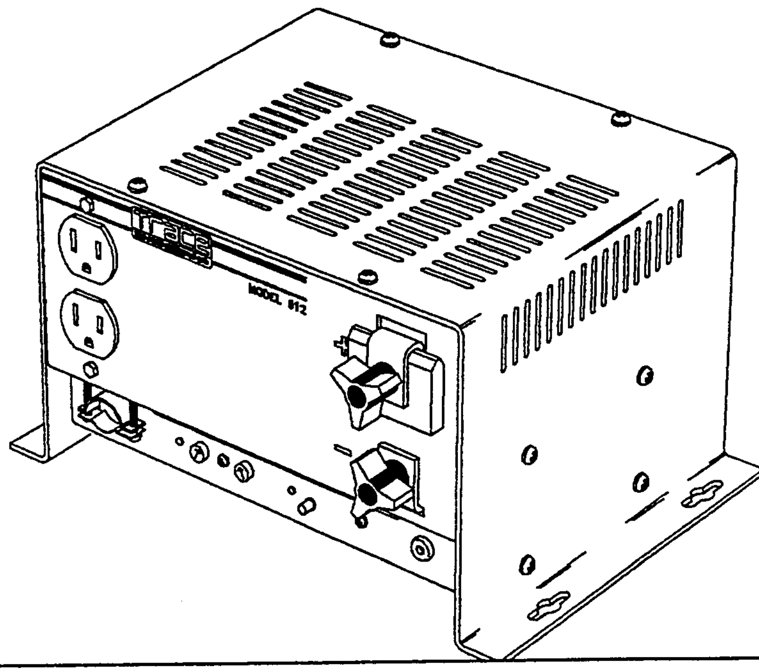
Owner's Manual



724 Series Inverters

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Part #869

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Start-up

On/Off Control

Turning the inverter on and off is controlled by a momentary switch. When the inverter has been reconnected to the batteries, or when its automatic protection

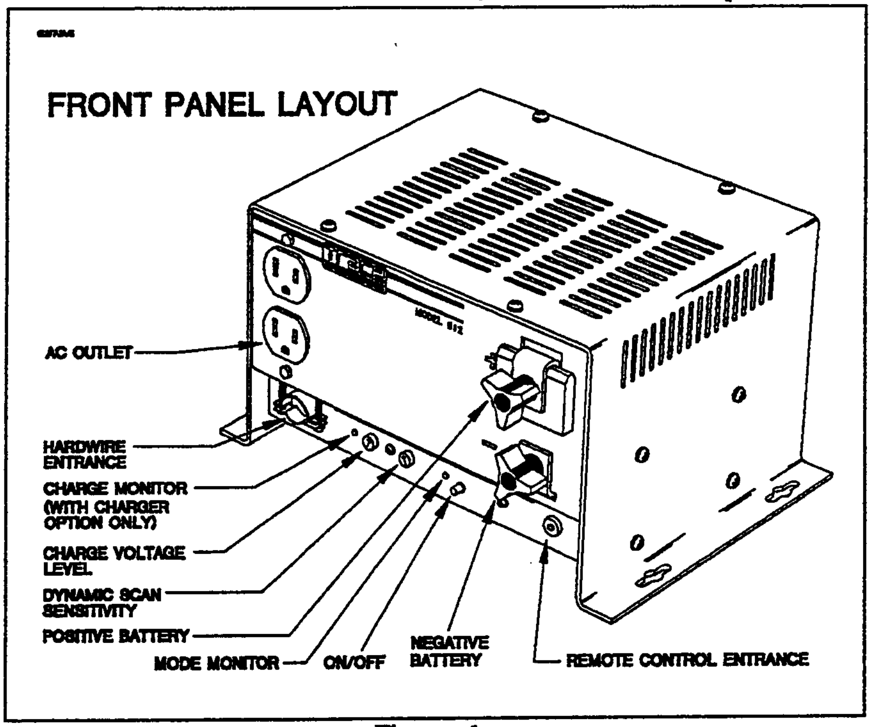

Figure - 1
Front Panel Controls and Access

circuit has turned the inverter off, the ON/OFF switch will have to be pressed twice to start the unit. Once the inverter has been turned on, pressing the ON/OFF switch alternately turns the unit on and off.

Mode Monitor

The Mode Monitor is a red LED that reports on the operational mode of the inverter. When the LED is :

- OFF - The inverter is off.
- ON - The inverter is on and under load.

- **Blinking** - The inverter is on, but in the Search Mode (no load present).

Standby models inverters with the internal battery charger are equipped with a second, amber LED to indicate whether the inverter is in Battery Charge Mode (amber LED on) or Inverter Mode (amber LED OFF)

With this option, the red Mode Monitor LED takes on two additional functions. When inverter is in Battery Charge Mode (amber LED ON) and the red LED is :

- **On Solid** - The battery charger is putting out more than one amp.

- **Blinking** - The battery charger is putting out less than on amp.

Search Mode Control

The Model 724 features an adjustable search mode sensitivity. This circuit allows the inverter to draw very little power when there is no load being run. When no load is present search pulses are sent to test for the presence of a load. These pulses flash the Mode Monitor lamp at a rate of 6 times per second. If a load is detected (when you turn something on) the inverter goes to full output voltage. This circuit can be adjusted to detect different sized loads.

Adjustments are made with the *Dynamic Scan Control* knob. Rotating the control knob clockwise will increase the scan sensitivity. The smallest load that can be consistently detected is approximately 1 watt. Lower levels may be possible with careful adjustment. Turning the knob all the way clockwise defeats the search mode circuit entirely. When adjusting the sensitivity there is a time delay of a few seconds between when the setting is made and when it takes effect.

The factory setting is for approximately 5 watts.

Normally the optimum setting results in the inverter falling into the search mode when all normal loads are turned off. However, some problem loads do not lend themselves to this setting. Televisions and VCR's often draw considerable power when they are turned off. This is to maintain memory, run clocks and energize instant-on circuits. If the search mode is adjusted to not detect these loads, they will not start from their control panel. One solution is to control these devices with an extension cord that has an in-line switch. The drawback to this approach is that clocks and channel memory will need to be reset. If this is unsatisfactory, the inverter can be turned on and off manually, either at the inverter or with the optional remote control (Option RC3). See page 8 for further details.

Protection Circuit

The inverter is automatically protected from the following abnormal conditions: low battery, high battery, shorted output, over current and over temperature. When an error condition is removed the inverter resumes operation.

The Mode Monitor LED displays a series of rapid flashes when the inverter protects itself. Even momentary activity by the protection circuitry will produce a series of flashes.

- **Over Load** - If the load being run demands more current than the inverter can safely supply (even momentarily), the protection circuit initiates a series of rapid flashes. Since the protection circuit is temperature compensated, a large load that runs satisfactorily when the unit is cold may begin to trip the protection circuit and blink the Mode Monitor LED when the inverter is warm. If the inverter sees an overload that lasts for approximately 20 seconds, it turns itself off and needs to be manually restarted.

- **Over Temperature** - The inverter will turn off if either the power transformer or the heat sink rise above their designed operating limits. After cooling sufficiently it will restart itself. The maximum heat sink temperature is set at 80°C (176°F). Typically the unit will cool quickly and restart. See Figure 3, Power vs. Time graph.

- **High Battery** - This feature is provided to protect electronics that may be operating off the inverter. If battery voltage rises above 30.9V the inverter shuts down. When the voltage has dropped to 28.7V the inverter restarts. High battery voltage means high peak output voltage. This condition cannot occur unless the batteries are being charged from an unregulated source, such as solar panels with no charge controller or a faulty battery charger.

