PMC-400A

PEAK MODULATION CONTROLLER

FOR AM BROADCAST

INSTALLATION AND OPERATION MANUAL

PRELIMINARY

Circuit Research Labs, Inc.
2522 W. Geneva Drive
Tempe, Az. 85282 U.S.A.
602-438-0888

PMC-400A
PEAK MODULATION CONTROLLER

INSTALLATION AND OPERATION MANUAL

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

3,582,964 4,393,346 4,406,923
4,350,845 4,398,158 4,609,878
4,383,229 4,679,239

PROPRIETARY NOTICE

CIRCUIT RESEARCH LABS. INC.
2522 W. Geneva Drive
Tempe, AZ 85282
(602) 438-0888

P/N 10081 DWNG 11-2500-01 Rev. PRELIMINARY

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SECTION 1 - GENERAL

1.1 SAFETY INFORMATION

1.1.1 DEFINITIONS OF SAFETY SYMBOLS

****
WARNING
****

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 2.2 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:

-NRSC Pre-Emphasis and Filtering Characteristic
-Gated Input Gain Reduction
-Patented Overshoot-Corrected Filtering Technique Removes Out-of-band Components Without Loss of Peak Modulation
-Selectable Low-frequency Tilt Correction Circuit Improves the Modulation Capability of Many Plate-modulated Transmitters
-22 dB Range, 10 Segment Input Peak Indicator
-Programmable 1 dB step Peak Limiting Control
-Rugged 1 3/4" Rack-mount Chassis With Integral RFI Protection

The CRL PMC-400A incorporates designs originally developed for AM stereo. Gain reduction, pre-emphasis, filtering, and limiting are combined to permit maximum loudness with minimum distortion.

The PMC is the ideal choice to upgrade a monaural audio processing chain to meet the NRSC (National Radio Systems Committee) Voluntary National Standard of January 10, 1987. This transmission standard defines specific pre-emphasis and filtering requirements which are intended to help solve many of the technical concerns in AM broadcasting. The pre-emphasis curve was developed to allow receiver manufacturers to employ a complementary de-emphasis characteristic in wideband radios while improving the frequency response of narrower and medium-bandwidth radios. The filter specification, which limits transmitted audio bandwidth to 10 kHz, is intended to greatly reduce much of the interference

between stations by reducing the conditions that cause "splatter" effects (see Figure 1-1). An 11 kHz cutoff frequency option can also be selected via a rear panel switch. This option, in many cases, can also yield a significant reduction in occupied bandwidth (this mode does not conform to NRSC requirements).

A gated input gain reduction circuit is included which provides >20 dB of input gain control to prevent detrimental limiting effects by maintaining consistent levels into the limiter circuits. This eliminates "pumping" and other processing artifacts caused by excessive peak limiting.

A resonant low pass clipping filter is used to prevent excessive clipping harmonics which could result in higher intermodulation artifacts. This patented filter eliminates these excessive clipping harmonics, allowing the user to increase limiting to obtain maximum loudness capability without audible distortion.

In addition, the PMC-400A includes a selectable tilt correction circuit, which compensates for the low frequency phase shift common in many plate-modulated transmitters. This often results in an ability to increase the overall modulation level by several percent.

Programmable 1 dB per step peak limiting circuitry is provided with a range from 0 to +5 dB. This circuitry selects the amount of instantaneous gain reduction (limiting) applied to the audio signal.

To aid the user in properly setting the audio level into the unit, a 10 segment peak-reading LED input level meter with a range from -20 to +2 dB is provided. A red overload LED is also provided as one segment of the indicator. Additional indicators are included to monitor the activity of filter overshoot-correction circuitry.

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

The PMC 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.

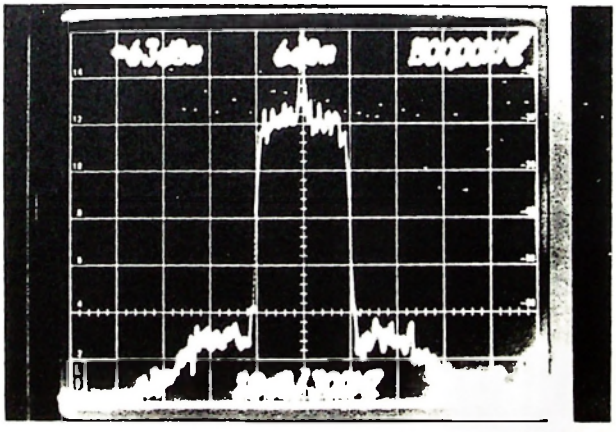


FIGURE 1-1 TYPICAL TRANSMITTED SPECTRUM
(Laboratory transmitter, 15 minute peak-store display; V:10 dB/div., H: 10 kHz/div., 300 Hz resolution

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 NRSC VOLUNTARY STANDARD COMPLIANCE RECORD

Please return the enclosed post paid card to the NRSC, so that broadcast equipment manufacturers, receiver manufacturers, and the trade press can be informed as to the progress of conversion to the voluntary national standard.

If this card is missing notify Circuit Research Labs Inc or:

National Radio Systems Committee
c/o NAB Science & Technology
1771 N Street, N.W.
Washington, D.C. 20077-6316

1.5 PMC-400A SPECIFICATIONS

ELECTRICAL

INPUT	(Ref. 0 dBm=0.775 VRMS)
Type:	Active balanced (differential)
Impedence:	>10K ohms bridging
Termination:	Selectable 600 ohms
Level (adjustable):	<-10 to +20 dBm; ref. to 0 dB indication on front panel level meter
OUTPUT	
Type:	Active balanced (differential)
Impedence:	100 ohms (to drive 600 ohm load)
Level (adjustable):	<-20 to +20 dBm; ref. to 100% negative modulation level, as established internally
FREQUENCY RESPONSE	(0 dB ref. at 400 Hz, +10 dBm input/output)
9.5 kHz filter bandwidth selected:	50 Hz to 8 kHz; +0/-1.5 dB -3 dB at 9.5 kHz >30 dB atten. at 10.5 kHz >40 dB atten. at 11.0 kHz Conforms to NRSC standard using required dynamic measurement method
11 kHz filter bandwidth selected:	50 Hz to 10 kHz; +0/- 1.5 dB - 3 dB at 11 kHz >30 dB atten. at 13.5 kHz
Proof Mode:	50 Hz to 15 kHz; +/- 0.5 dB
HARMONIC DISTORTION	(+10 dBm input/output, 20 kHz bandwidth)
9.5 or 11 kHz BW:	<0.25% over selected operating bandwidth, at or below 100% negative modulation level
Proof mode:	<0.1%
S+N/N:	>65 dB in operate mode >75 dB in proof mode
INPUT GAIN REDUCTION:	Input leveling AGC; selectable in 2 dB increments to 8 dB, >20 dB overall range
LIMITING:	Selectable in 1 dB increments from 0 to +5 dB; dual band, crossover frequency: 3.5 kHz
PRE-EMPHASIS:	Follows NRSC standard pre-emphasis characteristic, 20 Hz to 10 kHz, when front panel ***PRE-EMPHASIS*** switch is in ***STD*** position. Continuously variable via front panel ***HI-FREQ EQUALIZATION*** control when front panel ***PRE-EMPHASIS*** switch is in ***VAR.*** position

BASS PRE-EMPHASIS:	Internally selectable bass boost function can be placed in circuit to improve apparent low frequency response of many AM receivers
ASYMMETRY:	Adjustable threshold allows up to +150% positive peak modulation
TILT CORRECT:	Selectable circuit allows correction of low frequency phase shift found in some plate-modulated transmitters
INDICATORS:	1. 10-Segment LED-type input level meter with a 22 dB (28 dB with OVLD) dynamic range 2. +/- limit indicators monitor activity of patented overshoot-corrected filter circuitry

GENERAL

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 maximum, 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 PMC-400A 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 SWITCH 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.

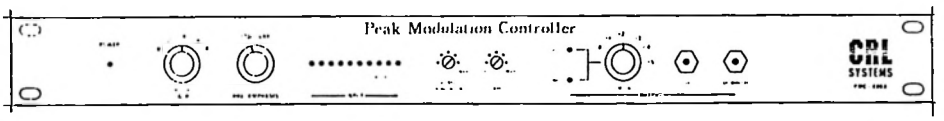


FIGURE 2-1 PMC-400A FRONT PANEL

FIGURE 2-2 PMC-400A 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.

2.3 POWER LINE AC VOLTAGE SELECTION

The PMC-400A 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.

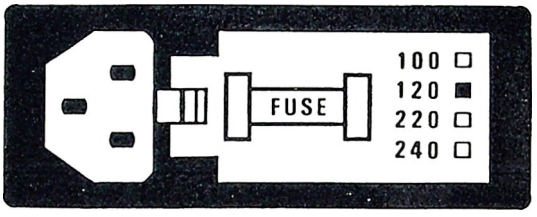


FIGURE 2-3 LINE VOLTAGE SELECTION

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 PMC 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 potentiometer R146 on the PCB at this time. See Section 6.2 for making this adjustment).

JUMPER	FACTORY SET POSITION	FUNCTION OF JUMPER
J5	INSTALLED	+15 V DISCONNECT JUMPER. The positive DC power connection between the power supply and the circuitry is broken when this jumper is removed.
J6	INSTALLED	-15 V DISCONNECT JUMPER. The negative DC power connection between the power supply and the circuitry is broken when this jumper is removed.
J9	TERM	TERMINATING OR BRIDGING INPUT JUMPER. In the ***TERM*** position, the input has a 600 ohm termination. The ***BRIDGE*** position presents an impedence of >10K ohms.
J10	OUT	BASS CLIP JUMPER. This jumper selects the low frequency response of the input leveling AGC circuitry. In the ***OUT*** position the low frequency response is flat. In the ***IN*** position the G/R circuits do not respond to frequencies below 100 Hz.
J11	IN	BASS PRE-EMPHASIS JUMPER. The ***IN*** position produces a response peak at approximately 105 Hz of approximately 3 dB above 400 Hz reference. It also produces a rapid roll-off below 100 Hz to prevent the transmission of subsonic information. This position is used to improve the apparent frequency response of many receivers. It may also increase the performance of some plate modulated transmitters that are unable to tolerate subsonic information. In the ***OUT*** position, the frequency response is flat.
J19 J20	NORM NORM	AUX 2 | These jumpers are provided AUX 1 | for future options and each must remain in the ***NORM*** position.

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	Fixed; measure at TP4
DS2	-15 VDC +/- 50 mVDC	Fixed; measure at TP5

GATE LED INDICATOR

This LED is illuminated when the gate circuitry is activated. This freezes all gain control action when the level drops below the gate threshold (-20 dB).

LED	DESCRIPTION
DS3	Gate Indicator

2.6 INTERCONNECTIONS

2.6.1 GENERAL

The PMC-400A 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 and is always placed immediately before the transmitter in the audio path.

