

**USER'S GUIDE AND
TECHNICAL REFERENCE**

AC SOURCE

BEHLMAN MODEL BL12000C-1

PART NUMBER: 106-676-401

FOR SERVICE ASSISTANCE

**CONTACT BEHLMAN
CUSTOMER SERVICE DEPARTMENT**

PHONE TOLL FREE 1-800-874-6727

OR WRITE

**BEHLMAN
CUSTOMER SERVICE DEPARTMENT
80 CABOT COURT
HAUPPAUGE, NY 11788**

PHONE: (516) 435-0410

FAX : (516) 951-4341

FOR SALES INFORMATION:

PHONE: (516) 435-0410

USA : (800) 874-6727

FAX : (516) 951-4341

DATE:10/94

REV. —

PACKAGING INSTRUCTIONS

RACK MOUNTED UNITS

1. Box(es) must be double wall with minimum 350 lbs. bursting test.
2. Box(es) must provide for a minimum of 2 to 3 inches of clearance around sides, top and bottom of unit.
3. When packing unit, utilize either a foam-in-place system or high density foam. Clearance provided for above must be completely filled with foam.

FAILURE TO COMPLETELY SECURE UNIT IN BOX WILL ALLOW MOVEMENT DURING SHIPPING, RESULTING IN DAMAGE.

DO NOT USE PEANUTS OR BUBBLE WRAP

4. Secure box(es) to pallet(s). This is necessary to insure proper handling and protection during shipping.
5. Place the following warning label on box(es)
DO NOT STACK
6. Ship unit(s) using a freight cargo carrier; air or ground.

DO NOT USE UPS

CABINET MOUNTED UNITS

Cabinet mounted units require that a special crate be used. The crate should be manufactured of plywood (3/8" or thicker) and reinforced (using 1 x 3 or larger pine) on all edges. The unit must be firmly secured to the crates base. The crate must be shock mounted to avoid damage during shipping.

Detail drawings for Behlman's crates are available upon request.

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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.

Insure that the return authorization numbers (RMA) is available on the container.

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 516-435-0410 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 has 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 any 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.

SECTION 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The Behlman AC Source models (table 1) are sophisticated ac power supplies. Each of the models provide independent verification of operating voltage, current, and frequency values thereby lessening the need for external measuring devices. All models provide a single voltage range output.

Any of the models can include all or any combination of the available options if desired (see OPTIONS listed below table 1).

TABLE 1. BEHLMAN MODELS

| MODEL | INPUT VOLTAGE (ac) | OUTPUT VOLTAGE (ac) |
|-----------|--------------------|---------------------|
| BL12000C1 | 120V/208V | 0 - 270V, 1 ϕ |
| BL12000C2 | 220V/380V | 0 - 270V, 1 ϕ |
| BL12000C3 | 277V/480V | 0 - 270V, 1 ϕ |
| BL12000C4 | 200V Δ | 0 - 270V, 1 ϕ |
| BL12000C5 | 346V/600V | 0 - 270V, 1 ϕ |
| BL12000C6 | 230V/400V | 0 - 270V, 1 ϕ |

OPTIONS:

- Add an E to the dash number for extended frequency range.
- Add an I to the dash number for Remote GPIB IEEE-488/RS232 Interface.
- Add a K to the dash number for single phase output.
- Add an L to the dash number for front panel locking controls (VOLTS, FREQ) on voltage and frequency.
- Add an S to the dash number for chassis slides.

1.2 SPECIFICATIONS

INPUT POWER

Voltage: 120/208 Vac, $\pm 10\%$, 3 ϕ

Frequency: 47-440 Hz.

OUTPUT POWER

Voltage: 0-270 Vac, 1 ϕ

Frequency: 45-500 Hz

Maximum Power: 12000 VA

Maximum Current: 50 amperes.

Current Crest
Factor: 3:1

Power Factor: 100% of rated output into any power factor load.

