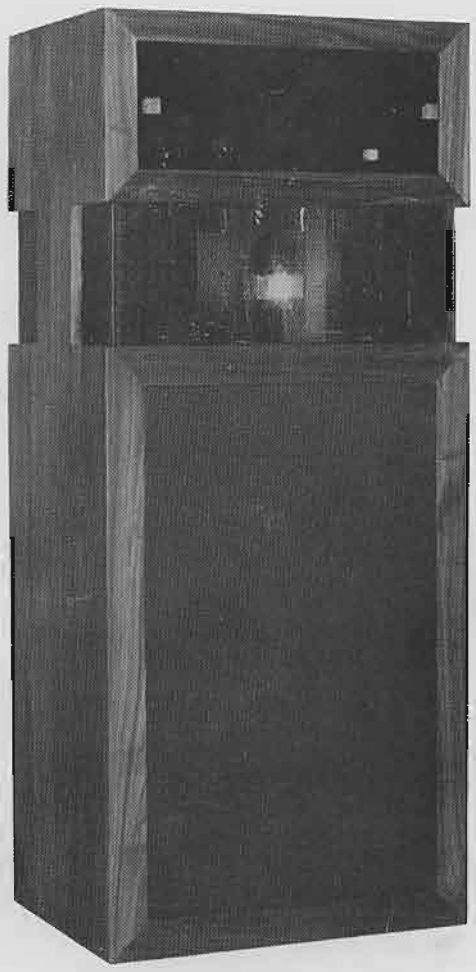
# The Hill Type-1 Plasma Speaker System



# Owner's Manual

Plasmatronics Inc.

2460 Alamo SE Suite 101 Albuquerque, NM 87106

Dear Owner:

Just a word of thanks for selecting what we believe to be the world's finest loudspeaker system. I would feel personally gratified, having spent many difficult years on its development, if this application of forefront technology brings you, the owner, enjoyment that is not obtainable with any other speaker. You have also demonstrated dedication to audio excellence by having made this choice.

We at Plasmatronics will continue to strive for perfection and I personally will review and appreciate all comments from our family of users who share our enthusiasm for the finest possible audio reproduction.

Sincerely,

Alan E. Hill
President and Chief Scientist
Plasmatronics, Inc.

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Patent Pending

# I. OVERVIEW

## A. INTRODUCTION

The Hill Type 1 Plasma Speaker System is the result of 10 years of research applying laser plasma physics principles to sound reproduction. Its primary objective is simply to set an unprecedented standard of excellence which is not achievable from any other technology base, and to make this available for home use by meeting the necessary reliability and safety requirments. Cost, owner convenience and appearance were also strong considerations, but were never given priority over the primary objective, which could compromise its near perfect performance capability. Many earlier designs offered certain advantages but were rejected because they created ozone or produced x-rays or used excessively high voltages. The **consumer version** is safe, reliable, and has not been compromised sonically in any way to our knowledge.

For years audio engineers have talked about the desirability of a "massless driver" which has no inertia and therefore responds instantly and accurately with no "coloration" or self-induced resonances. Also frequently discussed is the concept of an "ideal pulsating sphere" which radiates uniformly over a wide solid angle with constant phase. Until now these were esoteric theoretical concepts, never achieved in practice, even independently.

B. FEATURES AND CHARACTERISTICS

A single massless plasma driver operates from 700 Hz to well above audibility. Since the air molecules are excited directly by electric forces, there is no electro-mechanical coupling. This means that there are no resonances to "color" the sound, no inertia to damp transient response, no cone excursion limits to cause distortion or clipping, and no Doppler shift or other intermodulation distortion mechanisms to fragment the sound (short of theoretical limits due to properties of air itself). Its frequency response is essentially flat and linear compared to any mechanical transducer operating at comparable amplitudes. It can produce single transient pulses with no ring up or overshoot and its steady state distortion level is comparable to good amplifiers at normal listening levels. The plasma background noise level is normally inaudible in a typical listening environment, even in the absence of program material.

The plasma transducer radiates uniformly in phase in all directions. There is no backgoing, out of phase wave. Hence, neither an acoustical enclosure nor horn loading is required as is the case with conventional drivers. Consequently, coloration normally associated with horns or enclosures is absent. Since the wave front is spherical (except for physical blockage toward the rear), excellent stereo imaging qualities from a pair of these units may be expected. Phase coherence is almost "laserlike" owing to the small physical

size of the single mid and upper frequency plasma transducer; its entire volume is only several cubic centimeters. This aids diffraction spreading around solid objects.

Size, cost and AC power considerations preclude the use of plasma to reproduce the bass and low midrange frequencies. Instead, we use an extremely heavy duty 12" subwoofer which operates from 10 to 100 Hz, combined with a highly accurate conventional 5" low midrange driver which operates from 100 to 700 Hz. The integrated system is optimized to yield excellent transient response and flat, smooth frequency response. We have extended its response into the bass as far as possible without compromising our primary objectives. Tone burst ring-up time is, at worst, 1 cycle in the 30 to 100 Hz range and 3/4 cycle in the 100 to 1 KHz range. The system is nearly flat over its operating range down to 40 Hz and falls off 10 db at 10 Hz.

C. SUPPORTING AUDIO ELECTRONICS

Due to the nature of the plasma transducer, the system must be bi-amped. We intend that the user supply a conventional high quality power amp which covers the bass frequencies only. Interfacing to the user's equipment is accomplished by a separate 4 1/8" by 19" panel mount chassis intended to be placed next to the user's amp and pre-amp. We supply an electronic crossover, a LED display system which allows

optimum choice of 700 Hz or 1000 Hz crossover frequency depending on listening level, an electronic balancing circuit which permits perfect balance of upper and lower frequency units, and all power amplification and plasma control circuits for the upper frequency driver. Our amplifier electronics are all vacuum tube, class A, and are coupled directly to the plasma without use of transformers. The waste power normally associated with class A circuitry is salvaged to create the plasma. Exceptionally heavy filtering is used in our power supplies to maintain quiet operation. A single cable connects each stereo speaker unit to the chassis, which, in addition to carrying the audio signals, provides high-low frequency balancing and also on-off control. Care has been taken to drive both high and low frequencies into appropriately impedance matched cables.

Each speaker unit contains independent power supplies, plasma control circuits and power amplifiers, and a 100 Hz passive crossover to split the subwoofer and low midrange drivers. Adjustments, warning lights, and appropriate meters are housed on a panel hidden behind tinted reflective plexiglas on each unit. No adjustment is needed during normal operation or startup unless signalled by lights which shine through the glass.

D. SUPPORTING GAS FLOW AND CONTROL ELECTRONICS

In order to achieve our performance objectives, it is

necessary to bleed minute quantities of helium into the plasma discharge. (This gas is inert and totally harmless, even in large quantities.) The gas is supplied by a tank housed internally in each speaker unit. These must be refilled or exchanged with full bottles approximately every 300 hours of playing time. The transfer can be accomplished by the user in a few minutes, and local welding supply companies can furnish and deliver the replacement bottles on less than a day's notice. The helium supply cost is 30-40¢ per playing hour. We feel that this inconvenience is reasonable to the serious audiophile in that there is no other way known at this time to approach this new plateau of excellence. All gas flow control as well as plasma control circuits function automatically, and a "LOW TANK" light warns the user that the helium tank must be exchanged. To start the units, the user simply flips the power switch at the electronic interface unit, and all else happens under internal control. Startup time is about one minute.

E. SPECIFICATIONS

Unfortunately, many of the specifications which provide the unique performance characteristics of these units are not standardized. (See section I-B for discussion.) Some of the more readily quantifiable "standard" specifications follow:

Frequency Response: less than 3 db variation from 30 Hz to greater than 20,000 Hz (significant acoustical power

greater than 100 KHz); down only 10 db at 10 Hz.

Harmonic Distortion: less than 1% at 90 db SPL at 10' (3.3 meters) from two units, as measured in a room of average dimensions, 15' x 28'.

Maximum Steady-State Acoustical Power Available: 107 db at 1 meter SPL, single plasma driver (or 107 db at 3.3 meters from two units) as measured in a room 15' x 28'.

Cabinet Dimensions: 57½" high x 24½" wide x 18½" deep, with a separate rack-mount Interface Unit measuring 4 1/8" high x 19" wide.

Required Accessories: high quality, full range pre-amplifier, high quality stereo amplifier for low frequency section (100-200 watts RMS per channel suggested).

Helium Supply: Use standard 9" x 52" 1A gas bottle, nominally 213 cu ft of helium at 70°F. Fresh bottle pressure should be approximately 2000 psig.

## II. SETUP

### A. UNPACKING PROCEDURES

Procedure for the unpacking of the two speakers and interface unit are sent to you through your dealer under separate cover. Included with these instructions is a list of all the items you should receive with the Hill Type 1.