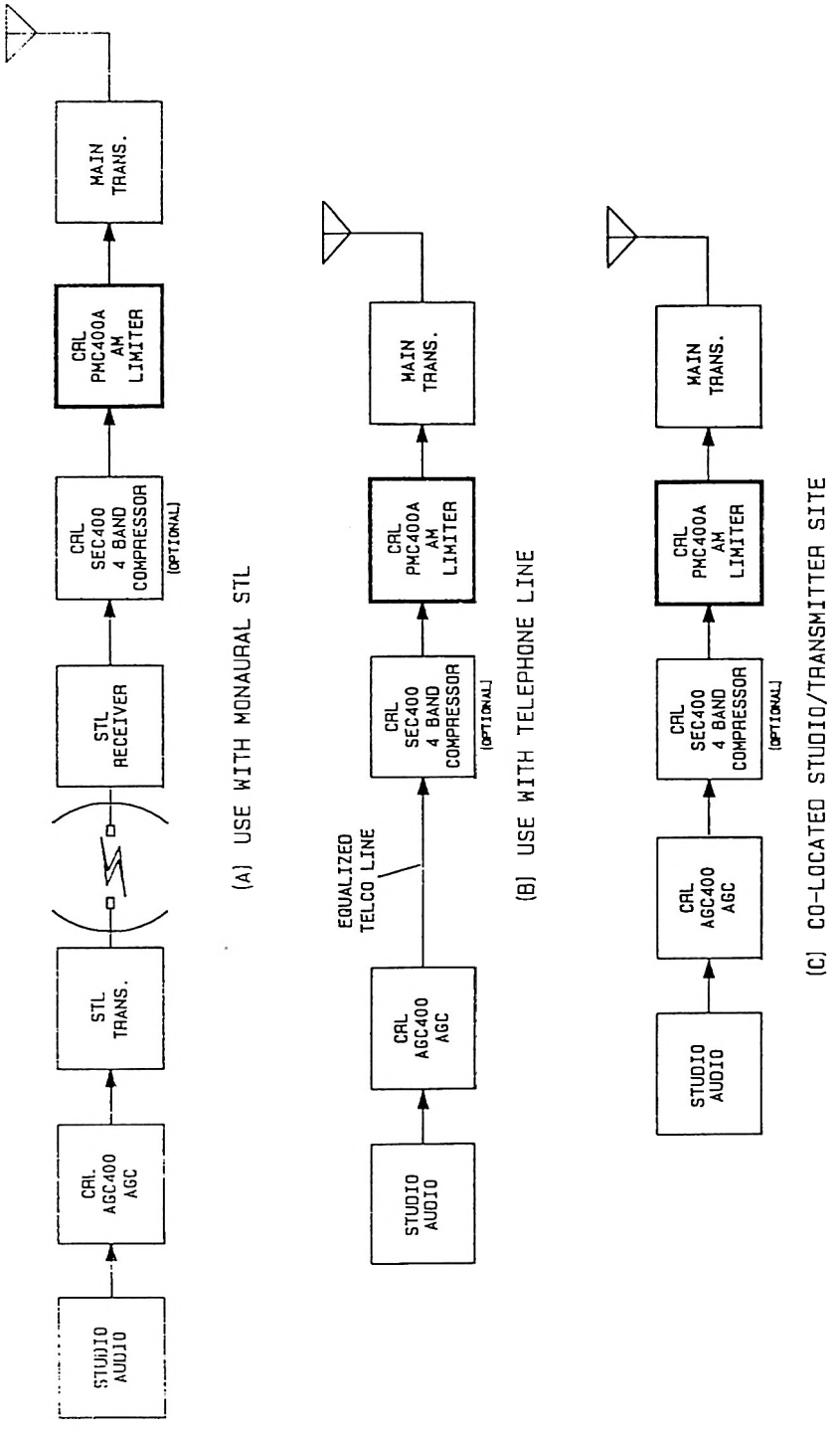


FIGURE 2-4 TYPICAL SYSTEM CONFIGURATIONS

2.6.2 BALANCED LINE CONNECTIONS

Most broadcast equipment is designed for balanced line operation. Connect as per FIGURE 2.5. The PMC-400A has one input and one output connection. 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 PMC-400A has one input and one output connection.

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 must be connected to the ground terminal. 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. Unbalanced operation is not recommended in most applications since RFI supression is most effective when a balanced-line connection is used.

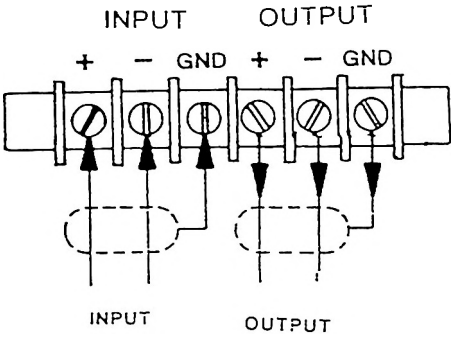


FIGURE 2-5 BALANCED LINE CONNECTIONS

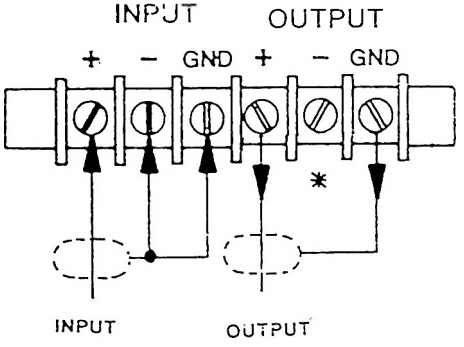


FIGURE 2-6 UNBALANCED LINE CONNECTIONS

2.7 INITIAL SET-UP

2.7.1 GENERAL

The following procedure is given to aid in interfacing and setting up the PMC for general program requirements. It is recommended that the entire manual be read first to become familiar with all of the capabilities of this unit.

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

2. Connect audio input and output as per Section 2.6.

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

2.7.2 SET-UP PROCEDURE

INITIAL CONTROL SETTINGS

CONTROL OR SWITCH	SETTING
INPUT AGC G/R	-8
PRE-EMPHASIS	STD
EQUALIZATION	OFF (fully CCW)
TILT CORRECT	OFF
LIMITING	+5
OUTPUT - LEVEL	FULLY CCW (20 turns or more)
ASYMMETRY	FULLY CCW (20 turns or more)
INPUT CALIBRATE*	FULLY CCW (20 turns or more)
BANDWIDTH*	9.5 (Out)
PROOF/OPERATE*	OPERATE

CAUTION: When setting up the PMC with an older transmitter it may be desirable to use less than full limiting to avoid damage to the transmitter or antenna system.

*Located on back panel

SET-UP PROCEDURE

1. Feed a line level program signal through the system to the input on the PMC-400A. All equipment prior to the PMC should be set for normal operation.

2. Increase the setting of the PMC-400A ***INPUT CALIBRATE*** 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 with normal program material.

NOTE: If unable to get the LED indicator to illuminate in the above step after 20 complete clockwise rotations, the input sensitivity may need to be adjusted (see Section 6.4).

3. Increase the setting of the ***OUTPUT LEVEL*** control (front panel) clockwise until the negative modulation peaks, as observed on the modulation monitor or oscilloscope are peaking at 90-95%. The setting of this control is dictated by the negative modulation capability of the transmitter.

CAUTION: The output level of the PMC-400A should never be set such that the negative modulation capability of the transmitter is exceeded.

4. When the output level control is properly set, the ***G/R*** (input AGC) switch and the ***LIMITING*** switches should be reduced to the desired settings as required by the program format. The suggested initial settings are:

SWITCH	SETTING
G/R	-4
LIMITING	+2

5. The asymmetry and tilt correct functions may be enable as required (see Sections 2.7.3 and 2.7.4).

2.7.2 ASYMMETRY SET-UP

NOTE: Verify that the station transmitter, as per manufacturer's specifications and condition is capable of producing the positive modulation desired.

1. Feed a line level program signal through the system to the input on the PMC-400A. All equipment prior to the PMC should be set for normal operation.

2. Adjust the ***ASYMMETRY*** control clockwise until the desired positive modulation level as indicated on the modulation monitor is achieved.

NOTE: It may be desirable to use higher initial settings of the ***G/R*** and ***LIMITING*** switches to magnify the effect of the ***ASYMMETRY*** control. This increases the density of the program material providing a higher amount of peak modulation which enables the upper limit of positive peak modulation to be set accurately.

3. If the asymmetry control increases negative modulation, check for phase reversal of PMC output connections.

4. Return the ***G/R*** and ***LIMITING*** switches to the normally used positions.

2.7.3 TILT CORRECT SET-UP

NOTE: This procedure should be done only after all other adjustments have been completed.

NOTE: This adjustment can be performed either using test equipment or dynamically with program material. Although the method employing test equipment will yield greater accuracy at a single frequency, the dynamic set-up method is preferred in most cases. This is due to the fact that the average tilt (or phase shift) can be corrected over a wider range of frequencies when program material is used.

METHOD #1: SET-UP USING TEST EQUIPMENT

1. Obtain the following test equipment (or equivalent):

MODEL	MFG.	NOTES
AG-51	Potomac	Audio Generator (Set the output switch to L+R)
2445	Tektronix	Oscilloscope (5 MHz minimum response, dual channel)

2. Turn the PMC ***OUTPUT LEVEL*** control fully CCW (counter-clockwise).

3. Disconnect the PMC ***AUDIO INPUT*** connections (back panel). Connect the audio generator to the ***AUDIO INPUT*** connections. Feed a 100 Hz tone to the unit at a level 6 dB higher than the level at which the OVLD indicator illuminates.

NOTE: If the audio generator is set for a +10 dBm output level when the front panel meter indicates +2, the specified level can be obtained by increasing the generator output level by 10 dB to +20 dBm. Other generator output levels can be accommodated by adjusting the PMC ***INPUT LEVEL*** control.

4. Increase the settings of the PMC ***G/R*** and ***LIMITING*** switches to maximum settings (-8 and +5 respectively).

5. Connect an oscilloscope across the R. F. input of the modulation monitor (or other suitable R. F. monitor point in the transmission system).

6. Set the PMC ***OUTPUT LEVEL*** control as required to obtain about -70% modulation, as observed on the oscilloscope or modulation monitor. The display will be highly clipped as shown in the figures on the following page.

********** TO AVOID DAMAGE, THE TRANSMITTER SHOULD BE
WARNING OPERATED FOR A FEW SECONDS AT A TIME ONLY.
****

NOTE: If the modulation envelope as viewed on the oscilloscope appears as in Figure 2-7, no tilt correction is necessary and the following procedure should not be performed.

7. If tilt is present as shown in Figure 2-8, enable the tilt correct circuitry by rotating the front panel ***TILT CORRECT*** potentiometer until it just 'clicks' on.

8. If tilt is present, as shown in Figure 2-8, adjust the ***TILT CORRECT*** control to obtain a waveform similar to Figure 2-7. Over-correction will resemble Figure 2-9 and cause poor performance. Turn ***TILT CORRECT*** control counter-clockwise to correct.

9. After adjustment has been made, disconnect the generator and reconnect the program audio to the PMC ***AUDIO INPUT*** connections. Recalibrate the PMC ***INPUT LEVEL*** AND ***OUTPUT LEVEL*** controls for normal operation. Return the ***G/R*** and ***LIMITING*** switches to their previous positions.

10. If the results indicated cannot be obtained or if the display initially appears overcorrected as per Figure 2-11, turn the ***TILT CONTROL*** control fully CCW until a 'click' is heard. The condition of transmitter modulating components should be checked; also, the presence of inadequate A. C. coupling at the transmitter audio input or modulator should be investigated and corrected before attempting to repeat the procedure.

METHOD #2: SET-UP USING PROGRAM AUDIO AND OSCILLOSCOPE

NOTE: In lieu of program material, the pulsed-USASI noise function on the CRL AGC-400 may be used.

