CRL systems

THE FM-2

The Processing Specialists

CRL AUDIO

WHY YOUR FM STATION NEEDS THE FM-2

Your FM radio station is in the business of selling only ONE PRODUCT . . . SOUND!

As you know, that product is made up of two very important elements . . . CONTENT AND QUALITY.

We're certain that your station has invested a tremendous amount of time and effort in producing the BEST CONTENT possible for its sound through careful research, programming, promotion.

Now . . . the **CRL FM-2 Audio Control System** can provide your station with the very BEST QUALITY sound by providing you with the most important ingredient . . . TOTAL CONTROL.

Packed in two separate stereo units for ultimate flexibility, the **FM-2** utilizes both advanced state of the art technology and CRL pioneered concepts.

Together, these units produce a crystal clear sound that is loud and full with great definition and depth. Our customers describe it as the best FM sound they have heard.

It is a proven fact that use of the CRL High Performance Control System can be AS IMPORTANT TO YOUR COVERAGE AS YOUR TRANSMITTER'S OUTPUT POWER!

The **FM-2 Control System** is the result of years of research and development by engineers who have grown up in the Broadcast Industry. Our work has resulted in a careful blend of superb sounding stereo multiband AGC's, low distortion pre-emphasis limiters, and overshootless low pass clipping filters which make outstanding quality and loudness improvements EASY TO OBTAIN.

If you are truly a broadcast perfectionist and want the VERY BEST for your radio station . . . you need to have your station order the **CRL FM-2 Audio Control System** on our two week trial plan today.

THE INPUT UNIT OF THE FM-2:
SPP-800 Stereo Preparation Processor

The unique design of the stereo SPP-800 allows it to automatically correct for errors in audio source program levels, tonal balance, and other qualities which most AGC's simply cannot handle. Totally unlike any other AGC, the SPP-800 actually enhances transient musical qualities and punch while maintaining perfect control of audio levels.

MAIN FEATURES:

ASYMMETRY REMOVAL (optional). The SPP-800 first passes the audio through a harmonic phase rotator in order to reduce any extreme asymmetry in the program content which could adversely affect later processing and cause unwanted distortion.

MULTIBAND GAIN CONTROL. The audio is next split apart into two bands for independent level controlling. The splitting frequency and patent pending gain control designs eliminate the normal "pumping and hole punching" problems found in normal AGC's.
Sudden bass and other tonal bursts are prevented from causing unnatural level changes in vocals and other instruments.

USER CONTROLLED LOUDNESS. Program dependent gain control action is easily user controlled in three ranges allowing your programmer to safely and easily tailor your station's sound needs.

USER CONTROLLED OUTPUT EQUALIZING. The low and high frequency bands are recombined back together by a unique control circuit which allows your programmer to safely and easily custom tailor the output tonal balance without affecting the output level of the unit.

DE-ESSING. Aggravating sibilance and essing are greatly reduced in voices and commercials by special transient limiters.

DYNAMIC EQUALIZATION. Program audio which is extremely deficient or excessive in bass or highs is automatically re-balanced and improved while normal program audio is unaffected.

ADDITIONAL FEATURES:

EASY PROGRAMMABLE AGC'ING OF LOW INPUT LEVELS.
FRONT PANEL ADJUSTMENT OF G/R
MAINTENANCE FREE HIGH TECHNOLOGY INTERNAL CIRCUITRY.
INTERNAL PINK NOISE GENERATOR FOR EASY SYSTEM SET UP.
SPECIAL STEREO STRAPPING TECHNIQUE.
ACTIVE BALANCED INPUT AND OUTPUT CIRCUITRY.

THE OUTPUT UNIT OF THE FM-2:
SMP-800 Stereo Modulation Processor

The SMP-800 is designed to accompany the powerful SPP-800 to form a high quality stereo FM audio control system for competitively superior sound control. In one simple package, it contains AGC'ing, multiband pre-emphasis control, and non-overshoot audio low pass filtering.

MAIN FEATURES:

INPUT AGC'S FOR PRECISE PRE-EMPHASIS CONTROL. High quality input AGC's provide transparent yet wide range input level control to insure proper levels to the following multiband pre-emphasis circuitry.

REDUCED DISTORTION MULTIBAND PRE-EMPHASIS CONTROL. Audio is next separated into low and high frequency bands which are gain controlled by audio program and frequency content in a manner which anticipates the action of the following clipping filter. This achieves both maximum audio loudness and minimum audible distortion.

OVERSHOOTLESS 15KHZ LOW PASS FILTER CONTROL. A high performance but simple patent pending 15KHz low pass clipping filter insures both absolute peak control and complete stereo pilot and sub-channel protection.

TRANSPARENT TRANSIENT FIDELITY DESIGN. The special design concepts of the pre-emphasis gain control circuits and the low pass clipping filter are selected to minimize the FM limiting degradation of transient fidelity which exists in other pre-emphasis limiting techniques.

TOTALLY ALIGNMENT FREE INTERNAL CIRCUITRY. All internal gain control and filter circuitry are developed from self aligning CRL pioneered techniques which eliminate maintenance and most importantly, improves equipment reliability.

ADDITIONAL FEATURES:

(AUTO CLIP) FEEDBACK OF CLIPPING FILTER TO INPUT G/R STAGES.
SELECTABLE BYPASS OF INTERNAL AGC STRAPPING.
25, 50 OR 75 MICROSEC. PRE-EMPHASIS OPTIONS.
AUTOMATIC INTERNAL AGC GATING.
HIGH MODULATION DENSITY WITH NO OVERSHOOT FOR ABSOLUTE PEAK CONTROL.
BALANCED INPUT AND OUTPUT CIRCUITRY.

STATIC TEST SPECIFICATION OF THE CRL FM-2

SYSTEM SPECIFICATIONS:

Over All System Dimension: 19" rack mount × 3½" × 11"
Operating Temperature Range: 0 C. to 50 C.
Total Power Requirements: 40W nominal @ 110 — 125 VAC.
Input Level Range: —30 dbm to +20 dbm re: input G/R threshold
Input Impedance: 600 Ohms or 10K Ohms balanced or unbalanced. Active Transformerless Input
Output Level Range: Adjustable to +18 dbm peak
Output Impedance: Less than 200 Ohms balanced or unbalanced. Active Transformerless Output
Frequency Response: +1, —1 db 50 Hz to 15 KHz in Proof (ref: 75 microsec de-emphasis)
THD: Less than .2% in proof: .4% in operate
S+N/N: Better than 65 db in proof; 60 db in operate
Dynamic Pilot Protection: Better than 60 db
Dynamic L-R Protection: Better than 50 db

UNIT SPECIFICATIONS:

SPP-800 — Stereo Preparation Processor (Split-Band AGC)

Dimensions: 19" rack mount × 1¾" × 11"
Operating Temperature Range: 0 C. to 50 C.
Power Requirements: 20 W nominal @ 110-125 VAC.
Input Level Range: —30 dbm to +20 dbm re: input G/R threshold
Input Impedance: 600 Ohms or 10K Ohms balanced or unbalanced. Active Transformerless Input
Output Level Range: —10, .0, +10 dbm switchable
Output Impedance: Less than 200 Ohms balanced or unbalanced. Active Transformerless Output
Frequency Response: +.15 — .5 db 50 Hz to 15 KHz
THD: Less than .1% in proof: .4% in operate
S+N/N: Better than 70 db in proof: 60 db in operate
G/R Type: 2 band VCR alignment free design (pat. pending)
Maximum G/R Range: 30 db overall: programmable in 3 db steps to —15 db below calibrated input G/R threshold
Multiband Crossover Frequencies: 400 Hz @ 6 db/octave filters
Attack and Release Times: Program dependent with user selection of Slow, Medium, or Fast activity
Output E.Q. Range: + 6, —6, low band to high band with constant summed output level
Stereo Tracking: Either channel within 1 db of controlling channel thru 30 db G/R range:

SMP-800 — Stereo Modulation Processor (Limiter)

Dimension: 19" rack mount × 1¾" × 11"
Operating Temperature Range: 0 C. to 50 C.
Power Requirements: 20 W nominal @ 110 — 125 VAC.
Input Level Range: — 15 dbm to +15 dbm re: input G/R threshold
Input Impedance: 600 Ohms or 10K Ohms balanced or unbalanced. Active Transformerless Input
Output Level Range: Adjustable to +15 dbm
Output Impedance: Less than 200 Ohms balanced or unbalanced. Active Transformerless Input
Frequency Response: +.8, —.8 db 50 Hz to 15 KHz
THD: Less than .1% in proof: .2% in operate
S+N/N: Better than 65 db in proof: 60 db in operate
Dynamic Pilot Protection: Better than 60 db
Dynamic L-R Protection : Better than 50 db
G/R Type: Stereo 1 band AGC followed by stereo 2 band. Clipper/Limiter VCR alignment free design
Maximum G/R Range: 30 db overall; programmable in 3 db steps to —15 db below calibrated input G/R threshold
Multiband Crossover Frequencies: 2 KHz with 18 db/octave filters
Attack and Release Times: Program dependent with low pass clipping filter controlled AGC threshold

