610
DUAL COMPRESSOR/EXPANDER

Preliminary Operating Instructions

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MODEL 610 DUAL COMPRESSOR/EXPANDER

1. General Information

1.1 DESCRIPTION

The Valley People Model 610 Dual Compressor/Expander consists of two independent channels containing a compressor section and an expander section, both of which control the channel Voltage Controlled Amplifier (VCA). The independent channels may be coupled in order to process stereo program material.

Each of the two compressor sections features continuously variable thresholds and compression ratios, with an unique threshold/ratio/output coupling scheme which computes the amount of additional output gain required to maintain a constant nominal output level under varying conditions of threshold and ratio settings. The compressor sections use Valley People's Linear Integration Detector with peak, fast average and average attack times selectable by a front panel switch (20 µs, 1 ms and 10 ms respectively for 20 dB of gain reduction), and incorporate peak reversion correction circuitry to lessen "pumping" of the program material in the presence of low-frequency information.

The compressor function may be altered, by means of a front panel switch, to accept external audio for control thus producing a "voice-over" effect.

Each of the two expander sections features selectable slopes of 1:2 or 1:20, and continuously variable thresholds. The expanders also use the proprietary Linear Integration Detector.

Coupling of the release circuitry in the channel compressor and expander sections results in tracking, symmetrical release characteristics. The nominal release time is set by the VCA release time control, and may be modified by the use of the Anticipatory Release function. The proprietary Anticipatory Release alters the control voltage release time in response to program contour, and greatly enhances the dynamic integrity of the program, especially at high compression ratios when using large amounts of compression.

The inputs of each channel are balanced, and capable of handling +25 dB maximum input level. The outputs are quasi-balanced, with balanced-to-unbalanced gain recovery compensation which compensates for the usual 6 dB level loss normally associated with unbalancing a quasi-balanced output section. The outputs are capable of driving a 600 ohm load to +24 dBm balanced, or +21 dBm before clipping when unbalanced.

1.2 ELECTRICAL SPECIFICATIONS

Notes: 0 dB = 0.775 Vrms.
All data refers to use with "vu meters".
RMS noise measurements made unweighted in 20 Hz to 20 kHz bandwidth using 3rd order filters with -3 dB points at 20 Hz and 20 kHz.

Input Specifications:	GUARANTEED	TYPICAL	UNITS
Input Impedance:	>47 k	---	ohm
Maximum Input Level @ 1 kHz:	+24.5	+25	dB
Nominal Input Level @ 1 kHz:	---	0	dB

	GUARANTEED	TYPICAL	UNITS
Range of Input Levels for 0 dB Output, no compression @ 1 kHz:	±15	0	dB
Input CMR @ 50-60 Hz (ref. input):	>60	---	dB

Requires A3M or equivalent mating connector.

Output Specifications:

Output Source Impedance, balanced:	<40	---	ohm
Output Impedance, unbalanced:	<27	---	ohm
Nominal Output Level, 600 ohm balanced:	0	---	dBm
Nominal Output Level, 600 ohm unbalanced:	0	---	dBm
Maximum Output Level, 600 ohm balanced*:	+24	---	dBm
Maximum Output Level 600 ohm, unbalanced*:	+21	---	dBm
Static THD @ 1 kHz, 0 dBv input, unity gain RL = 600 ohm:	0.015	0.01	%

*0.1% THD into 600 ohm.

Static SMPTE IMD; 0 dB input, unity gain, RL = 600 ohm:	0.015	0.010	%
Dynamic THD @ 1 kHz +20 dB input, 20 dB compression, RL = 600 ohm, 20 µs attack:	0.2	0.15	%
Dynamic THD @ 1 kHz, +20 dB input, 20 dB compression, RL = 600 ohm, 1 ms attack:	0.1	0.08	%
Dynamic THD @ 1 kHz, +20 dB input, 20 dB compression, RL = 600 ohm, 10 ms attack:	0.05	0.04	%

Compression ratio adjustable from 1:1 to 50:1.

Expansion ratio selectable for 1:2 (expand) or 1:20 (gate).

Output Noise @ unity gain, R source: 1 kohm, RL = 600 ohm:	-82	-84	dB

Power Supply:

Mains voltage, 50-60 Hz: (100, 120, 200, 220, 240) Vac

Power Consumption: (12 VA) VA

Uses standard IEC connector and cord.

Features: External audio input for "voice-over" or keyed operation (requires an A3M or equivalent input connector). External meter drive and external VCA control voltage input accessible via ¼" 3-conductor jack on the rear panel. An eight-segment LED gain reduction meter monitors the VCA control voltage. "Compress" and "Expand" LED indicators show the operation of their respective sections. Inputs and outputs contain RF suppression. Channel bypass switches provide a hard-wired bypass from signal input to output. A clip warning indicator provides a visual warning when the peak output signal approaches clipping. Stereo coupling switch provides VCA control voltage coupling, allowing each channel to retain control of its respective signal without stereo image shift.

1.3 MECHANICAL SPECIFICATIONS

The Model 610 Dual Compressor/Expander is packaged in a 19" (482mm) rack mount, 2 units high (3½" or 88mm) and 8½" deep (216mm). Weight 6.5 pounds (3kg).

1.4 APPLICATIONS AND USES

Introduction to Dynamics Processing. Dynamics processing is defined as manipulation of the dynamics of an audio signal. The most familiar of these processes are COMPRESSION, LIMITING, and EXPANSION.

COMPRESSION is a method of reducing the dynamic range of a signal by increasing the gain of the processing signal chain in the presence of signal levels below a given THRESHOLD, or "switching point", and decreasing the gain in the presence of signals above the threshold. The degree to which the gain is altered above the threshold setting is expressed as the RATIO of a signal level change at the input to the resulting signal level change at the output. In a compressor, for example, a 2 dB increase in signal level above the threshold may result in a 1 dB increase in output level, thus the COMPRESSION RATIO may be stated as being 2:1. Typical compressor transfer curves are shown in Figure 1.

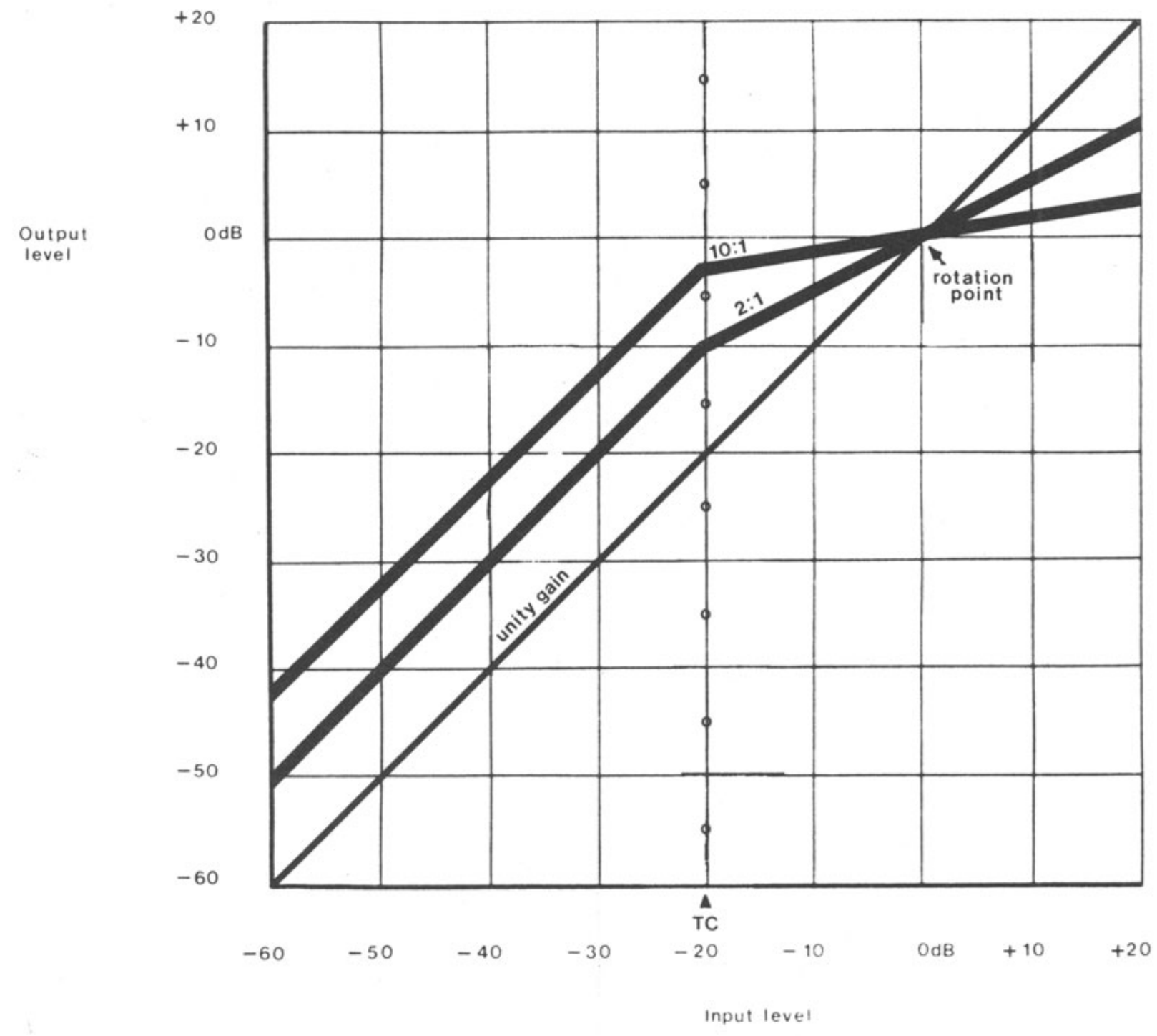


FIGURE 1

Input vs. Output Voltage Levels of a Continuous Tone Signal Through a Compressor with Threshold @ -20 dB

Note that the compressor adds gain to signals below the threshold. At the threshold, TC, the compressor begins to add less gain up to the rotation point, which is the unity gain point for the processor signal chain. As the input level exceeds the rotation point, the compressor begins to attenuate the signal.

LIMITING is a method of confining the maximum signal output level of the processor to a preset value. Although compression at high ratios is considered to constitute limiting, a limiter, in its pure form, does not add gain to signals below its threshold. A perfect limiter has a ratio of infinity to 1 (Inf:1), indicating that an infinite increase in signal level is required to produce an output level increase of 1 dB. In practice, limiters exhibit limiting ratios of 8:1 to 60:1. A typical limiter transfer curve is shown in Figure 2.