1. Feed normal program audio through the processing system including the PMC and transmitter. The pre-emphasis function should be disabled. (PMC ***PRE-EMPHASIS*** switch set to ***VAR*** and the ***HI FREQ EQUALIZATION*** set fully CCW).

2. Connect an oscilloscope across the R. F. input of the modulation monitor or other suitable monitor point (use an oscilloscope of at least 5 MHz bandwidth).

3. Decrease the PMC ***OUTPUT LEVEL*** control to a point where the transmitter peak modulates at about -70%, as observed on the modulation monitor (or oscilloscope).

4. Increase the PMC ***INPUT LEVEL*** control such that the ***OVLD*** indicator flashes to a point where it is illuminated most of the time with program audio present. Increase the settings of the PMC ***G/R*** and ***LIMITING*** switches to maximum settings (-8 and +5 respectively). Demodulated audio will be distorted during this adjustment.

NOTE: If a multi-band compressor (such as the CRL SEC-400 or SEP-400B) is present in the system, the ***LOW*** band control should be increased to a setting fully clockwise, while the ***M1***, ***M2***, and ***HIGH*** band controls should all be set fully counter clockwise. This will make the low frequency components easier to see on the oscilloscope. BE SURE TO LOG SETTINGS OF THESE CONTROLS SO THEY CAN BE RETURNED TO THEIR ORIGINAL POSITIONS AFTER ADJUSTMENT IS MADE.

5. As viewed on the oscilloscope, it should be noted if bass notes clip in a similar tilted manner as shown in the photo of Figure 2-8. If this is the case, proceed to step 6. If the clipped bass information appears similar to Figure 2-7, no correction is necessary.

NOTE: It is easiest to determine the presence of tilt by observing the negative portion of the modulation envelope.

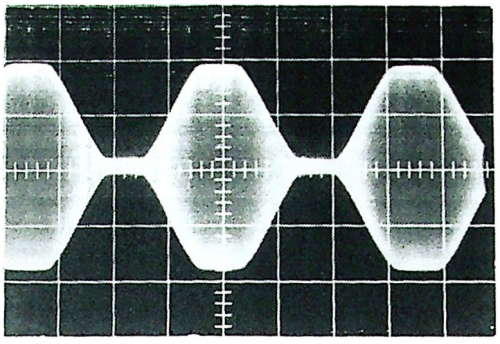


FIGURE 2-7 NORMAL MODULATION ENVELOPE
(No Tilt Present)

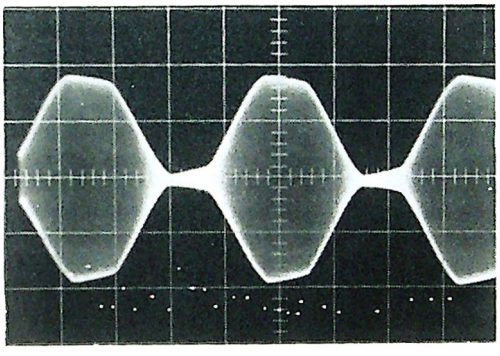


FIGURE 2-8 UNDER-CORRECTED MODULATION ENVELOPE
(Tilt Present)

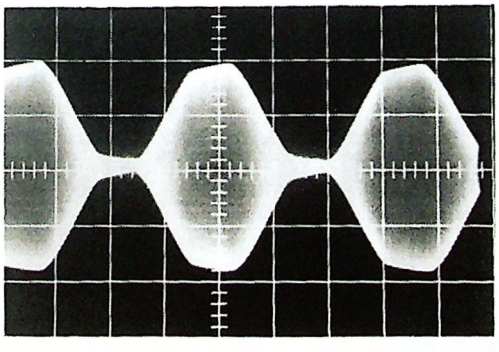


FIGURE 2-9 OVER-CORRECTED MODULATION ENVELOPE

6. If tilt is present as described above, enable the tilt correction circuitry by rotating the ***TILT CORRECT*** control clockwise until it just 'clicks' on.

7. Adjust the PMC front panel ***TILT CORRECT*** control such that bass clipping is horizontal (as in Figure 2-7). The trace should be studied for several minutes as the adjustment is made to verify that the majority of low frequency tilt is removed.

CAUTION: BE CAREFUL NOT TO OVER-CORRECT, AS SHOWN IN FIGURE 2-11. DAMAGE TO THE TRANSMITTER MAY RESULT IF TILT IS LEFT SIGNIFICANTLY OVER-CORRECTED.

8. If this adjustment cannot be successfully made, or if the waveform initially tilts in the manner as shown in Figure 2-11, the transmission system requires troubleshooting (see METHOD 1, Step #10).

9. Readjust the PMC input and output level controls for normal program operation (decrease input level and increase output level). Return PMC ***PRE-EMPHASIS*** switch to the ***STD*** position (or ***VAR*** position with the ***HI FREQ EQUALIZATION*** control at the previous setting). Return the ***G/R*** and ***LIMITING*** switches to their previous positions.

2.8 GUIDELINES FOR SYSTEM SOUND SETTING

The following chart should be followed for the initial settings after the previous alignments have been completed. The chart should also be used for reference to insure that the final combination of sound settings are within the recommended ranges.

NOTE: Settings outside these ranges may indicate incorrect alignment of individual units in the system.

AGC-400 dynafex® NOISE REDUCTION USAGE

In conjunction with any of the above control settings, the dynafex noise reduction circuitry can be activated. The front panel ***THRESHOLD*** control should be set to obtain the maximum amount of noise reduction during program pauses without audible expansion artifacts. It may be desirable to change the positions of internal jumpers J11 and J19 to optimize the dynafex operating VCR bandwidth for the program format (see Section 2.4 of the AGC manual).

NOTE: The ***BAND - MULTI/WIDE*** switch may be set as desired for dynamic equalization on the SEC-400.

CAUTION: If the SEC-400 is not being used with the system add 3 to 6 db to the AGC-400 G/R levels.

SYSTEM SOUND SETTING GUIDE

SUGGESTED CONTROL SETTINGS

	AGC-400			*SBC-400*			*PMC-400A*	
FORMAT	G/R	OPER	BAND	G/R	OPER	LIM/ COMP	G/R	LIM
Rock								
Heavy 1	-12	F	DUAL	-12	M	L	-8	+4
Heavy 2	-12	F	BOTH	-9	F	C	-6	+3
Heavy 3	-9	F	DUAL	-9	F	L	-6	+3
Medium 1	-9	F	BOTH	-9	M	C	-6	+3
Medium 2	-9	M	DUAL	-6	F	C	-4	+3
Medium 3	-9	M	BOTH	-6	F	L	-4	+2
Soft 1	-6	M	DUAL	-9	S	C	-4	+2
Soft 2	-6	M	BOTH	-6	M	C	-2	+1
Soft 3	-6	S	WIDE	-6	S	L	-2	+1
Beautiful Music								
Heavy	-9	M	DUAL	-9	M	C	-6	+2
Medium	-6	S	BOTH	-6	S	C	-4	+1
Soft	-3	S	WIDE	-3	S	C	-2	0
Country								
Heavy	-9	F	DUAL	-9	M	C	-6	+3
Medium	-6	M	BOTH	-6	M	C	-4	+2
Soft	-3	S	WIDE	-3	S	C	-2	+1
Talk								
Heavy	-12	M	DUAL	-12	M	L	-6	+4
Medium	-9	M	BOTH	-9	M	L	-4	+3
Soft	-6	S	BOTH	-6	S	L	-4	+2
Classical								
Heavy	-9	S	BOTH	-9	S	C	-4	+2
Medium	-6	S	BOTH	-6	S	C	-2	+1
Soft	-3	S	WIDE	-3	S	C	-2	0
Easy Listening								
Heavy	-9	M	BOTH	-9	M	C	-6	+3
Medium	-6	M	BOTH	-6	M	C	-4	+2
Soft	-6	S	BOTH	-6	S	C	-2	+2

SECTION 3 - OPERATING INSTRUCTIONS

3.1 GENERAL

The purpose of this section is to further describe the operation of the switches, indicators, and controls on the PMC-400A. A thorough understanding of this section will enable the user to get the most from this unit. Each switch, indicator, and control 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 G/R (Input AGC) SWITCH

The ***G/R*** (Input AGC) switch sets the signal level to the circuits that control the range of gain reduction. For example, when the switch setting is -4, the output of the unit will be held constant even though the input may drop as much as 4 dB below the calibrated input level. If the input level drops 6 dB, the output will drop only 2 dB. Input signals may increase as much as 15 dB above the "0" dB indication on the LED input level meter and not be affected by the setting of this switch, since G/R 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 -2 to -4 and from -4 to -6.

CAUTION: **It is suggested that the user select a setting as low as possible to accomplish the objectives. Most users choose -2 or -4. Also, it is assumed that the audio applied to the unit is already gain controlled and compressed as desired. Unprocessed audio should not be directly applied since this circuit is not designed to operate over an extremely wide dynamic range.**

3.2.3 PRE-EMPHASIS SWITCH

A switch is provided to select either the NRSC (National Radio Standards Committee) standard pre-emphasis characteristic in the ***STD*** position or a user adjustable variable pre-emphasis characteristic in the ***VAR*** position. The ***STD*** pre-emphasis function is characterized by a single zero at 2122 Hz and a single pole at 8700 Hz, as defined by the NRSC. This is essentially a 75 us pre-emphasis characteristic rolled off at higher frequencies such that the maximum gain is 10 dB at 10 kHz.

NOTE: If undesirable modulation artifacts are present when using the ***STD*** position due to transmitter or antenna deficiencies, the ***VAR*** position should be used to troubleshoot the system (see note in Section 3.2.5).

In the ***VAR*** position, the desired pre-emphasis is set by the ***HI FREQ. EQUALIZATION*** control (see Section 3.2.5).

3.2.4 INPUT LEVEL INDICATOR

The input indicator displays the input signal level. 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 HI FREQ EQUALIZATION

This control provides a continuously variable high frequency pre-emphasis of the program material.

NOTE: This control is activated only when the ***PRE-EMPHASIS*** switch is in the ***VAR*** position.

When this control is rotated clockwise, the amount of pre-emphasis (emphasis at higher frequencies) is increased. When it is set to approximately the 2:00 position, the pre-emphasis is essentially the same as when the ***PRE-EMPHASIS*** switch is in the ***STD.*** position. The use of this control allows the user to set the pre-emphasis between 0 (none) and the NRSC ***STD*** setting (2:00) or slightly higher than this standard setting (fully clockwise).

NOTE: The ***HI FREQ EQUALIZATION*** control may be used in lieu of the ***PRE-EMPHASIS - STD*** switch setting if undesirable modulation artifacts are present. If this is necessary, the user should determine the reason for not being able to use the ***STD*** setting so that the problem can be corrected. Generally, the inability to pass an audio pre-emphasis characteristic is caused by a poor impedence match between the transmitter and antenna system at higher audio frequencies.

3.2.6 TILT CORRECT CONTROL

The ***TILT CORRECT*** control is used to adjust the correction circuitry which compensates for low frequency 'tilt' (phase shift) found in some plate-modulated transmitters. The operation of this control is enabled by rotating the control clockwise until it 'clicks' ***ON***. This function is not normally required with transmitters that do not have a plate modulation transformer. The PMC will work without using the tilt correction circuitry, however higher peak modulation capability will likely result when the circuitry is enabled and correctly adjusted, as required (see Section 2.7.4).