- **Low Battery** - There are two protection modes for low battery conditions. (1) Short term: The inverter shuts down if the battery voltage falls below the inverter's safe operating limits (20.4 volts). If the condition does not persist for over 5 seconds the unit will reset itself. (2) Long term: The purpose of this circuit is to keep from over discharging the batteries. Because batteries exhibit a voltage drop while delivering current, their voltage does not represent their state of charge. This circuit makes a battery voltage measurement that compensates for battery voltage drop due to current being drawn from the batteries. Its parameters are based on a 175 amp/hr battery bank. If the inverter determines that the batteries are below approximately 10% charge (23.5 VDC), it turns off the inverter requiring a manual restart.

Three protection modes require the inverter to be manually restarted.

- If an overload lasts for approximately 20 seconds, the inverter turns itself off and needs to be manually restarted.

- If the inverter has its output connected to an external AC source (generator or public power), or if an attempt is made to start a very large motor, it may need to be restarted.

- Low battery voltage (long term).

If the error condition requires a manual restart the Mode Monitor will be off.

Internal Battery Charger (Option 724/SB)

With the 724/SB Option the Model 724 inverter is a versatile fully automatic battery charging system complete with a 25 amp transfer switch.

Method of Operation

To operate as a battery charger AC power must be fed to the inverter's AC input. This is done via the cord supplied or by hardwiring to an internal terminal strip. When the inverter detects that AC power is present at the its AC input, it waits approximately 15 seconds and then stops converting battery power to AC power. The automatic transfer relay, then, connects the inverter's AC input to its AC output. At this point the unit begins charging the batteries. While the unit is operating as a battery charger all loads connected to it are operated from the AC input power source.

When AC power is removed from the inverter's AC input the unit returns to the inverter mode and delivers AC power from the energy stored in the batteries.

Battery Charger

The charger is a constant current voltage limited design. The unit will try to charge at full current (25 amps) until the maximum charge voltage set point is reached. Then the charger will deliver the necessary current to hold the batteries at that point. It is fully voltage and current limited.

If there are DC loads (24 VDC lights, etc.), the only effect will be a reduction in charge current as seen by the battery. Should the DC loads exceed the capacity of the charger, the battery will start to discharge. Continued operation in this mode will cause the battery to fully discharge. The inverter charger will not be injured, but should the battery become fully discharged, the inverter will turn off. Since the inverter/battery charger is a 24 volt appliance it will not function at battery voltages below **18** VDC. If the battery recovers to **18** VDC the unit will start charging.

The unit is factory set to charge at maximum rated current of 12 amps into a lead acid battery at 27.4 volts DC with a power line of 117 VAC RMS sine wave from public power lines (234 VAC for 724/E and 240 VAC for 724/A).

Charging at lower battery voltage or higher line voltages will increase heating and may cause activate its thermal protection circuit. This will not hurt the unit. Forced air cooling will reduce heat build up.

An additional external charger may be connected to the batteries. If the external charger raises the battery voltage above the Trace 724 charger's voltage setting, the Model 724/SB will stop charging until the battery voltage is reduced.

Adjusting Battery Charge Voltage

Charger voltage setting is not critical. Full counter clockwise rotation sets the battery charge rate at 25.6 volts. Full clockwise rotation sets the charge rate to 29.6 volts - a very full battery. It is recommended that you consult the battery manufacturer on correct voltage. A good general setting is at 12 o'clock or 27.4 volts. If you are in a very cold climate where the battery temperature does not get above 40°F, or if you are using a generator system and a time charge process, set the charge voltage to maximum. Be sure to watch for gassing and water loss, if either is excessive lower the charge voltage.

Transfer Switch

When the AC input power is removed, the unit will transfer to inverter mode. This takes about .015 seconds. When the AC power is fed to the inverter it checks for power line voltage stability, then switches to the charger mode . A built in time delay of 5 seconds eliminates relay chatter. While not designed as a computer UPS systems, transfer time is fast enough to hold up many systems.

APPLICATIONS

Resistive Loads

These are the loads that the inverter finds the simplest and most efficient to drive. Voltage and current are in phase with one another. Resistive loads usually generate heat in order to accomplish their tasks. Toasters, coffee pots, heaters and incandescent lights are typical resistive loads. While the inverter is happy to run these loads and manufacturers are happier still to publish efficiency curves based on them, chemical energy sources, such as propane, are often more cost effective.

Inductive Loads

Anything that has a coil of wire in it probably has an inductive characteristic. Most electronics have transformers (TV's, stereos, etc.) and are therefore inductive. Typically, the most inductive loads are motors. And the most difficult load for the inverter will be the largest motor you manage to start. With inductive loads the rise in voltage applied to the load is not accompanied by a simultaneous rise in current. The current is delayed. The length of the delay is a measure of inductance. The current makes up for its slow start by continuing to flow after the inverter stops delivering a voltage signal. How the inverter handles current that is delivered to it while it is essentially "turned off", affects its efficiency and friendliness with inductive loads. The best place for this current is in the load, and "impulse phase correction" routes it there. The return current of inductive loads is making its second pass thru the inverter. Whenever current is run thru transformers and semiconductors some is wasted as heat. Therefore, inductive loads are run less efficiently.

Induction motors (motors without brushes) require 2 to 6 times their running current to start. The most demanding are those that start under load, i.e. compressors and pumps. The largest of this type that the inverter will run is 1/6 hp. Of the capacitor start motors, typical in drill presses, band saws, etc., the largest you may expect to run is 1/2 hp. Since motor characteristics vary, only testing will determine if a specific load can be started and how long it can be run.

Problem Loads

The Model 724 can drive nearly every type of load. However, there are special situations in which the inverter may behave differently than grid power.

- **Very small loads** - If the power consumed by the device is less than the threshold of the search mode circuitry, it will not run without the inverter being adjusted to stay in the full output voltage state. See the "Operation" section for instructions on defeating the search mode feature.

- **Florescent lights & power supplies** - Some devices are difficult or impossible for load sensing circuit to detect. Small fluorescent lights will require careful adjustment of the load sensing control. Some computers and sophisticated electronics have power supplies that do not present a load until line voltage is available. In these cases each unit will wait for the other to begin. To drive these loads either a small companion load must be used to bring the inverter out of its search mode or the inverter may be adjusted to remain out the search mode. See the "Operation" section.

- **Clocks** - The crystal controlled oscillator will keep accuracy to within a few seconds a day. However, when the inverter drops to the search mode, clocks will have to be reset. Also, most clocks do not draw enough power to trigger the load sensing circuit. In order to operate without other loads present, the load sensing will have to be defeated. See the section "Operation".

- **Searching** - If the amount of power a load draws decreases after it turns on, and if the "on" load is less than the threshold of the load sensing circuit, it will be turned alternately on and off by the inverter. For example: the load sensing threshold is set for 16 watts. A ten watt incandescent light is turned on. Cold, the light bulb looks like a 60 watt load, so the load sensing detects it and the inverter goes to full output voltage. The filament of the bulb heats, increasing its resistance, and the power drawn drops to 10 watts. Since this is below the load sensing threshold the inverter returns to its search mode and the light goes out.

- **Dimmer Switches** - These devices employ SCR's (silicon controlled rectifiers) which can be accidentally triggered by sudden voltage changes. Modified sine wave inverters make only sudden voltage changes. Most dimmer switches do not work.

- **Rechargeable Battery Packs** - Most quality products with Rechargeable batteries work well (Makita for example). However, **Sears First Alert Flashlights, Bosch power tools and Skill screw drivers will fail**. If a product is not going to work properly, it will heat up fairly quickly when plugged into the inverter. By monitoring the temperature of the plug-in module, proper operation can be determined.

- **Radios, cassettes, computers** - AM radios will pick up noise, especially on the lower half of their band. Inexpensive tape recorders are likely to pick up a buzz. Computers should not be run while large loads are being started. If a heavy load causes the inverter to momentarily protect itself, the temporarily reduced output voltage may "crash" the computer.

