

OWNERS MANUAL
MODELS 500D/750A
STEREO POWER AMPLIFIER

SERIAL NO. _____

- IMPORTANT -

PLEASE READ THIS PAGE BEFORE OPERATING

YOUR

BGW MODEL 750A POWER AMPLIFIER

Your new BGW power amplifier is designed to provide years of trouble free performance. Observing these few precautions will insure proper operation.

Speaker fuses should be used to afford maximum speaker protection.

Never connect the output of one channel with that of another.

Never connect a direct short from the output of any channel to ground.

Connect the power cord to the proper voltage mains as indicated on the serial number tag. Conversion to another voltage requires the replacement of the circuit breaker and internal rewiring.

Connections should be made to the power amplifier with the power OFF.

Do not remove the factory lead seal. Amplifiers will not be covered under warranty if the seal is broken. There are NO adjustments within.

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SECTION 1: DESCRIPTION

The BGW Model 750A/500D is the most advanced dual solid state power amplifier available. The basic design criteria used are those which are applied to present day computers and other related equipment.

The mechanical construction of the Model 750A features an all steel, welded chasis for maximum strength and rigidity.

Two massive cast aluminum handles are provided for ease of handling. The circuit breaker/on-off switch and the solid state (L.E.D.) pilot lamp are mounted on the front panel for ready access.

A unique forced air cooling system employing a thermostatically controlled two-speed fan draws air in through the rear of the chassis, forces it through the heat sink fins, and exhausts it through both sides of the unit.

Both units have a push-push rear panel switch which instantly converts it from a two channel stereo amplifier to a bridge-connected monaural amplifier. The monaural mode is ideally suited for 70 volt systems of for large dirver arrays having 8 or 16-ohm impedances.

Only the finest components have been qualified for use in BGW power amplifiers. For example, all resistors used in signal circuits are low noise 5% tolerance carbon film types, all harness wiring is insulated with Teflon, and all circuit boards are made of flame retardant epoxy glass. All transistors used in the signal path are in hermetically sealed metal cans--no plastic packages are used.

Unique design features incorporated in the Model 750A/500D make it virtually "FAIL SAFE" and free from accidental damage caused by human error in audio service.

A fast acting SCR (silicon controlled rectifier) crow bar is employed as a safeguard for your speakers. The sophisticated sensing circuitry for the crow bar constantly samples the individual outputs of each channel. The outputs of each channel are integrated and passed through an absolute value detector. The output of the detector is connected to a comparator which is activated by the presence of a large DC component. If such a voltage is present, the comparator in turn triggers a fast discharge pulse circuit which gates the SCR crow bar. The crow bar is essentially a direct short placed across the two power

supplies. If activated, this causes abnormally high current to flow in the primary circuit and within a fraction of a second the ultra-fast acting circuit breaker disconnects the power. The crowbar circuit quickly discharges all energy stored in the power supply internally, not into the speaker; thus protecting the load.

The packaging inside your 750A/500D is unlike ordinary power amplifiers. Each channel assembly is on its own separate module, which simply plugs in or out for quick and easy service. Each of these units is constructed on a 8 x 9-7/8 x 1-3/4 aluminum extrusion. The total radiating surface area of each heatsink is 540 square inches. The heatsinks have mating circuit boards which carry the passive components. Each unit's wiring is identical with the next as the circuits are photo etched. The heatsink plugs in with an 11-pin connector.

The output stage of your amplifier uses the most powerful type of transistors available. Each channel uses 10, 150-watt dissipation, single-diffused power transistors, and two 150W double diffused multiple emitter site driver transistors. The tremendous Safe Operating Area and high degree of redundancy inherent in this arrangement makes the output stage extremely rugged and able to dissipate the total output of the power supply. In this way the need for current limiting circuits has been eliminated along with their associated problems. Load impedances as low as 2-ohms are handled with ease. Electrostatic and other highly reactive speaker systems present no difficulties for the Model 750A. Two sets of 4-ohm speakers can be powered with one Model 750A.

All the semiconductors in the output stage are in intimate contact with the heatsink. The bias circuit is also mounted on this isotherm which provides rock steady bias stability with temperature.

The voltage gain circuits are also mounted on the same module. A true operational amplifier integrated circuit, hermetically sealed in a metal can, acts as the front end. The op amp (as they are called) is a special unit featuring high speed (15MHz) and a high slew rate (50 volts/microsecond) yet still having very low noise due to its darlington input stage and careful design. The op amp stage is followed by a discrete complementary pair acting as active current source/sink and providing additional voltage gain. The current source is the ideal way to drive the output stage which is basically a voltage follower.

This sophisticated circuit design makes for an extremely accurate amplifier. The open loop gain is higher than found in the com-

petitors' products. The accuracy of an amplifier is a function of the difference between the open loop gain and the closed loop gain. In this case, the closed loop gain is 26dB (a voltage gain of only 20) while the open loop gain is about 1,000,000. The accuracy of the 750A/500D is so great that conventional audio test equipment is unable to provide meaningful measurements. Harmonic distortion measurements are simply the residual level of the distortion analyzer. This extremely accurate signal processing enables the Model 750A/500D to drive speakers at very high levels while adding absolutely no coloration of its own. Even at milliwatt levels the output wave-form exhibits no sign of crossover distortion. The dynamic range capability of a typical 750A/500D is 115 dB.

SECTION II. SPECIFICATIONS
GUARANTEED SPECIFICATIONS: 500D

The following specifications are made in accordance with the FTC Trade Regulation rule on Amplifier Power-Output Specifications effective November 4, 1974.

All measurements are made after one (1) hour preconditioning as provided in the regulation.

200-watts minimum sine wave continuous average power output per channel with both channels driving 8-ohm loads over a power band from 20Hz to 20kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 200-watts shall be no more than 0.1%.

251-watts minimum sine wave continuous average power output per channel with both channels driving 4-ohm loads over a power band from 20-Hz to 15-kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 251-watts shall be no more than 0.25%.

501-watts minimum sine wave continuous average power output monoaural driving an 8-ohm load over a power band from 20-Hz to 15-kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 501-watts shall be no more than 0.25%.

Small Signal Frequency Response:

+0, -3dB, 1-Hz to 65-kHz.

+0, -0.25dB, 20-Hz to 20-kHz.

Noise and Hum Level:

Better than 110dB below rated output into 8-ohms.

Input Sensitivity:

2.0-volts for 40-volts out (full power at 8-ohms). Voltage gain 26dB (20 times).

Input Impedance:

47,000-ohms.

Damping Factor:

Greater than 200 to 1 reference to 8 ohms.

Output Impedance:

Designed for any load impedance equal to or greater than 2-ohms.

Power Requirements:

Available factory wired for any of the following voltage-current combinations: 100-volts @ 15-Amps, 120-volts @ 10-Amps, 200-volts @ 7.5-Amps, 220-volts @ 7.5-Amps, or 240-volts @ 7.5-Amps.

Note: Field conversion is possible but usually requires replacement of the circuit breaker.

Semiconductor Complement:

2 Op Amp ICs (equivalent to 44 transistors each), 37 transistors, 1 unijunction transistor, 1 thyristor, 5 zener diodes, and 19 diodes.

Dimensions:

7-inch by 19-inch standard rack front panel by 12-inches deep.

Weight:

52 lbs. net, 58 lbs. shipping.

GUARANTEED SPECIFICATIONS: 750A

The following specifications are made in accordance with the FTC Trade Regulation rule on Amplifier Power-Output Specifications effective November 4, 1974.

All measurements are made after one (1) hour preconditioning as provided in the regulation.

200-watts minimum sine wave continuous average power output per channel with both channels driving 8-ohm loads over a power band from 5-Hz to 15-kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 200-watts shall be no more than 0.2%.

300-watts minimum sine wave continuous average power output per channel with both channels driving 4-ohm loads over a power band from 5-Hz to 10-kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 300-watts shall be no more than 0.25%.

600-watts minimum sine wave continuous average power output monaural driving an 8-ohm load over a power band from 5-Hz to 10-kHz. The maximum total harmonic distortion at any power level from 250-milliwatts to 600-watts shall be no more than 0.25%.

Small Signal Frequency Response:

+0, -3dB, 1-Hz to 65-kHz
+0, -0.25dB, 20-Hz to 20-kHz

Noise and Hum Level:

Better than 110dB below rated output into 8-ohms

Input Sensitivity:

2.0-volts for 40-volts out (full power at 8-ohms). Voltage gain 26dB (20 times).

Input Impedance:

47,000 ohms

Damping Factor:

Greater than 200 to 1 reference to 8 ohms

Output Impedance:

Designed for any load impedance equal to or greater than 2-ohms

Power Requirements:

Available factory wired for any of the following voltage-current combinations: 100 volts at 15 Amps, 120 volts at 15 Amps, 120 volts at 15 Amps, 200 volts at 7.5 Amps, 220 volts at 7.5 Amps or 240 volts at 7.5 Amps. Note: Field conversion is possible but usually requires replacement of the circuit breaker.