3.2.7 POSITIVE AND NEGATIVE LIMIT INDICATORS

The positive and negative limit indicators are used to show when the limiting circuitry built into the overshoot compensated low-pass filter is being activated. These indicators should begin to flash as the setting of the ***LIMITING*** switch is increased. When the asymmetry function is enabled (see Section 2.7.3), the positive indicator should flash less often than the negative indicator (or not at all).

3.2.8 OUTPUT - LIMITING SWITCH

This switch is used to select the amount of instanteous gain reduction (limiting) applied to the audio signal. Lower settings (0, +1, or +2) will provide well controlled but less dense program audio. Higher settings (+3, +4, or +5) will produce very dense and louder but still tightly controlled audio. The setting of this switch is entirely up to the user depending on the desired 'on-air' apparent loudness.

3.2.9 OUTPUT - LEVEL CONTROL

The ***OUTPUT LEVEL*** control is provided to adjust the audio output level of the PMC. The control is adjusted so that the proper modulation level is supplied to the transmitter.

3.2.10 ASYMMETRY CONTROL

The ***ASYMMETRY CONTROL*** is used to adjust the amount of asymmetry or positive peak audio present in the output signal. This control is increased to the point at which the desired asymmetry is observed on the modulation monitor. As this control is increased clockwise the positive limit LED indicator will flash less often.

NOTE: If negative modulation increases as the PMC ***ASYMMETRY*** control is increased, this indicates that the polarity of the signal at the output connection of the PMC is reversed. This connection should be reversed before proceeding.

NOTE: When this control is at its maximum clockwise setting, the PMC is capable of producing greater than +150% positive modulation peaks. If the control is at its maximum and the desired result is not obtained, check the positive modulation capability of the transmitter.

3.3 REAR PANEL CONTROLS AND SWITCHES

3.3.1 INPUT CALIBRATE CONTROL AND INDICATOR

An ***INPUT CALIBRATE*** control is provided to adjust the audio input signal level to the 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 on the front panel level meter.

3.3.2. BANDWIDTH SELECT SWITCH

This switch selects the cutoff frequency of the internal low-pass filter. In the ***STD*** (out) position a 9.5 kHz filter characteristic is enabled, corresponding to the NRSC stopband specification. In the ***11 kHz*** position (in), the PMC does not conform to the NRSC stopband specification. See Figure 3-1 for a typical transmitted spectrum comparison between the two filter selections when used with a laboratory transmitter.

3.3.3 PROOF/OPERATE SWITCH

This switch selects either ***PROOF*** (bypass) or ***OPERATE*** mode of operation. In the ***PROOF*** position the input amplifier connects directly to the output amplifier. In the ***OPERATE*** position all functions in the PMC are enabled.

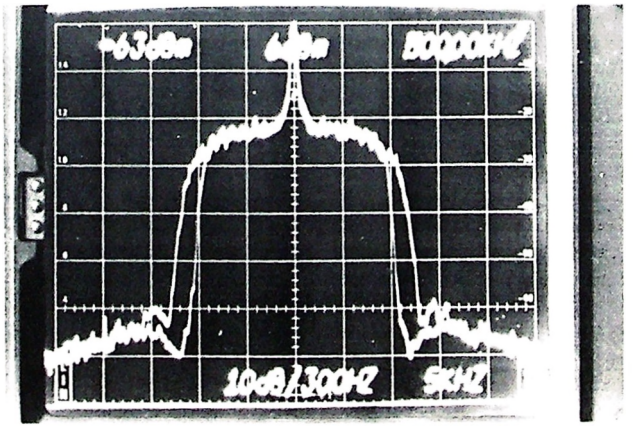


FIGURE 3-1 TYPICAL TRANSMITTED SPECTRUM COMPARISON (9.5/11 kHz Bandwidth Selection, 15 minute peak-store display; V:10 dB/div, H: 5 kHz/div., 300 Hz resolution)

SECTION 4 - DESCRIPTION OF THE NRSC STANDARD*

4.1 GENERAL

On January 10, 1987, the NRSC (National Radio Systems Committee) approved an Interim Voluntary National Standard pertaining to the use of audio pre-emphasis and occupied bandwidth filtering in AM broadcasting. The NRSC believes that implementation of the standard by all stations will reduce AM interference, increase useful AM service area, and encourage the production of higher fidelity AM receivers. The standard applies to both monaural and stereophonic AM broadcast stations. The NRSC consists of interested parties including broadcast station representatives, receiver manufacturers, broadcast equipment manufacturers (including CRL), and others.

4.2 PRE-EMPHASIS/DE-EMPHASIS

The purpose of the NRSC pre-emphasis/de-emphasis standard is to create a transmission/reception system where (1) AM broadcast stations will know, with certainty, the likely audio response characteristics of AM receivers, and (2) AM receiver manufacturers will know, with certainty, the likely audio response characteristics of AM broadcasts. A "matching" of pre-emphasis and de-emphasis is expected to improve the consumer's overall satisfaction with the technical quality of listening to AM radio.

Most AM stations have used pre-emphasis to varying extents. This pre-emphasis is employed in an attempt to compensate for the "narrow" response of most AM receivers. If AM pre-emphasis is not controlled, one station may interfere with AM receivers listening to neighboring stations located on adjacent AM channels.

The response of the chosen pre-emphasis curve is shown in Figure 4-1. It is characterized by a single zero with a break frequency at 2122 Hz, along with a single pole with a break frequency at 8700 Hz. This curve has been found to improve the frequency response of narrower and medium-bandwidth radios, while allowing receiver manufacturers to employ a simply-derived complementary de-emphasis characteristic in wideband radios. It is also felt that the amount of boost at high frequencies (+10 dB at 10 kHz) is not excessive in terms of transmitters being able to operate normally with the curve employed.

* Adapted in part from the actual text of the standard. A complete copy of the standard is available from Circuit Research Labs, Inc., upon request.

4.3 FILTERING

The standard also includes a specification for the maximum audio bandwidth transmitted by AM broadcast stations.

Implementation of a bandwidth specification can reduce second-adjacent channel interference and thereby lead to (1) a significant reduction of interference as perceived on "wideband" AM receivers; (2) a corresponding increase in the interference-free service areas of AM stations; and (3) an incentive for the further building of AM "wideband" receivers.

The specification of the chosen stopband characteristic is shown graphically in Figure 4-2. It is implemented through the use of appropriate and carefully designed audio low-pass filters as the final filtering prior to modulation. Compliance is measured dynamically, to take all audio processing functions into account. A specially derived pulsed-noise test signal is used as the modulating waveform (complete details of compliance measurement for both pre-emphasis and filtering functions are contained in the full NRSC specification).

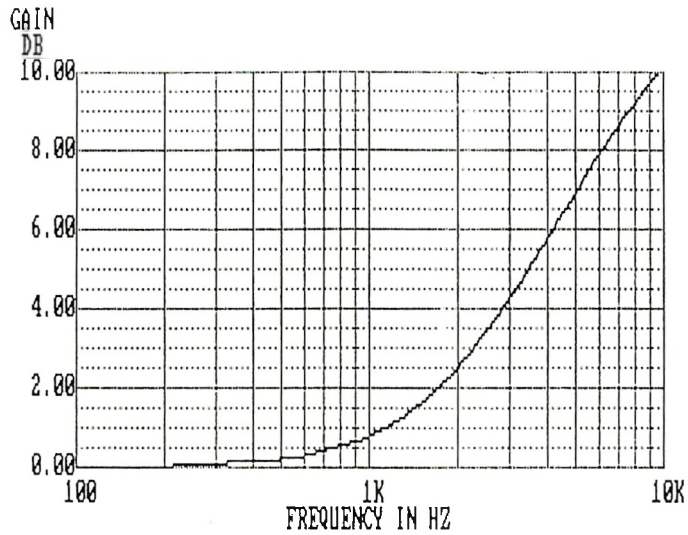


FIGURE 4-1 NRSC PRE-EMPHASIS CHARACTERISTIC

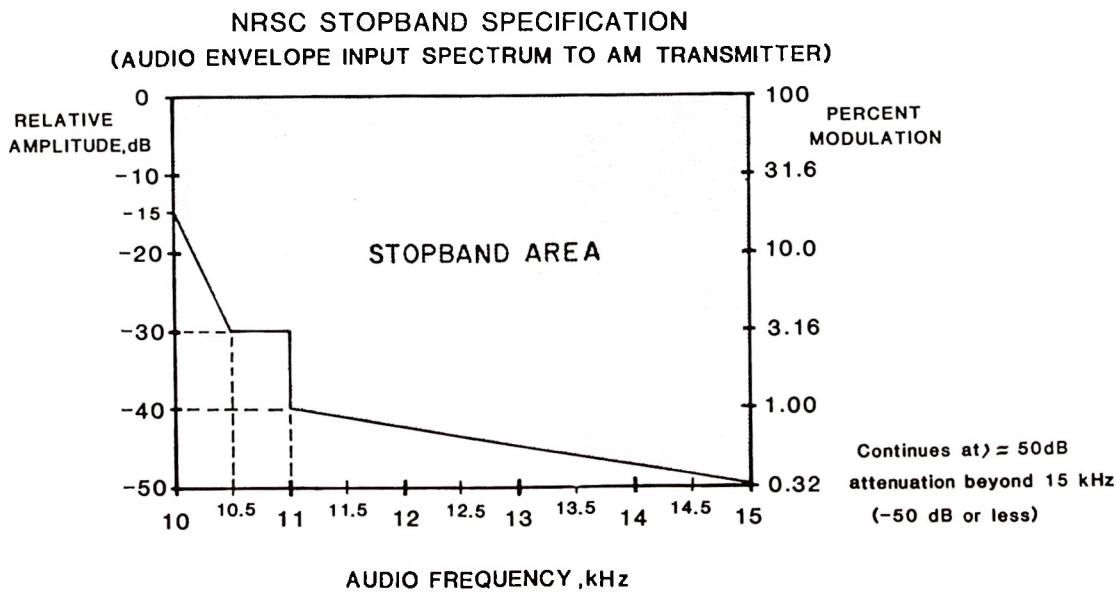


FIGURE 4-2 NRSC STOPBAND SPECIFICATION

SECTION 5 - THEORY OF OPERATION

5.1 GENERAL

This section contains theory of operation for the PMC. A detailed block diagram of the PMC is found in the Appendix. A schematic drawing and PCB parts placement drawing is also found in the Appendix.

5.2 POWER SUPPLY

AC power is supplied to the unit via a standard 3-conductor power cable which plugs into a connector on the back panel of the unit. This connector is an integral part of the AC input module. AC power is applied to power transformer T1 via the AC input module. This module consists of fuse F1, an RFI filter, and a voltage selection PCB. 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 AC input 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 separate AC supply voltages from which the separate DC voltages required by the PMC are derived. A separate secondary winding on T1 provides the operating voltages for the full wave bridge rectifier consisting of CR3, CR4, CR5, and CR6. The pulsating DC voltage is filtered by C10 and C11. The DC voltage from the rectifier is fed to voltage regulators U1 and U2 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. DS1 illuminates when a positive DC voltage is present at TP4 with respect to ground at TP3. DS2 illuminates when a negative DC voltage is present at TP5 with respect to ground at TP3. Jumper J5 disconnects positive DC power from the circuitry when it is removed. Jumper J6 disconnects negative DC power from the circuitry when it is removed.

A separate secondary winding on T1 provides the operating voltages for the ***V LED*** full wave bridge rectifier consisting of CR7, CR8, CR10, & CR12. The pulsating DC voltage is filtered by C6. The DC voltage from the rectifier is fed to voltage regulator U3 which develops the regulated ***V LED*** output voltage. CR11 is employed as a protection diode. This voltage can be measured at TP1 with respect to ground at TP6.