Toll Free (800) 535-7648
Call (602) 894-0077

Circuit Research Labs, Inc.
3204 South Fair Lane
Tempe, Arizona 85282

THE CRL A.M. INTELLIGENT PROCESSOR SYSTEMS
DELIVERY, INSTALLATION, PAYMENT TERMS, AND COST SCHEDULE INFORMATION
EFFECTIVE: JULY 1977

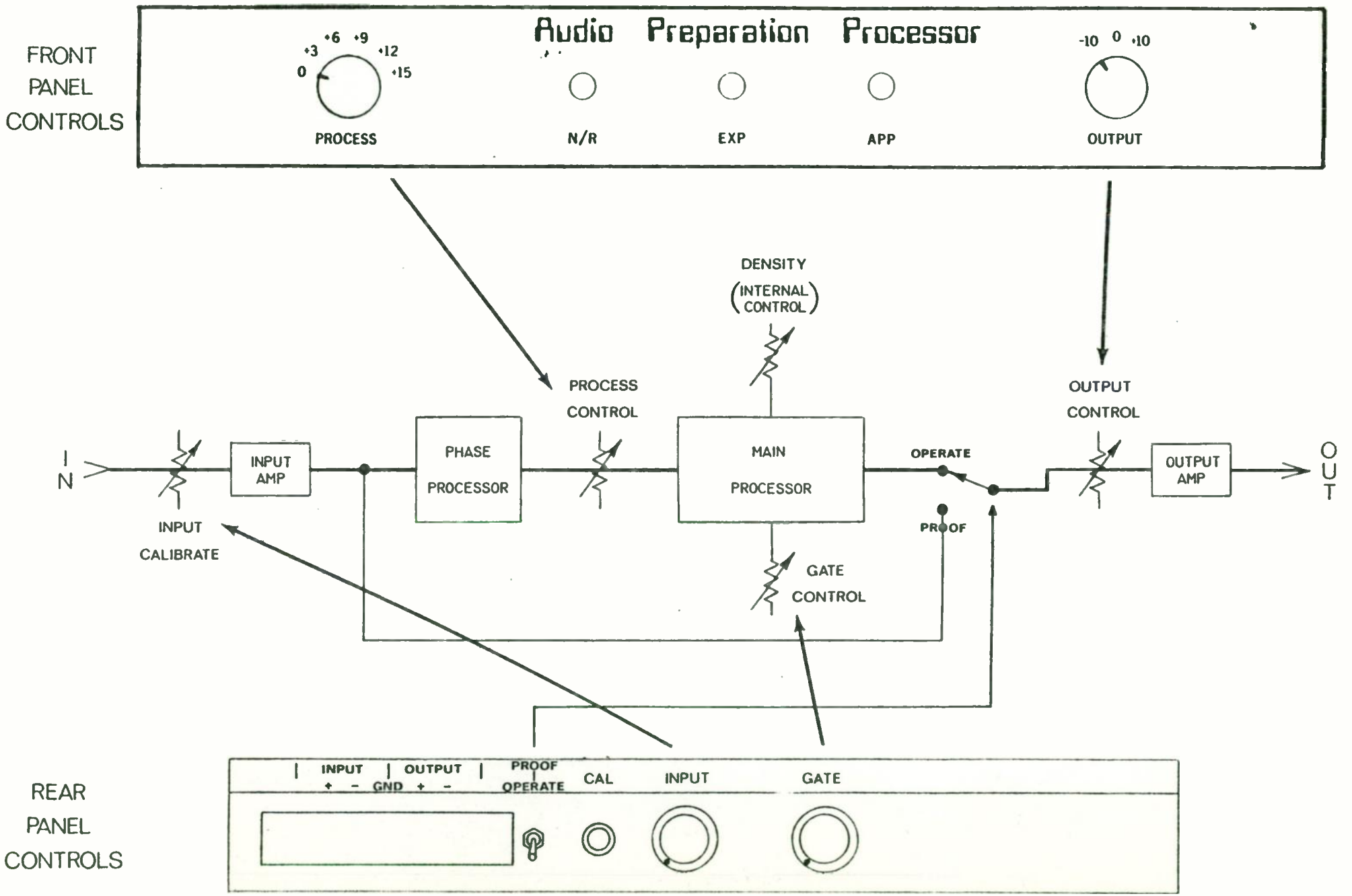
DELIVERY AND INSTALLATION:

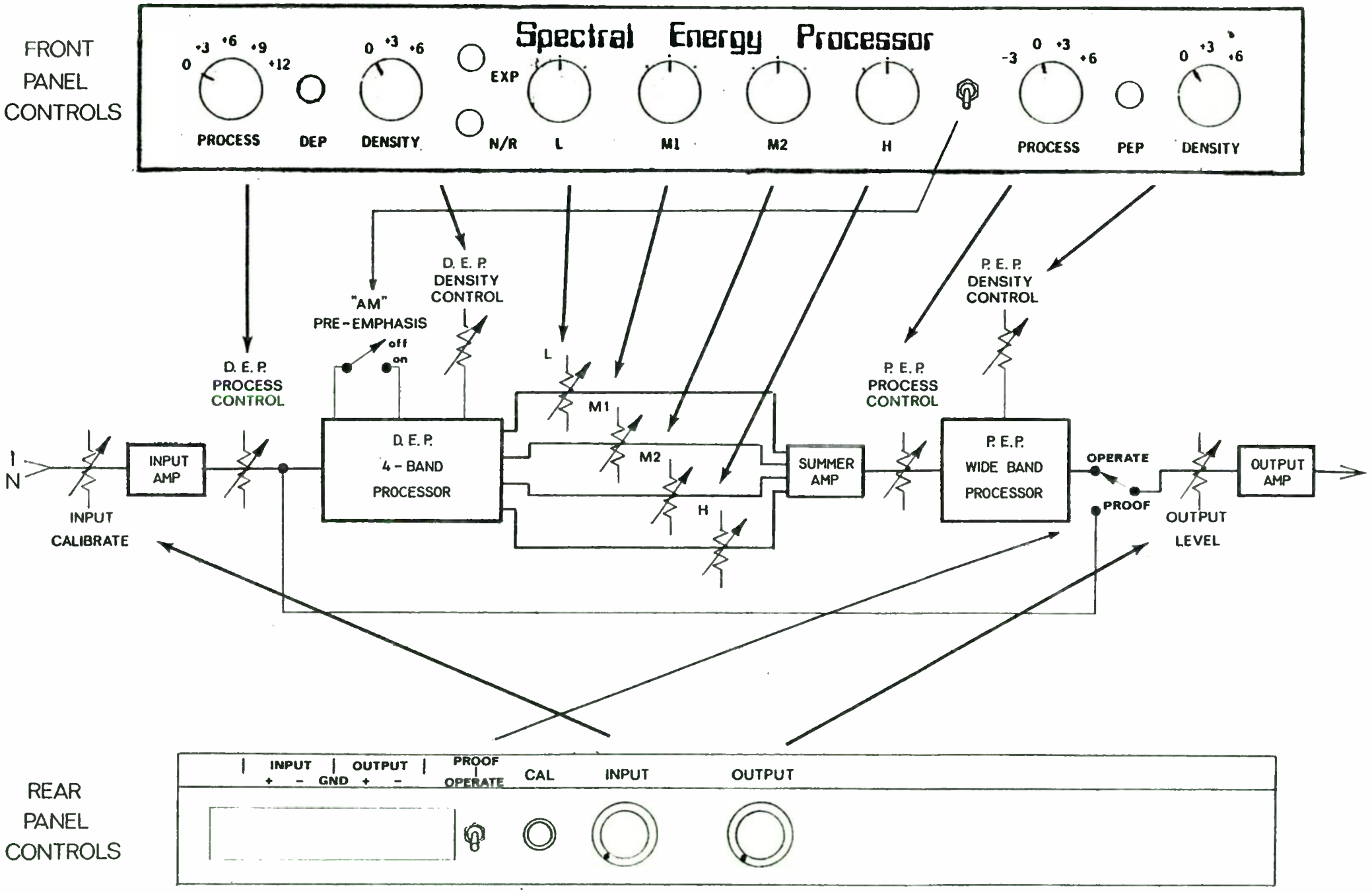
Normal delivery time will be 30 days or less after confirmation of an order. We insist on our personal installation of the equipment and evaluation of your transmitting system since our system is radically different and unlike any other present "state-of-the-art" system. There is no installation or engineering fee other than transportation fare for one person to and from your location. Our installation consists of:

1. Demonstration of the system capability.
2. Recommending initial settings.
3. Running 50HZ through 4KHZ square waves through the transmitter for Lo and Hi phase distortion correction.
4. Check P.A. and Modulator overloads and readjusting if necessary.
5. Checking Modulation level linearity from 50HZ through 12KHZ.
6. Checking Modulation monitor accuracy.
7. Checking level of RF feedback in audio chain.

