OPERATING MANUAL

BEHLMAN POWER PASSPORT
AC POWER SOURCE

MODEL P1350

FOR SERVICE ASSISTANCE

CONTACT BEHLMAN
CUSTOMER SERVICE DEPARTMENT

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OR WRITE

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80 CABOT COURT
HAUPPAUGE, NY 11788

PHONE: (631) 435-0410
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FOR SALES INFORMATION:

PHONE: (631) 435-0410
USA : (800) 874-6727
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CLAIM FOR DAMAGE IN SHIPMENT

Under the FOB factory terms of sale, ownership and responsibility are transferred to the customer when the equipment leaves the factory. Each Behlman equipment is shipped from the factory in proper operating condition.

Immediately upon receiving equipment, unpack and inspect it for evidence of damage incurred in shipment. File a claim with the freight carrier if the equipment has been damaged in any way or it fails to operate properly. Forward a copy of the damage claim report to Behlman. Include the model number, serial number and date the shipment was received. Behlman will advise the disposition of the equipment and will arrange for necessary repair or replacement.

RETURNING EQUIPMENT TO FACTORY

Do not return equipment to the factory without prior authorization from Behlman.

This equipment, like all precision electronic equipment, is susceptible to shipping damage. It contains heavy magnetic components as well as delicate electronic components.

If equipment is returned without prior authorization, the shipment will be refused, the customer being liable for all shipping, handling and repair costs.

When packing for reshipment, use the original shock absorbent material and shipping container to preclude damage to the equipment.

Ensure that the return authorization number (RMA) is available on the container.

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BEHLMAN AC SOURCE, MODEL POWER PASSPORT

SECTION

LIMITED WARRANTY

Behlman Electronics, Inc. warrants, to the original purchaser, for a period of one (1) year from the date of shipment from Behlman, each item to be free from defects in material and workmanship. Behlman's obligation and the Purchaser's sole remedy for any breach or violation of this agreement is limited to adjustments, repair or replacement for parts which have been promptly reported by the Purchaser as having been, in its opinion, defective and so found by Behlman upon inspection. All replacement parts will become the property of Behlman on an exchange basis. This warranty will not apply if such adjustments, repair or parts replacement is required because of accident, neglect, misuse, failure of environmental controls, transportation damage or causes other than normal use.

If during the warranty period a defect should impair the performance of the unit, Behlman agrees, at its option, to repair or replace the unit or its defective components F.O.B. Behlman at 80 Cabot Court, Hauppauge New York 11788 or at another Behlman service facility at Behlman's option. To obtain service under this warranty, the original Purchaser shall notify Behlman at the above address or by Telephone at 631-435-0410 and provide information about the defect or impairment of performance. Behlman will then supply the Purchaser a Return Material Authorization (RMA) number. This number must be attached to the equipment sent back for warranty repair. Equipment must be shipped back to Behlman prepaid. No collect shipments will be accepted.

Behlman shall be excused from supplying warranty service if the units case shall have been opened or if the unit had been subject to unauthorized repair. All service outside the scope of this Warranty shall be paid for by the Purchaser at Behlman's rates in effect at the time of repair. Behlman will not perform any repairs outside of the Warranty without written authorization by the Purchaser. If the repair is a warranty repair, Behlman will ship the unit back to the Purchaser, by a method determined solely by Behlman, prepaid. If the Purchaser requests any other means of transportation it shall be at the Purchaser's expense.

The use of the equipment shall be under the Purchaser's exclusive management and control. The Purchaser will be responsible for assuring the proper installation, use, management and supervision of the equipment. Behlman will not be liable for personal injury or property damage.

The foregoing warranties are in lieu of all other warranties, expressed or implied including without limitation warranties of merchantability and fitness for purpose.

In no event shall Behlman be liable for loss of profits, loss of use, or an other indirect, consequential or incidental damages. Purchaser agrees that Behlman will not be liable for any damages caused by the Purchaser's failure to fulfill any of the Purchaser's responsibilities set forth herein.

