SEC–800

SPECTRAL ENERGY COMPRESSOR

INSTALLATION AND OPERATION MANUAL

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SEC-800

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INSTALLATION AND OPERATION MANUAL

Manufactured under one or more of the following U.S. patents:

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PROPRIETARY NOTICE

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SECTION 1 - GENERAL

1.1 SAFETY INFORMATION

1.1.1 DEFINITIONS OF SAFETY SYMBOLS

****
WARNING
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THE WARNING SIGN DENOTES A HAZARD. IT CALLS ATTENTION TO A PROCEDURE, PRACTICE, CONDITION, OR THE LIKE, WHICH, IF NOT CORRECTLY PERFORMED OR ADHERED TO, COULD RESULT IN DAMAGE TO THE UNIT.

CAUTION: **The CAUTION sign denotes a precaution. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in the unit not performing properly.**

NOTE: The NOTE sign denotes important information. It calls attention to procedure, practice, condition, or the like which is necessary to highlight.

1.1.2 IMPORTANT SAFEGUARDS

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings in this manual violates safety standards of design, manufacture, and intended use of this equipment. Circuit Research Labs Inc. assumes no liability for the customer's failure to comply with these requirements.

READ ALL INSTRUCTIONS. All safety and operating instructions should be read before the equipment is operated.

GROUND AND POWER CONNECTIONS. To minimize shock hazard, this equipment must be connected to an electrical ground. Grounding is accomplished by proper use of the three-conductor AC power cable supplied with the equipment. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground at the power outlet. This equipment must only be operated from the type of AC line power source specified. See Section 2.3 for power line AC voltage selection.

TRANSIENT VOLTAGE PROTECTION. In areas where power fluctuations and voltage spikes are present on the AC power line additional protection may be necessary.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE. Do not operate this equipment in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

WATER AND MOISTURE. Do not operate this equipment near water or in areas with wet floors. Do not operate this equipment in high humidity atmosphere where condensation forms on the equipment.

ATTACHMENTS. Do not use attachments not recommended by the manufacturer.

VENTILATION. This equipment should never be placed near or over a heat register or other source of heated air. This equipment should not be placed in a built in installation or rack unless proper ventilation is provided.

PARTS REPLACEMENT AND/OR MODIFICATION. The maintenance instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in this manual. Do not replace components with the power cable connected. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to this equipment.

1.2 INTRODUCTION

FEATURES

- Programmable 3 dB Gain Reduction Steps
- Programmable Attack/Release Time Ranges
- Switchable AGC Gating Threshold
- Switchable Processing Configuration Capability:
  - Wideband or Multiband Action
  - Limit or Compress Mode
- Adjustable four Channel Output Equalization Capability
- 20 dB Range, 10 Segment Audio Input Indicators

Circuit Research Labs has developed a multiband dynamic range controller for stereophonic applications. The SEC-800 is intended to give the user precise dynamic control and equalization of 'ON AIR' or other selected program material.

The SEC-800 incorporates exclusive CRL patented gain reduction elements and voltage controlled output VCA's. The VCA's provide absolute gain/phase tracking of the stereophonic output signals during equalizing adjustments.

The SEC-800 also has several unique control features which gives the unit more flexibility and power than has ever been possible with other multiband audio processors. These features include the compress/limit and the multi/wide band selection switches. Selectable bass boost high pass filters help improve bass clarity and punch while at the same time removing sub-sonic program content.

Designed with STEREO in mind, the SEC-800 has unique control circuits which maintain absolute stereo imaging. These control circuits enable the SEC-800 to achieve greater stereo loudness without sounding as processed. This difference is evident when placing the SEC on the air.

To aid the user in properly setting the audio level into the unit, each channel has a separate 10 segment peak-reading LED input level meter with a range from -20 to +2 dB. A red overload LED is also provided as one segment of the indicator.

Audio interfacing is done through the use of a barrier connector strip on the back panel. Inputs and outputs are active-balanced and fed through second-order RFI suppression filters.

The SEC accepts either 115 or 230 volts AC (selectable by programming the back panel power module), 48-440 Hz. The unit is housed in a steel enclosure for maximum RFI immunity and conforms to a standard 1 3/4" rack height measurement. A rack slide mount is available as an option.

1.3 WARRANTY

PRODUCT WARRANTY

Circuit Research Labs, Incorporated warrants its products to be free of defects in materials and/or workmanship. This warranty shall extend for a period of (1) year from the date the product was originally shipped to the user.

Circuit Research Labs' warranty does not apply to products that have been damaged due to and/or subjected to improper handling by shipping companies, negligence, accidents, improper use, or alterations not authorized by Circuit Research Labs, Incorporated.

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. CIRCUIT RESEARCH LABS, INCORPORATED WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGE WHATSOEVER, WHETHER BASED UPON ALLEGATIONS OF NEGLIGENCE, BREACH OF WARRANTY, OR OTHERWISE. THIS DISCLAIMER OF INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDES, BUT IS NOT LIMITED TO, PROPERTY DAMAGES, LOSS OF PROFITS, LOSS OF TIME OR OTHER LOSSES OR INCONVENIENCE RESULTING FROM ANY DEFECT IN THE MATERIAL OR WORKMANSHIP OF THIS PRODUCT OR ANY OTHER CONNECTION WITH THE PURCHASE, OPERATION OR USE OF THIS PRODUCT. (SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU).

PRODUCT CHANGES

Circuit Research Labs Inc. reserves the right to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications. While many previously sold products are later upgraded by field bulletins, Circuit Research Labs Inc. reserves the right to do so without incurring any liability or obligations to modify or update any equipment previously sold.

1.4 SEC-800 SPECIFICATIONS

ELECTRICAL
(All ***OUTPUT EQUALIZERS*** set to ***FLAT***, 12 o'clock, unless specified)

FREQUENCY RESPONSE:	+.1 to -.6 dB proof, at 9 dB G/R (***BAND*** switch in ***MULTI*** position), 50 Hz to 15 kHz, +4 dBm output level
HARMONIC DISTORTION:	<0.25% proof, <0.6% operate (<0.25% typical) at 9 dB G/R (***BAND*** switch in ***MULTI*** position), 100 Hz to 15 kHz, +4 dBm output level
IM DISTORTION:	<0.08% proof, <0.35% operate (<0.3% typical) at 9 dB G/R (***BAND*** switch in ***MULTI*** position), SMPTE method, 4:1 ratio
S + N/N:	>75 dB proof, >70 dB operate (>75 dB typical) measured from threshold of G/R, +10 dBm input output level
STEREO SEPARATION:	>55 dB proof, >45 dB operate (>50 dB typical) at 9 dB G/R (***BAND*** switch in ***MULTI*** position), 50 Hz to 10 kHz
GAIN REDUCTION RANGE:	>30 dB, 50 Hz to 15 kHz
COMPRESSION RATIO:	2.6:1 typical above 9 dB G/R
GAIN REDUCTION METHOD:	4 band VCR alignment free design followed by 4 output control VCA's. ***BAND*** switch allows individual selection of ***WIDE*** band only or ***MULTI*** band.
STEREO TRACKING:	Each channel of wideband AGC within 0.2 dB of control channel over a 30 dB G/R range
GATE FUNCTION:	Locks gain reduction at 10 or 20 dB (switch selectable) below G/R threshold to prevent amplification of noise floor.
TIME CONSTANTS:	Program dependent attack; switch selectable release action ***S*** (Slow), ***M*** (Medium), ***F*** (Fast)
G/R ELEMENTS:	Voltage Controlled Resistor (patented by CRL)
CROSSOVER FREQUENCY:	200 Hz, 1 kHz, and 5 kHz with 6 dB/octave filters

GENERAL

INPUT
(Ref. 0 dBm = 0.775 VRMS
into 600 ohms)

TYPE:	Active balanced (differential)
IMPEDENCE:	>600 ohms balanced terminated >10K ohms unbalanced bridging
TERMINATION:	600 or 10K ohms (selectable)
LEVEL:	-30 dBm to +20 dBm referenced to input G/R threshold

OUTPUT

TYPE:	Active balanced (transformerless)
IMPEDENCE:	<200 ohms balanced (designed to drive 600 ohm load)
LEVEL (maximum):	+18 dBm into 600 ohms @ 400 Hz

METERING:	Two channel relative input level LED-type meters with 22 dB (28 dB with OVLD) of dynamic range in ten steps
OPERATING TEMP. RANGE:	32 to 122 degrees F (0 to 50 degrees C)
POWER REQUIREMENTS:	100-130 or 200-250 VAC, 48-440 Hz, 20 VA max. EMI suppressed, IEC connector standard
OPERATING HUMIDITY:	0-95% RH, non condensing
OPERATING ALTITUDE:	0-15,000 feet AMSL
SHIPPING WEIGHT:	18 lbs. (including standard accessories)
DIMENSIONS:	19" (48.3 cm) W, 1.75" (4.5 cm) H, 16" (40.6 cm) D, including protruding controls and connectors.

Product specifications are subject to change without notice because of technology updates and product improvements.

SECTION 2 - INSTALLATION

2.1 GENERAL

The front panel of the SEC-800 is pictured in Figure 2-1 and the back panel is pictured in Figure 2-2.

****
WARNING
****

DO NOT PLUG IN THIS UNIT UNTIL THE POWER LINE MODULE HAS BEEN CHECKED AND/OR SET FOR THE CORRECT AC POWER LINE VOLTAGE AS PER SECTION 2.3. IT IS IMPORTANT TO CAREFULLY FOLLOW THE PROCEDURES LISTED BELOW IN SECTION 2.2 BEFORE POWER-UP OF THIS UNIT.

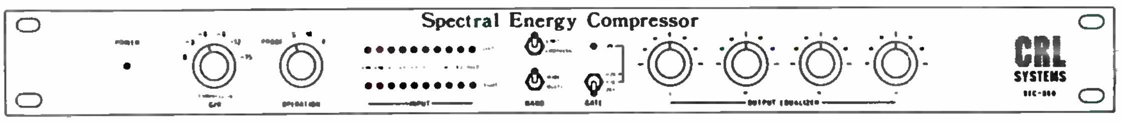


FIGURE 2-1 SEC-800 FRONT PANEL

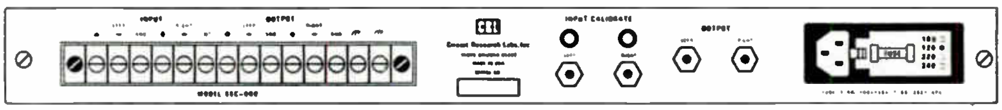


FIGURE 2-2 SEC-800 BACK PANEL

2.2 BEFORE POWER-UP

1. Set the power line module as per Section 2.3

2. Set the internal jumpers as required for the intended system application as per Section 2.4.

3. Connect the unit as per Section 2.6.

4. Set the switches and controls to the initial settings listed in Section 2.7.

2.3 POWER LINE AC VOLTAGE SELECTION

The SEC-800 is equipped with a power line module on the back panel with an integral line voltage PCB selector so that the unit can be operated in areas having various line voltage availabilities. The unit is shipped to USA destinations set-up for a line voltage of 115/120 VAC, using a 1/4 ampere, slow-blow type fuse. To set-up the unit for a different line voltage see Figure 2.3 and follow the procedure below.

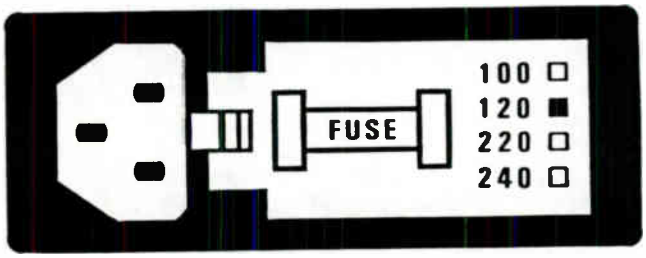


FIGURE 2-3 LINE VOLTAGE SELECTION

Note: The power line module used may vary from the one shown above.

1. Disconnect the power cord from the module. Open the compartment containing the fuse and the PCB voltage selector by pushing in on the raised lever adjacent to the power plug receptacle.

2. Remove the PCB voltage selector and position it so that the red line on the edge of the PCB corresponds to the opening in the cover opposite the legend for the desired line voltage.

3. Insert the PCB voltage selector firmly into the module slot.

4. Remove the fuse from the fuse holder on the back of the compartment cover. Select a fuse as listed below and insert the fuse in the fuse holder.

100 to 130 VAC operation	1/4 ampere, slow-blow type
200 to 250 VAC operation	1/8 ampere, slow-blow type

NOTE: Operation of the unit on 200-250 VAC will require replacement of the plug that is used to connect the unit to the AC line.

5. Close the compartment cover and insert the line cord into the receptacle on the module.

2.4 INTERNAL JUMPERS

The SEC is equipped with internal jumpers to configure the unit to individual operational requirements. Set the jumpers as applicable for the individual station requirements. (DO NOT adjust potentiometers R3, R4, R20, R97, R148, R201, and R264 on the PCB at this time. See Section 5.2 for making these adjustments).

JUMPER	FACTORY SET POSITION	FUNCTION OF JUMPER
J1	IN	+15 V DISCONNECT JUMPER. The positive DC power connection between the power supply and the circuitry is broken when this jumper is moved to the ***OUT*** position.
J2	IN	-15 V DISCONNECT JUMPER. The negative DC power connection between the power supply and the circuitry is broken when this jumper is moved to the ***OUT*** position.

CAUTION: The following jumpers (J3, J4, J5, & J6) must be in the same relative position, i.e., they must all be in either the low, medium, or the high position.

JUMPER	FACTORY SET POSITION	FUNCTION OF JUMPER
J3 J4	L (Low) L (Low)	INPUT GAIN L JUMPER. Left Input sensitivity range. LOW: +15 to 0 dBm MED: +5 to -15 dBm HIGH: -10 to -30 dBm Referenced to threshold of gain reduction
J5 J6	L (Low) L (Low)	INPUT GAIN R JUMPER. Right Input sensitivity range. LOW: +15 to 0 dBm MED: +5 to -15 dBm HIGH: -10 to -30 dBm Referenced to threshold of gain reduction
J7	IN	BASS BOOST JUMPER, LEFT. The ***IN*** position activates a LF boost network and high pass filter which significantly removes frequen-cies below 50 Hz (see Figure 4-1).
J8	IN	BASS BOOST JUMPER, RIGHT. The ***IN*** position activates a LF boost network and high pass filter which significantly removes frequen-cies below 50 Hz (see Figure 4-1).

J17	STEREO	STEREO/MONO OPERATION JUMPER. In the ***MONO*** position the inputs to the left and right channel processing circuits are connected together for mono operation. When using this mode, the input signal must be applied to the left channel input.

2.5 PCB LED INDICATORS

POWER SUPPLY PCB INDICATORS

Apply AC Line power to the unit and verify that the power supply voltages are present. The voltages are present when DS1 and DS2, the red LED's on the main PCB, as listed below, are illuminated. IF DS1 and/or DS2 ARE NOT illuminated go to Section 5.3, TROUBLESHOOTING.

