SECTION IV

THEORY OF OPERATION

4.1 INPUT AMPLIFIER

The audio signal is applied through the rear panel barrier strip to a differential input amplifier (IC 2, Sections A & B). This input can accept either balanced or unbalanced signal sources. When used in an unbalanced mode, either the COM terminal or the "±" terminal is connected to ground, the latter causing a polarity reversal (180° out of phase) of input versus output signal.

Common mode rejection is typically better than 60 dB.

4.2 VOLTAGE-VARIABLE RESISTOR ATENUATOR

The input signal is coupled from the differential amplifier through the Input Level control to an "L" section consisting of R6 as the series element and field-effect transistor Q1 as the voltage-variable shunt element (VVR). Below the threshold of limiting, the VVR has a high resistance due to its quiescent bias. Starting at the threshold point, the bias is reduced, causing the VVR resistance to decrease. The rate of change of bias, as well as the threshold point, is controlled by the Compression Ratio pushbutton switches.

4.3 SIGNAL PREAMPLIFIER

Transistors Q2, Q3 and Q4 comprise a low-noise preamplifier. A large amount of overall negative feedback results in low distortion and more than adequate drive capability. The preamplifier output signal is applied simultaneously to the Output Level control and to a signal voltage divider for use in the gain reduction control amplifier.

4.4 LINE AMPLIFIER

The signal from the output control is coupled to the output amplifer consisting of Q5 through Q9 and associated components, and hence to the output transformer T2. This circuit uses a special transformer designed by UREI for low phase shift, flat response, and excellent overload characteristics.

4.5 GAIN REDUCTION CONTROL AMPLIFIER

This amplifier receives its input signal from a voltage divider at the output of the preamplifier. The signal from the divider is selected by the Compression Ratio pushbutton switches. Transistors Q12 and Q13 make up a phase inverter and emitter-follower. The

output of Q13 is supplied to a rectifier diode CR4 and to another phase-inverter emitter-follower combination Q14 and Q15. The output of Q15 is supplied to rectifier diode CR3. Since the two signals are out-of-phase, CR3 and CR4 full wave rectify the signals. When filtered by C27, this produces a dc voltage proportional to the signal amplitude. This is a positive-going voltage which subtracts from the bias on the VVR. To create a threshold of limiting, diodes CR3 and CR4 are biased by a dc voltage divider which is ganged with the Compression Ratio pushbutton switches.

4.6 GR METER DRIVER CIRCUIT

Gain reduction is indicated on the front panel VU meter by measuring the bias on the VVR. Field-effect transistor Q11 provides an impedance transformation from the high impedance VVR bias line to the relatively low input impedance of operational amplifier IC 1. Zero gain reduction is indicated by a quiescent current through the VU meter. When limiting occurs, and the VVR bias is reduced, the current in the VU meter is reduced by an amount corresponding to the amount of gain reduction, and the needle deflects downscale.

4.7 POWER SUPPLY

Two independently regulated voltages are supplied to the circuitry of the 1176LN, +30 VDC and -10 VDC. The AC mains voltage is connected through the front panel switch assembly which also selects the meter function. The 1176LN is switched ON when any of the meter function buttons is depressed. The positive voltage is regulated through VR1. The negative voltage is regulated with a 10 volt zener diode, CR6.

SECTION V

MAINTENANCE

5.1 GENERAL

The Model 1176LN is an all solid-state unit, ruggedly constructed with only the highest quality components. As such, it should provide years of trouble free use with normal care. All parts used are conservatively rated for their application, and workmanship meets the rigid standards you have learned to expect in UREI products.

NO SPECIAL PREVENTIVE MAINTENANCE IS REQUIRED.

5.2 REPAIRS AND WARRANTY

This product is factory warranted to the original purchaser against defects in material and workmanship for one year after initial purchase. This limited warranty must be activated at the time of purchase by returning the registry portion of the Warranty Card to the factory. Should a malfunction ever occur, the dealer from whom the unit was purchased will be glad to handle return for factory repair. Please call or write to the factory for a Return Authorization Number which must accompany all repairs. For prompt service, ship the unit prepaid directly to the factory with the RA Number visible on the shipping label. Be sure it is well packed in a sturdy carton, with shock-absorbing material such as foam rubber, styrofoam pellets, or "bubble-pack" completely filling the remaining space. Particular attention should be paid to protecting the controls, switches, etc. Tape a note to the top of the unit describing the malfunction, and instructions for return. We will pay one-way return shipping costs on any in-warranty repair.