Please do not attempt to unpack the speaker system before reading these procedures.

### B. HELIUM SUPPLY

#### 1. Helium Bottle Acquirement

In order to save shipping expense and difficulties as well as to pass on overhead savings to the consumer, Plasmatronics Speaker Systems are shipped and sold without helium bottles included. You will need to acquire two standard helium "H" bottles from a local welding supply. Normally these may be rented on an indefinite basis for a nominal fee, but do require an initial refundable holding deposit. Once acquired, most supply houses will deliver full bottles for exchange with your empty ones when needed for a minimal delivery fee plus helium cost. Installation is simple as outlined below and most delivery personnel will be happy to aid in handling or installation. Your Plasmatronics dealer should be able to help locate a suitable helium supplier near your neighborhood.

#### 2. Helium Bottle Installation

Installation is perfectly safe as long as precautions

outlined below are rigidly followed. When your helium bottle arrives, unplug the speaker power and audio system and unscrew the wing nuts which support the rear panel (see A on Figure 1). Unscrew and remove the safety cap on the gas bottle just prior to installation. WARNING: Do not turn valve on tank prior to installation and be absolutely sure tank is not knocked over with safety cap removed prior to installation. Slip the bottle into the tank compartment (B in Figure 1) and securely fasten it with the strap indicated as C in Figure 1. Next, screw the regulator assembly into the mating connection on top of the bottle and tighten securely in a clockwise direction with a large crescent wrench as shown in Figure 2. Now and only now, open the valve located on top of the bottle as far as it will go by unscrewing it counterclockwise. Failure to open this valve all the way could result in leakage and premature helium loss.

You may wish to insure that no leakage results from an improperly seated or tightened fitting where the bottle and regulator connect (A in Figure 2). A simple test is to sprinkle a little liquid detergent mixed with water over the connection and look for bubbles. A second test is to re-close the tank valve and watch the regulator gauge to see if gas trapped in the regulator escapes. If a leak is indicated, try tightening. (If the leak still remains, the tank threads may be worn. This situation may be corrected by applying 1½ turns of teflon tape (no more!) to the