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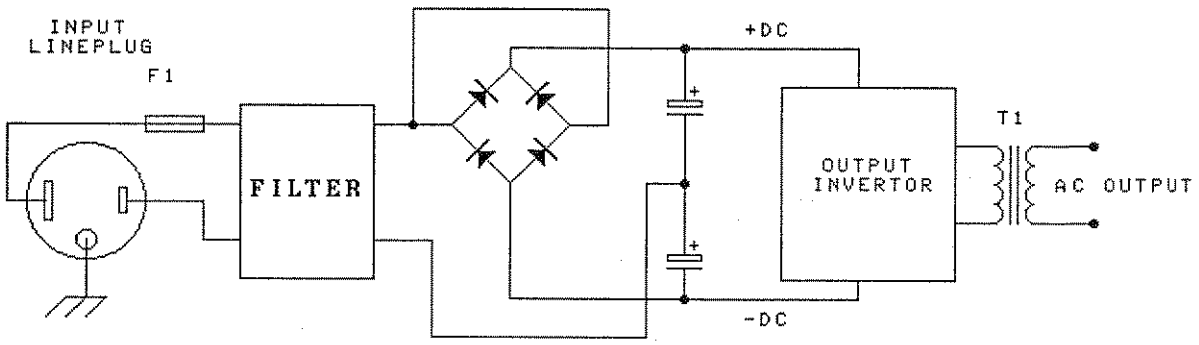
SECTION 1

INTRODUCTION

The Behlman model P1350 "*POWER PASSPORT*" is a solid state frequency converter. It provides regulated AC power at frequencies not available from local utility power. The output of the model P1350 is transformer coupled providing an isolated voltage source similar to utility power.

The model P1350 incorporates the latest in hard switched, PWM technology. A high frequency "Class D" type output stage provides a savings in weight and waste heat. This accounts for the compact size and high power capability of this AC power source. The following is a brief description of the conversion process performed by the *POWER PASSPORT*.

Line power at 115 VAC 50 or 60Hz is applied to the input of the unit. After passing through a noise filter, the input AC is converted to a bulk DC link voltage. This DC voltage is applied to the output inverter (refer to block diagram). The output inverter is a switchmode power amplifier. A sinewave signal of the desired frequency is developed by the control circuitry and applied to the input of the power amplifier. This sinewave is amplified and "stepped - up" by the output transformer to provide the proper voltage. The output voltage of the unit is sensed electronically and used as feedback to regulate the output. This action rejects fluctuations in the input line voltage and provides an output that may be adjusted above or below the input line. The output current of the power source is monitored and used to provide overload protection for the output inverter.



Block Diagram

SECTION 1

SPECIFICATIONS

INPUT REQUIREMENTS:	120 VAC +/- 10% 50 /60 Hz (400Hz requires option)
OUTPUT POWER:	1350 VAC MAX. (with input @ 120 VAC)
LOAD POWER FACTOR:	Zero to Unity with no derating
OUTPUT VOLTAGE:	0 -135VAC @ 10 AMPS AND 0-270VAC @ 5 AMPS
OUTPUT FREQUENCY:	50, 60, or 400 Hertz +/- 1%
OUTPUT REGULATION:	Less than 1% of full scale from no load to full load
SETTLING TIME:	Approximately 100mS to 1%.
LINE REGULATION:	+/- 0.1% for +/- 10% line change @ 115V 10A/230 5A
OUTPUT DISTORTION:	1% Typical @ 115 V 50Hz into pure resistive load.
OUTPUT NOISE :	2.5 V peak to peak typ.(on low range into 10 ohms.)
FRONT PANEL METER	
RESOLUTION:	1 Volt
ACCURACY:	+/- 1% of full scale + (+/- 1 count)