- **TV's and VCR's** - While these devices operate properly on the Model 724, they usually draw power when they are "off". If they are drawing power while off, the load sensing circuit will not allow the inverter to fall into its energy saving search mode state. If the search mode control is adjusted so that it does not detect them, then they may not turn on from their control panel. They may need power to be smart enough to turn on. The simplest solution is to control devices, that draw power while off, from an extension cord that includes an in-line switch.

- **Low battery dropout** - If your battery bank cannot deliver the necessary amperage to drive a particular load without falling below the safe operation level for the inverter, the inverter will turn off. With the inverter off the battery voltage will rise and the inverter will resume operation. Since this happens quickly it can be mistaken for a problem with the inverter. This condition is most likely with a very discharged battery. If this occurs check your battery voltage. With no load on the battery, a voltage of 23.2 indicates complete discharge.

Medical Equipment

The Model 724 Trace Engineering Inverter is not to be used to run either life supporting equipment or life saving equipment.

PRODUCT DESCRIPTION

Features

The Model 724 is an advanced design product with a combination of features not available on other products regardless of cost.

Impulse Phase Correction

This circuit improves the shape of the output waveform while the inverter is running reactive loads. It allows the inverter to closely duplicate the characteristics of standard public power. With this design approach the limitations of the modified sine wave format are largely overcome. "Impulse Phase Correction" has several positive aspects. The primary benefits are realized when the inverter is running induction motors and florescent lights. Induction motors are commonly used to run drillpresses, fans, bandsaws, etc. When this type of load is being driven it tries to return a large portion of the energy that it has received. This returned energy can be thought of as going "backwards" thru the household wiring to the motor, giving it an extra push and making it run smoothly. "Impulse Phase Correction" provides a similar path for this "backwards" energy. Consequently, the Model 724 runs small motors at full speed, starts larger ones and run them both more efficiently.

Search Mode Circuitry

This circuit determines how much power the inverter draws while no load is running. Using only .025 amps the Model 724 draws very little idle power. Its transition from the no load state to full output voltage is fast, eliminating delays when operating devices such as hand tools. Additionally, the threshold sensitivity of the search mode is user adjustable or may be defeated.

Extensive Protection Circuitry

The inverter is protected against high battery, low battery, over temperature, over current and short circuit conditions. Where appropriate the protection circuits are automatically resetting. Under overload conditions the inverter will automatically shut down after 20 seconds. In the ugly event that the inverter's AC output is accidentally connected to an external AC source the Model 724 and other Trace inverters are the only units made that are designed to survive. The low battery protection circuit is smart. It considers the amount of current being drawn from the batteries before shutting down.

True RMS Voltage Regulation

With battery voltages from 22 to 30 VDC and power levels up to 750 watts the inverter will deliver RMS regulated power. This insures that while battery voltages and power level change, the inverter will deliver the correct amount of power.

To measure the inverter's output voltage requires a true RMS reading meter. A standard meter will erroneously read voltages from 90 to 130 VAC (180 to 260 VAC for 50 hz units).

Crystal Controlled Time Base

Proper frequency regulation is assured with use of a 3.9 mHz computer crystal. Battery voltage, power and temperature have no effect on the inverter's operating frequency.

Model 724 Specifications

Power @ 20 deg.C	1000 watts for 7 minutes 600 watts for 55 minutes 500 watts for 90 minutes 425 watts continuous
Efficiency	Over 90% from 40 to 300 watts
Surge power @ 20 deg.C	2400 watts
Input idle current (search mode active)	.(.025) amps / .6 watts
Input idle current (search mode defeated)	(.190) amps / 4.6 watts
Rated current	34 amps DC
Maximum current	150 amps short circuit
Load sensing (watts)	Adjustable/defeatable
Input voltage	21.6 to 30.7 nominal
Voltage regulation (60 hz models)	117 VAC +/- 3 %
Voltage regulation model 612/E	234 VAC +/- 3%
Voltage regulation model 612/A	240 VAC +/- 3%
Frequency regulation	Crystal controlled, +/-.04%
Power factor	All conditions allowed 1 to -1
Wave form	Modified sine wave, with dynamic impulse phase correction for inductive loads
Reverse polarity protection	150 amp maximum
Output protection	Passive and dynamic energy push back absorbers
Protection circuitry	
High battery	above 30.9V with return to operation below 28.7 VDC
Low battery	dynamic current compensation Shut down at 20.4 VDC
Overcurrent	instantaneous limiting at 150 amps
Temperature	Linear temperature compensation
Environmental	
Operating ambient temperature	0 deg.c to +50 deg.C
Non-operating ambient temperature	-35 deg.C to +75 deg.C
Operating altitude	to 15,000 ft.
non-operating altitude	15,000 to 50,000 ft.
Dimensions	Height 5.75",width 10.5", depth 8"
Weight	16 lbs.

Option 724/SB Specifications

Maximum AC input voltage (724/SB)	141 RMS VAC
117 VAC 60 Hz (domestic model)	
Maximum AC input voltage (724/E/SB)	282 RMS VAC
234 VAC 50 Hz (European model)	
Maximum AC input voltage (724/A/SB) . . .	289 RMS VAC
240 VAC 50 Hz (Australian model)	
Minimum AC input voltage (724/SB)	105 RMS VAC for 25.2 VDC out
Minimum AC input voltage (724/E/SB)	205 RMS VAC for 25.2VDC out
Minimum AC input voltage (724/A/SB)	210 RMS VAC for 25.2 VDC out
Operation temperature	Minimum 0 deg.C.
	Maximum 50 deg.C.
Non operating temperature	Minimum -30 deg.C.
	Maximum +75 deg.C.
AC Transfer delay	5 Second typical
Transfer switch speed	Inverter to AC - 15 MS typical
	AC to inverter - 50 MS typical
Maximum charge current	12 Amps average
Charge voltage range	25.6 VDC to 29.6 VDC
Fusing	Internal 30 amp fuse on AC input
Required protection	20-25 amp fuse or circuit breaker
	on AC input wiring

All specifications subject to change without notice.

Performance Graphs

The capabilities and characteristics of the Model 724 can be most easily understood by examining the following performance graphs.

POWER VS. EFFICIENCY

There are primarily two types of losses. The first is the energy that is required to operate the inverter at 117 VAC output while delivering no current. This is the idle power. At low power the greatest loss is the result of the idle power required. For example: if the idle power is 5 watts then the inverter will be 50% efficient running a 5 watt load.

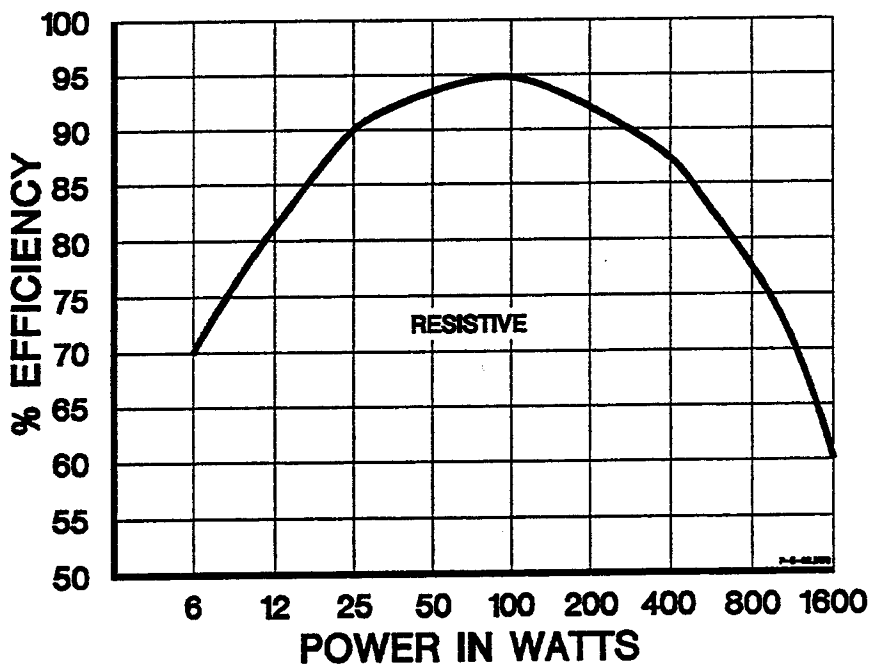

Figure 2, Power vs. Efficiency

The second and largest source of loss is a result of the resistance of the transformer and power devices. The power lost is proportional to the square of the output power. Therefore, losses at 600 watts are four times higher than the losses at 300 watts.