Distortion: 1.5% maximum THD (measured at full load, 100 Vac, 50 Hz).

Load Regulation: $\pm 0.7\%$ from no load to full load.

Line Regulation: $\pm 0.1\%$ for $\pm 10\%$ of line change.

Efficiency: 85-90%

MECHANICAL

Dimensions: 22.06 in. wide, 28.50 in. high, 31.70 in. deep .

Weight: 500 lbs.

Operating
Temperature: 0°C to 55°C (32°F to 131°F).

SECTION 2

UNPACKING AND INSTALLATION

2.1 UNPACKING

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

2.2 INSTALLATION

- 1) Ensure that the line circuit breaker and all other unit controls are in the OFF position before connecting input power.
- 2) Connect input/output power lines as follows:

CAUTION

Be careful to connect input neutral, if desired to GND stud.

- a) INPUT POWER- Connect 47-440 Hz, power lines to the designated terminals on the INPUT terminal ϕA , ϕB , ϕC on the baseplate of the cabinet.
- b) With a minimum of AWG 6, connect TB1 HI of baseplate to Input HI of the control chassis; TB1 LOW of baseplate to Input LOW of control chassis; TB1 GND of baseplate to Input GND of control chassis..
- c) OUTPUT POWER- Output power lines are connected to the HI and LO terminal strip provided on the baseplate of the cabinet.

NOTE: SEE OUTLINE DRAWING FOR PROPER INSTALLATION.

SECTION 3 OPERATION

WARNING

This equipment involves the use of voltages and currents that can be hazardous. Only qualified personnel should be allowed to operate or service it. The top cover(s) must always be in place during operation.

3.1 CONTROLS AND INDICATORS

Table 1 lists the controls and indicators used on the different models of the AC Source. The table also includes their function. Figure 1 locates these front panel controls and indicators. Also shown are the rear panel REMOTE PRGM connector, two terminal strips, cooling fan, and a GND stud.

3.2 TO OPERATE THE EQUIPMENT

- 1) Ensure that line circuit breaker and OUTPUT switch are set to OFF.
- 2) Connect suitable load across output terminals. (Do not exceed rating of unit.)
- 3) Set line circuit breaker of power chassis to ON (cooling fan noise should become evident).
- 4) Rotate VOLTS control to desired voltage.
- 5) Rotate FREQ control to desired frequency.
- 6) Set OUTPUT switch to ON to energize load.

NOTE

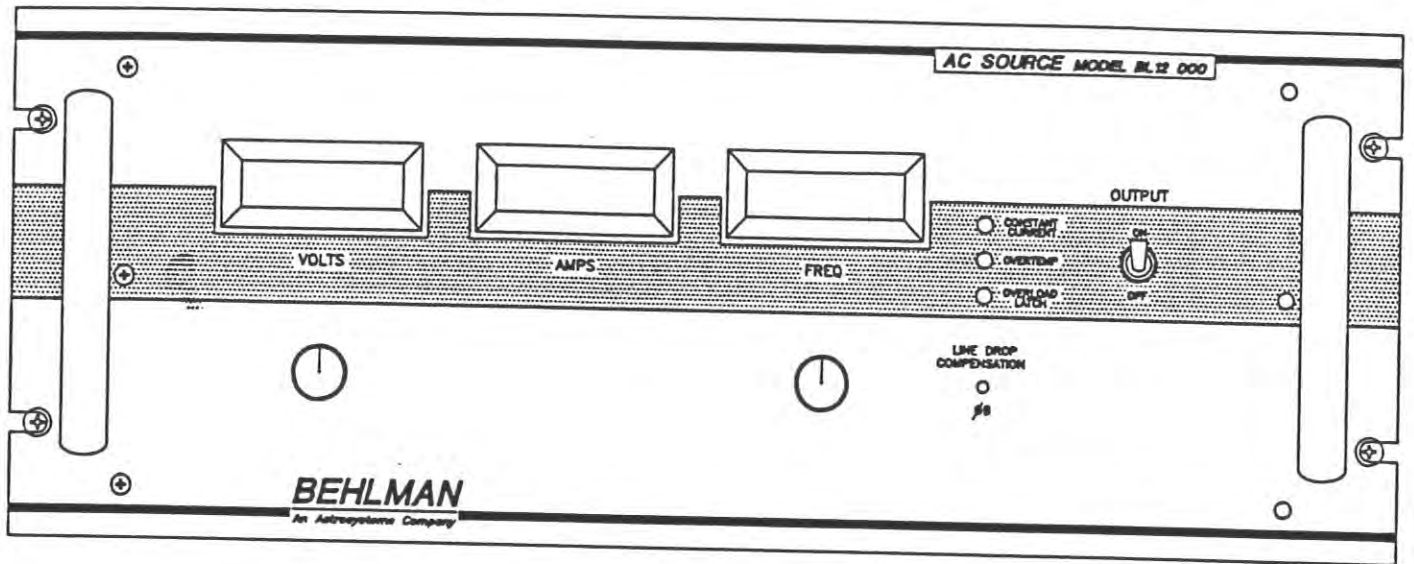
It is permissible to energize a load gradually by setting the OUTPUT switch ON and rotating the VOLTS control from zero to low voltage position up to the voltage desired.