LED	VOLTAGE	COMMENTS
DS1	+15 VDC +/- 50 mVDC	Variable adjust with R3 (See Section 5.2)
DS2	-15 VDC +/- 50 mVDC	Variable adjust with R4 (See Section 5.2)

ATTACK/RELEASE TIME CONSTANT LED RANGE INDICATORS

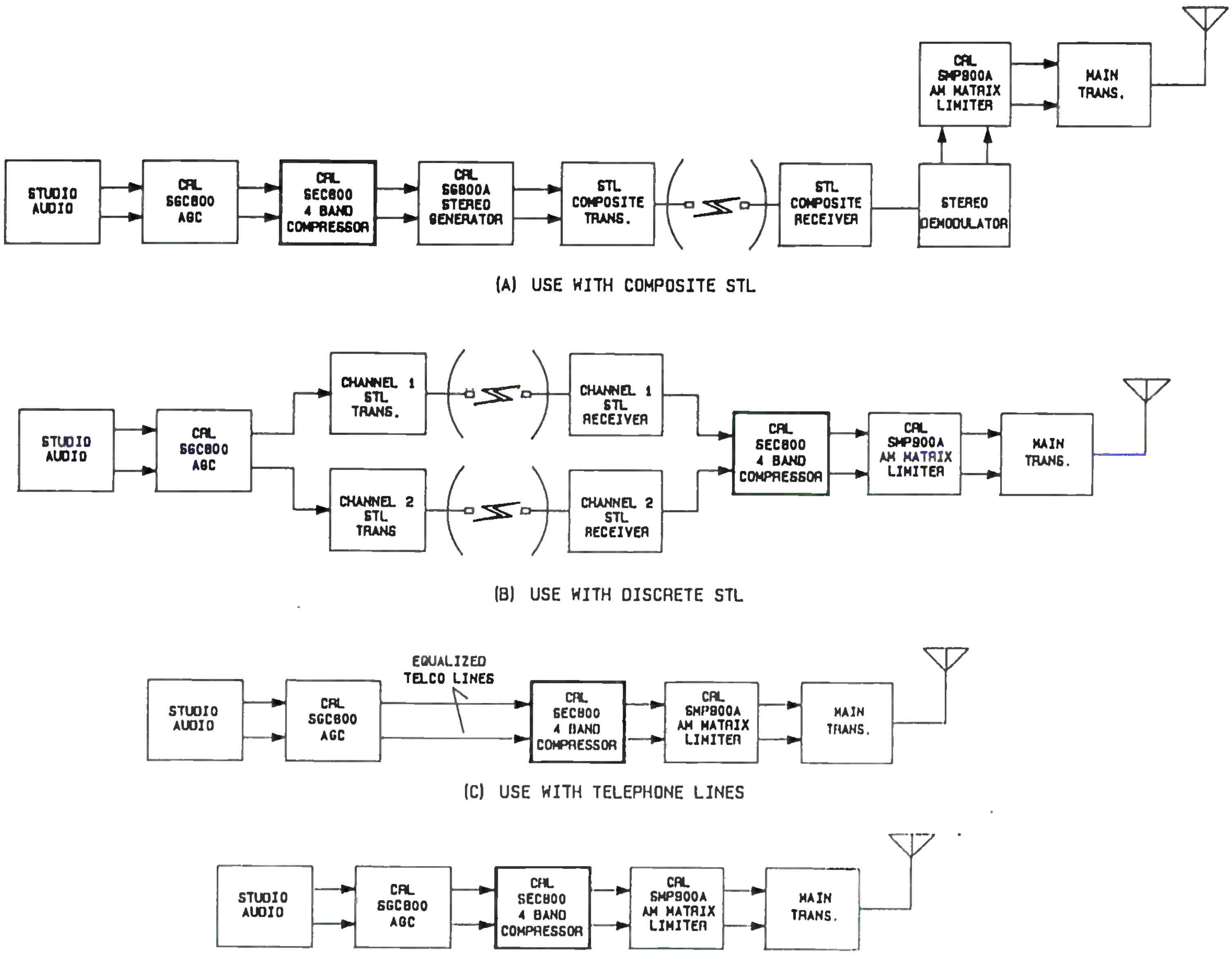
LED	DESCRIPTION
DS3	ATTACK/RELEASE TIME CONSTANT RANGE, MEDIUM. This LED is illuminated when the ***MED.*** range is selected by the front panel ***OPERATION*** switch.
DS4	ATTACK/RELEASE TIME CONSTANT RANGE, FAST. This LED is illuminated when the ***FAST*** range is selected by the front panel ***OPERATION*** switch.

NOTE: Both LEDs (DS3 and DS4) will not be illuminated when the front panel ***OPERATION*** switch is in the ***SLOW*** position.

2.6 INTERCONNECTIONS

2.6.1 GENERAL

The SEC-800 is designed to interface with many types of broadcast equipment. See Figure 2.4 for some typical applications for this unit within the overall system. This unit may be wired for either balanced or unbalanced operation.



(A) USE WITH COMPOSITE STL

(B) USE WITH DISCRETE STL

(C) USE WITH TELEPHONE LINES

(C) CO-LOCATED STUDIO/TRANSMITTER SITE

FIGURE 2-4 TYPICAL SYSTEM CONFIGURATIONS (AM STEREO)

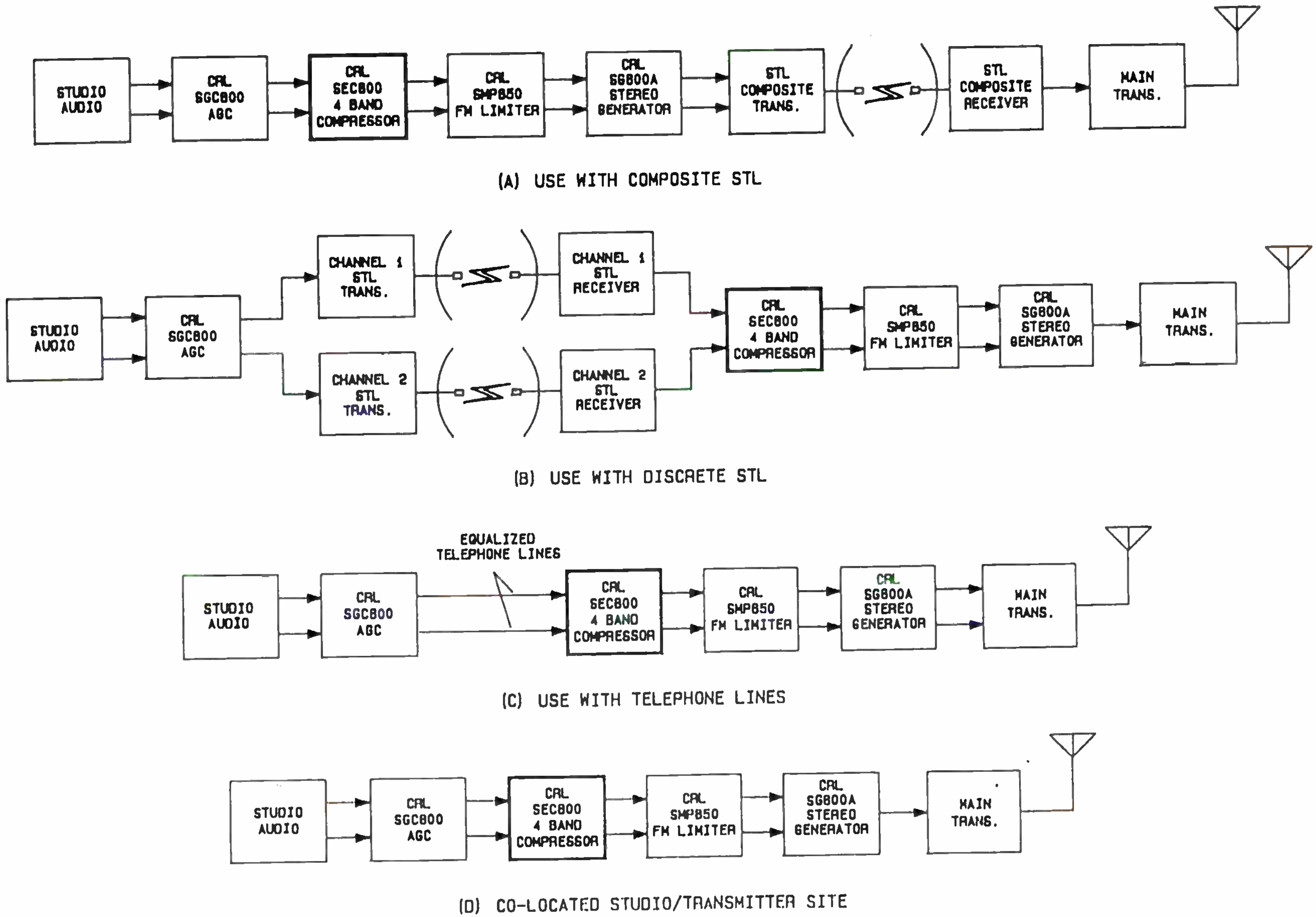


FIGURE 2-4 TYPICAL SYSTEM CONFIGURATIONS (FM STEREO)

2.6.2 BALANCED LINE CONNECTIONS

Most broadcast equipment is designed for balanced line operation. Connect as per FIGURE 2.5. The SEC-800 has two input and two output connections. A two conductor shielded cable should be used (Belden #8451 or equivalent) with a red and black twisted pair inside a shielded covering. Connect the red lead to + terminal on the barrier strip, the black lead to the - terminal on the barrier strip, and the shield (ground) to *GND* terminal on the barrier strip. THE CABLE SHIELD SHOULD BE CONNECTED TO GROUND AT THE SOURCE END ONLY TO PREVENT GROUND LOOPS.

2.6.3 UNBALANCED LINE CONNECTIONS

Connect the equipment EXACTLY as shown in Figure 2.6 for operation with unbalanced line equipment. The SEC-800 has two input and two output connections.

NOTE: When using the unbalanced INPUT connection only, the shield is connected to the ground terminal and the negative (-) terminal is connected to the ground by a jumper wire as shown in Figure 2-6.

CAUTION: When using an unbalanced output, the shield(s) must be connected to the ground terminal(s). The negative (-) output terminal must be left unconnected. This equipment does not use transformers; therefore, accidental grounding of the negative (-) output terminal will short half of the output circuit. Also, the output level will be 6 dB lower than the balanced output level.

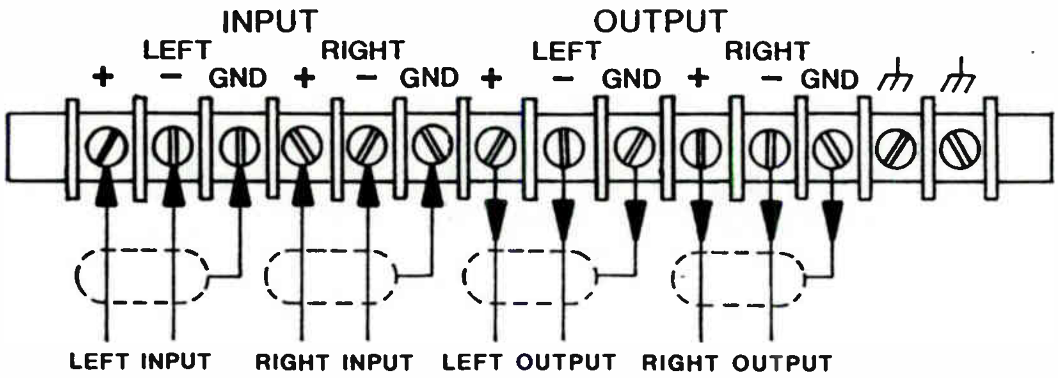


FIGURE 2-5 BALANCED LINE CONNECTIONS

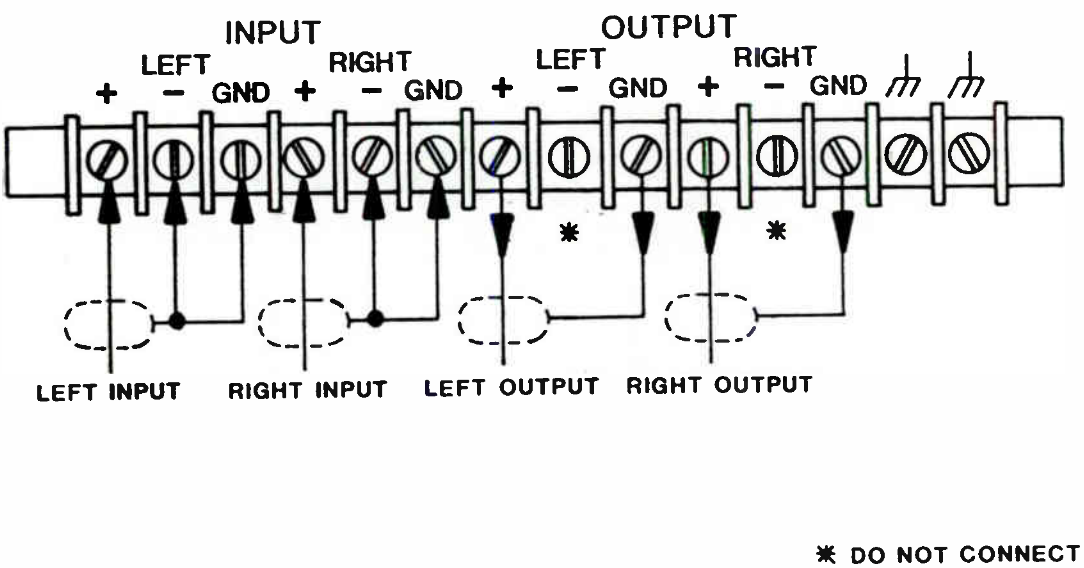


FIGURE 2-6 UNBALANCED LINE CONNECTIONS

2.7 INITIAL SET-UP

2.7.1 GENERAL

The following procedure is given to aid in setting up the unit for general program requirements. It is recommended that the entire manual be read to become familiar with all of the capabilities of the SEC-800.

1. Verify that the unit is set for the correct AC line voltage (see Section 2.3).

2. Connect audio inputs and outputs as per Section 2.6.

3. Verify that the internal jumpers are set properly, as per Section 2.4.

4. Feed a line level program signal through the system to both inputs on the SEC-800. All equipment prior to the SEC should be set for normal operation.

NOTE: The best balance will be obtained initially by using a monaural source to insure the same input material to both channels.

5. Verify that the power supply PCB indicators are illuminated as per Section 2.5.

2.7.2 INITIAL CONTROL SETTINGS

CONTROL OR SWITCH	SETTING
G/R (Compression) SWITCH:	Set to -6
OPERATION SWITCH:	Set to M
LIMIT/COMPRESS SWITCH:	Compress
WIDE/MULTI SWITCH:	Multi
GATE SWITCH:	Set to -20 position
OUTPUT EQUALIZER CONTROLS:	Set each control to vertical or 12 o'clock
INPUT CALIBRATE CONTROLS*: (screwdriver adjustment)	Factory set for +10 dbm
OUTPUT CONTROLS*: (screwdriver adjustment)	Factory set for +4 dbm

*Located on back panel

2.7.3 DYNAMIC SET-UP PROCEDURE (for input level setting)

The SEC-800 can be operated with or without the CRL SGC/SPP-800 ahead of it. This procedure is used to calibrate the SEC-800 for stand alone operation, for connecting the SEC-800 to non-CRL AGCs, and as an alternative to the CRL noise generator system set-up (see Section 2.7.4). When used alone, the capability of the SEC-800 becomes restricted. The ***BAND*** switch must be in the ***WIDE*** position in order to provide acceptable AGC and compression action. This means that its dynamic equalization capability is canceled. If an SGC/SPP-800 is used before this unit, the noise generator set-up described in Section 2.7.4 should be used for a more accurate calibration.

