURNS TO:

Sensata Technologies / 4467 White Bear Parkway / St. Paul, MN 55110

LIMITED WARRANTY: Sensata warrants to the original purchaser for use that the goods or any component thereof manufactured by Sensata will be free from defects in workmanship for the period listed on the product label from date of purchase, provided such goods are installed, maintained and used in accordance with Dimensions and the original manufacturer's written instructions.

Components not manufactured by Sensata, but used within the assembly provided by Sensata, are subject to the warranty period as specified by the individual manufacturer of said component, provided such goods are installed, maintained and used in accordance with Sensata and the manufacturer's written instructions.

Sensata's sole liability and the Purchaser's sole remedy for a failure of goods under this limited warranty and for any and all claims arising out of the purchase and use of the goods, shall be limited to the repair or replacement of the goods that do not conform to this warranty. The return of the purchase price in cash is at the sole discretion of Sensata.

To obtain repair or replacement service under the limited warranty, the purchaser must contact the factory for a Return Material Authorization (RMA). Once obtained, send the Return Material Authorization Number along with the defective part or goods to: Sensata Technologies, 4467 White Bear Parkway, St. Paul, MN 55110, freight prepaid.

THERE ARE NO EXPRESS WARRANTIES COVERING THESE GOODS OTHER THAN AS SET FORTH ABOVE. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE ARE LIMITED IN DURATION TO ONE YEAR FROM DATE OF PURCHASE.

SENSATA TECHNOLOGIES ASSUMES NO LIABILITY IN CONNECTION WITH THE INSTALLATION OR USE OF THE PRODUCT, EXCEPT AS STATED IN THIS LIMITED WARRANTY. SENSATA TECHNOLOGIES WILL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

WARNING: LIMITATIONS ON USE: Dimensions products are not intended for use in connection with Life Support Systems and for Avionic use. Sensata makes no warranty or representation in connection with their products for such uses.