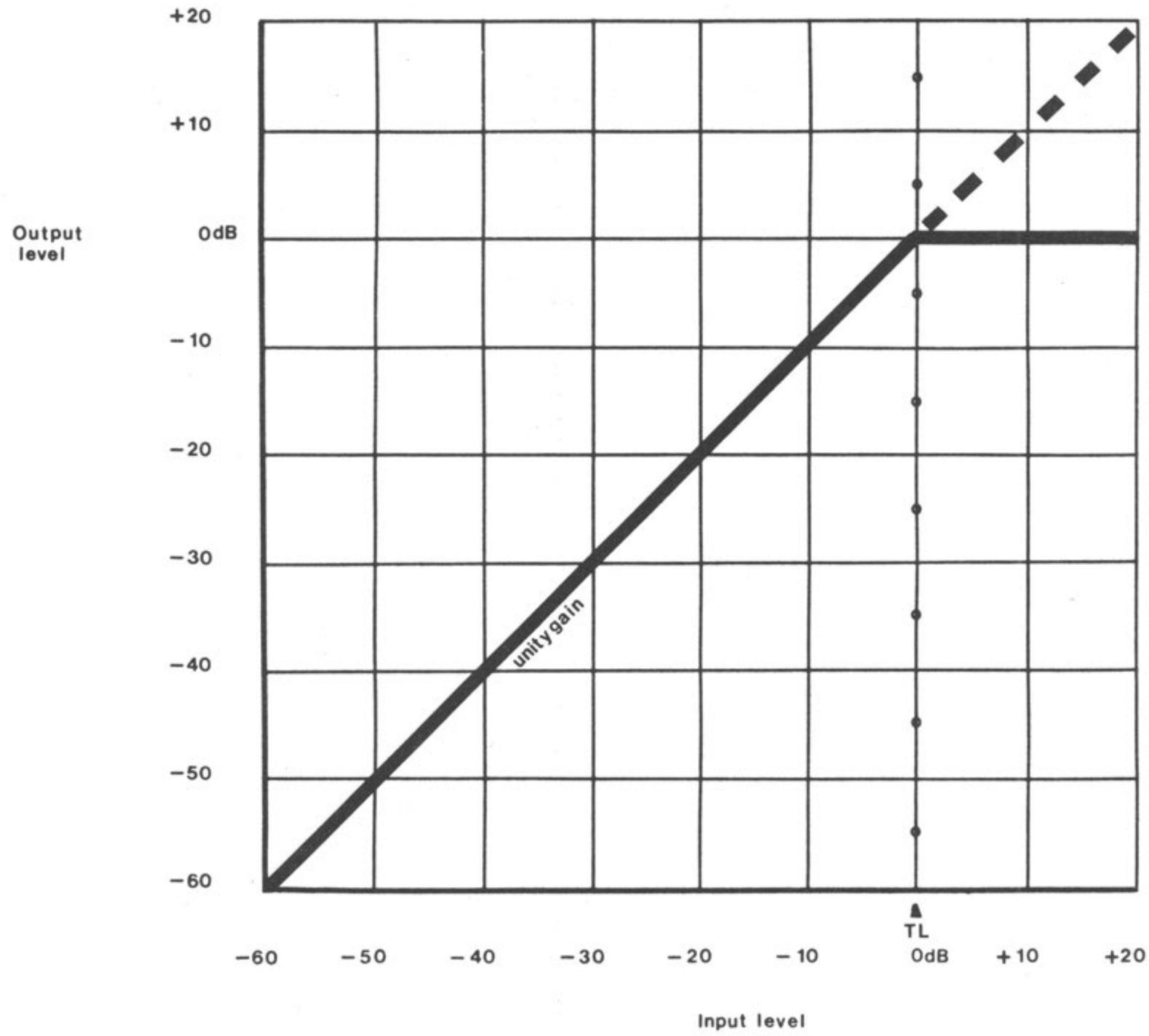


FIGURE 2
Input vs. Output Voltage Levels of a Continuous Tone Signal
Through a Limiter with Threshold @ 0 dB

Note that the processor signal chain exhibits unity gain until the input signal level reaches the limiting threshold, TL. As the input signal exceeds the threshold, TL, the processor attenuates the signal in such a manner that the output level is not allowed to exceed the threshold setting.

EXPANSION is a method of increasing the dynamic range of a signal by automatically increasing the processor signal chain gain in response to an increase in input level. Since headroom limitations do not allow unlimited increases in gain, the reciprocal action is used in an expander, i.e., the signal chain gain is reduced in response to a reduction in input level. A typical expander transfer curve is shown in Figure 3.

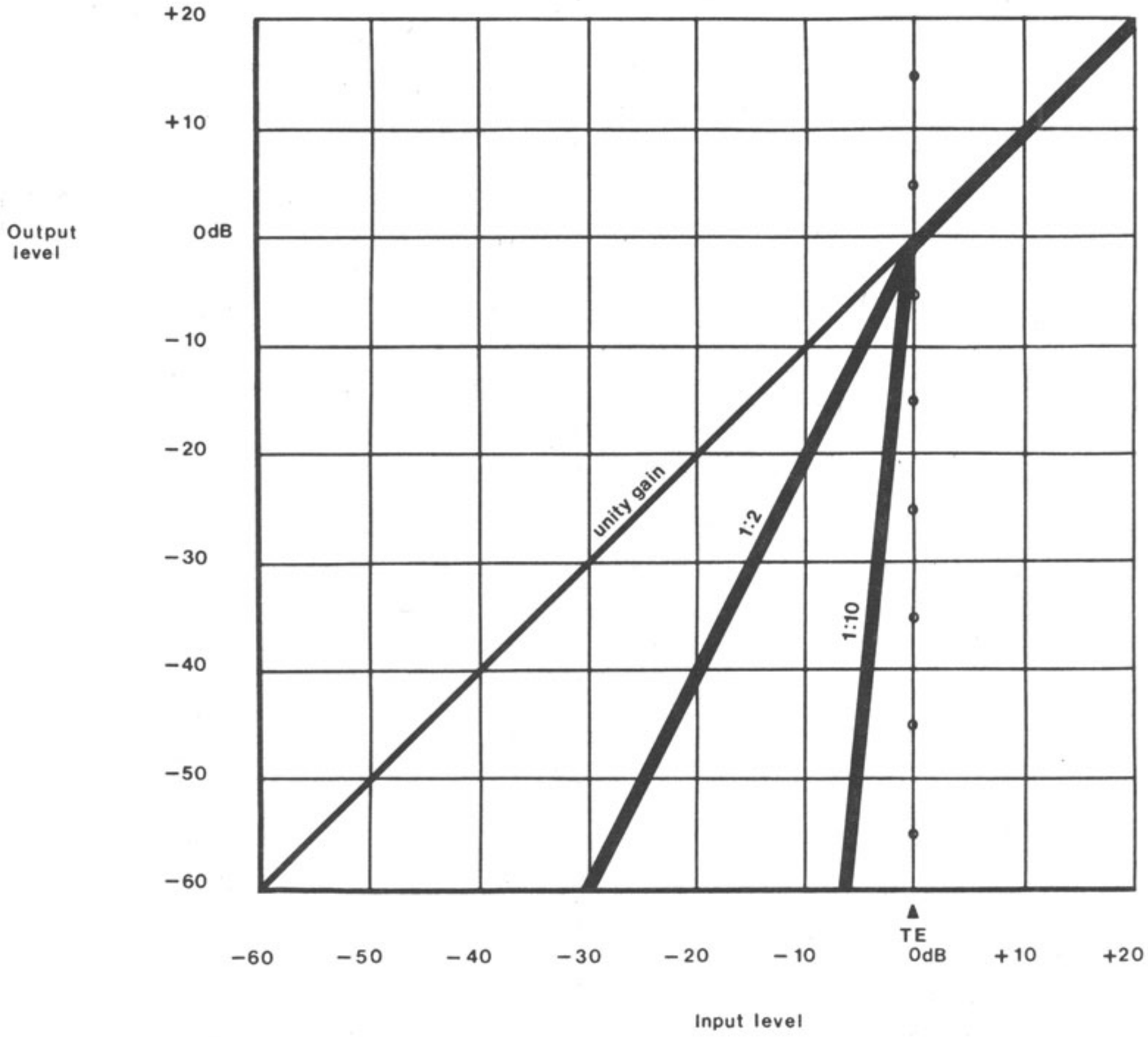


FIGURE 3
Input vs. Output Voltage Levels of a Steady State Tone
Through an Expander with Threshold @ 0 dB, Slopes of 1:2 and 1:10

Note that in the graph above, as the input signal level falls below the expansion threshold, TE, the processor gain is reduced. Each dB of drop below threshold, TE, of the input signal level causes the output level to fall 2 dB, thus the slope, or expansion ratio is 1:2. As the input signal exceeds the expansion threshold, TE, the processor recovers to unity gain. The process thus described is properly termed DOWNWARD EXPANSION. Higher expansion ratios of, for example 1:10 or 1:20 are used for a process commonly called "gating" wherein the expansion ratio, TE, is set at some point just below the level of the desired signal such as a drum. Any input level exceeding the threshold then causes the processor to rapidly recover to unity gain. Although the reduction in the unwanted signal at the output is more dramatic, the threshold setting is very critical, and the result is not as unobtrusive as expansion using a gentle slope, especially for noise reduction purposes.

Attack and Release Structures. Dynamics processors cannot be allowed to operate instantaneously, as do normal amplifiers, following exactly the input waveform; the result is operation as a non-linear gain block which creates distortion. The objective in dynamics processing is not to alter the waveform of the signal, but rather to control the envelope of the signal as shown in Figure 4.

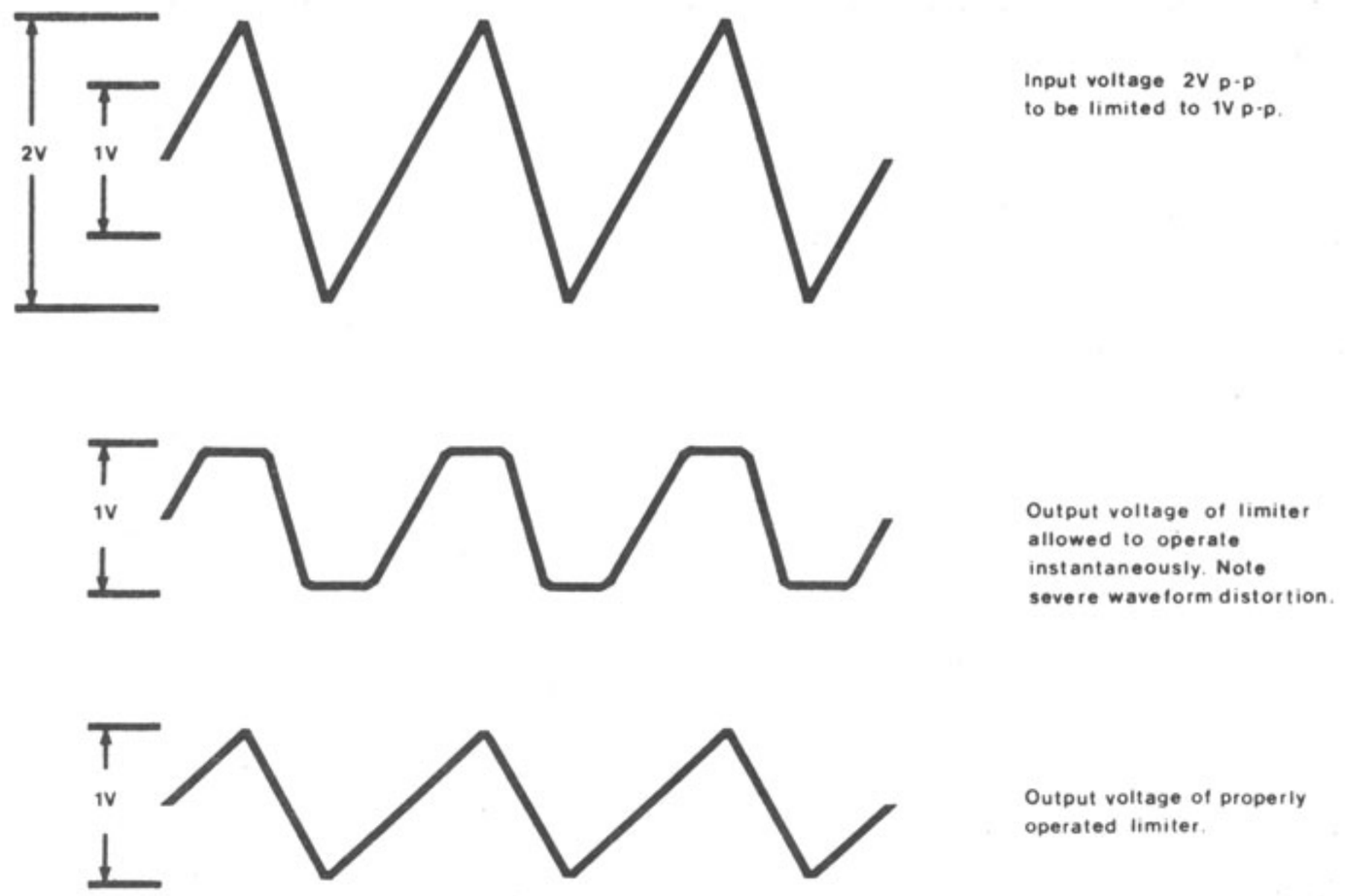


FIGURE 4
Steady-state Non-sinusoidal Tone Through Limiter Adjusted to
Provide 6 dB of Limiting at Ratio of 60:1

The ideal processor should be able to distinguish the input waveform from its relatively slower envelope, and follow the envelope contour without regard to the frequency content of the waveform. This, in practice, is nearly impossible; the processor must react quickly enough to control the level of sudden bursts of high level signal and transients, thus, sometimes it must react to the waveform. The parameter which determines the processor's ability to respond to sudden bursts of high level program material and fast transients is called ATTACK TIME. The ATTACK TIME is generally characterized as the time required for a processor to alter its gain from some starting point to within a specified percentage of its required ultimate gain or attenuation. The attack time is measured starting the instant the signal causing the change in gain appears at the input of the processor. If the attack time is stated as the time required for a given amount of gain change, it must include settling time, which is the time required for the control element to recover from any overshoot or ringing and to stabilize at 100% of the specified gain change.