NOTE: IF NO AGC IS USED IN FRONT OF THE SEC, SET THE G/R CONTROL TO -12.

1. Increase the setting of the SEC ***LEFT INPUT LEVEL*** control (back panel) until the LED above the control is illuminated approximately 10-20% of the time. The 0 dB indicator segment on the front panel level meter may also be used, since its function is the same as this back panel LED.

NOTE: The OVLD LED (front panel) should never illuminate.

2. Increase the setting of the SEC ***RIGHT INPUT LEVEL*** control (back panel) until the LED above the control is illuminated approximately 10-20% of the time. The 0 dB indicator segment on the front panel level meter may also be used, since its function is the same as this back panel LED.

NOTE: The OVLD LED (front panel) should never illuminate.

NOTE: When using a monaural source both rear panel LEDs should light at the same time.

3. If unable to get the LED indicators for both channels to illuminate in the previous steps after 20 complete clockwise rotations, the input sensitivity should be increased using internal jumpers J3, J4, J5, & J6 (see Section 2.4).

2.7.4 NOISE GENERATOR SYSTEM SET-UP

When used with a CRL SGC-800 or SPP-800, the input levels of the SEC-800 can be easily set using simulated dynmic program material. With the SGC/SPP-800 set for normal operation, activate the rear-panel noise generator function switch (in this mode, the audio input to the SGC/SPP is disconnected). With the SGC/SPP output level switch set for 0 or +4 dBm nominally, adjust the SEC ***LEFT*** and ***RIGHT INPUT CALIBRATE*** controls such that the noise level peaks at *O* as observed on the front panel display or rear-panel indicators. When the SGC-800 gain controller is used, its internal noise select jumper should be set to the ***PULSED*** position.

NOTE: This method can also be used to set up the entire transmission system, including the final limiter (see appropriate limiter operating manual for more details).

2.7.5 ALTERNATE SET-UP PROCEDURE USING AUDIO GENERATOR

1. Use a Potomac model AG-51 audio generator (or Equivalent).

2. Disconnect the SEC inputs and connect the Potomac audio generator to the SEC.

3. Set the audio generator for a 0 dBm output level at 1 kHz.

   NOTE: If the particular system being interfaced to the SEC has a different output level than specified in step 3 (above), then the audio generator should be set to correspond to the actual system level.

4. Increase the setting of the SEC ***LEFT INPUT LEVEL*** control (back panel) until the LED above the control is just illuminated. The 0 dB indicator segment on the front panel level meter may also be used, since its function is the same as this back panel LED.

NOTE: The OVLD LED (front panel) should never illuminate.

5. Increase the setting of the SEC ***RIGHT INPUT LEVEL*** control (back panel) until the LED above the control is just illuminated. The 0 dB indicator segment on the front panel level meter may also be used, since its function is the same as this back panel LED.

NOTE: The OVLD LED (front panel) should never illuminate.

6. If unable to get the LED indicators for both channels to illuminate in the previous steps after 20 complete clockwise rotations, the input sensitivity should be increased using internal jumpers J3, J4, J5, & J6 (see Section 2.4).

7. Disconnect the Potomac generator and reconnect the SEC inputs disconnected in step #1.

2.7.6 OUTPUT LEVEL SET-UP

The ***OUTPUT LEVEL*** control located on the back panel should be set to provide an output level compatible with the input level required by the unit immediately following the SEC.

CAUTION: To prevent decreased system signal to noise ratio, the output level controls of the SEC-800 should be set for at least a 0 dBm average output level.

NOTE: At this time proceed immediately to the next section for final adjustments to set system for the best possible on-air sound.

2.8 FINAL CONTROL AND SWITCH ADJUSTMENTS

SOUND SETTING GUIDELINES

In order to adjust this processor for optimum performance the user must be thoroughly familiar with the operation of each control function. See Section 3 for a description of each control function. After completing the adjustment procedures, special attention should be given to achieving the final desired sound. Since the SEC-800 is used in a signal path with other equipment, consideration must be given to all the settings in the audio path in the complete system.

NOTE: If the sound seems distorted at the output of the unit it may be because the input signal is distorted. Under normal operating conditions, the SEC will not cause audible audio distortions such as THD, IM, etc. If these sounds are perceived, it may be caused by misalignment of other devices in the system, an over-driven amplifier, or impedence matching problems between equipment.

It is recommended that the sound setting guide on the next page be used as a starting point in setting the ***G/R***, ***OPERATION***, and ***LIM/COMP*** SWITCHES. These settings are only applicable when the SEC-800 is being used with a CRL SGC/SPP-800 gain controller before it. If the SEC-800 is not being used in conjunction with an AGC, add 3 to 6 dB to the G/R levels listed in the sound setting guide. The ***BAND*** switch must also be in the ***WIDE*** position.

SOUND SETTING GUIDE

SUGGESTED CONTROL SETTINGS

Format	G/R	OPERATION	LIM/COMP
Rock			
heavy 1	-12	M	L
heavy 2	-9	F	C
heavy 3	-9	F	L
medium 1	-9	M	C
medium 2	-6	F	C
medium 3	-6	F	L
soft 1	-9	S	C
soft 2	-6	M	C
soft 3	-6	S	L
Beautiful Music			
heavy	-9	M	C
medium	-6	S	C
soft	-3	S	C
Country			
heavy	-9	M	C
medium	-6	M	C
soft	-3	S	C
Talk			
heavy	-12	M	L
medium	-9	M	L
soft	-6	S	L
Classical			
heavy	-9	S	C
medium	-6	S	C
soft	-3	S	C
Easy Listening			
heavy	-9	M	C
medium	-6	M	C
soft	-6	S	C

NOTE: The ***BAND – MULTI/WIDE*** switch may be set as desired for dynamic equalization.

CAUTION: These settings are only suggested if the SEC-800 is being used with a CRL SGC/SPP-800 gain controller ahead of it. If the SEC-800 is being used with no input AGC, add 3 to 6 db to the G/R levels. The *BAND* switch must also be in the *WIDE* position.

SECTION 3 - OPERATING INSTRUCTIONS

3.1 GENERAL

The purpose of this section is to describe the operation of the switches, indicators, and controls on the SEC-800. A thorough understanding of this section will enable the user to get the most from this unit. Each control, switch, and indicator is described as to its operation and purpose.

3.2 FRONT PANEL SWITCHES, INDICATORS, AND CONTROLS

3.2.1 POWER LED INDICATOR

A red LED is used as a power on indicator.

3.2.2 GAIN REDUCTION SWITCH

The ***G/R - COMPRESSION*** (Gain Reduction) switch adjusts the signal level to the compression circuits that control the range of gain reduction. For example, when the switch setting is -9, the output of the unit will be held constant even though the input may drop as much as 9dB below the calibrated input level. If the input level drops 12 dB, the output will drop only 3dB. Input signals may increase as much as 25dB above the "0" dB indication on the LED input level meter and not be affected by the setting of this switch, since compression action is automatic above "0". Proper setting of this switch is determined by the sound the user is trying to achieve. The amount of apparent loudness increase is most noticeable when switching from 0 to -3 and from -3 to -6.

NOTE: It is suggested that the user select a setting as low as possible to accomplish the objectives. Most users choose -6 or -9.

3.2.3 OPERATION SWITCH

The ***OPERATION*** switch controls the program dependent attack and release time ranges of all four gain reduction bands and also selects the ***PROOF*** or ***BYPASS*** mode of operation. As the switch is moved from ***S*** (Slow) to ***M*** (Medium) to ***F*** (Fast), the RMS energy (loudness) of the signal is increased without increasing the peak amplitude. While this does decrease the dynamics of the source material, the technology of this unit is such that undesirable audible effects are minimal. A description of each switch setting is listed in the following chart.

SETTING	DESCRIPTION
PROOF	This setting connects the input amplifier directly to the output amplifier. The unit becomes a linear amplifier.
S (slow)	This setting provides a slow release time. The four bands operate primarily as dynamic equalizers with extremely transparent compression. This maintains a consistent equalization and average level with variations in program material. This position is suggested for use by easy listening stations in broadcast applications.
M (medium)	This setting provides a medium release time. The four bands resemble more aggressive type compression devices and cause moderate loudness increases by compressing and reducing the dynamic range. This position is recommended for most broadcast applications.
F (fast)	This setting provides a fast release time. The dynamic range is reduced to produce maximum loudness.

3.2.4 INPUT LEVEL INDICATORS

The input indicators display the input signal level for two separate channels (left and right). The readout is in logarithmic notation as indicated by the scale and is always peak reading. The red ***OVLD*** indicator will begin to illuminate when the signal level is 8 dB above the 0 dB calibration reference level.

3.2.5 BAND - LIMIT/COMPRESSION SWITCH

This switch selects the processing configuration used for gain control.

POSITION	DESCRIPTION
COMPRESS	When this position is used, the SEC produces a substantial increase in the RMS energy and loudness of program material while having little effect on the transient and apparent dynamics of the program content. This position allows substantial levels of audio processing of program signals without sounding significantly processed and is the recommended position.

POSITION	DESCRIPTION
LIMIT	When this position is used, the gain reduction elements function to produce peak control action on the program material. This setting does not sound as open as the ***COMPRESS*** position, however it does allow for a more consistent loudness capability. When this setting is used, greater levels of on-air loudness can be achieved without resorting to greater amounts of post peak clipping.

3.2.6 BAND - WIDE/MULTI SWITCH

This switch selects either normal or multiband operation.

POSITION	DESCRIPTION
MULTI	In this position the SEC performs as a conventional multiband gain control processor. The audio is split into separate frequency bands and each band undergoes independent gain control action. This causes automatic re-equalization of the audio spectrum when the bands are re-combined at the output. This type of equalization is used for most applications. This position should not be used when the SEC is used without a companion AGC unit such as the CRL SGC-800.
WIDE	In this position the SEC-800 short duration processing characteristics are still multiband. Long duration varying input levels are now controlled by one combined time constant that is derived from the average G/R of each band. This reduces the total amount of dynamic equalization available while maintaining low gain intermodulation qualities on program dynamics.

3.2.7 GATE SWITCH AND INDICATOR

This switch may be set in any of three positions; ***OFF***, ***-10***, or ***-20***. When the input level drops below the selected threshold, all gain control circuits are frozen at their previous gain (or attenuation) levels. If the switch is set for ***-10***, signals that fall below that level will be passed through without AGC amplification. This means that no background noise is brought up during pauses in program material. For example, during a newscast, if a teletype background sound is present that is more than -10db or -20db down in level (depending on choice of setting), this effect will not be increased in loudness during pauses. The ***GATE*** LED on the front panel illuminates whenever the gain is frozen by this circuit.

3.2.8 OUTPUT EQUALIZATION (L, M1, M2, & H) CONTROLS

The ***OUTPUT EQUALIZATION*** controls adjust the output levels of the four gain control channels. They control individual band output levels from -12db to +6db from their 12 o'clock positions. Precision tracking of the stereo audio bands is achieved through the use of stereo VCA's which control the actual audio levels. The stereo VCA's are in turn adjusted by control voltages which are set by the respective front panel control.

These controls adjust the frequency balance of the program for the station's format. They operate much as a simple audio equalizer would. The four bands are logarithmically equal in audio frequency spectrum size in order to match the way our ears perceive sound. The four bands use 6db per octave filters to insure 'peak' and 'hole' free band recombination. The frequency range of the audio band for each control is as follows:

OUTPUT EQUALIZER CONTROL RANGES

POSITION	CONTROL RANGE
L (LOW)	20 to 200 Hz.
M1	200 to 1000 Hz.
M2	1000 to 5000 Hz.
H (HIGH)	5 kHz to 15 kHz.

CAUTION: If all controls are advanced beyond 12 o'clock and their settings are equal, no equalization has been accomplished, only the total output drive level of the unit has been increased. In these cases, it is recommended that all equalizer controls be returned to their 12 o'clock positions and the rear panel *OUTPUT* controls be re-adjusted instead.

NOTE: There are small markings at numerous positions about the perimeters of these controls. These are used to log different types of equalizer settings.

3.3 REAR PANEL CONTROLS AND SWITCHES

3.3.1 INPUT CALIBRATE LEFT CONTROL AND INDICATOR

An ***INPUT LEVEL*** control is provided to adjust the audio input signal level to the left channel input amplifier. A LED indicator (located above the control) is provided for proper setting of the input level. This LED should flash during program peaks (see Section 2.7 for set up). This LED is a duplicate of the 0 dB indicator segment in the front panel level meter.

3.3.2 INPUT CALIBRATE RIGHT CONTROL AND INDICATOR

An ***INPUT LEVEL*** control is provided to adjust the audio input signal level to the right channel input amplifier. A LED indicator (located above the control) is provided for proper setting of the input level. This LED should flash during program peaks (see Section 2.7 for set up). This LED is a duplicate of the 0 dB indicator segment in the front panel level meter.

3.3.4 OUTPUT - LEFT, CONTROL

This control adjusts the left output level of the unit. It has a range from off to +18 dBm into a 600 ohm load when the front panel control settings are as per Section 2.7.2.

3.3.5 OUTPUT - RIGHT, CONTROL

This control adjusts the right output level of the unit. It has a range from off to +18 dBm into a 600 ohm load when the front panel control settings are as per Section 2.7.2.

SECTION 4 - THEORY OF OPERATION

4.1 GENERAL

This section contains theory of operation for the SEC-800. A detailed block diagram of the SEC is found in the Appendix. A schematic drawing and PCB parts placement drawing are also found in the Appendix. The signal is traced through the unit using the L audio channel. The parts for the R audio channel are referenced in ( ).

4.2 POWER SUPPLY

AC power is supplied to the unit via a standard 3-conductor power cable which plugs into the power module on the back panel of the unit. AC power is applied to power transformer T1 through fuse F1. The power transformer has dual windings to permit powering from either 100 to 130 VAC or 200 to 250 VAC. A PCB located inside the power module is positioned to select the transformer winding combination required for each input voltage.

************ WARNING ************	**SEE SECTION 2.3 FOR INSTRUCTIONS ON SELECTING THE AC INPUT VOLTAGE. OPERATION ON 200-250 VAC WILL ALSO REQUIRE REPLACEMENT OF THE AC PLUG AND FUSE.**

Power transformer T1 provides two sets of operating voltages. One voltage set is routed to the main PCB and the other set is routed to the auxiliary interface PCB. On the main PCB a full wave bridge rectifier consists of CR3, CR4, CR5, and CR6, which provides the main DC power for the unit. The pulsating DC voltage is filtered by C5 and C6. The DC voltage from the rectifier is fed to voltage regulators VR1 and VR2 which develop the two regulated outputs of +15 VDC and -15 VDC. CR1, & CR2 are employed as protection diodes. The circuitry is well bypassed on each supply line through the use of several decoupling capacitor sets. Each output voltage can be precisely adjusted using R3 to adjust + 15 V and R4 to adjust - 15 V.