SECTION 2.0

UNPACKING AND INSTALLATION

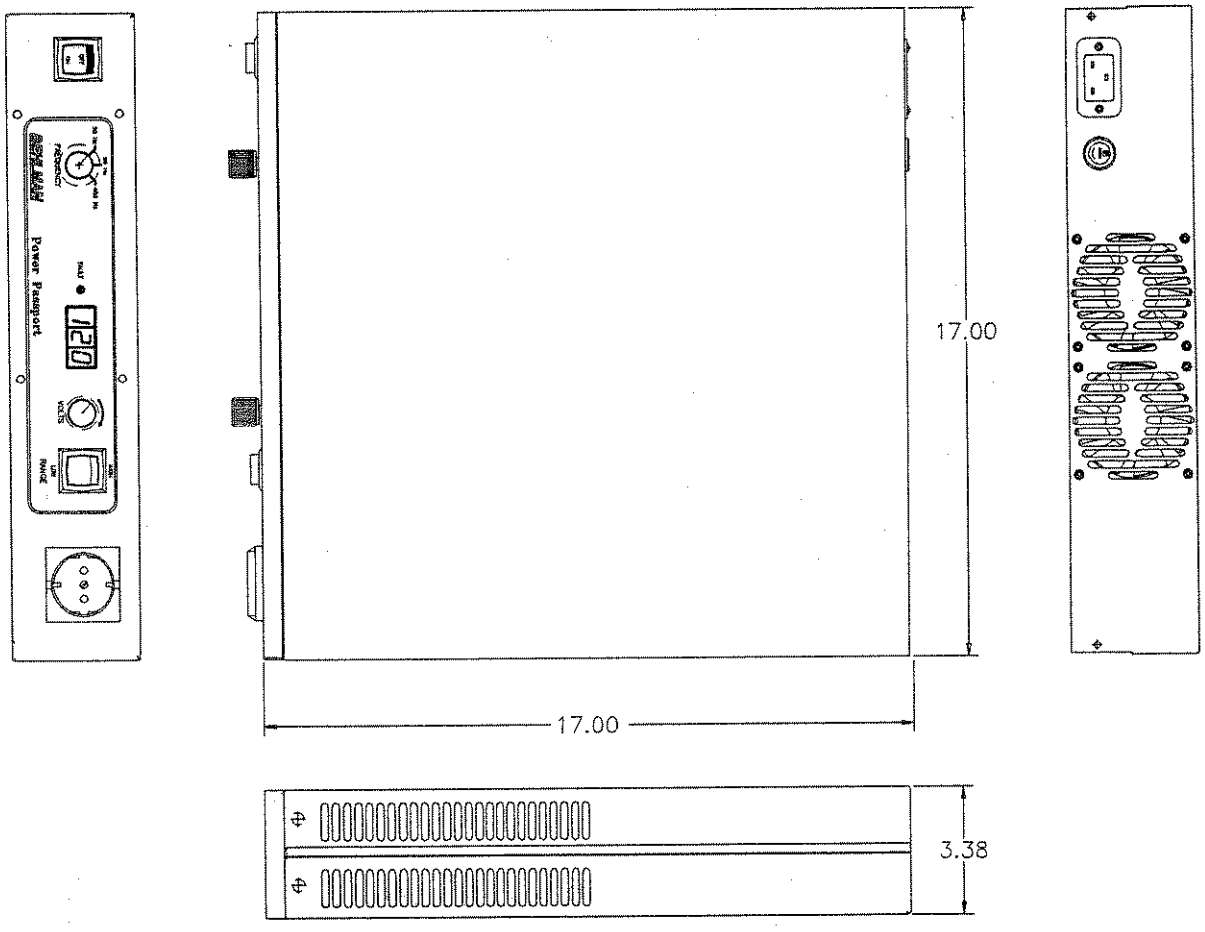
2.1 UNPACKING

After unpacking the equipment, carefully conduct a thorough inspection of all controls, indicators, and chassis. If the unit shows signs of shipping damage, do not attempt to operate. File a damage claim with the responsible carrier. Notify Behlman immediately.

2.2 INSTALLATION

This device is designed to operate on a bench or desk top. It can be mounted in a standard 19 inch rack cabinet using the RM option. **The unit must have bottom support when mounting in rack or other enclosure. DO NOT ! ATTEMPT TO MOUNT BY RACK "EARS" ONLY.** It is preferable to operate this equipment in a location which will maintain an air temperature of 0 to 40 degrees C around the ventilation ports. If the unit is to be rack mounted, it is recommended that the enclosure be forced ventilated or air conditioned. The installation should insure that the side and rear vents are unobstructed.

2.3 MECHANICAL OUTLINE



OUTLINE DRAWING & OVERALL DIMENSIONS

SECTION 3
OPERATING INSTRUCTIONS

3.0 The following section provides descriptions of the various features of the *POWER PASSPORT* front and rear panels. Refer to figure 1 on the following page for locations.