SPEAKER BACK

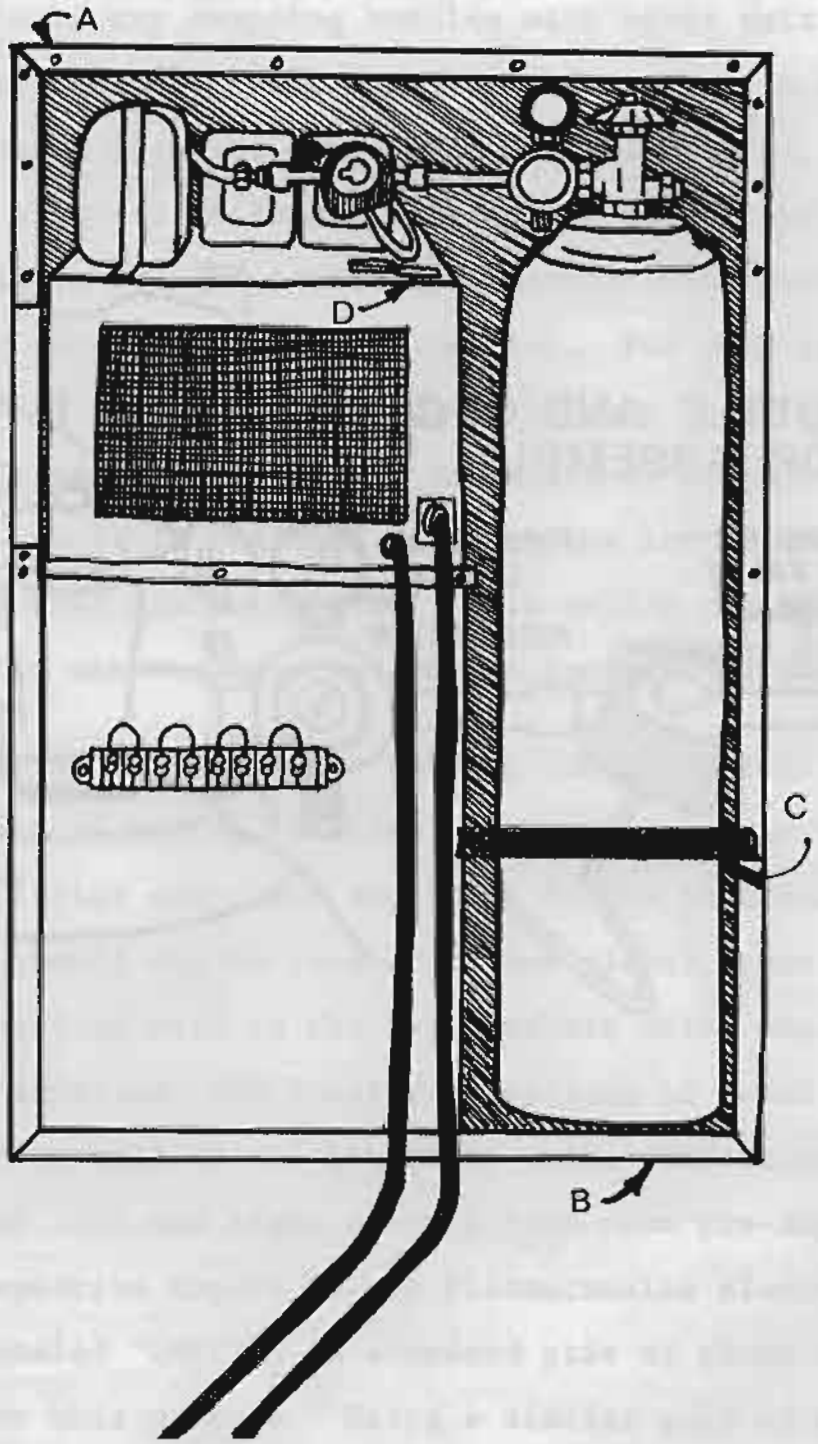



Figure 1

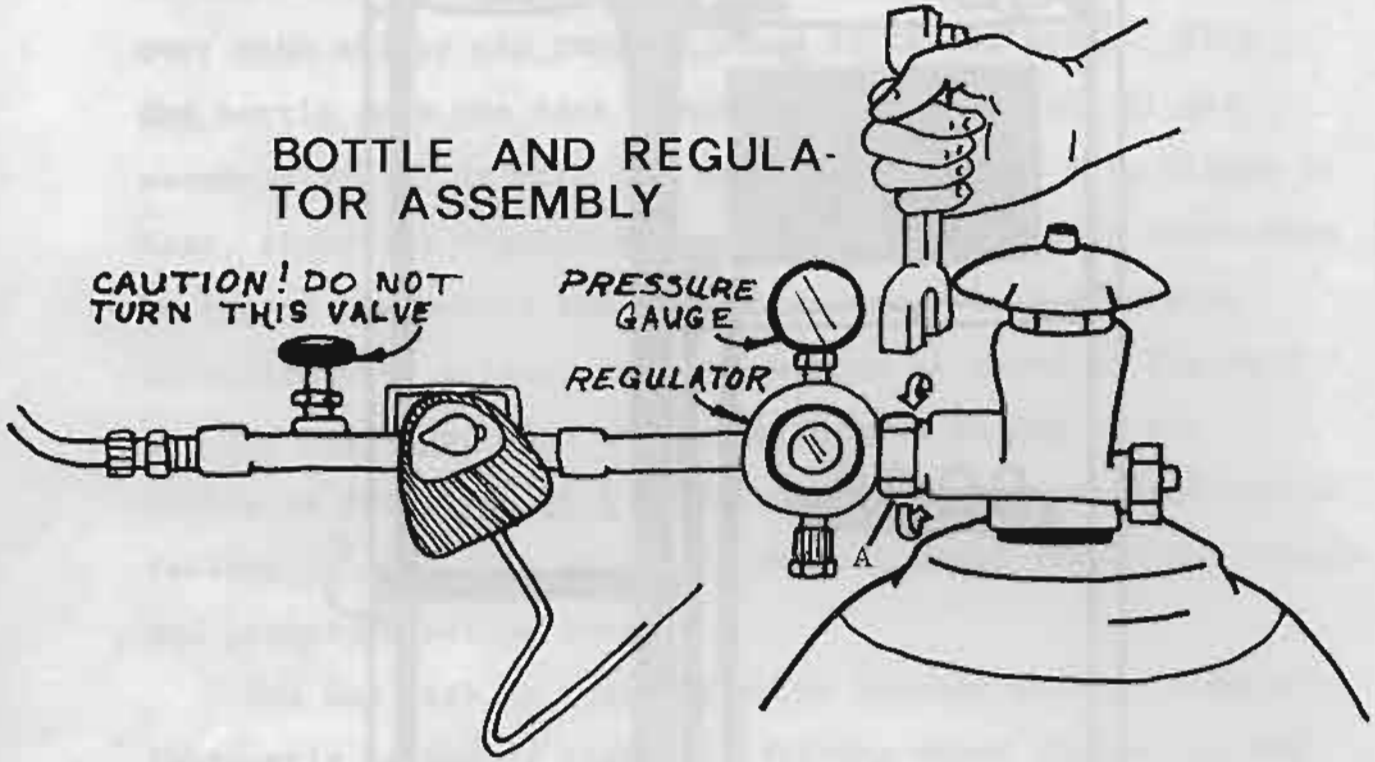

BOTTLE AND REGULA-
TOR ASSEMBLY
CAUTION! DO NOT
TURN THIS VALVE
PRESSURE
GAUGE
REGULATOR
A

Figure 2

threads.) Always completely shut off tank valve before loosening the tank-regulator connection! If the fitting still leaks try swapping bottles with other unit to determine if bottle seat is not damaged. Exchange bottle with supplier if needed. Once the tank is properly installed, apply safety strap (C on Figure 1), replace back cover and secure with wing nuts. Unit will not function with back cover removed due to interlock protection. For your safety, do not defeat this interlock. Do make sure interlock switch (D in Figure 1) is properly depressed by contact with back cover when it is replaced. Repeat the installation procedure on the other stereo speaker. This entire procedure takes but a few minutes once you become familiar with it.

C. INITIAL SYSTEM HOOKUP (NORMAL CONFIGURATION)

Initial hookup consists of connecting your existing pre-amplifier and power amplifier to the interface unit (which should all be located in one place), then connecting the interface unit to the two speakers using the special cables supplied, and finally, supplying AC power to each speaker as well as the interface unit. Referring to Figure 3, hook the left and right outputs from your pre-amplifier to the respective inputs on the Plasmatronics electronic interface unit labeled "INPUT". A standard pair of phono cables are used for this purpose. Using a similar pair of phono cables, hook the left and right connections on the interface labeled "TO BASS AMP" to the respective inputs on your power amp.

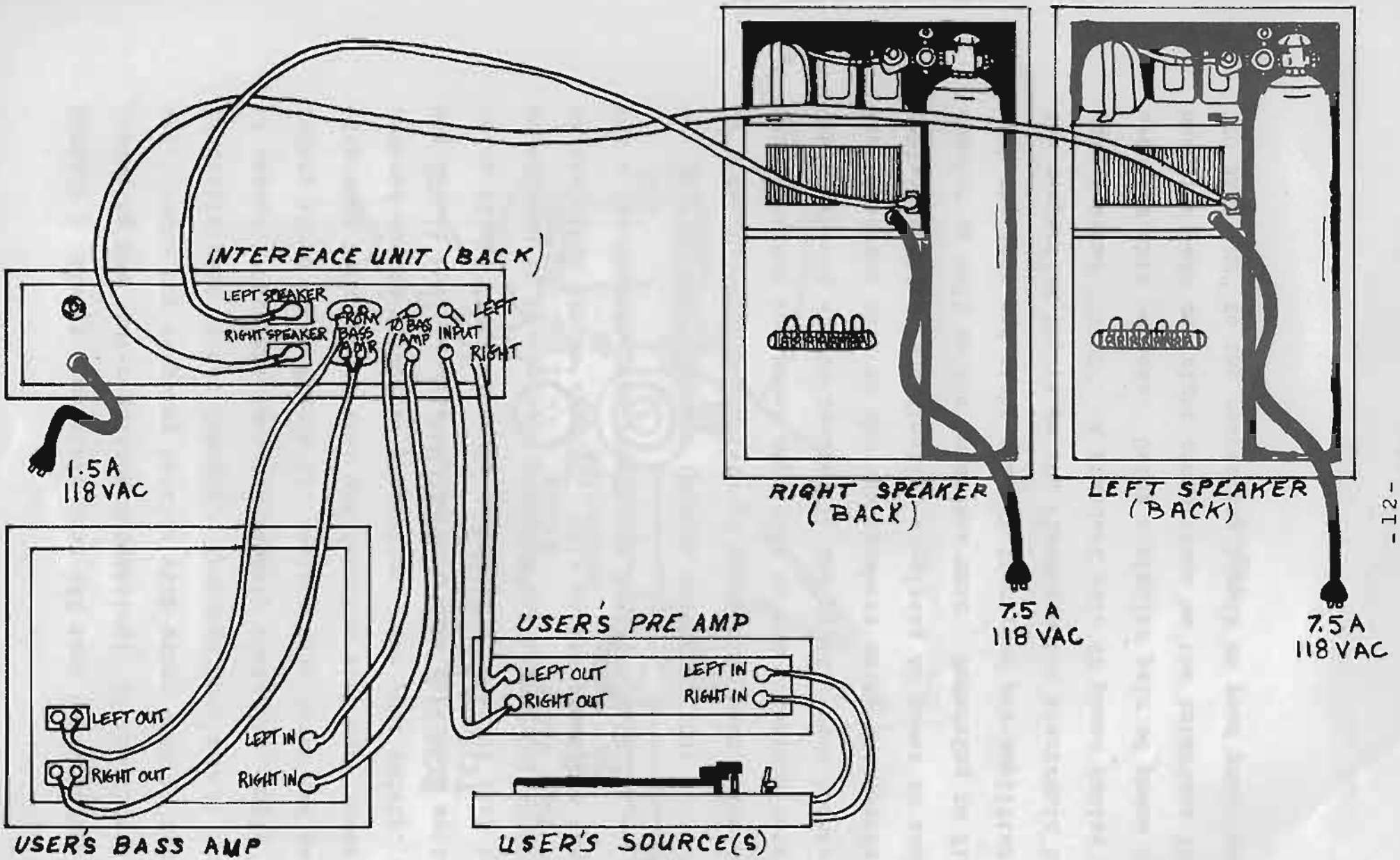



Figure 3

## CONVENTIONAL HOOKUP

Next, using the two dual banana jack plugs, hook the left and right outputs from your power amp to the respective input on the interface unit labeled "FROM BASS AMP". If your power amp offers a range of output impedances use 8 ohms. If you are unable to do so without using your amplifier chassis ground as the low side, refer to the "Special Hookup" section of this manual.

Note that it is possible to short out your amplifier by reversing the polarity of one of these connectors so be sure the terminal with the top marked "Gnd" is grounded (plugged into the black socket in all four connections). Also, note that inadvertent crossing of left to right connections to the power amp will mix left bass with right upper range; so be sure these are consistent.

Finally, connect the left and right speaker units to the correspondingly marked outputs on the interface electronics labeled "LEFT SPEAKER" and "RIGHT SPEAKER". Two special cables with Cannon connectors are provided for this purpose (there is no way to misconnect these except left and right channels may be inadvertently reversed). Do not substitute other audio cables with Cannon connectors for this cable, as this is a specially prepared triaxial cable designed specifically for this device. Other cables similar in appearance do not have the same impedance or wiring scheme.

All that remains is to plug the interface as well as both speaker units into an AC power line. Prior to doing this, be sure the power switch on the interface panel is in the off position. It is recommended that each speaker be plugged

into AC sockets serviced by different circuit breakers, if possible, to avoid overload- especially if your power amp or other high power device is shared with one of the speakers. Startup transients exceed the continuous power consumption so failure to distribute the power load could result in a tripped circuit breaker. Each unit normally draws a maximum current of 7.5 amps.

You will note a terminal strip on the rear of each speaker panel. This is pre-strapped at the factory for a normal set up as described above, as indicated in Figure 1. This should not be changed unless you desire to tri-amp your system or integrate it with additional speakers, or adapt it for use with special amplifiers which cannot share a common ground or use a chassis ground. This procedure is discussed in Section IV of this manual.

WARNING: READ THE FOLLOWING SECTION CAREFULLY BEFORE APPLYING POWER TO YOUR SYSTEM FOR THE FIRST TIME!

