INSTRUCTION MANUAL

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MODEL TFL-280B

AUDIO LIMITER

SN #19784, SN #19785

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

ORDER # 6165

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MOSELEY ASSOCIATES, INC.
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TFL-280B INSTRUCTION MANUAL

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MODEL TFL-280B

AUDIO LIMITER

I. INTRODUCTION

The Moseley Associates, Inc., Model TFL-280B Audio Limiter* has been designed to provide the broadcaster with a means of precisely controlling the modulation of an FM transmission system. It is frequency-conscious and cleanly solves the problems associated with the transmission of a pre-emphasized audio signal. By the use of agile circuitry, clipping (with its attendant problems, especially in stereophonic transmission) has been essentially eliminated. The TFL-280 incorporates the latest technological advances including the use of monolithic semiconductor arrays, wideband operational amplifier circuitry and distortion-reducing techniques. High-speed critically-damped metering circuitry allows accurate monitoring of the degree of limiting. Plug-in audio lowpass filtering prevents interference to the stereo pilot as well as to the stereo and SCA subchannels. Switchable AGC interconnections are provided to accommodate multi-channel service. Pre- and de-emphasis may be switched in or out from the rear of the unit as may an external noise-reduction encoder. The unit is fully temperature compensated for operation from -20°C to +60°C, and RF filtering allows operation in high-intensity RF fields. Trimmable pre-emphasis allows audio channel phase matching. The output de-emphasis network may be switched out when the unit is used to excite a transmission system operated in the flat mode. The TFL-280B may be ordered or easily modified to accommodate time-constants other than the normal 75 micro-seconds. The TFL-280B power supply accommodates standard line voltages of 120 or 240 VAC, 50 or 60 Hz.

*Patent Pending

II. SPECIFICATIONS

Input Level	-20 dBm for low-frequency limiting threshold; adjustable
Input Impedance	600 ohms ±10%, resistive, balanced, floating
Output Level	+17 dBm maximum; adjustable
Load Impedance	600 ohms, resistive, balanced or unbalanced
Control Range	Greater than 35 dB
Control Mechanism	Monolithic semiconductor arrays
Input/Output Leverage	Greater than 50:1 in dB
AGC Attack Times	Less than 20 microseconds to 2 milliseconds, field-changeable (wideband controller); less than 50 microseconds (high-frequency controller)
Recovery Times	Low frequencies: continuously variable, program-controlled triple time-constant; 0.2 seconds on transients to 5 seconds on steady program material; ripple-free AGC. High frequencies: program-controlled dual time-constant; 20 milliseconds on transients to 200 milliseconds on sustained high-frequency material
Frequency Response	±1 dB, 50 Hz to 15 kHz (below limiting thresholds)
Harmonic Distortion	Less than 0.7% at any frequency (50 Hz to 15 kHz) and any degree of limiting (0 to 30 dB)
Clipping	Customer controllable, 0 to 5 dB
Signal to Noise Ratio	Better than 70 dB, de-emphasized
Audio Frequency Filtering	Plug-in low-pass filter located prior to the high-speed high-frequency AGC
Metering	High-speed critically-damped meter calibrated 0 to 20 dB of limiting
Power Requirements	120/240 VAC + 10%, 50/60 Hz, 10 watts
Operating Temperature Range	-20°C to + 60°C

Size	4.5 cm H x 48.4 cm W x 25.4 cm D (1.75" H x 19" W x 10" D)
Domestic Shipping Weight	4.1 kg (9.1 pounds)

III. UNPACKING

The TFL-280B should be carefully unpacked and inspected for any shipping damage. Keep all packing material until performance is confirmed. Should inspection reveal shipping damage, or should hidden damage be revealed, immediately file a claim with the carrier.

It is recommended that the top cover be removed for a brief, superficial inspection.

> NOTE: DO NOT MAKE ANY ADJUSTMENTS OF ANY KIND TO THE EQUIPMENT AT THIS TIME.

This inspection should ascertain that the various components are mechanically secure. Replace the cover after the quick checks mentioned under Installation have been accomplished.

IV. INSTALLATION

A. General

For the most accurate modulation control, the following points are to be observed:

1. The TFL-280B must be located electrically immediately prior to the exciter, stereo or SCA generator, etc. It must not, for example, be located prior to a studio-to-transmitter telephone loop.

2. The audio lowpass filtering should be removed from that following equipment. This should be done in order that ringing or overshoot due to this filter be removed as a possible cause of transient over-modulation. The TFL-280B contains audio lowpass filtering internal to its circuitry.

3. A potentially flatter post-limiting frequency response (with the resultant possibility of a higher modulation level capability) may be achieved by operating the exciter in the flat mode and also operating the output de-emphasis network in the TFL-280B in the flat mode. Should it be impossible or impractical to remove the exciter's pre-emphasis network, then the output de-emphasis network in the TFL-280B should be switched in. The TFL-280B contains pre-emphasis in its circuitry, which may be switched out for test purposes.

4. Some exciters contain low-frequency (30 Hz) highpass filters to prevent very low frequency audio components from interfering with the transmitter AFC system. Such filters will jeopardize the effectiveness of the TFL-280B in controlling modulation levels. The filter should be removed and reinstalled prior to the TFL-280B.

5. In stereophonic and quadraphonic systems, each audio channel should be processed identically. Be sure when any modifications are made to make the same modifications to each audio channel. Failure to do this will result in audio channel phase and amplitude disparities, as well as preventing accurate modulation control by the TFL-280B.

