TECHNICAL MANUAL

HARRIS

COMMUNICATIONS AND INFORMATION HANDLING

WARRANTY

Seller warrants new equipment manufactured by Harris Corporation, Gates Broadcast Equipment Division against defects in material or workmanship at the time for delivery thereof, that develop under normal use within a period of one year (6 months on moving parts) from the date of shipment, of which Purchaser gives Seller prompt written notice. Other manufacturers' equipment, if any, including electron tubes, and towers shall carry only such manufacurers' standard warranty.

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Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. Custom built equipment or merchandise specially ordered for you is not returnable. Where return is at the request of, or for the convenience of the customer, a restocking fee of 15% will be charged. All returned merchandise must be sent freight prepaid and properly insured by the customer. When writing to Harris Corporation, Gates Broadcast Equipment Division about your order, it will be helpful if you specify the Harris/Gates Factory Order Number or Invoice Number.

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MODIFICATIONS

Harris/Gates reserves the right to modify the design and specifications of the equipment shown in this manual without notice or to withdraw any item from sale provided, however, that any modification shall not adversely affect the performance of the equipment so modified.

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Purchaser assumes all responsibility for and risk of loss of, or damage to, the Equipment upon delivery at Seller's shipping point, notwithstanding the fact that Seller may have selected the carrier.

In no event shall Seller be liable under any provision of this contract for loss of business or of anticipated profits by Purchaser, outlays by Purchaser in anticipation of business, other incidental or consequential damages on account of negligence.

Purchaser agrees to indemnify Seller against all claims, whether on account of negligence or otherwise, except those asserted by Seller's employees, arising out of or resulting from the erection, operation or use of the Equipment.

TECHNICAL MANUAL

AM LIMITER

994 7059 001

HARRIS CORPORATION Broadcast Equipment Division

MANUAL PART NO. 888 1531 001
Price: $15.00

Printed: May 1975

SAFETY NOTICE

WARNING: THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS AND UNDER CERTAIN CONDITIONS, COUD BE FATAL.

This manual is intended as general guidance for trained and qualified installation, operating, maintenance and service personnel who are familiar with and aware of the dangers inherent to handling potentially hazardous electrical and/or electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

THE INSTALLATION, OPERATION, MAINTENANCE AND SERVICING OF THIS EQUIPMENT INVOLVES RISKS TO BOTH PERSONNEL AND EQUIPMENT, AND MUST BE PERFORMED ONLY BY PROPERLY TRAINED AND EXPERIENCED PERSONNEL EXERCISING DUE CARE. PERSONNEL MUST FAMILIARIZE THEMSELVES WITH SAFETY REQUIREMENTS, SAFE HANDLING AND OPERATING PRACTICE, AND RELATED FIRST-AID PROCEDURES (E.G., FOR ELECTRICAL BURNS AND ELECTRICAL SHOCK).

HARRIS CORPORATION Broadcast Equipment Division shall not be responsible for injury or damage resulting from improper installation, operation, maintenance or servicing, or from the use of improperly trained or inexperienced personnel in the performance of such tasks, or from the failure of persons engaged in such tasks to exercise due care.

As with all electronic equipment, care should be taken to avoid electrical shock in all circuits where substantial currents or voltages may be present, either through design or short circuit. Caution should also be observed in lifting and hoisting equipment, especially regarding large structures, during installation.

LIABILITY LIMITATION

The procedures outlined in this Manual are based on the information available at the time of publication and should permit the specified use with minimum risk. However, the manufacturer cannot assume liability with respect to technical application of the contents and shall, under no circumstances, be responsible for damage or injury (whether to person or property) resulting from its use.

The manufacturer is specifically not liable for any damage or injury arising out of failure to follow the instructions in this Manual or failure to exercise due care and caution during installation, operation, maintenance and service of this equipment.

CAUTIONARY NOTICE

Always disconnect power before opening covers, doors, enclosures, gates, panels or shields. Always use grounding sticks and short out high voltage points before servicing. Never make internal adjustments, perform maintenance or service when alone or when tired.

Never remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances. Proper training of experienced personnel and observing the above guidelines will help assure safe and continued operation of this equipment.

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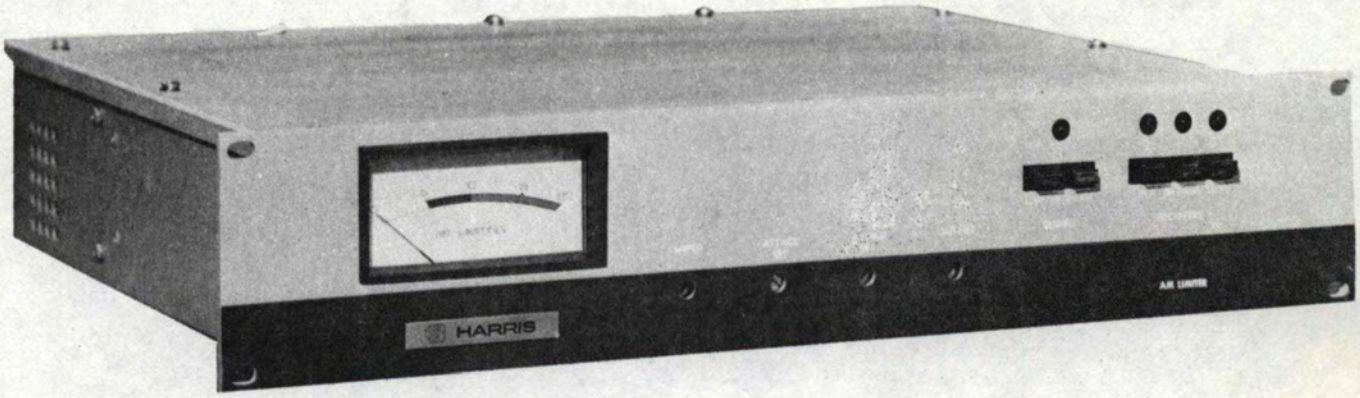

Figure 1-1. AM Limiter 994 7059 001

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual contains all information necessary to install, operate, and service the Model 994 7059 001 AM Limiter. Figure 1-1 shows the AM Limiter. The various sections in this manual provide the following types of information.

a. SECTION I, GENERAL INFORMATION, provides a description of the equipment, identifies the major components, lists operating parameters and specifications, and contains other pertinent information.

b. SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, input and output connections, and mounting requirements.

c. SECTION III, OPERATION, provides identification and functions of front panel controls and indicators, and other information relative to operation of the AM Limiter.

d. SECTION IV, PRINCIPLES OF OPERATION, provides a description of the functional circuits within the AM Limiter.

e. SECTION V, MAINTENANCE, provides information pertaining to preventive and corrective maintenance, fault location, and equipment servicing.

f. SECTION VI, PARTS LIST, provides information for ordering replacement electrical parts and assemblies.

g. SECTION VII, DIAGRAMS, provides block and schematic diagrams and other drawings necessary for maintenance of the AM Limiter.

1-3. EQUIPMENT SUPPLIED.

1-4. The AM Limiter contains printed circuit and component mounting boards consisting of an amplifier card, relay and power supply card, peak phasing card, output clipper card, and a transformer chassis assembly. Other times such as attenuators, meters, controls, and circuit components are mounted externally/internally on the chassis. The front panel of the AM Limiter accomodates installation in a standard 19-inch equipment rack and occupies a 3-1/2 inch vertical space.

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1-5.- DESCRIPTION.

1-6. GENERAL.

1-7. The Model 994 7059 001 AM Limiter uses the time-averaging, gain-reduction technique of peak control. This technique of peak control causes little or no distortion of the waveform in comparison to that required to make positive peaks of a symmetrical wave 25 percent larger than the negative peaks.

1-8. Using this technique, the Model 994 7059 001 AM Limiter operates only by taking advantage of the natural asymmetry of the program waveform where: If operation is set for 125 percent positive asymmetry and the positive peaks are more than 125 percent of the negative, the positive will cause gain reduction and the negative will not reach 100 percent; however, if the positive peaks are less than 125 percent of the negative, the negative will cause gain reduction and the positive will not reach 125 percent. As the asymmetry ratio changes, limiting is controlled by either the positive or negative peaks and the net effect at the transmitter is that the signal peaks reach, but do not exceed, 125 percent positive and 100 percent negative modulation. Considering the asymmetry of the aforementioned limits and the lack of absolute phasing standards in recorded source material, the Model 994 7059 001 AM Limiter employs the additional capability to automatically phase the largest program peaks so that they cause increased positive modulation.

1-9. If, for any reason during operation, the phasing of the highest peaks becomes reversed to where they are limited at 100 percent negative modulation, this model limiter promptly reverses the program line to allow the highest peaks to reach the 125 percent modulation limit. Subtle, noise-free switching aids in the elimination of the "ticks" and "pops" normally encountered in solid-state switching techniques.

1-10. MODEL 994 7059 001 AM LIMITER.

1-11. The Model 994 7059 001 AM Limiter is a factory tested and calibrated unit that constantly evaluates the amplitude and phase of signal peaks being fed to an AM transmitter. It has asymmetrical, positive peak capabilities over a continuously adjustable range between 100 percent and approximately 140 percent, and a switching arrangement that provides inaudible phase control. In addition, a variable ATTACK time screwdriver adjustment aids in the elimination of audible "ticks" and "pops" normally associated with high-speed limiters and narrow bandwidth signals and, absolute peak control is permitted via an adjustable output clipper section. Other features include a three-position selector that determines the recovery time, variable screwdriver adjustments to control input/output signal levels, and disable switches for the limiter and phase reversal sections of the limiter.

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1-12. SPECIFICATIONS.

1-13. Equipment specifications are listed in table 1-1. These specifications are the performance standards, or limits, against which the AM Limiter may be tested. Table 1-2 lists supplemental performance and/or physical characteristics. Supplemental characteristics are not specifications, but are typical electrical or physical operational requirements.

Table 1-1. Specifications

Maximum Gain:	44 ± 2 dB at 1,000 Hz with input and output attenuators in the maximum CW position.
Frequency Response:	± 1 dB maximum from 30 Hz to 16,000 Hz, with or without limiting.
Harmonic Distortion:	Less than 1% from 30 Hz to 16,000 Hz except between 0 and 10 dB of limiting when using fast recovery time for low frequencies where partial recovery on each half-cycle occurs. Less than 1% from 100 Hz to 16,000 Hz with 10 dB of limiting. Less than 3% maximum from 30 Hz to 16,000 Hz with 10 dB of limiting.
Noise:	70 dB or better below the threshold of limiting, 30 Hz to 16,000 Hz.
Attack Time:	30 microseconds, adjustable to 1 millisecond.
Recovery Time:	Adjustable: Fast-3 seconds; Medium-5 seconds; Slow-7 seconds.
Amount of Limiting:	At least 30 dB with a 30:1 compression ratio.
Limiting Threshold:	Approximately -24 dBm input level: Adjustable from -24 dBm to +16 dBm.
Output Level:	Adjustable to +20 dBm maximum with compression. Amplifier maximum is +26 dBm without compression.
Input/Output Impedance:	600 ohms, balanced or unbalanced.