PAYMENT TERMS:

After installation of the system, the station has 30 days for evaluation on a free trial period basis. At the conclusion of the 30 days or any period prior, the system may be accepted or may be returned in a good condition at no further cost or obligation. Upon acceptance of the system, 1/3 of the total cost will become due with the balance due on a follow up 30-60 day payment schedule.





THE CRL AM SYSTEM

#4

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THE CRL AM SYSTEM #4

Introduction - Why the CRL System is a Superior System.

The CRL system #4 was designed to provide the following advantages which existing audio processing systems have shown not to provide in the areas of action, operation, and useage:

1. Ultimate processing capability and range of control.
2. Maximized ease of process adjustment, operation, and calibration checking.
3. Ultimate control flexibility to the point of multi-function process sections which can operate in one or more modes or can be easily defeated.
4. A method for the "tuning out" and thereby the elimination of many of the older tube type transmitter limitations.
5. Capability of maximum reception coverage area increase through ultimate psycho-acoustic process control.
6. Ease of serviceability and maintenance by the use of fault/status LED indicators located internally for troubleshooting or normal operation checking and easy flip out circuit boards with plug-in IC sockets.
7. Exceptionally stable circuitry with non-critical and non-selected component values.

The CRL AM System #4
SPECIFICATIONS

APP 300 - Audio Preparation Processor
Dimensions: 19-inch rack mount X 1.75" X 8"
Frequency Response: -1db, +0db 30Hz - 15KHz
Harmonic Distortion: .6% in process, .2% in proof
Input Level: -10dbm - +10dbm
Output Level: -10dbm, 0dbm, +10dbm switched
Signal + Noise/ Noise: greater than 80db re +10dbm output
Input Impedance: 600 Ohm balanced or unbalanced
Output Impedance: less than 100 Ohms active balanced
Attack and Release Times: Program Dependent
Maximum Operating Temp.: 130 degrees F.
Power Required: 4 W. @ 115 - 130VAC

SEP 400 - Spectral Energy Processor
Dimensions: 19-inch rack mount X 1.75" X 11"
Frequency Response: -1db, +0db 40Hz - 15KHz
Harmonic Distortion: .7% in process, 80Hz - 15KHz
.2% in proof
Input Level: -21dbm - +8dbm
Output Level: adjustable to +10dbm peak
Signal + Noise/ Noise: greater than 75db re +10dbm output
Input Impedance: 600 Ohm balanced or unbalanced
Output Impedance: less than 100 Ohms active balanced
Attack and Release Times: Program Dependent
Maximum Operating Temp.: 130 degrees F.
Power Required: 7 W. @ 115 - 130VAC

PMC 300 - Peak Modulation Controller
Dimensions: 19-inch rack mount X 1.75" X 8"
Frequency Response: -1db, +0db D.C. - 15KHz
Harmonic Distortion: 1.0% at threshold, .2% in proof
Input Level: +0dbm balanced
Output Level: adjustable to +21dbm peak
Signal + Noise/ Noise: greater than 80db re +10dbm output
Maximum Operating Temp.: 130 degrees F.
Power Required: 4 W. @ 115 - 130VAC

The CRL AM System #4
Theory of Operation

Connection Methods:

The CRL System #4 is divided strategically into three physically separated units to provide maximum flexibility for use with direct, remote telephone, and remote STL operations.

For direct operations, all three units are connected in series at the same location. For remote telephone operations, the first unit (APP 300) is located at the studio and the two following units (SEP 400 and PMC 300) are located at the transmitter site. Finally, for use with remote STL operations, the first two units are located at the studio and the final unit is located at the transmitter.

The CRL AM System #4
Theory of Operation

APP 300 - Audio Preparation Processor, function and purpose:

The APP 300 is a simple to operate, but actually complex unit which first sends the audio signal through a symmetry generating harmonic phase processing circuit. This removes asymmetry from modulation and process robbing voice and lead musical instrument waveforms. The following gain control stages are then able to operate many times more efficiently.

Next, the audio signal passes through the front panel controlled wide band gain processing element which programs the amount of average level stabilization desired to pre-load the following main processor (SEP 400). While set up from the factory for medium action level control only, so that medium and short term dynamics remain unaffected, the APP 300 can be programmed to faster or slower actions of level controlling and can also be programmed to use low level expansion by a 4 pole IC sized micro-switch located internally on the main processor circuit board

A precision threshold and continuously adjustable gate circuit is available for use by a control located on the rear panel. The gate control prevents upward expansion of background noises and undesireable noise levels during program pauses by "freezing" the gain level previously caused by the interrupted program material. This allows intelligent gain controlling without the usual effects of pumping upward of background sounds like hum and noise, newscast teletype machines, and background reverberation sounds which might occur during program pauses.

These additional features make the APP 300 capable of being many processors in one and can be used for special applications in production and news areas.

The CRL AM System #4
Theory of Operation

SEP 400 - Spectral Energy Processor, function and purpose:

The SEP 400 is the heart of the CRL processing system and consists of 5 analog computer controlled gain processors all of which can be externally controlled and programmed.

First, 4 of the processors are ganged in parallel to form one 4 channel discriminate processor which carefully divides the audio spectrum into 4 electro-acoustically chosen bands. This section is called the DEP or Dynamic Energy Processor section. In order to match with human hearing, these bands were chosen upon their logarithmically equal spacing through the audible frequency range. Choice was also made to separate the musical instrument bands of bass and high frequencies apart from the human voice band. In addition to these divisions, the human voice band was further divided into the vowel or fundamental harmonics band and the consonant or presence and intelligibility band. This division of the audio spectrum produces a maximum audio presence not capable with other discriminate processors.

The amount of processing in the DEP section is controlled by the front panel DEP Process switch. After input level calibration has been initially performed, the desired level of 4 channel processing can be adjusted in 3db steps from 0 to 12db. The process switch is a precision step type which controls the total input level to all bands and therefore allows for REPEATABLE levels of processing.

The attack and release times of all 4 channels are controlled by analog computer circuits. These circuits produce the complex program dependent attack and release times from the measurement of program density, frequency content, transient content, and average to peak level ratio. While the processing is automatically program controlled, the range or activity of the automatic control can be varied. The ability to control this range or activity was incorporated into the DEP Density switch on the front panel. In the 0 density position the 4 channels resemble AGC action and operate primarily as dynamic equalizers which maintain consistant sound equalization. In the +3 density position the 4 channels resemble AGC/Compression devices and operate on reducing long term and medium dynamic ranges. Finally, in the +6 density position the channels become more similar to compression/ limiting devices and operate heavily on medium term dynamic reduction.

In conjunction with the gain reduction element in each band, a low level linear reverse expansion circuit has been incorporated which controls the lower levels of audio 20db below the gain reduction point. These circuits are used to smoothly aid in reducing noise levels which could possibly otherwise become audible at high process levels. Utilizing feed forward and negative reverse feedback, extremely linear and smooth expansion has been accomplished. Internal expansion defeat switching has also been provided should low level expansion not be desired on any or all bands.

Output control of each processing channel has been provided on the front panel and has been arranged into a 4 channel equalizer so that a specific ON AIR sound can be tailored to any individual taste. These outputs have been labeled L or low, M1 for the lower range, M2 for upper mid-range, and H for high frequencies.

It should also be noted that when the PEP section is operated at the process level (Odb), it becomes basically a standard 4 band equalizer and can be used as such.

The input levels to the 4 channels can also be "pre-loaded" with the front panel toggle switch which in the upward position provides an exclusive AM pre-emphasis curve. This curve was researched and determined by us to provide a high fidelity response curve working against the I.F. bandpass response losses of typical AM receivers. While many receivers varied in I.F. response, a definate average value was able to be computed and the results were utilized in disigning this pre-emphasis curve.

The final and most powerful of the 5 computer controlled gain processors is placed following the summation of the previous 4 channel processor section. Called the PEP section (Peak Energy Processor), this stage controls the peak to average energy level of the previously processed audio and does so in such a fashion that its level of processing produces almost the same level of loudness and energy increase.

The process capability of this stage can also be by-passed by simply placing the PEP Process switch in the -3 position.

The range and activity of the PEP computer controlled attack and release times can also be controlled as in the 4 channel section (except to a lesser degree) by the front panel PEP Density control which features 0, +3, and +6 positions.

It might be asked at this time why must such complexity of control be necessary. The answer is in the elimination of conventional processing circuit deficiencies which have long "colored" the audio coming from them. Such things as pumping, loss of

apparent dynamic punch, "hole" punching or gain intermodulation, and fatigue creating over-driven sounds are eliminated by this method. The results have proven to be an obviously processed but transparent and quality sound.

The CRL AM System #4
Installation and Set-Up
Audio Preparation Processor-APP 300

STEP 1 Set Process switch to 0 on front panel and rear panel Gate control to OFF, or fully counter clockwise.

