VANNER POWER GROUP

SYSTEM 3600

OPERATION MANUAL

Preliminary Operating and Setup Instructions for System 3600

Inverter/Charger Models: 20-3600C and 24-3600

Inverter Models: 20-3600, 24-3600, 20-3600D and 24-3600D

INTRODUCTION

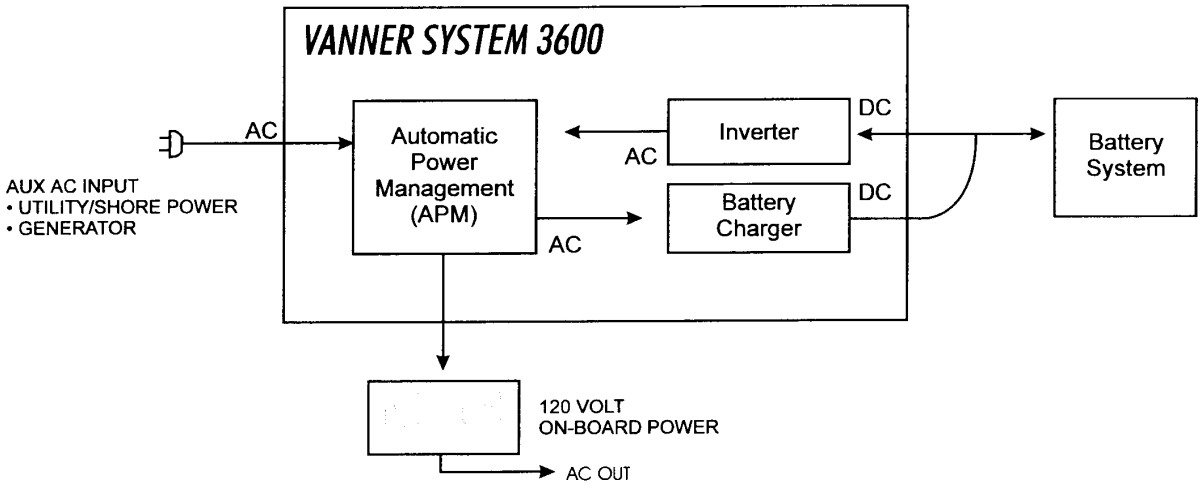
The Vanner 20-3600C and 24-3600C units are 120 Vac, 3600 watt continuous output inverters with a built-in, 120 Vac input battery charger and AC power transfer system. The inverter is a new design which allows it to very effectively and efficiently handle any type of AC load, especially motor type loads, within the power rating of the inverter. The battery charger is a sophisticated three stage charge cycle with an independent timed equalize function to quickly recharge and maintain lead-acid batteries. The battery charger maximum output voltage and DC output current are user adjustable to configure the unit to your particular battery system type. In addition, a built in load sharing control allows the unit to automatically reduce the charger AC input current draw if the total input current exceeds the preset limit.

INSTALLATION

The inverter should be installed in a location that will allow ventilation and prevent exposure to moisture and extreme temperatures. Allow at least three inches of clearance around the inverter for cooling air (Air is drawn in the rear and exits on the left side, looking from the front).

DC cables should be directly connected from the DC terminals on the inverter to the battery (see wiring diagram below). We recommend installing a fuse and disconnect in the plus (+) DC cable near the battery end of the cable. Two cables should be used (Do not use the vehicle chassis for the negative DC cable). Be sure to make good terminations to prevent voltage losses, and use the proper cable size (see figure 1, Cable Size Chart).