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Table 1-2. Supplemental Performance Characteristics

POWER REQUIREMENTS	
Line Voltage and Frequency:	117 (as supplied)/234 ±10% Vac, 50/60 Hz
Power Consumption:	5 Watts, maximum
Power Supply Output Voltage:	39.0 ± 10% Vdc
ENVIRONMENTAL	
Temperature Range:	-20° to +55°C (-4° to +131°F)
PHYSICAL SIZE	
AM Limiter:	19 inches wide (48.26 cm) 13.625 inches deep (34.61 cm) 3.5 inches high (8.89 cm)
AM Limiter Weight:	Unit; 12.5 lbs. (5.663 kg) Shipping; 22 lbs. (9.966 kg)

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SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section describes the preparations necessary to make the AM Limiter operational. Information relative to power requirements, environmental conditions, input/output connections, etc., is also included.

2-3. INITIAL INSPECTION.

2-4. Upon receipt of the AM Limiter, inspect the shipping container for damage. If damage is evident, the shipping container and cushioning material should be placed in a storage area for possible reuse until the unit has been mechanically and electrically checked for proper operation.

2-5. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is mechanically or electrically damaged, notify the carrier and Harris Corporation Broadcast Equipment Division, Quincy, Illinois. Retain the shipping materials for inspection by the carrier.

2-6. PREPARATION FOR USE.

2-7. POWER REQUIREMENTS.

2-8. The AM Limiter requires a power source of 117 or 234 Vac $\pm$10% 50/60 Hz, single phase. Power consumption is approximately 5 watts. The AM Limiter, as delivered from the manufacturer, is connected for 117 Vac operation as shown in figure 2-1a.

2-9. AM LIMITER. The AM Limiter is panel-mounted for installation in a standard 19-inch equipment rack. As shipped from the factory for domestic use, the primary windings of the power transformer (T4) are connected in parallel for 117 Vac, 50/60 Hz operation. However, for 234 Vac operation, access to the primary windings is achieved by removing the top cover to connect the windings in series as shown in figure 2-1b.

2-10. POWER CABLE. In accordance with safety standards, the AM Limiter is equipped with a three-wire power cable. When connected to a power line outlet, this cable grounds the AM Limiter unit. The cable includes a standard three-wire plug. An adapter is supplied for ungrounded or two-wire installations.

2-11. OPERATING ENVIRONMENT.

2-12. The operating environment should be within the limitations listed below. Adequate ventilation must be maintained; and if the AM Limiter is mounted in close proximity to heat producing units, ventilation fans should be installed.

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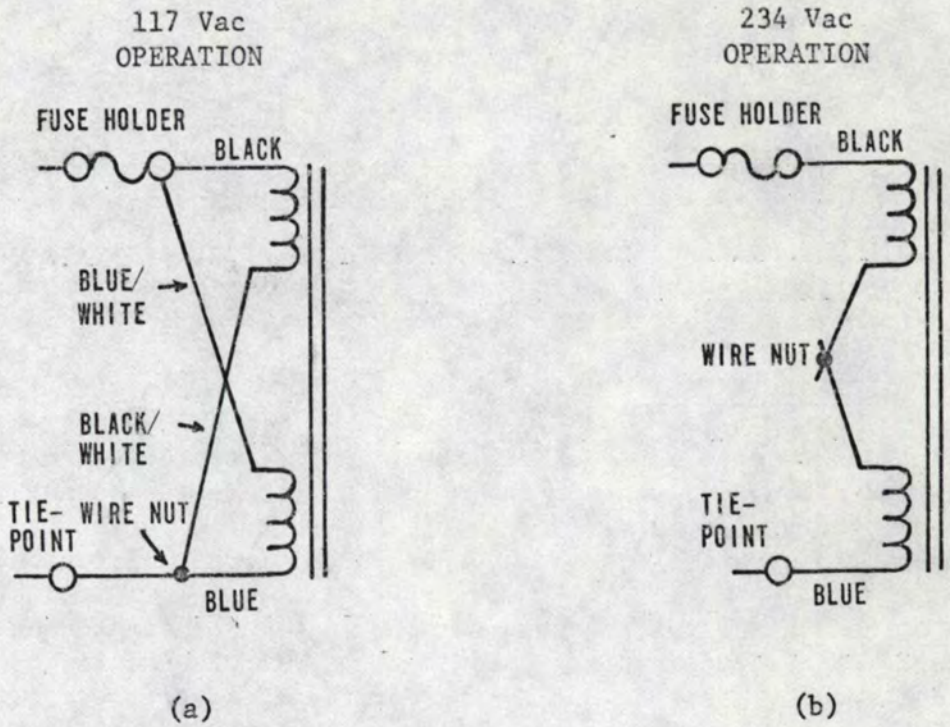

Figure 2-1. Power Transformer Connections

a. Temperature: -20° to +55°C (-4° to +131°F)
b. Relative Humidity (5 to 95 percent, non-condensing)
c. Altitude: 10,000 feet

2-13. INPUT/OUTPUT CONNECTIONS.

2-14. Each input/output signal connection presents a 600 ohm, ungrounded input/output impedance. A modification that allows an input/output impedance of 150 ohms can be implemented but should not be attempted without prior consultation with the factory service department.

2-15. Input signal cables are to be connected to terminals TB1-1 and TB1-2 (figure 2-2), which are located on the left side of the terminal strip mounted on the rear panel. The input cables should be 2-conductor shielded wire, with an overall vinyl sleeve. The vinyl sleeve prevents the shield from shorting to other grounds and resulting in a troublesome ground loop. Tie the input shields to shield ground-terminal TB1-3.

NOTE

It is recommended that the center tap of transformer T1 not be grounded.

2-16. Output signal cables are to be connected to terminals TB1-4 and TB1-5 (figure 2-2), which are located on the right side of the terminal strip mounted on the rear panel. Because the output from terminal TB1-4 will have the largest (positive) signal peaks, it should be connected to the transmitter input terminal since it is phased to cause positive modulation.

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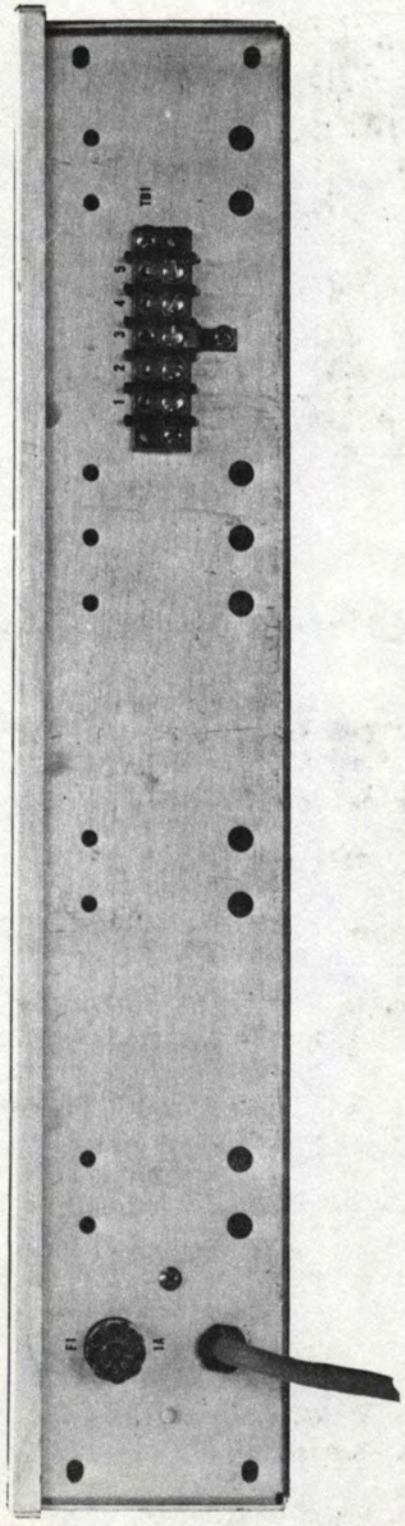

Figure 2-2. Input/Output Terminal Board

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SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section identifies and describes the functions of the front panel controls and indicators on the Model 994 7059 001 AM Limiter and provides a procedure for initiating unit operation. The section also provides rationale and methods for changing unit operational parameters to meet varying station requirements.

3-3. CONTROLS AND INDICATORS.

3-4. All operating controls and indicators are located on the front panel of the AM Limiter. Figure 3-1 identifies the location of each control and indicator and table 3-1 describes the function.