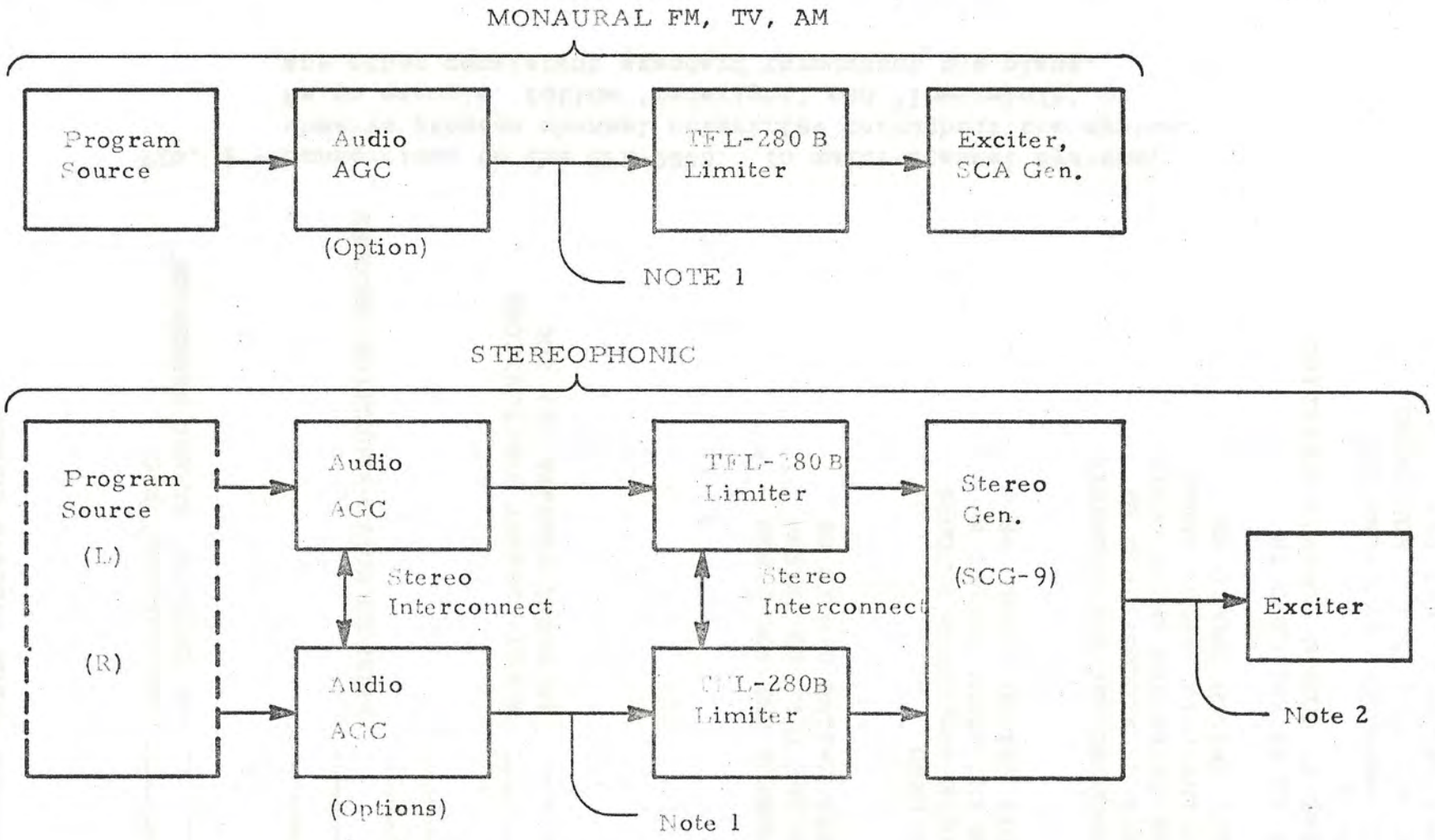
If possible, the TFL-280B should be mounted between waist and eye height. This will enable convenient monitoring of the degree of limiting and will facilitate occasional level adjustments. The rack should be grounded.

Program connections (and multi-channel interconnections, if applicable) should then be accomplished as shown in Figures 1 and 2. As indicated in the installation drawings, an audio gain-riding amplifier (AGC) may optionally precede the TFL-280B.

B. Monaural FM, TV, SCA

For single-channel operation, the following procedure is recommended:

1. Using a 400 Hz test tone, adjust the prior AGC unit (if used) input level control until the AGC unit is operating at the desired degree of average gain reduction.



RECOMMENDED INSTALLATION BLOCK DIAGRAMS

Figure 1

NOTES:
1. Aural STL or telephone loop option at this point
2. Composite STL option at this point
3. Multi-channel operation similar to stereo