## III. SYSTEM OPERATION

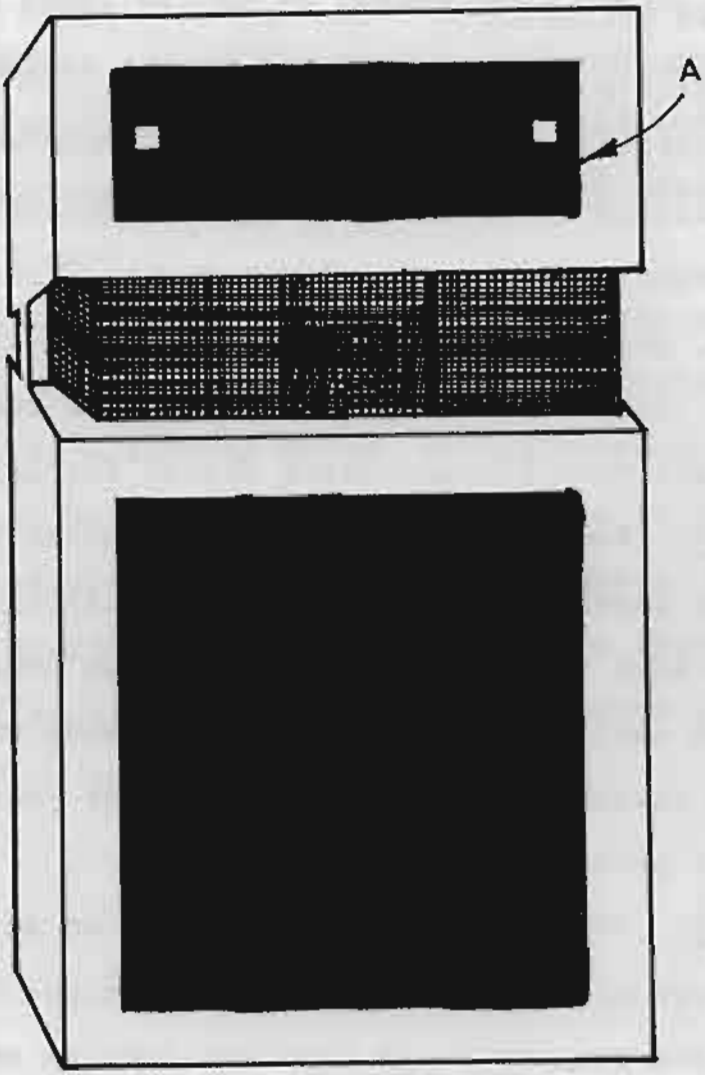
### A. INITIAL TURN ON

Once initial adjustments are made, your speakers start up automatically under internal control and will seldom require further adjustment. However, the first time you turn it on, initial adjustments must be made carefully and correctly. If you have any questions after reading this section, call your Plasmatronics dealer for assistance!

Step 1: Remove the plastic covers which hide the electronics panels of both speakers by lifting up, tilting the bottom edge forward, then sliding down over the bottom edge of the enclosure. The electronic panel which you have exposed is sketched as "A" in Figure 4 for your reference during this procedure.

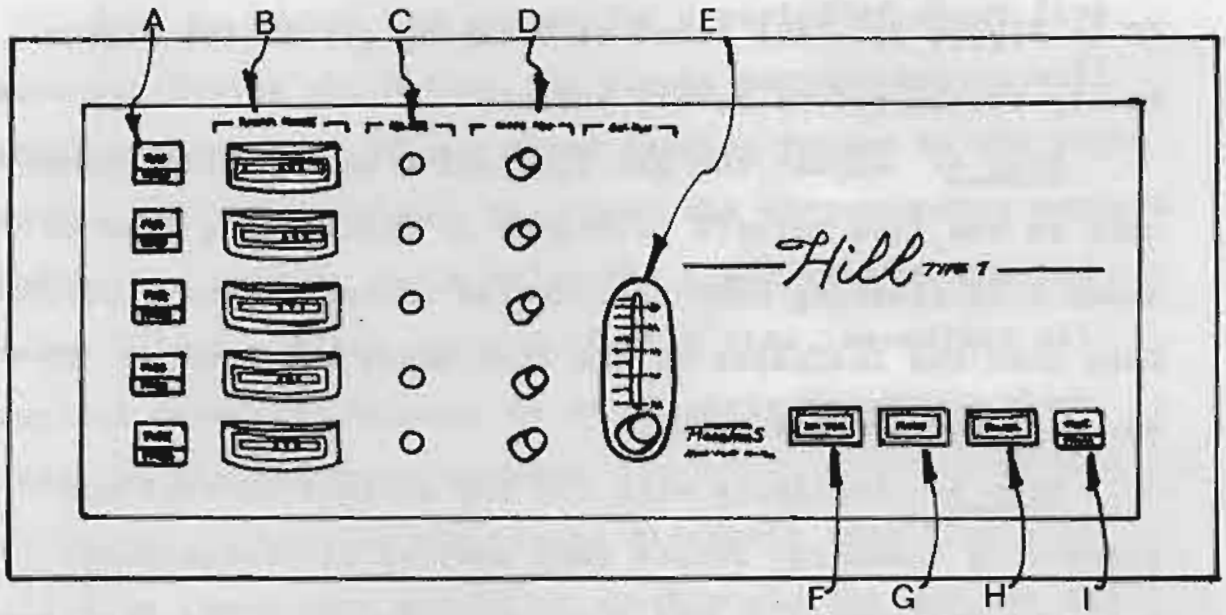
Step 2: Prior to turning the power on at the interface unit, be sure all five plasma current control knobs (D in Figure 5) are rotated fully counterclockwise on both speaker units.

Step 3: Plug the interface unit and only one speaker unit into the AC power line. After making sure the test switch on the interface is in the "OPERATE" position, flip on the power switch to the interface unit. The white "POWER" indicator located to the far right on the speaker electronics




FRONT OF SPEAKER

Figure 4




SPEAKER CONTROL PANEL

Figure 5

panel (H in Figure 5) will light on that unit which has been connected to AC power. The yellow "LOW TANK" indicator (F in Figure 5) should not be lit, indicating that the tank is installed, its valve is open, and that it contains gas. Wait about 30 seconds until the red "PURGE" button lights (G in Figure 5). The sound of escaping gas at the plasma cavity should become barely audible.

Step 4: Adjust the gas flow valve on the front panel unit so the flow meter(E in Figure 5) indicates a flow of about 1.25 (turning counterclockwise increases the flow). Note that the indicator on the flow meter may bounce. If so, read the average value.

Step 5: Beginning with the top current control and proceeding downward, rotate each control clockwise until a slight deflection on the current meter (B in Figure 5) directly to the left of each control is indicated. Continue to raise each control successively by small, equal increments until a jump in each of the current meters indicates that the plasma section it serves has ignited. This will be visible in the plasma chamber. Some erratic flashing on and off of the discharge corresponding to similar fluctuations of the "PURGE" light may be expected during this phase of the adjustment. Continue raising each of the current controls by a small increment until all 5 channels are lit and remain stable. When all five plasma sections have struck, re-adjust the controls until all meters read about the same position,

slightly to the left of the red section on the meters. Some interaction between these controls will occur, so successively finer re-adjustment of all five controls may be needed to achieve this balance. The red "PURGE" light will extinguish when all plasma units are drawing sufficient current.

Step 6: Watch the gauges for a period of about five minutes, during which time the plasma current meters will show an increase. If any meter reading raises to the right of the red meter column, re-adjust the corresponding current control so that it falls below the black line on the red meter column. After about 5 minutes time, re-adjust all current levels to balance on or slightly below the black lines on the red meter columns.

Step 7: Look at the plasma discharge (see Figure 6). All five lower jets should be visibly glowing and the red "PURGE" button should not be lit, indicating that the helium flow has been reduced to its normal operating level. If not all of the five jets are glowing, push the red "PURGE" button to inject additional helium to strike the discharge. The plasma color should be violet at the top and bottom electrodes, fading into a whitish-yellow hue throughout its interior volume. If the violet color extends throughout the discharge volume, then the helium flow can be reduced*.

* At the expense of an increased helium consumption rate, it is permissible to operate helium-rich (so the discharge glows violet throughout). This may be desirable if exceedingly loud listening is anticipated. The upper, maximum consumption should never exceed 2 on the flow meter scale.