WIRING DIAGRAM



DC CABLE SIZE CHART

12 VOLT INVERTERS Models 20-3600, 20-3600C & 20-3600D		24 VOLT INVERTERS Models 24-3600, 24-3600C & 24-3600D	
Cable Length Up To:	Cable Size:	Cable Length Up To:	Cable Size:
12ft.	4/0	10ft.	1
17ft.	300 MCM	12ft.	1/0
20ft.	350 MCM	15ft.	2/0
22ft.	400 MCM	20ft.	3/0
		25ft.	4/0

Figure 1—Cable Size Chart

OPERATOR CONTROLS

The controls and enunciator lamps are located on the front panel of the unit as shown in Figure 1. The same enunciator lamps are used to indicate an inverter or charger condition except for the green "ON" lamps and the inverter "LOAD DEMAND" lamp. The legends to the left of the lamps are for the inverter functions and to the right of the lamps are the charger functions. There are two on/off switches on the unit so that the inverter and charger can be independently controlled. The inverter switch is a three position rocker which allows the operator to select between "OFF", "ON", or for energy conservation, "LOAD DEMAND". The charger switch is also a three position rocker which allows the user to select from "OFF", "ON", or "CURRENT LIMITED" if the available AC source is rated less than 30 amps. The same lamps and switch functions are duplicated on the optional remote panel.

There are nine dials on the unit front panel which are used to program the charger and inverter settings and one push button. The dials and push button are recessed to prevent damage or accidental movement and the dials are adjusted by using a small flat blade screw driver. There is a cover over the seven charger adjustment dials and push button to prevent unintended adjustment. *An improperly adjusted charger could ruin a set of batteries!* More details will be given later on how to properly adjust the unit for a specific installation.

INVERTER OPERATION

The *System 3600* inverter produces a modified sine wave AC output and a special designed power output circuit that enables it to effectively operate most resistive and inductive loads. It also has superior surge power capability to power loads such as motors that have high inrush AC current requirements.

Problem Loads—Although modified sine wave inverters will operate most AC loads, some loads may exhibit problems because the wave form is different than the pure sine wave of utility power. This is due to the square wave components and that the peak voltage is not quite as high as a pure sine wave. Loads that may exhibit problems include speed controls such as ceiling fans and air conditioner fans; light dimmer controls; clocks; microwave ovens (cooking time may vary and the clock may be erratic); video monitors and TVs (may have lines in the picture); AM radios (may pick a noise); laser printers; copying machines; fluorescent lights; and power supplies in some electronic devices. Rechargeable battery devices may also overheat and cause damage. If you desire to operate a rechargeable battery device on the inverter you should first power it up and closely observe it for a period of time to ensure that it does not run too hot.

INVERTER SETTINGS

There are two adjustment dials for the inverter. The "LOAD DEMAND WATTS" dial adjusts the minimum load required to start the inverter when in Load Demand mode and "LOW BATT. SETPOINT" to adjust the DC voltage level at which the inverter indicates "LOW BATTERY" shutdown, "LOW-WARNING," and "LOW-NO START". Either adjustment can be made using the scale on the panel or more precisely as described in the following paragraphs.

LOAD DEMAND WATTS Adjustment: Switch the inverter to "LOAD DEMAND WATTS" and gently turn the "LOAD DEMAND" adjustment dial fully clockwise (cw) until it meets the stop. Connect the load to the inverter and switch it on. If the inverter starts immediately, then no further adjustment is required, if the inverter does not start, then slowly turn the adjustment dial counter clockwise (ccw) and stop turning when the inverter starts. The inverter will turn off automatically when the AC load is reduced to below approximately 7.5 watts.

LOW BATT. SETPOINT Adjustment: This feature is used to protect your batteries from severe discharge if the inverter runs unattended, and it is the operators prerogative on where this adjustment is set. The LOW BATT. SETPOINT dial adjusts three things: 1) It adjusts the voltage at which the inverter will shutdown on low DC input voltage, 2) the voltage at which a "LOW-WARNING" is indicated, and 3) it adjusts the minimum voltage required for the inverter to start. The scale on the dial is the setting for the "LOW BATTERY" shutdown, ranges from 10 to 12 volts (or 20 to 24 volts for 24 volt system), and is marked in increments of .25 volts (.5 volt increments for 24 volt systems). The "LOW-WARNING" is one half volt (one volt for 24 volt system) greater than the "LOW BATTERY" setpoint and the "LOW-NO START" is one volt (2 volts for 24 volt system) greater than the "LOW BATTERY" set point.