The auxiliary PCB provides DC power for the LED PCB and the power *ON* LED. Power transformer T1 provides the operating voltage (via a separate winding) for the full wave bridge rectifier consisting of CR2, CR3, CR4, & CR5. The pulsating DC voltage is filtered by C1. The DC voltage from the rectifier is fed to voltage regulator U1 which develops the positive 5 volt regulated output voltage. CR1 is employed as a protection diode.

4.3 SIGNAL CIRCUITRY

The left and right audio signals enter the SEC-800 through the (+) and (-) audio input terminals located on the rear panel. The audio lines are then RF bypassed to chassis ground by LC low pass input filters located in the RF shield compartment.

The audio signals are next sent to the input attenuation networks for the differential input amplifiers U5a (U5b). The audio levels to these balanced amplifiers are adjusted by the rear panel ***INPUT CALIBRATE*** potentiometers which set the left and right reference levels into the unit.

After the ***INPUT CALIBRATE*** potentiometers R316 (R317), the overall unit input sensitivities are adjusted in 3 ranges by jumpers J3 to J6. These ranges are High (-10 to -30 dbm), Medium (+5 to -15 dbm), and Low (+5 to 0 dbm).

Next, the input signals enter the ***G/R*** (compression) switch S1a (S1b). This switch is configured in 3db steps and is used to adjust the audio drive level into the G/R stages. The attenuation selected causes corresponding amounts of gain reduction.

Following the ***G/R*** (compression) switch, the left and right audio enters the specially designed bass boost high pass filters U14a (U14b). The operation of the filters is selected by jumpers J7 (J8). See Figure 4-1 for a frequency response curve for this circuit. These filters also act as buffer amplifiers for the following frequency splitting filters.

The frequency splitting filters used in each channel divide the audio into four separate bands which have been selected to give the optimum performance in processing capacity.

These filters break the audio spectrum into the musical bass bands controlled by the front panel ***L*** control, the vocal resonance bands controlled by the front panel ***M1*** control, the vocal presence bands controlled by the ***M2*** control and finally the musical high bands controlled by the ***H*** control. The four stereo bands combined contain the audible frequency range from 50Hz to 15KHz. See Section 3.2.8 for a table listing the output equalizer control ranges. Figure 4-2 shows the response curves for the 4 band filter.

The left and right channel dynamic ranges are compressed by four independent gain reduction stages. The ***L*** band consists of U13a and U12a (U13b and (U12b). The ***M1*** band consists of U18b and U17b (U18a and U17a). The ***M2*** band consists of U24a and U23a (U24b and U23b). The ***H*** band consists of U29b and U28b (U29a and U28a). The gain reduction action of these stages is controlled by complex gain determining signals

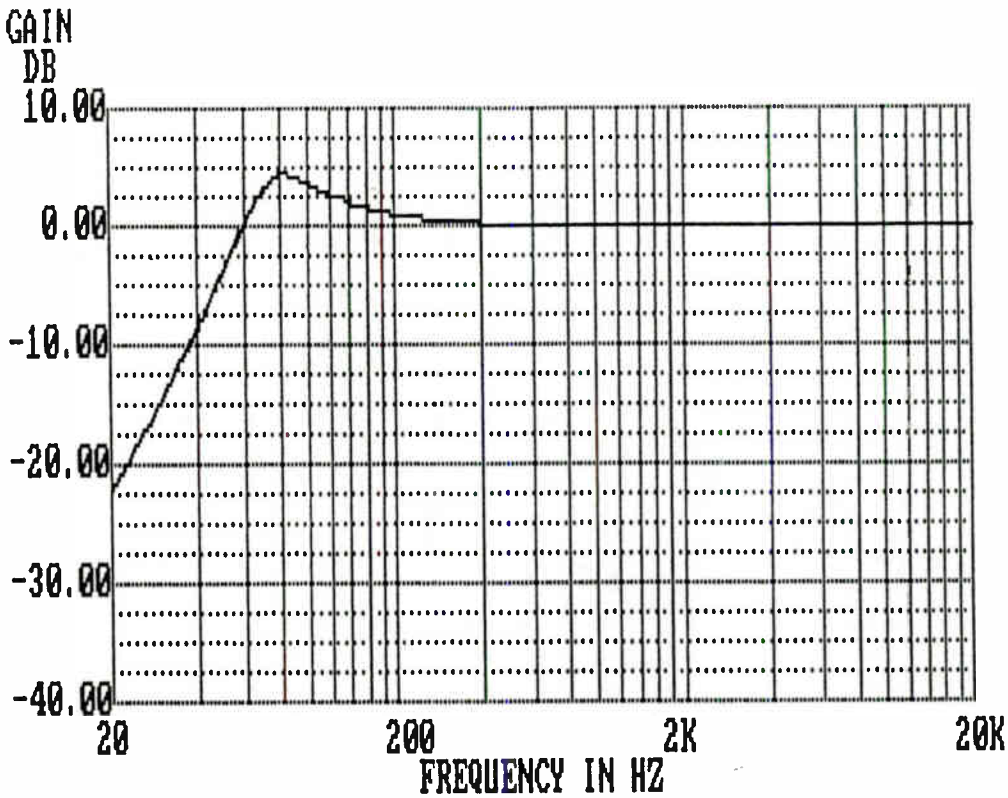


FIGURE 4-1 HIGH PASS FILTER RESPONSE CURVE

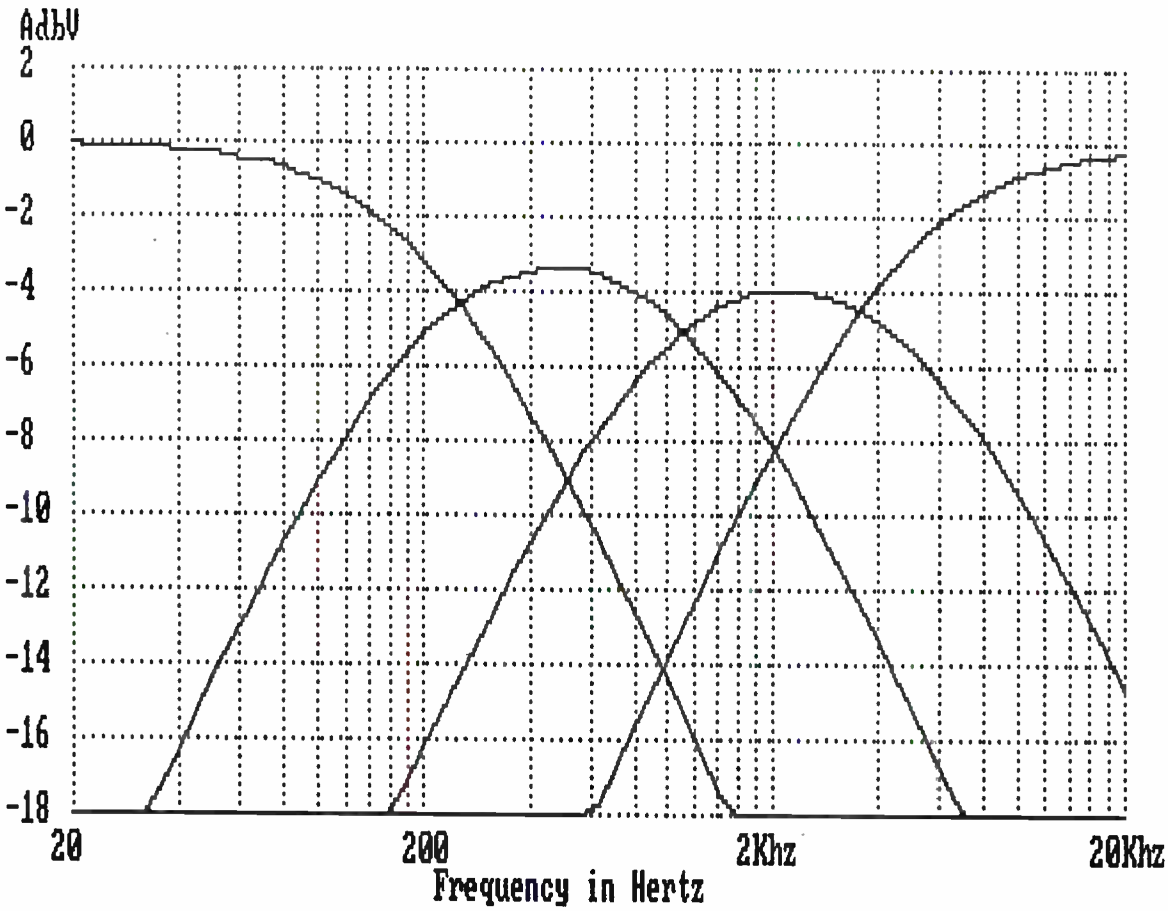


FIGURE 4-2 4 BAND FILTER RESPONSE CURVES derived from the combined and weighted absolute values of each band's left and right audio channels. The ***L*** band consists of U9a, U10a, U10b, and U8a. The ***M1*** band consists of U9b, U15a, U15b, and U8b. The ***M2*** band consists of U20a, U21a, U21b, and U19a. The ***H*** band consists of U20b, U26a, U26b, and U19b.

The ***OPERATION*** switch S2a (S2c) controls the overall attack and release time ranges of the bands. It can be set for ***S*** (slow), ***M*** (medium), or ***F*** (fast). This allows the user the flexibility to tailor the gain reduction action for the required format. The fourth position of the switch is labeled ***PROOF*** S2b. It is used to bypass the multiband gain control devices and output equalizers. This is accomplished by connecting the balanced input amplifier stages to the master output level controls and output amplifiers U6a and U7a (U6b and U7b).

This four position switch tailors the overall response of the bands. When placed in the ***S*** position, the gain reduction stages act as transparent AGC's and as dynamic equalizing devices. When placed in the ***M*** position, the stages act as more aggressive medium speed compressors. When placed in the ***F*** position, they act as more radical high speed compressors.

Two additional switches provide even more audio sound quality control. These switches are called the ***MULTI/WIDE*** S4 and ***COMPRESS/LIMIT*** S5 switches.

The positive effect of multiband audio processing is its ability to control the pieces of the audio waveform separately. This prevents the audible gain intermodulation effects of wideband devices that occurs when large amplitudes of one portion of the audio spectrum abruptly enter and leave a complex audio waveform. An example of this can be best envisioned by imagining what happens to a gain controlled audio waveform of a -10 dbm voice soloist when abruptly joined by a +10 dbm bass drum beat.

The negative side effect of multiband processing is the automatic equalization effect at the output of such processors. This is apparent as the output signal audibly varies if the input signals vary widely in levels. This is the reason for placing some form of AGC in front of multiband compressors.

These effects are controlled by the ***MULTI/WIDE*** switch S4. In the ***MULT*** mode, the SEC-800 behaves as a conventional four band audio processor. In the ***WIDE*** position the characteristics of the unit are modified to eliminate negative side effects. When processing audio in multiple bands, and providing multiband control of program dynamics, the bands are controlled to eliminate automatic dynamic equalization.

The ***COMPRESS/LIMIT*** switch S5 allows the SEC-800 processor to behave as two different types of processors. This is achieved by changing the dynamic attack and release characteristics of the unit and the peak to average control characteristics of the unit as well.

In the ***COMPRESS*** position, the unit produces substantial increases in loudness (RMS level) of program material while having little effect on the transient portions of program content. This allows substantial levels of audio processing of program signals without sounding processed.

In the ***LIMIT*** position, the unit provides simultaneous peak and average limiting which significantly reduces the peak to average ratios of the audio signals. This setting does not sound as natural as the ***COMPRESS*** position, but it allows greater loudness without having to resort to the same amounts of post peak clipping.

The left and right four band outputs are fed to D.C. VCA (Voltage Controlled Amplifier) circuits. The ***L*** band VCA consists of U11a (U11b) and R313. The ***M1*** band VCA consists of U16b (U16a) and R314. The ***M2*** band VCA consists of U22a (U22b) and R315. The ***H*** band VCA consists of U27b (U27a) and R316. Each band of the stereo channels is controlled by a single potentiometer which provides a control voltage that regulates the output gain of both channels.

The ***OUTPUT EQUALIZER*** controls are labeled ***L***, ***M1***, ***M2***, and ***H***. They adjust the stereo output gains of each band from -12db to +6db from a 12 o'clock reference setting. These controls equalize the stereo audio signals to the desired tonal balance required by the user.

The outputs of the four stereo bands are fed into summation amplifiers U25a (U25b) which recombine the individually gain controlled bands back into full frequency response left and right audio channels.

Following the summation amplifiers, the recombined audio channels are fed to the left and right rear panel ***OUTPUT*** controls R320 (R319), which allow control of the output levels from off to a maximum of +18dbm at the balanced output terminals.

The ***OUTPUT*** controls then feed pairs of non-inverting U7a (U7b) and inverting amplifiers U6a (U6b), which form differential output amplifier pairs. These pairs provide equal but opposite phased (+) and (-) output signals that become balanced when referenced to the unit's chassis ground.

The left and right processed audio signals are RF bypassed to chassis ground by using LC low pass output filters located in the RF shield compartment. The left and right processed audio signals leave the SEC-800 through the (+) and (-) balanced audio output terminals located on the rear panel.

SECTION 5 - MAINTENANCE, TROUBLESHOOTING, AND CUSTOMIZATION

5.1 PREVENTIVE MAINTENANCE

A minimum amount of preventive maintenance is required to insure optimum performance of this unit. If a regular preventive maintenance schedule is not in existence, Circuit Research Labs suggests the following check list be performed on a periodic basis.

1. Check to insure that the input and output cables are properly connected to their respective terminals. Inspect the cables to make sure they are in good physical condition. (FRAYED WIRES CAN SHORT OUT, CAUSING INTERMITTENT FAILURES).

2. Check to insure that all switches and indicators are secure and in good working condition.

3. Remove any dirt or dust around the unit. This may not immediately affect the unit, but long term exposure may.

4. Keep all liquids away from the unit. Accidental spillage can result in serious damage to the unit and will void the warranty.

5.2 ALIGNMENT PROCEDURES

5.2.1 GENERAL

Three types of internal alignment in the SEC-800 are provided. These alignments are used mainly for manufacturing purposes but can be used in the field if certain component replacements are found necessary.

These alignments are for LM337/LM317 power supply regulator adjustments, certain LM13600 adjustments, and display calibration. Even with replacement of these components, re-alignment is not normally necessary for proper unit operation.

5.2.2 SWITCH AND CONTROL SETTINGS FOR ALIGNMENT

CONTROL OR SWITCH	SETTING
G/R (Compression) SWITCH:	Set to -6
OPERATION SWITCH:	Set to M
LIMIT/COMPRESS SWITCH:	Compress
WIDE/MULTI SWITCH:	Multi
GATE SWITCH:	Set to -20 position
OUTPUT EQUALIZER CONTROLS:	Set each control to vertical or 12 o'clock
INPUT CALIBRATE CONTROLS*: (screwdriver adjustment)	Factory set for +10 dbm
OUTPUT CONTROLS*: (screwdriver adjustment)	Factory set for +4 dbm

*Located on back panel

5.2.3 TEST EQUIPMENT REQUIRED (or Equivalent)*

MODEL	MFG.	NOTES
AG-51	Potomac	Audio Generator (Set the output switch to L+R; attenuator to 20 dB for a 0 dBm output level)
IX-51	Potomac	Input transformer(s) (Set to the 600 ohm position)
AA-51	Potomac	Audio Analyzer (Set the input switch to L or R as required)
1803	B & K	Frequency Counter
8050A	Fluke	Digital Multimeter
2445	Tektronix	Oscilloscope (5MHz minimum, dual channel)

*All test equipment must be properly calibrated.