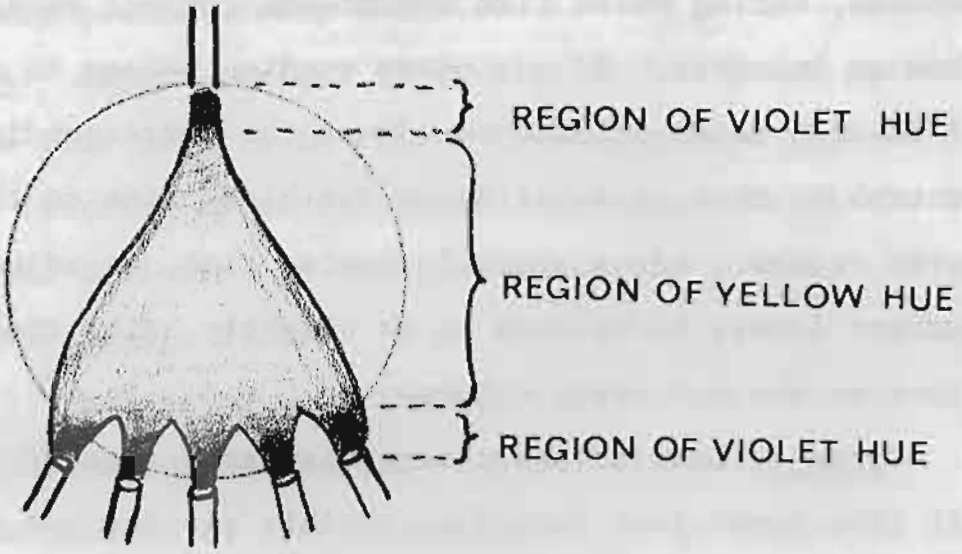



Figure 6

## PLASMA DISCHARGE

If, however, the discharge is unsteady or generates a slight crackling or hissing noise, or if it shows no purple hue near the electrodes, the helium level must be increased by turning the control valve counterclockwise or electrode damage may result. Normal operating range is typically between 1 and 1.25 on your flow scale.

Step 8: Now connect the remaining plasma speaker unit to AC power and repeat the initial current adjustment procedure, Steps 1 through 7 for this unit. The first unit need not be shut down during this procedure, as its helium consumption rate should be stabilized to a normal operating level. You may replace the plastic covers (if you wish) and forget about any further adjustments on these panels unless at some point lights (other than the white "POWER" indicators) become visible through the plastic cover.

Step 9: It is a good idea to re-check the current and gas flow positions on both units after about 20 minutes warm up. Re-adjust as needed. Here after, upon cold start-up, the currents will initially read low and perhaps unbalanced but should stabilize to the correct values in a few minutes so do not immediately re-adjust.

B. OCCASIONAL ADJUSTMENTS

1. High Current Indicators

Five neon bulbs (C in Figure 5), one associated with each current channel will light if, due to line voltage or other changes, the plasma current should become excessive.

These bulbs do glimmer intermittently during the playing of program material, which does not indicate a need for adjustment. If, however, one or more of these light steadily in the absence of an audio signal, then remove the plastic cover and re-adjust the plasma currents as indicated in Step 6. Failure to do so could result in a blown fuse on the front panel (A in Figure 5).

2. Low Tank Indicator

The yellow tank indicator light will become lit when the helium tank is low or its valve is closed. The plasma unit is automatically shut down as a protective measure when this happens. Do not attempt to defeat this interlock, as damage to the electrode structure will result. Refer to Section II-B for instructions on helium installation.

In order to insure against automatic shut-down in the middle of a performance, you may want to check the tank pressure gauges occasionally. These are located near the tank valve and are plainly visible through the back metal grille without having to remove anything. A completely full tank usually reads 2200 psi.

3. "PURGE" Light and Manual Control

The red "PURGE" light indicates when additional bursts of helium are being (or about to be) automatically injected into the plasma unit. This is normal during startup and will occur any time plasma stabilization is needed. Strong air currents in the room or intense plasma modulation during loud passages may require such stabilization. This is normal and

should be ignored. If, however, the red button remains lit more than one minute after turn-on in the absense of intense audio reproduction, it may indicate that the plasma currents have fallen too low, and current re-adjustment should be made as described in Section III-A. Prolonged operation with the red light steadily on will run down your helium tank prematurely. If the plasma of all five channels is not lit or if the plasma appears unstable, the purge may be manually activated by pushing this red button.

The only light which should normally be constantly visible through the plastic panel is the white "POWER" indicator, which signifies that the interface unit is switched on and that power and interface connections are properly made to each unit.

4. High-Low Balance Adjustment

We have provided an electronic means for precisely matching the low and high frequency balance of your bi-amped system, which includes the properties of your existing power amplifier as well as the characteristics of all drivers in the Plasmatronics system. With both plasma units in operation, switch the mode selector to "LEFT" on the interface unit (see A on Figure 7A) and you will hear a loud multi-frequency sound over the left speaker unit. With the left balance control rotated fully counterclockwise, the red LED directly above this control and to the left will be lit. Rotate the control clockwise until this light fades out and the adjacent red LED to the right begins to come on. The

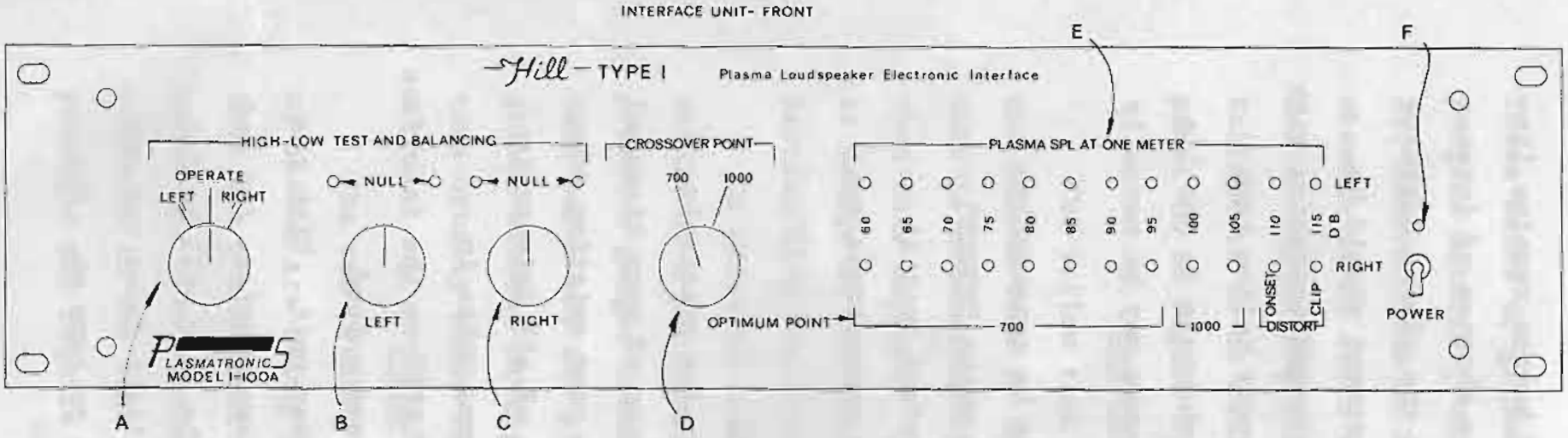



Figure 7A

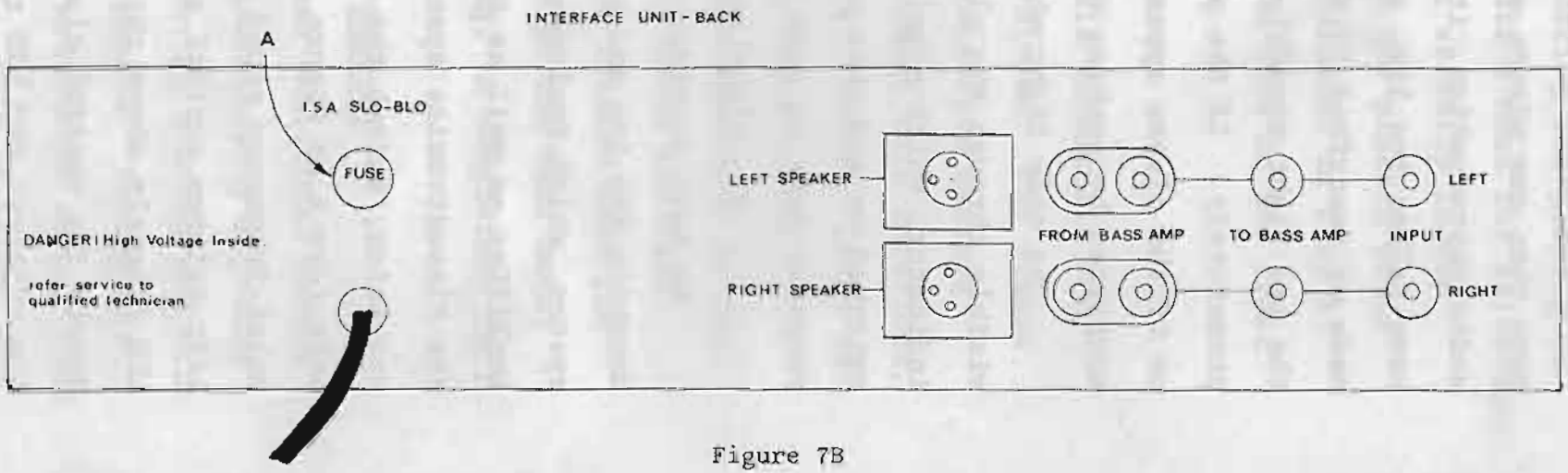



Figure 7B

system is theoretically in balance when both lights are simultaneously off or comparably nulled. Now switch the test selector to the position marked "RIGHT" and repeat the procedure by balancing with the right balance control. Upon completion, return the test selector switch to the "OPERATE" position. These controls can be set to suit the individual listener during program execution, if for room equalization or other reasons you feel that some deviation from the electronically achieved balance is desirable.