Semiconductor Complement:

2 Op Amp IC's (equivalent to 44 transistors each), 37 transistors, 1 unijunction transistor, 1 thyristor, 5 zener diodes, and 19 diodes.

Dimensions:

7 inch by 19 inch standard rack front panel by 12 inches deep.

Weight:

54 lbs. net, 60 lbs. shipping.

SECTION 3: INSTALLATION

3.1 Preliminary

DO NOT PLUG THE AMPLIFIER IN YET!

SAVE BOTH CARTONS AND MOLDED CORNERS

The container should be saved in event the unit is moved or shipped at some future date.

Inspect the unit for damage in transit immediately upon receipt. If damage is found, notify the transportation company immediately. Only the consignee may institute a claim with the carrier for shipping damage. BGW will cooperate fully in such event. Be sure to save the container as evidence of damage for the shipper to inspect.

The Mains (AC line) voltage is indicated on the serial number label on the rear of the amplifier. Amplifiers supplied for use in the United States are factory wired for 120 volts. Only the indicated mains voltage should be used. If the mains voltage must be changed, see Section 6.

All connections should be made before power is applied!

DO NOT PLUG THE AMPLIFIER IN YET!

INPUT CONNECTIONS - BRIDGE MODE

Follow the same procedure as outlined for Stereo mode but use only one shielded cable plugged into channel 1. Do not connect anything to the input of channel 2.

3.4 OUTPUT CONNECTIONS - STEREO MODE

Connect the left speaker to the binding posts marked CH 1 and the right speakers to the binding posts marked CH 2. Observe the phasing of the speakers. Most connectors on speaker cabinets are either color coded or marked +,-. Connect the black or minus \ominus terminal on the speaker cabinet to the black binding posts on the amplifier. Connect the other speaker terminal to the fuse holder and the fuse holder to the red binding post.

A fuse in the lead to the red terminal is required to protect the speaker when the level of the program material exceeds the power handling capacity of the speaker. If more than one speaker is connected to each channel, each speaker should be fused separately. Any high power audio amplifier is capable of destroying almost any loudspeaker so be sure to use fuses.

The electronic crow bar protects the speakers from damage due to high level subsonic transients and from damage which would result from catastrophic failure of an amplifier component. It cannot protect the speaker from all hazards.

The fuse size depends upon many factors, most of which work towards opposite ends, making it practically impossible to determine the proper fuse size from easily made measurements. The ideal situation exists when the loudspeaker manufacturer specifies a fuse size. Do not exceed his recommendations. You might destroy the speaker and void its warranty. If no fuse is specified use the chart provided to choose the appropriate fuse size (Figure 1).

To use the chart, take a ruler and line up the speaker's impedance rating with the speaker's peak music power rating.

INPUT CONNECTIONS - BRIDGE MODE

Follow the same procedure as outlined for Stereo mode but use only one shielded cable plugged into channel 1. Do not connect anything to the input of channel 2.

3.4 OUTPUT CONNECTIONS - STEREO MODE

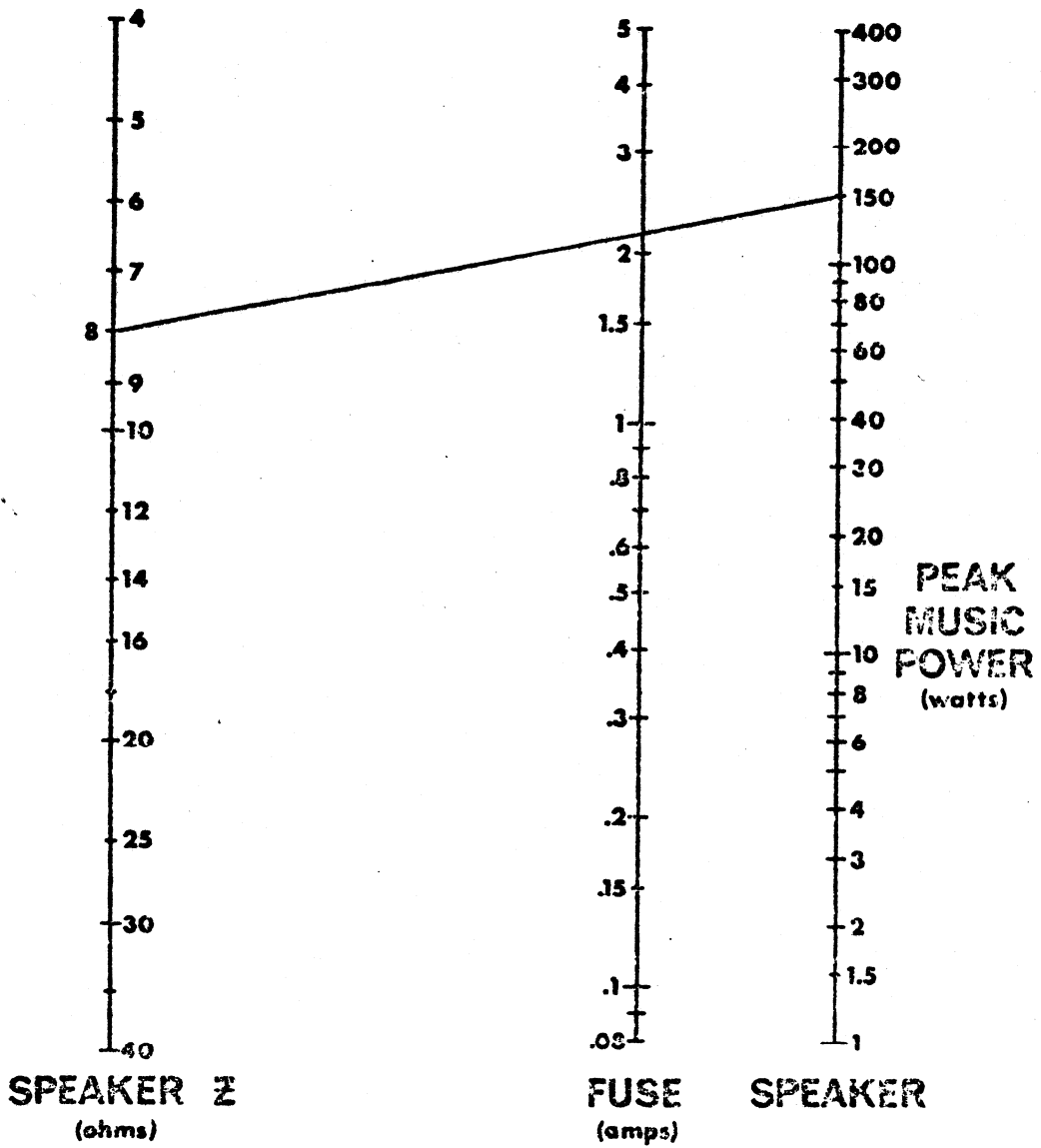
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To use the chart, take a ruler and line up the speaker's impedance rating with the speaker's peak music power rating.