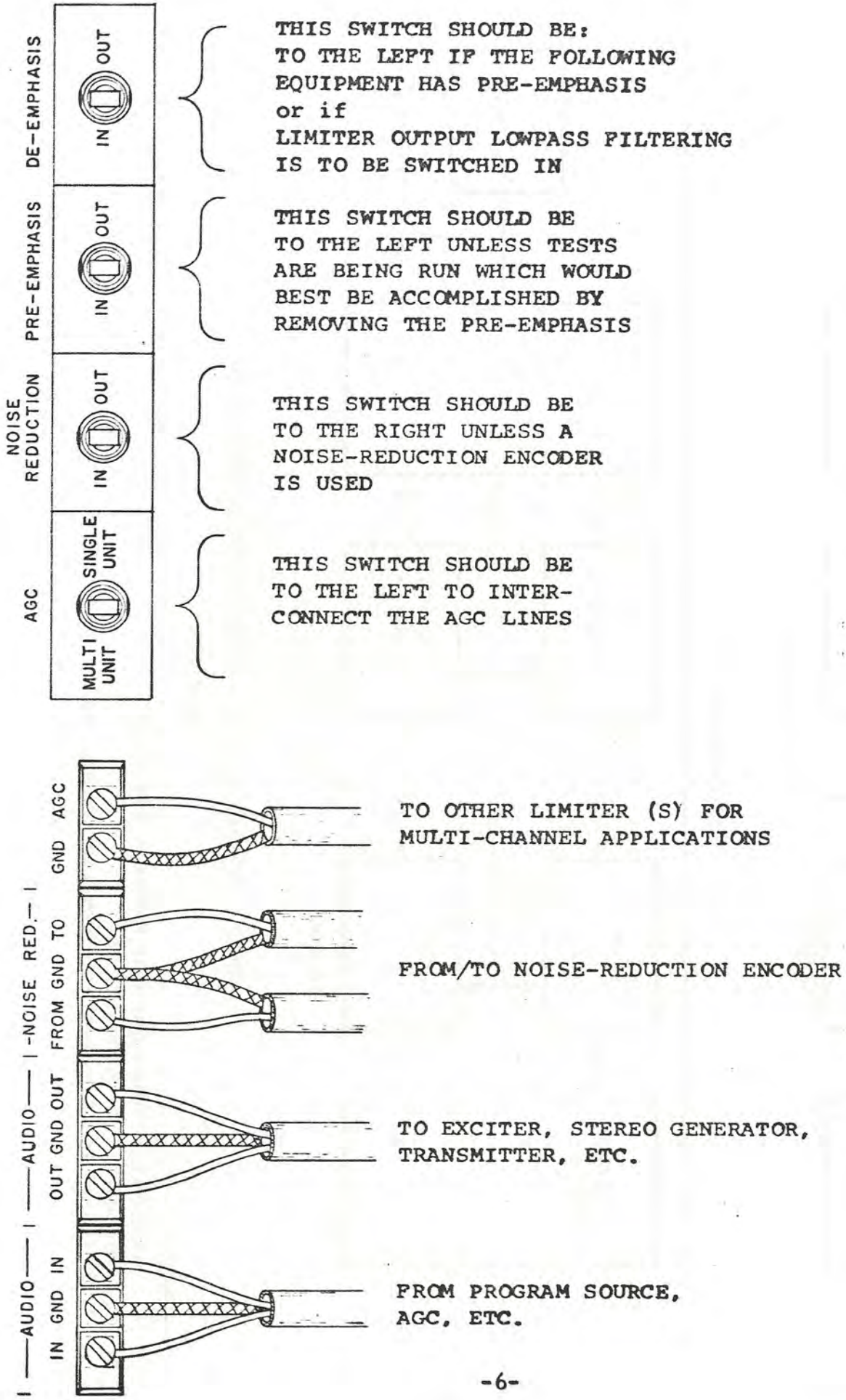


FIG. 2 - Connections to the TFL-280B. In multi-channel systems, observe program channel polarities throughout the system. As an example, follow 'red=right' and 'lower=left' or any other consistent standard throughout the plant.

2. Then adjust the TFL-280B limiting control until the limiter is operating at the desired degree of limiting.

3. Adjust the TFL-280B output control for a reading of 100% on the modulation monitor.

C. Stereo, Quadraphonic FM

For multi-channel FM operation, the following procedure is recommended:

1. Using a 400 Hz test tone, adjust the prior AGC unit (if used) input level controls until the AGC units are operating at the desired degree of average gain reduction without any stereo interconnections.

2. Adjust the TFL-280B limiting controls until the limiters are operating with the desired degree of limiting without the stereo interconnection.

3. Adjust one of the TFL-280B output controls for a reading of 100% on the modulation monitor. (Alternatively, if a Moseley Associates, Inc., Model SCG-9 is used, adjust the limiter output level control for a "0" reading on the SCG-9 front panel meter.) Then adjust the other limiter output level control for a null in the stereo monitor subchannel reading. In this manner both limiters are exciting their audio channels in an identical manner. If the SCG-9 is used, its output level control may be adjusted for the correct modulation level.

4. Reapply the AGC and limiter stereo interconnections.

   NOTE: A small increase in average modulation level and a reduction in the stereo subchannel component may be achieved by not employing the limiter stereo interconnection. This should be considered only if the limiters are used primarily for protection against overmodulation. The preceding "gain-riding" AGC units should always be interconnected to preserve the stereophonic effect.

D. AM Transmission

For Standard Broadcast, the following procedure is recommended:

1. Using a 400 Hz test tone, adjust the prior AGC unit, if used, until the AGC unit is operating at the desired degree of average gain reduction.

2. Adjust the TFL-280B limiting control until the limiter is operating at the desired degree of limiting.

3. Adjust the TFL-280B output control for 100% modulation of the transmitter.

4. Switch in the de-emphasis, which for AM transmission is actually a non-overshooting lowpass filter. Using upper-frequency test tones, it will be noted that full modulation will not be achievable at frequencies above 7500 Hz. In practice this will be inaudible.

5. Switch in the pre-emphasis; this will yield a brighter sound from the audio delivered from a wideband monitor but will merely restore the lost upper audio response which is commonly removed by the receiver selectivity.

6. To run a proof of performance, switch out both the pre- and the de-emphasis networks. They may be considered to be in the category of equalization.

E. Noise-Reduction Encoder

It is recommended that the TFL-280B be placed in service and its input, output and recovery controls be slightly readjusted if necessary prior to the addition of an optional external noise-reduction encoder.

The requirements for the encoder are as follows:

1. It should have an input impedance of 500 ohms or more. This may be unbalanced.

2. It should have an output impedance of 600 ohms or less. This may be unbalanced.

3. It must have unity gain. The input level and the output level must be identical at high program levels. Of course, at low levels (as, for example, 40 dB below normal), there will be a treble boost in the encoder.

If the encoder input or output impedances are not as outlined above, the audio frequency response may suffer. If the gain is not unity, midrange audio may operate the high-frequency limiter in the TFL-280B.

Bearing the above three requirements in mind, proceed as follows with a previously set up TFL-280B:

1. Make the connections to and from the noise-reduction encoder as shown in Figure 2.

2. Operate the noise-reduction switch to in.

3. With a 400 Hz test tone applied to the TFL-280B at a level sufficient to cause some limiting as observed on the TFL-280B panel meter, adjust the input level to the encoder (this level control being a part of the encoder) to cause the encoder to operate at the correct level.

4. Measure the level of the test tone as observed at the NOISE RED, TO terminal, to ground. An oscilloscope or high-impedance meter may be used.

5. Observe the NOISE RED, FROM terminal as in step 4. Set the encoder output level control for the same reading as noted in step 4.

F. Limiting and Recovery

It is recommended that good-music stations operate the input level control (limiting) such that the TFL-280B panel meter indicates little limiting except on the loudest passages. Stations with quiet popular music will probably choose about 5 dB of limiting on peaks of frequent recurrence, while fast-paced operations may choose as much as 10 dB of limiting.

The recovery time will always be fast for transients (as, for example, a click in a recording), regardless of the setting of the front-panel recovery control. Under sustained limiting, however, the recovery time will automatically lengthen, the degree of this process

depending on the setting of the recovery control. For maximum loudness, use a short or fast setting; for maximum naturalness, use a long or slow setting. Both limiters in stereo systems should be operated at about the same setting.