Because of specially selected components in this product, field repairs are not authorized during the warranty period, and attempts to perform repairs may invalidate the warranty.

Even if your unit is out of warranty, we recommend that you return it to the factory for repairs. Our experienced personnel, supported by special test equipment, will be able to find and eliminate any problem in the most efficient way.

5.3 INTERNAL SERVICE ADJUSTMENTS

These controls have been set at the factory and should not require adjustments except after service work. If recalibration is necessary, the test procedure that follows should be peformed very carefully, and adjustments performed in the exact manner and order specified.

Before attempting any calibrations, the limiter should be operated for approximately 15 minutes. This avoids subsequent drifting.

WARNING: The full AC line voltage is present at several points inside the chassis. Be careful to avoid personal shock when you work on the limiter with the covers removed.

5.3.1 POWER SUPPLY

The positive DC voltage should be +30 volts (±0.5 volts). The test point to measure the level is at the collector (metal tab) of Q8.

The level of the negative voltage supply is a fixed -10 volts (±0.5 volts), and cannot be adjusted. The test point is the metal case of IC 1.

5.3.2 "Q" BIAS ADJUSTMENT

This is a very important parameter to assure the linear operation of the limiter. Therefore, the adjustment should be performed very carefully. Set the controls as follows:

Input =	full CCW
Output =	full CW
Attack =	full CCW (switched to OFF position)
Release =	full CW
Compression Ratio =	20:1
Meter Mode =	+4 dB
Q-Bias Adjust =	full CCW

(R81, internal trimpot)

Apply a signal (1 kHz, 0 dB) to the input, and turn the Input control CW until the VU meter reads +1 VU. Slowly turn the Q-Bias Adjust (R81) CW until a drop of 1 dB occurs, and the meter reads 0 VU. This places the gain reduction FET Q1 slightly into conduction.

5.3.3. GAIN REDUCTION METER TRACKING

Due to interaction of the adjustments, this procedure may have to be repeated to achieve satisfactory tracking. Set the controls as follows:

Input =	mid rotation
Output =	full CW
Attack =	full CCW (switched to OFF position)
Release =	full CW
Compression Ratio =	20:1
Meter Mode =	"GR"
R54 =	1/4 turn from full CCW

(internal trimpot)

With no input signal applied, adjust the GR meter (R55) to read "0" VU. This adjustment is accessible through a small hole in the front panel between the Input and Output controls.

Apply a signal (1 kHz, -10 dB), switch the meter mode to +4 dB, and turn the Output Level control CW until the meter reads "0" VU. Turn the Attack control ON (CW) and observe the drop in the meter reading. Adjust the Input Level control until -10 dB is indicated on the VU meter. Turn the Attack control OFF (CCW) and readjust the Output Level control for "0" VU, if necessary. Repeat these last two steps until the output drops 10 dB whenever the Attack Control is turned ON.

Now, without touching the Input or Output controls, select the "GR" meter mode and turn R54 (tracking adjustment) until the GR meter reads -10 when the Attack control is ON, and adjust R55 until the GR meter reads "0" VU when the Attack control is OFF. Due to interaction of these controls, the fastest technique to adjust for best tracking is to correct only one half the error with R54 before rechecking the "0" reading with the Attack control turned OFF. Several iterations will be necessary.

5.3.4 GR METER ZERO

This adjustment is accessible through a hole in the front panel (R55) and was adjusted during calibration of GR meter tracking in Section 5.3.3. However, it may be readjusted without significantly affecting the other control settings. A small amount of drift (±1 dB) is normal in this circuit.

5.3.5 SIGNAL PREAMP LINEARITY

This control (R16) is in the feedback loop of the amplifier and affects the operation of Q1. It will never be necessary to perform any adjustment of R16 unless resistors in this section of the circuit have been replaced. If adjustment is required, set the controls as follows:

Input =	full CW
Output =	to number "18" on the front panel
Attack =	full CCW (switched to OFF position)
Release =	full CW
Compression Ratio =	20:1
Meter Mode =	"GR"

Apply an input signal (500 Hz, -30 dB) and measure THD of the resulting output signal. Adjust R16 until the minimum amount of distortion is achieved.

5.4 IN CASE OF DIFFICULTY

5.4.1 GENERAL

The overall schematic, circuit description (Section IV), and troubleshooting table (Table 5-1) can often be used to isolate a problem. Safety considerations outlined in Section II apply when working inside the device. If a problem cannot easily be solved, it is best to send the unit to the factory using the procedure described under paragraph 5-2. Remember, our technicians have tested and aligned thousands of 1176LNs, and are most qualified to repair your instrument.