1. INPUT POWER SWITCH Controls input line power.

2. FREQUENCY SELECTOR Used to select 50, 60, or 400 Hertz output frequency. It is recommended that this switch be set to the desired value prior to connecting a load to the unit. Certain loads are frequency sensitive and may be damaged by application of the wrong frequency.

3. OVERLOAD FAULT Illuminates when the unit has entered a protection mode. This can be due to application of a short circuit or other gross overload to the output terminals. It is necessary to recycle input power to reset this feature.

4. VOLTAGE DISPLAY LED display provides indication of output voltage. Accuracy is +/- 1% of full scale +/- 1 count .

5. VOLTAGE ADJUST "Ten Turn" control provides continuous adjustment of output voltage.

6. RANGE SWITCH Selects output voltage range . Low range is 0-135V High range is 0 - 270 V.

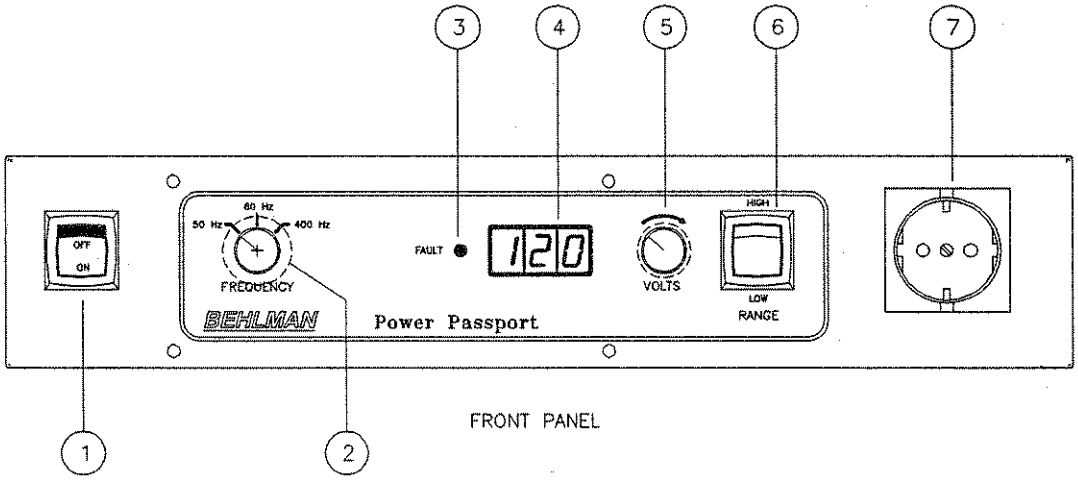
7. OUTPUT CONNECTOR European style "Schuko" connector for use with various output adaptors. A standard NEMA type 5-15R is supplied with the unit.

8. INPUT CONNECTOR IEC 320 C-20 receptacle for use with supplied line cord. **IMPORTANT,** See section on operational considerations further information on input power.

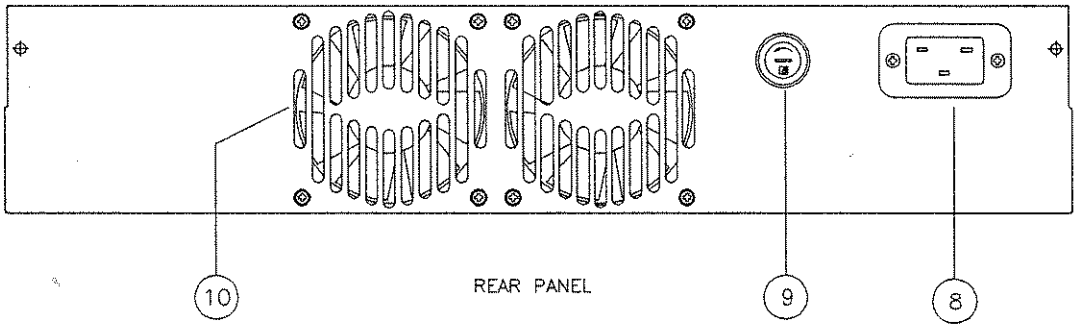
9. INPUT FUSE Receptacle for input power fuse. For fuse replacement use a slotted screwdriver to turn counter clockwise. **WARNING! DISCONNECT INPUT POWER BEFORE REMOVING FUSE COVER. FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE FUSE WITH SAME TYPE ONLY! 25 AMP/125V SLO BLO.**