5.3 SIGNAL CIRCUITRY

The audio signal enters the PMC-400A through the (+) and (-) audio input terminals located on the rear panel. The audio lines are then RF bypassed by a second-order filter in a shielded compartment which remove frequency components above 160 kHz. Zener diodes are also provided to protect against line spikes generated from external sources.

The audio signal can be terminated via jumper J9. The signal then passes through a passive attenuator network in which ***INPUT CALIBRATE*** control R227 is located. The balanced signal is converted to an unbalanced signal by U5. This signal can be measured at TP5. This signal is split 3 ways as follows:

a. It is applied to ***PROOF/OPERATE*** switch S2 which connects the input audio directly to the output stage when this switch is in the ***PROOF*** position.
b. It provides a signal for the display driver circuitry.
c. It provides the audio signal for the G/R circuitry via the ***G/R*** switch S3. This switch provides a calibrated amount of attenuation to the G/R circuitry.

The display driver consists of U4 (full wave rectifier). The output of U4 is applied to R6 and C9 which provide the time constant for the meter display. The output of the network can be monitored at TP3. This drive signal is applied to the display PCB and ***OVLD*** detector Q3 and Q4. The OVLD signal is threshold detected and routed to the ***OVLD*** segment of the meter display.

The display PCB provides 2 signals which are as follows:

a. A 0 dB level signal is provided which is buffered by Q1 and used to light the rear panel ***CAL*** LED.
b. A -20 dB signal (a -10 dB signal can alternately be selected by user) is provided to operate the gating circuits. This signal is routed to Q5 and Q7 which buffer and level convert the signal. Q7 drives the internal gate LED DS3 as well as the gating circuits in U9.

The signal from the ***G/R*** switch S3 is routed to AGC amplifier U10. The active gain control element is VCR (voltage controlled resistor) U11. The feedback control loop is accomplished by a signal sample from U10 driving full wave rectifier U6. The rectified signal is threshold detected by Q10. The time constants for this circuit are contained in module U9. The output of U9 is buffered by U7. This control signal can be monitored at TP12 and is applied to the control port of U11. ***BASS CLIP*** jumper J10 determines the lower cutoff frequency of the AGC circuit. When it is in the ***OUT*** position, the AGC circuit is essentially flat at lower frequencies. When it is in the ***IN*** position, frequencies below 100 Hz are allowed to pass unattenuated into the limiter circuits.

The output of leveling AGC amplifier U10 can be monitored at TP16. At this point signal level is tightly controlled over a >20 dB range when the input signal is above the threshold of G/R as set by S3. This signal is routed to ***LIMITING*** switch S5, a selectable attenuator which determines the signal level to the following limiting circuit. The output of this attenuator is applied to U12. This amplifier serves a dual purpose. First, the amplifier can be configured at lower frequencies as a bass boost/high pass filter when jumper J11 is in the ***IN*** position. The frequency response is shown in Figure 5-1. This circuit has been found to improve apparent low frequency response of many receivers while preventing sub-sonic information from entering the transmitter. Secondly, U12 provides a pre-emphasis function in conjunction with the setting of ***PRE-EMPHASIS*** switch S4 and the ***HI FREQ EQUALIZATION*** potentiometer R278. When S4 is in the ***STD*** position, the NRSC standard pre-emphasis characteristic is implemented. When S4 is in the ***VAR*** position ***HI FREQ EQUALIZATION*** potentiometer R278 can be adjusted to provide a user determined amount of pre-emphasis. The range is from 0 (no pre-emphasis) to approximately +12 dB at 10 kHz.

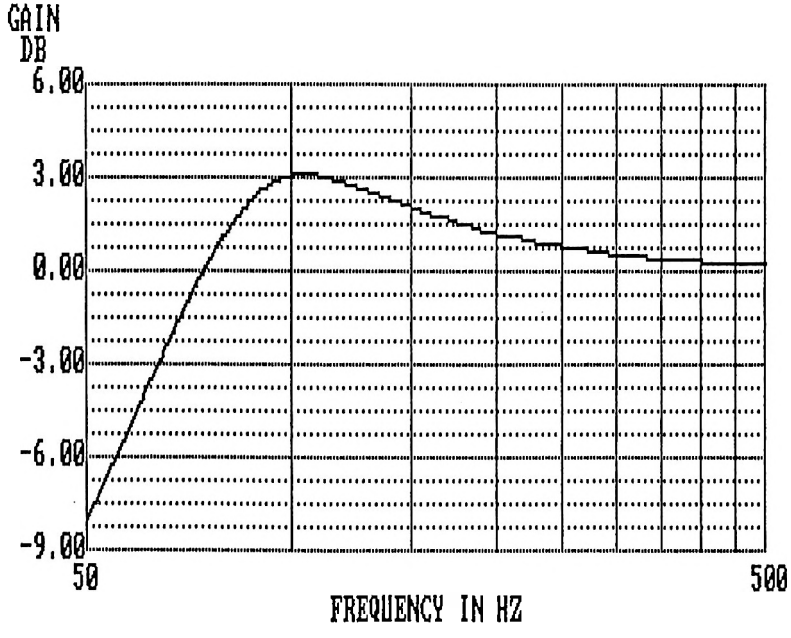


FIGURE 5-1 BASS PRE-EMPHASIS FILTER RESPONSE

The output of pre-emphasis amplifier U12 is monitored at TP23. The signal is split 2 ways into high and low frequency bands for the dual band limiter. The low band filter consists of U19a and associated components to provide a third order low pass characteristic at 3500 Hz. The signal can be monitored at TP21. The low band limiter circuit consists of VCR U18A. The control signal to U18A is rectified by a circuit consisting of Q14 and Q15. The output of the limiting circuit is summed with the high band limiter output by U17. The high band filter consists of U19b and associated components (third order characteristic). This filter is pre-conditioned by passive diode network CR22, CR23 and associated components. The filter output can be monitored at TP28. The signal is applied to an active high band VCR U18B. The control signal for U18B is developed by rectifier circuit consisting of Q22, Q23, and Q24. The output of the high band limiter is summed by U17 as previously described.

Limiter circuit U23, Q25, Q26, Q27, and associated components is provided for future expansion and is not used in the standard configuration of the PMC-400A.

The output of summing amplifier U17 can be monitored at TP19. The signal is then applied to U16, an amplitude and delay equalizer used in conjunction with the output low pass filter. The output is monitored at TP27. This signal drives a 9.5 kHz low pass filter consisting of L3 to L9 and associated components. It produces a filtering characteristic that exceeds the NRSC recommended stopband specification. Switch S1 (back panel) allows this filter to be reconfigured to produce an 11 kHz cutoff frequency. In this mode the filter characteristic does not meet NRSC specifications. An integral part of this filter is a CRL patented overshoot correction circuit. Negative overshoots are controlled via nodal sense diodes Q18 and Q19 (Q11, Q12, Q18, and Q19 are used as diodes with bases tied to emitter leads). Q19 drives threshold detector Q16 and the circuitry used to illuminate front panel negative limit LED DS6. Q18 drives threshold detector Q46. Positive peaks are controlled via diodes Q11 and Q12 which are connected to threshold detector Q21. The threshold at which Q21 conducts is adjustable via front panel ***ASYMMETRY*** control R280. R146 (located on PCB) is provided to calibrate this circuit such that limiting takes place equally on positive and negative peaks when the front panel ***ASYMMETRY*** control is fully CCW. Q21 also drives Q20 and Q13 which level converts and inverts the signal that is used to drive U15a. The output of U15a then drives the front panel positive limit LED DS5. The positive limit LED will flash less on program peaks as the setting of the ***ASYMMETRY*** control is increased.

The output of the low pass filter can be monitored at TP25. This signal drives a passive compensation network which is connected to the operate section of ***PROOF/OPERATE*** switch S2. The output of S2 is connected to ***OUTPUT LEVEL*** control R279. This control is connected to tilt correct amplifier U27. The tilt correct feature is selected via front panel switch/potentiometer S6/R281. This circuit, when enabled, can produce a low frequency phase shift equal and opposite to the phase shift common in many plate modulated transmitters. This cancels the low frequency tilt inherent in such transmitters. The output of the tilt correct circuitry can be monitored at TP31.

The signal is then fed to U21a which produces the - balanced output and U21b which produces the + balanced output. These outputs are fed through an RFI supression network consisting of L14, L15, and associated components (identical characteristic to input RFI filter). The balanced audio signals leave the PMC400A through the audio output terminals located on the rear panel.

NRSC FILTER COMPATIBILITY

See Figure 5-2 for the output spectrum of the PMC using the NRSC dynamic test method for filter bandwidth. It can be seen that the PMC filter circuitry fully meets NRSC bandwidth requirements.

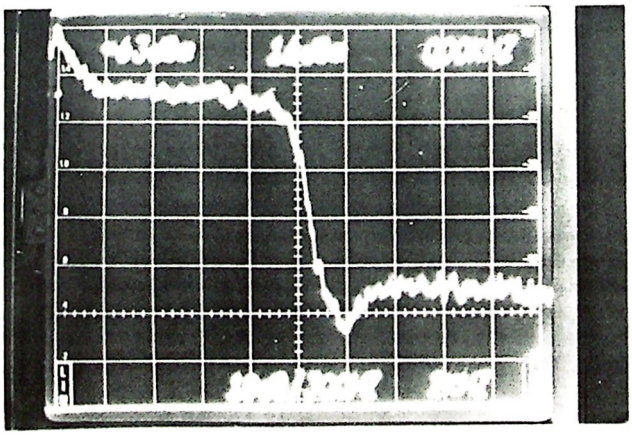


FIGURE 5-2 OUTPUT SPECTRUM OF PMC
(NRSC Pre-emphasis employed using required NRSC dynamic test method)

SECTION 6 - MAINTENANCE, TROUBLESHOOTING, AND CUSTOMIZATION

6.1 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.

6.2 ALIGNMENT PROCEDURES

6.2.1 GENERAL

The PMC-400A is designed so that only a minimum amount of initial alignment is necessary. This section covers the PCB mounted control. This control is aligned at the factory. No normal or routine re-alignment is required. When some of the integrated circuits are changed, re-alignment may be required.

The purpose of this adjustment is to set the positive limit threshold such that it is the same as the negative limit threshold when no asymmetry is present.

6.2.3 TEST EQUIPMENT REQUIRED (or Equivalent)*

MODEL	MFG.	NOTES
8050A	Fluke	Digital Multimeter

*All test equipment must be properly calibrated.

6.2.4 ALIGNMENT PROCEDURE

1. Turn the front panel ***ASYMMETRY*** control fully CCW (20 turns or more).

2. Set the DVM for a full scale reading of 2.0 VDC.

3. Measure and record the DC voltage present at the common point of R115 and R139 (right side of R115). This voltage should be approximately +1.5 VDC.

4. Monitor the DC voltage present at the common point of R140 and R141 (left side of R140). Adjust PCB potentiometer R146 so that this DC voltage is equal and opposite in polarity to the voltage measured in the previous step.

6.3 TROUBLESHOOTING

6.3.1 GENERAL

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

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 PMC. 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 input and output. Listening can quickly locate a bad unit or clear a suspected unit.