After the processor has "attacked" and altered its gain in order to control the signal level, it cannot be allowed to recover to its previous gain by simply following the input waveform as it falls in level. This, again, will cause waveform distortion. Some provision must be made to slow this recovery time, or RELEASE TIME. The problems associated with release times are analogous to those of attack times. The processor must follow the envelope of the input signal, but at times, must release relatively quickly.

Figure 5 illustrates attack and release characteristics of a limiter and an expander.

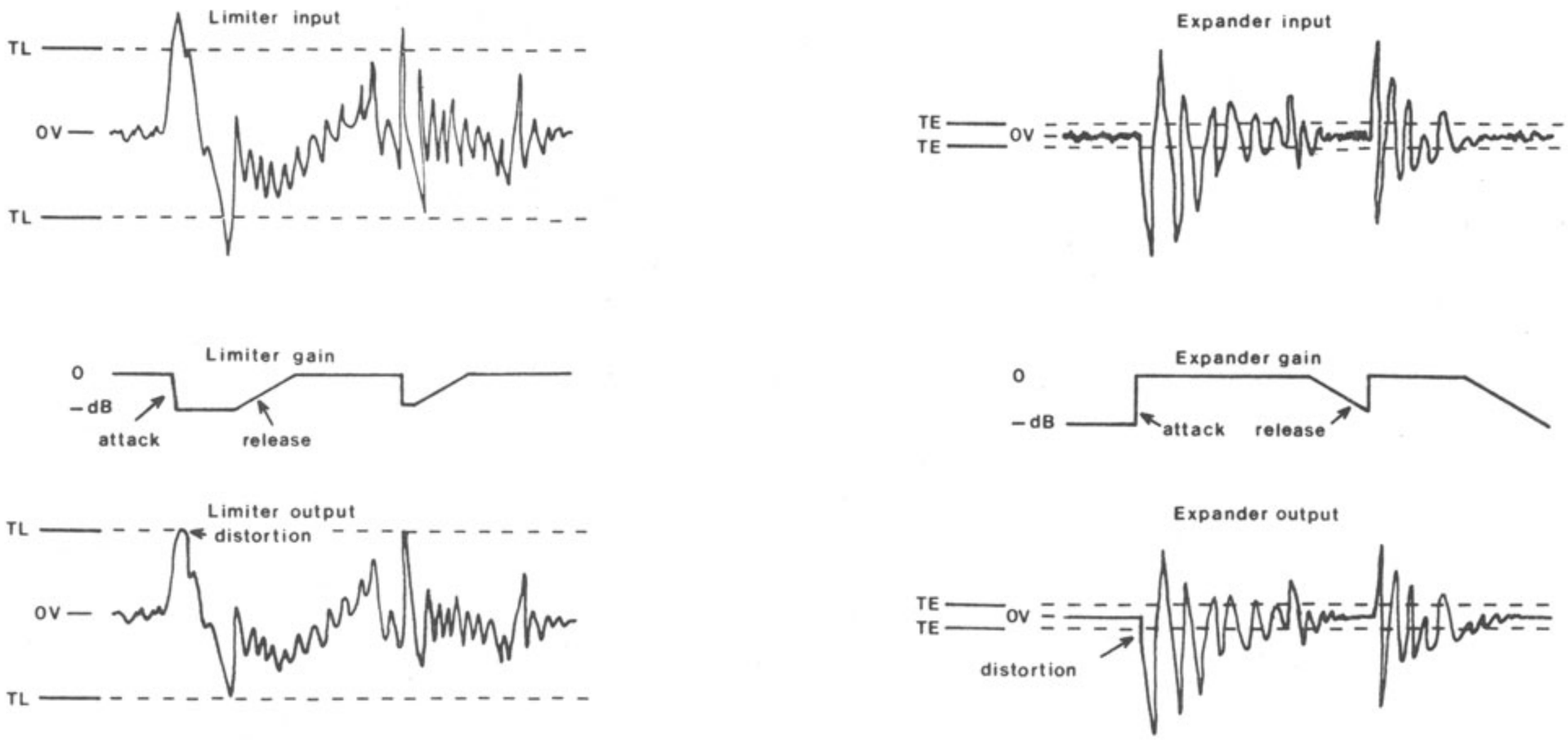


FIGURE 5
Drawing of Oscillographs Representing Musical Program Material Processed by a Limiter @ 60:1 Ratio and an Expander @ 1:20 Slope

As can be seen, a fast attacking limiter inherently causes some waveform distortion, as does a fast attacking expander. While the distortion induced in the limiter, when present in sufficient amounts, sounds like "clipping" or "fuzziness", that caused by an expander sounds like a "click", as if the signal has been turned on by a switch.

One solution to the problem of waveform distortion is to lengthen the attack time of the processor. While this approach does result in better dynamic integrity of the processed signal, it has certain drawbacks, the most serious being less dynamic control of the signal. Another approach to minimize waveform distortion is to select relatively long release times, thus not allowing the processor to recover fully before the next attack is called for. This approach suffers serious and obvious drawbacks: a limiter with a very long release time reduces the level of signals which do not require reduction, and an expander with a long release time will not attenuate unwanted signals properly. Both are forms of dynamic distortion, or unwanted, unnatural sounding gain changes. Dynamic distortion is variously described as "pumping", "breathing", "shimmering", etc. All processing devices introduce dynamic distortion in some amounts as a function of release time, however, automatic circuitry, when properly applied, can reduce dynamic distortion dramatically.

Detection Schemes. Since a dynamics processor must have a gain control element, and

since this element must be electrically controlled, usually by a voltage, the dynamics processor must also possess some means to measure the level of the input signal, compare it to the threshold setting, and generate the appropriate control voltage to adjust the gain of the controlled element. The device which performs this function is called the DETECTOR. A very simple type of detector simply measures the voltage excursions of the input waveform. Such a detector called a PEAK DETECTOR; it measures the peak excursions of either polarity of the input waveform. Peak detection is useful to prevent overloading of subsequent devices in any signal chain which may be peak level sensitive, such as in disk cutting and broadcasting. These detectors react very rapidly, typically exhibiting attack times of 10 μs to 100 μs, in order to place an absolute limit on the peak voltage at the processor output. Peak limiting is the only processing scheme which can provide protection against overmodulation in disk cutting or broadcasting.

Most contemporary use of processing equipment is no longer for protection of following stages, but for the purpose of increasing the apparent loudness of a signal within the level constraints of a transfer medium, such as a tape.

The peak voltage of a signal unfortunately bears little relationship how loud the signal sounds to a human. The human ear responds to power levels. Two waveforms of equal loudness are shown in Figure 6.

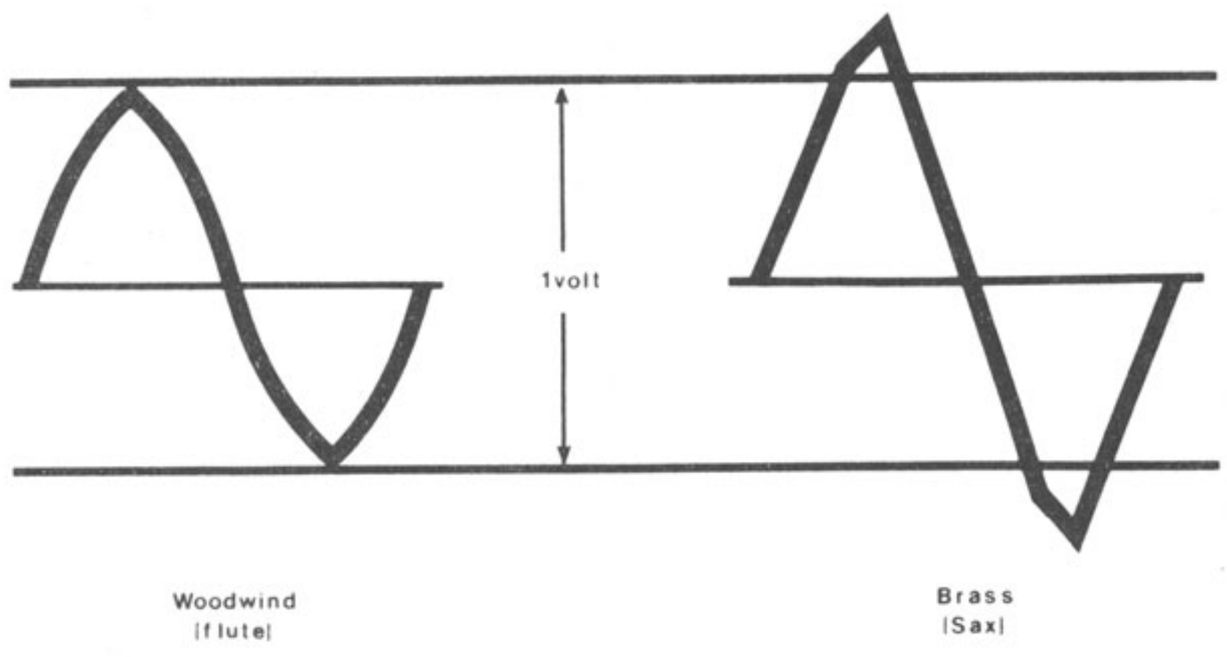


FIGURE 6
Simplified Waveforms of Same Loudness
from Woodwind and Bass Instruments

Note that the saxophone produces a more complex waveform than the flute. The two tones are of equal loudness to a human, but the peak voltage value of the saxophone waveform is much higher than that of the flute. A peak detector will cause this signal to be lower in loudness, when processed, because the peak detector reads the peak voltage level, not the power level. The more complex a waveform is, the more error exists between a peak responding processor's output and what the human ear hears as a "correct" loudness.