C. NORMAL OPERATION

1. Startup and Shutdown

Once the preliminary adjustments described in Section III-A are made, the startup and shutdown procedure is internally controlled. Simply flip the interface unit power switch off. The plasma unit will shut down within about 15 seconds. This also stops the flow of helium to prevent undue waste.

2. LED VU Meter

The LED display on the interface front panel is calibrated to tell you how much actual acoustic power one plasma driver is producing in db SPL at 1 meter. This serves a threefold purpose: 1) it is useful in matching your stereo channels at a desired listening level, 2) it indicates where the crossover point should be set for optimum fidelity, depending on your listening level, and 3) it indicates when listening levels reach objectionable distortion and amplifier clipping limits, as defined by the red LEDs to the right.

### 3. Electronic Crossover

It is desirable to operate the plasma driver over as much of the audio spectrum as is possible without producing significant distortion. However, the low frequency limit set by distortion onset depends on how loud you listen. For this reason we provide a choice of two conventional-to-plasma driver crossover points, 700 Hz and 1000 Hz and recommend that the 700 Hz point be used when peak signal levels do not exceed 100 db SPL or when only green LEDs flash on the LED display. The yellow region which requires the 1000 Hz crossover selection constitutes an abnormally loud listening level in an average size living room! The crossover select control is located immediately to the left of the LED display and is color coded for ease of immediate selection.

### 4. High-Low Balance Controls

Electronic calibration for theoretical balance is covered in Section III-B and we simply repeat here for sake of completeness, that the listeners may wish to vary these controls from the calibrated position to suit their taste during program execution particularly if it is felt that some compensating for room effects is desirable.

## IV. SPECIAL SETUPS

### A. ACCOMMODATION TO AMPLIFIERS WHICH REQUIRE FLOATING GROUNDS

Very rarely a particular bass amplifier may have outputs with local grounds which float above the input ground, or the ground sides of each stereo output must float relative to the other. Occurrence of an output floated from an input is exceedingly rare; we know of only one of these, the Marantz 500. However, there are several cases where the stereo output grounds must remain independent, particularly when two weaker stereo amps are bridged to form a more powerful single stereo unit. Two strapped audio Research D-100 amps are a prime example. Consult your amplifier instruction manual or your dealer if you are not familiar with your bass amp in this regard. If either of these conditions do exist, then make the following connections instead of those outlined in the conventional hookup in Section II-C.

Begin by connecting your preamp to the interface unit, (Figure 8) the interface unit to the input of your bass amp, and the interface unit to each speaker just as outlined in Section II. However, <u>instead</u> of hooking the bass amp back into the interface unit, hook these outputs to the terminal strips provided on the rear of each speaker unit. A high quality, low inductance cable specifically intended as speaker lines is highly recommended for making the following terminal strip connections: first remove the jumpers