3.3 SHUTDOWN PROCEDURE

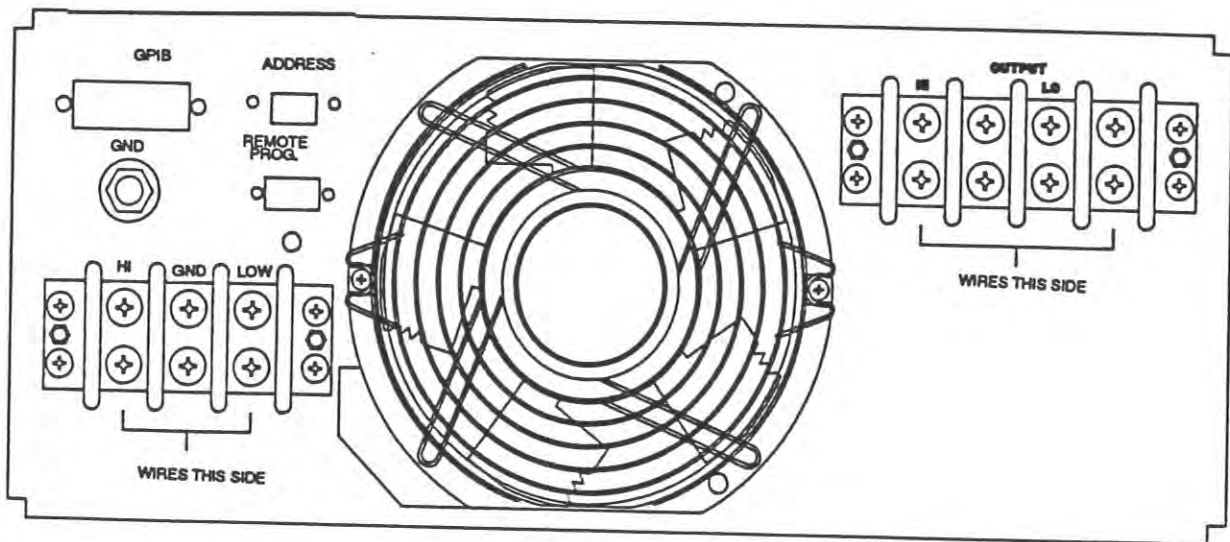
- 1) Set OUTPUT switch to OFF.
- 2) Set line circuit breaker to OFF.