6.3.2 Suggested Component Checks

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

SYMPTOM	PROBABLE CAUSE

THIS SECTION NOT AVAILABLE AT TIME OF PUBLICATION

6.4 CUSTOMIZATION

THIS SECTION NOT AVAILABLE AT TIME OF PUBLICATION

6.5 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:

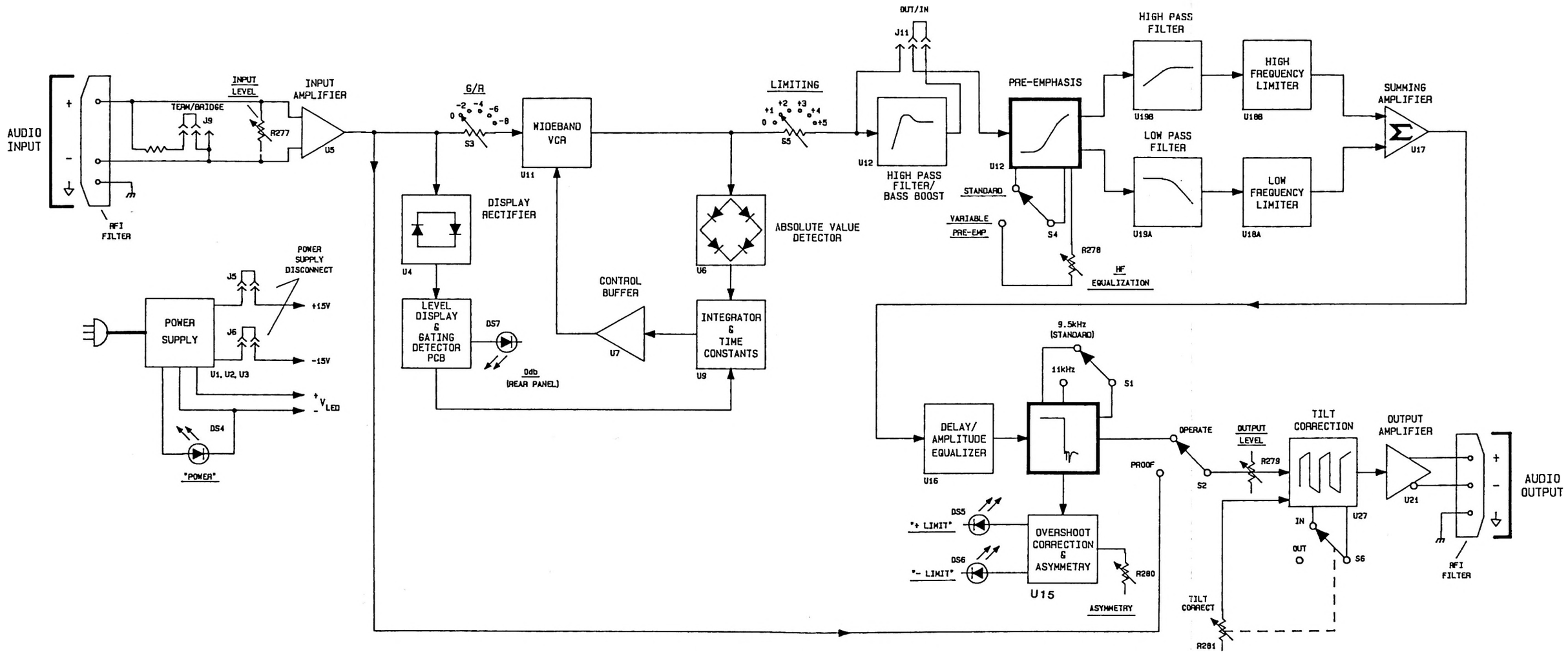
   Circuit Research Labs, Inc.
   2522 W. Geneva Drive
   Tempe, Arizona 85282 USA
   Att: CUSTOMER SERVICE
   RA #_____

SECTION 7 - APPENDIX

A. PARTS LIST PMC-400A

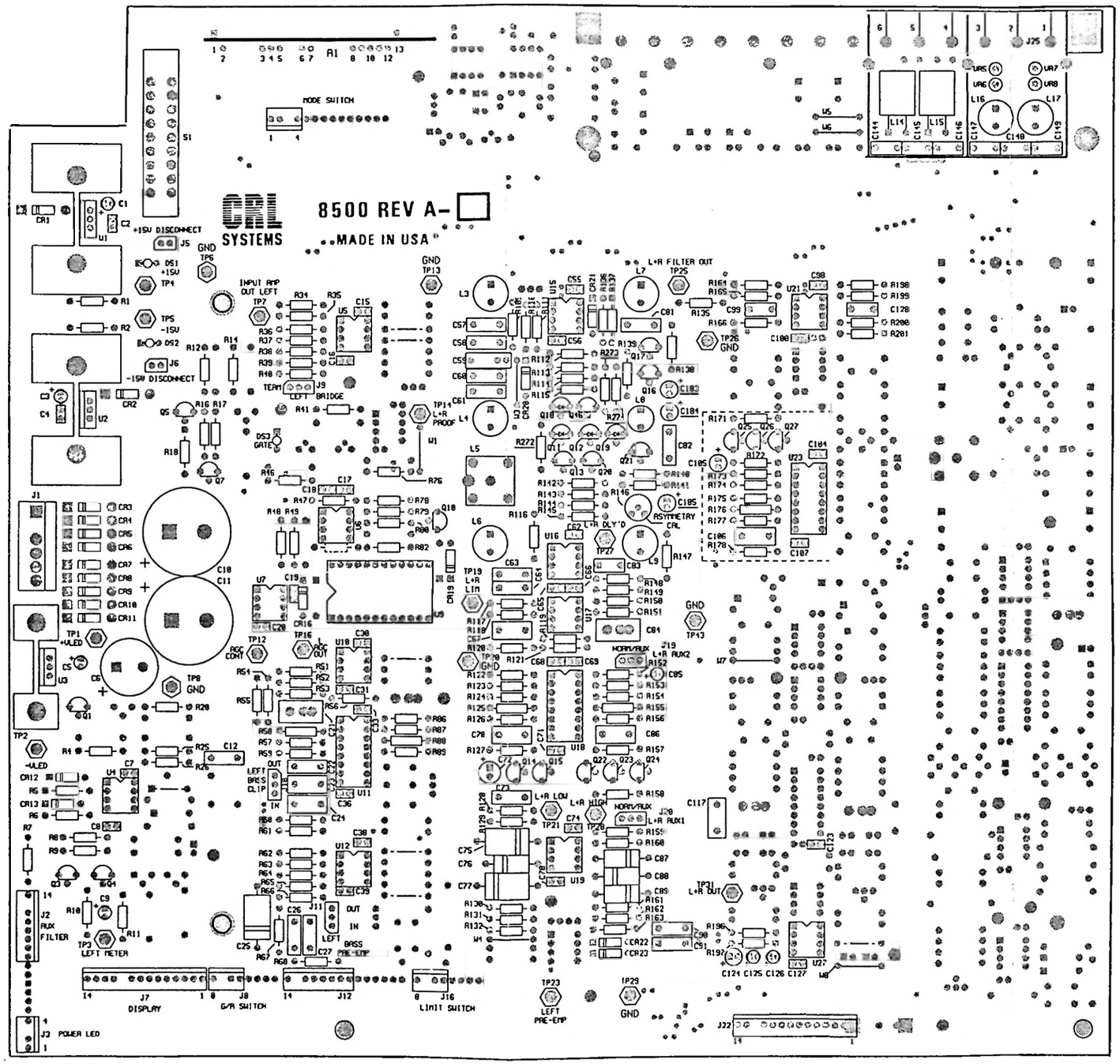
DES.	DESCRIPTION	P/N	DES.	DESCRIPTION	P/N