# AMPLIFIERS WHICH REQUIRE FLOATING GROUNDS

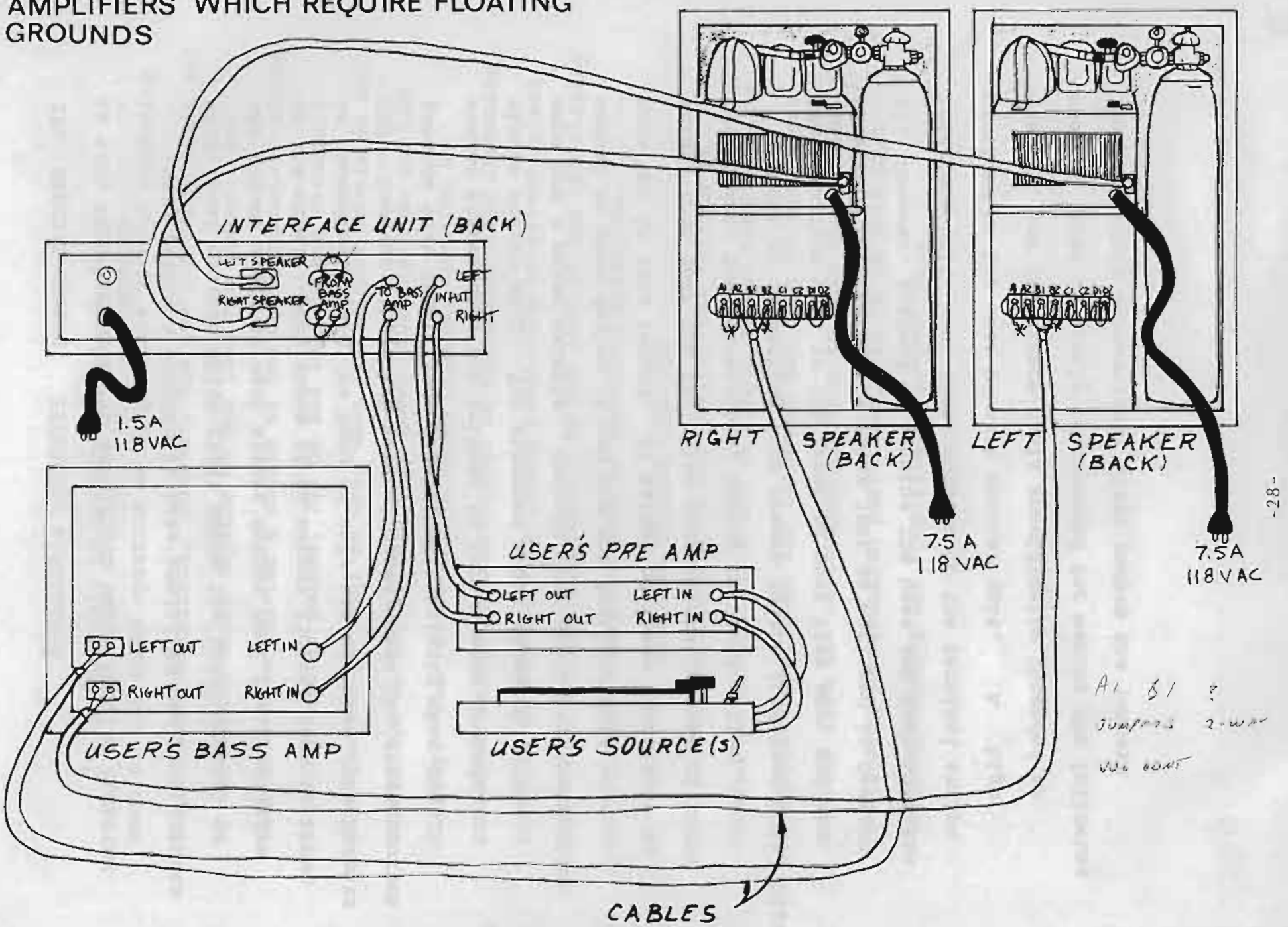


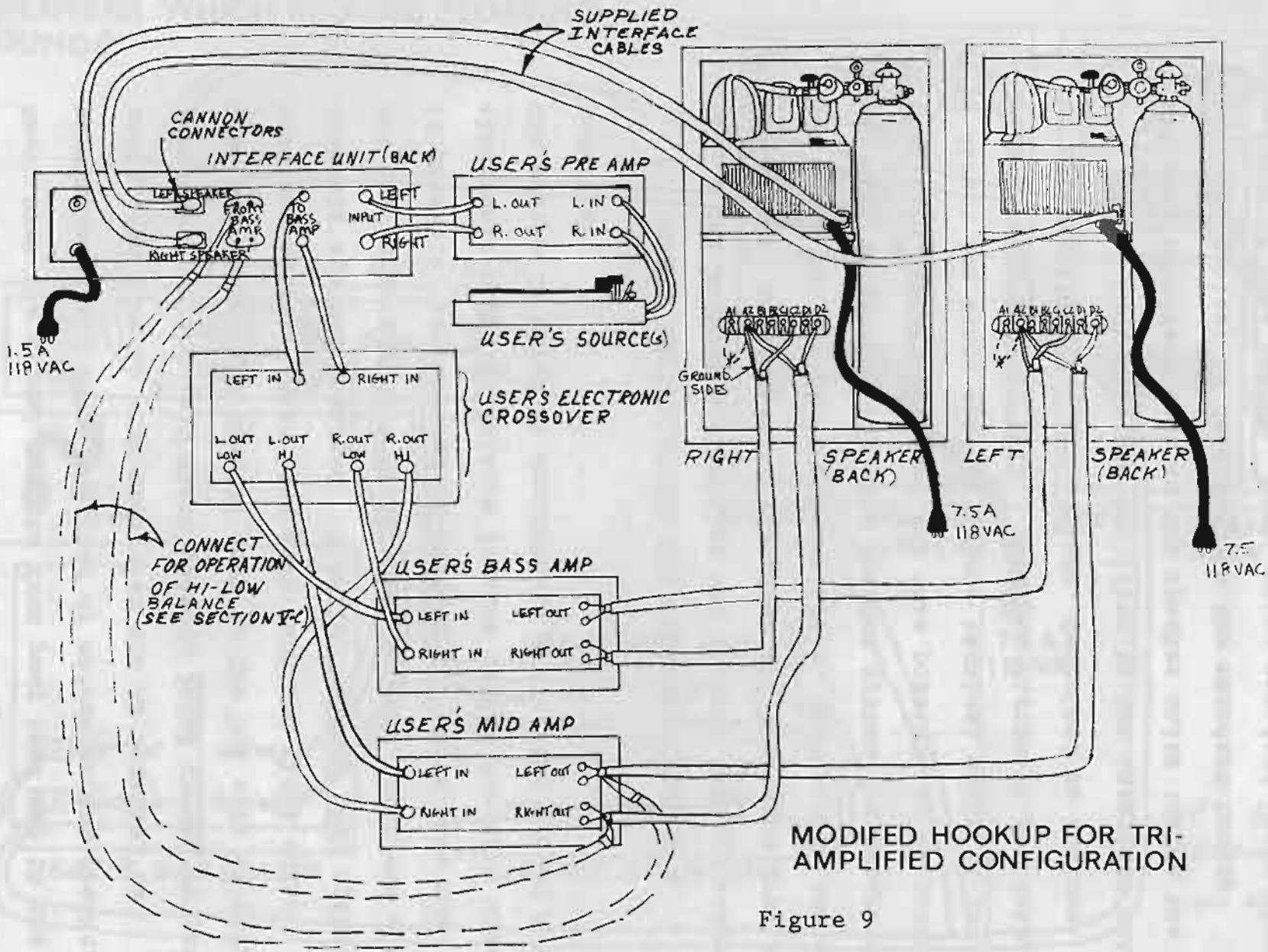

Figure 8

connecting A1 to A2 and B1 to B2 on both speaker units. Next, hook the signal outputs from your bass amp to the terminals A2 and B2 on the rear of corresponding speaker units. Be sure in each case that the A2 terminal is connected to the lead which goes to local ground on your bass amp output and that B2 goes to the hot side of your bass amp output. Also make sure left and right audio channels are not reversed. Finally, connect both speakers and the interface unit to AC power sources (separate outlets if possible) as outlined in Section II. Note that the electronic high-low balance feature cannot function when the system is wired to accommodate a floating ground A amplifier.

B. HOOKUP MODIFICATIONS FOR TRI-AMPLIFICATION

A few serious audiophiles who already own two stereo amplifiers, an electronic crossover which crosses over at (or close to) 100 Hz, a pre-amplifier, and audio cables, may wish to tri-amplify this speaker system for ultimate results. We have arranged for this possibility by providing a direct low range speaker access terminal strip at the rear of each speaker unit. Refer to Figure 9 for details of tri-amplification connections, described as follows:

First, hook your pre-amplifier to the interface unit and your interface unit to the speaker units (using the provided cables) as described in the standard hookup section of this manual. Next, using standard phono plug




MODIFED HOOKUP FOR TRI-AMPLIFIED CONFIGURATION

Figure 9

stereo connectors, hook the left and right outputs on the interface unit labeled "TO BASS AMP" to the corresponding inputs of your 100 Hz electronic crossover (a 12 db/octave slope crossover is recommended).

You must now select which of your amplifiers is best suited as a bass amp (below 100 Hz only) and which is best suited for low mid-range operation (from 100 to 700 Hz). In general, your higher power, highest damping factor amplifier (preferable a DC coupled transistor amp) should be used for the sub-woofer. A high quality vacuum tube amp such as (but not limited to) the Audio Research D75 would be an excellent choice for your low mid-range driver. Having made this choice, connect the left and right low frequency outputs to the corresponding inputs of your designated bass amp, and likewise, connect the left and right higher frequency outputs from your electronic crossover to the corresponding inputs of your designated low mid-range amp. Since this setup is an ultimate "cost at no issue" approach, you will want to avoid compromise by using four audio cables (or other specially designed low inductance speaker cables) for your bass and mid-amp speaker connections.

Disconnect all jumpers from the terminal strips on the rear of both speaker units. Now connect the left bass amp output to terminals A2 and C2 on the left speaker and the left mid-amp to terminals A2 and D2 on the left speaker.

Likewise, connect the right bass amp output to terminals A2 and C2 on the right speaker. If your amplifiers have multiple taps, use 8 ohms. Also note that the polarities indicated on the terminal strips in Figure 9 assume neither amplifier shifts the signal phase. That is, if there is no amplifier phase shift then the grounded sides of your amplifier goes to the A2 terminals in all cases.

Your HIGH-LOW balance indicators (B and C, Figure 5 ) will not be operational with this particular circuit hookup. They may, however, be reinstalled by connecting the output of your mid-amp back to the inputs on the rear of the interface units marked "FROM BASS AMP", unless your mid-amp has a floating output as discussed in Figure 8 in Section IV-A. If so, then do not make this connection, as operation of the balance indicator is no longer possible.

C. HOOKUP TO ACCOMMODATE ADDITIONAL, EXTERNAL SPEAKERS

We feel the integrated system as offered cannot normally be improved and would be exceedingly difficult to match by use of additional conventional drivers. However, such improvement may be possible under one of several circumstances: a) access to considerable further financial expenditure is available coupled with uncommon technical knowledge, or b) the acoustical environment is quite extraordinary. If the situation is such, extra drivers may be accomodated by accessing them directly from the output of the users mid and bass amp shown in Figure 9, in lieu of making the connections to the terminal strips, as shown. Alternately, the terminal

strips may be connected as shown in Figure 9 in addition to hooking up external drivers, if both internal drivers are desired simultaneously. In the latter case, amplifier impedance selection should account for the use of multiple drivers (the impedance of low and mid-range internal drivers is 8 ohms).

Multiple external drivers may also be accommodated in the bi-amped mode, using the passive low frequency crossover contained within the speaker woofer enclosure and the electronic crossover contained within the interface box. Simply hookup the entire system for normal operation as discussed in Section II-C and shown in Figure 3 of this manual. Next, run a speaker cable from terminals A1 and C1 on the rear of your left Plasmatronics speaker unit to your left external low-midrange driver. Now repeat the same operation for the right hand side of your speaker system.

If you wish both an internal and external low range drivers to operate simultaneously, leave the original bridges from A1-A2, B1-B2, C1-C2 and D1-D2 in place on both units and use a 4 ohm output from your power amplifier instead of 8 ohm. If you wish to kill the internal Plasmatronics mid-range, remove the D1-D2 jumpers on each unit. If you wish to kill the internal Plasmatronics sub-woofers, remove the C1-C2 jumpers on both units. Finally, check to be sure that all phasing on your external drivers matches the internal Plasmatronics units!