TABLE 1. CONTROLS AND INDICATORS

| CONTROL/INDICATOR | FUNCTION |
|----------------------------|--|
| Circuit breaker | ON: Connects input power to unit. OFF: Disconnects input power from unit. |
| CONSTANT CURRENT indicator | Lights to indicate protective circuits are automatically operating to provide rated current and distortionless output during an overload condition. |
| FREQ control | Used to establish output frequency. |
| OUTPUT switch | ON: Connects output power to baseplate output terminals. OFF: Disconnects output power from baseplate. |
| OVERLOAD LATCH indicator | Lights to indicate short circuit protection for overload conditions that disables the output. Overload latch is reset by removing load and recycling power. |
| OVERTEMP indicator | Lights to indicate over temperature condition and removal of output power. Output power is automatically restored on termination of overtemperature condition. |
| Digital readout meters | VOLTS: Provides output voltage (RMS) display. AMPS: Provides output current (RMS) display. FREQ: Provides output frequency display. |
| VOLTS control | Used to establish desired output voltage. |
| Line drop compensation | Allows for output adjustment due to IR drops in the load lines. |



FRONT PANEL



REAR PANEL

Figure 1. AC Source, Front and Rear Panel Views

3.4 REMOTE PROGRAMMING

3.4.1 REMOTE PRGM CONNECTOR

The REMOTE PRGM connector, a nine-pin connector located on the rear panel, is provided to enable the user to program the unit remotely. A mating nine pin male connector is supplied to the user for fabricating the cable required for remotely setting the unit's amplitude, frequency, and on dual range models, the voltage range. It is recommended the user use AWG 20 wire to fabricate the cable.

Table 1 lists the connector pin descriptions. During remote operation, the unit's front panel VOLTS and FREQ controls must be set fully ccw. A isolated 0 to 10 Vdc remote voltage is used to control the unit's output voltage from 0 to full-scale and its output frequency from 45 to 500 Hz.

3.4.2 REMOTE AMPLITUDE AND FREQUENCY CONTROL

Two 0-10 Vdc control voltages from externally isolated voltage sources are used to control the unit's amplitude and frequency via the fabricated remote cable.

TABLE 2. REMOTE PRGM CONNECTOR PIN DESCRIPTIONS

| PIN | DESCRIPTION |
|-----|--------------------------------------|
| 1 | External synch HI |
| 2 | External synch LO |
| 3 | Amplitude & frequency control (rtn). |
| 4 | Amplitude control (hi) |
| 5 | Frequency control (hi) |
| 6 | Output relay control |
| 7 | Output relay control |
| 8 | Not used. |
| 9 | Not used. |

EXTERNAL SYNC

The unit provides for external syncing via its rear panel REMOTE PRGM connector. When an external sync signal is applied to the unit, it reacts to produce an output frequency that is equal to the sync signal regardless of the FREQ control setting. The external sync can be either TTL compatible or an AC signal from 5 to 30 VRMS.

CAUTION

The external sync signal applied to the unit must not be lower than 45 Hz to avoid possible damage to the unit.

ADDENDUM TO OPERATING MANUALS BL SERIES OF AC POWER SOURCES

IMPORTANT NOTE:

The BL series of AC power sources make use of electronic rectification with capacitive filtering. All of these units contain large "banks" of electrolytic capacitors. During the turn on period, these capacitor banks can cause extremely large in-rush current to be drawn. A "soft start" circuit is employed in all units to prevent premature tripping of the unit's input circuit breaker.

The soft start circuit used relies on the time constant for charging the power capacitor banks. When the unit is turned off for any reason, a time period of about one minute is required to allow these banks to discharge. This action "resets" the soft start circuit. Failure to allow sufficient discharge time will result in the breaker tripping at turn on. For more information on the soft start circuit, refer to the theory of operation in this manual.

**SECTION 4
MAINTENANCE AND ADJUSTMENTS**

WARNING

This equipment involves the use of voltages and currents that can be hazardous. Only qualified personnel should be allowed to operate or service it. The top cover(s) must always be in place during operation.