STEP 2 Apply programming at 0 Vu peak level on the audio console (a constantly peaking or compressed song is recommended).

STEP 3 Adjust the rear panel Input control until the rear panel calibration light marked CAL just begins to flash on program level peaks. The rear panel CAL light is for convenience and is actually an extension of the amber front panel APP process light.

STEP 4 Select the -10, 0, or +10 output drive level desired by the front panel output switch.

STEP 5 Select the desired level of APP processing of long term dynamic level control by simply "dialing" the Process switch to the chosen value.

STEP 6 The Gate control prevents pumping of background noise levels during speech pauses by means of "freezing" the gain reduction at what ever level was present previous to the pause. The rear panel control sets the threshold level level at which the "freezing" action of the output occurs. The most clockwise setting causes "freezing" at the highest level, typically 5 - 10 db below the threshold of gain reduction. Near the most counter clockwise setting causes "freezing" at the lowest level, typically 25 - 30 db below threshold. A fully counter clockwise setting turns the Gate OFF. For Process setting of +3 to +6, an 8 - 11 o'clock setting of the gate control is recommended. For Process settings of +9 to +15, an 12 - 5 o'clock setting is generally required for proper action. NOTE: the front panel Red "N/R" LED will activate when ever the gate "freezing" action is occuring.

INSTALLATION AND SET-UP IS NOW COMPLETE FOR THE APP 300

The CRL AM System #4
Installation and Set-Up
Spectral Energy Processor-SEP 400

STEP 1 Set Process switches to 0, Density switches to +3, and L, M1, M2, H controls to 12 o'clock, and Pre-Emphasis switch to OFF or downward.

STEP 2 Adjust the rear panel Input control until the rear panel calibration light marked CAL just begins to flash on program level peaks. The rear panel CAL light is for convenience of set-up and is actually an extension of the amber front panel DEP process light.

STEP 3 Select the desired level of 4 channel DEP processing by "dialing" the left hand DEP Process switch to the chosen value. This controls the amount of input to the 4 channel Dynamic Energy Processor section.

STEP 4 Select the desired activity of program dependent recovery times by switching the DEP Density to 0 for slow ranges, +3 for medium ranges, and +6 for fast ranges. In the 0 density position, the 4 channel processor resembles a 4 channel AGC and operates only on long term dynamics control and dynamic equalization. In the +3 density position, the action resembles 4 channel compression type processing. In this position both long term and much of the medium term dynamics are effectively controlled. Finally, +6 density activates higher speed actions and total medium and long term dynamics are controlled. NOTE: Changes of the DEP density control at higher levels of DEP processing may require re-adjustment of the 4 channel output equalization as the processing unit becomes primarily a dynamic equalizer in 0 density and on the opposite extreme of +6 density, it resembles primarily a 4 channel compression/limiting type processor.

STEP 5 The equalizing of the ON AIR sound can now be set by the arrangement of the L, M1, M2, and H output controls of the DEP section. Because the sum of the 4 channel outputs drives the following PEP processor stage, all outputs

should be initially adjusted in unison to the point where the amber PEP process light just starts to flash at 0 Process level. The Pre-Emphasis circuit may now be switched in and final equalizing adjustments may be made. NOTE: Increases or decreases of a channel output controls not only affects equalization but also the amount of following processing upon that channel. This may be strategically used for maximizing format loudness.

STEP 6 Select the desired value of wide band PEP processing by "dialing" the PEP Process switch to the chosen value. The Peak Energy Processor is an exceedingly sophisticated wide band program controlled attack and release processor. The unit adjusts peak to average levels based upon average to peak energy levels. This is generally the opposite control action of conventional peak limiters. It should be noted that wide band PEP processing can be effectively used for direct increases of loudness.

STEP 7 While release and attack times are totally program controlled, the intensity of their variable control actions can be increased or decreased by the PEP Density switch. In the 0 density position, activity is the slowest and mildest in action. The +3 density is a medium level and provides greater loudness increases. In the +6 density position, maximum control of processing occurs which brings about maximum loudness and sound punch.

INSTALLATION AND SET-UP IS NOW COMPLETE FOR THE SEP 400.

APP 300 Audio Preparation Processor
Internal Alignment

Unless the gain control FET, Q1, or Power Supply zeners are replaced, internal alignment of the APP 300 should not be necessary unless an alignment check is desired.

TEST EQUIPMENT:

1. Audio Generator
2. A.C. Voltmeter (or calibrated oscilloscope)

PROCEDURE:

STEP 1 Set Process switch to 0, and rear panel Gate control to OFF.

STEP 2 Connect the audio generator to the + and - input terminals and jumper the - terminal to the ground terminal.

STEP 3 Apply a 400 Hz sine wave and bring the generator level up until the APP amber LED just starts to light on the front panel.

STEP 4 Set Process switch to +6 and measure the jumper wire in front of terminal "0" on the U1 board for 2.8Vrms (0db gain reference). Adjust Output control (R38) for this value if necessary.

STEP 5 Reduce generator output until the jumper reads 2.2Vrms (-2db). Adjust Bias control (R52) to the point where the voltage on the jumper <u>just</u> <u>begins</u> to reduce.

STEP 6 With the Expansion Defeat (S4) switched to ON, reduce the generator output until the jumper reads 89mVrms (-30db).

STEP 7 Switch Expansion Defeat (S4) to OFF and the jumper voltage should drop smoothly to 28mVrms (-40db) after approximately 4 seconds. Expansion control (R50) is adjusted for this value if necessary. Adjustment is not necesaary if the voltage is between 23mV (-42db) to 33mV (-38db).

ALIGNMENT IS NOW COMPLETE.

SEP 400 Spectral Energy Processor
Internal Alignment

Unless the gain control FET's, Q1's or Power Supply zeners are replaced, internal alignment of the SEP 400 should not be necessary unless an alignment check is desired.

TEST EQUIPMENT:

1. Audio Generator
2. A.C. Voltmeter (or calibrated oscilloscope)

PROCEDURE:

STEP 1 Set the front panel Process switches to 0 and Density switches to +3 and the L, M1, M2, and H controls fully clockwise. Set the front panel AM pre-emphasis switch to OFF or downward.

STEP 2 Connect the audio generator to the + and - input terminals and jumper the - terminal to the ground terminal.

STEP 3 To align each band, set the generator to the below listed frequency and connect the voltmeter to the correspondingly listed band output terminal and repeat the following steps.

Band:	L	M1	M2	H
Gen.Freq:	100HZ	400HZ	2KHZ	8KHZ
B-4 Board Terminal:	D	E	F	G

STEP 4 Apply the appropriate band frequency and bring the generator level up until the DEP amber LED just starts to light on the front panel.

STEP 5 Set the DEP Process switch to +6 and measure the appropriate output terminal on the B-4 processor board for 2.8Vrms (0db gain reference). Adjust the Output control (R29) for this value if necessary.

STEP 6 Reduce generator output until the output terminal reads 2.2Vrms (-2db). Adjust Bias control (R24) to the point where the output terminal voltage <u>just begins</u> to reduce.

STEP 7 With the appropriate band Expansion Defeat switch switched to ON, reduce the generator output until the output terminal voltage reads 89mVrms (-30db).

STEP 8 Switch the Expansion Defeat switch to OFF and the output terminal voltage should smoothly drop to 28mVrms (-40db). Adjustment is not necessary if the voltage is between 23mV to 33mVrms.

STEP 9 Set the DEP Process switch back to 0 and repeat steps four through nine for the next band to be aligned.

STEP 10 Set DEP Process to 0 and bring a 400HZ level up until the DEP amber LED just starts to light, then switch the Process to +12.

STEP 11 Set PEP Process to +6 and measure the B-4 processor board Peak Energy Processor output terminal I for 2.8Vrms. Adjust Output control (R29)for this value if necessary.

STEP 12 Reduce generator output until the output terminal reads 2.2Vrms. Adjust Bias control (R24) to the point where the output terminal voltage is reduced 1db (or 10%) by the effect of the Bias control.

ALIGNMENT IS NOW COMPLETE.

The CRL AM System #4
FIELD TROUBLESHOOTING TECHNIQUES

When referring to this section, panic has usually inspired it, so let us be brief and to the point.

I No Audio Output from Unit	Cause
Power light off:	No power input or blown internal fuse.
No Process LED's showing activity:	A) Check for no audio input or input level control turned down. B) Switch to proof. If audio then, processor board has failed.
Process LED's showing activity:	A) Check for output control turned down or shorted input of following load. B) Check for defective output amp on I/O board.

II Audio Output Distorted from Unit	Cause
Process LED's showing little activity:	A) Check for distorted and low input audio.
Process LED's showing too much activity:	A) Check for calibration of input level control, too high of input level will overload unit.
Process LED's showing normal activity:	A) Switch unit to proof, if distortion disappears - process board has failed. B) Check input level calibration for possible too high of input level. C) Check for possible RF to Audio feedback especially if high frequencies approach the point of feedback. Bad or no grounds on input and output connections can cause this.