When conducting transmission performance measurements, the test tone level should be reduced until limiting activity is not present. Limiting will be indicated by a deflection of the TFL-280 panel meter, or by observing that the modulation level (limiter output) does not increase with an increase in test tone level.

V. CIRCUIT DESCRIPTION

Audio limiting, as used in broadcast transmission, is used to apply a definite ceiling to the level of modulation. By allowing the limiter to be active or to work an appreciable portion of the time, an increase in the received signal volume may be achieved. In addition, in FM transmission systems, the limiter should be frequency-conscious in some manner to insure protection against overmodulation in spite of the pre-emphasis (treble-boost) used in such systems.

Pre-emphasis may be installed ahead of a limiter and the following device (stereo generator, exciter, SCA generator, etc.) operated in the "flat" mode. This can prevent overmodulation, but relatively low-level treble audio signals can cause the limiter to go into a gain-reducing mode and cause an "audio hole."

The limiter may be followed by pre-emphasis which in turn is followed by a clipper. This system, too, can prevent overmodulation but yields unusually high difference-frequency intermodulation. The audible effect is a spitting type of sound, similar in nature to an off-tune AM receiver. In addition, such a system must be followed by a 15 kHz lowpass filter to remain within specifications as regards nonlinear crosstalk. The accepted specifications on these components is 40 dB of suppression which clearly requires the use of a 15 kHz lowpass filter following the clipper. Such a filter will tend to ring on some audio components, particularly when a clipped signal with a fundamental frequency near one-third of the filter cutoff frequency is applied to its input. Such ringing will result in overmodulation on a transient basis, hence the term transient overmodulation.

The problem of ringing with consequent overmodulation can be solved by a number of techniques. One is to use a post-clipping lowpass filter with a gentle rolloff such as the Halpern, Bessel or Gaussian types, or any of the transitional designs. Another method would be the use of a shelving lowpass filter. But these systems will prohibit full modulation of the transmission system at the upper modulating frequencies. In addition, difference-frequency intermodulation components due to clipping are left intact, with the resultant degradation of audio quality.

The TFL-280B sidesteps these problems by using very fast-acting two-stage processing. The program material is first applied to a wideband gain-controlling system. Subsequent to this processing it is applied to a 15 kHz lowpass filter and then to a pre-emphasis network. The treble audio frequencies are processed by a second gain-controller. Both of these gain-controlling circuits are of low distortion types using modern but proven techniques.

The following discussion of the TFL-280B is with respect to the block diagram and schematic diagram 91C6987.

Program material is applied to the input pad via RF filtering. The pad terminates the input and (by component value changes) allows the correct excitation to the input transformer and LIMITING control. The input transformer has a 1:1 turns ratio, which is required for low vector crosstalk; step-up transformers are poor performers in this respect. The LIMITING control applies an audio sample to the input variolosser without intermediate amplification; this results in a low-noise system. The variolosser is designed for single-ended audio and push-pull AGC signals. The vario-losser output is applied to a wideband linear amplifier U2, whose output is sampled by a full-wave rectifier (U6, CR1 and CR2) and comparator U7. When the output of U2 is deemed to be excessive by the comparator, an AGC voltage is generated across capacitor C16. This voltage is applied to buffer U8. It is measured by a metering system using meter driver U9. This amplifier provides 12 dB per octave acceleration to the meter movement, with critical damping, resulting in a fast and accurate meter indication. Buffer U8 also applies the AGC voltage, along with the temperature compensating voltage (from R43) to another buffer, U10. This same voltage is inverted and appears at the output of buffer U11. These two buffer outputs are used to provide a current through the variolosser U1.

Low audio frequencies would normally result in a ripple component in the AGC system, but timing capacitor C16 can discharge primarily only through diode CR6, which is back-biased by a second and larger AGC voltage appearing across capacitor C15. Ripple on the AGC line is essentially eliminated by this technique, which reduces harmonic and intermodulation distortion at the lower audio frequencies.

Comparator U7 operates at a controlled gain for stability; it is this fact which enables stability in this reverse-acting system. The output of U7 may be applied to other mating limiters in multi-channel applications. The switch on the rear of the TFL-280B enables this interconnection of the AGC voltages.

The attack time of this first AGC system is determined by resistor R36; the recovery time is determined by resistors R31 and R32 in the recovery-delay circuitry.

The output of this first AGC system is applied to the 15 kHz lowpass filter via filter input terminating resistor R66; the filter output is terminated with R67. Buffer Q1 is used to provide low-impedance drive to the pre-emphasis network. This network is trimmable (using C29) to allow precision in the pre-emphasis curve as well as to allow phase-matching between the various units in a multi-channel system.

The output of the pre-emphasis network is applied to a second AGC system which is similar to the first except that the recovery-delay is not needed, and the second variolosser is functional only for the treble audio frequencies.

The attack time of the second AGC system is determined by resistor R96; the recovery time is determined by resistor 94.

The second AGC system output is applied to the output program amplifier, the output level attenuator and the switchable de-emphasis network. The program amplifier is a discrete operational power amplifier using transistors Q2 through Q9, and affiliated components.

The power supply for the TFL-280B incorporates standard full-wave rectification and integrated-circuit voltage regulators for both the positive and negative power supplies.

VI. INTERNAL ADJUSTMENTS

The following adjustments are with reference to the TFL-280B component layout, drawing 20B2627.

A. LF Pre-Bias

This control adjusts the idling attenuation of the low-frequency variolosser. It is adjusted while applying a 400 Hz tone well below the threshold of gain-reduction. Short the LF pre-bias terminals located immedicately adjacent to this control and adjust the LF pre-bias control, R42, for a gain-reduction of 3 dB when the short is removed. This is a vernier control and its adjustment is satisfactory if the gain-reduction, upon removal of the short, is between 2 and 4 dB. This gain-reduction will not be indicated on the TFL-280B panel meter; the relative gain must be noted on an external meter monitoring the output of the TFL-280B.

B. LF Thump Bal

This control allows the low-frequency thump or pedestal components to be nulled. Remove the input program signal and, while alternately shorting and unshorting the pre-bias terminals, adjust the LF Thump Bal control R46 for a null in the audible or oscilloscopically-observed output from thelimiter. Alternatively, vary the input tone level from below the threshold of limiting to about 10 dB above minimum low-frequency component ("bounce").