Before performing any adjustments where access to the inside of the equipment is required, be sure to turn off the unit and allow five minutes for the DC power supply capacitors to discharge.

4.1 MAINTENANCE

WARNING:

FAILURE TO MAINTAIN OR OPERATE THE UNIT PROPERLY WILL VOID THE WARRANTY. AMONG THE ABUSES THAT ARE INCLUDED (BUT NOT LIMITED TO) ARE:

NOT MAINTAINING THE CLEANLINESS OF THE FILTERS (VACUUMING), OPERATING OUTSIDE THE ALLOWABLE ENVIRONMENT, AND PHYSICALLY DAMAGING THE UNIT.

The decision on whether a units warranty is voided will be exclusively reserved for Behlman.

4.2 ADJUSTMENTS

NOTE

All the potentiometers used in the procedures that follow are located on the controller card A1. See the printed wiring assembly in Section 6 for parts location. Always use a non-metallic screwdriver when adjusting potentiometers.

4.2.1 TEST EQUIPMENT REQUIRED

| TEST EQUIPMENT | MANUFACTURER/MODEL |
|-------------------------|---|
| Current ClampFluke | Fluke 80I-600 (or equivalent current transformer) |
| Digital Voltmeter (DVM) | Fluke 8062A (or equivalent) |
| Frequency Counter | HP 5314A (or equivalent) |
| Oscilloscope | Iwatsu SS-5571 (or equivalent) |

4.2.2 CONTROLLER CARD POTENTIOMETER ADJUSTMENTS

Since certain potentiometer adjustments affect other associated potentiometer settings, a sequence of adjustments must be followed to ensure the proper setting of each potentiometer within the three groups comprising the unit. The three groups: frequency, voltage, and current, are listed below in the sequence to be performed within each group.

| FREQUENCY | | VOLTAGE | | CURRENT | |
|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>POT.</u> | <u>PARA</u> | <u>POT.</u> | <u>PARA</u> | <u>POT.</u> | <u>PARA</u> |
| R15 | 4.2.3 | R29 | 4.2.6 | R129 | 4.2.9 |
| R16 | 4.2.4 | R61 | 4.2.7 | F.P. | 4.2.10 |
| R19 | 4.2.5 | R58 | 4.2.8 | | |

4.2.3 LOW FREQUENCY TRIM (45 Hz R15)

- 1) Connect frequency counter to rear panel ϕ A and NEUT terminal strip.
- 2) Turn FREQ control fully ccw.
- 3) Set circuit breaker to ON.
- 4) Set OUTPUT switch to ON
- 5) Set selector switch to ϕ A.
- 6) Adjust VOLTS control until volts meter indicates 10 Vrms minimum.
- 7) Adjust 45 Hz potentiometer R15 until frequency counter indicates 45 Hz.

4.2.4 HIGH END FREQUENCY TRIM (500 Hz R16)

- 1) Turn FREQ control fully cw.
- 2) Adjust 500 Hz potentiometer R16 until frequency counter indicates 500 Hz.

4.2.5 FREQUENCY METER ADJUST (Hz-METER R19)

- 1) Turn FREQ control fully ccw.
- 2) Adjust Hz-METER potentiometer R19 until front panel meter indicates 500 Hz.

4.2.6 FULL SCALE OUTPUT VOLTAGE ADJUST (R29)

- 1) Using DVM set to ac volts, connect it across rear panel HI and LO on output terminal strip.
- 2) Turn VOLTS control fully ccw.
- 3) Set circuit breaker of power chassis to ON.
- 4) Set OUTPUT switch of power chassis to ON.
- 5) Adjust R29 until DVM indicates 120 VMS..

4.2.7 VOLTAGE METER ADJUST (R61)

- 1) Turn VOLTS control fully cw.
- 2) Adjust F.S. potentiometer R61 on ϕ A control card until front panel voltage meter indicates same as DVM.