D) Improper or overdriven use of unit.

III Troubleshooting Internally

Fusing - All units are internally fused for the protection against damage to the power transformer and power supply board.

Internal Fault/Status LED's - On the power supply board in all units, the + and - voltage terminals of the power supply board are monitored internally by 2 LED's and should be normally lit indicating normal voltage.

The main processor boards contain monitor LED's on both control IC's. D4 monitors the process IC and D3 monitors the expansion IC. With no audio applied both LED's should be lit. With audio applied, the LED's should flicker with processing and grow more dim with heavier process levels. If an LED is not lit or does not flicker with processing, the associated IC should be changed out. Refer to the appropriate process board schematic and board layout.

Signal Flow - At the beginning of each unit's schematics section an over all signal flow and circuit board interconnection diagram has been provided with labeled input and output connection terminals. These should be referred to in testing signal flow and isolating any possible defective circuit boards.

Flip Out Circuit Boards - The boards in the processor units have been specially wired so that no wires need be disconnected for removal of the circuit boards in order to gain access to their undersides. Simply remove the hold-down nuts and carefully lift the boards up from their mounting studs. Once clear, the circuit boards can be easily flipped to the forward of the units and total access is possible to their undersides.

IF IT'S REALLY BROKEN: PLEASE, if you need help, call us at 1-602-955-6491 any time of the day or night and calmly scream HELP! Although we enjoy our sleep, this number is open to you 24 hours a day, 365 days a year. Give us the details and if necessary we will have you a loaner unit on the next Airline flight to your city.

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CIRCUIT RESEARCH LABS

3920 E. INDIAN SCHOOL • PHOENIX, ARIZONA 85018 • (602)955-6491

FOR REFERENCE ONLY

FIELD CHANGE

APP 300 LIGHTNING PROTECTION MODIFICATION

This modification is for stations that are using a telephone line to carry audio programming between studio and transmitter sites in lightning prone areas.

The modification will prevent any spikes or transients that might be induced into the telephone line by lightning from damaging the output I.C. in the APP 300 unit.

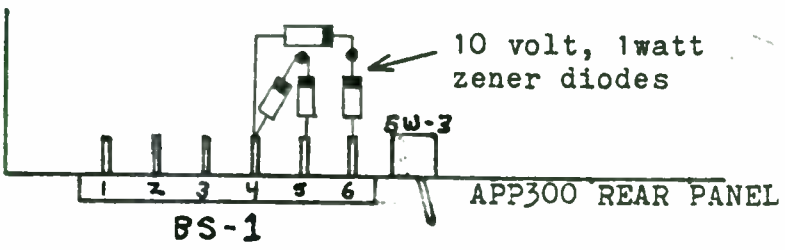
Failure analysis has shown that the APP 300's output I.C. will only fail when a transient's peak amplitude exceeds the I.C.'s power supply voltage. To prevent the peak amplitude of any transient from exceeding the power supply voltage, two back-to-back 10volt zener diodes are connected from each output terminal of the APP 300 to ground as shown below. This will effectively limit the peak amplitude of any transient without degrading the APP 300's performance.

INSTRUCTIONS

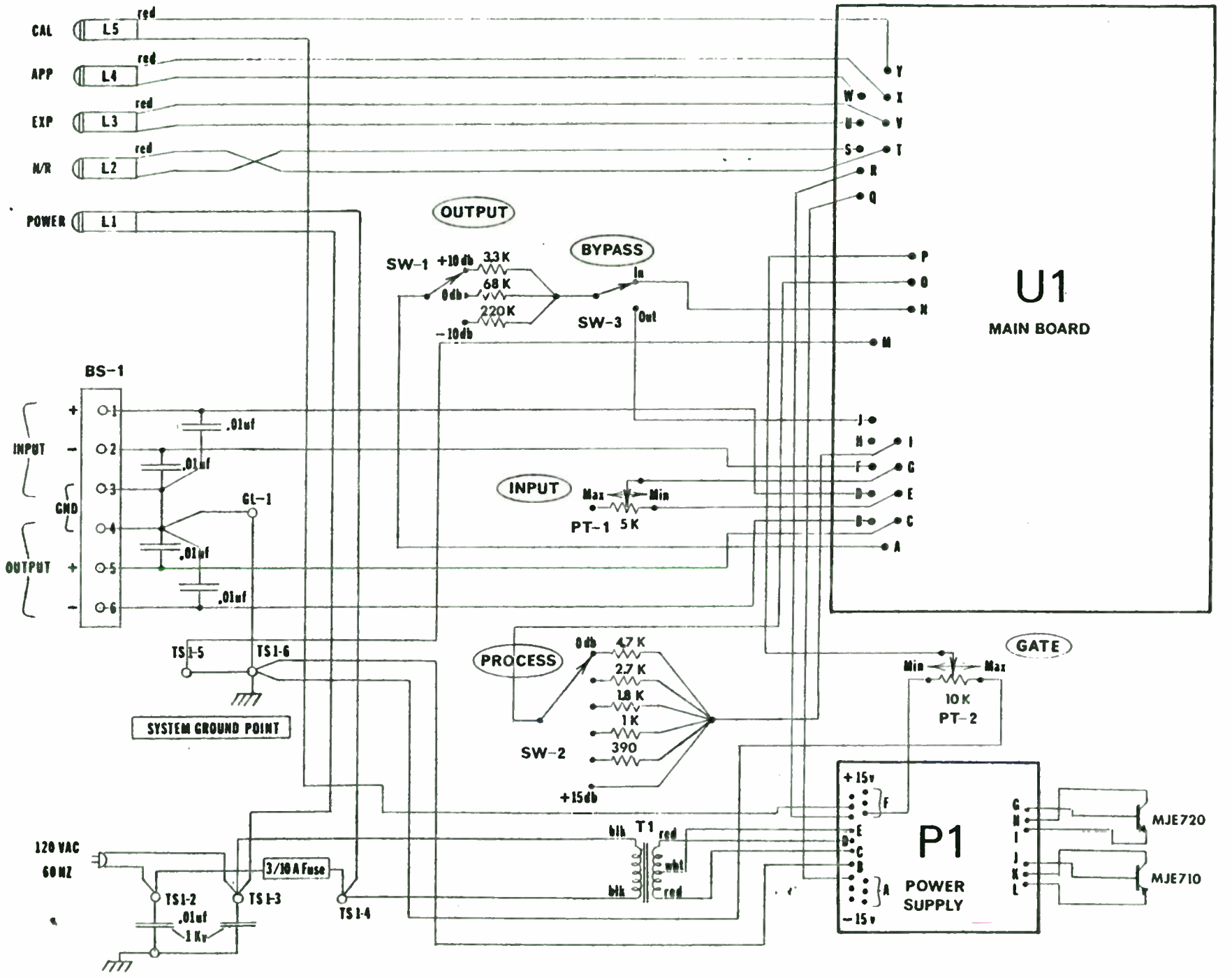
(1) Connect two 10 volt, 1watt zener diodes back-to-back (cathodes on each diode facing each other) between terminal #4 and #5 of the Input/Output Barrier strip BS-1.

(2) Also connect two 10 volt, 1watt zener diodes back-to-back between terminal #4 and #6 of BS-1.

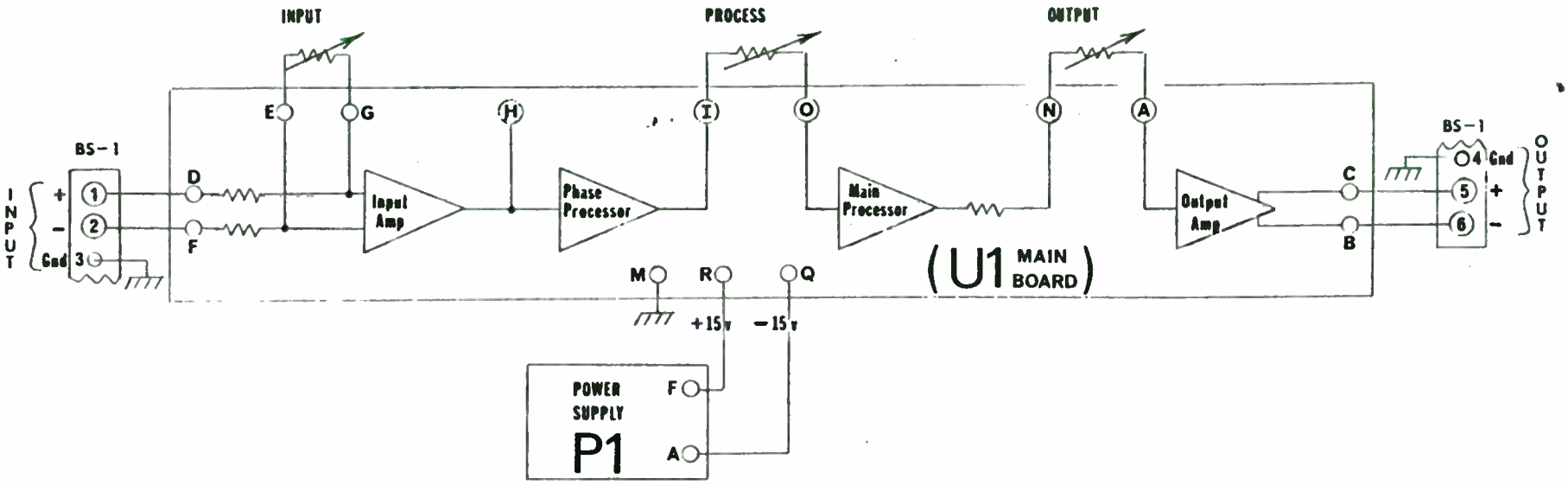
THE MODIFICATION IS NOW COMPLETE.