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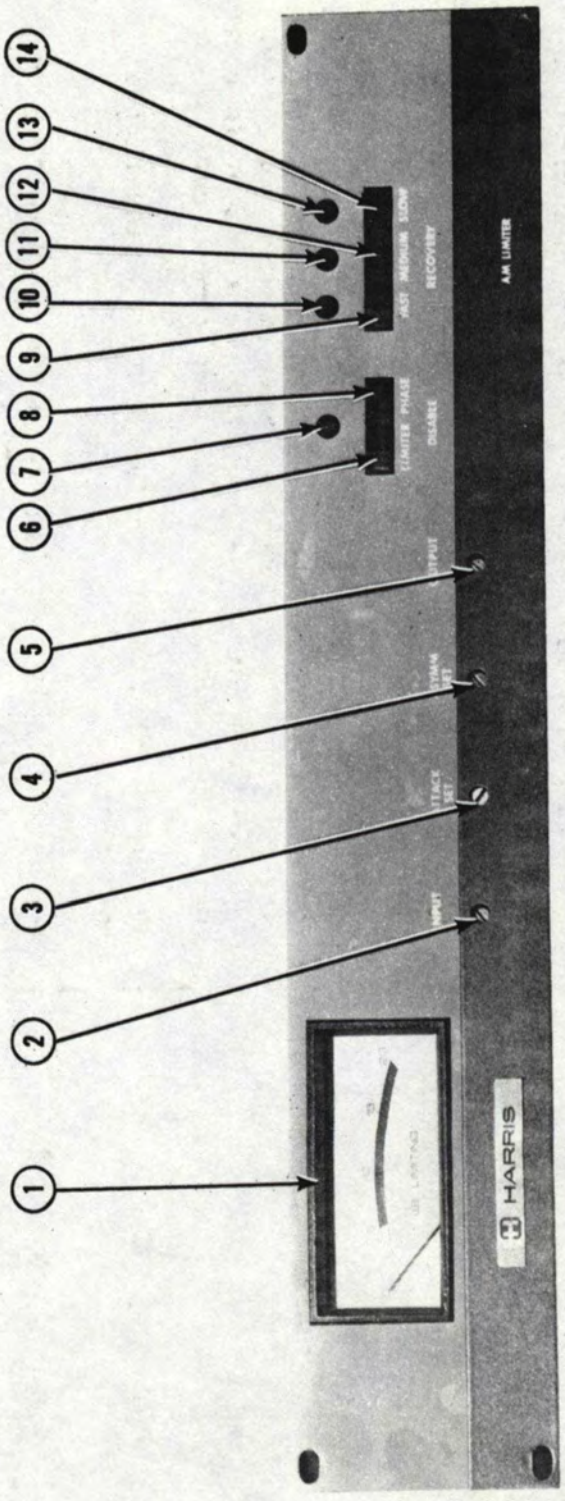

Figure 3-1. AM Limiter Controls and Indicators

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Table 3-1. Controls and Indicators

REF	CONTROL/INDICATOR	FUNCTION
1	dB LIMITING meter M1	Displays the number of decibels of peak limiting of the output signal.
2	INPUT attenuator, AT1	Provides up to 40 dB of continuous attenuation to the input signal.
3	ATTACK SET control, R100	Varies the attack time from a minimum of approximately 30 microseconds to a maximum of approximately 1 millisecond. Clockwise adjustment increases the attack time and decreases the limiting threshold.
4	ASYMM SET control, R68	Adjusts the ratio of positive-to-negative peak limiting between 100% and approximately 140%. Asymmetrical limiting adjustment does not cause baseline shift in the limiter or artifically alter the positive/negative balance of the program content. It does permit greater modulation due to less control by the positive peaks which, in turn, results in a power increase from the transmitter.
5	OUTPUT attenuator, AT2	Provides up to 40 dB of continuous attenuation to the output signal.
6	LIMITER DISABLE switch, S1A	Disables the limiter by increasing the bias voltage on applicable limiter diodes. Also removes the output clipper from the circuit. Used for proof-of-performance tests.

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Table 3-1. Controls and Indicators (cont'd)

REF	CONTROL/INDICATOR	FUNCTION
7	LIMITER/PHASE DISABLE LED indicator, DS1	When illuminated, signifies that LIMITER DISABLE switch S1A is depressed, or PHASE DISABLE switch S1B is depressed to inhibit operation of the automatic phase control circuit. Used for proof-of-performance tests.
8	PHASE DISABLE switch, S1B	Disables the automatic phase control circuit by interrupting the operation of relay K1 and bypassing the LDR switches.
9	FAST RECOVERY switch, S1C	Selects a FAST (3 seconds), long-term recovery time for AM Limiter operation.
10 .	FAST RECOVERY LED indicator, DS2	When illuminated, signifies that the AM Limiter is operating with a FAST recovery time of 3 seconds.
11	MEDIUM RECOVERY LED indicator, DS3	When illuminated, signifies that the AM Limiter is operating with a MEDIUM recovery time of 5 seconds.
12	MEDIUM RECOVERY switch, S1D	Selects a MEDIUM (5 seconds), long-term recovery time for AM Limiter operation.
13	SLOW RECOVERY LED indicator, DS4	When illuminated, signifies that the AM Limiter is operating with a SLOW recovery time of 7 seconds.
14	SLOW RECOVERY switch, S1E	Selects a SLOW (7 seconds), long-term recovery time for AM Limiter operation.

3-5. CONTROL ADJUSTMENTS.

3-6. GENERAL.

3-7. The only adjustments necessary to place the AM Limiter in fully automatic operation are those performed during initial calibration. The unit is factory tested and calibrated to manufacturer specifications prior to customer shipment, and set for the fastest operational attack time. In addition, during factory adjustment, asymmetrical limiting of the positive peaks is set for approximately 125 percent and the output-clipper printed-circuit board is jumpered in the configuration that inhibits unconntrolled positive peaks from exceeding 125 percent. For initial operation, the following front panel controls must be set to the indicated positions.

a.	INPUT	maximum CCW
b.	ATTACK SET	maximum CCW
c.	ASYMM SET	factory set
d.	OUTPUT	maximum CCW
e.	LIMITER DISABLE	out
f.	PHASE DISABLE	out
g.	FAST RECOVERY	depressed
h.	MEDIUM RECOVERY	out
i.	SLOW RECOVERY	out

3-8. RECOVERY.

a. Apply a normal input level (-14 to +26 VU) to the AM Limiter. Slowly turn INPUT attenuator AT1 (figure 3-1, item 2) in a clockwise direction and observe dB LIMITING meter M1 (figure 3-1, item 1). The meter pointer will move to the right, signifying that the unit is performing a limiting function.

NOTE

Do not operate the AM Limiter with off-scale meter indication. Off-scale operation may result in clipping and distortion.

b. Adjust INPUT attenuator AT1 for a 5-to-10 dB indication on the meter during loud portions of the program material.

c. Adjust OUTPUT attenuator AT2 in a clockwise direction for the desired output level. The OUTPUT attenuator should be used in conjunction with an AM Modulation Monitor to set the level of negative modulation. The maximum output level during compression is +20 dBm with a test tone and +10 VU with the program. Figure 3-2 illustrates maximum output levels for specific input levels.

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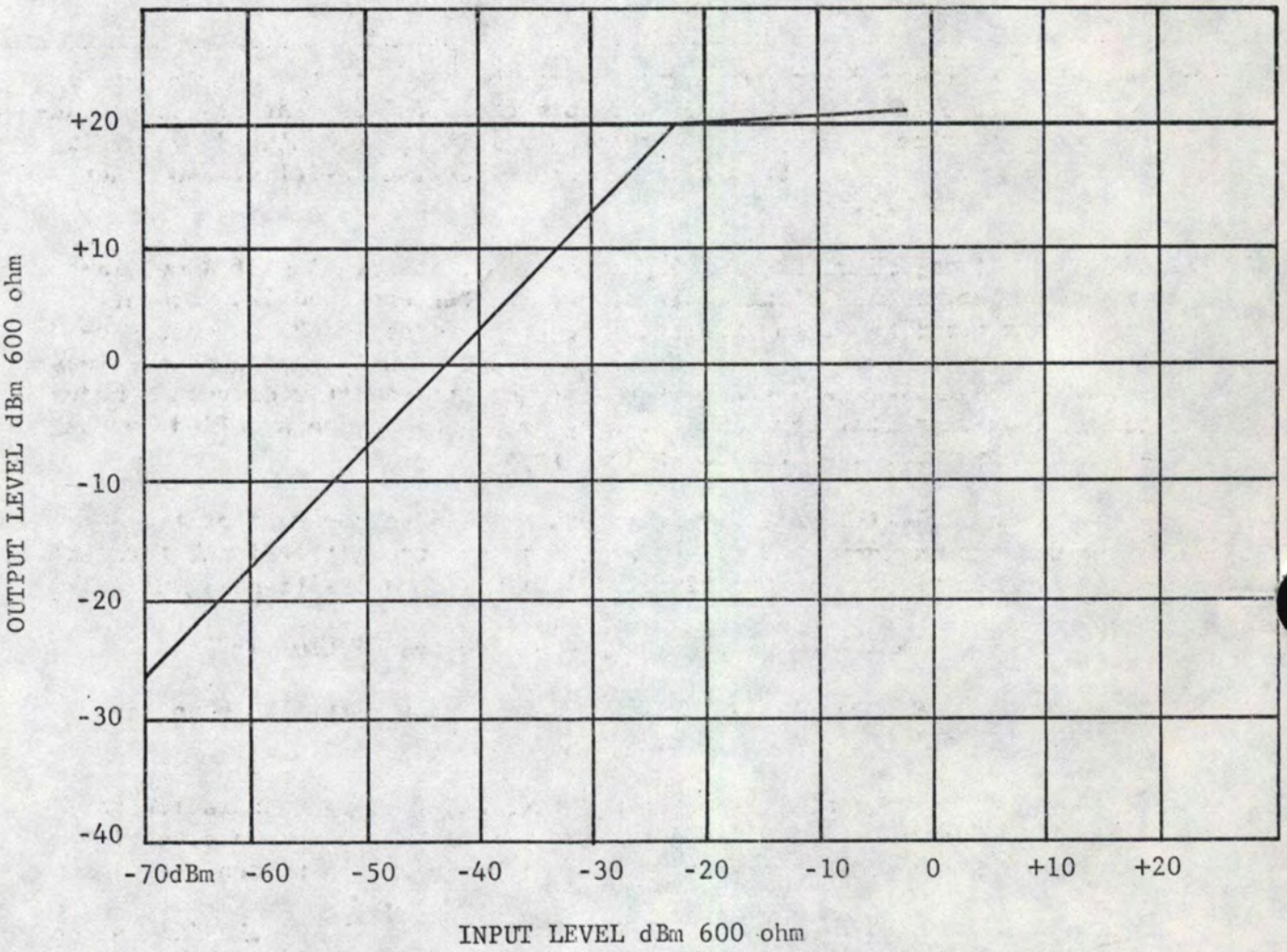

NOTE: Input attenuator AT1 and OUTPUT attenuator AT2 are set at the maximum CCW position.

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Figure 3-2. Output/Input Levels

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3-9. OPERATING PARAMETER MODIFICATIONS.

3-10. GENERAL.

3-11. Due to varying station program requirements, it may be necessary to change the factory adjustments that determine the operating parameters of the AM Limiter. The following paragraphs discuss the control adjustments that may have to be changed and the reason(s) for the change.

3-12. ASYMMETRY SET CONTROL.

3-13. A lesser degree of asymmetry may be set into the AM Limiter if the station transmitter cannot produce as much as 125 percent positive modulation. Symmetrical (100 percent) positive limiting is achieved by turning ASYMM SET control R68 to the maximum counterclockwise position. No other changes are necessary.