This graph represents the inverters efficiency while operating resistive loads. Inductive loads such as motors are run less efficiently.

Power VS. Time

In order to provide the maximum utility, the inverter is allowed to operate at power levels that can not be maintained continuously. Typically, large loads are operated for only short periods of time while smaller loads are run for long time periods. It is, for example, reasonable to operate a 1000 watt hair dryer for a few minutes. Whereas, for extended periods of time, loads such as a TV/VCR or computer/printer are operated easily.

The time that the inverter can operate at high power is limited by temperature. When large loads are run the inverter's temperature increases. At the point

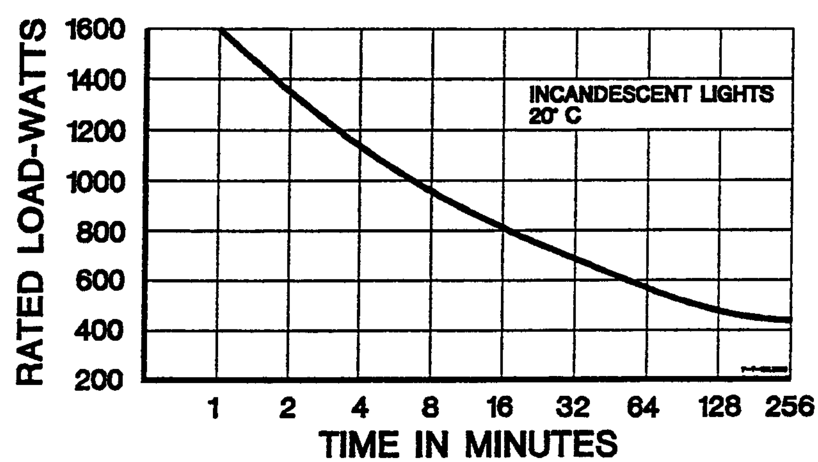

Figure - 3

Power vs. Time

where more heat is created in the inverter than it can dissipate, its ability to operate becomes time limited. The accompanying graph indicates how long the inverter can operate at different power levels.

This graph assume and operating temperature of 20° C and resistive loads. Reactive loads (motors, florescent lights) and/or elevated ambient temperatures will reduce the time that the inverter can operate at a particular power level.

Maximum Regulated Power vs Battery Voltage

As the battery voltage is reduced, the maximum regulated power the inverter can produce is decreased. When the inverter is no longer able to regulate, its output voltage will be below its rated output voltage.

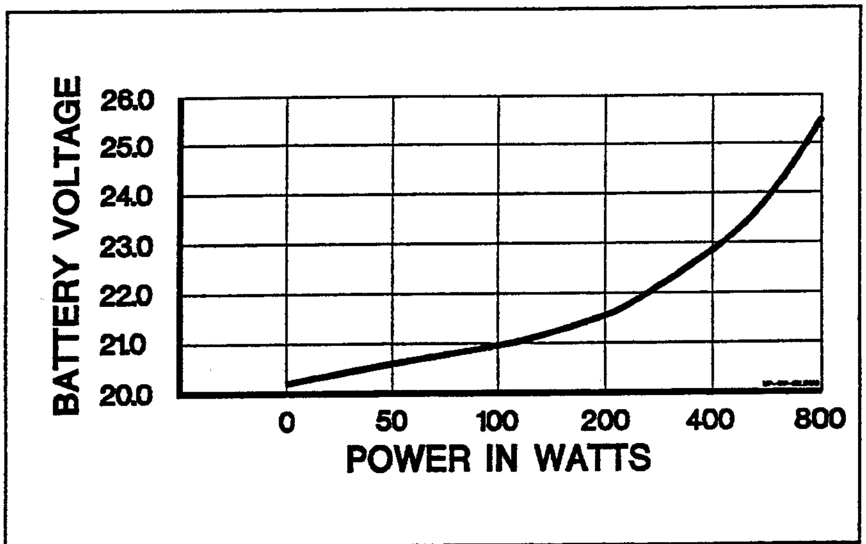

Figure - 4

Maximum Power vs Battery Voltage

The inverter regulates by changing the width of its output waveform. When the inverter falls out of regulation its output is a squarewave. The graph above defines the point at which the output wave form becomes a squarewave.

INSTALLATION

ENVIRONMENT

When selecting the operating environment for the inverter please don't think of it in the same terms as other equipment that works with it, i.e. batteries, diesel generators, motor generators, washing machines etc. It is a highly complex device. There are nearly 20,000 silicon junctions in its output devices and integrated circuits. The crystal oscillator runs at 4 megahertz. The drive circuitry timing is accurate to .1 millionth of a second. Genetically speaking, it is a cousin to stereo equipment, television sets or computers. Steps have been taken to improve tolerance to hostile environments. Circuit boards are solder masked top and bottom then covered with a protective coating. All electro-mechanical connections are made using special non-oxidizing compound. Metal components are plated. However, in a condensing environment (one in which humidity and/or temperature change cause water to form on components) all the ingredients for electrolysis are present - water, electricity and metals. In a condensing environment the life expectancy of the inverter is indeterminate.

Install the inverter in a dry, protected location.

Locate the inverter as close to the batteries as possible in order to keep the batteries cables short. However, do not locate the inverter in the same compartment as the batteries. Batteries generate hydrogensulfide gas which is very corrosive to electronics equipment - and everything else. They also generate hydrogen and oxygen. If accumulated, this mixture would be ignited by an arc from the connecting of battery cables or the switching of the relay in the standby model.

Do not mount the inverter in a closed container. If unrestricted air flow is not available, the inverter will run at higher temperature causing the protection circuitry to reduce maximum output power.

Using the four holes at the base of the unit, it may be mounted in any position. Before mounting, if you are going to hardwire the inverter's AC output, first read the section "AC Connections".

Treat the inverter as you would any fine piece of electronic equipment.

BATTERY CONNECTIONS

The maximum peak current requirement is 150 amps. This is a considerable amount. If battery cables are too small and/or connections are loose, efficiency and maximum output power are degraded.

Distance to Batteries	Battery Cable Size
5 ft and Less	6 Gauge
6 to 10 ft	4 Gauge
11 to 15 ft	2 Gauge
16 to 25 ft	0 Gauge

Table - 1
Battery Cable Size

Code your battery cables with colored tape or heat shrink tubing. Cable ends should have soldered, copper ring terminals.

WARNING - This inverter is NOT polarity protected. If the battery cables are connected wrong (positive to negative), THE INVERTER WILL FAIL.

AGW	Diameter/mm	Area/mm^2
14	1.628	2.082
12	2.052	3.308
10	2.588	6.681
8	3.264	8.367
6	4.115	13.299
4	5.189	21.147
2	6.543	33.624
1	7.348	42.406
0	8.252	53.482
00	9.266	67.433

Table - 2
English Wire Size to Metric

Table 2 can be used to convert the intriguing English wire size system to metric.

DC Fusing

Protect the DC input to the inverter with a 100 amp fuse.