THIS SECTION NOT AVAILABLE AT TIME OF PUBLICATION

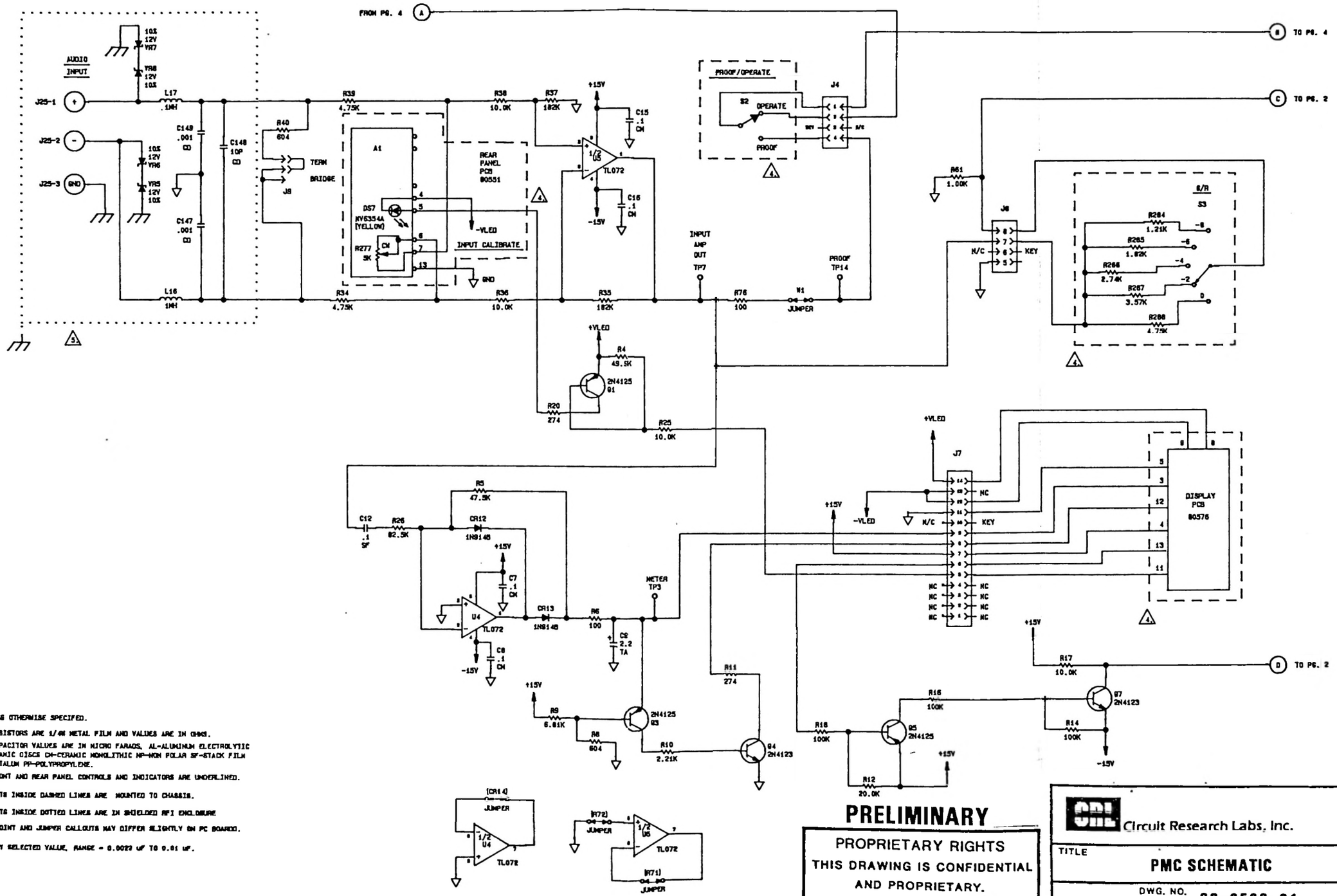


PMC-400A PEAK MODULATION CONTROLLER

BLOCK DIAGRAM



PC BOARD LAYOUT DIAGRAM



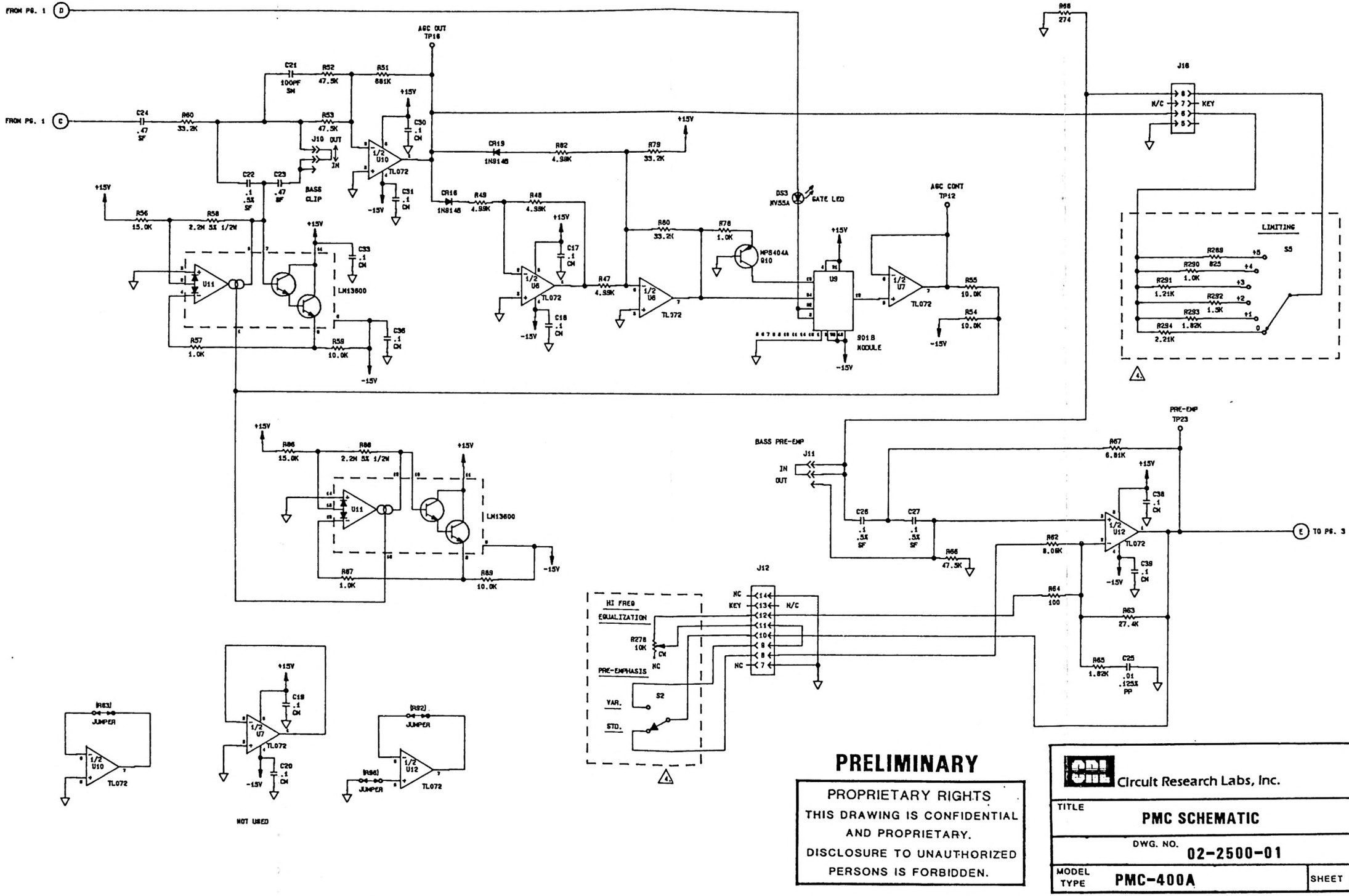
NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTORS ARE 1/4W METAL FILM AND VALUES ARE IN OHMS.
2. ALL CAPACITOR VALUES ARE IN MICRO FARADS, AL=ALUMINUM ELECTROLYTIC CH=CERAMIC DISCS CH=CERAMIC MONOLITHIC MP=NON POLAR SF=STACK FILM TA=TANTALUM PP=POLYPROPYLENE.
3. ALL FRONT AND REAR PANEL CONTROLS AND INDICATORS ARE UNDERLINED.
4. CIRCUITS INSIDE DASHED LINES ARE MOUNTED TO CHASSIS.
5. CIRCUITS INSIDE DOTTED LINES ARE IN SHIELDED RFI ENCLOSURE
6. TEST POINT AND JUMPER CALLOUTS MAY DIFFER SLIGHTLY ON PC BOARDS.
7. FACTORY SELECTED VALUE, RANGE = 0.0022 uF TO 0.01 uF.

PRELIMINARY

Circuit Research Labs, Inc.

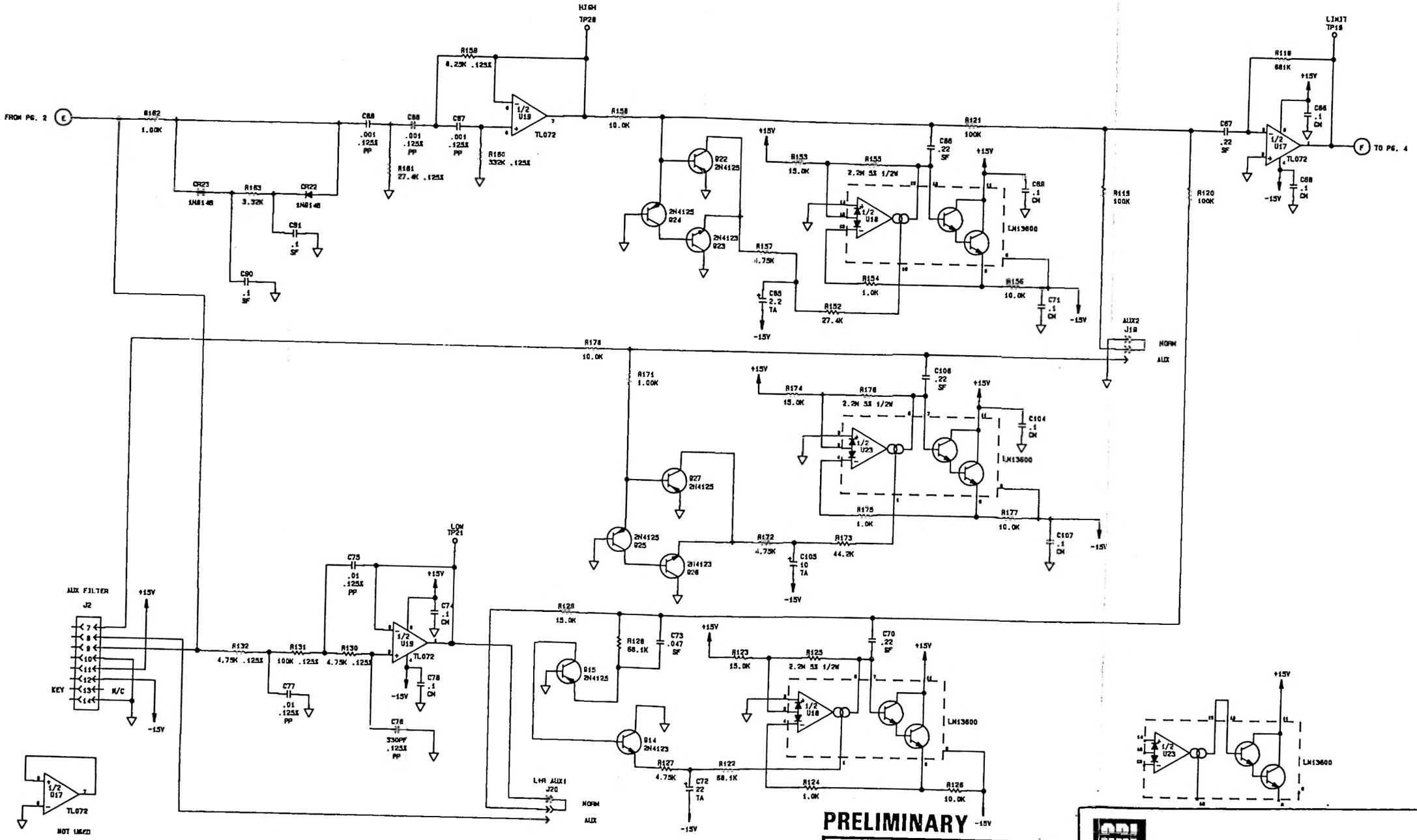
TITLE	PMC SCHEMATIC	
DWG. NO.	02-2500-01	REV
MODEL TYPE	PMC-400A	SHEET 1 OF 5



PRELIMINARY

Circuit Research Labs, Inc.

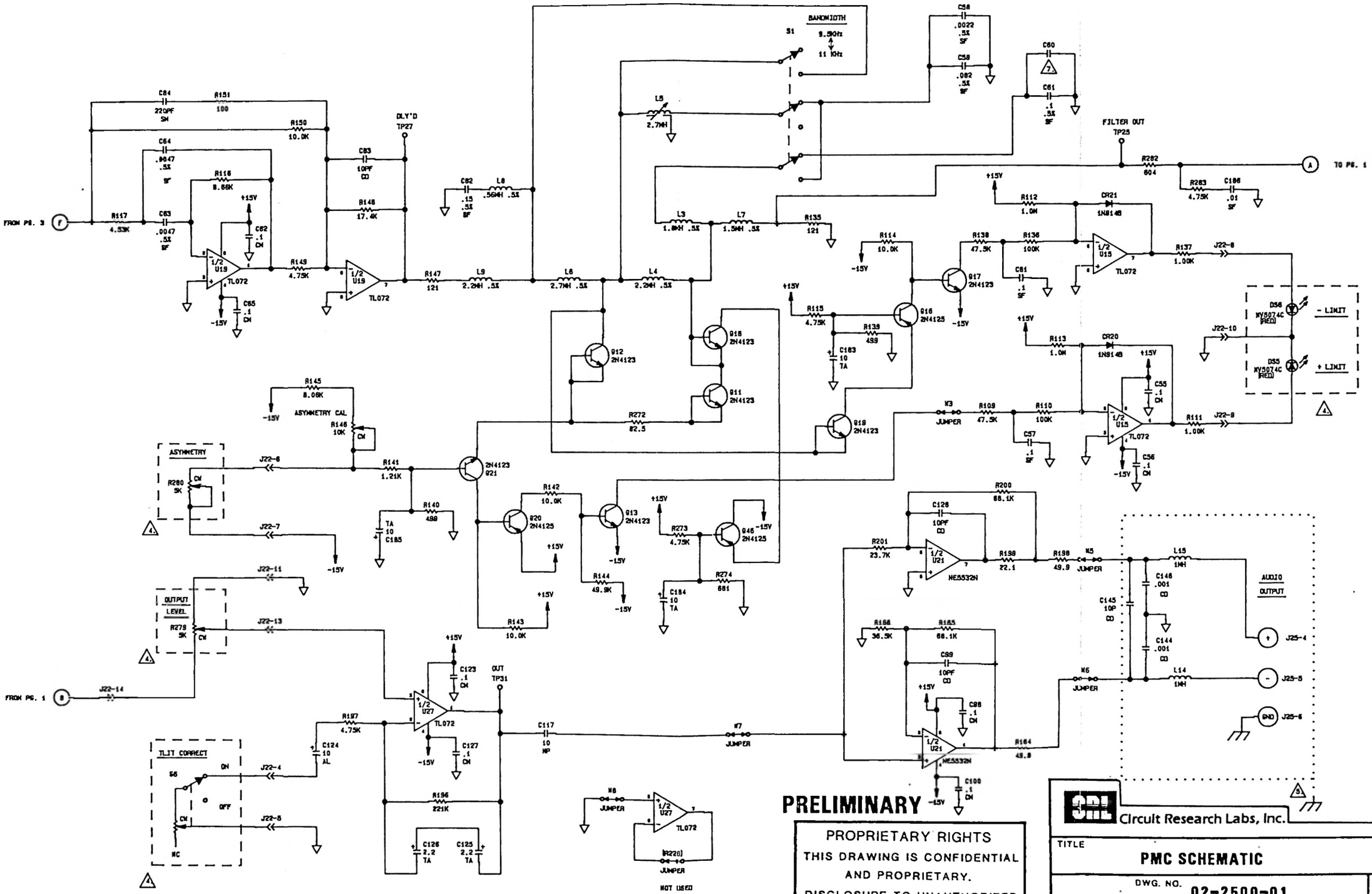
TITLE	PMC SCHEMATIC
DWG. NO.	02-2500-01
REV	
MODEL TYPE	PMC-400A
SHEET	2 OF 5



PRELIMINARY

Circuit Research Labs, Inc.