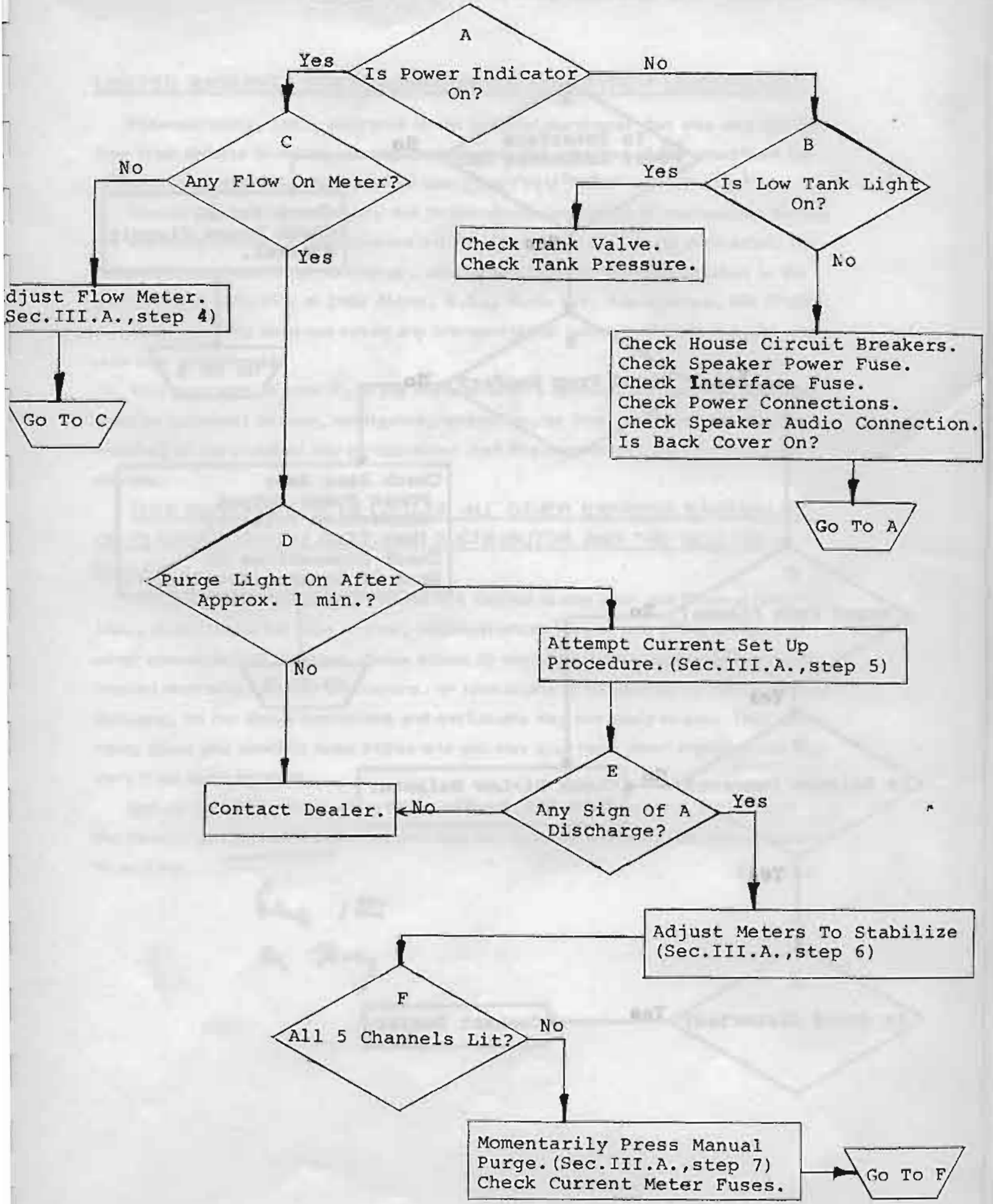
## VI. TROUBLESHOOTING

### A. EXPLANATION OF FLOW CHARTS

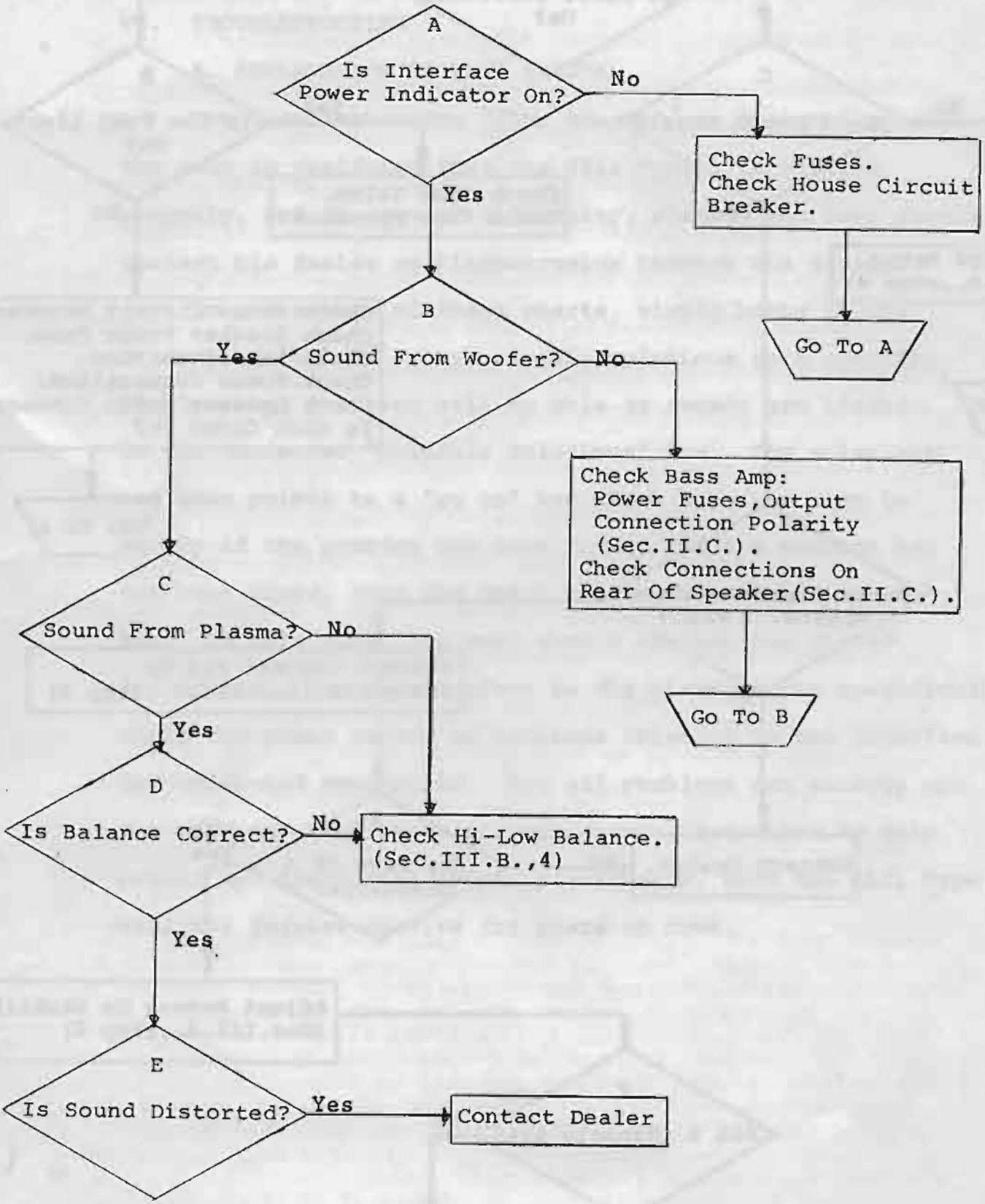
The troubleshooting "flow charts" are designed to aid the user in verifying that the Hill Type 1 is working properly, and in case of difficulty, whether the user should contact his dealer or Plasmatronics through his dealer.

To use either of these charts, simply begin at the diamond labeled "A". Any possible solutions to a specific problem that the user will be able to remedy are listed in the connected "possible solutions" box. The solutions box then points to a "go to" box which asks the user to verify if the problem has been fixed. If the problem has not been fixed, then the chart will return to the "go to" box. In this case, the user should contact the dealer for advice. One chart refers to the plasma units specifically while the other refers to problems relating to the interface and connected components. Not all problems are serious and the user may find that, through careful attention to this manual and making the proper adjustments, that the Hill Type 1 will not require service for years to come.

B. Flow Chart for Plasma Driver



C. Flow Chart for Related Electronics



LIMITED WARRANTY FOR PLASMATRONICS HILL TYPE-1 LOUDSPEAKER

Plasmatronics, Inc., warrants to the original purchaser that this unit will be free from defects in materials and workmanship for a period of ~~one~~ 3-5 years from the original purchase date under normal use. (See registration warranty)

Should service be necessary due to manufacturing defect or malfunction during the warranty period, Plasmatronics will repair or replace, at its discretion, the defective merchandise at no charge, upon prepaid delivery of this product to the manufacturer's facility at 2460 Alamo, S.E., Suite 101, Albuquerque, NM 87106.

This warranty does not cover any transportation costs, nor does it cover vacuum tube components.

This warranty is void if, in the manufacturer's opinion, the unit has been damaged by accident, misuse, negligence, alteration, or fire, or if the unit has been modified or serviced by any person other than Plasmatronics, Inc. factory technicians.

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES OF PLASMATRONICS, INC., THE DISTRIBUTOR AND THE SELLING DEALER.

Any applicable implied warranties are limited to one year and Plasmatronics, Inc., is not liable for loss of time, inconvenience, loss of use of the product or other consequential damages. Some states do not allow limitations on how long an implied warranty lasts or exclusions, or limitations of incidential or consequential damages, so the above limitations and exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which may vary from state to state.

Before returning this unit to Plasmatronics, Inc., for service, please call the factory at (505) 843-9430. No unit may be returned without prior authorization in writing.

135 lbs

Gene 1st
or Tony