5.2.4 POWER SUPPLY ADJUSTMENTS

1. Move the +15V and -15V Supply jumpers to their ***OUT*** positions.

2. Measure the voltage at the cathode of CR1 and adjust R3 for +15V plus or minus .05V.

3. Measure the voltage at the anode of CR2, adjust R4 for -15V plus or minus .05V.

4. Replace both jumpers to their ***IN*** positions. Calibration is now complete.

5.2.5 GAIN AND BALANCE ADJUSTMENTS

1. Apply monaural program material to the left input of the SEC-800.

2. Adjust the ***INPUT CALIBRATE LEFT*** control until the rear calibration LED begins to light.

3. Move the ***STEREO/MONO*** jumper on the circuit board to the ***MONO*** position.

4. With an oscilloscope, monitor the ***LEFT*** and ***RIGHT OUTPUTS*** of the SEC-800 in the X-Y or lissajous mode with all controls at normal operating positions.

5. Adjust the ***L, M1, M2,*** and ***H BALANCE*** controls (R97, R148, R201, and R264 respectively) located on the circuit board for the thinnest diagonal line as can be displayed on the oscilloscope trace.

6. Move the ***STEREO/MONO*** jumper back to the ***STEREO*** position. Calibration is now complete.

5.2.6 INPUT INDICATOR ADJUSTMENT

1. Apply a 1KHz tone to the ***LEFT*** and ***RIGHT INPUTS*** of the SEC-800.

2. Adjust the ***INPUT CALIBRATE, RIGHT*** potentiometer until the ***RIGHT*** rear calibration LED just begins to light.

3. With an RMS Voltmeter or Oscilloscope, measure the rms or peak to peak voltage of the signal at pin 7, U5.

4. Move the Voltmeter or Oscilloscope to pin 1, U5 and carefully adjust the ***INPUT CALIBRATE, LEFT*** potentiometer until the rms or peak to peak voltage of the signal at this pin is equal to the pin 7 voltage.

5. Adjust the ***L CH INDICATOR*** (R-20) Potentiometer on the circuit board until the ***LEFT*** rear calibration LED just begins to light. Calibration is now complete.

5.3 TROUBLESHOOTING

5.3.1 GENERAL

The items listed below should be checked before troubleshooting the SEC:

1. Check for input and output levels causing overloads to the unit or the equipment following it. Make certain any additional equipment which may be connected to the unit is not being over-driven.

2. Check for failures in monitoring or other test equipment if measurements are erratic. Strong RF fields can make some test equipment give strange results. Poor equipment grounds and incorrect grounding of balanced line interconnects will cause problems that are not faults within the SEC. It is a good idea to use an oscilloscope to verify testing.

3. Since this is audio equipment, don't be afraid to listen to the unit while it is in operation. A pair of good quality, 600 ohm or higher impedence headphones can be used to bridge across the inputs and outputs. Listening can quickly locate a bad unit or clear a suspected unit.

5.3.2 Suggested Component Checks

This section lists typical failure conditions followed by components and other factors that could cause that failure mode.

SYMPTOM	PROBABLE CAUSE
1. Power indicator not illuminated:	Check AC power to unit Fuse: F1 Transformer: T1 Power indicator LED: DS5
2. Fuse repeatedly blows:	Rect. diodes main PCB: CR3 to CR6 Rect. diodes aux. PCB: CR2 to CR5 Prot. diodes main PCB: CR1 & CR2 Prot. diode aux. PCB: CR1 Filter cap. main PCB: C5 & C6 Filter cap. aux. PCB: C1 Reg. IC main PCB: VR1 & VR2 Reg. IC aux. PCB: VR1

3.	No input audio indicated on LED indicators:	Check for presence of audio Check setting of ***INPUT CALIBRATE*** controls IC's: U2, U3, U5
4.	Level present but low:	Jumper position: J3 to J6
5.	No output, LED indicators read normal:	Check setting of ***OUTPUT LEVEL*** controls IC's: U6, U7, U14, & U25
6.	Low output level:	Verify next unit has imped. 600 ohms or more If next device is unbalanced verify unused output is not grounded IC's: U6, U7
7.	Low band missing:	IC's: U9, U10, U11, U12, U13
8.	M1 band missing:	IC's: U1, U9, U15, U16, U17
9.	M2 band missing:	IC's: U20, U21, U22, U23, U24
10.	High band missing:	IC's: U20, U26, U27, U28, U29
11.	No low band G/R:	IC's: U9, U10, U11, U12, U13 Transistors: Q7, Q8
12.	No M1 band G/R:	IC's: U1, U9, U15, U16, U17 Transistors: Q11, Q12
13.	No M2 band G/R:	IC's: U20, U21, U22, U23, U24 Transistors: Q15, Q16
14.	No high band G/R:	IC's: U20, U26, U27, U28, U29 Transistors: Q19, Q20
15.	No G/R Low or M1 band:	Module U8
16.	No G/R M2 or high band:	Module U19

5.4 CUSTOMIZATION

5.4.1 LOW BAND AND M1 BAND CROSSOVER FREQUENCIES

The crossover freqeuncy may be changed to give more control over low bass frequencies for stations with listeners that primarily use large speaker systems. See Figure 5-1 for the four band filter response curves with the customized configuration.

1. Remove C53 and C32 (left channel). Take the .22 UF capacitor (C53) and solder it in place of C32.

2. Solder a .47 UF capacitor at C53.

3. Remove C45 and C40 (right channel). Take the .22 UF capacitor (C45) and solder it in place of C40.

4. Solder a .47 UF capacitor at C45.

5.4.2 REMOVING LIMITER CIRCUITRY

Each of the 4 bands have separate compressor and limiter circuitry. See the table below to determine the resistor to lift to remove each specific band. When voice programming is being used the limiter circuitry should not be removed from ***M1*** and ***M2*** bands. For stations requiring maximum dynamic range the limiting may be removed on the ***LOW*** and ***HIGH*** bands.

BAND	LIFT ONE END OF THIS RESISTOR
LOW	R89
M1	R140
M2	R193
HIGH	R256

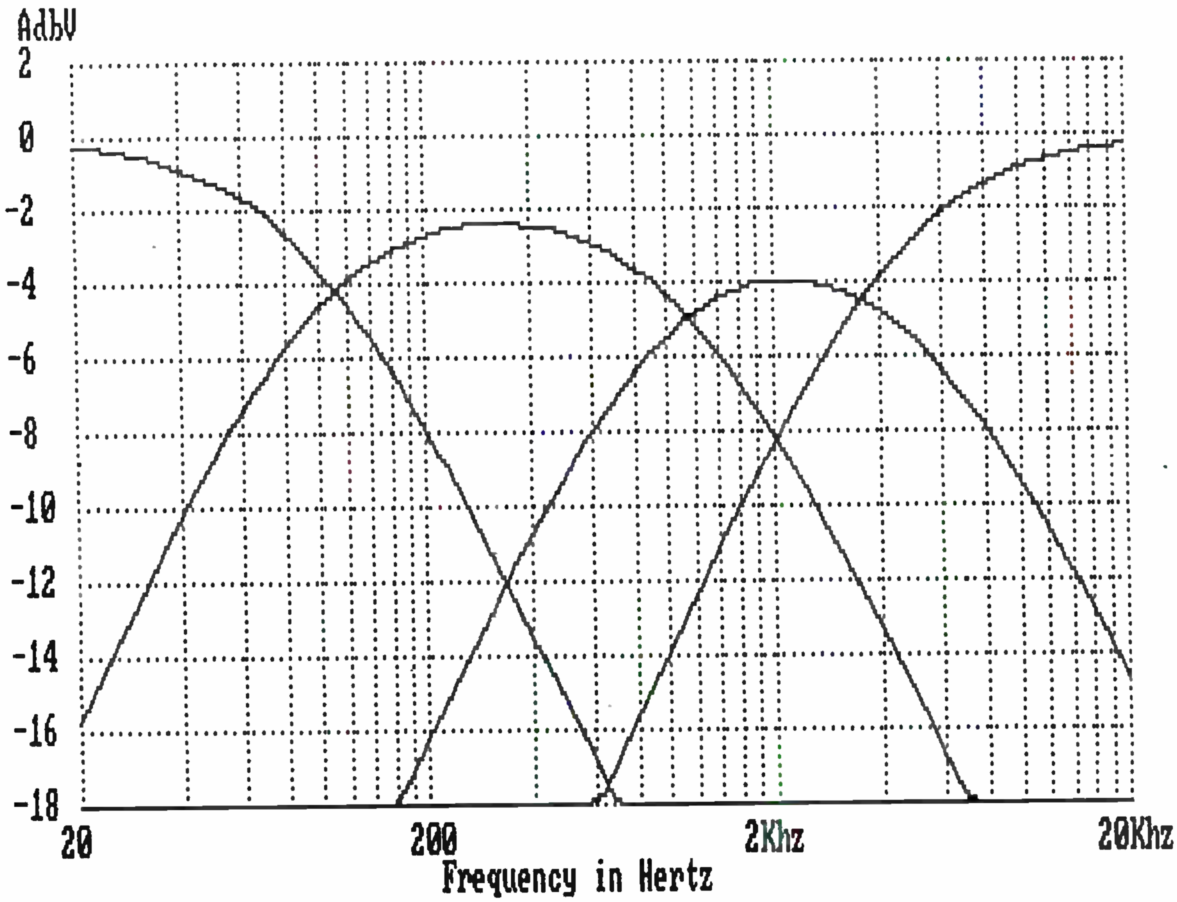


FIGURE 5-1 FOUR BAND FILTER RESPONSE CURVES (CUSTOMIZED)

5.5 FACTORY SERVICE

In the event this unit must be returned to the factory for repair, IN or OUT of warranty, Circuit Research Labs requires that a RETURN AUTHORIZATION (RA) NUMBER be obtained from the CUSTOMER SERVICE department. Call CRL prior to shipment at 602-438-0888 for this number or the equipment will be returned without being serviced. In order to insure prompt service, the following information must also be included with the returned unit:

1. The return authorization number CLEARLY MARKED ON THE OUTSIDE of the shipping container. (See example below)

2. Description of trouble which includes:
   a. The symptom description
   b. The unit switch settings when the trouble was detected
   c. A short description of the facility in which the unit is used.

3. Approximate date of purchase and the serial number of the unit - This will aid in the determination of billing for warranty or out of warranty repairs.

   All repairs must be shipped PRE-PAID (via United Parcel Service when shipped in the USA) to:

Circuit Research Labs, Inc.
3240 S. Fair Lane
Tempe, Arizona 85282 USA
Att: CUSTOMER SERVICE
RA #__________________

SECTION 6 - APPENDIX

A. SYSTEM SET-UP

AM4S SYSTEM INFORMATION

1. SGC-800. This is a split band AGC amplifier that maintains a constant level and tonal balance into the following unit. It contains USASI noise generator for system set up and an optional phase rotator for removing asymmetry from voices.
2. SEC-800. This is a stereo 4 band compressor with gating in each band. It provides a very dense, controlled signal that results in improved stereo coverage and loudness. The output of each of the 4 bands has a control that allows the "mix" of lows, mid-range, and highs to be adjusted to create a specific sound to suit the stations format. It dynamically equalizes program material for a consistant sound balance.
3. SMP-900B. This is a matrix processor for AM stereo. L+R and L-R are processed separately. It is designed to support mono loudness and prevent any loss of coverage.

SUGGESTED INITIAL SETTINGS

SGC-800:	G/R:	-9	GATE:	On	OUTPUT:	+4 dBm
	EQ:	12 to 2 o'clock	OPERATION:	M		

This unit is connected between the console and the phone lines or aural STL with the other units at the transmitter site. The 0 dB input indicator segment should flash on peaks and the red OVLD LED should not flash with normal program material.

SEC-800:	G/R:	-6	OPERATION:	M
	LIMIT/COMPRESS:	Compress	WIDE/MULTI:	Multi
	GATE:	-20	BAND CONTROLS:	12:00

This unit is generally connected to the phone lines or dual channel STL receivers at the transmitter site. The 0 dB input indicator should flash on peaks about 10 to 20 percent of the time. The red OVLD LED should not flash with normal program material.

SMP-900A:	G/R:	-4	LIMITING: +1
	EQUALIZATION:	12:00	

The statement above concerning the input indicators LED's applies here also. This unit is quite different from most limiters. PLEASE READ THE MANUAL CAREFULLY, and contact CRL if you need help at 602-438-0888.

NOTE: This equipment is designed to sound good on typical consumer radios. It may sound overly bright on studio monitors. The CRL MDF-800 Monitor De-Emphasis Filter should be used in conjunction with the station modulation monitor to judge the right sound. Various types of radios should also be used. Change only one control at a time and PLEASE READ THE MANUAL.

FM4G SYSTEM INFORMATION

1. SGC-800. This is a split band AGC amplifier that maintains a constant level and tonal balance into the following unit. It contains a pink noise generator for system set up and an optional phase rotator for removing asymmetry from voices.
2. SEC-800. This is a stereo 4 band compressor with gating in each band. It provides a very dense, controlled signal that results in improved stereo coverage and loudness. The output of each of the 4 bands has a control that allows the "mix" of lows, mid-range, and highs to be adjusted to create a specific sound to suit the stations format. It dynamically equalizes program material for a consistant sound balance.
3. SMP-850. This is a split band limiter/clipper. The input AGC circuit is designed to support stereo loudness. The multiplex clipper treats highs and lows separately to provide a tightly controlled signal with very low distortion. The pre-emphasis and low pass filter are contained in this unit. If the stereo generator being used contains Pre-emphasis and or Low Pass Filters they should both be switched out or removed.
4. SG-800A. This unit is connected between the SMP-850 and the FM Broadcast Exciter. It contains no audio processing or pre-emphasis. The pre-emphasis is contained in the SMP-850 Limiter. The unit is extremely dynamic and will provide un-paralleled separation for the total system.

SUGGESTED INITIAL SETTINGS

SGC-800:	G/R:	-9	GATE:	On	OUTPUT:	+4 dBm
	EQ:	12 to 2 o'clock	OPERATION:	M		

This unit is connected between the console and the phone lines or aural STL with the other units at the transmitter site. When using a composite STL, everything can be located at the studio. The *0* dB input indicator segment should flash on peaks and the ***OVLD*** LED should not flash on normal program material. (Set output switch to -10 when feeding most STL's).

SEC-800:	G/R: -6	OPERATION:	M	LIMIT/COMPRESS:	Compress
	GATE: -20	WIDE/MULT:	MULT	BAND CONTROLS:	12:00

This unit is connected to the phone lines or dual channel STL receivers at the transmitter site when not using a Composite STL. The *0* dB input indicator should flash on peaks about 10 to 20 percent of the time. The red ***OVLD*** LED should not flash with normal program material.

SMP-850: G/R: -3 LIMITING: +1

This unit is connected between the SEP800 and the stereo generator in use. The 0 dB input indicator segment will flash brightly on program peaks. The red ***OVLD*** LED should not flash on normal program peaks.

SG-800A: There are no Processing controls as such on this unit. Refer to the equipment installation procedure for correct input calibration.