C. Meter Zero

This control (R53) allows the TFL-280B panel meter to read 0 when no gain-reduction is occurring. Remove the input signal and adjust the control for a zero reading.

D. Meter Cal

This control (R56) allows the TFL-280B meter to correctly indicate the degree of gain-reduction. It is adjusted by applying a 400 Hz signal 10 dB above the threshold of limiting and adjusting the control for a reading of 10 on the TFL-280B panel meter.

E. Meter Damping

This control (R50) enables the TFL-280B panel meter to be critically damped. While applying an input signal (400 Hz is suggested) varying in level between threshold of limiting and 10 dB above that threshold, adjust this control for a critically-damped response. Do not switch the tone on and off; vary it with a continuously-variable control.

F. Buffer Drive

This control (R58) is adjusted so that the buffer amplifier U3 is on the verge of clipping with a steady sine-wave test tone applied at a level sufficient to cause 10 dB of limiting. Adjust R58 while monitoring the yellow test point TP2 with an oscilloscope.

G. HF Threshold

This control (R87) enables the high-frequency AGC comparator to function at the correct operating point. Apply a 400 Hz tone to the TFL-280B and set its level to cause 10 dB of limiting as indicated on the TFL-280B panel meter. While monitoring the limiter output, adjust the HF threshold control so that the output level is the same when switching from 400 Hz to 4000 Hz. The de-emphasis must be switched out for this adjustment.

H. HF Thump Balance

This control (R100) allows thump or pedestal components from the HF AGC to be nulled. Apply a 15 kHz test tone to the TFL-280B. Switch the de-emphasis in. Increase the input level until the threshold of AGC is reached as noted on an external oscilloscope or monitor.

NOTE: HF AGC ACTIVITY IS NOT REGISTERED ON THE TFL-280B PANEL METER.

Now increase the test tone level 10 dB. While alternately applying and removing the test tone from the limiter input, adjust the HF thump bal control for a thump component null as noted in a loudspeaker or on an oscilloscope connected to the limiter output.

Restore the de-emphasis switch if necessary following this test.

I. Amplifier Drive

This control (R106) adjusts the drive level into the output program amplifier. It is set at the factory to be slightly below the threshold of clipping in the program amplifier. This control may be reset using intermodulation test methods, or advanced for a small amount of clipping, or any other method that the individual station desires.

J. Output Offset

This control (R110) allows symmetrical clipping in the program amplifier if the amplifier drive control is advanced to the point of clipping in that amplifier.

K. Pre-Emphasis Adjustment

This control (C29) is adjusted for a frequency-response increase of 3 dB at the desired break-point frequency. This control is adjusted while operating clearly below the threshold of limiting, with the de-emphasis network switched out. Switch the audio oscillator back and forth between 212 and 2120 Hz (for 75 microseconds; see Figure 3 for other time-constants). Adjust C29 for a 3 dB rise in amplitude at the higher test frequency as observed at the output of the TFL-280B. Restore the de-emphasis switch if necessary following this adjustment. Be sure the TFL-280B is terminated at its output with the correct value of load, and be sure the audio oscillator level is equal and stable at the two test frequencies.

VII. FIELD MODIFICATIONS

A. Input Sensitivity

The level required for a given amount of limiting in the TFL-280B may be changed not only by readjustment of the limiting control, but also by changing the values of the resistors on the input pad. This pad is shown schematically on the main schematic.

B. Lowpass Filter

The audio lowpass filter normally shipped with the TFL-280B has a cut-off frequency of 16.45 kHz. Other values of cutoff frequency (8kHz for AM service, 5 kHz for SCA service) are available on request.

C. Pre-Emphasis

The pre-emphasis time-constant normally used with the TFL-280B is 75 microseconds. Figure 3 shows the component value changes required for other time-constants.

D. De-Emphasis

The de-emphasis network normally used with the TFL-280B is arranged for a 600 ohm load and a 75 microsecond time-constant. Networks for other impedances or time-constants, as well as output lowpass filter (8 kHz for Am service, 2600 Hz for SCA) are also available.

E. Attack Time

The wideband gain controller in the TFL-280B is normally set at the factory for an attack time of 100 microseconds. The loudness of the signal as transmitted may be increased by lengthening the attack time. Figure 4 indicates the values of resistors R35 and R36 for various attack times. Keep the values of R35 and R36 equal in value. Lengthening the attack time to as much as 5 milliseconds will make a small increase in signal loudness apparent. Attack times in excess of 5 milliseconds are not recommended for quality transmission. Changing the values of these resistors will have no effect on steady sinusoids; only transients will be affected. Transients of shorter time duration than the attack time will be clipped by buffer U3.

Service	Time-constant, microseconds	C30 pf	+3 dB frequency	C31 µf
Special	25	150	6366.2	.0047
FM/TV (International)	50	360	3183.1	.01
FM/TV (North America)	75	560	2122.1	.015
SCA	150	1200	1061.0	.033

Figure 3 -- Parts values and break-point frequencies for various values of pre-emphasis

Attack time, microseconds	R35	R36
50	220	220
100	470	470
200	1K	1K
500	2.2K	2.2K
1000	4.7K	4.7K
2000	10K	10K
5000	22K	22K

Figure 4 -- Parts values for various attack times

ADDENDUM A

INTERFACE INFORMATION

for

TFL-280B

For maximum accuracy in controlling modulation levels, it is advisable to remove the pre-emphasis and lowpass filtering, if used, in the stereo generator or exciter used in conjunction with the TFL-280B. Recommended changes are listed here for commonly used exciters. For information on other generators, contact the manufacturer of that generator or exciter. The object is to operate the exciter in a flat (no pre-emphasis) mode without any audio lowpass filtering. If the pre-emphasis cannot be removed, operate the TFL-280B output network in the de-emphasized position.

Where the following instructions indicate the removal of a component, it may be advisable to merely disconnect a single end of the component in question; this facilitates restoration of the equipment to its original condition. Where a lowpass filter is to be bypassed, do not merely connect a jumper wire from the input to the output of that filter: it must be electrically removed from the circuit.