If the human ear responds to power levels, then some form of rms detection would seem to be in order. An rms responding detector circuit would produce an output analogous to the waveform's power level. This would correct the 10 to 14 dB discrepancy between a peak detector's indication of level and the actual power contained in a complex waveform. Although the rms detection scheme is a vast improvement over peak detection, it still suffers from some drawbacks in that it does not, in itself,

compensate for the frequency response of the human ear. Humans are woefully deficient in aural acuity both in the low frequency and high frequency portions of the audio spectrum. In the example of Figure 6, an rms detector would read the high frequency (harmonic) content of the saxophone waveform as contributing significantly to the waveform's loudness. Although the harmonic content does contribute significantly to the power level of the waveform, because the human ear is deficient in aural acuity at high frequencies, the ear does not interpret the harmonics as contributing significantly to the waveform's loudness. In order for a detection scheme to make sense to the human operator, it then must take into account the frequency response of the ear. The Valley People Model 610 uses a well-integrated systemic approach to dynamics processing which results in a multi-function device incorporating attack times which are user selectable, a release structure incorporating a program controlled anticipatory release feature to eliminate modulation distortion, and a detector scheme which takes into account the preferences of the listener by emulating the response of the human ear.

2. Installation

2.1 CONNECTING THE 610 TO OTHER EQUIPMENT

The 610 is designed to interface with all commonly used professional audio equipment with nominal line levels of 0 dB to +8 dB. No provisions are made for direct connection to microphones or other equipment having nominal signal levels below -10 dB (250 mV rms). Due to the nature of the RF suppression networks at the input of the 610, it is recommended that the 610 be driven by devices with output source impedances of less than 5 kohm. The 610 may be transformer coupled at both the inputs and outputs, and will drive loads of 600 ohm or greater to +24 dB maximum. The 610 requires no termination for proper operation, nor does it provide termination for equipment used to drive it. If the 610 is fed from a source requiring termination, consult the instructions for that equipment and provide appropriate termination resistors external to the 610.

The 610 is connected to the ac mains by means of a standard 3-terminal IEC cordset. The safety ground is connected directly to the chassis of the 610. For prevention against possible shock hazard, the 610 should be powered only from a 3-terminal grounded outlet.

If extensive hum is introduced in the 610 interconnections due to ground loops, the internal jumper connecting 0 Vdc to the chassis safety ground may be removed from the power supply board (See Section 5. Maintenance). Do not remove the safety ground wire from the chassis lug connector nor the grounding prong from the ac mains cordset.

3. Theory of Operation

3.1 EXPLANATION OF BLOCK DIAGRAM

Figure 7 shows a functional block diagram of a single channel of the 610. The 610 consists of a CHANNEL SECTION comprised of the input balancing amplifier, the VCA and the output line driver, and two CONTROL SECTIONS. The compressor control section includes the compressor FM compensation network, detector-attack circuit, and the detector processing section consisting of the ratio and threshold controls, the threshold/ratio/output coupling computer, and the compressor anticipatory release computer. The expander control section is comprised of the expander FM compensation network, detector circuit, and a detector processing section consisting of a slope switch, a threshold control and range control as well as the expander antici-

patory release computer. The release circuits are coupled at the detector processing sections and operated by a common release control.

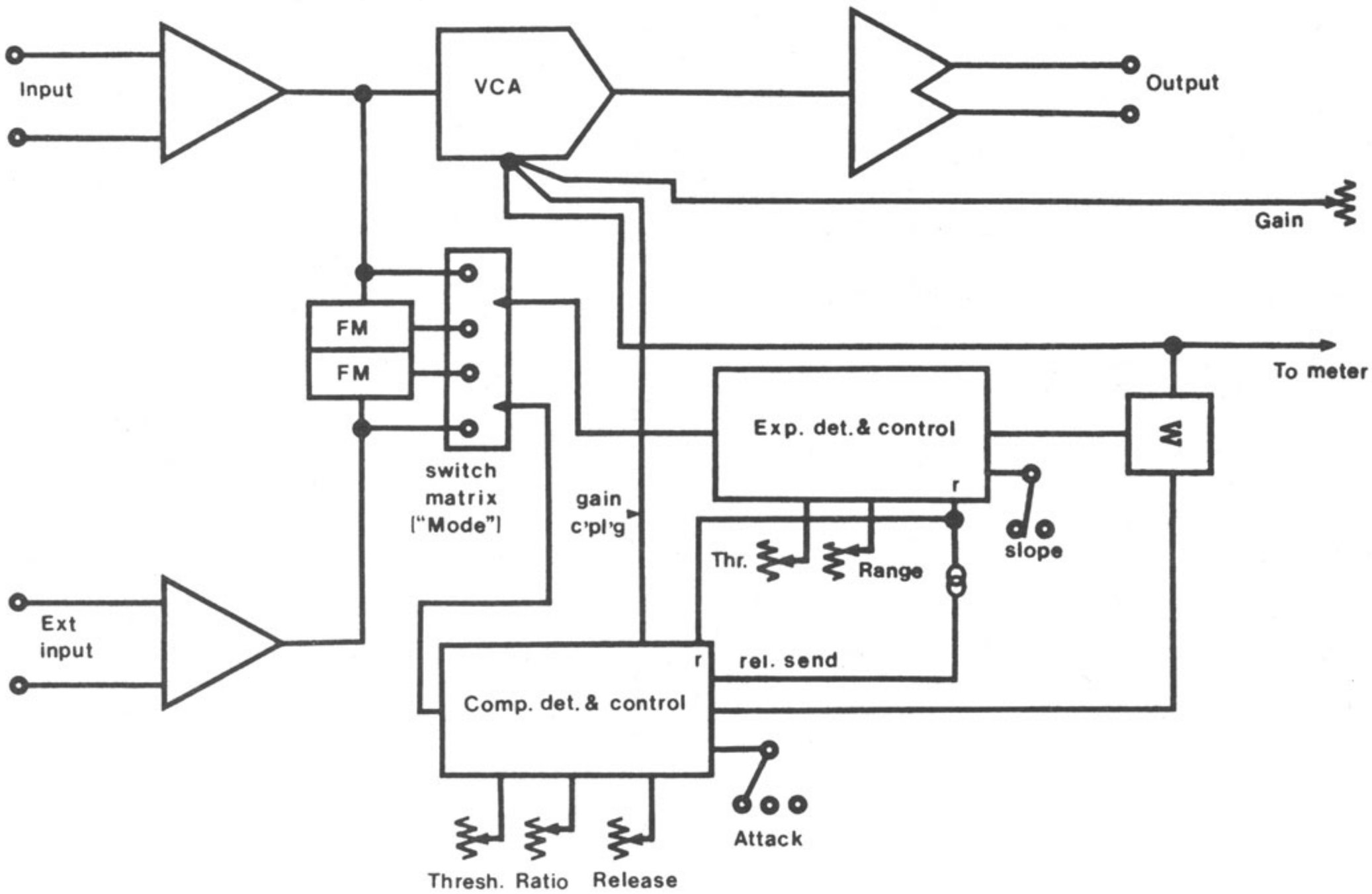


FIGURE 7
Block Diagram

3.2 CIRCUIT DESCRIPTION

The audio signal path, or channel consists of the input balancing amplifier, the VCA and the output stage. The VCA is the control element for the 610, and all gain or loss in the signal chain is accomplished by the VCA.

The detector circuits may be sourced from the input balancing amplifier, from the FM pre-emphasis compensation networks, or from the external audio input, thus allowing the control sections to react to either the incoming signal, an FM compensated signal, or an external audio input.

The detector circuits convert the incoming audio signal either into the log of the absolute peak voltage, or into the log of the average of the absolute voltage depending on the attack characteristics desired.

In the detector processing sections, such parameters as threshold, make-up gain, ratio, slope, range and release times are computed using the detector output voltage and the voltages produced by the front panel controls.

The control signals derived by the detector processing sections are then fed to the VCA control voltage summing network and to the gain reduction meter.

A feed line to drive an external VCA is provided at the ring terminal of the back panel jack marked CONTROL. The external VCA control voltage send, as it is called, provides +1 Vdc per 20 dB of attenuation directed by the detector processing sections. The tip terminal of the CONTROL jack allows the channel VCA to be fed by an external control voltage. The voltage-to-gain scaling at this terminal is +1 Vdc/20 dB attenuation, or -1 Vdc/20 dB gain.

4. Operating Instructions

4.1A CONTROLS

COMPRESSOR THRESHOLD CONTROL: Calibrated in dB,determines the level above which the compressor gain reduction begins.

COMPRESSOR RATIO/VOICE-OVER DEPTH CONTROL: Determines the compression ratio when the 610's compressor section is used in the normal or FM modes. When the compressor section is switched into the voice-over mode, this control limits the amount of gain reduction occurring to the audio signal (referenced from the nominal output level) when responding to an external audio signal.

COMPRESSOR ATTACK SELECTOR SWITCH: Allows the operator to select 20 μs fast peak attack characteristics, 1 ms or fast average attack, or 10 ms slow attack.

COMPRESSOR MODE SWITCH: Selects the compressor control sections operating mode, either normal (Compressor in), voice-over, in which the compressor detector is sourced by the external input section, or out which disables the compressor control section.

EXPANDER THRESHOLD CONTROL: Calibrated in dB. Determines the signal level below which gain reduction begins.

EXPANDER RANGE CONTROL: Limits the amount of gain reduction during downward expansion.

EXPANDER SLOPE SELECT SWITCH: Allows the operator to select a gentle expansion slope (1:2) for apparent noise reduction, a sharper slope (1:20) for "hard" noise gating, or expander 'out', which disables the expander control section.

RELEASE TIME CONTROL: Calibrated in seconds per 20 dB of release, allows the adjustment of both the compressor control and expander control release time.

AUTOMATIC RELEASE ON/OFF SWITCH: Inserts or removes the anticipatory release computing circuit which lengthens release time in presence of 'attacking' action from the compressor or expander control sections.

VCA MODE SWITCH: Selects normal operation, FM pre-emphasis compensation for both control sections, or external audio source for both control sections.

VCA GAIN CONTROL: Calibrated in dB. Allows trimming of output level. When performing normal compression or limiting the output gain control markings correspond to the nominal output level in dB.

CHANNEL BYPASS SWITCH: Provides a hard-wired audio bypass around the processor or signal chain, shorting input directly to output.

POWER SWITCH: Connects ac mains to power supply primary.

2-CHANNEL/STEREO OR 'COUPLE' SWITCH: Allows coupling of both compressor sections and both expander control sections for maintaining center channel integrity when processing stereo information. NOTE: When using the 'couple' switch, the operator must set the operating controls on each of the two channels to correspond closely to each other.

4.1B THE INDICATORS

COMPRESSOR LED 'COMP': Indicates that the expander control section is causing gain reduction.

EXPANDER LED 'EXP': Indicates that the expander control section is causing gain reduction.

'OVERLOAD' LED: Indicates excessive signal level at the line driver stage. This LED starts to glow when the peak signal level approaches to within 3 dB of clipping.

GAIN REDUCTION LED DISPLAY: Indicates the amount of gain reduction control voltage applied to the VCA by both the Compressor and Expander control sections. The display does not indicate the amount of gain added to the VCA by the threshold/ratio/output coupling computer or by the VCA gain control.

POWER INDICATOR LED: Indicates presence of bi-polar 15 V from the dc supply.

4.2 SAMPLE SETTINGS FOR OPERATING THE 610

A. LIMITING for broadcast or disk cutting.

In this application, the 610 is used to limit the peak excursions of the output voltage waveform in order to protect equipment following the 610 in the signal chain from overload.

Assume a nominal line input level to the 610 of +4 dB (0 vu on most professional studio equipment) and an overload level or clipping point of +18 dB in the following signal chain.

Select the following modes using the control switches:

ATTACK TIME:	20 µs
COMPRESSOR MODE:	Compressor 'in'
EXPANDER SLOPE:	Out
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal
CHANNEL BYPASS SWITCH:	Normal (no indicator)

Adjust the controls to the following settings:

COMPRESSOR THRESHOLD: Set for +15 to +16 dB, or about half-way between +10 and +20 on the control calibration. This will insure a 2 to 3 dB margin of safety for the following signal chain in reference to its clipping level of +18 dB.