NOTE: This equipment is designed to sound good on typical consumer radios. It may sound overly bright on studio monitors. Use various types of radios to judge the right "sound" for your format. Change only one control at a time and PLEASE READ THE MANUAL.

USING THE SEC-800 WITH OTHER EQUIPMENT

Interfacing the SEC-800 to the Optimod 8100

This procedure is to be done after the SEC-800 has been set up according to the manual and the output of the SEC-800 is feeding the input of the 8100.

1. Place the ***AGC*** switch inside the 8100 to the ***PROOF*** position (this will also defeat the gating on the 8100).

2. Set the ***INPUT*** attenuators of the 8100 so that there is a 0 to -20 indication on the 8100 multimeter in the left or right metering positions.

3. Set the ***MULTIMETER*** to ***L-R*** and adjust the ***RIGHT INPUT*** attenuator for the best null while sending FULL MONO.

4. Now observe the High Frequency Limit indicators. They should be blinking no more than 10 to 15 percent of the time. If they are blinking more than this, reduce the output of the SEC-800 to around 0dbm, then re-adjust the INPUT attenuators on the 8100 to arrive at the above conditions.

B. PARTS LISTS

MAIN PCB 8200

P/N	QTY	DESCRIPTION & DESIGNATOR
13970	1	PC BOARD, A500
12800	6	DIODE, 1N4001 CR1-CR6
12790		DIODE, 1N914B CR7-CR38
13700	4	LED,MV55A DS1-DS4
14150	58	RES,FXD,10K OHM,1%,1/4W,METAL FILM R26,R27,R30,R31,R32,R37,R39,R60,R62, R82,R83,R95,R96,R106,R110,R113,R114, R115,R116,R126,R130,R133,R134,R146, R147,R157,R158,R162,R166,R167,R168, R169,R182,R186,R187,R199,R200,R210, R214,R218,R219,R220,R221,R231,R235, R249,R250,R262,R263,R258,R273,R274, R281,R282,R283,R284,R278,R297
14180	26	RES,FXD,100K,1%,1/4W,METAL FILM R19,R21,R88,R91,R111,R131,R139, R163,R183,R192,R215,R236,R239,R240 R241,R242,R243,R244,R245,R246,R247 R248,R255,R298,R279
14040	19	RES,FXD,1K OHM,1%,1/4W,METAL FILM R34,R36,R55,R57,R59,R78,R79,R89, R108,R128,R140,R160,R180,R193,R212, R233,R256,R276,R295
16510	22	RES,FXD,100 OHM,1%,1/4W,METAL FILM R17,R22,R44,R48,R67,R71,R100,R101, R120,R121,R151,R152,R173,R174,R204, R205,R225,R226,R267,R268,R288,R289
14810	4	RES,FXD,4.75K OHM,1%,1/4W,METAL FILM R41,R42,R64,R65
14500	12	RES,FXD,22.1K OHM,1%,1/4W,METAL FILM R15,R16,R99,R119,R142,R150,R172,R195 R203,R224,R266,R287
14510	2	RES,FXD,22.1 OHM,1%,1/4W,METAL FILM R45,R68
14620	6	RES,FXD,121K OHM,1%,1/4W,METAL FILM R23,R28,R46,R49,R69,R72
14720	4	RES,FXD,332K OHM,1%,1/4W,METAL FILM R33,R35,R56,R58
14600	2	RES,FXD,27.4K OHM,1%,1/4W,METAL FILM R11,R12
14820	2	RES,FXD,4.99K OHM,1%,1/4W,METAL FILM R2,R5
14090	2	RES,FXD,475 OHM,1%,1/4W,METAL FILM R1,R6
14630	2	RES,FXD,274 OHM,1%,1/4W,METAL FILM
14850	9	RES,FXD,47.5K OHM,1%,1/4W,METAL FILM R18,R105,R125,R156,R178,R209,R230 R272,R293
14215	2	RES,FXD,6.19K OHM,1%,1/4W,METAL FILM R13,R14
14690	8	RES,FXD,33.2K OHM,1%,1/4W,METAL FILM R29,R93,R94,R144,R145,R197,R198,R260, R261
14650	16	RES,FXD,3.32K OHM,1%,1/4W,METAL FILM R84,R85,R86,R135,R136,R137,R164, R184,R188,R189,R190,R216,R237,R251, R252,R253
14760	4	RES,FXD,39.2K OHM,1%,1/4W,METAL FILM R38,R40,R61,R63
14910	2	RES,FXD,604 OHM,1%,1/4W,METAL FILM R43,R66
14950	2	RES,FXD,68.1K OHM,1%,1/4W,METAL FILM R53,R76
14298	2	RES,FXD,19.6K OHM,1%,1/4W,METAL FILM R47,R70
14560	2	RES,FXD,23.7K OHM,1%,1/4W,METAL FILM R50,R73
14900	2	RES,FXD,6.81K OHM,1%,1/4W,METAL FILM R54,R77
14100	4	RES,FXD,1.21K OHM,1%,1/4W,METAL FILM R80,R81,R300,R301
14350	12	RES,FXD,18.2K OHM,1%,1/4W,METAL FILM R87,R102,R122,R138,R153,R175, R191,R206,R227,R254,R269,R290
14435	11	RES,FXD,20K OHM,1%,1/4W,METAL FILM R103,R118,R123,R154,R176,R207,R223,R2 R270,R286,R291,R171
14410	16	RES,FXD,2.2MEG OHM,5%,1/2W,CARBON FIL R104,R109,R124,R129,R155,R161, R177,R181,R208,R213,R229,R234,R271, R277,R292,R296
14290	18	RES,FXD,15K OHM,1%,1/4W,METAL FILM R107,R117,R127,R159,R165,R170,R179, R185,R211,R217,R222,R232,R238,R275,R2 R285,R294,R299
15040	2	RES,FXD,8.25K OHM,1%,1/4W,METAL FILM R112,R132
15140	5	RES,TRIM,10K,1/2W,BUTTON R20,R97,R148,R201,R264
17160	2	RES,TRIM,500 OHM,1/2W,BUTTON R3,R4

P/N	QTY	DESCRIPTION & DESIGNATOR
15970	2	XSTR,2N4123 Q1,Q2
15980	2	XSTR,2N4125 Q3,Q4
15990	16	XSTR,MPS404A Q5,Q6,Q7,Q8,Q9,Q10,Q11,Q12,Q13, Q14,Q15,Q16,Q17,Q18,Q19,Q20
13590	17	IC,LIN,DUAL OPAMP,TL072CP U1,U4,U5,U6,U7,U9,U10,U12, U14,U15,U17,U20,U21,U23,U25,U26,U28
80470	2	ASSEMBLY,MODULE, NO 1001 U8,U19
13600	8	IC,LIN,DUAL,LINEARIZED,OTA,LM13600N U11,U13,U16,U18,U22,U24,U27,U29
15380	17	SOCKET,DIP,8 PIN
15370	2	SOCKET,DIP,24 PIN
15350	8	SOCKET,DIP,16 PIN
11970	10	CAP,FXD,10UF,ELECTRO,20%,25V C1,C2,C30,C37,C42,C49,C55,C64 C78,C84
12290	4	CAP,FXD,TANT,2.2UF,20%,25V,RADIAL C3,C4,C7,C8
12000	2	CAP,FXD,AL,470UF,20%,50V,RADIAL C5,C6
12250	33	CAP,FXD,SF,.1UF,5%,63V,RADIAL C9,C10,C11,C12,C13,C20,C21,C22 C32,C33,C34,C35,C36,C40,C46,C47, C48,C59,C60,C61,C62,C63,C69,C70,C71 C72,C73,C74,C75,C76,C81,C82,C83
80150	4	ASSY,CAP,FXD,SF,.1UF,5%,63V,RADIAL C25,C26,C27,C28
11975	4	CAP,FXD,AL,NON POLAR,10UF,20%,25V C14,C15,C16,C17
11930	4	CAP,FXD,CER,10PF,10%,1KV C18,C19,C23,C24
12180	8	CAP,FXD,SM,270PF,5%,500V C29,C38,C41,C50,C54,C65,C77,C85
12280	8	CAP,FXD,SF,.47UF,5%,63V,RADIAL, C31,C39,C43,C51,C56,C66,C79,C86
12130	2	CAP,FXD,PP,.01UF,2.5V,160V,AXIAL C44,C52
12110	4	CAP,FXD,PP,.0022UF,2.5%,160V,AXIAL C57,C67,C80,C87
12260	2	CAP,FXD,SF,.22UF,5%,63V,RADIAL C45,C53
12050	2	CAP,FXD,PE,.047UF,5%,100V,RADIAL C58,C68
13980	1	REG,VAR,POS,LM317T VR1
13990	1	REG,VAR,NEG,LM337T VR2
13160	2	HDWR,HEATSINK
13240	2	HDWR,INSUL,SIL-PAD
13190	2	HDWR,NUT,HEX,4.40X1/4,SILVER
13450	4	HDWR,WASHER,FIBER, NO6,1/16"X3/8"
13380	2	HDWR,MS,NYLON,SPH,4.40X1/4
12710	31	CONN,MALE,MINI,.1SP (4 PIN) J3,J4,J5,J6 (3 PIN) J1,J2,J7,J8,J17
13050	10	HDWR,RUBBER,BUMPER PADS,.218
12660	9	CONN,FEMALE,MINI JUMP,.1SP J3,J4,J5,J6,J1,J2,J7,J8,J17
12690	8	CONN,MALE,10 PIN, .1SP STRAIGHT J9,J10,J11,J12,J13,J14,J15,J16

LED PCB 6100

P/N	DESCRIPTION & DESIGNATOR
13975	6100 PC BOARD
14040	RES,FXD,1K 1/4W 1%, R1
15360	SOCKET,18 PIN
12290	CAP,FXD,TANT,2.2uf,25V, C1
13570	IC,LM3916N, U1
15372	SOCKET,20 PIN,SIP
13674	LED,GREEN,T-1, -20 (QUAN. 2)
13674	LED,GREEN,T-1, -10 (QUAN. 2)
13674	LED,GREEN,T-1, -7 (QUAN. 2)
13674	LED,GREEN,T-1, -5 (QUAN. 2)
13674	LED,GREEN,T-1, -3 (QUAN. 2)
13674	LED,GREEN,T-1, -1 (QUAN. 2)
13676	LED,YELLOW,T-1, 0 (QUAN. 2)
13676	LED,YELLOW,T-1, +1 (QUAN. 2)
13676	LED,YELLOW,T-1, +2 (QUAN. 2)
13684	LED,RED,T-1, OVLD (QUAN. 2)

PC BOARD,8220,SEC800

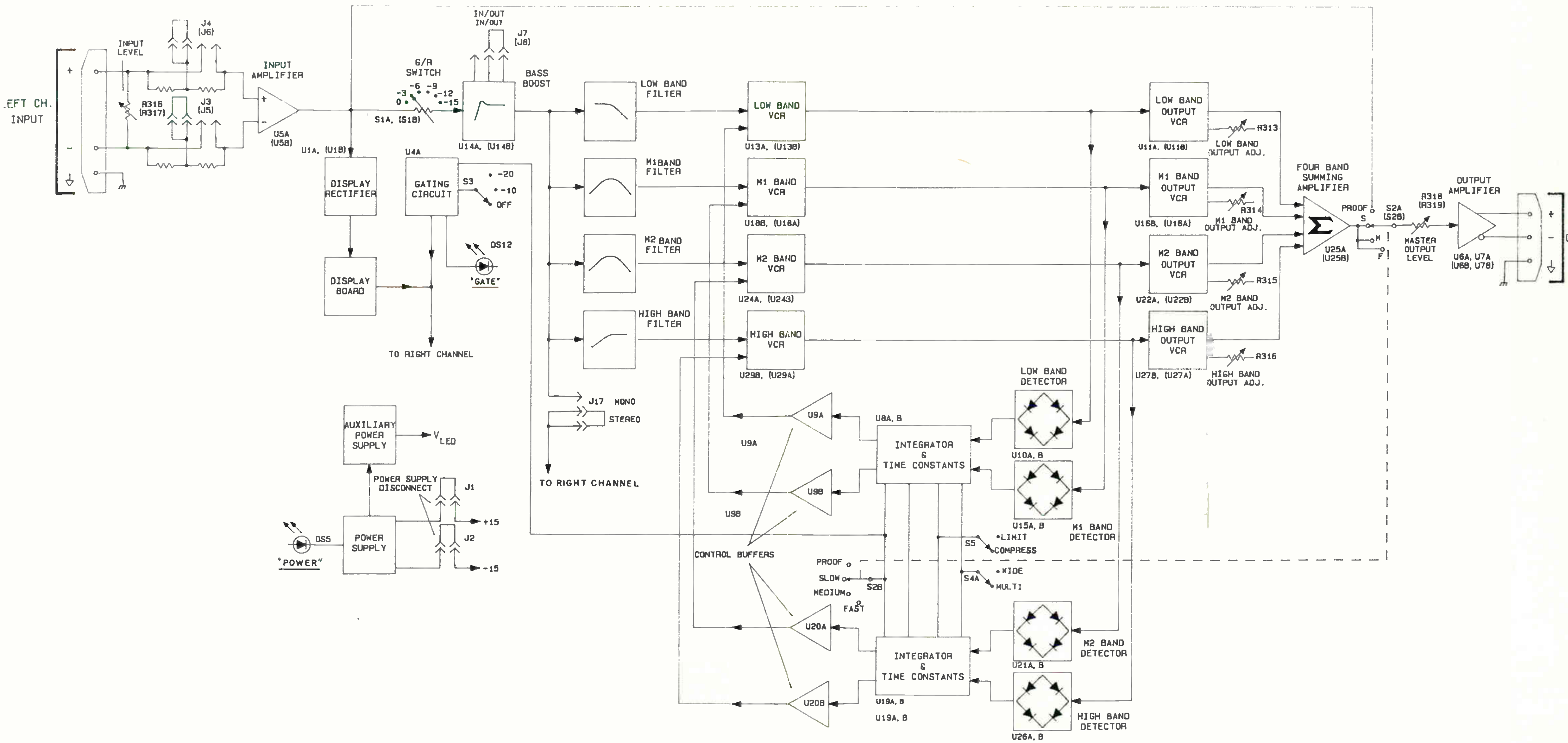
P/N	QTY	DESCRIPTION & DESIGNATOR
11967	8	CAP,FXD,CER,.001UF,10%,1KV,RADIAL C1,C3,C4,C6,C7,C9,C10,C12
12570	8	INDUCTOR,FXD,1.0MH,10%,RADIAL L1,L2,L3,L4,L5,L6,L7,L8
11930	4	CAP,FXD,CER,10PF,10%,1KV,RADIAL C2,C5,C8,C11
14015	16	REG,ZENER,DIODE,12.0V,10% VR1,VR2,VR3,VR4,VR5,VR6,VR7,VR8, VR9,VR10,VR11,VR12,VR13,VR14,VR15,VR16
12690	1	CONN,MALE,10 PIN,.1SP,STRAIGHT J1
12608	1	CONN,BARRIER,14 POSITION,PC,RTANGLE J2
13975	1	PC BOARD,8220
11851	1	BRACKET,SHIELD,RF,STEREO
11853	5	BRACKET,SHIELD,RF,DIVIDER TAB
13325	2	HDWR,MS,SBH,6.32X1/4" YELLOW
13200	2	HDWR,NUT,HEX,6.32X1/4,SILVER