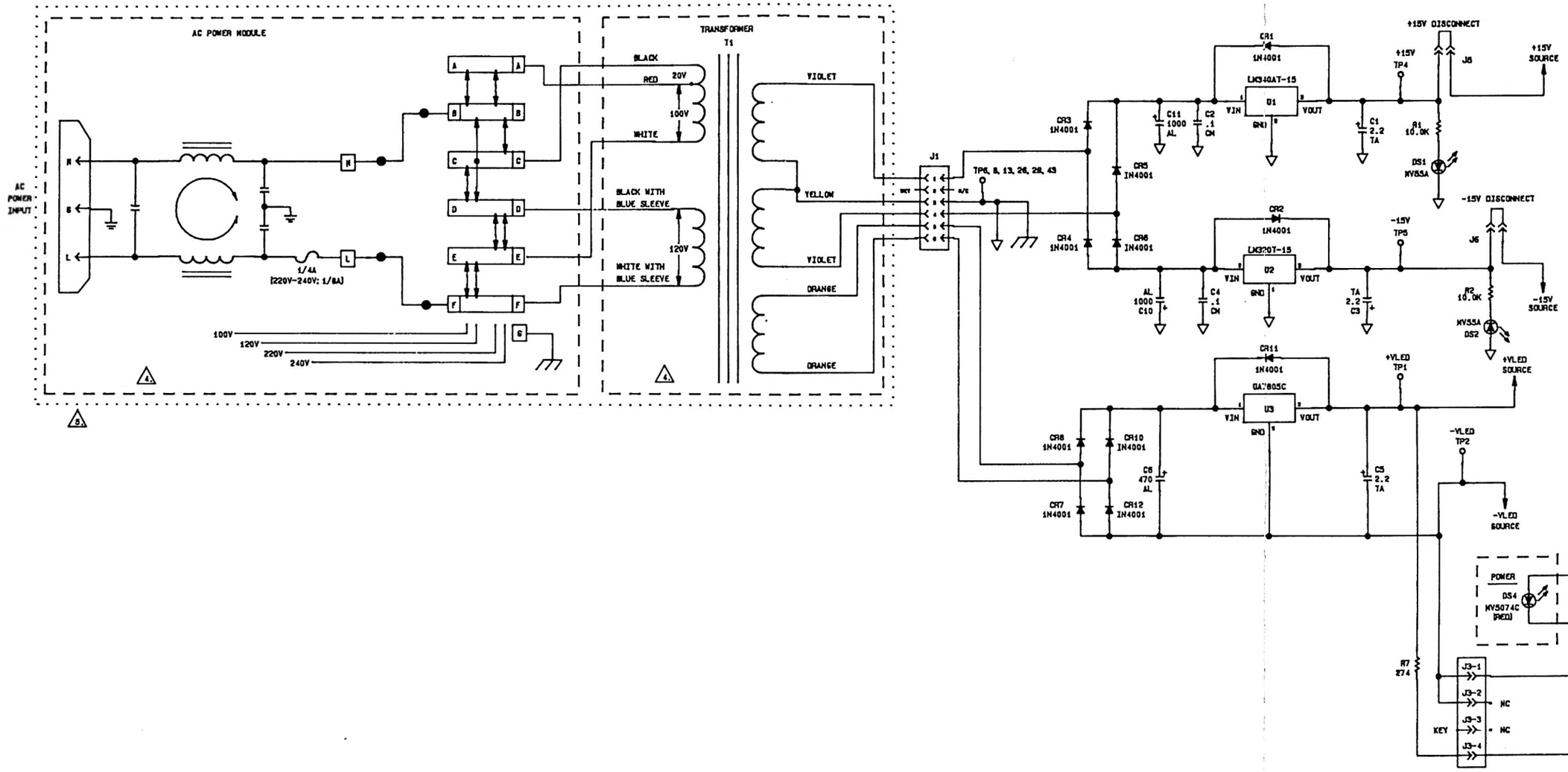
TITLE	PMC SCHEMATIC
DWG. NO.	02-2500-01
REV	
MODEL TYPE	PMC-400A
SHEET	3 OF 5



PRELIMINARY

Circuit Research Labs, Inc.

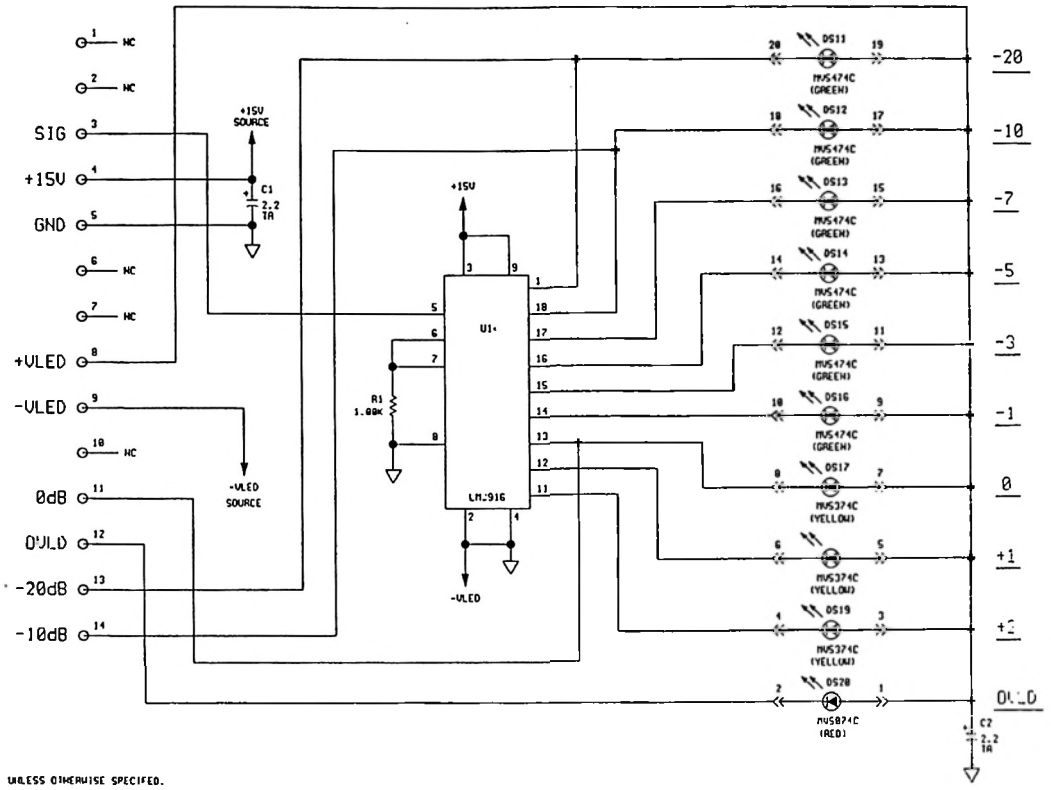
TITLE	PMC SCHEMATIC	
DWG. NO.	02-2500-01	REV
MODEL TYPE	PMC-400A	SHEET 4 OF 5



PRELIMINARY

Circuit Research Labs, Inc.

TITLE	**PMC SCHEMATIC**	
DWG. NO.	**02-2500-01**	REV
MODEL TYPE	**PMC-400A**	SHEET **5** OF **5**



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	Circuit Research Labs, Inc.				
CHKD Paul Stark 7/22/87	TITLE LED INDICATOR SCHEMATIC (MONAURAL)				
PROJ. ENGR Hall 7-22-87	TYPE	SIZE A	DWG. NO. 02-6100-01	REV A-1	

From: AM Radio Station Call Letters: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: (_____) _____

☐ I have implemented the 75 microsecond preemphasis and 10 kHz audio bandwidth specifications contained in the NRSC voluntary national standard. Please count my station as being compatible with new NRSC receivers.

_____ _____

Authorized Station Representative Date

NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 10142 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

National Radio Systems Committee
c/o NAB Science & Technology
1771 N Street, N.W.
Washington, D.C. 20077-6316

WARRANTY

CIRCUIT RESEARCH LABS, INC. warrants products to be free of defects in materials and workmanship for a period of one year from the date of purchase. This warranty does not apply to products that have been damaged due to improper handling during shipping, or by negligence, improper use, or alterations not authorized by Circuit Research Labs, Inc.

In no event shall Circuit Research Labs, Inc. be liable for any loss of anticipated profits, incidental or consequential damages or any other losses incurred by the purchaser in connection with the operation of any CRL product.

PLACE
STAMP
HERE

Circuit Research Labs, Inc.
2522 W. Geneva Drive
Tempe, Az. 85282

CIRCUIT RESEARCH LABS, INC.
WARRANTY RECORD

MODEL # _____ SERIAL # _____

DATE OF PURCHASE _____

PURCHASED FROM _____

A return authorization number must be obtained before any equipment may be returned to the factory. Call 602-438-0888 for the number and mark it on the outside of the shipping carton. Otherwise, the equipment may not be accepted.

Detach Here

CIRCUIT RESEARCH LABS, INC.
WARRANTY REGISTRATION

MODEL # _____ SERIAL # _____

CUSTOMER NAME _____

COMPANY NAME _____

ADDRESS _____

CITY, STATE, ZIP _____

TELEPHONE # ( ) ____ _____

PURCHASE DATE _____

PURCHASE FROM _____

Circuit Research Labs, Inc.
2522 W. Geneva Drive
Tempe, Az. 85282 U.S.A.
602-438-0888

PRELIMINARY

This product has been supplied with a preliminary manual. The final version of the operation manual will be completed soon.

Please complete and return this card to receive the appropriate manual when it becomes avaialble.

MODEL NUMBER_____ SERIAL NUMBER_____

STATION CALL LETTERS or COMPANY _____

ATTN:_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

https://bh.hallikainen.org