Moseley Associates SCG-3T Stereo Generator

To remove the pre-emphasis, remove resistors R335R and R335L.

To remove the lowpass filters, disconnect the wires from the main printed-circuit board terminals 10 and 18; connect terminal 10 to terminal 18. Also remove the wires from ternimals 4 and 7 and connect terminal 4 to terminal 7.

Moseley Associates SCG-9 Stereo Generator

To remove the pre-emphasis, remove resistors R8 and R41.

To remove the lowpass filters, unplug them and install a jumper wire from the filter input terminal to the filter output terminal. Place the filters in a secure place for possible future use. In addition, change integrated circuits IC1 and IC3 from type 318 to type 741.

Moseley Associates SCG-4T SCA Generator

To remove the pre-emphasis in this generator, remove resistor R4.

To remove the audio lowpass filter (if used), connect input transformer T1 directly to the high side of the modulation control, R93.

Moseley Associates SCG-8 SCA Generator

To remove the pre-emphasis from the SCG-8 subcarrier generator, remove capacitor C13. Place it in a secure place for possible future use.

To remove the lowpass filter, unplug it and install a jumper wire from the filter input terminal to the filter output terminal using the pads supplied.

Collins 786V-1 Stereo Generator (310Z-2 Exciter)

To remove the pre-emphasis, remove the plug-in network and replace it with an 18 dB pad. The pad may be reduced to zero attenuation (wire) if the original input level specifications can be set aside.

To remove the lowpass filtering, refer to the Collins 310Z-2 section.

Collins 786V-1 Stereo Generator (310Z-2 Exciter)

To remove the pre-emphasis, remove capacitor C21 and C16. Place them in a secure place for possible future use.

To remove the lowpass filtering, cut the stereo generator circuit board foil in two places, at the filter input and output terminals. Leave intact a small piece of trace near the actual filter terminals. Then install a short jumper wire to route the signal around the filter. Be sure to modify both audio channels identically.

Collins 786W-1 SCA Generator

To remove the pre-emphasis from this subcarrier generator, remove resistor R55. This resistor is in series with C3 on some units. Alternatively, C3 itself may be removed.

RCA BTS-1B Stereo Generator

To remove the pre-emphasis, remove resistors R331 and R431.

To remove the lowpass filters, remove the wires from the main printed-circuit board terminals 13 and 16; connect terminal 13 to terminal 16. Also remove the wires from terminals 20 and 23; connect terminal 20 to terminal 23.

RCA BTE-15A Exciter

To remove the pre-emphasis from this monaural exciter, remove resistor R210.

To remove the audio lowpass filter, remove the wires from the printed-circuit board terminals 11 and 12; connect terminal 11 to terminal 12.

RCA BTX-1B SCA Generator

To remove the pre-emphasis from this subcarrier generator, remove resistor R554.

To remove the audio lowpass filter, if installed, connect input transformer T501 directly to the modulation control, R506.

TFL-280 AUDIO LIMITER
FINAL CHECKOUT SHEET

Date: 22 September 1977

Tester:

F.O.#: 10950

Station: KCBN

Serial #: 19784

Signal-to-Noise Ratio: 76 dB (70 dB minimum)

(re +10 dBm output, de-emphasized)

Harmonic Distortion

(re +10 dBm output, de-emphasized, with 10 dB of indicated limiting)

50 Hz: .32 % 5 kHz: .28 %

500 Hz: .30 % 15 kHz: .38 %

(less than 0.7%, any frequency)

Frequency Response

(re 1000 Hz, below the threshold of limiting, de-emphasized)

-1 dB at 8 Hz and 16.45 kHz (50 Hz or lower, 15 kHz or higher)

(re 200 Hz, below the threshold of limiting, not de-emphasized)

+3 dB at 2120 Hz (2022 Hz min., 2222 Hz max., for 75 microseconds)

TFL-280
9/76

TFL-280 AUDIO LIMITER
FINAL CHECKOUT SHEET

Date: 22 September 1977 F.O.#: 10950

Tester: Chip Station: KCBN

Serial #: 19785

Signal-to-Noise Ratio: 76 dB (70 dB minimum)

(re +10 dBm output, de-emphasized)

Harmonic Distortion

(re +10 dBm output, de-emphasized, with 10 dB of indicated limiting)

50 Hz: .28 % 5 kHz: .25 % (less than 0.7%, any frequency)

500 Hz: .22 % 15 kHz: .26 %

Frequency Response

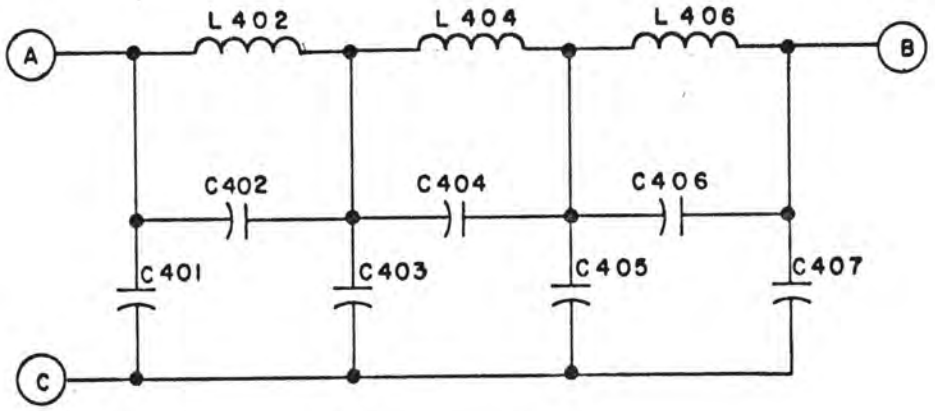
(re 1000 Hz, below the threshold of limiting, de-emphasized)

-1 dB at 8 Hz and 16.2 kHz (50 Hz or lower, 15 kHz or higher)

(re 200 Hz, below the threshold of limiting, not de-emphasized)

+3 dB at 2120 Hz (2022 Hz min., 2222 Hz max., for 75 microseconds)

ITEM	CUTOFF	C 401	C 402	C 403	C 404	C 405	C 406	C 407	L 402	L 404	L 406
1	15 KHz	1930 pf	360pf	2530pf	1815pf	2200pf	1300pf	1300 pf	†-140	†-141	†-142
2	5KHz	.0075μF	—	.0124μF	—	.0124μF	—	.0075μF	†-146	†-147	†-146
3	8KHz	4700	470	.0068μF	2240	.0056μF	1670	3600	†-156	†-157	†-158



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10 %
   CAPACITOR VALUES ARE IN PICOFARADS.
2. ALL PARTS ARE FREQUENCY DEPENDENT, SEE CHART.
3. P.C. BOARD 51A5724.
4. COMPONENT LAYOUT 20A2593.
5. †-( ) DENOTES COIL 2C1400-( )

REVISIONS	DATE	MGMT. APPR.
B ADD ITEM 3	21JUNE77	SAM
A ADD ITEM 2	8DEC76	F.X.Y.