SPECIALIZING IN CUSTOM CIRCUIT DESIGN, RESEARCH, AND DEVELOPMENT

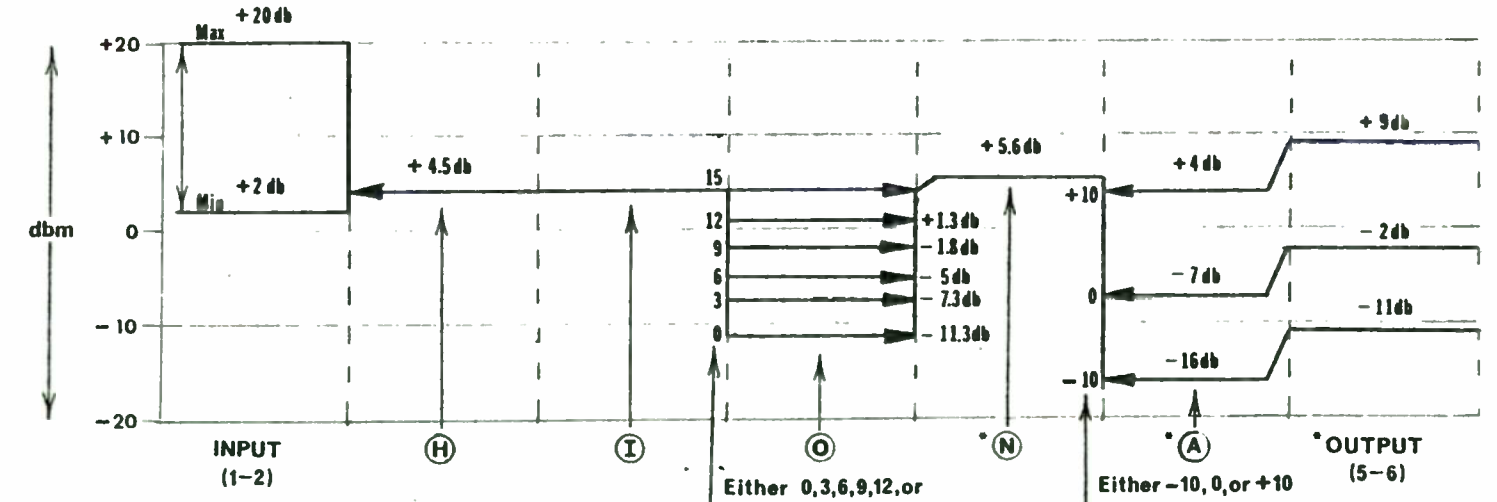


APP300
MAIN SCHEMATIC



BLOCK DIAGRAM

SIGNAL LEVEL DIAGRAM



NOTE: (1) Input level set at the point where the rear panel "Cal" light just lights,using a 1KHz sine wave.

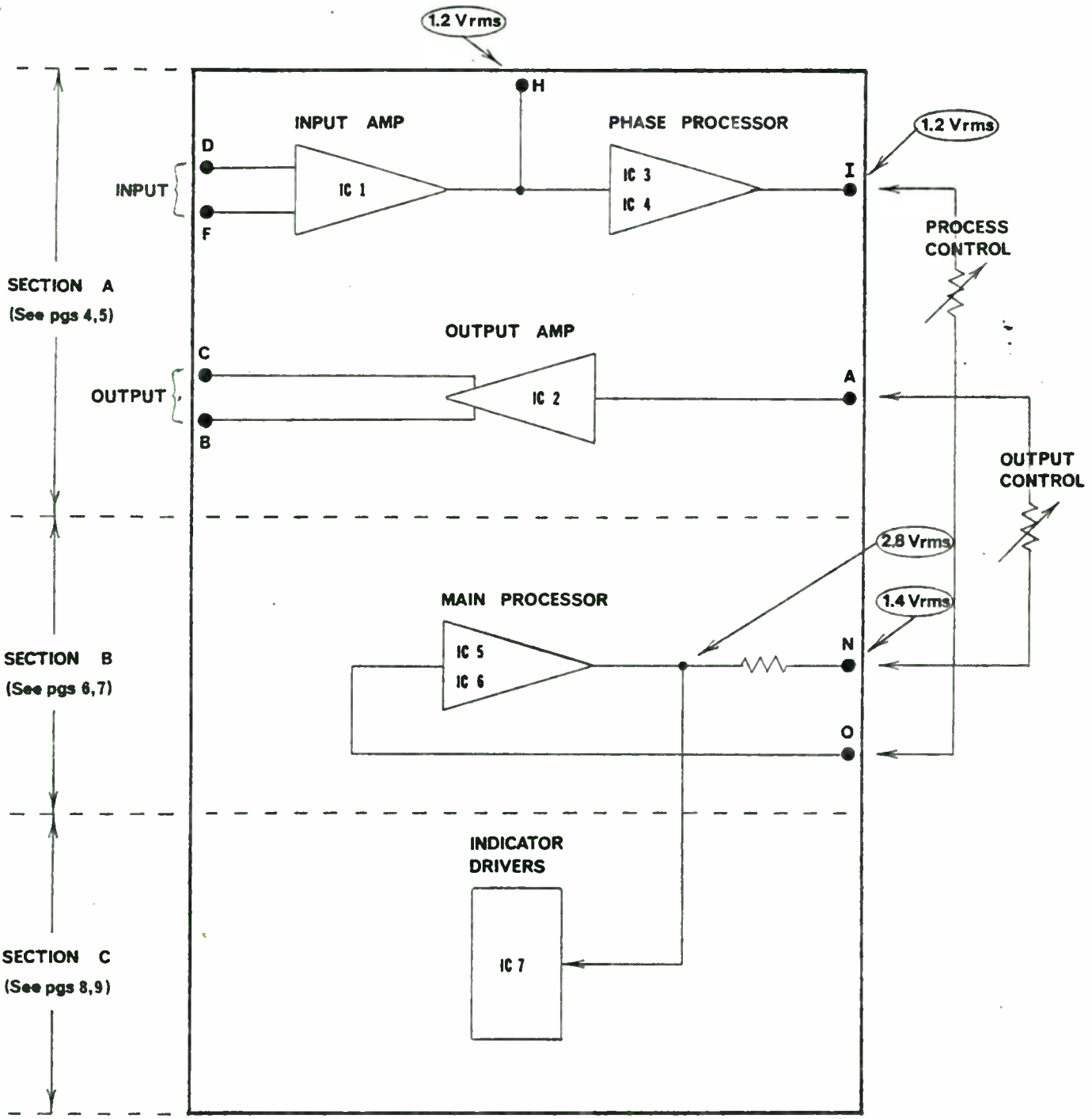
(2) 0dbm = .774v

(3) Circles containing letters refer to connection points on U1 board. See Block Diagram above.

* (4) Levels shown at N, A, and Output are with the Process switch in +6.