3-14. If asymmetrical limiting is desired, observation of a modulation monitor meter will signify whether or not the expected 125 percent program modulation has been attained. Non-attainment of 125 percent program modulation is usually a result of incorrect signal-phasing connections between the AM Limiter and transmitter, or weak transmitter driver or modulator tubes. A greater asymmetrical program signal may be supplied to the transmitter by performing the following steps.

a. Verify that output terminal TB1-4 on the rear of the AM Limiter chassis is connected to the positive (+) transmitter input terminal. This connection results in positive modulation from a positive signal peak.

b. Remove the top cover plate from the AM Limiter.

c. Remove all jumpering from terminals 3 through 6 on the output clipper printed-circuit board (figure 4-2).

d. While observing the positive peak program modulation on the modulation monitor meter, adjust ASYMM SET control R68 in a clockwise direction until the meter indication slightly exceeds 125 percent.

e. Referring to the table on figure 4-2, lower the indication on the modulation monitor meter to 125 percent by jumpering applicable terminals (2 through 6) on the output clipper board to strap-out the necessary diodes.

f. Replace the top cover plate.

3-15. RECOVERY TIME SWITCH.

3-16. The AM Limiter has a dual recovery rate consisting of a relatively fast short-term rate and switchable long-term rates. The long-term rates include fast (3 seconds), medium (5 seconds), and slow (7 seconds) recovery times. The AM Limiter is initially set for the fast (3 seconds) long-term rate.

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3-17. Depending upon the type of program material and amount of limiting, the fast long-term recovery time may exhibit audible limiting effects. If so, either the medium or slow long-term recovery time may be selected by depressing the appropriate switch. However, the fast long-term recovery time generally produces the highest average modulation and should be used if possible. The medium and slow long-term recovery times produce a lower average modulation.

3-18. ATTACK SET CONTROL.

3-19. Generally, no adjustment of the ATTACK SET control will be required in most installations. This control varies the attack time of the AM Limiter from a minimum to approximately 1 millisecond. During limiter operation, as the control is turned in the clockwise direction, the attack time is increased and the limiting threshold is decreased. This action results in nearly constant peak control even though the slower attack time allows more peaks to exceed the limiting threshold. Optimizing the limiting/clipping ratio for the highest modulation level is achieved in this manner.

3-20. Adjustment of the ATTACK SET control may be required to slow the attack time and eliminate static or spotty intermodulation noise associated with audio peaks. This adjustment is usually required when using program material having a restricted bandwidth. Restricted bandwidth may be caused by an unequalized telephone link, a poor-quality program source supplying the input to the AM Limiter, or certain types of program content.

3-21. The required adjustment is determined by the bandwidth of the program material. If the program material has no frequencies above 3000 Hz, the ATTACK SET control may require a setting that results in the slowest attack time (fully clockwise). An intermediate control setting (midway between fully clockwise and fully counterclockwise positions) is sufficient for program material bandwidths between 3000 Hz and 7500 Hz. Normally, the setting of the ATTACK SET control should be that which results in the fastest attack time (counterclockwise direction) compatible with good sound quality of the program.

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides a functional description of the operating circuits in the AM Limiter. As shown on figure 4-1, the functional circuits in the AM Limiter can be separated into the major areas listed below. Refer to figure 8-1 in Section VII for the overall schematic diagram of the AM Limiter.

a. Variable Gain Amplifier

b. Main Amplifier Section

c. Control Section

d. Automatic Peak Phasing Section

e. Output Clipper Section

4-3. FUNCTIONAL DESCRIPTION.

4-4. VARIABLE GAIN AMPLIFIER.

4-5. Operation of the variable gain amplifier is dependent upon the level of the input signal. It does not function when the input level to the AM Limiter is very low. As the input signal level is increased past the limiting threshold point, the output signal is rectified, amplified, and applied, via the control section, to the variable gain amplifier. The variable gain amplifier is capable of limiting up to 30 dB with only a 1 dB increase in the output level.

4-6. DIRECT-SIGNAL FUNCTIONAL OPERATION.

4-7. The input signal to the AM Limiter is applied through variable-input attenuator AT1 to a phase-reversal switch consisting of four neon-operated LDR units. After passing through the reversal switch, the signal is applied to step-up transformer T1, which provides the input signal for the variable-gain amplifier stage. This stage consists of the diode sections of transistors Q1 and Q2. The balance control (R8) is adjusted for low distortion, and the variable-gain amplifier stage has good frequency response and a wide control range. The output from the variable-gain amplifier stage is applied through transformer T2 to the first amplifier stage (Q3). Transistor Q3 and the following stages (Q4 through Q8) are direct coupled. Temperature compensation and idle current adjustments are incorporated in the collector of transistor Q4. The last-stage output is emitter follower coupled through output transformer T3 to variable attenuator AT2 and the output clipper. The attenuator is connected to output terminals 4 and 5 on TB1.

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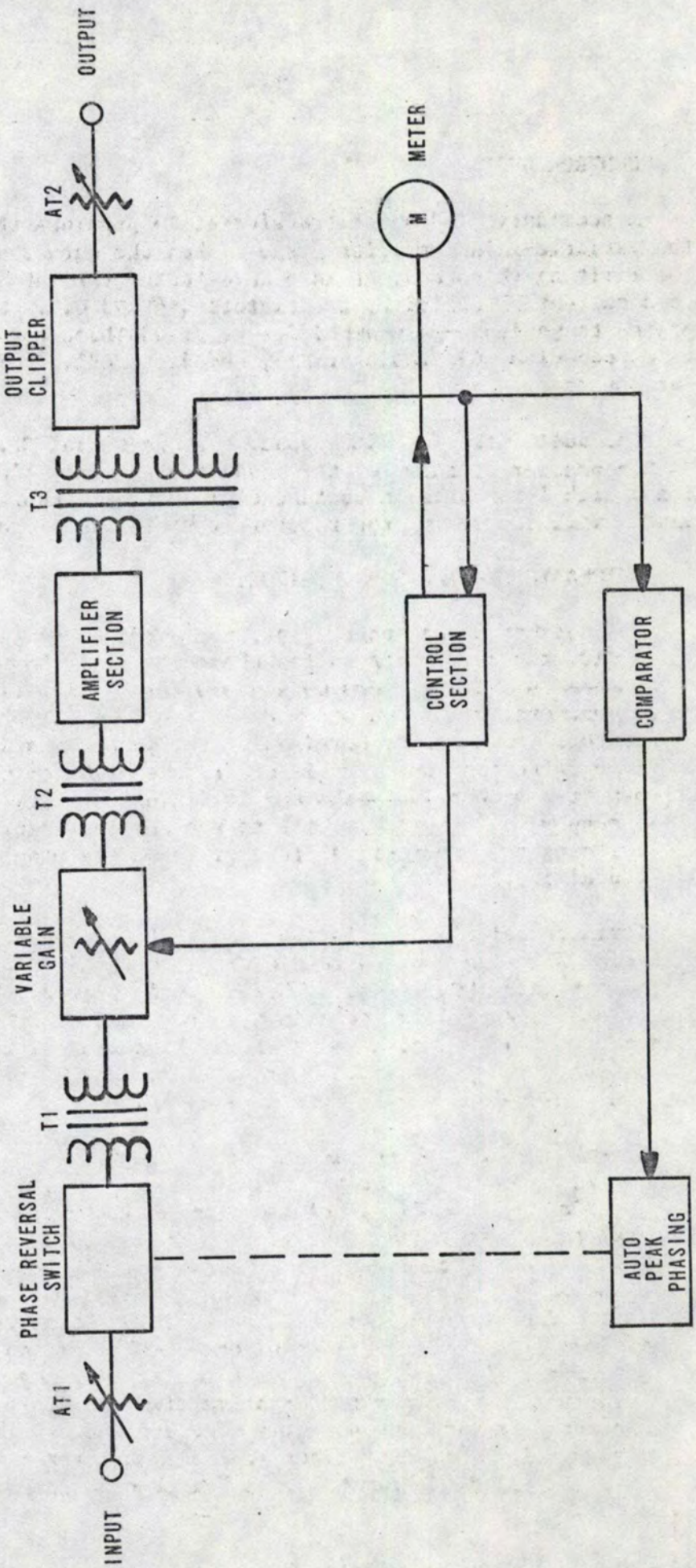

Figure 4-1. AM Limiter Block Diagram.

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4-8. CONTROL SECTION.

4-9. A secondary winding of transformer T3 provides the control signal for the variable-gain amplifier stage. When the output signal level exceeds the limiting threshold, it is peak detected through diodes CR14 and CR15 and current amplified by transistors Q14 and Q15. This control signal is applied to variable-gain amplifier stage Q3 through a shaping network consisting of capacitor C3, resistor R13, and diode CR1. This control signal also drives meter stage Q13.

4-10. The dual recovery-time capacitors are C1 and C2. Short random peaks permit capacitor C2 only to charge and the recovery time is quite fast. With a high level program content of larger and recurring peaks, both C1 and C2 will charge and the recovery time is proportionally slower.

4-11. AUTOMATIC PEAK PHASING SECTION.

4-12. The automatic peak-phasing section consists of relay K1, transistors Q9 and Q10, the components on the phase reversing board, and other associated components. Transistors Q9 and Q10 form a flip-flop circuit (i.e. when Q9 conducts, Q10 is cutoff and K1 is energized; when Q10 conducts, Q9 is cutoff and K1 is deenergized). Relay contacts K1-C alternately allow FET Q12 to drive the base circuit of transistor Q9 or Q10 to cutoff when the transmitter modulation peaks are predominately negative. Relay contacts K1-A supply voltage (112 volts) to the corresponding LDR circuits. This action switches the input signal to again make the modulation peaks predominately positive.

4-13. Asymmetrical limiting is the result of a different bias voltage applied to diode CR14 than applied to diode CR15 when ASYMM SET control R68 is set greater than 100 percent. When properly phased, the resultant higher peak becomes the positive peak in the transmitter. The AM Limiter will limit negative peaks of program waveforms having a natural unbalance of positive and negative peaks at 100 percent and, will allow positive peaks to attain 100-to-140 percent before limiting.

4-14. A peak comparator, consisting of diodes CR6 and CR7 and associated components, is used to control the functioning of the automatic peak phasing section. Diode CR6 is biased at +9 volts by resistors R41/R35 so that a signal peak must exceed -9.6 volts to cause conduction. Diode CR7 is biased at approximately -9 volts by resistors R43/R36 so that a signal peak from the same half of the T3 secondary winding must exceed +9.6 volts to conduct. Resistors R39 and R42 feed the resultant comparator signals into capacitor C20 or C21 (relay contacts K1-E) where the predominant signal polarity causes the gate of Q12 to go positive or negative. A phase reversal at transformer T3 allows the negative signal peaks from the comparator to be coincident with the positive modulation peaks in the associated transmitter. Thus, if the output from the comparator is predominantly negative, Q12 is driven further into "pinch-off" and peak phasing remains unchanged.