CHARGER OPERATION

The battery charger is a three stage charger with user accessible adjustments dials to tailor the charge parameters to your specific application. The three stages of charging are the BULK, the ABSORPTION, and the FLOAT. Figure 2 shows how the battery voltage and the charger output current to the battery are related over the entire charge cycle. Each time the charger is turned on, it begins in the bulk charge mode. During the bulk stage of charge, the charger is in constant current mode and will maintain this current until the battery voltage reaches the "BULK VOLTAGE" setting. This begins the absorption stage of charging where the charger maintains a constant voltage and the current begins to diminish. The final stage of charging is the float stage where the charger output voltage is reduced to the FLOAT VOLTAGE setting to maintain the battery at a fully charge state. The charger will automatically switch to float when the battery voltage reaches the BULK VOLTAGE setpoint *and* the DC current falls below the FLOAT INIT. AMPS setting (an override timer will switch into the float mode in case the current level does not fall below the FLOAT INIT. AMPS set point). The charger will also return to the float mode at the end of an equalize cycle.

The charger settings should be carefully considered when the unit is installed. The charger will quickly recharge and maintain the battery when configured properly, but could also damage or fail to fully charge the battery if improperly configured. The two things that can damage or reduce the effective life of the battery are a voltage set too high or DC current limit set too high. *The battery manufacturers recommendations should always be followed when charging batteries.*

Guidelines For Battery Charging

CAUTION

The following information on battery charging setup adjustments should be used as guidelines only. We strongly recommend that you contact the manufacturer of your batteries to obtain the specific setup values for the type and model you are using. This is due to the fact that battery charging parameters such as bulk, float and equalize voltages vary from one manufacturer to another, and that gel cell batteries have different parameters than wet lead acid batteries.

An improperly adjusted battery charger may cause damage to your batteries.

1. The maximum charging current for a battery is usually equal to 20% to 25% of the battery's C rate for lead acid batteries, and 50% of the battery's C rate for gel cell batteries. The C rate is numerically equal to the amp-hour capacity for the battery. For example, a 280 amp-hour battery has a C rate of 280 amps, and the maximum charge rate is 56 amps DC. (Note that this is not the same as the battery's Cold Cranking Amp rating.) You should also take into consideration that if two batteries are connected in parallel their amp-hours add but if batteries are connected in series their amp-hours remain the same.

2. For most lead-acid wet cells, whether sealed or not, the float voltage is approximately 13.6 volts for a 12 volt battery which will be operated at a temperature around 77 degrees F. Over an extended period of time, a lower voltage will not keep the battery charged and a higher voltage may cause excessive water consumption and deterioration of the plates. For "gel" cell type batteries, the float voltage may be 0.2 volts lower.

3. If the operating temperature of the battery is much different than 77 degrees F, then the voltage needs to be adjusted according to the following formulas for a 12 volt system:
   A. For each degree F. above 77 degrees F., subtract .017 volts from the float voltage.
   B. For each degree F. below 77 degrees F., add .017 volts to the float voltage.

4. The bulk voltage and equalize voltage settings should be equal. For most lead-acid batteries this is equal to approximately 14.4 volts for a 12 volt battery being operated at a temperature around 77 degrees F. For "gel" cell type batteries, this voltage may be 0.2 volts lower. If the operating temperature is much different, then adjust the bulk and equalize voltage settings according to the formulas given for the float voltage temperature compensation.

BATTERY CHARGER SETUP

The battery charger should be adjusted after the unit has been installed. *Follow the battery manufacturer's recommendations when setting the charger voltage and current settings.* To set the bulk voltage and float voltage, you will need to use an accurate DC volt meter. You will also need a #2 Phillips screw driver and a small flat blade (1/4 inch) screw driver.