U1 BOARD

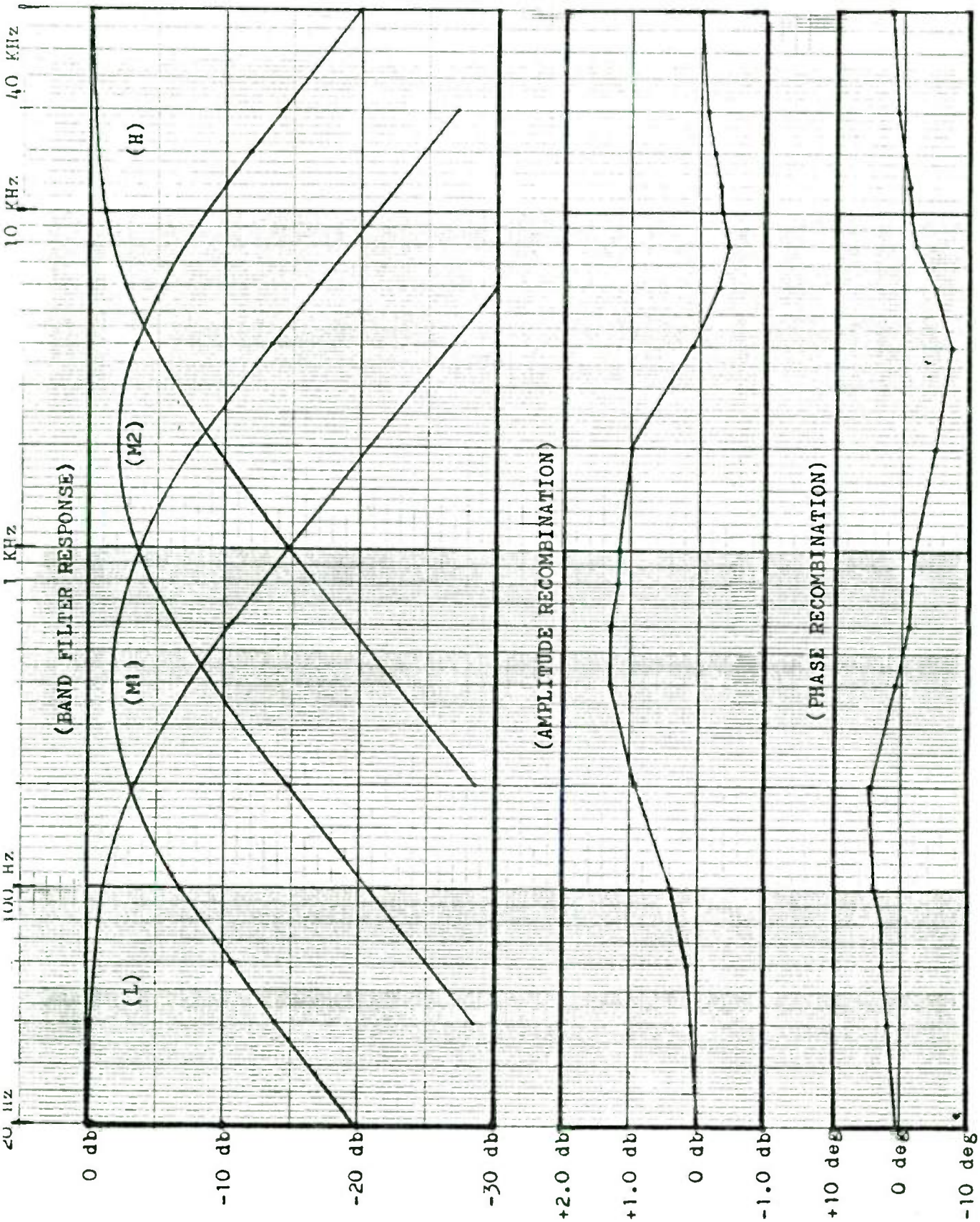
BLOCK DIAGRAM

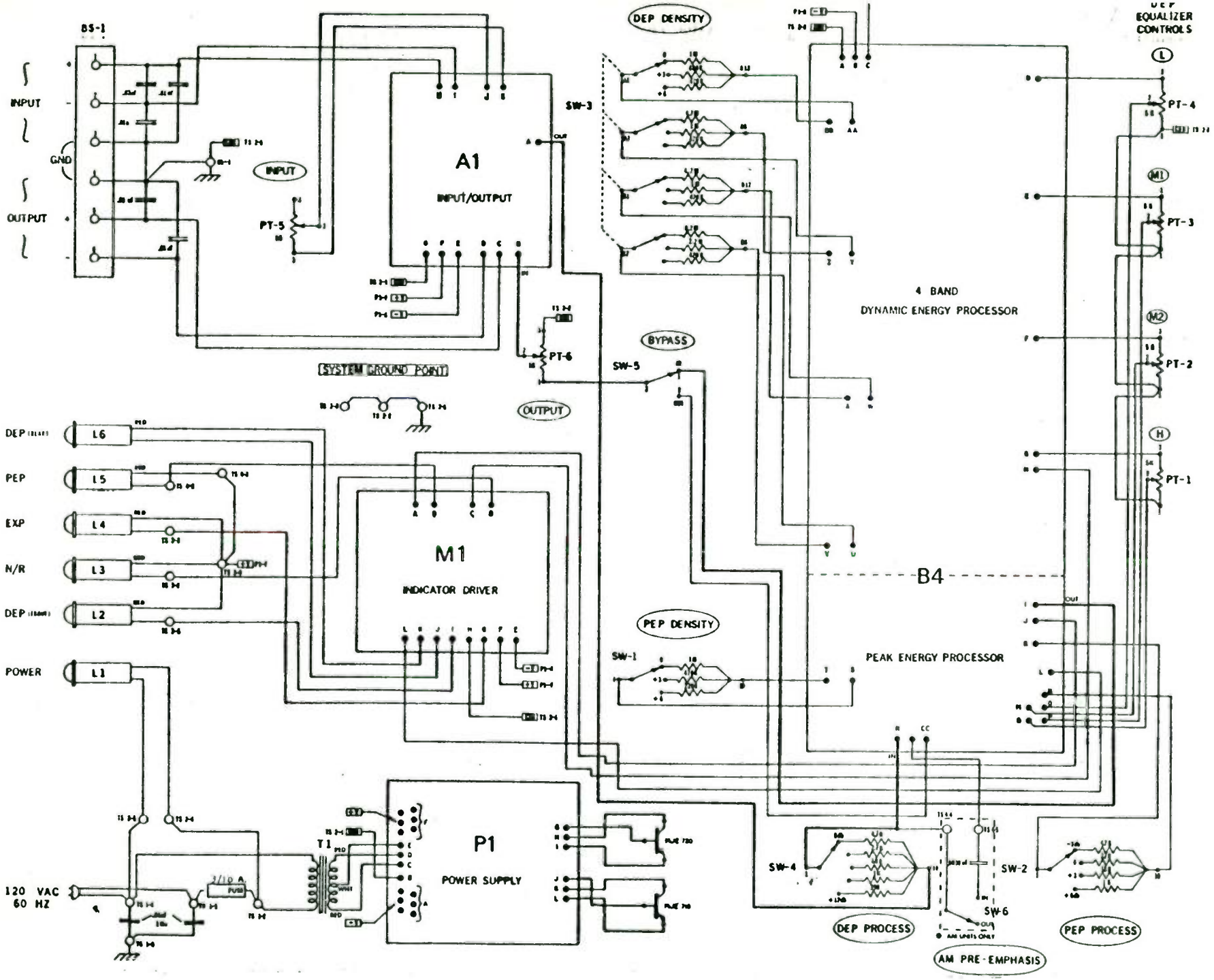


SEP 400

BAND FILTER RESPONSE and RECOMBINATION

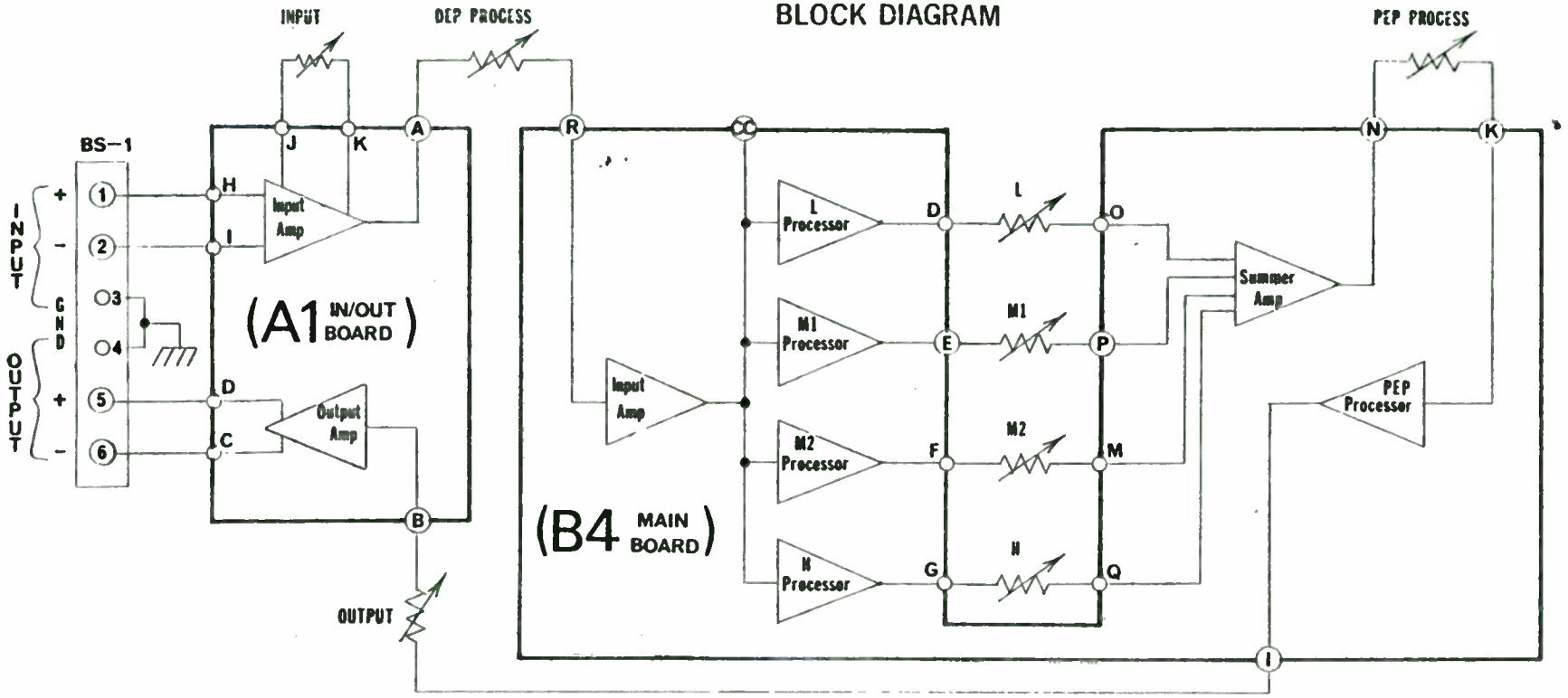
(FM Units, and AM Units without Pre-emphasis)