EXAMPLE: $Z = 8\Omega$, PEAK POWER = 150W. ANSWER: FUSE = 2 AMPS

FIGURE 1
FUSE SELECTOR NOMOGRAPH FOR LOUDSPEAKER PROTECTION

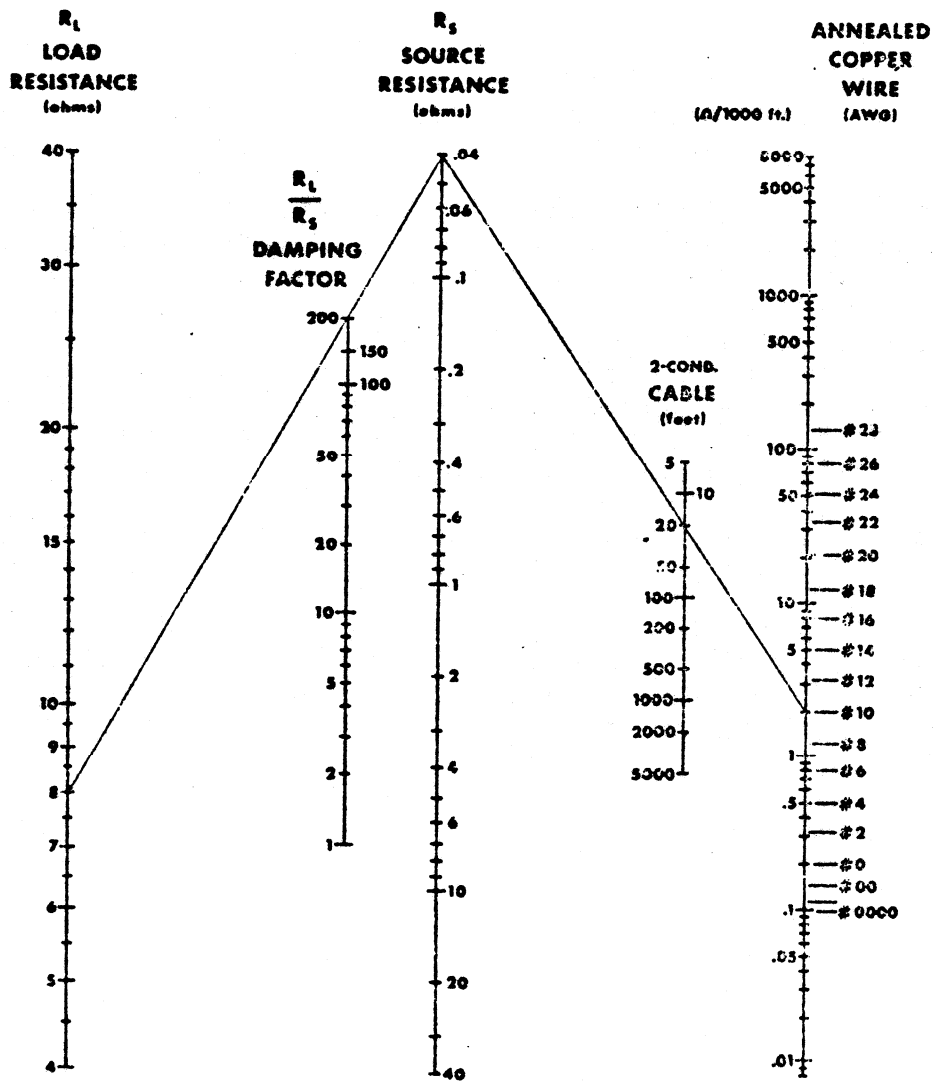
Choose the fuse indicated. If a fuse of the value indicated by the chart is not available, choose the fuse that is closest in value and below the value indicated.

The wires used for the speaker leads should be of the largest gauge possible in order to retain the highest damping factor possible. The chart provided below shows the relation between wire size and damping factor. (See Figure 2.)

To find the damping factor of a particular configuration of wire size and length and speaker impedance, take a ruler and line up the length of two-conductor-cable used with the wire gauge used and mark the resulting source resistance. Then line up this value with the resistance of the load and read off the resulting damping factor. For dynamic moving coil speakers, the load resistance should be that measured with an ohmmeter across the speaker terminals, not the manufacturer's stated impedance value. For electrostatic speakers, the manufacturer's value should be used.

For best results, choose a configuration of wire size and length that will result in a damping factor of 50 or greater.

Ideally, the output leads should be connected to the amplifier with standard banana plugs; however, the five-way action of the binding posts permits the use of tinned wires or spade lugs. Remember, of course, to put a fuse in series with the load.



EXAMPLE: $R_L = 8\Omega$, $R_S = .04\Omega$ OR D.F. = 200
 CABLE LENGTH OF 20 FT. ANSWER: #10 WIRE

FIGURE 2
 SOURCE RESISTANCE AND DAMPING FACTOR VS. LENGTH AND SIZE OF OUTPUT LEADS

OUTPUT CONNECTIONS - BRIDGE MODE

Follow the same procedure as outlined for Stereo mode but connect the single output across the two red binding posts of channels 1 and 2. Do not connect anything to the channel 1 or channel 2 ground binding posts.

CONNECTING POWER MAINS

The Model 500D/750A is furnished with a three wire cord and a grounding plug. Defeating the grounding provision may create hazardous conditions.

The amplifier should only be plugged in when it has been established that it is wired for the correct power mains voltage and after all other connections to the amplifier have been made.

The mains (AC line) voltage is indicated on the serial number label on the rear of the amplifier. Amplifiers supplied for use in the United States are factory wired for 120 volts. Only the indicated mains voltage should be used. If the mains voltage must be changed, see power supply terminal connector pictorial in Schematics Section.

SECTION IV. OPERATION

4.1 Precautions

1. Speaker destruction is often due to improper equipment operation. This often occurs when someone without the proper appreciation for the components of a high power, high quality music system has the opportunity to change records or adjust levels. The best protection here is caution. Keep the equipment out of the reach of untrained adults and children.
Make sure the speaker is properly protected with fuses (see Section 3.4).
2. Never parallel the two amplifier output together; instead, connect the amplifier for bridge mode operation (see Sections 3.3 and 3.4).
3. When driving any load with an impedance of less than 2 ohms, the load should be isolated from the amplifier with a series capacitor in order to avoid both damage to the load and wasting of output power.
4. If the amplifier shuts itself off for any reason by tripping its circuit breaker, always wait 15 seconds before turning it on again. If the amplifier continuously shuts itself off, something is wrong--refer to Section 6.
5. Do not connect an input ground lead to an output ground lead; to do so may cause a ground loop and oscillations.
6. Do not operate the amplifier from power mains which exceed the indicated mains voltage by more than 10%.
7. Never connect the output of the amplifier to another power source such as a battery or power main.
8. Do not expose the amplifier to corrosive chemicals such as lye, soft drinks, salt water, etc. Also never immerse the amplifier in any liquid.
9. Breaking the factory lead seal will invalidate the warranty.
10. The amplifier is not intended for high frequency-high power use; the 500D should not be used for high power at above 20kHz, the 750A should not be used for high power at above 15kHz.
11. Neither the amplifier nor any of its leads should be exposed to areas likely to be struck by lightning.

4.2 Turn-on Procedure

The amplifier incorporates a time delay network and a relay which connects the speakers only after the amplifier has stabilized thus eliminating transients.

Often, turn-on transients originate in the pre-amp or tuner. This is especially true of tube-type units. If this situation arises, turn the amplifier on after the other units have had adequate time to stabilize.

SECTION 5: CIRCUIT DESCRIPTION

5.1 Amplifier

The signal from pin 8 of J1 is applied to the inverting input (pin 2) of the operational amplifier (op amp) IC1 through the coupling network C1, R1, R2, and R3. This network provides a high input impedance to the amplifier and prevents any DC from appearing at the op amp input. It also serves as a filter for radio frequency interference.

The output of the op amp is divided by networks C10/R14 and C11/R15, and is applied to the base of Q1 and Q2. Q1 and Q2 provide the voltage gain, and Q4 and Q5 the current gain, necessary to drive the driver (buffer) transistors Q6 and Q7. Q4 and Q5 are operated in a quasi-complementary configuration with their power transistors, Q8 through Q17.

The output of Q6 is applied to the common bases of Q8, Q10, Q12, Q14 and Q16; the output of Q7 is applied to the common bases of Q9, Q11, Q13, Q15, and Q17. The combined operation of these sets of output devices provide a push-pull output appearing at back-swing clipper diodes D3 and D4. This output is applied to network R25, R26, C20, and L1 to the output binding post through thermal switch S2, connector J1, and relay M1.

To maintain overall amplifier stability and linearity, degenerative feedback is utilized throughout the amplifier. This feedback is also necessary to reduce distortion to within specified limits. R/C networks R5/C3 and R6/C4 condition the feedback signal for application to the non-inverting input (pin 3) of the op amp, IC1. The network comprising R9 and C9 provides the local feedback to the bases of Q1 and Q2. Except for the input, the amplifier uses direct coupling throughout.

A biasing voltage is applied to the bases of driver transistors Q6 and Q7 by Q3 in a V_{be} multiplier configuration. Q3 is attached thermally to the heatsink, and together with R20, provides a variable base bias for Q6 and Q7 that automatically maintains the proper bias voltage with temperature change. The value of R20 is selected to produce a drop of 470 millivolts across R28 with no signal applied.

Stereo-mono operation selection is performed by switch S1 on heat-sink Channel 2. Switch S1 on Channel 1 should always be in the stereo (out) position. When S1 on Channel 2 is in the mono position, it connects the output of Channel 1 to the non-inverting input of Channel 2 and shorts out the inverting input of Channel 2.

5.2 Power Supply

A transformer operated power supply furnishes all AC and DC voltages. The transformer has dual primary windings and may be operated on any of the following voltages: 100, 120, 200, 220, and 240 VAC. A circuit breaker provides protection to the primary winding. One secondary winding provides 12 volts for the relay and back panel circuitry. The other secondary winding delivers power to a full wave bridge comprising rectifier, M4, with the centertap grounded to the chassis. Since neither side of the bridge is grounded, the output appears as +75 V and -75 VAC referenced to circuit ground. Plus and minus outputs are each filtered with 10,000 microfarad (500D) or 21,000 microfarad (750A) capacitors, C31 and C32. The filtered outputs are applied directly to all but the operational amplifier circuit, which received plus and minus 10 volts from voltage dividers connected between ground and the 75 volt source. R10 and Zener diode D1 provide a regulated output of +10 volts; R11 and Zener diode D2 provide a regulated output of -10 volts. C5 and C8 filter the 10 volt sources.