- Connect the voltmeter to the battery.
- Remove the cover over the charger adjustment dials by removing the two Phillips head screws on either side. Before you energize the battery charger, make a rough adjustment of the dials by using the scale on the panel for each dial. The dials are adjusted using the flat blade screw driver and **gently** turning the dial until the arrow end of the dial's indicator is pointing in the direction of the desired scale marking. The "BULK DC AMPS LIMIT" and "AC LINE AMPS LIMIT" can be adjusted at this time and left unless you have a need to be more accurate than the dial's scale indicates. You will need the appropriate ammeters to fine tune these adjustments.
- The first adjustment you will make is to the BULK VOLTAGE.
- Adjust the FLOAT VOLTAGE dial fully clockwise during the bulk voltage adjustment.
- Start the charger by applying 120 Vac to the input of the unit and switching the CHARGER switch to the ON or CURRENT LIMIT position.
- **DO NOT ADJUST the voltage if the "DC CURRENT LIMIT" or "AC CURRENT LIMIT"** enunciator lamps are lit. If they are lit, watch as the battery is charged and make the voltage adjustment when the current limit lamps go out. Be sure the yellow BULK CHARGE lamp stays lit while making the adjustment.
- Adjust the FLOAT VOLTAGE dial fully counter clockwise as the starting position.
- The second adjustment you will make is the FLOAT VOLTAGE. You will have to allow the charger to run through the bulk and absorption

stages before the float voltage can be adjusted. The float mode is indicated by the yellow enunciator marked "FLOAT CHARGE". **DO NOT ADJUST** the voltage if the "DC CURRENT LIMIT" or "AC CURRENT LIMIT" enunciator lamps are lit. If they are lit, watch as the battery is charged and make the voltage adjustment when the current limit lamps go out. Depending on the battery size and state of charge, it could take from a few minutes to many hours before this stage is reached. Until you are confident that the voltages are correctly set, you should not let the unit operate while unattended.

- The last adjustment to be made is the EQUALIZE VOLTAGE. The equalize cycle will not start unless the unit is already in the float mode. Start the equalize cycle by adjusting the "EQUALIZE HOURS" dial clockwise to the first or second mark on the scale. Use a pencil eraser or small stick to depress the "START EQUALIZE CYCLE" button. The red "EQUALIZE MODE" lamp should light to indicate the equalize mode has started. Adjust the EQUALIZE VOLTAGE dial until the desired voltage is obtained. The equalize cycle can be stopped by switching the charger off or allow the equalize cycle to time out. **DO NOT ADJUST** the voltage if the "DC CURRENT LIMIT" or "AC CURRENT LIMIT" enunciator lamps are lit. If they are lit, watch as the battery is charged and make the voltage adjustment when the current limit lamps go out.

CAUTION

It may be necessary to disconnect DC loads from the battery when using the Equalize Mode to prevent overvoltage damage to loads that may be voltage sensitive.

THE ENUNCIATORS

Since this unit is an inverter/charger combination, the enunciators have been made to serve both. As mentioned earlier, the legend to the left of the lamps is for the inverter functions and the legend to the right of the lamp is for the charger function. The only lamps that do not serve both purposes are the inverter and charger "ON" and the "LOAD DEMAND" lamps. In normal operation, one of the green ON lamps will be lit to indicate whether the inverter or charger is operating. If neither is lit, the unit is idle. If the inverter switch on the inverter/charger unit (not the remote panel) is in the LOAD DEMAND position, the yellow LOAD DEMAND lamp will be lit all the time. If the green inverter ON lamp is flashing, it means the inverter has shutdown and a red lamp will be lit to indicate the fault which caused the inverter to shut down. The red OVERLOAD lamp also will flash when a load greater than 105% of rating is applied to the inverter. If the overload persists long enough the red overload lamp will light solid, the inverter will shutdown, and the green inverter ON lamp will flash to indicate shutdown.