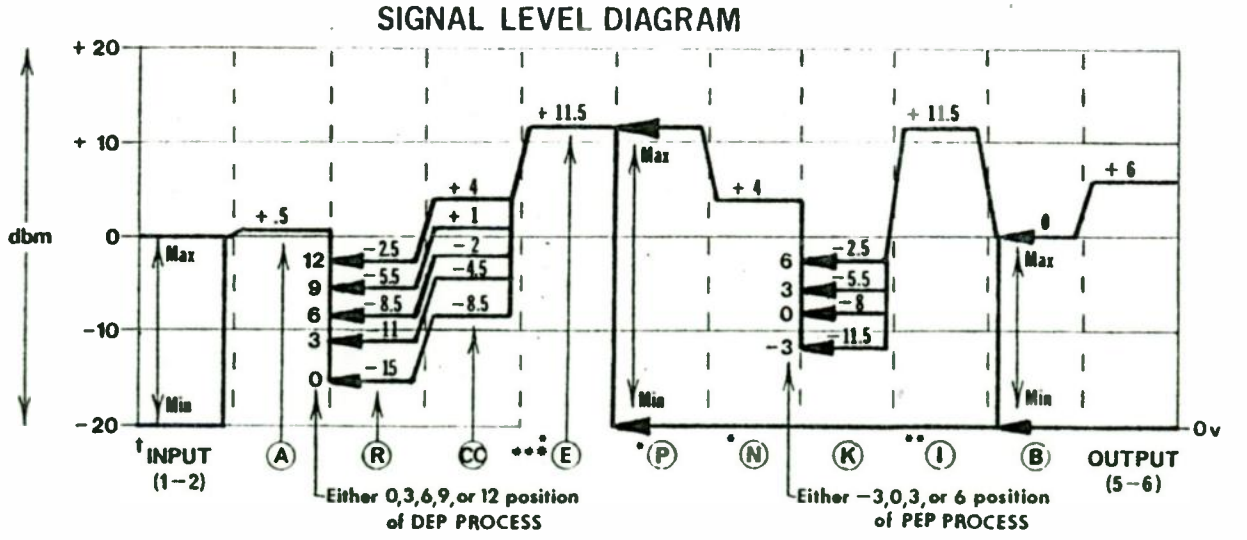


SEP 400

BLOCK DIAGRAM



SIGNAL LEVEL DIAGRAM



NOTES:

† 1. Input level set just below the point where the rear panel "CAL" light comes on, using a 400Hz tone.

2. 0 dbm = .774 v

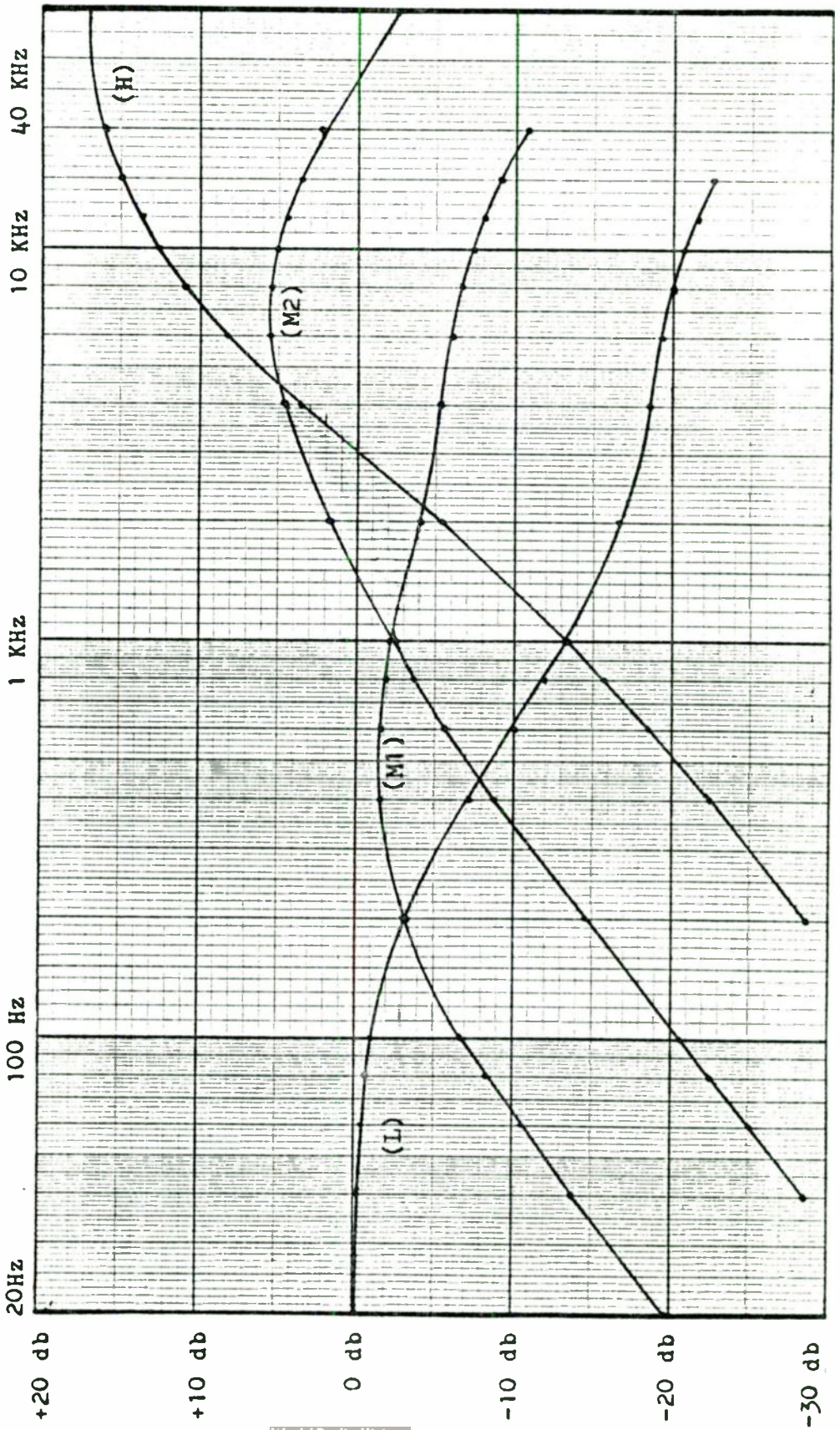
3. Circles containing letters refer to connection points on A1 & B4 boards. See Block Diagram above.

* 4. Levels shown at E, P, and N are with the "DEP PROCESS" switch in +6; L, M1, M2, and H Band controls in 12 O'clock position.

** 5. Level at I is with PEP PROCESS switch in +6.

*** 6. 400 Hz is only used to check the operation of M1 Processor. The other bands should be checked with the following frequences: L : 100 Hz H: 8KHz M2: 2KHz

BAND FILTER RESPONSE
(AM Units with Pre-emphasis)



PROOF OF PERFORMANCE PROCEDURES

Proof of performance testing is quite simple with the CRL system. The system has been designed such that none of the processing input calibrations or processing settings need to be re-arranged and lost. Understanding that many stations will have critically set the different values of processing and would not particularly appreciate "starting over" after performance testing, the minimum of switching is necessary. The procedure for proof is as follows:

STEP 1 Switch the rear panel switch on the APP 300 upward to PROOF.

STEP 2 Switch the rear panel switch on the SEP 400 to PROOF.

STEP 3 Switch the front panel DEP Process control to +12 and the AM pre-emphasis to OFF or down.

STEP 4 Switch the rear panel switch on the PMC 300 upward to PROOF.

NO OTHER CHANGES SHOULD BE NECESSARY.