5.3 Fan

The fan is in series with the parallel combination of S3 and R57. When the heatsinks are cool, the fan turns at slow speed because it is connected through resistor R57. When the heatsinks reach 180 degrees F. and up, S3 closes and shorts out R57 making the fan turn faster.

5.4 Time Delay Turn-on

Transients during turnon are avoided through the use of a time delay relay circuit. Q21 is used with C27 and R46 to comprise a time delay circuit which drives relay M1. The time constant of the circuit, determined by C27 and R46 is about one second. C27 is discharged to the -75 volt supply when the amplifier is turned off by D1 and R45.

5.5 Protection

Three protection circuits are employed:

1. The fast acting magnetic circuit breaker shuts the unit down whenever it is drawing excessive current.
2. Our SCR crowbar circuit, exclusive to BGW Systems, discharges the power supply capacitors and triggers the circuit breaker instantaneously if any conditions exist which could potentially start to damage the speakers.

3. Thermal switches mounted on each heatsink protect the amplifier from thermal failure. The amplifier will shut off if the heatsink temperature is over 70 degrees Centigrade (158 degrees Fahrenheit), and will turn on after the temperature drops. Activation of the thermal switches usually means that sufficient air circulation is NOT being provided.

Section 6. Service Procedures

6.1 Warranty

BGW Systems warrants all power amplifiers for a period of three years from date of manufacture. This warranty covers both defects in workmanship and materials. If malfunction does occur, the product will be replaced or repaired, at our option, without charge for materials or labor; if returned prepaid to BGW Systems. This warranty does not cover equipment damaged due to negligence, misuse, shipping damage or accident, or if the serial number is defaced, altered or removed, or if the factory lead seal has been broken, or if the equipment has been altered or modified. Please fill out the warranty registration form on the next page and return to the factory within 2 weeks of purchase.

6.2 Service Options

6.2.1 Factory Service

Should service be required, contact the dealer from whom the unit was purchased. Chances are that he will be able to service the unit himself by changing one of the unit's modules. If he is unable to service the unit, he will direct you to return the unit either to the nearest authorized factory service station or the factory itself.

Whenever service is required, the Service Authorization Form on the next page should be filled out and sent to whomever will be servicing the amplifier.

If the dealer directs you to return the unit to the factory for service, follow this procedure:

1. Fill out the Service Authorization Form and mail it to BGW Systems.
2. Repack the unit in the factory supplied shipping container. All units to be returned for factory service must be shipped in this container in order to prevent damage in transit. Replacement containers are available from BGW Systems for \$14.00 freight included.
3. Ship the unit prepaid to BGW Systems. Units will be returned by freight, collect.

Service performed on units which are covered by warranty will be performed with no charge for parts and labor. If the unit is no longer covered by warranty a nominal charge will be made for parts and labor.

6.2.2 User Service

The service information included in this manual is intended for those who wish to service their own units with full understanding that in doing so they render their units ineligible for warranty service; units which are not covered by the warranty will not be repaired without charge.

There is nothing within the amplifier that is user serviceable; service by anyone other than factory instructed service personnel is not recommended.

The BGW 750A/500D is a state of the art high power amplifier and, as such, is fairly complex. Without the proper equipment and knowledge of the amplifier's operation, one risks both unnecessary loss of warranty service privileges and damage to the amplifier.

6.3 Service Procedures for Module Replacement

The following tests can be performed with little or no test equipment and require only the most elementary knowledge of electronics. This procedure is intended for those who are not set up to perform the more elaborate tests required for module repair but can replace modules. It should be mentioned, however, that not all problems can be solved by module replacement; in this case, more thorough testing is required.

6.3.1 Preliminary Checks

NOTE: Whenever the unit shuts itself off via its circuit breaker, always wait 15 seconds before turning it on again. This is necessary because if the crowbar has been activated, it may take this long to totally discharge the power supply through the SCR. If the unit is turned on before the power supply has been discharged, the SCR will still be activated and the unit will draw excessive current unnecessarily. This procedure will help determine if the amplifier is defective, and if it is, what the probable cause is.

1. Find out from the user what the problem is. Preferably, the user should be contacted and the problem discussed with him. If this is not possible, and the problem is fairly straightforward, it will probably be sufficient to read the user's comments on the Service Authorization Form.
2. With no input or output connections made to the amplifier, plug the unit in and with the line voltage at the level indicated on the serial number tag, turn on the amplifier's circuit breaker. Note one of the following results:

- a. The circuit breaker immediately shuts off;
- b. The circuit breaker stays on for about 2 seconds and then shuts off as soon as the relay pulls in;
- c. The circuit breaker stays on and the relay does not pull in (no click heard from inside the amplifier);
- d. The circuit breaker stays on and the relay pulls in.

3. Analyze the results of the test above. Possible causes of each result are listed:

- a. Indicates excessive current draw or defective circuit breaker. Excessive current draw could be caused by: shorted output devices; shorted crowbar SCR; unit wired for wrong power mains voltage; shorted bridge rectifier (could be short to ground); shorted wires in power supply harness; shorted transformer or line cord; shorted filter capacitors; bad solder joint on heatsink bias transistor lead; open, intermittent or leaky capacitor in crowbar circuit causing crowbar to trip. Miscellaneous components not soldered properly.
- b. Indicates D.C. offset on one or both channel outputs caused by: bad op amp; bad compensation capacitor; bad ground connection; shorted or leaky coupling capacitor; bad bias transistor; leaky output device; bad zener diode.
- c. Result may be analyzed as follows: (Check for one)
 - (1) Fan turning very slowly, LED not lit or very dim. This indicates excessive current draw. The unit should be turned off and checked for causes as in a.
 - (2) Fan not turning at all, LED not lit. This indicates that the unit is receiving no power. This could be caused by: bad line resistor; blown fuse; bad line cord; bad transformer. Since this condition usually follows (1) above, when it is connected the unit will usually revert to condition (1) and then should be checked for causes as in a.
 - (3) Fan turning at its regular speed, LED not lit. This usually indicates a defective 12 volt supply, and the associated components should be checked.

(4) Fan turning at its regular speed, LED lit. This probably indicates either a defective relay or a defective relay timing circuit.

d. This indicates normal operation as far as the scope of this test is concerned.

4. Once the preliminary check has been made, it is desirable to isolate the cause of the problem to a particular part of the unit. The 750A/500D can be divided into four basic parts:

- 1) Left Channel Heatsink
- 2) Right Channel Heatsink
- 3) Back Panel Board
- 4) Power Supply and Harness

If the cause of the problem is in either heatsink, this may be discovered by simply unplugging one or both heatsinks from the unit and checking to see if the problem disappears.

If the cause of the problem is in the back panel board, various leads may be disconnected judiciously in order to discover the cause.

If the cause is in the power supply or harness, it should be fairly easy to locate by checking for burned or shorted parts.

6.4 Disassembly for Servicing

The BGW 750A/500D is modularly designed for quick and easy service. Each amplifier channel can be removed completely by simply unscrewing the heatsink and unplugging its cord. (When removing Channel 2, remember to unscrew the stereo-mono switch first -- see 6.4.1 below.) The crowbar circuit is on its own printed circuit board which also simply unscrews and unplugs. All components in the amplifier are easy to find and replace. Please follow the steps outlined in 6.4.1 when disassembling the unit.

NOTE: For no service or replacement procedure listed is it necessary to remove the front panel (except to replace a damaged front panel). This is a long and troublesome process; take care while servicing to avoid damaging the front panel or any other outside surface.

CAUTION!

DO NOT attempt component replacement or other repairs while power is applied.

6.4.1 General Disassembly Steps for Heatsink Disassembly

1. Remove power from the amplifier and turn off the circuit breaker.

2. Remove the three cover screws from the rear of the amplifier.
3. Remove the three cover screws from the top of the amplifier.
4. Take a #2 Phillips screwdriver and place its tip in one of the holes near the middle of the cover grill on the side of the cover. Taking care not to slip or scratch the paint, strike the end of the screwdriver with a hammer or mallet until the cover bottom edge clears the top of the heatsink fins. Lift off cover.
5. If the heatsink to be removed is Channel 1, skip this step. If the heatsink to be removed is Channel 2 (directly above the stereo-mono switch), it is necessary to remove the stereo-mono switch shaft by gently turning it counter-clockwise with a slotted screwdriver until it can be removed from its bushing.
6. Cut and remove the factory lead seal between the two filister heatsink screws.
7. Remove the six heatsink screws from the edges of the heatsink.
8. Taking care not to pinch the wires of the fan thermal switch, gently lift up the outer side edge of the heatsink. Reach inside the amplifier and gently work the heatsink plug back and forth while pulling it out of the heatsink socket.
9. If the unit has no fan thermal switch (commercial wired), skip this step. If the fan thermal switch is glued to one of the output devices, carefully unsolder the wires on the lugs of the switch. If the switch is screwed to the output device, the leads may be unplugged from the lugs of the switch by gently pulling the lug connector off the switch lug.
10. Lift out the heatsink.