WARNING: Disconnect primary power prior to servicing.

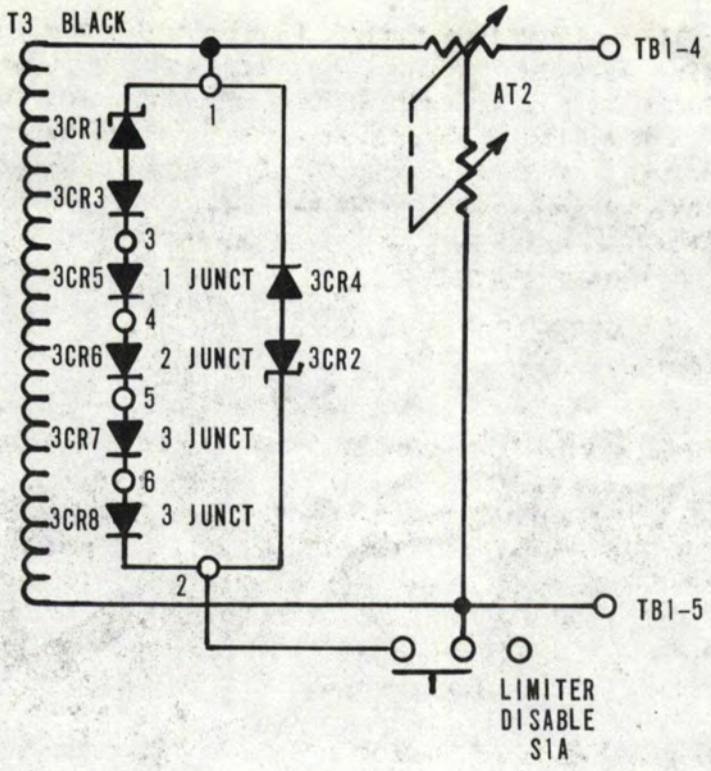
4-15. When the comparator output is predominately positive, the automatic peak phasing section reverses the phase of the input program signal by the action of relay K1, through 2LDR1 and 2LDR4, and into the primary of transformer T1. This action occurs when the comparator output is predominately positive for a sufficient length of time to charge capacitor C20 or C21. This action, in turn, increases the forward gate bias at Q12, which causes the drain voltage to drop from the normal value (10 volts) to approximately six volts.

4-16. OUTPUT CLIPPER.

4-17. Absolute positive and negative peak control is achieved by connecting the output clipper section to the secondary winding of transformer T3 ahead of output attenuator AT2. Factory adjustment of the output clipper ensures that the negative peaks coincide with 100 percent negative modulation of the transmitter. Clipping of the positive peaks of the output signal is adjustable by jumpering terminals on the output clipper board. Jumpering determines the correct diode configuration for the desired amount of positive modulation at the transmitter. Prior to shipment, the AM Limiter is factory adjusted for 125 percent positive modulation.

4-18. Figures 4-2 and 4-3 depict the method used for determining the jumpering required for the desired positive peak modulation. Overall, the positive modulation peaks will attain approximately 150 percent with no jumpering and approximately 112 percent with the diodes jumpered out (terminals 2 to 3).

WARNING: Disconnect primary power prior to servicing.



SIGNAL POLARITIES	% MODULATION	STRAP CONNECTIONS
Negative		
NOM. 16.7V	100	NONE
Positive		
NOM. 18.7V	112	2 to 3
+1CR 19.4V	116	4 to 3
+2CR 20.1V	120	3 to 4, 5 to 2
+3CR 20.8V	125*	5 to 2
+4CR 21.5V	129	4 to 6
+5CR 22.2V	133	3 to 4, 6 to 2
+6CR 22.9V	137	3 to 5
+7CR 23.6V	141	4 to 5
+8CR 24.3V	146	3 to 4
+9CR 25.0V	150	NONE

* Factory set near 125%

Absolute values of clipping will vary somewhat due to diode tolerances.

Figure 4-2. Output Clipper Board Jumpering

WARNING: Disconnect primary power prior to servicing.

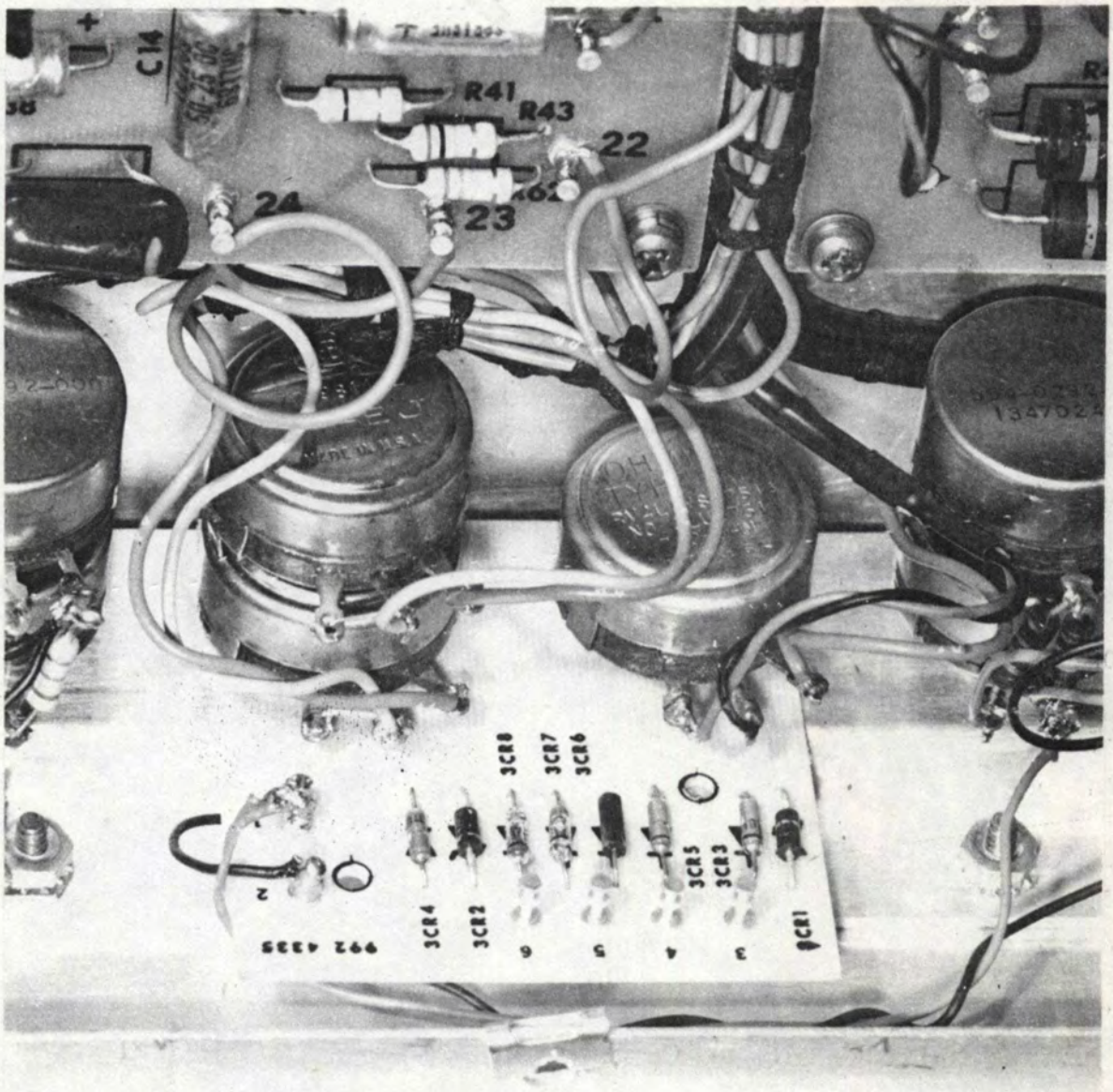


Figure 4-3. Output Clipper Board

WARNING: Disconnect primary power prior to servicing.

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides information for servicing the AM Limiter. Standard testing techniques for semiconductor devices apply to the circuitry contained in this unit.

5-3. Measure dc voltages with the same meter that will be used for maintenance. Record these voltages on the schematic for reference should troubleshooting be required.

5-4. Do not remove or insert transistors with power applied. The failure time for transistors is measured in microseconds and a momentary short is all that is required to damage them in some circuits. Observe polarities when installing replacement capacitors or diodes.

5-5. When ordering replacement parts from Harris Corporation Broadcast Equipment Division, list the stock numbers and part description as tabulated in Section VI.

5-6. PREVENTIVE MAINTENANCE.

5-7. Preventive maintenance for this unit is limited to standard good housekeeping practices. Dust and dirt should be removed periodically. Using a soft brush, remove dust and dirt from power transformers, rectifiers, and other components that require heat dissipation for proper operation.

5-8. CORRECTIVE MAINTENANCE.

5-9. ADJUSTMENT/CALIBRATION.

5-10. The adjustment or calibration procedures described in the following paragraphs may be easily performed after the top cover is removed. Each specific adjustment/calibration procedure should be performed whenever circuit components are replaced or component value changes are suspected. Figure 5-1 identifies and locates all adjustable components.

5-11. POWER SUPPLY. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate and adjust variable resistor R77 to set the power supply voltage to 39.0 Vdc at the positive (+) terminal of capacitor C26.

5-12. OUTPUT BIAS. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate and select variable resistor R82 to set the no-signal voltage across resistor R84 to 25 mV $\pm$5 mV.

5-13. BALANCE. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate variable resistor R8. This component balances transistors Q1 and Q2 for the lowest harmonic distortion. Insert

WARNING: Disconnect primary power prior to servicing.