COMPRESSOR RATIO: Set for 60:1, fully clockwise. The high ratio setting prevents even signals much higher than the threshold setting from exiting the processor at levels above the threshold setting, thus a +21 dB peak will be "clamped" or limited to +15 to +16 dB as indicated on the threshold control.

EXPANDER THRESHOLD: Since the Expander Slope switch is in the OUT position, the expander control section is disabled. The Expander Threshold will have no effect on operation.

EXPANDER RANGE: Same as above. As an added precaution, the Expander Range control may be turned fully CCW to "0", thus, should the Expand Slope switch be turned on to 1:2 or 1:20, the expander will not cause any gain reduction.

RELEASE TIME: Set initially for 0.5 s/20 dB, or midpoint on the dial calibration. This control should later be adjusted 'by ear' while listening to the program material while it is being processed.

CHANNEL VCA GAIN: Because the compressor Threshold control is set higher than 0 dB, indicating that the device is being used for LIMITING, the threshold/ratio/output coupling adds no make-up gain before limiting. If the +4 dB input level is assumed to be the required nominal output level, the Channel VCA Gain control should be set at 0 dB, or unity gain. If an output level other than the nominal input level is required, the Channel VCA Gain control may be adjusted to increase or decrease the output level by the amount indicated on the control dial markings. If, for example, the input level is +4 dB and the required output level is +8 dB, the Channel VCA Gain control should be adjusted for 4 dB of gain, or +4. Keep in mind that this gain is added after the control sections, so the maximum output level, when limiting, in the example given would no longer be +15 or +16 dB, but +19 or +20 dB, reflecting the 4 dB of gain added by the Channel VCA Gain control.

B. COMPRESSION to increase apparent loudness.

In this application, the 610 is used to decrease the dynamic range of the input signal, thus increasing the "apparent loudness" of the program.

Assume a nominal line input level to the 610 of +4 dB (0 vu on most professional studio equipment).

Select the following operating modes using the front panel control switches:

ATTACK TIME:	1 ms (fast averaging)
COMPRESSOR MODE:	Compressor 'in'
EXPANDER SLOPE:	Out
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal
CHANNEL BYPASS SWITCH:	Normal

Adjust the controls to the following settings:

COMPRESSOR THRESHOLD: Set initially for -20 dB. This control will be re-adjusted while listening to the program material and/or monitoring the vu meters on the following devices in the signal chain.

COMPRESSOR RATIO: Set initially for 2:1. This control will also be re-adjusted.

EXPANDER THRESHOLD: The expander slope switch is in the "Out" position, disabling the expander control section. This control will not affect the processor.

EXPANDER RANGE: Same as above. As an additional safeguard, this control may be turned fully CCW to 0 dB.

RELEASE TIME: Set initially for 0.5 s/20 dB, or mid-range on the dial calibration. This control may be readjusted "by ear" while listening to the program.

CHANNEL VCA GAIN: Set initially for 0 dB. When the 610 is used as a compressor, the Channel VCA Gain Control indicates the level at which a 0 dB input signal will exit the device. For further explanation, see Section 6.1.

In operation, both the Threshold and Ratio controls will usually be readjusted to obtain the most pleasing audible effect. By monitoring the channel overload LED and/or the vu meters on devices following the 610 in the signal chain, the Threshold and Ratio controls can be adjusted to achieve the desired degree of increased loudness without overdriving the following stages.

C. APPARENT LEVEL LIMITING or HIGH RATIO COMPRESSION

The purpose of this setup is to control both the maximum output level and the perceived loudness of the program material. The front panel controls should be adjusted as in configuration 'B' with these exceptions:

COMPRESSOR ATTACK TIME SWITCH:	10 ms
COMPRESSOR RATIO CONTROL:	60:1
CHANNEL VCA GAIN CONTROL:	Set for desired nominal output level.

An inherent characteristic of the threshold/ratio/output coupling feature using high compression ratios (20:1 to 60:1) when compressing (threshold less than 0 dB) is that the Channel VCA Gain control dial markings correspond closely to the nominal line level at the output. Any input signal above the threshold will exit the 610 at the level indicated by the Channel VCA Gain Control. Assuming an input level of +4 dB and a threshold setting of -20 dB, any signal with a level of -20 dB or higher will appear at the output of the 610 at the level indicated on the Channel VCA Gain Control, so if +4 dB is the desired output line level, adjust the gain control to indicate +4 dB.

When large amounts of high ratio compression are used, certain percussive signals, or those with a high crest factor such as drums, bells, or piano, may cause overshoots due to the relatively long attack time. Although the overload LED may flash indicating clipping, the decision to lower the output level or reduce the amount of compression should be based upon what is heard. If the signal sounds "clean" under these conditions no adjustment is normally required. Should this "edge" or "percussiveness" become objectionable, the 1 ms attack time may be selected, or the threshold may be raised to reduce the amount of compression. Use of the 20 μs attack time (peak detection) in this operational mode results in a more tightly controlled output level, but the increase in perceived loudness obtained with use of the averaging detection modes (1 ms, 10 ms) will be lost.

D. FM PRE-EMPHASIS COMPENSATION in limiting and compression.

The purpose of this setup is to pre-condition the program to decrease the number of hits at the FM transmitter's final limiter. The operating modes are selected as in examples A, B and C. The Channel VCA Mode switch is set to FM, inserting the 25, 50 or 75 μs pre-emphasis curve in the control line causing a rising response to high frequencies which duplicates the response of the transmitter pre-emphasis network. The program signal path remains unequalized. In the presence of large amounts of high frequency information, the broadband threshold of compression is lowered, thus compensating for the high frequency boost at the transmitter. See Section 6, Schematic Diagram for time constant selection information.

E. VOICE-OVER OPERATION

In this configuration, the 610 will be used to cause a pre-determined amount of gain

reduction in response to an external signal, such as an announcer's voice. This function is otherwise known as "ducking", "auto-dimming", and "VOXAGC". Select the following operational modes using the front panel switches:

ATTACK TIME:	1 ms
COMPRESSOR MODE:	Voice-over
EXPANDER SLOPE:	Out
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal

Adjust the controls to the following settings:

COMPRESSOR THRESHOLD: Set somewhat below the expected line level of the external source. If, for example, an announcer's voice is being used to reduce the level of a jingle and the line output level from the fader of the announcer's microphone channel is +8 dB, try setting the threshold at -10 dB. The desired result of correctly adjusting the threshold is dependable gain reduction caused by the announcer's voice without gain reduction caused by extraneous noises such as lip "smacks", background room noise, etc.

COMPRESSOR RATIO: In this case, refer to the bracketed numbers indicating voice-over gain reduction. These numbers represent the amount of gain reduction which will occur when the signal appearing at the external input exceeds the indicated threshold.

EXPANDER THRESHOLD: The expander control section is disabled by selecting "out" with the expander slope switch.

EXPANDER RANGE: As a precaution, this control may be set to 0 (full CCW).

RELEASE TIME: Try a relatively long release time for this effect, perhaps 1 or 2 seconds/20 dB.

CHANNEL VCA GAIN: Unless gain or attenuation is required to match the main audio input level to the stages following the 610, set at 0 dB (unity gain).

Note that the external audio input signal will not appear at the output of the 610; only the main input signal will be present at the output of the 610.

4.2B EXPANSION AND GATING

A. APPARENT NOISE REDUCTION BY EXPANSION

The purpose of this configuration is to reduce the apparent noise floor of a noisy source, such as cassette, cart, or disk.

Select the following modes with the front panel switches:

COMPRESSOR MODE:	Out
EXPANDER SLOPE:	1:2
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal

Adjust the front panel controls for the following settings:

COMPRESSOR THRESHOLD: N/A - Compressor control is disabled by selecting "Out" with compressor Mode switch.

COMPRESSION RATIO: N/A - For additional safeguard, may be turned full CCW (1:1).

EXPANDER THRESHOLD: Start at 10-20 dB below nominal input signal level. This control will be readjusted later.

EXPANDER RANGE: Start at 10-20 dB. This control is the maximum amount of gain reduction the expander will exhibit when the input signal falls below the expander threshold. This is most easily set with no input or with the channel bypass switch activated. Simply adjust the Range control for the desired amount of attenuation as shown on the gain reduction meter LED array. With program applied, threshold should be adjusted during very quiet passages or between cuts, then readjust Range to produce least obtrusive "quieting" effect in conjunction with RELEASE TIME control, which will probably result in a release time of about 0.5 s/20 dB.

CHANNEL VCA CONTROL: Usually 0 dB (unity gain) unless gain or attenuation is required to match output levelto input level of devices following the 610 in the signal chain.

B. NOISE GATING

Select same modes as configuration A (Apparent Noise Reduction) except Expander Slope switch is in 1:20 position. The purpose of this setup is to "turn on" the signal chain when a signal is present. This is most frequently used for "tightening" muddy-sounding percussion tracks. Threshold and Range settings are very critical when gating in order to achieve unobtrusive operation.

C. KEYING

Same configuration as A or B, but CHANNEL VCA MODE switch in External position. This setup turns the main signal path "on" in response to an external input over expander threshold. This is useful as an effect, or, when the 1:2 slope is selected, as an "Envelope follower". By judicious adjustment of the Release time control and by switching the Auto Release "Out", the main signal chain envelope can be made to follow the envelope of the signal present at the external input.

4.2C INTERACTIVE MODES

A. EXPANDED COMPRESSION

This is perhaps the most used of the 610's many functions. The purpose of this setup is to increase the apparent loudness of program material while reducing the noise floor level that is "pumped up" by the compression process.

Select the following modes using the front panel switches:

ATTACK TIME:	As desired, usually 1 ms
COMPRESSOR MODE:	Compressor In
EXPANDER SLOPE:	1:2
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal

Adjust the front panel controls to the following settings:

COMPRESSOR THRESHOLD: Assuming a nominal input level of +4 dB, set initially to -10 to -20 dB. This control will be readjusted in use to provide the desired amount of compression.

COMPRESSOR RATIO: As desired for best "loudness" with least distortion.

EXPANDER THRESHOLD: Initially try -10 to -20 dB. This control will also be readjusted for best results.

EXPANDER RANGE: This control should be set for the required amount of gain reduction during quiet passages.

RELEASE TIME: With the auto-release "In" between 0.5 s/20 dB and 1 s/20 dB will usually provide best dynamic integrity with least "pumping" of the noise floor. This control should be adjusted "by ear".

CHANNEL VCA GAIN: Usually 0 dB for unity gain.

B. "GATED" COMPRESSION

Controls are set as in configuration A with the exception of the EXPANDER SLOPE switch, which will be set to the 1:20 position. The adjustment of the Expander Threshold and Release Time controls will be very critical in this setup, as will be the Expander Range control.

C. LIMITED EXPANSION

This setup is useful to process highly compressed material for transfer. The Expander increases the dynamic range of the input signal while the compressor limits the output level to the devices following the 610 in the signal path. To perform this function, select the following modes using the front panel switches:

ATTACK TIME:	As required for peak (20 μs) fast average (1 ms) or average (10 ms) attack characteristics. This choice will depend on the peak level sensitivity of the devices in the signal chain following the 610.
COMPRESSOR MODE:	Compressor In
EXPANDER MODE:	1:2
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal

Adjust the operating controls to the following settings:

COMPRESSOR THRESHOLD: Adjust for highest output level required in the same manner as any peak limiter. The compression threshold should be above 0 dB, and will usually be at +15 dB or higher with nominal line levels of +4 to +8 dB.

COMPRESSOR RATIO: Usually high in this application, 6:1 to 60:1 is typical.