6.4.2 Positioning heatsink for in-unit measurements

1. Follow Section 6.4.1, steps 1-7.
2. Get a 12" wooden or plastic ruler. Taking care not to pinch wires of the fan thermal switch, gently lift up the outer side edge of the heatsink and place the ruler between the 5.1 ohm 2 watt resistor and the junction of the chassis bottom and side wall. In this position, with the other amplifier channel screwed down, the amplifier may be operated for the purposes of in circuit measurements.

DO NOT apply power to the amplifier with a heatsink in its normal position with the heatsink screws removed; the heatsink may short out against the chassis.

6.4.3 Positioning Heatsink for Component Replacement

1. Follow Section 6.4.1. steps 1-3.
2. Place the heatsink fins down on top of the opposite channel heatsink.
DO NOT apply power to the amplifier while a heatsink is in this position.
3. All heatsink components are now accessible for replacement. When replacing components on the heatsink board, bend and cut the new leads so that they do not short out against the extrusion before they are soldered into place.

6.4.4. Positioning the Back Panel for Component Replacement

1. Position Channel 2 heatsink for component replacement.
2. Remove the four binding post nuts and lock washers.
3. Pull the printed circuit board off of the binding posts. This will expose the foil and components may be replaced.

6.4.5 Positioning the Back Panel for In-Unit Measurements

1. Remove Channel 2 heatsink from unit.
2. Since all parts are on the top of the board, they are all accessible with the board attached to the back panel; all that is necessary for in circuit testing is to match up each part on the board with each part in the schematic.

6.4.6 Changing the Power Mains Voltage

1. Position Channel 1 heatsink for Component Replacement
2. In order to change the power mains voltage, wires on the barrier strip M2 must be changed. Depending on the change to be made, one, two, three or four lugs will have to be moved to different positions on the barrier strip. Find the following wires connected to the barrier strip: brown wire coming from transformer, Teflon wire coming from power mains resistor, and jumper wire with both ends connected to barrier strip. The following chart shows where these wires should be when the

barrier strip is wired for the different mains voltages:

VOLTAGE DESIRED	BROWN WIRE	TEFLON FROM RESISTOR	JUMPER
100	Pin 3	Pin 5	Pin 2 and 5
120	Pin 3	Pin 4	Pin 1 and 4
200	Pin 2	Pin 5	(put both ends
220	Pin 1	Pin 5	on Pin 6 for
240	Pin 1	Pin 4	for storage)

3. When the power mains voltage is changed, it may be necessary to change both the line resistor and the circuit breaker. The following chart shows the circuit breaker and line resistor requirements for the different mains voltages.

MAINS VOLTAGE	CIRCUIT BREAKER		LINE RESISTOR
	500D	750A	
100	10A	15A	9 ohms or 12 ohms
120	10A	15A	9 ohms or 12 ohms
200	7.5A	7.5A	12 ohms
220	7.5A	7.5A	12 ohms
240	7.5A	7.5A	12 ohms

In order to change the circuit breaker and the line resistor, see the appropriate sections.

6.4.7 Changing the Circuit Breaker

1. Position Channel 2 heatsink for component replacement.
2. Disconnect the lug connectors from the circuit breaker lugs.
3. Remove the two circuit breaker screws from the front panel.
4. Remove the circuit breaker.

6.4.8 Replacing the line resistor or crowbar resistor.

1. Position Channel 2 heatsink for component replacement.
2. Disconnect the wires from the resistor lugs.
3. Remove the two nuts and their hardware from the resistor and remove the resistor from the unit.

4. Solder the wires to the new resistor lugs.

6.4.9 Replacing the power supply capacitors

1. Position either the Channel 1 or Channel 2 heatsink for component replacement.

2. Using a long slotted screwdriver with a fairly wide blade and small shaft, remove the two electrical connection screws at the end of the capacitor and the leads through which they pass by carefully sticking the screwdriver through the fan.

3. Gently bend the bussbar towards the fan.

4. Loosen the capacitor clamping screw or nut (whichever is easier) and work the capacitor out of its bracket.

5. Place new capacitor in the bracket and orient it so that the lugs will be connected to the correct polarity. Screw two electrical connection screws and their lugs tightly to the new capacitor.

6. Fully tighten the capacitor clamping screw or nut.

6.4.10 Replacing the SCR

1. Position the Channel 2 heatsink for component replacement.

2. Using a razor blade, slit the heatshrink tubing up the side of the wires and peel off the pieces.

3. Disconnect the leads from the SCR by heating the lug connectors on the ends of the leads with a soldering iron.

4. Remove the nut and lock washer from the screw holding down the SCR and remove the SCR.

5. Bend the leads on the new SCR into a shape similar to the leads on the defective SCR.

6. Install new heatshrink tubing on the leads, solder them in place, then shrink the tubing over the connection with a heat gun.

7. Position the new SCR over its mounting hole and replace the hardware.

6.4.11 Replacing Bridge Rectifier M4

1. Position Channel 1 or 2 for component replacement.

2. Unplug four lug connectors from bridge lugs using long nose pliers to grip the connectors and taking care not to damage any components leads secured in the connectors.

3. Remove hex nut, lock washer, flat washer and bridge.

4. Coat the bottom of the new bridge with silicone heatsink compound.
5. Position new bridge and secure with hardware.
6. Noting markings on side of bridge, replace lug connectors to bridge lugs.

6.4.12 Replacing the LED Panel Indicator

1. Position Channel 2 heatsink for component replacement.
2. Gripping the tubing covering the ends of the two wires going to the LED, gently pull wires away from the front panel and they will unplug from the LED pins.
3. Gripping the knurled nut on the front of the front panel with fingers and using a socket or wrench on the hex nut on the back of the front panel, unscrew either the knurled nut or the hex nut and remove the indicator assembly.
4. When installing the new assembly, insert the LED into the black threaded insulator and note that one side of the red LED rim has a flat face. Bend the lead adjacent to this rim outward to indicate that it is the cathode. Now, holding the black insulator with fingers, screw on the knurled nut over the LED rim until it is fairly tight. Insert the assembly into the hole in the front panel and screw on the hex nut from the rear. DO NOT OVERTIGHTEN. Insert the LED pins into the connectors on the ends of the LED wires; the black wire goes to the cathode, the other wire to the anode.

6.4.13 Replacing the Transformer

1. Position Channel 2 heatsink for component replacement.
2. Unplug the two twelve volt transformer winding leads from the back panel board.
3. Position Channel 1 heatsink for component replacement.
4. Using a long screwdriver with a fairly wide flat blade and small shaft, remove the top electrical connection screw at the end of the capacitor nearest the transformer and pull the transformer center tap lead away from the capacitor.
5. Unplug the two secondary transformer leads from the bridge rectifier using long nose pliers.

6. Unplug the six primary transformer leads from barrier strip M2.
7. Remove the two bottom transformer screws. These are secured with Jay clips so no gripping of inside hardware is necessary. Remove the two top transformer screws and their nuts, lockwashers, and washers. Carefully lift out the transformer.
8. Reverse the above steps for replacement. Twist all primary leads together. Twist both secondary leads together. Twist both 12V leads together. Make sure all lug connectors are pushed all the way on to their lugs. Make sure the capacitor electrical connection screw is fully tightened.