10. FAN EXHAUST Cooling fan exhaust. Requires minimum 4" clearance.

CONTROLS AND INDICATORS



FRONT PANEL



REAR PANEL

1) INPUT POWER SWITCH
2) FREQUENCY SELECT
3) OVERLOAD FAULT INDICATOR
4) OUTPUT VOLTAGE DISPLAY
5) OUTPUT VOLTAGE ADJUST
6) OUTPUT RANGE SWITCH
7) OUTPUT CONNECTOR (SHOWN WITHOUT ADAPTOR)
8) INPUT POWER RECEPTACLE
9) INPUT POWER FUSE
10) COOLING FAN EXHAUST

(Figure 1)

OPERATING INSTRUCTIONS (CONTINUED)

3.1 TYPICAL OPERATION.

1. Connect unit to a suitable source of 115 VAC 60 Hz power using the supplied line cord. (see operational considerations for further information on input power requirements.)

2. Connect the load or device to be tested to the front panel (or rear for units with RO option). outlet using the appropriate adapter (see table 1.).

3. Set the frequency select switch to the desired value. It is recommended that ouput be set to zero before changing frequency.

4. Set the range switch to the desired range . Low range is 0 - 135V high range is 0 - 270.

5. Turn the voltage control fully counter - clockwise and turn on the power switch.

6. At this point the sound of the cooling fans should be evident and the front panel display should indicate zero volts. (000 to 002 is normal)

7. Adjust the voltage to the desired value and switch the load on (if so equipped) . It is also permissible to energize the load slowly by turning up the output voltage with the load set in the on position. This step is dependent on the type of load being driven. Further information on loading is provided in this manual under operational considerations.

3.2 OPERATION UNDER FAULT CONDITIONS.

The *POWER PASSPORT* incorporates three levels of over-current protection. The first line of defense is a foldback circuit that reacts to long term RMS over-current. In the event that the load applied is outside the range of the power source, the output voltage will decrease or "foldback" in order to maintain the current. During foldback, the output waveform remains sinusoidal. This can be a useful feature for starting AC induction motors and other types of motion related loads.

In the event the load becomes short circuited, the amount of fault current could rise to levels high enough to damage the output of the power source. The current of the output stage is monitored on a cycle by cycle basis (at the 20Khz switching frequency). If the peak current exceeds a preset value, a logic signal is sent to the drive circuits and initiates a controlled shutdown of the output stage. This circuit can respond very fast . The action of this circuit is "latching" and requires the input power to be cycled to reset the power source. Further information is provided in this manual under operating considerations.

The final line of defense is provided by a 25 amp input fuse. This fuse is employed primarily to provide line protection in the event of an internal failure of the power source. This fuse should be replaced with the same type only!

OPTIONS AND OUTPUT ADAPTER INFORMATION

The table below is a listing of available accessories and options for the model P1350 *POWER PASSPORT.*

OPTION	DESCRIPTION	PART #
A001	ADAPTER, "SCHUKO" TO NEMA 5-15R	107-771-001
A002	ADAPTER, "SCHUKO" TO NEMA 6-15R	107-771-002
A003	ADAPTER, "SCHUKO" TO UK 1-13R	107-771-003
A004	ADAPTER, "SCHUKO" TO SWISS SW1-10R	107-771-004
A005	ADAPTER, "SCHUKO" TO ITALIAN IT-10R/16R	107-771-005
A006	ADAPTER, "SCHUCKO" TO AUSTRALIAN 10R	107-771-006
RM	RACK MOUNT KIT	107-822-000
RO	REAR OUTPUT NEMA 5-15 R	107-821-000
LC001	LINE CORD, IEC-320-C20 TO NEMA 15P	107-802-000

TABLE 1

SECTION 4
4.0 OPERATING CONSIDERATIONS

4.1 OPERATION INTO LINEAR LOADS

The model P1350 will provide the best overall performance into a linear load. A linear load is characterized by that fact that it's current wave shape is sinusoidal. The phase relationship between the voltage and current may be anything between 0 and 90 degrees (leading or lagging). Some examples of linear loads are as follows:

Most AC Motors	Power Transformers	Heating Elements
Resistors	Capacitors	Most Inductors
Incandescent Lighting (without dimmers.)		Most Solenoids

Operation into these types of loads usually cause little interaction with the output stage of the model P1350. The main concern with a linear load is the "in rush current" associated with it.Most heating elements and resistors have no in rush concerns and usually do not present any problem for the power source. Inductive and capacitive loads may present a special problem based on their construction and the way in which they are energized. Motors and tungsten filament lamps also present some special "start-up" concerns. The following is intended to give the end user some insight into appling the *POWER PASSPORT* to these types of loads.

4.2 DRIVING REACTIVE LOADS

Capacitors and inductors are reactive in nature. If the load is applied during the peak of the AC cycle there may be a considerable in rush of current several magnitudes larger than the steady state current. This current is only limited by any series resistance that may be present in the load circuit. Under the right conditions, this could trip the overload protection circuits in the power source. Certain transformers and solenoids (inductance) present the same problem.

Several methods can be used to prevent tripping the protection circuits in the power source . One common method is to insert a limiting impedance in series with the load. This could be in the form of a fixed resistor or NTC (negative temperature coefficient) thermistor. Also, zero crossing switching can be employed. The most obvious way to prevent a high in rush current is to apply the load with the voltage set to zero (or some low value) and energize the load slowly by turning up the voltage.

4.3 DRIVING LAMPS

Tungsten filaments lamps, when cold, present a very low resistance. Once they are energized, their resistance quickly climbs to it's steady state value. This characteristic must be accounted for when driving tungsten filament lamps. The same methods for driving reactive loads can be applied to tungsten.

4.4 DRIVING MOTORS

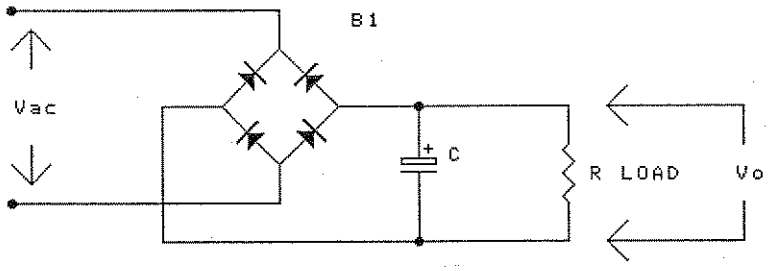
Driving an AC motor presents a special problem. Most motors require a starting current that is several times higher than the running current. This current may last for a few cycles to several seconds depending on the construction and mechanical load on the motor. This current is sometimes referred to as the motor's "locked rotor" current. This current is not to be confused with the in rush current that usually occurs over the course of one or two cycles of the AC waveform.

The model P1350's foldback current limiting can be an advantage when starting motors. During the starting period, the motor will attempt to draw excessive power from the power source. The foldback circuit will reduce the output voltage in order to maintain the maximum output current for the range in use. During this time the current supplied to the motor will remain sinusoidal, this allows the motor to start rotating. Once the motor reaches it's normal operating speed, it generates the required "back EMF" and the supply current drops off to the nominal "run" current for the motor.

4.5 DRIVING NON-LINEAR LOADS

Loads utilizing rectifiers and SCRs interact with the AC power source and have a profound effect on the distortion of the output waveform. Consider the use of a bridge rectifier followed by a capacitive filter, the current waveform associated with this circuit is illustrated in figure 4-1. The input current to this type of circuit is drawn in large "gulps" whenever the voltage across the capacitor falls below the peak of the input waveform. This current is limited only by the series impedance present in the wiring and capacitor . The impedance of large electrolytic capacitors is very small. This action causes a current waveform with a peak value that may be several times the RMS value. This ratio of peak current to RMS current is known as " Crest Factor". High values of crest factor cause distortion of the AC voltage waveform.

The amount of distortion incurred is dependant on many factors and is beyond the scope of this manual. It should be noted that this type of load may cause the output waveform to exhibit "flat topping" . This should not be associated with a defect of the power source. Most "real world" electric distribution systems exhibit this distortion for this reason.