ESTIMATING BATTERY REQUIREMENTS

Batteries are the inverter's fuel tank. The larger the batteries the longer the inverter can operate. In order to determine the proper battery bank size, it is necessary to compute the number of amp hours that will be drawn from them between charge cycles. When this is known, size your batteries at approximately twice this amount. This is done because the batteries may not be fully charged at the beginning of the cycle. Also, the life of the battery is related to how often and how deeply they are cycled. Typically batteries should not be cycled to below 20% of their capacity.

To compute the battery amp hours, the requirements of each appliance that is going to be run are added together. *Table 3* provides a means of figuring the amp hours drawn by various types and sizes of loads. To use this table (1) enter on the left with the row of the appropriate appliance or wattage (2) enter from the top with the column of the length of time the appliance will be run, (3) the intersection of row and column provides the correct amp hours.

		Time in Minutes				
Watts	Appliance	5	15	30	60	120
30	Stereo	.1	.3	.7	1.4	2.8
60	B&W TV	.3	.7	1.4	2.8	5.6
100	Color TV	.4	1.7	2.3	4.6	9.3
200	Computer	.8	2.3	4.6	9.3	18.5
400	Blender	1.6	4.6	9.3	19.0	37.0
800	Skil Saw	1.6	4.7	9.3	37.0	74.0
1000	Toaster	4.4	13.0	—	—	—
		Amp/Hours				

Table - 3
Watts Out vs Time vs Battery Drain

Follow this Procedure for each item you want of use with the inverter. Add the resulting amp hour requirements. The minimum properly sized battery bank is double this amount.

If you haven't forgotten your high school algebra you may wish to compute your battery requirements. The critical formula is *Watts = Volts X Amps*. Knowing the wattage of your load you divide this by 24 (battery voltage) to determine the amperage the load will draw from the batteries. Multiply the amperage times the hours and you have, reasonably enough, amp/hrs. Remember that amounts of time less than and hour will be fractions (10 minutes is 1/6 of an hour).

If the AC current is know, then, for 60Hz units, the current at 24 volts will be 5 time greater. With 50hz 240 AC units the battery current will be 10 times greater than the AC current.

Keep in mind that motors are often marked with their starting current rather that there running current. Refrigerators an ice makers typically run about 1/3 of the time and draw about 2.5 amps at 117 VAC. Therefore, their average battery current is about 4.2 amps (2.5 X 5 X 1/3).

The following two formulas may be used for computing battery drain. The first assumes you know the rating of the load being driven in watts, the second in amps:

- Battery drain (amp/hrs) = (Watts X Minutes) / 1324
- Battery drain (amp/hrs) = (Amps [117VAC] X Minutes) / 11
- Battery drain (amp/hrs) = (Amps [234VAC] X Minutes) / 5.5

AC CONNECTIONS

Power may be drawn from the inverter by using its AC duplex outlet or by hardwiring to a terminal strip located internally.

If your inverter has the 724/SB option (internal 12 amp battery charger), it is supplied with a 14 gauge line cord. This line cord is connected to either public or generator AC power. It provides the power to the internal battery charger. The line cord is connected to the internal terminal strip. The line cord is supplied for your convenience.

WARNING! For installations that take full advantage of the 25 amp transfer capabilities of the Standby Option, the line cord must be replaced with wire sized per local code.

HARDWIRING AC CONNECTIONS

To access the AC terminal strip, the cover plate on the bottom of the inverter must be removed. The AC access cover is secured with 2 metal screws to the bottom of the inverter. See Figure 5.

IMPORTANT! Standby option (724/SB) only. The AC input wiring must be protected by a 20-25 amp fuse or circuit breaker.

1. Disconnect the battery cables.
2. Remove power from the AC input wires.
3. Remove the screws that attach the AC access cover.
4. Route the AC wires thru the romex connector (cable clamp) located on the front edge of the bottom cover.

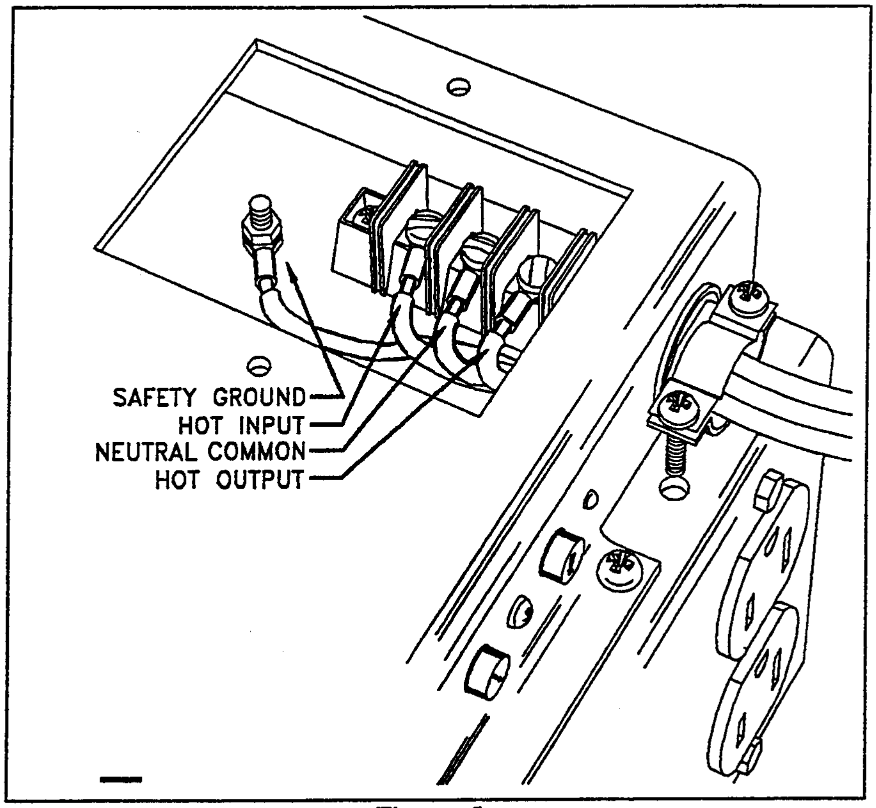

Figure - 5
Hard Wire Terminal Strip

5. Secure the AC wires to the terminal strip as illustrated in Figure 5. Remember that with standard color coding (USA) black is hot/live, white is neutral and green is safety ground .

   Without the battery charger option, there will be three wires to connect. The AC output wire is connected to the terminal screw labeled **"HOT OUTPUT"**. The neutral wire is connected to the center of the three terminals and is labeled **"NEUTRAL"**. The safety ground wire connects to the chassis using a nut and bolt located near the terminal block and is labeled **"SAFETY GROUND"**. See Figure 5.

   With the battery charger option, the AC output wiring is the same as described above. However, in order to power the battery charger section of the inverter, there will be three additional wires to connect. These come from an external AC source (generator, public power). Make sure that you install a 20-25 amp fuse or circuit breaker in the AC input wiring. The hot, neutral and safety ground from the external AC source are lead thru the romex connector on inverter's front . The hot/black input wire is connected to the screw terminal labeled "HOT INPUT". The additional safety ground wire is connected to the safety ground nut and bolt. The additional neutral wire is connected to the center screw of the terminal strip labeled "NEUTRAL".

6. Re-attach the AC access cover.

7. Reconnect the battery cables.

IMPORTANT! Pay attention that the AC output is at no time connected to the grid or generator. While the unit is protected from this condition, it will shut down and need to be restarted.

AC Input Fusing (Standby Option Only)

With the Model 724 with 724/SB option, it is very important to protect the AC input wiring. Install a 20-25 amp fuse or circuit breaker on the AC input wiring. The inverter is internally fused at 30 amps. If the unit is asked to carry currents of over 30 amps the internal fuse will fail. This should only be replaced by an authorized service station. To replace the fuse the top cover is removed. The fuse is located on the charger PCB (the smaller of the two circuit boards). It is located between the white covers of the two relays.

Installation Diagrams

The following diagrams show the most commonly used methods of installing the Model 724 and 724/SB.