4.2.8 CURRENT METER ADJUST (I-METER R58)

- 1) Set circuit breaker to OFF.
- 2) Set OUTPUT switch to OFF.
- 3) Turn VOLTS control fully ccw.
- 4) Connect load to rear panel OUTPUT terminals HI and LO.
- 5) Connect current clamp or other current measuring device across load.
- 6) Set circuit breaker to ON.
- 7) Set OUTPUT switch to ON.
- 8) Adjust VOLTS control, making certain current does not exceed 50 amps, to 100 VRMS.
- 9) Adjust I-METER potentiometer R58 on ϕ A board until front panel current meter indication is same as load current noted in step 9.

4.2.9 20 KHz TRIANGLE WAVE TRIM (DIST. TRM R34)

- 1) Turn VOLTS control fully ccw.
- 2) Connect oscilloscope across rear panel ϕ A and NEUT .
- 3) Set oscilloscope gain to 500 mV/div.
- 4) Adjust DIST. TRM potentiometer R34 for smallest waveform peak-to-peak value.

4.2.10 LINE DROP COMPENSATION TRIM

- 1) Connect selected load to rear panel OUTPUT terminals HI and LO.
- 2) Connect DVM at load input so as to compensate for IR losses in the connecting lines.
- 3) Set circuit breaker to ON.
- 4) Set OUTPUT switch to OFF.
- 5) Adjust VOLTS control to desired setting on DVM. Note voltage setting. (Should be the same as the panel meter indication.)
- 6) Set OUTPUT switch to ON.
- 7) Adjust front panel I.R. COMP potentiometer to pre-load voltage setting noted in step 5.

SECTION 5

THEORY OF OPERATION

5.1 GENERAL

5.1.1 The BL10000 and BL20000 series represents low cost, high performance, AC to AC power invertors. These units provide variable output voltage and frequency from 0 to 135 Vac and 45 to 500 Hz respectively. This series may be operated from a 120/208 Vac, 220/380 Vac, 277/480 Vac, 200 Vac (Delta), or 346/600 Vac three phase input line at 50 or 60 Hertz. Other versions include higher single phase outputs and external step-up/down output transformer options.

5.2 INPUT POWER

5.2.1 The BL series models consist of two basic sections, an input power chassis (DC power supply) and an inverter/control chassis. The incoming line voltage is connected to the input chassis where it is applied to a multi-pulse transformer/rectifier system. The output of the rectifier circuit is applied to a large bank of electrolytic capacitors to provide the required filtering. The output of the power chassis is a bipolar DC voltage of +/- 250 Vdc centered around the circuit common. Additional circuitry is incorporated to provide inrush current limiting and overload protection.

5.2.2 Inrush surge limiting is provided by placing large power resistors in series with two of the input phase voltages and the power chassis transformer primary. During power up, these resistors limit the current surge to the filter capacitor bank. Once full voltage is reached, a relay is used to bypass the limiting resistors allowing normal operation.

5.2.3 Over current protection for the DC supply is provided by the multi-pole input circuit breaker. Additional protection is provided by fast acting semi-conductor fuses located in the control chassis.

5.2.4 The output of the power chassis is available at a rear panel mounted terminal block. Connection to the control chassis is afforded by supplied jumper cables. Note that the length of these cables is somewhat critical. Do not substitute with long cables.

5.3 CONTROL CHASSIS

5.3.1 The control chassis contains the main power invertors and bias and also the control circuitry. The diagram of Figure 1 depicts the basic functional blocks. Note that in the case of three phase units, only one phase is illustrated as the others are identical. The circuitry is configured so that each of the three "Phase control Cards" plug in to a "Motherboard". The output devices and output filter components are mounted on separate assemblies.