AUXILIARY INTERFACE PCB 8210

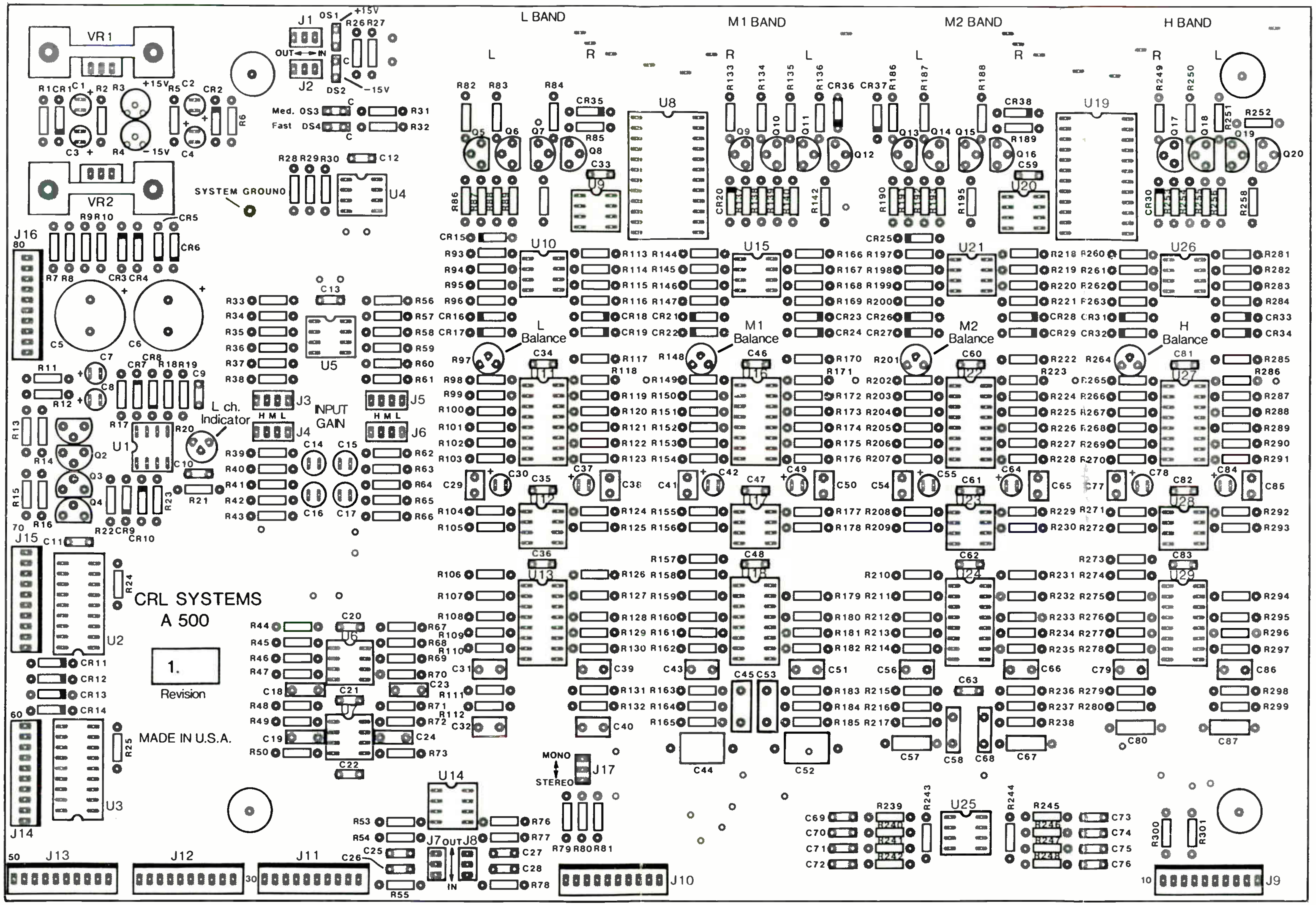
P/N	DESCRIPTION & DESIGNATOR
13969	8210 PC BOARD
17140	RES,FXD,49.9K 1/4W 1%, R1
17140	RES,FXD,49.9K 1/4W 1%, R2
14720	RES,FXD,332 OHM 1/4W 1%, R3
14150	RES,FXD,10.0K 1/4W 1%, R4
14720	RES,FXD,332 OHM 1/4W 1%, R5
14150	RES,FXD,10.0K 1/4W 1%, R6
14720	RES,FXD,332 OHM 1/4W 1%, R7
12800	DIODE, 1N4001, CR1
12800	DIODE, 1N4001, CR2
12800	DIODE, 1N4001, CR3
12800	DIODE, 1N4001, CR4
12800	DIODE, 1N4001, CR5
11200	CAP,AL,470uf,20%,50V,RAD, C1
11945	CAP,CER MONO,.1uf,10%, C2
12300	CAP,TANT,2.2uf.20%,25V, C3
12740	CONN,WIRING PIN, TP1
12740	CONN,WIRING PIN, TP2
15980	XSTR,2N4125, Q1
15980	XSTR,2N4125, Q2
12705	CONN,4PIN,.156 VERT, J1
12690	CONN,10PIN .1 VERT, J2
14032	REG,ua7805C, U1
13160	HDWR,HEATSINK,EXTRD
13240	HDWR,SIL INSUL TO5
13295	HDWR,4.40X5/16 SLOT SCREW
13271	HDWR,#4 INT LOCKWASHER
13190	HDWR,4.40X1/4,HEX NUT

CHASSIS PARTS LIST

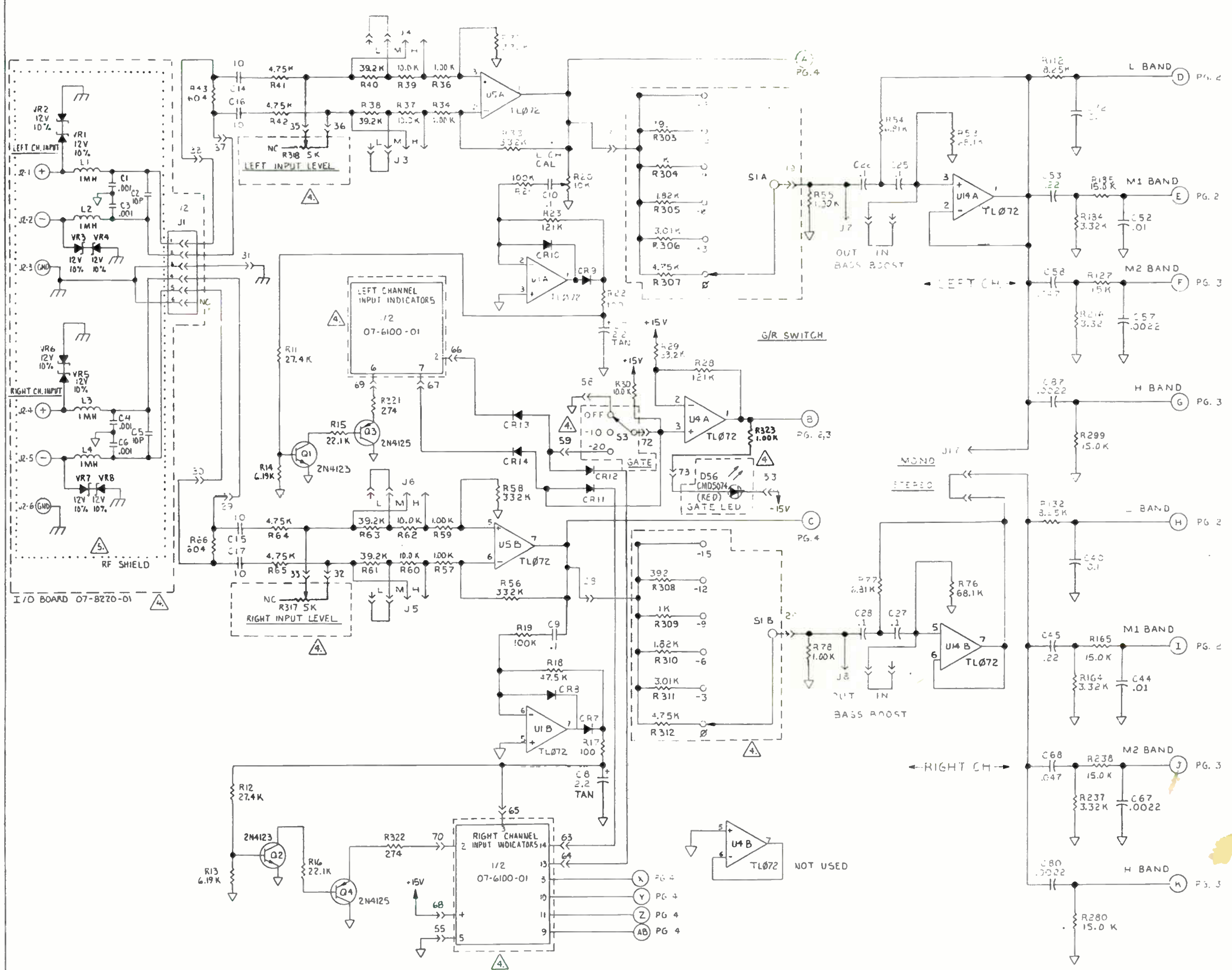
P/N	QTY	DESCRIPTION
12325	1	CHASSIS
12952	1	PANEL,REAR,SEC-800
16645	1	POWER,MODULE,AC
15916	1	TRANSFORMER,POWER,TOROID
15919	1	HDWR,WASHER,SILICON,LG
15918	1	HDWR,WASHER,SILICON,SM
15917	1	HDWR,WASHER,STEEL,CUP,RETAINER
13324	1	HDWR,MS,BINDER,6,32X5/8IN
13140	1	HDWR,GROUND LUG,#6
13200	1	HDWR,NUT,HEX,6.32X1/4
16250	3"	WIRE,GREEN,22AWG,.009PVC
12951	1	PANEL,FRONT,SEC-800
13203	4	HDRW,NUT,HEX,KEP,6.32X1/4
80575	1	ASSY,LED INDICATOR
13254	1	HDWR,INSUL,NOMEX,LED
13322	2	HDWR,MS,BINDER,4.40X1/4
80810	1	ASSY,SWITCH,NO. 22
80820	1	ASSY,SWITCH,NO. 23
15580	1	SWITCH,TOGGLE,SPDT
15570	1	SWITCH,TOGGLE,ON-NONE-ON
13325	14	HDWR,MS,BINDER,6.32X1/4,YELLOW
15585	1	SWITCH,TOGGLE,4PDT
13250	6	HDWR,KNOB,W/SKIRT,ALUM,1/4
13130	1	HDWR,GROMMET,RUBBER
13042	1	FUSE,1/4X1 1/4 IN,SB,1/4A
13685	2	LED,RED
13673	2	LED,YELLOW
13866	2	PC BOARD,LED SUPPORT
80604	1	ASSY,AUXILIARY INTERFACE PCB
80491	1	ASSY,I/O PCB
80301	1	HARNESS, WIRING
15120	4	POT,MT,5 K OHMS,R317,R318,R319,R320
13370	4	HDWR,POT,MTG.
15200	4	POT,VAR,5 K OHMS,R313,R314,R315,R316
13745	1	CHASSIS LID
16435	1	POWER CORD
10111	1	MANUAL, SEC-800
10150	1	MINIFIX SCREWDRIVER
15230	1	SHIPPING BOX
15250	2	SHIPPING END BLOCK
15275	1	SHIPPING BOTTOM BLOCK



BLOCK DIAGRAM



PC BOARD LAYOUT DIAGRAM
PAGE 6-10



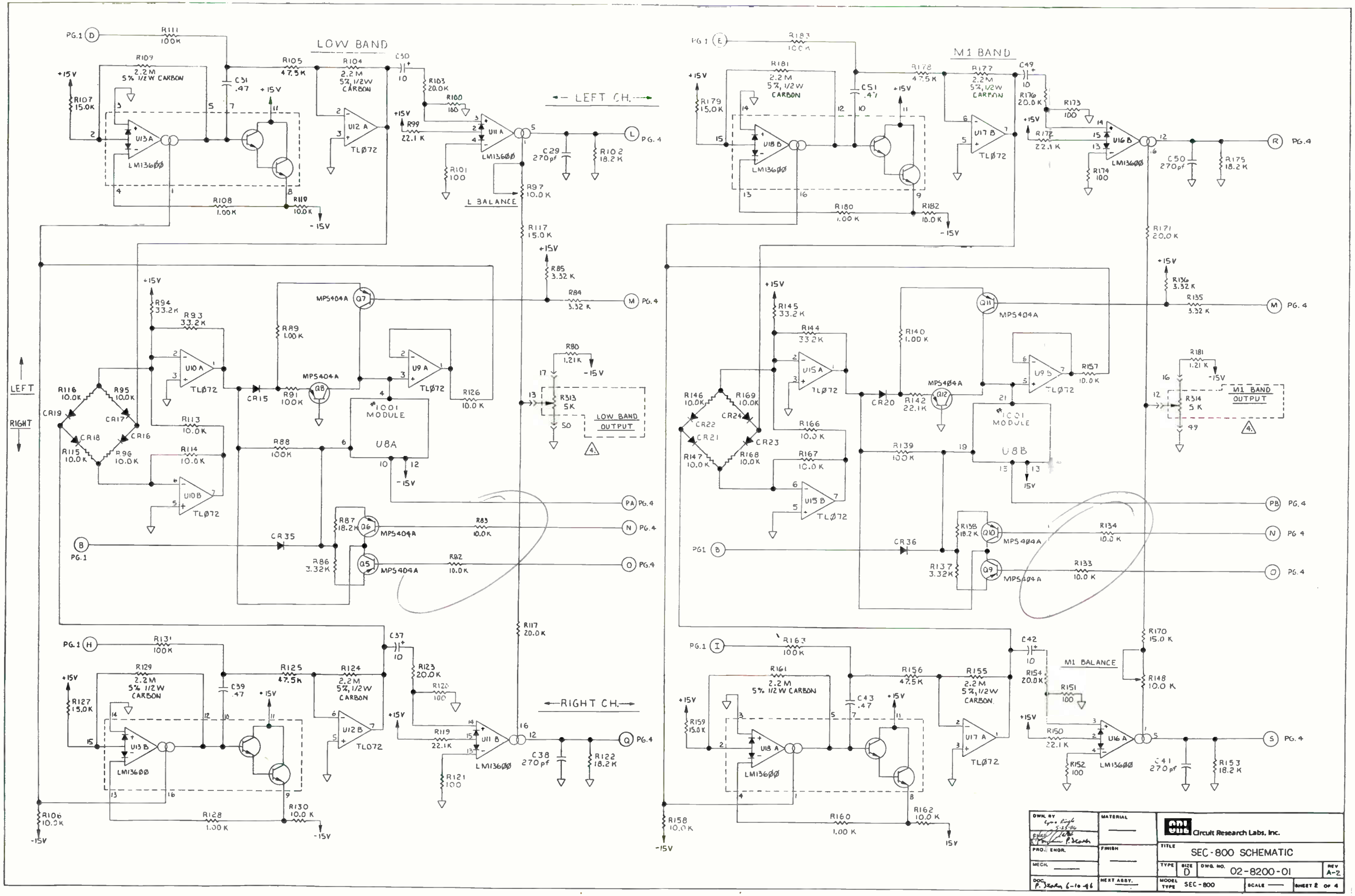
REV	DATE	DESCRIPTION		
A-1	6-10-86	Released for Production		
A-2	7-20-87	REVISED AND REDRAWN	CK	