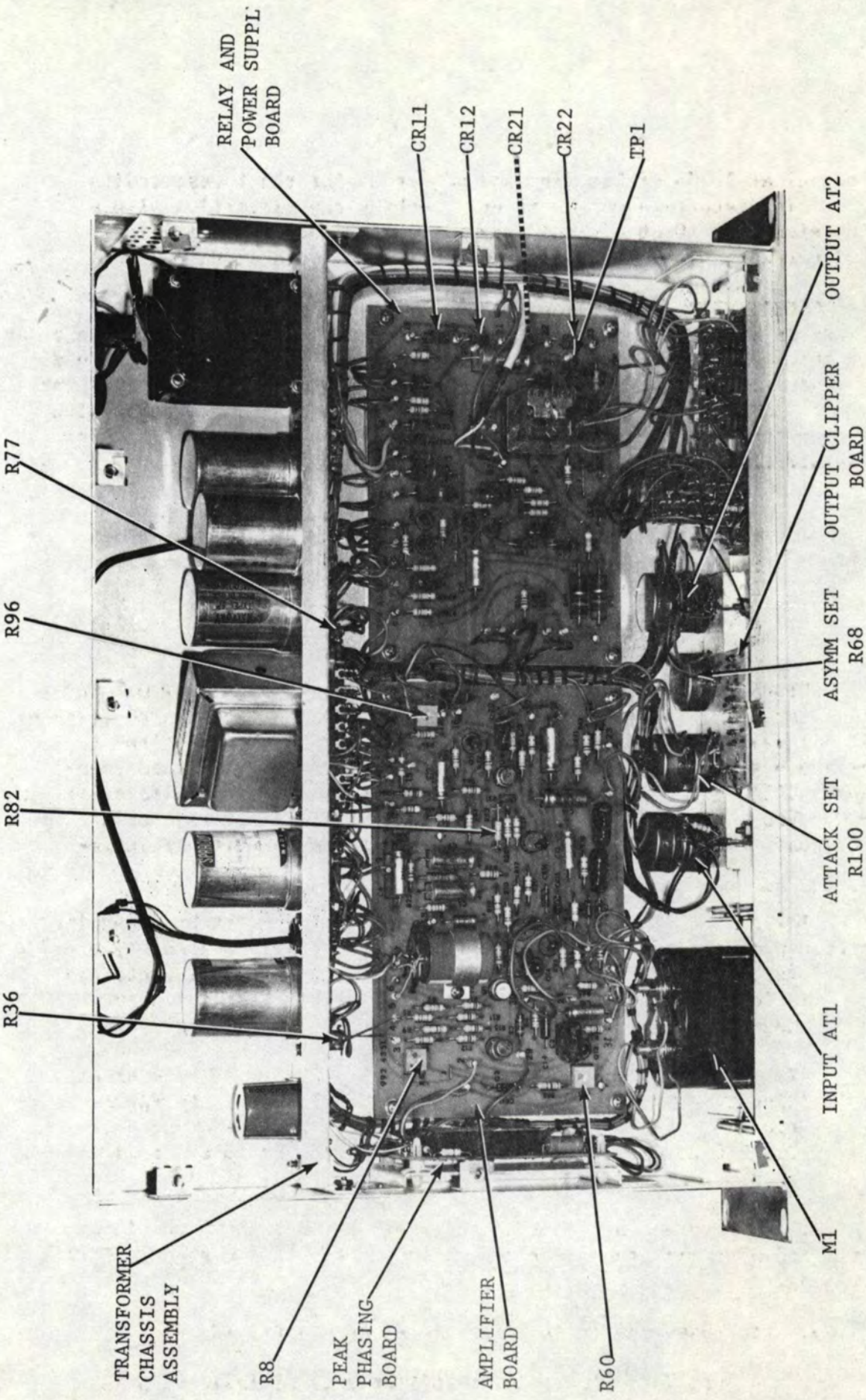


Figure 5-1. AM Limiter Component Locations

WARNING: Disconnect primary power prior to servicing.

a 10 kHz signal at 10 dB of limiting and adjust R8 for the lowest indication of harmonic distortion on the meter. Recheck the distortion with a 1 kHz input signal at 10 dB of limiting. If the distortion indication exceeds 0.7 percent, select transistor Q1 and/or Q2 for a closer match.

5-14. SENSITIVITY. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate variable resistor R36. This component determines the sensitivity of the automatic peak phasing section and should be factory adjusted so that phasing relay K1 does not clatter when operating with 10 dB of limiting at 20 Hz. Turning the control in a counterclockwise direction from the factory adjusted setpoint increases sensitivity and in a clockwise direction, decreases sensitivity.

CAUTION

Do not remove or install FET Q12 with power applied to the AM Limiter.

5-15. AUTOMATIC PEAK PHASING. Field-effect transistor (FET) Q12 must be properly biased in order for the automatic peak phasing section to operate correctly. Since this parameter is variable in most FETS, the desired source-to-gate bias may be obtained by removing one or more of series-connected diodes CR11, CR12, CR21, and CR22 by strapping. A voltage level of +8.5-to-+10.5 Vdc must be present on the drain of FET Q12 and test point TP1. Recalibrate the bias for a new FET in the same manner if Q12 is replaced.

5-16. LIMITING THRESHOLD. The limiting threshold is set by observing the distortion products of a 1 kHz signal and 20 dB of limiting set by external pads. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate and adjust R96 for barely visible distortion products caused by the negative clipper.

5-17. METER CALIBRATION. This adjustment should only be made after adjusting limiting threshold variable resistor R96. Referring to Figure 5-1 and schematic 843 0409 001 contained in Section VII, locate and adjust variable resistor R60 to calibrate dB limiting meter M1 at 10 dB of limiting. Adjust the meter as follows:

a. Determine the limiting threshold by increasing the input signal level and observing the meter indication of the output signal until it stops rising.

b. Increase the input signal level by exactly 10 dB.

c. Adjust variable resistor R60 for a 10 dB indication on meter M1.

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5-18. TROUBLESHOOTING.

5-19. GENERAL TROUBLESHOOTING TECHNIQUES. When a malfunction occurs, the first step is to isolate the problem to a particular circuit or printed-circuit board. This is accomplished by noting which signal paths and controls affect the troublesome operation. Disconnecting certain input or output wiring will possibly stop the malfunction, indicating a bad ground connection or shorted load condition.

5-20. The next step is to measure the dc voltages in the suspect circuit. Most of the amplifier circuits are the direct-coupled type and proper biasing is indicated by a single measurement at the circuit output.

5-21. FAULT LOCATION GUIDE. The information listed in table 5-1 is presented as an aid for troubleshooting the AM Limiter. This table lists the most common trouble symptoms for this type of equipment and includes the probable cause and corrective action required.

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WARNING: Disconnect primary power prior to servicing.

Table 5-1. Fault Location Guide

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
NO OUTPUT	1. No input.	1a. Check input wiring. 1b. Check source equipment.
	2. Input attenuator AT1 turned down.	2a. Adjust attenuator AT1 in a clockwise direction.
	3. Output attenuator AT2 turned down.	3a. Adjust attenuator AT2 in a clockwise direction.
	4. Output shorted.	4a. Check output wiring.
	5. No power.	5a. Refer to following symptom.
NO POWER	1. AC line cord.	1a. Provide connection to 117 Vac (or 234 Vac) power source.
	2. Fuse F1 blown.	2a. Check F1. Replace if defective.
	3. Transformer T4.	3a. Check T4. Replace if defective.
NO +39 VDC	1. Diodes CR17 and CR18 open.	1a. Check CR17 and CR18. Replace if defective.
	2. Transistor Q17 open.	2a. Check Q17. Replace if defective.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	3. Transistor Q11 shorted.	3a. Check Q11. Replace if defective.
UNREGULATED +39 VDC	1. Transistor Q17 shorted.	1a. Check Q17. Replace if defective.
	2. Transistor Q11 open.	2a. Check Q11. Replace if defective.
NO -30 VDC	1. Diode CR16 open.	1a. Check CR16. Replace if defective.
	2. Diode CR20 shorted.	2a. Check CR20. Replace if defective.
UNREGULATED -30 VDC	1. Diode CR20 open.	1a. Check CR20. Replace if defective.
DISTORTED OUTPUT	1. Unit is being overdriven.	1a. Turn down attenuator AT1.
	2. DC operating voltages not stable.	2a. Check +39 Vdc and -30 Vdc for proper level. Adjust R77 at positive side of C26 for proper +39 Vdc level.
	3. Output level being clipped by output protection diodes.	3a. Adjust ASYMM SET control R68 in a counterclockwise direction. Refer to page 4-4 for diode strapping selection.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
NO LIMITING	1. Input level too low.	1a. Adjust attenuator AT1 in a clockwise direction.
	2. Limiter disabled.	2a. Release LIMITER DISABLE switch S1A.
	3. Transistors Q1 and/or Q2 defective or not in socket.	3a. Check Q1 and/or Q2. Replace if defective.
	4. Transistors Q14 and/or Q15 open.	4a. Check Q14 and/or Q15. Replace if defective.
	5. Diodes CR14 and/or CR15 open.	5a. Check CR14 and/or CR15. Replace if defective.
NO PHASE SWITCHING	1. Phase switching disabled.	1a. Release PHASE DISABLE switch S1B.
	2. Relay K1 out of socket.	2a. Check K1. Ensure firm socket connection.
	3. Relay coil of K1 open.	3a. Check K1. Replace if defective.
	4. Transistors Q9, Q10, and/or Q12 open or shorted.	4a. Check components. Replace if defective.
	5. Diodes CR6 and/or CR7 open.	5a. Check CR6 and/or CR7. Replace if defective.

WARNING: Disconnect primary power prior to servicing.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
NO AUDIO OUTPUT EXCEPT WHEN PHASE DISABLE SWITCH S1B IS DEPRESSED.	1. LDR neon drivers disabled or not turning on.	1a. Check ±56 Vdc lines for proper level. Repair, replace, and/or adjust as necessary. 1b. Check primary power source for low input line voltage. 1c. Check for -56 Vdc at pin 7 of peak phasing board. 1d. Check for +56 Vdc at pins 5 or 6 of peak phasing board.
	2. No +56 Vdc at pins 5 or 6 of peak phasing board. Open resistor R94.	2a. Check R94. Replace if defective.
	3. 25 to 30 volts at pins 5 or 6 of peak phasing board.	3a. Shorted capacitor 2C1 or 2C2. Check and replace if defective. 3b. Shorted neon in 2LDR1, 2LDR2, 2LDR3, or 2LDR4. Check and replace if defective.
	4. Shorted neon.	4a. Check voltage across 2R3, 2R4, 2R5, and 2R6. Voltage indication should be approximately 1.5 Vdc when good neon is on.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
AUDIO OUTPUT PUMPS, SWITCHES, ETC.	1. Recovery time incorrect.	1a. Select fast (S1C), MED (S1D), or SLOW (S1E) RECOVERY switch compatible with program material.
	2. Capacitor C1 or C2 open.	2a. Check C1 and/or C2. Replace if defective.
AUDIO OUTPUT MAKES A STATIC TYPE NOISE WHEN LIMITER IS OPERATING.	1. Audio bandwidth of signal is too narrow.	1a. Improve source material, defective phone line, poor cart, etc. 1b. Adjust ATTACK SET control R100 in a clockwise direction until the static noise decreases.
OUTPUT TRANSISTOR HOT WITH NO SIGNAL.	1. Input or output lines improperly grounded or defective wiring. Unit oscillating.	1a. Check input and output ground connections. Restore connections if required. 1b. Check input and output wiring. Replace wiring if required.
	2. Output transistor bias current high.	2a. Adjust resistor R82 for 0.25 Vdc across resistor R84 (25 mA).