5.3.2 Bias power for the control chassis is derived from the +250 Vdc rail. This voltage is applied to the Motherboard. All other operating voltages are provided by the Motherboard.

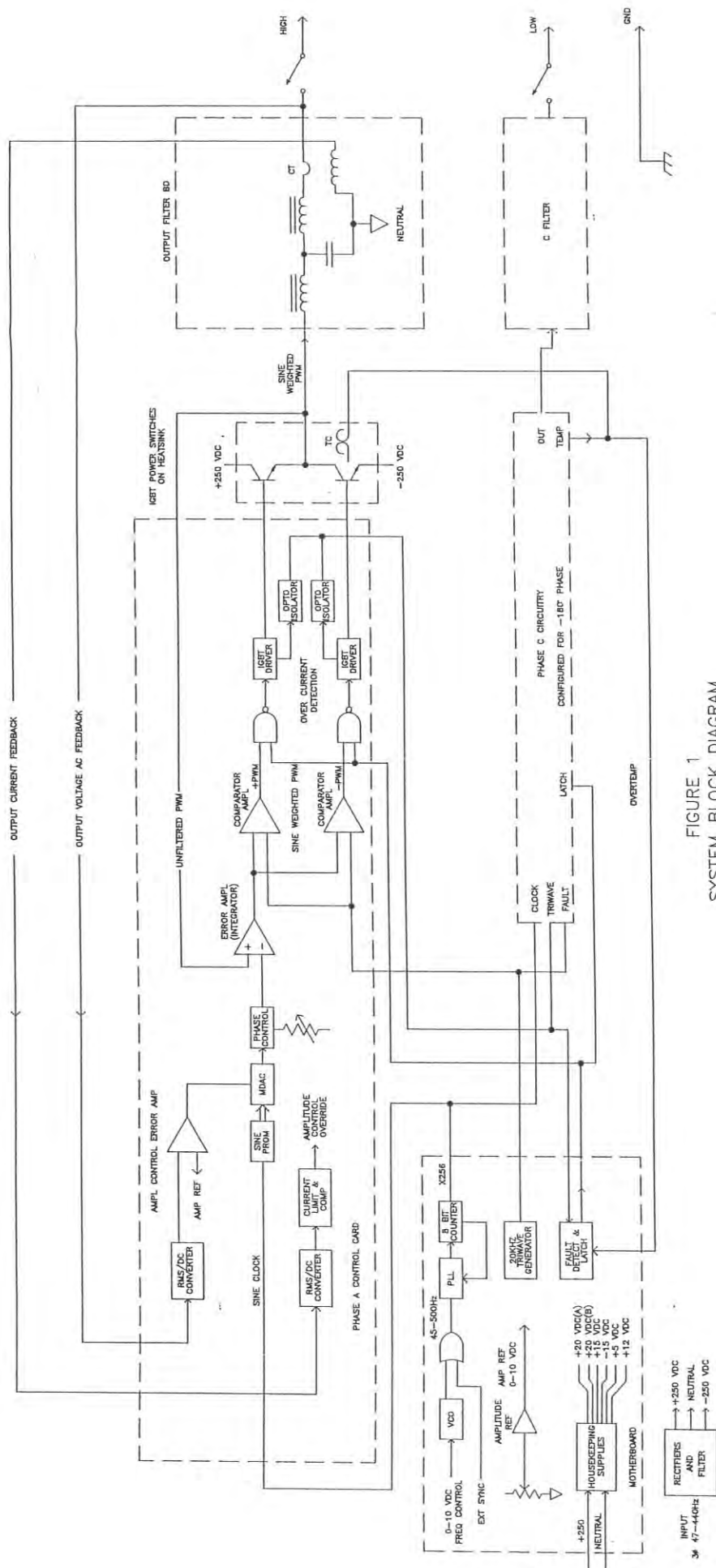


FIGURE 1
SYSTEM BLOCK DIAGRAM
(BRIDGED 0-270 V)