EXPANDER THRESHOLD: This control should be set to the highest peak level anticipated in the program material. For a +4 dB nominal line level, try a setting of +10 dB. This control will be readjusted "by ear" with program material.

EXPANDER RANGE: Usually 30 dB or higher. This control must also be adjusted "by ear".

RELEASE TIME: Adjust this control for least distortion, also "by ear".

CHANNEL VCA GAIN: Usually 0 dB for unity gain operation.

This configuration is perhaps the most difficult to use, but is valuable in restoring natural dynamic range to highly compressed material as in some types of "compander" noise-reduced tapes.

D. EXPANDED VOICE-OVER

This is a very useful configuration which allows the compressor of the 610 to "duck" program material in response to an external signal while the expander performs ap-

parent noise reduction on the signal present in the main channel. The expanded voice-over function finds greatest use in commercial production when announcing over cart "jingle" material which may have been stored and re-used many times, thus raising its noise floor.

To configure the 610 for Expanded Voice-over, select the following operating modes using the front panel switches:

ATTACK TIME:	20 µs or 1 ms
COMPRESSOR MODE:	Voice-over
EXPANDER MODE:	1:2
AUTO-RELEASE:	In
CHANNEL VCA MODE:	Normal

Adjust the operating controls to the following settings:

COMPRESSOR THRESHOLD: Adjust so that extraneous noise will not cause gain reduction in the main channel signal, typically -10 to -20 dB for a +4 dB nominal line level.

COMPRESSOR RATIO: Observing the bracketed numbers, adjust for desired amount of gain reduction for effective "ducking".

EXPANDER THRESHOLD and EXPANDER RANGE: Adjust these controls "by ear" for most effective and unobtrusive apparent noise reduction.

RELEASE TIME: A relatively long release time is usually most pleasing for voice-over operation, but effective and unobtrusive apparent noise reduction will dictate moderation. The best compromise is perhaps 0.5 s/20 dB.

CHANNEL VCA GAIN: Usually 0 dB for unity gain.

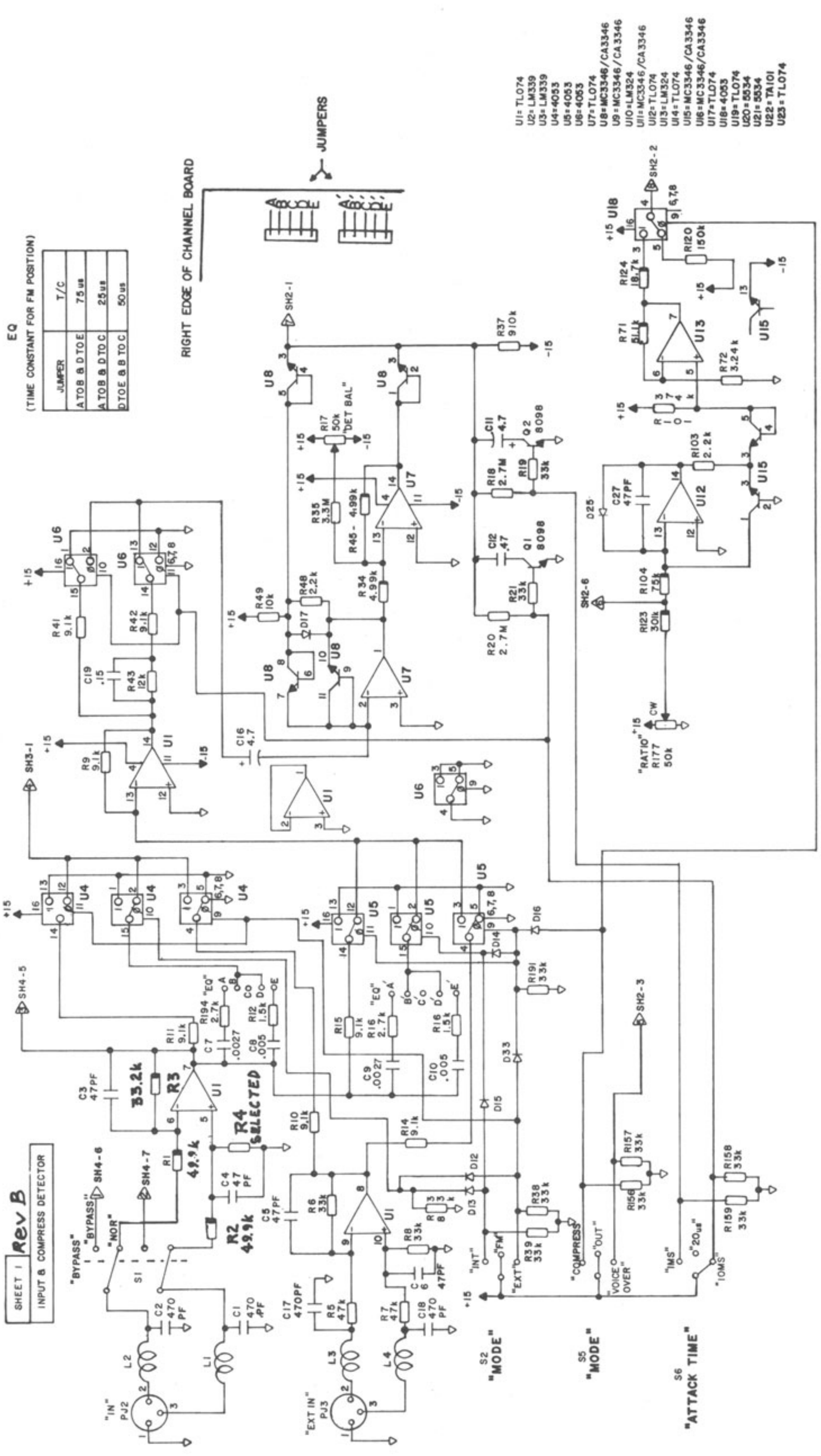
Because of the versatility of the 610's interactive operational modes, the best guide for effective use of the device is experience gained by experimentation.

4.3 OPERATING PRECAUTIONS

Stereo Coupled Operation. Due to the complex nature of the Compressor-Expander release coupling scheme and the threshold/ratio/output coupling in the 610, when using the stereo coupling switch it is imperative that the operating controls for both channels are adjusted to correspond closely to each other. Large discrepancies in the relative settings between the two channels will cause spurious interaction between the Channel VCA control voltages. The Channel VCA Gain controls may, however, be adjusted to different levels to "balance" the center channel information.

5. Maintenance

Due to the complexity of the 610, a detailed tutorial discussion of its circuit operation is beyond the scope of this manual. A schematic diagram is provided to assist users who possess sufficient technical background to perform in-field troubleshooting and repair. Valley People, Inc. recommends that defective units be returned to factory authorized dealers or directly to the factory for repair. The technical staff at Valley People, Inc. is available to aid technical personnel in solving maintenance problems.


EQ
(TIME CONSTANT FOR FM POSITION)
JUMPER | T/C
A TO B & D TO E | 75 us
A TO B & D TO C | 25 us
D TO E & B TO C | 50 us
RIGHT EDGE OF CHANNEL BOARD
JUMPERS
U1= TL074
U2= LM339
U3= LM339
U4=4053
U5=4053
U6=4053
U7=TL074
U8=MC3346/CA3346
U9=MC3346/CA3346
U10=LM324
U11=MC3346/CA3346
U12=TL074
U13=LM324
U14=TL074
U15=MC3346/CA3346
U16=MC3346/CA3346
U17=TL074
U18=4053
U19=TL074
U20=5534
U21=5534
U22=TA101
U23=TL074
KEY
= 5% 1/4W CARBON FILM RESISTORS
= 1% 1/4W METAL FILM RESISTORS
ALL DIODES IN914 EXCEPT WHEN NOTED OTHERWISE
= 0V
= +15
= -15
SHEET 1 Rev B
INPUT & COMPRESS DETECTOR
R1 49.9k
R2 49.9k
R3 33.2k
R4 SELECTED
"BYPASS"
"NOR"
"IN" PJ2
"EXT IN" PJ3
"RATIO" R177 50k
S2 "MODE"
S5 "MODE"
S6 "ATTACK TIME"
"INT"
"EXT"
"FM"
"COMPRESS"
"OUT"
VOICE OVER
"1MS"
"10MS"
"20us"

5.1 ADJUSTING THE VCA CONTROL REJECTION TRIM.

The only user-accessible internal adjustment on the 610 is the VCA control rejection trim, adjustable through access holes on the rear of the chassis. Should this trim be substantially out of adjustment, clicking sounds may be heard in the output during operation. Adjustment of this trim in the field is relatively simple.

a. Set the front panel controls as follows:
   1) Disable the compressor control section by selecting the OUT position of the Compressor Mode switch.
   2) Select 1:20 position of the Expander Slope switch.
   3) Set the Expander Range control to maximum CW position (60 dB), Release time to minimum 0.05 s/20 dB, and the Channel VCA Gain control to maximum (+15 dB).
   4) Set the Expander Mode switch to external.
   5) Insure that the device is in the 2-channel mode (uncoupled).

b. Monitor the output of the 610 with an amplifier and speaker.

c. Apply a rapidly changing music source to the EXTERNAL input. Drums or bass are ideal. Make no connection to the main input connector.

d. Adjust the Expander Threshold control for maximum deviation of the Gain Reduction Meter LED array.

e. While listening to the monitor, slowly adjust the control rejection trimfor minimum sound in the monitor. The signal will be distorted and raspy in normal operation. To verify correct adjustment, you may monitor the output with an oscilloscope.

5.2 WARRANTY STATEMENT

Warranty

VALLEY PEOPLE, INC. warrants its products and their related enclosures and power supplies to be free from defects in workmanship and material under normal use and service. Said warranty is to extend for a period of twelve months after date of purchase. In the case that a VALLEY PEOPLE, INC. product or any of its related enclosures or power supplies is believed to be defective, same may be returned with transportation prepaid to VALLEY PEOPLE, INC., within twelve months after date of purchase, accompanied by proof of purchase. If the product is found by VALLEY PEOPLE, INC.'s inspection to be defective in workmanship or material, it will be repaired or replaced (at VALLEY PEOPLE, INC.'s election) free of charge and returned, transportation prepaid, to any point in the United States. If inspection by VALLEY PEOPLE, INC. of such products does not disclose any defect in workmanship or material, VALLEY PEOPLE, INC.'s regular charges will apply.

This warranty is expressed in lieu of any and all other warranties, whether expressed or implied, and the sole liability of VALLEY PEOPLE, INC. under this warranty is to either repair or replace (at VALLEY PEOPLE, INC.'s election) the product or its related enclosure or power supply. Any incidental damages are expressly excluded.

The foregoing warranty is VALLEY PEOPLE, INC.'s sole warranty, and all other warranties, expressed, implied, or statutory, are negated and excluded.

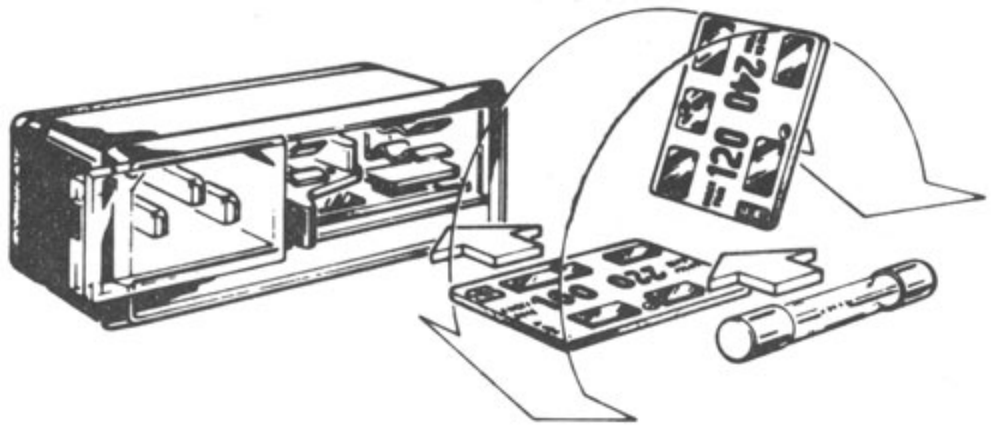
---IMPORTANT---

This instrument can be set to operate from one of four nominal power line voltages. Unless otherwise specified, instruments shipped to North American destinations are set to operate from 120 Vac. The units shipped to other destinations are set and fused for 220 Vac. Prior to connecting this instrument to an ac power source, please ensure that both the voltage selection and fuse rating are correct.