Installation using Plugs

Figure 6 shows a simple and fool proof installation. This would typically be used in an RV that presently has a power cord that plugs into the shore power and the generator.

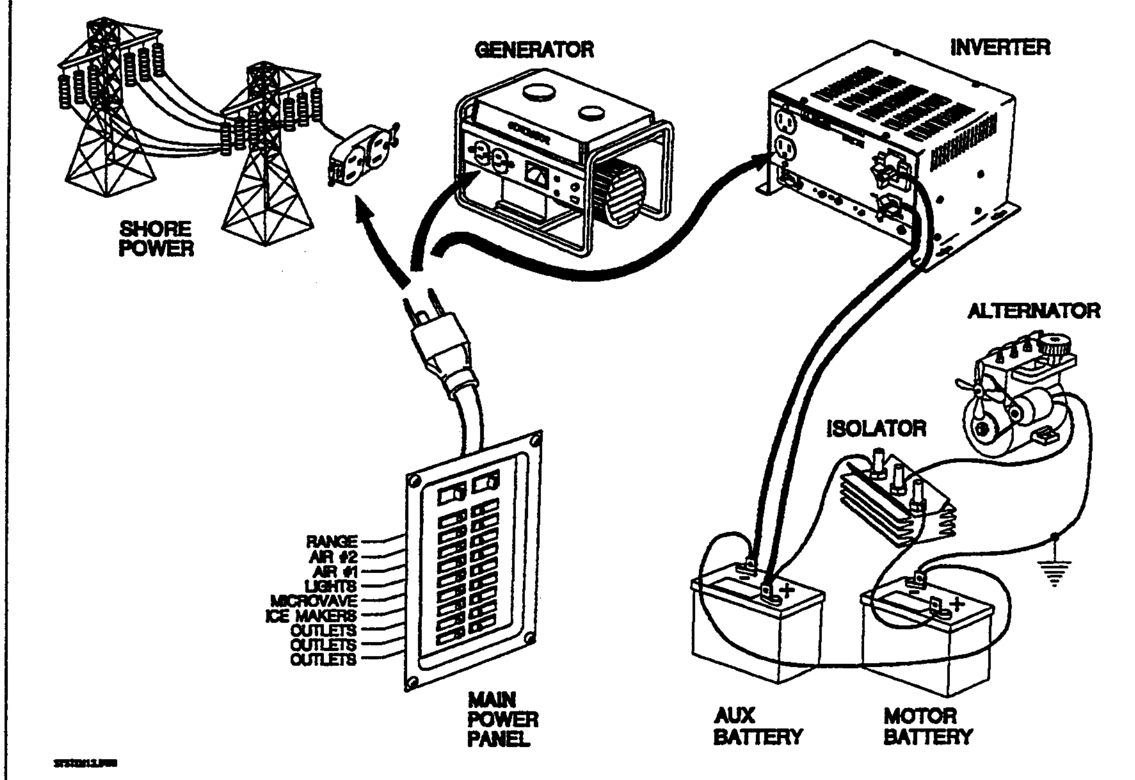

Figure - 6
Inverter Installation Using Plug in Connections

If the power from the generator is terminated in a junction box with an AC receptacle, the same thing can be done with the inverter. Power is lead from the hardwire access in the inverter to a new junction box near the generator's. This may be more convenient as all plug receptacle are now located together.

Standby Inverter With Single AC Panel

The installation in figure 7 insures that AC power is never fed to the inverters AC output. It is important to use a breaker or fuse on the AC input to the inverter.

The advantage of this method is that it is simple. There are two disadvantages.

- The inverter is connected to loads much larger that it can operate.
- The total current to the breaker panel is limited by the amperage rating of the inverter.

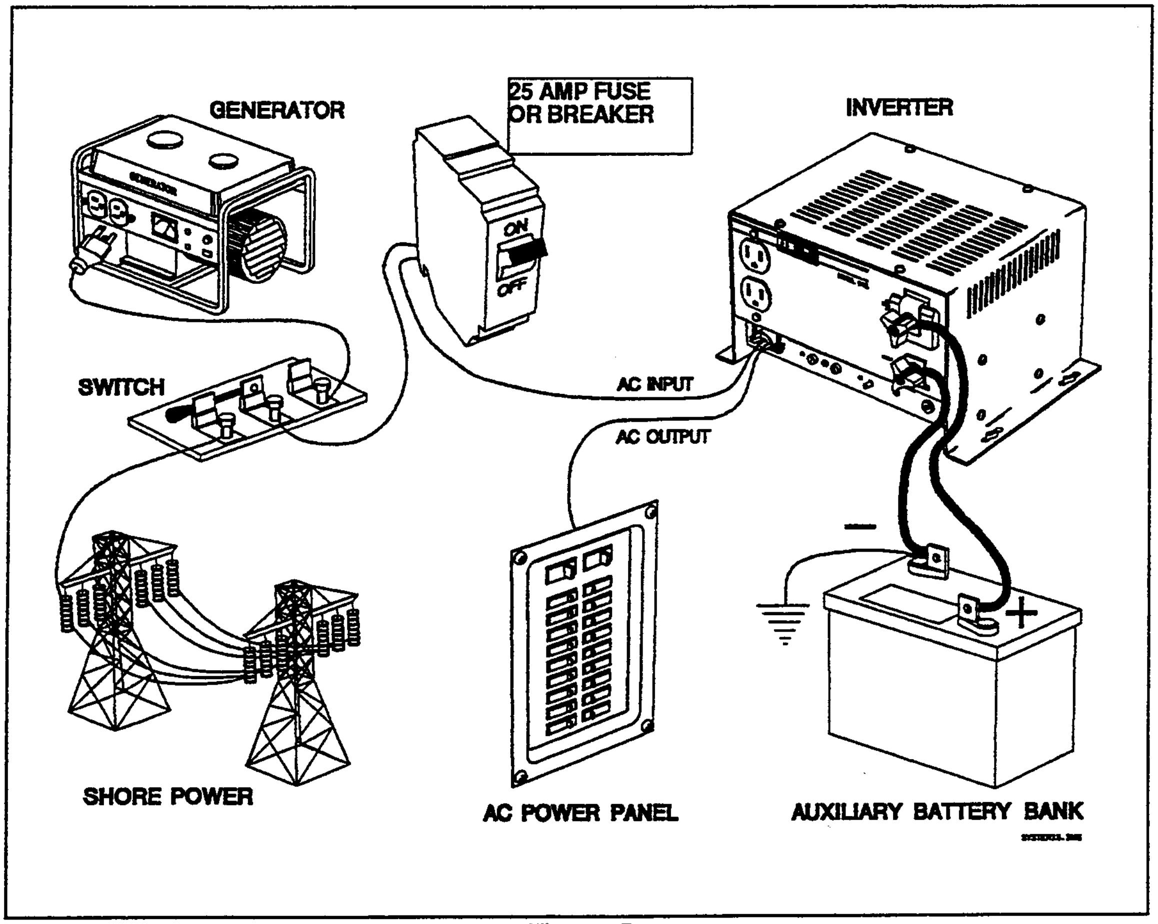

Figure - 7
Standby Inverter Installation with Single AC Panel

Using two AC panels is a superior method of installation.

Inverter with Two AC Panels

This is the recommended configuration for installing an inverter without the built in battery charger. It operates in the following manner. When there is power available at the main panel the relay closes connecting the main panel to the sub panel. When there is no AC present at the main panel the relay switches to its normally open position connecting the sub panel to the output of the inverter.