5.4.2 PRECAUTIONS FOR TROUBLESHOOTING

Be cautious when testing IC and transistor circuits. Although they have almost unlimited life when used properly, they are very vulnerable to damage when accidentally shorted or connected to incorrect voltages.

Be sure not to short any terminals when making measurements. If a probe should slip, for example, and short out a bias or supply point, it will very likely damage IC's, transistors or diodes. Do not remove any components while the line cord is connected to the AC outlet.

5.4.3 VISUAL TEST

Look at wiring and connections. Check to be sure that all transistors and IC's are properly fitted into the sockets. Check for resistors which may look burned, indicating trouble in associated circuitry.

TABLE 5-1. TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
Signal does not pass through the device.	1. Power supply defective.	Check supply voltages.
	2. Device in full limiting.	Remove Q1. If signal passes, go to problem of "full limiting".
	3. Loose or broken wires between PC board and front panel controls or barrier strips.	Isolate and resolder.
	4. Incorrect hookup.	See Section II, Installation.
	5. Bad amplifier section.	Repair.
No limiting.	1. Limiting switched OFF.	Turn Attack control CW.
	2. No compression ratio button is depressed.	Select desired ratio.
	3. Input level is below threshold.	Increase input signal level.
	4. "Q" Bias misadjusted.	Adjust (¶ 5.3.2).
	5. GR amplifier defective.	Repair.
	6. Wire from Attack control to R7 is open.	Repair.
Always in full limiting.	1. Shorted GR bus.	Check wiring; check stereo interconnect; unplug 1176SA.
	2. Negative supply voltage.	Replace zener diode and realign.
	3. "Q" Bias misadjusted.	Adjust (¶ 5.3.2).
	4. Contaminated PC board.	Clean (¶ 5.5).
Hum through output.	1. Ground Loop, etc.	See Section II, Installation.
	2. Failure to unbalance output transformer into unbalanced load.	Ground "COM" to chassis.

(Continued on next page)

TABLE 5-1. TROUBLESHOOTING (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
(Hum through output)	3. Mounted too close to strong EMI field.	Relocate unit.
	4. Power supply.	Check filter caps.
Distortion (during no limiting mode).	1. Power supply voltage.	Repair as needed.
	2. Input level too high.	Adjust.
	3. Defective output amp.	Repair.
Distortion (during limiting).	1. "Cracking" sound on attack.	Attack set too fast or check Q-Bias (¶5.3.2).
	2. Low frequency distortion.	Select slower settings of Attack and/or Release controls.
Release control changes the output level.	1. Contaminated PC board.	Clean (¶ 5.4.4).
	2. Diodes CR3, CR4 leaky.	Replace with Fairchild FD 333.
	3. Caps C19, C20 leaky.	Replace, 6.8 µf, 35V.
	4. Attack pot R77 faulty.	Replace, 25 kohm.
VU meter reads low on +4, +8 range.	Bad meter.	Replace.
GR meter zero control inoperative.	1. Bad connection from PC board.	Repair.
	2. Dirty switch assembly.	Clean with good contact spray through back of switch.
Excess noise.	Problem in IC2, Q2,3,4,5.	Replace.
1176SA Stereo Adapter does not work.	Dead battery.	Replace, NEDA 15 M (1.4 V). Life is normally >3 years.

5.5 PC BOARD CLEANING

Due to very high impedance circuits, it may happen that contamination on the PC board causes the limiter to perform poorly. Moisture, smoke or polutants in the air may result in slightly conductive deposits which affect the operation of Q1 due to leakage. Existence of contamination can be verified with a simple test. Supply a steady input tone and, with no limiting indicated, adjust the Input and Output controls to read 0 VU on the meter. Remove the top and bottom covers from the limiter and locate Q1. From close proximity, exhale deeply on the circuit board around Q1. The moisture in the breath will induce surface leakage, and the VU meter will indicate a drop in output level. If no contamination is on the board, the output level will return very rapidly to 0 VU (within 10 seconds or less). If contamination is on the PC board, the moisture will be retained for a longer time and cleaning of the board is necessary.

Disconnect the power cord from the AC mains. Prepare a cleaning solution by mixing equal parts of distilled water and pure isopropyl alcohol (not rubbing alcohol). Use a new tooth brush (or similar stiff bristle brush) and apply the mixture to the circuit board. Brush vigorously to thoroughly clean the top and bottom of the board, and allow the board to dry completely before applying power to the limiter. In extreme cases it may be necessary to replace the socket which holds Q1. Repeat the moisture test before replacing top and bottom covers.