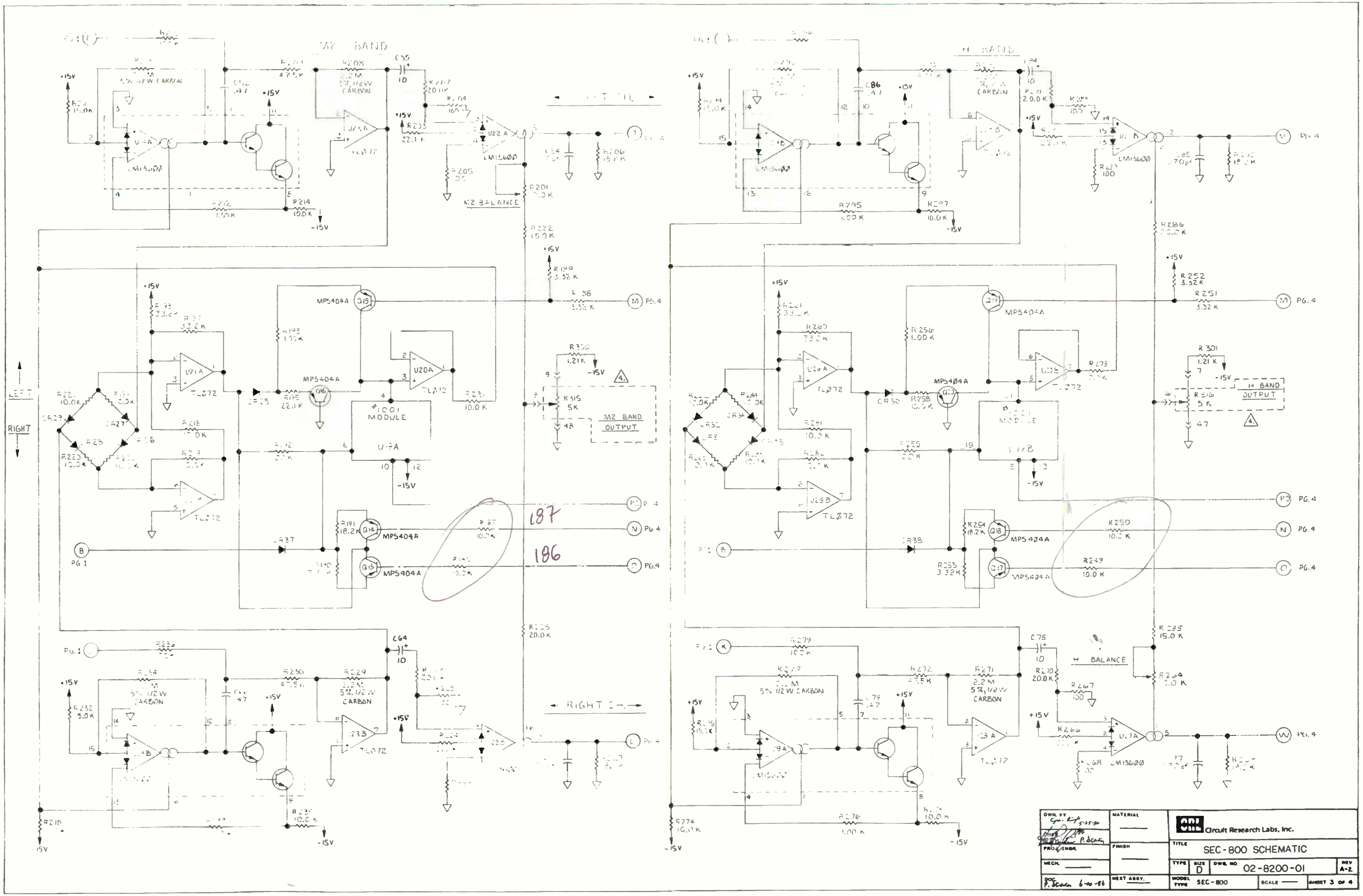
NOTES:

1. ALL RESISTORS ARE 1%, 1/4 WATT METAL FILM UNLESS OTHERWISE NOTED.
2. ALL DIODES ARE 1N914B UNLESS OTHERWISE NOTED.
3. ALL CAP VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
4. CIRCUITS INSIDE DASHED LINES ARE MOUNTED TO CHASSIS.
5. CIRCUITS INSIDE DOTTED LINES ARE IN SHIELDED RFI ENCLOSURE.

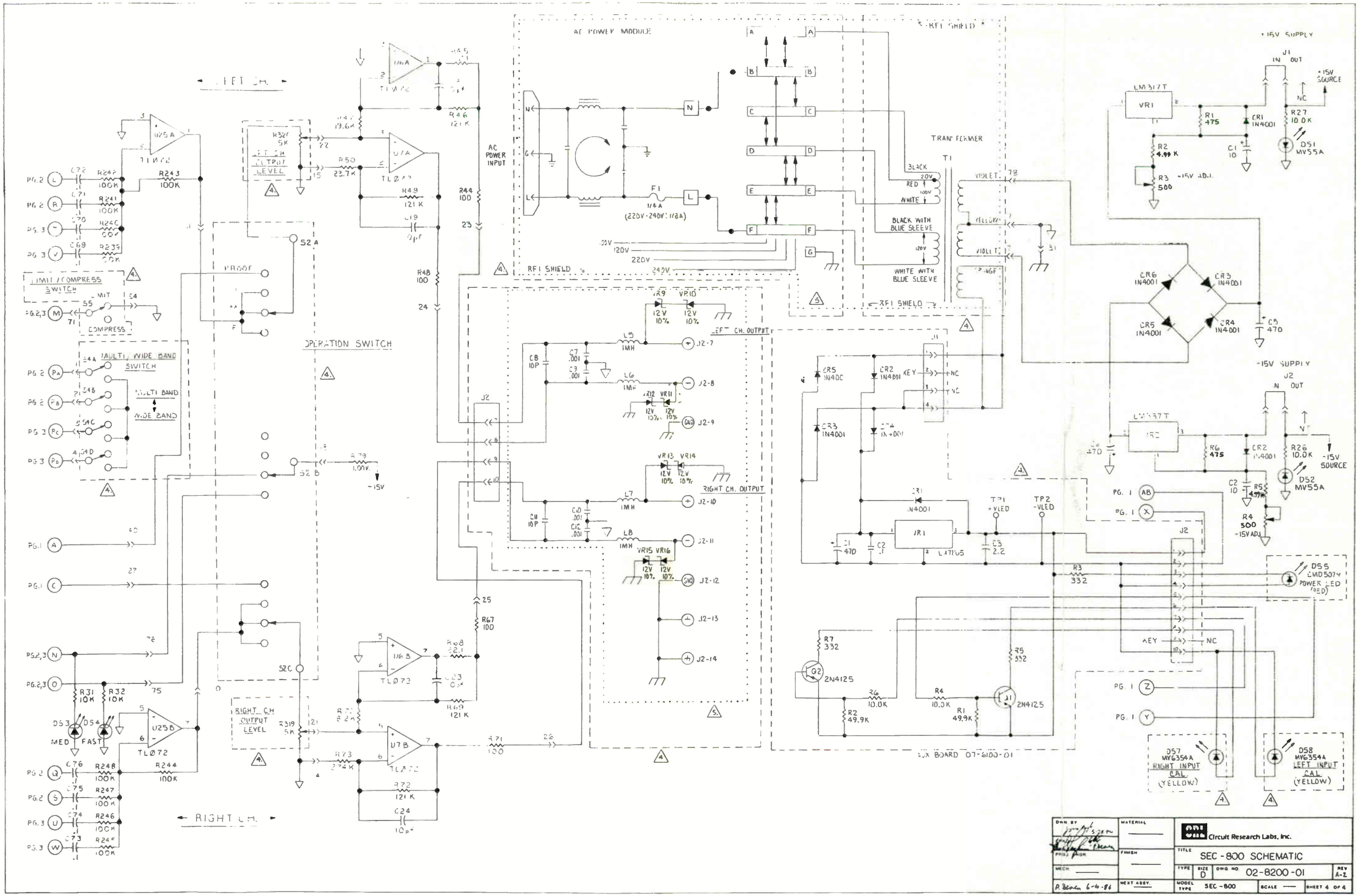
COMPONENT DESIGNATIONS		
FIRST	LAST	DELETED
C1	C89	C90 THRU C98
CR1	CR35	
[illegible]	[illegible]	
J1	J17	
L1	L8	
Q1	Q20	
R1	R322	R7,8,9,10,24,25
[illegible]	S5	
T1	T2	
U1	U29	U2,U3

DWN BY 5-25-86	MATERIAL —	Circuit Research Labs, Inc.	
CHKD		TITLE SEC-800 SCHEMATIC	
PROJ ENGR	FINISH —	TYPE / SIZE D / DWG NO 02-8200-01	REV A-2
MECH —			
P. Scanlon 6-10-86	NEXT ASSY. —	MODEL TYPE SEC-800 / SCALE —	SHEET 1 OF 4

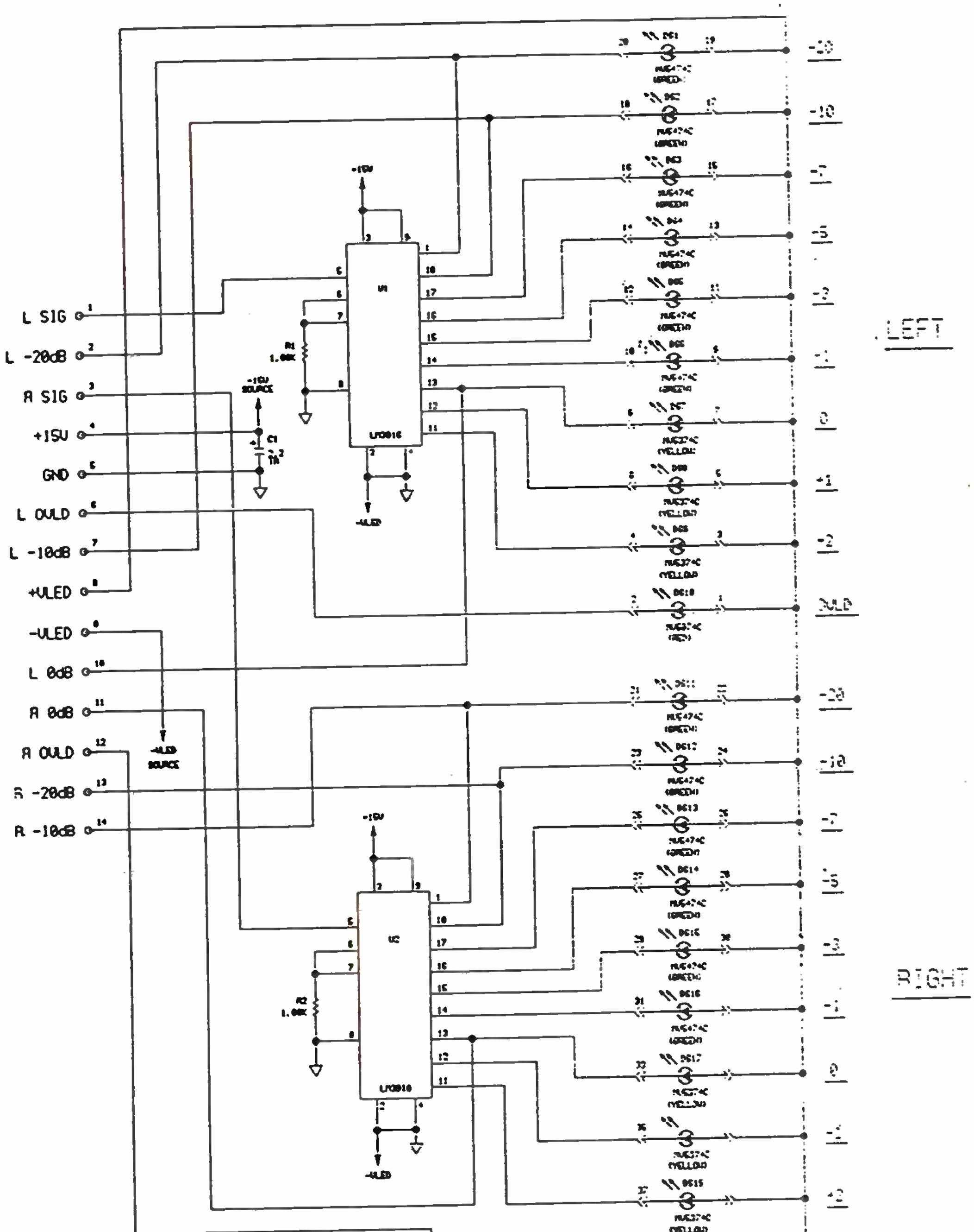

LOW BAND
LEFT CH.
M1 BAND
RIGHT CH.
L BALANCE
M1 BALANCE
LOW BAND OUTPUT
M1 BAND OUTPUT
LEFT
RIGHT
1001 MODULE
U8A
U8B
LM13600
TL072
MPS404A
Circuit Research Labs, Inc.
SEC-800 SCHEMATIC
02-8200-01
SEC-800



M2 BAND
H BAND
LEFT
RIGHT
M2 BALANCE
H BALANCE
M2 BAND OUTPUT
H BAND OUTPUT
RIGHT CH.
1001 MODULE
MPS404A
LM13600
TL072
187
186
Circuit Research Labs, Inc.
SEC-800 SCHEMATIC
02-8200-01
SEC-800
SHEET 3 OF 4



LEFT CH.
RIGHT CH.
LIMIT / COMPRESS SWITCH
MULTI / WIDE BAND SWITCH
OPERATION SWITCH
PROOF
AC POWER MODULE
AC POWER INPUT
RFI SHIELD
TRANSFORMER
BLACK
RED
WHITE
BLACK WITH BLUE SLEEVE
WHITE WITH BLUE SLEEVE
VIOLET
YELLOW
LEFT CH. OUTPUT
RIGHT CH. OUTPUT
+15V SUPPLY
-15V SUPPLY
+15V SOURCE
-15V SOURCE
LM317T
LM337T
POWER LED (RED)
RIGHT INPUT CAL. (YELLOW)
LEFT INPUT CAL. (YELLOW)
AUX BOARD 07-6100-01
Circuit Research Labs, Inc.
TITLE SEC - 800 SCHEMATIC
SIZE D
DWG NO 02-8200-01
REV A-Z
MODEL TYPE SEC - 800
SHEET 4 OF 4
P. Henn 6-4-86



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTORS ARE 1/4W METAL FILM AND VALUES ARE IN OHMS.
2. ALL CAPACITOR VALUES ARE IN MICRO FARADS, TA=TANTALUM.
3. ALL FRONT PANEL INDICATORS ARE UNDERLINED.

ORIG. Cyrus Ringle 07-22-87	CRL Circuit Research Labs, Inc.			
CHKD Paul Stone 7/22/87	TITLE LED INDICATOR SCHEMATIC (STEREO)			
PROJ. ENGR Stah 7-22-87	TYPE	SIZE A	DWG. NO. 02-6100-02	REV A-1