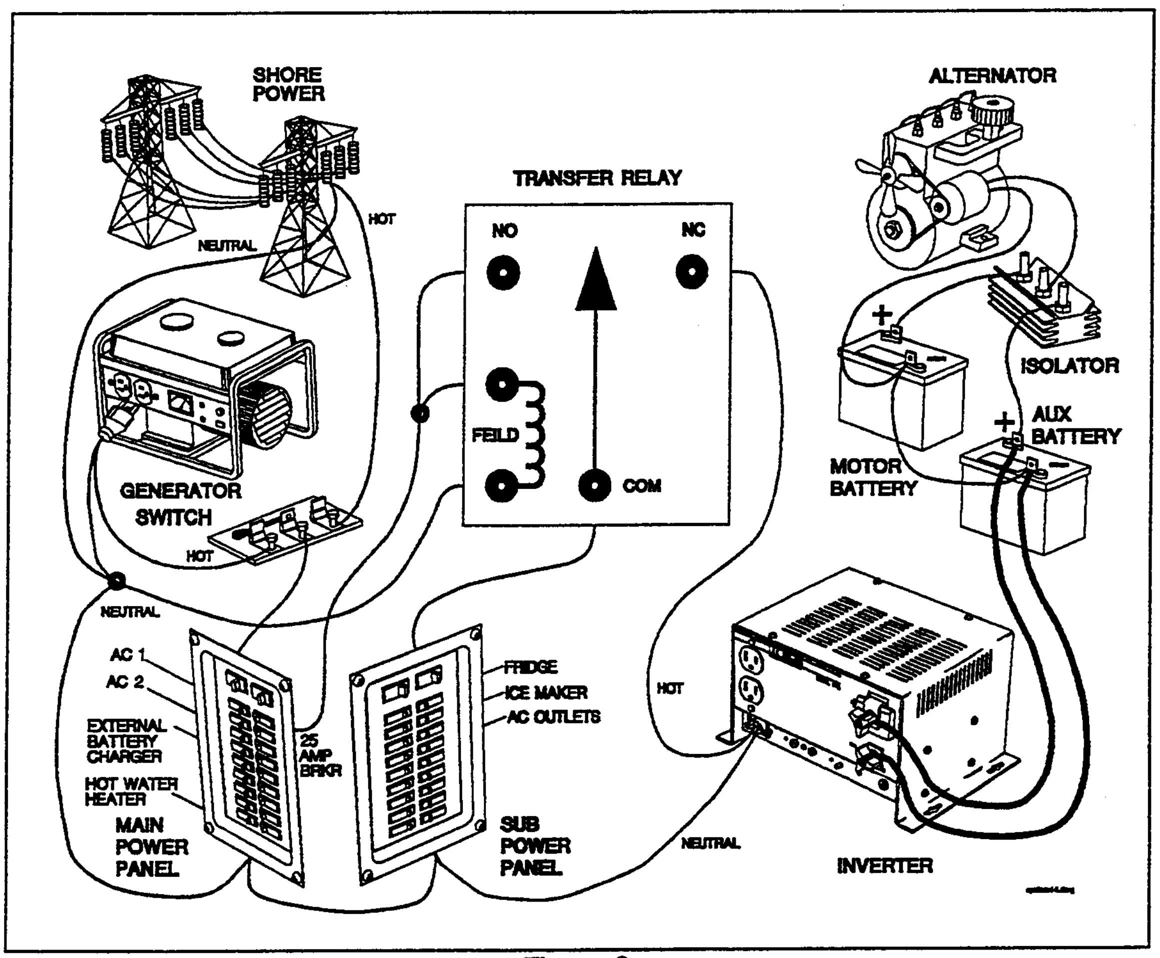

Figure - 8
Inverter Installation with SubPanels and External Transfer Relay

This installation automatically insures that public or generator AC power is never routed to the output of the inverter. The inverter's AC output cannot be feed to its input. Additionally, the inverter will only be connected to appropriately sized loads.

Standby Inverter with Sub Panel

This is the recommended configuration for installing an inverter with the built in battery charger. It operates in the following manner. When there is power available to the main panel it is passed to the inverter. The inverter recognizes that there is AC present and that it does not need to invert to deliver AC power. After AC has been present for approximately 15 seconds, the inverter's automatic transfer circuit connects the inverter's AC input to its AC output. The loads in the sub panel are then operated directly from the AC source feeding the main panel. The inverter uses some of this power to charge the batteries.

When AC power is not available at the main panel, the inverter returns to providing AC power to the sub panel from the energy stored in the batteries.

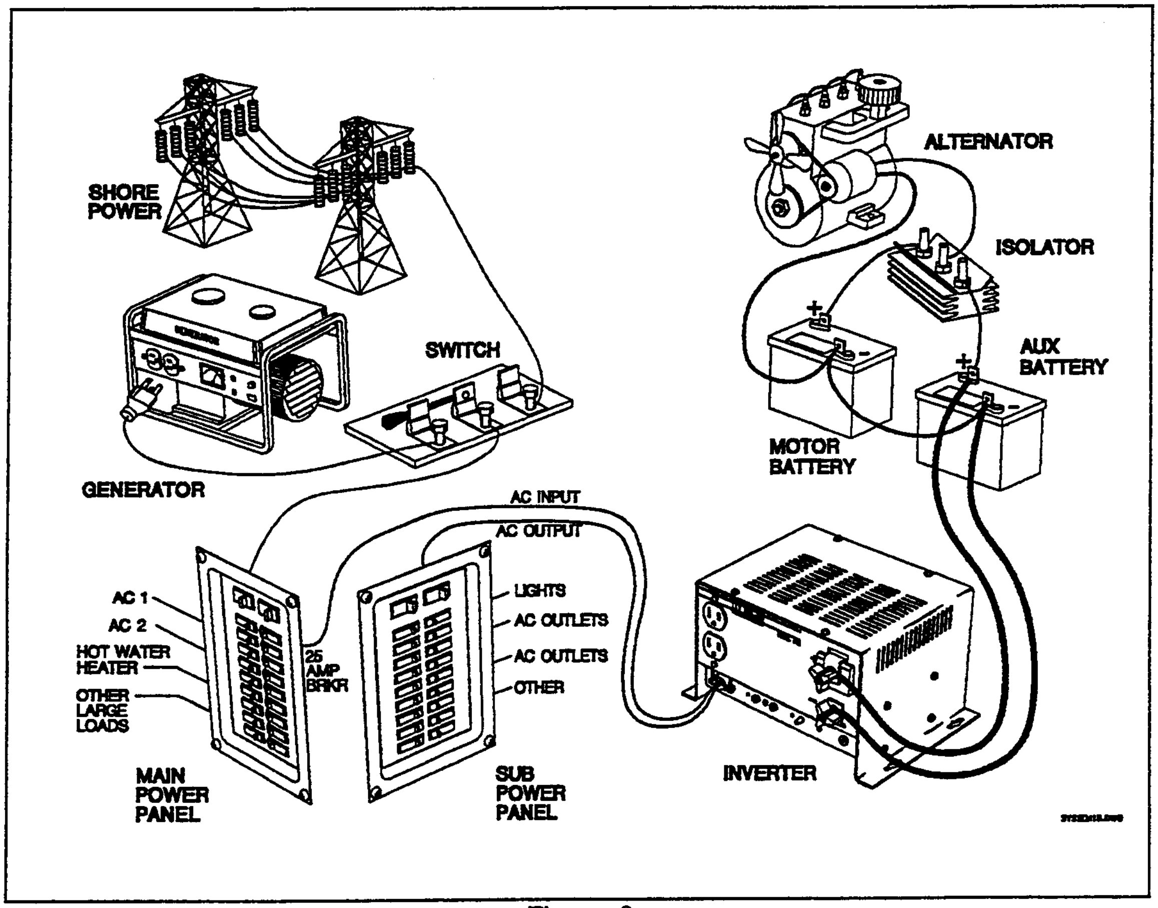

Figure - 9

Standby Inverter Installation with Sub Panel

This installation insures that public or generator AC power is never routed to the output of the inverter. The inverter's AC output cannot be connected to its AC input. Additionally, the inverter will only be connected to appropriately sized loads.