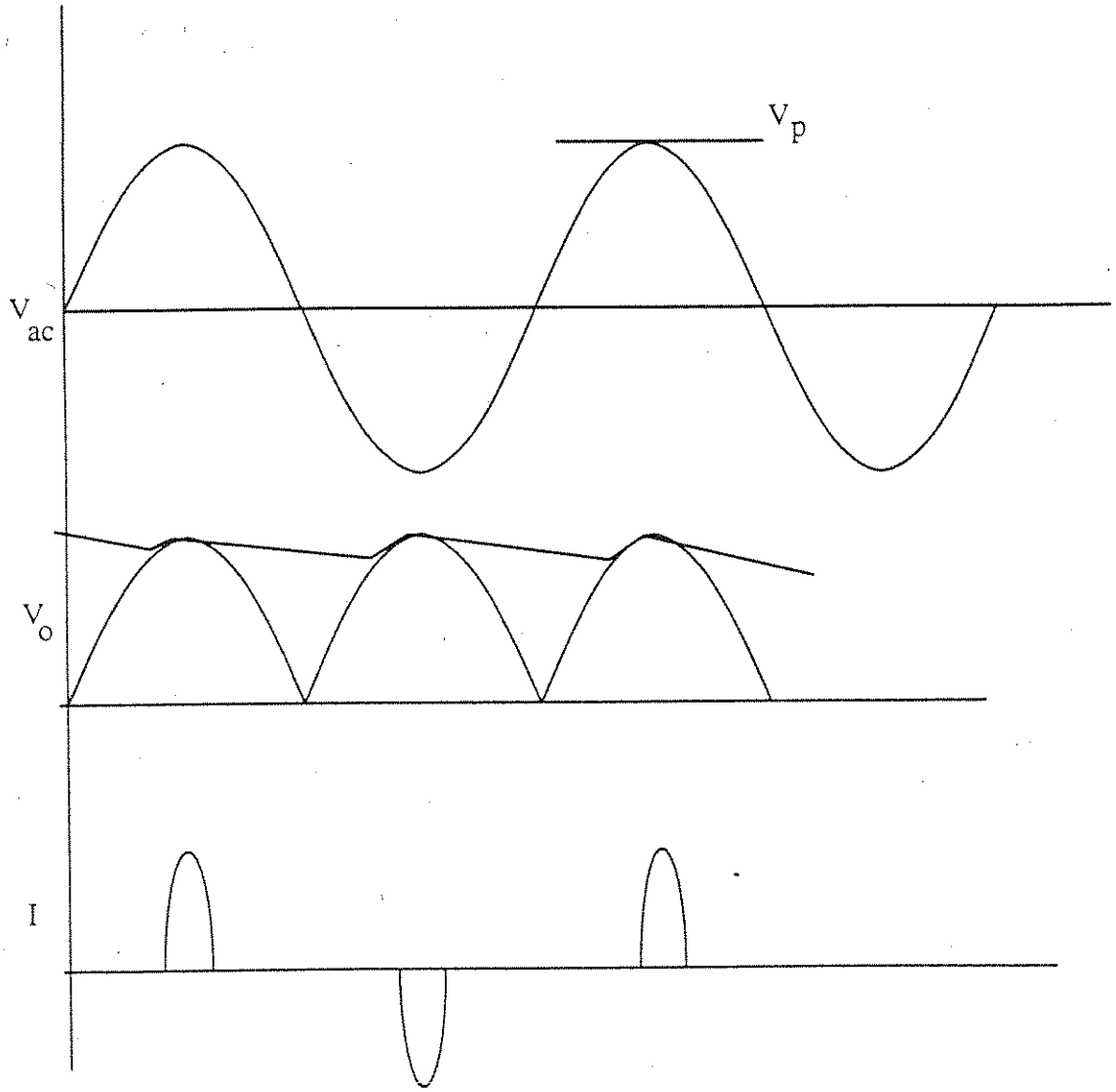


FIGURE 4-1

4.6 INPUT POWER REQUIREMENTS

The model P1350 utilizes a rectifier followed by a bank of filter capacitors. Because of this fact it presents non-linear load to the utility power. Because it's input current waveform has a high crest factor, it contains a large amount of harmonic current. These harmonic currents do not contribute to the output power of the power source but must still be supplied by the input line. This adds up to a poor input power factor.