WARNING: Disconnect primary power prior to servicing.

WARNING: Disconnect primary power prior to servicing.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
+39 VDC CURRENT LOAD TOO HIGH OR POWER SUPPLY NOT ADJUSTED PROPERLY.	1. Resistor R82 not adjusted properly.	1a. Adjust resistor R82 for 0.25 Vdc across resistor R84 (25 mA).
	2. Resistor R77 not adjusted properly.	2a. Adjust R77 at positive side of C26 for proper 39 Vdc level.
RELAY OPERATES WITH NO SIGNAL OR WITH LOW-FREQUENCY SINE WAVE (20-30 Hz).	1. ASYMM SET R100 voltage improperly adjusted.	1a. Adjust voltage at wiper of resistor R36 to 8.9 Vdc or, as needed to prevent operation with 10 dB of limiting at 20 Hz.
HIGH FREQUENCY DISTORTION WITH LIMITING.	1. Unbalance in gain control circuit.	1a. Adjust resistor R8 for minimum distortion with 10 dB of limiting at 10 kHz.
METER M1 OPERATES IMPROPERLY.	1. Defective meter.	1a. Check meter. Replace if defective.
	2. Transistor Q13 open or shorted.	2a. Check Q13. Replace if defective.
	3. Meter improperly calibrated.	3a. Adjust resistor R60 for 10 dB meter indication with a known 10 dB of limiting at 1 kHz.

Table 5-1. Fault Location Guide (Continued)

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
NEGATIVE PEAKS OF OUTPUT SIGNAL CLIPPED.	1. DC voltages at improper level.	1a. Check power supply voltages. Replace defective components as necessary and/or adjust resistor R77 at positive side of C26.
	2. Limiting threshold improperly adjusted.	2a. Using an external meter and input attenuator AT1, set the input at the verge of limiting. Increase the input by 20 dB and adjust resistor R96 for a barely visible distortion (external meter) from the negative clipper. A distortion analyzer and oscilloscope must be used for this adjustment.

SECTION VI

PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides a description, reference designator, and order number for replaceable electrical parts and assemblies along with selected mechanical parts necessary for proper maintenance of AM Limiter 994 7059 001. Figure 5-1 locates and identifies the major assemblies in the unit. Table 6-1 lists the assemblies having replaceable parts, the numbers of the associated table, and the page number on which the table is located.

NOTE

Actual component values may vary slightly from component values listed on schematics and in parts lists. Due to industry wide shortages of electrical components, it is sometimes necessary to use parts other than those specified. In every case, however, a substitute part is selected for conformance to overall design specifications so that equipment performance is not affected.

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Table 6-1. Replaceable Parts List Index

TABLE NO.	UNIT NOMENCLATURE	PART NO.	PAGE
6-2	AM Limiter, Basic Unit	994 7059 002	6-3
6-3	Amplifier Board	992 4351 001	6-5
6-4	Relay and Power Supply Board	992 4352 001	6-8
6-5	Peak Phasing Board	992 4336 001	6-10
6-6	Output Clipper Board	992 4335 001	6-11
6-7	Transformer Chassis Assembly	992 4353 001	6-12

WARNING: Disconnect primary power prior to servicing.

Table 6-2. AM Limiter, Basic Unit-994 7059 002

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
AT1,AT2	914 8167 001	Attenuator, 600/600 ohms	2
C31,C32,C33, C34	516 0074 001	Capacitor, 0.005 uF, 1kV	4
C36,C37	516 0084 000	Capacitor, 0.02 uF, 1kV	2
DS1,DS2,DS3, DS4	384 0327 000	LED, Bushing Included	4
E1	614 0347 000	Tie Point	1
F1	398 0017 000	Fuse, 3AG, 1 ampere	1
M1	632 0718 000	Meter, 0-1 ampere, (815 5371 001)	1
R1,R2	540 0132 000	Resistor, 3.0M ohm, ½W, 5%	2
R64	540 1111 000	Resistor, 10K ohm	1
R68	550 0061 000	Potentiometer, 1K ohm	1
R69,R90,R91, R92	540 0617 000	Resistor, 1800 ohm, 2W, 5%	4
R100	550 0866 000	Potentiometer, Dual 2K/50K ohm	1
R101	540 1187 000	Resistor, 1300 ohm, 5%, LN	1
S1	604 0788 000	Switch, Pushbutton, 5 Station (Spec. 828 7900 001)	1
TB1	614 0027 000	Terminal Board, 5 Position	1
TB2,TB3	614 0128 000	Terminal Board, 1 Position	2
XF1	402 0023 000	Fuse Holder	1
Z1,Z2,Z4,Z5, Z8,Z9,Z10	414 0087 000	Ferrite Bead	7
	992 4351 001	Amplifier Board (Refer to Table 6-3)	1
	928 8308 001	Cable Assembly	1

WARNING: Disconnect primary power prior to servicing.

Table 6-2. AM Limiter, Basic Unit-994 7059 002 (Continued)

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
	992 4335 001	Output Clipper Board (Refer to Table 6-6)	1
	992 4336 001	Peak Phasing Board (Refer to Table 6-5)	1
	992 4352 001	Relay and Power Supply Board (Refer to Table 6-4)	1
	992 4353 001	Transformer Chassis Assembly (Refer to Table 6-7)	1

WARNING: Disconnect primary power prior to servicing.

Table 6-3. Amplifier Board-992 4351 001

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
C1	526 0004 000	Capacitor, 1.0 uF, 35V, K1C35K	1
C2	508 0306 000	Capacitor, 0.33 uF, 100V, DMP-1P-33	1
C3,C7	508 0215 000	Capacitor. 0.01 uF, 100V, 1PP-1-103	2
C4	522 0178 000	Capacitor, 25 uF, 6V, C426AR/C25	1
C5,C9	522 0164 000	Capacitor, 250 uF, 3V, TE-1065	2
C6,C14,C17	522 0244 000	Capacitor, 50 uF, 25V, TE-1209	3
C10	522 0243 000	Capacitor, 35 uF, 25V, TE-1208	1
C12,C15	508 0268 000	Capacitor, 0.1 uF, 100V, 1DP-2-104	2
C13,C16	522 0192 000	Capacitor, 25 uF, 10V, TE-1118	2
C27	516 0386 000	Capacitor, 0.22 uF, 3V	1
CR1,CR6,CR7, CR14,CR15	384 0204 000	Diode, Silicon 1N456A	5
Q1,Q2	380 0018 000	Transistor, 2N1307	2
Q3	380 0147 000	Transistor, TZ-1218	1
Q4,Q5	380 0111 000	Transistor, 2N3417	2
Q6	380 0044 000	Transistor, 40319	1
Q13,Q14,Q15	380 0091 000	Transistor, 2N4250	3
R3	540 0132 000	Resistor, 3M ohm, ½W, 5%	1
R4	540 1162 000	Resistor, 1M ohm, ½W, 5%	1
R5,R6,R61	540 1145 000	Resistor, 6.8K ohm, ½W, 5%	3
R7,R9	540 1130 000	Resistor, 620 ohm, ½W, 5%	2
R8	550 0625 000	Potentiometer, 500 ohm, ½W	1
R10	540 1210 000	Resistor, 150K ohm, ½W, 5%	1

WARNING: Disconnect primary power prior to servicing.

Table 6-3. Amplifier Board-992 4351 001 (Continued)

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
R11,R12,R14, R15	540 1215 000	Resistor, 20 ohm, ½W, 5%	4
R13	540 1184 000	Resistor, 15K ohm, ½W, 5%	1
R16	540 1106 000	Resistor, 6.2K ohm, ½W, 5%	1
R17	540 1131 000	Resistor, 30K ohm, ½W, 5%	1
R18	548 0216 000	Resistor, 1.37K ohm, ½W, 1%	1
R19	540 1110 000	Resistor, 68 ohm, ½W, 5%	1
R20	540 1107 000	Resistor, 20K ohm, ½W, 5%	1
R21	540 1142 000	Resistor, 240K ohm, ½W, 5%	1
R24	540 1195 000	Resistor, 16K ohm, ½W, 5%	1
R25	540 1116 000	Resistor, 1K ohm, ½W, 5%	1
R26	540 1102 000	Resistor, 100 ohm, ½W, 5%	1
R27	540 1135 000	Resistor, 24 ohm, ½W, 5%	1
R28	540 1118 000	Resistor, 220 ohm, ½W, 5%	1
R29	540 1114 000	Resistor, 4.7K ohm, ½W, 5%	1
R30	540 1201 000	Resistor, 910 ohm, ½W, 5%	1
R31	559 0014 000	Thermistor, 500 ohm, 25°C.	1
R32,R33	540 1128 000	Resistor, 200 ohm, ½W, 5%	2
R35	540 1189 000	Resistor, 9.1K ohm, ½W, 5%	1
R37,R38,R39, R42	540 1159 000	Resistor, 100K ohm, ½W, 5%	4
R41	540 1131 000	Resistor, 30K ohm, ½W, 5%	1
R43	540 1111 000	Resistor, 10K ohm, ½W, 5%	1
R58	540 1136 000	Resistor, 56 ohm, ½W, 5%	1
R59	540 0343 000	Resistor, 3K ohm, 1W, 5%	1

WARNING: Disconnect primary power prior to servicing.

Table 6-3. Amplifier Board-992 4351 001 (Continued)

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
R60	550 0625 000	Potentiometer, 500 ohm, ½W	1
R62	540 1147 000	Resistor, 27K ohm, ½W, 5%	1
R63	540 1182 000	Resistor, 2.2K ohm, ½W, 5%	1
R65	540 1104 000	Resistor, 2K ohm, ½W, 5%	1
R66,R67	540 1107 000	Resistor, 20K ohm, ½W, 5%	2
R81	540 1153 000	Resistor, 8200 ohm, ½W, 5%	1
R82	540 000	Resistor, ½W, 5%, Selected Between 75 and 221 ohm	1
R83	540 1127 000	Resistor, 820 ohm, ½W, 5%	1
R84	540 1151 000	Resistor, 10 ohm, ½W, 5%	1
R85,R86	540 1117 000	Resistor, 150 ohm, ½W, 5%	2
R95	540 1127 000	Resistor, 820 ohm, ½W	1
R96	550 0622 000	Potentiometer, 1K ohm, ½W	1
R22	540 1143 000	Resistor, 24K ohm, ½W, 5%	1
T2	478 0183 000	Transformer, Input	1
ZQ1,ZQ2	404 0066 000	Socket	2
ZQ6	404 0198 000	Transipad, 10020 DAP	1

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WARNING: Disconnect primary power prior to servicing.