Transfer Relay

Using a transfer relay allows the A.C. panel to be automatically connected to either the output of the inverter or the generator.

The proper relay to use is described as *single pole - double throw - 30 amp - 117VAC.* This relay is commonly available electrical supply outlets for a cost of about $14.00. Pre-wired relays enclosed in electrical boxes are also available thru system suppliers. These range in price from $75 to $250.

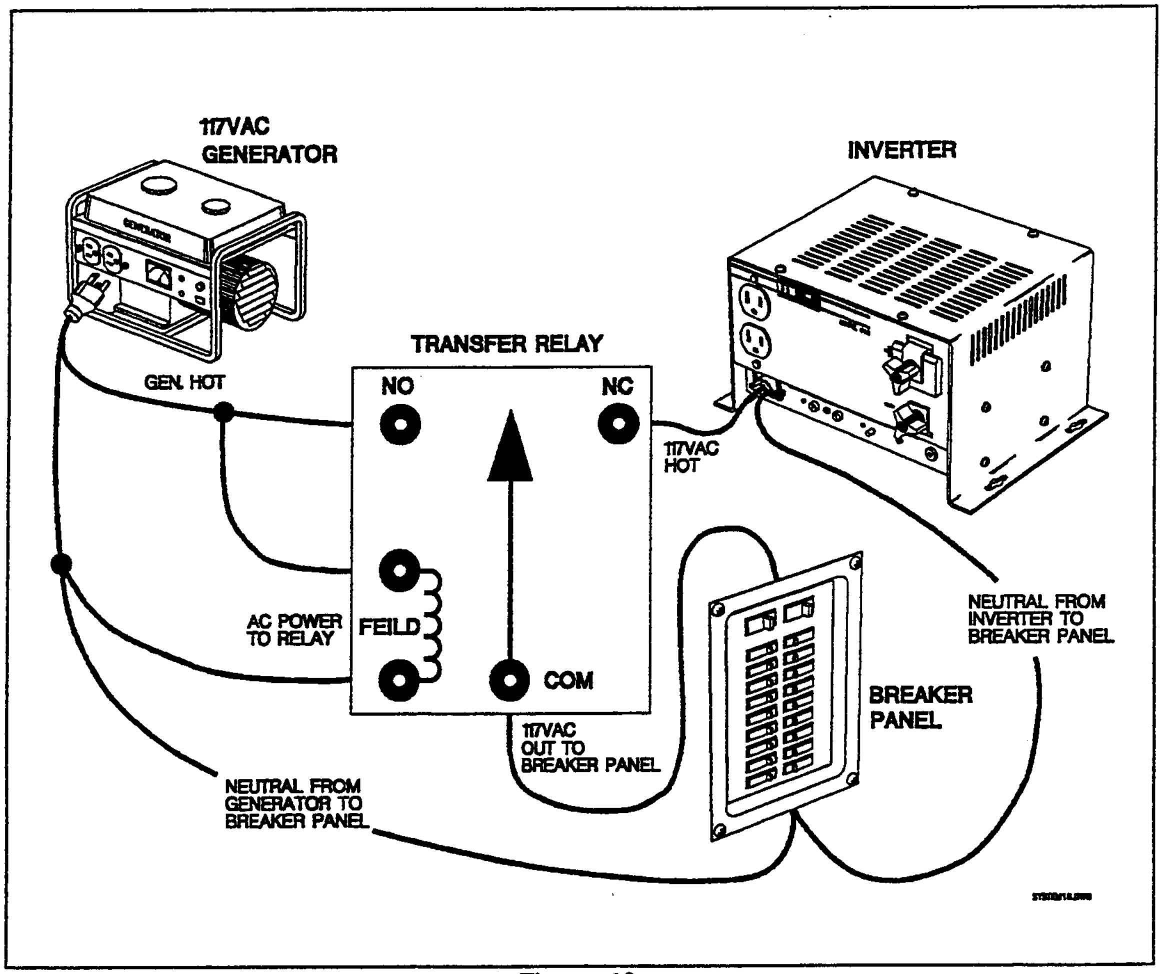

Figure - 10

724 with Single AC Panel and Transfer Relay

The NC and NO in the diagram stand for normally open and normally closed.

Limited Warranty

Trace Engineering Company Warrants all Trace Engineering power products against defects in material and workmanship for a period of two (2) years from date of purchase by the original retail purchaser from an authorized Trace Engineering dealer, or two (2) years from date of manufacture, which ever is longer. This warranty extends to all purchasers or owners of the product during the warranty period. Trace Engineering does not, however, warrant its products against any and all defects: (1) Arising out of material or workmanship not provided or furnished by Trace Engineering, or (2) resulting from abnormal use of the product or use in violation of the instructions, or (3) in products repaired or serviced by other than Trace Engineering repair facilities, or (4) in components or parts or products expressly warranted by another manufacture. Trace Engineering agrees to supply all parts and labor or repair or replace defects covered by this warranty with parts or products of original or improved design, at its option in each respect, if the defective product is returned to any Trace Engineering authorized warranty repair facility or to the Trace Engineering factory in packaging providing at least as much protection from damage as the original packaging, with all transportation costs and full insurance paid by the purchaser or owner.

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SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGE, SO THE ABOVE MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

Warranty Procedure

TO VALIDATE your warranty the warranty card must be filled out and mailed to Trace Engineering within ten (10) days from the date of purchase. It is also advised that you KEEP YOUR BILL OF SALE as proof of purchase, should any difficulties arise concerning the registration of the warranty card.

WARRANTY REGISTRATION is tracked by model and serial numbers only, not by owner's name. Therefore, any correspondence or inquires made to Trace Engineering must include the model and serial number of the product in question. Be sure to fill in the model and serial number in the space provided below and keep this portion of the warranty card in a safe place for future reference.

WARRANTY SERVICE must be performed ONLY AT AN AUTHORIZED TRACE SERVICE CENTER, OR AT THE TRACE ENGINEERING FACTORY. It is recommended that advance notice be given to the repair facility to avoid the possibility of needless shipment. UNAUTHORIZED SERVICE PERFORMED ON ANY TRACE PRODUCT WILL VOID THE EXISTING FACTORY WARRANTY ON THAT PRODUCT.

FACTORY SERVICE: If you wish your Trace Engineering product to be serviced at the factory, it must be shipped FULLY INSURED IN THE ORIGINAL PACKAGING OR EQUIVALENT; this warranty will not cover repairs on products damaged through improper packaging. If possible, avoid sending products thru the mail. Be sure to include in the package:

1. Complete return shipping address (P.O. Box numbers are not acceptable).
2. A detailed description of any problems experienced, including the make and model numbers of any other equipment in the system, load, operation environment, time of unit operation and temperature.

Repaired products will be returned freight C.O.D. unless sufficient return shipment funds are included with the unit.

Products sent to the factory from outside the U.S. MUST include return freight funds, and sender is fully responsible for all customs documents, duties, tariffs and deposits.

Record the model and serial number below and retain for your files:

Trace ENGINEERING

Model ______________

Serial Number ______________

Date of purchase ______________

DETACH THIS PAGE AND MAIL TO TRACE ENGINEERING

Please fill in the following information:

Model and Options ____________________

Serial Number ____________________

Purchase Date ____________________

Owner's Name ________________________________

Address ______________________________________

City ________________ State _____ Zip ___________

Phone ______________________

The following information is appreciated but not required:

Dealer Name ________________________________

Address ________________________________

In what application is your Trace Product being used?

- ☐ Home
- ☐ Home with Generator
- ☐ Home with Grid Power
- ☐ Construction Site
- ☐ Commercial Power Backup
- ☐ Sailboat
- ☐ Power boat
- ☐ RV
- ☐ UPS
- ☐ Other

What other products would you like Trace to manufacture?

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Comments: ______________________________________

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