The green battery charger ON lamp will light when the charger is operating. Along with the green ON lamp, one lamp will be lit to indicate the charge mode (BULK, FLOAT, EQUALIZE), and one lamp may be lit to indicate a current limiting condition. If the green charger ON lamp flashes when the charger is first turned on with no other indicators lit, it means the battery voltage is too low (below 9 volts on 12 volt systems and below 18 volts on 24 volt systems) for the charger to start. If the green charger ON lamp is flashing an the AC CURRENT LIMIT lamp is lit, it means the AC input voltage is outside the parameters allowed (less than 100 or greater than 132 Vac) and the charger is not actively charging, i.e., the charger is waiting for the AC input voltage to come into the limits before it will start.

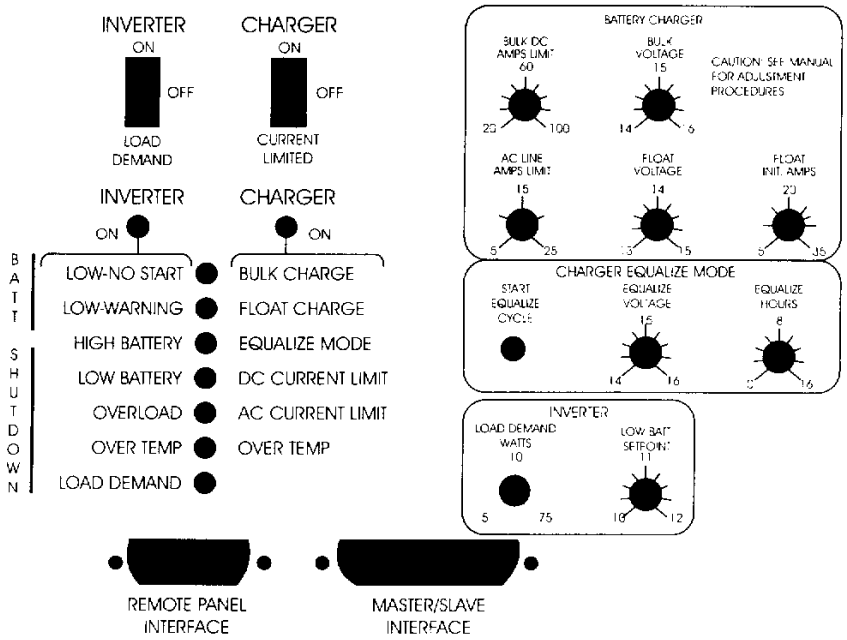
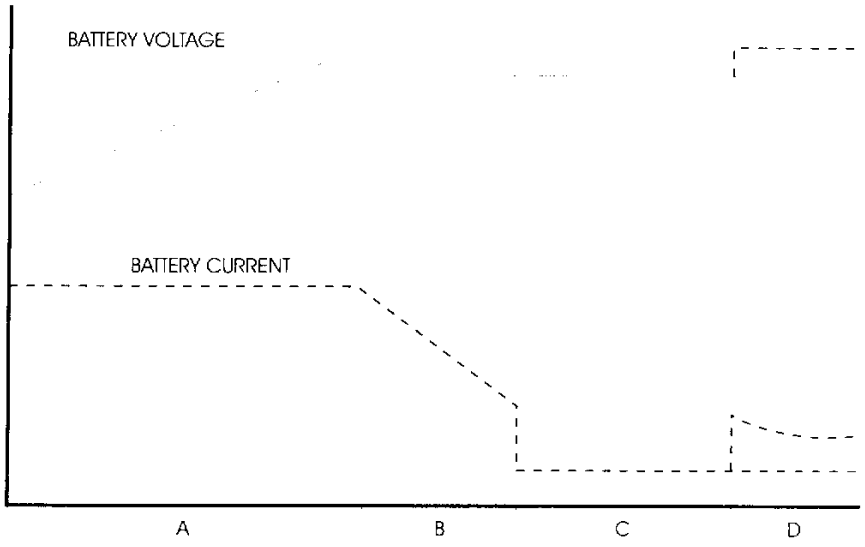