VOLTAGE AND FUSE SELECTION					
INPUT VOLTAGE (48 TO 440 Hz)	MAX	105	126	231	252
	MIN	90	108	198	216
VOLTAGE SELECTION		100	120	220	240
FUSE SELECTION		500 mA		250 mA	

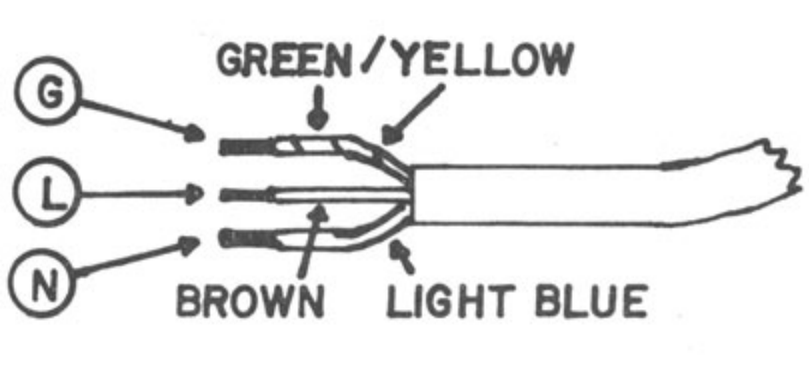
To select operating voltage:

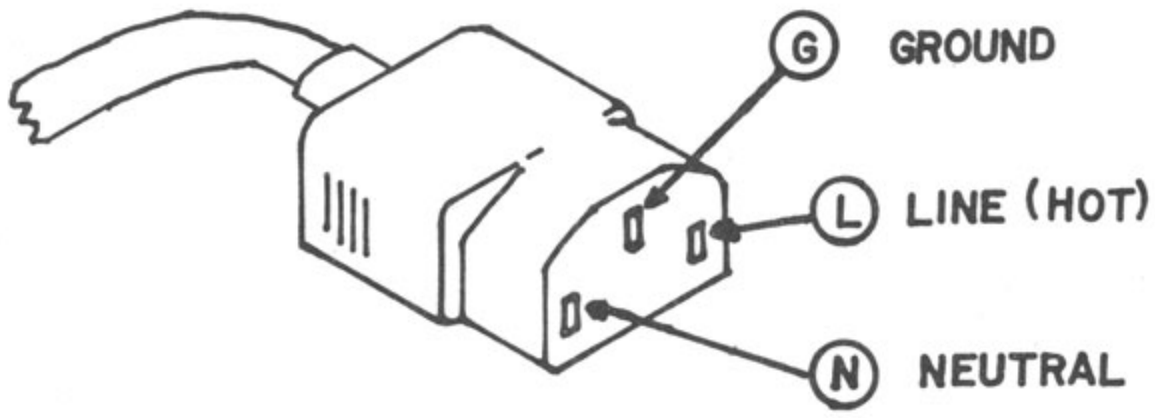
1. Open cover door and rotate fuse pull to the left.
2. Select operating voltage by orienting PC Board to position desired voltage on top left side. Push board firmly into module slot.
3. Rotate fuse-pull back into normal position and re-insert correct value fuse into holders.

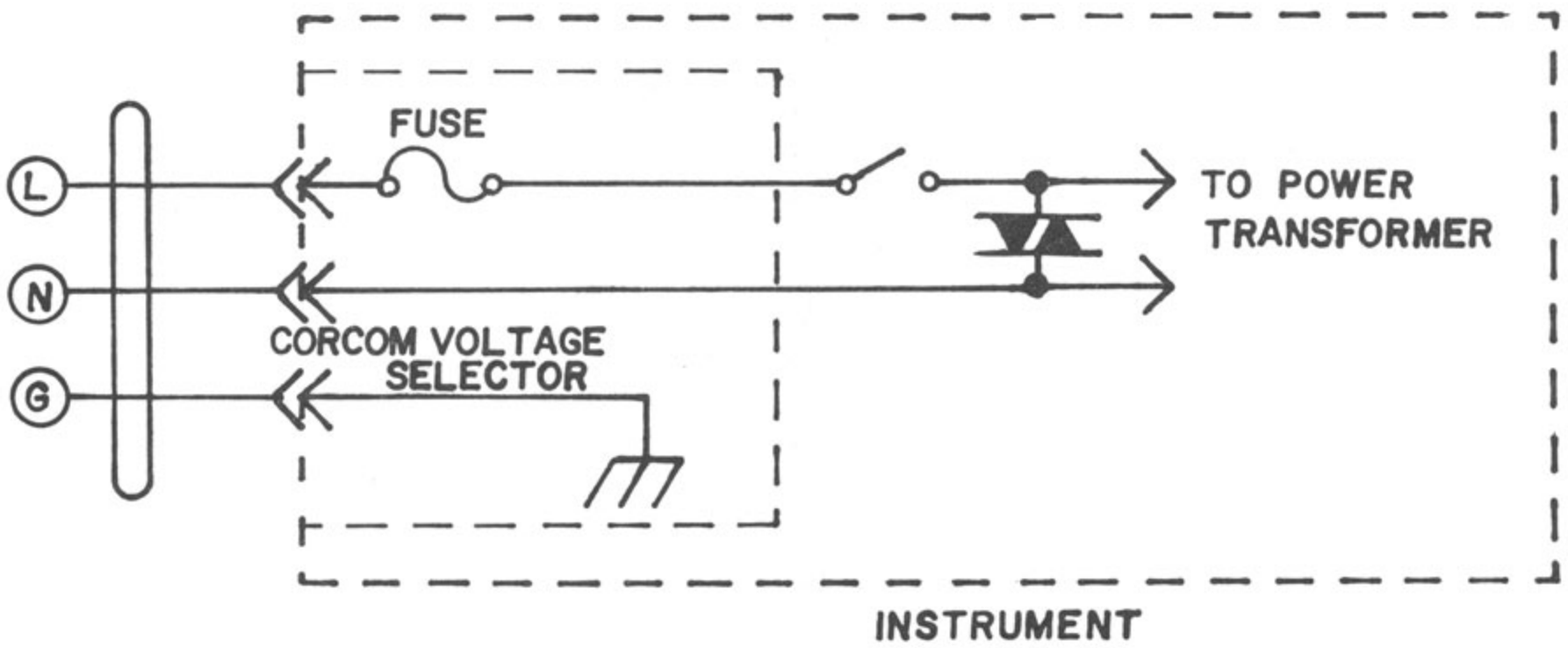


Power Cord Preparation:

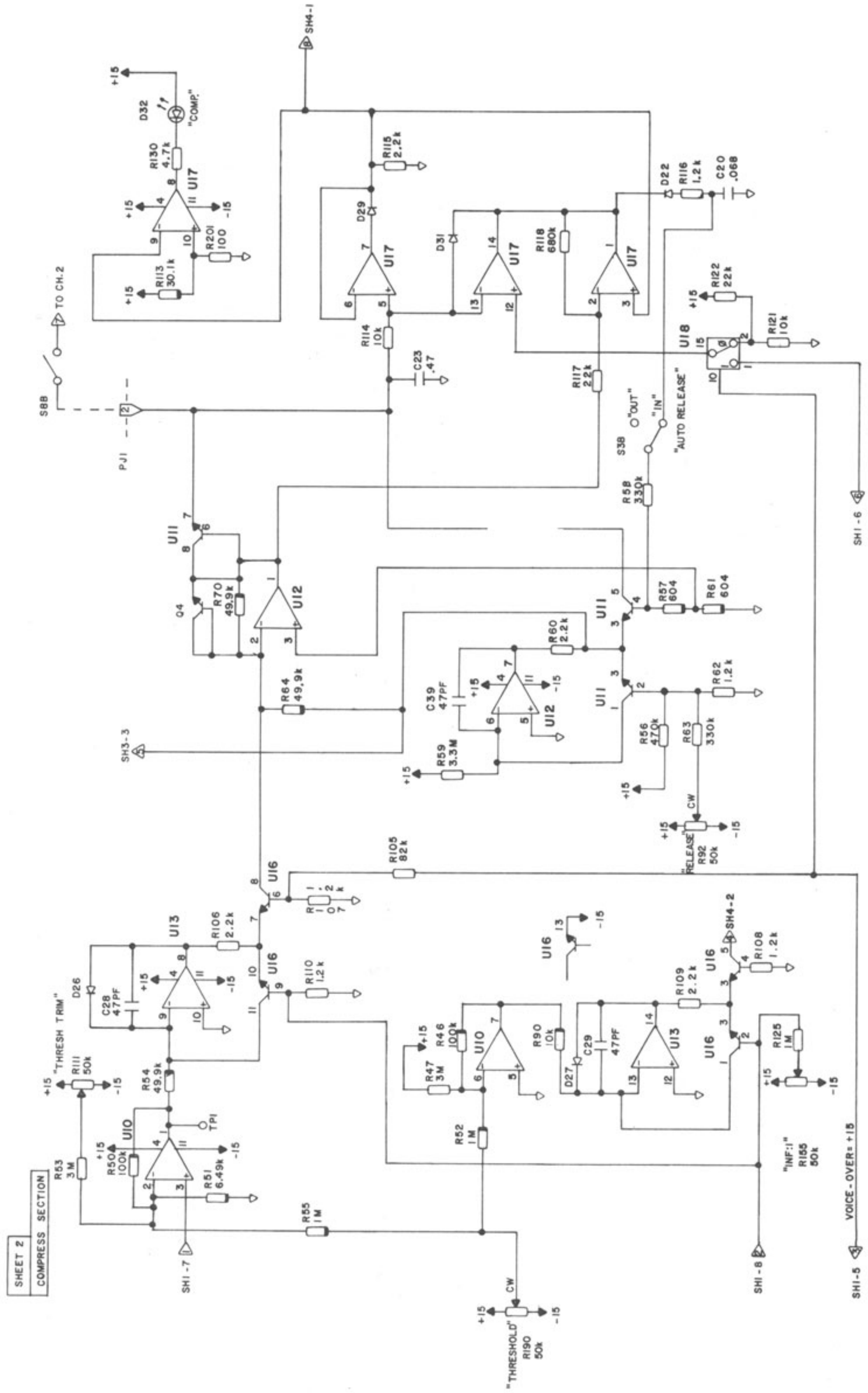
Instruments shipped to destinations outside North America are supplied with a power cord with conductors employing IEC color code and ready to accept a male plug (not supplied) to mate with the customers receptacle. Refer to the accompanying sketch to determine connection procedure. (Instruments shipped to North American destinations are supplied with a power cord terminating in a molded female receptacle at one end and a molded standard twin blade plus ground male plug at the other end. These cords, of course, require no preparation.)