PARTS LIST - 750A/500D

<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REFERENCE</u>
<u>CAPACITORS</u>			
7	0226-0010	10 UF 25V TANT.	C1, C21, C22, C23, C24, C28
2	0090-0240	240 PF 5% 500V MICA	C2
8	0100-0047	47 PF 1KV DISC	C3, C9, C12, C6
2	0456-0050	50 UF 12V ELEC.	C4
4	0129-0047	.047 UF 25V DISC	C5, C8
4	0090-0120	120 PF 5% 500V MICA	C7, C13
4	0486-0020	20 UF 100V ELEC.	C10, C11
6	0100-1000	1000 PF 1KV DISC	C14, C16, C17
5	0369-0100	.1 UF 100V MYLAR	C15, C18, C19, C20, C26
1	0389-0010	.01 UF 400V MYLAR	C25
1	0426-0330	330 UF 0-3V ELEC.	C27
2	0553-0021	21, 000 UF 85V DC	C31, C32
1	0446-0330	330 UF 0-16V ELEC.	C29
1	0199-0100	.1 UF 500V DC DISC	C30
<u>CONNECTORS</u>			
3	1202-0011	SOCKET, 11 PIN	J1, J6
2	1231-0009	TERMINAL POST, BLACK	J2, J5
2	1231-0008	TERMINAL POST, RED	J3, J4
18	1349-9312	PIN, MOLEX R93-12A	USED ON BACK PANEL
2	1350-0011	PLUG, 11 PIN	J7, J8
2	9999-0111	JACK, INPUT N111	J9, J10
18	1231-1102	LUG, MOLEX 02-08-1102	
24	1201-2001	SOCKET, TRANSISTOR 2TS-1	
1	9999-4406	FUSE HOLDER	
5	1231-1105	LUG, MOLEX 02-05-1105	
24	1322-9700	LUG, S09700	
7	1313-3457	LUG, CRIMP #10 STUD R3457B	
2	1231-1112	LUG, MOLEX 02-04-1112	
<u>CONTAINER SET</u>			
1		20½" X 13-3/4" X 7½" 200# KRAFT INNER BOX	
2		7" X 13½" X 1-3/8" RAIL BLOCK	
1		23-3/4" X 17½" X 11½" 275# EGGSHELL OUTER BOX	
8		CORNER BLOCK 1½" FOAM	

<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REFERENCE</u>
<u>DIODES</u>			
1	1886-2502	BRIDGE RECTIFIER	M4
	1900-4740	1N4740A 16V ZENER	D1, D2
	1900-4004	1N4004	D3, D10, D12, D16
	1900-4752	1N4752 33V ZENER	D11
<u>INDUCTOR</u>			
	9999-0020	0.5 UH OUTPUT INDUCTOR FORM	L1
<u>INTEGRATED CIRCUIT</u>			
	1885-0318	LM318H (NATIONAL SEMICONDUCTOR)	IC1
<u>MECHANICAL COMPONENTS</u>			
2	9007-0750	PRINTED CIRCUIT BOARD, H5751B	
22.5"	9902-0022	TUBING, TFT 200-22	
1	9017-0750	PRINTED CIRCUIT BOARD, BP 751	
2	1330-1410	LUG, 1410-04 (GROUNDING LUG ON HEATSINK)	
2	2315-2250	4-40 X 3/8 HEX SMS SLOTTED CADMIUM	
8	9605-0250	SPACER, SMITH 8501 (FOR THERMAL SWITCHES)	
2	8122-0000	#4 INTERNAL TOOTH L/WASHER	
1	9999-0013	SHAFT, FOR STEREO/MONO SWITCH	
1	9002-0750	CHASSIS	
1	1261-0119	PANEL BEARING FOR STEREO/MONO SWITCH	
1	1235-6034	CLAMP, STRAIN, FOR POWER CABLE	
1	9999-6039	GRILL, FAN	
4	1235-0406	CLIP, FOR FAN	
1	9004-0750	BRACKET, POWER SUPPLY	
4	9999-0080	FEET, F8B	
2	1235-0010	CLIP, #10 JAY	
4	2111-3625	6-32 X 5/8 PH MS P. BLACK	
4	2311-3375	6-32 X 3/8 FH MS P. BLACK	
2	8530-0250	6-32 X 1/4 HEXNUT	
2	2315-4375	8-32 X 5/8 FH MS P. BLACK	
2	2111-4750	8-32 X 3/4 PH MS P. BLACK	
13	8540-0312	8-32 X 5/16 HEXNUT	
4	3115-4625	8 X 5/8 PH SMS P. CADMIUM	
1	2315-2625	6-32 X 5/8 FH MS P. BLACK	
2	2111-5500	10-32 X 1/2 PH MS P. BLACK	
2	1000-0750	HEAT SINK EXTRUSION, HS 750EXT	
10	1001-0001	TRANSISTOR CUP, HEAT SINK	
40	3125-3625	6 X 5/8 PH SMS SLOTTED CADMIUM	
8	3125-3375	6 X 7/8 PH SMS SLOTTED CADMIUM	

<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REFERENCE</u>
		MECHANICAL COMPONENTS, CONT'D.	
2	3111-5500	10 X 1/2 PH SMS P. BLACK	
4	8141-0000	#8 F/WASHER	
4	8151-0000	#10 F/WASHER	
8	8154-0000	#10 SPLIT/WASHER	
2	1235-0003	CLAMP, CAPACITOR	
6	2115-4437	8-32 X 3/8 PH MS PHIL CADMIUM	
2	2225-3625	6-32 X 5/8 RH MS SLOTTED CADMIUM	
3	2315-4750	8-32 X 3/4 FH MS PHIL CADMIUM	
1	2315-2625	6-32 X 5/8 FH MS PHIL CADMIUM	
1	2115-3375	6-32 X 3/8 PH MS PHIL CADMIUM	
7	8143-0000	#8 EXT. TOOTH L/WASHER	
2	8133-0000	#6 EXTERNAL TOOTH L/WASHER	
2	8142-0000	#8 INTERNAL TOOTH L/WASHER	
2	8151-0000	#10 FLAT/WASHER	
2	8530-0312	6-32 X 5/16 HEXNUT	
1	9000-1750	FRONT PANEL, 750A	
2	2311-3375	6-32 X 3/8 FH MS PHIL BLACK	
2	9999-9151	HANDLES, 9151B	
4	2451-5750	10-32 X 3/4 FILISTER MS AL BLACK	
6	2311-5500	10-32 X 1/2 FH MS PHIL BLACK	

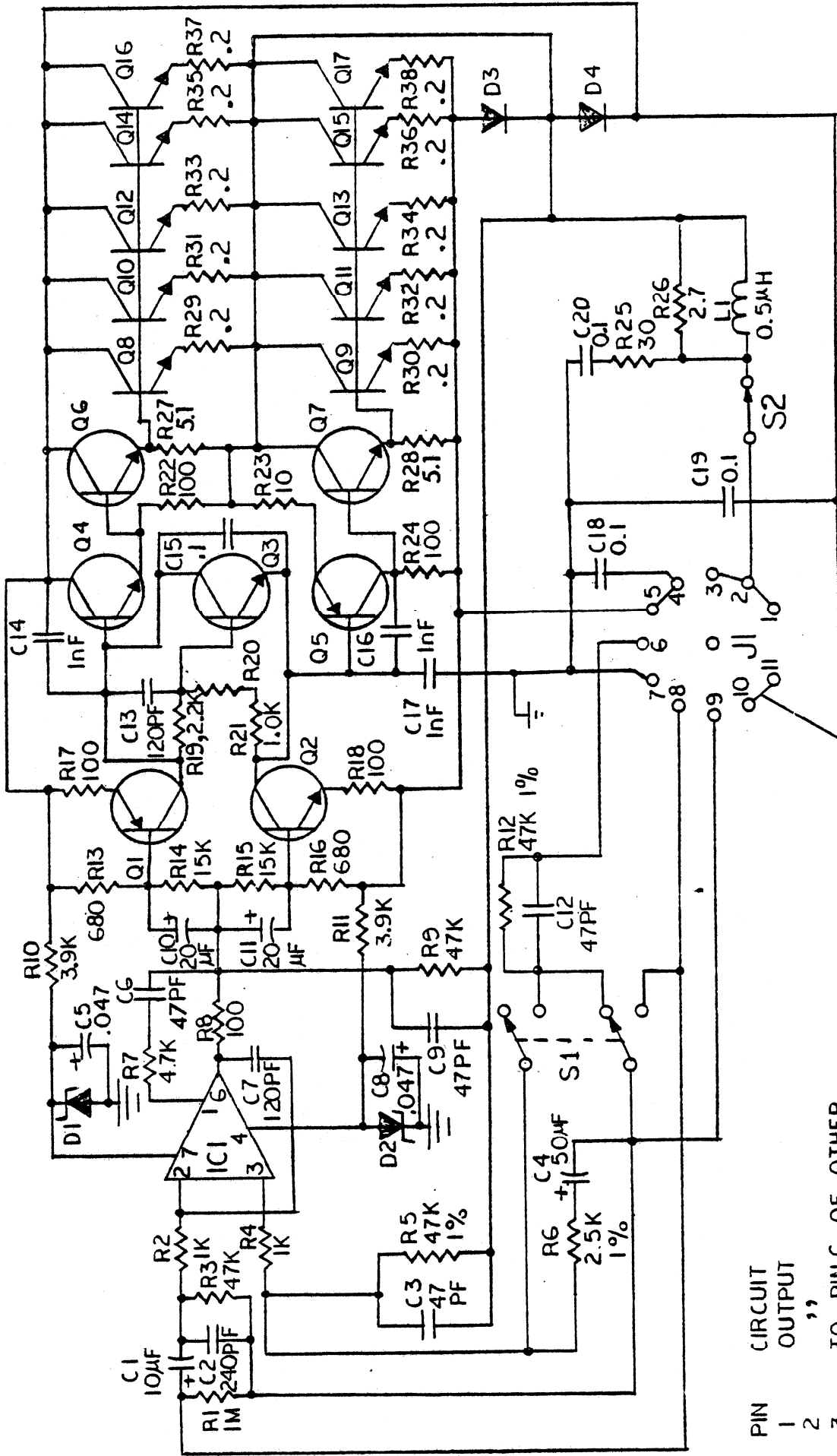
MISCELLANEOUS

1	8709-5163	POWER CABLE #16 AWG 3 COND 9' BLACK	
			M1
1	0721-9126	BARRIER STRIP 6 LUG	M2
1	8800-3450	FAN 100 CFM HOWARD 3450	M3
1	0721-9126	BARRIER STRIP 3 LUG	M5