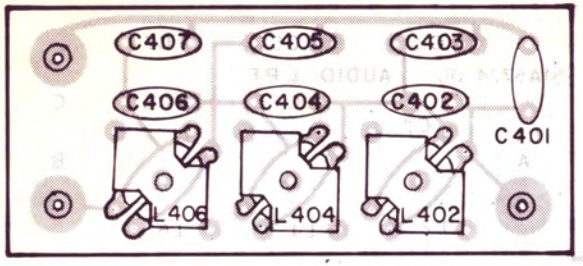
MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC
TFL-2808 AUDIO LPF

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	T. A	1/SEP/76	SCALE:
CHK	FXY	16 SEP 76	91A6929 B
ENG	JCP	16SEP76	

ITEM	CUTOFF	C401	C402	C403	C404	C405	C406	C407	L402	L404	L406
1	15 KHz	1930	360	2530	1815	2200	1300	1300	†-140	†-141	†-142
2	5 KHz	.0075µf	—	.0124 µf	—	.0124µf	—	.0075µf	†-146	†-147	†-146
3	8KHz	4700	470	.0068µf	2240	.0056µf	1670	3600	†-156	†-157	†-158



NOTE:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10 %
   CAPACITOR VALUES ARE IN PICOFARADS.

2. P C BOARD 51A5724.

3. SCHEMATIC 91A6929.

4. †-( ) DENOTES COIL-2C1400 ( )

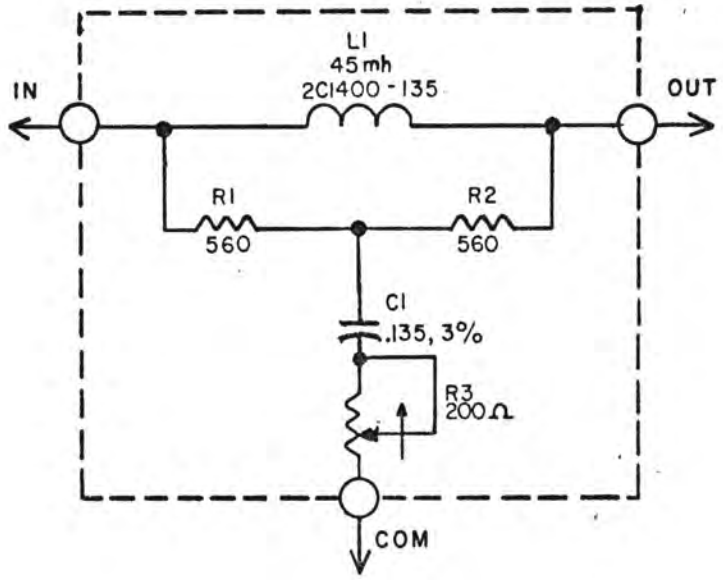
REVISIONS	DATE	MGMT. APPR.
B ADD ITEM 3	17JUNE 77	TAM.
A ADD ITEM 2.	8 DEC 76	F.X.Y.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

COMPONENT LAYOUT
TFL-280 B AUDIO LPF

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	T A	9/7/76	SCALE:
CHK	F X Y	16 SEP 76	20A2593 B
ENG	J C P	16SEP76	



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. COMPONENT LAYOUT 20A2626.
3. P.C. BOARD 51A5782.

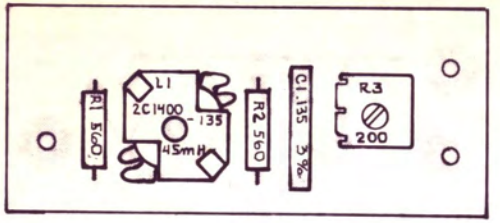
REVISIONS	DATE	MGMT. APPR.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC
TFL-280B DE-EMPHASIS NETWORK

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	JAM	23JUN 77	SCALE:
CHK	FXY	7 JUL 77	91A6986
ENG	JCT	11 JUL 77	



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5782
3. SCHEMATIC 91A6986

REVISIONS	DATE	MGMT. APPR.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

COMPONENT LAYOUT
TFL-280B DE-EMPHASIS NETWORK

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	JAM	23 JUNE 77	SCALE:
CHK	FXY	7 JUL 77	20A2626
ENG	JCP	11 JUL 77	

VARIOLOSSER

LINEAR AMPLIFIER

BUFFER

INPUT

AUDIO

GND

AUDIO

L1 10uh

L2 10uh

C1 470pf

C2 470pf

R1 22

R2 22

R3 560

R4 150

R5 150

LIMITING

T2 SAT-109

BLK/WHT

RED

R6 10K

RED/WHT

BLK

ORG

REF NOTE 4

R.F. PARTITION

TP1 ORG 0.35 VP-P

R7 22K

R8 1K

R9 10K

C3 150pf

TID-140N U1

R10 4700

R11 3300

C4 47/20

C5 47/20

U2 318

+12V

R12 100

C6 .1

C7 10/20

C8 .1

R13 100

C9 10/20

-12V

R14 220K

C10 10pf

R15 22K

BUFFER DRIVE

R57 4700

R58 1K

R59 470

4.8VP-P 0V DC

U3 318

+12V

R60 100

C24 10/20

R61 100

C25 10/20

-12V

R62 22K

C26 22pf

R63 1K

R64 2200

R65 680

20VP-P 0V DC

TO GND. FROM NOISE RED.