IMPORTANT !

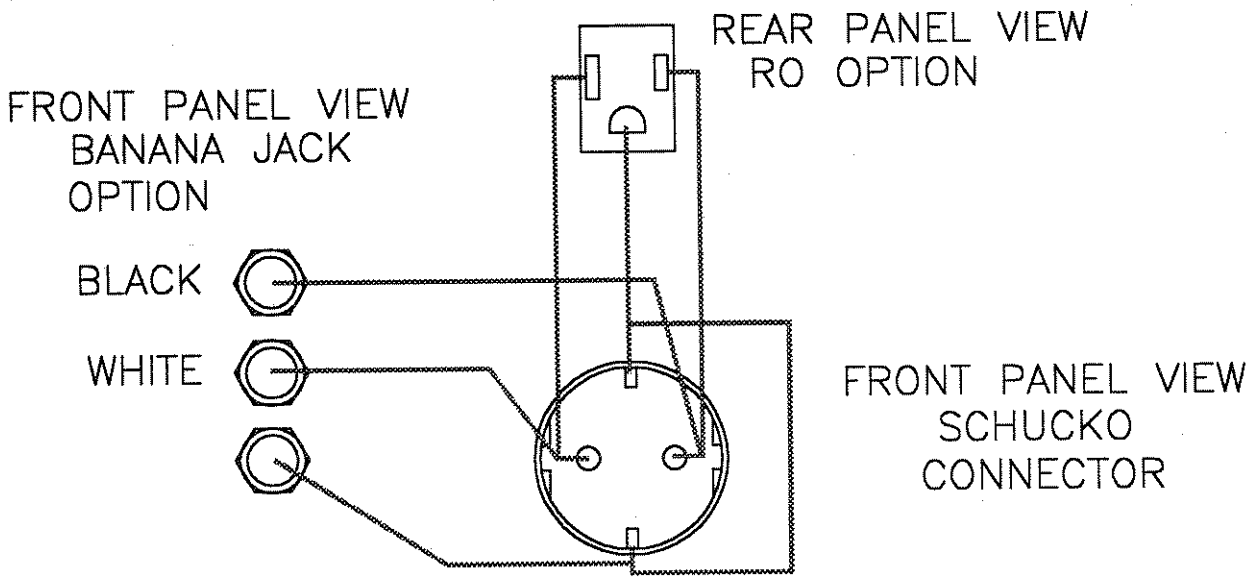
When selecting a suitable line input, it must be understood that the input current required for full output power (1350 watts) from the P1350 may exceed 20Amps RMS. This is only true for purely resistive loads (real Watts V.s. Volt Amperes). For this reason, the unit is supplied with a IEC 320 C-20 input receptacle. If continuous full power operation is desired, the unit must be supplied from the equivalent NEMA type line and receptacle. The line cord supplied with the unit has standard north American NEMA 15P at one end. This was done due to the fact that it is more convenient to most end users. Although the cord itself can handle the current, the line end should be changed to the appropriate mate for prolonged full power operation. Failure to do so may cause overheating of the input line connection. This may cause a fire hazard.

Due to the high current required by the model P1350, full power operation into a full resistive load may cause loading (sagging)of the supplied line voltage if a large series impedance is present. If problems are encountered while trying to achieve full output power, monitor the input line. If the line drops below 110VAC, move the unit to a known "stiff" line.

4.7 OUTPUT NOISE

Because the model P1350 uses a high frequency PWM conversion technique, a certain amount of output noise or ripple is to be expected. The amount of noise present on the output voltage waveform from this unit varies somewhat with the load. Maximum noise levels are present when there is no load applied. In any event, the amount of noise present should not constitute a problem for properly designed equipment. If the devices being tested are disabled by the noise present on the output waveform, then serious consideration should be given to the design of the unit being tested as they may not pass the European EMI tests.

In special cases where the output noise is objectionable , an external line filter can be added to the output of the unit. Please note that most line filters are not intended to be used at 400Hz. If the noise level is interfering with low level measurements a linear type AC source should be considered. For more information on linear sources, contact Behlman Sales.



RECEPTACLE WIRING
BLOCK DIAGRAM