RESISTORS

2	5005-1006	1 MEG OHM 5% 1/2 W CARBON FILM	R1
6	5005-1003	1K OHM 5% 1/2 W CARB FILM	R2, R4, R21
4	5005-4703	47K OHM 5% 1/2 W CARB FILM	R3, R9
4	5001-4703	47K OHM 1% 1/2 W CARB FILM	
2	5001-2491	2.5K OHM 1% 1/2 W CARB FILM	R6
2	5005-4702	4.7K OHM 5% 1/2 W CARB FILM	R7
10	5005-1002	100 OHM 5% 1/2 W CARB FILM	R8, 17, 18, 22, 24
4	6025-2702	2.7K OHM 10% 2W DEP. CARB.	R10, 11
4	5005-6801	680 OHM 5% 1/2 W CARB FILM	R13, R16
6	5005-1503	15 K OHM 5% 1/2 W CARB FILM	R14, 15, 50
2	5005-2202	2.2 K OHM 5% " " " " "	R19
2	4005-1001	10 OHM 5% 1/2 W CARB FILM	R23
2	4050-3001	30 OHM 10% 5W WIREWOUND	R25
2	4025-2070	2.7 OHM 5% 2W CARB FILM	R26
20	4050-0200	.20 OHM 10% 5W WIREWOUND	R29, R38
4	4005-5010	5.1 OHM 5% 2W CARB FILM	R27, R28

<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REFERENCE</u>
<u>RESISTORS, CONT.D</u>			
8	5005-3303	100 KOHM 5% 1/2W CARB FILM	R39, 40, 41, 42
6	5005-1004	10 K OHM 5% 1/2W CARB FILM	R43, 47, 48
2		560 OHM 5% 1/2 W CARB FILM	R44
2	6025-5102	5.1 K OHM 5% 2W DEP CARB	R45
2	5005-3303	33 K OHM 5% 1/2 W CARB FILM	R46
4	5005-3001	30 OHM 5% 1/2 W CARB FILM	R49, 51
2	4020-2701	270 OHM 10% 2W	R52
2	4005-5010	5.1 OHM 5% 1/2 W CARB FILM	R53
2	4100-4003	4.0 K OHM 10% 10W WIREWND	R54
2	4550-9000	9.0 OHM 10% 55W WIREWND	R55
2	4550-2000	2.0 OHM 10% 55W WIREWND	R56
2	4200-4002	400 OHM 10% 20W WIREWND	R57
<u>SWITCHES</u>			
2	0660-0680	STEREO/MONO SWITCH	S1
2	0630-3441	THERMAL SWITCH, NORMALLY OPEN	S3
2	0630-3442	THERMAL SWITCH, NORMALLY CLOSED	S2
1	9999-6025	FUSE 6 1/2 AMP SLO-BLO	S5
1	0650-0153	CIRCUIT BREAKER, 15 AMP ROCKER	S4
<u>TRANSFORMER</u>			
1	0900-0750	TRANSFORMER	T1
<u>TRANSISTORS</u>			
	1853-5415	2N5415	Q1, Q5
	1854-0346	40346 <i>OR 2N3440</i>	Q2, Q4
	1854-2219	2N2219A	Q3
	1854-1005	RCA1805 OR 65728	Q6, Q7
	1854-3773	2N3773	Q8, Q17
	1853-5401	2N5401	Q18
	1854-3394	MPS3394	Q19
	1853-4871	GET4871	Q20
	1854-0013	MPS A13	Q21
	1884-4442	2N4442 (SCR)	Q22
	1990-0110	LED WITH HARDWARE	



PIN	CIRCUIT
1	OUTPUT
2	"
3	TO PIN 6 OF OTHER CHANNEL
4	-75
5	-75
6	TO PIN 3 OF OTHER CHANNEL
7	POWER SUPPLY GROUND
8	+ INPUT
9	SIGNAL GROUND
10	+75
11	+75

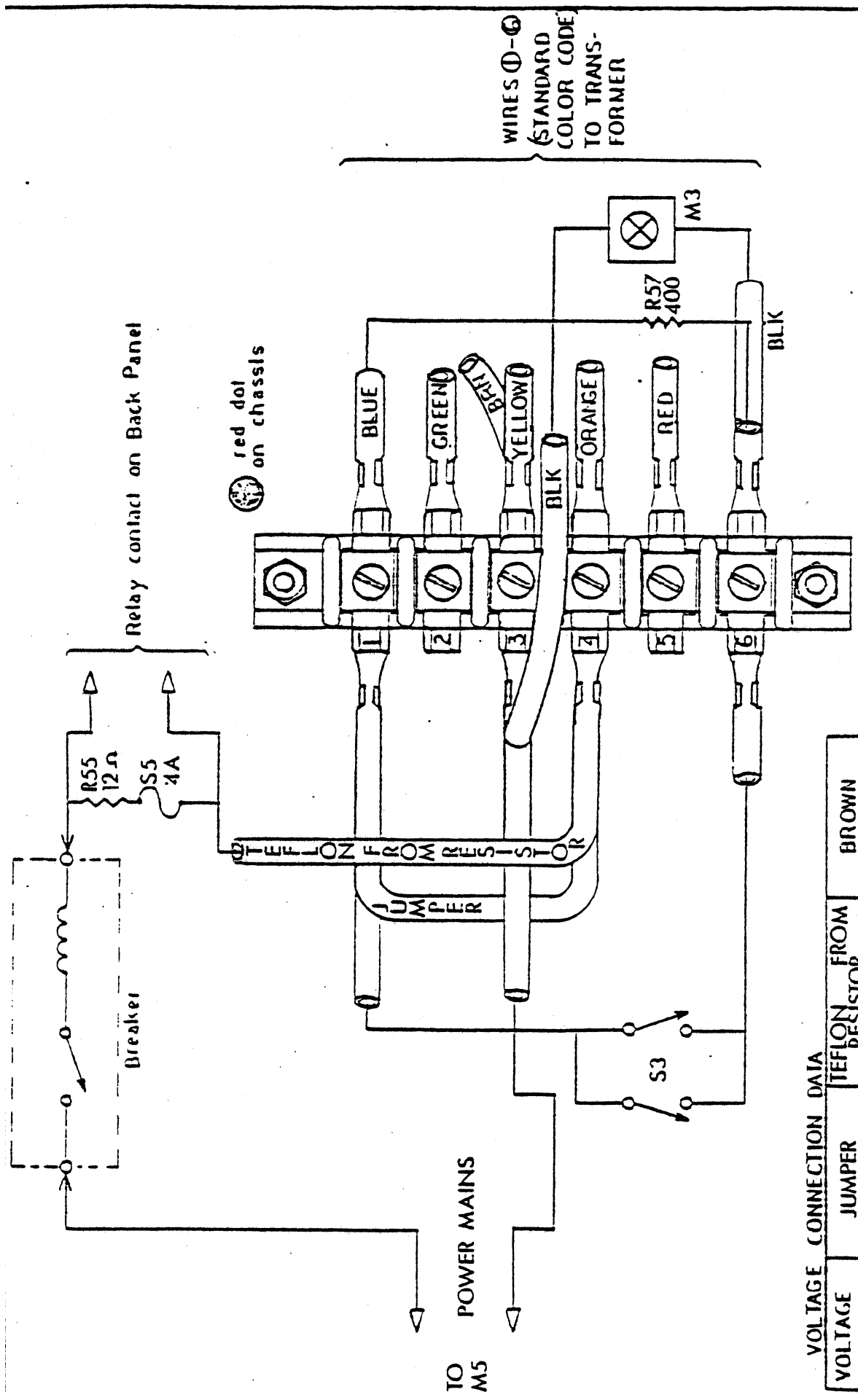
NOTES:

- 1 - S1 SHOWN IN STEREO POSITION.
- 2 - R20 SELECTED FOR 340 mV ACROSS R28.
- 3 - ALL RESISTOR VALUES SHOWN IN OHMS.