Figure 2—Unit Front Panel Layout



A = BULK STAGE
B = ABSORPTION STAGE
C = FLOPATE STAGE
D = EQUALIZE MODE

Figure 3—Battery Voltage and Current During Typical Charge Cycle

System 3600 Front Panel LED Indicator Functions

The following functions pertain to the Inverter Mode only

LED	COLOR	CONDITION	DESCRIPTION
Inverter	Green	On	System in Inverter Mode (Inverter is on).
Inverter	Green	Flashing	Shutdown has occurred. Inverter switch must be turned OFF, then back ON to reset.
Low-No Start	Yellow	On	Input DC voltage below "Low Batt. Setpoint" adjustment +1.0 volt (2.0 V).
Low-Warning	Yellow	On	Input DC voltage below "Low Batt. Setpoint" adjustment +0.5 volt (1.0V).
High Battery	Red	On	Input DC voltage above 15.0 (30.0) and inverter has shutdown. Inverter switch must be turned OFF, then back ON to reset.
Low Battery	Red	On	Input DC voltage below "Low Batt. Setpoint" adjustment and inverter has shutdown. Inverter switch must be turned OFF, then back ON to reset.
Overload	Red	Flashing	AC output above 105% of output continuous rating [1.05 x 30.0 amps RMS = 31.5 amps (3,780 VA)]. If this condition persists (depending on the amount of overload and the time) the inverter will eventually shutdown. Inverter switch must then be turned OFF, then back ON to reset.
Overload	Red	On	Overload shutdown has occurred. Inverter switch must be turned OFF, then back ON to reset.
Over Temp	Red	On	Over temperature shutdown has occurred. The inverter must be allowed to cool, then the inverter switch must be turned OFF, then back ON to reset.
Load Demand	Yellow	On	Inverter in Load Demand Mode. If actual load is below "Load Demand Watts" setpoint, Inverter is in standby mode. If actual load is above "Load Demand Watts" setpoint, inverter will turn on.

Special Error Condition LED indicating light functions:

1. If High Battery LED is On with all LEDs flashing (except for the Load Demand LED), the inverter's AC output was over 132 volts AC.

2. If Low Battery LED is ON with all LEDs flashing (except for the Load Demand LED), the inverter's AC output was under 66 volts AC.

System 3600 Front Panel LED Indicator Functions

The following functions pertain to the Battery Charger Mode only

LED	COLOR	CONDITION	DESCRIPTION
Charger	Green	On	System in Battery Charging Mode.
Charger	Green	Flashing	Shutdown has occurred: A. Green flashing with no other LEDs: DC input voltage under 8.0 (16.0) volts. B. Green flashing with Bulk, Float, or Equalize LED: AC input under 90 volts or over 132 volts.
Bulk Charge	Yellow	On	Charger in Bulk or Absorption Mode. (Bulk mode: Bulk Charge *and* DC Current Limit LED ON; Absorption mode: Bulk Charge LED ON.)
Float Charge	Yellow	On	Charge in Float Mode.
Equalize Mode	Red	On	Charger in Equalize Mode.
Equalize Mode	Red	Flashing	Equalize Mode pending (will start after Bulk & Absorption Modes complete).
DC Current Limit	Red	On	Charger's output is at current limit ("Bulk DC Amps Limit" setpoint). With Bulk Charge LED On and DC Current Limit LED On unit is in the Bulk Charge Mode. With Bulk Charge LED on and DC Current Limit LED off, unit is in Absorption Mode.
AC Current Limit	Red	On	Aux. AC Input is above the "AC Line Amps Limit" setpoint, or AC Input ("Shore Power") is below 100 Volts AC.
Over Temp	Red	On	Over temperature shutdown has occurred. The charger must be allowed to cool, then the Charger switch must be turned OFF, then back ON to reset.