Table 6-4. Relay and Power Supply Board-992 4352 001

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
C18	522 0258 000	Capacitor, 50 uF, 50V	1
C19	522 0160 000	Capacitor, 100 uF, 3V	1
C20,C21	526 0004 000	Capacitor, 1.0 uF, 35V	2
C25,C29,C30	508 0253 000	Capacitor, 0.04 uF, 100V	3
C28	516 0386 000	Capacitor, .022 uF, 3V	1
C36	516 0087 000	Capacitor, 0.05 uF, 600V	1
CR8,CR9,CR10, CR11,CR12,CR16, CR17,CR18	384 0020 000	Diode, 1N2071	8
CR19,CR20	386 0154 000	Diode, Zener, 1N4751A	2
CR21,CR22	384 0128 000	Diode, 1N270, Germanium	2
K1	572 0134 000	Relay, 590 ohm, Coil/2AV. DC.	1
Q9,Q10,Q11, Q16	380 0111 000	Transistor, 2N3417	4
Q12	380 0180 000	Transistor, 2N5952	1
R44	540 0319 000	Resistor, 300 ohm, 1W, 5%	1
R45,R48	540 1189 000	Resistor, 9100 ohm, ½W, 5%	2
R46,R47,R50, R51	540 1145 000	Resistor, 6.8K ohm, ½W, 5%	4
R49,R52	540 0617 000	Resistor, 1.8K ohm, 2W, 5%	2
R54	540 1190 000	Resistor, 240 ohm, ½W, 5%	1
R55	540 1192 000	Resistor, 51 ohm, ½W, 5%	1
R56	540 1108 000	Resistor, 36K ohm, ½W, 5%	1
R57	540 1151 000	Resistor, 10 ohm, ½W, 5%	1
R70	540 1102 000	Resistor, 100 ohm, ½W, 5%	1

WARNING: Disconnect primary power prior to servicing.

Table 6-4. Relay and Power Supply Board-992 4352 001 (Continued)

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
R71,R72	540 0563 000	Resistor, 10 ohm, 2W, 5%	2
R73	540 1154 000	Resistor, 7.5K ohm, ½W, 5%	1
R74	540 1163 000	Resistor, 300 ohm, ½W, 5%	1
R75,R78	540 1138 000	Resistor, 3K ohm, ½W, 5%	2
R76	540 1147 000	Resistor, 27K ohm, ½W, 5%	1
R79	540 1137 000	Resistor, 3.9K ohm, ½W, 5%	1
R80	540 0151 000	Resistor, 18M ohm, ½W, 5%	1
R94	540 1116 000	Resistor, 1K ohm, ½W, 5%	1
XK1	404 0209 000	Socket, Relay	1
XQ12	404 0066 000	Socket, Transistor	1

WARNING: Disconnect primary power prior to servicing.

Table 6-5. Peak Phasing Board-992 4336 001

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
2C1,2C2	508 0371 000	Capacitor, 0.1 MFD, 200V	2
2R1,2R2	540 1116 000	Resistor, 1K ohm, 5%	2
2R3,2R4,2R5, 2R6	540 1107 000	Resistor, 20K ohm, 5%	4
2R7,2R8	540 1164 000	Resistor, 390 ohm, 5%	2
2R9	540 1187 000	Resistor, 1300 ohm, 5%	1
2LDR1,2LDR2, 2LDR3,2LDR4	670 0028 000	Raysistor	4

Table 6-6. Output Clipper Board-992 4335 001

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
3CR1	386 0137 000	Diode, Zener, 1N4746A, 5%	1
3CR2	386 0136 000	Diode, Zener, 1N4745A, 5%	1
3CR3,3CR4	384 0205 000	Diode, Zener, 1N914	2
3CR5	384 0255 000	Diode, MZ2360	1
3CR6	384 0256 000	Diode, MZ2361	1
3CR7,3CR8	384 0603 000	Diode, MZ2362	2

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WARNING: Disconnect primary power prior to servicing.

Table 6-7. Transformer Chassis Assembly-992 4353 001

REF. SYMBOL	HARRIS PART NO.	DESCRIPTION	QTY.
C11,C26	524 0094 000	Capacitor, 500 uF, 50V	2
C22,C23,C24	524 0134 000	Capacitor, 200 uF, 150V	3
Q7	380 0065 000	Transistor, 2N3766	1
Q8	380 0066 000	Transistor, 2N3740	1
Q17	380 0062 000	Transistor, 40310	1
R36,R77	552 0783 000	Potentiometer, 10K ohm	2
T1	478 0313 000	Transformer, Input	1
T3	478 0289 000	Transformer, Output	1
T4	472 0580 000	Transformer, Power	1
TB3	614 0164 000	Terminal Strip Assembly	1
XQ7,XQ8,XQ17	404 0206 000	Socket, Transistor	3

WARNING: Disconnect primary power prior to servicing.

SECTION VII

DIAGRAMS

7-1. INTRODUCTION.

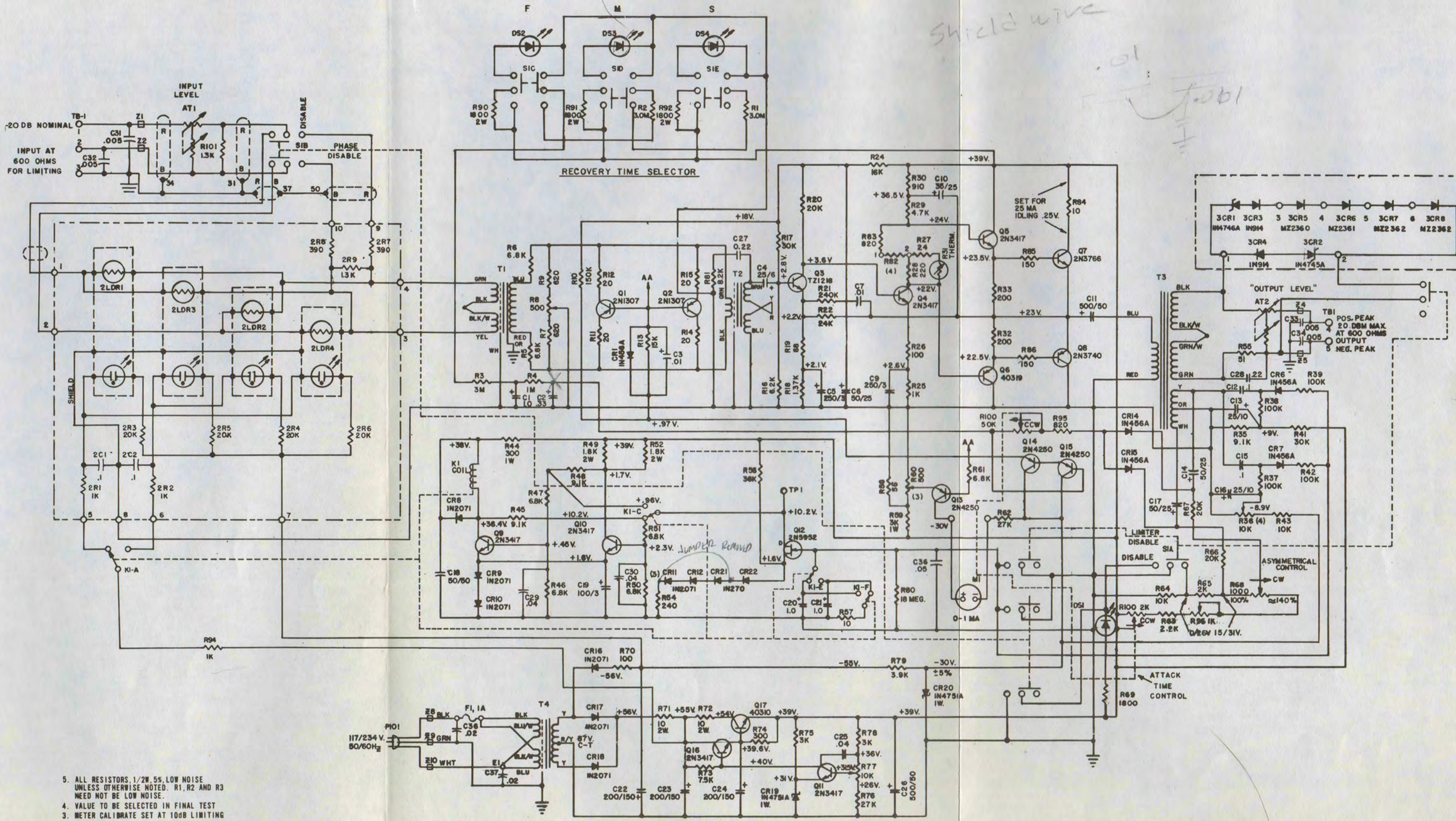
7-2. This section contains the overall schematic diagram (843 0409 001) for AM Limiter 994 7059 001. Use this diagram when reading the priciples of operation in Section IV and during performance of the maintenance procedures presented in Section V.

WARNING: Disconnect primary power prior to servicing.

Shield wire

.01

.001



NOTES:

1. SELECT Q12 & STRAP OUT CR11, CR12, CR21 AND/OR CR22 FOR A VOLTAGE OF 8.5 TO 10.5V. ON TP1
2. R36 MAY BE ADJUSTED TO REDUCE THRESHOLD OF SENSITIVITY OF AUTOMATIC PEAK PHASING CIRCUIT. INCREASING VOLTAGE DECREASES SENSITIVITY
3. METER CALIBRATE SET AT 10dB LIMITING
4. VALUE TO BE SELECTED IN FINAL TEST
5. ALL RESISTORS, 1/2W, 5%, LOW NOISE UNLESS OTHERWISE NOTED. R1, R2 AND R3 NEED NOT BE LOW NOISE.

HARRIS CORPORATION Broadcast Equipment Division
123 Hampshire Street, Quincy, Illinois 62301

SCHEMATIC
AM LIMITER
843 0409 001

Warning, disconnect primary power prior to servicing.

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