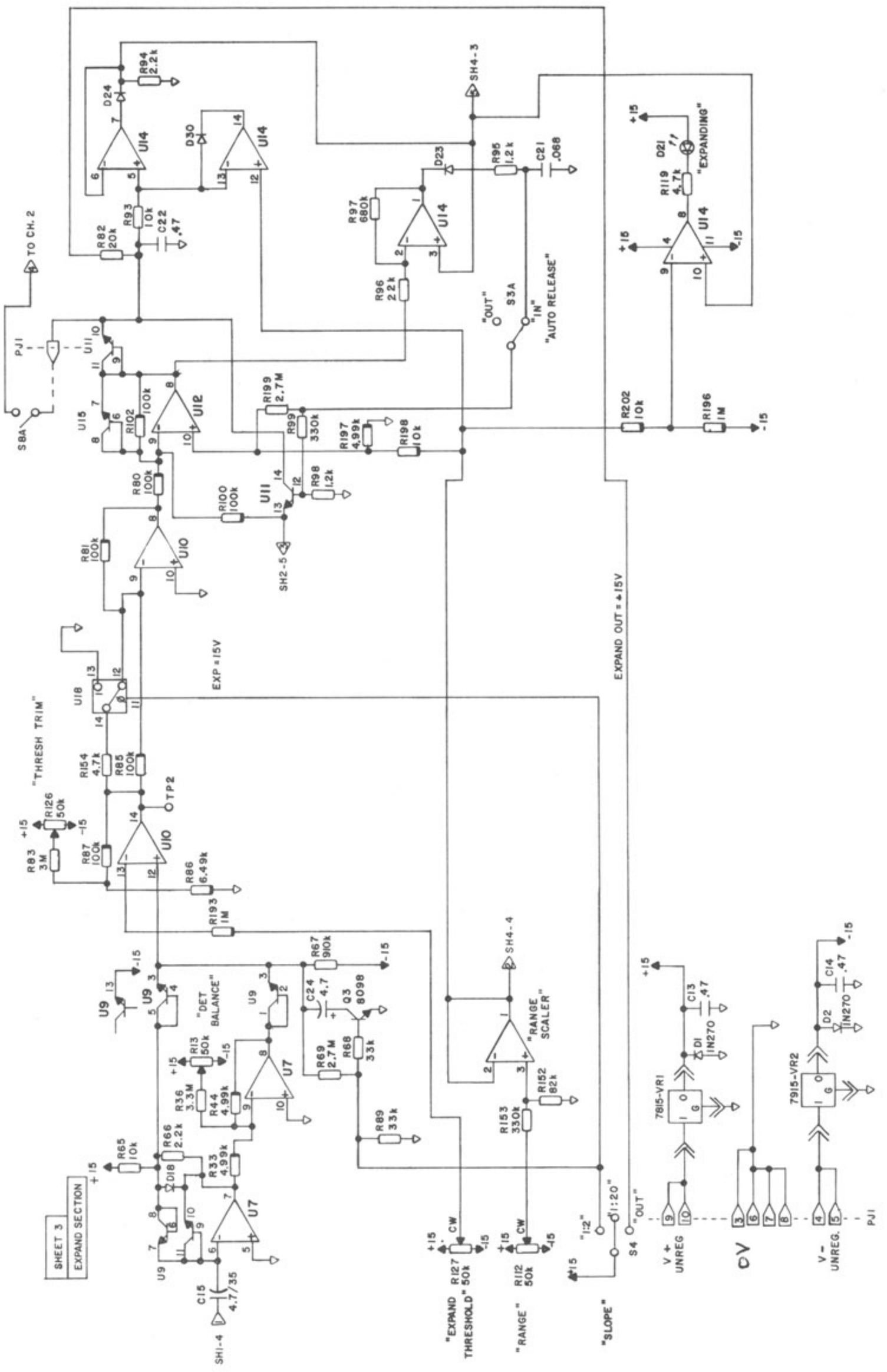


6.7 Compress Section Schematic



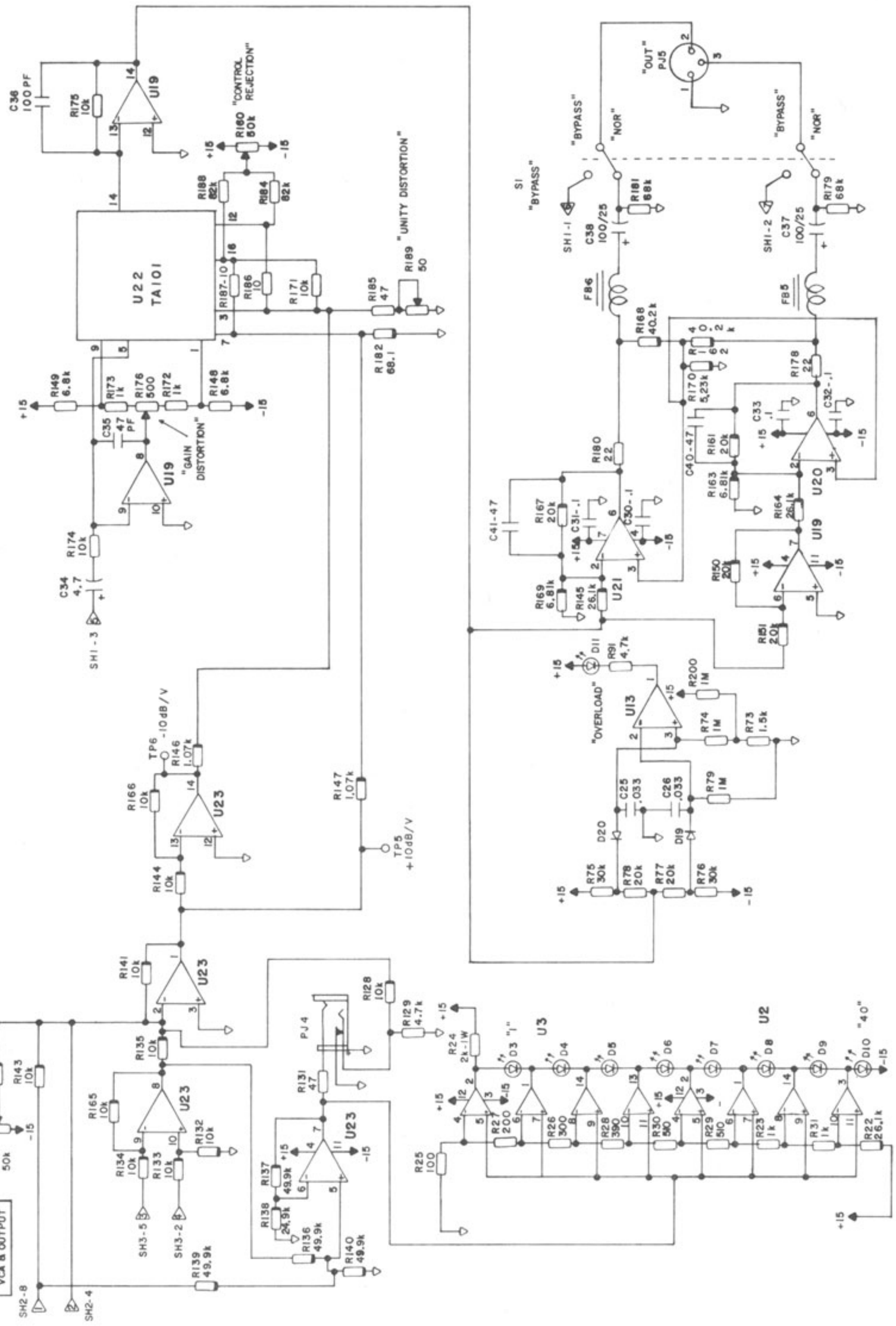
NOTE: Key to 'U' numbers on 6.6 Input & Compress Detector Schematic

6.8 Expand Section Schematic



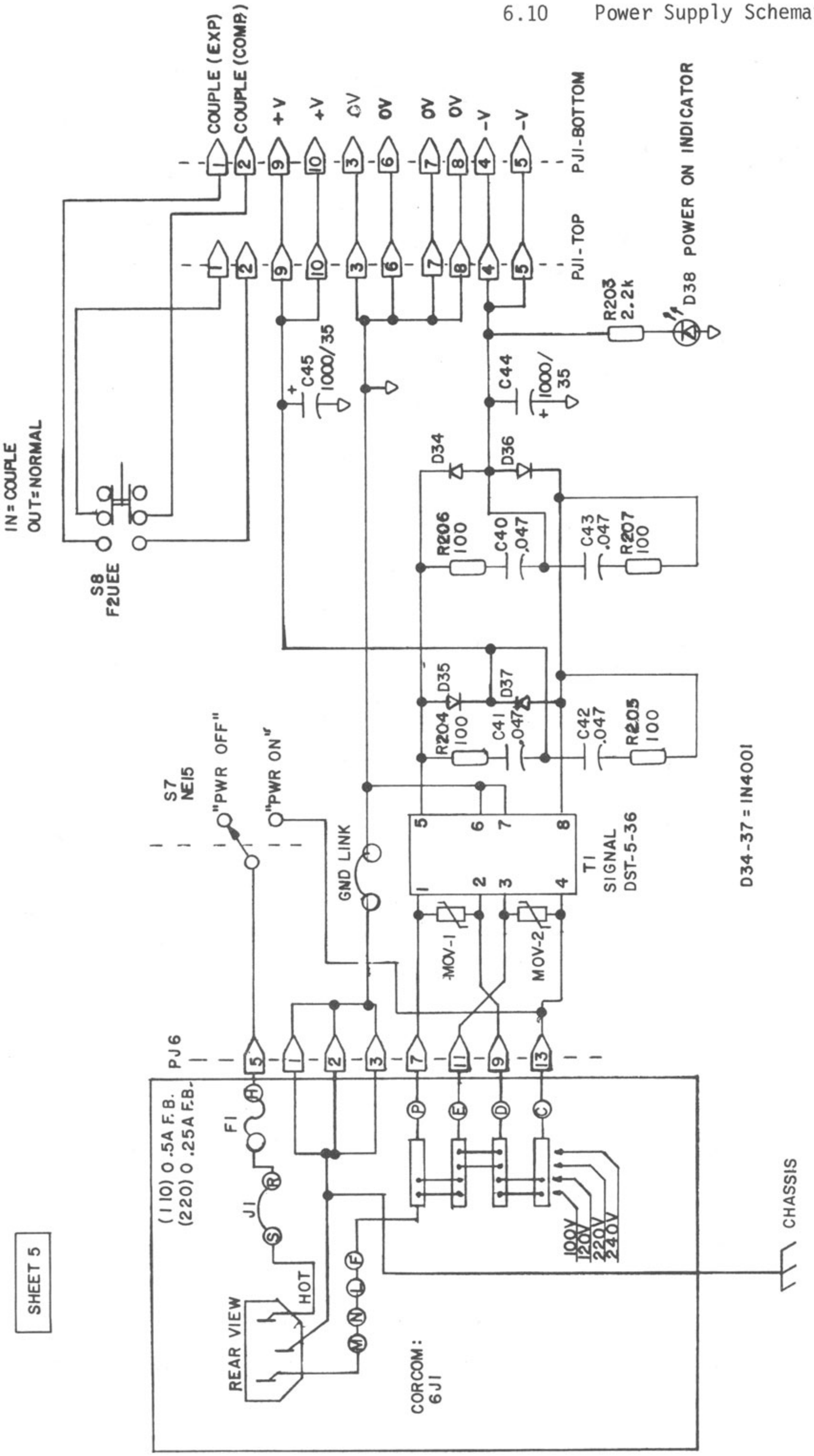
NOTE: Key to 'U' numbers on 6.6 Input & Compress Detector Schematic

6.9 VCA & Output Schematic



NOTE: Key to 'U' numbers on 6.6 Input & Compress Detector Schematic

6.10 Power Supply Schematic



SHEET 5

6.11 Power Supply Parts Overlay