5.6 CLEANING THE LIMITER

The front panel of the 1176LN may be cleaned with a non-abrasive cleanser such as "Formula 409" or "Fantastic" applied with a soft clean cloth. Additional protection of the anodized panel can be afforded through a light application of a spray wax preparation such as "Pledge." Never spray the panel directly, as the cleanser or wax may adversely affect controls or meter, and can contaminate circuit boards if it penetrates the chassis.

SECTION VII

APPENDIX

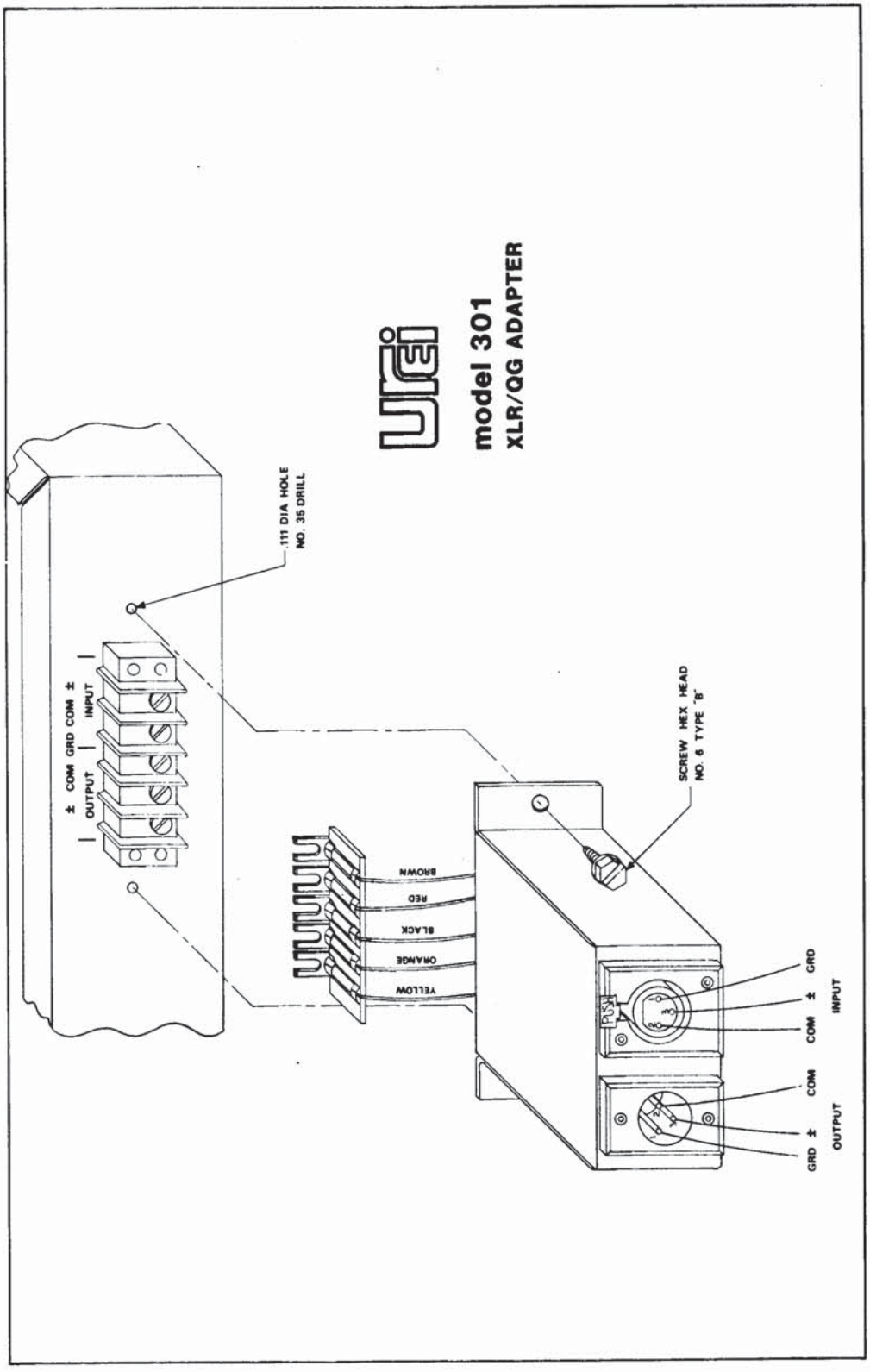

FIGURE 6-1. MOUNTING INSTRUCTIONS FOR MODEL 301.