L6 10uh

L7 10uh

C27 470pf

C28 470pf

R.F. PARTITION

IN

OUT

SW1

TP2 YEL 4.2VP-P 0V DC

R66 4700

TP3 GRN 4.2VP-P 0V DC

PRE-EMPHASIS

OUT

IN

SW2

AUDIO L.P.F.

91A6929 20A2593 51A5724 PLUG-IN BOARD

BUFFER

+12V

Q1 2N3053

R67 4990 1/4W,1%

R68 1K

2.1VP-P

TP4 BLU

R69 220

R70 120K

R71 4700

-12V

R72 2200

C30 560pf

C29 15-150pf

PRE-EMPHASIS ADJ.

SHT. 2

INVERTER RECTIFIER COMPARATOR

R16 4990 1/4W,1%

R17 4990 1/4W,1%

+12V

CR1 IN4154

CR2 IN4154

U6 318

-12V

R128 2200

2.2V PEAK

R18 100K

+12V

+12V

R19 100K

R21 100

C11 10/20

U7 318

R22 100

C12 10/20

-12V

R23 680K

R20 22K

CR3 IN4154

AGC BIAS GENERATORS

+12V

Q10 2N3053

CR5 IN4154

R27 10K

-12V

R31 47K

R35 470

R37 150K

R38 22K

CR6 IN4154

C15 .47 10%

C13 10/20

C14 2.2/35

RECOVERY

R32 500K

R33 10K

-12V

CR7 IN4154

TP7 V10 OV(N.S.) 3V PEAK (10DB LIM.)

R24 1K

GAIN TEMPERATURE COMPENSATION

NON-INVERTING BUFFER

R39 4700

+12V

R40 5K

T

R41 1K L.F. PRE BIAS

R42 1K

R43 3300

U10 318

+12V

C20 10/20

C21 10/20

-12V

INVERTING BUFFER

U8 741

+12V

R44 4700

R45 6800

R46 1K

R47 6800

L.F. THUMP BALANCE

+12V

U11 318

R129 3300

-12V

TP8 GRY -.5V(N.S.) +.35V(10DB LIM.)

METER DRIVER

U9 741

+12V

C23 10/20

R51 220

R52 3300

R54 22K

R55 220

R48 4700

R50 100K

METER DAMPING

R49 6800

C22 2.2/35

+12V

R53 10K

METER ZERO

R56 1K

METER CAL.

MI 200uA

TI PRIMARY WIRING FOR 240VAC

BLK

BLK/RED

WHT

BLK/WHT

F1 1/4ASB

#18 YEL

FL1

FL2

T1 3-1067

BLK

BLK/RED

WHT

BLK/WHT

GRN

GRN/YEL

GRN

120VAC

19V RMS TO GROUND

10D2 (4 PLACES) CR20

CR21

CR22

CR23

.3V RMS +24

-24 .3V RMS

C52 500 75

C53 500 75

U101 7812KC OR LM340K

U102 7912KC OR LM320K

+12

+12V

GND

-12

-12V

R127 1K, 2W

CR24 LED,GRN MV5254

POWER

R.F. PARTITION

R28 10

C17 10/20

R25 4700

Q11 2N3053

CR4 IN4154

R36 470

R29 3300

R30 10K

R34 10M

C16 .47 10%

C18 10/20

-12V

R26 10

C19 470pf

L3 10uh

R.F. PARTITION

SINGLE UNIT

MULTI-UNIT

SW3

AGC GND

OUTPUT

NOTES:

SEE SHEET 2 OF 2.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC
TFL-2808 AUDIO LIMITER

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°			
DWN	FHLenny	26 MAY 77	SCALE: NONE
CHK	FXY	28 JUN 77	91C6987
ENG	JCP	28 Jun 77	

REVISIONS | DATE | MGMT. APPR.

SHEET 1 OF 2

H. F. VARIOLOSSER

LINEAR AMPLIFIER

OUTPUT AMPLIFIER

DE-EMPHASIS NETWORK

OUTPUT 600 OHM T-PAD

DE-EMPHASIS IN/OUT

OUTPUT

REF. NOTE 4

R.F. PARTITION

INVERTER

RECTIFIER

COMPARATOR

AGC BIAS GEN.

BUFFER

NON-INVERTING BUFFER

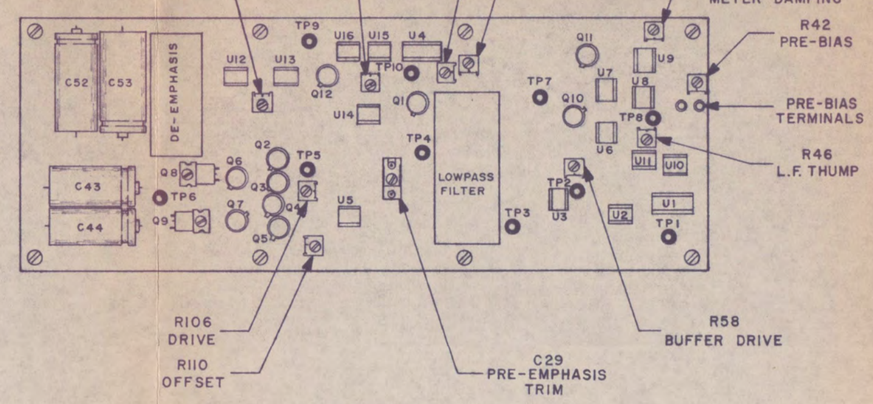
INVERTING BUFFER

I.OV PEAK

OUTPUT OFFSET

H.F. THUMP BALANCE

AUDIO LIMITER BOARD 5IB5720



TFL-280B ADJUSTMENTS GUIDE

NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10% CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD SHOWN WITHIN DASHED LINES.
3. COMPONENT LAYOUT 20B2627.
4. VALUES AND WIRING SHOWN FOR 600 OHMS SERVICE.
5. * OPTIONAL COMPONENTS USED AS REQUIRED.
6. VOLTAGE MEASUREMENTS MADE AT 10DB OF LIMITING AT 400HZ.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC
TFL-280B AUDIO LIMITER

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	FHLenny	26MAY77	SCALE: NONE
CHK	FXY	26JUN77	91C6987
ENG	JCJ	28JUN77	

DATE / REVISIONS / MGMT. APPR.