OUTPUT MODULE

BGW MODEL 750A

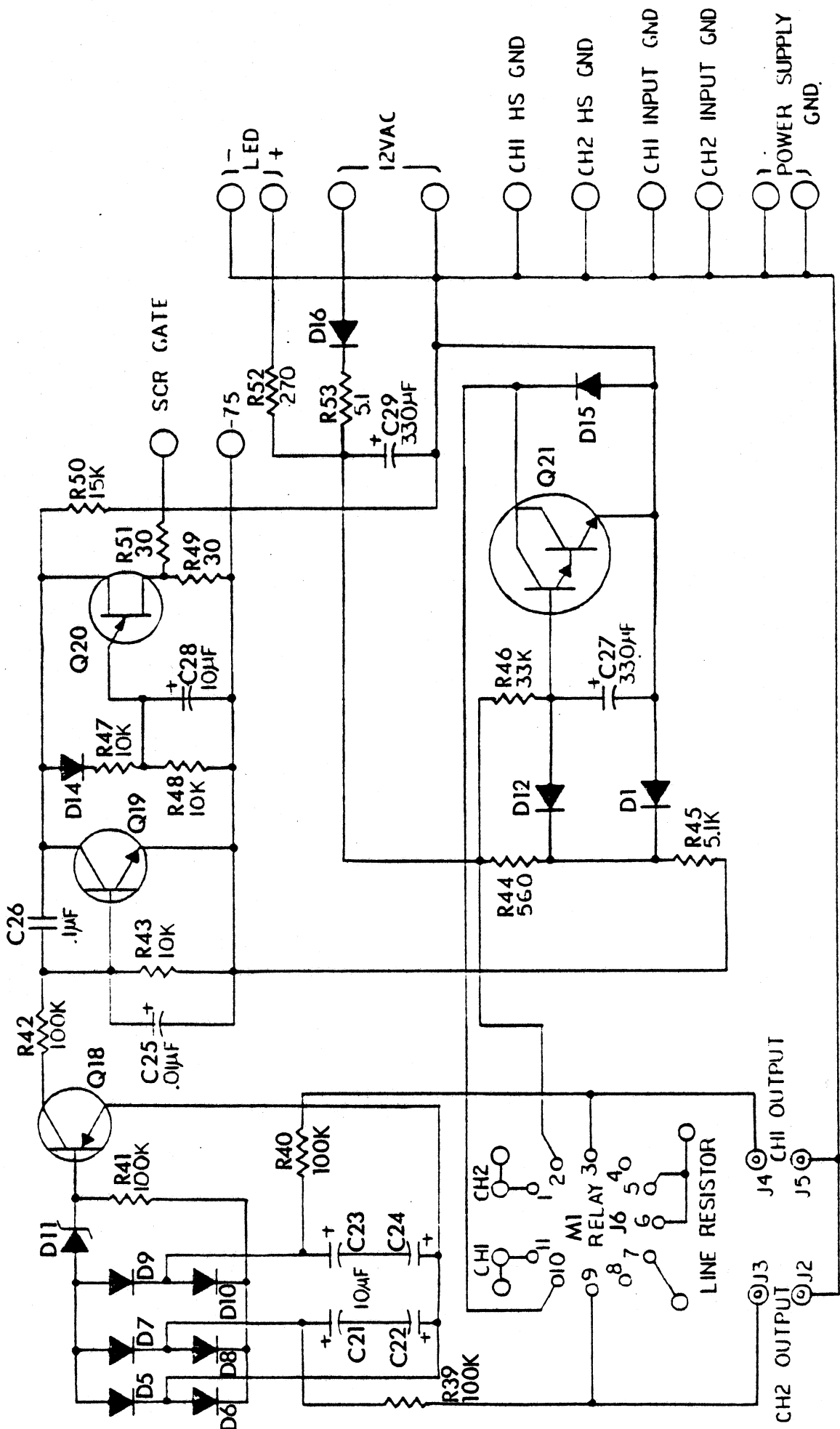
CIRCUIT BOARD MARKED HS751A/B
 DRAWING 10-15-74 .115K. APPD: 12-4-75 *caj*



VOLTAGE CONNECTION DATA

VOLTAGE	JUMPER	TEFLON FROM RESISTOR	BROWN
100	PIN 5	PIN 2 & 5	PIN 3
120	AS SHOWN	AS SHOWN	AS SHOWN
200	PIN 5	NOT USED	PIN 2
220	" 5	" "	" 1
240	PIN 4	" "	" 1

POWER SUPPLY
 TERMINAL CONNECTOR PICTORIAL
 BGW MODEL 500 & 750A
 DRAWING: M-24-74. IISK APPD:12-4-75 *ada*



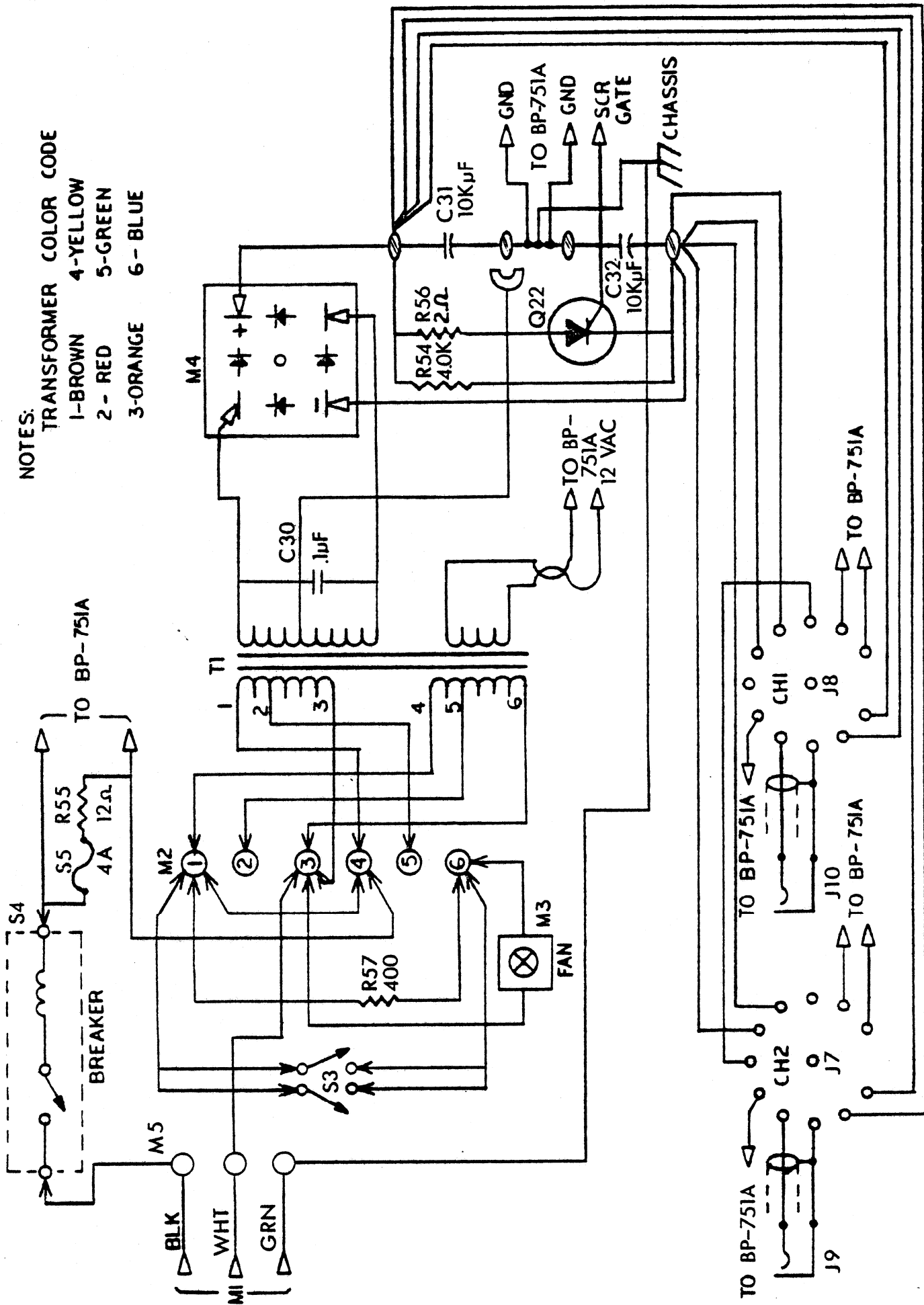
BACK PANEL BOARD

RGW MODELS 500D & 750A

CIRCUIT BOARD MARKED BP751A

REV. 10-17-14 .115K APPD: 12-4-75

NOTES:
 TRANSFORMER COLOR CODE
 1-BROWN 4-YELLOW
 2-RED 5-GREEN
 3-ORANGE 6-BLUE



POWER SUPPLY & HARNESS
 BGW MODEL 500D & 750A
 BP71001: 11-19-74 USV